White Paper

The Superclass Softswitch

What service providers require from day one to deploy VoIP in their core networks

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Introduction

The heart and soul of the next-generation network is the softswitch—the software-based switching center for Voice over IP (VoIP) networks. With a more flexible and efficient architecture, the softswitch enables service providers to expand their service delivery capabilities and open new revenue streams. But the benefits don't end with top line revenues. By providing the ability to lower operational costs, the softswitch also effectively addresses the services provider's bottom line. In short, the softswitch can assist in reshaping the economics and revenue potential of the public switched telephone network (PSTN).

As we get deeper into the transition from circuit to packet networks, the key roles of the softswitch are now clear. It carefully coordinates intercommunication among application servers, media gateways, and audio servers. It provides overall call management, enabling subscribers to complete calls and other communications. It allows service providers to deliver services more flexibly than ever before. And it does all this using open, standards-based protocols to interoperate seamlessly with 'best-in-class', next-generation network elements.

Although the softswitch is the lynchpin of the VoIP network, there are many different types on the market today. Softswitches come in various shapes and sizes, with many of them targeting niche applications such as PRI offload or toll arbitrage. The time has now come to draw the distinction between softswitches that can truly replace the core of the PSTN network and those that fit niche applications on the fringe.

Defining the superclass softswitch

This paper focuses on providing a clear definition of the attributes of the *superclass softswitch*—a softswitch with all the necessary features, capabilities, and support requirements for deployment in the core of a service provider's network. A superclass softswitch enables complete migration to VoIP.

Nortel Networks is a leader in deploying global packet solutions for local, long distance, and wireless carriers. Our vast customer experience in both circuit-switched and packet-based networks around the world gives us a unique ability to define and develop this new category of softswitch.

The four core attributes of the superclass softswitch that we will discuss in depth are:

- **Integrated architecture**—The superclass softswitch supports multiple core applications on a single platform including local, long distance, and tandem.
- **Services**—The superclass softswitch delivers feature transparency and provides a 'future-proof' platform for next-generation multimedia services.
- **Regulatory requirements**—The superclass softswitch complies with existing government regulations.
- **Carrier-grade attributes**—The superclass softswitch is intended to satisfy the service provider's most stringent robustness and operational requirements.

Nortel Networks has worked hand-in-hand with leading global voice and data service providers that are forging ahead in deploying Voice over IP today. The criteria we use to define the superclass softswitch derives from a set of rigorous requirements gathered over many years in working with these providers. These requirements are designed to:

- Enable service providers to transition their existing networks seamlessly to packet-based networks
- Drive incremental revenue opportunities
- Enable service providers to significantly reduce capital and operational expenses

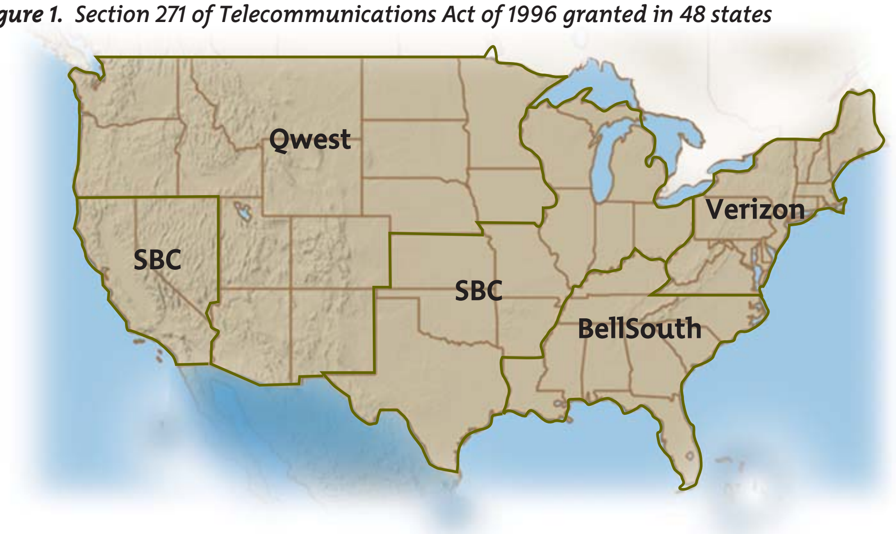
Integrated architecture

Many softswitches deployed today began by offering an economical way to deliver specialized applications, such as trunking for niche applications (PRI offload, for example), basic 1+ long distance for toll arbitrage, and calling card services.

A subset of softswitch vendors are beginning to offer Class 5 line applications and lifeline services on some softswitches.

Providing leading network and service flexibility, a superclass softswitch delivers the full vertical set of switching and service

Figure 1. Section 271 of Telecommunications Act of 1996 granted in 48 states



delivery applications in one package—including local, tandem, long distance, business Centrex, and residential line applications. With a superclass softswitch, service providers can now leverage their significant infrastructure investment (such as softswitches and media gateways) to address multiple segments—including local, tandem, long distance, wireless transit, and cable.

An excellent example of the business value of an integrated architecture is the opportunity that sections 271 and 272 of the Telecommunications Act of 1996 bring. (The Telecom Act of 1996 governs deregulation in the US.) On a state-by-state basis, Bell operating companies (BOCs) were allowed to apply for what is often referred to as 271 relief, allowing them to enter the in-region long distance market with some restrictions.

