CIO
Custom Solutions Group

Found in the Clouds:
Determining Your Best Infrastructure Options

Cloud computing brings a higher level of flexibility to both IT and the business, but it's important to analyze all the infrastructure options available on a holistic level.

With every new technology come questions—and they're frequently the same questions: How does it perform compared to what I have now? Is it reliable? Where will my data reside? How do we make sure it's secure? How do we manage it? Cloud computing is no exception.

In many regards, however, cloud computing is different. It brings business and cost advantages rarely seen in IT. It brings flexibility IT has rarely enjoyed in terms of methods of deployment—internal, external, or a combination of each. Cloud computing, combined with virtualization,

CISCO

PAETEC

Cloud computing, combined with virtualization, **simplifies provisioning, application services, and business continuity, and helps increase availability and reduce environmental impact**.

simplifies provisioning, application services, and business continuity, and helps increase availability and reduce environmental impact.

As with any new technology, it requires understanding the best way to deploy it, and a roadmap to the optimum destination for your company. It requires an understanding of what it can do for you—and what it can't. For instance, if you provision a cloud computing solution from Amazon, your data resides in Amazon's data center, but it's transmitted over the public Internet. If you provision a similar solution from a service provider that uses its own private network, such as PAETEC, the provider has much more control over both the data and the user experience.

In this white paper, we'll examine the technologies that make cloud computing so enticing from a business standpoint. Then we'll look at its infrastructure options, and the opportunities it holds for both enterprises and service providers. We'll also look at how it helps PAETEC, one of the leading telecom service providers in the U.S.

Business Drivers for Cloud Computing

Few technologies have the clear and compelling business advantages of cloud computing. Cloud computing removes many of the financial restrictions that have plagued business and IT, and its technological capabilities also deliver other financial advantages. While corporate and IT budgets are limited, companies welcome its flexibility. Advantages include:

✔ **Replacing capital expenses with operating expenses:** With the private or public cloud, companies essentially rent computing capacity at a predict-

able rate, rather than making a capital investment in extensive infrastructure. The budget shows a predictable cost rather than an ongoing investment.

✔ **Reduced hardware costs:** Deploying a private data center offering virtualized applications to specific users has a financial payoff. Companies may be able to deploy thin-client devices for certain employees, and reduce both the cost of the device as well as maintenance and technical support costs.

✔ **Reduced capacity needs:** On the private or the public cloud, companies pay for the computing capacity they use, not the capacity they potentially need. This means IT does not have to deploy servers and networks to serve peak needs, reducing the need for physical space and the need to manage those systems. By taking advantage of a platform-as-a-service (PaaS) delivery model, companies can develop new applications and conduct pilot projects without deploying new systems.

✔ **Reduced technology risk:** Using the software-as-a-service (SaaS) delivery model, companies can determine whether there is a strong business case for deploying new applications, especially if they don't have the resources to support the application initially. If the deployment is successful, the company can increase the number of seat licenses through the SaaS vendor.

✔ **Increased productivity:** When employees can access confidential data from any location or from any device, they are more productive. Offering access through a private network such as PAETEC's, the company can enforce security policy from a central location.

✔ **Improved user experience:** With more employees using mobile devices such as tablet PCs or smartphones from remote locations, companies can deploy either private or public clouds to give them access to enterprise applications no matter where the employees' work takes them. Using a service provider's private network offers QoS capabilities for network performance and data availability that can't be matched by cloud providers who do not control the network.

✔ **Reduced environmental impact:** Innovations that support green IT services are desirable, but need investment and expertise to deploy. Having a service provider implement a green data center can reduce a company's carbon footprint and decouples their reliance on its local grid.

✔ **Accommodating globalization:** Just as companies have outsourced certain business processes, they can take advantage of cloud computing facilities in countries where maintenance and technical services are less expensive.

