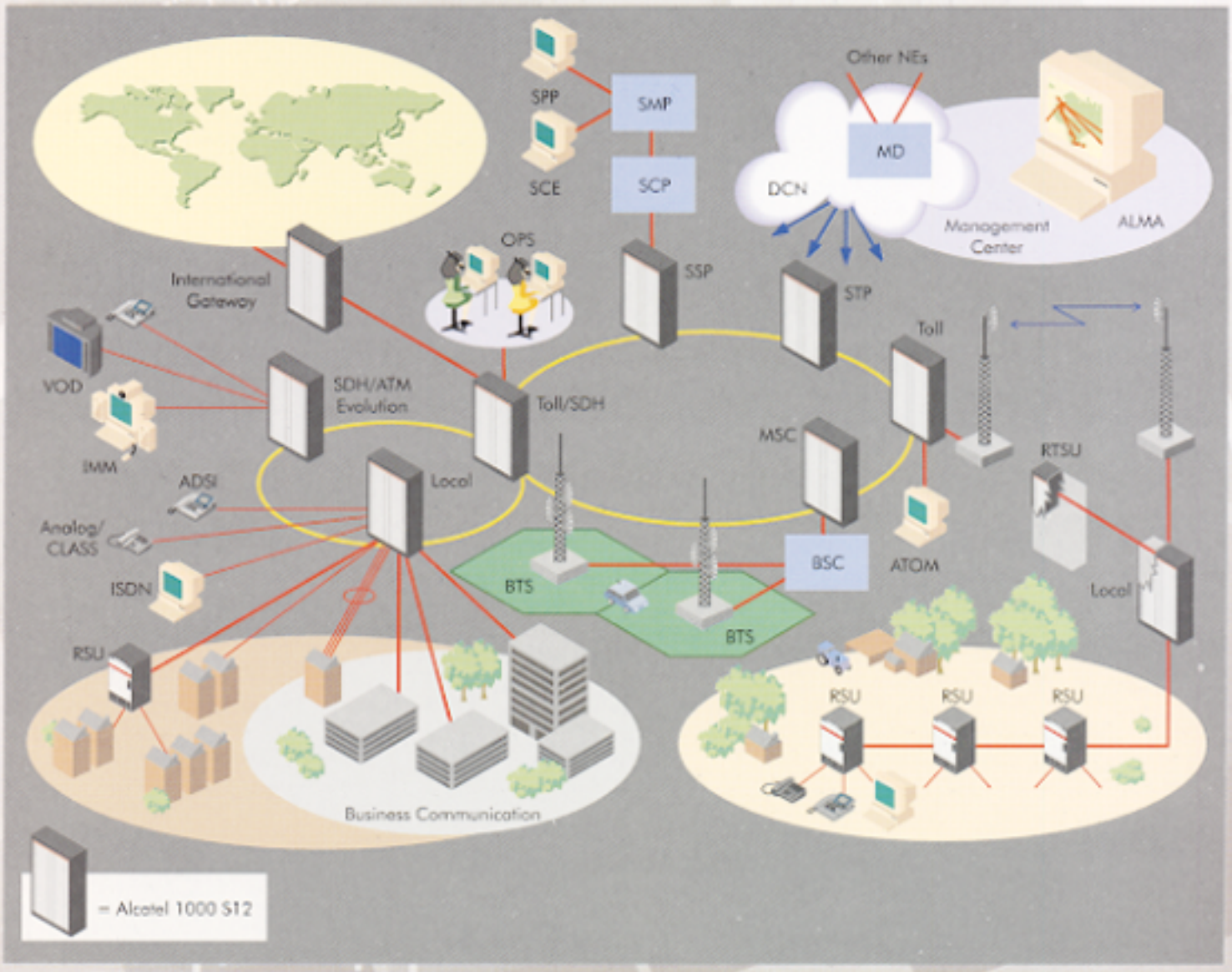
Alcatel 1000 S12
Digital Switching System

ALCATEL

Abbreviations

ABCE	ATM Broadband Control Element
ACE	Auxiliary Control Element
ADSI	Analog Display Services Interface
ALCN	Analog Line Card
ALMA	Alcatel Management Application
ALMAP	Alcatel Management Application Platform
ARCU	Alcatel Remote Concentrating Unit
ATM	Asynchronous Transfer Mode
ATOM	Advanced Terminal for Operations and Maintenance
BB	Broadband
BSC	Base Station Controller
BSS	Base Station Subsystem
BTS	Base Transceiver Station
CCS7	Common Channel Signalling No 7
CLASS	Custom Local Area Signalling Services
DCN	Data Communication Network
DDI	Direct Dialling In
DDO	Direct Dialling Out
DSN	Digital Switching Network
DTM	Digital Trunk Module
EIR	Equipment Identification Register
EMC	Electro Magnetic Compatibility
ETSI	European Telecommunications Standards Institute
FMM	Finite Message Machine
GSM	Global Subscriber Mobility
HLR	Home Location Register
IMM	Interactive Multimedia
IN	Intelligent Network
INAP	Intelligent Network Application Part (Interface)
IP	Intelligent Peripheral
IPTM	Integrated Packet Trunk Module
IRIM	ISDN RSU Interface Module
IRSU	ISDN Remote Subscriber Unit
ISDN	Integrated Services Digital Network
ISM	ISDN Subscriber Module
ISO	International Standards Organization
ISTB	ISDN Line Termination Board
ITU	International Telecommunications Union
JSSA	J-Rack family Small Stand Alone
IWLK	Interworking Link
kW	kilo Watt
LAN	Local Area Network
MCUC	Modular Control Unit Board
MD	Mediation Device
MPSR	Multi-Path Self Routing
MSC	Mobile Switching Center
NB	Narrowband
NE	Network Element
NSC	Network Service Center
NSS	Network Subsystem
OPS	Operator Position System
OSF	Operations Support Function
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
PDH	Plesiochronous Digital Hierarchy
PDK	PDH ATM Termination Link
PSTN	Public Switched Telephone Network
RSU	Remote Subscriber Unit
RTSU	Remote Terminal Subscriber Unit
SBCE	STM Broadband Control Element
SCE	Service Creation Environment
SCP	Service Control Point
SDH	Synchronous Digital Hierarchy
SLK	SDH STM Termination Link
SMF	System Management Functions
SMP	Service Management Point
SPP	Service Provisioning Point
SSP	Service Switching Point
STM	Synchronous Transfer Mode
STP	Signalling Transfer Point
TCE	Terminal Control Element
TLK	SDH ATM Termination Link
TMN	Telecommunications Management Network
UPT	Universal Personal Telecommunication
VC	Virtual Container
VLR	Visitor Location Register
VLSI	Very Large Scale Integration
VOD	Video On Demand
VPN	Virtual Private Network

Alcatel 1000 S12 Total Network Offering



Alcatel 1000 S12
We help you grow

Alcatel 1000 S12 : One System for All Applications

The unique Alcatel 1000 S12 modular concept features fully distributed control. The various functions are handled exclusively by individual microprocessors. Each processor treats the traffic for a limited amount of network terminals. Owing to this unique distributed control system architecture, the Alcatel 1000 S12 uses the same basic hardware and software elements, to offer the entire range of applications including :

- Remote subscriber units
- Small local exchange
- Medium to large local exchanges
- Tandem exchanges
- Toll exchanges
- International exchanges
- Operator assistance systems
- Network service centers
- Telephone traffic charging centers
- Mobile switching centers
- Service switching points
- Signalling transfer points

All Alcatel 1000 S12 exchanges throughout the range provide a full set of modern services and features to both subscriber and network operator, including ISDN, IN and Centrex services.

Capacity

- 120,000 lines (local exchange)
- 85,000 trunks (toll exchange)
- Traffic : 35,000 Erlang
- Busy Hour Call Attempts : More than 2,000,000

The Digital Switching Network

The key to the distributed control structure of Alcatel 1000 S12 is the Digital Switching Network or DSN. The DSN replaces not only the conventional switching network with its centralized control, but also the complex bus intercommunication systems required for a centralized processor to communicate with and control each of the individual terminal devices.

The main functions of the DSN are to respond to processor commands to set up connections between subscriber or trunk terminations, to transmit digital speech and data, and to transmit messages between the microprocessors.

Consistent with the concept of distributed control, logic and memory for path search and path connection are also fully distributed within the DSN. In other words, each functional unit of the DSN incorporates all the necessary logic in hardware to act as an independent entity.

The Digital Switching Element is the functional unit of the Digital Switching Network.

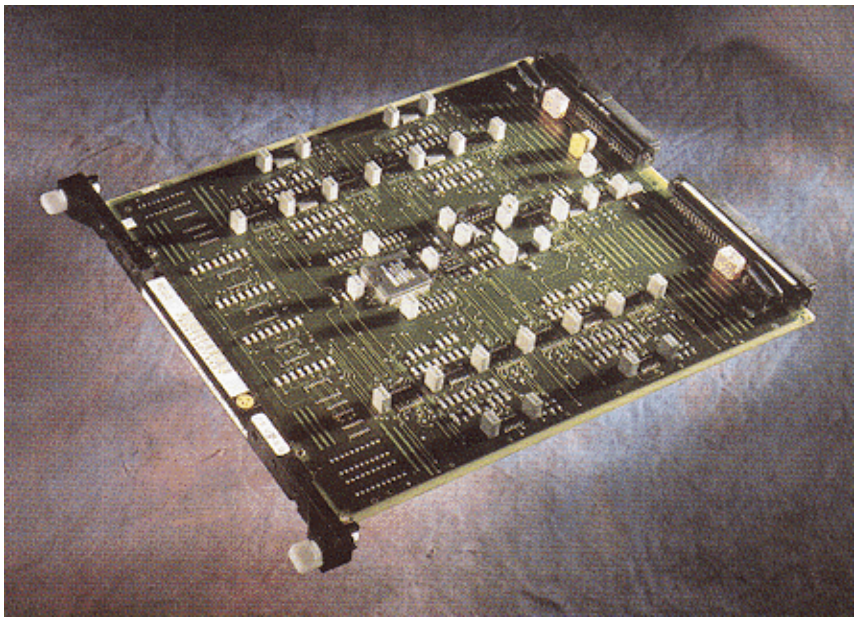
Each switching element has 16 ports, each port having a separate incoming and outgoing 32-channel PCM bit stream, with each channel carrying a 16 bit word.

