



EHRPD EV-DO & LTE INTERWORKING

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EHRPD – LTE & CDMA INTERWORKING

What is eHRPD?

- HRPD Is Standards Name For EV-DO
- eHRPD Is “evolved HRPD”
- eHRPD Enables EV-DO & LTE Interworking



Purpose / Value of eHRPD

- Enables Inter-Technology Handoff Between LTE and EV-DO Networks
- Enables Roaming For LTE Subscribers On EV-DO Networks
- Leverages Existing EV-DO Network Coverage When Deploying LTE
- Enables Common Applications To Be Used Across EV-DO & LTE Access

EV-DO - LTE APPLICATION UBIQUITY

CDMA With LTE For High Traffic Corridors



- › LTE – EV-DO Interoperability & Handover Enabled Via eHRPD
- › Functionality Is Generally Available In EV-DO Products Today
- › Launched In Commercial Networks In North America

Enabling CDMA – LTE Broadband Synergies

EHRPD – SUBSCRIBER NEEDS

- › Subscribers Require Universal Coverage
- › Subscribers Expect Seamless Mobility Between Access Technologies
- › Applications / Services Must Function Consistently Irrespective Of Access Technology
- › Universal Roaming

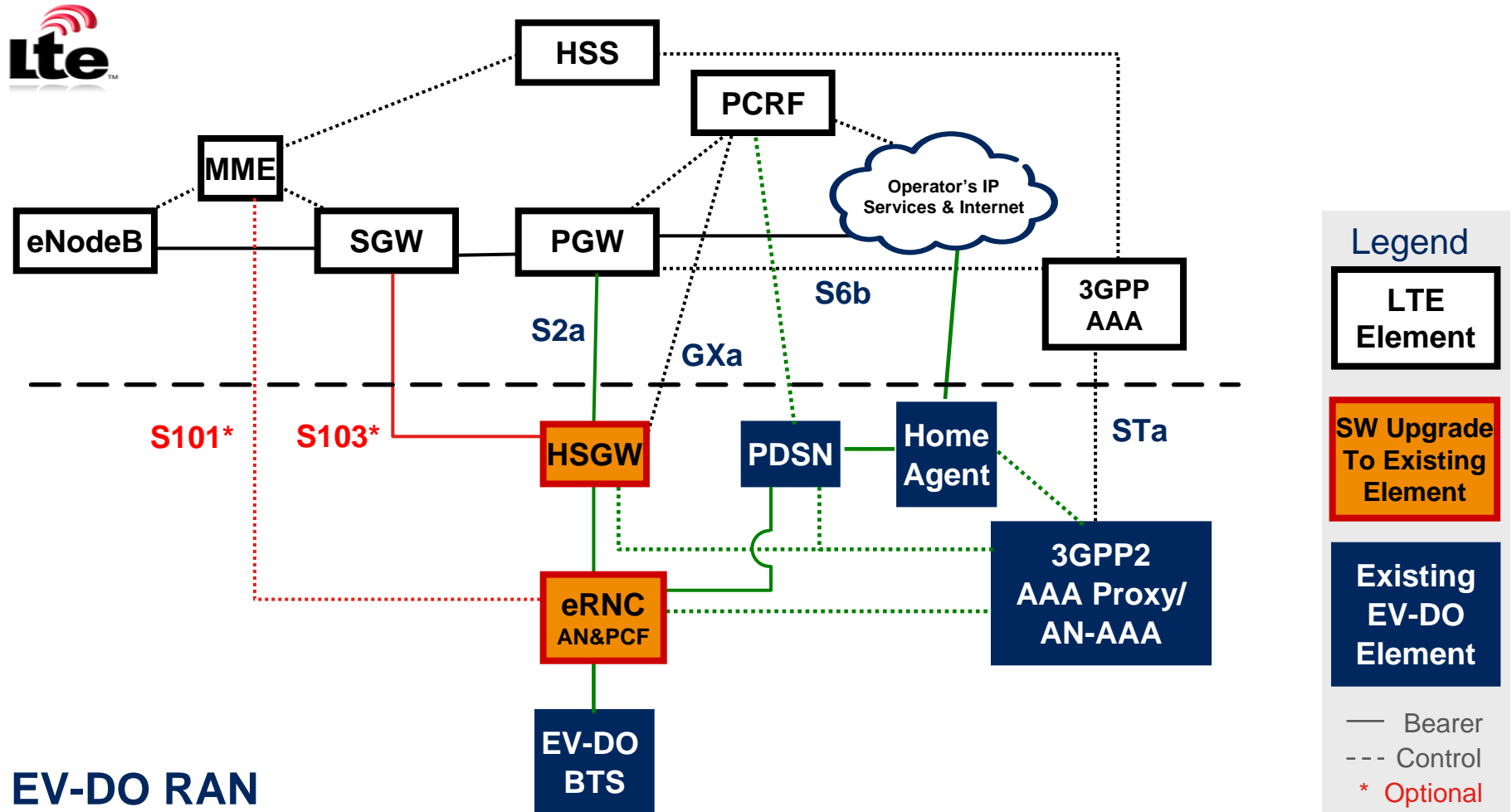
EHRPD Integrates EV-DO & LTE Networks

EHRPD – OPERATOR BENEFITS

