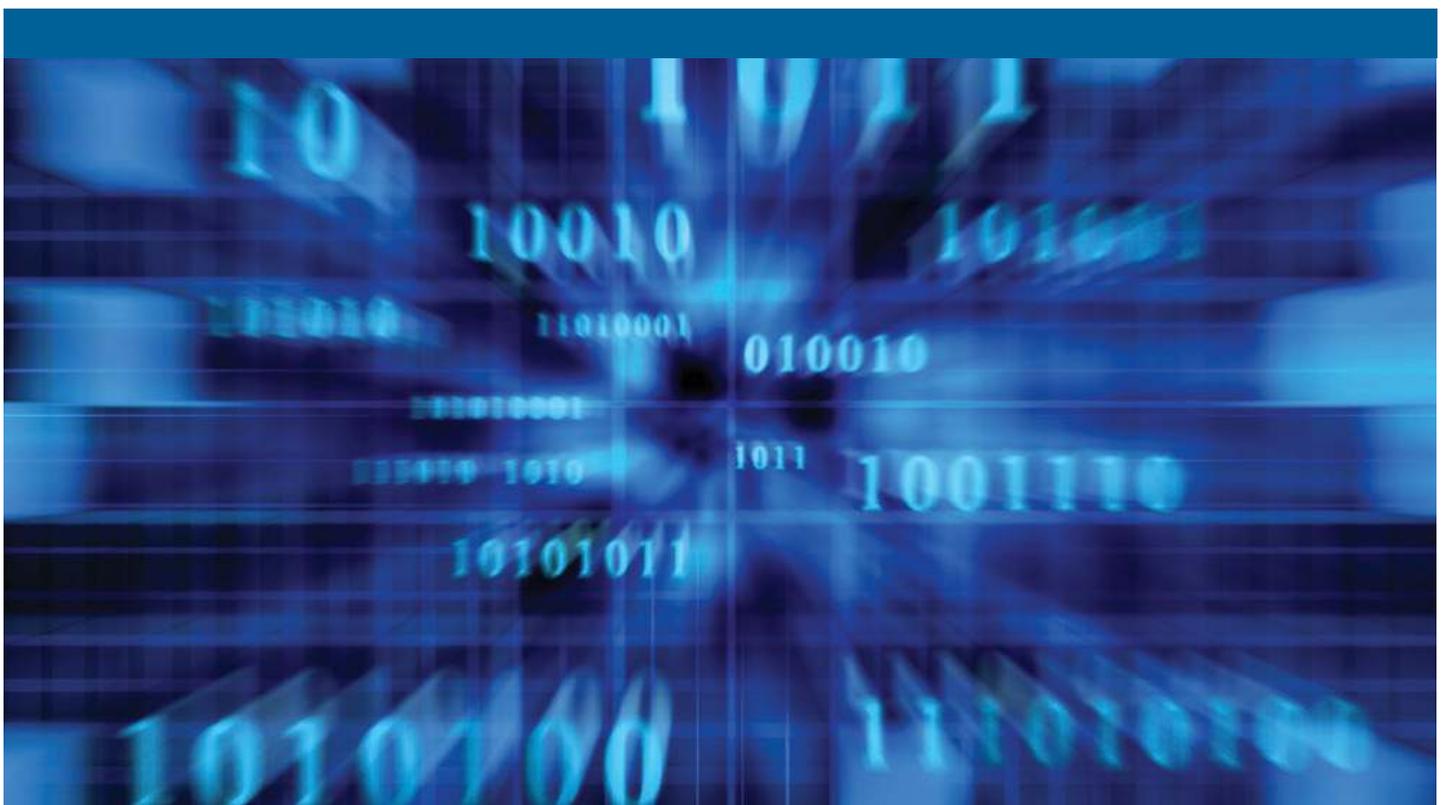


## Executive Report

# How Big Internet Organizations Can Scale IT Infrastructure Securely, Rapidly and Inexpensively



“The engineers behind today’s mega data centers – some call them internet data centers to differentiate them from earlier ones – are turning to a host of new strategies and technologies to cut construction and operating costs, consume less energy, incorporate greener materials and processes, and in general make the facilities more flexible and easier to expand.”<sup>1</sup>



### **Big Internet’s Quest – Scaling with Unprecedented Innovation, Speed, Agility and Reliability**

Big internet powers the world’s economy. It also regularly revolutionizes the way we live, work and play. Amazon and eBay have changed the way we shop. Facebook and Twitter have changed the way we interact with each other. Kickstarter has changed the way startups raise money. Netflix and Hulu have changed the way we watch movies and TV. These innovative, world-changing technology companies generate huge – and growing – demand for big data and big content.

