

# Ericsson's family of carrier-class technologies

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Ericsson is leading the way to a horizontally layered network that consists of a content and user applications layer, a communications control layer, and a connectivity layer. This network sets the stage for new service applications and for the introduction of a common transport technology.

Ericsson's way of developing systems and applications is thus undergoing a transformation: the company strategy involves a family of carrier-class technologies—AXE, TSP and CPP—on which to base telephony, server and access applications.

The authors describe the technologies and point out some applications and products based on them. They also emphasize a key feature of the strategy—the use of common system components and the same building practice for AXE, TSP and CPP.

## Introduction

The ever-growing demand for rapid introduction of novel services and the pursuit of the most effective transport technology have led the telecommunications industry to shift to a horizontally layered architecture.<sup>1</sup> An underlying trend—the convergence of telephony, data communication and media technologies—is further accelerating the development of new products and services for introduction into the network. In response to this trend, Ericsson—besides evolving AXE—has introduced two carrier-class technologies: TSP for servers, and CPP for gateways (Figure 1). Each of these meets the fundamental requirements for high availability and has been optimized for its role in the network.

In the layered network architecture, tele-

phony services are being aligned with what is called the server-gateway split (applications and control functionality are separated from connectivity and transport). In accordance with this architecture, services are introduced in the applications and control layers. A family of servers is being introduced in operator networks and will be subjected to the same requirements for carrier-class performance as all other network equipment. The servers occupy a central position in the network, storing and processing large amounts of data. The access-network products are based on a technology which

- meets stringent requirements for high performance; and
- is optimized for cost-effective ATM and IP data transport.

## A family of carrier-class technologies

AXE has distinguished itself as the most successful switching system in the market. AXE equipment installed all over the world provides a base for extending networks and evolving them into the new-generation network, which is capable of circuit switching and packet data transport.

The new generation of AXE is designed to function as a complete switching node and as a server. It accommodates all software functionality for existing network solutions and new layered-network solutions.

TSP is Ericsson's choice of carrier-class server technology for all new multimedia applications and control functionality. Designed for server solutions where high availability is required, TSP has been introduced in second-generation networks. Networks built with TSP technology enable operators to configure their nodes by packaging different kinds of functionality on the same mechanical structure. In this way, operators can reduce the amount of site equipment and simplify network operation.

CPP is a packet-switching technology for ATM and IP, introduced in the market as Ericsson's technology for third-generation radio access. Ericsson uses the CPP technology to optimize the access transport solutions in its base station, radio network control and media gateway equipment.

### Principal requirements

The principal requirements put on systems and applications based on carrier-class technology are

### BOX A, ABBREVIATIONS

AAA	Authentication, authorization and accounting	IP	Internet protocol
ASIC	Application-specific integrated circuit	MGCF	Media gateway control function
ATM	Asynchronous transfer mode	MGW	Media gateway
BSC	Base station controller	MP	Main processor
BTS	Base transceiver station	MSC	Mobile switching center
CDMA	Code-division multiple access	PDSN	Packet data service node
CPP	Cello packet platform	QoS	Quality of service
EM	Element management	RBS	Radio base station
GEM	Generic Ericsson magazine	RNC	Radio network controller
GGSN	Gateway GSN	SGSN	Serving GSN
GMSC	Gateway MSC	STM	Synchronous transport module
GPRS	General packet radio service	TDM	Time-division multiplex
GSM	Global system for mobile communication	TSP	Telecom server platform
GSN	GPRS support node	UMTS	Universal mobile telecommunications system
HLR	Home location register	WCDMA	Wideband CDMA

