# Building a fast and scalable architecture for SKY TV Video Encoding

with Openshift Container Platform and Red Hat Gluster Storage

Davide Gandino
Technology Manager
Sky Italia

Federico Nebiolo
Cloud Architect
Red Hat

Samuele Dell'Angelo
Solution Architect
Red Hat

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# Who we are

- Davide Gandino - OTT and cloud processing & Delivery Manager - Sky

- Samuele Dell'Angelo - Solution Architect - Red Hat

- Federico Nebiolo - Cloud Architect - Red Hat

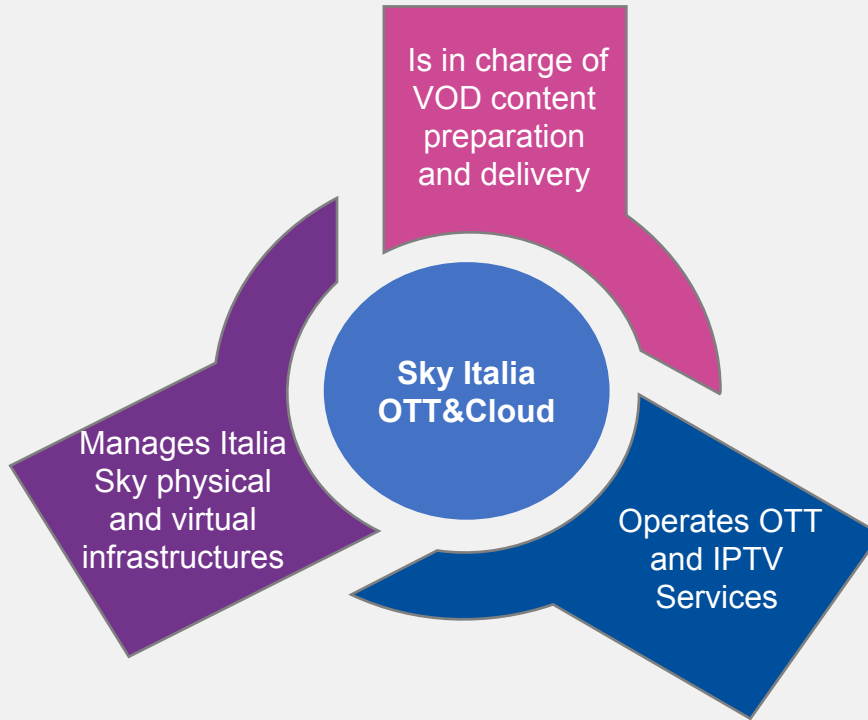# SKY ITALIA AND OTT SERVICES OVERVIEW

# Sky Italia (1/2)

- **Sky Italia**, established on July 31st, 2003, has a 4.8-million-subscriber base. It is part of **Sky plc**, Europe's leading entertainment company with **22 million customers** across **five countries**: Italy, Germany, Austria, the UK and Ireland.

- Sky operates on different broadcasting platforms with different business models.

- Sky Italia is strongly expanding his offer in the online streaming and on-demand offer where there are already more than 2 million connected customers that can use the on demand service with their **DTH Set Top Boxes**.

# Sky Italia (2/2)

- **DTH / SAT:** Satellite Digital TV

- **OTT:** Over The Top, services and contents available through the network
  - OTT Sky Go - OTT service for DTH Subscriber
  - OTT Now TV - OTT service / transactional model
- **IPTV:** Internet Protocol TV. Technology that transmits the signal through an internet bandwidth connection visible by STB

- **DTT:** Digital Terrestrial Television

# OTT & Cloud Processing and Delivery - Sky Italia Technology



Is in charge of VOD content preparation and delivery

Sky Italia OTT&Cloud

Manages Italia Sky physical and virtual infrastructures

Operates OTT and IPTV Services

# THE PROJECT

# Business needs (1/2)

- HD project

  - HD VOD available on STBs and on OTT devices
  - More asset to encode per day

- Handling of editorial content preparation peaks

  - Late master file delivery
  - Late content acquisition
  - Content rights deals
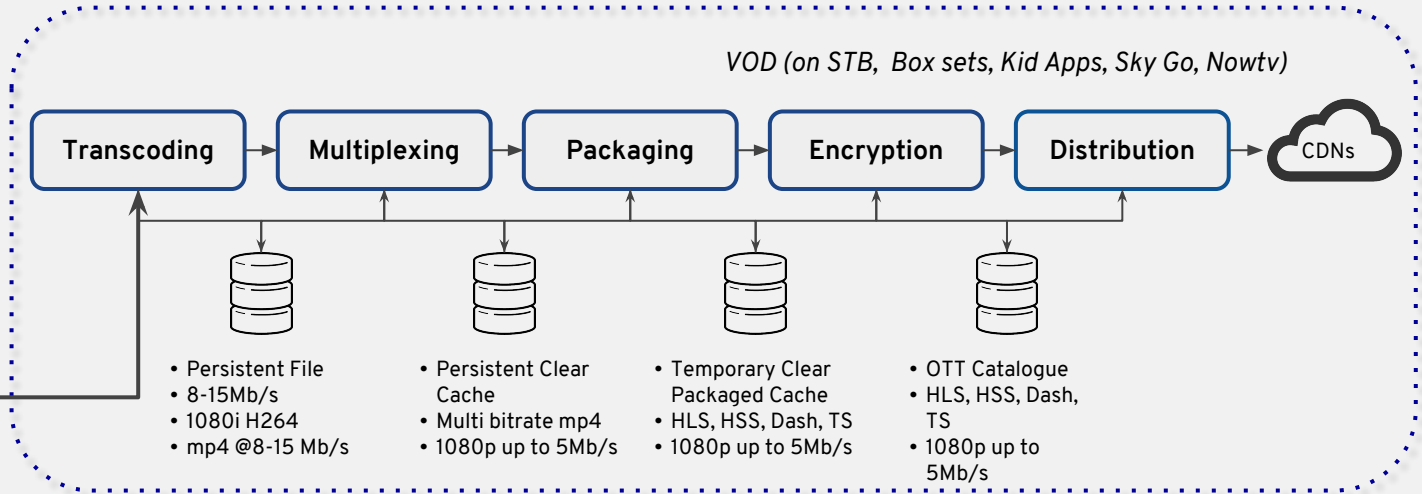  - Reduce time to market

