VSF
VIDEO SERVICES FORUM

# IP to IP Boundary

## WHY VIRTUALIZED, IP-NATIVE GATEWAYS ARE THE REAL KEY TO REMOTE MEDIA PRODUCTION

APERI

# Problem Statement

- Many types of boundaries

Concrete

Steel

See-thru

Media

# Problem Statement

- Constant state of change within contribution and primary distribution environments
  - New media signal formats
  - New compression technologies
  - Virtualized workflows
  - Goal achieving a 99.99% (4 hours MTTR) to 99.999% SLA.
- One constant across all of these arenas is a foundation built on IP infrastructure

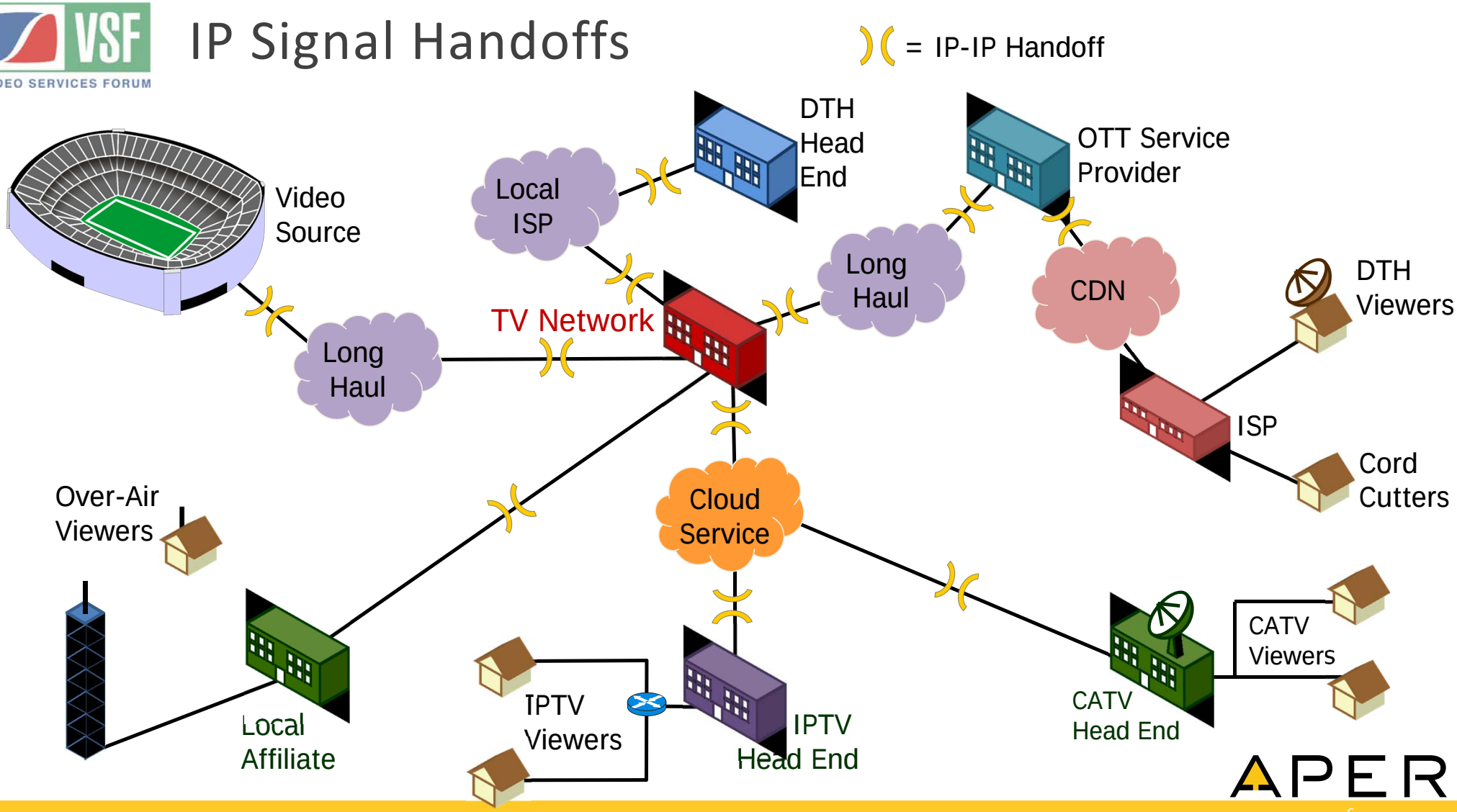
# Problem Statement (con't)

