NORTEL

Position Paper

Centralized versus distributed unified communications systems

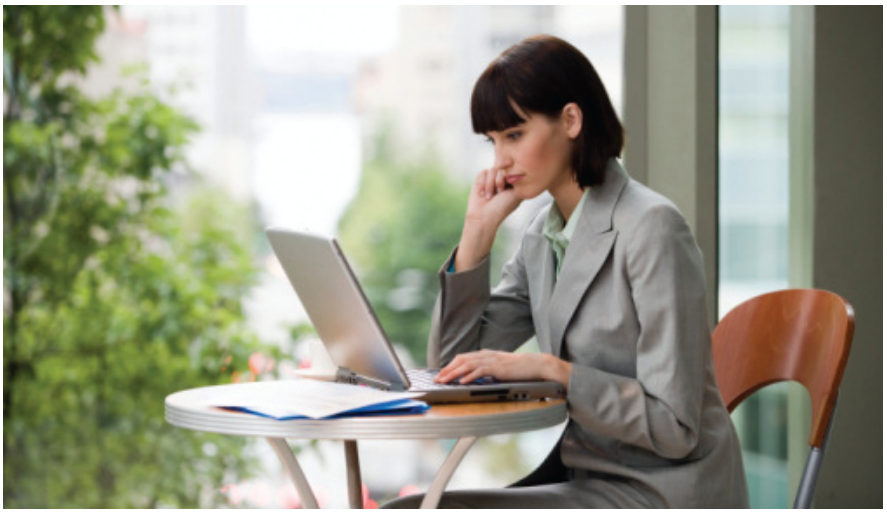
Convergence options for the customer-driven enterprises

Introduction

Unified communications provides connectivity anytime, anywhere, anyhow, with a common look and feel adapted to the device used and to the available capabilities. Unified communications delivers benefits of lower Total Cost of Ownership (TCO) compared to multiple single purpose systems, enhances employee productivity across the virtual enterprise and most importantly, enhances customer service in three ways. Unified communications enhances the responsiveness of the organization as a whole (if you don't interact directly with a customer, you should be assisting someone who is); enhances the operation of contact centers through stronger collaborative capabilities across a virtualized environment; and ultimately enhances the customer experience through real-time multimedia. It's all about engaging customers through time-critical, media-adaptive, anticipatory applications. It doesn't stop there. Integrating unified communications into business applications is highly transformational for enterprises by accelerating 'time to X' — time to decision, to revenue, to service, to support, to product; and by delivering increased business agility, accuracy, service velocity and business productivity.

Business-grade telephony is an intrinsic part of unified communications. Business telephony has traditionally been implemented on a node-by-node distributed basis, with sophisticated voice networking capabilities (such as Nortel's MCDN) linking PBXs and key systems together. It would be incorrect to say that this node-by-node approach applies to all telephony-based systems within the enterprise. For example, Centrex, centralizing voicemail and outsourced audio conferencing are instances of centralization. In addition, contact centers, including Interactive Voice Response (IVR) systems, have generally been implemented with all agents in one site, although larger enterprises often run many contact centers along regional, organizational and functional lines (some of which are networked together).

Unified communications deployment flexibility is enabled by breaking down system functionality into a number of elements — most importantly, decoupling clients, Communication and Application Servers, and Media Gateways from the switching mechanism (i.e., IP). Clients, of course, are by their nature distributed. The other elements of a unified communications



system can be centralized or distributed across an IP network leveraging the Session Initiation Protocol (SIP) — the lingua franca of unified communications. Whether centralization or distribution (or anything in between) is the right choice for your unified communications system depends on how well either approach meets your customer service and feature/functionality needs; your operational and business needs; and your business continuity, reliability and scalability requirements.

