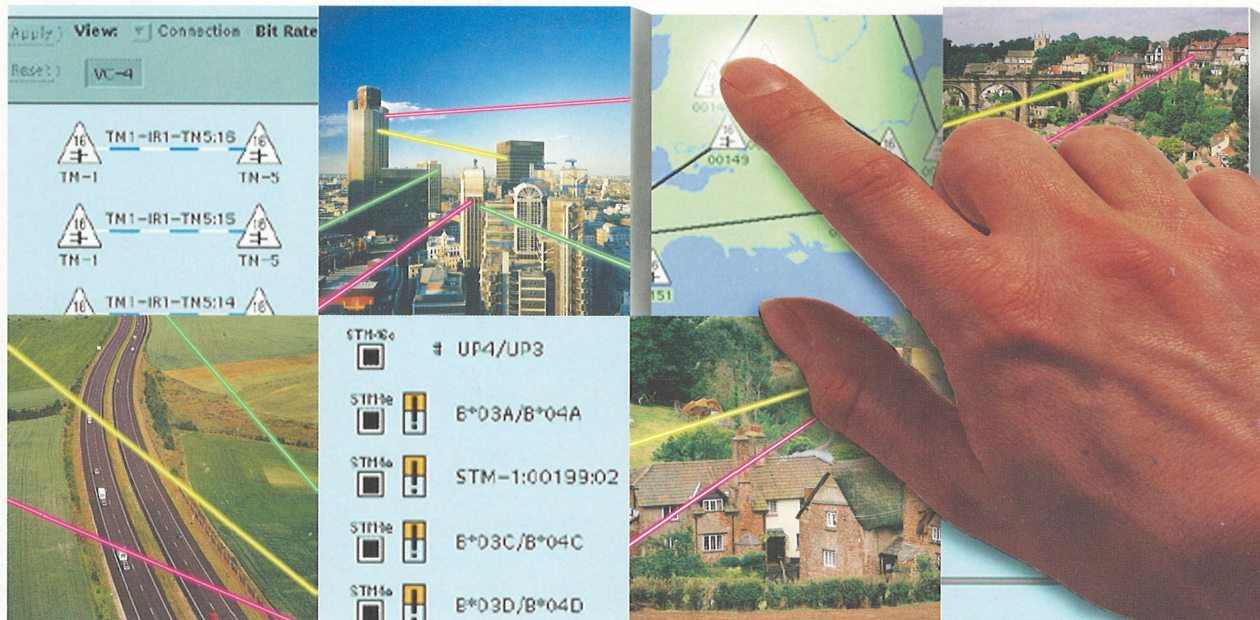# Getting the most out of the transport network

Building the Ericsson Transport Network Architecture:
SDH Network Management

ERICSSON

Unlock the real potential of SDH

An SDH transport network can deliver real benefits. It allows you to provide advanced, high-quality end-user services quickly and efficiently; it supports dynamic reconfiguration of transmission resources in a multi-service network; and it helps you to maximise the productivity of your operational personnel, reducing your field engineering commitment.

SDH can do all of this. But it can only do so, with the right management systems.

The Synchronous Digital Hierarchy (SDH) standards for transport networks are creating a new era in transport network evolution. Until SDH, transmission systems were basically passive systems: their functions were defined in hardware. Changes to the transmission network meant physical changes to hardware and cabling.

With SDH, most of the functions of the transport network are software-controlled. And the transport network itself is immensely more flexible and powerful than before.

But how do you harness that power and flexibility? Although the basic transmission standards of SDH have been well defined, standardization of management issues and systems is still a long way away. And yet it is the management system that is the real key to exploiting the benefits of an SDH network.

THE BRAINS BEHIND THE NETWORK

Management and control systems are the real brains behind the SDH network. They are what enable the provision of high-quality services — such as leased lines — quickly and at the right price for your end-user customers. They can also provide you with audited quality measurements — so that you can guarantee service quality to your most valuable customers.

Management systems also put you in control of the total configuration of your network: letting you re-plan and re-configure the network as traffic patterns change. With the
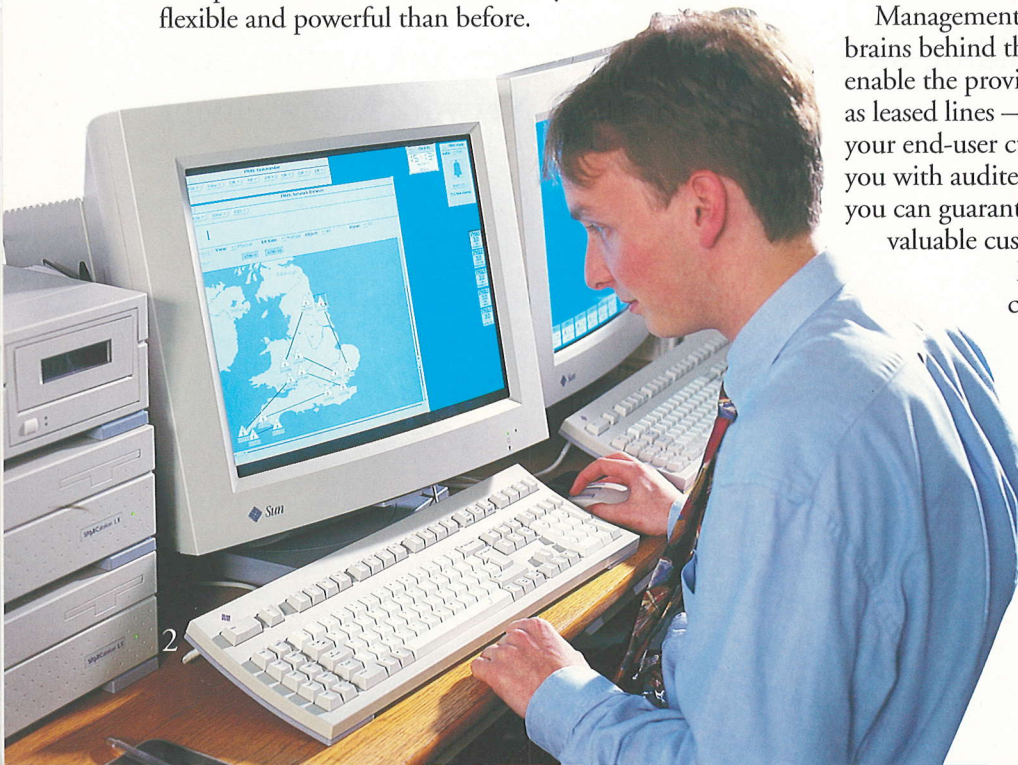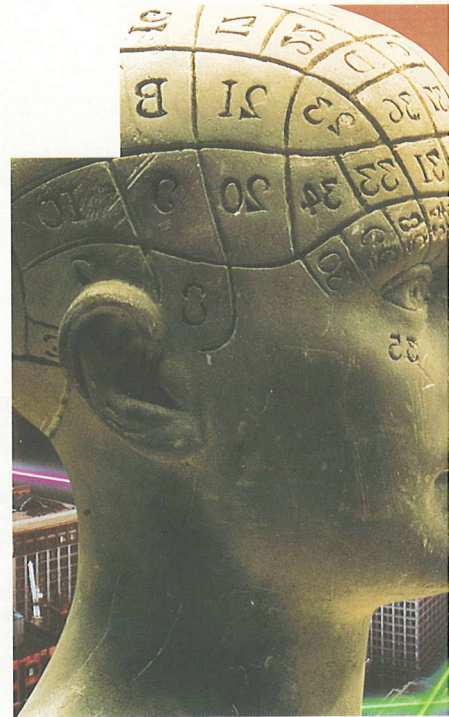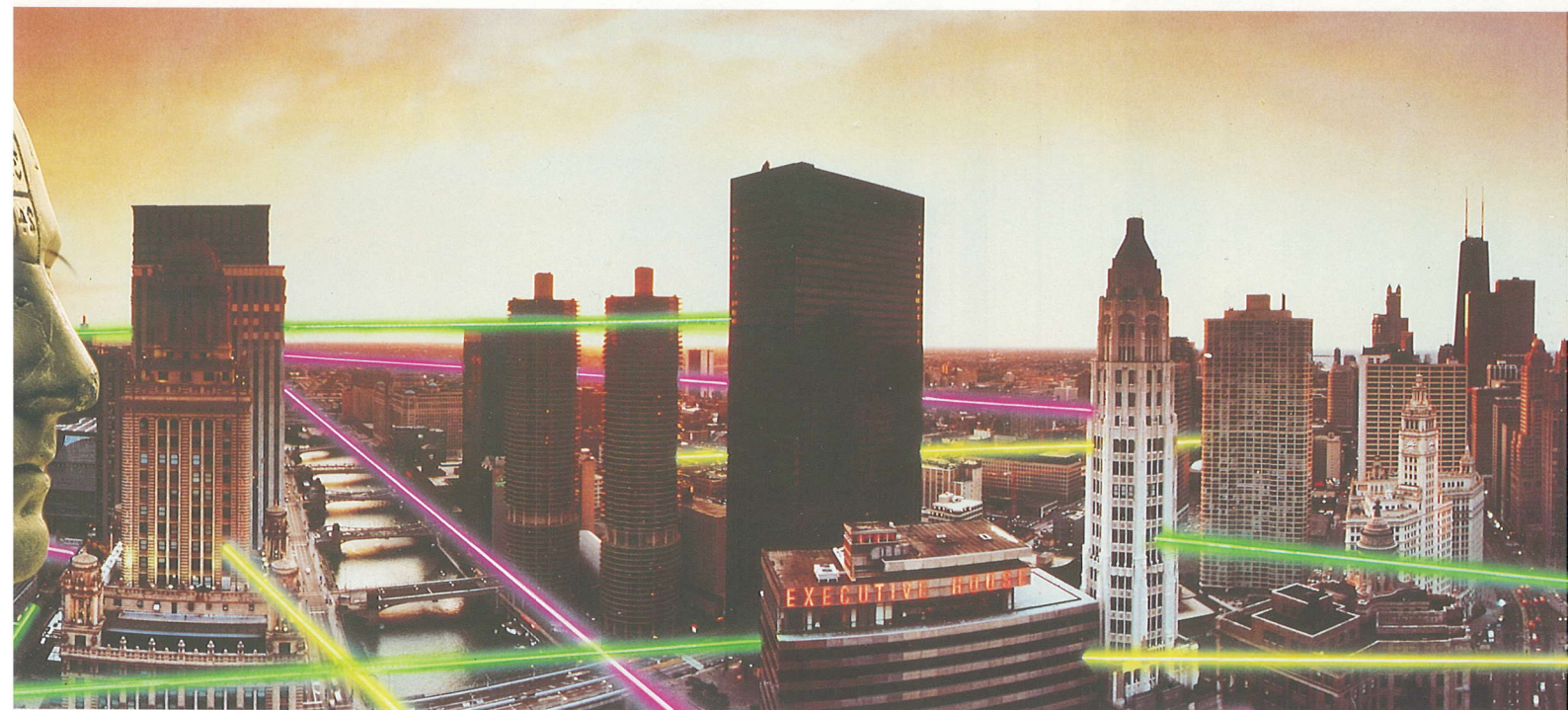
right management systems, you can run your transport network as a bearer infrastructure for a multitude of other networks and services — always with accurate control over traffic priorities, routings and billing data.

