

The Changing Data Centre





Trade costs have skyrocketed, virtualization is driving up energy consumption and generating more heat, certification requirements are increasingly stringent, permit requirements more prolific, and uptime expectations higher.

By Denise Deveau

Economic uncertainty is doing nothing to stop the onslaught of data that organizations will need to manage; or the investments that service providers are making in top-of-the-line data centres.

“Despite the downturn organizations are still building and renovating or upgrading their data centres,” says Matt Stansberry, New York-based Uptime Institute’s director of content and publications. “Demand doesn’t stop when the economy slows down.”

A big reason for that is the ever-escalating data boom. In a recent survey, ITBusinessEdge.com found that 28% of businesses said they expect data to grow faster than 25% this year. Since it is unlikely any IT department can justify that kind of budget increase, it is easy to understand why there is also a growing movement to infrastructure outsourcing and/or cloud-based services.

There has definitely been an uptick in the demand for outsourcing data centre services, notes Ron Ethier, vice president, data centres and managed services for Primus Telecommunications Canada Inc. in Toronto. “A lot of that is being driven by the fact there are a number of aging data centres in North American enterprise portfolios that are in need of refurbishing or rebuilding.”

This time around; however, organizations that have kept data centre resources under their own wing are finding that getting up to speed is a much different ball game.

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“There are also a lot more rules and regulations around access

and safety, and everything has become so highly specialized making it difficult to find and retain qualified staff,” Ethier says. “This has made running your own data centre more cumbersome.”

The time factor is also a hurdle of mammoth proportions, he adds. “Facilities aren’t developing as quickly as IT infrastructures. It takes an organization two to three years to complete an upgrade. In the meantime, data demands are escalating, and organizations simply can’t add 25% capacity in 60 days.”

The biggest challenge in data centre management today is the fact that there are more moving parts than ever.

Given all these factors, it is no surprise that more and more organizations are migrating to multi-tenant facilities. But expectations are extremely high indeed, Ethier says. “They have to operate to the highest standards available.”

The certification conundrum: Primus Business Services’ newest project in Markham, Ont. is the ideal case study in what a top tier data centre should have. This particular facility has been awarded Uptime Institute’s Tier III Certification for Design Documents, making it the only multi-tenant data centre in Canada to achieve the certification for both design and construction.

Tier III certification is one a veritable catalogue of certifications that today’s data centres need to add to their selling proposition. Table stakes can also include compliance with PCI (payment card industry) and SSAE (Statement on Standards for Attestation Engagements) standards, along with SAS (Statement on Auditing Standards), SOC (Service Organization Control), BICSI (Building Industry Consulting Service International) and ISO (International Standards Organization).

For many organizations, certifications are too expensive to get on their own, and the complexities are simply getting beyond in-house capabilities, notes Spencer Rasmussen, director of facility services at Tenzing, an ecommerce and cloud services provider based in Toronto. “Today, clients require multi-layered apps, multiple tiers, and strong security offerings, and uptime expectations are pretty much 100% across the board now.”

Mixing the models: Given fluctuations in business cycles, organizations are also looking for more flexible, modular approaches to data centre planning, says Duncan Campbell vice president, worldwide marketing, converged infrastructure for HP in Cupertino, Calif. “They don’t want to be shackled to old processes.”

Modular containers or data-centre-in-a-box-type systems are increasingly popular add-ons in industries where demand ebbs and flows (e.g. film animation). Many opera-

tions are also looking to hybrid models, in which resources are managed by different tiers depending on availability needs.

“Not every data centre has to be at the maximum tier,” Campbell explains. “Today, organizations are picking their tiers based on the mission criticality of their applications. You could use a combination of data centres, private cloud and public cloud, depending on your needs. The whole point is how dynamic you can be and how workloads can be moved with different delivery mechanisms.”

The biggest challenge in data centre management today is the fact that there are more moving parts than ever. “Five years ago the right hand wasn’t talking to the left,” says Joe Oreskovic, strategic accounts manager for Eaton Power Quality Company in Toronto. “IT and network individuals were putting in what made sense from a networking perspective, leaving facilities managers struggling with how to support it.”

Now it is a different approach, he says. “If you are having a rack discussion, power and cooling are not far behind.”

