



eHRPD

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Agenda

- eHRPD... What, Why, and When?
- eHRPD's Impact on the Core Network
- eHRPD's Impact on the Mobile Device
- Verifying eHRPD works

Acronyms

AAA	Authentication, Authorization, and Accounting server
AN	Access Node
BSC	Base Station Controller
BTS	Base Transceiver Station
BTS	Base Transceiver Station or “base station”
EAP- AKA	Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement
eHRPD	evolved High Rate Packet Data
EMFPA	Enhanced Multi-Flow Packet Application (sometimes abbreviated as EMPA)
eNB	evolved NodeB
EPC	Evolved Packet Core System Architecture Evolution (equivalent to SAE)
FA	Foreign Agent
FCP	Flow Control Protocol
HA	Home Agent
HSGW	HRPD Serving Gateway
ICPC	IP Control Protocol (IPv4 Network Control Protocol)
LUP	Location Update Protocol

Acronyms

MFPA	Multi-Flow Packet Application (sometimes abbreviated as MMPA)
MME	Mobility Management Entity
PCF	Packet Control Function
PDF	Packet Data Function
PDSN	Packet Data Serving Node
PGW	Packet Data Network Gateway
PGW	Packet Data Network Gateway (interface to other IP networks such as IMS-based Evolver Packet Core [EPC])
PMIP	Proxy Mobile IP
QoS	Quality of Service
RAN	Radio Access Network
RLP	Radio Link Protocol
RSVP	Resource reSerVation Protocol
SAE	System Architecture Evolution (equivalent to EPC)
SGW	Serving Gateway
SGW	Serving Gateway
VSNC	Vendor-Specific Network Control Protocol
VSNP	Vendor-Specific Network Protocol



eHRPD... What, Why, and When?

What is eHRPD (10,000' Level)?

- An upgrade of existing HRPD (EV-DO) networks to allow EV-DO service providers to introduce SAE/EPC architecture elements to their existing packet core network
- Includes both air interface and packet core network changes

eHRPD provides for a high quality of experience for multi-mode UEs

Why eHRPD (Carriers' Perspective)?

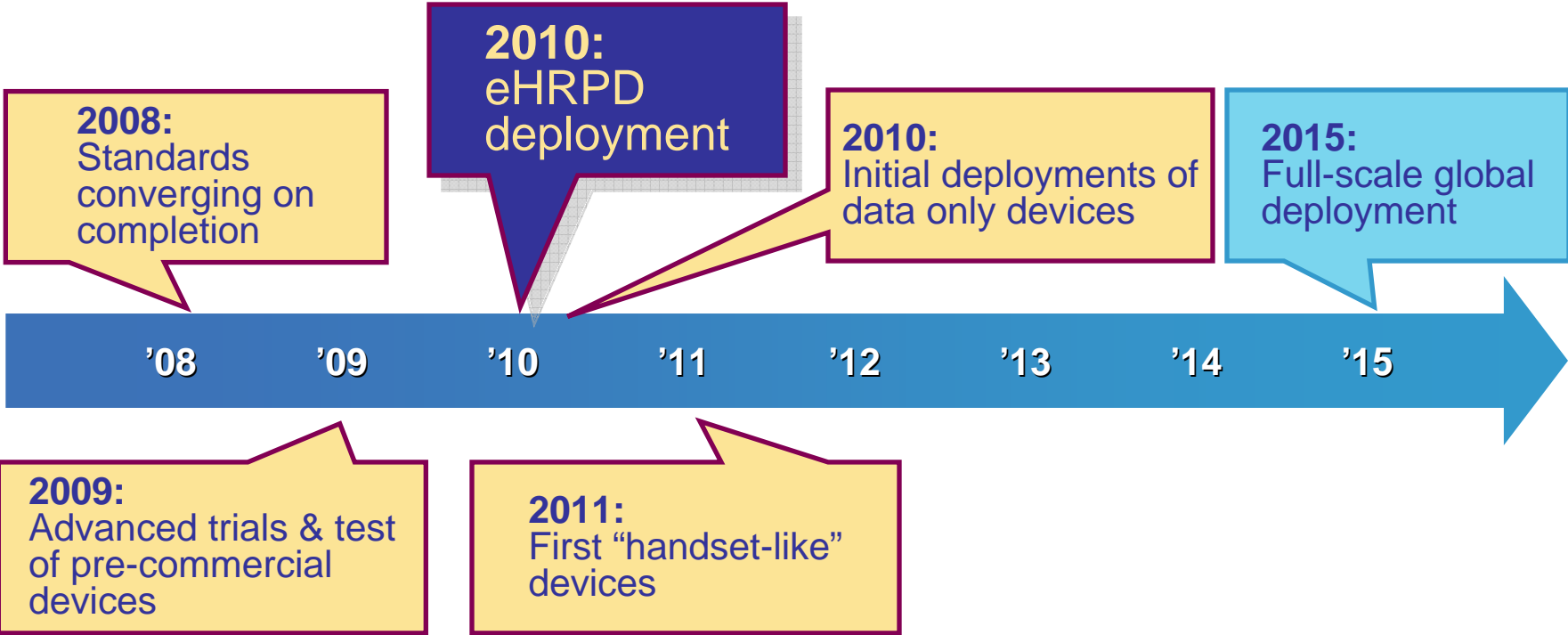
- CDMA/EV-DO carriers transitioning towards LTE don't want to do massive "forklift upgrades"
 - Carriers will have to deploy 1X, EV-DO, and LTE all at the same time
- It's a phased migration
 - Carriers can upgrade one small piece at a time without interruptions

