



Monitoring Scale-Out with the MySQL Enterprise Monitor

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MySQL-Sun, Enterprise Tools Team

Wednesday, April 16, 2008
5:15 pm – 6:00 pm
Ballroom E

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Agenda

- MySQL Enterprise Monitor
- ReplMxj
- Detecting Replication Topologies
- Replication Monitoring and Rules
- Mysqslap – Stressing a System
- Q&A
- Related Sessions

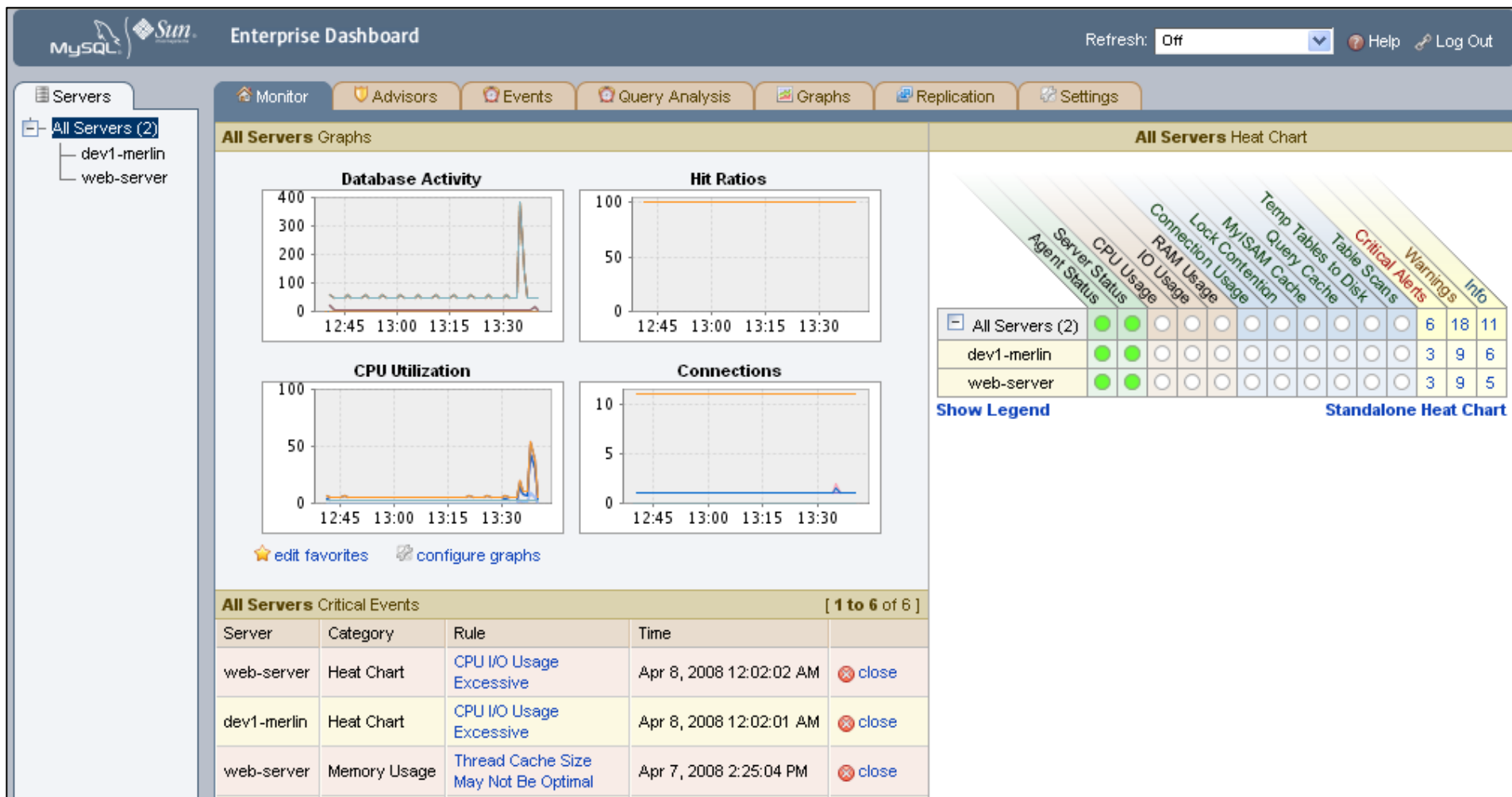
MySQL Enterprise Monitor

- Virtual DBA Assistant
- Consolidated view into the health of all your MySQL servers
- Monitor & graph over 600 MySQL and OS variables
- View replication topologies through auto detection and grouping
- View real-time master/slave performance
- Run over 110 Advisor Rules
- Notification of issues using threshold driven alerts

