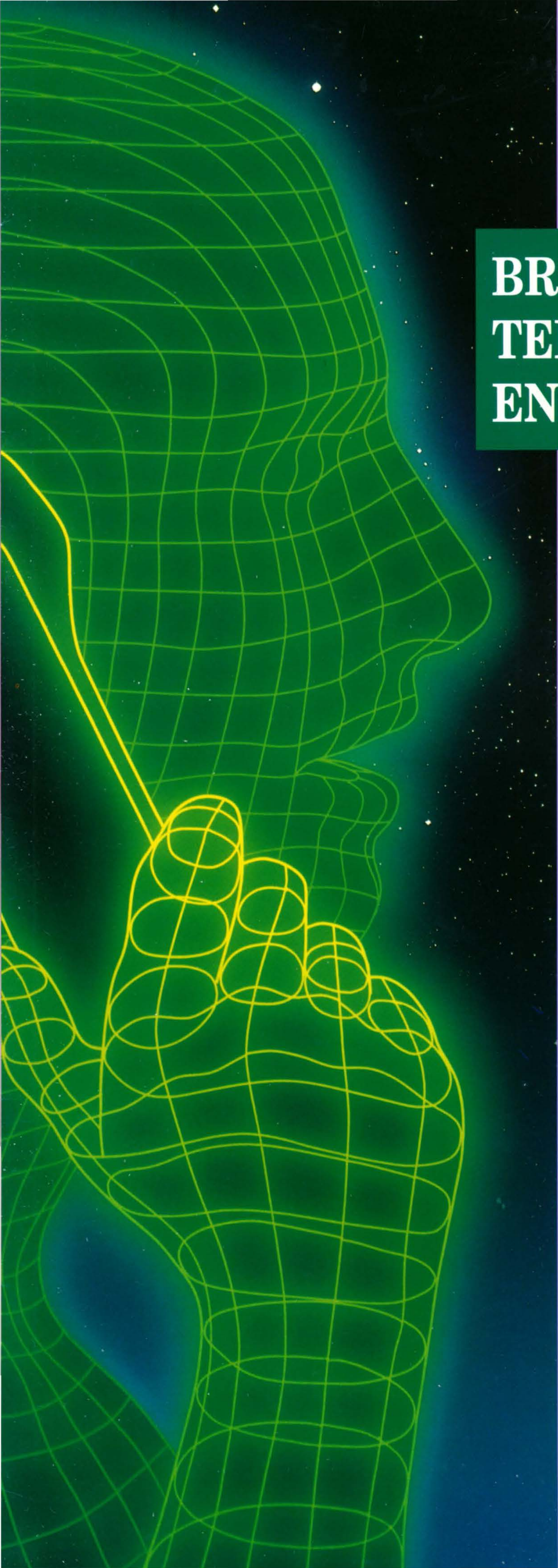

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BRITISH TELECOMMUNICATIONS ENGINEERING

Special Issue on Managed Recorded Information Services

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ISSN 0262-401X

BRITISH TELECOMMUNICATIONS ENGINEERING

FOREWORD

I am delighted to be able to introduce this special series of articles on managed recorded information services.

Customers are the stimulus behind the establishment of BT's managed service and will continue to be the driving force. BT has drawn on its resources from all work areas to develop the technology and the quality service management required to respond quickly to its customers and provide a world-class service. BT is committed to continuous improvement and, as a result of its past successes, is investing in advanced service features to ensure the future growth of network managed services. Managed services provide two key benefits. Firstly, they provide major users with the flexibility to ensure that as many of their calls as is practicable get answered, improving their customer service and business results, and of course BT's at the same time. Secondly, they allow businesses to try new ways of interfacing with their customers as they become available. In this respect, I look forward to the development of the first PSTN fax and video managed services and then ISDN and broadband-based multi-media managed service.

This project has involved all parts of BT and has been an excellent example of one-team working, which has been further demonstrated in this valuable series of articles.

ANDY GREEN
Director Public Communications Products
BT Products and Services

The managed recorded information services project has delivered a new platform that has re-focused and brought up to date BT's capability for delivering managed information services to customers.

The development capability within BT Development and Procurement has been able to contribute significantly through the development of innovative products such as interactive services distribution equipment and the auxiliary switch, to provide a unique capability for BT. These developments have ensured that BT is well positioned to meet customer needs, both in providing advanced service features to the information service providers and to the calling customer, and in efficiently delivering calls to the services through the network.

The managed recorded information services platform has only recently been established and is already successful in the market-place. It will be the subject of further innovation and improvements as BT seeks to strengthen its position in the face of increasing competition.

ALAN RUDGE
Managing Director
BT Development and Procurement

The Need for BT's Managed Recorded Information Services

PETER SHAW†, JOAN STEWART†, and NIGEL CRISP*

The managed provision of recorded information services, although well established, is one which has seen much change over the years, both in its market and in its realisation. This article shows how in recent years these services have evolved at an ever increasing rate to match customer expectations within the fast changing telephony environment. The current product offerings are considered in the article, relating these to customer requirements and the specialised network infrastructure.

INTRODUCTION

The British Post Office, and later BT, has provided recorded information services from within the telephony network for over 50 years. The principle of this managed provision, although well established, is one which in detail has shown much change over the years in order to match customer needs.

The managed form of service is known as *managed recorded information services* (MRIS) and has taken an enhanced profile in recent years with the establishment of a particular type of customer who has information to distribute. In the managed arena, this customer, usually referred to as the *service provider*, puts information into the network and BT automatically makes it available to a large number of calling customers. Information that can be distributed in this way can be vast ranging and apply to the commercial, sporting, entertainment and retail markets.

MRIS also provides a facility for other parts of BT's business wherever there is a need to give customers information on such topics as network conditions. Providing information in this way can significantly enhance the company image, by keeping the customer informed, helping when in difficulty and generally providing a caring service.

INFLUENCING FACTORS

The need for MRIS relates to being in a position to provide BT users and service providers with features and facilities which enable the calling customer to access a vast wealth of information. The realisation of a product to meet these needs has been determined by a number of influencing factors:

- information market,
- growth potential,
- BT network announcements,
- technology, and
- history.

† BT Product and Services Management
* BT Development and Procurement

Information Market

The growth of the information market, commonly known as *Audiotex*, has accelerated as a result of the change to the UK telecommunications operating conditions and the ability to charge calling customers' calls at a premium rate.

Growth Potential

Continued growth in applications indicates that the facilities offered today have not yet reached an end-point; there is potential for many more applications and service enhancements. Confidence in this relates to recent growth in the product offering. As an example, the established MRIS product is based on the principle of passing information in one direction. This is currently being enhanced to provide the capability to interact with the customer. The principle promises considerable potential for growth.

BT Network Announcements

As the general public's awareness of quality increases, fed by continued network modernisation and improvement, informative and friendly network announcements come to be expected. This will undoubtedly enhance everyone's confidence in BT.

Technology

Developments in the information technology industry have been a significant enabling factor in the fulfilment of Audiotex applications, because without that technology the applications could not have been realised to the level that they have. The technology has progressed to a point which enables BT to respond quickly to customer needs.

History

In the current environment, the historical background is by no means the strongest influence, but certainly is not an insignificant factor, because of the long establishment and acceptance of recorded information services by the public.

HISTORY OF MANAGED SERVICES

In 1936, the speaking clock was introduced and provided the first managed recorded information service for the general calling public. In 1956, the weather forecast service was launched, and this was quickly followed by cricket, road and tourist information services. These services became collectively known as *Guidelines* and were priced at standard local charges. The *information providers*, such as the Meterological Office or Tourist Board, were paid a percentage of the call revenue earned, based on a fixed unit fee per call. By 1986, BT's Guidelines were generating in excess of 400 million calls per year.

Although these services were popular, they were not regarded as profitable. Under the terms of its operating licence, BT could not cross-subsidise the payments for the information with the revenue earned from the transportation of the call. Demand was also increasing from businesses and entrepreneurs who wanted to provide information services similar to Guidelines, but with added value and added features.

The managed business has now changed, and of the original Guideline services Timeline is the only survivor, being regarded as an exception because of sponsoring arrangements. In many ways, this service is seen as a national institution.

Premium Rate Services in the UK

To adhere to the licence and to satisfy the growing added-value need, *national premium rate services* were introduced in April 1986, the concept of which can be described as a partnership between BT, who provides the network and the technical capability, and a third party (service provider), who provides a service to the calling customers. Callers to premium rate services are charged at a premium rate; that is, a rate above BT's normal call charges. This premium is then passed on to the service provider.

Currently, two national number access codes are used for premium rate services: 0891 and 0898. Both have identical charging arrangements to the calling customer and give the same revenue share to the service provider. The two codes are differentiated by the types of information allowed on each.

Premium Rate Services Worldwide

BT led the world with the introduction of national premium rate services when it launched its service in 1986, two years in advance of the comparable service in the USA. European countries have followed and are now in various stages of progress. Currently, BT has the largest premium rate service in Europe in terms of numbers of lines and calls.

CALLSTREAM CALL SERVICE

Callstream is the commercial name for BT's national premium rate services and encompasses the means of transporting and terminating calls. There are two methods of call termination within Callstream services:

- independent; and
- managed.

Independent Callstream Facility

Under this option, service providers have calls delivered to their premises via lines connected to the BT network. The service providers then have their own answering capability on their premises and, by using this capability, provide information services.

The independent service is most suitable for service providers with complex and highly specialised applications. However, this type of service is costly to set up and requires expertise to maintain and operate. Also, keeping up to date with developing features and facilities can be a costly overhead.

Callstream Managed

The managed service provides the service provider with a total product package: the service is run on BT lines and equipment is installed on BT premises. The service provider has only to provide the audio information.

The advantages of managed service are:

- calls are answered on high-quality, reliable answering equipment, which is sited within the telephony network;
- it enables the service providers to focus on promoting and marketing their information;
- the service provider is released from the capital outlay associated with the provision and installation of the independent service;
- the service provider does not need expertise in the maintenance and operation of complex telephony equipment;
- BT provides the telephony aspects of service administration by monitoring the call volumes and configuring the equipment to cope with demand; and
- it can provide additional capacity to independent service providers as and when required.

Other Managed Applications

The ability to charge calling customers at a premium rate has been instrumental in setting up the current MRIS infrastructure. However, once MRIS was realised, the ability to provide capacity, economically, for BT products other than Callstream became viable. Therefore, LinkLine™ services (using 0800 and 0345 codes) and public switched telephone network (PSTN) services have made good use of MRIS. As an example, the mammoth task of providing PSTN change-number announcements for the recent London code change was an easy one for MRIS.

MRIS MARKET

The overall market requirements are generally derived by working closely with service providers, to assess and understand their real needs. Indeed, recent experience has shown this to be highly effective. From the identified market requirements the resulting MRIS product offerings are derived, having taken into account the influencing factors previously discussed.

Identified Market Requirements

The following market requirements, drawn both from internal BT and from external customers, have been identified and are currently being satisfied or realised:

- services which start at the beginning of the message,
- direct update of announcement services,
- high-call-volume answering,
- real-time call statistics,
- live service,
- fast delivery,
- interaction with the calling customer,
- information capture, and
- full BT call management.

Start-at-the-Beginning Messages

Messages and services which are provided starting at the beginning are now generally demanded by calling customers, most of whom are paying at a premium rate and expect a high quality of service.

Direct Update of Announcement Services

Those service providers who supply up-to-the-minute 'fresh' information need to gain direct access to their services and update messages immediately.

High-Call-Volume Answering

Services which are promoted by the high-volume media, such as television and radio, can generate high call volumes over a relatively short period of time. MRIS therefore needs to handle these calls in a manner that achieves the highest possible call answering rate.

Real-Time Call Statistics

Service providers promoting services in the daily or short-term market need to assess the effectiveness of their advertising to allow them to take action to maximise their revenue. Therefore, access to real-time call statistics is essential. Also, televote applications used by television and radio need their calling figures available in this manner to feed back results to their viewers and listeners.

Live Service

Many service providers, particularly in the sporting market, need to be able to give live commentary on events and hence need a broadcast, or *live feed*, facility.

Fast Delivery

Service providers can often demand the fast provision of services to meet specific market niches that become evident on short time-scales or to meet emergency situations.

Interaction with Calling Customer

Once a call is established, the most convenient method for the calling customer to request multiple choice information is by interaction using voice or TouchTone™.

Information Capture

Service providers, for example, in the retail market, generally want to take orders; hence the ability to capture information from the calling customer is a prime need.

Full BT Call Management

It has been recognised by the market that the lines-based service requires the service provider to administer call management by the purchase of additional lines. This has led to inefficiencies in call completions, but full call management by BT has overcome these difficulties by using MRIS and the network infrastructure[1].

Current Product Offering

Based upon the market requirements, the following product offerings are available:

- Callstream Managed service;
- Callstream Enhanced Managed service;
- LinkLine MultiLink; and
- network announcement services.

This is an evolving product range and future product enhancements are discussed in a later article[2].

Callstream Managed Service

This product was launched in late-1986 to address smaller businesses looking for an entry into the premium services market. The current service incorporates the following features:

- Calling customers can listen to start-at-the-beginning messages, which last a maximum of two plays after which the call is automatically disconnected.
- The service providers can update their service by cassette tapes, which they supply to BT. This is ideal for studio-quality recorded announcements, which often combine speech and music.
- The service providers can directly update their messages via the telephone network free of charge. This is commonly known as *remote update* and is ideal for frequently updated announcements, such as news bulletins.

● Call status reports are dispatched weekly to the service providers and provide a day-by-day analysis of the number of calls received and the associated revenue for each active service number.
● Charges are based around rental of lines in blocks of ten.

Identified market requirements not currently addressed by this product are scheduled to be incorporated in the summer of 1992[2].

Callstream Enhanced Managed Service

Enhanced Managed is the latest addition to the Callstream portfolio introduced in May 1991. It was designed for those occasions when service providers need to run a high-volume campaign requiring full call management, such as a televote or a television advertised service, and is also ideal for information services with a wide appeal such as live commentaries.

This service incorporates the following features:

● Messages can be updated by cassette tape and remote update.
● The facility of providing live services such as horse racing commentaries is made possible by using one of two methods: dialling over the telephone network or direct connection from the service provider's premises.
● Weekly status reports are provided.
● Real-time statistics are available by using a TouchTone telephone. This information is updated every 1 minute or 15 minutes and the call counts can be reset to zero at any time.
● Real-time statistics can also be accessed directly by using a modem and personal computer to provide a more detailed analysis on each service.
● Charges are based around the rental of individual services; that is, one announcement.
● Full call management.

Two identified products are available within the Enhanced Managed service: Broadcast and Televote:

● *Broadcast* announcements may be start-at-the-beginning and can be updated by tape or remote update. The facility of giving live commentaries on events is available. Some examples of broadcast services are racing commentary, competition lines and information lines. Broadcast services can be rented on a weekly, monthly, quarterly or annual basis.
● *Televote* announcements are short duration, non-start-at-the-beginning announcements and can be updated by tape or remote update. Televote announcements are primarily used for voting via the telephone network, but can be used whenever a very short announcement is required. Televote services can be rented on a daily, weekly, monthly, quarterly or annual basis.

LinkLine MultiLink

This product was launched in the summer of 1987 and modified in late-1990. It satisfies the LinkLine demand for campaign style, free and local-charge-rate promotions. The current service incorporates the ability to update messages by cassette tape and offers full call management to the service provider. Identified market requirements not currently addressed by this product are scheduled to be incorporated in summer-1992[2].

Network Announcement Services

This service is available via network operations[3] and is aimed at network planners and operators requiring network emergency announcements or changed-number announcements. It incorporates the following features:

● start-at-the-beginning announcements to the calling customer, which may be charged or not charged;
● remote update or tape;
● fast delivery;
● full call management, high or low call volume; and
● statistics on the number of calls.

CONCLUSION

Working closely with external and internal customers to identify and understand their needs and then matching these to BT's operating strategy is enabling MRIS products to be aligned precisely with the identified market requirements. The infrastructure itself is future-proofed to allow new services to be realised quickly and efficiently with advanced features and facilities. Value has been added to the managed product which realises BT's quality and style and satisfies fully the needs of the customer.

The MRIS platform as it is today grew out of the above elements and from public demand for information services. It is an extremely successful market and BT as a company is constantly exploring and refining markets in which to expand its expertise. MRIS enables service providers to be divorced from having to concern themselves with decisions regarding their telecommunications infrastructure and capacity maintenance.

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Biographies

Peter Shaw joined the then British Post Office in 1966 as a three-year trainee technician apprentice in London South East Area. He was then employed on PABX and exchange construction, and subsequently became clerk of works for TXK3 local exchanges. On management promotion, he joined the Circuit Laboratory in Headquarters and was responsible for testing equipment. He moved to the department responsible for national TXK3/TXK4 maintenance, and in 1985 to National Networks and the LinkLine group. He was involved in the derived services network project and worked closely with sales groups and LinkLine customers to ensure the success of the LinkLine product. He was part of the original Callstream project team, being involved in the launch of national Callstream in 1986 and in the local and regional Callstream products shortly afterwards. Peter is currently the Callstream network development manager within Products and Services Management, being responsible for all new product launches requiring network infrastructure.

Joan Stewart joined BT in 1980 providing clerical support in the West of Scotland District sales department. She moved to the network marketing unit in 1985 and worked on various call stimulation projects and the network modernisation programme. When national Callstream was introduced in 1986, she formed part of the original West of Scotland area support team. She moved to the Callstream product development group in 1989 and was involved in the Callstream Enhanced Managed service project, managing its launch into the market-place. She is currently project-managing the introduction of a wide range of Callstream customer features.

Nigel Crisp joined the then British Post Office in 1967 as an apprentice and graduated from Middlesex Polytechnic with an honours degree in Electronic Engineering in 1973. He has been working on audio storage using computer technology since 1976, and led the hardware design of the System X automatic announcement subsystem in the late-1970s and early-1980s. Other work has included developments for Talon and the production of a feasibility study in 1985 in which the current recorded information distribution equipment (RIDE) switch block was first described. Since 1987 he has been involved in the auxiliary switch, voice services equipment, voice services developments and related consultancy. He is currently team leader for Callstream work within the speech applications division.

Glossary of Abbreviations Used in this Issue

ASCP	Auxiliary switch call point
AS/MMI	Auxiliary switch man–machine interface
BMIS	Basic managed interactive service
CAF	Caller audio file
CFEP	Caesar front-end processor
COU	Central operations unit
CPU	Central processing unit
DDI	Direct dial-in
DMSU	Digital main switching unit
DSN	Derived services network
DTMF	Dual-tone multi-frequency
DULF	Dial-up live feed
EPROM	Erasable programmable read-only memory
FRP	Fault reporting point
ICSTIS	Independent Committee for the Supervision of Standards of Telephone Information Services
LAN	Local area network
MAU	Monitor alarm unit
MMI	Man–machine interface
MRIS	Managed recorded information services
NAC	National announcement centre
NMC	Network management centre
NNG	National number group
NPG	Network Planning Guide
NU	Number unobtainable
OPRA	Opinion poll registration application
OSMU	OPRA system management unit
PC	Personal computer
PCM	Pulse-code modulation
PIN	Personal identification number
PMUX	Primary-order multiplexer
PSTN	Public switched telephone network
RAC	Recorded announcement centre
RAM	Random-access memory
RDL	Remote download
RIDE	Recorded information distribution equipment
RISCP	Recorded information services control processor
RUD	Remote update
SAB	Start-at-the-beginning
SABRE	Start-at-the-beginning registration equipment
SMU	System management unit
SPAF	Service provider's audio file
SSG	Start-stop generator
VDU	Visual display unit
VSE	Voice services equipment
WAN	Wide area network
WN	Worldwide Networks

Managed Recorded Information Services—An Overview

JOHN SHEPHERD, and KEVIN BOSHER†

This article begins by tracing the history of the managed recorded information services (MRIS) and the development of the equipment to the present state of the art. It leads into an overview of the architecture of the network system, together with a summary of the operation of MRIS.

INTRODUCTION

This article gives an overview of the systems and equipment used to provide BT's managed recorded information services (MRIS), giving emphasis to the technology and techniques used. It begins with a brief account of the history of recorded information services, which leads into a description of the core equipment and service forms now provided.

In setting the scene this way, the reader is guided into the other articles in this *Journal*, which describe the equipment and services in greater detail.

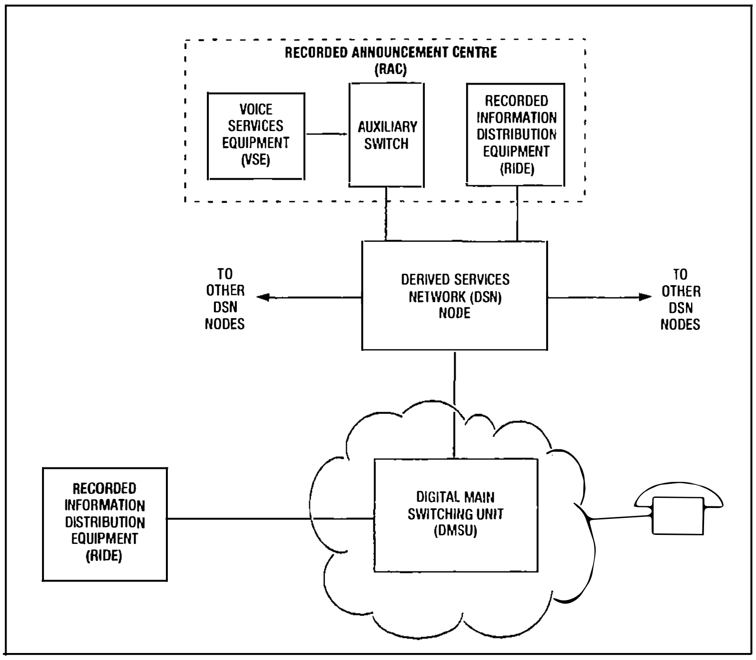
MANAGED SERVICE

The first product offering for a managed recorded information service comprised a basic announcement service with tape-only update. This has been supplemented by more advanced services, as more-enhanced equipment has become available to give a greater degree of customer control; for example, in high-volume televotes, remote update of announcements, interactive services and call statistics.

The fundamental factor identifying a managed service from an independent service is that, for a managed service, the voice equipment, in all its forms, is within the telephony network and installed on BT premises. The information loaded is normally provided from non-BT sources by service providers.

† BT Worldwide Networks

Figure 1
Network positioning of MRIS equipment



The First Fifty Years

The use of recorded information services in the telephony network is not a new concept; notably, the first service of this sort was the speaking clock, originally introduced in London in 1936 and expanded nationally in 1942. Throughout its history, this service has been provided by specialised equipment which has stored the information by using optical discs, magnetic tape drums and, currently, solid-state semiconductor stores.

From the 1950s onwards, more general information services were developed which 30 years later formed a portfolio of 'Guideline' services, giving information on subjects such as cricket matches, weather and road traffic. The technology used was magnetic tape and drum stores, in the form of the British Post Office Equipment Announcer Numbers 9 and 11. The services were charged at local call rate, and generally the beginning of the announcements did not coincide with the start of the call.

The first 50 years of recorded information services has been described in a previous issue of the *Journal*[1], and in many ways this current issue forms a continuation of the story, which has now been enabled by the extensive use of new and sophisticated technology.

Derived Services Network

Flexibility in charging requirements for calls has been made possible by a national overlay network, known as the *derived services network* (DSN). This has been fundamental in allowing calls to be charged at rates above the normal trunk rate, and thereby enabling MRIS to be viable. Access to the overlay network is determined by the calling customer dialling non-geographical national number group codes, such as 0800, 0345, 0898 and 0891, from the public switched telephone network.

The DSN originally used analogue switches[2], but is now entirely digital[3]. The network is formed from eight switching nodes, each of which now has associated with it a recorded announcement centre (RAC), which provides a gateway for connecting to the managed information services. See Figure 1.

An Early Managed Facility

A BT product, the mass answering facility, enabled customers to conduct televotes by using the analogue DSN. This used amplifier circuits to provide 500-circuit access to announcements nationally. It was known within BT as the *Roland Rat* service, since the first service it carried was for a national television Roland Rat phone-in. The service was expanded by using CEPTEL equipment to provide a live-feed capability and a total of 1280 lines capacity nationwide, which was split into two units known as *Kevin* and *Erol*, each of 640 lines. This has since been replaced by the recorded information distribution equipment (RIDE)[4].

ANNOUNCEMENT CENTRES

To widen the attraction of the service, the first RAC was opened in 1986 in London. It consisted of three items of announcement equipment, known as the first-generation *voice services equipment* (VSE1). This enabled lower volumes of calls to be connected economically to announcements, and was directly linked into the DSN switch.

The RAC was in service for only three months before demand created a need to expand the equipment room. The growth continued with two new RACs at Birmingham and Leeds, eventually leading, by 1988/1989, to the current eight sites, (as before, plus Glasgow, Guildford, Cambridge, Manchester and Bristol), and the establishment of a *national announcement centre* (NAC) at Oswestry for central control and statistics collection. This provided the flexibility needed for BT to produce a fast response to customers' (service providers') changing needs.

Call Access

For services operating on RAC-based equipment, the announcements are provided at specific RACs, with calls to the announcement service networked across interconnecting routes on the DSN. For services generating higher volumes of calls, the announcements are distributed by the RIDE system, with calls terminating at the RAC collocated with the point-of-entry to the DSN. This arrangement avoids congestion of the DSN interconnecting routes.

RIDEs are also connected directly to digital main switching units (DMSUs) (see Figure 1), and these were used recently to provide announcements for the London code change, with calls to these being routed directly to the RIDE corresponding to the DMSU to which the call is sent. Future uses of the DMSU RIDEs will include Timeline, high-volume televotes and national code change announcements (for which they are currently being upgraded).

RECORDED ANNOUNCEMENT CENTRES

Each RAC consists of two areas: the equipment area, providing an air-conditioned room for the MRIS hardware; and the operations area contain-

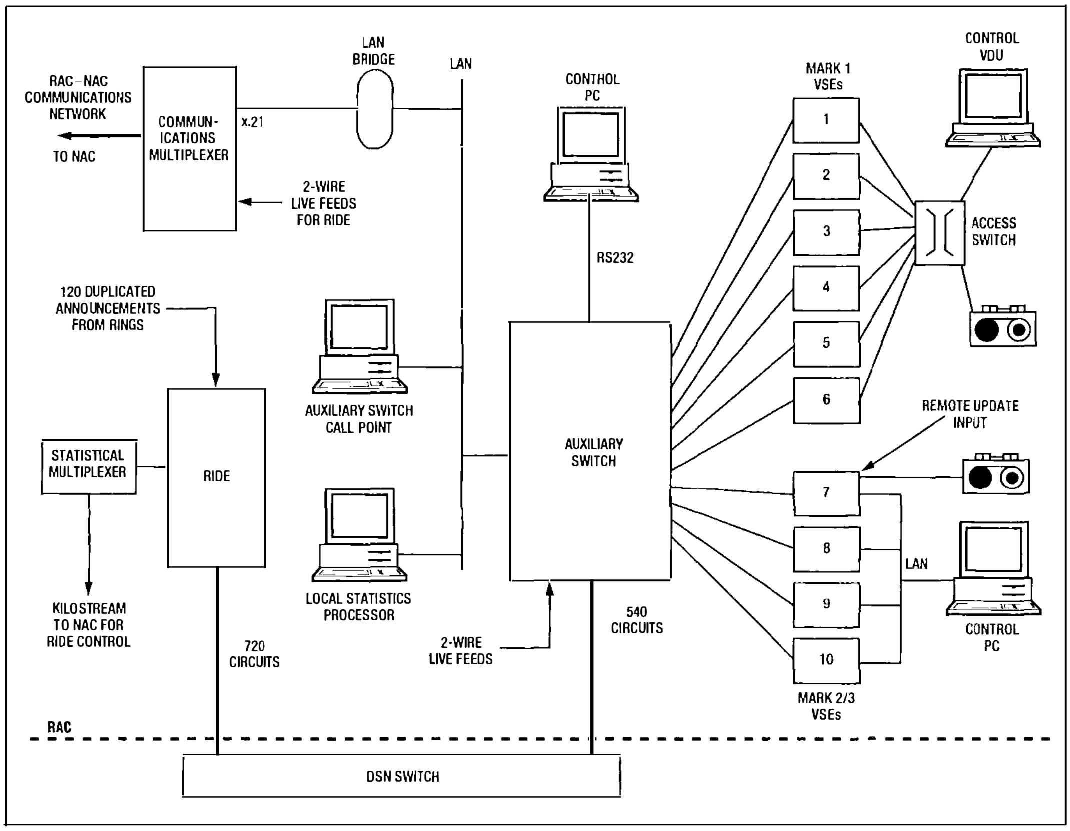
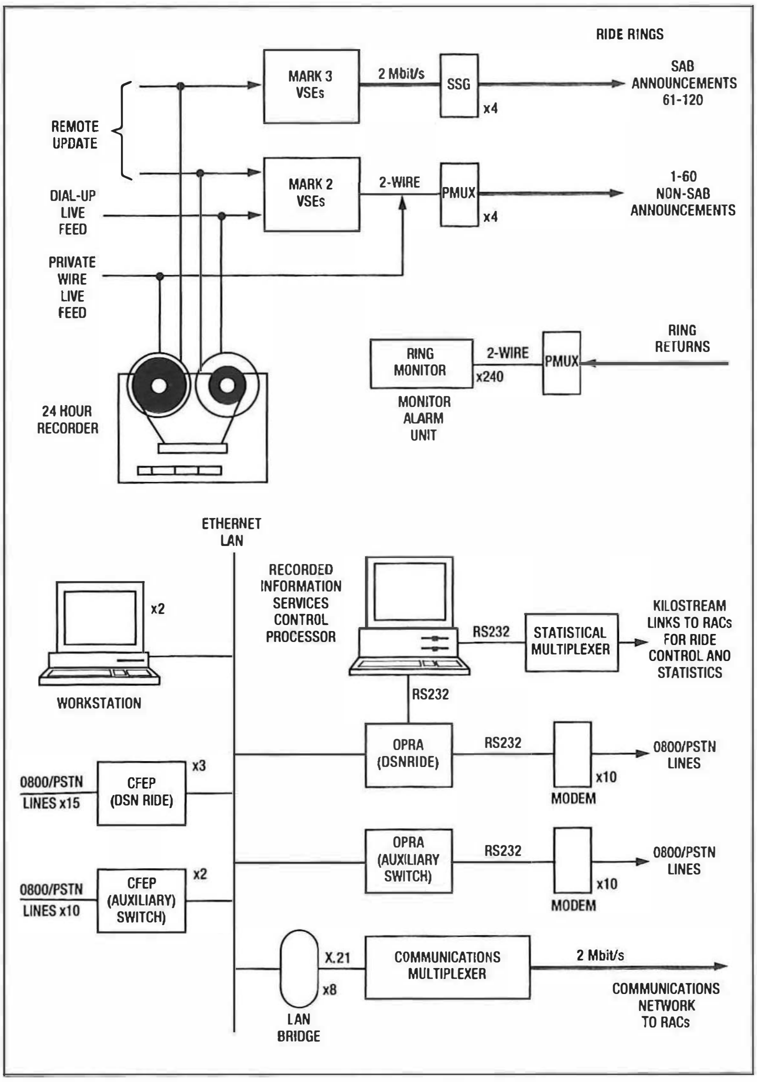


Figure 2
RAC configuration

DSN: Derived services network
LAN: Local area network
NAC: National announcement centre
RAC: Recorded announcement centre
RIDE: Recorded information distribution equipment
VSE: Voice services equipment

Figure 3—NAC operation room



CFEP: Caesar front-end processor
DSN: Derived services network
OPRA: Opinion poll registration application
SAB: Start-at-the-beginning
RAC: Recorded announcement centre
RIDE: Recorded information distribution equipment
SSG: Start-stop generator

Figure 4—NAC configuration

ing the application control terminals. A typical RAC configuration is shown in Figure 2.

Voice services are primarily sourced from the VSE[5]. Initially, VSEs were connected directly to the DSN, but to increase flexibility and to help overcome the problem of call volume fluctuations, an auxiliary switch was introduced between the VSE and DSN.

Typically, low to medium call volumes to announcements terminate on the VSEs, routing through the auxiliary switch, which determines the appropriate announcement and hence destination VSE. The auxiliary switch and VSE are controlled by their own control PCs, with management and call statistics being collected from the auxiliary switch via the auxiliary switch call point (ASCP). Access to the management statistics is from the local statistics processor. Service provider access to call statistics is from the auxiliary switch opinion poll registration application (OPRA)[6] processor located at the NAC, which is connected to the ASCP via the communications network[7].

High call volumes to announcements are connected to the RIDE and terminate on the appropriate announcement within the RIDE switch, the announcement being sourced from the NAC at Oswestry.

The RIDEs are remotely controlled from the NAC by the recorded information services control processor (RISCP). This also collects call statistics from the RIDEs, with service providers receiving their call statistics from the OPRA processor located at the NAC.

NATIONAL ANNOUNCEMENT CENTRE

The NAC at Oswestry, see Figure 3, is the focal point for MRIS. It currently houses equipment for:

- announcement generation and the insertion of 'live feeds' on the DSN RIDE network;
- start-stop message generation for 'start-at-the-beginning' (SAB) announcements on the DSN RIDE network;
- distribution of information/announcements to the RACs;
- collection of call statistics from the DSN RIDE network and auxiliary switch installations;
- control of the DSN RIDE network; and
- recording units needed for regulatory purposes to monitor announcements supplied by service providers.

The configuration of the equipment in the NAC is shown in Figure 4.

MRIS EQUIPMENT

The eight RACs and the NAC contain MRIS equipment as described in the following sections:

Voice Services Equipment (VSE)

VSE is call terminating equipment which provides access to stored announcements, with the ability to answer 30 simultaneous incoming calls. The announcements themselves are stored digitally on internal hard discs. The dialled digits received determine the announcements played to the caller.

The basic VSE1 includes the following facilities:

- VDU control;
- announcements loaded from tape; and
- low announcement storage capacity.

The advanced generations of VSEs (VSE2/VSE3) provide the following:

- PC control;
- announcements loaded from tape or remotely updated;
- high announcement storage capacity;
- analogue connections in the case of VSE2 and digital connections in the case of VSE3;
- advanced features, such as the interactive service, and dial-up live feed; and
- remote access and control.

As the VSEs have developed, their physical size has decreased, which has allowed more effective use of the available accommodation. For example, a VSE1 in a single cabinet provides 30 channels of service, whereas four VSE3 units in a similar single cabinet provide 120 channels of service.

Auxiliary Switch[5]

The auxiliary switch comprises three modules and a controlling PC. Each module is a secure non-blocking bidirectional 300-channel digital switch (ten groups of 30 channels). It is possible to allow a call to arrive on one module of the auxiliary switch and to be passed to another, as all three are interconnected by a 64-channel ring of intermodule links.

The auxiliary switch has the capacity for 30 × 2 Mbit/s terminations and can switch any incoming channel to any outgoing channel. It can provide a concentration point when using the wait-on-start facility to allow several calls to a common announcement to be held for a short period (or until a set number has accumulated or a set time elapsed), before all calls are passed down the same channel for connection to the announcement in a 'start-at-the-beginning' manner. This maximises the use of the VSE channels.

The auxiliary switch has a translation capacity which enables up to six digits to be accepted and a maximum of 10 digits to be passed forward with the call. Currently on MRIS, four digits in and two digits out are being used.

Recorded Information Distribution Equipment (RIDE)[4]

The RIDE is a totally non-blocking switch, targeting a maximum of 720 simultaneous calls to any one of a maximum of 120 announcements. Announcement distribution and control for RIDE is centred on the NAC for a fast response to announcement changes and statistics provision.

The DSN RIDE network (see Figure 5) provides a total answering capacity of 6480 lines to 120 duplicated announcements (consisting of live feed, SAB and non-SAB services). Nine RIDE switches are installed, one in each RAC except London, which includes two.