Technical Drivers for Cloud Computing

An impressive group of technical advancements are also boosting adoption of cloud computing. These technologies bring advantages to IT, but collectively, they create a whole that is greater than the sum of its parts:

✔ **Blade servers:** Blade servers have been around for several years, but as companies have been relying increasingly on data centers, they have increased in importance. The ability to stack multiple servers in a small space makes

Mobile · Network · Database · Server · Laptop
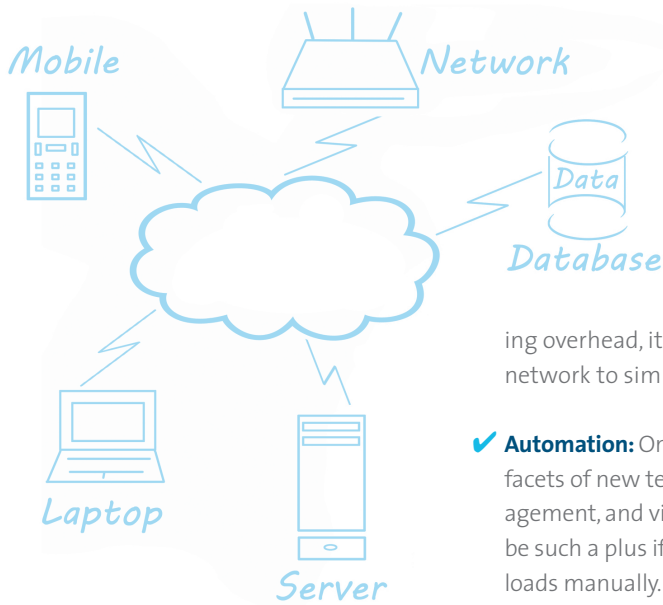
cabling, management, and maintenance less cumbersome.

✔ **Virtualization:** Adding virtualization to blade servers is also rewriting the rules of capacity utilization and redundancy. Because virtualization technology lets IT use server capacity more fully, IT has fewer servers to manage (and pay for). Because virtualization lets IT offload capacity in an on-demand, at-will fashion, IT can more easily set up virtualized off-site systems that support business continuity. This capability also supports hybrid cloud scenarios.

✔ **Networking technology:** This, too, is evolving, with the move to Ethernet fabrics such as Cisco's Unified Computing System. With a single data-center network transport—one that can simultaneously transmit IP and Fibre Channel traffic over a single connection—IT has more options. Along with sophisticated new management capabilities, it gets high performance, low latency, robust security and lossless transmission. At a time when IT is dealing with the moves to virtualization on thousands of devices, transition to 10Gb Ethernet (while still supporting support legacy servers and applications), and the reduction of power and cool-

ing overhead, it needs a more efficient network to simplify its workload.

✔ **Automation:** One of the most complex facets of new technology is its management, and virtualization wouldn't be such a plus if IT had to shift workloads manually. Automating the daily provisioning activities associated with customer registration, multitenant segmentation, and virtual machine placement minimizes recurring costs. Also, service providers such as PAETEC can provide a multitenant infrastructure that enables them to offer service on a per-customer, per-virtual machine basis.

Determining the Infrastructure

If there is a challenge to cloud computing, it's that its multitude of options means IT must make smart decisions about the kind of cloud service that is appropriate for them. But this high degree of flexibility allows companies to deploy a network infrastructure that can accommodate whatever flavor of cloud computing fits their computing needs, even as they shift based on customer practices.

The National Institute of Standards and Technology (NIST) has defined four deployment models:

A **PRIVATE CLOUD** is operated solely for one organization; it may be managed by the organization or a third party, and it may reside on-premise or off-premise.

A **COMMUNITY CLOUD** is shared by several organizations and supports a specific community with shared concerns (e.g.,

mission, security requirements, policy, and compliance considerations). Like a private cloud, it may be managed by the organizations, or by a third–party, and may reside on-premise or off-premise.

A **PUBLIC CLOUD** is made available to the general public or a large industry group, and is owned by an organization selling cloud services.

A **HYBRID CLOUD** combines two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., load-balancing between clouds).

Once a company has determined the deployment model, it must determine the service model (SaaS, PaaS, or IaaS). This is where a service provider such as PAETEC can offer insight, as it can highlight the best way to deliver the applications the business needs. For instance, service providers like PAETEC can deploy SAP on an IaaS basis, and can also provide the secure and gated network for accessing a SaaS application such as Salesforce.com.