MEM -- Advisors

- Administration - recommends database administration best practices
- Memory Usage - monitors dynamic memory related server metrics (cache usage, hit ratios, etc.); recommends config changes to improve performance
- Performance - identifies parameters to tune to improve database performance
- Replication - finds issues and recommends solutions to replication setup and performance problems
- Schema - assists in finding and addressing DB design issues
- Security - helps identify and fix security vulnerabilities in a MySQL Server
- Upgrade - Monitors and advises on specific bugs that can potentially impact versions of MySQL deployed within an environment
- Custom - allows you to add your own custom best practice rules

MEM – Monitoring



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MEM – Architecture

MySQL AB



Enterprise
Software &
Updates



Advisor Rules
Server Updates



Profiles & Alerts
Knowledge Base



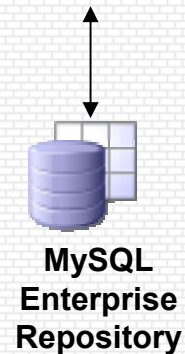
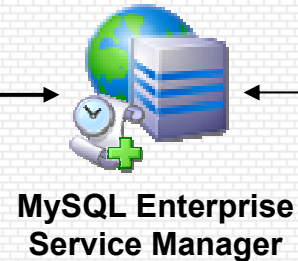
Production
Support



Multi-vendor
Support, IP
Protection



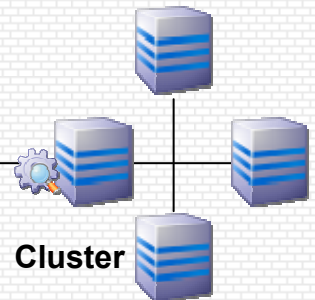
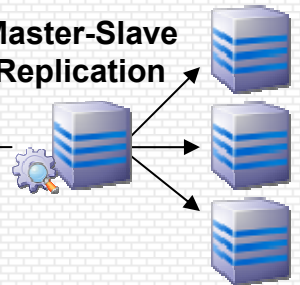
Your Company



