



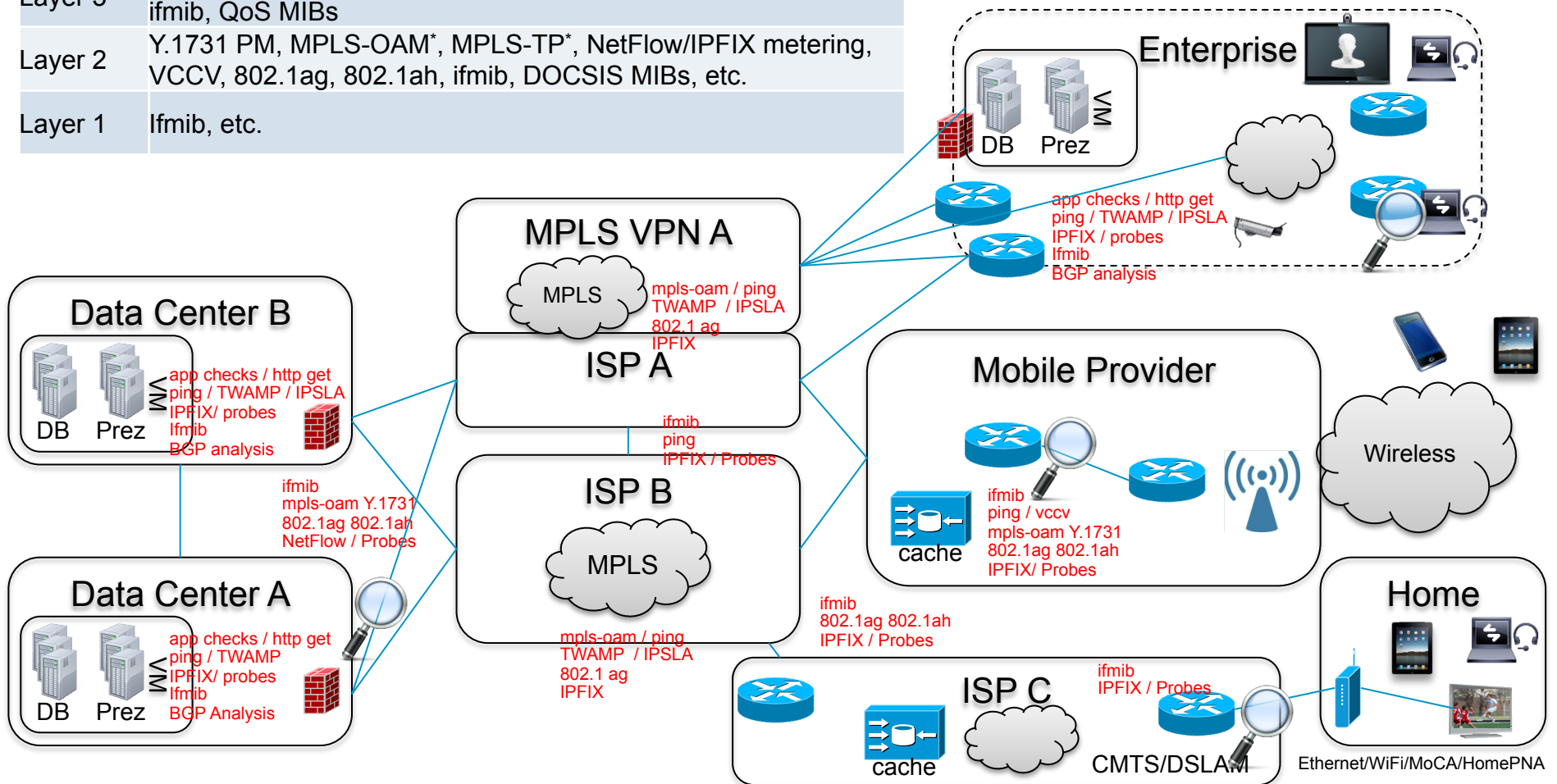
# Challenges in End-to-End Network-Centric Performance Monitoring & Management

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# Performance Management Components

Application	Service checks, app internal instrumentation, probe passive monitoring
Layer 4	Passive protocol analysis, active service checks
Layer 3	ping, traceroute, IGP/BGP Analysis, NetFlow/IPFIX metering, ifmib, QoS MIBs
Layer 2	Y.1731 PM, MPLS-OAM*, MPLS-TP*, NetFlow/IPFIX metering, VCCV, 802.1ag, 802.1ah, ifmib, DOCSIS MIBs, etc.
Layer 1	Ifmib, etc.



# Network Requirements of Video Collaboration Apps

reference

	One Way Latency	Jitter	Loss
Desktop Share (WebEx)	< 1000 ms	< 100 ms	< 0.05%
Video Conferencing	< 150 ms	< 30 ms	< 0.10%
TelePresence	< 150 ms	< 10 ms	< 0.05%
IP Telephony	< 150 ms	< 30 ms	< 0.10%
VC Soft Clients	< 150 ms	< 30 ms	< 0.10%

Media Synchronization	
audio + discrete info (slide show):	< 1000 ms
audio + pointed objects w/ narration:	< 200 ms
Lip Sync: audio advance over video:	< 30 ms
Lip Sync: audio delay following video:	< 100 ms

# Monitoring Models

- Application performance validation
  - Is the end user experience within acceptable bounds?
- Severity assessment
  - How serious is the problem?
  - Do I need to worry about it? Today?
- Troubleshooting
  - Where is the problem? Application? Network?
  - Where in the network?
  - What is the problem?
- Historical analysis
  - What is the timeline of changes & stress to the network?
  - Where and what is causing the change?
  - Do I need to do something different?

