The End of the Network as You Know It

The new opportunities of enterprise networking

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Today, an enterprise network functionally extends well outside its conventional and controllable borders. Referred to as an "extended enterprise network" by some industry analysts and experts, this new generation network is borderless, dynamic, and organic with a high level of virtualization. It expands and contracts its reach and services with the movement of users, rise of new technologies, inclusion of new partners and supply chains, advent of new attacks, and enhanced use of cloud-based resources. Enterprise networking the way we know it is transitioning from network-centric solutions to transformational architectures, services, and comprehensive solutions. Emerging Internet technologies, mobile device proliferation, and new security threats are challenging all known paradigms of networking, and require a fresh architectural and design review of many existing enterprise networks.

The next generation of Internet technologies enables users to escalate their requirements from "on-premises-off-premises" access to data to the high demand for a rich media experience. The network-centric solutions are maturing more and more as users experience them. In contrast, the extended enterprise network drives the user experience, and the user experience drives the business impact. Thus, the seamless user experience is becoming a core property of extended enterprise networks.

The extended enterprise network has to be designed and architected to provide any device access. Anywhere connectivity requires users have consistent, pervasive access to the corporate premises and beyond whether they are using company assets, third-party, or their own devices. Employees want to access services from any laptop, smartphone, or virtual desktop over Wi-Fi, cellular, and wired networks in a uniform and device-agnostic way.

The ability for employees to work from any location and have unified access to all the corporate resources requires the extended enterprise to provide network services from and to any location. The work is becoming a human function and not about a location. The suppliers, vendors, partners and other manufacturing boundaries are moving beyond corporate firewalls—beyond the conventional borders of enterprise networks. The extended enterprise has to offer ubiquitous mobility to its employees, vendors, suppliers, partners and other participants in this extended supply chain. Today, networks reach to full- and part-time telecommuters, day extenders, and "road warriors," to home, road, sales office, and branch, partner, and customer premises, anywhere. Increasingly, corporate networks offer new means of connectivity from everywhere. Mobility solutions cost less to operate when they can be managed in conjunction with the wired network and share the same security architecture with other places in the network (PIN).

In borderless networks, potential security risks far exceed the virus-infected laptop. Business partners, contractors, and employees working in branches and customer premises, combined with the advent of user-owned devices in the workplace, make locking down a network harder. Gone are the days when security risks primarily existed outside defined and protected borders, and only a limited number of restricted users could access internal resources. Now there are no boundaries for data exchange from the inside out. If the network is protected but data is not, the conventional security model is defeated. Some industry analysts refer to "zero trust networks" where the effective security model is from "inside out." A zero trust network is built on data-centric architecture. The network

is security data "aware" and thus more intelligent, that is, equipped with the capability to handle some decisions automatically based on the security awareness.

The baseline of services offered to users has changed as well, because video is no longer only a killer application but a "must have," and secure data and voice over IP are default services offered to every employee. Voice-only conference calls are becoming voice, video, and data by default. Legacy meeting tools are evolving to web collaboration tools. Email is depreciating as a business tool in favor of multimedia collaboration tools. New tools are transforming collaboration itself, as interactive media appliances, telepresence units, and software clients become more widely available. High-tier, user-specific service-level agreements (SLAs) to any location of the network will soon be a demand. Thus, the extended enterprise network has to become video, voice, data, and application aware. Proactive, real-time, reactive monitoring tools, the capacity planning and video simulation of the network behavior are becoming common monitoring features of the video-enabled network architecture.

The extended enterprise network will be unattainable without increased operational efficiency, minimized total cost of ownership (TCO), and increased agility. The services offered to users in any location, on any device have to be associated with reduced time to capability and the ability for users to self-provision their services. The service model based on "open a case with IT" will soon prove ineffective due to the sheer variety of offerings, locations, and devices that need to be dealt with. Time to market for new devices is becoming a showstopper. This reality requires that the enterprise change its service offering to employees and clients to a "self-advertising—self-subscription service," where the network carries the services that advertise themselves at places or ports in the network and devices, and users can self-provision.

The number and variety of devices and associated services to be deployed and provisioned in the next several years is about to explode. Mobile device proliferation is expected to associate every human being with 70 to 100 IP devices by 2020. The traditional provisioning model is obsolete and has to be abandoned because the TCO becomes prohibitive. Instead, the extended enterprise network must allow zero touch deployment. Users have to be able to self-provision on any device, from any location, for any service and any application with no IT admin involvement and little to no productivity downtime. "The simplicity is the ultimate sophistication," according to Leonardo da Vinci, and his words apply here to the fullest. The self-provisioning process must be fast and provide an intuitive user interface. An effective self-provisioning process helps to create a competitive advantage and reduces TCO significantly, as it scales the architecture and expands the footprint.

