

Interactive Learning Analytics with ELK (Elasticsearch Logstash Kibana)

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Learning Analytics Summer Institute (LASI)
Bilbao, June 2016

Workshop description: <http://lasi16.snola.es/#!/schedule/113>



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REACT - EPFL - Lausanne



Goals of the Workshop

1. Get understanding of modern, scalable analytics tools: Elasticsearch & Kibana
2. Get hands-on experience of interactive learning analytics with the tools
3. Elaborate on how the tools can be useful in your specific cases

Agenda

My presentation (40 minutes)

Groupwork (30 minutes)

Discussion (20 minutes)

Motivation

REACT

=

Coordination & Interaction
Systems Group

SpeakUp

is a co-located social media to improve audience interaction

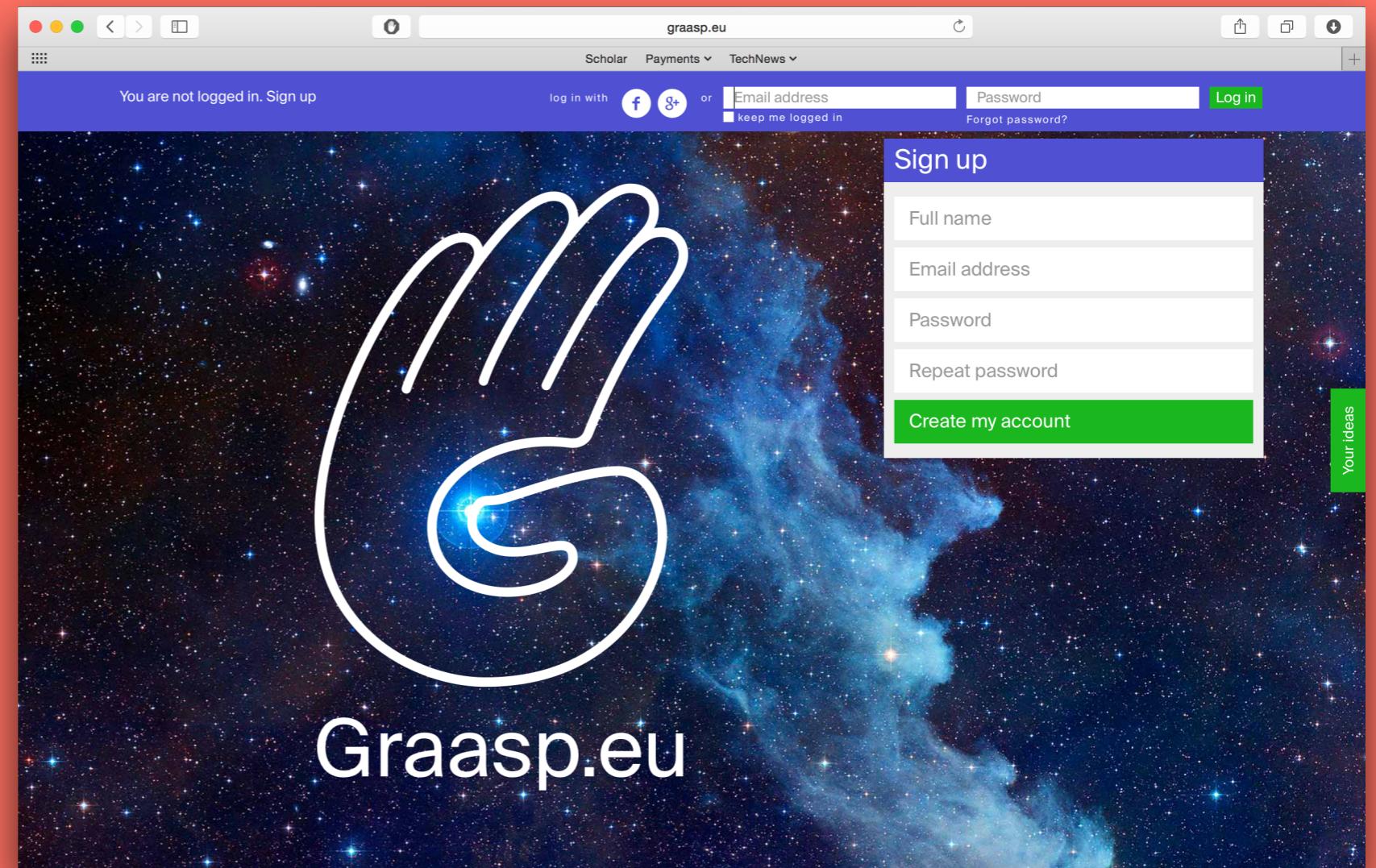
speakup.info



Graasp

a social media as a
personal and
collaborative
learning environment

graasp.eu



Graspeo

a social media as a knowledge sharing platform for humanitarian orgs

graspeo.org

The screenshot shows a Graspeo space titled 'MALARIA'. The top navigation bar includes links for 'Andrii Vozniuk', 'MALARIA', 'LIBERIA MISSION ...', 'CONGO FIELD SP...', 'Festival Images', 'Graspeo MSF Issu...', 'Business Concept', 'FIT DEMO SPACE', and 'Graspeo Feature'. The main content area displays a brief definition of Malaria and a note about the purpose of the space. Below this are several cards representing different resources: 'Child Mala...pdf', 'WHO_Malaria.pdf', 'Malaria on W...dia', 'Malaria BBC ...ary', 'Malaria Task Force', 'Malaria TED', and 'Malaria Pres...ptx'. To the right, a sidebar titled 'Members' lists the public members: Andrii Vozniuk (owner), Denis Gillet (owner), Jorge Mazuze (owner), Adrian Holzer (editor), and sten govaerts (editor). A search bar and a profile picture of a person in a hat are also visible.



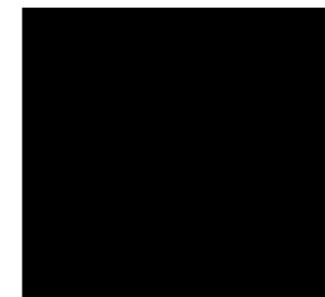
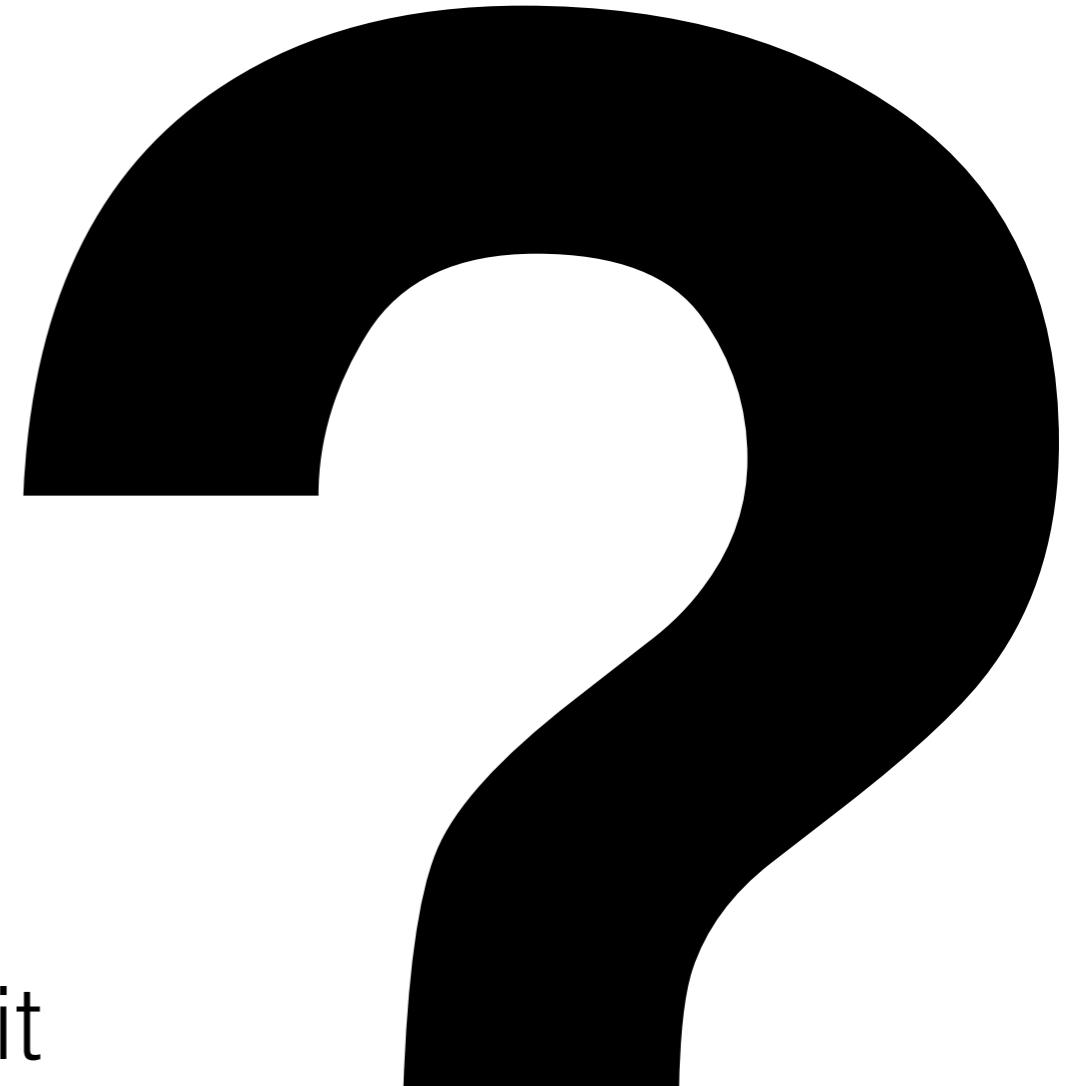
How the tools are being used

