

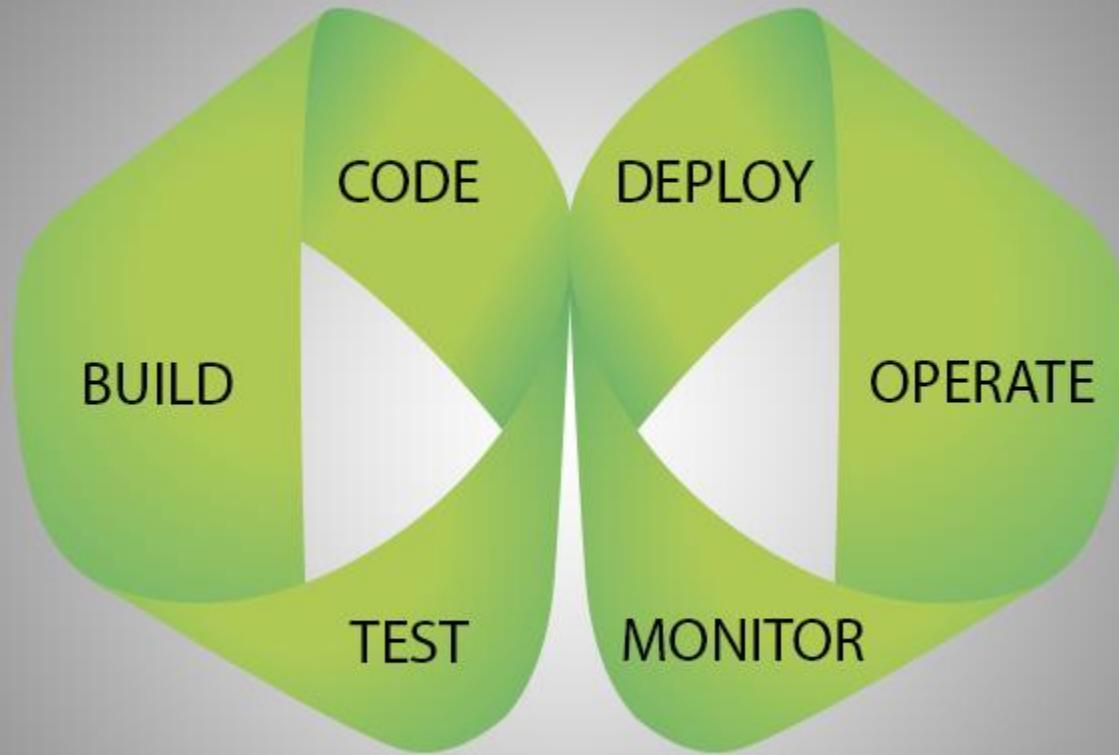


Anatoly Kulakov

The Metrix has you...







# Why metrics?

- Troubleshooting & Remediation
  - *Where did the problem occur?*
- Performance & Cost
  - *How my changes impact overall performance?*
- Learning & Improvement
  - *Can I detect or prevent this problem in the future?*
- Trends
  - *Do I need to scale?*
- Customer Experience
  - *Are my customers getting a good experience?*



NET-КОНФЕРЕНЦИЯ  
В РОССИИ;



Event Viewer

File Action View Help

Event Viewer (Local)

Custom Views

Windows Logs

- Application
- Security
- Setup
- System
- Forwarded Events

Applications and Services Logs

- Subscriptions

Security Number of events: 51 565 (1) New events available

Keywords	Date and Time	Source	Event ID	Task Category
Audit Failure	30.09.2017 13:04:24	Microsoft Windows security auditing.	4656	File System
Audit Success	30.09.2017 13:04:24	Microsoft Windows security auditing.	4611	Security System Extension
Audit Failure	30.09.2017 13:04:24	Microsoft Windows security auditing.	4656	File System
Audit Success	30.09.2017 13:04:24	Microsoft Windows security auditing.	4611	Security System Extension
Audit Failure	30.09.2017 12:37:34	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:36:14	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:34:57	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:34:56	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:34:55	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Success	30.09.2017 12:34:42	Microsoft Windows security auditing.	4672	Special Logon
Audit Success	30.09.2017 12:34:42	Microsoft Windows security auditing.	4624	Logon
Audit Failure	30.09.2017 12:34:41	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:34:37	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:34:31	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Success	30.09.2017 12:33:03	Microsoft Windows security auditing.	4985	File System
Audit Success	30.09.2017 12:33:03	Microsoft Windows security auditing.	4985	File System
Audit Failure	30.09.2017 12:31:15	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:31:15	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:31:10	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:31:10	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:31:10	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:31:06	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:31:06	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:31:03	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:30:11	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:30:03	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Failure	30.09.2017 12:29:46	Microsoft Windows security auditing.	4673	Sensitive Privilege Use
Audit Success	30.09.2017 12:29:20	Microsoft Windows security auditing.	1085	File System

Event 4656, Microsoft Windows security auditing.

General Details

A handle to an object was requested.

Subject:

Security ID:	AKulakov
Account Name:	AKulakov
Account Domain:	PAL
Logon ID:	0x6b3e6

Object:

Log Name: Security  
Source: Microsoft Windows security Logged: 30.09.2017 12:27:34  
Event ID: 4656 Task Category: Other Object Access Events  
Level: Information Keywords: Audit Failure  
User: N/A Computer: AKulak .com  
OpCode: Info

More Information: [Event Log Online Help](#)

Actions

- Open Saved Log...
- Create Custom View...
- Import Custom View...
- Clear Log...
- Filter Current Log...
- Properties
- Find...
- Save All Events As...
- Attach a Task To This Log...
- View
- Refresh
- Help

Event 4656, Microsoft Windows security auditing.

Event Properties

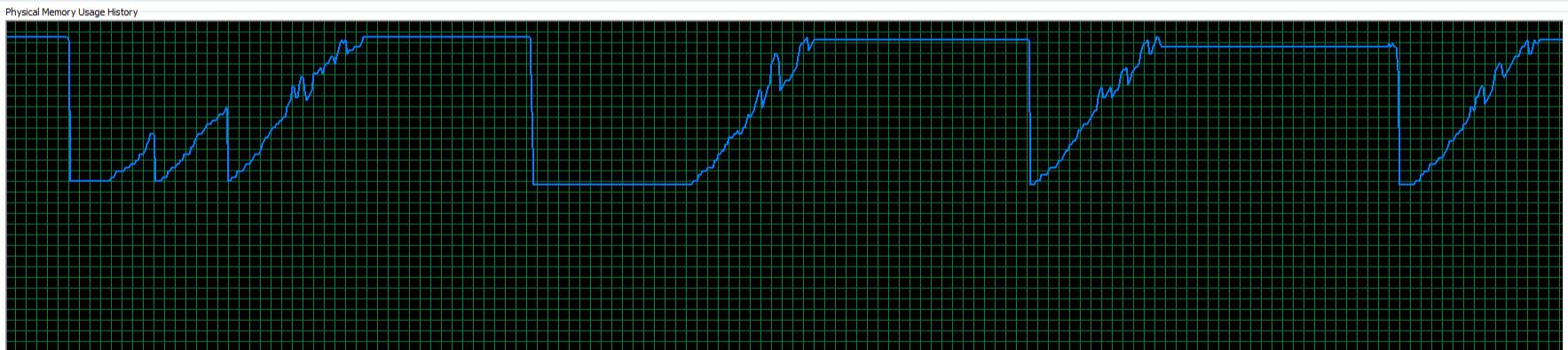
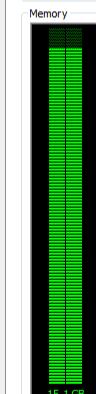
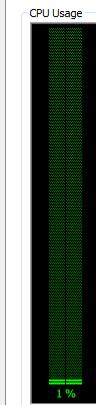
Attach Task To This Event...

Copy

Save Selected Events...

Refresh

Help

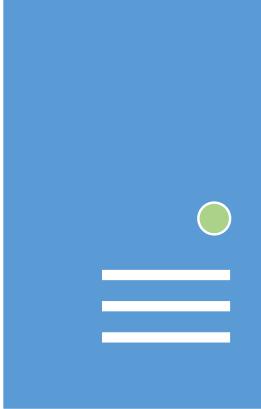


Physical Memory (MB)		System	
Total	16323	Handles	57403
Cached	348	Threads	2358
Available	808	Processes	164
Free	461	Up Time	0:01:19:08
		Commit (GB)	17 / 47

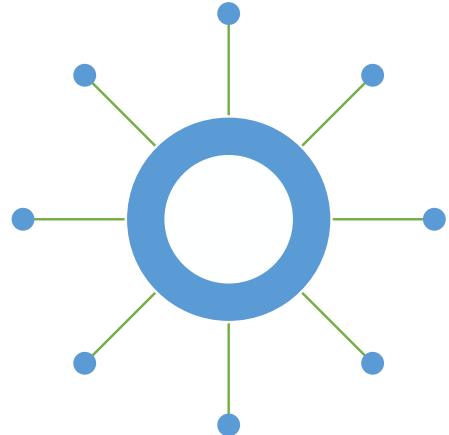
  

Kernel Memory (MB)	
Paged	558
Nonpaged	153

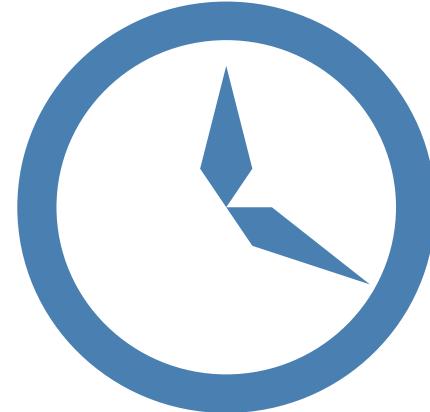
[Resource Monitor...](#)



