

### Introduction to the Course

Jaakko Kangasharji

General Overview

Course Topics Session Initiation Protocol XML and WWW Peer-to-Peer System

# Introduction to the Course Applications and Services in Internet 2008 (4 cr)

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Helsinki University of Technology

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### Outline

Introduction to the Course

Jaakko Kangasharju

General Overview

Course Topics Session Initiation Protocol XML and WWW Peer-to-Peer Systems

### 1 General Overview

**2** Course Topics



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### Introduction to the Course

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#### General Overview

Course Topics Session Initiation Protocol XML and WWW Peer-to-Peer Systems • So what does the course title mean, anyway?



### Introduction to the Course

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#### General Overview

- So what does the course title mean, anyway?
- Application layer: The layer above transport layer



### Introduction to the Course

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#### General Overview

- So what does the course title mean, anyway?
- Application layer: The layer above transport layer
- The *end-to-end principle*: Application functionality is impossible to implement as part of the communication subsystem (TCP/UDP)



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- So what does the course title mean, anyway?
- Application layer: The layer above transport layer
- The *end-to-end principle*: Application functionality is impossible to implement as part of the communication subsystem (TCP/UDP)





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- So what does the course title mean, anyway?
- Application layer: The layer above transport layer
- The *end-to-end principle*: Application functionality is impossible to implement as part of the communication subsystem (TCP/UDP)





Introduction to the Course

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#### General Overview

Course Topics Session Initiation Protocol XML and WWW Peer-to-Peer Systems • What is a service, then?



# Introduction to the Course

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#### General Overview

- What is a service, then?
- Services manage resources and provide access to them



# Introduction to the Course

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#### General Overview

- What is a service, then?
- Services manage resources and provide access to them
- Services are loosely coupled



### Introduction to the Course

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#### General Overview

- What is a service, then?
- Services manage resources and provide access to them
- Services are loosely coupled
- Service-Oriented Architecture, service composition



# Introduction to the Course

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#### General Overview

- What is a service, then?
- Services manage resources and provide access to them
- Services are loosely coupled
- Service-Oriented Architecture, service composition
- So we can cover pretty much anything we want!



### Course Areas

### Introduction to the Course

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Course Topics Session Initiation Protocol XML and WWW Peer-to-Peer Systems Design Communication patterns, theoretical modeling, "essential complexity" Development Concurrent activities, testing, "Postel's Law" Deployment Only at end-hosts, network effect Maintenance Access, piecewise upgrades, forward and backward compatibility



### General Requirements

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#### General Overview

- Availability
- Efficiency
- Flexibility
- Reliability
- Scalability
- Security
- Simplicity



# Client-Server Architecture

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General Overview

Course Topics Session Initiation Protocol XML and WWW Peer-to-Peer System • Server host provides a service, client hosts connect to it and access the service



• Server a single point of failure  $\Rightarrow$  Availability and scalability?



# Peer-to-Peer Architecture

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#### General Overview

- Network not divided to few servers and many clients but hosts that are all equal
- Service can be provided by multiple "peers"





# Peer-to-Peer Architecture

Introduction to the Course

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#### General Overview

- Network not divided to few servers and many clients but hosts that are all equal
- Service can be provided by multiple "peers"



- Well, that's the Internet! (in a way)
- How to find a peer providing the desired service?



# Application Communication Models

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#### General Overview

- One-off send
  - Varying levels of reliability
- Request-response
  - Synchronous or asynchronous
- Subscribe-notify
  - Separation in time and sometimes space
- Store-and-forward
  - Multi-hop on application layer



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### Course Topics

Session Initiation Protocol XML and WWW Peer-to-Peer System

### General Overview



### Course Content

# Introduction to the Course

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General Overview

### Course Topics

Session Initiation Protocol XML and WWW Peer-to-Peer System

- SIP Protocol for negotiating session establishment ... and a lot more
- XForms HTML forms on steroids, generic application platform

**REST** Architectural principles of the WWW

Peer-to-Peer Ditch client-server, equality among hosts



### Material

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### Course Topics

Session Initiation Protocol XML and WWW Peer-to-Peer System

- SIP Demystified, Gonzalo Camarillo
- XForms: XML Powered Web Forms, T. V. Raman
- Architectural Styles and the Design of Network-based Software Architectures, Roy Fielding, Ph.D. Thesis
- "Principled Design of the Modern Web Architecture", Roy T. Fielding and Richard N. Taylor, ACM Transactions on Internet Technology, vol. 2, no. 2, pp. 115–150
- *Peer-to-Peer Systems and Applications*, Ralf Steinmetz and Klaus Wehrle



