NetApp

Tech OnTap

Highlights

September 2009

T-Systems Delivers Cloud Services with High SLAs

Stefan Bucher, Global Delivery Manager

When you contract for cloud services, you normally expect lower service levels than those for internal IT.

Find out how T-Systems built its Dynamic Services offering to meet or exceed enterprise service levels with NetApp® storage, MetroCluster, VMware® HA, and VMotion™. Learn about the company's unique "twin core" data centers.

More

Tips from the Trenches

Tips to Supercharge Your Cloud Deployment

Hamish McGovern, Product Manager

Thinking about cloud services but not sure how to start? Get up to speed with expert tips on cloud networking, automation, and more.

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Blog of the Month

You Really Do Know Clouds

There are those who think the cloud is the next wave of IT and the future of everything. Then there are those who think it is just a repackaging of things they already use. They both are right.

Read the Blog

Engineering Talk

Make the Switch to Oracle11*g*

Kannan Mani, Oracle Reference Architect
Peter Schay, Database Solution Architect

Oracle® Database 11*g*™ Release 2 is shipping. Key NetApp® and Oracle technologies can simplify and improve your application testing and upgrade process.

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  Connect with experts about optimizing your Exchange and SharePoint® network storage environments.
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Case Study: Implementing Enterprise-Class Cloud Services

By Dr. Stefan Bucher, T-Systems

Most of the time when you contract for cloud services, you accept the fact that, along with lower costs, you get lower service levels (SLAs). T-Systems began developing its dynamic services offering five years ago—long before cloud computing became popular—with the idea of providing services via a flexible IT model that would boost efficiency and decrease costs while delivering high service levels. Originally, Dynamic Services was designed for low-cost and easy implementation that we thought would appeal to low-end markets, but the service quickly attracted the interest of high-end customers with its enterprise-class SLAs.

Today, we deliver a full range of IT as a service (ITaaS) offerings ranging from storage as a service (SaaS) and infrastructure as a service (IaaS) up to popular applications such as SAP®, Lotus Notes/Domino, and Microsoft® Exchange while at the same time:

- Decreasing costs by at least 30% versus on-premise IT
- Providing rapid provisioning of new resources
- Enabling self-service recovery in minutes
- Ensuring 100% backup/recovery success
- Delivering DR at one seventh the cost
- Offering RPOs of zero and RTOs of 15 minutes
- Simplifying migration for new customers
- Providing nondisruptive upgrade capabilities
- Increasing storage utilization by 50%

We deliver these capabilities using a combination of technologies from NetApp and VMware. In this article, I explain the technologies we use, describe how this benefits T-Systems and its customers, and talk about future plans and opportunities.

Creating a Simple, Standardized, Virtualized Architecture

To create our Dynamic Services offering, we knew we needed to create an architecture based on simple, virtualized building blocks that we could scale out as necessary. Only full virtualization on servers and storage would give us the flexibility to scale up and down rapidly to meet customers' changing needs while keeping costs low.

Ultimately, we settled on a combination of NetApp® storage and VMware® running on standard servers. We deploy only the largest available NetApp storage systems for production storage to be sure we can deliver optimal performance even at very high storage utilization rates.

We chose NetApp over other vendors because so far it's the only vendor that meets our requirements. Every 90 days we issue our requirements catalog to all the major storage vendors, but so far only NetApp has been able to meet all requirements.

We rely on Network File Systems (NFS) to access storage rather than using a storage area network (SAN). By opting for Ethernet-based storage, we eliminate the complexities of a large SAN, so it requires much less administration than our legacy SAN equipment. Errors are reduced, so service levels are higher. In addition, we get much higher storage utilization. The net is much lower storage cost with greater flexibility.

For example, under our old service model, it took six to nine weeks to deploy a full SAP solution for a customer. With Dynamic Services, we can build a custom SAP system from scratch, configured for a customer's needs, in eight hours.

Using standard components gives us a further benefit in that we implement a "replace versus repair" policy. If a component, such as a server, fails, we replace it immediately from a pool of standard spare components, so we never have to wait for a technician to come on site to resume operations, and we avoid expensive maintenance contracts, keeping our costs low.

Meeting or Exceeding Existing Enterprise SLAs

Using the infrastructure described above as our basic building block, we are able to provide SLAs that meet or exceed what our customers were achieving from their internal IT infrastructure.

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About T-Systems

T-Systems provides IT on tap, just like water or electricity. The company delivers IT resources on demand so that you no longer have to invest in infrastructure and applications and pay only for what you actually use.

T-Systems was formed to provide IT services to its parent, global giant Deutsche Telekom, and over time expanded to offer information and communications technology (ICT) services to outside companies. Today it serves more than 160,000 medium- and large-sized customers—including 60 multinational corporations—in more than 20 countries.

With a workforce of more than 46,000 and six data centers worldwide, T-Systems generated revenues of €11 billion (US$15 billion) in 2008.