Individual Databases



Master-Slave Replication



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MEM – Architecture



Service Agent written in C and supports all MySQL Enterprise platforms



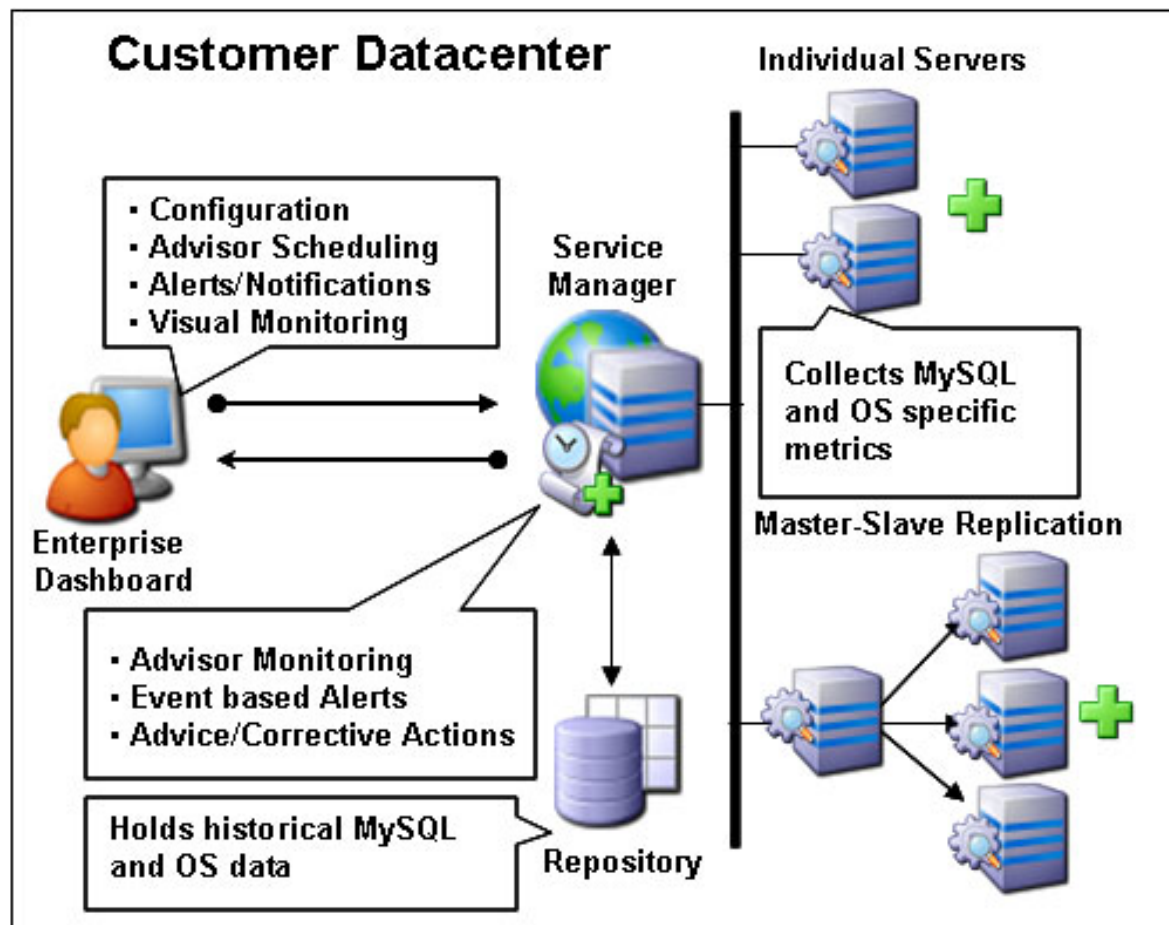
Service Manager written in Java servlets exposed as web services. Supports Linux, Solaris, Mac OSX and Microsoft Windows



Enterprise Dashboard Web-based, written in JSP



Repository holds historical performance data for analysis



ReplMxj

- Written by Darren Oldag
- Deploys a MySQL replication topology on a single host
- Topology defined in a DOT file
 - http://en.wikipedia.org/wiki/DOT_language
- Also creates service agent INI files for each of the nodes, and a shell script to start agents with each of those INI files
- Connector/MXJ
 - Linux (i386), Mac (i386 & PPC), Solaris (SPARC & x86), Windows (x86)
- Open Source? Interested?

ReplMxj – Master and Slaves

```
digraph Master3Slaves
```

```
{
```

```
  "manager.url"="http://agent:mysql@localhost:8080/merlin/heartbeat"
```

```
  baseport=10100;
```

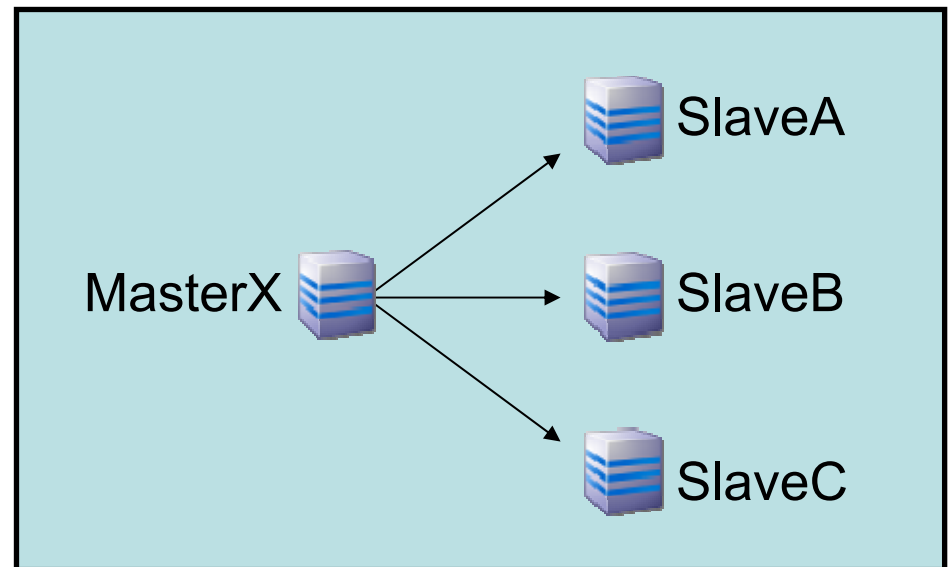
```
  MasterX;
```

```
  MasterX->SlaveA;
```

```
  MasterX->SlaveB;
```

```
  MasterX->SlaveC;
```

```
}
```



