EqualLogic Best Practices for SQL Server Deployments

李光明

Goldman_Li@dell.com
Storage Solution Specialist
Notices & Disclaimers

Copyright © 2010 by Dell, Inc.

No part of this document may be reproduced or transmitted in any form without the written permission from Dell, Inc.

This document could include technical inaccuracies or typographical errors. Dell may make improvements or changes in the product(s) or program(s) described herein at any time without notice. Any statements regarding Dell’s future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

References in this document to Dell products, programs, or services does not imply that Dell intends to make such products, programs or services available in all countries in which Dell operates or does business. Any reference to an Dell Program Product in this document is not intended to state or imply that only that program product may be used. Any functionality equivalent program, that does not infringe Dell’s intellectual property rights, may be used.

The information provided in this document is distributed “AS IS” without any warranty, either expressed or implied. Dell EXPRESSLY DISCLAIMS any warranties of merchantability, fitness for a particular purpose OR INFRINGEMENT. Dell shall have no responsibility to update this information.

The provision of the information contained herein is not intended to, and does not, grant any right or license under any Dell patents or copyrights.

Dell, Inc.
300 Innovative Way
Nashua, NH 03063 USA
Storage Infrastructure and Solutions Engineering

• 目标:
  – Improve overall customer experience with EqualLogic deployments in the Enterprise

• 章程:
  – Development of reference architectures, best practices and sizing guidelines for Enterprise applications and SANs with EqualLogic products:
    › Exchange, Oracle, SQL, SharePoint, VDI, Cloud
    › 1/10Gb Ethernet fabrics, network architectures, DCB, Replication, initiators, switches
    › EqualLogic Configuration Guide (ECG)
  – SAN interoperability validation

• 投资:
  – 2010: Multi-million $ budget
  – 2011: ~40% investment increase
AGENDA

• Database Workload Characteristics 数据库负载特性
• Configuration Best Practices 最优配置
• Performance Analysis 性能分析
• Case Study 案例介绍
SQL的数据结构
Workload Characteristics: SQL Server

• 在线交易系统 (OLTP)
  – Random Read-Write I/O
  – Short transactions from large number of users
  – Response times critical

• 决策支持系统 (DSS) / 在线分析处理 (OLAP)
  – Sequential Read I/O
  – Long running queries submitted by limited users
负载优化

**OLTP (在线交易系统):**
- Physical disks cannot serve data onto the pipe fast enough
- Slow response times without sufficient disks = “Add more spindles”

**DSS (决策支持系统):**
- Physical disks do a good job of serving sequential data
- Bottleneck typically shifts to available I/O bandwidth or processing resources
- Optimizations required at every layer in stack
EqualLogic 最佳实践：磁盘

• 根据工作负载，确定磁盘驱动器的类型、速度和容量

• EqualLogic Storage Pools (存储池)
  – 利用 EqualLogic 跨阵列卷负载均衡的先进功能
  – Large environments (several databases):
    * Data volumes in one storage pool
    * Log volumes in separate storage pool
  – Smaller environments:
    Data and log volume in same pool
选择最恰当的 EqualLogic 型号

- 关键硬件提供:
  - End-to-end 可靠性
  - 按需扩展
  - 按需选择磁盘类型

- 企业级软件特性:
  - 容易安装
  - 简化管理
  - 快速识别
  - 优化性能
  - 无缝扩展
  - 多种数据保护机制
  - 灵活的在线分级存储

<table>
<thead>
<tr>
<th></th>
<th>PS6000E</th>
<th>PS6000X</th>
<th>PS6000XV</th>
<th>PS6000S</th>
<th>PS6000XVS</th>
<th>PS6500E</th>
<th>PS6500X</th>
<th>PS6510E</th>
<th>PS6510X</th>
</tr>
</thead>
<tbody>
<tr>
<td>SATA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>磁盘类型</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SATA</td>
<td>Up to 16TB</td>
<td>10K SAS</td>
<td>15K SAS</td>
<td>SSD</td>
<td>SSD &amp; SAS</td>
<td>SATA 96TB</td>
<td>SAS 28.8TB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>磁盘配置</td>
<td></td>
<td>9.6 TB</td>
<td>Up to 9.6TB</td>
<td>1.6TB</td>
<td>Auto Tiering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 高容量配置，适用于数据密集型应用程序和高度整合的环境</td>
<td>• 均衡企业数据中心的成本、性能和容量数据库、邮件系统、虚拟服务器环境等</td>
<td>• 最高性能的HDD系统具有可观的容量，可满足关键应用程序的需求</td>
<td>• 最高的随机读取IOPS性能，最低的延迟时间，可满足要求苛刻的企业应用程序需求</td>
<td>• SSD和SAS之间自动均衡</td>
<td>• 分层存储、文件服务中等I/O交换、数据库、备份数据、灾难恢复站点等</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Common software and functionality across all form factors
All inclusive SW updates for life of array
Peer Scaling, Snapshots, Thin provisioning, replication