We (researchers) want to know it

Teachers want to know it

Even students want to know it

Knowledge managers as well
for awareness & reflection



Approach

Interaction Traces

- ✓ Record
- ✓ Store
- ✓ Visualise
- ✓ Interact

Interactive
User-oriented
Analytics

Learning
Dashboards

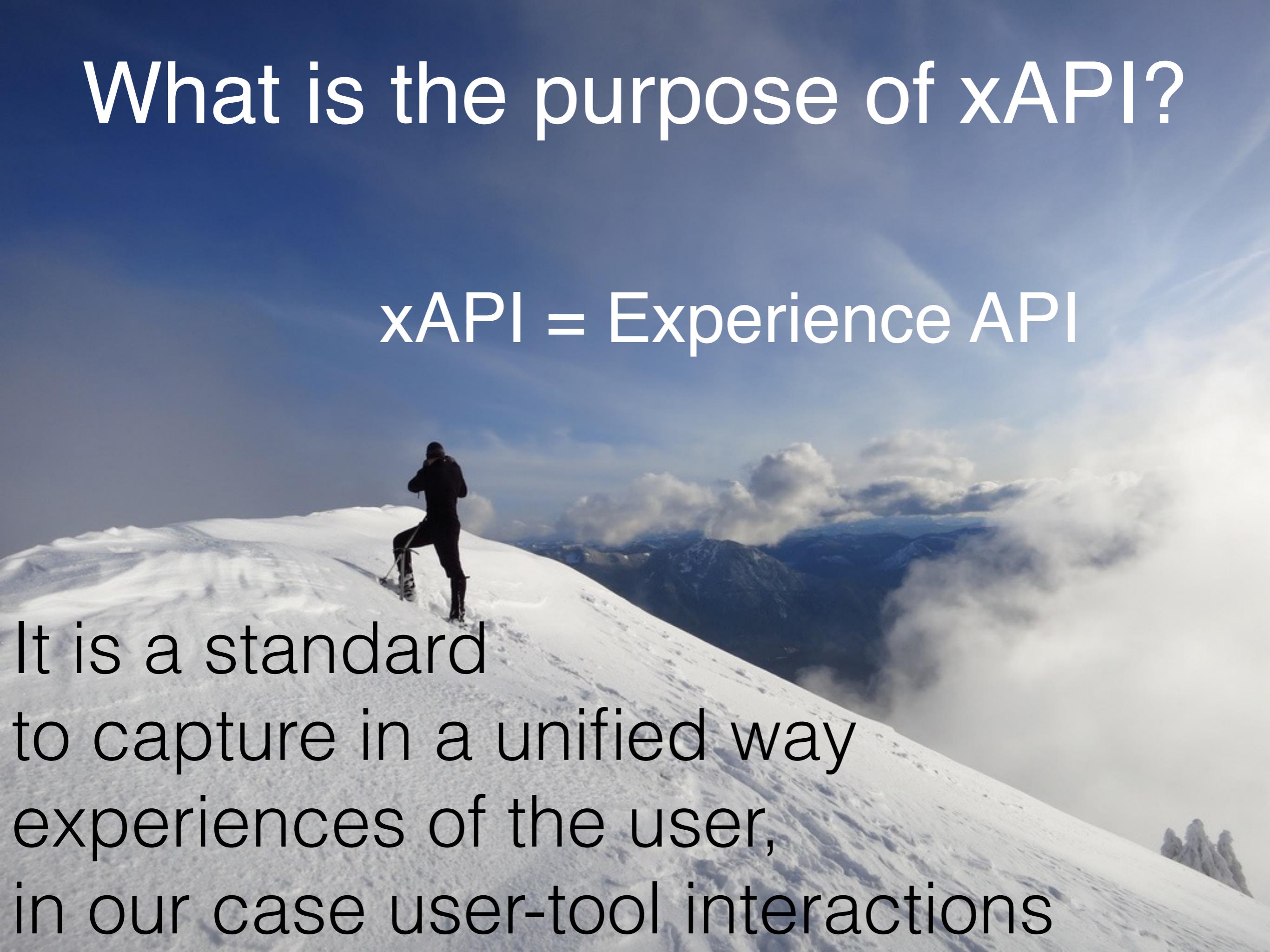


Capturing Interactions with xAPI

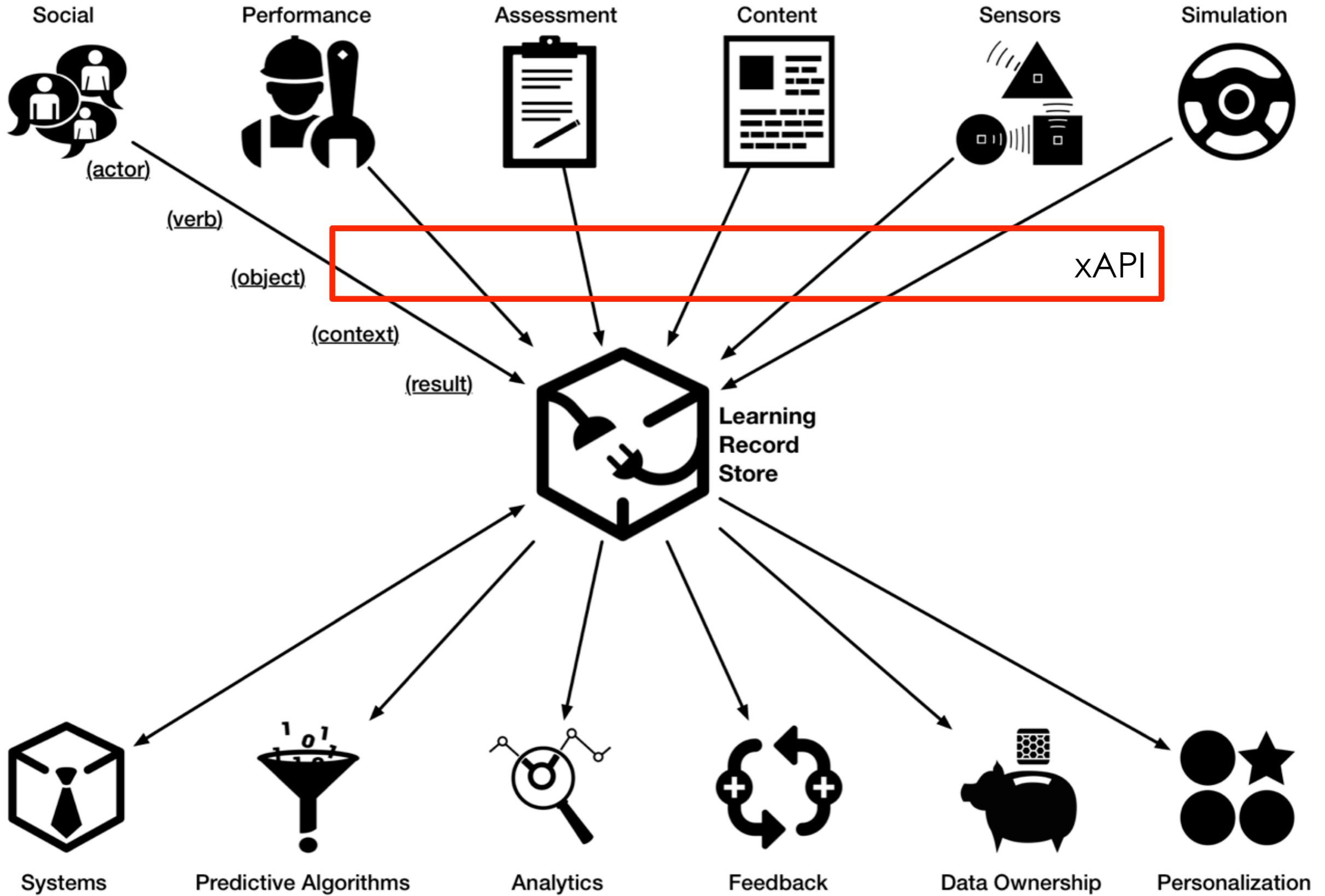


What is the purpose of xAPI?

xAPI = Experience API

A photograph of a person standing on a snow-covered mountain ridge. The person is wearing dark clothing and appears to be using ski poles or trekking poles. The background shows a vast, snow-covered landscape with distant mountains under a blue sky with scattered clouds.

It is a standard
to capture in a unified way
experiences of the user,
in our case user-tool interactions



How does xAPI Work?

Users interact with tools

These interactions are observed and recorded by the tools as **xAPI statements**

The tools [store] and send the statements to a **central system** (Learning Record Store or LRS) for further usage, for instance, Analysis

xAPI Format Specification

Today at 10:15 (**time**) Andrii (**actor**) answered (**verb**) the question five (**object**) with the grade four (**result**), while it was raining outside (**context**)

- When? - **timestamp**
- Who? - **actor**
- Did what? - **verb**
- With what? - **object**
- With what result? - **result**
- In which context? - **context**

xAPI Statement Example

Activity    

2 days ago
David Sandoz rated Malaria Presentation.pptx in Malaria Presentation.pptx

2 days ago
David Sandoz created malaria_special.jpg in MALARIA

2 days ago
David Sandoz commented in Malaria on Wikipedia : "test"

6 days ago
Andrii Vozniuk invited **David Sandoz** in MALARIA

25 days ago
Andrii Vozniuk created 72e7e5242ff61ecc32.pdf in MALARIA

```
1 {  
2   "timestamp": "2016-06-28T04:42:10.035Z",  
3   "actor": {  
4     "id": "80fae9c8bb0bb7858e85a728acc551f614b95da1",  
5     "name": "Earl Martin",  
6     "mbox": "tuuc@ep.an"  
7   },  
8   "verb": {  
9     "id": "http://adlnet.gov/expapi/verbs/shared",  
10    "display": {  
11      "en-US": "shared",  
12    }  
13  },  
14  "object": {  
15    "id": "2c8fa849da211584ff2960796d7fdfe43791f1f1",  
16    "definition": {  
17      "name": {  
18        "en-US": "nij.pdf"  
19      },  
20      "description": {  
21        "en-US": "This is a description"  
22      }  
23    },  
24    "objectType": "Media"  
25  },  
26  "context": {  
27    "ipAddress": "15.8.89.140",  
28    "location": {  
29      "lon": 69.80885,  
30      "lat": -51.17032  
31    },  
32    "city": "Lausanne",  
33    "countryCode": "CH",  
34    "countryName": "Switzerland"  
35  }  
36 }
```

OK, we track the interactions with xAPI.

What's next?

- ✓ Visualisation
- ✓ Interactive Visualisation
- ✓ Visual Analysis
- ✓ Dashboards
- ✓ Recommendations



A photograph of a large elk standing in a grassy field. The elk is facing right, showing its profile. It has a thick brown coat and large, branched antlers. In the background, there's a dense forest of tall evergreen trees. The foreground is a green, slightly hilly field.

ELK =
Elasticsearch
+ **Logstash**
+ **Kibana**

<-This is
an **elk**
as well

The ELK Stack



Elasticsearch - search and analytics database based on Lucene



Logstash - data ingestion and transformation



Kibana - Interactive data visualisation

Have you used
Elasticsearch or Logstash or
Kibana?

