

# 行政院國家科學委員會專題研究計畫 成果報告

## B3G 網路中 OSA 及 IMS 互通效能研究(2/2) 研究成果報告(完整版)

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                  國際合作計畫研究心得報告

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中華民國 96 年 04 月 13 日

# 行政院國家科學委員會國際合作計畫成果報告

B3G 網路中 OSA 及 IMS 互通效能研究(2/2)

## A Study on the Interworking of OSA/IMS in B3G Networks (2/2)

計畫編號：94-2219-E-009-001-

執行期限：2005/12/01 ~ 2006/11/30

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### Abstract

The IP Multimedia Subsystem (IMS), as part of the Universal Mobile Telecommunications Services (UMTS) R5/6/7 architecture is a major core network evolution that enables Session Initiation Protocol (SIP) services in a mobile network environment. The IMS introduces into the packet network environment the concepts of call control, application and service control.

This project consolidates the efforts from reputable research teams in China, France, Singapore, Taiwan, and Thailand to collaborate on the cutting-edge enabling technologies that will support and facilitate the new applications in next generation mobile networks.

The support from National Science Council (NSC) successfully established an experimental platform in National Chiao Tung University (NCTU). With this foundation, we proposed a research project to French government, jointly with our French partner *Institut National des*

*Télécommunications* (INT). The proposal was approved by the French government and bilateral collaboration was facilitated.

Keyword: IMS, SIP

### 簡介

IMS 是 UMTS 架構中核心網路的一個重要部分。其中 SIP 讓 IP 多媒體服務加入行動網路。IMS 採用通話控制、應用以及服務控制的概念。本計畫結合法國、台灣、泰國新加坡以及中國具知名度的研究團隊，共同合作開創出新一代行動網路的應用服務。

基於國科會計畫補助於交大建立的 VoIP 實驗平台，我們向法國政府提出一個研究計畫，與我們的合作伙伴 INT 共同執行台法雙邊合作計畫。目前計畫成果包括 15 篇國際期刊及會議論文、一篇書籍章節、四份 3GPP 標準文件。VoIP 實驗平台也與所有合作伙伴互通。

# Goal

Session Initiation Protocol (SIP) is becoming the dominant protocol for real-time multimedia services. SIP provides the mechanisms to enable a wide range of services, for instance Internet telephony, video, instant messaging, presence server, conference, push-to-talk, collaborative applications as well as e-learning applications.

The IP Multimedia Subsystem (IMS) as part of the UMTS R5/6/7 architecture (Figure 1) is a major core network evolution that enables SIP services in a mobile network environment. The IMS introduces into the packet network environment the concepts of call control, application and service control. In parallel to this evolution of mobile networks, the development of services in fixed networks offering broadband access will become an important aspect for the differentiation between Service Providers. The interactions required between the call control and service platforms are not currently defined in the fixed network as they are for the mobile network as described above. Furthermore, emerging wireless broadband technologies based on IPv6 must be defined and developed (WLAN, WIMAX, Mobile-Fi). According to the trend of 3G technology development, real-time services will be based on SIP, but there is currently no defined architecture yet.

## IMS overall architecture

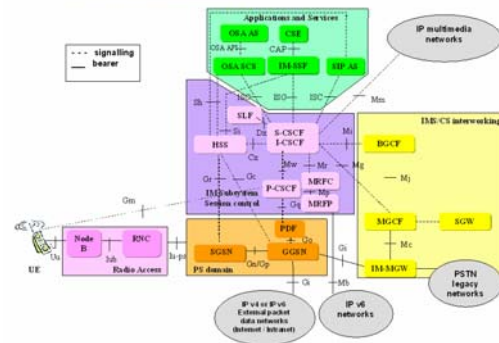


Figure 1. Overall architecture of IMS

Many operators and vendors have shown great interest in adopting SIP as the core signaling protocol to support their multimedia services on All-IP networks. The research in this area is very active around the world, but many key issues still need to be further solved; current technologies and existing standards are still insufficient to support and deploy multimedia services. Essential elements necessary for the deployment of an integrated architecture that are not covered in the standards and for which no technical solution exists today will be investigated in this project.

