

# Collaboration Times

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## A new ecosystem - The morph effect

Truth is, if you always think the way you've always thought, you'll always get what you always got. The same old ideas over and over again. The future belongs to those thinkers who embrace change, break new ground, forge new paths, and transform the way they think.

Thinkers use paradigm and paradigm shift to explain how some people or companies fail and others succeed. The ones who succeed are those who can embrace a new paradigm; the ones who fail are those who stubbornly cling on to traditional ideas because they have proved successful in the past, or because they simply refuse to see some new idea. The Swiss failed to patent or market the quartz watch, even though they invented it, because they couldn't shift paradigms. They couldn't shift paradigms because they couldn't see that there would be a market for another kind of watch besides the kind they'd been successfully making and selling for generations. The Japanese made all the money from the quartz watch because they didn't have an old paradigm that locked them into a way of thinking that precluded patenting and marketing quartz watches.



Pascal Turchi

Fact is like an individual species in a biological eco system, each member of a business eco system enjoys the success of the overall system, regardless of every partner's strength and contribution. A classic example is Walmart. Unlike organizations that depend mainly on their internal strengths and capabilities, this giant has aggressively pursued strategies that don't just further its own interests, but also promote the ecosystem's overall health. There are many forward thinking organizations that have forged ahead at what they do, outwitting competition, by working with partners whose specialized capabilities complemented, or the business goals aligned, to their own.

### The new ecosystem play.

Playing in a new ecosystem will benefit enterprises looking for innovative ways to penetrate markets.

The IT industry, for instance, already revolves around a partner ecosystem where technologies and IT services come together to deliver greater customer value as a whole than in parts. The next step is to broaden the influence by designing a more holistic ecosystem where an ICT ecosystem becomes central to the strategy. This would be the coming together of complementary technologies - telecom, SPs, system integrators, application & services partners and vertical technology players.

When a business occupies the **core of such an innovation network**, it will alter the way connected businesses that play around this ecosystem are managed, shaped and leveraged.

### Fundamental blocks that build this new ecosystem paradigm:

1. Place ICT at the core of this ecosystem. Enable vertical businesses to offer more value to customers by drawing from this core.
2. Create a confluence of vertical and horizontal businesses across segments and geographies which will result in a totally new level and new line of offerings to the end customer. At this stage, new business and revenue models will emerge.

3. Revolutionize the way the new offerings are delivered to end customers with a significant cost advantage as the ecosystem reaches a new level of maturity

The new ecosystem will comprise companies who use a common and collective platform of assets, processes and norms to co-create and thus deliver incremental value to customers, partners, themselves and the overall community. Over time, all the diverse constituents of this ecosystem will align investments, decide on mutually supportive roles and move towards a collective vision.

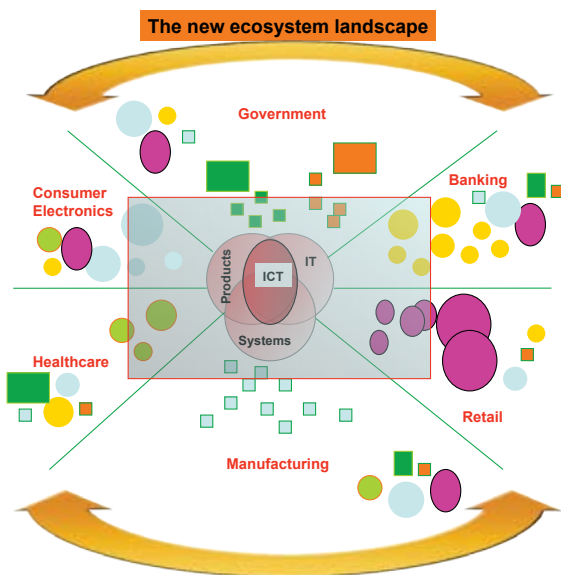
### The benefits of such an ecosystem play are manifold.

This opens up access to deal flows and opportunity fulfillment, generates customer pull for rapid innovation, finds accelerated entry to sophisticated capabilities worldwide and enjoy lower cost when entering new markets. This new ecosystem will also attract significant resources and fast-forward the change required to move to new opportunities. Designing and operating this new ecosystem will be a key competitive advantage as markets metamorphose.

As the right partners and resources come together and achieve unprecedented results, the new ecosystem will continuously reinvent and morph into more creative forms. This positive flux will successfully navigate challenges and the potential pitfalls of volatile markets, and turn every change into positive growth.

Source: Cisco

FIGURE 1



Source: Cisco

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# Consider Key Trends When Planning Data Center Strategies and Architectures

## Consider Key Trends When Planning Data Center Strategies and Architectures

Donna Scott, Paul McGuckin

Key trends in space, efficiency, cost of service, business continuity (BC) and virtualization are influencing data center strategies and architectures. Enterprises seeking to align data center strategies with long-term business goals should look for impacts and opportunities.

### Key Findings

- Most enterprises lack insight into energy use, a key cost of delivering IT services and a requirement for data center efficiency improvements.
- Enterprises want economies of scale in hosting services and, therefore, continue to consolidate and rationalize data center space and locations.
- Industry regulations often dictate BC and recovery requirements, which influence data center strategies for numbers and locations.
- Server virtualization is often implemented as a tactical measure to optimize data center space, enabling more business growth and better asset use.

### Recommendations

- Aggressively implement best practices in data center cooling to reduce operational costs.
- Know your industry's BC, disaster recovery (DR) and compliance regulations, and use them as inputs to your data center and application architecture requirements.
- Global enterprises should use the cost of IT service delivery as a driver for their hosting strategies.
- When building new data centers or optimizing existing ones, evaluate virtualization technologies at every part of the architecture to gain the most flexibility for hosting IT services.

### ANALYSIS

Market and industry trends are changing the way enterprises approach their data center strategies and develop data center architectures. An integral part of any strategy-building exercise is understanding these trends, assessing their implications for your enterprise, and using them to building an intelligent plan that aligns with the business. We have identified five key trends, which enterprises should consider when developing their data center strategies and architectures. We have also provided short-term recommendations where appropriate (see Note 1).

### Aging Data Center Portfolios

The majority of data centers, especially those built before 2002, lack the capacity and operational efficiency to meet the needs of the next 10 years. Older data centers are typically configured for 35 watts to 70 watts per square foot of power, whereas new data centers are configured for about 125 watts to 150 watts, expandable to 250 watts to 300 watts per square foot of power for future demands.

The strain on older data centers is an issue that emerged at the Gartner Data Center Conference in November 2007. More than 120 of those attending the session on data center power and cooling challenges rated

their most-pressing data center facility concerns. Insufficient data center power and cooling topped their lists. Power and cooling deficiencies combined accounted for 74% of users' concerns, up from 68% in 2006, 57% in 2005 and 46% in 2004. Many respondents indicated that during the next two years, they would relocate their current data center to a new leased or owned facility (37%), or would undertake an expansion or upgrade of their current facility (33%).

IT organizations with aging data center portfolios can use this analysis to determine how data center space can be maintained, modernized or replaced over the long term to meet business requirements, given cost or capital constraints. Additional recommendations include:

- Implement server virtualization to more effectively live within the power and space envelope of the data center (to extend its useful life).
- Consolidate multiple computer rooms and regional data centers into a smaller number of more-efficient and more-effective modern data centers.
- Analyze the termination of expensive outsourced DR contracts to help justify the building out of new data center space, especially where IT service recovery time objectives have dropped to less than 24 hours.