And without management, how could you keep the network running at peak efficiency? How could you spot faults and traffic disturbances, and put them right before your customers notice?

Finally, how do you make the best use of your skilled personnel? SDH expertise is in short supply — without the best centralized management systems to help them, your own network management staff will spend too much of their time putting out fires, and too little time managing the network.

How do you manage?

Ericsson's SDH management systems, part of ETNA — the Ericsson Transport Network Architecture — give you the tools to achieve all these aims, and more.

Our network management systems are unique, in that they have been developed alongside the network systems they manage — not added on later, as an after-thought.

The result? A range of management solutions that can be precisely tailored to your needs. Small and simple when your network is small and simple; and growing to large, sophisticated systems when your network becomes large and sophisticated.

These are systems with a future. We've thought of all the problems you need to solve when your SDH network is first established. But we haven't stopped there. Our management solutions address your future requirements too. Such as managing multi-vendor SDH networks. Handling growth, and handling new services such as broadband and multimedia communications.

And linking together with your other systems, to provide painless automation of your complete business processes.

All in all, we don't think you'll be able to manage without our systems.

3
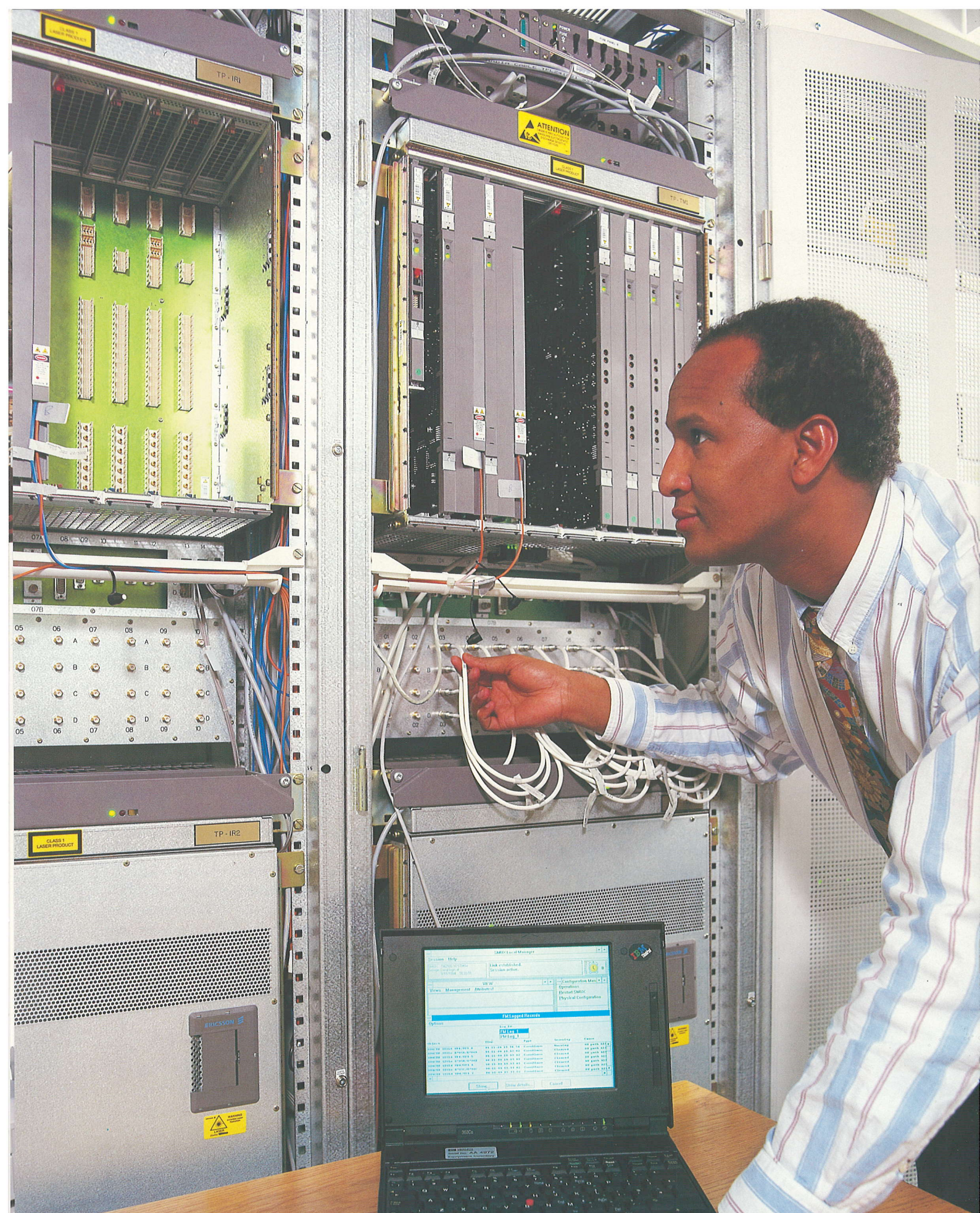
A Local Operations Terminal (LOT) provides comprehensive configuration and fault management for SDH network equipment. Usually installed on a portable PC, it provides an interface for field engineers to initialize and configure equipment when it is first installed, and to make adjustments and reconfigurations as necessary.