Cloud Technology in Tech OnTap

Given the increasing focus on cloud infrastructure at NetApp and across the industry, Tech OnTap is committed to bringing you the latest and most relevant information. Get up to speed with these recent articles:

Find out more about the forces fueling this convergence in two recent NetApp white papers:

- Storage Infrastructure for the Cloud
- T-Systems Case Study: Implementing Enterprise-Class Cloud Services
- Six Tips to Supercharge Your Cloud Deployment
- Boosting Data Center Efficiency
- NetApp and Cisco: Virtualizing the Data Center

Reducing RPO and RTO for Cost-Effective Recovery
Aggressive customer RPO and RTO requirements are among the most difficult SLAs to meet cost effectively. Complex clustering software is management intensive, which raises cost, and it can be prone to failure. We've seen legacy clustering solutions with a success rate of just 70 to 80%.

For Dynamic Services, we settled on a much simpler approach using NetApp MetroCluster software for synchronous mirroring in combination with what we refer to as "twin-core" data centers, in which we have two data centers that are over 100 kilometers apart. For instance, to serve the U.S. market we have a data center in Houston, Texas, matched with a twin data center in Westland, Texas, which is 160 kilometers away. We had to work with NetApp to certify that MetroCluster could span such a long distance, but the company went the extra mile for us to make it work.

With MetroCluster in place, data can be mirrored synchronously between all our twin-core data centers. If a failure occurs in one data center, we can restart affected applications in the other data center with zero data loss (an RPO of zero), and we can get applications restarted in 15 minutes or less (to achieve an RTO of 15 minutes).

We also use VMware HA to provide high availability for applications running in virtual machines. In the event of physical server failure, affected virtual machines are automatically restarted on other production servers with spare capacity. This is complementary to the functionality of MetroCluster. At both the storage and server levels a physical failure results in minimal or no disruption.

Because the MetroCluster solution is simple, we can offer it at only about a 30% premium versus a typical two or three times premium for a clustering solution. This makes it extremely attractive to our enterprise customers. Virtually all of our large Dynamic Services customers choose this solution for their most critical data. (You can read more about implementing MetroCluster in a recent Tech OnTap case study.)

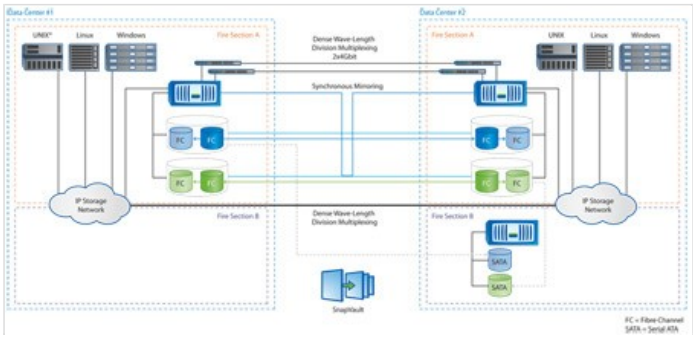

Figure 1) T-Systems storage infrastructure.

Elimination of Planned Downtime
Another advantage conferred by the MetroCluster configuration described in the preceding section is the ability to eliminate the need for planned downtime for storage upgrades and maintenance. Because we have a multi-tenant architecture in which multiple customers share the same hardware, it would be impossible to get customers to agree on a time for maintenance.

With MetroCluster, we simply do a manual failover to one side of the cluster and upgrade the storage system on the other side; then we fail back and reverse the process so no disruption occurs.

We do exactly the same thing for applications running within VMware virtual machines on our servers using VMware VMotion™. The entire state of a virtual machine is encapsulated in a set of files on NetApp storage. Using VMotion for a virtual machine preserves the precise execution state, the network identity, and the active network connections, so there is zero downtime and no disruption to users. Therefore, we can migrate all the virtual machines running on a particular server somewhere else, either in the same data center or to its twin; upgrade or maintain the server; and then move the virtual machines back with no disruptions.

Disk-Based Backup and Self-Service File Recovery
Another important aspect of our ability to deliver enterprise-class SLAs to our customers at low cost is the elimination of tape-based backup. As everyone knows, tape backup is complicated, so it has high management overhead and it's slow and prone to errors that make recovery difficult or impossible.

We do an average of 50 test restores every month on our legacy tape environments (T-Systems hosts legacy infrastructure in addition to its Dynamic Services offering) and the success rate is around 75%. We needed to offer our customers a solution that was more reliable and at the same time cost effective. We opted for a combination of NetApp Snapshot™ copies on primary storage and NetApp SnapVault® for longer-term backup retention on secondary storage. For applications, the NetApp SnapManager® suite gives us consistent, application-aware backups by coordinating this efficient Snapshot approach with popular applications such as SAP, Oracle®, and Microsoft Exchange. By default, we keep 30 days worth of Snapshot copies for every customer.

Customers can access these Snapshot copies themselves and perform recoveries without help from T-Systems. Recoveries now take minutes instead of hours, and the success rate is virtually 100%.

Security
Security is an important issue for T-Systems. Understandably, many customers have questions about our Dynamic Services offering when they learn that infrastructure is shared. Because of this, we have our systems reviewed, penetration tested, and certified by external auditors to demonstrate our security on a regular basis.