Big internet companies need big data centers - to provide the following:

- Scale massively and with unprecedented speed.
- Deep and powerful connections between every layer of the data center.
- Low-cost interconnection.
- Exponentially increasing performance and personalization.
- Energy efficiency.
- Help keeping it simple.
- Provide security and 100% uptime.

**The ability to scale massively and with unprecedented speed** – No one knows better than big internet companies the massive scale and unprecedented speed with which data usage is growing. Every minute, we send over 204 million emails, download 50,000 apps, view 6 million Facebook posts and stream 62,000 hours of music. The reality is that big internet firms need the ability to scale massively and with unprecedented speed.

<sup>1</sup>Joe Weinman, “Why data centers have a big impact on the economy,” GigaOM, 27 Oct 2012. <http://gigaom.com/2012/10/27/why-data-centers-have-a-big-impact-on-the-economy/>. Also Quentin Hardy, “Hard Times Could Create a Tech Boom,” New York Times, 7 Nov 2012. <http://bits.blogs.nytimes.com/2012/11/17/hard-times-could-create-a-tech-boom/>



“Amazon, Google, Microsoft and Yahoo are trying to keep up with the ever-growing demand for internet services like searching, image and video sharing, and social networking. But they’re also betting on the explosive growth of web-based applications that will run from the cloud.”<sup>2</sup>

Many internet firms are already leveraging their ability to scale fast as an enabler of growth and innovation. “Increasingly, large data centers at large web service providers set the standard for data center design and operational excellence. Their application of infrastructure and software technologies is on the cutting edge and is a key enabler to growth, innovation and monetization strategies.”<sup>3</sup>

Overall, in order to accommodate the scale and speed at which internet companies are growing, the data center must be more dynamic. “The enterprise data center is undergoing a transition to a more dynamic model that can accommodate frequent and rapid business change. In these data centers, melding the management and expansion of data and storage networks will be critical as the changing IT landscape drives greater growth in mobility. In addition, an explosion in content and the use of public, private and hybrid cloud computing are driving the transition to a more dynamic data center.”<sup>4</sup>

**Deep and powerful connections between every layer of the data center –**

Because cloud computing is one of the drivers of big internet’s need for speed and scale, today’s data center designs must support rapidly evolving cloud services. And that means a powerful, deep network. “The growing importance of the network has been a central theme in the history of modern computing. Now with cloud computing, the network has become paramount. Without the network, there is no cloud.”<sup>5</sup>

**Low-cost interconnection** – In addition to deep and powerful connections between layers in the data center, big internet companies will need interconnection with other data centers as well. Interconnection allows internet firms to provide their customers with fast, reliable and cost-effective services. Peering – one type of interconnection – virtually eliminates geographic boundaries and network confinements associated with data exchange, and expands cloud platform viability and cost-effectiveness. For big internet companies, peering enables increased redundancy, increased traffic capacity, increased routing control and improved performance.

<sup>2</sup>Randy H. Katz, “Tech Titans Building Boom.”

<sup>3</sup>“Inside The Data Center Technology Powering Six Top Social Media Sites.” <http://wikibon.org/blog/social-media-data-center-technology/>

<sup>4</sup>IDC Technology Spotlight, “The Dynamic Data Center Network in Transition: Building Scalable, Open Fabrics,” September 2011. [http://www.brocadegrid.com/fabrics101/FlowCommunications/assets/US/pdfs/wp\\_idc\\_dynamic-data-center.pdf](http://www.brocadegrid.com/fabrics101/FlowCommunications/assets/US/pdfs/wp_idc_dynamic-data-center.pdf)

<sup>5</sup>Juniper Networks, “Cloud Ready Data Center Network Design Guide.”



