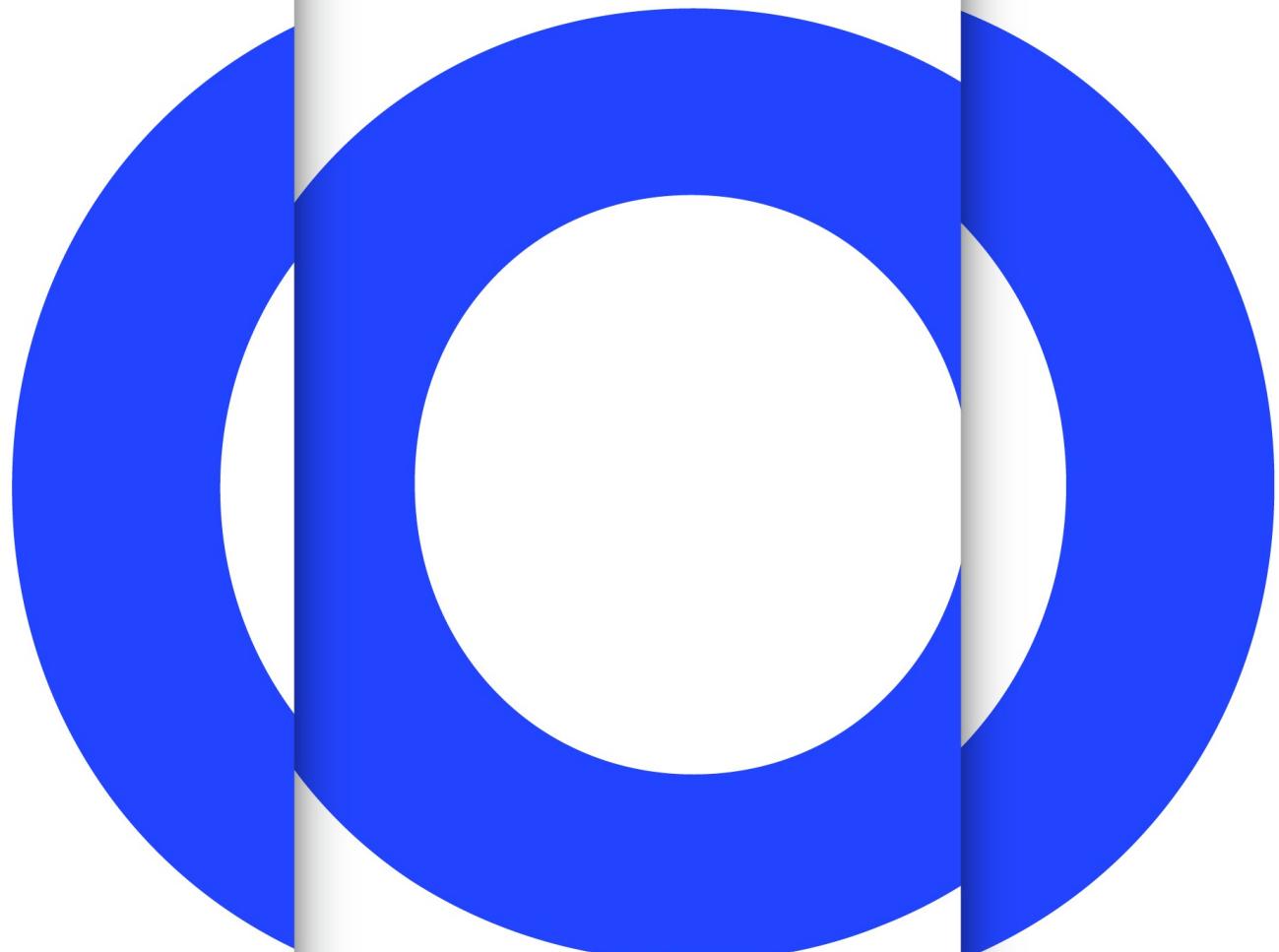


h e p i a

Haute école du paysage, d'ingénierie  
et d'architecture de Genève

**EBU**  
OPERATING EUROVISION



# BROADCASTING FROM THE CLOUD

Using cloud infrastructures  
to fulfil broadcasters needs

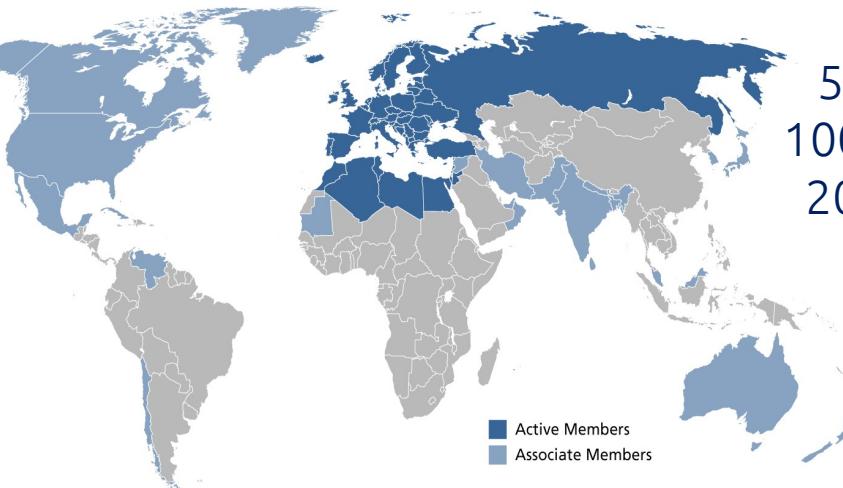
By David Fischer ([github.com/davidfischer-ch](https://github.com/davidfischer-ch)),  
Prof. : Andrés Revuelta / EBU : Bram Tullemans

# Plan

- What is EBU (3 slides)
- Mass vs Personalized Media Delivery
- IT/Files – Based Media Workflow
- The Promise of Cloud Computing
- The Project called OSCIED (more slides)
- Demonstrator v1.0, v2.29.40
- Conclusion & Future
- Questions & Answers
- Bonus Slides

# What is European Broadcasting Union ?

85 active members  
in 56 countries and  
35+ associate members  
around the world