Deploying the Optimized Infrastructure

The key is to ensure that you create a network infrastructure that can quickly accommodate the option that works best for business needs. That means building a network infrastructure that supports security, performance, and availability. Customers can leverage PAETEC's network capabilities and Cisco's state-of-the-art technology, developed in concert with industry leaders such as EMC and VMware, to get the flexibility necessary to handle these business needs.

First, PAETEC can deliver MPLS nationwide, allowing you the ability to manage different data streams based on priority and providing the opportunity to route network traffic to a private or public cloud

"Cloud computing creates an environment for us to create solutions that differentiate us from our larger competitors. **We can centralize applications in a redundant, secure, accessible environment, but it also allows us to continually serve the needs of our customer base**."

— Jeremy Needham, Alliance Program Manager, PAETEC

based on bandwidth and congestion. By enabling an MPLS VPN, PAETEC can also offer the customer QoS capabilities based on similar criteria.

The VPN's ability to encrypt data transmission also allows cloud computing providers like PAETEC the ability to segment network traffic from two different clients on a single physical circuit. With this solution, security and privacy concerns can best be addressed

Further examining the infrastructure, Cisco contributes the Unified Computing System (UCS), which streamlines the number of data-center resources needed, while reducing the number of devices requiring setup, management, power, cooling, and cabling. It combines switches, interconnects, and management software into a unified fabric with fewer connection points. This supports private cloud deployments by offering more reliability, faster performance, and greater simplicity of management. Further, once a network is unified—and essentially, highly standardized—it's far easier to optimize it for the highest performance possible.

Beyond the data center, service providers and Cisco can optimize WAN connections to offer more predictable and efficient network performance. Addressing IT management needs, it offers end-to-end visibility of all applications running on the network—whether internally or in the cloud—and helps IT optimize both network and the applications that run on it. WAN optimization capabilities also help determine how hybrid applications can run most efficiently.

Finally, the Virtual Computing Environment (VCE) coalition, the partnership formed by Cisco, EMC, and VMware, offers technology called Vblock™ Infrastructure Packages. This integrated offering combines virtualization, networking, computing, storage, security, and management technologies for state-of-the-art virtualization deployment.

PAETEC: Optimized for the Cloud

These technologies, working together, create the foundation for a cloud-optimized network infrastructure that can help companies increase their competitive advantage. PAETEC, a Fairport, N.Y.-based telecommunications service provider serving 84 of the top 100 metropolitan areas in the U.S., has deployed these capabilities to offer its customers both state-of-the-art networking and several SaaS-based applications.

"Cloud computing creates an environment for us to create solutions that differentiate us from our larger competitors," says Jeremy Needham, Alliance Program Manager for PAETEC. "We can centralize applications in a redundant, secure, accessible environment, but it also allows us to continually serve the needs of our customer base."

PAETEC is also a strong proponent of the SaaS delivery model. Through the launch of its Pinnacle Online software, PAETEC is able to offer midsize enterprises an integrated management tool that provides a unified view of all IT services and assets. Leveraging advanced business intelligence capabilities within Pinnacle, customers

can proactively reduce expenses through better management of their overall IT spending. "By deploying Pinnacle Online in the cloud, PAETEC has made it easier for enterprises to procure and run the application. They can focus on making the right business decisions, and not have to make additional investments in managing additional hardware and software," says Needham, adding that PAETEC is considering other SaaS applications in the future.

The big advantage for PAETEC—and any enterprise, service provider or not—is the ability to create a private cloud that lets customers (or users) access data over their network. "Thanks to PAETEC's multiple state-of-the-art data centers, we're able to offer our customers a variety of private cloud computing options," says John Chapman, Senior Vice President of Marketing with PAETEC. "Despite the fact that their hardware resides off-premises, these customers are able to forego the public Internet and access their data over our private network, where we keep it secure and separate from other customers' data."

The result is an infrastructure optimized for cloud computing, one that coalesces a variety of business and technological advantages. On one hand, companies enjoy reduced costs through better utilization of both computing and human resources, along with a higher level of agility for business responsiveness. On the other hand, IT departments derive benefits through increased automation, reduced power consumption, and easier management of resources. The journey to cloud computing is one worth the trip. ∎