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IPv6 and 3G

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Outline

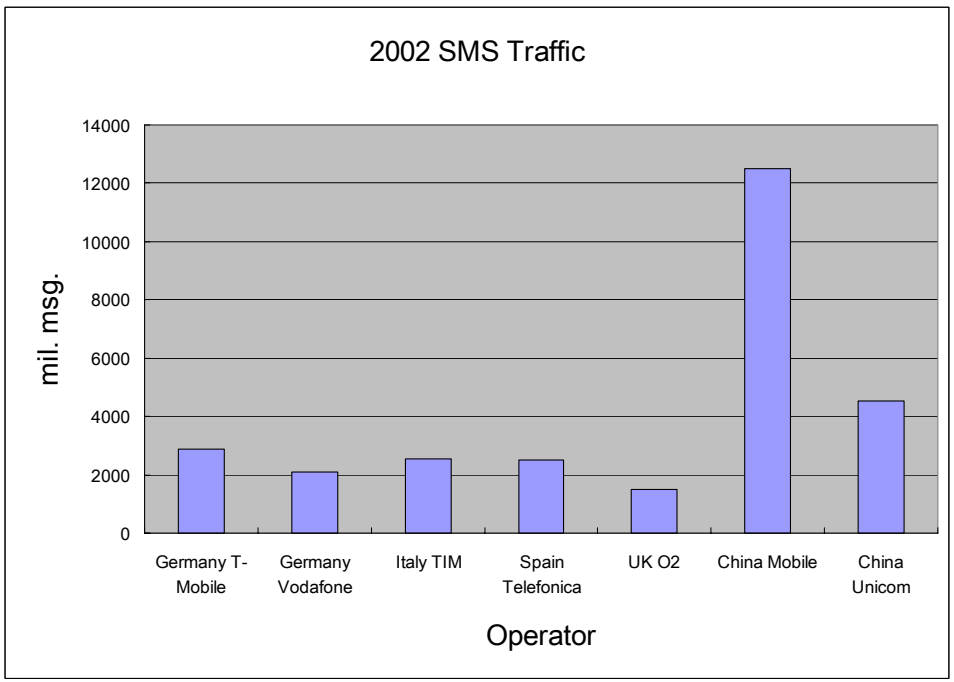
- Why using IPv6 in 3G ?
- IPv6 and 3GPP
- IPv6 and 3GPP2
- Conclusions

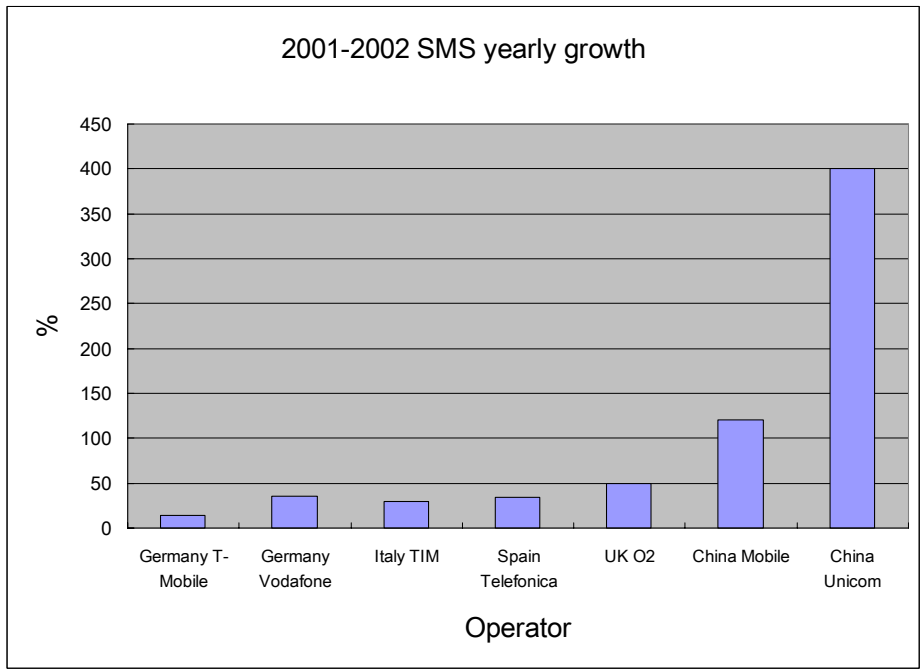
Why using IPv6 in 3G ?

- Why using IPv6 in 3G terminals ?
  - Why 3G ?
    - Capacities
      - Voice service is still the main stream
    - Services/applications
      - Mobile data
      - Lesson learned from GSM/SMS
      - How about EMS/MMS/MIM (mobile instant messaging)
    - (Internet) data services/applications over 3G
    - All-IP (VoIP) over 3G

Why using IPv6 in 3G ?

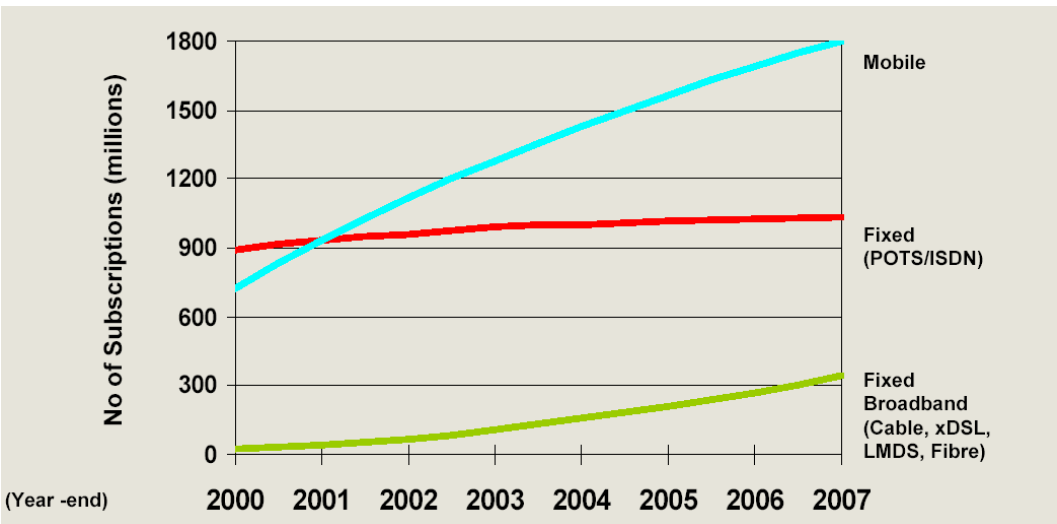
- SMS statistics





Why using IPv6 in 3G ?

- VoIP/Data services over 3G
  - We need more IP addresses
  - We need e2e security
  - We need mobility between 3G and other networks
  - We need e2e QoS

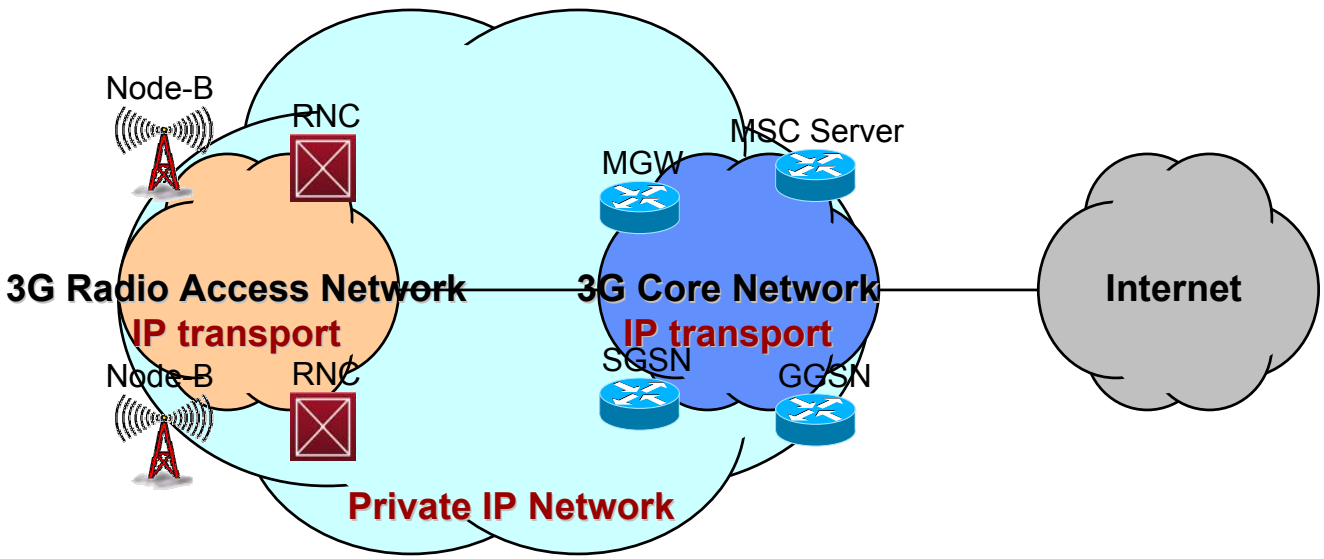


Why using IPv6 in 3G ?

- How about NAT (network address translation) ?
  - Management effort
  - Performance issue
  - SIP
  - End-to-end security
  - End-to-end QoS
  - Seamless mobility

Why using IPv6 in 3G ?