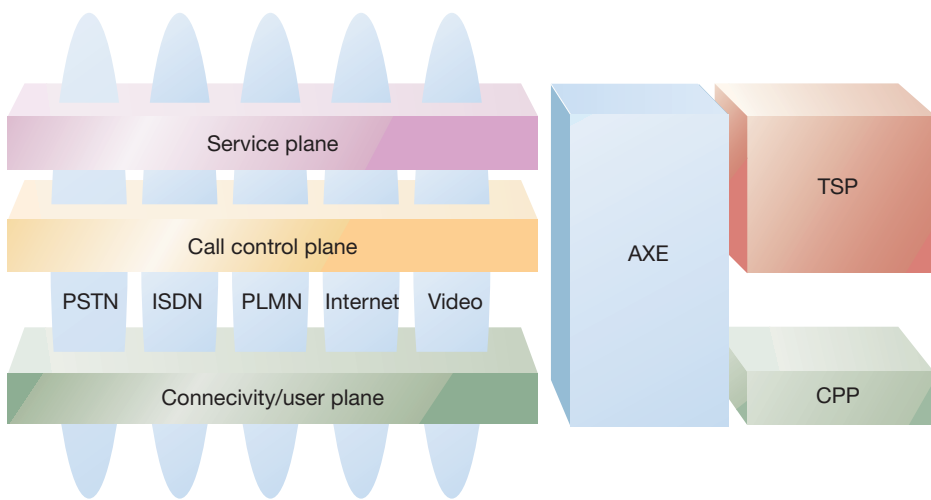


Figure 1  
Carrier class technologies in the layered network.

- high availability;
- real-time performance;
- scalable capacity; and
- openness.

## AXE

AXE 810 represents the present stage of AXE development with a dramatically reduced footprint (Figure 2). Its innovative design, which incorporates commercially available, standardized components, excels at voice traffic and packet switching.

AXE 810 is being deployed in GSM and UMTS core networks in which AXE switches continue to serve as

- mobile switching centers (MSC);
- base station controllers (BSC); and
- MSC servers connected to media gateways in layered network solutions.<sup>2</sup>

Likewise, in Ericsson's ENGINE solutions for multiservice networks, AXE is employed as a telephony server connected to a gateway AXD 301 ATM switch for packet data. To a large extent, the open architecture of the AXE system is achieved through the use of

- commercially available hardware components;
- standard hardware building practices and buses; and
- commercially available software components and interfaces.

Increased capacity and enhanced in-service performance have been the main focus of attention in the continuing development of the central processor. The newest version, APZ 212 40, is a milestone in hardware im-

### BOX B, CARRIER-CLASS TECHNOLOGY

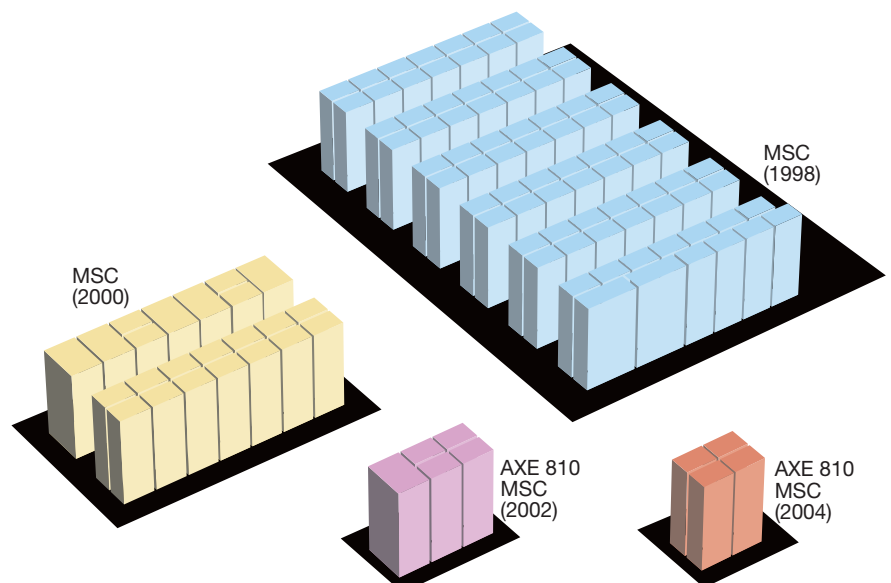
In Ericsson parlance, *telecom platform* denotes a specific technology and architecture.

