Telefónica
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# History of Alcatel's 1240 system in the REDT

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# 1. General

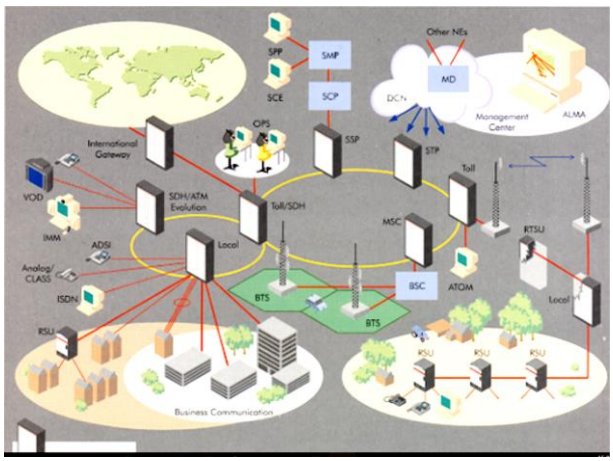
In the 1980s, the emergence of new technologies such as microprocessors and circuits with a high degree of integration (LSI) led to important changes such as the incorporation of processors in switchboards and digital transmission mechanisms, and also to the need to transport voice, data and images, which had an impact on the design of networks.

These technologies had a positive influence on the design of telephone networks, contributing to their evolution, being able to offer a new world of services to society, such as digitalization and the incorporation of ISDN, as well as a door to facilitate their growth, evolution and new advantages to users.

One of the pillars on which Telefónica relied for this objective was the deployment of System 12, not only in large cities but even in the most remote rural environments. Thus, this digitalization could be offered to all levels of the population.

The Alcatel 1000 S12 system, known as System 12 and initially as System 1240, is a digital switching system installed at the Telefónica plant from the 1980s to the early 1980s.

We can define it with its basic characteristics as a fully digital system with a distributed control architecture, which was a unique novelty in the market, using the same Hw equipment and software package for the full range of network applications. That is, the same equipment for any type of exchange or network function (Local, Transit, Mobile, International, Remote Units, Signaling Transfer Point, etc.). This architecture gives it great flexibility to grow in size and functions and great resistance to failures, and also does not require a large investment for a small node or for gradual growth.




Its capacities are up to 120,000 lines for local exchanges or 80,000 links and 35,000 erlangs.

System 12 does not distinguish the information it carries, everything is digitized with the same treatment, which allows the network to be treated as integrated voice, data or image.

This system made it very easy to grow in size and functionality in each installation. From the beginning, the Alcatel 1000 S12 system used the most advanced state-of-the-art integration technology in rack manufacturing, cable distribution, multilayer board manufacturing and LSI, CLSI, hybrid, microprocessor components, etc.

This system played a very important role in the deployment of Telefónica's digital network, incorporating digital technology to millions of lines with a wide range of services and facilities to the plant and great flexibility to incorporate new network features and functions.

This digital system came to replace the electromechanical telephone systems that had been used until then throughout the Telefónica plant, so that all subscribers could enjoy great advantages such as

Much higher quality of service: Noise-free voice quality, control panel availability, minimization of failures...

Access to new facilities and services: subscriber facilities such as transfer, call waiting, conferencing, etc., ISDN services, data transport without distinguishing text, voice, data or image, number portability due to change of operator, access to 900, 901 and 902 Smart Network services and many others.

More sustainable telephone centers, with much lower plant occupancy, less consumption, more reliability due to the elimination of electromechanical components, longer useful life, less need for resources for maintenance, greater ease of operation, etc.