500+ TV channels  
1000+ radio channels  
200+ million TV HH



# EBU's Headquarters (Geneva)



# EBU Technology & Innovation

## Mission

A common interest to cooperate and act on a European and worldwide level

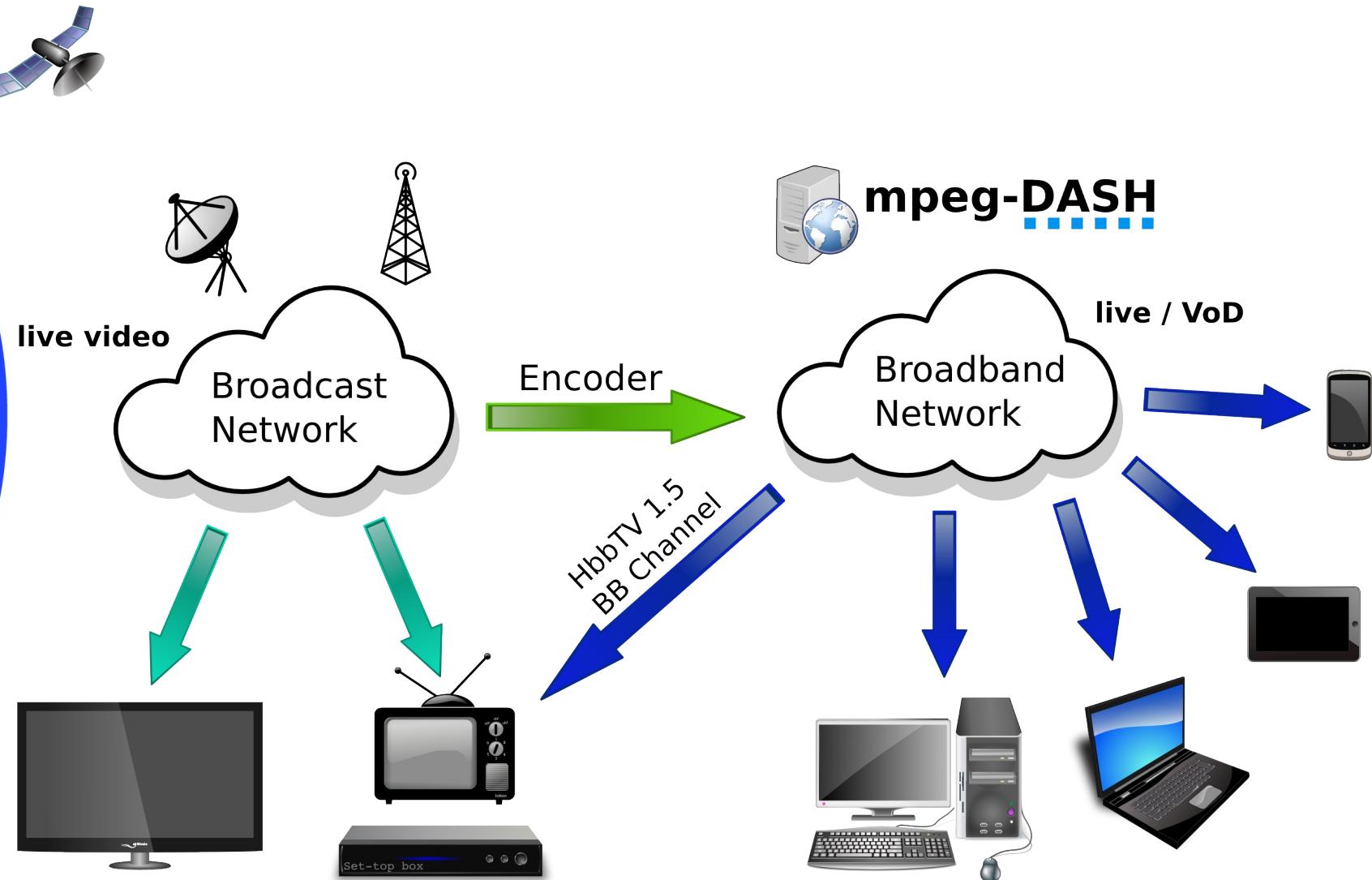
- To connect people and **share** their experiences and best practices
- To advise and **guide** in technology developments and decisions
- To drive innovation and **develop** the future of media in the best conditions for PSM and citizens
- To **promote** and represent our values and insights in standardization, regulatory and industrial bodies
- To **harmonize** market implementations and strive for interoperability

## High level objectives

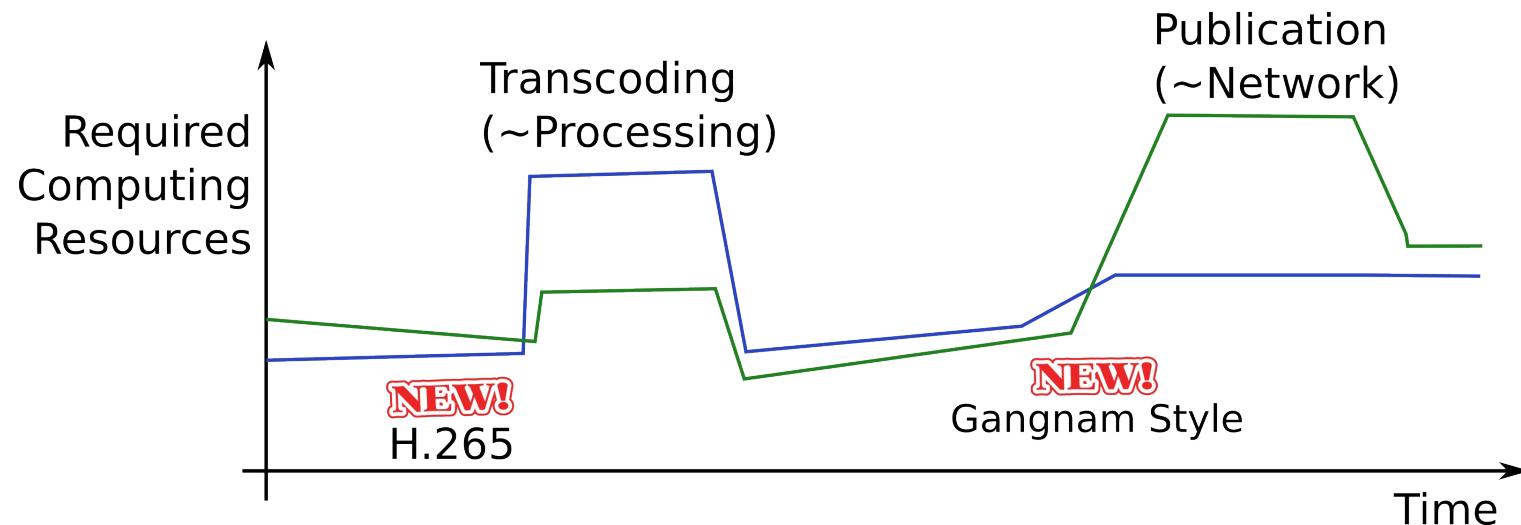
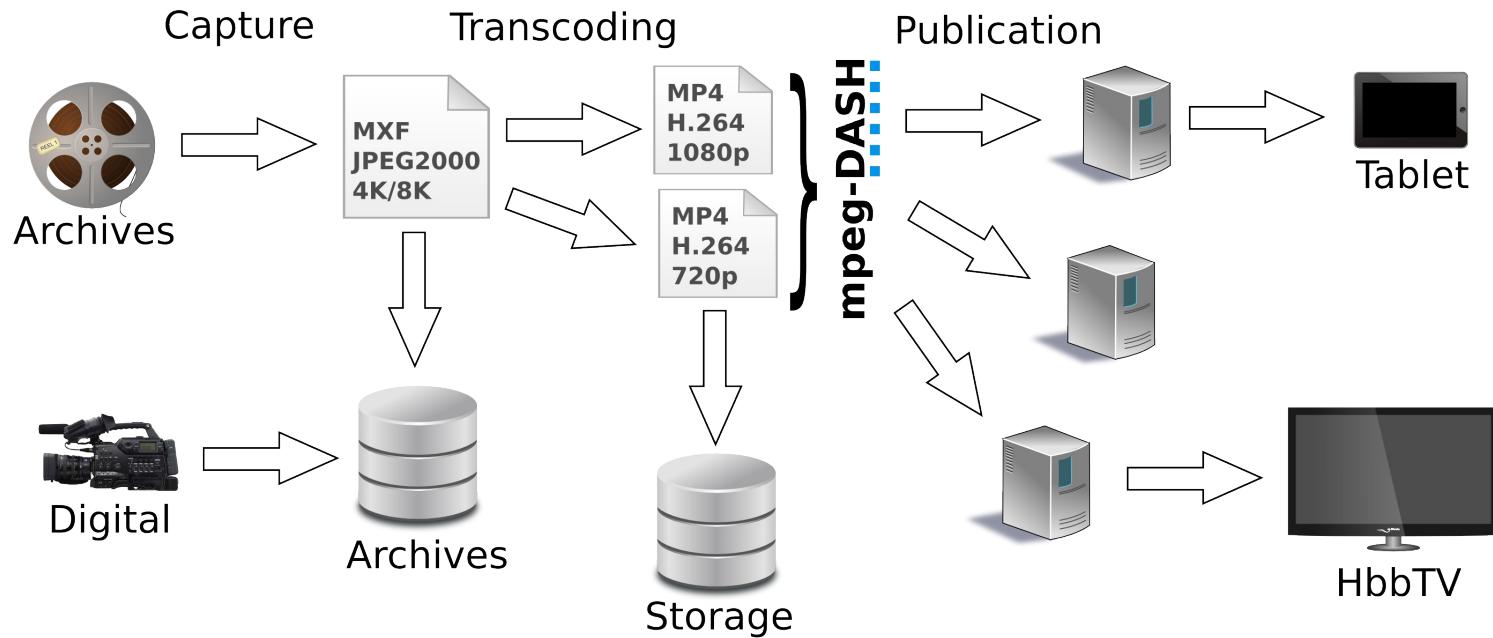
with the aim to