# Business needs (2/2)
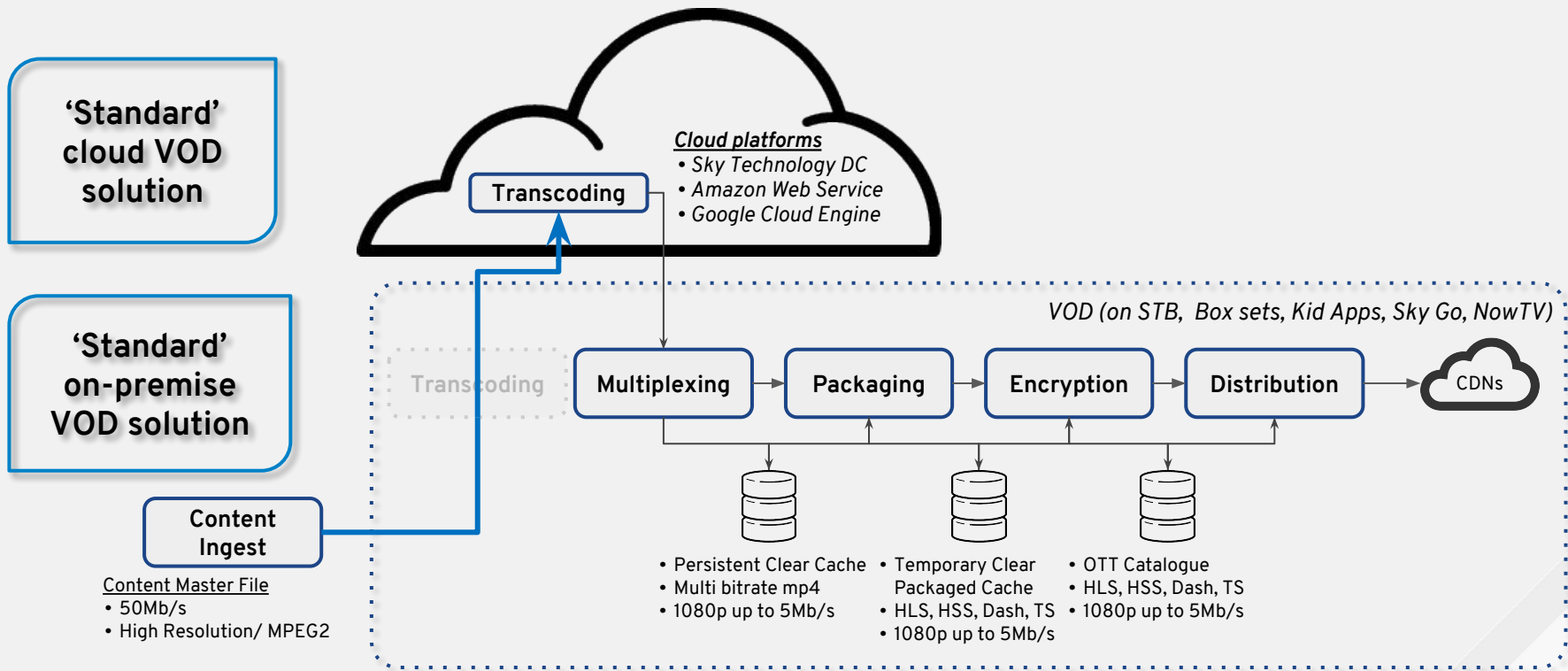
# Video Encoding Workflow as it was

**'Standard' on-premise VOD solution**

*VOD (on STB, Box sets, Kid Apps, Sky Go, Nowtv)*

Transcoding → Multiplexing → Packaging → Encryption → Distribution → CDNs

**Content Ingest**

Content Master File
- 50Mb/s
- High Resolution/ MPEG2

- Persistent File
- 8-15Mb/s
- 1080i H264
- mp4 @8-15 Mb/s

- Persistent Clear Cache
- Multi bitrate mp4
- 1080p up to 5Mb/s

- Temporary Clear Packaged Cache
- HLS, HSS, Dash, TS
- 1080p up to 5Mb/s

- OTT Catalogue
- HLS, HSS, Dash, TS
- 1080p up to 5Mb/s

# Video Encoding Workflow Evolution

**'Standard' cloud VOD solution**

**'Standard' on-premise VOD solution**

**Transcoding**

*Cloud platforms*
- *Sky Technology DC*
- *Amazon Web Service*
- *Google Cloud Engine*

