Deployment and monitoring

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CERN

Outline

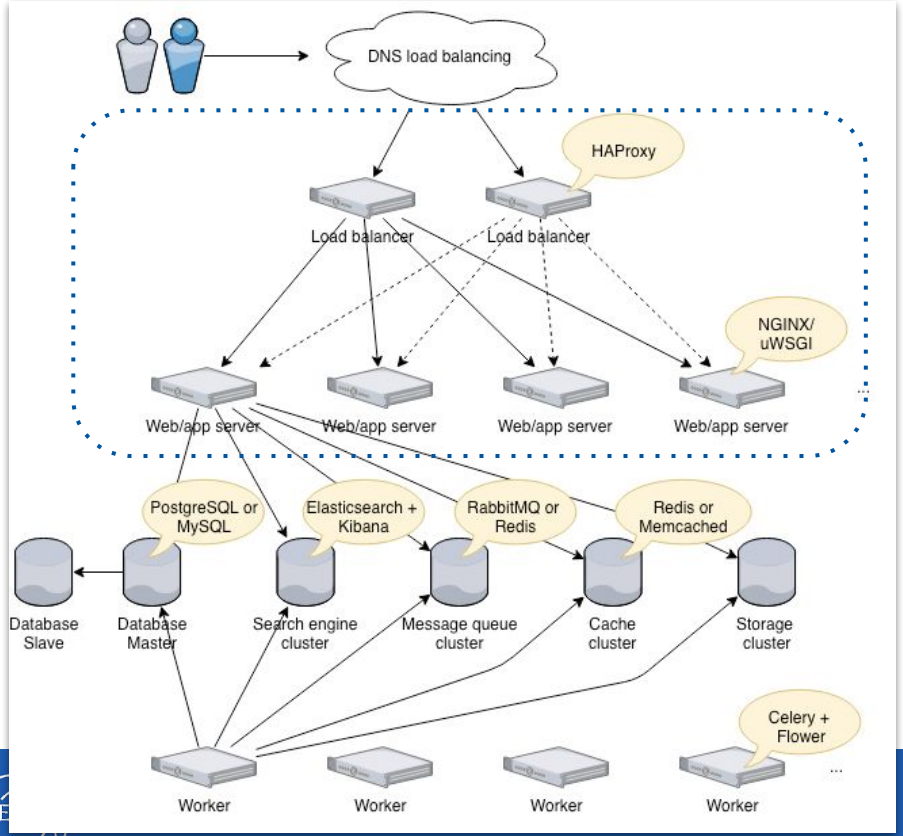
- Deployment configurations
- Dimensions
- Monitoring
- Logging

Deployment configurations

Prepare your infrastructure for production

https://invenio.readthedocs.io/en/latest/architecture/infrastructure.html

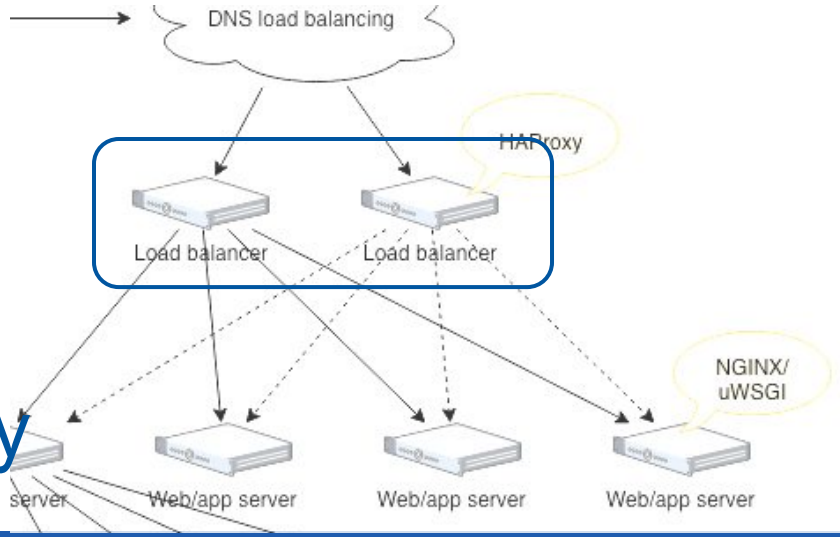
Infrastructure overview



- *Load balancers:* HAProxy, Nginx or others.
- *Web servers:* Nginx, Apache or others.
- *Application servers:* uWSGI, Gunicorn or mod_wsgi.
- *Distributed task queue:* Celery
- *Database:* PostgreSQL, MySQL or SQLite.
- *Search engine:* Elasticsearch (v5 and v6).
- *Message queue:* RabbitMQ, Redis or Amazon SQS.
- *Cache system:* Redis or Memcache.
- *Storage system:* Local, S3, XRootD, WebDAV and more.