Section 272 spells out how a BOC's local and long distance lines of business must be structurally separate. This *arm's length* relationship between the different market segments is aimed at stifling anti-competitive practices by service providers such as cross-subsidization or favoring of their own long distance service. In essence, this section mandates two completely distinct entities, with separate accounting, officers, directors, employees, and operating infrastructure (such as switching equipment and networks).

Under the sunset provision of section 272, the separate affiliate requirement ceases to apply three years after a BOC has been authorized to provide in-region, inter-LATA telecommunications services under section 271(d). The FCC could also extend this period, but they have not yet done so.

Given that 48 states have already granted 271 approval to BOCs and one more is pending, BOCs nationwide may be in the local and long distance business in the very near term. Moreover, within three years, most—if not all—states are expected to operate without separate affiliate requirements. Verizon in New York is the first to reach this stage.

The significance of sections 271 and 272 is that many North American service providers may be providing local, tandem, and long distance services within any serving area they choose. This includes BOCs (previously restricted), CLECs, IXCs, and cable MSOs (not currently restricted). All of these service providers may benefit from leveraging a single switching infrastructure—powered by a superclass softswitch—to deliver services. By doing so, the service provider may gain significant operational and capital expense reductions derived from consolidated assets and simplified operations management.

Services

Another critical attribute of the superclass softswitch is the ability to provide full-featured service transparency. There are over 3,000 features in use today within the global PSTN. These features include:

- Centrex business customer services (200+ services)
- CLASS/Custom Calling residential services (300+)
- A long list of tandem, long distance, and operational features, including alarms, logs, performance metrics, security, billing, regulatory, operator and directory services, and international signaling variants

See Appendices A and B for sample lists.

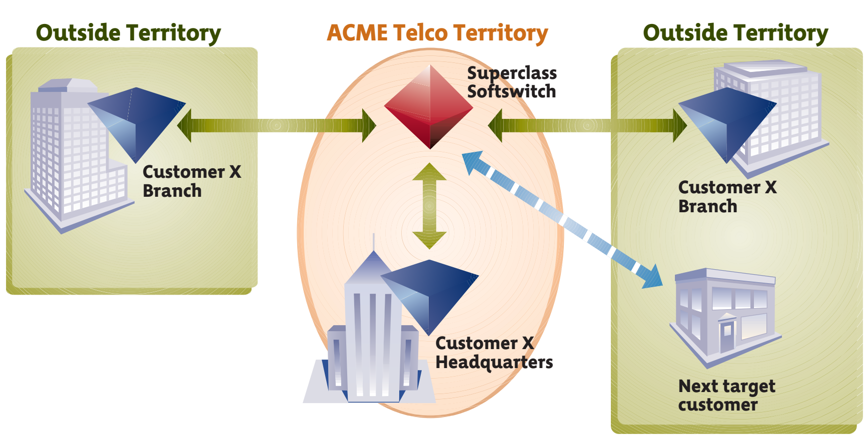
Some service providers simply do not want to alter their service offerings to their customer base. They have no wish to notify a customer that a set of features they have subscribed to and relied on for years is being eliminated or changed due to a technology "upgrade" in the network core.

There is good reason for this. The services revenue stream from subscribers is relatively constant and predictable—as long as service providers do not change the terms. Reducing or changing the service offering opens the door to negotiating the service at a lower price. Worse yet, the subscriber could solicit alternative offers, since a change is occurring anyway.

The feature transparency delivered by a superclass softswitch allows the service provider to migrate their customers seamlessly to a next-generation architecture *without the need to negotiate on the delivery of current services.* Instead, service providers can focus on up-selling new multimedia services as a value add-on to their current service bundles. This strategy may increase current revenues instead of putting existing revenue at risk.

Addressing the service provider's installed base with feature transparency is a huge advantage in transitioning the network. But now let's take a look at how it can affect market growth. How does the richly expanded service set help increase revenue opportunities?

Figure 2. Out-of-territory example—Voice over IP VPN



Clearly, one way to increase the size of the 'pie' in today's difficult market is to increase the service provider's addressable market. The superclass softswitch can assist service providers in doing this by combining a complete, centrally located feature set with the distributed network advantages of a VoIP architecture.

By deploying cost-effective media gateways for out-of-territory deployment, service providers have the opportunity to attract new customers in another provider's traditional territory. This can be especially effective when you have a campus customer with satellites in other regions that you do not currently serve. By leveraging your strong relationship with your customer's headquarters, the superclass softswitch enables you to gain access to branch offices nationwide under the control of a single softswitch.

An example service that addresses out-of-territory expansion is the Voice over IP (VoIP) Virtual Private Network (VPN) application. This service enables providers to offer a private dial plan for customers using any service access architecture—including Centrex, Centrex IP, PBX, and IP PBX. Support for H.323 enables integrated access of voice, video, and data as well as cost-effective out-of-territory reach to pick up branch offices.

Regulatory requirements

In today's telecom environment, the final hurdle to clear in migrating from circuit to packet is often softswitch support for regulatory requirements.

Governments around the world are concerned with functionality that addresses the needs of public safety as well as promoting fair competition. A superclass softswitch must support the broad set of services available in today's network to enable lawful intercept, number portability, emergency, and operator services.

Superclass softswitches benefit from having an architectural framework that makes it easier to deliver these services and adapt to the needs of new countries and territories requiring softswitches in their networks.

From a public safety perspective, a superclass softswitch must support three key areas:

- Law enforcement—including investigative and reporting
- Emergency call handling
- Service availability—lifeline service

Lawful intercept

In times when we are all acutely aware of the need for national security, lawful intercept—the ability of law enforcement agencies to monitor private communications—is key.