Centralization of IT resources has resulted in the path to lowest TCO, while distributed approaches tend to offer a path to a better user experience by getting functionality as close to the user as possible. So which way should you go? This is discussed in the remainder of this position paper, with a particular focus on IP Telephony, since many of the other elements of unified communications are already targeted for data center-based deployment.

Functional elements of unified communications

Every unified communications system is a hardware/software solution that is made up of a set of four logical functions:

- Clients
- Communication Servers
- Media Gateways, providing interworking with the public network, legacy PBXs and non-IP phones
- Application Servers, supporting, for example, unified messaging and conferencing

These functional components can be implemented in various ways ranging from discrete servers and gateways, to office-in-a-box solutions, to software and hardware add-ons, to PBXs, key systems and data networking switches.

Illustrative unified communications applications

Personal unified communications. Unified experience across the phone and the PC, with tight integration with desktop applications; presence-enabled personalization and customization; and network-enabled find-me follow-me.

Unified communications collaboration. Multimedia, video and audio conferencing, collaboration, secure instant messaging, application sharing, file exchange and web push.

Unified communications-enhanced customer services. Multimedia collaboration, mobility, productivity and information interactions as the basis of new engaged customer services and for customer contact center operational effectiveness. Experts and supervisors can transparently enter and provide insight into customer interactions without transferring the customer from person to person.

Unified communications-enabled applications: Embedding unified communications in applications to accelerate business processes.

Multiple instances of this functionality can be implemented to meet business, scalability and reliability needs.

Unified communications clients, for example, are no long tethered to a particular switch and can be anywhere on an IP network. Clients can be wired and wireless IP telephones and logical soft clients running on PCs, laptops and smart phones. These allow users to make phone calls, invoke features and have a window on certain applications (such as directories). Analog and digital phones and fax machines are supported through client Media Gateways. Unified communications clients include telephony functionality and allow users to set up two- and multiple-party sessions supporting a range of communication modalities including voice, video, instant messaging (IM), application sharing and the like. Converged desktop technologies allow integration between traditional or IP desktop phones and computing devices running unified communications clients, such as Microsoft® Office® Communicator® and IBM® Lotus® Sametime®.

Communication Servers are the brains behind IP Telephony systems and provide the control required to allow voice calls to be established across the network. Communication Servers coordinate address translation (between telephony and IP addresses), and handle call signal processing, call setup, resource management and admission control in an IP network environment. They can instruct Media Gateways to set up, handle and terminate individual media flows, and provide an administration point on the network for IT managers to control traffic through these Media Gateways — for example, blocking off-net calls from unauthorized users. IP Telephony Communication Servers interoperate or integrate with unified communications solutions from Microsoft and IBM; interoperation is the norm from other PBX vendors, although Nortel's tight relationships with Microsoft and IBM have created a high degree of integration across all elements of unified communications.

Media Gateways provide media mapping and transcoding functions between the IP Telephony and unified communications clients, and circuit-

based voice networks and clients, including compression, silence suppression and echo cancellation mechanisms as necessary. Media Gateways can also provide gateway functionality for other forms of traffic as well, providing, for example, interworking between desktop video and room video conferencing systems.

Application Servers support a range of services and applications including unified messaging, customer contact centers, voice and/or video conferencing, and IVR and advanced speech applications.

While clients are wherever the desktops or mobile users are, other components of a unified communications system can be distributed in whichever way meets the business needs. You can mimic what is likely your current voice topology with Gateways, Communication Servers and Applications Servers deployed at every site. Alternatively, you can centralize servers and optimally distribute Media Gateways, for example, to minimize call-minute charges and to minimize latency. Most other unified communications functions, including Presence Servers, are best offered on a centralized basis to provide the richest level of functionality, particularly for an increasingly mobile work force.

Five key factors In distributing or centralizing unified communications

To help assess whether a centralized or distributed approach is best for you, let's consider the simpler case of a single head office/data center campus with any number of remote sites ('branches' or 'remote offices') distributed across a number of cities. In this paper, the term 'branch' implies a point of customer interaction, while 'remote office' implies more of an employee-centric operation.

