Building a fast and scalable architecture for SKY TV Video Encoding

with Openshift Container Platform and Red Hat Gluster Storage

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Who we are

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SKY ITALIA AND OTT SERVICES OVERVIEW
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

Sky Italia OTT&Cloud

- Is in charge of VOD content preparation and delivery
- 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

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

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

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

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

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

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

CDNs
Video Encoding Workflow Evolution

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

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

Content Ingest
Content Master File
• 50Mb/s
• High Resolution/ MPEG2

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

CDNs

‘Standard’ cloud VOD solution

‘Standard’ on-premise VOD solution

Encryption
Multiplexing
Transcoding
Transcoding

Transcoding

Transcoding

Transcoding

Transcoding

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Transcoding
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.
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

Sky Italia VOD Hybrid Solution
ARCHITECTURE
Encoder OpenShift Architecture

- Raw Segments
- Agents
- OpenShift nodes (physical) x8
- Encoder Segments
- Jobs
- Scheduler
- OpenShift masters (virtual) x3

RED HAT
GLUSTER STORAGE

Raw contents
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
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 and Openshift

- Gluster storage used as target destination of workflows and encoding
- Endpoint exposed to Openshift PODs
  ```yaml
  kind: Endpoints
  metadata:
    name: glusterfs-cluster
  subsets:
    - addresses:
        - ip: x.x.x.x
  ```
- Volume mounts from DeploymentConfigs
  ```yaml
  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

Metadata Storage

Extract metadata from video with Apache Spark, ffmpeg and opencv
Spark Workers

Spark WebUI
Spark Master

Jobs

Openshift nodes (physical) x8

Openshift masters (physical) x3

Assets

Apache Cassandra

RED HAT CLUSTER STORAGE
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 contextualized information gathered from several sources, e.g. telemetry, monitoring and analytical tools...
THANK YOU

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