Research on Automatic Device Detection Service Implementation Mode

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Abstract. In view of the fact that sometimes the network is unreasonable and users cannot use certain mobile services, this paper studies the standard service-automated device detection ADD service based on the 3GPP protocol and discusses two implementations of the ADD service: based on the home location register HLR (Home Location Register) and the implementation of EIR (Equipment Identity Register) and compares these two types of services. Operators can decide to deploy in the same way based on their actual network conditions.

Introduction

At present, some mobile services need to rely on the support of terminal handsets, such as GPRS services[1]. If users want to enjoy GPRS Internet access services, they first need to set complex access point information on mobile phones, and have higher requirements for end users, especially For roaming users, due to language barriers, they cannot normally be set up successfully, and they cannot use the GPRS service[2]. In this context, the automatic device detection (ADD) service came into being.

The ADD service mainly relies on over-the-air technology OTA (Over The Air Technology). OTA is a technology based on the short message mechanism and can automatically configure the terminal. In the process of implementing the ADD service, the ADD Server stores the configuration information of the terminal and uses the OTA technology to automatically configure the terminal.

The 3GPP protocol defines the ADD service and the cells required for the service. However, there is no explicit definition for the end-to-end implementation. This document describes the common mode of the ADD service in the industry based on the 3GPP protocol. The location register HLR (Home Location Register) implementation and the device identity register EIR (Equipment Identity Register) implementation.

Based on the Implementation of HLR

The HLR-based ADD service has two triggering modes. The ADD service caused by the first network side includes, for example, when the user replaces the mobile phone and first roams to the network of the foreign operator, and the second case changes the ADD service caused by the user's subscription information. Business process flow; for example, when the user's GPRS service changes, the user changes from pre-paid to post-paid. Next, this article describes the ADD transaction processing in these two scenarios:

ADD Service Caused by the Network

This scenario is based on whether the user accesses the network for the first time or whether the terminal has replaced the SIM card. The ADD traffic is handled according to the specifications of 3GPP29002 and 3GPP23012 as follows Figure 1:
1) The MSC/SGSN initiates a location update request to the HLR. First, check whether the user's HLR supports the ADD feature. If it is not supported, update it according to the normal process location, and do not carry the ADD support capability identifier in the location update response information. If it is supported, carry the terminal's international mobile in the location update request. Device identification software version IMEISV (International Mobile Equipment Identity Software Version). The message carries an ADD-info cell and is used to identify that the MSC/SGSN supports the ADD feature.

2) The HLR checks the location update request information. If the request message carries the ADD-info and IMEISV cells, it is determined whether the value of the IMEISV carried in the message is the same as the value of the IMEISV stored in the HLR by the user:
   a) If the IMEISV changes and the skipSubscriberDataUpdate cell is carried (the cell carries the HLR and does not require location update), the HLR updates the IMEISV value and then sends a SOAP message to the ADD Server; the HLR does not insert the user data operation directly to the MSC/ The SGSN returns location update response information. The message carries the ADD support capability identifier; the HLR does not update the location information of the user.

   b) If the IMEISV changes and does not carry the skipSubscriberDataUpdate element, the HLR updates the IMEISV value and sends a SOAP message to the ADD Server; the HLR inserts the user data operation and returns a location update response message to the MSC/ The SGSN returns location update response information. The message carries the ADD support capability identifier; the HLR supports the ADD feature. Identity: HLR updates user's location information. At the same time, the IMEISV of the terminal is stored for use in the next location update. The location update returned by the HLR carries the add-Capability cell identity. The HLR supports the ADD feature.

   c) If the IMEISV does not change and the skipSubscriberDataUpdate element is carried, the HLR directly returns a location update response message carrying the ADD support capability identifier. The HLR does not update the user's location information.

   d) If the IMEISV does not change and the skipSubscriberDataUpdate element is carried, the HLR directly returns a location update response message carrying the ADD support capability identifier. The HLR does not update the user's location information.

3) ADD Server automatically modifies user's terminal settings through OTA technology.

Modify the user's Subscription Information caused by the ADD Business

Based on the operator's network planning and design, when some of the user's subscription information changes, the terminal needs to be configured again to enjoy the service. For example, changing the card, changing the number, and replacing the prepaid fee with the post-paid user result in APN. Change, GPRS modification, need to modify the GPRS parameters of the user terminal, the user can enjoy the GPRS service. The ADD service processing flow in the scenario is as follows Figure 2:

1) The Provisioning system sends a request to modify the contract information to the HLR.

