grnet
Networking Research and Education

GRNET eScience platform for Big Data management

Codename: ***orka***

Monday, February 1, 2016

European Union
European Regional Development Fund
digitalgreece
Everything is possible
Operational Programme "Digital Convergence"
NSRF 2007-2013
The project is co-financed by Greece and the European Union

Project Vision

- Data-Intensive Science (store and process big data, at Petabyte scale)
- Scientific workflows
- Virtual Research Environment
- Data streaming

The project is co-financed by Greece and the European Union

Big data

- The problem: data deluge
- Solution:
  - PaaS over
    - ~okeanos (VM, processing)
    - Pithos+ (storage)

grnet
Networking Research and Education
European Union
European Regional Development Fund
digitalgreece
Everything is possible
Operational Programme "Digital Convergence"
NSRF 2007-2013
The project is co-financed by Greece and the European Union

Hadoop project

- Most popular implementation for the MapReduce programming paradigm
- Open source, commodity hardware
- Hadoop core (MapReduce, Hadoop distributed file system)
- Rich ecosystem (Pig, Hive, Hbase, many more)
- Researcher focuses on the **algorithm** and not the software install/maintain/scale etc.

grnet Networking Research and Education
European Union European Regional Development Fund
digitalgreece Everything is possible Operational Programme "Digital Convergence"
NSRF 2007-2013
The project is co-financed by Greece and the European Union

Hadoop cluster with ~orka

- GUI, CLI, REST on top of ~okeanos to:
  - Create cluster (with configurable options) from a range of Hadoop distro's (aka images)
  - Transfer your data
  - Submit, execute, monitor jobs
  - Delete cluster
  - Start/stop/format cluster
  - Scale cluster, add/remove nodes
  - Save cluster creation metadata for reproducibility

The project is co-financed by Greece and the European Union

Hadoop cluster with ~orka

grnet
Networking Research and Education

~Okeanos Project Selection

Projects: escience.grnet.gr VM:14CPU:18RAM:24576MBDisk:200GB — Apply Last Cluster Configuration

Common Settings

Available Images: Debian Base
Cluster Name: cluster_name
Only with Workflow:
public keys: Select public key
Cluster size: Select size
Storage: Standard

~okeanos project maximum cluster size: 25

Master Settings

Predefined VM Flavors: Small Medium Large

CPUs: 0 — 1x 2x 4x 8x
RAM: 0 — 512 1024 2048 4096 6144 8192
Disk Size: 0 — 5 10 20 40 60

CPUs (18 available) | RAM size (24576 MB available) | Disk size (200 GB available)

Slaves Settings

Predefined VM Flavors: Small Medium Large

CPUs each: 0 — 1x 2x 4x 8x
RAM each: 0 — 512 1024 2048 4096 6144 8192
Disk Size each: 0 — 5 10 20 40 60

CPUs (18 available) | RAM size (24576 MB available) | Disk size (200 GB available)

Hadoop Configuration

Replication Factor: 2 (default)
HDFS blocksize in MB: 128 (default)
Default HDFS Configuration

Cancel | Create Cluster

European Union
European Regional Development Fund
digitalgreece
Everything is possible
Operational Programme "Digital Convergence"
NSRF 2007-2013
The project is co-financed by Greece and the European Union

Add-ons to basic Hadoop

- Other components & runtimes
  - Spark
- Apache Hadoop-based distro's
  - Cloudera
  - Hue (HDFS explorer, Oozie web editor)
- Storage backend
  - Pithos ⇔ HDFS connector (analogous to Amazon S3 Filesystem for Hadoop)

grnet Networking Research and Education
European Union European Regional Development Fund
digitalgreece Everything is possible Operational Programme "Digital Convergence"
NSRF 2007-2013
The project is co-financed by Greece and the European Union

Scientific Workflows

- Orchestration of atomic jobs
- Apache Oozie
- Apache Pig
  - Built-in in orka images

grnet
Networking Research and Education
European Union
European Regional Development Fund
digitalgreece
Everything is possible
Operational Programme "Digital Convergence"
NSRF 2007-2013
The project is co-financed by Greece and the European Union