- › Enables A Phased Build-Out Of The LTE Network
 - Operators can build LTE in phases by deploying LTE in selective areas first
 - Operators can utilize LTE core network elements in place of EV-DO core network elements for eHRPD subscribers
- › Enables Operator to Provide Roaming Services
 - Incoming Roamers will be able to access the eHRPD network and the same services from their home EPC
- › Mitigates LTE Transition Challenges

CDMA & LTE Networks Will Coexist For A Long Time

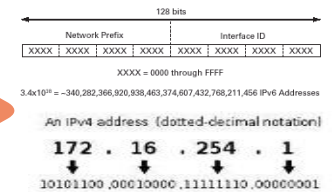
EHRPD NETWORK ARCHITECTURE



eHRPD Integrates EV-DO RAN Into The LTE Network

EHRPD FUNDAMENTAL CONCEPTS

Common IP Address & Services Between EV-DO & LTE RAN via the PDN Gateway



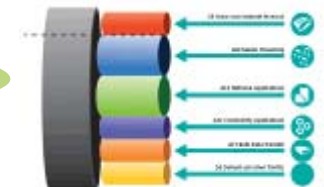
Common Subscriber Database & Authentication Mechanism Via The 3GPP HSS
EAP-AKA' For Authentication In Place Of CHAP



Common QoS Control Mechanism Via PCRF
Network Directed QoS



Support Multiple & Dedicated LTE Bearer Functionality Via The EV-DO RAN



Support The LTE Functionality Of Multiple PDN Gateway Connectivity Via The EV-DO RAN

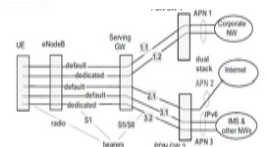
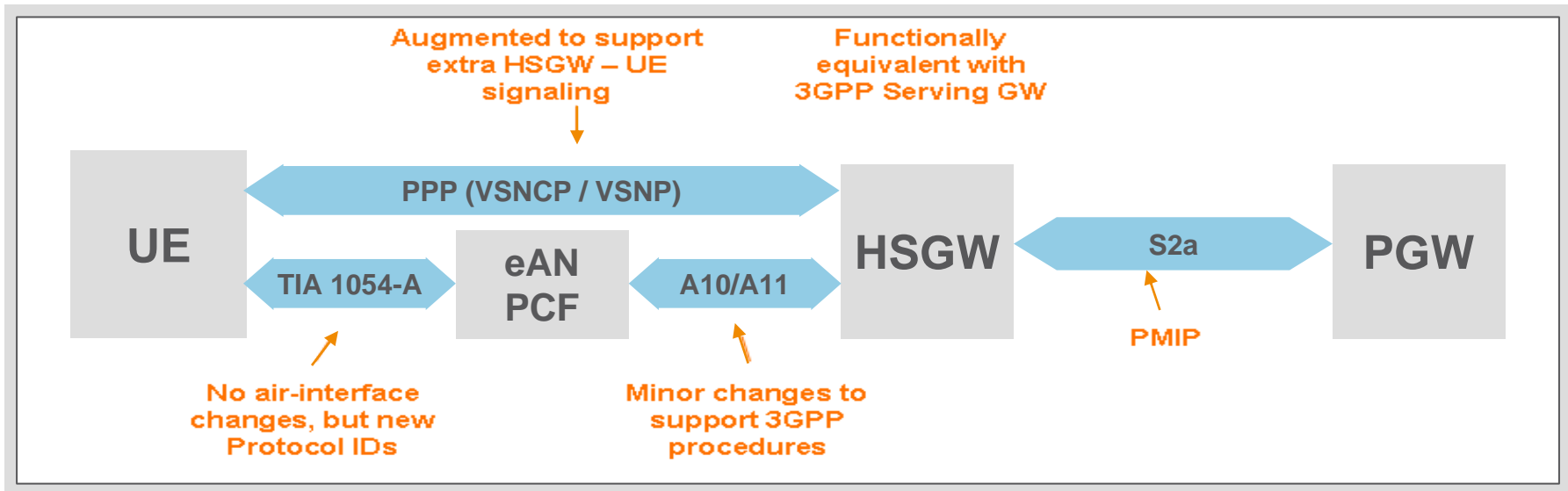