A management strategy that delivers the goods – at every stage of network development

A job is always easier if you have the right tools to do it. That's why Ericsson's SDH management systems come in a range of shapes and sizes — so that the systems you use are always appropriate for the applications, and the networks, you want to run.

Even better, Ericsson's management systems are modular and upgradable: you can start small, and finish up big, without losing any of your investments along the way.

Ericsson's SDH management systems come in a variety of sizes and configurations: from a single terminal to manage a single network element, through sub-network management systems, right up to national-scale management systems that give you an overview of the complete network operation.

Each system serves specific needs — and you can combine different systems to serve the needs of your specific network situation. It might not be appropriate to manage the configuration of every small multiplexer or access node in your network from a single, centralized system — so with Ericsson's management architecture, you can devolve those functions to small, manageable sub-networks. And still take over from a central network management system if necessary.

Equally, you might be misguided to invest in a full-function network management system, when all you have to manage is a handful of cross-connects and multiplexers. With Ericsson, you don't have to. You can buy the functionality you need in a relatively inexpensive element management system, and then upgrade to full network management functionality later, when your network grows to need it.
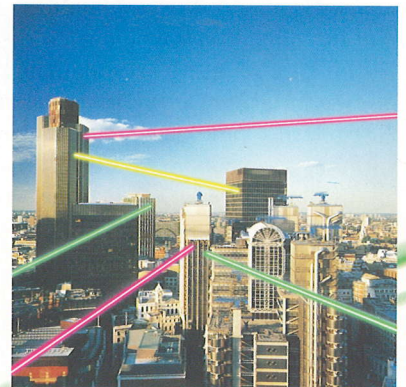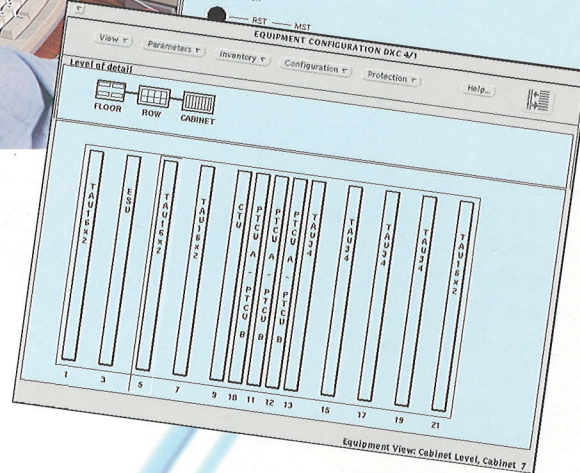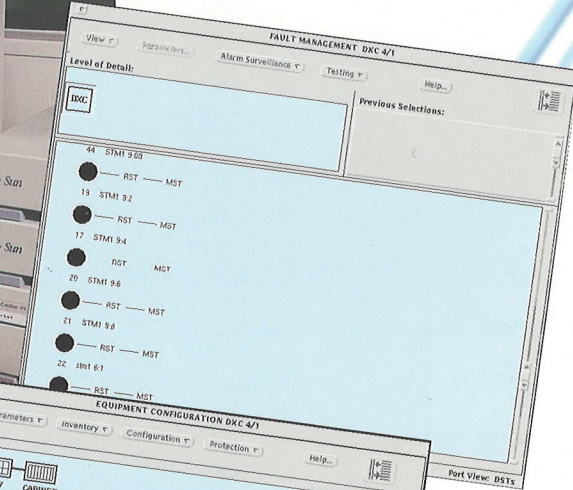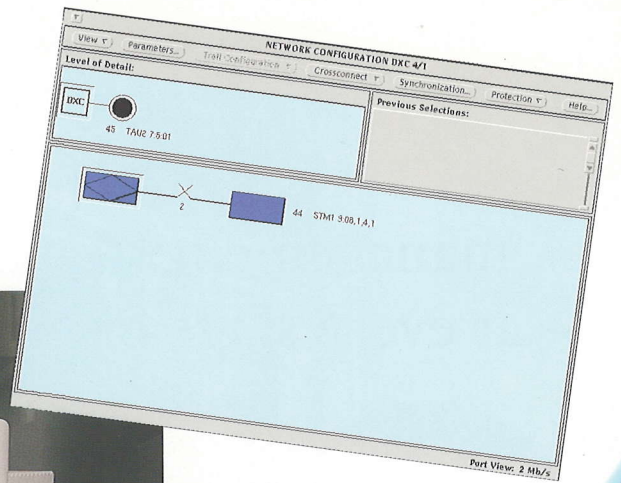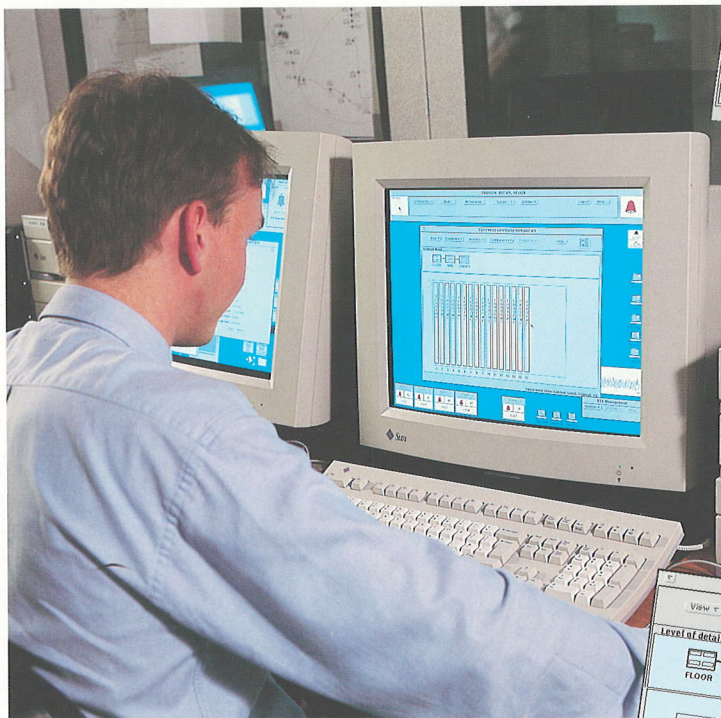
The Remote Operations Terminal (ROT) has the same functions as the LOT, but is centrally located. The ROT can log in to several network elements, handling them one at a time for functions such as configuration and fault management. The ROT application can also be run on a window in an element or network management workstation.

STEP-BY-STEP MANAGEMENT EVOLUTION

Ericsson has four levels of SDH management system, each suited to particular needs, or particular stages of network evolution:

Local Operations Terminal (LOT) This is a single terminal, to manage a single network element. It is used on-site, to initialize and configure a network element when it is first installed, and by field engineers to make adjustments and reconfigurations as necessary. Typically, the LOT might be installed on a portable PC terminal, which is moved around from one network element to another.

Remote Operations Terminal (ROT) This has the same functions as the LOT, but it is centrally located. The ROT can communicate with network elements via the ECC (Embedded Control Channel) in an SDH signal, and can be run in a window on an element or network management system.

