

行政院國家科學委員會專題研究計畫成果報告

UMTS 即時計費協定之研究

A Study on UMTS Online Charging Protocol

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一、 中文摘要

Parlay是一個有效率並有彈性的制訂服務平台。透過Parlay，電信業者提供有效率的電信核心網路服務功能給第三方服務開發者，使第三方服務開發者可以有彈性地接取電信核心網路服務功能，並發展新的應用服務。本研究基於Parlay X，在網際網路與行動網路互連平台上開發電信應用程式，利用網際網路與下世代網路/IP多媒體網路子系統，開發整合型服務。Parlay網路服務功能的實作是採用IBM WebSphere電信軟體以開發符合服務導向架構之服務。WebSphere電信軟體藉由連結下世代網路/IP多媒體網路子系統以取得核心網路服務功能。我們以群體計費系統為例，描述如何在WsT平台中開發新的服務，以及WsT如何與應用程式伺服器和下世代網路/IP多媒體網路子系統互動，以提供群體計費系統服務。

關鍵詞：Parlay，IP多媒體網路子系統，下世代網路，服務導向架構

Abstract

Parlay is an efficient and flexible approach that enables telecom operators to efficiently wrap up their network services and capabilities and allows third parties to flexibly access those services for deployment of new applications that drive consumption of network services. This paper describes an Internet-mobile platform for telecom applications based on Parlay X. Our solution aggregates resources from the Internet and Next Generation Network (NGN) IP Multimedia Network Subsystem (IMS) mobile networks to enable “mashup” service creation. Our solution uses the IBM WebSphere software for Telecom (WsT) to implement Parlay service capability that accommodates service oriented architecture services. The WsT is connected to the NGN/IMS platform for network capability provisioning. Then we use

the Group Accounting System (GAS) as an example to illustrate how a new service can be created in the WsT platform and how the WsT interacts with the application server and NGN/IMS to provide GAS services.

Keywords: Parlay, IP Multimedia Subsystem (IMS), Next Generation Network (NGN), Service-oriented Architecture (SOA)

二、 前言

In Next Generation Network (NGN), IP Multimedia Subsystem (IMS) integrates mobile telecom network with the Internet, which allows a telecom operator to flexibly bring attractive services to their customers [3]. NGN/IMS utilizes Session Initiation Protocol (SIP) for signaling and Diameter for Authentication, Authorization and Accounting (AAA). On the top of these protocols, Parlay can be implemented to make NGN/IMS service creation easier and more general through CORBA, WSDL or Java. The Parlay Group, together with European Telecommunications Standards Institute (ETSI) and Third-Generation Partnership Project (3GPP), has proposed the Parlay/Open Service Access (OSA) standard that defines application programming interfaces (APIs) for the control of mobile network capability [2, 4, 5]. Furthermore, through Parlay, network capability is opened to third-party service providers other than the telecom operators to create and deploy new telecom services.

Figure 1 depicts the Parlay architecture. In this architecture, The Application Server (AS; see Figure 1 (1)) offers an environment for application development. The Service Capability Servers (SCSs; Figure 1 (2)) provide the AS access to network capability functionalities through the Parlay APIs. Before accessing an SCS, the AS should be authorized by the Framework (Figure 1 (3)) that

provides an extensive framework of security and service management. Network access of third-party applications is subject to authentication and authorization. Parlay allows a telecom operator setting different privilege levels to the service providers according to the service level agreements (SLA). While some service providers are only allowed to receive notifications from the telecom network, other more trusted providers can control calls and connections. In 2003, Parlay Group defined a more complex and powerful web service of functionality exposed by Parlay API, namely Parlay X. Based on Parlay X, this paper describes an Internet-mobile platform for telecom applications. Our platform aggregates resources of Internet and mobile networks to enable “mashup” service creation by using Parlay X APIs. Our solution uses the IBM WebSphere software for Telecom (WsT) to implement Parlay service capability that accommodates service oriented architecture (SOA) services. The WsT is connected to the NGN/IMS of Chunghwa Telecom (Figure 1 (4)) for network capability provisioning. Then we uses “Group Accounting System (GAS)” as an example to illustrate how a new service can be created in the WsT platform and how the WsT interacts with the AS and NGN/IMS to provide GAS services.

