Next-gen Flash-based MySQL and NoSQL Solutions

Real World Case Studies of Extreme Performance, Scalability, and Availability

Darpan Dinker
Vice President, Database Technologies
Agenda

• Datacenter trends and challenges
• Next-gen flash-based solutions
• MySQL case studies
• NoSQL case studies
Too Much Rack, Power, Pipe, and Complexity

U.S. data-centers use more energy than the entire nation of Sweden.
- EE Times

Datacenter equipment is only utilized 6% to 10%.
- William Forrest Forbes

The number of installed servers in the U.S. will increase from 2.2 million in 2007 to 6.8 million in 2010.
- Frost & Sullivan

From 2003 to 2008 the data size of the average web page has more than tripled.
- websiteoptimization.com

For every 100 units of energy piped into a data center, only three are used for actual computing.
- U.S. Department of Energy
Typical Datacenter Deployment

**Web/App Tier**
- PHP, Perl, Ruby, Java

**Caching Tier**
- Memcached

**Database Tier**
- MySQL
  - Master
  - Slaves

**NoSQL Tier**
- Key-Value Store, Document Store, etc.

**Data Access Tier**

**End User**

- Ensure Quality of Service

- Scale to Meet Demand

- Minimize Costs

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Key Challenges

- **Scale to Meet Demand**
  - Pain of sharding and re-sharding
  - Complexity of adding new servers
  - Headache of managing server sprawl

- **Ensure Quality of Service**
  - Poor response time and availability
  - Trade-offs in consistency models
  - Complex, defensive app development

- **Minimize Costs**
  - Too much underutilized hardware
  - Wasted power, pipe, and cooling
  - Integration & management burden
Integrated, optimized, scalable MySQL & NoSQL solutions:

- Effectively leverage flash memory, multi-core processors, high-speed networking, scalable data access software
- Incorporate highly optimized, balanced hardware platform, operating environment, integrated MySQL and NoSQL
- Provide efficient, higher level scalable building blocks
- Eliminate complex integration projects and leverage out of the box performance, scalability and availability
- Deliver enterprise class reliability
Tightly Coupled Software Architecture

MySQL Conference & Expo, 2010

Operating Environment

Intelligent Caching Hierarchy
- Optimized buffer mgmt & scan resistant algorithms
- Write-through and write-back caching flexibility
- Adaptive, fine-grained memory management
- Efficient object metadata for persistence

Optimized Flash Memory Access
- Highly parallel read and write access
- Intelligent flash wear algorithms
- Durability with high-performance
- High-performance, integrated RAID

Multi-Core Scalability
- Fine grain locking
- Scalable and concurrent data structures
- Optimized thread to core allocation
- Efficient handling of network interrupts

Transparent HA/DR
- Synchronous and async replication
- Failure detection and automated VIP failover
- Fast, incremental data recovery
- Incremental/full online backup and restore

Optimized, Balanced Hardware Platform

Networked Clients

MySQL

NoSQL

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Schooner MySQL and NoSQL Solutions

- **Integrated, turnkey appliance**
  - Integrated hardware and software
  - Enterprise-class support
  - 100% compatibility, fully certified

- **High performance**
  - 8x performance improvement
  - 1/8x the power and rack space
  - 50% lower TCO over 3 years

- **High availability**
  - Complete data & service availability
  - Transparent and fully integrated
  - 90% higher availability

1. The Schooner Appliance for MySQL Enterprise™ with InnoDB

2. The Schooner Appliance for Memcached / NoSQL

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Schooner Powered Datacenter

Web/App Tier
PHP, Perl, Ruby, Java

Caching Tier
Memcached

NoSQL Tier
Key-Value Store, Document Store, etc.

Database Tier
MySQL

Ensure Quality of Service

End User

Data Access Tier

Scale to Meet Demand

Minimize Costs
Schooner Appliance for MySQL Enterprise™ with InnoDB

**High Performance**
- Highly parallel, optimized flash memory access
- Advanced buffer pool caching algorithms
- Multi-core scalability with fine grained locking
- Delivered on proven IBM server with up to 1TB of flash

**High Availability**
- Fully ACID-compliant with data durability
- Integrated replication and automated failover
- Integrated, high-performance backup and restore
- RAID across SSDs and HDDs

**Turnkey Appliance**
- Multi-instance consolidation on single appliance
- Web-based GUI/CLI for centralized management
- Integration with 3rd party mgmt & monitoring tools
- 100% compatible and fully certified by Sun/MySQL

**DBT2 Performance (TPM)**
- Measured DBT2 throughput at 1000 warehouses, 32 connections, 8 SSDs/HDDS with RAID 5. All databases configured for durability and consistency. Legacy results were on MySQL version 5.1.44 (most commonly used today). Schooner MySQL Appliance results were on Schooner-optimized 5.1.44.

**Connection Scalability**
MySQL Consolidation and Cost Savings

THE BOTTOM LINE

- Immediate capex savings
- 66% TCO savings ($550,000) over 3 years
- Power & space reductions enable green datacenter

TCO: $832,000
TCO: $282,000

TCO SAVINGS: $550,000

CapEx: 32 Servers
OpEx

CapEx: 4 Appliances
OpEx

Without Schooner
32 servers, 17.9 kW

With Schooner
4 Schooner appliances, 1.8 kW

MySQL Consolidation and Cost Savings

MySQL Conference & Expo, 2010

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What Can I Do With It?

Reduce sharding and consolidate slaves

Scale performance and process queries faster

Reduce planned and unplanned downtime

Eliminate integration and optimization headaches

- Software
- Hardware
- Support
- Certified
- Complete

MySQL Replication + MMM Failover

SSD RAID & Data Durability

70K TPM (DBT2)
20K Connections

½ TB or 1TB Flash

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Case Study: Financial Services

Scale Performance and Process Queries Faster

High-performance, out-of-the-box
100% compatible

"Our ad-hoc MySQL queries run at least five times faster after installing the Schooner Appliances. They deliver a huge performance benefit and are a breeze to install and manage."

