



# ***5G ESSENCE Contributions to New Generation of In-Flight Entertainment and Communications (IFEC) Systems***

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The 5G Infrastructure Public Private Partnership

# Outline



- *Overview of the 5G ESSENCE approach for future In-Flight Entertainment and Connectivity*
- *Planned Services & the 5G Ecosystem*
- *The way forward*

# Overview



- **Objectives:** Deploy, Validate and Demonstrate the 5G ESSENCE use case on IFEC systems, highlighting the capabilities of the 5G ESSENCE architecture to deliver multi-tenant, high-definition content on-board. 5G ESSENCE dedicates WP7 to IFEC innovations.
- **Approach:** Integrate the multi-tenant mobile connectivity payload with 5G/LTE and Multi-RAT Wi-Fi components and high-performance servers into a Cabin Mock-Up.

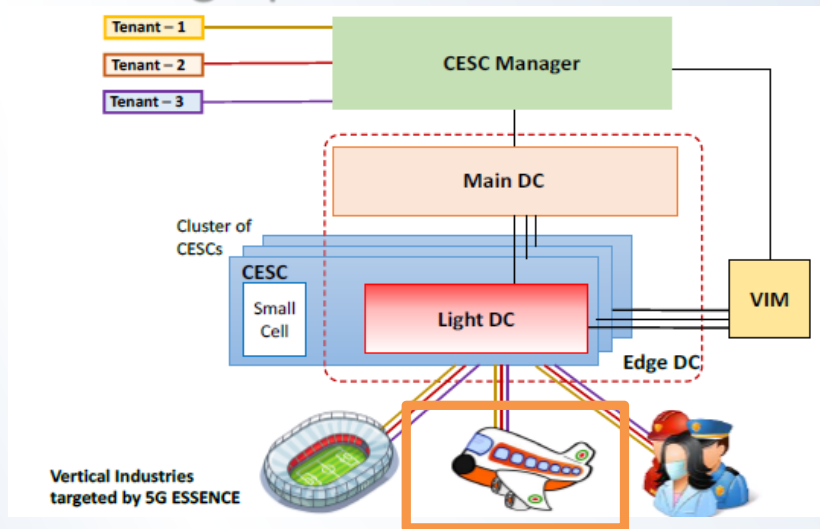


Figure 1: Architecture overview.



Figure 2: Cabin mock-up (ZII demonstration environment).

# Planned Services & 5G Ecosystem(I)



- **Multi-tenancy**
  - RAN slicing (FBK)
  - Wi-Fi slicing (i2CAT)
- **Multi-RAT**
  - Wi-Fi APs (ZII)
  - Small Cells (CASA): LTE/LAA
  - Open source solutions: srsLTE + Ettus
- **Video Transcoding** (ITL)
- **Caching** (ORION)
- **Telemetry** (ATOS)
- Current aircraft provide a chain of Access Points serving multimedia content to a number of clients



Figure 3: Transcoding service.