In the U.S., CALEA (the Communications Assistance for Law Enforcement Act) defines the standard for lawful intercept. Outside the U.S., the generic term lawful intercept is often used. Lawful intercept must be implemented in the superclass softswitch so that new countries can easily extend this capability to meet strict regulatory requirements and ensure undetected lawful monitoring by enforcement agencies.

Government Emergency Telecommunications Service (GETS)

Also related to national security, the Government Emergency Telecommunications Service (GETS) was implemented in the 1990s. GETS enables emergency officials to make maximum use of all available telephone resources in the event of congestion or outages caused by emergency, crisis, or war.

GETS provides access authorization, priority treatment, and enhanced routing for government agencies and officials using a calling card and a pin code mechanism. This is a common feature today in the PSTN, especially in highly populated areas and areas with large concentrations of government offices.

On September 11, 2001, there were more than 18,000 GETS calls worldwide, with a completion rate of 95 percent.[1] GETS was also used during the Nisqually Earthquake and Hurricane Opal. In such times of crisis, there is often no other way to get communications through for the National Security/Emergency Preparedness (NS/EP) community. As service providers migrate their network cores to packet, GETS support in a superclass softswitch will be more critical.

E911

Emergency services such as E911 support the public safety mandate by enabling location identification, reporting, and dispatch support. This capability has been proven over a period of years in the public network for traditional lines and standards are being developed for nomadic IP-based lines.

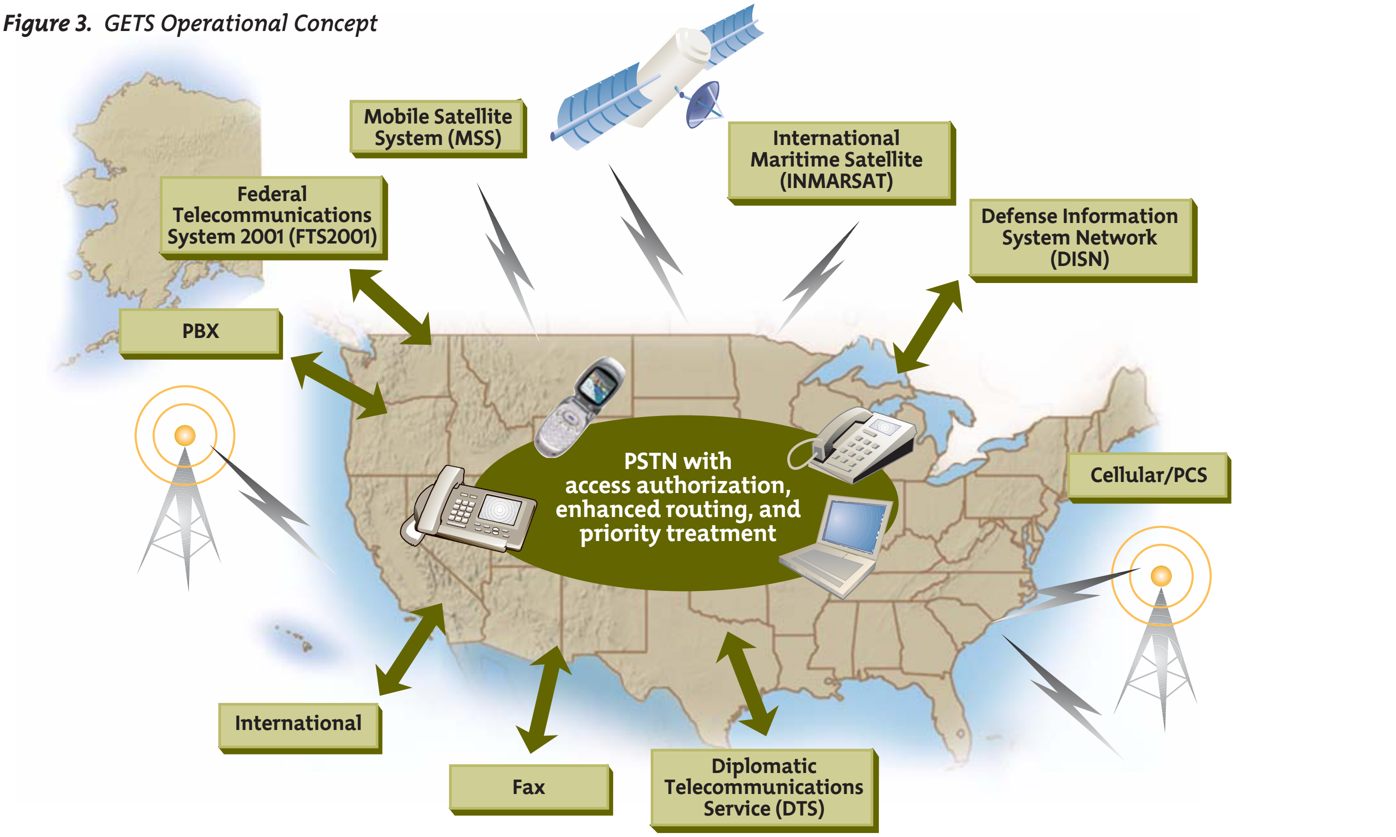
The challenge is to offer these same capabilities in the softswitch, so that service providers can avoid any impact to service. A commonly used example service is Anti-Disconnect (or Call Back), which prevents a caller from disconnecting an emergency service call. This service ensures that an accidental hang-up does not happen and that a dispatcher does not lose the critical information needed to send appropriate and timely support.

