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Independent Assessment of Nortel Networks Meridian 1 PBX Conversion to Succession 1000M IP PBX

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Independent Assessment of Nortel Networks Meridian 1 PBX Conversion to Succession 1000M IP PBX

Migration of the Meridian 1 PBX

For years, users of Nortel Networks Meridian 1 PBX have benefited from the flexibility, the reliability and the feature richness of their telephony circuit-switched network. This flexibility over the past five years has also afforded Meridian 1 PBX customers the ability to IP-enable their investment for specific voice over IP (VoIP) capabilities including IP trunks, lines and wireless applications.

Now, with the growing adoption of IP PBXs in corporations, Meridian 1 PBX owners may want to realize the cost-effective benefits of fully integrating their voice network and applications into a converged IP architecture.

Before an IT group begins to make any such transition plans, it is imperative that it evaluate multiple aspects of the move to IP PBX facilities.

Several IP Telephony solutions providers, particularly IP data switch-centric vendors who supply gear for IP-based backbone networks, may attempt to convince IT groups that the reliable Meridian 1 they've depended on for years is now incapable of making the transition to support IP-based PBX services without significant effort. A Meridian 1-based offering, they may contend, is encumbered with a legacy architecture that requires a complete forklift upgrade to a true IP PBX offering.

IT organizations in today's economy are driven largely by cost-of-ownership. While alternative IP PBX suppliers may suggest that customers scrap their investment in existing Meridian 1 systems, there would be an enormous hard and soft dollar cost to an organization in doing so. Sizable Meridian 1 PBX-based investments could exist in business critical applications, user training, configuration data and management.

Another approach may include a vendor offering a parallel implementation of its IP PBX solution to serve specific user requirements for IP services which often results in restricted feature and network transparency — ultimately limiting the functionality and impairing user's ability to communicate efficiently.

For Meridian 1 customers, the assumption that a completely new investment is required for an IP PBX implementation is not true as one of the basic tenets of Nortel Networks IP Telephony strategy is to provide investment

Migration Choice: Nortel Networks offers two upgrade choices for its Meridian 1 customers:

- Meridian 1 PBX's can be upgraded to Succession Release 3.0 software for enhanced TDM functionality with a seamless path to IP Telephony.
- Meridian 1 PBX's can be upgraded to Succession Release 3.0 software with new Signaling Server hardware that transforms the system into a pure IP PBX that also retains its ability to support analog and digital telephones and trunks.

protection – thereby providing an evolutionary 'evergreen' path from the circuit-switched Meridian 1 world to the world of the packet-switched IP PBX.

With an update to Succession 3.0 software and the addition of a Signaling Server for IP traffic and endpoint management, customers easily can migrate their current Meridian 1 system to become a Succession 1000M IP PBX. Succession 1000M is a model addition to the Succession 1000 IP PBX family, leveraging the architectural and interworking benefits of today's Meridian 1 systems.

Nortel Networks, in fact, makes a compelling case to transition a Meridian 1 to a Succession 1000M by reducing the element of risk for users to upgrade. Some of Nortel Networks basic tenets of the Succession 1000M upgrade include:

- The upgrade must be completed with minimal to no service interruption
- The convergence of the Meridian 1 PBX and the Succession 1000M IP PBX should result in attributes that leverage and represent the best of both technologies
- Investment protection must ensure users that the majority – if not all – of their existing hardware will be retained and not made obsolete by the upgrade
- Innovative features and the value they deliver should entice users to make the move
- Choice must be an option of paramount importance — users should be able to upgrade at their own pace, instead of being forced to unnecessarily replace equipment

Nortel Networks migration path options for the Meridian 1 PBX to the IP PBX world of the Succession 1000M demonstrates the company's commitment and understanding of its installed base investment required to transition to new IP-based functionality.

Migration Verification

In January 2004, Nortel Networks commissioned The Tolly Group, the IT industry's foremost independent evaluator of Enterprise-class IP Telephony equipment, to observe and to validate the migration of a Meridian 1 PBX to the Succession 1000M IP PBX.

This hands-on exercise, conducted at The Tolly Group's facilities in Boca Raton, Florida, provides Meridian 1 owners with a view into an actual migration from a Meridian 1 to a Succession 1000M. The goal was simple: Chronicle the effort required to transition the Meridian 1 to the Succession 1000M, plus identify the hardware and software components that are necessary to make the migration a success.

Software Familiarities:

Succession 3.0 software includes the familiar user interfaces, business telephony features and application interfaces available from the Meridian 1, along with new IP-based services such as IP peer networking, gatekeeper functionality, application gateway support (i.e. Visual Voicemail, Express Directory, etc.) multimedia applications, and increased support for IP-based open standards.

Scalability for Thousands:

Today's Succession 1000M system supports up to 10,000 IP users per system with the capability to connect over 1,000 systems under a common management platform.