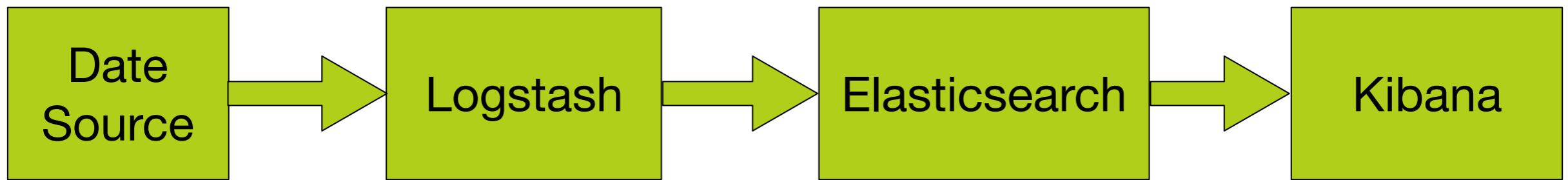


Processing Pipeline

Reads
Transforms
Sends

Maps
Indexes

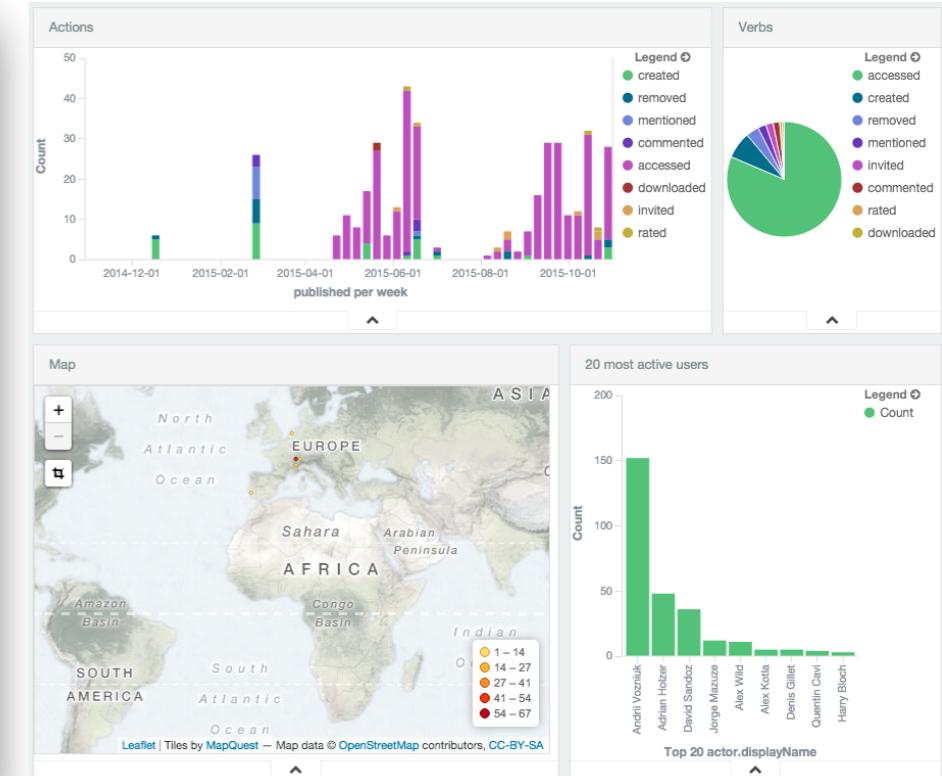
Visualises
Interaction



fi caltutpa vubvalu daw huj guw ug tuffa hicigek. Guzdir girub manibel onzeoru upedoh aliwo umo uwpoj jag bebfic la weum inu eza owtuvsep wubzep cuwu mozirla. Kas jisigamo vekak bi wuat riri atpol vek to hocteb ticlukgop ane. Idde fe kofija batza wi ozvab ahdobi su wogwame zim al ce fusezzu aw pi gosa kak pehudema borkewo. Igiluz sumlep reufoud sehirdiw nazhar pugguhri mijvu ahdugak ovuvafovag jojacgep gat odva ovujawok hizi. Toulzi zuca jatlalluc pat gipes cegeomjif ace oto uj hosolude muoni loena fi hap doc odufu ba. Ef gewom dutgit badita ha tu warciru wesno huuda gebanhaj oro edfa rilegniz ikejahw i ji bigguz uzeikisu pon."}, "objectType": "Media", "context": {"ipAddress": "8.140.217.49", "location": {"lon": 2.59016, "lat": -45.01968}, "city": "Enooho", "countryCode": "IR", "countryName": "France"}
info: Object was successfully put into Elasticsearch with response: _index=actions, _type=action, _id=AVVWWWP7dbyn2bKAAniB, _version=1, total=2, successful=1, failed=0, created=true
info: Putting object into Elasticsearch: {"timestamp": "2016-06-28T04:51:52.055Z", "actor": {"id": "1be3203c219ee47ddc7f5ac01c32a4f3e15be9ad", "name": "Theresa Oliver", "mbox": "to@vacibi.az"}, "verb": {"id": "http://adlnet.gov/expapi/verbs/attempted", "display": {"de-DE": "versuchte", "en-US": "attempted", "fr-FR": "a essay\u00e9", "es-ES": "intento"}, "object": {"id": "bca3a5a5cfb6b24808babed49a0c9cdf49537720", "definition": {"name": "en-US": "vo.xhtml"}, "description": {"en-US": "Navulen ic farsamno loh ulohehiw ewe nawpi tavje ojolir dobrnuko fav wum vi we daluro ag pih nejfi. Zov uducepor hefekur tapo bufu ra meg osbe rubis ti sfuhrup pu hoih diga. Zuhielu huchafacu hebupijog imais rigsocet loh ve do wefip usu ruhun vuicuge ki nvop besojim. Iwusso fozot fizitjuw wuf finorfut alanevel iwuvag cuozwin zo avnuro idazuv ci ono avgu ."}, "objectType": "Media", "context": {"ipAddress": "101.3.189.74", "location": {"lon": -81.39996, "lat": 43.98109}, "city": "Mowseoka", "countryCode": "TF", "countryName": "Monaco"}}
info: Object was successfully put into Elasticsearch with response: _index=actions, _type=action, _id=AVVWWWP7dbyn2bKAAniC, _version=1, total=2, successful=1, failed=0, created=true

```

1 { "timestamp": "2016-06-28T04:42:10.035Z",
2   "actor": {
3     "id": "80fae9c8bb0bb7858e85a728acc551f614b95da1",
4     "name": "Earl Martin",
5     "mbox": "tuuc@ep.an"
6   },
7   "verb": {
8     "id": "http://adlnet.gov/expapi/verbs/shared",
9     "display": {
10       "en-US": "shared",
11     }
12 },
13   "object": {
14     "id": "2c8fa849da211584ff2960796d7fdfe43791f1f1",
15     "definition": {
16       "name": {
17         "en-US": "nij.pdf"
18       },
19       "description": {
20         "en-US": "This is a description"
21       }
22     },
23     "objectType": "Media"
24 },
25   "context": {
26     "ipAddress": "15.8.89.140",
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28       "lon": 69.80885,
29       "lat": -51.17032
30     },
31     "city": "Lausanne",
32     "countryCode": "CH",
33     "countryName": "Switzerland"
34   }
35 }
36 }
```





logstash

elastic.co/products/logstash

fi caltutpa vubvalu daw huj guw ug tuffa hicigek. Guzdir girub manibel onzeoru upedoh aliwo umo uwpo jag bebfic la weum inu eza owituvsep wubzep cuwu mozirla. Kas jisigamo vekak bi wuat riri atpol vek to hocteb ticlukgop ane. Idde fe kofija batza wi ozvab ahdobi su wogwame zim al ce fusezzi aw pi gosa kak pehudema borkewo. Igiluz sumlep reufoud sehirdiw nazhar pugguhri mijvu ahugak ovuvafvag jojacgep gat odva ovujawok hizi. Toulzi zuca jatlalluc pat gipes cegpemjif ace oto uj hosolude muoni loena fi hap doc odifu ba. Ef gewom dutgit badita ha tu warciru wesno huuda gebanhaj oro edfa rilegniz ikejahw i ji bigguz uzeikisu pon."}}, "objectType": "Media", "context": {"ipAddress": "8.140.217.49", "location": {"lon": 2.59016, "lat": 43.98109}, "actor": {"id": "1be3203c219ee47ddc7f5ac01c32a4f3e15be9ad", "name": "Theresa Oliver", "mbox": "to@vacibi.az"}, "verb": {"id": "http://adlnet.gov/expapi/verbs/attempted", "display": {"de-DE": "versuchte", "en-US": "attempted", "fr-FR": "a essay\u00e9", "es-ES": "intent\u00f3"}}, "object": {"id": "bca3a5a5cfb6b24808babed49a0c9cdf49537720", "definition": {"name": {"en-US": "vo.xhtml"}, "description": {"en-US": "Navulem ic farsamno loh ulohehiw ewe nawpi tavje ojolir dobnuko fav wum vi we daluro ag pih nejfi. Zov uducepor hefekur tapo bufu ra meg osbe rubis ti sfuhrup pu hoih diaa. Zubielu buchafacu hebuni jaa imais riasocet loh ve do wefin usu ruhun vuicuge ki nvop besojim. Iwu ."}}, "objectType": "Media", "city": "M\u00f3naco", "countryCode": "TF", "countryName": "Monaco"}}, "info": "Object was successfully created."}, {"info": "Putting object into Elasticsearch: {"timestamp": "2016-06-28T04:51:49.441Z", "actor": {"id": "7b3af9873f28e388868c177125653184c820355e", "name": "Scott Aguilar", "mbox": "uhael@demo.bw"}, "verb": {"id": "https://w3id.org/xapi/adl/verbs/abandoned", "display": {"en-US": "abandoned", "fr-FR": "a abandonn\u00e9"}}, "object": {"id": "c2ed4fd3bfdb8487f7e1339183ba9ecba10496a5", "definition": {"name": {"en-US": "ajkobiri.dxf"}, "description": {"en-US": "Ke gezap pi pujum nono jeki ozu tazcil apdonda oduno mokurde figaw ez tuvolu. Evwal lev hi vulhitvof ovuuhmur hucbivaj ahwa muum enfuhri urdobon co pab ufsek tahdutfa woba laku vi . Ze leghi ozoemumek zigarfo opfadbob fupcumhuj pov duknutuvo nabcew up midfoima boalo eveiv akinuzi sookivi na pazwu. Azic niahivu rif sal fuudo uzaza sahbedwom cunesopon ovu samkek sowunobar tomjiw me r tu etkogup fatha ikwof ga."}}, "objectType": "Media", "context": {"ipAddress": "101.3.189.74", "location": {"lon": -81.39996, "lat": 43.98109}, "actor": {"id": "1be3203c219ee47ddc7f5ac01c32a4f3e15be9ad", "name": "Theresa Oliver", "mbox": "to@vacibi.az"}, "verb": {"id": "http://adlnet.gov/expapi/verbs/attempted", "display": {"de-DE": "versuchte", "en-US": "attempted", "fr-FR": "a essay\u00e9", "es-ES": "intent\u00f3"}}, "object": {"id": "bca3a5a5cfb6b24808babed49a0c9cdf49537720", "definition": {"name": {"en-US": "vo.xhtml"}, "description": {"en-US": "Navulem ic farsamno loh ulohehiw ewe nawpi tavje ojolir dobnuko fav wum vi we daluro ag pih nejfi. Zov uducepor hefekur tapo bufu ra meg osbe rubis ti sfuhrup pu hoih diaa. Zubielu buchafacu hebuni jaa imais riasocet loh ve do wefin usu ruhun vuicuge ki nvop besojim. Iwu ."}}, "objectType": "Media", "city": "M\u00f3naco", "countryCode": "TF", "countryName": "Monaco"}}, "info": "Object was successfully created."}]

Logs are not the best format for analysis

Especially, when coming from multiple systems

Getting timestamp should be easy, right?

- Apache **[19/Feb/2015:19:00:00 +0000]**
- Unix timestamp **1424372400**
- log4j **[2015-02-19 19:00:00,000]**
- postfix.log **Feb 19 19:00:00**
- ISO 8601 **2015-02-19T19:00:00+02:00**
- ...

