
2. Mobile IPv6

- IPv6
- Mobile IPv6

IPv6

- **Sufficient Address Space**

- ◆ 128 → IPv4 : 32

- **Fixed IP header + Extension**

- ◆ Processing overhead →

- ◆ checksum

- ◆ (flow label)



- ◆ Stateless Address Auto-configuration

- ◆ Neighbor Discovery



- IPSec

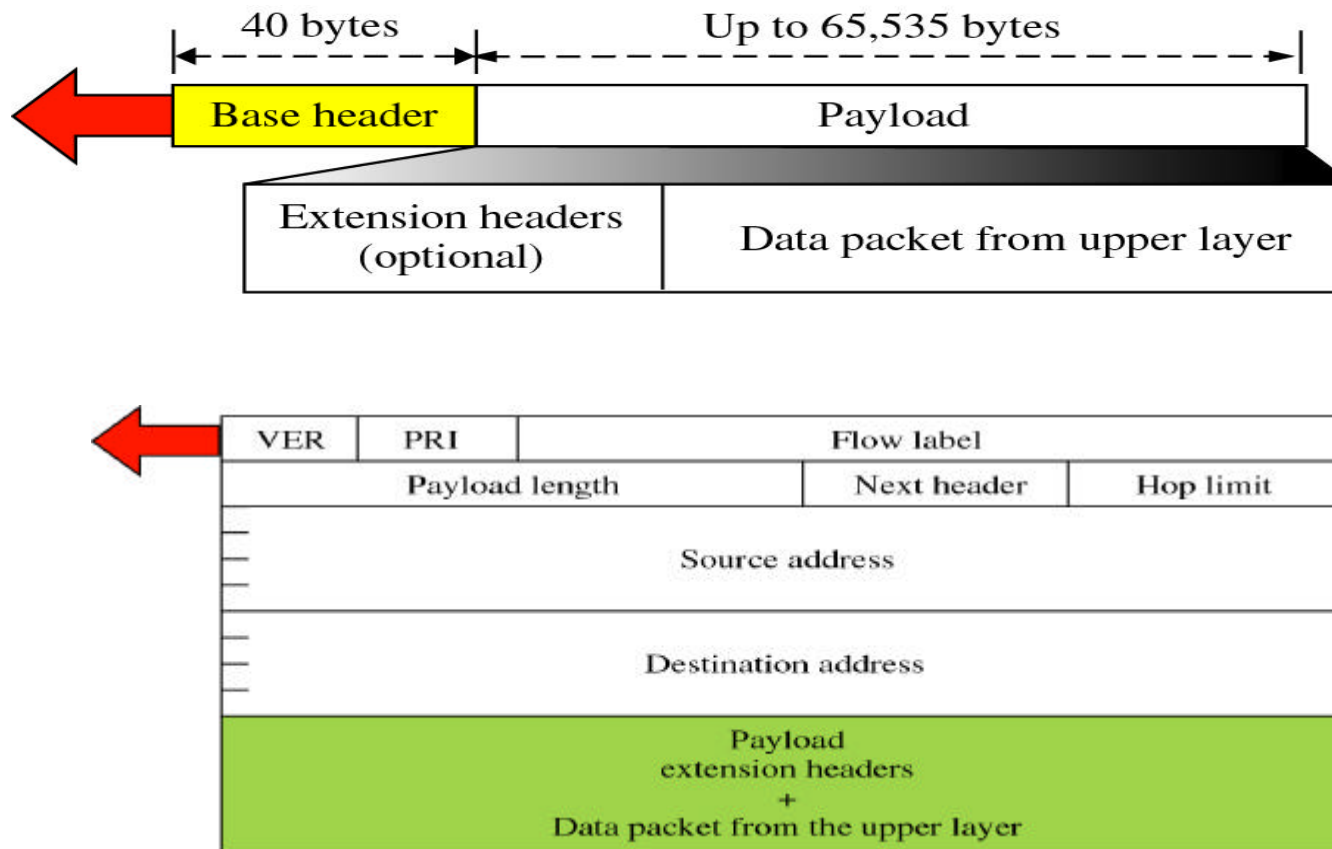
- **Address Renumbering**

- ◆ address renumbering

- IP
(Neighbor Discovery)

IPv6

● IPv6 Base Header



IPv6

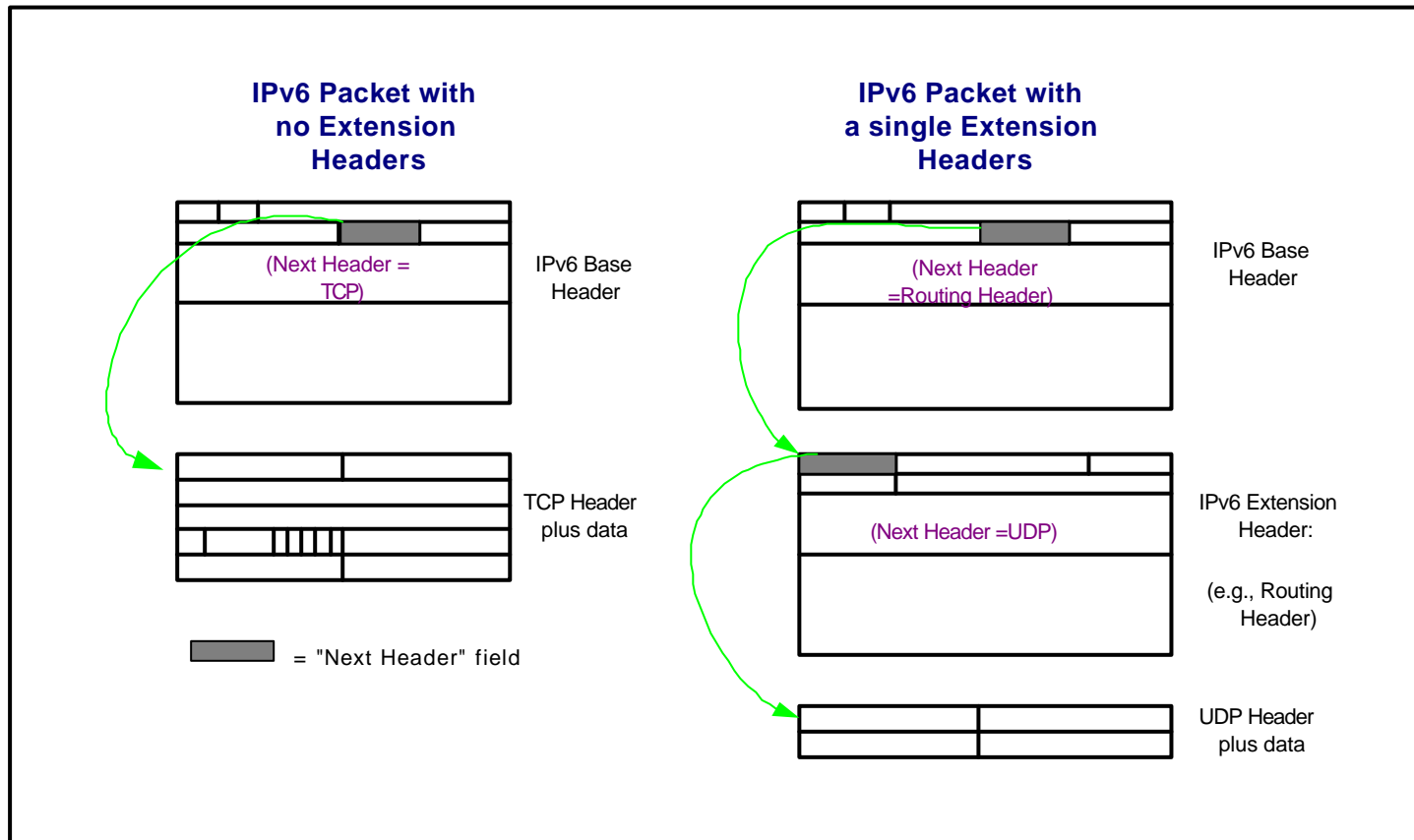
● IP v6

- ◆ Prio : relative priority to a given packet
- ◆ Flow label : real-time traffic
- ◆ Payload length : header IPv6
- ◆ Next header : extension header higher-layer
protocol type
- ◆ Hop limit : IPv4 TTL → packet forward

● IPv6 extension header

- ◆ Hop-by-Hop Option Header
- ◆ Destination Options Header
- ◆ Routing Header
- ◆ Fragment Header
- ◆ IP Authentication Header
- ◆ Upper-Layer Header

IPv6



IPv6

● Larger Address

- ◆ FA COA in M-IPv4 : provide a COA that can be shared by many MN' s



co-located COA가

- ◆ Simple auto-configuration of address 가

● New Routing Header

- ◆ IPv4 loose source & record route option
- ◆ Route optimization in a secure fashion 가

● Authentication Header

- ◆ mandatory

Mobile IPv6

- - ◆ Mobile IPv6 home network, home agent, COA mobile IPv4
 - ◆ address auto-configuration Neighbor Discovery
 - ◆ IPv6 address auto-configuration, Neighbor Discovery MN(mobile node) COA
 - ✚ MN foreign agent
- Binding update option MN CN
→ MN CN .
- IPv6 destination option

Mobile IPv6

- HA가 MN network에 있는 경우, Neighbor Discovery protocol을 사용하여 MN의 MAC address를 알아내어 home network에 있는 CN에게 proxy ARP를 수행하게 한다.
- CN가 MN가 HA에 IPv6-encapsulation을 보내는 경우, MN가 CN에게 COA를 보낸다.