Load balancer: HAProxy

- Traffic distribution depending on its “type”
  - /static, /<path>
- URL Rewriting
- SSL Termination
- Downtime static website
- More than 1: redundancy



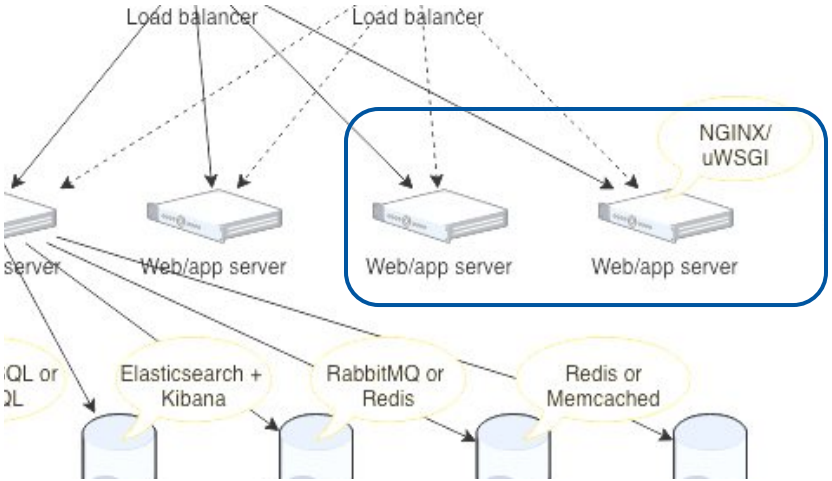
HAProxy configuration

- Frontend
- Backend
- Headers: X-Forwarded-For

Go to documentation

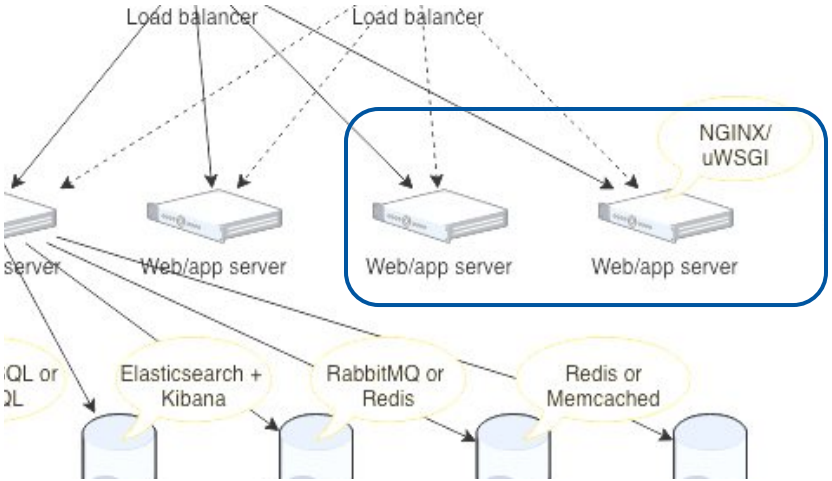
Web app: uWSGI (behind Nginx)