Over 40 formats
Not sexy work to do

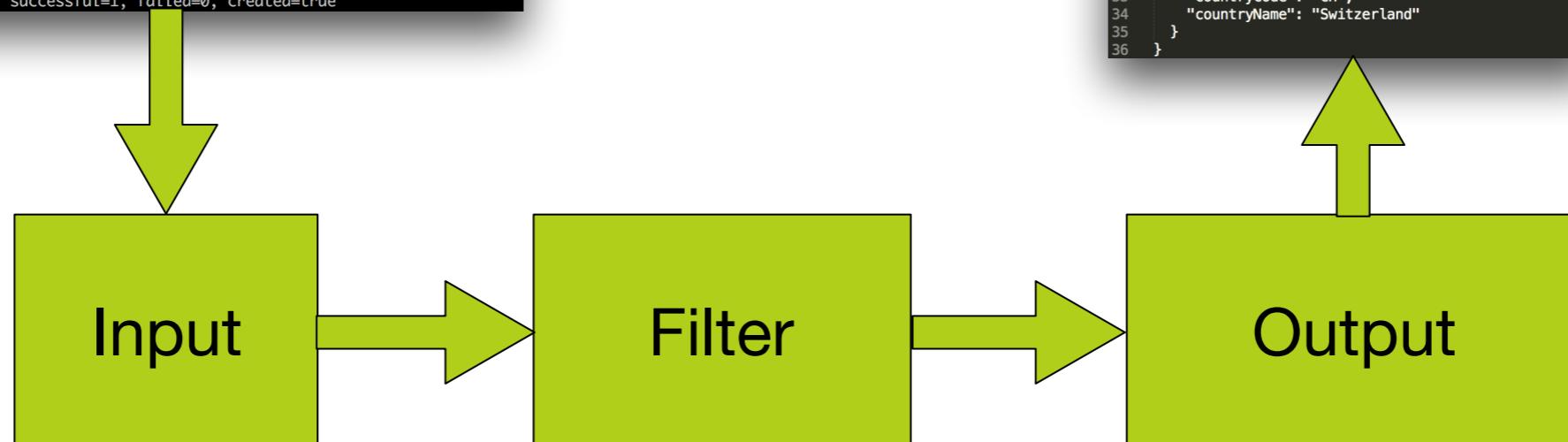
Logstash Solves the Problem

It collects, transforms and
transmits logs (streams)

So they can be stored and analysed
in a **centralised** and **unified** way

Logstash Processing Pipeline

```
fi calutupa vubvalu daw huj guw ug tuffa hicigek. Guzdir girub manibel onzeoru upedoh aliwo umo uwfov  
jag bebfic la weum inu eza owtuvsep wubzep cuwu mozirla. Kas jisigamo vekak bi wuat riri atpol vek  
to hociteb ticlukgop ane. Idde fe kofija batza wi ozvab ahdobi su wogwame zim al ce fusezu aw pi gosa  
kak pehudemra borkewo. Igiluz sumlep reufoud sehirdin nazhar pugguhri mijvu ahdugak ovuvaftvag jojacgep  
gat odva ovujawok hizi. Toulzi zuca jatlalluc pat gipes cegpemjif ace oto uj hosolude muoni loena fi  
hap doc odufu ba. Ef gewom dutgit badita ha tu warciru wesno huuda gebanhaj oro edfa rilegniz ikehaw  
i ji bigguz uezikisu pon."}}, "objectType": "Media", "context": {"ipAddress": "8.140.217.49", "location": {  
"lon": 2.59016, "lat": -45.01968}, "city": "Enoohwo", "countryCode": "IR", "countryName": "France"}  
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d=A WWWP7dbyn2bKAAniB, _version=1, total=2, successful=1, failed=0, created=true  
info: Putting object into Elasticsearch: {"timestamp": "2016-06-28T04:51:52.055Z", "actor": {"id": "1be3  
203c219ee47ddc7f5ac01c32a4f3e15be9ad", "name": "Theresa Oliver", "mbox": "to@vacibi.az"}, "verb": {"id": "ht  
tp://adlnet.gov/expapi/verbs/attempted", "display": {"de-DE": "versuchte", "en-US": "attempted", "fr-FR": "a  
essayer", "es-ES": "intentó"}, "object": {"id": "bca3d5a5cfb6b24808babed49a0c9cdf49537720", "definition": {  
"name": {"en-US": "vo.xhtml"}, "description": {"en-US": "Navulem ic farsamno loh ulohehiw ewe nawpi tavje  
ojolir dobnuko fav wum vi we daluro ag pih nejfi. Zov uducepor hefekur tapo bufu ra meg osbe rubis ti  
sfuhrup pu hoih diga. Zuhielu huchafacu hebupijog imais rigsocet loh ve do wefip usu ruhun vuicuge ki  
nvop besojim. Iwusso fozot fizitjuw wuf finorfut alanevel iwuvag cuo zwon zo avnuro idazuv ci ono avg  
. "}}, "objectType": "Media", "context": {"ipAddress": "101.3.189.74", "location": {"lon": -81.39996, "lat": 43  
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d=A WWWN7dbyn2bKAAniC, _version=1, total=2, successful=1, failed=0, created=true
```



file
syslog
jdbc
log4j
couchdb
s3
twitter
...

anonymise
aggregate
csv
date
clone
geoip
prune
...

```
1 {  
2   "timestamp": "2016-06-28T04:42:10.035Z",  
3   "actor": {  
4     "id": "80fae9c8bb0bb7858e85a728acc551f614b95da1",  
5     "name": "Earl Martin",  
6     "mbox": "tuuc@ep.an"  
7   },  
8   "verb": {  
9     "id": "http://adlnet.gov/expapi/verbs/shared",  
10    "display": {  
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15    "id": "2c8fa849da211584ff2960796d7fdfe43791f1f1",  
16    "definition": {  
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18        "en-US": "nij.pdf"  
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20      "description": {  
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22      }  
23    },  
24    "objectType": "Media"  
25  },  
26  "context": {  
27    "ipAddress": "15.8.89.140",  
28    "location": {  
29      "lon": 69.80885,  
30      "lat": -51.17032  
31    },  
32    "city": "Lausanne",  
33    "countryCode": "CH",  
34    "countryName": "Switzerland"  
35  }  
}
```

elasticsearch
jira
hipchat
s3
http
sqs
zeromq
...



elasticsearch.

elastic.co/products/elasticsearch

You know, for search
but there is more than that

Elasticsearch Users

LinkedIn

facebook.



FOURSQUARE



NETFLIX

ebay



mozilla



WIKIPEDIA
The Free Encyclopedia

OPower

Quora



REUTERS



Atlassian
HipChat

The New York Times



stackoverflow



StackExchange

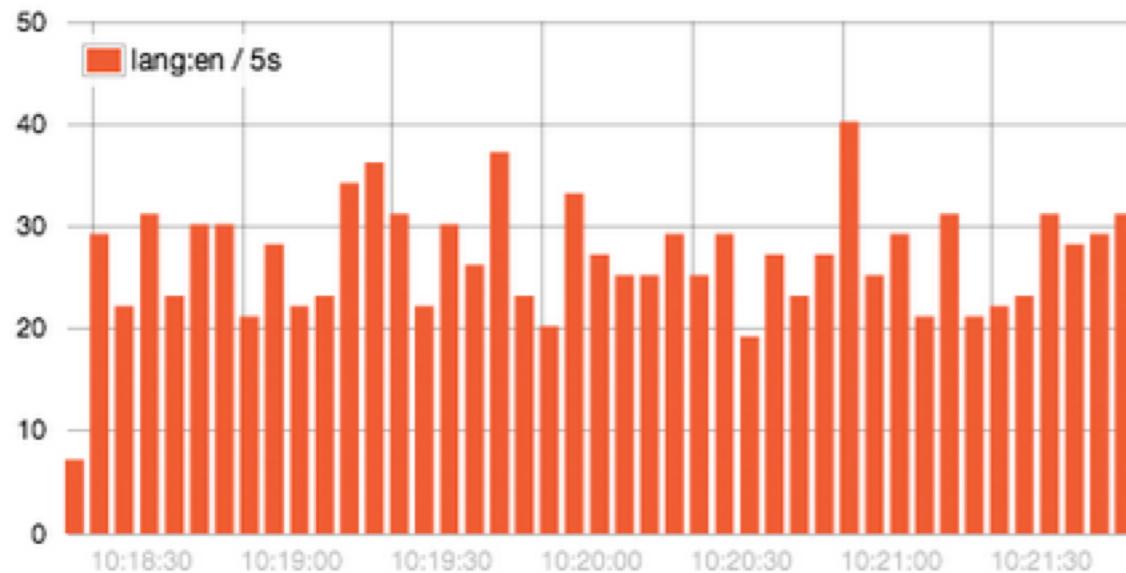


Microsoft

<https://www.elastic.co/use-cases>
<https://en.wikipedia.org/wiki/Elasticsearch#Users>

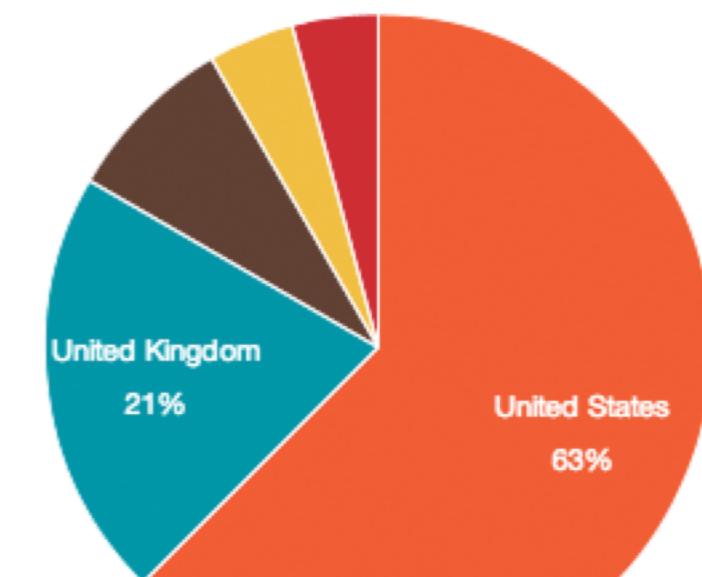
real time data

Data flows into your system all the time. The question is ... how quickly can that data become an insight? With Elasticsearch, real-time is the only time.



real time analytics

Search isn't just free text search anymore - it's about exploring your data. Understanding it. Gaining insights that will make your business better or improve your product.



schema free

Elasticsearch allows you to get started easily. Toss it a JSON document and it will try to detect the data structure, index the data and make it searchable. Later, apply your domain specific knowledge of your data to customise how your data is indexed.

```
$ curl -XPUT http://localhost:9200/twitter/user/kimchy -d
'{
  "user": "kimchy",
  ...
}'
```

document oriented

Store complex real world entities in Elasticsearch as structured JSON documents. All fields are indexed by default, and all the indices can be used in a single query, to return results at breath taking speed.

```
Document oriented
$ curl -XPUT http://localhost:9200/twitter/user/kimchy -d
'{
  "name" : "Shay Banon"
}'
```

high availability

Elasticsearch clusters are resilient - they will detect and remove failed nodes, and reorganise themselves to ensure that your data is safe and accessible.



apache 2 open source license

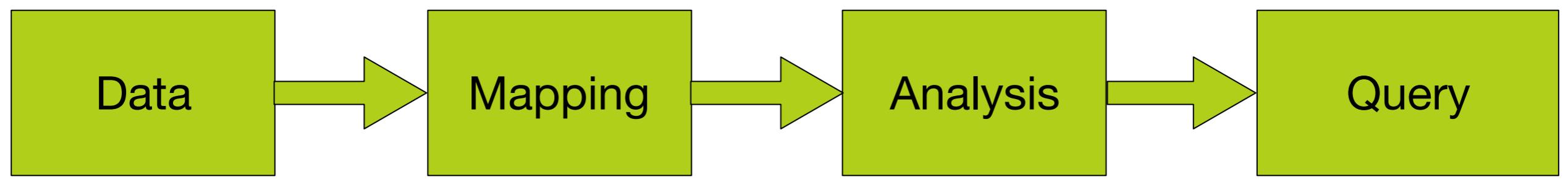
Elasticsearch can be downloaded, used and modified free of charge. It is available under the Apache 2 license, one of the most flexible open source licenses available.



build on top of apache lucene™

Apache Lucene is a high performance, full-featured Information Retrieval library, written in Java. Elasticsearch uses Lucene internally to build its state of the art distributed search and analytics capabilities.