- Strict boundaries are required between networks
  - Translating
  - Policing
  - Protecting
  - Identifying information allowed across these boundaries
- Presentation will explore the importance of an IP based gateway
  - At IP to IP boundaries
  - Replacing legacy baseband environments
  - Focus on signal integrity, flexibility, integration and synchronization into remote production based workflows

# IP-to-IP Signal Handoffs

- IP technology is everywhere in modern media production
  - Contribution and distribution networks (VSF TR-01 and RIST)
  - Inside media production facilities (SMPTE ST 2022 and ST 2110)
  - Consumer delivery platforms (CATV, VoD, OTT)
- However, many signal handoffs are still SDI or DVB/ASI
  - Common standards for signal quality monitoring
  - Boundary between incompatible network packet formats
  - Industry inertia
- Typical signal may cross 6 or more handoffs from source to consumer

# IP Signal Handoffs



## Benefits of IP-to-IP Handoffs

Keep signals in native IP formats
- Reduce number of signal conversion steps
- Preserve RTP packet timestamps
- Maintain elementary flows
- Audio embedding/de-embedding not needed

More network flexibility
- Simplified flow replication
- Dynamic signal re-routing
- Support ST 2022-7 seamless protection switching
- Maintain FEC through entire end-to-end chain
- -or- Terminate FEC where needed
- Easy migration to public and private cloud

## Drawbacks of IP-to-IP Handoffs

IP Networks use different packet headers
- Private and Public IP addressing
- Unicast vs. Multicast
- Multiple VLAN tagging schemes

Compression may be required for some links

Cross-boundary flows need to be inspected, policed
- Filter out unwanted or malicious traffic
- Check packet and media signal integrity
- System and signal status reporting
- Flow prioritization and rate limiting

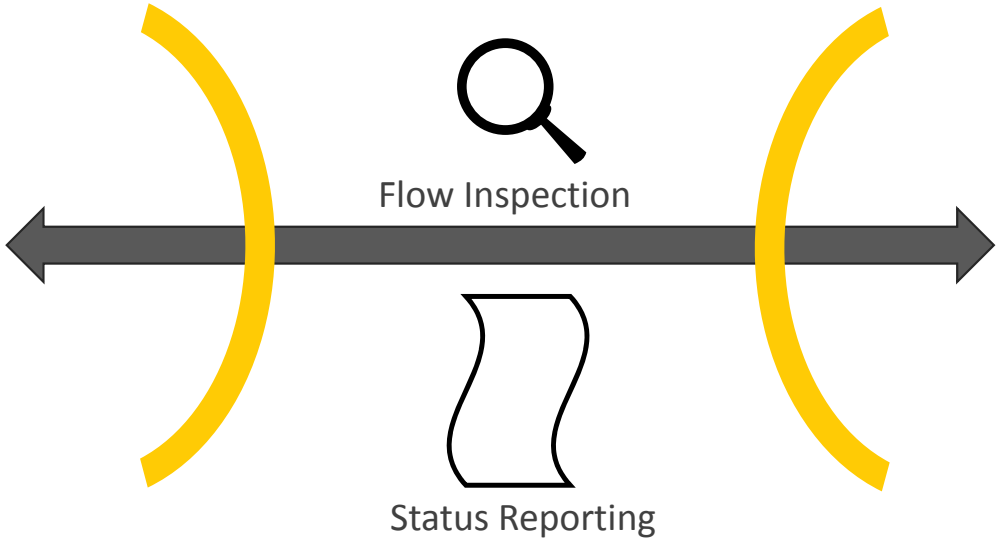
Scalable MPEG monitoring is not cost effective

# IP to IP Interface Functions

Service Provider Network

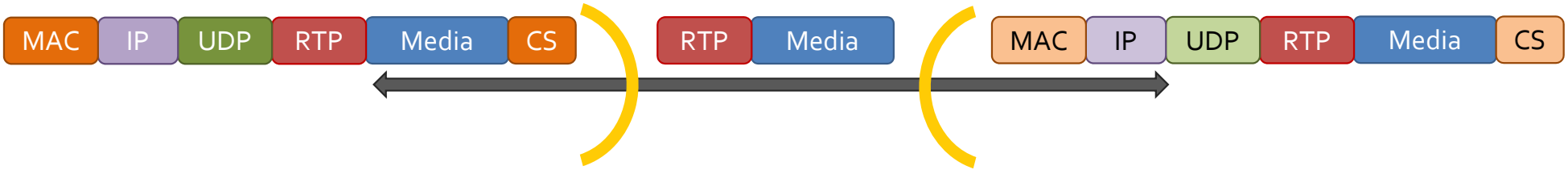
Media Producer Network

Packet Header A
Signal Format A
FEC Standard A
Traffic Monitoring
Flow Management



