

Visualization of dCache accounting information with state-of-the-art Data Analysis Tools

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for DESY dCache operating Team

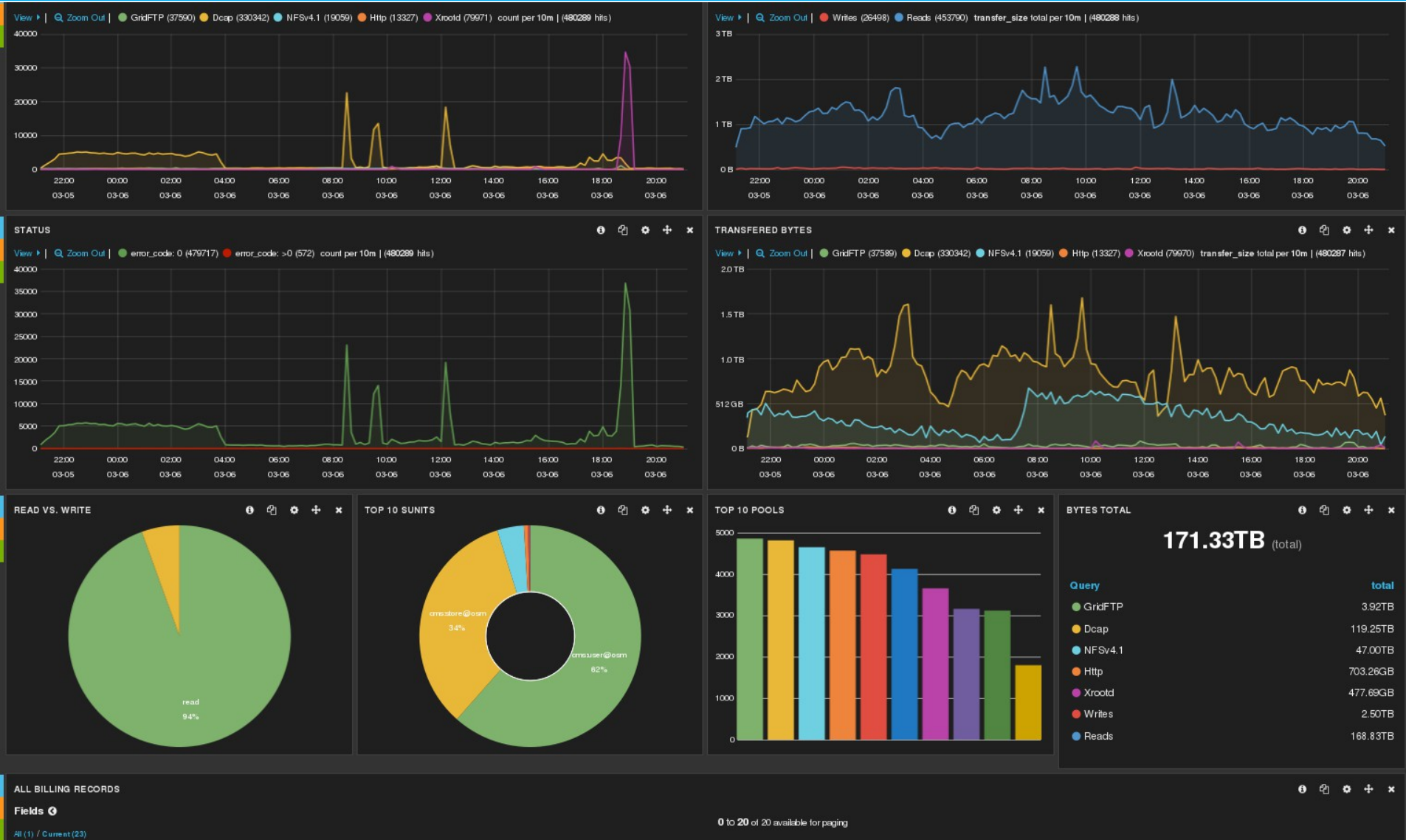


Outline

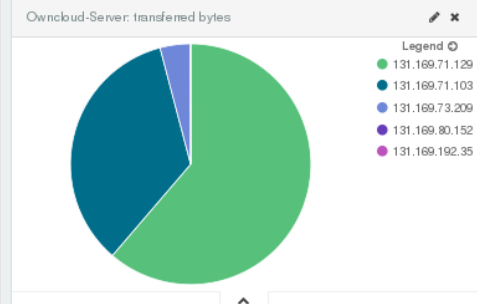
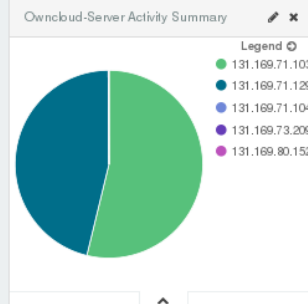
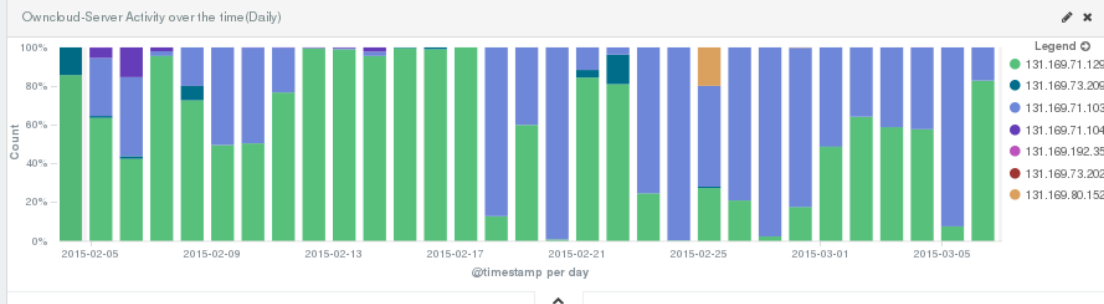
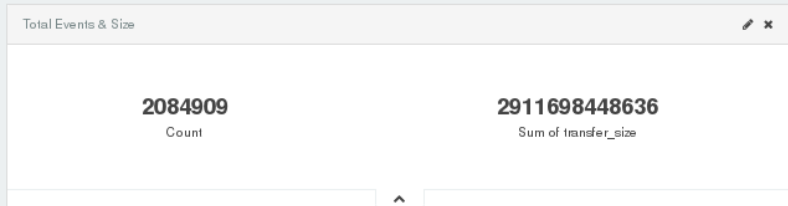
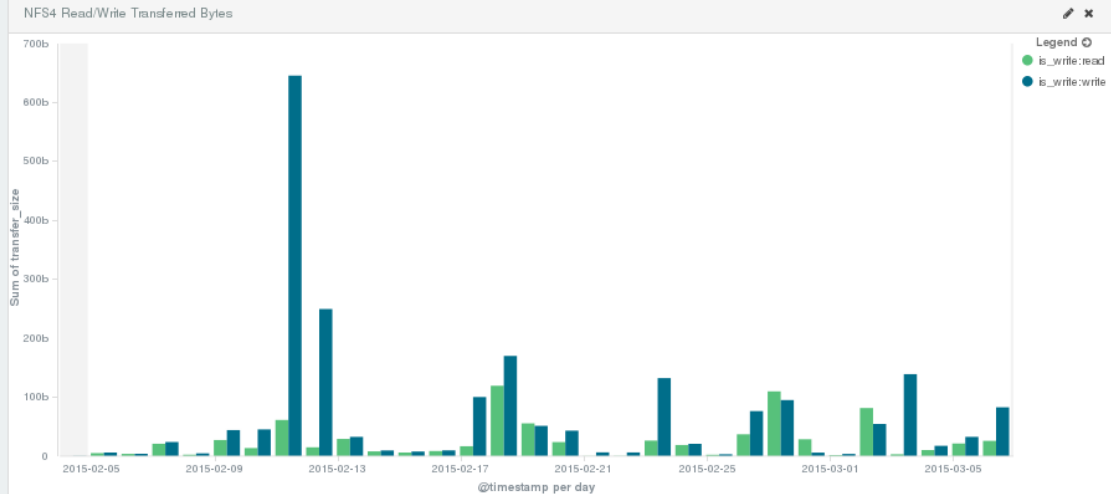
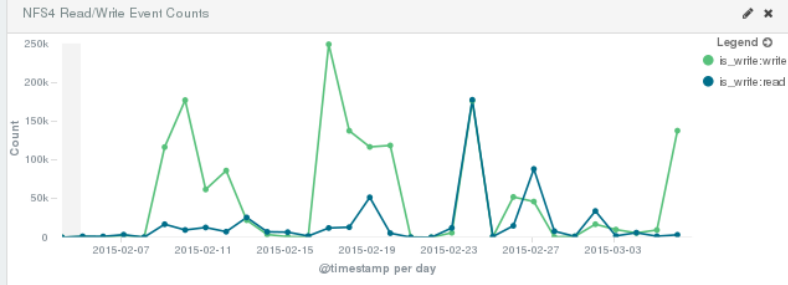
```
root@dcache-se-cloud01:~  
03.06 08:00:08 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":0:0:131.169.73.209] [0000DD58A17B379487FA36837C905C30916,242812942] [/  
] dcache:replica@osm 3308 0 {0:""}  
03.06 08:00:25 [pool:dcache-cloud05-03:transfer] [0000DD58A17B379487FA36837C905C30916,242812942] [Unknown] dcache:replica@osm 242812942 96  
7 false {Http-1.1:dcache-cloud03.desy.de:0:dcache-cloud03-01:dcache-cloud03-01Domain:/0000DD58A17B379487FA36837C905C30916} [pool:dcache-cl  
oud03-01@dcache-cloud03-01Domain] {0:""}  
03.06 08:14:34 [pool:dcache-cloud05-07@dcache-cloud05-07Domain:remove] [00009FF450A8F02246A284E969D66C64D64E,4472832] [Unknown] dcache:repl  
ica@osm {0:""}  
03.06 08:14:34 [pool:dcache-cloud05-07:transfer] [00009FF450A8F02246A284E969D66C64D64E,4472832] [/] dcache:replica@osm 4472832 44428570 tru  
e {NFS4-4.1:131.169.71.129:690} [door:NFS-dcache-dir-cloud01:AAUQjxeRIGA:1425581645308001] {10027:"Abandoned mover"}  
03.06 08:14:34 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.129] [00009FF450A8F02246A284E969D66C64D64E,0] [/] dca  
che:replica@osm 44428717 0 {10027:""}  
03.06 08:23:48 [pool:dcache-cloud03-08:transfer] [0000C8DC13A531794A998524CC24135FD76A,441013] [/] dcache:replica@osm 441013 1029 false {NF  
S4-4.1:131.169.71.129:817} [door:NFS-dcache-dir-cloud01:AAUqmZC01KA:1425626627364001] {0:""}  
03.06 08:23:48 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.129] [0000C8DC13A531794A998524CC24135FD76A,441013] [/  
] dcache:replica@osm 1058 0 {0:""}  
03.06 08:23:49 [pool:dcache-cloud03-05:transfer] [0000DD37B05D661F4CA7BD1C25CA221052E7,924] [/] dcache:replica@osm 924 1005 true {NFS4-4.1:  
131.169.71.129:817} [door:NFS-dcache-dir-cloud01:AAUqmZDLEAg:1425626628821001] {0:""}  
03.06 08:23:49 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.129] [0000DD37B05D661F4CA7BD1C25CA221052E7,924] [/] dc  
ache:replica@osm 1050 0 {0:""}  
03.06 08:24:17 [pool:dcache-cloud03-05:transfer] [0000DD37B05D661F4CA7BD1C25CA221052E7,924] [Unknown] dcache:replica@osm 924 28 false {Http  
