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Cloud & Virtualization

Flexible MAC Architecture in the Cloud: Architectures for a virtual world

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2021 Fall Technical Forum
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FMA: Does it Cloud?

CableLabs FMA Intro

DOCSIS MAC located flexibly in network

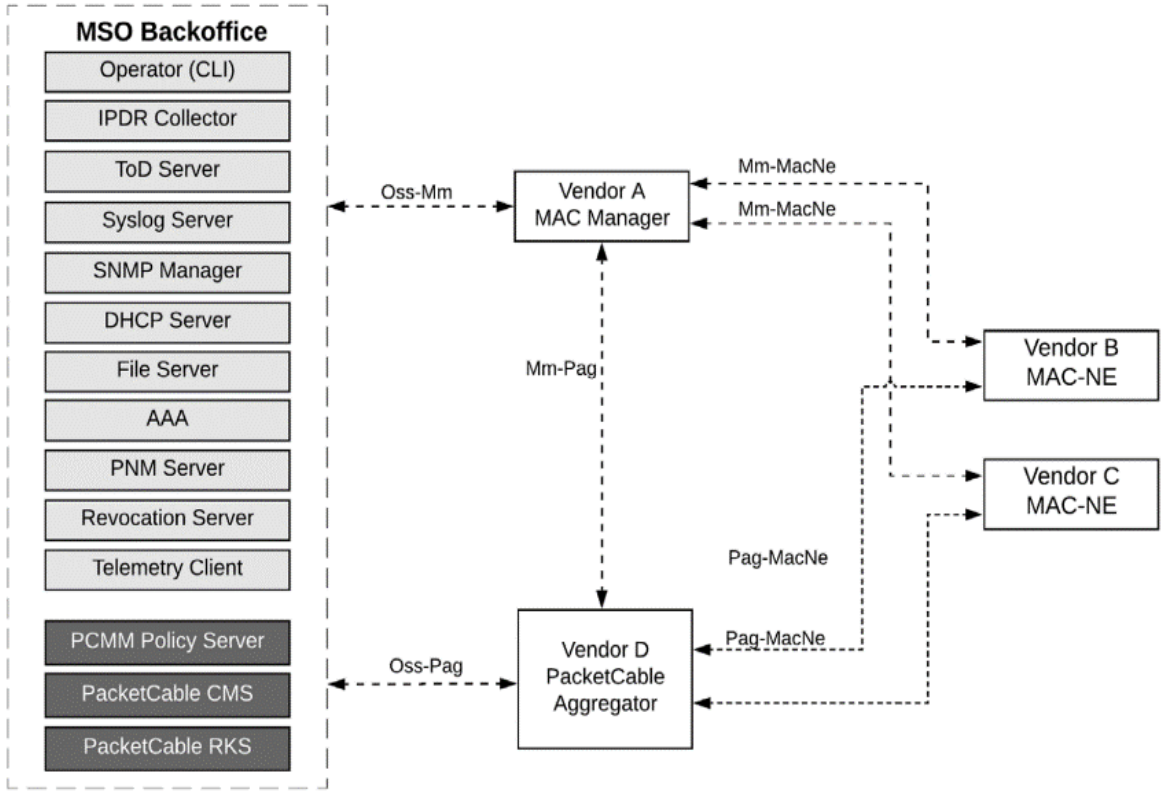
- First: **Remote MACPHY (RMD)**
- Later: Remote MAC Core (RMC)

3 main Components:

1. MAC Manager
2. PacketCable Aggregator
3. MAC-NE (RMD)

Under CableLabs DCA / DAA project

- “brother” to RPDs (MHAv2)



