6CN Demos here (requires v6)

http://demo.6cn.solutions/

6CN

IPv6 Centric Networking

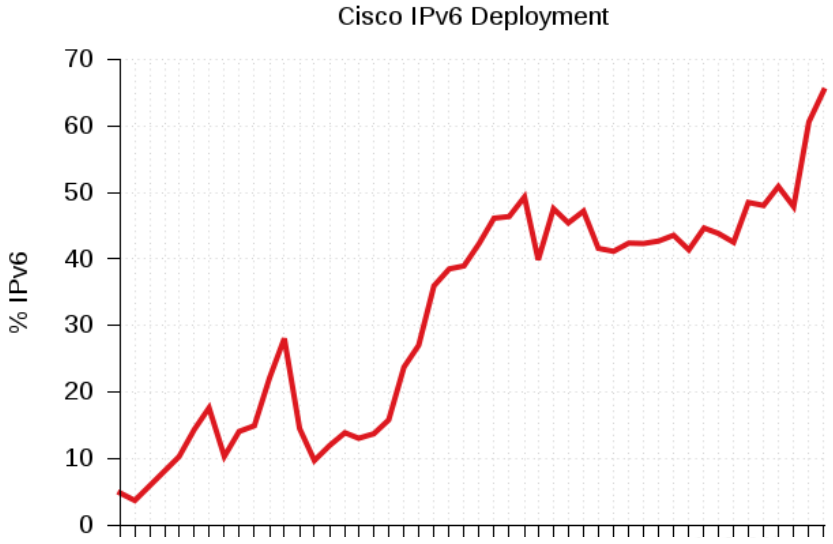
Six Centric Networking

Simplicity
Scale
Services
Security

W. Mark Townsley, Cisco Fellow

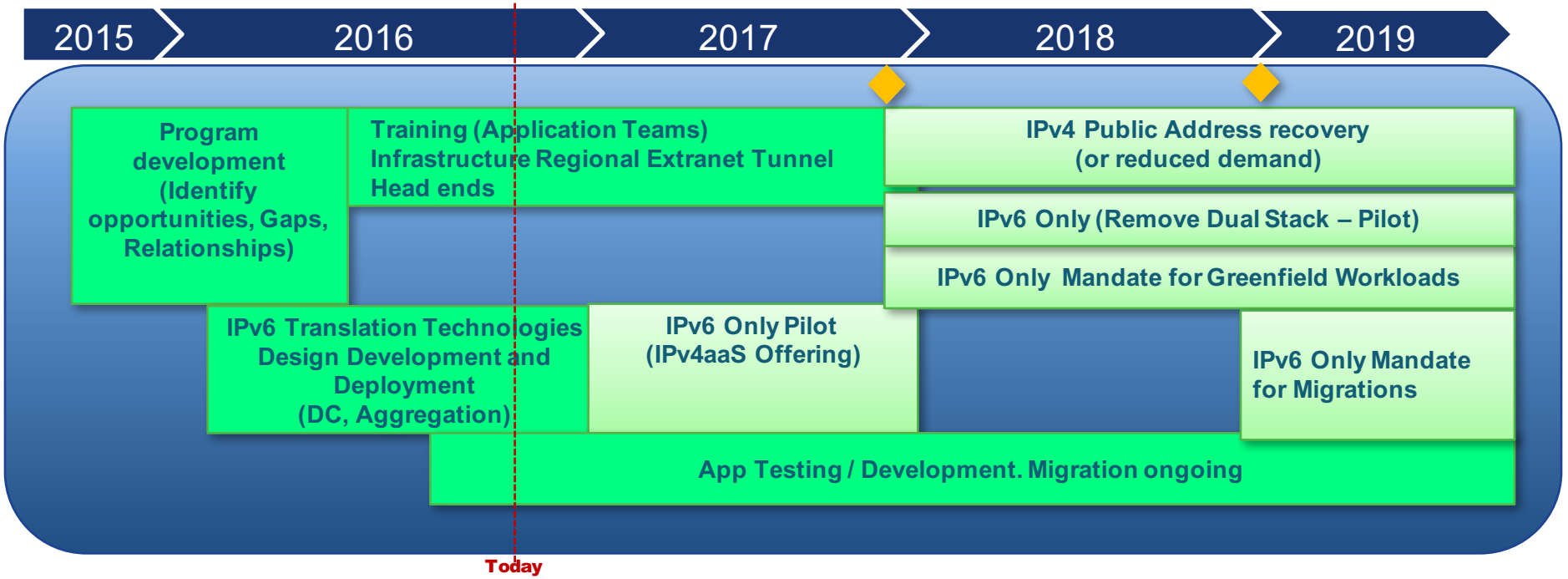
UK IPv6 Deployment Council Meeting, October 31, 2016

http://www.worldipv6launch.org/measurements/



47	Ziggo	9143	
48	Fastweb Spa	12874	
49	Tele2 AB	1257	
50	its communications Inc.(iTSCOM)	9365	
51	kt	4766	
52	Copel Telecomunicacoes S/A	14868	
53	Cisco	109	65.30%
54	Xfone 018	47956	19.37%
55	TIM Brasil	26615	5.37%
56	Chunghwa Telecom (HiNet)	3462, 9680, 17419	0.23%
57	BH Telecom d.d. Sarajevo	9146	7.40%

Towards IPv6 Only at Cisco



Contact: Khalid Jawaid (kjawaid) <kjawaid@cisco.com>

- *All dates and efforts subject to change*
- *2018 is an IPv6 Only DC Mandate for any new Apps*

