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Theory and Practical Aspects for Service Providers

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BRKSPM-1005



Introduction



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Cisco Webex App

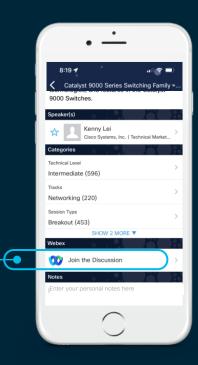
Questions?

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Why even MEC?

Agenda

MEC Mechanisms and Practical Aspects

Summary of Options & Recommendations

Why even MEC?





Does latency even matter?

Yes, latency clearly does matter

- Any TCP traffic benefits from low latency (including HTTP adaptive video)
- Some use cases absolutely require low latency: online gaming, mission critical enterprise

What is needed to deliver latency?

 A flexible network architecture that can provide lower latency based on value i.e., deliver it when needed – on demand (isn't everything?)

Will people pay for lower latency?

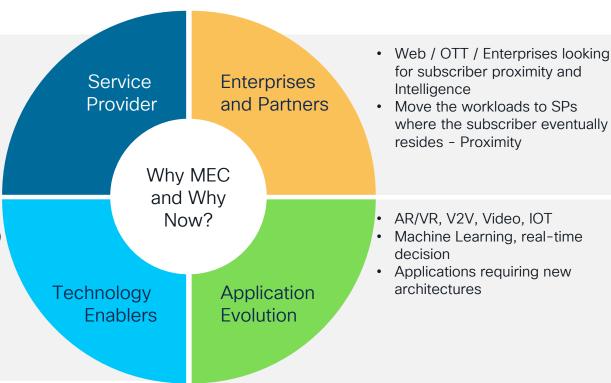
- Unknown and unlikely from regular consumer perspective but could be a differentiator
- Enterprises expect low latency as a key requirement in private networks and on top would love for service providers to offer this as a "perk"



Tipping point for MEC

- Looking for new revenue sources and new service offerings
- New peering partnerships
- Access to content and ownership

- Control-plane and userplane separation (CUPS, 5G) enable new deployment models with user-plane at edge
- RAN Architecture splits
- Convergence on Linux containers and x86 architectures





What we intend to achieve with MEC i.e., Goals

End User

Improved quality of experience, new services, reduced cost for service access and more personalized networks

Enable our Service Provider Customers with tools to manage their extended cloud deployments supporting VNFs, Applications and Services with ease regardless of VMs vs. Containers, Compute Heavy vs. Storage Heavy vs. Network Heavy workloads.

Increase ease of operations without compromising security regardless of the location of the service and network components so that SPs can launch services faster, closer to the end user with lower costs, improved agility and increased Revenue Service Provider

Enterprise

Enable a new set of use cases and address existing scenarios requiring lower latency with more reliable 5G networks – using either private or public 5G architectures



