

## WHITE PAPER

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### Architecting the Network for the Cloud

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#### EXECUTIVE SUMMARY

Cloud computing is now one of the prevailing IT trends as we head into the new decade. In fact, IDC is predicting that cloud computing will be moving from a talking point to just another way to deliver IT in 2011 as one of the key transformation technologies in the marketplace. By providing greater levels of automation, orchestration, provisioning, and deployment, cloud computing can help organizations become more nimble, reduce operating costs, improve application performance, and better allocate their compute resources.

But cloud computing does not come without its challenges. In particular, organizations with traditional infrastructures may find their networks are not set up to take full advantage of the cloud, and they may suffer from poor application performance or expose themselves to security risks when migrating to the cloud. In a January 2010 IDC survey of IT decision makers, security was cited as the number 1 obstacle to cloud deployments, especially public cloud. To transition to the cloud effectively, organizations should architect their network with the appropriate routing, application performance, and security technologies.

To support this service delivery evolution, Cisco offers the Borderless Networks architecture, which is based on a key set of embedded network services and infrastructure technologies that help enterprises optimize their networks for the cloud. These technologies include routing and application performance solutions to provide superior performance for key enterprise applications, as well as security solutions that provide a consistent approach to securing any device on the network.

This white paper describes some of the benefits and challenges in migrating to the cloud and the importance of deploying a cloud-ready network architecture. It is based on IDC's ongoing conversations with and surveys of CIOs and network administrators, as well as interviews with executives from Cisco's internal IT organization, which has deployed Cisco Borderless Networks for its own use.

# SITUATION OVERVIEW: ENTERPRISES MOVING TO CLOUD ADOPTION

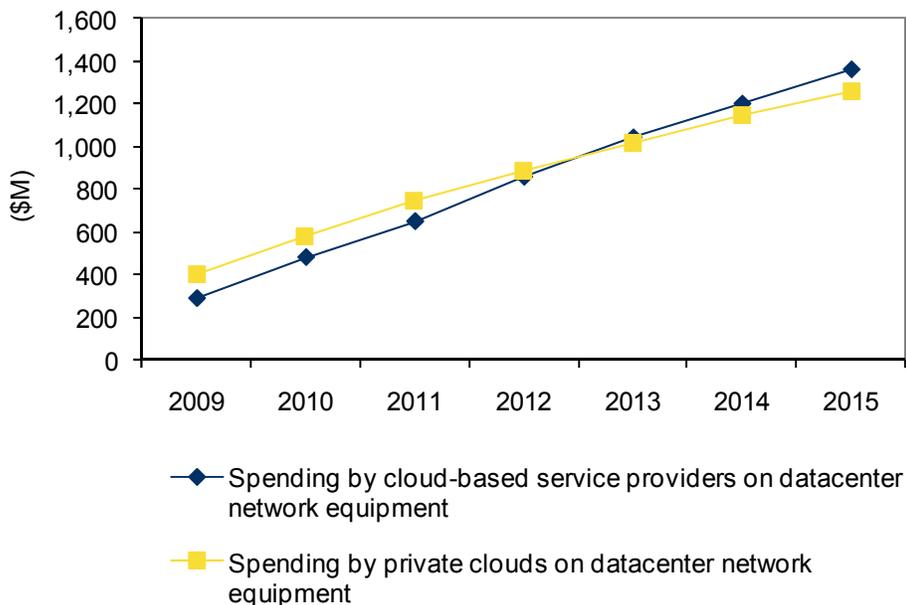
## Growth of Cloud Computing

Cloud computing is emerging as a viable option for IT organizations to reduce the complexity in their environments and ensure quality of service while reducing the burden on their IT staff. It enables higher levels of automation, orchestration, provisioning, and deployment and can help IT departments more rapidly scale their compute resources while retaining the flexibility to adapt to changing business requirements. In the words of the Cisco IT executives interviewed for this study, cloud provides elasticity — being able to put the right amount of resources in the right place at the right time.

IDC is forecasting growth in cloud computing over the next five years. A 2010 IDC survey of IT decision makers found that fully 44% are "considering private clouds," which reflects both user interest in cloud technology and the early stages of cloud adoption. Looking at the projected network buildout to support cloud deployments, IDC expects network infrastructure investments to more than double over the next three years, growing to over \$1 billion each by 2013 for the public and private cloud segments (see Figure 1).

**FIGURE 1**

Worldwide Public and Private Cloud Network Forecast, 2009–2015



Source: IDC, December 2010

## Cloud Deployment Models

There are three primary types of cloud deployment models:

- ☒ **Public cloud.** In public clouds, the deployment is open to a largely unrestricted universe of potential users, provided by a service provider, and targeted to be used by a market and not a single enterprise.
- ☒ **Private cloud.** Private clouds are designed for access restricted to a single enterprise and are used as an internal shared resource and not a commercial offering.
- ☒ **Hybrid.** In hybrid cloud deployments, a portion of the infrastructure is deployed in the service provider's cloud and a portion is at the customer premise.