A telecom platform, generic in nature and composed of hardware, an operating system, and applications on top, serves as a technological and architectural base for the development and evolution of systems and applications.

In the past few years, the term *platform* has

been used somewhat indiscriminately to denote a technology, an architecture, a system, or an application. The term as such is also considered to have too obvious connotations of mechanical engineering and "squareness." That is why, for the purposes of this article, the authors have opted for the synonymous term "carrier-class technology," hoping that it will gain general acceptance when used in its proper context.

Figure 2  
Volume reductions for a typical AXE MSC site.



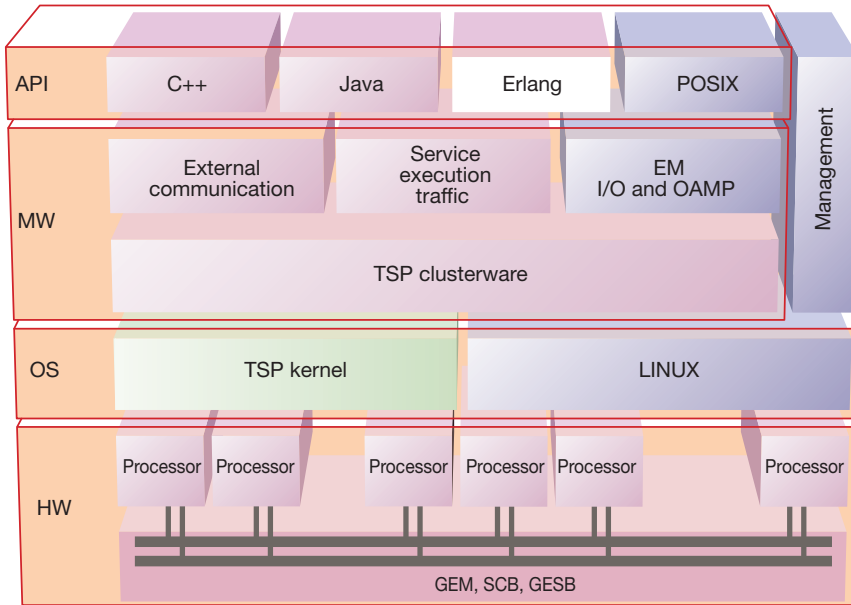


Figure 3  
The TSP architecture.

plementation—its processor core is based on industry-standard, high-end microprocessors. The implementation technique reduces time to market, in particular for future upgrades, since they can be based on mainstream microprocessor development. Even so, seen in terms of the application, the APZ 212 40 is fully backward compatible, which means that operator investments made in AXE applications software are secure.

The evolution of AXE enables it to grow for the foreseeable future while continuing to be the basis for all telephony applications.

## TSP

TSP is more robust and fault-tolerant than any comparable open server technology. It offers

- extremely high reliability;
- linearly scalable capacity; and
- real-time operation, which means that transmission takes place with minimal and controlled delay (Figure 3).

### TSP—a strategic choice

TSP is a strategic choice for server and control nodes that provide the availability and scalability needed by large systems in exist-

ing networks and in future IP multimedia networks. Examples include the home location register (HLR), the media gateway control function (MGCF), multimedia servers, and authentication, authorization and accounting (AAA) servers. Another example is the GPRS support node (GSN), which is based on a dedicated wireless packet-data technology being integrated into TSP.

These nodes, typically located in the center of a network, must provide superior in-service performance and must be allowed to grow in capacity. They include central databases that contain essential user data, traffic data and charging data.

TSP is particularly well-suited for building small and medium-sized systems from the same components and functional units. And being highly scalable, it enables operators to expand their networks at the desired rate. Key characteristics of TSP are extremely efficient internal signaling and a unique distribution algorithm.