Key Benefits of the Succession 1000M Upgrade:

- Succession 3.0 enables new applications that foster productivity improvements. Features like Virtual Office and Mobile Voice Client for IP Telephony allow users to log onto a personal telephony profile to access pertinent data anytime and anywhere.
- Succession 3.0 delivers greater resiliency to remote offices. Succession Branch Office (SBO) and Survivable Remote Gateway (SRG) ensure minimal-to-no-downtime and enhanced disaster recovery; Costs are reduced since remote office workers take advantage of distributed PSTN trunking.
- Succession 1000M extends Meridian 1 benefits to IP Telephony. Supporting and managing up to 10,000 IP clients on a single, robust server results in simplified management as opposed to managing multiple servers scattered across an enterprise. Support of call server hot-standby redundancy for Call Servers ensures real-time delivery of services. Support for IP peer networking among IP clients on Meridian 1, Succession 1000, Succession 1000M, Communication Server 2100 and Business Communication Manager (BCM) systems ensures compatibility and transparency with high-quality voice.
- Succession 3.0 software can be installed without service disruption. There is a common interface, common system element and common management and a unified interface between Meridian 1 and Succession 1000M which enables upgrade plans to proceed either all at once or in phased-in fashion. The common links between installed systems and Succession 1000M translates into investment protection, reliability, reduced training and convergence.

Big Picture Findings

Tolly Group personnel observed a smooth and orderly transition that required a fair degree of upfront planning to ensure IP network resources were properly identified for use with the Succession 1000M.

More importantly, the Meridian 1 upgrade progressed with only minor configuration hitches, and at no time was there ever a loss of call processing services — the migration occurred over a live network testbed with locally attached IP and digital telephones as well as telephones connected to a 'remote' office system.

While the Meridian 1 PBX to Succession 1000M IP PBX migration was an involved process that required discipline, careful upfront planning and a coordination of resources during the upgrade process, it by no means required a forklift of the original Meridian 1 internal components. In fact, with the exception of adding two Signaling Servers deployed in the network, the migration hinged upon software or firmware updates to the existing Meridian 1 PBX hardware.

It is important to note that the Succession 1000M upgrade requires adequate technical assistance. This effort is a joint collaboration between a Nortel Networks certified channel partner who handles the software conversion and the equipment installation, in tandem with the local network or telephony manager who provides assistance with the existing IP network planning and implementation.

In the sections that follow, The Tolly Group recounts the major milestones it chronicled during the Meridian 1-to-Succession 1000M transition.

Nortel Networks dispatched a team of two specialists to oversee the upgrade, which occurred during the span of two days during normal business hours. While Nortel Networks personnel say that such migrations often occur at off-hours, this upgrade was scheduled during a two-day span during normal business hours for practical purposes only.

View into the Succession 1000M Conversion

Meridian 1 Configuration

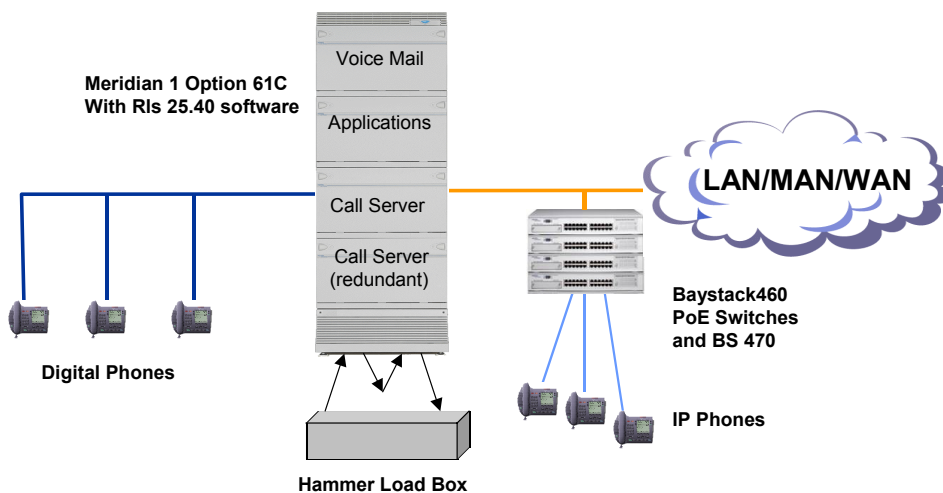
Nortel Networks deployed a typical Meridian 1 Option 61C in The Tolly Group's lab during January 2004. The unit was a single group Meridian 1 configured with dual Motorola 68060E CPUs (CP4s), redundant I/O, and Release 25.40 software that supports the core, networking and Intelligent Peripheral Equipment (IPE) facilities.

On the network side, the Meridian 1 supported two Conference/TDS (XCT) cards (NT8D17). The PBX was configured with four Superloop Controller cards (NT8D01) for IPE non-blocking shelf connections.

