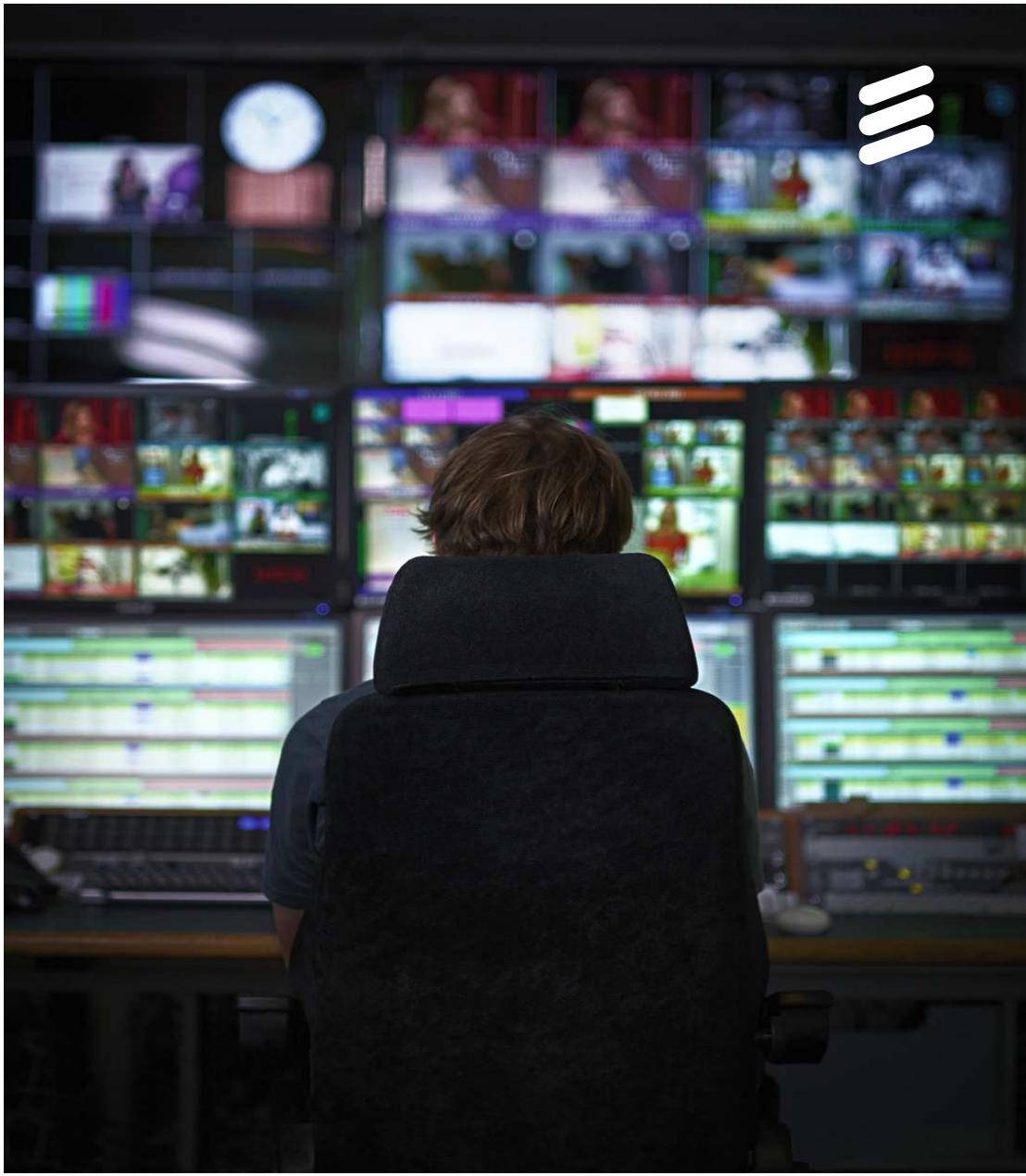
ERICSSON VIDEO STORAGE AND PROCESSING PLATFORM INTRODUCTION

BASICS OF THE PLATFORM

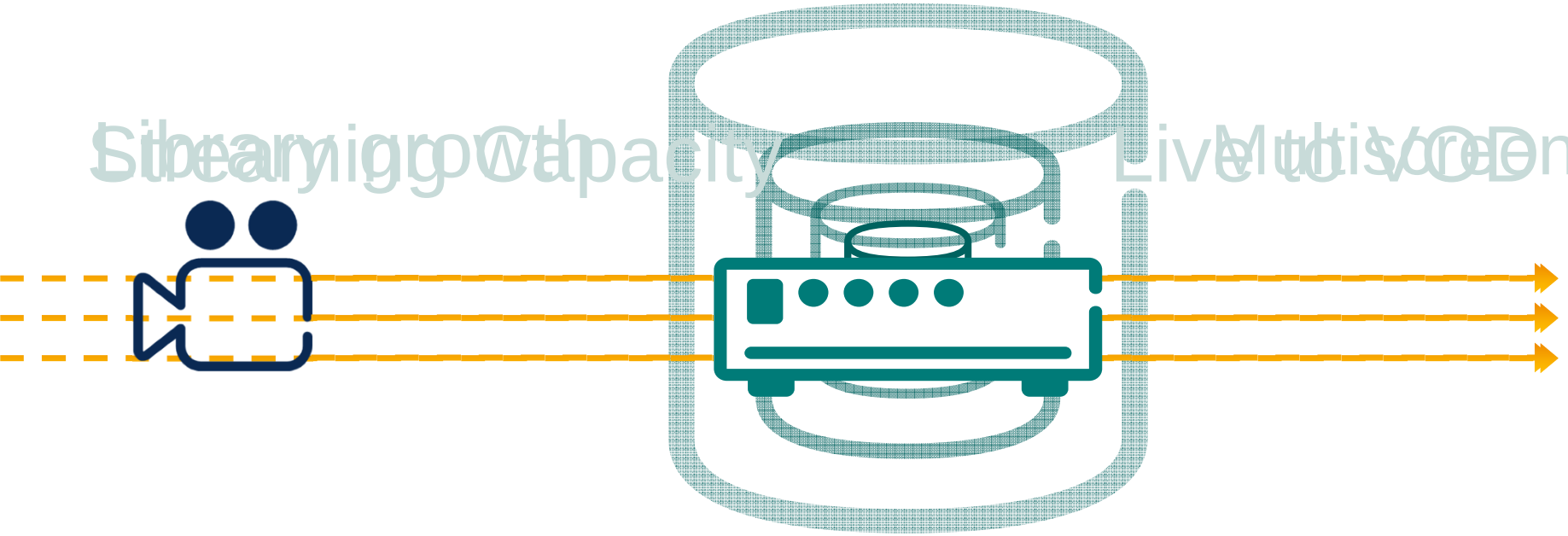
AGENDA

- Introduction to VSPP
- VSPP Components
  - Looking at the Manager
  - What is a POD?
- Recording Features
  - CloudDVR
  - Rolling Buffers
- A tour of the GUI
- API
  - Using the API to drive recordings
  - Using the API to perform Playouts
- Diagnostics
  - Monitoring using the diagnostics Server
  - Quick look at Graphite
  - Looking at logging

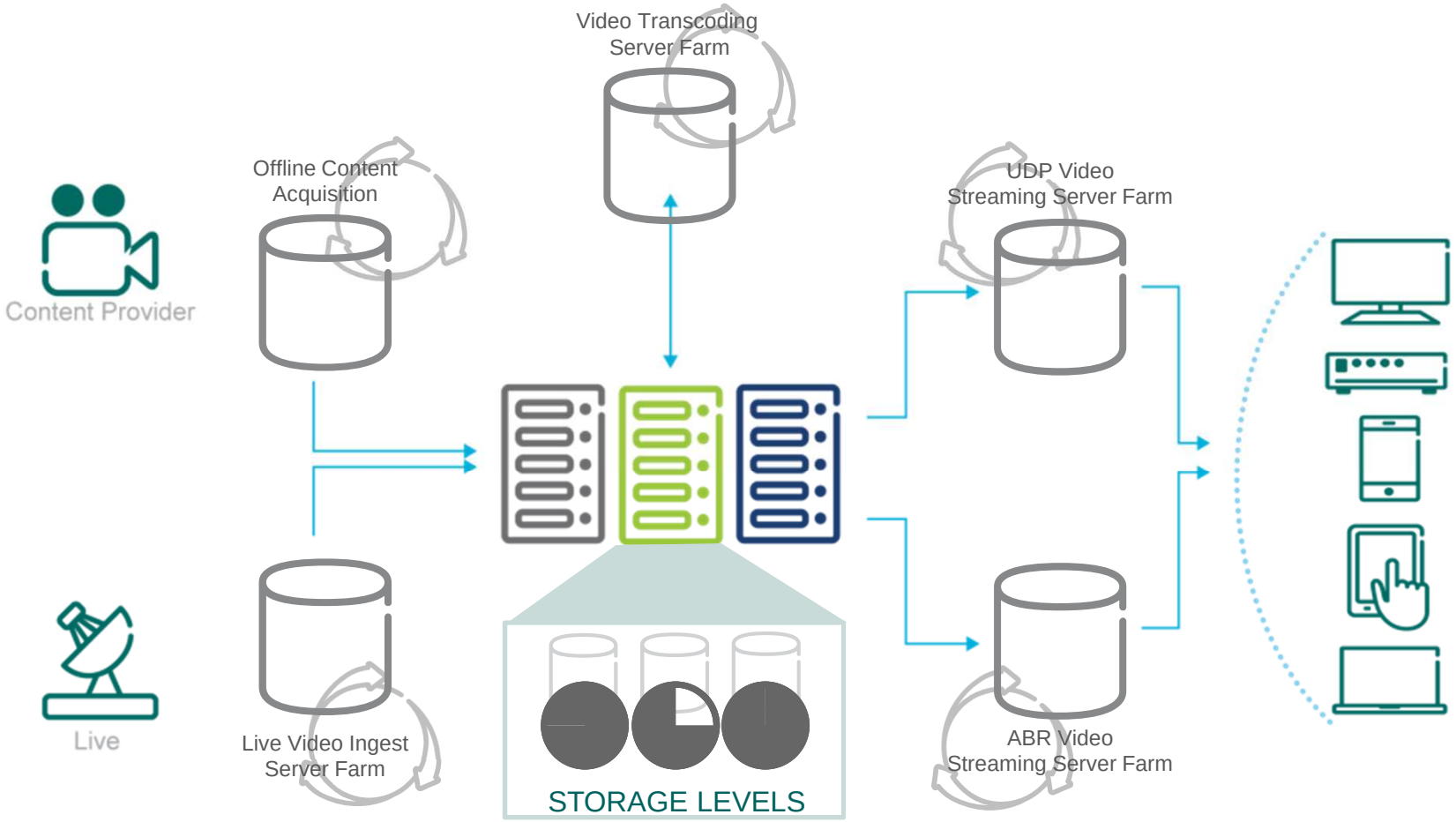



AN INTRODUCTION TO
VSPP

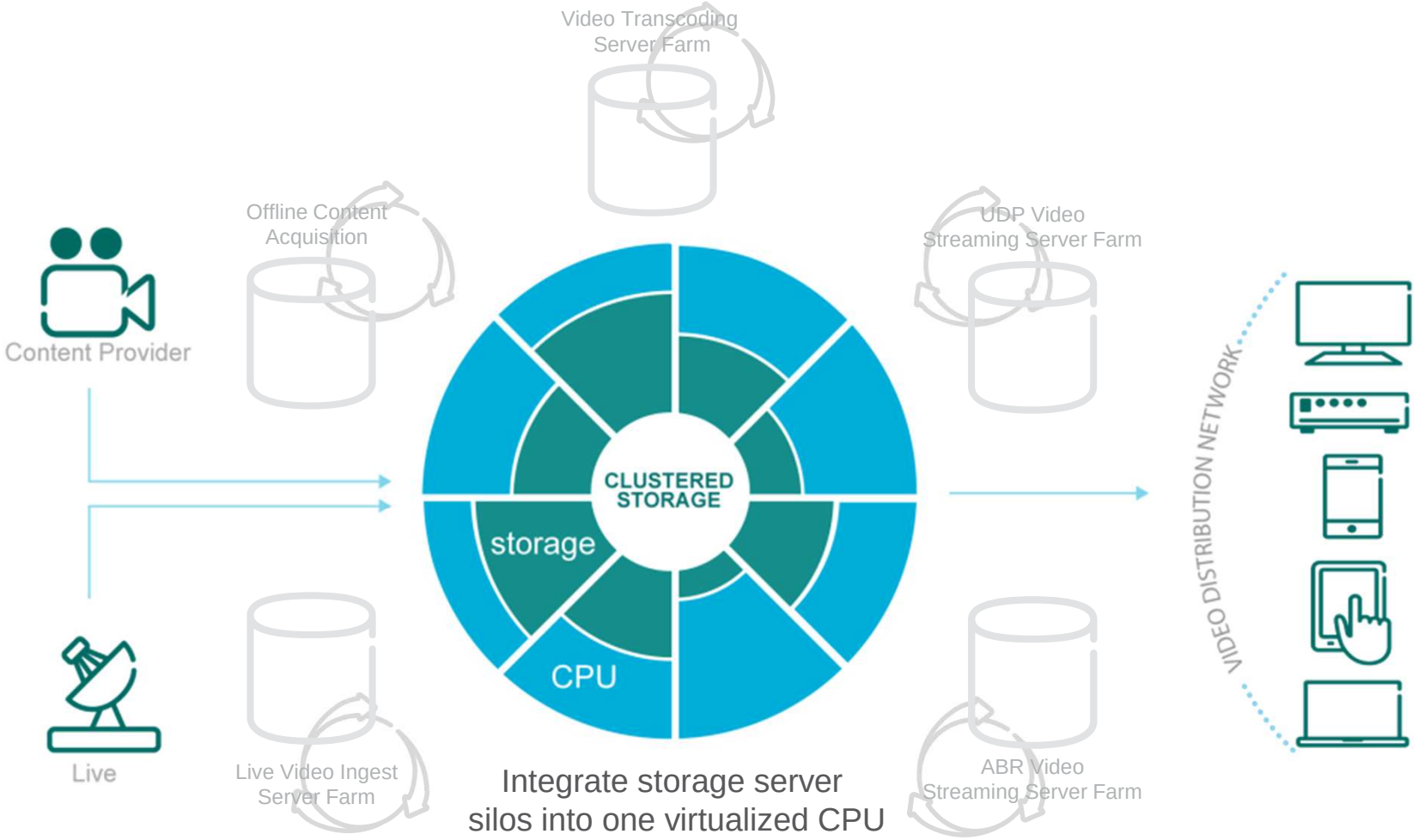
CHALLENGES



TYPICAL VIDEO INFRASTRUCTURE IMPLEMENTATION

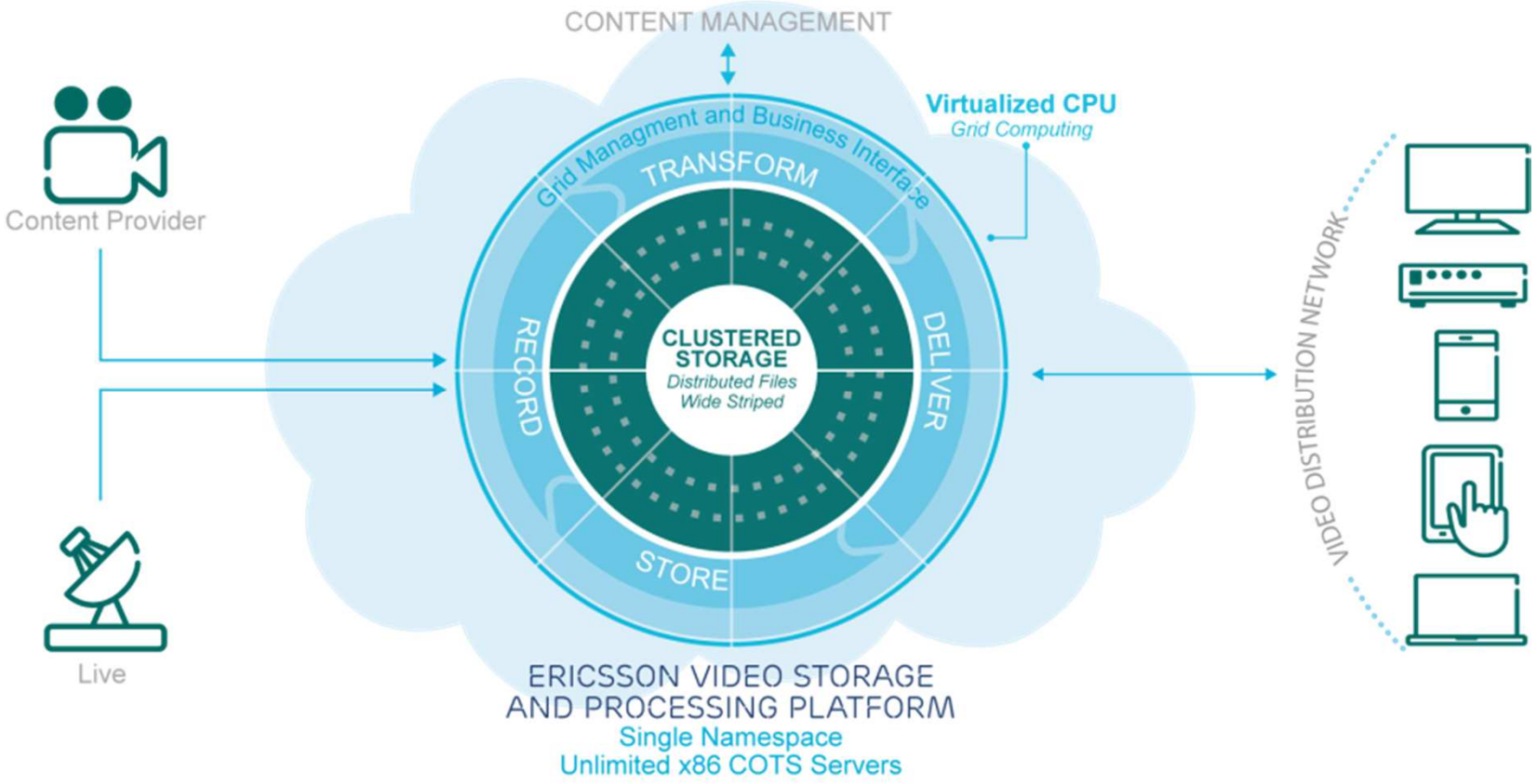


ERICSSON APPROACH



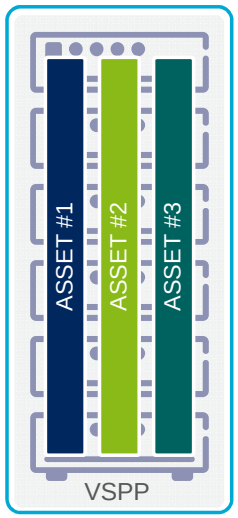
Integrate storage server
silos into one virtualized CPU

ERICSSON APPROACH



HOW IS VSPP DIFFERENT?

Ericsson VSPP
Video Storage and Processing Platform

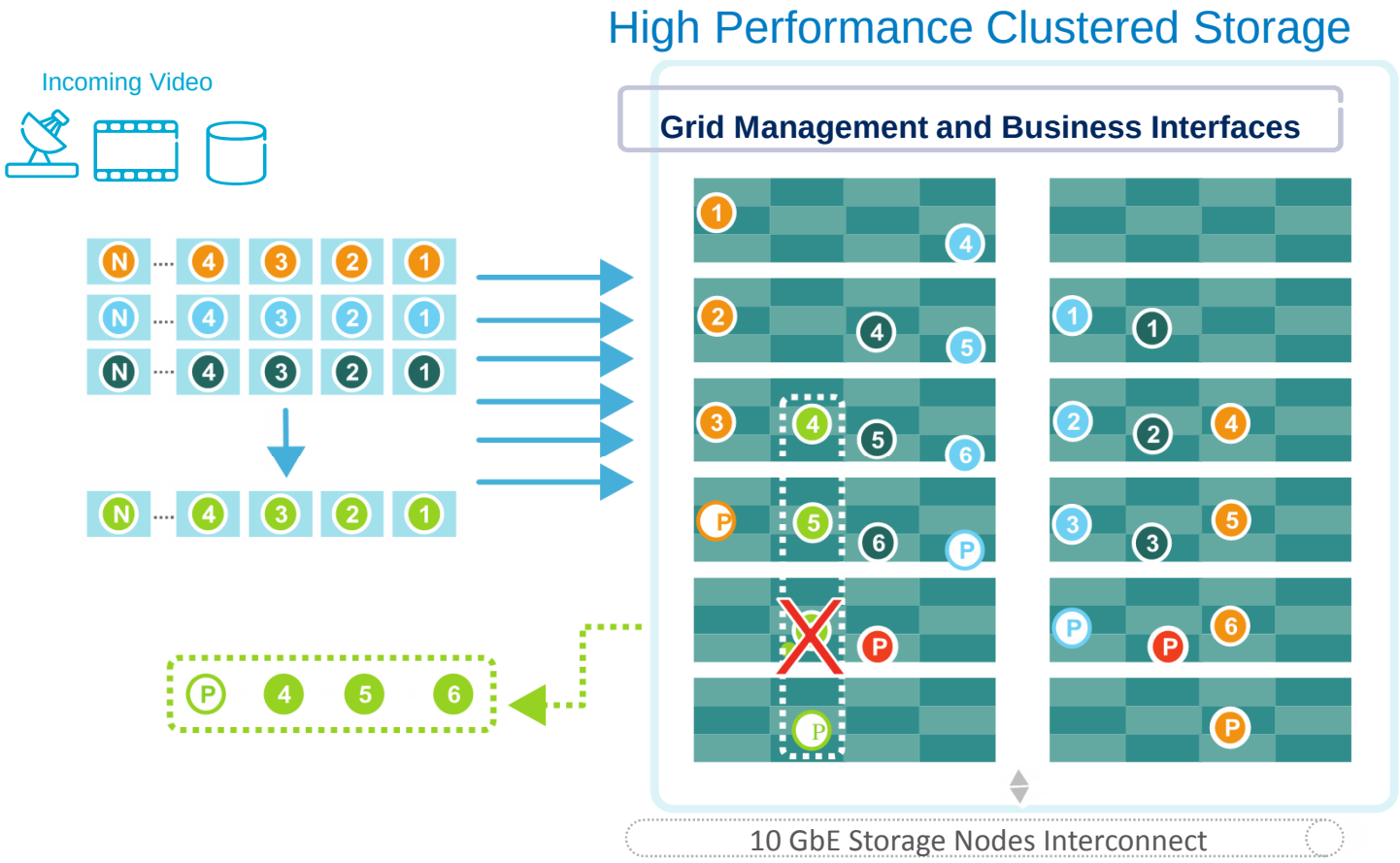


COMPETITION

RACK OF INDIVIDUAL SERVERS

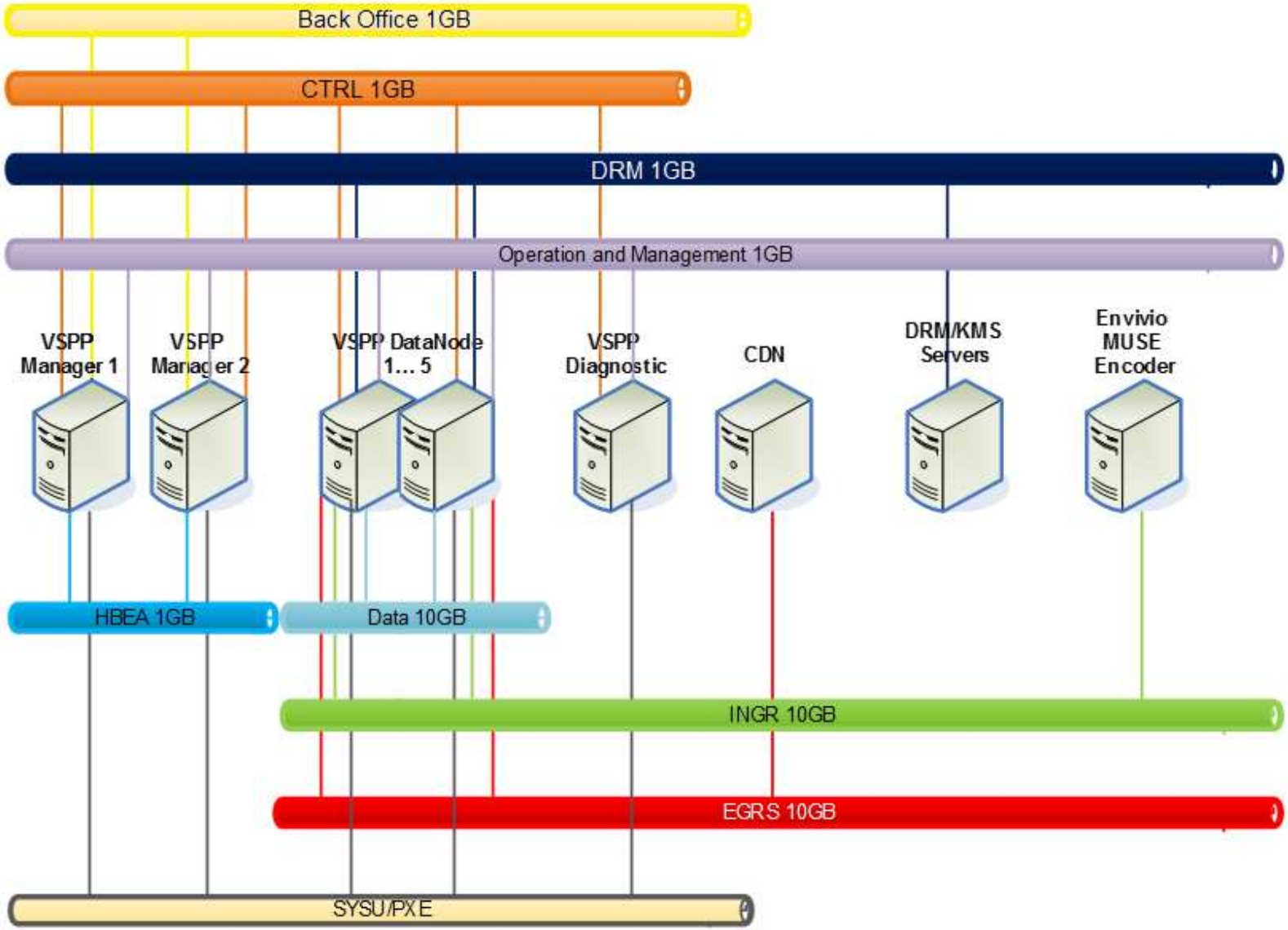
VSPP	COMPETITIVE SOLUTION
Distributed File System - Recordings are distributed on all hard drives in the cluster	Relies on HW RAID controller Recordings are stored on individual servers
High performance – Our file system fully control disk access, block size for increased performance	Lower performance due to HW RAID controller one size fits all configuration
Server protection – Our distributed RAID - Recordings are accessible from any server in the cluster	No server protection – On server failure, recordings on the specific server are unavailable

OPTIMIZED FOR MEDIA STORAGE AND DELIVERY



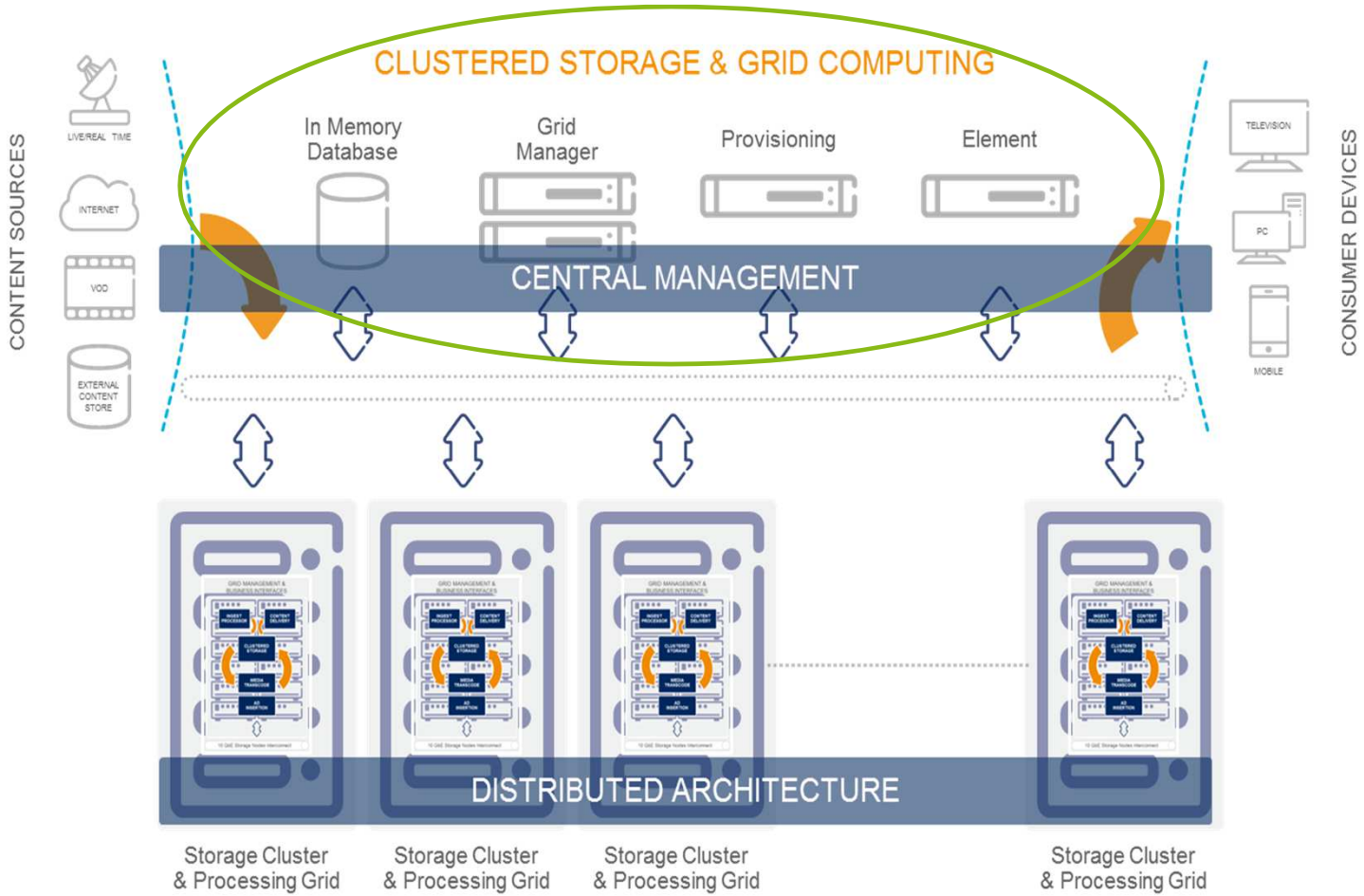
- No Single Point Of Failure
  - Disk or machine failure – no missing data
  - Fully resilient
  - Maintenance keeps cluster healthy and balanced.