To provide data security, we use NetApp MultiStore® software, which lets us create multiple, separate, and completely private logical partitions on a single storage system, so we can share the same storage system between many clients without compromising privacy and security. MultiStore is one of a number of features of NetApp storage that makes it uniquely suited for the cloud.

Rapid Migration Services
Many new T-Systems customers have existing applications and data that must be migrated to T-Systems to take advantage of Dynamic Services. Once again, NetApp technology helps us streamline this process. We accomplish this by installing a NetApp storage system at the customer site to stage the data. Then we use NetApp SnapMirror® software to asynchronously replicate data from the customer site to one of our data centers. We recently migrated a petabyte of data for one customer using this approach with no problems.

Future Plans

We've had tremendous success with our Dynamic Services offering since it was introduced in 2005, but we're not resting on our laurels. In fact, Dynamic Services 2.0 is already in the planning phases.

Our current twin-core data center design allows us to transparently move applications between two paired data centers because the data is synchronously mirrored to both locations. However, if we want to move an application to a data center where the data has not been mirrored, there's no way we can currently do this nondisruptively. The NetApp Data Motion™ feature [2] in conjunction with VMware VMotion will allow us to nondisruptively migrate any application to any data center.

Data center boundaries literally disappear with this capability, so we'll be able to offer truly global cloud services that allow us to take the fullest advantage of our data center resources. We can use each data center to the maximum level and move applications as needed to spread the load evenly across all of our data centers.

Find Out More About T-Systems

Interested in learning more about T-Systems or its use of NetApp technology as part of its cloud services? Here are a number of additional resources:

- Success Story: Customers Such As Shell, Porsche, and Airbus Count on T-Systems Cloud Services - Built on NetApp
- Success Story: T-Systems Standardizes on NetApp to Deliver Enterprise Cloud Services at 30% Less than On-Premises IT
- T-Systems Dynamic Services

Got opinions about T-Systems Dynamic Services?

Ask questions, exchange ideas, and share your thoughts online in NetApp communities.

Dr. Stefan Bucher
Global Delivery Manager, Shell Account
T-Systems

Stefan Bucher has held various positions since he joined T-Systems in 1998. He became head of Application Support in 2000 and then led the Global Delivery Unit for T-Mobile, gaining insight into large international customers. Since 2007, Stefan has been responsible for over 36,000 servers, 140,000 MIPS, and 8PB of storage. He guarantees high-quality hosting and storage services through steady optimization, maximum security, disposability, availability, and continuous development. Additionally he focuses strongly on innovations.

Stefan holds a PhD in Physics from Ludwig-Maximilians University in Munich.

Six Tips to Supercharge Your Cloud Deployment

By Hamish McGovern, NetApp

When it comes to cloud infrastructure, there's a lot more marketing hype out there than there is real advice based on field experience. I was lucky to help Telstra, Sensis, and other companies build large shared infrastructures, and recently I saw first hand how other large enterprises built dynamic infrastructure services. What NetApp learned in building these environments contributed directly to the creation of the NetApp Dynamic Data Center, which encapsulates NetApp best practices for cloud deployment in a flexible cloud-storage solution.

In this article, I give you a few of what I believe are the most important things to consider for enterprise-class cloud services. These tips should apply equally well to enterprises looking to deploy internal cloud infrastructure and service providers interested in offering enterprise service levels to demanding cloud customers. A companion case study in this issue of Tech OnTap looks at one service provider who has gone down this road and put many of the tips I provide here into practice.

Cloud is all about offering technology that's packaged, priced, and offered as a standardized and repeatable service offering. The first two tips I provide focus on how you can define your cloud offering; later tips drill down on the technology.

Tip #1: Determine the Type of Cloud You Need

The first thing you have to decide is where to demarcate your cloud service. What will be provisioned? What will you manage? What are the physical bounds of the service in terms of compute, network, storage, OS, applications, and data protection? You need to be crystal clear on what you provide—and what the customer provides—in order to meet service-level agreements (SLAs). NetApp uses four subcategories of service under the broad heading of IT as a service (ITaaS), as illustrated in Figure 1.

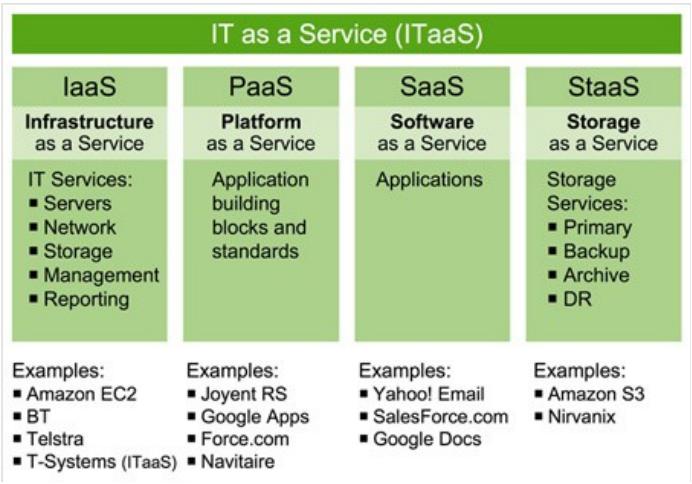

Figure 1) Types of cloud services to consider.