Figure 1. Meridian 1 Configuration Before IP PBX Conversion

Meridian 1 Configuration Before IP PBX Conversion Option 61C with Release 25.40 Software

- 128 Digital Lines
- 96 IP Lines (with 24 IP/TDM channels)
- NO IP Trunks
- 8 Spans PRI (Digital Trunks)



Four Dual Digital Trunk Interface/ Primary Rate Interface (DTI/PRI) cards (NT5D12) provided eight PRI Spans — two each NI-2 inbound and outbound to a network-based Hammer test tool.

Four Multi-purpose Serial Data Link (MSDL) cards (NT6D80) provided DCH (D-channel handler) services for the PRI spans, one Enhanced Network (ENET) card (QPC414) providing connectivity for the Meridian Mail unit, and one Enhanced Serial Data Interface (CSL/ESDI) card (QPC513) providing Application Module Link (AML) support for the Meridian Mail services.

In terms of IPE gear installed, the Meridian 1 Option 61C PBX contained six Digital Line (XDLC) cards (NT8D02) in slots 0-2 and 4-6 to digital telephone sets; one Recorded Announcement (RAN) card (NTVQ01)

in slot 3 provided integrated recorded announcement and music on hold services; one Universal Trunk card (NT8D14) resided in slot 7; one IP Telephony Gateway Pentium (ITG-P) card (NTVQ55) resided in slots 8 & 9 providing IP line services (up to 24 ports) on Release 25.40 (later converted to Succession Media Gateway services on Succession 3.0); two Succession Media (SMC) cards (NTVQ01) resided in slots 12 and 13 provided dynamic Media Gateway IP-to-PSTN call traversal services (up to 32 ports per card) on Succession 3.0; one CallPilot 201i card (NTRH30) resided in slots 10 and 11; and two Digitone Receiver (DTR) cards (NT8D16) in slots 14 and 15 provided DTMF tone and signaling-based services.

The pre-upgrade Meridian 1 PBX configuration supported up to 128 digital lines, up to 96 IP telephony lines (with 24 IP/DTM channels via the ITG-P card), eights PRI spans and no IP trunks.

The integrated Meridian Mail utilized one voice processor card (NT6P04), two Meridian Mail Processor 40 (MMP40) cards (NT6P97), one Utility (NT6P42)card, two hard drives and Meridian Mail 12.12.7 software running in a dual node, non-shadowed configuration.

Upgrade to an IP PBX

Tolly Group engineers set out to validate that a Meridian 1 upgrade to a Succession 3.0 IP PBX software architecture allows users to retain traditional telephony features, training and system hardware investments.

For this portion of the evaluation, Tolly Group personnel witnessed three operations:

- Succession 3.0 software upgrade of the Meridian 1 Option 61C system from Release 25.40
- Verification of retained investment (features/ applications, user interface training, hardware)
- Addition of Succession Signaling Server hardware

Succession 3.0 Software Upgrade

Succession 1000M Call Server Key Attributes:

- VxWorks Real-Time Operating System from WindRiver
- Redundant Call Server Processors; 256 MB DRAM
- CCS (Hundred Call Seconds) only limited by IP network characteristics: 320,000 Busy Hour Call completions (BHCCs)
- Up to 65,536 Virtual Terminal Numbers(TNs)
- Up to 10,000 IP telephones; 16,000 digital telephones; 16,000 analog telephones

One of the first steps Nortel Networks personnel took in beginning the transition from the Meridian 1 to the Succession 1000M was to split the call server processors, leaving one in service and parking the other in maintenance mode while loading the new Succession 3.0 software onto it.

While not terribly complex, the process to split the call server processors was time consuming, taking almost three hours to conduct the full pre-upgrade verifications including processor system checks, partition/validation of the existing drives and loading the Succession 3.0 software. As one call server processor remains in full service, the upgrading of the processor in maintenance mode can be done in the hours prior to the final switch to the new software load. In addition, should a problem be discovered during the upgrade verification process or if the upgrade needs to be postponed, the processor in maintenance mode can be converted back to the original software release and returned to full service as a hot standby. All steps are carefully chronicled in a thorough software upgrade manual that guides implementers with exact information, diagrams and photographs.

Well before any Succession 3.0 software was installed, the Nortel Networks personnel created a data dump image of the existing database info and verified that available memory was sufficient for the new code.

Two unique IP addresses are used by the Succession 1000M call server processors into the ELAN — a Ethernet Virtual Private LAN, Nortel Networks equivalent to a virtual LAN. One unique IP address is used for the active call processor and one is used for the inactive call processor.

Once the inactive call server processor was loaded with the Succession 3.0 software, it was brought online and the other call server processor was taken out of service. Call processing was transferred from the call server processor with Meridian 1 software to the upgraded call server processor running Succession 3.0 software. The same upgrade steps were then run to load the Succession 3.0 on the remaining call server processor.