- Why using IPv6 in 3G network transport ?
  - IP transport network



Why using IPv6 in 3G ?

- Why using IPv6 in 3G network transport ? (Cont.)
  - Benefits to use IPv6 in IP transport network
    - Offer QoS transport
    - Easy to manage networks
      - Intra-PLMN
      - Inter-PLMN

IPv6 and 3GPP

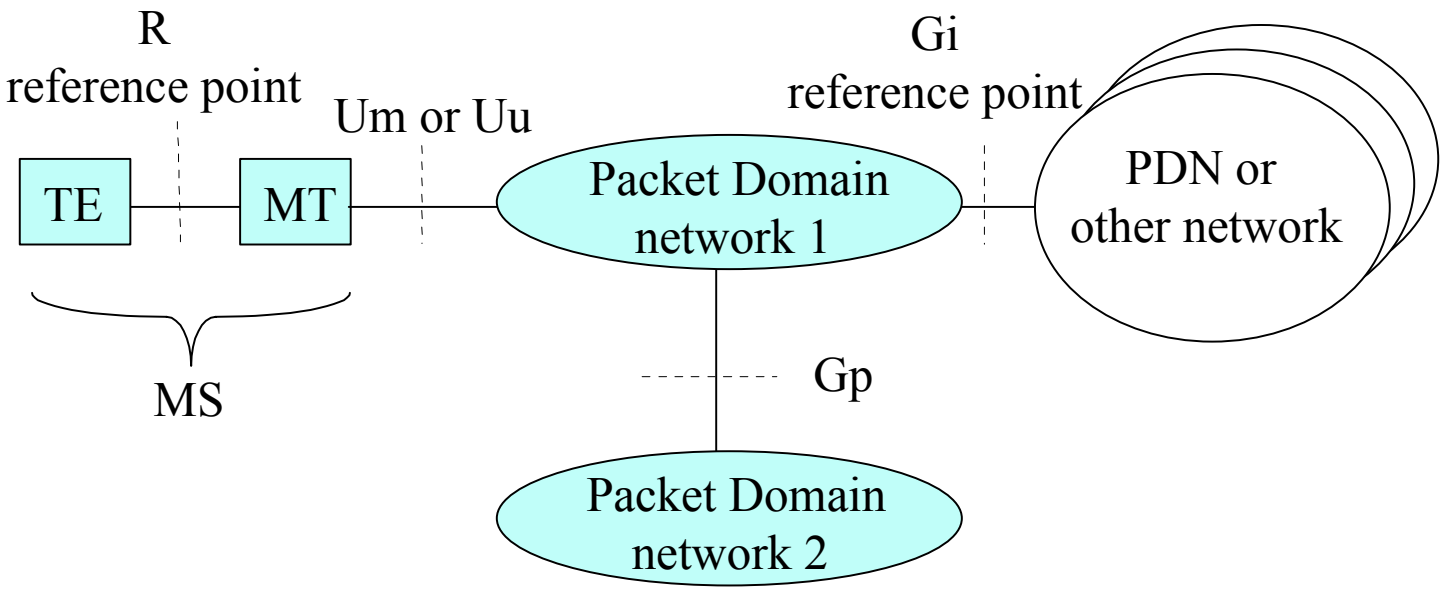
- 3GPP R99
  - Transport network
    - Core network IPv4 transport
  - User Equipment
    - IPv4
- 3GPP R4
  - Transport network
    - Core /Radio access network IPv4/IPv6 transport
  - User Equipment
    - IPv4
- 3GPP R5
  - Transport network
    - CN/RAN (IPv4 or IPv6) transport
    - **IPv6 for IP multimedia subsystem (IMS) elements**
  - User Equipment
    - IPv4 and IPv6 to Internet
    - **IPv6 for IMS**

IPv6 and 3GPP (Cont.)

- 3GPP R5 architecture requirements
  - IP transport between network elements
    - both IPv4 / IPv6 are options for IP Connectivity
  - IM CN subsystem elements
    - The architecture shall make optimum use of IPv6
    - The IM CN subsystem shall exclusively support IPv6
    - The UE shall exclusively support IPv6 for the connection to services provided by the IM CN subsystem.
  - Access to existing data services
    - The UE can access IPv4 and IPv6 based services.

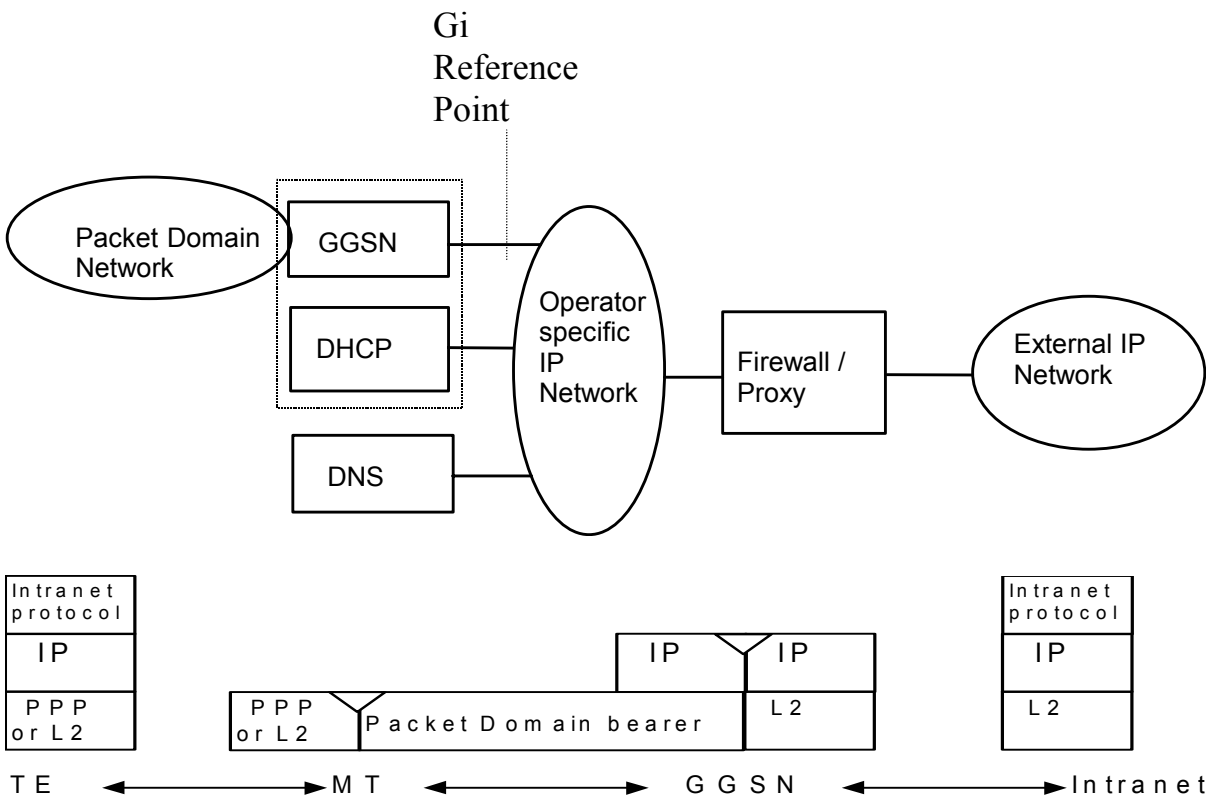
IPv6 and 3GPP (Cont.)

- Packet Domain Access Interfaces and Reference Points



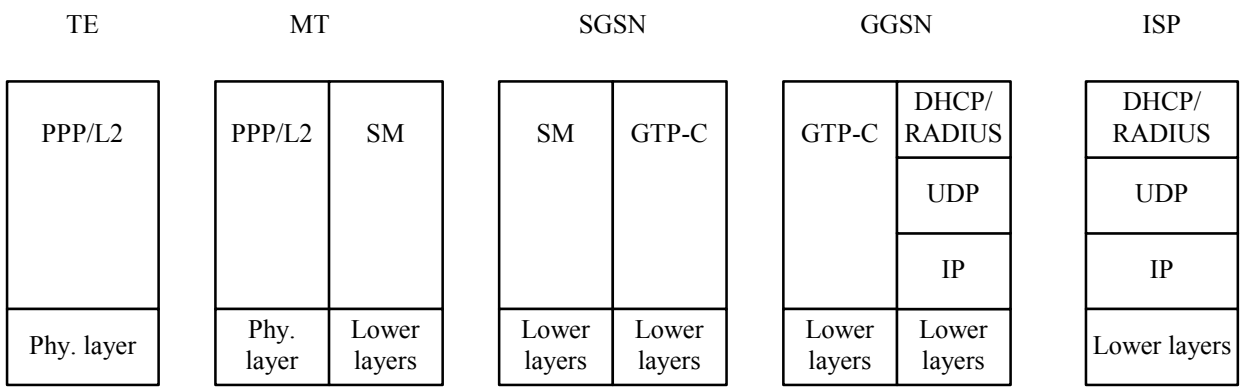
IPv6 and 3GPP (Cont.)

- Transparent mode



IPv6 and 3GPP (Cont.)

