KT’s MPTCP Proxy Experiences

Deployment and testing considerations

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01 Introduction

• What we’ve done
  - Designed MPTCP proxy deployment model for Korea Telecom (operates national-wide LTE/3G and public WiFi)
  - Implemented the proposed MPTCP proxy on x86 server
  - Also, implemented UE solution with MPTCP kernel

• KT’s proposed MPTCP proxy deployment model
  - No touch on existing NW infrastructure: no modification or interworking with LTE EPC and wireline middle boxes
  - Only the specific traffic from UE is routed to the proxy, other traffics flows through normal routing path
  - We call it “Explicit MPTCP deployment model”
Introduction: Explicit Deployment Model

01

1. White-list Policy Synchronization
   - pM-UE
   - EPC (LTE)
   - eNB
   - Public or Private AP

2. Proxy Agent redirects white-list app’s traffic
   - WiFi
   - Premium/Internet
   - pM-UE
   - NW Stack @ pM-UE (w/ Proxy Agent)

3. Protocol Relay (MPTCP ↔ TCP)
   - MPTCP Session
     - Primary subflow over LTE
     - Secondary subflow over WiFi
   - MPTCP Session
   - TCP Session
   - Flow over wired infra.
   - Proxy @ MP
   - Contents @ ICP

TCP based services

ICPs

Internet

TCP based services

ICPs
Main Features

1. **Mobile Throughput Enhancement**
   Aggregated connection provides higher throughput than LTE and WiFi single connection (both up and downward TCP-based services).

   \[ \text{LTE + WiFi} = \text{Aggregated Throughput} \uparrow \]

2. **Robust when WiFi getting worse**
   Supplement path (LTE) still works when suffering from bad WiFi coverage, malfunctioned APs, etc.
   - No signal
   - Low signal
   - High signal but AP backhaul failure

   Session continuity over LTE path

3. **Operator-driven service options**
   White-list: a group of services involved in MPTCP proxy by operator’s selective provisioning

   - Working with Proxy
   - otherwise,

4. **Service class differentiation**
   Available to adjust LTE-WiFi ratio according to subscribers’ preference and their plan

<table>
<thead>
<tr>
<th>Service classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>speed (\Rightarrow) LTE+WiFi aggregation</td>
</tr>
<tr>
<td>Silver</td>
<td>savvy (\Rightarrow) Minimized LTE usage</td>
</tr>
<tr>
<td>Bronze</td>
<td>sensitive (\Rightarrow) WiFi-centric usage</td>
</tr>
</tbody>
</table>

General) GiGA Path provides WiFi automatic on/off functionality to white-list Apps
1) Development of terminal side white-list architecture is done, integration with MP-PE is under development
2) It may vary depending on business requirement, throttling based differentiation for subscribers’ class is ready
03 MP OAM and pM-UE

1) Run GiGA Path Mgr
2) White-list selection
3) Start GiGA Path service

※ 1GB HTTP get by using wget command at pM-UE
04 Deployment topology @ commercial site

- **Wideband LTE Repeater**
  - ICT Lab

- **DU/RU 1800MHz**
  - ICT Lab

- **S/PGW, MME**
  - EPC
  - Seoul, Korea

- **KORNET**
  - premium wireline infra

- **Content Server**
  - domestic/international service providers

- **SWITCH**

- **MP**
  - ICT Lab

- **GiGA AP**
  - 802.11ac WiFi AP
  - ICT Lab

- **pM-UE**
  - (MPTCP capable UE w/ Proxy agent)

  - Nexus 5 (Google's reference), etc
  - MPTCP v0.86 (from UCL)
  - GiGA Path Manager (KT's propriety)
  - include proxy agent and dual-interface functionality

- **MP (MPTCP Proxy)**

  - COTS x86 Server (HP DL380 Gen7)
  - MPTCP v0.88 (from UCL)
  - Proxy and protocol relay (SOCKS, http dual support)
Possible IETF work
- Participate in authoring internet draft for the explicit proxy model and/or MP-PE

Cooperation with terminal vendors for MPTCP support
- Requires common requirements within telecom operators

Stabilization of MPTCP kernel for Proxy architecture
- Minimize side effect on kernel against UE-driven proxy support
Thank you