When choosing the cloud that suits your needs, start with realistic goals. Start simply with storage as a service or infrastructure as a service, or perhaps desktop as a service (built on IaaS). Figure out what you'll offer, the line of demarcation for management, and the layer at which secure multi-tenancy is required (do you securely separate clients within the application or within the infrastructure)? Get the foundation right—once you successfully launch your initial capability you can add capabilities on top of it.

You should also ask yourself what you can cloud source. For instance, many application teams use external cloud services to satisfy their needs for development and test infrastructure. Some enterprises outsource their full production IT. A number of the biggest cloud service providers offer not only IaaS in the form of a hosting environment with virtual compute, network, and storage, but also provide managed operating systems and managed application and development environments—effectively offering IaaS, PaaS, and SaaS—such that even very large enterprises can completely cloud source their IT if desired. T-Systems is a great example of this. The company built enterprise-grade

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Cloud Technology in Tech OnTap

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- NetApp and Cisco: Virtualizing the Data Center

What Type of Cloud?

Having trouble choosing between StaaS, IaaS, PaaS, and SaaS? Here are a few additional ideas to think about.

Storage as a service (StaaS) can be a good entry point. A number of NetApp customers run StaaS, often including data protection, backup, and sometimes DR. StaaS provides substantial savings by consolidating storage and data protection and can serve as a foundation for infrastructure as a service.

If yours is an internal IT group servicing many departments across the organization, then an infrastructure hosting service that provides virtual compute, network, and storage—**infrastructure as a service**—may be the answer. You provide an infrastructure "container" to host an application. The offering should include a range of standard operating systems and versions (e.g., Windows®, Linux®, Solaris™, perhaps AIX). Beyond that you must answer the following questions:

- Are you going to manage the OS or only provision it?
- Are you going to provide standard applications such as Oracle®, Microsoft® SQL®, and SAP®? Are these standard templates that you provision as part of your IaaS?
- Will clients be contained in a shared application-level environment with development tools and capabilities? If so, you've crossed the boundary from IaaS to PaaS.

Finally, if you're going to offer the highest level of service and run the complete application for the client software as a service—you should ask yourself whether you need your own infrastructure or if you can outsource that piece to an IaaS service provider.

IaaS, PaaS, and SaaS clouds servicing several hundred large enterprises.

A final piece of advice regarding your choices here is to make sure you have executive support for whatever decisions you make, including policy, governance, security, and centralization of procurement. Moving to a cloud offering often involves new processes and organization change and that needs champions in all levels of the company.

Tip #2: Apply the 80-20 Rule to Figure Out What Services to Offer
If you try to build a cloud that satisfies 100% of the requests you receive from your customers, you're probably doomed to failure. In accordance with Pareto's 80-20 Principle, you should be able to satisfy 80% of your application requirements with a set of standard offerings that require 20% of the effort. Build a catalog or menu of standard services targeted at meeting this 80% of requests. A typical service catalog provides:

- Storage tiers, so that applications can be matched with their capacity and performance needs
- Different levels of data protection to meet varying RPO and RTO requirements
- Support for a standard set of physical and virtual operating systems and server types
- Activation guides to provide standards for application connectivity and data layout that have been tested for throughput and latency
- A long-term retention option for archive or compliance needs

For each catalog item, you should also consider the service-level agreements, security and isolation expectations, how customers will be charged, the metrics you'll track, and how you will bill back to each department. You need to be able to report on conformance for all SLAs.

The remaining 20% of requests can easily absorb 80% of your effort if you let them. These will take a much longer time to fulfill—since they can't be met through your standard cloud offering—and, as a result, will cost more. However, over time requestors will begin to realize the benefits of using the standard offering (faster time to market and lower cost), and you'll likely find that 90% or more of the new requests you receive are for your standard offering.

Tip #3: Use 10-Gigabit Ethernet as a Foundation

If you've got a big investment in Fibre Channel storage area networks, you might be tempted to use Fibre Channel as part of your cloud infrastructure. I recommend against it. Almost all of the large cloud services—at service providers and within enterprises—are based on Ethernet for the greater flexibility, scalability, and visibility it provides, as well as for the fact that greater economies of scale lead to continuing cost reductions.

The clouds I've been involved in primarily use NFS and some iSCSI, and we're seeing interest in Fibre Channel over Ethernet (FCoE). NFS is the protocol of choice for large providers such as T-Systems, Thomson-Reuters, Oracle, and Telstra for its low cost, simplicity, ease of thin provisioning and cloning, and the visibility of the file system within the storage cloud. These guys use NFS for all the large Oracle databases as well as for their VMware® infrastructure.

If you want to be able to move virtual servers and storage across data centers or have your storage and compute networks span multiple data centers, Ethernet and Internet Protocol (IP) are typically required. They also simplify mobility of workloads and applications.