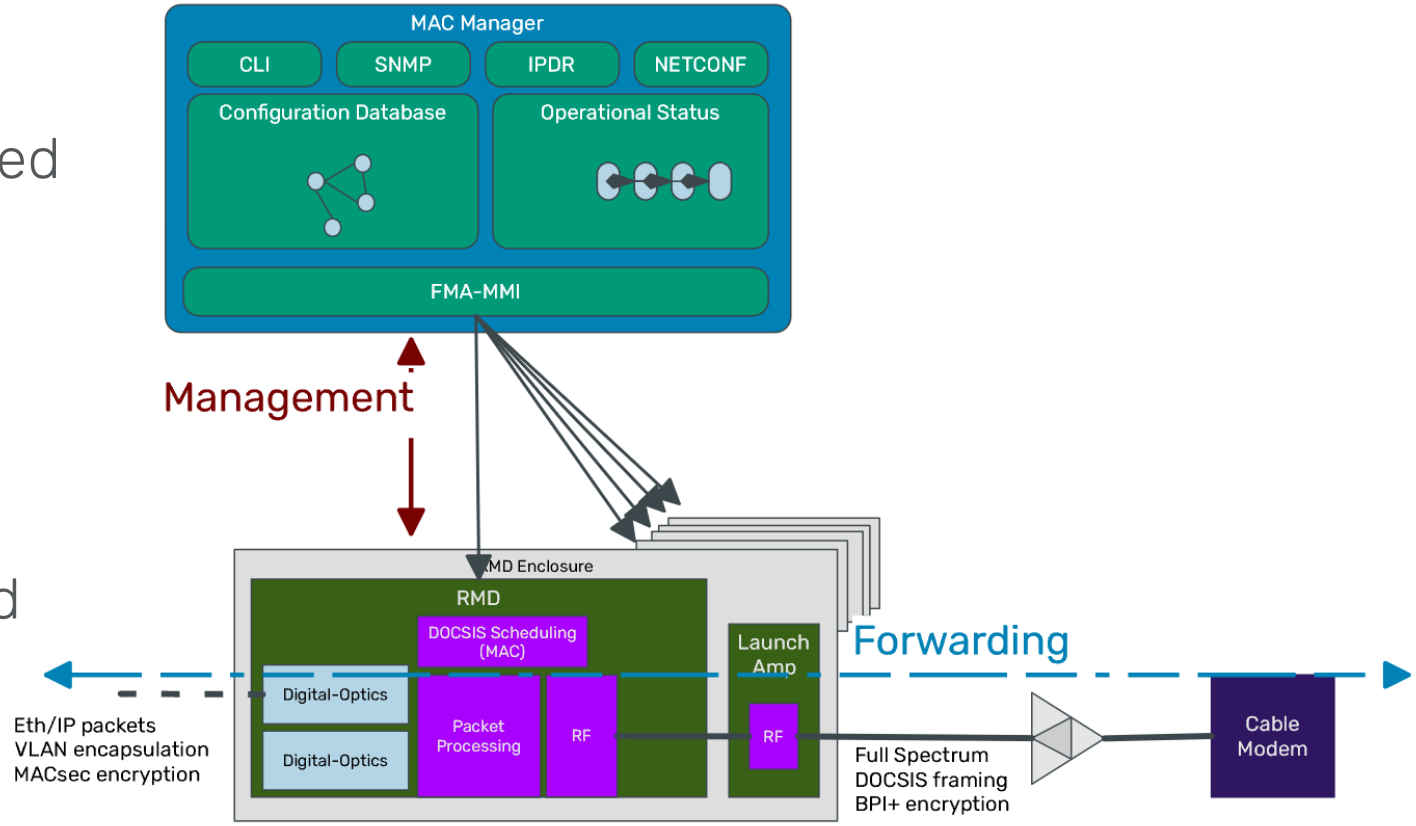
Management and Data plane separation

FMA: separates Management and Control plane functionality

- Management plane can be virtualized
- Data plane optimized in silicon