Operator services

Every U.S. LATA (Local Access and Transport Area) requires a tandem switch with operator services. A number of services are included under the banner of operator services, including directory assistance, call placement, busy line verification, and interruption. The operator service suite includes capabilities that span Class 4 and 5 switches.

[1] GETS FAQ on ncs.gov Web site.

Figure 3. GETS Operational Concept



Let's look at an example of a critical operator service. A subscriber may need to reach his or her child in an emergency, but the line is busy for over an hour. An operator at the Class 4 tandem verifies that the line on the Class 5 system is actually busy and not off-hook. The operator then interrupts the call in progress to get the message through.

This service requires seamless interoperability between multiple systems and potentially between different technologies—that is, the circuit-switched and packet-based network. The superclass softswitch must support these capabilities and interoperate with existing Class 4 and 5 systems—whether circuit- or packet-based.

Number portability

Regulatory issues are not restricted to public safety. Another area of focus is promoting fair competition in the marketplace. The Telecom Act of 1996 mandates that residential and business subscribers who are not changing their location must be allowed to retain their existing directory numbers when changing from one service provider to another. In addition to the U.S., this requirement also exists in many deregulated global telephone networks around the world. It will also be required in U.S. wireless networks in November 2003 barring a deadline extension.

The number portability feature set meets this requirement. A number of technical options exist to satisfy this requirement and a superclass softswitch should address several of them. This includes All Call Query (N-1 switch) in the U.S., as well as IN-based solution with off-board SCP and Signal Relay Function (SRF) for wireless in Europe.

Number portability causes some other problems in operating an efficient public network. These problems include allocating NPA-NXXs in blocks of 10,000, which is wasteful. Number pooling is an implementation option that reduces the size of blocks to 1,000, and thus conserves the numbering plan.

Features inspired by regulatory requirements are crucial for serving public safety and leveling the playing field for a competitive telecommunications market. Service providers who are serious about circuit-to-packet migration in the core of their network must consider the breadth of regulatory support in the softswitches they evaluate.

Carrier-grade attributes

Finally, a superclass softswitch must enable service providers to migrate easily from circuit-switched to packet-based technology with minimal or no impact. To do this, it must offer:

- Uptime and robustness
- Ease of network growth
- Seamless integration with third-party products

Robustness defined

The North American public network has a long legacy of leadership in performance and reliability. Our critical emergency, government, and financial services rely on a dependable communications network. And, the same is true of the telecommunications requirements for daily commerce and for keeping in touch with family and friends.

Five-nines (99.999 percent) availability has been the gold standard for measuring uptime requirements in the public network. This number is not simply a benchmark for designing equipment and networks. It is used to measure and report annually by the United States Federal Communications Commission (FCC).

The U.S. FCC Automated Reporting Management Information System (ARMIS) tracks operational, financial, service quality, and infrastructure information for most of the larger local exchange carriers (LECs) in the US. Specifically, the Service Quality Report (FCC ARMIS Report 43-05)[2] documents uptime and outage statistics.

Vendors with a history of deploying highly robust software and hardware (as documented in this report) are well positioned to deploy a superclass softswitch with similar robustness characteristics. The skills that a vendor gains from developing and testing carrier-grade software are equally applicable in both circuit-switched and packet-based environments.

The platinum standard for softswitches

A softswitch is not carrier-grade simply because it is deployed on a commercial server hardware platform with 99.999 percent availability. The standard requirement is five-nines availability *across the network*, end-to-end—not simply in softswitch hardware performance. The aggregation of all the hardware components must be considered when assessing availability of the network. This includes softswitches and media gateways, with associated software for each component.

A superclass softswitch must also incorporate the fault-tolerant software and redundant hardware that is required to transparently perform fault handling, thus assuring the highest degree of availability. As the central point of control within a VoIP network, the softswitch standard for robustness must be the very highest. A platinum, rather than gold, standard is preferred to enable five-nines availability for the end-to-end network.

Softswitch platform options

The architecture of the softswitch platform directly affects system availability. There are two primary hardware architectures employed—the commercial server and the blade-based chassis.

Commercial servers

Server-based systems typically use commercial, NEBS-compliant, carrier-grade server platforms. Server-based platform benefits include pre-testing for product integrity and the use of commercially available technology (which leverages service provider information technology experience). These are significant benefits for applications such as OAM&P management platforms.

However, for softswitches, there are some limitations to using commercial servers. Scalability often requires additional physical servers, which take up space and thus add to operational costs. In addition, servers are often deployed in a load-sharing arrangement where the engineered load requires all servers to be active. If a peak network condition occurs and a server becomes unavailable, the overall network capacity can be significantly reduced at a critical time.

Another issue is convenience. Adding an incremental component such as an SS7 signaling gateway requires a separate physical hardware platform that may or may not co-reside in the same frame as the servers.

Blade-based platforms

Blade-based platforms allow service providers to install off-the-shelf commercial processor blades within a common physical chassis. By merely adding a blade to the chassis, you can achieve scalability that will accommodate network growth and result in an overall reduction in footprint. By deploying the blades in pairs (using active and standby processors), the engineered network capacity is unaffected by outages with individual components within a mated set of processors.

From an operational cost savings perspective, specialized third-party hardware (such as SS7 signaling gateways) provides the ability to integrate seamlessly with little impact to footprint. To gain operational savings and flexibility, even the computing server market has moved toward integrated, blade-based applications for data centers.