COMPONENTS


Back Office 1GB
CTRL 1GB
DRM 1GB
Operation and Management 1GB
VSPP Manager 1
VSPP Manager 2
VSPP DataNode 1... 5
VSPP Diagnostic
CDN
DRM/KMS Servers
Envivio MUSE Encoder
HBEA 1GB
Data 10GB
INGR 10GB
EGRS 10GB
SYSU/PXE

CLUSTER MANAGER

- Expose Interface for cluster configuration
- Connected to Database for cluster meta data
- Keep HELLO handshake with all Cluster Servers
- Perform background maintenance operation on the cluster
  - Rebuild
  - Restripe
  - Balance
- Responsible for files creation/deletion and read/write permission
- Download File System configuration to the Storage Servers



VSPP- COMPONENTS

The VSPP Manager Server is an application server that controls and orchestrates the entire set of processes.

It dynamically controls and load balances the virtual video server clusters (**pods**) in a real-time environment in terms of storage capacity allocation, content processing capabilities, ingest and streaming throughput.

In addition to managing the pods, the VSPP Manager communicates with the operator Back Office (BO) infrastructure using multiple interfaces. (APIs)

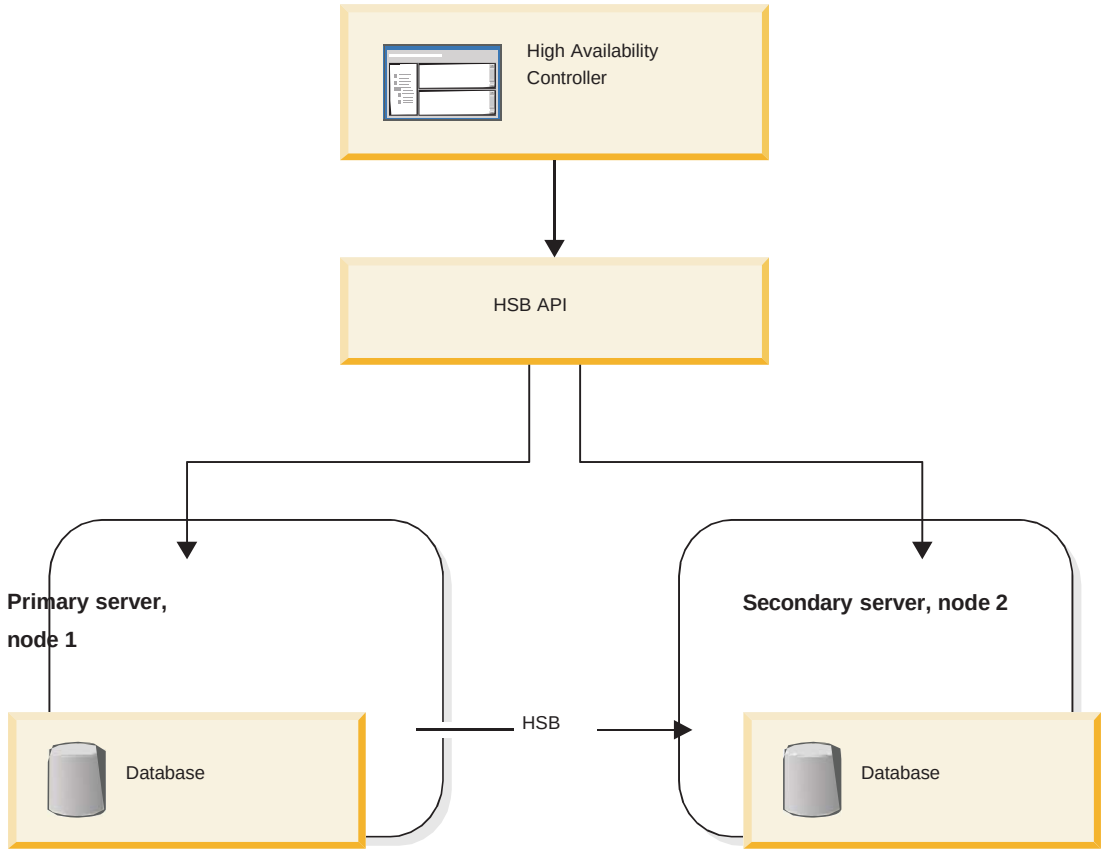
EXAMPLE HARDWARE

- 2 x HP ProLiant DL360/G9 servers
- 6 SFF SAS disks per node
  - 300GB per disk
  - No 10Ge dual port cards required

VSPP- COMPONENTS

SolidDB: An in-memory database system that delivers high speed performance and provides extremely fast access to critical configuration and service data of the Video software layer.

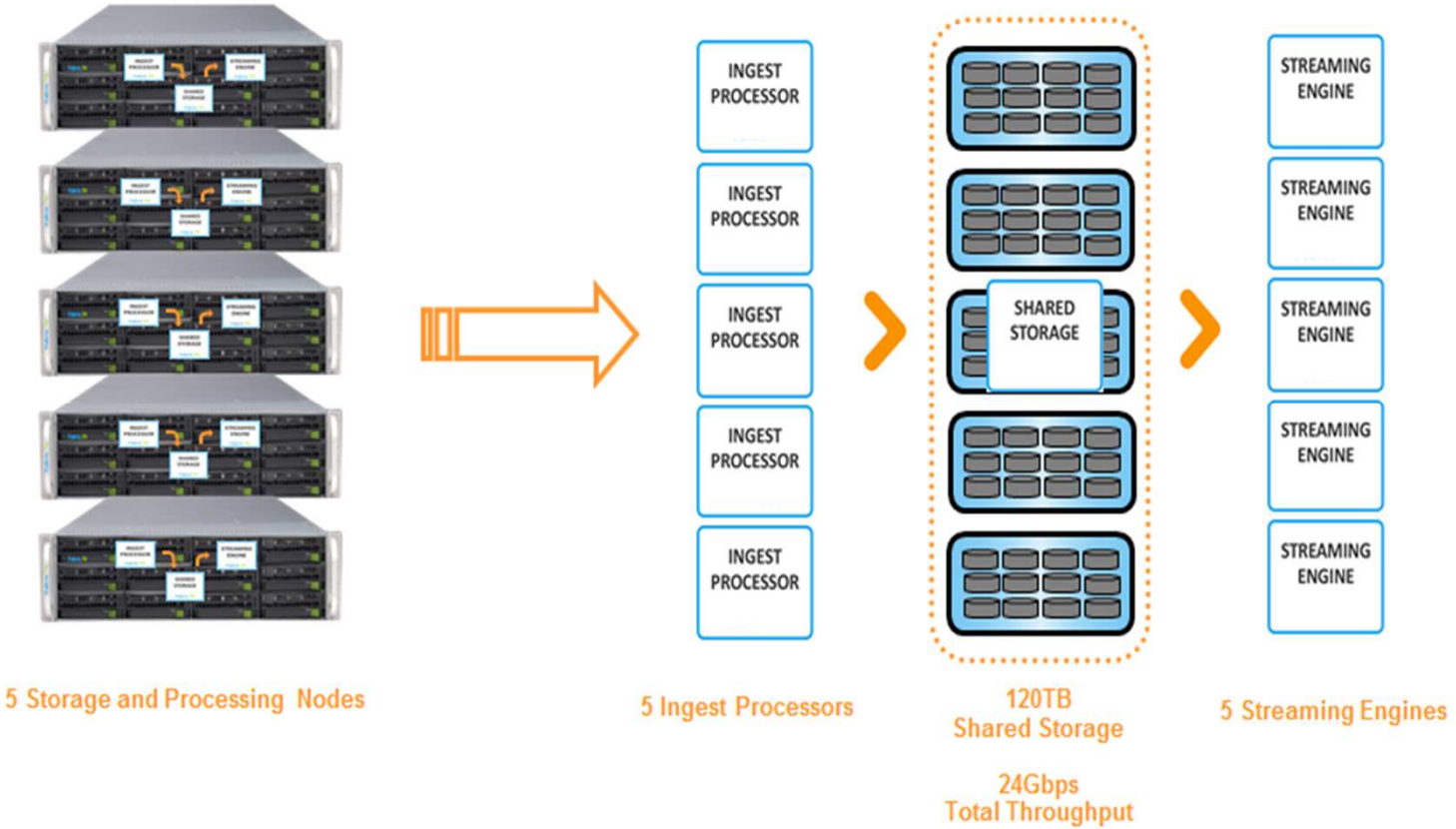
SolidDB: may scale to hundreds of thousands of transactions per second, thereby reducing latency in the overall cDVR system functionality.



Solid was acquired by IBM in 2007. It was subsequently sold to UNICOM Global in 2014.

STORAGE CLUSTER

- Storage Server is an Intel-based server, each server can support any number of disks
- Handle configuration commands from Cluster Manager
- Manipulates data upon requests from Storage Clients
- Advanced data caching for better performance
- Collects statistics



VSPP- COMPONENTS

Nodes

Nodes are hardware and software components that are responsible for both storing and streaming the videos.

Each Pod is comprised of one or more Nodes. Each Node has disks and processing power. Collectively, the Nodes of a Pod provide its functionality.

The streaming software on each Node delivers the content from the **storage volumes** of the Node to the end-user devices.

Nodes are also responsible for recording broadcast channels and for ingesting VOD Assets.

EXAMPLE POD NODES

- HP ProLiant DL380/G9 servers
- 14 LFF SATA disks per node
  - 4TB per disk
  - 12 in the front 2 in rear
  - 10Ge dual port cards

VSPP- COMPONENTS

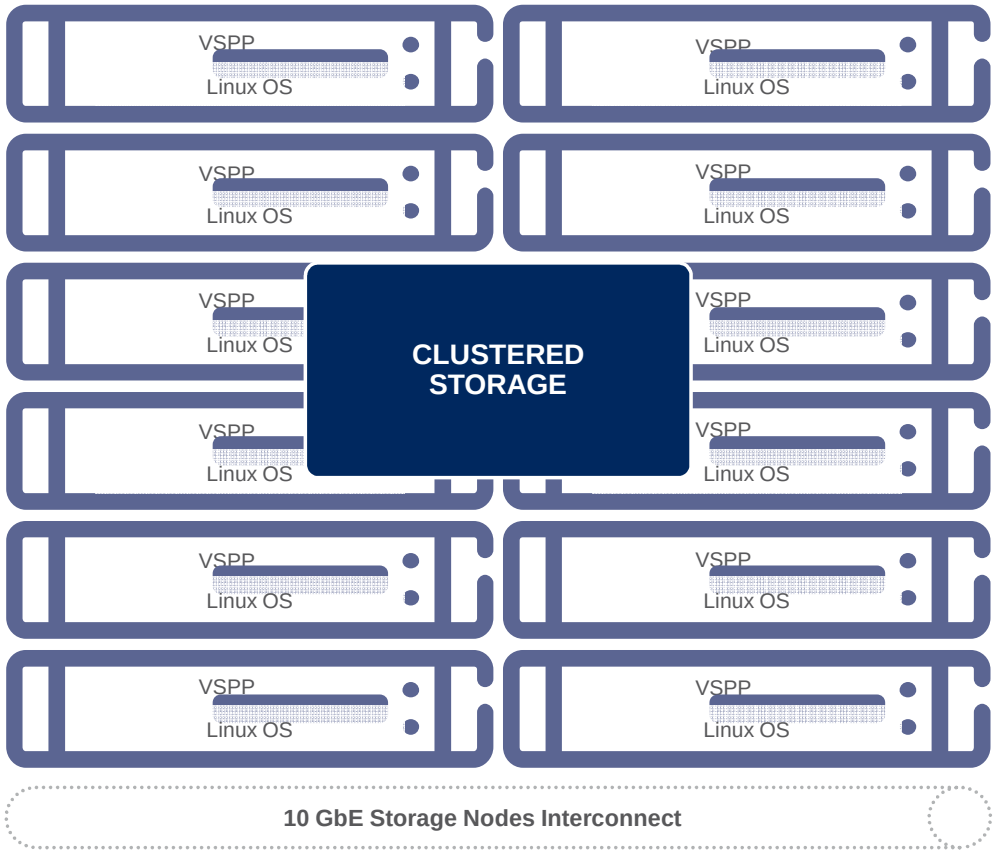
Pods

Pods are the basic logical building blocks of the system.

Each Pod is comprised of one or more Nodes, with each Node containing one or more disk drives.

The disk (storage) resources of all the combined Nodes are shared within a Pod as required.

Each Pod runs a video ingest streaming process and can handle numerous sessions (video streams) simultaneously.



VSPP STORAGE AND COMPUTE GRID

Generally, a single pod scale is limited by the interconnection network bandwidth.

A full mesh high throughput interconnection is required between all the nodes in a pod: in order to transfer the dispersed chunks of the data on the fly during ingest or streaming.

SYSTEM ARCHITECTURE

The VSPP systems cluster could be divided into two node types -

- **Stateful node** - A node where the operating system is installed on the local hard drive, at Ericsson those nodes are referred as **management nodes**.
- **Stateless node** - A node where the operating system is packed into an image (archived cpio in bz2/gz format) which is downloaded at boot time and extracted to an area of the memory which is used as file system, at Ericsson those nodes are referred as **data nodes**

SYSTEM ARCHITECTURE

Ericsson Applications are divided into 2 types.

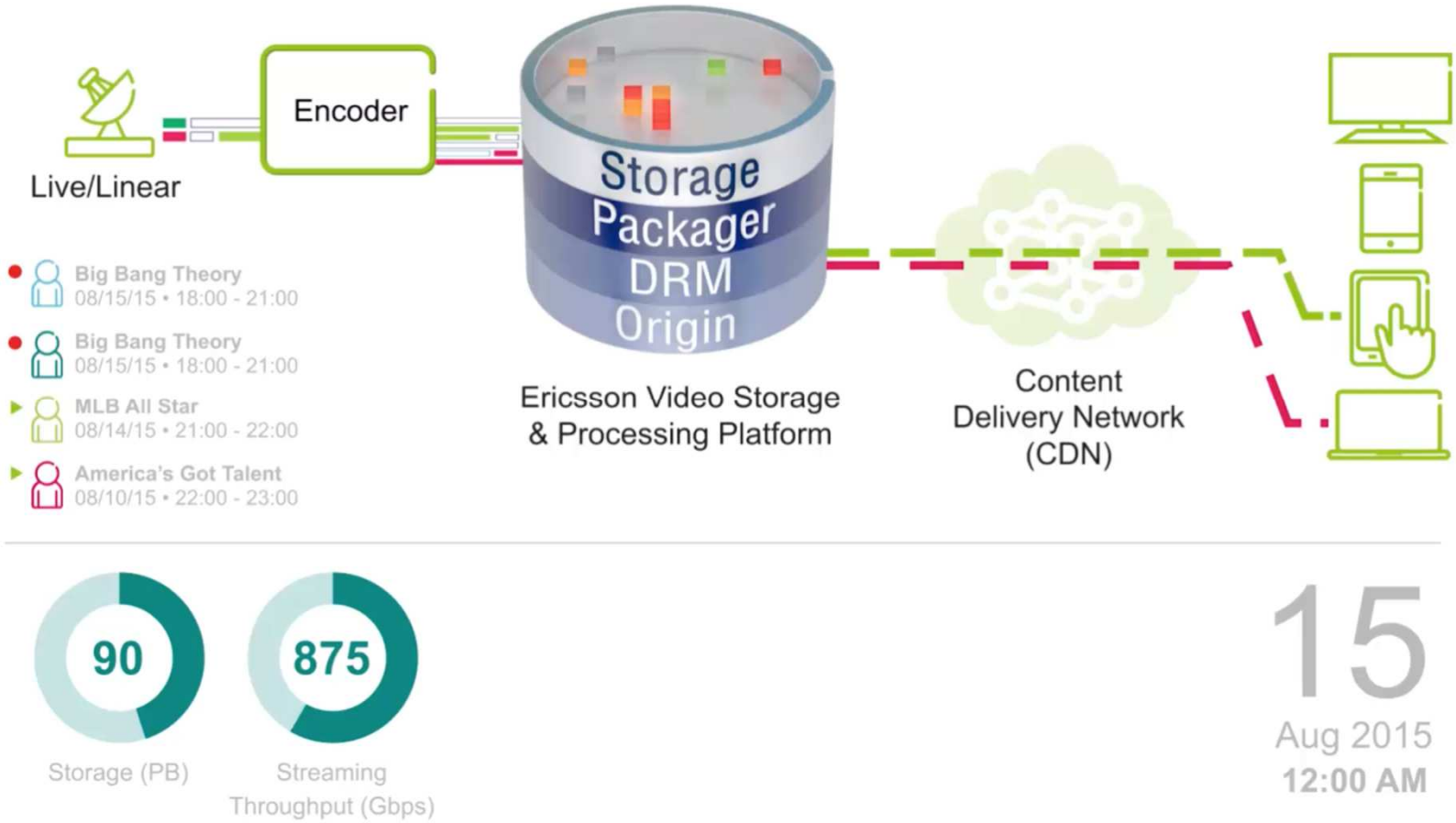
- **Management applications** – Manager, Scheduler, syspu, Gui, Database, and RTSP Plugin. Those applications are installed on management node due the need of operating system with persist data saved.

- **Non-management applications** – Streamer, Storage, FTP/NAS, and Transcoder. Those applications are installed on stateless nodes and does not require operation system persist data and all the configurations are pulled from the manager application using HTTP.

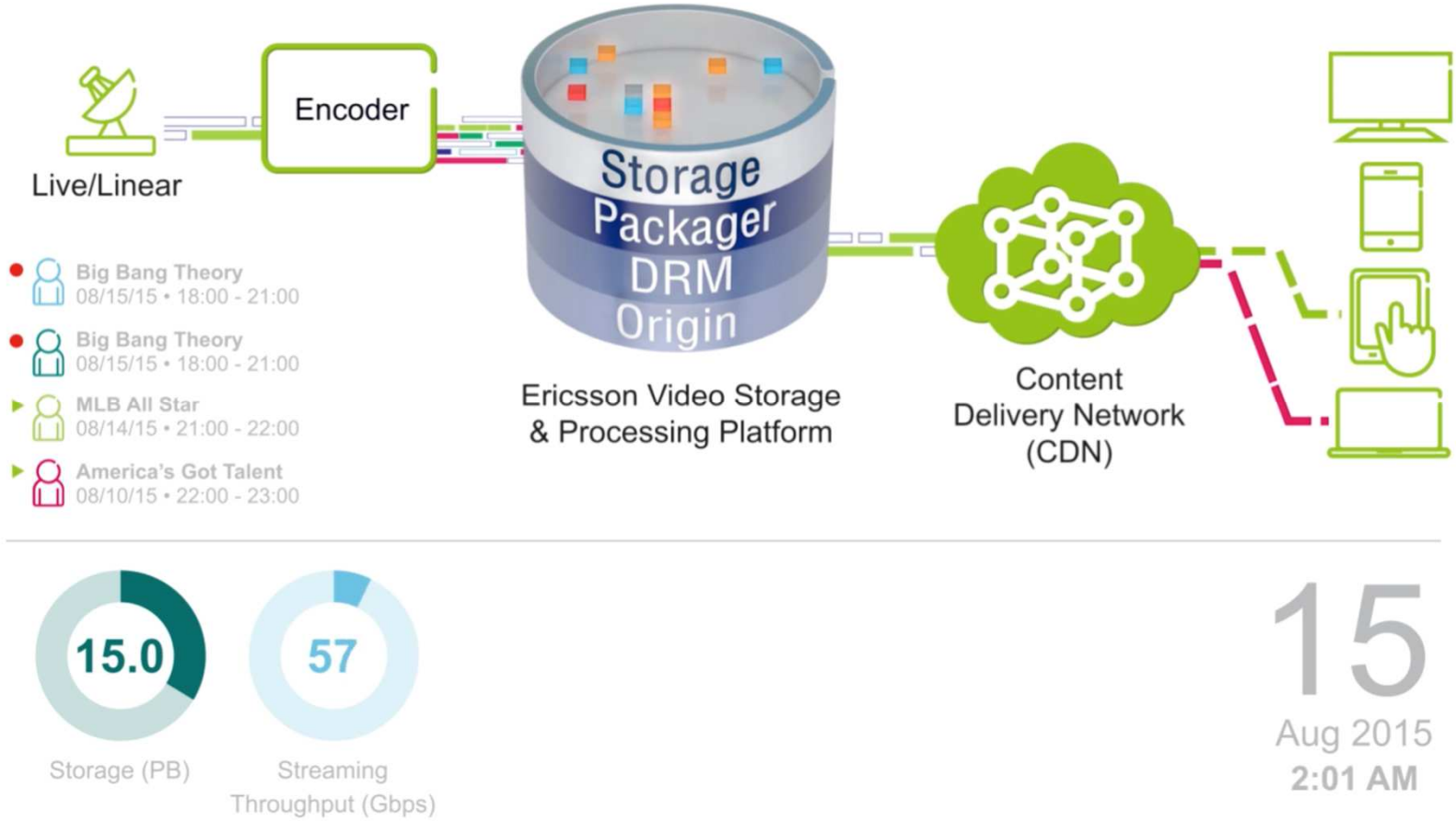
This layout allows to save all the video data on the stateless nodes disks disabling the need to some special storage hardware.