Why eHRPD (Consumers' Perspective)?

- Subscribers are used to seamless mobility
 - Provides an evolutionary path from EV-DO networks to LTE networks
 - Allows seamless services, including handovers, between eHRPD and LTE networks
 - One IP address no matter where the user roams, and no matter what network it's on.

When Will eHRPD Be Here?

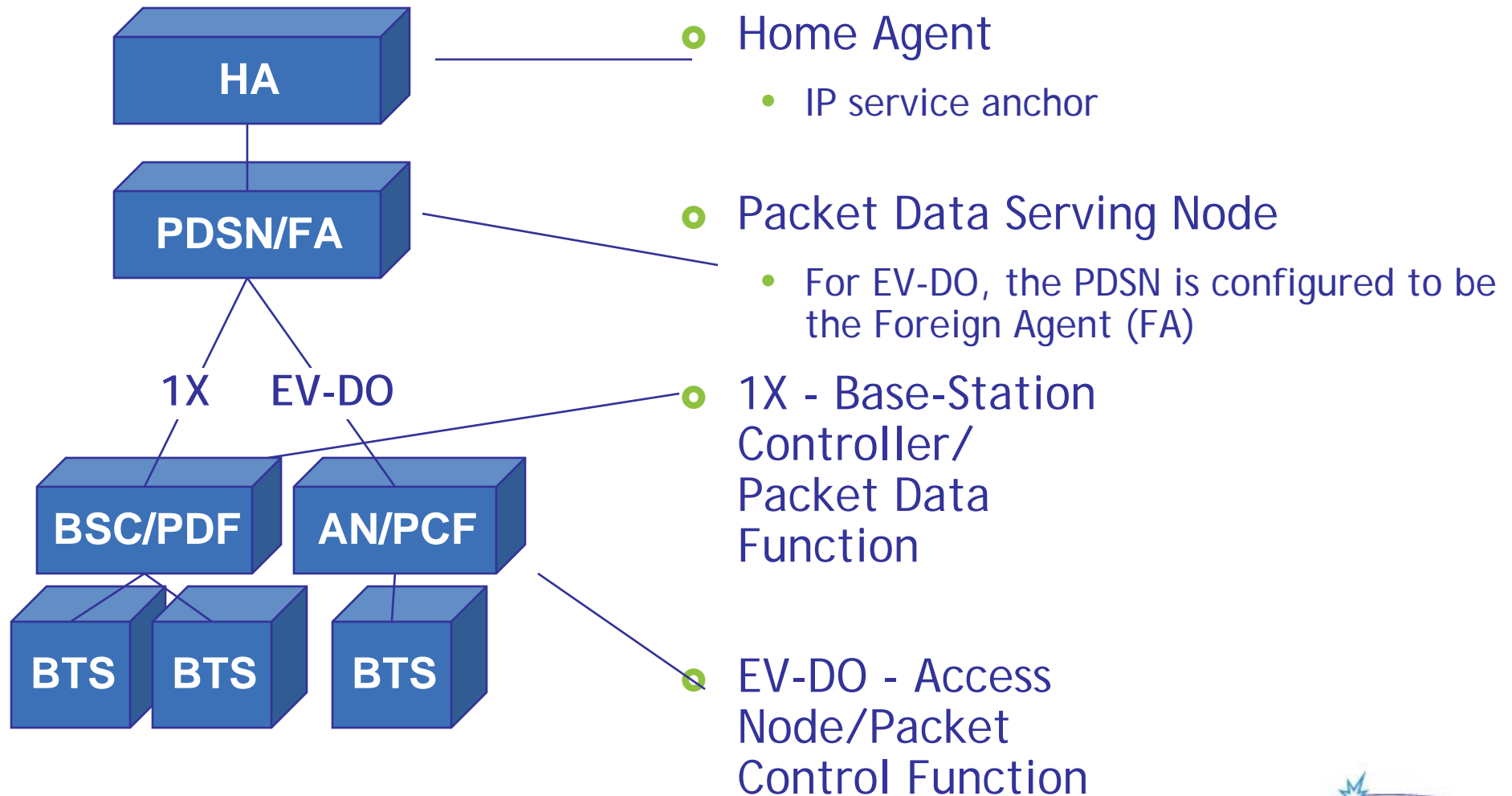
LTE Deployment Timetable