FMA: limits DOCSIS to RMD

MAC Manager uniquely suited to Cloud deployment

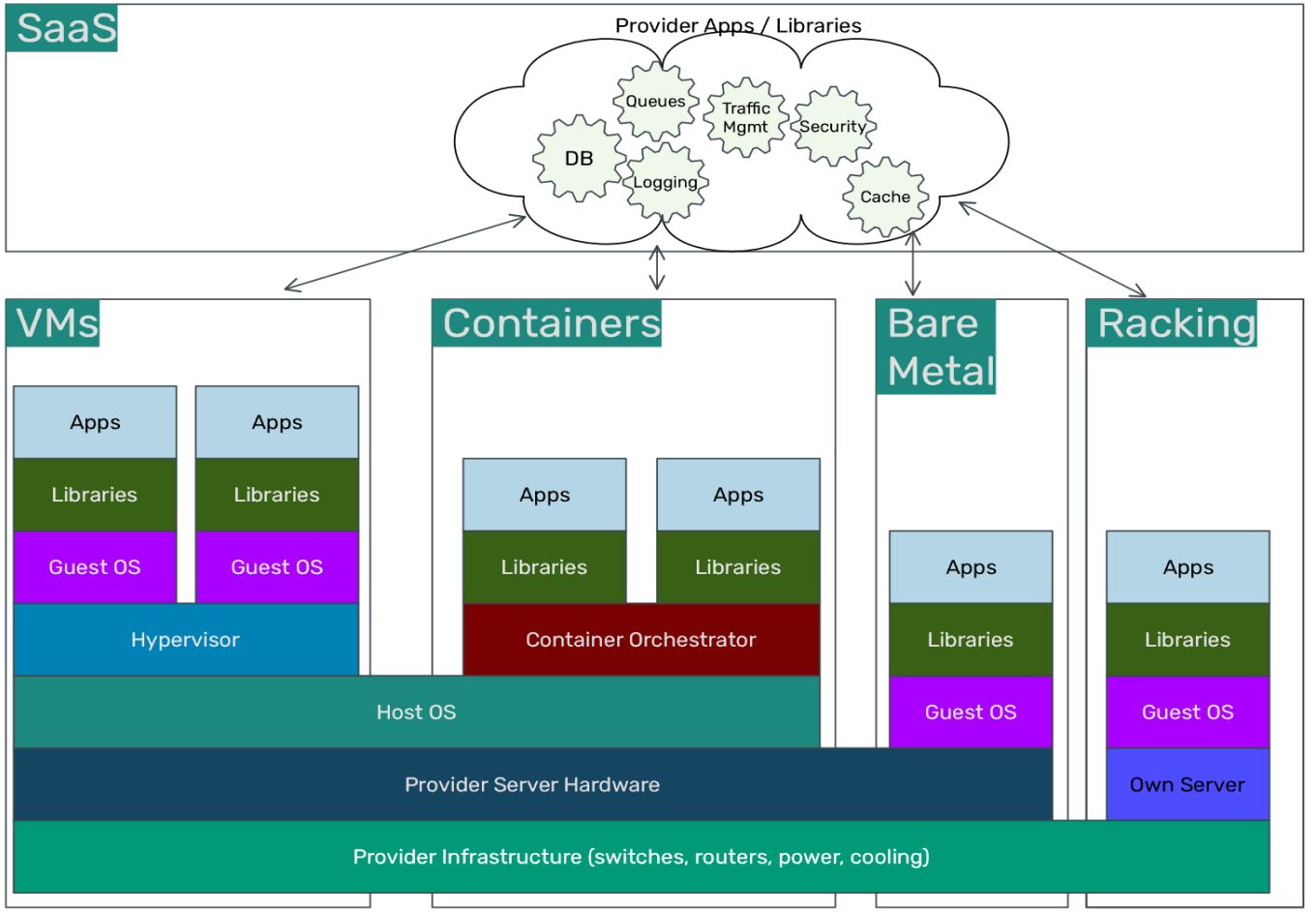


Cloud Operators

Different ways to deploy into the Cloud

MAC Manager does not do data plane