Scalable Container Workflows for IP Video Streaming
Cisco Knowledge Network

June 20, 2018
Outline – Cloud Data Plane

• Update on SPVSS transaction with Permira

• Industry Dynamics – drivers for cloud data plane
  • Growth of Live Streaming in IP: Cisco data and market data on sports streaming
  • Industry examples: SKY and DirecTV Now

• Why Cloud Models for Live Streaming
  • Flexibility, speed, complexity, operating model

• Cloud Data Plane for Live Streaming
  • Application Stack
  • Architecture
  • Use Cases

• How it Works: Reference Architecture and Blueprints
  • Walk though blueprint for use cases and leverage screen shots from demos to show how it works in reality

• Next Steps
  • IBC
Cisco announced a change to its SP video business strategy

Announcement

Cisco and Permira, a global private equity firm, announced that a company backed by the Permira Funds has entered into a definitive agreement to acquire Cisco’s Service Provider Video Software Solutions (SPVSS) business.
Commitment to Service Providers

Cisco

Committed to service provider segment and its success

Benefits
• Deliver technology innovations and in systems, silicon and software
• Unrivalled expertise in mass-scale networking, automation, optical, optics, cable access, and mobility

Customer

Shared commitment to customer relationship and success

Benefits
• Healthy stand alone business in the new company with singular focus on video innovation and success
• Customer centric focus and innovation to deliver new revenue-generating services and experiences

The New Company

Leading end-to-end video technology business

Benefits
• Independent entity, able to execute faster, more effectively, and aligned to the specific needs of the industry
• Integrated engineering, marketing, sales, services and customer success
The New Company
Market leading, standalone end-to-end video technology business
Cloud Data Plane Drivers
Global Internet Video Traffic by Type

By 2021, Live video will increase 5-fold and reach 13% of Internet video traffic

31% CAGR
2016–2021

Exabytes per Month

* Figures (n) refer to 2016, 2021 traffic share

Source: Cisco VNI Global IP Traffic Forecast, 2016–2021
Live Streaming - By the Numbers

• 2018 Olympic Winter Games in PyeongChang
  • NBC Olympics
  • Total of 2.17 Billion streamed minutes
  • Live streaming 1.85 Billion minutes

• Super Bowl LII 2018
  • NBC Sports
  • 106 Million Total Audience Delivered (across all platforms)
  • 2.02 Million streaming audience (Average Minute Audience)
  • 633.7 million minutes live streamed
Industry Examples

**Streaming Forum Keynote:**
Sky Spins Up New Channels in Minutes

“How a move from appliance-based workflows to container-based workflows now means that the broadcaster can spin up new channels in minutes, a process that used to take up to 4 weeks”

**AT&T Misses Q1 Targets, as DirecTV Now Streaming Service Hits 1.46 Million Subscribers**

“Our investment in customer growth and our integrated service offerings helped drive solid first-quarter subscriber gains across our wireless, video and broadband businesses”
Old World Video Distribution Challenges

- Appliance-based deployments limit flexibility
- Slow process to stand up new streaming channels
- Complex and manual operations and maintenance
- Virtualization moved this world to software without addressing fundamental underlying challenges
New World Video Distribution Opportunities

- Flexible container and microservices deployments
- Spin up new services quickly
- Simplify operations with consistent and template-based management
- New world DevOps models
Benefits

• Fast approach to deliver channels
  • From 4-5 weeks to minutes
  • Channels configuration is version controlled and built from templates
  • Configuration can be updated quickly by modifying templates

• Repeatability
  • Scripted and Automated Updates
  • Less Error prone

• Marriage of Streaming and DevOps Engineering
  • Ansible Playbooks complemented by Service Oriented Operational Workflow UIs
Cloud Data Plane for Live Streaming
Containerized ABR System

**Ingest**
- Media Service Management and Automation
- Video Service Manager for ABR Channel Plans
- ABR / Streaming Any Screen
- Video Microservice Applications

**Content Process**
- Video Service Manager
- ABR Channel Plans
- Video Service Manager for ABR Channel Plans
- Encode/Transcode
- Linear Packaging
- Media Service Management and Automation
- Video Microservice Applications

**Distribution**
- Distribution / Streaming / ABR / Any Screen
- Smart Origin
- JSIP / DRM
- JITP / DRM
- Media Service Management and Automation
- Video Microservice Applications