**200** hosts



**100** measurements



every **10** sec

$\times 86\,400$   
seconds in a day

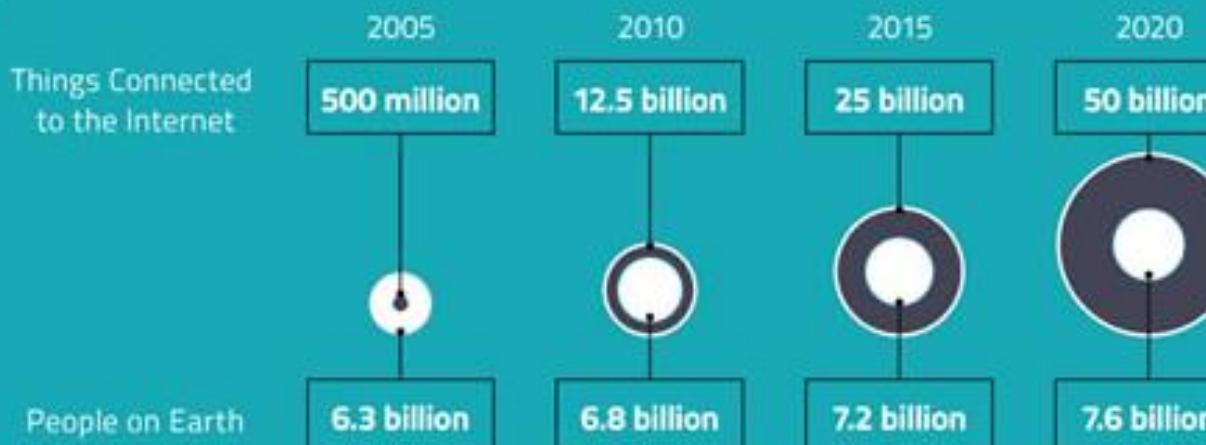


**172 800 000**  
points per day

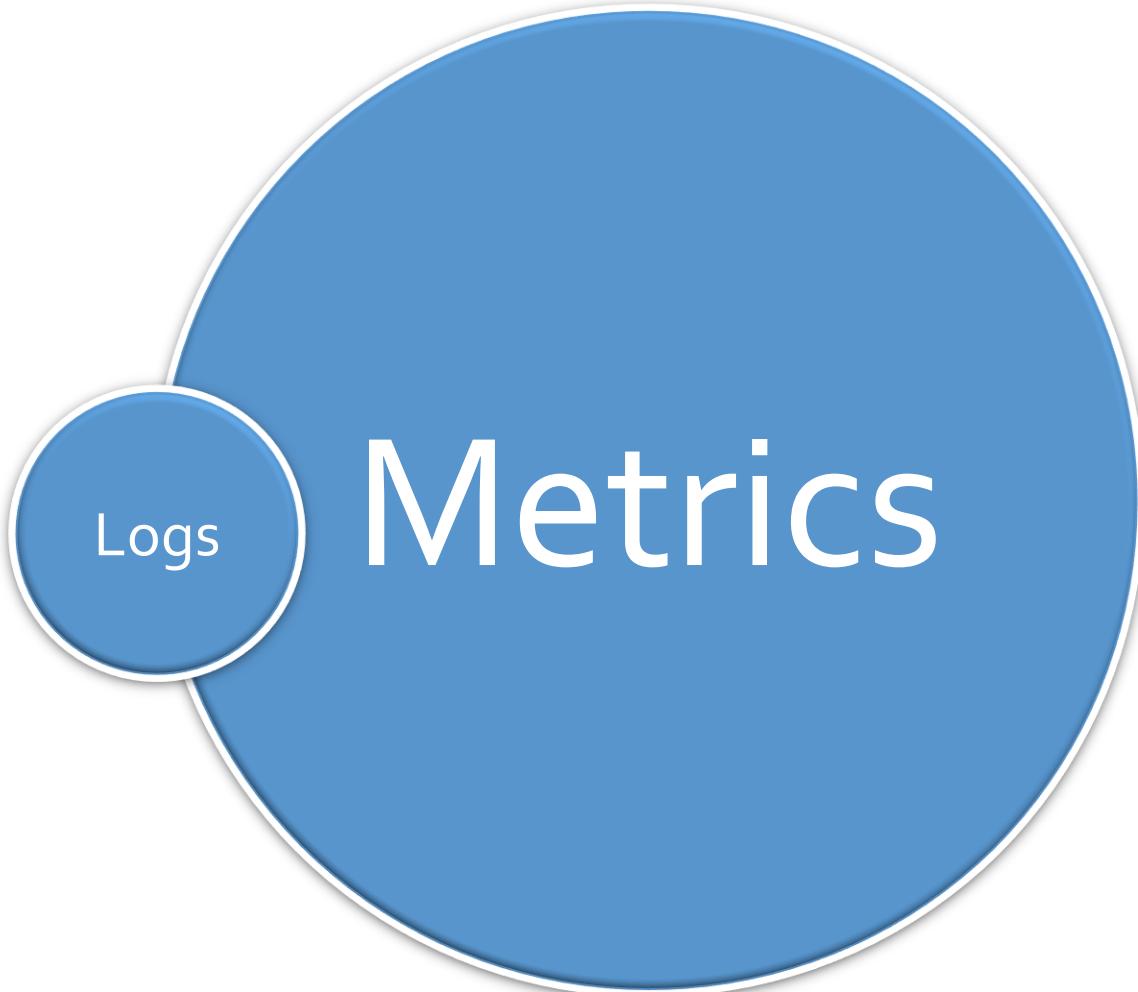


By 2020, there will be  
**50 billion devices**  
connected to the internet.

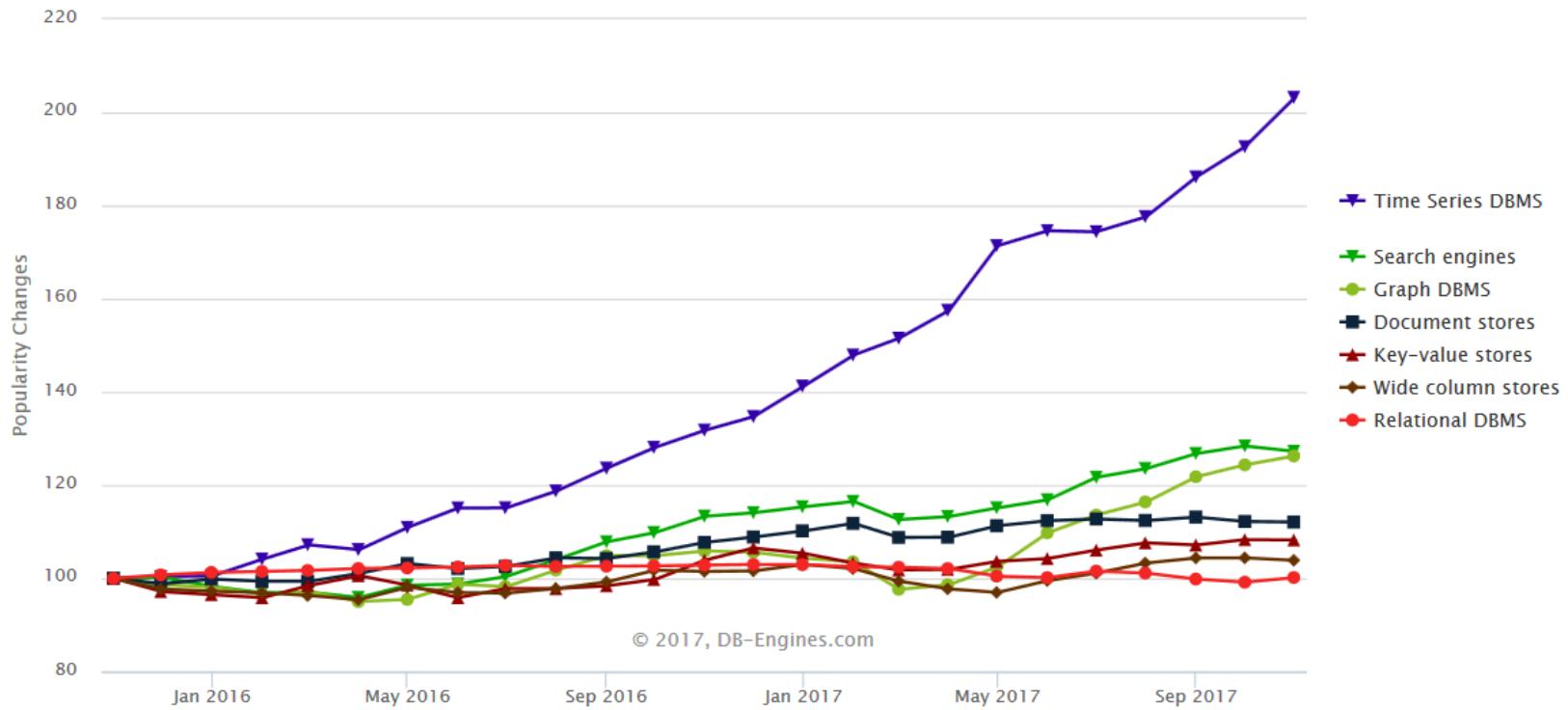
<https://www.i-scoop.eu/internet-of-things-guide/>