Announcements

Announcements are distributed from the NAC over 2 Mbit/s rings. Both the transmit and receive

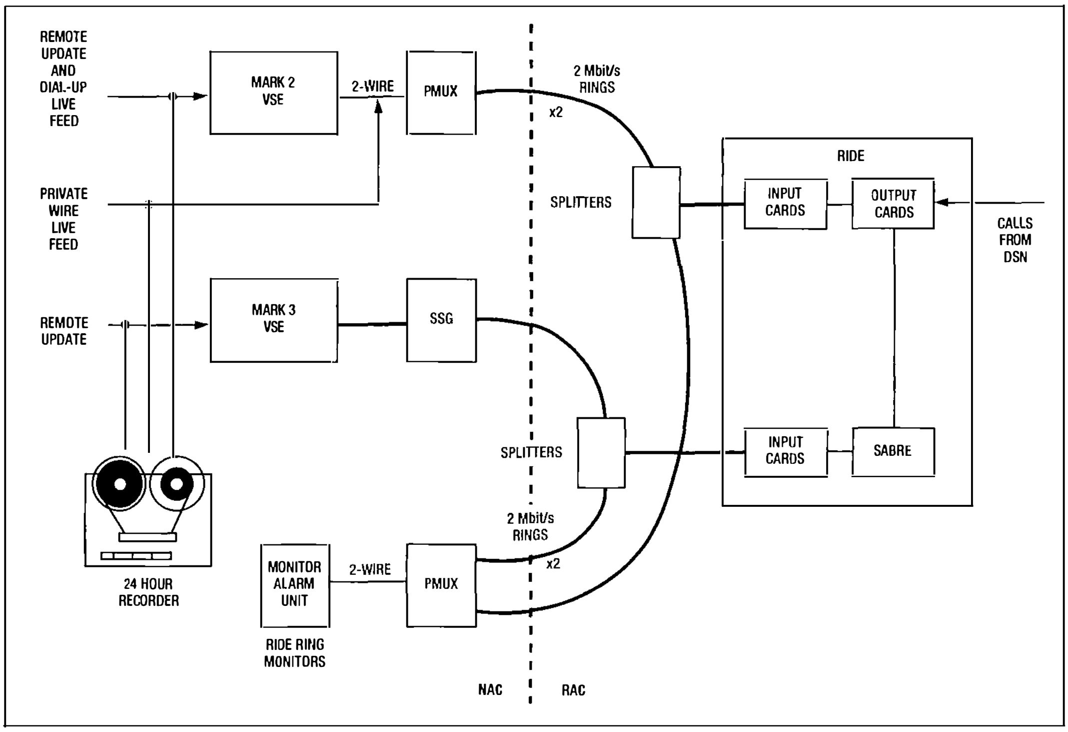


Figure 5 RIDE announcement distribution

DSN: Derived services network
NAC: National announcement centre
PMUX: Primary-order multiplexer
RAC: Recorded announcement centre
RIDE: Recorded information distribution equipment
SABRE: Start-at-the-beginning registration equipment
SSG: Start-stop generator
VSE: Voice services equipment

paths are used to provide 60 channels per 2 Mbit/s system. Four rings are used to provide 120 duplicated announcements, diversely routed for security.

SAB announcements are fed from the VSE3 via the start-stop generator (SSG)[4], which provides announcements with start and stop signals. The signals are detected by start-at-the-beginning registration equipment (SABRE)[4] connected to each RIDE switch, which stores the announcements. Incoming calls are connected to the announcement within the SABRE.

Non-SAB announcements are fed via the VSE2 to the RIDE ring and are played continuously. Incoming calls are connected directly to the ring announcement by the RIDE.

Private wire live feeds are connected to the rings, as are other non-SAB services, via the PMUX. Ring returns are passed through a PMUX and monitor alarm unit (MAU)[7], which checks for the presence of an audio signal and generates an alarm if the signal is not detected after a preset period of time.

Control

The DSN RIDE network is controlled centrally from the NAC by using the RISCP, which is connected to each RIDE via a dedicated KiloStream link. The RISCP also collects RIDE call statistics and passes these to the OPRA.

Opinion Poll Registration Application (OPRA)[6]

Two OPRA systems (comprising an OPRA processor and Caesar front-end processors (CFEPs)) are provided at the NAC, and these centrally collect and collate call-statistic information from the DSN RIDE and auxiliary switches (via the RISCP and ASCP respectively).

The OPRA provides three statistics services, presented on a DSN regional basis:

- *Detailed* Totals of calls and call holding times at 15 minute intervals.
- *Summary* Call totals only, at 15 minute intervals.
- *1 minute* Call totals only, at 1 minute intervals, available for RIDE statistics only.

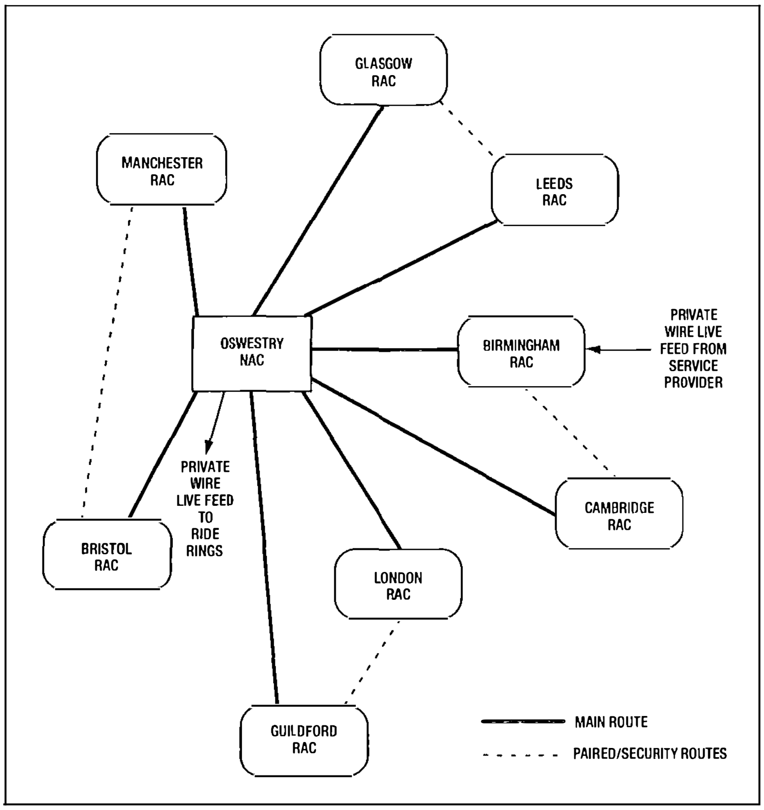
Service providers can access and collect these statistics by using a PC and modem via a dial-up/dial-back process, or a TouchTone™ telephone (CFEP access), where the call statistics are converted into speech messages.

NAC–RAC Communications Network[7]

The communications network (see Figure 6), comprising 2 Mbit/s links, has been installed to enable duplicate live-feed connections to be provided quickly to the RIDE. This speeds up provision and reduces costs for service providers, since the only private wire needed is that from the service provider to the RAC.

From the RAC, the live feed announcement is sent direct to the NAC, with a security route provided via the paired RAC.

Figure 6
NAC–RAC communications network



NAC: Network announcement centre   RAC: Recorded announcement centre

SYNCHRONISATION

All the digital MRIS equipment is synchronised from the main network.

Two diversely routed KiloStream circuits terminating on synchronisation equipment provide the synchronisation source for the NAC. This equipment detects failure of the main feed, and switches automatically to the security feed. Links from the distribution equipment supply the RIDE rings, from which the RIDE switches derive their timing.

The RAC equipment not connected to the RIDE rings (for example the auxiliary switches) derive their timing from the master clock, via the DSN exchange. This arrangement is shown in Figure 7.

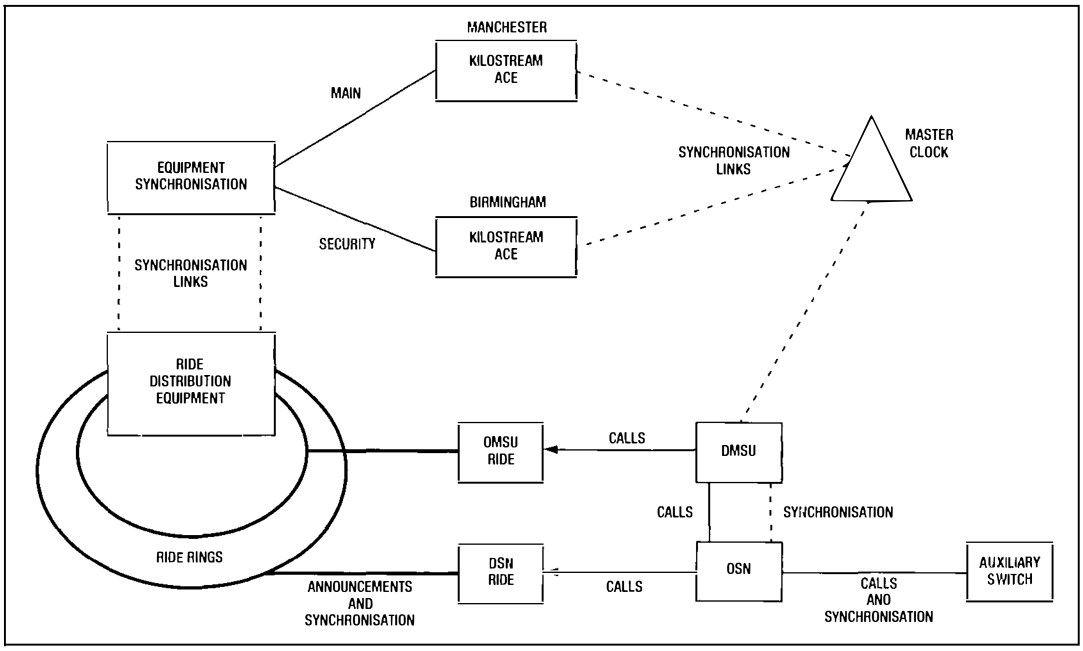
FURTHER DEVELOPMENTS

A number of developments are in progress and these are described below:

RIDE on Digital Main Switching Units[4]

The RIDEs were initially installed on digital main switching units (DMSUs) to provide courtesy announcements for the London code change, with announcements being provided internally by RIDE. They are currently being enhanced and expanded for the national code change, Timeline, and high-volume televote applications by being connected to centrally generated announcements provided by a further set of RIDE rings.

Because of the number of DMSU RIDE units (at present 65), the distribution network will be



ACE: Automatic cross-connection equipment
DMSU: Digital main switching unit
DSN: Derived services network
RIDE: Recorded information distributon equipment

Figure 7
Synchronisation of MRIS equipment

configured as three sets of rings serving RIDE switches in three geographical zones (see Figure 8).

The DMSU RIDE network will have its own OPRA, with the same facilities provided for the DSN RIDE OPRA. Control is via seven RISCPs at the NAC, but these will be integrated by the RIDE system management unit (SMU) development in the future (see Figure 9).

RAC Monitor Alarm Unit[7]

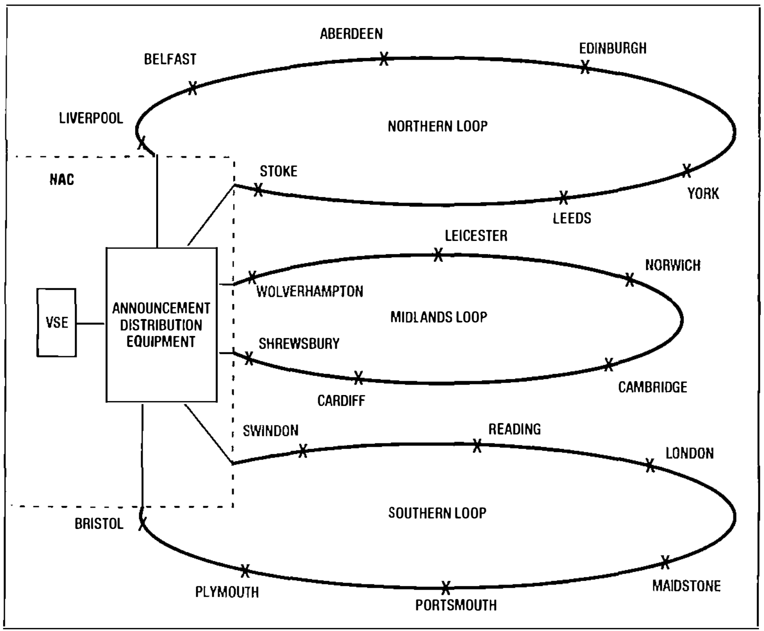
Installation of MAUs within each RAC will enable all RAC equipment alarms to be extended to the NAC. This arrangement will provide centralised visibility of the status of all MRIS equipment.

RIDE System Management Unit (SMU)[7]

The RIDE SMU consolidates the control terminals required by the DSN and DMSU RIDEs, by interfacing the eight RISCPs to a pair of work stations which provide the operator with a common window-based management system.

Enhanced NAC–RAC Communications Network[7]

The introduction of the auxiliary switch OPRA created the need to transmit large amounts of data between the RACs and the NAC. The existing KiloStream links were unable to handle this, and so a new strategy was undertaken to create an RAC local area network and connect this to the NAC local area network via the communications network, effectively creating a wide area network (see Figure 10). The enhancements to the communications network to do this involve replacing the PMUXs with intelligent network multiplexers, which have a variety of interfaces (X.21, analogue 2-to-4 wire and 2 Mbit/s) and provide centralised control and route creation.



NAC: National announcement centre
VSE: Voice services equipment

Figure 8
DMSU RIDE loop configuration

The wide area network creates a secure platform (with automatic rerouting upon link failure), which can quickly and easily accommodate growth and new service equipment.

ACKNOWLEDGEMENTS

The authors would like to thank Andrew Jones and Tony Warren for their help in the preparation of this article.

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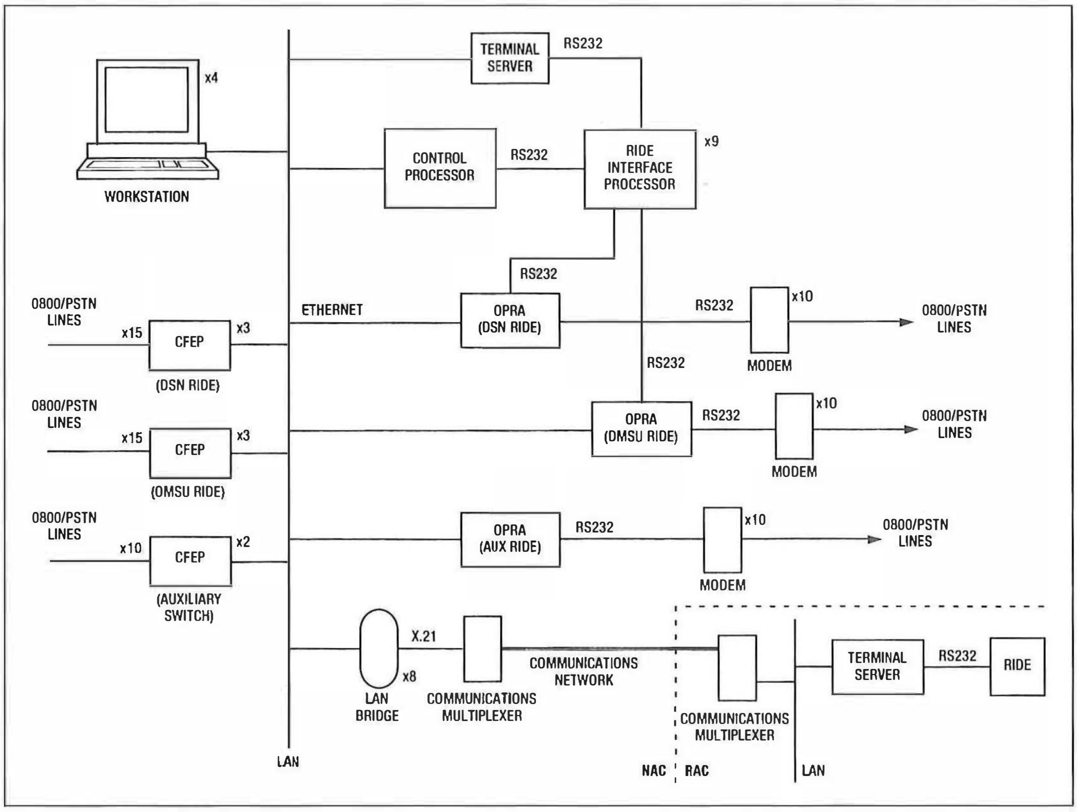
Figure 9
Future MRIS control and statistics architecture



CFEP: Caesar front-end processor
DSN: Derived services network
DMSU: Digital main switching unit
NAC: National announcement centre
OPRA: Opinion poll registration application
RAC: Recorded announcement centre
RIDE: Recorded information distribution equipment

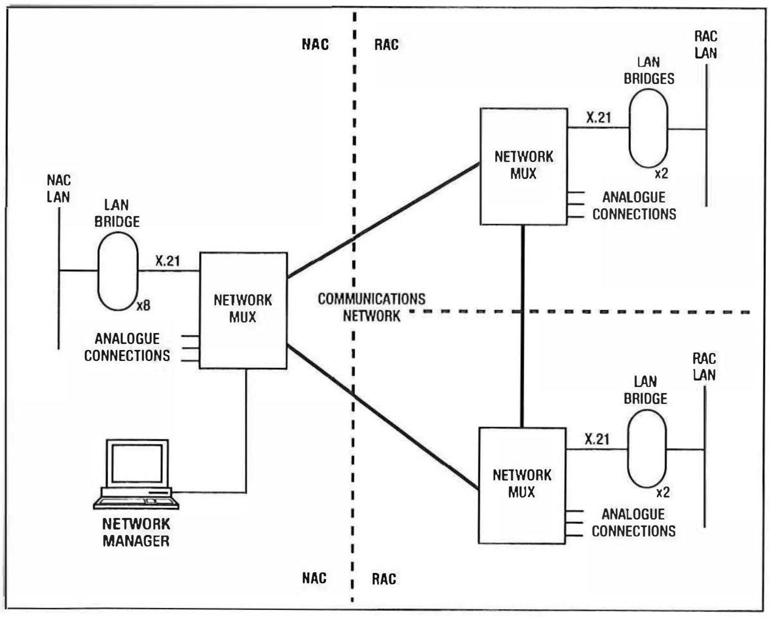


Figure 10
Enhanced NAC–RAC communications network

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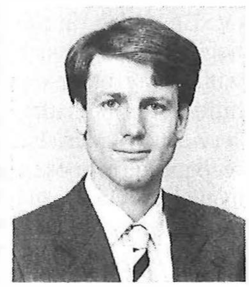
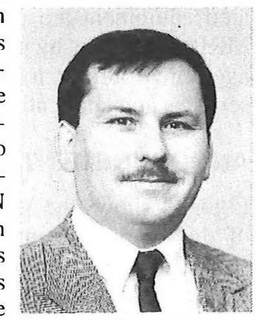
Biographies



John Shepherd joined BT as a technician working on electronic exchanges. He then worked for several years on a traffic duty, where he was dimensioning new exchanges. On becoming a manager, he moved to Headquarters, where he worked on digital exchange specifications and tendering. After further promotion he moved to the MRIS project team, and led a small team responsible for specifying the technical requirements of the equipment and networks used. He is currently with the Specialised Networks project team. He obtained an open university degree and is an associate member of the IEE and BIM.



Kevin Bosher joined BT in 1974 as an apprentice. His first job was in Telex exchange construction. On the inception of National Networks, he was transferred to the group responsible for installing the analogue DSN switches in London. From here he entered the works planning group with duties associated with the DSN. He was promoted to manager responsible for the Central Office planning duty in Network Planning and Works. This has involved planning the MRIS equipment, including the DSN RIDE and DMSU RIDE for the London code change.

Sourcing Voice Services

Voice Services Equipment, Auxiliary Switch and Voice Applications

NIGEL CRISP†

The prime source of voice services in the managed recorded information services (MRIS) environment centres on voice services equipment (VSE). This article describes the many aspects of VSE, from its capabilities and development, through to its continuing market-led enhancements. The article shows how the VSE is configured for MRIS and, in particular, how it is used, alongside the auxiliary switch, to provide a highly-efficient means of giving service to customers. Emphasis is placed on the service applications as perceived by the calling customer and the service provider, showing how the MRIS service offerings range from simple passive messages to complex generic applications and how, from an engineering sense, the capabilities of voice services continue to evolve to match the emerging requirements of customers.

INTRODUCTION

Ten years ago, recorded messages in the telephone network were generally restricted to non-start-at-the-beginning announcements provided by mechanical tape recorder technology, as that was the only way to make the information available at the calling capacity required. Over the intervening years, new technology has enabled the development of voice services equipment (VSE), which, in turn, has enabled start-at-the-beginning announcements as the norm, together with many other new features and new capabilities for both the calling customer and the service provider. In particular, highly reliable recognition of spoken words has recently become available, which can be used cost effectively in a multi-channel manner.

All these developments, prompted by new technology, have stimulated the market for voice services and, in recent years, have resulted in a complete cultural change in the provision of managed message-based services. Hence managed recorded information services (MRIS) have become possible.

This article shows how the VSE and associated equipment are used to meet the needs of MRIS customers by providing an efficient managed environment to source a variety of voice services and applications.

ANNOUNCEMENT CENTRES

Figure 1 shows the VSE within the architecture of the announcement centres. The VSE is installed in two general locations: the national announcement centre (NAC) at Oswestry, and at the recorded announcement centres (RACs), which are collocated with each of the derived services network (DSN) switching centres.

† BT Development and Procurement

VSE at the RAC

The RAC provides the gateway for directing the calling-customer traffic to all VSEs.

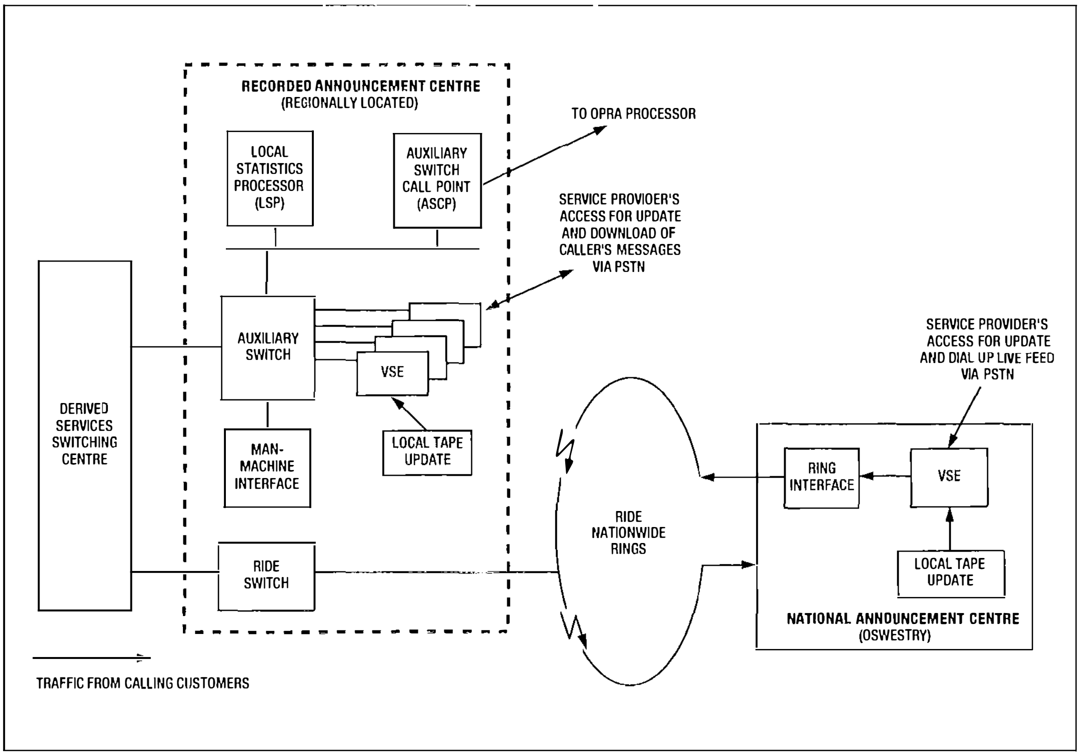
The VSE installed in the RACs generally handles services taking medium-calling-rate traffic; the traffic is connected via a flexibility point, known as the *auxiliary switch*. The services provided in this manner can be interactive with the calling customer and can capture information left by the calling customer. The VSEs at the RAC also have dial-up access from the service provider for both updating services and downloading messages left by calling customers; this access is controlled by special procedures described later in this article. Audio update locally from tape is also provided. Call statistics for provision to the service provider via the opinion poll registration application (OPRA)[1] are conveyed via the auxiliary switch call-point processor, and statistics for operational purposes are provided by the local statistics processor.

VSE at the NAC

Some VSE is provided centrally at the NAC, with the services distributed to the RAC via digital transmission rings and connected by using recorded information distribution equipment (RIDE)[2] switches. This provides a highly effective means of handling traffic to the high-calling-rate services, but because these switches are unidirectional in transmission-carrying capability, interactive services cannot be connected in this way.

Live feeds can be provided, which effectively puts the VSE in a switched feed-through mode to allow the service provider to provide, for example, a commentary on a sporting event; this feature is described in more detail later in this article under the RUD/DULF procedure.

Figure 1
VSE in the announcement centres



RIDE: Recorded information distribution equipment
OPRA: Opinion poll registration application
VSE: Voice services equipment

VOICE SERVICES EQUIPMENT (VSE)

The VSE is the heart of voice services provisioning for MRIS, since it is where the services are formulated and where the voice message information is stored.

The basic requirements of VSE are that it should connect to the switched telephony network, answer incoming calls and play the recorded messages starting at the beginning. The VSEs used for MRIS are exclusively provisioned as 30-channel units with each incoming channel operating and providing service asynchronously and independently of any other channel.

The design of the VSE has relied heavily on computer technology for its development and continued evolution. In particular, high-speed processors, hard disc technology and high-capacity solid-state storage devices have made highly-flexible announcement equipment possible.

In the very earliest VSE, messages were selected purely on the channel to which the incoming call was connected. As the market for voice services grew this proved to be inefficient and restrictive, and now all VSE selects services on either two or more direct-dial-in (DDI) digits passed from the network; these digits usually correspond to the last digits of the number dialled by the calling customer.

All VSEs used for MRIS are designed to work in a secure operational environment, operate from the exchange battery supply, interconnect with the exchange alarm scheme and comply with the appropriate safety and electromagnetic compatibility requirements. The need to keep service downtime at an absolute minimum is of high importance in choosing VSE for MRIS.

Since the first developments of VSE in the early-1980s, three generations of equipment have become established, offering more and more flexibility and future-proofing to keep pace with the market requirements.

First-Generation VSE

The first-generation VSE (VSE1) offered a basic message replay capability with functionality embedded in the main equipment software. The operation is simple: on connection of the call, the DDI digits select the message, which is then played a predefined number of times before the call is completed. Messages are always loaded directly to the VSE1 via a tape recorder interface.

One of the earliest VSE1 products grew out of a BT-sponsored development for a voice services platform which was carried out during the early-1980s. After various developments in the emerging MRIS environment, the platform became a product known as *Talon*. The architecture thus developed set the pattern and the principles for subsequent VSE design; that is, computer hardware with non-volatile hard disc storage using dual main/stand-by format, which is controlled by a processor handling 30 channels of service simultaneously. The Talon VSE1 connects via 2048 kbit/s bearers, uses 2-digit DDI to select from 100 services, can store up to 250 messages and has storage space for up to 4 hours of audio information.

When the VSE1s were first installed, they were connected directly to the main network switch and only later were the auxiliary switches connected in between to give an added dimension of flexibility.

Second-Generation VSE

The main restriction of the VSE1 is that its functionality is embedded in the software. This means that, although the content of the recorded message can change, the form of the service is fixed and cannot be changed or altered without major development by the VSE manufacturer. With the second-generation VSE (VSE2), while the equipment actually has no service functionality initially, users can define and install services of their own form and functionality. This is achieved by the use of a service definition language, which enables the user to produce high-level application software to extend the simple replay-message type of service in a number of ways including:

- controlling the number of message replays;
- constructing the services in a multi-message format;
- generating specialised statistics;
- recognising audio signals and activity from the calling customer; and
- selecting messages from a portfolio.

The coding scheme used to store audio data on a disc is continuously variable slope delta modulation at 32 kbit/s, which is a comparatively simple coding scheme giving good-quality reproduction. Dual discs are provided for security and designated as main and stand-by. Information is written to both discs and played back from the main disc; however, if the main disc fails, the VSE automatically switches over to the stand-by disc for replay; on the first generation VSE1, the change-over is manual.

The VSE2 has a much greater storage space than the VSE1: it can hold up to 1000 services, and has a maximum of 8000 messages, with up to 23·5 hours of audio available. The VSE2's interface to the network switches is via standard two-wire analogue with DDI signalling. Standard BT incoming signalling conditions are used; that is, the line potential is sourced by the equipment, and the potential is reversed on answer of the call and removed during back-busy conditions.

Messages can be loaded from a collocated tape recorder by using special record ports, but by using the service definition language, messages can also be loaded from the normal traffic channels.

Third-Generation VSE

The VSE3 is a state-of-the-art development which has much in common with the VSE2, and includes the main functional features of the VSE2. The main features of the VSE3 are:

- the services are defined by using the same service definition language as the VSE2, but with enhanced capabilities;
- the ability to fully interconnect in the digital domain;
- better future-proofing capabilities;
- faster processing; and
- easier maintenance.

More channels are available for a given footprint: one cabinet holds four VSE3 units and serves 120 channels, compared with 60 channels with the VSE2 and 30 channels with the VSE1.

Figure 2 shows a VSE3 cabinet, which stands 1·8 m high.

The audio coding scheme used is adaptive differential pulse-code modulation at 32 kbit/s, to CCITT Recommendation G.721, and offers reproduction close to that of the transmission network. The storage is 47 hours per 30 channel unit, in duplicated disc mode, and the unit is able to handle 32 000 audio messages and 10 000 services.

One particular advantage of the VSE3 is its ability to provide quality speaker-independent voice recognition, for recognising the words 'yes', 'no', 'zero' and the digits 'one' through to 'nine' all as separate words.

VSE Cluster

VSE units are each able to handle 30 channels of simultaneous and independent traffic, but the

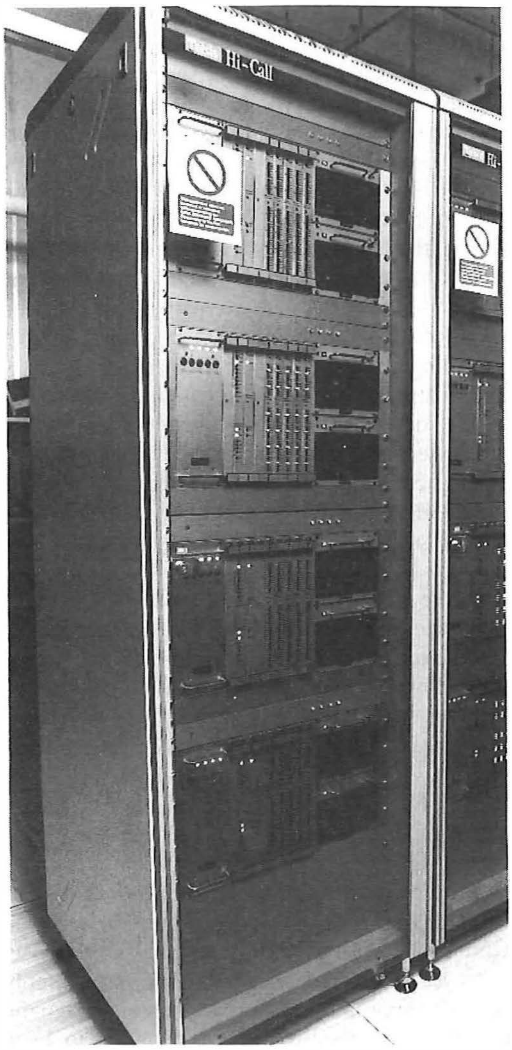
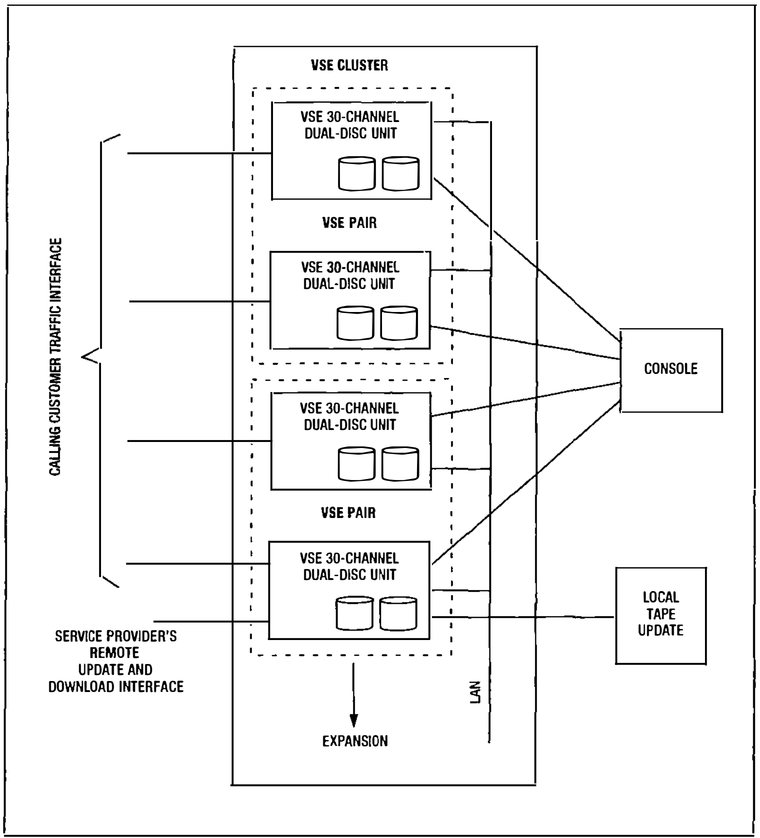


Figure 2
VSE3 cabinet



LAN: Local area network VSE: Voice services equipment

Figure 3
VSE cluster

VSE2 and the VSE3 have the added advantage that the basic units are able to be interconnected by using a local area network and hence form a VSE cluster.

The advantages of clustering are:

- audio files are easily transferred between 30 channel units;
- voice applications are easily transferred between the units in the service definition language code;
- data can be copied between units; and
- given services may be easily made available on greater than 30 channels.

Figure 3 shows diagrammatically the form of a VSE2 or a VSE3 cluster in the RACs. Generally, four-unit clusters are used, and for added security of service provision, given services are duplicated on each unit within a VSE pair.

VSE Console

A complete cluster of VSE2s or VSE3s is controlled from a single console, which for security is connected separately to each VSE unit, independent of the local area network.

The console allows the MRIS administration to:

- provide general administration of the VSE;
- define the voice (application) services by using the service definition language;
- allocate incoming service (DDI) numbers to the defined voice services;
- achieve central activation of the voice services;
- gain access to local statistics; and
- provide local control of audio file record and review.

Remote connection to the console is also possible by using modem access. This has the advantage that second-line support can more easily be given from the central operations unit at Oswestry, including the ability to install voice services at the RACs remotely.

Messages may be recorded onto the VSE from a collocated source such as a tape recorder by using the console to control both the recording and the review.

Service Definition Language

The fundamental advantage of using the VSE2 and VSE3 is the ability for BT to develop services to MRIS requirements on equipment which is basically a proprietary type. The service definition language that gives this ability is not at too low a level to be time consuming and complex to use and not at too high a level to be over-restrictive in the functionality provided.

In its simplest form, the language is activated by an incoming call and consists of a *play message* command, which could be followed by a *jump* command to return to the *play* command and repeat the message again. The language allows this simple structure to be expanded to enable a set number of replays, or play another message, or clear the call down and so on. For the MRIS services, the resulting programs are considerably more complex than this simple example and take account of many added features including file management, system administration and special statistics.

Examples of the types of commands in the service definition language used in the VSE2 and VSE3 equipment are:

- play audio file;
- record audio file (message) from incoming call;
- detect and recognise dual-tone multi-frequency (DTMF) digits;
- detect audio activity and spoken words;
- detect end of audio activity; for example, to stop recording an incoming audio file;
- activate speaker independent recognition;
- jump to subroutine or to another service, depending on a detection criterion; and
- general algorithm control features.

By using the service definition language it is possible to update messages remotely by using a dial-up circuit over the public switched telephone network (PSTN), controlled by DTMF inband signalling. With this method, there is an automatic level control system in the VSE to take account of network attenuation and variations in the level of the source material and hence to provide a reproduced audio level suitable for high-quality messages.