processing, so focus on Agility

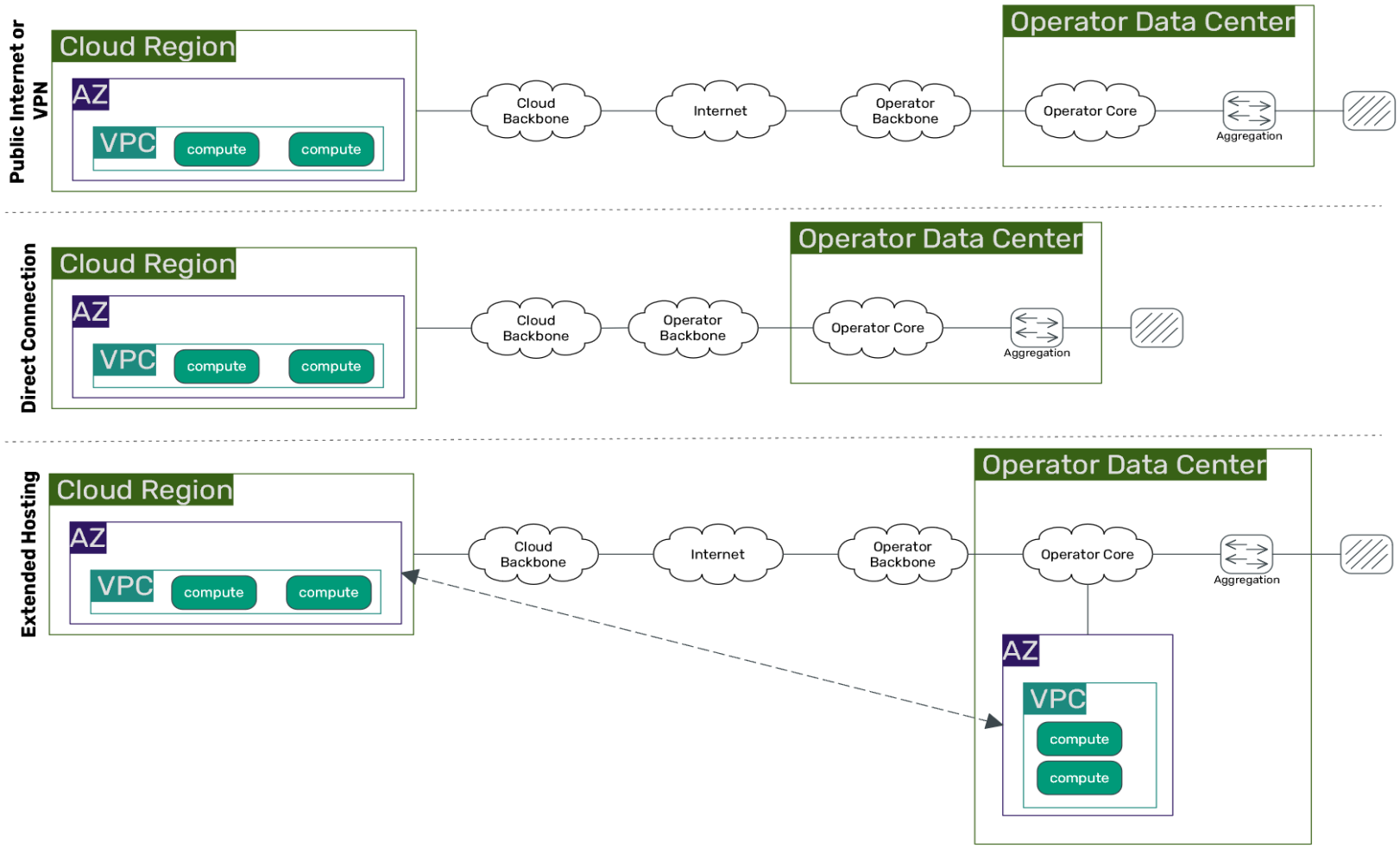
SaaS additions to MAC Managers can offer big benefits but some are often cloud-vendor specific reducing flexibility in cloud partner