PIRL – Paris Innovation & Research Lab

Research & Academic

The CHAIRS
- Ecole Polytechnique
- CESI
- Telecom ParisTech

RESEARCH PARTNERSHIPS
- System-X,
- INRIA-LHS
- PEC

Co-Innovation

2 Smart City Vertical Accelerators
Cisco Solution Garage
Co-innovation Projects - Workshops
Cisco CHILL

Open Innovation

Co & Post Acceleration with Key-Partners
- NUMA, X-Up
- Paris&Co, SO DIGITAL

CISCO FRANCE Hackathons & Switch-up Challenge

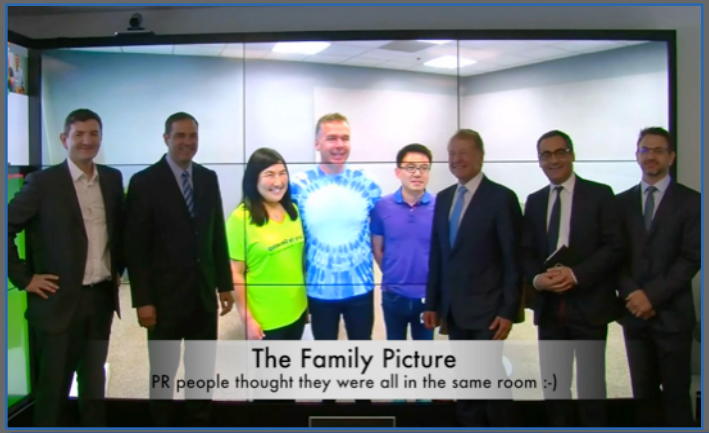
DEVNET & OpenSource

62 startup monitored
15 engaged / 5 Co-acceleration

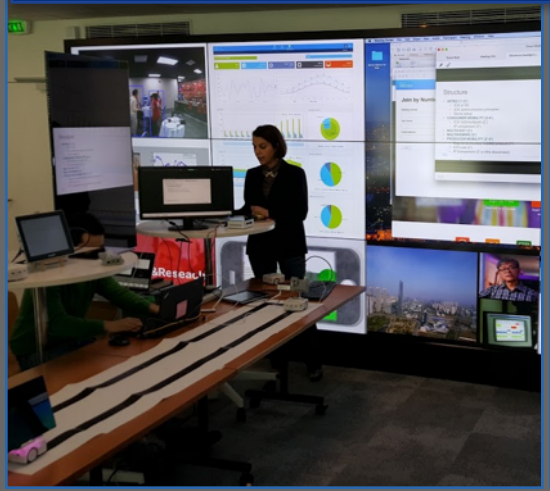
PIRL

CTO

development / engineering

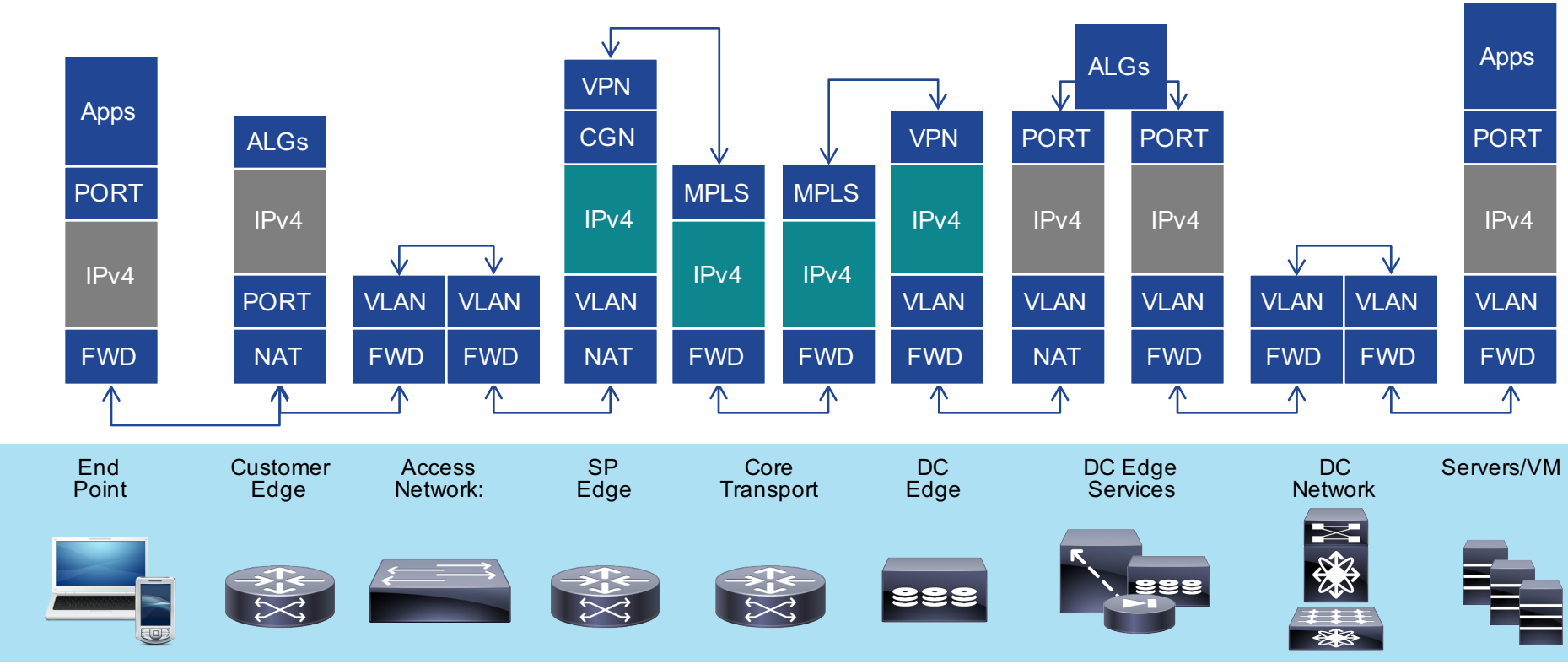


PIRL Immersive Laboratory for Advanced Media Production and Distribution



Cisco – Ecole Polytechnique Networking Innovation and Research Symposium

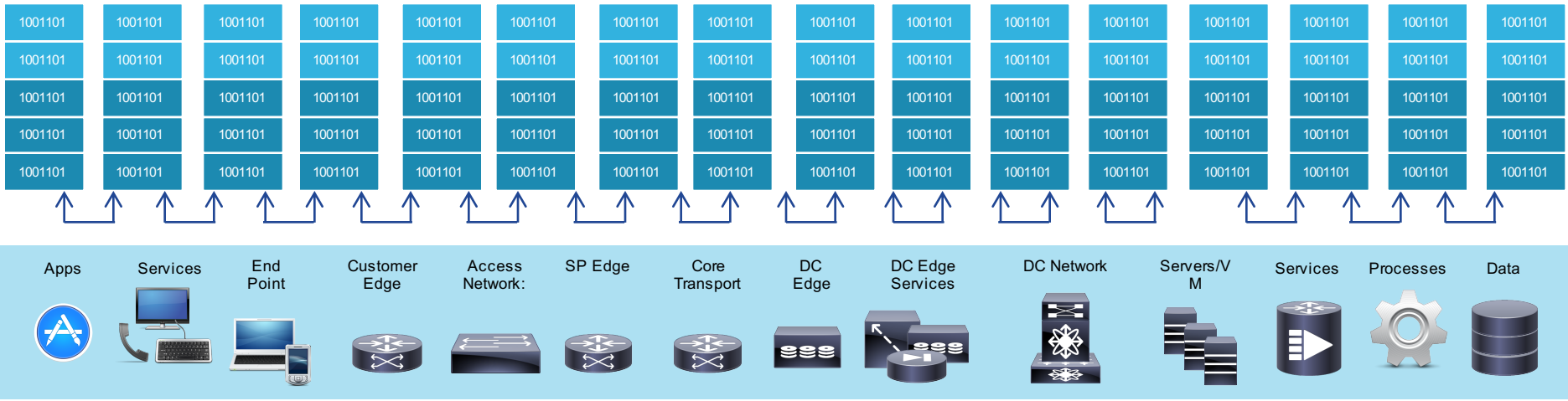
7th and 8th March 2016
Paris Innovation and Research Lab (PIRL)
http://pirl.tech/symposium


Apps
PORT
IPv4
FWD
ALGs
IPv4
PORT
NAT
VLAN
FWD
VLAN
FWD
VPN
CGN
IPv4
VLAN
NAT
MPLS
IPv4
FWD
MPLS
IPv4
FWD
VPN
IPv4
VLAN
FWD
ALGs
PORT
IPv4
VLAN
NAT
PORT
IPv4
VLAN
FWD
VLAN
FWD
VLAN
FWD
Apps
PORT
IPv4
VLAN
FWD
End Point
Customer Edge
Access Network:
SP Edge
Core Transport
DC Edge
DC Edge Services
DC Network
Servers/VM

IPv6 Centric Networking - Simplicity

Creating a global conduit of shared information touching applications, services, networks, processes, data…