-1.1:dcache-cloud05.desy.de:0:dcache-cloud05-04:dcache-cloud05-04Domain:/0000DD37B05D661F4CA7BD1C25CA221052E7} [pool:dcache-cloud05-04@dcac  
he-cloud05-04Domain] {0:""}  
03.06 08:24:32 [pool:dcache-cloud03-07:transfer] [00001ABED8CC572646A4AF38F6113C9C2BB0,42335] [/] dcache:replica@osm 42335 1005 false {NFS4  
-4.1:131.169.71.129:817} [door:NFS-dcache-dir-cloud01:AAUqmZNWQxA:1425626671498001] {0:""}  
03.06 08:24:32 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.129] [00001ABED8CC572646A4AF38F6113C9C2BB0,42335] [/  
] dcache:replica@osm 1034 0 {0:""}  
03.06 09:06:38 [pool:dcache-cloud06-03:transfer] [00009B4F74F9CD964C05B02D002B74C2FC9A,2174] [/] dcache:replica@osm 2174 16 false {NFS4-4.1  
:131.169.71.103:944} [door:NFS-dcache-dir-cloud01:AAUqminuJFA:1425629198034001] {0:""}  
03.06 09:06:38 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.103] [00009B4F74F9CD964C05B02D002B74C2FC9A,2174] [/] d  
cache:replica@osm 42 0 {0:""}  
03.06 09:07:40 [pool:dcache-cloud03-07:transfer] [0000B2DC64D153D349F7AC1DBF1F6618B889,25738] [/] dcache:replica@osm 25738 17 false {NFS4-4  
.1:131.169.71.129:817} [door:NFS-dcache-dir-cloud01:AAUqmi2r59A:1425629260802001] {0:""}  
03.06 09:07:40 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.129] [0000B2DC64D153D349F7AC1DBF1F6618B889,25738] [/  
] dcache:replica@osm 40 0 {0:""}  
03.06 09:07:42 [pool:dcache-cloud05-07:transfer] [000081CC3D17C4E2440183EE1300DC1879C9,172413] [/] dcache:replica@osm 172413 1022 false {NF  
S4-4.1:131.169.71.129:817} [door:NFS-dcache-dir-cloud01:AAUqmi2vQzA:1425629261022001] {0:""}  
03.06 09:07:42 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.129] [000081CC3D17C4E2440183EE1300DC1879C9,172413] [/  
] dcache:replica@osm 1043 0 {0:""}  
03.06 09:07:43 [pool:dcache-cloud05-08:transfer] [0000B4A92533AC9B408A84D164FC2281CDFD,207592] [/] dcache:replica@osm 207592 1019 false {NF  
S4-4.1:131.169.71.129:817} [door:NFS-dcache-dir-cloud01:AAUqmi3D1lA:1425629262354001] {0:""}  
03.06 09:07:43 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.129] [0000B4A92533AC9B408A84D164FC2281CDFD,207592] [/  
] dcache:replica@osm 1040 0 {0:""}  
03.06 09:09:17 [pool:dcache-cloud03-08:transfer] [0000A9C0D1BB5BD04A318EA27DDA15FC1706,47969687] [/] dcache:replica@osm 48797079 151942 fal  
se {NFS4-4.1:131.169.71.103:944} [door:NFS-dcache-dir-cloud01:AAUqmiphd8A:1425629205592001] {0:""}  
03.06 09:09:17 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [":48:48:131.169.71.103] [0000A9C0D1BB5BD04A318EA27DDA15FC1706,47969687] [/  
]:█
```