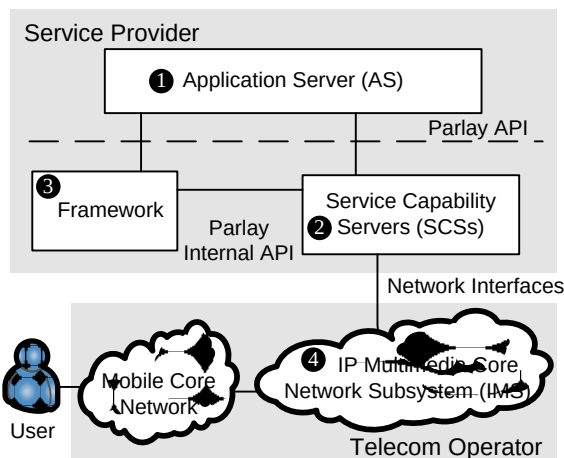


Figure 1: The Parlay Architecture

三、研究目的與文件探討

WsT (Figure 2 (3)) [1] is a platform providing IMS/NGN standard-compliant *network services*. A network service is a collection of self-contained functions that perform a defined task (e.g., call control and short message) and expose it through a well known interface. Service providers only need to know what a network service does and what the interface is without knowing how the network service is implemented. The WsT consists of the following products: IBM WebSphere Telecom Web Services Server (TWSS; Figure 2 (4)), IBM WebSphere XML Document Management Server (XDMS; Figure 2 (5)) and IBM WebSphere IP Multimedia Subsystem Connector (IMSC; Figure 2 (6)).

The TWSS enables service providers to access secure, reliable, and policy driven network services. Therefore, third-party service providers can enhance consumer and enterprise applications (resided in the AS; Figure 2 (2)) through open standard-based web services (e.g., Parlay X). The network services are located in Web Service Implementations (SI; Figure 2 (11)), which is connected to the Call Session Control Function (CSCF; Figure 2 (12)) in NGN/IMS network through SIP. The Service Platform (SP) provides common service implementation functions that enables more efficient and smaller deployment platform sharing among the network services. The Access Gateway (AG; Figure 2 (9)) plays the role of the Framework in Parlay. The AG provides a common control point for service providers to define, manage, and enforce policies and SLA for *requesters*. A requester can be either an application or a user (e.g., mobile user; Figure 2 (13)). By using SLA, the TWSS determines applications and users that can access certain network services under specific service policies. Such policies are stored in The Service Policy Manager (SPM; Figure 2 (10)), which provides management, storage, and retrieval functions for a given requester to manipulate the policy rules (e.g., Quality of Service, such as minimum and maximum bit-rates). Every network service for a particular requester is associated with one or more policies. For example, call control service for different users and applications may have different charging policies (online/offline charging rate).

