

Applications and Services in Internet (4 cr)

Autumn 2007
Periods I, II

Course information

- Lectures are on Wednesdays at 16-18 in T5
- The requirements to pass this course:
 - Lectures and two home exams (period I)
 - An article (period II)
 - A seminar presentation (period II)

Course information

- The grading consist of two parts:
 - 1) two home exams
 - 2) an article and a presentation
- both parts must be passed
- the final grade will be the average of the grades of the two parts
 - effect of the presentation can be +/- one grade to the article grade

Prerequisites

- T-110.4100 Computer Networks
 - periods I, II

Course material

- Peer-to-peer systems and applications, Ralf Steinmetz, Klaus Wehrle
- SIP Demystified, Gonzalo Camarillo (ebrary)
- Internet Communications Using SIP, Henry Sinnreich, Alan B Johnston
- The IMS: IP Multimedia Concepts and Services, 2nd edition Miika Poikselkä, Georg Mayer, Hisham Khartabil, Aki Niemi (ebrary)

Course material

- **SIP in IETF** (<http://www.ietf.org/html.charters/sip-charter.html>)
- **SIP Simple** (<http://www.ietf.org/html.charters/sip-charter.html>)
- **SIP Forum** (<http://www.sipforum.org/>)
- **SIP P2P** (<http://www.p2psip.org/>)

Additional material

- Remember the TKK library services
 - Nelli
 - IEEE Xplore, ACM, Elsevier
 - ebrary
- Google scholar (sfx@TKK)
- Citeseer
- Distributed Systems – Concepts and Design, Coulouris, 2005

Contact information

- Course web pages:
 - <http://www.tml.hut.fi/Studies/T-110.7100/>
- General questions about the course:
 - T110.7100@tml.hut.fi

Sign up for the course

- Sign up for the lectures (and for the home exams) in WebTopi
- The topic of the article is requested by email
 - more details at the end of this lecture

Applications and Services in *Internet*

- Evolution of the Internet architecture
 - *End-To-End Arguments in System Design*, Saltzer, Reed, 1984
 - *Architectural Principles of the Internet*, Carpenter, 1996
 - *The Rise of the Middle and the Future of End-to-End: Reflections on the Evolution of the Internet Architecture*, Kempf, Austein, 2004
 - *Reflections on Internet Transparency*, Aboba, Davies, 2007
- Which is more valuable? Connectivity or services?

Applications and Services in *Internet*

- Few characteristics of the Internet:
 - datagram-oriented
 - no single-point of failure
 - applications are independent from the network
 - exceptions: performance metrics
 - users control the applications and selection of services!

Applications and Services in Internet

- Scalability
- Security and reliability
- Availability
- Flexibility and Quality of Service
- Complexity
 - "Things should be made as simple as possible, but no simpler." -- Albert Einstein
 - artificial dependencies vs. real dependencies
 - minimize artificial dependencies → loose coupling

Applications and Services in Internet

- Development of applications and services
 - results in a distributed system
 - uses Internet protocols
 - aims to reuse simple and generic interfaces
- Deployment of applications and services
 - at the edge of the network
 - distributed applications include a number of end-to-end communication flows
- Maintenance

System Architectures

- Client-server model
 - “best for simple and small applications or systems with a limited number of participants”
 - data retrieval $O(1)$, network load and storage capacity $O(N)$
 - scales poorly in large settings
 - single point of failure
 - top-down

System Architectures

- Peer-to-Peer model
 - minimal (or no) use of dedicated servers
 - all peers play similar roles
 - scales better than client-server and provides availability
 - bottom-up