- Non-transparent mode

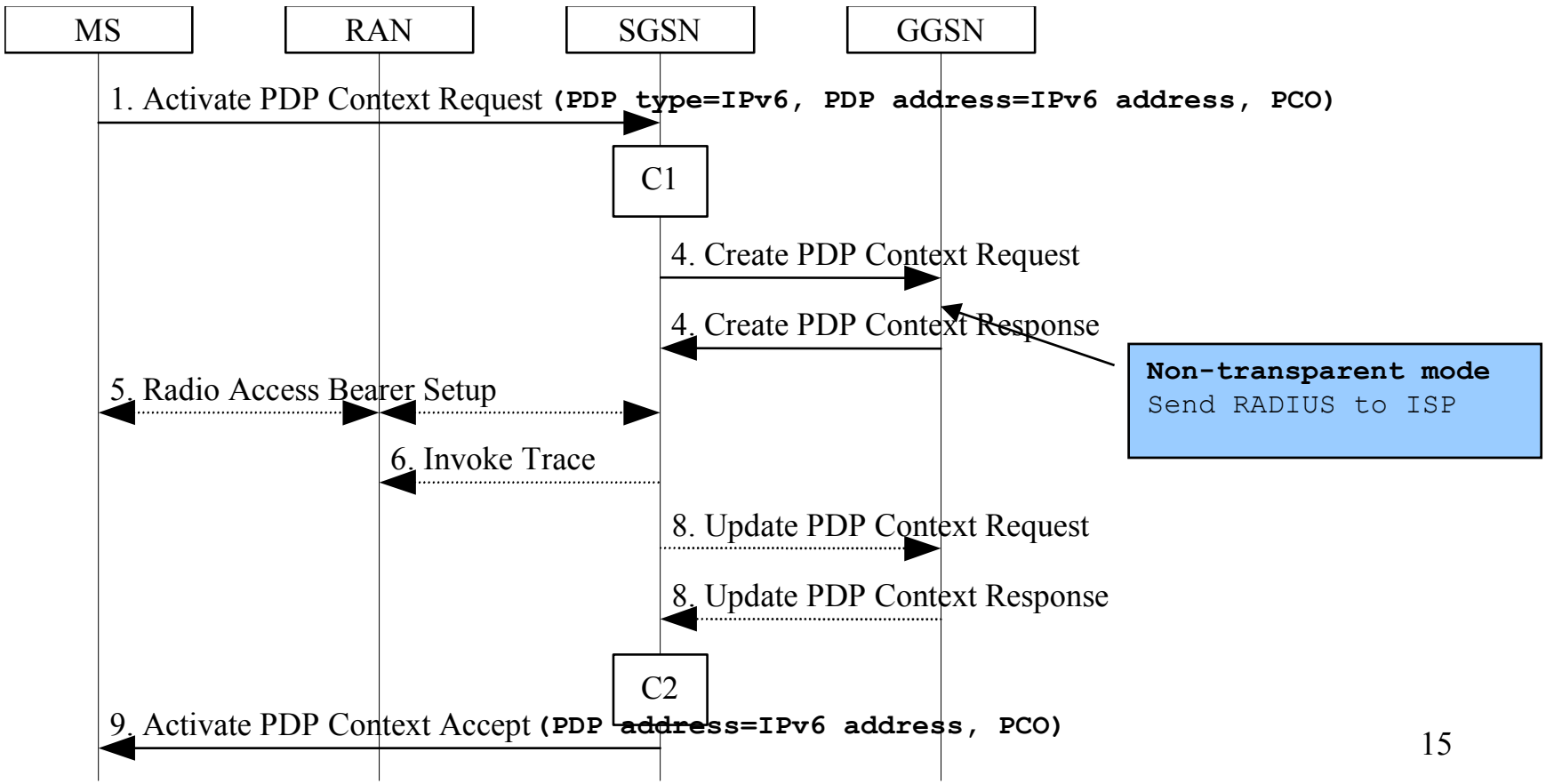


IPv6 and 3GPP (Cont.)

- Methods to obtain IPv6 address
  - Network access mode
    - Transparent mode
    - Non-transparent mode
  - IPv6 address type
    - Static IPv6 address
    - Dynamic IPv6 address
  - Automatic configuration
    - Stateless
    - DHCPv6

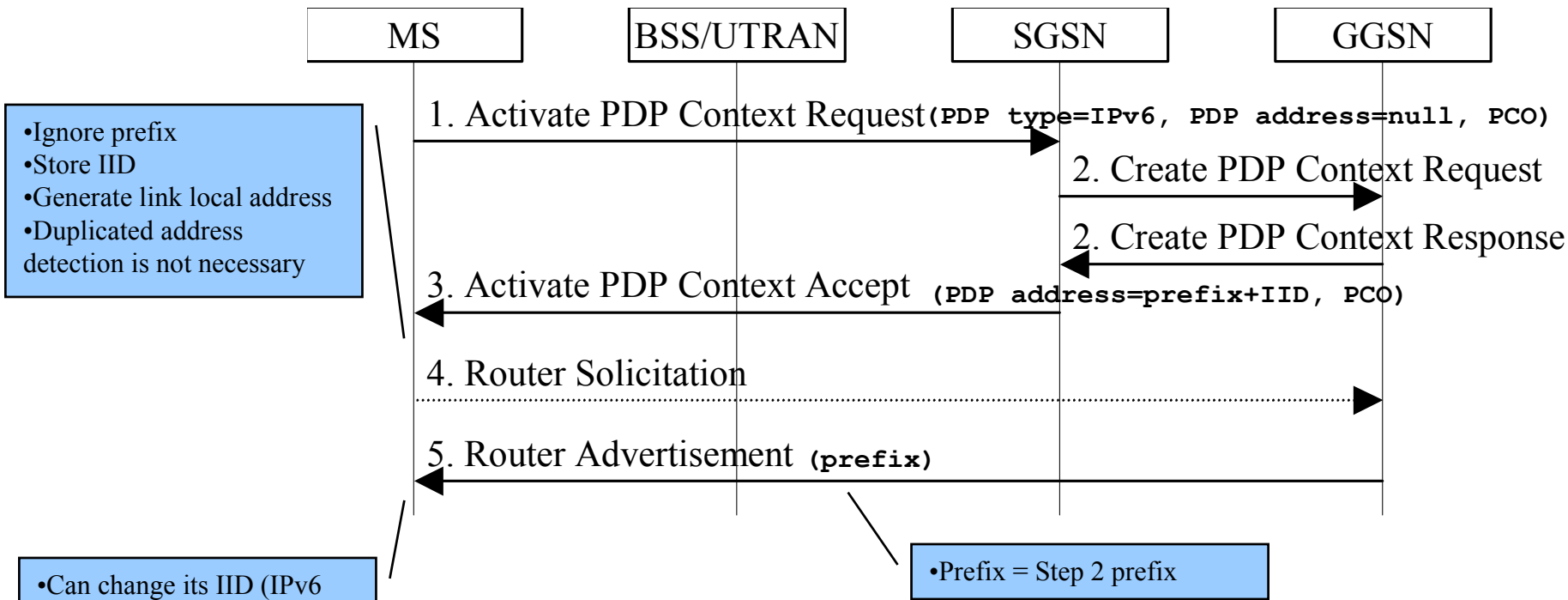
IPv6 and 3GPP (Cont.)

- Static IPv6 address



IPv6 and 3GPP (Cont.)

- Stateless IPv6 address



IPv6 and 3GPP (Cont.)

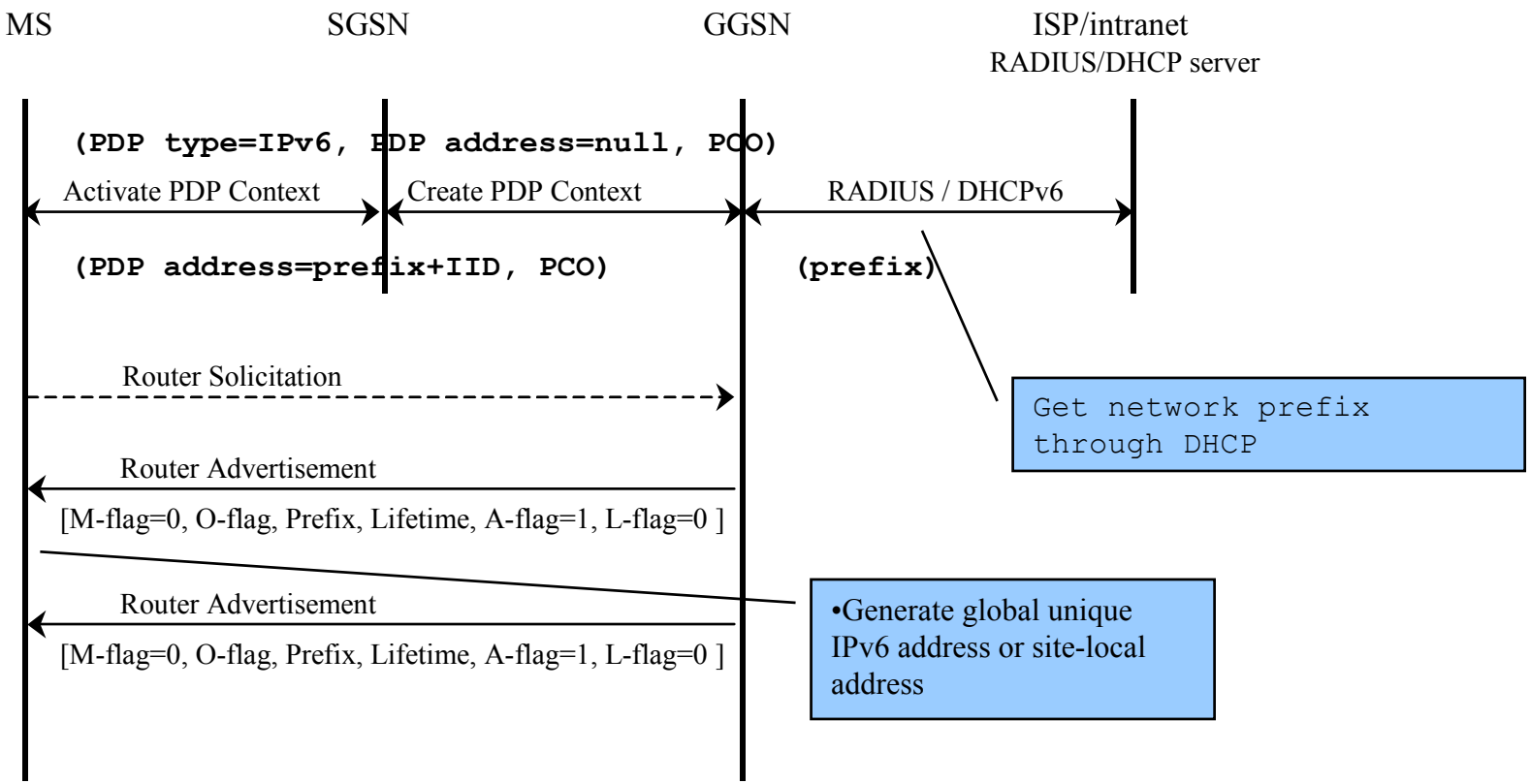
- In a PLMN
  - UE A
    - $Prefix_a$+IID_c
  - UE B
    - $Prefix_b$+IID_d
  - $Prefix_a \neq Prefix_b$
  - $IID_c = IID_d$ or $IID_c \neq IID_d$
  - $Prefix_a$+$IID_c \neq Prefix_b$ +IID_d

