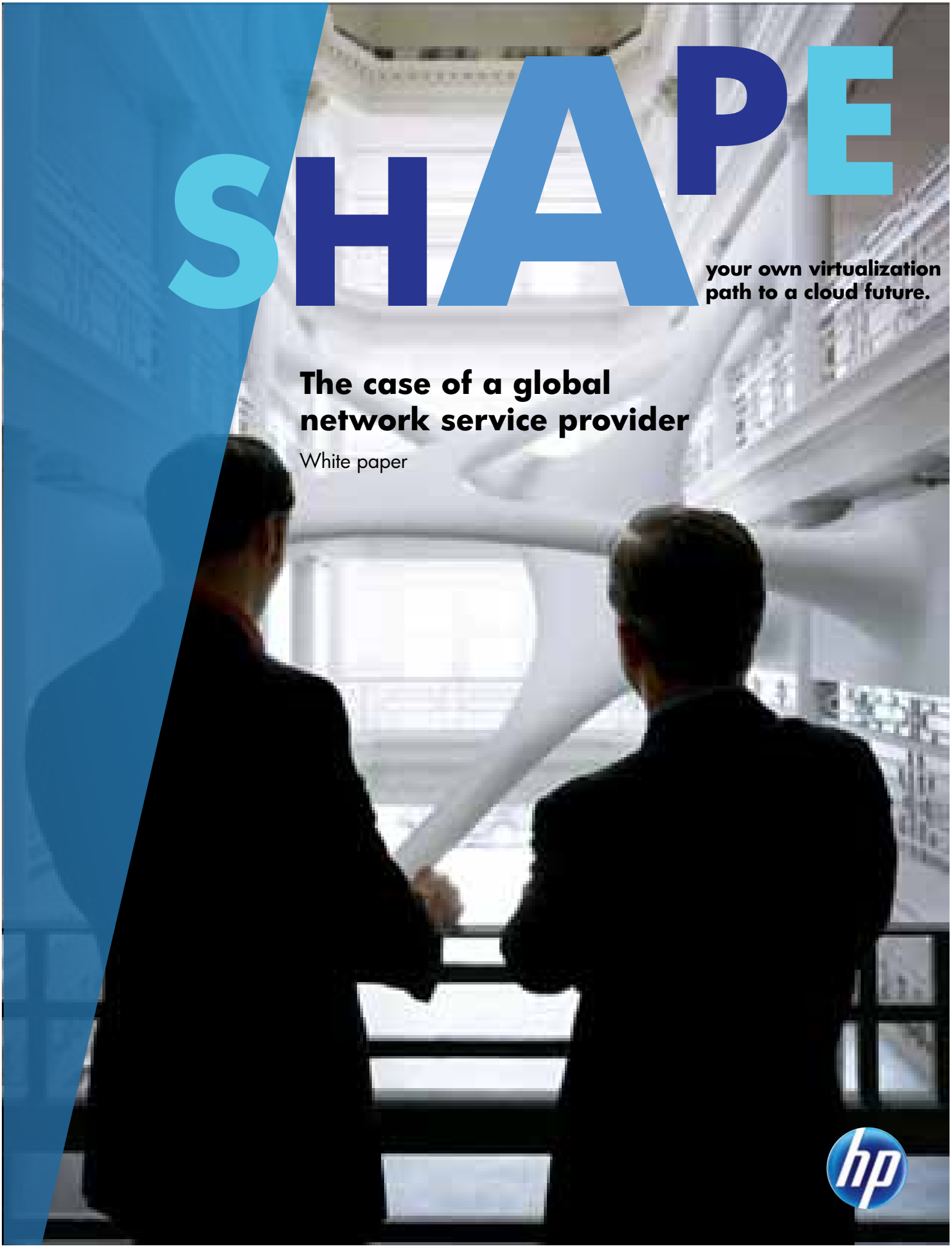


SHAPE

your own virtualization path to a cloud future.