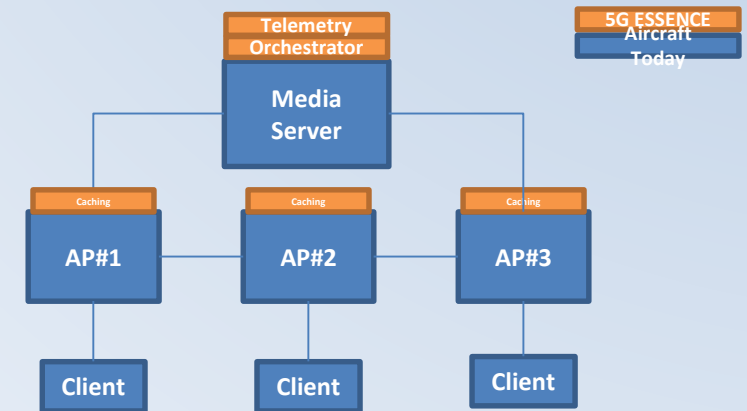
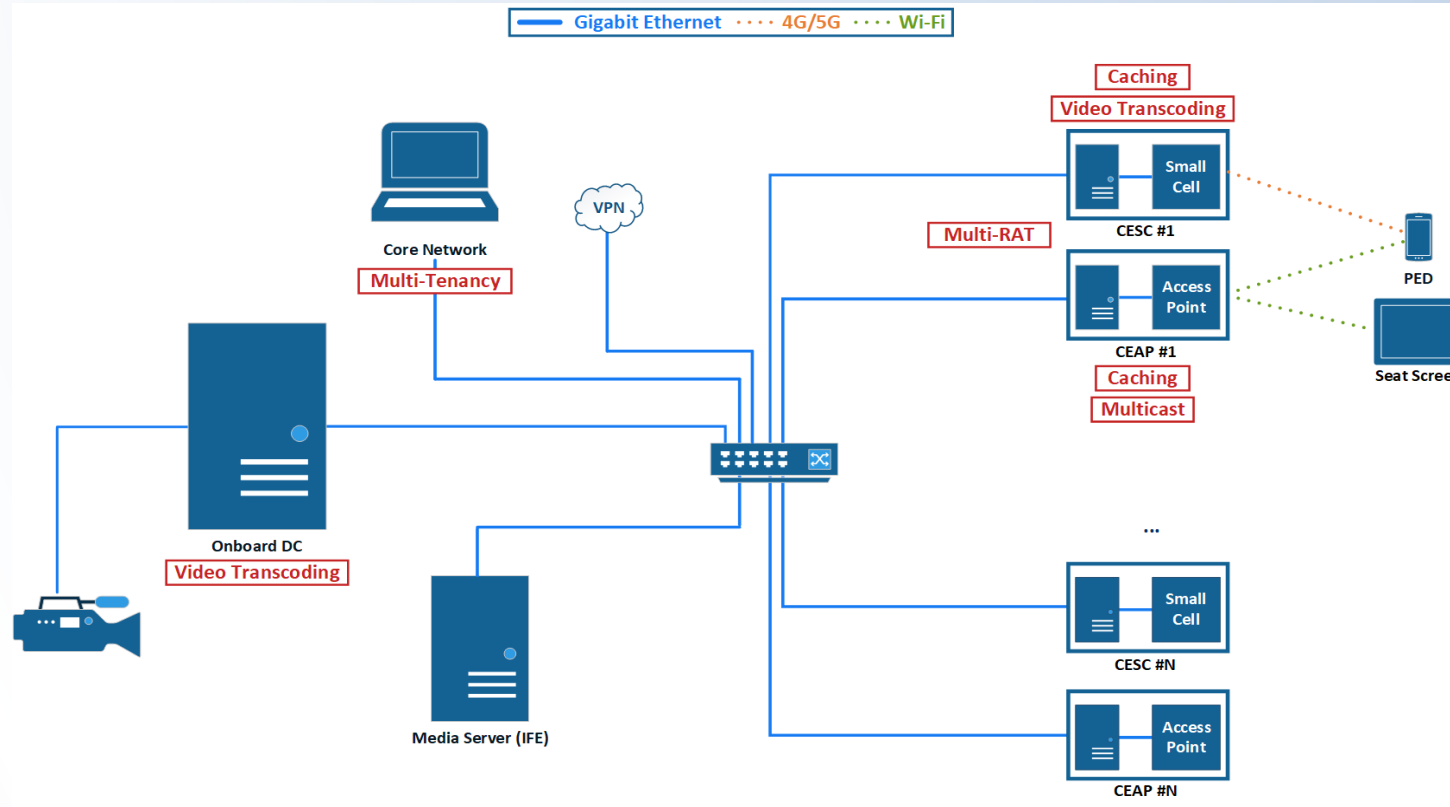


Figure 4: Current IFEC architecture.