*VOD (on STB, Box sets, Kid Apps, Sky Go, NowTV)*

Transcoding

**Multiplexing** → **Packaging** → **Encryption** → **Distribution** → CDNs

**Content Ingest**

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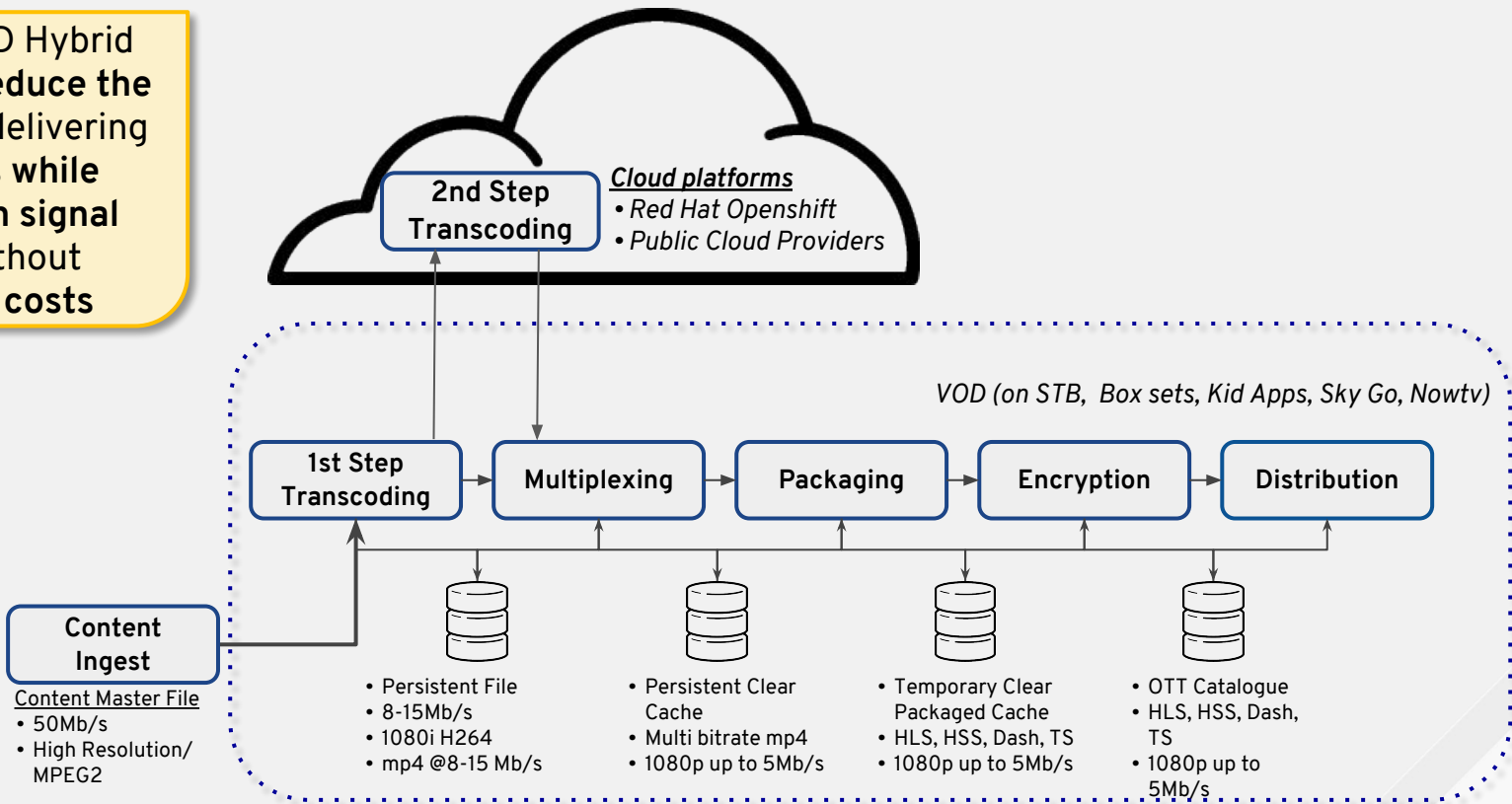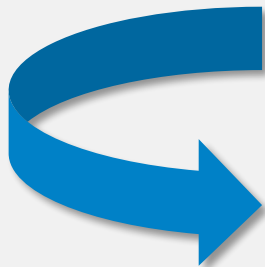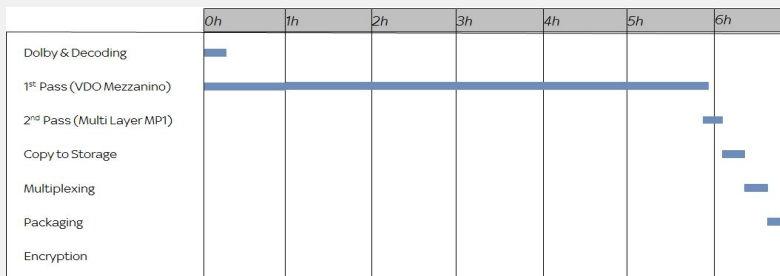
# Video Encoding Workflow: Sky Italia Solution

Sky Italia VOD Hybrid solution can **reduce the lead time** for delivering VOD assets **while keeping high signal quality** without **increasing costs**
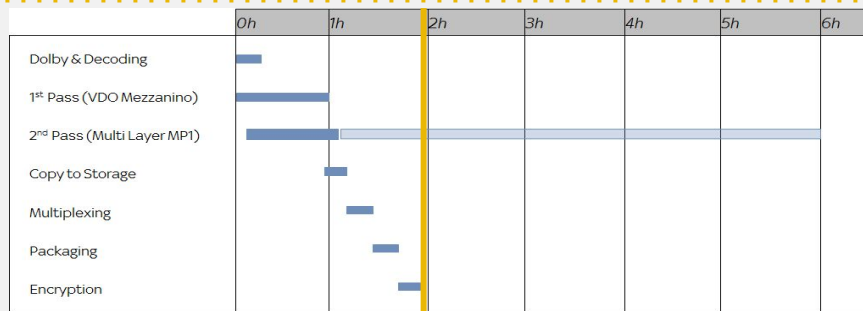
**2nd Step Transcoding**