Collaborative scientific research

- Virtual Research Environment
- Complete system for teams and projects
- Components:
  - Research/Project home page (portal, wiki)
  - Project Management
  - Teleconference
  - Digital repositories
- Implemented as Docker images

The project is co-financed by Greece and the European Union

Virtual Research Environment

grnet
Networking Research and Education

Category	Software stack
Portal / CMS	**Drupal** (v7.37)
Wiki, blog, forum	**Mediawiki** (v1.2.4)
Project management	**Redmine** (v3.04)
Web conferencing	**BigBlueButton** (v0.81)
Digital repositories	**DSpace** (v5.3)

European Union
European Regional Development Fund
digitalgreece
Everything is possible
Operational Programme "Digital Convergence"
NSRF 2007-2013
The project is co-financed by Greece and the European Union

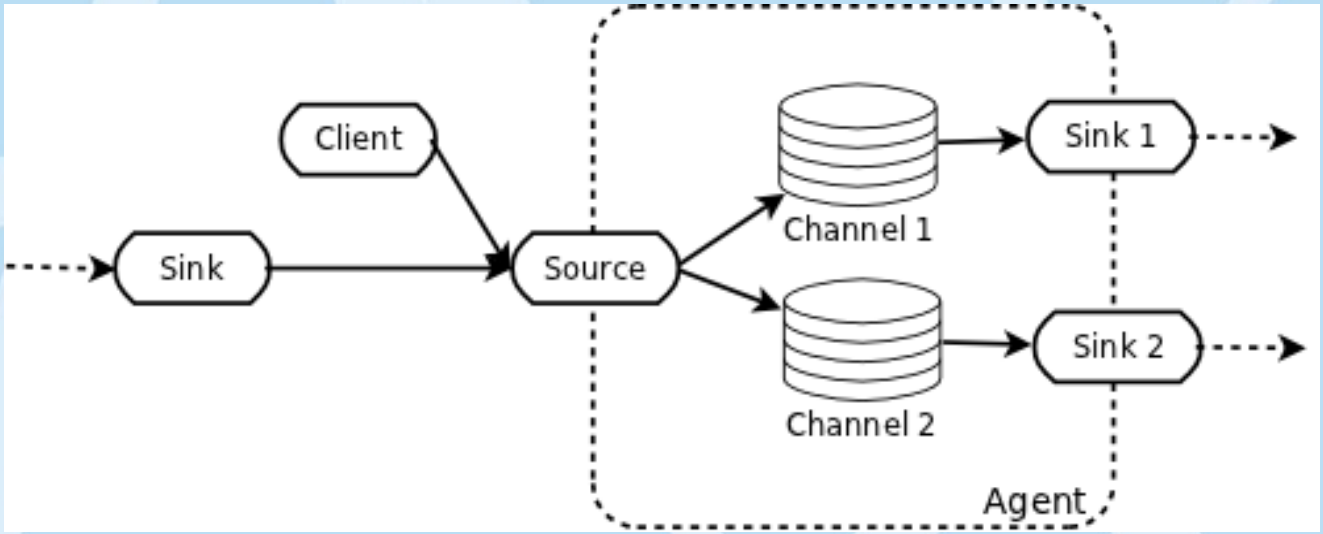
Reproducible Research

- Save your experiment's metadata as a bundle
- Domain Specific Language (DSL) that fully describes an experiment/job
- Text editor => simple YAML file
- Re-play, possibly with different parameters
- Save bundle to Pithos
- Share your bundle with other ~okeanos users