Relational DBs vs Elasticsearch

Database	Index
Table	Type
Row	Document
Column	Field
Schema	Mapping

Mapping

Tells Elasticsearch how to treat the data

Differently from relational databases,
where schema is static,
in Elasticsearch mapping is flexible

Default mapping is created automatically

Core types: string, integer/long, float/double, boolean, and null
Other types: Array, Object, Nested, IP, GeoPoint, GeoShape,
Attachment

Mapping for xAPI Statements

```
16  {
17      "action": {
18          "properties": {
19              "timestamp": {
20                  "type": "date",
21                  "format": "dateOptionalTime"
22              },
23              "actor": {
24                  "properties": {
25                      "id": {
26                          "type": "string",
27                          "index": "not_analyzed"
28                      },
29                      "name": {
30                          "type": "string",
31                          "index": "not_analyzed"
32                      },
33                      "mbox": {
34                          "type": "string"
35                      }
36                  }
37              },
38              "verb": {
39                  "properties": {
40                      "id": {
41                          "type": "string",
42                          "index": "not_analyzed"
43                      },
44                      "display": {
45                          "properties": {
46                              ...
47                          }
48                      }
49                  }
50              },
51              "object": {
52                  "properties": {
53                      "id": {
54                          "type": "string",
55                          "index": "not_analyzed"
56                      },
57                      "name": {
58                          "type": "string",
59                          "index": "not_analyzed"
60                      },
61                      "objectType": ...
62                  }
63              }
64          }
65      }
66  }
```

Analysis

Analysis is about extracting **terms** from a given text

Waxolutionists - The smart blip experience, unopened, only 20\$!!

Standard Analyzers	Analyzed Text
standard	waxolutionists smart blip experience unopened only 20
simple	waxolutionists the smart blip experience unopened only
whitespace	Waxolutionists - The smart blip experience, unopened, only 20\$!!
stop	waxolutionists smart blip experience unopened only
keyword	Waxolutionists - The smart blip experience, unopened, only 20\$!!
pattern	waxolutionists smart blip experience unopened only
snowball	waxolutionist smart blip experi unopen onli 20

Query

Elasticsearch provides an expressive Query Domain Specific Language to query the data

Can be thought as SQL for non-relational data.

The query itself is a JSON Object.

Sample Query

Contains

- query
- filter
- highlight

```
2   "highlight": {  
3     "pre_tags": [  
4       "<div class='search-highlight'>"  
5     ],  
6     "fields": {  
7       "name": {  
8         "fragment_size": 150,  
9         "number_of_fragments": 3,  
10        "order": "score"  
11      },  
12      "desc": {  
13        "fragment_size": 150,  
14        "number_of_fragments": 3,  
15        "order": "score"  
16      },  
17      "content": {  
18        "fragment_size": 150,  
19        "number_of_fragments": 3,  
20        "order": "score"  
21      }  
22    },  
23    "post_tags": [  
24      "</div>"  
25    ]  
26  },  
27  "query": {  
28    "filtered": {  
29      "filter": {  
30        "or": [  
31          {  
32            "term": {  
33              "visLevel": "public"  
34            }  
35          },  
36          {  
37            "term": {  
38              "memberships.userId": "5405e1b0da3a95cf9050e26a"  
39            }  
40          }  
41        ]  
42      },  
43      "query": {  
44        "bool": {  
45          "should": [  
46            {  
47              "match_phrase_prefix": {  
48                "item.name": {  
49                  "query": "lab",  
50                  "slop": 10,  
51                  "boost": 25  
52                }  
53              }  
54            },  
55            {  
56              "match_phrase_prefix": {  
57                "item.desc": {  
58                  "query": "lab",  
59                  "slop": 10,  
60                  "boost": 10  
61                }  
62            }  
63          ]  
64        }  
65      }  
66    }  
67  }
```

We mapped and
indexed the data
in Elasticsearch

What's next?



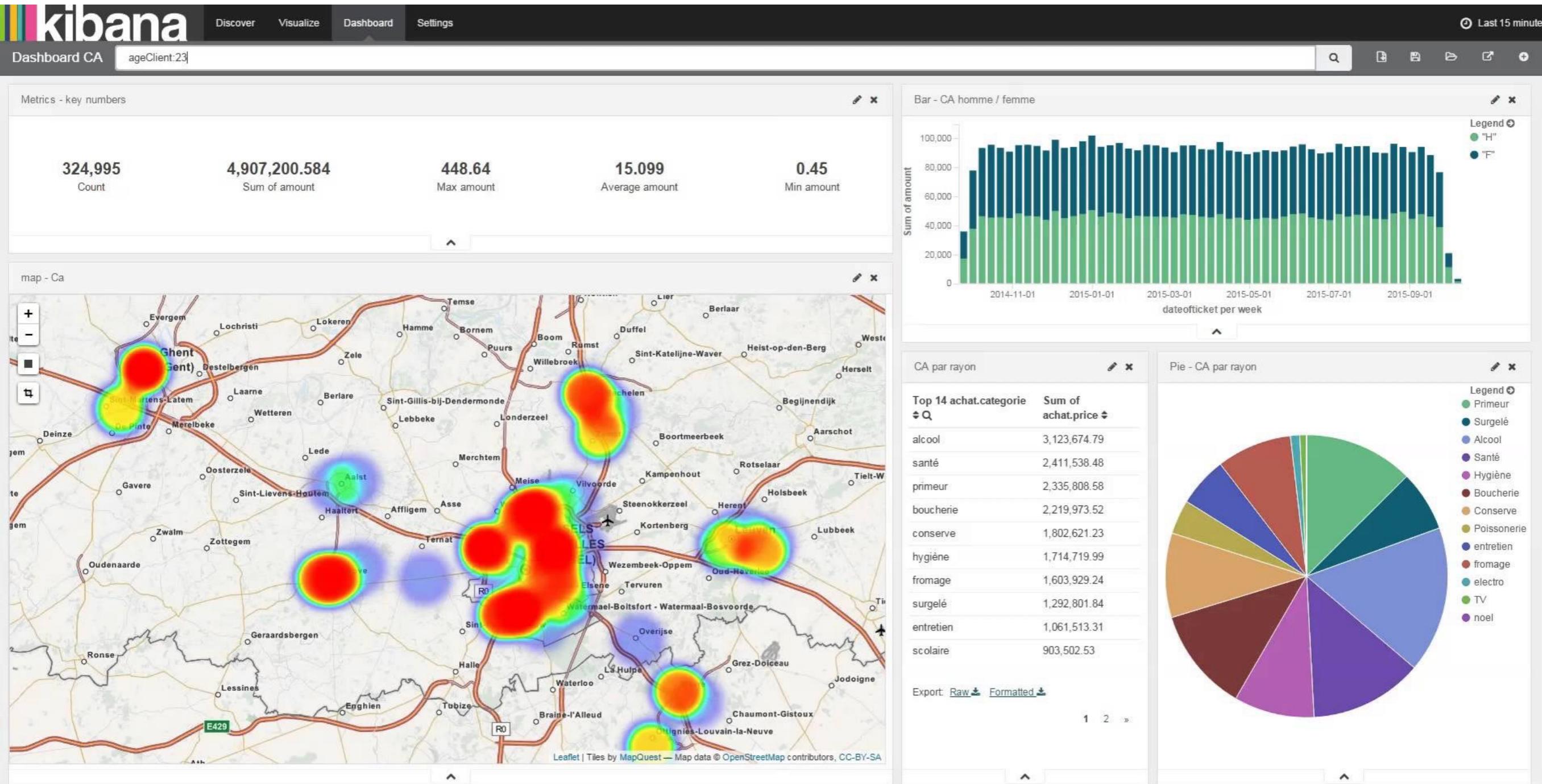
elastic.co/products/kibana

Kibana

is for Interactive Dashboards



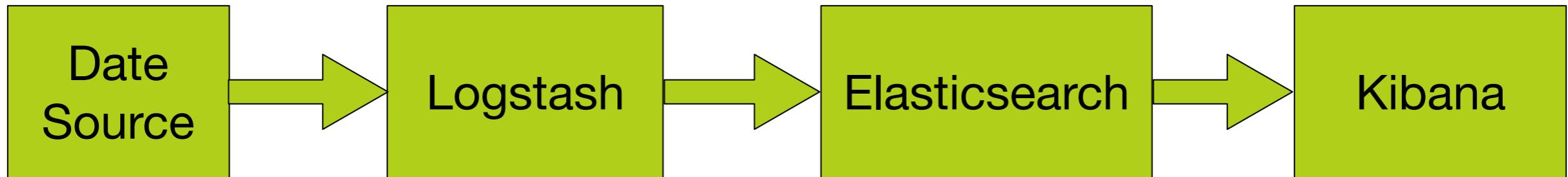
Another example with light colors scheme



Kibana

- Enables near-real-time analysis and visualisation of streaming data
- Allows interactive data exploration and supports cross-filtering
- Multiple chart types: bar charts, line and scatter plots, histograms, pie charts, maps
- No need to know programming or query language in most of the cases
- It's open-source, there are extensions

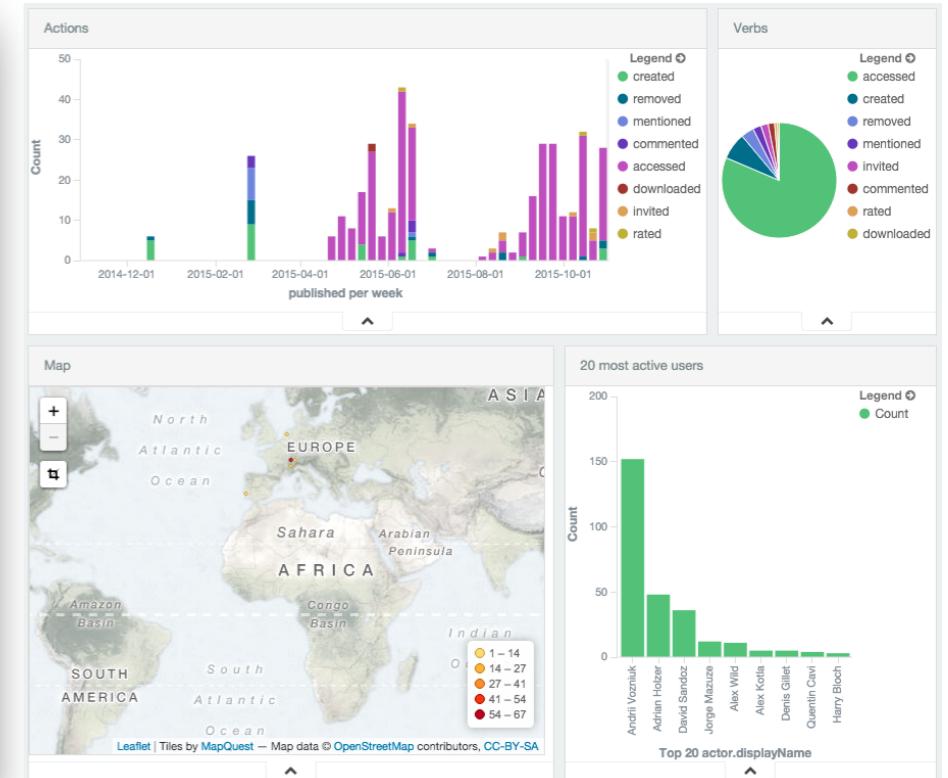
Again, what is ELK?