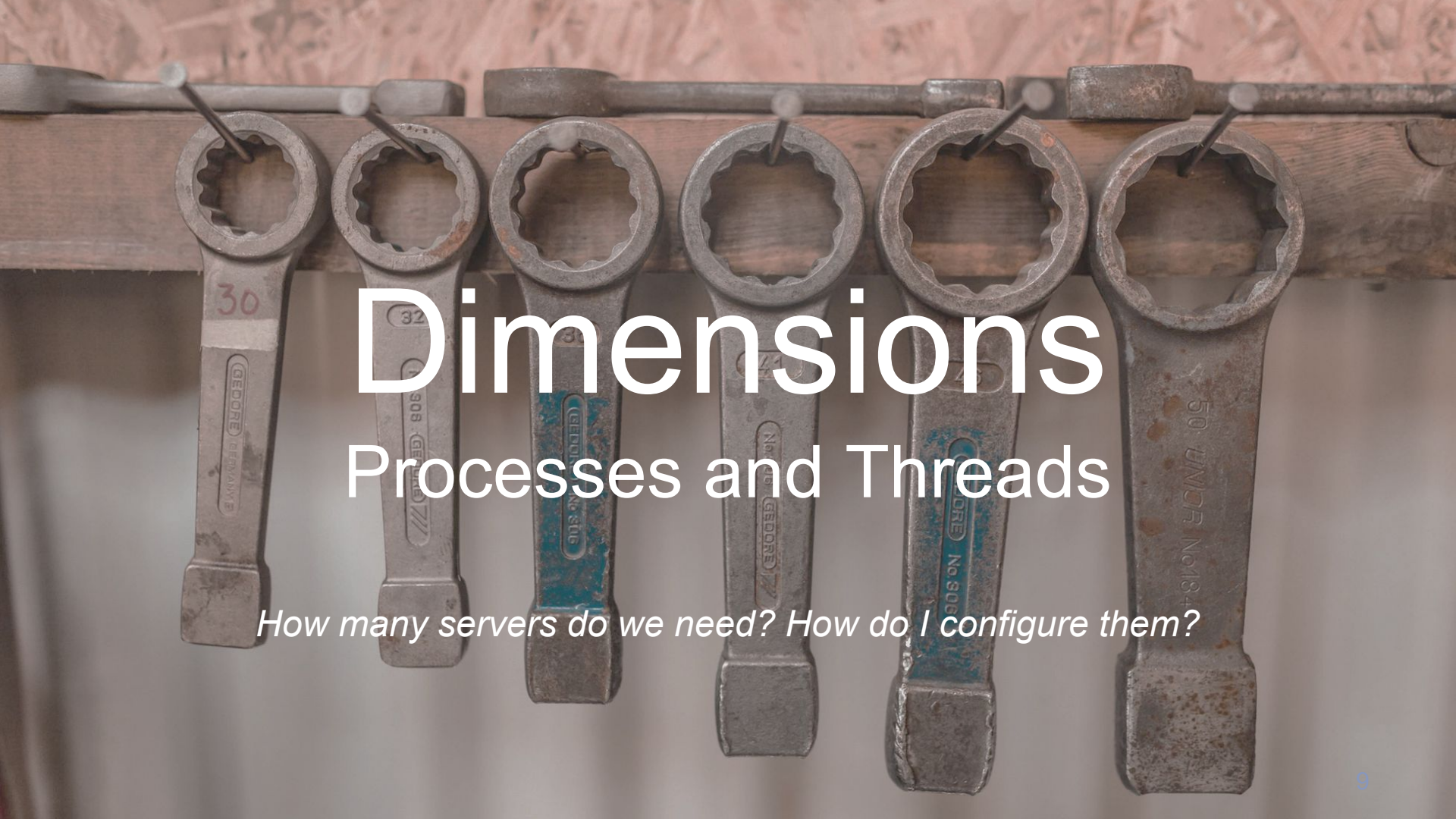
- PEP 333 (TL;DR)
- Invenio UI and REST
- processes and threads



Web app: Nginx

- ngx_http_uwsgi_module: translate HTTP -> WSGI
- Reverse proxy to distribute traffic
  - ui, api, static, files
- protocols and ciphers
- logging
- headers: X-Request-ID





Dimensions

Processes and Threads

How many servers do we need? How do I configure them?

Let’s start with the database

- Depends on DB: Postgresql? MySQL? Servers?
- General: configure max connections
- DB specific: check documentation

Example: 200 max connections

```
$ less /var/lib/pgsql/data/postgresql.conf
max_connections = 200

$ mysql
> SET GLOBAL max_connections = 200;
```

Web nodes: uWSGI

- From the uWSGI documentation (interesting discussion here)

*"There is no magic rule for setting the number of processes or threads to use. It is very much application and system dependent. Simple math like processes = 2 * cpucores will not be enough. You need to experiment with various setups and be prepared to constantly monitor your apps. uwsgitop could be a great tool to find the best values."*

- Processes:
  - 1 process -> 1 Invenio app
  - start with 2 * CPU Cores, and then measure and adjust
- Threads: low, it really depends (take into account GIL, multithreading, etc...)

Example: 8 processes, 2 threads

Max processes per web node

- SQLAlchemy: pool of db connections `pool_size` (default 5) per process
- Each uWSGI process -> 5 db connections
- 8 process per web node -> 5 * 8 = **40** connections
- **200** max connections on db / **40** per web node = ???

5 web nodes max

BUT

- You have to count all Invenio apps (your workers, celery apps)!

Dimensions

HTTP Connections

How many connections per web node? How do I distribute traffic?

Measure!