The project is co-financed by Greece and the European Union

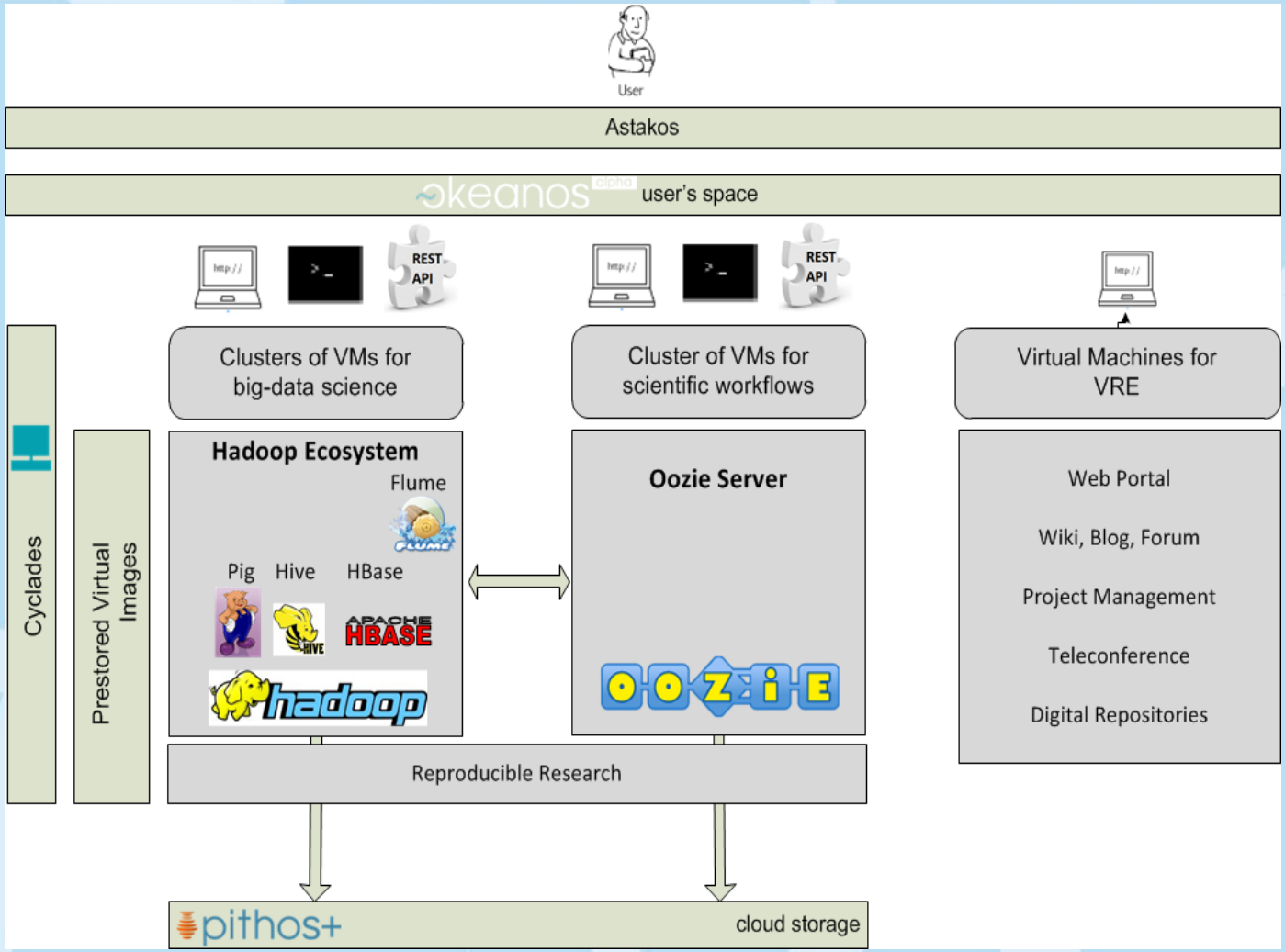
Data streams into HDFS

- Apache Flume
