

SPB
DOT
NET

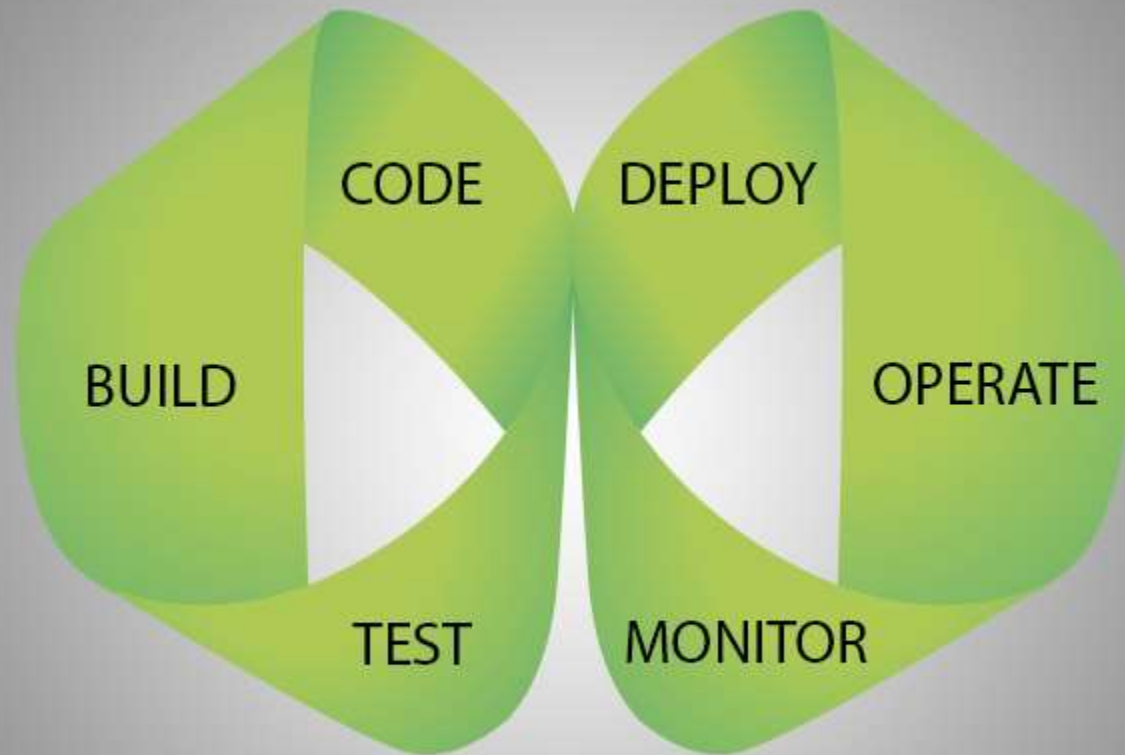


Anatoly Kulakov

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 (Local)

- Custom Views
- Windows Logs
 - Application
 - Security
 - Setup
 - System
 - Forwarded Events
- Applications and Services Logs
- Subscriptions

Security Number of events: 34,365 (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	4606	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	4606	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 12:36:34	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	4685	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 Failure	30.09.2017 12:29:35	Microsoft Windows security auditing	4686	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: PAU
 Logon ID: 0463a6

Process

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: AKulakov .com

OpCode:

Info

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

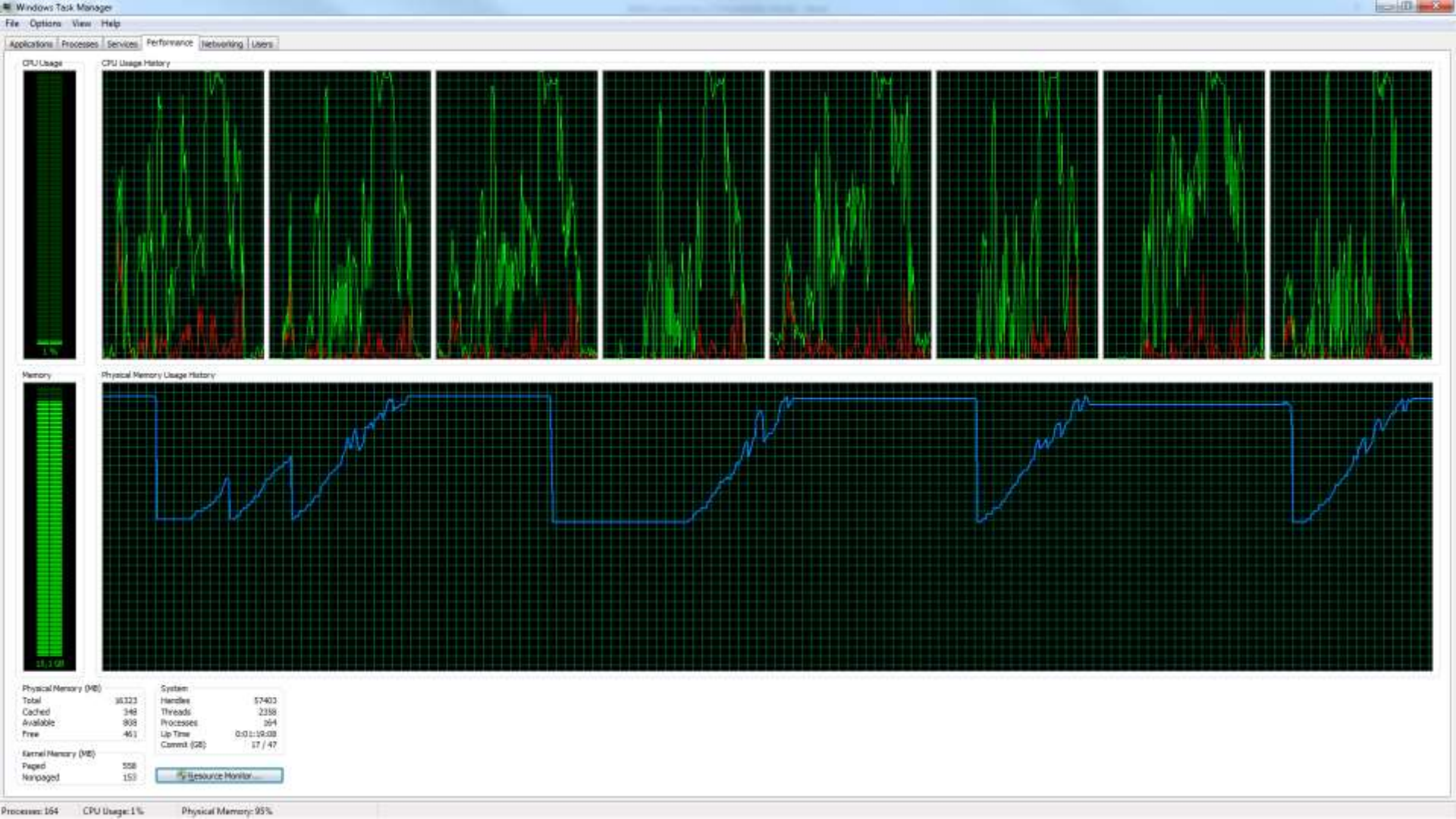
Actions:

Security

- 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

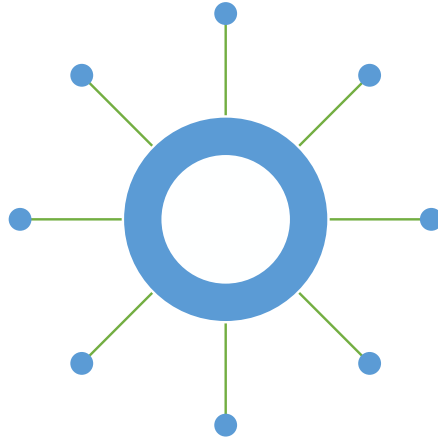
Event 4656, Microsoft Windows security auditing.