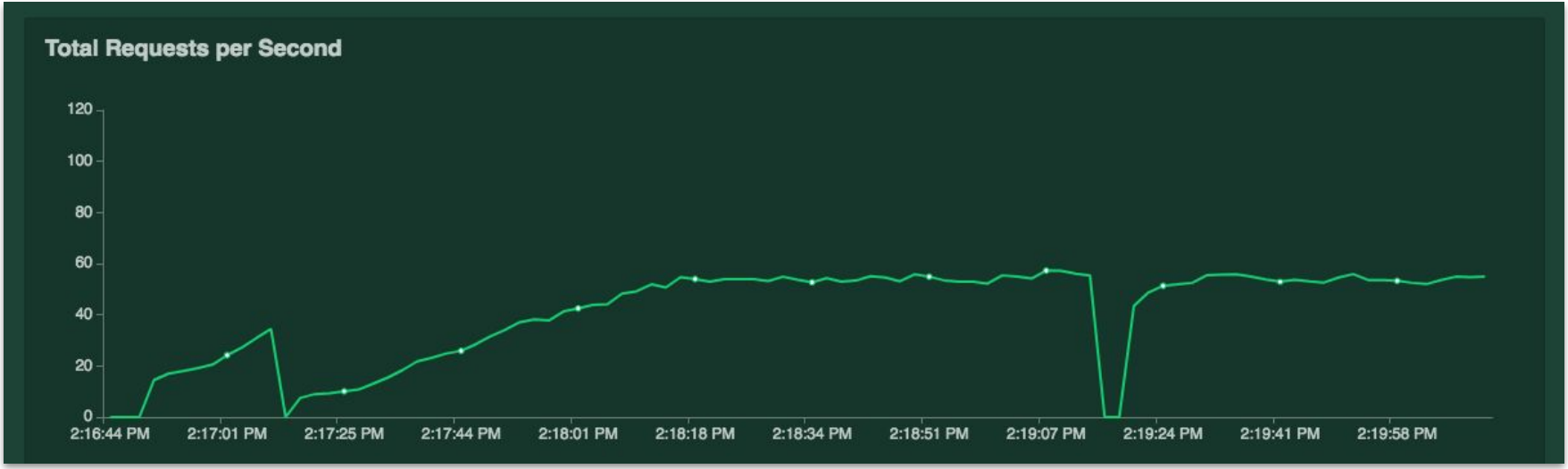
uWSGI: Start small

1. Predict/Estimate the n. of request/sec you need
2. Take one web node
3. Configure number of uWSGI processes
4. Benchmark by increasing number of requests

locust --host=https://mydomain.org/ --no-web -c 1000 -r 100

uWSGI: Iterate

Keep tuning processes/memory until your reach your target



We found out how many connections per web nodes.

And now?

HAProxy: distribute load

Since we now know how many connections per node, we can distribute the load

```
backend ssl_invenio_app
  ...
  server web-backup 127.0.0.1:444 backup check check-ssl fall 2 inter 5000 maxconn 255 rise 1 ssl verify none weight 2
  server web1 frontend:443 check check-ssl fall 2 inter 5000 maxconn 40 rise 1 ssl verify none weight 2
  server web2 frontend:443 check check-ssl fall 2 inter 5000 maxconn 40 rise 1 ssl verify none weight 2

backend ssl_invenio_files
  ...
  server web5 frontend:443 check check-ssl fall 2 inter 5000 maxconn 100 rise 1 ssl verify none weight 2
  server web6 frontend:443 check check-ssl fall 2 inter 5000 maxconn 100 rise 1 ssl verify none weight 2

backend ssl_invenio_static
  ...
  server web3 frontend:443 check check-ssl fall 2 inter 5000 maxconn 255 rise 1 ssl verify none weight 2
  server web4 frontend:443 check check-ssl fall 2 inter 5000 maxconn 255 rise 1 ssl verify none weight 2
```

Recap

1. Max db connections
2. Processes/threads per web node
3. Max connections per web node
4. Load balancer config

Monitoring

Health of your production infrastructure

Load balancer: HAProxy

http://127.0.0.1:8080

HAProxy

Statistics Report for pid 20749

> General process information

pid = 20749 (process #1, nbproc = 1)
uptime = 93d 18h25m07s
system limits: memmax = unlimited; ulimit-n = 8057
maxsock = 8057; **maxconn** = 4000; **maxpipes** = 0
current conns = 3; current pipes = 0/0; conn rate = 1/sec
Running tasks: 1/38; idle = 100 %

- active UP
- active UP, going down
- active DOWN, going up
- active or backup DOWN
- active or backup DOWN for maintenance (MAINT)
- active or backup SOFT STOPPED for maintenance
- backup UP
- backup UP, going down
- backup DOWN, going up
- not checked