Source: Cisco IBSG



# DBMS by model popularity



© 2017, DB-Engines.com

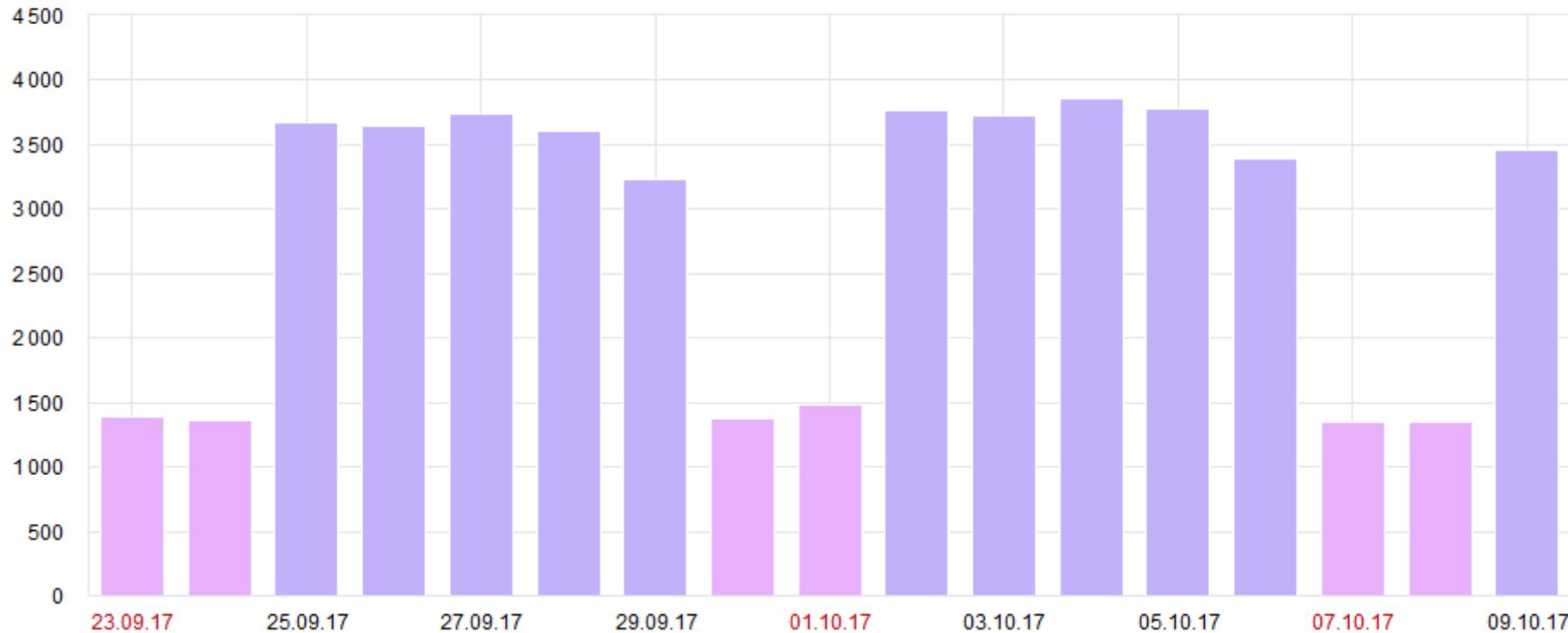
# Посещаемость

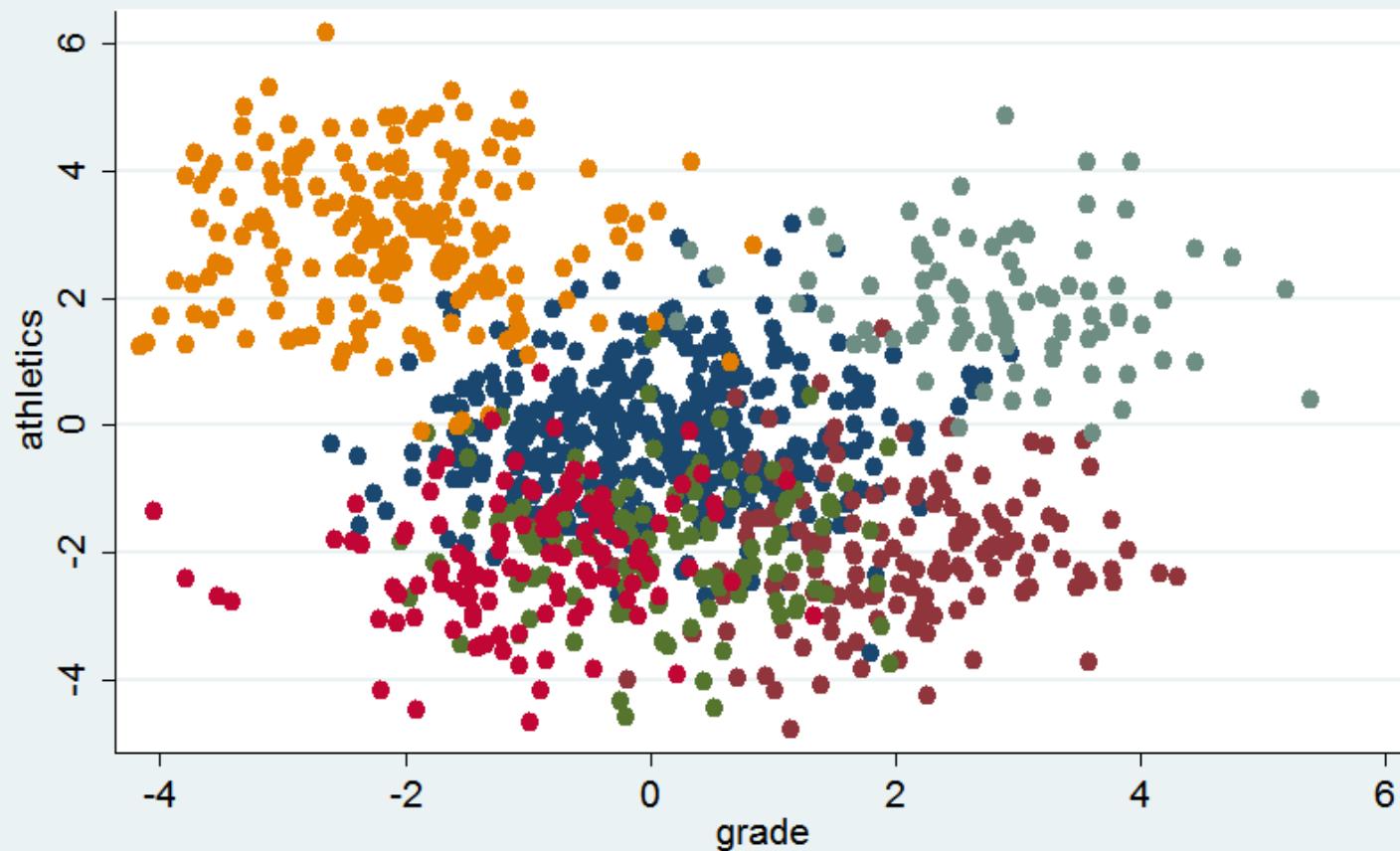
Сегодня Вчера Неделя Месяц Квартал Год

23 сен — 22 окт 2017

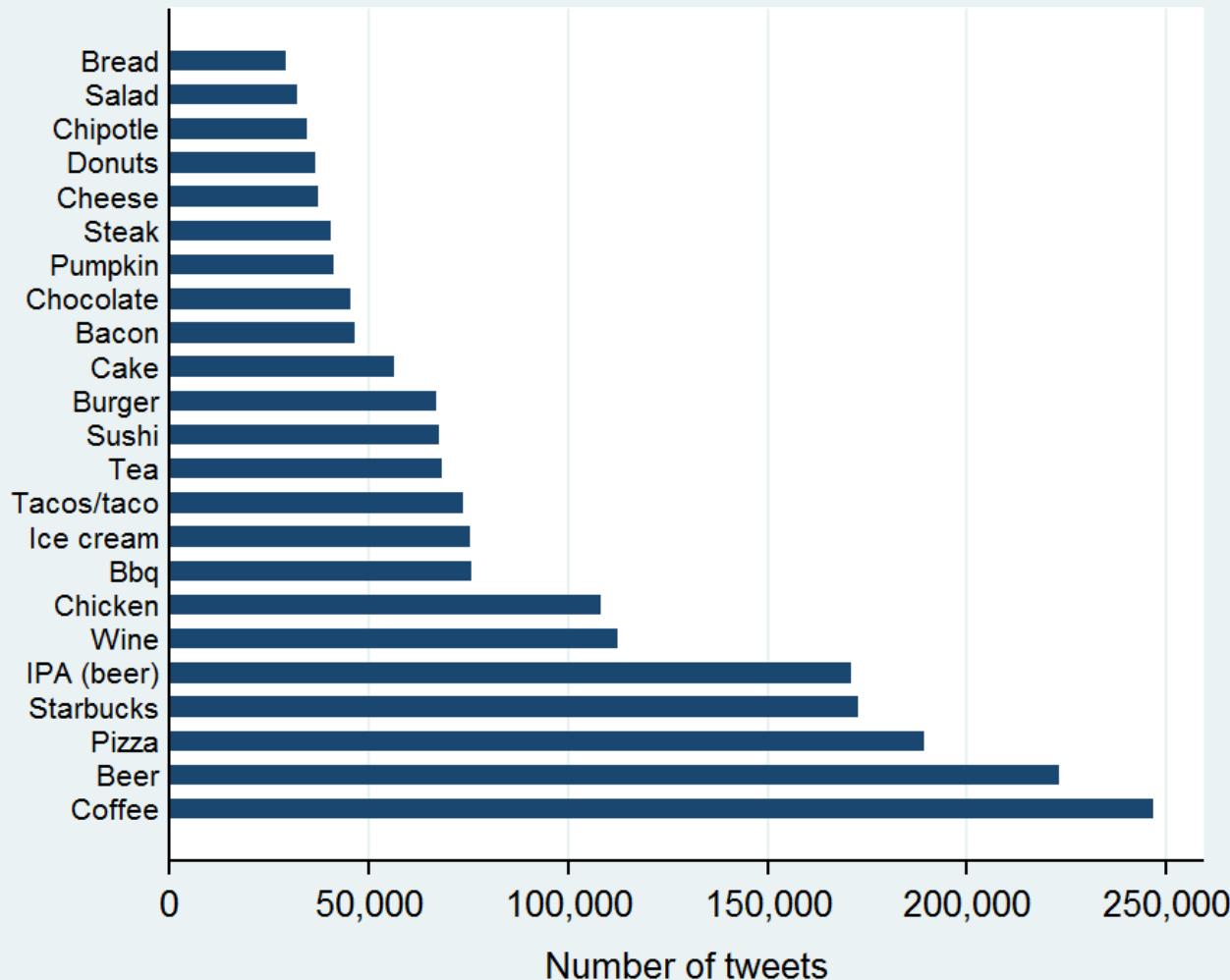
Детализация: по дням

## Визиты

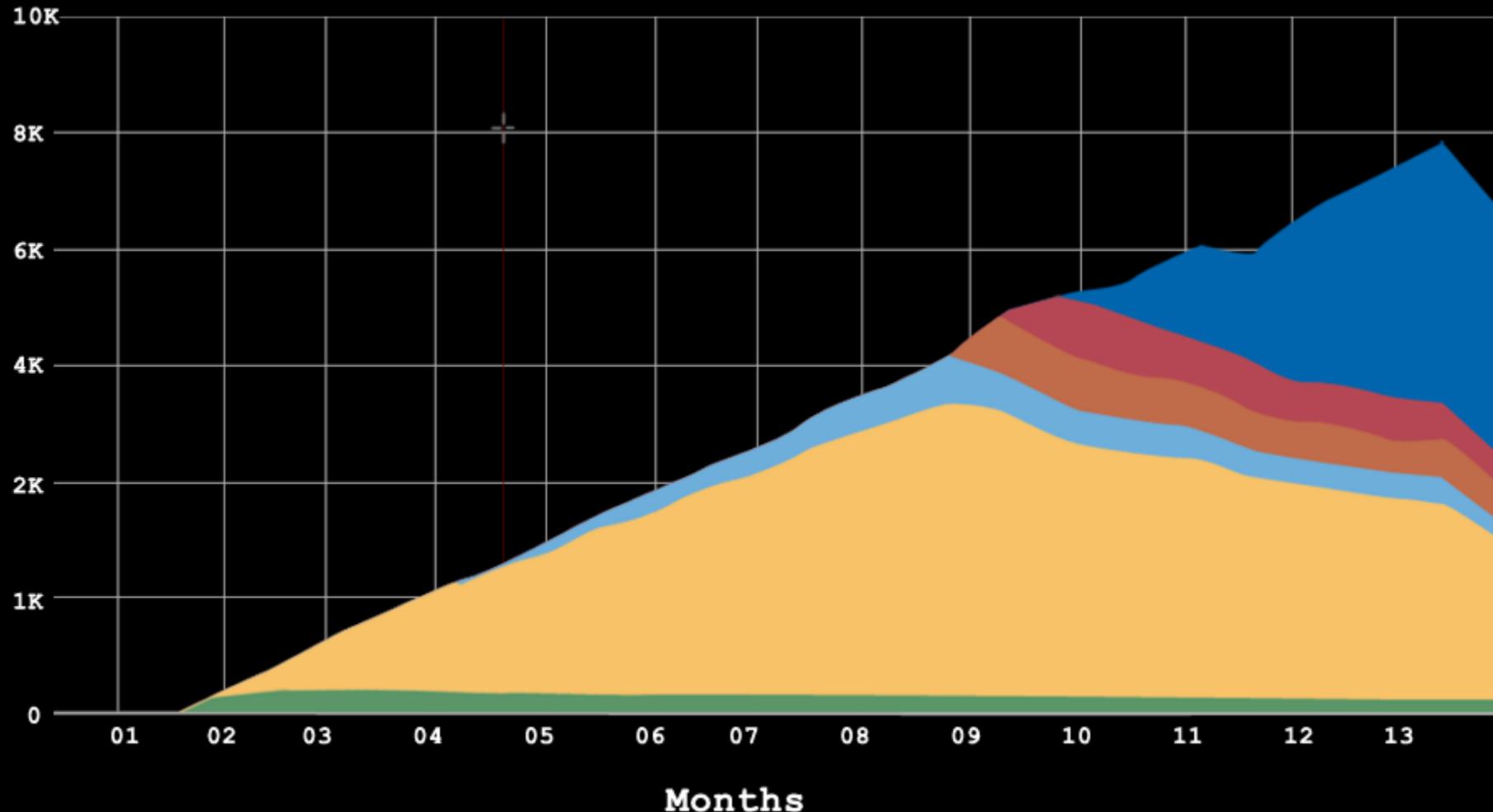


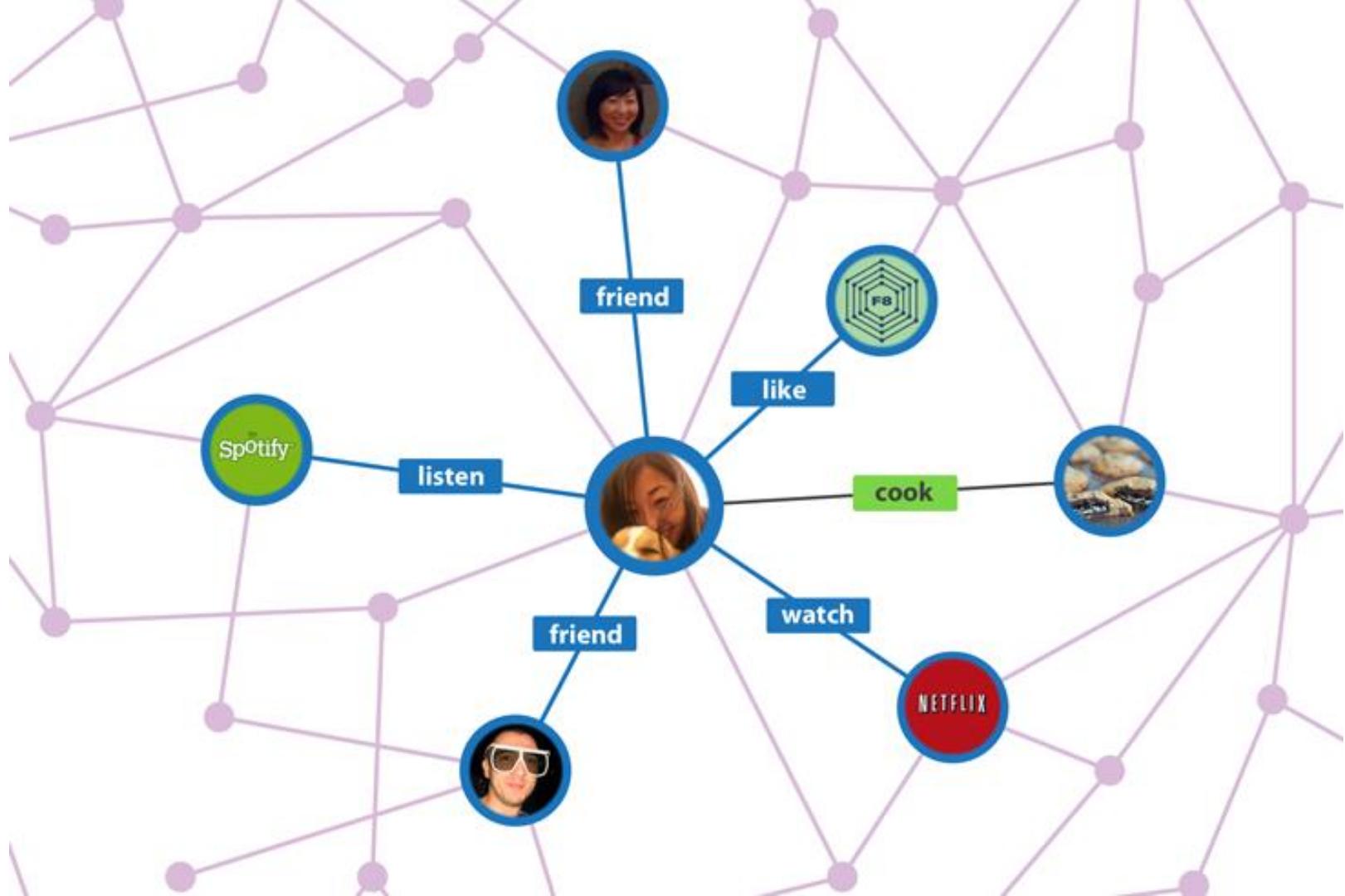


- Base
- Jock
- Nerd
- Iconoclast
- Super-Star
- Diva



# Installations





# Microsoft Corporation

NASDAQ: MSFT - Oct 20, 7:59 PM EDT

**78.81** USD **↑0.90 (1.16%)**

After-hours: 78.81 0.00%

1 day

5 day

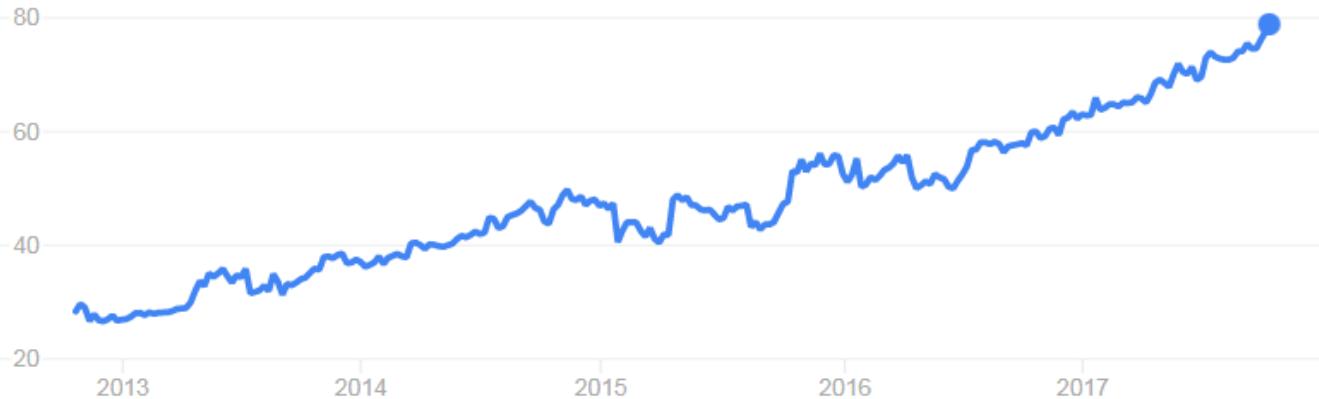
1 month

3 month

1 year

**5 year**

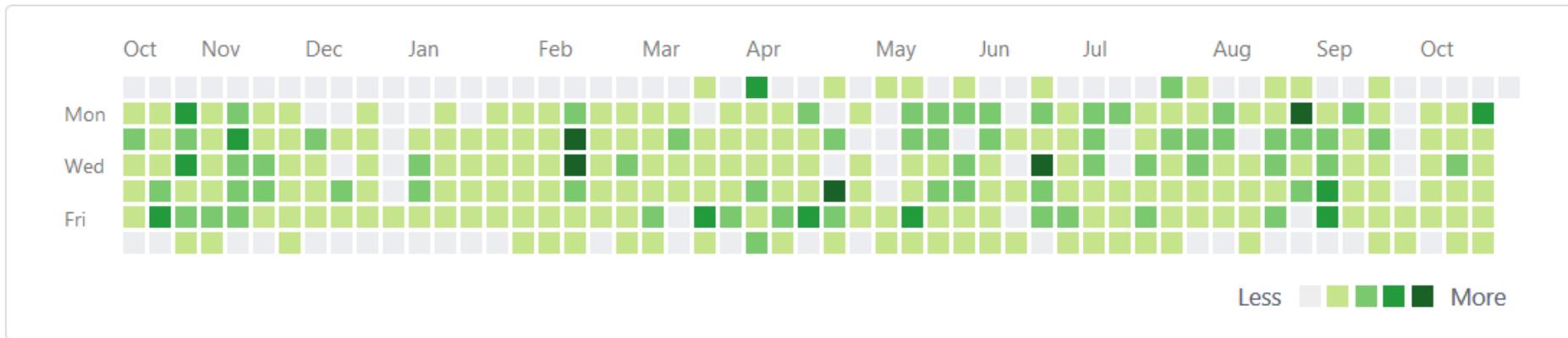
max



Open 78.32  
High 78.97  
Low 78.22

Mkt cap 608.05B  
P/E ratio 29.1  
Div yield 2.13%

2,271 contributions in the last year





14 человек  
купили этот товар  
на этой неделе



14 человек  
купили этот товар  
на этой неделе



lamoda

# Time Series structure

## Network

### Timestamp



2017-11-12T06:42:17

2017-11-12T06:43:18

### Tags



host = **dev**  
if = **eth1**

host = **dev**  
if = **wlan1**

### Fields



rx = **42**  
tx = **10**

rx = **50**  
tx = **88**

# Time Series analogy

Network

Timestamp



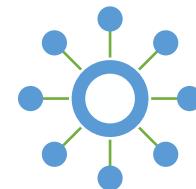
Primary Key

Tags



Indexed Column

Fields



Not Indexed Column

# Time Series size

## Network

Timestamp



Datetime

**8 bytes**

2017-11-12T06:42:17

Tags

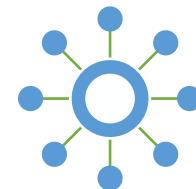


string[]

$\approx 24$  bytes

dev, eth1, ...

