Content Delivery Networking

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EMEAR SP Video

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Cisco Investment
Leading Innovation in Video
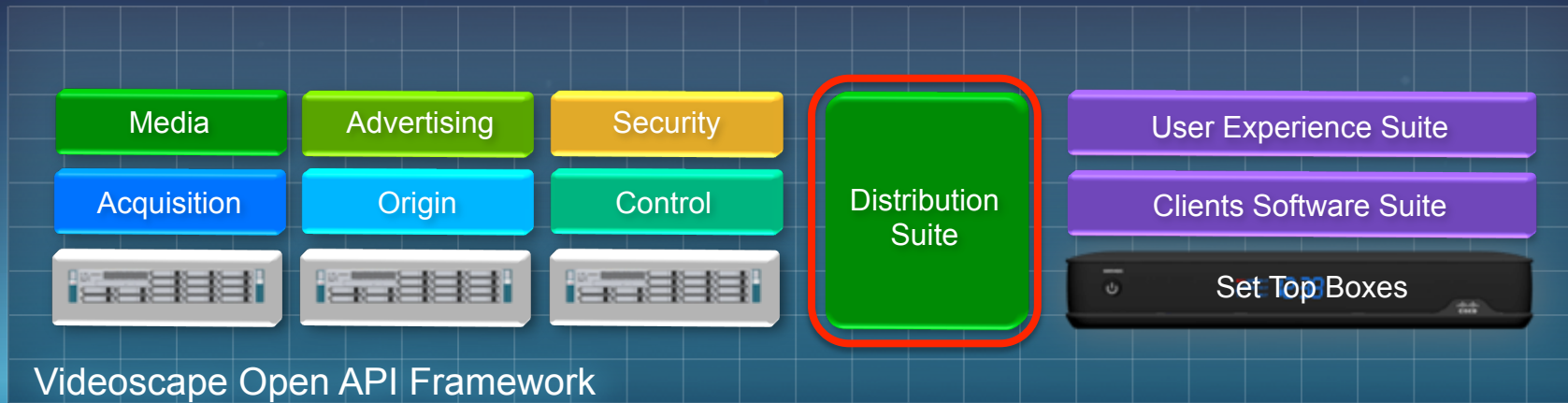
30+ Offices and R&D Centers

8,000+ Video Professionals

Not an exhaustive list

Over 200 Customers Deployed in over 300M homes

Videoscape Modular & Open Platform

Media	Advertising	Security	Distribution Suite	User Experience Suite
Acquisition	Origin	Control		Clients Software Suite
				Set Top Boxes

Videoscape Open API Framework

Personalized

Synchronized

Social

New & Unimagined

Cisco has a long history in Content Delivery Networks

✓ Many customers

Global CDN Customers	Deployed Streaming Capacity	Global CDN Services in Production
120	16,000+ Gbps	Retail CDN. Wholesale CDN, CatchUpTV, cDVR, Enterprise Video

✓ A selection...

Cisco Videoscape Distribution Suite (VDS) Portfolio
Comprehensive Solution for CDN, Cloud Services, Analytics, Transparent Cache

Cisco VDS Service Manager (VDS-SM)
Analytics and Monitoring

| VDS-SB Service Broker	VDS-IS Internet Streaming	VDS-TV Television	VDS-TC Transparent Caching	Video Quality Experience
• CDN Service Selector • CDN Service Broker • CDN Federation	• Retail CDN (B2C) • Wholesale CDN (B2B2C) • IP-based managed content across devices	• VOD, TSTV for TV • Cable & Telco MPEGP2TS	• OTT Content for PC, TV • Peer and Edge Cache	• Rapid Channel Change • Error Repair • For multicast video

VDS Hardware Portfolio
UCS Servers & Blades, CDE-250 Appliance, Nexus and Catalyst Switches + 3rd Party hardware support

Complements Cisco IP Network (Core, Aggregation, Access, Wireline, WiFi, 3G, 4G)