- Event Properties
- Attach Task To This Event...
- Copy
- Save Selected Events...
- Refresh
- Help





200 hosts



100 measurements



every **10** sec

× **86 400**
seconds in a day

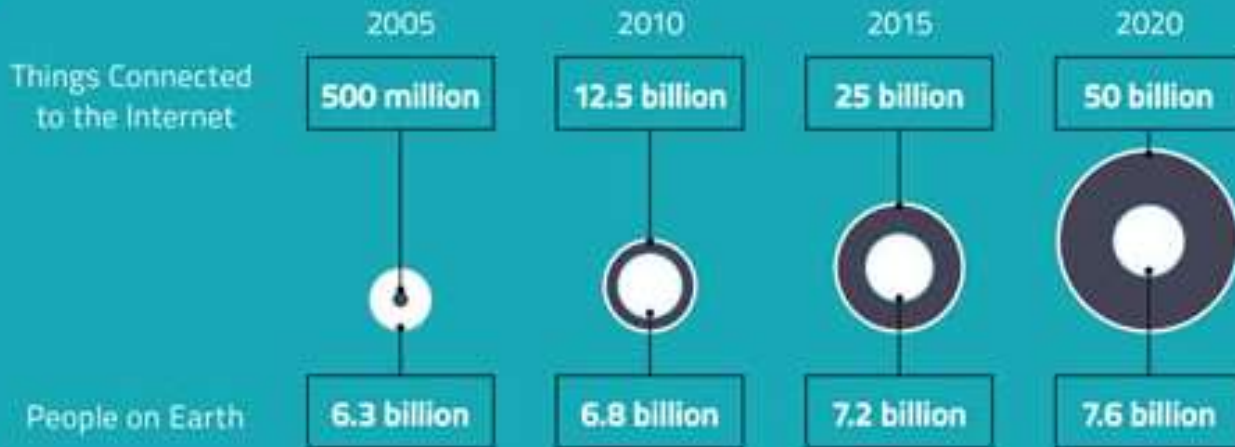


172 800 000
points per day



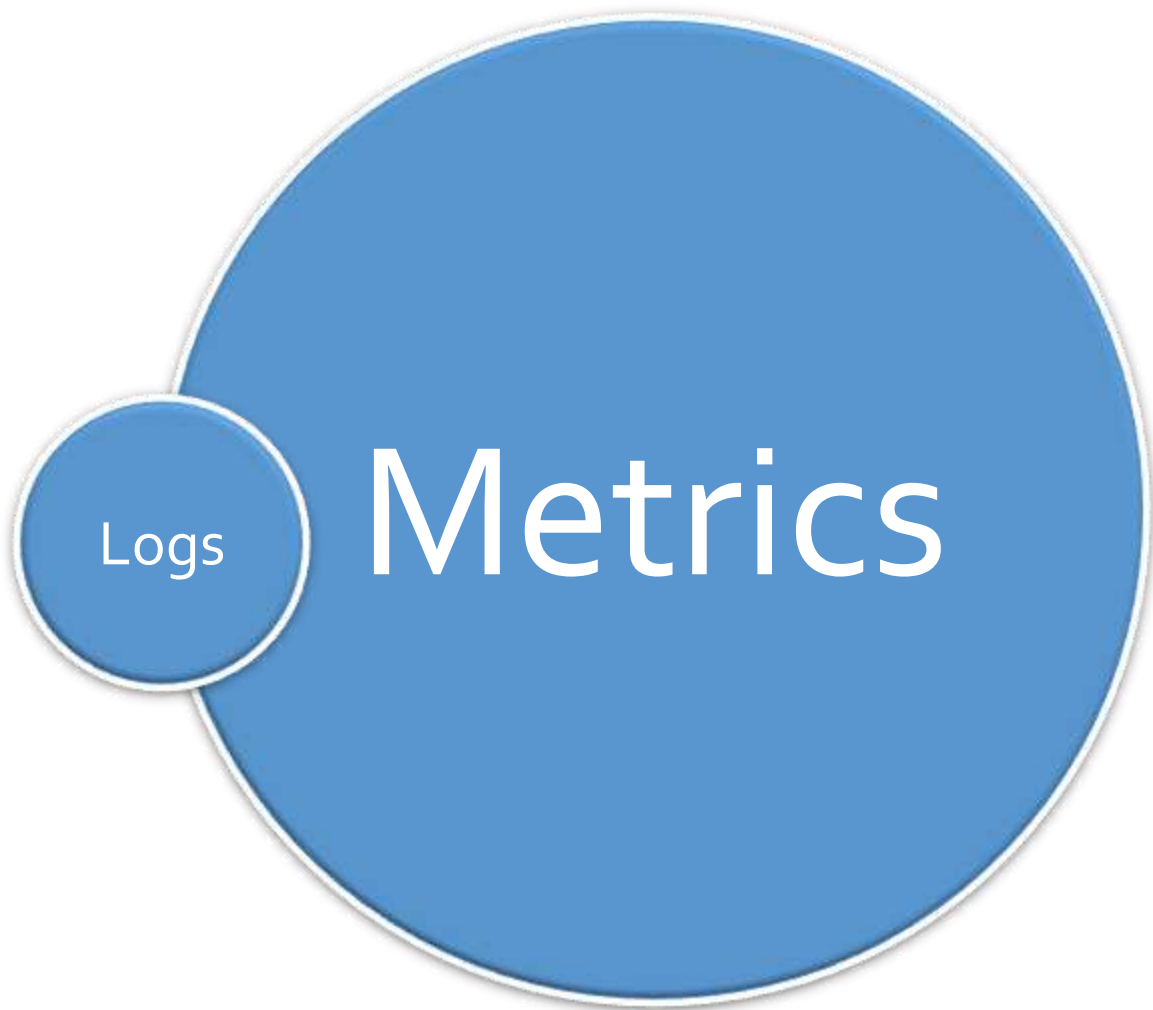
By 2020, there will be
50 billion devices
connected to the internet.

