White Paper

Digital Transformation and Cloud Computing Driving IT Organizational Transformation: Are You Ready?

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IDC OPINION

In today's software economy, firms are investing in digital transformation (DX) initiatives to transform customer engagement, decision making, internal operations, and business models. For the business, this can mean a shift from a physical product to a subscription service, targeting an entirely new market or reaching new customers that bring a different level of scale. As a consequence, IDC projects that by 2018, corporations pursuing digital transformation strategies would more than double the size of their software development teams.

DX initiatives are driving a growing investment in software developers to build custom applications. These new applications, commonly built using DevOps methodologies, are infused with mobility, cloud, and analytics capabilities. Cloud computing is fast becoming the fundamental technology engine used by corporations in executing on their DX strategies. The use of cloud computing offers the promise of greater scale, automation, and agility as current enterprise application workloads and new distributed applications are migrated to cloud computing models.

> *"The vast majority of IT are developers, writing code, building programs, customizing applications."*
>
> IT Director and CISO, Incentive Services Division of multibillion dollar greetings firm

These objectives are the catalysts driving transformation in IT organizations, including people, processes, and organizational roles. At the organizational level, this means a shift in staffing requirements and skill sets and execution of different infrastructure processes. This transformation, like any change, is challenging. IT leaders must prepare their organizations for this change, which means developing staffing assessments, role-based profiles and process, and procedural maps. The transformation will bring change in future hiring plans, capital investments, annual budgeting, processes/procedures performed, and training and development conducted.

IN THIS WHITE PAPER

This IDC white paper focuses on the transformation occurring in successful, forward-looking IT organizations today. IT leaders recognize that change is under way and are embracing a road map to evolve and modernize their IT organizations and rightsize their investments to prepare for the next decade.

IDC spoke with senior IT leaders from three organizations: The Incentive Services Division of a multibillion dollar greetings firm, a major financial service corporation, and a multi-hospital healthcare provider network. Driven by DX and cloud computing initiatives, all three organizations have adopted

converged systems. Their experiences, shared in this white paper, can serve as best practices to firms facing similar business and technology pressures.

Based on research of leading business and technology teams, IDC has developed an IT Organization Transformation Maturity Model (refer to Table 2) that identifies the corresponding changes in IT roles, skill sets, and processes that come as a result of DX and cloud computing. This model can be used by IT leaders to compare themselves against their peers. This white paper also provides specific and prescriptive steps the IT leaders can take to prepare their organization for the transformative effect of 3rd Platform computing, including skill assessments, organizational planning strategies, and skill set/role to processes mapping.

DIGITAL TRANSFORMATION AND CLOUD COMPUTING INFRASTRUCTURE

To execute on DX initiatives, technology executives today are called upon to leverage 3rd Platform technologies and new business and operating models to transform and disrupt their businesses, customers, markets, and competitors. The competitive strengths of the past — corporate size and history, brand strength, and market leadership — have given way to a "new order" where agility, technology savvy, innovative ideas, and acumen with big data, analytics, and algorithms rule the day. To survive — let alone compete — traditional organizations have to change, sometimes dramatically.

> *"We are transitioning patient care and moving to a risk-based model focused on outcomes. Leadership recognizes IT is the key enabler."*
>
> Director of IT Infrastructure and Operations, healthcare provider network

Business and technology executives must view and act on digital transformation threats and opportunities as an urgent "disrupt or be disrupted" imperative for their enterprises. Digital transformation is the approach by which enterprises drive changes in their business models and ecosystems by leveraging 3rd Platform technologies and competencies. The 3rd Platform is the third model of computing and succeeds the first two platforms — mainframe and client/server/internet technology, respectively. 3rd Platform computing leverages the interdependencies between mobile computing, social media, cloud computing, and big data analytics and is transforming the way people and businesses relate to technology. These forces are driving the development of next-generation applications (NGAs) or cloud-native applications running on public and private cloud infrastructure.

At the same time, as next-generation applications are being developed, often in a DevOps or agile development methodology, existing enterprise applications must also be supported. 3rd Platform infrastructure supports both enterprise applications and NGA. 3rd Platform infrastructure brings with it attributes such as data locality, support for Hadoop and NoSQL analytics, petabyte-scale capacity, flash-accelerated configurations for performance, support for open APIs for orchestration and application integration, and the ability to run on industry-standard servers leveraging local persistent storage.