Each type of cloud deployment has its own unique advantages and best-fit use cases. For example, private cloud deployments can yield the automation, provisioning, and deployment orchestration benefits associated with cloud computing, but in a way that ensures visibility and control over data. Private clouds are also well suited for workloads with high security, availability, and serviceability requirements. Private cloud is ideal for applications that, for regulatory or compliance reasons, require a greater degree of control and ownership of data within a particular geographic domain.

Public cloud, on the other hand, provides the added benefits of reduced start-up costs, in terms of capital expenditures on hardware and software infrastructure as well as personnel time required for implementation. It is often the most scalable option as many public service providers can scale quickly to meet the needs of their clients. Public clouds are commonly used for workloads such as collaboration, HR, and CRM.

Finally, the hybrid model provides the best of both worlds in that it affords the scalability and rapid ramp-up of public cloud, combined with the security and control of private. With hybrid, elements that need to be supported at the service provider can be deployed while still providing an element of security and control by locating certain data and functions at the user's site. Further, organizations that support a hybrid model can achieve benefits in terms of flexibility. It may be faster and easier to move certain workloads from public to private or vice versa based on changing business needs.

While different industries will migrate to the cloud at different rates, enterprises across all verticals are actively considering some form of cloud deployment, with many looking at both private and hybrid. IDC has observed the popularity of private cloud firsthand, as respondents in the January 2010 survey indicated that they are more open to private cloud deployments than public cloud over the next three years.

## **NETWORK CHALLENGES AND ENABLERS FOR MOVING TO THE CLOUD**

Despite the benefits of cloud computing, moving to the cloud can be difficult. Organizations need to be conscious of a number of issues and of the unique requirements for each cloud deployment model.

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### **Routing Optimization for Key Business Applications**

There has been a dramatic increase in the amount of media-rich content being transported over the Internet during the past five to seven years. Video has become a key business application for communications between customers, partners, and employees — one that is particularly sensitive to latency.

A key challenge for enterprises to consider is how the network can recognize, scale, and prioritize video as it is delivered through the cloud. In private and hybrid cloud environments, the network should be adaptable for delivering the optimal experience based on parameters such as user location, device type, or reachability. And of course, the network must be capable of supporting a diversity of devices — whether tablets, smartphones, or PCs.

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### **Reliability and Latency in WAN Performance**

WAN performance is another key issue because applications are the lifeblood of an organization. The application performance provided by the network directly impacts employee productivity, customer experience, and partner interactions with the company. As a greater proportion of enterprise employees work remotely, predictability in WAN performance also becomes a central issue.

The challenge is giving consistent, high-quality performance to applications when they are delivered from the cloud — with maximum reliability and minimum latency. As datacenter consolidation occurs and more remote locations become consumers rather than providers of services, WAN optimization is a requisite. In both private and hybrid clouds, the network should be capable of providing optimization of WAN and cloud resources while yielding visibility and control.

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### **Security**

Security involves change management on several fronts: business practices and policies, as well as provisioning, management, and operations. As data and applications move to internal or external service provider clouds, a greater onus is shifted to securing a more complex network structure with a greater number of enforcement/demarcation points. Invariably, cloud services need to be as secure and compliant as on-premise services.

Users should be able to access the Internet seamlessly, while IT maintains control, visibility, and management. Further, organizations need assurance from their cloud service provider(s) that policies are constantly in sync with them (e.g., once an employee leaves an organization, the service provider needs to act quickly to deny access to sensitive data).

## CISCO BORDERLESS NETWORKS

To address these challenges, Cisco has developed an architecture called Borderless Networks to align with the public, private, and hybrid cloud strategies of organizations. It is based on a key set of embedded network services that balance network performance with operational simplicity.

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### Routing and Application Performance

In private and hybrid cloud environments where high levels of control and visibility are required, application performance helps organizations maximize efficiency of their WAN and control key applications. This is especially relevant when enterprises are looking to leverage the flexibility and scalability aspects of cloud deployments — supporting a diverse set of mobile users and devices accessing applications across geographically dispersed datacenters. Application performance is one of the key embedded network services in Cisco Borderless Networks:

- ☒ **Performance Routing (PfR) and Network Based Application Recognition (NBAR).** PfR selects the best path for applications based on real-time parameters and redirects them to the best public or private cloud resources. NBAR identifies, classifies, and policy routes mission-critical applications such as ERP while guaranteeing bandwidth.
- ☒ **WAN Optimization.** Cisco WAN Optimization technologies reduce the amount of bandwidth required for application performance across the WAN while allowing monitoring and control of network traffic.
- ☒ **Voice and Video.** Cisco WebEx Node for Aggregation Services Router (ASR) 1000 helps IT maximize its investment in Cisco technology. It enhances performance and resiliency for Web, voice, and video sessions while reducing WAN bandwidth requirements.

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### Security

Many traditional security technologies from the physical world must be brought to bear in the virtual/cloud environment. Secure access is vital for connecting dispersed enterprise datacenters into cohesive private clouds or connecting to external hybrid cloud services. Identity, data security, and access control also take on more critical roles in a dynamic cloud environment, where cloud workloads can be created, moved, and deprovisioned based on business needs. Security is another key embedded network service within Cisco Borderless Networks.