Redundancy

Geographic redundancy is yet another key component of robustness in a superclass softswitch. This is especially true as the scale approaches hundreds of thousands of ports. The softswitch must continue functioning at full capacity when a single central office is isolated and rendered unavailable. In the event of a terrorist attack or natural disaster, the importance of individual, business, and government communications becomes more critical, since the chance of damage to the communications infrastructure increases.

A solution to this problem is to deploy fully redundant softswitch components in geographically dispersed locations for a single softswitch. When a superclass softswitch supports true, end-to-end,

[2] ARMIS database on fcc.gov Web site

five-nines availability in a geographically redundant architecture, the result is a high degree of robustness and network availability. This platinum level availability is necessary when the service provider intends to migrate the core of their network to packet.

Third-party interoperability

The foundation of next-generation VoIP networks is the ability to interoperate in best-in-class, multi-vendor networks. This is true whether the focus is on media gateways, application servers, or back office Operations Support Systems (OSSs). Service providers should be passionate about embracing open standards as they deploy a superclass softswitch.

Since there are numerous applications and products within VoIP networks, it is not surprising that there are a number of different protocols. However, to provide the broadest support for multi-vendor interoperability, a superclass softswitch must support the most common call signaling protocols. These include H.248, MGCP, PacketCable NCS, H.323, and SIP. H.248 and MGCP are common protocols for controlling both line and trunk gateways. PacketCable NCS is exclusively used in the cable segment for controlling line gateways.

Enterprise customers have used H.323 for quite a while for VoIP and for softswitch intercommunication with H.323-enabled IP-PBXs (an important capability). Session Initiation Protocol is another broadly supported VoIP-oriented protocol. It is used in a number of applications, including VoIP clients, application server interworking, and virtual trunking with enterprise IP-PBXs.

Note that supporting the protocols is only the first step towards multi-vendor interoperability. Many of the protocols continue to evolve, thus interoperability partner programs are crucial for establishing successful multi-vendor networks. A robust interoperability testing program offers service providers choice and flexibility in their deployments.

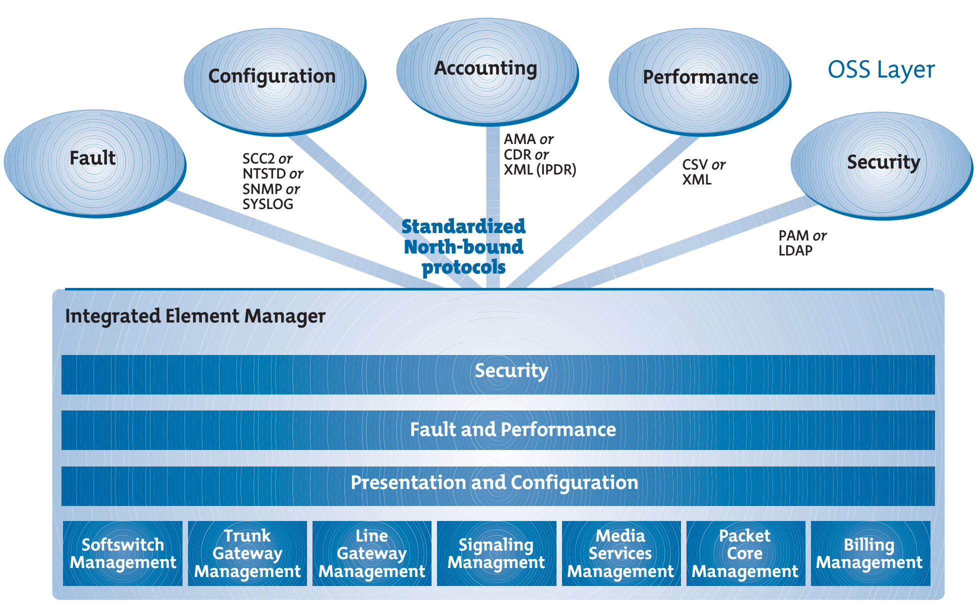
Softswitch interoperability with other elements of the VoIP network is critical, but so is interoperability with back-office OSSs for fault, configuration, accounting, performance, and security (FCAPS). A number of traditional interfaces exist—such as AMA, CDR, LDAP, PAM, SCC2, and NTSTD—as well as CSV-based data formats. If the superclass softswitch is designed from the ground up to support these protocols, the cost and complexity of integrating into back-office OSSs is reduced.

In addition, a number of next-generation protocols (including data-oriented protocols) are being used in greenfield (new network) back-office OSS implementations—including IPDR, XML, SNMP, and Syslog. An integrated element manager that centralizes viewing and northbound interfaces to back-office systems is the best way to manage the superclass softswitch in a VoIP network. This type of manager reduces the cost and time required to integrate into the back office by aggregating and standardizing the protocols in use.

Support for third-party interoperability, using open-standard protocols, enables service providers to deliver best-in-class, end-to-end solutions while:

- Reducing system integration costs
- Delivering a differentiated service set
- Providing seamless back-office interfaces

Figure 4. Consolidating user interface, OSS feeds, and platforms



Conclusion

We have defined the superclass softswitch as a softswitch with the rich capabilities required by service providers to evolve the heart of their core networks to Voice over IP.

As the telecommunications environment continues to change, service providers are trying to keep up by deploying packet networks with the new services and applications that IP and the Internet promise. The ideal lynchpin in this transition is the superclass softswitch, which incorporates both the stringent performance standards of the past and the flexible, innovative services of the future.

