Charts from the evaluation of Asynchronous Replication, Group Replication and Galera

Part 1: Summary Charts

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12th December 2016
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1. Sysbench OLTP RW
2. Sysbench Update Index
3. Flow-control effects

For details refer to:
http://mysqlhighavailability.com/performance-evaluation-mysql-5-7-group-replication/
1. OLTP RW, Maximum throughput

Single-master Maximum Throughput: Sysbench RW

<table>
<thead>
<tr>
<th>Group Size</th>
<th>Asynchronous (non-durable)</th>
<th>Group Replication (non-durable)</th>
<th>Galera (non-durable)</th>
<th>Asynchronous (durable)</th>
<th>Group Replication (durable)</th>
<th>Galera (durable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 members</td>
<td>13,000</td>
<td>2,500</td>
<td>500</td>
<td>10,500</td>
<td>2,000</td>
<td>500</td>
</tr>
<tr>
<td>5 members</td>
<td>13,500</td>
<td>3,000</td>
<td>750</td>
<td>10,750</td>
<td>2,250</td>
<td>750</td>
</tr>
<tr>
<td>7 members</td>
<td>14,000</td>
<td>3,500</td>
<td>1,000</td>
<td>11,000</td>
<td>2,500</td>
<td>1,000</td>
</tr>
<tr>
<td>9 members</td>
<td>14,500</td>
<td>4,000</td>
<td>1,250</td>
<td>11,250</td>
<td>2,750</td>
<td>1,250</td>
</tr>
</tbody>
</table>
1.1. OLTP RW, Throughput by Clients

Throughput by Number of Clients: Sysbench RW
(3 members)

higher is better

- Group Replication (non-durable)
- Galera (non-durable)
- Group Replication (durable)
- Galera (durable)

maximum sustained throughput (transactions per second)

<table>
<thead>
<tr>
<th>total number of clients/threads</th>
<th>8</th>
<th>16</th>
<th>32</th>
<th>64</th>
<th>128</th>
<th>256</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Replication (non-durable)</td>
<td>2500</td>
<td>4000</td>
<td>5500</td>
<td>7000</td>
<td>9000</td>
<td>11000</td>
</tr>
<tr>
<td>Galera (non-durable)</td>
<td>2000</td>
<td>3500</td>
<td>5000</td>
<td>6500</td>
<td>8500</td>
<td>10500</td>
</tr>
<tr>
<td>Group Replication (durable)</td>
<td>3000</td>
<td>5000</td>
<td>7000</td>
<td>9000</td>
<td>11000</td>
<td>13000</td>
</tr>
<tr>
<td>Galera (durable)</td>
<td>2500</td>
<td>4500</td>
<td>6500</td>
<td>8500</td>
<td>10500</td>
<td>12500</td>
</tr>
</tbody>
</table>

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1.1. OLTP RW, Throughput by Clients

Throughput by Number of Clients: Sysbench RW (5 members)

- Group Replication (non-durable)
- Galera (non-durable)
- Group Replication (durable)
- Galera (durable)

higher is better
1.1. OLTP RW, Throughput by Clients

Throughput by Number of Clients: Sysbench RW (7 members)

- Group Replication (non-durable)
- Galera (non-durable)
- Group Replication (durable)
- Galera (durable)

Higher is better

Maximum sustained throughput (transactions per second)

Total number of clients/threads

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1.1. OLTP RW, Throughput by Clients

Throughput by Number of Clients: Sysbench RW (9 members)

- Group Replication (non-durable)
- Galera (non-durable)
- Group Replication (durable)
- Galera (durable)

higher is better
1.2. OLTP RW, Latency by Clients

Single-master Latency: Sysbench RW
(3 members)

- Group Replication (durable)
- Galera (durable)
- Group Replication (non-durable)
- Galera (non-durable)

lower is better

logarithmic scale

client 95% transaction latency (ms)

number of clients (threads)
1.2. OLTP RW, Latency by Clients

Single-master Latency: Sysbench RW
(5 members)

lower is better

logarithmic scale

<table>
<thead>
<tr>
<th>number of clients (threads)</th>
<th>Group Replication (durable)</th>
<th>Galera (durable)</th>
<th>Group Replication (non-durable)</th>
<th>Galera (non-durable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>16</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>32</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>64</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>128</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>256</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
1.2. OLTP RW, Latency by Clients

Single-master Latency: Sysbench RW
(7 members)

- Group Replication (durable)
- Galera (durable)
- Group Replication (non-durable)
- Galera (non-durable)

Lower is better

Logarithmic scale

Client 95% transaction latency (ms)