- maximize **COST** and **EFFICIENCY**
- improve **QUALITY OF SERVICE** and **EXPERIENCE**
- maximize **REACH**
- optimize **STRATEGIC POSITIONING**

# Mass vs Personalized Media Delivery



# IT/Files - Based Media Workflow



# Conclusion – The Project

- This demonstrator is an **FLOSS** media platform allowing EBU's members :
  - To use in-house IT resources mixed with necessary amount of public cloud resources
  - To easily **adapt scale** of transcoding and publication services
  - To **optimize costs** of services :
    - By adapting **CAPEX / OPEX** balance based on business needs
    - By avoiding « **vendor lock-in** » to dedicated media services (SaaS) or even Cloud providers (IaaS)
  - To test it, use it, even add missing features as it is Free/Libre Open-Source licensed
- Developed application is designed to being **simple** to use but rather **powerful** :
  - **Deployment is made easy**, thanks to JuJu and developed charm's hooks
  - Is **elastic**, balance of private & public resources is easy and can be **automated**
  - **Proof of concept** : Open-Source based Encoding and Distribution Platform

# The Promise of Cloud Computing

Public Clouds :

Pay as you go ...

But mind the bill.

Private Clouds :

Manage as you will ...

But mind the bugs.

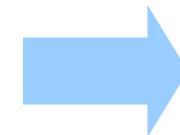
# Open-Source Cloud Infrastructure for Encoding and Distribution

- Providing a scalable FLOSS media platform to members of EBU
- A platform based on cloud-era FLOSS technologies, dedicated to :
  - **Transcoding** of a wide collection of medias to new formats
  - **Online publication** of popular medias
- A platform that is designed to allow :
  - Deployment of services in-house, enterprise IT infrastructure
  - Scaling of transcoding and publication points to public clouds (IaaS)
  - Ease of scale-up or scale-down of services
  - Separation of development, testing and production environments
  - Future features or capabilities (MPEG-DASH, auto-scaling, ...)