Cisco offers a number of technologies designed to address private, public, and hybrid cloud security requirements:

- ☒ **Cisco Adaptive Security Appliance (ASA) 5585-X and Cisco Virtual Security Gateway for Nexus 1000V Series Switch.** Integrated firewall services and comprehensive real-time threat defense protect remote users when cloud- and premise-based applications are accessed.

- ☒ **ScanSafe Web and IronPort Email Security.** Cisco offers Web security as a service, spanning private and public clouds, to keep malware off corporate networks and secure employee Web usage. IronPort solutions provide spam protection, data loss prevention (DLP), and virus defense to email in private and hybrid cloud environments.
- ☒ **AnyConnect Secure Mobility Solution.** As data hosting changes with the cloud, the way in which users access applications varies, thus increasing security risks. The Cisco AnyConnect solution combines cloud- and premise-based remote access to connect mobile users regardless of location or device. This helps organizations easily manage these new security risks.

## RECOMMENDATION

A well-designed network to support a cloud architecture should address the issues and challenges described above. It should meet the needs of private cloud deployments by maximizing datacenter-to-branch traffic using technologies such as WAN optimization and sophisticated routing. It should also address the needs of public cloud deployments with technologies such as security designed to support multiple points of enforcement/demarcation in the network.

When constructing a cloud-friendly network, IT should pursue an end-to-end approach to its network architecture, beginning with the user experience and the devices supported. The architecture should also bring appropriate local area and wide area networking technologies and even multimedia optimization. By taking a holistic approach to networking, IT can lay the critical foundation to seamlessly rolling out cloud and on-premise services that accelerate business innovation.

## OPPORTUNITIES AND CHALLENGES

IDC sees a number of opportunities and challenges both for enterprises, as they consider rearchitecting their network to take advantage of cloud computing, and for Cisco and other vendors that offer products in this area.

Opportunities include:

- ☒ **For enterprises: realizing the full benefits of cloud computing.** Customers who rearchitect their networks to take full advantage of these features can achieve the many benefits associated with cloud computing, including increased flexibility in their networks, greater automation, better application performance, and reduced management burden and operating costs.
- ☒ **For IT: demonstrating value to the organization.** This is an opportunity for IT to chalk up a real "win" and to demonstrate its value to the business by adding much-needed business intelligence via cloud services.
- ☒ **For Cisco: establishing new, differentiated value-added offerings.** The network equipment market is highly competitive, with vendors competing on the need to bring to market innovative new technologies and to develop

solutions that drive attractive return on investment (ROI). By addressing the needs of networks as they relate to cloud computing, Cisco is again pushing the boundaries of its current offerings and is working to differentiate itself from other vendors in the market.

Challenges include:

- ☒ **For enterprises: redesigning the network.** Many enterprises today have networks that are static, traditional, and somewhat inflexible. Redesigning them can be expensive and difficult, as equipment needs to be changed out, cabling needs to be physically rerouted, and staff needs to be trained on new technologies. Further, network managers are measured on network uptime, and they are conservative and hesitant to make changes to the network.
- ☒ **For enterprises: implementing technologies while new standards may emerge.** Some enterprises are hesitant to deploy technologies until there is a recognized standard, and this may hold them back from implementing some of the more cutting-edge Borderless Networks technologies, despite their basis on current industry standards. Cisco must demonstrate its track record and commitment to make customers "whole" by retrofitting products through firmware and software upgrades to guarantee compatibility when new standards do emerge.
- ☒ **For Cisco: packaging Borderless Networks.** Cisco is coming to market with an architecture consisting of key network services. This is enabled through an infrastructure portfolio under the Borderless Networks umbrella. Cisco will need to develop and concisely outline its packaging, positioning, and benefits so that customers can understand the value of purchasing the total solution.
- ☒ **For Cisco: demonstrating the ROI of the solution.** Implementing these new technologies will require new capital expenditures for many enterprises and may have an effect on ongoing operational expenditures as well. Cisco will have to demonstrate how the benefits and savings to the broader business will yield an attractive ROI to make the change worthwhile.

## CONCLUSION

Cloud computing is a growing trend that will potentially change the face of IT organizations in the coming decade. By shifting the burden of IT infrastructure management to the cloud, organizations can achieve greater levels of automation, orchestration, provisioning, and deployment and can become more agile, reduce operating costs, and improve application performance.

But cloud computing can come at a price. Implementing cloud without properly rearchitecting the network can lead to problems in application performance and security. Cisco has launched a portfolio of solutions under the Borderless Networks umbrella that are designed to address these challenges and enable organizations to architect their networks to take full advantage of the cloud.

Borderless Networks consists of key routing and application performance technologies, including Performance Routing and Network Based Application Recognition, which are

designed to optimize cloud services. It also includes security technologies such as the Adaptive Security Appliance, AnyConnect, and ScanSafe, which are designed to provide higher levels of security to cloud deployments. Taken together, the Borderless Networks solutions can enable organizations to more quickly implement cloud infrastructures and take advantage of the benefits that will accrue from such deployments.

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