– Darryl Weatherspoon, VP of Eng at Xoom.
"In our business, website performance and efficiency is key to the success of our web properties. The Schooner MySQL Appliances have significantly helped GuteFrage improve their overall website response time while at the same time allowing them to consolidate their database slaves onto a single Schooner appliance, dramatically reducing the time necessary for database administration."

– Frank Penning, CTO of Holzbrinck Digital
Schooner Appliance for Memcached / NoSQL

**High Performance**
- Highly parallel, optimized flash memory access
- Fast, efficient DRAM-to-Flash caching algorithms
- Multi-core scalability with parallel thread allocation
- Delivered on a proven IBM server with a ½ TB of flash

**High Availability**
- Persistent key-value store mode and cache mode
- Transparent replication and automated failover
- Non-disruptive, rolling upgrades
- RAID & high-performance backup and restore

**Easy Appliance**
- Dynamic containers for consolidation & multi-tenancy
- Web-based GUI/CLI for centralized management
- Integration with 3rd party mgmt & monitoring tools
- 100% compatible and fully memcapable compliant

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**Memcached Caching Service**
- 150GB capacity, 250K TPS
- Replication & Failover
- 100% Memcapable

**Key-Value Store Service**
- 350GB capacity, 150K TPS
- Replication & Failover
- Persistence, RAID, and Backup
- Memcached-based key-value API
Cache Capacity per Node (GB)

<table>
<thead>
<tr>
<th></th>
<th>Traditional Memcached</th>
<th>Schooner Appliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cache Capacity per Node (GB)</td>
<td>0</td>
<td>500</td>
</tr>
</tbody>
</table>

Reduction in Downtime (%)

<table>
<thead>
<tr>
<th></th>
<th>Traditional Memcached</th>
<th>Persistent Caching</th>
<th>Storage RAID</th>
<th>Replication &amp; Failover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in Downtime (%)</td>
<td>0</td>
<td>20</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>
Memcached / NoSQL Consolidation and Cost Savings

THE BOTTOM LINE

- Immediate capex savings
- 54% TCO savings ($328,000) over 3 years
- Power & space reductions enable green datacenter

3 Year TCO (2 TB Memcached)

OpEx

CapEx: 32 Servers

TCO: $610,000

OpEx

CapEx: 4 Appliances

TCO: $282,000

TCO SAVINGS: $328,000

Without Schooner

32 servers, 17.9 kW

TCO: $610,000

With Schooner

4 Schooner appliances, 1.8 kW

TCO: $282,000

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What Can I Do With It?

Consolidate and reduce server sprawl

- Traditional Memcached
- Schooner

Reduce planned and unplanned downtime

- Application Transparent
  - Synchronous Replication
  - Automated Failover
  - SSD RAID & Persistence

Scale cache capacity and process requests faster

- 250K TPS
- ½ TB Flash

Reduce application development complexity

- Application Tier
  - Failure Detection
  - Replication
  - Group Delete
  - Data Durability

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Consolidate and Reduce Server Sprawl

Scaling with 12:1 Consolidation using Persistence, Multi-Get, Replication and Recovery

Scaling the data tier is a common challenge, and Schooner is helping us do just that. Power is the big constraint right now, so anything we can do to reduce that footprint right now is helpful. From an administrative perspective, fewer machines is always better, from a monitoring and scripting standpoint, and it also means reductions in potential failures due to fewer boxes.

– Saran Chari, CTO and Founder at Flixster

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Reduce Planned and Unplanned Downtime

Application Transparent

Synchronous Replication + Automated Failover

SSD RAID & Persistence

SSD RAID & Persistence

40 Million Users Address Books in Key Value Store with 8:1 Consolidation

In the wonderful Schooner world, failovers go away. Schooner replication means that you’re sure that what you have on one node will also be on the other. Our developers don’t have to worry about cache coherency. They can plan on the data being available so they don’t have to program defensively.

– Ethan Erchinger, Director of Ops at Plaxo
Market Segments

- Social Networking
- Business Analytics
- Gaming
- Cloud
- Media
- Telco
- Finance
The Schooner Advantage

- **Vastly Higher Performance and Scalability**: 8x compared to traditional servers
- **Significantly Lower TCO**: Replacing 8 traditional servers with 1 reduces TCO by more than 50%
- **Quick Deployment**: Easy plug-and-play installation and configuration
- **Seamless Operation**: 100% compatible with existing client applications and management tools
- **Higher Reliability**: Delivers enterprise-class reliability by leveraging persistence, replication, and recovery software
- **Easy Management**: Simple but powerful centralized management and reporting with integrated CLI and GUI
- **More Revenue**: Powers new revenue-producing applications enabled by fast access to terabyte-scale data
- **World-Class Support**: IBM provides 24/7/365, single-point-of-contact service and support for every Schooner appliance, worldwide
Abstract

Scale out data centers are realizing order of magnitude improvements in performance, scalability, and availability while reducing TCO with innovative MySQL and NoSQL solutions. These architectures tightly couple MySQL and NoSQL with flash memory, multi-core processors and high performance networking into balanced, highly available, scalable solutions.

In this presentation, Darpan Dinker, Vice President of Database Technologies, Schooner Information Technology, will discuss:

- business and technology challenges
- tightly coupled MySQL and NoSQL scale out architectures
- case studies of large scale web site deployments in premier web 2.0, enterprise, and cloud companies, discussing their realized order of magnitude improvements in performance, scalability, downtime and TCO.