# Layers of OSCIED (!= OSI)



*Core Concept*

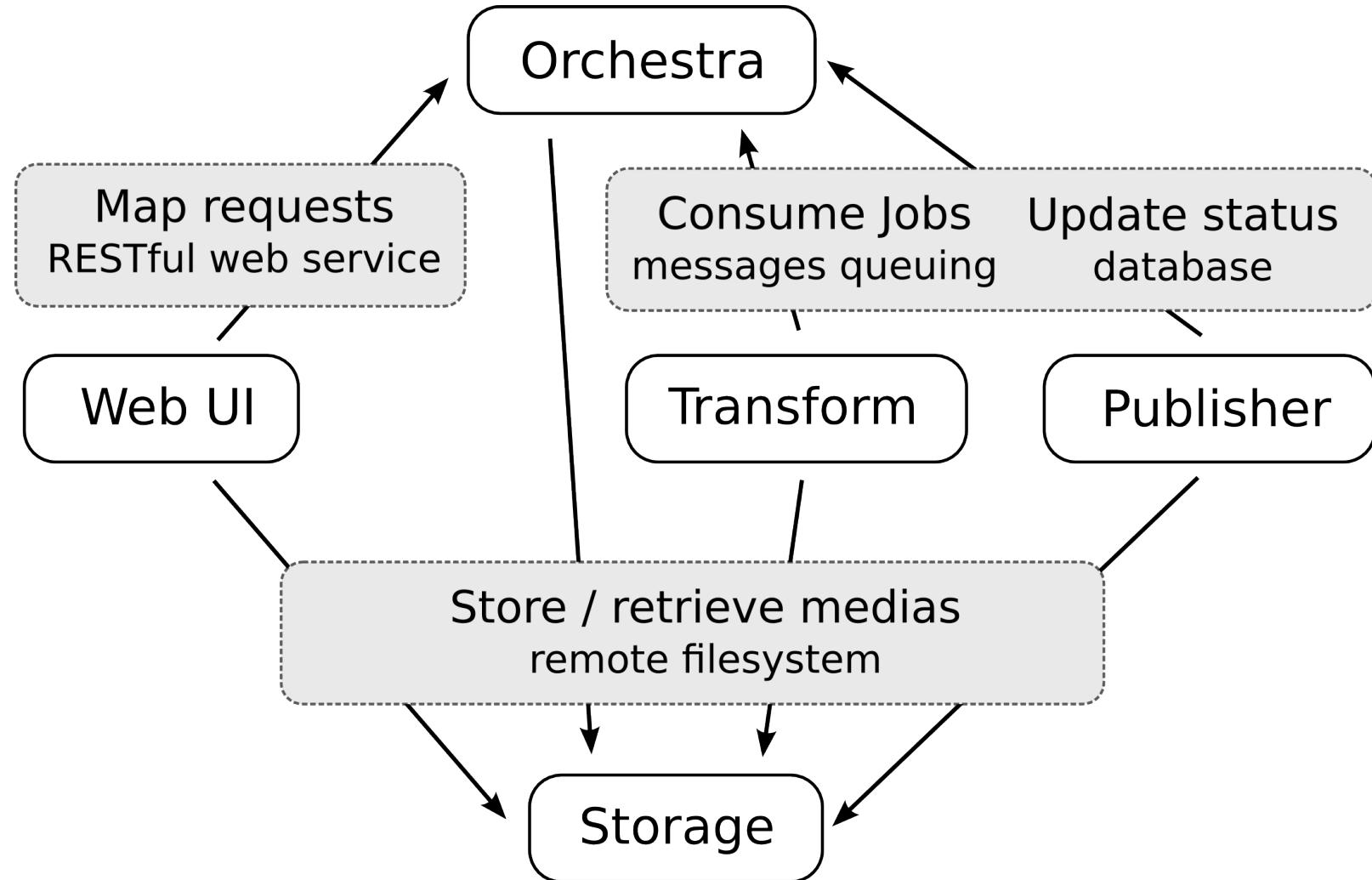


*Implementation n°1*

# Application Architecture

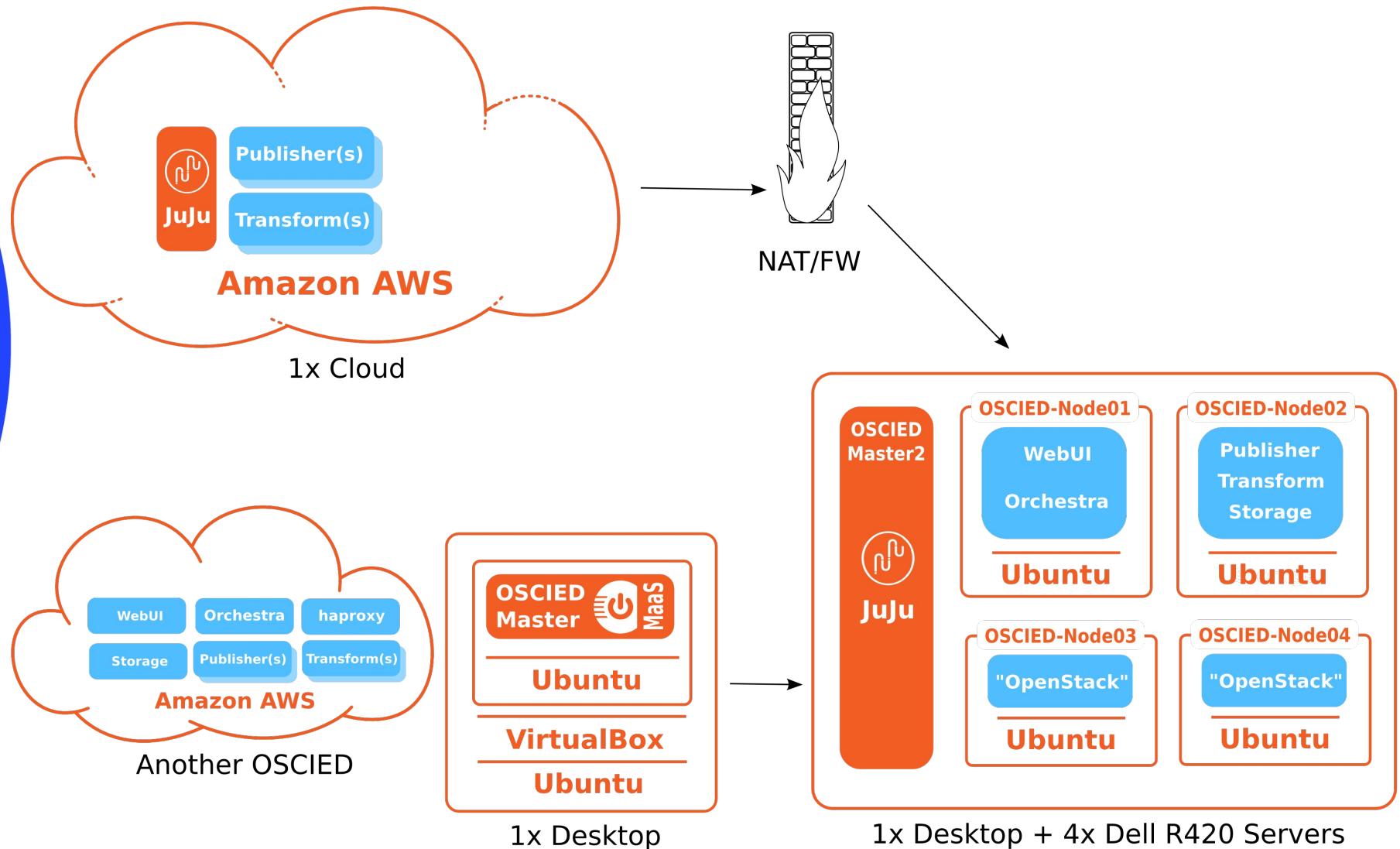
## Relation between components

Application  
Deployment  
Clouds / IaaS  
Servers



# Demonstrator v1.0

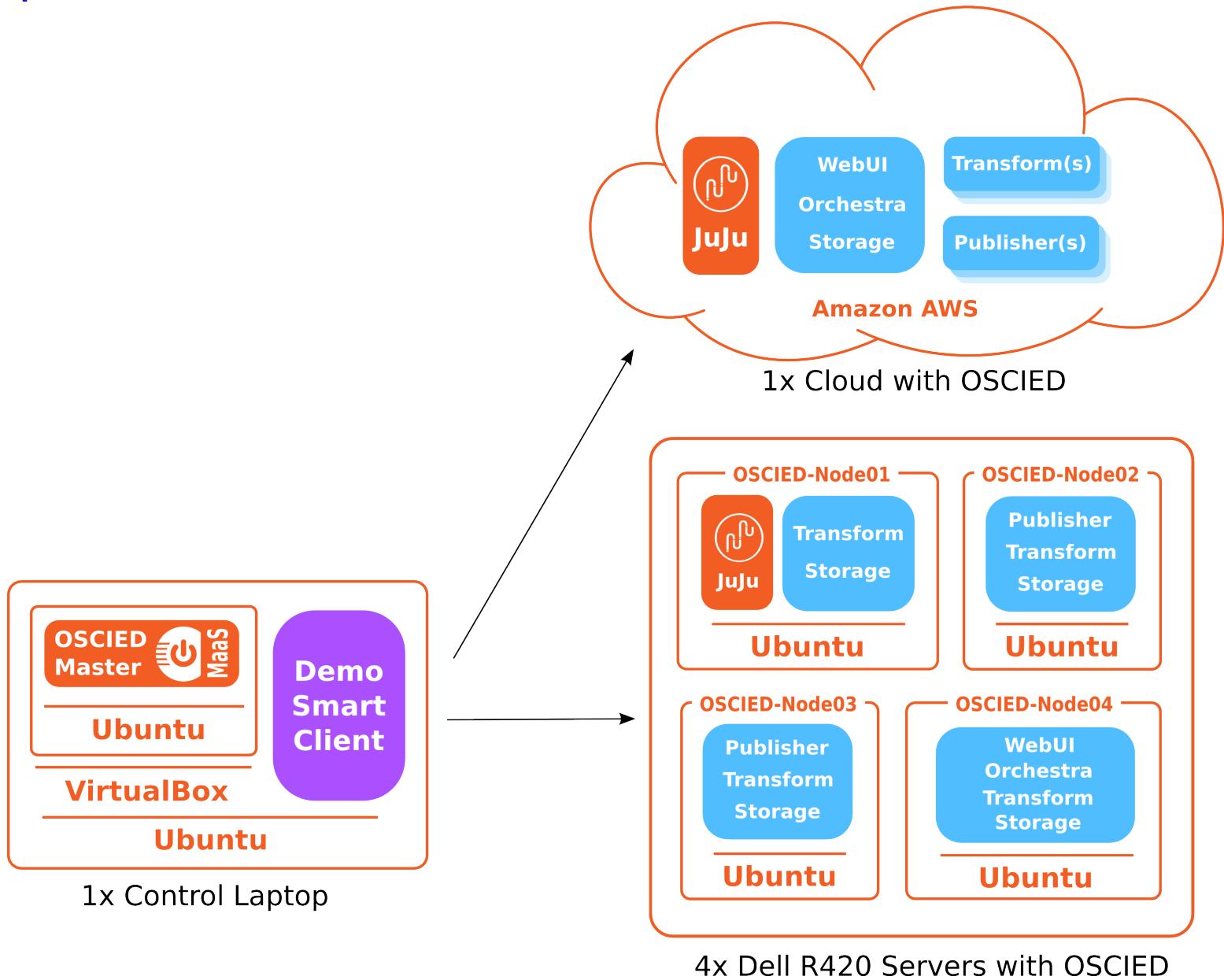
## March 2013 - Master Thesis



An hybrid setup running in parallel of a 100% public cloud setup.