The switching element performs space switching between ports and time switching between channels, allowing each of the 512 incoming channels to be switched to any of the 512 outgoing channels. The digital switching element is realized on one circuit board which is the basic building block of the DSN. The DSN simply consists of a number of digital switching elements. Because the DSN consists of a set of one, and only one building block type and because the addition of a new element results in a very small cost increment, expansion of the DSN can be tailored to suit the telephone administration's individual needs.

Major advantages of the network architecture for the operators are :

- Expansion of the network is possible on line.
- No fixed cable lengths are required, owing to the full asynchronous nature of the network.
- It is possible to connect n x 64 kbit/s channels with n = 1, 2, 6, 24, 30.

Digital Switching Element



Future-Safe Control

Distributed control is the chief functional characteristic of Alcatel 1000 S12. Because there is no central processor, telephone administrations are not constrained to make large, uneconomic investments neither when the system is small, nor later when the system expands.

Furthermore, distributed control helps to make Alcatel 1000 S12 fail-safe (no single central processor controls the call handling of the entire exchange), future-safe (new applications only require additional modules), and full range (the system expands smoothly and economically to meet customer needs).

All control functions in the Alcatel 1000 S12 switching system are performed by microprocessors, called control elements. These control elements are organized into two groups, respectively the Terminal Control Elements (TCEs) and the Auxiliary Control Elements (ACEs).

The TCEs are dedicated to a number of network terminals. As an example, the subscriber module comprises 128 analog line circuits or 64 ISDN basic accesses or any mix, and the 32 channel Digital Trunk Modules (DTM). The ACEs perform auxiliary control functions such as administration, resource management, translations, maintenance checks etc.

ACEs with specific functions, such as resource management, are fully replicated for data and some of their functions are distributed over several ACEs, working independently for added control capacity and safety.

Furthermore, a pool of spare ACEs is provided. Should one ACE in a duplicated pair fail, the other takes over and a spare ACE from the pool is loaded with the relevant software and replaces the failing member of the pair. In this way there is always a standby ACE ready for immediate operation.

All control elements, whether TCEs or ACEs, are made of identical component types and are connected to the Digital Switching Network in the same way.

Software

Software functions are distributed over the processors controlling the exchange, reflecting the distributed control of Alcatel 1000 S12.

Alcatel 1000 S12 software has five major subsystems :

- Operating system
- Telephonic support
- Call handling
- Maintenance
- Administration

For tasks common to many control elements and where several of these perform the same function, software from the appropriate subsystem is replicated in each processor. Examples are the operating system software, resident in all control elements, and the telephonic device handler software which is replicated in all TCEs connected to the same type of terminal.

Other software may be either shared between different control elements or assigned to a specific control element.

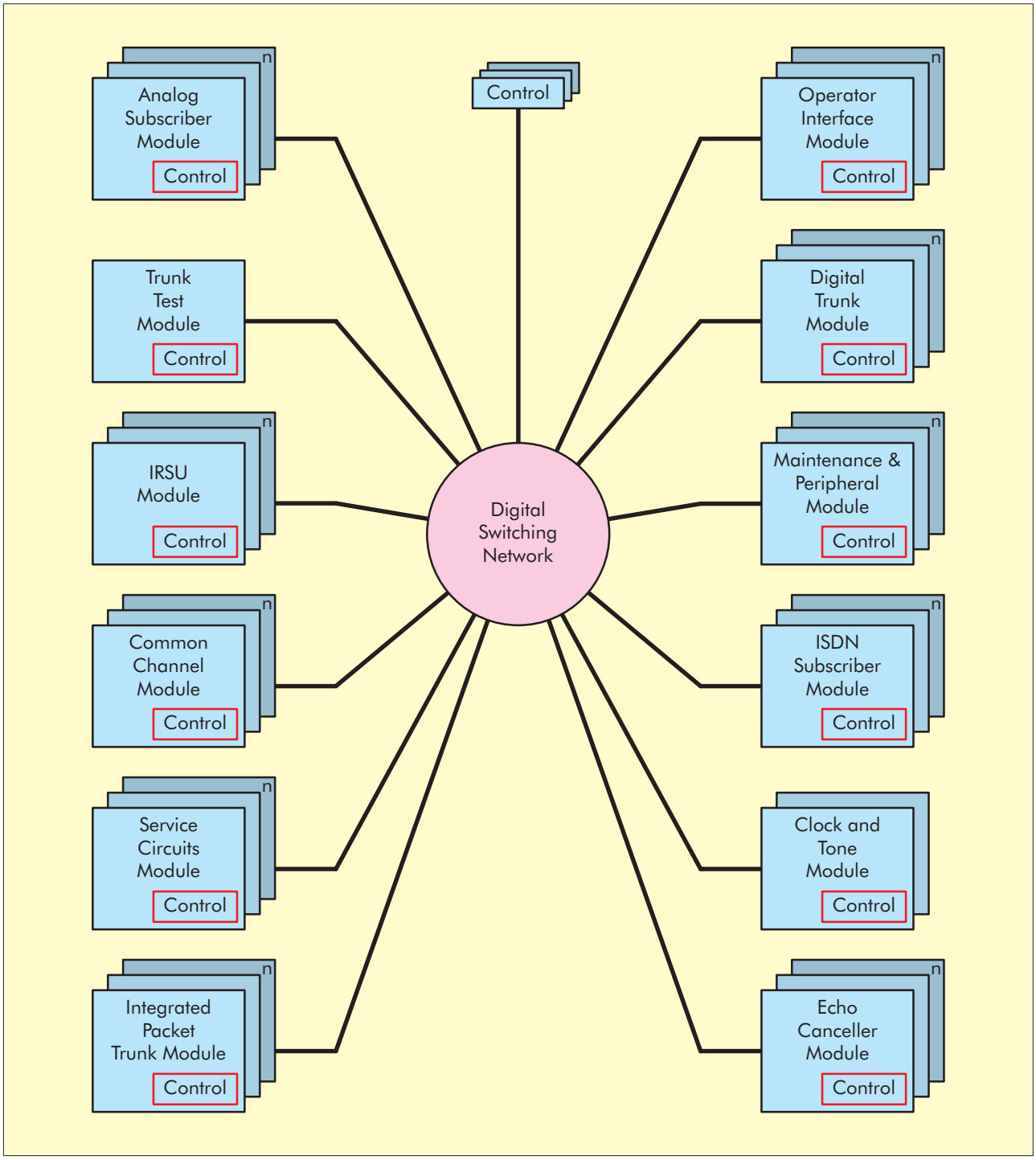
Alcatel 1000 S12 software subsystems are further partitioned into a number of functional software modules with well defined interfaces and which communicate with each other by messages. The software modules are called Finite Message Machines (FMMs) and contribute to the highly modular structure of the Alcatel 1000 S12 software.

Distributed software has a number of advantages :

- Total breakdown of the system is virtually impossible.
- Fewer software functions for each control element reduces complexity and thus increases reliability.
- Extensions can be made more easily and safely.
- Open-ended control capacity.
- Reduced load on individual processors, resulting in a good buffer against overload situations.

Alcatel 1000 S12 software is characterized by its high reliability, immunity to total system failure and its ability to accept easily and inexpensively the introduction of new services and technologies. In order to achieve these objectives, Alcatel 1000 S12 has introduced some of the most advanced design methods and concepts.

Alcatel 1000 S12
Distributed Control



Flexibility

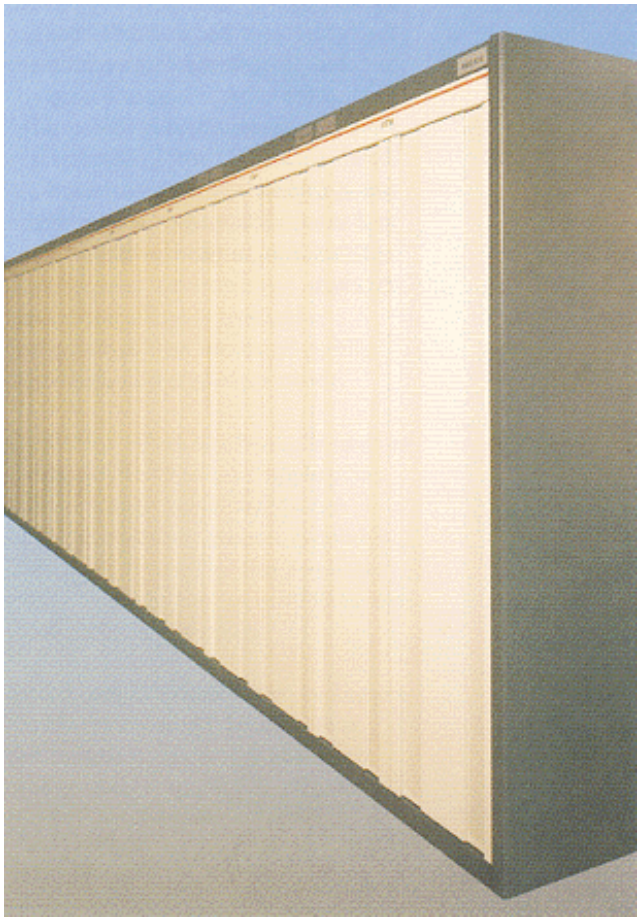
Additional proof of Alcatel 1000 S12's flexibility is its application in various specialized configurations or entirely specialized networks.

Examples are exchanges which deal specifically with Signalling Transfer Point functions (STP) for ITU-T common channel signalling No 7 (CCS7), Mobile Switching Center functions (MSC) for cellular mobile radio applications and Network Service Center functions (NSC) providing centralized operation and maintenance facilities for Alcatel 1000 S12 networks.

As required for the introduction of several advanced features and in view of the ongoing deployment of ISDN in many networks, the ITU-T CCS7 is operational in many networks throughout the world.