- Integrated into the Hadoop ecosystem
- Focus on streaming data



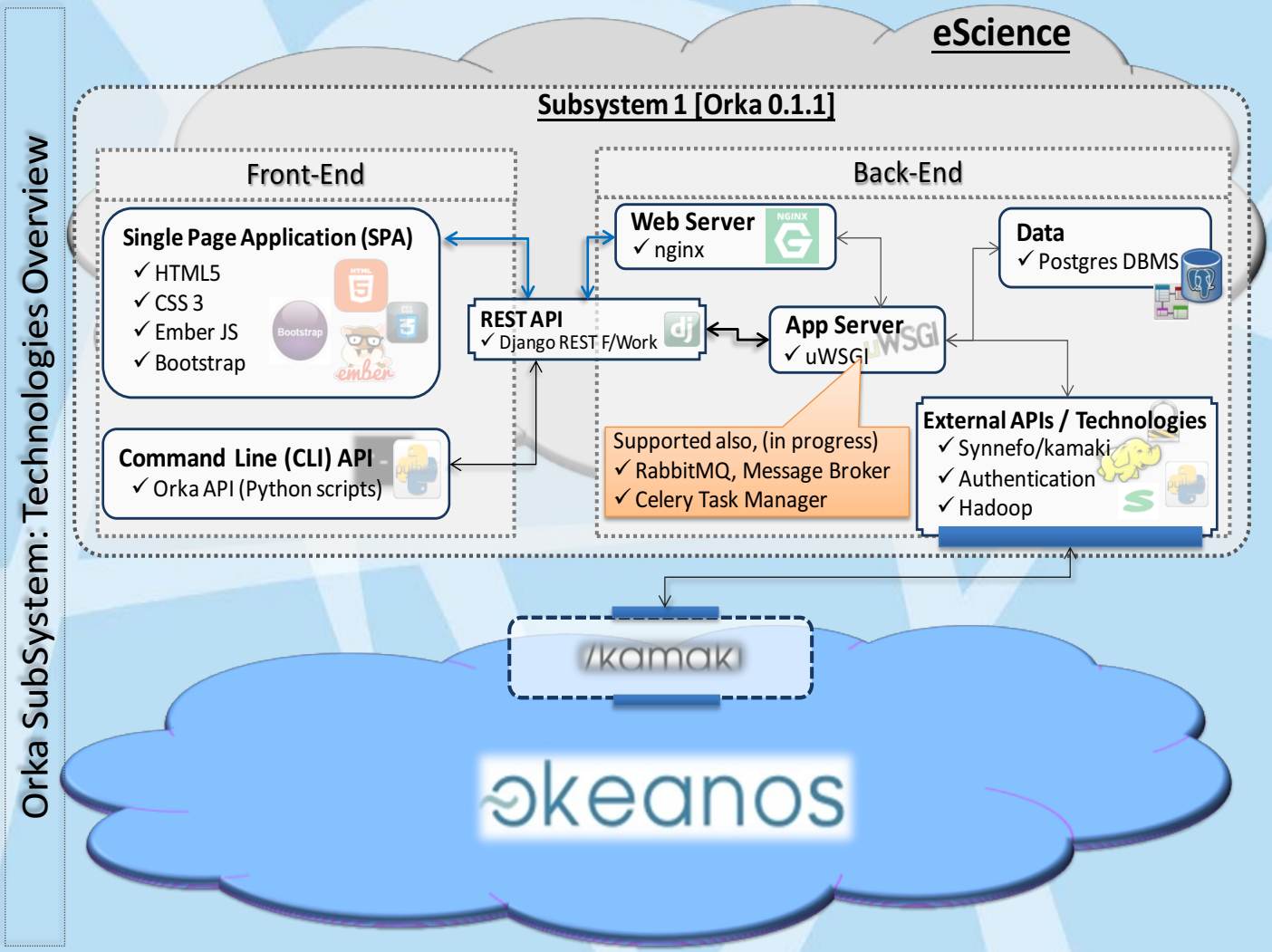
The project is co-financed by Greece and the European Union