Cloud

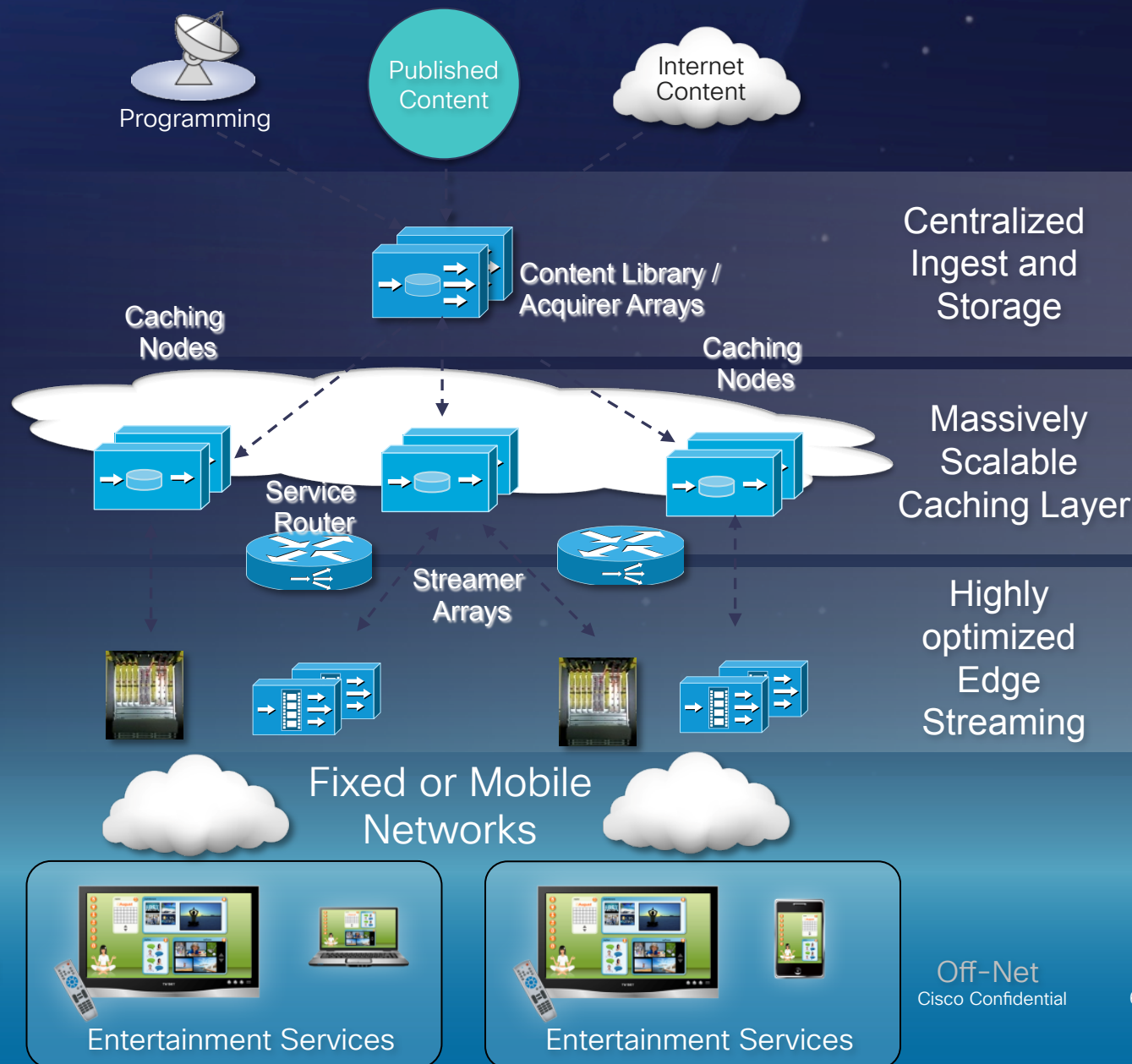### Bridging Cloud and Network

Network
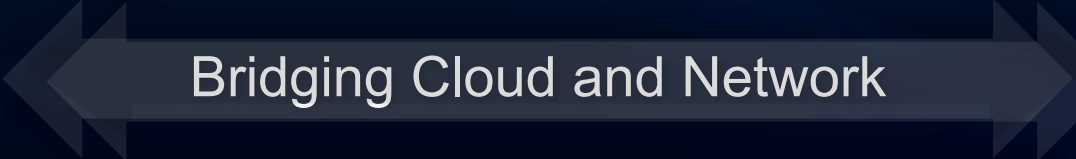
CDN Architecture

Acquires Content in Multiple Formats for Live and On-Demand

Independent Scalability of Content Delivery Functions

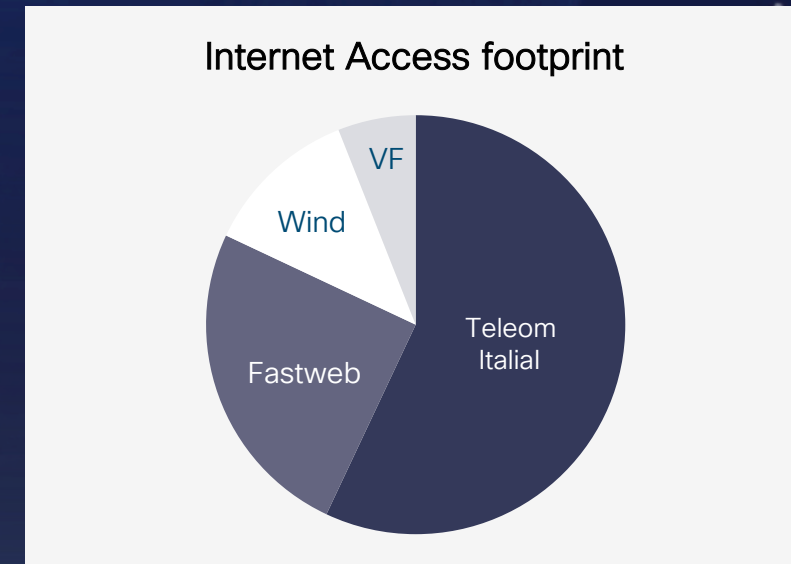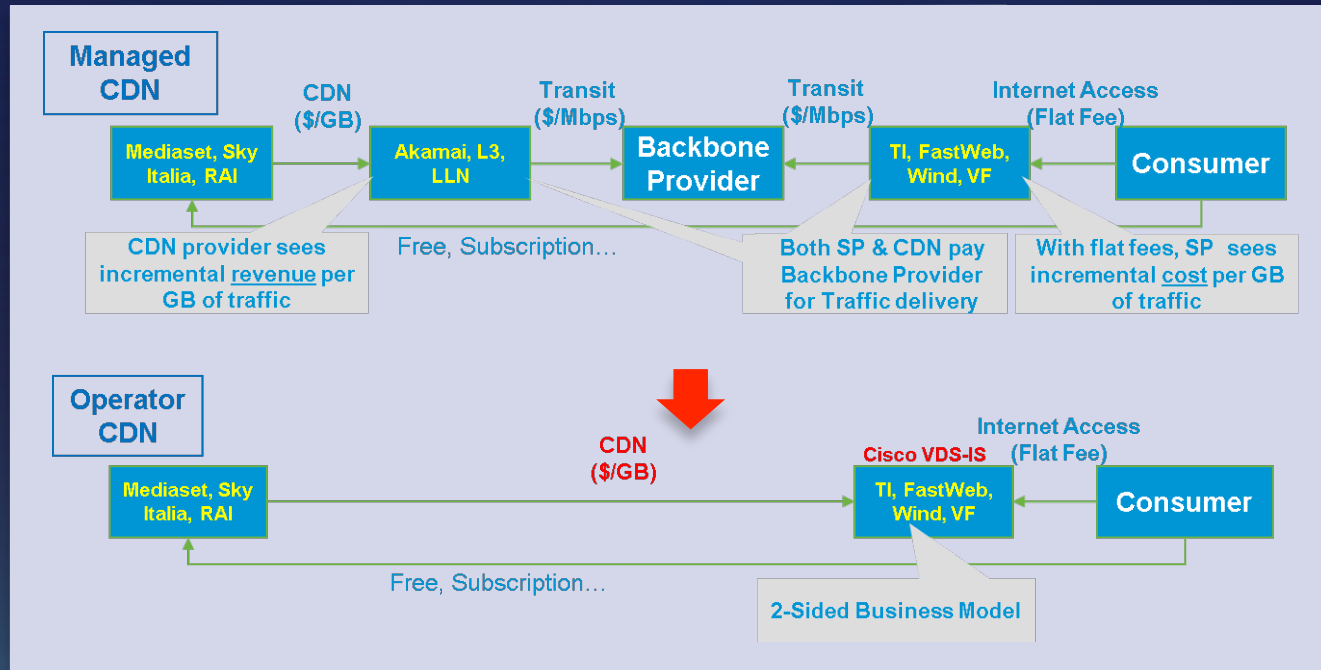Low Latency Content Propagation for On-Demand and Live

Non-stop Service Availability through Advanced Resiliency

Intelligent Service Routing for Global Network

Programming

Published Content

Internet Content

Content Library / Acquirer Arrays

Centralized Ingest and Storage

Caching Nodes

Caching Nodes

Massively Scalable Caching Layer

Service Router

Streamer Arrays

Highly optimized Edge Streaming

Fixed or Mobile Networks

On-Net

Off-Net

Entertainment Services

Entertainment Services

Italian CDN Market Evolution
Case Study

Managed CDN

	CDN ($/GB)	Transit ($/Mbps)		Transit ($/Mbps)		Internet Access (Flat Fee)	

