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Getting your WLAN Ready for Enterprise-grade UCC & VoIP

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AGENDA

- UCC Trends & Challenges
- It's all about the QoS..
- UCC Applications on Aruba WLAN (6.x Architecture)
- Skype for Business on 8.x Architecture
- Troubleshooting

Unified Communication & Collaboration (UCC)

1. UCC is all about Voice/Video/Conferencing/Desktop-Sharing
2. Wireless Controller ‘unifies’ various aspects of it
3. Media Detection – Media Classification – Media/Traffic Prioritization
4. In-depth VO/VI call visibility – Monitoring
5. Various UCC applications – Skype for Business, SIP, Jabber, etc.

UCC Trends & Challenges

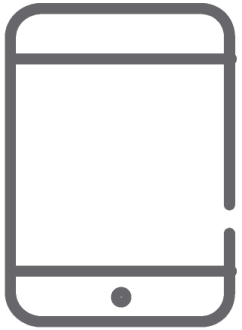
UCC Trends

- Digital Workplace adoption with Wi-Fi

- Voice no longer a “standalone application”
  - SIP, SCCP, SVP, H323, Vocera

- UCC is the “new wave” in IT
  - Skype for Business, Wi-fi calling, Jabber, FaceTime, Hangout etc.
  - Device mobility
  - Application anytime and anywhere

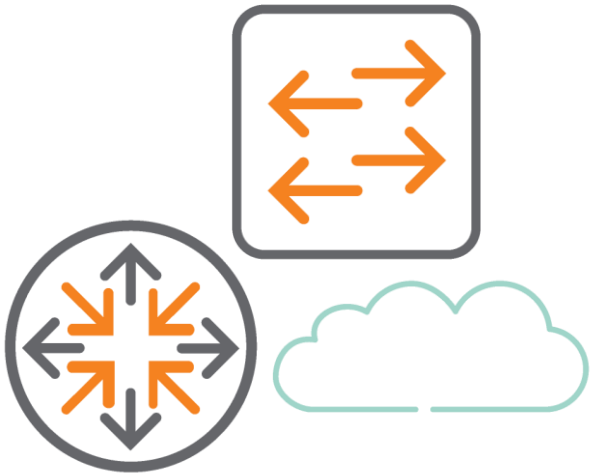
UCC Challenges over Wireless



- Diversity of Clients
- AV
- App incompatibility

- AP placement
- Channel Capacity
- AP Capacity
- Tx/Rx Characteristics
- Interference
- Mobility

- QoS on wireless



- QoS on wire
- Queue overflows/drops
- Routing/path changes
- WAN
- UC server monitoring

QoS Considerations

–Voice/Video traffic transmission at lower priority

– QoS incompatibility between Wired and Wireless

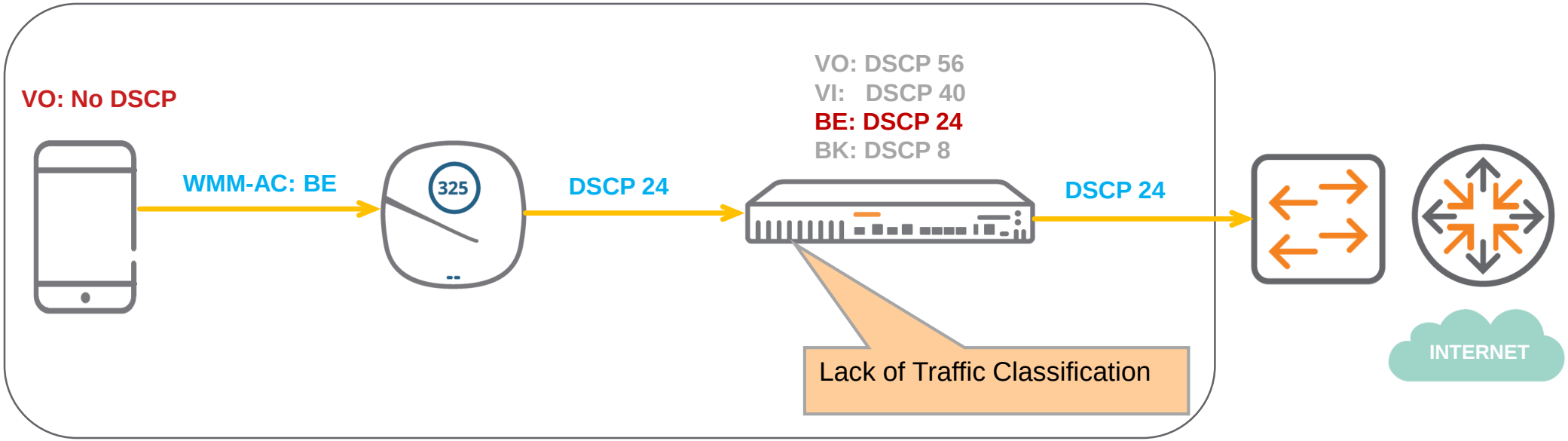
– No End-to-end QoS

QoS Considerations

- Voice/Video traffic transmission at lower priority
- QoS incompatibility between Wired and Wireless
- No End-to-end QoS

Voice/Video Traffic Best-Effort?

Lack of visibility to different application traffic types



QoS Considerations

- VO/VI traffic is going at lower priority
- QoS incompatibility between Wired and Wireless
- No End-to-end QoS

WMM, 802.11p, DSCP

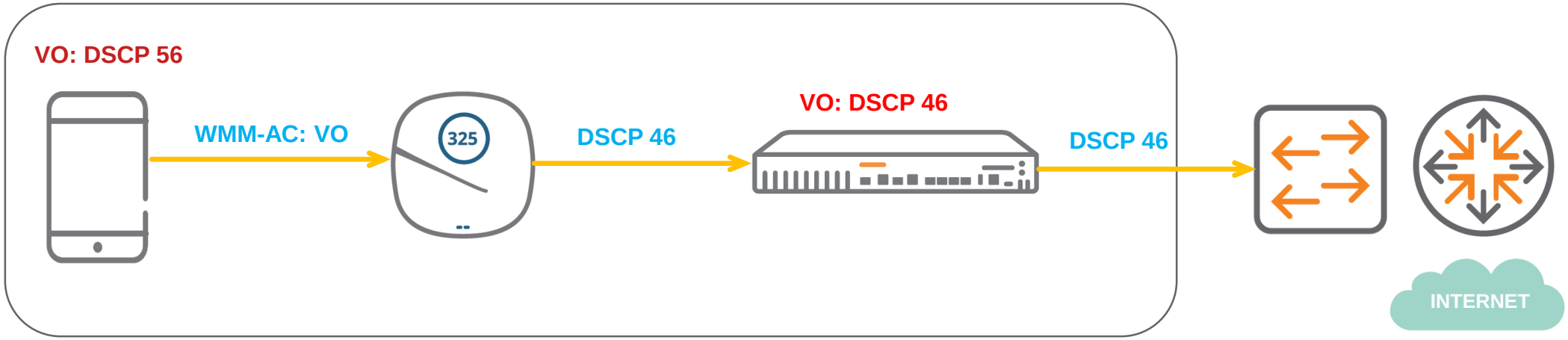
Priority	802.1P Priority	802.1P Designation	WMM Access Category
Lowest	1	BK	AC_BK
	2	BK	
	0	BE	AC_BE
	3	EE	
	4	CL	AC_VI
	5	VI	
	6	VO	AC_VO
Highest	7	NC	

WMM	DSCP
AC_VO	48-63
AC_VI	32-47
AC_BE	22-31
AC_BK	0-21

- Legacy wired networks have DSCP 46 (EF) defined for Voice
- If client does upstream tagging of VO packets with DSCP 46, wireless driver on the client will send the traffic on air as WMM-AC as VI instead of VO
- It is recommended to follow DSCP values mandated by WMM standard to have end-to-end QoS

DSCP 46 (EF) Recommendation

- Configure wireless clients with DSCP 48 – 63 for VO
- On the HPE Aruba infrastructure, configure DSCP 46 for VO



QoS Considerations

- Voice/Video traffic transmission at lower priority
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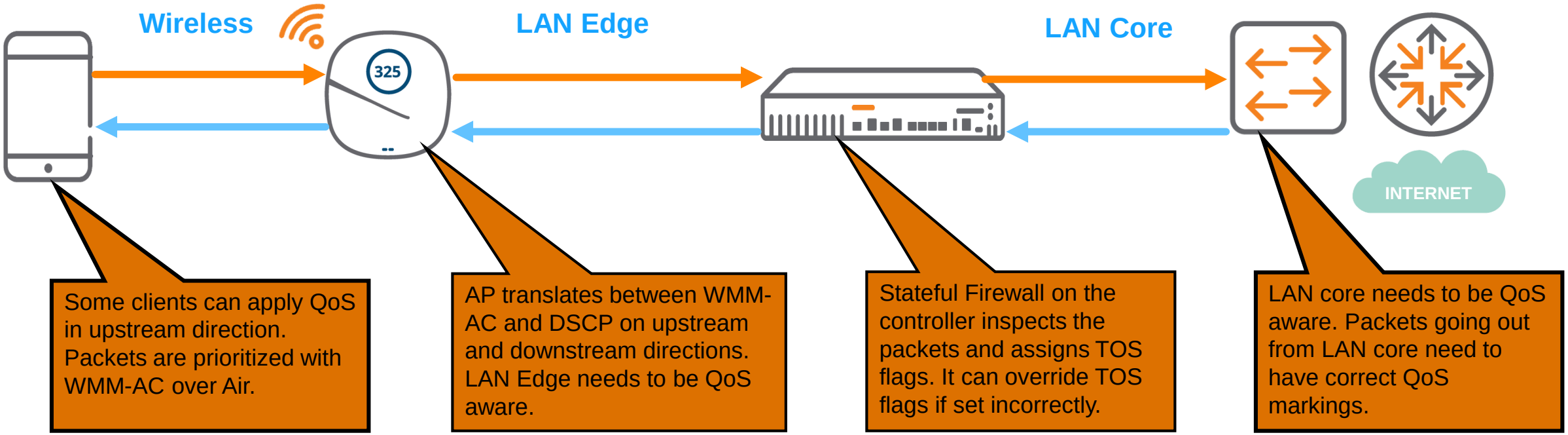
End-to-End QoS