High-level Architecture



The project is co-financed by Greece and the European Union

Technology Stack



The project is co-financed by Greece and the European Union

Current state

- `github.com/grnet/e-science`
- escience.grnet.gr ORKA

The project is co-financed by Greece and the European Union

lambda on demand

grnet okeanos

Simplifying Computing

The lambda architecture

a. a useful framework to think about designing big data applications

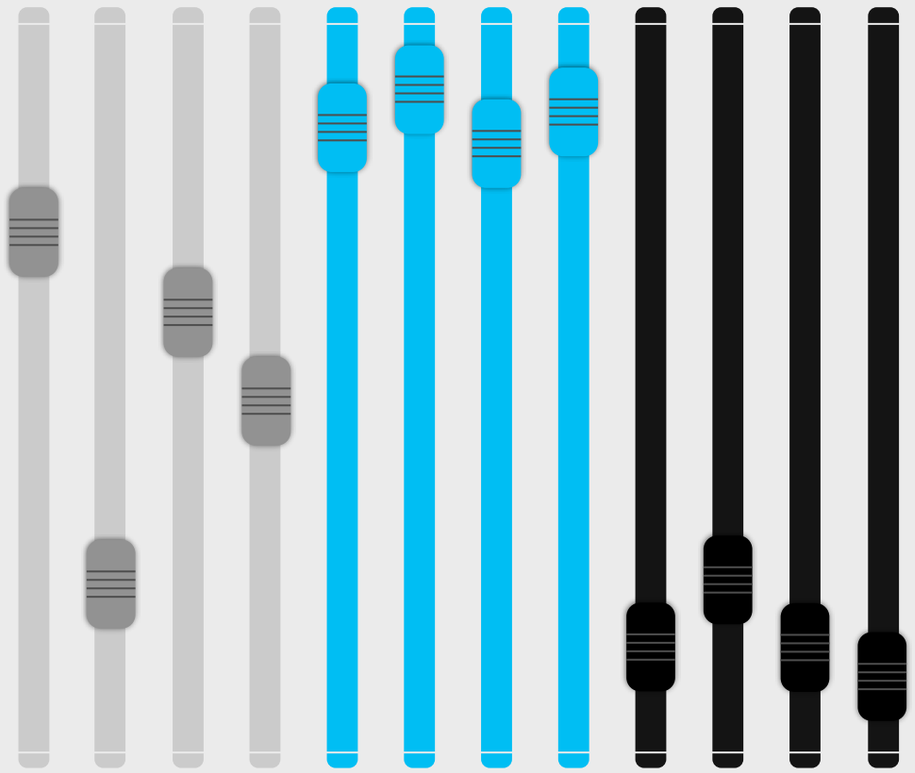
b. a robust framework for ingesting real-time streams of data while providing efficient stream and batch analytics.

c. fault-tolerant against both hardware failures and human errors

d. serves a wide range of use cases, and in which low-latency reads and updates are required

λ: lambda architecture

The Lambda Architecture solves the problem of computing arbitrary functions on arbitrary data in realtime by decomposing the problem into three layers: the batch layer, the serving layer, and the speed layer.



Batch Layer

The batch layer has two functions: (i) managing the master dataset (an immutable, append-only set of raw data), and (ii) pre-computing arbitrary query functions, called batch views.

Serving layer

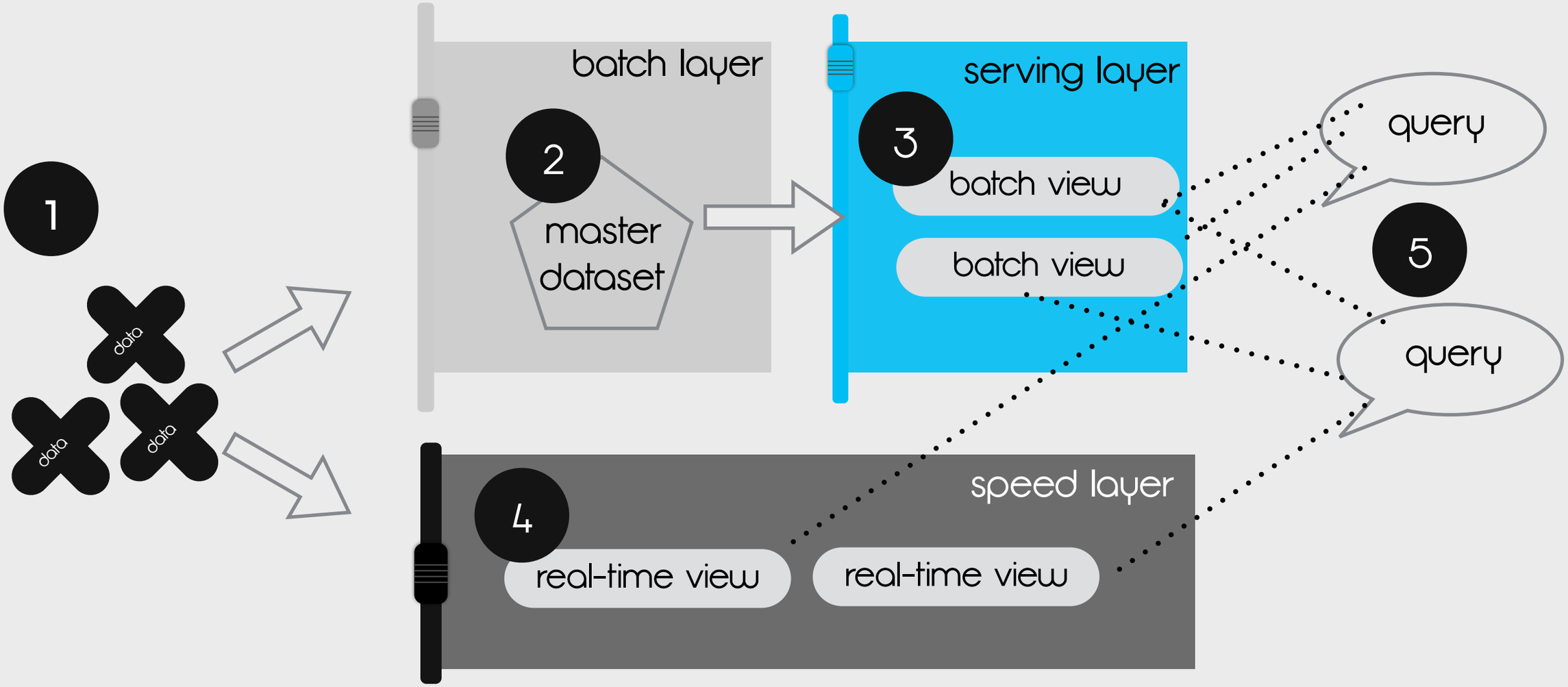
The serving layer indexes the batch views so that they can be queried in low-latency, ad-hoc way.