Facility Management System — Element Manager (FMAS-EM) This is a centralized application, which manages a group of network elements of the same type, at a relatively low cost. FMAS-EM systems run on PC or UNIX platforms, and can manage from a handful to several hundred network elements, depending on their size and configuration.

Ericsson's SDH management and control systems work at all levels of the management hierarchy. Local or remote terminals control single network elements; FMAS-EM systems control multiple elements of a single type; and at the top, FMAS-NM can integrate the control of the complete SDH network, providing interfaces to other vendors' equipment and management systems as necessary. FMAS-NM can also connect to your existing business or service management systems, to provide increased automation throughout your business processes.
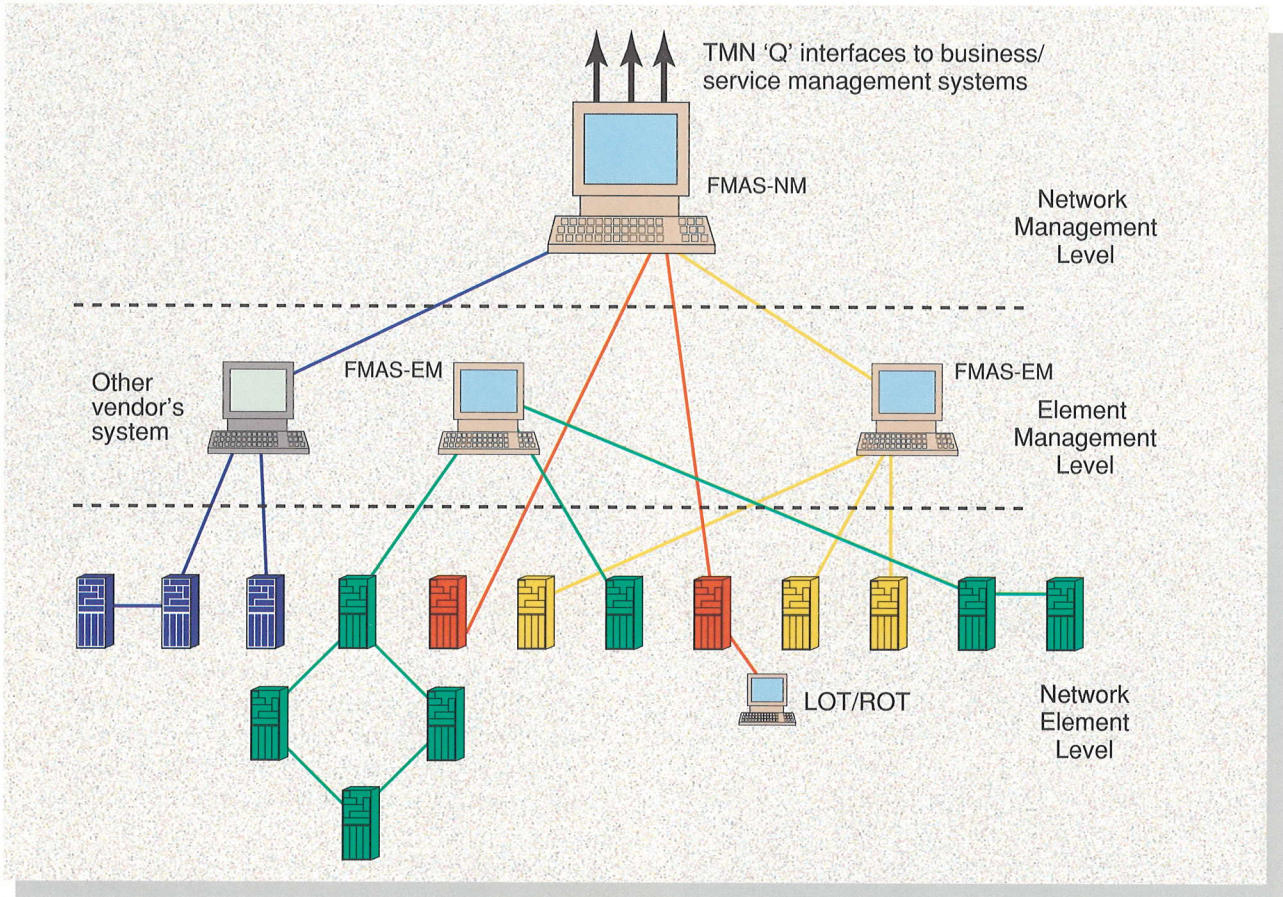
In some cases, they can be used for end-to-end service provision within local and regional sub-networks — or across a complete national network, while the network is growing towards its full size and scope.

Facility Management System — Network Manager (FMAS-NM) FMAS-NM provides centralized management for the entire SDH network, with the possibility also to manage multi-vendor network elements via TMN Q interfaces. In a large, fully-developed SDH network, FMAS-NM controls end-to-end service provision, and can completely take over this application from FMAS-EM systems. FMAS-EM systems can be accessed via a graphical

user interface from FMAS-NM. In this way, they can act as 'gateways' between FMAS-NM and the network elements.

FMAS-NM is a member of Ericsson's TMOS (Telecommunications Management and Operations Support) family of network management systems. It implements industry standards in computing and telecommunications, and uses modular and scalable hardware and software. As a TMOS system, FMAS can be integrated with other TMOS applications: for instance systems for the management of PSTN services, cellular networks, and in the future for broadband service management. FMAS can also provide standards-based interfaces upwards to operators' service and business management systems.

Turn your transport network into a business

One of the most exciting aspects of SDH is the opportunity it gives you to turn your transport network into one of your primary sources of revenue: supporting the needs not just of private leased-line networks, but of other network operators and service providers too.

Ericsson's SDH network management systems give you the edge in a fiercely competitive environment.

Today, just about every telecom network operator is taking a long, hard look at all aspects of its operations. Deregulation, reregulation and competition all sharpen the focus on the bottom line. Every part of the business is assessed for cost-efficiency and effectiveness.

The transport network is no exception. In the past, transmission was simply a function within telephone networks — of course, the network couldn't function without it, but transmission had no value in itself.

The arrival of private networks, and with them leased-line business, changed the way operators looked at transmission. In most developed countries, revenues from leased lines and other non-telephony services are set to outstrip revenues from telephone calls by the year 2000. The transport network's role as a profit centre has arrived.

MAXIMISING THE PROFIT FROM THE TRANSPORT NETWORK

A well-managed transport network can create many new revenue-earning services. Leased-line connections, for instance, can be set up or removed in minutes, with just a few commands from an FMAS-EM or FMAS-NM terminal. This is a vast improvement from the days when it took weeks or months to hard-wire every connection.

Service quality is an issue of critical importance for many of today's leased-line users: and it's an area of special weakness when connections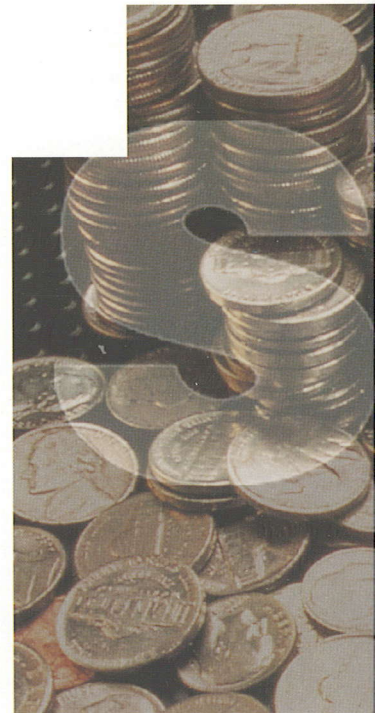 are hard-wired within PDH networks. In an SDH network, Ericsson's management systems can provide end-to-end quality measurements on any end-user service: giving you the chance to spot problems and solve them before your customers do; and the opportunity to provide audited reports on service quality.

