Native Deployment of ICN in 4G/LTE Mobile Networks

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https://tools.ietf.org/html/draft-suthar-icnrg-icn-lte-4g-02
Objectives: Provide ICN deployment scenarios for 4G/LTE mobile networks

Because current research/projects covers

- ICN as an overlay (assuming consumer is attached to the network with IP address and requesting data using ICN messages).
- ICN scenarios to date are either in fixed wireline or WiFi network without involving cellular network.
- Majority of video content consumed by mobile devices and cellular mobile network have different characteristics
ICN Deployment Options in UE - Dual Stack or Native

Select the transport (e.g. ICN or IP) and radio interface (e.g. LTE, WiFi or both), preference (e.g. content location, content type, content publisher, congestion, cost, QoS etc.)

PDCP modified to support ICN for RLC (sequencing, drop detection, retransmission), ROHC header compression, ciphering/deciphering

ICN forwarder (co-exists with IP) for ICN packets, e.g. Interest packet to eNodeB or response "data packet" from eNodeB to the application
ICN Deployment in Base Station

eNodeB (ICN forwarder)

- UE preference and transport availability (IP, dual stack, native ICN)
- Application Programming Interface (API) from management systems
ICN Deployment in Transport

<table>
<thead>
<tr>
<th>App</th>
<th>Transport selector</th>
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<tbody>
<tr>
<td>ICN/IP</td>
<td></td>
</tr>
<tr>
<td>PDCP</td>
<td>L1</td>
</tr>
<tr>
<td>RLC</td>
<td>L1</td>
</tr>
<tr>
<td>MAC</td>
<td>L1</td>
</tr>
</tbody>
</table>

- Removing GTP tunnel with native ICN
- Forwarding strategy and transport availability (IP, dual stack, native ICN)
- Application Programming Interface (API) from management systems

Diagram showing the integration of ICN in transport with components like UE, BS (enodeB), SGW, PGW, SGI, CDN, and transport selector.
ICN Security Considerations

7 Key security domains
1. UE authentication and authorization
2. Radio or air interface security
3. Denial of service attacks on mobile gateway, services
4. Content positioning either in transport or servers
5. Content cache pollution attacks
6. Secure naming, routing, and forwarding
7. Application security

Further research is underway Security related encrypted content, mobile gateway capabilities for deep packet inspection (DPI), lawful intercept (LI), etc.

Existing/revised security spec
TS33.310, TS33.320

ICN research/drafts
Next steps

1. Additional input and ICNRG/IETF community Collaborations
2. Adopting as ICNRG working draft

For additional collaborations contact psuthar@cisco.com
BACKUP
Deploying ICN in Mobile Gateway - Modified Attach Procedures

3GPP TS 23.401 V13.6.1 (2016-03) section 5.3.2.1 covers attach procedure. This require modification is step 12 to 22 (because of additional parameters ICN capability is populated in PCO IE TLV. Modified steps will support enhanced capabilities in PGW to support ICN attach in addition to normal IP attach procedures.

1. UE sends initial attach request. ICN capable device will send PCO IE field populated (Details provided in previous section) with ICN capability
2. BS (eNB) will forward attach request to MME. NAS signaling (step 3 to 6) will be performed to authenticate the UE. There is no modification for steps 7 to 11.

12. When attach request is successful, PGW/GGSN assigns identity to UE and creates session using PDN types. Type of attach is communicated to UE in step-16.

16. For UE requesting attach using PDN Type=IP, PGW will assign either IPv4 or IPv6 (Link local) in create session response (CSR). For PDN type = ICN, PGW will register UE with named identity. This will be used for creation of session and all context related function (billing, mediation, enhanced charring function/deep packet inspection, lawful intercept etc.) in function.
LTE Network Architecture – ICN User Plane Impact

S1U GTP Tunnel traffic
S2a GRE Tunnel traffic
S2b GRE Tunnel traffic
SGi IP traffic

3G NodeB
S4
S3
S6a
Gxc
Gx

 UART

HSS

Diameter

SPR

PCRF

SGW

PGW

S1U

S1MME

MME

S11

4G/LTE eNodeB

S2A
ePDG

S2B
SGi

Trusted
non-3GPP

Untrusted
non-3GPP

CDN

UE

UE

UE

UE
LTE Signaling Messages

<table>
<thead>
<tr>
<th>NAS Event Type</th>
<th>MME</th>
<th>HSS</th>
<th>SGW</th>
<th>PGW</th>
<th>PCRF</th>
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<tr>
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<td>3</td>
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