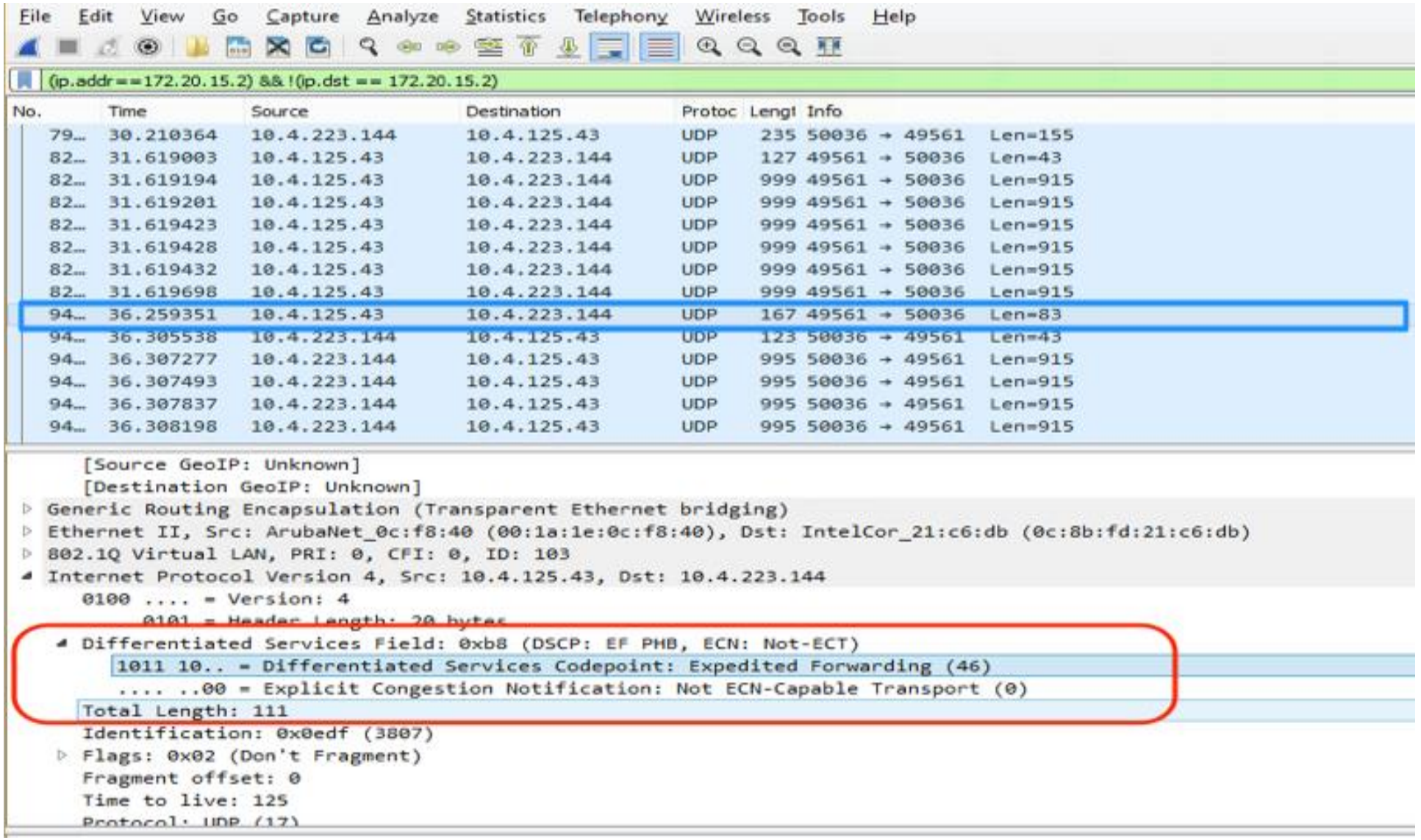


QoS Configuration on Aruba Controller

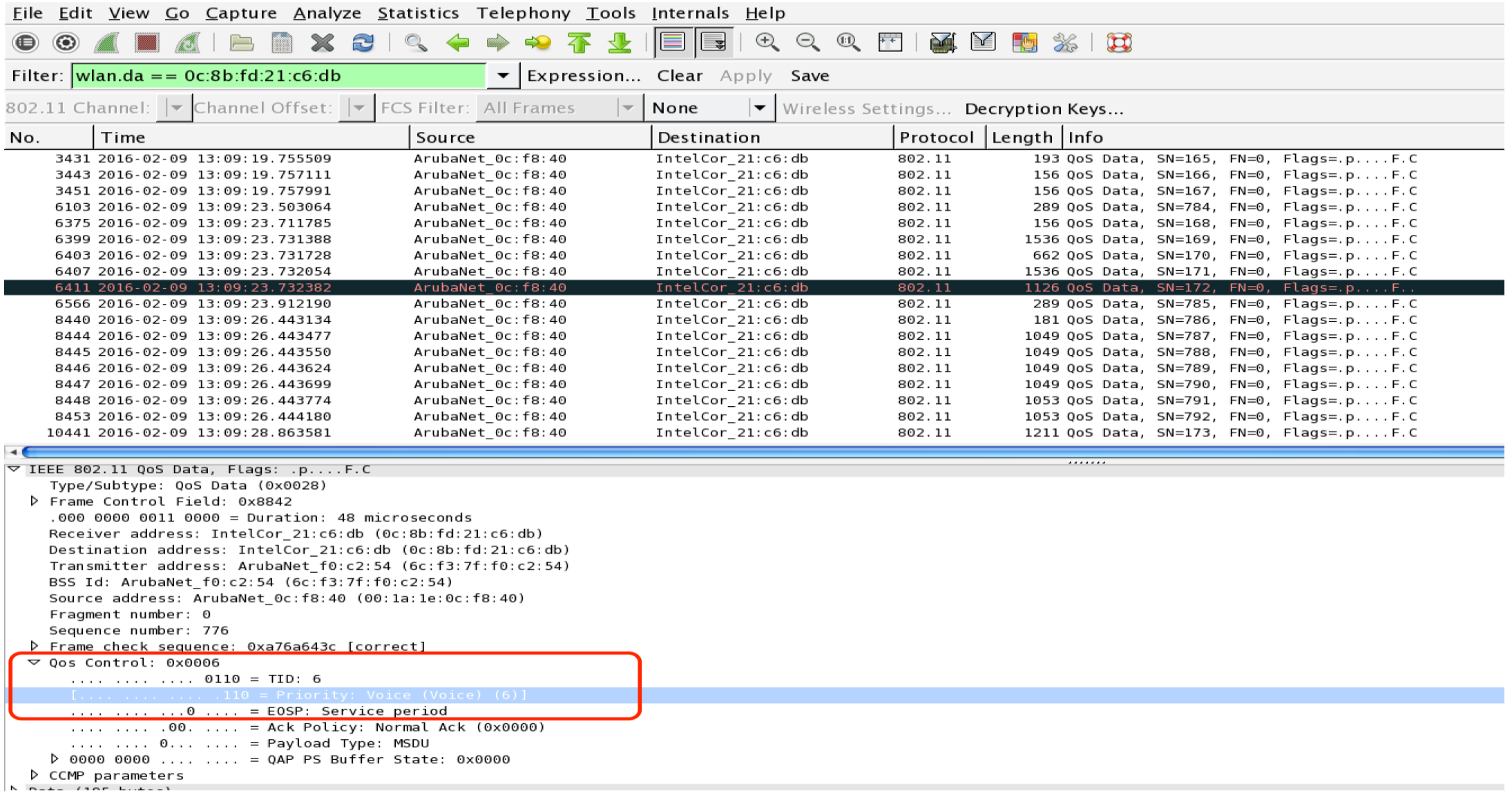
Configuration > AP Group > Edit "UCC"

Profiles		Profile Details	
Wireless LAN		Short Preamble	☑
Virtual AP		Max Associations	64
POC_PSK_AD-prof		Wireless Multimedia (WMM)	☑
AAA	default	Wireless Multimedia U-APSD (WMM-UAPSD) Powersave	☑
802.11K	default	WMM TSPEC Min Inactivity Interval	0 msec
Hotspot 2.0		Override DSCP mappings for WMM clients	☐
SSID	POC-PSK-AD-prof	DSCP mapping for WMM voice AC (0-63)	56
EDCA Parameters Station		DSCP mapping for WMM video AC (0-63)	40
EDCA Parameters AP		DSCP mapping for WMM best-effort AC (0-63)	24
High-throughput SSID	default	DSCP mapping for WMM background AC (0-63)	8
802.11r		Multiple Tx Replay Counters	☐
		Hide SSID	☐

Wired QoS (Controller -> AP)



Wireless QoS (AP -> Wireless Client)

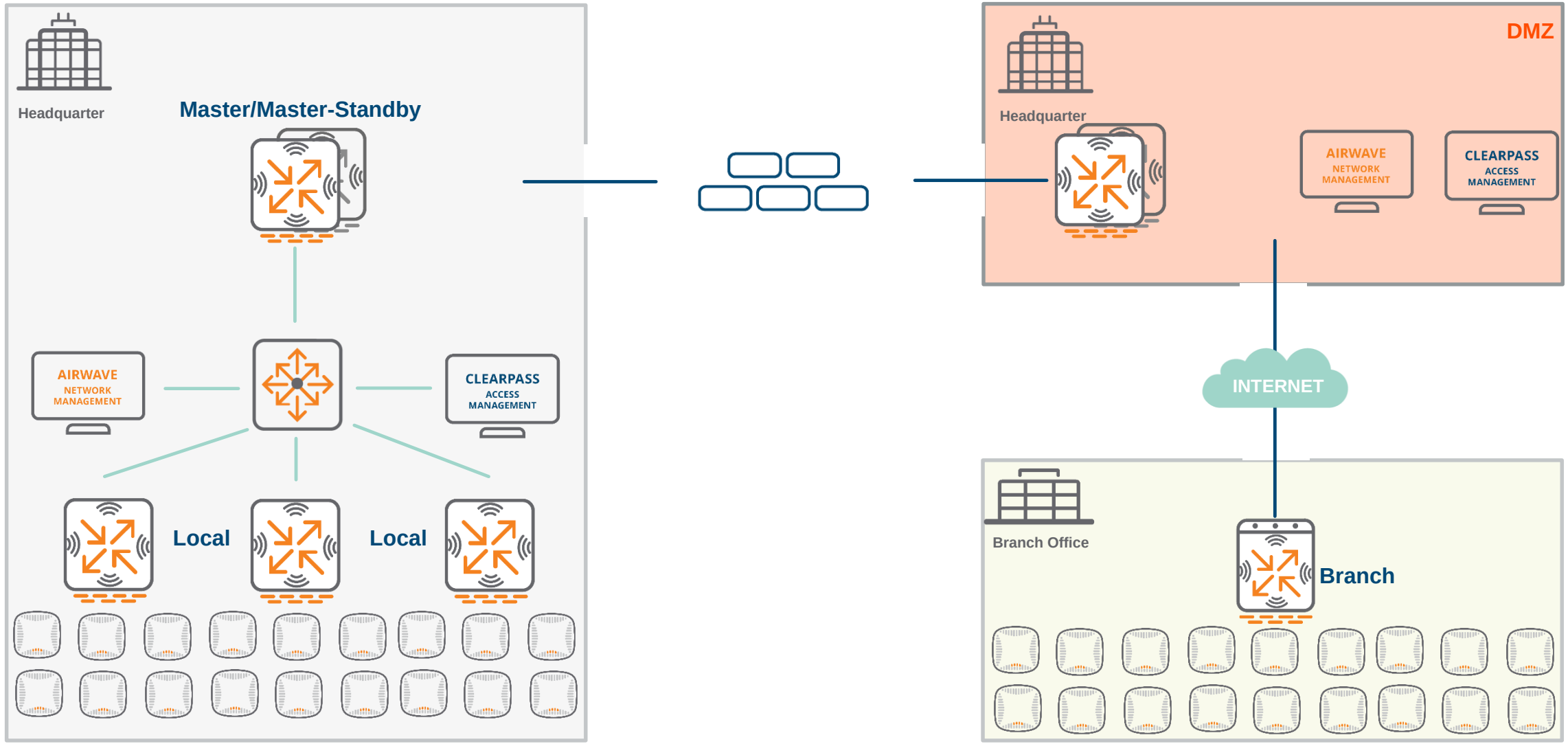


UCC Apps on Aruba WLAN 6.x Arch

UC Apps on Aruba WLAN

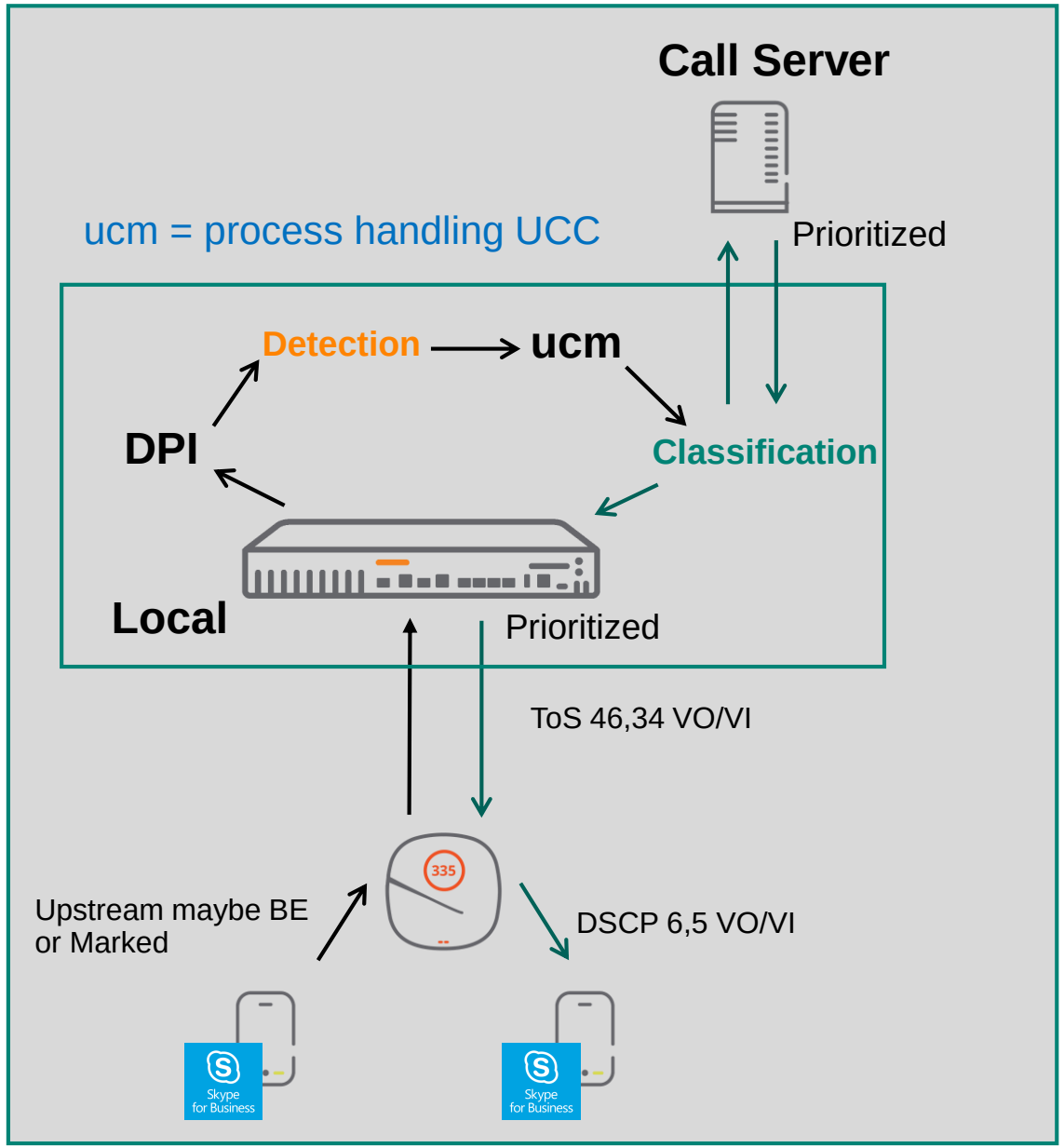
- Skype for Business
- Wi-Fi Calling
- Jabber
- FaceTime
- Hangout