To provide a smooth transition without stranding existing customers, the superclass softswitch must:

- Deliver integrated local, long distance, and tandem applications, with legacy service capability
- Meet the regulatory requirements for critical lifeline services using carrier-grade standards
- Deliver feature transparency and next-generation multimedia services

The purpose of this white paper was to provide an overview of the generic requirements of a superclass softswitch. In closing, we would like to refer to the softswitch series from Nortel Networks—the Succession Communication Server 2000 and Succession Communication Server 2000 – Compact. Both of these softswitches were designed from their inception to incorporate the superclass capabilities described in this paper.

It is not surprising that the Succession Communication Server 2000 series was recognized in the first half of 2003 by Synergy Research as #1 in Worldwide Softswitch[3] market share. Nor is it surprising that the Succession Communication Server 2000 series has been deployed globally since 1999 in the world-class networks of many leading service providers. Our list of customers includes Bell Canada, Cable & Wireless, Charter Communications, China Netcom, China Telecom, China Railcom, Connex, Cox, GVT, Hong Kong Broadband Networks, ish, KabelBW, MCI, New World Tel, Optus, Sasktel, Sprint, Telstra, Telus, Tiscali, TeleCable, Verizon, and Vodafone.

Such global market acceptance and measured softswitch leadership demonstrates that the superclass softswitch attributes of the Succession Communication Server 2000 series are clearly valued as service providers make the transition from circuit to packet.

[3] Synergy Research, 1Q03 and 2Q03 Carrier Packet Voice Worldwide, May and August 2003.

Appendix A

Class 5 features supported

- 18-Button Add-On for Meridian M5000 Series
- 22-Key Add-On for Aries
- Access to Messaging
- Access to Messaging Deny
- Additional Call Offering Unrestricted
- Advanced Intelligent Network
- Advanced Intelligent Network DN
- AFC – Additional Functional Calls
- Agent Status Lamp
- AIN Message Waiting
- Alternate Service Provider
- Analog Display Services Interfaces
- Anonymous Caller Rejection
- Answer Agent Key
- Answer Emergency Key
- Automatic Answer Back
- Automatic Call Back
- Automatic Call Distribution
- Automatic Call Distribution Not Ready
- Automatic Dial
- Automatic Display
- Automatic Line
- Automatic Message Accounting Test Call Capability
- Automatic Recall
- Automatic Recall Dialable Directory Number
- Automatic Time and Charges
- Bearer Capability
- Bridged Night Number
- Bulk Calling Line Identification
- Busy Lamp Field for Meridian Business Sets
- Call Agent
- Call Busy Intragroup or Channel Bus Interface
- Call Forward Fraud Prevention Override
- Call Forward Indication
- Call Forward Timed for CFB
- Call Forward Timed for CFD
- Call Forwarding
- Call Forwarding Busy
- Call Forwarding Busy Internal Calls Only
- Call Forwarding Busy Line
- Call Forwarding Busy Unrestricted
- Call Forwarding Do Not Answer (Business Sets)
- Call Forwarding Do Not Answer (RES)
- Call Forwarding Do Not Answer for Hunt Group
- Call Forwarding Do Not Answer Unrestricted
- Call Forwarding Do Not Answer Variable Timer
- Call Forwarding Fixed
- Call Forwarding Group Do Not Answer
- Call Forwarding Intragroup
- Call Forwarding MADN Secondary Member
- Call Forwarding on a Per Key Basis
- Call Forwarding Remote Access
- Call Forwarding Simultaneous/Screening
- Call Forwarding Universal
- Call Forwarding Usage Sensitive Denial
- Call Hold
- Call Logging
- Call Management Group
- Call Park
- Call Pickup
- Call Redirect
- Call Screening, Monitoring, and Intercept
- Call Supervisor
- Call Transfer
- Call Transfer Warning
- Call Waiting
- Call Waiting Conference
- Call Waiting Exempt
- Call Waiting Intragroup
- Call Waiting Originating
- Call Waiting Ringback
- Calling Identity Delivery and Suppression Delivery
- Calling Identity Delivery and Suppression
- Calling Line Identification
- Calling Line Identification with Flash
- Calling Name Delivery
- Calling Name Delivery Blocking
- Calling Number Delivery
- Calling Number Delivery Blocking
- Calling Party Identification
- Cancel Call Waiting
- Carrier Toll Denied
- Circular Hunt
- Common Control Switching Arrangement
- Conference Join
- Control Multiple Call Forwarding
- Controlled Interflow
- Convert
- Customer Data Change
- Customer Originated Trace
- Customer Originated Trace with AMA
- Cutoff on Disconnect
- Denied Call Forwarding
- Denied Incoming Calls
- Denied Origination
- Denied Termination
- Deny Access to CLASS Features
- Deny Call Redirect
- Deny Call Waiting
- Deny Call Waiting Conference
- Deny CSMI