Mobile IPv6

Mobile IPv4 Concept	Equivalent Mobile IPv6 Concept
Mobile node, home agent, home link, foreign link	(same)
Mobile node's home address	Globally routable home address and link-local home address
Foreign agent	A "plain" IPv6 router on the foreign link (foreign agent no longer exists)
Collocated care-of address	
Care-of address obtained via Agent Discovery, DHCP, or manually	Care-of address obtained via Stateless Address Autoconfiguration, DHCP, or manually
Agent Discovery	Router Discovery
Authenticated registration with home agent	Authenticated notification of home agent and other correspondents
Routing to mobile nodes via tunneling	Routing to mobile nodes via tunneling and source routing
Route optimization via separate protocol specification	Integrated support for route optimization

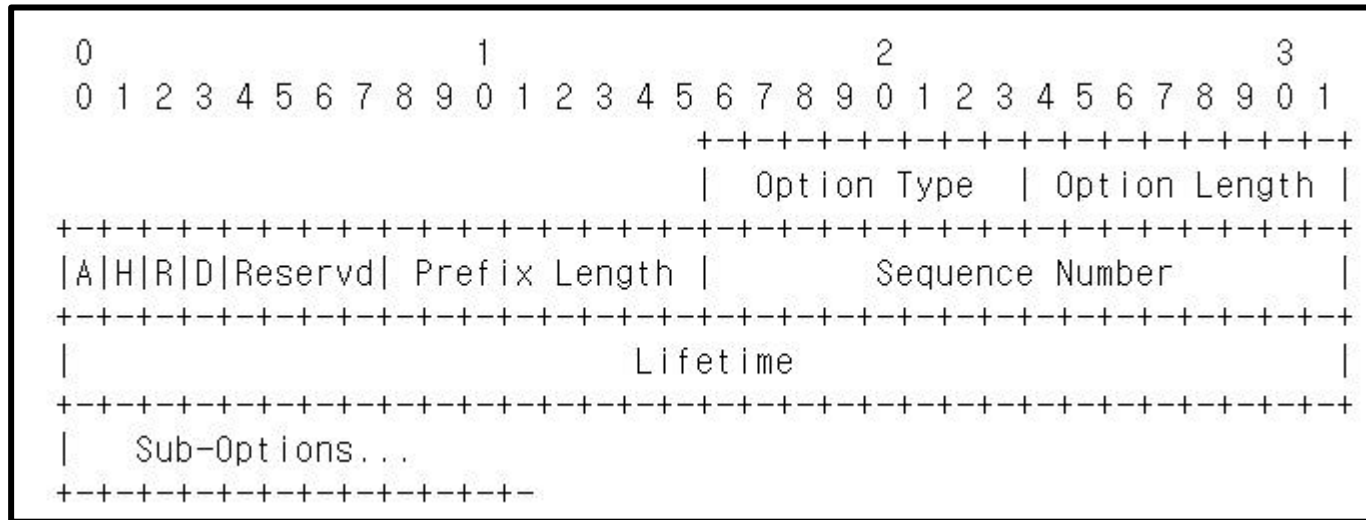
Mobile IPv6

IPv6 Neighbor Discovery Functions	Similar IPv4 Functionality	Description
Router Discovery	ICMP Router Discovery [RFC 1256]	How nodes locate routers on their link.
Prefix Discovery	DHCP [RFC 2131] or Manual Configuration	How nodes determine the network-prefix(es) assigned to the current link
Parameter Discovery	Manual Configuration	How nodes learn such things as the link MTU and a reasonable value to put in the Hop Limit (Time to Live) field
Address Autoconfiguration	DHCP [RFC 2131]	How nodes automatically obtain an IP address for use on an interface.
Address Resolution	ARP [RFC 826]	How nodes determine the link-layer address of a neighbor whose IP address is known.
Next-Hop Determination	Routing Table Searches	How nodes choose a Next Hop for any outgoing packets.
Neighbor Unreachability Detection	(No standard mechanism)	How nodes determine that a neighbor is no longer reachable.
Duplicate Address Detection	(No standard mechanism)	How nodes determine that their respective addresses are unique.
Redirect	ICMP Redirect [RFC 792]	How routers inform nodes of a better choice for a Next Hop to a destination.

Binding Update Option

- MN HA CN COA
- MN home network binding
 - ◆ HA “Binding Acknowledgement” option MN
- option
 - ◆ IP source address binding home address
 - ◆ IPv6
- Binding Update, Binding Acknowledgement, Binding Request option IPv6 MN
 - MN binding cache
 - destination option

Binding Update Option



- ◆ Option Type : 198
- ◆ Option Length : 8

length	option	octet	option type	option
--------	--------	-------	-------------	--------
- ◆ A:Acknowledge H:Home Registration R:Router
- ◆ D:Duplicate Address Detection
- ◆ Prefix Length : home registration binding update

Binding Update Option

● CN MN

◆ CN MN binding 가 cache

◆ Cache binding 가 IPv6 Routing header
cache COA MN

◆ IPv6 encapsulation

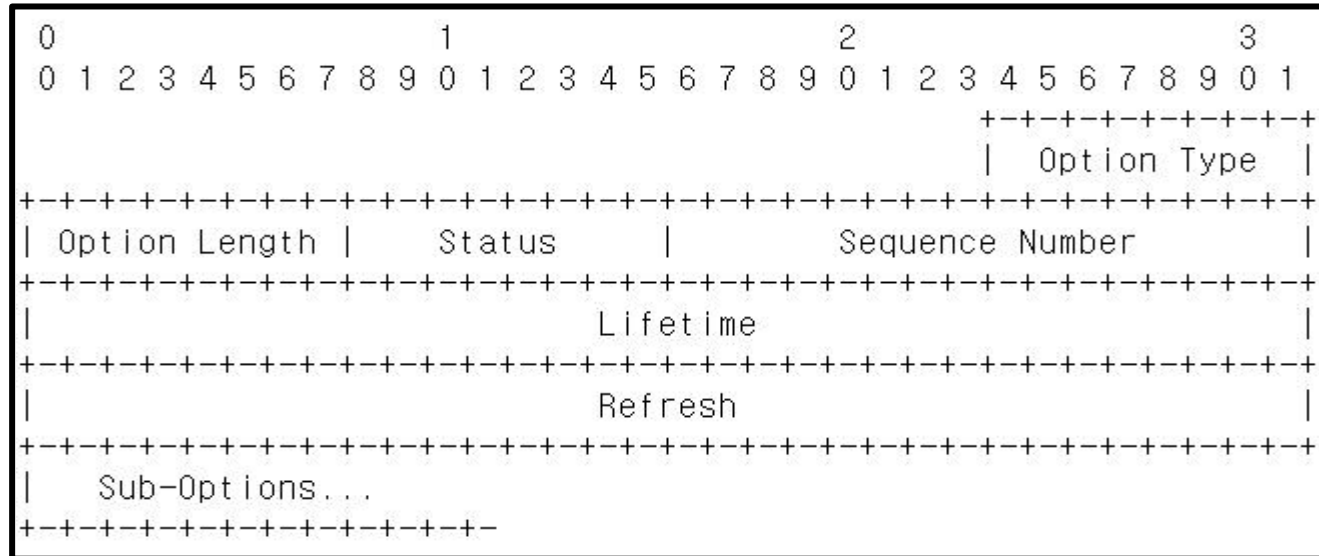
◆ Binding 가 .
HA 가 tunneling

◆ HA MN CN Binding Update
binding

Binding Acknowledge Option

- binding acknowledgement가
acknowledgement , HA MN binding update .
- option
 - ◆ IP binding update
 - ◆ IPv6

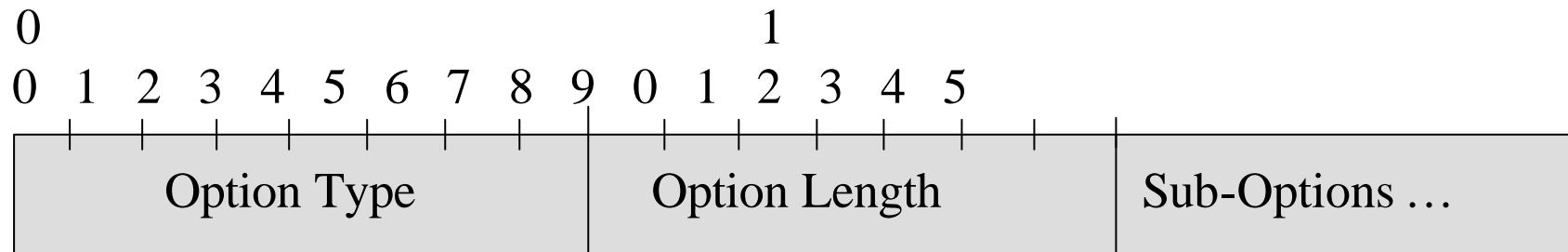
Binding Acknowledge Option



- Option Type : 7
 - Status : Binding Update
 - Refresh : Binding Update
 - Sub-Option : Binding Acknowledgement
- 가

Binding Request Option

- CN MN binding update
 - ◆ MN CN clock rates가 MN CN binding timer가
 - binding update 가
 - expire



Option type : 194

Binding Management

- MN primary COA HA Binding Update
- HA Binding Update Binding Acknowledgement
- MN HA CN Binding Update
 - ◆ CN binding MN routing
- Binding MN 가 CN lifetime expire . MN Binding Update

Movement Detection in IPv6

● Movement Detection

- ◆ MN Router Advertisement router
MN
- ◆ Advertisement MN router MN
prefix 가
- ◆ MN router solicitation
- ◆ MN home default router list
router default router router가
network prefix primary COA .
HA COA

Movement Detection in IPv6

- Neighbor unreachable detection(NUD)

- ◆ MN default router가 unreachable

- ◆ MN forward가 (, TCP 가 expire) - unreachable

- ◆ neighbor solicitation default router - neighbor advertisement unreachable

- ◆ MN default router IPv6 reachable

- ◆ Default router가 unreachable MN solicitation router

- ◆ MN router router reachability NUD

Home Agent Discovery

Ubiquitous Home Agents

- ◆ HA 가 , 가
MN COA
- ◆ router 가
router HA 가 ,
network HA broadcast anycast 가 home 가

Special Handling by Routers

- ◆ router가 HA
router HA 가
- ◆ router anycast binding update
network interface HA multicast

Home Agent Discovery

- Home Agents Anycast Address

- ◆ HA 가 anycast 가
- ◆ anycast HA IPv4

- ◆ HA address discovery

- ✚ MN prefix mobile IPv6 HA
anycast “Home Agent Address Discovery Request” ICMP
- ✚ HA HA HA
“Home Agent Address Discovery Reply”
ICMP MN
- ✚ HA HA ,
Router Advertisement multicast