Aruba WLAN Enterprise Network Architecture - AOS 6.x



UCC 6.x Design Overview - Heuristics

1. ‘ucm’ is name of process handling UCC
2. Client flow goes thru DPI – media detection, passes onto ucm
3. Ucm classifies media streams into VO,VI, determines type of call
4. Installs prioritized flows uplink to call server and downstream to client

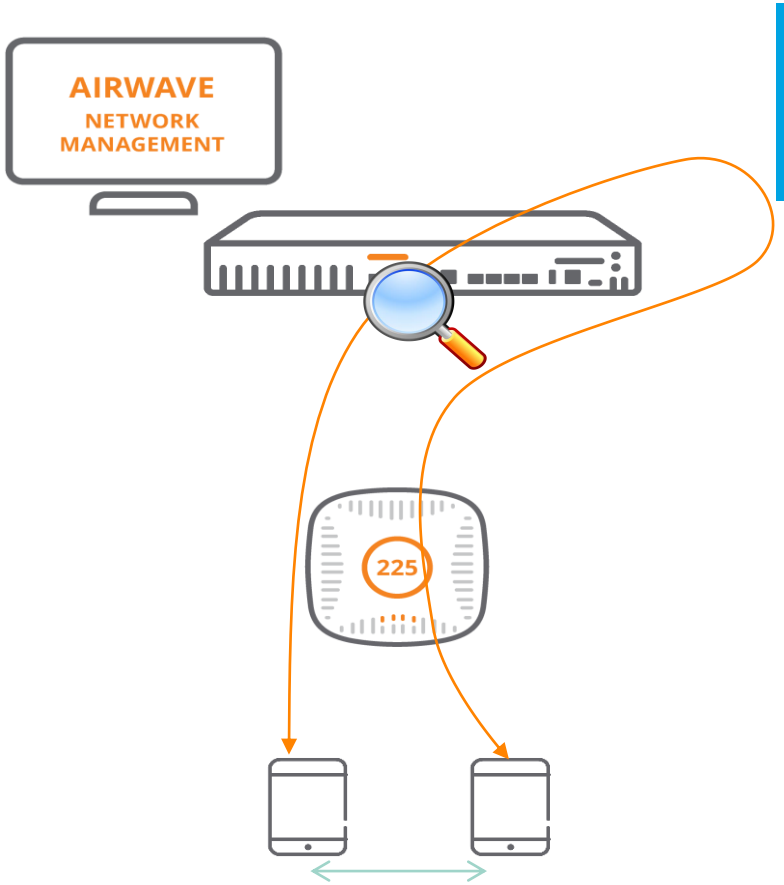


Skype for Business on Aruba WLAN

SfB Classification Methods

- Heuristics
- SDN API

SfB Heuristics



Skype for Business

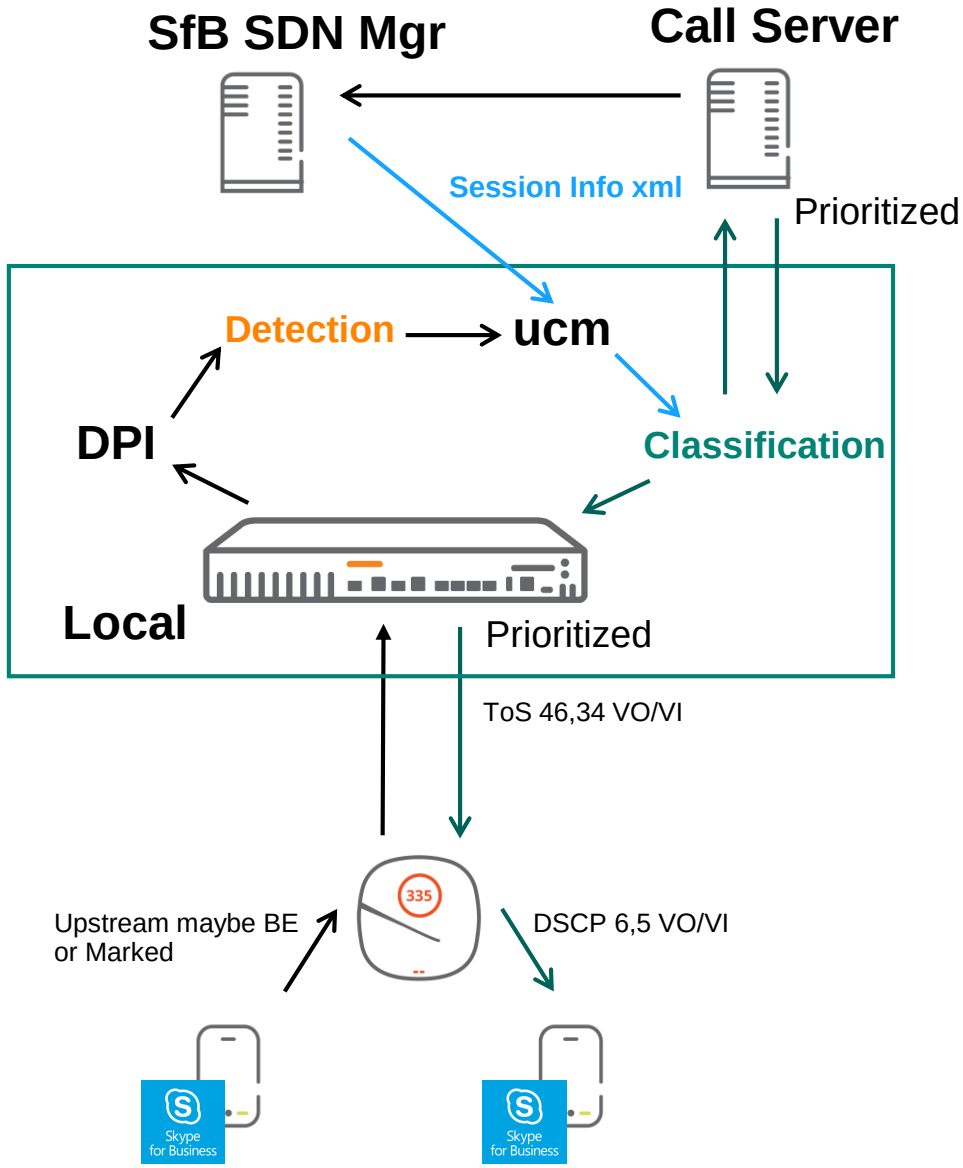
- Leverages DPI to identify & prioritize real time voice and video traffic
- Ideal for SfB online deployments
  - On-prem and hosted deployments without SDN API can leverage heuristics
- AirWave aggregates network wide data for visibility
- SfB clients multiplexes RTCP and RTP packets over the same session; packets treated as RTCP packets instead of media
- For Controllers, SfB Heuristics is supported from AOS 6.4.4
- For Instant APs, SfB Heuristics is supported from Instant OS 4.3.0

Skype for Business (SfB) SDN API Overview

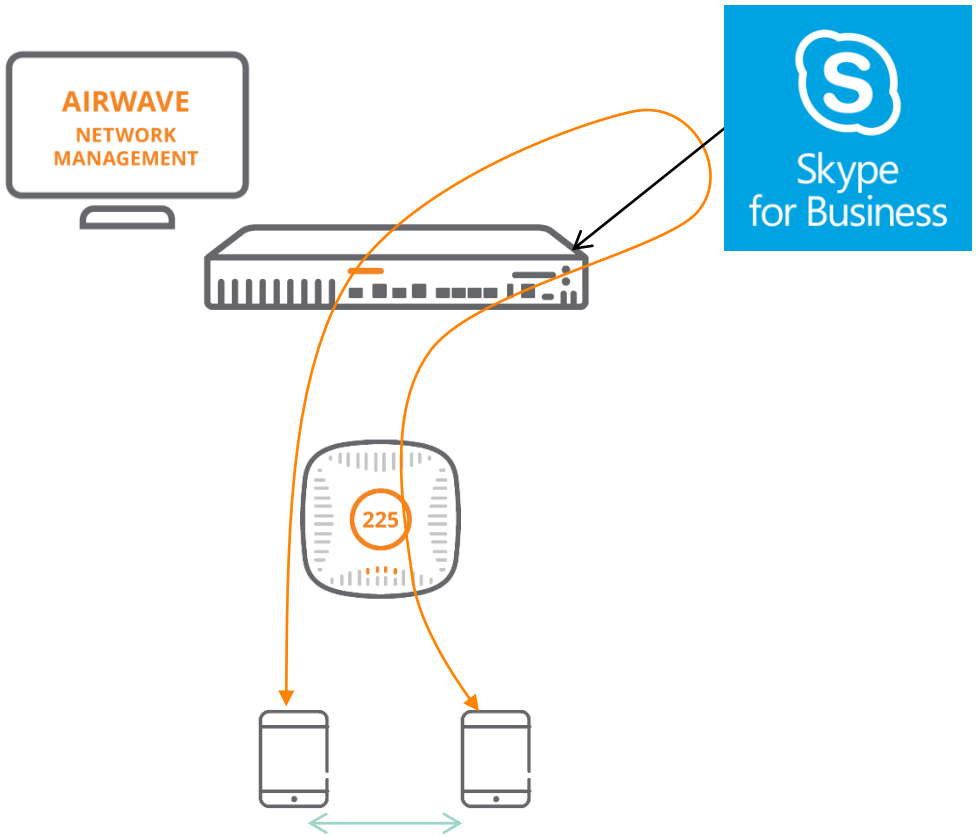
1. Microsoft terminology for a service that provides call info to switches
2. Not to be confused with ‘networking related SDN’
3. SDN API are xmls that contain rich call/media/endpoint info and statistics
4. ArubaOS Controller Capable of receiving SDN API msgs
5. Controller programs prioritized flows for VO, VI, etc based on those msgs

UCC SfB SDN API Design in 6.X

1. SDN API provides call session info and rich visibility
2. Controller is in listening mode for SDN xml messages from SDN Mgr
3. Call start triggers SDN msg from mgr to controller
4. Xml contains details on caller, callee, ports, media classification etc.
5. End call provides end-to-end call quality metrics



Call Details via SDN API



- CALL START
  - Caller/Callee, device, session, BW, time etc.
- PERIODIC INTERVALS
  - Instantaneous Call quality
- CALL END
  - Avg. call quality, time, microphone/speaker glitch rate etc.