Hybrid-Networks

Hybrid network connects Operator network to Cloud network

- Public Internet (Not recommended)
- VPN (over Internet)
  - Pro: Easy to get started
  - Con: Scaling issues
- Direct Connection
  - Pro: Fast, predictable latency
  - Con: Expensive, not software provision-able
- Extended Hosting
  - Pro: Even faster
  - Con: Reliant on Operator DC

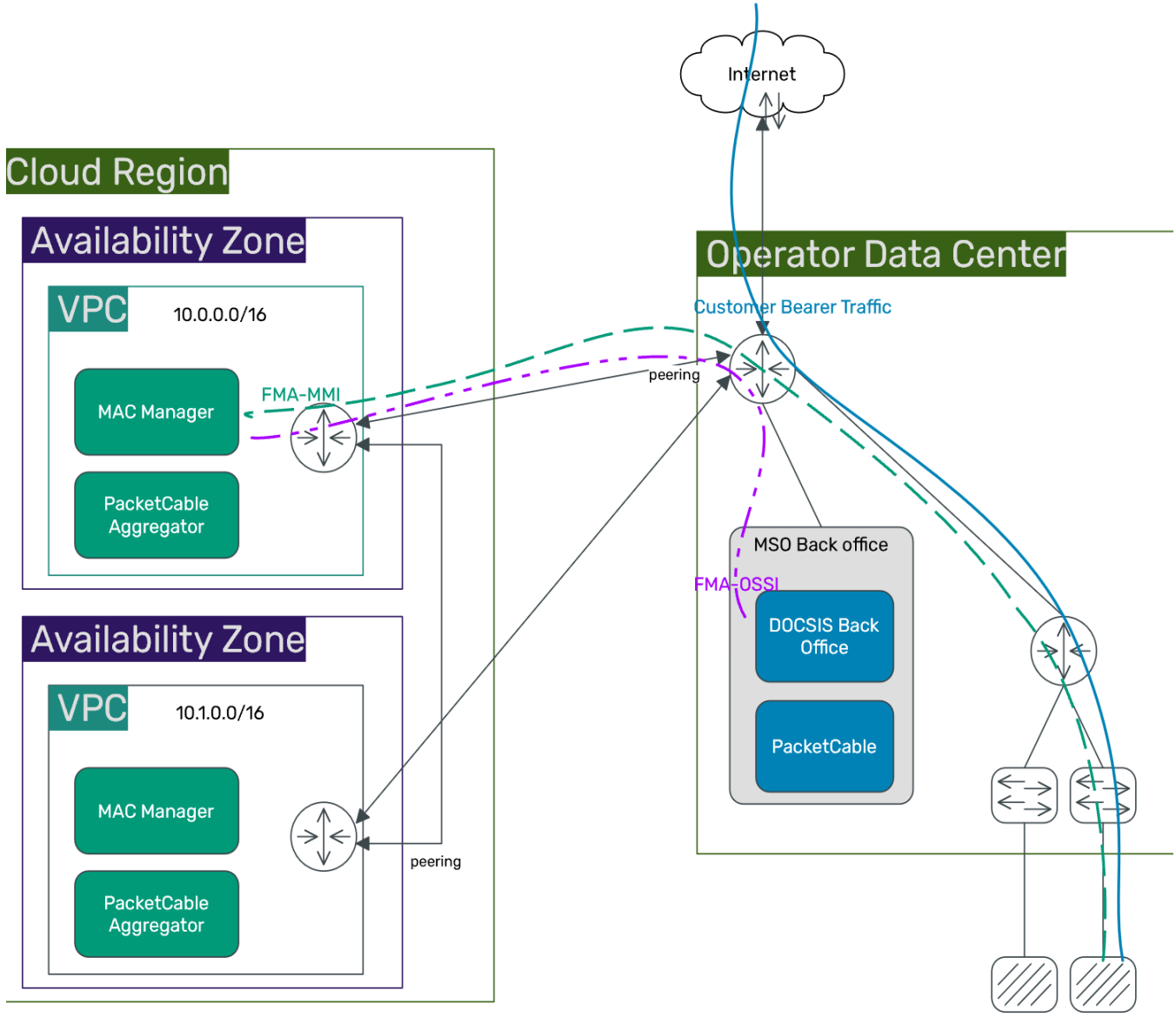


Experiment Topology

Management Plane in Cloud

Data Plane (Customer traffic) “on-prem”

- Local Cloud Region
  - US Northeast
- Availability Zone
  - Unique networking and power
- VPC
  - A private network for compute
  - No internet access



Traffic Types

1. Steady State
   - While the system is operational, this is all the steady state control and management plane data exchanged between MAC Manager and Nodes

2. On Demand / Burst
   - Traffic 'Bursts' triggered by user actions, such as downloading new software releases

Category	Type	Description
Telemetry	Steady State	Ongoing streaming of metrics and statistics used to monitor operation and fulfill SNMP, CLI, Alarms, etc
IPDR	Steady State	Regular streaming of metrics to fulfill IPDR records
Support Info	Steady State	Gathering of debug counters, history, and status information
