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Smart Infrastructure Represents Significant Turning Point for Data Centers

Analyst: Brian J. Dooley

Management Summary

The data center has been growing in complexity over the past several years, spurred by advances in virtualization, networking, and application hosting. It has been further molded by environmental concerns and the need for cost savings in a declining economy. This has resulted in the emergence of new infrastructure concepts based on flexibility and efficiency. **The new architecture might best be described as a *Smart Infrastructure*, which is capable of adapting to a wide range of new challenges though a cloud-based central management.**

Virtualization is one of the foundations of the new infrastructure, making it possible to gain vastly improved efficiency in hardware server usage. At the same time, virtualization has added to complexity and made the requirement for systems and network management an imperative.

In addition to virtualization, the data center must respond to technological changes in computing and in networking. For example, cloud computing demands use of multiple processors to provide services, with management of these processor arrays to ensure optimal delivery of services. Service oriented architecture (SOA) is fundamentally changing the way applications work with each other and are accessed by the user. Vastly increased network bandwidths are, meanwhile, eliminating the traditional distinctions between memory, storage, mirroring, and backup.

These are just some of the changes that are creating a fundamentally new vision of data center architecture. The vision is one of efficiency, scalability, and flexibility capable of providing an architecture to meet the vastly expanded information needs of the 21st century.

Vendors have responded to these challenges by introducing a range of concepts. Some larger players have created all-encompassing visions that reach beyond the data center and are supported by comprehensive product ranges. Others address large portions of the problem, while smaller companies offer more focused niche solutions. Most of these concepts heavily emphasize standardization and interoperability, as required, to achieve flexibility. This means that it becomes easier to mix and match from a broad range of products available, and create a unique solution that is nonetheless capable of central management and control.

If one were to seek an analogy, perhaps the closest might be the advent of Henry Ford's *Model T*. Prior to the Model T, automobiles were expensive luxury items produced by meticulous craftsmen in small numbers. Many were excellent, and many similar, but few were the same. Cars were expensive, difficult to drive, and difficult and costly to repair. Ford introduced the assembly line, standardization of parts, improved utilization of resources, and efficient production. Cars became cheaper to buy, cheaper to run, cheaper to maintain, and usage vastly increased. These changes had repercussions across the technology, across the workplace, and ultimately, across society. Today's data centers are moving away from the period of custom architecture and into something like a period of mass production. **There are now many more data centers, which have become considerably more complex. Flexibility, management control, and efficiency are all now imperative.**

IN THIS ISSUE

The current evolution has reached a turning point in the cumulative effect of a number of forces. These forces come from both the internal and external environment. They include a need for improved efficiency and lower costs, a requirement to handle extreme growth in data, plus environmental concerns. At the same time, growing complexity demands better management and security. External factors include the pressures of constant 24x7 operations, improvements in technology, and development of organizational structures favoring collaboration and modularity.

This is clearly a multi-dimensional event. While Clipper traditionally focuses on the data center, and, while the evolutionary turning point discussed here is about the data center, there is a great deal more at stake. Going back to the automobile analogy, it wasn't just the vehicles that created a century of change. It was also about the infrastructure on which they ran. The U.S. Highway system[1] followed by the Interstate Highway System[2] made driving an automobile about more than frolic in the country on a Sunday afternoon. As the highways became the backbone of commerce, the need for better planning and smarter infrastructure became clear.

Now, we see that what had been a largely insulated world of information technology (loosely, the IT infrastructure) has become part of a more multi-dimensional *enterprise infrastructure*, where data, processing, flow of information, business units, and physical infrastructure all become components in an integrated concept based on a variety of services that must be delivered, managed, and automated. So, when we talk about Smarter Infrastructure, it is a broad topic. **When we talk about *Smart Infrastructure for the Data Center*, it is just one of many dimensions of a broader issue, whose bounds are continuing to expand as an increasing range of digital devices moves onto the shop floor and into everyday life.** Read on for a discussion and analysis of the latter, **but don't lose sight of the search for answers to *smarter infrastructure for our multi-dimensional world*.**

The Imperative for Change in the Data Center

The data center has continued to evolve, as new technologies have become available and new requirements have arisen. The new technologies have themselves had a disruptive effect, demanding new methods for maintaining a robust and secure platform with high availability. Virtualization has promoted efficiency, yet increased overall complexity; cloud computing has increased versatility, yet introduced new problems of management, resource allocation, and accounting. Greatly increased bandwidth has reduced some of the common distinctions between memory, storage, mirroring, and archives. And demands for improved efficiency, aligned with environmental concerns over power consumption and heat, have made it necessary to consider different physical layouts and improved management of basic facilities.

In addition to these changes, security is of increasing concern; the economic environment is constricting resources, compliance and operations transparency issues are forcing greater care in detailing and recording business processes, and agility is an ever-increasing requirement as IT organizations seek to cope with vastly expanded processing requirements and frequent changes brought about by organizational realignment.