支持的磁盘类型
SATA：1TB/2TB
SAS 10K：600GB
SAS 15K：600GB
SSD：100GB

支持的接口类型
1 Gbps Ethernet
10 Gbps Ethernet
## EqualLogic 最佳实践：RAID

<table>
<thead>
<tr>
<th>Volume Type</th>
<th>RAID Recommendation</th>
</tr>
</thead>
</table>
| Database Volumes | DSS:
|                  | RAID 50 to optimize on capacity and performance;         |
|                  | RAID 5 to optimize on capacity                           |
|                  | OLTP:
|                  | RAID 10 to optimize for performance;                      |
|                  | RAID 50 to optimize on capacity for read intensive workloads |
| TempDB Volumes   | DSS:
|                  | RAID 50 to optimize on capacity and performance;         |
|                  | RAID 10 for high write activity                          |
|                  | OLTP:
|                  | RAID 10 to match database volumes;                       |
|                  | RAID 50 if write activity is low                         |
| Log Volumes      | DSS:
|                  | RAID 50 to optimize on capacity and performance;         |
|                  | RAID 10 if DSS DB refreshes include very large bulk updates |
|                  | OLTP:
|                  | RAID 10 to optimize on performance due to write log activity |

---

*Dell Storage Forum: EqualLogic User Conference, Xiamen, 2011*

*Accelerate the Virtual Era with EqualLogic*
**EqualLogic 最佳实践： switches**

- **专用存储网络** infrastructure for storage related traffic
- **冗余设计** switches with appropriate settings recommended for HA
- Determine the switches capability / connectivity based on the requirements of the workloads
EqualLogic 最佳实践：Server Configuration

- You have to **size the server** resources for the appropriate workload
  - Dell has tools like SQL Server Advisor Tool: [www.dell.com/sql](http://advisors.dell.com/advisorweb/Advisor.aspx?advisor=214e88fe-eb6e-4d1c-86bf-b7d7dd092c38&c=us&l=en&cs=555)

- You will need to think **beyond CPU and memory**

- Make sure you have enough highly available **IO bandwidth**
**EqualLogic 最佳实践：Operating System**

- **Align disk partitions** to storage stripe boundaries
- **NIC/HBA settings**
  - Use flow control and jumbo frames
  - Utilize NIC offload capabilities
  - Disable NIC teaming and unused NICs
- **Use Windows MPIO with EqualLogic DSM**
  - Installed with EqualLogic HIT kit
  - Spread across members
  - “Least Queue Depth” MPIO setting recommended
最佳实践：SQL Server

• **Size** the database, log and ‘tempdb’ volumes appropriately
  – Capacity and Performance

• Implement **SQL optimizations** such as table partitioning

• Consider advanced **SQL Server settings**

• Leverage **SQL Server high availability features**
有问题吗？
最佳实践：Sample Illustration
DSS Scalability: 10GbE Storage (PS6010XV)

- SQL DSS 两种测试环境
  - Single storage array for SQL Server data
  - Three storage arrays for SQL Server data
  - Transaction logs were hosted on a separate array in both configurations
- Workload
  - 22 streams of SQL queries and 5 streams simulating 5 users

![NIC Instantaneous Peak Throughput](image)
DSS Scalability: 10GbE Storage (PS6010XV)

- Increased available I/O throughput reduced response time of queries
DSS Scalability: 10GbE Storage (PS6010XV)

- Increased I/O throughput moved the bottleneck upstream
  - Processor utilization increases to process the queries quick with data arriving at a faster rate

![Average Processor Utilization](chart.png)
虚拟化 Virtualization

• Initiator Mode
  – Guest iSCSI initiator
    › Application consistent VSS snapshots for backup using EqualLogic Provider
    › EqualLogic Auto-Snapshot Manager (ASM/ME)
  – Host iSCSI initiator and virtual disks for guest
    › Backup solution design needs evaluation

• Hypervisor choice
  – EqualLogic aware multipathing at host: ESX and Hyper-V
  – VSS aware backup capabilities for guest OS vary

• Microsoft support
  – support version: SQL 2005 and higher
  – Guest failover clustering is supported in SQL Server 2008 R2
  – Live Migration is supported when using Windows Server 2008 R2 with Hyper-V or Hyper-V Server 2008 R2
  – Virtualization Snapshots for Hyper-V or any virtualization vendor are not supported to use with SQL Server in a virtual machine.

http://support.microsoft.com/?id=956893
有问题吗？
Case Study - Safeway Insurance Company

http://www.safewayinsurance.com/
Company Overview

- Safeway Insurance Company – 最大的私营汽车保险集团
- Family owned since 1959
- Offer auto insurance coverage in 10 states and homeowners coverage in 1
- Business is primarily generated by a network of independent agents
SQL Server Deployment

- Web based application with a Microsoft SQL 2008 cluster backend
- **DB Performance** is key to maintaining business
- Business application is highly transactional
- I/O bottleneck discovered with DAS
- Evaluated iSCSI SAN vs. DAS for performance
EqualLogic Choice

• 2005 - Started off with a PS100x array SATA 10k drives
• Immediately saw a 20% improvement in I/O performance
• 2010 - Expanded to 2 groups, 11 arrays, nearly 40TB of storage mixed SAS/SATA 7200, 10K & 15k drives
EqualLogic Operations
EqualLogic Benefits

- 操作管理费用 = $0
- 分级存储
- MPIO
- 远程复制 Replication
- 基于快照管理器的数据备份解决方案
  VSS via Symantec BackupExec 2010 on Dell PowerVault DL2100
  – 120GB < 40 minutes
Network Infrastructure
有问题吗？
Resources

- www.equallogic.com
  - Storage platform
  - Solution aids

- www.dell.com/sql
  - Deployment guides
  - SQL Advisor tool
Thank You!