

Time series

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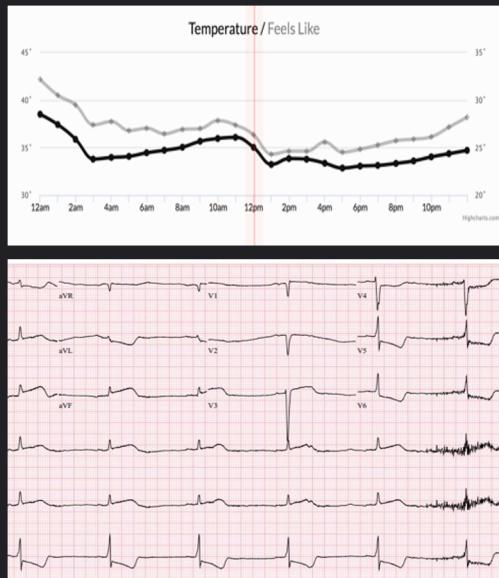
Founder & CEO @ Quantia Consulting



What are time series?

Let's start by example

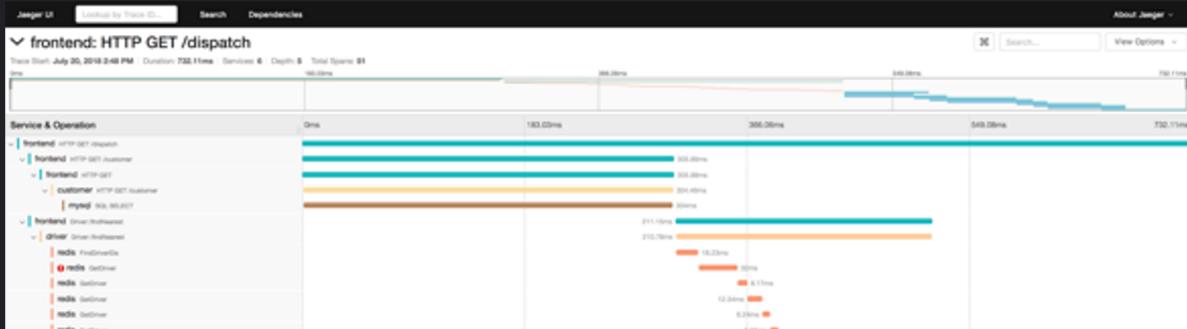
- Weather conditions
- Stock exchange
- Cluster monitoring
- Healthcare



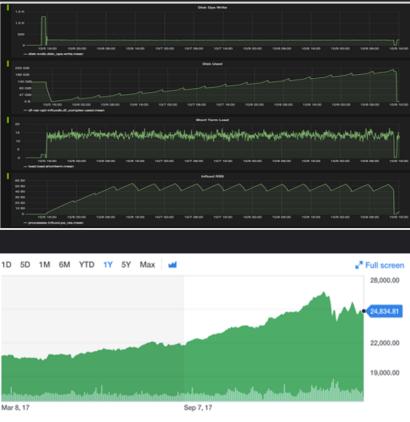
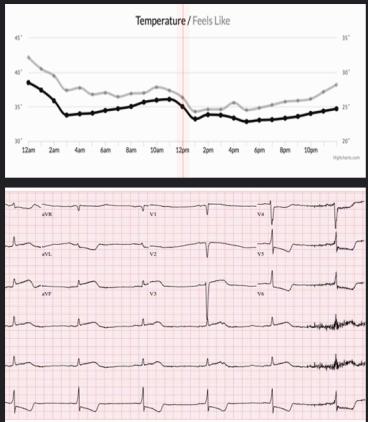
Now some different type of time series