*Cloud platforms*
- *Red Hat Openshift*
- *Public Cloud Providers*

*VOD (on STB, Box sets, Kid Apps, Sky Go, Nowtv)*

**1st Step Transcoding** → **Multiplexing** → **Packaging** → **Encryption** → **Distribution**

**Content Ingest**

Content Master File
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# Video Encoding Workflow explained

Sky Italia VOD Hybrid Solution can reduce "1st (VOD Mezzanine)" phase as evidenced in the figures below

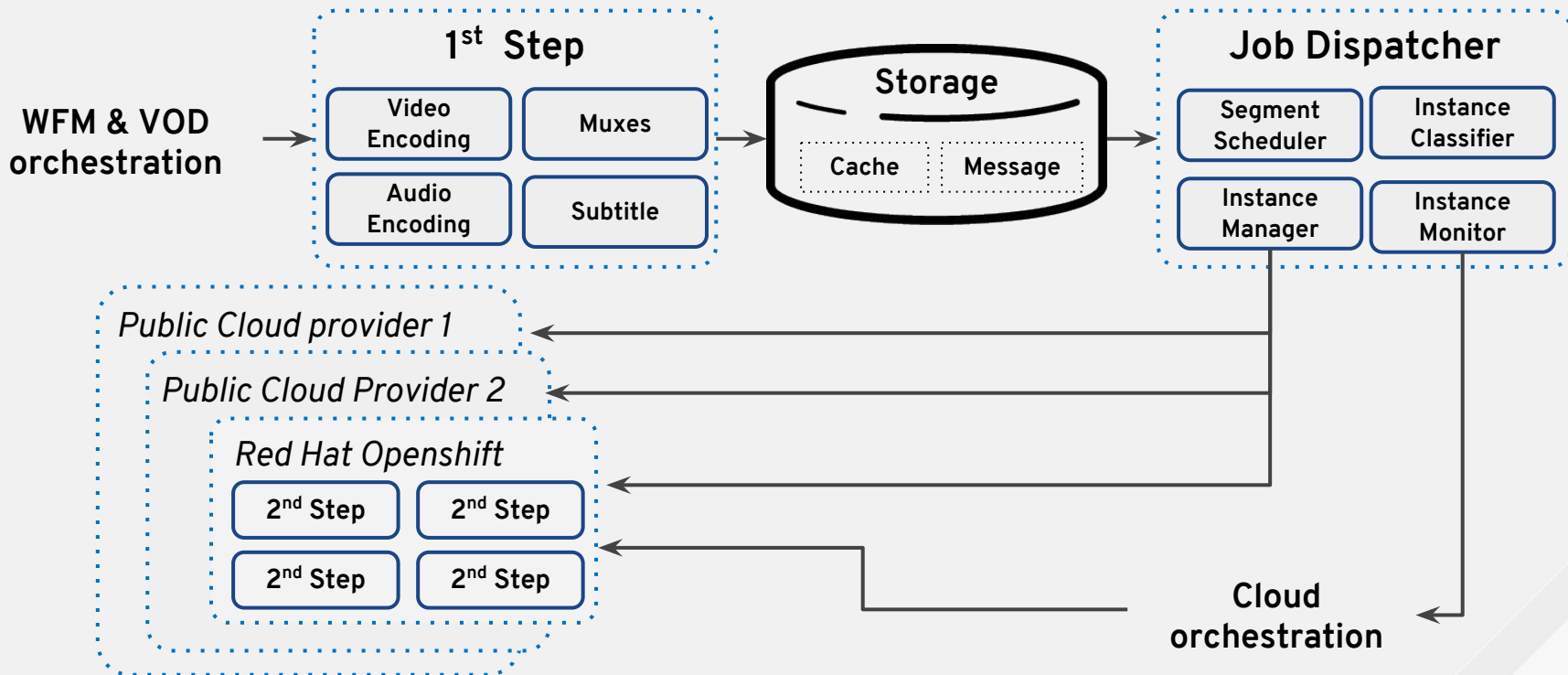**'Standard' on-premise VOD solution**

| | 0h | 1h | 2h | 3h | 4h | 5h | 6h |
|---|---|---|---|---|---|---|---|
| Dolby & Decoding | | | | | | | |
| 1st Pass (VDO Mezzanino) | | | | | | | |
| 2nd Pass (Multi Layer MP1) | | | | | | | |
| Copy to Storage | | | | | | | |
| Multiplexing | | | | | | | |
| Packaging | | | | | | | |
| Encryption | | | | | | | |

**Sky Italia VOD Hybrid Solution**

| | 0h | 1h | 2h | 3h | 4h | 5h | 6h |
|---|---|---|---|---|---|---|---|
| Dolby & Decoding | | | | | | | |
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| 2nd Pass (Multi Layer MP1) | | | | | | | |
| Copy to Storage | | | | | | | |
| Multiplexing | | | | | | | |
| Packaging | | | | | | | |
| Encryption | | | | | | | |