2) The HLR detects the instruction sent by the Provisioning system, and after completing the contract data modification and the resulting MAP message processing according to the protocol, if the operator specifies the rules, a SOAP message is constructed, and the relevant data is sent to the SOAP message. ADD sever.
3) ADD server automatically modifies user's terminal settings through OTA technology.

Based on the Implementation of EIR

There is only one type of ADD service based on EIR, that is, ADD service caused by the network side: For example, when a user replaces a mobile phone and first roams to a network of a foreign carrier, the processing flow is as follows Figure 3:

1) Check IMEI request initiated by MSC/SGSN to EIR. First, check whether the EIR supports the ADD feature. If it is not supported, process it according to the normal Check IMEI; the EIR strips out the terminal information (IMEI) and the user's identity information (IMSI) from the Check IMEI message, and then judges whether the user is in the EIR. The saved IMEI values are the same. If they are consistent, the ADD service is not triggered.

2) If the IMEI carried in the Check IMEI message does not match the IMEI value stored in the EIR by the user, the EIR first constructs a MAP message to the home HLR of the user to obtain the user's mobile phone number (ie MSISDN). Because the standard protocol does not define MAP messages to obtain MSISDNs from the HLR according to the IMSI, you can generally use the Send Routing For LCS message to obtain the user's MSISDN. That is, the EIR constructs the Send Routing For LCS message to send to the user's home HLR, and then from Send Routing For The MSISDN of the user is stripped out of the LCS response message.

3) The EIR sends the IMSI, IMEI, and MSISDN to the ADD Server through a SOAP message.

4) ADD Server automatically modifies user's terminal settings through OTA technology.

The Comparison of two Business Methods

The above describes the ADD service solutions that are commonly used in the industry based on the 3GPP protocol standards. The following table shows the comparison of the two ADD service implementation modes. Operators can decide how to deploy according to their actual network conditions:
| Overall network reliability | HLR has a high reliability requirement in the network. Introducing new services in the HLR has a relatively large impact on the reliability of the overall network. | EIR has relatively low reliability requirements in the network. The introduction of new services in the EIR brings reliability to the overall network. |
| Future evolution | The HLR is located in the storage of user data, and the ADD service is located in the configuration of the terminal. Both have their own evolution direction. | EIR is located in the management of the terminal, and the ADD service is located in the configuration of the terminal. The evolution direction of the two is the same. |
| Business connection risk | For the ADD service, there is a standard protocol basis between the MSC and the SGSN and the HLR, and the interconnection risk is small. | For the ADD service, there is a lack of necessary standard protocol basis between MSC, SGSN, and EIR. |
| Business deployment difficulty | HLR is a necessary equipment for mobile networks. It is only necessary to perform software upgrades on existing HLRs to deploy ADD services. | Currently, many operators do not have EIR equipment on their networks. If EIRs are deployed for ADD services, it will inevitably bring about an increase in investment. |
| Trigger condition flexibility | The ADD service can be triggered based on the modification of the network side and user subscription information. | ADD services can only be triggered based on network-side information, with relatively little flexibility |
| Configuration delivery flexibility | The LR can transfer service subscription data such as user identifiers (including IMSI, MSISDN), terminal identifiers (IMEI), and APN to the ADD Server through SOAP messages for terminal configuration. The flexibility of configuration is strong. | The EIR can only pass the user ID (including the IMSI, MSISDN) and the terminal identity (IMEI) to the ADD Server through the SOAP message for terminal configuration. The configuration flexibility is strong. |

Summary
In recent years, with the continuous improvement of terminal capabilities, operators have launched numerous new services, such as WAP Internet access, WeChat, and mobile phone mailboxes. Operators use these new services to build new profit growth points and improve user stickiness. However, these services are affected by the configuration of mobile phone parameters. Due to the complex configuration, these services cannot be quickly promoted, which affects the development of new services[3]. ADD business support automatically configures mobile phone parameters, allowing users to quickly and easily enjoy new services. It is a rapid promotion of new services, and also increases customer satisfaction and enhances the overall competitiveness of operators. The application of ADD services very promising widely.

References
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