ReplMxj – Ring and Spoke

digraph RingSpoke

{

"manager.url"="http://agent:mysql@localhost:8080/merlin/heartbeat"

baseport=10200;

B;

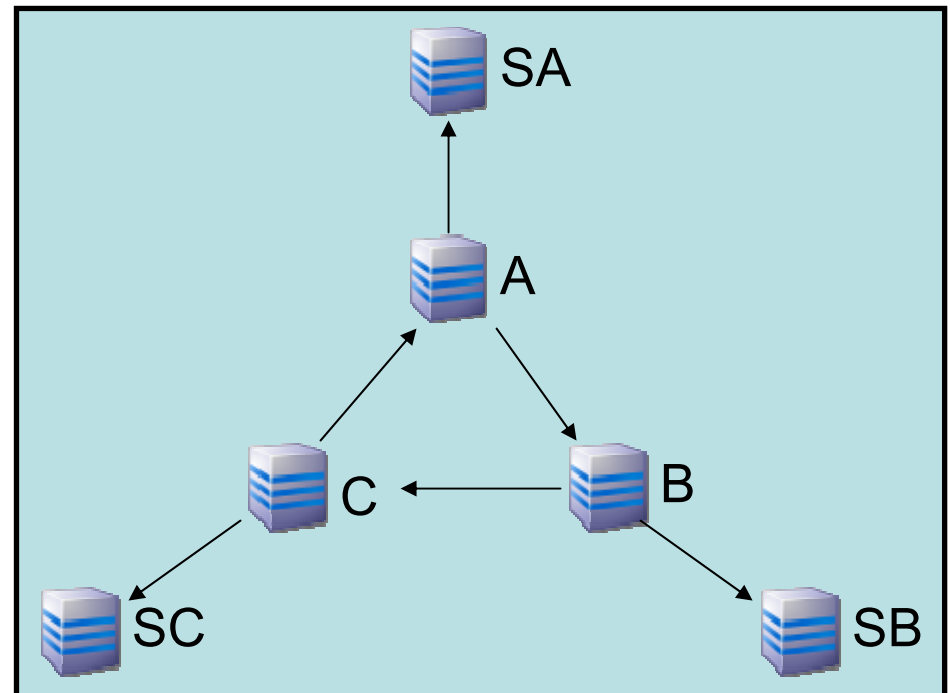
A->B->C->A;

A->SA;

B->SB;

C->SC;

}



ReplMxj – Deploying a Topology

- Deploying the MySQL server instances
 - `java -jar replmxj.jar Master3Slaves.dot`
 - Creates subdirectories for each server
 - Installs servers in each directory (based on OS)
 - Configures replication and starts servers
- Starting the Enterprise Monitor agents
 - `cd Master3Slaves`
 - `start-agents "C:\Program Files\MySQL\MySQL Network\Agent\mysql-service-agent.exe"`

MEM – Auto-Detection of Topology

MySQL Enterprise Dashboard

Monitor Advisors Events Graphs Replication Settings

Replication Monitoring

Servers	Type	Slave IO	Slave SQL	Time Behind	Binlog	Binlog
[-] Replication 1 (4)	TREE	Running	Running			
MasterX:10100	master				MasterX-bin.000001	
SlaveA:10103	slave	Running	Running	00:00:00		
SlaveB:10102	slave	Running	Running	00:00:00		
SlaveC:10101	slave	Running	Running	00:00:00		
[-] Replication 2 (6)	MIXED	Running	Running			
A:10201	master/slave	Running	Running	00:00:00	A-bin.000001	
SA:10202	slave	Running	Running	00:00:00		
B:10205	master/slave	Running	Running	00:00:00	B-bin.000001	
SB:10200	slave	Running	Running	00:00:00		
C:10203	master/slave	Running	Running	00:00:00	C-bin.000001	
SC:10204	slave	Running	Running	00:00:00		

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MEM – Auto-Detection Details