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#### Course Topics

Session Initiation Protocol XML and WWW Peer-to-Peer System

### General Overview

### Ourse Topics Session Initiation Protocol

XML and WWW Peer-to-Peer Systems



## SIP Fundamentals

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### Course Topics

Session Initiation Protocol XML and WWW Peer-to-Peer System

- Originally, an application-layer protocol for managing multimedia sessions
- Nowadays, pretty much any kind of session
- Extensibility
- Proxy-based architecture



# SIP Trapezoid



![](_page_24_Figure_3.jpeg)

![](_page_25_Picture_0.jpeg)

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Course Topics Session Initiation Protocol

XML and WWW

### 1 General Overview

### **2** Course Topics

Session Initiation Protocol

### XML and WWW

![](_page_26_Picture_0.jpeg)

# Why XForms?

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Course Topics Session Initiation Protocol

XML and WWW

- Web moving towards XML-based XHTML from HTML (well, perhaps not...)
- Forms important in Web applications, XHTML needs forms too
- XHTML principle: modularization
- XForms: An independent XML vocabulary for forms

![](_page_27_Picture_0.jpeg)

# XForms Applicability

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Course Topics Session Initiation Protocol

XML and WWW

- Model-View-Controller approach
  - $\Rightarrow$  Suitable for a wide variety of platforms
- Can fill out data for any XML language
  - $\Rightarrow$  Integrates with non-XForms-aware requirements

![](_page_28_Picture_0.jpeg)

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Course Topics Session Initiation Protocol

XML and WWW

Peer-to-Peer Systems

• Question: How do we design a scalable distributed system?

![](_page_29_Picture_0.jpeg)

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Course Topics Session Initiation Protocol

 $\mathsf{XML}$  and  $\mathsf{WWW}$ 

- Question: How do we design a scalable distributed system?
- Answer: Look at examples

![](_page_30_Picture_0.jpeg)

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Course Topics Session Initiation Protocol

XML and WWW

- Question: How do we design a scalable distributed system?
- Answer: Look at examples
- The Internet scales pretty well...
  - more than  $2.8\times10^9$  IP addresses, nearly 30,000 ASs, more than  $1.4\times10^9$  users

![](_page_31_Picture_0.jpeg)

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Course Topics Session Initiation Protocol

XML and WWW

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- The World Wide Web too
  - more than  $1\times 10^8$  sites, more than  $27\times 10^9$  pages

![](_page_32_Picture_0.jpeg)

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Course Topics Session Initiation Protocol

XML and WWW

- Question: How do we design a scalable distributed system?
- Answer: Look at examples
- The Internet scales pretty well...
  - more than  $2.8\times10^9$  IP addresses, nearly 30,000 ASs, more than  $1.4\times10^9$  users
- The World Wide Web too
  - more than  $1\times 10^8$  sites, more than  $27\times 10^9$  pages
- What are the principles of WWW that allow it to scale?

![](_page_33_Picture_0.jpeg)

### **REST Style Constraints**

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Course Topics Session Initiation Protocol

XML and WWW

- Client-cache-stateless-server
- Uniform interface
- Layered system
- Code-on-demand (optional)

![](_page_34_Picture_0.jpeg)

### **REST Style Constraints**

### Introduction to the Course

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General Overview

Course Topics Session Initiation Protocol

XML and WWW

- Client-cache-stateless-server
- Uniform interface
- Layered system
- Code-on-demand (optional)
- Implementation: HTTP and URI

![](_page_35_Picture_0.jpeg)

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### 2 Course Topics

Session Initiation Protocol XML and WWW

![](_page_36_Picture_0.jpeg)

## Peer-to-Peer Applications

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General Overview

- Instant messaging and presence
- Content distribution
- Storage and processor sharing
- Collaborative work

![](_page_37_Picture_0.jpeg)

# Peer-to-Peer Applications

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General Overview

- Instant messaging and presence
- Content distribution
- Storage and processor sharing
- Collaborative work
- Not just for pirating sharing with your neighbor

![](_page_38_Picture_0.jpeg)

### Peer-to-Peer Architectures

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- Unstructured, keyword searching
  - Centralized (Napster)
  - Decentralized (Gnutella)
  - Hybrid (Kazaa)
- Structured, key-value lookup
  - Distributed Hash Tables (Chord, Pastry, Tapestry)

![](_page_39_Picture_0.jpeg)

### Lecture Over

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# Have a good week!