Mediaset, Sky Italia, RAI → Akamai, L3, LLN → Backbone Provider ← TI, FastWeb, Wind, VF ← Consumer

CDN provider sees incremental <u>revenue</u> per GB of traffic

Free, Subscription…

Both SP & CDN pay Backbone Provider for Traffic delivery

With flat fees, SP sees incremental <u>cost</u> per GB of traffic

Operator CDN

CDN ($/GB)

Cisco VDS-IS

Internet Access (Flat Fee)

Mediaset, Sky Italia, RAI → TI, FastWeb, Wind, VF ← Consumer

Free, Subscription…

2-Sided Business Model

Internet Access footprint

Pie chart segments: VF, Wind, Fastweb, Teleom Italial

Telecom Italia

www.yalp.it

- Video content live and on-demand on PCs
- "Community TV": offers consumers the creation, publication and sharing of their own TV channel
- Major national and international TV channels
- On-demand: thousands of movies, programs, music, news, sports
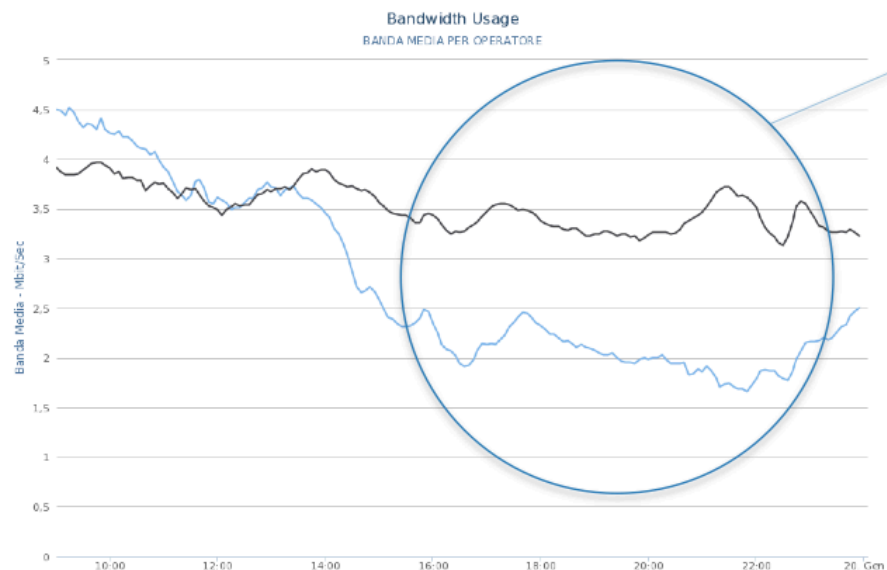- For all broadband subscribers in Italy

inCUBOVISION   TV E MOLTO DI PIU'

Yalp!

Global vs Local CDN Services

A local CDN, geographically distributed in a local ISP network, can offer better performances, bringing our content nearer to final users

A higher and stable bandwidth/quality can be guaranteed to the ISP broadband customers
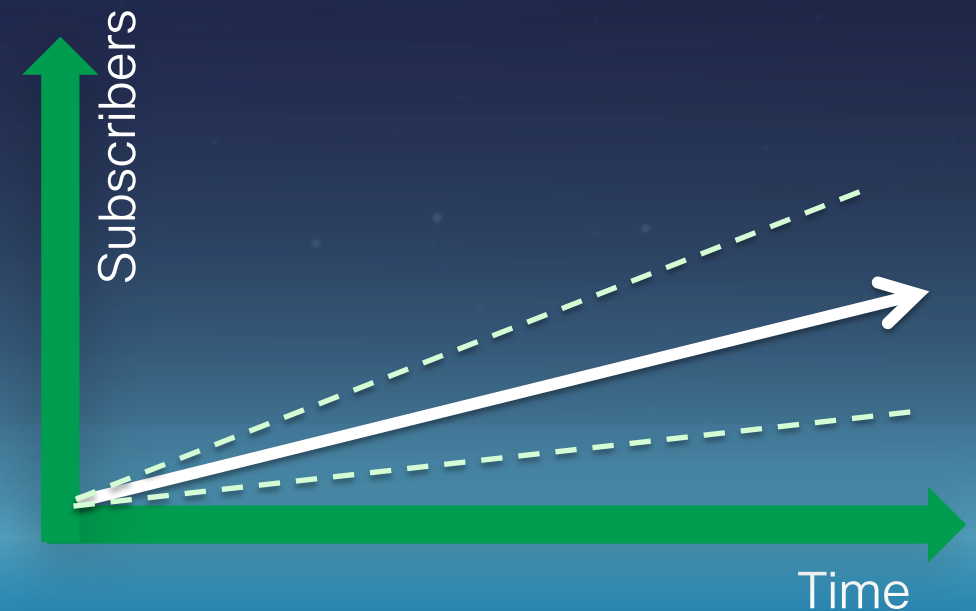
— Global CDN service
— Local ISP CDN

⚠️ Few ISP in Italy have not a CDN services

Beating the statistics

Early days of Content Delivery Network

- In the early days of CDN, the subscriber growth was linear over time

- Most streaming was directly linked with revenue

- As a result, CDN utilization and investment was predictable with cost and revenue aligned

Subscribers

Time

But …..

- In the early days of CDN, the subscriber growth was linear over time

- A STB was needed, and that was also the physical limitation

- As a result, CDN utilization and investment was predictable and could be continuously expanding