IPv6 and 3GPP (Cont.)

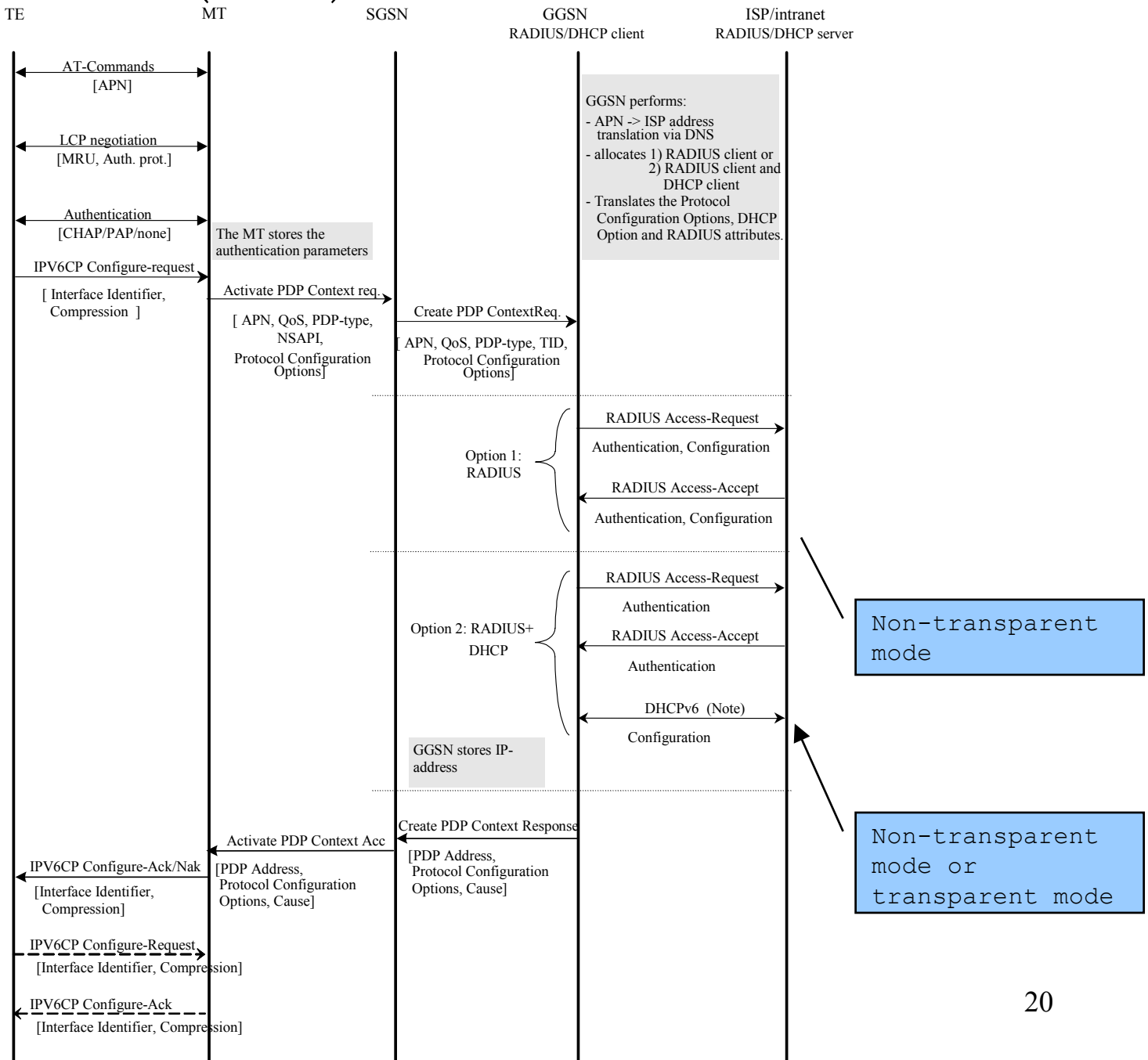
- Address assignment solutions
  - #1 assign one or more entire /64s to a PDP context
    - Is a /64 per PDP context too much ?
    - Still has 61 bits (3-bit prefix 001 for aggregatable global unicast addresses) = 490x10^22 /64 prefixes can be used
  - #2 share the same prefix between multiple PDP context connected to the same PLMN
    - DAD is required
    - Increase GGSN workload
      - Prefix match or complete address match
      - Determine temporary addresses that are no longer in use

IPv6 and 3GPP (Cont.)

- Stateless IPv6 address (Cont.)

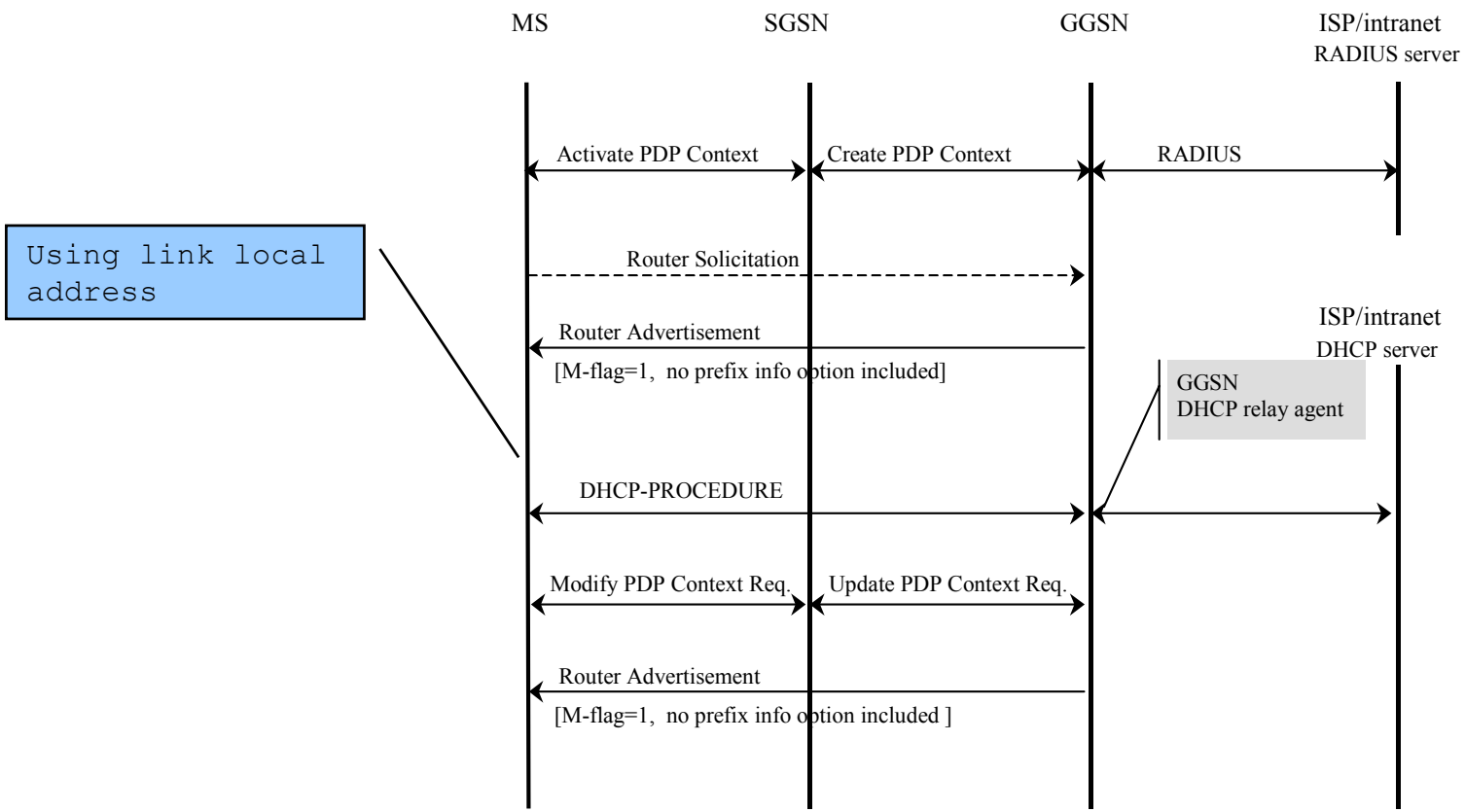


Stateless IPv6 address (Cont.)