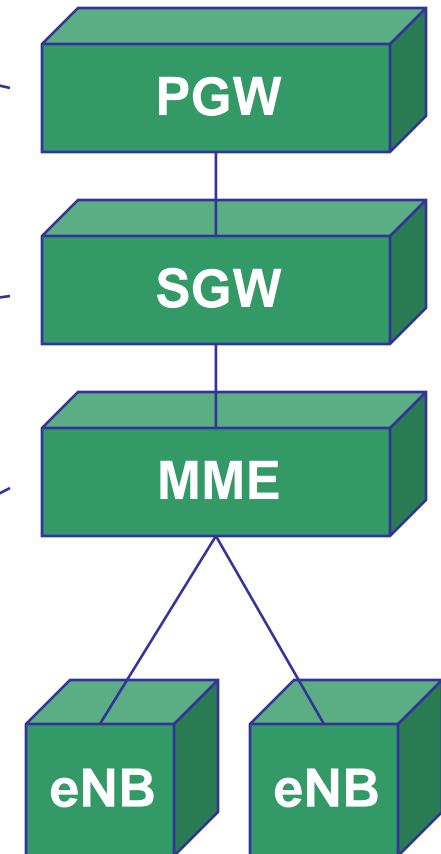
eHRPD's Impact on the Core Network

3GPP2 technology networks

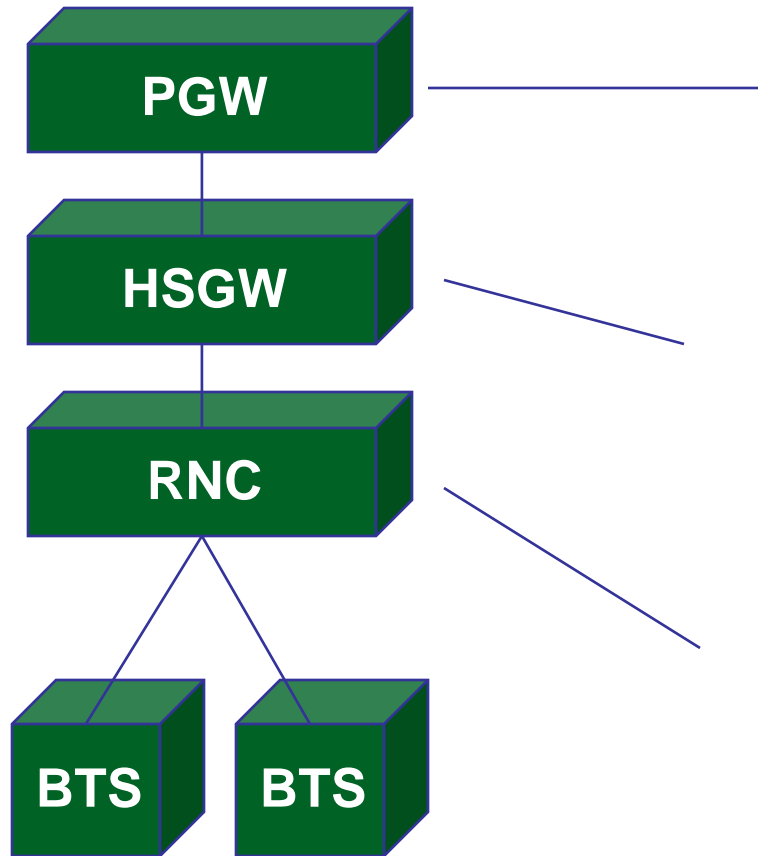


LTE networks

- Packet Data Network Gateway
 - IP policy enforcement on packet flows to and from mobile devices
- Serving Gateway
 - InterRAT anchor
 - Mobility anchor
- Mobility Management Entity -
 - Paging & Authentication
 - Signaling Control
 - Tracking