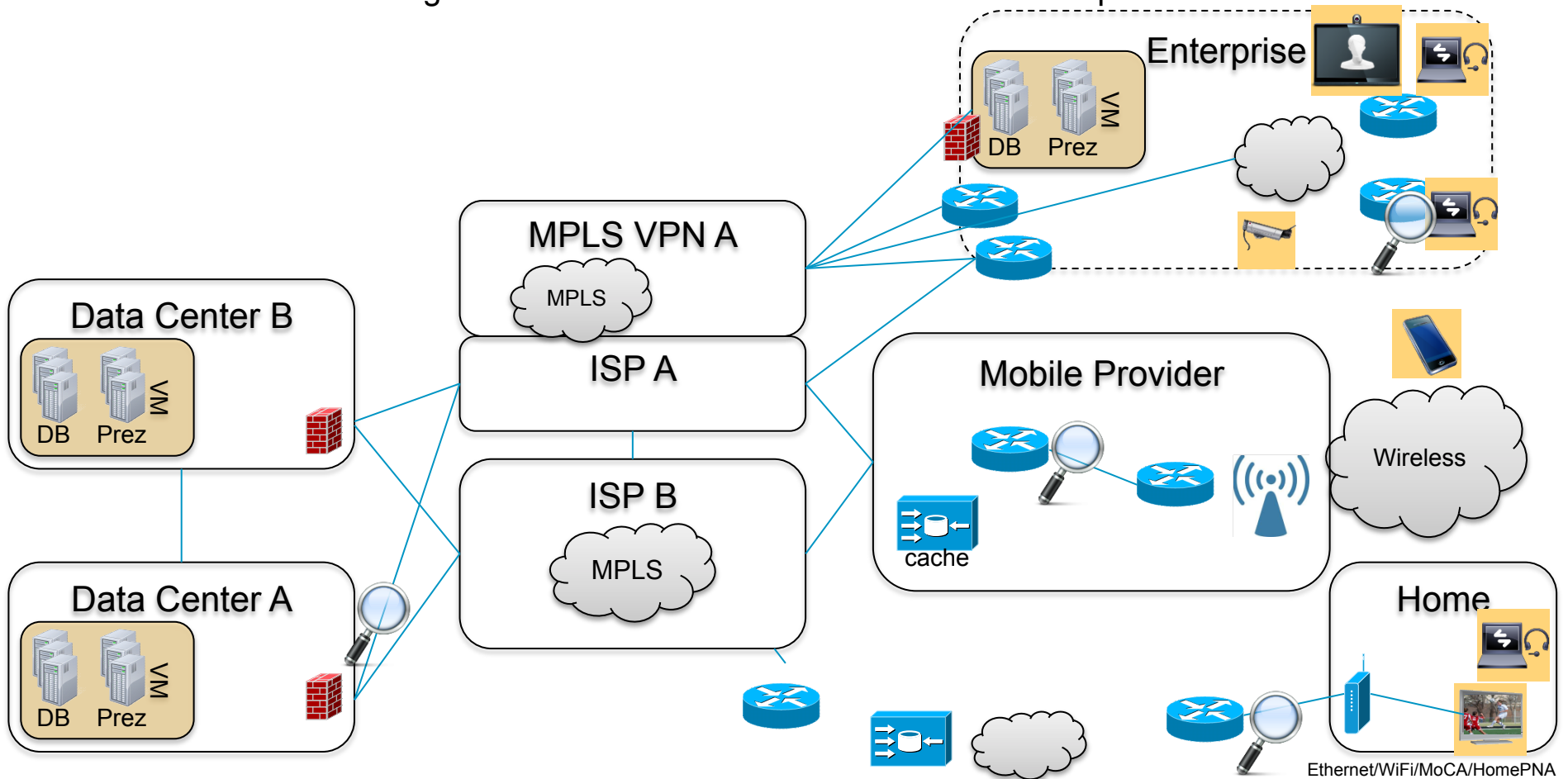
# Endpoint vs. Network Points of Measurement

An example using video flows

Metric	Metric	Routers/ Switches	Application
Layer 2	VLAN	✓	✗
	MAC address	✓	✗
IP	IP Address(s)	✓	✓
	DSCP	✓	✓
Transport	RTP - Loss	✓	✓
	TCP – Loss	✗ (only loss event)	✓
	TCP Round Trip Time	✓	✓
	RTP Jitter	✓	✓
Media	Frame Discards	✗	✓
	Frame Repairs	✗	✓
	Frame IDR Count	✗	✓

# Integrated Network and Application Monitoring

- Applications are in best position to judge severity and presence of problem
- Network & Management needs to be able to drill into details of problem resolution



# Application and Topology Embedded Passive Monitoring

- Application and network nodes are able to discover & validate user traffic on hop by hop basis

Where possible, analysis **built into forwarding hardware**

- Allows for **fault isolation** and network span validation
- Per-application threshold and altering.
- Open interfaces management and reporting interfaces

