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Next-Generation Networks for PSTN Transformation

Questions and Answers

October 2006



Q. What is the Next-Generation Networks for Public Switched Telephone Network Transformation solution?

A. The Next-Generation Networks for Public Switched Telephone Network (NGN for PSTN) Transformation solution is aimed at helping service providers migrate their time-division multiplexing (TDM) networks to voice over IP (VoIP), at both the transit level (Class 4) and the access level (Class 5). Moreover, a service provider can leave its PSTN as it is and use the VoIP technology only for network expansions, transparently integrating existing TDM assets.

Q. What do you mean by migration at the transit or at the access level?

A. In the first case (Class 4 solution), the transit layer is implemented with Italtel softswitches and Cisco® media gateways, while local exchanges are left unchanged; in the latter case (Class 5 solution), instead of using traditional TDM local exchanges, the Cisco and Italtel solution uses multiservice access nodes or V5.2 concentrators controlled by the Italtel softswitch.

Q. In more detail, how is the Cisco and Italtel Class 4 solution implemented?

A. The Class 4 solution consists of the creation of NGN transit POPs, spread over a geographical area, linked through an IP Multiprotocol Label Switching (MPLS) infrastructure allowing support for quality of service and security. With the Class 4 solution, the TDM transit layer is implemented with Cisco media gateways that are connected to the local exchanges and perform the TDM-to-IP conversion. ISDN User Part (ISUP) signaling messages are sent to the softswitch that controls the media gateways using Media Gateway Control Protocol (MGCP) or H.248 standard protocols. The traffic related to voice calls is transported over IP using Real Time Protocol (RTP) / Real Time Control Protocol (RTCP) and then again converted in TDM through the media gateway in the exit point of presence.

Q. How are ISUP signaling messages sent to the softswitch?

A. Many options are available.

SS7 signalling can be terminated on the Cisco MGWs and via M3UA SIGTRAN (Signaling Transport) protocol backhaul to the SoftSwitch. An other option could be use a Cisco Signalling Gateway ITP (IP Transfer Point) with M2PA/M3UA (MTP2 User Peer-to-peer Adaptation / MTP3 User Adaptation) SIGTRAN protocols. Alternatively SS7 links can be directly connected to the softswitch in TDM or else carried out by the backhaul of the SS7 signaling through a clear channel RTP connection. The choice among these options is dictated by customer requirements and network topology.

Q. Can you provide us some more details about the Class 5 migration/expansion?

A. The Class 5 solution consists of the creation of NGN access POPs, spread over a geographical area, linked through an IP Multiprotocol Label Switching (MPLS) infrastructure allowing support for quality of service and security. The user database and call handling functions are centralized in the Italtel softswitch. Different approaches are possible:

- If the operator does not need V5.2 interfaces, the best solution is the use of Italtel IP access gateways managed by the Italtel softswitch through H.248/IUA. The twisted pairs are directly connected to the new equipment but the call control and the session control are located on the Italtel softswitch for both POTS and ISDN users; because of this, the user signaling must be sent to the softswitch, by means of a specialized IP protocol such as M2PA/M3UA. In this solution third-party IP access gateways can also be used along with the Italtel access gateway.
- If the operator still has V5.2 concentrators or needs to connect primary rate interfaces in the peripheral POPs, for small access POPs (less than 2,000 DS0s), you can introduce the Italtel Multiservice Gateway, which can provide the TDM local exchange functionalities offering all the PSTN and ISDN interfaces. V5.2 or ISDN Primary Rate Interface (PRI) bearer and signaling channels are terminated in the Italtel Multiservice Gateway hosting a local media gateway functionality for circuit-to-packet conversion. In case of bigger POPs, the softswitch components, remotely located in the POPs, terminate the access signalling and Cisco MGWs perform the packetization at the boundary of the network, i.e. where the PSTN is connected.