TSP employs a component-based architecture that consists of several functional units within a framework of open interfaces. This allows the same software to be run on hardware from different suppliers. In principle, TSP uses commercially available components. Only the most essential components for adding value in terms of robustness and scalability are developed in-house. The TelORB software package with TSP clusterware and kernel facilitates these special characteristics.<sup>3</sup> It is capable of executing on different processor architectures and with different operating systems, which makes for easy adaptation to general technical developments.

### Linearly scalable capacity

TSP also contains basic functions that are common to several applications, such as a complete and standardized management interface and protocol for network signaling. A cluster of loosely coupled central processors in TSP supports scaling from very small systems to nodes with several dozen processors. This design makes for the creation of extremely powerful server nodes whose capacity can be increased linearly through the addition of new processors (Figure 4).

Development plans include the introduction of Linux in the TSP processor cluster. Together with TelORB, Linux components will guarantee TSP scalability and availability.

The cluster software design guarantees availability. All board components (power

and Ethernet ports, for example) are duplicated, and all software and data on each processor board are copied to another board using the TelORB distribution algorithm. In this way, entire nodes can be duplicated.

**Reliability**

The database used by TelORB is distributed among all the processors in the system. If one processor crashes, any other processor in the system can take over. The same mechanisms are also used for identifying and handling software faults. Thus, there is no risk of a software fault hanging the system: if a fault occurs, the system is automatically restarted in real time.

**CPP**

Ericsson's CPP carrier-class technology can be used for

- small base stations that contain few radio channels; and
- large control units that employ hundreds of processors and fill dozens of cabinets.<sup>4</sup>

CPP is based on a duplicated packet switch that supports the switching of TDM, ATM and IP traffic with selectable quality of service (QoS) levels. The switch handles user data and all control data in the node as well as to and from other nodes. CPP supports various types of network interface (including E1/J1/T1, STM-1 and Ethernet) for connecting user data, signaling information, and operation and maintenance channels.

The first CPP applications solely switch ATM traffic, but IP is being introduced in CPP to enable access-network products to switch ATM and IP traffic (Figure 5).

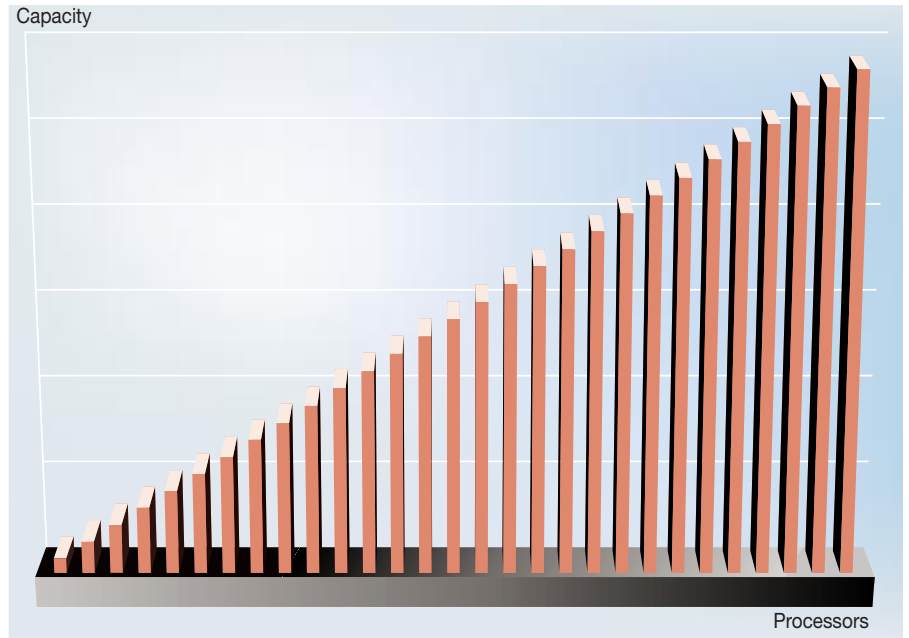
Physically, CPP employs several magazines with different types of circuit board including

- switch boards, which use a proprietary ATM switch-core circuit;
- processor boards;
- interface boards;
- transcoders;
- echo cancellers; and
- application boards for multi-stream functions, for example.