A further very significant development for the Alcatel 1000 S12 is the addition of Intelligent Network capability (SSP). This gives the system a generic capability for adding an open-ended range of new features such as advanced freephone, virtual private networking, wide area centrex etc.

The Alcatel 1000 S12 provides all means to cope with the fast evolving needs in the area of Business Communication. In this respect Centrex functionality, including ISDN capabilities, is available in the ISDN Professional Service / Centrex package of the system.



Introduction of broadband ISDN capabilities is planned through the replacement of the DSN by an ATM-based MPSR (Multi-Path Self Routing) switch and the addition of specific broadband modules. Operation and maintenance of such combinations of narrowband and broadband ISDN modules will be handled by common subsystems.

Leading Edge Hardware and Software Technology

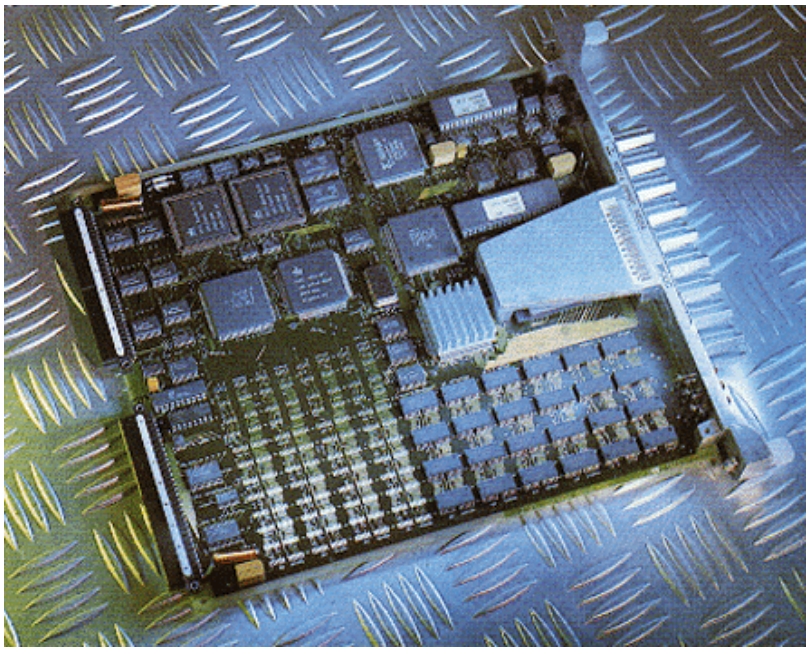
Mastering technological evolution for both hardware and software is essential in order to guarantee customers constant satisfaction for their present and future needs. Alcatel 1000 S12 integrates the latest technology, and its design and manufacturing processes are optimized to minimize time to market.

Modular Architecture towards State-of-the-art Evolution

The Alcatel 1000 S12 with its distributed control architecture incorporates modular hardware components conform to a strictly defined interface with the digital switching network (DSN).
The use of Finite Message Machine software modules, the Virtual Machine concept for isolating software from hardware, and the strict adherence to defined interfaces between the VLSI circuits, assure a robust design capable of evolving in line with advances in hardware technology.

Consequently, owing to the evolution of semiconductor technology towards smaller feature sizes, components such as memories, microprocessors, custom VLSI circuits, codecs etc., can all be updated to achieve higher densities, better reliability, lower manufacturing cost, without changing the exchange architecture or top level software.

Modular Control Unit Board (MCUC)



Component Technology

At the basis of technological evolution we find the progress of integrated circuits. As these are becoming faster and smaller, and power dissipation decreases, more functions can be accommodated within the same physical area and operate at ever higher speeds. The latest microprocessor components and memory chips, as used in control elements for special applications, create additional possibilities that were not possible with older generations.

Miniaturization also allows a great deal of functions, previously requiring various components, to be combined on a single board. An example is the subscriber line board containing 16 line subscriber interfaces.

Software Technology

Software quality depends on system architecture and design methodology : two fields in which Alcatel 1000 S12 has a proven expertise.

Alcatel 1000 S12 is controlled by many commercial type processors. (Several thousand for a large exchange application). Some perform specific functions of hardware management related to the position of the controller in the system. Other processors can carry software logic that may be allocated freely, depending on the availability of processing power and memory resources.

The Alcatel 1000 S12 software modules are numerous, and are developed in a rich design environment, supported by a variety of automated methods and tools.

All software, including the software related to on-board controllers, is downloadable.

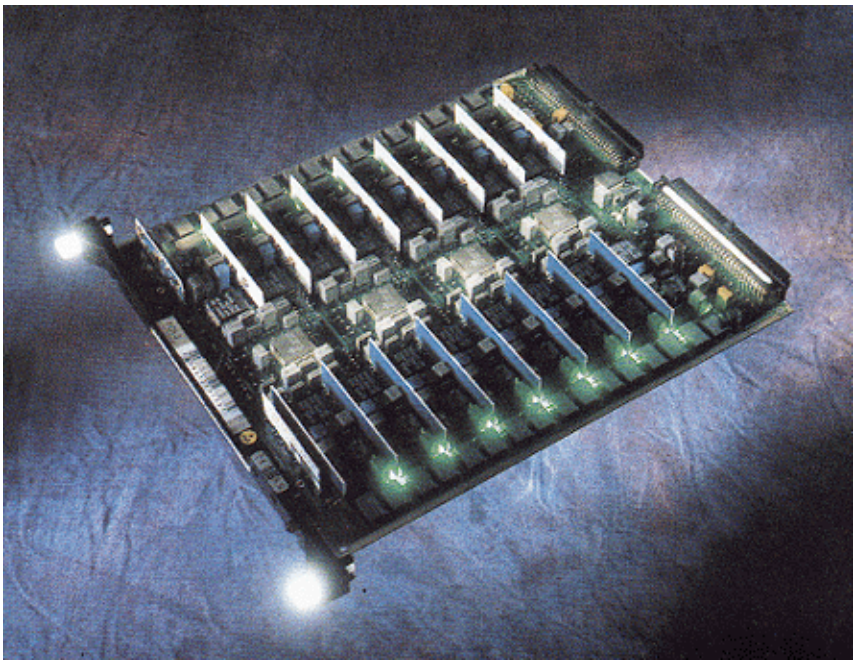
Functional evolution is mastered through the management of major periodic releases, complemented by sub-releases.

An Alcatel 1000 S12 software package consists of 3 layers : the generic kernel release, the common package (essentially the call handling), and specific customer related functions. Since these components might be sourced by different design centers, only an optimal development environment can guarantee a timely available end-product that meets all public standards and customer needs.

Particular effort has been devoted to automatic tools to port application software onto newer hardware platforms as they become available. This is illustrated by the processor evolution from the early 8086 to the most recent technology.

In recently extended older exchanges various processor type mixtures can coexist in the same exchange, managed by a single SW release.

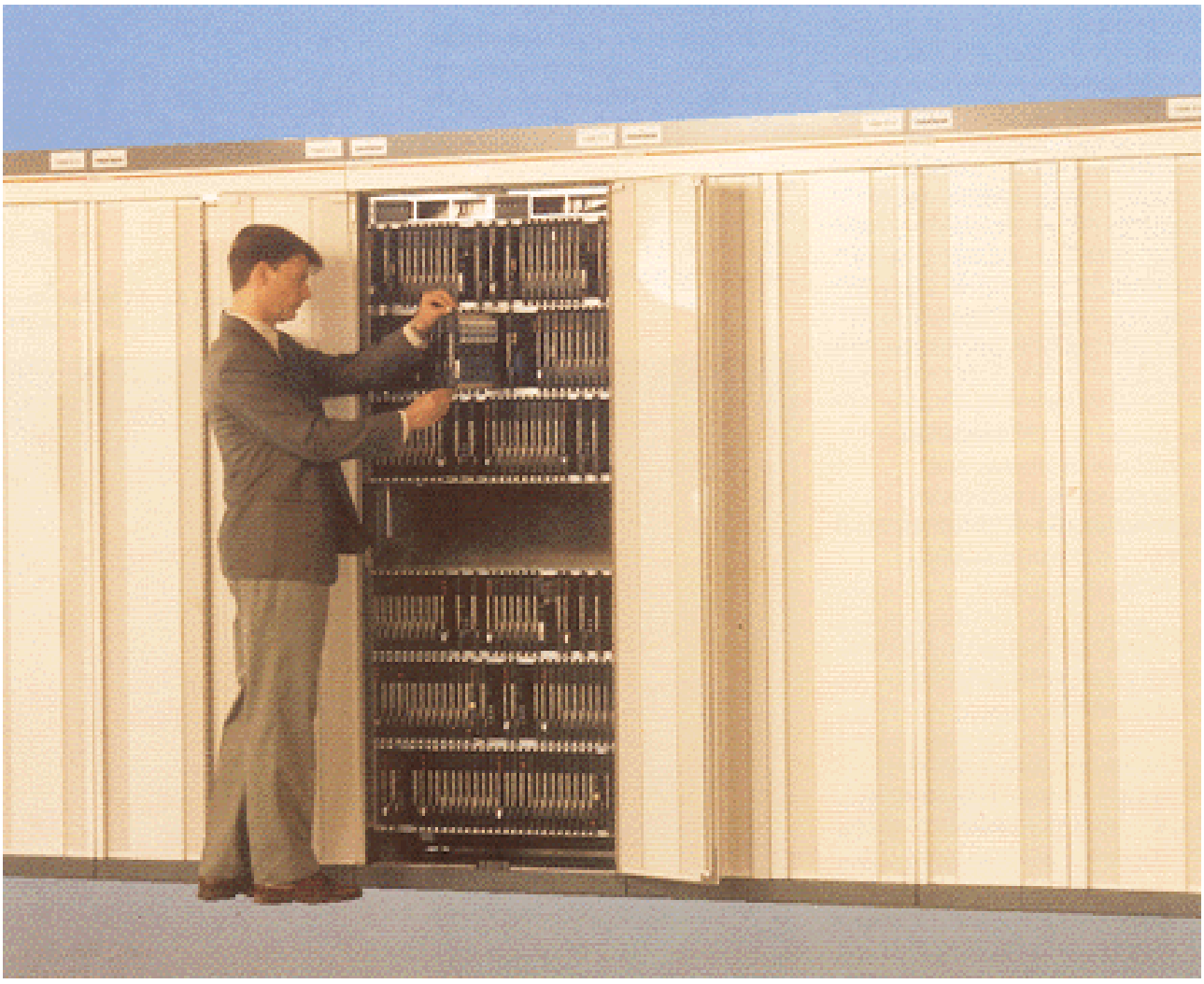
Analog Line Card for 16 Subscribers (ALCN)



Alcatel 1000 S12 Implementation

Owing to its unique and versatile system architecture, the Alcatel 1000 S12 can easily exploit new technological advances without altering its basic structure. The number of different printed circuit board types is only 29 for a typical exchange. The number of different rack types from which a typical exchange is built is 4.