## 2. Origins and deployments

Originally, the system was developed by ITT, which owned the Spanish company Standard Electrica, in the late 1970s at the Shelton Technology Center in Shelton, Connecticut, USA. In this center, a group of engineers from Telefónica and another group from Standard Eléctrica collaborated in the development, laying the foundations for the design of hardware components and program architecture or software for their subsequent industrialization. This industrialization of the product was carried out in Europe in four development centers, one of them in Standard Eléctrica, later Alcatel, and the first plant facilities were put into service in the 80s, one of the first being the Salamanca Concejo plant, in the historic Alonso de Solís Palace building, with a capacity of 10,000 lines in 1984.

Since then, since the 1980s, it has been deployed by Alcatel worldwide, with 140 million lines in more than 100 countries with multiple network applications.

Since 1985 and at the beginning of the century, the Telefónica de España plant has installed some 7.5 million users and nearly 9 million equivalent Alcatel 1000 S12 lines, some 330 exchanges and 7000 remote units, some of them in multisegregation.

Likewise, Alcatel Standard Eléctrica exported the system to numerous countries, some to Telefónica itself, such as Argentina and Peru, and also to Brazil, Poland, Uruguay, Guatemala, El Salvador, Bolivia, and in large volume to China.

This equipment was always entirely manufactured in Spain in the Villaverde and Toledo plants, in addition to the production of software with the data programming of each plant.

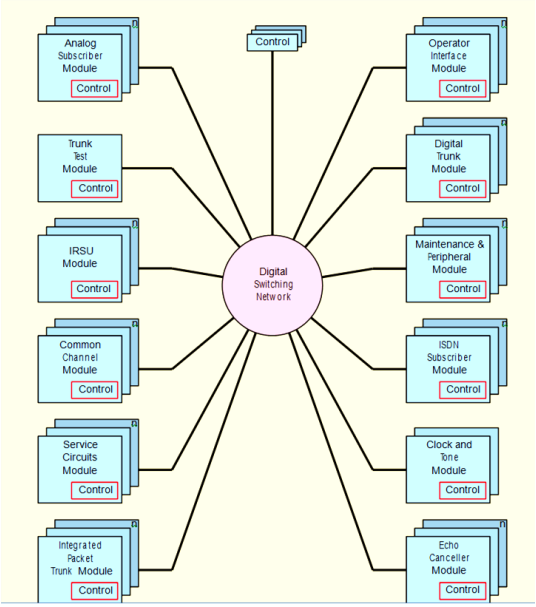
In the Telefónica plant, the applications of Local Exchange, Tandem, Transit, Small Capacity Autonomous Central and Remote Units were mainly used and important functionalities such as ISDN, Intelligent Network Access (SSP), Signalling Transfer Point (STP) were integrated... and other functionalities throughout its life.

# 3. Architecture

System 12 control panels are characterized by two essential properties: digital technology and distributed control.

A control panel consists of a digital switching network to which the terminal modules are connected in the form of a large spider, these modules can have different functions or their number can be sized according to traffic needs, there is no centralized control.

The switching network is a non-blocking self-routing system organized into multi-stage and multi-plane, scalable according to needs, and consists of a set of identical basic elements (CLSI). Each element provides the logic and memory for the control of the network, which is controlled by the Hw equipment so there is no network control processor.




Connected to the network are the Terminal Control Elements (TCE) that provide the programs and memory for the different types of terminals required in each installation, for example lines, basic accesses, primary accesses, links, receivers/transmitters, CCITT No. 7, etc. Its number is sized according to the needs of terminals or traffic and communicates with the Network through a standardized interface. There are also other Auxiliary Control Elements (ACEs) that add additional processing capacity for auxiliary control functions such as routing, numbering, pricing, etc. Scalable in number according to process or traffic needs.

The functions and data of the Auxiliary Control Elements are replicated, they are equipped in load sharing and there is also a set of additional control elements that in the event of failure, one of them is recharged with the appropriate program and replaces the control element in failure.

The network transports everything as data, not just voice, text, or switched images. It also provides the entire intercom system - message packets, control commands - between all the control elements of the control unit, between the various processors. The switching network allows interconnection of nX64 channels of 64kb/s.