- Logs
- Traces

```
Jun 24 13:45:36 haproxy epo-http.txt ix-eve-w2-02.ix.netcom.com [30:01:46:50] "GET /logos/small_gopher.gif HTTP/1.0" 200 935
Jun 24 13:45:38 haproxy epo-http.txt dd14-034.compuserve.com [30:01:46:54] "GET /logos/small_ftp.gif HTTP/1.0" 200 124
Jun 24 13:45:40 haproxy epo-http.txt ix-eve-w2-02.ix.netcom.com [30:01:46:55] "GET /docs/EPA-WASTE/1994/October/Day-05 HTTP/1.0" 302 -
Jun 24 13:45:40 haproxy epo-http.txt dd14-034.compuserve.com [30:01:46:56] "GET /icons/book.gif HTTP/1.0" 200 156
Jun 24 13:45:41 haproxy epo-http.txt ix-eve-w2-02.ix.netcom.com [30:01:46:56] "GET /EPA-WASTE/1994/October/Day-05/ HTTP/1.0" 200 623
Jun 24 13:45:42 haproxy epo-http.txt dd14-034.compuserve.com [30:01:46:58] "GET /logos/us-flag.gif HTTP/1.0" 200 2788
Jun 24 13:45:43 haproxy epo-http.txt ix-eve-w2-02.ix.netcom.com [30:01:47:12] "GET /docs/EPA-WASTE/1994/October/Day-03 HTTP/1.0" 302 -
Jun 24 13:45:45 haproxy epo-http.txt ix-eve-w2-02.ix.netcom.com [30:01:47:14] "GET /EPA-WASTE/1994/October/Day-03/ HTTP/1.0" 200 785
Jun 24 13:45:46 haproxy epo-http.txt dd14-034.compuserve.com [30:01:47:19] "GET /icons/ok2-0.gif HTTP/1.0" 200 231
Jun 24 13:45:48 haproxy epo-http.txt bettong.client.uq.oz.au [30:01:47:24] "GET /enviro/html/emci_overview.html HTTP/1.0" 200 2352
Jun 24 13:45:49 haproxy epo-http.txt bettong.client.uq.oz.au [30:01:47:31] "GET /enviro/gif/efacts.gif HTTP/1.0" 200 1367
Jun 24 13:45:50 haproxy epo-http.txt 202.96.29.111 [30:01:47:34] "GET /PressReleases/ HTTP/1.0" 200 1241
Jun 24 13:45:51 haproxy epo-http.txt bettong.client.uq.oz.au [30:01:47:37] "GET /enviro/gif/blueball.gif HTTP/1.0" 200 983
Jun 24 13:45:53 haproxy epo-http.txt ix-eve-w2-02.ix.netcom.com [30:01:47:37] "GET /Rules.html HTTP/1.0" 200 3273
Jun 24 13:45:53 haproxy epo-http.txt 202.96.29.111 [30:01:47:38] "GET /icons/circle_logo_small.gif HTTP/1.0" 200 2624
Jun 24 13:45:54 haproxy epo-http.txt 202.96.29.111 [30:01:48:04] "POST /cgi-bin/waispote/134.67.99.11=earth1.epo.gov~210/~usrl/comwais/indexes/PressReleases-gopher%40earth1-0.00:free HTTP/1.0" 200 3993
Jun 24 13:45:54 haproxy epo-http.txt 202.96.29.111 [30:01:48:16] "GET /waisicons/text.xbm HTTP/1.0" 200 527
Jun 24 13:45:55 haproxy epo-http.txt dd14-034.compuserve.com [30:01:48:22] "GET /Rules.html HTTP/1.0" 200 3273
```



What's the difference?



```
Jun 24 13:45:38 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:46:50] "GET /logos/small_laptop.gif HTTP/1.0" 200 935
Jun 24 13:45:38 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:46:54] "GET /logos/small_laptop.gif HTTP/1.0" 200 124
Jun 24 13:45:40 httpoxy epo-https.txt ix-eve-m2-02.ix.netcom.com [30:01:46:55] "GET /docs/EPA-MASTE/1994/October/Day-05 HTTP/1.0" 382 -
Jun 24 13:45:40 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:46:56] "GET /icons/book.gif HTTP/1.0" 200 156
Jun 24 13:45:42 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:46:58] "GET /logos/us-flag.gif HTTP/1.0" 200 2788
Jun 24 13:45:43 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:46:59] "GET /docs/EPA-MASTE/1994/October/Day-03 HTTP/1.0" 382 -
Jun 24 13:45:43 httpoxy epo-https.txt ix-eve-m2-02.ix.netcom.com [30:01:47:12] "GET /docs/EPA-MASTE/1994/October/Day-03 HTTP/1.0" 382 -
Jun 24 13:45:43 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:47:13] "GET /logos/usa-flag.gif HTTP/1.0" 200 785
Jun 24 13:45:44 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:47:14] "GET /icons/concept2.gif HTTP/1.0" 233 -
Jun 24 13:45:44 httpoxy epo-https.txt bettingo.client.uq.oz.au [30:01:47:24] "GET /enviro/html/enc/enc_overview.html HTTP/1.0" 200 2352
Jun 24 13:45:49 httpoxy epo-https.txt bettingo.client.uq.oz.au [30:01:47:33] "GET /enviro/gif/effects.gif HTTP/1.0" 200 1367
Jun 24 13:45:50 httpoxy epo-https.txt bettingo.client.uq.oz.au [30:01:47:34] "GET /enviro/gif/heart_beat.gif HTTP/1.0" 200 983
Jun 24 13:45:51 httpoxy epo-https.txt ix-eve-m2-02.ix.netcom.com [30:01:47:37] "GET /Rules.html HTTP/1.0" 3273
Jun 24 13:45:51 httpoxy epo-https.txt bettingo.client.uq.oz.au [30:01:47:37] "GET /enviro/gif/bluebell.gif HTTP/1.0" 200 2624
Jun 24 13:45:52 httpoxy epo-https.txt ix-eve-m2-02.ix.netcom.com [30:01:48:01] "POST /cgi-bin/wispsite/134.67.99.11-earth1.epo.gov/~218/~commas/indexes/PressReleases/gopher@earth1-0.0-free HTTP/1.0" 200 3993
Jun 24 13:45:54 httpoxy epo-https.txt 202.96.29.111 [30:01:48:04] "POST /cgi-bin/wispsite/134.67.99.11/~earth1.epo.gov/~218/~commas/indexes/PressReleases/gopher@earth1-0.0-free HTTP/1.0" 200 527
Jun 24 13:45:55 httpoxy epo-https.txt d0d14-034.compuserve.com [30:01:48:22] "GET /Rules.html HTTP/1.0" 200 3273
```