> *"The shift to a shared services private cloud required a change in traditional mindset. My competitor is AWS, and I needed to provide a differentiated service."*
>
> IT Director and CISO, incentive services firm

For organizations undertaking digital transformation at the business level, cloud isn't just about picking among a specific set of product or service delivery models such as public, private, or hybrid cloud. Developers and business leaders expect their IT teams to automate the provisioning of tuned IT resources for mobile, analytic, and IoT workloads at the right locations while also achieving the maximum reuse of all their IT and data assets as applications evolve.

Achieving these goals will require the monitoring, service management, and data control capabilities needed to support multiple cloud/datacenter options.

> *"With HCI, it meant less worry about the infrastructure and more focus on the end-user experience."*
>
> Director of IT Infrastructure and Operations, healthcare provider network

In the longer run, a cloud strategy must also be in the position to provide transition financing so that companies can more painlessly and quickly shift their procurement and budgeting policies and practices to more cloud-attuned models. At the same time, IT organizations must deliver a diversified portfolio of cloud services (on-premise and off-premise), improve their ability to manage a growing range of data and application assets in multiple internal and third-party datacenters, and develop a hybrid IT and developer operations model. They must also continue to realign their cloud selection and operations strategies based upon changing cloud options and requirements.

The rise of cloud computing has driven awareness of new infrastructure models among IT purchasers and consumers. Many of today's largest public cloud environments leverage a modern infrastructure architecture, referred to as hyperconverged. One mechanism organizations use to build out cloud infrastructure is hyperconverged infrastructure.

HYPERCONVERGED ARCHITECTURES AND THE CHANGING IT ORGANIZATION

> *"Converged is the new business as usual."*
>
> SVP, Director of Business Technology, major financial service corporation

First made popular by the largest datacenter operators such as Google and Facebook, hyperconvergence emerged as a modern infrastructure architecture for both traditional and next-generation cloud-native applications. Companies born on the 3rd Platform such as Twitter and Uber have ignited demand for scale-out software-defined infrastructure designed for hyperscale datacenters and next-generation applications. Meanwhile, established enterprises with physical products around the world are also demanding the benefits that an HCI approach can provide – that of scale, automation, and agility when building out their private clouds.

These web-scale hyperconverged environments found early success within midsize environments and virtual desktop infrastructure (VDI) projects due largely to their ability to eliminate the complexity, expense, and latency often associated with SAN-based storage solutions, but the mix of workloads running on these solutions has changed. The number of general business applications running on HCI systems continues to increase steadily, and these applications are being used for mission-critical SAP, Oracle, and custom application and cloud deployment use cases.

Hyperconverged systems are distinguished from converged systems in that they natively collapse core storage, compute, and storage networking functions into a single software solution or appliance. This is in contrast to converged systems (i.e., VCE vBlock, NetApp FlexPod), which are largely the packaging of autonomous compute, storage, and networking systems at the factory by the vendor or by resellers into a single frame. In addition to integrating storage and compute functions into a single node (or a cluster of nodes, each offering compute and storage functions), hyperconverged systems employ a distributed file system or object store for data organization and access, an abstraction mechanism for pooling hardware resources and providing a substrate for workload adjacency.

Today's well-designed, commercially available hyperconverged solutions are based on web-scale architectures and share attributes of a distributed everything architecture, scale-out design, and analytics but don't require businesses to develop their own new technology stack. Hyperconverged architectures

are being used as a platform of choice when building out today's public and private cloud infrastructure. With the adoption of hyperconverged systems, IT organizations are realizing organizational transformation as well. There is a consolidation of roles once individualized or specialized, such as networking, storage, or server management. With the use of HCI, the administrator takes on the responsibility for virtualization, compute, and storage, although at a more generalist level. The role of a dedicated Fibre Channel administrator evolves into a hyperconverged administrator.