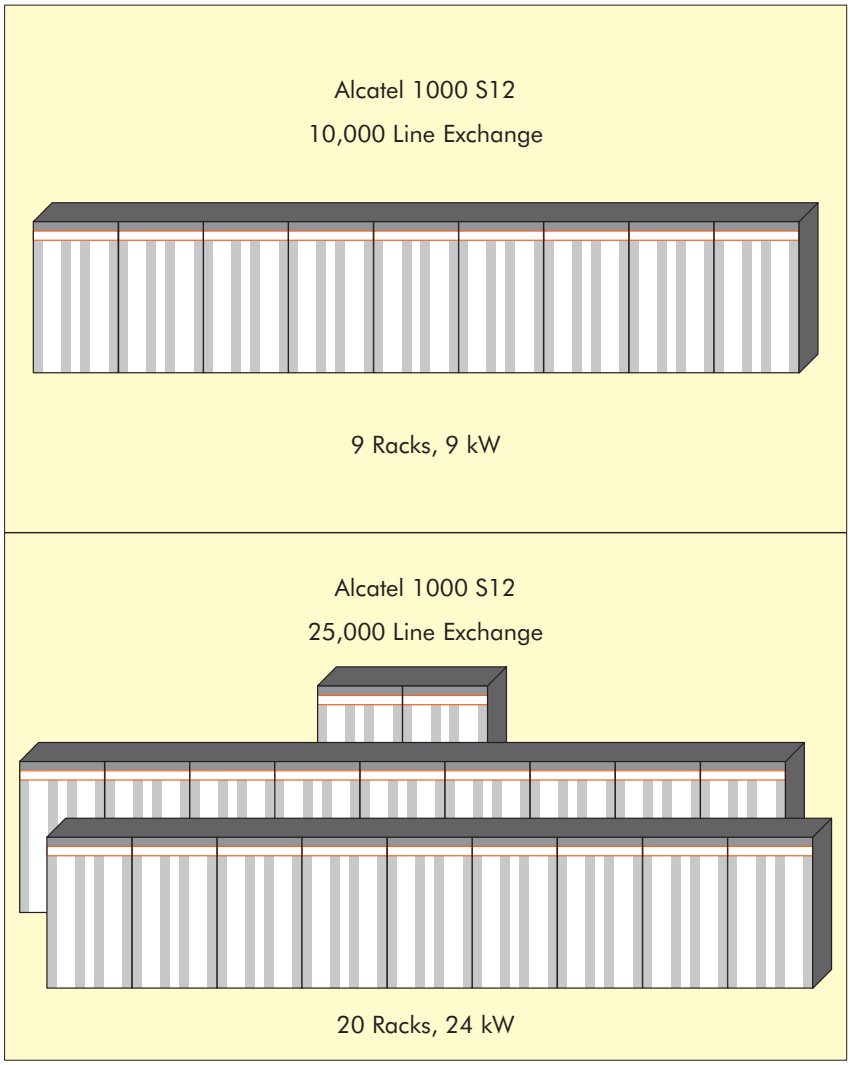
For a typical 10,000 line exchange the Alcatel 1000 S12 requires 9 racks and 9 kW power.



The smallest Alcatel 1000 S12 exchange consists of only one telephone equipment rack.
This one rack, which is also the first rack in any Alcatel 1000 S12 local exchange, comprises 256 analog line circuits (or 128 ISDN basic accesses). Apart from the subscriber line interface circuits this rack comprises the initial digital switching network equipment, a full complement of auxiliary control elements (ACEs), up to 8 digital trunk modules (240 channels) and all required clock and tone circuitry as well as all required peripheral and load functions to implement a full-featured exchange.

Just power up this one single rack and your fully featured Alcatel 1000 S12 exchange swings into action. By the judicious addition of a sequence of equipment racks, consisting of only three different rack types, your Alcatel 1000 S12 exchange may grow to 120,000 lines.

The most commonly used rack in a local exchange is the high density line rack which comprises 1,536 line circuits plus up to 8 digital trunk modules totalling 240 digital trunk channels. Hence this rack brings with it, apart from the line circuits, enough digital trunks to ventilate incoming and outgoing traffic for an equivalent of 1,536 lines.



Typical Layout of Alcatel 1000 S12

Remote Subscriber Unit

The Alcatel 1000 S12 ISDN Remote Subscriber Unit (IRSU) is suited to serve remote concentrations of subscribers and to shorten the loop length in urban areas.

It is a mixed analog / ISDN telephone line concentrator which provides cost-effective access to an Alcatel 1000 S12 exchange. The IRSU concentrates the subscriber traffic on one to four PCM links.

Subscribers connected to an IRSU enjoy exactly the same services and facilities as subscribers who are directly connected to Alcatel 1000 S12 exchanges.

The modular structure of the IRSU equipment allows to combine it with line transmission equipment in common racks.

Several IRSU versions, from 96 to 976 lines, exist to fit different subscriber densities and traffic conditions. Also outdoor versions for up to 256 lines are available.

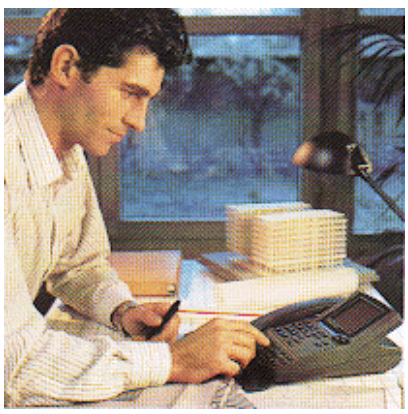
World of Service for Subscribers

The Alcatel 1000 S12 product family supports a wealth of supplementary services. Services comply with ETSI specifications where applicable, others are the result of direct discussions with our customers. The list below is not exhaustive.

End User Services

Number Identification Services

- Malicious Call Identification
- Calling Line Identification Presentation
- Calling Line Identification Restriction
- Connected Line Identification Presentation
- Connected Line Identification Restriction
- Called Line Identification Presentation
- Called Line Identification Restriction



Addressing Related Services

- Abbreviated Address
- Fixed Destination Call
- Direct Dialling In
- Subaddressing
- Direct Dialling Out
- Interworking Number
- Multiple Subscriber Number

Call Waiting and Call Completion Services

- Call Waiting
- Call Completion to Busy Subscriber
- Call Completion on No Reply
- Queue Service
- Interception
- Emergency Call Service

Call Forwarding Services

- Call Forwarding Unconditional Fixed
- Call Forwarding Unconditional Variable
- Call Forwarding Busy
- Call Forwarding on No Reply
- Call Forwarding Timed
- Call Forwarding Restriction
- Call Forwarding to Announcement
- Call Forwarding to Voice Mail
- Call Forwarding to Paging
- Selective Call Forwarding
- Explicit Call Transfer
- Follow-me
- Call Deflection

Charging Related Services

- Advice of Charge (ETSI)
- Home Meter
- Coinbox
- Credit Card Call
- Hotel Billing

Restriction Services

- Closed User Group
- Incoming Calls Barred
- Outgoing Calls Barred
- Selective Call Rejection
- Do not Disturb

Multiparty Services

- Call Hold
- 3 Party Call
- Add-on Conference
- Meet-me Conference
- Kiosk Service (Chat Type)

Mobility Services

- Terminal Portability
- Message Wait Indication

Special Alerting Services

- Alarm Call
- Priority Calls
- Distinctive Ringing
- Selective Ringing

PBX Related Services

- Direct Dialling In
- Direct Dialling Out
- Line Hunting
- Call Queuing

Control of Supplementary Services

- Remote Control
- Password Control
- Subscriber Control Procedures
- General Deactivation

Specific ISDN Services

User-to-User Signalling

Circuit Mode Bearer Services

- 64 kbit/s Unrestricted
  - 8 kHz structured
  - 8 kHz structured, for Speech
  - 8 kHz structured, for 3.1 kHz Audio
- n x 64 kbit/s Unrestricted, 8 kHz structured (n = 1, 2, 6, 24, 30)

Packet Mode Bearer Services B&D Channels

Teleservices

- 3.1 kHz Telephony
- 7 kHz Telephony
- Video Telephony
- Teletex
- Telefax 4

Centrex Functionality

Centrex Related Services

- Private Number Plan
- Uniform Call Distribution
- Call Pick-Up
- Abbreviated Dialling
- Direct Dialling In (DDI)
- Direct Dialling Out (DDO)

Attendant Services

- Attendant Call Hold
  - Re-establishment of communications
  - Make a second call
  - Answer a waiting call
- Attendant Call Transfer
- Dot not Disburb
- Attendant Recall on No Reply
- Serial Call
- Call Waiting Indicated by Attendant
- Night Service
- Intrusion
- General Incoming Call Forwarding on No Reply

Intelligent Network Services

- Advanced Freephone
- Alternative Billing Service
- Automatic Call Distribution
- Credit Card Calling
- Kiosk Service
- Call Duration Advice
- Massive Calls
- Personal Number
- Redirection of Calls
- Universal Access Number
- Virtual Private Network
- Televoting
- Wide Area Centrex
- Universal Personal Telecommunications

Interfaces

- Analog Subscriber Lines
- Advanced Analog Subscriber Lines
- Basic Access : 2B+D (4B3T and 2B1Q)
- Primary Rate Access : 30B+D
- 1.5 and 2 Mbit/s / PCM Systems
- Fiber or PCM Links to remote Switching Units
- Digital Interfaces to Voice Mail, Paging, Mobile Message Service Equipment, and ADSI servers