### NOTE 1

#### Data Center Strategy and Architecture Determines Facilities

Data center strategy and architecture determines the facilities that host IT services and the strategy for placement of those services. It also determines the resiliency strategy (for example, for service outages, site outages and data corruption). The prerequisite for an effective data center strategy is determining IT service SLAs by service-criticality tier. Most organizations have from three to five such tiers, with the highest for their most mission-critical services with the most stringent service levels, and the lowest for the less-critical services and lower service levels. When developing the strategy and architecture, an "end state" architecture may be developed; however, execution of that strategy typically takes place over many years, because it takes time to implement building and/or consolidating data centers and migrating services.

Source: Gartner

- Design and build out new data center space in modules or pods, which can defer capital expenditures until the capacity is required. In the meantime, keep operational costs at a level commensurate with the data center space being used.

*Action Item:* If your enterprise has an older data center, then assess its ability to efficiently meet space and energy demands, and assess whether extension, modernization or replacement/consolidation is most appropriate.

## Energy Efficiency

In the past, data centers would sometimes consume three times as much power as was ultimately used for powering servers, storage and networking equipment. Enterprises tolerated data center energy inefficiencies because of:

- Lack of visibility about energy use and costs by the IT organization
- Speed of new application and infrastructure deployments
- Uptime and reliability goals, which superseded efficiency

Today, conventional designs often use twice as much power as is ultimately used for powering these items. Leading-edge, energy-efficient data centers use only about 1.25 times the power overall, as is ultimately delivered to servers, storage and networking equipment. Much of this efficiency improvement is in the area of cooling; in a conventional data center, 35% to as much as 50% of the electrical energy consumed is used for cooling versus 15% in best-practice green data centers. However, just because you contract for new data center space does not mean you will get the most efficient design for power use.

Whether the goal is to make a facility more efficient or whether you're building a new facility, we recommend the following:

- Do not assume that new data center design, even from a top-tier firm, will

aggressively implement energy efficiency. Communicate your energy savings goals to design firms, and demand at least one design scenario that targets a power use efficiency rating (PUE) of 1.5 or less (thereby limiting data center infrastructure overhead to no more than 50% greater than the power delivered to servers, storage and networking equipment).

- Best practices in data center cooling can save 1 million kilowatt hours or more of electricity annually in most data centers. These practices include radically reducing bypass air, implementing hot and cold aisles and cold or hot aisle containment, and making maximum use of free cooling.
- Traditional, raised-floor-perimeter air distribution systems have long been the method used to cool data centers. However, mounting evidence points to the use of modular cooling (in-row or in-rack) as more energy efficient.

*Action Items:* Look at best practices in data center cooling to improve the energy efficiency of existing and new data centers. Work with design firms to achieve energy saving objectives.

## Reducing the Cost of IT Hosting Services

The most relevant IT service for a data center strategy is the hosting of business systems and applications. Data center hosting services provide the facilities in which to run the business systems and applications at the right level of quality, risk and cost to the customers. Typically, hosting costs can be driven down through economies of scale, so there's a tendency to rationalize the number of data centers to what is needed to run the business, and in locations that make sense from a perspective of quality, risk and cost to the business. Moreover, enterprises are clarifying their hosting policies so that there is consistency across data center locations.

Key recommendations include:

- If your IT organization is unclear about the cost of the service it provides, then develop a subledger for critical IT services so that the costs are understood. Educated allocations are a good start. Once you have an understanding of the cost of providing hosting services, decide which facility or facilities are best able to host your IT services.
- Rationalize and consolidate data centers to a small number, with appropriate backup (see next section). For global enterprises, this often results in two data centers in each geographic location. For an enterprise with most of its workforce in a single geography, this typically results in two data centers in a single geography.
- Where latency is insignificant, host the application/service in a single data center for worldwide access (with appropriate backup) to reduce hosting costs.
- Where application/service latency is noticeable/significant, host the applications in geographically regional data center locations so that performance is optimal for users in the region (but at a higher cost).
- Know that selecting a hosting location is not an exact exercise; it involves evaluating business operations locations, available real estate, technical considerations, costs and location risks.
- Downsize at the data center to reduce the overall costs of operations, work toward "lights out" operations, provide greater physical security and enable remotely managed operations. For some functions, such as tape handling and facilities management, a small staff should be retained. Locations of operations centers should be separate from data center facilities to facilitate remote event and incident management, and to ensure that it is not impacted by a disaster event.

*Action Items:* Examine strategies to reduce the costs of hosting solutions. If you don't know the cost of the services you provide,

then outline a high-level service portfolio, and allocate the costs of hardware/ depreciation, software, labor and facilities to them. Estimate when no hard data is available. Then, look across the data centers, and see whether there is significant variation in the costs of delivering; this will help in identifying the best locations from which to host services.

## High Availability, DR, BC and Regulations

Some industries (such as financial services) and certain government agencies regulate BC and DR service-level agreements (SLAs) for specific applications or business functions. For example, financial institutions in the U.S. are governed under the [“Interagency Paper on Sound Practices to Strengthen the Resilience of the U.S. Financial System, 2003,”](#) and are required to follow sound BC practices related to clearance and settlement activities. Other countries enforce similar requirements to ensure the strength of their critical financial infrastructures. It is essential for data center planners to understand the regulations and compliance requirements for their respective industries and companies, and to build a data center strategy that meets business and regulatory requirements. In fact, regulations often drive action and investment on the part of the board of directors to fund a data center strategy. These regulations have influenced companies with respect to the number and locations of their data centers, the distance among them and the architecture of the applications.

Besides regulations, other high-availability/ DR/BC factors influencing data center strategies include:

- Assess and tier IT services according to mission criticality, identifying availability and the recovery SLAs and strategies for achieving them. For the more mission-critical application portfolio (typically around 20% to 30% of the portfolio) with more-stringent SLAs, consider insourcing your DR as a more effective, less-

expensive means of achieving recovery time and point objectives.

- To reduce DR hosting costs, implement an architecture that has a primary facility backed up by one that runs development and tests under normal circumstances, and that also is used for DR testing and recovery.
- Implement more-granular DR failover strategies so that individual applications and groups of applications can failover independently, thus increasing flexibility and enabling the use of the DR resources for staging migrations and upgrades, reducing planned downtime.
- When your data centers are outside synchronous replication limits (around 100 kilometers [km]), consider implementing three hosting sites versus two. One site is primary, one is a data “bunker” that is within 100 km of the primary site and synchronizes data with the primary site, and the third is the target DR site, further away, but with asynchronous replication to it. If a disaster occurs at the first or second site, then the DR site would complete data synchronization with the third site. If both fail, however, then data loss would occur.
- Where business requirements for 24/7 availability are increasing, steer application architectures toward more-active processing across multiple site locations.

*Action Item:* Understand the requirements and regulations applicable to your industry, as well as the SLAs required by your business, and build a data center strategy accordingly.

## Virtualization

Enterprises are deploying virtualization across all IT components – servers, storage, networks, applications and databases. Virtualization abstracts software from hardware and enables greater flexibility in processing IT services on different resources and at different locations at lower hardware

and maintenance costs. In addition, server virtualization can extend the use of existing data center space (and the existing power and cooling capacity provided by the data center) and thus increase efficiencies (see section on Aging Data Center Portfolio).