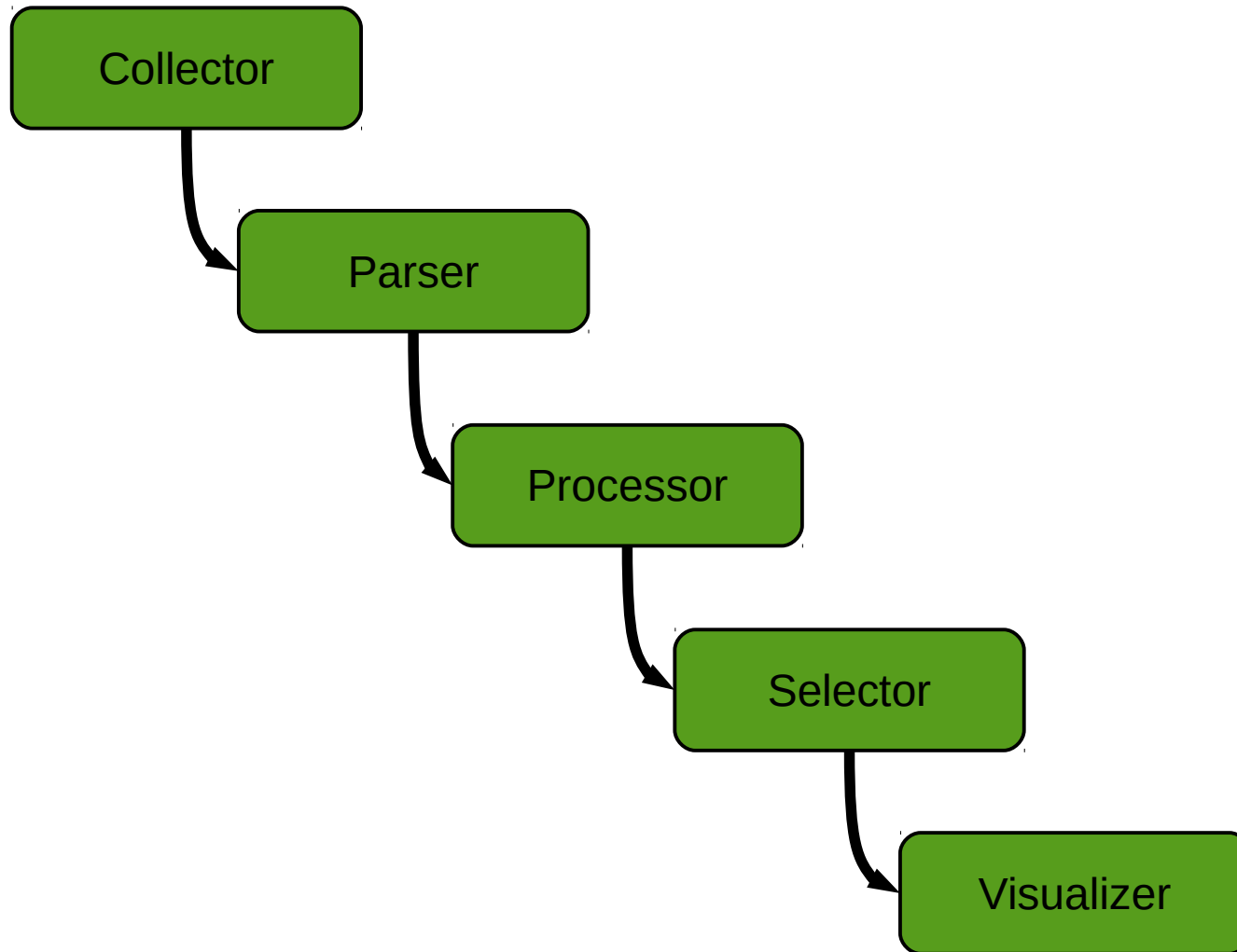
Outline



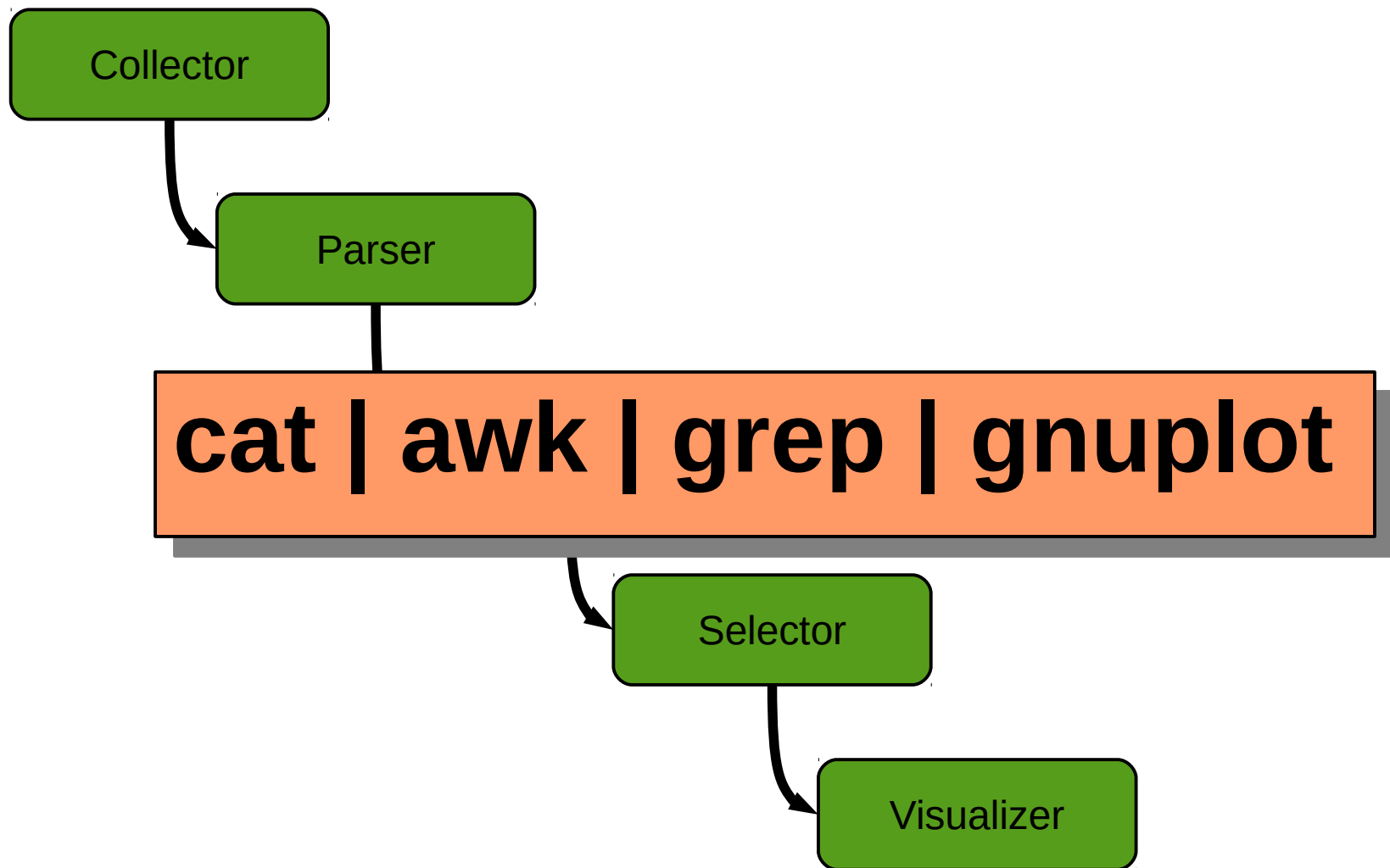
Outline



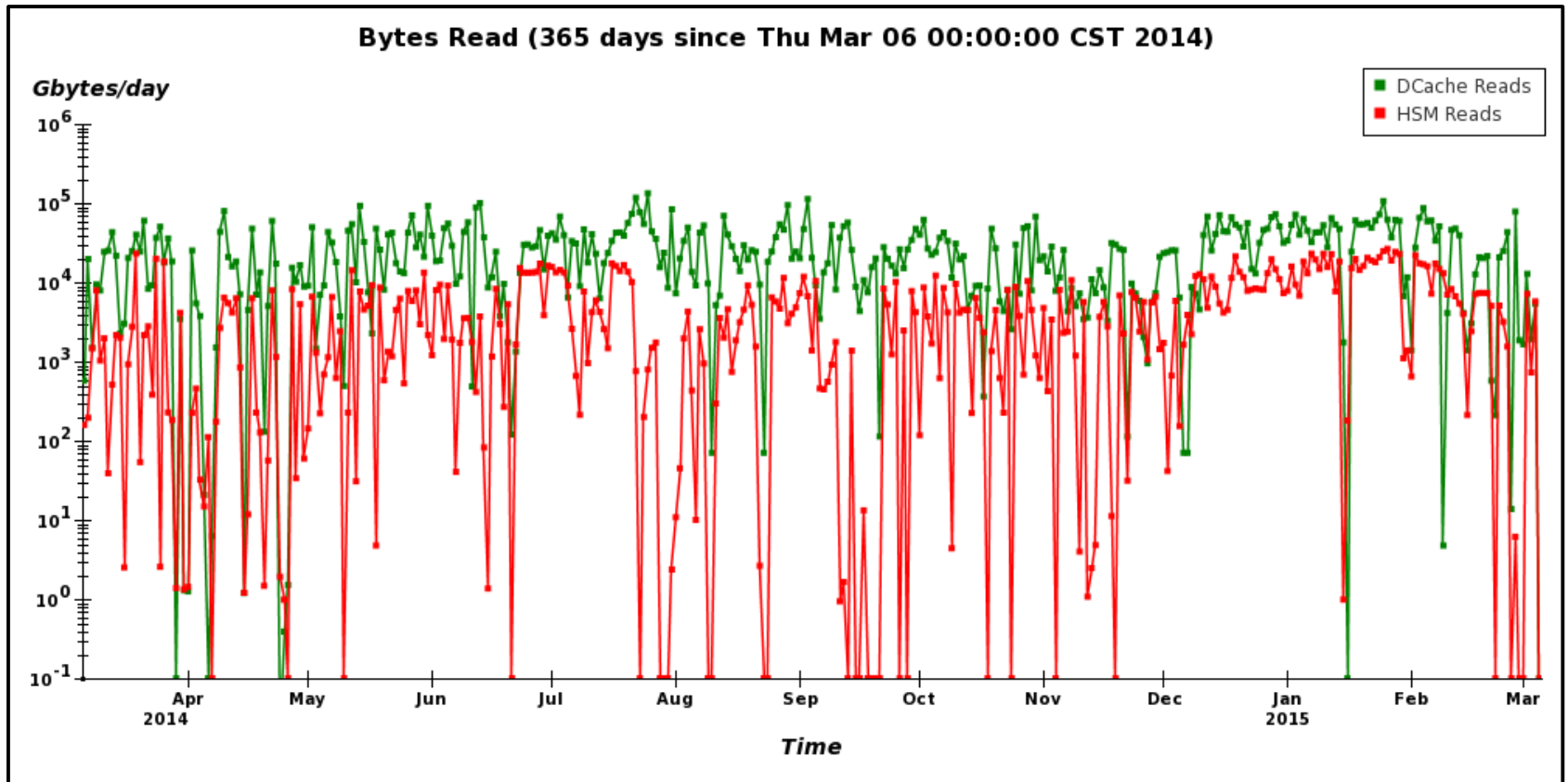
The Flow



The Flow (typical)