Subscriber, National and International Signalling Systems

Full Service for Network Operators (*)

Fault Management / Supervision

- Fault diagnosis and fault localization of all hardware
- Alarm + fault indication threshold management
- Routine checking of all hardware while in service
- Continuity checking on established connections
- Testing subscriber lines and sets (routine and on demand)
- Incorporated line testing and/or interfacing to external line testing system
- Testing trunk circuits (routine and on demand)
- Device utilization rate checks
- Alarm display on PC type terminal and further relaying
- Visual display for exchange management
- Fault statistics processing management
- Interface management
- Complaints monitoring

Configuration / Operation Management

- Graphical, menu driven and command mode (PC type terminal)
- Subscriber management of normal lines, PBX lines, supplementary services
- Telephone equipment management trunk circuits, common channel signalling circuits, equipment status
- Transaction files management (analysis trunk group routings, routing time tables)
- Charging procedures management (parameters, time tables, codes, counters)
- Common channel network management (analysis routing channel assignments)
- Centrex management (business groups and industrial users)
- Operator position management, traffic flow variations, specialized operator assignments, operation mode

(*) The list of services is not exhaustive

Accounting / Charging Management

- Automatic ticket retrieval
- Bearer capability dependent analysis
- Business charging
- Called or calling classmark subscriber free of charge
- Charge pulse from higher / lower order exchange
- Charge recording
- Charge recording for immediate output
- Charging display
- Charging output
- Charging statistics
- Credit limit
- Daily (midnight) charging for resource occupancy
- Day- and time-dependent analysis
- Destination-dependent analysis
- Detailed billing for B-Channel usage related to packet services
- Detailed billing observation
- Detailed billing record
- Division of revenue analysis for origin, destination, routing and time
- Division of revenue call / pulse / time counters
- File transfer to charging / service center
- Hard copy of detailed billing record
- Home meter 50 Hz or 4, 12 or 16 kHz
- Hotel billing
- Intermediate collection after time or amount of pulses
- Intermediate detailed billing record
- Magnetic tape : duplication / formatting / multi-volume
- No charging – incoming call
- No charging – outgoing call
- Number free of charge
- Origin-dependent analysis
- Polarity reversal for cashing
- Price enquiry service
- Residential charging
- Reverse charging
- Start charging (different event types)
- Subscriber class dependent analysis
- Subscriber control charging
- Supplementary service charging
- Switchover of tariff plan
- Transit charge pulses
- Type of call dependent analysis
- Type of traffic dependent analysis
- Unit fee + Karlsson or pseudo Karlsson, synchronized or not, non-linear algorithm
- Up to 4 counters per subscriber, for different call types
- Warning for expensive calls

Performance Management

- Traffic measurement management (traffic, subscriber lines, charging, translation, time counters, event counters)
- Charging data control

Security Mechanisms

- Operator and terminal access rights
- Intrusion tracing
- Password allocation

ISDN with Alcatel 1000 S12 : Service Backed by Experience

ISDN with Alcatel 1000 S12 : Field Proven Efficiency

ISDN, Integrated Services Digital Network, is the integration of all forms of communication : voice, data and images. It allows information to be transferred more quickly and more flexibly, and therefore more efficiently. ISDN offers a number of features which create benefits both for the users and the operator.

Systematic research and development as well as a keen eye for the needs of private users and companies have established Alcatel as a leader in the field of ISDN.

The ISDN equipment of Alcatel with its field proven efficiency and performance is commercially implemented in telecom networks worldwide.

ISDN with Alcatel 1000 S12 : Gradual Introduction

The open telecommunication market makes it essential that exchanges designed and built primarily for present telephone service are suitable for use in an ISDN environment.

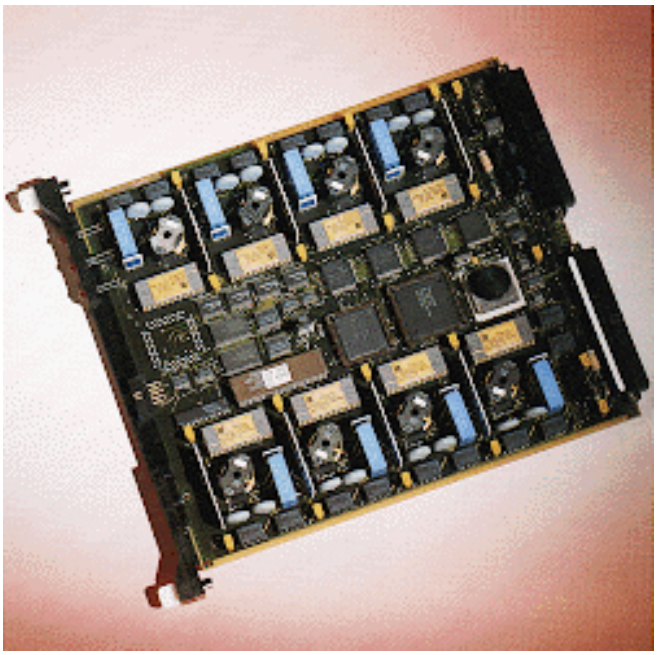
The Alcatel 1000 S12 has been designed to meet these requirements. The modular distributed control architecture of Alcatel 1000 S12 is ideally suited to the gradual introduction of ISDN in existing telecommunications networks.

ISDN with Alcatel 1000 S12 : Modular Architecture

The modular architecture and distributed control of Alcatel 1000 S12 is illustrated in the well-known spider diagram. The system consists of a digital switching network connected by a standard interface to a series of modules. New modules can be added to Alcatel 1000 S12 to provide a full range of non-voice services without changing the basic exchange architecture or affecting existing hardware.

Three Alcatel 1000 S12 modules are designed for ISDN : the ISM (ISDN Subscriber Module) for basic access lines, the IPTM (Integrated Packet Trunk Module) for primary rate access, D channel multiplexing and X.25 access, and the IRIM (ISDN RSU Interface Module) for remote basic access lines. Together with the existing supporting modules in Alcatel 1000 S12, they can handle the mix of circuit and packet mode connections required in an ISDN environment.

ISDN Line Termination Board (ISTB)



ISDN with Alcatel 1000 S12 : ISDN Packet Switching

One of the major economies made possible by the 2B+D (and 30B+D) integrated access is the elimination of separate access lines to the packet network. Packet switching is therefore one of the driving forces in the successful introduction of ISDN.

Alcatel 1000 S12 is ideally positioned to provide ISDN packet switching due to its end-controlled digital switching network which allows to handle both circuit switching and packet switching simultaneously.

The Alcatel 1000 S12 ISDN modules discussed earlier give a high degree of flexibility in providing ISDN packet switching configurations.

In the minimum integration scheme, a circuit-switched access is given to an X.25 inlet port of the packet network.

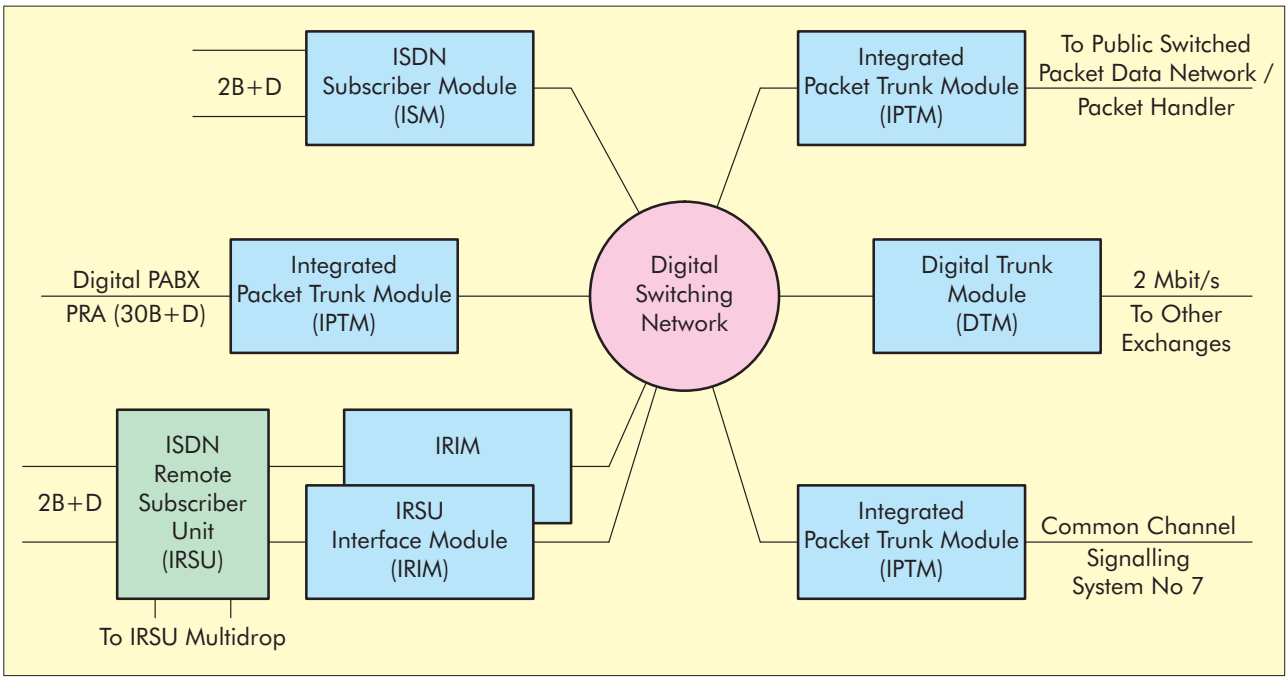
In the intermediate integration scheme, frame multiplexed packet traffic is sent to the packet network where the full Layer 3 functionality is available. This solution avoids implementation of the full Layer 3 functions in the ISDN public exchanges.

With the availability of the X.25 and X.75 variants of the IPTM, Alcatel 1000 S12 is also prepared for the full integration of packet switching within ISDN.