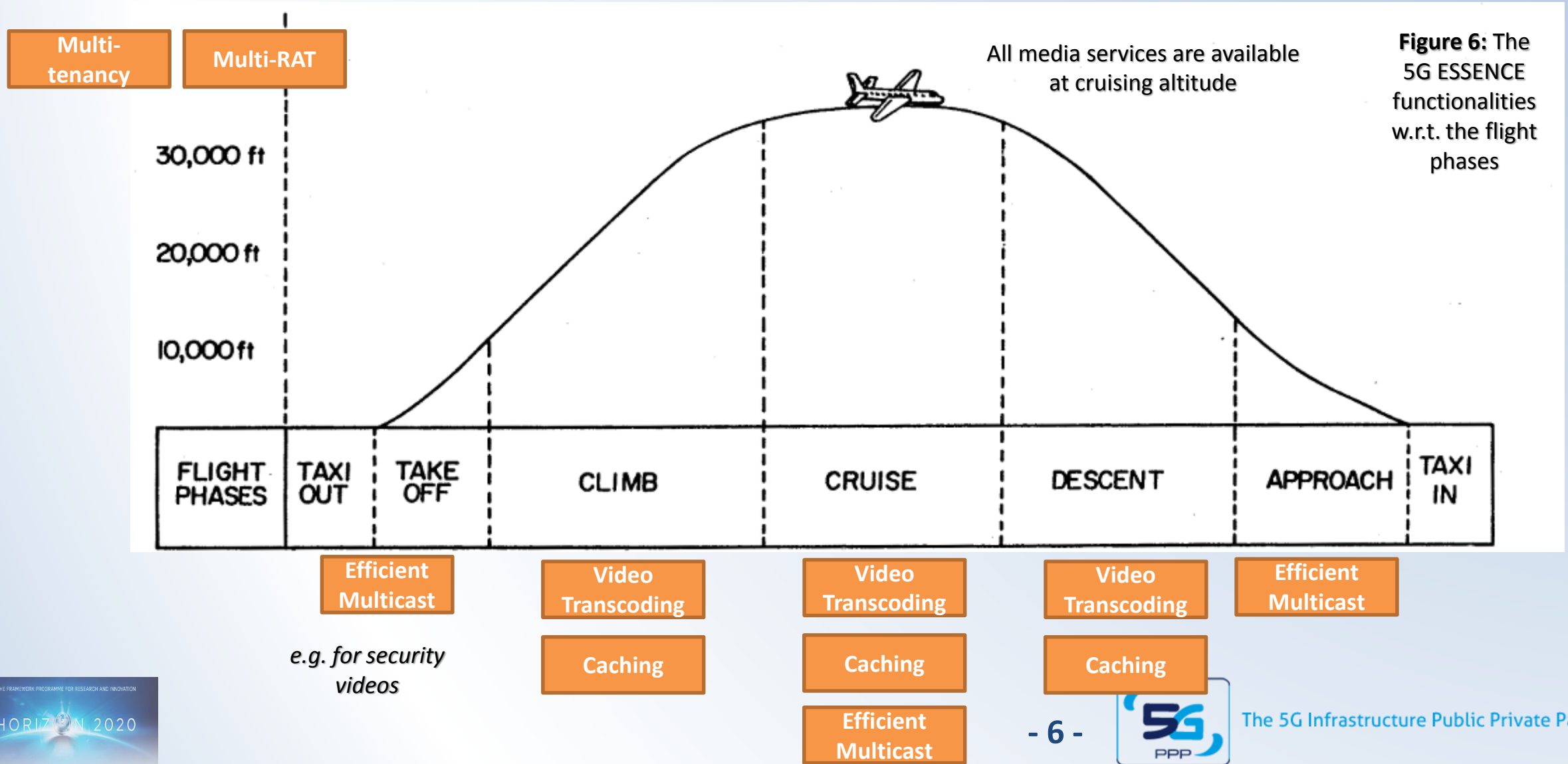
# Planned Services (II)