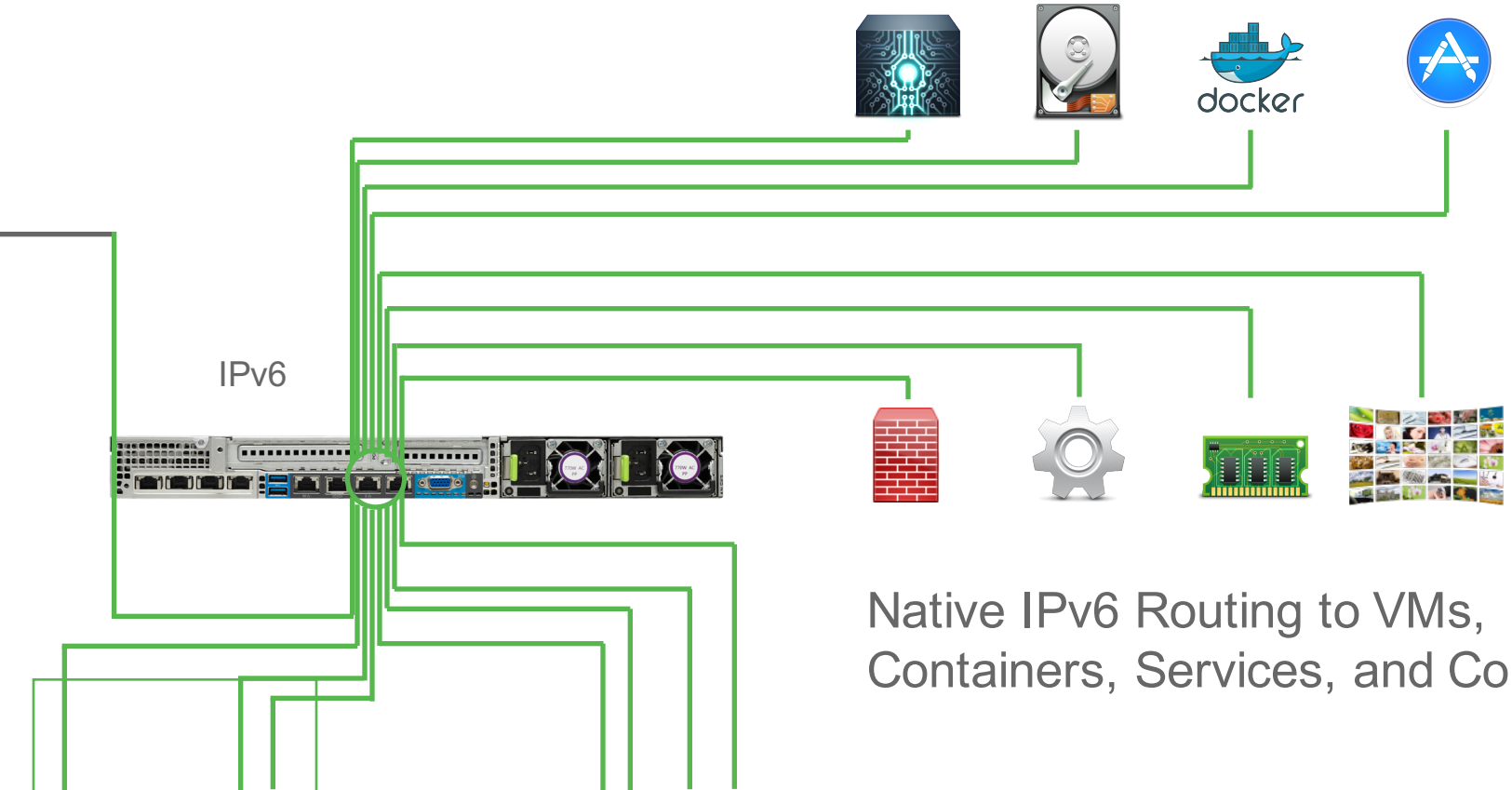
While Collapsing Layers of Complexity…



Scale


IPv6 Source Address (128 bits)
IPv6 Source Address (128 bits)
IPv6 Source Address (128 bits)
IPv6 Destination Address (128 bits)
IPv4 Destination Address (32 bits)
IPv6 Destination Address (128 bits)
IPv6 Destination Address (128 bits)
IPv6 Destination Address (128 bits)
IPv6 Source Address (128 bits)
IPv6 Segment Routing (128 bits)
IPv6 Segment Routing (128 bits)
IPv6 Segment Routing (128 bits)
IPv6 Segment Routing (128 bits)
IPv6 Segment Routing (128 bits)
IPv6 Segment Routing (128 bits)
IPv6 Segment Routing (128 bits)
IPv6 Segment Routing (128 bits)

IPv6 - Routing past the Interface

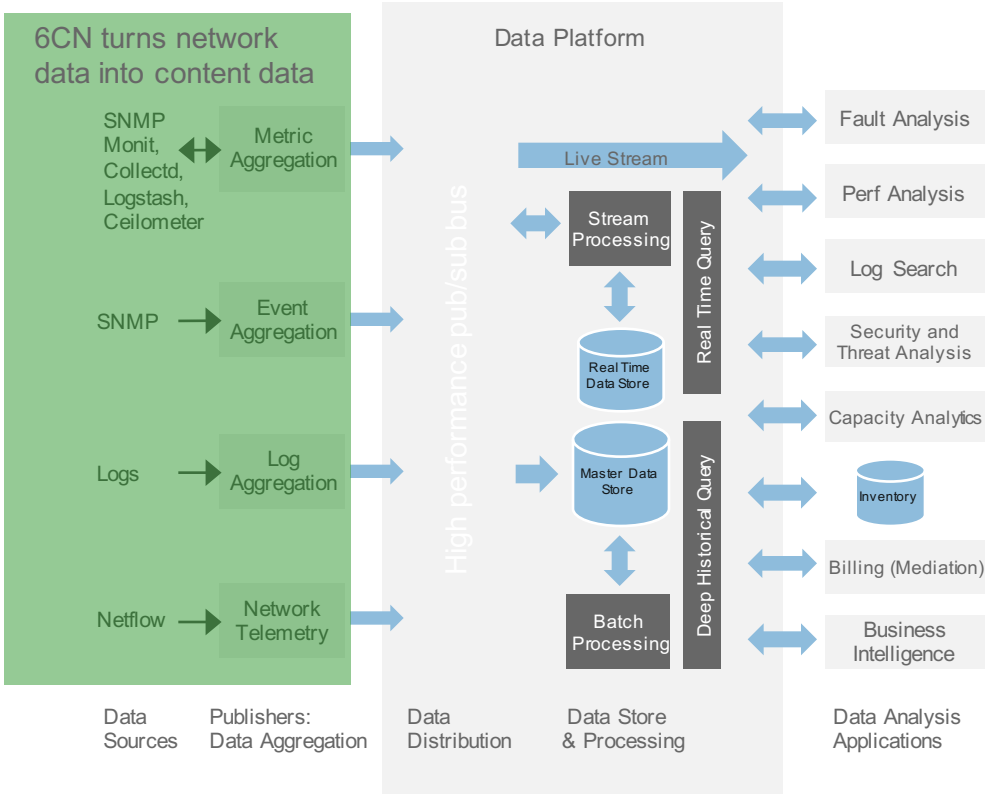


Native IPv6 Routing to VMs,
Containers, Services, and Content

What is PNDA?

- Open source Platform for Network Data Analytics
- Aggregates data like logs, metrics and network telemetry
- Scales up to consume millions of messages per second
- Efficiently distributes data with publish and subscribe model
- Processes bulk data in batches, or streaming data in real-time
- Manages lifecycle of applications that process and analyze data
- Lets you explore data using interactive notebooks