USE CASES

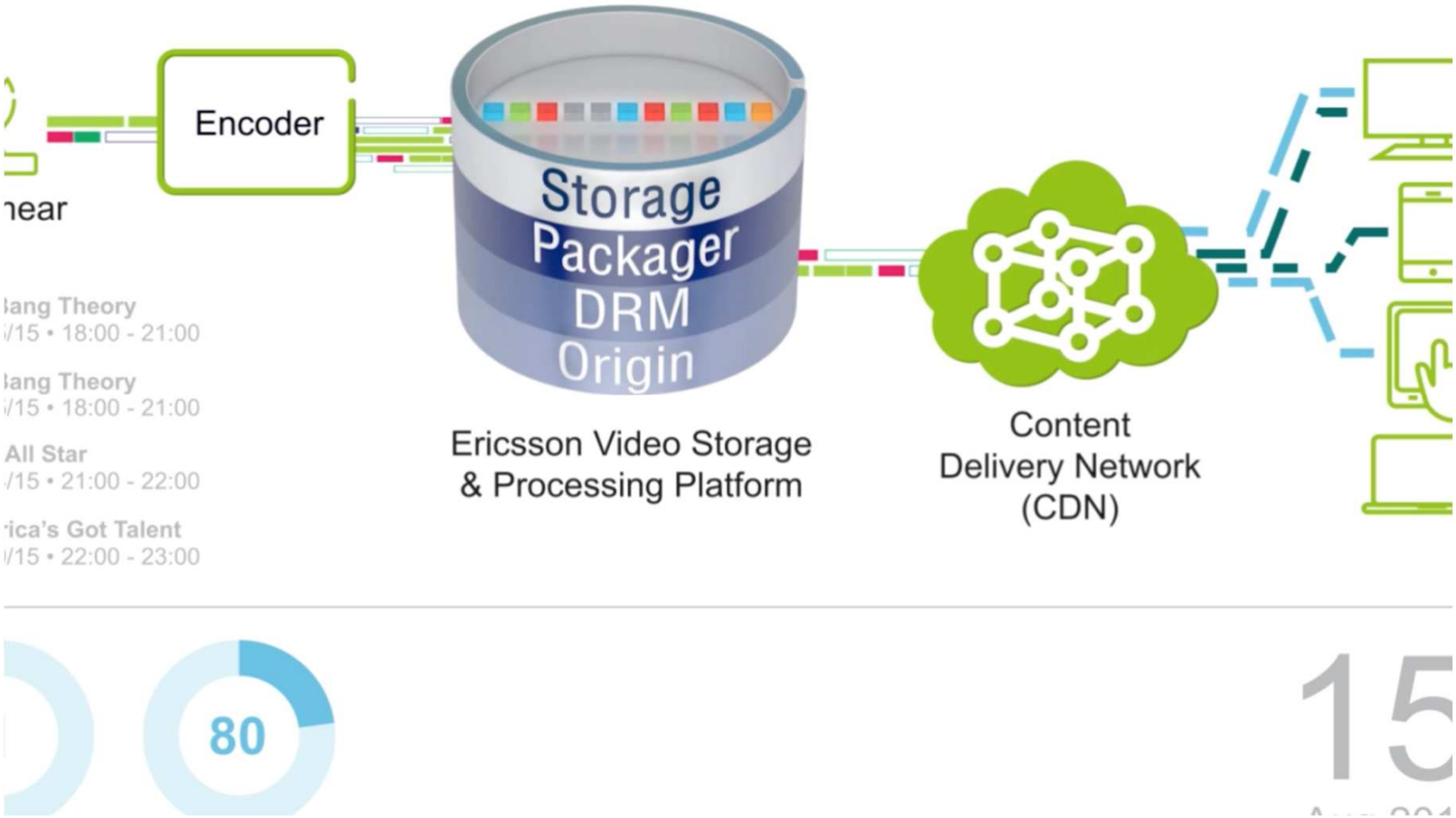
PRIVATE COPY CLOUD DVR



SHARED COPY CLOUD DVR

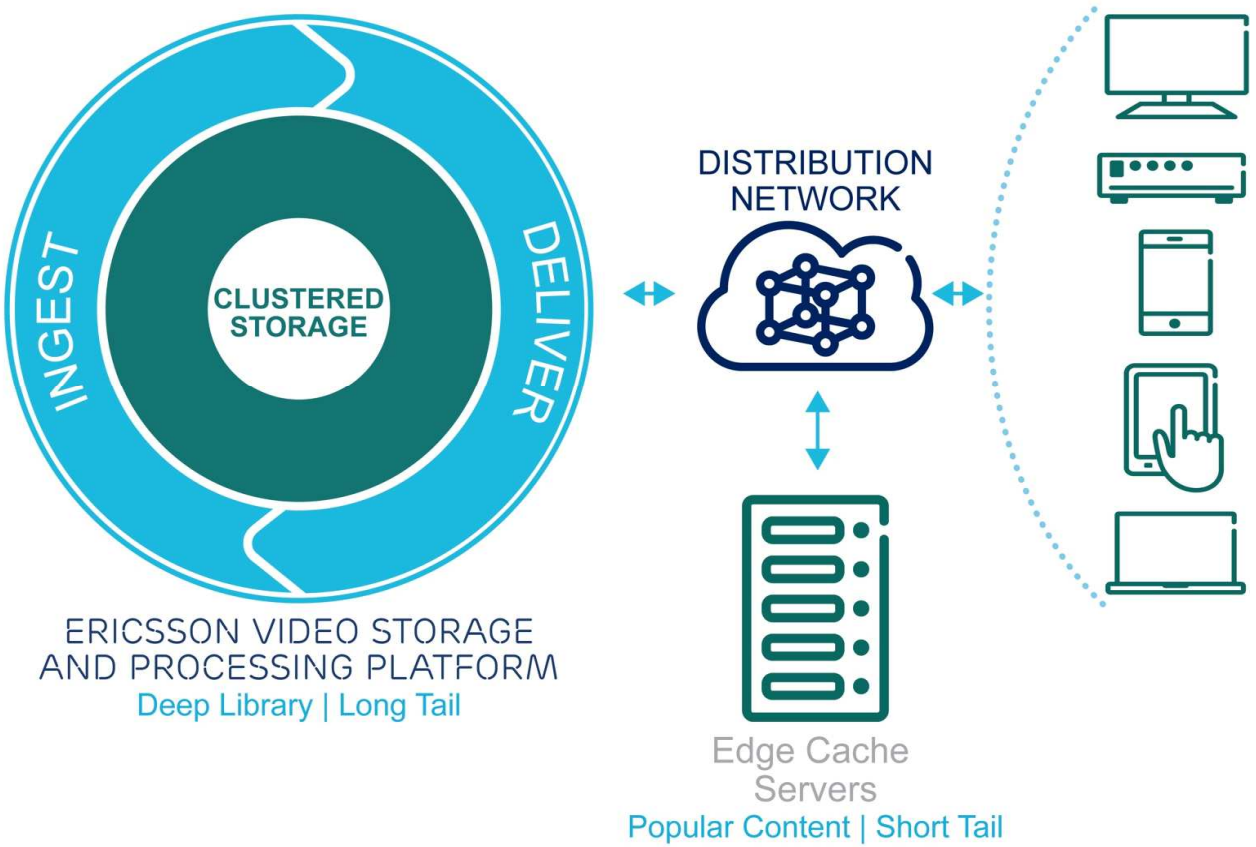


TIME SHIFTED TV



LONG TAIL VIDEO SERVER

Optimize your network




THE INGEST PROCESS

Ingest

- The first stage of video streaming is fetching the data and saving it in our clustered storage. We call this stage ingest.
- The input streams are either MPEG-TS video stream or converted into MPEG-TS video stream before saved.
- For allowing random access and other special functionality, the streamer parse and save an index during the ingest.
- The resulting files at the end of the ingest are the video stream file with the mpg extension and the two index files with the fx/mfx extensions.

VSPP INGEST PROCESS

Video Analyzing for Index File Generation

During the ingest of the content, whether a VoD file on an FTP server or a live program recorded from the encoder using IP multicast, the manager creates index files. These files describe the structure of the ingested asset.

The index files later enable the cDVR to perform time optimized random access to any point in the recorded asset, according to the subscriber device request, and also to create trick play modes during the streaming of the asset.

The trick play modes are generated on-the-fly without using pre-generated “trick files”, thus can create any requested scale without adding storage overhead.

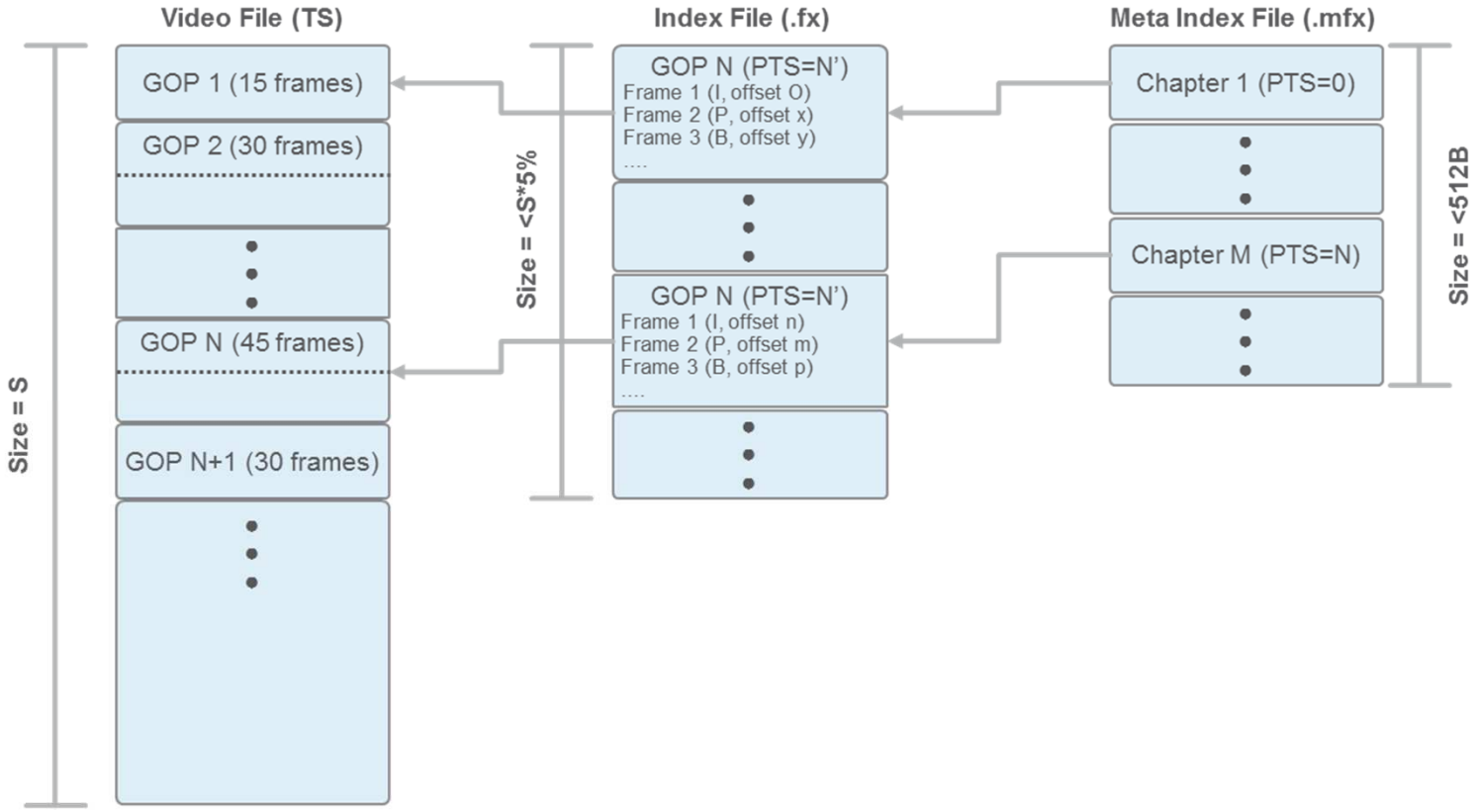
INGEST

- VOD sources – FTP/HTTP/FS MP4 and MPEG-TS
- Live Sources - SPTS MPEG-TS Multicast (IGMP V2/V3)
- Video - MPEG-2/H.264/HEVC Video
- Audio - MPEG audio/AAC-LC/AAC-HE/AC3
- Subtitles/CC

FEATURES: RECORDING, PROCESSES WHILE INGEST

NAME	INGEST PROCESSES
Description:	VSPP performs several processes while ingesting a video
Main Purpose	To prepare the video, check quality and improve for later use (stream). 1. Indexing: Video analyzing and creation of index file per each ingested SPTS. 2. Error detection: Performing Video and MPEG Transport Stream level integrity check and errors detection. 3. Prepare for ad-insertion: Detection of SCTE-35 markers for seamless Ad-insertion and splicing purposes. 4. Null packets removal from the TS for storage capacity efficiency. 5. Original PIDs remapping to the common values. 6. Segmenting and dispersion of the content across the entire cluster

FEATURES: RECORDING, PROCESSES WHILE INGEST



VSPP STORAGE AND COMPUTE GRID

As a final point in the ingest process the content is optionally segmented to small chunks (~1MB) and dispersed across the entire cluster to provide better storage capacity efficient and ensure the highest reliability level and most advanced content redundancy scheme.

Fabrix Mega

1,155,072 BYTES **188**

(MPEG2 TS packet size)


STREAMING

WHAT IS ABR?

OTT

- OTT services for companion devices are served only from the **Origin** servers.
- Manifests and segments of the ABR protocols are tunnelling through the CDN and built in a way that can be cached on CDN nodes and reduce throughput from the Origin.

- OTT protocols in use are:
  - HLS (Apple HTTP Live Streaming)
  - HSS (Microsoft Smooth Streaming)
  - DASH Dynamic Adaptive Streaming over HTTP

OTT PACKAGING

Packaging Protocols:

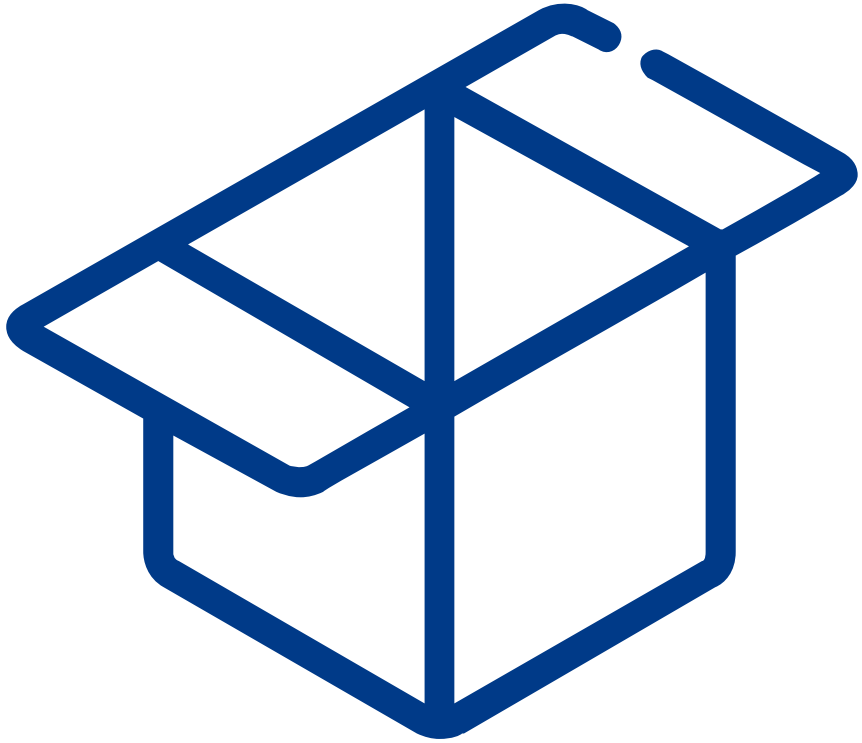
- HLS
- Microsoft Smooth Streaming
- MPEG-DASH *(ISOBMF)*

Video:

- H264
- H265 with MPEG-DASH

Audio:

- AAC

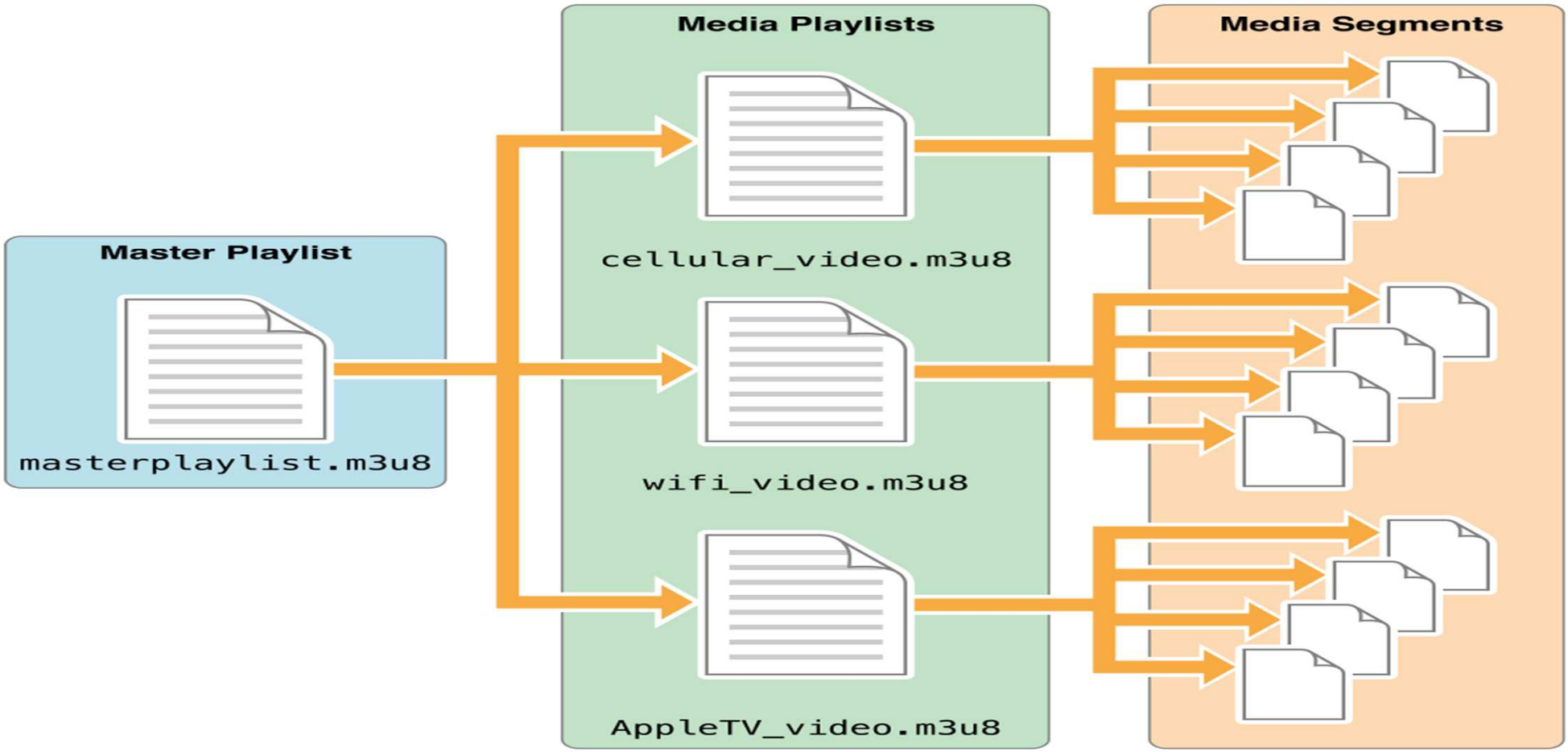


HLS

- HLSv3
  - single audio embedded in the segment
- HLSv4
  - optimal alternate audio (as AAC es, or MPEG2-TS)
- HLSv5
  - Iframe manifests support
  - WebVTT Subtitles

- AES-128-CBC encryption
- HLS Sample Encryption *(HLSv5+)*

HLS MANIFESTS



HLS VARIANT MANIFEST (TOP LEVEL)

```
#EXTM3U
#EXT-X-VERSION:5
#EXT-X-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=713008,RESOLUTION=320x240
IGAAAAAABAENBCDF.m3u8/Level(1)
#EXT-X-I-FRAME-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=110102,URI="IGAAAAAABAENBCDF.m3u8/Iframe(1)"
#EXT-X-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=963005,RESOLUTION=448x336
IGAAAAAABAENBCDF.m3u8/Level(2)
#EXT-X-I-FRAME-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=141101,URI="IGAAAAAABAENBCDF.m3u8/Iframe(2)"
#EXT-X-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=2295015,RESOLUTION=640x480
IGAAAAAABAENBCDF.m3u8/Level(3)
#EXT-X-I-FRAME-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=239571,URI="IGAAAAAABAENBCDF.m3u8/Iframe(3)"
#EXT-X-STREAM-INF:PROGRAM-ID=1,BANDWIDTH=96000
IGAAAAAABAENBCDF.m3u8/Level(4)
```

HLS LEVEL MANIFEST

```
#EXTM3U
#EXT-X-VERSION:3
#EXT-X-TARGETDURATION:5
#EXT-X-PROGRAM-DATE-TIME:2013-12-07T21:17:00
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-KEY:METHOD=AES-128,URI="http://83.174.61.245:80/encrypted_hls_static_key"
#EXTINF:4,
Level(1)/Segment(0).ts
#EXTINF:4,
Level(1)/Segment(1).ts
#EXTINF:4,
Level(1)/Segment(2).ts
#EXTINF:4,
Level(1)/Segment(3).ts
#EXTINF:4,
Level(1)/Segment(4).ts
#EXTINF:4,
Level(1)/Segment(5).ts
#EXT-X-ENDLIST
```

SMOOTH STREAMING

- ISOBMF fragmented mp4
- AAC audio (multiple streams)
- Supporting multiple audio streams
- Supporting TTML subtitles

- PlayReady
- AES-128-CTR sample based encryption

MSS (SMOOTH) MANIFEST

```
<!--
  Created with Fabrix Systems VIDFX Streamer version 3.4.0.0
-->
<SmoothStreamingMedia MajorVersion="2" MinorVersion="1" Duration="0" DVRWindowLength="600000000" LookAheadFragmentCount="2"
 IsLive="TRUE" CanSeek="TRUE" CanPause="TRUE">
  <StreamIndex Type="video" Name="video" Chunks="0" QualityLevels="5" MaxWidth="1280" MaxHeight="720" DisplayWidth="1280"
   DisplayHeight="720" Url="QualityLevels({bitrate})/Fragments(video={start time})">
    <QualityLevel Index="0" Bitrate="346030" FourCC="H264" MaxWidth="320" MaxHeight="240"
    CodecPrivateData="00000001674D400D96528283F7FE000800060500000000168EF3880"/>
    <QualityLevel Index="1" Bitrate="629145" FourCC="H264" MaxWidth="480" MaxHeight="360"
    CodecPrivateData="00000001674D4015965283C17FCBFF80020001E0A0000000000168EF3880"/>
    <QualityLevel Index="2" Bitrate="1468006" FourCC="H264" MaxWidth="640" MaxHeight="480"
    CodecPrivateData="00000001674D401E965281407B7FE000800060500000000000168EF3880"/>
    <QualityLevel Index="3" Bitrate="2097152" FourCC="H264" MaxWidth="640" MaxHeight="480"
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    CodecPrivateData="00000001674D4020965280A00B760205000000000168EF3880"/>
    <c t="1000000000" d="40000000"/>
    <c d="40000000"/>
    <c d="40000000"/>
  </StreamIndex>
  <StreamIndex Type="audio" Index="1" Language="eng" Name="audio_483_eng" Chunks="0" QualityLevels="1"
   Url="QualityLevels({bitrate})/Fragments(audio_483_eng={start time})">
    <QualityLevel FourCC="AACL" Bitrate="48000" SamplingRate="16000" Channels="1" BitsPerSample="16" PacketSize="2" AudioTag="255"
    CodecPrivateData="340E"/>
    <c t="1000000000" d="40000000"/>
    <c d="40000000"/>
    <c d="40000000"/>
  </StreamIndex>
  <StreamIndex Type="audio" Index="0" Language="eng" Name="audio_482_eng" Chunks="0" QualityLevels="1"
   Url="QualityLevels({bitrate})/Fragments(audio_482_eng={start time})">
    <QualityLevel FourCC="AACL" Bitrate="32000" SamplingRate="16000" Channels="2" BitsPerSample="16" PacketSize="4" AudioTag="255"
    CodecPrivateData="3416"/>
    <c t="1000000000" d="40000000"/>
    <c d="40000000"/>
    <c d="40000000"/>
  </StreamIndex>
</SmoothStreamingMedia>
```

MPEG-DASH

- ISOBMF fragmented mp4
- AAC audio (multiple streams)
- Supporting H265(hevc) packaging
- Subtitles:
  - TTML for textual subtitles
  - SMPTE-TT for image based subtitles (bitmaps)

- CENC encryption (AES-128-CTR sample based encryption)
- PlayReady and WideVine
- Supporting multi DRM packaged stream