- Agent sends “inventory” of data collection items
 - Tries to run SHOW MASTER/SLAVE STATUS
- SM schedules data collections for interfaces & variables
- Agent collects data, resolves host names to IP addresses, and sends data items to SM every 5 minutes
- SM uses data items to determine if server is master and/or slave
- SM uses IP address & port to match slaves to masters & create groups
- Potential Problems:
 - DNS not working
 - Remote agents
 - Localhost

MEM – Replication Monitoring



Enterprise Dashboard
Refresh:

Monitor
Advisors
Events
Graphs
Replication
Settings

Replication Monitoring

Servers	Type	Slave IO	Slave SQL	Time Behind	Binlog	Binlog Pos	Master Binlog	Master Binlog Pos	Last Error
<input checked="" type="checkbox"/> Replication 1 (4)	TREE	Running	Running						
MasterX:10100	master				MasterX-bin.000001	21,196,972			
SlaveA:10103	slave	Running	Running	00:01:16			MasterX-bin.000001	2,032,097	
SlaveB:10102	slave	Running	Running	00:01:16			MasterX-bin.000001	2,039,739	
SlaveC:10101	slave	Running	Running	00:01:24			MasterX-bin.000001	2,159,773	
<input checked="" type="checkbox"/> Replication 2 (6)	MIXED	Running	Running						
A:10201	master/slave	Running	Running	00:00:00	A-bin.000001	272	C-bin.000001	272	
SA:10202	slave	Running	Running	00:00:00			A-bin.000001	272	
B:10205	master/slave	Running	Running	00:00:00	B-bin.000001	272	A-bin.000001	272	
SB:10200	slave	Running	Running	00:00:00			B-bin.000001	272	
C:10203	master/slave	Running	Running	00:00:00	C-bin.000001	272	B-bin.000001	272	
SC:10204	slave	Running	Running	00:00:00			C-bin.000001	272	

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Logged in
Monitoring 10 instances on 1 host (49 hosts remaining).

MEM – Replication Monitoring

Slave Status

Slave Configuration

MasterX-bin.000001

SlaveA:10103

Master	MasterX:10100
Slave IO Running	Yes
Slave SQL Running	Yes
Slave IO State	Waiting for master to send event
Time Behind Master	00:00:00
Last Error Number	None found.
Last Error	None found.
Master Log File	MasterX-bin.000001
Read Master Log Position	272
Relay Log File	SlaveA-relay-bin.000003
Relay Log Position	237
Relay Master Log File	MasterX-bin.000001
Execute Master Log Position	272
Relay Log Space	237
Skip Counter	None found.
Until Condition	None specified.
Until Log File	None found.
Until Log Position	None found.

hide

Slave Status

Slave Configuration

MasterX-bin.000001

SlaveA:10103

Master Host	10.100.64.220
Master User	slave
Master Port	10100
Connect Retry	60
Replicate Do DB	None specified.
Replicate Ignore DB	None specified.
Replicate Do Table	None specified.
Replicate Ignore Table	None specified.
Replicate Wild Do Table	None specified.
Replicate Wild Ignore Table	None specified.
Master SSL Allowed	false
Master SSL CA File	None specified.
Master SSL CA Path	None specified.
Master SSL Certificate	None specified.
Master SSL Cipher	None specified.
Master SSL Key	None specified.

hide

MEM – Replication Rules

The screenshot displays the MySQL Enterprise Monitor (MEM) interface. On the left, a tree view shows the server hierarchy under 'Servers'.

- All Servers (10)**
 - A:10201
 - B:10205
 - C:10203
 - MasterX:10100
 - SA:10202
 - SB:10200
 - SC:10204
 - SlaveA:10103
 - SlaveB:10102
 - SlaveC:10101
- Replication 1 (4)**
 - MasterX:10100
 - SlaveA:10103
 - SlaveB:10102
 - SlaveC:10101
- Replication 2 (6)**
 - A:10201
 - B:10205
 - C:10203
 - SA:10202
 - SB:10200
 - SC:10204

The main panel shows the 'Replication' tab with a 'Current Schedule' section. Below this, a table titled 'Schedule Advisors Against All Servers' lists various advisors and their default frequencies.