Wi-Fi Call Quality Analysis

- UCC Score
  - Calculated by analyzing the RTCP/RTP information for related media flows over the wireless link
  - Delay, jitter and packet loss calculated
  - Computation performed for voice calls only

UCC Score	Quality Indication
Greater than 70	Good quality perceived by the network
Between 30 and 70	Fair quality perceived by the network
Less than or equal to 30	Poor quality perceived by the network

Capability Comparison between Heuristics & SDN API

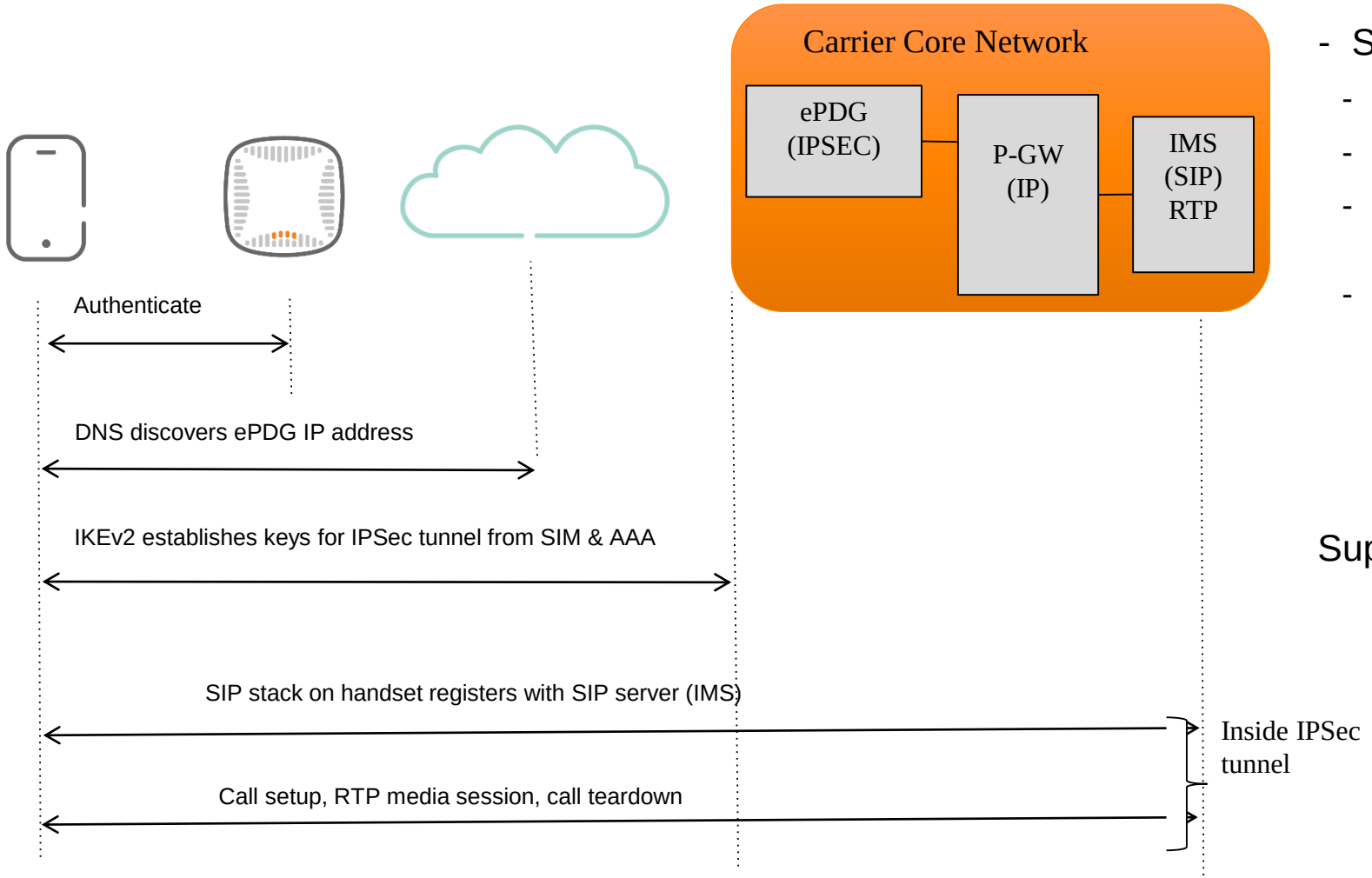
Feature	Heuristics	SDN API
Tagging and retagging WMM/DSCP values	✓	✓
Dynamic identification/prioritization of SfB Voice/Video streams	✓	✓
Prioritization of Office365 traffic	✓	
Independent of SfB Infrastructure	✓	
Real-time call quality analysis using UCC score	✓	✓
Correlation between UCC score and Wi-Fi health metrics on UCC dashboard	✓	✓
Dynamic identification/prioritization of SfB desktop sharing, file transfer		✓
End-to-end call metrics including MOS for diagnostics and troubleshooting		✓
Correlation between MOS and Wi-Fi health metrics on UCC dashboard		✓
Visibility into dialled numbers and gateway endpoints		✓
Visibility into endpoint speaker and microphone glitch rates		✓
Accurate identification of 100% of all SfB traffic		✓

Wi-Fi Calling

Wi-Fi Calling

- Native phone number
- Carrier text messaging
- Response to OTT
- Improved indoor coverage
- Roaming avoidance
- Complements VoLTE / IMS

Wi-Fi Calling Detection



- Sequence of events
  - Gateway Learning Phase
  - IPSEC Tunnel Establishment
  - Media flow and Call Classification based on Heuristics
  - Apply QoS on media traffic

Supported from AOS v6.5

Global CDRs

New Devices: 370 | Up: 41 | Down: 4 | Mismatched: 10 | Rogue: 3186 | Clients: 23 | Alerts: 20450

APs/Devices | Clients | Reports | System | Device Setup | AMP Setup | RAPIDS | VisualRF

RF | UCC | RF Performance | RF Capacity | Network Deviations | Search | Documentation | License | User Info

l Details

ails [Total Row Count: 75] Export as CSV

ngth 10 | Next >

End Time	Client	Protocol	Device Type	Call Type	Call Quality	Client Health	Call State	Termination Reason
2/21/15, 11:57 AM	sverma@arubanetworks.com	Lync	Windows 7	Voice	Good	Good	Success	Terminated
2/21/15, 11:31 AM	sverma@arubanetworks.com	Lync	Windows 7	Voice	Good	Good	Success	Terminated
2/24/15, 4:48 AM	Sathya	Lync	Windows 7	Voice	Good	Good	Success	Terminated
2/24/15, 4:48 AM	Sathya	Lync	Windows 7	Voice/Conf	Poor	Poor	Success	Terminated
2/24/15, 4:15 AM	Sathya	Lync	Windows 7	Voice/Conf	Good	Fair	Success	Terminated
2/23/15, 3:13 AM	Peter	Wi-Fi Calling	Android	Voice	Good	Good	Aborted	Inactivity
2/22/15, 6:44 PM	Peter	Wi-Fi Calling	Android	Voice	Good	Good	Success	Terminated
2/23/15, 2:58 AM	Peter	Wi-Fi Calling	Android	Voice	Good	Good	Success	Terminated
2/21/15, 12:14 PM	nsoragavi	Lync	Windows 7	Voice/Conf	Good	Good	Success	Terminated
2/21/15, 12:14 PM	Jari	Lync	Windows 7	Voice/Conf	Poor	Poor	Success	Terminated

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Jabber

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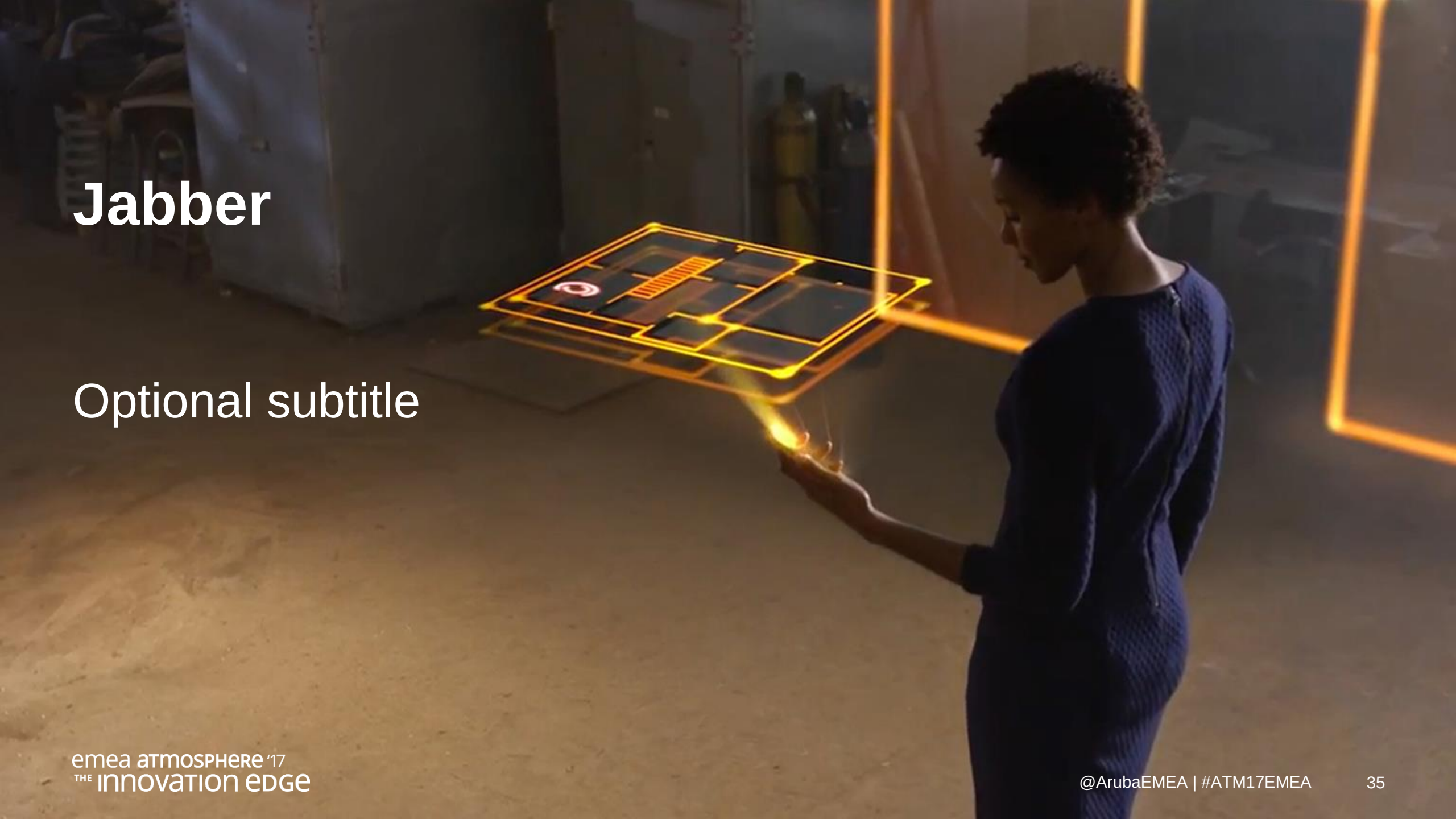


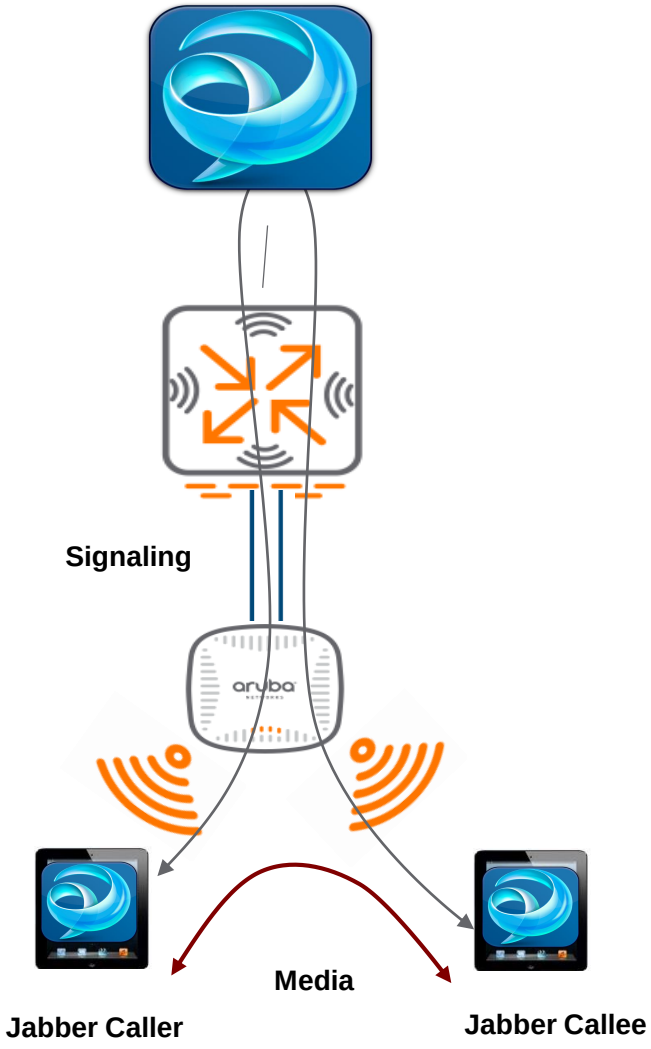
What is Jabber?