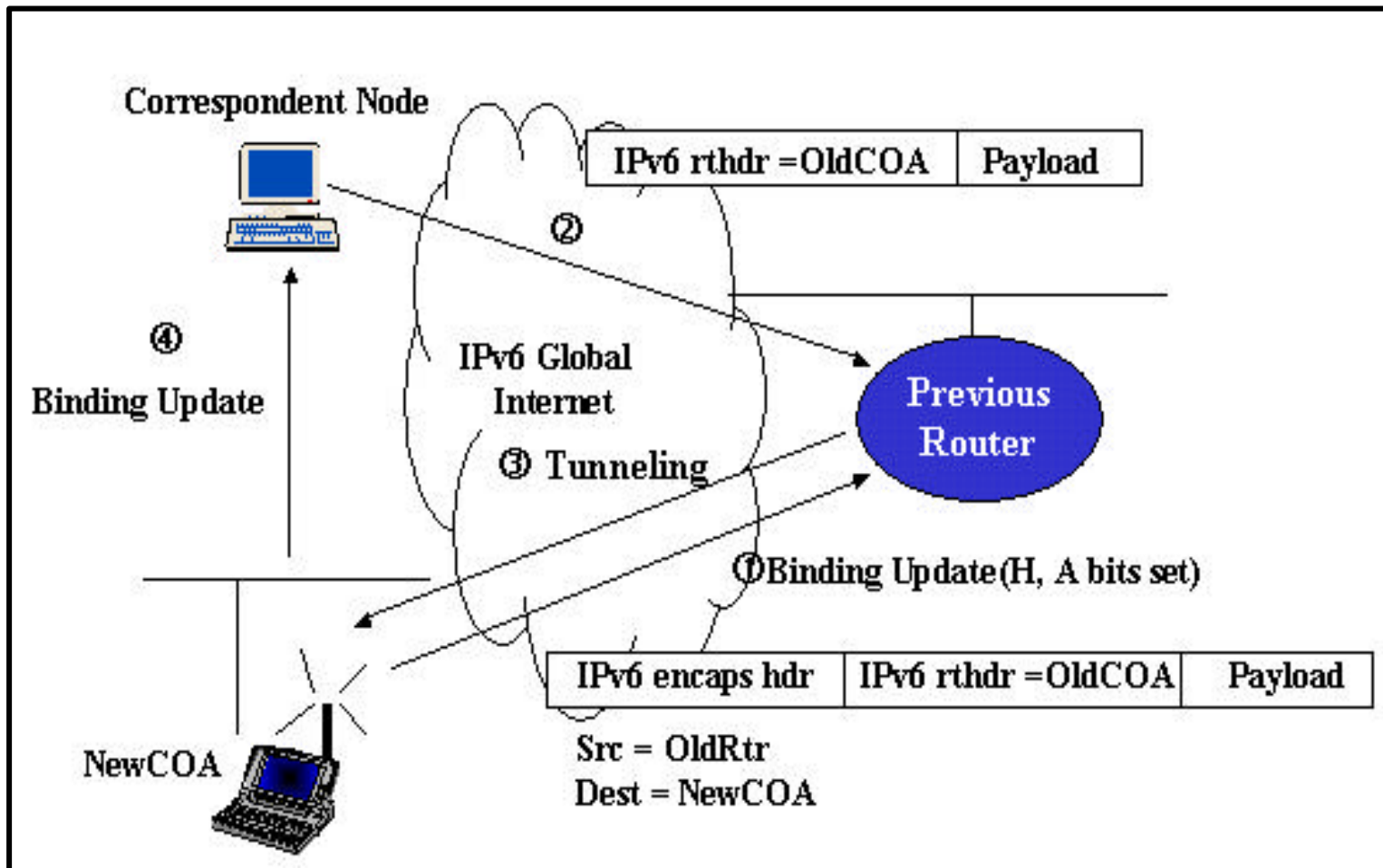
Smooth Handoffs

- MN primary COA COA
- Smooth Handoffs
 - ◆ MN Update HA router H router A set Binding COA
 - ◆ COA COA IPv6 encapsulation router가 가
 - ◆ router CN Binding Update cache MN binding

Smooth Handoffs

- MN router MN COA proxy
neighbor advertisement
- Smooth Handoffs MN
- COA COA 가

Smooth Handoffs



Renumbering the Home Subnet

● IPv6 Neighbor Discovery network prefix가

● HA MN HA가 Router

Advertisement multicast

MN COA renumbering

◆ MN prefix 가 Router Advertisement
home network prefix가

◆ MN home network HA Router
Advertisement

Renumbering the Home Subnet

- Home network prefix가 , HA RA
home MN
- RA IPv6
- MN home network prefix
RA , autoconfiguration
home

Requirements for Supporting Mobility

● Requirements for Correspondent Nodes(CN)

◆ Binding Update

✚ MN COA binding update가
 destination cache

● Requirements for Mobile Nodes(MN)

◆ Binding Update

✚ COA가
✚ CN HA binding update

✚ Packet decapsulation

● Requirements for Home Agents(HA)

◆ Encapsulation

◆ Proxy neighbor advertisements

3. Mobile IP in Wireless Packet network

- 3G packet data system
- GPRS
- Mobile IP in 3G packet data system & GPRS

Mobile IP in Wireless Packet network

- 3G packet data system

Packet Network Standardization for Mobile Internet



- ◆ 3GPP2
- ◆ 3G packet data system
 - ◆ IETF Mobile IP



- ◆ 3GPP
- ◆ GPRS(General Packet Radio System)
 - ◆ SGSN,GGSN
 - ◆ GTP

Wireless Mobile Internet

IETF's Mobile IP

- . Global Roaming & Mobility
- . LAN Based Scheme
- . Static Mobility
- . Non-Seamless Hand Off
- . Hard to Implement
- . Mobile Agents Support
- . Insufficient IP address
- . Additional Cost for Wireless Access Port if it was
- . IP Mobility

Wireless Mobile Internet

- . Regional Roaming & Mobility
- . Cellular Based Scheme
- . Dynamic Mobility
- . Seamless Hand Off
- . Easy to Implement
- . VLR/HLR Support
- . Insufficient IP Address
- . No Additional Cost for Wireless AP from its inherent features
- . Host(User&Server) Mobility & IP mobility

3G packet data system



- ◆ 3GPP2
- ◆ CDMA2000

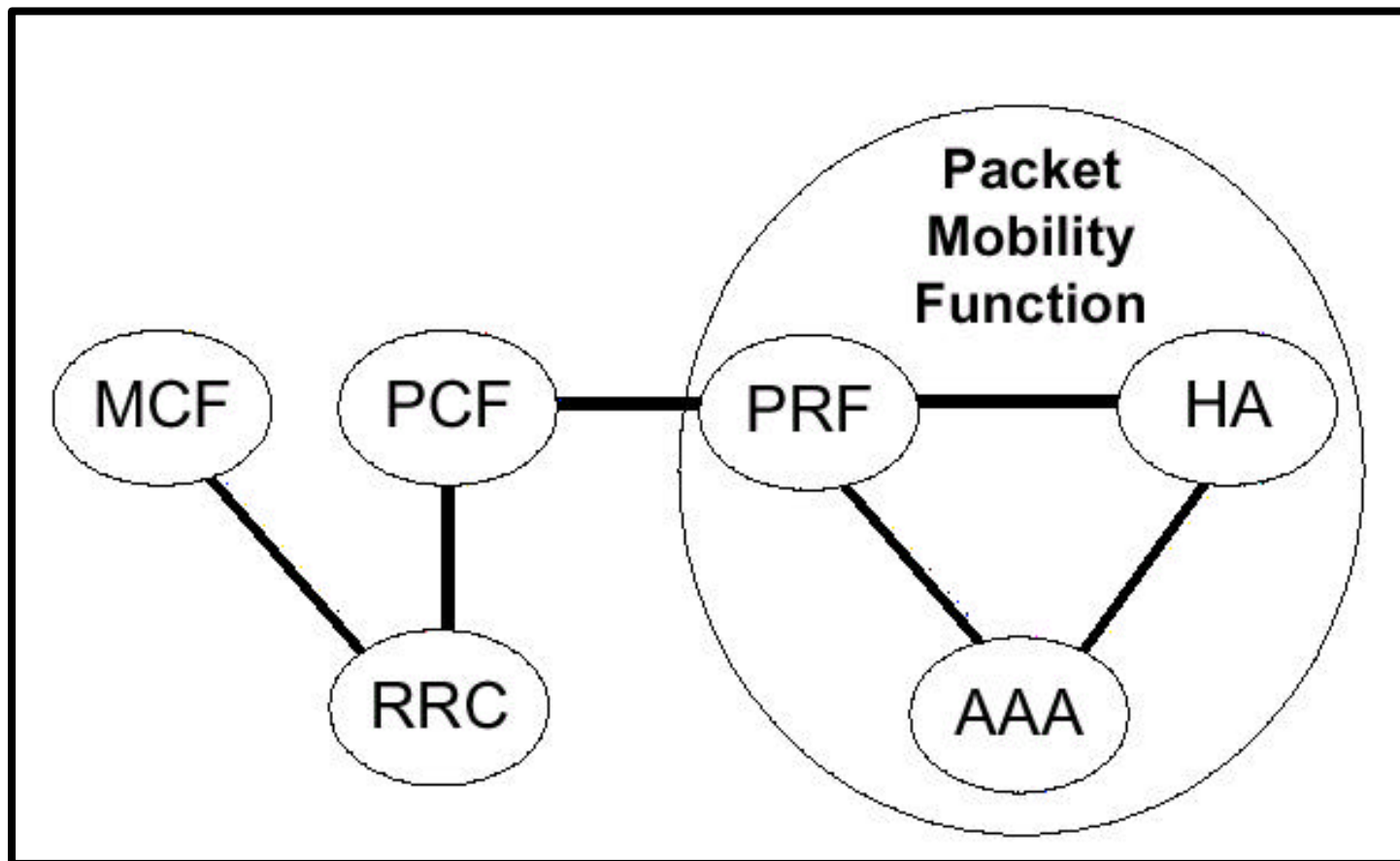


IETF

- ◆ Mobile IP , AAA , MIP



Functional Model



HA Function



FA

FA

AAAF



(Home AAA)

IP

Packet Routing Function(PRF)

- Link , ,
- Simple IP IP (PRF
AAA 가)
- Mobile IP FA , FA
- Session(=NAI + IP + R-P Link ID)
- HA
- 2 PCF
- AAAF Mobile Client parameter
- , AAAF
- packet routing
- handoff PPP serving ,target
PCF

AAA function



, ,
PRF, HA



HA



profile QoS PRF



Mobile IP/Simple IP

IP

Packet Control Function(PCF)

- **Hand off**
- **Mobile Client packet data service profile**
- **PRF RRC data**
- **PRF MCF**
- **Handoff PCF packet Session**
- **Packet Session IMSI R-P Link ID**

RRC & MCF

● Radio Resources Control Function(RRC)

- ◆ MS PCF ,

- ◆ MS가 packet zone ID system overhead packet zone ID

● Mobile Client Function(MCF)

- ◆

- ◆ MS Packet service (e.g., active, standby, dormant)