Real-world networks are generally more complex than this with a mix of branch and remote offices (possibly numbered into the thousands), and multiple regional offices, serving business units, perhaps on an international basis.

There are five key technology and business factors to consider in deciding whether a centralized or more distributed approach optimally meets enterprise needs.

Factor 1: Remote site business model and requirements

Enterprises differ in the business role of remote sites. Industries such as consumer retail and banking rely on multiple service delivery channels, including brick and mortar branches and electronic channels, to serve their customers. These invest heavily in a network of stores and bank branches respectively, to serve their customers directly. These **customer-centric** environments can be contrasted with more **employee-centric** offices, such as those of operational departments at various levels of government or administrative offices for employees who spend all their time on the road with customers.

For **customer-centric** branches, it is particularly important to provide high reliability, maintain voice and video quality, and deliver a range of capabilities under various failure conditions. The enterprise objective is to create local affinity with customers, by offering a consistent experience whether face-to-face or across electronic channels, and to make effective use of contact center and branch staff. For example, these often publish local phone numbers for their customers, and may even make their branches an intrinsic part of their contact center environment. Local calls made to the branch are often front-ended with an IVR system that routes calls either to a local agent or to a centralized contact center. In other cases, toll-free calls handled by a contact center may need to be routed to a branch, either to meet a customer need or to increase contact center capacity (e.g., if peak contact center hours coincide with slow branch hours). Additionally, fax handling and voicemail may be an intrinsic part of the business process. In all cases, customer service needs to be delivered under various failure conditions and in a manner that provides a consistent customer experience.

A tier 1 financial institution is deploying a centralized Nortel Communication Server 2100 integrated with Microsoft Office Communications Server 2007 to provide consistent unified communications services across its business units.

In contrast, for **employee-centric** remote offices, the requirements may be somewhat less stringent, in support of local staff in performing their duties. For example, occasional voice impairments may be tolerated by employees for internal calls. Reliability may be also less of an issue, because in some cases, employees may have cell phones either as a backup or as a primary device.

There's a third important case which recognizes that in some enterprises, budgets are totally distributed. For example, if remote sites are run as separate businesses and traditionally look after their own communications needs (e.g., as in some franchise environments), then a fully distributed model may be the preferred business-driven answer.

A national retailer has deployed over 1,000 'office-in-a-box' Nortel Business Communications Managers (BCMs) at its store locations, recognizing the fact that there is little communications affinity among stores and between stores and the head office. The BCM Network Configuration Manager provides central management, including the ability to centrally change store messages and Music on Hold in each store (e.g., for special promotions).

The business model and requirements for remote sites have an impact on the adopted architecture. With customer-centric branches, it is very important to pay careful attention to voice calling scenarios including possible contact center integration. This particularly includes making business policy decisions on how unified communications services are impacted under various failure conditions.

Factor 2: Reliability, business continuity and disaster recovery

If you are going to centralize your IP Telephony system (and "put all your eggs in one basket"), then reliability emerges as the #1 requirement. In addition, emergency calling (E911) requirements must be fully met in both cases.

Users traditionally expect telephony-grade reliability from their desktop phones. They expect to get dial-tone and be able to make an emergency call, even when the power is out (this is also a regulatory requirement in some environments). With IP Telephony, users will expect no less.

The key question is what is the acceptable business impact in case of IP Telephony failure. For example, if telephony is critical in serving customers and lost or abandoned calls are revenue-impacting, then maintaining telephony operation and quality under failure and disaster conditions may be a business imperative. On the other hand, if telephony operation is less business-critical or if other means are provided to deal with emergency calling (e.g., a business line to the CO providing red phone public network access or cell phones), then reliability may be less of an issue.

