Cenni sui Sistemi Distribuiti

Definizione

Esempi: Internet, WWW

Modelli di Sistemi Distribuiti:

architettura, interazione, errori, sicurezza

Some material from:

Coulouris, Dollimore and Kindberg

Distributed Systems: Concepts and Design

Edition 5, © Addison-Wesley 2011

Outline

- introduction to distributed and web systems
- introduction to network programming concepts
- terminology …

ARP, ATM, CDMA, CDPD, CSMA, DQDB, DNS,FAQ, FTP,GSM, ISO,ITU,MAC, MACA,MAN,NAP,NNTP,NSAP, OSI, PPP, PTT, SAP, SDH, SNA, SNMP, TCP, UDP, WWW, HTML, XHTML, XML, REST, SOAP, WSDL, ….

What is a Distributed Systems ?

- “A distributed system is a collection of autonomous hosts that are connected through a computer network. Each host executes computations and operates a distribution middleware, which enables the components to coordinate their activities via message-passing in such a way that users perceive the system as a single, integrated computing facility.”

Facts from the definition

1. Hosts
2. Computer Network
3. Distributed computations
4. Middleware
5. Message-passing
6. Perceive single and integrated

- Concurrency of components
- Lack of global clock
- Independent failures of components

Examples

- IP based networks
  - Internet
  - WWW
  - …
- Mobile networks
  - GSM/WAP
  - GPRS
  - UMTS
  - 3G
  - LTE