The case of a global network service provider

White paper

Table of contents

Figure 1: Considerations for a cloud infrastructure

Executive summary

After achieving initial success with targeted server virtualization implementations, for consolidation purposes mostly, CIOs and IT managers are now looking to gain greater benefits from virtualization. They are shifting their focus to the question: How can we apply virtualization strategies more broadly across our environment to realize better business outcomes?

IDC estimates that 51% of data center workloads will be virtualized by 2010 and 69% of data center workloads will be virtualized by 2013.[1] The market intelligence provider's research indicates that customers are increasingly moving beyond simple consolidation objectives, and looking at adopting virtualization to improve business continuity and application performance. The findings revealed another trend: 70% of decision makers responsible for implementations that have more than 50 virtual machines expect automation to play a very important role in their virtualization management environment going forward.[2]

Virtualization is also a key catalyst for cloud computing. Typically, enterprise organizations that have virtualized are more likely to move to a cloud computing model. Successful transition from virtualization to cloud computing really depends on an organization's ability to create a shared infrastructure model, and adapt its people and processes along the way.

This paper discusses how one of the biggest telecom service providers in the industry is successfully evolving from virtualization to cloud computing through a next-generation infrastructure program, with HP support.

It's time to think about infrastructure beyond virtualization

While trying to get more from their valuable IT resources, many CIOs are also looking to move from an approach that focuses only on maintenance and operations to one that can design and support business innovations faster. Such a shift requires creating a well-architected portfolio of modular and repeatable cloud-like services that, like building blocks, can be rapidly composed to meet market demands today. This need has triggered the next phase of virtualization—where the fundamental elements are automation, service management, self-service functionality, metering, and usage-based pricing.

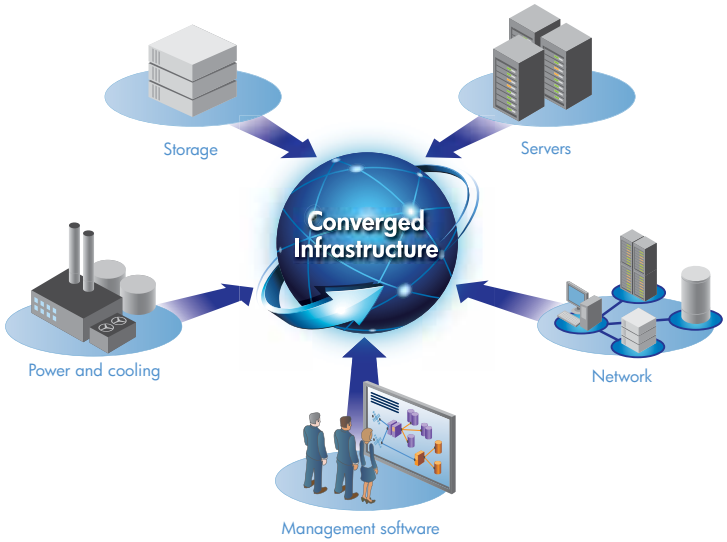
In an increasingly digital world, almost all business innovations may require IT infrastructure and application hosting capabilities that can be converted to repeatable, scalable, flexible, transparent, and efficient services. For this reason, data centers are becoming service-driven environments with pooled and virtualized resources. IDC defines these environments as internal or private clouds.[3]

[1] Michelle Bailey's Directions Speech, March 2010, IDC

[2] North American Virtualization Survey: Large-Scale Implementation Requires Sophisticated Management Strategy, Mary Johnston Turner, Frederick W. Broussard, February 2009, IDC

[3] HP Cloud Infrastructure Services: Jumpstart Enterprise Decisions and Deployments, Sponsored by HP, IDC, March 2010

Figure 2: Tomorrow's business will be built on a converged infrastructure



HP can help you lay the foundation for an internal cloud using converged infrastructure. The newly introduced HP Converged Infrastructure solution offers a platform to integrate networks, storage, servers, hypervisors, energy efficiency methods, and automated system management software. We've helped many businesses combine virtualization, converged infrastructure, service management catalogs for infrastructure data, application layers, and service automation with self-service portals to design and deploy internal clouds successfully.

An internal cloud promotes large-scale dynamic resource sharing and automated service delivery and operations across a wide range of business applications and workloads. It can be fine-tuned to dynamically improve end-to-end service delivery and management of a catalog of services for a specific set of needs.