**Exponentially increasing performance and personalization** – At the same time that consumers demand fast, reliable service, they also demand increasingly complex, richer web experiences. Delivering those experiences requires a higher level of performance. A recent report by Forrester indicates that “companies are struggling to keep up with rising expectations for web responsiveness, rich content and support for mobile devices.” In addition, “most web teams underutilize services that can improve the performance of their web and mobile architectures. Instead, most web teams prefer to expand the capacity of their internal architectures.”<sup>6</sup>

**Energy efficiency** – There has been increasing public scrutiny around the energy usage of data centers, and there are great opportunities to increase energy efficiency in the data center and generate significant cost savings in the process. Dean Nelson, vice president of global foundation services at eBay, quoted by GigaOM, says, “With great power comes great responsibility. Internet companies need to use their immense technological prowess and bargaining power to make their chosen – and very lucrative – business as environmentally friendly as possible. Companies spend tens of millions of dollars, if not billions, trying to achieve maximum efficiency,” he says, and “we do have a lot of leverage, we can influence a lot of things.”<sup>7</sup>

**Help keeping it simple** – In an environment where internet companies manage billions of searches, uploads, downloads, posts, shares, likes, purchases, check-ins and many other activities, complexity is increasing. Keeping operations simple wherever possible is key. For example, “In computing at this scale, the data center is a factory floor,” says Frank Frankovsky, vice president of hardware design and supply chain at Facebook. “We try to keep things simple.”<sup>8</sup>

<sup>6</sup>Forrester Research, “Shifting Performance Strategies and Solutions for Mobile and Web Delivery,” August 2012. [http://www.akamai.com/html/industry/retail\\_consumer.html](http://www.akamai.com/html/industry/retail_consumer.html)

<sup>7</sup>Derrick Harris, “With data centers, web giants have great eco-responsibility,” GigaOM, Sept. 26, 2012. <http://gigaom.com/cloud/with-data-centers-web-giants-have-great-eco-responsibility/>

<sup>8</sup>Quentin Hardy, “Facebook’s 5% Solution in Data Centers,” The New York Times, Oct. 5, 2012.



## Colocation Facilitates Growth for Big Internet Companies

Data center colocation offers a proven path for big internet companies to obtain the ability to scale massively and with unprecedented speed, deep and powerful connections between every layer of the data center, low-cost interconnection, exponentially increasing performance and personalization, energy efficiency, and help keeping it simple.

The pace of data center innovation is increasing, says James Hamilton, vice president and distinguished engineer at Amazon Web Services. “We’ve seen more innovation in the last five years than in the previous 15. That innovation is driven by cloud service providers and very high-scale internet applications like search. The focus on innovation has centered around infrastructure – driving down cost, increasing aggregate reliability and reducing resource-consumption footprints.”<sup>9</sup>

Data center colocation can be a powerful source of infrastructure innovation. This Netflix story provides a good example of why a big internet company would choose to collocate its data center: “Netflix’s business is growing rapidly and experiences very uneven demand (highly skewed toward evenings, when, by some accounts, its video streaming service represents 29 percent of all internet traffic). In this kind of environment, Netflix didn’t want to experience service interruptions due to its inability to build data centers fast enough. Even though Netflix is a highly technical organization, it wasn’t as good as the provider when it came to automating data center operations. Rather than try to replicate that ability, Netflix chose to leverage a highly efficient, low-cost expert provider.”<sup>10</sup>

### Colocation enables Internet firms to:

- Leverage innovative data center design, including leading-edge energy efficiency.
- Scale up bandwidth more quickly.
- Realize lower latency, consistent performance and reliability.
- Achieve uptime and reliability goals.
- Leverage flexible architecture for diverse requirements.
- Strategically leverage multiple markets and locations.
- Take advantage of interconnection.
- Maximize the cost-effectiveness of their data center operations.
- Ensure security and 100% uptime.

<sup>9</sup>James Hamilton, presentation at Amazon Technology Open House, June 2011. [http://mvdirona.com/jrh/TalksAndPapers/JamesHamilton\\_AmazonOpenHouse20110607.pdf](http://mvdirona.com/jrh/TalksAndPapers/JamesHamilton_AmazonOpenHouse20110607.pdf)

<sup>10</sup>Bernard Golden, “Cloud Computing Done the Netflix Way,” CIO, April 5, 2012. [http://www.cio.com/article/703627/Cloud\\_Computing\\_Done\\_the\\_Netflix\\_Way?page=1&taxonomyId=3024http://bits.blogs.nytimes.com/2012/10/05/facebooks-5-percent-solution-in-data-centers/](http://www.cio.com/article/703627/Cloud_Computing_Done_the_Netflix_Way?page=1&taxonomyId=3024http://bits.blogs.nytimes.com/2012/10/05/facebooks-5-percent-solution-in-data-centers/)