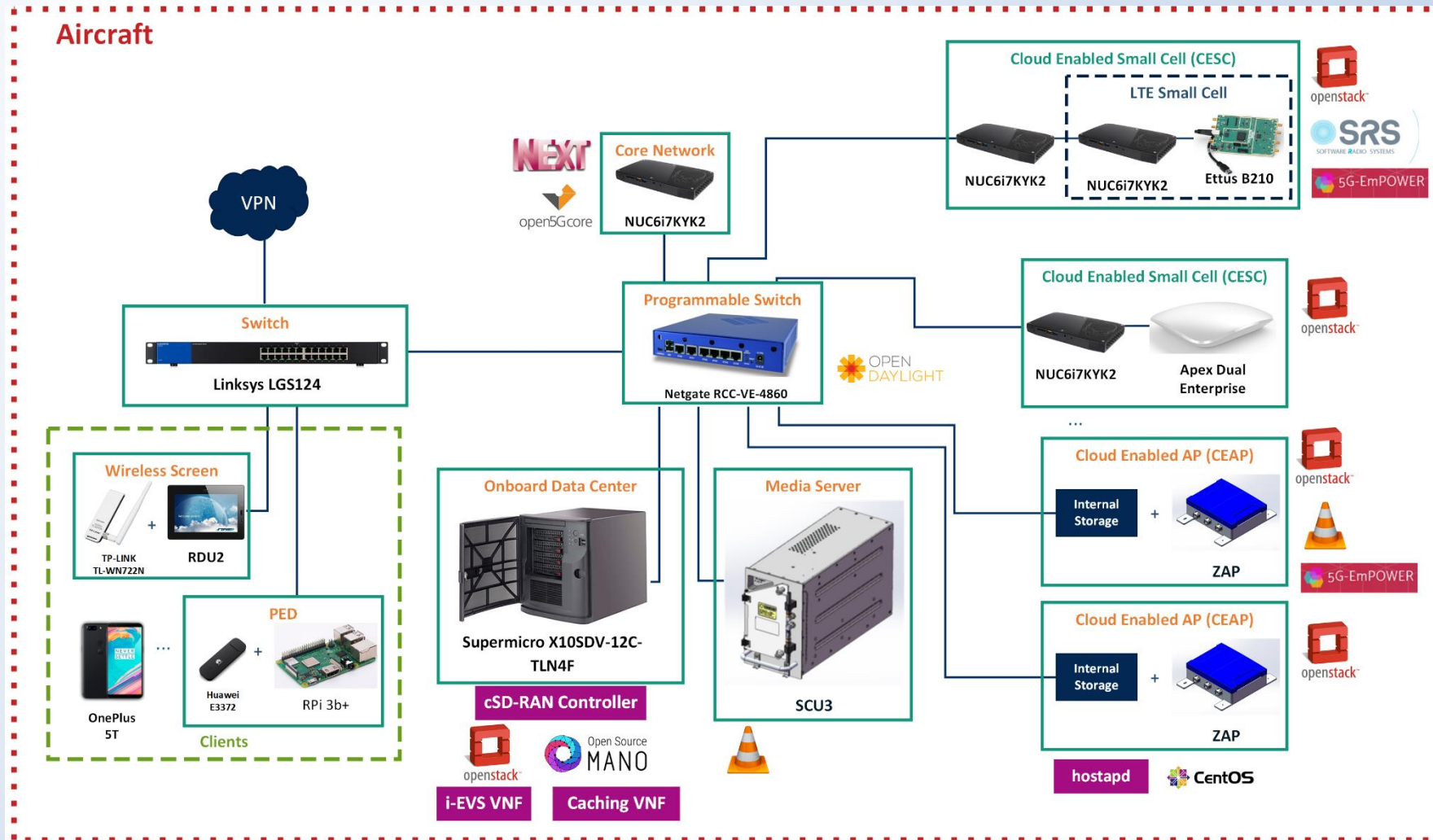
**Figure 5:** The 5G ESSENCE vision brings on-board small cells and cloud-enabled multimedia servers, rather than daisy-chained APs.