As a result, standalone storage and storage networking personnel are reallocated over time. Also with the adoption of HCI, the storage/compute/virtualization administrator may take on a cloud architect role. For detailed analysis on infrastructure tasks, which change as a result of HCI usage, see Table 1. In summary, HCI brings the following IT organizational and process changes:

- **Change of infrastructure roles and responsibilities.** Cloud and HCI administrators take on a horizontal infrastructure role — across compute, networking, and storage infrastructure. This means existing storage specialists such as SAN administrators broaden their scope of responsibility and influence to include virtualization, compute, and networking resources.
- **Shift in focus to virtual machine and service-oriented management.** Infrastructure staff transition their focus from management of physical resources such as arrays, LUNs, ports, and servers to management of virtual machines, applications, and services. With traditional SAN domain administrators, there is often extensive correlation of virtual machines or applications to the LUNs and devices that support those resources. Typical processes such as reporting, utilization monitoring, provisioning, backup/snapshotting, and security analysis take longer to perform and face risk of human error.

> *"We needed to mitigate the need for specialists. I was driven by that. We are able to allocate generalists to manage HCI."*
>
> Director of IT Infrastructure and Operations, healthcare provider network

- **Agility, infrastructure automation, and service levels.** While application teams are providing greater levels of agility in the development and iteration of software, the infrastructure has not kept pace with this level of automation. Technology leaders are being tasked to provide greater levels of responsiveness to the business, and this includes infrastructure. One means to address this is through the adoption of cloud computing. For private cloud deployments, this brings the development of service catalogs and self-service portals with the natural evolution being the programmatic access to and automation of infrastructure such as storage through APIs. The freeing up of infrastructure staff from lower-level tasks allows for focus on developing the skills to programmatically control infrastructure for the benefit of transparently achieving performance, availability, and recovery SLAs.

TABLE 1

Infrastructure Tasks Eliminated/Reduced with Hyperconverged Systems

Task	With Traditional SAN	With HCI	HCI Details
Create and manage RAID groups, LUNs, and aggregates.	Yes	No	HCI administrators manage resource pools of compute and storage rather than RAID groups, LUNs, or physical devices.
Assign LUNs to hosts.	Yes	No	
Create and manage LUNs for snaps, replicas, and clones.	Yes	No	
Identify orphan storage and reclaim capacity.	Yes	No	
Manage host storage configuration files.	Yes	No	
Expand or reconfigure LUNs.	Yes	No	
Manage storage API, storage software, and microcode compatibility.	Yes	No	HCI provides automation updates to all software and firmware in the system.
Manage device driver, firmware, and hardware compatibility.	Yes	No	
Upgrade microcode, firmware, and host-level software.	Yes	No	
Correlate VMs to LUNs for reporting and troubleshooting.	Yes	No	HCI management and data services are all on a per VM basis.
Correlate VMs to LUNs for security, change management, and data protection.	Yes	No	
Configure and manage Fibre Channel SAN directors, switches, and ports.	Yes	No	HCI leverages an internal Ethernet network for east/west communications between nodes.
Perform Fibre Channel zoning and masking.	Yes	No	
Conduct data migration analysis.	Yes	No	HCI allows for performance/ capacity scaling and upgrades with hot addition and removal of multigenerational nodes.
Schedule/coordinate data migration between domain teams.	Yes	No	
Perform data migration during migration window.	Yes	No	
Maintain change control schedule (infrastructure).	Yes	Reduced	HCI consolidates compute, storage, and networking roles. Change control processes are reduced.
Coordinate with domain teams on change control tasks.	Yes	Reduced	
Conduct change control reviews (infrastructure).	Yes	Reduced	

Source: IDC, 2016

INFRASTRUCTURE AND IT ORGANIZATION TRANSFORMATION MATURITY MODELS

The adoption of 3rd Platform computing is driving IT organizational people, process, and technology changes. Some firms are navigating these changes and transforming the business of IT, while others view things as status quo. Therefore, based on research of leading business and technology teams, surveys, and observed industry trends, IDC has developed an IT Organization Transformation Maturity Model (see Table 2). This model can be used by IT leaders to compare themselves against their peers. It is made up of three stages a firm may operate in: Steady State, Evolving, and Transformative.