Each of these areas has been subject to evolution over the past several years. They have now reached a point where a new vision of the data center is starting to emerge, based upon cloud computing[3] and virtualization[4] and a greater alignment with business requirements.

Major infrastructure change happens slowly in IT, but the growing complexity has now made re-evaluation a priority. Without a central vision, it will become increasingly difficult to manage the current technology and promote the levels of efficiency and agility that will be required in the years to come.

The New Requirements

Convergence of a number of issues within the data center environment has created a need for a *watershed infrastructure*. This

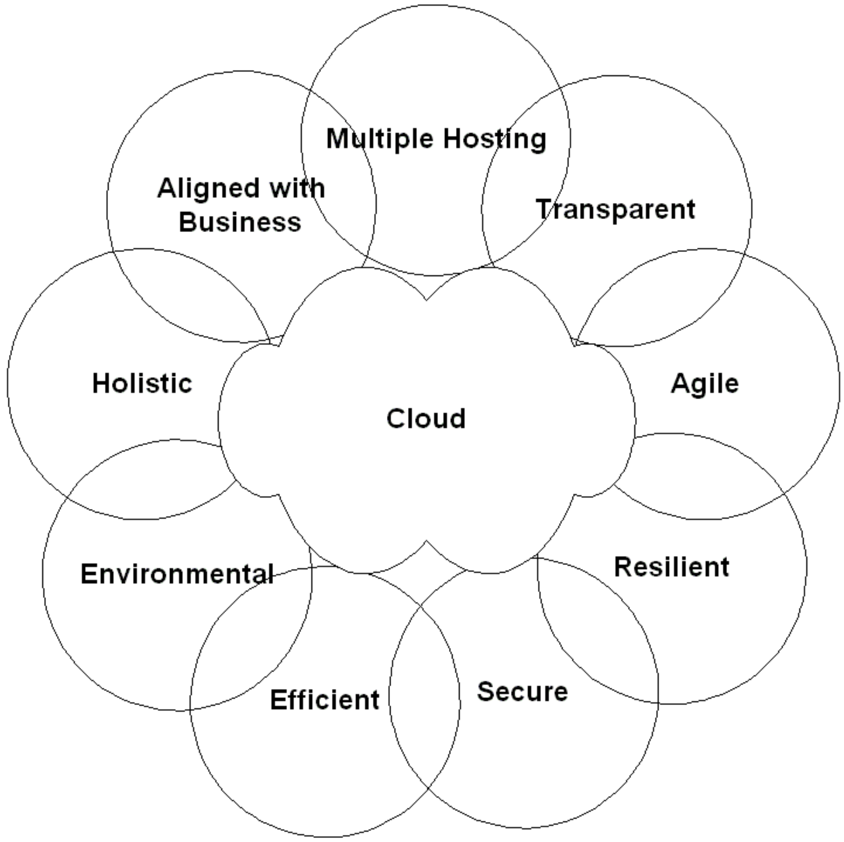
[1] Developed in the first half of the 20th Century.

[2] Developed in the second half of the 20th Century.

[3] For a backgrounder on cloud computing and storage, see *As the Cloud Turns - A Cloud Computing and Storage Exposé* in the December 18, 2008, issue of *The Clipper Group Captain's Log*, which is available at http://www.clipper.com/research/TCG2008063.pdf.

[4] For backgrounders on virtualization, see *Server Virtualization Made Real (Part 1 of a Multi-Part Series on Server Virtualization)* in the February 27, 2007 issue of Clipper Notes, which is available at http://www.clipper.com/research/TCG2007028.pdf and also see Top 10 Buying Considerations for Storage Virtualization Solution in the issue of Clipper Notes updated November 13, 2007, available at http://www.clipper.com/research/TCG2007098.pdf.

Exhibit 1 — Smart Infrastructure



represents a turning point in bringing together a number of different technologies to create a seamless, secure, and scalable service delivery platform capable of meeting the needs of 24x7 operations in today's complex IT environments.

The new architecture must be efficient and agile, but it also must meet a range of new requirements. This architecture might be termed a *Smart Infrastructure*, which is capable of adapting and adjusting to a wide range of new technologies and conditions, backed by centralized management and automation. This architecture must be:

- Environmental
- Efficient
- Secure
- Resilient
- Agile
- Transparent
- Multiple Hosting
- Aligned with Business
- Holistic

These areas have all been addressed by the primary data center suppliers. All of these are heavily interconnected (as shown in Exhibit 1, above).

Environmental

Environmental issues relating to the generation and power consumption, in particular have arisen from a number of different sources. Purely from the perspective of improved efficiency and cost effectiveness, saving energy and better managing heat output are likely to result in cost savings. Meeting environmental objectives can benefit the corporate image. Equally important, these objectives can also result in more efficient overall utilization of processors through virtualization, which reduces processor count, and through cloud computing, which reduces resources required at the network's edge.