With both processors loaded with the Succession 3.0 software, our Nortel Networks personnel synchronized memories of the call server processors and relegated one to primary mode and the other as a hot backup. Once complete, they then enabled system redundancy between the processors.

All during the call server processor upgrade, a command line interface was used from a terminal emulation session on a laptop, which was attached via a 9600 bps connection to the call server processor.

Note also, that during various intervals of the call server upgrade, Nortel Networks personnel demonstrated that the digital and IP telephones connected to the test network retained dial tone and were able to call one another without service interruption.

Verification of Retained Investment

With the Succession 3.0 software now running on the upgraded call processors, Nortel Networks personnel verified that existing applications continued to work with the upgraded software.

Verification of other services including: dial-tone, voicemail, call attendant and other applications worked unabated by the presence of the Succession 3.0 software. Additionally it was demonstrated that Meridian Mail, CallPilot and other applications responded to user commands without issue.

Adding the Signaling Server

Figure 2. Succession Signaling Server



When a Meridian 1 system is upgraded to run Succession 3.0 software and is configured with a Succession Signaling Server, it becomes a Succession 1000M IP PBX system.

The Succession Signaling Server is an industry-standard Intel-based server running VxWorks that provides a central processor to drive H.323 signaling, IP telephone signaling, and IP peer networking. It is required in all Succession 1000 and Succession 1000M systems.

Succession Signaling Server Key Attributes:

- H.323 Gatekeeper (up to: 2,000 endpoints; 10,000 number plan entries; 100,000 calls per hour)
- IP Peer H.323 Trunks (up to 382)
- Terminal Proxy Server (up to 5,000 IP users per server)
- Web-based Element Manager

The Succession Signaling Server performs the following functions:

- Acts as an H.323 Gatekeeper
- Runs the H.323 Signaling Gateway (for Virtual Trunks)
- Acts as a Terminal Proxy Server (TPS)
- Acts as a Web server for Element Manager

Like Succession Media Cards, the Succession Signaling Server has both an ELAN and a Telephony LAN (TLAN) Ethernet interface.

With the core processors now supporting Succession 3.0 software, the Nortel Networks personnel added the Succession Signaling Server to the system. For the purpose of our test, the Signaling Server was already connected to the Fast Ethernet-based network, so we did not consume extra time cabling the device.

For the purpose of resiliency, dual Signaling Servers were installed (typical for a dual call-processor system). This redundant configuration allows one of the Succession Signaling Servers to be designated as the "leader" while the second Succession Signaling Server is designated as the "follower."

The Gatekeeper (Primary, Alternate, or Failsafe) must reside on the leader Signaling Server (Node Master). In the event of a leader Signaling Server failure, the follower Signaling Server or Succession Media Card resources will assume the role of the Node Master. The Node Master is chosen by software elections and will be the healthiest of the Signaling Servers or media cards in order of rank.

As the Gatekeeper is a network-wide resource, Nortel Networks recommends that the Primary and Alternate Gatekeeper be installed on Signaling Servers at different sites. A third level of redundancy is available by installing Gatekeeper Failsafe on Signaling Servers in sites where there is no Primary or Alternate.

Once the Signaling Server was connected to the ELAN and to the available TLAN, the Nortel Networks personnel tied in a maintenance terminal to begin the stream of configuration tasks.

The Nortel Networks personnel began first by partitioning the server's hard drive and formatting it. A disk test was then completed to verify the disk worthiness before the Succession 3.0 software was installed onto the Signaling Server.

The Succession 3.0 software CD's Install Tool loads all Succession Signaling Server software, including the operating system, applications, and Web files. The Install Tool also copies software files for the Voice Gateway Media Cards (VGMCs) and IP telephones, which are used to upgrade these components. For a new Succession Signaling

Server, the Install Tool prompts for IP Telephony parameters to perform basic system configuration.

After installing the Signaling Server software and configuring basic information about the system, the on-site personnel continued to configure the Signaling Server by using the Web-based Element Manager interface.

A significant portion of the Signaling Server install is identifying and configuring network parameters: inserting the IP address of the Signaling Server, keying in cIP addresses for the virtual LAN and ELAN, gateway addresses and subnet masks. The installer also defined the TLAN network address, node IP address and call server IP address so the Signaling Server could communicate with the core IP PBX.

Following the network configuration, the Nortel Networks personnel set up a Signaling Server function that controls the database for all endpoints in the network. Here is where we witnessed detailed work setting up the Gatekeeper, H.323 virtual trunks, and a variety of IP lines. Afterwards they then upgraded the ITG cards to Succession Media Cards capable of supporting dynamic pooled resources. The benefit here is instead of having a line card dedicated to one type of service, ports on all available Succession Media Cards may be defined to support a variety of service on an as-needed basis. Therefore, the upgraded Succession Media cards provide digital signaling processing (DSP) for calls that cross the IP domain to the traditional TDM-based telephony circuits.