10-Gigabit Ethernet is now widespread, and 40-Gigabit Ethernet is coming, so, from the standpoint of both higher bandwidth and lower latency, it makes sense to choose Ethernet as your backbone for both data and user traffic. Because Ethernet storage is the wave of the future, choosing Ethernet storage provides investment protection.

As you may know, Cisco is investing heavily in Ethernet technology, including research and development for FCoE and Data Center Ethernet (aka Data Center Bridging, DCB), to ensure its success. DCE/DCB not only makes Ethernet lossless for storage traffic, but also provides different priorities to split traffic based on importance, adding queuing per priority and, hence, QoS capabilities. Cisco UCS is arguably one of the biggest changes in server design in the last decade, and it's optimized for 10 GbE.

Tip #4: Automate Networks, Servers, and Storage First to Simplify Infrastructure Orchestration

The cloud is about being able to treat each layer of infrastructure as a large pool of resources with a few different classes of service in each. You no longer have to care what physical system the resources reside on; you simply draw on resources as needed and then give them back when they are no longer necessary. Choosing the right tool set is what makes this possible.

For each layer in the infrastructure you need an automation tool to hide the complexity of managing all the individual devices and abstract them into a pool of resources. For example, NetApp® Protection Manager is based on three key concepts that make it simple to make broad changes with a few clicks:

- **Data sets.** A data set is a collection of data objects with similar protection requirements.
- **Policies.** You can use an existing policy or create a new policy to accommodate different procedures and/or schedules.
- **Resource pools.** Secondary storage resources are grouped into "resource pools."

More

These concepts remove the need to manage individual storage systems and give you a lot of power. For instance, if you want to provide a class of service in which data is replicated to a secondary site, you define a data set containing the volumes or LUNs you want to be replicated and apply a replication policy. To give the same protection to new volumes you only have to add them to the data set.

Once you have separate tools in place that can pool server, storage, and network resources, tying the complete cloud service together becomes easier for orchestration tools such as BMC Atrium Orchestrator, IBM TPM, HP Orchestrator, VMware Lifecycle Manager, or one of the more than 50 other cloud orchestration vendors. This allows the orchestration engine to easily request resources without worrying about managing capacity and performance on storage and so on. Instead it manages workflow and approvals, connects resources to customers, configures billing, and can be used to build the all-important self-service portal that clients use to access the cloud.

Tip #5: Build in Security from the Ground Up

When you think about deploying enterprise applications on cloud infrastructure, security becomes a key consideration. How can you be certain that applications, data, and customers are securely isolated in an infrastructure in which servers, networks, and storage are all shared resources? You need technologies that effectively partition data and applications on servers, networks, and storage without resorting to the inefficient, siloed architectures of the past. You can achieve this by layering security throughout your infrastructure. You should have at least two layers of security in each infrastructure layer to prevent operator mistakes from creating exposure. Key technologies you should consider include NetApp MultiStore®, vFiler® units, VLANs, virtual data centers (VDCs), ACLs, port ACLs, the Cisco Nexus 1000v, and VMware VShield Zones. All of these help with secure multi-tenancy throughout the infrastructure stack.

I'll cite the technology I know best as an example. NetApp MultiStore software lets you achieve secure multi-tenancy through the creation of separate, private logical partitions on a single storage system so that no information on a secured virtual partition can be viewed, used, or downloaded by unauthorized users. MultiStore is like a hypervisor for storage controllers. A recent independent security analysis of MultiStore validated its strength. Large cloud providers using NetApp storage almost always choose MultiStore.

Tip #6: Create an Always-On Infrastructure

One thing that people often fail to realize soon enough is that, once you have 50 applications sharing the same physical infrastructure, there's no way to shut it down for maintenance. It took 18 months to plan downtime for a shared storage system at one of the sites I'm involved with. We could never get an outage window that suited the five large clients using the infrastructure—one of which is the largest CRM environment in the southern hemisphere.

You have to plan ahead and be able to manage workloads without infrastructure outages; this means using technologies that allow you to provide live application migration for equipment maintenance, hardware replacement, or software upgrades. You can leverage these same technologies to balance the load across your infrastructure.

For live data migration, NetApp offers Data ONTAP® 8 and NetApp Data Motion™ to manage storage infrastructure capacity, performance, and equipment. NetApp Data Motion integrates with NetApp MultiStore, SnapMirror®, and Provisioning Manager to provide both live migration and secure multi-tenancy for Ethernet-storage workloads. All data migration operations are performed while your applications continue to run, with just a short pause in I/O during the cutover. There is no impact on host systems because the operation occurs at the storage system level. Once data migration completes, applications and clients make the transition to the destination system with no service disruption.

VMware VMotion™, XenServer XenMotion, and Microsoft® Hyper-V™ Quick Migration let you do the same thing with virtual machines that NetApp Data Motion lets you do with storage: You can migrate VMs between physical servers without application disruption. In addition to its use for nondisruptive maintenance and upgrades, this capability is used by virtual infrastructure managers to optimize per-machine performance or meet other requirements.