Standards & Industry Group Landscape*

* Partial List



Architecture & Service Edge



MEC WG

Focus for our conversation today













guidelines Edge Computing MEC WG

NFVI

Virtualization Infrastructure

Fast Data Plane

Fast Virtual Networking

Reference

NFV

Many Topics

Many Topics

architecture &

Orchestration. Automation







TOT IVIEU

NFV. Edge

Computing













Edge Computing

Agility + DC

CO Transformation

Many Topics

Many Topics

Project

Infrastructure

Infrastructure

APIs

enable M2M

Edge Computing

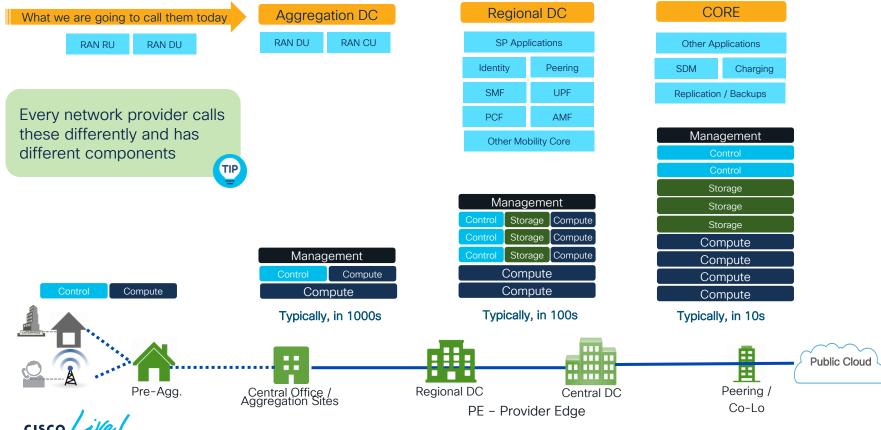
Reference

Edge Computing

Edge Computing



Let's agree on terms and what is where



Typical SP Architecture for MEC Aggr. DC CORE Regional DC Local Anchor (UP) Subscription Local SP DNS webex IP@EAS1 N6 LAN **Policy** Central Central Anchor SP DNS Resolver Aggr. DC Internet/ **Control Plane** N6 LAN Interception Local Anchor Lawful (UP) Local SP DNS webex IP@EAS2 Resolver EAS Edge Application Server Internet webex webex m IP@AS 用 шп **Public Cloud** Regional DC Pre-Agg Central Office / Aggregation Sites Peering / Central DC - Provider Edge Co-Lo #CiscoLive BRKSPM-1005 © 2022 Cisco and/or its affiliates. All rights reserved. Cisco Public

Edge vs. Centralized - Which should we use?

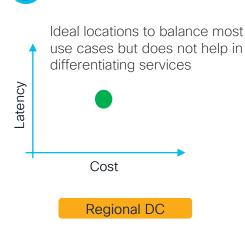
The answer will be **use case dependent** specifically on the required latency and associated value

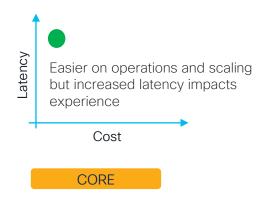


Real estate, power (including back-up) and the OpEx of managing multiple edge locations drives cost but automation could help

Cost

Aggr. DC







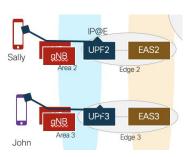
Latency

MEC
Mechanisms and
Deployment
Aspects





Distributed Anchor Point



Agenda

Multiple Sessions



Session Breakout



UPF User Plane Function
EAS Edge Application Server
ULCL Uplink Classifier



Comparison of the three 3GPP MEC Solutions

		Distributed Anchor Point	Multiple Sessions	Session Breakout
	Communication Model	Sally QNB UPF2 EAS2 Edge 2 John EAS3 John Edge 3	IP@E UPF-C Sally SNB Area 2 Edge 2	Sally UPF2 EAS2 Area 2 Edge 2
Mobile Impacts	UE Modem Impacts		M	
Mobile I	Application / modem interaction (DNS)			H
Network Impacts	Application Specific Config in network			
	5G Core network impacts			
Features	Application Session Continuity	×		
	Support on 4G	✓		

Distributed Anchor Point



Distributed Anchor Point Aggr. DC **CORE** Regional DC Tunnel IP@E Local Anchor (UP) Local SP DNS webex IP@EAS1 Resolver Policy Central SP DNS Central Anchor Resolver Aggr. DC Internet/ **Control Plane** N6 LAN **Local Anchor** (UP) Intercept Local SP DNS webex IP@EAS2 Internet 💯 webex



Distributed Anchor Point Aggr. DC **CORE** Regional DC **Local Anchor** (UP) Local SP DNS webex IP@EAS1 Policy Central SP DNS Central Anchor Resolver Aggr. DC Internet/ **Control Plane** N6 LAN Local Anthor Lawful (UP) Local SP DNS webex IP@EAS2 Resolver Internet



Comparison of the three 3GPP MEC Solutions

		Distributed Anchor Point	Multiple Sessions	Session Breakout
	Communication Model	Sally UPF2 EAS2 Area 2 Edge 2 John EAS3 John EAS3	Sally P@E UPF-C EAS2 Sally Edge 2	Sally UPF2 EAS2 Edge 2
Mobile Impacts	UE Modem Impacts	Low for make-after-break (SSC Mode 2) High for make-before break (SSC Mode 3)		
	Application / modem interaction (DNS)	Need to perform DNS query on IP@ change		
Features Network Impacts	Application Specific Config in network	• None		
	5G Core network impacts	Edge UPF needs higher capacity		
	Application Session Continuity	• None		
	Support on 4G	Yes for make-after break		