VS.



What's the difference?

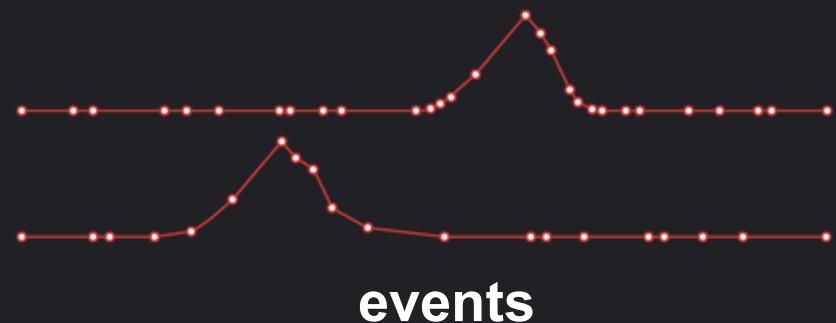
both of them are time series, but ...

We monitor the
phenomena
regular



The phenomena happen
and we observe them
irregular

VS.



Metrics	Events
<h2>Regular Time Series</h2> <hr/> <p>Measurements gathered at <i>regular</i> time intervals</p>	<h2>Irregular Time Series</h2> <hr/> <p>Measurements observed at <i>irregular</i> time intervals</p>

Summarization of Events

Events become regular time intervals, for example

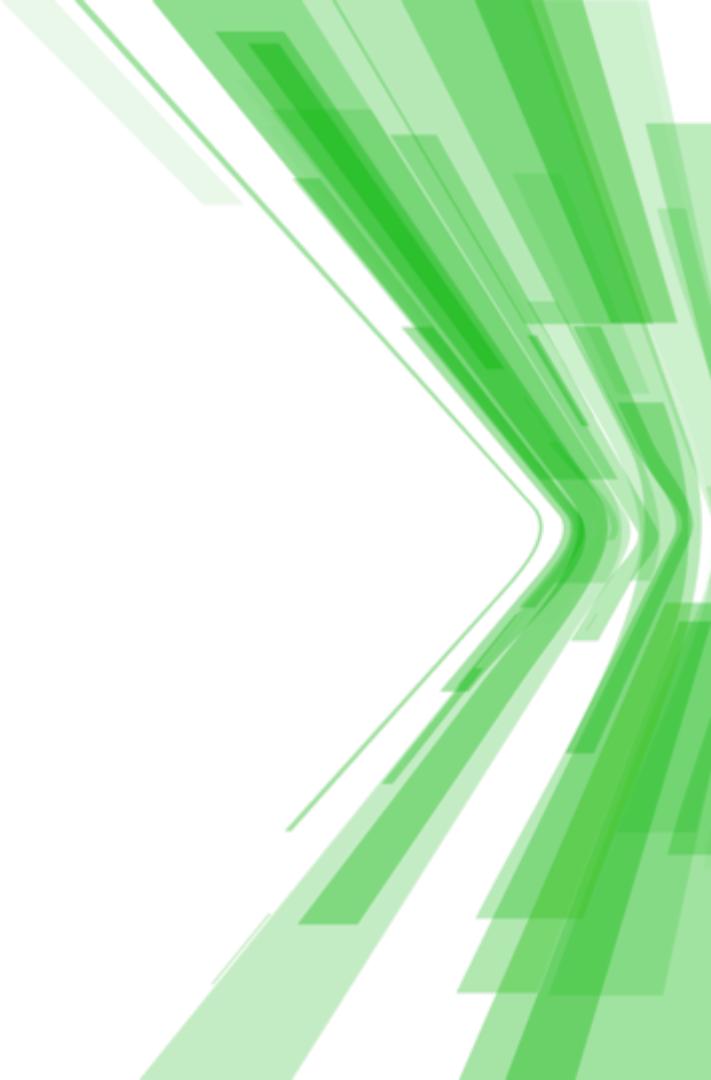
Summarizing the average trade price of Apple stock every 10 minutes over the course of a day

Summarizing the average response time for requests in an application over 1 minute intervals

Characteristics of the time series

- All Time-stamped data
- Generated in
 - regular (Metric) and
 - irregular (Event) time periods
- Huge volumes of data
- High variety of semi-structured data
- Real-time
- Time sensitive

Who uses time series and how?