# Planned Services (III)



# UC3 Testbed



**Figure 7:**  
Key technologies include OpenStack, OpenDaylight, Open5G Core, Open Source MANO, 5G EmPOWER etc.

# *The way forward*



- To jointly deliver the required **communication and network/cloud infrastructure for the wireless IFEC (to both the embedded IFE devices and the wireless BYOD)**.
- Effectively integrate and test E2E application scenarios.
- Functional testing of the Video encoding and Caching service will support a wide range **of input file formats**, allowing easy integration with existing production systems, and a comprehensive **array of output formats**.
- Output parameters will be **configurable, enabling precise tuning for the desired output devices**.
- CESCO will be elaborated **for indoor dense deployment of small cells and limited processing power**, due to the space and weight constraints imposed by the aeronautical industry.



**Thank you for your attention**  
***For more information please contact:***

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# Validation Plan



- **Durability tests:** Run the service for 12h, 24h, 48h and monitor for faults
- **Performance:** Time to deploy, Time to configure, Mean Time to Failure, Latency measurements (if necessary), energy consumption
- **Security and privacy:** CVE tracking, hardening measures, privacy and data protection, use of encryption, assessment of overall attack surface and security risks associated with the service.
- **Usability:** Measure time to launch a service and configure it using a cognitive walkthrough scenario and/or heuristic evaluation

# *Integration & Testing plan*



- **Platform functional requirements:**
  - Start and Stop a service
  - Scale in and out
  - Modifying a running service (autoscaling)
- **Functional testing**
  - Video Caching, Real Time Video Transcoding and streaming from an HM camera
- **Testing the integration with other 5G ESSENCE components**
  - SDN controller, MANO stack, VIM, Barometer/Prometheus etc.

# *Service deployment – Future steps*



- Finish development of WP7 VNFs by December 2018
  - Create packages for OSM Rel 4
  - Test deployment in OSM
  - Test lifecycle management in OSM
- Align with use case architecture and 5G ESSENCE architecture
  - Testbed location
- Design full demo for the Use Case (output of T7.1)
- Deploy and test individual components and services
- Run end-to-end tests and scenarios (output of T7.3)

# *RT Video Transcoding (ITALTEL)*



- The VNF named i-EVS has been tested in Italtel Lab.
- i-EVS is able to perform Real Time Transcoding of Video streams (with or without GPU) with the possibility to store files and to add augmented reality information.
- An Android App has been developed to take advantage of i-EVS services on mobile terminals.
- EVS is a VNF composed by 3 VNFC: database, storage and transcoding engine.
- It has been originally developed with OpenBaton as orchestrator but following 5G Essence requirements, we generated VNFD and NSD in order to use OSM (rel.3).



# *Video Caching (ORION)*



- VNF prototype is based on VideoCache (Squid URL rewriter plugin).
- Testing is performed using the the Plex media server.
- Once testing is done, packaging for OSM Release FOUR is expected.
- Development and testing is performed in Orion's testbed, equipped with OSM (Rel 2), OpenStack Ocata and OpenDayLight Carbon.
- The VNF will be deployed at ZII's testbed for testing with RAVE.

# *Service deployment – Current Status*



- ITALTEL VNF is packaged for OpenBaton or OSM rel.3
- Orion's VNF will be deployed with OSM on Orion's testbed (KVM/CentOS based VNF on an OpenStack/OSM/ODL environment)
- WP7 will consider the possibility of using OSM Release FOUR for future deployments
- Orion intends to test OSM Release FOUR & integrate VIM monitoring (Ceilometer & Aodh)