# ARCHITECTURE

# Encoder High level Architecture

**WFM & VOD orchestration**

## 1st Step

- Video Encoding
- Muxes
- Audio Encoding
- Subtitle

## Storage

- Cache
- Message

## Job Dispatcher

- Segment Scheduler
- Instance Classifier
- Instance Manager
- Instance Monitor

*Public Cloud provider 1*

*Public Cloud Provider 2*

*Red Hat Openshift*

- 2nd Step
- 2nd Step
- 2nd Step
- 2nd Step

**Cloud orchestration**

# Encoder Openshift Architecture
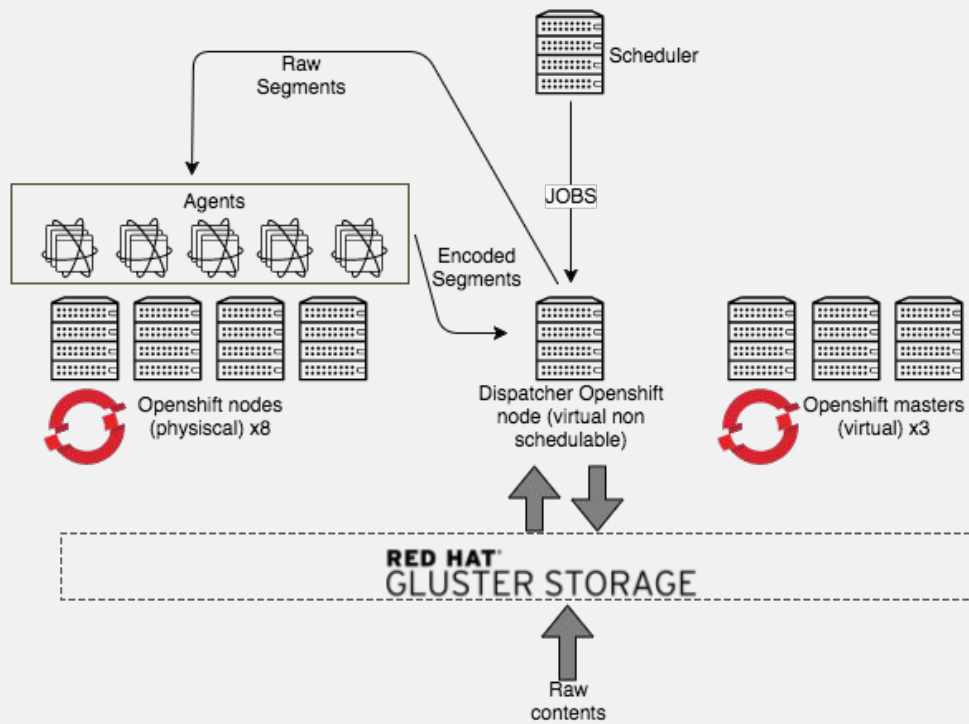
# How it works: Master/Agent Architecture

- Historic architecture for Job Scheduling software

- Job Scheduling software is installed on a single machine (Master)

- While on production machines only a very small component (Agent) is installed

- That awaits commands from the Master, executes them, then returns the exit code back to the Master

# How it works: Scheduler and Dispatcher

**Scheduler**

- Sends encoding Jobs to the Dispatcher.

- Resides outside Openshift.

- Controls scalability on Public Cloud if needed.

**Dispatcher**

- Resides on a non schedulable node inside Openshift (non containerized).

- Works as master for agents.

- Split encoding jobs for the agents.

- Is responsible of the interactions with storage.

# How it works: Agents

- Run as Pod on Openshift Cluster.

- Node.js application.

- At startup subscribe to the Dispatcher.

- Receive segments to be encoded from the dispatcher.

- Fixed number of Agents Pod on the cluster based efficiency calculation and CPU usage.