Number of clients (threads)

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1.2. OLTP RW, Latency by Clients

Single-master Latency: Sysbench RW
(9 members)

- Group Replication (durable)
- Galera (durable)
- Group Replication (non-durable)
- Galera (non-durable)

Lower is better

Logarithmic scale

Client 95% transaction latency (ms)

Number of clients (threads)

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1. Sysbench OLTP RW
2. Sysbench Update Index
3. Flow-control effects

For details refer to:

http://mysqlhighavailability.com/performance-evaluation-mysql-5-7-group-replication/
2. Update Indexed, Maximum Throughput

Single-master Maximum Throughput: Sysbench Update Indexed

<table>
<thead>
<tr>
<th>Group Size</th>
<th>Asynchronous (non-durable)</th>
<th>Group Replication (non-durable)</th>
<th>Galera (non-durable)</th>
<th>Asynchronous (durable)</th>
<th>Group Replication (durable)</th>
<th>Galera (durable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 members</td>
<td>Yellow (non-durable)</td>
<td>Blue (non-durable)</td>
<td>Orange (non-durable)</td>
<td>Yellow (durable)</td>
<td>Blue (durable)</td>
<td>Orange (durable)</td>
</tr>
<tr>
<td>5 members</td>
<td>Yellow (non-durable)</td>
<td>Blue (non-durable)</td>
<td>Orange (non-durable)</td>
<td>Yellow (durable)</td>
<td>Blue (durable)</td>
<td>Orange (durable)</td>
</tr>
<tr>
<td>7 members</td>
<td>Yellow (non-durable)</td>
<td>Blue (non-durable)</td>
<td>Orange (non-durable)</td>
<td>Yellow (durable)</td>
<td>Blue (durable)</td>
<td>Orange (durable)</td>
</tr>
<tr>
<td>9 members</td>
<td>Yellow (non-durable)</td>
<td>Blue (non-durable)</td>
<td>Orange (non-durable)</td>
<td>Yellow (durable)</td>
<td>Blue (durable)</td>
<td>Orange (durable)</td>
</tr>
</tbody>
</table>
2.1. Update Indexed, Throughput by Clients

Throughput by Number of Clients: Sysbench Update Indexed (3 members)

higher is better

- Group Replication (non-durable)
- Galera (non-durable)
- Group Replication (durable)
- Galera (durable)
2.1. Update Indexed, Throughput by Clients

Throughput by Number of Clients: Sysbench Update Indexed (5 members)

- Group Replication (non-durable)
- Galera (non-durable)
- Group Replication (durable)
- Galera (durable)

higher is better
2.1. Update Indexed, Throughput by Clients

Throughput by Number of Clients: Sysbench Update Indexed (7 members)

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- Group Replication (non-durable)
- Galera (non-durable)
- Group Replication (durable)
- Galera (durable)
2.1. Update Indexed, Throughput by Clients

Throughput by Number of Clients: Sysbench Update Indexed (9 members)

higher is better

Group Replication (non-durable)  |  Galera (non-durable)
Group Replication (durable)     |  Galera (durable)

maximum sustained throughput (updates per second)

<table>
<thead>
<tr>
<th>total number of clients/threads</th>
<th>8</th>
<th>16</th>
<th>32</th>
<th>64</th>
<th>128</th>
<th>256</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Replication (non-durable)</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Galera (non-durable)</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Group Replication (durable)</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Galera (durable)</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
</tbody>
</table>
2.2. Update Indexed, Latency by Clients

Single-master Latency: Sysbench Update Indexed
(3 members)

lower is better

client 95% transaction latency (ms)

number of clients (threads)

Group Replication (durable)  Galera (durable)  Group Replication (non-durable)  Galera (non-durable)

logarithmic scale
2.2. Update Indexed, Latency by Clients

Single-master Latency: Sysbench Update Indexed
(5 members)

- Group Replication (durable)
- Galera (durable)
- Group Replication (non-durable)
- Galera (non-durable)

lower is better

logarithmic scale

client 95% transaction latency (ms)

number of clients (threads)

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2.2. Update Indexed, Latency by Clients

Single-master Latency: Sysbench Update Indexed
(7 members)

lower is better

Group Replication (durable)  |  Galera (durable)  |  Group Replication (non-durable)  |  Galera (non-durable)

logarithmic scale

client 95% transaction latency (ms)

number of clients (threads)

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2.2. Update Indexed, Latency by Clients

Single-master Latency: Sysbench Update Indexed
(9 members)