MPEG-DASH MANIFEST

```
<!--
  Created with Fabrix Systems VIDFX Streamer version 3.5.1.0
-->
<MPD profiles="urn:mpeg:dash:profile:isoff-live:2011" type="dynamic" availabilityStartTime="2014-09-18T12:29:58Z" minimumUpdatePeriod="PT8.021S" suggestedPresentationDelay="PT12.032S" minBufferTime="PT4.010S">
  <Period id="1" start="PT0.000S">
    <AdaptationSet id="1" group="1" bitstreamSwitching="true" segmentAlignment="true" contentType="video" mimeType="video/mp4" maxWidth="320" maxHeight="240" par="4:3" maxFrameRate="989/33" startWithSAP="1">
      <SegmentTemplate timescale="10000000" media="QualityLevels($Bandwidth$)/Fragments(video=$Time$)" initialization="QualityLevels($Bandwidth$)/Fragments(video=Init)">
        <SegmentTimeline>
          <S d="40040000" t="160160000"/>
          <S d="40040000" r="11"/>
        </SegmentTimeline>
      </SegmentTemplate>
      <Representation id="video.1.L1" bandwidth="700000" codecs="avc1.4d401f" width="320" height="240" frameRate="989/33" sar="1:1"/>
    </AdaptationSet>
    <AdaptationSet id="2" group="2" bitstreamSwitching="true" segmentAlignment="true" contentType="audio" mimeType="audio/mp4" lang="eng">
      <SegmentTemplate timescale="10000000" media="QualityLevels($Bandwidth$)/Fragments(audio_482_eng=$Time$)" initialization="QualityLevels($Bandwidth$)/Fragments(audio_482_eng=Init)">
        <SegmentTimeline>
          <S d="40106667" t="160213333"/>
          <S d="40106666"/>
          <S d="39893334"/>
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        </SegmentTimeline>
      </SegmentTemplate>
      <Representation id="audio_482_eng.2.L1" bandwidth="96000" codecs="mp4a.40.2" audioSamplingRate="48000"/>
      <AudioChannelConfiguration schemeIdUri="urn:mpeg:dash:23003:3:audio_channel_configuration:2011" value="2"/>
    </AdaptationSet>
  </Period>
</MPD>
```
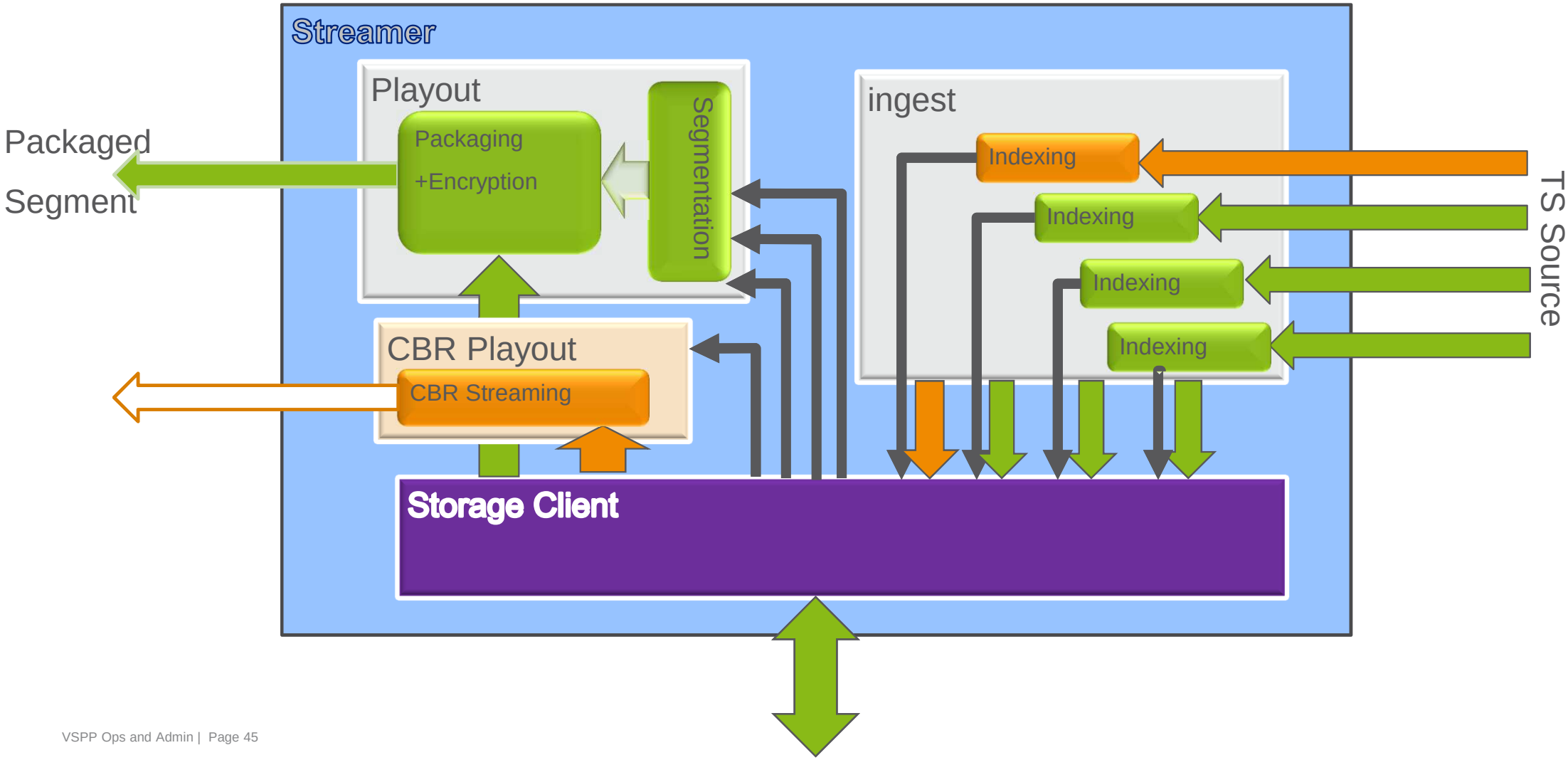
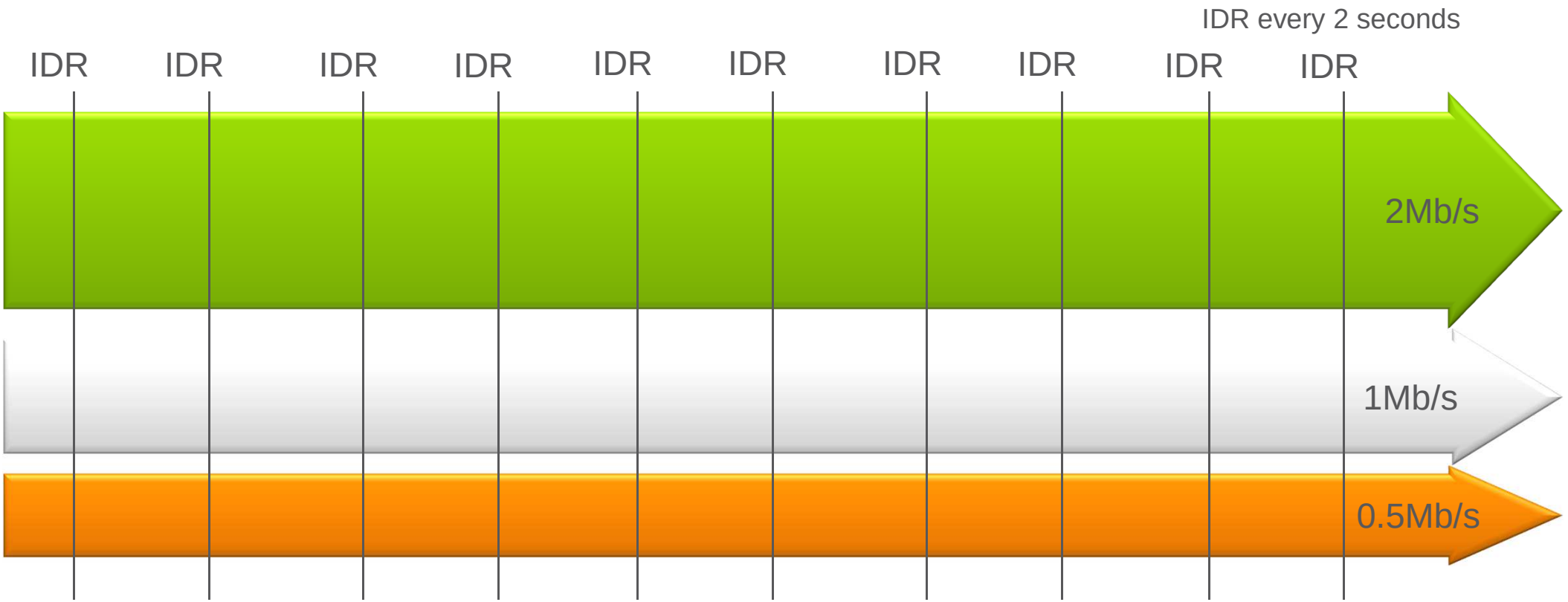
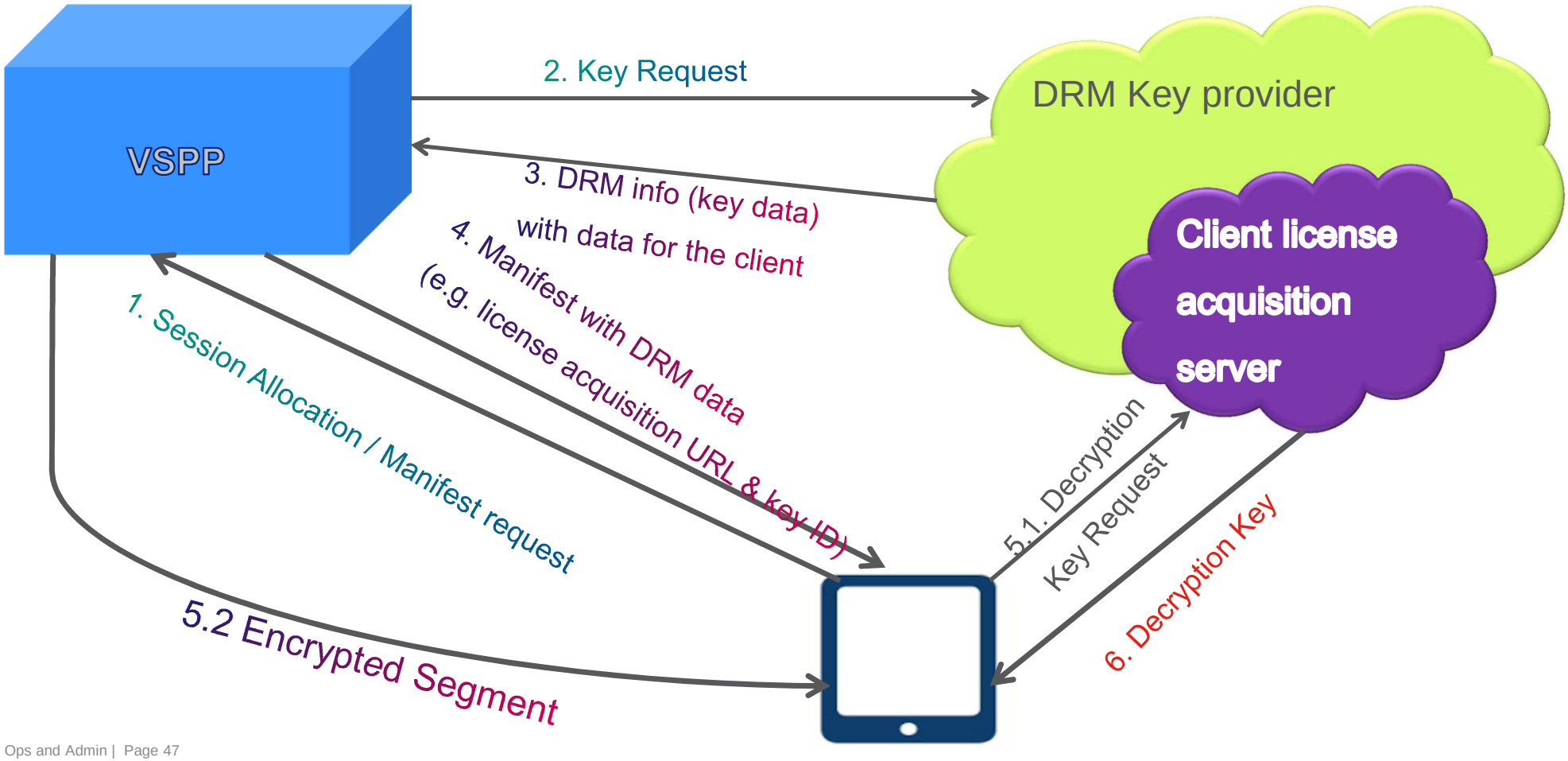

VSPP STREAMER



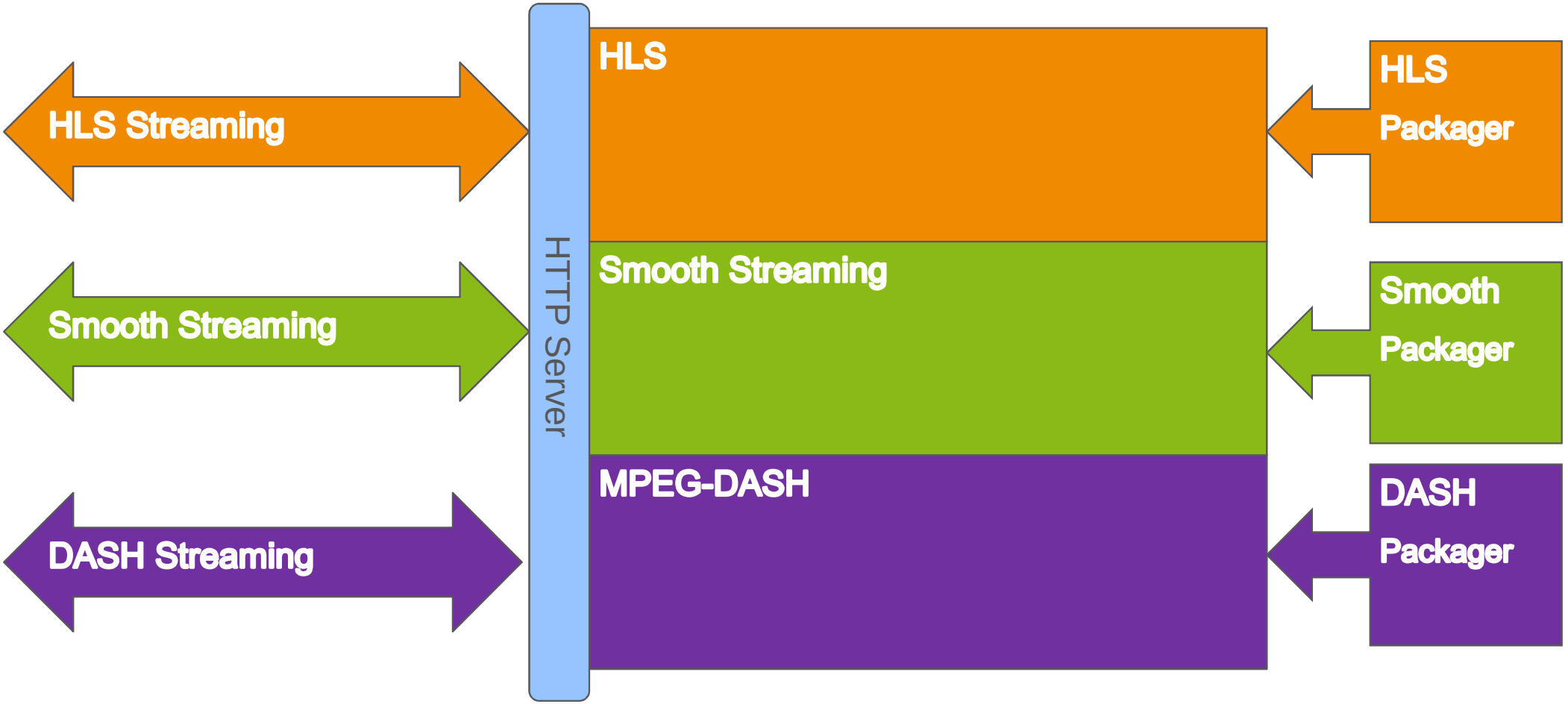
SEGMENTATION



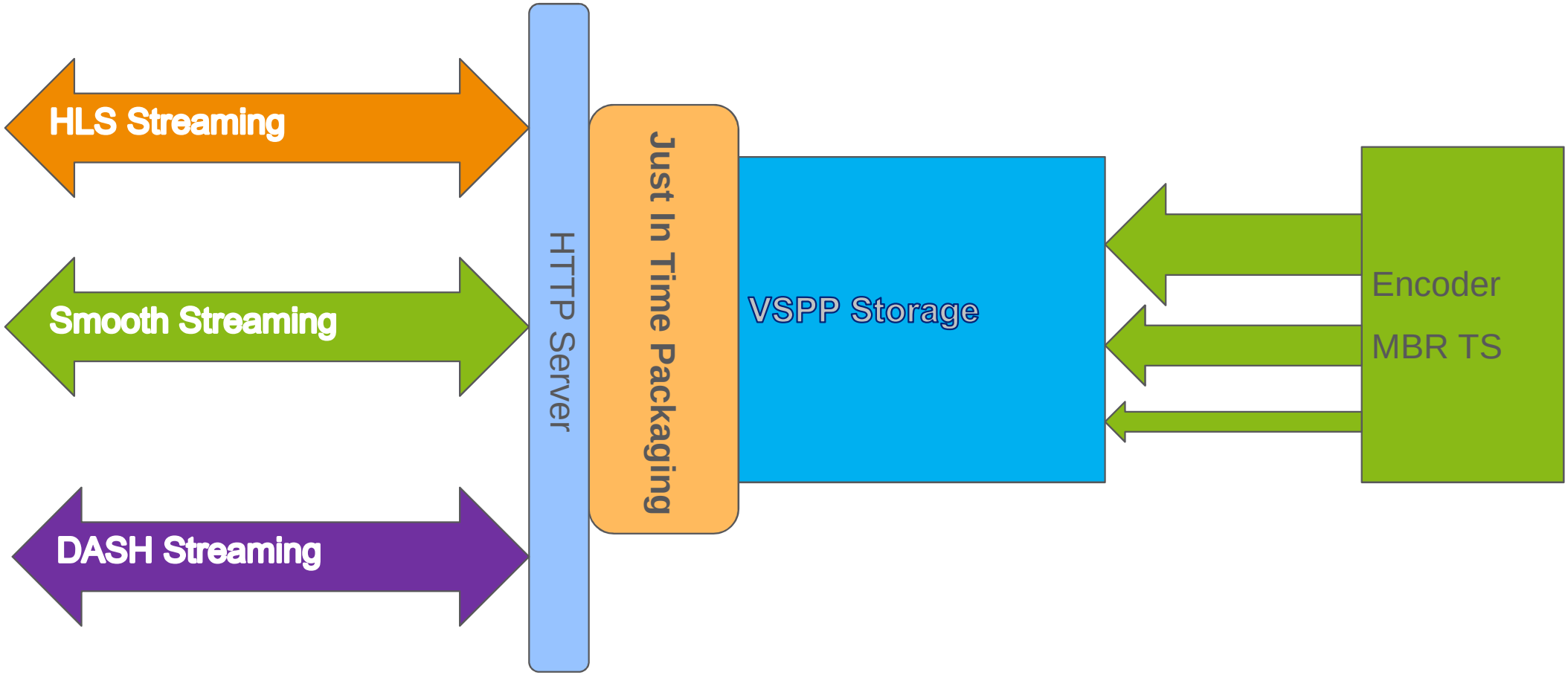
DRM - HOW IT IS DONE?



TRADITIONAL OTT SYSTEM



VSPP USING JITP



FEATURES: ON THE FLY MEDIA PROCESSING

The VSPP offers an out of the box integration with a number of leading DRM vendors:

- Verimatrix PlayReady for HSS/HLS
- Irdeto PlayReady for HSS/HLS
- BuyDRM
- Cisco (NDS)
- Nagra
- Latens

Ericsson uses the standard OpenSSL library to implement various encryption algorithms as defined by any ABR/DRM streaming specifications:

- HLS: AES-128 CBC encryption
- HSS: AES-128 CTR encryption

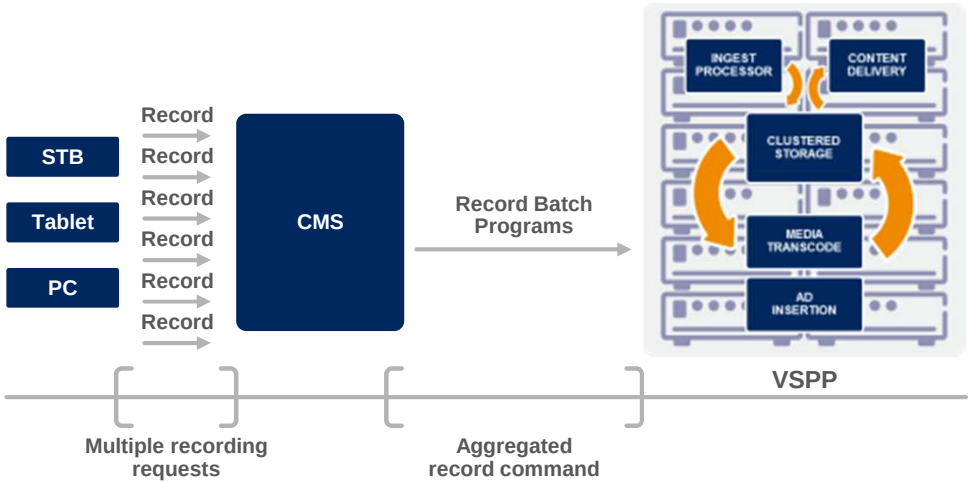

RECORDING
FEATURES OF VSPP

FEATURES: RECORDING

NAME	RECORDING
Description:	Basic functionality by which the Manager is requested to record a video. The manager allocate a node and sends a record request for a streamer process
Main Purpose	Enables recording based on Time based, recording splits into 2 types: user driven and operator driven User driven includes cDVR recording (time-based or EPG) Operator driven is rolling buffer

FEATURES: RECORDING, TIME BASED

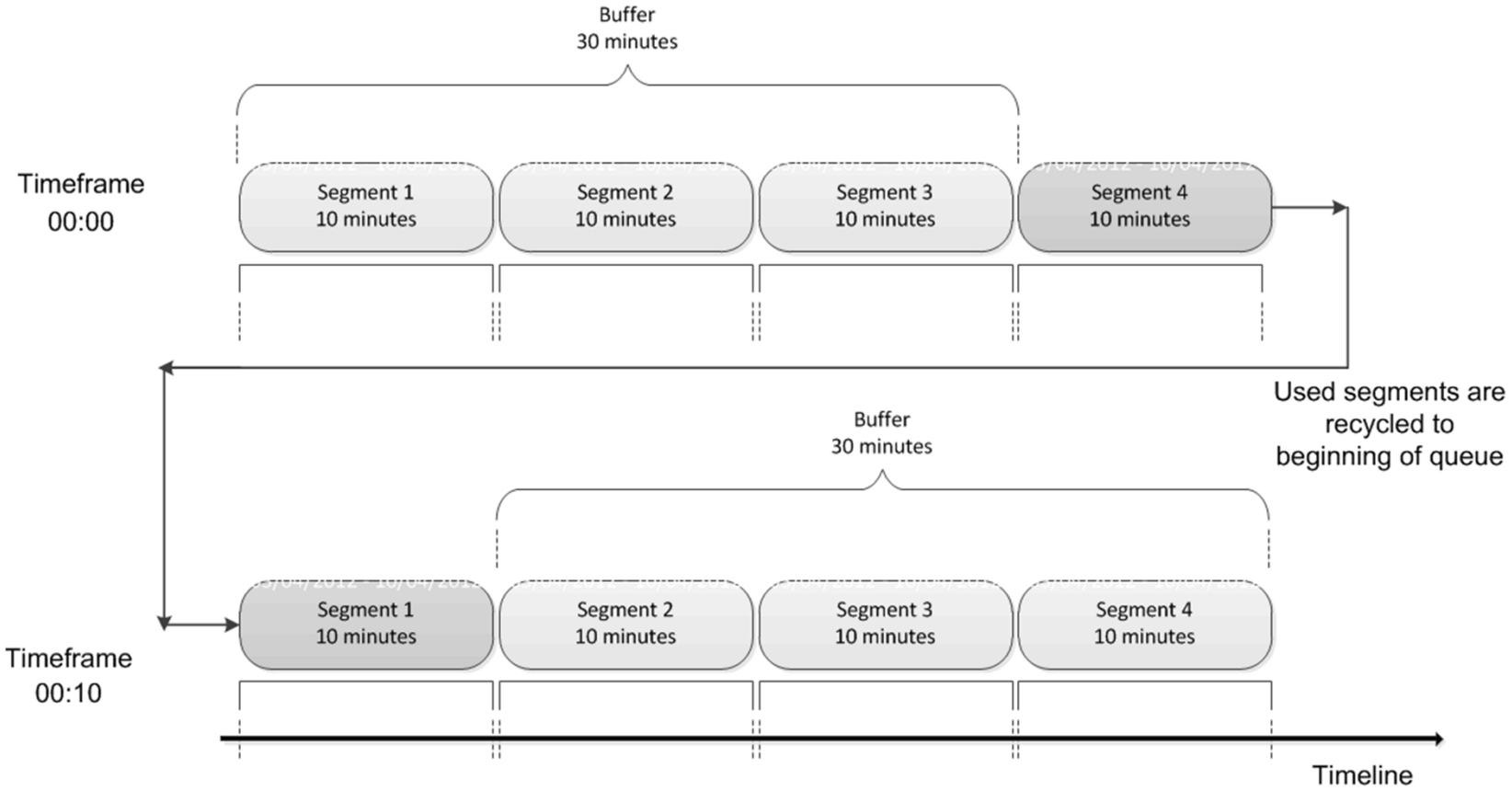
NAME	TIME BASED RECORDING
Description:	Basic functionality by which the Manager is requested to record a video based on time boundaries (channel, start time, end time)
Main Purpose	To record an asset based on time (channel, start time, end time), used by Manager (no EPG awareness).



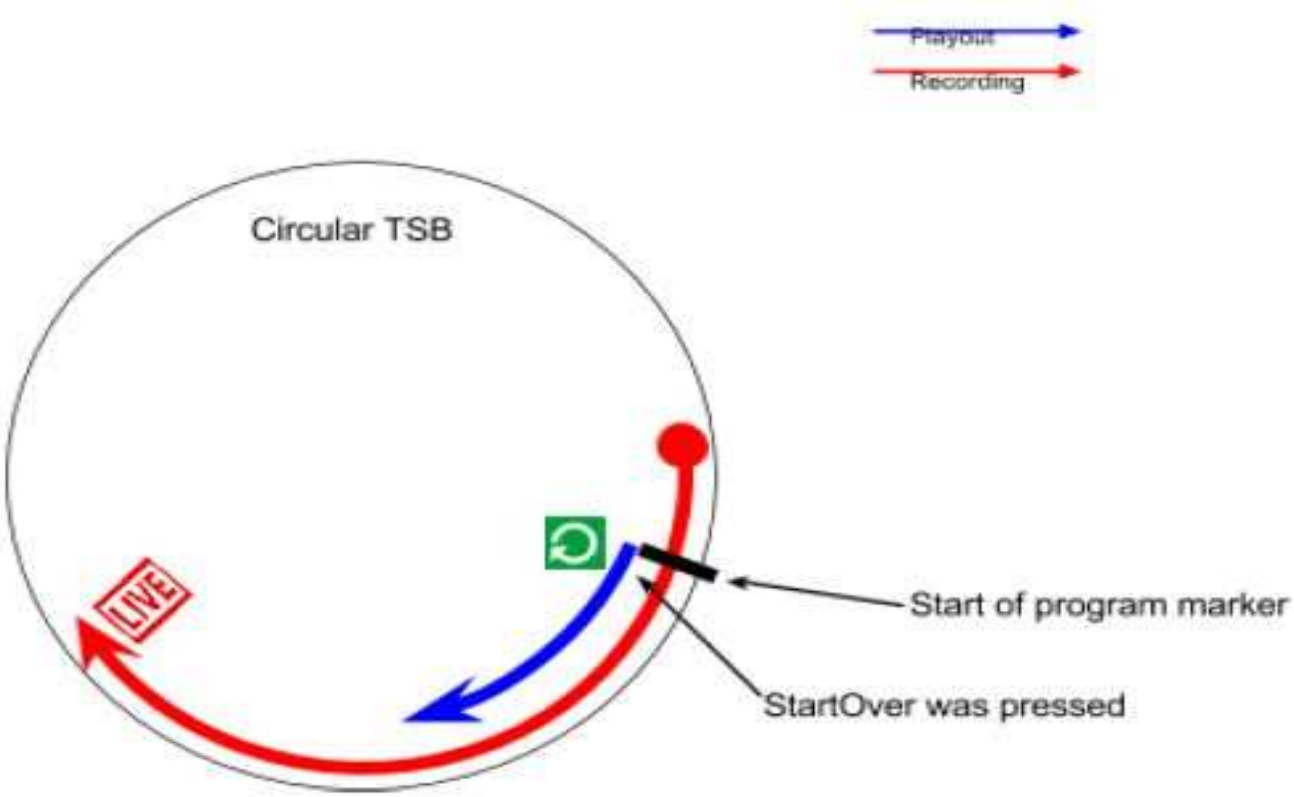
FEATURES: ROLLING BUFFER

NAME	TIME SHIFT BUFFER
Description:	Operator-driven automatic recording feature
Main Purpose	To allow for “Catch-Up TV”, “Start Over”, “Record In The Past”, and other features, all live broadcast channels in the line-up are automatically recorded by the cDVR, stored, and made available for all subscribers during a predefined time-based sliding window called Time Shift Buffer (TSB).