Note: "NOLB"/"DRAIN" = UP with load-balancing disabled.

in-cds_cdslabs_http

	Queue			Session rate			Sessions						Bytes		Denied	
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	R
Frontend				0	68	-	0	67	3 000	16 535			14 945 003	20 964 447	0	

in-cds_cdslabs_https

	Queue			Session rate			Sessions						Bytes		
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Re
Frontend				0	43	-	2	47	3 000	801 526			330 327 397 112	2 265 959 457 193	

in-cds_cdslabs_stats

	Queue			Session rate			Sessions						Bytes		Denied	
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp
Frontend				1	2	-	1	2	3 000	37			108 078	11 547 457	0	

cds_cdslabs_app

	Queue			Session rate			Sessions						Bytes		
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Re
videos-cds-lb2.cern.ch-backup	0	0	-	0	0		0	0	255	0	0	?	0	0	
videos-cds-web1.cern.ch	0	0	-	0	16		0	2	40	12 904	12 904	40m8s	3 738 807	5 206 625	
videos-cds-web2.cern.ch	0	0	-	0	19		0	2	40	12 908	12 908	19m52s	3 680 512	5 211 161	
videos-cds-web3.cern.ch	0	0	-	0	16		0	2	40	12 903	12 903	39m44s	3 768 591	5 205 159	
videos-cds-web4.cern.ch	0	0	-	0	17		0	2	40	12 904	12 904	9m5s	3 658 629	5 203 619	
Backend	0	0		0	68		0	8	300	51 619	51 619	9m5s	14 846 539	20 826 564	

cds_cdslabs_files

	Queue			Session rate			Sessions						Bytes		Denied		
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	R
videos-cds-web5.cern.ch	0	0	-	0	1		0	1	256	8	8	25d10h	1 199	3 486		0	
videos-cds-web6.cern.ch	0	0	-	0	1		0	1	256	7	7	28d20h	897	3 052		0	
Backend	0	0		0	2		0	1	300	15	15	25d10h	2 096	6 538	0	0	

Web app: uWSGI

- uWSGI Stats Server
- uwsgitop

```
uwsgi-2.0.14 - Wed Mar 22 12:17:30 2017 - req: 1195253 - RPS: 1 - lq: 0 - tx: 616.0G
node: 127.0.0.1 - cwd: /opt/zenodo - uid: 1001 - gid: 1001 - masterpid: 28932
```

WID	%	PID	REQ	RPS	EXC	SIG	STATUS	AVG	RSS	VSZ	TX	ReSpwn	HC	RunT	LastSpwn
7	10.1	28968	120274	0	2528	0	idle	776ms	0	0	52.0G	1	0	1278m	11:45:37
10	10.1	28971	120126	0	2559	0	idle	1ms	0	0	57.0G	1	0	1394m	11:45:37
2	10.0	28946	120067	0	2564	0	idle	1ms	0	0	54.0G	1	0	1447m	11:45:37
1	10.0	28942	119980	1	2526	0	idle	1ms	0	0	57.0G	1	0	1546m	11:45:37
8	10.0	14707	119859	0	2548	0	idle	2ms	0	0	49.0G	2	0	1552m	10:13:16
5	10.0	28958	119785	0	2616	0	idle	846ms	0	0	89.0G	1	0	1655m	11:45:37
3	10.0	28952	119741	0	2500	0	busy	5ms	0	0	61.0G	1	0	1589m	11:45:37
4	10.0	8635	119062	0	2643	0	idle	1ms	0	0	67.0G	2	0	2230m	12:07:51
9	9.9	28970	118862	0	2623	0	busy	1ms	0	0	63.0G	1	0	2199m	11:45:37
6	9.8	28967	117497	0	2505	0	busy	12ms	0	0	62.0G	1	0	3222m	11:45:37

ElasticSearch: Kibana

http://127.0.0.1:5601

kibana

- Discover
- Visualize
- Dashboard
- Timelion
- Logout
- Indices
- Own Home
- Management