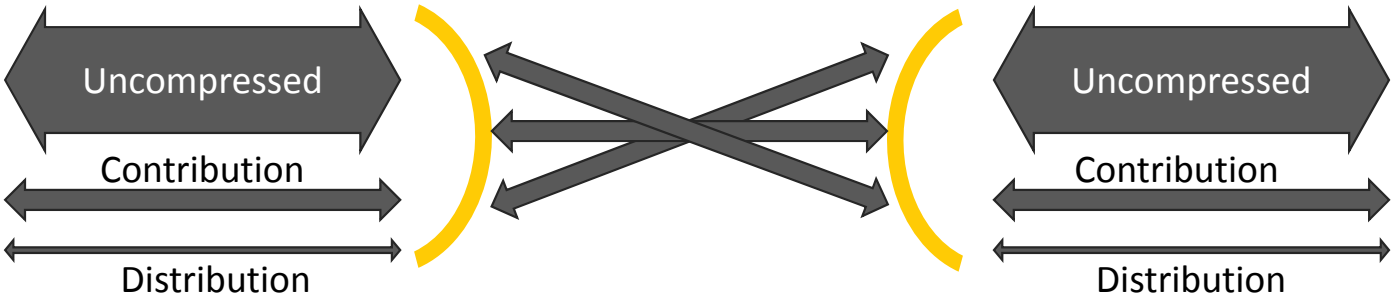

Packet Header B
Signal Format B
FEC Standard B
Signal Validation
Flow Termination

# Packet Header Manipulation



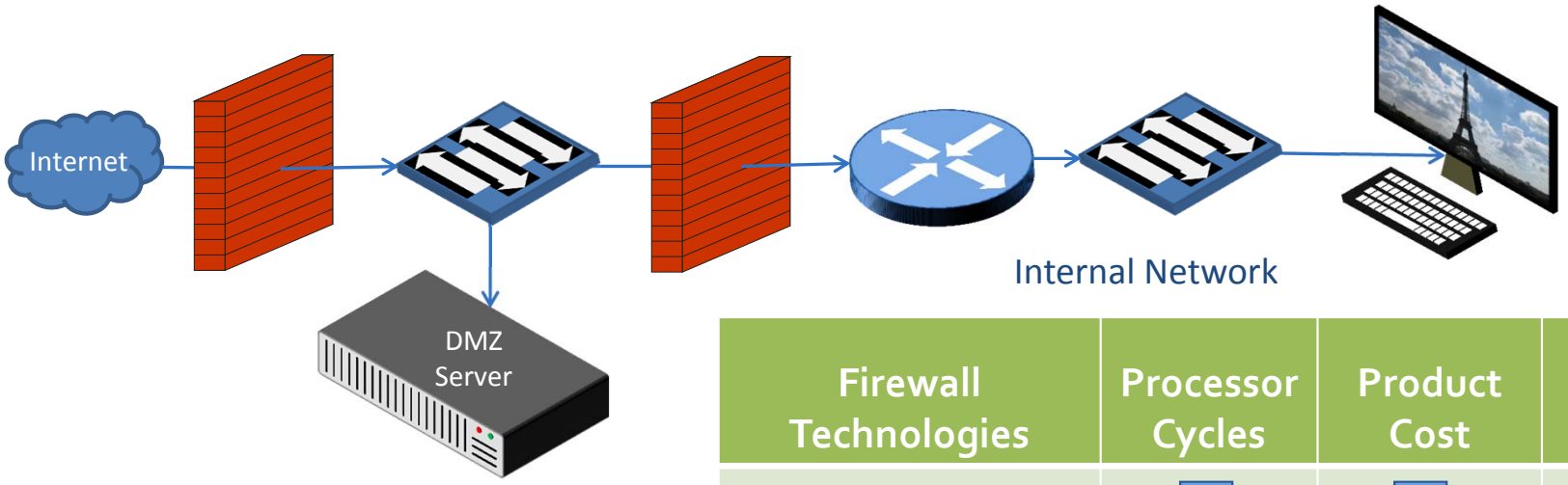

- Service Providers need different packet headers than Media Producers
  - Carriers need to manage flows from multiple sources and destinations over single backbone
  - Video Service Providers need to convert between sources and destinations
- Variety of conversions in real-time on high-bandwidth flows
  - Reconfigure UDP port numbers
  - Public vs. Private IP addresses
  - Unicast vs. Multicast IP addresses
  - Manage DiffServ values in IP headers
  - Add/remove Service Provider VLAN tags
  - Remap Media Producer private VLAN tags

