Building Highly Available and Scalable Real-Time Services with MySQL Cluster

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Program Agenda

- Introduction
- The Current Web Environment
- New Database Requirements
- Cluster Benefits
- NDB Architecture
- Distributed Clusters
- High Availability Clustering
- Cluster Management
- Questions & Next Steps
40% DATA GROWTH PER YEAR

850M USERS

20M APPS PER DAY

1 TR VIDEO PLAYBACKS

$1TR BY 2014

$700BN IN 2011

2.1BN USERS

8X DATA GROWTH IN 5 YRS

70+ NEW DOMAINS EVERY 60 SECONDS

5.9BN MOBILE SUBS IN 2011

250m TWEETS PER DAY

2.1BN iOS & ANDROID APPS DOWNLOADED PER WEEK

370K CALL MINUTES EVERY 60 SECONDS

1 BILLION iOS & ANDROID APPS

$1TR VIDEO PLAYBACKS

20M APPS PER DAY

1 TR VIDEO PLAYBACKS

$700BN IN 2011
Only MySQL Can.....

blend the agility & innovation of the web....

craigslist

....with the trust & capability of the network.
Driving new Database Requirements

EXTREME WRITE SCALABILITY

REAL TIME USER EXPERIENCE

ROCK SOLID RELIABILITY

RAPID SERVICE INNOVATION
No Trade-Offs

Transactional Integrity
Complex Queries
Standards & Skillsets
MySQL Cluster – Users & Applications

Extreme Scalability, Availability and Affordability

- **Web**
  - High volume OLTP
  - eCommerce
  - User Profile Management
  - Session Management & Caching
  - Content Management
  - On-Line Gaming

- **Telecoms**
  - Subscriber Databases (HLR / HSS)
  - Service Delivery Platforms
  - VAS: VoIP, IPTV & VoD
  - Mobile Content Delivery
  - Mobile Payments
  - LTE Access

http://www.mysql.com/customers/cluster/
## Key Benefits

| Scaling Reads & Writes | Auto-sharding + Multi-master  
| Transactional, ACID-compliant relational database |
|------------------------|--------------------------------------------------|
| 99.999% Availability    | Shared-nothing design, no Single Point of Failure  
| On-Line operations: Scale, Upgrade Schema, etc. |
| Real-Time Responsiveness| High-load, real-time performance  
| Predictable low latency, bounded access times |
| SQL & NoSQL APIs        | Complex, relational queries + Key/Value Access  
| MySQL, Memcached, C++, Java, JPA, HTTP / REST |
| Low TCO, Open platform  | GPL & Commercial editions  
| Commodity hardware, management & monitoring tools |
MySQL Cluster Architecture

Node Group 1

Node Group 2

Data Nodes

Application Nodes

Cluster Mgmt

Cluster Mgmt
MySQL Cluster - Extreme Resilience

Node Group 1
- Node 1
  - F1
  - F3
- Node 2
  - F3
  - F1

Node Group 2
- Node 3
  - F2
  - F4
- Node 4
  - F4
  - F2

Application Nodes
- JPA
- REST

Data Nodes
- Cluster Mgmt
- Cluster Mgmt

MySQL
Simplified Provisioning & Maintenance
User Privilege Consolidation

GRANT mrfoo

MySQL Cluster Data Nodes
MySQL 5.5 Server Integration

- Configure storage engine per-table
- Choose the right tool for the job
  - InnoDB: Foreign Keys, XA Transactions, Large Rows
  - MySQL Cluster: HA, High Write Rates, Real-Time
- Reduces Complexity, Simplifies DevOps
- Take advantage of MySQL 5.5
  - 3x higher performance
  - Improved partitioning, diagnostics, availability, etc.
Auto-Sharding with High Availability

- Transparent to the application
  - No need for application-layer sharding logic
  - Each node stores primary fragment for 1 partition and back-up for another
- Transparency maintained during failover, upgrades and scale-out
- No need to limit application to single-shard transactions
Multi-Site Clustering

- Split data nodes across data centers
  - Synchronous replication and auto-failover between sites
  - Improved heartbeating to handle network partitions
- Extends HA Options
- Active/Active with no need for conflict handling
Active/Active Geographic Replication

• Replicating complete clusters across data centers
  • DR & data locality
  • No passive resources
• Simplified Active / Active Replication
  • Eliminates requirement for application & schema changes
  • Transaction-level rollback
Handling Scheduled Maintenance
On-Line Operations

• Scale the cluster (add & remove nodes on-line)
• Repartition tables
• Upgrade / patch servers & OS
• Upgrade / patch MySQL Cluster
• Back-Up
• Evolve the schema on-line, in real-time
MySQL Cluster Manager

Reducing TCO and creating a more agile, highly available database environment

- Monitoring & Recovery
- Automated Management
- High Availability Operation
How Does MySQL Cluster Manager Help?

Example: Initiating upgrade from MySQL Cluster 7.0 to 7.2

**Before MySQL Cluster Manager**
- 1 x preliminary check of cluster state
- 8 x ssh commands per server
- 8 x per-process stop commands
- 4 x scp of configuration files (2 x mgmd & 2 x mysqld)
- 8 x per-process start commands
- 8 x checks for started and re-joined processes
- 8 x process completion verifications
- 1 x verify completion of the whole cluster.
- Excludes manual editing of each configuration file.

**Total: 46 commands - 2.5 hours of attended operation**

**With MySQL Cluster Manager**

**upgrade cluster --package=7.1 mycluster;**

**Total: 1 Command - Unattended Operation**

- **Results**
  - Reduces the overhead and complexity of managing database clusters
  - Reduces the risk of downtime resulting from administrator error
  - Automates best practices in database cluster management
Bootstrap single host Cluster

1. Download MCM from edelivery.oracle.com:
   - Package including Cluster
2. Unzip
3. Run agent, define, create & start Cluster!
   `$> bin\mcmd -bootstrap`

MySQL Cluster Manager 1.1.2 started
Connect to MySQL Cluster Manager by running "D:\Andrew\Documents\MySQL\mcm\bin\mcmd -a NOVA:1862"
Configuring default cluster 'mycluster'...
Starting default cluster 'mycluster'...
Cluster 'mycluster' started successfully
   ndb_mgmd NOVA:1186
   ndbd NOVA
   ndbd NOVA
   mysqld NOVA:3306
   mysqld NOVA:3307
   ndbapi *
Connect to the database by running "D:\Andrew\Documents\MySQL\mcm\cluster\bin\mysql" -h NOVA -P 3306 -u root

- Connect to Cluster & start using database

To bootstrap with Cluster 7.2 replace contents of mcm/cluster directory
http://www.clusterdb.com/mysql-cluster/mysql-cluster-manager-1-1-2-creating-a-cluster-is-now-trivial
When to Consider MySQL Cluster

- What are the consequences of downtime or failing to meet performance requirements?
- How much effort and $ is spent in developing and managing HA in your applications?
- Are you considering sharding your database to scale write performance? How does that impact your application and developers?
- Do your services need to be real-time?
- Will your services have unpredictable scalability demands, especially for writes?
- Do you want the flexibility to manage your data with more than just SQL?
Evaluate MySQL Cluster CGE

30-Day Trial

- Navigate to http://edelivery.oracle.com/ and step through (selecting “MySQL Database” as the Product Pack)

- Select MySQL Cluster Manager
Q&A
Hardware and Software
Engineered to Work Together