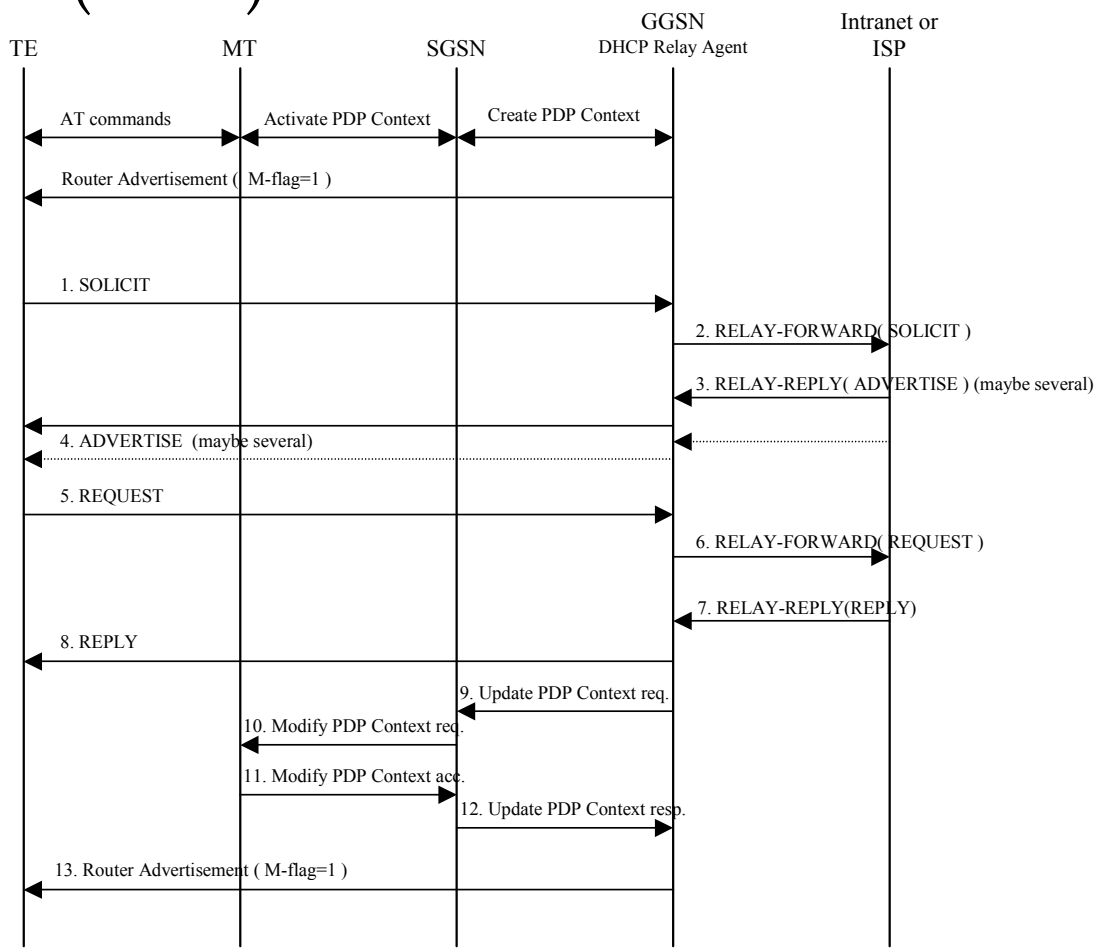
IPv6 and 3GPP (Cont.)

- DHCPv6



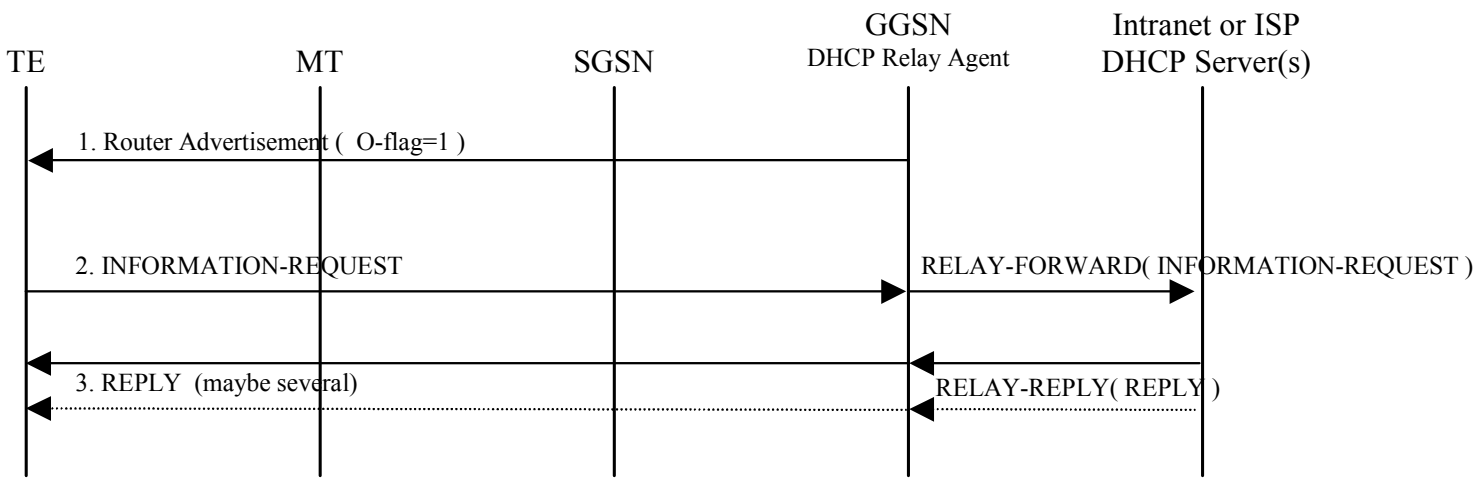
IPv6 and 3GPP (Cont.)

- DHCPv6 (Cont.)



IPv6 and 3GPP (Cont.)

- Other DHCPv6 configuration

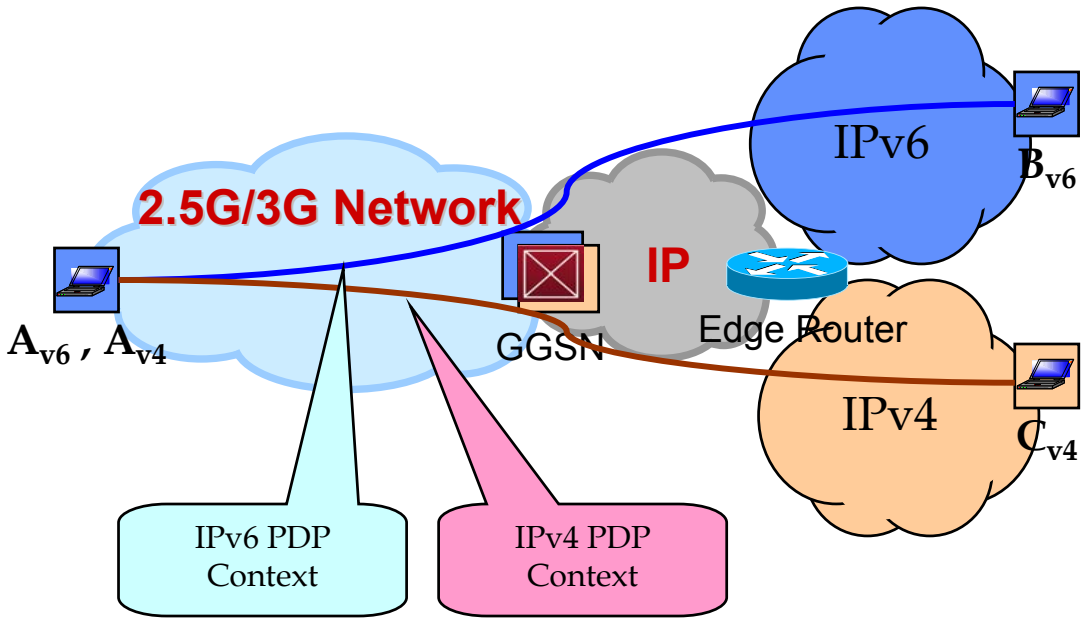


IPv6 and 3GPP (Cont.)