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

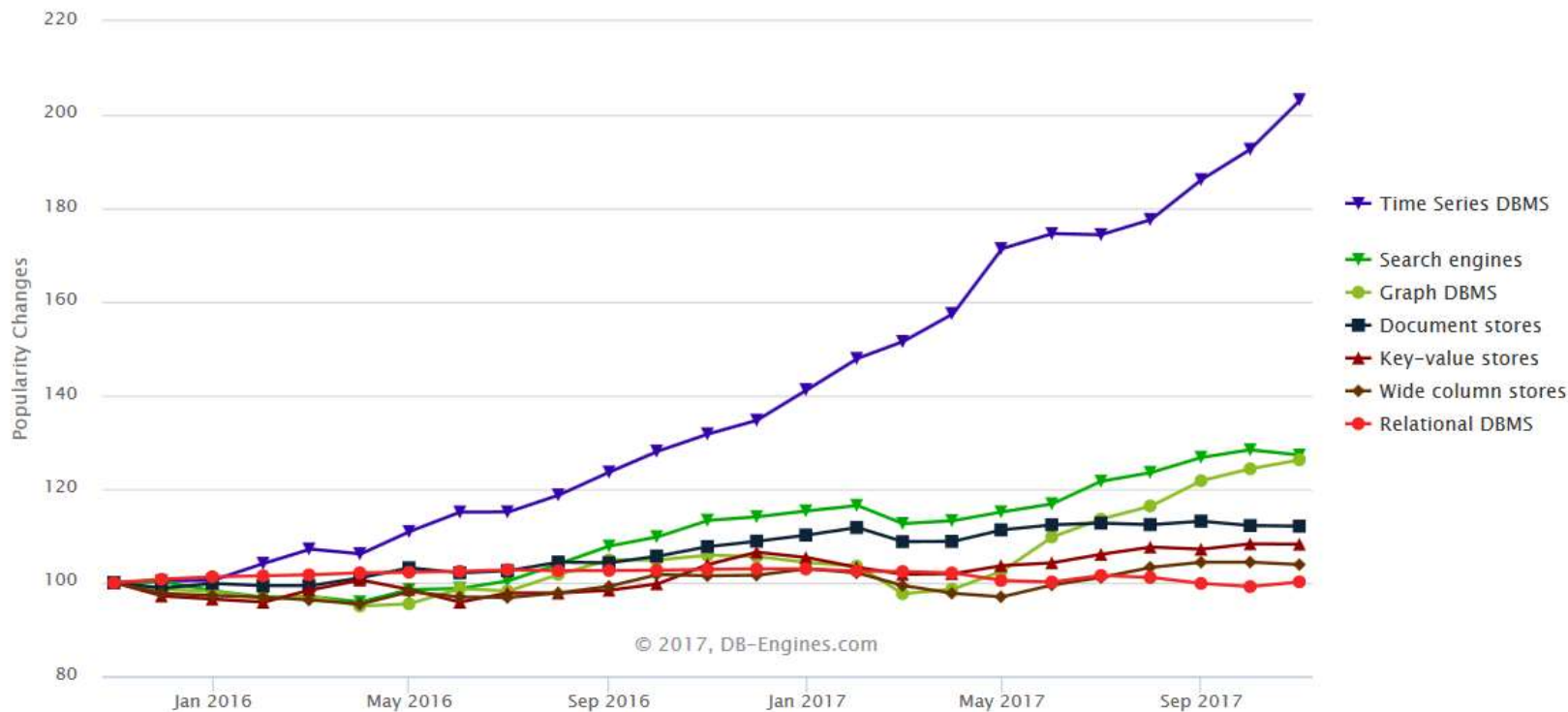


Source: Cisco IBSG





DBMS by model popularity



https://db-engines.com/en/ranking_categories

Сегодня

Вчера

Неделя

Месяц

Квартал

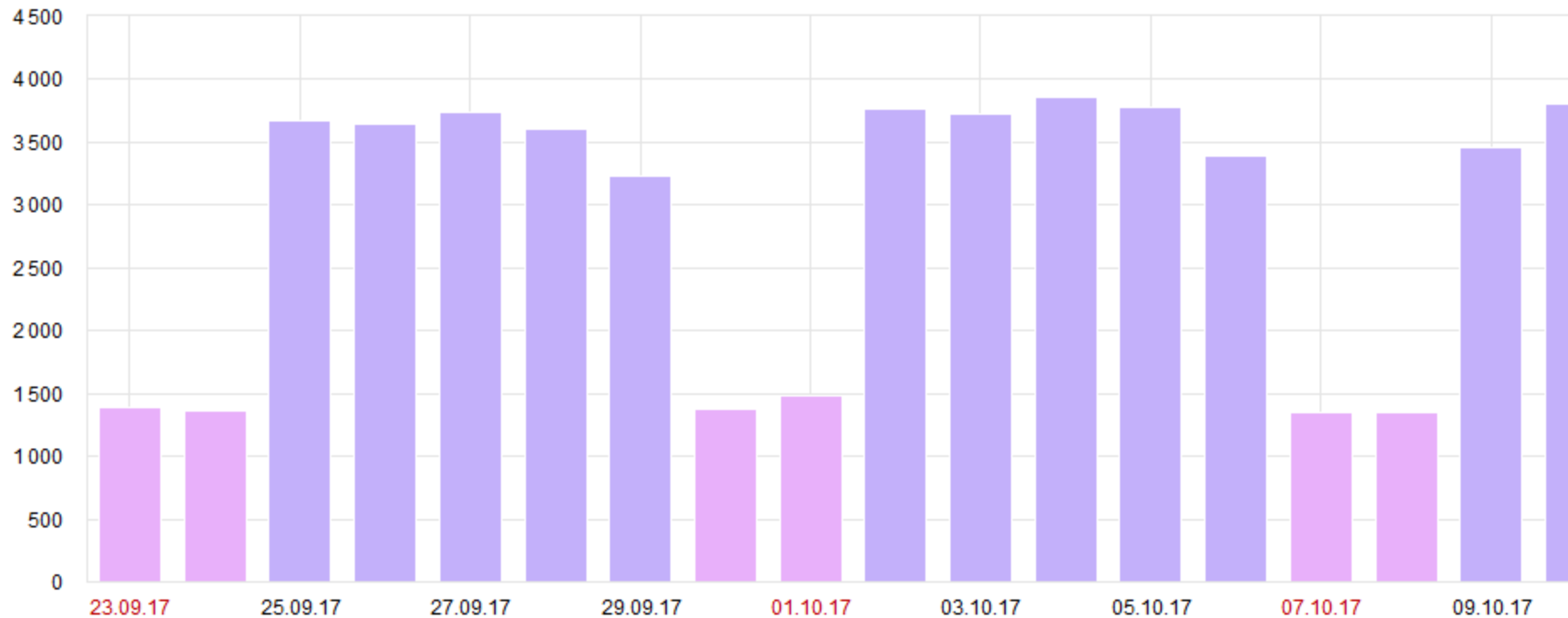
Год

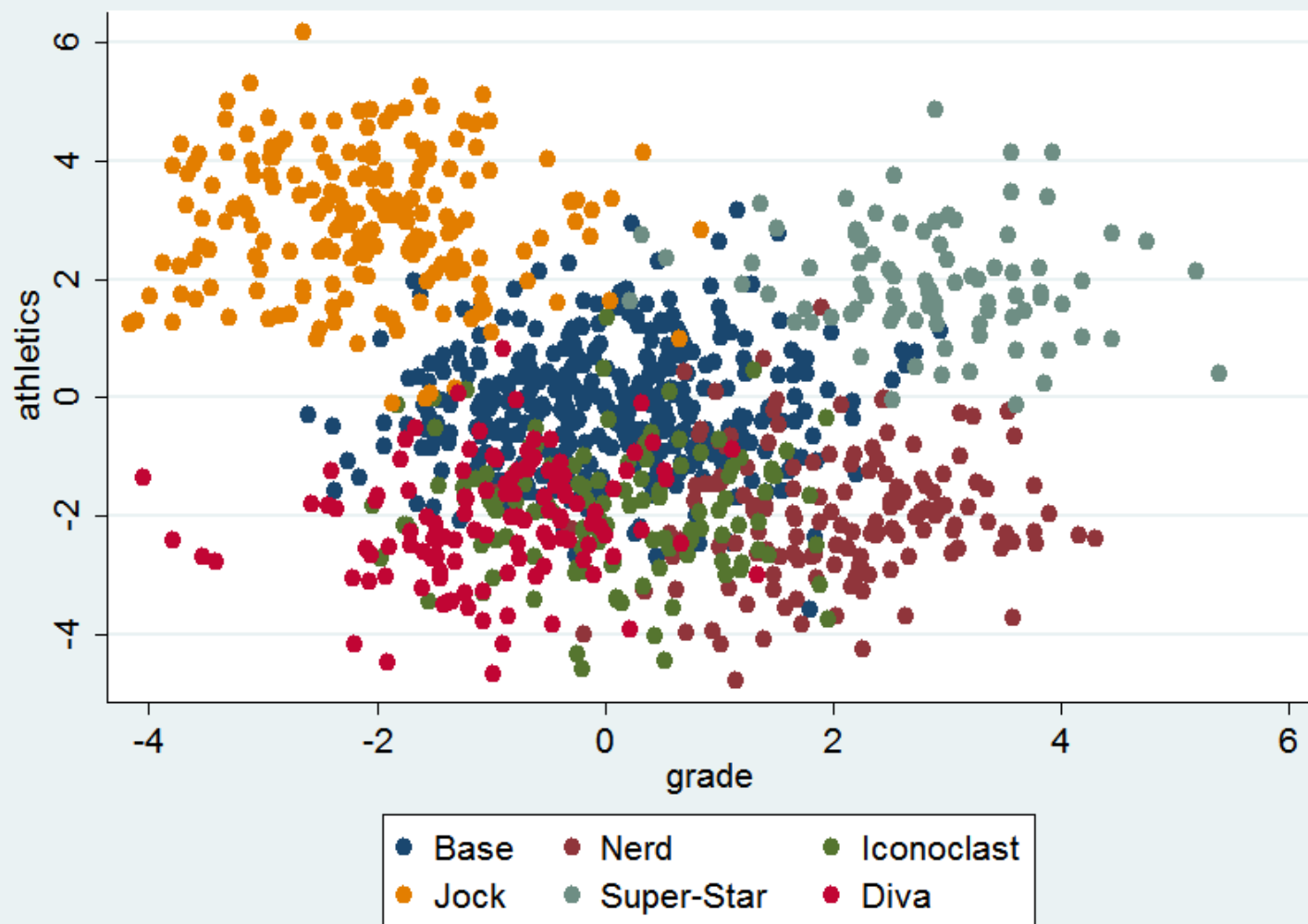


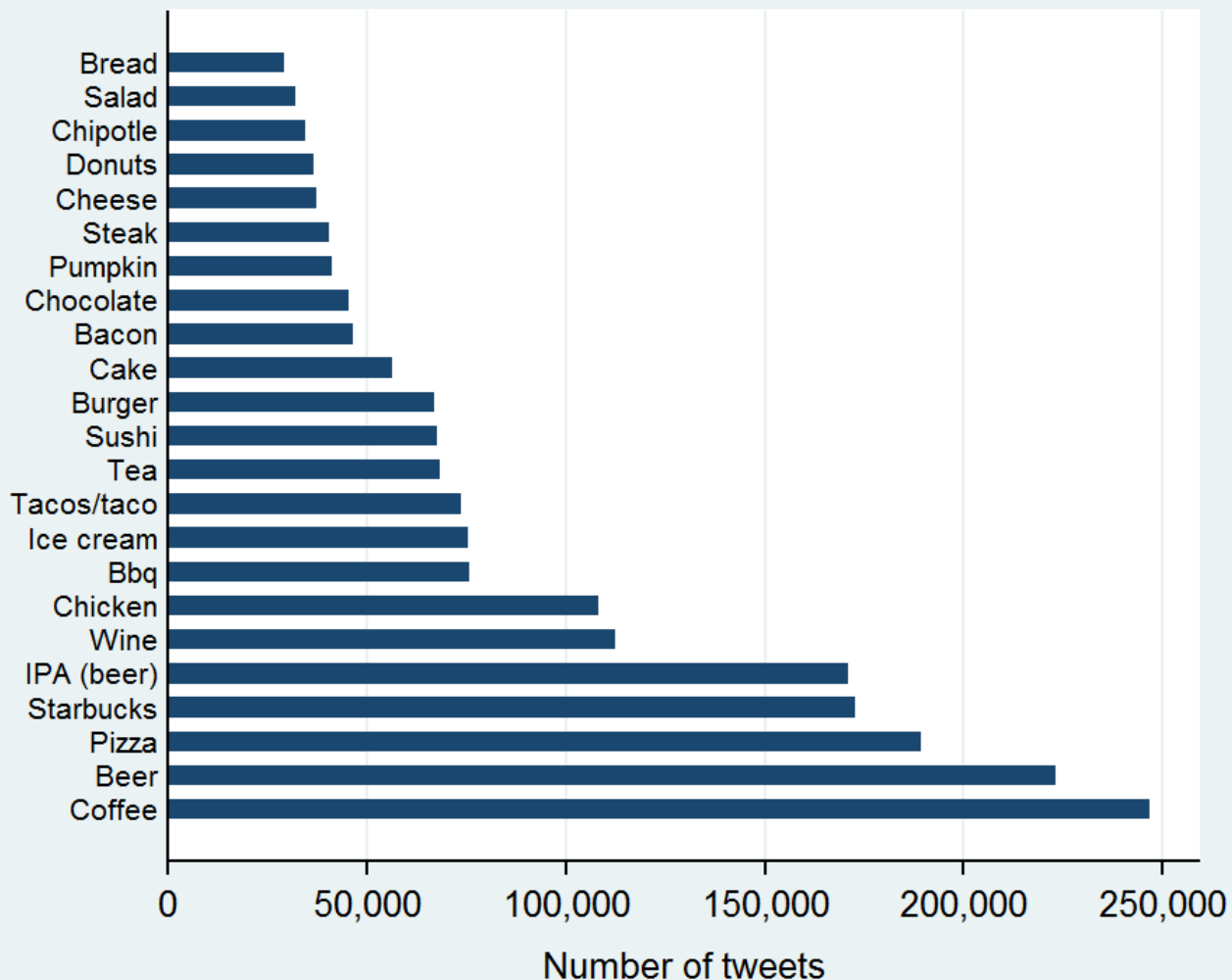
23 сен — 22 окт 2017

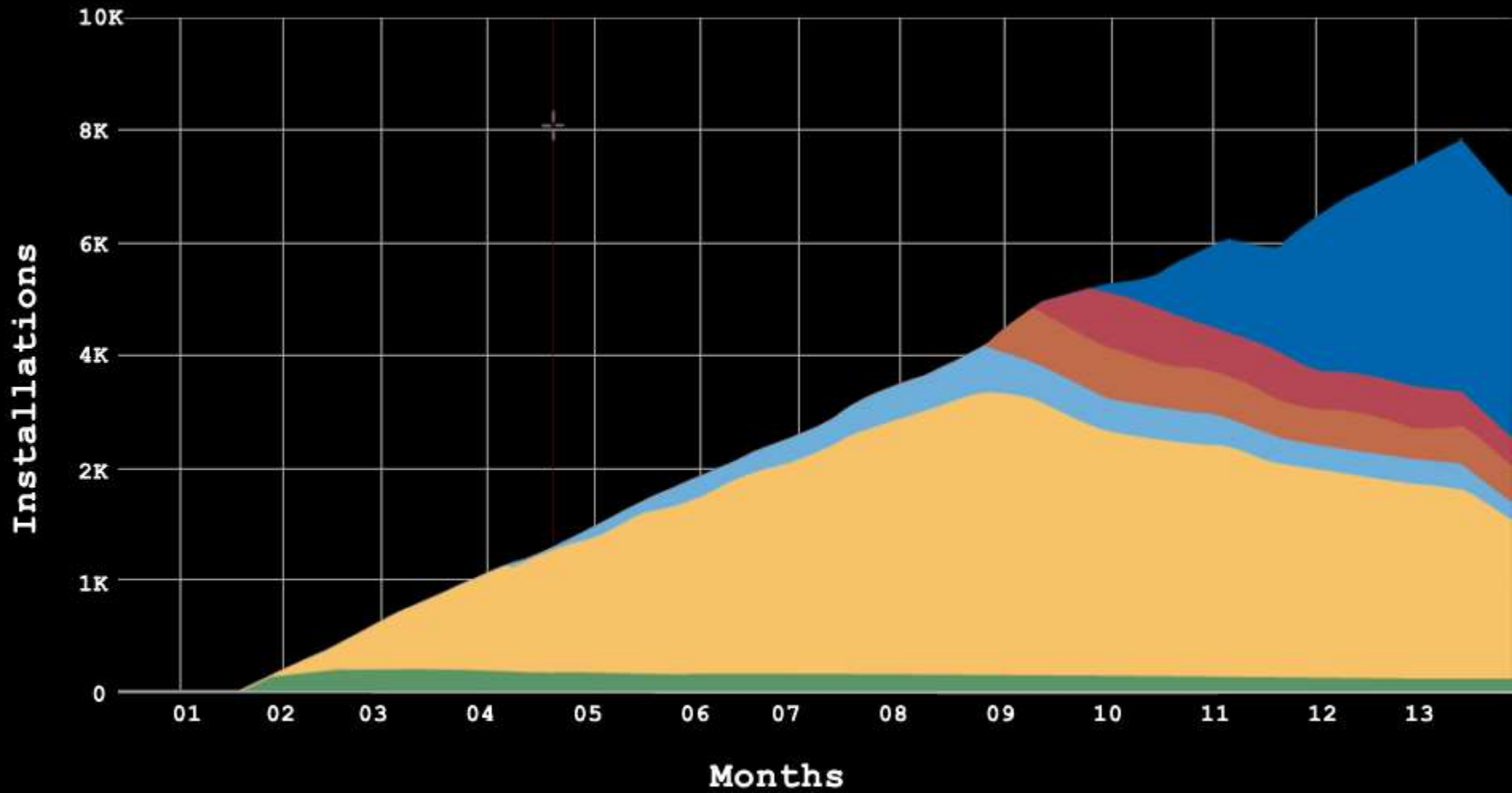
Детализация: по дням ▾

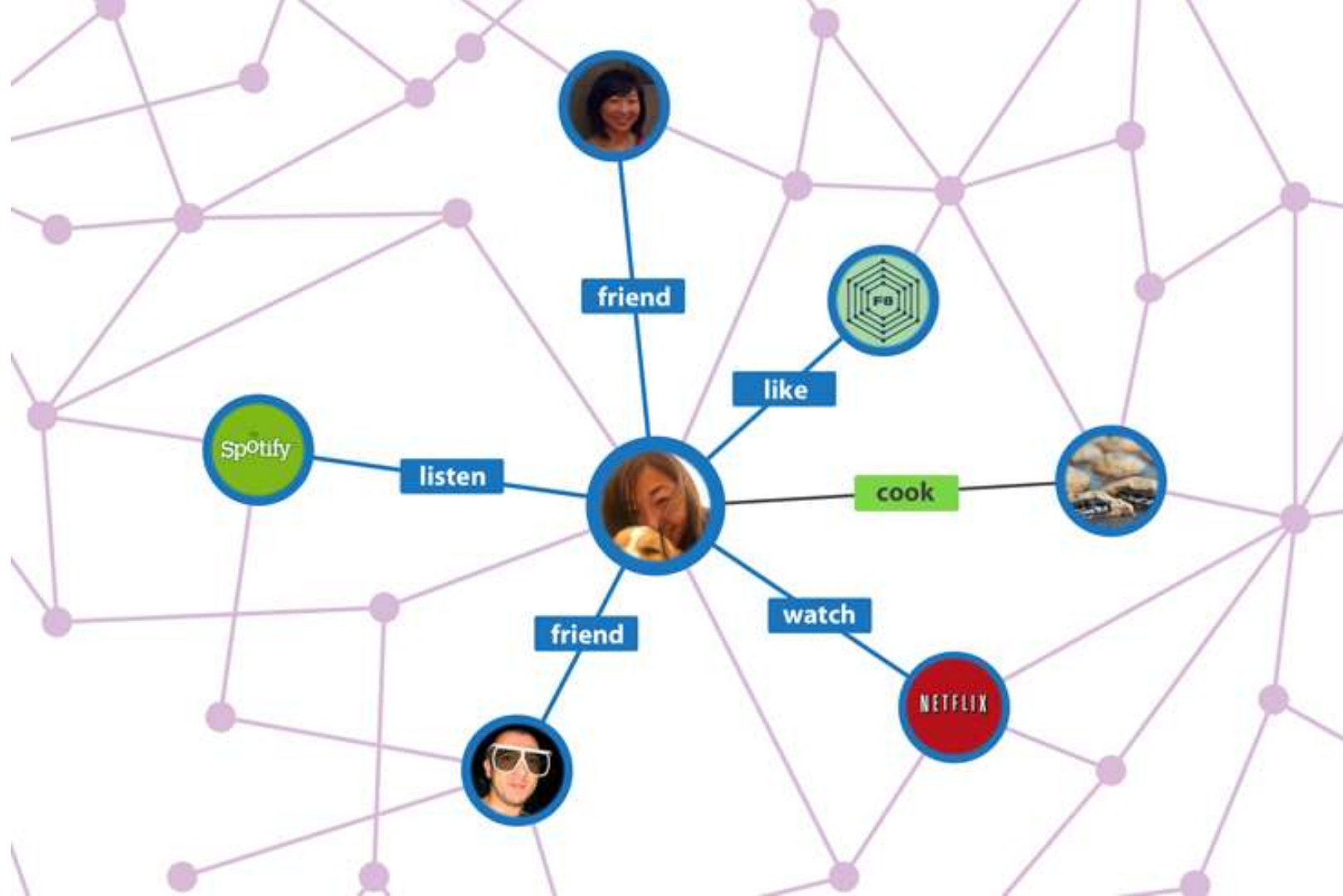
Визиты











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