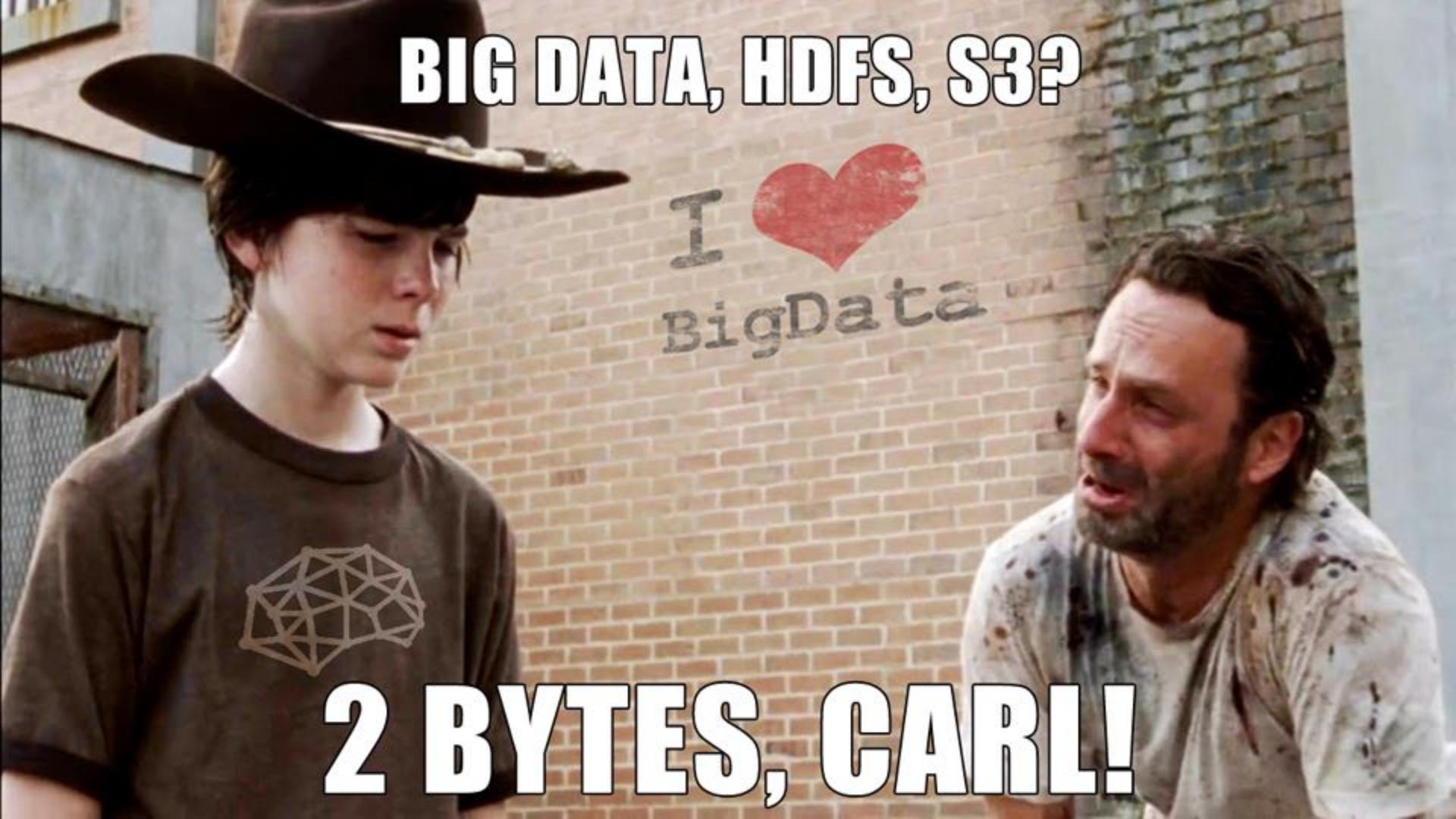
Fields



double

**8 bytes**

42.0173, 1.0, ...



**BIG DATA, HDFS, S3?**

I ❤️  
BigData

**2 BYTES, CARL!**



*bzip2*

# Series

## Network

Tags



host = **dev**  
if = **eth1**

host = **dev**  
if = **wlan1**



network,host=dev,if=eth1

network,host=dev,if=wlan1

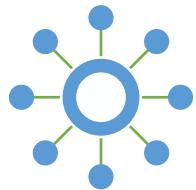
# Timestamp



	<u>Delta</u>	<u>Delta 2</u>
2017-11-12T06:00:00	-	-
2017-11-12T06:00:05	05	-
2017-11-12T06:00:10	05	0
2017-11-12T06:00:15	05	0

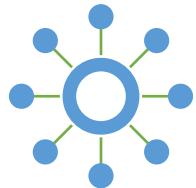
«We have found that about **96%** of all time stamps can be compressed to a **single bit**.»

# Fields



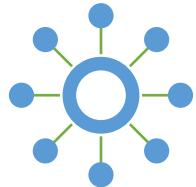
Decimal
15.5
14.0625
3.25
8.625

# Fields



Decimal	Double Representation
15.5	0x402f000000000000
14.0625	0x402c200000000000
3.25	0x400a000000000000
8.625	0x4021400000000000

# Fields



Decimal	Double Representation	XOR with previous
15.5	0x402f000000000000	
14.0625	0x402c200000000000	0x0003200000000000
3.25	0x400a000000000000	0x0026200000000000
8.625	0x4021400000000000	0x002b400000000000

«Roughly **51%** of all values are compressed to a **single bit**»

«... compress time series to an average of **1.37 bytes** per point»

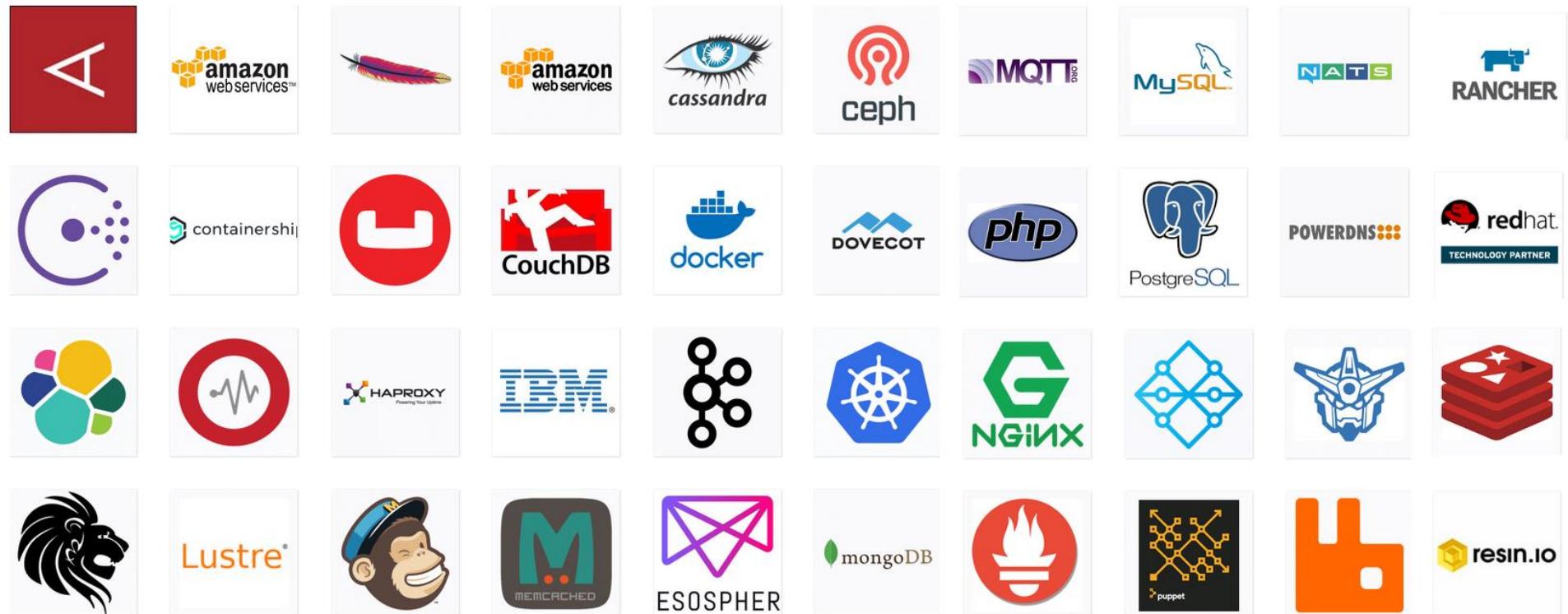
# Time Series sources

- Performance Counters
- Third party statistics API
- Event Tracing for Windows
- Application measurements