AUXILIARY SWITCH

In providing the MRIS capability at the RACs, service provisioning must be flexible so that changes, in the traffic generated by the calling customers and the changing needs of the service provider, can be quickly and efficiently coped with. This flexibility point operates as a means of directing traffic and selecting channels and services, the objective being to make the RAC environment operate efficiently and to allow the operations people to be alerted to changes in traffic profiles. This allows a quick response for adapting local traffic handling capabilities to the changes.

In simple terms, this requires a switch, but this switch needs to be designed for the specialised MRIS environment for control of voice services, by, for example, relieving the relatively expensive VSE from performing pseudo-switching tasks. This has resulted in the *auxiliary switch*, which has been developed to MRIS specifications. These specifications have been produced by the Speech Applications Division of BT Development and Procurement. The equipment, shown in Figure 4, stands approximately 1·3 m tall and is designed to operate in a typical operational environment.

In the RAC environment, the auxiliary switch connects to channels from the DSN and forwards calls as necessary to the VSEs. The route translation capability of the auxiliary switch is designed to minimise the translating needed in the main network and to maximise the traffic on the VSE channels.

Without the auxiliary switch, channels to the VSE would be directly related to channels from the DSN, and hence, in terms of traffic handling, this would lead to a constrained structure and inflexibility in responding to real-time traffic needs. With the auxiliary switch, the traffic, which is offered for voice services, can more easily be guaranteed to progress to an answered state.

Also, with traffic being channelled via the auxiliary switch, statistics for managing the RAC environment may be more easily and more usefully gathered. The auxiliary switch also gives a common access for gathering OPRA statistics.

In many ways, the development of the auxiliary switch has removed the need to develop bigger VSE, which otherwise would be essential to cater for increased MRIS traffic. Hence, since the auxiliary switch provides a flexible front end for the incoming traffic, the developments to the VSE have been able to concentrate on voice features rather than traffic carrying capabilities. In the MRIS environment, the auxiliary switch is the location where calls are answered, and hence call progress tones are inserted at this point.

Architecture

An auxiliary switch comprises three switch modules, each module having 300 channels connected in the form of 10 groups of 30 channels. Each group of 30 channels includes an interface unit, which determines the signalling system provided at that periphery of the switch, including whether the signalling is incoming or outgoing. One aspect of the future-proofing of the switch is that the interface units can be replaced by functional units; for example, DTMF digit detectors. The switch modules and the interface units, shown in Figure 5, together form a complete auxiliary switch of 900 channels. Generally, the auxiliary switch operates in a totally digital environment. All incoming channels and most of the outgoing channels connect via 2048 kbit/s bearers; hence for connection to VSE with analogue interfaces, primary-order multiplexers need to be used.

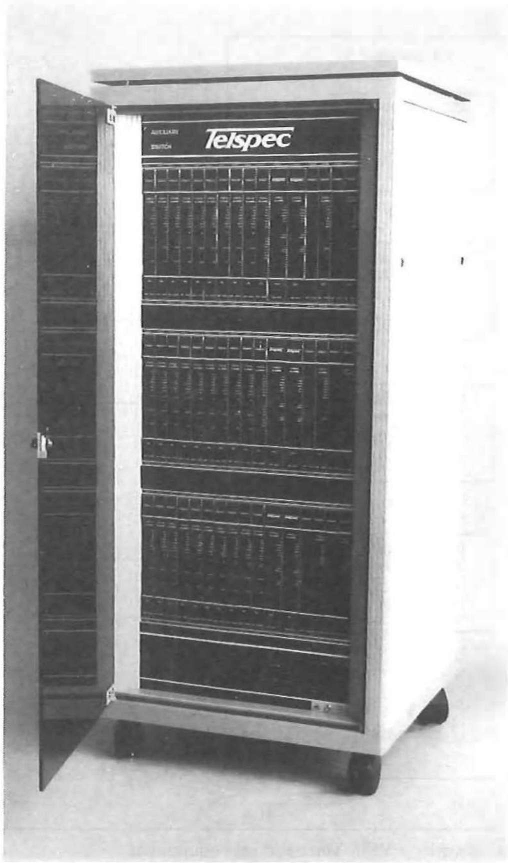


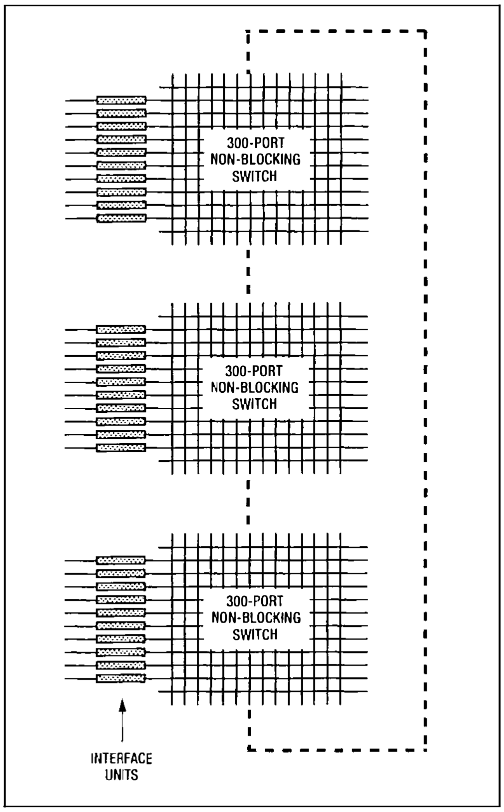
Figure 4
Auxiliary switch

The 2048 kbit/s interface operates on channel-associated signalling with a number of signalling systems available, although the usual one for the MRIS network is the DDI (A1/B1) system. Common-channel signalling systems are in development for the auxiliary switch.

Synchronisation

Two of the 2048 kbit/s bearers from the DSN are designated as main and stand-by for synchronising the auxiliary switch to the network; for synchronisation purposes, automatic switch-over occurs should the bearer providing synchronisation fail. Thus, the auxiliary switch takes synchronisation from the network and forwards that synchronisation to the VSE.

Figure 5
Auxiliary switch architecture



Reliability and Performance

The auxiliary switch has very high reliability: for total failure, the estimated mean-time-between-failures is 24 years. This is achieved by duplicating common functional areas. For each switch module, the central processing unit (CPU) provides the main processing and switching functions. The CPU is duplicated within a module, with each CPU unit holding the current database and the real-time call-connection map. Hence if the working CPU fails, the duplicated unit can automatically take over with the minimum disruption to service. The power supply unit for the switch module is also duplicated, each with separate power feeds from the exchange battery.

The auxiliary switch can handle 27 000 call set ups and 27 000 clear downs every hour.

Man–Machine Interface

Control is carried out by the auxiliary switch man–machine interface (AS/MMI) software, running on a processor external to the auxiliary switch, and connected to it via RS232, although in later systems a local area network is used. The primary function of the AS/MMI is to download configuration information and routing tables to the auxiliary switch. All call-handling and traffic-handling functions operate within the auxiliary switch, and so the AS/MMI could be removed and calls could still be handled as normal, albeit on the routing information loaded before the AS/MMI was removed.

The functions provided by the AS/MMI are at two levels:

- the technician level, and
- the user level.

Access to both these levels is separately password protected.

Technician Level

At the technician level, configuration data is programmed and all channels on the auxiliary switch are given logical identities for use at the user level. Information so programmed would be expected to remain stable with only infrequent downloading necessary to the auxiliary switch.

The technician level allows:

- the switch configuration to be defined;
- checks to be made on the interface cards installed in the switch;
- channels to be grouped and designated incoming or outgoing; and
- channel groups to be given logical names for reference at the user level.

User Level

The user level gives control of the routing tables, and hence relates the digits received on groups of incoming channels to digits sent out on channels selected from groups of outgoing channels. The routing tables are expected to be changed frequently, and since it takes a finite time to download routing tables from the AS/MMI, the CPUs in the auxiliary switch will hold two routing tables, one running and current, and another time stamped ready to become current at the defined time. In this way, the routing table can be changed over smoothly, without loss of calls. After change-over, the AS/MMI downloads the next routing table to take effect; if only one routing table is predefined or if an immediate change of routing tables is required, then this can also be achieved by the AS/MMI.

Routing Tables

An auxiliary switch can accept up to six DDI digits from incoming calls, and from these digits call-routing decisions can be made by reference to the routing table. Up to eight priorities of outgoing routes can be specified for each incoming digit sequence and the use of wildcard digits and ELSE conditions can be used to make system programming as simple, yet as flexible, as possible. Up to 10 outgoing dialled digits may be specified for each outgoing route and the routing table typically allows up to 1000 entries.

The AS/MMI calendar provides 3 months of advanced programming for up to 100 different routing tables, which are prepared either on the AS/MMI or on a remote terminal and transferred to the AS/MMI by using a floppy disc.

As an example, a simplified routing table is shown in Figure 6. The incoming group name is shown as 'CBRAC3' with a translation given against four incoming digits *345, the star indicating that the first digit is a wildcard and in this case is not used in the routing decision for the outgoing route. The first digit may be used as the regional identity for the OPRA statistics.

The OPRA number given in Figure 6—that is, '125'—is the service identity number. For the outgoing route, the table contains the priority number, the logical name of the outgoing channel group and the digits to be forwarded. In the example, there are three options, the first is at priority one which connects to channel group 'VSE3/A' and forwards digits '877'. When all channels in the priority one route are busy, then routing would be on priority two, and if all these routes are busy, then routing on priority seven would be used. There is a hidden priority which would give engaged tone if no routes are available.

As well as the priorities that are explicit in the routing table, there is also an implied priority for internal module routing. This means that at a given priority level, the switch always tries to route a call out on an outgoing channel that is connected to the same switch module as the incoming channel. If this is not possible, then inter-module routing could be used. In this way, it always tries to take advantage of the non-blocking characteristic of the switch modules.

Referring to the routing table in Figure 6, the lower portion of the screen is used for editing.

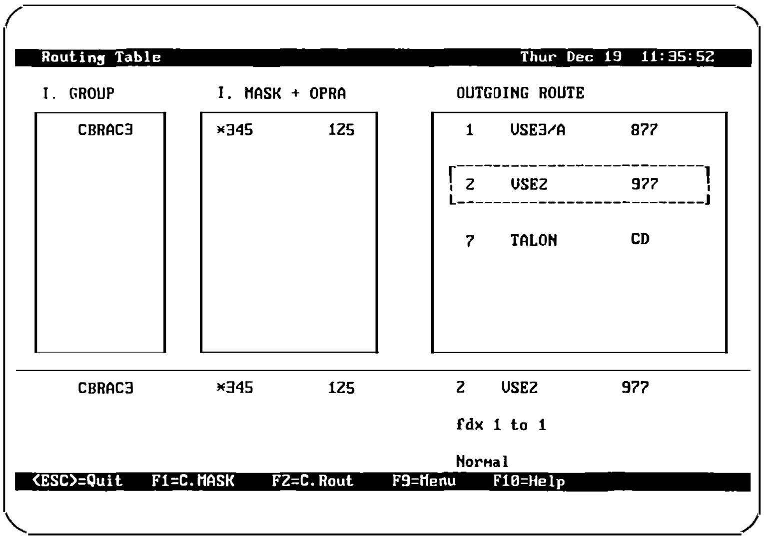


Figure 6 Simplified example of auxiliary switch routing table

Switching Functions

All incoming calls to the auxiliary switch in the RACs connect digitally by using A1/B1 channel-associated signalling; however the auxiliary switch can handle three types of outgoing call:

- outgoing to DDI connection;
- outgoing to a broadcast connection;
- outgoing to a wait-on-start connection.

DDI Connection

This is a connection between one incoming channel and one outgoing channel, with the auxiliary switch having the ability to forward up to 10 digits on the outgoing route.

Broadcast Connection

In this case, no DDI digits are forwarded, since a continuous audio feed is provided on the outgoing channel. Transmission is provided only in the backward direction and many incoming channels can connect to a single outgoing channel. The services thus provided are of the non-start-at-the-beginning form, such as for the live commentary of a sporting event.

The broadcast connection can be provided by using a special analogue live-feed interface card. This enables an added security of service feature, and with this feature the source feed can be duplicated to the auxiliary switch and designated *main feed* and *stand-by feed*. The auxiliary switch can operate such that if the main feed goes down for whatever reason, and/or the auxiliary switch detects no audio activity on that feed, then the switch automatically connects all calls to the stand-by feed.

Wait-On-Start Connection

This connection is analogous to the broadcast connection, except that, by controlling the access to DDI outgoing routes, start-at-the-beginning services can be provided in a broadcast manner. With this type of connection, incoming calls are queued on the auxiliary switch ring tone for a short period, before all calls in the queue are connected to a single outgoing DDI service. Because the queuing period has to be short, for example, less than 10 seconds, the connection can be used on high-calling-rate services to useful effect. Also in this situation, because a number of incoming calling customers are connected to a single outgoing route, wait-on-start cannot be used for interactive services.

Call Statistics

In early installations of the auxiliary switch, some compiled statistical information was available from the AS/MMI, primarily to assist the operations personnel in the management of traffic. Later requirements for central service provider access to call statistics, as part of the OPRA work[1], has instigated the development of a dedicated statistics interface on the auxiliary switch to provide raw information over a local area network. Because the information is in a raw form, it can not only be post-processed for the OPRA by using the auxiliary switch call point, but also be used to provide the local operations personnel with comprehensive information on the RAC traffic.

Raw Information

The interface, which conveys raw call statistical information from the auxiliary switch, contains messages of the following form:

- single call data for effective calls, containing the OPRA references, hold time, incoming channel and outgoing channel information;
- single call data for ineffective calls due to no answer, no outgoing routes or switch congestion;
- accumulated call data for successful calls, under circumstances of downtime on the statistics interface;
- accumulated call data for failed calls; and
- auxiliary switch database information.

Auxiliary Switch Call Point

The auxiliary switch call point performs post-processing on the raw statistics from up to eight auxiliary switches, correlates the information against service identity numbers and regional identity numbers and forwards the resulting data to the central OPRA processor at Oswestry.

Local Statistics Processor

The local statistics processor post-processes statistical information for use by the operations personnel, in order to ensure efficient use of the RAC environment.

VOICE SERVICES

The equipment and environment so far described offer considerable capabilities for providing MRIS services. To provide a managed service in an environment which is highly flexible, the resultant services must be carefully conceived in order to be manageable for the operations personnel and comprehensible to the service provider. If the service is provided, for example, by allocating areas of audio storage to the service provider, into which messages can be deposited, then the service provider must also be aware of how those messages will be accessed and heard by the calling customer.

To achieve this, the MRIS services must be generic and the service provider must have procedures to control the services.

Generic Services

The services as perceived by the service provider must be generic if they are to be manageable and can be described thus:

- generalised services, suitable for the requirements of a number of different service providers, yet flexible to fulfil a wide variety of requirements;
- services initially provided must be easy to install by BT, without the need to customise application software for every installation; and
- the interface to the service provider should be user friendly.

Replay-only services are clearly generic. The sort of services that would not fall into the generic category are highly customised services, such as adventure games, which would prove to be a significant overhead to support and maintain in a managed environment. However, a very wide range of services do fall into the generic category.

Procedures for the Service Provider

In providing MRIS services, the service provider must have procedures to update services and to insert information into the services provided to the calling customer.

In the case of the early managed services, which were replay only, the only procedure that the service provider had to follow was to transport a tape cassette to BT, for manual loading to the VSE. This type of procedure, although still used, can be restrictive for the service provider in terms of the time to update and the need to rely on carriers. To give the service provider a more controlled option, the remote update (RUD) procedure was developed. This procedure, which is described in more detail later in this article, allows the service provider to update his service remotely over dial-up PSTN lines by using DTMF inband signalling for control.

Two specialised forms of RUD procedure are also used:

- *Remote update/dial-up live feed* (RUD/DULF) enables the service provider to speak direct to the calling customers. This procedure is currently used only on services connected via the NAC.
- *Remote update/basic managed interactive service* (RUD/BMIS) gives a nested level of control for the more complex interactive services provided within the BMIS portfolio.

In the same way that the RUD procedure provides the service provider with the ability to update services remotely, so the remote download procedure (RDL) allows the service provider to recover remotely audio information captured as a result of calling customers accessing services. The type of information captured in this way would be, for example, names and addresses and purchase orders and for this, RDL avoids transferring the information to the service provider via tape cassettes.

Services for the Calling Customer

The services to the calling customer have developed from the non-start-at-the-beginning form, typical with tape recorder technology, to the start-at-the-beginning form which became possible with the advent of the VSE. Therefore, the common form of MRIS services is simply message replay.

More recently, the form of services, as perceived by the calling customer, has been significantly enhanced with the development of interactive services within the BMIS portfolio.

Basic Managed Interactive Services

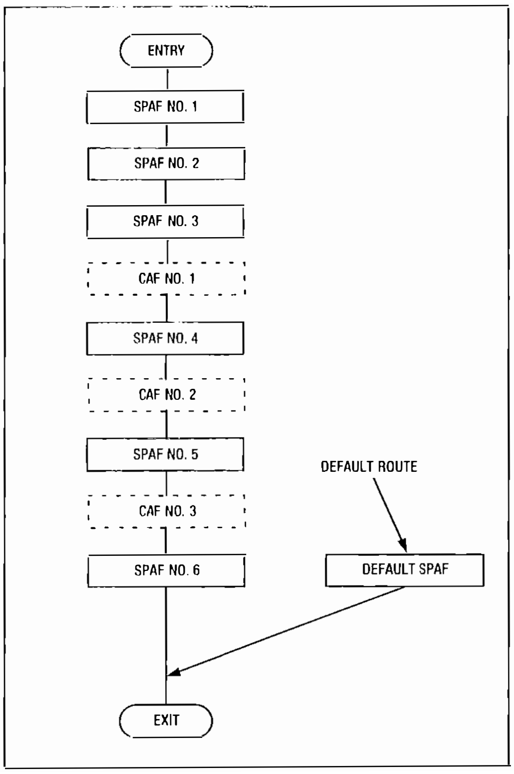
During 1991, BMIS has been developed to give MRIS services the ability to interact with the calling customer. In developing BMIS services, two new terms have been used for convenience of description:

- The *service provider's audio file* (SPAF) is a message played to the calling customer. The ordinary or pre-BMIS services are single SPAF services.
- The *caller audio file* (CAF) is a message left by a calling customer to be conveyed to the service provider.

The BMIS services are based on multi-message structures in which more than one SPAF can be serially provided to the calling customer. The service provider can update each SPAF independently of other SPAFs by using the RUD procedure. SPAFs can be repeated in a single service and can be shared between services. Although the multi-message structure is not itself truly interactive with the calling customer, it is an essential ingredient to achieving the interactive service structures. The essential features of BMIS services are:

- the use of CAFs interleaved with SPAFs;
- the use of branching structures, based on twin branching decisions determined by the calling customers responding by saying 'yes' or 'no';
- the use of branching within a multi-branch structure, with decisions determined by the calling customer responding by saying digits in the range '1' through to '9'; and
- a controlled mix of the above features. Control is necessary to retain the generic constraint and the manageability of the services.

Therefore BMIS service can be either of a non-branching or a branching nature.



CAF: Caller audio file
SPAF: Service provider's audio file

Figure 7 Typical non-branching form of BMIS service

Non-Branching Form of Service

Non-branching services are characterised by having single entry and single exit points and a single fixed path through the service. A typical non-branching form of the BMIS service is shown in Figure 7, which shows a number of SPAFs with three CAFs interleaved. When the services are installed, the exact number of SPAFs and CAFs are configured according to the service provider's needs, up to a maximum of eight SPAFs per service.

In cases where the CAF storage area is full and no more messages from calling customers can be stored, calls are automatically connected to the default SPAF, which will play a courtesy message or promotional message, depending on how the service provider has updated that SPAF. If the service provider wishes to do a major update to a number of SPAFs in his main service, he can force all incoming calls to the default SPAF, while the update is carried out. This can be done by using the enable/disable facility available within the RUD/BMIS procedure.

Non-branching services enable the service provider to receive information, such as names and addresses, orders for purchasing goods and entries to competitions. As an example of the service provider's service, the calling customer can be given information on products available for purchase and can then have the opportunity to leave his/her name and address in one CAF and be asked to leave a purchase order effectively in a second CAF.

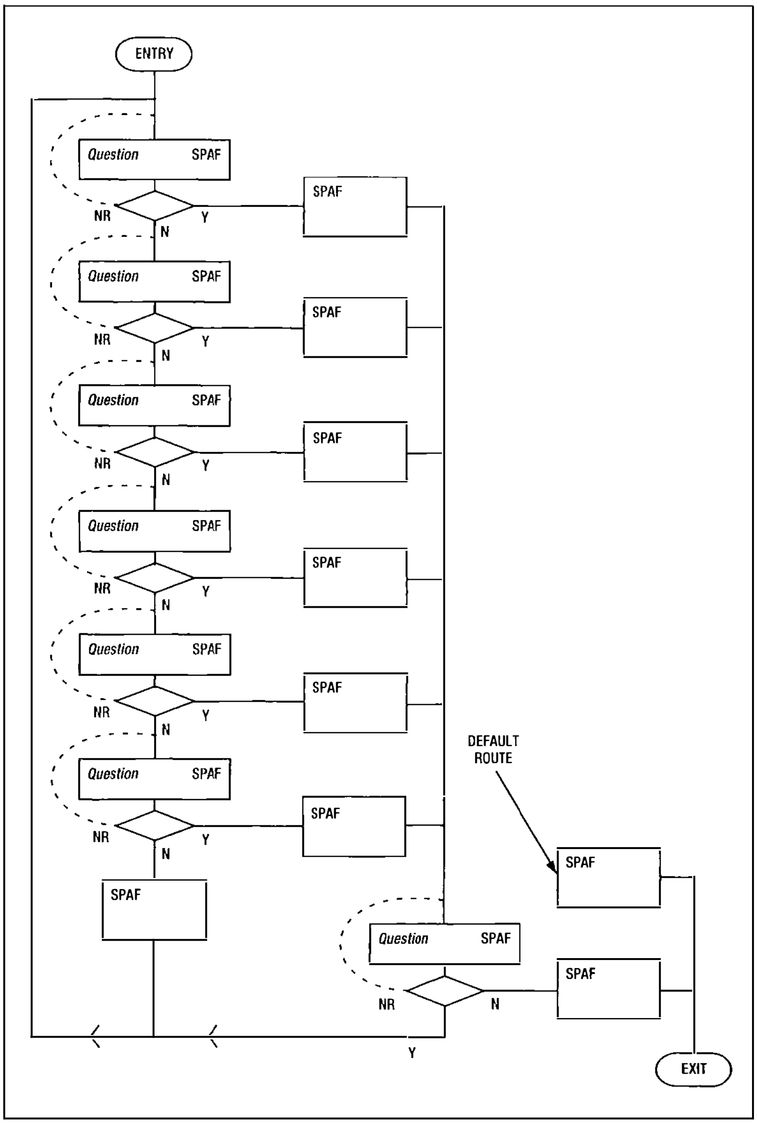
Branching Form of Service

BMIS services also offers the ability to make decisions based on voice responses made by the calling customer and then to branch within the service structure.

A typical branching form of a BMIS service using voice selection, is shown in Figure 8. Recognition of the words 'yes' or 'no' are used to gain access to the information. The number of branches are set at the time of installation to match the service provider's requirements. If the calling customer's voice cannot be recognised at first, a further two attempts are made, after which the default SPAF is played. Other branching services can use the recognition of spoken digits to choose the branch to be taken by the calling customer. CAFs can be inserted in the branches.

As an example of a service provider's service, the calling customer could be asked if he wants any information on the best buys in electrical goods. If he says 'yes', then a message containing information on electrical goods is played; if he says 'no', then other information can be given on other questions asked.

An example of an alternative structure, where the calling customer responds with numbers is,



SPAF: Service provider's audio file

Figure 8
BMIS service using voice selection

'if you want information on electrical goods, say one; for furniture say two; ...' and so on.

Remote Update (RUD) Procedure

The service provider accesses the RUD procedure by dialling a PSTN number to connect, this number being different from that dialled by the calling customer to access the service. Once the procedure has answered, the service provider signals by using inband DTMF digits. Throughout the procedure, audio guidance messages are provided to the service provider to help achieve the update in a user friendly manner. The guidance messages use a consistent voice and style to achieve quality procedures.

Figure 9 shows the RUD procedure in graphical form. The service identity code is first signalled, followed by a personal identification number (PIN). The following options are then available:

- digit 1 allows the service provider to record a message;
- digit 2 causes the newly recorded message to be played back and checked, before it is made available to calling customers;
- digit 4 causes the message currently available to the calling customers to be played;
- digit 3 allows the newly recorded message to be made available to the calling customers;
- digit 6 allows some statistical information to be played; and
- digit # generally halts execution of a previous command.

The RUD procedure as described has been available for a number of years and concentrates on the update of services containing single SPAFs. The procedure has more recently been developed to two further procedures; RUD/DULF and RUD/BMIS.

RUD/DULF Procedure

The RUD/DULF procedure is very similar to RUD, but has the added use of the '0' digit to enable the service provider to gain real-time broadcast access, to the calling customers, from within his update procedure. Currently the live-feed service, controlled by the RUD/DULF procedure, is only available over the RIDE[2] distribution network, where the VSEs are situated at the NAC.

The typical use of such a service is for sporting events, where the pre-recorded messages provide the pre-event and post-event information, but the service provider is able to provide live commentary while the event is in progress.

RUD/BMIS Procedure

The RUD/BMIS procedure, used for the BMIS services, develops the RUD procedure to operate at two levels, one level updates the individual SPAFs in the service and the second level acts on the service as a whole. This enables a complete review and provides control of the enable and disable facility.

Remote Down-Load (RDL) Procedure

The service provider accesses the RDL procedure in the same way as for RUD, including the use of a service identity and PIN. As with RUD, the service provider signals with DTMF and the procedure provides user-friendly messages for guidance.

The menu of options is noted below and shown graphically in Figure 10. All CAFs received in a single call are accessed as a single audio file referred to as a *caller entry*. When the RDL procedure is accessed, statistics on the number of caller entries currently held are given verbally to the service provider before the menu is entered. The commands available in the menu are as follows:

- digit 2 plays the caller entry, against a current entry pointer;
- digit 1 moves the pointer backwards one caller entry and then plays that caller entry;

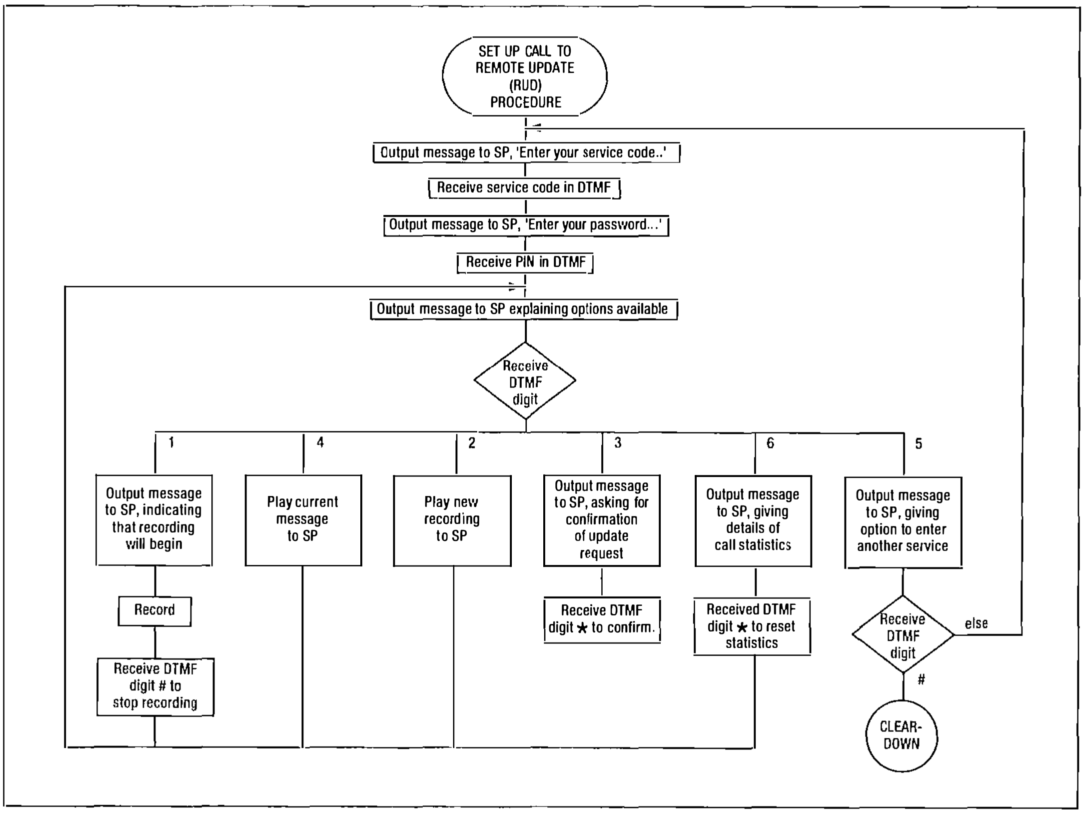


Figure 9
Remote update procedure

DTMF: Dual-tone multi-frequency PIN: Personal identification number SP: Service provider

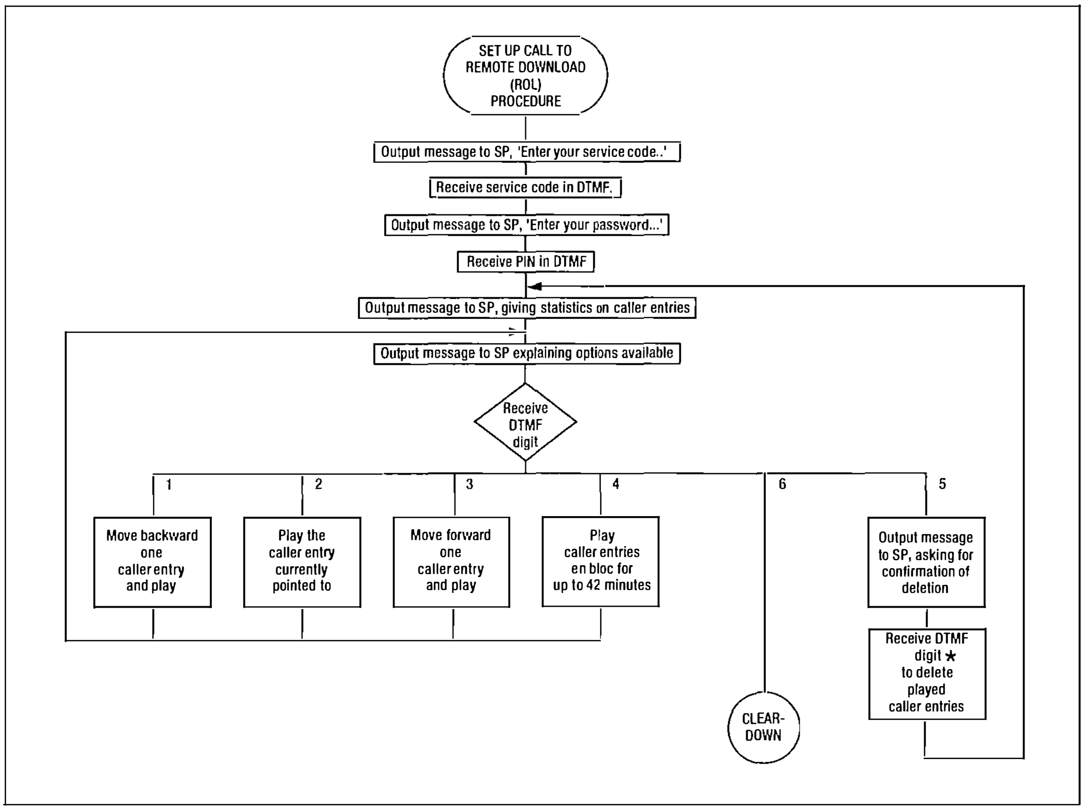


Figure 10
Remote download procedure

DTMF: Dual-tone multi-frequency SP: Service provider

● digit 3 moves the pointer forwards one caller entry and then plays that caller entry;
● digit 4 plays caller entries *en bloc*;
● digit 5 controls the deletion of caller entries;
● digit # generally halts execution of a previous command.

CONCLUSIONS

MRIS voice services have a solid, well future-proofed base of specialised equipment and special applications, and the infrastructure is tailored to meet the demanding needs of service providers wanting the many advantages of managed service. The market lead for new MRIS services has been strong and continues to be so and this in turn has produced a strong influence in the market of VSE.

This article has covered the voice services as developed at the end of 1991, but further significant features and facilities, not included in this article, are under development and are expected to become available during future years.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the hard work of colleagues in the Speech Applications Division, BT Development and Procurement, who have been actively involved in the work described in this article.

Acknowledgement is also given to Telspec Ltd of Rochester, Kent, for their contribution to the development of the auxiliary switch and to Telsis Ltd of Fareham, Hampshire, for their involvement in the provision of VSEs.

Note

Much of the equipment described in this article is based on proprietary products which have been described in the form used to meet BT's requirements. It should be noted that this article does not necessarily define or imply the full specification or the full capabilities of that equipment.

References

1 BOOMER, M. Opinion Poll Registration Application. *Br. Telecommun Eng.*, Apr. 1992, **11** (this issue).
2 ALLARD, E., and WARREN, A. RIDE: Recorded Information Distribution Equipment. *ibid.*, Apr. 1992, **11** (this issue).

Biography

Nigel Crisp joined the British Post Office in 1967 as an apprentice, and graduated from Middlesex Polytechnic with a honours degree in Electronic Engineering in 1973. He has been working on audio storage using computer technology since 1976 and led the hardware design of the System X automatic announcement subsystem in the late-1970s and early-1980s. Other work has included developments for Talon and the production of a feasibility study in 1985 where the current RIDE switch block was first described. Since 1987, he has been involved in the auxiliary switch, VSE and voice services developments and is now project leader for Callstream work within the Speech Applications Division of BT Development and Procurement.

RIDE: Recorded Information Distribution Equipment

ERIC ALLARD and TONY WARREN†

The recorded information distribution equipment (RIDE) system provides a highly-effective means of handling traffic to high-calling-rate managed recorded information services. This article describes the RIDE switch, the RIDE announcement distribution network and the control and management aspects of the system. It also details the start-at-the-beginning registration equipment (SABRE) and the start-stop generator, which enable RIDE to answer calls with start-at-the-beginning announcements.

INTRODUCTION

Recorded information distribution equipment (RIDE) is a system for providing economic mass access to recorded announcements and comprises a network of specialised fully non-blocking digital switches with a centralised management system. The system is designed for high availability for applications with a high customer profile, generating a large number of calls.

RIDE has been developed by the Switched Networks Division located at BT Laboratories, and was initially used at the London digital junction switching units to distribute Guideline services. The system has been further developed and the RIDE switches have now been installed in both the derived services network (DSN) and at digital main switching unit (DMSU) sites. Within the DSN, the RIDEs are located at recorded announcement centres (RACs) at the eight DSN nodes.

The use of the RIDE in the DSN enables recorded information service announcements to be distributed from a central location, the national announcement centre (NAC), to all the RIDE switches. Calls to the announcements are then delivered from the DSN to the local RIDE switches. This arrangement reduces the demand on the DSN's transmission and switching capacity by only switching calls through one DSN node to the RIDE switch. It also provides for a large number of answering points for the announcements. Without the RIDE, calls to popular announcements would be switched via DSN inter-nodal routes to the DSN node providing the announcement. This would result in many of the circuits on the inter-nodal routes carrying the same information, with the number of simultaneous calls to an announcement restricted to the number of access channels available on the recorded announcement machine at the particular DSN node.

The RIDE distribution network carries information in one circuit to all of the DSN exchanges, thus reducing the demand on transmission and switching capacity. Coupled with the greatly increased number of access channels provided by the RIDE switching nodes, this network significantly reduces congestion at periods of peak demand.

The RIDEs at the DMSU sites have been used to answer misdialled calls for the London code change, providing courtesy announcements to the callers. In the future, the DMSU RIDEs will be interconnected by ring distribution networks to allow the system to be used for distributing Timeline services, announcements for the forthcoming national code change and to support high-volume televoting services.