The tide is definitely shifting in more ways than one, says Chris Willis, Americas senior director of cloud for Hitachi Data Systems in Toronto. “In the past, server provisioning and management was the bottleneck. Now it is power. In other words, the bottleneck has moved on to a different group. That has been happening since the mainframe days. Now organizations are just paying someone else to take over responsibility for the complexities so they don’t need to worry about power limitations, rack space or cooling.”

The power factor: In today’s world, the lion’s share of operating expense is energy costs. “Salaries and service contracts pale in comparison,” says Ian Seaton, global technology manager for Chatsworth Products, Inc. (CPI) in Westlake Village, Calif. “Controlling energy costs has become a competitive business initiative and is the key to maintaining margins and business survival.”

According to Oreskovic, in 2004, infrastructure became more expensive than servers. By 2008, energy also exceeded the cost of servers. Much of that is attributable to virtualization and associated cloud topologies, he says. “What we’re ending up with is a trend towards higher per sq. ft. density and higher per rack density.” While density may be more efficient, it creates issues on several



Primus Business Centre’s newest project in Markham, Ont.: The multi-tenant facility is now open for business.

Uptime Institute Data Centre Industry Survey Highlights

- 80% of respondents have built a new data centre in the past five years
- 55% increased their data centre budgets in 2011
- Organizations plan to handle demand for more infrastructure in the next 12 to 18 months through:
 - Server consolidation (66%)
 - Mechanical infrastructure updates/upgrades (42%)
 - Deploying workloads to the cloud (30%)
 - New builds (29%)
 - Leasing collocation space 24%
 - Deploying container/modular/prefab solutions (10%)
- Strategies to increase efficiencies at existing sites include:
 - Cold aisle/hot aisle containment (72%)
 - Raising inlet air temperature (58%)
 - Detailed power monitoring and benchmark improvement (46%)
 - Power management of features on servers (42%)
 - Variable frequency drives on chillers, CRAH or pumps (41%)
 - Modular data centre design plans and components (28%)
 - Air side economization (27%)
 - Water side economization (20%)
 - Liquid cooling (13%)
 - Direct current power (5%)
- 90% of organizations are looking at or deploying DCIM software
- Annual growth rate of data processing within data centres is 33% for IP traffic, and 50% for storage (Source: CNBC Data — 2015 projections IT Infrastructure Loads)

fronts, Oreskovic explains. “Yes you can get 8,000 times more computing power for about a 30% increase in energy use. But that energy is given off as heat. Then you have to pay money to rid of it.”

He equates the heat generation of one blade server to cranking a stove on high then trying to cool it down. “That’s occurring 100 times over in a data centre. It’s like putting two or three stoves into each rack.”

Cogeco Data Services’ latest data centre expansion in the downtown Toronto market is a rarity for that very reason. “The fact is power is a key issue in the downtown area,” says Tony Cicireto, president of Cogeco Data Services, Toronto. In Cogeco’s case, the new space will be running on a closed loop system which will drive very efficient power utility numbers.

“Servers processing more data consume more electricity,” confirms Stew Munns, CPI’s national sales manager for Canada in Vaughan, Ont. who estimates that cooling systems account for 30-40% of energy consumption in a data centre.

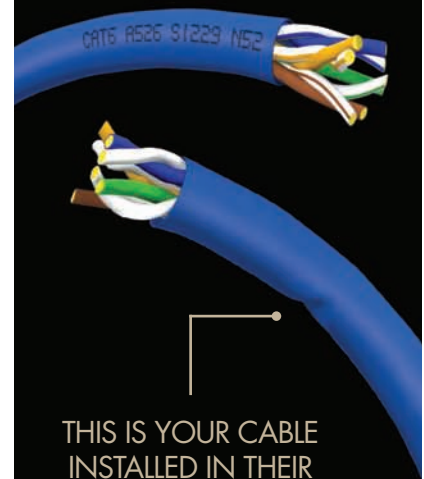
The push is on for designs to capture hot exhaust air and channel it directly to cooling systems. Options often considered include hot aisle/cold aisle containment systems, chimneys cabinets (aka vertical exhaust ducts) and air dams to prevent air leaks at openings.

“It’s all about air isolation,” Munns notes. “Newer designs no longer exhaust hot air into the room so you can keep things at a homogeneous temperature and your air conditioning runs far more efficiently.”