# Some data: Traffic
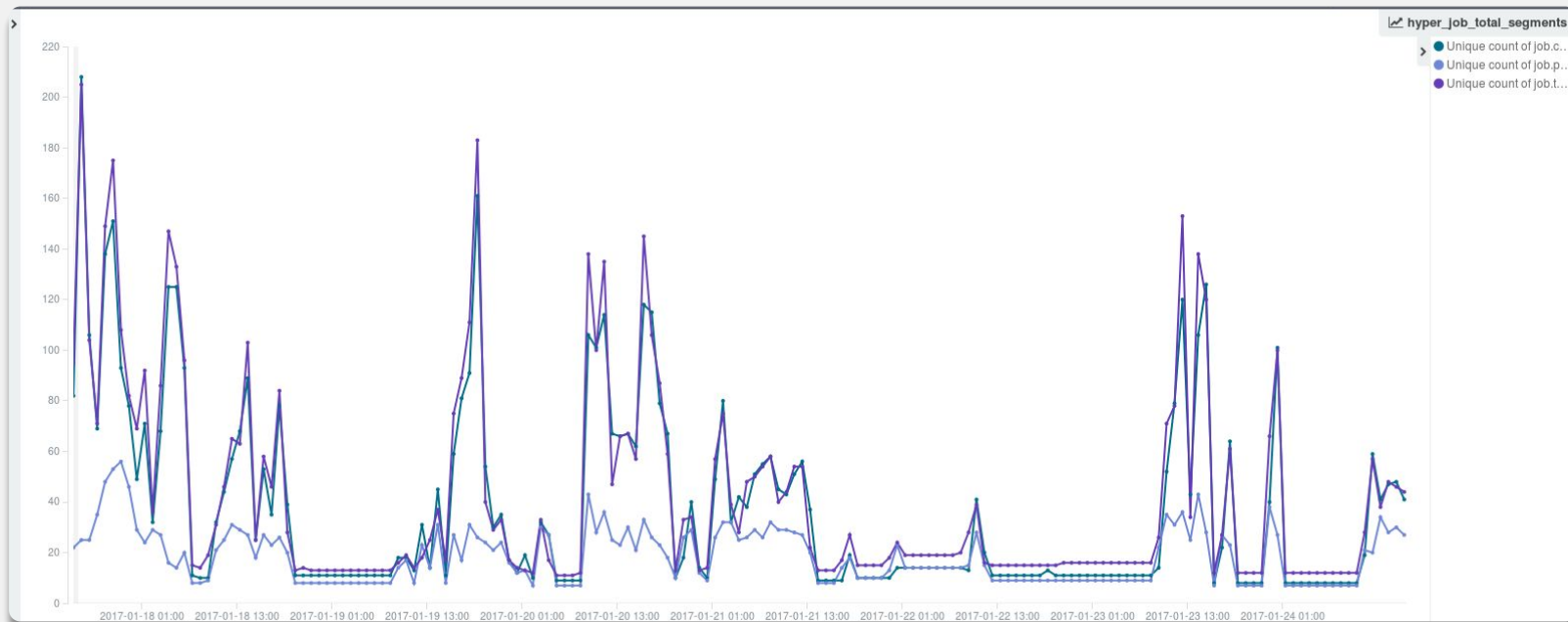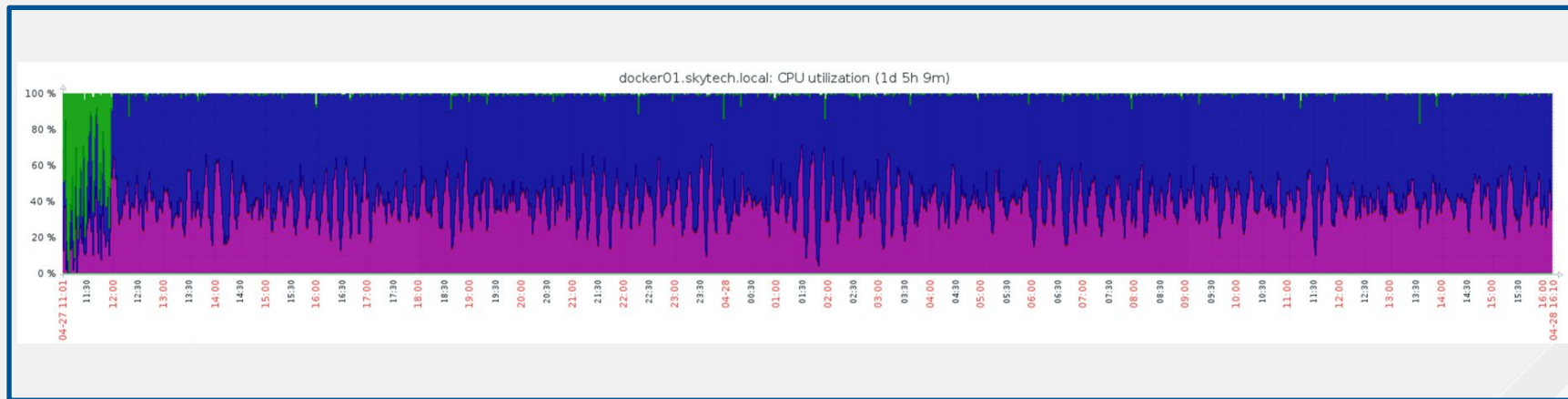


Encoding job segments per hour

# Some data: Cluster
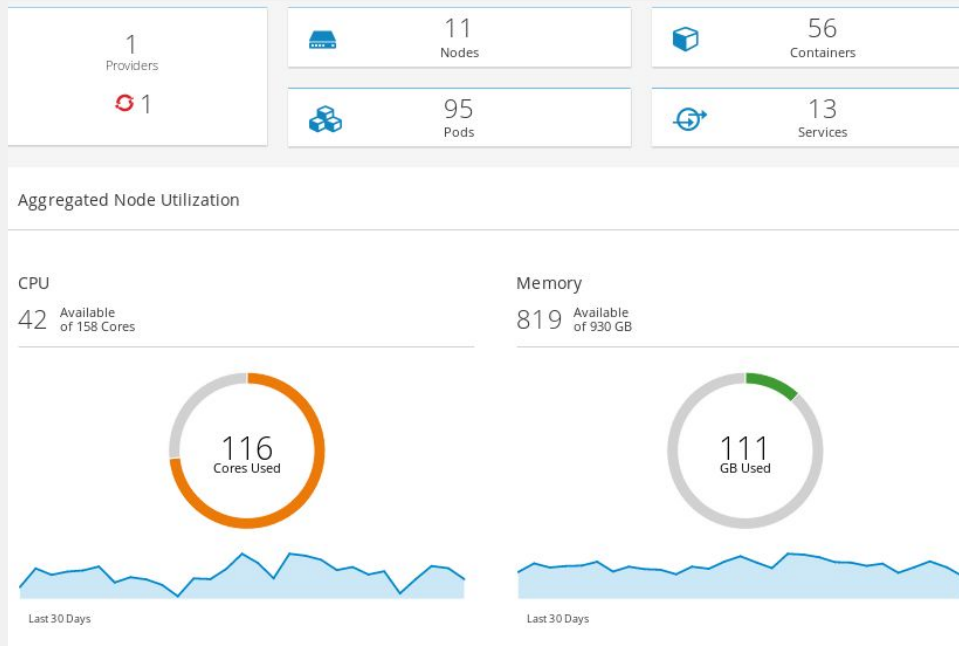


320 daily encoded video hours (180 SD + 140 HD)

