EHRPD
EV-DO & LTE INTERWORKING

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ERICSSON CDMA PRODUCT MANAGEMENT
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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
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

### 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

## Overview

- Requires S101 / S103 interfaces & UE / eAT support
- Interruption suitable for voice services handoff

## Handoff Types

<table>
<thead>
<tr>
<th>LTE Network</th>
<th>eHRPD Network</th>
<th>Handoff Type</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Idle        | Idle          | Non-Optimized | - IP continuity at PDN GW  
- No user impact |
| Active      | Idle          | Non-Optimized | - Handoff Initiated by UE / eAT  
- IP continuity at PDN GW  
- Interruption of data flow or call to be re-initiated (e.g. VoIP) |
| Idle        | Active        | Non-Optimized | - UE / eAT initiated when active call is completed on eHRPD  
- IP continuity at PDN GW  
- No user impact |
| Active      | Active        | Optimized    | - Requires S101 / S103 interfaces & UE / eAT support  
- Interruption suitable for voice services handoff |

## IP Continuity

*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 SearchParms (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

› **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

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

› 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

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