All told, from the start of the Signaling Server configuration to the completion of the gateway definition, just about an hour passed.

At this stage, the Signaling Server became an active node on the network and was able to be accessed via Nortel Networks Element Manager Web-based software. Here is where the defined parameters for the ELAN and imported node files from the Signaling Server to the Element Manager database are made.

There are quite a few install steps to configure the Signaling Server including:

- Defining the role of a Signaling Server as a leader/follower
- Defining ELAN and TLAN parameters
- Identifying and selecting the Gatekeeper service the Signaling Server will provide
- Importing IP telephony node files
- Importing and upgrading IP trunk nodes
- Transferring IP telephony files
- Backing up IP telephony node configuration files

With the Signaling Servers fully configured, the Nortel Networks personnel then successfully verified the configuration by logging into the device and pinging the server, the ELAN address and pinging the Succession 1000M Call Server.

IP Peer Networking

Third-Party Gateways for Succession 1000M

Several third-party gateways have been verified through Nortel Networks Developer Program Lab offering customers increased: price/port options, feature choices, small site scalability, and connectivity interfaces (i.e. analog FXO, FXS).

Details on the specific third-party vendor gateways supported can be found at: <http://www.nortelnetworks.com/developer>

Succession 3.0 Software supports IP Peer Networking Phase 2. IP peer networking allows direct IP connections between IP entities (IP telephones, gateways, etc) on different call servers. It also enables the customer to distribute the functionality of the Succession 1000 and Succession 1000M systems over a Wide Area Network (WAN), using either standard third party H.323 Gateways or Nortel Networks IP Gateways (Nortel Networks Succession Branch Office, Business Communications Manager (BCM), or Survivable Remote Gateway (SRG)).

IP peer networking on the Succession 1000M drives a number of strategic benefits:

- Provides global coverage of line and trunk interfaces
- Enables the networking of multiple systems across an IP network
- Allows signaling be determined by control-points (i.e. Call or Signaling Servers) with IP endpoints communicating directly with each other (i.e. enabling a IP trunk routing a TDM call to communicate directly with an IP telephone)
- Enables the customer to provision IP telephones anywhere on the connected network (LAN/MAN/WAN)
- Enables the Succession 1000 and Succession 1000M systems to provide an industry-leading telephony feature set on an IP PBX architecture that can be distributed throughout a customer's IP network
- Ability to consolidate voice and data traffic on a single Quality of Service (QoS)-managed network
- Network-wide feature transparency is provided using the Nortel Networks Meridian Customer Defined Network (MCDN) protocol giving users at each site common user features and access to network based applications
- Enables multiple Succession 1000 or 1000M Call Servers to work together in a network, over IP facilities, without using circuit switching (if desired circuit switching could be used as a backup)

The Nortel Networks personnel configured the Succession Signaling Server to provide H.323 signaling for Virtual Trunks. The Virtual Trunks appear to the call server as an H.323 protocol trunk route.

The Succession 1000M Call Server supports MCDN features and the H.323 protocol over Virtual Trunks, including control signaling for the IP telephony media path. This enables end-to-end direct media path connections between IP Telephones and Voice Gateway media ports over Virtual Trunks.

IP peer Virtual Trunks are called "virtual" because Voice Gateway (VGW) media ports, located on Voice Gateway Media Cards, are allocated to IP peer Virtual Trunks per call as needed. VGW media ports are customer-level resources that are shared by IP lines and IP peer Virtual Trunks.

Virtual Trunks are not associated with hardware, and do not require dedicated Digital Signaling Processor (DSP) resources to provide these features. Virtual Trunks include all of the features and settings available to ISDN Signaling Link (ISL)-based TIE trunks, and are configured within trunk routes. Succession Media Card (DSP) resources are only allocated for Virtual Trunks when it is necessary to transcode between IP and circuit-switched devices.

Once IP Peer Networking was defined, the Nortel Networks personnel demonstrated that the network supported a broad array of call scenarios including: IP telephone to circuit-switched telephone calls; Internet telephone call transferred to recorded announcement or music; virtual trunk to virtual trunk calls, and a variety of other call scenarios.

Investment Strategy with an "Evergreen" Philosophy

What becomes obvious to anyone upgrading a Meridian 1 to a Succession 1000M is the enormous retention in existing hardware and software.

Most evident, of course, is the continued ubiquity of the Meridian 1 CLI, which is used extensively for configuration of Succession 1000M and Signaling Server functions. On another front, the Meridian 1 dual Motorola 68040E (CP4) Call Processors were not discarded but retained and fully transformed to Succession 1000M via a software-only upgrade.

Moreover, existing Meridian 1 integrated applications, such as voicemail/unified messaging, conferencing, recorded announcements, etc., all continued to run on the Succession 1000M system. Meaning that applications like CallPilot and Symposium Call Center continue to serve telephony clients (digital, IP, or analog) in the Succession 1000M domain.