- Enterprise Application that supports IM, Voice, Video, Desktop Sharing & File Transfer
  - Voice, Video & Desktop Sharing is based on RTP
  - File Transfer is based on TCP
- Available in two different flavors
  - Cisco Jabber Enterprise Version (common in enterprise)
  - Cisco Jabber Video
- Enterprise version runs on SIP or SIPs

Aruba UC Solution for Jabber

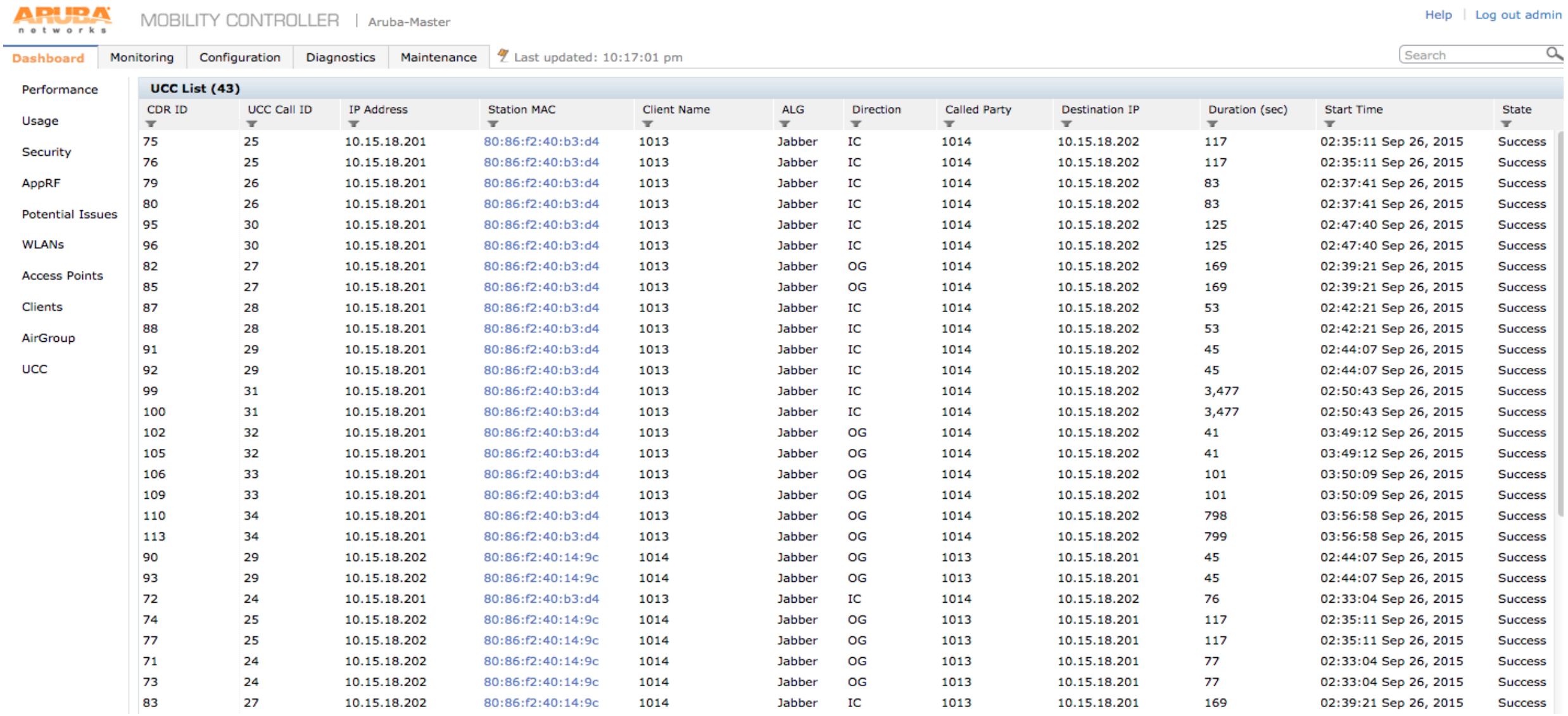
1. Wi-Fi optimization to make UC user experience cellular like
2. Resiliency and guaranteed QoS for Jabber in the presence of other traffic
3. Built-in real time Visibility
4. Network health (RF, WAN) characterization & correlation
5. Network Analytics for proactive trends and patterns
5. Reporting, alerts and triggers

Jabber Aware Aruba WLAN



- Majority of Jabber deployments use open SIP mode
- Existing SIP ALG has been enhanced to support Jabber calls
  - Special characteristics of Jabber calls tracked to provide visibility
- Ability to identify Voice, Video and Desktop Sharing
- Ability to apply QoS respectively
- Supported from AOS 8.0

Call Detail Records



UCC List (43)

CDR ID	UCC Call ID	IP Address	Station MAC	Client Name	ALG	Direction	Called Party	Destination IP	Duration (sec)	Start Time	State
75	25	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	117	02:35:11 Sep 26, 2015	Success
76	25	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	117	02:35:11 Sep 26, 2015	Success
79	26	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	83	02:37:41 Sep 26, 2015	Success
80	26	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	83	02:37:41 Sep 26, 2015	Success
95	30	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	125	02:47:40 Sep 26, 2015	Success
96	30	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	125	02:47:40 Sep 26, 2015	Success
82	27	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	169	02:39:21 Sep 26, 2015	Success
85	27	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	169	02:39:21 Sep 26, 2015	Success
87	28	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	53	02:42:21 Sep 26, 2015	Success
88	28	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	53	02:42:21 Sep 26, 2015	Success
91	29	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	45	02:44:07 Sep 26, 2015	Success
92	29	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	45	02:44:07 Sep 26, 2015	Success
99	31	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	3,477	02:50:43 Sep 26, 2015	Success
100	31	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	3,477	02:50:43 Sep 26, 2015	Success
102	32	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	41	03:49:12 Sep 26, 2015	Success
105	32	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	41	03:49:12 Sep 26, 2015	Success
106	33	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	101	03:50:09 Sep 26, 2015	Success
109	33	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	101	03:50:09 Sep 26, 2015	Success
110	34	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	798	03:56:58 Sep 26, 2015	Success
113	34	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	OG	1014	10.15.18.202	799	03:56:58 Sep 26, 2015	Success
90	29	10.15.18.202	80:86:f2:40:14:9c	1014	Jabber	OG	1013	10.15.18.201	45	02:44:07 Sep 26, 2015	Success
93	29	10.15.18.202	80:86:f2:40:14:9c	1014	Jabber	OG	1013	10.15.18.201	45	02:44:07 Sep 26, 2015	Success
72	24	10.15.18.201	80:86:f2:40:b3:d4	1013	Jabber	IC	1014	10.15.18.202	76	02:33:04 Sep 26, 2015	Success
74	25	10.15.18.202	80:86:f2:40:14:9c	1014	Jabber	OG	1013	10.15.18.201	117	02:35:11 Sep 26, 2015	Success
77	25	10.15.18.202	80:86:f2:40:14:9c	1014	Jabber	OG	1013	10.15.18.201	117	02:35:11 Sep 26, 2015	Success
71	24	10.15.18.202	80:86:f2:40:14:9c	1014	Jabber	OG	1013	10.15.18.201	77	02:33:04 Sep 26, 2015	Success
73	24	10.15.18.202	80:86:f2:40:14:9c	1014	Jabber	OG	1013	10.15.18.201	77	02:33:04 Sep 26, 2015	Success
83	27	10.15.18.202	80:86:f2:40:14:9c	1014	Jabber	IC	1013	10.15.18.201	169	02:39:21 Sep 26, 2015	Success

Facetime

Classification and Prioritization

- Built-in FaceTime ALG
- Uses heuristics method to classify FaceTime Audio/Video calls
- Controller Stateful firewall applies QoS on FaceTime traffic
- Visibility and Troubleshooting on UCC Dashboard

Configuring FaceTime

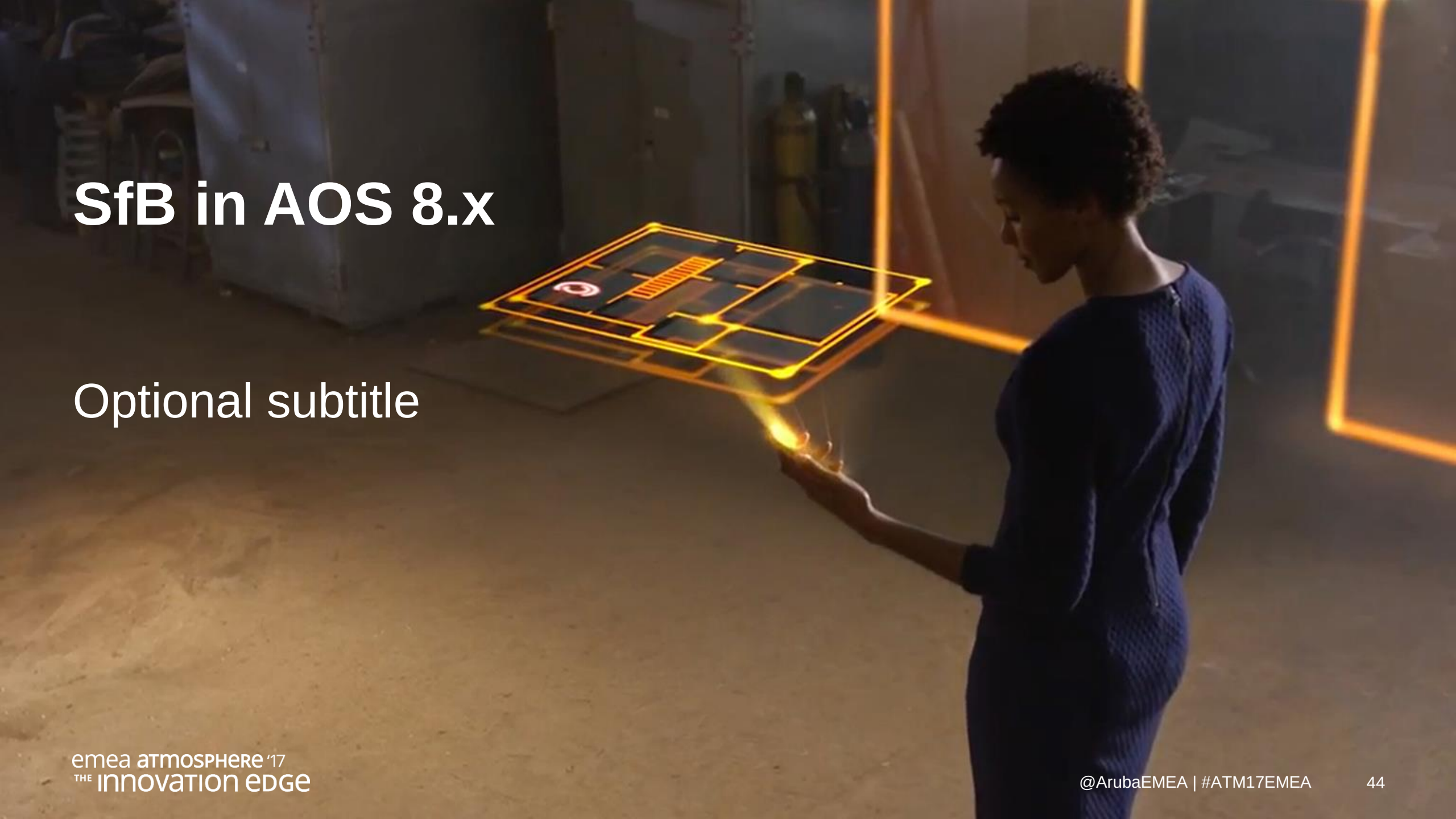
```
ip access-list session facetime
  any any svc-http  permit
  any any svc-https  permit
  any network 17.0.0.0 255.0.0.0 tcp 5223  permit classify-media
  any any udp 3478 3498  permit
  any any udp 16384 16387  permit
  any any udp 16393 16402  permit
!
```

Controller Datapath for FaceTime call

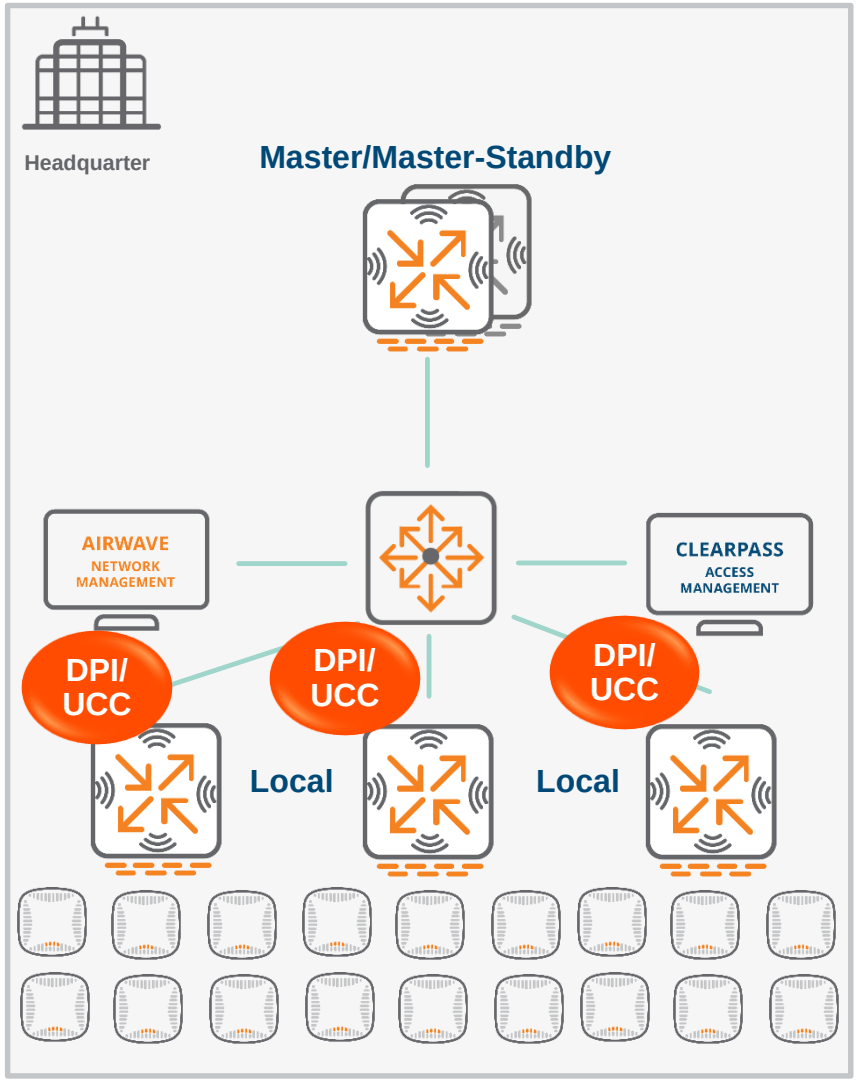
```
(pfe-controller) #show datapath session


Datapath Session Table Entries
------------------------------

Flags: F - fast age, S - src NAT, N - dest NAT
       D - deny, R - redirect, Y - no syn
       H - high prio, P - set prio, T - set ToS
       C - client, M - mirror, V - VOIP
       Q - Real-Time Quality analysis
       I - Deep inspect, U - Locally destined
       E - Media Deep Inspect, G - media signal
       r - Route Nexthop
       A - Application Firewall Inspect


Source IP       Destination IP  Prot SPort DPort  Cntr    Prio ToS Age Destination TAge Packets    Bytes      Flags

192.168.1.12    192.168.1.8     17   16402 16402  0/0     6    46  0   vlan 1      f    725        69270      FHPTV
192.168.1.8     192.168.1.12    17   16403 16403  0/0     6    46  1   local       f    0          0          FYHPTCV
192.168.1.8     192.168.1.12    17   16402 16402  0/0     6    46  0   vlan 1      f    755        107966     FHPTCV
192.168.1.12    192.168.1.8     17   16403 16403  0/0     6    46  1   local       f    0          0          FYHPTV
```