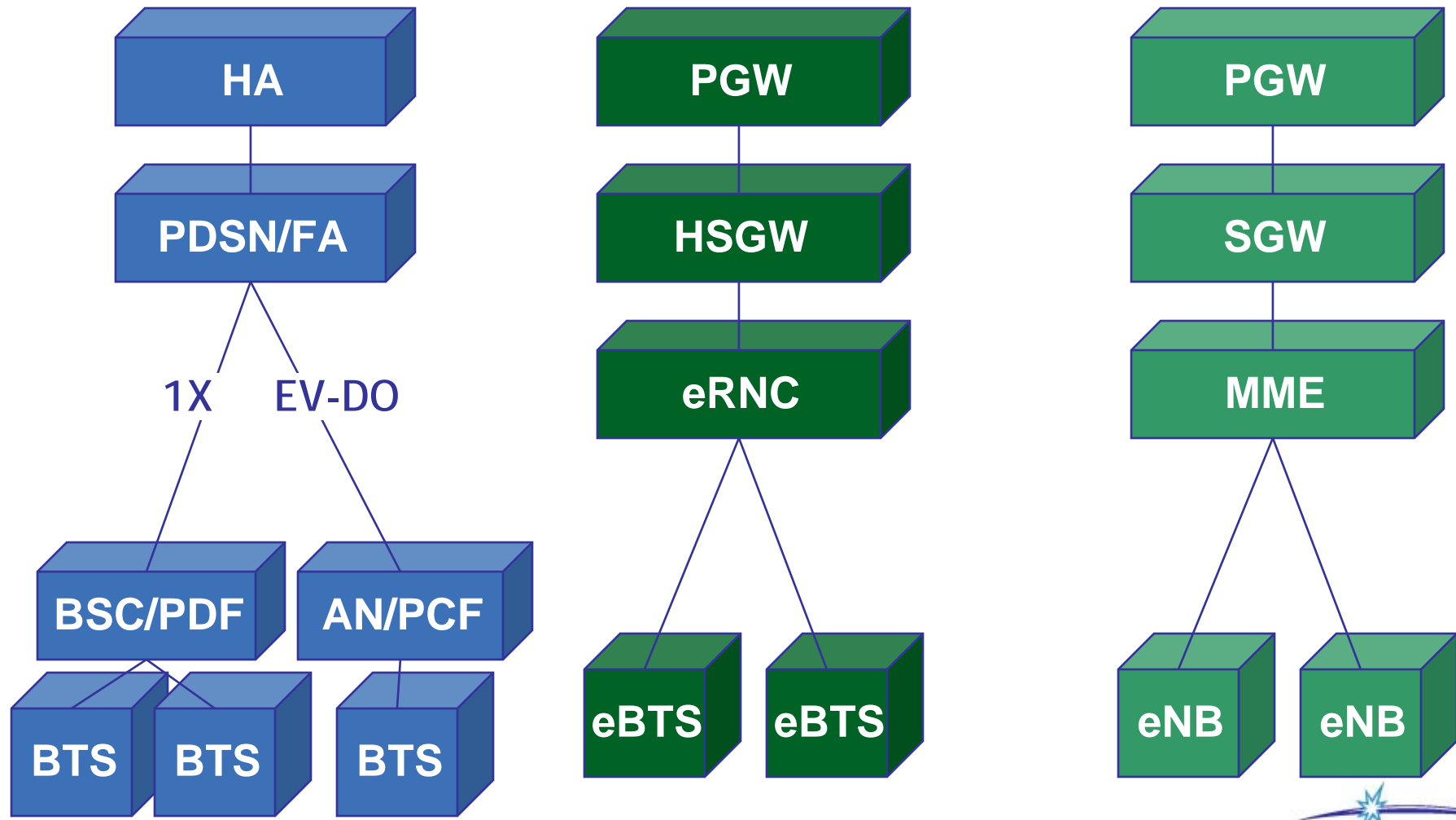


eHRPD - The “glue” between the two

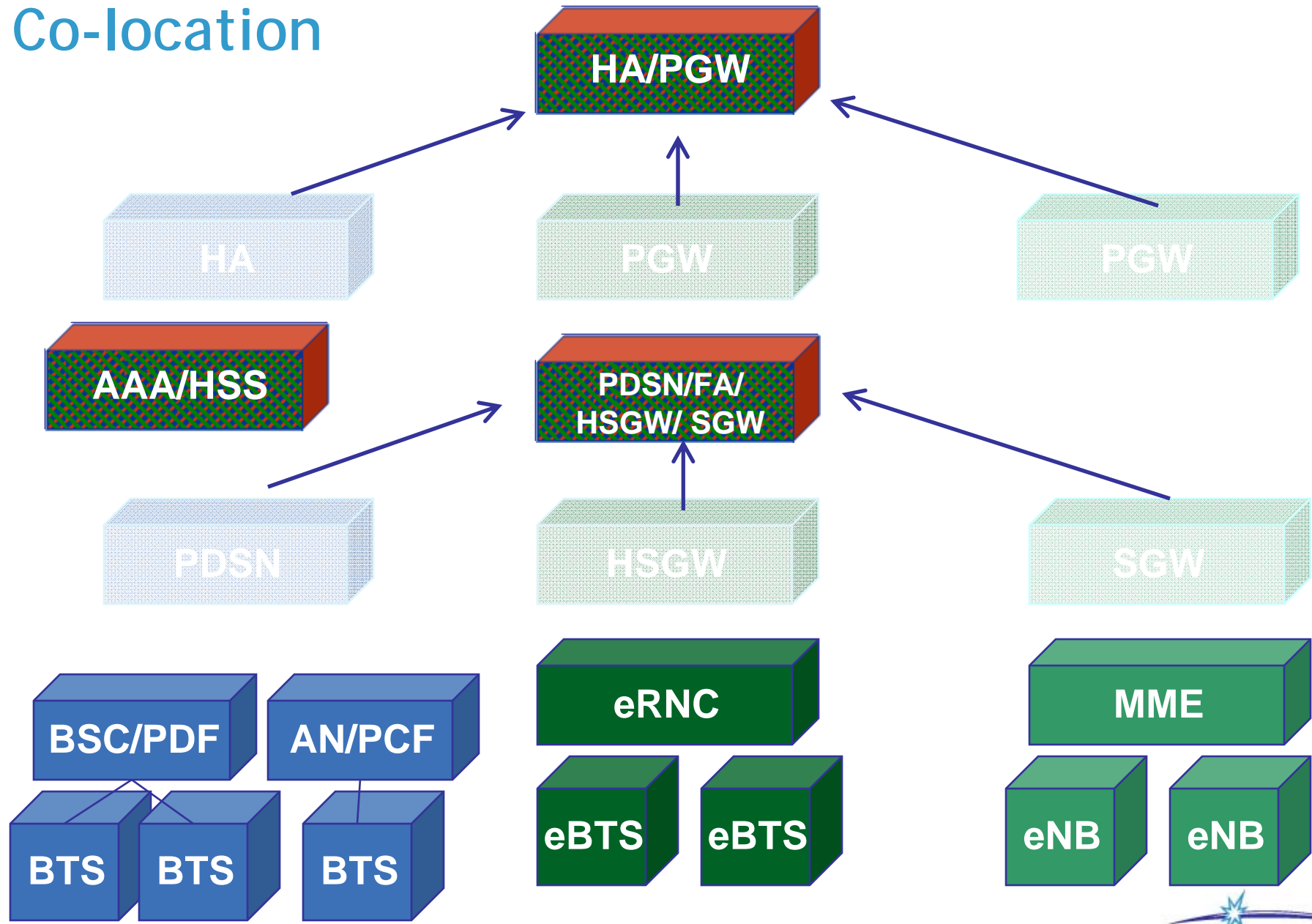


- Packet Data Network Gateway
 - IP policy enforcement on packet flows to and from mobile devices
- HRPD Serving Gateway
 - Converges mobility functions between LTE and CDMA/EV-DO
- eHRPD Radio Network Controller