Q. What if a service provider needs to connect a VoIP network?

A. This solution allows operators to provide the interconnection of H.323, MGCP, and Session Initiation Protocol (SIP) networks from other service providers; moreover, it can also provide the interworking between dedicated IP access networks and the public TDM telephony network. The “VoIP to PSTN gateway” functionality supports all the network services that are required by PPTs (post, telephone, and telegraph companies) and authorities at the point of interconnection, like lawful interception.

Q. Which are the main components of the NGN for PSTN Transformation solution?

A. First is the Italtel i-SSW Class Independent Softswitch. Cisco provides Cisco Media Gateways AS5XX0 and MGX (VISM-VXSM) Voice Gateways, and IP MPLS core equipment, such as Cisco CRS-1 and GSR, 7600, etc.

For the Class 5 solution, a relevant portion of the network is usually based on multiservice access nodes, such as the Italtel i-MSG Multiservice Gateway, or IP and traditional V5.2 access gateways. For IP access gateways, the solution includes both Italtel and third-party equipment.

Also, for both companies there are operations support system (OSS) and network management products for billing, service assurance, fault management, and performance management.

Q. Which are the main functions of the Italtel softswitch in this architecture?

A. The Italtel i-SSW is a class-independent softswitch. “Class independent” means that it is suitable for both Class 4 and Class 5 deployments. It performs the functions of call agent, signaling gateway, and media gateway controller. The main features provided are:

- Standard interfaces in order to gather the traffic originated by access and network interfaces

- Signaling relay through the IP network from TDM interfaces to centralized call handling functions, directly performing the relevant functions of a signaling gateway or in conjunction with Cisco MGW or ITP solution using SIGTRAN (M2PA or M3UA interface).
- Protocol handling through standard MGCP/H.248/IUA interfaces for controlling trunking and access gateways, thus acting as media gateway controller and offering all the relevant call handling, bearer control, and resource management functions
- Supplementary Telephony Services (STS) and operator services (for example, embedded functions for lawful interception, number portability, voice VPN, CS/CPS (Carrier Selection / Carrier Pre-Selection), and so on), as well as interfaces toward traditional intelligent network platform

The i-SSW is a carrier-grade system with an overall service availability greater than 99.999 percent and with no single point of failure. There are different mechanisms that allow the platform to achieve this, such as the full redundancy of the centralized components, the sharing of processing functions between the modules, the server cluster architecture, and the use of hardware load balancers in order to route incoming and outgoing signaling through the servers.

When fully equipped, a node made of a single softswitch supports up to 1 million total subscribers, up to 3 hundred thousand total trunks, and up to 1024 SS7 signaling links. Italtel softswitch flexibility and scalability allow for different solutions in terms of network capacity, ranging from small single-site installations with thousands of users up to complex systems with hundreds of thousands of users. This allows a smooth network evolution and increased optimization of an operator's investments. In addition, because of its high capacity, the i-SSW has an extremely compact layout, requiring reduced space and power supply.

The Italtel softswitch is suitable for all kinds of applications: it supports the coexistence of PSTN migration and expansion with VoIP innovative services for business and residential users.

Q. Which elements perform the media gateway function?

A. Cisco Media Gateways AS5XX0 and MGX (VISM-VXSM). These devices provide a scalable, carrier-grade, field-proven platform to offer a full suite of packet voice services, including toll-quality voice, fax, and modem. The Cisco media gateways deployed with the i-SSW enable a variety of packet voice services using MGCP or H.248.

In case of small POPs (less than 2000 DS0) with V5.2/PRI signaling termination requirements, the Italtel Multiservice Gateway (i-MSG) can be used to terminate the access signaling (V5.2 and PRI) and perform the media gateway function. For bigger POPs, using the distributed i-SSW architecture, the i-SSW components located in the POPs terminate the access signaling (V5.2 and PRI), and the Cisco media gateways perform the voice packetization.