Our management systems also give you full control of the grade of service your customers receive: from FMAS terminals you can specify protection schemes to give your most important customers guaranteed service — at a premium price.
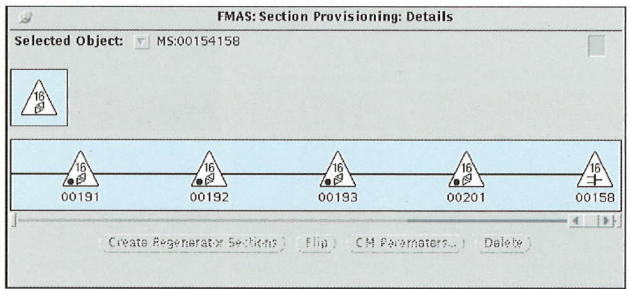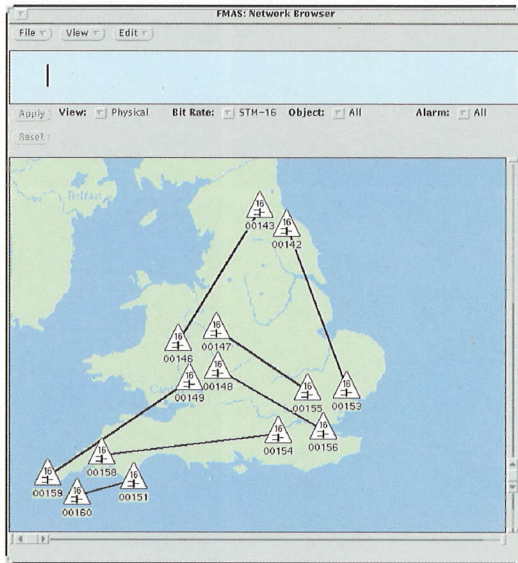
THE MULTI-SERVICE TRANSPORT NETWORK

It's not just your traditional leased-line customers who can give you extra business. As the telecoms service provision industry fragments, more and more operators will enter the market with niche service offerings. Cellular telephone networks were the first example; in the near future, the number of specialist data network providers can be expected to grow quickly.

All of these new operators need transport network capacity. Your ability to provide that capacity quickly, flexibly and economically will win you the business. And Ericsson's SDH management systems will ensure you can do this.

FMAS: Network Browser

File ▾ View ▾ Edit ▾

Apply View: ▾ Physical Bit Rate: ▾ STM-16 Object: ▾ All Alarm: ▾ All

Reset

FMAS: Section Provisioning: Details

Selected Object: ▾ MS:00154158

00191   00192   00193   00201   00158

Create Regenerator Sections   Flip   CM Parameters...   Delete

FMAS: Section Provisioning

File ▾ Edit ▾ Parameters ▾

Object Name	Bit Rate	Prov. State
MS: 00153142	STM-16	In Service
MS: 00155147	STM-16	In Service
MS: 00156148	STM-16	In Service
MS: 00159149	STM-16	In Service
MS: 00154158	STM-16	In Service

Object Name: MS:00154158

From: 00000154:STM-16:00

To: 00000158:STM-16:00

Length (m): 100000

Apply   Reset

READY TO MEET YOUR BUSINESS CHALLENGES

With our top-level network management system, FMAS-NM, we have built in functions that support key parts of any network operator's business processes: such as service provision, network configuration, and operation and maintenance. These functions have been designed to fit in with existing processes and support systems; and they are continuously being refined and improved.

With open interfaces to any management system above, below or at the same level in the management hierarchy, FMAS-NM is ideally placed to become part of a much bigger machine. A machine composed of collaborative systems supporting a complete business function. In this scenario, FMAS-NM will receive orders from above, and translate them into actions within the network, completely automatically.

FMAS-NM gives you end-to-end control over the provision of infrastructure and services within the SDH transport network. You can set up sub-networks, implement routing rules, and define the multiplex structure of high-order paths; and you can also set up and remove end-to-end leased-line services for customers, on demand.
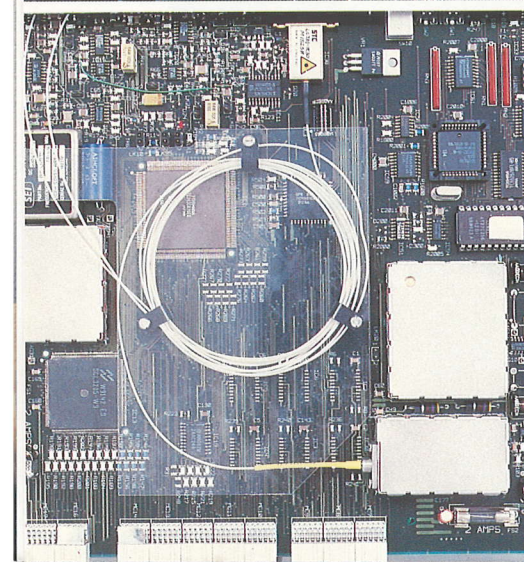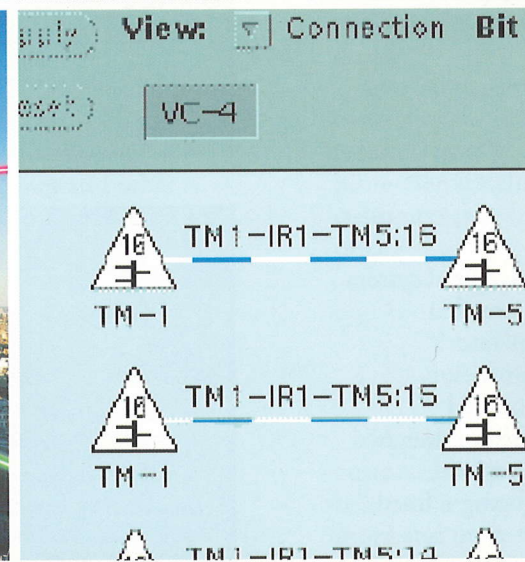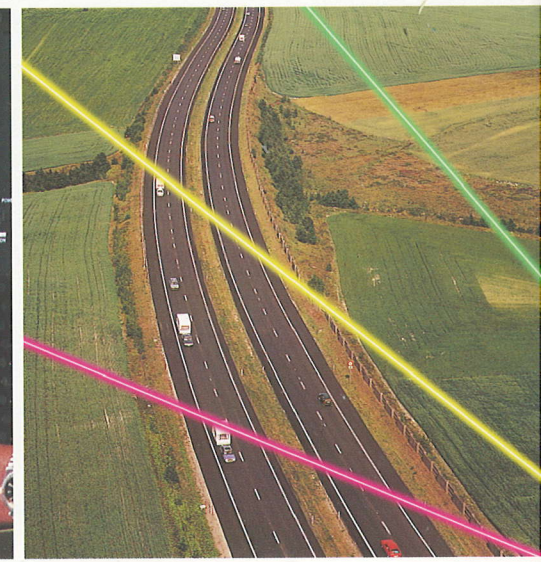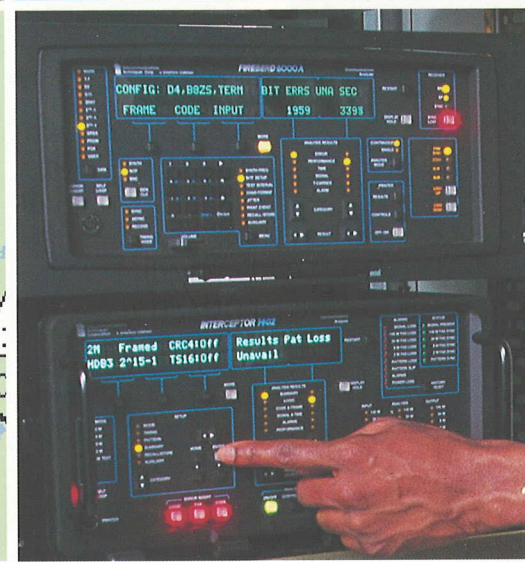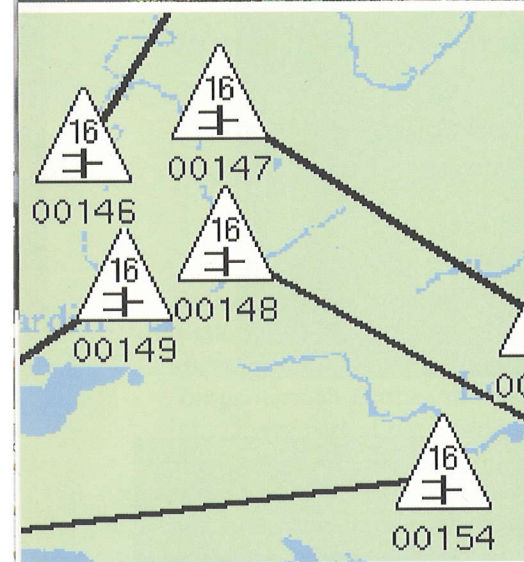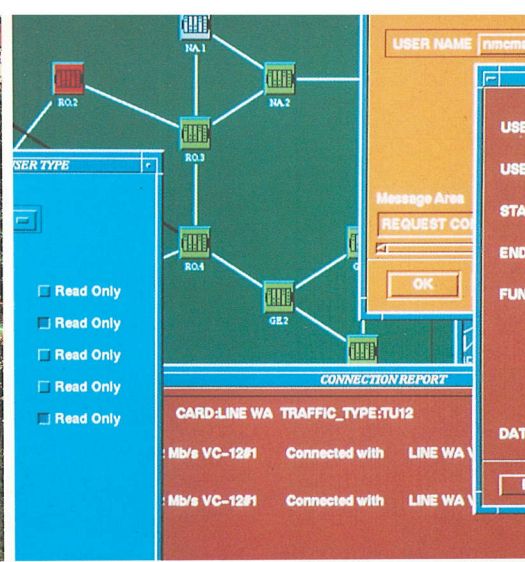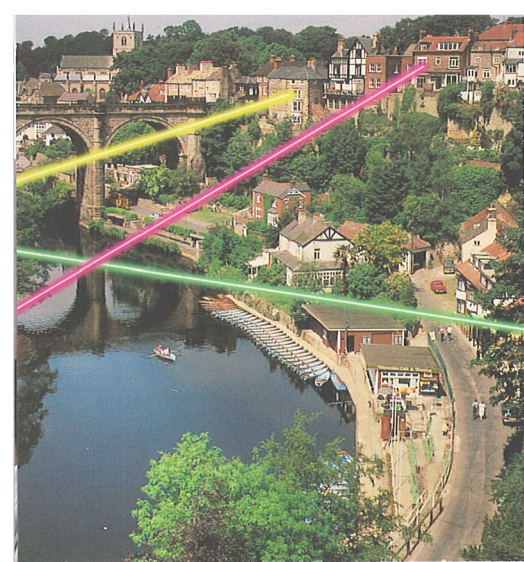
9