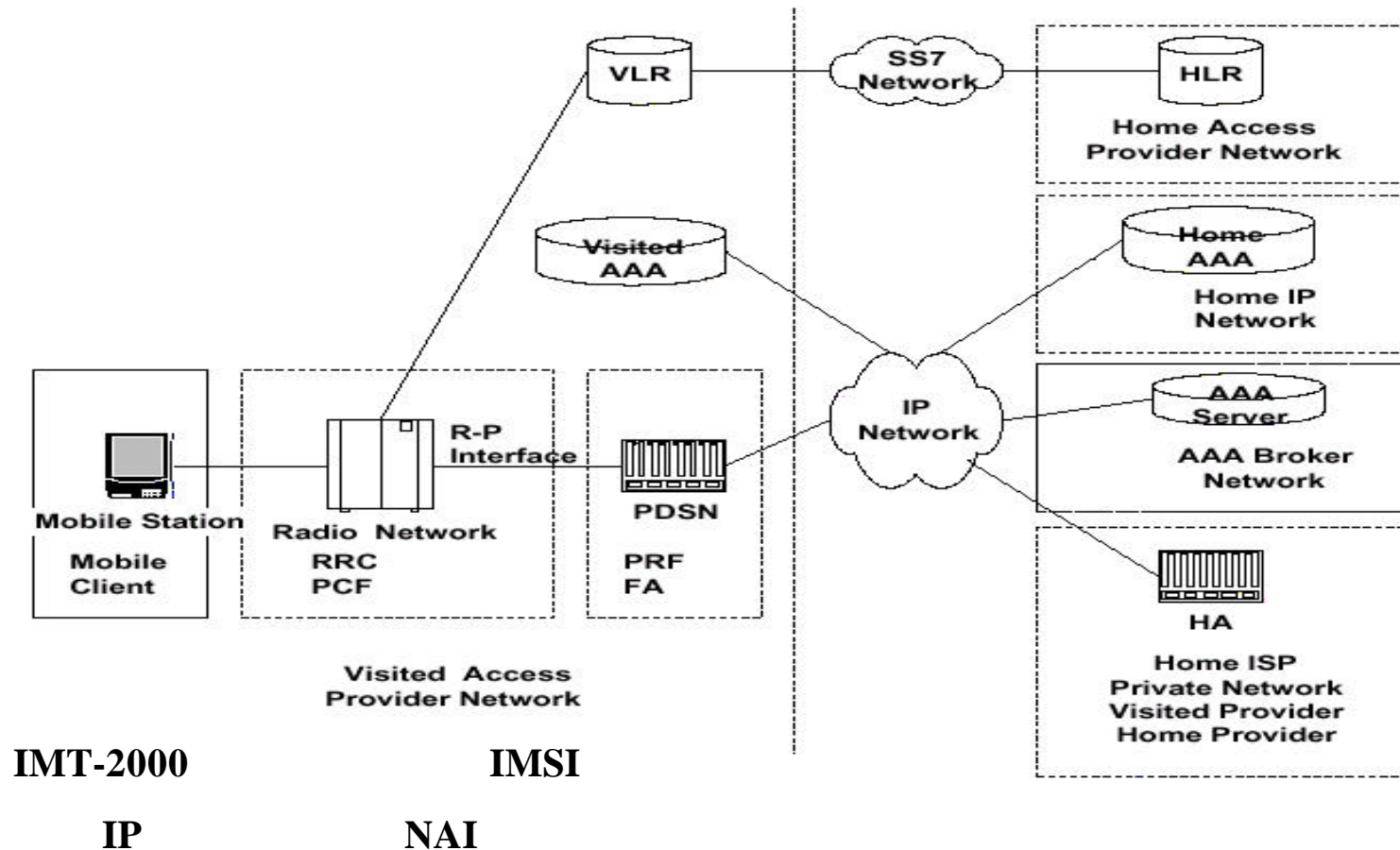
- ◆

Packet buffering

- ◆ Packet zone ID , Dormant PCF Origination

Functional to Architectural Mapping

Architecture Reference Model



Architecture Reference Model



IP packet

◆ RAN, VLR/HLR



,

,

,

◆ PDSN, Home Agent, DIAMETER Server



packet

, packet

,

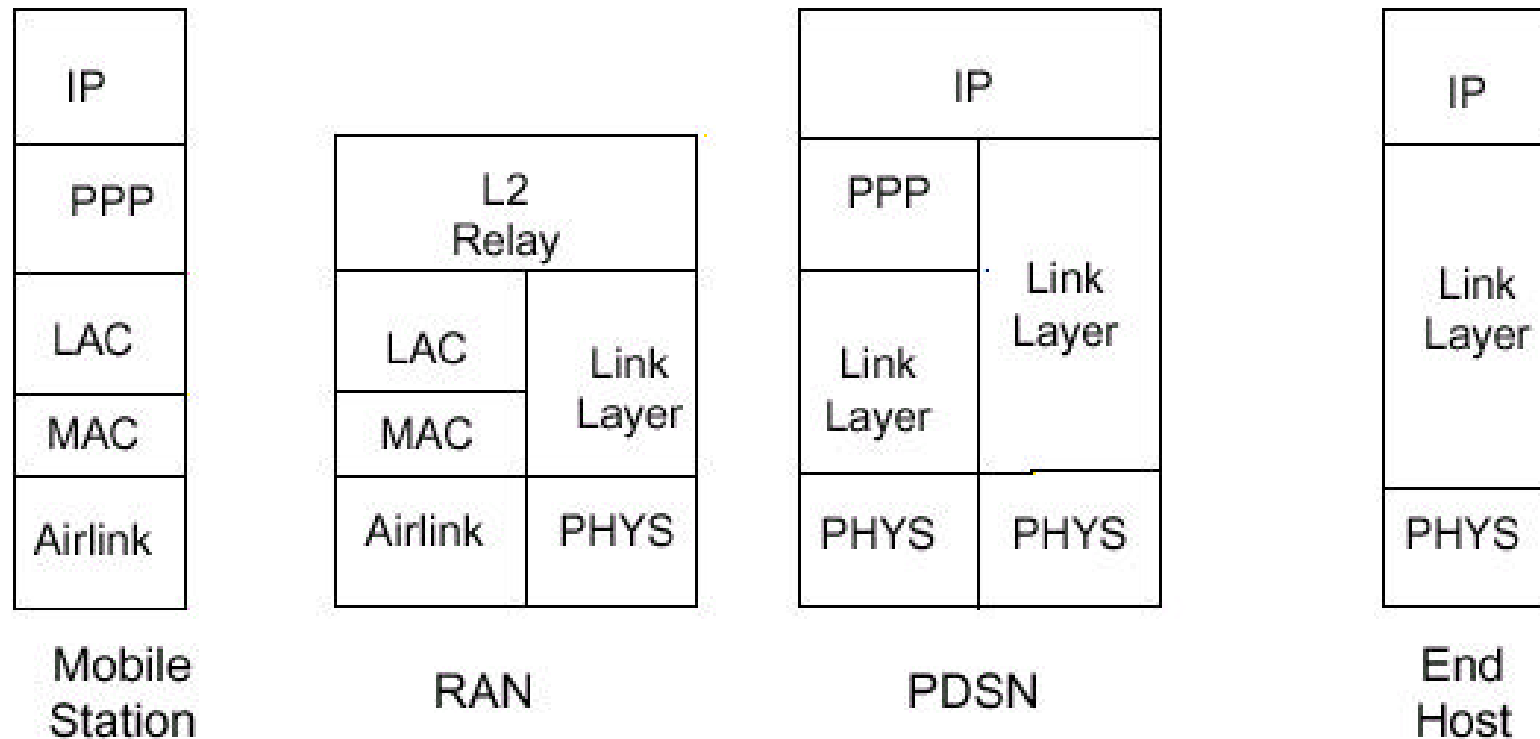


packet
TIA

IETF

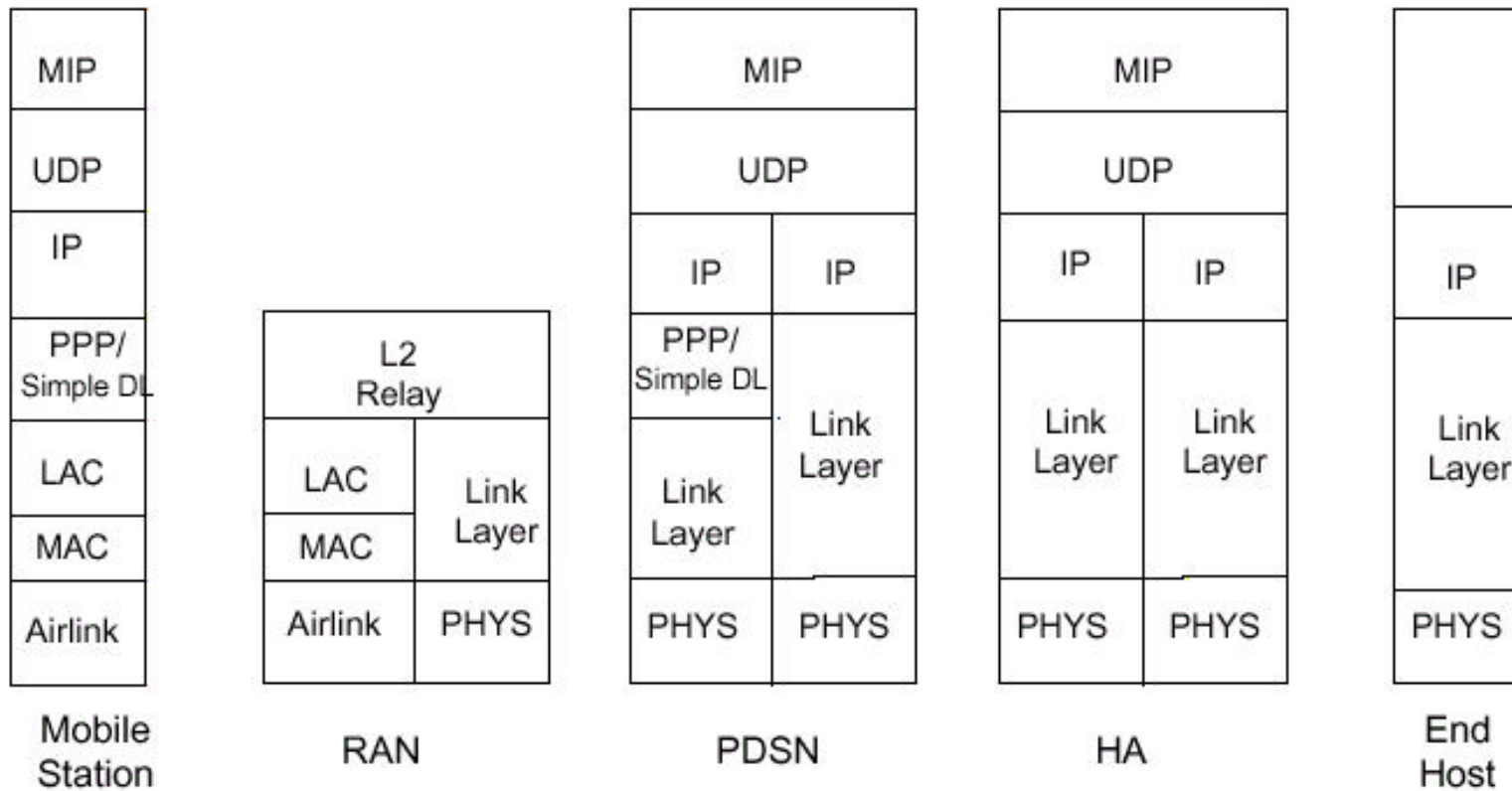
Protocol Architecture

● Protocol Reference Model for Simple IP

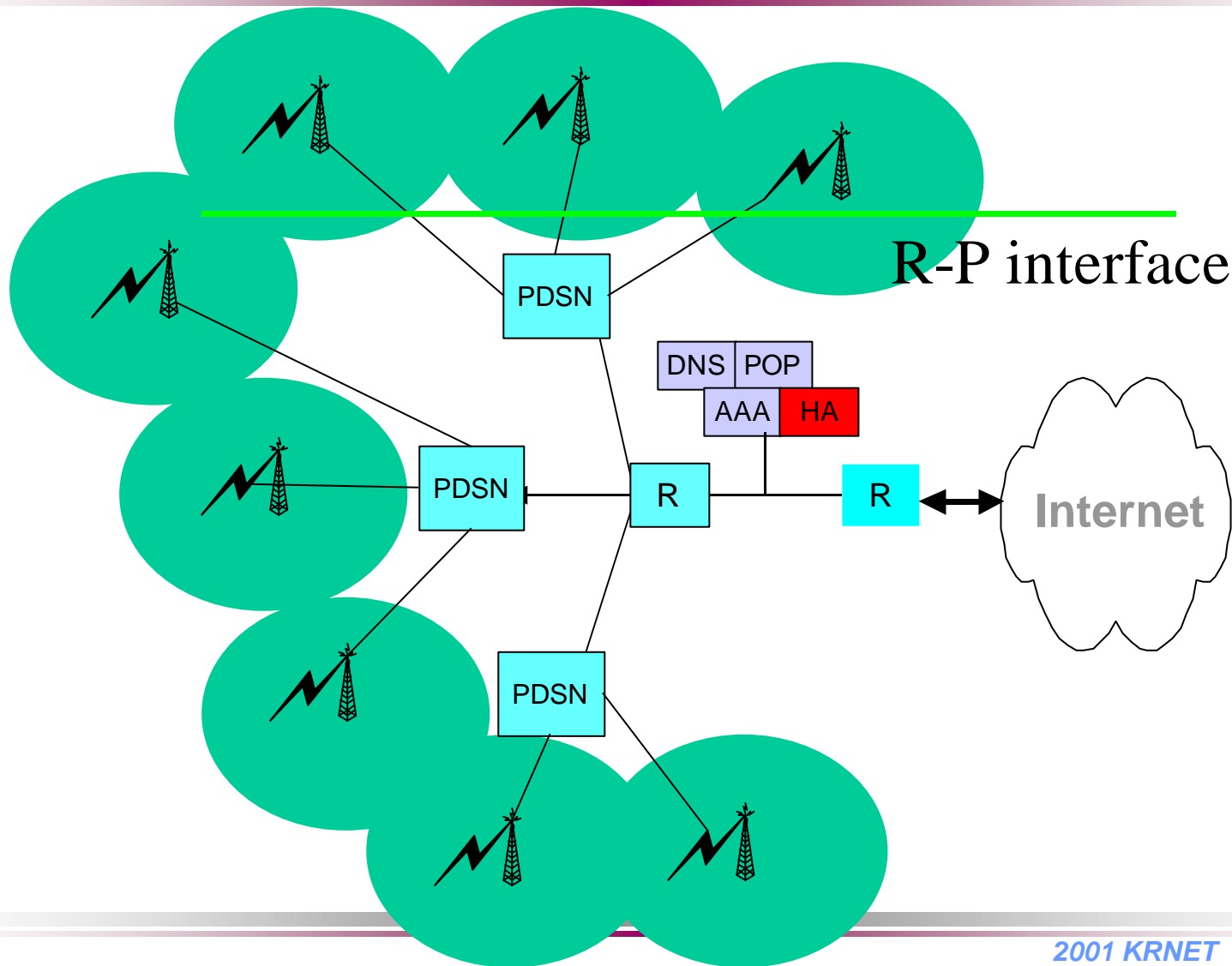


Protocol Architecture

● Protocol Reference Model for Mobile IP control



R-P interface



R-P interface

- Packet session Link ID , Link ID
RN 가
- Dormant R-P Link Layer
- R-P Link Protocol Data Rate 가
- Link Protocol

3G packet data system

Mobile IP

● 3

Mobile IP 3

●

◆

FA

+

, Packet zone ID , PDSN , (NAI)

●

MIP AAA가

Mobile IP in Wireless Packet network

- GPRS

GPRS overview

- GPRS



 - ◆ GSM

2.5

- GPRS

 - ◆ IPv4, X.25 , IPv6

 - ◆ Voice



 - MSC



 - GSN



resource

 - ◆ GSM time-slot

 - ◆ TCP/IP

GPRS characteristics

● Radio subsystem Network subsystem



TDMA + GPRS



W-CDMA + GPRS



- 0.5 ~ 1



QoS



IP GPRS



(SGSN,GGSN)