# Demonstrator v2.29.40

September 2013 – IBC 2013 Amsterdam



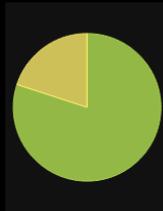
# Demonstrator v2.29.40

## September 2013 – IBC 2013 Amsterdam

### PRIVATE CLUSTER & PUBLIC CLOUD: ACTIVE SERVICES

Number of public encoding nodes

- 0 error
- 4 started
- 1 pending



Number of public distribution nodes

- 0 error
- 0 started
- 0 pending

No unit

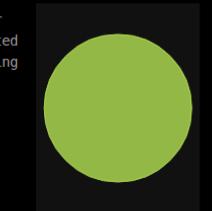
Number of private encoding nodes

- 0 error
- 4 started
- 0 pending



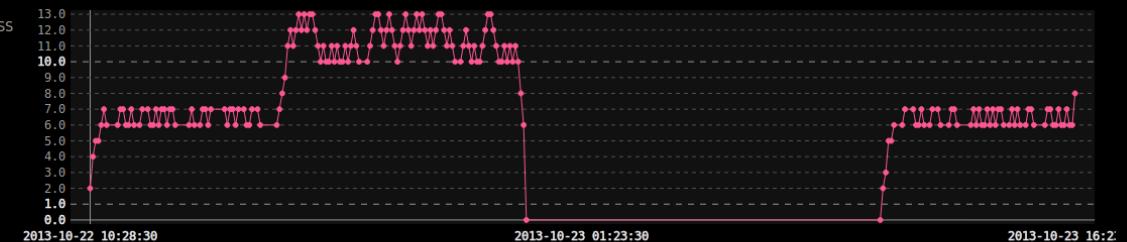
Number of private distribution nodes

- 0 error
- 2 started
- 0 pending

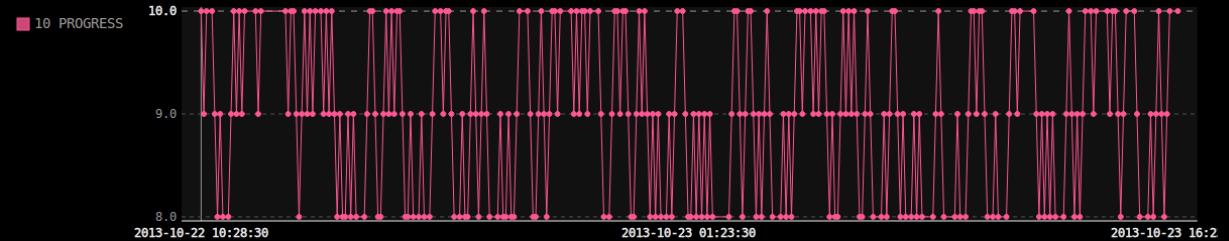


### SCHEDULING OF ENCODING TASKS

Scheduling of encoding tasks on Public Cloud



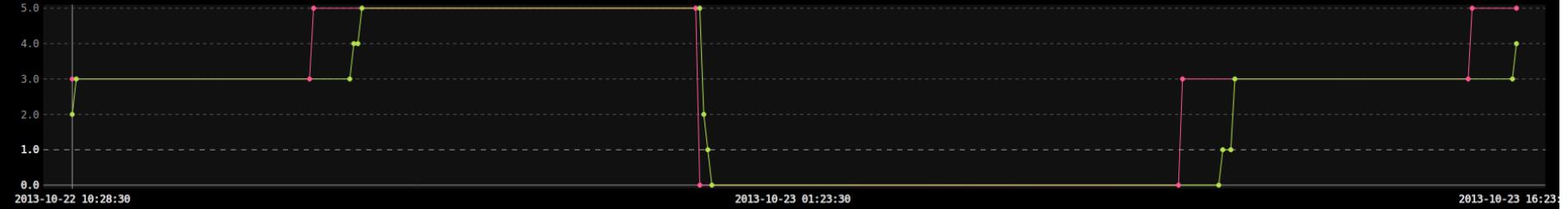
Scheduling of encoding tasks on Private Cluster



### PUBLIC CLOUD: ACTIVE AND PLANNED AMOUNT OF NODES DURING THE DAY

Number of encoding nodes

- 5 planned
- 4 current



*The demo client handling the deployment, scaling and usage of the platform (OSCIED) into the public (Amazon) and private (MAAS) environments.*

# Demonstrator v2.29.40

September 2013 – IBC 2013 Amsterdam



# IBC 2013 : Debriefing

13.09.2013 IBC Daily News

86 Friday 13.09.13 theibcdaily

## Making the hybrid cloud work for broadcasters

By Bram Tullemans, project manager, EBU

In the current climate broadcasters can't afford to have capacity sitting idle. This is why the cloud and the virtualisation of services offer so much promise. But to fully meet the needs of broadcasters, solutions need to integrate scalability in a private cloud setting and the possibility of extending virtualised services to the public cloud. While there are solutions out there, they're not optimised to meet broadcasters' needs.

Virtualised and cloud services are beneficial for both production and distribution. More and more actors in the production domain work from different locations connected via third party (fibre) networks. We are not talking about fixed location only but also, for example, ENG crews uploading live feeds via cellular networks.

This decentralised model creates new requirements. In the ENG case one could imagine a cloud service providing editing functions for a journalist in the field.

Temporarily installing this cloud-based service in the network of the local access service provider would optimise the latency and data provisioning requirements.

If latency is not a bottleneck the cloud service could be provided from a media gateway close to well-connected hubs or even from the broadcast facility. The decision to use a private, public or hybrid cloud setup rests on the need to optimise data flows with regard to latency, sustained bandwidth and transport costs.

We could imagine a distribution use case where a single broadcaster needs to efficiently allocate resources for

three activities: encoding a constant content flow of live and on-demand files; serving a variable number of concurrent users accessing this content via broadband platforms throughout the day; and the transcoding of an archive library for on-demand services.

The first operation requires a constant capacity; the second typically peaks during the prime viewing period in the evening; and the third is not a daily routine but more a one-time effort with a separate allocated budget. While it's relatively easy to allocate resources to a constant, predictable process, it doesn't make sense to install permanent servers for a one-time activity or to handle traffic peaks.

### Elastic change

The use of public clouds for distribution can also bring the benefit of a better connection with certain ISPs (Internet Service Providers), resulting in improved Quality of Service for the end user. Normally broadcasters deliver their content via (private or public) peering and/or CDNs.

Nowadays one can add Amazon's connectivity to the equation by using their cloud (CDN) services to upscale distribution nodes. Imagine the possibilities if content providers can themselves temporarily install caching nodes deep into third party networks close to the end user.

Distribution will take on a whole new meaning, as the up-and-down-scaling of caching at specific locations could be automated on the basis of real-time information about what part of the internet network is congested and how expensive



it will be to use alternative online delivery routes. This again is the promise of Service Defined Networks (SDNs) and it is expected that such CDNs in the future will be able to deliver these kinds of 'cloud' service.