Q. Why should a service provider choose this solution?

A. There are several good reasons, the most relevant ones are:

Operating expenditure (Opex) savings. The solution allows a reduction in the number of transit nodes, switching ports, and transmission requirements; moreover, it permits the replacement of obsolescent equipment with new generation IP and TDM solutions, which lead to lower site costs and easier network reengineering. The service provider realizes savings in power consumption, real estate, and operational and maintenance costs of the network.

For example, Telecom Italia experienced extremely significant operating expenditure savings, mainly coming from the reduction in switching equipment, ports, and transmission bandwidth.

Also, for a new operator, which needs to build a brand new network, having a centralized and simplified network management is an important competitive advantage, because it allows operating expenditure savings that can produce low prices and attractive services for end users.

The second reason takes into account capital expenditure (Capex) savings related to technology expansion or migration. There is no need to invest in TDM technology while new NGN nodes have a lower cost per trunk and per user and allow the service provider to share backbone resources between voice and data. The solution enables service providers to “pay as they grow,” in case of deployment of new POPs, with very low incremental costs compared to traditional TDM technology. And finally, the NGN for PSTN Transformation solution allows the service provider to be “new service ready.” This means the solution uses inside-out VoIP insertion. That is, VoIP first replaces the core of the network, and in a second phase it is pushed to the edge of the network to enable new end-user applications, such as business voice services and revenue-generating services for residential users.

Q. Which customers will get the most benefits from the NGN for PSTN Transformation?

A. Potential customers for this solution are all service providers that experience the need to control costs and cap investment in TDM technology, to compensate for a stalled growth of revenues coming from switched access, and to solve PSTN obsolescence problems. Moreover, this solution allows them to launch innovative services in order to attract new customers and/or retain existing ones.

In particular, a Class 4 solution is primarily aimed at:

- Service providers that intend to replace their existing transit network, reducing cost for leased lines
- Service providers that need to expand their network with a pay-as-you-grow approach
- New operators that need to build a multiservice network to transport CS/CPS traffic
- International and long distance carriers and carriers’ carriers for “minutes trading” among different countries

A Class 5 solution is suitable for:

- Restructuring of obsolete multivendor networks
- Avoiding investments in traditional TDM technology

This solution is also suitable for mobile operators that intend to migrate to a multiservice IP backbone for inter-MSC trunking, replacing (or expanding) their traditional TDM transit. The Italtel and Cisco solution for mobile operators (virtual transit network) has been available and deployed at customer sites since 2002.

Q. Which kind of experience can Cisco and Italtel use to help service providers in implementing this solution? Which lessons have they learned from past experiences?

A. Italtel and Cisco first deployed this solution more than five years ago and since then have successfully worked with many different customers worldwide. Cisco and Italtel have acquired a unique set of experiences, as well as valuable hands-on implementation skills, from:

- Learning how to fine-tune an IP MPLS backbone in order to optimize the transport of voice traffic, adopting all the mechanisms and techniques needed to achieve a truly converged network across all technologies over MPLS
- Understanding how to smoothly migrate an operator's network to (1) avoid service disruption during the migration, (2) do the job without requiring configuration changes to any of the interconnected networks, (3) minimize the configuration changes on traditional exchanges or softswitches and gatekeepers, and (4) minimize the need for new hardware or software upgrades on the traditional switching systems

In summary, Cisco and Italtel have learned that network design and reengineering activities actually never stop until the deployment is complete. For that reason, it is essential that suppliers develop new features and functions for existing products, allowing them to adapt to changing requirements.

The fundamental factor to success for a service provider's transition to NGN is working with solid companies: companies that share a vision as well as a common technical point of view. The Italtel and Cisco alliance is based on open standards-based architectures, and Italtel and Cisco have proven themselves to be excellent partners of choice for all service providers who want to start their journey to NGN.

Q. Which are the Cisco and Italtel main references for the NGN for PSTN Transformation solution?

A. Aside from Telecom Italia in Italy, Cisco and Italtel's main customers are Hansenet in Germany, TIF in France, du in UAE, and TPSA in Poland. There are some international deployments—that is, multicountry networks, such as the Pan European Backbone for Telecom Italia Sparkle.

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