# Key Benefit: Performance gain

- No CPU limits on PODs

  - Steady CPU usage by Agents (always around 100% usage on host)
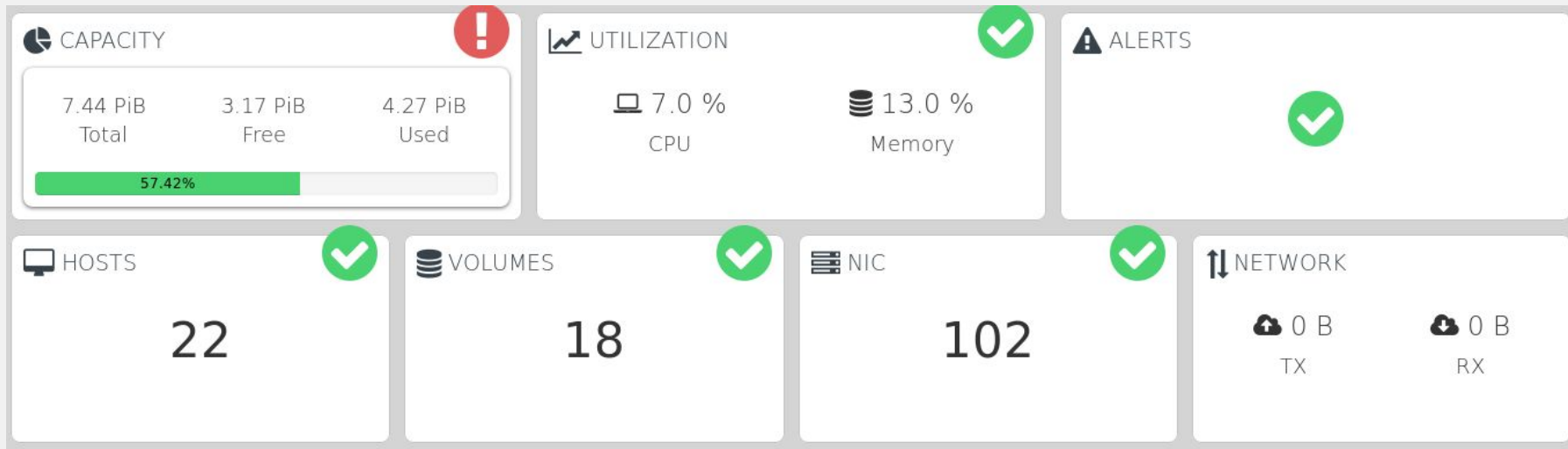
  - 10% gain on Openshift vs VMs



docker01.skytech.local: CPU utilization (1d 5h 9m)

# Key Benefit: Management

- Easier changes to the application.

  - Standard environment.

  - Easier deploy and promotion of artifacts.

- Easier to scale up / down based on encoding segments.

- Allow multiple dispatcher / agents binding on the same infrastructure.

- Allow the evolution to Openshift Jobs.

  - More control on encoding Jobs.

  - Priority based Jobs and pod scaling.

# Gluster

- Used as storage for media content delivered to on-demand platforms

- Built on physical nodes
  - Redundancy (replica 2)
  - Data distribution on different nodes (50 to 250 TB each)

- Multi-protocol exposure
  - NFS and CIFS for legacy workflows
  - Gluster native client for all newer applications

# Gluster overview

**CAPACITY** ❗

| 7.44 PiB | 3.17 PiB | 4.27 PiB |
|----------|----------|----------|
| Total    | Free     | Used     |

57.42%

**UTILIZATION** ✅

💻 7.0 %     🗄 13.0 %

CPU     Memory

**⚠ ALERTS** ✅

**HOSTS** ✅

22

**VOLUMES** ✅

18

**NIC** ✅

102

**NETWORK**

☁ 0 B    ☁ 0 B

TX     RX

# Gluster and Openshift

- Gluster storage used as target destination of workflows and encoding

- Endpoint exposed to Openshift PODs

```
kind:Endpoints
metadata:
  name: glusterfs-cluster
subsets:
- addresses:
  - ip: x.x.x.x
```

- Volume mounts from DeploymentConfigs

```
volumeMounts:
  - mountPath: /xxxx
    name: xxxx-volume-1
volumes:
  - glusterfs:
    endpoints: glusterfs-cluster
    path: ose-xxxx
    name: xxx-volume-1
```