PNDA Platform For Net Data Analytics http://pnda.io/

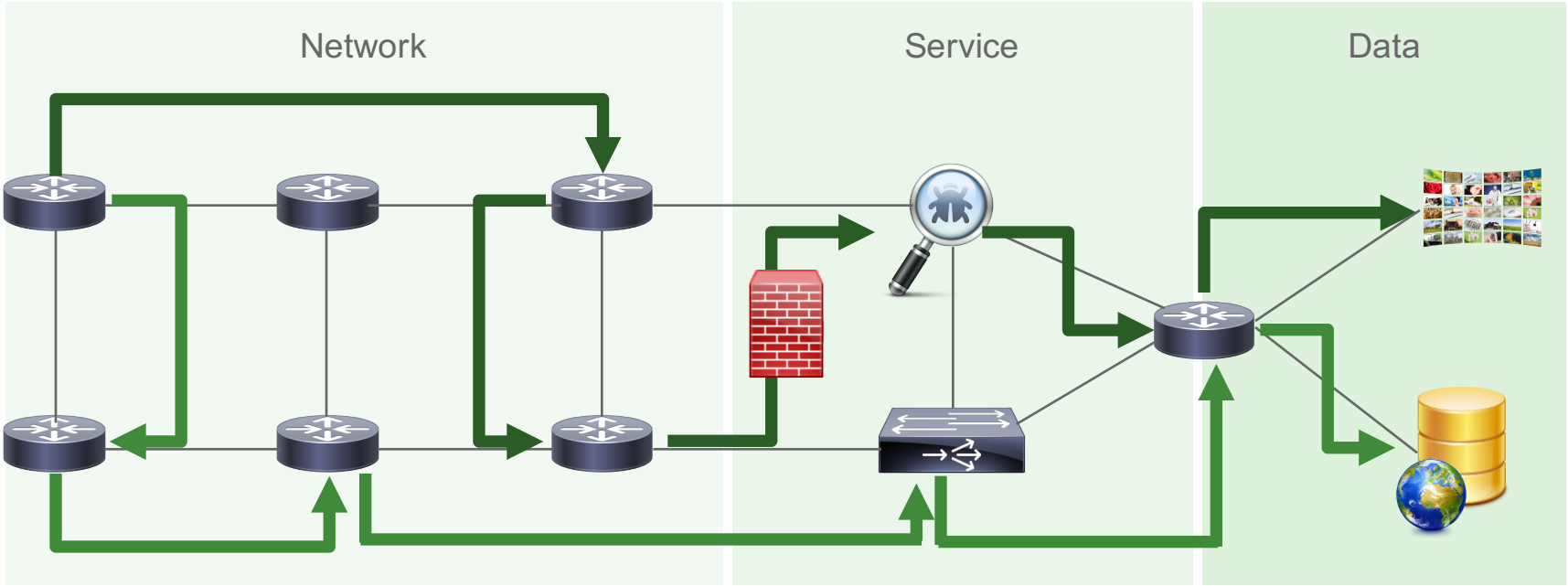


Principles

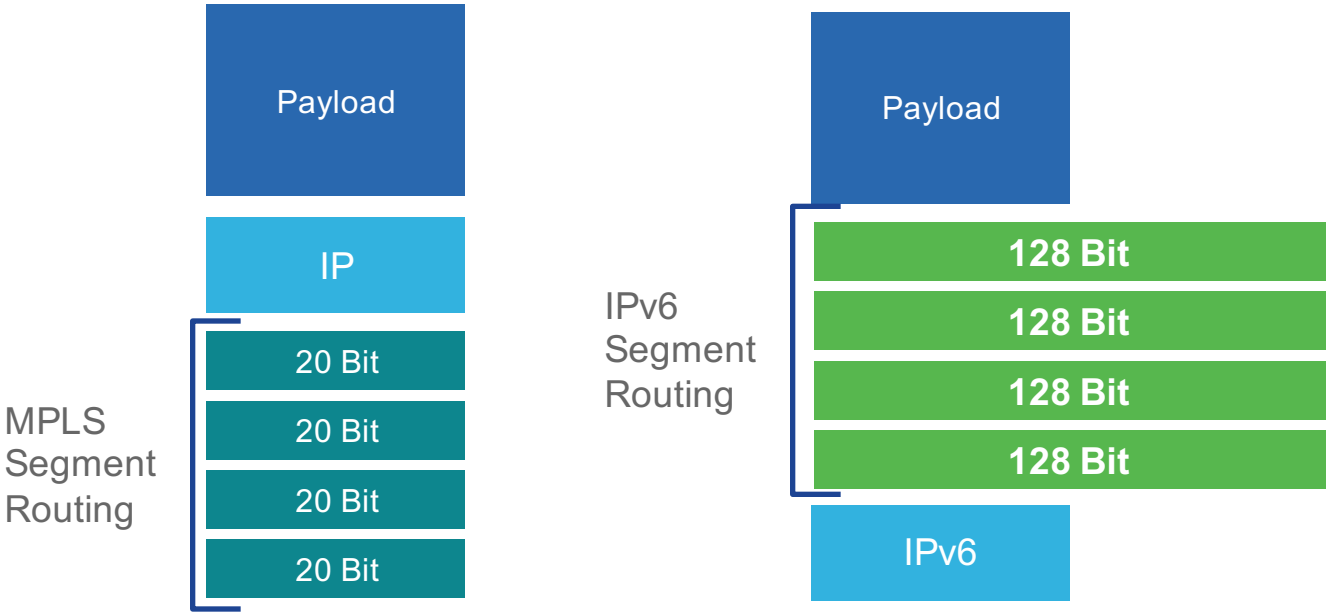
- Decouple data aggregation (publishers) from data analysis (consumers) – allow any OSS app the potential to access any data source
- Simple, scalable, open data distribution platform
  - Scale-out architecture with support for horizontal scale in all core components
  - Very highly available core platform
  - Low and predictable latency
- Immutable Dataset
  - All data stored raw
  - Minimal filtering/processing on ingress
- Minimal filtering/processing on ingress
- Analytics based approach to analysis functions
- Support for streaming apps, real-time queries and batch processing