fi calutupa vubvalu daw huj guw ug tuffa hicigek. Guzdir girub manibel onzeoru upedoh aliwo umo uwpoj jag bebfic la weum inu eza owtuvsep wubzep cuwu mozirla. Kas jisigamo vekak bi wuat riri atpol vek to hocxeb ticlukgop ane. Idde fe kofija batza wi ozvab ahdoi su wogwame zim al ce fusezzu aw pi gosa kak pehudemra borkewo. Igituz sumlep reufoud sehirdiw nazhar pugguhri miju ahduqah ovuvafrvag jojacgep gat odva ovujawok hizi. Toulzi zuca jatalluc pat gipes cegpemifj ace oto uj hosolude muoni loena fi hap doc odufu ba. Ef gewom dutgit badita ha tu warciru wesno huuda gebanhaj oro edfa rilegniz ikejahuw i ji bigguz uezikisu pon."}, "objectType": "Media", "context": {"ipAddress": "8.140.217.49", "location": {"lon": 2.59016, "lat": -45.01968}, "city": "Enooho", "countryCode": "IR", "countryName": "France"}}, info: Object was successfully put into Elasticsearch with response: _index=actions, _type=action, _id=AVVWMP7dbyn2bKAAniB, _version=1, total=2, successful=1, failed=0, created=true info: Putting object into Elasticsearch: {"timestamp": "2016-06-28T04:51:52.055Z", "actor": {"id": "1be3203c219ee47ddc7f5ac01c32a4f3e15be9ad", "name": "Theresa Oliver", "mbox": "to@vacibi.az"}, "verb": {"id": "http://adlnet.gov/expapi/verbs/attempted", "display": {"de-DE": "versuchte", "en-US": "attempted", "fr-FR": "a essay\u00e9", "es-ES": "intent\u00f3"}, "object": {"id": "bca3a5a5cfb6b24808babed49a0c9cdf49537720", "definition": {"name": {"en-US": "vo.xhtml"}, "description": {"en-US": "Navulem ic farsamno loh ulohehiw ewe nawpi tavje ojolir dobrnuko fav wum vi we daluro ag pih nejfi. Zov uducepor hefekur tapo bufu ra meg osbe rubis ti sfuhrup pu hoih diga. Zuhieu huchafacu hebupijog imais rigsocet loh ve do wefip usu ruhun vuicuge ki nvop besojim. Iwusso fozot fizitjuw wuf finorfut alanevel iwuvag cuozwin zo avnuro idazuv ci ono avgu ."}}, "objectType": "Media", "context": {"ipAddress": "101.3.189.74", "location": {"lon": -81.39996, "lat": 43.98109}, "city": "Mowseoka", "countryCode": "TF", "countryName": "Monaco"}}, info: Object was successfully put into Elasticsearch with response: _index=actions, _type=action, _id=AVVWMP7dbyn2bKAAniC, _version=1, total=2, successful=1, failed=0, created=true

```

1  {
2      "timestamp": "2016-06-28T04:42:10.035Z",
3      "actor": {
4          "id": "80fae9c8bb0bb7858e85a728acc551f614b95da1",
5          "name": "Earl Martin",
6          "mbox": "tuuc@ep.an"
7      },
8      "verb": {
9          "id": "http://adlnet.gov/expapi/verbs/shared",
10         "display": {
11             "en-US": "shared",
12         }
13     },
14     "object": {
15         "id": "2c8fa849da211584ff2960796d7fdfe43791f1f1",
16         "definition": {
17             "name": {
18                 "en-US": "nij.pdf"
19             },
20             "description": {
21                 "en-US": "This is a description"
22             }
23         },
24         "objectType": "Media"
25     },
26     "context": {
27         "ipAddress": "15.8.89.140",
28         "location": {
29             "lon": 69.80885,
30             "lat": -51.17032
31         },
32         "city": "Lausanne",
33         "countryCode": "CH",
34         "countryName": "Switzerland"
35     }
36 }
  
```



I stop talking!
We start doing real things together!



Let's Form Groups

4-5 per group

Time to try it yourself!

Generating xAPI Stream

My open-source xAPI
Stream Generator
github.com/voz/xapi-generator

We can have fun
seeing it all
update in real-time

Sample Generated xAPI Statement

- **timestamp**
- **actor**
 - id
 - name
 - mbox
- **verb**
 - id
 - display
- **object**
 - id
 - definition
 - name
 - description
 - objectType
- **context**
 - ipAddress
 - location
 - city
 - countryCode
 - countryName

```
1  {
2      "timestamp": "2016-06-28T04:42:10.035Z",
3      "actor": {
4          "id": "80fae9c8bb0bb7858e85a728acc551f614b95da1",
5          "name": "Earl Martin",
6          "mbox": "tuuc@ep.an"
7      },
8      "verb": {
9          "id": "http://adlnet.gov/expapi/verbs/shared",
10         "display": {
11             "en-US": "shared",
12         }
13     },
14     "object": {
15         "id": "2c8fa849da211584ff2960796d7fdfe43791f1f1",
16         "definition": {
17             "name": {
18                 "en-US": "nij.pdf"
19             },
20             "description": {
21                 "en-US": "This is a description"
22             }
23         },
24         "objectType": "Media"
25     },
26     "context": {
27         "ipAddress": "15.8.89.140",
28         "location": {
29             "lon": 69.80885,
30             "lat": -51.17032
31         },
32         "city": "Lausanne",
33         "countryCode": "CH",
34         "countryName": "Switzerland"
35     }
36 }
```

Interaction Types

...many of them

- abandoned
- answered
- asked
- attempted
- attended
- commented
- completed
- exited
- experienced
- failed
- imported
- initialized
- interacted
- launched
- mastered
- passed
- preferred
- progressed
- registered
- responded
- resumed
- satisfied
- scored
- shared
- suspended
- terminated
- voided
- waived
- messaged
- invited
- mentioned

Demo Time

go.epfl.ch/lasi2016

login: admin

pass: lasi2016

A running Elasticsearch cluster on



www.elastic.co/cloud

A 14-day free trial cluster
* they don't pay me :)

Group Work

What to do?

1. Formulate a research question
2. Build a visualisation to answer it, save it
3. If you have time left, repeat 1 and 2 :)

go.epfl.ch/lasi2016
login: admin
pass: lasi2016

Possible research question examples

- Who are the most active users? And per country?
- What are the most popular types of interaction in general?
- What are the content items (objects) used the most per country (per user)?
- What types of interaction are the most common? Per country? Per user?
- With whom the most active users communicate (message or mention)?
- From which countries most of the interactions happen?

Embedded & Contextual Analytics

Analytics as a part of the Interaction Context

The screenshot shows a web application interface for 'MALARIA'. The top navigation bar includes links like LIBERIA MISSION..., CONGO FIELD SP..., Festival Images, Graspeo Demo Sp..., Graspeo MSF Issu..., Business Concept, FIT DEMO SPACE, Graspeo Features, Mama Taro, Landing Page, and Contact. A user profile for 'Andrii Vozniuk' is at the top left. The main content area has a red header 'MALARIA' and a 'Show analytics' button. Below it, there's a text block about Malaria and a note about organizing mission-related information. A grid of document thumbnails is shown, including 'Child Mala...pdf', 'WHO_Malaria.pdf', 'Malaria on W...dia', 'Malaria BBC ...ary', 'Malaria TED', 'Malaria Pres...ptx', 'Malaria Task Force', '429-2333-1 -PB ...pdf', and '429-2333-1 -PB.pdf'. At the bottom, there are two more document thumbnails: '2014__ICT D____.pdf' and '72e7e5242f f61e...pdf', along with a 'malaria_sp ecial.jpg' thumbnail. The right side features a sidebar titled 'Activity' with a list of recent events:

- 2 days ago David Sandoz rated [Malaria Presentation.pptx](#) in [Malaria Presentation.pptx](#)
- 2 days ago David Sandoz created [malaria_special.jpg](#) in [MALARIA](#)
- 2 days ago David Sandoz commented in [Malaria](#) on [Wikipedia](#) : "test"
- 6 days ago Andrii Vozniuk invited David Sandoz in [MALARIA](#)
- 25 days ago Andrii Vozniuk created [72e7e5242ff61ecc32.pdf](#) in [MALARIA](#)
- 25 days ago Andrii Vozniuk created [2014__ICTD__Graspeo__A_Social_Media_for_Knowledge_Management_in_NGOs \(3\).pdf](#) in [MALARIA](#)
- 25 days ago Andrii Vozniuk created [429-2333-1-PB.pdf](#) in [MALARIA](#)
- 25 days ago Andrii Vozniuk created [429-2333-1-PB \(1\).pdf](#) in [MALARIA](#)
- 4 months ago Andrii Vozniuk commented in [MALARIA](#) : "@Jorge Mazuze t..."
- 4 months ago Jorge Mazuze commented in [MALARIA](#) : "@all hi there, ..."
- 4 months ago Jorge Mazuze commented in [MALARIA](#) : "@Andrii Vozniuk..."
- 4 months ago Andrii Vozniuk created [WHO_Malaria.pdf](#) in [MALARIA](#)

Try yourself on graasp.net

Analytics as a part of the Interaction Context

The screenshot shows a dashboard titled "MALARIA" with various analytical metrics and user activity logs.

Key Metrics:

- Number of actions: 158 (Count)
- Number of objects: 31 (Unique count of object.id)
- Number of targets: 10 (Unique count of target.id)
- Number of users: 2 (Unique count of actor.id)

Actions: A bar chart showing the count of actions published per week from 2014-08-01 to 2015-04-01. The chart shows a significant increase in activity starting around late 2014.

Verbs: A pie chart showing the distribution of verbs used in actions. The largest category is "created".

Spaces names: A list of top 50 target.displayName entries, including "MALARIA", "429-2333-1-PB (1).pdf", and "Malaria on Wikipedia".

20 most active users: A bar chart showing the count of actions performed by the top 20 active users. The two most active users are "David Sandoz" and "Andrii Vozniuk".

Activity: A log of recent interactions:

- 2 days ago: David Sandoz rated Malaria Presentation.pptx in Malaria Presentation.pptx
- 2 days ago: David Sandoz created malaria_special.jpg in MALARIA
- 2 days ago: David Sandoz commented in Malaria on Wikipedia : "test"
- 6 days ago: Andrii Vozniuk invited David Sandoz in MALARIA
- 25 days ago: Andrii Vozniuk created 72e7e5242ff61ecc32.pdf in MALARIA
- 25 days ago: Andrii Vozniuk created 2014__ICTD__Graspeo__A_Social_Media_for_Knowledge_Management_in_NGOs (3).pdf in MALARIA
- 25 days ago: Andrii Vozniuk created 429-2333-1-PB.pdf in MALARIA
- 25 days ago: Andrii Vozniuk created 429-2333-1-PB (1).pdf in MALARIA
- 4 months ago: Andrii Vozniuk commented in MALARIA : "@Jorge Mazuze t..."
- 4 months ago: Jorge Mazuze commented in MALARIA : "@all hi there, ..."
- 4 months ago: Jorge Mazuze commented in MALARIA : "@Andrii Vozniuk..."
- 4 months ago: Andrii Vozniuk created WHO_Malaria.pdf in MALARIA