- IPv4 to IPv6 transition in 3GPP
  - GPRS Scenarios (data service)
    - Dual Stack UE connecting to IPv4 and IPv6 nodes
    - IPv6 UE connecting to an IPv6 node through an IPv4 network
    - IPv4 UE connecting to an IPv4 node through an IPv6 network
    - IPv6 UE connecting to an IPv4 node
    - IPv4 UE connecting to an IPv6 node
  - Transition scenarios with IMS (IMS service)
    - UE connecting to a node in an IPv4 network through IMS
    - Two IPv6 IMS islands connected via an IPv4 network

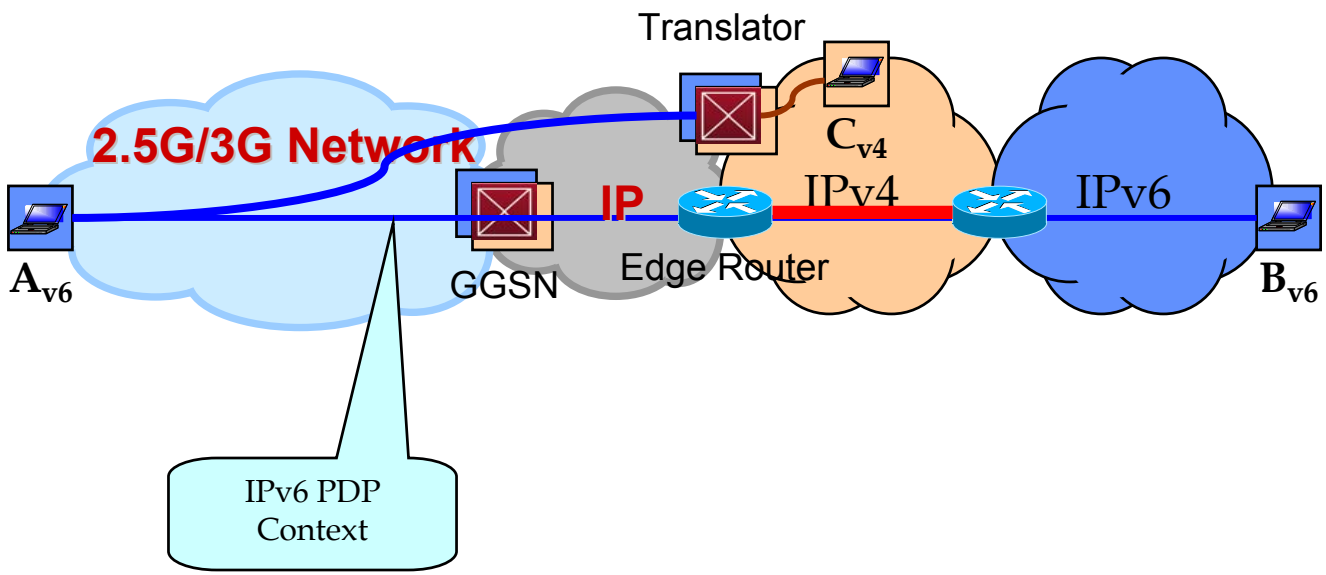
IPv6 and 3GPP (Cont.)

- Dual stack UE connecting to IPv4 and IPv6 nodes



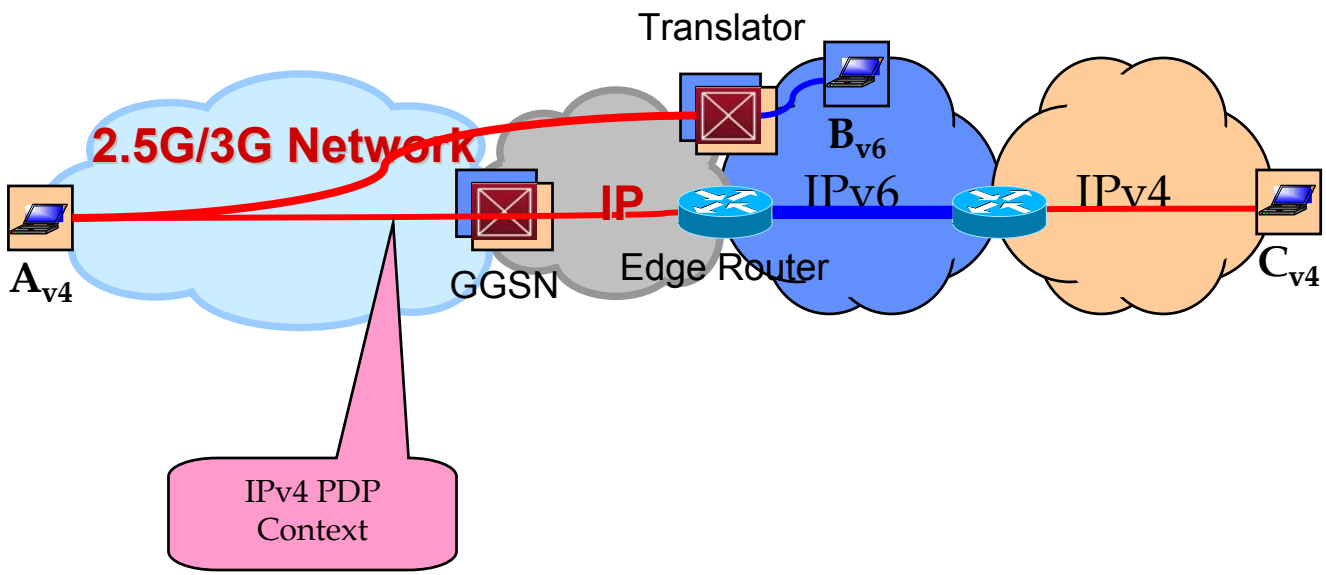
IPv6 and 3GPP (Cont.)

- IPv6 UE connecting to IPv6 node through an IPv4 network
- IPv6 UE connecting to an IPv4 node



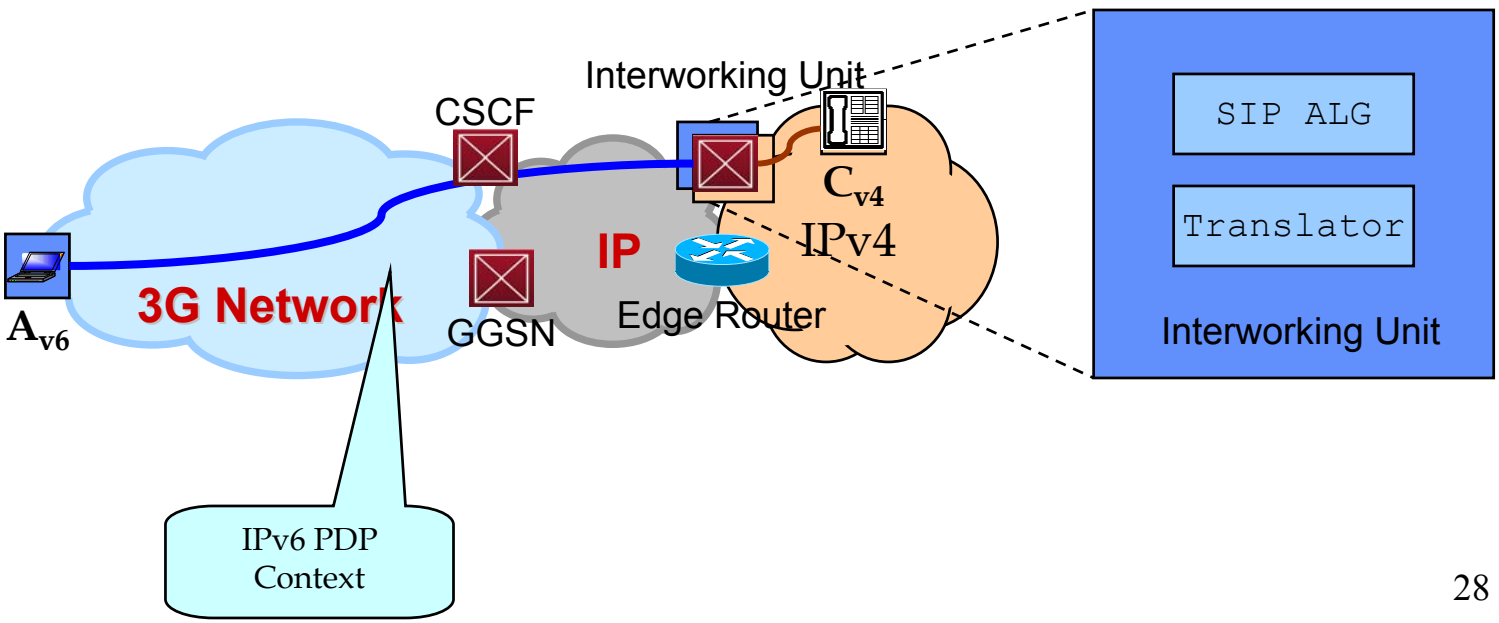
IPv6 and 3GPP (Cont.)