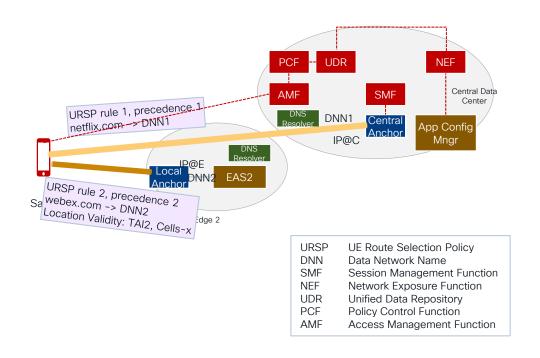
Multiple Sessions



Multiple Sessions Aggr. DC **CORE** Regional DC Local Archor (UP) Tunnel Local SP DNS Resolver webex IP@EAS1 IP@C Policy Central SP DNS Central Anchor Resolver (UP) Charging Aggr. DC Internet/ **Control Plane** N6 LAN **Local Anchor** (UP) Local SP DNS webex IP@EAS2 Internet webex webex



Multiple Sessions: Filtering Traffic to the Two PDU Sessions





Comparison of the three 3GPP MEC Solutions

		Distributed Anchor Point	Multiple Sessions	Session Breakout
	Communication Model	Sally 9NB UPF2 EAS2 Edge 2 UPF3 EAS3 John Area 3 Edge 3	IP@E UPF-C Sally QNB Area 2 Edge 2	DLCL UPF-C UPF-C Sally Area 2 Edge 2
Mobile Impacts	UE Modem Impacts		Support of URSP rules. M	
Mobi	Application / modem interaction (DNS)		Use of SP DNS resolver optional	
Network Impacts	Application Specific Config in network		Need to create URSP rules based on applications	
	5G Core network impacts		Support of many DNNs.	
Features	Application Session Continuity	×	No for MEC Application	
Feat	Support on 4G	✓	Some. URSP rules cannot be provided/updated in 4G	



Session Breakout



Starting Configuration Aggr. DC **CORE** Regional DC Application **Local Anchor** (UP) Tunnel Local SP DNS webex IP@EAS1 Policy Central SP DNS Central Ancion Charging Internet **Control Plane** N6 LAN Lawful Internet webex webex

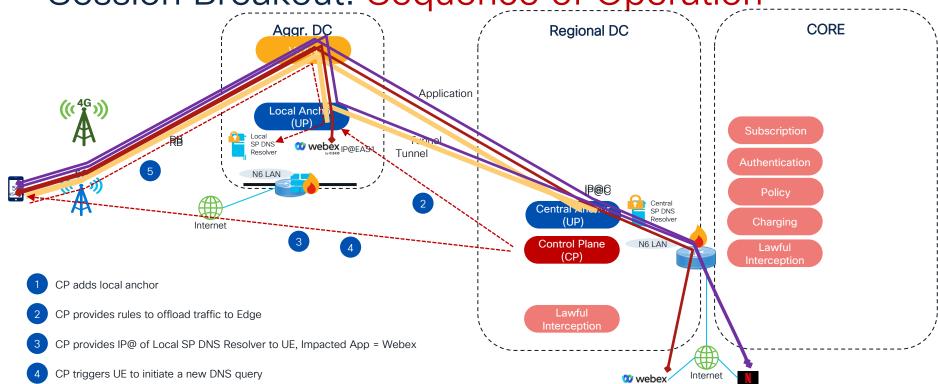


RB Radio Bearer

Session Breakout: End Configuration Aggr. DC **CORE** ional DC **Uplink Classifier** Sends UL Pkts to UE Filters DL packets for local services Local Anch (UP) Local SP DNS webex IP@EAS1 Tunnel N6 LAN IP@C Policy Central Central Ancho: SP DNS (UP) Resolver Aggr. DC Internet, **Control Plane** N6 LAN Interception Local Anchor Lawful (UP) Local SP DNS webex IP@EAS2 Internet webex webex