Logs	Steady State	Ongoing streaming of log messages
Heartbeats	Steady State	Ongoing Heartbeat and Keep-alive traffic
Firmware Upgrade	On Demand	Triggered downloads of new Node firmware
CLI	On Demand	SSH connections directly to the Nodes

Consumption

- Variable bandwidth consumption
  - Implementation dependent
  - Services deployed
  - Configured reporting, if applicable
- Steady-State: mostly Upstream
- On-Demand: mostly Downstream
- Our experiment used:
  - 6-10 Mb/s per RMD Steady-State

Category	Total Size	Downstream Bandwidth	Upstream Bandwidth
Telemetry	Constant		4.3 Mb/s
IPDR	Constant		1.0 Mb/s
Support Info	~ 30MB		76 Mb/s
Configuration	n/a	Negligible	Negligible
Logs	Constant		Negligible
Heartbeats	Constant	Negligible	Negligible
Firmware Upgrade	~ 131MB	116 Mb/s	
SSH/CLI	n/a	Negligible	Negligible

Latency into the Cloud

Can be highly variable…

- MAC Managers Regionally deployed to RMDs
- Establish Hybrid-Cloud connections
- Monitor RMD <-> MAC Manager latency

Zone (US Southeast to…)	Average RTT (ms)	Std Dev (ms)
US Northeast	30.37	9.16
US Central	64.79	13.52
US Northwest	85.99	17.43
US Southwest	79.26	14.82
Europe (Frankfurt)	132.08	17.31
Asia (Tokyo)	254.31	26.26