This article describes the basic RIDE switch and its distribution network. It also describes the start-at-the-beginning registration equipment (SABRE) enhancement to enable the RIDE to answer calls to the recorded information services with start-at-the-beginning (SAB) announcements, and the system management function required to control and manage the network of RIDE switches.

Announcement Distribution

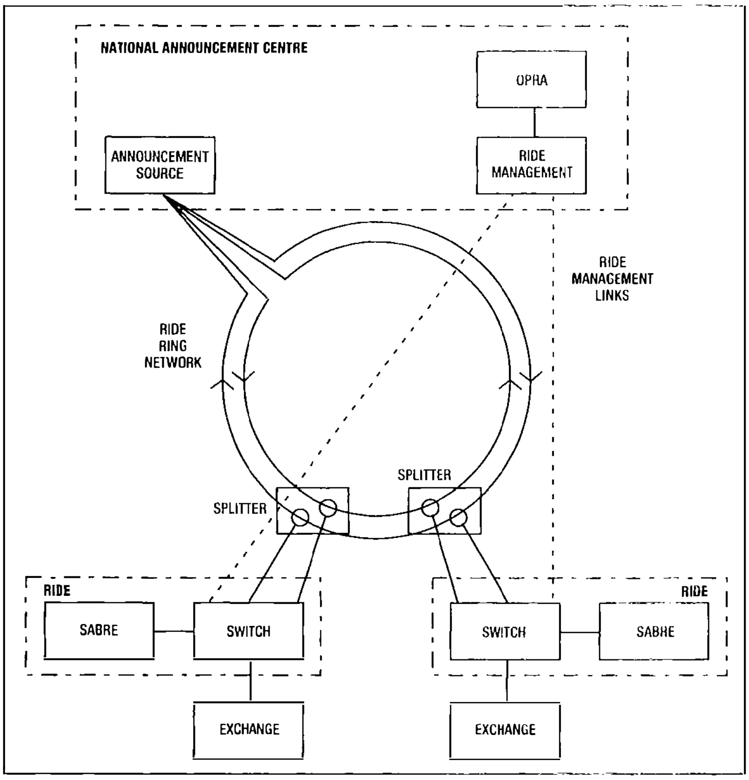
The recorded information announcements fed to the RIDEs are carried in 64 kbit/s channels of 2 Mbit/s pulse-code modulation (PCM) systems. These are connected to form a distribution ring which links all of the RIDE switching nodes. In practice, these systems are duplicated and use diverse routing over higher-order systems to maintain the distribution under fault conditions. Figure 1 shows this network.

Recorded announcements, by their nature, require only distribution, which would leave the return direction of transmission of the PCM systems unused. By using a ring network, both transmit and receive directions are available to distribute announcements, doubling the capacity of the network. The use of a ring also allows the returning announcement to be monitored to check the integrity of the distribution network.

Each RIDE switch obtains access to the ring network via 2 Mbit/s splitter equipment which provides 'tapped' 2 Mbit/s feeds to the RIDE switches, while maintaining the integrity of the ring network.

The recorded information services are fed from the NAC, at Oswestry, on four 2 Mbit/s rings connecting all eight RACs. A maximum of 120 messages can be distributed from the NAC

† BT Development and Procurement



OPRA: Opinion poll registration application
RIDE: Recorded information distribution equipment
SABRE: Start-at-the-beginning registration equipment

Figure 1
RIDE network

to the eight RACs, where the RIDE switches incoming calls to the messages.

Switching

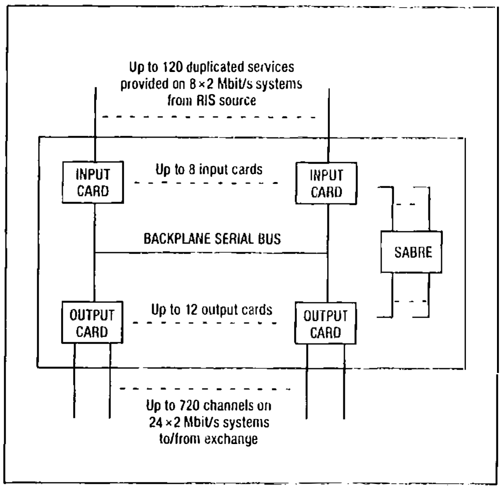
The services provided by the RIDE switches are non-start-at-the-beginning (non-SAB), which means that many calls can connect to the same announcement, but each new caller will probably start to listen to a partially completed message.

The RIDE network has been enhanced to provide it with an SAB capability. The enhancement consists of a modification to the software running on the RIDE network and additional equipment, called *start-at-the-beginning registration equipment* (SABRE), installed in each RIDE switch.

The SABRE system stores a copy of the non-SAB announcements in random-access memory (RAM). When an announcement is replayed to a customer, the SABRE retrieves the samples sequentially from the beginning. With this enhancement, the RIDE is thus able to answer calls with an SAB version of the distributed announcements.

Data on the calls to the various recorded services provided by the RIDE is collected and passed to the opinion poll registration application (OPRA) system[1]. This system allows the data collected to be accessed by the service providers.

Figure 2
RIDE switch



RIS: Recorded information service
SABRE: Start-at-the-beginning registration equipment

THE RIDE SWITCH

Overview

The RIDE switch uses digital switching based on a central broadcast bus. This arrangement allows announcements from the recorded information services feeds to be presented on the bus, and be accessed by a large number of calling channels. The system enables any number of calling channels to be connected to any announcement service, or all of the calling channels to any one announcement service.

The primary function of the RIDE switch is to connect calls from an associated exchange to the requested recorded information service. The recorded information services and the calls from the exchange are presented to the RIDE as digital 64 kbit/s channels within a 2 Mbit/s PCM system. The switching function is used to connect the calling customer's channel to the channel carrying the required announcement. The appropriate recorded information service is selected by interrogation of the dialled digits received in the channel-associated signalling carried by the 2 Mbit/s streams from the exchange. Figure 2 shows a basic block diagram of the RIDE switch.

The channels carrying the recorded information services are terminated on input cards, with one input card terminating a single 2 Mbit/s system. The maximum configuration of the RIDE will handle up to 120 duplicated services with eight input cards installed. Each input card converts the received signals to transistor-transistor logic levels and switches them on to the serial bus within the system. The first three input cards also provide the RIDE internal synchronisation and the synchronisation to its external 2 Mbit/s interfaces. An input processor is provided on each input card to provide control and monitoring of the 2 Mbit/s interface and other functions.

As an alternative to providing announcements from the ring via the input cards, the RIDE may also be equipped with announcement cards which provide the announcement source. Each announcement card provides five 65 s announcements onto the serial bus in the same way as an input card. These cards replace input cards 5 to 8 and therefore reduce the announcement channel capacity of the RIDE if they are fitted. To provide duplication of announcement sources, announcement cards are installed in pairs, with identical announcements recorded on each of the pair of cards.

The channels carrying the customers' calls from the exchange are terminated on output cards, each handling two 2 Mbit/s systems. Up to 12 output cards can be provided to give the RIDE a total call handling capability of 720 channels on 24 × 2 Mbit/s systems. Each output card has two digital time/space crosspoint switches, one dedicated to each terminated 2 Mbit/s stream. The crosspoint switches provide the switching function, connecting channels in the 2 Mbit/s streams to the recorded information service channels on the system's serial bus. The call-control function is provided by two output selection processors; an output selection processor is associated with a time/space crosspoint switch.

A request for a particular service is carried by dialled-digit information in the incoming signalling received by the RIDE, which connects the call to the appropriate service. Any service may optionally be prefaced by ring tone, a pre-announcement or both. The pre-announcement may be provided as SAB or non-SAB. This control data is held in a parameter table which is accessed by the output selection processor in setting up the call.

An important function of the RIDE is to provide management information for statistics, maintenance and diagnostics purposes. (The statistical information is also passed to the OPRA system.) This function is provided by a supervisory processor which has communication paths with all output selection processors, input processors and the SABRE control processor. The supervisory processor, in turn, is controlled from a management system that also allows operator control of the system. Figure 3 shows the connection of the processors.

The management system routinely requests system management information, including alarms and call statistics, from the RIDE and also sends control information to the RIDE to invoke further action. In response to these communications from the management system, the RIDE replies with the required information or with an appropriate response. A message protocol is used on the link between the management system and the RIDE to give an acceptable data transmission performance. Should the communication link or the management system fail, the RIDE is able to perform all telephonic functions in isolation.

Switching Function

The switching function is the primary function of the RIDE. It is provided by the input and output cards connected by the passive serial synchronous bus system. Figure 4 shows a block diagram of the RIDE switching function.

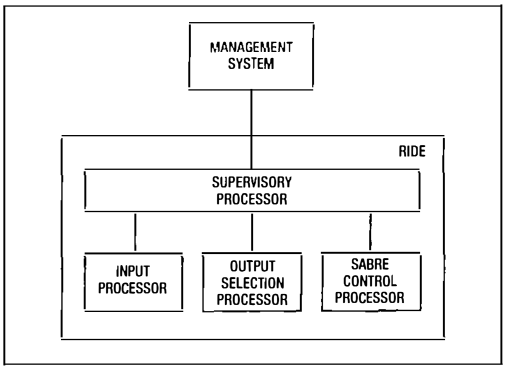


Figure 3
Connection of RIDE processors

Each input card terminates a 30-channel non-SAB recorded information service stream, aligns the data, and transmits it onto two serial synchronous bus lines. One bus line is connected to all of the output cards, the other direct to the SABRE. Separate bus lines are supplied for each input card. Two more bus lines from each input card, one connected to all the output cards, the other directly to the SABRE, carry a signal that indicates the 'health' of the recorded information service stream.

The arrangement allows the RIDE to handle up to 120 non-SAB services. The SABRE provides conversion of any 60 out of the 120 non-SAB services to SAB format.

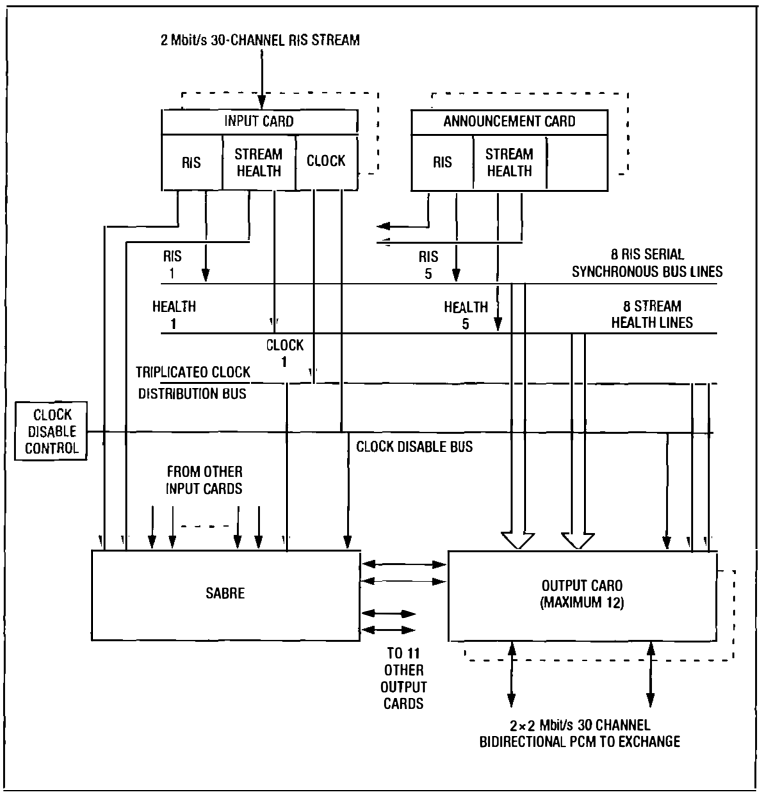


Figure 4
RIDE switch functional blocks

RIS: Recorded information service
RIDE: Recorded information distribution equipment
SABRE: Start-at-the-beginning registration equipment

The use of a synchronous bus system requires that clock signals are distributed with the data. The RIDE uses a triplicated clock scheme, with the clock generation on three input cards (cards 1 to 3) which are interconnected to ensure synchronisation of the distributed waveforms.

This arrangement of input cards ensures that failure of any one card does not affect the operation of the RIDE switch.

Each output card terminates two 30-channel PCM systems from the exchange, and has an output selection processor dedicated to each PCM system. The output selection processor inspects the signalling information from the exchange for the 30 speech channels and instructs its associated crosspoint switch to set up the appropriate connection. The crosspoint switch can connect any channel on the PCM system to any channel on any of the non-SAB serial bus lines, or to any channel in the SAB serial line from the SABRE. A maximum of 12 output cards can be plugged in to a RIDE.

Each output selection processor uses a separate serial line to instruct the SABRE to replay services in SAB format.

Failure or removal of any one output card does not affect the service on any other output card.

Failure of the SABRE prevents the RIDE switch from providing SAB announcements. However, the switch is still able to answer calls with non-SAB versions of the services affected.

Input Card

The input card terminates a 2 Mbit/s tap from the recorded information service ring, and the 30 speech channels are connected through a time/space crosspoint switch and then buffered onto a serial backplane bus to output cards and a serial line to the SABRE. The switch device is not used to perform a switching function, but is used to allow the input processor to access the alarm and signalling conditions generated by the PCM interface. If the alarm conditions indicate a particular stream is faulty, the input processor signals this to the output cards and to the SABRE.

The PCM signalling is monitored to detect START and STOP of service replays, and an indication of the replay status is passed to the SABRE over the serial line.

Each input card has the ability to synchronise a local oscillator to the recorded information service stream, but this facility is only used on the first two input cards. The first three input cards combine to form a triplicated clock and waveform generator to supply the rest of the RIDE switch. Two waveforms are distributed, a 4·096 MHz clock and a frame vector.

The distributed clock and frame vector are used by various devices on the input and output cards and the SABRE cards. Each card uses majority decision logic to obtain a single clock and frame vector from the triplicated distribution.

Announcement Card

An announcement card provides five fixed announcements that are buffered onto a serial backplane bus. Each of the announcements is stored as 8-bit PCM samples in eight EPROMs. A counter is used to read out each of the locations of the EPROMs in turn. Data is simultaneously read from five EPROMs, one for each announcement, and fed to five parallel-to-serial convertors. The outputs from the five convertors are then multiplexed to give one serial output stream.

Output Card

An output card can connect a recorded information service, carried in any channel on any of the eight serial bus lines, or one of the two serial lines from the SABRE, to any channel in either of two 30-channel PCM connections to the exchange.

An output selection processor accesses the crosspoint switch over the processor address and data bus. Registers within the device allow the output selection processor to read and write signalling information for the PCM interface and the SABRE; read the alarm status of the PCM interface; and set up connections across the switch according to dialled digit information from the PCM signalling stream. The output selection processor determines the status of a particular non-SAB announcement feed by inspecting the 'stream health' status line associated with it.

If connection to a requested service is not possible, connection is made to number unobtainable (NU) tone. The NU tone is generated on the card and connected to one of the crosspoint switch inputs. A 'silence' tone (that is, the idle pattern) is also generated within the switch device and is connected to IDLE channels.

One input to and one output from the time/space crosspoint switch are used for switching calls from the exchange to a SAB announcement feed from the SABRE. Signalling information requesting the SABRE to play a particular message in a particular channel is sent to the SABRE, and an indication of the success or failure of the request is returned by the SABRE, which then starts the service playing, if available.

Supervisory Processor

The supervisory processor is a proprietary rack system based upon the STE bus. The bus master processing element is a single CPU card with on-board RAM, EPROM, serial I/O, and counter timers. There is also a system controller card to oversee the functions of the bus system. Additional memory is provided by a non-volatile memory board which also has a real-time clock capability. Nine 4-port intelligent serial I/O cards provide the interface to the input cards, output cards, SABRE and the management system link. Each intelligent serial I/O card includes a single CPU with on-board RAM and EPROM. A non-intelligent 4-port serial I/O card provides an interface to an optional printer. All communication links are serial asynchronous bidirectional RS232 connections.

RIDE Cabinet

Physically the RIDE switch is provided in a 19 inch free-standing cabinet. Input cards and output cards are provided in two shelves in the cabinet, interconnected by backplanes, one in each shelf, which in turn are interconnected by dedicated cables. 2 Mbit/s connectors are by 75 Ω cables that terminate directly on the backplanes.

Mounted above the shelves for the input cards and output cards is the supervisory processor.

The SABRE unit is provided in a shelf mounted at the bottom of the cabinet below the input cards and output cards.

Power for the input cards, output cards and the SABRE is provided from the 50 V DC exchange supply; power for the supervisory processor is 240 V AC mains.

Figure 5 illustrates the RIDE cabinet.

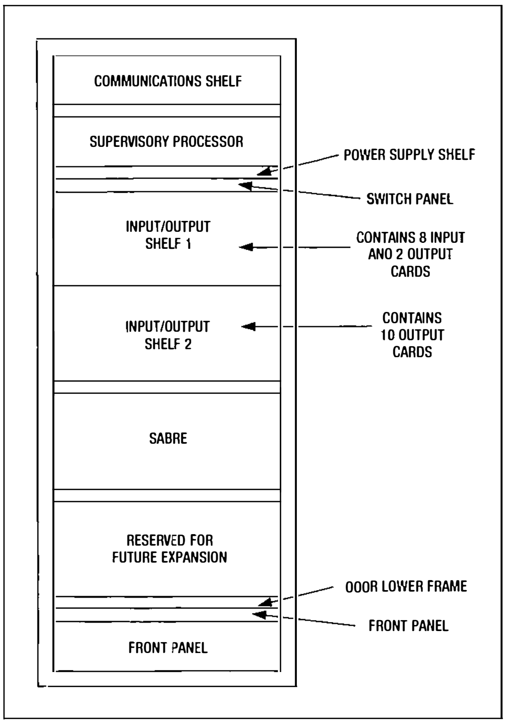


Figure 5
RIDE cabinet

SABRE

Overview

To enable the basic non-SAB RIDE to provide SAB announcements, it is equipped with a SABRE attachment. This stores a copy of the PCM samples of the non-SAB services in RAM. When an announcement is connected to a calling customer, the SABRE retrieves the samples from memory to replay the announcement as an SAB announcement. Figure 6 shows a block diagram of the SABRE.

A fully-equipped RIDE is provided with 120 duplicated announcements on eight 2 Mbit/s inputs. The SABRE can be configured to record up to 60 of these announcements. In the event of one of the duplicated inputs failing, or failure of the RIDE input card, the SABRE automatically records from the alternative input.

The selection of which 60 of the 120 services SABRE records is dependent on data held in an EPROM located on one of the SABRE cards. To change the selection, the EPROM device is replaced with a device containing the new selection data.

The maximum length of the messages that can be stored by the SABRE is fixed; 48 of the recorded services have a maximum length of approximately 4·3 minutes, the remaining 12 have a maximum length of approximately 8·6 minutes. The SABRE raises alarms if an attempt is made to record an announcement that is too long.

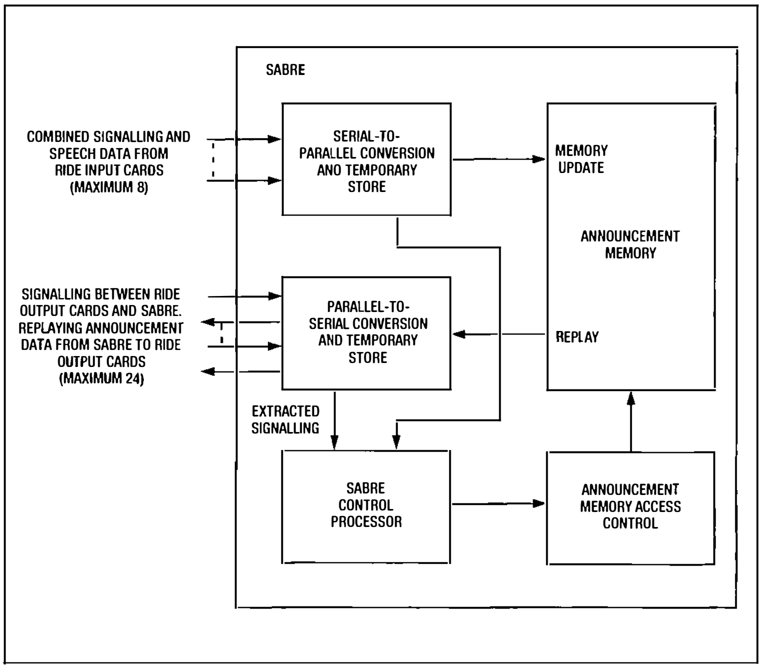
The SABRE enhancement enables the RIDE to connect all of the 720 possible simultaneous calls to SAB announcements. There is no limitation as to how many calls may be connected to any of the announcements, so if required, all calls could be connected to a single announcement, or distributed across 60 different announcements.

When the SABRE has replayed the complete announcement to the caller, it repeats it again from the beginning. This will continue until the caller clears down, or the RIDE output card force releases the connection to the caller.

The SABRE control is integrated into the RIDE control system. Alarms raised by the SABRE unit are passed to the management system, and commands to control the SABRE are available on the management system.

The SABRE has circuitry to check the integrity of the announcement storage memory.

Figure 6
SABRE functional blocks



Memory failures are reported to the management system. Under exceptional circumstance, calls which are destined for an SAB announcement that is unavailable because of a fault condition are connected by the RIDE output card to the non-SAB version of the announcement.

Recording Announcements

The voice service equipment (VSE)[2] at the NAC providing the recorded announcements continuously relays the repeating announcements in all channels of the 2 Mbit/s inputs to the RIDE input cards.

For each of the 60 channels selected for SAB conversion, services are supplied via the start-stop generator equipment, also located at the NAC. The start-stop generator indicates that an announcement is playing by setting a code in the signalling field of the 2 Mbit/s PCM multiframe for the channel carrying the announcement. For channels that have not been selected for SAB conversion, no signalling is required from the equipment, but if signalling does appear for these channels it is ignored.

Hardware on the RIDE input cards extracts the signalling from the multiframe and performs a persistence check. Software then compresses the signalling data which is to be sent to the SABRE. The channels containing the received announcements are transparently switched through the input card, combined with the signalling data and sent to the SABRE in serial data streams.

The signalling data from the RIDE input cards is extracted by the SABRE control processor to determine when a non-SAB announcement is about to repeat. The serial announcement data is converted to parallel format and held in a temporary store until it can be transferred to the announcement memory.

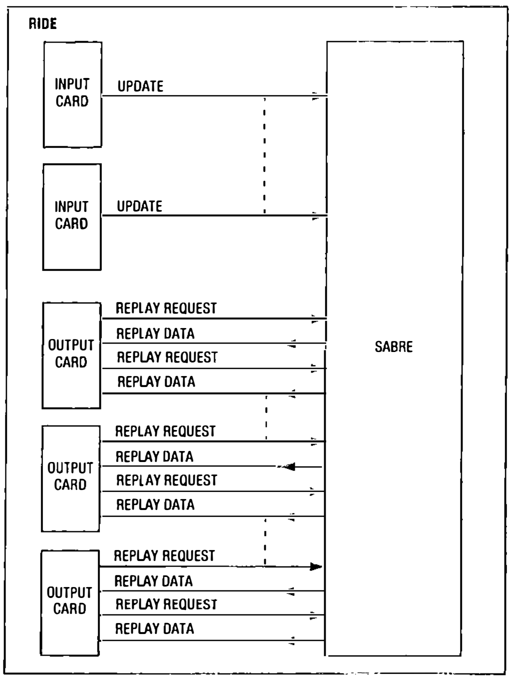


Figure 7
Connection of RIDE input and RIDE output cards to SABRE

The Announcement Memory

For each of the 60 announcements that the SABRE can record, a dedicated block of RAM is reserved within the announcement memory address range. When the SABRE control processor detects that a particular announcement is about to start, it instructs the SABRE hardware to record the PCM samples of the announcement sequentially in the RAM reserved for that announcement. However, access to the announcement memory is time shared between the 60 updating channels and the replaying channels, hence the need for temporary storage of the announcement data for each channel until it can be put in the announcement memory.

Replaying

An incoming call is handled by an output selection processor on a RIDE output card. The dialled-digits information allows the output selection processor software to determine if an SAB service is required. The output selection processor requests a particular announcement from the SABRE by sending a message to the SABRE control processor. The request is acknowledged by the SABRE control processor by a return message.

The RIDE is able to serve up to 720 simultaneous incoming calls, all of which may request an SAB service. For each replaying channel, the SABRE control processor instructs the SABRE hardware to retrieve samples from the memory allocated to the requested announcement, when it is the turn of that particular replaying channel to access the announcement memory.

The retrieved samples are temporarily stored until they can be converted to a serial stream and sent to the output card that requested them.

Interfaces

The SABRE is connected to the RIDE input and output cards by 2 Mbit/s serial streams. The bit stream is divided into a 32 time-slot format. The RIDE input cards also provide the SABRE with triplicated system clocks for the timing of these streams. Figure 7 shows the connection of the RIDE input and the RIDE output cards to the SABRE.

The eight connections to the RIDE input cards are unidirectional from the RIDE input cards to the SABRE. The 30 time-slots on each stream are used to transmit the non-SAB services to the SABRE, from which it records the PCM samples of the services. The remaining two are used to signal to the SABRE whether or not an announcement is playing in each of the 30 announcement channels.

The connections to each of the RIDE output cards are bidirectional. The 30 time-slots in each stream from the SABRE to the RIDE output cards are used to replay the requested SAB announcement; two time-slots are available in each direction for a message-based signalling system to set up the call.

The SABRE communicates with the RIDE supervisory processor over the bidirectional RS232 link. This is used to receive command instructions from the management system and to report alarm conditions.

Outline of SABRE Hardware

The SABRE consists of fifteen cards interconnected by a backplane, and a DC–DC converter to supply the cards with the required voltages from the exchange –50 V supply. There are five different types of card:

- signalling card,
- controller card,
- memory card,
- update card, and
- access card.

The cards are described below.

Signalling Card

The SABRE has a single signalling card that provides the interface to the signalling from the RIDE input cards, indicating that a non-SAB announcement has started to repeat, and signalling from the RIDE output cards to set up a call to a particular SAB announcement. The SABRE control processor, with its program memory, is physically located on this card, but can control peripheral devices that are located on other SABRE cards over the backplane.

Controller Card

The SABRE has a single controller card. Access to the announcement memory, where the announcements are stored, is shared between the 60 channels that need to write in new messages and the 720 channels that want to retrieve the stored sample. It is the controller card, under instruction from the SABRE control processor, that sets up the address and control lines for the memory cards for each channel in turn.

Memory Card

The SABRE has nine memory cards, each holding eight 4·3 minute announcement units, giving a total of 5·16 hours of announcement storage. The announcement memory is constructed from dynamic RAM devices.

Update Card

A single update card provides the SABRE with an interface to the eight streams of announcement messages from the RIDE input cards. It is on this card that the selection is made as to which one of the duplicated streams will be used to make the recording, and which 60 of the possible 120 different announcements will be recorded.

This card also temporarily stores the PCM samples until they can be written into the announcement memory.

Access Card

There are three access cards in the SABRE system. Each card provides the interface to four RIDE output cards over the replay data streams. The access card provides a temporary store for the announcement data retrieved from the announcement memory until it can be sent to the RIDE output cards.

START-STOP GENERATOR

In order to provide the SABRE with signalling to indicate the start and stop of an announcement, an additional piece of equipment, known as a *start-stop generator*, is used to provide this signalling, in conjunction with the VSE servicing the announcement. The start-stop generator communicates with the VSE to detect the start of the announcement, and then sets a code in the signalling field of the 2 Mbit/s PCM multiframe for the channel over which the announcement is distributed. This code is detected by the SABRE, as described earlier.

The start-stop generator itself is provided as a shelf of equipment provided at the head of the RIDE rings at the NAC. The start-stop generator is able to signal over 60 duplicated channels of the 120 duplicated channels distributed to the RIDEs.

SOFTWARE FUNCTIONAL DESCRIPTION

The software of the RIDE and the SABRE has its functionality divided into a number of functions spread across the hierarchy of processors. These functions are:

- *call handling* which covers all telephonic aspects and, in particular, monitors the time-slot 16 signalling from the exchange interface and connects calls accordingly. It runs only on the output selection processor and the SABRE control processor.
- *system management* which includes all non-telephonic aspects. This can be split into three main areas: alarms, call statistics and commands.
- *inter-processor communications* which is responsible for carrying all communication between processing sites. It uses special protocols between all communicating processors to ensure the reliable transmission of data.

SYSTEM MANAGEMENT

A hierarchy of processors is used to monitor and control the RIDE network. This allows the centralised collection of call statistics, centralised alarm monitoring and issuing of commands. Four of the processors in the hierarchy are within each RIDE switch:

● supervisory processor,
● input processor,
● output selection processor, and
● SABRE control processor.

Communication between the supervisory processor and the other processors is by means of serial RS232 links.

Overall system management of each RIDE switch is performed by a recorded information services control processor (RISCP), and the three system management functional areas—alarms, commands and call statistics—are described below.

Alarms

Each of the processors within the RIDE monitor their associated hardware areas and interfaces, and generate alarms if faults or exception conditions are detected.

The output selection processor generates alarms for the following:

● faults detected on the 2 Mbit/s PCM interface to the exchange, and
● faults detected on the interface with the SABRE.

The input processor generates alarms for the following:

● faults detected on the 2 Mbit/s PCM interface to the recorded information service ring, and
● faults detected in the synchronisation system.

The SABRE control processor generates alarms for faults detected within the SABRE hardware.

The supervisory processor generates alarms for loss of communications with other processors (output selection processor, input processor, or SABRE control processor).

In addition, each processor monitors itself for internal processor faults, and its associated hardware, and generates alarms if faults are found.

All alarm conditions are collected regularly by the supervisory processor, which builds a fault record for the RIDE. When requested, the fault record is passed to the RISCP by the supervisory processor.

Commands

The commands function allows an operator at the RISCP to interrogate and control a particular RIDE or a number of RIDEs.

The following types of operation are available:

● further interrogation of alarms information received to identify fully a fault within the RIDE,
● control of the RIDE call-handling function by which the operator is able to clear calls in progress, or prevent new calls from being handled, and
● requests for statistics information (configuration information, number of calls in progress etc).

Any commands request from the RISCP is received as an inter-processor message by the supervisory processor. The supervisory processor either acts on the request itself, or forwards the message to other processors for action. Once the required action has been performed, a response message is sent to the RISCP. If the required action cannot be carried out, an error message is sent to the RISCP.

Call Statistics

For every call that is completed on the RIDE, the output selection processor generates a statistics record. All output selection processors' statistics records are then, in turn, regularly collected by the supervisory processor for further processing. The statistics information is then made available in two ways:

● on a per-call basis output to an external printer connected to the supervisory processor, or
● as total calls and call duration to a particular recorded information service and fed into a statistics record. This record is passed to the RISCP, on demand, and is subsequently passed to the OPRA[1] system.

Recorded Information Services Control Processor (RISCP)

The RISCP provides centralised management of the RIDE, and can control up to 10 RIDE switches. It is based on a BT personal computer, equipped with additional cards to provide the serial ports for communication to the RIDEs. It also provides a serial connection to the OPRA system for the transfer of call-statistics information. Figure 8 shows the configuration of the RISCP.

The RISCP performs the following functions:

● it sends poll messages to its RIDEs every 30 s to collect alarm information,
● it sends poll messages to its RIDEs every minute to collect call statistics information which is then forwarded, on demand, to the OPRA, and
● it sends control information to one or all of its RIDEs in response to requests from the operator.

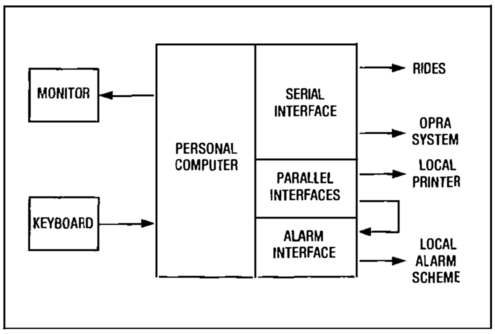


Figure 8—RISCP configuration

Man–Machine Interface

The RISCP also provides a man–machine interface (MMI) to allow an operator to interact with the RIDE system. A typical screen display provided as part of the MMI is shown in Figure 9. A banner is displayed at the top of the screen, and this shows the current status of all the RIDEs connected to the RISCP. The status shows if prompt or deferred alarms exist, and shows any alarms that have been marked RECEIVING ATTENTION. The remainder of the screen provides a dialogue area for display of commands entered into the system and responses received.

Control of the system is by keyboard entry and certain commands are password protected.

RIDE System Management Unit

In order to control the DSN and DMSU RIDEs from the NAC a total of eight RISCPs are required. The RIDE system management unit provides a rationalised approach, reusing the RISCPs to provide a system where all the RIDEs can be managed from a pair of workstations. The RIDE system management unit is described further in a separate article in this issue of the *Journal* [3].

ACKNOWLEDGEMENTS

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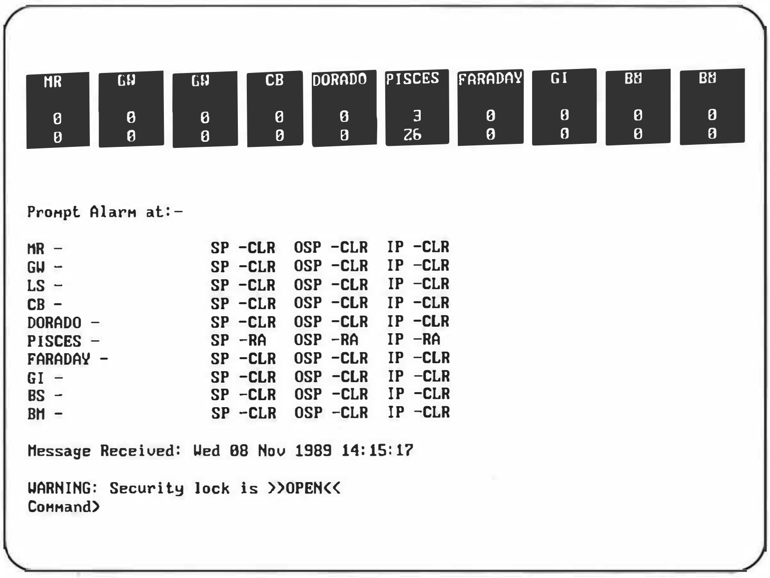
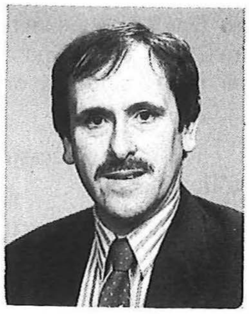
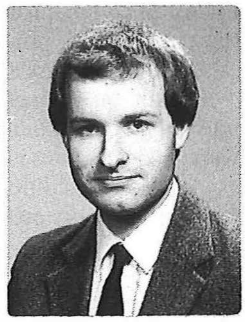


Figure 9—Typical RIDE MMI screen display

Biographies



Eric Allard joined the Post Office in 1966 as an apprentice, and as a technician worked on subscriber's apparatus and line maintenance duties. He moved to the Research Department in 1972, and since then has worked in a number of areas including the development of digital radio-relay systems, System X developments, and switching for private networks. Since 1986, he has been involved in the RIDE and OPRA developments, and now leads a group in the Intelligent Network Infrastructure Section within Switched Networks Division, located at BT Laboratories, responsible for these areas and other developments for Callstream, and future product developments for BT's evolving intelligent network. Eric has obtained the CEI Part 2 professional qualification, and is an associate member of the IEE.



Tony Warren joined BT in 1980 as a student, and graduated from Birmingham University, in 1984, having studied Electronics and Electrical Engineering. He then worked on various aspects of digital line interfaces, including the digital communications tester. More recently, he has contributed to the development of the SABRE, and is currently leading a team working on further enhancements to the RIDE. He is an associate member of the IEE.

Opinion Poll Registration Application

MICHAEL BOOMER†

The opinion poll registration application (OPRA) system collects call statistics data from recorded information distribution equipment (RIDE) and the auxiliary switch within the managed recorded information services (MRIS) platform. Service providers are then able to access OPRA to obtain statistics for their services. This article describes the services offered by OPRA and provides a history of OPRA's development and an architectural description of the present system.

INTRODUCTION

The opinion poll registration application (OPRA) system is a means of providing service providers with on-line access to call statistics for services delivered on the managed recorded information services (MRIS) platform.