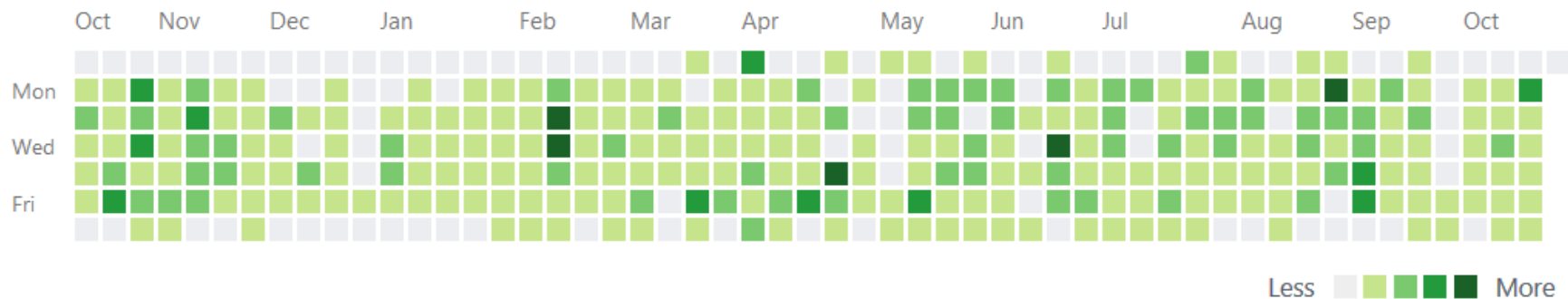
Low 78.22

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



*la***moda**

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



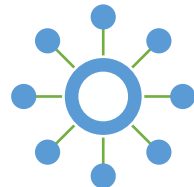
Primary Key

Tags



Indexed Column

Fields



Not Indexed Column

Time Series size

Network

Timestamp



DateTime

8 bytes

2017-11-12T06:42:17

Tags



string[]

≈ 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

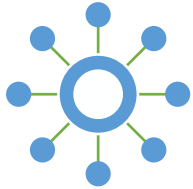
Timestamp



	<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

