

Performance Analysis and Troubleshooting Methodologies for Databases

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Monitoring and Cloud devroom



Databases and Performance

**Databases are frequent
Performance Trouble Makers**

Why Databases are Painful ?

Generally Non-Linear Scalability

Complex

Often Poorly understood by developers

Performance Work with Databases

Troubleshooting

Capacity Planning

Cost and Efficiency Optimization

Change Management

Points of View

BlackBox –
“Application
Developer”

WhiteBox –
“DBA, Ops”

Developer Point of View

Database as a Blackbox

I throw queries at it and it responds

DBaaS bring this “promise” to OPS too

BlackBox Success Criteria for Databases

Availability

Response Time

Correctness

Cost

Ops Point of View

Load

Resource Utilization

System/Hardware Problems

Scaling/Capacity Planing

Methodologies for Performance Troubleshooting and Analyses

Typical Default

**Troubleshooting by Random
Googling**

Problems with Typical Approach

Hard to Assure Outcome

Hard to Train People

Hard to Automate

Methodologies Save the Day

USE (Utilization,
Saturation, Errors)
Method by Brendan
Gregg

RED (Rate, Errors(Rate),
Duration) Method Tom
Wilkie

Golden Signals (Latency
- Traffic - Errors -
Saturation) Method by
Rob Ewaschuk

USE Method

USE Method Basics

Developed to Troubleshoot Server Performance Issues

Resolve 80% of problems with 5% of Effort

Operating System Specific Checklists Available

USE Method in One Sentence

**“For every resource,
check utilization,
saturation, and errors.”**

USE Method Terminology Definitions

Resource

- all physical server functional components (CPUs, disks, busses, ...)

Utilization

- the average time that the resource was busy servicing work

Saturation

- the degree to which the resource has extra work which it can't service, often queued

Errors

- the count of error events

USE Method Resources

CPUs: sockets, cores, hardware threads (virtual CPUs)

Memory: capacity

Network interfaces

Storage devices: I/O, capacity

Controllers: storage, network cards

Interconnects: CPUs, memory, I/O

USE Method with Software

Same Basic Resources Apply

Additional Software Resources Apply

Mutex Locks

File Descriptors

Connections

USE Method Benefits

Proven Track Record

Broad Applicability

Detailed Checklists Available

USE Method Drawbacks

Requires Good Understanding of System Architecture

Requires Access to Low Level Resources Monitoring

Hard to apply in Service “Blackbox” environments

RED Method

RED Method Focus

Microservices

“Cattle not Pets”

Mapping to Resources can be fluid

RED Method

**For every
Service Check
Request
check these
are within
SLO**

- Rate
- Error (Rate)
- Duration (Distribution)

RED Method for Databases

Looking at Service Level

Looking at Individual Database Servers

Can be applied to Components/Resources

Can be applied to individual Types of Queries

RED Method Benefits

Easily maps to what Developers Care About

Does not require as deep understanding of architecture

Does not need access to low lever resource monitoring

RED Method Drawbacks

**Does not have as
much tools and
checklists support
yet**

**More focused on
Answering WHAT
rather WHY**

Four Golden Signals

Focus

**Monitoring Distributed Systems from
SRE Book**

**To Be used for Alerting,
Troubleshooting, Trend Analyses**

Four Golden Signals

Latency

- Distribution not just Average; Latency for Successful requests vs Errors

Traffic

- How much Demand is being placed on the System

Errors

- Error Codes are Easy; Bad Content is hard

Saturation

- How Full your system “capacity”. Forecast when Possible.