FEATURES: ROLLING BUFFER

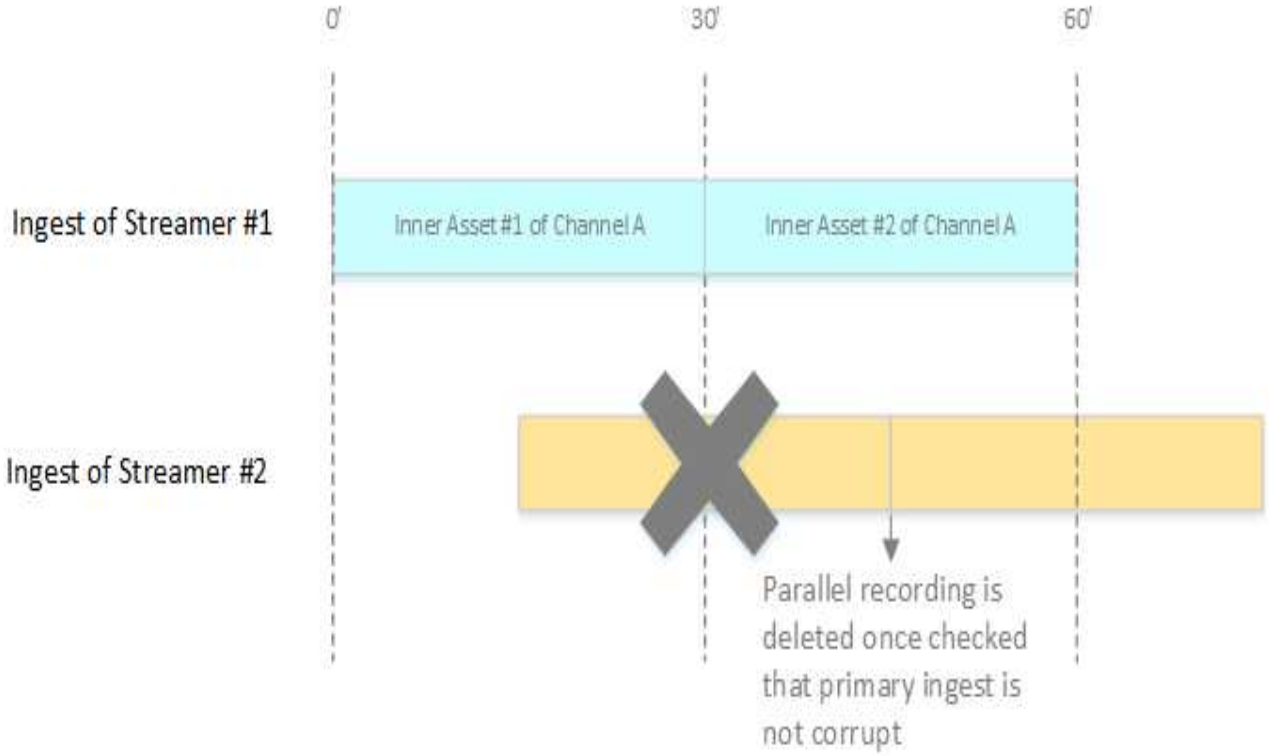


ROLLING BUFFERS



LIVE STREAM RESILIENCE

- If using the option to ingest the live stream to two streamers this will cause VSPP to compare the two recordings and to reject that which is lowest quality.
- If both recordings are of the same quality then one is selected to be removed.



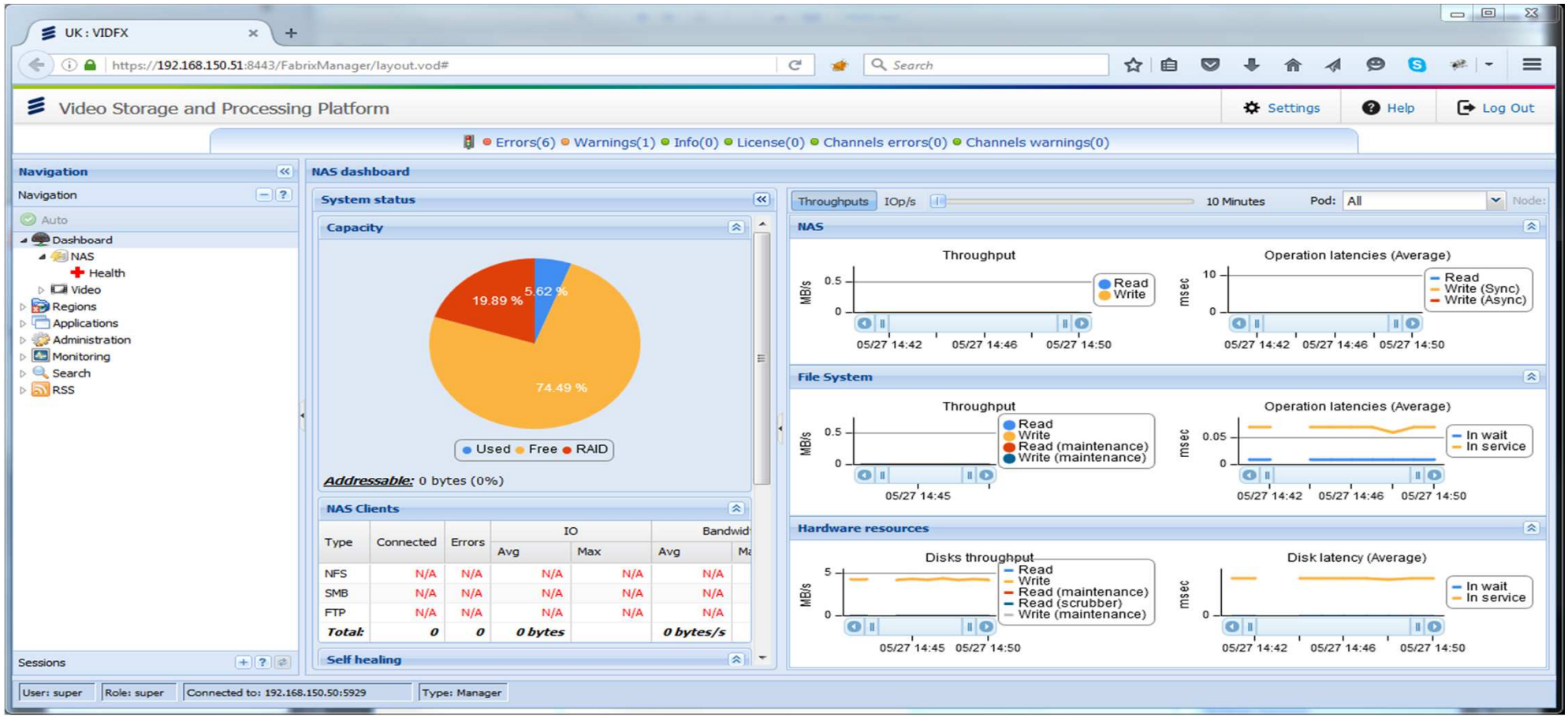

GUI

GUI OVERVIEW

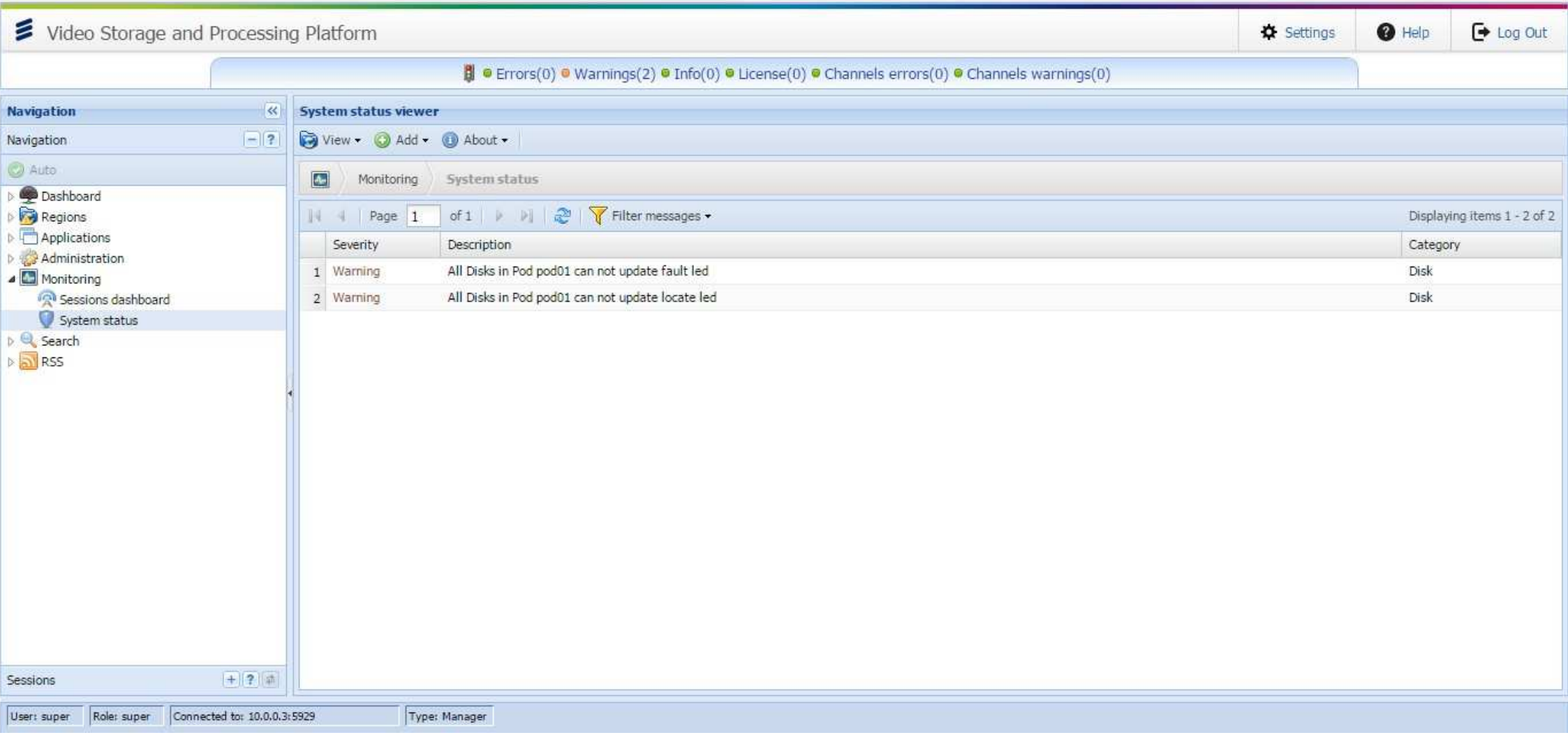
- Region, Pods, Streamers
    - Sessions view
    - Streamer Networks
    - Region and Streamers Properties. Configuration Editor
- Volume and Disks
- Storage jobs: rebuild, restripe, repair, balance, disk utilities
- Applications Tab
- Administration Tab
    - Channels Map: adding and viewing channels properties
    - Profiles
    - Security
- Monitoring Tab
    - Sessions Dashboard
- Search Tab