Chasing down the cable runs: Ethier says that while there have not been any huge changes to the essentials of cable plants, there is a lot going on with what is being put inside cage spaces. “A lot of customers for example are coming in with pre-terminated-type technology and fiber, so when we deliver services to a customer that has 10 cabinets in a cage for example, they may only need two cables.”

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How Photonic Switching Helps Converge Data Centre Fabrics

By Daniel Tardent

With the complexity of data centre technologies and fabrics increasing dramatically, companies are finding that collapsing their network designs to simpler, flatter architectures has dramatic benefits. But data centres are also moving just as quickly to fiber-optic cabling infrastructure and it's worth looking at how this is built out to see if there are ways to help simplify network building, reconfiguration and technology upgrades.

Specifically, photonic switches are now emerging as a way to replace L2/3 switches and routers in building the aggregation networks that connect between server clusters and between core routers and top-of-rack (TOR) switches.

The photonic switches that are ideal for the data centre are all optical switches, where the light signals are switched without being converted into electrical impulses, a process that adds latency. Data centre fabric architectures have been moving to fat tree or Clos designs that seek to interconnect up to thousands of servers using no more than four networking layers.

Functionally, this means that 1 Gbps top-of-rack switches are used for connection to servers with 10 Gbps links back to an intermediate cluster aggregation layer, and then to a data centre core routing layer at the top, which then connects to a metro or wide area network.

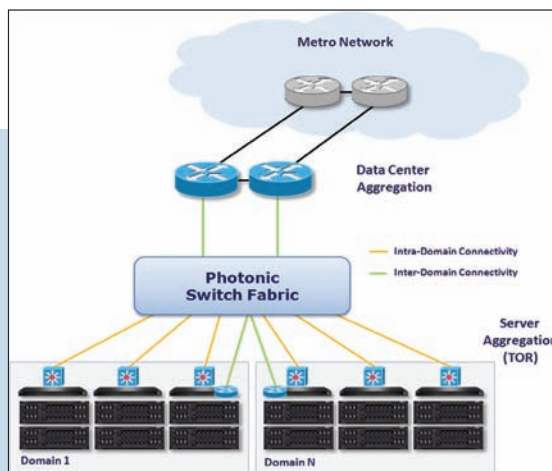
An alternate design would add layer 3 capabilities to interconnected clusters and replace aggregation switches with high-density photonic switches, switching at layer one.

This provides a high-density, low latency, full bandwidth aggregation fabric with some additional benefits.

Photonic switching supports complete automation of single-mode fiber management, resulting in cable management automation for the entire physical network northbound from top of rack switches. Any connectivity changes can be made on-demand from a network management console.

Additionally, the racks and clusters within the data centre can be reconfigured either on demand or cyclically to support real-time resource and bandwidth demands. For example, the data centre fabric can be dynamically reconfigured to accommodate instantaneous changes in demand, cyclical patterns throughout a day or a month, or potentially even predictive network traffic algorithms that can predict when specific resources need more bandwidth.

Building on this flexibility, data centre managers can creatively adjust the network to accommodate certain use cases. For example, if super low-latency is needed between specific server racks, a network manager could connect the racks directly by setting up a physical connection between the TOR switches. Similarly, changes could be made for disaster recovery or scheduled maintenance. Without the photonic switch, manual cabling or patch panel adjustments would need to be made to reconfigure the network.



The diagram above explains where the photonic switches are inserted. They can be updated from 10 Gbps to 40 Gbps to 100 Gbps and potentially beyond.

A photonic switching fabric operating at layer 1 is also transparent to protocols and line speed, thus further future proofing the data centre network when higher speeds are needed, either at the core or at the edge. These switches can be updated from 10 Gbps to 40 Gbps to 100 Gbps and potentially beyond without having to replace the aggregation layer.

Control Plane: For advanced automated applications, an integrated photonic-routing control plane is needed. In the absence of a centralized cluster aggregation layer this functionality gives the network manager a way to share the forwarding and routing information between clusters meshed together without paying a penalty on convergence time.

The control plane federates the collection and distribution of this information via the management control ports on the TOR switches. Similarly, a separate control plane is needed to manage multiple photonic switches connected in Clos-architecture for large multi-switch fabrics. Combining photonic control for the optical switch, together with routing control for the TORs, considerably simplifies the control plane for the end-to-end solution. This would also serve as the interface to the management plane that could provide inter-operability with other parts of the network and business operations systems.