Result

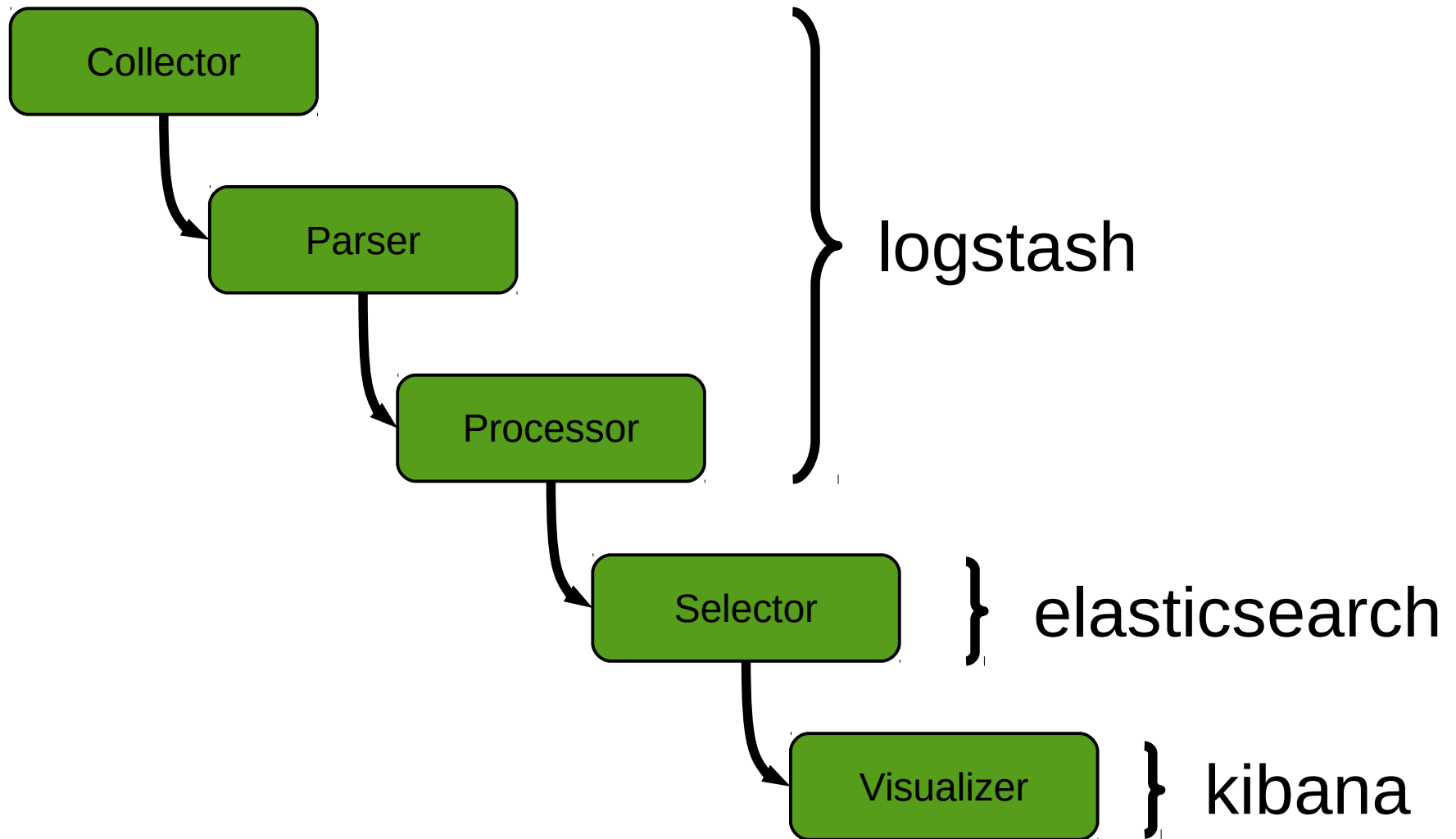


Scaling problems

- > ~20GB billing files/day
- > ~50.000.000 records/day
 - ~500 records/sec
- > 4 dCache instances
- > need to adopt scripts for different needs
- > need for a '**State at Glance**'



The Flow



Logstash

- > Collect logs from any source
- > parse them
- > gets the right timestamp
- > index them
- > and move it into a central place



Logstash anatomy

```
input {
```

```
  # read log events
```

```
}
```

```
filter {
```

```
  # parse, fix formats, mutate
```

```
}
```

```
output {
```

```
  # store processed events
```

```
}
```



Logstash, single liner

```
$ echo "hello logstash" | logstash -e 'input { stdin{} } output { stdout {codec => rubydebug} }'  
{  
  "message" => "hello logstash",  
  "@version" => "1",  
  "@timestamp" => "2015-03-06T22:49:37.797Z",  
  "host" => "dcache-lab"  
}
```



Real life example

```
05.02 08:35:49 [pool:dcache-desy23-05:transfer]
[00009A23BB6D280F46A7A6C12AC67F5EA897,59419220] [Unknown]
desy:generated@osm 90112 1195 false {Http-1.1:dcache-
infra03.desy.de:0:WebDAV-dcache-door-desy13:webdav-dcache-door-
desy13Domain:/pnfs/desy.de/desy/dcache.org/2.1/dcache-server_2.1.1-
1_all.deb} [door:WebDAV-dcache-door-desy13@webdav-dcache-door-
desy13Domain:1399012548236-1399012548243] {0:""}
```



Parse

```
filter {  
  grok {  
    match => [ "message", "%{TRANSFER_CLASSIC}" ]  
    remove_field => [ "message" ]  
  }  
  
  date {  
    match => [ "billing_time", "MM.dd HH:mm:ss" ]  
    timezone => "CET"  
    remove_field => [ "billing_time" ]  
  }  
}
```



Parse

- > Regexp like syntax
- > Lot of ready patterns for common cases
- > supports labels and types



Parser, example

```
[00009A23BB6D280F46A7A6C12AC67F5EA897,59419220]  
[00380000000000000000559888,46305280]
```

```
PNFSID_NEW (?:[A-F0-9]{36})
```

```
PNFSID_OLD (?:[A-F0-9]{24})
```

```
PNFSID %{PNFSID_OLD}|%{PNFSID_NEW}
```

```
PNFSID_SIZE \[%{PNFSID:pnfsid},%{NONNEGINT:size:int}\]
```



Parser, example

```
{DCap-3.0,131.169.74.175:34232}
```

```
PROTO (?:%{DATA}-[0-9]\.[0-9])
```

```
PROTOCOL \{%{PROTO:proto}(:)(%{IPORHOST:remote_host})(:)(%  
{NONNEGINT:remote_port:int})
```



```
TRANSFER_CLASSIC %{BILLING_TIME:billing_time} %  
{CELL_AND_TYPE} %{PNFSID_SIZE} %{PATH} %{SUNIT}  
%{TRANSFER_SIZE} %{TRANSFER_TIME} %{IS_WRITE}  
%{PROTOCOL} %{DOOR} %{ERROR}
```



Real Life example

```
{
  "@version" => "1",
  "@timestamp" => "2015-05-02T06:35:49.000Z",
  "type" => "dcache-billing",
  "host" => "ani",
  "path" => "/var/lib/dcache/billing/2014/05/billing-2004-05-02.log",
  "pool_name" => "dcache-desy23-05",
  "bill_type" => "transfer",
  "pnfsid" => "00009A23BB6D280F46A7A6C12AC67F5EA897",
  "size" => 59419220,
  "file_path" => "/pnfs/desy.de/desy/dcache.org/2.1/dcache-server_2.1.1-1_all.deb",
  "sunit" => "desy:generated@osm",
  "transfer_size" => 90112,
  "transfer_time" => 1195,
  "is_write" => "false",
  "proto" => "Http-1.1",
  "remote_host" => "dcache-infra03.desy.de",
  "remote_port" => 0,
  "payload" => ":WebDAV-dcache-door-desy13:webdav-dcache-door-desy13Domain:",
  "initiator_type" => "door",
  "initiator" => "WebDAV-dcache-door-desy13@webdav-dcache-door-desy13Domain:1399012548236-1399012548243",
  "error_code" => 0
}
```