GPRS service class



◆ Class-A mode

+ GSM GPRS 가

◆ Class-B mode

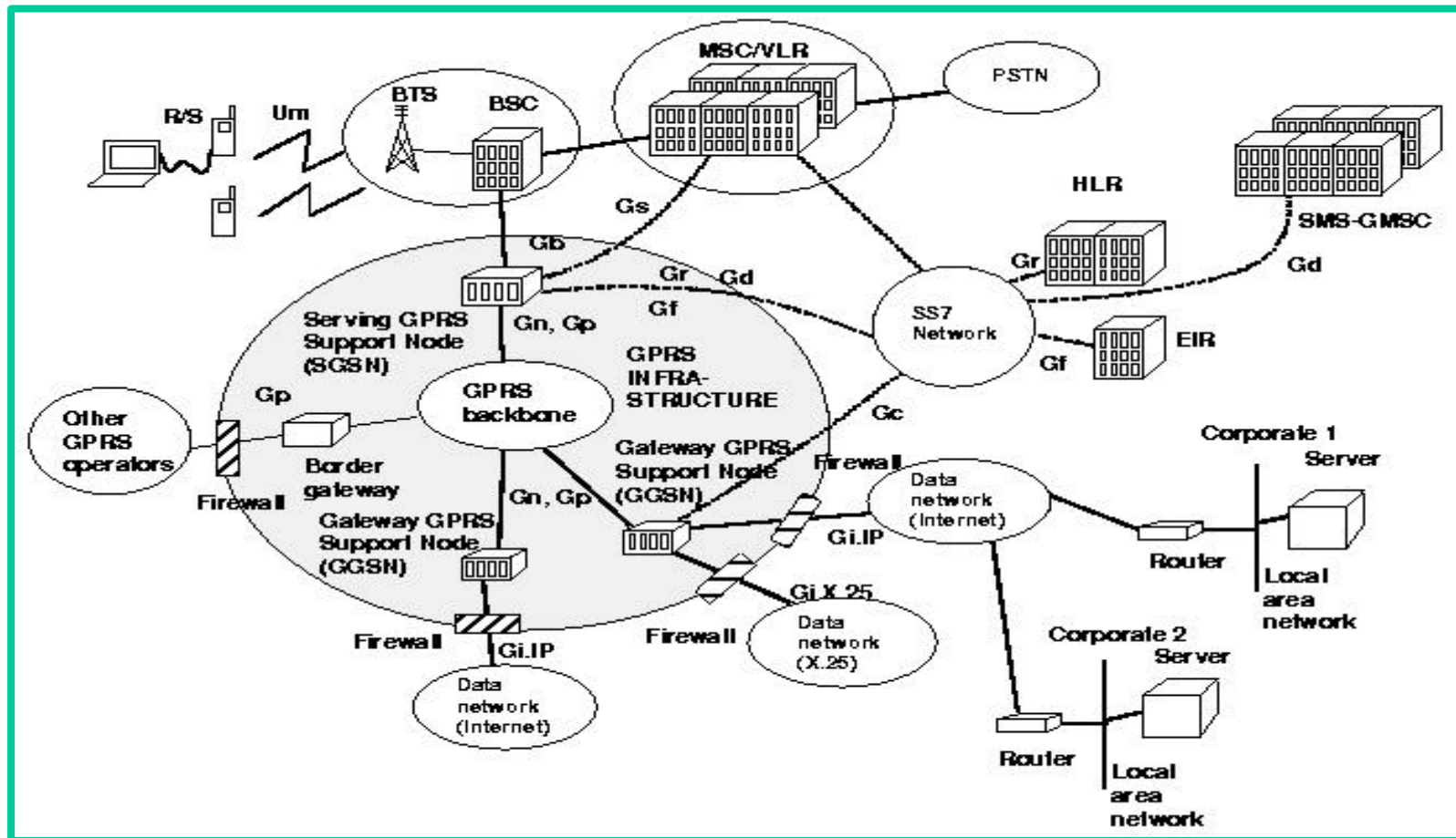
+ GSM GPRS ,
가

+ Service Holding - Resume

◆ Class-C mode

+ GPRS 가

GPRS Network Logical Architecture



GPRS Network component

● **SGSN**

- ◆ **Serving GPRS Support Node**

- ◆ 가

- ◆

- ◆ MS attach SGSN MM Context

-

- ,

- ◆

- ◆ MS SGSN PDP Context

-

GPRS Network component

- **GGSN**

- ◆ Gateway GPRS Support Node



- ◆ MS

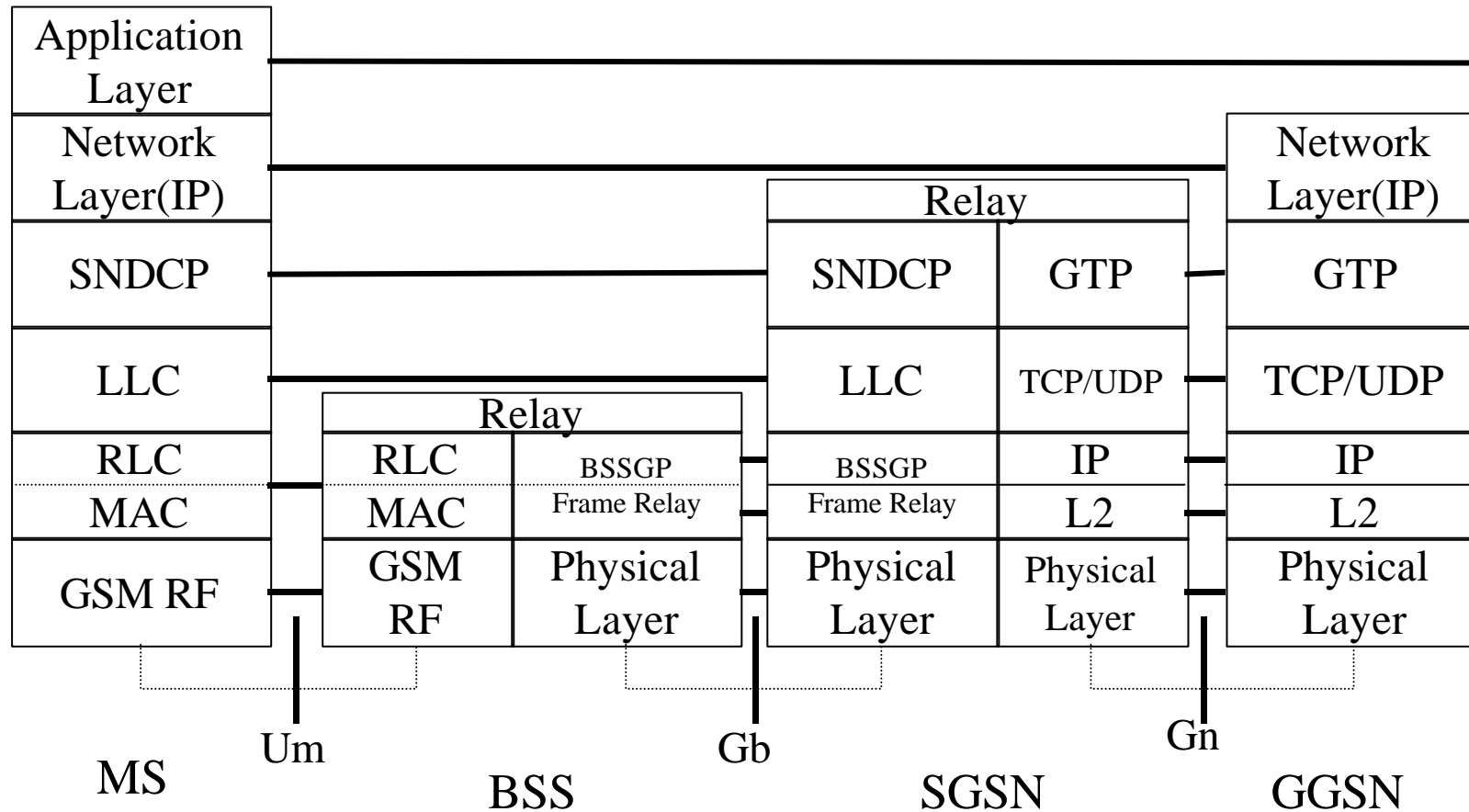
- ✚ PDP Context

- **BG(Border Gateway)**



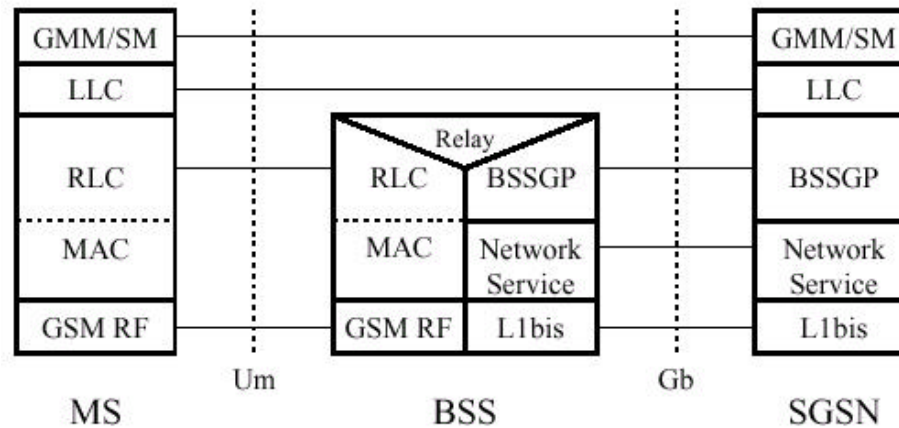
- PLMN

GPRS Transmission Plane

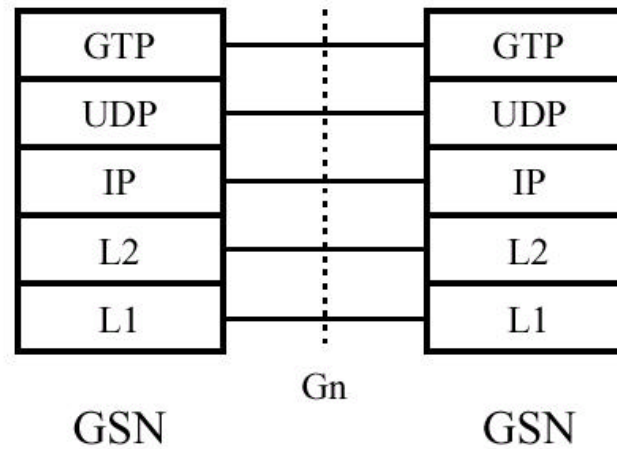


GPRS Signaling Plane

● MS - SGSN



● GSN-GSN



Mobility Management State



?



MM Context



MM Context

- ◆ IMSI, MM State, P-TMSI, IMEI, Routing Area, Cell Identity
- ◆ New SGSN Address, flag

Mobility Management State

● GPRS

◆ Ready



가 ,

가, cell

,

◆ Stand by



가 ,

가 , RA(Routing

Area)



RA

가 , RA

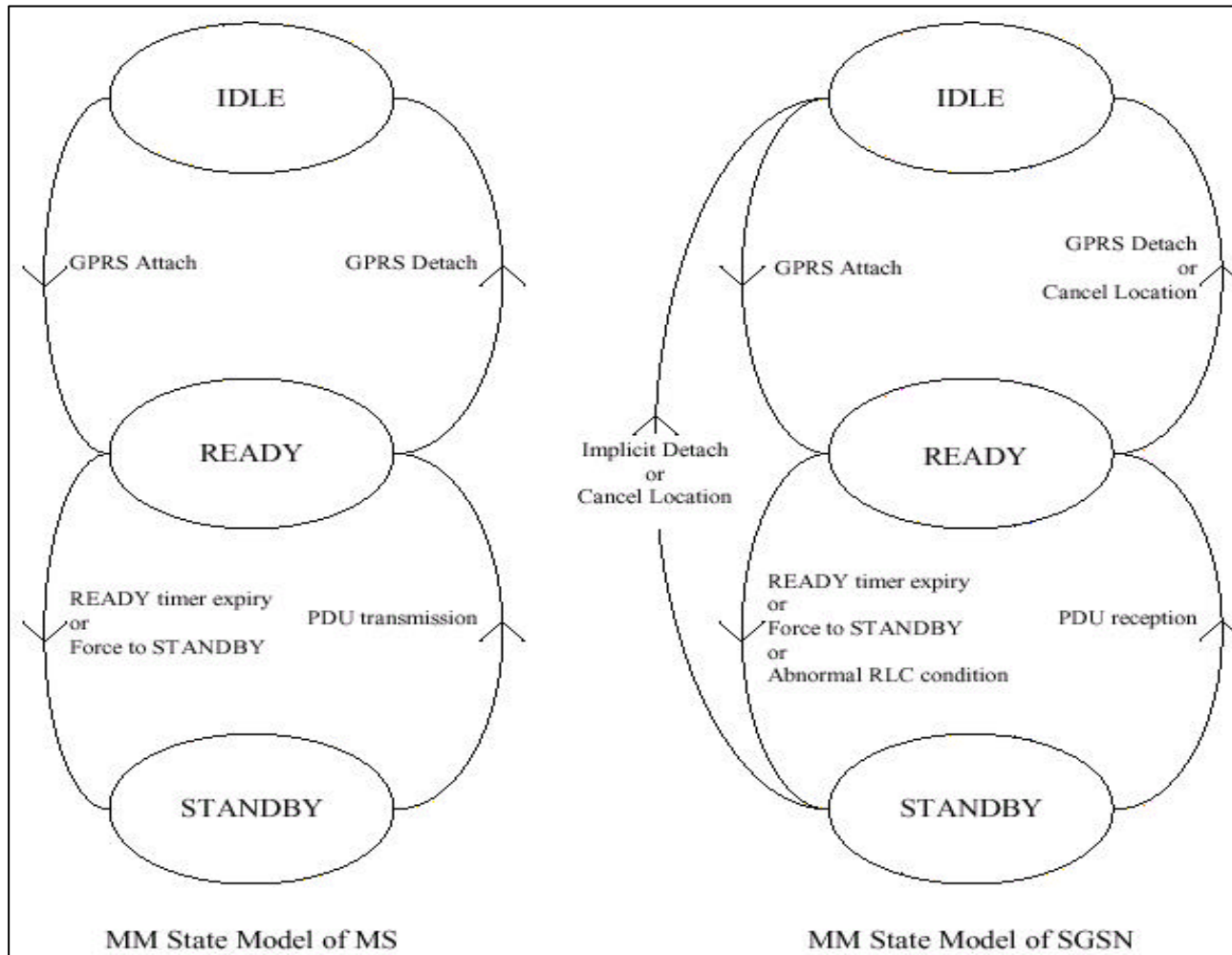
◆ Idle



,

가,

Mobility Management State Diagram



Mobility Management

● Attach

- ◆ MS

- ◆ MS ID attach type

- ◆ SGSN HLR 가

- ◆ SGSN MS MM

- ◆ IMSI attach 가 MSC/VLR

 - ⊕ combined GPRS/IMSI attach - save radio channel

- ◆ SGSN MS P-TMSI

- ◆ Attach MS READY 가 MM context

Mobility Management

● Detach

◆ MS

◆ MS MM & PDP context

◆ Detach



detach

- Switch off or detach request



detach

- STANDBY timer

Location Update

● Cell update

- ◆ MS READY RA Cell ID
- ◆ MS가 Standby IDLE
- ◆ MS origination data BSS BSSGP Cell ID
가
- ◆ SGSN MM context ()