This project set up a research network between partners having developed in-depth expertise on the key issues that need to be addressed for the deployment of next generation real-time multimedia services based on SIP. The key areas of cooperation include:

1. Architecture of multimedia services
2. VoIP architecture on wireless broadband technologies (WLAN, WIMAX, Mobile-Fi).
3. Mobility and service continuity for inter-technology handover

4. Peer-to-Peer Model in SIP-based VoIP Network.
5. SIP-based e-Learning applications
6. Interconnection of SIP platforms

## Achievement & Discussion

This project consolidates the efforts from reputable research teams in France, Singapore, Taiwan, and Thailand to collaborate on the cutting-edge enabling technologies that will support and facilitate the new applications in next generation mobile networks.

### INT-GET



Institute of National de Technology (INT) is a member of the Group of Telecommunication Schools of France (Groupe des Ecoles de Télécommunications – GET). The group includes ENST in Paris, ENST-B in Bretagne, Eurecom Institute in Sophia Antipolis, ENIC in Lille). INT has a wide range of research, consulting, and teaching activities are conducted by its two schools the Engineering School (Telecom INT) prepares graduates for the design, implementation and engineering of Information and Communication systems and networks, and the School of Management (INT Management ) to extend their understanding of the I&CT industry.

GET-INT has established close ties with the telecommunications industry with key manufacturers, network operators and service providers of the telecommunication

industry. External funding contributes considerably to GET-INT annual R&D budget and originates from various companies such as: France Telecom, Bouygues Telecom, Cegetel, Nortel, Motorola, Alcatel, EDF/GDF, and national research centres such as the FT R &D. Part of the funding originates also from national research programs such as RNRT, RNTL, RIAM, and RNTS. The Faculty is involved in projects : MMQoS, ROM, ROMEO, Numerobis, SEMANTIC, ERASME, PLATONIS and more recently AMPROS on middleware.

INT along with its sister schools from the group GET have been very much involved in European Research Programs under RACE, ACTS, IST and ESPRIT. Permanent Faculty, Senior and Junior Engineers have more recently been involved in ACTS projects STORMS and LEVERAGE and IST projects DAVID, MONASIDRE, ViSiCAST, HOME. Under the European ITEA collaborative framework GET-INT is involved in OSMOSE and Jules Verne and project BISANTE within the ESPRIT framework.

A list of research and development areas reflecting GET-INT's skills and academic abilities include:

- Broadband and wireless networks modelling, performance analysis, design and planning, protocols, architectures, applications and services
- Mobile communications networks and services in Cellular, WLAN and WPAN.
- Security paradigms, mechanisms and

architecture in computer networks for fixed and wireless networks

- Advanced distributed systems-parallel computing, middleware and object oriented data base management systems
- Protocols specification, validation and testing
- Economic, marketing, financial, sociological and legal aspects of information and communication technologies. Services and strategic issues for all providers.
- Communications, Signal and image processing. Emphasis on Adaptive filtering, MIMO systems, movement/image/scene characterisation, video compression and advanced image applications such as virtual and augmented reality
- Robotics for the handicapped and severely impaired (includes Adaptive Man Machine Interfaces and use of wireless technologies)

Specifically, GET-INT's research team has developed a strong and recognised expertise in Telephony over IP, in particular: SIP Based VoIP, 3G IP Multimedia Subsystem, Multimedia service architectures, WLAN and any IP-based networks access to 3G services, and Context awareness.

**Institute for Infocomm  
Research (I<sup>2</sup>R)**



The Institute for Infocomm Research (I<sup>2</sup>R) is a premier research organisation in infocomm technology in Singapore. I<sup>2</sup>R was created through the merger of the Institute for Communications Research (ICR) and the

Laboratories for Information Technology (LIT). I<sup>2</sup>R integrates the R&D strengths of ICR and LIT, bridging the world of communications and information technology to develop holistic solutions across the ICT value chain. The Institute has around 350 Research Scientist and its research capabilities are in wireless and optical communications, and information technology and science. The research directions are focused on creating distinctive and innovative solutions in ICT for software and services, communications for wired, wireless, broadband and broadcasting and media for the creation and delivery of content, entertainment and games.

I<sup>2</sup>R has R&D collaboration activities that are not confined to local partners but with Government Agencies, International Research Consortiums and Multi National Companies.