So we can see that the virtualisation of services using a hybrid cloud setup could optimise resources and minimise operational costs by elastically changing the amount of encoding or distribution

**'We are not talking about a virtualised encoder anymore but a whole cloud infrastructure that can connect to other interoperable cloud environments'**

nodes in a private and public cloud. The hybrid scenario is attractive as there is a payoff when choosing wisely between temporarily rented and structurally allocated capacity.

The flexibility of the cloud approach also allows a broadcaster to adapt to the sudden growth of popularity for a service, as one can temporarily upscale the capacity. At the same time it

can make costs more transparent as capacity can be allocated to specific projects rather than to the infrastructure as a whole.

There is a growing demand

for integrated services that help broadcasters to create their own application environment in the cloud that can be rolled out elastically throughout the internet, optimising data flows that arise from a temporary need. We are not talking about

decentralised cloud setups.

One example is SWISS TXT who, for the Swiss public broadcast umbrella organisation SRG SSR, have built a private cloud setup using two well-connected media gateways located in Zurich and Biel. From these locations common services will be provided for all four of the organisation's broadcasters in the different language regions.

We in the EBU have also

been working on a prototype

cloud infrastructure, based on

entirely on open source

software, both for the services

themselves and the virtualisation

of those services. This work,

which is demonstrated at IBC

(10 F20), has revealed many

potential use cases as well as

architectural and technical

solutions that would be of

interest to broadcasters and

service providers.

The total constant capacity of

the private cloud can be used

by different virtualised services

throughout the day. The public

cloud is used only for offloading

distribution peaks or cost

efficient upscaling of

transcoding jobs.

03.2014 FKT Schiele Schoen (DE)

" FKT (with Radio Technical Notes RTM), the trade magazine for professional television, film and electronic media in Europe. The range of topics publish posts ranging from television and video equipment via the film sound and audio technology to the new media. Practical, timely and competent reporting feature to know this high-profile journal.

FKT readers are decision-makers in the TV, film, audio and video industry. (...) "

<http://www.youtube.com/user/FKTONline/about>

# Conclusion – The Project

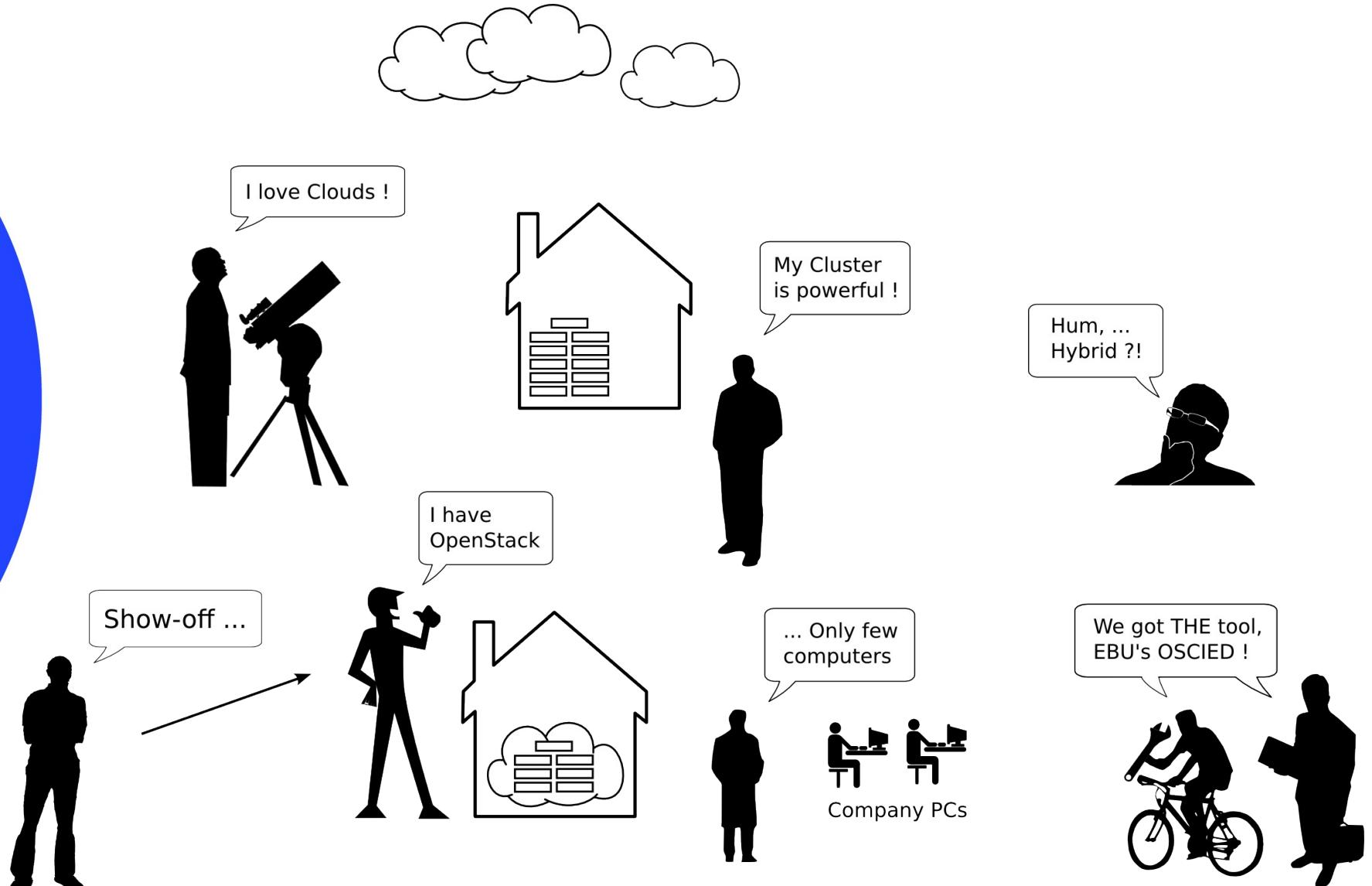
- This demonstrator is an **FLOSS** media platform allowing EBU's members :
  - To use in-house IT resources mixed with necessary amount of public cloud resources
  - To easily **adapt scale** of transcoding and publication services
  - To **optimize costs** of services :
    - By adapting **CAPEX / OPEX** balance based on business needs
    - By avoiding « **vendor lock-in** » to dedicated media services (SaaS) or even Cloud providers (IaaS)
  - To test it, use it, even add missing features as it is Free/Libre Open-Source licensed
- Developed application is designed to being **simple** to use but rather **powerful** :
  - **Deployment is made easy**, thanks to JuJu and developed charm's hooks
  - Is **elastic**, balance of private & public resources is easy and can be **automated**
  - **Proof of concept** : Open-Source based Encoding and Distribution Platform

# Future

- OSCIED can grow into a full-fledged media platform with professional management layers :
  - Enhancements and future features are already listed on GitHub [1].
  - **[OK]** Add MPEG-DASH encoding capabilities (DashCast/GPAC Team [2])
  - **[work in progress]** Integrate OSCIED to EBU's io platform (common Web UI)
  - **[scheduled]** Accept live MPEG2-TS input feeds / multi-storage architecture / HTTP proxy
  - Improve security and avoid single point of failure (SPOF)
  - Open Broadcast Encoder for delivering MPEG2-TS feeds (OBE [2])
  - Add of automatic scalability functions (e.g. based on business rules)
  - Use SaaS services of public Cloud providers (AWS Endcoding [2])
  - Distribute with Mist FLOSS Content Delivery Network (DDVTECH [2]) ...
- OSCIED was and will be an opportunity for me to work on topics such as FLOSS, cloud, media, automation, cluster storage, API ... GitHub, Python, Amsterdam :)