**Encode/Transcode**
- ABR / Streaming Any Screen
- Video Microservice Applications

**Linear Packaging**
- ABR Channel Plans
- Video Microservice Applications

**Video Microservice Applications**
- Encode/Transcode
- Linear Packaging

**OS, Virtualization, Container Mgmt**
- Compute Pool
- Cloud Object Store

**Datacenter Infrastructure Mgmt**
- Ingest
- Content Process
- Distribution

**Activities**
- Deploy (new/delete)
- Scale / Scale Back
- Rolling Upgrade
**Infrastructure Agnostic**

- Container/Kubernetes layer as demarcation

<table>
<thead>
<tr>
<th>Clients Video Service Offer</th>
<th>On-Premise</th>
<th>Off-Premise</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDN</td>
<td>Live (Sports, News, Events ...)</td>
<td>Live (Sports, News, Events ...)</td>
</tr>
<tr>
<td>Video Workflows</td>
<td>Http</td>
<td>Http</td>
</tr>
<tr>
<td>Platform Services</td>
<td>Ingest &gt; xCode &gt; Package &gt; DRM &gt; Origin</td>
<td>Ingest &gt; xCode &gt; Package &gt; DRM &gt; Origin</td>
</tr>
<tr>
<td>Container and Container Orchestration</td>
<td>ELK, GRAFANA, VSM, ANSIBLE</td>
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</tr>
<tr>
<td>Virtualization</td>
<td>Docker, K8S, Openshift</td>
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</tr>
<tr>
<td>Compute (Servers)</td>
<td>VMWARE, Bare Metal, KVM</td>
<td>Compute</td>
</tr>
<tr>
<td>Network</td>
<td>Server</td>
<td>Network</td>
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</tbody>
</table>

Demarcation
Live Video Processing in Container format
Support for a variety of Blueprinted Work Flows

Linear ABR delivery – 1st and 2nd screen
Pull / JITP Workflow (cDVR)

Linear ABR delivery – 1st and 2nd screen
Push Workflow (Live, Low-Latency)

Linear Cable, IPTV, ATV delivery

Linear TS Processing

Linear Cable / DTH / Terrestrial delivery
How it Works:
Blueprints and Reference Architecture
Background
variants of deployment and applications

<table>
<thead>
<tr>
<th>Customer</th>
<th>Platform</th>
<th>Orchestration</th>
<th>Use case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer A</td>
<td>on premise BM (UCS) + VMWare 6.0.3</td>
<td>K8S v1.5.2</td>
<td>Linear ABR Single Channel Fault Domain (SFCD) Deploy + Config via Ansible</td>
</tr>
<tr>
<td>Customer B</td>
<td>on premise BM (UCS) IVP OpenShift v1.5</td>
<td>IVP OpenShift v1.5</td>
<td>Linear ABR Multiple channels - not SCFD</td>
</tr>
<tr>
<td>Customer C</td>
<td>on premise BM (HP) OpenShift (RedHat) v1.5</td>
<td>Linear ABR and Broadcast Delivery: ABR transcoding, Linear CBR, URC SMX Service Config via GUI</td>
<td></td>
</tr>
<tr>
<td>Customer D</td>
<td>AWS GCE provided K8S (probably v1.6)</td>
<td>Linear ABR: ABR transcoding</td>
<td></td>
</tr>
<tr>
<td>Customer X</td>
<td>on premise BM (HP Moonshot) Proprietary</td>
<td>Linear ABR: ABR transcoding, Linear CBR, Mux Use Cases</td>
<td></td>
</tr>
<tr>
<td>Customer Y</td>
<td>on premise OpenShift (IVP COE as in cDVR)</td>
<td>TBD</td>
<td>Transport from and to public Cloud- FEC/DEFEC</td>
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<tr>
<td>Customer Z</td>
<td>on premise OpenShift (IVP COE as in cDVR)</td>
<td>TBD</td>
<td>Transport from and to public Cloud- FEC/DEFEC</td>
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</tbody>
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Reference model – Linear ABR use case
Reference model – Linear ABR use case