In addition to traditional deployment of shared infrastructure and virtualization, recommendations include:

- When building new data centers (or performing significant upgrades), consider virtualization technologies and architectures that optimize cost efficiencies and agility. For example, the DR location can be designed to include input/output (I/O) virtualization (across server and network and storage connectivity), and can be rapidly reconfigured to run production applications – in a shared environment with development/test. Although this solution can be retrofitted into current environments, it often requires a rip-and-replace approach (with associated downtime), which is difficult to justify for existing environments. However, they should be evaluated seriously when building out new data center space, because change and migration will occur as a result of the new data center architecture.
- Consider using virtualization as the foundation for a consolidated, shared test lab environment to reduce the cost of hardware, software and space. Moreover, consider test lab solutions that enable planning for capacity and self-service provisioning to reduce labor costs.
- Analyze whether the use of server virtualization for the DR environment (both physical and virtual) can cut DR costs and reduce recovery time by enabling faster repurposing. Virtual machines can be replicated and kept “hot,” or they can be backed up to disk or tape.

*Action Items:* Consider investments in virtualization and their benefits – efficiencies, flexibility in hosting IT services and fast provisioning both for existing data centers and new ones. Moreover, virtualization is the foundations of the real-time infrastructure, where business demand for IT services drives automatic and dynamic allocation and optimization of IT resources to meet SLAs. Although data-center-wide, real-time

infrastructure does not yet exist, there are opportunities to lay the foundation when planning new data centers.

### Bottom Line

A data center architecture lays out a plan for the number and location of facilities and a hosting and recovery strategy that meets business and regulatory requirements.

We recommend clients consider the aforementioned key trends when building their strategy and implement the actions outlined in this note.

Gartner RAS Core Research Note G00162830, Donna Scott, Paul McGuckin, 24 November 2008

## Virtualization - The Road Leading To Cloud Computing



**Douglas Gourlay**  
Vice President, Data Center Solutions, Cisco

There is a difference between the words “Virtual” and “Virtualization”; we often mix the two up with confusing results.

*The word “Virtual” refers to the creation of effective illusions.*

Virtual LANs give the illusion of network privacy while in reality they are on a shared network segment. Virtual Applications may run on a mobile device while on-the-go and virtually transfer to the desktop when in the office. Then you have Virtual Reality which is simply ‘fake real life.’ Telepresence is a form of Virtual Reality – it enables global communications with such a high level of interaction and experience that it gives participants the illusion of being in the same room, not continents apart.

*All these “virtual” examples boil down to the illusion of something.*

So, how do we define “virtualization”? Some have used the previous virtual examples as definitions for Virtualization, but Virtualization to most IT audiences is all about the virtual machine (VM) – an operating system and application packaged together as one system hosted on a physical server that is shared with other VMs. However, virtualization is more than the illusion of a dedicated machine – it is a system and an architecture.

Virtualization is about the fundamental shift from hardware systems to the use of software based systems and architectures. In short, now IT can do in software (logically) what they used to have to do in hardware (physically). With virtualization we can create software architectural definitions that allow for a high degree of change, variability, and complexity to effectively isolate one computing resource from another.

The key to enabling multiple virtual machines to run on a single physical server is the Hypervisor – a thin operating system that runs on the host machine and provides the interface between the VM and the hardware. It is the Hypervisor that provides VMs an isolated and secure environment, as if they were each on their own discrete hardware. Best of all, these VMs are not bound to any specific server hardware.

So, you may ask – *why is this important?*

Well, here are three main immediate visible positive business impacts of virtualization:

- 1) *Multiple VMs per physical server.* Rather than binding one O/S and application to each server you can now run multiple VMs on each server. The benefit is clear when you realize that most workloads consume only a fraction of the physical server capabilities on which they reside and that by matching complementary workloads in terms of processing and memory consumption, an IT organization can reduce the number of physical servers needed to support the operations of a business.
- 2) *Virtual Machine Mobility.* VMs can move from one physical server to another. If you have enough network capacity between two servers you can move the workload statefully, without dropping client connections, and without changing the network addresses used for global communications. Again, this provides better and more efficient utilization of the IT resources, this time across multiple physical servers and while user sessions are active. This benefit comes in handy when extra capacity is needed during peak user access.

3) *Homogenization of the x86 server.* Prior to Virtualization, server choices and applications went hand-in-hand or were locked-in because applications were developed to work with specific hardware. In some cases, the hardware addresses associated with the server were even used to license the applications. The advent of virtualization gave flexibility to IT, allowing them to effectively remove the vendor lock-in and decouple applications from the physical servers.

Let's bring some reality to these business impacts.

The ability to run *Multiple VMs per Physical Server* effectively uses untapped processing power. Why? Most commercial-grade servers are designed with at least two sockets holding either 'Dual Core' and now 'Quad Core' processing chips. The problem is that there are not many 'parallel' or multi-threaded' application systems designed to use the available processing power. The net-net is that we have these really fast processors, yet most applications use only a quarter (1/4) of the processing power at best. Put two sockets together, and you are utilizing only an eighth (1/8) of the available resources. Putting multiple Virtual Machines on each physical server means that you can use a greater percentage of the CPU resources available on the server, extending the capacity and life of expensive server resources.

Cisco is one of the larger users of virtualization technologies in the IT industry – our recent data center move exemplifies the benefits of both the *virtual machine mobility* and the *homogenization of the x86 server*. When Cisco acquired WebEx it gained us a new data center in Mountain View, CA – a wonderful fringe benefit, because our data centers in our main San Jose, CA campus were near full capacity. The value of virtualization was evident when we virtually moved over 150 virtual servers from

the production data centers in San Jose to the new WebEx facility 10 miles away. From planning to execution, the IT department took only a few weeks to complete this amazing feat. We moved the 150 virtual machines onto homogeneous x86 systems over the Internet, preserving their addressing, naming, identity, policy, security, and all that intangible hard-to-see bits and pieces necessary to run a data center.

Traditionally this project would have taken 6 to 12 months to complete. We would have had to phase the move, hire movers, plan long outages, deal with transit-related equipment failures, re-address applications at the receiving site, and cross our fingers hoping that nothing was too hard-coded into the core applications. Because of virtualization technology, it took only eight hours to complete the move of 150 virtual servers on a sunny Saturday afternoon.

### **Virtualization – An Architecture**

IT infrastructure architecture can be compared to toy models made out of Lego blocks – those colorful interlocking bricks used to build creative designs from a child's mind. Today enterprises buy servers from one company, operating systems from another, application from a third, networks from a fourth, storage area networks (SANs) from maybe a fifth, storage from sixth, and management from lucky number seven. Each is a Lego piece that IT must architect into a solution for their enterprise.

When snapped together, Lego pieces have just the right amount of strength and flexibility that allows you to join them and later pull them apart. The design of your Lego creation can be as sturdy as a solid block, or so fragile that it shatters in a young child's clumsy hands. Just like an IT architecture, the sturdiness of a Lego creation depends on the foundation and the interconnection points. Stress an IT implementation built without a solid foundation and you get shattered pieces and an unhappy customer.

