the *Availability Digest*

Verizon Cloud Down for Forty Hours
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Verizon has its sights set on becoming one of the major cloud providers, joining competitors such as Amazon, Google, Microsoft, and Rackspace. The youngest of the cloud players, Verizon came online with its cloud offering just four years ago. Verizon has taken a substantially different approach than other clouds to offer enhanced services.

However, in early January 2015, Verizon announced a planned downtime of up to 48 hours for its cloud services over the weekend of Saturday, January 10th. This is hardly the action to take to elicit confidence in the availability of its cloud services for the corporate world. But the story isn't so black and white. It may have been a judicious move on Verizon's part to give it a competitive edge in the future.

The Verizon Cloud

Verizon originally entered the cloud marketplace with Verizon Enterprise Cloud. It is now replacing that cloud service with new services that it calls Verizon Cloud Compute and Verizon Cloud Storage. It refers to its Verizon Enterprise Cloud as its "legacy" cloud.

The Verizon Enterprise Cloud

Verizon began its cloud business via the acquisition of Terremark Worldwide, Inc., in January, 2011. Terremark provides managed hosting, colocation, disaster recovery, data storage, and cloud computing services via its thirteen data centers in the United States, Europe, and Latin America.

Terremark's cloud-computing services are remarketed by Verizon as the *Verizon Enterprise Cloud*. Terremark's original customer base represents the bulk of Verizon's Enterprise Cloud customers.

Terremark has had a rocky road. It is generally perceived as one of the highest quality managed hosting and cloud service providers. The U.S. government chose Terremark to host its USA.gov and Data.gov web sites. However, it also chose Terremark to host the web site for HealthCare.gov, the failed web site for ObamaCare. In October, 2013, Kathleen Sebelius, the U.S. Secretary of Health and Human Services, identified Terremark as the company responsible for the "outages that disrupted the website" when it was initially rolled out. The contract was re-awarded to Hewlett-Packard.

Verizon's New Cloud

Verizon realized that in order to compete effectively with other cloud services, it had to provide a unique service that excelled all others. It studied what needed to be changed to achieve this goal and decided that "everything had to change." It therefore set out to build an entirely new cloud platform.

Rather than using a standard, off-the-shelf hypervisor to host its virtual machines, Verizon developed its own hypervisor. One enhancement that it built into its new hypervisor was the ability to run native virtual

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machine images from other clouds. It also provided the ability for customers to choose their own processing power and storage capacities from a continuous spectrum rather than from preconfigured combinations, as most other clouds provide. The pay-as-you-go charges for compute capacity and storage can be simply charged to the customer's credit card.

The new cloud was also intended to provide seamless upgrades. Seamless upgrades allow Verizon to update its hardware, software, and firmware with no planned downtime.

Another departure was to use solid-state storage devices (SSDs) rather than hard disks. As a result, a virtual machine in the Verizon cloud can support up to 5,000 input/output operations per second. All data is replicated multiple times within a data center or between geographically dispersed data centers. Verizon Cloud Storage supports Amazon's S3 protocol and the OpenStack Swift protocol as well as the DAV protocol from HTTP web servers.

Verizon's new cloud offering is built on an entirely new hardware platform. Its host servers use a single, heavily customized version of AMD's SeaMicro eight-core computer chip. 64 servers with 64 GB of main memory can be packed into a single 1U chassis.

Verizon's new cloud services, dubbed Verizon Cloud Compute and Verizon Cloud Storage, were announced in 2013. They become generally available in October, 2014, after a year of beta testing. In addition to supporting Verizon's new public cloud, the services support private and hybrid clouds.

The new cloud services do not affect customers using Verizon's legacy Enterprise Cloud. However, Verizon's long term plan is to migrate all of its existing customers to its new cloud offering.

The Verizon Cloud Update

Verizon shocked the cloud community when it announced on January 5, 2015, that it would take down its Cloud Compute and Cloud Storage systems for routine maintenance for up to 48 hours starting in the early morning hours of Saturday, January 10th. There was no plan to move active virtual machines to other operating physical servers in other data centers during the maintenance period. All hosted virtual machines (VMs) in all data centers would be unavailable. The Twitter universe was filled with angry and sarcastic comments about Verizon's lack of concern for the availability of its cloud services.

Verizon explained that the update's purpose was to enable "seamless upgrades." There would be no need in the future for planned downtime when updates were made. But wasn't this already supposed to be a capability of its new cloud services? Verizon explained that some elements of the new architecture had not been optimized in the first release. One was the ability to apply firmware changes non-disruptively. This update would add that capability.

However, Verizon stated that the affected corporate customers represented only a small fraction of those currently using Verizon's clouds. None of the legacy cloud users would be affected, and most had not yet migrated to the new cloud. Verizon had wisely left its legacy cloud intact for now.

The Long-Term Benefit of the Two-Day Upgrade

As it turned out, the update took 40 hours. Verizon amazingly escaped scathing comments following the upgrade. Customers seem to have accepted the outage.

Now, according to Verizon, its new cloud services truly support *seamless upgrade* capabilities. There should be no downtime in the future for any upgrade activity, whether the upgrade be for hardware, software, or firmware. There will be no need for customers to reboot VMs after any maintenance or upgrade action. Seamless upgrades also mean that customers do not have to set up VMs in multiple regions or fault domains to survive upgrades (though of course this is still necessary to protect against server outages or data-center outages).

This capability is particularly meaningful in light of the recent security vulnerability discovered in the Xen hypervisor in September, 2014.[1] The flaw allowed one VM to read the memory of other VMs on the same host server. Correcting this flaw meant that many major cloud services, Amazon and Verizon included, had to take down massive numbers of virtual machines; and these VMs had to be rebooted.

Perhaps it was this experience that encouraged Verizon to add firmware updates to its seamless upgrade capability. Verizon now can perform upgrades affecting active virtual machines without having to move them within a two-zone environment or rebooting them.

Summary

In implementing its seamless upgrade capability to include firmware updates, Verizon risked earning the wrath of its enterprise customers by taking down all cloud services for almost two days. Clearly, if a corporation had not planned for such an unexpected event, it might not have been able to provide critical services during the outage.

However, Verizon seems to have weathered the storm. It is now in a very strong position relative to other cloud offerings in that it claims that it can perform any type of upgrade to its cloud infrastructure with no planned downtime. If it would have had this capability when the Xen hypervisor vulnerability was exposed, it would have been unique among cloud providers using Xen in that it could have patched Xen with no planned downtime and no requirement to reboot active virtual machines.

Acknowledgements

Information for this article was taken from the following sources:

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[1] Build to Fail, *Availability Digest*; November 2014.