- IPv4 UE connecting to IPv4 node through an IPv6 network
- IPv4 UE connecting to an IPv6 node



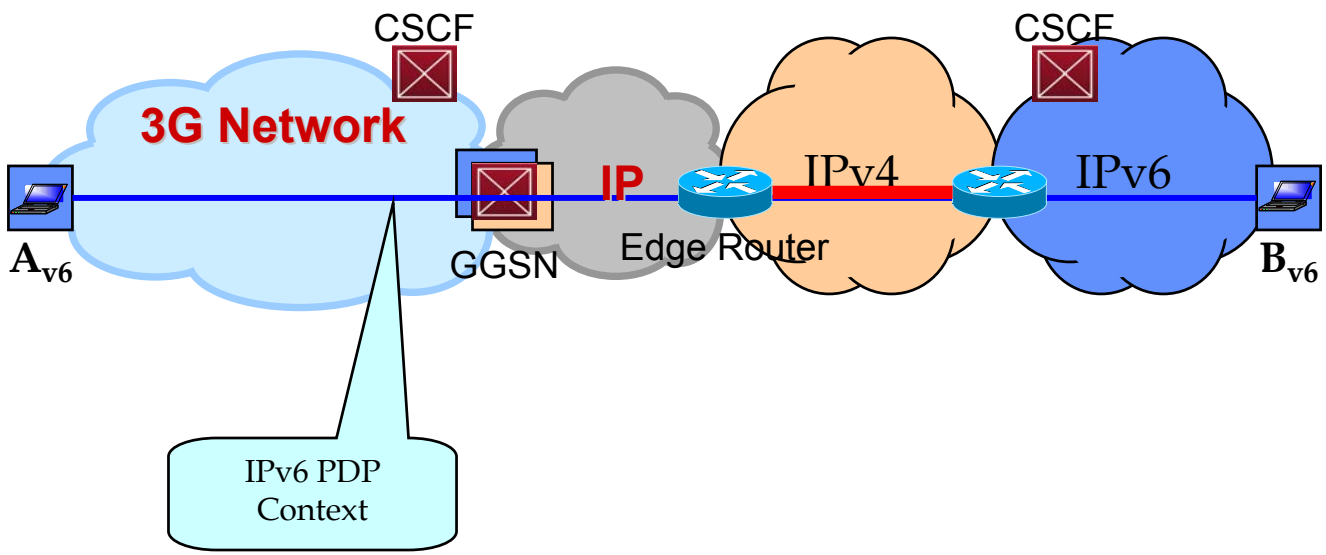
IPv6 and 3GPP (Cont.)

- UE connecting to a node in an IPv4 network through IMS



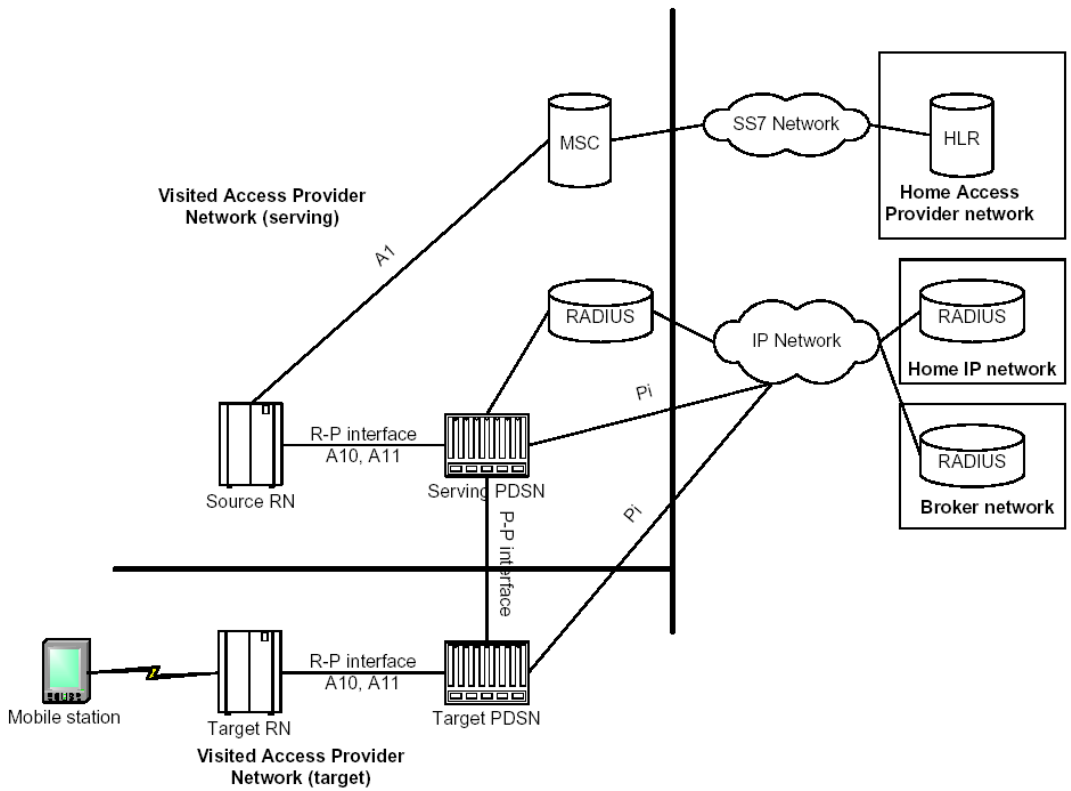
IPv6 and 3GPP (Cont.)

- Two IPv6 IMS islands connected via an IPv4 network



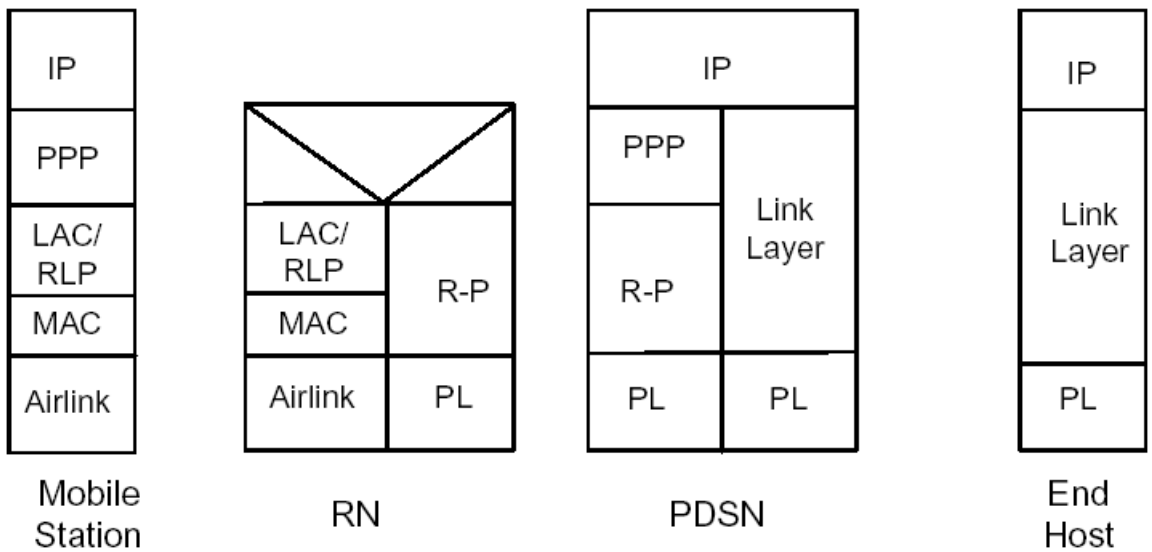
IPv6 and 3GPP2

- 3GPP2 Architecture
  - Simple IPv4 and Simple IPv6



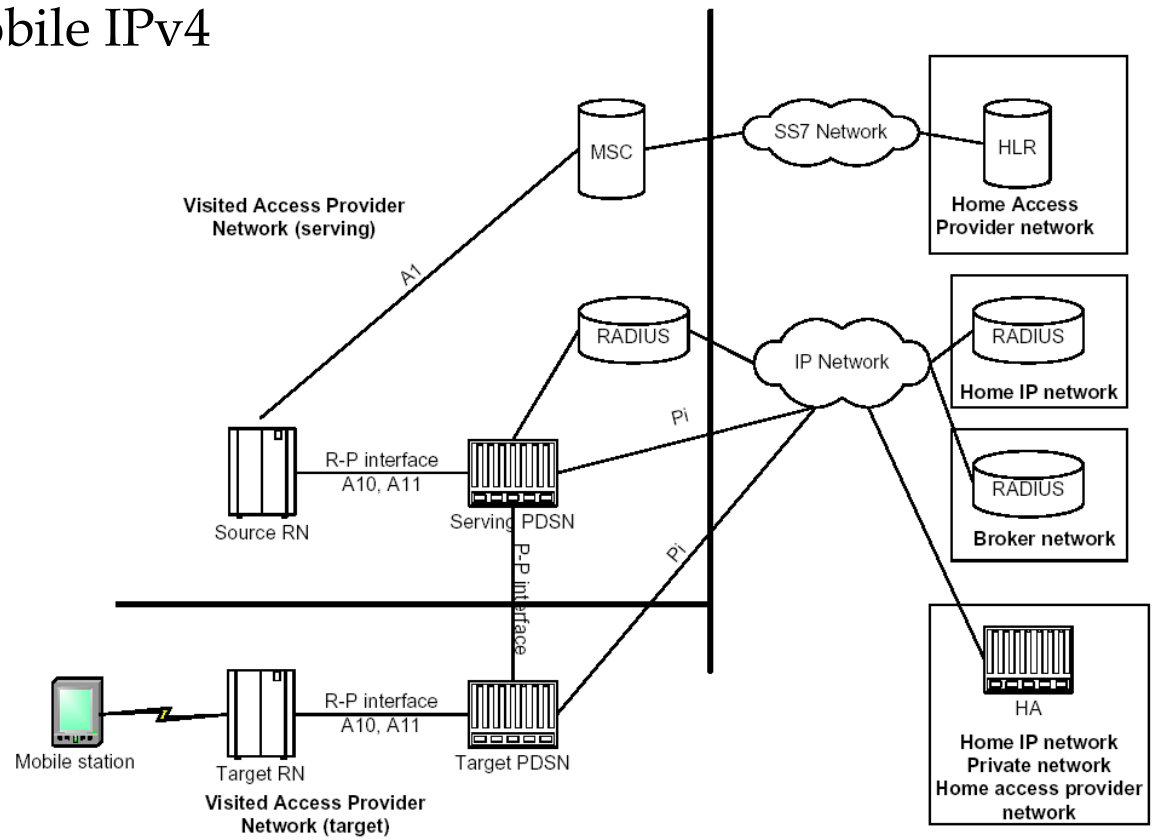
IPv6 and 3GPP2 (Cont.)