Virtualization coupled to the infrastructure and applications, with real integration, can be simple, elegant, and successful. However, to succeed, virtualization projects must be implemented with a plan and an architecture. Cisco believes that the network is the platform or the solid foundation on which we can build a strong IT solution. The networks inherently enable the whole to be greater than the sum of its parts and make everything work better together in a virtualized architecture.

Cisco is evolving the network from being an inhibitor of virtualization to making networks embrace and enable virtualization. Our network solutions are integrated with virtualization platform, such as VMWare, and are accelerating the adoption of virtualization. Today we have a virtualization architecture – protocols, the linkages (the connecting bits on top of the Lego bricks), and the foundation – on which IT can build a strong solution for their enterprise.

### **The Enterprise Data Center Journey**

Competitive businesses need to be strong and nimble. They need to be operationally efficient and innovative while they face an increasing need for business agility and corporate productivity. As a result, enterprises are facing growth challenges in the data center.

Thomas Edison observed when writing later in his life about the invention of the electrical system, "...all parts of the system must be constructed with reference to all other parts, since, in one sense, all the parts form one machine." Analogous to what Edison wrote, you can think of the data center as a multi-faceted system which includes the building, cooling, servers, storage, electrical, flooring, chillers, cabling, racks, network, tape archival, uninterrupted power supplies (UPS), and power distribution – all working together to form the 'data center'.

The key issue faced by our enterprise customers is that the data center facilities are expected to last fifteen years, while the IT assets are only expected to last three to five years. The constant refresh of servers to newer more powerful processors that deliver more capability and capacity, but also require more power and cooling, strain the data center system. Therefore the data center, as-a-whole, reaches obsolescence every five years, not fifteen. This means that a mission critical facility that costs well over \$100 Million reaches obsolescence one third of the way through its depreciation schedule. Virtualization provides the architecture that enables enterprises to extend the life-cycle of their capital assets, reduce operating costs, run cleaner and greener, and put more people on automating the business and less on manually implementing IT. Virtualization makes the shift from months to minutes and from the physical to the logical.

## **Roadmap To Implementing Virtualization**

### **Step 1 – Centralize**

The first step in embracing virtualization must be the standardization of the underlying infrastructure by consolidating servers and reducing the number of disparate platforms, which in turn will ease the IT support burden. Distributed enterprises can consolidate branch servers into key data centers to gain efficiency. Enterprises can centralize storage, and manage information and data consistently. Key to its success, is making the necessary investments that allow IT to scale people resources. As enterprises consolidate, they must first build the infrastructure to implement virtualization successfully in labs and development environments, then scale it to production.

### **Step 2 – Production**

The next step is the production implementation of virtualization. This is where we really start extending the life-cycle of our capital assets. In the move to production virtualization VM usage tends to

grow dramatically, and often new servers with more memory are added to support increased VM densities.

Key to this step, is to ensure optimization of each technology area that supports Virtualization, not just the server platforms. In this deployment step we look to consolidating the storage area networks (SANs), and enabling every server to boot any O/S image from a central repository. We homogenize the I/O to and from the server just as we homogenize the server to a smaller number of x86 platforms. We virtualize core network services like security and load balancing to enable all aspects of workload provisioning to be done in software, not just VM cloning.

Taking a systems and architectural approach to the deployment of virtualization and the data center as a whole allows for the data center to last longer by using the most efficient infrastructure necessary to support the workload requirements within their VMs. It also means that a workload can be rebalanced across the supporting infrastructure to improve performance.

### **Step 3: Dynamic Virtualization**

Step three is when VMs start moving, when virtualization becomes dynamic and workloads become mobile. From a business perspective, the ability to balance workloads across multiple machines and move entire applications from one set of devices to another – across racks and rows of servers and even across data centers – is so valuable, that network architectures must evolve. Dynamic virtualization is driving the biggest change in a decade in network architecture. Networks are moving away from the traditional split of Layer-2 and Layer-3 devices with a rigid hierarchical addressing model that enabled scale and stability, to a model that supports flat ad hoc addressing which enables workload portability.

Dynamic Virtualization and the concept of workload portability changes much of what we know about networking, but it also

changes operational tasks such as change controls. Some enterprises require over 140 approval signatures just to upgrade the software on a network switch, because business application owners must approve if shared device, such as network switches, are taken out of service. This process would be a lot easier if the application workloads were moved-off a shared device prior to the device ever being taken out of service.

In order to accelerate the adoption of virtualization, Cisco is pioneering new technologies to enable larger flat networks, while maintaining concepts of scalability, protocols for reliability and failover, and common operating models that serve the current network architecture. For example, Cisco created storage systems that allowed workloads to move without requiring all of the data to directly follow that move, we just remapped the address/pointer. Most recently, Cisco embedded our network operating systems into the VM so the network identity and profile is consistently observed as the workload moves between VMs.

Once a workload is portable the question then simply becomes, how far can we move it? Can we move it from one server to another? Certainly. Can we move it across data centers? Yes, but it is harder. Can we move it across companies? No, it is impossible today, but perhaps possible in the near future.

### **Virtualization, Utility, and Clouds – the next frontier!**

Networks provide the most efficient transport for the delivery of IT services anywhere in the world. Network globalization has created tremendous freedom of choice for where IT services are delivered from. Cisco sees that the next market transition is to enable freedom of choice on the provider of these services, which leads to the budding concept of cloud computing.

With cloud computing, virtualized application workloads will flow seamlessly from

enterprise businesses to third party providers. These third party cloud providers will be able to capture new customers faster, provision services quickly, and generate revenue faster than today's hosting architectures allow. Because of these new capabilities, Enterprise IT resources will be seen as a utility able to automate and dynamically provision infrastructure using cloud services.

Cloud computing is the new market transition that will require a new wave of innovation and investment similar to what we saw with the

Internet explosion of the mid-1990s, this time predicated not on addressing federation across providers but on portable workloads. The movement of entire application suites – whether for business continuance or for capacity on demand – will lead to the largest increase in network capacity we have seen in a decade. To put things in perspective, moving just one workload from one organization to another is equivalent to an order-of-magnitude more data movement than high-definition video.

This transition will happen over networks – the most efficient utility transport medium ever invented having the broadest reach and offering the richest services – the 'Uber Utility.' Hence Cisco is investing in future technologies that enable workloads to be portable across organizations/companies; technologies that address the challenges hindering this vision of workload portability and cloud computing – security, service levels, interoperability and portability. Cisco is poised for capturing this market transition.

Source: Cisco

## Wipro's New Generation Data Center - FluidState



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### Traditional Datacenter - Challenges

It's not very long ago that we were bombarded by articles discussing the logical limit of IC miniaturizing, the semiconductor functionality as it neared the nanometer limit seemed like a dooms day for all micro chip innovations. It was not very different again for Internet address range reaching its limits and end of internet expansions.

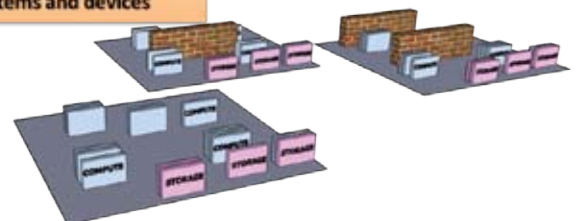
Though we have still not seen these affecting us, there is high probability that we will encounter these sometime.