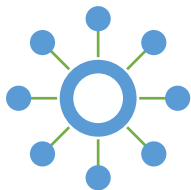
«We have found that about **96%** of all time stamps can be compressed to a **single bit**.»

Fields



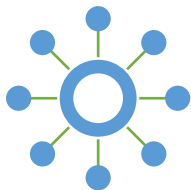
Decimal
15.5
14.0625
3.25
8.625

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»

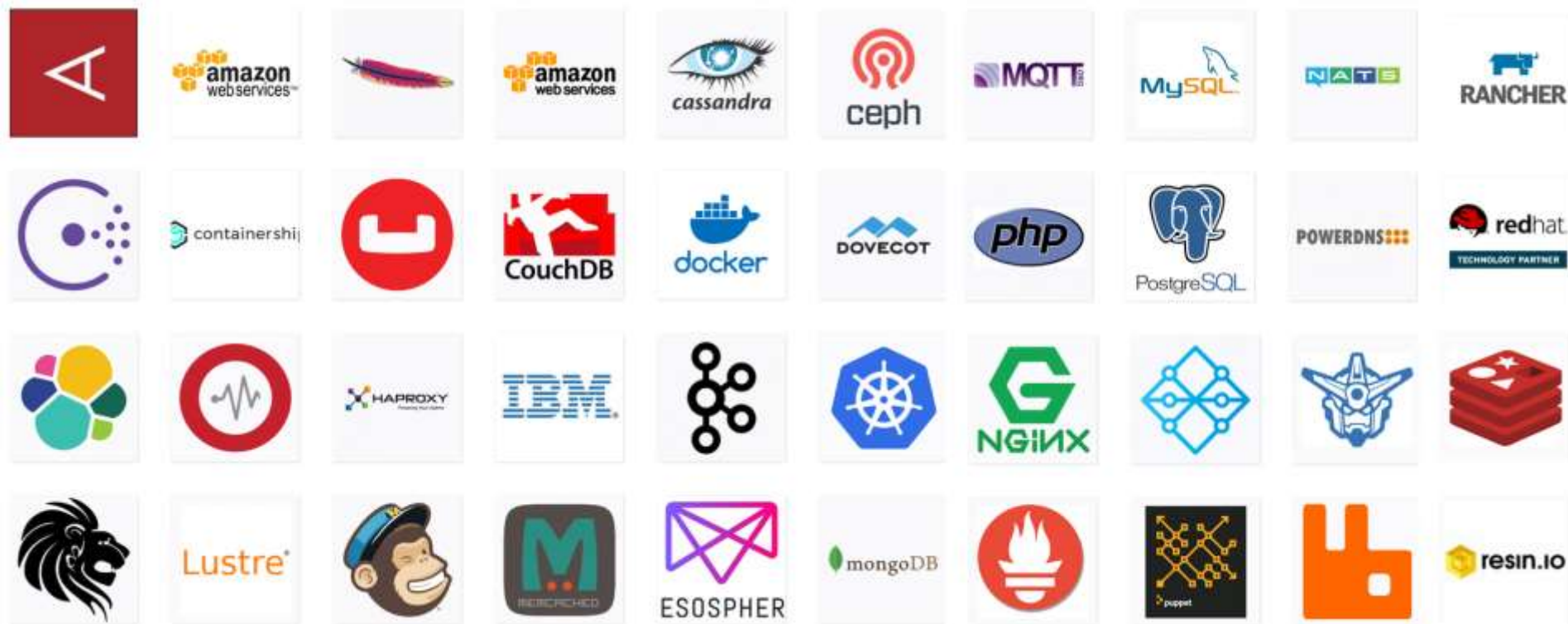
Time Series sources

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



Telegraf

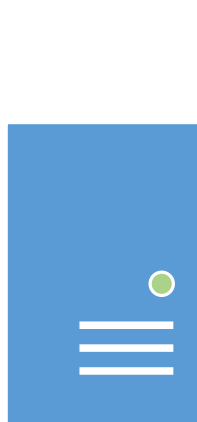
Telegraf Integrations



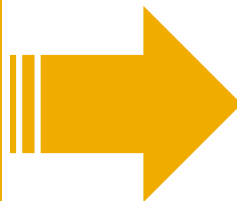
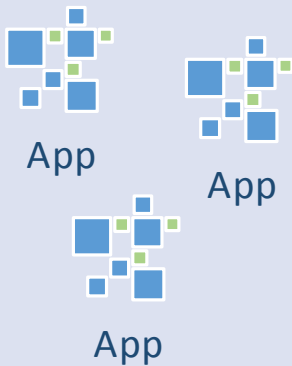
Demo powered by