Location Update

● Routing Area update



RA

+ MS가 Ready

cell id가

RA

+ MS가 Standby

RA



RA

,

P-TMSI



Intra SGSN RA

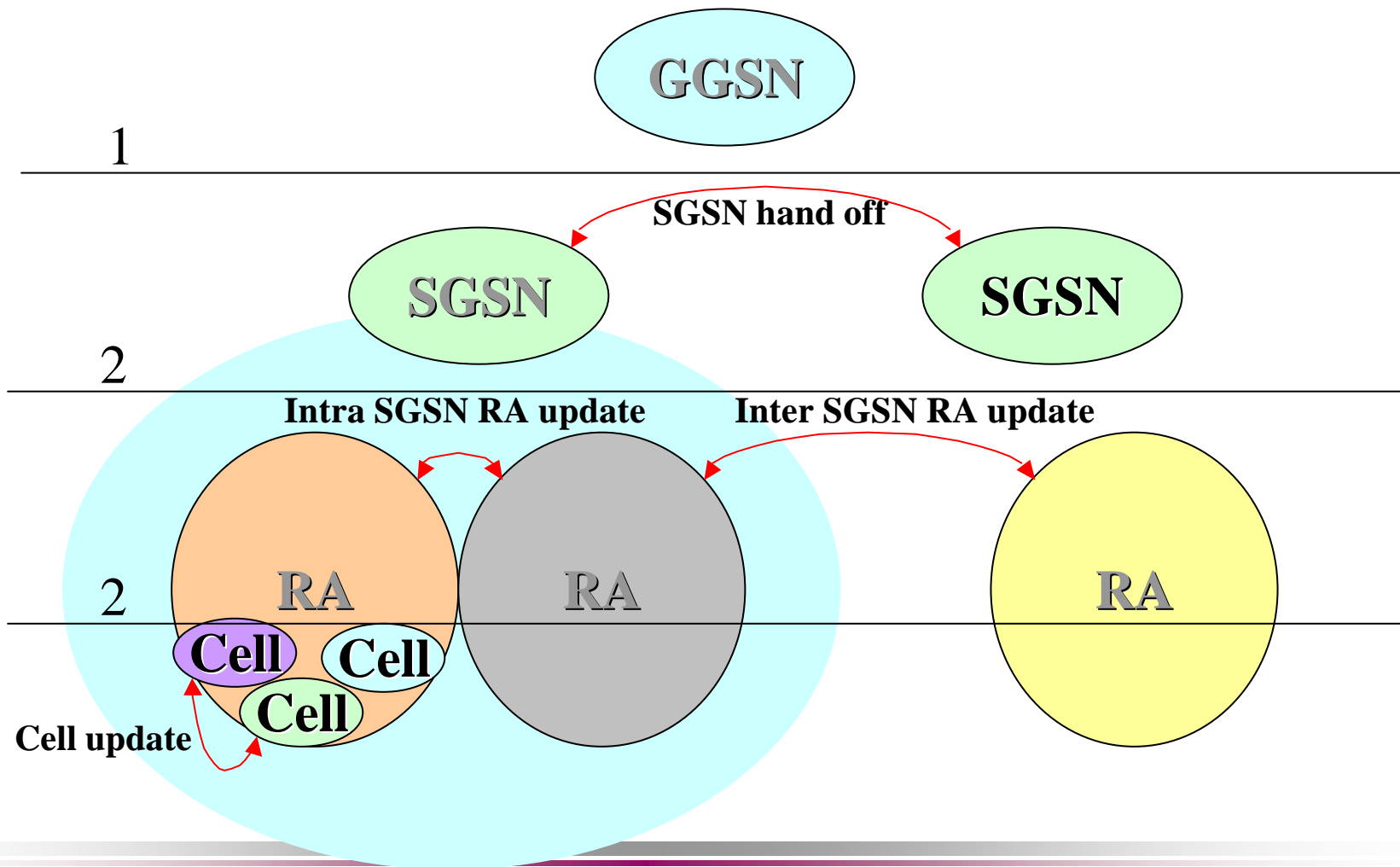
+ MS SGSN



Inter SGSN RA

+ MS, SGSN

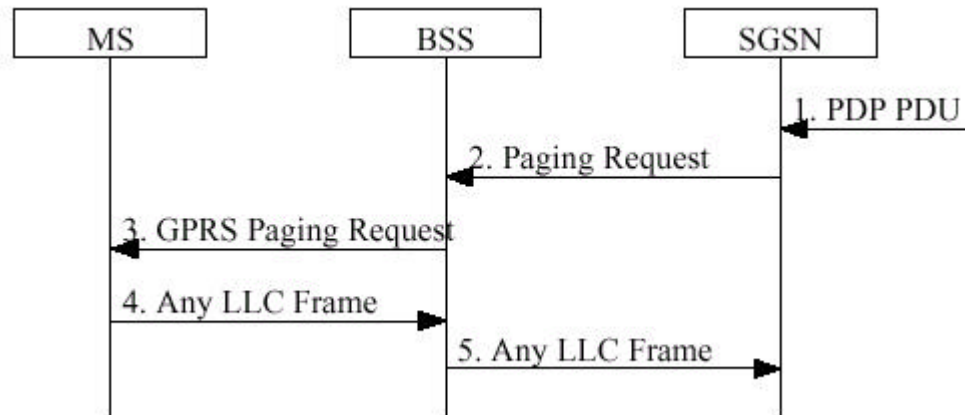
+ HLR , GGSN



Paging

● GPRS

- ◆ MS가 Standby paging가
- ◆ RA
- ◆ SGSN MS MM Standby paging



Session Management

- 가
- - ◆ PDP
- PDD Context
 - ◆ PDP Type
 - ✚ X.25, PPP, IPv4, IPv6
 - ◆ PDP Address
 - ◆
 - ◆
 - ◆ QoS
 - ◆