For Golden Signals and Databases

Latency

- Query Response Time Distribution by Digest

Traffic

- Number of Queries of Specific kind Served

Errors

- Error codes but also Wrong Query Responses (hard)

Saturation

- Resource Usage but also Connections; Disk Space etc

Golden Signals Benefits

**Methodology Well
Tested by Google
and Many Others**

**Good Resource
Book Available**

Golden Signals Drawbacks

**Framework for
Monitoring**

**No specific
troubleshooting
checklists**

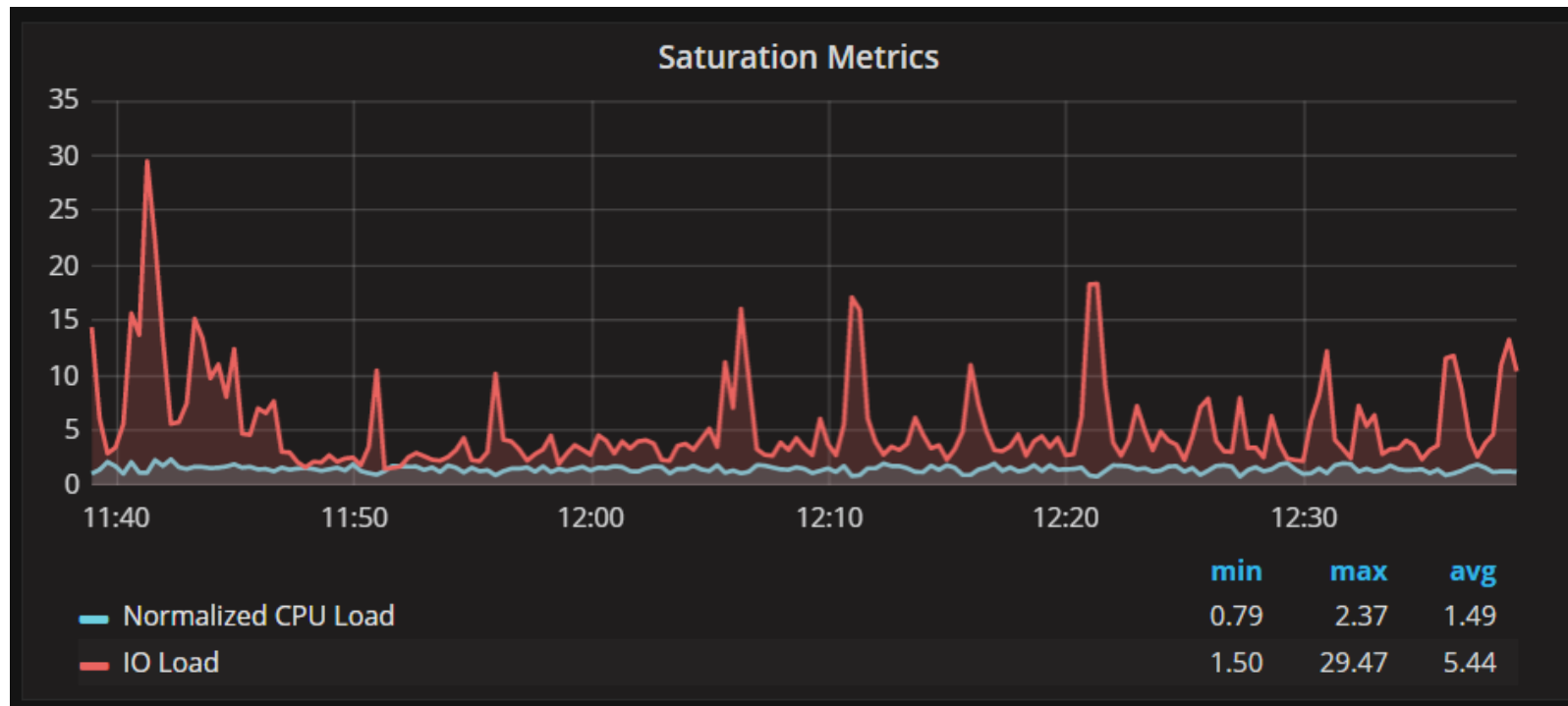
Take Aways

**Great innovation in
Performance
Analyses Methods**

**Significant Overlap –
Looking at mainly
same things, different
way**

Further Work by Percona

- Making Database Performance Analyses Methods available and easy to use in [Percona Monitoring and Management](#)



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April 23-25, 2018
Santa Clara Convention Center



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Thank You!