The Networking group that is participating in this project belongs to Communications and Devices division of I<sup>2</sup>R. Wireless and optical technologies are the twin pillars within this Division. All the groups in this division, namely the Radio Systems, Digital Wireless, Multimode Devices, Lightwave and Networking groups, focus their research on communication systems, protocols and algorithms, wireless networking, radio devices and optical networks. The current research interest in the Networking group is in the areas of ad-hoc networks, sensor networks, mobile middleware, Internet protocols and QoS. Within the Networking group, there are

experts that actively contribute to standardization activities and publish their findings in reputable conferences and Journals. In terms of R&D prototyping, the group has excellent capabilities in developing protocols such as IPv6, Mobile IPv6, IPsec, RoHC, etc.

I<sup>2</sup>R achievements in SIP can be summarized as follows:

- Java-based SIP UA which is compliant to RFC3261
- Java-based SIP registrar, proxy, redirect, and presence server
- SIP client with call transfer feature
- SIP based presence system

### **National Chiao Tung University (NCTU-CSIE)**



National Chiao Tung University (NCTU) was founded in the suburbs of Shanghai in 1896, sixteen years before the end of the Ching Dynasty. It was established to meet the urgent need to introduce western civilization into China. By Including new vocational programs, such as business, electrical engineering, shipping management, and railway management, the college played a major role in science and engineering education in modern China. During the Sino-Japanese war, the University was temporarily relocated to the French Concession in Shanghai. At the end of the war, all sectors of the University returned to their original campuses. Shortly afterwards, however, the University was dissolved in 1949. In July 1958, the National Chiao Tung University is re-established at its present location in Hsinchu, Taiwan.

The Department of Computer Science and Information Engineering (CSIE), was established in 1974. It offered the first graduate program in the Republic of China devoted to academic research in the area of computer science. The Department offers graduate programs leading to the degrees of Master of Science and Doctor of Philosophy. The wide spectrum of courses offered by the Department covers topics including programming languages, operating systems, software engineering, algorithms, formal languages, data base management systems, pattern recognition, artificial intelligence, image processing, computer graphics, microprocessors, computer architecture, VLSI design, computer-aided design, neural networks, advanced logical design, computer networks, system simulation and performance evaluation, and multimedia information systems.

The department conducts research projects in many areas and boasts of excellent research laboratory facilities. Students have ample opportunity to participate in research activities. Research now in progress at the Department can be divided into five groups: computer communications, software engineering, system software, computational theories, intelligent man-machine interface. The five research groups include 25 laboratories working on Chinese Information Processing, Computer Graphics and Geometric Modeling, Computer System, Computer Network, Digital Signal Processing, Distributed Software System, Distributed System and

Network Security, Document Analysis, Information Systems, Internet and Network Security, Integrated Multimedia Interactive Information System, Microprocessor Design, Multimedia Communication, Neural Computing, Office Automation, Operating System, Parallel and Distributed Processing, Parallel/Distributed System and Software, Pattern Analysis and Intelligent Systems, Scientific Computing, Software Engineering Environment, Software Engineering, System Simulation.

Specifically, the research teams in NCTU CSIE has developed a strong and recognized expertise in modern communication technologies. Active research & development projects includes:

- Wireless Internet and Applications
  - o WLAN/3G Integration with SIP/ENUM Applications
- B3G Wireless Access Technology
  - o SDR/OFDM/MIMO
- Network Benchmarking
  - o Performance/Security/Inter-Operability
- Intelligent Transportation System (ITS)
  - o ITS Information and Communication Platform and Testing
- Optical Internet Enabling Technology
  - o Optical Coarse Packet Switching/GMPLS

### Prince of Songkla University (PSU)



The CNR (Centre for Network Research), the research laboratory in the Department of Computer Engineering, Faculty of Engineering, Prince of Songkla

University, Thailand, consists of around 10 full-time lecturers and 60 of undergraduate and postgraduate students. The CNR just was founded in year 2000. The mission of the Centre is to enhance research and education through Government/University/Industry partnerships, and to be a centre of research excellence in this region and internationally.

The main objectives of the Centre are: To foster research and development in information and communications science technologies, and to offer manpower training, and enhance trained researchers in their understanding and application of strategic technologies.