VSPP MANAGER GUI

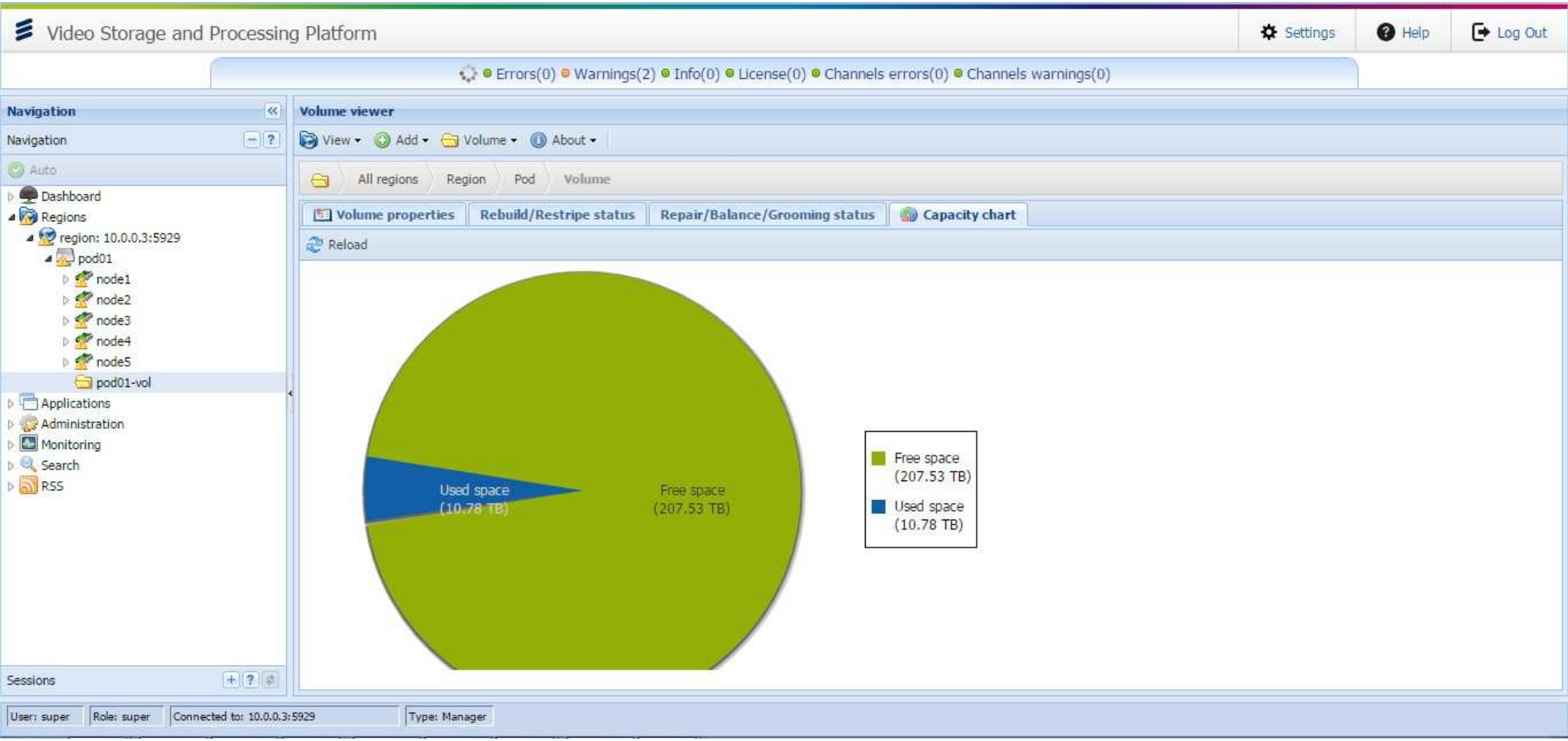
https://mgr-vip:8443



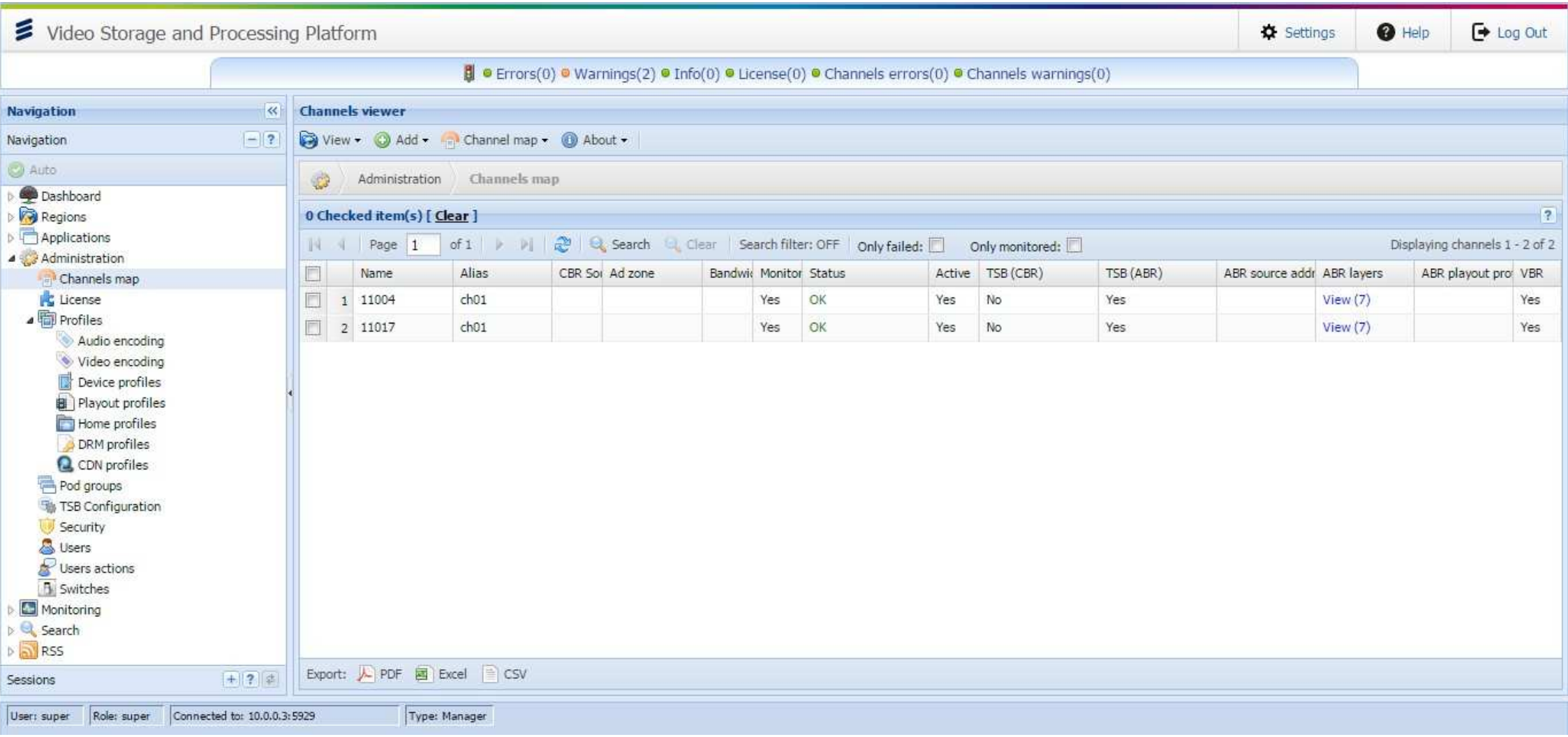
VSPP MANAGER GUI – SYSTEM STATUS



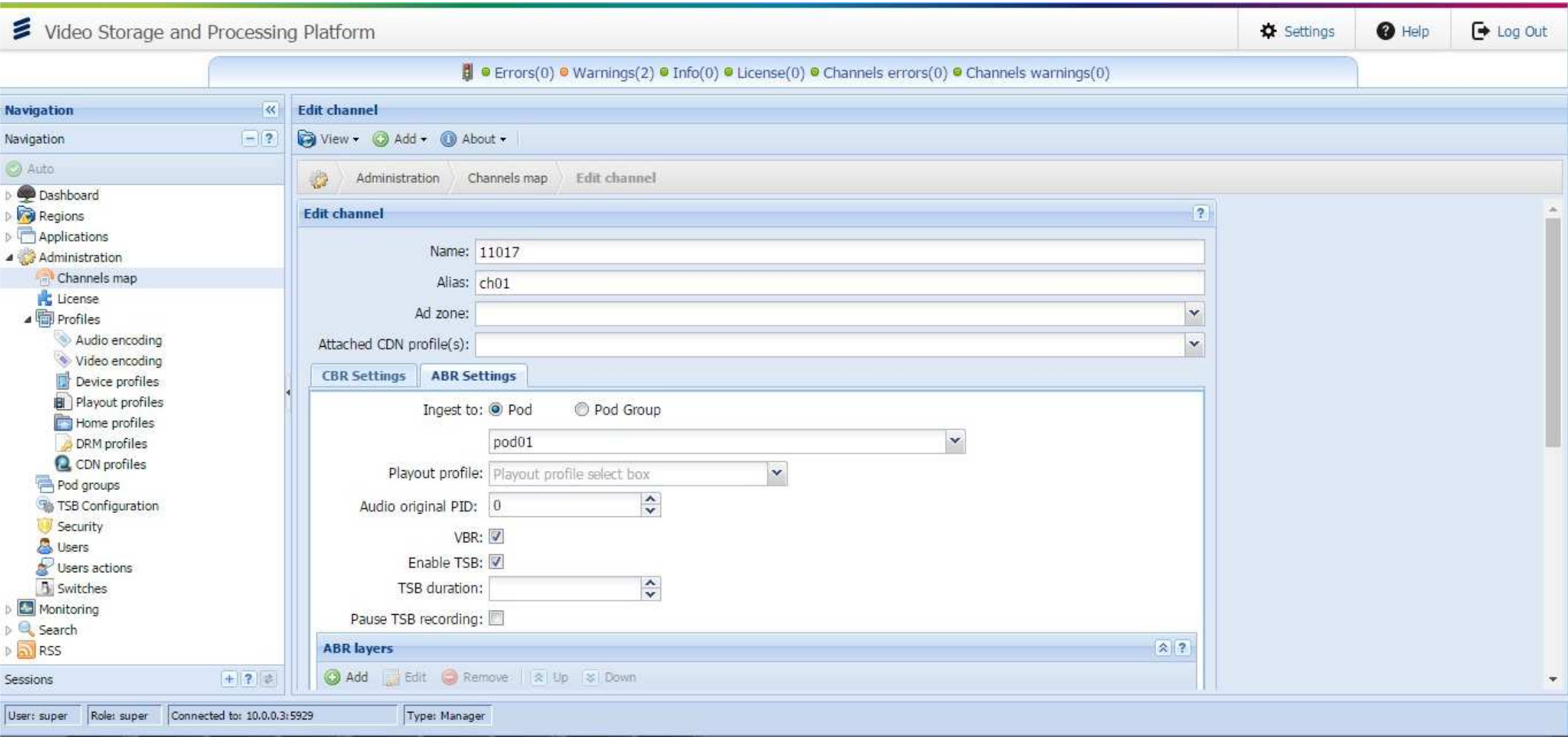
VSPP MANAGER GUI – SYSTEM VOLUME



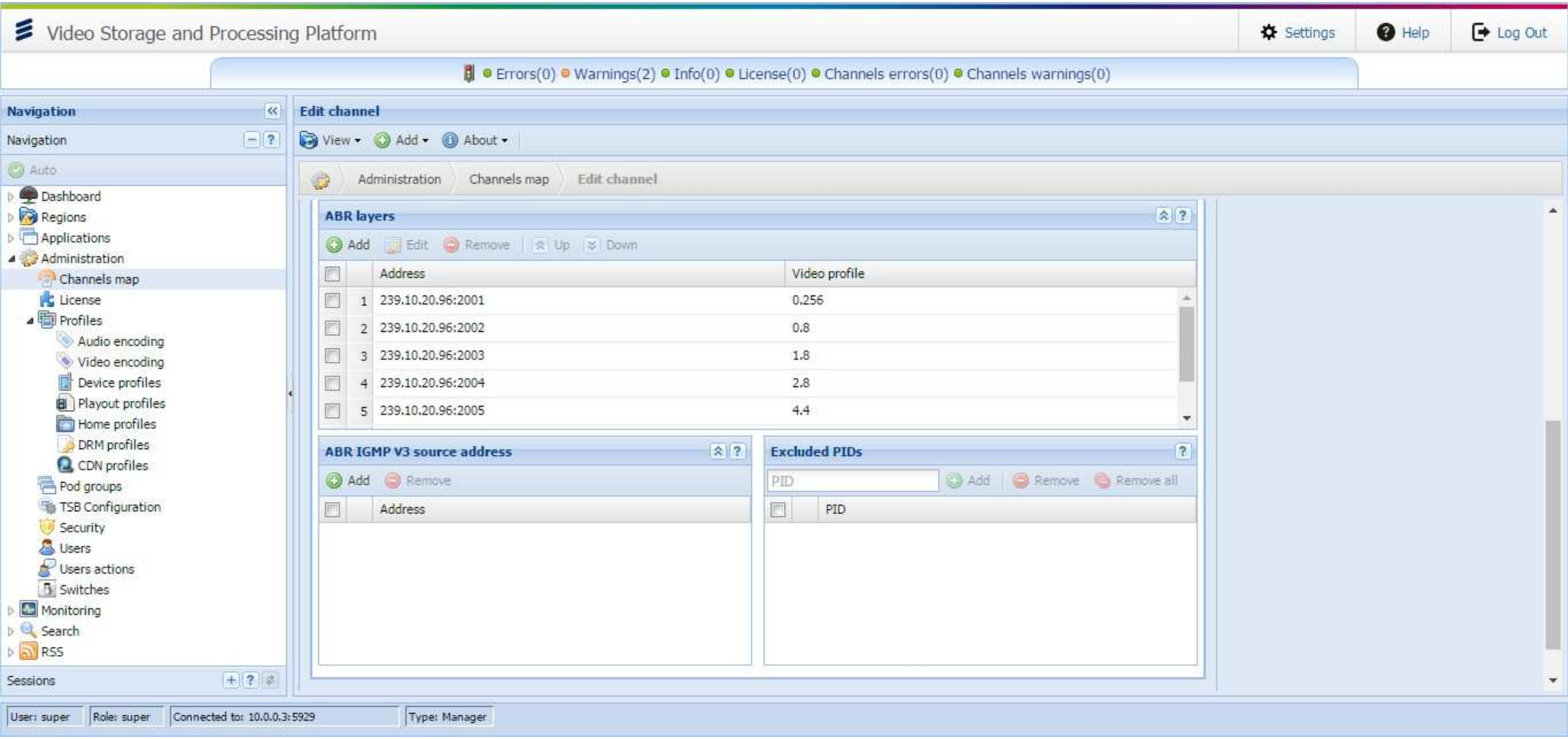
VSPP MANAGER GUI – CHANNELS



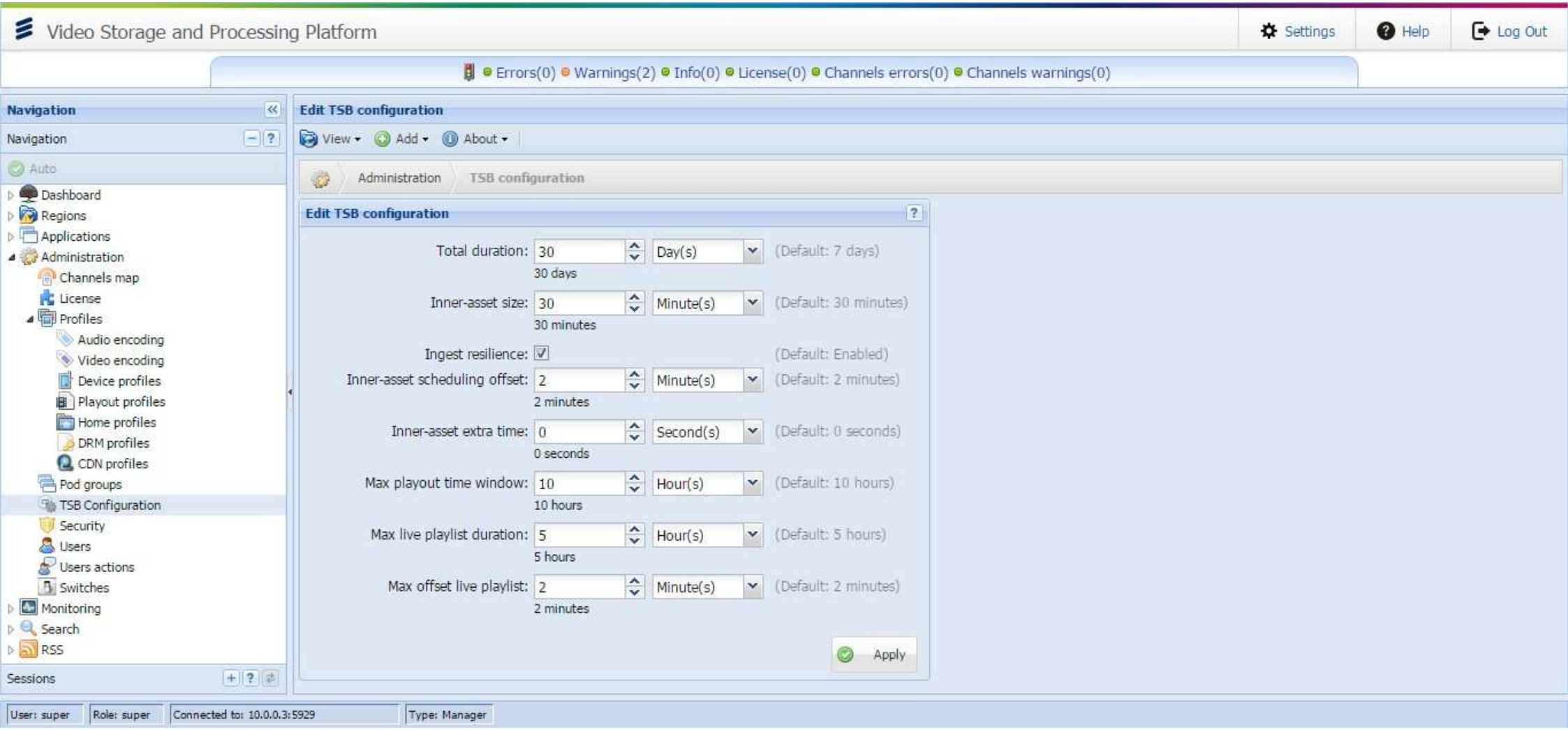
VSPP MANAGER GUI – CHANNELS



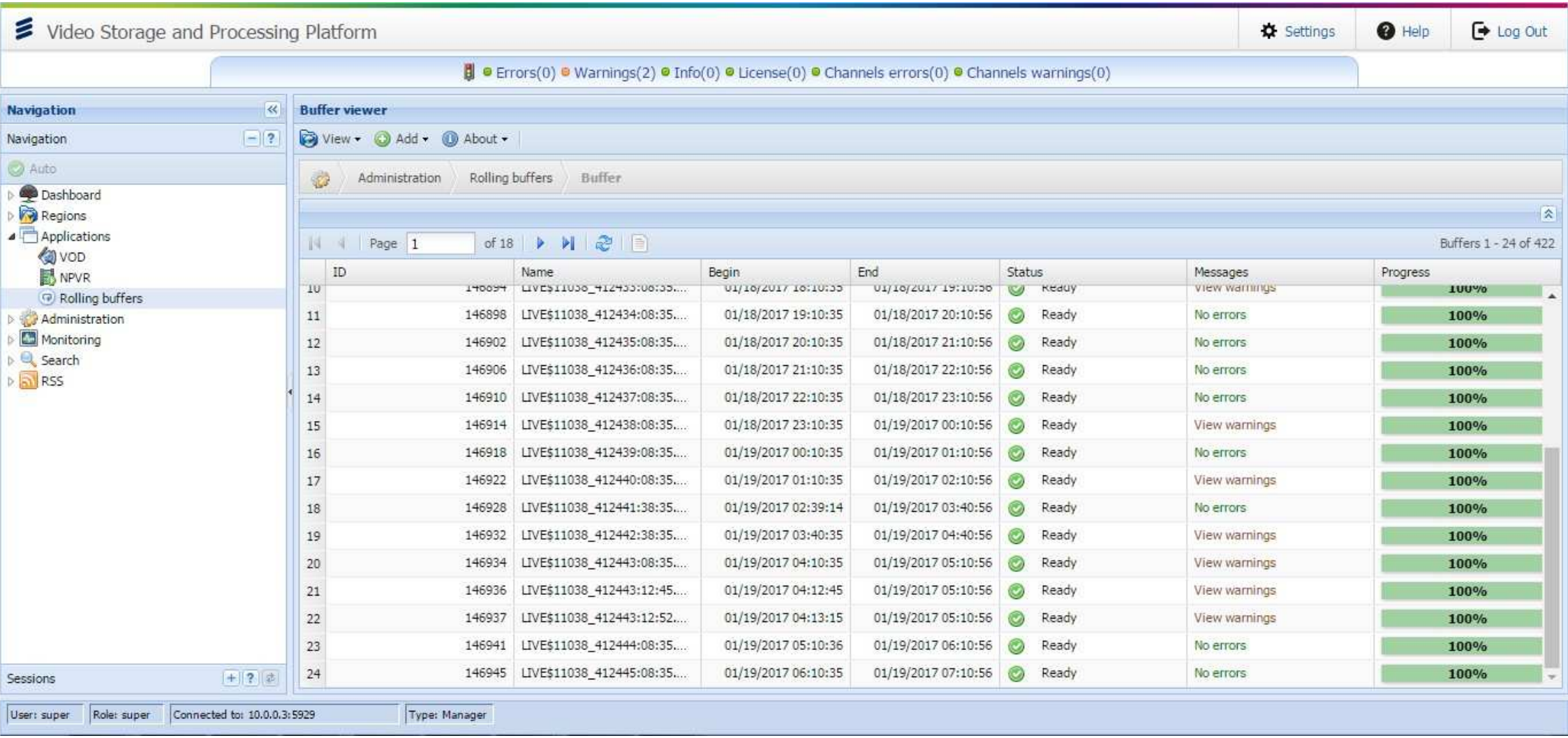
VSPP MANAGER GUI – CHANNELS



VSPP MANAGER GUI – ROLLING BUFFER



VSPP MANAGER GUI – ROLLING BUFFER



PROFILES

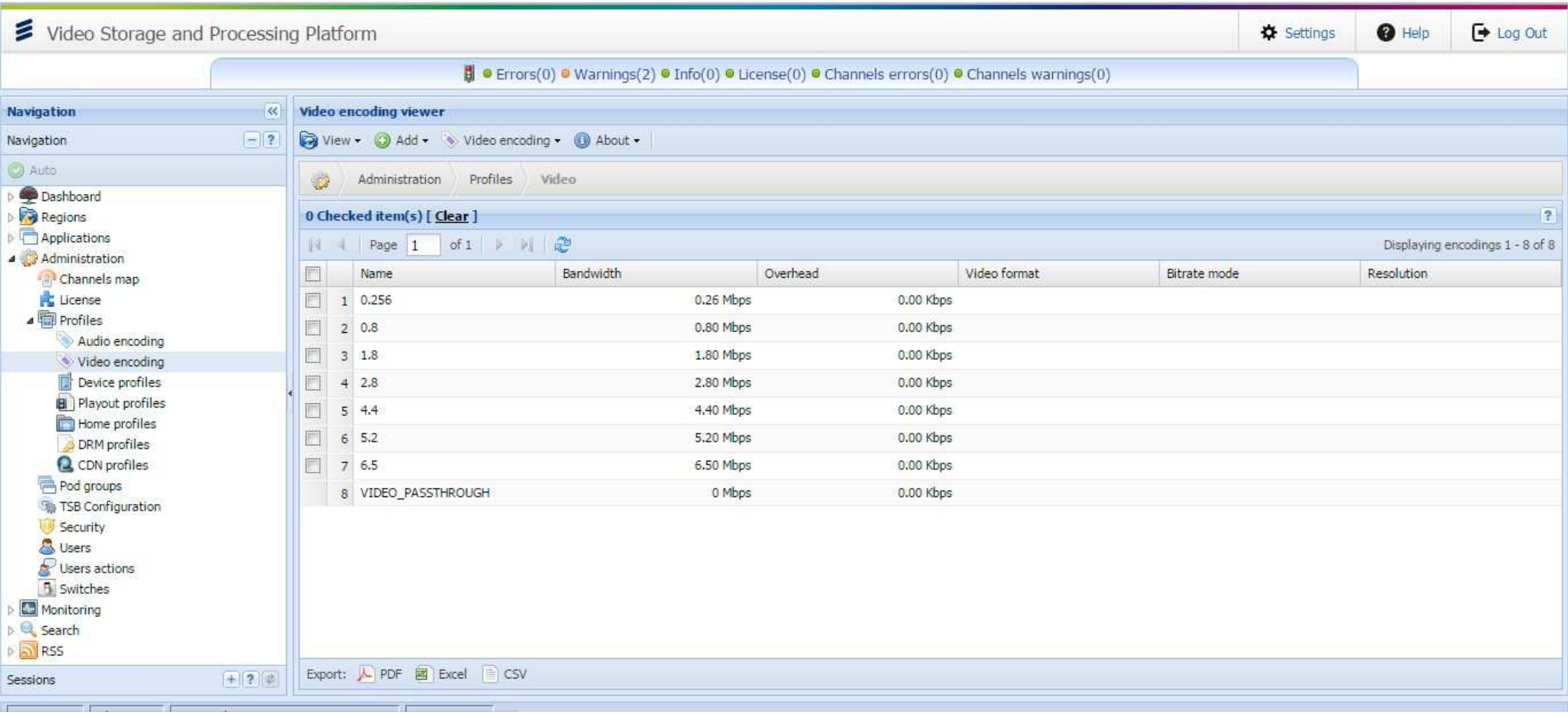
Audio and Video Profiles:

- Match a bit rate for input layers of channels
- Are used for Ingest
- Are used for Playout

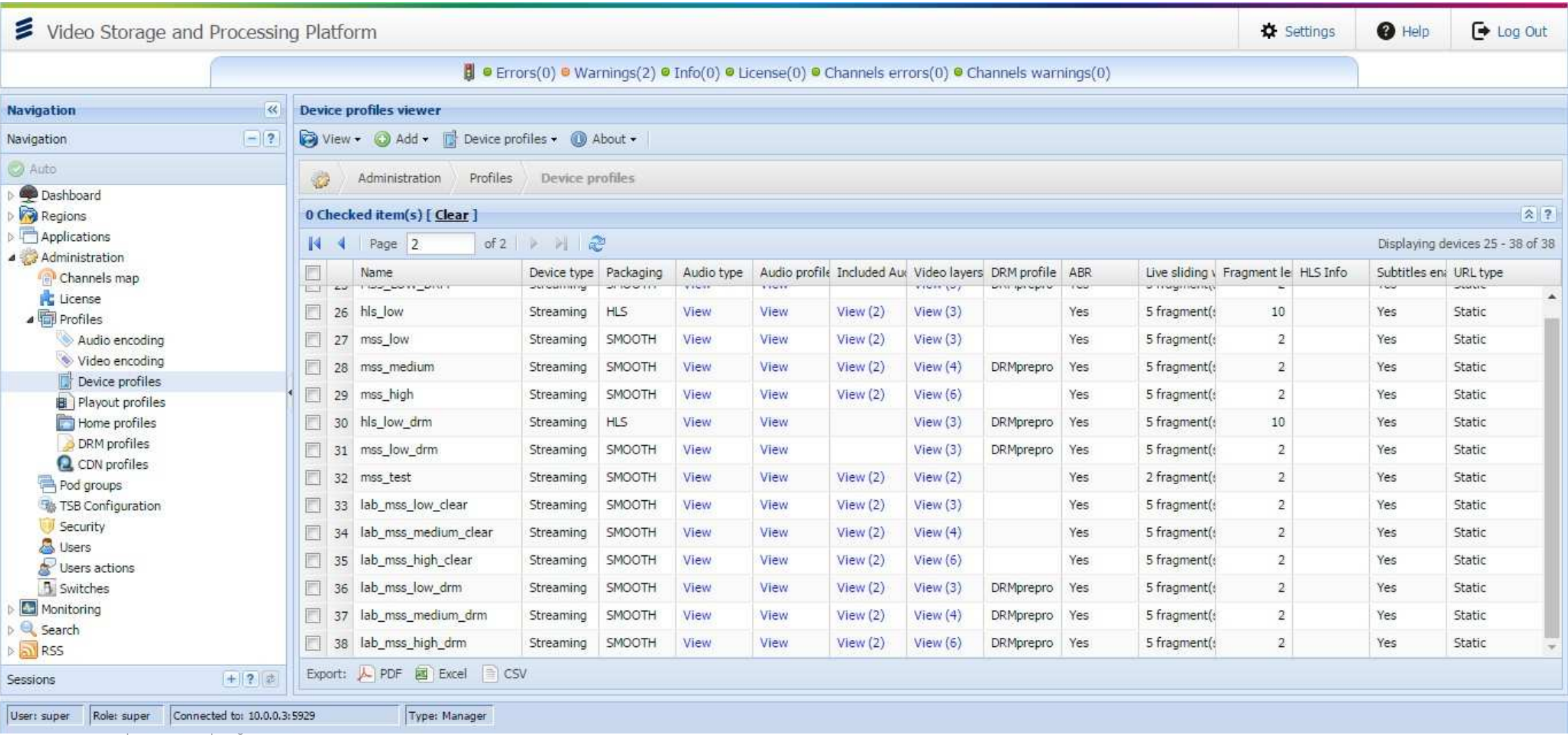
Device Profiles:

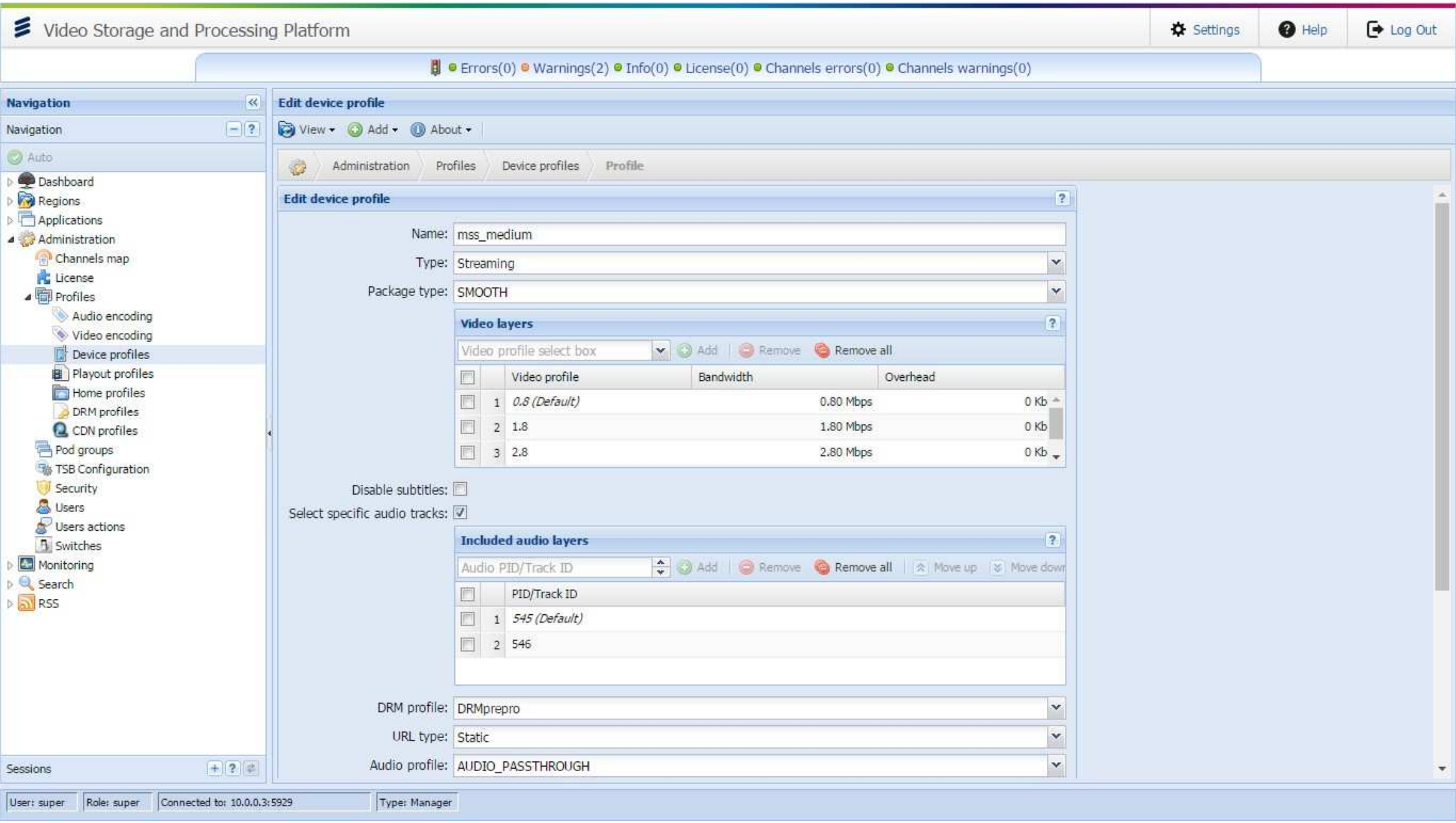
- Have different types according to streaming type
- Default profiles can be used only by some simple checks
- Custom profiles should be created according to client devices and used in production

VSPP MANAGER GUI – VIDEO PROFILES

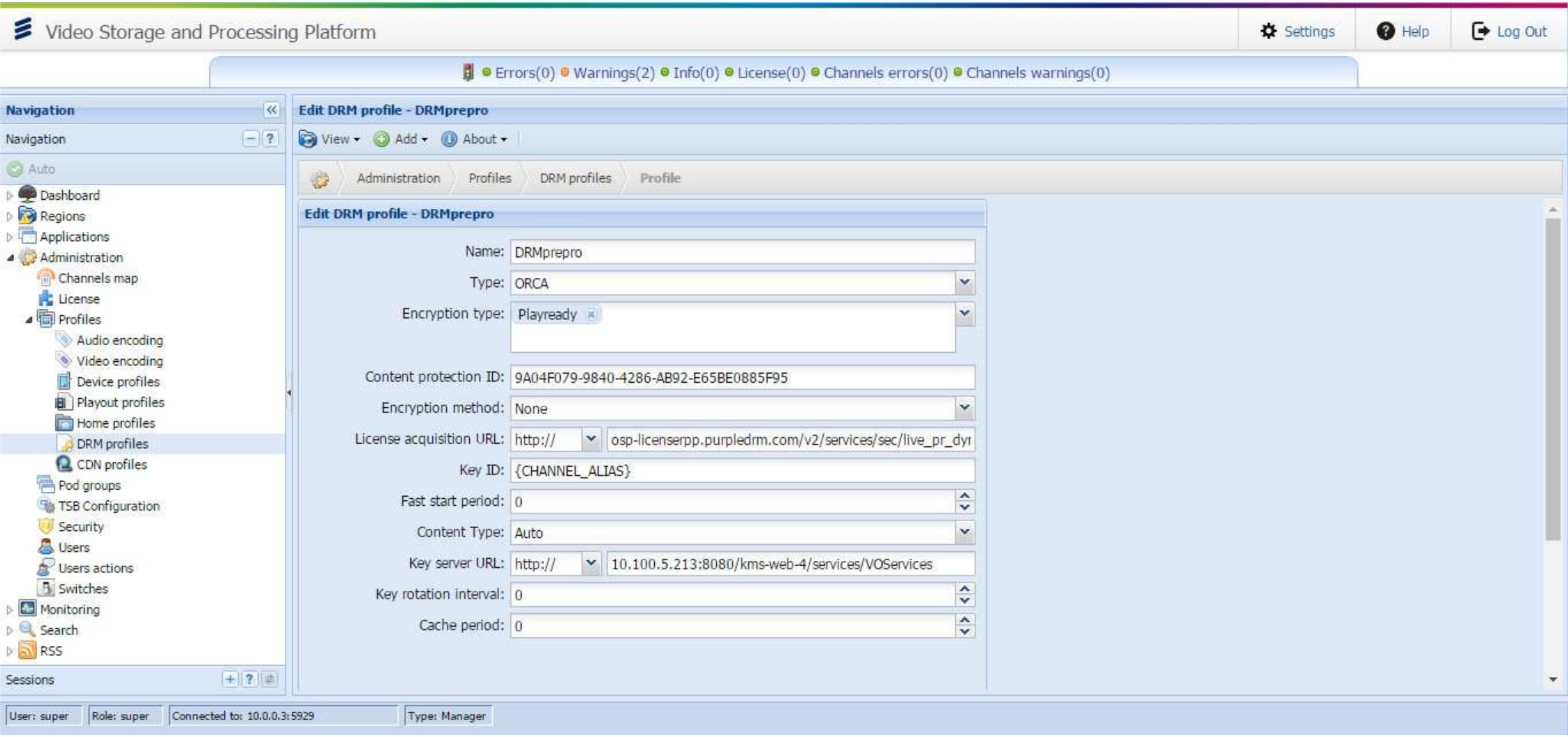


VSPP MANAGER GUI – DEVICE PROFILE




Video Storage and Processing Platform
Settings
Help
Log Out
Errors(0) Warnings(2) Info(0) License(0) Channels errors(0) Channels warnings(0)
Navigation
Navigation
Auto
Dashboard
Regions
Applications
Administration
Channels map
License
Profiles
Audio encoding
Video encoding
Device profiles
Playout profiles
Home profiles
DRM profiles
CDN profiles
Pod groups
TSB Configuration
Security
Users
Users actions
Switches
Monitoring
Search
RSS
Sessions
Edit device profile
View
Add
About
Administration
Profiles
Device profiles
Profile
Edit device profile
Name: mss_medium
Type: Streaming
Package type: SMOOTH
Video layers
Video profile select box
Add
Remove
Remove all
Video profile
Bandwidth
Overhead
1 0.8 (Default) 0.80 Mbps 0 Kb
2 1.8 1.80 Mbps 0 Kb
3 2.8 2.80 Mbps 0 Kb
Disable subtitles:
Select specific audio tracks:
Included audio layers
Audio PID/Track ID
Add
Remove
Remove all
Move up
Move down
PID/Track ID
1 545 (Default)
2 546
DRM profile: DRMprepro
URL type: Static
Audio profile: AUDIO_PASSTHROUGH
User: super
Role: super
Connected to: 10.0.0.3:5929
Type: Manager

VSPP MANAGER GUI – DRM PROFILE




VSPP APIS

APIS

Name:	Time-Based Recording Management API
Description:	This API exposes a set of commands that assist to initiate programs recordings request and manage the recording data based on time. Recording command can be sent to Scheduler or Manager. The cDVR will receive from the CMS/3rd party Scheduler applications a "ShowingID" attribute as an external content identifier for the schedule recordings and recordings management requests
Main Purpose	To allow operations such as:

Methods	Scheduler	VSPP Manager
ScheduleRecording	X	X
UpdateRecordingsTime	X	X
StopRecording	X	X
DeleteRecordings	X	X
BookMarkRecording	X	
GetRecordingBookmark	X	
ProtectRecording	X	
StartPauseLive		X
StopPauseLive		X
SetRecordingMetadata	X	
GetRecordingMetadata	X	
GetSubscriberRecordingsList	X	X
GetRecordingDetails	X	X
SearchForRecordings	X	X
GetRecordingPlayoutURL	X	X

APIS

Name:	Recording Notifications API
Description:	This API exposes a set of commands that report about the status (success/fail) once the recording completes. Such notifications are typically sent to the recording request originator or any other operator CMS/BO system.
Main Purpose	To allow operations such as: • RECORDING_COMPLETED • RECORDING_LOST

APIS

Name:	Cloud DVR ABR API Specifications
Description:	This API exposes a set of commands playout ABR video either at VOD or cDVR
Main Purpose	To allow operations such as: • Rolling Buffer - Dynamic Mode • Rolling Buffer - Static URL • RS-DVR Playout Request • VOD Playout - Static URL • VOD Playout - Dynamic URL • MP4 Download Request • Session Destroy • Rolling Buffer Status • Mixed Rolling Buffer Status

APIS

Name:	Content Management API
Description:	Cloud DVR content management interface and encapsulates set of commands for external management of the content stored on the Cloud DVR storage grid (VOD files, live channels and rolling buffer recordings etc.
Main Purpose	To allow operations such as: • VOD - Create Asset Request • Single File Delete • Delete Multiple Files • View VOD Files • Search VOD Assets • View Ingest Progress • View Video Properties • Fetch Playable ABR VOD Assets

How does this work in practice?