- Deny In-Session Activation
- Deny Suppressed Ringing Access
- Deny Three-Way Calling—Usage Sensitive
- Dial Call Waiting
- Dialable Directory Number
- Dialed Number Identification Delivery
- Digitone
- Directed Call Park
- Directed Call Pickup
- Directed Call Pickup Barge-In
- Directed Call Pickup Barge-In Exempt
- Directed Call Pickup Exempt
- Directory Number Hunt
- Display
- Display Agent Status
- Display Option for Aries
- Display Queue Status
- Display Queue Threshold
- Distinctive Ringing
- Distinctive Ringing/Call Waiting
- Distributed Line Hunt
- Do Not Disturb
- Downloadable softkeys for ADSL set
- EKTS Hold
- Emergency Key
- Essential Line
- Exclude External Calls from Call Forwarding
- Exclude Intragroup Calls from Call Forwarding
- Executive Busy Override
- Executive Busy Override Exempt
- Executive Message Waiting
- Extension Bridging
- Extension/Add-On
- Fast Transfer
- FAX-Thru Service
- Feature Group
- Feature Group A
- Feature Keys
- Flash Ignore
- Forced Agent Availability
- Free Number Terminating
- Full Carrier Toll Deny for International Carriers
- Ground Start
- Group Intercom
- Group Intercom All Calls
- Hotel/Motel
- In Call Service Deactivation
- Inhibit Line Busy
- Inhibit Ring Reminder
- In-Session Activation
- In-Session Activation Deactivation
- Inspect Key
- Intercom (Business Sets)
- Intercom (Single-Party Revertive Calling)
- Inter-LATA Full Carrier Toll Denied
- Internal/External Call Forwarding Busy
- Internal/External Call Forwarding Do Not Answer
- International Primary Carrier
- Intra-LATA Full Carrier Toll Denied
- Intra-LATA PIC
- Key Set Music on Hold
- Key Short Hunt
- Last Number Redial
- Last Number Redial Associated with Set
- Leave Message
- Line Music on Hold
- Line of Business
- Line Overflow to DN
- Line Overflow to Route
- Line Study
- Local Call Detail Recording
- Local Number Portability Test
- Local Service Provider Account Owner
- Local Service Provider Switch Owner
- Long Distance Signal Activate
- Long Distance Signal Option
- Long Distance Signal Ring
- Long Distance Signal Tone
- M536 36-Button Add-On for Meridian M5000 Series
- MADN (Multiple Appearance Directory Number)
- MADN Ring Forwarding Manual
- Make Set Busy
- Make Set Busy Intragroup
- Malicious Call Hold
- MDN Lamp
- MDN Member Display
- MDN Member Name
- MDN Release
- MDN Ring Forwarding
- Meridian Business Set Station Camp-On
- Message Deactivation
- Message Waiting
- Message Waiting Indication
- Message Waiting Query
- Multi-Line Hunt
- Multi-Party Bridging
- Name Display
- Night Service
- No Cancel Call Waiting Without Call Waiting
- No Deny
- No Receiver Off-Hook Tone
- Observe Agent
- Operator Number Identification
- Originating Line Select
- Overflow Register (Software)
- Override Call Forward on Account Codes
- Permanent Hold
- Pilot DN Billing
- Plug-Up (Trouble Intercept)
- PORT
- Power Features
- Preferential Hunting
- Prevent Delete Option
- Primary Inter-LATA Carrier
- Privacy Change Allowed CIDS
- Privacy for MADN
- Privacy Release
- Private Business Line
- PVN Priority Line
- Query Busy Station
- Query Time and Date
- Quick Conference Key
- Rate Area
- Reason Display
- Received Digits Billing
- Remote Message Indicator
- Repeated Alert
- Requested Suspension
- Residential Call Hold
- Restricted Sent Paid
- Ring Again
- SCWID with Disposition
- Secondary Directory Number
- Secondary Language
- Security
- Selective Call Acceptance
- Selective Call Forwarding
- Selective Call Rejection
- Series Completion
- Service Group
- Set Based Lamp Field
- Set Model
- Short Timed Release Disconnect
- Simplified Message Desk Interface
- Simultaneous Ringing
- Single-Line Queuing
- Single-Line Variety Package
- SMDI-SMDI Calling Number Delivery
- Special Billing
- Special Delivery Service
- Special Delivery Service Deny
- Speed Calling Long
- Speed Calling Long List L30
- Speed Calling Long List L50
- Speed Calling Short
- Speed Calling Short List

- Speed Calling User
- Spontaneous Call Waiting ID
- Station Controlled Conference
- Station Message Detail Recording
- Station Origination Restriction
- Station Origination Restrictions Controller
- Station Specific Authorization Codes
- Subscriber Activated Call Blocking
- Subscriber Line Usage
- Subscriber Programmable Ringing
- Supervisor
- Suppress Line Identification Information
- Suppressed Ringing Access
- Suspended Service
- Talking Call Waiting
- Terminating Billing Option
- Terminating DN Billing
- Terminating Fault Option
- Terminating Line Select
- Terminator Billing Option on Hunt Group
- Three-Way Calling
- Three-Way Calling Public Announcement
- Toll Denial
- Toll Essential
- Translations Plan
- Uniform Call Distribution
- Uniform Call Distribution Logged In Indication
- Uniform Call Distribution Login
- Voice Mail Easy Access Deny
- Voice Mail Easy Access Directory Number
- Wake-up Call Ring Timeout
- Wake-Up Call
- Warm Line
- Who's Calling

Class 4 features supported

- 900 Services
- Account Codes
- ANI Screening
- Audio Text
- Call Detail Recording
- Call Prompter
- Calling Card Services
- Debit Card Acceptance
- Dialable Wideband Service
- End-User Man-Machine Interface
- Follow-Me Services
- Fraud Control Features
- Global Virtual Private Networks
- Hotline Services
- Networked Automated Call Distribution
- Networked Centrex
- Operator Access
- Personal Identification Codes
- Speed Dialing Plans
- Telecommuting Services
- Toll-free Services
- Travel Card Services
- Voice Print Services
- Voice Recognition
- Voice Response
- Dialing Plan Features
  - 30 Digit
  - International
  - Voice VPNs
    - >Private Dial Plan
    - >Closed User Groups
    - >Off-net
    - >On-net
    - >Forced On-net
    - >Dedicated Access
    - >Registered Site Access
    - >Remote Access
  - Flexible Translations
  - Call Screening
  - Least Cost Routing
  - Time of Day Routing
  - Proportional Routing
  - Overflow Routing
- Tandem Features
  - 8xx via TCAP
  - LNP via TCAP
  - Multistage Dialing
  - Direct Access Line
  - 0+/0–
  - Feature Group D
  - E911
  - X11

