Chapter 5
Transaction Monitoring System
: Performance Monitoring System

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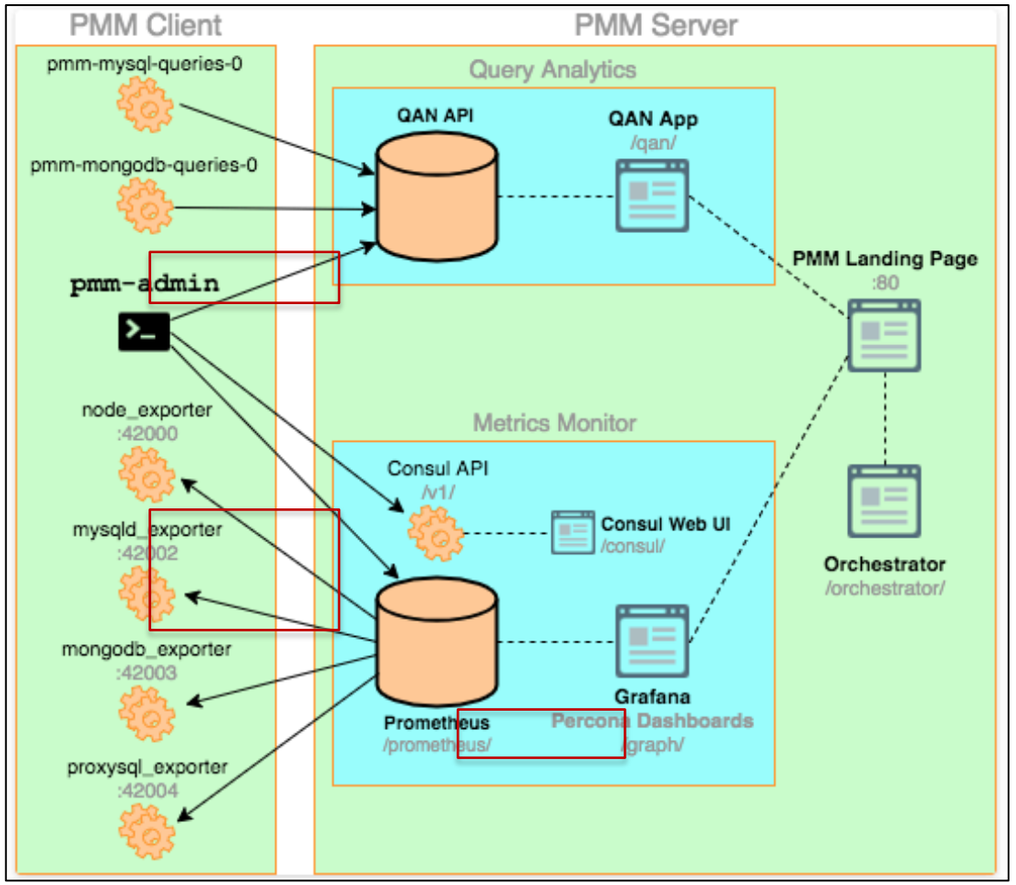
VLDB Lab.