Conclusion

The recommendations above are based on solutions that are currently available (NetApp Data Motion will be available in Data ONTAP 7.3.3). By paying attention to current best practices and ignoring the hype, you can create a flexible cloud infrastructure that increases efficiency to lower your costs without sacrificing the service levels that your internal and external customers expect.

The key is to have good information and to study what has worked for other companies. If you're relatively new to cloud computing, you can learn more in a recent Tech OnTap article and white paper. To read relevant customer stories go to the NetApp Library and search on "cloud" or click on any of the links associated with customer names in this article. You can access information on all NetApp cloud technologies at cloud.netapp.com or read our new Cloud Team blog for the latest developments

Got opinions about this article?

Ask questions, exchange ideas, and share your thoughts online in NetApp communities.

Hamish McGovern
Senior Product Manager
NetApp

Hamish joined NetApp in 2000 to lead the technical team for Telstra, one of NetApp's largest customers. He is currently product manager for the NetApp dynamic data center solution, enabling IT as a service with a secure multi-tenancy infrastructure, NetApp's infrastructure-as-a-service cloud offering, and NetApp Data Motion for live migration. Prior to working at NetApp, Hamish led the systems integration team at Australia's largest ISP and spent 10 years in the telco and online services industry.

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Making a Safe Transition to Oracle 11*g*

By Peter Schay and Kannan Mani, NetApp

Oracle® Database 11*g* Release 2 is here. The arrival of this long-awaited update will almost certainly result in a flurry of upgrade activity as Oracle users who did not make the jump to the first release of 11*g* now take the plunge.

Any major database upgrade poses significant challenges in terms of testing existing applications on the new platform and making a smooth transition. In this article, we'll explain how you can take advantage of NetApp® technologies for cloning and data masking in conjunction with Oracle Real Application Testing to make sure your applications are ready to run on Oracle 11*g*. We'll also describe steps you can take to make the upgrade process on production systems as smooth and painless as possible.

Simplifying the Application-Testing Flow

Testing applications—whether for a new or existing database release—is always a complicated, time-consuming, and potentially expensive process:

- To be certain your applications work correctly, you have to test with production data, and you might need many copies of that production data to make sure that testing doesn't bottleneck. Using traditional copying methods, you usually can't create as many database copies as you would like due to space limitations.
- Because you're using real data from your production database, you probably also need to protect sensitive information such as names, addresses, account information, credit card information, and so on.
- You need a testing methodology that really tests your application against your test database.

You can streamline the process of application testing on Oracle 11*g* using a combination of capabilities from NetApp and Oracle:

- **NetApp FlexClone® technology** lets you make as many "clones" of a data set as you need without requiring a full copy each time. A FlexClone copy only consumes storage space incrementally as changes are made.
- **The Oracle Data Masking Pack** provides regulatory compliance through consistent and rule-based application of masking formats. A rich and extensible format library supports a variety of mask formats.
- **NetApp SnapManager® for Oracle** automates cloning, data masking, and other processes for maximum efficiency while reducing the chance of operator error.
- **Oracle Real Application Testing**, introduced in Oracle Database 11*g*, in conjunction with NetApp technology makes it possible to quickly test applications to make sure of proper functioning and performance.

The following figure illustrates the process flow for testing using these technologies.

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NetApp at Oracle OpenWorld 2009

Interested in learning more about upgrading to Oracle Database 11*g*? Come see our session titled "Going to 11: Managing Upgrades with Minimal Risk" at Oracle OpenWorld on Tuesday, October 13, 2009, at 4 p.m. in Moscone South, Room 307. We'll dive into all the details of how you can use proven NetApp techniques to efficiently clone your existing Oracle Database and safely upgrade to 11*g*. You'll learn valuable lessons from real-world deployments by NetApp and Oracle customers.

We'll also perform a live demo of a terabyte-sized Oracle RAC and ASM database and show you how to take advantage of NetApp storage technology and Oracle Database 11*g*'s Real Application Testing for rapid, efficient, and nondisruptive upgrades.

Want to know more about what NetApp is doing at Oracle OpenWorld? Check out all the details at our Oracle OpenWorld 2009 community

Solve Your Top Oracle Data Management Problems

NetApp SnapManager for Oracle is designed to solve common data management challenges, including:

- Backing up data frequently without affecting production
- Enhancing recoverability
- Providing enough copies of a production database for QA, testing, and other purposes
- Managing data across both primary and secondary storage