- **Steady State.** These are organizations that tend to be reactive to conditions or events. The organization spends little time planning for the future, and as a result, the infrastructure is highly heterogeneous. Traditional batch-driven analysis occurs, but there is no appreciation or realization from the C-suite on the strategic importance of technology. There may be some internal application development, but it is largely in maintaining legacy applications. This organization may be considering or using outsourcing or hosting service. Staffing and skill sets are tied to the technology domains such as servers, storage, networking, VI admin, applications, and databases.
- **Evolving.** These are organizations that understand and appreciate that technology decision will be strategic to the future outcome of the company. Or conversely, that the company needs to incorporate technology into its strategy. The evolving stage finds IT environments where the compute estate is already virtualized fairly well and there is use of analytics on structured and unstructured data. Application rationalization and infrastructure standardization is in process or has occurred. Investments in converged infrastructure have been made. At this stage, firms are evaluating the next infrastructure gains from software-defined storage to hyperconverged systems. They have some use of public and/or private cloud in place.

  > *"Assume 20% of our work, storage engineering, carving out LUNs, we've done zero of that work. We've seen several million dollars of savings."*
  >
  > Director of IT Infrastructure and Operations, healthcare provider network

- **Transformative.** The transformation organizations are information led. They have excellent insight into all their systems and documented data maps. Their CEO views technology as central to the corporate strategy, and they have many systems of engagement and insight in development or use. This translates to line-of-business and C-suite investments in chief digital officers, innovation labs, and teams of technical resources focused on digital transformation, either in a team-based or embedded line-of-business fashion. With DX initiates, the concepts of failing fast and iterative innovation are prevalent because time to market is usually an imperative. This spawns the application teams to embrace agile development processes and a DevOps methodology.

  > *"My goal is to leverage common infrastructure APIs to drive automation."*
  >
  > SVP, Director of Business Technology, major financial service corporation

  Depending on the use case and application, this may also include consideration of continuous integration/continuous delivery. The automation seen in the application development process is increasingly expected in the infrastructure. This drives interest in open APIs, OpenStack integration, and the software-defined infrastructure approach. There is a use of public and private cloud with an awareness of and some development in place for a cloud orchestration layer/broker across clouds. The level of communication between centralized IT infrastructure teams and line-of-business DevOps teams varies. Organizations are also adopting/repurposing this model for their traditional app development.

TABLE 2

IT Organization Transformation Maturity Model

	Stage 1 *Steady-State / Business as Usual*	Stage 2 *Evolving / Enlightened*	Stage 3 *Transformative / Business Driven IT*
IT Organizational Roles	• Separate server, storage and networking roles • Centralized IT infrastructure/Operations teams • Application development and Infrastructure teams run individually • Merging of Virtualization/server administrator roles	• Merging of storage and networking roles • Consolidation of compute, storage and networking infrastructure under cloud operations • Application development and operations integrate via DevOps teams • Cloud Architects take on cloud automation tasks	• Infrastructure provisioning becomes automated through APIs. This delivers automated provisioning of storage volumes for new virtual machines or containers. • Creation of storage services with predefined performance, availability and recovery attributes • Programmatic access to those storage services through service catalogs and APIs • Infrastructure roles become script/ programmatic-based • Cloud automation and deployment APIs integrate with infrastructure APIs • DevOps becomes standard for all environments
Processes/Management	• Infrastructure centric management • Lower level device management tools/ CLIs for each element managed • Knowledge specialized by device and vendor • Manual standard operating processes and procedures	• VM centric management • Some processes automated via Public and/or private clouds– selective based on workload requirements • DevOps methodology is partitioned	• Data and policy centric management • Infrastructure completely automated for private and public clouds • DevOps methodology is embedded • Software-defined infrastructure
Software Dev and Delivery	• Waterfall process [requirements, design, implement, verify, maintain] • Older processes for code review, defect triage • Long development cycles (tedious)	• Agile • Automation in testing and infrastructure • Develop in continuous improvement cycle • Develop, integrate and test in iterations	• Continuous integration and delivery process [commit, build, automate, deploy] • DevOps practices • Frequent builds and releases (fluid) based on business need
Infrastructure Standardization	• Highly heterogeneous, many snowflakes • Some x86 virtualization • Some OS and MW standards • Mix of many storage platforms and vendors	• Standardize on OS, hypervisor, Server • Consolidated to fewer storage platforms • Investments in Converged Infrastructure platforms • Evaluating/POC or departmental use of HCI, SDS, SDI	• Standardized on common infrastructure stack • Implemented HCI as underlying cloud infrastructure • Departmental or P3 applications using software defined infrastructure • Use of APIs to avoid lock in at infrastructure level
Skillset and Staffing	• Silo'd responsibilities and teams • Specialists by protocol, vendor and platform • OS and/or VI specialists • Networking specialists	• Specialist and Generalist • Generalists by CI vendor and platform and hypervisor management.	• Singular/Integrated • Generalist for compute and storage • Specialists for hypervisor & hypervisor management
Storage Skill / Knowledge	• Fiber channel • Vendor specific CLIs/APIs and tools	• Vendor specific CLIs and tools • Some scripting	• Automation and API integration • Programming, Application integration and script writing • Development of Chef and Puppet templates