And store it in....

```
output {  
  elasticsearch {  
    host => "elastic-search-master-node"  
    index => "logstash-%{+YYYY.MM.dd}"  
  }  
}
```



Elasticsearch

- > Open-source full-text search engine
- > Schema-free JSON documents
- > Powerful JSON based REST-API
- > Distributed
 - data can be divided into shards
 - each shard can have zero or more replicas
- > Node can be Master-node, Data-node or both
- > Can be used as a NoSQL database



Document, Index and type

- > Document is a basic unit of information
- > Documents are expressed in JSON
- > Each log entry corresponds to a document
- > Index is a collection of documents
- > An index is identified by a name
- > Name is used to refer to the index when performing actions
- > Type is a logical category/partition of an index
- > Type is defined for documents that have a set of common fields

(something like DATABASE (index), ROW(document) and TABLE(type) in RDBMS)



Shards and Replicas

- > Index can be subdivide into multiple pieces
- > Each piece called shard
- > Each shard is an independent "index" and can be hosted on any node in the cluster.
 - allows horizontally split/scale data volume
 - allows distribute operations across shards
- > You can make one or more copies of index's shards called replicas
 - provides high availability in case a shard/node fails
 - allows to scale out search volume/throughput since searches can be executed on all replicas in parallel

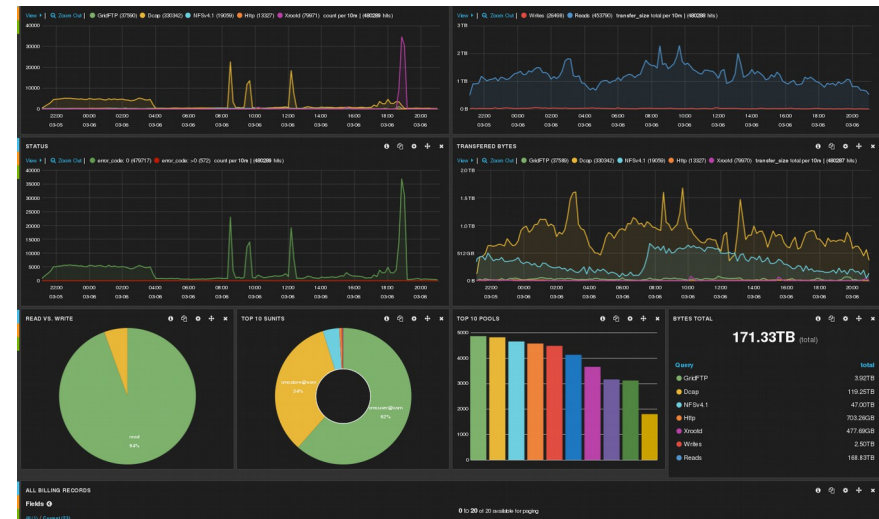


> REST API

- **POST** – create document, index
- **GET** – search/read document
- **PUT/PATCH** – update document
- **DELETE** – delete document, index



- Flexible analysis and visualization platform
- Real-time summary and charting of streaming data
- Intuitive interface for a variety of users
- Instant sharing and embedding of dashboards



Get started

- > Dump data into elasticsearch
- > Create a simple dashboard (discovery in Kibana4)
- > Play with data



Get started

Type to filter...

- @timestamp
- @version
- _id
- _index
- _type
- bill_type
- billing_time
- error_code
- file_path
- host
- initiator
- initiator_type
- is_write
- message
- path
- payload
- pnsid
- pool_name
- proto
- remote_host
- remote_port
- size
- sunit
- tags
- transfer_size
- transfer_time
- type

_source (select columns from the list to the left)

```
{"message":"03.07 15:25:31 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [\\\"48:48:131.169.71.129] [00008BC0B8CF551D4FBEBBA226932E6C8F88,6374] [\\\"dcache.replica@osm 45 0 {0:\\\"\\\"}], @version\":\"1\", @timestamp\":\"2015-03-07T14:25:31.052Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", ...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud05-03\", bill_type\":\"transfer\", pnsid\":\"0000F3DB76ABFB6E4E818FC3FABA...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud03-01\", bill_type\":\"transfer\", pnsid\":\"00008781A83D24F94C36AF504B78...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud06-08\", bill_type\":\"transfer\", pnsid\":\"000084BF865FC985447C98BB5FB7...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud06-02\", bill_type\":\"transfer\", pnsid\":\"0000C2AE03753E9947A29AA64A69...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud05-06\", bill_type\":\"transfer\", pnsid\":\"000005D2298BE7044F98814A6A41...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud03-01\", bill_type\":\"transfer\", pnsid\":\"0000E2741BA717804348A945920C...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud06-02\", bill_type\":\"transfer\", pnsid\":\"0000451504AED8CF458193AA5E8A...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:30\", pool_name\":\"dcache-cloud06-06\", bill_type\":\"transfer\", pnsid\":\"0000F737FBEF4E2A4CA48778E86B...
```

```
{\"message\":\"03.07 15:25:29 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [\\\"48:48:131.169.71.129] [0000311A9C4F88314E64A135874D0F46C04F,10856] [\\\"dcache.replica@osm 45 0 {0:\\\"\\\"}], @version\":\"1\", @timestamp\":\"2015-03-07T14:25:30.034Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", ...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:28.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:28\", pool_name\":\"dcache-cloud06-08\", bill_type\":\"transfer\", pnsid\":\"0000DC898169FF2C44B7983EE2B6...
```

```
{\"message\":\"03.07 15:25:52 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [\\\"48:48:131.169.71.129] [00009073B9697F1D4A35A4AD94BB74214948,7918] [\\\"dcache.replica@osm 44 0 {0:\\\"\\\"}], @version\":\"1\", @timestamp\":\"2015-03-07T14:25:53.149Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", ...
```

```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:52.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-2015.03.07\", billing_time\":\"03.07 15:25:52\", pool_name\":\"dcache-cloud05-02\", bill_type\":\"transfer\", pnsid\":\"0000B2F87B8FFAFC4B64B3208DEC...
```

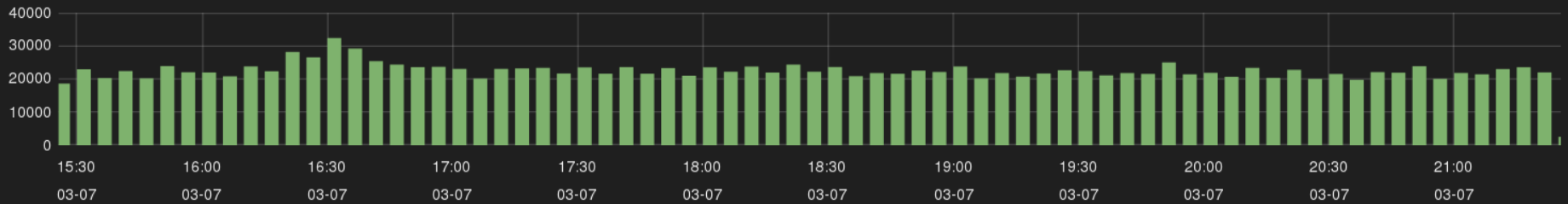
```
{\"@version\":\"1\", @timestamp\":\"2015-03-07T14:25:52.000Z\", type\":\"dcache-billing\", host\":\"dcache-se-cloud01.desy.de\", path\":\"/var/lib/dcache/billing/2015/03/billing-
```



Get started

HISTOGRAM

View | Zoom Out | * (1627535) count per 5m | (1627535 hits)



TABLE

Fields

All (1) / Current (27)

Type to filter...