IPv6 Segment Routing

Stack of 128-bit Segment IDs within the IPv6 header



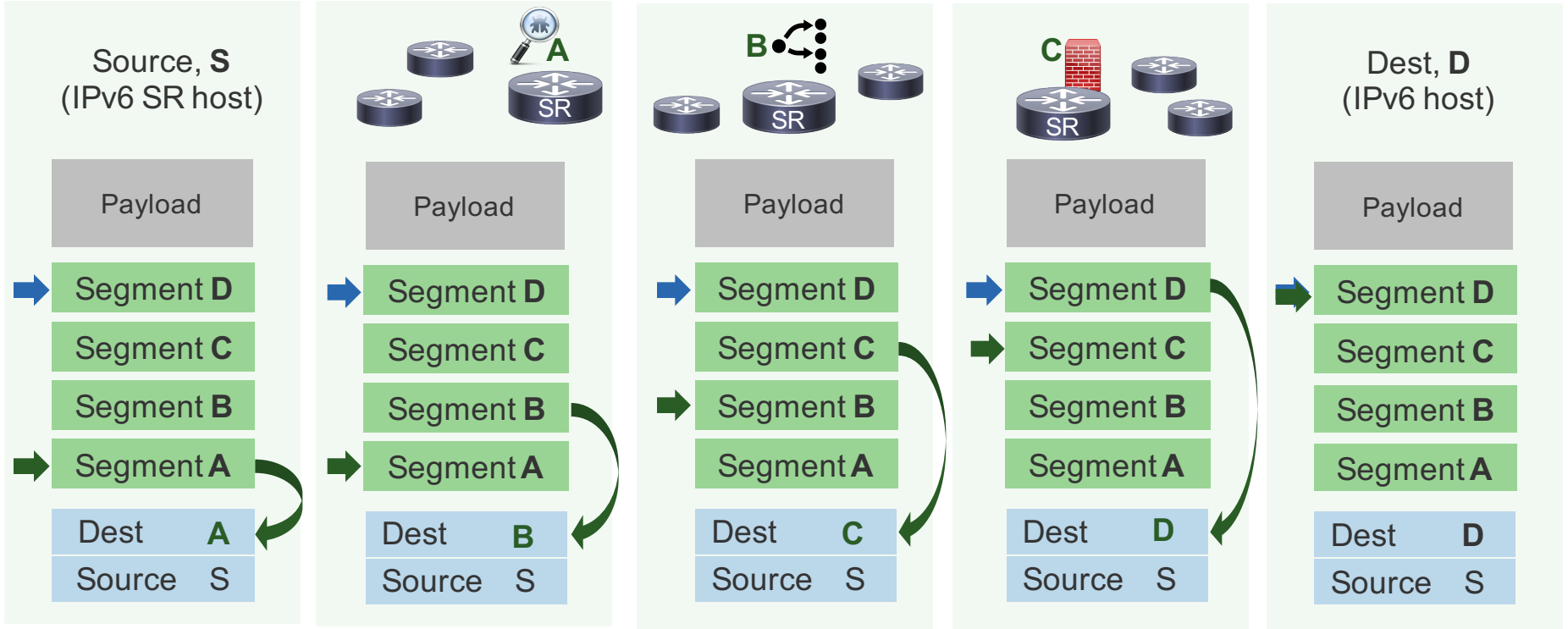
MPLS and IPv6 Segment Routing



For more information on Segment Routing, see: http://www.segment-routing.net/

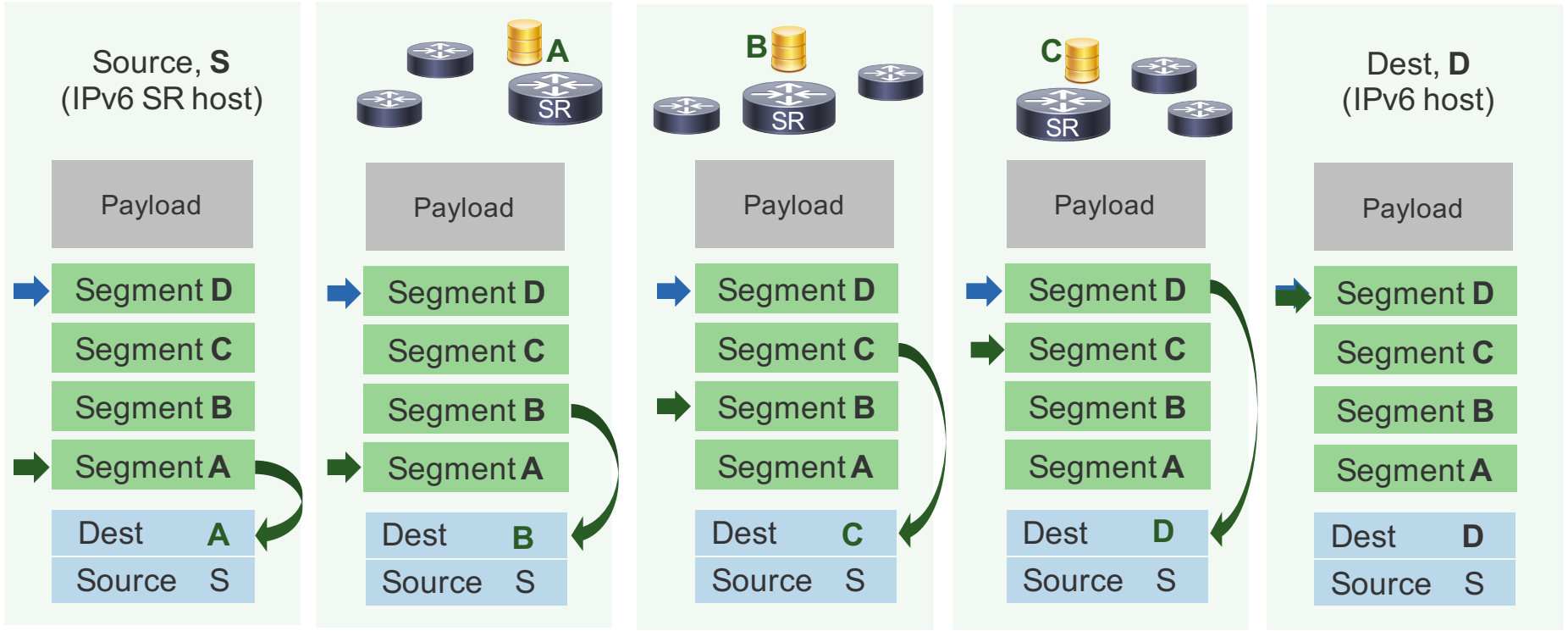
IPv6 Segment Routing

= Functions represented by IPv6 addresses



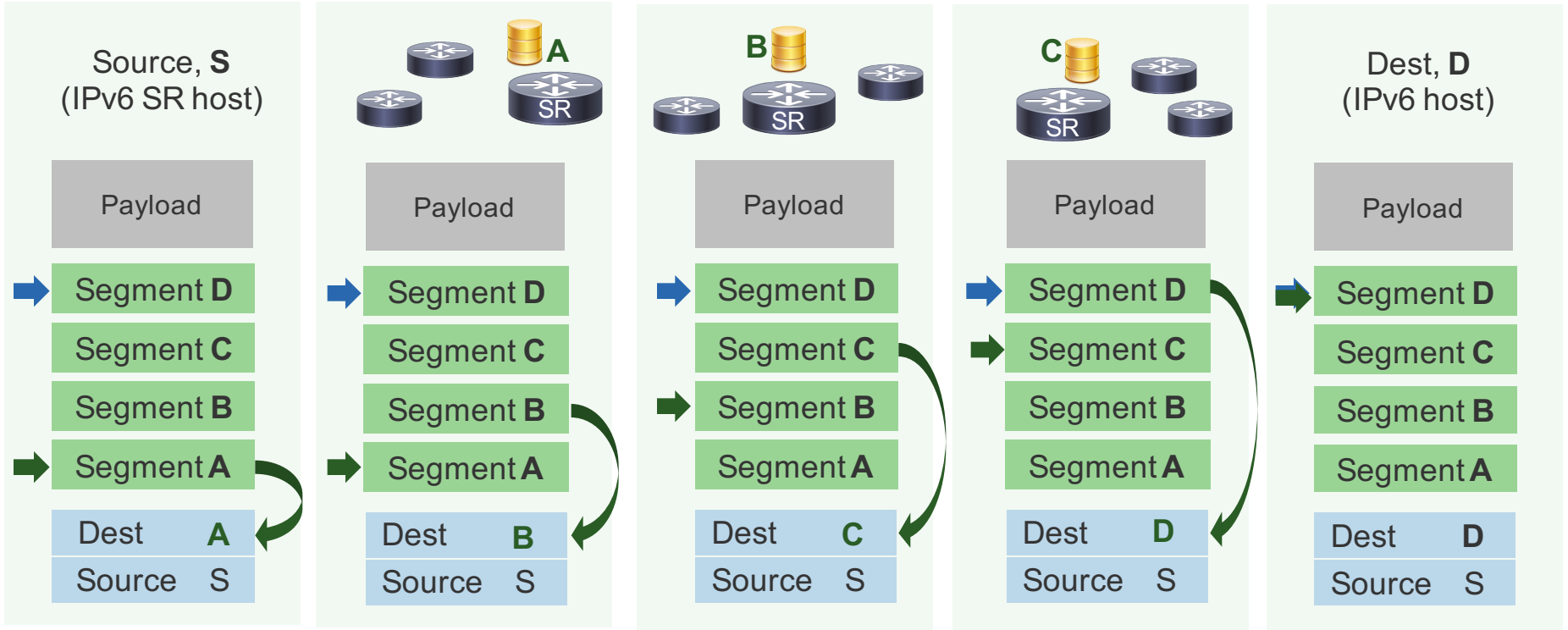
IPv6 Workload Discovery

= Is there an instance of D here?

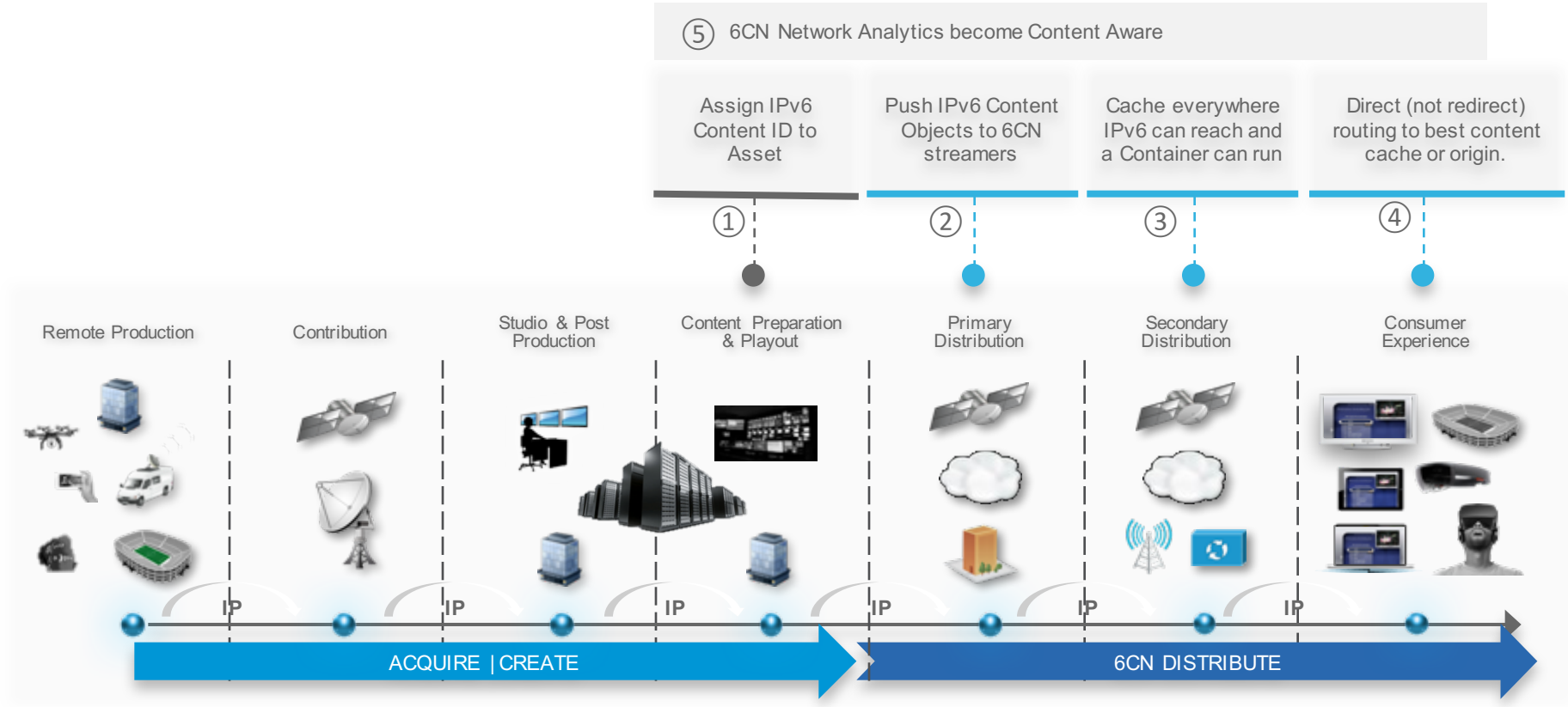


IPv6 Content Hunting

= Is there a copy of D here?