Telegraf



Telegraf



Telegraf



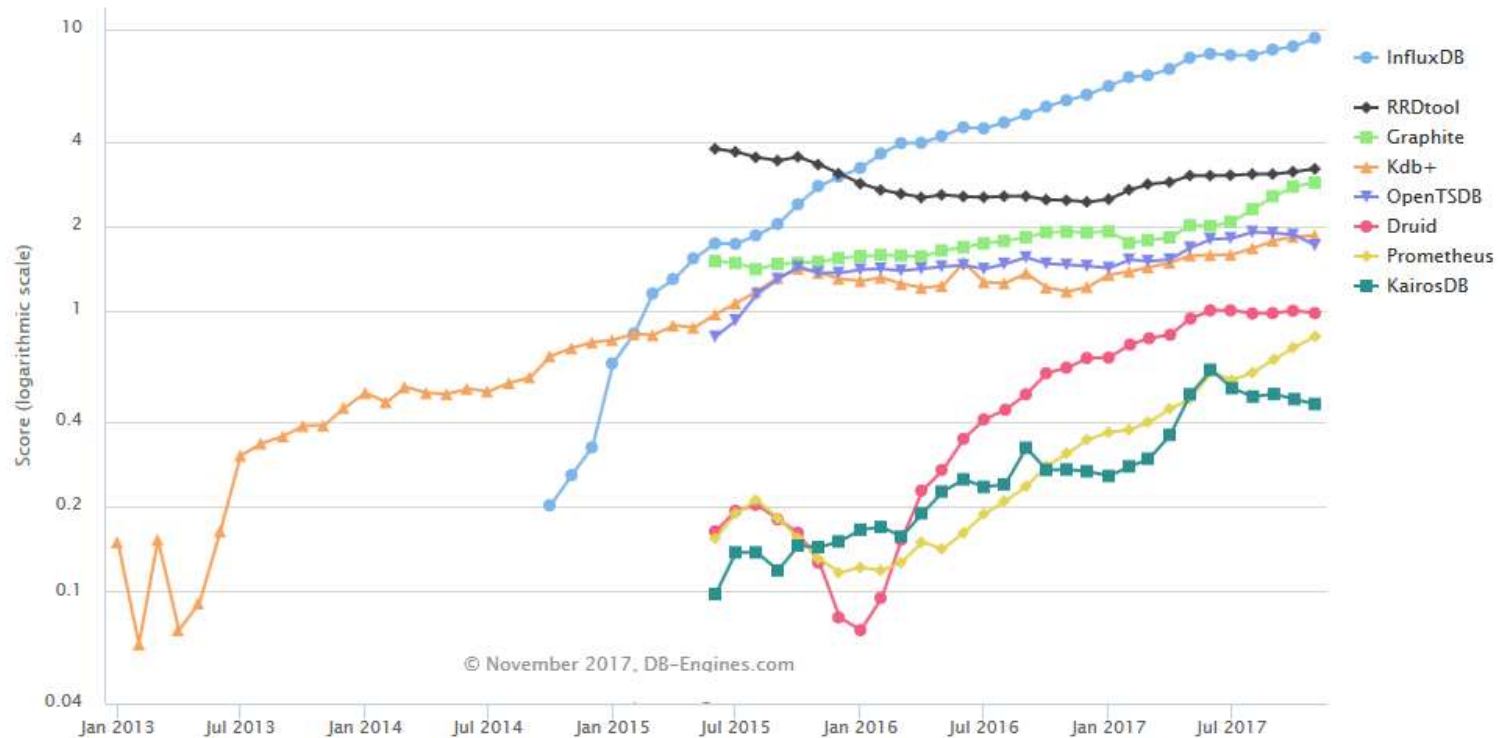
Telegraf





InfluxDB

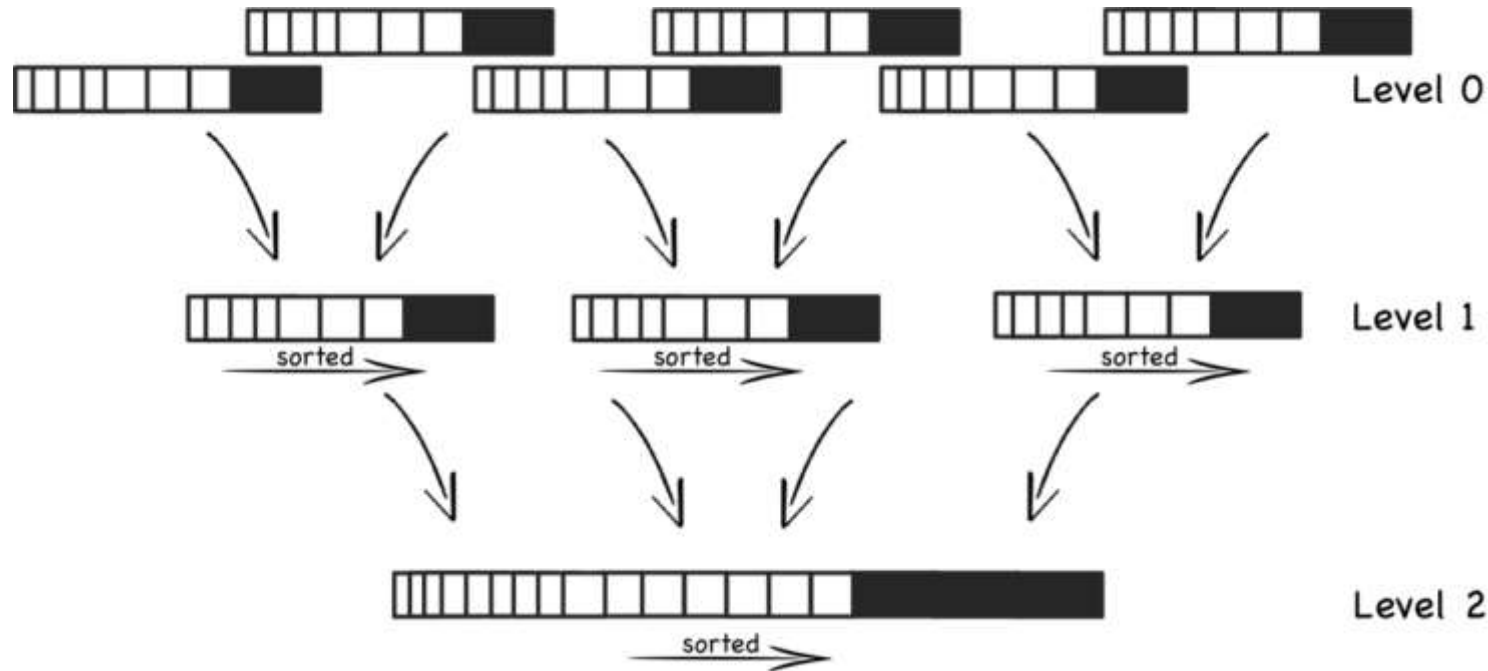
Time Series DBMS Popularity



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

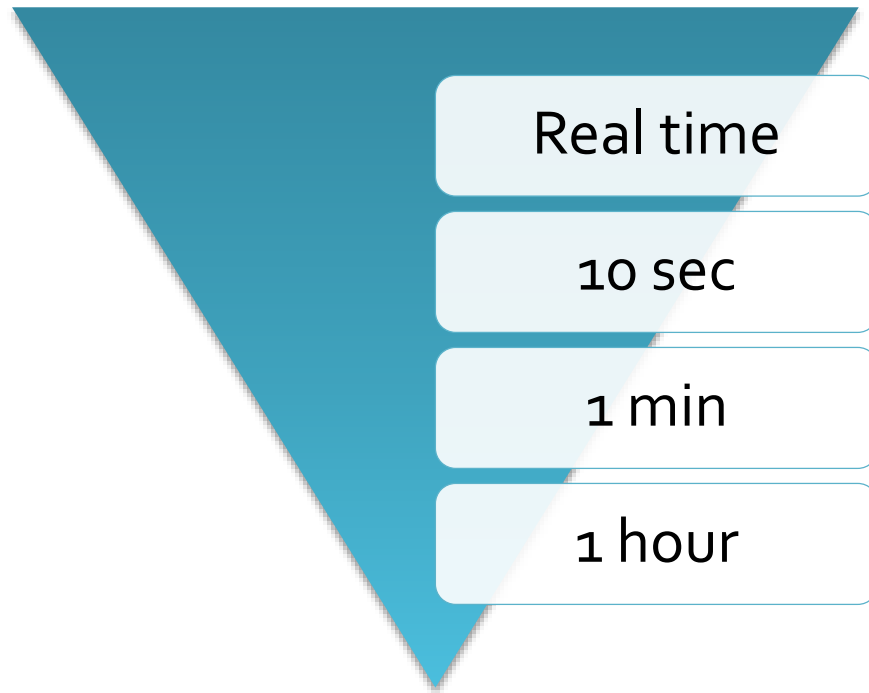
Time-structured merge-tree



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



OPENTSDDB



cassandra



mongoDB