# telegraf



# Telegraf Integrations



Demo powered by

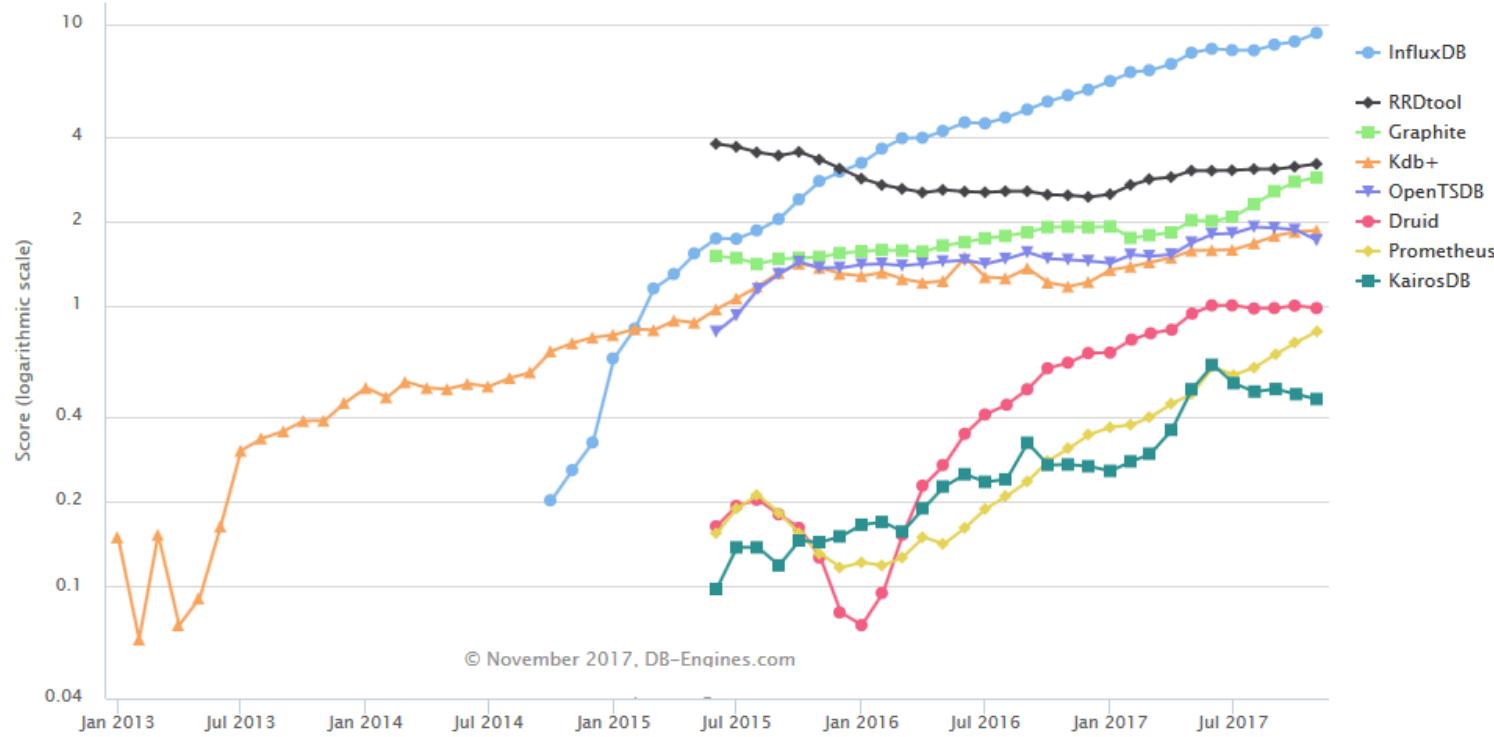


Telegraf



# InfluxDB

# Time Series DBMS Popularity

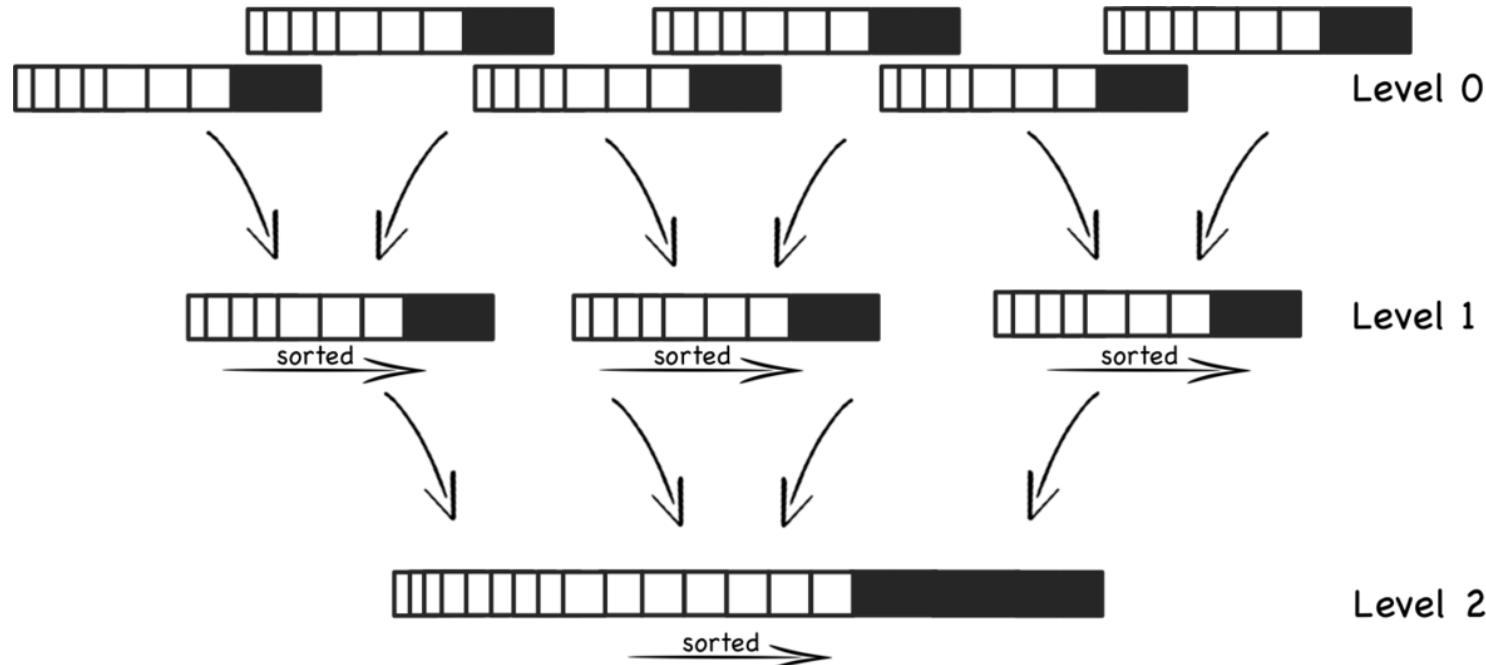


© November 2017, DB-Engines.com

# Specifics of the workloads

- Billions of individual data points
- High write throughput
- High read throughput
- Large deletes (data expiration)
- Mostly an insert/append workload, very few updates

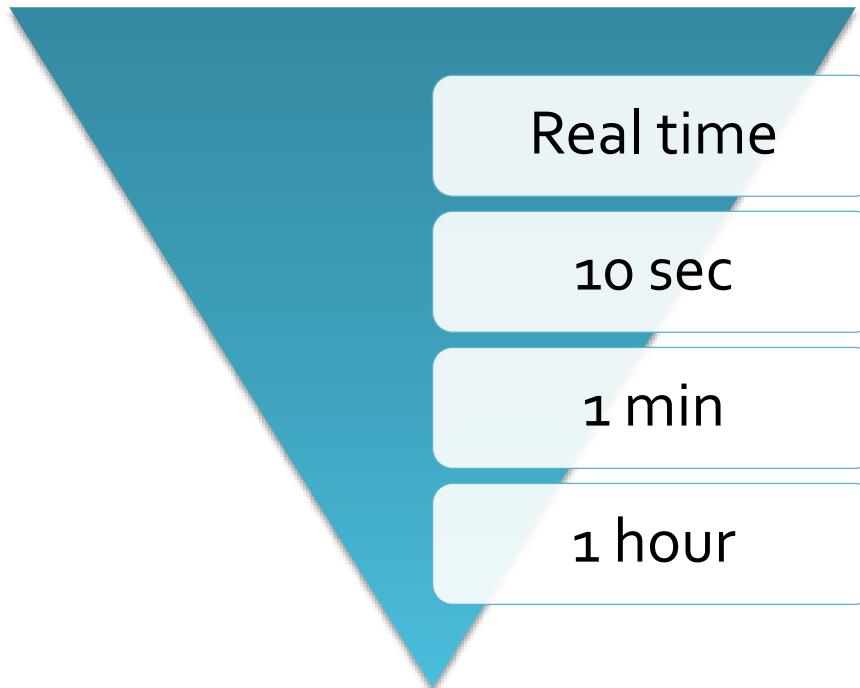
# Time-structured merge-tree



# InfluxQL

```
SELECT median(rx), mean(tx)
FROM network
WHERE time > now() - 15m
    AND host = 'dev'
GROUP BY time(10s)
```

# Retention policies

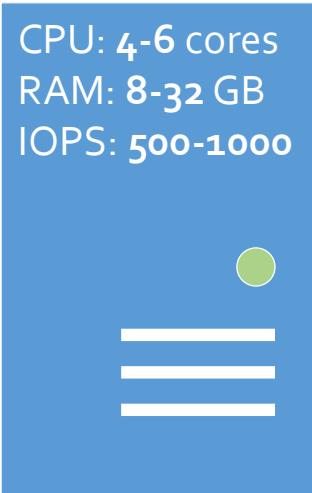


# Single node performance

CPU: **4-6** cores

RAM: **8-32** GB

IOPS: **500-1000**



# Single node performance

CPU: 4-6 cores  
RAM: 8-32 GB  
IOPS: 500-1000



Load	Field writes per second	Queries per second	Unique series
Low	< 5 thousand	< 5	< 100 thousand
Moderate	< 250 thousand	< 25	< 1 million
High	> 250 thousand	> 25	> 1 million
Infeasible	> 750 thousand	> 100	> 10 million