ISDN with Alcatel 1000 S12 : Applications and Services

- Telephony
- Bearer services
- Teleservices
- Supplementary services
- File transfer
- Transmission of still / moving pictures (image downloading, telemonitoring, video conference)
- LAN interconnection

ISDN Modules of Alcatel 1000 S12



Alcatel 1000 S12 : Ready for Broadband ATM

Compared with analog networks, ISDN provides substantial improvements in the available bit rate. However, the range of services that will develop in the emerging era of generalized high definition colour pictures and moving images will need even higher bit rates, at tens of Mbit/s, and, in some cases, even beyond 100 Mbit/s.

Broadband networks operating at these high speeds can provide exceptional ranges of interactive user services, while offering the potential for significant network rationalization by carrying distributive services, such as TV channels. They also provide adequate solutions for the inter-connection of a rapidly increasing number of LANs without restricting the bandwidth of the provided services.

ATM Technology

ATM technology has been chosen by the ITU-T as the basis for broadband networks. The reason for this choice is the flexibility that ATM offers for handling services requiring widely different bit rates, from several kbits per second to over one hundred megabits per second.

ATM (Asynchronous Transfer Mode) is a technique for transferring digital information in the form of cells of fixed length, regardless of the information conveyed. The number of cells needed to transfer a bit stream depends on its actual bit rate.

Operation is asynchronous, meaning that the cells do not have an identified position in time, unlike the bytes of a synchronous link which occupy a fixed position within a frame.

Information is transferred in connection-oriented mode over a virtual circuit that has been previously set up, either by call handling functions between subscribers, or semi-permanently between network entities.

The virtual circuit is identified by a header that consists of a binary number representing a logical address to which the cell is assigned.

The header also conveys information for network management functions. Additionally, the header contains an error detecting and correcting code which provides protection against errors which may be introduced in the network. This is an essential precaution as the address in the header is the only information available for routing the cell through the network. After being multiplexed in time, cells generated by the information sources are sent over the transmission links.

The physical data rate of the multiplex must be distinguished from the throughput of a virtual circuit. Both are expressed in bits per second, but the latter value only takes into account the cells assigned to the virtual circuit.
The major advantage of ATM technology is flexibility. It can be used to transmit any type of digital information in both switched mode and semi-permanent links.

The network infrastructure can now integrate all services, regardless of their bit rate. Taking for granted that people want to enhance their communication with high quality colour pictures or moving images, Alcatel is introducing ATM technology into the Alcatel 1000 S12.

Evolution Strategy

The main step in the evolution to broadband technology of Alcatel 1000 S12 design is the replacement of the Digital Switching Network (DSN) by the Multipath Self-Routing switch (MPSR). This allows it to handle all types of information, namely ATM cells, SDH synchronous payloads, 64 kbit/s channels.

Replacing the DSN switch fabric of Alcatel 1000 S12 by the broadband MPSR switch fabric is the cornerstone of the Alcatel 1000 S12 evolution to broadband. The MPSR switch will permit the termination of SDH in Alcatel 1000 S12 and the extension of the exchanges with broadband interfaces and broadband switching capabilities.

This allows the design of an integrated network architecture concept built around the Alcatel 1000 S12.

The switch system architecture which makes this possible is shown in the figure below. It shows that the exchange is built around the MPSR switch. This switch gives the possibility to terminate :

- All existing NB interfaces on Alcatel 1000 S12 modules.
- SDH STM-1 interfaces carrying lower order containers (VC12).
- ATM interfaces on PDH as well as on SDH.

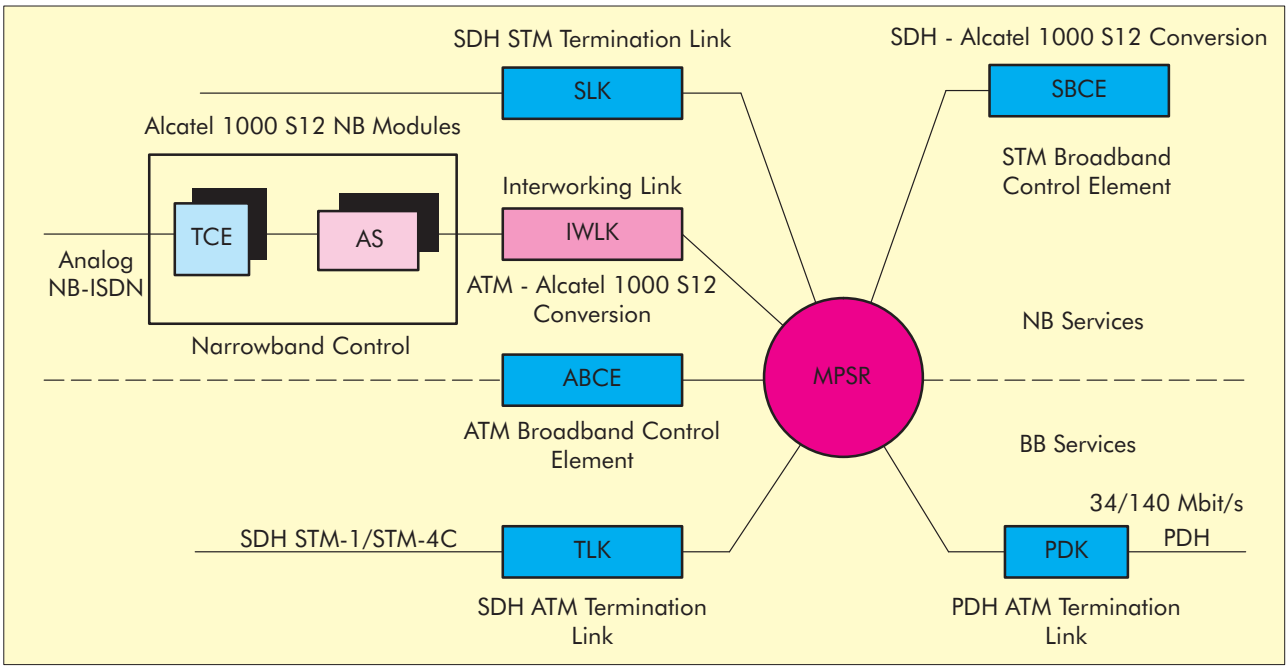
Specific interworking control elements provide for the interworking of the different interfaces and services :

- The STM Broadband Control Element provides for the interworking between SDH VC12 and (n x) 64 kbit/s narrowband channels.
- The ATM Broadband Control Element provides for the interworking between ATM connections and (n x) 64 kbit/s narrowband connections.

This system architecture evolves in the following steps :

1. Replacement of the DSN by the MPSR switch in a narrowband Alcatel 1000 S12 exchange.
2. Addition of SDH STM-1 terminations to the narrowband exchange.
3. Addition of ATM terminations to the narrowband exchange.
4. Full interworking between ATM and narrowband 64 kbit/s switched services.

Broadband Evolution of Alcatel 1000 S12



The Alcatel Intelligent Network

The Alcatel Intelligent Network Concept

The Intelligent Network is a concept in telecommunications in which intelligence supporting global network services is concentrated into centralized nodes of the network. Especially services requiring network-wide translation and validation find elegant solutions within the framework of intelligent networking.

The prime advantages obtained through the Alcatel Intelligent Network approach are :

- Easy and flexible implementation of new services in a uniform and global way, allowing subsequent modifications to meet changing user needs.
- Flexible service management.
- Enhanced subscriber control over certain service parameters in order to customize the service to the subscribers' needs.
- Allows previous generation exchanges to access new services, making it possible to offer these services throughout the network.

The main characteristics of the Alcatel Intelligent Network are :

- Large centralized databases containing global network information with rapid access.
- ITU-T and ISO compliant telecommunications protocols, i.e. : Common Channel Signalling No 7 (CCS7), ETSI Core INAP (CS1) and X.25 to interconnect the various network components.
- The provision of easy access to network operators and service providers in order to create or modify services in a timely manner and to offer customers access to their individual parameters.

A Standardized Architecture

The Intelligent Network (IN) concept is designed to meet the requirements of service operators / providers for handling advanced telecommunication network services. The architecture is based on a three level structure : the access point to the services (SSP), the intelligence of the services (SCP) and the technical and commercial management (SMP). The Service Creation Environment (SCE), although not used for commercial operation of the services, is also part of the Intelligent Network system.

- The SSP (Service Switching Point) enables users to access intelligent network services from anywhere in the public switched telephone network and is implemented in the Alcatel 1000 S12 through the addition of control elements and related software.
- The SCP (Service Control Point) performs real-time call processing and switch control functions for one or more services. Based on SSP queries, the SCP handles the execution of service programs logic relying on service databases. The SCP uses the Alcatel 8300 multiprocessor system.
- The SMP (Service Management Point) provides technical management for the SCP operation and maintenance (SCP supervision, remote software loading, remote maintenance and data backup).

The SMP also provides commercial management enabling subscribers to manage service related data.

The SMP is based on a general purpose machine running on OSF/1 UNIX. The SMP platform defines the management infrastructure and environment to support IN services. A common software platform, used by all IN services, is implemented here in order to prevent the same or similar functionality being developed for each new service.

Total Networking Flexibility

Alcatel's IN solution offers extensive flexibility to the network administration in engineering the introduction of new services. Alcatel's IN supports both overlay and embedded network structures. From its conception, Alcatel's IN has been designed for multi-system environments. The Alcatel 1000 S12 exchange can be equipped with the SSP software package.

Depending on the customer's choice these switches will be either dedicated or combined switches (e.g. SSP and toll functions).

In addition, Alcatel 1000 S12 can concentrate new services traffic originating from switches not equipped with the SSP function (in particular older electromechanical exchanges). SCP number and location are flexible. The SSP/SCP signalling link can either be dedicated or switched through the CCS7 network.

As a consequence, depending on the traffic, the SCPs can either be centralized or closely associated to the SSP (a choice often made in an overlay structure). The SCPs are designed to support multiservice operation. An SSP can address several SCPs if necessary.

The SMP may support several services, but the management of any one particular service is supported by one SMP only.

A typical IN introduction strategy is to install SSP functional software in all or some selected transit offices, with shared or associated SCPs, and to progressively extend SSP functions to all network digital switches accessing the relevant number of SCPs through the CCS7 network.