Streamline your business processes

Ericsson's SDH management systems fit in with any strategy for SDH network deployment, always providing appropriate, economical solutions. But it doesn't stop there: our systems are ready to integrate with other network management systems, other vendors' equipment, and with your own administrative systems for service and business management.

The end result is a solution that can automate and streamline your total business processes.

If your SDH implementation plans start with your backbone national and regional transport networks, then FMAS-NM will provide a strong, centralized network management system, controlling the complete network configuration,
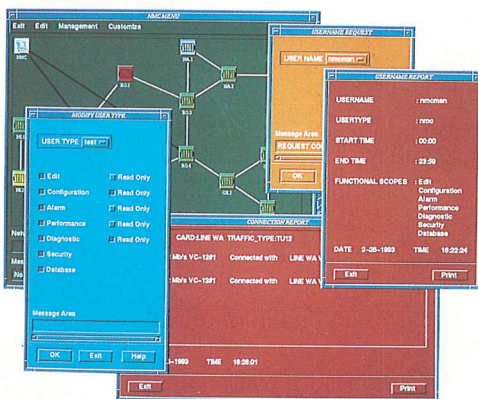
FMAS-EM systems allow you to control sub-networks composed of multiple network elements of the same type, with complete configuration, performance and fault management. In the early stages of network development, they are a cost-effective alternative to a full FMAS-NM system; and they offer a migration/integration strategy with FMAS-NM systems when these are introduced.

fault and performance management from a central point. Supplemented, if you wish, by FMAS-EM systems for AXD 4/1 cross-connects, and AXD 2500 and 620 multiplexers.

This solution is fully standards-compliant, and can be extended as your network grows, to interface with systems controlling the lower-order SDH network elements in the local and access networks.

If, on the other hand, you're focusing on local networks, and building out STM-1 rings to serve your demanding business customers, then we can meet your needs with scalable FMAS-EM systems, each dedicated to sub-networks small or large, and providing full end-to-end management of the configuration and performance of leased-line services.

Later, as your backbone network takes shape, you can consolidate the FMAS-EM systems into an FMAS-NM system, that looks after both the backbone and the local networks. This will give you total flexibility: you can continue to manage sub-networks from your FMAS-EM systems, or migrate all activities functions to the central FMAS-NM, with the FMAS-EM systems acting as 'gateways' to the network.

FMAS-NM lets you 'zoom in' on individual network elements, and see both the physical and logical structure of your network graphically.
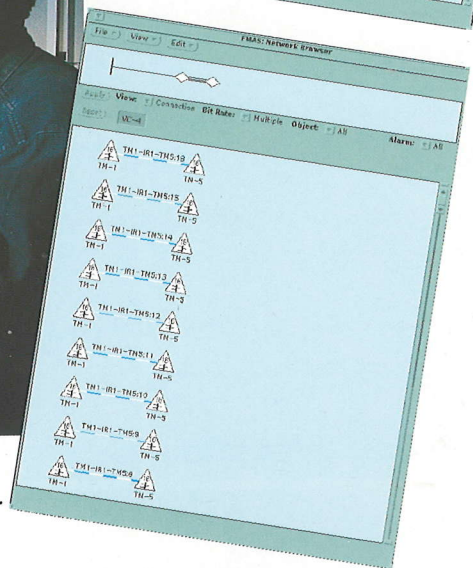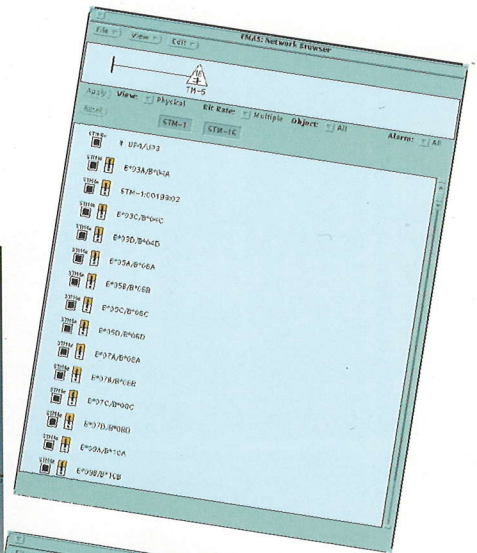
. . . A STRATEGY FOR EVERYTHING AT ONCE

Or, let's say you're aiming to build all the SDH layers at once, in an overlay network. Here too, Ericsson has the appropriate management strategy: using scalable FMAS-EM systems to centralize management at all levels, until the network is large enough to require the addition of FMAS-NM to bring together the management of all the network layers.

At every stage, you're never buying functionality you can't use, or making investments that don't pay off. Thanks to the step-by-step building blocks of Ericsson's SDH management systems, you always have just what you need.

READY FOR A MULTI-VENDOR ENVIRONMENT

Most SDH networks will contain network elements from at least two vendors. While functions such as alarm handling and fault management can be handled from the individual management systems for each vendor's elements, there are some areas — such as configuration management — where a network-wide view will be a big advantage.