Speed layer

The speed layer compensates for the high latency of updates to the serving layer and deals with recent data only.

λ: lambda architecture

an example



1 data is dispatched to batch and speed layer for processing.

2 precomputes the batch views

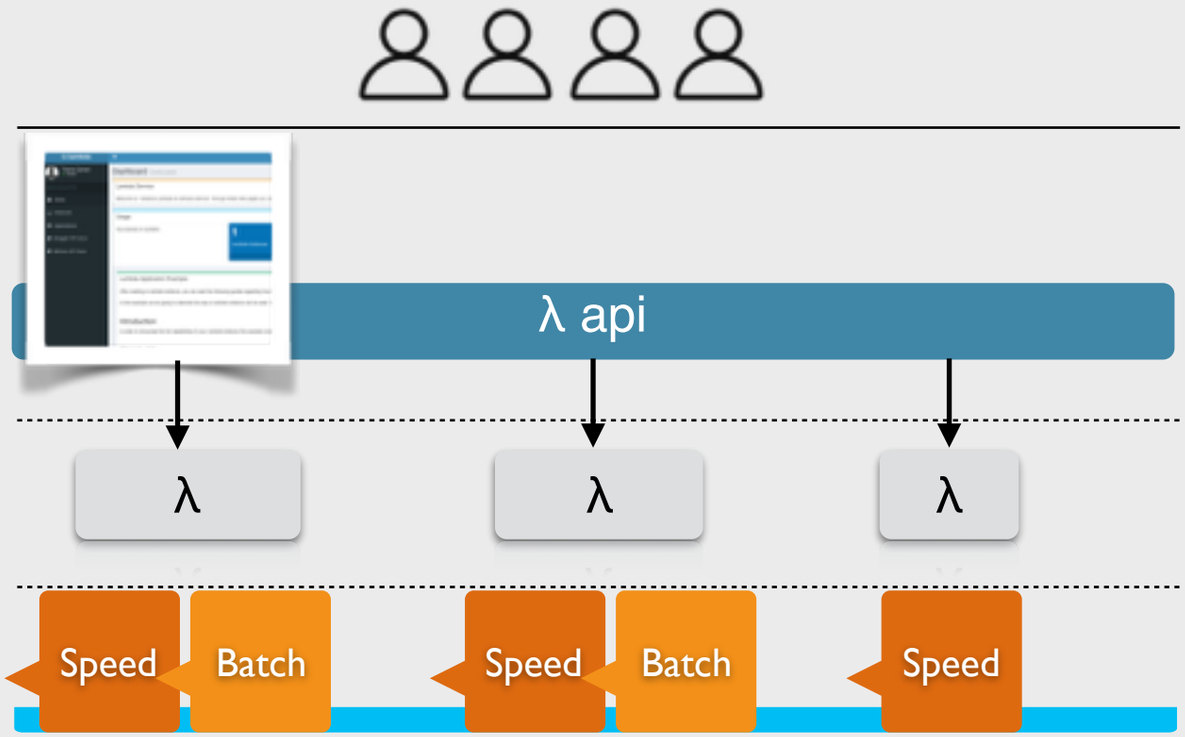
3 indexes the batch views

4 deals with recent data only.