Two OPRA systems are provided at the national announcement centre (NAC). One system collects call statistics data from the recorded information distribution equipment (RIDE) systems[1], in the derived services network (DSN), and provides service providers with on-line access to the data for calls to the particular service provider's announcements answered by RIDE. The second system collects call statistics data from the auxiliary switches[2], and provides service providers with data on calls answered by the auxiliary switches.

This article describes the on-line statistics services offered by OPRA, and then provides an overview of the architecture of the OPRA systems. A history of the development of OPRA is then given, followed by a more detailed description of the present systems. Finally, future developments of OPRA are considered.

ON-LINE STATISTICS

Service providers can access the on-line statistics services in two ways:

- by using a personal computer (PC) connected to a public switched telephone network (PSTN) line, terminated by a BT NS2232B modem connected to OPRA, to collect data that can be displayed on, or further processed by, the PC; or
- by using a TouchTone™ telephone connected to a PSTN line to receive data as spoken messages automatically generated by the OPRA system.

Three basic types of call statistics data are available on-line to the service providers:

- detailed statistics,
- summary statistics, and
- one-minute statistics.

† BT Development and Procurement

Detailed Statistics

The detailed statistics services provide detailed information on single numbers (announcements), with statistics updated every 15 minutes. The reports generated contain statistics giving both call counts and accumulated call holding times (in seconds) for each 15-minute period. Where a service provider's announcement is provided nationally (for example, on RIDE), the reports also provide a breakdown of statistics, split over eight geographical regions. Access to the detailed statistics services is by using a PC connected to OPRA via a modem connection over the PSTN. Using a dial-up/dial-back protocol for security of access, service providers are able to access the statistics and display them, or process them further, by using the PC. The detailed statistics services are not available by using the TouchTone telephone method of access. The services are available however from both OPRA systems—the DSN RIDE OPRA, and the auxiliary switch OPRA.

Summary Statistics

The summary statistics services provide information on a group of numbers (announcements), with statistics updated every 15 minutes. The reports generated contain data on up to 16 numbers, and consist of counts of the total calls to each of the numbers since the service was started or last reset. The reports also provide a breakdown of the data, split over eight geographical regions. Access to the summary statistics services is via a PC (as for the detailed statistics services), or by using a TouchTone telephone to obtain automatically-generated spoken reports. With both types of access, the service provider is able to reset the counts for his/her announcements. The services are available from both OPRA systems—the DSN RIDE OPRA and the auxiliary switch OPRA.

One-Minute Statistics

The one-minute statistics services are similar to the summary statistics services, but the call data is accumulated every minute. Access is via a PC or a TouchTone telephone. The services are only available from the DSN RIDE OPRA system.

A service provider may have several recorded information services active at any one time. Each recorded information service supports an announcement for a detailed, summary or one-minute service.

Each OPRA system accommodates a maximum of 2000 service provider customers, 2000 services and 2000 announcements. The collected data is held for up to seven days, and a separate file is created for each service and each day's collected data. At the NAC, the operator administration functions on OPRA provide facilities for defining customers, services and associated recorded announcement channels on the RIDEs, or announcements on the auxiliary switches.

A description of the operations performed by NAC personnel in using the OPRA to provide services is more fully described in another article in this *Journal*[3].

OVERVIEW OF THE ARCHITECTURE OF OPRA

OPRA is a real-time computer system, based on a central OPRA processor, that can collect data on calls answered by the MRIS platform and deliver the data to service providers via connections over the PSTN. The system also provides administration access for operators at the NAC. The two OPRA systems provided at the NAC collect data from the DSN RIDE system and the auxiliary switches. Schematics of the two systems are shown in Figures 1 and 2, respectively.

OPRA communication between the RIDEs is via asynchronous serial data links (see Figure 1), and between the auxiliary switches is via Ethernet connections over the NAC–RAC communications network (see Figure 2). Both systems provide service provider on-line access by using PCs via PSTN lines terminated by modems. Ten lines are provided per OPRA system, and the modems are arranged to provide a dial-in/dial-back protocol for security of access. Two modems are configured as 'dial-in', while the remaining eight are configured as 'dial-back' to allow for the longer call holding times when down-loading data to the service providers.

Access for TouchTone telephones is via adjunct processors—Caesar front-end processors (CFEPs)—which accept dual-tone multi-frequency (DTMF) signalling in response to spoken dialogues, automatically generated by the CFEPs. The service providers use the dialogue to request a particular spoken report from the particular CFEP. In addition to providing access for TouchTone telephones, the CFEP is also able to generate 'continuous audio feed' announcements, which can be fed to other equipment (for example, RIDE)

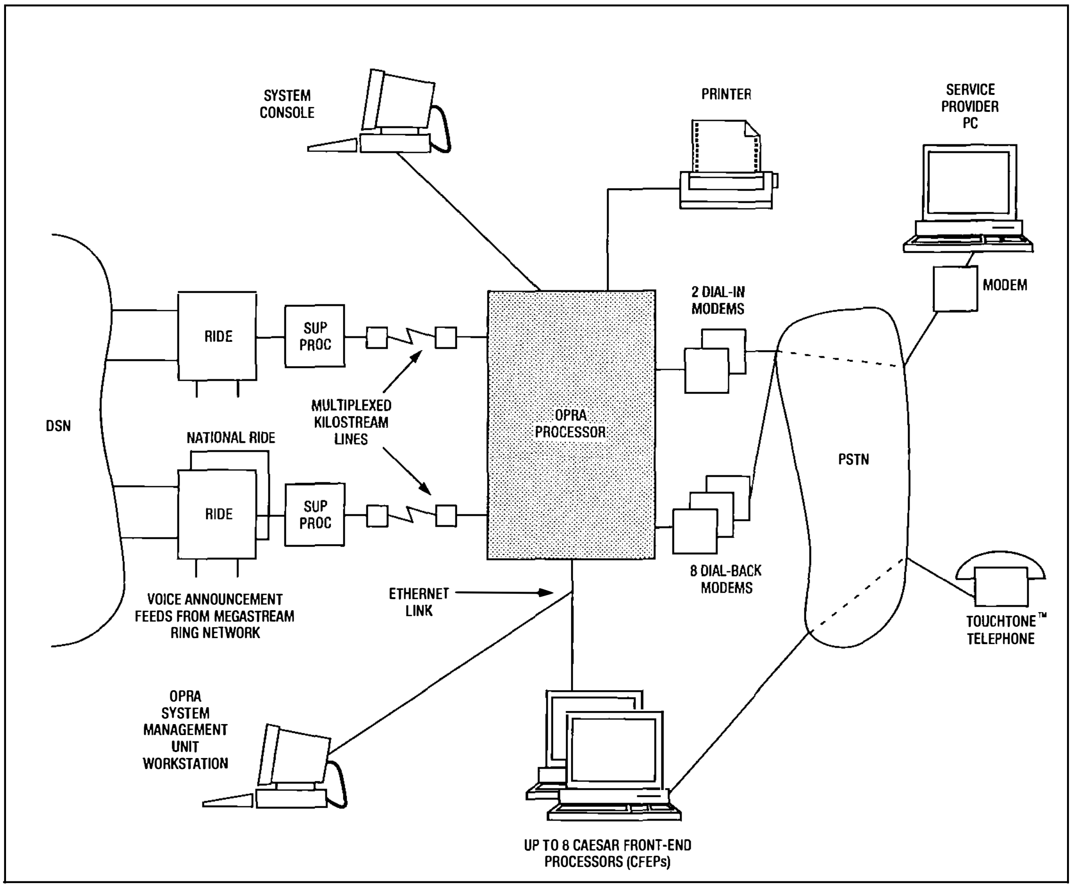
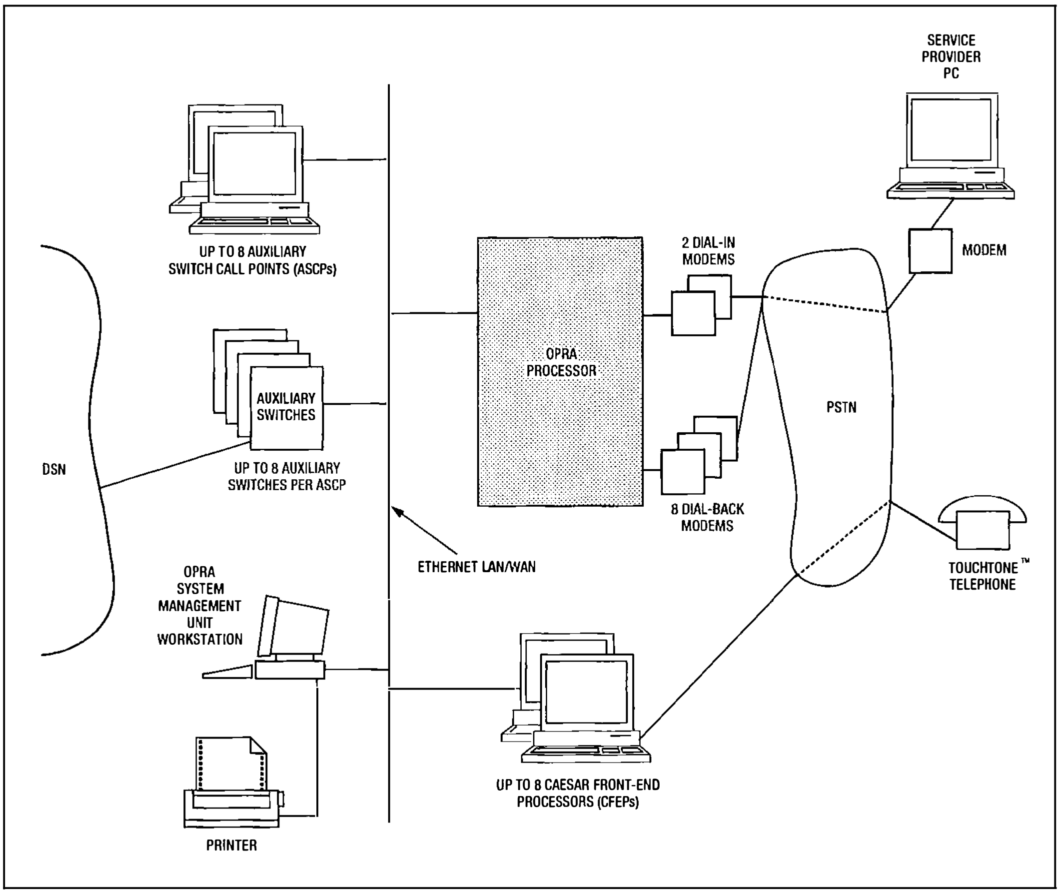


Figure 1
Schematic of the DSN RIDE OPRA system

DSN: Derived services network
OPRA: Opinion poll registration application
PSTN: Public switched telephone network
RIDE: Recorded information distribution equipment
SUP PROC: Supervisory processor

Figure 2
Auxiliary switch
OPRA configuration



DSN: Derived services network
OPRA: Opinion poll registration application
LAN: Local area network
PSTN: Public switched telephone network

and used as an MRIS announcement service. This announcement could be used to provide a 'televote results' service, when associated with the service provider's summary services. Each CFEP can provide five lines, split between TouchTone telephone access and continuous audio feed. The DSN RIDE OPRA system uses three CFEPs giving 15 lines, while the auxiliary switch OPRA uses two CFEPs giving 10 lines, although either OPRA system can support up to a maximum of eight CFEPs.

Both OPRA systems also provide administration access via a common workstation-based OPRA system management unit (OSMU) and a printer. The OSMU also provides a mechanism for reporting exception conditions which may occur during day-to-day operation of the OPRA systems. Each OPRA processor has a system console to provide specialist access for maintenance purposes. A tape streamer (integral with the OPRA processor) is provided to allow operational personnel to back-up statistics data on a regular basis.

The following section briefly reviews the history of OPRA developments, leading to the present systems. A more detailed description of the hardware and software architecture of the present systems is then given.

HISTORY OF OPRA

OPRA has evolved through two major software releases leading to the present systems. The first release provided a basic system and the subsequent releases have expanded the functionality of the system.

First Release of OPRA

The first release provided facilities for collecting call data from the DSN RIDEs installed at the recorded announcement centres (RACs), and provided data to service providers via PC access. A system for commissioning was delivered in December 1989 and the operational system was delivered to the NAC in February 1990.

The first release of OPRA was provided on a UNIX-based PC, equipped with a 350 Mbyte hard disc, and a 60 Mbyte tape streamer for data back-up. The system also included separate terminals for administration access and exception reporting.

In addition to the system for DSN RIDEs, the software developed for the first release was also used on a separate OPRA system to collect call data from RIDEs installed at DMSU sites. These RIDEs were used to provide recorded announcements during the London code change, and the resulting statistics for calls to these announcements were delivered by OPRA for analysis within BT.

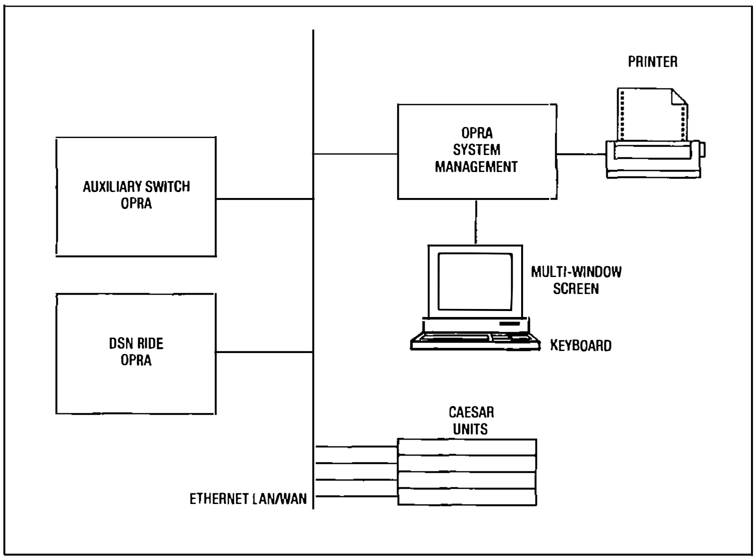
Second Release of OPRA

The second release, serving the DSN RIDE system, ran on the same computers as the earlier release, and extended the earlier software to provide the following additional facilities:

- By using a TouchTone telephone, service providers were able to obtain access to spoken summary reports over the PSTN via CFEPs. Two CFEPs were used to provide up to 10 lines of access.
- A 'televote' results announcement could be generated by the CFEP and fed into the RIDE distribution network. This facility, although to date not yet used commercially, allows the public to telephone the announcement and listen to the progress of the televote.
- The data values from a number of RIDEs serving a geographical region could be aggregated to form single values.

The OPRA processor was equipped with an Ethernet adapter board to communicate with the CFEPs, by using the TCP/IP protocol.

The second release of OPRA went into service at the NAC in April 1991.



DSN: Derived services network
LAN: Local area network
RIDE: Recorded information services
OPRA: Opinion poll registration application

Figure 3 OPRA present releases

Present Releases of OPRA

DSN RIDE OPRA (Third Release)

The third release of OPRA, available in May 1992, is used for the DSN RIDE OPRA. The release runs on UNIX workstation-based computers equipped with asynchronous communication ports and Ethernet adapters. In terms of software, the system extends the earlier releases to include:

- configuration of RIDE communication paths, for the collection of data;
- delivery of one-minute summary statistics for assigned announcement channels on the RIDEs; and
- spoken reports from the CFEP which are continuously updated as new data is collected during the call.

Auxiliary Switch OPRA (Fourth Release)

The fourth release of OPRA, available in mid-1992, is used for the auxiliary switch OPRA. As for the third release, UNIX workstation-based computers equipped with asynchronous communication ports and Ethernet adapters are used. Connection to the auxiliary switches is via Ethernet, in addition to the connection to the CFEPs. In terms of software, the system extends earlier releases to provide:

- collection of data from the auxiliary switches, and
- configuration of auxiliary switch communications paths, for the collection of data.

The release supports the standard detailed and summary statistics services; it does not provide one-minute statistics.

For both releases, the CFEP hardware remains unchanged, although the CFEP software is enhanced. In particular, for the DSN RIDE OPRA, the CFEP supports dialogues and report generation for the one-minute services. Also for the DSN RIDE OPRA, an additional CFEP is used to provide extra lines to support the one-minute services.

For both releases, the administration and exception terminals are replaced by the OSMU, and this is illustrated by Figure 3, which shows a block diagram of the present systems, served by the common OSMU system.

OPRA System Management Unit (OSMU)

The OSMU provides:

- an operator interface for controlling and administering the two OPRAs (the DSN RIDE OPRA and the auxiliary switch OPRA), which is achieved by two windows, each running a terminal emulator running the command menus and forms for an OPRA; and
- a common window, in which is displayed the exception reports from each of the two OPRAs.

The OSMU is connected to the OPRAs by an Ethernet using the TCP/IP protocol to communicate between the machines.

OPRA HARDWARE

The hardware for the present system can be considered in four main areas:

- OPRA processor,
- OPRA system management unit,
- CFEPs, and
- modems.

OPRA Processor

The system computer is rack-mounted and consists of a Sun Sparcserver 2 with a Sun Sparc 2 processor, 32 Mbyte random-access memory (RAM) and two 1·3 Gbyte mirrored discs. It is equipped with a 32-asynchronous-port Baydell Box, Ethernet interface card and runs the SunOS 4.1.1 (UNIX) operating system.

Security of data is provided by the use of mirrored discs (that is, data is written simultaneously to two discs), and daily archiving of the database to tape.

A stand-by OPRA is provided to which, in the event of failure, the database can be transferred, with a maximum of 1 day's data lost.

The stand-by OPRA can be used to retrieve archived service data that is older than 7 days from magnetic tape.

OPRA System Management Unit (OSMU)

The OSMU is a Sun Sparcstation IPC with 12 Mbyte RAM, 200 Mbyte disc and colour monitor, and runs the SunOS 4.1.1 (UNIX) operating system.

Caesar Front-End Processors (CFEPs)

OPRA can connect up to eight CFEPs via Ethernet. Each CFEP consists of a 80386-based personal computer. It is equipped with five BT speech cards, developed by the Speech Applications Division at BT Laboratories, and an intelligent Ethernet card. The system runs the QNX 2.1.5 operating system.

Modems

Each OPRA system is equipped with 10 modems. These are BT NS2232B modems which operate full duplex at line rates between 300 and 14 400 bit/s, and provide the Hayes command set for controlling the operation of the modem.

OPRA SOFTWARE

The OPRA software for the present releases consists of several concurrently executing processes run under the UNIX operating system. Each process performs a separate task involved in the collection, management, and examination of the data. Figure 4 illustrates a highly simplified overview of the functional software components and data stores contained within the OPRA software for the RIDE application.

The application for the auxiliary switch has a similar functional architecture.

The OPRA software is partitioned into the following functional components:

Operator Interface—provides the human interface to the OPRA system.

Datel Interface—enables service providers to obtain reports for their services via the PSTN on data communication lines equipped with modems.

Customer Voice Interface—enables service providers to obtain spoken reports on their services over the telephone.

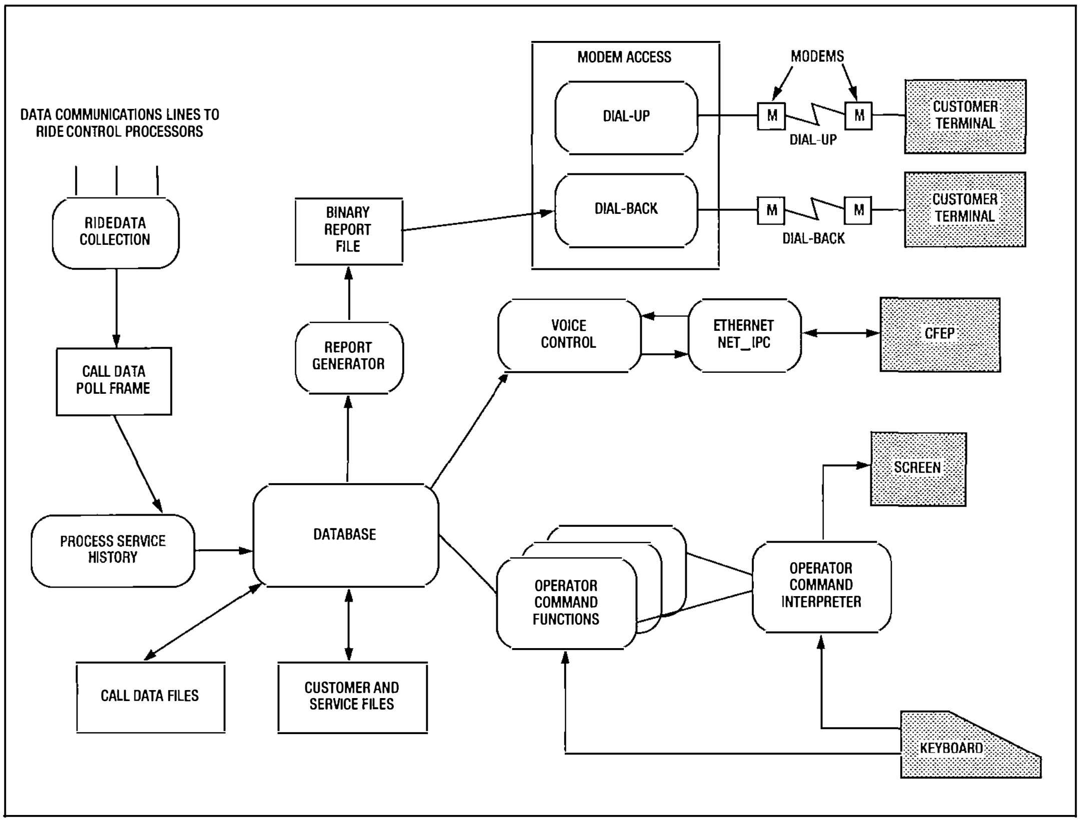
Report Generation—obtains service-provider reports from the database and reformats them into a form suitable for delivery.

Database Management—provides the customer and service data, service history files and the various logs.

RIDE Data Collection—collects the data from the control processes and processes it to produce the service history files.

System Management—provides various facilities for starting the OPRA system and controlling its operation.

Figure 4
Software overview



CFEP: Caesar front-end processor

Operator Interface

The operator interface provides a menu-driven command set:

- to control the OPRA system and its communication with other systems;
- to enter data to define service providers, their services and the associated equipment channels used to provide announcements; and
- to display or obtain printed reports.

The external operator interface is provided by the OSMU, which functions as a multiple window display and is connected via the Ethernet LAN to a number of OPRAs. Each controlled OPRA has a separate window on the OSMU in which is run a terminal emulator (this replaces the separate operator terminals required for the earlier OPRA releases). Exception reports from all of the controlled OPRAs are displayed in a common window, which replaces the separate exception terminals required for earlier OPRA releases.

The operator interface software on OPRA uses a menu and windows style implemented by using the Panel Plus screen handling package. A typical menu screen displayed in an OSMU window is shown in Figure 5.

The operator selects commands from a list by using the cursor up/down keys to move to the required command option and keying RETURN to invoke the command. Return to a higher level menu is obtained by using the ESCAPE key.

Voice Interface

The CFEPs enable service providers to obtain spoken summary reports and phone poll reports. The customer dials into OPRA and is connected to a free CFEP port. The CFEP prompts the customer to supply a 4-digit customer identity and a 6-digit PIN by using his/her telephone's DTMF keypad to identify the service for which a report is required, and these are sent to OPRA. The PIN must identify a summary or one-minute service.

If the customer's identity number and the PIN are valid and correspond, a report is downloaded from OPRA to the CFEP. The caller, via spoken menu prompts, can obtain selected parts of summary reports by keying appropriate TouchTone keys on his/her telephone.

For one-minute reports, the report is continually updated after each 1 minute collection period and spoken for up to 20 minutes. On the completion of a one-minute data collection cycle, the RIDE data collection component sends a message to update voice cards handling one-minute reports.

Facilities are also provided to enable the service providers to reset the count values for their services.

The CFEP is also able to supply continous spoken reports that can be a service in their own right. At the completion of each data collection cycle, a message is received from the data collection process to send the latest report to voice cards supplying spoken report services.

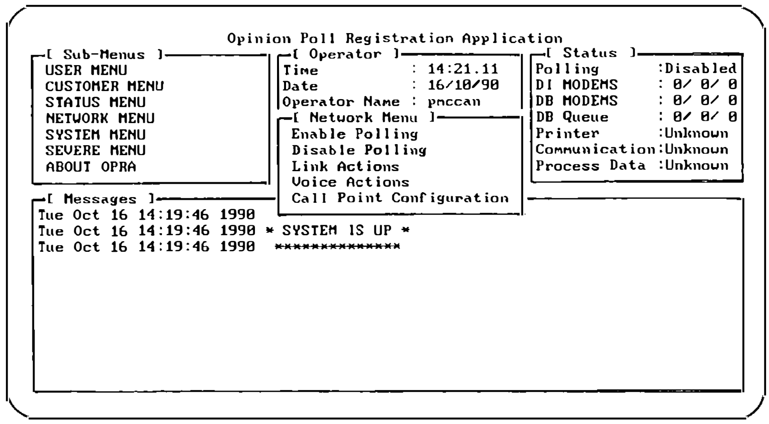


Figure 5
Typical menu screen

The mode of operation of a CFEP port is established by using the CFEP configuration operator commands.

The CFEPs are connected to the OPRA via Ethernet by using the TCP/IP protocol and are handled by the voice-component software. The voice component consists of two processes:

- the *CFEP process*, which controls the CFEPs as single units and its component voice cards, and handles requests from the CFEP voice cards arising from requests for service reports; and
- the *Ethernet voice circuit*, which handles all communication over the Ethernet circuits to the CFEPs in conjunction with the Ethernet communication process.

DATABASE MANAGEMENT

Since the OPRA software consists of several concurrent, communicating processes, and numerous shared databases, it is possible for two processes to be attempting to read from, or write to, the same database at the same time. This can result in corrupted data being read from, or written to, the disc. In order to prevent this, some form of database arbitration is required. The arbitration in the OPRA is provided by the database-manager process, which handles all requests for data and controls the processes which access the data.

The database manager is implemented as a controlling process which decodes database access requests into simple commands directed to the server process which accesses the required logical data store. This allows simultaneous access to different data entities to enhance system disc performance, and allows the different data entities to reside on separate physical disc subsystems to allow true concurrent disc accesses if required for speed.

The server approach also hides the physical structure and format of the data from the users of the data.

FUTURE DEVELOPMENTS

The functionality of OPRA will be further enhanced to match the needs of the MRIS service offering. Already planned is the delivery of a third OPRA system to collect and deliver call statistics from the DMSU RIDEs. This system will use the functionality provided by the third release used for the DSN RIDE OPRA, and will be controlled for administration purposes by the OSMU system. Other enhancements are also planned; these could include increasing the total number of services handled by each OPRA from the current 2000 maximum, and providing one-minute statistics for all announcement services handled by OPRA.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the work of colleagues in the London Engineering Centre, Speech Applications Division, and Switched Networks Division, who have been actively involved in the work described in this article. In particular, thanks are given to Chris Burrows and John Tillson, in the London Engineering Centre, and Eric Allard, in the Switched Networks Division, for their contributions to this article.

Note

Much of the equipment described in this article is based on proprietary products which are in a form to meet BT's requirements. It should be noted that this article does not necessarily define or imply the full specification or the full capabilities of that equipment.

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Biography

Michael Boomer joined the British Post Office as a Technician Apprentice in 1963. After graduating from Newcastle Polytechnic with a B.Sc. in Electronic Engineering, he joined the Management Services Department in 1969. In 1970, he joined Computer Systems Division of Telecommunications Headquarters, where he worked on a number of computer-based projects, including the evaluation of processors for System X. From 1976 to 1984, he worked upon the design and development of the BT Radiopaging system. Currently he is a Technical Group Leader in the London Engineering Centre of BT Development and Procurement's Systems and Software Engineering Department, where in addition to managing a number of projects, he is also the centre's Quality Manager.

Managed Recorded Information Services—Control and Management

ERIC ALLARD and DAVE WOODS†

Several platforms are being developed that will contribute to the control and management of the managed recorded information services systems. The monitor alarm unit is a specialist system for monitoring announcement services, live feeds and other equipment in the managed recorded information services platform. The system management unit at the national announcement centre (NAC) provides a common platform for the management of recorded information distribution equipment (RIDE), the opinion poll registration application equipment and other systems. The NAC–RAC enhanced communications network provides communications paths between the NAC and the recorded announcement centres (RACs) for relaying control and management data, and for conveying live-feed services.

INTRODUCTION

Three main developments are under way for the control and management of the managed recorded information services platforms. These are described in this article.

The *monitor alarm unit* is a specialist system for monitoring and providing alarms for a number of aspects of the managed recorded information service platform. The alarm status information is displayed on personal computers (PCs) located at the national announcement centre (NAC). The monitor alarm unit is used to monitor services such as the recorded information distribution equipment (RIDE) announcements, live feeds, equipment failure and traffic overflow conditions.

The *system management unit*, developed and designed at BT Laboratories, provides a management platform for RIDE, the opinion poll registration application (OPRA) system and other applications. More details of RIDE and OPRA are provided in other articles in this issue of the *Journal* [1, 2].

The *communications network* between the NAC and the eight recorded announcement centres (RACs) carries control and management data (including that required for RIDE and OPRA) and has the capacity to allow several other communications systems to migrate onto the network. It also provides the distribution of live-feed services from the RACs to the NAC.

MONITOR ALARM UNIT

The monitor alarm unit provides four basic functions:

- monitoring of audio announcements;
- monitoring of live-feed services;
- monitoring of equipment alarms; and
- monitoring of traffic overflow conditions.

The monitor alarm unit is managed by a network of master and slave PCs, which provide displays of alarm conditions and enable remote call-out and interrogation by maintenance personnel for out-of-normal-hours working.

Each RAC and the NAC has a master PC which is responsible for servicing and monitoring for that centre. Each master PC may be connected to a local slave PC and, via a modem, to a portable PC, which may be carried by the engineer on call. The NAC has, additionally, a singleton alarm for each RAC. The operator at the NAC can dial from a single PC into any of the RACs to obtain more information. This method of access is protected by password control.

As shown in Figure 1, the monitor alarm unit at each site physically comprises five 19 inch shelves in a cabinet, a master PC and printer, a slave PC, a modem link and the associated

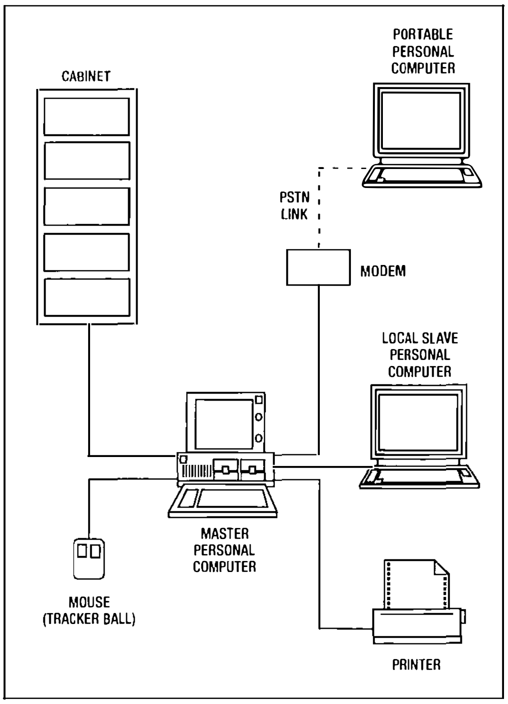


Figure 1
Monitor alarm unit hardware configuration

† BT Development and Procurement

cables. Each shelf can contain a MUX/power card and up to 15 other cards, or up to 12 cards if an exchange control unit is fitted. The cards are arranged in modules of three cards, each module containing one central processor unit (CPU) card and two line interface cards.

The monitor alarm unit is designed to operate in a normal public telecommunications environment.

The connection of the monitor alarm unit system to work in this environment is illustrated by Figure 2.

The functionality of the monitor alarm unit is provided by three main types of line interface card. These are described in the following sections.

Line Interface Monitor—Type 1

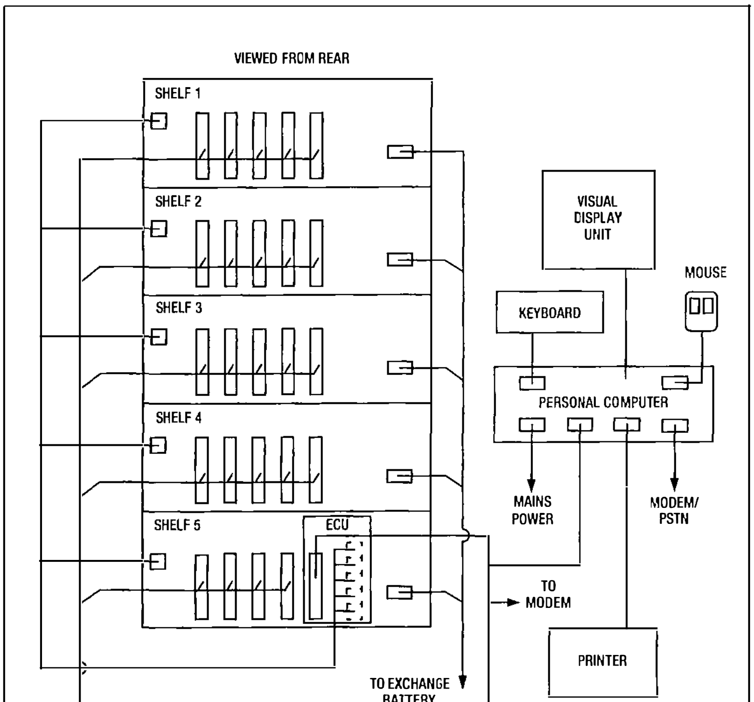
The Type 1 card is used to monitor announcement services. If an announcement service is not detected, the card raises an alarm.

Each card provides monitors for eight audio announcement channels.

Each channel monitor checks for 'silence' on the channel, and the card generates an alarm when the level of audio activity is below a set level. There are various different types of 'silence'; for example, a pause in speech, the gap between the end of one message and the message being repeated, and that caused by a fault. It is only the latter that generates an alarm. When the card detects non-activity on a circuit, it begins counting seconds. If the count reaches a preset threshold, normally set at 60 s, it generates an alarm.

The Type 1 card is configurable to detect activity on the circuits above audio signal levels of –20 dBm or –30 dBm.

Figure 2
Monitor alarm unit connection details



ECU: Exchange control unit

Line Interface Monitor—Type 2

The Type 2 card is a change-over switch which is used to monitor live feeds.

The live-feed network provides two feeds, a primary feed and a secondary feed. These are generally transmitted over different paths for security.

The Type 2 card normally switches the primary feed for onward distribution to announcement equipment. It continuously monitors the primary feed for audio activity, and, in the event of failure of this feed, it switches to the secondary feed and uses this for onward distribution.

The card remains switched to the secondary feed until it is manually switched back to the primary feed. On switching to the secondary route, an alarm is produced indicating that the primary route is 'silent'.

If the secondary route fails before the primary route has been repaired, the card switches to another back-up line, connected to a local announcement source which could replay a courtesy message.

One Type 2 card is required per set of feeds.

Line Interface Monitor—Type 3

The main function of the Type 3 card is to provide feed and monitor circuitry for seven alarm relays connected to external equipment. In addition, it has the capability of monitoring traffic overflow conditions.

Other Equipment

In addition to the three cards described above, the monitor alarm unit comprises a number of other items of equipment.

The line interface monitor CPU card contains the CPU and random-access memory for control cards 1–3 inclusive. One CPU card is required for each pair of monitor cards. The CPU card contains a rechargeable battery to support memory for up to four days if the power is disconnected.

Each line interface shelf contains a single MUX/power card to provide power at 5 V DC to the line modules, the card/CPU selection logic, and a communications link with the exchange control unit. The exchange control unit enables the user to communicate with up to five shelves. A loudspeaker on the front panel allows the operator to listen to the lines in use. A speaker jack is also provided for switching the sound to a separate room, if required.

Within each monitor alarm unit, the upper four shelves can contain up to five modules of three cards, and the bottom shelf can hold the exchange control unit and up to four modules. This modular construction provides economic expansion and flexibility, where a complete module of two line interface cards and one CPU card will serve up to 16 terminations (two Type 1 cards installed) or a sub-equipped module with only one line interface card and one CPU card will support up to eight lines (Type 1 card installed). Each exchange control unit can support a maximum of five fully-equipped shelves.

