Enabling ICN in 3GPP's 5G NextGen Core Architecture

https://www.ietf.org/id/draft-ravi-icnrg-5gc-icn-04.txt

Ravi Ravindran, Prakash Suthar, Dirk Trossen, Chonggang Wang, Greg White

IETF-105, ICN RG, July 2019
Introduction

• Related WG Draft
  – draft-irtf-icnrg-icn-lte-4g-03 (Native Deployment of ICN in LTE, 4G Mobile Networks), enabling ICN over 4G systems.
  – draft-trossen-icnrg-ip-icn-5glan-00 (IP over ICN over 5GLAN), utilizing solutions outlined in 5GLAN section

• The present I-D: draft-ravi-icnrg-5gc-icn-04
  – To enable ICN over 5G systems.
  – Leverage some similar design principle in draft-irtf-icnrg-icn-lte-4g-03 with some extensions unique to 5G systems.
Updates in v04

• Combined “4. 5G NextGen Core Architecture” & “5. 5GC Architecture with ICN Support” from v03

• Simplified “6. 5GC Architecture with 5GLAN Support” from v03
  – Removed “IP over ICN over 5GLAN” to a separate I-D ([draft-trossen-icnrg-ip-icn-5glan-00](draft-trossen-icnrg-ip-icn-5glan-00))
  – Only kept “ICN over 5GLAN” in current v04.

• Added new description on “Deployment Considerations” in current v04.
  – Based on guidelines outlined in [draft-irtf-icnrg-deployment-guidelines-06](draft-irtf-icnrg-deployment-guidelines-06)
Recap: 5GC Architecture

Non-Roaming & Service-Based Interfaces (SBI)

- Control Plane:
  - Network Slice Selection Function (NSSF)
  - Network Exposure Function (NEF)
  - Network Repository Function (NRF)
  - Policy Control Function (PCF)
  - Unified Data Management (UDM)
  - Application Function (AF)

- Data Plane:
  - Authentication Server Function (AUSF)
  - Access and Mobility Management Function (AMF)
  - Session Management Function (SMF)
  - User Equipment (UE)
  - (Radio) Access Network ((R)AN)
  - User Plane Function (UPF)
  - Data Network (DN)

5GC Design Principles

- Service APIs: Service Centric Design
- Distributed LAN Support
- Control and User Plane Split
- Decoupling of RAT and Core Network
- Non-IP PDU Session Support
ICN over 5GS – User Plane Dual Stack

TCL: Transport Convergence Layer

- App
- TCL
- ICN&IP
- PDCP|GTP-U
- RLC|UDP/IP
- MAC|L2
- L1
- UE|gNB/RAN
- Uu

- App
- TCL
- ICN&IP
- PDCP|GTP-U
- RLC|UDP/IP
- MAC|L2
- L1
- UPF (UL-CL)
- N3

- App
- TCL
- ICN&IP
- PDCP|GTP-U
- RLC|UDP/IP
- MAC|L2
- L1
- UPF (PDU Anchor)
- N9

- App
- TCL
- ICN&IP
- PDCP|GTP-U
- RLC|UDP/IP
- MAC|L2
- L1
- DN
- N6
ICN over 5GLAN

• **Path-based Forwarding** over Nx Interface for End-to-End LAN Communication
  – Path between UPFs encoded through a **path identifier**.
  – Path identifiers are **bidirectional** and can therefore be used for request/response communication without incurring any need for path computation on the return path.
  – Several path identifiers can be combined into **multicast path identifiers**, used in IPolICNo5G draft for multicast of HTTP responses.

• Realizes sending a packet from one Layer 2 device (UE) connected to one UPF (via a RAN) to another L2 device connected to another UPF through
  – Provide MAC address of the destination and perform path-based forwarding between ingress to egress UPF.
  – Upon arrival at the egress UPF, the end destination MAC address is being used for UPF-local forwarding, creating the perception of a link-local L2 communication between the end source and destination devices.

General Packet Structure:

```
+----------+----------+----------+----------+----------+----------+
| Src MAC  | Dst MAC  | pathID   | NAME_ID  | Payload  |
|----------+----------+----------+----------+----------+----------+
```
Next Steps

• Collect feedback from ICNRG
  – Address any comments during/after the IETF 105

• Request for WG adoption
  – To be a companion WG document to draft-irtf-icnrg-icn-lte-4g-03