Each board is fitted with a device board module that includes communication circuits for the processors and memory. All inter-board communication is handled by the magazine backplane and switches.

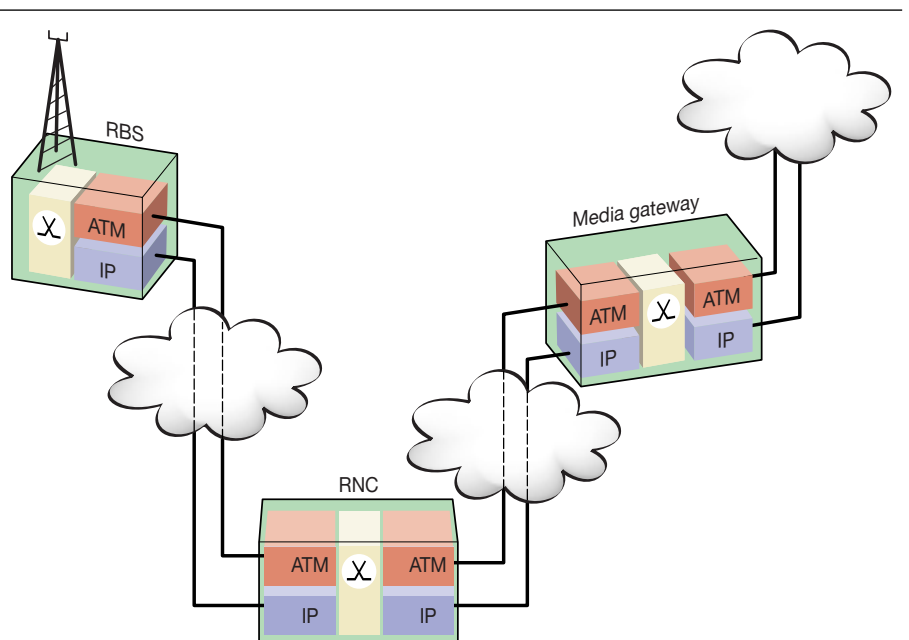
**Extremely scalable**

The traffic load on CPP is distributed among several processors, including main proces-



**Figure 4**  
Linear scalability of TSP.

**Figure 5**  
CPP network nodes.



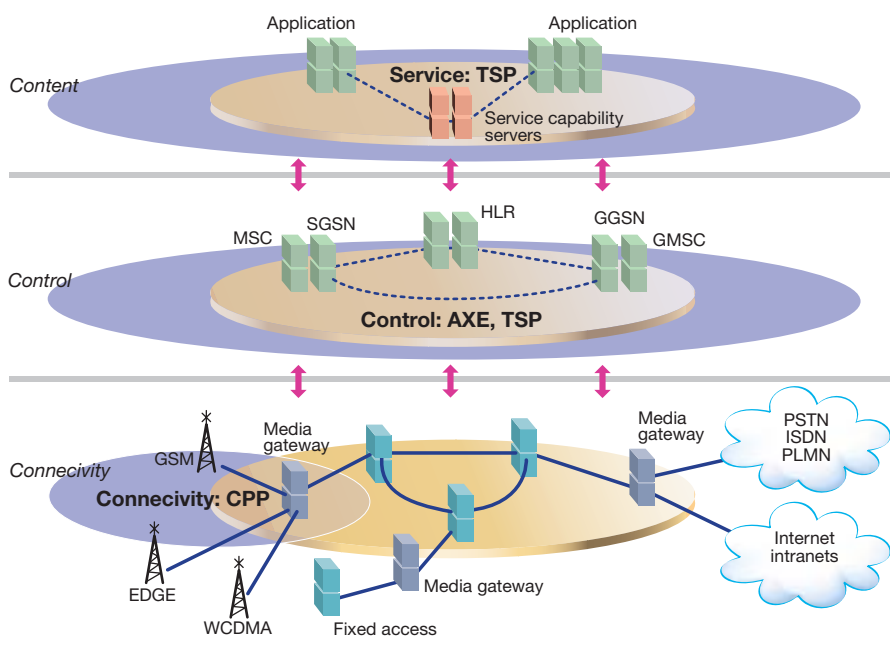


Figure 6  
The network solution.

