

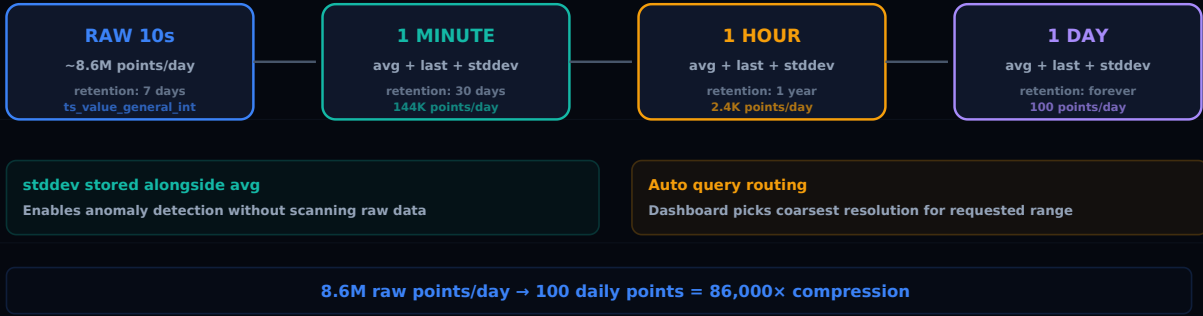


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- PMACONTROL
- TIME-SERIES
- AGGREGATION
- MONITORING
- ARCHITECTURE

MULTI-RESOLUTION TIME-SERIES AGGREGATION

10s raw → 1min → 1hr → 1day — inspired by Prometheus + Graphite



PmaControl — Multi-resolution time-series inspired by Prometheus + Graphite



PmaControl 10 MariaDB / MySQL

- 6
- 360
- 8,640
- 60,480**

100 50

$$100 \times 50 \times 8,640 = 43,200,000$$

4300 3.02

10 6 10

Prometheus Graphite



- Prometheus **Recording rules** PromQL
- Graphite **Whisper**

PmaControl

			100
	10	7	3.02
1	1	30	2.16
1	1	1	4380
1	1		180

100

```

7 3.02
1 30 2.16
1 1 4380
1 200
5.64

```

158

```

CREATE TABLE ts_aggregated_1min (
  server_id INT,
  metric_id INT,
  timestamp DATETIME,
  last_value DOUBLE, --
  avg_value DOUBLE, --
  stddev_value DOUBLE, --
  PRIMARY KEY (server_id, metric_id, timestamp)
)

```



```

WHERE r2.server_id = ts_raw.server_id
AND r2.metric_id = ts_raw.metric_id
AND r2.timestamp >= DATE_FORMAT(ts_raw.timestamp, '%Y-%m-%d %H:%i:00')
AND r2.timestamp < DATE_FORMAT(ts_raw.timestamp, '%Y-%m-%d %H:%i:00') + INTERVAL 1
MINUTE
ORDER BY r2.timestamp DESC LIMIT 1),
AVG(value),
STDDEV(value)
FROM ts_raw
WHERE timestamp >= NOW() - INTERVAL 1 MINUTE
GROUP BY server_id, metric_id, minute;

```

2.1 1 1

60

```

σ_combined = sqrt( mean(σ²_i) + var(μ_i) )

```

σ_i

3.1 1

24

4

```

DELETE FROM ts_raw WHERE timestamp < NOW() - INTERVAL 7 DAY;
DELETE FROM ts_aggregated_1min WHERE timestamp < NOW() - INTERVAL 30 DAY;
DELETE FROM ts_aggregated_1hr WHERE timestamp < NOW() - INTERVAL 1 YEAR;
-- ts_aggregated_1day:

```

PmaControl

```

function selectResolution(int $timeRangeSeconds): string {
    if ($timeRangeSeconds <= 3600) { // <= 1
        return 'ts_raw'; // 10
    } elseif ($timeRangeSeconds <= 86400 * 2) { // <= 2

```

```

return 'ts_aggregated_1min'; // 1 [ ]
} elseif ($timeRangeSeconds <= 86400 * 90) { // <= 90 [ ]
return 'ts_aggregated_1hr'; // 1 [ ]
} else {
return 'ts_aggregated_1day'; // 1 [ ]
}
}

```

365 [] 310 [] 10 []

[]

[]	[]	[]	[]
1 []	10 []	360	< 10 ms
24 []	1 []	1,440	< 20 ms
30 []	1 []	720	< 15 ms
1 []	1 []	365	< 10 ms

[]

[]

[]PmaControl []

1. [] 30 []
2. []
3. [] 3 []

[]

- threads_running []_stddev = 2.1, stddev_stddev = 0.8
- []_stddev = 14.3
- $(14.3 - 2.1) / 0.8 = 15.25$ []

[] CPU []