- Simple IP protocol stack



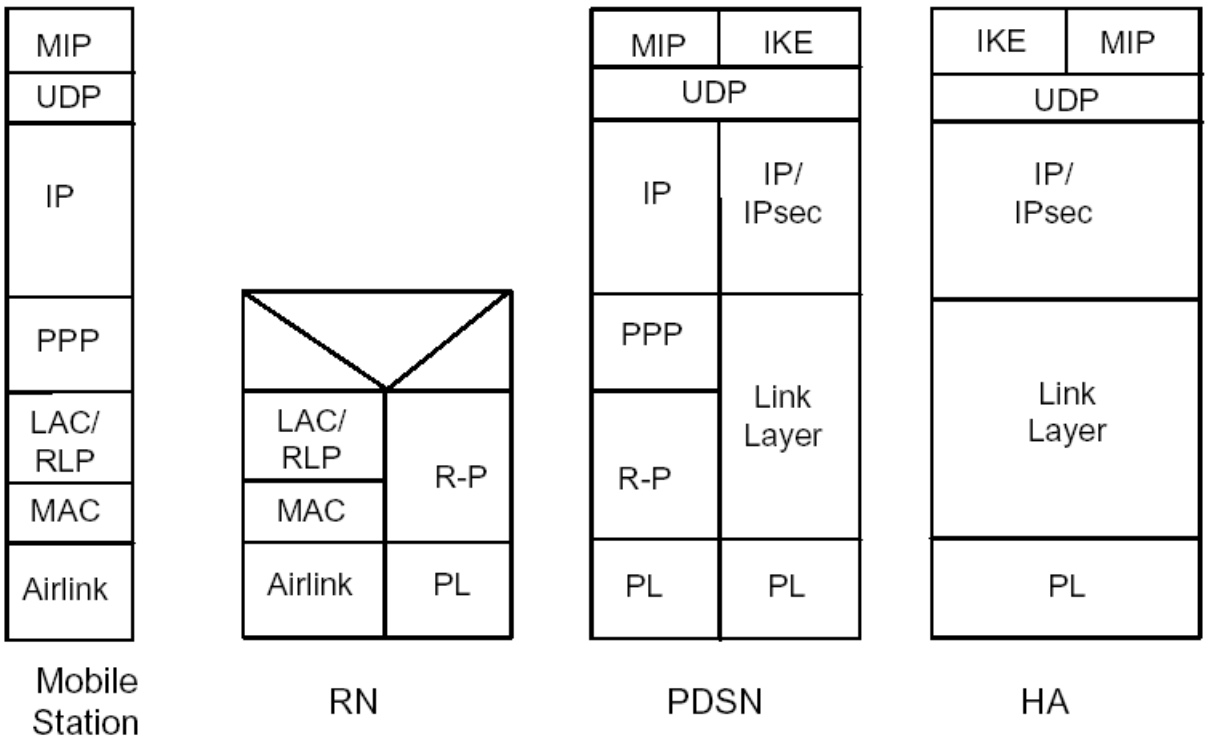
IPv6 and 3GPP2 (Cont.)

- 3GPP2 Architecture
  - Mobile IPv4



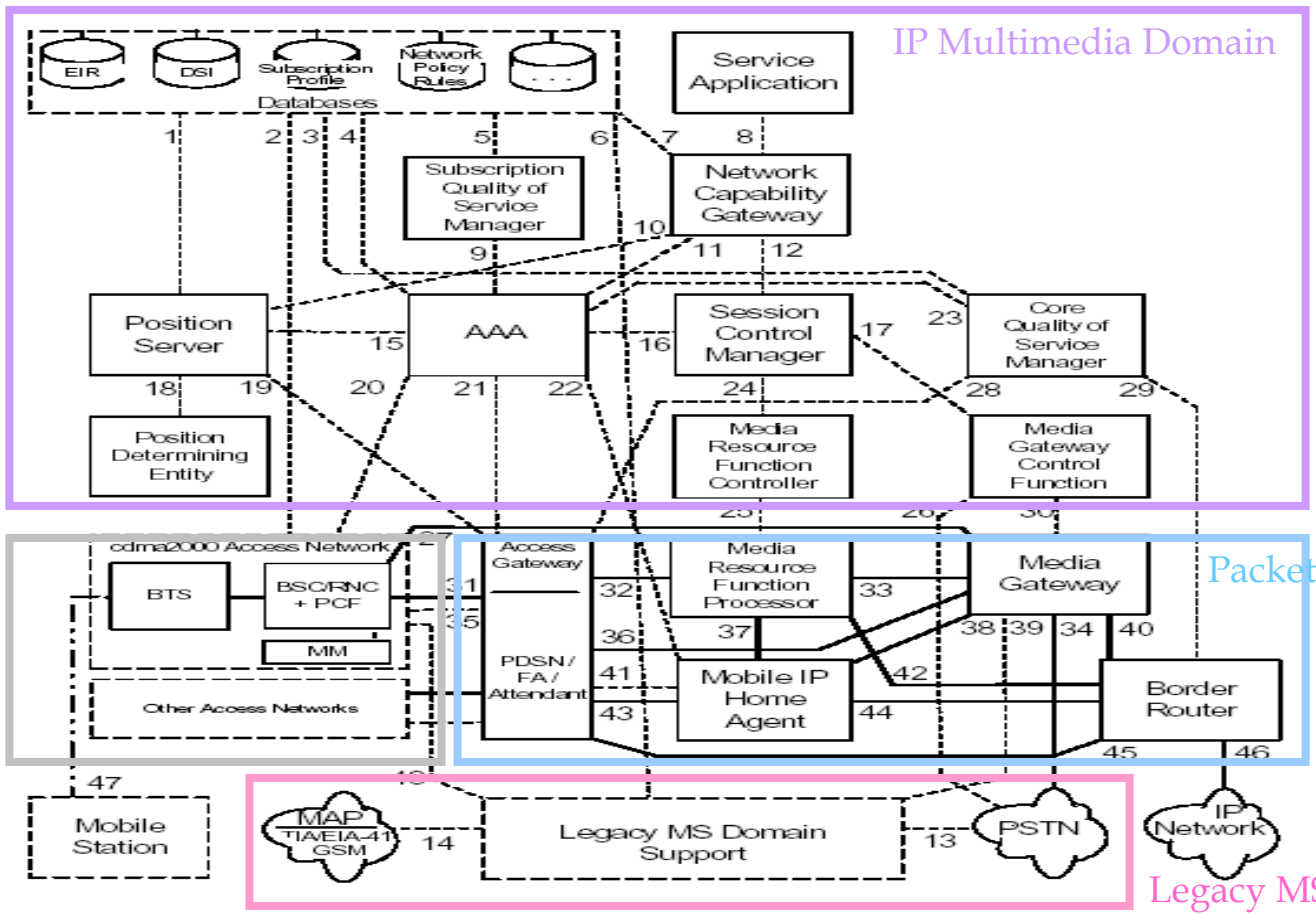
IPv6 and 3GPP2 (Cont.)

- Mobile IP protocol stack



IPv6 and 3GPP2 (Cont.)

- 3GPP2 Wireless All-IP Network Architecture Model



IPv6 and 3GPP2 (Cont.)

- Current 3GPP 2 architectural principal
  - "The All-IP architecture shall be designed in such a way that a migration from IPv4 to IPv6 is feasible and that IPv4 and IPv6 based All-IP networks may interoperate"

Conclusions

- IPv6, an infrastructure work
- 3G, still seeking for APs

- R99 and R4 still use IPv4
- In R5, IPv6 is a MUST
- In 3GPP2 All-IP, IPv6 is recommended

- Killer mobile data (Internet) service/applications will speed up the deployment of IPv6 over 3G
  - Messaging service
  - All-IP (VoIP) over 3G
    - Still need to wait

References

- 3GPP
  - **3GPP TS 29.061**
  - **3GPP TS 23.060**
  - 3GPP TS 24.228
  - 3GPP TS 24.229
  - 3GPP TS 22.941
  - 3GPP TS 23.221
  - 3GPP TS 27.060
- 3GPP2
  - 3GPP2 S.R0037-0
  - 3GPP2 P.S0001-B
- IETF
  - RFC 3316
  - RFC 3314