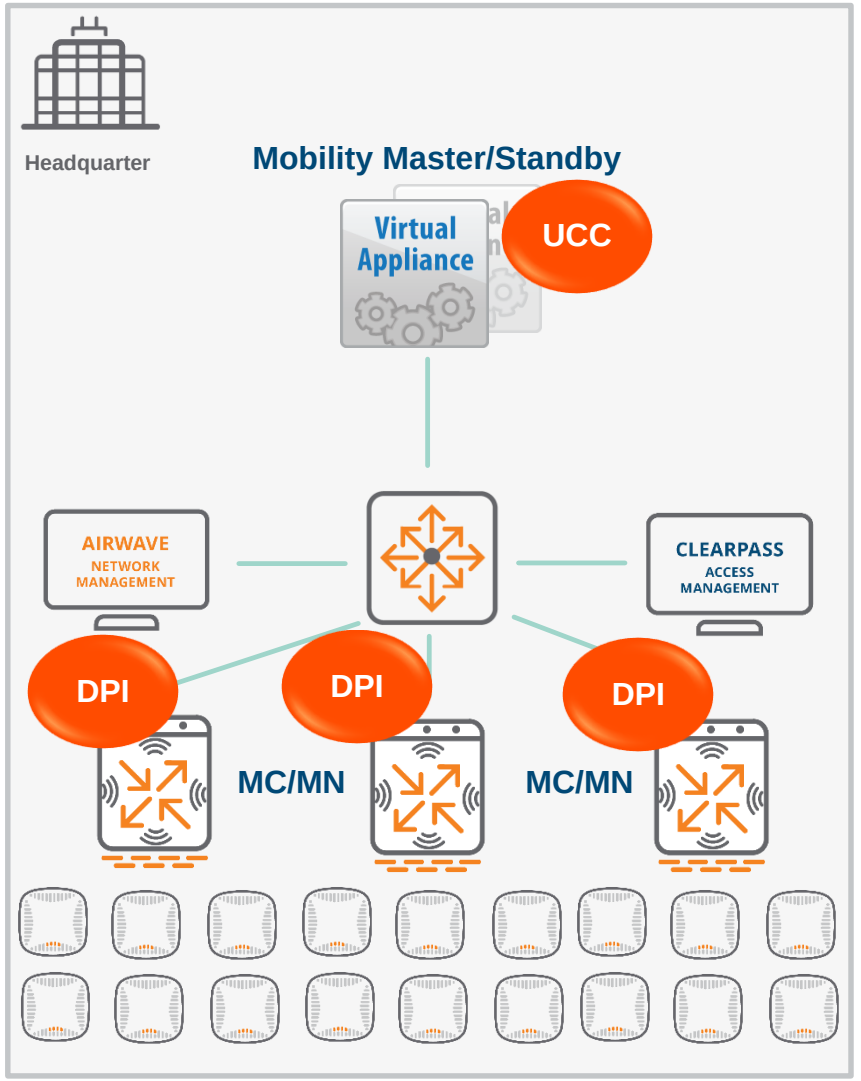
SfB in AOS 8.x

Optional subtitle



UCC Design Change from 6.x to 8.x





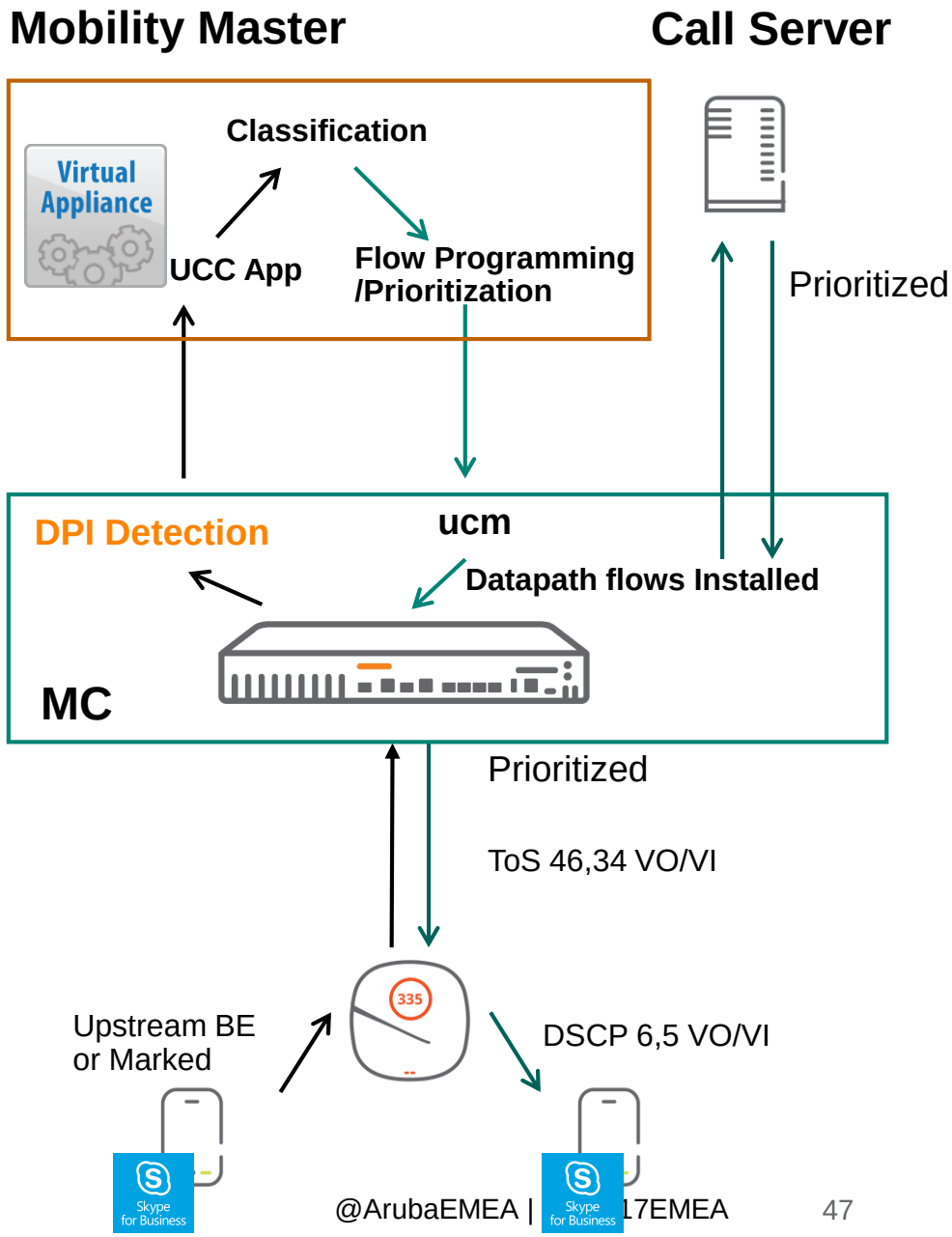
DPI = Deep Packet Inspection

UCC Design Highlights in 8.x

1. UCC App – Classification and Prioritization decisions moved to MM.
   - Implements the VoIP Application Layer Gateway(ALG)
2. Ability to upgrade UCC pkg alone, doesn't require entire box upgrade or MD upgrade
3. Enables us to add new Voice application support without network disruption
4. MM aggregates SDN msgs for 'ALL' Managed Devices under it. Makes it very powerful by not having to configure 1000s of MDs
5. 'Centralized View' for all UCC activity across MDs available at MM

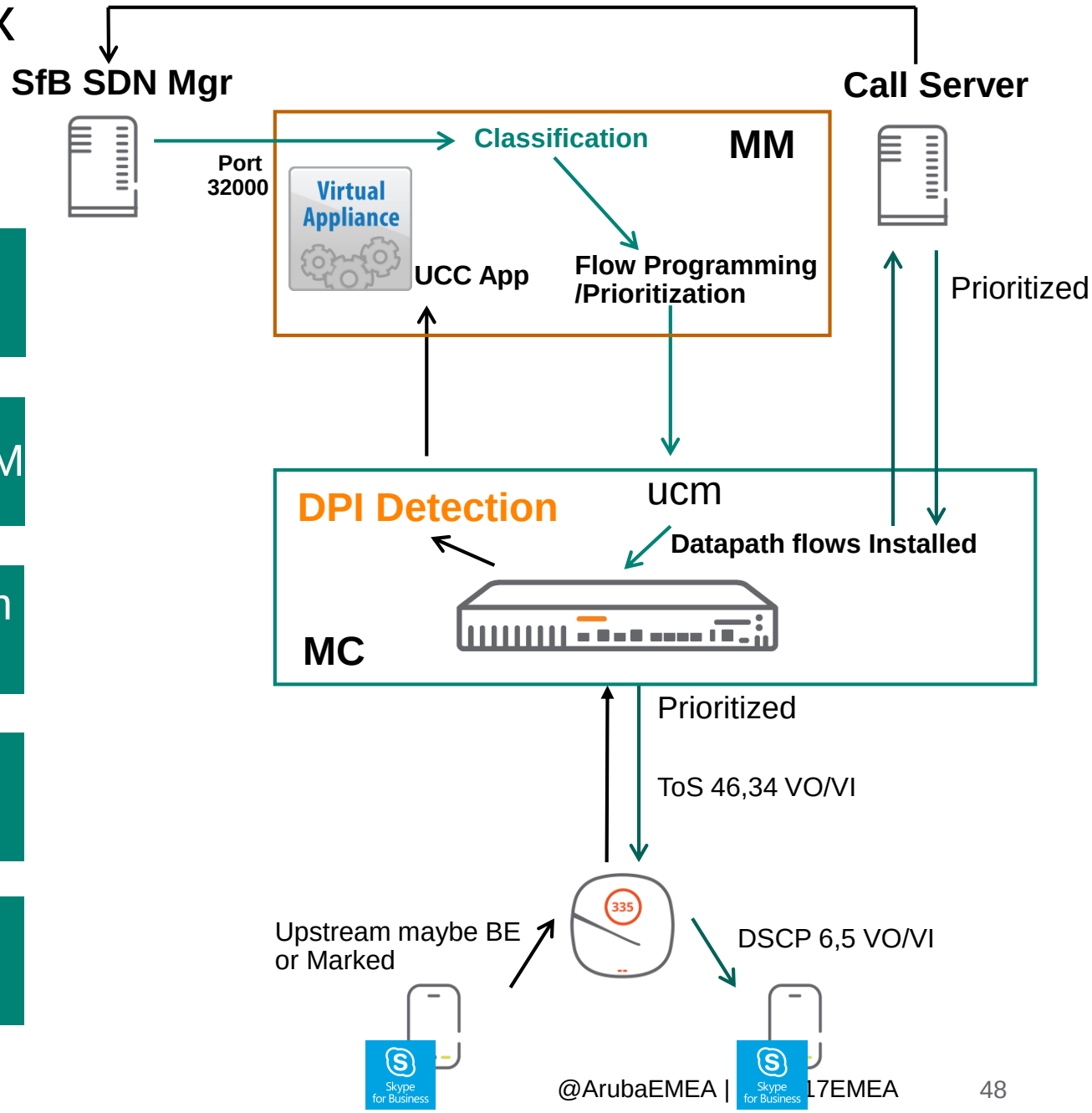
UCC Heuristics Approach in 8.x

1. UCC runs as an App on the Mobility Master (MM)
2. DPI performs media detection on the Mobility Controller (MC)
3. Meta data result from DPI is sent to the UCC App on the MM
4. UCC App runs media classification, plumbs prioritization flows to MC
5. MC installs datapath flows per priority map received from MM