The actual implementation of the integrated control plane will vary depending on the specific vendor's networking products and, for complex networks, may also require some collaborative development.

As data centres continue to grow in complexity and owners look for new ways to streamline architecture, optical switching is emerging as an alternative that delivers high-density, low latency, full bandwidth aggregation to simplify network building, reconfiguration and technology upgrades. Replacing aggregate switches with optical switching can provide additional benefits, including network automation that enables connectivity changes to be made from a central network management system.

In conclusion, photonic switching provides flexibility for dynamic reconfiguration to accommodate changes in demand and cyclical patterns and is scalable to meet future speed increase needs.

Daniel Tardent is the Director of Marketing and Product Line Management at CALIENT Technologies.



The Primus data centre has been awarded Uptime Institute's prestigious Tier III Certification for Design Documents.

There is also a growing focus on keeping cable pathways clean. It is not just about good housekeeping and easier maintenance, cabling can directly impact heating and cooling efficiencies, Munns explains. Overhead network cabling and modular busways for example can play a big part in avoiding air flow restriction under floors.

Having been in the service provider side of things for some time, Rasmussen says he always goes with overhead cabling. "We like to keep as little under the floor as possible, to eliminate the risk of damages from air conditioning leaks or condensation."

An interesting trend he has his eye on is converged fabrics to reduce density of cabling in racks. "It simplifies everything from managing to the cabling installation itself."

HP's Virtual Connect capability is another technology designed to address the increasing shift to virtualized environments. By using server and virtual machine connections to simplify storage, server and network management, it reduces cabling and energy costs.

In legacy environments, newer connectors enable data centres to condense equipment components while creating more space, says Jacob Macias, product manager for Cable Wholesale in Livermore, Calif.

Where a wholesale upgrade is not in the cards (or budget), Cable Wholesale has introduced a new line of 12- and 24-fiber MTP cables. These can bridge legacy 1Gbps/10Gbps networks over to 40Gbps/100Gbps networks, and act as the trunk line on a network backbone, which translates into fewer requirements, less labour and installation costs, and improved air flow.

"The wonderful thing is that you don't have to go through an overhaul of your legacy equipment to enable much more data flow," Macias notes. "You can do your equipment upgrades piece by piece by condensing one section at a time."

Keeping your eyes on the prize(s): Whether talking servers, networks or mechanical systems or infrastructure management, the real buzz is around all-knowing/all-seeing data centre infrastructure management tools (DCIM) that integrate multiple functions.

"Virtualization of the physical network is causing a lot of

complexity and change," says David Leith, technical product manager, for uptime software inc. in Toronto. "Physical wiring matters less and less in these new networks, because you can change things on the fly. This is putting a lot of pressure on maintaining visibility into all changes."

Increasingly, data centres are moving beyond point tools to single consolidated monitoring tools for all aspects of the facility, from networks and servers to databases and applications, he adds. "It really has to be a complete picture. Monitoring is pretty difficult if you can't cover off all the silos."

Even shifting power loads are part of the monitoring equation, Oreskovic says. "There used to be a time when applications resided upon the server and support was in the form of multiple and redundant power systems and cooling. Racks and zones couldn't go down. In a virtualized environment, you don't even know where the load is. With processors moving around, so do the power requirements and heat generation."

Eaton's Energy Advantage Architecture (EEA) has the ability to dynamically change to maximize the efficiency of the load

The push is on for designs to capture hot exhaust air and channel it directly to cooling systems. Options often considered include hot aisle/cold aisle containment systems, chimneys cabinets (aka vertical exhaust ducts) and air dams to prevent air leaks at openings.

demand. Users can program UPS profiles remotely, depending upon load requirements, Oreskovic explains. "It's like a hybrid car that provides battery power when you need energy savings, but you step on the gas you get raw horsepower. With clean power and good conditions it will operate at 95% efficiency."

Whether looking at servers, networks or heating/cooling systems, Oreskovic says the key for today's data centre lies in tackling more than one solution. "There are a lot of little things going on right now and a lot of different ways to skin the cat. No one solution can meet the needs of multiple data centres, so every team needs to do their own assessment and come up with the best solutions for them ... or put in systems that are flexible enough to accommodate as things change." **CNS**

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