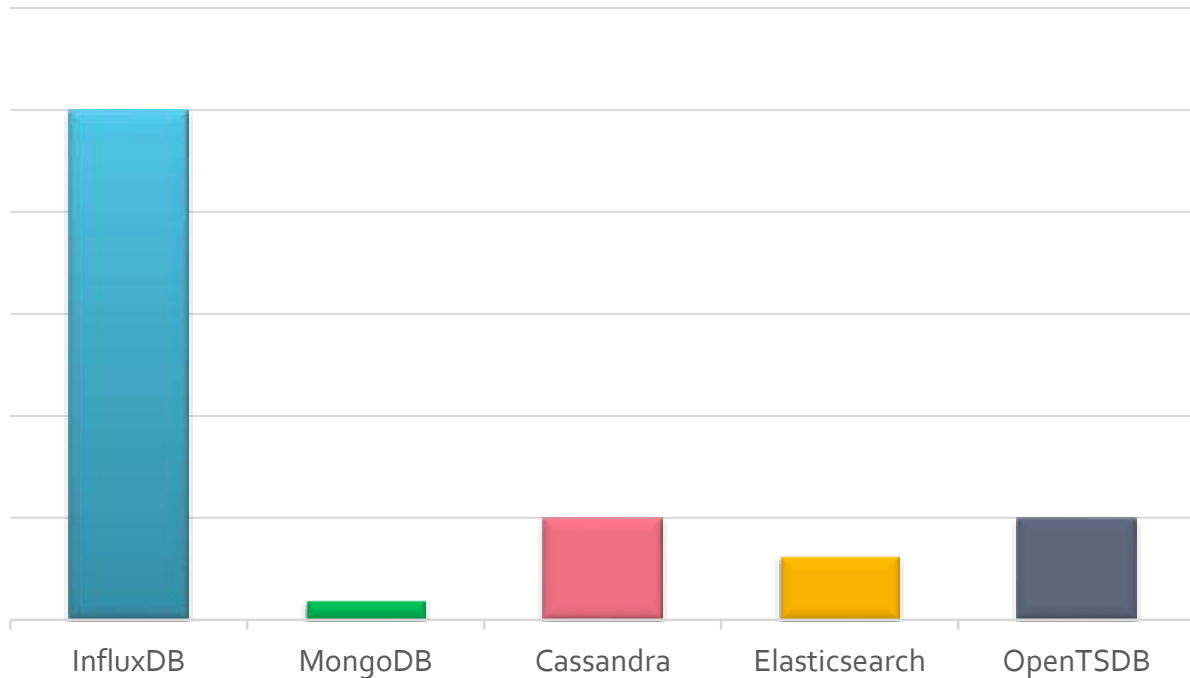


elasticsearch

Write Performance

InfluxDB outperformed:

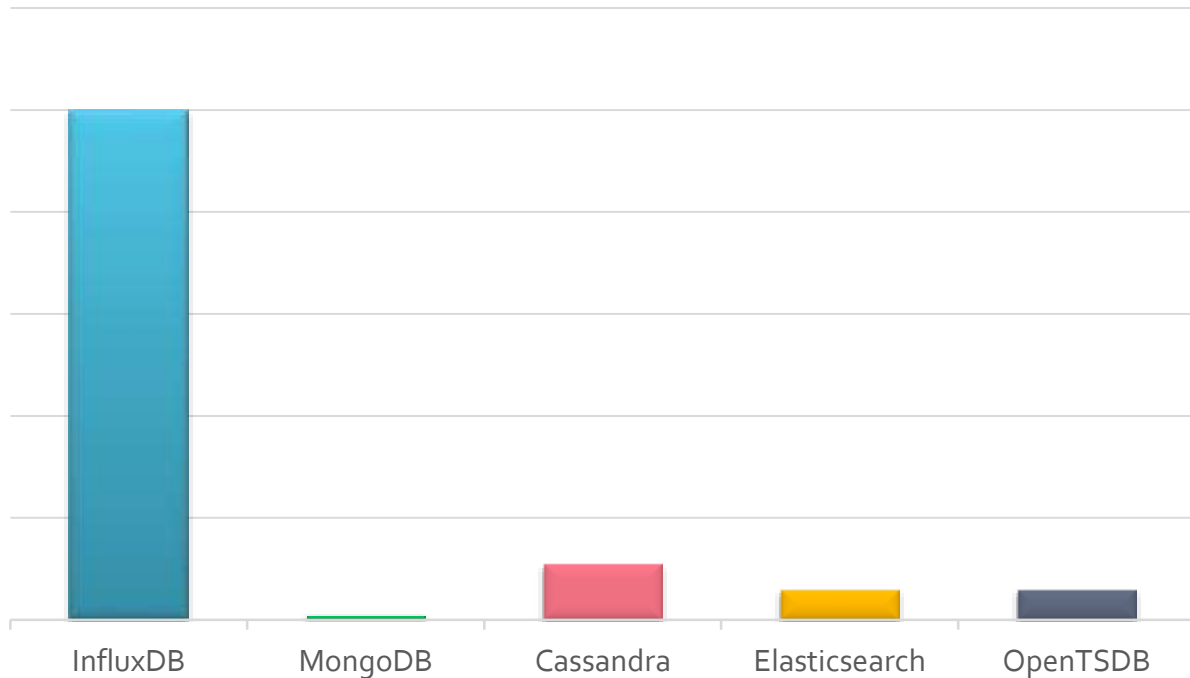
- MongoDB by **27x**
- Cassandra by **5x**
- Elasticsearch by **8x**
- OpenTSDB by **5x**



Compression

InfluxDB outperformed:

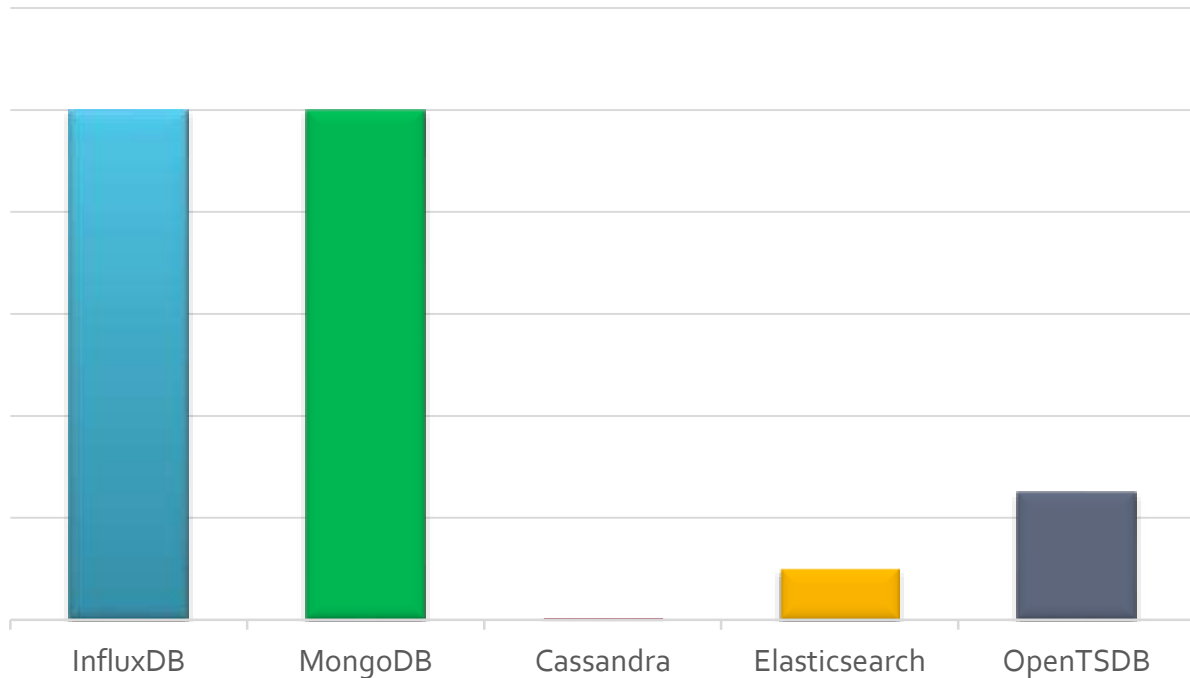
- MongoDB by **84x**
- Cassandra by **9x**
- Elasticsearch by **16x**
- OpenTSDB by **16x**