More

Choosing a Storage Protocol for Oracle

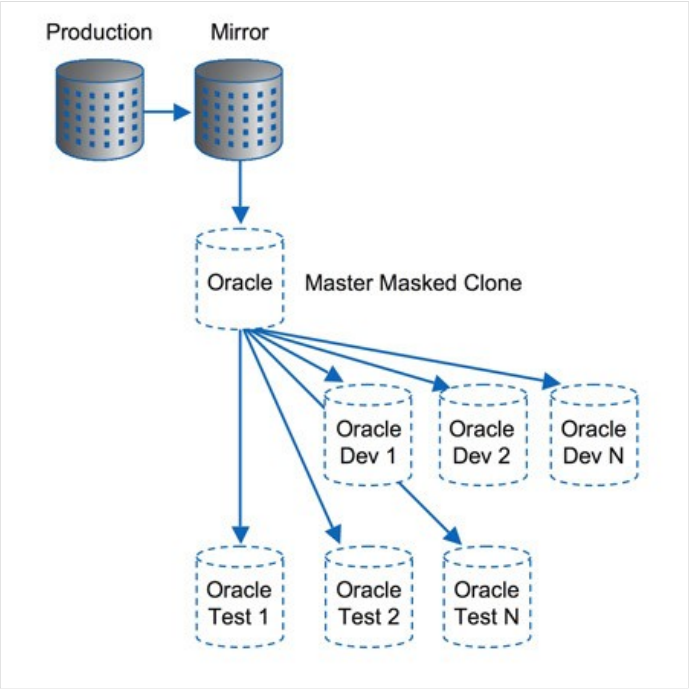

Figure 1) Process flow for creating test environments and testing using a combination of NetApp and Oracle technologies.

Preparing for 11*g* Testing with SnapManager for Oracle

NetApp SnapManager for Oracle (SMO) makes it simple to carry out most of the processes required to create a test environment for Oracle 11*g*. In this section we'll describe steps you can follow (with or without SMO) to create a productive test environment.

Creating an Initial Database Copy

In most cases, you'll want to make a full copy of your production database as a starting point for Oracle 11*g* testing so that ongoing production operations aren't impaired. If your Oracle 10*g* production database resides on third-party storage, you'll need to put the database in hot backup mode (to make sure of consistency) and copy the database to NetApp storage to take advantages of the procedures that follow.

If your database resides on NetApp storage, you can clone the production database directly, but most people still prefer to work with a full copy. You can replicate your production database to secondary storage (either locally or at a secondary site) using SMO and NetApp SnapMirror® software.

Through integration with NetApp Protection Manager, SMO lets you create a replication schedule to periodically synchronize your production data with your secondary site. This secondary copy can be used for both disaster recovery and testing purposes. Efficient bandwidth utilization reduces your network effect, and you can mirror to less-expensive secondary storage to cut costs.

SMO makes sure the database is in hot backup mode before a Snapshot™ copy of the database is made prior to replication. Because this Snapshot copy takes only seconds to complete, the amount of time spent in hot backup mode is kept to a minimum.

If you intend to use Oracle Real Application Testing, you'll probably need to coordinate the creation of your database copy with the Real Application Testing capture process. This is described in a later section on Real Application Testing.

Creating a Master Masked Clone

Once you've got a copy of your production database, you can use SMO to create a master clone that has been fully data masked and upgraded to 11*g*. This then serves as the starting point for all additional clones. You only perform the data masking and software upgrade operations once, and you can then be sure that all additional clones used for testing are correct.

An initial FlexClone copy is made to capture a consistent, point-in-time copy of the database. Data masking is then performed on this clone, and the success of the masking process is verified. SMO includes the ability to perform postprocessing on clones using scripting. This allows you to automate the creation of clones that are fully data masked or to perform other modifications after a clone is created.

The resulting data-masked clone is then upgraded to Oracle 11*g*. This then serves as the "master clone." The process of cloning and masking using SMO has been more fully illustrated in a recent demonstration. You can also learn more about data masking in a recent NetApp technical report.

Your choice of protocol depends on a wide variety of factors that include existing infrastructure, processes, and skill sets, in addition to the relative capabilities of each technology.

NetApp offers a range of implementation options and tools for deploying and managing Oracle environments using NFS, Fibre Channel, or iSCSI, alone or in combination. Find out more specifics in a series of past articles:

- Oracle on NFS
- Oracle on Fibre Channel
- Protocol Is Irrelevant

FlexClone can then be used to create as many clones of the master as required, guaranteeing that all copies are correctly masked, compliant, and space efficient. Because all the processes necessary to replicate your production database, create a master masked clone, and then clone the master many times can be accomplished from SMO, you can do it all from your desktop with a few mouse clicks and simple commands.