Performance Monitoring System

- Percona PMM
- Intel PCM

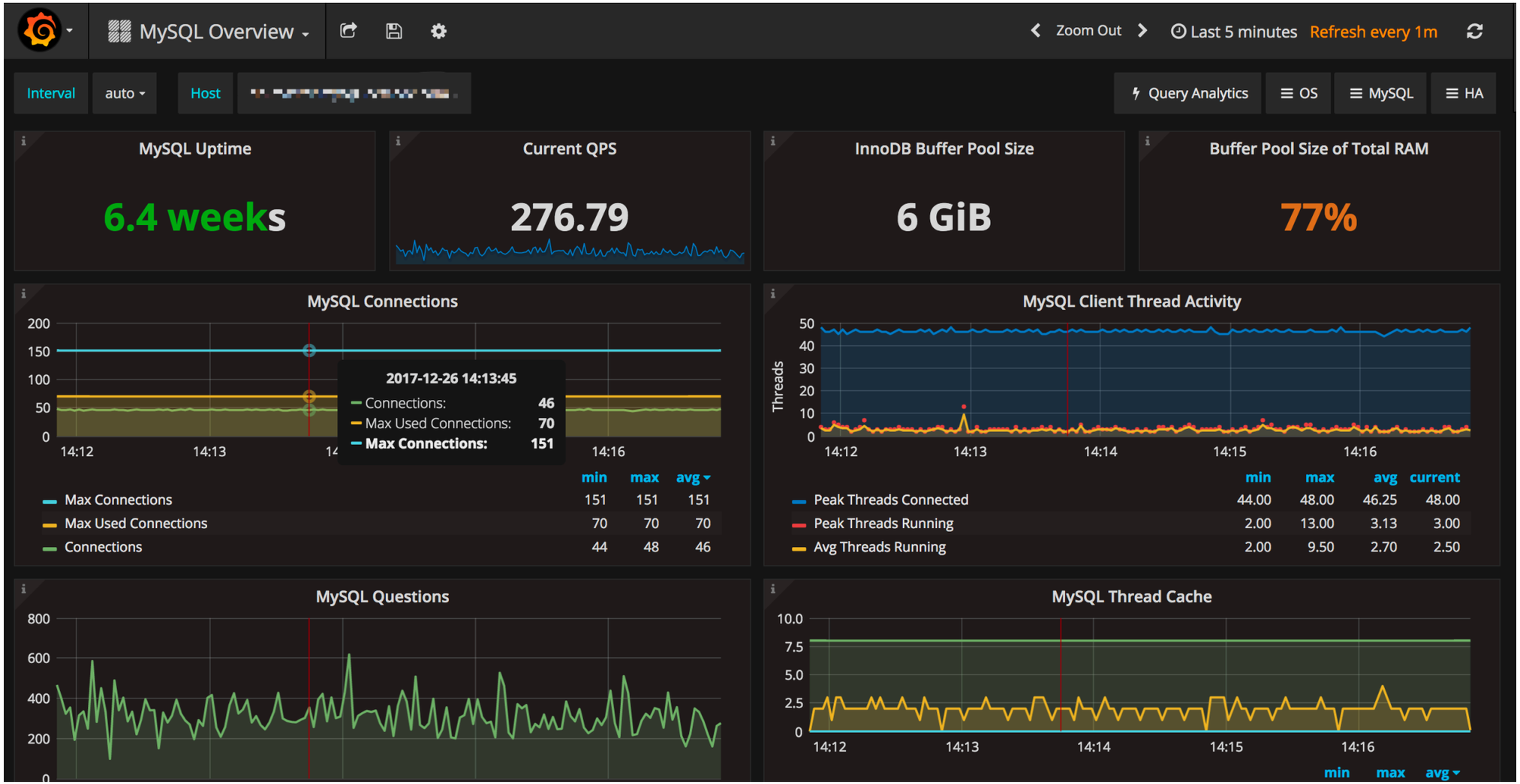
Percona PMM

- Percona Monitoring & Management



- **pmm-admin**: command-line tool for administering PMM communication with PMM server & client
- **mysqld_exporter** : Prometheous exporter for MySQL server
  - High-res metrics (1s) : Global status, InnoDB metrics
  - Medium-res metrics (5s) : Slave status, InnoDB engine
  - Low-res metrics (1m) : Global variable, Schema, Bin log
- **Prometheus** : collect / monitoring / alert toolkit

Percona PMM


MySQL Overview
Zoom Out
Last 5 minutes
Refresh every 1m
Interval
auto
Host
Query Analytics
OS
MySQL
HA
MySQL Uptime
6.4 weeks
Current QPS
276.79
InnoDB Buffer Pool Size
6 GiB
Buffer Pool Size of Total RAM
77%
MySQL Connections
2017-12-26 14:13:45
Connections: 46
Max Used Connections: 70
Max Connections: 151
min max avg
Max Connections 151 151 151
Max Used Connections 70 70 70
Connections 44 48 46
MySQL Client Thread Activity
Threads
min max avg current
Peak Threads Connected 44.00 48.00 46.25 48.00
Peak Threads Running 2.00 13.00 3.13 3.00
Avg Threads Running 2.00 9.50 2.70 2.50
MySQL Questions
MySQL Thread Cache
min max avg

InnoDB Metrics

- InnoDB Log Buffer Performance
  - If the Used graph is too high and gets close to Size, additional log writes will be required.
- InnoDB Locking
- InnoDB Transactions Information
- InnoDB Undo Space Usage
  - If the amount of space grows too much, look for **long running transactions** holding read views opened in the InnoDB status.
- InnoDB Page Reorgs
- InnoDB Page Splits
- InnoDB Purge Performance
- …

Intel PCM

- Monitor performance hardware counters on Intel® processors
- Performance Monitoring Unit

- pcm-memory
  - monitor memory bandwidth (per-channel and per-DRAM DIMM rank)
- pcm-latency :
  - monitor L1 cache miss and DDR/PMM memory latency
- pcm :
  - basic processor monitoring utility (instructions per cycle, core frequency, etc.