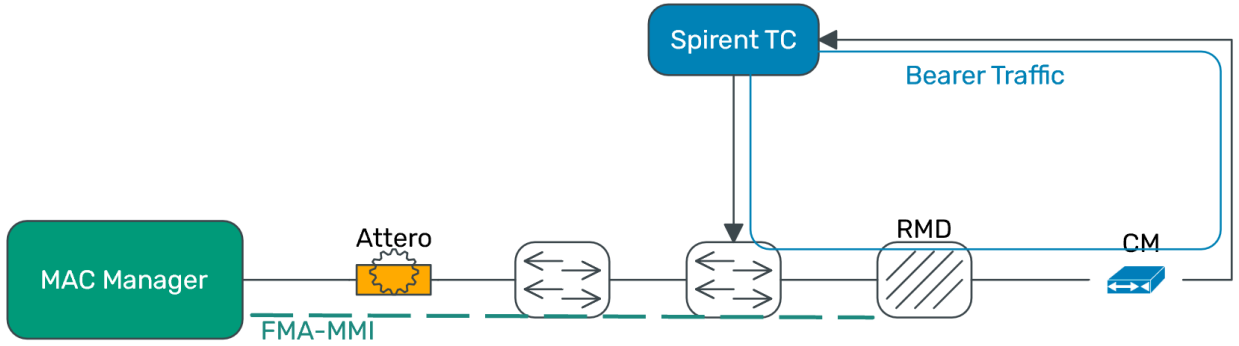
Latency Results

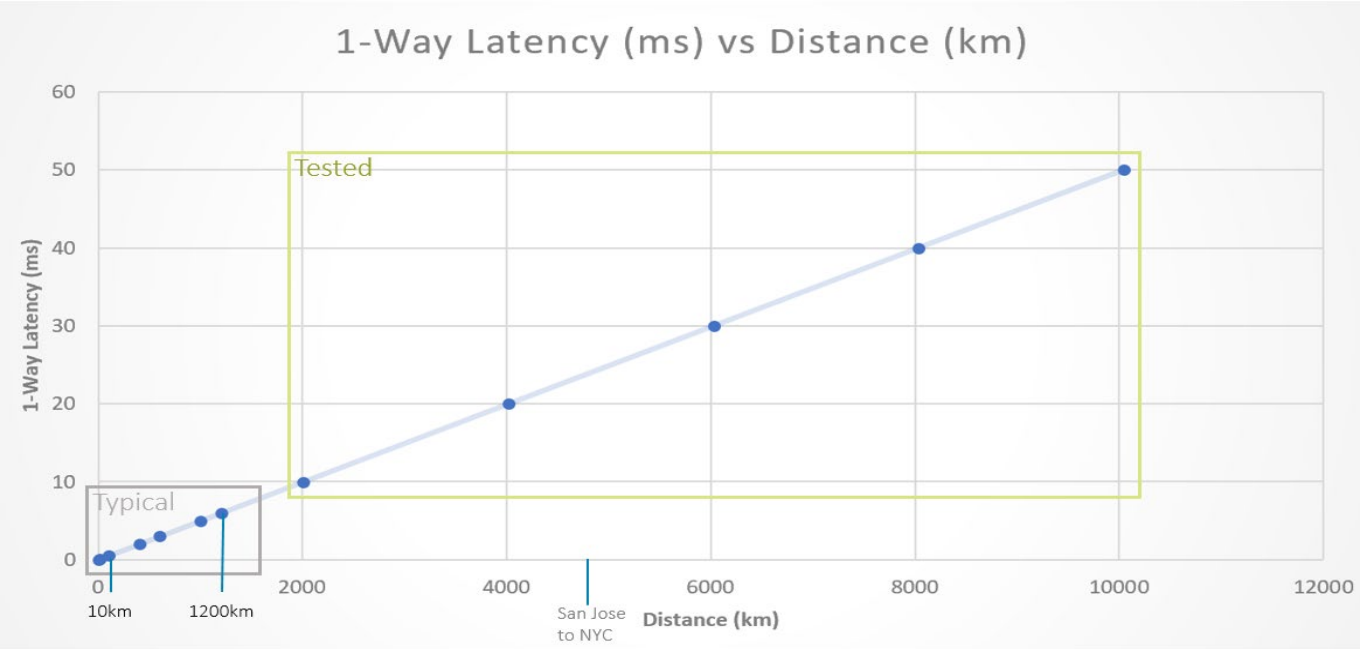
Latency to the Cloud provider

- Affects Management traffic
- Does not affect customer traffic
- Does not add to customer latency

Tested a range of latencies

- No operational faults in higher latencies
- Some operations, particularly big On-Demand workloads, were slower but successful