As discussed earlier, the Meridian 1 IP line and trunk cards gain new life and are not made obsolete by the Succession 1000M upgrade but instead they transition their roles to provide DSP processing for

IP-to-PSTN call traversal. The point is, repeatedly hardware investments from the Meridian 1 PBX were retained during the conversion to a Succession 1000M, translating to minimal hardware investments with true IP PBX qualities being delivered by the upgraded system.

Succession Branch Office Support

Figure 3. Succession Branch Office



Succession 1000M supports Succession Branch Office (SBO) for distributed network or remote gateway implementations. SBO configurations require at least one Succession Signaling Server at the Succession 1000M (main office), and one at each remote SBO node. Each Succession 1000M can support up to 255 SBO nodes, and each SBO can support up to 400 IP telephones.

For the purpose of our project, the Nortel Networks personnel deployed a 'remote' SBO system in our test lab 'branch office,' located away from the Succession 1000M IP PBX core equipment. The SBO is an H.323 WAN gateway that communicates to the main office Succession 1000M IP PBX over a LAN or WAN connection.

The Succession 1000M Call Server at the main office supports call processing for IP telephones in the main and remote branch offices. The Succession System Controller (SSC) located in the SBO H.323 WAN Gateway provides call processing functionality to local digital telephones and analog devices, with digital and analog trunk access to the local PSTN.

SBO traffic connects to the main office over virtual trunks on a LAN or WAN connection. The main office transmits and controls IP telephone calls and IP network connections. If the main office fails to function, or if there is a network outage, the Succession Branch Office SSC provides failover service to the telephones located in the branch office. This enables the IP Telephones to survive the outage between the remote branch office and the main office.

With the remote SBO installed off of the Succession 1000M main office, Nortel Networks personnel configured zone and dialing plans for the remote office.

Even though branch office IP telephones are controlled by the main office Succession 1000M Call Server, it is possible — and probably desirable — to have these IP telephones exhibit dialing plan behaviors that are location-specific rather than specific to the main office — including such services as local area calling and emergency 911 access.

Succession Branch Office (SBO) Key Attributes:

- Up to 400 users per SBO (IP, digital or analog)
- Survivable branch telephony services
- Support for local digital or analog trunks
- H.323 gateway services
- E911 services
- Choice of local or distributed Media Services (i.e. conference, tones, RAN/music) and Applications (i.e. Unified Messaging, Call Center Agents, etc)

When a number is dialed, it is identified as either internal or external for call routing. If internal, the system terminates the call on the appropriate terminal. If external, the system routes the call in one of two ways:

- Uniform Dialing Plan (UDP) or Coordinated Dialing Plan (CDP) routes the call to the proper trunk group.
- Vacant Number Routing (VNR) routes the call to a Virtual Trunk.

Emergency Services Access

The Succession 1000 Emergency Services Access (ESA) feature is being extended to support the Succession Enterprise E911 architecture for IP-enabled mobility - which includes support of the Succession 1000 Virtual Office as well as client mobility.

Once the call is sent over the IP network, the call goes to the Gatekeeper, which authorizes the call, and routes it to an H.323 Gateway across the LAN, MAN, or WAN.

For our test, the Nortel Networks personnel defined a simple local dialing plan and provisioned the necessary virtual trunks, but also ensured that Emergency Services Access to 911 service coverage was in effect.

Since IP telephone SBO calls are initiated through the centralized call processor, if a user dials an emergency services number (i.e. 911 in North America), the call will not be recognized as an emergency service call local to the remote SBO and the outgoing call will be redirected to that locality's emergency services 911 operation.

The Nortel Networks personnel configured the Succession Emergency Services Access feature to dial out to a 'local' 911 number relevant to the remote SBO. A 911 call was then placed from an SBO IP telephone and we witnessed the call being rerouted to the local 911 entity.

Verification of Core Functions/Features

At various intervals during the Succession 1000M migration, Tolly Group engineers validated that certain strategic functions/features remained operational or were brought online during the upgrade process. The following paragraphs summarize The Tolly Group's observations on verification of those core features/functions.

Direct end-to-end voice path/virtual trunk.

Once the Succession Signaling Server was installed at the remote site, the Nortel Networks personnel migrated the IP Trunk 3.0 network and an associated remote BCM network to use the Gatekeeper-resolved Network Numbering Plan. The Tolly Group then witnessed the migration of the upgraded Succession 1000M to use IP peer Virtual Trunks.