Primary Use Cases

IoT

Industrial settings:
factories, oil & gas,
agriculture, smart roads
& infrastructure

Consumer: wearables,
consumer devices &
trackers

DevOps

**Custom monitoring
solutions to track**
servers, VMs,
applications, users or
events

Real-Time Analytics

Apps that instrument
business, social or
development metrics in
real-time

So what's a time series DB?

Time series DB

optimized for

- collecting
- storing
- retrieving
- processing
(historical and
real-time)

timestamped &
semi-structured data

Other DBs

Traditional relational

Databases optimized for storing and querying
structured data

Document databases

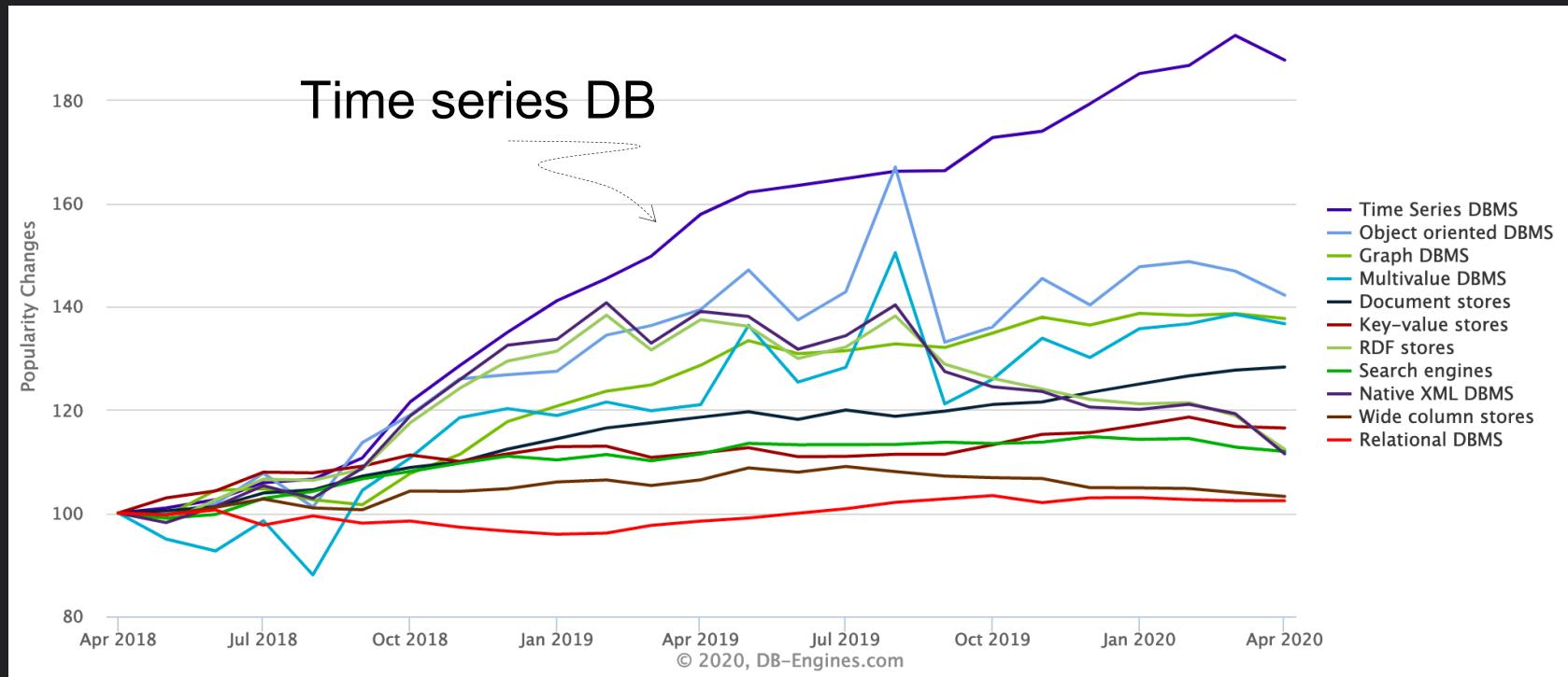
Optimized for storing and retrieving semi-structured
JSON documents

Search databases

Optimized for storing and retrieving unstructured
data (e.g., full-text searches)

The interest about time series data bases is growing

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





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