5 Any incoming query can be answered by merging results from batch views and real-time views.

Provisioning a λ instance

okeanos

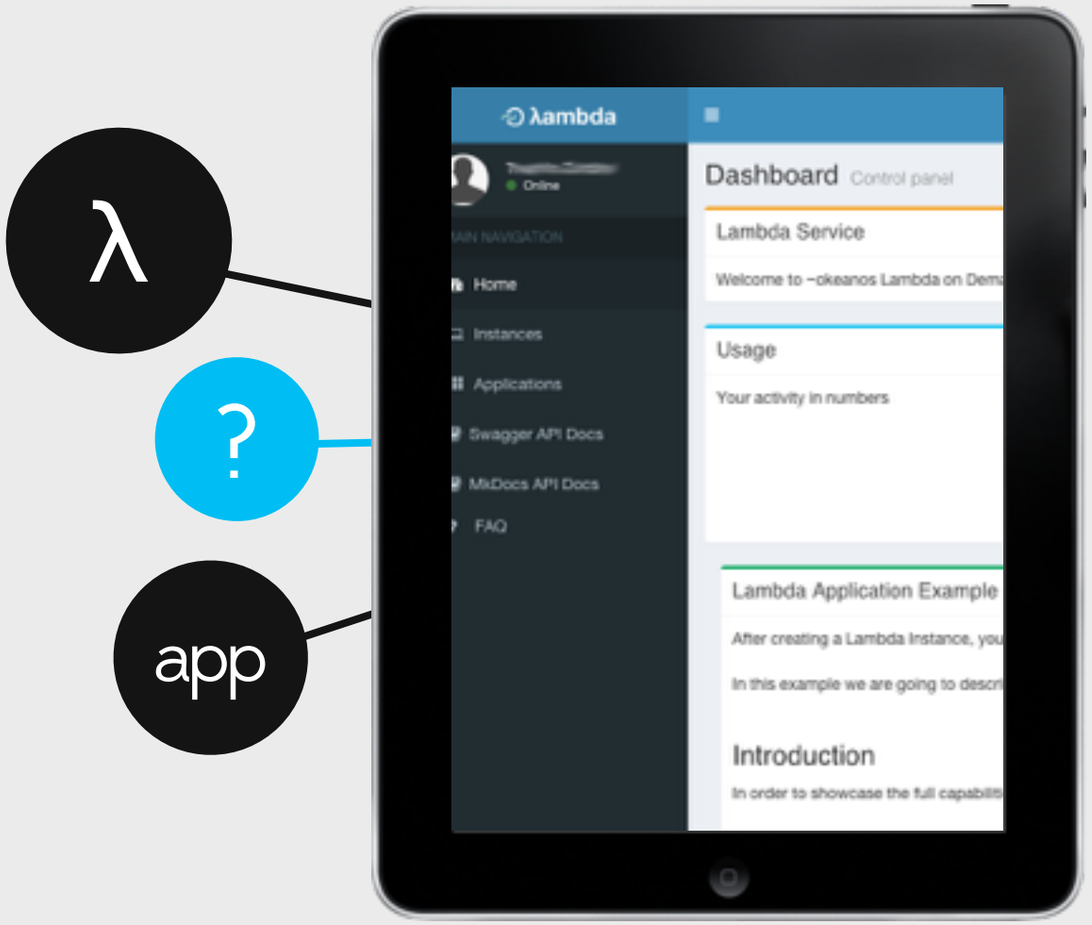


Based on

hadoop Flink kafka

λambda UI

Dashboard, Instances, Applications and help



λ - Instances

manage lambda instances

Create your lambda instances based on your needs. Manage , deploy applications and start your lambda instance.