Appendix B

Signaling variants supported

- ETSI ISUP v1
- ETSI ISUP v2
- ANSI ISUP
- ANSI UCP ISUP
- IBN7 (ANSI+)
- UK NUP (BTUP, UK TUP)
- UK ISUP (on ETSI v1)
- SSUTR2 (French TUP)
- SPIROU (French ISUP)
- Spanish ISUP (on ETSI v1)
- Aus Interconnect ISUP
- Aus Inter. ISUP (G.500)
- Aus ISUP (CA 30)
- German ISUP (on ETSI v2)
- Israeli ISUP (on ETSI v2)
- Portuguese ISUP (on ETSI v1)
- Brazilian ISUP (on ETSI v1)
- Czech ISUP (on ETSI v1)
- Mexican ISUP & Mexican (Telmex) ISUP
- Chinese ISUP
- Turkish ISUP
- Italian ISUP
- Spanish v2 ISUP
- Argentinean ISUP
- Malaysian (APC Version) ISUP
- NTNA PRI
- NI-2 PRI
- AT&T (U449/4ESS, N449/4ESS, U459/5ESS)
- ETSI PRI
- French PRI (VN4)
- Spanish PRI (Network side)
- VN4 (France) PRI
- VN6 (France) PRI
- Italian PRI
- Belgium PRI
- Netherlands PRI
- Swiss PRI

Glossary

ATM Asynchronous Transfer Mode

CableLabs CableLabs is funded by the largest cable operators (Multi-System Operators or MSOs) to develop hybrid fiber/coax (HFC)-based standards and to certify vendor products as meeting the standards to ensure vendor interoperability.

CAP Competitive Access Provider

CLEC Competitive Local Exchange Carrier

CS Communication server (also referred to as a softswitch, call server, or call management server (CMS)

FCAPS Fault, Configuration, Accounting, Performance, and Security for network management

H.248 Also referred to as Megaco, a joint ITU and IETF standard for media gateway call control.

H.323 H.323 was the first prevalent standard for carrying voice and video over the Internet. It is actually an umbrella standard encompassing audio coding (G.711, G.723, G.729) and video coding (H.261, H.263) over RTP/UDP, as well as call control (H.225, H.245) over IP. H.323 defines an architecture consisting of terminals, gateways, gatekeepers, and multipoint control units.

IXC Interexchange Carrier

ILEC Incumbent Local Exchange Carrier

IP Internet Protocol

ISDN Integrated Service Digital Network

LATA Local Access and Transport Area

MG Media Gateway—the bridge between an IP-based network and traditional trunk or line interfaces.

MGCP Media Gateway Control Protocol—a predecessor of H.248/Megaco that is commonly used for controlling line or trunk media gateways by a softswitch.

NCS Network-based Call Signaling—a line gateway (Multimedia Terminal Adapter or MTA) control protocol exclusive to cable VoIP telephony. Similar to the MGCP protocol.

OAM Operation, Administration, and Maintenance service

OAMP Operation, Administration, Maintenance, and Provisioning service

OSS Operations Support System

PacketCable The PacketCable architecture is aimed at defining interface specifications that can be used to develop interoperable equipment capable of providing packet-based voice, video, and other high-speed multimedia services over hybrid fiber/coax (HFC) cable systems.

PVC Permanent Virtual Circuit—the class of permanent connection types provisioned through operator commands in advance of connection being established (primarily ATM PVC).

Service provider A carrier that provides services. This includes ILECs, CLECs, IXCs, and other types of providers.

SIP Session Initiation Protocol—SIP has a couple of roles in the network. In the most typical sense, it has the role of setting up a session with an end user/SIP client. It is also the protocol of choice in setting up sessions between elements such as multimedia servers and other servers within the network. It delivers both network services and services at the edge.

SNMP Simple Network Management Protocol—the SNMP is a protocol for Internet network management services.

SPVC Soft PVC (see PVC)—a virtual connection in which permanent connections originate and terminate at the user interfaces, but are established via signaling within the network. Advantages of SPVCs include reduced operations effort in setting up hop-by-hop PVCs through network, taking advantage of dynamic routing, and the ability to re-route connections upon link or switch failures.

SVC Switched Virtual Circuit—the class of connection types created dynamically through network signaling and exist only for the duration of the data transfer. (Includes ATM SVC, SPVC, Frame Relay PVC, IP, and others.)

Succession Nortel Networks end-to-end portfolio of Voice over IP products and solutions.

TMN Telecommunications Management Network—developed by ITU as an infrastructure to support management and deployment of dynamic telecommunications services. It provides a framework for achieving interconnectivity and communication across heterogeneous operating systems and telecommunications networks.

UAS Universal Audio Server—provides announcements, conferencing, and lawful intercept service.

USP Universal Signaling Point—Nortel Networks SS7 signaling gateway and Signaling Transfer Point (STP).

VC Virtual Circuit

VP Virtual Path

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