Monitor Alarm Unit Management

During normal working hours, the monitor alarm unit provides both visual and audio alarms via the PCs in use. However, for out-of-hours working, the monitor alarm unit also has the capability to page maintenance personnel. In the event of an out-of-hours alarm being raised, the master PC can dial up to six preprogrammed numbers in turn until the fault receives attention. The maintenance officer who is on-call can use a portable PC and dial directly into the system, by using a modem, and obtain the same display on the portable as is on the master PC. Thus, any fault can be investigated immediately and a decision made as to whether to clear the alarms and deal with the problem the next day, or to investigate the problem immediately.

A man–machine interface (MMI) is provided by the two PCs at each site. The master PC provides the user with the main configuration and control point for the whole system. With the MMI, the user can configure the system, monitor line activity, monitor alarms, acknowledge alarms, check hardware configuration and manually switch to back-up lines.

Three additional cards are also fitted in the PCs, two of these are internal modem cards and the other is a card to allow mouse operation.

Man–Machine Interface

The MMI function is divided between the master and secondary PCs. The information required is displayed on the visual display unit (VDU) and can be printed on command. The MMI is controlled by means of the PC keyboard and mouse. The operator options are given on pull-down menus on the VDU and selections can be made by using either the keyboard or the mouse. An example of an MMI display is shown in Figure 3. In this display, the upper SYSTEM box displays information about the operation of the MMI; that is, the log-in details after the operator has logged in; the shelf number, module number, card number and line number currently being monitored by the MMI; or the voice monitor condition when the operator turns the voice monitor ON or OFF.

The box below this displays the status code, in matrix form, of each line associated with the cards in the current shelf, displaying up to five modules of three cards each per shelf. The bottom line of the matrix is the card line. The operator can configure individual lines and cards from the card/line matrix.

SYSTEM MANAGEMENT UNIT

The system management unit is located at the NAC and, as part of its first application, it is being used to manage the DSN RIDEs and the digital main switching unit (DMSU) RIDEs from a central point.

Initially, the DSN and DMSU RIDEs were managed by using a number of recorded information services control processors[1], which are PC-based machines, running RIDE management software. The operational need to reduce the volume and complexity of operating a large number of such processors had led to the rationalised approach of providing the system management unit to allow management of the RIDEs from a smaller number of workstations.

The need to rationalise equipment also led to the development of a management workstation for OPRA administration, replacing the separate terminals needed to manage the OPRA systems used with RIDE and the auxiliary switches.

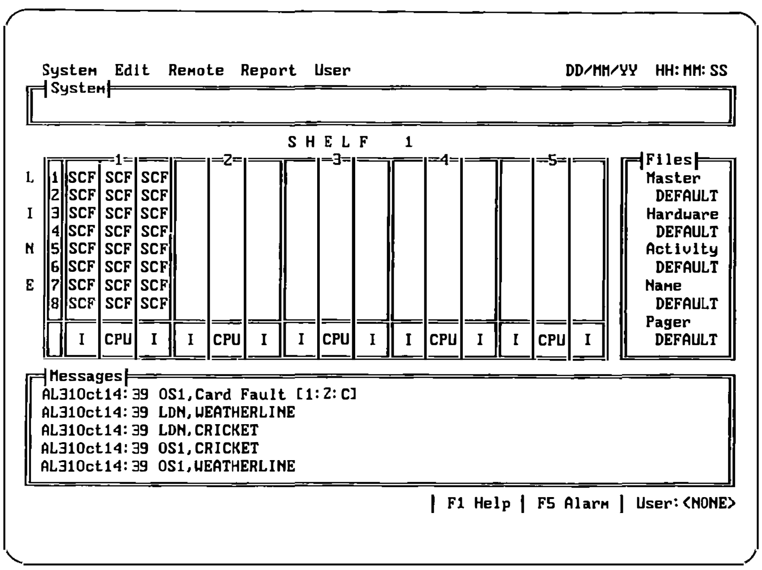
The OPRA management workstation forms part of the system management unit, although its function is separate to that provided for RIDE management. OPRA is described more fully elsewhere in this issue of the *Journal*[2].

The system management unit is provided as a local area network (LAN)-based platform using Ethernet. This allows the interconnection of processors running specific applications, workstations for operator access, databases, and the connection to the RACs via the NAC–RAC wide-area network (WAN). Although initially developed for the RIDE and OPRA applications, the system management unit will be used for other managed recorded information service applications.

RIDE System Management Unit

The RIDE system management unit is designed to manage all RIDEs in the network. To ease

Figure 3
Monitor alarm unit display



operations, the RIDEs are grouped into logical systems, dependent on the distribution network to which they are connected. There is one system for DSN RIDEs, and three systems for DMSU RIDEs. Any one system can be controlled from the system management unit by the operator establishing a session with the particular system.

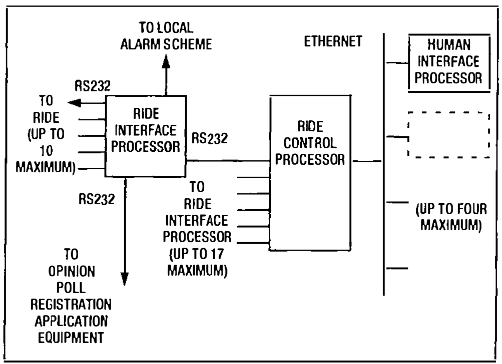
For each RIDE system, the RIDE system management unit application:

- gathers and displays RIDE alarm information every 30 s,
- allows user interrogation and control of individual RIDEs, and
- collects, every minute, call statistics generated by RIDEs.

The RIDE system management unit is designed to manage up to a total of 170 RIDEs, grouped in up to ten systems, although currently there are 82 RIDEs (at DSN and DMSU sites) grouped in four systems.

Figure 4 shows a block diagram of the system management unit hardware that is provided at the NAC. The human interface processors are SUN workstations, which are connected to the RIDE control processor (a SUN workstation server) via an Ethernet LAN. The RIDE control processor, in turn, is connected to the RIDE interface processors (which are reused recorded information services control processors with appropriate modifications to the existing software). Two human interface processors are normally used, although up to four can be used. There is a single RIDE control processor and eight RIDE interface processors, but up to 17 can be used to provide connections to 170 RIDEs.

Figure 4
RIDE system management unit hardware



RIDE: Recorded information distribution equipment

The RIDE control processor runs the RIDE management application and performs the following functions:

- provides an interface to the human interface processors,
- provides an interface to the RIDE interface processors,
- acts as a communications concentration point for both the human and RIDE interface processors,
- controls access to RIDE systems from the human interface processors,
- processes user requests/responses (entered via the human interface processor),
- maintains a record of the current alarms on all RIDE sites,
- maintains a record of the current call restrictions on all RIDE sites, and
- stores and controls access to the current configuration of RIDE systems and RIDEs.

The RIDE control processor does not require a keyboard or screen. Connection to the RIDE interface processors for the passing of control signals and for receiving status information is by an asynchronous bidirectional RS232 link to each processor.

The connection to the human interface processor is provided by the Ethernet LAN.

The RIDE interface processor performs the following functions:

- provides an interface to the RIDE control processor,
- provides an interface to the RIDE nodes,
- provides an interface to OPRA for statistics gathering,
- schedules the polling of RIDEs for alarm and statistics information,
- acts as a communications concentration point, and
- provides a connection to the external alarm scheme.

Connection of a RIDE interface processor to each RIDE for the transfer of system management messages (commands, alarm information, call statistics information) is by an asynchronous bidirectional RS232 link. For DSN RIDE communications this connection is made via a terminal server connected to the LAN and the NAC–RAC WAN. The RIDE interface processor also has a connection to the OPRA processor and the RIDE control processor, using bidirectional RS232 links.

To interface to the NAC alarm scheme, additional cards are provided within the RIDE interface processors. These cards have a relay contact that is controlled by software and can raise an alarm as part of the NAC alarm scheme. The relay contact is used to signal a call-out alarm, either by a message from the RIDE control processor or by the failure of power to the RIDE interface processor.

The human interface processor is a SUN workstation with a keyboard, mouse and a colour monitor. It provides the following functions:

- a human interface using a window-icon-mouse-pointer interface;
- multiple windows on screen;
- password access for security; and
- all audible alarm indications.

Alarms

Alarms generated by the RIDEs are collected by the RIDE interface processors every 30 s and passed to the RIDE control processor for further processing. The RIDE control processor implements four levels of alarms:

- raw alarms;
- level 1 alarms;
- level 2 alarms; and
- call-out alarms.

Raw alarms are the individual alarm conditions reported on the RIDE[1].

Every raw alarm causes one or more level 1 alarms and, where appropriate, the level 1 alarms group together raw alarms to rationalise and reduce the amount of alarm information that is presented to the operator.

The RIDE system level 1 alarms are formed into five groups which focus on the different objects within the RIDE that are being managed, namely:

- communications,
- the interface to the RIDE distribution network,
- the public exchange interface (DSN or DMSU),
- the start-at-the-beginning announcement[1] availability, and
- equipment (that is, processor) status within RIDE.

For each group of level 1 alarms there is a level 2 alarm, giving the five level 2 alarms per RIDE. The level 2 alarm is activated when certain level 1 alarms or combinations of level 1 alarms within the group are active. The criterion used for selecting the requirement for a level 2 alarm is 'a condition which requires urgent attention'.

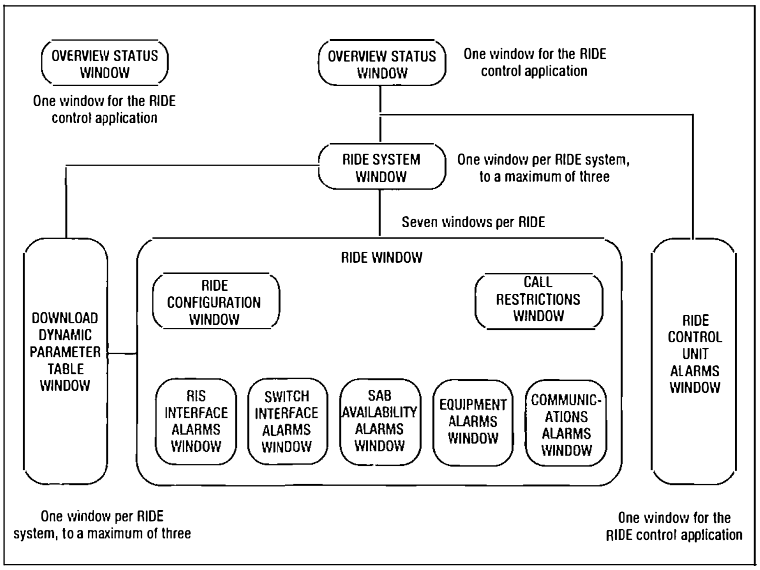
In addition to the five level 2 alarms per RIDE, there is a level 2 alarm which relates to the RIDE control processor and the RIDE interface processors, and this also represents 'a condition which requires urgent attention'.

The fourth alarm type is the call-out alarm. There is one call-out alarm per RIDE plus one for the RIDE control processor/RIDE interface processors. It is triggered by any one of a number of pre-defined conditions, which may be specific level 1 alarms or combinations of level 1 alarms.

For general operation, two of these four alarms are used, the level 1 and level 2 alarms. However, it is possible to retrieve information on raw alarms by means of further interrogation. The call-out alarm is primarily used for determining if assistance is required during out-of-hours periods. Conditions causing a call-out alarm also cause a level 2 alarm; the converse is not necessarily true.

Operation

During operation, the operator is presented with high-level information on all of the applications being supported by the system management unit. The operator's screen has a RIDE control application window plus windows for general service applications. The service applications appear at the bottom of the screen and are visible at all times.



RIDE: Recorded information distribution equipment
RIS: Recorded information service
SAB: Start-at-the-beginning

Figure 5
Human interface window hierarchy

By using a mouse, it is possible for an operator to interrogate and control any RIDE system through the selection of the appropriate commands. The operator can have control of a maximum of three RIDE systems simultaneously from any human interface processor, with no more than one processor in control of a particular RIDE system at any one time. The status of the RIDE systems is shown to the operator by using alarm indications, call restriction records and configuration tables. Warnings are given to the operator of the potentially serious effect of some actions.

A hierarchy of windows is used to present the large amount of alarms, call restrictions and configuration information and to enable interrogation and control of the RIDEs. The level of detail presented increases as the operator moves lower in the hierarchy. Other windows outside this hierarchy can be used as necessary. Six window types are used, as shown in Figure 5.

Within the window hierarchy, the highest-level window presents an overview of the RIDE systems, while the second-level window presents a RIDE system as a number of RIDEs (up to 32) and provides interrogation and control facilities that apply to the whole RIDE system.

At the lowest level, there are two window types: the RIDE window and the RIDE control unit (RIDE control processor/RIDE interface processors) alarms window. The RIDE window presents data relating to an individual RIDE location and provides interrogation and control facilities that are limited to a single RIDE in scope. There are seven variations of this window for each RIDE showing different alarms, call restrictions or configuration information. The RIDE control unit alarms window presents and manages alarms data specific to the RIDE control unit.

Software Architecture

The RIDE control unit software is spread across three sites: the human interface processor, the RIDE control processor and the RIDE interface processor. There are defined interfaces between sites and between processes on each site. The software architecture is divided first into functions—related activities which involve all relevant processing sites; and then processes—the implementation of a function on a particular processing site.

The functions implemented include:

- alarms handling;
- user request handling;
- call restrictions;
- message handling and RIDE interface processor link handling; and
- dynamic parameter table downloading.

Dynamic Parameter Tables

Within RIDE, call progression is controlled by data held in a parameter table[1]. This data typically provides the translation from dialled-digit information received by RIDE from the exchange to the required announcement service to be connected by the RIDE. Other data controls other parameters (for example, whether a start-at-beginning announcement shall be played or not).

The current table is fixed, but the system management unit development provides a dynamic means of updating the tables.

The parameter table is built and processed off-line by using an ORACLE™ database application, running as an application on the system management unit. The database allows the creation and editing of service-type templates that define the phases of a call.

New tables are created by defining service instances using the service-type templates and adding details of the recorded information services used for the announcements. Alternatively, new tables can be created by copying and editing existing tables. The resulting table is checked by generating and examining reports of the usage of recorded information services and digit combinations. When the parameter table has been processed, the data is generated in a file. Under command from the operator, the RIDE control processor can read the file and download the data to parameter tables held in RIDE.

At each RIDE site, the information is stored in a number of tables known as *alternative tables*, while calls continue to be connected using information held in a corresponding number of *current tables*.

The operator can download a table to one or all RIDEs in a system by executing the appropriate command at the RIDE or system level. The command prompts for the name of the file to be downloaded, which is then read and checked. If the file cannot be found or is of the wrong format, then the operator is informed and the command is aborted.

If a valid file is found, the download is started and control is returned to the operator while downloading continues in the background. While the download is in progress, the operator cannot release control of the RIDE system, but further commands, excluding parameter table commands, can be executed on that system. The operator can also take control of another RIDE system and can initiate a download to that system while the first download continues.

Progress of the download operation is indicated to the operator and any errors are reported as they occur. Re-tries are used where there are communications problems with a RIDE. If required, the operator can abort a download to a system and take corrective action. When complete, the success of the download operation is reported, indicating any cases where a valid table is not held. The operator must acknowledge completion of the download before continuing with further parameter table commands. If necessary, the download command can be repeated before the table is committed.

Upon completion of a download, the operator is informed of the success of the operation. A separate VERIFY command is also provided to allow the operator to verify subsequently that the required parameter table is still available for use on each RIDE.

When the operator is satisfied that a valid alternative table is available, and is ready to change over to the new table, a COMMIT command can be executed. The current table becomes the alternative table and all new calls use the new current table. The change-over can be reversed by executing the command with the filename of the previous table.

ENHANCED NAC–RAC COMMUNICATIONS NETWORK

The NAC–RAC communications network consists of dedicated 2 Mbit/s links terminated by primary-order multiplexers (PMUXs), connecting the eight RACs to the central NAC.

The network was initially installed to provide duplicate connections for live-feed services from the RACs to the NAC, for onwards distribution by RIDE. This arrangement allows speedy live-feed provision, reducing service provider costs, since the only private wire needed is that from the service provider to the RAC.

The topology of the communications network is shown in Figure 6. The eight routes between the individual RACs and the NAC are in the form of a star, with four additional routes added to form a delta configuration between paired RACs. This method provides for security of transmission of the duplicated line feeds. The primary feed is fed directly from an RAC to the NAC, with the secondary security routes provided via the paired RAC.

The introduction of the auxiliary switch OPRA[2] saw the need to transmit large amounts of data between the RACs and NAC. To satisfy this need, the communications network has been enhanced to allow not only the secure transmission of live-feed services, but also to provide a network for the transmission of data and control and management information for OPRA and DSN RIDE. The enhancement also allows other services to use the capacity of the network.

The enhanced network is shown in Figure 7. The enhancements to the network involved replacing the standard PMUXs associated with the 2 Mbit/s links with intelligent MUXs. The intelligent MUXs connect to LAN bridges at the NAC and RAC which in turn allow connection of the LANs at the NAC and RAC forming a WAN. The WAN is used to carry the data for RIDE and OPRA. Live-feed connections are provided by direct connections to the intelligent MUXs.

Intelligent MUXs

An intelligent MUX is provided at each RAC site and eight, one for each link to the RACs, are provided at the NAC. Each MUX provides the following interfaces:

- analogue 2/4 wire;
- X.21 data; and
- 2 Mbit/s.

The analogue 2/4 wire interfaces provide the connections for the analogue live-feed services for transmission from the RAC to the NAC.

The X.21 data interfaces provide the connection to the LAN bridges to form the WAN.

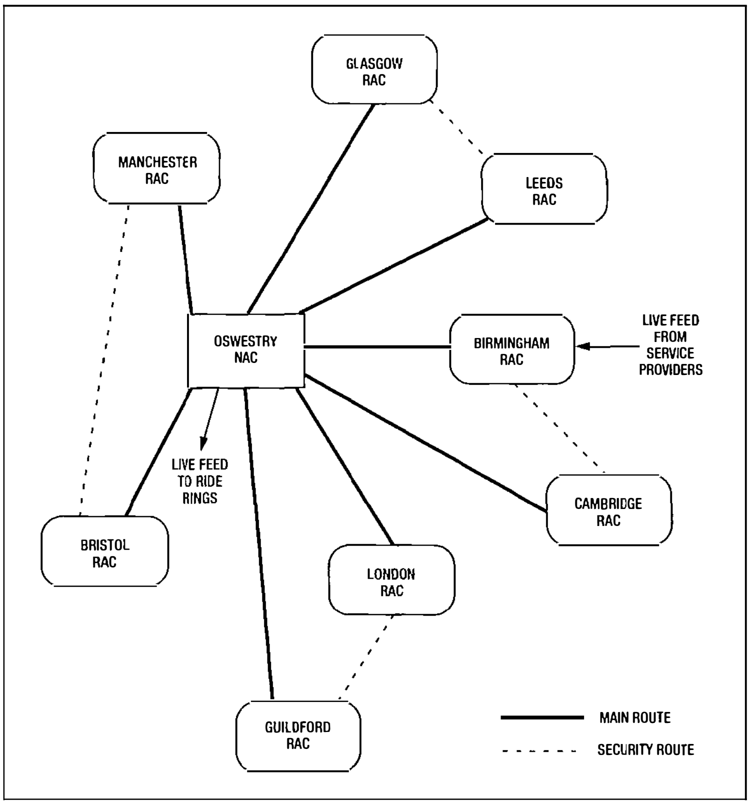
The 2 Mbit/s interfaces provide the connection to the physical 2 Mbit/s links forming the transmission paths for the network.

Control of the intelligent MUXs is performed by a network manager function provided at the NAC. The network manager function is currently provided as an application on a PC which connects to the intelligent MUXs at the NAC (see Figure 7). A later version of the network manager function will run as an application on the system management unit platform at the NAC. From the network manager function, an operator is able to configure routes used by the network by modifying data held in each of the MUXs. This configuration includes the presetting of alternative paths should a primary link fail. The network manager function is also able to monitor the status of the MUXs and report alarm information.

Once configuration data has been extended into the system, the resilience of the network is controlled automatically by the MUXs. If the main primary link between an RAC and the NAC fails, the MUXs automatically switch the required live feed and data channels to use the alternative path provided via the adjacent RAC route.

Wide Area Network

The LAN bridges are provided to interconnect the RAC-based LANs and the NAC-based LAN



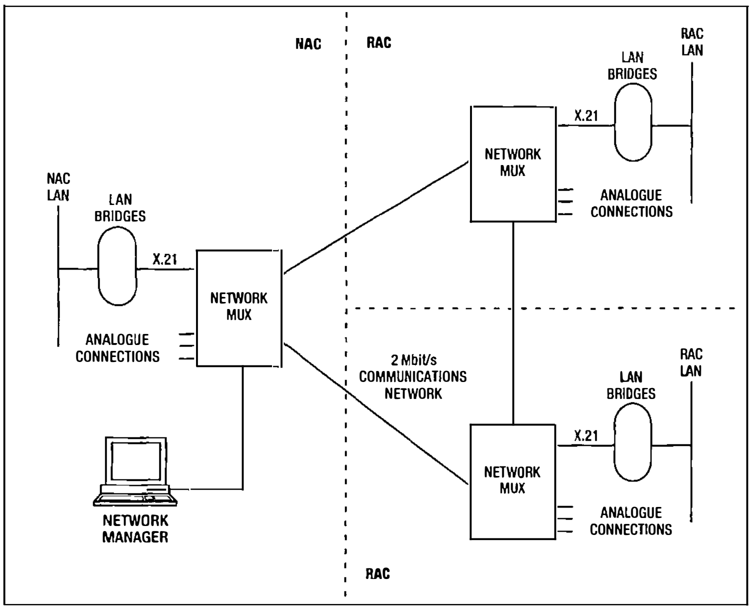
NAC: National announcement centre RAC: Recorded announcement centre

together to form the WAN. Interconnection of the bridges is provided by the X.21 interfaces on the intelligent MUXs, providing a semi-permanent 128 kbit/s data channel between each of the bridges.

Resilience of the data paths is provided by the security of the communications network, but additionally, the bridges are able to communicate and operate their own rerouting mechanisms if

Figure 6
NAC–RAC communications network

Figure 7
Enhanced NAC–RAC communications network



LAN: Local area network RAC: Recorded announcement centre
NAC: National announcement centre

necessary. Management of the WAN is provided by an application on the system management unit. This management application is able to communicate with all LAN bridges in the system and is able to display status information, including bridges or interconnecting links that may have failed.

Applications Using the Communications Network

Initially, the communications network will be used to provide connections for DSN RIDE management applications, auxiliary switch OPRA data and live feeds. Future applications will include:

- bulk data transfer from RAC to NAC,
- customer-controlled data,
- DMSU RIDE communications,
- electronic mail,
- remote control from NAC to RAC,
- remote display of major events information, and
- managed answering service database.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the hard work of colleagues in the Switched Network Division and the London Engineering Centre, who have been involved in the work described in this article. Acknowledgement is also given to Telspec Ltd. of Rochester, Kent for their contribution to the development of the monitor alarm unit.

Note

Much of the equipment described in this article is based on proprietary products which have been described in the form used to meet BT's requirements; it should be noted that this article does not necessarily define or imply the full specification or the full capabilities of that equipment.

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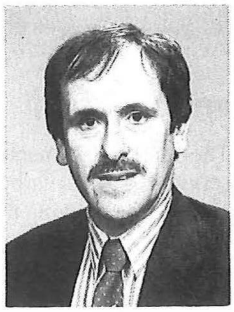
Biography



Eric Allard joined the Post Office in 1966 as an apprentice, and as a technician worked on subscriber's apparatus and line maintenance. He moved to the Research Department in 1972, where he worked in a number of areas including the development of digital radio-relay systems, System X developments, and switching for private networks. Since 1986, he has been involved in the RIDE and OPRA developments, and now leads a group in the Intelligent Network Information Section within Switched Networks Division, located at BT Laboratories, responsible for these areas and other developments for Callstream and future product development for BT's evolving intelligent network. Eric has obtained the CEI Part 2 professional qualification, and is an associate member of the IEE.

David Woods joined BT in 1985, having graduated from Brunel University with a B.Sc. in Applied Physics. He joined the Systems Reliability Consultancy in the Switched Networks division, working on many and varied network and system designs for local, trunk and international networks. He provided technical support for the monitor alarm unit development. In April 1991, he moved to the Intelligent Network Infrastructure section and is currently working as part of a team considering architectural issues and other aspects of national and global intelligent networks.

Managed Recorded Information Services—Project Planning and Installation

BILL MARTINELLI, and KEVIN BOSHER†

This article describes the planning and installation of various aspects of the managed recorded information services, together with the project management processes used.

INTRODUCTION

The market for managed recorded information services (MRIS) is both specialised and highly competitive. Owing to the nature of this market, BT has to be highly responsive to meet the requirements of its MRIS customers. In order to meet this challenge, the small teams of experts from the product line, BT Laboratories, network operations, technical support, project management and planning and maintenance, work closely together. This close cooperation requires an efficient project management framework; this article describes the processes used.

PROJECT LIFE CYCLE

Figure 1 is a simplified flow chart of the various processes an MRIS product development undergoes from conception to roll-out.

The product line is responsible for identifying new markets for BT and potential new products. Because of the short time-scales that are necessary, a number of processes have to occur simultaneously to ensure that all aspects of the development are installed and ready for network roll-out.

Once a market opportunity has been identified, the appropriate product line produces a client requirements definition for the new feature or application which forms the basis for a feasibility study.

Feasibility

During the feasibility process, all potential network solutions are investigated, with input from the MRIS teams, as appropriate. Among those consulted on the various aspects of the development are BT Laboratories and BT Worldwide Networks (technical support, planning, maintenance and operations). Information on full lifetime costs is obtained together with possible time-scales for development and installation.

The feasibility process delivers an agreed solution, defining the technical deliverables, time-scales and associated costs. This information is used to prepare a business case to obtain the necessary authority to implement the solution.

Design and Development

After the feasibility process, there are two possible paths depending on whether there is a development required, or whether existing equipment is to be used.

A new development could be for a specific piece of equipment, requiring project management of the development and planning of the environment to accommodate the new equipment. If the new equipment is a network-based solution, additional project management and planning are required to provide the network aspects. This could include, for example, the planning and installation of transmission routes.

If the project uses existing equipment, it goes straight to the planning stage; however, if it requires new equipment (in its broadest sense) the project management process is used. The project manager appointed uses the resources of the same groups who advised in the feasibility process. This ensures that the same experts are involved throughout the life of a project to ensure consistency of information and continuation of knowledge.

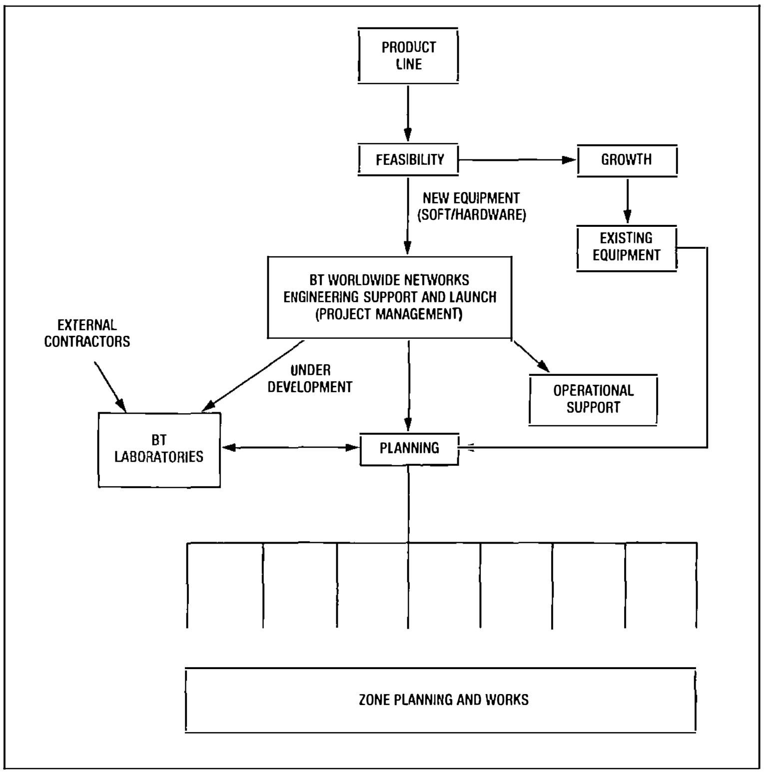


Figure 1
Product development processes

† BT Worldwide Networks

BT Laboratories develops most of the equipment for the specialised MRIS platforms, but it also uses external contractors who can supply off-the-shelf solutions to meet the product requirements. In these cases, BT Laboratories is responsible for ensuring that the external contractors and the equipment they supply meet BT's required specifications. Occasionally, the product required is a combination of an external contractor's product and a BT Laboratories development, where BT Laboratories enhances the supplied product. BT Laboratories acts as an agent in negotiations with external contractors for the development.

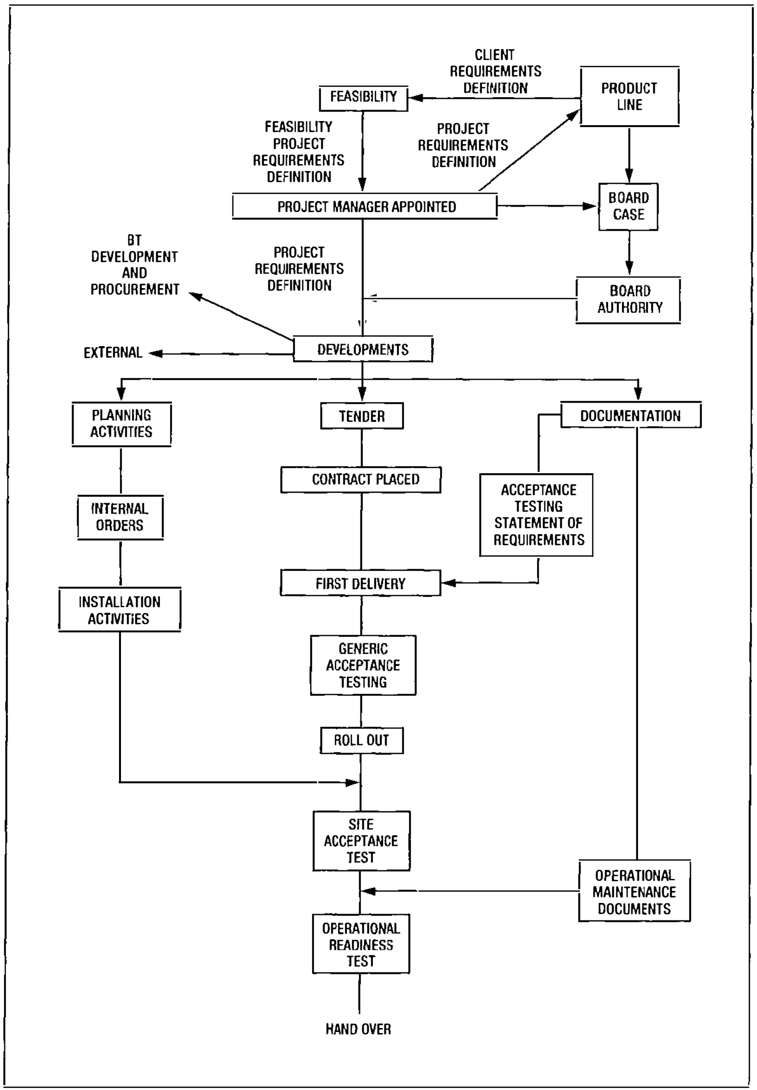
Planning

While BT Laboratories is negotiating with the external contractors, or developing the equipment, planning within BT is already taking place. This ensures that all site work, cabling requirements and so on are being planned and will be installed ready for the roll-out of the product. The planning manager has to provide information to the appropriate zones on such topics as the accommodation required, the power required, ventilation required, time-scales, and so on. This information is provided through network planning guides.

In addition, extra equipment may have to be centrally ordered for the zones. Lead times may be critical, as all the necessary extra equipment must be ordered, received, installed and tested before the new development is rolled out to ensure that the delivery date is met. All development of equipment is the responsibility of the project manager.

For the case where existing equipment is added, and no upgrades or new products are required, the process is simplified, with the planning manager investigating the existing capacity, obtaining forecasts from the product line and usage figures from operations. This ensures that capacity is provided and that the operators are informed of the changes to the existing equipment.

Figure 2
MRIS project management process



PROJECT MANAGEMENT

Two aspects make MRIS different from other projects. Firstly, the time-scales involved can be very short, for example, only six months from inception to roll-out, with very little float and most activities being critical. Secondly, MRIS is a continuous programme and several projects are always in progress at any one time using the same people.

Figure 2 shows a simplified block diagram of the project management process.

The client requirements definition is produced by the appropriate product line for the new feature or application and is subject to the feasibility process which, as explained earlier, uses the input from various groups within BT to determine whether the proposal is viable. From this process, a feasibility project requirements definition is produced which details the potential technical solution, expected costs and time-scales.

Once a project has been deemed viable, a project manager is appointed who produces a project plan and obtains agreement for the use of resources required. A project requirements definition is written, which defines how the product-line requirements are to be met and the project time-scales. This is returned to the appropriate product line who prepare a business case.

The business case is a document that describes what needs to be done, the capital cost of the whole project and, specifically, the costs to Worldwide Networks, the expected payback period and the benefits to BT. This process enables the necessary financial authority and funding to be obtained. The project manager provides a supporting paper to the product-line business case confirming that the required resources are available and that the end dates can be met.

Once financial authority has been obtained, the project goes into development, with all tasks being coordinated by the project manager.

Tenders are invited from, and eventually contracts are placed with, the relevant external suppliers, in-house development by BT Laboratories is commissioned, and installation work is planned.

Network planning guides are written and passed to the various zones for implementation, along with the generic acceptance testing, the acceptance testing statement of requirements, installation guides, and operational guides. Depending on the project these can either be new documents or additions and amendments to previously published documents. Operation support and network management procedures are agreed and distributed.

PROJECT PLANNING

In order to ensure that the various parallel activities operate successfully, the planning manager has to take a strategic overview of the whole process, taking into consideration possible future projects and other simultaneous projects.

The planning manager has to compile strategic information such as the equipment required and its attributes: physical size, weight, power requirements, footprint size, connections, venting, environmental considerations, and so on.

This information is collated in a Network Planning Guide (NPG) and issued to all zone planners to enable them to ensure that they can meet all the accommodation requirements. They also use this information to schedule work programmes.

The planning manager will also have forecasts for the new equipment; that is, whether it will have any spare capacity, or whether further equipment is required to complement the development.

In addition, new pieces of equipment, should they be required, are identified and ordered.

Installing and Testing

The generic acceptance testing is carried out on the first delivery and is usually done at BT Laboratories. The first product from the external contractor is thoroughly tested in all aspects of its design, quality, construction and functionality. Once it has passed all the tests satisfactorily, generic acceptance is granted and the product is rolled out to the zones.

A number of the agreements with the external suppliers are 'supply and install' contracts, so it is the external contractors who install the equipment in the zones during roll-out. This will be under the supervision of the project manager.

Occasionally, the zones are advised to order equipment themselves, rather than having the items ordered via the planning manager. These details are provided in the Network Planning Guides.

Once installed in the zones, a site acceptance test is performed on the products. This is a functional test and does not repeat all the tests carried out in the generic acceptance tests. This is followed by the operational readiness test, which is basically a network trial, ensuring that the procedures and developments operate correctly. All the procedures are verified including fault reporting, fault escalation, billing, and so on, and when this has been satisfactorily completed, the project manager obtains operational sign-off and the project is finished.

SUMMARY

This article has described the important role of project planning and installation in ensuring that the MRIS platform is delivered. The tasks involved are varied with demands to plan, manage and install new developments which may be single items of equipment or network-based solutions, or enhancements to the existing platform. Of paramount importance is the need for clear procedures to ensure that projects move efficiently through their life cycles from conception to roll-out.