Advisors	Default Frequency	
<input type="checkbox"/> Administration (16)		
<input type="checkbox"/> Heat Chart (12)		
<input type="checkbox"/> Memory Usage (6)		
<input type="checkbox"/> Performance (17)		
<input type="checkbox"/> Replication (19)		
<input type="checkbox"/> Binary Log File Count Exceeds Specified Limit	06:00	+ schedule
<input type="checkbox"/> Binary Log Space Exceeds Specified Limit	06:00	+ schedule
<input type="checkbox"/> INSERT ON DUPLICATE KEY UPDATE Bug May Break Replication	06:00	+ schedule
<input type="checkbox"/> Slave Detection Of Network Outages Too High	06:00	+ schedule
<input type="checkbox"/> Slave Execution Position Too Far Behind Read Position	00:05	+ schedule
<input type="checkbox"/> Slave Has Been Stopped	00:01	+ schedule
<input type="checkbox"/> Slave Has Experienced A Replication Error	00:05	+ schedule
<input type="checkbox"/> Slave Has Login Accounts With Inappropriate Privileges	06:00	+ schedule
<input type="checkbox"/> Slave Has Problem Communicating With Master	00:05	+ schedule
<input type="checkbox"/> Slave Has Stopped Replicating	00:01	+ schedule
<input type="checkbox"/> Slave I/O Thread Not Running	00:01	+ schedule
<input type="checkbox"/> Slave Not Configured As Read Only	06:00	+ schedule
<input type="checkbox"/> Slave Relay Log Space Is Very Large	06:00	+ schedule
<input type="checkbox"/> Slave Relay Logs Not Automatically Purged	06:00	+ schedule
<input type="checkbox"/> Slave SQL Thread Not Running	00:01	+ schedule
<input type="checkbox"/> Slave SQL Thread Reading From Older Relay Log Than I/O Thread	00:05	+ schedule
<input type="checkbox"/> Slave Too Far Behind Master	00:01	+ schedule
<input type="checkbox"/> Slave Waiting To Free Relay Log Space	00:05	+ schedule
<input type="checkbox"/> Slave Without REPLICATION SLAVE Accounts	06:00	+ schedule

MEM – Replication Events

The screenshot displays the MySQL Enterprise Dashboard interface. On the left, a tree view shows the hierarchy of servers, including 'All Servers (10)' and 'Replication 1 (4)'. The main panel shows the 'Events' tab, specifically 'Replication 1 Events'. A filter section allows users to select severity (Alerts), time range (From/To), advisors (Replication Rules), and rules (All). Below this is a table of events with columns for Severity, Server, Category, Rule, and Time. The table lists several events related to replication configuration and network outages. A 'close' button is visible at the bottom of the event list.

MySQL Enterprise Dashboard

Refresh:

Monitor | Advisors | **Events** | Graphs | Replication | Settings

close

Replication 1 Events

Severity: Alerts | From: | To: | Advisors: Replication Rules | Rules: All

filter | reset

<input type="checkbox"/>	Severity	Server	Category	Rule	Time	
<input type="checkbox"/>	Warning	SlaveA:10103	Replication	Slave Not Configured As Read Only	Apr 12, 2008 8:12:09 PM	close
<input type="checkbox"/>	Warning	SlaveC:10101	Replication	Slave Not Configured As Read Only	Apr 12, 2008 8:12:08 PM	close
<input type="checkbox"/>	Warning	SlaveB:10102	Replication	Slave Not Configured As Read Only	Apr 12, 2008 8:12:06 PM	close
<input type="checkbox"/>	Warning	MasterX:10100	Replication	Slave Detection Of Network Outages Too High	Apr 12, 2008 8:11:26 PM	close
<input type="checkbox"/>	Error	MasterX:10100	Replication	Slave Has Been Stopped	Apr 12, 2008 8:11:26 PM	close
<input type="checkbox"/>	Warning	SlaveA:10103	Replication	Slave Detection Of Network Outages Too High	Apr 12, 2008 8:11:26 PM	close
<input type="checkbox"/>	Warning	SlaveB:10102	Replication	Slave Detection Of Network Outages Too High	Apr 12, 2008 8:11:26 PM	close
<input type="checkbox"/>	Warning	SlaveC:10101	Replication	Slave Detection Of Network Outages Too High	Apr 12, 2008 8:11:26 PM	close

close

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Monitoring 10 instances on 1 host (49 hosts remain)

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MEM – Replication Events

Results Close Event Details Advanced Time

WARNING Alert - Slave Detection Of Network Outages Too High(v 1.1*)

Server
SlaveA:10103

Time
Apr 12, 2008 8:11:26 PM (3 minutes ago)

Advisor
Replication

Problem Description
Slaves must deal with network connectivity outages that affect the ability of the slave to get the latest data from the master, and hence cause replication to fall behind. However, the slave notices the network outage only after receiving no data from the master for **slave_net_timeout seconds**. You may want to decrease **slave_net_timeout** so the outages -- and associated connection retries -- are detected and resolved faster. The default for this parameter is 3600 seconds (1 hour), which is too high for many environments.