Efficient

A more efficient data operation inevitably results in cost savings as the systems are permitted to operate at a higher level. Efficiency is promoted through use of virtualization to better utilize processor resources; cloud computing; and centralized network and service management capable of balancing workloads and assuring that resources are available to handle jobs. Automation of management tasks and provisioning is also essential to creation of an efficient infrastructure.

Secure

The requirement for security is a given in today's environment. Threats continue to increase at every level from e-mail viruses to full-blown hacker attacks. Meanwhile, infrastructures increasingly are open and vulnerable. Centralized management and control of security becomes an imperative in the new infrastructure. There are so many points of vulnerability that lack of centralized monitoring and control is certain to leave unforeseen vulnerabilities. Patches and security fixes also need to be rolled out instantaneously across the corporate network to avoid first day attacks against new vulnerabilities.

Resilient

Resiliency is also considerable importance in the new architecture. Enterprise architecture needs to be robust and secure, capable of scaling to meet maximum requirements of the enterprise, with minimal chance for error and complete backup/mirroring support to provide continuous protection against loss of data. This is particularly important as the online environment continues to emerge and critical transactions take place on a regular basis. The old notion of a backup window has, within the past decade, disappeared entirely, for most data centers.

Agile

The new infrastructure needs to be quickly reconfigurable to handle the shifting requirements of applications, development, and business changes. Agility is achieved through virtualization, making it possible to architect virtual servers and associated disk and memory to meet any new requirement. Cloud computing makes it possible to extend virtualization using large numbers of processors within a controlled environment that eases deployment and provides for efficient centralized management. A Service Oriented Architecture makes it possible to respond more rapidly to business changes. Additionally, agility requires adherence to standards and a modular outlook so that hardware and software components can be reassigned at will.

Transparent

Supporting requirements for efficiency and robustness, the new architecture must be laid out in a transparent manner that permits logging and centralized management and also enables auditing. Compliance also figures in this requirement, since IT systems must now be able to demonstrate and verify all of the steps and communications relating to certain processes and transactions.

Multiple Hosting

To support the agility and resilience requirements, the new infrastructure needs to permit hosting of applications at any level, including hosting within the cloud, hosting at a server in the data center, hosting at the workstation level, and support for configuration such as grid computing. This all requires centralized management and rapid automatic provisioning, combined with adequate security to ensure that configurations can be changed securely and as needed.

Aligned with Business Needs

The infrastructure itself must meet and support real business requirements. It must fit within organizational budgets, be auditable and suitable to meeting compliance requirements; it must be scalable to meet business objectives, support security needs, and efficiently meet the applications requirements of the company. It needs to be based on service delivery rather than purely upon processing power.

Holistic

The new infrastructure must support a comprehensive and integrated solution. This solution must fall under a single centralized management structure and must be backed by a single vision.

Implications

When the first Model Ts rolled out of Henry Ford's factory, they created a wave of change that ultimately affected numerous areas of technical development, business, the workplace, and society. Many of these changes were impossible to predict, because they arose from interactions between the new processes. Although changes in the data center are unlikely to have the widespread impact of the mass produced automobile, they do create the setting for changes within business and its relation to information technology. These changes likely are to include new ways of handling business processes, and greater support for the development of modular, collaborative organization.

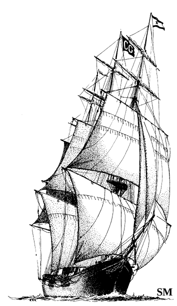
All of the components of the new infrastructure represent evolutionary change which, when brought together, create a new design. Implementation, however, could be difficult because legacy applications and systems likely will be difficult to integrate. Additionally, the vision is still evolving as the components are brought together to create new possibilities and new requirements.

For the CIO, this means that the critical areas need to be closely monitored. Introduced hardware, software, and network components need to be able to accommodate the expanded requirements.

Conclusion

Data center infrastructure is changing, and it appears to have reached a watershed within the past year. Vendors are now vying to bring together a vision that embraces new technologies, a new computing environment, organizational changes, and the pressures of the economy. Flexibility and efficiency are paramount, and these objectives, in turn, create other imperatives, such as the need for centralized control and a holistic vision.

The visions that have been proposed by vendors in many ways are similar because they need to address all of the categories in which change has occurred. It is important to watch this area, because these visions will need to work together. **Standardization and interoperability will be fundamental to creating a resilient and agile environment capable of incorporating all of the processing requirements of an enterprise.** Smarter infrastructure for your data center is now your imperative.



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- ***The Clipper Group can be reached at 781-235-0085 and found on the web at www.clipper.com.***

About the Author

Brian J. Dooley **is a Contributing Senior Analyst for The Clipper Group.** He has more than 25 years experience as an author, analyst, and journalist focusing on IT trends. He has written six books, numerous user manuals, hundreds of reports, and more than 2,000 magazine features. Mr. Dooley is the founder and past president of the New Zealand chapter of the Society for Technical Communication. He initiated and is on the board of the Graduate Certificate in Technical Communication program at Christchurch Institute of Technology. Mr. Dooley currently resides in New Zealand.

- ***Reach him via e-mail at bj.dooley@clipper.com.***

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