Source: IDC, 2016

CHALLENGES AND OPPORTUNITIES

For an IT organization of any size, the challenge is at once maintaining the existing estate of applications, servers, and SAN/NAS infrastructure while evolving to next-generation, scale-out software-defined infrastructure. As this white paper discusses, there are economic, cultural, staffing/organizational, and process challenges that must be addressed. Change does not happen overnight and is instead an evolution that happens over time. As Vijay Govindarajan, a leading innovator and strategist, said, "Strategy is really about how you create your future while managing the present."

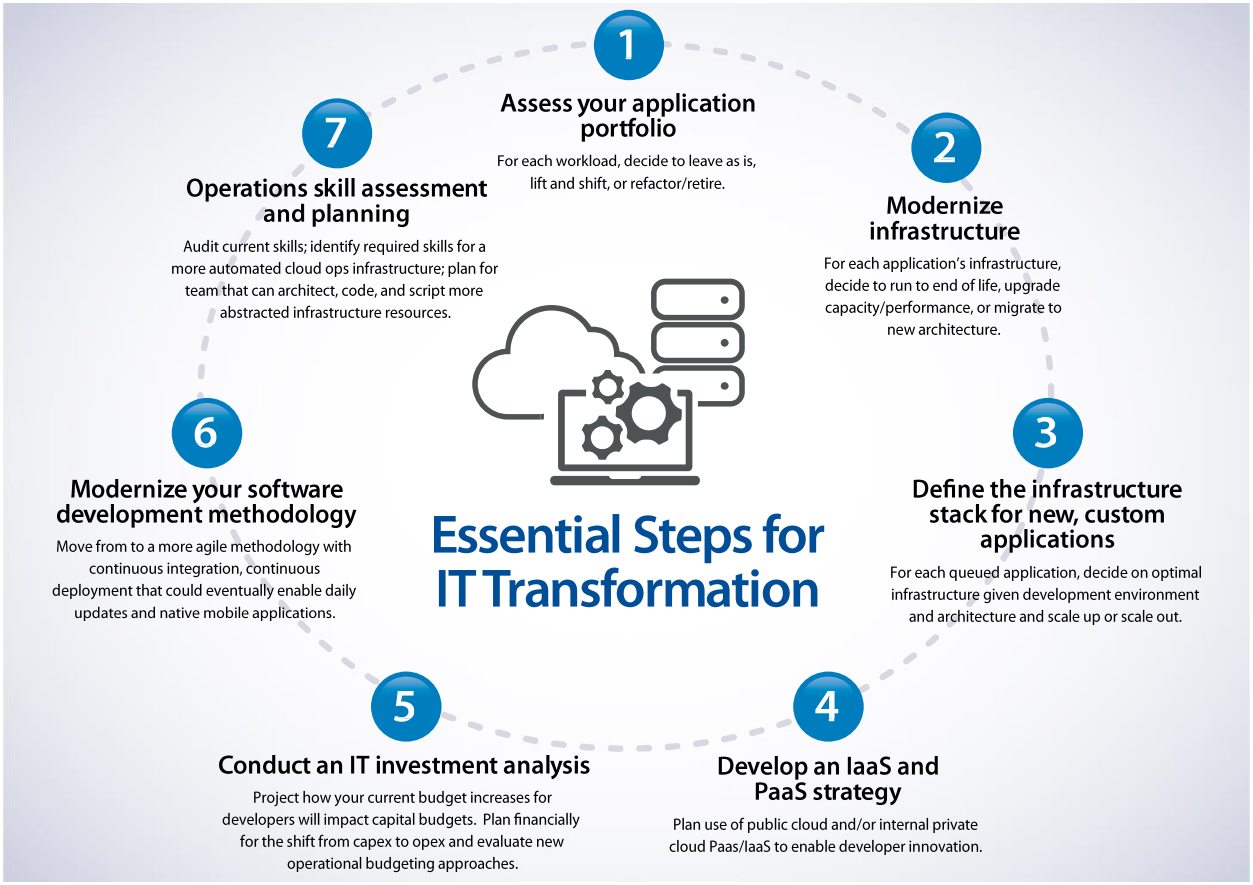
> *"Managing a storage network takes a special skill set. We did not have the time or energy to invest in maintaining that."*
>
> IT Director and CISO, incentive services firm