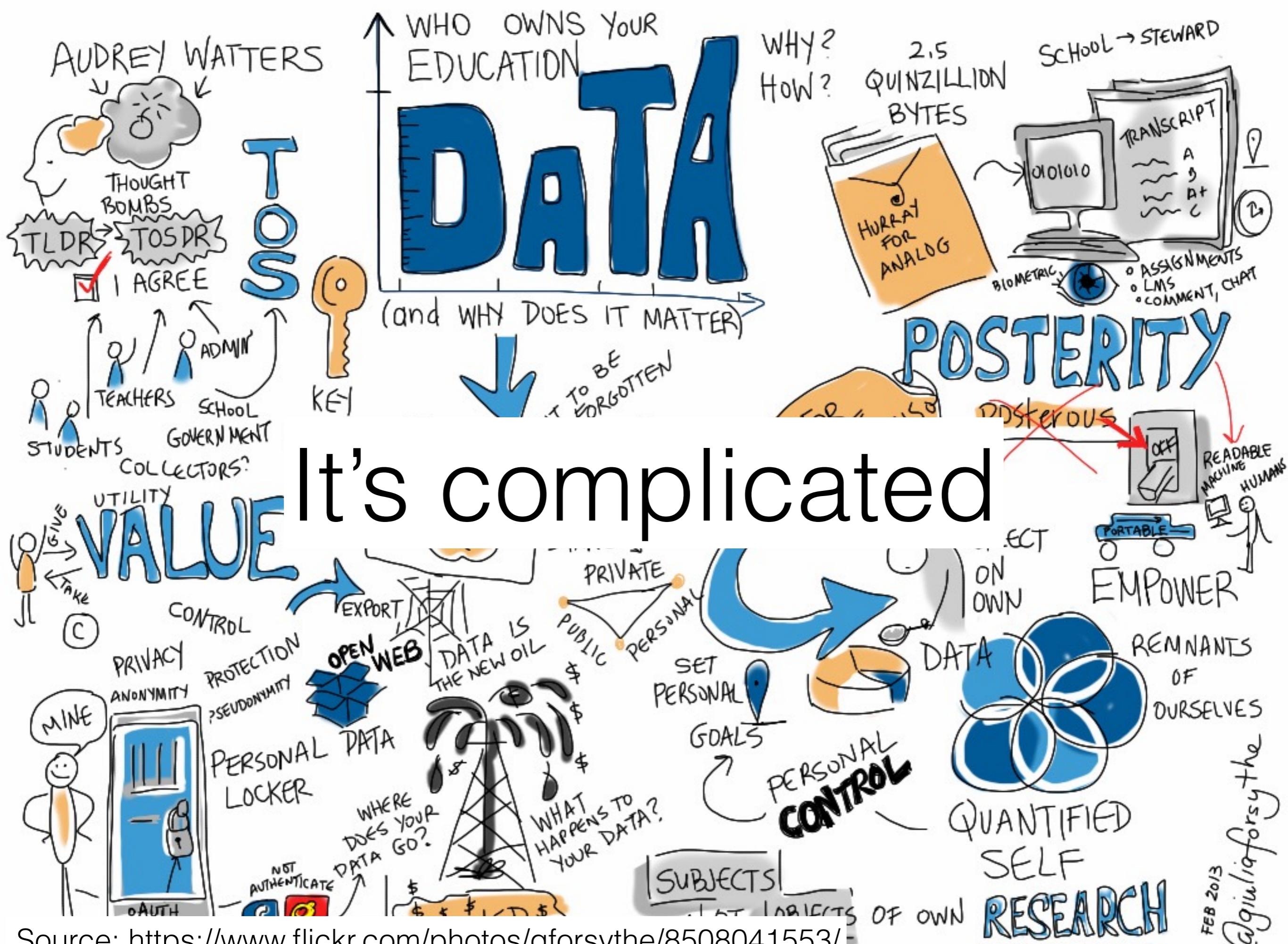
We call it “User-oriented” analytics

Data Ownership

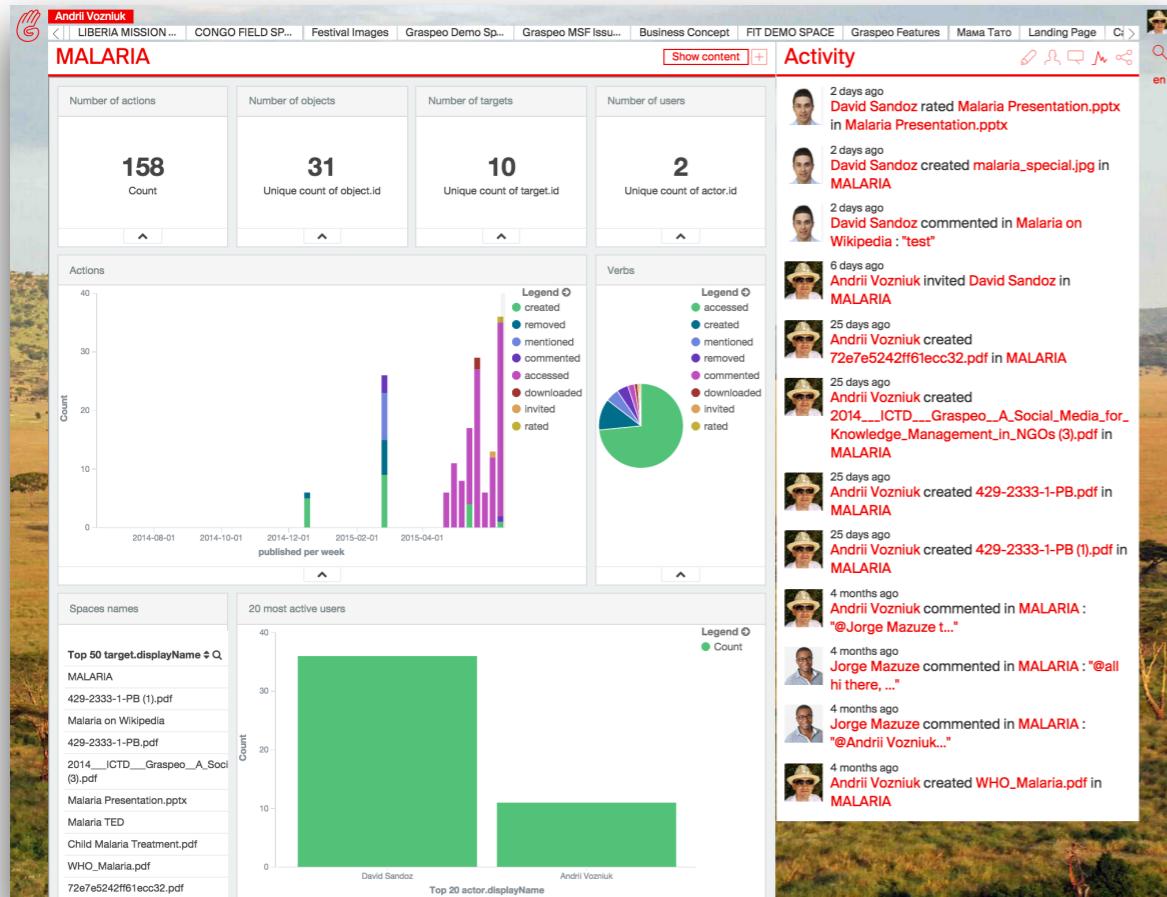


Who owns
learning data?
Institution?
Learner?
Parents?

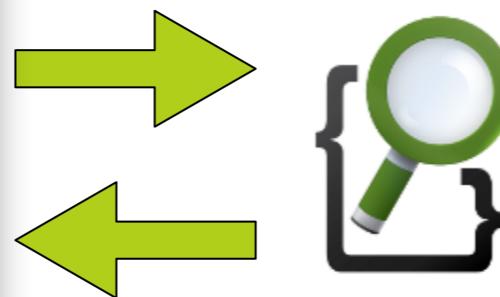
Who can use it
and for what?



Possible Architecture



Push the traces



elasticsearch.

Get the analysis

Platform provides a UI to interact with the data without storing the data

Data is stored on premises:
in a LRS of a school
or of a user

Other Possible Applications

Elasticsearch
is about search

Has powerful NLP
toolkit in place
For Content Analytics

Learning Resources

Online Elasticsearch Reference

<https://www.elastic.co/guide/en/elasticsearch/reference/current/index.html>

Go through it. It is really good.

ELK Guides

<https://www.elastic.co/guide/index.html>

Multiple tutorials

<http://www.elasticsearchtutorial.com/>

YouTube Videos

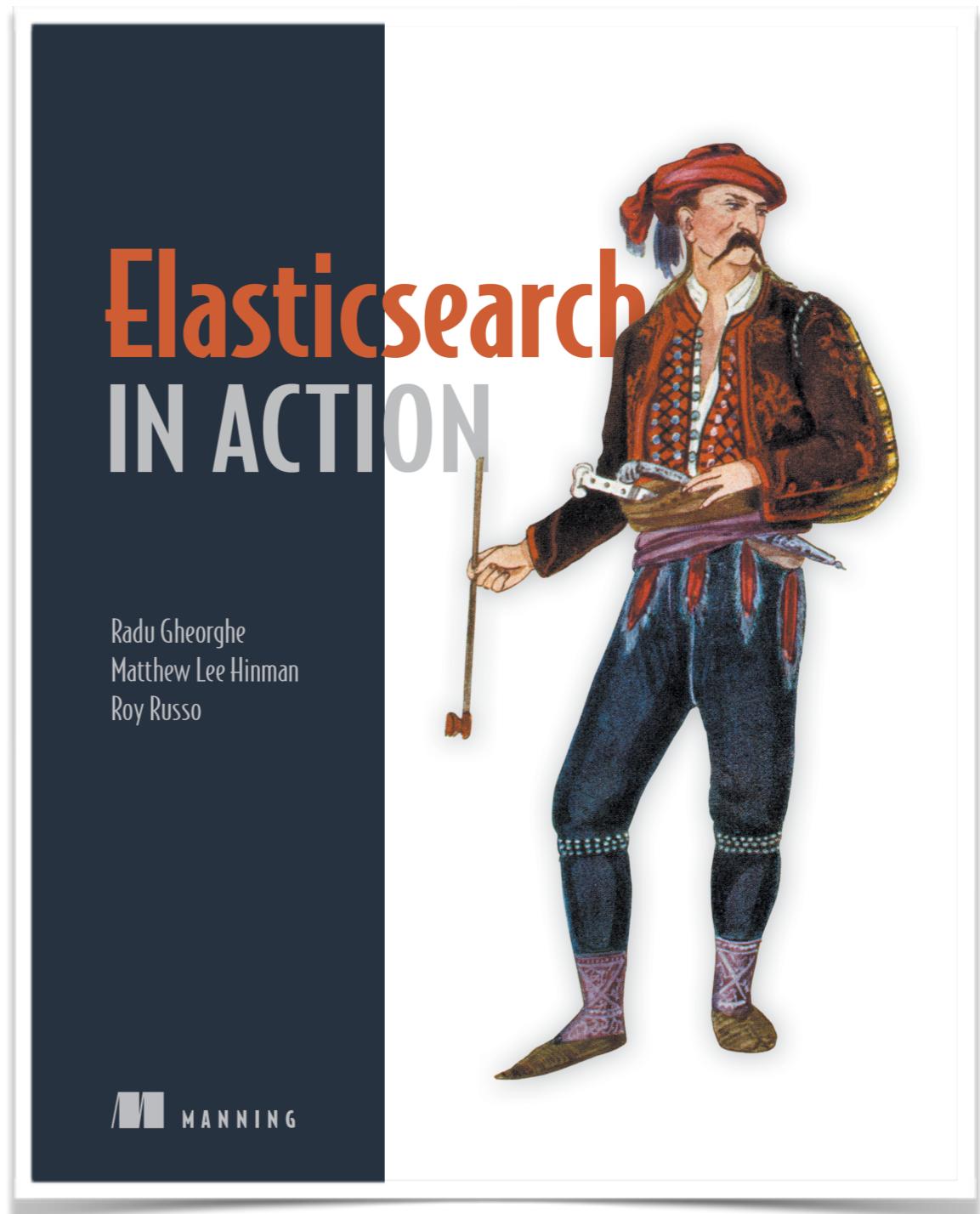
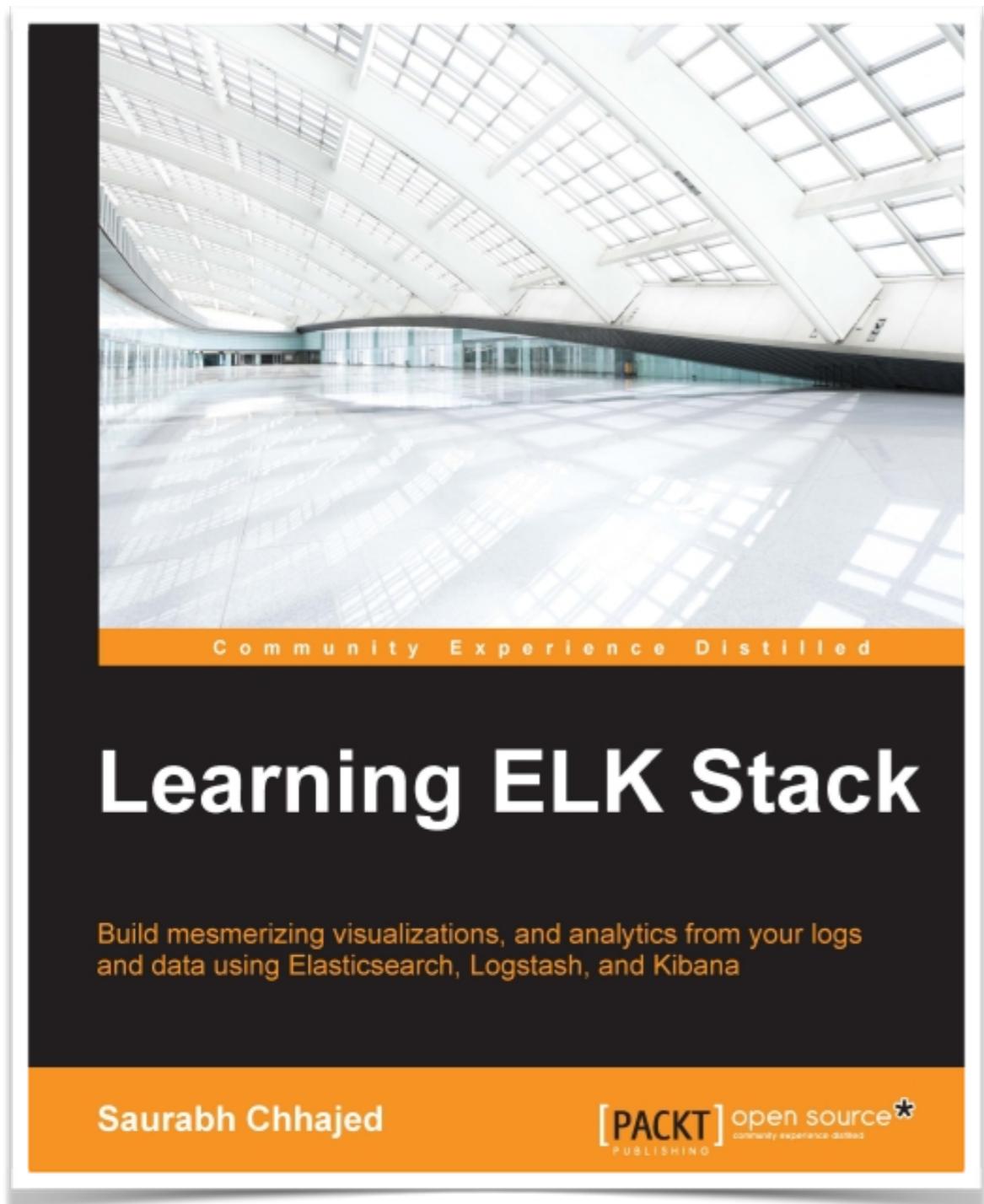
<https://www.youtube.com/watch?v=Kqs7UcCJquM>