On the other hand some of the common datacenter challenges that have already hit us today didn't get the kind of forethoughts that they really deserved. It's not unusual that we are forced away from a cost effective hardware solution just because the present data center doesn't meet the prerequisites. The most common of these situations arises because of the constant and increasing demand for deployment of x86 based servers. With the coming of age of the x86 platform and in combination with some of the complimentary feature of additional software services running on top, the platform delivers features available in some very high end enterprise class RISC systems and mainframes.

The seemingly simple decision to embrace these technologies often ends up being far more complex than it initially appeared. The additional requirements stemming from the choice of Blade Servers follows may be the need for a few KVA of power subsequently and will lead to requirements for high density racks, special cabling, new cooling technologies etc. In other words your data center is simply not able to cater to these new demands.

FIGURE 1

- TRADITIONAL DATA CENTER**
- ✓ Based on design principles of the 90's
  - ✓ Application & Project based environment
  - ✓ Complex interconnects and wirings
  - ✓ Changes not easy to implement
  - ✓ Capacity trapped in Islands, under utilized
  - ✓ Expensive to maintain
  - ✓ Mix of inefficient systems and devices



Source: Wipro

Need to rejig existing datacenters or building new datacenters has been forced upon most CIO as a common initiative lately. The need is no different even for small organizations - a small server room with a few servers need the equivalent of a small datacenter while they consider a 2 or 3 year horizon. Regardless of the size of organization, the inherent skill required to evaluate all the aspects and make the decision is beyond the comfort zone of current in-house expertise. The risk of things going wrong from this DIY (Do it Yourself) approach due to the choice of a wrong component means a longer due diligence process often pushing deadlines beyond acceptable timeframes.

### FluidState – the new Wipro Datacenter Framework

Wipro’s infrastructure engineering and research team has spent significant amount of time looking at this Data Center problem from a 360 degree perspective and simplifying the overall Data Center transformation. Of particular importance was to work on the charter keeping in mind the local Indian context.

We at Wipro believe that though designing and building a new datacenter can be a daunting challenge, it also presents a great opportunity for organizations to cleanup a few legacy systems and start with a clean slate. The present day Data Center needs tight integration between all its components, systems need to be deployed dynamically into various network zones, the computing and storage capacity must be closely linked to the power, and the power to the cooling system. It’s highly logical to look at the datacenter as a single entity and have an approach for a repeatable model for design, build and operate to reduce the risk component and to leverage the knowledge of multiple deployments.

Close examination generally shows this to be the better approach than trying to refurbish existing datacenter and custom integrate existing systems which can either prove costly or introduce inefficiency or create loosely coupled integration.

Wipro has taken this concept further and embracing an innovative approach to developing a framework to have a productized approach for the datacenter. The framework named *FluidState™* (standing for Flexible Linear Upscalable Intelligent DataCenter STandardized for AccelerateD Establishment) will have standardized components with predefined interconnects, build procedure, intelligence logic and preconfigured rules engine. **Coming with a set of standard capacity, FluidState™ will provide seamless modular expandability to grow and accommodate the future needs of business.**

The result of synthesizing an organization’s capacity requirement, processed typically for a 3 or 5 year horizon, will provide a clear direction to *FluidState* base models of Small,

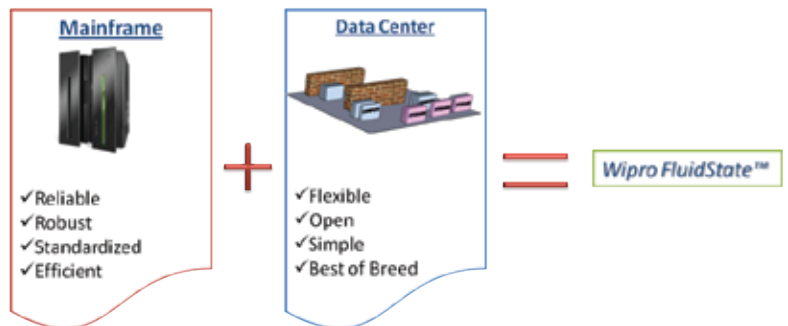
Medium and Large. A further application of relevant patterns on this model will incorporate the requisite variation required for the scenario.

The approach simplifies the datacenter to the extent that it can be equated to buying a PC for your Home. Identifying the right model and then subsequently look for additional hard disk, memory or changing to enhanced graphics card for better gaming performance. The base models are based on industry leading hardware carefully chosen after various benchmark. Though variations are allowed for a few areas, **key components like the Network, that forms the backbone is standardized on model specific Cisco components because of the requisite features and overall design advantages provided.**

FluidState is a Data Center framework that optimizes all the components and packages required in a datacenter to fit capacity requirement of **Small(Small dash Zone), Small, Medium and Large to be used as a full DC or a Zone expansion.** For an example the **Small** version that is a single DC rack equivalent enclosure that takes a **maximum capacity of virtualized Server 192 x86 cores, 4TB Storage, requisite Network & zones, load balancer, firewall, UPS Batteries, 17kva Cooling, Wipro Supported 14 different open source software** that can effectively build an entire enterprise (though customer can decide to use their own software or OS). The open source software addresses several areas viz. Firewall, Intrusion prevention system, e-mail, Office suite etc which are provided as Virtual appliances.

The accelerators and patterns help final fine tuning and customization of the solution. The package is modular and expandable within and outward. This will not require any false flooring or roofing and can

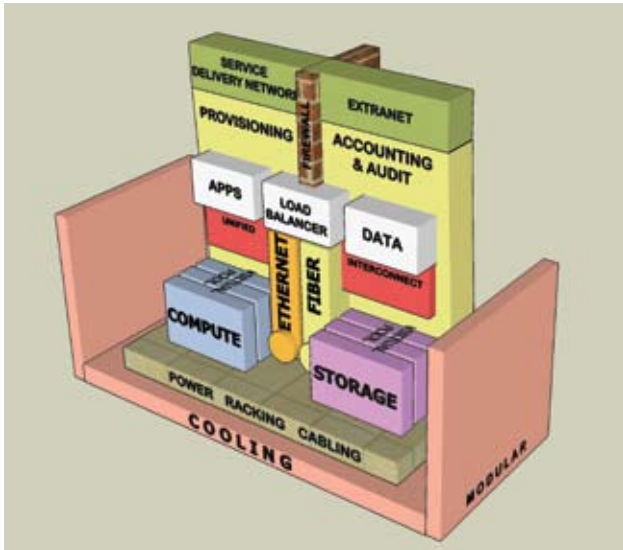
**FIGURE 2**  
Design principles in the Evolution of Datacenter



*FluidState™*: Flexible Linear Upscalable Intelligent DataCenter , STandardized for AccelerateD Establishment

Source: Wipro

**FIGURE 3**  
Model Driven Datacenter, the FluidState Framework



Source: Wipro

be deployed as per customer. The armor protection for this comes optional at a small additional cost. This all built using a discrete approach at a customer site in 3 to 4 weeks using components that can be sourced and supported globally.

To further make the solution easily adoptable Wipro will also provide tools to seamlessly migrate existing application and systems to the FluidState™.

The TCO for this is compelling and can suit most medium and small organizations aiming for a big bang transformation.

