

Cloud Provider Delivers Revolutionary Throughput Performance Using Mellanox InfiniBand Products



Dramatically improves hardware efficiency, improves the delivery of cloud services, permitting higher application scalability and performance.

Background

ProfitBricks is a Cloud Computing - Infrastructure as a Service (IaaS) provider that offers computing resources to companies, developers, and IT personnel. In 2010, ProfitBricks founder and industry veteran Achim Weiss assembled an international team of 50+ engineers from various specialist fields in Berlin to develop the platform. After two years of development, ProfitBricks added low-level KVM kernel modifications and other significant network breakthroughs. Thereafter, they launched their service in the EU in 2011. With a complete vision, ProfitBricks is now entering the crowded US cloud market as an innovator. Many of their significant technological achievements were accomplished based on the research that ProfitBricks performed as it evaluated several interconnect technologies, lending specific focus to the needs and demands of their customers.

Goals

- The ability to deploy more VMs per physical server with high transfer speeds.
- Reduction of networking with I/O to reduce capital and operational expenditures.
- Accelerated access to data storage devices for customers, while enabling superior internal storage capabilities and processes.

Challenges

VM Deployment

ProfitBricks recognized that a 10GbE solution would not allow them to meet the performance requirements of their customers. ProfitBricks' research showed that the average customer would get basic connectivity with 0.5 Gb/s network throughput per virtual machine (VM). Yet, with more than 60 VMs on each physical server, the performance needed would be much more than a 10GbE solution could supply without expensive link bonding.

Networking with I/O

Typically, cloud infrastructure is heavily stressed by storage-intensive I/O operations and communications between applications. For example, applications interact across virtual machines on different physical servers. These applications often have a database-intensive load on one or more VMs, resulting in interconnect lag. The resulting delay from the lag can force customers to overpay for their computing resources, especially with a high VM density.

Access to Storage

A cloud server can be responsible for dozens of VMs, each generating independent I/O storage transactions. Because of the high density and random I/O patterns involved, traditional storage systems cannot cope with the load. This translates to decreased performance and response time.



OVERVIEW

ProfitBricks is a worldwide cloud computing company, providing computing resources and infrastructure to customers. Faced with the choices of interconnect technologies, they chose Mellanox's InfiniBand with the desire for higher internal network speeds and throughput. By combining the InfiniBand technology with their organic software, ProfitBricks offers a premier cloud service with unprecedented performance capabilities.

This leads to underutilized CPU resources and degraded application performance.

Solution

After thorough analysis of competitors, customer demands and the current industry solutions, ProfitBricks selected the following hardware and software components for its cloud infrastructure:

- Mellanox dual QDR 40Gb/s InfiniBand PCIe 2.0 adapter cards and switches to connect the server and storage infrastructure.
- KVM Kernel-based VM software on servers with four 16 Core AMD Opteron processors.
- High performance storage initiator and target software – SRP.

ProfitBricks chose industry-leading Mellanox InfiniBand adapters and switches because of its enterprise-class performance and availability. Achim Weiss was confident that the QDR 40Gb/s InfiniBand connections between servers and storage would allow enhanced functionality and unprecedented throughput for his customers. By using InfiniBand, ProfitBricks also wanted to deliver the ability to support CPU-intensive applications for customers. These speeds would support intense I/O virtualization, transparent NIC, and storage interfaces to VMs.

Results

3x Increase in VMs per Physical Server

By utilizing InfiniBand, ProfitBricks has reached a dual QDR 40Gb/s InfiniBand threshold for internal back-end network connections. ProfitBricks servers can support over 60 VMs per physical server (at 0.5 Gb per VM rate), which is a 3x increase over VM deployment relative to 10 GbE (20 VM maximum). This enhanced internal network speed, coupled with the 3x increase in VMs per server, allows an unprecedented level of performance for its cloud customers. Figure 1. represents the throughput that ProfitBricks attains with dual QDR 40Gb/s InfiniBand PCIe 2.0 adapter cards versus traditional cloud competitors.