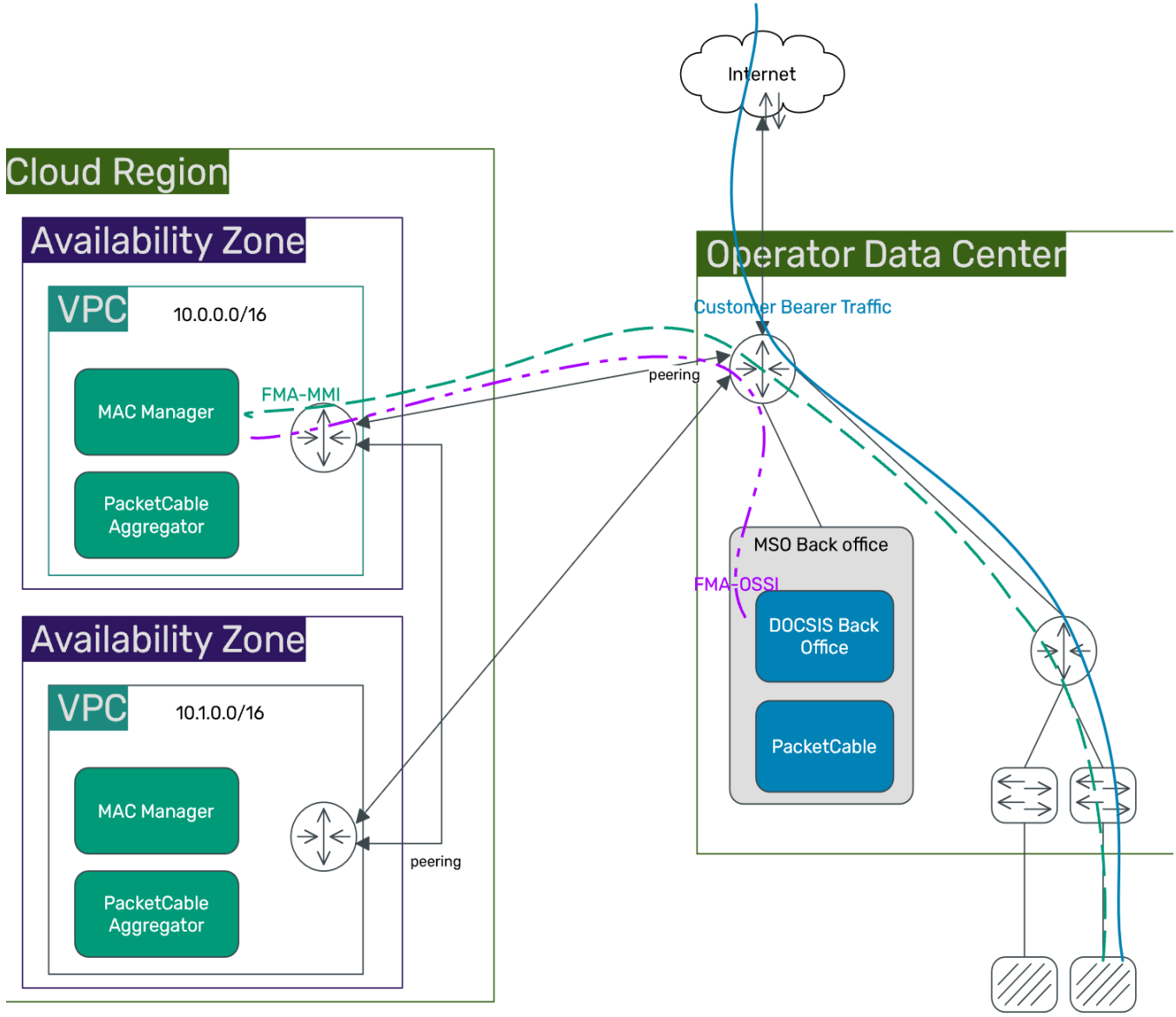
Conclusion

FMA Management/Data Plane separation uniquely suited for Cloud deployment

FMA MAC Manager absolutely works in Cloud environments

Cloud providers can provide “instant on” compute and services availability

Increased agility, flexibility, and software-defined services



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Thank You!

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