### Fluidstate – The benefits

The evolution of IT saw very similar phases earlier; mainframes were downsized to mini and super mini systems. Many organizations made firm decisions and stopped further investments on their mainframe systems; all new solutions and applications were developed or bought with specifications of the new platform. The remaining applications on the mainframe were treated as legacy and migrated or allowed to go through a normal retirement.

It's hard for the industry to ignore some of the trends coming in such as the economies of scale brought in by the x-86 platform, virtualization, commoditizing of storage, unified interconnect, modular cooling, and seamless provisioning. The FluidState™ will bring in the benefits of all these components in a tightly integrated fashion which can be adopted while going in for a Greenfield data center, a large

expansion of an existing data center or establishing a new premise that will be the strategic long term way forward for the organization.

The effect of a loosely coupled datacenter has been highest felt by the operations and management teams. Many attempts to automate the operations failed or attained minimum benefits due to the very component-specific features or protocol. The site specific customization therefore needed to implement the necessary logic often outweighed the benefits from a commercial and effort perspective.

Just to quote one simple area that has potential for large savings but hardly gets practiced is around managing the infrastructure availability and aligning to service demands. The cost of electricity to keep a server running for its lifetime (3 years approx) surpasses the cost of procuring the server. This widely accepted fact makes compelling reason to power on the server only on a need basis. Not many services today are required on a 24x7 basis; many services are needed only during the business hours, many development and test systems are needed only occasionally. It is very much possible to power off the systems and power on the systems when needed.

However this is never practiced in most data centers. The Servers and depending infrastructure components are left running at all times and never switched off except for maintenance activities. This is primarily attributed to the challenge of managing the dependencies with power ups, though often this down to personal experiences of unpredictability while starting up the applications and its supporting systems.

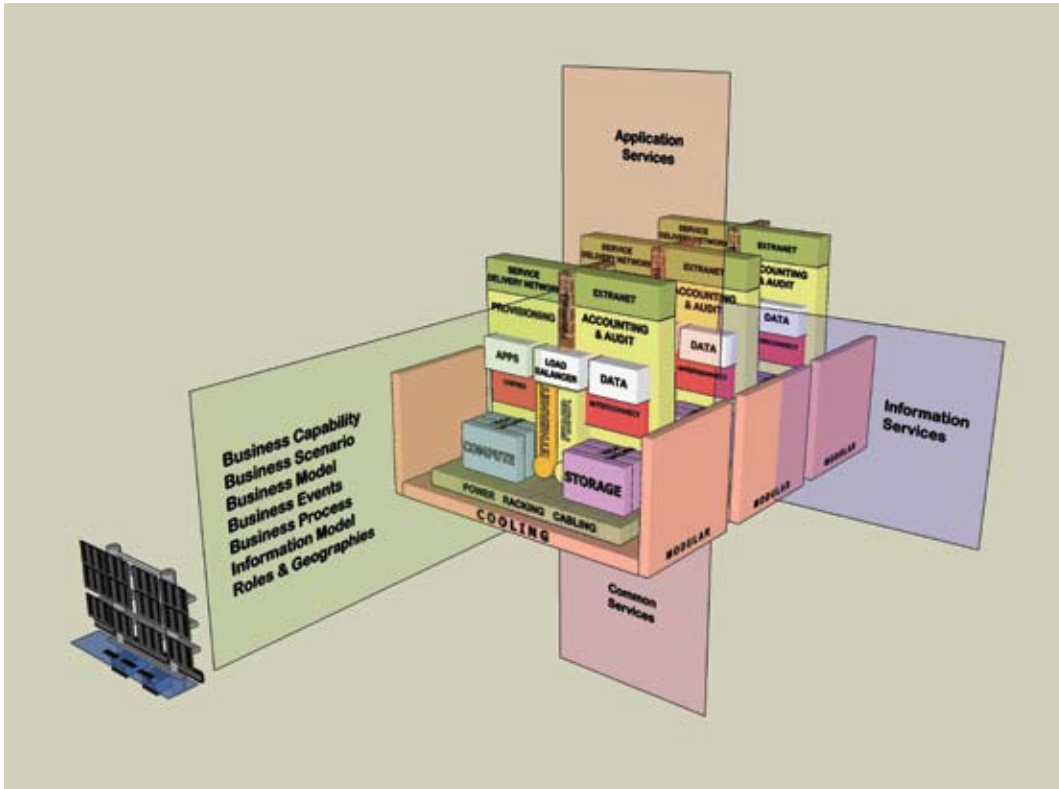
Such scenarios are common cases where automation can play a crucial role; these startup sequencing can be automated to attain a hands free startup for every service. A standardized data center platform can draw the readymade intelligence provided at the data center layer and build further logic by concentrating fully at further automation.

It is therefore very important that future design of data center capture inputs from every stakeholder and attempt to incorporate them into the implementation.

CFOs around the world are under constant pressure to reduce overall expenses as expenditure on IT most often comes under the scanner and there is constant directive to relook at the fundamentals of its investments, maintenance and future upgrades. As Data center is centric to many of these, these inputs are very relevant:

- Leveraging economies of scale and using commodity technologies rather than proprietary technology that may give a seemingly small advantage on some areas.
- Look at every aspect of operational expenses with minute scrutiny over component utilization, power consumption, air conditioning and cooling, automation of operations, personnel, optimization of space used etc.

**FIGURE 4**  
FluidState in operation



Source: Wipro

- Adopt as far as possible a just-in-time approach rather than an upfront investment based on a forecast-driven capacity.
- A Resilience and ability for Disaster recovery is important but the overall premium price paid needs scrutiny.
- The need to look at taking the management and automation to a higher level that can effectively reduce human intervention and system integration efforts owing to changes in technology, process and people changes.

Over the years IT has brought on many benefits to the business, and there will undoubtedly be further strides this way. But CEOs today have key charters beyond and want IT to be an enabler to the business and provide a platform for business to rapidly experiment and come out with innovative products and services, tap potential new markets.

The User Community has their own expectations; it's natural that they expect the best experience at their interface. These

expectations boil down mostly to good performance, simple, smart intelligent and effective interaction.

Surprisingly one of the most often ignored stakeholders are the system integrators and their inputs is not sought, this in spite of the fact that many SIs are often the prime Data Center architects and builders. Some of the design inputs needed to look at facilitating Install, Add, Move and Changes in the most hands free way and with minimum disruption of services. The repeatability aspect of integration is crucial; a templatised approach for deployment is most desirable and helps mitigate the risk and simplify the approach. Better operating models are explored today and how the IT integrates to Business, ways of practically implementing chargeback based on infrastructure service usage – Standardized tiered cost unit of capacity data, compute, network, common services eg. Mailbox, internet etc

The dynamics and new business reality pose a very different set of demands on IT, most of these have a direct bearing on the way

the services today are delivered from the Data center. The business managers who are often the most influential have seemingly unreasonable expectations.

- **Business Capability:** Having multiple choices of what an enterprise does to address the goals and objectives, rather than how it does it, is crucial to organizations profitability and success
- **Business Scenario:** Today's enterprises require the agility to address varying business scenarios and the ability of its functional area to repurpose themselves or scale its services on need.
- **Business Model:** Various Business models are experimented to address the market opportunity with creative approaches and this often differentiates its ability to handle competition.
- **Business Events:** Enterprises need to have business processes that have the ability to address internal or external business events occurring in a unpredictable rate.
- **Business Process:** The need for Business Process to be agile, resilient and deliver on goals and objectives is paramount to the success of an organization in a competitive environment.
- **Information Model:** With convergence of various media the Information model needs tools and technology to address data

formats with Relational, XML & hierarchical, unstructured data Interchange and B2B & B2C.