# Mortal Kombat

InfluxDB



OPEN TSDB



elasticsearch

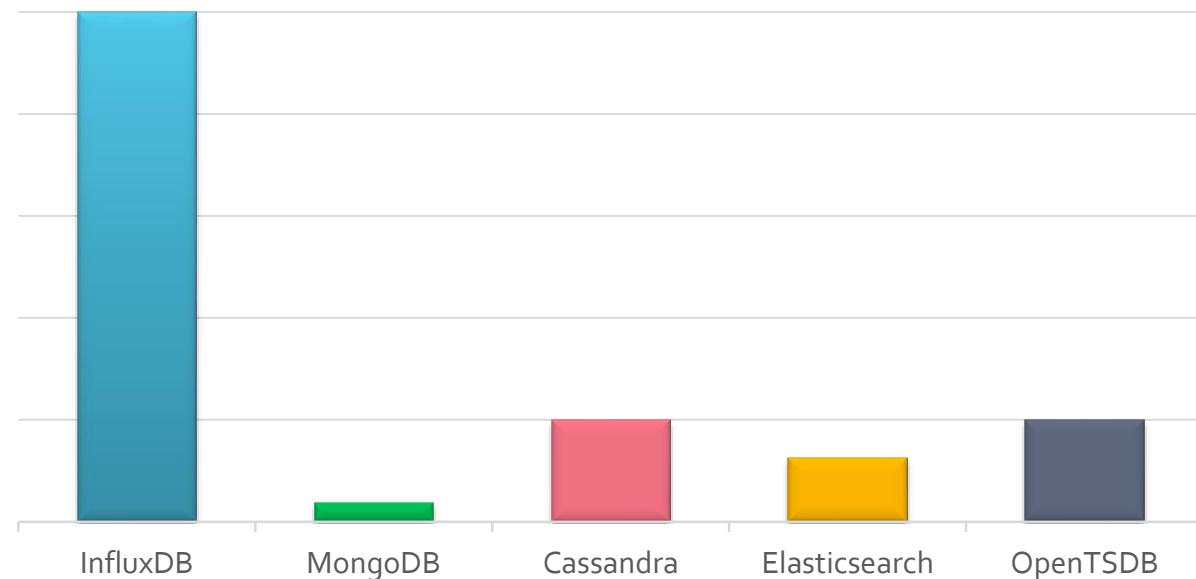


mongoDB

## Write Performance

InfluxDB outperformed:

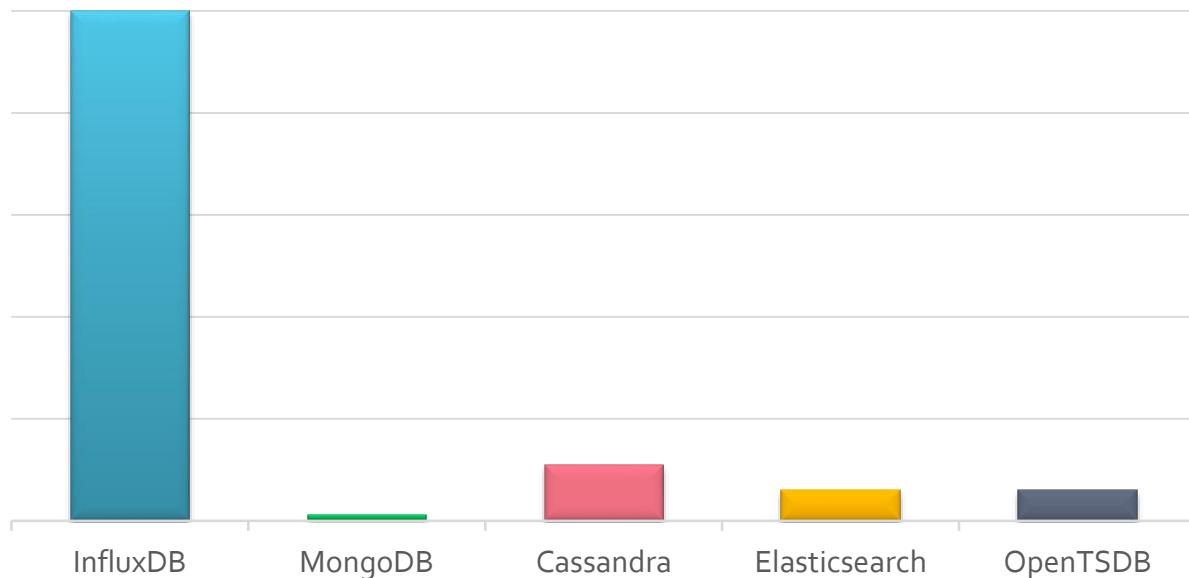
- MongoDB by **27x**
- Cassandra by **5x**
- Elasticsearch by **8x**
- OpenTSDB by **5x**



## Compression

InfluxDB outperformed:

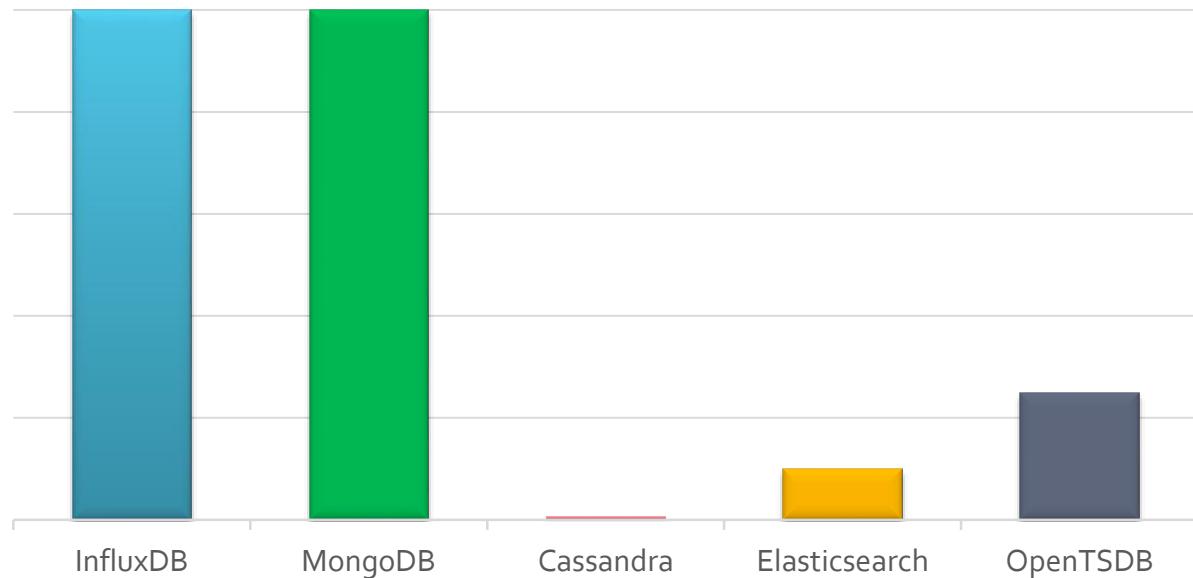
- MongoDB by **84x**
- Cassandra by **9x**
- Elasticsearch by **16x**
- OpenTSDB by **16x**



## Query Performance

InfluxDB outperformed:

- MongoDB similarly
- Cassandra by **168x**
- Elasticsearch by **10x**
- OpenTSDB by **4x**



DEMO POWERED BY



APP METRICS



InfluxDB  
Grafana



# First Step

- Install [Telegraf](#) and [Dashboard](#)
- Install [AppMetrics](#) and [Dashboard](#)
- Use it
- Remove unnecessary metrics
- Add new application-specific metrics

Demo powered by



# BenchmarkDotNet

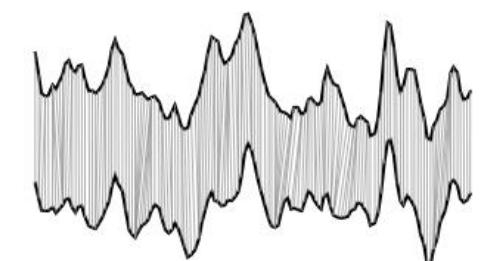
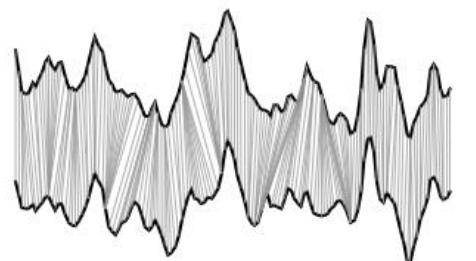
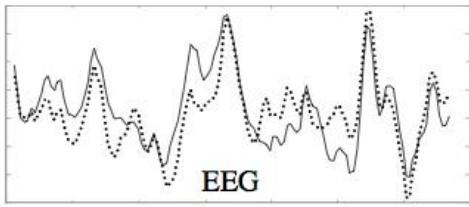
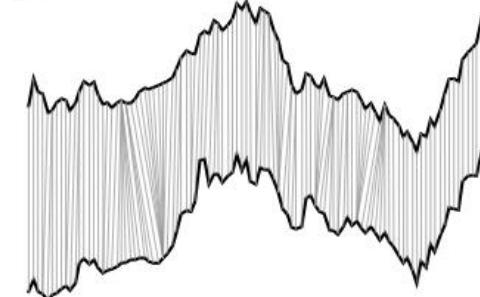
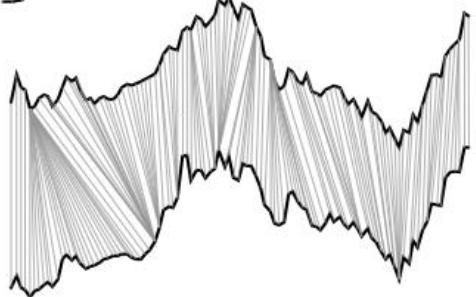
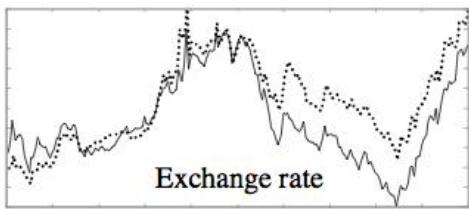
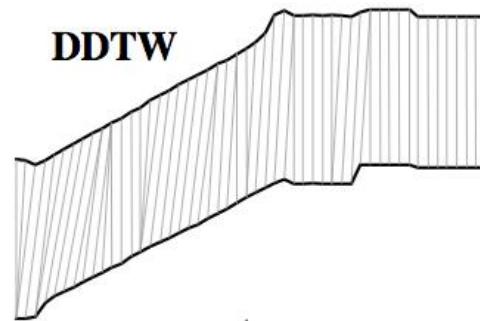
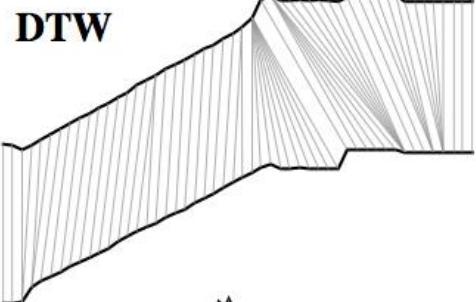
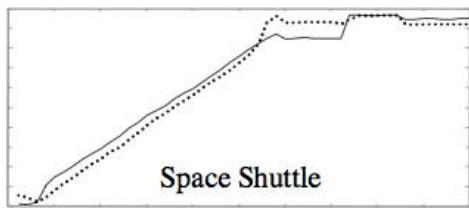
Powerful .NET library for benchmarking