# Signal Format Conversion



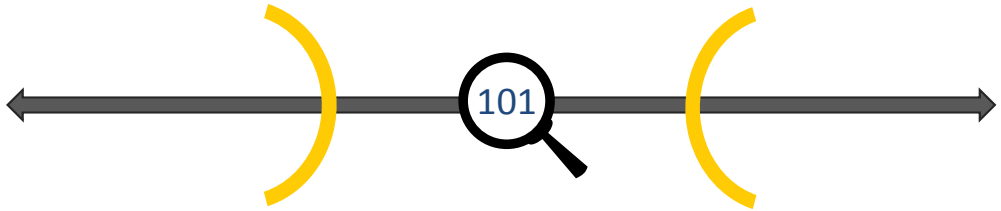

- Signals travel in many formats from source to viewer
  - Uncompressed
  - Lightly compressed for contribution
  - Highly compressed for consumer distribution
- Compression/decompression can happen at network boundary
  - Contribution formats: JPEG 2000, TICO
  - Distribution formats: H.264, HEVC

# Firewalls and Firewall Technologies



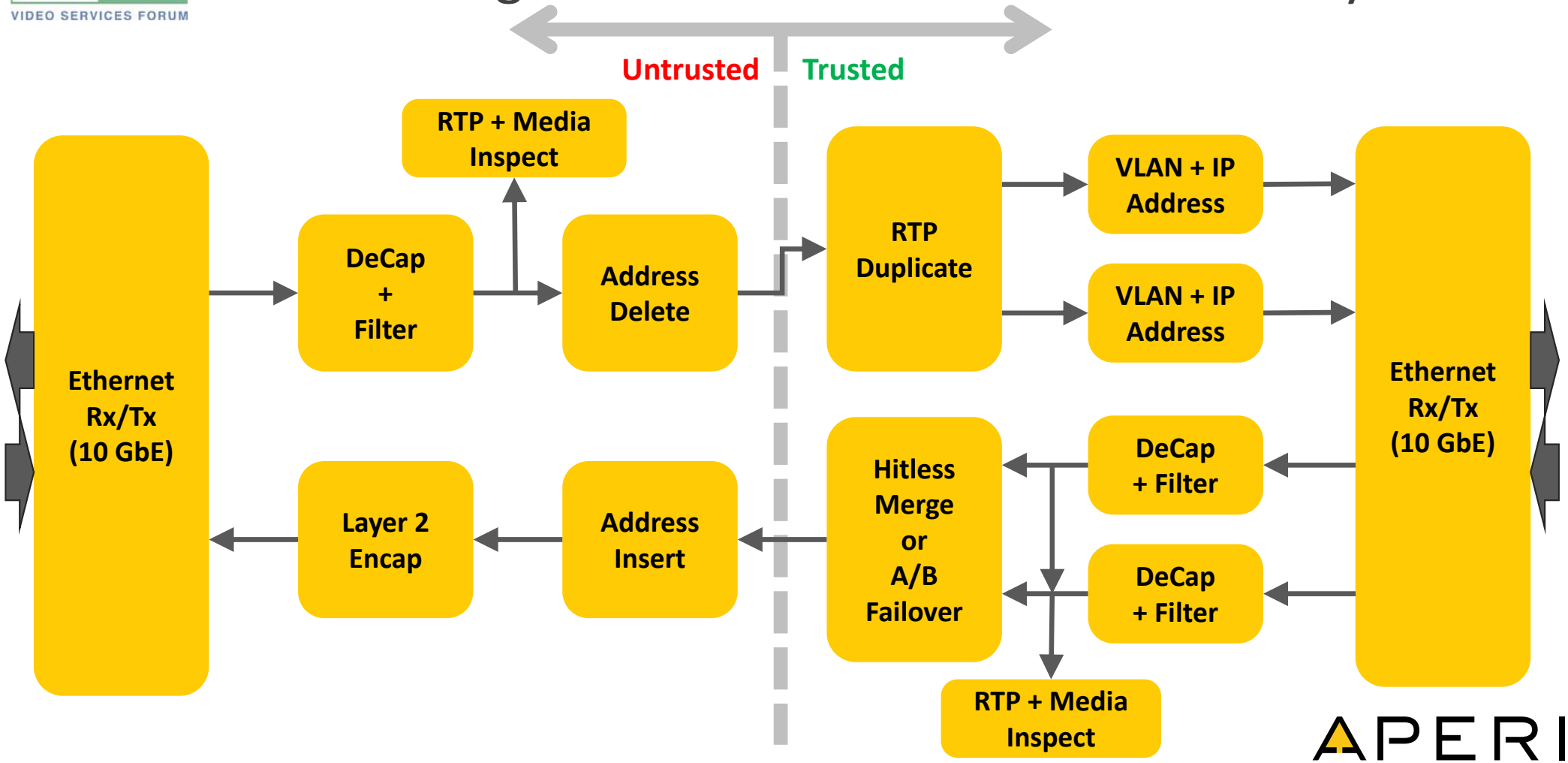

| Firewall Technologies | Processor Cycles | Product Cost | Security Level | Ease of Use |
|---|---|---|---|---|
| Port Blocking | Increasing | Increasing | Increasing | Decreasing |
| Stateful Inspection | | | | |
| Deep Packet Inspection | | | | |
| Air Gap | None | None | Overkill? | Nothing can pass |

# Media Flow Inspection

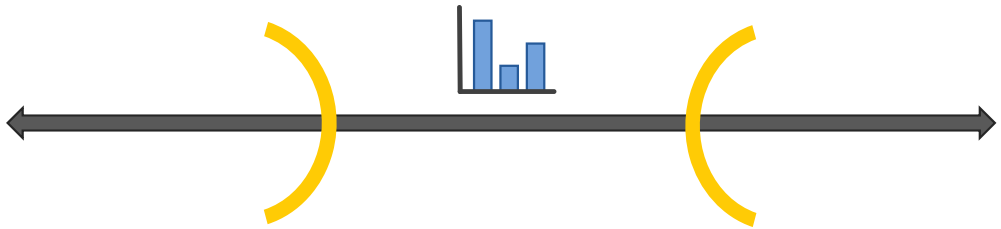



- Media flows should be checked as they cross network boundaries
- Check integrity of media signals
  - Verify signal presence, type, validity
  - Hitless protection switching and/or A/B failover
  - Capture in-stream metadata for analysis
  - Check signal timing, clock rates
  - Re-synchronize streams to local clock if necessary
  - Deliver video flows to local or remote multiviewers
  - Audio monitoring and audio channel re-mapping as appropriate

# Flow Management Across Network Boundary



# Signal Performance Monitoring



- Signal performance monitoring at each network boundary
  - Fault sectionalization
  - SLA (Service Level Agreement) verification
- Accumulate and report network performance statistics
  - Packet loss, packet delay variation, FEC intensity
  - TR 101 290 data for MPEGTS signals
  - RTP sequence number and timestamp validity
  - Across total interface and for each individual media flow