While pooling, virtualization, and shared services are vital aspects of internal clouds, these may not be sufficient for addressing all organizational needs at an infrastructure level. In the near future, you are likely to have a hybrid services environment that includes:

- Dedicated infrastructure for select business services and applications
- Traditional shared services infrastructure
- Converged infrastructure
- Private cloud infrastructure for specific business services
- Managed or outsourced infrastructure

The unique opportunity for telecom players in the cloud era

Internal cloud capabilities now enable telecom service providers to offer hosted private or public cloud services to their enterprise customers. Telecom networks are essentially centralized shared tenant architectures for the delivery of capabilities such as dial tone and network-embedded services such as inter and intra-network switching and routing that enables point-to-multipoint connectivity, audio conferencing, security, and hosted TDM and IP telephony. Over time, some telecom players also made moves into the converged network-IT services space. They layered on hosted infrastructure and application management services delivered from data centers that sit atop the network and are connected via the carriers' IP backbones.

Telecom service providers have always focused on delivering high levels of availability for their services and applications, and they have the know-how to lead this new era of cloud services with the right level of service. Beyond being part of an ecosystem dominated today by "over-the-top" players for popular cloud services, they have the opportunity to take a leading role between enterprise cloud consumers and cloud service providers. Besides, telecom service providers have deep experience in customer care (mainly from call centers), which can be helpful in providing entry points for handling customer inquiries, such as: "Why can't I access this cloud service?," "Is the service down?," "Is the network down?," and "Has my contract expired?." Also crucial is their ability to establish billing relationships with those customers.

The time has never been better for telecom service providers to begin their cloud journey. And at HP, we offer innovative solutions and a reliable partnership for those who have decided to seize the opportunity.

Observations from a global telco case study

Challenge

A global telco operates in fixed and mobile telecommunications, Internet, and media. The group offers integrated communication services for consumers as well as advanced information and communication technology solutions for businesses. It manages:

- 16.1 million fixed-line network connections and 7 million broadband access
- Italy's largest internet community
- 30.8 million mobile lines
- 4.6 mobile broadband users

To achieve better business alignment, its technology organization needed to reduce:

- The number of physical servers to save on related operating costs
- Server maintenance and energy costs
- The time it takes to deploy services

Solution approach

In 2008, the company introduced its next-generation data center (NGDC) program, based on a holistic server virtualization approach. The objective of the NGDC program was to reduce the number of physical servers by 6:1 ratio, by implementing the following plan:

- UNIX® high end: From 500 systems (partitioned) to 150
- UNIX mid and low end: From 3,500 servers to 250
- "x86" (Intel® and AMD): From 7,500 servers to 1,500

HP assisted the telco in analyzing its server assets, building the business case, and identifying transformation risks and success factors. Our IT transformation experience influenced the company's decision to adopt an infrastructure delivery model that was consistent with the HP concept of IT shared services. This service-oriented delivery model was introduced to provide pre-configured virtual infrastructure to application engineers and developers with some level of transparency about the virtualized environment configuration aspects. The model focuses on standardization of physical server setups and I/O ports to be able to plan for cabling and power paths.

In this company's NGDC model, application engineers develop, customize, and test their enterprise applications directly on the virtual servers provisioned by infrastructure engineers. And operations engineers address the final release-to-production stage and provide ongoing support to the entire solution.

Solution execution

The infrastructure deployment process had three phases:

- Infrastructure service definition—where the physical and virtual infrastructure resources were designed and related operating processes were defined
- Infrastructure service creation—where the physical infrastructure was set up and virtual servers were provisioned (with OS pre-installed) according to IT resource requirements planning
- Infrastructure service activation—where the virtual infrastructure was configured according to application owners' requests and deployed

A new IT organization—Infrastructure Engineering and Deployment (IE&D)—was put in place to design, organize, and deliver virtualized infrastructure in line with the service-oriented model. IE&D designs and provides application engineers with standardized virtual resources that can be provisioned for specific application needs. In other words, IE&D provides "infrastructure-as-a-service" (IaaS) to application engineers—implementing what is recognized today as an internal cloud delivery model.

