

**TITLE: Beyond Internet Telephony: SIP, IMS and P2P**

INSTRUCTOR: Adam Wierzbicki, Ph.D.

INTENDED DURATION: 4 hours

**DESCRIPTION – OBJECTIVES**

While Voice over IP is becoming a commonplace application of the Internet, the full potential of the SIP protocol will be realized with the ongoing convergence of the technology and business models of telecom operators' and the Internet. SIP is the signaling protocol of UMTS, and fourth generation (4G) networks are going to use SIP and IP technology. Telecom operators want to be more than bit carriers; their goal is the offering of complex services that can be accounted and billed, over a network that will be the result of a merger between the closed telecom network and the public Internet. For this purpose, the IP Multimedia System (IMS) has been developed, a rich middleware that utilizes SIP technology. IMS enables developers to create applications that fully integrate data, voice and video using SIP and IP, while making use of services provided and controlled by the operator. At the same time, in the Internet community, P2P-SIP is being developed with the goal of independence of infrastructure. This goal is partially in conflict with the aims of telecom operators. The use of SIP as a common tool for P2P applications is envisaged as a possibility. The addition of new middleware functions on top of P2P-SIP could facilitate the development of a P2P-IMS.

The tutorial will introduce participants to all of the relevant technologies: SIP, IMS, and P2P-SIP. The objective is first to understand SIP, and basing on this knowledge, to learn about IMS and P2P-SIP. Since all of these technologies are currently under development, the tutorial will introduce the most established parts of the technology, focusing on information that is being used by application developers. At the same time, the objective of the tutorial is to point out research and development problems relevant to the discussed subjects. Where possible, the tutorial will include programming samples in the form of handouts that can be used by the more advanced participants; however, to make the tutorial self-contained, the material related to programming will be regarded as additional. Another goal of the tutorial is for the participants to understand the trends of IMS and P2P-SIP development.

**CONTENT AND OUTLINE (bullets only + expected time per sub-topic)**

**1. The Session Initiation Protocol (1.5 hours)**

The SIP protocol in its basic version is a relatively simple, application layer protocol that resembles HTTP. Its messages and communication scenarios are not difficult to understand. The more complex part of SIP is its server infrastructure that is used to register users and resolve their addresses. More advanced usage scenarios involve SIP proxy servers. SIP can be used to establish any type of session and is therefore very useful in programming; several approaches to program with SIP in Java will be discussed.

- Introduction: goals and history
- SIP services
- SIP communication scenarios and messages

- SIP address resolution and user location
- SIP Registrar server
- SIP Proxy server
- The Session Description Protocol (SDP)
- Advanced SIP functions and extensions: subscription and notification; user mobility; multihomed users and session transfers; SIMPLE
- SIP Programming in Java (+code tutorial handouts)
  - JAIN SIP
  - SIP Lite
  - SIP Servlet
  - SIP for J2ME

## 2. The IP Media System (1 hour)

IMS is a service platform that has been developed as a standard for UMTS networks. It uses SIP proxy servers and specialized servers that interface with the operator's network QoS services. Additionally, IMS provides Authentication, Authorization and Accounting (AAA) services for the operator. There are currently many implementations of IMS. The tutorial will cover two of them: OpenIMS by Fraunhofer Institute and Ericsson IMS.

- Introduction: Next Generation (4G) Networks and motivation for IMS
  - 3GPP and IETF IMS standards
- AAA and the Diameter Protocol
- IMS and the UMTS standard
- IMS CSCF SIP Proxy Servers
- QoS in IMS
- AAA in IMS
- IMS SIP Signalling
- IMS extensions to SIP
- OpenIMS
- Ericsson IMS
- IMS Deployment and Evolution

## 3. Peer-to-Peer SIP (1.5 hours)

Peer-to-Peer SIP aims to distribute the registration and location services of SIP by using a P2P overlay network. The P2P SIP specification introduces the concepts of a P2P protocol that should be a general-purpose protocol of P2P overlay network design. There are many proposed version of this protocol; the main difference in the approach is whether SIP is used also as an underlying protocol for overlay formation (the SOSIMPLE approach) or whether the P2P Protocol should be standalone (Schulzrinne's Peer-to-Peer Protocol proposal). For understanding the P2P SIP proposal, participants must understand relevant issues of P2P overlay networks; the tutorial is self-contained in that respect. The tutorial also covers the possibilities of developing applications using the P2P model.

- Introduction: SIP server scalability and the Peer-to-Peer computing model
- P2P Structured Overlay networks
- Reliability and Persistence in P2P overlay networks
- NAT Traversal

- Stun
  - Teredo
- Security in P2P Overlay networks
- P2P SIP Reference model
  - P2P SIP Peer Protocol
  - P2P SIP Client Protocol
  - Types of P2P SIP nodes
- Distributing the SIP Location Service
- The Peer-to-Peer Protocol
- Mobility and Session Maintenance in P2P SIP
- SOSIMPLE
- Support for Peer-to-Peer SIP Application Development (+code tutorial handouts)
  - JXTA
  - Microsoft P2P SDK

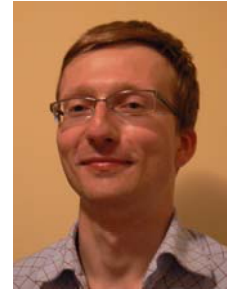
## WHO SHOULD ATTEND

Participants are expected to be familiar with Internet protocols such as HTTP and with IP networking. Knowledge of Java programming is not necessary, but would be useful for participants interested in the additional programming examples of the tutorial.

Participants who are working for telecom operators or for companies that develop services for telecom operators will benefit from an in-depth treatment of SIP, IMS, and P2P-SIP technology. Application developers will be interested to learn of the new possibilities offered by P2P SIP and IMS. ITC company managers are invited to learn about the technological background and new service opportunities of the IMS and P2P SIP technologies. Researchers should be able to identify the most challenging research and development problems in this emerging technological area.

## RELATED PREVIOUS TUTORIALS (if any)

This tutorial will be given for the first time.



## About the instructor

Adam Wierzbicki received his B.S. in mathematics and M.S. in informatics from the University of Warsaw, in 1997 and 1998. In June 2003, he received a Ph.D. degree from the Institute of Telecommunications of the Warsaw University of Technology. His Ph.D. thesis titled “Content Distribution and Streaming Media Communication on the Internet” concerned design of content delivery networks for improved quality and performance of streaming media communication.

Adam Wierzbicki is an expert in Peer-to-Peer computing. He has published several research papers on this subject and has been on the Program Chair of the International IEEE Peer-to-Peer Conference, as well as acted as co-editor of several journal issues on this subject. Apart from Peer-to-Peer computing, he is a specialist in the field of information security and trust management. His current research interests focus on trust management and fairness in distributed systems. Dr Wierzbicki heads the project uTrust (Universal Trust), financed by a research grant of the Polish Ministry of Science and Higher Education. See [uTrust.pjwstk.edu.pl/](http://uTrust.pjwstk.edu.pl/) for further details. Dr Wierzbicki has published several papers on applications of the theory of equity to providing fairness in open distributed systems. He is also interested in knowledge management and e-learning. His professional experience includes a research contract with Philips, Natlab and a two-year employment as a systems designer for Suntech, Ltd, a software company that specializes in telecom management. Adam Wierzbicki is currently employed at the Polish-Japanese Institute for Information Technology, where he has the position of Vice-Dean of the Department of Informatics. He is also a team member of the European 6<sup>th</sup> Framework Research project “eGov-Bus”.

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