In this case, FMAS-NM can become a powerful solution for multi-vendor networks. Thanks to its foundation on industry standards, such as TMN, and its modular architecture that permits special interfaces to outside systems to be built, FMAS-NM can grow to take on configuration management facilities across a multi-vendor SDH network.

These multi-vendor advantages can be exploited in various ways. FMAS-NM can be extended to manage all the elements in a multi-vendor transport network. Alternatively, it can manage just the Ericsson network elements, and pass information up via a standard interface to a higher-level network management system.

With Ericsson's family of SDH management and control systems, you can build up a management structure that provides the most efficient and economic solution at each stage in the build-up of your network. Here is a simplified illustration of how the strategy works.

1. In the initial stages of SDH network deployment, only a small variety and number of network elements will be deployed (for instance, large cross-connects and line systems within the backbone network). At this stage, systems can be controlled by LOT/ROT systems, moving to an FMAS-EM system once the network is established.
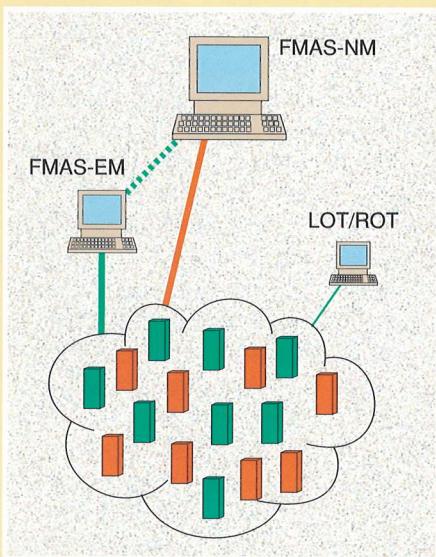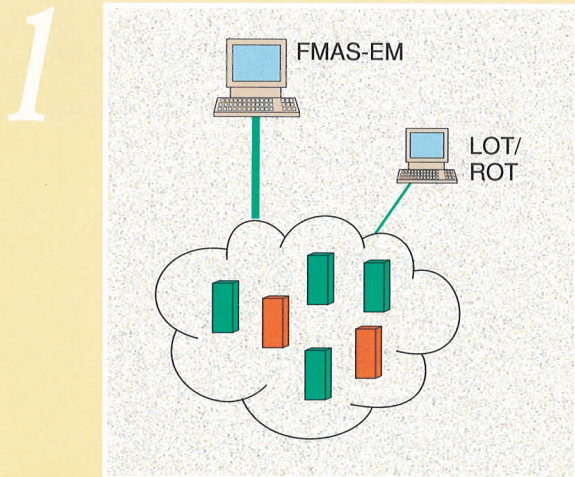
2. As the network grows, a small FMAS-NM system is installed, to manage the network from a central point. This FMAS-NM system is later enhanced by adding a link to the FMAS-EM — allowing the entire network to be controlled from a single, central system. At this point, the network is still limited to providing services in the backbone network. The next stage of development will extend SDH services out to the local networks.
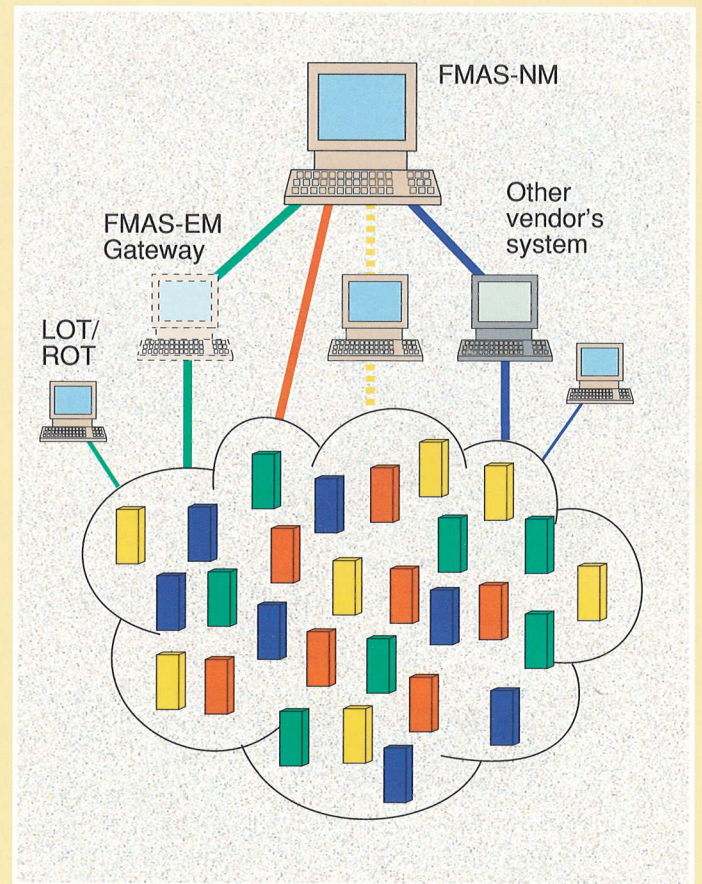
3. Later on, more network element types are added, as the network extends to provide services at the local level. Another Ericsson network element is installed, together with its FMAS-EM system. This FMAS-EM system is initially used to control sub-network configurations in local STM-1 ring networks; though a communication interface is also added to the FMAS-NM system, for centralized alarm handling and, ultimately, full control of the STM-1 network layer.

The other new network element type comes from a different vendor, with its own element management system. An interface (either using the TMN 'Q' standard or a specially-developed interface module) allows this element management system to report into FMAS-NM.

Also in this configuration, one of the original FMAS-EM systems has ceased to be a 'manned' system: all its functionality has been migrated to the FMAS-NM system, and the element manager remains purely as a 'gateway' between FMAS-NM and the network elements.

13

ETNA: the complete transport network solution
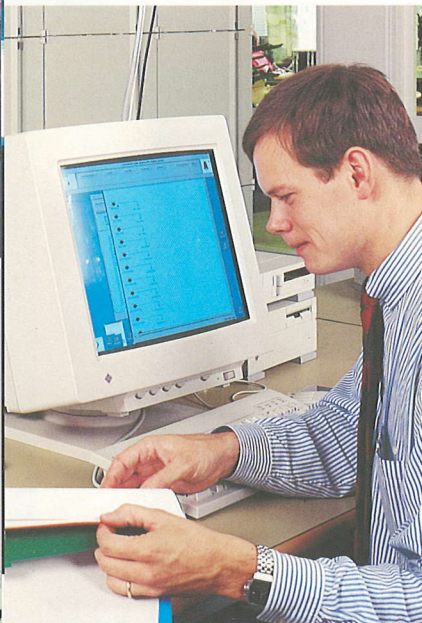
Upgrading the transport network is a strategic imperative for long-term revenue generation, and protection.

If a network cannot offer advanced, high-quality, flexible, high-bandwidth services, then it will lose revenue. Conversely, network operators who seize the opportunity to bring new services to market ahead of their competitors can quickly establish a market-leading position.

SDH is the mechanism for delivering these services.

ETNA — the Ericsson Transport Network Architecture — is a complete, integrated family of SDH systems, all optimised to work together for maximum efficiency and productivity.

There are three main equipment types: cross-connect systems, synchronous add-drop and terminal multiplexers, and management systems.

All of these systems have been designed from the ground up: the result of strategic research and development work at Ericsson centres in ten countries. Their modular design simplifies both hardware and software architectures, making for highly versatile network elements.

Because Ericsson has undertaken so much core development work in-house, the ETNA systems are exceptionally well integrated: ETNA is not just a collection of network elements, but a true SDH network solution.