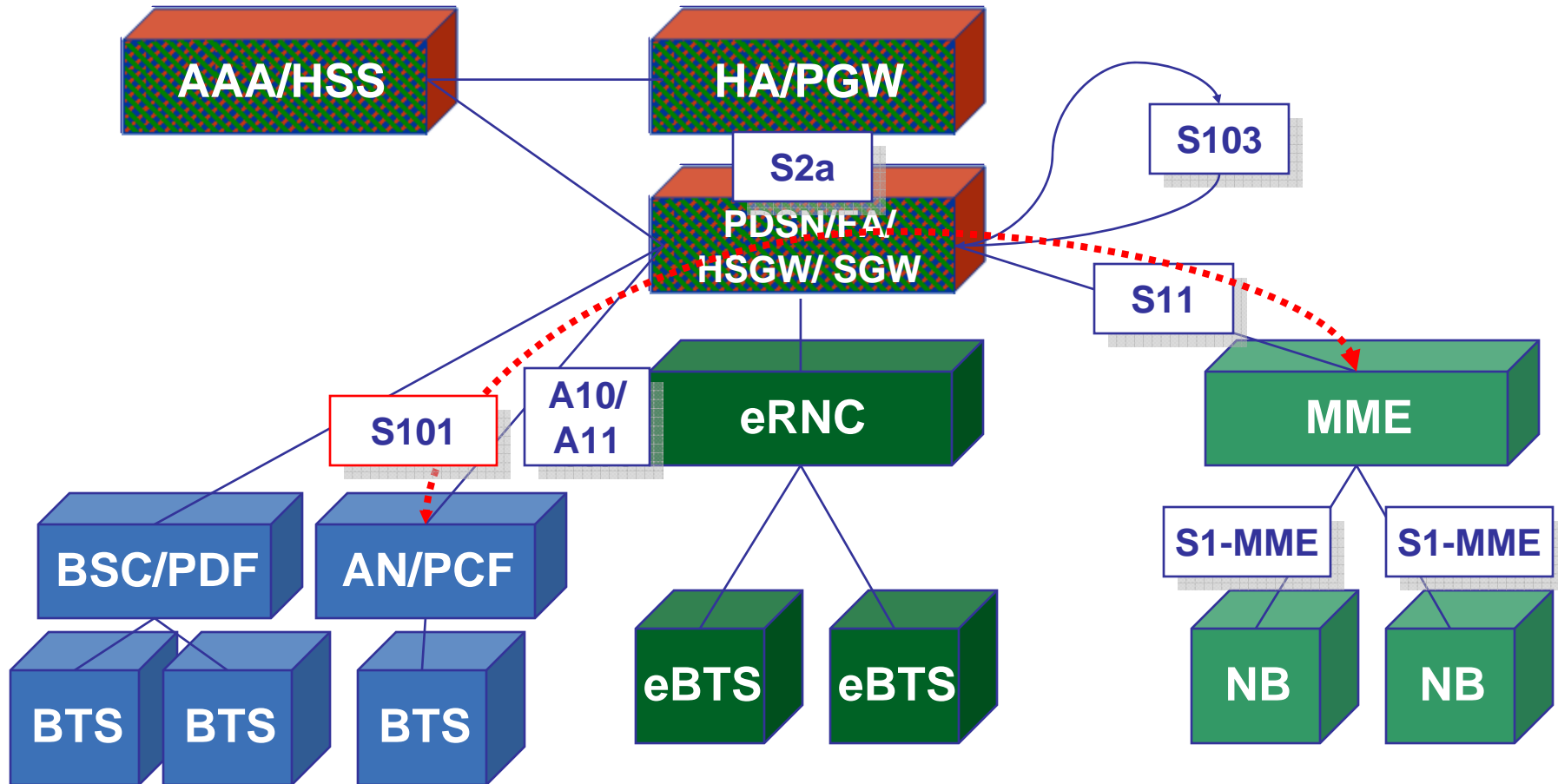
RAN Block Diagram



Co-location



Interfaces



Interfaces

S2a	PDSN/FA ↔ PGW
S11	MME ↔ SGW
S103	PDSN/FA ↔ SGW
S1-MME	MME ↔ eNB
S101	MME ↔ PCF
A10/A1	PDSN/FA ↔ PCF
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Implementation On the Network:



- New Service Options
 - SO59 - HRPD connection to a Packet Data Network
 - SO67 (possible future implementation) - QoS Bearer Service Option
- IPv6
 - Always on; IPv4 on demand
- Vendor-Specific Network Protocol (VSNP)
 - uses VSNCP (Vendor-Specific Network Control Protocol)



eHRPD's Impact on the Mobile Device

Implementation On Devices and the RAN



- On Devices and the RAN
 - Enhanced Multi-Flow Packet Application (EMFPA)
 - Implemented as changes in RLP, LUP and FCP
 - VSNCP - Vendor Specific Network Control Protocol
 - In lieu of IPCP, which EV-DO uses to connect to the PDSN, here we use VSNCP to connect to the PDN Gateway

Implementation On Devices and the RAN

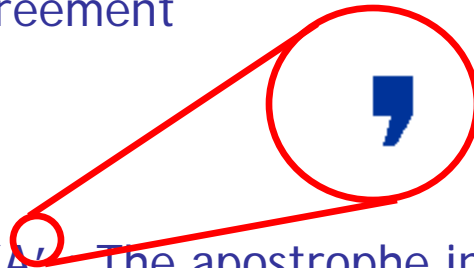


- On Devices and the RAN
 - VSNP - Vendor Specific Network Protocol
 - carries RSVP (Resource reservation Protocol) payload for QoS enforcement
 - PMIP - Proxy Mobile IP
 - Replaces MIP stack on the device
 - IP-based QoS bearer instead of PPP-based bearer

Implementation - Authorization



- New Authorization routine consistent with 3GPP standards:
 - EAP-AKA : Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement
 - EAP-AKA' . The apostrophe indicates that this is *Improved* EAP-AKA - Binds network name information to the key





Verifying that eHRPD works

eHRPD-specific Testing

- Conformance Tests
 - Session Negotiation Tests
 - With eHRPD, HRPD
 - With (and between) different application subtypes (MFPA, EMPFA, etc.)
 - Session Configuration Tests for Dormant Handoff between eHRPD and HRPD
 - With ProtocolID renegotiated at Connection Request & on access
 - with eHRPD ↔ HRPD personality switch
 - CDMA2000 1X and eHRPD Mobility
 - System Reselection, active & dormant
 - Dormant eHRPD to Idle E-UTRAN (and vice versa) Handoffs
 - With & without A13 session information transfers

eHRPD-specific Testing

- Conformance Tests (continued)
 - PPP Based Main-Service Connection Establishment
 - Session establishment and authentication
 - IP Address Assignment and PDN Attach and Detach Procedures
 - Includes Vendor Specific Network Control Protocol (VSNCP)
- Interoperability Tests
 - SMS origination and termination during active eHRPD session
 - SMS origination and termination during dormant eHRPD session
 - Voice call origination and termination during active eHRPD session
 - Voice call origination and termination during dormant eHRPD session

eHRPD-specific Adversarial Testing

- Adversarial Testing (examples)
 - HSGW unavailable
 - IP address pool depletion
 - PDSN/FA errors - no response



Questions?