Elasticsearch index status

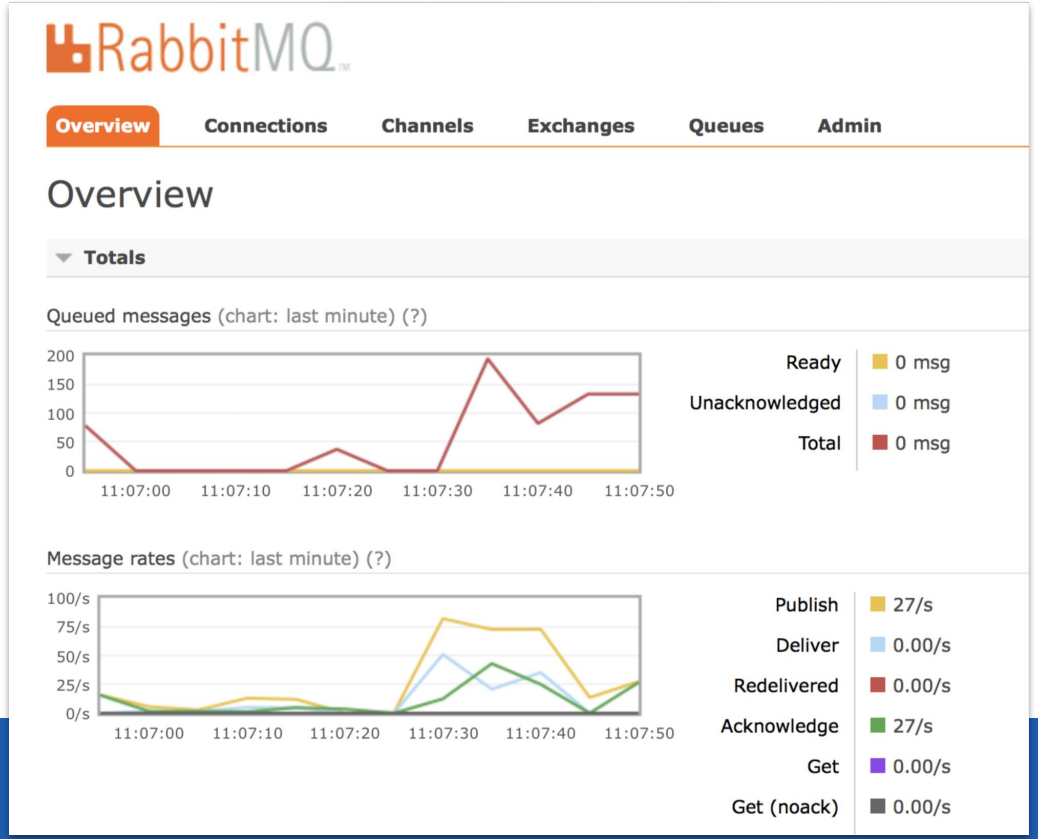
Sort by

name

Index name	health	# replicas	# shards	# docs	size (including replicas)
index name ...	health....	replicas ...	shards ...	docs ...	size ...
.kibana_cdsbooksqa	green	1	1	1	6.8kb
cdsbooks-documents-document-v1.0.0	green	1	5	19	259.3kb
cdsbooks-internal_locations-internal_location-v1.0.0	green	1	5	8	64.4kb
cdsbooks-items-item-v1.0.0	green	1	5	49	489.6kb
cdsbooks-loans-loan-v1.0.0	green	1	5	99	337.4kb
cdsbooks-locations-location-v1.0.0	green	1	5	1	12.6kb
Selected: 6		Selected: 6	Selected: 26	Selected: 177	Selected: 1.1mb
Total: 6		Total: 6	Total: 26	Total: 177	Total: 1.1mb

Job queue

http://127.0.0.1:15672 - guest:guest



Job queue

http://127.0.0.1:15672

Celery Flower | Dashboard | Tasks | Broker | Monitor | Docs | Code

Active: 0	Processed: 19781	Failed: 759	Succeeded: 18687	Retried: 361

Shut Down

	Worker Name	Status	Active	Processed	Failed	Succeeded	Retried	Load Average
	celery@zenodo-task7.cern.ch	Online	0	4929	202	4633	93	0.04, 0.03, 0.05
	celery@zenodo-task5.cern.ch	Online	0	4954	255	4607	101	0.08, 0.08, 0.05
	celery@zenodo-task6.cern.ch	Online	0	4953	133	4759	80	0.0, 0.01, 0.05
	celery@zenodo-task4.cern.ch	Online	0	4945	169	4688	87	0.0, 0.01, 0.05

Monitoring

Zenodo Control Tower

Last 2 days

Load balancers

Error rate (5xx)

App 5xx errors Max: 0.00667 Static 5xx errors Max: 0

Sessions

App sessions Max: 154 Static sessions Max: 8

Elasticsearch

Status

Nodes

Data Nodes

Shards

Active shards Current: 1.156 K Unassigned shards Current: 0
Relocating shards Current: 0 Initializing shards Current: 0