Table 1. Customer-centric branch and employee-centric remote site attributes

Attribute	Branch	Remote office
Business model	Customer-centric	Employee-centric
Features	Office- and customer-oriented	Office-oriented
Reliability	Very high	Potentially very high
QoS	Consistently high	More tolerant

One of Nortel's key differentiators is that its emergency calling technology is compliant with regulatory requirements (see Table 2), is affordable and is easy to deploy, in both distributed and centralized environments.

At the system level, there are three general approaches to meeting these requirements, from the perspective of designing the IP Telephony system, recognizing that the heart of the system is the IP Communication Server.

Total centralization (option 1) is only viable either when the network has been designed for telephony-grade reliability, or when telephony failures are not directly customer-impacting. Many enterprises see centralized Communication Servers with survivable media gateways (option 2) as a viable approach, since customer-driven telephony operation is maintained during network failures. A fully-distributed

Table 2. Options for meeting business continuity requirements

Option	Attributes
Option 1: Centralize Communication and Application Servers at the data center (and optionally at a second data center for redundancy), with Media Gateways deployed on a city basis	• Loss of network connectivity to the central site results in loss of all communications, including internal and external telephony • Highest dependence on the in-building and wide area network (WAN)
Option 2: Centralize Communication and Application Servers at the data center (and optionally at a second data center for redundancy), and deploy survivable gateways	• Continued telephony operation, including local public network voice calls in case of primary and secondary path failures • Survivable gateways continue to support key telephony features, even when connectivity to the central Communication Server is lost due to WAN failures • Under failure conditions, centralized applications like voicemail would be unreachable.
Option 3: Fully distributed architecture with Media Gateways and Communication and Application Servers at each site	• Replication of the traditional PBX approach • Fully-featured telephony services on a network-wide basis (as do the other two options) with the least reliance on the network • Redundancy may not be affordable at smaller remote sites

approach (option 3) mimics what is available today, but doesn't fully leverage opportunities for increased business continuity offered by IP Telephony.

With the first option and to a lesser extent with the second, not only must the network be very reliable, but the centralized IP Telephony solution must provide the appropriate level of business continuity and disaster recovery at the central and back-up sites. There are a number of approaches to providing Communication Server redundancy at a central site, or across geographically distributed central sites (e.g., two data centers).

- The most resilient approach is high availability options supported by some products, such as Nortel Communication Server 1000 HA single-site configuration, and Nortel Communication Server 2100 single-site and geographic survivability options. In this case, a communication server failure has no impact on existing TDM and IP calls, and on new calls being initiated. Non-stop operation is provided.
- Another approach utilizes load sharing across two data centers, through database replication providing total recovery from failures in tens of seconds; for example, the Nortel Communication Server 1000 with its geographic redundancy feature delivers this level of redundancy, and recovers full operation in a very short period of time. Existing IP calls are not impacted (although no new features can be activated), while new calls will be blocked during the short recovery interval.
- The simplest approach is basically a cold standby approach, which may only be appropriate for smaller networks. In this case, recovery may take minutes, during which time existing IP calls are maintained.

An IT Services firm achieved 100 percent business continuity for its distributed IP Telephony Contact Center. The system consists of a Nortel Communication Server 1000 with geographic redundancy, distributed across two data centers, supporting a 300-agent two-site IP Contact Center deployment of its help desk environment. Reliability is critical to meet stringent SLAs from its business customers.

Remote office survivability is another side to the business continuity challenge, basically addressing the need to continue to make local calls (e.g., to the public network), even if connectivity to a centralized Communication Server is lost. Nortel provides two types of solutions to meet this need. The first option, such as the Nortel Survivable Remote Gateway and Nortel Media Gateway 1000, is specifically designed to address this need, and is currently optimized for UNIStim, Nortel's IP phone protocol. The second meets the survivability needs and eases evolution of a Nortel installed base customer, by allowing either the Nortel BCM and Communication Server 1000 to be converted into a survivable gateway under a centralized architecture.