The world of video has changed significantly over the last couple of years
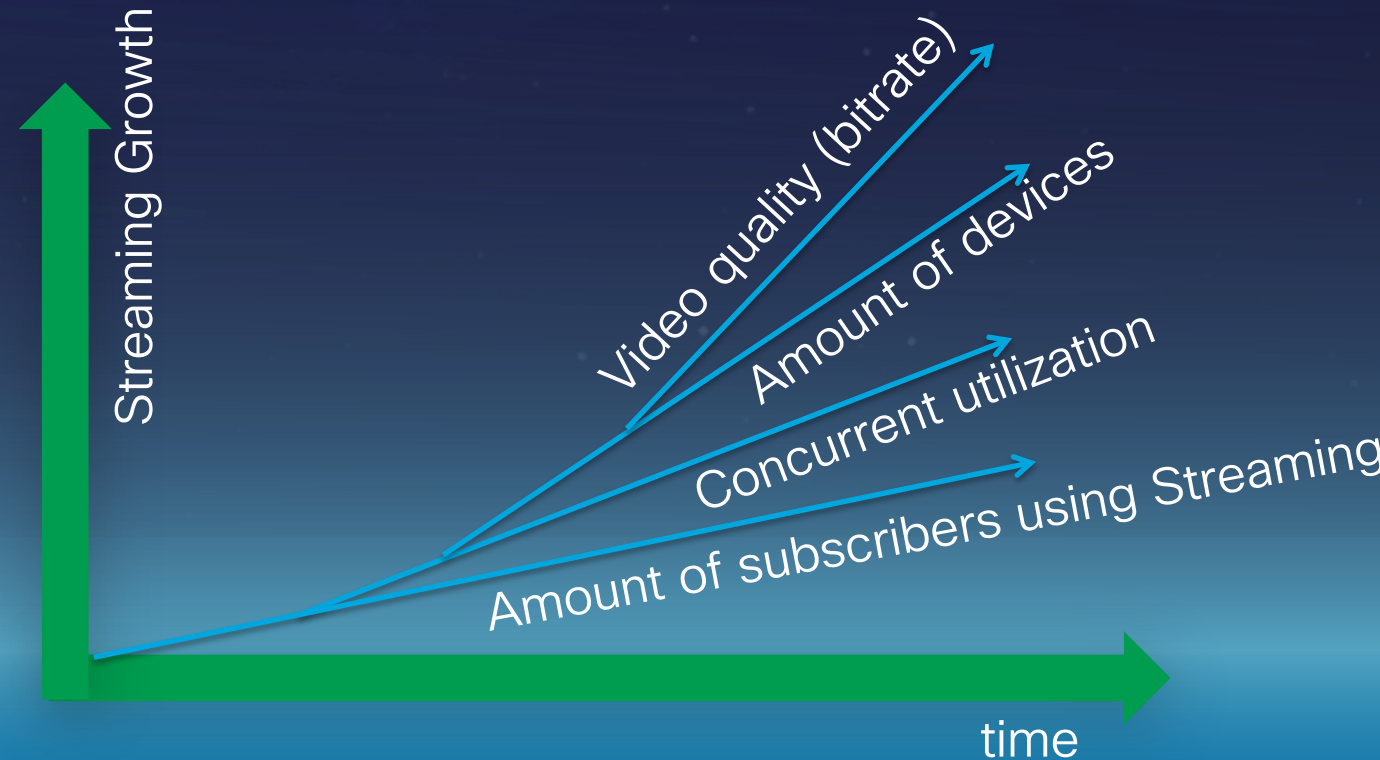
Subscribers

Time

164

7

23

Video Industry
Transforming

120

Impact to the CDN

- Amount of subscribers using the CDN
- Concurrent utilization
- Amount of devices
- Video Quality / Bit Rate

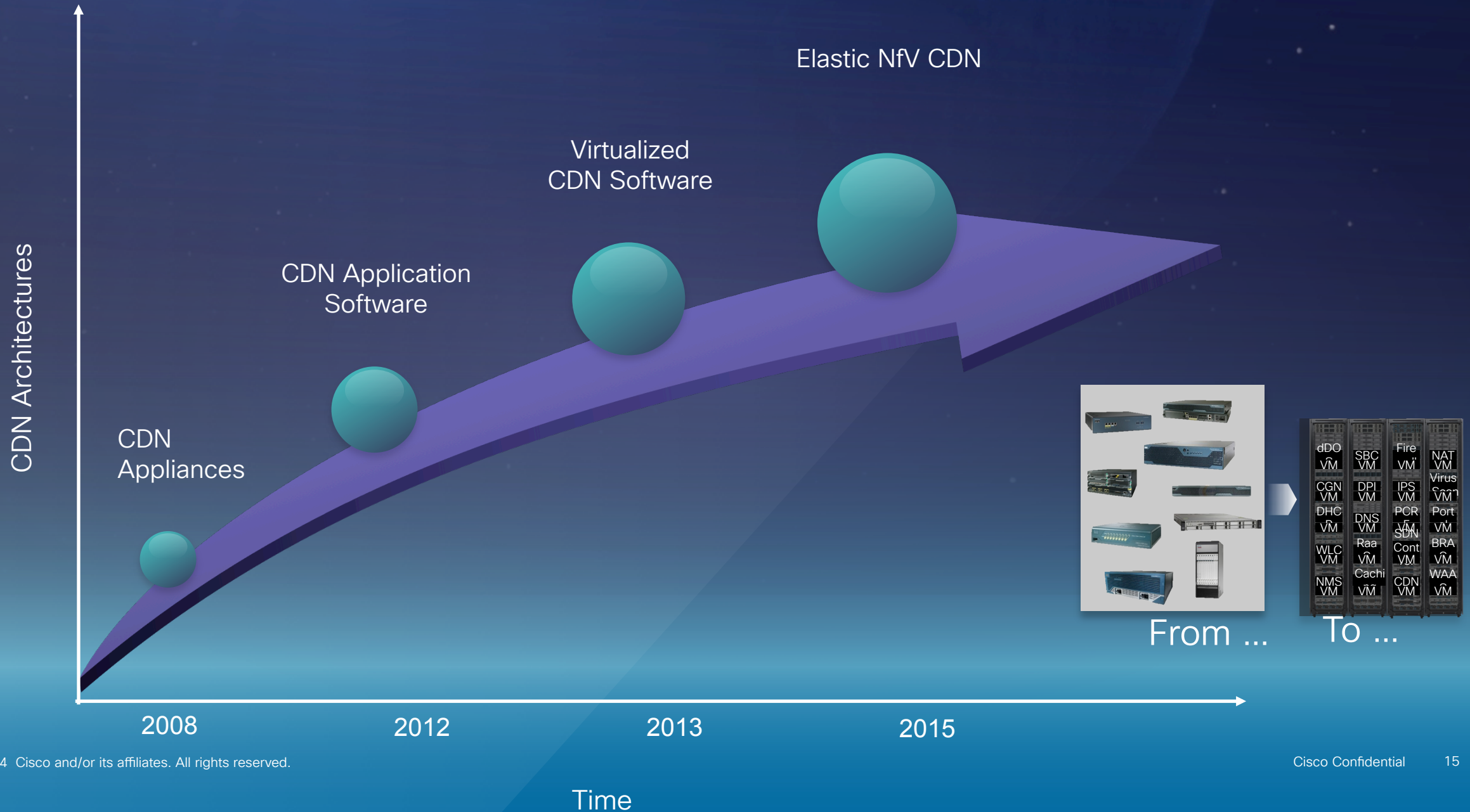Income not linked to usage

New pricing models and efficiency required

Streaming Growth

Video quality (bitrate)

Amount of devices

Concurrent utilization

Amount of subscribers using Streaming

time

Content Delivery Networks are evolving

Cisco vCDN Evolution

Elastic NfV CDN

Virtualized
CDN Software

CDN Application
Software

CDN Architectures

CDN
Appliances

From ...   To ...

dDO VM	SBC VM	Fire VM	NAT VM
CGN VM	DPI VM	IPS VM	Virus VM
DHC VM	DNS VM	PCR VM	Port VM
WLC VM	Raa VM	SDN Cont VM	BRA VM
NMS VM	Cachi VM	CDN VM	WAA VM

2008   2012   2013   2015

Time

Network Functions Virtualization (NFV)