- @timestamp
- @version
- _id
- _index
- _type
- bill_type
- billing_time
- error_code
- file_path
- host
- initiator
- initiator_type
- is_write
- message
- path

0 to 100 of 500 available for paging

_source (select columns from the list to the left)

```
{"@version":"1","@timestamp":"2015-03-07T14:40:52.000Z","type":"dcache-billing","host":"dcache-se-cloud01.desy.de","path":"/var/lib/dcache/billing/2015/03/billing-2015.03.07","billing_time":"03.07 15:40:52","pool_name":"dcache-cloud06-08","bill_type":"transfer","pnfsid":"000041343DEC479548E38A0FC0B9..."}
```

```
{"@version":"1","@timestamp":"2015-03-07T14:40:26.000Z","type":"dcache-billing","host":"dcache-se-cloud01.desy.de","path":"/var/lib/dcache/billing/2015/03/billing-2015.03.07","billing_time":"03.07 15:40:26","pool_name":"dcache-cloud05-07","bill_type":"transfer","pnfsid":"0000AA2B05EBAE884CACB0F7BF87..."}
```

```
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```

```
{"message":"03.07 15:40:24 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [\"\":48:48:131.169.71.129] [0000D1961DC52DBA4B90B4884F18ED70F336,112] [ dcache:replica@osm 45 0 {0:\\\"}\",\"@version\":\"1\",\"@timestamp\":\"2015-03-07T14:40:24.703Z\",\"type\":\"dcache-billing\",\"host\":\"dcache-se-cloud01.desy.de\", \"...\"}
```