Interaction models

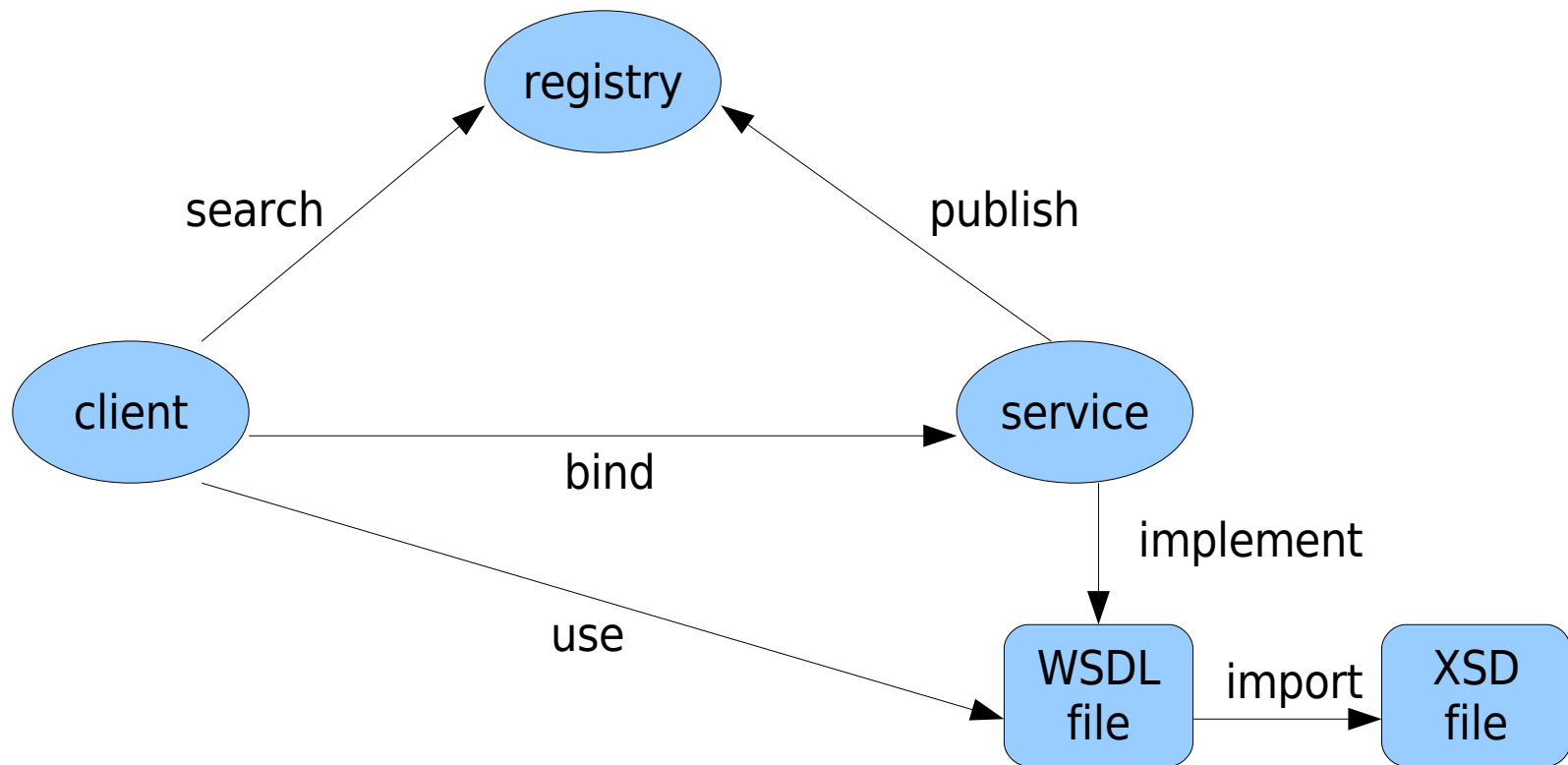
- Request-Reply (synchronous)
 - ie. clients and servers
 - upper and lower bound for processing time and for message delivery
 - a local clock drift rate from real time has known bound
- Publish-Subscribe (asynchronous)
 - intermediaries used to separate peers in time, in space, and in synchronization
 - ie. publishers and consumers

Applications and *Services* in Internet

- What is a service?
 - manages resources
 - provides exported functions that access the resources
- Service-Oriented Architecture
 - aims to provide loose coupling and software component integration
 - a definition for Web Services: SOA utilizing XML and Internet protocols

Web Services

- An overview



Peer-to-Peer System

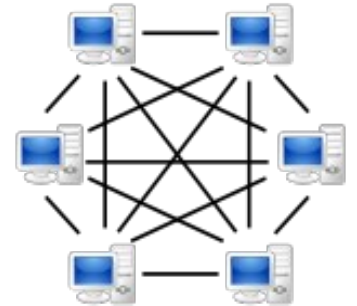
- "is a self-organizing system of equal, autonomous entities (peers) which aims for the shared usage of distributed resources in a networked environment avoiding central services." -- Steinmetz, Wehrle
- It is estimated that ~50-90% of the Internet traffic is due to P2P systems

Peer-to-Peer Systems

- Applications:
 - presence and instant messaging
 - collaboration and document management
 - file sharing
 - increased load-balancing and shared use of bandwidth
 - shared use of storage space and processor cycles
 - service discovery for Web Services?
 - publish-subscribe middleware?