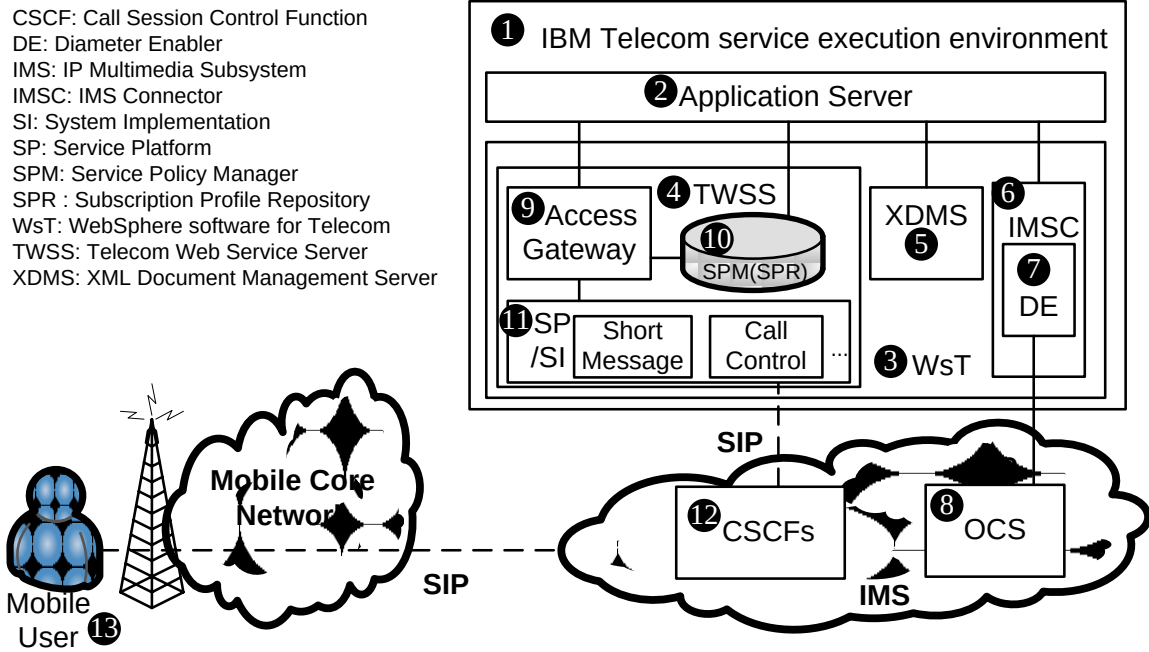


Figure 2: IBM WebSphere software for Telecom

The XDMS provides storage, management and subscription to documents that are owned by entities within the IMS-based solution. In our solution, XDMS stores the buddy list of the group. The TWSS will use the Address List Management (ALM) web service to retrieve these buddy list.

The IMSC is responsible for adapting the web services to the IMS protocols (i.e., Diameter and SIP). The adaption of Diameter protocol is implemented in the Diameter Enabler (DE; Figure 2 (7)). The DE allows the AS to retrieve and update NGN/IMS user data account, such as performing online charging through transactions with the Online Charging System (OCS; Figure 2 (8)). The DE receives online charging web service requests from the AS, sends an appropriate Diameter message (i.e., Credit Control Request (CCR)) to the OCS, receives authorization answers from the OCS (i.e., Credit Control Answer (CCA)), and sends the results back to the AS.

WsT is IBM's implementation for providing NGN network services. It not only provides the APIs for subscription and notification, but also provides Parlay X capability which accelerates the development of wellness management by removing the need to learn details of the mobile carrier network while developing the phone application.

With IBM WsT capability, one can easily implement applications for next generation network.

四、研究方法

In this section, we show how the IMS/NGN provides network capability to the IBM WsT described in Section II, and based on the WsT, how to provide the network service to a service called Group Accounting System (GAS).

Accounting is one of the most important business activities. GAS allows a group of people to share one or more accounts. An example of such group is the purchasing department of an enterprise with several on-going projects, and each project has its budget controlled by a project account. The GAS service is offered by WsT/IMS through a service access number, which has the same format as a telephone number. Through a user equipment's (UE's) GAS application (see Figure 3), a member of this group can make a purchase charging from the project account. In Figure 3, the user purchases a \$1000 USD laptop for *proj_a*. When the user clicks "Submit", the UE automatically dials the service access number, which results in a purchase request to the WsT.



Figure 3: The Graphical User Interface of iPhone for Group Accounting System

The GAS interacts with the OCS to manage projects' account balances. These account balances are stored in an account database of the OCS. An entry of the simplified OCS account database is shown in Table 1. In this entry, the remained credit of *proj_a* is \$50000 USD. When the amount of the remained credit in the OCS is less than a recharge threshold \$5000, the OCS will remind the project manager to refill this account [6]. New purchase request can still be accepted until the remained credit depletes.

Table 1: A Table Entry in the OCS's Account Database

User Name	Account Balance	Recharge Threshold
<i>proj_a</i>	50000	5000

The provision of GAS service through IMS consists of two parts: first, enrolling the GAS in the WsT. Before the GAS is authorized to access the network service, we should set up a GAS policy

rule in SPM. This policy rule sets GAS service as the requester to retrieve the Call Notification of the call control network service.