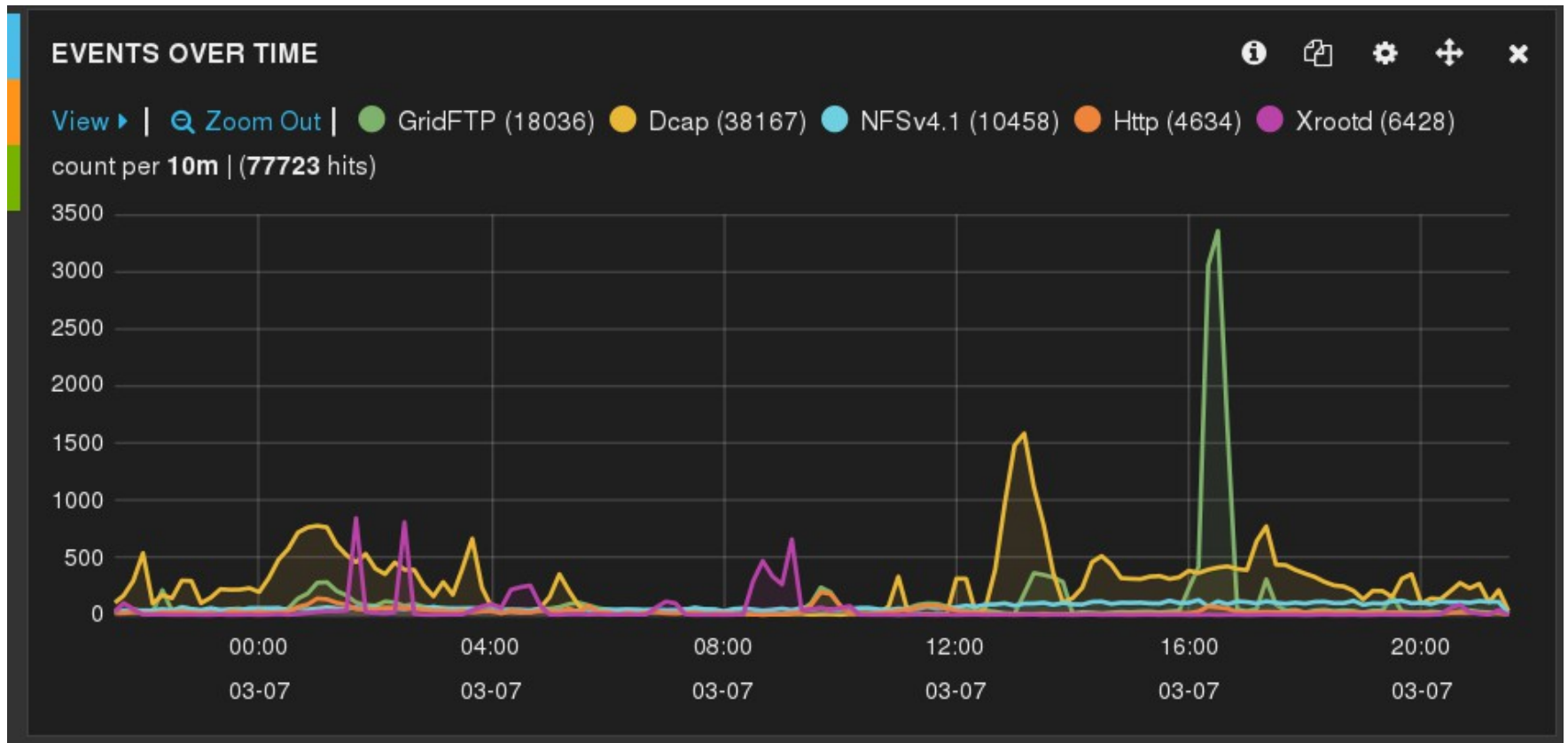
```
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```

```
{"message":"03.07 15:40:21 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [\"\":48:48:131.169.71.129] [0000398E8D952B654C7EB3CC13FE7C387525,3677] [ dcache:replica@osm 51 0 {0:\\\"}\",\"@version\":\"1\",\"@timestamp\":\"2015-03-07T14:40:22.698Z\",\"type\":\"dcache-billing\",\"host\":\"dcache-se-cloud01.desy.de\", \"...\"}
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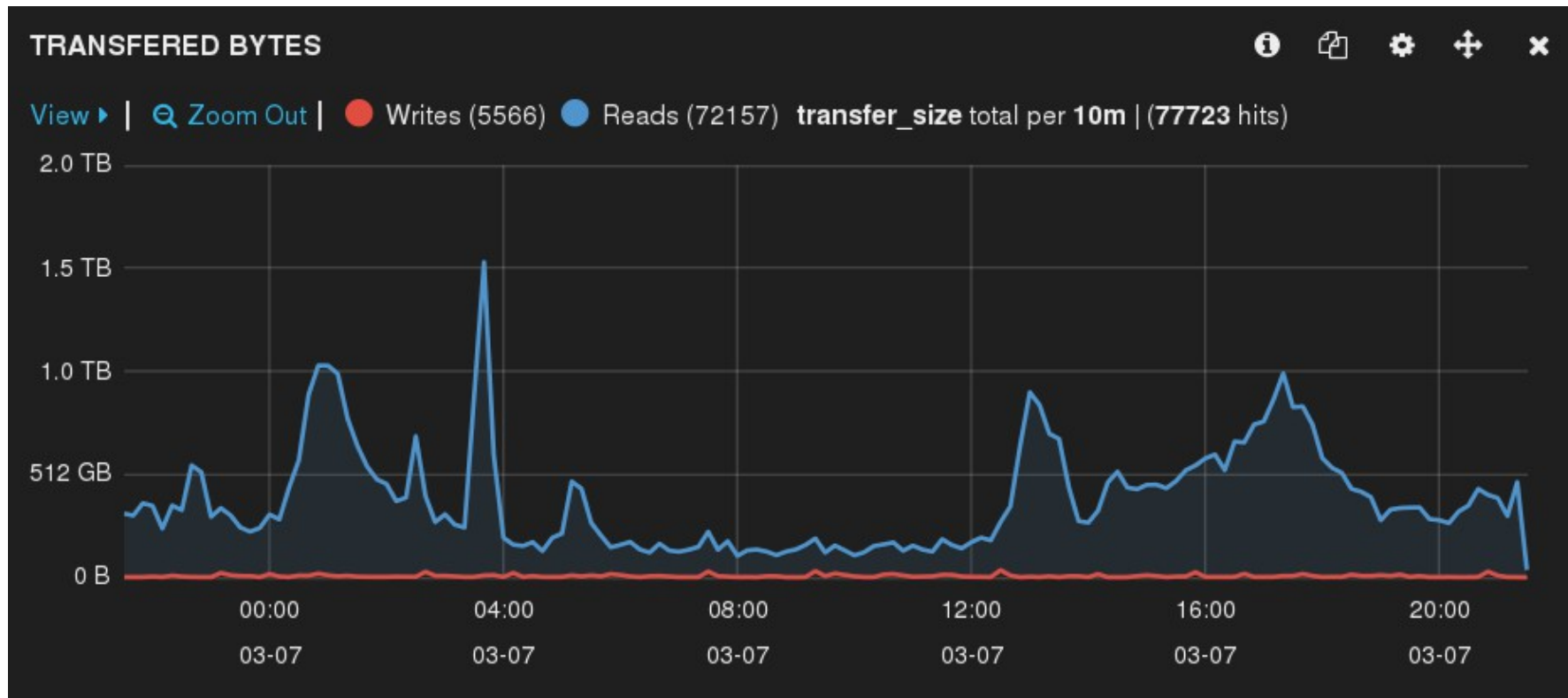
```
{"message":"03.07 15:40:41 [door:NFS-dcache-dir-cloud01@nfs4Domain:request] [\"\":48:48:131.169.71.129] [00008D1DD2D043974885A451929C9C7DC7DE,2175] [ dcache:replica@osm 51 0 {0:\\\"}\",\"@version\":\"1\",\"@timestamp\":\"2015-03-07T14:40:41.703Z\",\"type\":\"dcache-billing\",\"host\":\"dcache-se-cloud01.desy.de\", \"...\"}
```



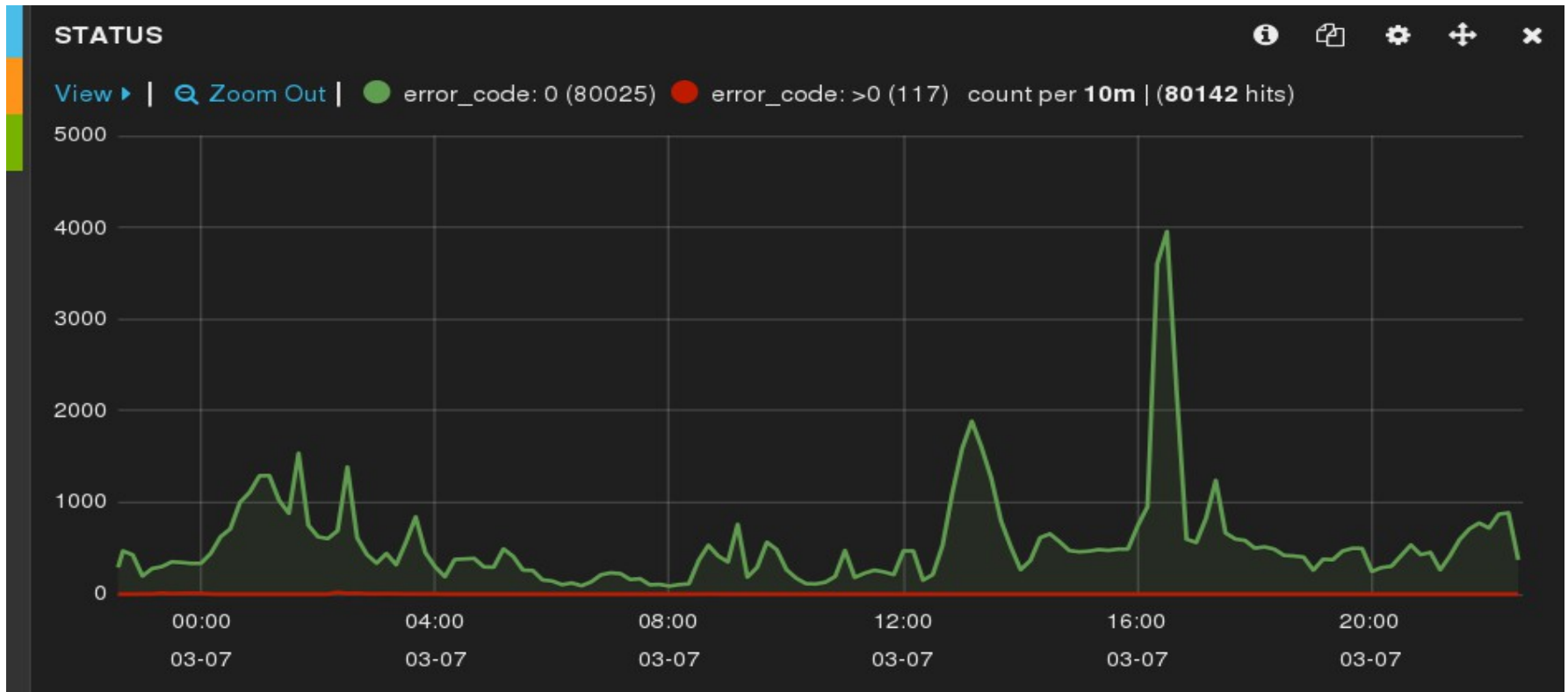
And you start to explore



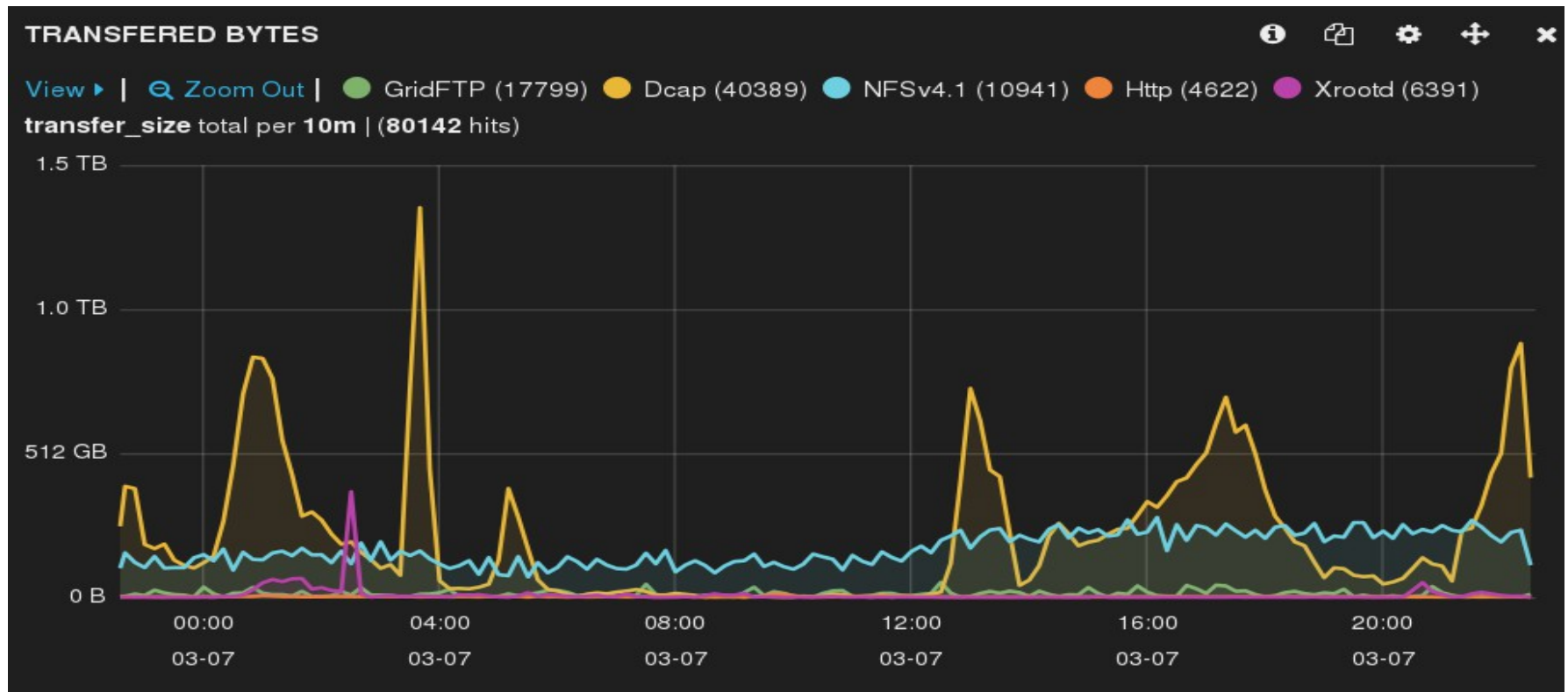
And you start to explore



And you start to explore

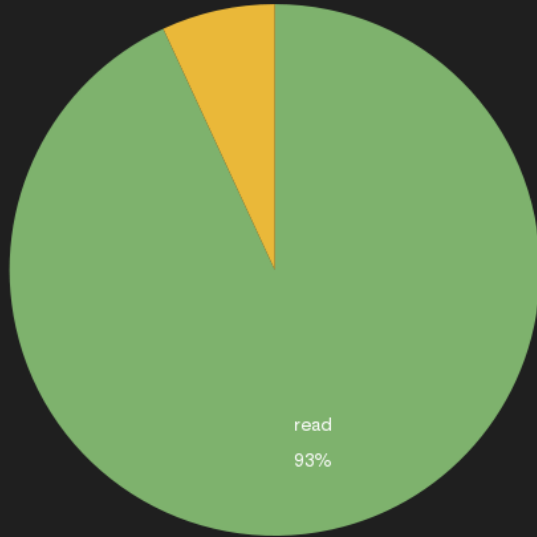


And you start to explore

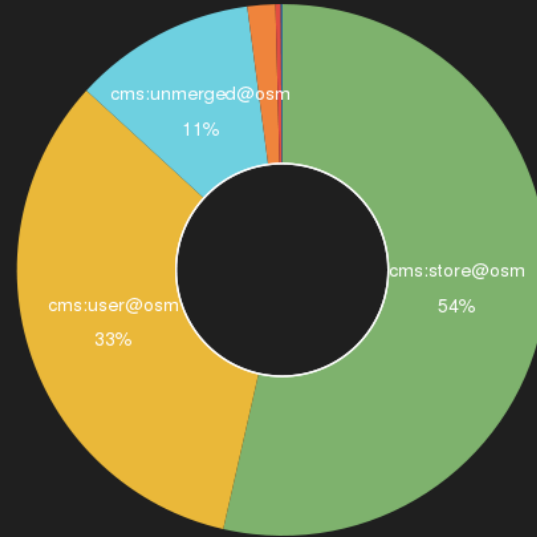


And you start to explore

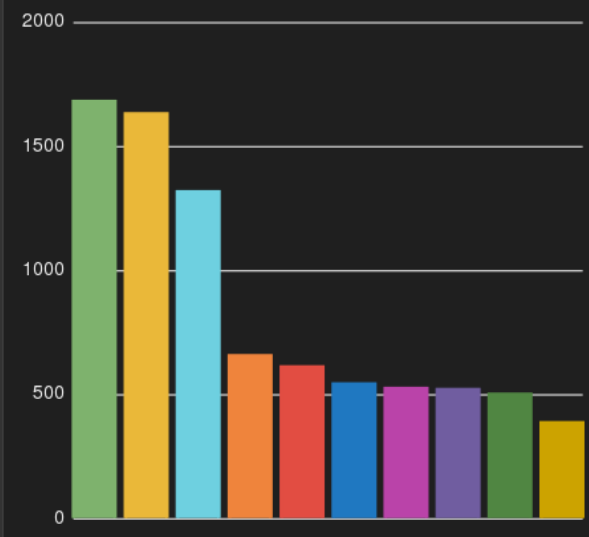
READ VS. WRITE



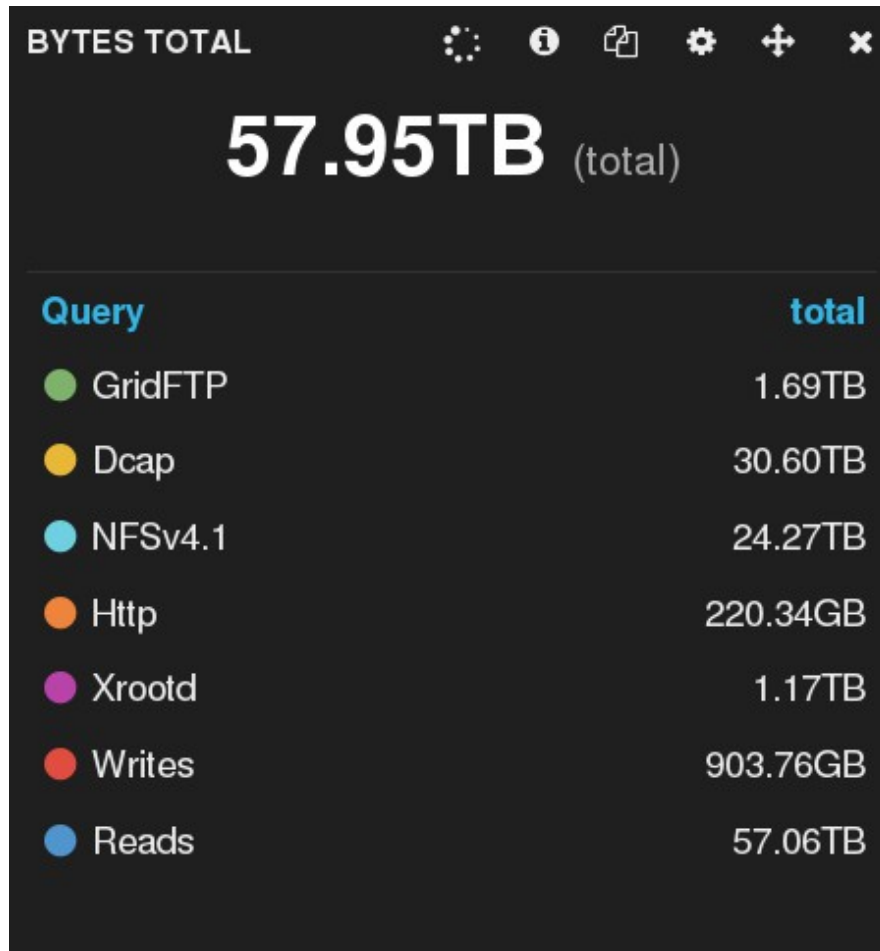
TOP 10 SUNITS



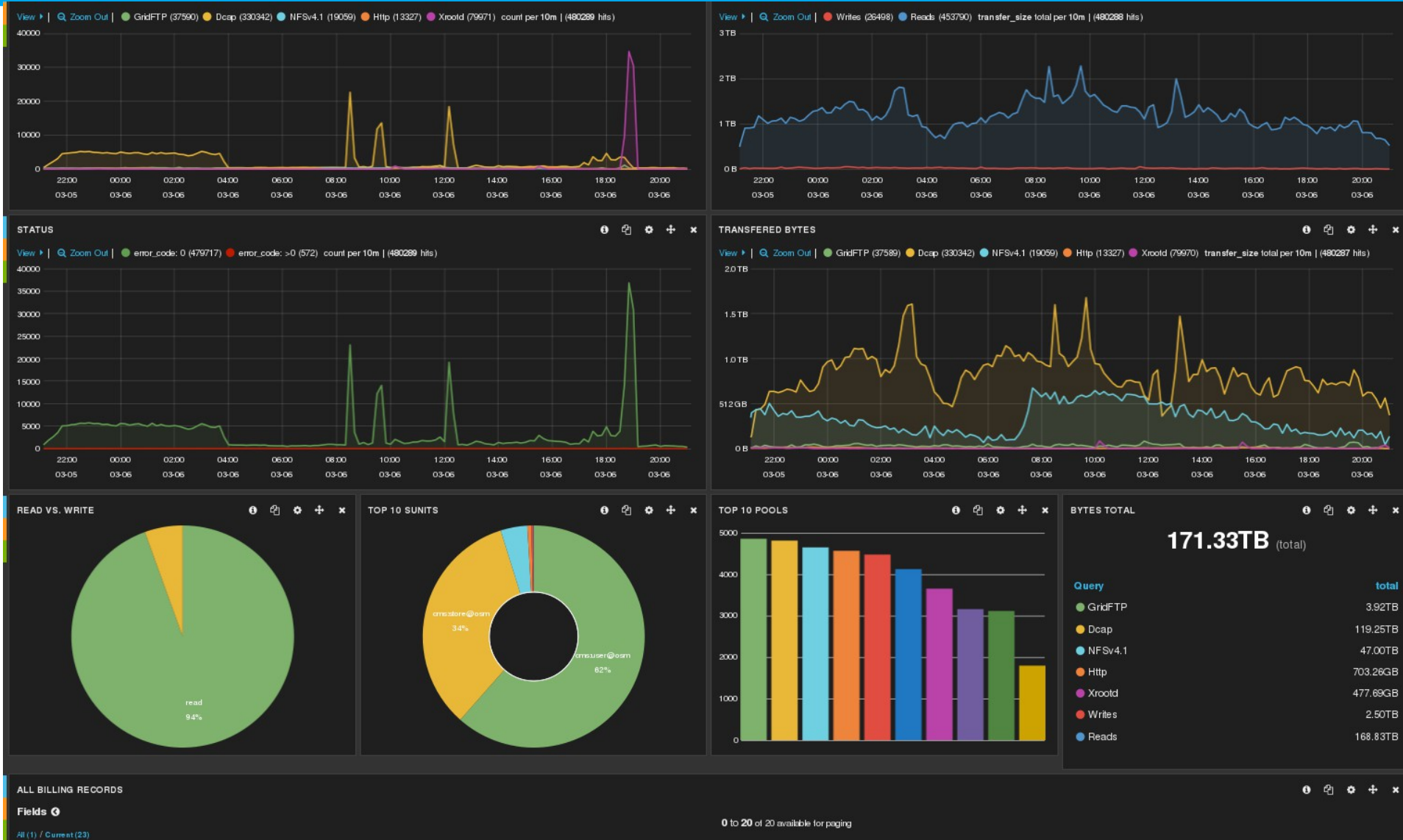
TOP 10 POOLS



And you start to explore



Transfers at glance



Too good to be the truth

- > Elasticsearch is very giddy component
- > Number of active indexes is limited by file descriptors
 - $\#indexes * \#shards * \#replicas * \#segments$
 - In production we can have max ~180 days
- > Can't be used to analyze historic data
- > But good enough for live monitors
 - not a reporting tool



Looking back (how to organize index)

> index => "logstash-%{+YYYY.MM.dd}"

- typical search will use 1-7 indexes
- typical search data overhead one day
- limited number of indexes
- discard granularity one day

> index => "logstash-%{+YYYY.MM}"

- typical search will use 1 index
- typical search data overhead one month
- discard granularity one month

> your 'live view' defines which type of index you need



Who-is-Who

- > No Authentication/Authorization
- > All data available as soon as you can get access to ES REST-API
- > Different projects to solve this issue
- > We are looking at Kibana_Auth
 - a proxy between and user and Kibana
 - modifies user requests
 - integrated with ldap



Kibana4

- > New concepts
- > Allows to have saved searches, visualization
- > Allows to create Dashboards with data from different indexes
- > We still collect experience



Questions?