Peer-to-Peer Systems

- Unstructured P2P
 - Centralized (ie. Napster)
 - Pure (ie. Gnutella v0.4)
 - Hybrid (ie. Gnutella v0.6, Skype)
- Structured P2P
 - Distributed Hash Table (DHT) (Pastry, Chord)

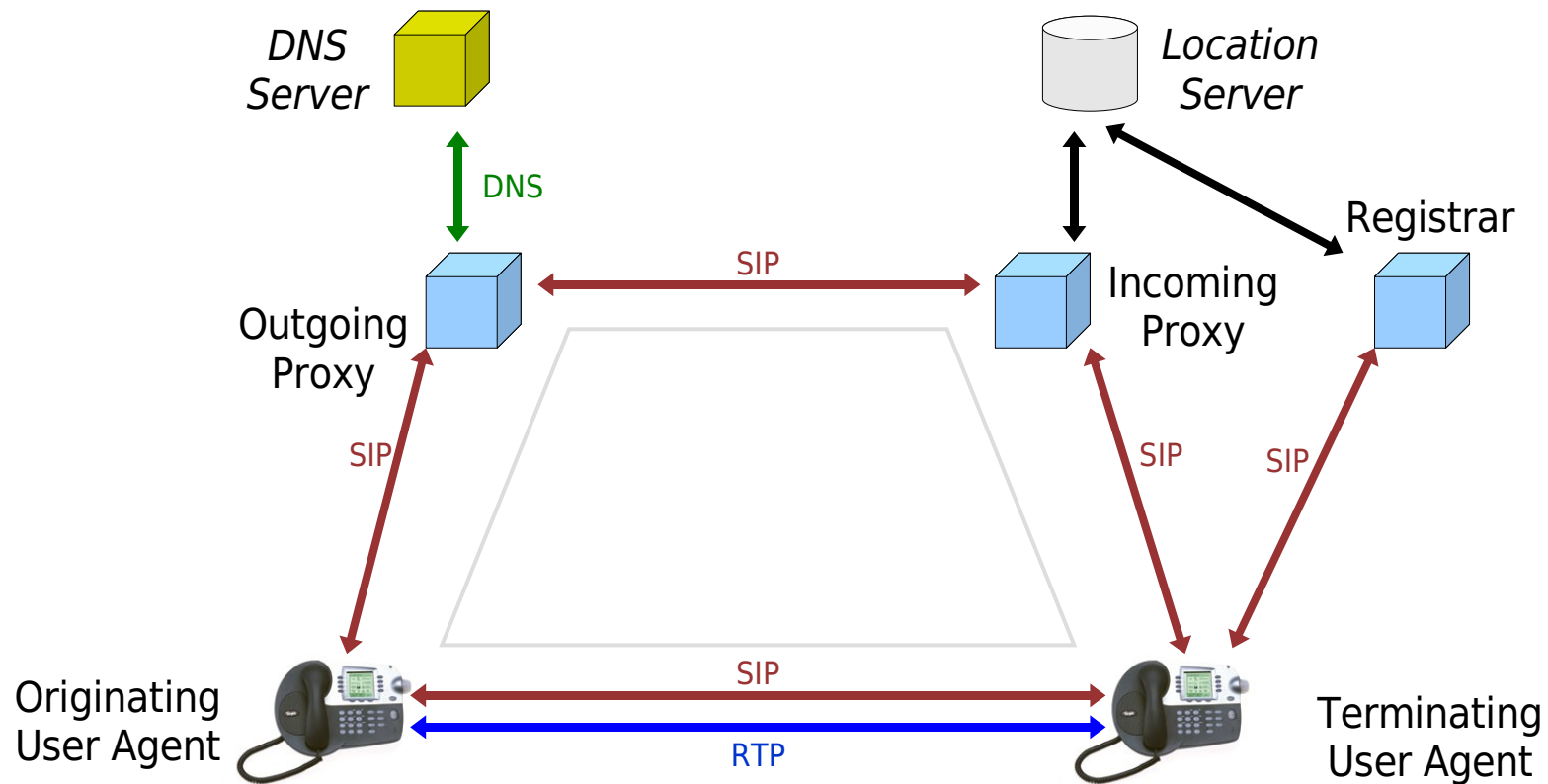


Session Initiation Protocol

- An Internet protocol standardized by the IETF
- inherits features from other protocols, such as HTTP and SMTP
- used for session initiation, modification, and termination
- extensible (IETF, 3GPP)