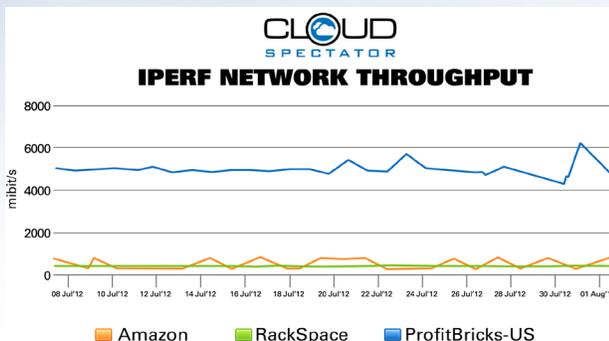


Figure 1. Mellanox dual QDR 40Gb/s InfiniBand PCIe 2.0 adapter cards vs. traditional cloud competitors.

Consolidation of Network and Storage I/O

The LAN and storage connectivity for VMs on KVM and the ProfitBricks management tool environment is already integrated. Mellanox provides multiple vNIC and vHBA interfaces, which from the VM perspective, are the same as what is available over multiple GbE NICs and FC HBAs. Also, some of the vNIC interfaces may be allocated to VM migration software or other management traffic. Configuration of vNICs and vHBAs is enabled by the technology. Customers can configure both by using standard management tools such as the Data Center Designer in conjunction with virtual machine software. In essence, from the VM and VM management’s perspective, InfiniBand is completely hidden as the underlying interconnect, allowing ProfitBricks to transparently consolidate LAN, SAN, live migrations, consoles, and other traffic.

Accelerated Storage Access

By utilizing SCSI RDMA Protocol (SRP) implemented in Red Hat KVM server over a single converged InfiniBand interconnect adapter, the SRP delivers lower latency and is less complex than FC/iSCSI.

This higher performance is a result of the combination of an efficient initiator stack, a 40Gb/s high bandwidth interconnect connecting server and storage, and the use of an SRP target on the storage systems with adequate number of backend disks to deliver the needed storage capacity.

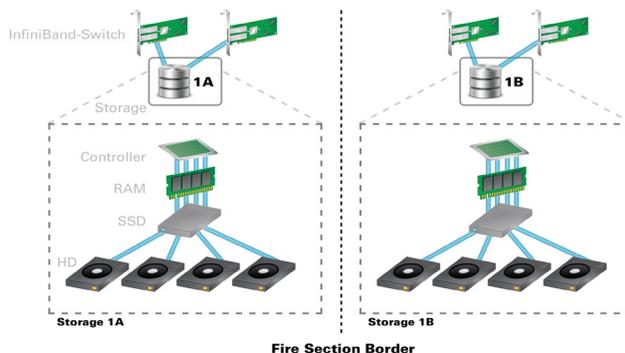


Figure 2. Fire Section Border

Conclusion

By deploying end-to-end InfiniBand, ProfitBricks can indeed support high-volume and high-performance requirements on-demand. Its customers are also able to take advantage of a low pricing structure that supplements their performance. Figure 3 outlines ProfitBricks' costs in comparison with Amazon and Rackspace.

ProfitBricks is able to offer a second-generation cloud solution, aided by the deployment of InfiniBand technology. Ultimately, by offering lower pricing in coordination with Mellanox technology, ProfitBricks provides a premium and innovative cloud service to enterprise businesses, developers and IT.

Provider	Cost Per Hour*
ProfitBricks	\$0.07
Amazon EC2	\$0.16
Rackspace	\$0.12

Provider	Cost Per Hour**
ProfitBricks	\$0.26
Amazon EC2	\$0.45
Rackspace	\$0.48

Provider	Cost Per Hour***
ProfitBricks	\$0.37
Amazon EC2	\$0.45
Rackspace	\$0.90

*1 Core, 2 GB RAM, 50 GB HDD Instance

**4 Core, 8 GB RAM, 100 GB HDD Instance

***6 Core, 8 GB RAM, 200 GB HDD Instance

Figure 3. ProfitBricks' costs in comparison with Amazon and Rackspace



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