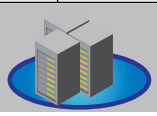
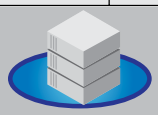
IE&D, assisted by HP, developed a light Web portal interface that allowed application engineers to address their configuration needs simply by choosing infrastructure from a catalog of standardized, virtual components. This helped save time typically needed to set up "vertical" configurations according to specific project essentials.

A custom capacity planning tool was also developed to study the capacity and balance resources among server farm components. The tool extracts utilization data from HP Insight Management databases (equipped with the HP Insight Dynamics capacity planning capability).

The main features of the current internal cloud model adopted by the global telco include:

- Pooling and sharing of standardized infrastructure resources
- Provisioning of virtual servers (Here, storage and network are pre-assigned to the logical servers, so that external resources are already available during the virtual server provisioning process)
- Internal separation of duties between virtual infrastructure providers (IT infrastructure engineers) and infrastructure consumers (IT application engineers)

Figure 3: NGDC deployment

Data centers	Ratio virtual : physical (at infr. creation)	Itanium cores	Boot SAN FC ports (with redundancy)	Boot TB (raw)
1	16:1	448	192	43
2	16:1	512	128	32
3	10:1	960	320	45
4	16:1	320	192	23
5	13:1	320	192	42
6	16:1	384	128	23
				

Both the provisioning process and separation of duties rely on the definition and adoption of an NGDC service catalog that consists of standardized, virtual infrastructure offerings available to application engineers. So far, NGDC HP-UX server farms have been deployed in six of the telco's data centers. Each server farm consists of physical and virtual HP-UX servers (both v2 and v3); centralized boot storage area network (SAN) and storage; and infrastructure resource management servers, based on HP Insight and HP Ignite/UX software.

Major enterprise-critical systems, such as customer relationship management (CRM) and data warehouse, have been deployed on the NGDC infrastructure—using HP Insight Dynamics—VSE—that is provided "as a service" through the telco's internal cloud approach.

The company's NGDC service catalog provides the following basic configuration elements:

- IP network virtual LAN (VLAN) characterization
- Logical server characterization (OS version, number of CPU cores, RAM: core ratio, data storage logical unit number (LUN) size and quantity)
- Data backup needs (Data traffic and quantity)

The SAN uses soft zoning to allow data traffic separation, facilitating multi-pathing and alternate routing. Also, a standard pre-provisioning model is adopted to provide data LUNs and SAN zoning configurations to a limited set of HP Integrity Virtual Machine hypervisors (HP-UX VM hosts) within the range of a pre-defined virtual machine migration domain. This enables logical server migrations among a set of pre-defined hypervisors.

Valuable contribution from HP

HP helped the global telco provide the following technology services:

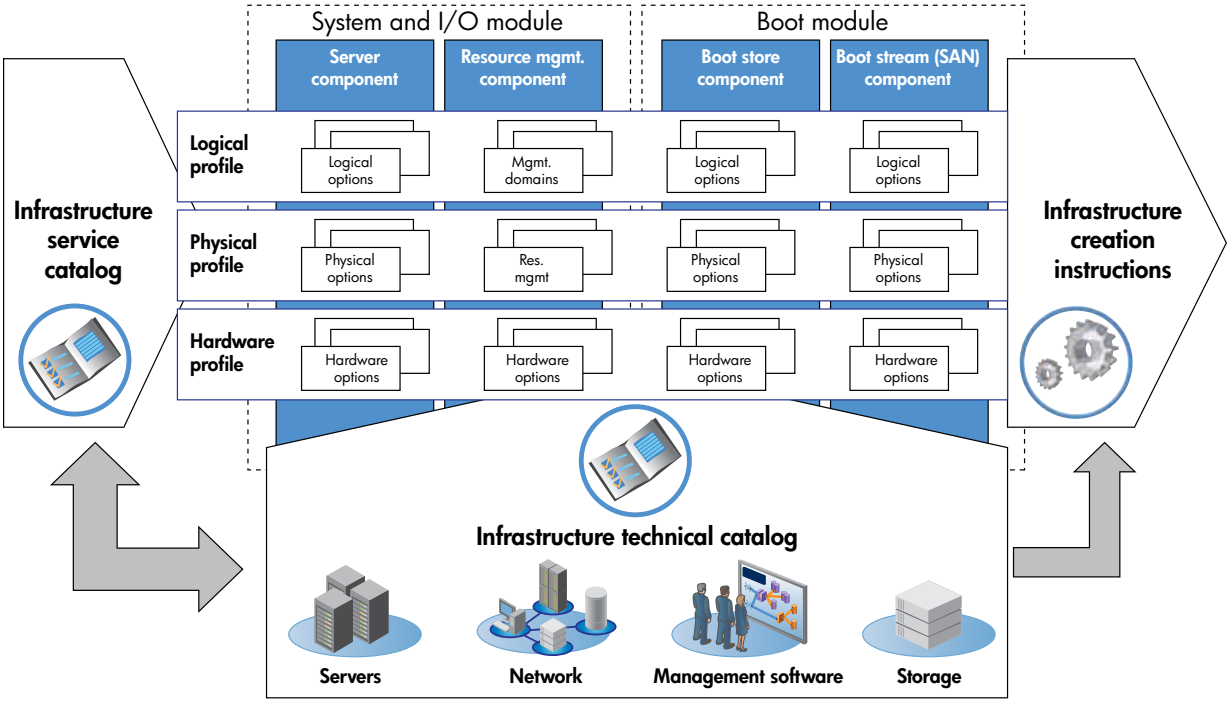
- The HP Integrity infrastructure—physical and virtual architecture design, including integration with the NGDC network and storage architecture, as well as definition of infrastructure processes and operating procedures
- HP-UX server farm—physical and virtual infrastructure deployment, where more than 20 HP experts assisted in designing and implementing the NGDC HP-UX server farms

The infrastructure elements designed and deployed by HP include:

- 45 HP Integrity Superdomes (dual core Itanium with 3,328 cores)
- 1,447 HP-UX logical servers (vPar and HPVM)
- 14 boot SAN switches (HP SAN Director 4/256 with 1,280 ports)
- 7 boot disk arrays (HP StorageWorks XP24000 with 140 raw TB boot storage)
- 14 CMS Insight servers (HP Integrity rx2660)
- 14 Ignite/UX servers (HP Integrity rx2660)
- 5,000 Intel x86 servers (ProLiant DL585) as VMware platform

Figure 4: Infrastructure standardization and profiling

The figure illustrates the categorized design reference model that HP built for the global telco to standardize resources as well as integrate them with existent network and storage design policies.



Also, HP brought with it a thorough understanding of designing and maintaining technical catalogs and defining the procedures required to build and provision a virtual environment. To realize the logical server sizes offered in the service catalog, HP helped create a technical catalog that specifies all NGDC-specific operating requirements, including:

- Physical infrastructure configuration (cabling and facility requirements)
- Logical configuration (the number and type of virtual servers, as well as boot storage and OS)
- Network and storage interfaces configuration
- Creation and activation (provisioning) procedures
- I/O interface requisites
- Virtualization-specific operations (virtual machine migration and OS backup/restore and hardening)

The technical catalog provided a clearly categorized design reference model to enable technical feasibility and integration with storage, network, and tape infrastructure. The categorization made it possible to update configuration elements without having much of an impact on the overall physical and virtual design. Also, it offered document templates (one for each physical/virtual component) to build (using a custom tool developed by HP) the operating instruction document.

The technical catalog supports and feeds the infrastructure service catalog that helps define operating instructions—which could be automated in future. And it offers application engineers the infrastructure options to implement the solution application layer.

By design, all HP-UX physical and virtual servers are managed by HP Insight Software-equipped CMS servers. This enables physical and virtual server monitoring and automated management of HP Insight Dynamics–VSE's dynamic resource features. HP Insight software collects and analyzes capacity data, and it provides detailed online reports about physical and virtual configurations. And HP Ignite/UX servers provide bare-metal OS installation (physical and virtual) and OS backup/restore functionalities.