6CN – NETWORK NATIVE DISTRIBUTION



Six Key Characteristics of 6CN

① **Content preparation** with the IP network in mind

② **The speed and scale of simplicity** routing to a billions of containers, objects, or content chunks in the same language

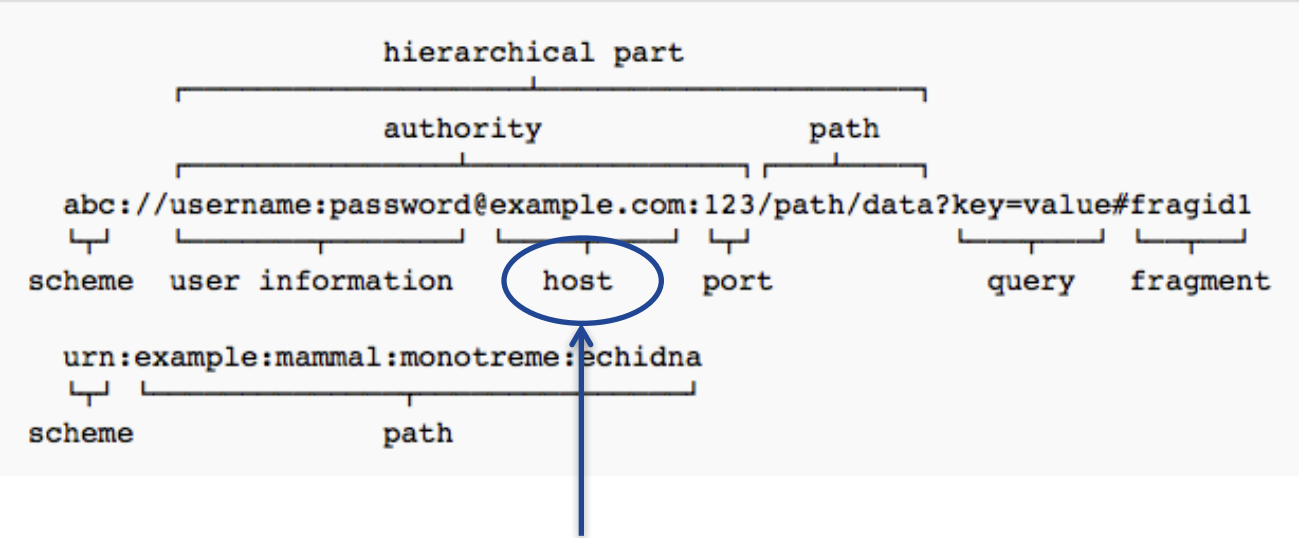
③ **Hybrid IPv6 Unicast/Multicast** – Network replication w/o Multicast Routing

④ **In-network caching and serving** anywhere and everywhere a micro-service container can run

⑤ **Leverages content and network** telemetry and analytics

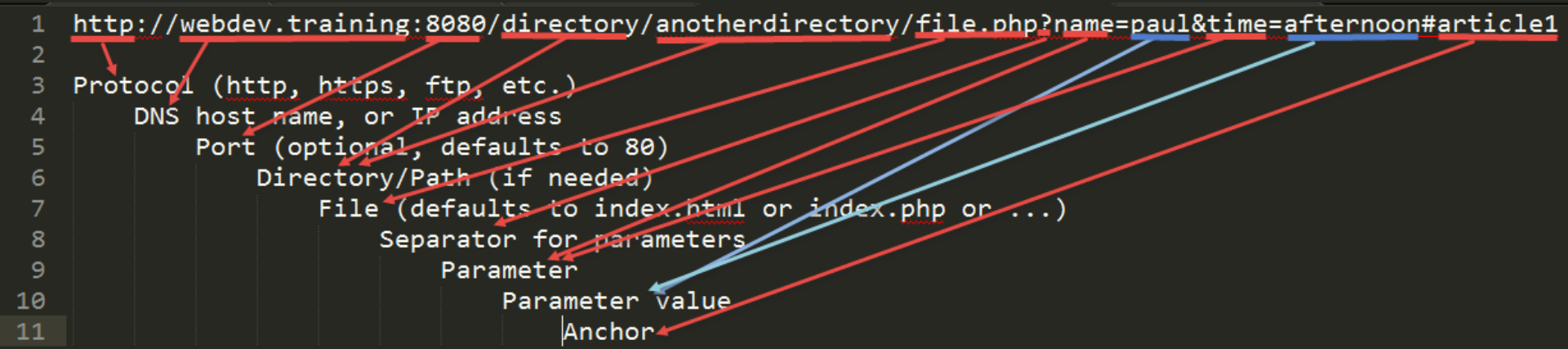
⑥ **Backwards compatible** with existing players - looks like a *very simple URL*

The Universal Resource (Locator) Identifier



IPv6 increases this part by around 30 orders of magnitude. 6CN uses it.

Accessing Content



Accessing Content

```
1  http://webdev.training:
```

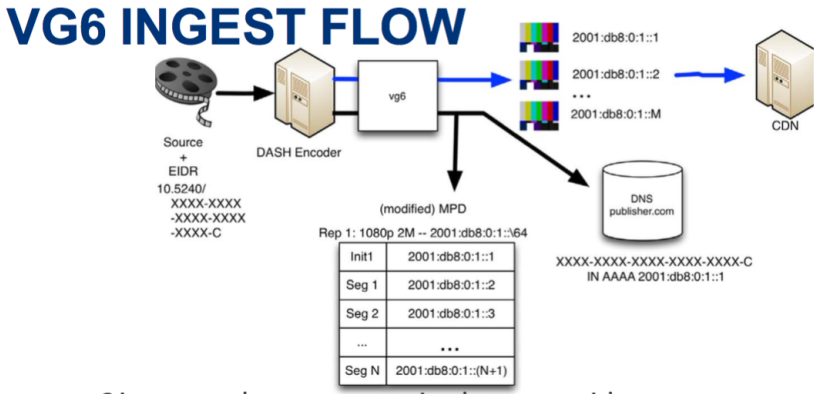
① 6CN Content Packaging

GGIE: the Glass to Glass Internet Ecosystem
GLASS GLASS
a foundation for evolving Internet Video distribution

Foundation: Media Identifier

- Identifies the Video
  - There are already many video naming systems
    - EIDR – Entertainment Identifier Registry
    - AD-ID – Used by the advertising industry
    - Many, many, many more…
  - We don't need another one
  - But having a standard way of referring to video by whatever naming system it uses would be useful
  - **A standard URI that carries the video's identifier**
  - **uri:eidr-s:F1F8-3CDA-0844-0D78-E520-Q** (this is the Minions movie)