sors (MP) and board processors (BP). Each node must contain at least one MP and one BP on each board. As is the case with TSP, robustness and fault-tolerance are achieved through processors working together in a cluster. The architecture of CPP has been designed to guarantee that essential functions survive hardware faults.

CPP is extremely scalable, both upward,

where 30 or more magazines can be combined, and downward, where the limit is one radio channel.

### Already in the market

CPP applications include radio base stations (RBS) and radio network controllers (RNC) for WCDMA and media gateway products; likewise, CDMA2000 will use CPP for its radio access and packet data service node (PDSN) solutions. CPP is also used for Ericsson's RXI real-time routers.

Like TSP, CPP is based on an open and dynamic operating system. Apart from its application-specific integrated circuits (ASIC) and switching components, which have been developed in-house, CPP uses commercially available processors and programming languages.

With the introduction of CPP, Ericsson can offer effective ATM and IP transport solutions for access networks.

### Common components

As described above, Ericsson has introduced two new carrier-class technologies, TSP and CPP, and is continuing to evolve AXE for future applications in the layered network architecture. Each technology is optimized to support different kinds of application or network node, since each type of node must be adapted to its specific requirements.

A far-reaching improvement is the generic Ericsson magazine (GEM), a high-capacity, flexible and scalable magazine in which several functions can be combined. This means that considerably fewer magazine and board types are needed in each node.

### TRADEMARKS

CDMA2000 is a trademark of the Telecommunications Industry Association (TIA).

By moving interfaces to the GEM backplane, designers were able to eliminate many cables, which resulted in an even more compact system.

The GEM concept can be used to build anything from an extremely small node to a very large one, using the same types of board and magazine. As capacity requirements grow, operators can add one or more GEMs with a suitable combination of devices, thereby smoothly extending the node without interruption of traffic.

The use of standard switch boards, such as Ethernet, makes the GEM an open magazine prepared for future developments.

By basing all the technologies on the same building practice, Ericsson can use common mechanical components and common control processors, Ethernet switches and interface boards. At a site installation, this gives operators the advantage of having one cooling system, one power supply system, and uniform alarm system handling.

The protocols and middleware for Ericsson's family of carrier-class technologies are also being based on the same software solutions.

Because all nodes must fulfill the same basic requirements for carrier-class performance, and meet customers' needs of reducing complexity and cost of network operation, AXE, TSP and CPP are based on

- the same building practice;
- the generic Ericsson magazine (GEM); and
- the same element management (EM) solutions.

All hardware and software are being aligned, which means that AXE, TSP and CPP can

be seen as configurations based on Ericsson's carrier-class technology portfolio and optimized for their specific purposes.

## Conclusion

Ericsson employs dedicated carrier-class technologies for different kinds of application in the layered architecture, where the fundamental requirement for high availability is the same for all network nodes but where specific requirements apply to each type of node. In implementing new products, the starting point has been to separate server and gateway functionality to enable the introduction of new services as well as packet-transport ATM and IP in parallel with traditional circuit-switched telephony services. AXE, TSP and CPP

- comply with carrier-class requirements in all network nodes;
- provide optimized site solutions through the packaging of different types of functionality on the same mechanical structure, which results in fewer nodes and simplified network operation;
- are uniquely scalable; and
- offer support for all transport technologies—TDM, ATM and IP—separate from the applications and control layers of the network.

Ericsson's carrier-class technology facilitates smooth migration all the way from the present-day circuit-switched network, where wideband packet-data services in the form of GPRS, WCDMA and ENGINE solutions are now being introduced, to the interactive multimedia network of the future.

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