Virtualization is a major enabler of the extended enterprise network. Virtualization technologies enable applications and operating systems, or virtual machines (VMs), to move easily between one server and another, and even between data centers. Virtualization improves server utilization to decrease costs; reduces space, power, and cooling costs; supports LAN-like performance over WAN networks, load balancing of application workloads, storage virtualization, and provisioning. Extended enterprise networks deploy a variety of virtual resources, such as VMs, desktops, and storage, to achieve a high level of virtualization.

The emerging ability for enterprises to securely share from a common pool of resources is typically associated with cloud networking. This capability can be applied to compute, network, and other resources, which reduce costs and allow network, security, and storage policies to be applied to VMs. In the cloud, policies move along with the VM during live migration, providing visibility into individual VMs, not only into the server as a whole. This approach simplifies troubleshooting and preserves organizational roles within IT by providing role-based access to VM server, storage, and network policy. The extended enterprise employs one or a combination of private, hybrid, and public clouds.

Understanding and reducing the energy consumption of computing and communication infrastructure in home, enterprise, and data center environments is an area of increasing importance for both researchers and commercial entities. Many architectural decisions have a direct impact on how networks are designed and provisioned. Green networking includes deploying technologies in the network infrastructure that help to reduce power, implementing green network design for high density data centers and cloud computing, and building capabilities into the network that enable telecommuting and other mobility solutions for employees. Networking technologies will play a significant role in reducing energy consumption in other domains such as utility networks and transportation systems, by helping to lower emissions and save re-forestation and other efforts that impact climate change.

Conventional networking focuses largely on routing and switching. The network, end devices, and users are not "aware" of each other. The new generation of enterprise networking offers a variety of technologies to associate the end devices, applications, and services into one ecosystem. It allows for traffic recognition, application recognition, auto quality of service (QoS) techniques, dynamic- and network-based traffic management such as dynamic call admission control (CAC), media aware routing, and acceleration of traffic-based on priority, context, and classes of service. Video-enabled devices are becoming media and status capable, reporting quality parameters to the network. Device, application, service, and location awareness and traffic acceleration are becoming core properties of extended enterprise networks.

All enterprises deploy a variety of management tools, scripts, and procedures, non-connected management domains, or home-based enterprise management systems. This arrangement makes operational efficiency and network resiliency challenging, often driving time to capabilities higher than expected. Typically, no less than 45 percent of the TCO is considered to be associated with management and day-to-day operations of the enterprise network. Conventionally, network management is still about fault, configuration, performance, accounting, and security management. Federated computing and single control console is in the DNA of the extended enterprise network. A good network management system contributes to reduction in cost, increased scale and productivity, excellent customer support, and lower TCO.

 Policy decisions are often sets of rules on paper. Traditionally, policy-based access is about "who gets access to what." These types of policy-based decisions are difficult to impossible to implement and are typically statically configured. When there are no boundaries for the network, and the network is associated with the user but not with the device or location, policy-based decisions have to be more granular, context-based, and fully automated. Implementing policy management around context such as location, time of day, user role, and type of access is the first step toward making policy management one of the foundational capabilities of an extended enterprise network.

From the point of view of an enterprise organization, there is always a tradeoff between complexity of a feature set and the ease or simplicity of the implementation and operation. As mentioned, day-to-day operations and management typically take no less than 45 percent of the TCO, but of course may vary. Many organizations will choose to operate with fewer but more reliable tools, and nearly always will make choices on behalf of operational excellency. Reducing time to capabilities, automated certification and configuration, and zero touch provisioning are some of the major levers that can reduce TCO; increase the availability, agility, and robustness of services; avoid or decrease cost; and boost company productivity.

In summary, the next phase of enterprise networking is about providing connectivity to anyone, anywhere, from any device, to any application or service reliably, securely, and seamlessly. It comes with tremendous potential for increasing operational efficiency, minimizing TCO, and increasing agility of the operated network. It also poses

serious challenges for network professionals to provide converged data, voice, and video; enable pervasive mobility; protect the corporate data and infrastructure; and enable collaboration, virtualization, and cloud computing. At its core, the new generation of enterprise networking carries significant transformational changes and challenges to existing architectures and designs, which largely were constructed in the last century under different assumptions. It is an exciting time to be in IT.

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