Figure 4-15: example arrangement of bearers (with multiple PDN connectivity)

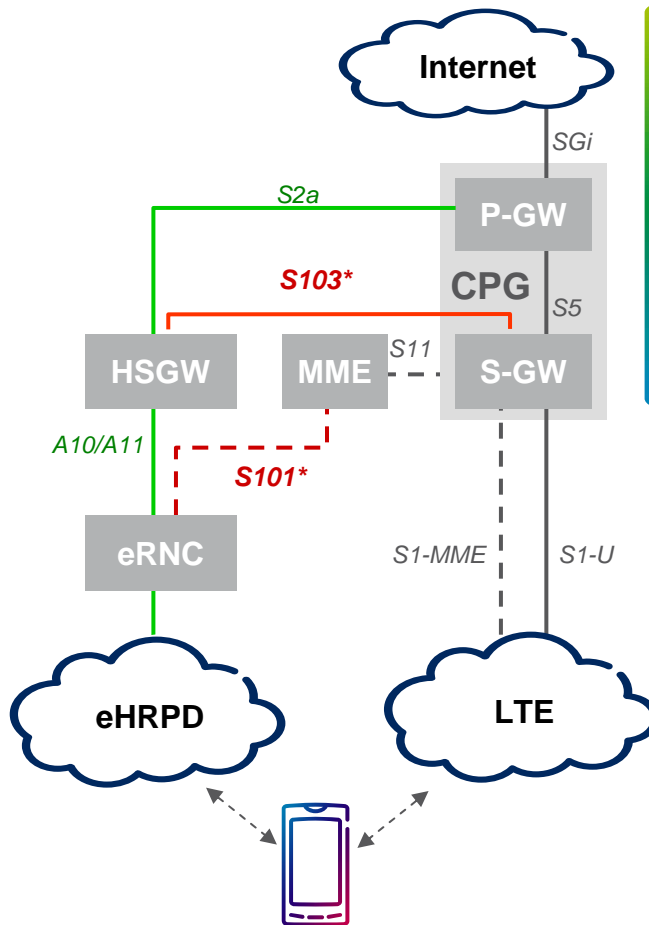
PDN: Packet Data Network HSS: Home Subscriber Server PCRF: Policy and Charging Rules Function

EV-DO RAN CHANGES FOR EHRPD



- › No Air Interface Changes
- › Simple IP For UE / eAT; Proxy MIP Between HSGW & PGW
- › Minor Changes On A10 / A11, A13 & A16 Interfaces
 - Support Of HSGW H1 IPv4 Address On A11, A13 and A16
 - Indication Of eRNC Capability During A13 Request
- › Network Directed QoS Support