Demo powered by



**BenchmarkDOTNEXT**  
Powerful .NET library for benchmarking











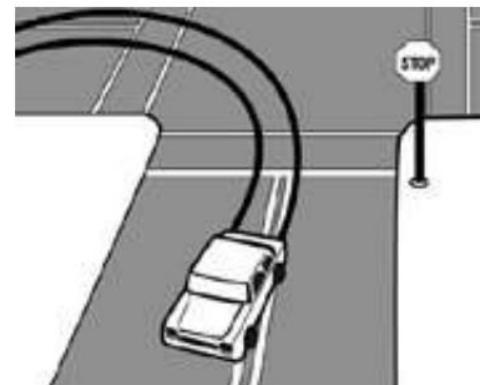
(a)weaving



(b)drifting



(c)swerving



(d)turning with wide radius

*Telegraf*

*InfluxDB*

*Chronograf*

*Kapacitor*

Agent for collecting  
and reporting metrics

*Telegraf*

*InfluxDB*

*Chronograf*

*Kapacitor*

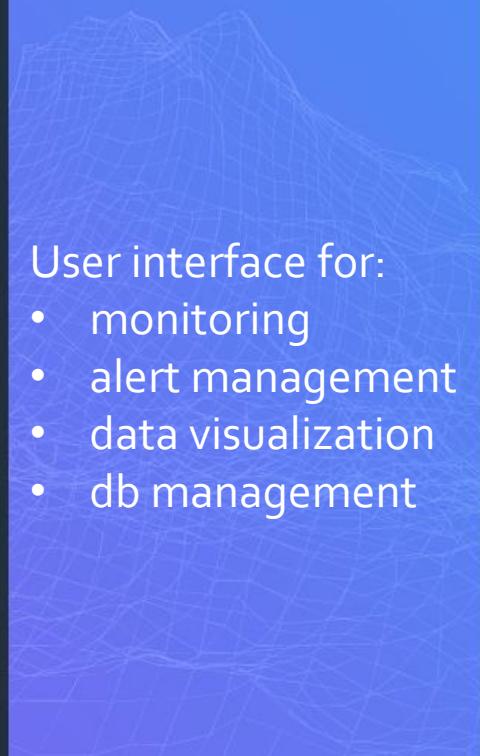
Time series database

*Telegraf*

*InfluxDB*

*Chronograf*

*Kapacitor*

- 
- User interface for:
- monitoring
  - alert management
  - data visualization
  - db management

*Telegraf*

*InfluxDB*

*Chronograf*

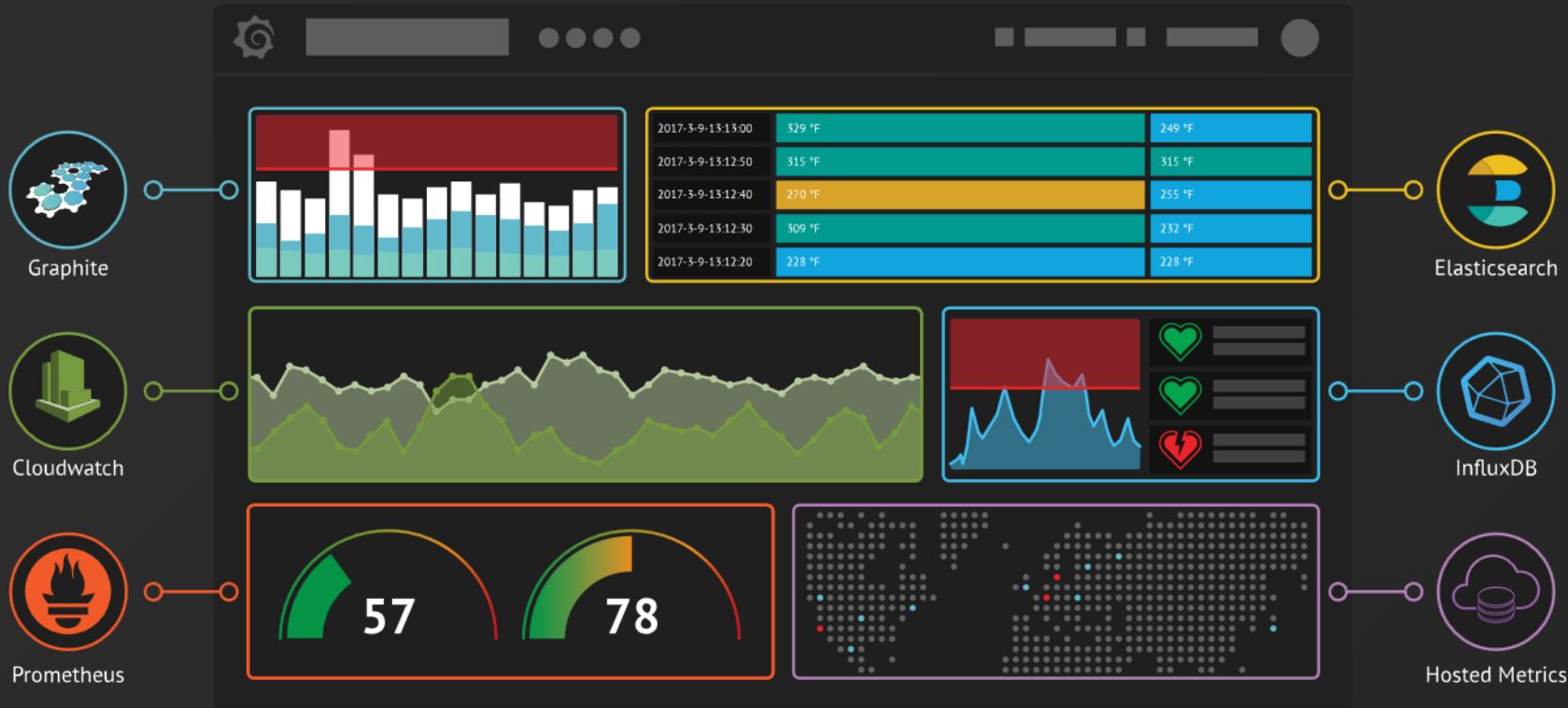
*Kapacitor*

Data processing  
framework for:

- create alerts
- run ETL jobs
- detect anomalies

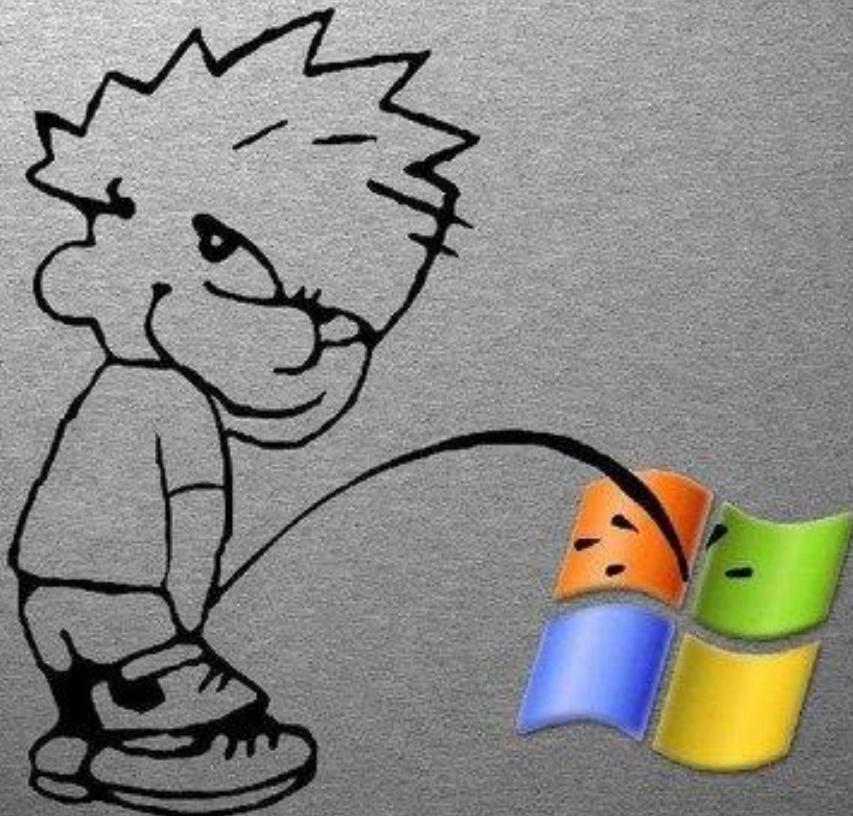


35 data sources, 28 panels, 16 apps and 530 dashboards available.



**NS  
SM**

<https://nssm.cc/>



# Realtime Analysis

High Loads

Compression

Retention Policy

Statistics and  
Aggregation



Query and Write  
performance

High Throughput

Downsampling

Continuous Queries

# Realtime Analysis

High Loads

Compression

Retention Policy

Statistics and  
Aggregation

Continuous Queries

~~Query and Write  
performance~~

High Throughput

Downsampling



# Realtime Analysis

High Loads

Compression

Retention Policy

Statistics and  
Aggregation

Continuous Queries

~~High Throughput~~

Downsampling



# Realtime Analysis

High Loads

Compression

Retention Policy

Statistics and  
Aggregation

Continuous Queries

Downsampling



# Realtime Analysis

High Loads

Compression

Retention Policy

Statistics and  
Aggregation

Continuous Queries



# Realtime Analysis

High Loads

Compression

Retention Policy

Statistics and  
Aggregation



# Realtime Analysis

High Loads

Compression

Retention Policy



## Realtime Analysis

High Loads

Compression



## Realtime Analysis

~~High Loads~~



## Realtime Analysis







PostgreSQL



ORACLE®



elastic



splunk > graylog



loggly

# Resources

- [Gorilla Paper](#)
- [Akumuli](#)
- [Run-length encoding](#)
- [Varints, ZigZag](#)
- [Dynamic time warping](#)
- [Sketch-based change detection](#)

# Resources

- InfluxData Docs ([docs.influxdata.com](https://docs.influxdata.com))
- Grafana Docs ([docs.grafana.org](https://docs.grafana.org))
- App Metrics ([app-metrics.io](https://app-metrics.io))
- Non-Sucking Service Manager ([nssm.cc](https://nssm.cc))

# Resources

- [Anatoly.Kulakov@outlook.com](mailto:Anatoly.Kulakov@outlook.com)
- [twitter.com/KulakovT](https://twitter.com/KulakovT)
- [github.com/AnatolyKulakov](https://github.com/AnatolyKulakov)
- [SpbDotNet.org](https://SpbDotNet.org)

