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Introduction

Today’s enterprise networks face challenges not even dreamt of when many of these infrastructures were built. The perimeters of the network, once firmly defined in brick and mortar, have become porous, and now include remote and mobile users that may be accessing content from the cloud, using a corporate laptop or a variety of their own devices. The strict list of corporately deployed and managed devices has dissolved to include user-owned devices that often cannot be managed. And applications, once housed only in data center appliances, have migrated to locations that include the cloud, in the data center, or in hybrid deployments. The era of a rigidly defined access paradigm has passed, leaving in its wake a dynamic, ever-changing set of requirements. Because of these rapid changes, most networks, which are at the heart of the enterprise, have simply not been able to keep up.

In this paper, we will examine the move toward an application-aware network. This new model promises to address many of the disparities between the existing, static network and the dynamic set of resources and clients that it must serve. We will consider how an application-aware network can dynamically respond to changing user and traffic demands in real time. We will also look at how Dell can help today’s enterprise move their existing deployments toward an application-aware network, without resorting to a wholesale rip-and-replace strategy.

Today’s New Network Requirements

The traditional approach to building enterprise networks was to follow a layered approach. The theory went that this model supported scalability, because new challenges could be accommodated by adding new devices into the appropriate layer. This model did not feature awareness between the applications and the underlying network infrastructure; the network was seen as “plumbing,” while the applications were what traveled through the pipes. This “closed” model, designed to provide scalability by making the infrastructure generic, has functioned tolerably for decades. Unfortunately, the demands on this model have changed rapidly, due to a combination of application and traffic shifts. This highly fluid, dynamic model is not well served by a static, rigid network infrastructure. There is also a compelling need to gain overall network visibility and to streamline the management of the many disparate devices that have been reactively added to the network over the years.

The situation is compounded by the conflicts that can be created if a network is not aware of the applications that are running over it. For example, let’s say that an enterprise is trying to run a live streaming webcast. In order for this service to run well, and to deliver a high quality user experience, latency must be minimized. Therefore, the application will try to take the amount of bandwidth required to accomplish this goal. At the same time, the network, which is designed to run with an even, consistent flow that facilitates maximum uptime, will see a sudden spike in a particular segment. The network will try to spread the load, assuming that this is some type of disruption. The load balancing introduced can cause an unacceptable delay in the video transmission. This situation can play out in the enterprise network many times a day; all because neither part of the network knew the context of the other part’s actions. The network was not “application-aware.”
Today’s applications and networks require information about each other that was unheard of when most enterprise deployments were initiated. This information includes:

- **The location from which the end user is accessing the network.** When many enterprise network infrastructures were originally built, user location was typically a corporate office. Some segment of the population required remote or mobile access, but this was the exception rather than the rule. Today’s user could literally be accessing the network from anywhere, and the inherent properties of each location can make a difference. Without this information, it becomes impossible to manage the network from the edge, resulting in latency and inefficiency at best.

- **The device being used to access the network.** In the last two decades, there were very few choices to be made when considering network devices. A user could work from their corporate desktop, their home computer, and possibly from a mobile corporate laptop. Today, the landscape is radically different. Users expect to be able to access the network from a myriad of devices, including corporate PCs, home laptops, and their own smartphones or tablets. To compound the situation, it is possible – even likely – that most users will have more than one device in operation at a time. It is essential that the application have information about the type of device being used in order to provide the appropriate access and response.

- **The type of interaction being requested.** Most legacy applications were fairly basic. Today’s applications can include everything from web-based email to full multimedia, voice, and video. The variety of requirements results in constantly changing network demands. If applications do not have a way to exploit the network’s capabilities, the result will be that some applications will be under provisioned, while some will be over provisioned.

The old paradigm where the network and the application functioned as independent entities is at an end. Without mutual visibility, neither can offer the optimized experience that today’s enterprise requires for a competitive edge. The network must empower the enterprise to remain agile and flexible; able to take full advantage of tomorrow’s innovations, even if they are a vision for tomorrow.

**Application-Aware Networking**

To achieve cooperation between applications and the network, an “application-aware network” is required. The next generation of infrastructure will move intelligence to the network itself, allowing the infrastructure to respond dynamically as the traffic flows, user locations, type(s) of audiences and devices change. Network layers will be transformed to fabrics that offer resiliency while minimizing latency. The data center, which functions as center of the enterprise network, will serve a more distributed environment, with the rigid, layered model of legacy deployments flattening to make the most of available assets while improving response time. Overall network management is critical to the success of the application-aware network, enabling IT to streamline operations, become automated and proactive, and lower both CAPEX and OPEX. Finally, while virtually any deployment could benefit from an application-aware network, there are several new initiatives that are driving it as a requirement; user mobility/Bring Your Own Device (BYOD) and cloud computing.
Why isn’t my network application-aware now?