# Gateway Transfer of 1588 Timing

- Configurable to allow 1588 traffic to pass through the firewall
  - Bi-Directional transfer of timing between Service Provider core and Media Producer Network
  - Monitor and report sequence number accuracy
  - Provide updates for current delay, time and identity
- Can also terminate PTP domains if needed for network isolation

# The Challenge of Synchronization

- Baseband handoffs typically require frame synchronizers
  - Venues normally have their own clock islands
  - Delivering PTP across WAN is fraught with issues
- IP handoffs can preserve signal timing
  - Allows media synchronization to be preserved by allowing PTP boundary clock located at receive site to distribute to media devices
  - All elementary streams can be referenced to GPS and SMPTE Epoch
  - MicroTCA supported solutions allows for clock distribution across rear I/O for applications where precision timing is essential

# Non-RTP flows

- Optional forwarding of non-RTP traffic
  - email, file transfers, control traffic or bridging LAN's
- Tunnel arbitrary IP traffic through the Service Provider core
  - Maintain current addressing and priority
  - Bandwidth limitations applied preventing over subscription or bandwidth contentions

# Summary

- Next generation demarcation for contribution media applications
- Offering the same protection levels and flexibility
- Tighter integration into IP Production workflows

VSF
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*Bringing datacenter agility, robustness, security and economics to live sports, entertainment and news production and distribution*

**TODAY !!!!**

**Thank You!**

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