Advice
Set **slave_net_timeout=60** (or whatever value is reasonable to detect network connectivity outages in your environment) in the section of your my.cnf/my.ini file. The current value of slave_net_timeout is 3600.

Recommended Action
SET GLOBAL slave_net_timeout=60;

Links and Further Reading
[MySQL Manual: Replication Features and Known Problems](#)
[MySQL Manual: Replication Startup Options](#)
[MySQL Manual: Replication Slave I/O Thread States](#)
[MySQL Manual: Troubleshooting Replication](#)

hide

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Mysqslap -- Overview

- Diagnostic program that emulates client load on a server
- Written by Brian Aker, included with 5.1.4 and later
- Inserts/Queries
 - Auto-generate
 - Command line
 - Read from a file
- More Info
 - <http://dev.mysql.com/doc/refman/5.1/en/mysqslap.html>
 - <http://krow.livejournal.com/385573.html>
 - <http://blogs.techrepublic.com.com/howdoi/?p=133>

Mysqslap – Slapping Our Master

- `mysqslap -uroot -P10100`
 - `--auto-generate-sql`
 - `--auto-generate-sql-execute-number=1000`
 - `--concurrency=5,10,15,20`
 - `--iterations=10`
 - `--number-char-cols=5`
 - `--number-int-cols=5`
 - `--only-print`

Mysqslap – Slapping Our Master

```
CREATE SCHEMA `mysqslap`;
```

```
use mysqslap;
```

```
CREATE TABLE `t1` (intcol1 INT(32) ,intcol2 INT(32) ,intcol3 INT(32) ,intcol4 INT(32) ,intcol5 INT(32)  
,charcol1 VARCHAR(128),charcol2 VARCHAR(128),charcol3 VARCHAR(128),charcol4  
VARCHAR(128),charcol5 VARCHAR(128));
```



```
INSERT INTO t1 VALUES
```

```
(41,18467,6334,26500,19169,'4lIMk551R1Bv2RcrO2ZsMLwebn6BI9snJvuNr2ZZkLXtSnkMxxJNLpyGbqiom  
g24SQtq9Aq6LZ89NOacKmwBSOfQjHyei9hZbJIOWxQt6h5ksW9HZxCmWhcbnFaBsq','AL4mARB7xdnZ35  
Tpeho2mQAZ80BibAzOH83vL2qXwEgcLof041utJle087n8DojnLWHDaTwbrKTJwy3kSOTp2FPZ3jRaN80II0  
wehTepdCiysezAHeBFSGr2uYFoQM','QbtpiOchl2r1zHcsTbYKq3phoL9FjMP2PSmxxsYTuhTw9SC5vEp1Y  
P0yZz3JG7ppd6pDbxGQP8Mbuu1wXQNtvIDC8Y5tc1y6M14c2p1FqDQkzCfZkuq59mZa28e75I','B2PHaEO  
uECzDqndIHDqNSY5iKt72Jnlj4jYhLjCltlBYM2QkgnKZEqAvtXKwnPAKEvOzPwaeMXQyZXkyOzsgRg6AHA  
bcnjIO9Mml7xEI7p8jK2M3wH1v54gMGqmXrr','nZgWk8jKX2T0DyyPnH0IJNgdkx8t71q0oZOP0XOvGCAjPc  
w6x6dxrpLw2dYxc5h39p5JscbtikausdTYNRNBvnove32uX1Ff5hq6EPjWyJLDEHEcDcP2oh0DLvF22B');
```

```
...
```

```
SELECT intcol1,intcol2,intcol3,intcol4,intcol5,charcol1,charcol2,charcol3,charcol4,charcol5 FROM t1;
```