The software functions are also distributed in the control unit on the various processors with a modular structure.

The various software subsystems of the Alcatel 1000 S12 are divided into functional software modules that are completely independent of each other, with well-defined interfaces that communicate with each other by means of a standardized data structure called messages.

All these Sw modules are distributed in the Control Elements according to the part of the programs that are needed for each operation.

For telephony there are six basic subsystems of programs, Operating System, Database, Call Handling, Telephone Support, Maintenance and Operation. Basic support software such as Operating System, Database and others are spread across all processors.

This modular layout offers important advantages such as:

- Makes a total downtime of an Alcatel 1000 S12 hub virtually impossible.
- Reduction of functions for each processor increasing reliability.
- Ease and safety for extensions.
- Reduces load on each processor, protecting the system from overload situations.

In summary, the design of the architecture allows the system to have a high reliability and high degree of immunity to total failure of the equipment and a great facility to incorporate new services and technologies.

# 4. Adaptation of the system to Telefónica's network

Alcatel developed a generic product in its European development centers, including Alcatel Engineering Spain, for all markets that was evolving with the incorporation of new functionalities offering new versions of both equipment and software packages.

These products were adapted to the characteristics of Telefónica's network through significant local engineering support.

Thus, adaptations and incorporation of new modules, mainly SW and some Hw variants, were necessary for some functions specific to the market and specified by Telefónica, such as:

- Signalling (interconnection to the Spanish grid, connection to Smart Grids, etc.)
- Routing and numbering (adaptation to the liberalization environment, portability, etc.)
- Pricing, (Data Collection, Detailing, Emptying, etc.)
- Subscriber facilities (analogue and PABX's, ISDN, CLASS)
- Operation and Maintenance Facilities (Completion Tests, Connection to External Measurement Equipment, Statistics, Reports, Traffic Measurements, etc.)

With great local support from Alcatel Spain, the Software packages and some Firmware and Hardware adaptation to the needs of the network were developed, in which the Technology department also collaborated in some developments, mainly in the area of Operation and Maintenance.

The delivery and acceptance of the new packages was done according to the protocol required by Telefónica. This included a delivery for acceptance in Telefónica's models and a final acceptance in a first exchange application (FOA), followed by the deployment of volume in the plant.

Subsequently, the collaboration of the Alcatel After-Sales team with Telefónica's Operation and Maintenance Center has continued with the monitoring of the behavior in the plant, resolution of incidents and any required support, as well as detection of any new requirement.

# 5. Equipment and evolution

According to its architecture and the high level of state-of-the-art integration in its deployment, a facility can be equipped with less than 30 different types of boards and 4 types of racks for a typical power plant, and a small capacity autonomous power plant can be mounted on a single rack. There are 16 line circuits per board, 1536 lines per rack and a 10,000-line exchange from 9 racks and a typical 25,000-line exchange from 20 racks.

The system evolved in Hw increasing the degree of integration with technological advances, which meant a reduction of equipment to only a third of the first version, maintaining the compatibility of the Program Package for all the equipment, existing and new, and for all types of applications in the plant.

From a functional point of view, the architecture of the Alcatel 1000 S12 allowed over the years a gradual evolution of the Telefónica network the incorporation of new software packages, accompanied by new equipment such as ISDN, handling circuit and packet switching, V5.x access for remote nodes, TCP/IP connectivity, wide range of supplementary services for analog and ISDN users, Legal interception, portability, access to Smart Grids, STP function, quality measures according to ITU-T standards, continuous improvements in Operation and Maintenance, etc.

Finally, the equipment was prepared for the planned evolution to the Next Generation Networks (NGN) with a new version of the switching network using a Broadband network and new STM-1 interface modules for VC12 and ATM containers.

System 12 was also prepared for connection to voice over the Internet, VoIP, with the introduction of the Media Gateway connection interface.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