The centre has 5 main research groups:

1. Next Generation Internet Protocol: The centre has been recognised as a leader of IPv6 in Thailand, the co-founder of Thailand IPv6 Forum. PSU has a collaborative research project with Institut National Polytechnique de Toulouse (INPT), *ENSEEIHT*, Toulouse, and University of Paris VI, France.
2. Multimedia and Voice over IP Networks: Multimedia and voice over IP network based on SIP project running at CNR is supported by NECTEC (National Electronics and Computer Center), Ministry of Science and Environment. PSU has developed SIP stack based on Java framework. Some applications based in SIP have been demonstrated, e.g. SIP based telephony, fast hand-over for real time traffic, e-learning with mobility.
3. Third Generation Mobile Phone

Systems: This is one of the largest research project which involving around 80 people. The group consists off 5 sub-groups: Radio Frequency, Front-end and Pre-processing, baseband processing, 3G software stack, and 3G applications. The contribution of PSU specifically to SIP includes:

4. E-learning: PSU have developed e-learning tools, e.g. LMS used by PSU with over 450 subjects, interactive distance learning (also are using by PSU).
5. Web Applications: some web based applications are deploy by local industries.

### Asian Institute of Technology (AIT)



AIT is an international graduate institution situated in Thailand. The Internet Education and Research Laboratory (intERLab) is a multidisciplinary research laboratory in AIT comprises of policy, application and Internet technology research groups. The network technology and the education groups have been associated with the Japanese WIDE project since 1997 and the INRIA's Planete group on Internet over satellite links. Its main concentration has been wireless networks such as satellite network and its application to remote classrooms. One of the products from intERLab is its E-learning Platform, Vclass, which has been widely adopted by many E-learning projects such as the ASEAN Virtual Institute of Science and Technology. The diagram below shows the different mobility action during year 1 :

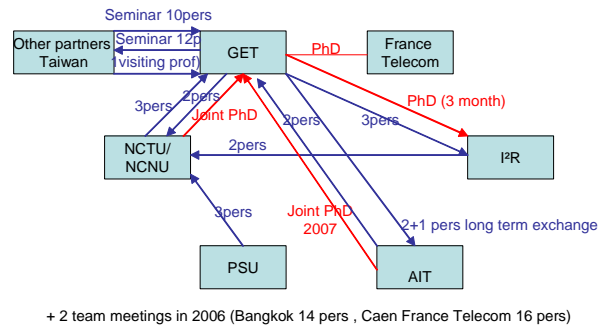


Figure 2. Actions between Project Members

Table 1 shows the contributors in each WP. NCTU leads two WPs (i.e., decentralised VoIP and interconnection of VoIP platforms). NCTU also joins two WPs (i.e., Mobility and Service Continuity and VoIP architectures on wireless broadband technologies).

Table 1.3 Contributors per WP

WP	Description	Lead	Contributors
Projet SUPER	Project management	GET-INT	GET-INT
WP 1	Service Architectures	FT	FT, GET-INT, AIT
WP 2	VoIP architectures on wireless broadband technologies	I²R	I²R, GET-INT, NCTU, AIT
WP 3	Mobility and Service continuity	GET-INT	GET-INT, I²R, NCTU
WP 4	Decentralised VoIP	NCTU	NCTU, GET-INT, I²R
WP 5	eLearning systems	PSU	PSU, AIT
WP 6	Interconnection of VoIP platforms	NCTU	All

In this cooperation project, we have the following publications.

- Architecture for converged services.
  1. Bertin E., Ben Yahia I., Crespi N., "Modeling IMS services", Journal of Mobile Multimedia, Rinton Press.
  2. E. Bertin, P. Lesieur, "Which architecture for integrated communication services ? ", IEEE International Conference on Networking and Services ICNS'06, Silicon Valley, USA, Juillet 16-18 2006