OPTIMIZED VS. NON-OPTIMIZED HANDOFF



* Optional

Non-Optimized Handoff

- Allows Handoff between LTE & eHRPD
- Interruption Of Active Calls From LTE To eHRPD
 - > ~6* seconds for 1st time handoff to eHRPD
 - > ~1-2* second with Partial HSGW Context * Based on lab measurements

Optimized Handoff

- Support Of Active Handoff Between LTE & eHRPD
- Expected Interruption Less Than 200 msec
- Complex Implementation; Requires Multi-Vendor Coordination

Non-Optimized Handoff Deployed In Commercial Networks Today

BEHAVIOR DURING HANDOFF

	LTE Network	eHRPD Network	Handoff Type	Comments
1	Idle ↔ Idle		Non-Optimized	<ul style="list-style-type: none"> › IP continuity at PDN GW › No user impact
2	Active → Idle		Non-Optimized	<ul style="list-style-type: none"> › Handoff Initiated by UE / eAT › IP continuity at PDN GW › Interruption of data flow or call to be re-initiated (e.g. VoIP)
3	Idle ← Active		Non-Optimized	<ul style="list-style-type: none"> › UE / eAT initiated when active call is completed on eHRPD › IP continuity at PDN GW › No user impact
4	Active ↔ Active		Optimized	<ul style="list-style-type: none"> › Requires S101 / S103 interfaces & UE / eAT support › Interruption suitable for voice services handoff