Documents & Size

Documents Current: 15 Mil Size Current: 12.99 GB

Heap usage

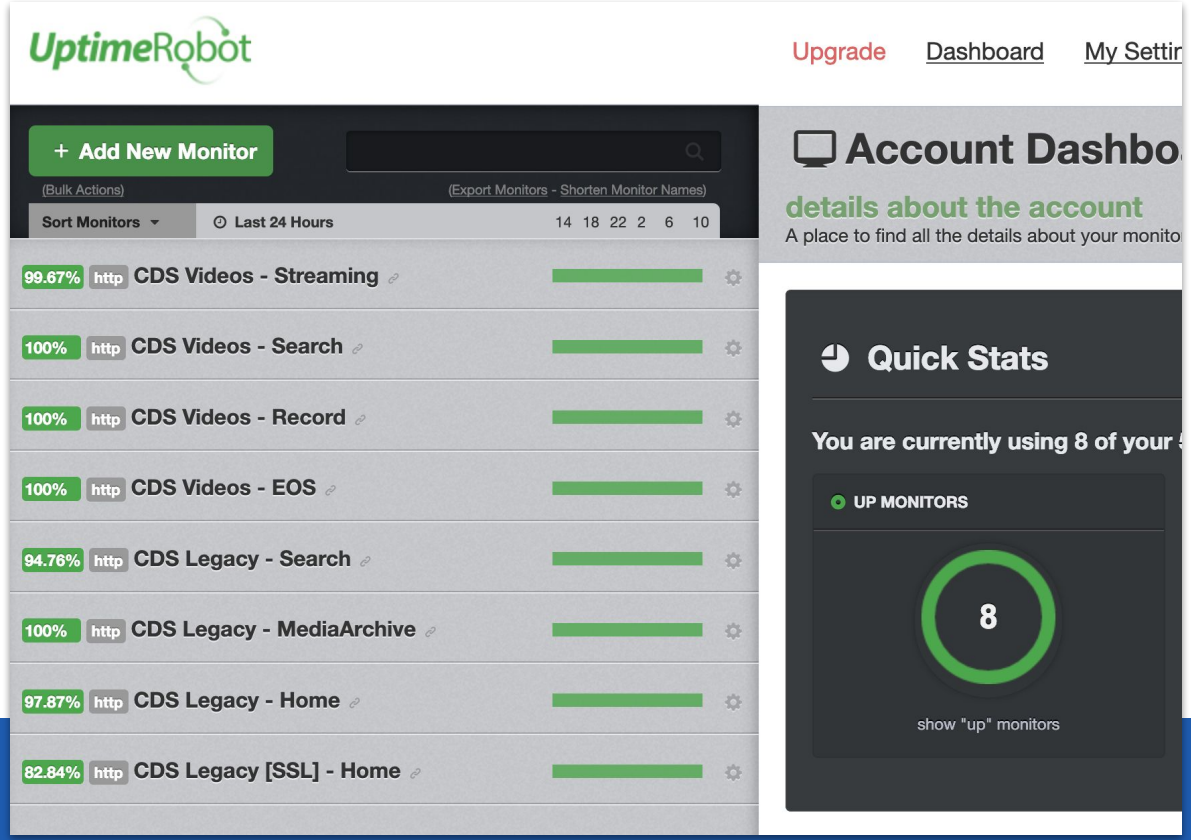
elasticsearch_percent.mean {host: zenodo-search-c2.cern.ch} Current: 45%
elasticsearch_percent.mean {host: zenodo-search-c3.cern.ch} Current: 20%
elasticsearch_percent.mean {host: zenodo-search-m4.cern.ch} Current: 68%
elasticsearch_percent.mean {host: zenodo-search-m5.cern.ch} Current: 67%
elasticsearch_percent.mean {host: zenodo-search-m6.cern.ch} Current: 69%

EOS

Storage quota

Storage volume

Alerting: UpTimeRobot



Logging

Understand what happened

Request tracing

How do we find the traces of a specific request in each server?

How can we get the request IP?

Load balancer: HAProxy

```
backend ssl_app
  balance leastconn
  http-check disable-on-404
  option http-server-close
  option forwardfor except 127.0.0.0/8
  option httpchk HEAD /ping HTTP/1.0
  server web1 frontend:443 check check-ssl fall 2 inter 20000 maxconn 30 rise 1 ssl verify none weight 2

backend ssl_static
  balance leastconn
  http-check disable-on-404
  option http-server-close
  option forwardfor except 127.0.0.0/8
  option httpchk HEAD /ping HTTP/1.0
  server web1 frontend:443 check check-ssl fall 2 inter 5000 maxconn 255 rise 1 ssl verify none weight 2
```