NFV = Transition of network infrastructure services to run on virtualised compute platforms leveraging IT automation
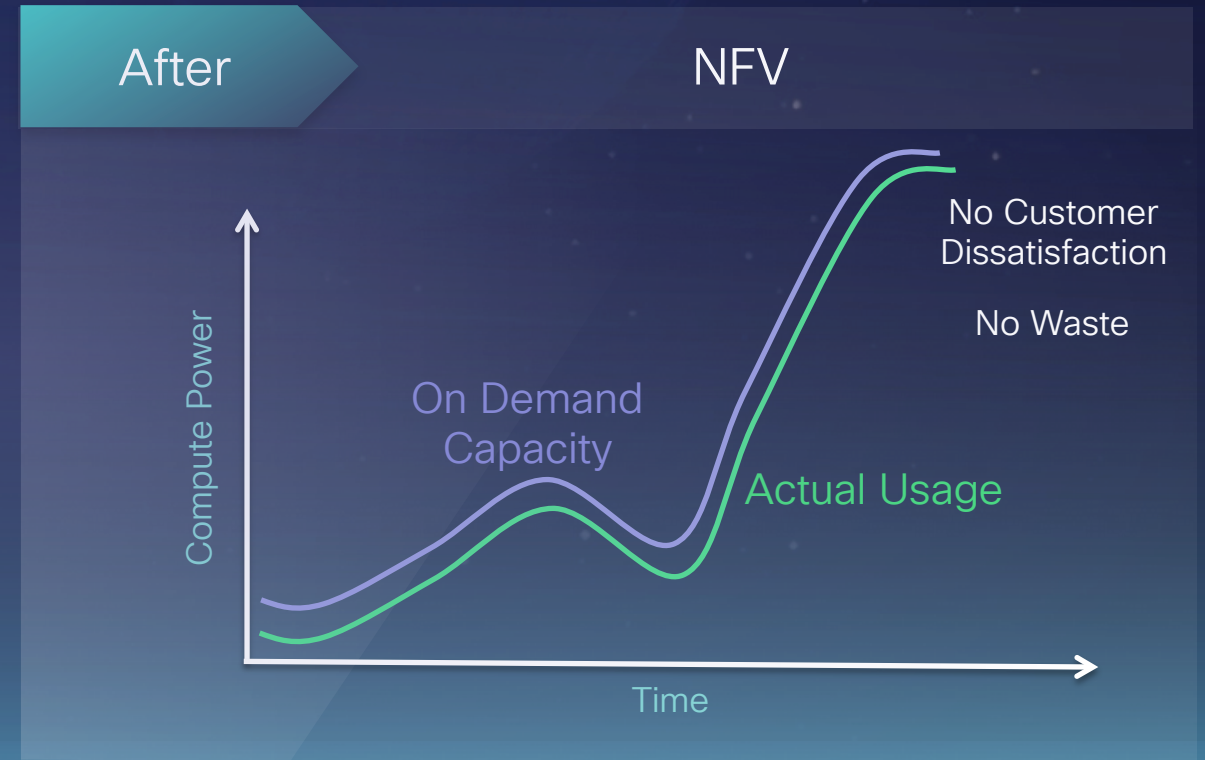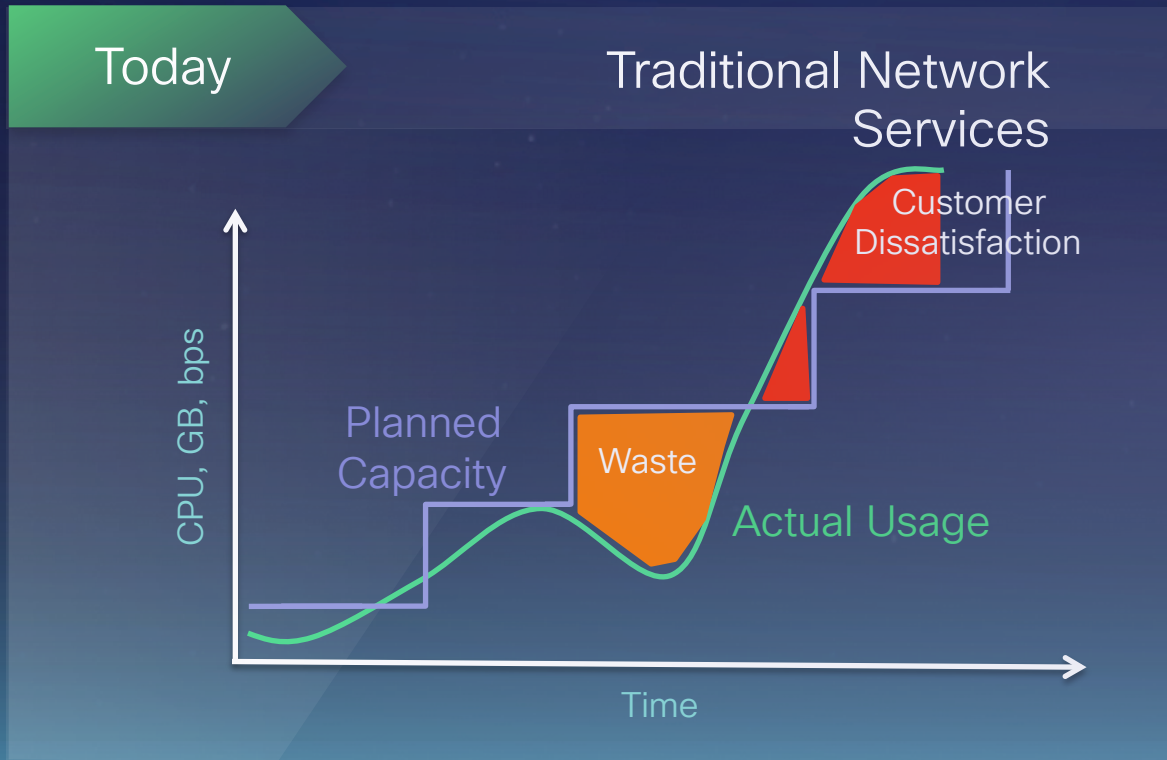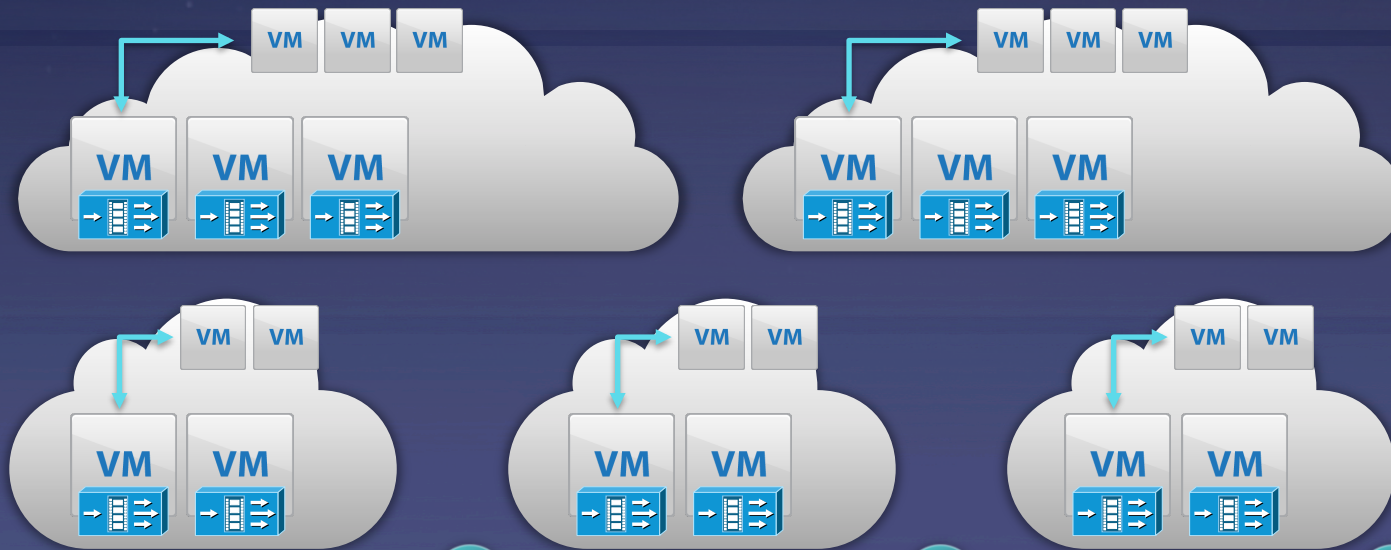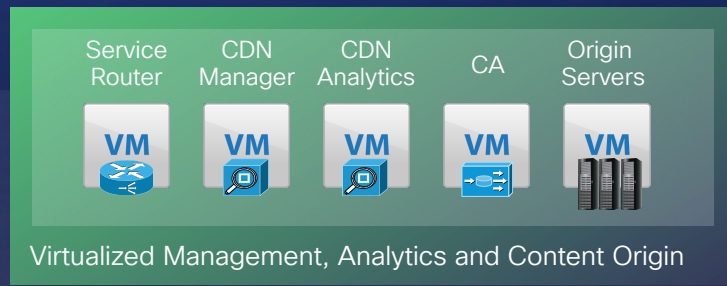
From...