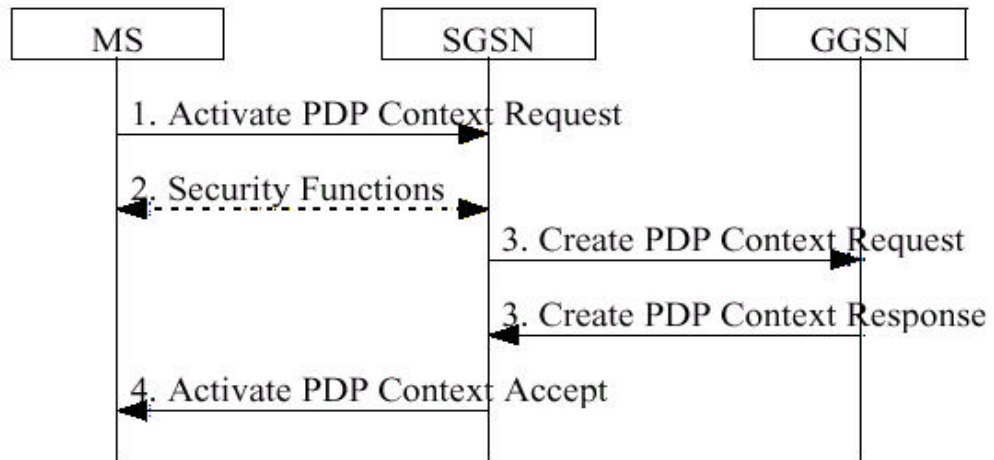
Session Management



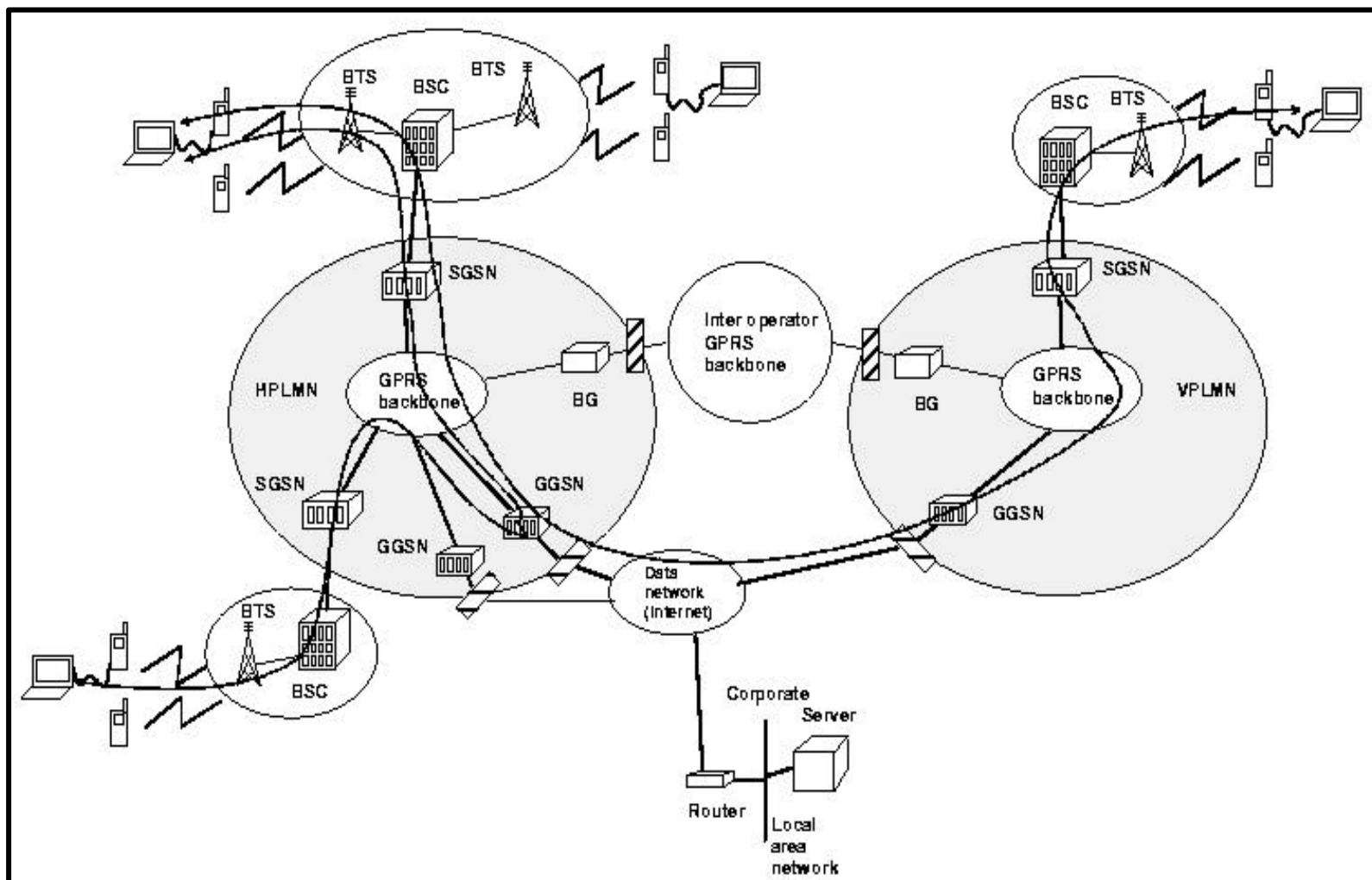
(static address) -

(dynamic address) - GGSN

PDP context activation procedure



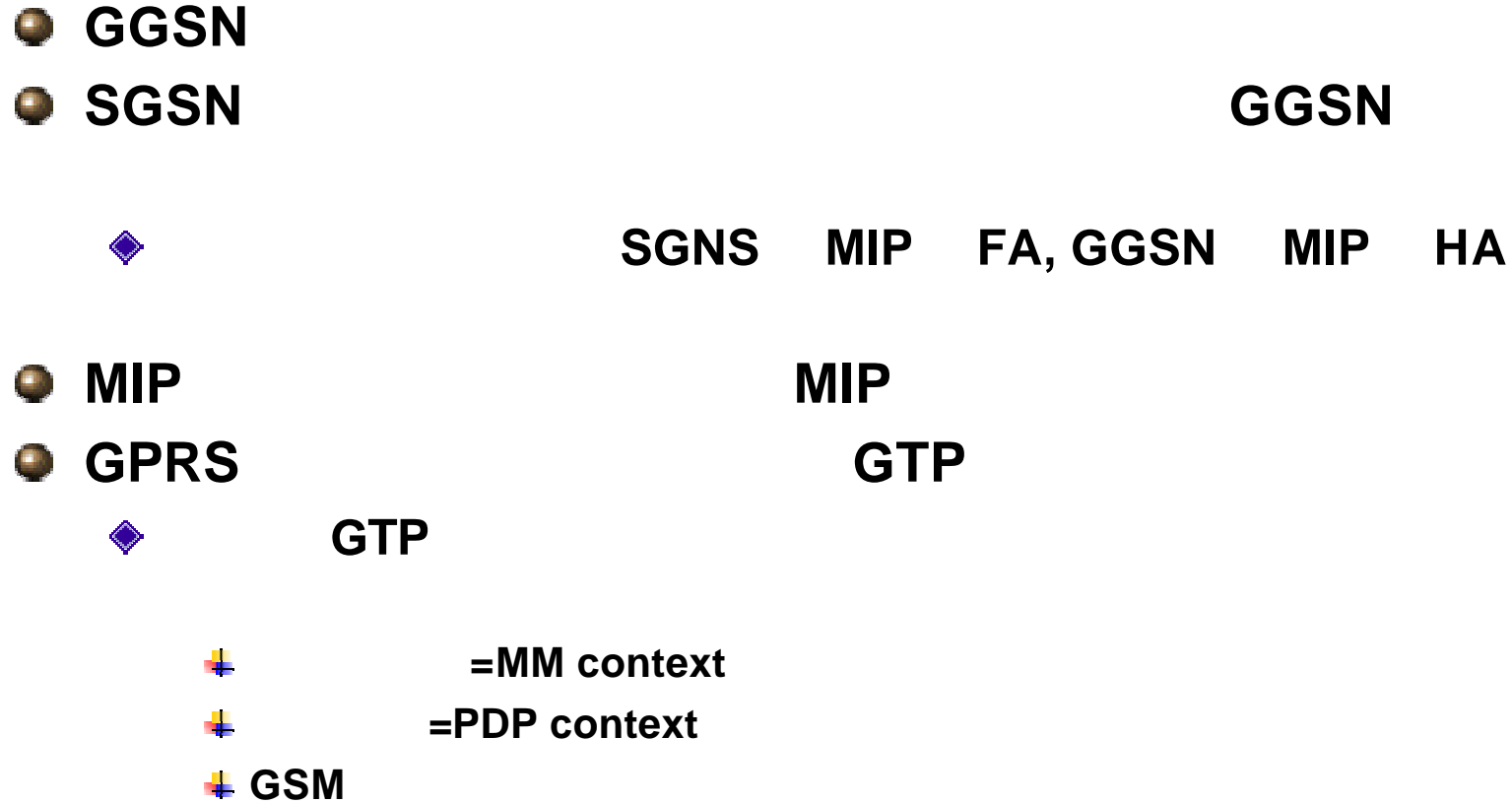
GPRS Data Transfer - MO & MT



Mobile IP in Wireless Packet network

● GPRS & Mobile IP

GPRS & Mobile IP



GPRS & Mobile IP

- **GPRS**



-

- ◆ **AAA**



- ◆ **Global interoperability 가**

Mobile IP(3G data packet) & GPRS

- GPRS



Message type = 1~52



Message type = 255

- 3G



MIP & GPRS GTP

	MIP	GTP
	FA, HA	SGSN, GGSN
	MIP	PDP
	MIP	PDP
	MIP (lifetime=0)	PDP
	Global Internet	Only in GPRS
	Only IP	IP, X.25



GPRS
GPRS **Mobile IP**

Mobile IP in GPRS

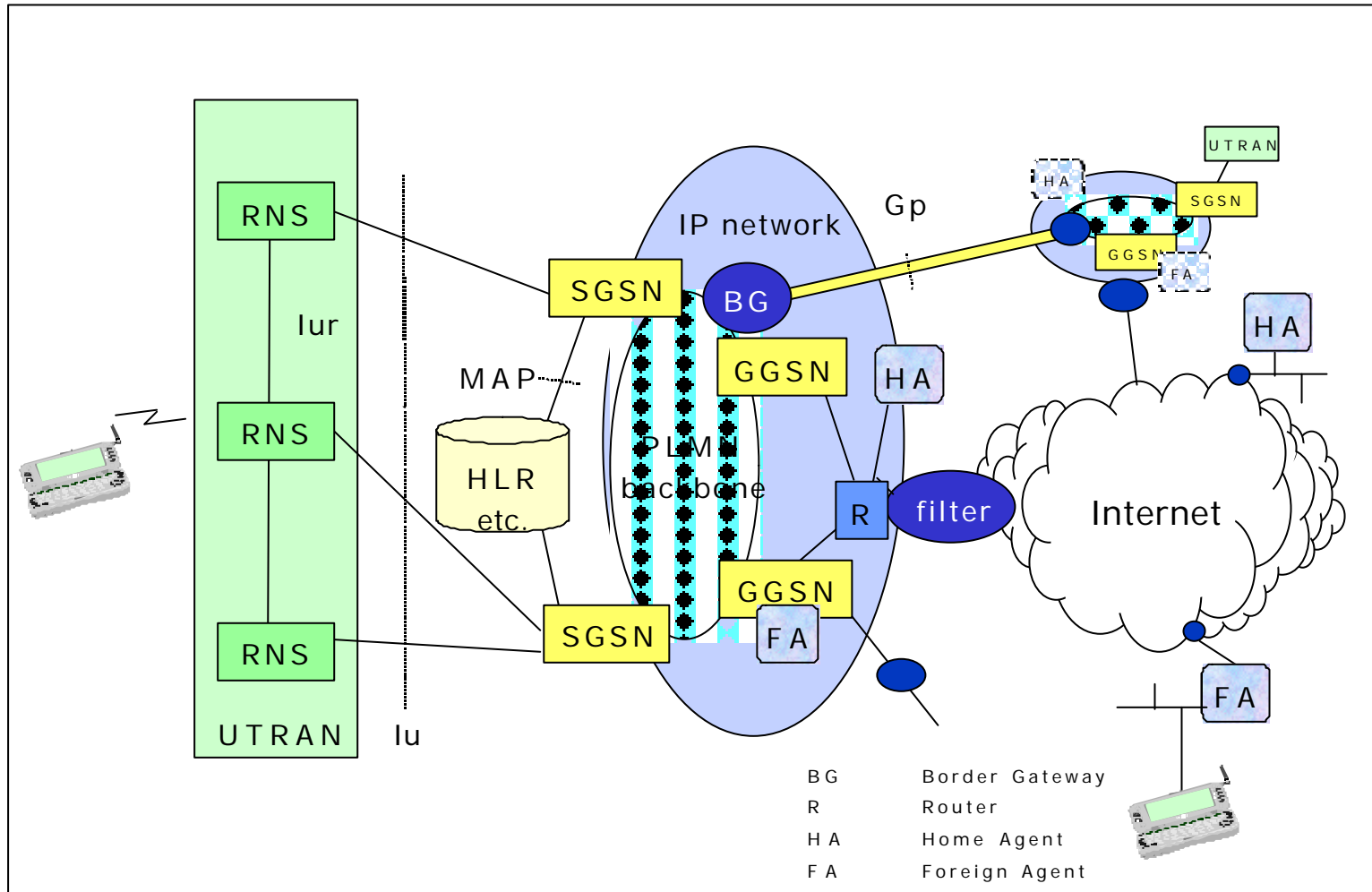
- - ◆ GPRS GTP
- GPRS GTP global
- ◆ GPRS Mobile IP
- ◆ Mobile IP
- Mobile IP UMTS GSM, CDMA2000,
LAN, PSTN

Mobile IP in UMTS - Staged Approach

● Step 1: MIP

- ◆ 가 M-IP