<table>
<thead>
<tr>
<th>Topic</th>
<th>What?</th>
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</thead>
<tbody>
<tr>
<td>Solution bundle – deploy</td>
<td>Logic, Software to Deploy the Product Bundle Containers</td>
</tr>
<tr>
<td>Solution bundle – configuration</td>
<td>The Configuration “Workflow” logic” = channel config</td>
</tr>
<tr>
<td>Product bundle – configuration aspects (Ansible)</td>
<td>Channel, Service Settings per application</td>
</tr>
<tr>
<td>Side car containers – provisioner, ABR sync proxy</td>
<td>Helper Containers to make the bundle work, resiliency, triggers, keep state</td>
</tr>
<tr>
<td>Product bundle – deployment aspects (Ansible)</td>
<td>xCode and Package application deployment and installation</td>
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<tr>
<td>Container – internals, fit for infra, fit for cluster</td>
<td>vDCM, VMP Containerization Features</td>
</tr>
<tr>
<td>Container profiling</td>
<td>VQ, Density</td>
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</tbody>
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Blueprint Package Contents

- Solution Bundle: Video Use Case covered
- Solution Bundles aggregates scalable micro-services into the video processing use case
- Resiliency of the Video Use Case (SCFD, traditional 1:1, N:M)
- Deployment scripts of the Containerized Applications
- Infrastructure
- Profiling

Example:
- ABR xCode + Package
- Single Channel Fault
- Openshift / Kubernetes
- Bare Metal or VMs
- # Channels
Single Channel Fault Domain

- Cloud Native Workflows can reduce the fault domain and protect channels.
- Simpler with containers than with appliances.
- The ability to recover channels whilst not affecting other channels.
- End to End automated deployment of channels and lights out recovery in the event of disaster.
- The same software stack can be deployed on or off premise, further reducing risk and support.
- Version control of channel configurations using software engineering best practices.
Linear ABR Bundle
Single Channel Fault Domain (SCFD)

- Every channel has an own “pipeline”, duplicated in 2 clusters.
  - Swimming lane consists of: Resilient RX + xCODE, LP, Smart Origin with RA, JITP, DRM Encryptor
  - Single channel fault domain (SCFD) -> no sharing of PODs having a dataplane effect.
  - Deal with Packet drops: minimize network streams + recover (RTP FEC or other forms)
  - 2 swimming lanes are synchronised at video, audio and segment level

- Load Balancer pulls content of the 2 swimming lanes on a per channel base
Linear ABR Bundle
Deploy and Provision -- Ansible Playbook

- Setup of end-to-end service flow based on an inventory file
  - Signal reception ➔ multicast (w/wo FEC), unicast, zixi receiver
  - Transcoding ➔ linear, ABR
  - Packaging
  - DRM encryption
- How do I want to configure these steps
Live Streaming Metrics and Diagnostics

- Logging and Monitoring through separate stack
- Dev teams provide well-formatted logs and APIs for metrics/health
- Dev and Ops teams collaborate on useful logs, metrics, checks, etc.
- Choose right tools for right job: container engine, container orchestration, container metrics, CI/CD, dashboards
Summary
Cloud Native Workflows, key Takeaways

- **Containerized Dataplane architecture blueprints**
  - Support both On-Prem and Off-Prem Deployment
  - Public cloud example use cases are disaster recovery or pop-up where extra capacity is spun up when needed
  - Same architecture for Service and Content Provider
  - Rapid reorganization of workloads
  - Consistent repeatable deployments in different environments

- **Deployment and Provisioning**
  - Cisco’s video dataplane uses Kubernetes (K8s) as standard orchestration engine
  - Cisco’s containerized dataplane blueprint, is architected around the support of OpenShift as Kubernetes reference.
  - OpenShift allows its minions (workers) to deploy on bare-metal nodes, avoiding VM CPU penalty for video processing application
  - A containerized video processing application is a concatenation of individual containerized smaller applications (micro functions).
  - To be able to create such an application, you typically have “deployment” and “provisioning” services
  - Products become micro-services and are shipped with the necessary deployment documentations and scripts
  - Scripts can be automated using Ansible Playbooks.
  - One can use both “deployment” and “provisioning” in single Playbook(s) or you can deploy independent of the provisioning.
Next Steps

• Meet us: IBC 2018
  • September 13–18, 2018 Amsterdam, Netherlands
  • Hall 1 Booth A71

• Learn more: https://www.cisco.com/go/infinitevideo
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