To...

Network Functions Virtualization (NFV)
Value Proposition of Dynamic and Elastic Scale

Today — Traditional Network Services

CPU, GB, bps

Planned Capacity

Waste

Customer Dissatisfaction

Actual Usage

Time

After — NFV

Compute Power

On Demand Capacity

Actual Usage

No Customer Dissatisfaction

No Waste

Time

vCDN as an NFV Use Case

Service Router — CDN Manager — CDN Analytics — CA — Origin Servers

Virtualized Management, Analytics and Content Origin

National DC/POP

Regional POP

Local POP

openstack

vmware

NFVI

Compute

Storage

Network

Home

SP DC VMs

SP vCDN

Content is king

...but POPs are getting crowded

OTT Content is growing rapidly

Top 10 Sites Account for 60% of Video Traffic
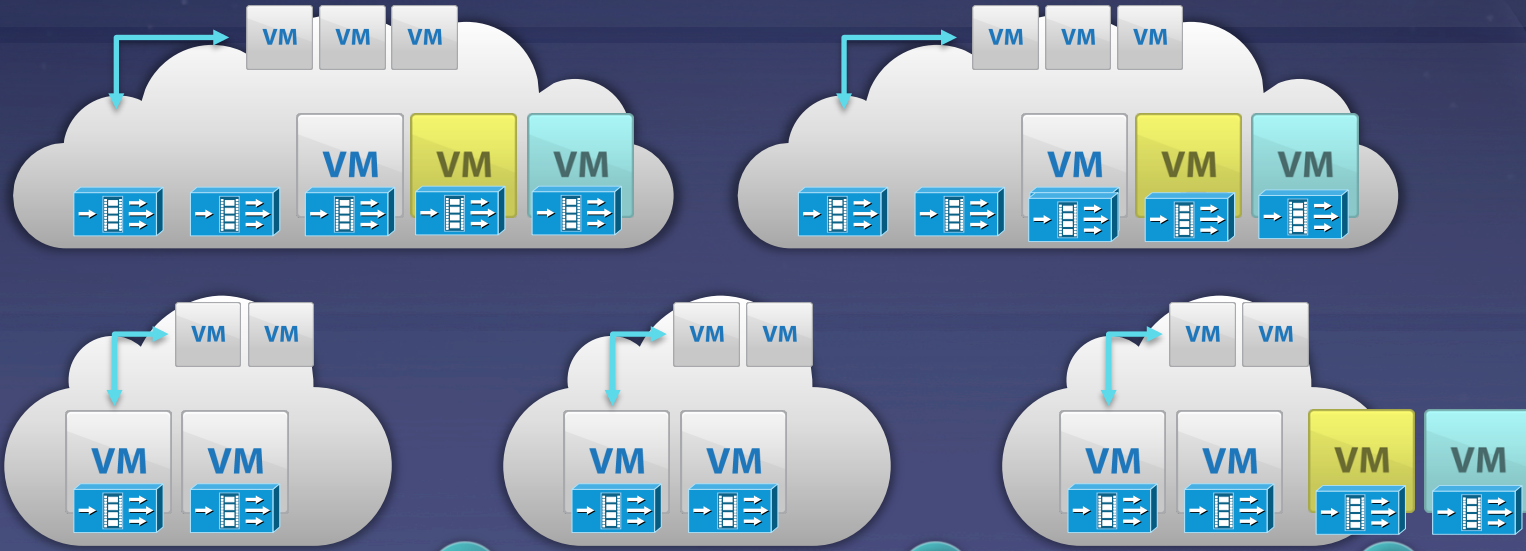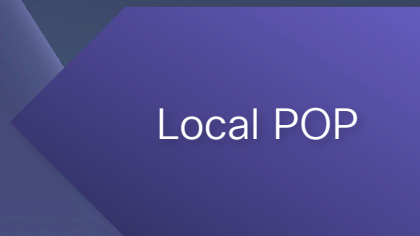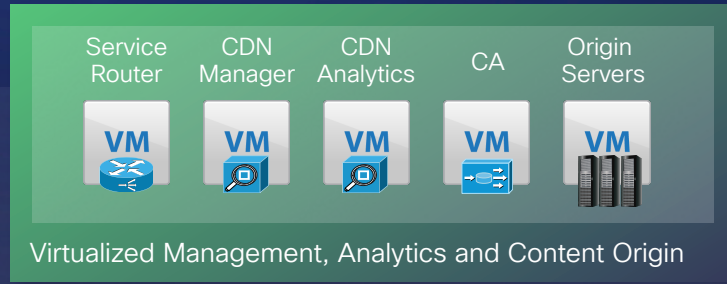
Exabytes per Month

Top Video Sites

- OTT video growing rapidly

- Large content providers increasingly building their own CDNs
  - NetFlix, Google. YouTube, Apple

- Content provider and OTT CDN caches going deeper into SP networks

- Proliferation – a zoo of CDN caches in SP POPs

- How to control the zoo?
  - CDN Federation
  - CDN Virtualisation

Apple's multi-terabit, $100M CDN is live—

Apple is still using Akamai and Level 3 CDN services for iTunes and app downloads, "but over time, much of that traffic will be brought over to Apple's CDN," Rayburn wrote.