Biographies

Bill Martinelli joined BT in 1962 as an apprentice. His first job was on exchange construction in the City of London. On promotion to the Management and Professional Group, he moved to London Telecommunications Region where he worked on the planning of direct labour work for Strowger, TXK1 and TXE2 exchanges. With the inception of National Networks, he became part of the original team set up in London. He was responsible for local planning aspects of the analogue DSN exchange at Faraday House, and then for planning its digital replacement, a 5ESS switch installed at Baynard House, eventually becoming the clerk of works. On further promotion, he moved to BT Headquarters working on the project management team for the DDSN project. From here, he moved on to manage the MRIS projects and has been responsible for the acceptance and roll-out of the auxiliary switch, VSE3 and OPRA. He is currently working on the provision of mid-call diversion and customer access manager—new features being developed for the auxiliary switch. He has obtained the Open University Certificate in Management and is presently working towards the Diploma in Management.

Kevin Bosher joined BT in 1974 as an apprentice. His first job was in exchange construction, dealing with Telex exchanges. On the inception of National Networks, he transferred to the group responsible for analogue DSN switches in London. From here, he entered the works planning group with duties associated with the DSN, and on promotion to the Management and Professional Group was responsible for the Central Office planning duty in Network Planning and Works. This has involved him in planning the MRIS equipment, which included the initial planning for DSN RIDE and DMSU RIDE for the London code change.

Managed Recorded Information Services—Customer Interface Processes

JOAN STEWART†

Robust processes are essential to ensure the success of any product in a competitive market-place. BT has offered information services since 1986 and the current processes have evolved in response to the need to provide customers with quality services. This article provides an overview of the support functions, processes and procedures associated with the provision of service for the managed recorded information services portfolio. All network provision is discussed in an accompanying article[1].

INTRODUCTION

BT is a world leader in the information services arena and, as such, has been proactive in facilitating entry into this market by the introduction of a managed recorded information services (MRIS) portfolio. Details of the features and facilities offered to customers, usually referred to as *service providers*, can be found in another article in this issue of the *Journal*[2].

In a fast-moving, competitive environment such as the information services market, customers demand a high standard of service. In order to satisfy these demands, BT has created a specialist sales group and a customer service centre to support both Callstream and LinkLine™ products, which together provide the necessary knowledge and expertise to enable customers' needs to be realised by the most efficient and cost-effective methods.

PRODUCT SUPPORT

The MRIS support structure consists of several departments and systems, each of which interact to ensure that both service providers and calling customers receive prompt and efficient service. These are:

- the Independent Committee for the Supervision of Standards of Telephone Information Services (ICSTIS)[3],
- Connections in Business,
- specialist sales,
- customer service centre, and
- the derived services network off-line support system.

ICSTIS

Consumers of Callstream services are offered protection in the form of a code of practice produced, managed and administered by ICSTIS. The code of practice provides the regulatory framework against which all premium-rate services should comply. Service providers contracting for Callstream service are bound by BT's terms and conditions to observe and adhere to this code of practice.

The ICSTIS terms of reference are:

- to set standards for the content and promotion of premium-rate telephone services and to keep such standards under review,
- to consult the industry and other interested parties prior to changing these standards,
- to monitor such services to ensure that both the content and promotional material comply with these standards,
- to investigate complaints relating to the content and the promotion of premium-rate telephone services and to recommend measures to achieve compliance where the code of practice has been breached,
- to provide a system for the adjudication of claims for compensation in respect of unauthorised use of live conversation services,
- to publish reports on the work of the Committee and adjudication of claims at regular intervals, and
- to make sure its work is known and understood by the public, network operators and service providers.

BT Connections in Business

Connections in Business is a BT-owned telephone answering bureau which handles queries and requests for customer literature on a range of BT products and services including Callstream. All customer enquiries are potential sales and are therefore passed to the appropriate sales team to progress.

Specialist Sales

Dedicated sales account management teams provide help and advice to potential and existing service providers. Account managers are the interface between BT and the service provider and offer guidance and support to customers on how best to support their service requirements.

† BT Products and Services Management

Customer Service Centre

Customer service centres provide technical and operational support for account managers and customers. The service-centre staff handle and process all orders for managed service and are the customer contact point for all queries and complaints on any issues.

Derived Services Network Off-line Computerised Support System

The off-line support system was developed to support derived services network (DSN)-based products such as Callstream and LinkLine and consists of two main parts, the order processing system and the charge raising system.

Order Processing System

The order processing system facilitates the entry of customer order details and distributes this information to network provisioning groups to allow for installation of Callstream and LinkLine services to be performed. The order processing system also provides the charge raising system with the necessary customer data for call record validation and charging.

Charge Raising System

The charge raising system calculates the charges for all calls made to services utilising the DSN. The number dialled and the duration of the call is logged at the appropriate DSN exchange. At the end of each day, this information is fed into the charge raising system, which calculates the associated call charges and, for Callstream services, apportions the service provider's share of the revenue. The charge raising system relies on the order information on the order processing system to allocate the payments and/or charges to the appropriate service provider.

PROCESSES AND PROCEDURES

The remaining part of this article describes the activities and processes associated with the provision of services utilising the MRIS platform and covers the following areas (Figure 1):

- pre-sales activity,
- the sale,
- order processing,
- revenue sharing and billing process,
- fault reporting, and
- after-sales support.

Pre-Sales Activity

Companies or individuals interested in finding out more about information services are encouraged to contact BT Connections in Business for further details. Interest might have been stimulated by press advertising or recommendation from existing service providers. BT Connections in Business takes initial enquiries, and dispatches brochures and the ICSTIS Code of Practice to callers. The caller's details are then passed to the specialist sales group for lead qualification.

The Sale

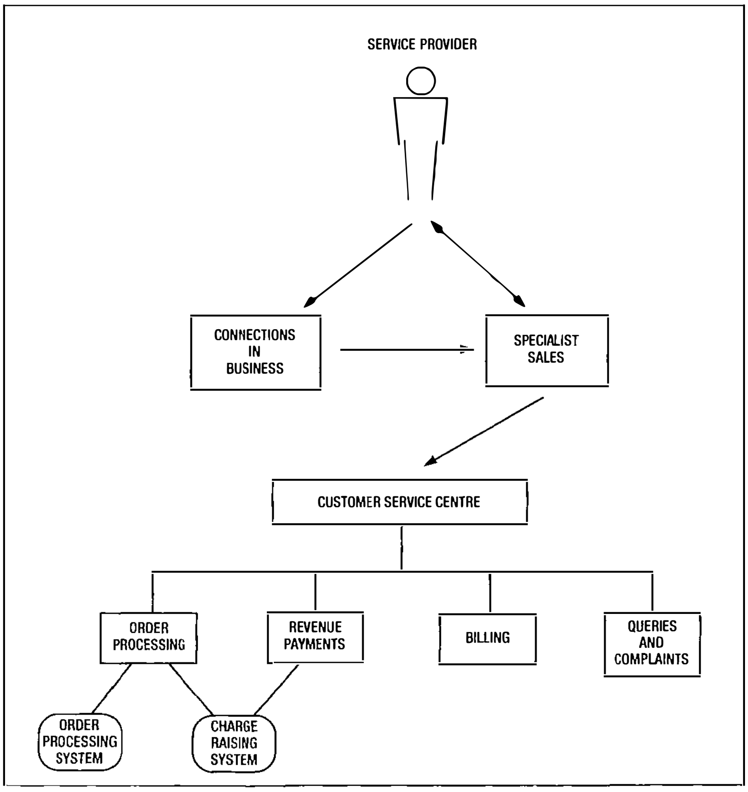
All leads received by the specialist sales groups are qualified; that is, each caller is contacted within two weeks of the initial enquiry. The sales account managers fully discuss the customer's needs and recommend the most appropriate service to satisfy these needs. The customer's service requirements are fully researched, taking into consideration his/her short-, medium- and long-term requirements.

New customers must complete and sign an application for service and return this to BT. If the customer is a limited company, a copy of the company registration certificate should be included. In line with standard BT policy, all new customer's credit records are vetted before service is provided.

Once the application form and any other documentation is received, the account manager arranges for a contract for service to be drawn up and signed by the customer. The contract details the customer's exact service requirements; the associated connection charges and quarterly rentals, if appropriate; the estimated date for service to begin; and the telephone number(s) which have been allocated to the customer.

On receipt of the signed contract, the order is then submitted to the service centre for processing.

Figure 1
Providing service



Order Processing

Order processing for both Callstream Managed and LinkLine MultiLink services is identical and performed by the appropriate product service centre.

Order Entry

On receipt of the order, the service-centre operator inputs the customer's order details from the contract onto the order processing system. After the initial entry, the order goes through various stages:

The first stage is the *proposed order stage*, where details of the order are passed to the network provisioning groups for time-scales and tasks to be allocated[1].

When the service-centre operator is satisfied that the details of the order are correct and the time-scales meet the customer's requirements, the order is authorised and the network provisioning commences[1].

When all the network provisioning is completed, the service is ready for calls to be received. However, before calls to a service provider's service can be charged at the correct tariff, each order has to be made *ready for charging*. A simple code and a date are appended to the order and the service is then fully implemented. The charge raising system is then primed to log the call data it receives against the appropriate service provider's number and calculates the revenue earned by each call.

Once the order has been implemented, the service-centre operator arranges for a welcome pack to be sent to the service provider. The welcome pack includes useful contact numbers and, if the customer is using remote update or any of the Enhanced Callstream features, all necessary access numbers, codes and personal identification numbers.

Time-scales

The standard time-scale for provision of Callstream Managed service and LinkLine MultiLink service is 10 working days from receipt of the customer's order. Time-scales for each order are negotiated between the service provider and the service-provision teams. If it is essential that the service be provided sooner, the service-provision teams endeavour to do so in order to meet the service provider's needs. Callstream Enhanced Managed service customers are normally provided with service within five to eight working days.

For Callstream Enhanced Managed service customers requiring to provide a live service using a direct connection, a timescale of 20 working days is quoted.

The Callstream customer service centre arranges for the customer to sign an additional contract for service for a private Speechline circuit. The service centre coordinates the provision and installation of the complete order on the customer's behalf.

Revenue Sharing and Billing

Callstream

Revenue Sharing Process As outlined in an earlier article[1], revenue earned from calls to Callstream services is shared between the service provider and BT. The charge raising system logs the number dialled and the duration of the call in called seconds. The service provider receives an agreed amount per second and BT retains the rest of the revenue as a charge for the use of the BT network and facilities.

Service providers are paid their share of the revenue, from which line or service rental is deducted, on a monthly basis. BT includes with the revenue cheque a tax invoice, pre-printed with a VAT amount, based on the revenue amount, which, if VAT registered, the service provider should present to HM Customs and Excise Department.

In order to keep administration costs for both service providers and BT to a minimum, revenue cheques are only processed for revenue earned of £500 or more. Monies accrue until this limit is reached and the cheque is then issued and dispatched.

Billing BT Callstream operates a *self-billing process*; that is, any rental due is deducted at source from the service provider's share of call revenue. Every month the service provider receives, from the BT billing centre, a statement of accounts detailing the Callstream rental charges. Around the same time, the customer will receive a cheque for his/her share of the revenue from BT with the rental already deducted.

LinkLine MultiLink

LinkLine MultiLink is used mainly for campaign style promotions. BT offers full call-management facilities with this service and service providers rent LinkLine telephone numbers instead of lines. Charges for both the number(s) and the call charges are associated with the service provider's PSTN telephone number and detailed on the normal quarterly PSTN invoice.

Fault Reporting

Callstream Managed Service and LinkLine Service

BT's managed service equipment is self monitoring and if any faults occur, they are normally identified and repaired before the service provider is aware that they have occurred.

If, however, the service provider does discover a service fault, he/she is encouraged to call the 24-hour fault reporting point (FRP) on 0800 110011. All fault reports are logged and progressed by the digital derived services network FRP. The FRP staff refer to the customer's service records, which are stored on a maintenance database; these records identify the managed services equipment on which the service provider's services are operated. The appropriate announcement-centre staff are contacted and the fault details are passed over for clearance. The FRP remains in control of the fault and advises the service provider of progress and when the fault is cleared.

If a fault is received outside normal working hours, currently only a fault reception service is available.

CallStream Enhanced Managed Service

As with the other managed services, all equipment on the CallStream Enhanced Managed service is fully self monitoring. If any faults occur on the service, service providers are encouraged to call 0800 155255; this number is answered at the network management centre at Oswestry, which provides 24 hour, year-round fault reception. On receipt of a fault report within normal working hours, the details are passed to the national announcement centre (NAC) for clearance. The service provider is kept informed on a four-hourly basis of progress and advised as soon as the fault is cleared.

When faults are received outside normal working hours, the network management centre staff either pass the fault to the NAC the next working day or call out a member of the NAC team, depending on the seriousness of the fault report.

After-Sales Support

There are two types of after-sales support

- account management, and
- customer after-sales service.

Account Management

Service providers are contacted on a regular basis by the specialist sales team. The account-management function ensures that the service providers are kept informed of the latest product developments and offers a forum for both BT and the service provider to identify potential growth opportunities.

Customer After-Sales Service

The customer service centre offers an essential after-sales support function to all service providers and deals directly with any requests for modifications to existing services. The service centre provides technical guidance on all service matters and is the customer contact point for any queries or complaints regarding billing, revenue and statistical issues.

CONCLUSION

With the advent of new, and increasingly sophisticated, network features designed for use within the information-service environment, product support functions perform an important pivotal role in ensuring service provider's needs are dealt with in a quality manner, matching up their needs with the very best products and services BT has to offer. By investing in the best technology and by placing emphasis on the development of solid processes, BT is consolidating its position as the service provider's first choice of network provider.

References

1 HOLMES, I. Managed Recorded Information Services—Network Operations. *Br. Telecommun. Eng.*, Apr. 1992, **11** (this issue).

2 SHAW, P., STEWART, J. and CRISP, N. The Need for BT's Managed Recorded Information Service. *ibid.*, Apr. 1992, **11** (this issue).

3 ICSTIS, Kingsbourne House, 3rd floor, 229-231 High Holborn, London, WC1V 7DA. Tel.: 071–430 2228.

Biography

Joan Stewart joined BT in 1980 and provided clerical support to the West of Scotland District sales department. She moved to the Network Marketing Unit in 1985 where she worked on various projects including local-call stimulation initiatives and the network modernisation programme. When national Callstream was introduced in 1986, she formed part of the original West of Scotland area support team. She moved to the Callstream Product Development group in 1989 and was involved in the Callstream Enhanced Managed service project, managing its launch into the marketplace. She is currently project managing the introduction of a wide range of Callstream customer features.

Managed Recorded Information Services—Network Operations

IAN HOLMES†

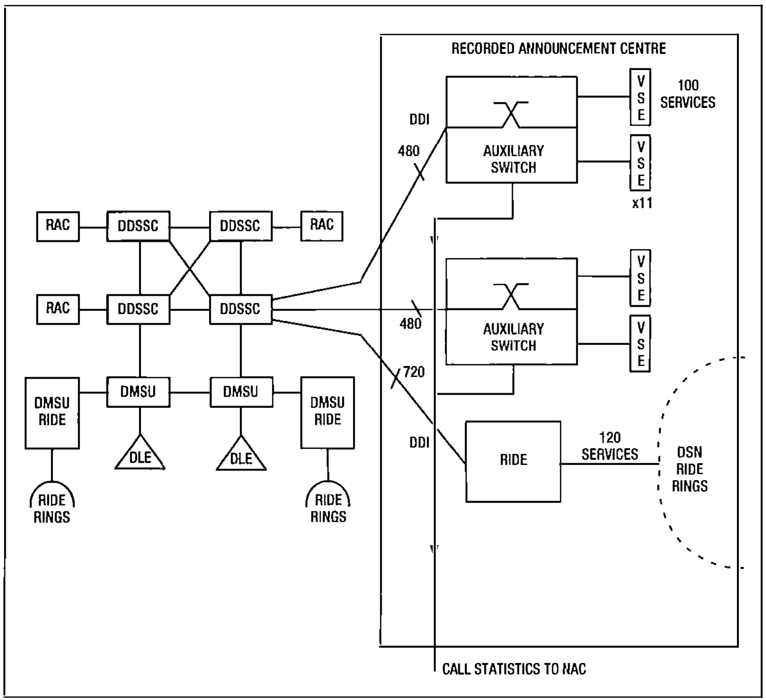
Operation of the managed recorded information services (MRIS) platform is described, along with the provision and management of the services. Access to the MRIS platform is via the derived services network and, potentially, the public switched network. Maintenance of the network and equipment is covered.

INTRODUCTION

Managed recorded information services (MRIS) have grown with developments in the derived services network (DSN). The MRIS operations comprises service provision, control and maintenance of the MRIS platform, which itself comprises eight regional recorded announcement centres (RACs) and the national announcement centre (NAC). Owing to their close associations with DSN developments, each RAC is collocated with a DSN node. A standard basic configuration has been adopted for all RACs with interconnection to the NAC, which is based at Oswestry. Figure 1 shows a schematic diagram of the access network and an RAC. More information can be found in the overview article describing the history and architecture of MRIS[1].

† BT Worldwide Networks

Figure 1
Access network



DDI: Direct dialling in
DDSSC: Digital derived services switching centre
DLE: Digital local exchange
DMSU: Digital main switching unit
DSN: Derived services network
NAC: National announcement centre
RAC: Recorded announcement centre
RIDE: Recorded information distribution equipment
VSE: Voice services equipment

A 2 Mbit/s communications network interconnects and provides the capability to transfer information between the RACs and the NAC (see Figure 2). Reference 1 details how the RACs are configured within the network.

There are two levels of services provided on the MRIS platform:

- those which use the auxiliary switch in combination with voice services equipment (VSE); and
- those which use the RIDE network.

The auxiliary switch and VSEs are designed to handle a high number of different service announcements, but with a relatively low call volume, whereas the RIDE network handles high call volumes, but with fewer services available. The RIDE itself offers two services—televote and broadcast.

Further information on these systems can be found elsewhere in this issue of the *Journal* [3, 4].

OPERATIONS

The MRIS platform consists of specialised and unique sets of network equipment which, because of the relatively small number of people involved, allow for economies of scale by centralising many of the functions and expertise at the central operations unit (COU). This is a small dedicated team of experts who have responsibilities spanning across the whole platform.

The central MRIS operations team has the responsibility for operational processes and procedures for the MRIS platform. It is responsible for the introduction of new services (for example, Callstream and LinkLine services) and negotiates the interfaces in the customer-facing groups (BT Business Communications). In addition, the team decides on the most appropriate way for an order to be processed and progressed through the system, and is also responsible for capacity management and equipment utilisation within the MRIS platform.

Service Provision

The provision of service can best be described by following the flow of a customer's order once it has been taken by the sales force[2].

Depending on the volume of calls anticipated, the customer will either purchase a VSE service (low call volumes, but a high number of services) or a RIDE service (high call volumes, but a low number of services). Other options which have to be considered if the service is to be provided on the RIDE network are whether to have televote or broadcast, start-at-the-beginning, or non-start-at-the-beginning announcements, remote update, live feed and so on. These decisions are taken following discussions and negotiations with the sales force.

A help desk is in operation at the COU at Whittington House, Oswestry, which provides help to the sales force during the initial negotiations. For example, sales staff may wish to check on the availability of equipment, or ascertain certain information such as possible time-scales.

After this interactive process, and once the most suitable services have been decided upon, the sales force submit the order to the Callstream customer service centre, which performs validation checks.

If the lead time is less than standard, the sales force will need to contact the service provision team and check that the service can be delivered.

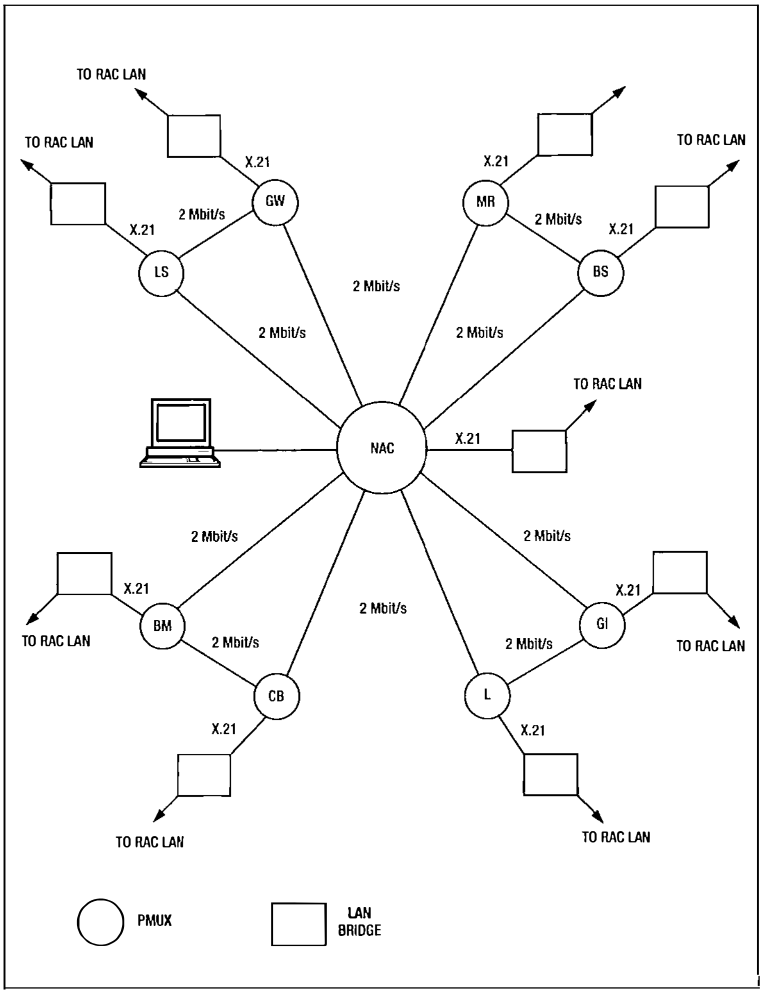
Order Processing

If time-scales and validation checks prove satisfactory, then the customer service centre builds the order on the order-processing system. This is part of the DSN off-line support system and is based at the computer centre in Bletchley. It is a task-based system which directs requests for information to specific workqueues. For all MRIS orders, a task will appear on a workqueue at the MRIS service provision team at Oswestry.

As shown in Figure 3, the customer's requirements together with the required-by date are built into the order processing system screen, and this is forwarded within the system to appear on a single workqueue at the COU at Oswestry for assessment of the MRIS order. The order-processing system screen carries all the details about the customer, but it does not define where the service is to be provided; this is decided by the service provision team.

Equipment Allocation

When the order arrives at the COU, the customer's requirements are analysed and a decision is made as to which of the eight RACs is best suited for the service—RIDE services are only provided at the NAC. If it is to be placed in a RAC, a number of factors are taken into consideration in order to maximise the utilisation of equipment and spread workloads. For example, if the order is from an existing customer, then attempts are made to place these additional services at whichever RAC is already holding the customer's present services. However, there are times when this is not always possible or even desirable. Certain other factors have to be considered; for example, the service capacity of each RAC, whether the customer's requirements include tape update or remote update, and so on.



LAN: Local area network
NAC: National announcement centre
PMUX: Primary multiplexer
RAC: Recorded announcement centre

Figure 2
Communications network for DSN

Figure 3
Order processing system screen

```
ORDER/D                  CUSTOMER ORDER DETAILS                     DDM31900

Customer Name: PSTN CNA ANNOUNCEMENTS                  Reference  : 040454
Order Reference : 070385          Comments Attached  Consultant : MARIOI

  Key Dates For This Order                          Order  Status     Date
Ordered     : 03/02/92  BT Target    : 04/02/92  Prev: 070214 IMPLEMENTD 07/02/92
Required    : 03/02/92  Service Date: 03/02/92  This: 070385 IMPLEMENTD 07/02/92
Authorised  : 03/02/92  Responsible : MARIOI    Next: 070391 AUTHORISED 03/02/92
ProductLine: TNS        Order Office: RSMORDER

  Action  Item Description                           Productitem Status
  PROVIDE Published number 0800 XXXXXX Answered at    X/0800      Implementd
          BS/RAC (RO3) from catchment area ALL        Packaging  0800    L3


Short Term Service Cease-On Date:            Order Supercedes Order :

Command:
DC900043 All data displayed
```

The COU receives reports from the RAC managers during the last full week in each month giving the available capacity at each site. This enables the COU to fulfil its capacity management function.

If the customer requires tape update of his service, then this demands more work of the RAC staff as, unlike remote update, the staff have to physically load tapes. It is the function, therefore, of the COU, to balance the workload of the RACs, ensuring none are overloaded and, equally, none are under-utilised.

Once it has been decided which RAC should support the service, the MRIS service provision team shows, via the order-processing system, the proposed order to that RAC. This provides details of the service requirement; that is, BT target date for provision, message length, service type (remote update/tape/live feed). This is usually followed up by a telephone call. Once the RAC staff confirm they can support the order, it is accepted by MRIS service provision. Acceptance is transmitted back to the customer service centre via the order processing system and the customer is advised. The order-processing system automatically generates the appropriate tasks on the workqueue at the chosen RAC.

If, for whatever reason, the order's target date cannot be met, the order is rejected and the reason explained to the customer, usually with a revised date being offered.

The RAC staff then allocate the appropriate capacity and file areas on a VSE as well as service code(s)—two-digit direct dialling in (DDI)—to access the service(s). They establish a routing across the auxiliary switch to the appropriate VSE: this involves preparing auxiliary switch routing translations. The preparation work could include setting up remote update details on the VSE as well as the translation on the auxiliary switch. Further details of the translation tables can be found in the article covering the auxiliary switch and VSEs[3]. The network address, which comprises the auxiliary switch routing number, the auxiliary switch routing and VSE service code, is entered onto the order processing system and filed. This operation causes the order processing system to generate an order on a workqueue within the DSN data operations team. This COU team prepares and loads the translation data linking the dialled telephone number and network address on all the DSN switching centres.

Update Service

If the customer requires remote update of their announcements, the RAC staff provide details of the 0800 number used to access the particular VSE. In addition, they also assign the service code and personal identification number (PIN) on the VSE to provide secure customer access to update their announcements. All these details are conveyed, via the order-processing system, to the customer service centre, which provides the relevant instructions to the customer.

For a tape updated service, the customer is advised to send a normal audio cassette tape of the announcement to the BT Tape Centre in Bristol, where it is vetted and then forwarded to the relevant RAC. The MRIS service provision team advises the distribution centre of all new provisions, changes or cessations. The tape must be received in Bristol at least two days before the message is due to go on the network. Announcement centres will not accept tapes directly from service providers. The vetting is for quality of content only and the centre is working to ICSTIS (Independent Committee for the Supervision of Standards of Telephone Information Services) guidelines. The day before the service is due to start, the tape is loaded onto the correct VSE.

RIDE Services

A similar provisioning process is followed for the RIDE services: the order comes to the MRIS service provision team as a RIDE order and, as long as the due date can be met, the service is accepted for the DSN RIDE platform.

In the case of the RIDE, instead of the task appearing on RAC workqueues, the order appears at the NAC's workqueue, where the staff check service availability, whether the service is start-at-the-beginning, whether a pre-announcement is required, whether it is a live feed etc; and allocate the appropriate number of channels. As before, the PIN number and service codes are supplied to the customer, via the customer service centre, if remote update service is required, together with online statistics service PIN numbers and service codes.

There are fixed translation tables within the RIDE which use three-digit DDI to determine the service characteristics (for example, message length and caller timeout) and channels on which the service is provided; for instance, a single service would have a pre-announcement on a different channel than its main announcement. The NAC staff determine the three-digit DDI code(s) required to provide the desired announcement characteristics and enter the details on the order-processing system to instigate provision of DSN translation data.

Basic Services

On the RIDE, the customer can purchase one of two services:

- televote, or
- broadcast.

Televote services are those which enable votes to be cast simply by ringing one number representing a caller's choice from a range of possible options available. They tend to have short holding times, typically 5 s. The message that is heard thanks the caller for voting and announces that the caller's vote has been registered. This service is useful for events which demand that the public vote on particular items, such as the various acts on 'Opportunity Knocks' or the UK entries to the Eurovision Song Contest.

For televotes, further announcements to the service can be networked, depending on the time called, advising callers that:

- the service has not yet commenced, or
- that the service has closed.

Broadcast services are continuous information services, normally of longer holding times, such as those used by bookmakers to give live commentaries of sporting events, or results services.

For the RIDE orders, the NAC staff prepare the VSEs at the head of the RIDE rings on which the announcements are to be loaded, and the relevant PIN numbers and service codes are determined. In addition, the online statistics system needs to be programmed to collect and collate statistics for the service and channels that are being used to support the service. The customer is provided with the relevant information to enable him/her to obtain statistics for the service.

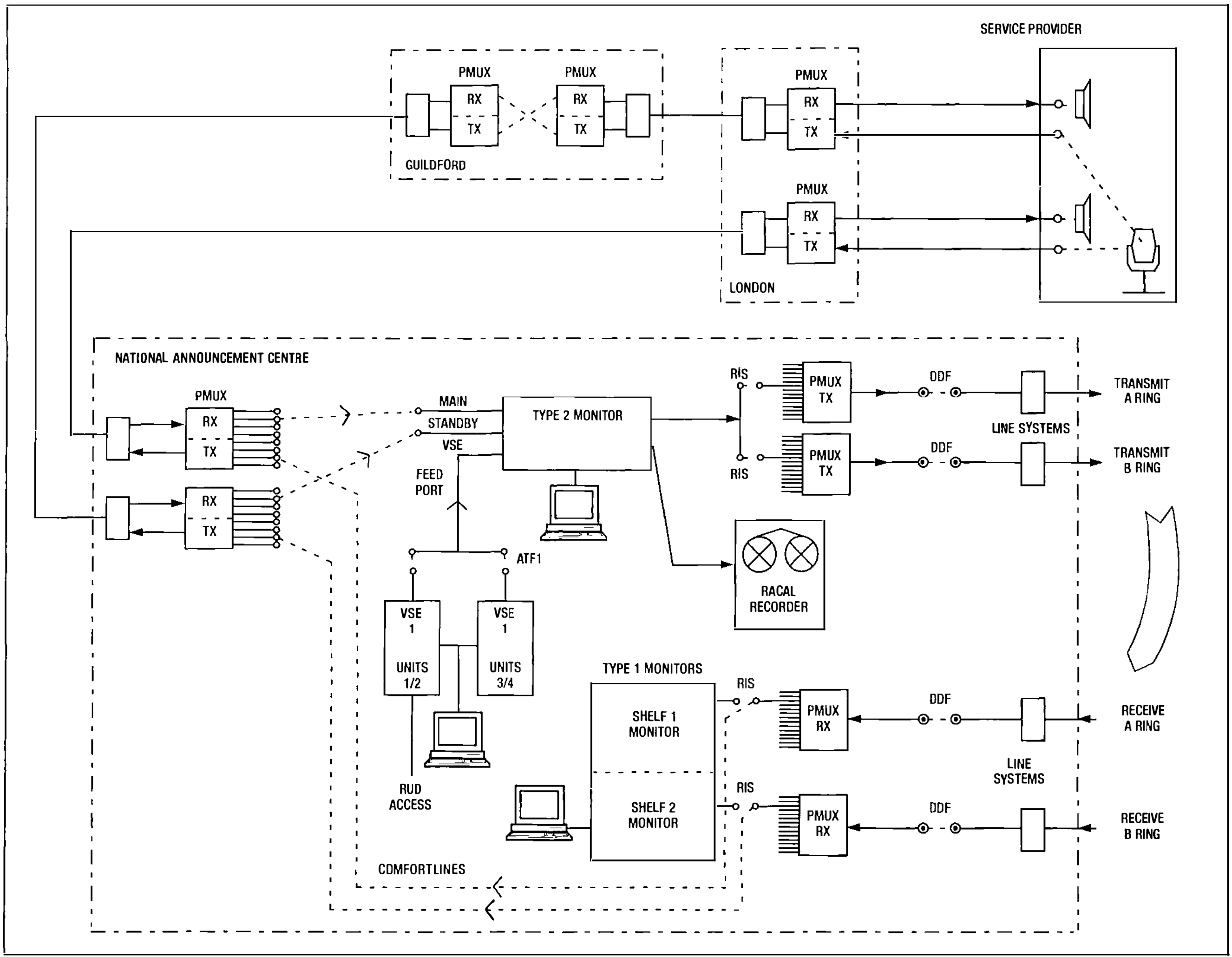
The monitor alarm unit is also set up to monitor the new service, and a test message is loaded on the particular channels to be used. This message provides a continuous announcement for the monitor alarm unit to monitor until the customer updates the service either by supplying a tape or by remote update.

Live-Feed Service

For live-feed customer services, private wires are installed from the customer's premises to the nearest RAC. For security, two private wires are supplied, acting as a main and stand-by. Each are allocated two channels on the communications network (see Figure 4), one with direct connection to the NAC, the other via an alternative RAC for increased security. The NAC staff then perform an end-to-end test from the customer's premises right through to the NAC to ensure the correct audio levels are received. The service is then patched into the appropriate channel on the RIDE network.

All live feeds and remote-update messages are recorded and retained for 28 days to comply with OFTEL (Office of Telecommunications) regulations. Thus, any networked message can be retrieved and replayed in the event of a complaint. RACAL voice-activated recorders are installed in each RAC and the NAC to monitor these direct feeds and updates. Equally, tape-updated messages are retained for the same period.

Figure 4
Live feed access



DDF: Digital distribution frame
PMUX: Primary multiplexer
RIS: Recorded information service
RUD: Remote update
RX: Receive
TX: Transmit
VSE: Voice services equipment

Service Management

Service management can be considered as the matching of available resources to the traffic volumes.

An RAC manager monitors the utilisation of the particular services at the RAC. If a particular VSE service is detected generating high call volumes, causing congestion, then a number of options are available. For example, the number of lines to that service can be increased in order to provide additional answering capability, which could result in the service being provided over two VSEs.

A further option available to RAC staff is to utilise the auxiliary switch wait-on-start facility. This facility enables the auxiliary switch to be used as a concentrator. The auxiliary switch can be programmed to wait until a pre-set number of incoming calls has been received, and can then switch all of these calls through together to one VSE line. The parameters that can be varied are elapsed time and number of calls. Thus, the auxiliary switch waits until, say, five calls have been received, or a set time has elapsed, say 5 s, whichever occurs first. A balance must be achieved with the parameters being set to ensure call connection is not delayed significantly. This facility provides a greater utilisation of VSE lines.

It is possible that the RAC manager may decide, in conjunction with the MRIS service-provision team, that the service is stimulating too many call attempts and would be better suited to operate on the RIDE systems. The MRIS service-provision team generates the necessary orders on the order-processing system, involving the NAC staff. The service can then be transferred from the VSE to the RIDE network. The calling customers will notice no difference, but the service provider is kept informed at all times and provided with new telephone numbers for on-line statistics and remote update access.

One of the aims of MRIS operations is to restore services upon failures as quickly as possible. The use of security channels on the RIDE reduces the risks to these services, while for services held at the RACs there is the ability to use the auxiliary switch to by-pass failed equipment and restore service on other equipment without the customer being aware of the failure.

Quality of Service

Several quality-of-service resources are placed on MRIS operations. These quality-of-service targets basically cover three areas:

- the standard lead times for provisioning;
- termination capacity (to terminate successfully 98% of all MRIS calls that arrive at the DSN node in a 48 hour period); and
- fault repair (targeted to restore to service any failure by the end of the next working day).

The fault repair target is the contractual agreement, but the reality is that networks achieve a 4 hour restoration in the vast majority of cases.

BT's Online Statistics Service

Call statistics are provided by the opinion poll registration application (OPRA) system.

The OPRA collects data on the usage of recorded information services and makes this data available to the service providers.

NAC staff program the OPRA system to provide statistics matching the particular service; for example, single or multiple outputs.

Statistics

There are two methods for customers to obtain the online statistics. They can dial the OPRA equipment from a suitable personal computer (PC) associated with a modem. They then are prompted for a service code number and PIN number of the particular service for which they wish to obtain statistics. The OPRA prompts the caller to clear down and dials the customer's terminal back a short time later and downloads to the PC the data requested.

Alternatively, the customer can dial the OPRA equipment with a TouchTone™ telephone, again entering a service code/PIN combination. On selecting the information required, the OPRA provides the latest statistics directly over the line by using voice messages (only call totals per service are available with this method).