- Static URLs:
  - http://str.pod01:5555/shls/1234567/5.m3u8?device=HLS
- Adding the MDN:
  - http://rr.ttg.tr/TTG/VOD/shls/1234567/5.m3u8?device=HLS
- Playout API relies on the concept of device profiles
  - These are created in the UI and describe the capabilities of the client device making the request
  - VSPP uses this profile to determine what bitrates may be available to that device


VSPP DIAGNOSTICS

MAIN CONCEPTS

- Centralized architecture for the monitoring and diagnostics of the VSPP deployment

- Provides a proactive view on the:
  - System performance and health
  - Service and application level monitoring and metrics
  - Business level analysis

- Exposes the following diagnostic capabilities and tools:
  - Real-time monitoring
  - Dashboards: visualization and graphs
  - Analytics: raw data export and offline reports

DIAGNOSTICS - PRODUCT

Out of the box features identical for all customers

- Real-time monitoring
  - Pre-defined real-time alerts with configurable thresholds (SNMP traps/emails)
  - SNMP monitoring (GET/WALK) for the seamless integration with deployed NMS
- Video dashboard - fixed graphs with a basic service KPI’s as part of VSPP UI
- Reporting services:
  - Raw data extraction for the offline analysis by external BI systems
  - Splunk reports: pre-defined by start-packs for different deployment cases

REAL TIME MONITORING

SNMP Monitoring

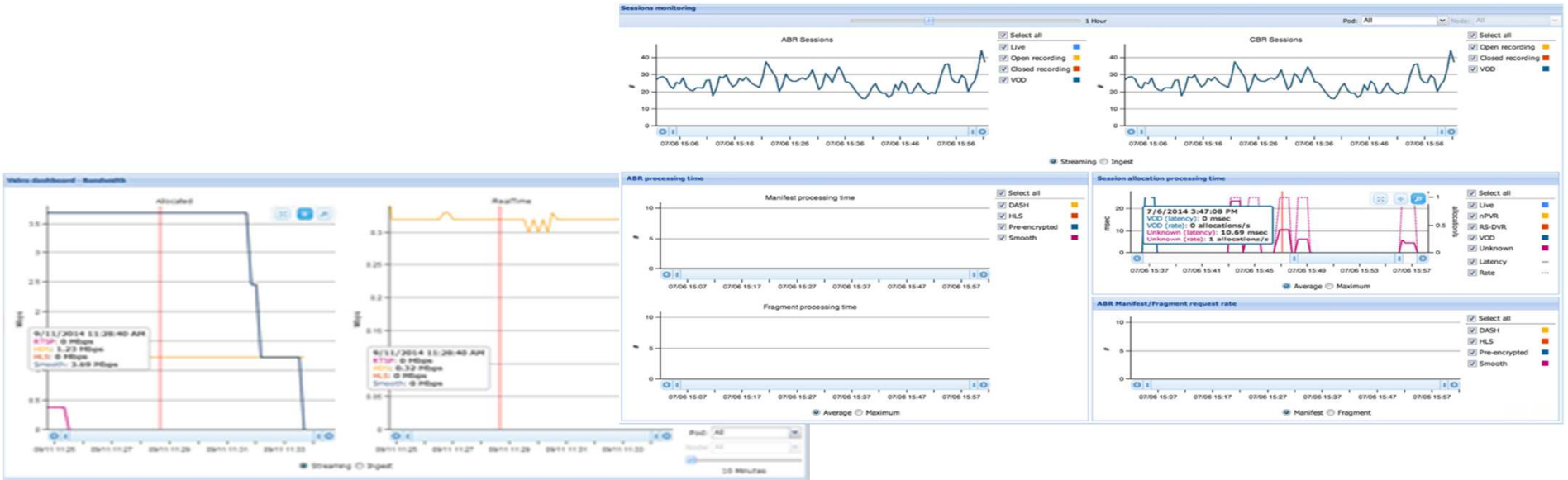
› Enables seamless integration with any NMS environment:
  – SNMP traps: real time system and service level alerts
  – SNMP counters: real time data based on system performance counters

Notifications

› Flexible and configurable on demand notification engine:
  – SNMP traps
  – Emails

DASHBOARDS

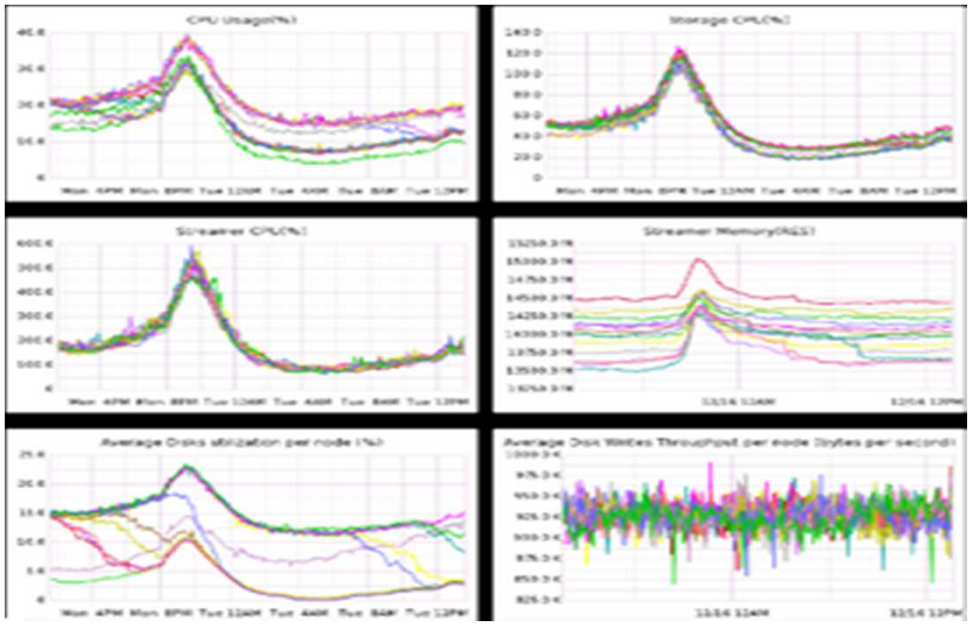
- Out-of-the-box basic service-level monitoring solution
- Part of the VSPP GUI
- Static structure
  - Supports a small amount of basic views



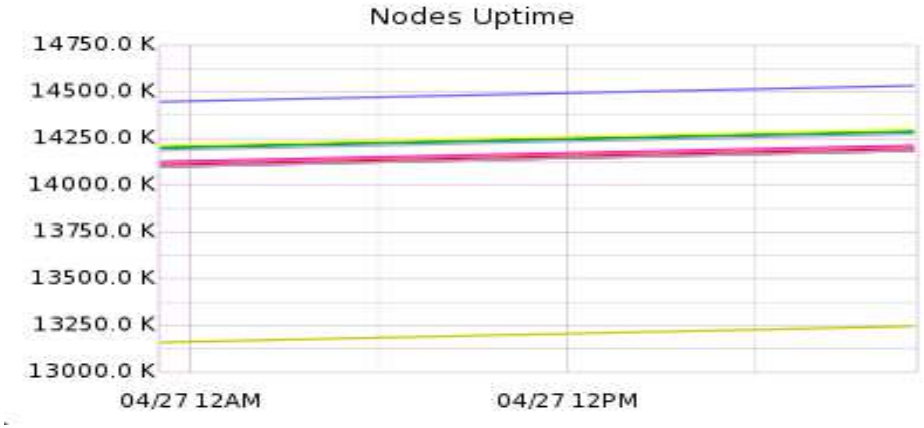
DASHBOARDS – CONT'D

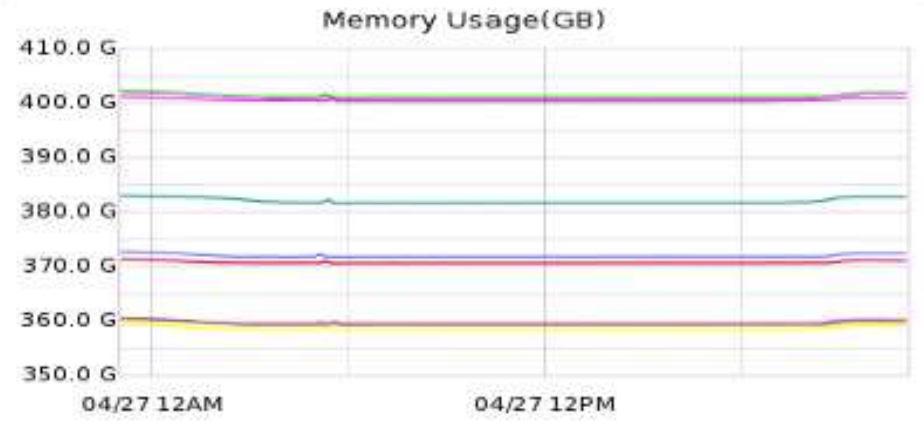
Graphite Dashboards: Visualization of Metrics - System and Service Level

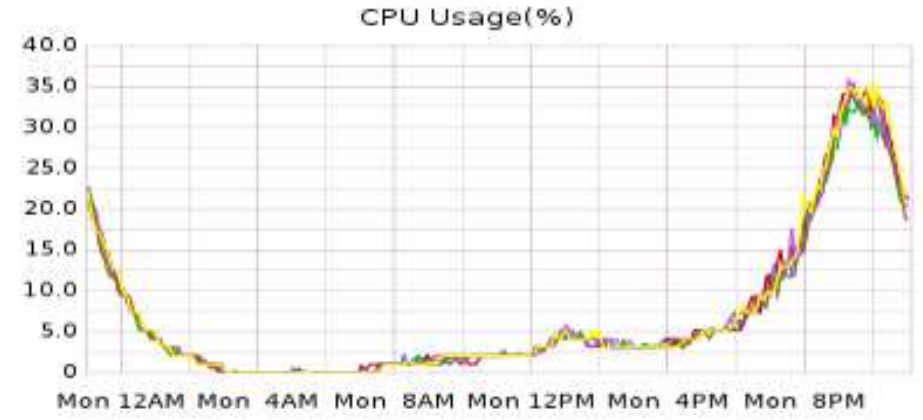
- Based on the continuously collated metric data
- Seamless on the fly provisioning and customization of new graphs and views

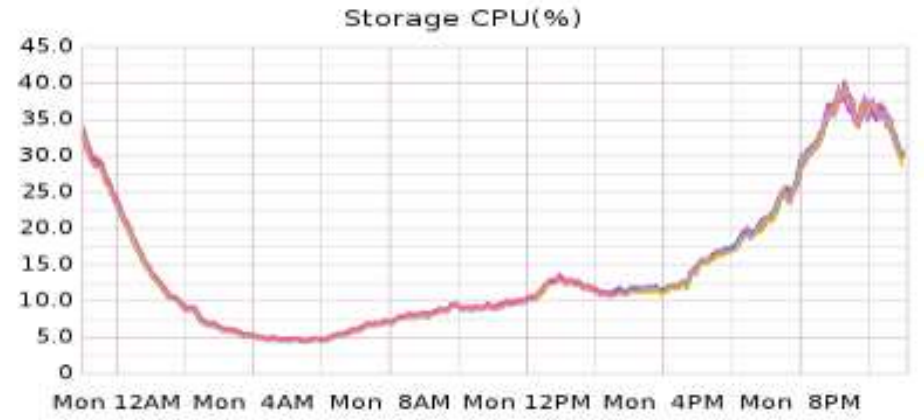


GRAPHITE EXAMPLES

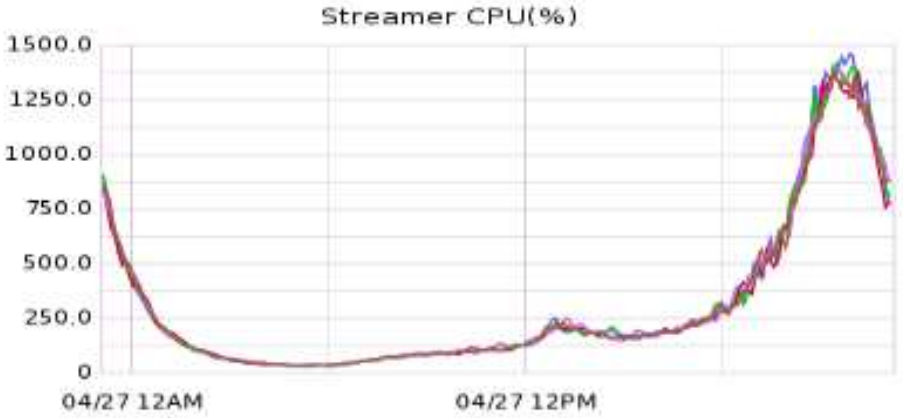


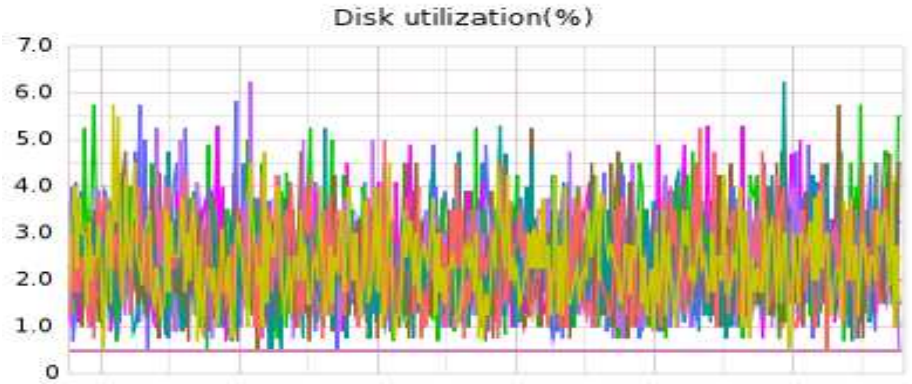


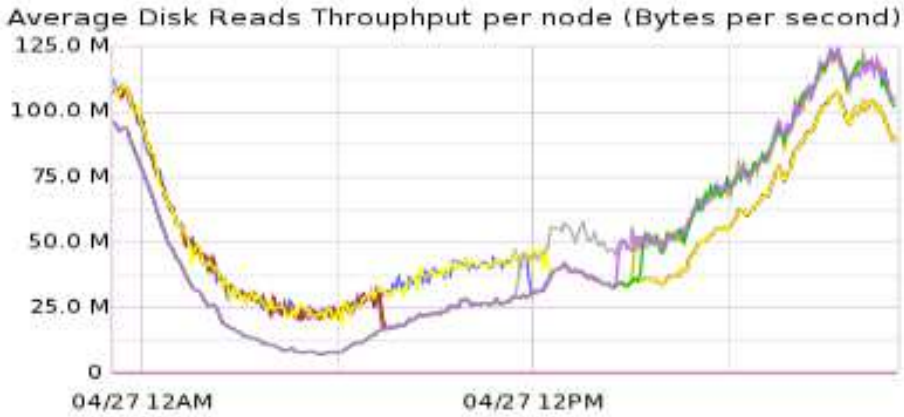


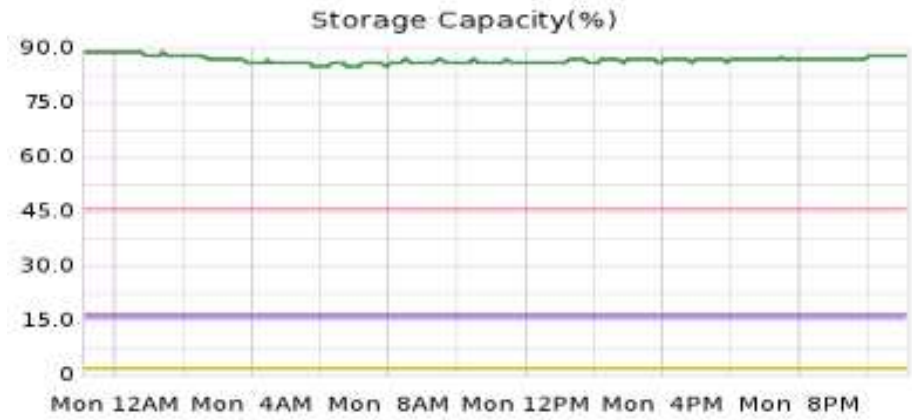


GRAPHITE EXAMPLES









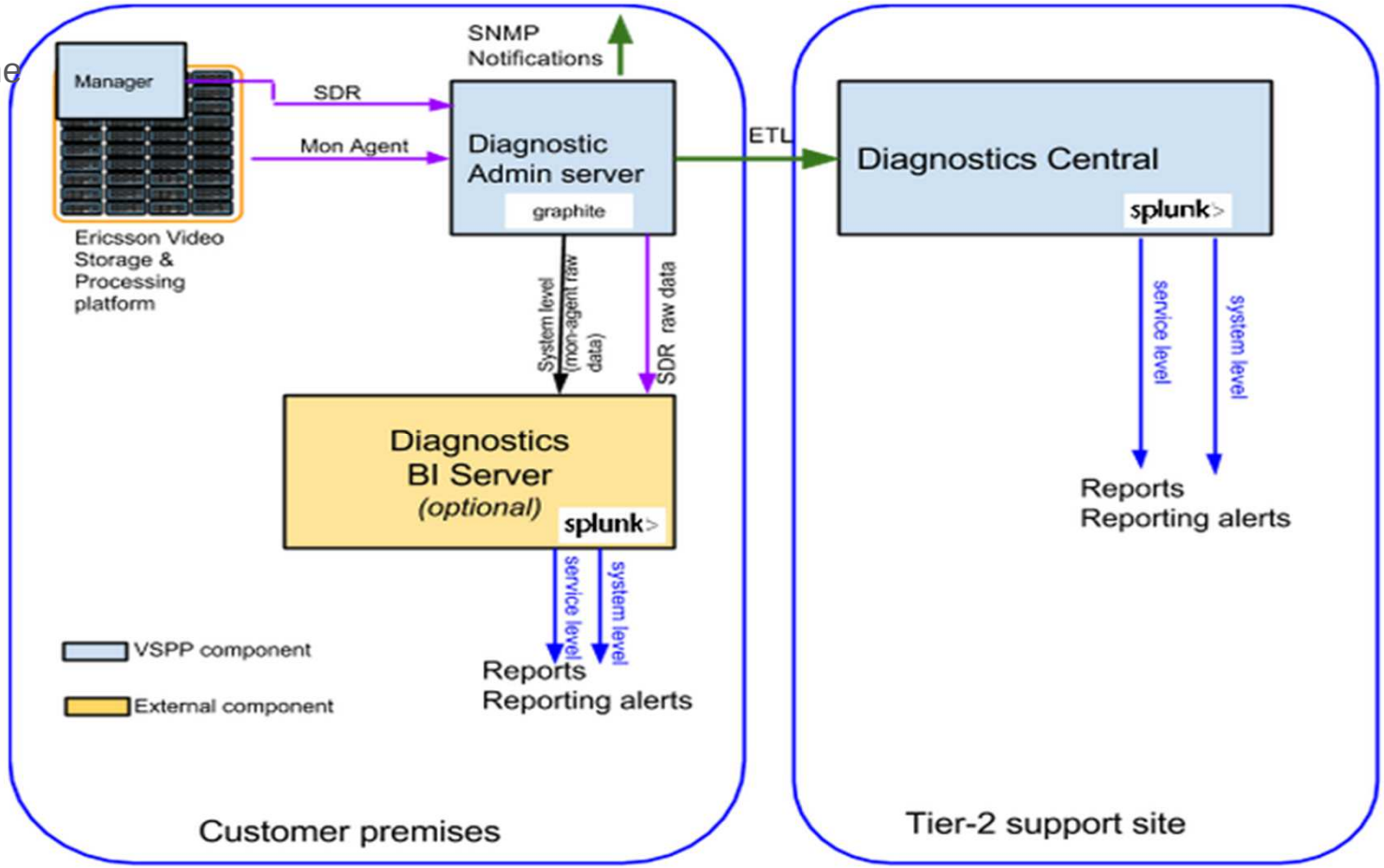
REPORTS

This feature enables performing an in depth business level system and a service level proactive analysis and monitoring of activities and exposes the following options:

- **Daily raw data CSV files generation and export** to any external BI systems used on customer premises for the analysis activities:
  - **SDRs and other file reports:** session-based metrics and statistics
  - **Mon-agent report:** aggregated system level metrics
- **Out of the box reports,** predefined reports start-packs as a installation packaged (vAPPs) for on-premises splunk based BI systems.
- **Diagnostics central,** splunk based cloud environment
  - Enables tier-2 support for the E/// operational team to maintain stable production systems

GENERAL ARCHITECTURE

- **Mon-agent,** VSPP in-house developed Python tool, runs on all the system nodes, collects different system/service level metrics and continuously reports them to the Diagnostics Admin server.
- **SDR,** A raw data daily report containing different metrics on sessions managed by the system during the course of a day.



DIAGNOSTICS ADMIN SERVER

- Centralized monitoring and diagnostics server (*)
- Resides on customer premises and continuously collects data and metrics from the deployed systems
- Exposes centralized SNMP interface and real-time notifications engine
- Graphite dashboard - visualization of system and service level data analysis over time, based on the collected metrics.
- Raw data files aggregation/extraction and ETL process
- Stand alone component with no dependency on the VSPP SW version.
- Recommended to install on VM cluster with the embedded HA technology for seamless scale out

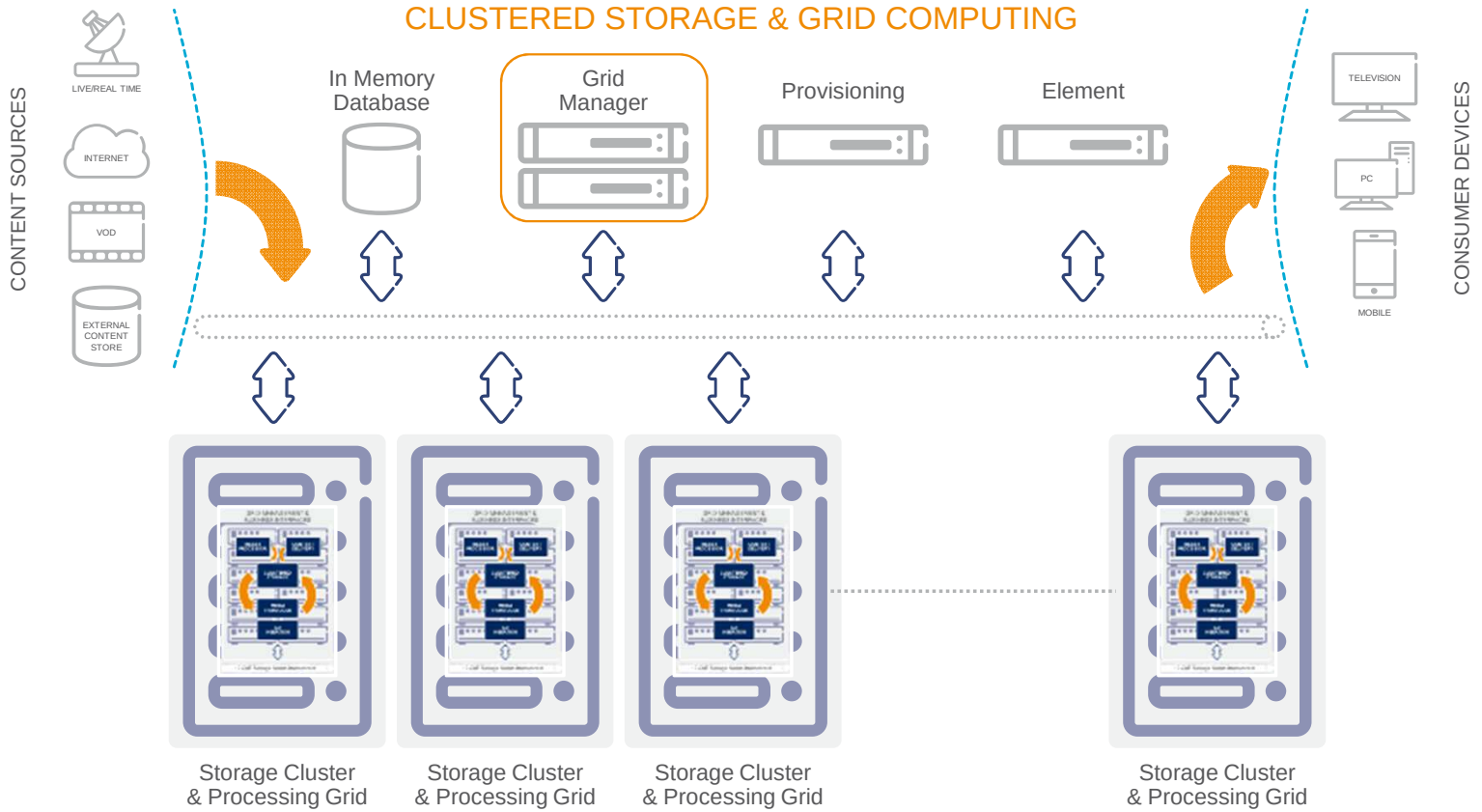
*** The HW/VM infrastructure to install on should be provided by the customer**

DIAGNOSTICS – SUMMARY VIEW

	Real-time Monitoring	Dashboard	Offline Reports Services
Exposed Features	• SNMP Monitoring • Notifications: SNMP Traps, e-mails alerts	• Out-of-box Video Dashboard • Automatic populated Graphite	• Daily Raw Data (CSV) export for any BI systems • Splunk Reports Start-pack
Users	NOC Engineer	• NOC • Support Engineers • VSPP Product Owner	• NOC • Business Analysts • Support Engineers • VSPP Product Owner
Available Professional Services	• Configuration services - on alerts • Training	• Graphite Dashboard Customizations • Training	• Developing Customized Reports • Proactive Tier-2 Monitoring Services
Required Hardware	Diagnostics Admin Server	Diagnostics Admin Server	Splunk Server for reports start-packs
Related Documentation Material (available in the Diagnostics Guide)	• VSPP SNMP interface description (MIB) • Real-time alerts list, description and default thresholds	• Video Dashboard Manual • Graphite Graphs and Dashboards	• Raw data files description : Metric, Purpose, Data Structure • Splunk Start-pack Reports (APPs) Installation Guidelines. • Reports Description and Analyzing Approach