3. Crespi N., "Challenges of Multi-access to the IMS and impact on service architecture", Thailand IPv6 Summit, Bangkok. May 2-4 2006
  4. Gouya A., Crespi N., "Service Broker for Managing Feature Interactions in IP Multimedia Subsystem", Sixth International Conference on Networking ICN 2007, April 22 - 28, 2007 - Sainte-Luce, Martinique
  5. El Saghir B., Crespi N., "An Intelligent Assistant for Context-aware Adaptation of Personal Communications", IEEE Wireless Communications and Networking Conference WCNC 2007, 11-15 March 2007, Hong Kong.
- Service architecture: Service Broker
6. Gouya A., Crespi N. and Oueslati L., "Next Generation Network Service Architecture in the IP Multimedia Subsystem" Asian Internet Engineering Conference, Vol. 4311, pp. 48-60, 28-30 November, 2006, Bangkok, Thailand.
  7. Gouya A., Crespi N. and Bertin E. "SCIM (Service Capability Interaction Manager) Implementation Issues in IMS Service Architecture", IEEE International Conference on Communications, ICC 2006, Istanbul 11- 15 June 2006.
  8. Gouya A., Crespi N. Bertin E., and Oueslati L., "Managing Service Capability and Service Feature Interactions in the IMS of UMTS", IEEE International Conference on Networking and Services, ICNS'06, pp: 50-56, July 16-18, 2006, Silicon Valley, USA.
  9. Crespi N., "A distributed mechanism to resolve dynamically Feature Interaction in the UMTS IP Multimedia Subsystem", Sixth International Workshop on Applications and Services in Wireless Networks, ASWN 2006, Berlin. May 29-31, 2006.
- SIP Mobility
10. Gouya A., Crespi N., Bertin E. and Oueslati L., "Service Invocation Issues within the IP Multimedia Subsystem", submitted to IEEE Vehicular Technology Magazine (Acceptance notification September 30 2006).
  11. Gouya A., Crespi N. Bertin E., and Oueslati L., "Managing Service Capability and Service Feature Interactions in the IMS of UMTS", IEEE International Conference on Networking and Services, ICNS'06, July 16-18, 2006, Silicon Valley, USA.
  12. Che-Hua Yeh and Quincy Wu, "SIP Mobility in IPv4/IPv6 Network". The 21st Asia-Pacific Advanced Network (APAN) Meeting. Tokyo, Japan, January 22-26, 2006.
  13. Che-Hua Yeh, Quincy Wu, Yi-Bing Lin, "SIP Terminal Mobility for both IPv4 and IPv6", The 8th International Workshop on Multimedia Network Systems and Applications (MNSA) in The IEEE 26th International Conference on Distributed Computing Systems (ICDCS 2006). Lisbon, Portugal, July 4-7, 2006.
  14. Mani M., Crespi N., "Handover Considerations in future convergent wireless wire-line networks", IEEE GLOBECOM 2006 November 27 December 1 2006, San Francisco USA.
- VoIP Meshed networks
15. Bin Hong Lee, Guan Yan Cai, Yu Ge and Winston K.G. Seah, "VoIP Capacity over Wireless Mesh Networks", In Proceeding of

the 31st Annual IEEE Conference on Local Computer Networks (LCN), LCN2006, Tampa, Florida, U.S.A., November 2006.

- Book

16. Bertin E, Ben Yahia I., Crespi N, Chapter "Next Generation Networks" in "Encyclopédie Vuibert des Systèmes d'Information".

The research results have been disseminated in 3GPP standardization body (Third Generation Project Partnership [www.3gpp.org](http://www.3gpp.org)) through GET-INT and France Telecom:

- New work Item accepted at 3GPP for UMTS Release 7. This work Item introduces in Release 7 the concept of Service Broker, a functional entity to manage service interactions. "Enhanced WI on IMS Service Brokering enhancements" S2-062001, 3GPP TSG SA WG2, Shanghai, May 8th 12th 2006.
  - o Charging Requirements for Service Brokering, S2-070440, 3GPP TSG SA WG2 Architecture, S2#56, Florence, Italy, 15 - 19 January 2007,
  - o General Architecture Requirements for Service Brokering, S2-070436, 3GPP TSG SA WG2 Architecture, S2#56, Florence, Italy, 15 - 19 January 2007,
  - o Architecture Alternatives for Service Brokering , S2-070437, 3GPP TSG SA WG2 Architecture, S2#56, Florence, Italy, 15 - 19 January 2007,
  - o Security Requirements for Service Brokering , S2-070439, 3GPP TSG SA WG2 Architecture, S2#56, Florence, Italy, 15 - 19 January 2007

The interconnected VoIP testbed in this project consists of seven sites:

1. GET-INT,
2. Asian Institute of Technology (AIT),
3. France Telecom (FT),
4. Institute for Infocomm Research (I2R),
5. National Chiao Tung University (NCTU),
6. National Chi Nan University (NCNU),
7. Prince of Songkla University (PSU).

## Conclusion

This project (i.e., MySIP) has been a catalyst to create joint cooperation between the 6 partners of the project. At institutional level, signature of joint a MoU, signature of a Consortium Agreement, and a joint call for project are specifically created. A research level, we have joint contribution, regular meeting, and exchanges of persons. At educational level, two joint PhDs are ongoing. An important number of publications are published in international conferences, journals and books. A dissemination of the results of the project is in standardization with the accepted proposal of a new work at 3GPP. The interconnection of VoIP research platforms are built between the partners

## Self-Assessment

The partners in this project jointly submitted a research project proposal "*Multimedia Architectures and Applications based on SIP*" to French government and got

granted with funding of 37,750 € in 2006 and 2007, respectively. It is obvious that the reputation of the team members is recognized by French government.