VG6 INGEST FLOW



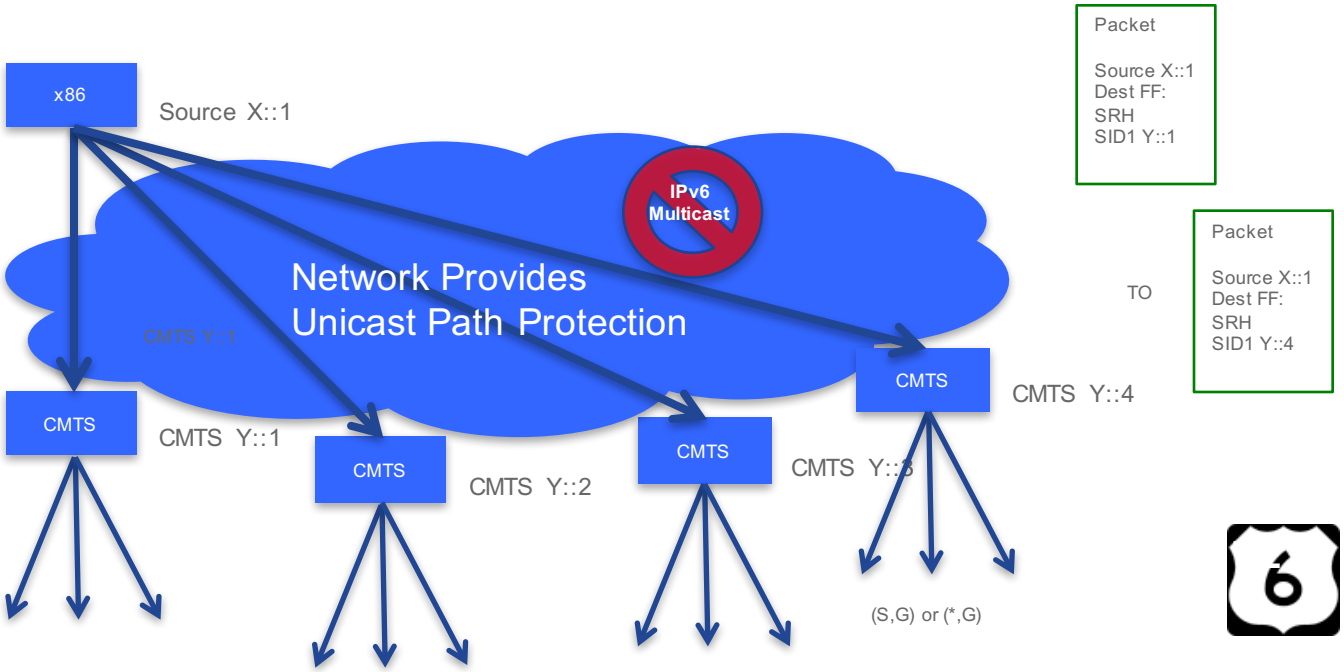
- vg6 ingest tool creates mapping between video segments and individual IPv6 addresses
  - First address in subnet returns a MPEG-DASH Manifest
- Creates AAAA DNS records: EIDR to first addr in subnet.

https://www.ietf.org/proceedings/96/slides/slides-96-dispatch-1.pdf

Credit: NBC Universal, Drexel University

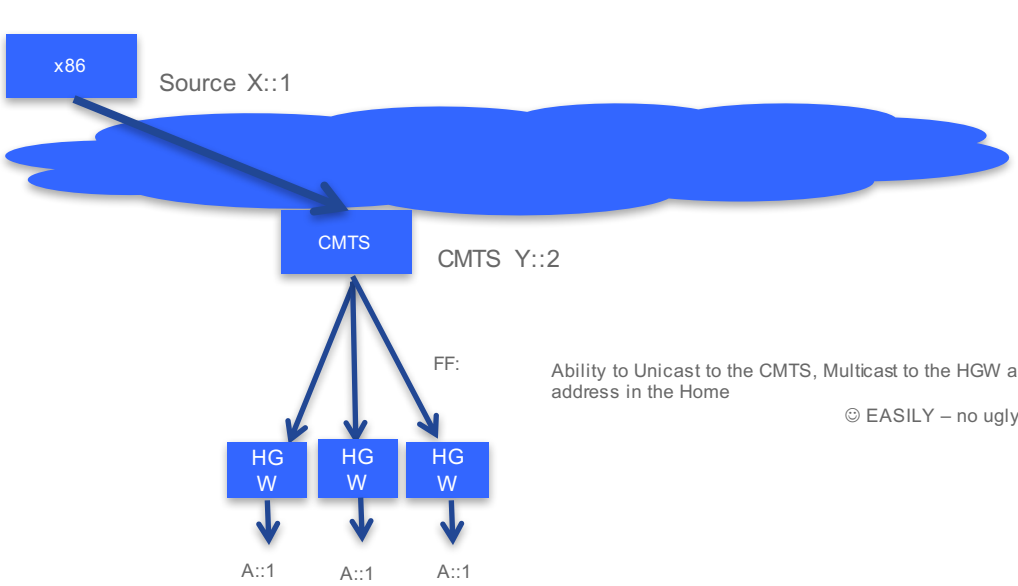
② 6CN SPRAY with IPv6 SR

IPv6 SR: Multicast



Source: John Leddy, Comcast

② IPv6 SR: Exploded AnyCast



Ability to Unicast to the CMTS, Multicast to the HGW and Unicast to an Anycast address in the Home

☺ EASILY – no ugly wifi issues

Source: John Leddy, Comcast

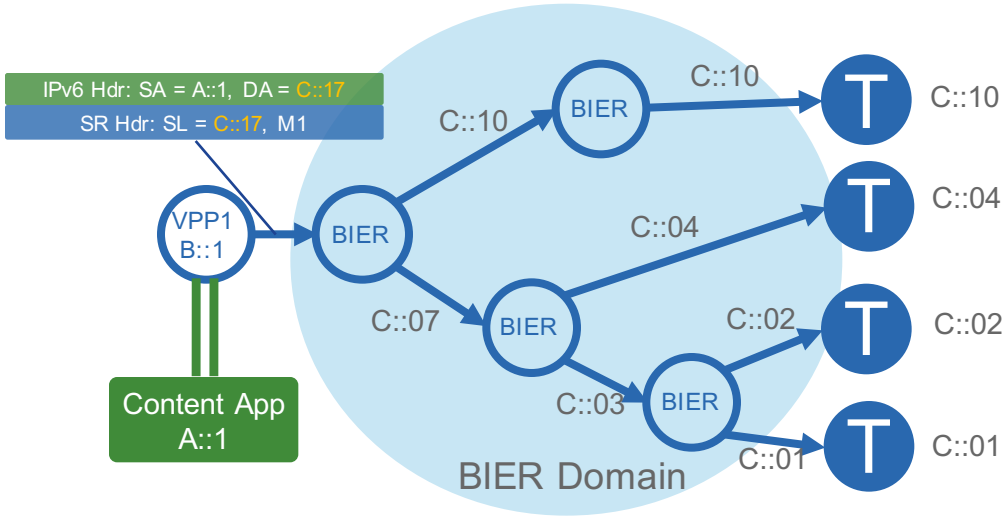
② 6CN Spray with IPv6-BIER

- VPP perform SRH insertion
- First SR segment is set to a BIER IPv6 address with each destination bit set to 1.
- BIER over IPv6 encodes BIER bitstring in the low-order bits of the destination address

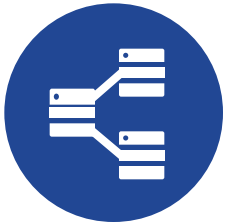
BIER IPv6 Prefix	BIER bit-string
C::	::17

- No additional header means it can be used in combination with IPv6 SR.
- A BIER IPv6 destination address is used as SR segment providing native replication through a BIER domain.

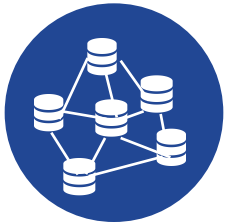
draft-pfister-bier-over-ipv6



③ In-Network Caching



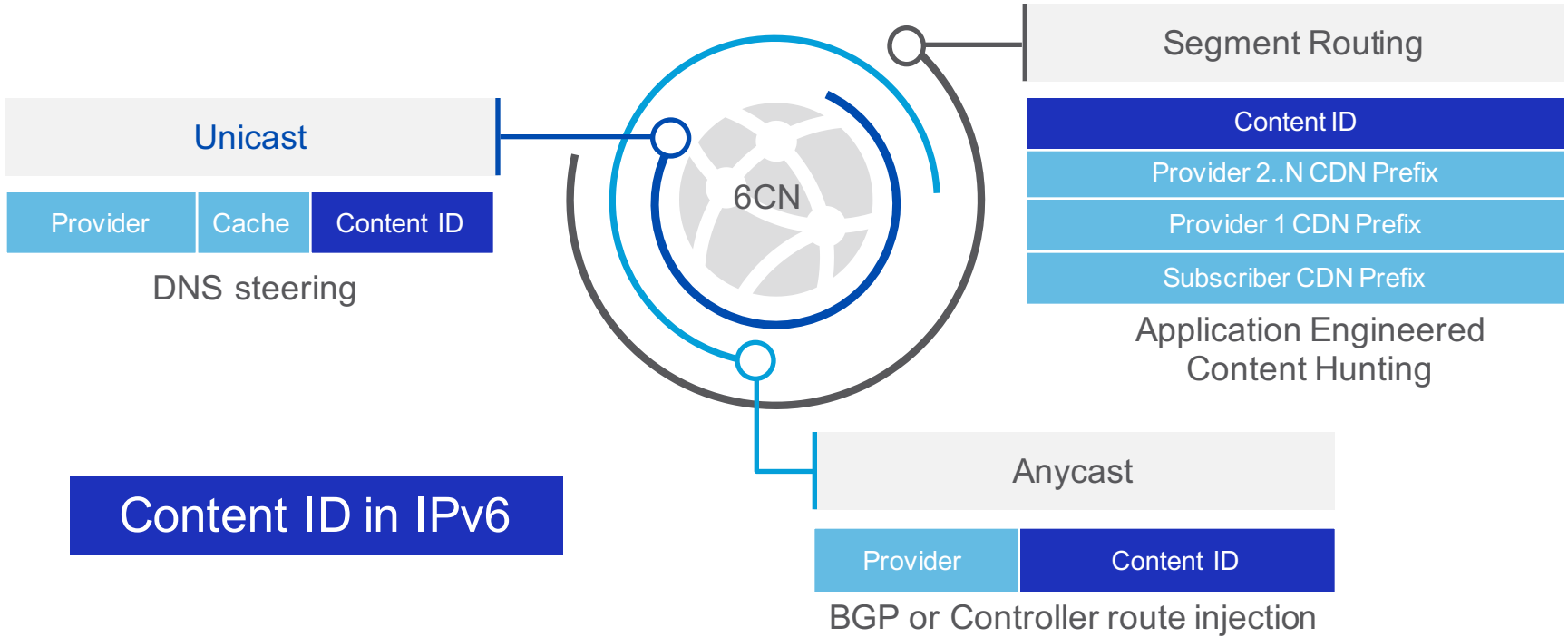
If your CDN works with IPv6, it already knows how to do 6CN