## Leverage Innovative Data Center Design, Including Leading-Edge Energy Efficiency

“A 2007 study by the U.S. Environmental Protection Agency (EPA) reported that typical enterprise data centers had a power utilization efficiency (PUE) of 2.0 or more. This means that for every watt used by servers, storage and networking equipment, an additional watt is consumed for cooling and power distribution. The study suggested that by 2011 most data centers could reach a PUE of 1.7, thanks to some improvements in equipment, and that with additional technology some facilities could reach 1.3 and a few state-of-the-art facilities, using liquid cooling, could reach 1.2.”<sup>11</sup>

Today, the typical data center still runs at a PUE of 1.75-2.0, but industry-leading colocation providers with innovative designs can reach 1.25. That represents less energy consumed to power the data center relative to expenditures on cooling and operations. With increased energy efficiency and a relatively smaller carbon footprint, these innovative designs can bring critical cost savings as energy costs continue to rise.

For example, CyrusOne employs a computational fluid dynamics (CFD) assessment to gauge the optimal floor layout for high-density/high-performance computing requirements. According to the CFD results, the most intelligent and effective use of floor space is to achieve superior efficiency in power and cooling technology, protecting the client’s hardware components and reducing power costs by targeting energy-efficiency metrics. It turns out what’s good for the environment is good for business too: At Amazon Web Services, for example, 31% of total monthly data center costs are functionally related to power, and those costs are trending up while server costs are trending down.<sup>12</sup> The right data center provider can help reverse this trend.

## Realize Consistent Performance and Reliability

Internet users expect always-on, 100% reliability. When severe thunderstorms in the mid-Atlantic states caused temporary shutdowns at one data center, the online dating service WhatsYourPrice.com was out twice for two-hour periods. “The outages prompted a flood of complaints from many of WhatsYourPrice.com’s 400,000 active members and damaged the dating site’s reputation for reliability,” said CEO Brandon Wade.” In response, WhatsYourPrice.com deployed servers in two colocation facilities.<sup>13</sup>

<sup>11</sup>Randy H. Katz, “Tech Titans Building Boom.”

<sup>12</sup>Rich Miller, “A Look Inside Amazon’s Data Centers.”

<sup>13</sup>Lucas Mearian, “Disaster Recovery Plans Get New Urgency,” CIO.  
[http://www.cio.com/article/711043/Disaster\\_Recovery\\_Plans\\_Get\\_New\\_Urgency?taxonomyId=3089](http://www.cio.com/article/711043/Disaster_Recovery_Plans_Get_New_Urgency?taxonomyId=3089)



An industry-leading data center provider should guarantee 100% uptime. To do that, CyrusOne relies on a meshed design integration with no single point of failure. For example, cooling or electrical systems can withstand a loss of two legs and yet the system still remains fully operational. When analyzing a data center provider's ability to provide latency, consistent performance and reliability, big internet companies should ask for:

- 2N redundancy of all mechanical and electrical systems.
- A distributed, redundant electrical design with multiple levels of redundancy within the same data hall.
- Carrier-neutral facilities to ensure uniform connectivity and uptime protocols.
- Multisite connectivity across the United States and around the globe.
- 100% uptime service-level agreements (SLAs).

### **Scale Massively and with Unprecedented Speed**

One of the most compelling reasons for data center colocation is the ability it gives big internet companies to scale massively and with unprecedented speed. Internet firms should expect their data center provider to provide data center space just in time to match demand.

There are a number of elements to CyrusOne's Massively Modular<sup>®</sup> approach that enable the rapid deployment of a data center:

- Investing in common infrastructure (land, building shell, substation, fire protection and management systems) upfront.
- A modular and scalable design facilitates easy "plug-in" of electrical and mechanical subsystems when needed.
- Building increments scalable to meet customer requirements.
- Infrastructure on the outside, computers on the inside.

Another aspect of being able to scale quickly is contractual and technical flexibility. CyrusOne's best-fit solution grows and adapts with big internet clients as their data center needs evolve.

