Using MySQL in a Virtualized Environment

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Agenda

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  > Considerations

• MySQL & Virtualization

• Best Practices
  > VMware
  > Solaris Zones Best Practices
  > Hyper-V Best Practices

• Cloud Computing
Why Use Virtualization

• Virtualization adds flexibility and agility to the computing infrastructure
• Can be used to solve many problems related to provisioning, manageability, security, …
  > Pool and share computing resources
  > Simplify administration and management
  > Improve fault tolerance
• Lower total cost of ownership for computing infrastructure
  > Fewer computing resources
  > More resilient and simpler to manage
  > Better utilization
Benefits of Virtualization

• Security
  > Separate instances of different operating systems running within a single host but with effective isolation from each other.

• Consolidation
  > Merging a number of individual systems with a relatively small load onto a single, larger, server.

• Development/QA/Testing
  > By creating different instances of different environments and operating systems you can test your MySQL-based application in different environments.

• Scalability
  > Although using virtualization imposes a performance hit, many virtualization solutions allow you to create a packaged version of an environment, including MySQL and the other application components.
Virtualization Options

• Native virtualization
  > Including products like VMware Workstation, Parallels Desktop/Parallels Workstation, Microsoft Virtual PC and VirtualBox, all work by acting as an application that runs within an existing operating system environment. Recent versions can take advantage of the virtualization extensions in the Intel and AMD CPUs to help improve performance.
Virtualization Options

- Paravirtualization (Hypervisor)
  - Including Xen, Solaris xVM (based on Xen), VMware ESX Server, Windows Server 2008 Hyper-V, and Solaris Logical Domains (LDOM), work by running a specialized version of the host operating system. The host OS then allows slightly modified versions of different operating systems to run within the virtualized environment.
Virtualization Options

• Operating System-Level Virtualization
  > Including BSD jails, and Solaris Containers/Zones, offer methods for isolating different instances of an operating system environment while sharing the same hardware environment. Unlike the other virtualization solutions, operating system level virtualization is not normally used to run other operating systems, but instead to provide a level of security isolation and resource control within the core operating environment.
Virtualization Considerations

• Does it offer true hardware virtualization?
• Are there different ways to manage the storage?
  > For example, raw vs virtual disk etc.
• Does it fit your budget and policy guidelines?
• Is it a platform that will be supported commercially?
MySQL in a virtualized environment … are you crazy?

On average*, overhead in a virtualized environment is less than 10%
MySQL & Virtualization
MySQL & Virtualization

• Contention of resources within the host should be taken into account.
• If your database application is time sensitive, including logging and real-time database applications, or you are using MySQL Cluster, then the effects of virtualization may severely reduce the performance of your application.
• Be aware of the limitation of using a single host to run multiple virtualized instances.
MySQL & Virtualized Storage

• Some virtualization solutions allow you to use a physical disk directly within your virtual host as if it were a local disk. You should use this whenever possible to ensure that disk contention issues do not affect the performance of your virtual environment.
MySQL & Virtualized Storage
Using standard file-based storage for your virtualized disks

• File-based storage is subject to fragmentation on the host disk. To prevent fragmentation, create a **fixed-size disk** (that is, one where the entire space for the disk file is preallocated) instead of a dynamic disk that will grow with usage. Also be prepared to defragment the disk hosting the files at regular intervals to reduce the fragmentation.

• Use separate disk files for the operating system and database disks, and try to avoid partitioning a disk file as this increases the contention within the file.
MySQL & Virtualized Storage
Using standard file-based storage for your virtualized disks

• Use a high-performance disk solution, such as RAID or SAN, to store the disk files for your virtualized environments. This will improve the performance of what is essentially a large single file on a physical device.

• When running a number of different virtualized environments within a single host, do not use the same physical host drive for multiple virtual disks. Instead, spread the virtual disks among multiple physical disks. Even when using a RAID device, be aware that each virtual host is equivalent to increasing the load linearly on the host RAID device.
MySQL & Virtualized Networking

- If your host machine has only one network card, you will be sharing networking throughput for all machines through only one card, this may severely limit the performance of your virtual environments.
- If possible, use multiple network cards to support virtualized instances.
- If you are using packaged virtual machines as the basis for deployment, make sure network interfaces are correctly reconfigured.
VMware Best Practices
VMware Best Practices for MySQL

• Ensure that database queries use indices effectively, thus reducing any unnecessary I/O operations. Overall, additional I/O operations may cause an increase in CPU use compared with physical systems.

• For Red Hat based versions of Linux, be aware of the effects of the frequent timer interrupts, which may need to be managed via the divider command. More information on this issue is available in the VI performance paper listed in the resources section below.
VMware Best Practices for MySQL

• Reduce the number of vCPUs in your virtual machines to the minimum, as larger numbers of vCPUs will incur more scheduling overhead.

• Disable the floppy drive, CD ROM and USB adaptors in your virtual machines.

• Use physical systems that have multiple physical NICs available, and separate network traffic across the two NICs to reduce network contention.
MySQL in Solaris Zones
MySQL in Solaris Containers

- When using MySQL 5.0.42, 5.1.18 and earlier versions, mount file systems with the direct I/O option. Accessing a file system without buffering and read-ahead is known as direct I/O.
- Later versions of MySQL 5.0.x and 5.1.x provide the `innodb_flush_method` parameter to bypass the file system cache for data files without forcing every application to use direct I/O on the entire file system. It can be enabled in the `my.cnf` file by setting the `innodb_flush_method` parameter to `O_DIRECT`.
- Using the raw devices is another way to avoid double buffering.
MySQL in Hyper-V
Hyper-V Best Practices

• Fixed disks or pass-through disks should be used for best performance

• Creating a dedicated or pass-through disk requires a different approach. This is not really a Virtual Disk, but it is a physical disk connected to a virtual disk controller in a Virtual Machine
Hyper-V Best Practices

- On the Hyper-V server, open the Server Manager and under storage select Disk Management. Make sure that the disk you want to use as a dedicated disk is Offline. This will ensure that the Parent Partition cannot access the disk. If it can access the disk, and write data on it, it will give unpredictable results in the Virtual Machine.
Hyper-V Best Practices

- In the Hyper-V Manager right-click the Virtual Machine and select Settings. Select the IDE Controller, select Hard Drive and click Add. Under Media select Physical Hard Disk and select the disk you want to assign to this controller.
Cloud Computing
Cloud Computing Solutions for MySQL

• MySQL Enterprise: Optimized for the Joyent Cloud
  > Joyent Virtual Appliance for MySQL is pre-configured to maximize the database's performance on Joyent's powerful, secure and stable virtualization technology.

• MySQL Enterprise for Amazon EC2
  > The MySQL Enterprise for Amazon EC2 subscription is a comprehensive offering of database software and production support to deliver applications on Amazon EC2 with optimal performance, reliability, security, and uptime.
Cloud Resources for MySQL

• Running MySQL on Amazon EC2 with Elastic Block Store
  > http://developer.amazonwebservices.com/connect/entry.jspa?externallID=1663

• MySQL/EC2 Forum

• Joyent Accelerator for MySQL
Thank You!

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