International Roaming Problem of Packet Switched Data in IMT-2000 network

M-27

Abstract: Present the current problem in 3GPP IMT-2000 specification concerning Packet roaming and proposed a solution by using an extension of DNS with common APN and unique APN specify explicitly and with assumption that UE will provide FQDN when making PDP Context Activation Request.

Keyword: 3GPP, IMT-2000, W-CDMA, UMTS, APN, ROAMING, DNS, HLR, SGSN, GGSN, CG, BG, PS, CS, Mobile IP, internet, IETF, RFC

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1. Subject

Packet roaming problem in IMT-2000 has not yet been fully addressed in 3GPP specifications. [1][2][4]

It is different from Mobile IP research by now [8] and is a potential key problem for developing ALL IP telecommunication network as the next step of IMT-2000.[6]

According to IMT2000 specifications (3GPP R99 2001 June, below R99), IMT-2000 core network(below IMT-2000) should select correct path from multiple choices for packets from subscribers as part of Network Access Control Functions during PDP Context Activation if HLR does not indicate which GGSN to be used for required APN[1].

Figure1 IMT-2000 Packet Switch (note: roughly MT+TE=UE)

Figure1 IMT-2000 Packet Switch

------ Signalling Interface
—— Signalling and Data Transfer Interface
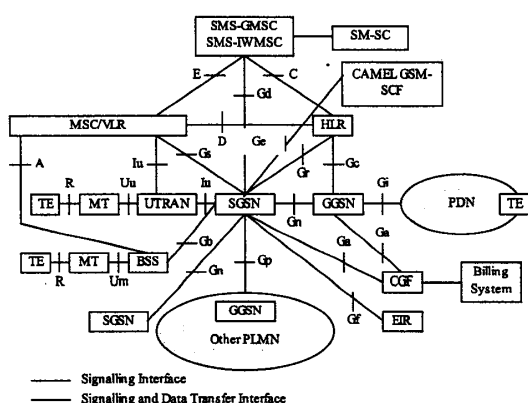
As a result of analysis, this can only be done in DNS for Packet Switch Domain of IMT-2000 in practice [7].

However, a RFC1034 DNS as R99 indicated can not solve following problem:

Operator A (in country J) and Operator B (in country C) agreed to allow roaming subscriber to use whatever local GGSN of visited network for APN of Internet access while redirect the traffic to home network for certain situation like traffic jam of local network and certain charging purpose. And the condition of redirection can be changed by home network configuration, and then spread automatically in both of network.[1][4]

2. Proposal

2.1 WDT : To solve above problem with 100% compatibility (or not so meaningful) with current protocol stacks, network equipments and handsets. I proposed following approach by extending the internal architecture of DNS to using a Weighted DNS Tree (WDT) with discrimination of common and unique APN among operators by increase one type of zone nodes.(C for Common APN, U for Unique APN),[7] Figure 2
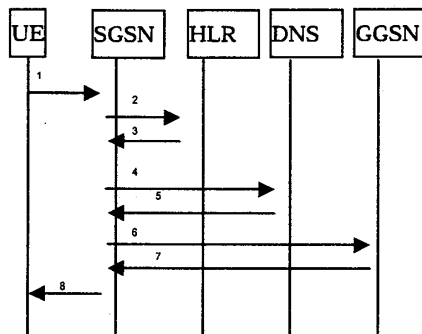
WDT(Weighted DNS Tree)

WDT   RFC1034
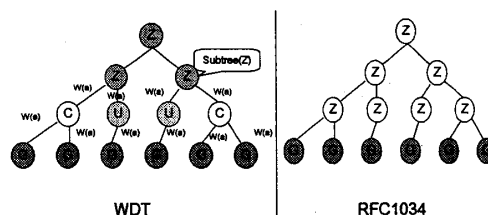
2.2 IMT-2000 International Roaming Packet Switche Framework

Figure 3 Framework
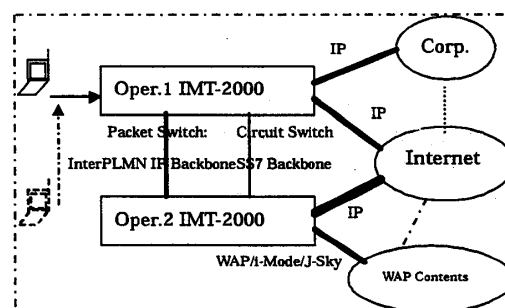
2.3 UE Initiated PDP Context Activation

Figure 4 Current Procedure

1. PDP Context Activation Request
2. Authentication Request
3. Authentication Ack
4. APN to GGSN resolve request
5. APN to GGSN resolve result
6. PDP Context Creation Request
7. PDP Context Creation Complete
8. PDP Context Activation Complete

2.4 WDT DNS Request Process Algorithm

For above Figure 4, Message 4.

- Step1. Divide the Full Qualified Domain Name(FQDN) given by User Equipment (UE) into APN (like internet) + Home Domain Suffix (like kantou.mnc002.mcc440)
- Step2. Check if the suffix match the visited network suffix to judge weither it is from a roaming user
- Step3. APN as key to search subtree of WDT addressing local Authoritative Domain,

    (1)if it is common APN, if it is a visited network specific APN, route the request to local GGSN, if it is a common APN, check the Roaming agreement (that can be abstracted expressed by management factor), and calculate the route cost while nessary before making the decision of routeing it to local(visited network) or roaming users home network.

    (2)If it can not be found in Local, it is regarded as specific APN for Roaming user's home network and then routed to Home network.

2.5 Building WDT

To build a WDT based solution, operators need to do followings when negotiating roaming agreement
- Find common APN
- Agree policy: Fixed(always home or visted) or Dynamic or Both(allow user selection as well)
- Build a common root DNS
- Agree updating procedure for root DNS

2.6 Merit of Adopting WDT

- Reduce the possibility of DNS's giving a wrong GGSN during PDP Context Activation, so that roaming user can get an average quicker response and better packet transfer speed.
- Able to implement flexibly much more type of roaming agreement between Operators concerning access control and charging.
- Less rely on HLR, thus make easier for migration to All-IP mobile telecommunication network thus shorten connection establish time.
- Fully compatible with current IMT-2000 infrastructure and mobile terminals
- Subscriber-friendly, the input of common APN can be done by operator when subscribing
- Easily deploy effective load sharing solution to improve efficiency and fault tolerance.

3. Conclusion and Summary

Although roaming problem for Circuit Switch like legacy voice phone service has been developed to a state of art in IMT-2000, effective resolution of the same problem for Packet Switched data have to extend traditional DNS to address common and specific APNs clearly, and most possible have to deploy a load sharing strategy, so that IMT-2000 can route packet data for subscriber in a cost-effective way.

Reference

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