Second, CSCF is configured to provide IMS network capabilities to the GAS. Specifically, we store the mapping of the GAS's service access number and WsT's IP address in the routing table of the CSCF as shown in Table 2. In this entry, the service access number of the GAS is +88621111111. The service type is *session terminating* or *mobile terminating* (MT; which means that the service is triggered when the message is sent to the callee). The initial filter criteria include the IP address WsT_ip of the WsT and the SIP method that triggers this service (which is INVITE in this example).

After the policy is configured in the SPM and the trigger profile is set up in the CSCF, the GAS AS can execute the notification process by initiating the "Call Notification" network service in the SP/SI of the WsT. Therefore, the GAS will be informed when a SIP message with the GAS's service access number is sent to the WsT. The notification message flow is shown in Figure 4 (a), and the details are given below.

Step a1. The GAS AS sends the Parlay X StartCallDirectionNotificationRequest message to the AG to provide notification for its service access number. The Simple Object Access Protocol (SOAP) header of the message stores the requester (i.e., GAS) and the network service (i.e., Call Notification).

Step a2. Upon receipt of the Parlay X message, the AG obtains the requester and the network service from the SOAP header.

Steps a3 and a4. The AG retrieves the policy rule from the SPM based on the requester "GAS" and the network service "Call Notification". The AG enforces the policy and performs SLA to authorize the offering of the GAS service through IMS.

Step a5. The AG instructs the Call Notification network service to execute the notification operation.

Steps a6 and a7. The Call Notification sends the response back to the GAS AS through StartCallDirectionNotificationResponse via the AG.

Table 2: The GAS Entry in the CSCF Routing Table

User Telephone Number (Service Access Number)	2*Service Trigger Type	Initial Filter Criteria	
		Application Server	Method
+88621111111	MT	Wst_ip	INVITE