Customer Services

Three basic types of service are available to customers:

- *Detailed statistics service* this provides detailed statistics on the number of calls and their accumulated call holding times split over eight regions for each 15 minute period.
- *Summary statistics* this provides the aggregate total of calls to a set of numbers, split over eight regions.
- *One minute statistics* this is similar to the summary statistics, but provides data on a one minute time period.

Normal circumstances are such that customers access the OPRA system directly either by dual-tone multi-frequency (DTMF) signalling or by PC and modem; however, there are administration screens which allow the NAC staff to retrieve data and archive data. These administration screens take the following format.

0, Summary of today's data for all regions
1, Today's data for regions 0 and 1
2, Today's data for regions 2 and 3
3, Today's data for regions 4 and 5
4, Today's data for regions 6 and 7
5, Today's data for all regions
6, Daily totals for all regions for the last 7 days
7, All region report for today –1
8, All region report for today –2 and today –3
9, All region report for today –4, today –5 and today –6

where region refers to DSN regions.

Accumulated call holding time is also given in a similar format. Figure 5 shows a typical report.

With a summary report, the call-count totals for each region are presented automatically; there are no other options. Figure 6 shows a typical report.

The OPRA database retains call data for seven days, but to enable reports to be available for earlier periods, archiving is provided, with archives being retained for 28 days.

Among the benefits to customers is the ability to determine the impact and effectiveness of advertising campaigns on a regional basis. For example, by looking at the results over a 24 hour period a customer can determine which television advertisements produced the best response.

MAINTENANCE

Within Worldwide Networks, the Operational Policy and Systems unit has responsibility for defining the processes and the procedures relating to the maintenance of MRIS equipment. Consequently, for each element within the MRIS platform, which could originate from a variety of manufacturers, this team determines the support requirements. These requirements include the level of first-line maintenance required, what spares should be carried within BT, where they should be held, etc.

This team negotiates and establishes with manufacturers or other support agents a maintenance support contract. The contract defines the level of support required from the company; that is, whether it is a 24-hour-call-out, or a next-working-day service etc. The support contracts are negotiated to provide appropriate cover to meet the quality-of-service targets and provide for automatic software upgrades.

Once these maintenance contracts have been negotiated and agreed they are effectively handed over to the maintenance groups who can call upon the contracts when necessary.

The responsibility of maintaining the RIDE system is that of the NAC staff using the recorded information service control processor (RISCP)[4], while maintenance of the auxiliary switches and VSEs is the responsibility of the RAC staff. Consequently, any alarms on the RIDE switches, although physically located at the RACs, are fed to the RISCP at the NAC. There are no RIDE alarms, other than power alarms, in the RAC.

The MRIS support manager monitors the support contract to ensure that it has been fulfilled and negotiates renewals.

Responsibilities

The RAC manager is responsible for the maintenance and availability of all the equipment in the RAC, with the exception of the RIDE switch. This includes the monitoring of all the printouts and alarms for indications of any problems, and the rectification of such problems by following the correct maintenance procedures. The manager is supported by technical officers and, in some sites, clerical staff, who may have additional responsibilities.

A technical support function is available at the COU to the RAC and NAC managers for VSE applications such as remote update, remote update with live feed, and basic managed interactive services. Any new software releases of either VSE operating systems or applications supplied by BT's Development and Procurement are first loaded onto the equipment at the COU test bed and tested to ensure they are functioning correctly and fit for operational use. Only then are they rolled-out to the RACs.

If there is a hardware problem at an RAC, the RAC manager escalates directly to the manufacturers; software problems, however, are escalated to the support unit at the COU. For example, if there are problems on a VSE in an RAC and the RAC manager suspects it is a software problem, then COU staff have the facility to interrogate the VSE system remotely. They can 'walk' through the system, the pointers, the files and so on, and ascertain if it is a software problem, effecting some software repairs remotely from the NAC.

The support team have similar responsibility for the auxiliary-switch software. An auxiliary

```
DETAILED REPORT

Report Time          :    14:20
                     :    Thu Jan 23  1992

Customer Name        :    NAC

Customer Address     :    WHITTINGTON HOUSE
                          OSWESTRY

Contact Name         :
Contact Telephone    :
FAX Number           :
Dial-back Number     :

Service Name         :    LONDON CODE CHANGE

Service Start Time   :    00:00
                     :    Tue Dec 10  1991
Service Stop Time    :    00:00
                     :    Fri Dec 10  1999

                 FOR MANAGEMENT PURPOSES ONLY
                         CALL COUNTS
Summary For All Regions
Data for :  Thu Jan 23
```

Time	:00/:15	:15/:30	:30/:45	:45/:00	TOTAL
0:00	88	88	68	89	333
1:00	48	56	40	30	174
2:00	24	32	27	22	105
3:00	17	30	14	15	76
4:00	15	25	21	34	95
5:00	46	15	23	38	122
6:00	32	32	70	75	209
7:00	67	86	154	196	503
8:00	307	460	556	797	2120
9:00	1434	1945	2229	2407	8015
10:00	2555	2612	2596	2620	10383
11:00	2660	2649	2660	2550	10519
12:00	2421	2325	2200	1908	8854
13:00	1897	1741	1819	1999	7456
14:00	2587	.	.	.	2587
15:00	.	.	.	.	0
16:00	.	.	.	.	0
17:00	.	.	.	.	0
18:00	.	.	.	.	0
19:00	.	.	.	.	0
20:00	.	.	.	.	0
21:00	.	.	.	.	0
22:00	.	.	.	.	0
23:00	.	.	.	.	0
Daily Total					51551

'.' > Not Available

Figure 5
Typical detailed statistics report

```
SUMMARY REPORT

Report Time             :    19:20
                        :    Thu Jan 23  1992

Customer Name           :    BT

Customer Address        :    NAC
                             WHITTINGTON HOUSE

Contact Name            :    NAC
Contact Telephone       :
FAX Number              :
Dial-back Number        :

Report Name             :    NATIONAL TELEVOTE DEMO

Report Start Time       :    00:00
                        :    Tue Oct  8  1991

Report Stop Time        :    00:00
                        :    Fri Oct  8  1999

Last Reset              :    18:00
                        :    Thu Jan 23  1992

Last Collected          :    18:50
                        :    Thu Jan 23  1992
                         FOR MANAGEMENT PURPOSES ONLY
                                             REGION       TOTAL CALLS
-----------------------------------------------------------------------
 1     CHOICE 1

                0891xxxxxx                   1               2443
                0891xxxxxx                   2               2401
                0891xxxxxx                   3               3422
                0891xxxxxx                   4               2602
                0891xxxxxx                   5               2353
                0891xxxxxx                   6               1971
                0891xxxxxx                   7               3391
                0891xxxxxx                   8               2252
                                                           ------
                                                            20835
 2     CHOICE 2
                0891xxxxxx                   1               4113
                0891xxxxxx                   2               5452
                0891xxxxxx                   3               6502
                0891xxxxxx                   4               4363
                0891xxxxxx                   5               4571
                0891xxxxxx                   6               3781
                0891xxxxxx                   7               5372
                0891xxxxxx                   8               4332
                                                           ------
                                                            38486
```

Figure 6
Typical summary statistics report

switch is held at the COU, where the staff replicate problems encountered at an RAC in an attempt to understand and resolve them.

In summary, the support team has two functions, the pre-release testing of new software and assisting in the resolution of any problems or operational difficulties in the VSEs and auxiliary switches.

Figure 7
RISCP screen

```
 MR    GW    LS    CB   DORADO  PISCES  FARADAY  GI    BS    BM
 0     0     0     0      0       3       0      0     0     0
 0     0     0     0      0       26      0      0     0     0

Prompt Alarm at:-

MR -              SP -CLR  OSP -CLR  IP -CLR
GW -              SP -CLR  OSP -CLR  IP -CLR
LS -              SP -CLR  OSP -CLR  IP -CLR
CB -              SP -CLR  OSP -CLR  IP -CLR
DORADO -          SP -CLR  OSP -CLR  IP -CLR
PISCES -          SP -RA   OSP -RA   IP -RA
FARADAY -         SP -CLR  OSP -CLR  IP -CLR
GI -              SP -CLR  OSP -CLR  IP -CLR
BS -              SP -CLR  OSP -CLR  IP -CLR
BM -              SP -CLR  OSP -CLR  IP -CLR

Message Received: Wed 08 Nov 1989 14:15:17

WARNING: Security lock is >>OPEN<<
Command>
```

RIDE Maintenance

The RISCP provides central management of the RIDE system. It monitors each of the DSN RIDE switches and receives alarms. From this PC, the RIDE switches can be fully controlled, configured and maintained, with the ability to interrogate system status, etc.

The RISCP shows a continuous on-screen display of the current alarm status of all the RIDES connected to the RISCP. This is shown in the form of a banner across the top of the screen, as shown in Figure 7. The alarms are colour coordinated depending on their severity. In addition to the alarm information in this banner, there is also an audible tone output.

Consequently, the people at the RACs do not need in-depth knowledge of the RIDE switches; NAC staff use the RISCP to interrogate the switches and locate, for example, faulty equipment which requires changing.

Alarms

Heat and environmental alarms are local RAC alarms while, on the RIDE network, all other alarms are reflected back onto the RISCP, enabling all fault management and investigation of the RIDEs to be carried out at the NAC.

Within the NAC, technical officers are responsible for monitoring and maintaining all the equipment within the NAC, and for monitoring the RIDE switches. They will use the RISCP as a means to identify a fault in a RIDE switch, and they effect a repair by instructing the RAC staff which cards to change. Once a switch has been repaired, the RAC manager is responsible for sending any faulty cards to the manufacturer for repair.

If any faults occur on the 2 Mbit/s RIDE ring, for example a channel is lost, then the monitor alarm unit activates an alarm and NAC staff use the RISCP to investigate the system. They can isolate the fault by investigating which RIDE is not receiving the correct 2 Mbit/s conditions. Depending on the alarms in the RIDE switches, staff can determine whether it is the 2 Mbit/s system which is faulty or a splitter[4]. It is then possible to isolate the fault to a particular 2 Mbit/s section.

If it is a 2 Mbit/s system failure, the network management centre is contacted to ascertain if a major transmission failure has occurred and to determine a predicted time to repair the service. Because of the security and replication aspects of the RIDE equipment and rings there has never been a total loss of service.

If it is a 2 Mbit/s splitter card problem, the NAC will contact the local repeater station and request a change of the splitter board. NAC staff are then able to confirm correct functioning of the system once the replacement is effected.

Contingency plans exist in case a RIDE switch fails completely. In these circumstances, calls for a particular RIDE switch can be diverted across the DSN network to be terminated on another RIDE switch.

Two classes of alarms are identified at the NAC:

- prompt and
- deferred.

Prompt alarms denote problems that are potentially service affecting; examples are:

- power loss,
- RISCP polls a RIDE switch and receives no response, or
- failure on the supervisory processor within a RIDE switch.

Deferred alarms are less serious, non-service-affecting alarms. A deferred alarm is one that has occurred but does not sufficiently deteriorate the service offered to the customer to warrant immediate action.

A prompt alarm is investigated immediately, whereas no deferred alarm is left for more than two hours before investigations are initiated.

NETWORK MANAGEMENT

The function of network management is to maximise call completions without jeopardising the network or the other customers of the network.

Consequently, there is 24 hour monitoring of call traffic and control of this traffic where necessary. The traffic-management system receives route and traffic statistics every five minutes, which are used to monitor directly traffic accessing all the RIDE routes.

Identification of traffic congestion is provided when thresholds are exceeded. In order to prevent other customers losing their ability to complete calls, the network management centre can control traffic by restricting call attempts to particular numbers that are generating high call volumes.

An example of the volume of calls which can occur is that during the first 15 minutes of choosing the UK entry for the 1991 Eurovision Song Contest, 2·5 million calls were generated. Even though these calls were terminating on the RIDE, the network had difficulty handling this large volume of instantaneous calls.

When customers are planning to operate an event likely to generate high call volumes, it is imperative that the network management centre is informed in advance with an estimate of call volumes and the number of terminating lines available. The network management centre can then plan to protect the network and other callers while ensuring the event maximises the call terminating capabilities. For example, if the event is expected to generate high call volumes, negotiations with the organisers are imperative to ensure the event does not conflict with anything of a similar size.

Hence, it is to the benefit of the service provider to inform the network management centre how many lines they have available, when the service is going to be run, and how many calls are expected. This will enable the network management centre staff to maximise the calls to the customer and still protect the network. If such discussions do not occur, then staff at the network traffic management centre will see unexpected congestion occurring and act to protect the network. This may inadvertently restrict the number of calls the customer is receiving.

Pre-event plans are instigated with call gapping installed in preparation, as far back in the network as possible with the gap interval calculated to ensure the customer's lines are filled without jeopardising the network.

In call gapping, the number of calls which can be offered to a particular number are restricted by setting time windows, the lowest being 0·1 s, which only allows one call through per window (see Figure 8). Consequently the higher the call volume expected, the wider the window. The rejected callers will hear the customer busy tone.

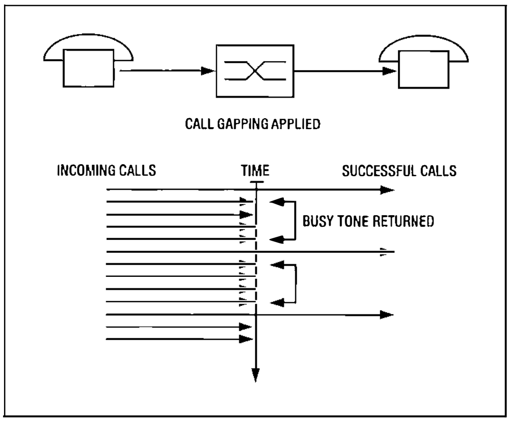


Figure 8
Principles of call gapping

Network Utilisation of MRIS Facilities

Although the MRIS platform was installed specifically for Callstream services, other applications such as LinkLine and network announcements use its capabilities. A prime example is the use of the announcement services for network change-of-number announcements. The most recent major event was the London code change, for which announcements were provided initially at the DMSU RIDEs and later migrated to the DSN RIDE. The London code change announcements 18 months after the change-over were still receiving 700 000 calls per week.

It is planned that the national code change announcements will be provided on the RIDE system.

As a result of action taken to provide announcements during the loss of service resulting from a fire in the Scarborough exchange, a permanent service has been provided on the DSN RIDE to enable the network management centre to provide network announcements in the event of major service failures. Permanent decode data has been installed at each DMSU which allows the network management centre to reroute any calls to a RIDE announcement. They can update the announcement by using the remote update facility to give specific information to the calling customers as to why their call cannot be completed. Initially provided as a UK-only facility, it is now also accessed by international services.

Fault Reporting

BT's Callstream managed service and LinkLine service equipment is self monitoring, and if any faults occur, they are normally identified and repaired before the service provider is aware it has occurred.

If, however, the service provider does discover a service fault, a 24-hour fault reporting point is available. All fault reports are logged and progressed by the digital derived services network fault reporting point. The fault reporting point staff refer to the customer's service records stored on a maintenance database to identify on which managed services equipment the services are operated. The appropriate announcement-centre staff are contacted and the fault details are passed over for clearance. The fault reporting centre remains in control of the fault and advises the service provider of progress and when the fault is cleared.

If it is a network fault, it is handed over to the DSN centralised maintenance team in London. If it is a RIDE service fault, it is passed to the COU for investigation.

All NAC alarms are extended out of hours to the COU building alarm system which identifies to the 24 hour security personnel on the COU site which alarm has been activated; that is, whether it is a monitor alarm unit or RISCP alarm. The security staff have detailed instructions on their course of action. There are technical officers on-site 24 hours a day who have been trained to respond to alarms in the NAC. One of these officers is advised of the alarm and performs first-line analysis of the problem. If, however, this is insufficient to rectify the problem, the officer instigates a call-out to the NAC technical support.

SUMMARY

Operation of MRIS has been described here, together with details of the benefits to its customers and to BT.

Service provision has been detailed by following the flow of a customer's order, and the decision processes involved have been described. Service management has been considered with respect to monitoring traffic for congestion, and has included details of quality-of-service targets. Maintenance of the MRIS equipment and the roles and responsibilities of the various personnel have been detailed.

Finally, network management, which is the maximisation of call completions, has been discussed and has emphasised the importance of negotiations with the customer in order to provide the best possible service.

ACKNOWLEDGEMENTS

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Biography

Ian Holmes joined BT in 1973 as a Youth-in-Training in the Liverpool Telephone Area. In 1981, he completed a B.Sc.(Hon) course in Computer Systems at Essex University on the Minor Award Scheme. He then joined BT's Research and Technology Software Development Group at Ipswich working on System X support tools. He led a team of programmers developing OMC2 application software for System X and AXE10 exchange systems. In 1987, he moved to Trunk Network Operations at Oswestry with responsibility for DMSU data management support and systems. He is currently responsible for the MRIS and Intelligent Network team at the COU, Oswestry.

Successes and Future of Managed Recorded Information Services

BILL JONES† and IAN HOLMES*

In this article, the recent successes of managed recorded information services (MRIS) are reviewed and shows how the flexibility of MRIS has allowed BT to respond to customer's needs. An indication is given of the flavour of some of the possible future MRIS products.

INTRODUCTION

The development of managed recorded information services (MRIS) from the first application, the speaking clock, to today's comprehensive portfolio has not been achieved in a steady linear way. The past 50 years has seen an explosion of information services (see Figure 1). There have been four key milestones throughout this period:

- introduction of the speaking clock service,
- expansion of the speaking clock into the Guidelines service,
- introduction of MRIS, and
- launch of Callstream Enhanced Managed Service.

Many factors have influenced the development of MRIS, notably the prevailing technical and commercial environments. For most of the past 50 years, relatively little advancement was made in recorded information services.

The speaking clock was the earliest form of automation, introduced primarily to reduce the demand on the then British Post Office telephone operators. The driving force behind the introduction of Guidelines was to stimulate telephone usage, especially outside the busy periods.

It has only been since the privatisation of BT, and the availability of premium rate services, that real growth has taken place in the MRIS market[1]. This growth will continue, responding, as in the past, to the prevailing customer demand for increased features and service flexibility. It is useful to note that the customer (that is, the service provider) rents MRIS from BT, while it is the caller who uses the telephone network to access the information.

SUCCESSES

The success of any platform or service may be measured by a number of attributes and achievements, such as: fast provision, prompt restoration, flexibility to meet customers' requirements, quality of service etc. In the case of MRIS, an additional and important aspect relates to the network's flexibility in terminating high volumes of calls. In this latter respect, MRIS call volumes are impressive:

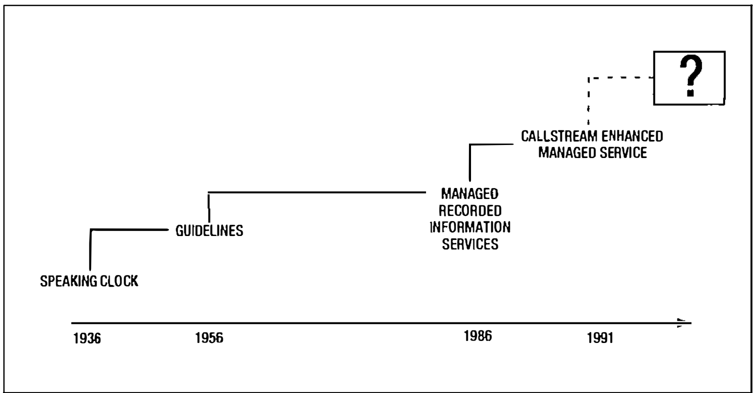

Figure 1 Growth of managed recorded information services

- since its launch in 1987, the basic managed platform, based on recorded announcement centre equipment, has terminated over 67 million revenue-earning calls,
- since May 1990, the recorded information distribution equipement (RIDE) systems (initially digital main switching unit (DMSU) RIDE and later derived services network (DSN) RIDE) have terminated over 65 million calls to the London code change announcements (non revenue earning).
- since its launch to customers in January 1991, the DSN RIDE system has terminated over 5 million revenue-earning calls.

Detailed below are examples that epitomise the success of the MRIS platform. While this success is partially attributable to the network and technology used within MRIS, it is the people and teams behind the technology that ensure success. As has been indicated in previous articles, MRIS is supported by small teams of experts across a number of functions in BT: product line, Worldwide Networks (WN) Technical and Project Management, BT Laboratories, Network Operations and Business Communications. It is the dedication and drive of these teams that enable MRIS to deliver the products and features customers require.

SERVICE PROVISION

MRIS is a pre-installed network of terminating equipment. Consequently, provisioning timescales are not restricted by difficulties associated with installation of customer lines. Although

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* BT Worldwide Networks

standard provisioning lead times are applied to the product, there are occasions when customers, or indeed Worldwide Networks, require service in considerably shorter time-scales. With the co-operation of the DSN data management team in Oswestry, service can and has been provided in hours, rather than days.

Gulf War Crises

At the outbreak of hostilities in the Gulf, the Navy and the Royal Air Force identified a need to provide information and contact telephone numbers to relatives of personnel serving in the Gulf. Within 24 hours of the request, an 0345 service was provided on DSN RIDE, with BT staff at the central operations unit (COU) recording the announcements.

BT International required a means of providing UK customers with up-to-date information on access availability to countries in the Gulf region. They were provided with a remote update service on DSN RIDE, thus allowing customer announcements to reflect the volatile situation.

Scarborough Exchange Fire

As the scale of network disruption resulting from the Scarborough exchange fire became apparent, a need to keep calling customers informed of access difficulties to certain number ranges was identified. At 03.00 hours, the network management centre (NMC), Oswestry, contacted the Head of MRIS Operations to explore the possibility of providing announcements on the DSN RIDE network. A scheme was devised to retranslate the affected national number groups (NNGs) at all DMSUs to an 0800 number, routing to the DSN RIDE. By 07.30 hours, through cooperation at the NMC, network operations units and the national announcement centre (NAC), customers calling the affected NNGs received an information message from the DSN RIDE. This announcement was updated as service was restored.

As a result of this incident, a permanent service has been established allowing the NMC to redirect calls to an information message in the event of a network problem.

Fast-Track Services

Fast-track services have been established to enable BT to react to a customer's request for immediate service; for example, television companies reacting to an unplanned major event. A number of broadcast and televote services have been installed on DSN RIDE with remote-update facilities and full availability of on-line statistics. The televote services allow for 2 to 6 voting options. All 0891 access numbers are preinstalled in the DSN; therefore, on request, the Callstream customer service centre can immediately provide the customer with details of access numbers, remote update details and on-line statistic access. Once the customer has finished with the service, the remote-update and statistics codes and personal identification numbers (PINs) are changed, ready for the next customer request.

FLEXIBLE SOLUTIONS

Dial-Up Live Feed

As part of the broadcast product, the ability for customers to provide live commentary services over the PSTN network provides a fast and flexible solution. Traditionally, provision of live commentaries has involved the ordering and installation of private wires or outside-broadcast facilities, which can be both expensive and inflexible, particularly for short one-off events. The dial-up live-feed service is a simple solution, with access to equipment at the NAC from any PSTN telephone via an 0800 number. Commentaries are then transmitted from the NAC around the RIDE network. Services have been provided for the Cheltenham Gold Cup and the 1992 Budget commentary.

Interactive Services

A trial of interactive services has involved close cooperation with a major home-shopping company, to develop a generic BT product that is efficient and cost effective to maintain and configure while being flexible enough to meet customers' requirements. BT Laboratories has developed a generic application that can be installed and configured by Network Operations, and will have a full product launch later in 1992. Although running as a trial, the service has been fully operational, with the customer offering information services, with name/address capture. Customer satisfaction with the service is high with generated revenue double that forecast at the start of the trial.

RIDE APPLICATIONS

As described in earlier articles, the RIDE system was developed to meet a market need for high-call-volume events such as media televotes, and medium-call-volume, but long-call-holding duration events such as sports commentaries. Currently, all such services operate on the DSN RIDE network. However, a significant increase in terminating capacity will become available with the upgrade of DMSU RIDEs.

The market demand for televote campaigns has developed significantly with the successes achieved by events operated on MRIS, particularly due to the ability to provide immediate access to on-line statistics within the time span of a television programme. Detailed below are just some of the campaigns that have operated on RIDE:

- 1991 British entry for Song for Europe (BBC) 500 000 votes (in 2 hours);
- 1991 Going Live final (BBC) 200 000 votes (in 30 minutes);
- weekly TV video vote (BBC) 30 000 votes (in 5 minutes); and

● Racing and Test Match commentaries 150 000 minutes of calls per week.

The call stimulation of major television events could cause problems within the PSTN network if not correctly controlled. Therefore, there is close cooperation between the NAC and NMC which allows traffic-management staff to preplan for such events and establish appropriate controls within the network to protect other users, while maximising call completions for the campaign.

NETWORK UTILISATION OF MRIS

London Code Change

As described earlier, the major network use of the MRIS platform has been to provide announcements to support the London code change. The use of DMSU RIDE and latterly DSN RIDE provides a cost effective and efficient means of terminating extremely large volumes of calls on a small number of announcements. Since the change of the London dialling codes in May 1990, over 65 million calls have been terminated. In December 1991, 18 months after the change-over, an average of 700 000 calls per week were still being routed to the announcement.

It is planned that the DMSU RIDE will provide announcements to support the national code change.

PSTN Changed Number Announcements

The use of MRIS to provide network changed-number announcement services originated from a request for assistance from WN Scotland. The zone required additional announcement capacity, which would have resulted in the purchase of additional equipment. However, it was identified that capacity existed within MRIS, on first-generation answering equipment, that would satisfy the requirements and provide a high-quality start-at-the-beginning announcement. Currently, 100 announcements are provided at Glasgow recorded announcement centre for this purpose, terminating 25 000 calls per day. Although using some network capacity, the resultant savings in capital expenditure are significant. An initiative to provide access to other zones is currently being pursued within WN (South).

IMMEDIATE FUTURE OF MRIS

In the immediate future, developments are planned for the MRIS product portfolio, each of which will enhance the previous product offering. When complete, all currently identified market requirements will have been fulfilled[1]. It is intended to complete this programme in three discrete phases :

Phase 1

The introduction of BT call management on managed services will remove the need for service providers to define the line capacity required to meet caller demand.

Phase 2

The following features will be added to the Managed Service portfolio:

- real-time statistics,
- fast-track scrvicc,
- interaction with the calling customer,
- information capture, and
- live service.

Within this phase the following features will be added to the Callstream Enhanced Managed Service:

- extra capacity will be installed to cater for the increasing popularity of televotes,
- high-calling-rate information-capture facilities will be made available, and
- interaction with calling customers will be made possible.

Phase 3

This phase sees the merging of all the current MRIS product offerings into a single enhanced managed service and will be achieved by extending the MRIS platform to encompass PSTN codes in addition to LinkLine and Callstream; and by moving from sole delivery of information by speech to using other media such as facsimile.

POSSIBILITIES FOR FUTURE MRIS GROWTH

In the future, there are many areas to explore and challenges to be met on MRIS. Novelty value may well lead the take up of new applications, but it is convenience and value for money that are essential in sustaining successful services.

Fulfilment of the currently identified market requirements will secure the short- and medium-term future of MRIS. However, for MRIS to survive in the longer term, three key areas will have to develop further to meet the growing expectations of both the callers to, and providers of, information services:

- technology,
- information, and
- service.

Although the development of these three areas can progress independently, a major breakthrough will only happen when the technological advancements and commercial needs coincide.

Technology

The technology associated with MRIS will advance in ever shortening time periods. The increased functionality, together with the reduction of technology costs (in real terms), will influence the expansion of MRIS and bring profitable new applications to the fore. It is evident from recent experience that there are two key enablers in the automated voice arena—voice recognition and computing power.

Given increased vocabulary on voice services equipment (VSE)[2] together with continuous word and number recognition, services run on MRIS will become more sophisticated and eventually a point will be reached when callers will not necessarily realise they are talking to a machine. It is conccivable that caller verification and voice security will be developed and, if loaded onto the MRIS platform, services requiring, say, closed user groups can be operated.

Improvements are needed in computing power to host programs running complex services, storing announcements/information for callers and capturing their responses. One way of realising the required computing power is to provide data links between VSEs and mainframe computers. This method opens up yet another rich new source of information and, subsequently, services.

As MRIS technology develops, other forms of information storage and interaction will be possible:

- The convergence of telecommunications and computing means that callers to MRIS could download, via ISDN for example, information in a data format.
- The telecommunications industry is entering the videophone age, and a future MRIS could be used to provide visual information to callers, everything from dial-a-film to an online picture library.

Information

With the exception of the speaking clock and BT network announcements, the basic philosophy of BT MRIS has been defined. The information provided for callers on the MRIS platform is always created by service providers, and it is BT's responsibility to continue providing flexible and convenient methods for delivery and updating of services. This is true for any information media from voice, through facsimile, to video.

Service

A dichotomy will arise as the MRIS technology becomes ever more complex while the need remains to keep the service as simple as possible for service providers and calling customers to use. It is therefore essential that mechanisms are provided to segregate the service management element from the supporting engineering platform. Progressive developments in this area will lead to remote service creation by service providers .

In a world where consumers are becoming more sophisticated and the demand for information seems insatiable, services will have to combine to give a multi-media package of services. An embryo of this can be seen in demonstration services where, for example, callers can first listen to weather information and then, in the same call, request a detailed picture by facsimile.

Other potential MRIS services and features are:

- unattended message taking and forwarding,
- voice-controlled interaction,
- network voice call guidance, and
- outgoing service.

CONCLUSION

MRIS is well placed to meet BT's requirements to provide high-quality information to callers, whether for network reasons or as a value-added product for customers. The successes so far and the view of the future given in this article give a flavour of the potential for MRIS.

To look forward 50 years and predict what MRIS will look like is not possible, even after using one of Callstream's recorded horoscope services. One certainty is that 'recorded' will be too restrictive with the introduction of multimedia services such as facsimile and data. Perhaps in the year 2042, the *Journal* will comprise articles covering 'Managed Information Services—Virtual Reality and Beyond'.

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Biographies

Bill Jones joined BT as an apprentice in 1973. He was involved in exchange construction and maintenance duties for London South East sector switching centres. After a spell on trunking and grading duties, later including work for Grenville DMSU data build, Bill was promoted to AEE with responsibility for trunk network planning of new PSTN services. This role was expanded to include planning for DSN and MRIS services. In 1989, he was appointed Technical Development Manager for the Callstream and LinkLine product line. He is currently a project manager for Callstream's network-based developments.

Ian Holmes joined BT in 1973 as a Youth-in-Training in the Liverpool Telephone Area. In 1981, he completed a B.Sc.(Hon) course in Computer Systems at Essex University. He then joined BT's Research and Technology Software Development Group at Ipswich working on System X support tools. He led a team developing OMC2 application software for System X and AXE10 exchanges. In 1987, he moved to Trunk Network Operations at Oswestry with responsibility for DMSU data management support and systems. He is currently responsible for the MRIS and Intelligent Network team at the COU, Oswestry.

BT Demonstrates Videophone

BT demonstrated at the Ideal Home Exhibition a prototype videophone for use in the home. The telephone, which will cost less than £500 and is expected to be available later this year, allows customers to see as well as hear the person on the line.

The videophone will form part of a portfolio of videocommunications products from BT, which at present includes videoconferencing and will in future comprise desk-top videoconferencing, digital videophones, and personal computer-based multimedia equipment.

Easy to use, the new telephone does not require a special line—it simply plugs into a standard telephone socket. To make a call, a customer dials the telephone number in the normal way.

The videophone has a small camera and a three-inch colour screen which are mounted on a flap that can be folded away. Privacy is assured by the press of a button or by lowering the flap.

Designed and manufactured by British company GEC-Marconi, the telephone is currently undergoing extensive quality and reliability tests.

BT has long recognised the benefits videotelephony can bring to customers and has made important inroads into the business market. However, the true worth of videocommunications will only be fully recognised when it becomes available to all customers.

Fax to the Future

BT has launched a new Group 4 fax machine that can send one page of A4 in as little as three seconds and prints out desktop-published quality documents.

The plain paper CF2000 is the newest addition to BT's range of specialist products for use on the integrated services digital network (ISDN).

Group 4 is the newest and most advanced fax mode. It uses the digital communications networks developing throughout the world's business communities. In the UK, BT's ISDN is available in all key commercial centres.

In Group 4 mode, transmission is far quicker than a Group 3 machine, reducing the time and cost of telephone charges: one page of A4 can be transmitted in 3 seconds compared with a typical 13 seconds in Group 3 mode. (When communicating with a Group 3 machine, the CF2000 reverts automatically to Group 3 mode.)

The CF2000 will be of particular benefit to businesses sending faxes internationally and those sending fine-detailed documents such as construction plans and engineering designs. International call time is the most costly and so it is here that the CF2000 can offer the greatest savings. Furthermore, detailed documents can now be transmitted in better quality than a photocopy. This could well revolutionise working practice in industries such as architectuure, engineering and design.

Channel 4 Backs World's Most Advanced Digital Network from BT

Channel 4 has backed BT's commitment to broadcasting by signing a £50M contract over 10 years to take the world's most advanced digital TV network.

The new BT managed network is expected to lead to more flexible scheduling in commercials from Channel 4, who will be able to broadcast different advertisements simultaneously in six regional TV areas. The commercials will be transmitted direct from Channel 4 headquarters in London. From 1 January 1993, Channel 4 will sell and play out its own advertisements.

Digital technology gives the network greater flexibility and speed. Channel 4 can utilise the new technology and BT's network management capability to achieve cost-effective regional scheduling while enhancing its advertising offer with a more geographically targeted option. It will enable Channel 4 to compete more aggressively with ITV franchise holders for regional advertising revenue next year.

BT has married computer and network technology to create management systems for round-the-clock monitoring with built-in performance guarantees. Channel 4 will have direct monitoring access for added control.

The network is designed for 10 seconds' restoration, and BT is guaranteeing 30 seconds for most of the transmitter sites. The digital network, operational from January 1993, is seen as fundamental to the success of the channel's regional network, and gives Channel 4 a technological lead over other commercial broadcasters.

The digital network breaks new ground in broadcasting and confirms BT's leading role in developing complete solutions for its customers.

The new network will improve quality and consistency of pictures transmitted to all parts of the UK. The core network and programme contribution material carried on it will operate initially at 140 Mbit/s, while sound, vision and associated signals carrying the output of the channel will be coded and delivered to transmitters at 34 Mbit/s.

BT's digital technology is a response to the demand for even higher-quality stereo sound and video transmission in today's 24 hour broadcast environment. BT has also built in new levels of network reliability and an upgrade path to wide-screen TV.

Steve Maine, Director of Visual and Broadcast Services, said, 'By committing major investment to the development of digital network technology, BT is driving a broadcasting equivalent of the "BigBang" which will revolutionise British TV in the 1990s.

'Our work with Channel 4 and our ability to innovate is a result of the understanding we have built up over 56 years working in television broadcasting.'

Book Review

Common-Channel Signalling
R. J. Manterfield.
Peter Peregrinus. xxxiii+221 pp. £38·00.
ISBN 0 86341 240 8.

This book identifies signalling as a key element, alongside switching and transmission, in a modern telephone network. The book briefly traces the evolution of signalling from the relatively simple systems of the past up to the sophisticated common-channel signalling systems of today.

The author has concentrated on giving a comprehensive introduction into the principles of common-channel signalling rather than describing any specific implementations in detail. This has resulted in an extremely readable book that provides an excellent introduction into this highly complex subject. The book provides sufficient breadth and depth to prepare the reader for the highly detailed and complex signalling specifications and international standards recommendations.

The book is well structured and introduces the reader to the subject in a logical step-by-step manner. It first describes the layered architecture of modern signalling systems and then describes each layer in turn. The author makes very good use c examples throughout the text to bring clarity to this difficu subject. Also the provision of a summary at the end of eac chapter is particularly useful.

The book identifies the inseparable relationship beteen com mon-channel signalling and the central processor of digit stored-program control exchanges. Also identified is the conver gence between the techniques used for signalling between ex changes within the main network and those used for signallin between the network and customer equipment.

The book makes little mention of the extensive use that being made of common-channel signalling on digital PBXs an within private digital networks. Coverage of this would hav been particularly appropriate in the context of PBX access to th integrated services digital network in the chapter on the Digit Subscriber Switching System No. 1.

The book contains a wealth of information and will provid an excellent reference for all those involved in telecommunica tions.

A. HIE

Notes and Comments

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