Intel PCM

sudo pcm-memory.x

```
Detected Intel(R) Xeon(R) Gold 6252 CPU @ 2.10GHz "Intel(r) microarchitecture codename
Update every 1 seconds
|---------------------------------------||---------------------------------------|
|--            Socket  0              --||--            Socket  1              --|
|---------------------------------------||---------------------------------------|
|--     Memory Channel Monitoring     --||--     Memory Channel Monitoring     --|
|---------------------------------------||---------------------------------------|
|-- Mem Ch  0: Reads (MB/s):     5.67 --||-- Mem Ch  0: Reads (MB/s):     6.47 --|
|--            Writes(MB/s):     4.48 --||--            Writes(MB/s):     8.62 --|
|-- Mem Ch  1: Reads (MB/s):     5.71 --||-- Mem Ch  1: Reads (MB/s):     6.47 --|
|--            Writes(MB/s):     4.54 --||--            Writes(MB/s):     8.59 --|
|-- Mem Ch  2: Reads (MB/s):     5.71 --||-- Mem Ch  2: Reads (MB/s):     6.53 --|
|--            Writes(MB/s):     4.55 --||--            Writes(MB/s):     8.67 --|
|-- Mem Ch  3: Reads (MB/s):     5.28 --||-- Mem Ch  3: Reads (MB/s):     5.29 --|
|--            Writes(MB/s):     4.21 --||--            Writes(MB/s):     7.97 --|
|-- Mem Ch  4: Reads (MB/s):     5.24 --||-- Mem Ch  4: Reads (MB/s):     5.40 --|
|--            Writes(MB/s):     4.14 --||--            Writes(MB/s):     8.13 --|
|-- Mem Ch  5: Reads (MB/s):     5.23 --||-- Mem Ch  5: Reads (MB/s):     5.30 --|
|--            Writes(MB/s):     4.17 --||--            Writes(MB/s):     8.04 --|
|-- NODE 0 Mem Read (MB/s) :    32.84 --||-- NODE 1 Mem Read (MB/s) :    35.47 --|
|-- NODE 0 Mem Write(MB/s) :    26.08 --||-- NODE 1 Mem Write(MB/s) :    50.02 --|
|-- NODE 0 P. Write (T/s):      37628 --||-- NODE 1 P. Write (T/s):      37632 --|
|-- NODE 0 Memory (MB/s):       58.92 --||-- NODE 1 Memory (MB/s):       85.49 --|
|---------------------------------------||---------------------------------------|
|---------------------------------------||---------------------------------------|
|--                 System Read Throughput(MB/s):         68.31                 --|
|--                System Write Throughput(MB/s):         76.11                 --|
|--             System Memory Throughput(MB/s):          144.41                 --|
|---------------------------------------||---------------------------------------|
```