### 出席國際學術會議報告

報告人姓名	吳坤熹	服務機構 及職稱	國立暨南大學通訊所 助理教授
會議時間	2006/9/14~2006/9/16	會議地點	法國諾曼第
會議名稱	(中文) 法國科學與高等教育局與亞洲地區資訊通訊領域合作會議 (英文) STIC-Asia Project Meeting		

報告內容:

#### 一.參加會議經過:

STIC-Asia Project Meeting 是由法國主導，與亞洲地區的夥伴進行資訊通訊領域學術合作的例行性會議。每半年一次。參加的夥伴共有來自法國的 France Telecom (FT)及 Institut National des Télécommunications (INT)，來自泰國的 Prince of Songkla University (PSU)，來自新加坡的 Institute for Infocomm Research (I2R)，隸屬於聯合國而設立在曼谷的 Asia Institute of Technology (AIT)，以及來自台灣的 National Chiao Tung University (NCTU)及 National Chi Nan University (NCNU)。

會議於第一天早上九點鐘開始，首先就計畫整體的議題，像是後勤支援、文件管理、NDA (Non-Disclosure Agreement) 等項目進行討論。接著就各技術分項進行專題報告及討論。第三分項 (Mobility and session continuity) 由 INT 的 Mehdi 報告 Handover criteria consideration in future convergent networks，第五分項

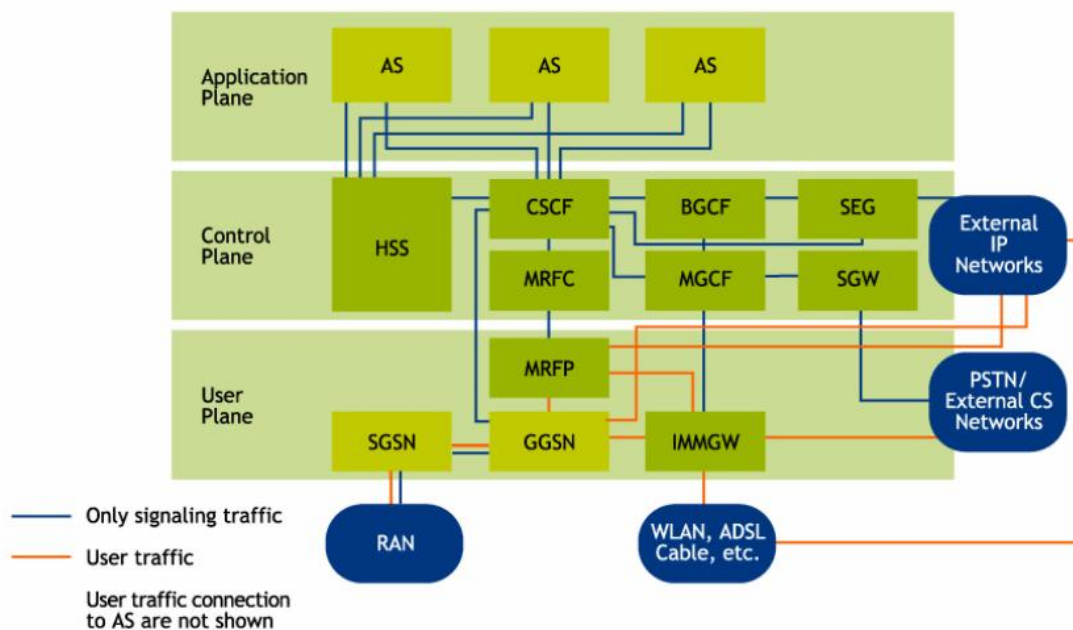
(eLearning systems) 由 PSU 的 Prof. Sinchai 報告 Architecture & Framework of SIP-based IDL: Components, Signals, and Design。中午略事休息後，於下午兩點繼續技術議程的報告。第二分項 (VoIP on wireless broadband) 由 I<sup>2</sup>R 的 Julia 報告 VoIP Capacity Analysis in Broadband Wireless Networks，以及由代表 NCTU 的吳坤熹教授報告 Research Group of OFDM Core Technology。第四分項 (P2P SIP) 由本次特別邀請與會的台大逢愛君教授報告 IMS P2P，INT 的 Mehdi 報告 IMS architecture for WiMAX，以及代表 NCNU 的吳坤熹教授報告 SIP Terminal Mobility over UDP/TCP/SCTP/DCCP。