Applications

manage your applications

Upload your Java or Scala application for streaming and batch jobs. Your applications are stored on the Pithos+ storage service.

Help

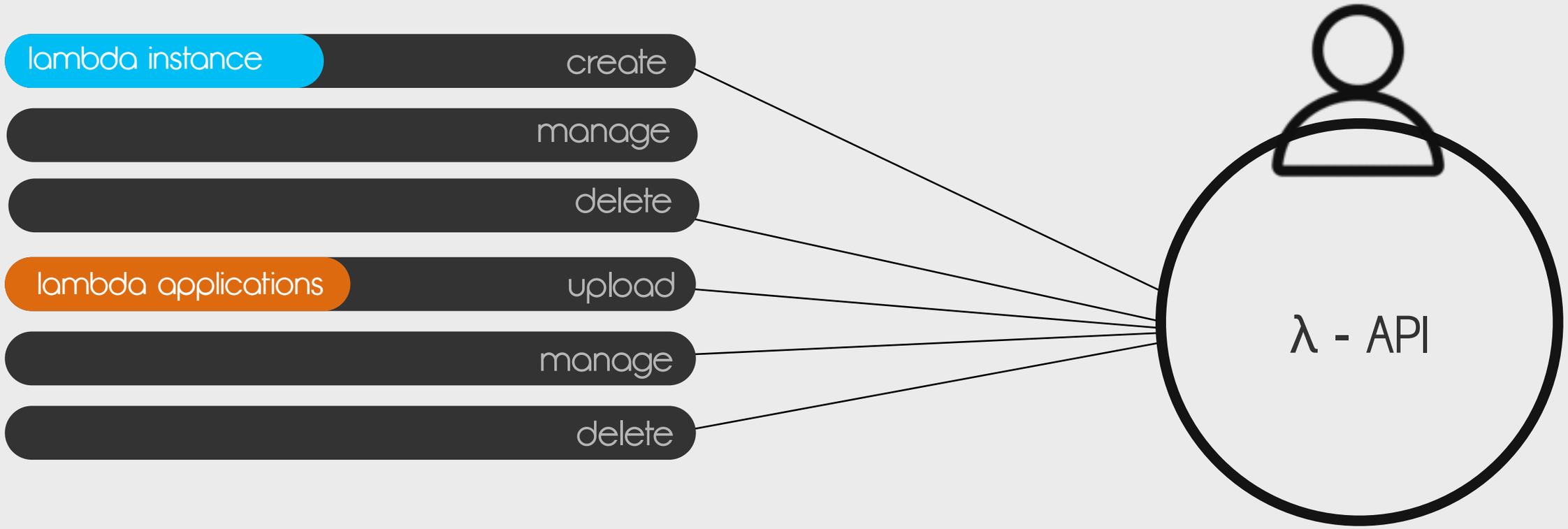
Informational guides

Short guides on how to

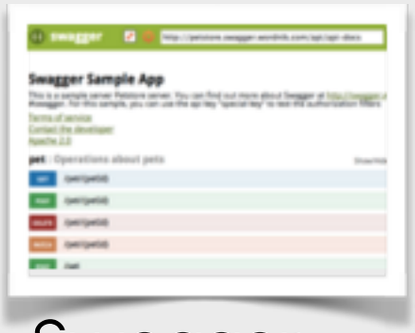
I) deploy, run and manage your lambda instances.
II) deploy, run and manage your applications
III) export and view your results

Experienced User

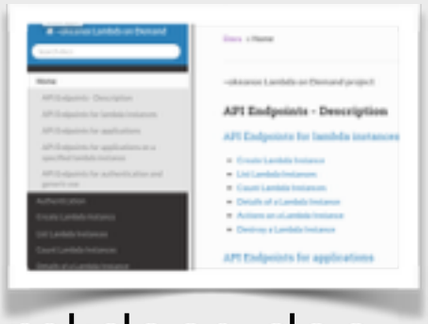
Use the λambda API



well documented with



Swagger



mkdocs doc

e-science vs λ

Lamda λ: focuses on analysing steaming Data

e-Science: focuses on existing data + offers a pre-installed collaborative tools to handle data

Questions ?