As part of the technical design, HP also provided the procedures and related operating instructions to support the "service activation" phase (logical server profiling) and the standard maintenance procedures affected by the NGDC service-oriented approach.

Recommendations for successfully creating a shared services environment

Based on the observations from the global telco project and hands-on experience from many other similar projects, HP recommends the following best practices:

- **Fine-tune processes**: When introducing a shared service infrastructure delivery model such as an internal cloud, it is essential to enhance and streamline the infrastructure delivery processes to realize the full potential benefits. A major part of the changes needed to implement a cloud environment comes from applying cloud service architecture principles—an activity that is typically led by the IT architecture team. But the inherent benefits of the architecture—such as tight integration, virtualization, automation, and dynamic scale up/down—can only become effective when the IT operations team is involved early. They need to work in parallel to enhance the operational processes, by identifying and addressing operating gaps right at the beginning, and streamline processes to take better advantage of the flexibility offered by a cloud model.
- **Consider the entire infrastructure lifecycle**: While operational processes (such as request/demand management, service and resource provisioning, and accounting/chargeback) are mapped to infrastructure delivery, it's crucial to consider the entire infrastructure lifecycle of service delivery, including change management. For example, the service catalog should not only include the capability to request new infrastructure services, but should also factor in possible change requests, additions, or deletions. From a management perspective, HP recommends both a service management layer as well as a resource management layer, which deals with the most effective (re)allocation of all infrastructure assets, both physical and virtual, throughout their lifecycle.
- **Make virtualization work better**: Virtualization technologies that provide full isolation of virtual machines at the kernel-level determine the least degree of software application and operations impact. Also, virtualization loads can be quickly cleared by physical resources capacity, including I/O—which is a virtualization-critical resource, as relevant as CPU and memory.
- **Create modular services**: Apart from standard cloud services offered through the service catalog, IT organizations need to continue to support custom "by project" requests from the business. Ideally, when designed well, the service catalog should be able to provide repeatable service building blocks to satisfy many of the requirements of custom project requests. This modular approach can help application developers and project owners appreciate the costs and time saved while using the more efficient cloud approach where possible. In addition, it can allow both shared and dedicated delivery models to compete and improve continuously.
- **Move soon to "platform-as-a-service" (PaaS)**: To accelerate internal cloud adoption, it's a good idea to start with IaaS and quickly move up to PaaS, which helps standardize and integrate middleware software components. PaaS can also rapidly become a key enabler in application consolidation or rationalization.

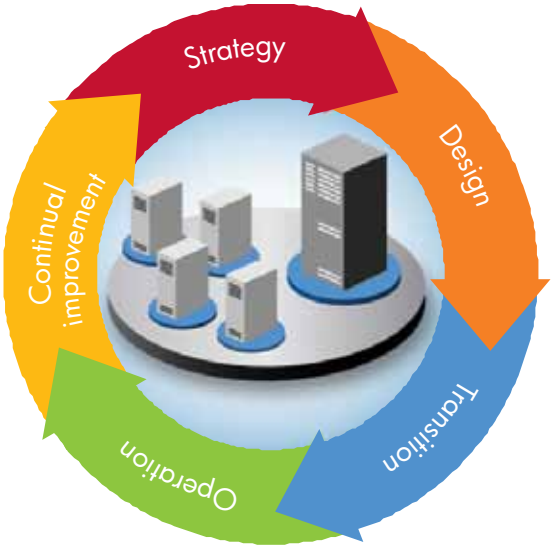
Services to help you embark on cloud computing and infrastructure convergence

To help avoid the potential organizational and decision-making pitfalls that can slow or derail cloud initiatives, HP offers a range of cloud consulting and support services, including:

- **HP Cloud Discovery Workshop**: This is a half-day or full-day engagement for C-level business decision makers, CTOs, and chief IT architects. The workshop can help you get key stakeholder buy-in and make decisions about cloud opportunities more quickly by facilitating a clear understanding of cloud opportunities, benefits, and implications to the business. The highly interactive and visual workshop provides attendees with an opportunity to discuss shared services transformations, cloud concepts, service portfolio concepts, governance, security, business case issues, and HP solutions.
- **HP Cloud Roadmap Service**: Using its automated transformation planning tool, HP works with your IT team to define your organization's desired cloud target state and provide detailed resource-gap analysis across service management, technical architecture, culture, staff, governance, and other domains. The tool also produces detailed analysis of staffing and return on investment models. The overall goal of the program is to help your IT team take ownership of the organization's cloud strategy and create a roadmap—supported by a fact-based business case for projects that can be executed over time to achieve the desired state.
- **HP Cloud Design Service**: HP experts conduct detailed technical and business analysis leading to specific technology, tools, and standards recommendations that are based on the HP cloud computing reference architecture. This architecture acts as a common framework for all cloud engagements with HP and accommodates different go-to-market plans, installed technologies, software stacks, and related cloud service needs. Major offerings include detailed designs that can evolve from private to public cloud solutions over time, as well as a bill of materials, cost estimate, implementation plan, full mapping of HP and partner technologies into the recommended cloud architecture, and set of IT Infrastructure Library (ITIL) v3 process best practice recommendations for your cloud environment.
- **HP Cloud Security Services**: We provide a review of compliance and security personnel, policies, procedures, products, and proof using our P5 model. Onsite review and analysis of 15 domains of cloud security result in a cloud computing security and compliance remediation roadmap. Gaps, if any, are addressed with a broad set of security services and products that are part of the HP Secure Advantage Solution portfolio. The aim is to strengthen your organization's unified risk management and infrastructure protection strategy.

- **HP Converged Infrastructure Services**: HP technology experts design and implement cloud-based infrastructures using four key HP Converged Infrastructure technologies—HP Matrix Operating Environment, HP FlexFabric, HP Virtual Resource Pools, and HP Data Center Smart Grid. And with HP BladeSystem Matrix—a pre-configured system that converges compute, storage, and network resources—you can realize the benefits of a converged infrastructure right away. Going beyond the full design and implementation lifecycle of your converged infrastructure, we can also support ongoing operations to enhance outcomes. In addition, we provide hosting and outsourcing options, if you prefer to have us build and manage your converged infrastructure on your behalf.
- **HP Cloud Implementation Services**: You can accelerate the implementation of your cloud solution using our factory pre-integration services, onsite installation expertise, proven and scalable methodologies, and flexible customization capabilities. Our worldwide network of authorized channel partners gives you easy access to all of our cloud implementation services.
- **HP Support Services for Cloud**: HP provides advice, analysis, and support to implement and manage your cloud computing environment as it scales up and becomes more mission-critical to your organization. HP options include multi-vendor support, remote support, and technology services for continuous improvement across the integrated cloud environment.
- **HP Education Services**: As you embark on cloud computing and infrastructure convergence, HP can address your change management and training needs with flexible options—including instructor-led classrooms, remote classrooms, and self-paced courses on topics such as ITIL, virtualization, data center, system management, networking, and storage. Our cloud consulting and support services have been matured using decades of experience in helping enterprise organizations across the world consolidate data centers and computing strategies, and enhance their efficiency.

Figure 5: Data center lifecycle



Putting together the building blocks of your cloud

HP has been involved with the cloud even before it was formally defined throughout the industry. We've developed deep shared services and service management expertise, and we understand the service-centric model at every phase—strategy, design, transition, and operations. Rather than focus on pieces of cloud computing, we provide a comprehensive framework for you to work toward a cloud future that addresses people, process, and technology. And through the HP Converged Infrastructure architecture and technologies, we enable tight integration and synergy among previously siloed servers, storage, networks, and management software—making the cloud infrastructure real.

Over the years, we've executed complex, global cloud implementations for network service providers, banks, and public sector organizations. This has helped us build an array of cloud solutions that feature an "everything-as-a-service" capability—providing the complete expertise you need to implement your chosen strategy. Using these solutions—which cover foundational and enabling technologies and services—you can realize the true potential of cloud computing.

Move a step closer to your cloud destination by visiting **www.hp.com/services/cloud**

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