- ◆ GPRS FA, HA 가
- ◆ Does not change GSM MAP, HLR, VLR
- ◆ FA functions at GGSN → PLMN 1
- ◆ Mobile Node MIP GGSN PDP Context Setup
- ◆ PDP Context Setup FA COA →
- ◆ Visited Network FA MN Gp I/F Home
- ◆ Network GGSN/FA

Mobile IP in UMTS(Step 1)



Mobile IP in UMTS - Staged Approach

● Step 2: MIP-GPRS

- ◆ FA functions at each GGSN

- ◆ MN가 SGSN

가 MN 가 가 GGSN FA

GGSN/FA

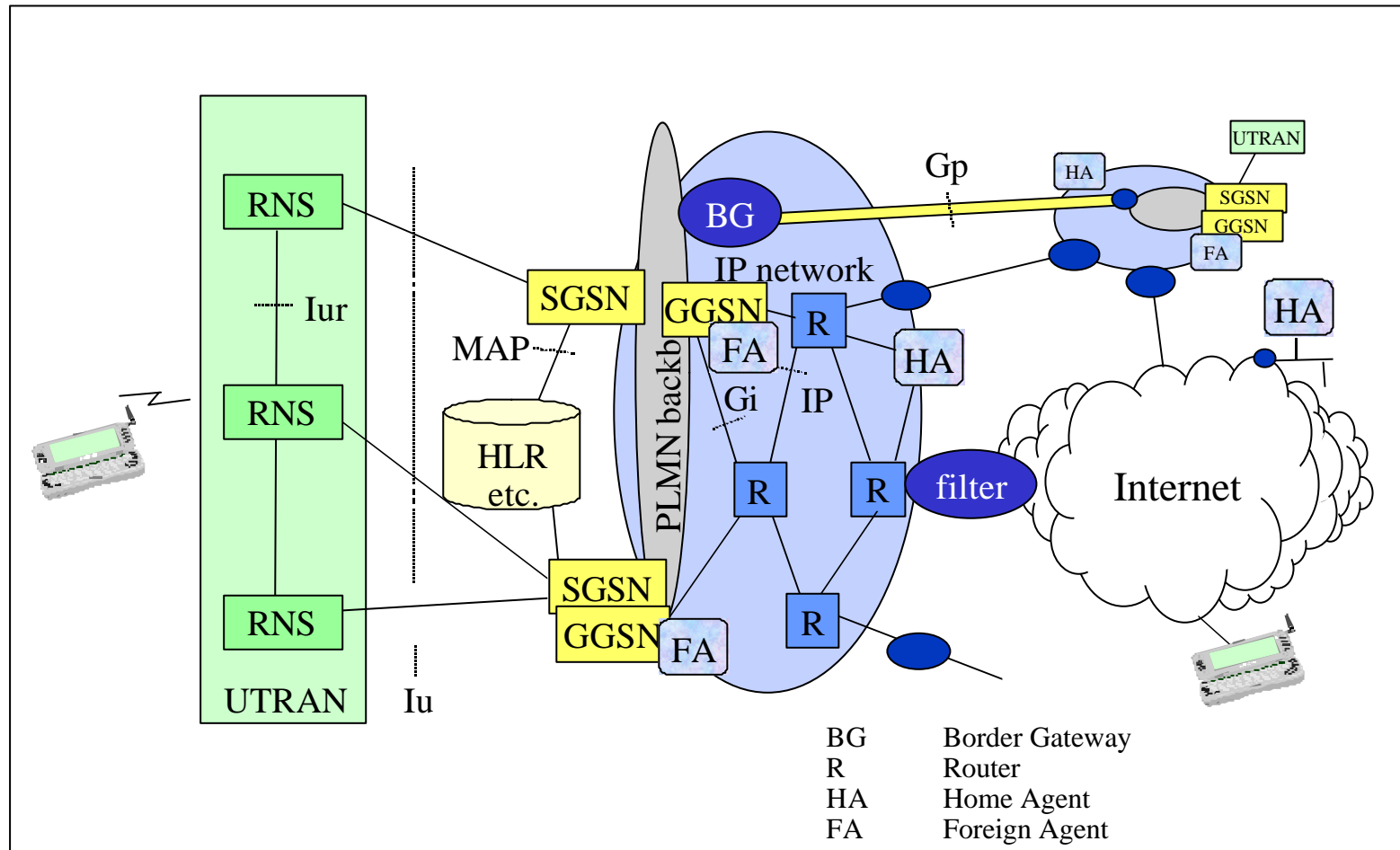
- ◆ /
GGSN/FA PDP Context Switching

old GGSN/FA

new

- ◆ Applicability : Maybe in Release 2000

Mobile IP in UMTS(Step2)



Mobile IP in UMTS - Staged Approach

● **Step 3: Using Mobile IP for Intra System Mobility**

◆ **SGSN + GGSN → IGSN(Inter GPRS Support Node)**

✚ MN PDP Context IP

✚ MIP FA

◆ **Mobile IP based Macro Mobility Management**

◆ **MS has to be changed to support Mobile IP**

◆ **IGSN/FA IETF , NAI , RADIUS, DIAMETER, AAA Server, IPsec**

Mobile IP in UMTS(Step 3)