Virtual CDN (vCDN)

More functionality is going deeper into the network

| Transcode | Capture | Encrypts | Ad Splices | Packaging | Playout |
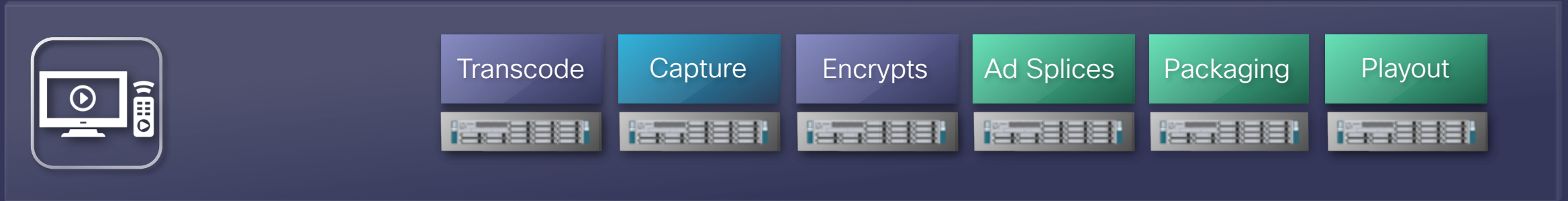
- In the old days, a CDN was a lonely device in the POP, its only friend the network

- Now more functionality is moving in the POP's
  - Multiple CDN
  - Video processing
  - Cloud Computing
  - Network Functions (VPN, DNS, Firewall, vRouters etc)

Virtualizing Video Processing

Applications

Live

Live to VOD

IOS VOD

cDVR

Orchestration

openstack™

OpenStack

Manageability and Quality Control

Orchestration

| Transcode | Capture | Encrypts |
| Ad Splices | Packaging | Playout |

Virtual Functions

Infrastructure

Compute

Network

Cloud DVR: Definitions and Benefits

Cloud DVR or Network PVR

Start-Over Restart TV

Time Shift TV Catch-UP Reverse EGP

Broadcast time
User Decision
Content Available

Broadcast time
User Decision
Content Available

Broadcast time
User Decision
Content Available
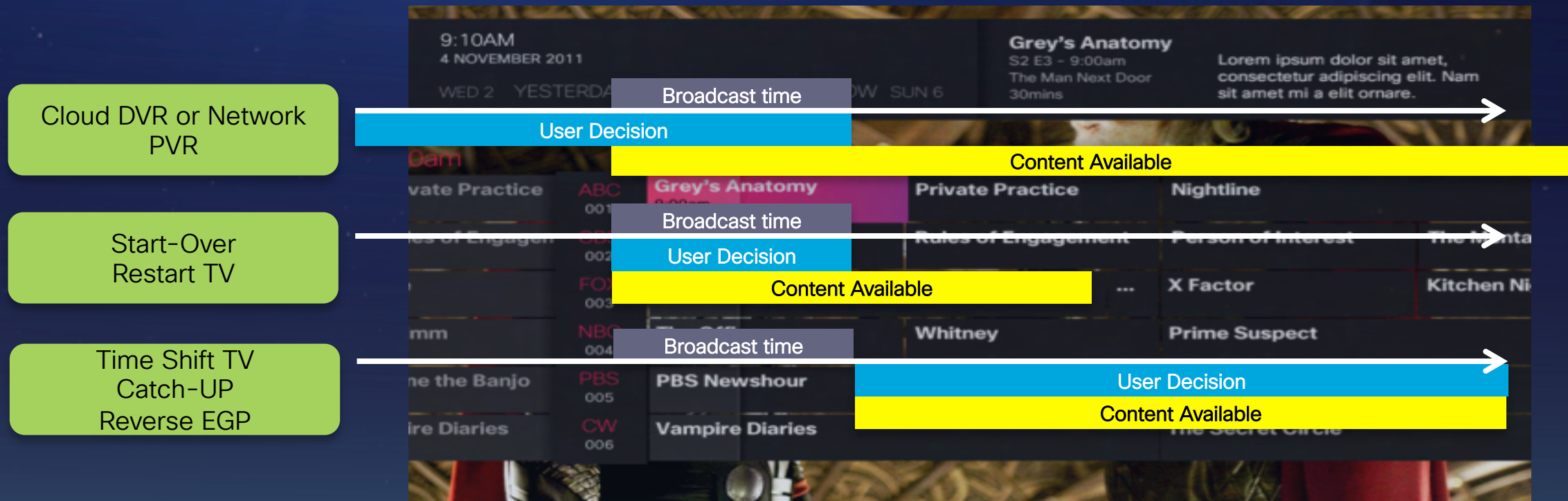
Advantages of cloud DVR

✓ STB CAPEX saving (No HDD, no or Single tuner)

✓ STB OPEX savings (less support calls, repairs and truck rolls)