MEM – Replication Monitoring

 Enterprise Dashboard Refresh: Off

Monitor Advisors Events Graphs Replication Settings

Replication Monitoring

Servers	Type	Slave IO	Slave SQL	Time Behind	Binlog	Binlog Pos	Master Binlog	Master Binlog Pos	Last Error
<input checked="" type="checkbox"/> Replication 1 (4)	TREE	Running	Running						
MasterX:10100	master				MasterX-bin.000001	21,196,972			
SlaveA:10103	slave	Running	Running	00:01:16			MasterX-bin.000001	2,032,097	
SlaveB:10102	slave	Running	Running	00:01:16			MasterX-bin.000001	2,039,739	
SlaveC:10101	slave	Running	Running	00:01:24			MasterX-bin.000001	2,159,773	
<input checked="" type="checkbox"/> Replication 2 (6)	MIXED	Running	Running						
A:10201	master/slave	Running	Running	00:00:00	A-bin.000001	272	C-bin.000001	272	
SA:10202	slave	Running	Running	00:00:00			A-bin.000001	272	
B:10205	master/slave	Running	Running	00:00:00	B-bin.000001	272	A-bin.000001	272	
SB:10200	slave	Running	Running	00:00:00			B-bin.000001	272	
C:10203	master/slave	Running	Running	00:00:00	C-bin.000001	272	B-bin.000001	272	
SC:10204	slave	Running	Running	00:00:00			C-bin.000001	272	

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MEM – Replication Monitoring

MySQL Enterprise Dashboard

Monitor Advisors Events Graphs Replication Settings

Replication Monitoring

Servers	Type	Slave IO	Slave SQL	Time Behind	Binlog	Binlog Size
<input type="checkbox"/> Replication 1 (4)	TREE	Stopped	Stopped			
MasterX:10100	master				MasterX-bin.000001	113
SlaveA:10103	slave	Running	Running	00:00:00		
SlaveB:10102	slave	Stopped	Stopped			
SlaveC:10101	slave	Running	Running	00:00:00		
<input type="checkbox"/> Replication 2 (6)	MIXED	Running	Running			
A:10201	master/slave	Running	Running	00:00:00	A-bin.000001	
SA:10202	slave	Running	Running	00:00:00		
B:10205	master/slave	Running	Running	00:00:00	B-bin.000001	
SB:10200	slave	Running	Running	00:00:00		
C:10203	master/slave	Running	Running	00:00:00	C-bin.000001	
SC:10204	slave	Running	Running	00:00:00		

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MEM – Replication Monitoring

Monitor

Advisors

Events

Graphs

Replication

Settings

close

All Servers Events

Severity Alerts From To Advisors All Rules

Severity	Server	Category	Rule	Time
Alerts	SlaveB:10102	Replication	Slave Has Been Stopped	Apr 13, 20
Alerts	SlaveB:10102	Replication	Slave Has Stopped Replicating	Apr 13, 20
Alerts	SlaveB:10102	Replication	Slave I/O Thread Not Running	Apr 13, 20
Alerts	SlaveB:10102	Replication	Slave SQL Thread Not Running	Apr 13, 20

Results

Close Event

Details

Advanced

Open

CRITICAL Alert - Slave Has Been Stopped(v 1.3*)

Server
SlaveB:10102

Time
Apr 13, 2008 10:36:07 AM (5 minutes ago)

Advisor
Replication

Problem Description
If replication on a slave has been stopped, it means the slave is not retrieving the latest statements from the master and it is not executing those statements on the slave.

Advice
Investigate why replication has been stopped on **SlaveB:10102**. Use SHOW SLAVE STATUS to try to determine whether there was an error or the slave was stopped manually. The STOP SLAVE statement is used to stop replication – determine if and why this statement was issued. Try restarting the slave with SLAVE START.

Recommended Action
SHOW SLAVE STATUS \G
START SLAVE;

Links and Further Reading
[MySQL Manual: Troubleshooting Replication](#)
[MySQL Manual: Server Status Variables](#)
[MySQL Manual: Replication FAQ](#)
[High Performance MySQL Chapter 7: Replication](#)

hide

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Q&A

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Related Sessions at the Users Conference

- MySQL Proxy, the Friendly Man in the Middle
 - Jan Kneschke, Jimmy Guerrero (Sun/MySQL)
 - Thursday, 04/17/2008 10:50am - 11:50am Ballroom F
- BoF Sessions
 - MySQL Enterprise Monitor w/Query Analyzer
 - MySQL Load Balancer, Query Analyzer, Connection Manager
- Exhibit Hall
 - Sun and MySQL booths – information, demos, Gurus, fun stuff!