Stateless vEPC


2014/03/27
Softbank Mobile
Today

EPC Core

RAN

Internet

HSS

PDN-GW

PCRF

MME

SGW

AAA
WHY: All packets incl. control signaling are routed to vEPC.
All IP Network defined in R-8, BUT

**Internet**

**P-GW**

**S-GW**

**Access NW (FD-LTE)**

**Access NW (TD-LTE)**

**IP over GTP**

**TUNNELING/Switching**

**EPC-E**

**Router**

**IP Routing**

**SoftBank**
Splitting Control and User Plane

Our Goal

• User packets bypass vEPC
• Network Services (DPI, Charging, etc.) are performed on the user plane
vEPC creates and manages UE’s state.

It should have routing capability based on the state information available in vEPC.
A mechanism is required to reflect states in C-plane to routers in U-plane.

- Routing protocols (BGP)
- Extension to Proxy Mobile IP (being WGLC in NETEXT)
- SDN/OpenFlow
- FORCES WG
Stateless user-plane architecture

We use BGP!!!
Simple Configuration

- Mobility Management
- Access NW (LTE)
- Access NW (WiFi)
- Core NW
- Edge Router
- Router
- Internet

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GTP is established to anycast address of EPC-E. It means GTP can be terminated to these virtually grouped EPC-E.
Stateless user-plane architecture for Mobile

1. Signaling (ex. PBU/PBA)
2. BGP Update to setup route per MN (Dynamic)
3. BGP route (Stable)

We have all components in IETF
BGP but not Boeing Model

**Boeing Model**

Access NW

Internet

Routes are updated across networks

**Stateless vEPC**

Access NW

EPC

Internet

EPC-E

Router

Routes are updated only at EPC-E
Dynamic Route Update

Every EPC–E have the same routing information of MN.

Dynamic: BGP Update
Remote Next Hop: draft-vandevelde-idr-remote-next-hop
Stable Routes

Aggregated Routes
Dst: 2001:abcd::/32
NxtHop: one of EPC-E

Every EPC-E advertise the aggregated prefix.

Stable: BGP Update
Route Information

Routes at all the EPC–E

<table>
<thead>
<tr>
<th>Destination</th>
<th>2001:abcd:e fgh::/64</th>
</tr>
</thead>
<tbody>
<tr>
<td>NextHop</td>
<td>GTP tunnel</td>
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Routes at routers

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Host Routes are aggregated

2001:abcd:efgh::/64
Asymmetric Route

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Path from/to the Internet can be asymmetric path

2001:abcd:efgh::/64
Handover

1. Hand-over Signaling

2. Route Update

New Routes at EPC-E

<table>
<thead>
<tr>
<th>Destination</th>
<th>UE Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>NextHop</td>
<td>GTP tunnel @ New eNB</td>
</tr>
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Internet
Address Delegation

② Reverse Lookup

<table>
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<tr>
<th>Destination</th>
<th>NextHop</th>
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<tbody>
<tr>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td>2001:db8::/64</td>
<td>GTP Tunnel</td>
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EPC-E has a route of every UE and uses that information to reply RS and DHCP REQ.

① RS or DHCPv6 Req

③ RA or DHCPv6 Res
(Delegate 2001:db8::/64)
Scalability by Operational Configuration

Tokyo

Access NW (LTE)

Osaka

Access NW (WiFi)

Core NW

vEPC

Internet

EPC-Es are divided by region, market, etc.
GTP is established to legacy EPC located in vEPC cloud.
IPv4 Support

IPv4 address allocation (GTP control-plane)

DS-Lite B4 or 464XLAT CLAT (Stateless)

IPv4 over IPv6 or v4v6 translation

DS-Lite AFTR or 464XLAT PLAT (Stateful)

GTP (IPv4-Only)

Internet