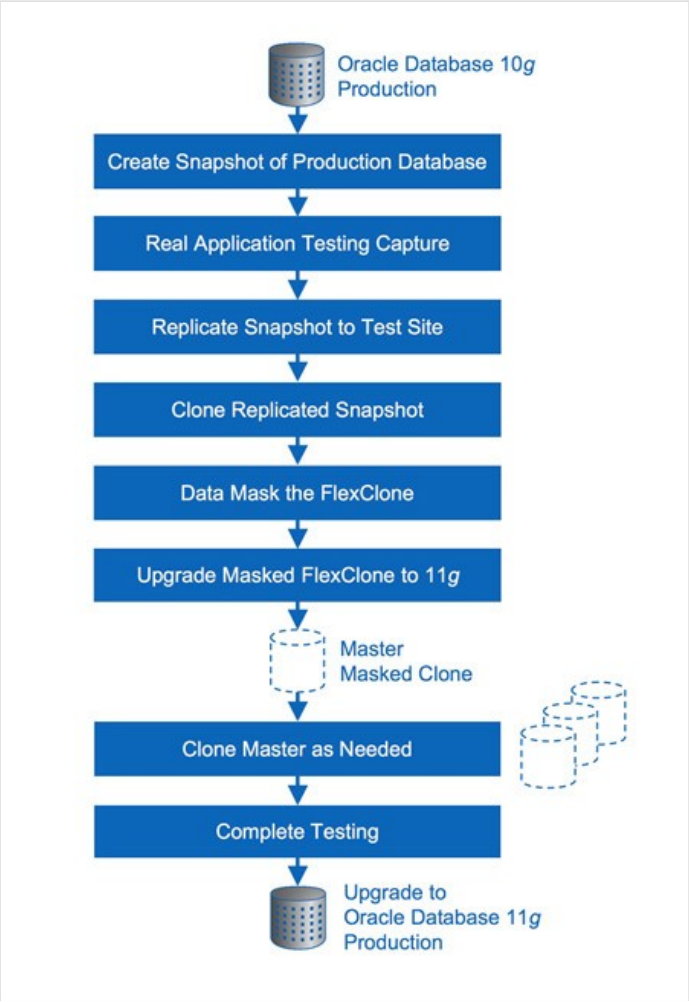

Figure 2) A master masked clone that has been upgraded to Oracle 11*g* serves as a starting point from which you can create as many clones as you require for testing without time-consuming and space-wasting full database copies.

Real Application Testing

Oracle Database 11*g* offers Real Application Testing to help eliminate the risks associated with upgrading, application changes, and so on. Real Application Testing combines a workload capture and replay feature with a SQL performance analyzer to help you test and fine tune changes using real-life workloads before putting them into production.

Unlike other testing methodologies that exercise the entire application stack and require complicated infrastructure to run, Real Application Testing simply captures transactions and timings for replay. No clients or middle tier is required to do testing. It's a much simpler way to exercise a database.

Because you don't need complicated infrastructure, Real Application Testing allows you to easily leverage resources at a secondary site such as a disaster recovery site for testing. You capture the desired workload from your production environment and then replay it against a test data set at your DR site.

The challenge then becomes creating a point-in-time Snapshot copy against which the workload can be run, since the data set needs to exactly match the production data set from the time when the capture was begun.

Once again, NetApp technologies complement Real Application Testing to make what would otherwise be a complicated and storage-intensive task simple. If your primary database is stored on NetApp storage, you can easily coordinate the Real Application Testing capture process with the process described above for creating a master masked clone:

1. Create an initial Snapshot copy of the production data set.
2. Perform the Real Application Testing capture process.
3. Use NetApp SnapMirror or SyncMirror® to replicate the initial Snapshot copy to the DR site.
4. Apply the process from the previous section to create a master masked clone of the replicated copy.
5. Create as many FlexClone copies as you need for use with Real Application Testing or any other testing process you require.

Upgrading Your Production Database to Oracle 11*g*

The procedures outlined in the previous sections can substantially improve your testing process, making it much easier for you to make sure that your applications are ready for the upgrade. NetApp Snapshot lets you protect yourself further by creating a point-in-time image of the production database before you apply the 11*g* upgrade. Should a problem arise, you can revert to the saved state in a matter of seconds using NetApp SnapRestore® and return to running your production environment on Oracle Database 10*g* until the problem is identified and resolved. The traditional alternative of restoring the database from either tape or disk-based backups is obviously much more time consuming.

Conclusion

If you hesitate to do major or minor database upgrades because of the risks involved and the difficulty of performing adequate testing, the processes described in this article can help. The combination of NetApp and Oracle tools gives you the power to create a more productive test environment that fully protects sensitive data in much less time using much less storage space. Because you can create as many database copies as you need, developers and testers are never bottlenecked waiting for the availability of testing resources.

By coordinating Oracle Real Application Testing capture with the creation of your testing environment on NetApp storage, you can play back real production workloads against your test databases without requiring the entire application stack and complicated infrastructure. This greatly simplifies the process of making certain that transactions are correct and performance meets expectations.

Got opinions about Oracle Database 11*g*?

Ask questions, exchange ideas, and share your thoughts online in NetApp communities.

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Pete joined NetApp in 2007 as a solution architect helping joint Oracle and NetApp customers succeed in their database deployments.

Prior to NetApp, Peter worked for Oracle, where he ported Oracle to the Cray, helped drive Oracle's Linux® strategy, and created the prototype for direct NFS, a central feature of Oracle 11*g*.

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Since 2008, Kannan has worked for NetApp creating reference architectures to simplify Oracle on NetApp deployments. Prior to NetApp, he worked at Oracle Partner Solutions and later joined Unisys, where he designed Oracle solutions for the Oracle Center of Excellence.

Kannan has over 10 years of direct Oracle experience and has been an active presenter at Oracle and NetApp joint seminars globally.