When looking for a colocation services provider, internet firms should look for:

- A secured, shared infrastructure that can deliver lower costs and faster responsiveness when the client is changing power or size requirements.
- State-of-the-art technology systems that provide low to very high density solutions tailored at the rack level; redundancy is tailored to the rack level as well so the client can choose the level of power redundancy (2N, N+1, 1N).
- A flexible contract that allows the client to grow into its purchased power and space over a given time period.
- Flexible architectures (such as flexible fabric and mesh design) for diverse requirements, so clients can maintain control over how their data centers work.



When looking for a data center provider, expect the provider to respond at the speed of business rather than the speed of IT. In a world in which consumers expect instant results (and with extreme competition to deliver those results), being the first to market with a new service offering can be a huge competitive advantage.

### **Take Advantage of Interconnection**

A data center that can offer its clients interconnection at three levels – interconnection to the client’s servers at other data centers, interconnection to partners at other data centers and interconnection to other network providers through peering – enables increased redundancy, increased traffic capacity, increased routing control and improved performance.

Big internet companies should ask data center providers about their interconnection offerings. CyrusOne has built the nation’s first statewide internet exchange, or National IX. For big internet companies, the benefits of colocation at a data center with access to a national internet exchange include lower transit costs and the ability to interconnect with a wide variety of carriers.

CyrusOne also has a peering exchange that links most of its data centers. Peering is a core operational protocol by which global internet enterprises hand off traffic to autonomous networks via the internet from multiple physical locations worldwide. Peering virtually eliminates geographic boundaries and network confinements associated with data exchange, and expands cloud platform viability and cost-effectiveness.

### **Strategically Leverage Multiple Markets and Locations**

Selecting a location involves many important considerations, including its proximity to population centers, power plants and network backbones; the source and price of electricity in the region; and the average temperatures at the location. As there can be many potential locations and issues to consider, the selection process can be extremely involved and time-consuming.<sup>14</sup>

<sup>14</sup>Goiri, Lez, Guitarty, Torresy and Bianchini, “Intelligent Placement of Datacenters for Internet Services.” <http://www.cs.rutgers.edu/~ricardob/papers/icdcs11.pdf>



### **Maximize the Cost-Effectiveness of Data Center Operations**

One of the main benefits of colocation for big internet organizations is reduced capital cost. With the right data center provider, the true expenses associated with colocation are typically significantly lower than the construction and operation of their own data center. That's because leading colocation service providers are focused on driving down capital and operational costs.

### **Big Internet Companies Power the World Economy, But Not Alone**

By hosting enterprise operations in the cloud; facilitating social networks; giving access to the world's information; and enabling e-commerce, entertainment and productivity, big internet companies power the world's economy. But they don't do it alone.

To succeed, internet firms need internet data centers. Some firms build and operate their own. But colocation can be a powerful source of infrastructure innovation. It can lower total cost of operations; increase an internet firm's agility and the reliability of the services it provides, and perhaps most significantly give big internet companies the ability to scale massively and with unprecedented speed.



## About CyrusOne

CyrusOne specializes in providing highly reliable, flexible and scalable enterprise data center colocation that meets the specific needs of customers across its broad portfolio of carrier-neutral data center facilities in the United States, Europe and Asia. CyrusOne employs its Massively Modular® engineering and design approach to optimize design and construction materials sourcing and enable just-in-time data hall inventory to meet customer demand. The company engineers its facilities with redundant power technology, including an available 2N architecture.

CyrusOne customers can mix and match data centers to create their own production and/or disaster recovery platforms by combining facilities via the low-cost, robust interconnectivity provided by the CyrusOne National Internet Exchange (IX).



## About the Author

### Kevin Timmons

#### Chief Technology Officer

Kevin Timmons is responsible for defining and sharing the technology roadmap for the company. He is also responsible for the site selection, design and construction of CyrusOne's worldwide data center assets.

Before CyrusOne, he led Microsoft's global data center team as general manager, data center services. In his two years at Microsoft he fundamentally changed the way that the company designed, developed and operated of its worldwide data center assets. Under his leadership, Microsoft opened four of the world's largest data centers. These facilities were recognized for their innovation and industry-leading cost performance.

Kevin's background also includes over 10 years of experience in real-time embedded systems software development with several leading aerospace firms such as Lockheed and Marconi Dynamics. He was instrumental in the development of the avionics display systems for the YF-22 fighter program, which was later selected by the U.S. Air Force as their next-generation fighter platform, the F-22 Raptor.