- Group Replication (durable)
- Galera (durable)
- Group Replication (non-durable)
- Galera (non-durable)

lower is better

Client 95% transaction latency (ms)

Logarithmic scale

Number of clients (threads):
- 8
- 16
- 32
- 64
- 128
- 256
1. Sysbench OLTP RW
2. Sysbench Update Index
3. Flow-control effects

For details refer to:

http://mysqlhighavailability.com/performance-evaluation-mysql-5-7-group-replication/
3. Flow-control effects

Throughput varying Flow-control: Sysbench OLTP RW
(3 members)

- Group Replication: default settings
- flow-control disabled
- flow-control=1000

- Galera: default settings
- flow-control disabled
- flow-control=1000

number of client threads

Durable settings

Non-durable settings

total transactions per second (TPS)

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3. Flow-control effects

Throughput varying Flow-control: Sysbench OLTP RW (5 members)

- **Group Replication**: default settings
- **flow-control** disabled
- **flow-control**=1000

- **Galera**: default settings
- **flow-control** disabled
- **flow-control**=1000

<table>
<thead>
<tr>
<th>Number of Client Threads</th>
<th>Durable Settings</th>
<th>Non-durable Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2500 (T/P)</td>
<td>2500 (T/P)</td>
</tr>
<tr>
<td>16</td>
<td>5000 (T/P)</td>
<td>5000 (T/P)</td>
</tr>
<tr>
<td>32</td>
<td>7500 (T/P)</td>
<td>7500 (T/P)</td>
</tr>
<tr>
<td>64</td>
<td>10000 (T/P)</td>
<td>10000 (T/P)</td>
</tr>
<tr>
<td>128</td>
<td>12500 (T/P)</td>
<td>12500 (T/P)</td>
</tr>
<tr>
<td>256</td>
<td>15000 (T/P)</td>
<td>15000 (T/P)</td>
</tr>
</tbody>
</table>

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3. Flow-control effects

Throughput varying Flow-control: Sysbench OLTP RW
(7 members)

- Group Replication: default settings
- flow-control disabled
- flow-control=1000
- Galera: default settings
- flow-control disabled
- flow-control=1000

<table>
<thead>
<tr>
<th>number of client threads</th>
<th>total transactions per second (TPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>15 000</td>
</tr>
<tr>
<td>16</td>
<td>12 500</td>
</tr>
<tr>
<td>32</td>
<td>10 000</td>
</tr>
<tr>
<td>64</td>
<td>7 500</td>
</tr>
<tr>
<td>128</td>
<td>5 000</td>
</tr>
<tr>
<td>256</td>
<td>2 500</td>
</tr>
</tbody>
</table>
3. Flow-control effects

Throughput varying Flow-control: Sysbench OLTP RW
(9 members)

- Group Replication: default settings
- flow-control disabled
- flow-control=1000
- Galera: default settings
- flow-control disabled
- flow-control=1000

The diagram shows the total transactions per second (TPS) for different numbers of client threads and flow-control settings in both durable and non-durable settings.
3. Flow-control effects

Throughput varying Flow-control: Sysbench Update Indexed (3 members)

- Group Replication: default settings
- flow-control disabled
- flow-control=1000
- Galera: default settings
- flow-control disabled
- flow-control=1000

Different settings for number of client threads:
- Durable settings: 8, 16, 32, 64, 128, 256
- Non-durable settings: 8, 16, 32, 64, 128, 256
3. Flow-control effects

Throughput varying Flow-control: Sysbench Update Indexed (5 members)

- **Group Replication**: default settings, flow-control disabled, flow-control=1000
- **Galera**: default settings, flow-control disabled, flow-control=1000

**X-axis**: number of client threads
**Y-axis**: total transactions per second (TPS)

Durable settings
- 8
- 16
- 32
- 64
- 128
- 256

Non-durable settings
- 8
- 16
- 32
- 64
- 128
- 256
3. Flow-control effects

Throughput varying Flow-control: Sysbench Update Indexed (7 members)

- **Group Replication: default settings**
  - flow-control disabled
  - flow-control=1000

- **Galera: default settings**
  - flow-control disabled
  - flow-control=1000

![Graph showing throughput varying flow-control](image)
3. Flow-control effects

Throughput varying Flow-control: Sysbench Update Indexed
(9 members)

- Group Replication: default settings
- flow-control disabled
- flow-control=1000

- Galera: default settings
- flow-control disabled
- flow-control=1000

The graph shows the total transactions per second (TPS) with varying number of client threads and different settings for flow-control. The x-axis represents the number of client threads from 8 to 256, and the y-axis represents the TPS ranging from 0 to 45,000.