[1] [github.com/ebu/OSCIED/issues](https://github.com/ebu/OSCIED/issues)  
[2] Met at IBC 2013

# Questions & Answers



# Even More Slides

*The bonus slides.*

# Demonstrator v2.29.40

September 2013 – IBC 2013 Amsterdam



## Available medias

Title	Virtual Filename	File size	Duration	Added on	Added by	Status	
Psy - Gangnam Style 720p	Psy_gangnam_style_720p.mp4	174.8 MB	00:04:12.16	2013-02-02 15:39	David Fischer	PUBLISHED	<button>Delete</button>
Project London MP2	Project_London.mpg	24.4 MB	00:00:01.95	2013-02-02 15:40	David Fischer	READY	<button>Delete</button>
s	s.mp4	0 Bytes		2013-02-02 15:40	David Fischer	DELETED	
Project London - Official Trailer (2009)	Project_London_trailer_2009.mp4	52.3 MB	00:02:44.88	2013-02-02 15:38	David Fischer	PUBLISHED	<button>Delete</button>
Psy - Gangnam Style	Psy_gangnam_style.flv	174.7 MB	00:04:12.16	2013-02-02 15:38	David Fischer	PUBLISHED	<button>Delete</button>
Gaga	gaga.mp2	0 Bytes		2013-02-02 15:46	David Fischer	PENDING	
PSY MP2	PSY.mp2	0 Bytes		2013-02-02 15:47	David Fischer	DELETED	
Project London MP2 Bis	Project_London.mpeg	24.4 MB	00:00:01.95	2013-02-02 15:48	David Fischer	READY	<button>Delete</button>

## Add a media

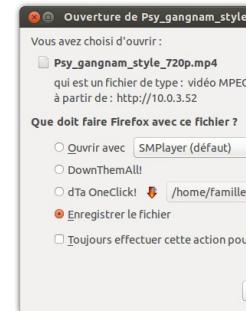
Title

Virtual filename

Add  Cancel all

You can drag and drop your files here

Add media



## OSCIED Home Links Contact Us Users Medias Profiles Transform Publisher

## Transform jobs

Input media	Output media	Profile	Added by	Added on	Started on	Elapsed	Progress	Error	Status
Psy_gangnam_style.flv	Psy_gangnam_style_720p.mp4	To MP4	David Fischer	2013-02-02 15:10	2013-02-02 15:39	00:00:05	<div style="width: 100%; background-color: #2e7131;"></div>		SUCCESS
Project_London_trailer_2009.mp4	Project_London.mpg	To MP2	David Fischer	2013-02-02 15:10	2013-02-02 15:40	00:00:21	<div style="width: 100%; background-color: #2e7131;"></div>		SUCCESS
Psy_gangnam_style_720p.mp4	s.mp4	To 720p	David Fischer	2013-02-02 15:10		00:00:00	<div style="width: 100%; background-color: #cccccc;"></div>	Unable to parse FFmpeg output, encoding probably failed1	FAILURE
Psy_gangnam_style_720p.mp4	gaga.mp2	To MP2	David Fischer	2013-02-02 15:10		00:00:00	<div style="width: 100%; background-color: #cccccc;"></div>	None1	PENDING
Psy_gangnam_style_720p.mp4	PSY.mp2	To MP2	David Fischer	2013-02-02 15:10	2013-02-02 15:47	00:00:52	<div style="width: 10%; background-color: #007bff;"></div>	terminated1	REVOKED
Project_London_trailer_2009.mp4	Project_London.mpeg	To MP2	David Fischer	2013-02-02 15:10	2013-02-02 15:48	00:00:16	<div style="width: 10%; background-color: #007bff;"></div>		PROGRESS

## Launch a transform job

Input Media	Profile	Virtual Filename	Media Title	Queue
Psy - Gangnam Style 720p - P	File Copy			transform_private

Launch job

# Servers Layer

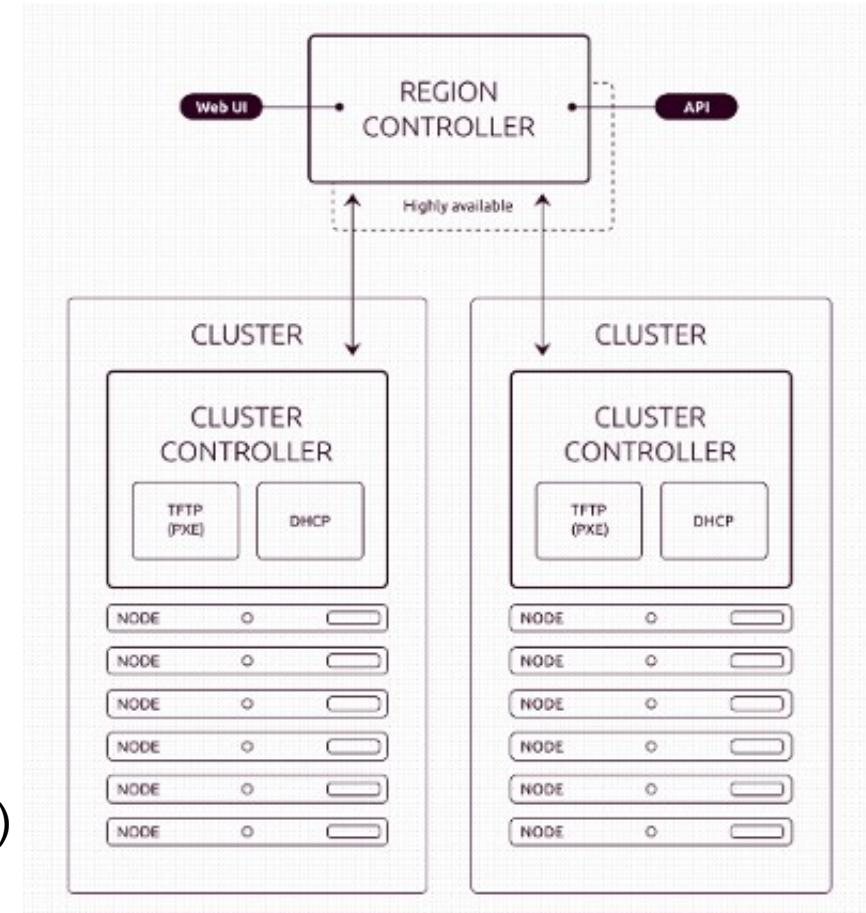
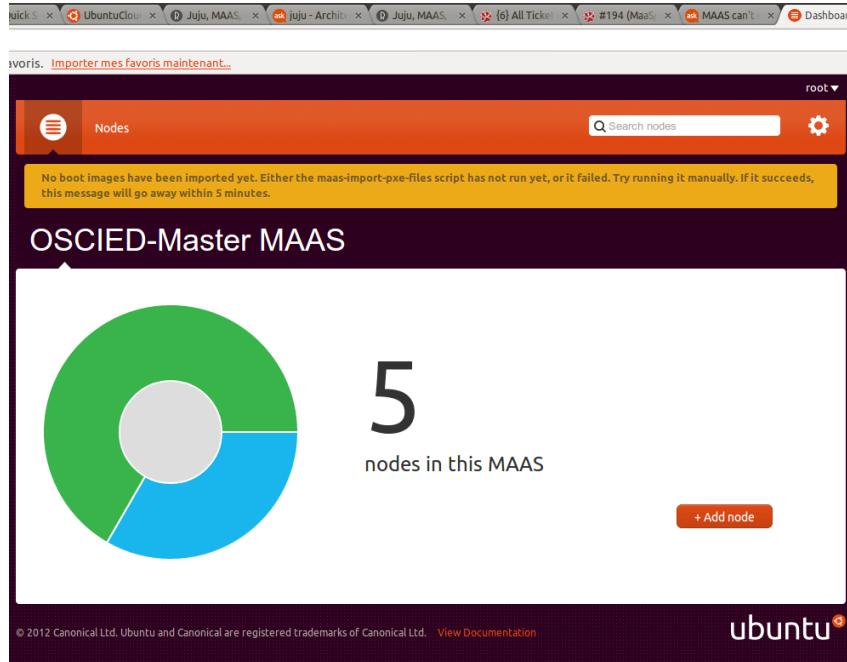
Application  
Deployment  
Clouds / IaaS  
**Servers**