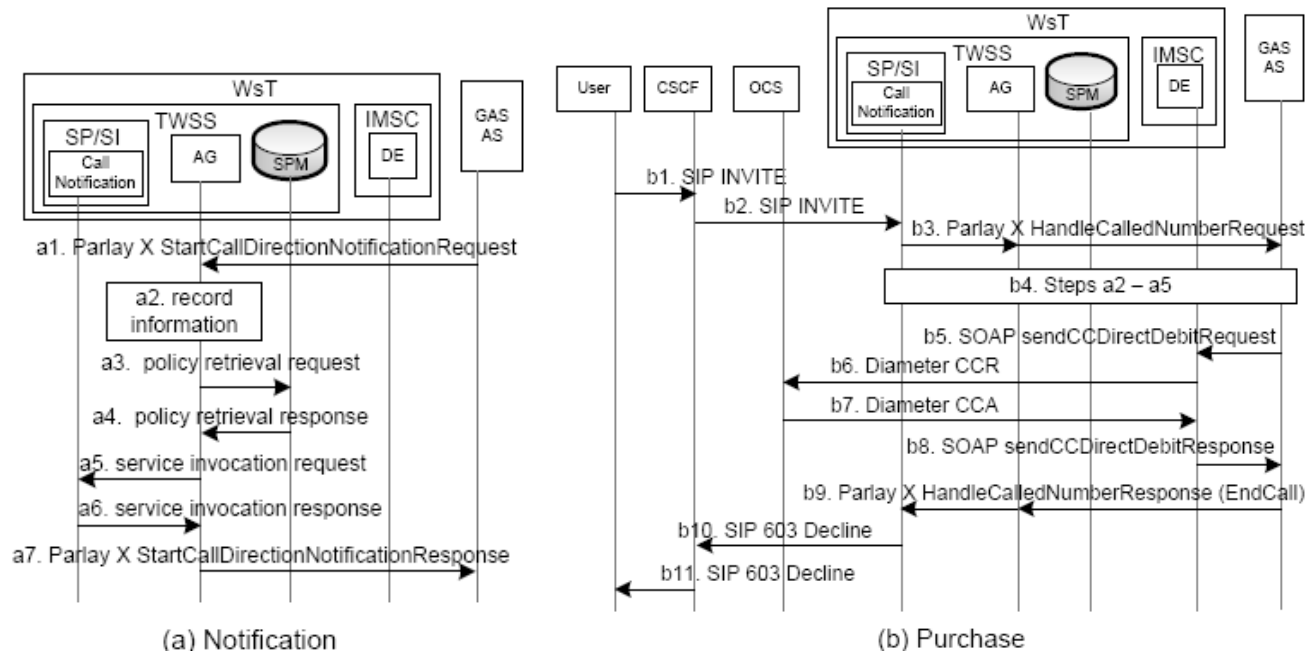


Figure 4: Message Flows for Group Accounting System

We note that Steps a2 - a5 are always executed whenever a Parlay X message arrives at the WsT. After the notification process, a GAS user can use a UE to request a purchase through IMS/NGN. Suppose that the user purchases a \$1000 laptop for *proj a* through his/her UE. The message flow for this purchase is shown in Figure 4 (b), and the details are given below.

Step b1. After the user clicks the “Submit” button (see Figure 3), the UE automatically dials the GAS’s service access number +88621111111, which results in a SIP INVITE message delivered to the CSCF. This message includes the purchase information: the price (\$1000), the item name (laptop), the project ID (*proj a*) and the purchase/receipt dates (optional). The information is carried in the display-name in the From Header of the INVITE message.

Step b2. By retrieving +88621111111 in the To Header of the SIP message, the CSCF checks if the service access number matches the MT filter criteria of the trigger profile. If the service trigger is

matched, the IP address Wst_ip is used to route the INVITE message to the WsT.

Steps b3 and b4. When the WsT SP/SI receives the SIP INVITE message with the GAS’s service access number, the WsT notifies the GAS AS through Parlay X HandleCalledNumberRequest. In this Parlay X message, the parameter CallingParticipantName carries the purchase information copied from the display-name of the SIP INVITE. Then Steps a2 - a5 are executed for policy enforcement.

Step b5. The GAS AS retrieves the purchase information (e.g., \$1000, laptop and *proj a*) in the CallingParticipantName parameter, and invokes sendCCDirectDebitRequest which instructs the WsT to request credit (\$1000 USD) through the DE. Note that the interface between DE and AS is not defined in Parlay X. This interface follows SOAP specified by IBM.

Step b6. Accordingly, the DE sends a Diameter CCR message to the OCS to request credit from *proj a*’s account.

Step b7. The OCS deducts \$1000 from *proj a*'s account. After the deduction, the OCS checks if the new balance (\$49000) is more than the recharge threshold. If not, the OCS will remind the project manager to refill the project account by, e.g., sending a short message. Then the OCS sends a Diameter CCA message back to DE. This message indicates that the credit deduction is successfully preformed.

Step b8. The DE sends the SOAP sendCCDirectDebitResponse message to the GAS AS to indicate that the credit request is successful.

Step b9. The GAS AS returns the Parlay X andleCalledNumberResponse message to the WsT to inform the user that the purchase is approved. Since the call is not necessary to be answered, we simply end the call by setting the ActionToPerform parameter of the message to "EndCall" to reject the call.

Steps b10 and b11. The SP/SI sends a SIP 603 Decline message to the UE through the CSCF. The purchase is successfully completed.

五、 結果與討論

In this paper, we presented how to integrate the IBM WebSphere software for Telecom (WsT) with the NGN/IMS platform for network capability provision. This WsT/IMS integration accommodates flexible service oriented architecture (SOA) services. We use Group Accounting System (GAS) as an example to illustrate how a new service can be easily created in the WsT platform. Specifically, we show how the WsT interacts with the AS and NGN/IMS to provide the GAS service.

六、 成果自評

- (一) 對於學術研究、國家發展及其他應用方面預期之貢獻：

1. 論文發表：本計畫之學術成果已投稿至 2010 IEEE International Conference on e-Business Engineering。
 2. 效能評估：以群體計費系統為例，實現 IBM WsT平台與應用程式伺服器及下世代網路/ IP多媒體網路子系統的互動。我們的成果可提供第三方服務開發者實作整合型服務之參考。
- (二) 對於參與之工作人員，預期可獲之訓練：
1. 整合型電信應用服務之開發。
 2. 計費機制之研究。

七、 參考文獻

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