- **Roles & Geographies:** Virtual enterprise with roles and responsibilities transcending physical and linguistic boundaries are creating new market opportunities.

Better operating models are explored today and how the IT integrates to Business, ways of practically implementing chargeback based on infrastructure service usage – Standardized tiered cost unit of capacity data, compute, network, common services eg. Mailbox, internet etc.

Do not forget the environmental issues as a stake holder; maybe its own voice was very feeble. The claim of 2% by many scientists as IT's overall contribution to global CO2 seems a bit unbelievable on the first look. Even if this scientifically validated figure is way off by 50%, it is reason enough for the alarm bells to ring. A small contribution from every source can make us look forward to a greener planet, a social responsibility well worth it while looking at a Quote from Charles Darwin "How paramount the future is to the present when one is surrounded by children".

Source: Wipro

## Dataquest Insight: Network Virtualization is An Emerging Trend in Data Center Communications

Telecom server solutions include:

- **The Network as the Platform:** Programmable routers with Unix Posix-compliant application programming interfaces (APIs) or service-orientated architecture (SOA)-based APIs for newer applications within routers (for example, Cisco's SONA architecture with SOA APIs, Juniper's Partner Solution Development Platform [PSDP]).
- **The Server as the Platform:** Rack-mounted, general-purpose computing platform vendors like IBM, Sun Microsystems and HP, as well as "cloud" computing solutions vendors, with integrated software-based telecom stacks along with GIG-Ethernet and cards supporting carrier interfaces creating "software applications switches."

- **The ATCA Blade as the Platform:**

Advanced telecommunications computing architecture (ATCA) proponents have advocated standards-based "plug-compatible" switch blades and processor blades as well as advanced mezzanine cards (AMCs) supporting the next generation of "carrier grade" communications equipment, with solutions from Alcatel-Lucent, Nokia-Siemens Networks, Nortel and others.

These solutions include service provider routers, softswitches, radio network controllers and applications servers. However, many different flavors exist with each approach providing varying degrees of performance, cost, resiliency and application flexibility.

### Key Findings

- Commoditized general-purpose cloud computing server components can be used more generically across multiple application domains with greater scale using load-sharing methods. However, they require additional support for telecom service resiliency and restoration, while lacking specialized networking interfaces (being addressed by specialized networking interfaces in AMC cards).
- Preferences by telecom equipment vendors with very-high-speed requirements will erode ATCA-based servers in favor of either general-purpose cloud computing Unix systems supporting

AMC cards with specialized networking interfaces, or router-based hosting of applications servers.

- Router-based hosting of applications servers are alternatives for some high-performance applications requiring native wire-speed performance, supporting network/data center consolidation and virtualization. Single vendor lock-in also means network interface support is highly vendor-specific.
- Network virtualization brings a new dimension of flexibility and scalability to the network infrastructure:
- Streamlined asset use.
- Support for new business models.
- Improved profitability.

### Recommendations for Network Engineers of Data Center Networks

- Prioritize the application infrastructure requirements in terms of computing performance, application domain flexibility, platform manageability, platform resiliency, memory, networking interfaces support, software stack availability, energy requirements, price, and multi-vendor support via system interoperability and platform longevity.
- Examine the business case for highly customized platforms and availability of software stacks within ATCA and blade servers compared to rack-mounted servers.
- Optimize competition and substitutability among hardware suppliers when buying commoditized server platforms. Reduce purchase costs using standardized commercial terms and baseline technical specifications.
- Develop contingencies for unsuitable vendors or technologies. Assess the market for alternative suppliers, assessing their strategies and viability.

### ANALYSIS

When procuring commoditized telecom server system components, carriers should seek to optimize competition and substitutability among hardware suppliers by:

- Using standardized technical specifications for plug-compatible hardware modules, operating system support and applications APIs.
- Differentiating hardware suppliers on the basis of life cycle services, manageability, account management and support.
- Undertaking regular price reviews.

Other than the savings gained by using separate applications servers (such as space and energy), converging applications within the same chassis must yield greater advantages to offset the additional efforts required. For example, in integration, overheads associated with cross disciplinary teams managing converged network elements (wireline voice, wireless voice and data teams managing the same "computer," each with different equipment depreciation policies) and the management of the converged network element of the new converged network-based solutions. In fact, more network elements may result in "diverged" offerings whereby application-specific routers may result in verticalized offerings (Internet Protocol television [IPTV]-only routers with subscriber-awareness, financial-transaction settlement routers and so on).

Juniper's PSDP offers access to routing features and data streams which can help third-party applications developers develop newer applications. For example, newer operations support systems extending command line interfaces to native embedded operations for potentially newer service-aware resilient solutions, newer security services that are native within network elements, subscriber-aware policy

control for peer-to-peer traffic management and application-aware real-time multimedia collaborative session control for converged voice and video applications.

Other examples have occurred such as Cisco's SONA solutions, with SOA-based instrumentation of deep packet inspection (DPI) solutions which extend the basic capabilities of first-generation DPI to supply the intelligence that can help service providers better manage traffic from specific subscribers and applications.

### BACKGROUND AND CONTEXT

Cloud computing, a style of computing in which massively scalable IT-enabled capabilities are delivered "as a service" to multiple customers using Internet technologies requires huge mega-plexes of massive, parallel server farms in huge data centers. These megaplexes comprise application servers running on 10 Gigabit-Ethernet general-purpose computers, with storage and high-performance processing power.

The ATCA standard was created by the PCI Industrial Computer Manufacturers Group, a consortium of over 450 companies that collaboratively developed open specifications for high-performance telecom and computing applications. It has been adopted by many leading telecom equipment vendors, with products including third generation and WiMAX base stations, softswitches as well as IP Multimedia Subsystem components. But some equipment vendors like Ericsson, Cisco and Juniper have stayed clear of ATCA due to limitations of the ATCA backplane (10 Gigabit-Ethernet), as well as fear of commoditization of network components.

The creation of a programmable telecom network element (such as telephone switches and routers) can offer new solutions, including:

- Infrastructure and application virtualization.
- New converged applications leveraging interworking between networks and applications.
- High-performance distributed computing with server clustering, load balancing and partitioning.
- Virtualization of storage and computing with newer forms of service restoration, resiliency, with dynamic policy control embedded within the network.

## THE IMPACT

Network virtualization can benefit telcos in many ways:

- Energy and space savings from a converged network element.
- Enhanced possibilities for multi-vendor solutions “systems-on-a-blade” that are plug-compatible (software compatible, back-plane compatible, AMC card compatible and so on).
- Shared infrastructure without changing organizational model.
- Service networks decoupled from infrastructure.
- New service networks introduced without new overlays.
- Each service network managed and controlled individually.
- Each division and/or service now runs its own “virtual service network.”
- Reduced total cost of ownership.
- Risk mitigation.

- Streamlined asset use.
- Support of new business models.
- Improved profitability.

The last two points may lead to newer business models that support:

- **“Open garden” networks, as opposed to “walled gardens.”** For example, carriers may host Google, Yahoo, salesforce.com applications and vice versa.
- **Virtual network operators (VNOs).** Cellular VNOs exist for cellular voice subscribers which can be duplicated for newer IT and network-as-a-service services via data center VNOs.
- **Network sharing.** Co-opetition among telcos, where carriers can share networks and hosted applications.