Full Security and Availability

Security and availability are key issues in designing the Intelligent Network and have been one of the major requirements imposed in the design of the Alcatel IN solution.

- Availability is the result of the redundant design of the Alcatel IN platform. Both SCP and SMP are built on duplicated fault tolerant machines. Provisions to ensure permanent service, even in case of catastrophic situations, have also been included.
- Network integrity is ensured by stringent controls at different points. The CCS7 network access is protected by the SCP. All customer terminal access is concentrated through the SMP, where a number of protection options are available, based on restriction rights, and including possible use of smart cards.

Service Creation Environment (SCE)

The Alcatel 1432 Service Creation Environment is a key element of Alcatel's IN product delivery. In the telecommunication environment the term SCE is used to cover two main functions : Service Customization and Service Development.

Service Customization

The Service Customization part can be regarded as a means to tailor a service specifically for a customer. In the IN architecture, the SMP will, among other activities, handle Service Customization. This function, supported by a graphical user interface based on icons, will allow the operators (i.e. the service provider and the service customer), in the context of the service, to specify methods (e.g. translation logic) and to configure the service on-line.

Typically, this facility can be made available to large customers who require a high level of service visibility and control. Service customization is available on a per service basis.

Service Development

The Service Development part can be viewed as a real modern software factory. Besides the creation of the service intelligence (service logic) the SCE also creates automatically the necessary management tools for both operator and service subscriber, the configuration parameters of the computing platforms, service simulation and service documentation.

Service development allows the service designer to create and modify services based on a very rich palette of predefined building blocks.

The SCE is part of the Alcatel IN product offering to the customer, providing the latter with tools and building blocks for speedy and easy generation of new services.

Typical IN Services

Advanced Freephone

Allows for the call to be charged to the service subscriber. It also allows the service subscriber to change routine parameters of the call and to obtain real-time information on traffic.

Universal Access Number

A unique number is assigned to a particular service subscriber. Depending on date, time of day and geographical location of caller, the call will be routed to a specific location of the service subscriber.

Virtual Private Network (VPN)

A VPN is embedded in the public network, providing a service subscriber with its own customized private configuration.

Credit Card Call

Using any telephone, the caller may charge a call to a particular credit card account.

Wide Area Centrex

PBX type service offered by the public network to a group of geographically dispersed service subscribers.

Additional Charge (Kiosk service)

Subscribers may call particular service providers offering information services. Services are charged according to their nature.

Personal Number

All calls addressed to the personal number of the service subscriber are routed to the destination at which he last registered.

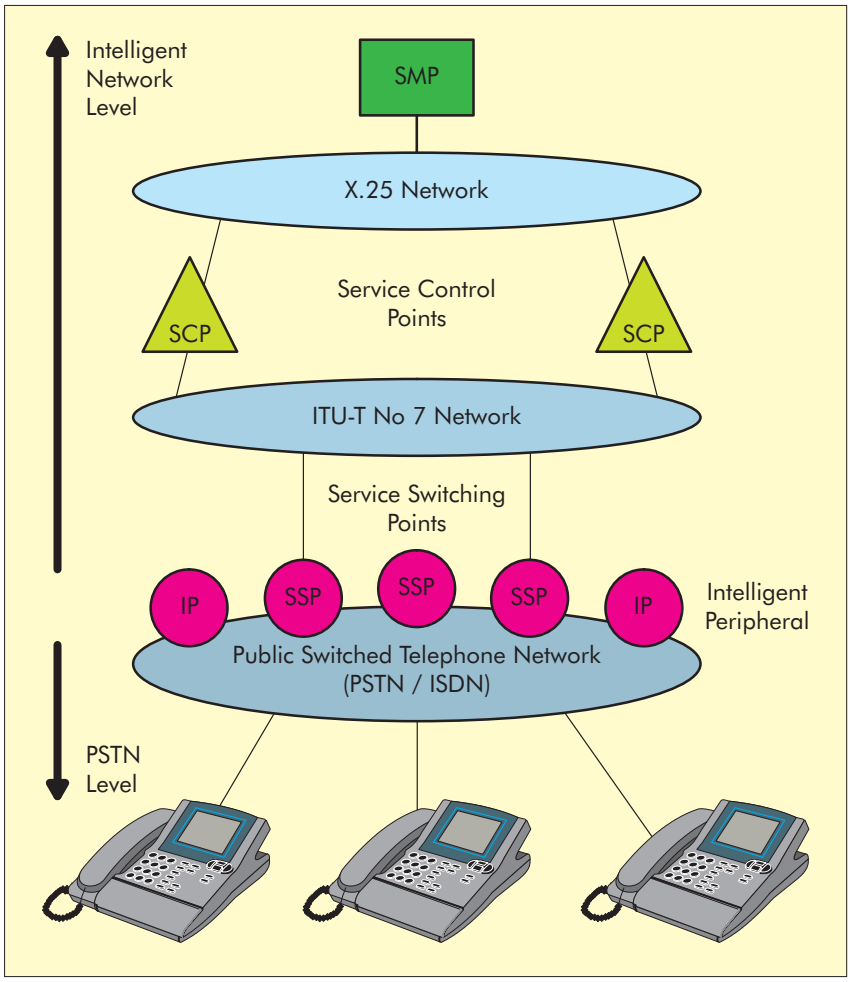
Televoting

Service mostly used in conjunction with broadcast events, in which people vote or express an opinion in a telephone interview.

Universal Personal Telecommunication (UPT)

UPT enables users to initiate and receive calls to/from any user (UPT or non-UPT) on the basis of a unique personal, network transparent UPT number across multiple networks at any terminal, fixed, movable or mobile, irrespective of geographic location, limited only by terminal and network capabilities and restrictions imposed by the network provider.

Intelligent Network Architecture



Digital Cellular Mobile Communications

GSM

One of the key elements in the mobile network is the Mobile Switching Center (MSC) with built-in Visitor Location Register (VLR). It forms an essential part of the Network Subsystem (NSS) which performs basic switching functions as well as mobility management.

The mobile Switching Center is implemented by means of Alcatel 1000 S12.

Mobile Network Architecture

Alcatel 900 is organized into two parts :

- The Base Station Subsystem (BSS) for the radio part of the network.
- The Network Subsystem (NSS), for switching of mobile radio calls and for interfacing between the Base Station Subsystem and the Public Switched Telephone Network (PSTN).

The connection between the BSS and NSS is made by a standard GSM “A” interface.

The Base Station Subsystem (BSS) basically comprises :

- A Base Transceiver Station (BTS), which is in charge of the radio links with the mobile subscribers.
- A Base Station Controller (BSC), which concentrates traffic channels providing links between different BTSs and the Network Subsystem and performs the radio resource management.

The Network Subsystem (NSS) is made up of :

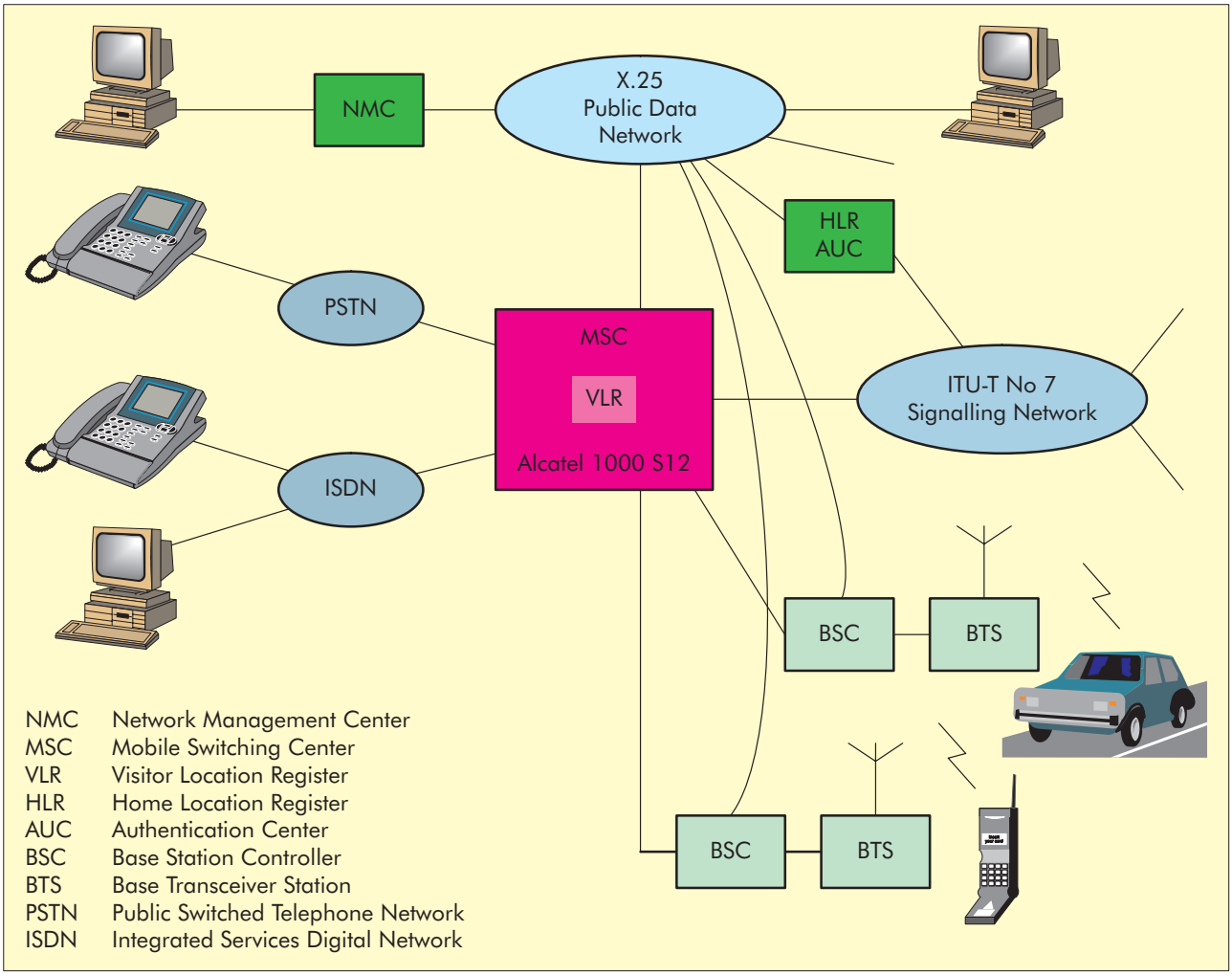
- The Mobile Switching Center (MSC) performs all the necessary functions to handle calls to and from mobile stations. It is the interface between the radio system and fixed networks.
- The Home Location Register (HLR) which stores data relating to mobile subscribers.
- The Visitor Location Register (VLR) which stores all the information relating to mobile subscribers who enter its coverage area, allowing the MSC to set up incoming and outgoing calls.
- In addition to its own network products Alcatel also offers a number of third party products, such as an Equipment Identification Register (EIR), for which it takes full system integration responsibility.