To be truly "application-aware," a network must be able to react dynamically to changing application requirements, traffic patterns and user demands. The fact is that the term "application-aware" has been around for some time. It has been used to sell everything from massive switch upgrades to new service provider deployments. So why aren’t all networks today "application-aware?" The answer is simply that in the past having a dynamically responsive network was a "nice to have," but not truly essential. The business has not mandated the change, and most enterprises have made do with the networks they have, addressing challenges by adding more devices.

Legacy networks were built on a "black box" model. User information, data, and applications entered this rigid infrastructure, and their flow through it was mandated by the network’s inherent limitations. The network, applications, users and data didn’t interact because they didn’t have to do so to yield acceptable performance and throughput. Users, devices and applications were static, so the network could be as well. This paradigm doesn’t function in an environment where user role and device type, as well as the location and type of applications and data they are accessing, are completely fluid.

One of the primary barriers to the application-aware network is that it has largely been touted by vendors that build only parts of the overall network infrastructure. In order for a network to be aware of the applications flowing over it, both elements must be able to communicate in real time, without the necessity of manual intervention. While it is possible to take steps toward the goal of application awareness by deploying a single device or set of devices, a truly application-aware network mandates a holistic approach. A solutions-based direction is required, with consideration that spans from the data center and server to the cloud and the end user device.

The results of moving intelligence from devices and components into the network itself are very real. The network and application infrastructure themselves will work to accommodate usage needs. The application-aware network will enable the enterprise to achieve more, see results faster and maximize efficiency, all while laying the groundwork that lets IT turn on a dime to take full advantage of the next new innovation.

Application-Aware Network Considerations

In order to be considered application-aware, several elements must be considered.

Avoid vendor lock-in. The long standing tradition of doing business as a “one vendor shop” is being called into question today. Regardless of any vendor’s innovations, infrastructure built on proprietary technology will inherently limit your choice in selecting best-of-breed products. Advancements in your network strategy – and ultimately, your business strategy – are limited by the vendor’s roadmap and partnerships.

Eliminate unnecessary layers. When legacy networks are faced with more performance requirements, the simple answer is to add another device; another layer; another process. The result is that the network threatens to collapse under the weight of more devices to traverse, more processes to complete.
**Remove the rigid structure.** Previously, networks were built in a similar fashion as the “pipes” to which they were so often compared. And in yesterday’s world, that model worked well; if you needed more throughput, you just added a bigger pipe. Unfortunately, business today requires the ability to change direction instantly, as well as to provision different levels of throughput in real time. Rigid structures cannot respond in a manner to support these requirements.

**Minimize manually controlled processes.** The fact is that networks don’t operate on the scale of human reactions. The network is measured not in seconds, but in fractions of a microsecond. Any response that is dependent upon human intervention serves to break the chain of awareness between the application and the network. Even the time required for a process to go from the edge of the network to the center is too long.

**Engineered for the status quo.** Today’s business requires a network that does more than just move packets faster. It must understand the nature of the traffic itself. This is a paradigm shift from even the best networks of yesterday.

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**Dell Delivers the Application-Aware Network**

Dell offers a comprehensive portfolio of solutions designed to make the most of your networking investment. By taking the more unique approach of architecting the network around the applications, Dell’s Networking Solutions can help you deploy an application-aware network at your pace, while setting the stage for future enhancement. Dell also offers the services you need to move your network from today to tomorrow: from simple assessments and workshops to full implementation and management. This holistic, solutions-based approach is what you need to take an application-aware network from the drawing room to your data center and beyond. Dell Networking products work together as solutions that enable such real benefits as:

- Application optimization
- Work scheduling
- Compression
- Bandwidth management
- Intelligent in session reroute
- LAN and WAN optimization

**An Open and Optimized Network**

At Dell, we take an open, standards-based approach in how we develop network architecture. We feel that this is the only way that you can truly take back your network strategy from vendors that seek to lock you in with proprietary technology. No matter how good a vendor’s roadmap is, we believe that it is not effective if it is not your roadmap. With Dell, you are free to deploy best-of-breed point products with the assurance of functionality that only open standards can deliver.