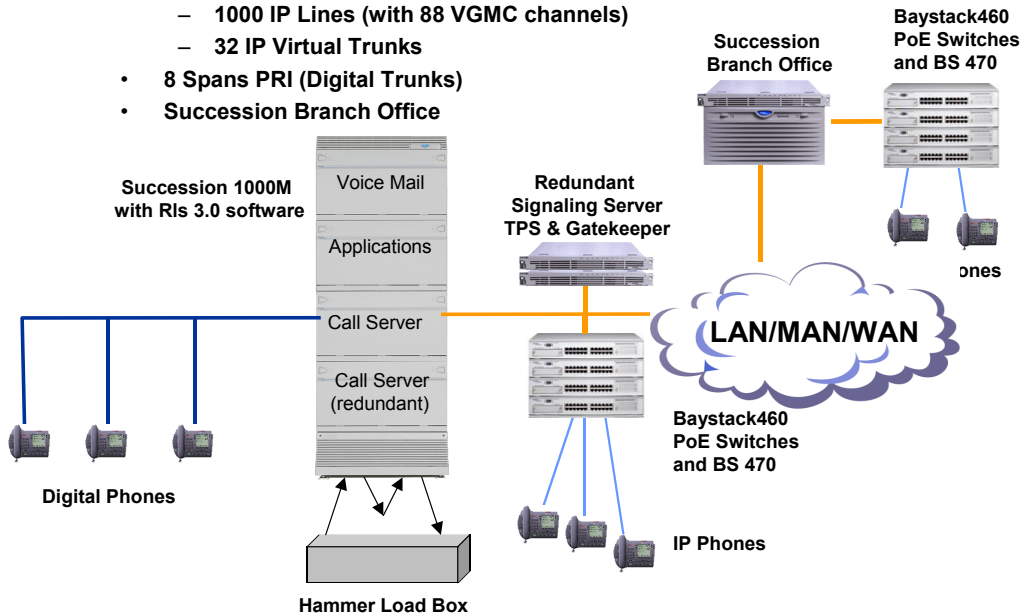
Call Completion Rate Performance.

Throughout the upgrade process, a Hammer load-generation tool was used to spool calls out to the Meridian 1 and subsequent Succession 1000M system in order to measure the effective call

Figure 4. Meridian 1 Configuration After IP PBX Conversion

Meridian 1 Configuration After IP PBX Conversion Succession 1000M with Succession Release 3.0 Software

- 128 Digital Lines
- Signaling Server (Redundant)
 - 1000 IP Lines (with 88 VGMC channels)
 - 32 IP Virtual Trunks
- 8 Spans PRI (Digital Trunks)
- Succession Branch Office



completion rate. During the Succession 3.0 software upgrade, Hammer test tool statistics were collected on call completion that show 144,774 calls were attempted over 23 trunks, and just one call failed to complete. That equates to a call completion rate of 137 calls per minute over the 17 hours, 34 minute test span.

Call Server redundancy.

The Nortel Networks personnel successfully demonstrated a primary Call Server failure that forced the calls to migrate seamlessly to the hot standby.

Survivable remote offices with application transparency and survivability.

Nortel Networks personnel pulled the WAN connection between the SBO and the Succession 1000M main office, hereby creating a loss of WAN condition. The SBO SSC in the Media Gateway assumed call processing control, providing local users with full access to the same telephony services as the main

site. Local branch office users were able to obtain PSTN dial tone from their local central office PRI trunk connectivity.

Network Virtual Office capability.

The Virtual Office feature provides a call service to 'travelling' users who want to use a different physical IP Telephone (other than the telephone they normally use). Users can log in to another IP Telephone using their DN and pre-configured Station Control Password (SCPW). Tolly Group engineers witnessed the logging onto a SBO IP telephone and placed a call, log off that phone and log into a main office IP telephone and made a call, all the while having the user's configuration resident in the IP telephone into which they were logged.

Key Observations

The conversion from a Meridian 1 PBX to a Succession 1000M IP PBX is an involved upgrade that required careful upfront planning, a thorough understanding of the installed IP network that will host the Succession 1000M, and a partnership between a qualified Nortel Networks-certified installer and the local IT staff.

Tolly Group personnel monitoring the Meridian 1-to-Succession 1000M conversion came away impressed by the relative ease with which the Meridian 1 platform was outfitted to support the new Succession 1000M IP PBX services.

Moreover, it was apparent by witnessing the upgrade that users with investments in the Meridian 1 system will benefit immensely from Nortel Networks 'evergreen' upgrade strategy to a fully functional IP PBX architecture.

Seemingly complex issues, such as network management, vastly simplify the migration because users are able to harness the familiar user interface tools they are accustomed to from the Meridian 1. Moreover, the management interface commonality means that configuration data relevant to the Meridian 1 will easily transfer to the Succession 1000M configuration.

Tolly Group engineers also came away impressed with the degree of hardware and service redundancy that is built into the Succession 1000M architecture — key components of the system, such as the Call Processors, Signaling Servers, and the Media Cards, are deployed in either a hot standby mode, or in a leader/follower mode to ensure continued service in the face of equipment outages.