Query Performance

InfluxDB outperformed:

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



DEMO POWERED BY



APPMETRICS



InfluxDB
Grafana



First Step

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

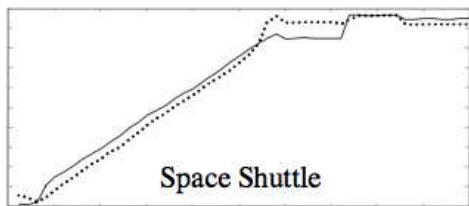
Demo powered by



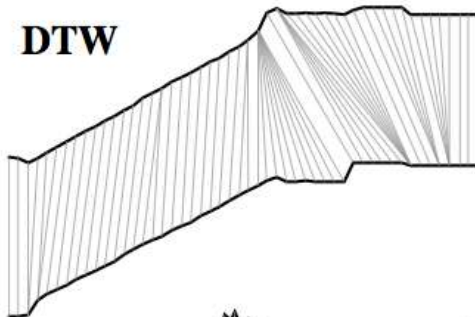
BenchmarkDotNet

Powerful .NET library for benchmarking

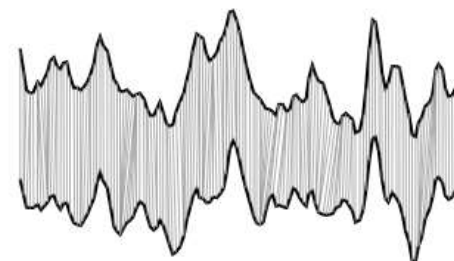
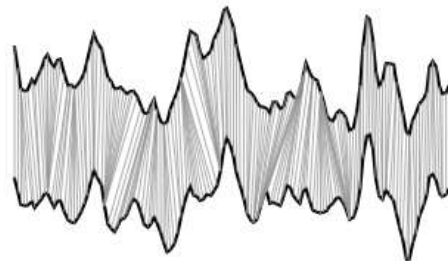
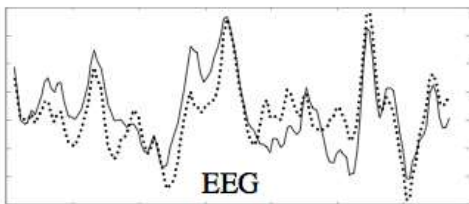
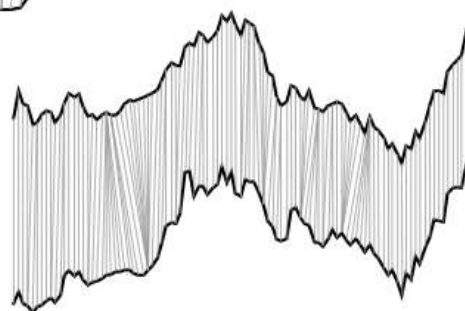
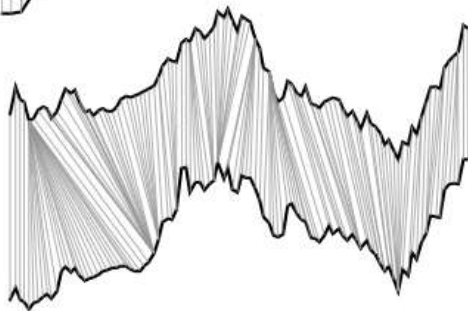
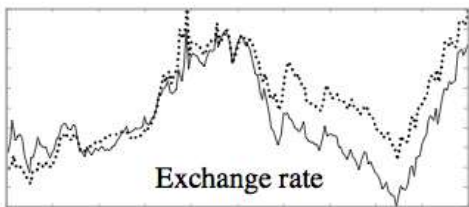
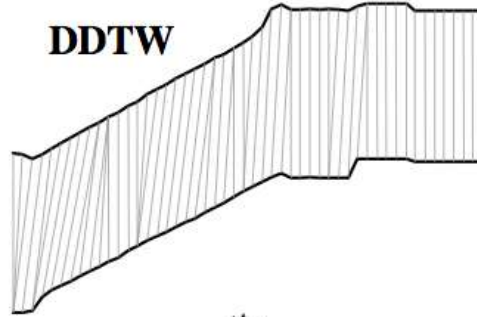




DTW



DDTW









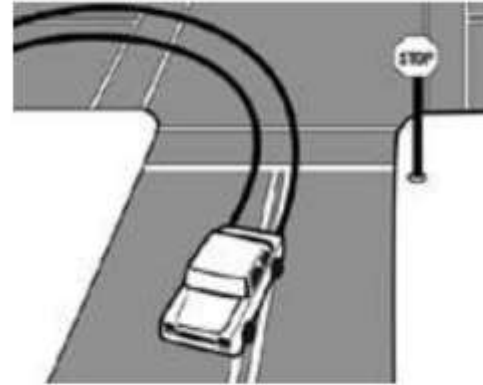
(a)weaving



(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

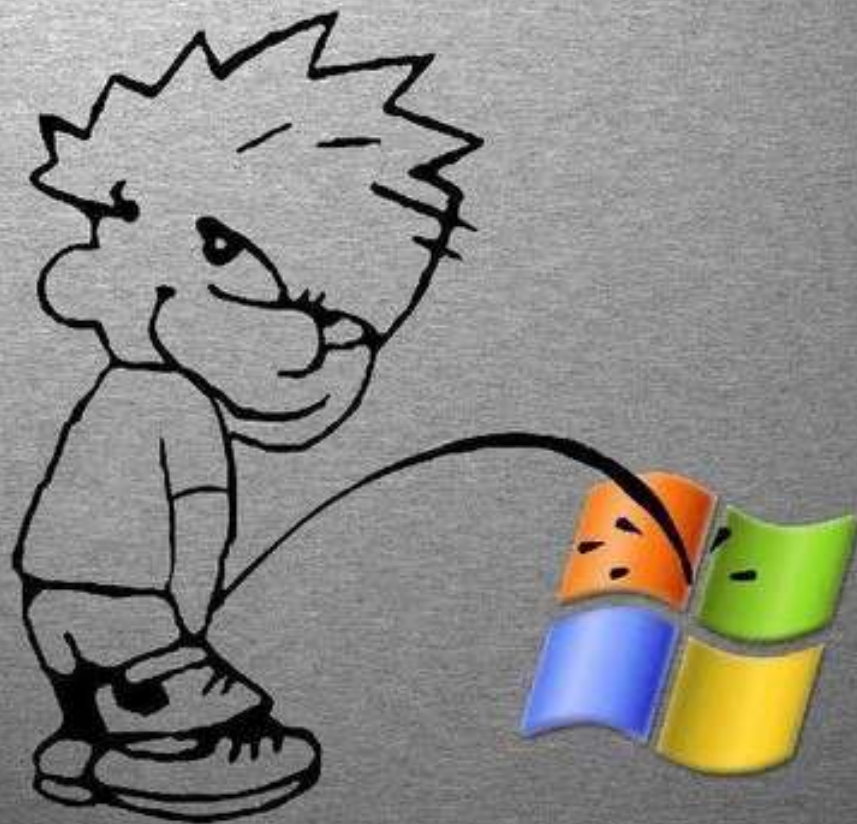
Kapacitor

Data processing
framework for:

- create alerts
- run ETL jobs
- detect anomalies

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





Realtime Analysis

High Loads

**Query and Write
performance**

Compression

High Throughput

Retention Policy



**Statistics and
Aggregation**

Downsampling

Continuous Queries

Realtime Analysis

High Loads

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Downsampling

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Realtime Analysis

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Realtime Analysis

High Loads

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Retention Policy



Realtime Analysis

High Loads

Compression



Realtime Analysis

High Loads



Realtime Analysis







PostgreSQL



elastic



splunk>

graylog



Resources

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

Resources

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

Resources

- Anatoly.Kulakov@outlook.com
- twitter.com/KulakovT
- github.com/AnatolyKulakov
- SpbDotNet.org