No matter what your network looks like at the edge, everything meets at the data center. “Efficiency” is the key quality in the data center, with scrutiny given to the use of both computing and energy resources. Today’s enterprise data center must support millions of queries a day, from a variety of locations and a host of different device types. The traffic loads on the data center can vary wildly and unpredictably, and a closed, legacy network just can’t keep up.
A network solution from Dell delivers the flexibility you need to enable next generation applications and services. With Dell, your network can be optimized to work with changing traffic flows, enabling users to get what they need, when and where they need it. And with traffic patterns that can change in an instant, the optimized network must be able to follow suit, to deliver fast, reliable service all the time.

**In the real world – financial services**

To illustrate the requirement of an optimized network in practice, consider a financial services firm. Retail trading accounts guarantee that your trade will be completed within two seconds; in large commercial trading houses, this response time is shaved to microseconds. The requirement for traffic to traverse a bloated legacy network, including the access and aggregation layers as well as different security process, quickly makes such guarantees untenable. A network that is optimized can help to reach these goals predictably, as well as to solve additional issues such as compliance.

**Agile and Automated**

In order to keep pace with application demands today and lay a foundation for tomorrow’s challenges, the network must be agile and quick to respond. IT must be able to instantly visualize performance to stop trouble before it starts. With Dell, visibility is built in to help you get deliver a network that can keep up.

Another essential factor in the application-aware network is automation. By removing the need for manual intervention, you’ll eliminate a known potential for errors and improve your response times as well. And, at the same time, your bottom line will benefit. Dell Networking Solutions are agile and automated to ensure that your network is highly efficient and delivers peak performance.

**In the real world - healthcare**

For an example of a network that must be agile and automated, consider the healthcare industry. In healthcare, applications go beyond being mission-critical to life-saving. Most healthcare activities today are functionally distributed, with activities often beginning in the field following the patient from triage and immediate intervention to follow up care. Portions of the patient record will go to different parts of the organization and beyond, while stringent compliance regulations must be observed. At the same time, the healthcare network must be sufficiently agile to accommodate instant flash crowds that literally cannot be foreseen. The network must be able to react dynamically and in real time.

**Empowered to Enable Cloud-Driven Mobility...and Beyond**

Today’s network faces a further challenge – cloud computing. Cloud computing is a compelling alternative to owning and managing costly infrastructure. By simply “renting” storage, networking and computing resources, enterprises inherently become more agile and flexible. While the business case for this model is compelling, implementation can be complicated. Because the enterprise doesn’t house the resources, the most efficient paths to get to them can vary moment by moment. The “on demand” nature of the cloud computing infrastructure model requires continuous optimization of server and network resource allocation to meet the dynamic needs of each application. A user in New York may be working with a resource that is actually housed around the world; but the demand remains that the resource performs as if it were housed locally.
The current drive to mobility – particularly the BYOD trend – complicates the issue exponentially. Now not only is the optimal path to the required resource changing, the user’s location and device type can change at any time as well. That means that our New York user may now be accessing a resource using a tablet!

The application-aware network can mitigate these issues. By working together, the application and the network can determine the optimal WAN resources to accommodate the user’s request, without requiring that the user know anything about the underlying choices being made by the infrastructure. Then the application and the network work together to determine the optimal delivery mechanism to best handle the mobile device.

But the application-aware network will inherently deliver additional value. The flexible, responsive base of this network goes past today’s hot initiatives because it is designed to address the underlying needs of flexibility, responsiveness and automation, rather than rigidly formed around a single trend. This positions your network to handle the killer apps of tomorrow, as well as those of today.

**Summary/Conclusion**

The application-aware network has been talked about by vendors for years. While it was a laudable goal, the combination of a rigid network with static users on single devices accessing fixed applications was reasonably well served by existing deployments. Problems were overcome – or at least hidden – with the addition of situation-specific point products.

Today’s trends, particularly around mobility and cloud computing, demand that the network become application-aware, and do so fast. Every element in today’s business, from user role to device, through to application location, has now moved from static to dynamic. An application-aware network not only improves responsiveness and delivers a significant competitive advantage, but it will also ultimately save the business time and money. Both capital and operational expenses can be minimized if the network works efficiently, automatically and in tandem with the applications and users themselves.

Dell Networking Solutions deliver an application-aware network – today. And not only will this infrastructure help new applications and services live up to their potential now, a Dell network lays the foundation for the initiatives that aren’t even on the horizon yet. Rather than being constantly reactive, an application-aware network from Dell will allow you to make the most of computing innovations today, while enabling a proactive look to the future.