Undoubtedly a key facet of the migration is the fact that existing Meridian 1 hardware is not lost but is able to be reused or upgraded to new functionality. ITG line cards, for instance, that previously served dedicated IP trunk or line functions under Meridian 1 can be fully redeployed as shared or pooled resources under the new Succession 1000M architecture. This pooling of resources may also result in overall customer savings by increasing the available DSP capacity without having to provision additional hardware. The pooled Succession Media Card resources can now dynamically support a variety of IP-to-PSTN call traversal services.

It is apparent that there is a common thread of investment protection in Nortel Networks Succession 1000M strategy to maximize the user's Meridian 1 investment.

During The Tolly Group's two-day audit of the Succession 1000M upgrade, personnel identified a number of issues for which IT managers at user sites, and Nortel Networks-certified installers, must be aware to make any such migration a successful endeavor.

Advice for Users

First and foremost is the need for careful upfront planning on the IP network.

Equally important is the need for careful upfront planning for the Succession 1000M migration from the Meridian 1, but on a broader scope, there is a need for an enterprise-level network assessment.

Carrying real-time voice over an IP-based data infrastructure requires a commitment to understand the varying requirements of bandwidth utilization within the data network. Moreover, it suggests a need for provisioning ample bandwidth for VoIP traffic, even while the IP network strains under peak loads.

For many that means implementing class-of-service definitions and quality-of-service (QoS) mechanisms to guarantee VoIP bandwidth even during times of bandwidth congestion. A network assessment is recommended to understand typical traffic patterns and peak periods where QoS is needed.

To assist customers in their migration planning, Nortel Networks and its channel partners offer IP network verification services that can help identify potential issues that may adversely impact the success of implementing IP telephony within the network.

Users: New Benefits, New Challenges

IP Telephony and its vast array of new applications bring new benefits to the enterprise along with new challenges to understand and manage a distributed workforce. On a technical side, there are new challenges about how to manage user moves, adds/changes and how to structure internal IT responsibilities properly.

When planning to integrate voice services within a data-oriented IP infrastructure, both the Telephony and the Data groups need to identify policies and requirements that address their specific needs and implementation. Telephony representatives, for instance, need to make clear the ELAN and TLAN port requirements as well as QoS requirements for the IP network.

From an applications standpoint, both Telephony and Data operations managers need to devise a coordinated plan for handling unified messaging and other emerging converged

applications. While voice-based applications such as voicemail have historically been part of a closed system, they now have key links into the data applications and servers.

Channel Partners: Planning and More Planning

For Nortel Networks-certified channel partners, a Meridian 1 PBX to Succession 1000M IP PBX migration is an exercise in diligent planning.

The Tolly Group's audit of the Succession 1000M migration revealed that the channel partner needs to assist users in assessing the available resources within the Succession 3.0 software to minimize and avoid possible service disruption or potential interoperability issues during the upgrade process.

Also important is the channel partners' understanding of the new IP resource implementation to maximize redundancy and scalability across the IP network. Gone are the specific-function IP resources like ITG cards, now evolved into general-purpose processors via Succession Media Cards (SMCs). The SMCs and new Succession Signaling Servers are better able to dynamically address the required functionality (IP line or trunk) with the capability to distribute the call traffic over multiple resources.

Moreover, a clean installation of the Succession 1000M Signaling Servers is vital to the success of the IP PBX migration. It is important for channel partners to understand how to maximize connections between the centralized Core Processors and the Signaling Servers deployed in the network.

From a channel-partner perspective, the upgrade process to a Succession 1000M Release 3.0 system requires adequate planning for access to new IP resources for remote administration and support — such as secure access to the Succession Signaling Server(s) and Call Servers. In the previous digital PBX world, there was commonly only one modem port for administrative purposes. Now in addition to an out-of-band channel, operations managers can access remote sites via Signaling Servers to manage and provision services on an as-needed basis.

An Evergreen Evolution

In summary, the Meridian 1 PBX migration to a Succession 1000M IP PBX is an exercise that requires implementation diligence and an understanding of the IP infrastructure into which the Succession 1000M will reside. Yet, users can make the transition with the confidence of knowing that a large portion — if not all — of their existing Meridian 1 hardware investment will make the move, too.

Also, because the core building blocks utilize common software attributes along with common management facilities, users can move ahead with the migration at a pace that best matches their organizational needs.

More importantly, users move forward knowing that their investment in Meridian 1 hardware is not lost, but continues into the Succession 1000M world. In the end, users will appreciate the care and thoroughness that Nortel Networks has taken to help ensure their investment in Meridian 1 and Succession 1000M will continue as new capabilities and IP-based functionality is introduced to the market.

In essence, Nortel Networks open support for standards, dedication to offer a choice of leading PBX, IP PBX or hybrid solutions that are tailored to the customer's requirements, and commitment to delivering new product enhancements that are conscious of previous investments, enables its customers to move at their own pace and when their business needs require change, not when the technology dictates it.

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