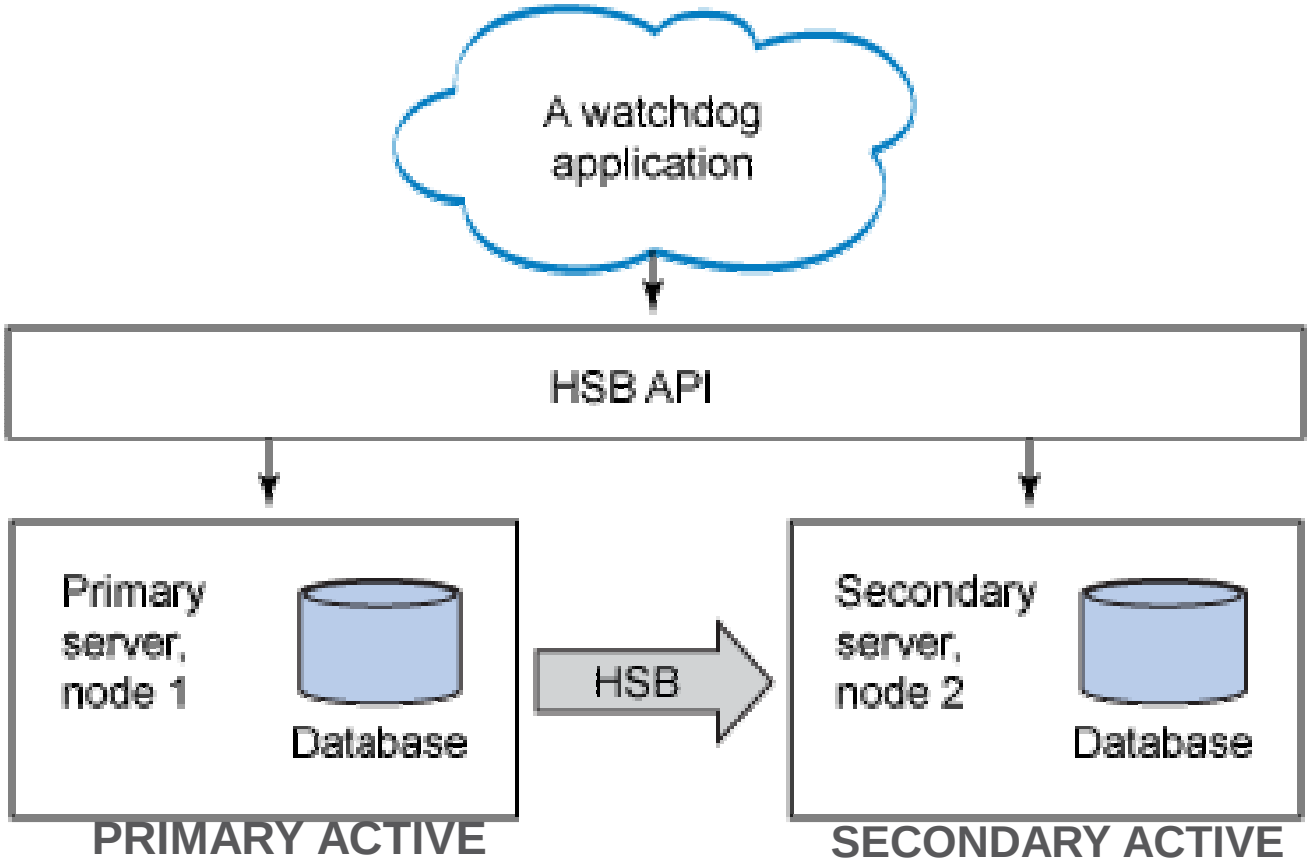
RESILIENCE FEATURES OF VSPP

FEATURES: MANAGER



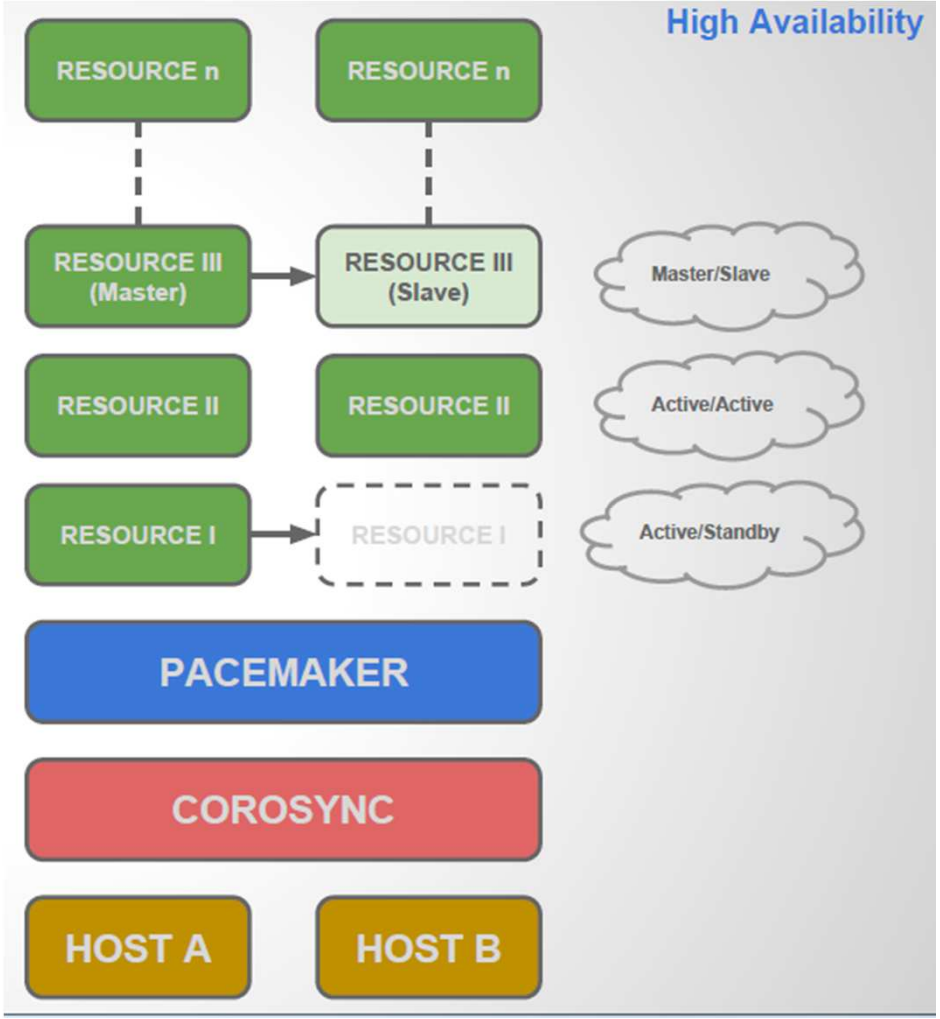
SOLIDDB HSB

› HotStandby provides database resilience

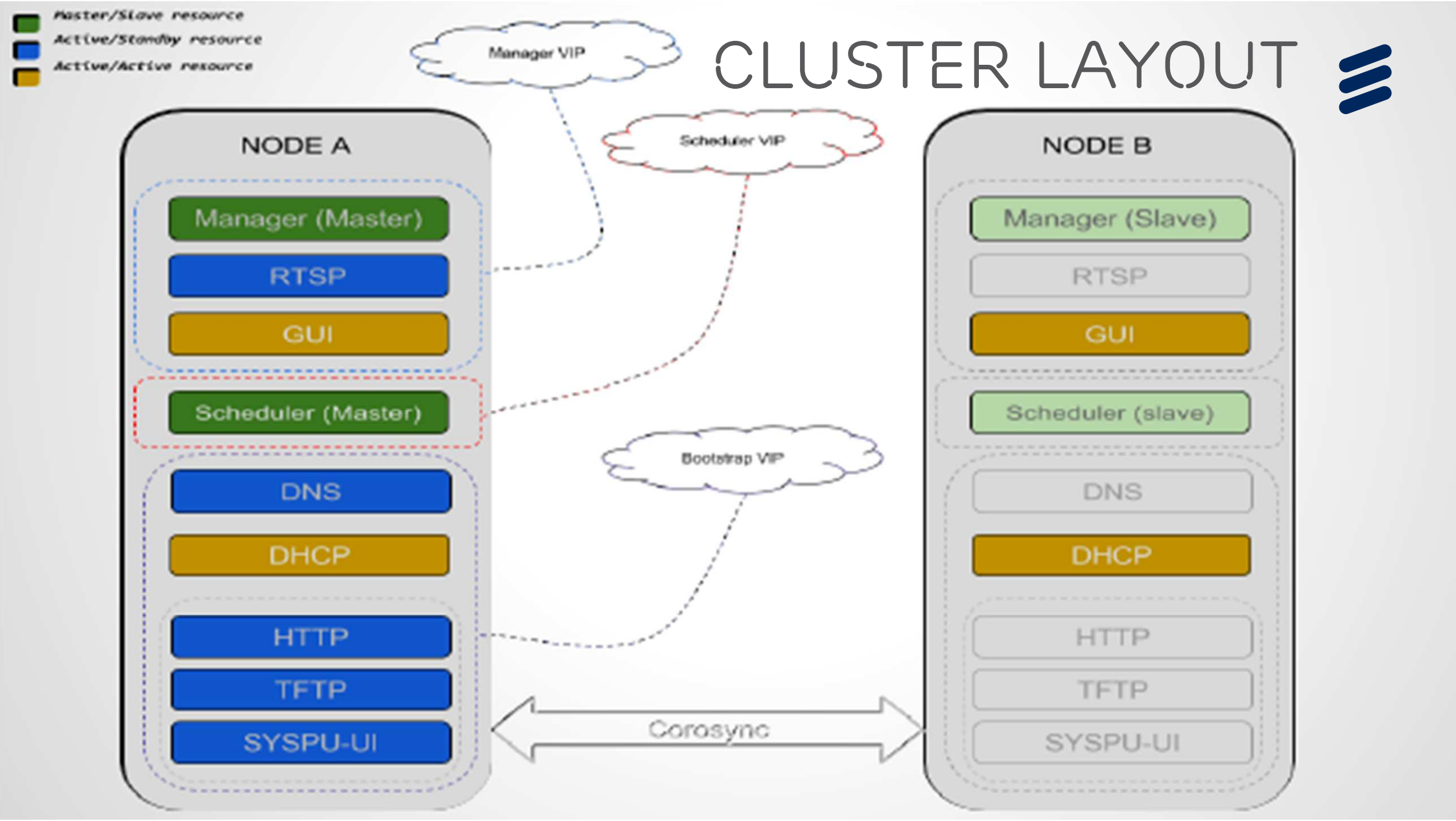


CLUSTER TOPOLOGY

- Layered on standard Linux cluster technology
  - COROSYNC:
    - Maintain cluster membership
    - Transport Layer
  - Pacemaker:
    - Resource Manager
      - Maintains resource availability
    - Resource Layer



CLUSTER LAYOUT




TROUBLESHOOTING,
DEBUGGING TOOLS,
AND LOGS

LOG FILES

All log files are located under **/opt/Fabrix.TV/logs/** directory.

On the manager server you'll find the corresponding manager log, and on the nodes themselves you'll be able to find streamer & storage log files, concerning ingestion of videos and their playout.

HOW DO WE DEAL WITH CHANNEL ISSUES

- A very common error is “**no data from source**”, or otherwise “**warnings from source**”

- In order to identify the problem (networking, actual no data, etc.) we'll have to try and capture the source (if available) and see if it's actually not coming through (**no data**) or has any issues by investigating it.

	Severity	Description
1	Error	No data from source at 239.0.32.2:11115 ykoren CBR ad zone empty reported by aio99

CHECKING INPUT MULTICAST - TCPDUMP

*tcp dump don’t send join IGMP messages

TCPDUMP utility is standard UNIX utility to capture network traffic

tcpdump -ni <multicast interface> host <multicast ip> -s0 -w /tmp/cores/capture.pcap

For Ex.

tcpdump -ni any host 239.0.32.12 and port 11115 -s0 -w /tmp/input.pcap -v

Wireshark is able to open the pcap file, then you should click ‘follow UDP stream’ and save it as TS file.

This should be done from the **streamer node**.

CHECKING INPUT MULTICAST - JOIN_MC

Same goal – only quicker!

JOIN_MC utility by **Fabrix** ← **May not be installed on all systems**

Will usually be located under **/opt/Fabrix.TV/Util/**

Usage: ./join_mc <ip> <port> <source> <if> <bytes_to_receive> [output_file]

For Example-

./join_mc -i 239.0.32.12 -p 11115 -s 0.0.0.0 -n eth2 -b 10000000 -w /tmp/layer.ts

join_mc is able to request **igmp membership** and save output as TS

HOW TO PLAYOUT?

Static URL syntax for ABR playout – VOD-JIT

SMOOTH

http://$VIDEO_SERVER_DNS_NAME/shss/$ASSET_ID/$FRAGMENT_LENGTH.ism?start=0&end=-1&device=$DEVICE_PROFILE

For ex.

http://192.168.6.99:5555/shss/1420705142672/5.ism/Manifest?device=SMOOTH

HLS

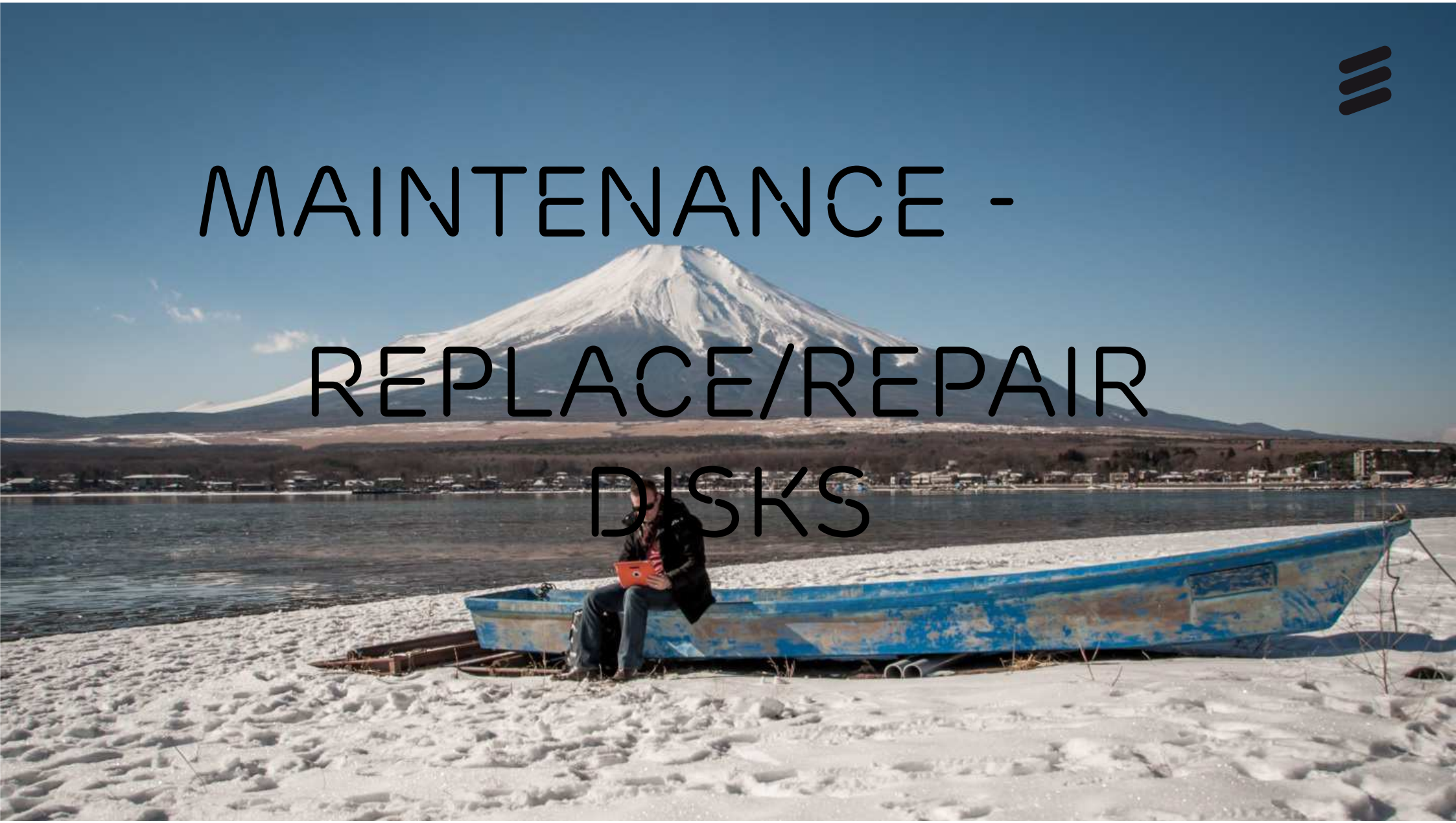
http://$VIDEO_SERVER_DNS_NAME/shls/$ASSET_ID/$FRAGMENT_LENGTH.m3u8?start=0&end=-1&device=$DEVICE_PROFILE

PLAYOUT LOGS

- The playout will include the **internal ID**, which can be searched in the streamer log to see the entire session.

-
```
02/01/17 11:47:31.202   I S10.0.1.11            STREAM_OTT       0  @DMEAAAAACKMLBJIF
FX_HTTP_HSS_Static_Streaming_Service_Data_Interface::on_http_request
url=/shss/LIVE$11004/2.ism/manifest?start=2017-01-26T14:15:00Z&end=2017-01-
26T16:09:00Z&device=mss_medium this=0x7f0728010100 con=0x7f072800f420
```

-
```
02/01/17 11:47:31.261   I S10.0.1.11            STREAM_OTT       0  @DMEAAAAACKMLBJIF
FX_HTTP_Adaptive_Streaming_Base_Service::release_http_handler
url=/shss/LIVE$11004/2.ism/manifest?start=2017-01-26T14:15:00Z&end=2017-01-
26T16:09:00Z&device=mss_medium this=0x7f0728010100 con=0x7f072800f420 in_progress=1
```

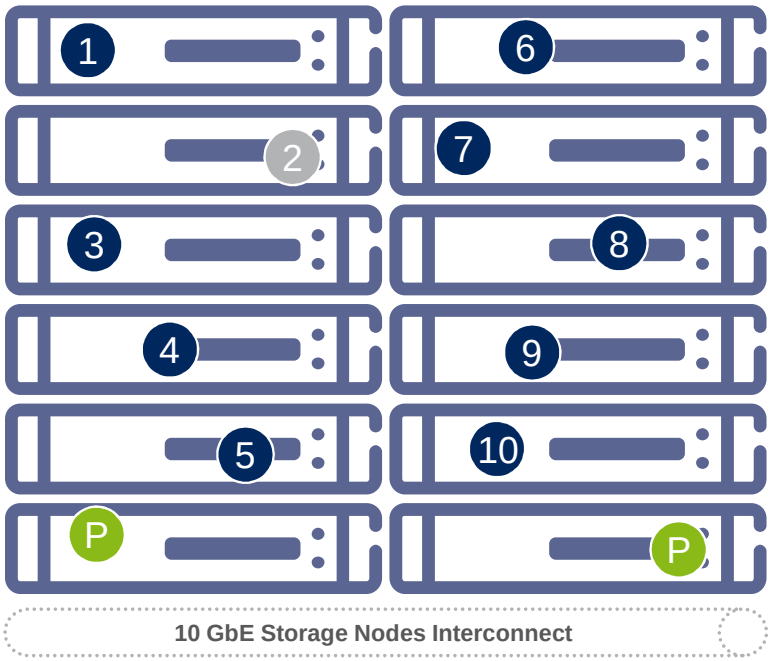

MAINTENANCE -
REPLACE/REPAIR
DISKS

STORAGE AND COMPUTE GRID

Data recovery

- In case of disk crash, the lost data is recovered using the parity chunk:

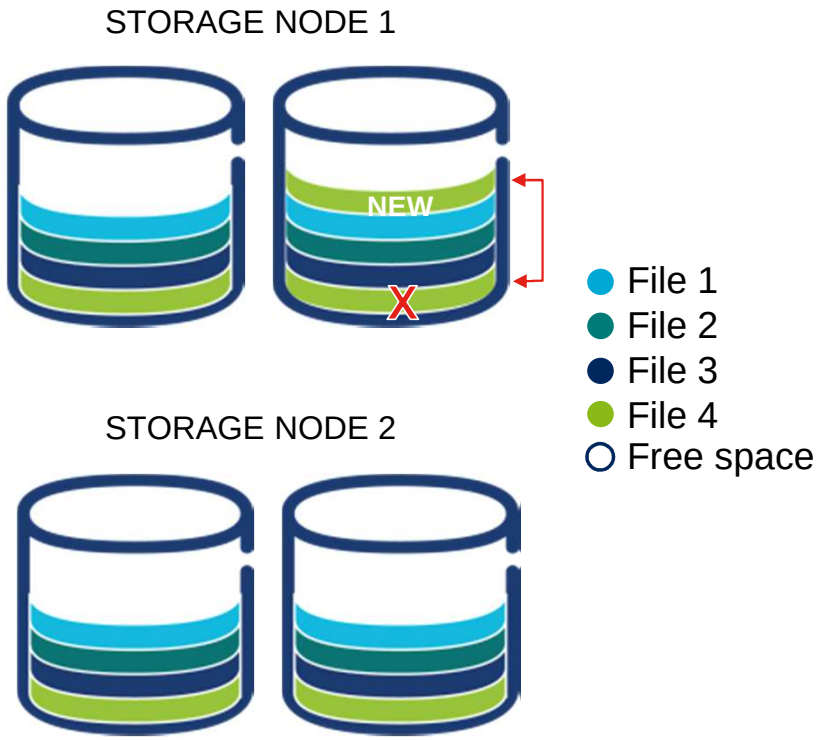
- Machine protection: the segments chunks are divided across servers so that no 2 segment chunks reside on the same node.



STORAGE AND COMPUTE GRID

Self-healing and maintenance operations - Repair

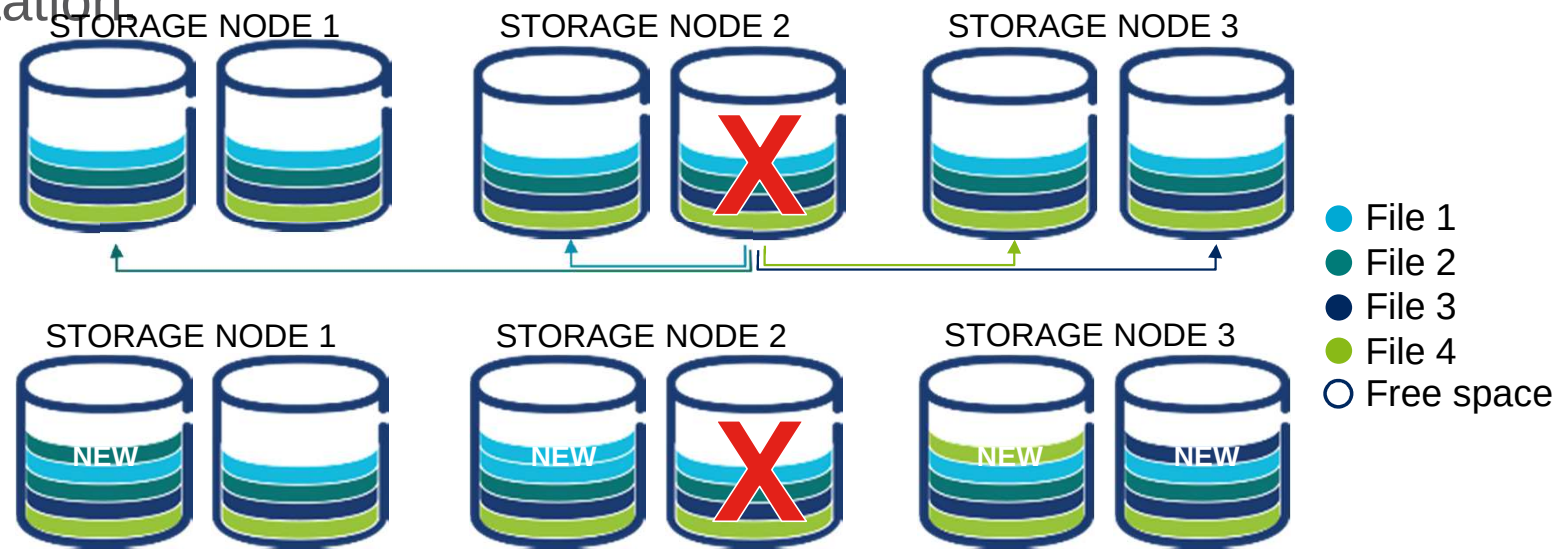
- Repair: the system will attempt to repair each missing/corrupted chunk by calculating it from its corresponding RAID chunks in the segment and write it back to the disk.
- Repair is triggered when a read data check, or a data integrity check, finds a bad chunk:



STORAGE AND COMPUTE GRID

Self-healing and maintenance operations - Rebuild

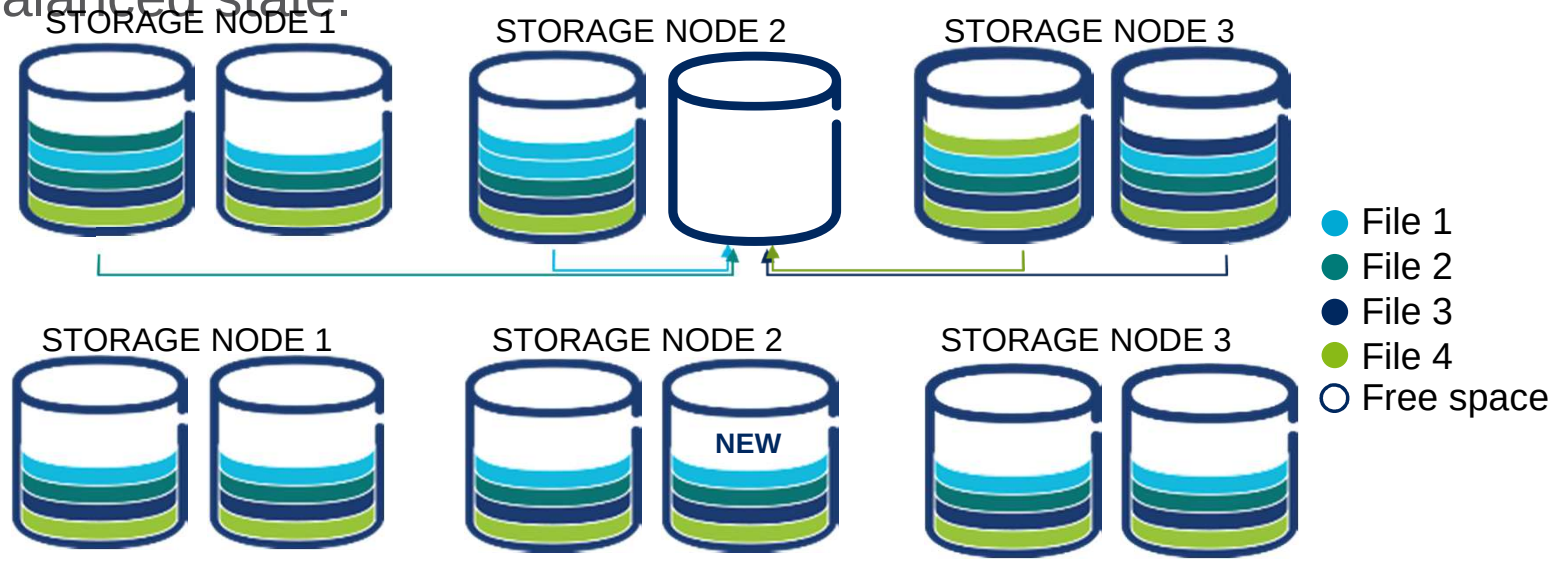
- Rebuild: when the system detects a bad drive, or a by manual user operation, Rebuild operation is triggered.
- The system rebuilds the failed drive with a many-to-many parallel IO operations. The chunks will be re-distributed to other drives and nodes according to the current permutation.



STORAGE AND COMPUTE GRID

Self-healing and maintenance operations - Balance

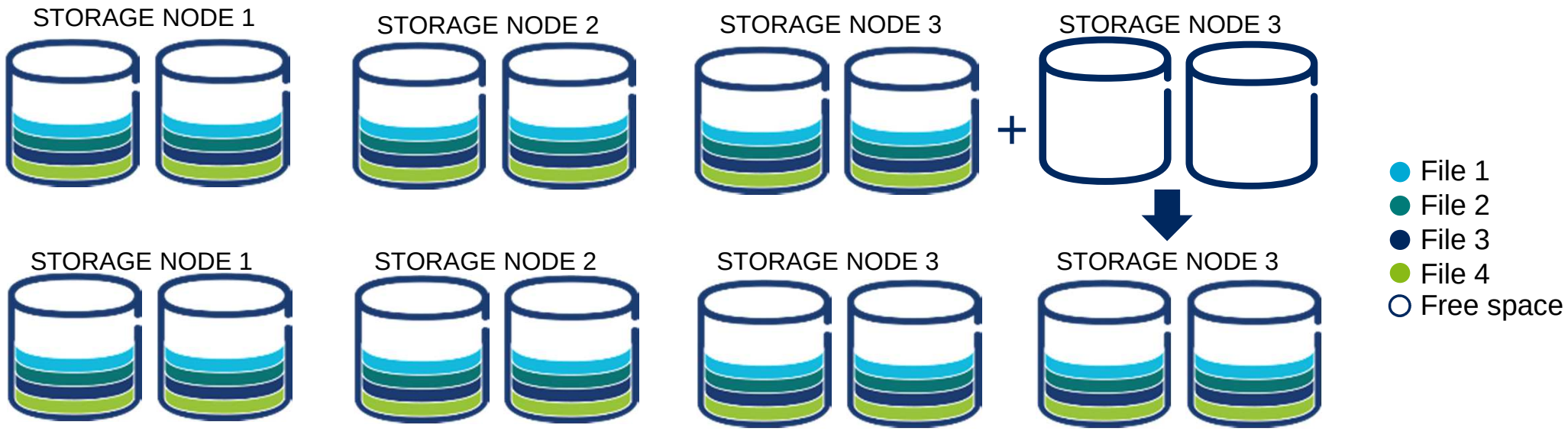
- Balance: When bad drives are replaced with new drives, the system is unbalanced and a balance operation is triggered.
- The drive will be populated by file chunks from other drives and will bring the system to balanced state.

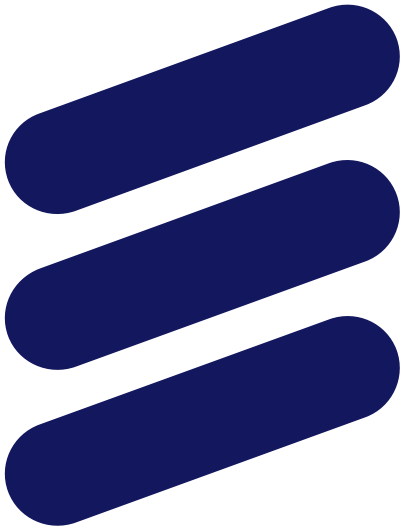


STORAGE AND COMPUTE GRID

Self-healing and maintenance operations - Restripe

› Restripe: When new storage attributes are added, the restripe mechanism will redistribute stored chunks into the newly added resources according to the new permutation.





ERICSSON