Alcatel 1000 S12 for Mobile Services

Alcatel 900 provides throughout the network :

- Mobile subscriber telephony,
- Mobile fax and data services,
- ISDN services,
- IN services
- All mobility functions (roaming, handover ...),
- Support for Voice Mail, Short Message Service, ...

Mobile Network Architecture



From Local Operation to the Telecommunications Management Network (TMN)

Integrated Network and Service Management

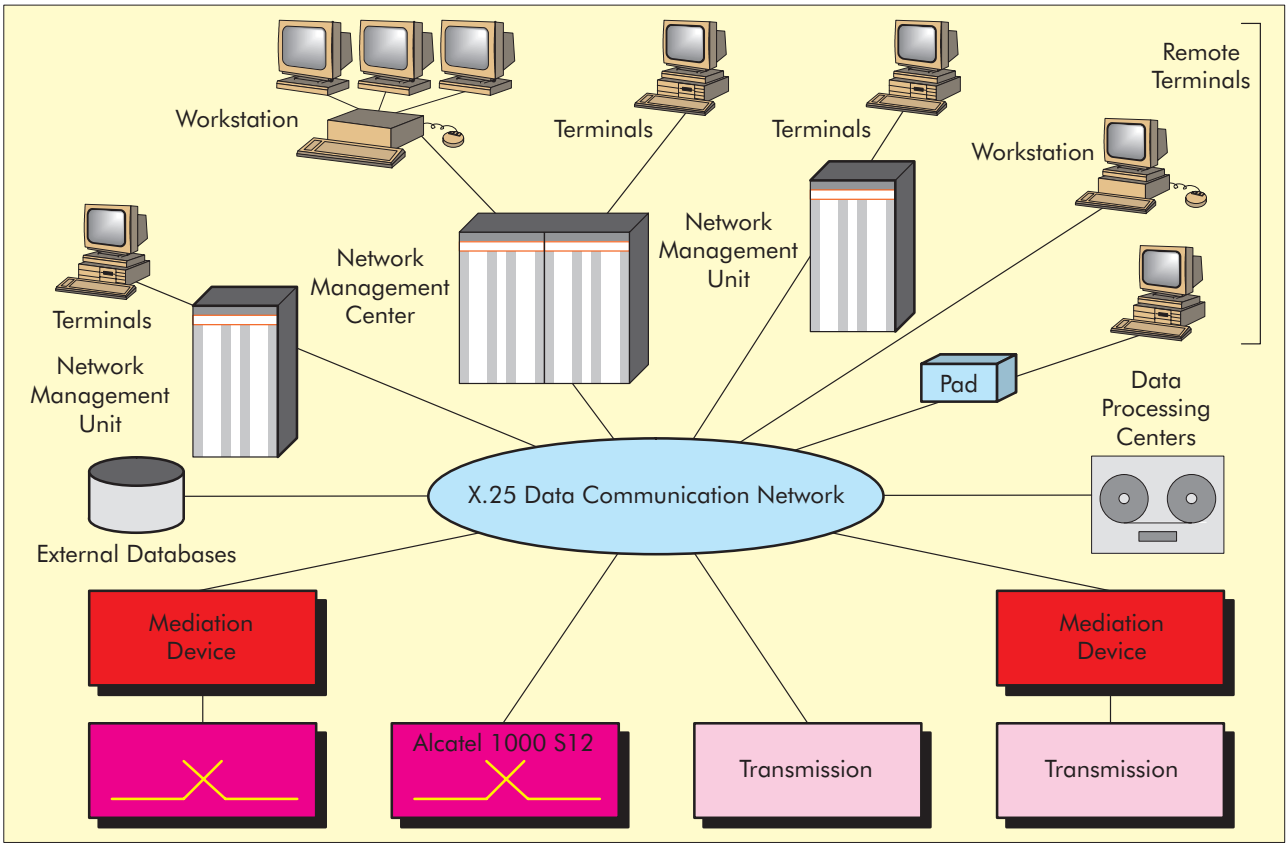
- Networking of equipment and applications.
- Access security.
- Databases of management information supplied by the network.
- Centralized equipment operation and maintenance.
- Advanced network and service management applications.
- TMN : Configuration, fault, performance and system management.

High Performance

- Real-time control and network supervision.
- High operating availability.
- High capacity through scalability.

Open System

- Compliance with TMN-related ITU-T Recommendations.
- Industry standard software components.
- Facility to incorporate equipment and applications from different manufacturers.
- Platform enabling the customer to develop his own management applications.



TMN Network Architecture

Flexibility

- Centralized and/or distributed organization.
- Easily redistributed applications and operator tasks.
- Continuity of management, even during TMN reorganizations.

Telecommunications Management Network

Operating companies are now faced with the burgeoning complexity of their networks in an increasingly competitive market. This trend requires new, powerful and competitive network management methods.

An Alcatel 1000 S12 switch comes with the features needed for efficient operation. They can be implemented per switch for local operation or integrated in a TMN, compliant with ITU-T recommendations.

The Alcatel 1000 S12 offers connection capability to network management servers via standardized Q.3 protocols and information models.

Advanced Network Management

Alcatel provides exchange operation and management functions of recognized and continuously improved quality. The experience gained with the NSC, the Network Service Center for the Alcatel 1000 S12 system and ATOM, the Advanced Terminal for Operations and Maintenance, played a major role in the definition of Alcatel TMN, which offers wider ranging and more powerful network management.

The introduction of TMN in a network is a long-term process which occurs in different steps. In addition, the architecture of the TMN system must be flexible in order to fulfil the specific demands of every Network Operator and to support heterogeneous multi-vendor networks. The Alcatel solution for TMN meets these requirements.

The Alcatel TMN systems are based on the general software platform ALMAP (Alcatel Management Platform). ALMAP is based primarily on commercial SW packages, complemented with a number of enhancements in the area of security management, System Management Functions (SMFs), database support, graphical map facilities, alarm surveillance, trouble ticketing, etc.

Due to the general services and generic building blocks offered by ALMAP, TMN applications become highly independent of the underlying system in terms of hardware, operating system, communication protocols, database services, etc.

This ensures that evolving standards in the field of interfaces and of management information can be integrated in all applications, thereby assuring usability in multi-vendor environments.

Typical applications provide functionality for centralized operations and maintenance, traffic and ITU-T No 7 common channel signalling management, subscriber administration, customer care and billing, and so on.

The main benefits for the network operator are :

- Sustained quality of service in unattended sites through sophisticated network supervision and control applications.
- Significantly reduced costs and much higher operating efficiency. The integration of management resources, the adaptability of Alcatel TMN and the comprehensive range of services offered provide genuine productivity gains.
- High availability of the TMN. Data and applications are backed up at network level so Alcatel TMN can be serviced without interrupting operations.

Total Quality ...

The Alcatel 1000 S12 development team has a strong commitment towards total quality. Consequently they are motivated to realize total quality in their products by continuously taking all measures to achieve and maintain the ISO 9001 quality system certificate. Commitment to quality is always realized at all levels in the organization in fulfilling their mission.

Quality by Organization

Development is done in highly experienced and skilled, international teams. An international project organization is set up ensuring that product requirements are understood and met. Local and Alcatel wide review boards are installed to guarantee the consistency of the system and the compliance with the customer requirements and future needs.

Quality Design

To ensure the quality of the product during its entire development cycle a complete and consistent set of instructions and quality standards is maintained. To minimize human errors the applied design methodology is supported by the latest generation tools on dedicated workstations.

Quality Release Strategy

Printed boards, racks and even complete assembled systems are subject to effective qualification programs including EMC, climatic, mechanical and other environmental tests.

Quality Manufacturing

Continuous upgrading of manufacturing machines, processes, and the qualification of operators assures that the Alcatel 1000 S12 is manufactured on time with optimum quality.

Quality by Feedback

Alcatel 1000 S12 reliability is measured in different countries. An Alcatel-wide working group is created to monitor the compliance of the perceived system performance with the design objectives and to analyze the data and systematically look for further improvements.

Alcatel 1000 S12 : Keeping Step with Time and Technology

Alcatel 1000 S12 : Synonymous with Robustness and Stability

Up to now the Alcatel 1000 S12 has already been selected in more than 40 countries all over the world to cover their telecommunication needs.

The system has been subjected to all climatic conditions and has been uninterruptedly doing its job at sea level as well as at high altitudes. Stability and robustness under the most extreme traffic situations have been proven repeatedly.

Alcatel 1000 S12 : Evolution Future-Safe

The modular architecture of Alcatel 1000 S12 allowed smooth introduction of new hardware technologies and features, with a full evolution of the existing exchanges in service, without affecting the installed hardware base. New hardware technologies and new software releases were implemented in many markets, upgrading the system to state-of-the-art technology and feature content.

Alcatel 1000 S12 : Broadband Capability

In all Alcatel 1000 S12 exchanges, broadband capability can be built in by adding broadband modules in the same fashion as other modules such as narrowband ISDN. All the architectural advantages of the present Alcatel 1000 S12 products will be continued when adding broadband services.

Keeping Step with Time and Technology

Alcatel 1000 S12 has had remarkable successes over the years. All development work is oriented to offer further features to cope with networks of year 2000 and beyond.

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