IP Continuity Maintained With eHRPD At PDN GW

NODES REQUIRED TO SUPPORT EHRPD

EV-DO RAN – Software Upgrade

Introduce HSGW or Upgrade PDSN
To HSGW

PDN Gateway – S2A Interface Support

Implement 3GPP AAA & HSS

Deploy Dual Technology Device
LTE & eHRPD Capable UE / eAT

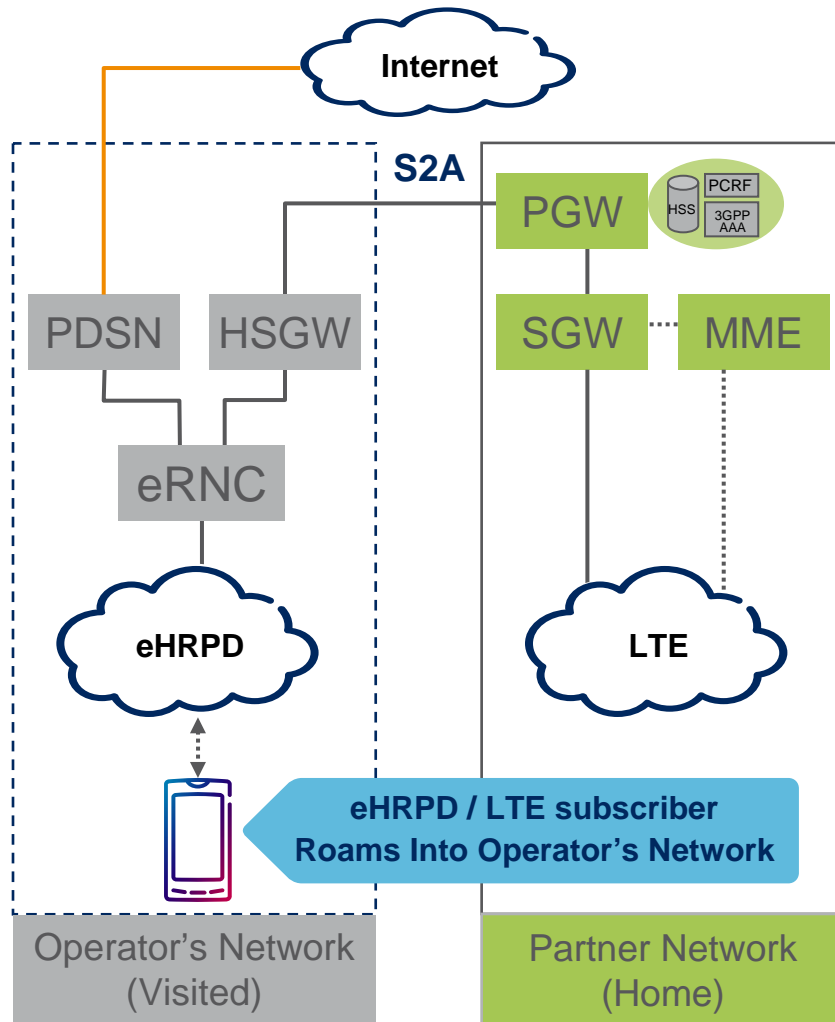


LTE HANDOFF TRIGGERS TO EV-DO RAN

- › Serving E-UTRAN Cell Controls Idle Mode Reselection Behavior
- › Broadcast Of Parameters Via The System Information Block Messages (SIB3 and SIB8)
 - SIB 3 (Intra-Frequency Cell Reselections)
 - › IRAT Search Params (LTE Signal Thresholds, etc.)
 - SIB 8 (IRAT Cell Reselection CDMA2000)
 - › List Of Target EV-DO Sectors To Optimize Search
 - Identified By Band Class, Frequency, PN

LTE Network Triggers Initiate Handoff to the EV-DO (eHRPD) RAN

DEPLOYMENT MODEL – ROAMERS ONLY



Network View Simplified To Illustrate The Concept

› Operator's (Visited) Network:

- eHRPD Capable EV-DO RAN
- HSGW Addition Or HSGW Capable PDSN
- Operator Roaming Agreement To Support Partner eHRPD Subscribers On RAN

› eHRPD-enabled Roaming Subscribers:

- Roamers Establish eHRPD Session In Visited EV-DO RAN
- Visited Network Routes IP Session to Partners' (Home) EPC
- Anchor Point For Roamer Is Home EPC

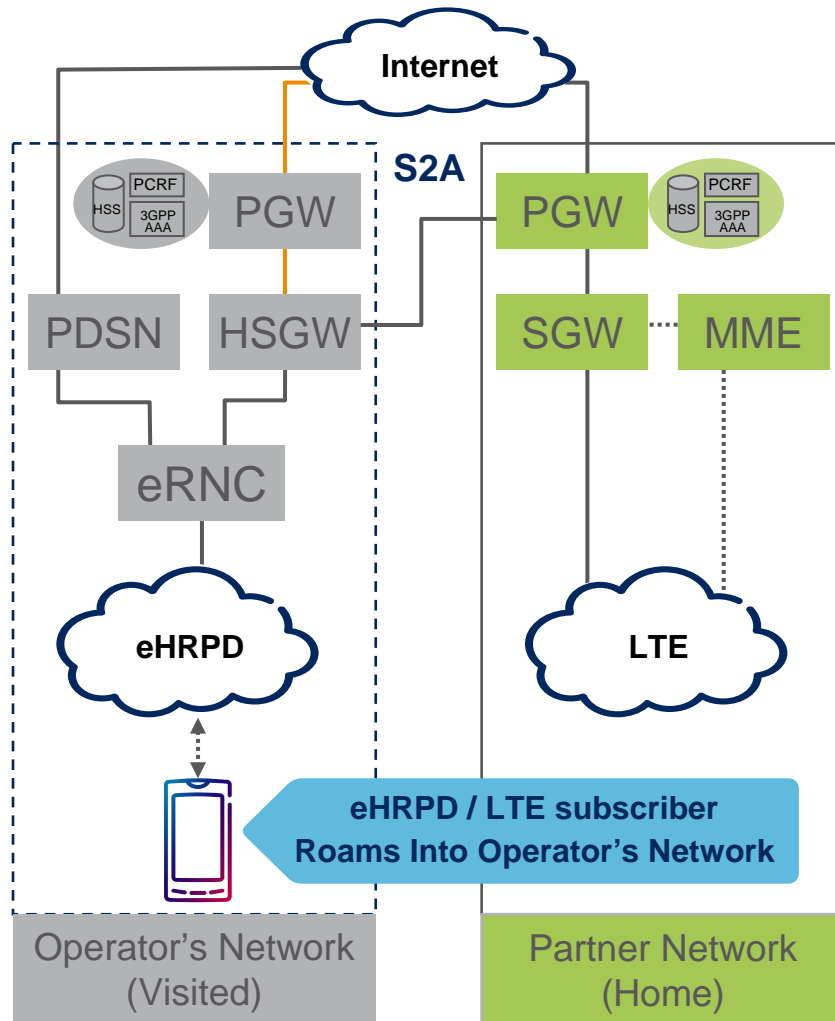
› Operator's eHRPD Enabled Subscribers:

- Operator's eHRPD Enabled Subscribers May Be Directed To use Partner EPC

Or

- Operator May Disable eHRPD For Their Own Subscribers

DEPLOYMENT MODEL – LTE LATER



Network View Simplified To Illustrate The Concept

› Operator's (Visited) Network:

- eHRPD Capable EV-DO RAN
- HSGW Addition Or HSGW Capable PDSN
- Operator Roaming Agreement To Support Partner eHRPD Subscribers On RAN
- **EPC Deployed For Future LTE Plans**

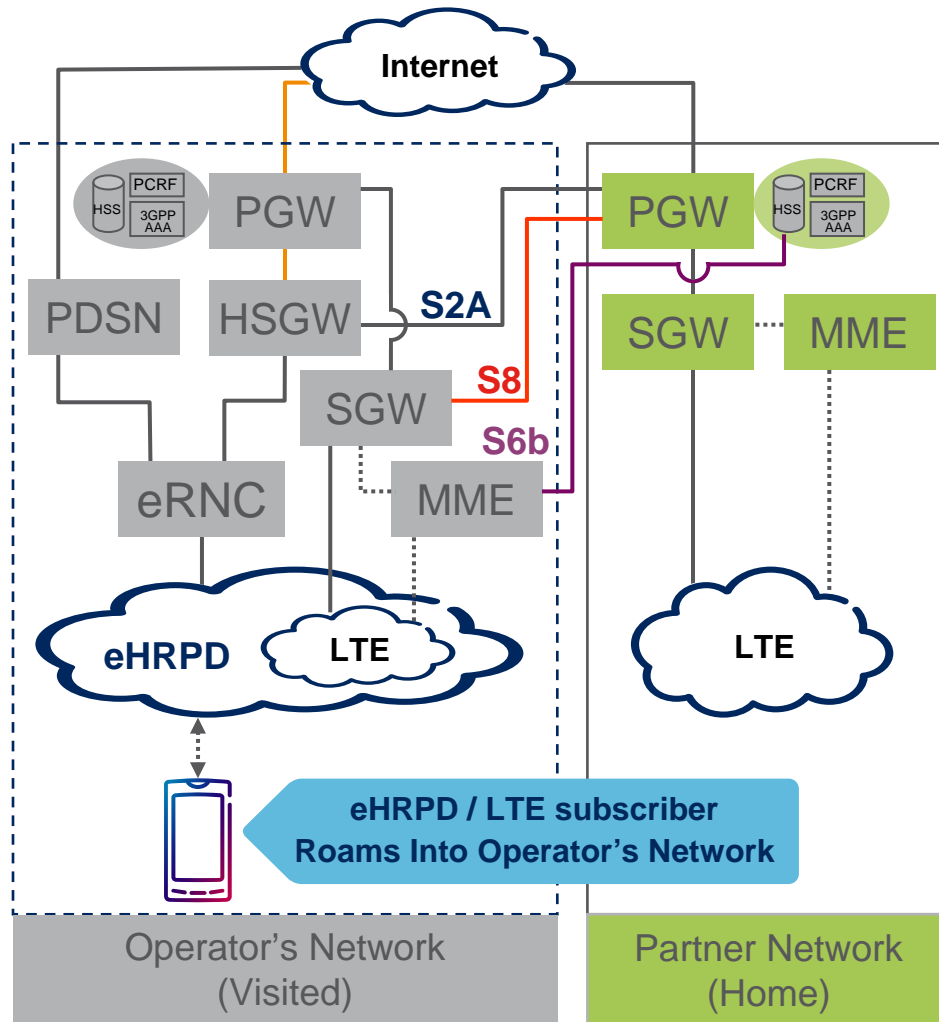
› eHRPD-enabled Roaming Subscribers:

- Roamers Establish eHRPD Service In Visited EV-DO RAN
- Visited Network Routes IP Session to Partners' (Home) EPC
- Anchor Point For Roamer Is Home EPC

› Operator's eHRPD Enabled Subscribers:

- **Operator's eHRPD Enabled Subscribers Use Operator's EPC**

DEPLOYMENT MODEL – LTE & EHRPD



Network View Simplified To Illustrate The Concept

› Operator's (Visited) Network:

- eHRPD Capable EV-DO RAN
- HSGW Addition Or HSGW Capable PDSN
- Operator Roaming Agreement To Support Partner eHRPD Subscribers On RAN
- EPC Deployed For LTE Support
- **LTE RAN Deployed**

› LTE & eHRPD-enabled Roaming Subscribers:

- **Roamers Establish LTE Service In Visited LTE RAN**
- Roamers Establish eHRPD Service In Visited EV-DO RAN
- Visited Network Routes IP Session to Partners' (Home) EPC
- Anchor Point For Roamer Is Home EPC

› Operator's Subscribers:

- Operator's eHRPD Enabled Subscribers Use Operator's EPC
- **Operator's LTE Subscribers Use Operator's EPC**

EHRPD SUMMARY

- › Continue to Utilize EV-DO RAN
 - Allow Gradual Build-out Of LTE Network
 - Provide Improved Day 1 Network Coverage
- › Enable Consistent User Services Across LTE and EV-DO Networks
 - Support Of Roaming Subscribers
 - Common Network Services
 - Common Evolved Packet Core Nodes
- › Leverage LTE Performance & Efficiency
 - Higher Data Rates
 - Reduced Network Latency
 - Improved Network Capacity



LTE Access While Inter-Working with EV-DO Network for Services Continuity & Expanded Coverage

QUESTIONS & DISCUSSION





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3GPP	3rd Generation Partnership Project	NAI	Network Access Identifier
3GPP2	3rd Generation Partnership Project 2	PDN	Packet Data Network
AAA	Authentication, Authorization and Accounting server	PGW	Packet Data Network Gateway
AN	Access Network	PCF	Packet Control Function
APN	Access Point Name	PCRF	Policy and Charging Rules Function
AT	Access Terminal	PDN	Packet Data Network
BS	Base Station	PDSN	Packet Data Serving Node
eAN	Evolved Access Network	PMIP	Proxy Mobile Internet Protocol
EAP-AKA'	Extensible Authentication Protocol - Authentication and Key Agreement	PPP	Point-to-Point Protocol
eAT	Evolved Access Terminal	QoS	Quality of Service
eHRPD	Evolved High Rate Packet Data	RADIUS	Remote Authentication Dial-In User Service
eNB	Evolved Node B	RAN	Radio Access Network
EPC	Evolved Packet Core	RFC	Request for Comment
ePCF	Evolved Packet Control Function	RLP	Radio Link Protocol
EPS	Evolved Packet System	ROHC	RObust Header Compression
E-UTRAN	Enhanced Universal Terrestrial Radio Access Network	RT	Radio Transceiver
EVDO	CDMA 2000 Evolution – Data Optimized	S-GW	Serving Gateway
HRPD	High Rate Packet Data	SC/MM	Session Control / Mobility Management
HSGW	HRPD Serving Gateway	SO	Service Option
HSS	Home Subscriber Server	UATI	Unicast Access Terminal Identifier
IMSI	International Mobile Subscriber Identity	UE	User Equipment (LTE Device)
IOS	Inter-Operability Specification	VoIP	Voice over Internet Protocol
IP	Internet Protocol	VoLTE	Voice Over LTE
LTE	Long Term Evolution	VSA	Vendor Specific Attribute
MEID	Mobile Equipment Identity	VSNC	Vendor Specific Network Control Protocol
MME	Mobility Management Entity	VSNP	Vendor Specific Network Protocol
MNID	Mobile Node Identification		
MS	Mobile Station		
MSC	Mobile Switching Center		



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