This is exactly what today's IT leaders face. The following provides some concrete and prescription steps technology leaders can take to prepare themselves for and enable IT transformation (see Figure 1):

1. **Assess your application portfolio** and the infrastructure. For the workload itself, identify a strategy of (a) leave as is, (b) lift and shift to new infrastructure, (c) refactor the application for new infrastructure, or (d) retire. Successfully rightsizing your IT environment means sunsetting older applications and refactoring others.
2. **Modernize infrastructure.** For each of your application's underlying infrastructure, determine an approach of (a) let it run to the end of its useful life, (b) upgrade capacity/performance, or (c) migrate to a new architecture. Older compute and storage resources still on maintenance can be used for smaller sites or DR. You can accelerate performance in your existing infrastructure by adding flash for persistence or caching.
3. **Define the infrastructure stack for new, custom applications.** Work with application teams and line of business to understand the range of applications in queue and how the infrastructure stack can be optimized from a software and hardware perspective. Understanding the application development environment and how teams are architecting the applications will inform a scale-up or scale-out infrastructure strategy.
4. **Develop an IaaS and PaaS strategy.** Research and develop acceptable use of public cloud PaaS and IaaS. Investigate use today and the need for internal, private cloud IaaS and PaaS environments. Leading IT organizations are building out PaaS and IaaS environments to enable innovation environments for developers and DX/CX initiatives.
5. **Conduct an IT investment analysis.** Is your budget for people increasing because of DX/CX initiatives or custom-built applications requiring greater numbers of developers? Will this have an impact on your capital budget? What is your strategy to plan for this shift from capex to opex? Does this increased investment in development warrant a new operational approach?
6. **Modernize your software development methodology.** The pace of today's business means upgrading a waterfall development process to a more agile approach. The use of DevOps and a CI/CD pipeline is ideal for applications with daily updates and native mobile applications.
7. **Operations skill assessment and planning.** The next several decades of infrastructure operations will be about programmatically accessing compute, storage, and networking resources. Northbound and southbound APIs will be used for both orchestration, control, and persistence. Therefore, IT leaders must go through staffing analysis to understand the current and future skills needed in their organization. Central to this will be professionals that can architect, code, and script more abstracted infrastructure resources.

FIGURE 1

Essential Steps for IT Transformation



Source: IDC, 2016

SUMMARY

DX and cloud computing combined with the implementation of next-generation applications are the catalysts for transformation in today's IT environment. This transformation is challenging, but technology leaders and organizations that can make this journey will be best positioned for the next decade of IT. Just maintaining the status quo creates opportunity for competitors or alternatives to disrupt your business. Successful IT leaders recognize that change is under way and are embracing a road map to evolve their IT organizations, modernize their infrastructure, and rightsize their investments to prepare for the future. Take the next step, and evaluate where your IT organization is on the transformation journey. Begin to map out a road map for the changes you need to make to prepare your IT organization. This IT transformation is your own, but you need to be ready.

> *"The business, they just want it more and faster."*
>
> IT Director and CISO, incentive services firm

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