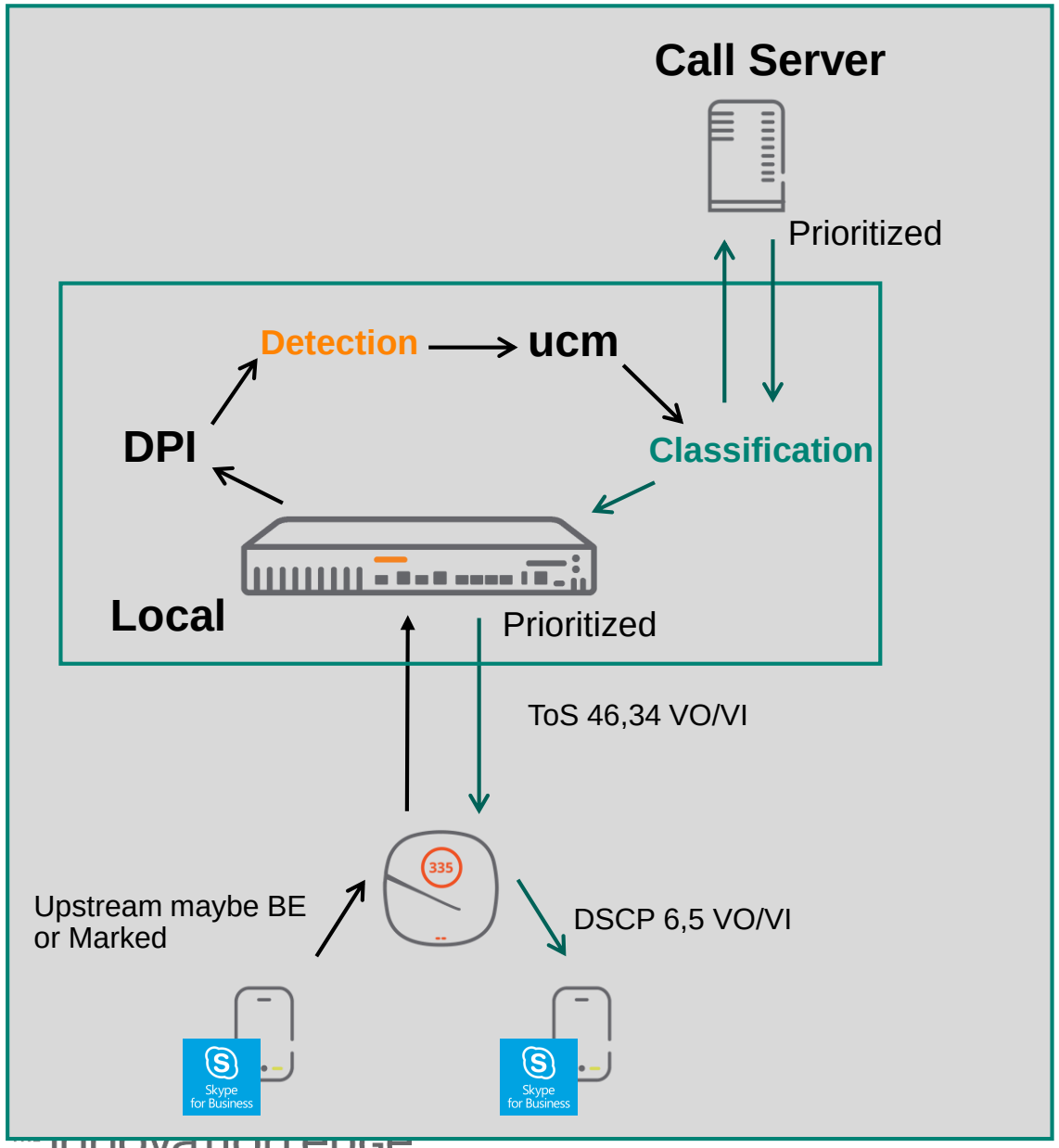


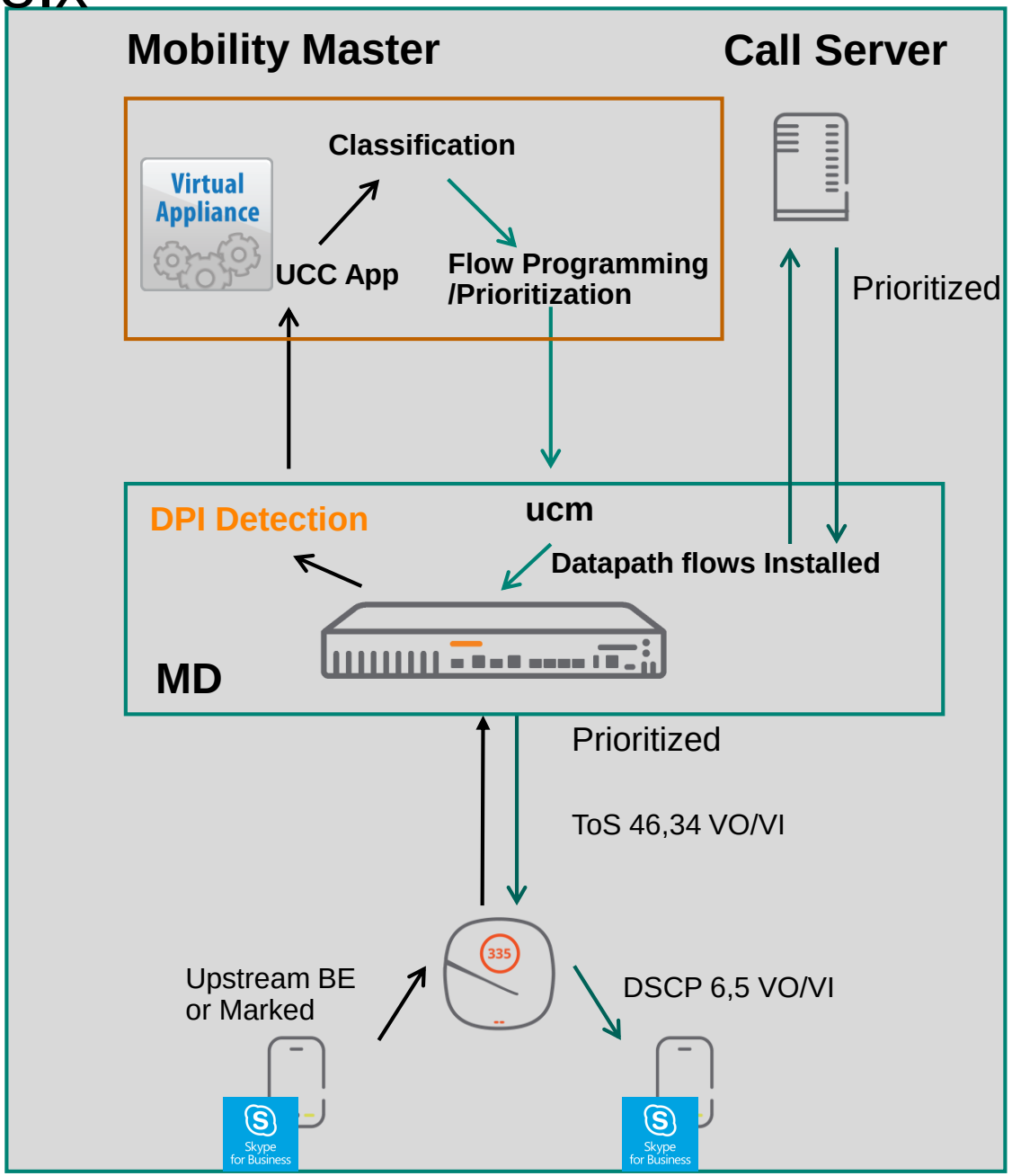
UCC SfB SDN API Approach in 8.x

1. SfB SDN API is configured to point to MM
2. Call start triggers SDN xml msg to MM
3. MM correlates SDN xml with MC from where it received DPI metadata
4. UCC App uses SDN session info to classify and program datapath flows
5. Flows are plumbed from MM to MC. MC installs priority datapath flows

