

# IPv6 Roaming Behavior Analysis

draft-chen-v6ops-ipv6-roaming-analysis-00

IETF 87- Berlin, August 2013

Gang Chen

China Mobile

Hui Deng

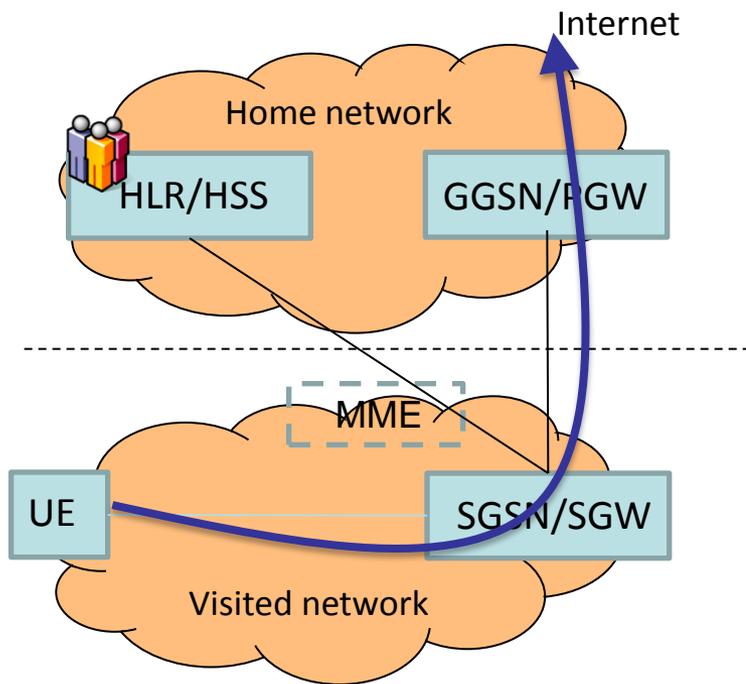
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# Motivations

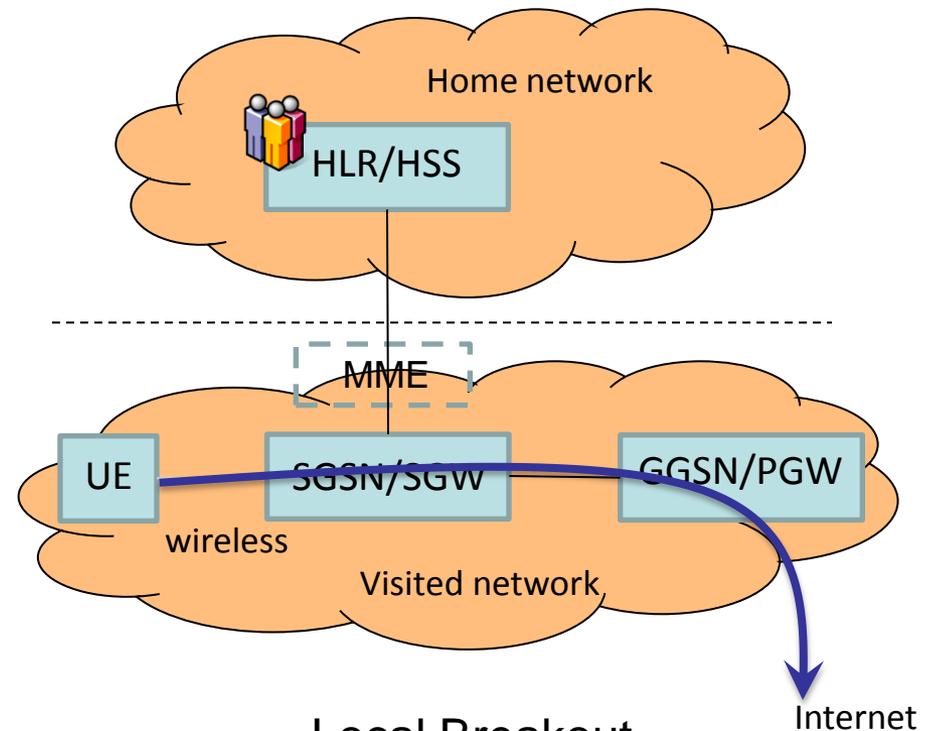
- We are experiencing some issues if IPv6 subscribers roam to different areas in mobile networks
- Several failure cases happen due to the lack of proper deployment considerations
- The draft intends to list "things that went wrong and lessons learnt"

# Roaming Architecture

- **Roaming:** a subscriber moves to other PLMN where different PLMN ID (equals MNC+MCC) is used
- **Intra-PLMN Mobility:** a subscriber moves to different network areas within same PLMN, where subscriber registration profiles are not stored