sudo pcm-memory.x -pmm

```
|---------------------------------------||---------------------------------------|
|--            Socket  0              --||--            Socket  1              --|
|---------------------------------------||---------------------------------------|
|--     Memory Channel Monitoring     --||--     Memory Channel Monitoring     --|
|---------------------------------------||---------------------------------------|
|-- Mem Ch  0: Reads (MB/s):     2.28 --||-- Mem Ch  0: Reads (MB/s):     2.12 --|
|--            Writes(MB/s):     2.19 --||--            Writes(MB/s):     2.08 --|
|--       PMM Reads(MB/s)   :    0.00 --||--       PMM Reads(MB/s)   :    0.00 --|
|--       PMM Writes(MB/s)  :    0.00 --||--       PMM Writes(MB/s)  :    0.00 --|
|-- Mem Ch  1: Reads (MB/s):     2.36 --||-- Mem Ch  1: Reads (MB/s):     2.12 --|
|--            Writes(MB/s):     2.27 --||--            Writes(MB/s):     2.08 --|
|--       PMM Reads(MB/s)   :    0.00 --||--       PMM Reads(MB/s)   :    0.00 --|
|--       PMM Writes(MB/s)  :    0.00 --||--       PMM Writes(MB/s)  :    0.00 --|
|-- Mem Ch  2: Reads (MB/s):     2.32 --||-- Mem Ch  2: Reads (MB/s):     2.16 --|
|--            Writes(MB/s):     2.24 --||--            Writes(MB/s):     2.13 --|
|--       PMM Reads(MB/s)   :    0.00 --||--       PMM Reads(MB/s)   :    0.00 --|
|--       PMM Writes(MB/s)  :    0.00 --||--       PMM Writes(MB/s)  :    0.00 --|
|-- Mem Ch  3: Reads (MB/s):     2.05 --||-- Mem Ch  3: Reads (MB/s):     1.84 --|
|--            Writes(MB/s):     2.07 --||--            Writes(MB/s):     1.88 --|
|--       PMM Reads(MB/s)   :    0.00 --||--       PMM Reads(MB/s)   :    0.00 --|
|--       PMM Writes(MB/s)  :    0.00 --||--       PMM Writes(MB/s)  :    0.00 --|
|-- Mem Ch  4: Reads (MB/s):     2.02 --||-- Mem Ch  4: Reads (MB/s):     1.88 --|
|--            Writes(MB/s):     2.05 --||--            Writes(MB/s):     1.92 --|
|--       PMM Reads(MB/s)   :    0.00 --||--       PMM Reads(MB/s)   :    0.00 --|
|--       PMM Writes(MB/s)  :    0.00 --||--       PMM Writes(MB/s)  :    0.00 --|
|-- Mem Ch  5: Reads (MB/s):     2.05 --||-- Mem Ch  5: Reads (MB/s):     1.84 --|
|--            Writes(MB/s):     2.06 --||--            Writes(MB/s):     1.89 --|
|--       PMM Reads(MB/s)   :    0.00 --||--       PMM Reads(MB/s)   :    0.00 --|
|--       PMM Writes(MB/s)  :    0.00 --||--       PMM Writes(MB/s)  :    0.00 --|
|-- NODE 0 Mem Read (MB/s) :    13.07 --||-- NODE 1 Mem Read (MB/s) :    11.96 --|
|-- NODE 0 Mem Write(MB/s) :    12.88 --||-- NODE 1 Mem Write(MB/s) :    11.99 --|
|-- NODE 0 PMM Read (MB/s):      0.00 --||-- NODE 1 PMM Read (MB/s):      0.00 --|
|-- NODE 0 PMM Write(MB/s):      0.00 --||-- NODE 1 PMM Write(MB/s):      0.00 --|
|-- NODE 0.0 NM read hit rate :  0.83 --||-- NODE 1.0 NM read hit rate :  0.81 --|
|-- NODE 0.1 NM read hit rate :  0.80 --||-- NODE 1.1 NM read hit rate :  0.78 --|
|-- NODE 0 Memory (MB/s):       25.95 --||-- NODE 1 Memory (MB/s):       23.94 --|
|---------------------------------------||---------------------------------------|
|---------------------------------------||---------------------------------------|
|--           System DRAM Read Throughput(MB/s):        25.03                 --|
|--          System DRAM Write Throughput(MB/s):        24.86                 --|
|--           System PMM Read Throughput(MB/s):         0.00                  --|
|--          System PMM Write Throughput(MB/s):         0.00                  --|
|--               System Read Throughput(MB/s):        25.03                 --|
|--              System Write Throughput(MB/s):        24.86                 --|
|--            System Memory Throughput(MB/s):        49.89                 --|
|---------------------------------------||---------------------------------------|
```

Intel PCM

- How to add Intel PCM in your application (c/c++)

- Step1. Add git submodule
- Step2. Add CMake options
- Step3. Implement PCM parameter in your code

- See also here!

References

[1] https://www.percona.com/blog/2016/02/29/graphing-mysql-performance-with-prometheus-and-grafana

[2] https://software.intel.com/content/www/us/en/develop/articles/intel-performance-counter-monitor.html

[3] https://prometheus.io/docs/introduction/overview/

[4] https://www.notion.so/Intel-PCM-dc09508aa656436ab23c2487d89da805

[5] https://www.percona.com/doc/percona-monitoring-and-management/dashboard.mysql-innodb-metrics.html#dashboard-mysql-innodb-metrics

[6] https://www.percona.com/doc/percona-monitoring-and-management/dashboard.mysql-innodb-metrics-advanced.html