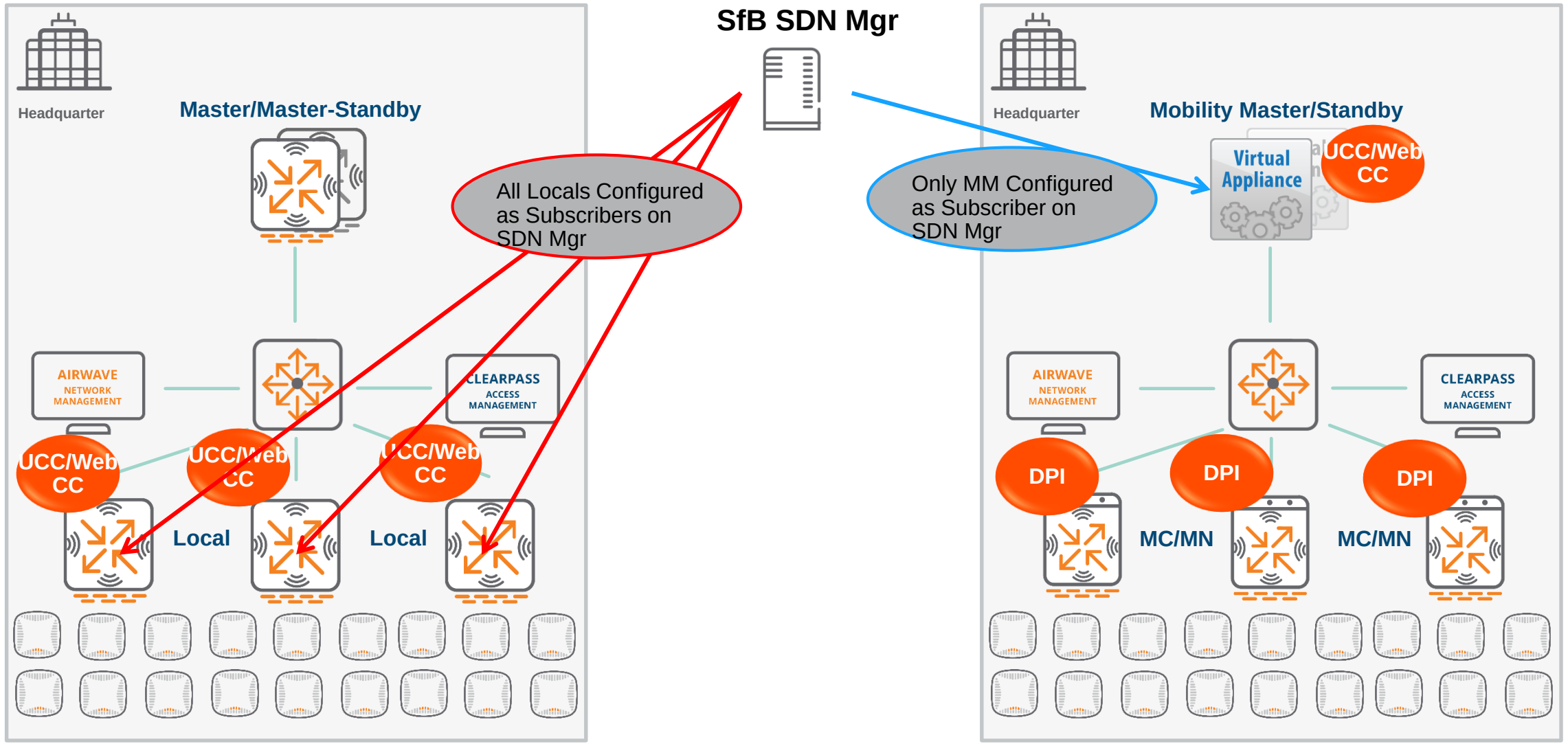


UCC Design Comparison between 6.x & 8.x



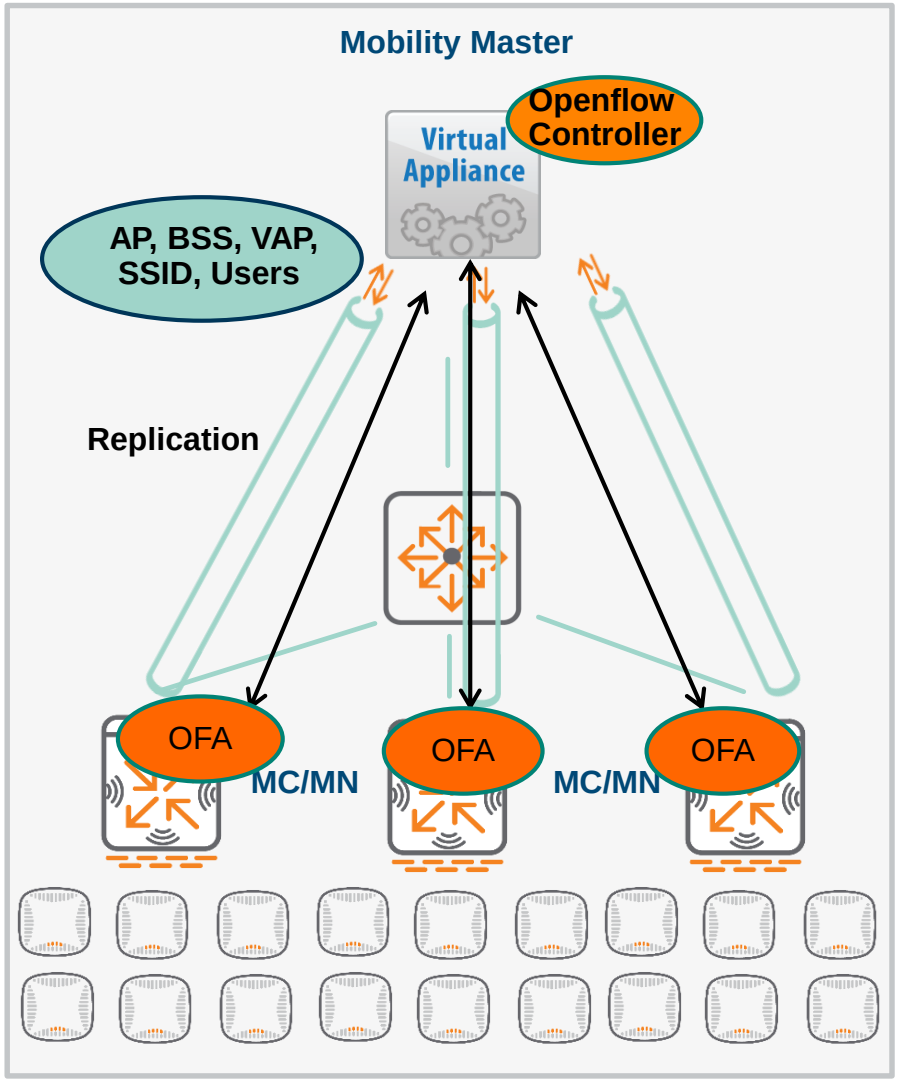


SfB SDN API Message Integration in 8.x

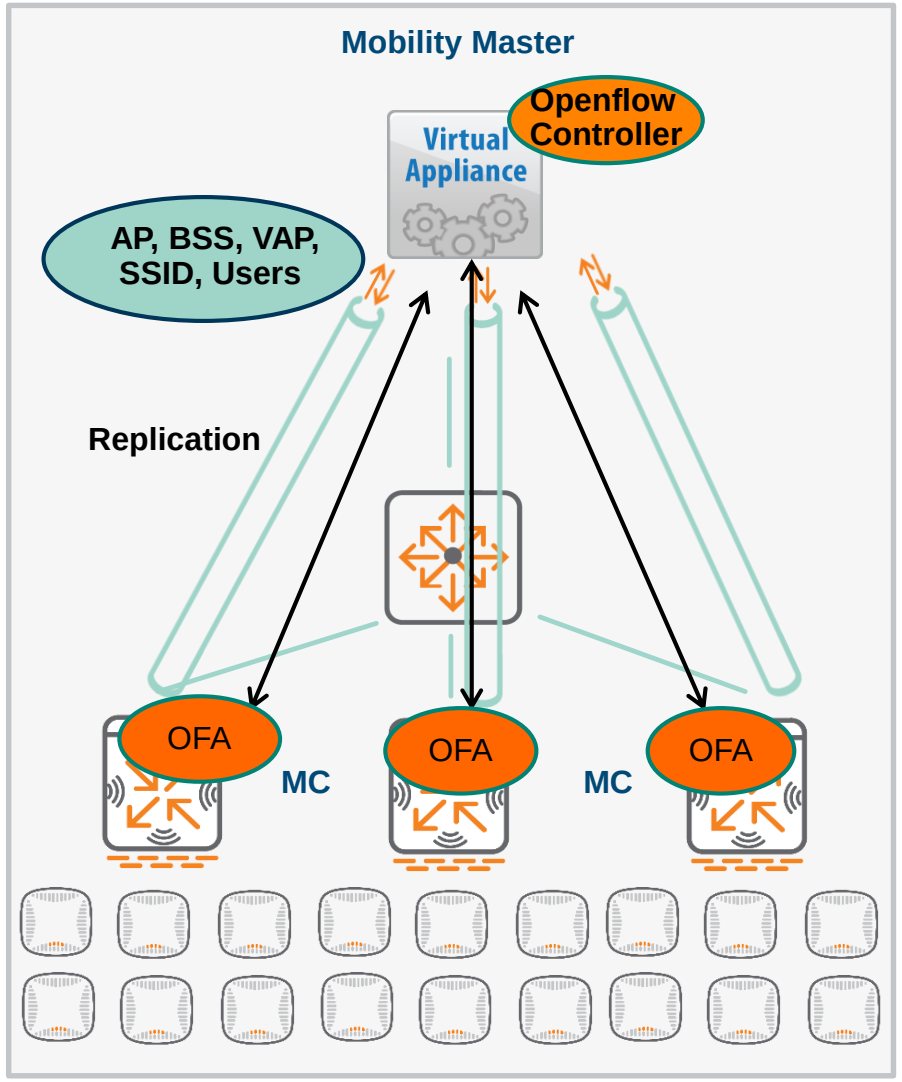


Flow Illustration between MM – MC for UCC

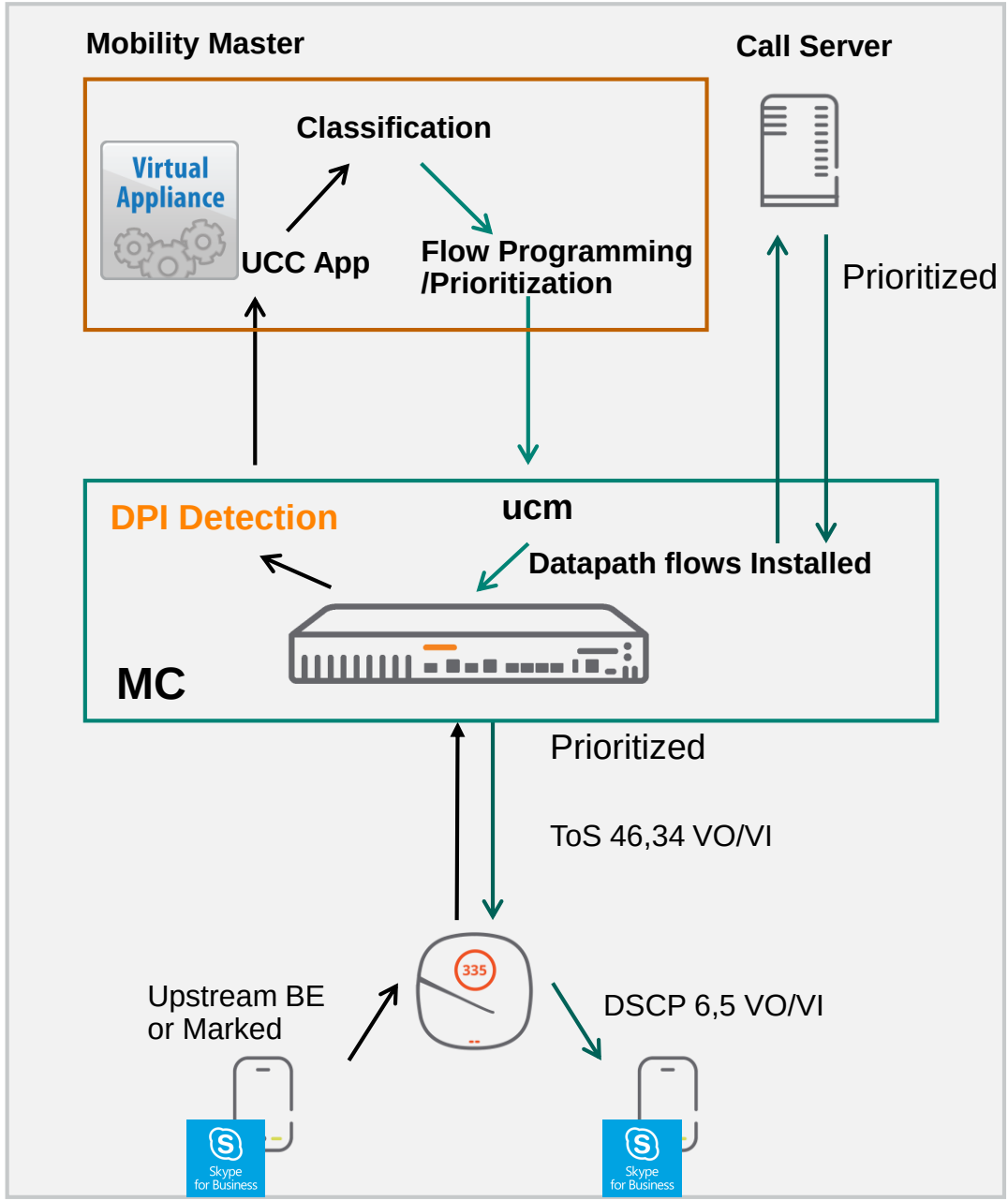
1. Replication channels setup from MC to MM during bring up
2. As and when APs terminate on MCs, they get notified/replicated to MM
3. VAPs, SSID, BSSIDs and User tables are sent up from MC
4. MM must run as Openflow Controller
5. MCs must run as Openflow Agents (OFA)



End to End Flow for UCC



System Ready To Process Calls



Noteworthy UCC Enhancements in 8.x

1. Support for Wi-Fi Calling and Cisco Jabber
2. Multi-ALG support - Multiple Voice applications running simultaneously on the same client device can be identified and prioritized
3. *AppRF Integration with ALGs and User Role
4. *Intelligent Call Handling
5. *Real-time analysis of VoIP calls in upstream direction

UCC Caveats

1. If MM unreachable, voice flows assigned default VI priority by MD Central Visibility unavailable
2. Openflow Controller supports 1000 Openflow agents only (1000 MCs)
3. Openflow has to be enabled under user-role, VAP on MC
   - Config knob under each
4. MM as openflow controller, MD as openflow agent – manual configuration that needs to be added

Basic Troubleshooting

1. Check UCC Client-info and Call-info CDRs
2. Check Datapath session tables for Client IP addresses
3. Check UCC Dashboard on Controller
4. Check UCC Dashboard on Airwave

Basic Troubleshooting
What to look for ?

1. Is your client detected as Voice Client
2. If yes, did datapath session show up with ‘V’ and ‘Q’ flag
3. What does the SNR (Signa-to-Noise) Ratio look like for the client
4. What is the channel and channel utilization

Basic Troubleshooting
What to look for – In case of Skype for Business

1. Enhanced visibility available for SfB clients via SfB SDN API
2. Client Roaming during call – MIC quality – Wireless Chipset/Driver
3. End-to-End Visibility
4. SfB Client version – Type of Call – More…

Basic Troubleshooting

```
(7240-CorpLocal1) (config) #show datapath session table | include 10.70.226.12
       C - client, M - mirror, V - VOIP
10.70.226.12    10.70.226.11    17   50038 50026  0/0     6    46  1   vlan 27     175  818         479215     FHPTIQV
10.70.226.12    10.70.226.11    17   58018 58000  0/0     5    34  0   vlan 53     175  10766       4024449    FHPTV
10.70.226.11    10.70.226.12    17   58000 58018  0/0     5    34  0   vlan 53     175  22709       19013400   FHPTCV
10.70.226.11    10.70.226.12    17   50026 50038  0/0     6    46  0   vlan 27     175  22635       3593475    FHPTCIQV

(7240-CorpLocal1) (config) #show datapath session table | include 10.70.226.11
       C - client, M - mirror, V - VOIP
       Q - Real-Time Quality analysis
10.70.226.12    10.70.226.11    17   50038 50026  0/0     6    46  0   vlan 27     17b  829         485555     FHPTIQV
10.70.226.12    10.70.226.11    17   58018 58000  0/0     5    34  0   vlan 53     17b  10887       4055686    FHPTV
10.70.226.11    10.70.226.12    17   58000 58018  0/0     5    34  0   vlan 53     17b  23002       19264385   FHPTCV
10.70.226.11    10.70.226.12    17   50026 50038  0/0     6    46  0   vlan 27     17b  22931       3638971    FHPTCIQV
```

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Thank You