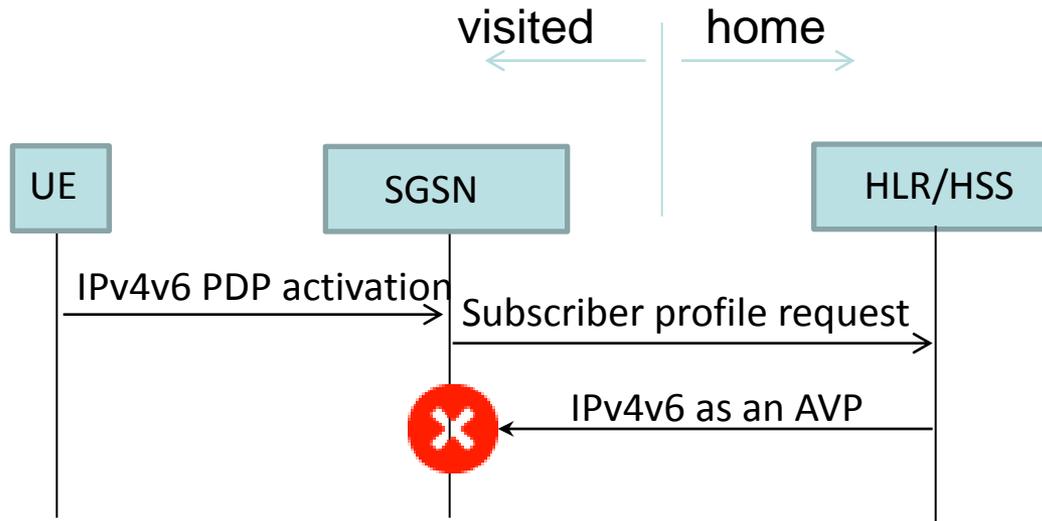


Home routed traffic



Local Breakout

# Failure case 1: DS UE->IPv4 networks with pre-R9 SGSN



- The visited pre-R9 SGSN don't understand the IPv4v6 PDP attribute for dual-stack, thus it refuse the subscriber registration
- Resolving the issue may request the deletion of a IPv4v6 PDP attribute in home HLR/HSS; That may restrict UEs only initiates IPv4 PDP or IPv6 PDP activation
- IPv4v6 PDP is superior than IPv4 PDP/ IPv6 PDP only if the visited SGSN can be upgraded to support the DS feature

# Failure case 2: DS UE -> old DS networks

- From LTE /post-R9 3G to pre-R9 3G networks
  - Same as failure case 1
  - Even the failure case 1 is resolved, it may have following issues
    - a single IPv4v6 PDP have to be split into two sequential PDP requests, which double PDP consumptions
    - Operators may only allow one PDP is alive, while IPv6 bear may likely lost
    - Other unrelated services may be broken due to overmuch PDP activation for each subscriber(reported by Pete Vickers)
- Known Solutions
  - Option 1: Only IPv4 PDP is initiated during the roaming
  - Option 2: Do not enable local-breakout/SIPTO

## Failure case 3: DS UE->IPv6-only networks

- The applications that are IPv4-specific can't work
- Known solutions
  - Option 1: Do not enable local-breakout/SIPTO
  - Option 2: Enable 464xlat or BIH in mobile terminals

## Failure case 4: IPv6-only UE->IPv4-only networks

- Fail to get the IPv6 address
- 3GPP doesn't provide the IPv4 fallback
- Known solutions
  - Option 1 : Do not enable local-breakout/SIPTO
  - Option 2: Setting roaming APN to IPv4 (As Android does)

# Failure case 5: IPv6(464xlat) UE->DS/IPv6 networks

- 464xlat terminals may roam to a IPv6-enable network, in which DNS64 or NAT64 isn't deployed.
  - NAT64 prefix can't be discovered
  - WKP and manual configuration may cause mistake
- Known solutions
  - Option 1: Do not enable local-breakout/SIPTO
  - Option 2: Disable 464xlat within the visited network and only performing IPv4 PDP activation

# Summary of Scenarios

<b>UE Type</b>	<b>Visited Network</b>	<b>Home routed</b>	<b>Local Breakout</b>
Dual-Stack(DS)	IPv4-only	Failure case 1	Failure case 1
Dual-Stack(DS)	IPv4 only +IPv6 only	OK	Failure case 2
Dual-Stack(DS)	IPv6-only	OK	Failure case 3
IPv6-only	IPv4-only	OK	Failure case 4
IPv6-only with 464xlat	Dual-stack	OK	Failure case 5
IPv6-only with 464xlat	IPv6-only	OK	Failure case 5
IPv4-only	Dual-stack	OK	OK
IPv4-only	IPv6-only	OK	Failure case 6 (if possible)

# Comments & Responses

- Clarify local breakout and home routed roaming
  - It has been refined in this slides and will add to the next version
- Differentiate inter-PLMN roaming and intra-PLMN GW selection
  - Already clarified in the slides
- Investigate relevant GSMA documents
  - Complete the references, e.g. IR.21, IR.33,..
- Detail the descriptions on each failure case, for example what is HLR/HSS configuration, SGSN/GGSN status, UE requests and various combinations

# Insights

- IPv4v6 PDP context may bring more issues for the time being, for example roaming incompatible, PDP licensing costs, etc
- A user profile with IPv4-only PDP or IPv6 only PDP may temporarily get easy through roaming areas
- Operators may deploy IPv6 only + 464xlat in the home network to advance IPv6 deployment at this time
- If roaming has to be enabled, there is no working solution other than IPv4 to guarantee roaming
- Local-breakout/SIPTO may be only considered for some specific services, for example IMS roaming

# Next Step

- Is it some thing useful v6ops should work?
- Adopted as a WG Item?