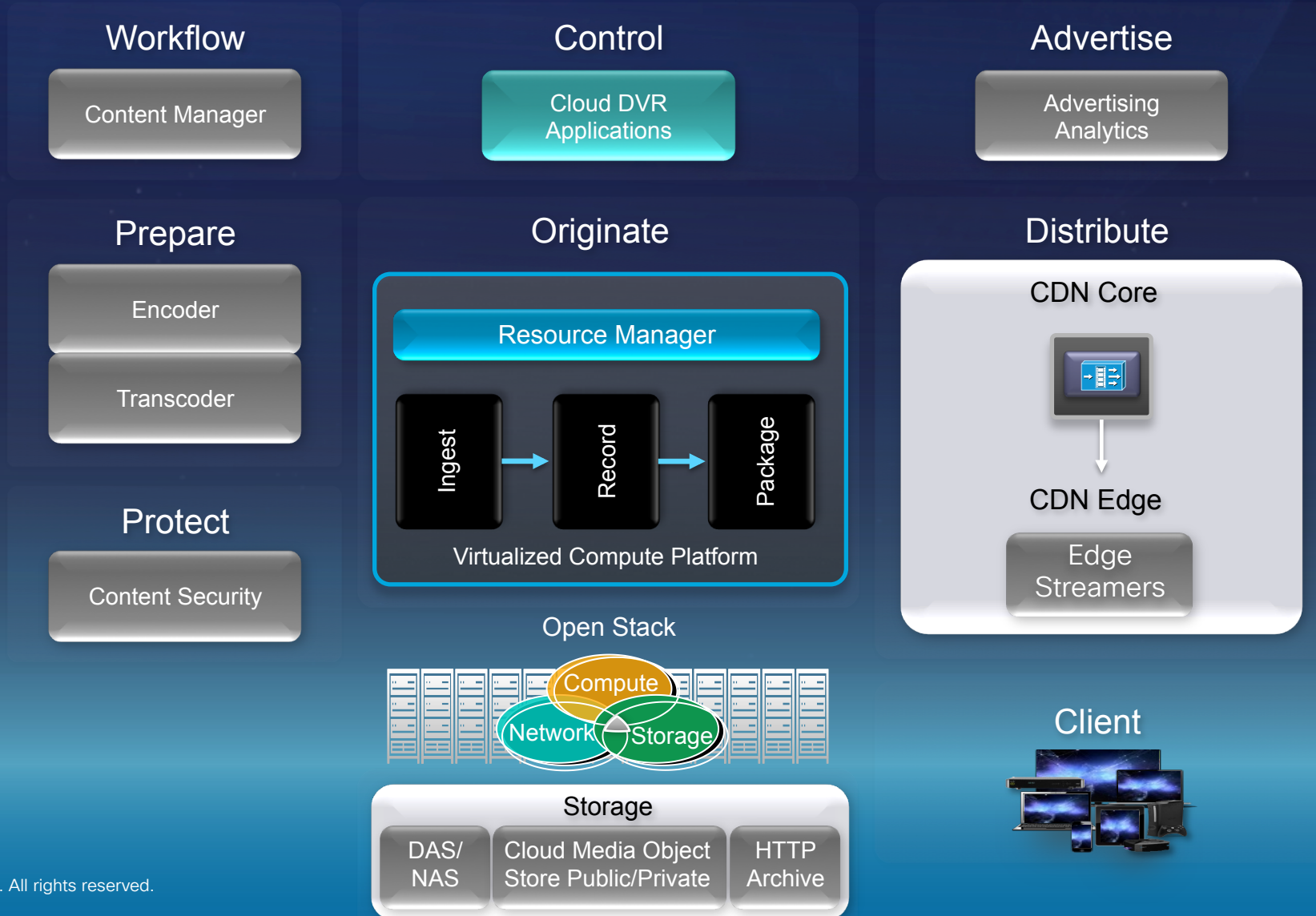✓ Able to upsell functionality (storage, tuners, 4k, synch and go ...)

✓ Availability on every device, everywhere

✓ Move to personalization (e.g. targeted advertisements)

Multiscreen Cloud DVR Ecosystem

Workflow

Content Manager

Control

Cloud DVR Applications

Advertise

Advertising Analytics

Prepare

Encoder

Transcoder

Originate

Resource Manager

Ingest → Record → Package

Virtualized Compute Platform

Open Stack

Compute

Network   Storage

Storage

| DAS/ NAS | Cloud Media Object Store Public/Private | HTTP Archive |

Distribute

CDN Core

CDN Edge

Edge Streamers

Protect

Content Security

Client

Streaming is part of a bigger Intercloud system

Native Cloud Applications

Enterprise Workloads

Big Data & Analytics

Video

Collaboration & Video

Collaboration

Intercloud

Enterprise Private Clouds

Portal

Partner Clouds

Intercloud Fabric

CISCO Cloud Services & Applications

APIs

CISCO Powered

APIs

Public Clouds

APIs

HCS

IaaS

PaaS

Microsoft Suite aaS

DRaaS

WebEx

Meraki

Security

Analytics

HANA aaS

vDesktop aaS

IOE aaS

Streaming

Microsoft Azure

amazon web services

Google

Proprietary or Open

Open components are still the strongest way forward

Multi-protocol support of traditional streaming technology and leading ABR Technology

Multi-Protocols

- ❑ The most common ABR formats are HLS/HSS and soon DASH
  - ❑ These run on TCP with all it's disadvantages

- ❑ Solutions start to become available that run UDP and multicast ABR
  - ❑ Advantage: better buffer management, possibility to do sort of error correction, possibility to do multicast, ….
  - ❑ Disadvantage: closed system that need proprietary adaptations to the gateway or routers. Different system, different rules

- ❑ Slowly open standards are being developed

- ❑ Cisco's philosophy is 100% openness, but as customer is king we can supply additional solutions today (ABR optimization and ABR multicast)

Technology does matter

CDE280

- High-performance CPU with 16 Cores
  - Promote high performance video streaming
- Industry-leading HTTP Adaptive Bit Rate stream density
  - 8 x 10 Gbps NIC with Etherchannel for up to 60 Gbps of Live HTTP Streaming
- Cache Storage with Flash memory SSD or HDD SAS
  - Flexible Options to optimize Price/Performance for Streaming & Storage
- High-efficiency redundant power supply
  - Dual AC or DC, high-efficiency for lower power consumption

Component	Specification
CPU	2 x Intel E5-2667 @ CPU 3.20 (16 Cores total)
Memory	96 Gbytes
Drive Bays (SFF)	24
SSD Options	240G, 480G, 960G
HDD SAS Options	600G, 1.2 TB
NIC	8 x 10GE Data
Boot Drive	2 X 480 GB 2.5 inch Enterprise Value 6G SATA SSD
RAID	Modular Controller with Memory for enhanced R/W

Still KEY to manage operations

- ✓ Density

- ✓ Power Consumption

- ✓ Monitoring System

- ✓ Flexibility

- ✓ Scalability

- ✓ Stability on full load

In reality those values make a BIG difference

Feature completeness

A Full feature set allows service providers to focus on their key business: delivering their desired content to their subscribers

Flexibility and neutrality is key to follow marketing demand

Key part of broader Videoscape portfolio

Multi-Media & Multi-Protocol

- VoD, Live, Download
- HTTP ABR (Apple, Microsoft, Adobe) , MPEG-DASH
- Windows RTSP and Adobe Flash RTMP

Multi-Device & Network

- STB's, TV's, Mobile, PC, Tablets, Consoles
- Wireline, WiFi, 3G, 4G Networks

Accurate Cache Selection

- Service Routing for Global & Local Load Balancing
- Static, Dynamic, and Geo-Location Based Routing

Flexible and Robust HW

- Scalable Solid State & HDD Caches
- Flexible Data Center Appliances
- Virtualised software – NFV & 3rd party hardware

Analytics & Reporting

- Rich real time content usage reporting
- Comprehensive analytics

Thank you.

CISCO