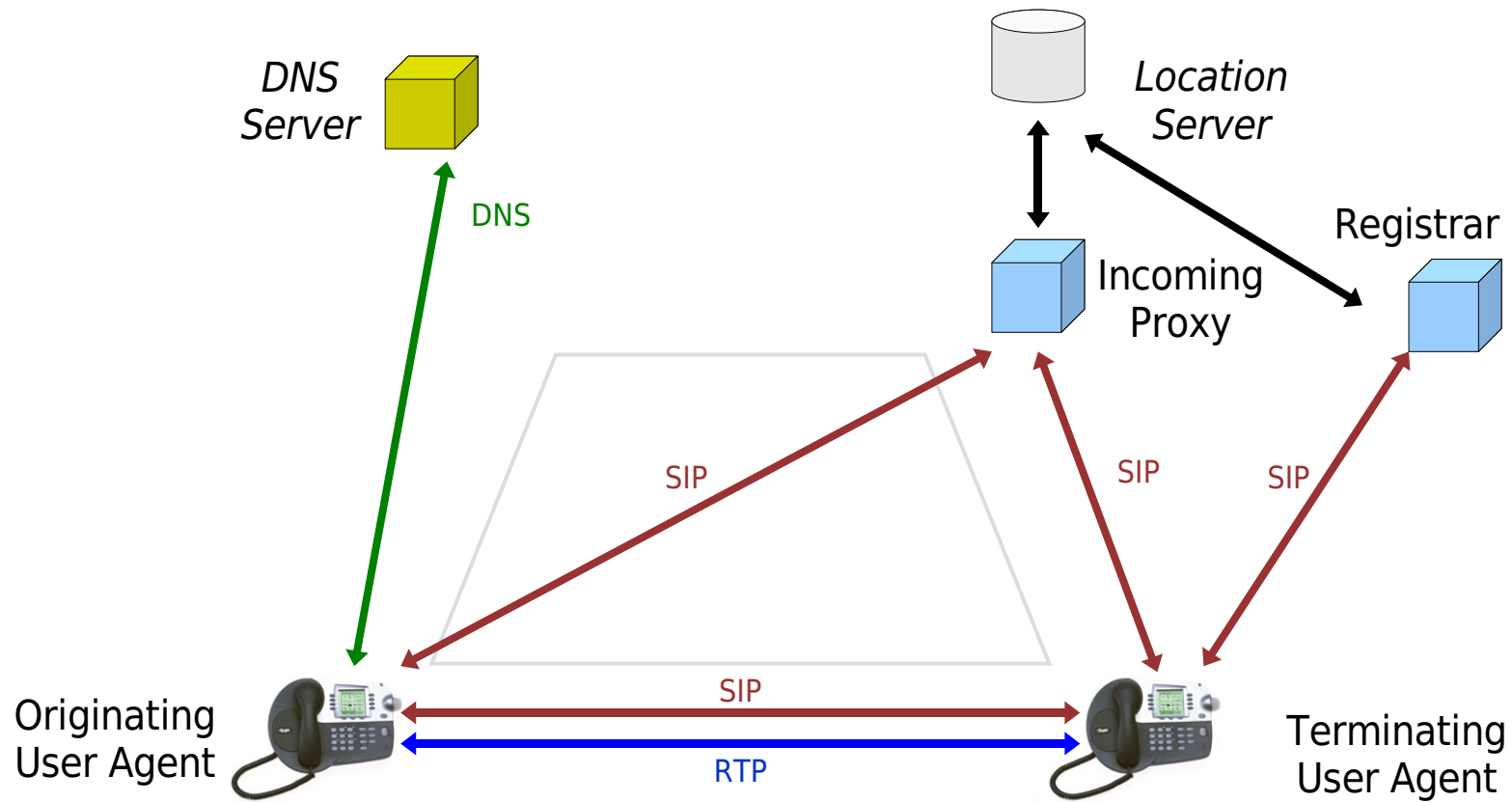
Session Initiation Protocol

- Trapezoid



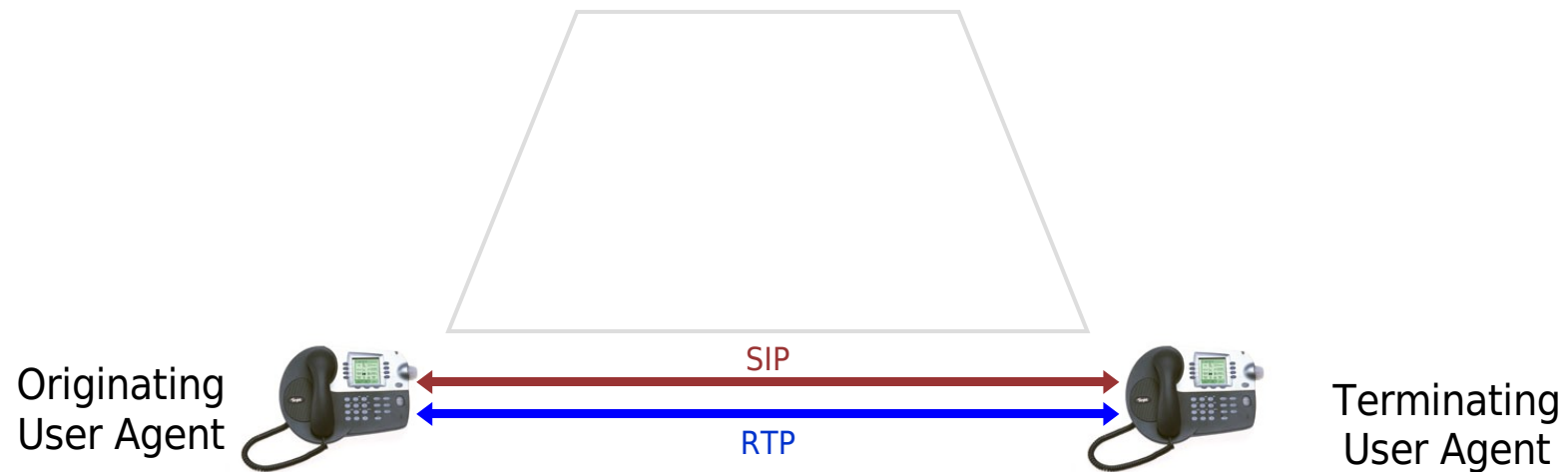
Session Initiation Protocol

- Triangle



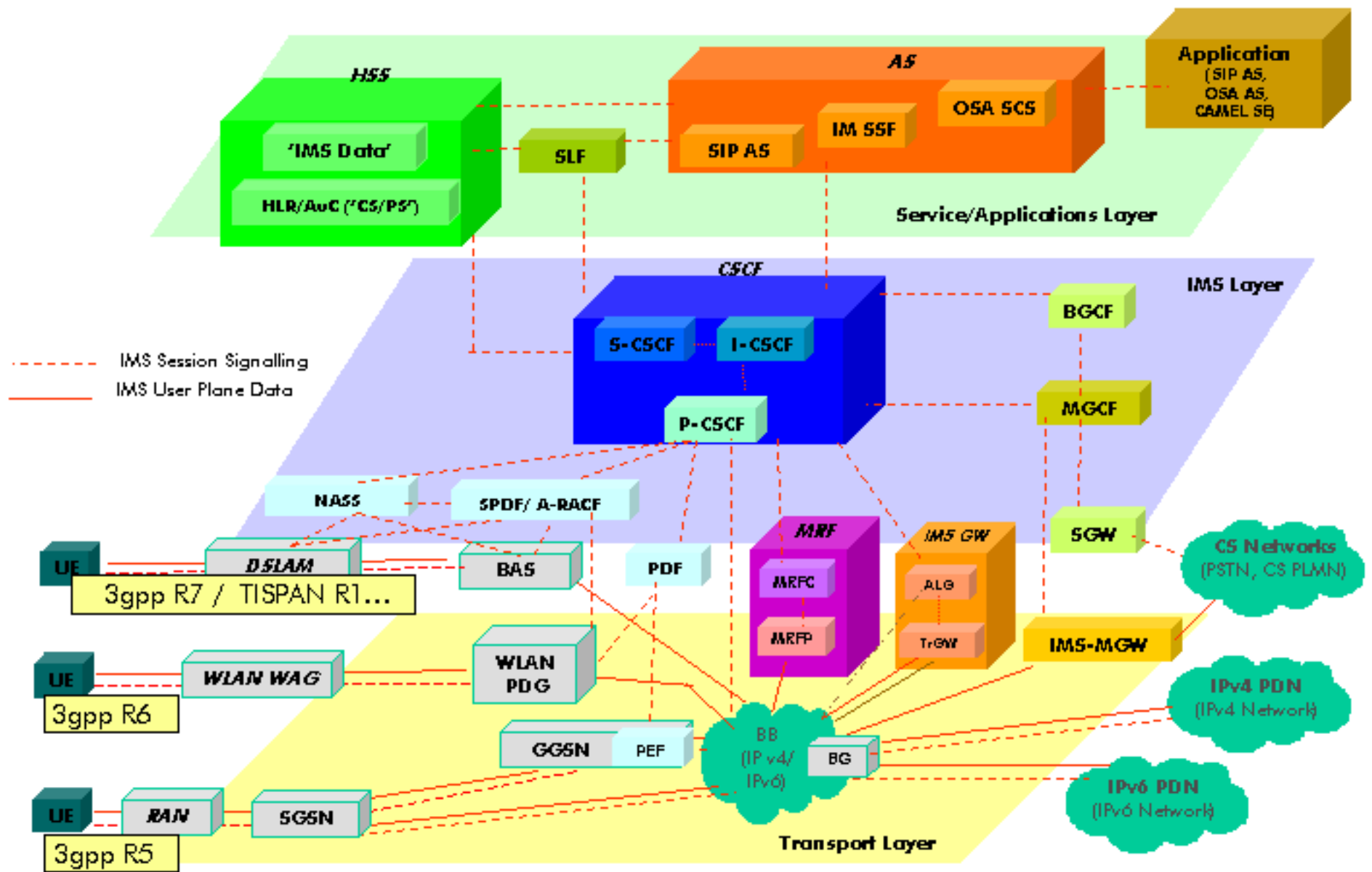
Session Initiation Protocol

- Peer-to-Peer



IP Multimedia Subsystem

- Layered architecture
 - user-, control- and application planes
- Access independency
- Few examples of the IMS entities:
 - Database: Home Subscriber Service (HSS)
 - Session management and routing: Call Session Control Functions (CSCF), ie. P-CSCF (SIP element)
 - Application Server



IP Multimedia Subsystem

- Services
 - Presence (ie. presence enabled phone book)
 - Messaging (Immediate, Session-based, Deferred)
 - Push to talk Over Cellular (PoC)
 - Conferencing
 - Group management

The 1. part: Home Exams

- Two home exams (P2P and SIP)
 - each includes three questions
- Based on the lectures and on the course material
- Returned by email to the course email address
- The grading scale: 0, 1, 3, 5 points
- The final grade of the home exams is the average of the both

The 2. part:

Articles and Presentations

- Use provided LaTeX template for the article
- A good article should include analysis, discussion or some new contribution to the topic of the article
- The grading criterion will be published on the web course page

How to progress...

- Select and prioritize three topics and send them to course email address
 - One primary topic with a short description of the idea of the article
 - Detailed instructions on the course page
 - **Deadline: 21.09.2007 at 16.00**
- After receiving the assigned topic, start writing a draft of the article and prepare a presentation based on the draft

Deliverables

- Submit a draft and give a presentation
 - Submit the draft of your article and your presentation slides two days before (on Monday) your presentation
 - Detailed presentation schedule will be published on the course page
- The final article is submitted in the end of this course