However, there is still much debate as to whether it is better to use general-purpose cloud-based network elements or purpose-built network elements, such as Cisco or Juniper switches supporting third-party software application integrations, or ATCA-platforms supporting third-party blade server integrations.

These solutions will require some basic features to provide network virtualization. Generic telecom requirements in servers supporting network virtualization should include:

### Interface support:

- OC3 – OC768 SONET/SDH; 100M, 1G, 10G, 40G; Ethernet; OC-12 ATM; DS-3.

### Routing and quality of service (QoS) features:

- Complete feature set for IGP, BGP, Multiprotocol Label Switching (MPLS), virtual private network, IGMPv3 Multicast, IPv6; extensive QoS capabilities; predictable latency and jitter.

### High availability features:

- Fully redundant hardware, MPLS fast reroute, provider backbone transport (optional), MPLS-TP (optional), aggregated interfaces, protocol graceful restart, graceful card or chassis switchover (ideally with geographic redundancy support), VRRP support, hitless software upgrades.

## CONCLUSION

Network virtualization will bring a new dimension of flexibility and scalability to the network infrastructure:

- Streamlined asset use.
- Support for new business models.
- Improved profitability.

Gartner believes careful planning is required for deployment of network virtualization solutions, which will be successful only if a valid business model exists with critical telecom features of network resiliency and the required network interfaces documented in this note.

Source: Gartner RAS Core Research Note G00160843, Akshay K. Sharma, 13 March 2009

# Data Center Consolidation - A Practitioner's View



**P.R. Krishnan**  
Vice President  
Head IT Infrastructure Services  
Tata Consultancy Services

Krishnan is responsible for defining the Service Offerings in the Infrastructure space, creating value differentiators and delivering them through the Global Delivery Centers of TCS. Under his leadership, the TCS IT Infrastructure Services Unit has successfully won and delivered some landmark engagements. He has also played a key role in establishing and institutionalizing several Centers of Excellence in collaboration with software and hardware vendors.

In his career spanning over two decades with TCS, Krishnan has been involved in diverse roles. As an offshore Project director for GE, Krishnan conceptualized the GDC model. For over 3 years, Krishnan focused his efforts in the growth and development of GE. Today, GE is one of the largest relationships for TCS and one of the largest GDCs in India.

Krishnan plays a key role in the Cisco - TCS alliance. He was responsible for building the Cisco Practice and was part of the MOU signing team in San Jose.

Krishnan holds a Bachelor's Degree in Electronics and Communication Engineering and a Master's degree in Instrumentation from Madras (India) University.

## From a practitioner's perspective, what would you say is the CIO's key look out in DC consolidation?

First and foremost, the CIO's single minded focus today is to align strategies to business priorities. The CIO welcomes any technology initiative that sustains and enhances the organization's competitive edge. Specially, when they look at a DC consolidation initiative, the primary objective is to enhance productivity. Speed to market is definitely one of the topmost look out. The CIO would also be looking to reduce the infrastructure footprints and thereby lower the cost of maintenance.

## What is one of the most critical challenges when you migrate an enterprise to a virtualized environment?

Application migration is probably the most critical aspect when we consolidate Data Centers. There are times when we have come across enterprise applications in an over virtualized environment which does not benefit the business. The obvious need is to optimize applications. A mere migration of certain applications will not necessarily be the right strategy in the target virtualized environment. So, one may have to look at an application re engineering to ensure better productivity. Therefore, we need to have an application migration strategy once an infrastructure assessment and an asset rationalization assessment are done. This strategy has to be focused on improved business process and increased business agility.

## You have had years of experience and several enterprise transformation successes in the infrastructure services space. Tell us how do you approach DC consolidation? What are the processes you have designed to effectively support business strategy?

[continued](#)

## Tata Consultancy Services (TCS) Data Center Consolidation

TCS is a \$5.7 Billion revenue company providing IT services, business solutions and outsourcing solutions to client's worldwide. TCS is a key strategic alliance partner especially as Cisco expands its products in the Data Center space. Their large - scale system integration capabilities and large Global infrastructure service contracts in US & UK, makes the Cisco - TCS alliance valuable.

TCS understands the final goal of an IT project 'The Business Process'. They specialize in skills which define, implement and operate IT systems closely aligned to business priorities. They have people skilled in ERP, Databases, OS, Server and Storage. These are some of the factors that make TCS a perfect fit with Cisco's vision of the Network as a platform, and which enable them to truly provide superior end to end solutions to joint customers.

TCS has been awarded the Cisco Gold Certification in India and is a part of Cisco's Outsourcing Channel Platform across the globe. The TCS Infrastructure Services is a SBU providing Transformation and Managed Services for Datacenter, Networking and End User Computing. Together, Cisco and TCS will ensure that customers will get next - generation solutions in the infrastructure space.

### TCS Fact file

- A strong presence in Cisco's key markets.
- 53% of \$5.7 B revenue comes from USA.
- 42% of their revenue comes from BFSI - a key Cisco segment
- 49 of Fortune100 are TCS customers.
- 6 of the top 10. Customers for more than 5 years
- Repeat business from 95% of clients
- Won 20 deals that are \$50M plus per year, last year

Source: TCS

continued

This is a fairly elaborate question; let me give you a detailed perspective. At TCS, we follow a very well defined process that is clearly focused on the business priorities throughout. We begin with an

- a. Assessment Framework. To start with, we assess the infrastructure and application relationship topology of the environment. This gives us the visibility to the infrastructure utilization quotient. Our four decades of application development experience enables us to clearly determine the optimum level of virtualization required. Our TCO assessment and DC assessment defines the consolidation strategy.
- b. Benchmarking. This is part of our best practices here at TCS wherein we benchmark common applications across different environments. This helps us define the target environment.
- c. Application assurance. Primarily this is to ensure that the business applications including any customization can be deployed in the target environment seamlessly. We do a regression test

that determines whether the defined outcomes built in the business case are met.

- d. Staging & deployment. The new environment is staged before it gets deployed. This is to ensure zero business disruption.

#### **What do you see are the emerging trends in DC consolidation?**

Virtualization is a big leap in DC consolidation. However the benefits of virtualization were not fully realized due to constraints in the existing infrastructure environment. I see the recently launched Cisco UCS architecture removing the key constraints. This will enable IT to streamline provisioning and management of physical and virtual data center resources. I am confident that UCS architecture will ensure flexible service delivery and help enterprises achieve their green IT objectives. And then, the future is not too far away from the cloud environments. The first step will be towards private clouds wherein enterprises will

benefit from shared infrastructure. It's quite probable that industries could collaborate together to form shared clouds due to their unique information security requirements. Once we have more clarity on the role of every service provider and the financial models, the next shift will be to public clouds. This would take us to a total service model wherein enterprises will begin to buy 'infrastructure as a service – (IaaS)', 'platform as a service (PaaS)' and of course 'software as a service (SaaS)'.

To conclude, we are committed to embracing the new technologies that will help build the next generation data centers. At TCS, we will continuously re-invent our skill sets to be ahead of the technology curve always keeping in mind the end business goal of an enterprise.

Source: TCS