Session Breakout: Sequence of Operation



5 UE uses the local SP DNS Resolver for Webex address

6 Webex traffic flows to local Webex Server

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RAB Radio Access Bearer

Session Breakout: Charging Challenges Aggr. DC Regional DC CORE Local Ancho (UP) Local SP DNS webex IP@EA. Policy Central Central Ancho: SP DNS (UP) Aggr. DC Internet, **Control Plane** Interception Local Anchor Lawful Local SP DNS webex IP@EAS2 Internet webex webex



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Session Breakout: Lawful Interception 1 Aggr. DC Regional DC **CORE** Local Ancho Local SP DNS webex page as 1 Policy Central Central Anchor SP DNS Resolver Aggr. DC Internet, **Control Plane** N6 LAN CC- PAG Local Anchor Lawful (UP) Local SP DNS webex IP@EAS2 Internet webex webex IP@AS CC Communications Content POI Point of Interception

PAG POI. Aggregation Session Breakout: Lawful Interception 2 Aggr. DC Regional DC **CORE** Local Ancho Subscription Local SP DNS webex IPMEAS1 Policy Central Central Anchor SP DNS (LCC-PO Resolver Aggr. DC Internet, **Control Plane** N6 LAN Interception Local Anchor Lawful (UP) Local SP DNS webex IP@EAS2 Internet webex webex IP@AS



CC Communications Content POI Point of Interception

Comparison of the three 3GPP MEC Solutions

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Communication Model	Sally QNB UPF2 EAS2 Sally QNB UPF3 EAS3 John Area 3 Edge 3	IP@C UPF-C UPF-C Sally Sally Edge 2	Sally UPF2 EAS2 UPF-C Edge 2
UE Modem Impacts Application / modem			• None
Application / modem interaction (DNS)			UE MUST use SP DNS and the DNS client must be controlled by network
Application Specific Config in network 5G Core network impacts			Required significant configuration about DNS and Application to edge DNS
5G Core network impacts			Use of ULCL. Charging and Lawful intercept impacts
Application Session Continuity			• Yes
Support on 4G			• No



Comparison



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Mobile Impacts	UE Modem Impacts		M	
Mobile I	Application / modem interaction (DNS)			H
Network Impacts	Application Specific Config in network		M	H
Network	5G Core network impacts	M		H
Features	Application Session Continuity	×	×	✓
	Support on 4G	✓	×	×

Highlights

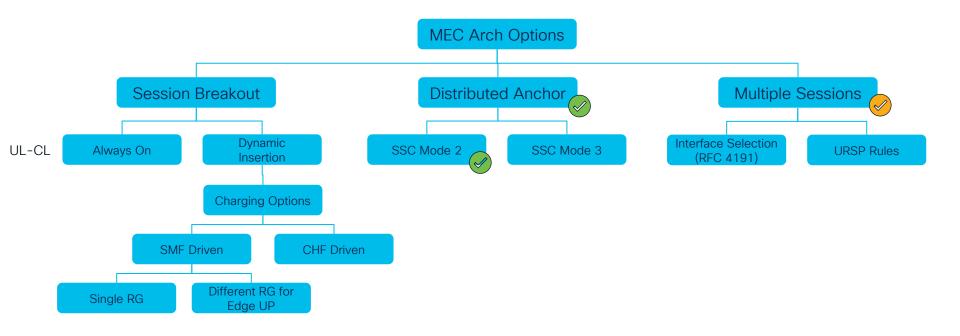
- Achieving Application Session Continuity is tricky without tight interaction between 5GC and Application Server/Client
- Session Breakout model provides more control to Operator for MEC applications
- Distributed anchor point may be easiest to implement from core network, but results in IP@ change for UE. Also requires dedicated APN/DNN or SSC Mode signaling
- Multiple sessions has dependencies on UE and is based on URSP, which cannot be updated when on 4G and does not work with NSA UFs



Cisco Recommendations



Choices for architecture and recommendations





The key is to understand that there is no single silver bullet option for MEC. Need to consider application and network interactions.



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