# Key Benefit: Gluster

- Scalability on commodity hardware

- Flexibility

- Native client access

- Openshift integration
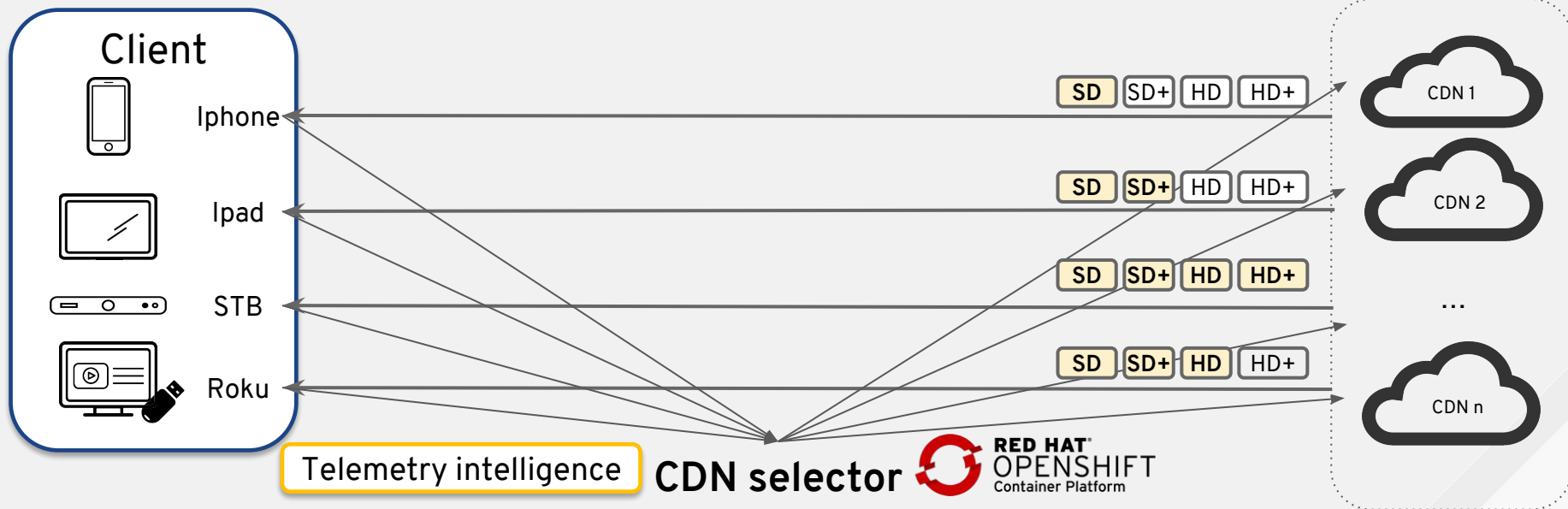
- Costs

# NEXT STEPS

# Video Metadata Analytics
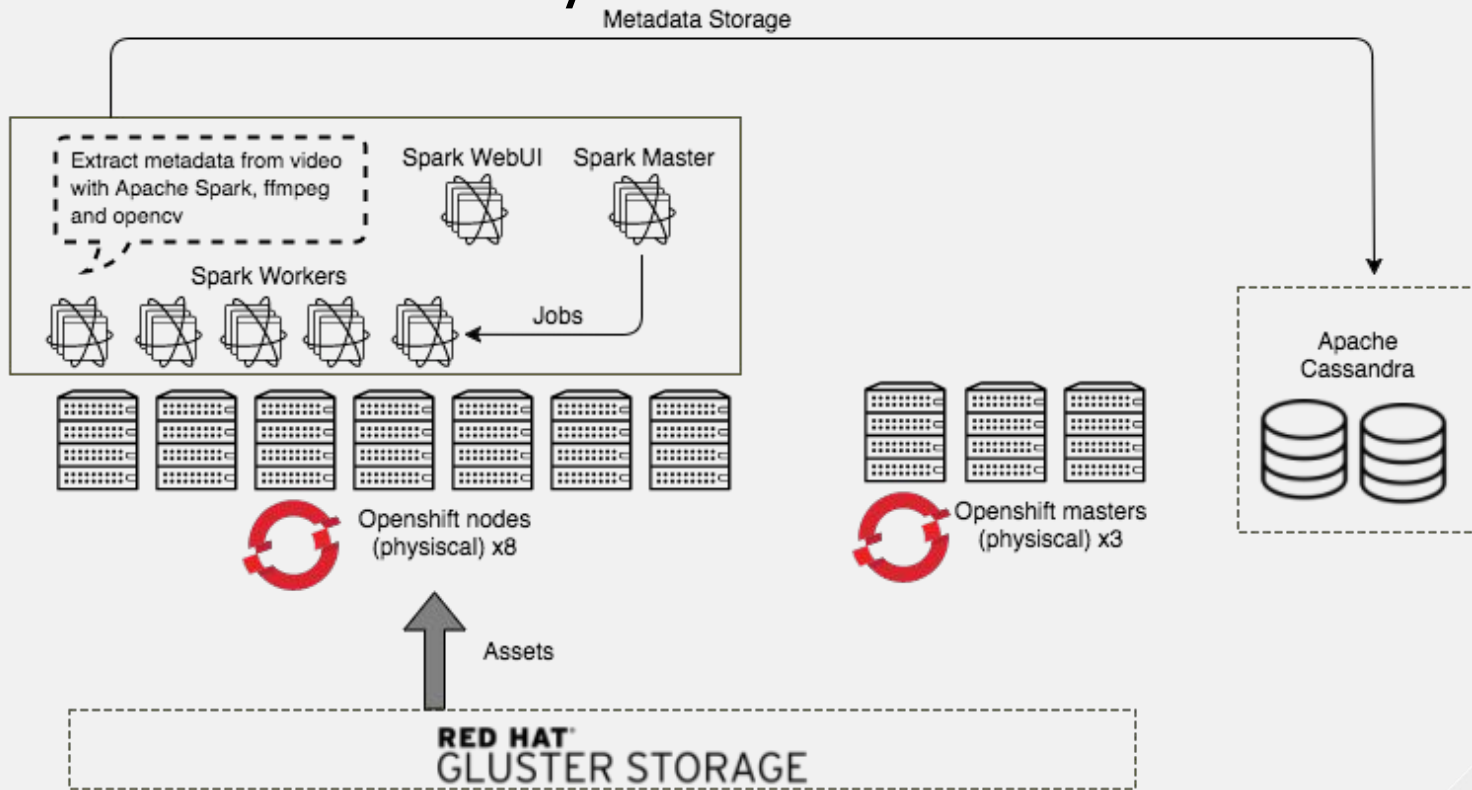
# CDN Selector

## CDN Selector at a glance

SKY Italia has developed the CDN Selector to efficiently work in a **MULTI-CDN ENVIRONMENT** to **route client devices to download multimedia/ streamed video files from the "best" CDN by**...

**...Deciding in real-time** which route to take based on flexible business rules and available information



**...collecting and processing contextualize information** gathered from several sources, e.g. telemetry, monitoring and analytical tools...

# THANK YOU

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