What's the bottom line? Your business need for reliability, business continuity and disaster recovery will influence which of the three deployment options is best for you: totally centralized, centralized with survivable remote gateways or highly distributed, emulating today's environment.

Factor 3: Scalability

The key factor in centralizing IP Telephony and unified communications, in general is to meet scalability requirements while addressing business needs for simplification. For example, centralizing a network with 5,000 users at a central site and with 50 users at each of 1,000 remote sites requires a system that can support 55,000 users. Many unified communications functions such as unified communications presence servers and multimedia conferencing have the requisite scalability attributes to meet enterprise needs. IP Telephony is more problematic since solutions from many vendors require many Communication Servers to be deployed at the central site, when serving larger enterprises of tens of thousands of users.

The Nortel Communication Server 2100 is a highly-scalable, carrier-grade platform that scales to 125,000 users on a single server, while the Nortel Unified Messaging 2000 scales to over one million mailboxes. Both offer better than five nines carrier-grade reliability. For example, a provincial government is deploying a highly resilient centralized IP Telephony system for 45,000 users based on the Communication Server 2100.

IP Telephony also allows easy virtualization of contact centers with centralized servers and agents virtually anywhere. This increases business agility in leveraging contact center resources and in better meeting fluctuating customer traffic volumes.

A service provider is deploying five networked regional IP Contact Centers to handle 10,400 agents in 120 sites across 500 functional groups. This very large networked contact center deployment runs on a Nortel Communication Server 1000 in each of the five regions.

If you are considering centralizing your unified communications system, then scalability and realizing simplification opportunities are key factors.

Factor 4: Reliability and network bandwidth

The network is another key technology factor to be considered. The key questions are how reliable is your IP network, at what cost can it be upgraded, and what is acceptable business impact in case of network failures.

It starts with the in-building IP/Ethernet wired and wireless network, which has to be designed for the appropriate level of Ethernet switch and uplink redundancy, power over Ethernet and power backup — particularly for IP phones.

Nortel Ethernet Switching products have been designed for convergence: dynamic wireless LAN redundancy and load balancing, failsafe stackability in the wiring closet, split multi-link trunking between wiring closets and the core, and resilient terabit clusters are all examples of features that contribute to delivering telephony-grade campus networks with sub-second failure recovery and an eye on the lowest TCO.

Into and across the WAN, the level of reliability you can afford for your converged network will be driven by your business needs, and by the level of trust you have in your service providers. Some options for redundancy at the remote site include various forms of multi-link operation into a single service such as Ethernet, frame relay or MPLS, or using different services (e.g., MPLS as primary and the Internet as secondary). These have differing price/performance attributes, a discussion of which is beyond the scope of this paper.

Nortel Secure Router uniquely integrates Microsoft OCS technology to provide media gateway deployment flexibility.

Another factor to be considered is the obvious need to provide adequate bandwidth for unified communications. The business case for unified communications must take into account any incremental bandwidth needs, as well as the need to deploy QoS on an end-to-end basis. Ideally, the WAN should support the added bandwidth requirements, and consistently deliver sub-150 msec end-to-end latency and zero percent packet loss for real-time voice and video. However, while the amount of signaling traffic will be impacted by choice of centralized or distributed deployments, the media path with IP is peer networking-based and would be less sensitive to the choice of centralized or distributed deployments. One obvious exception is the location of conference bridging.

Nortel Business Optimized Networking solutions are 7x more resilient, perform 20x better, use 40% less power and exhibit up to 50% lower TCO than those of the competition, as verified by third-party testing.

Factor 5: Business economics and migration risk

Centralization of IT resources has been the path to lowest TCO, whether we are talking about application processing or data storage. Centralization provides higher utilization of servers and reduces server costs; reduces operations costs including power, staffing and management; and provides increased agility to accommodate network changes (e.g., new sites, unexpected growth and site decommissioning).