Use 6CN to route directly to video “micro-streaming” containers

Cache anywhere a container can run and IPv6 can reach, including in the home

④ IP Content Routing Direct (not redirected) to Content



Time Warner Cable (now Charter)

IP Centric CDN Presentation at Cisco-X Symposium

*"In my session, **IP Centric Content Delivery Networks**, I discussed how Time Warner Cable has integrated the CDN into their network. This means that the content delivery nodes actually interact with the network at a protocol level, **placing the CDN at a more Network-Centric layer**…. we will start **mapping IPv6 addresses directly to content so you have automatic affinity**….to be sure we are doing the best we can to get customers to the edge caches that have the content they are looking for, **which lowers cost for us and allows us to give the customer a better experience**."*

Click to Watch Video (about 2 minutes)

-- Jamie Panagos, TWC Principal Architect, March 2016

⑤What's inside an IPv6 Address?

2001:420:44f1:1a01:c15c::ed72:1

Movie/chunk address	0000:0000:0000:0000:c15c:0000:ed72:0001	
Stream type	0000:0000:0000:0000:c000:0000:0000:0000	3
Service ID	0000:0000:0000:0000:015c:0000:0000:0000	87
Content descriptor	0000:0000:0000:0000:0000:0000:ed00:0000	237
Profile	0000:0000:0000:0000:0000:0000:0070:0000	14
Duration	0000:0000:0000:0000:0000:0000:0002:0000	4

6CN Address Decoder here :

http://flows.6cn.solutions/decode.py?addr=2001%3A420%3A44f1%3A1a01%3Ac15c%3A%3Aed72%3A1

6CN: Coding Content Description – Example of ipv6 address template

IPV6	Routing prefix + subnet id	Interface identifier
Bits	48 + 16	64

Fields	Stream Type	Service ID	Content Descriptor	Chunk Descriptor		
Bits	2	12	26	24		
				5	4	15
Comments	= 4 types 00 = linear 01 = non-linear 10 = UGC 11 = corp.	= 4096 services per type	= 70+ millions per service	= 32 profiles To combining appropriated AV formats and ABR qualities =0 reserved value	= duration From 1 to 15s =0 can be reserved for none, so a single (big) chunk/file	= chunk sequence number Allows by iteration to (pre)-fetch/cache over the network Combined with Duration, it references from 6 hours to 4 days per service/content. It also gives direct time stamps for trick modes =0 can be reserved for the dash manifest

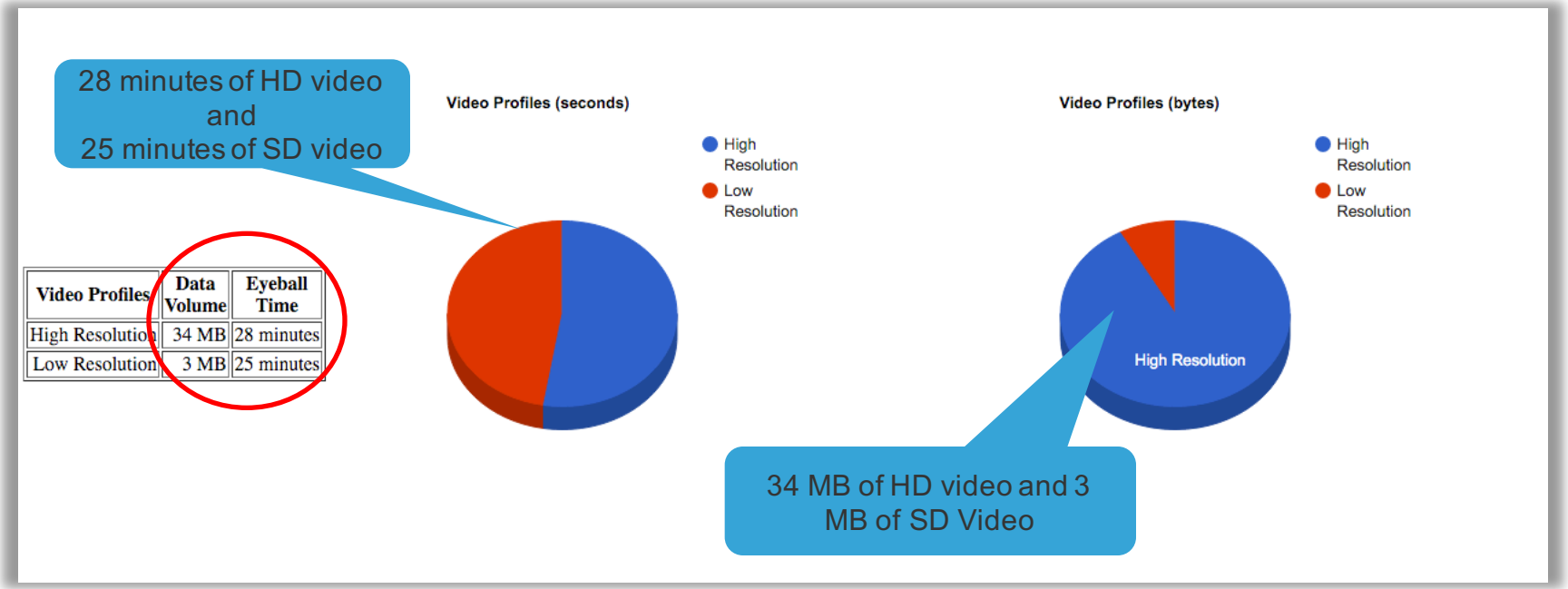
Example of recommendation

Fields	Show/Serie ID	Episode ID
Bits	16	10
Comment	= 65000+ per service	= 1000+ per show

Fields	Source ID	Movie ID
Bits	12	14
Comment	= 4000+ per service	= 16000+ per source

Fields	#Day	#Clock
Bits	15	11
Comment	*year/month/day*	*minute in the day*

Interpret Netflow Data in “Eyeball Minutes” or Bytes



Video Profiles	Data Volume	Eyeball Time
High Resolution	34 MB	28 minutes
Low Resolution	3 MB	25 minutes

Demo here: http://flows.6cn.solutions/dash.php?ds=p

Standards Work

IETF work led by NBC-Universal (Comcast)

draft-deen-daigle-ggie, draft-deen-naik-ggie-men-mpeg-dash

GGIE (Glass to Glass Internet Ecosystem) within the W3C

https://www.w3.org/2011/webtv/wiki/GGIE_TF

IETF Segment Routing WG (spring)

http://www.segment-routing.net/, draft-ietf-spring-ipv6-use-cases

IETF IPv6 Bit Indexed Explicit Replication (BIER)

draft-pfister-bier-over-ipv6

Summary

Cisco Paris Innovation and Research Lab

- Bringing IPv6 to production Media and next-gen Distribution

IPv6 Centric Networking:

- Scale, Simplicity, Security, and new Services
- Network-native containers operation and Content Distribution