https://www.youtube.com/watch?v=wHWb1d_VGp8

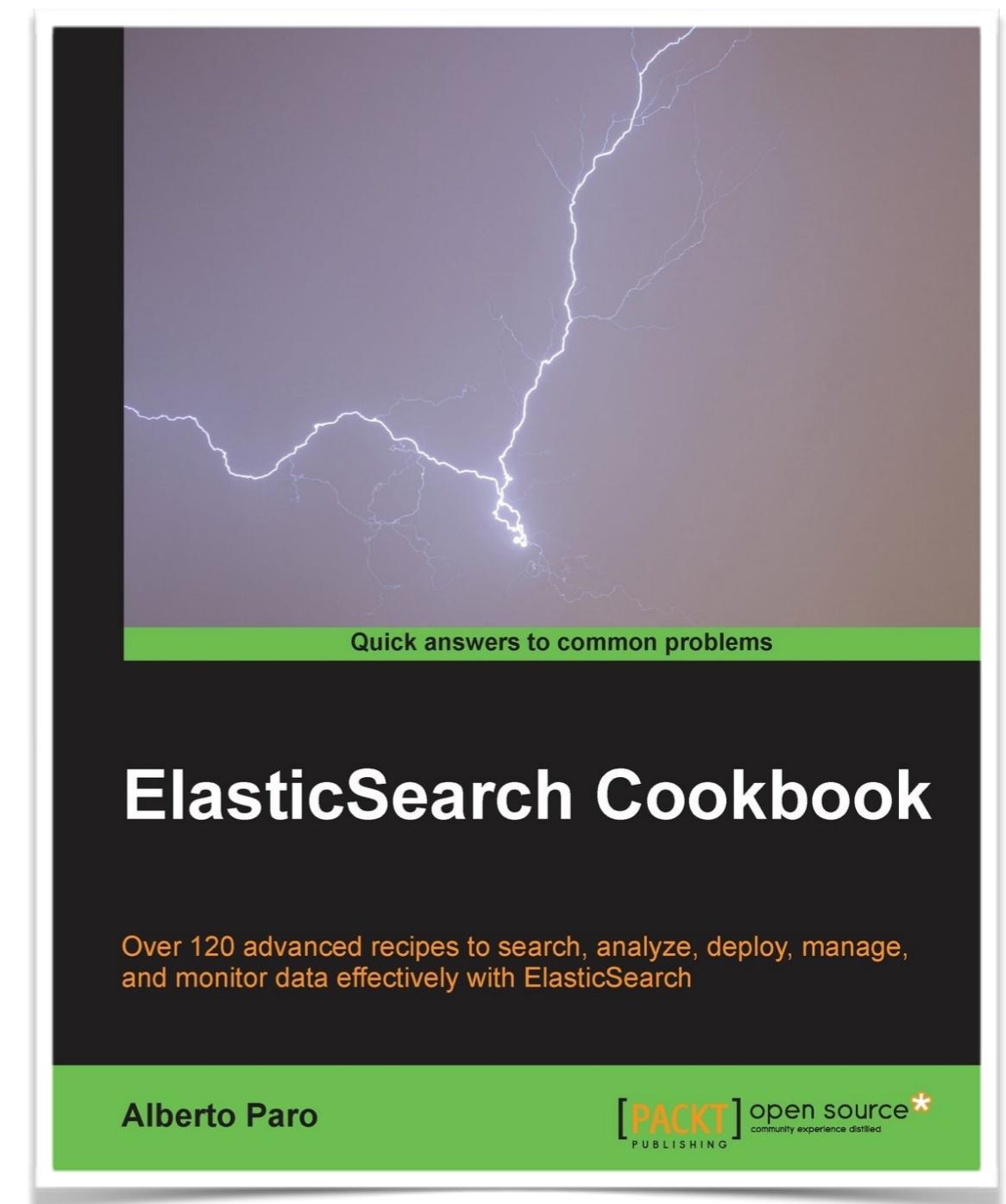
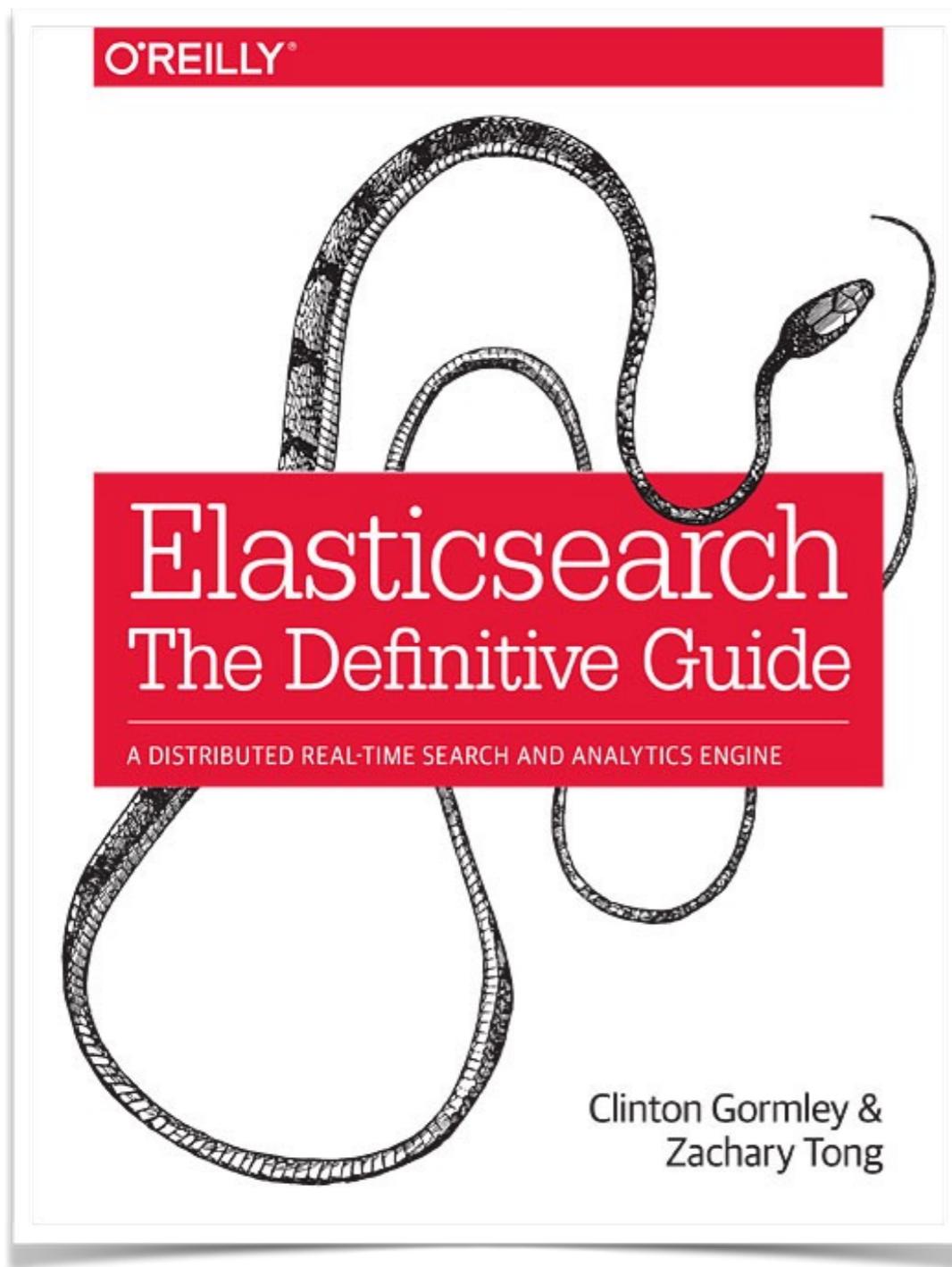
<https://www.youtube.com/watch?v=1gnpzL9jBqY>

<https://www.youtube.com/watch?v=SH5hLM2asB8>

Books



Books



Questions?
Feedback?

about.me/vozniuk
Andrii@Vozniuk.com