由於法國電信的代表第一天必須出席另一個會議，因此第一分項 (Service Architecture) 的議程特別改到第二天來進行。由 FT 的 Emmanuel 報告 Which architecture for integrated communication services，INT 的 Anahita (INT): Managing Service composition issues in IMS，AIT 的 Apinun 報告 Thoughts and issues on implementing SCIM/SIMF functionality，INT 的 Bassam 報告 Context Awareness。第六分項 (Interconnection of VoIP Platforms) 由吳坤熹教授代表 NCTU 報告目前互連狀況。午餐過後，與會代表總結第一年的成果，並且著手準備下年度預計於

首爾（Seoul）的 STIC Asia 大會中提出的報告。

## 二.與會心得:

為了發展 All-IP Network 的服務，第三代行動通訊夥伴聯盟（3<sup>rd</sup> Generation Partnership Project）在新一代的標準 3GPP Release 5 中引進了 IMS（IP Multimedia Subsystem）的設計。IMS 的架構分為數個 Layer（如下圖），分別處理 Call Control, Service Control, 和 Media Control（也就是所謂的 User Plane）。



在第三代行動網路中，接取網路提供終端設備以各種有線與無線的方式，包括行動手機、802.11 Wireless LAN、ADSL、Cable Modem 等，連接到核心網路。IMS 核心網路的優點在於，不論使用者是在固定式網路或是行動網路，它可以讓服務提供者（Service Provider）以相同的方式來提供服務。如此可以不須針對不同接取網路上的使用者去設計不同的服務，對電信業者而言是一大利基。User Plane 的部份，負責傳送網路中的多媒體封包，包括聲音、影像、及各式資料等。Control Plane 的部份包含通話的建立與終止，以及通話路由（call routing）的決定。Application Plane 的部份則包含所有提供進階 IMS 服務的伺服器。此外，IMS 核心網路的模組化架構利用個別的伺服器來提供不同的服務，有利於以分散式的架構來降低成本，這點和傳統電信網路中，所有功能都集中在一部超大型的交換機很不一樣。

在選擇 IMS 元件間的通訊協定時，3GPP 選用了 Session Initiation Protocol (SIP)，作為 3GPP IMS 的主要信令協定。SIP 是 Internet Engineering Task Force (IETF)

針對多媒體服務所發展出來的信令協定，主要用於會談 (session) 的建立、修改、及結束。SIP 以其簡易、富有彈性、易於擴充等特點著稱，同時過去幾年在固定式網路下的網路電話系統中已有極佳的表現。SIP 的語法是以純文字為主的，看起來非常類似於 Hypertext Transfer Protocol (HTTP)。這種做法的好處在於過去已經有許多設計來剖析 (parse) HTTP 語法的程式，只需要稍加修改，就可以用來處理 SIP。

在本次會議中，很明顯地看到各國的研究團隊，不論是來自學術界或是電信業者，對於 IMS 和 SIP 兩項技術都非常重視。可預期這將是未來 3G 無線通訊中的主流技術之一。

### 三.考察參觀活動:

由於九月已屆開學，因時間限制，本次未再安排考察活動拜會法國之學術機構。

### 四.建議:

法國國家電信研究所 (INT - Institut National des Télécommunications) 是法國在資訊與通訊方面的高等教育及研究中心。全職人員共有 150 人，此外還有 800 位合聘的訪問學者與研究人員，分別來自學界與業界，均是通訊系統與電腦網路等領域具有豐富經驗的專家。他們在進行 3G IMS 系統相關的研究時，除了自行研讀 3GPP TS 23.228、TS 24.228 等標準文件外，亦取得 Nortel (北方電信) 所生產之 IMS 商用系統，供研究人員對照使用。同時，亦透過與 France Telecom (法國電信) 的合作，實際進行 IMS 於 3G 網路中應用模式的研究。台灣在相關的電信研究上，產官學研的合作往往都還沒有這麼密切，是值得我們學習之處。

### 五.攜回資料名稱及內容:

會議資料及投影片均以電子檔，放置於計畫網站上。但限於合作協議之限制，僅對計畫參與人員開放，不對外公開。