Web app: Nginx

Infrastructure IPs

```
172.22.0.12 my-site_lb_1
172.22.0.11 my-site_frontend_1
172.22.0.10 my-site_web-ui_1
172.22.0.7 my-site_worker_1
172.22.0.9 my-site_web-api_1
172.22.0.6 my-site_flower_1
172.22.0.8 my-site_kibana_1
172.22.0.4 my-site_mq_1
172.22.0.5 my-site_db_1
172.22.0.3 my-site_cache_1
172.22.0.2 my-site_es_1
```

Nginx log config

```
log_format trace '$remote_addr - [$time_local] "$request" '
                 '$status  $body_bytes_sent "$http_referer"
                 '"$http_user_agent" '
                 '"$http_x_forwarded_for" $request_id '
                 '$msec $request_time '
                 '$upstream_http_x_session_id $upstream_http
```

Log example

```
172.22.0.12 - [15/Mar/2019:14:56:27 +0000] "GET /api/records
200  209 "https://127.0.0.1/search?q="
"Mozilla/5.0 (Macintosh; Intel Mac OS X 10.14; rv:65.0) Geck
"172.22.0.1" 00fdb97e91fe18238733045e9c23a331
1552661787.662 2.242
84e4ee86efbf0e53_5c8bb8cc -
```

Web app: Nginx

Nginx passes params to the uWSGI server

```
location /api/files {
  gzip off;
  uwsgi_pass api_server;
  include uwsgi_params;
  uwsgi_buffering off;
  uwsgi_request_buffering off;
  uwsgi_param Host $host;
  uwsgi_param X-Forwarded-For $proxy_add_x_forwarded_for;
  uwsgi_param X-Forwarded-Proto $scheme;
  # Pass request id to api server
  uwsgi_param X-Request-ID $request_id;
  # X-Session-ID / X-User-ID is read by nginx and included in the logs,
  # however we don't want to expose them to clients so we are hiding them.
  uwsgi_hide_header X-Session-ID;
  uwsgi_hide_header X-User-ID;
  # Max upload size for files is set to 50GB (configure as needed).
  client_max_body_size 50G;
}
```

Web app: uWSGI

- invenio-app can read the header X-Forwarded-For and the request_id
- It will contain the list of all IPs (HAProxy, Nginx, etc…)

Error reporting

- invenio-logging
- Sentry

Invenio Logging

- Log to file
- Configure logging level
- Configure file rotation
- Configure Sentry integration

Sentry

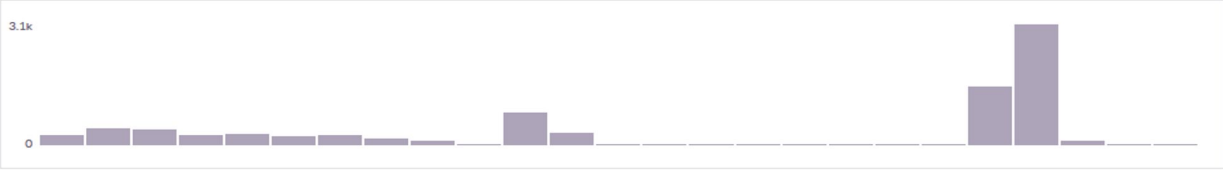
cds / videos

Issues | Overview | User Feedback | Releases

Star Project | Project Settings

Overview

1 hour | 1 day | 1 week



March 15, 2019

TRENDING ISSUES	EVENTS	USERS
KeyError cds.modules.records.serializers.v... 'duration' — an hour ago — a year old	16k	2.3k
GET [redacted] — 2 hours ago — a year old	10.3k	0
TypeError /opt/cds/src/cds/cds/modules/r... sequence item 4: expected string or Unicode, ... — 3 hours ago — 9 months old	316	8
AssertionError invenio_files_rest.storage.... — 12 hours ago — a month old	1.9k	0
RequestError /records/ TransportError(400, u'search_phase_executio... — 20 hours ago — 2 months old	256	22

NEW ISSUES	EVENTS	USERS
PIDDeletedError cds.modules.deposit.ap... — 8 days ago — 8 days old	1	0
PIDDeletedError /hooks/receivers/<stri... — 8 days ago — 8 days old	52	1
KeyError cds.modules.webhooks.receivers... '_tasks' — 9 days ago — 9 days old	1	0
KeyError /hooks/receivers/<string:receive... '_tasks' — 9 days ago — 9 days old	5	2
RequestError cds.modules.stats.views in g... TransportError(400, u'<html>\r\n<head><tit... — 9 days ago — 10 days old	154	1


Ready to GO LIVE?

Questions?