For example, in many customer service branch environments, service continuity is paramount and is driving distributed deployments of IP Telephony on a branch-by-branch basis. Nortel BCM with centralized management is particularly attractive when evolving from a Nortel Norstar installed base, and when BCM applications such as IVR, ACD and fax handling unified messaging are critical for customer service. Customers with more robust, higher-speed connectivity may opt for Nortel survivable remotes off centralized or regionalized Communication Server 1000s and 2100s, with optimal placement of Application Servers. Independent of how remote sites are served, customers may leverage business continuity features of the Communication Server 1000 and of the carrier-grade Communication Server 2100, to achieve business continuity at critical larger sites and for contact centers, and to enable mobility applications and virtualization of contact center staff.

In addition, centralized IP Telephony (e.g., based on the Nortel Communication Server 1000 and Communication Server 2100) simplifies the task of integrating telephony into Microsoft OCS and IBM Lotus Sametime environments, and of leveraging SOA-enabled frameworks such as Nortel Agile Communication Environment (ACE) to communications-enable business applications.

A 100-person private investment bank was the first to deploy unified communications across its entire company. This company has equipped its highly mobile staff with Nortel Multimedia Communication Server clients running off of centralized Nortel Communication Server 1000 IP Telephony and Multimedia Communication Server 5100 systems. This allows them to be much more responsive with their clients in closing on mergers and acquisitions. Payback was also less than a year.

Table 3. Options for dealing with remote sites when moving towards centralization

Remote site telephony base	Path to centralization
Manufacture-discontinued or old PBX	Replace with Media Gateway off centralized Communication Server
PBX that is expensive to upgrade to IP	Replace with Media Gateway off centralized Communication Server
Installed base of Nortel BCM or Communication Server 1000	Convert to Survivable Remotes off central site
Centrex-based telephony	Interwork via SIP trunking and replace with Media Gateway off centralized Communication Server on Centrex contract expiration
IP-enabled PBX	Interwork via SIP trunking and evolve as Media Gateway off centralized Communication Server

Finally, leveraging installed base telephony investments can be a very positive contributor to a business case. For existing sites, there may be an economically-driven desire to retain current digital phones (after all, they work and the user is familiar with their operation), complementing these with IP Telephony clients where required. These clients could run SIP, or a vendor-specific feature-rich option such as Nortel's UNIStim protocol. What is actually offered is vendor dependent. For example, Nortel provides an evolution path to IP Telephony for its Norstar, Meridian and SL100 customers, and preserves the customer investment in telephone sets by allowing them to be re-used on the BCM, Communication Server 1000 and Communication Server 2100 respectively.

Centralized and distributed unified communications: The choice must match your business needs

Enterprises are embracing unified communications solutions, aiming to reap the benefits of network, communications and application convergence. These include enhanced customer services through real-time, media adaptive, anticipatory applications; improved business and service continuity across multiple channels (including the branch and the contact center); improved employee collaboration and lower Total Cost of Ownership, both aimed at increasing enterprise competitiveness; and accelerated business processes through communications-enabled applications.

In deploying large-scale unified communications systems, you should carefully assess your business needs and the degree of centralization and distribution that best meets these needs. You should factor in the business model applying to remote sites, client mix, networking requirements, as well as the risk and economics associated with various approaches.

Nortel solutions support totally centralized, totally distributed and hybrid architectures, and allow enterprises to evolve from distributed to centralized architectures at their pace. Nortel Unified Communications Services can help you plan, deploy, operate and evolve your unified communications system for maximum business benefit.

Balancing business needs with the network costs (which increase as reliability is enhanced) and unified communications costs (which decrease as you centralize) is a critical factor in choosing between centralized and distributed solutions. Distributed architectures are the lower risk path, particularly since they have less dependence on the network and exhibit less risk of disrupting the customer service model, while centralized architectures can deliver business continuity and simplification while lowering TCO.

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