- A setup of 4x 1U servers chosen based on :
  - Project's CAPEX (the cash)
  - Optimization of configuration based on needs
  - Ubuntu Server's certified HW list for Dell Servers
- Dell PowerEdge R420
  - 2x Xeon E5-2430 2.20GHz, 15MB Cache, 7.2GT/s, 6C
  - 4x 4GB RDIMM 1333MT/s x8 Data Width
  - HW RAID PERC H310 Mini + 2x 1TB 7.2K SATA



# Servers Layer (MaaS)

Application  
Deployment  
Clouds / IaaS  
**Servers**



- ✓ Ease of servers provisionning (PXE install)
- ✓ Driveable through an API (enable automation)
- ✓ Developped to interact with JuJu

# Clouds Layer (Amazon, ...)

« Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers. »

- Manageable through an API or WUI
- Compute / network services :
  - **EC2 – Elastic Compute Cloud**
  - EMR – Cluster Hadoop
  - Route 53 – DNS
- Storage/CDN services :
  - **S3 – Simple Storage Service**
  - Glacier – Low-cost Archive Storage
  - EBS – Elastic Block Storage
  - CloudFront – Content Delivery Net.
- Database services :
  - RDS – Relational DB Services
  - DynamoDB – NoSQL data store
- Management services :
  - **AWS Management Console**

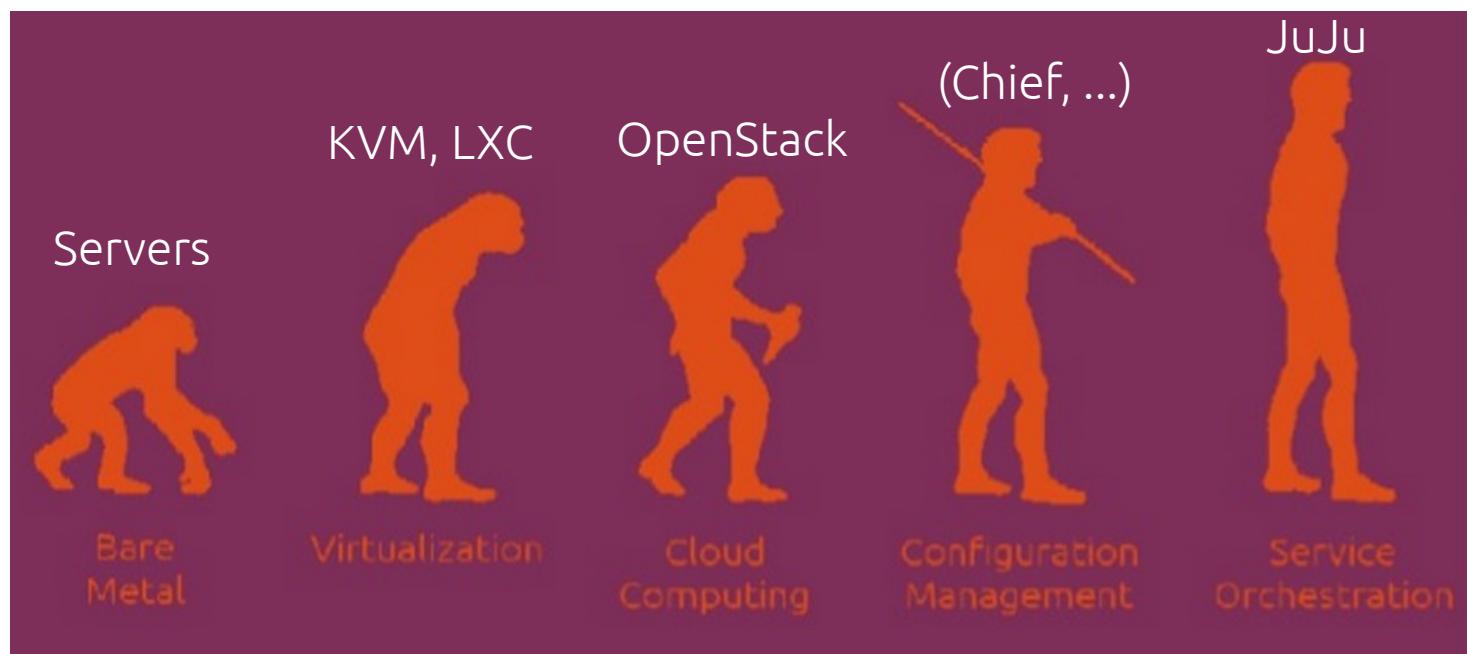
The screenshot shows the AWS Management Console interface for the EC2 service. The main area displays a table of running instances, each with a status check summary (e.g., 2/2 checks passed), alarm status (none), monitoring status (basic), and security group (juju-amazon-0, juju-amazon-1, etc.). Below the table, a specific instance named 'orchestra' is selected, showing its detailed configuration: AMI (ubuntu/images/ebs/ubuntu-quantal-12.10-amd64-server-20121218 (ami-7539b41c)), Zone (us-east-1b), Type (t1.micro), and Scheduled Events (No scheduled events). The bottom of the page includes standard copyright and footer links.

Name	Instance	AMI ID	Root Device	Type	Status	Status Checks	Alarm Status	Monitoring	Security Group
juju	i-a831fed8	ami-7539b41c	ebs	m1.small	running	2/2 checks passed	none	basic	juju-amazon-0, ji
orchestra	i-ee4b849e	ami-7539b41c	ebs	t1.micro	running	2/2 checks passed	none	basic	juju-amazon-1, ji
webui	i-544a8524	ami-7539b41c	ebs	t1.micro	running	2/2 checks passed	none	basic	juju-amazon-2, ji
storage	i-804a85f0	ami-7539b41c	ebs	t1.micro	running	2/2 checks passed	none	basic	juju-amazon-3, ji
transform	i-16498666	ami-7539b41c	ebs	t1.micro	running	2/2 checks passed	none	basic	juju-amazon-4, ji
publisher	i-8a4986fa	ami-7539b41c	ebs	t1.micro	running	2/2 checks passed	none	basic	juju-amazon-5, ji

VM Instances can be launched **On-demand**, Reserved (for 2 years) or Spot (if the price goes below 0.1\$/h).

**Instances Type** will define allocated capacity : #CPU, #MB RAM, iops ... \$/h

# Services Orchestration ...



Copyright Hardik Dalwadi

# Services Orchestration ...

## JuJu from CANONICAL