ETNA creates a stable, flexible, standard-based and intelligent transport network, taking you smoothly into the SDH era, and preparing you to support broadband and multimedia services. Indeed, much of Ericsson's development of ATM-based broadband systems has taken place in parallel with SDH systems, to ensure that ETNA will provide the best possible transport infrastructure for broadband services based on ATM.
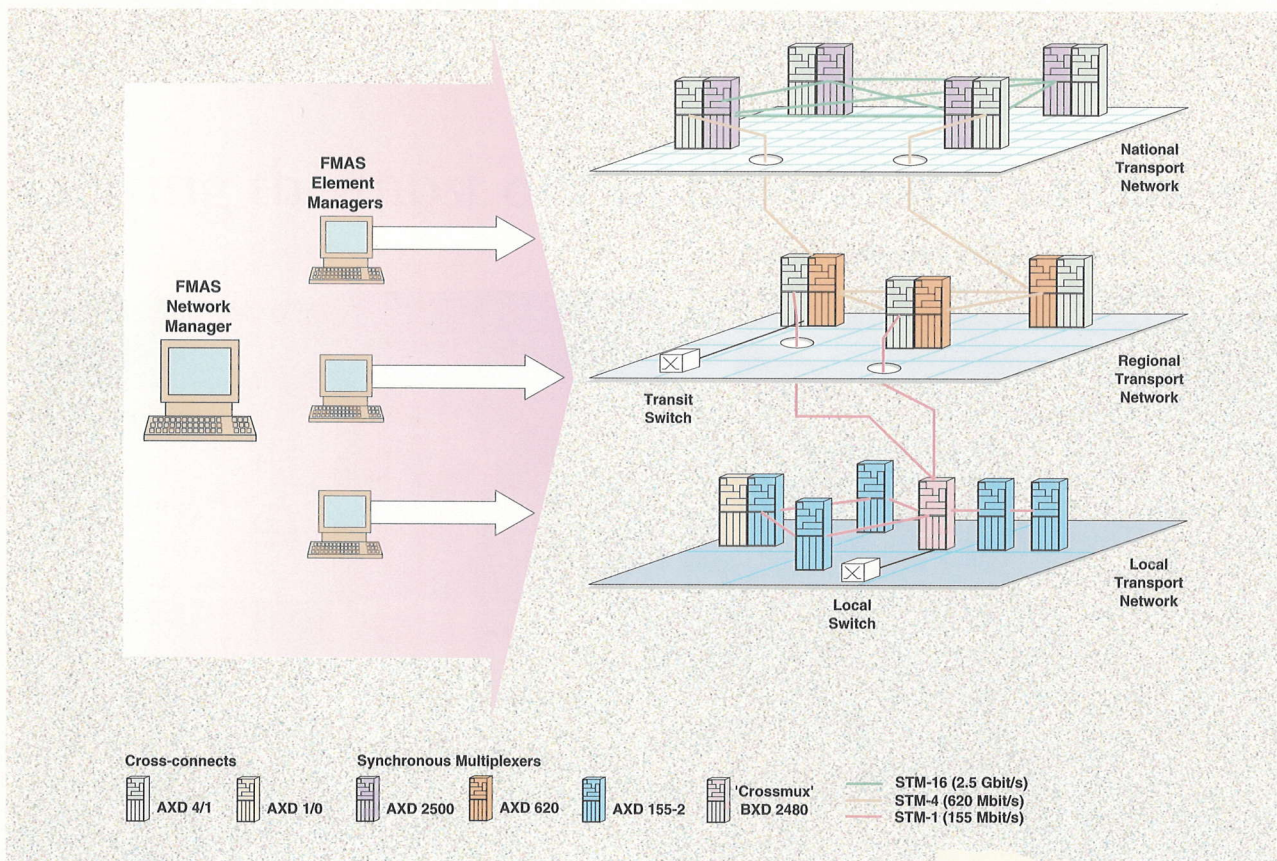
And just as important, ETNA systems fit seamlessly into the existing transmission environment, increasing its capabilities and maximising your returns on investment.

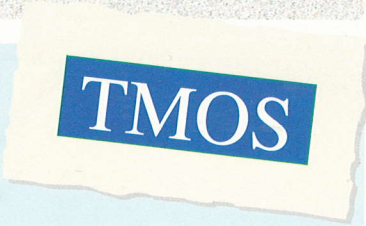## A HIERARCHY FOR ALL LEVELS OF THE TRANSPORT NETWORK

ETNA systems cover all applications, at all levels of the transport network hierarchy. High-capacity cross-connect and multiplexing systems handle high-speed trunks at up to 2.5 Gbit/s at the national and regional levels; at the local level, add-drop multiplexers, wideband cross-connects and a wide variety of other access systems provide end-user connection to services.

All this equipment, at every level in the network, is managed by Ericsson's range of SDH management systems. Local, regional and national management systems can be installed, each communicating with each other, and each able to take over the functions of subordinate systems whenever necessary.

At the top of the SDH management hierarchy is FMAS-NM: the command centre for the whole of the SDH network. FMAS-NM can manage all ETNA network elements; and thanks to standardized, open interfaces it can manage network elements and element managers supplied by other vendors too. FMAS-NM also provides open interfaces upwards towards service and business management systems, providing the opportunity to create powerful solutions that automate all aspects of the operator's business processes.

Cross-connects		Synchronous Multiplexers					
AXD 4/1	AXD 1/0	AXD 2500	AXD 620	AXD 155-2	'Crossmux' BXD 2480		

— STM-16 (2.5 Gbit/s)
— STM-4 (620 Mbit/s)
— STM-1 (155 Mbit/s)

TMOS: AN INTEGRATED SOLUTION FOR TOTAL TELECOMMUNICATION NETWORK MANAGEMENT

TMOS

TMOS (Telecommunications Management and Operations Support) is Ericsson's family of telecom network and service management systems.

TMOS implements TMN standards for network management, in order to manage networks with mixed-vendor equipment in a unified manner.

There are currently five main application areas within TMOS. FMAS is one: others are NMAS for PSTN/ISDN management, SMAS for Intelligent Networks, CMAS for cellular networks, and BMAS for business services such as Centrex and VPNs.

In TMOS systems, different functions are represented by discrete 'building blocks'. These can be combined in any way, to suit the needs of different types of network, or to fill the gaps left by other management systems.

TMOS applications also share a common hardware and software base. This means that different application systems can share the same computing resources, the same core software functions, and the same object-oriented model of the network.
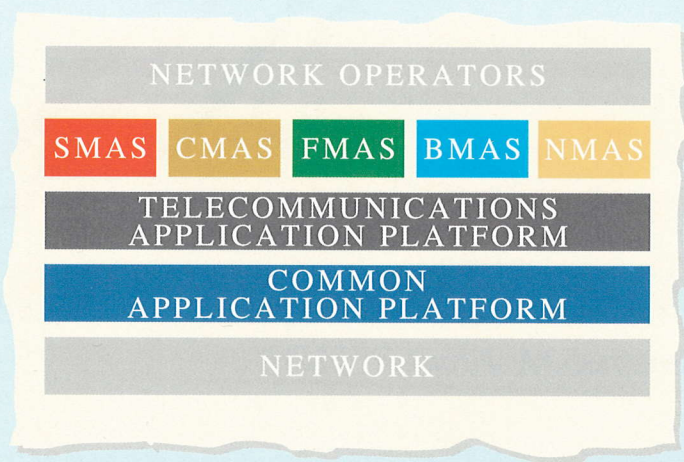
All systems are easily adaptable to different network management practices, and individual operator needs and preferences.

Graphical user interfaces, on-line help functions and user-defined menus, windows and report structures are key features that help to reduce operational costs and increase user satisfaction and productivity.

Ericsson's 75,000 employees are active in more than 100 countries. Their combined expertise in switching, radio and networking makes Ericsson a world leader in telecommunications.

Business Area Public Telecommunications creates, markets and supplies advanced systems and products for public telecommunications networks.

The successful AXE system for switching and intelligent network applications has been installed in more than 100 countries. Other important product areas are transport network systems and network management and operations systems.