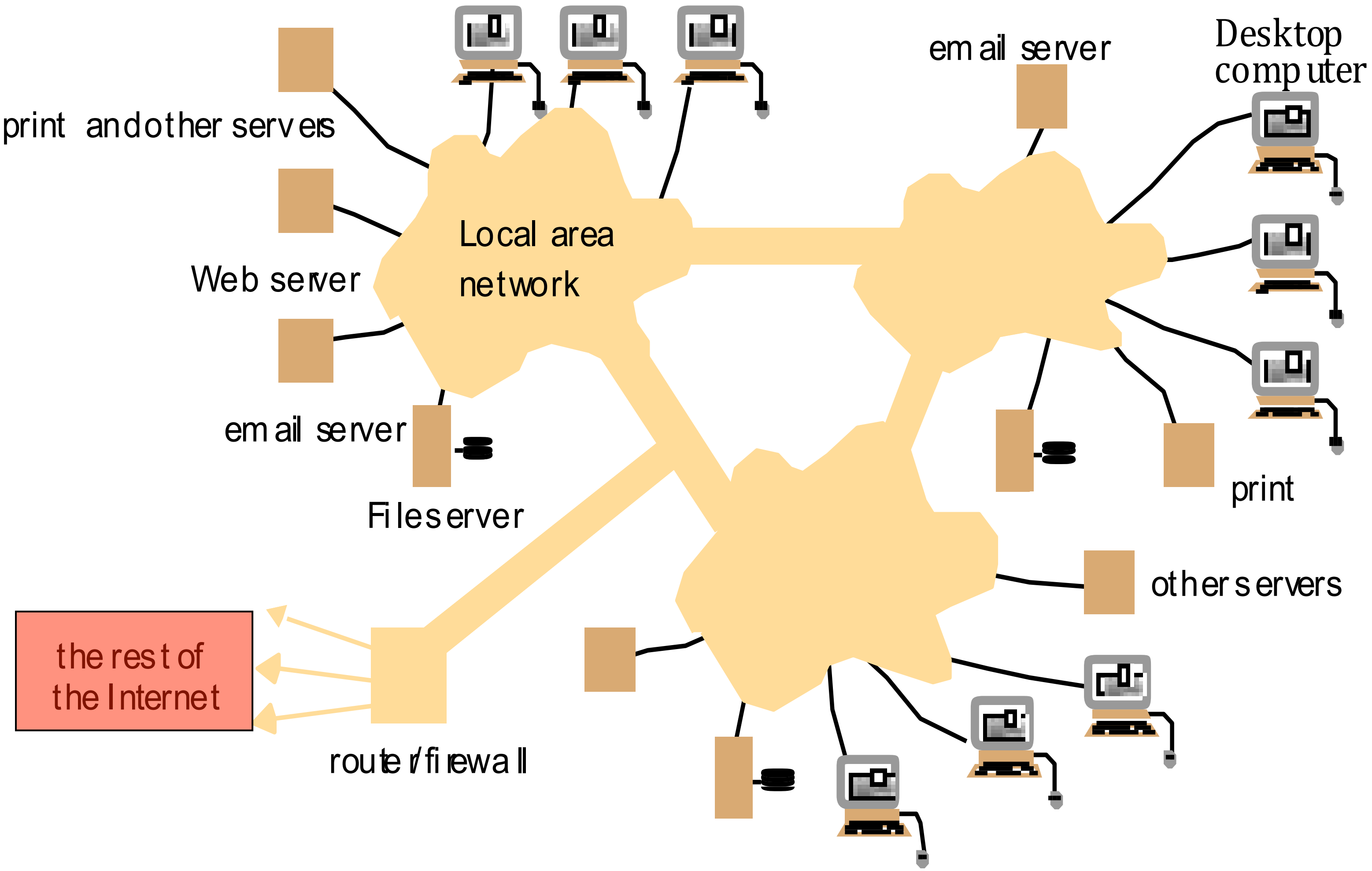
Internet

1. Hosts: computers connected to the Internet
2. Network: satellite links, optical fiber, ethernet, electrical, …
3. Distributed computations: each host has computational power
4. Middleware: TCP/IP based software, UDP, …
5. Message-passing: TCP/IP protocol
6. Perceive single and integrated: the Internet is one entity

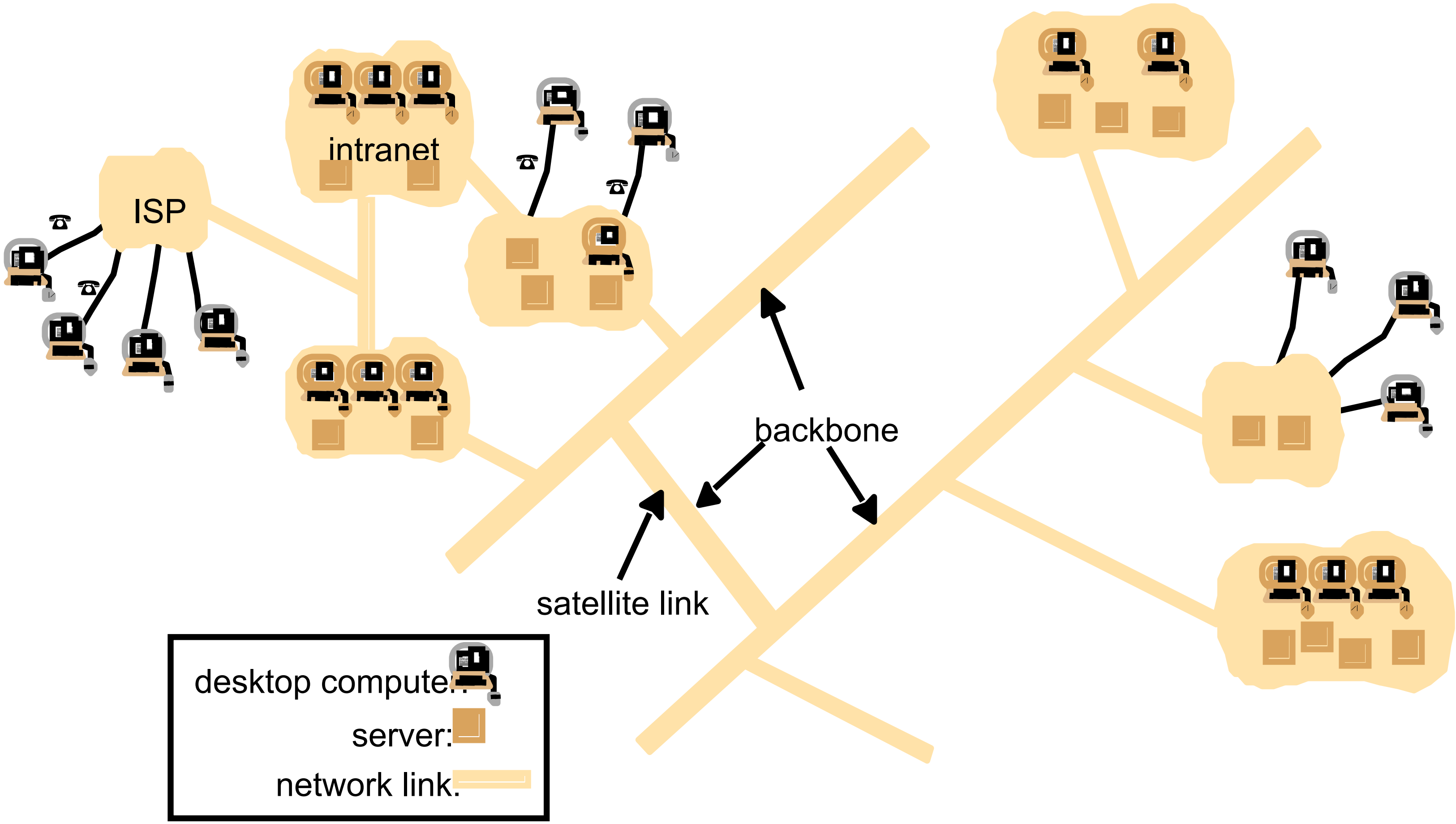
- Concurrency of components: hosts work concurrently
- Lack of global clock: the Internet has no global clock
- Independent failures of components: in general the failure of a host is independent from the failure of a different host

- History: first two nodes ARPANET : ???

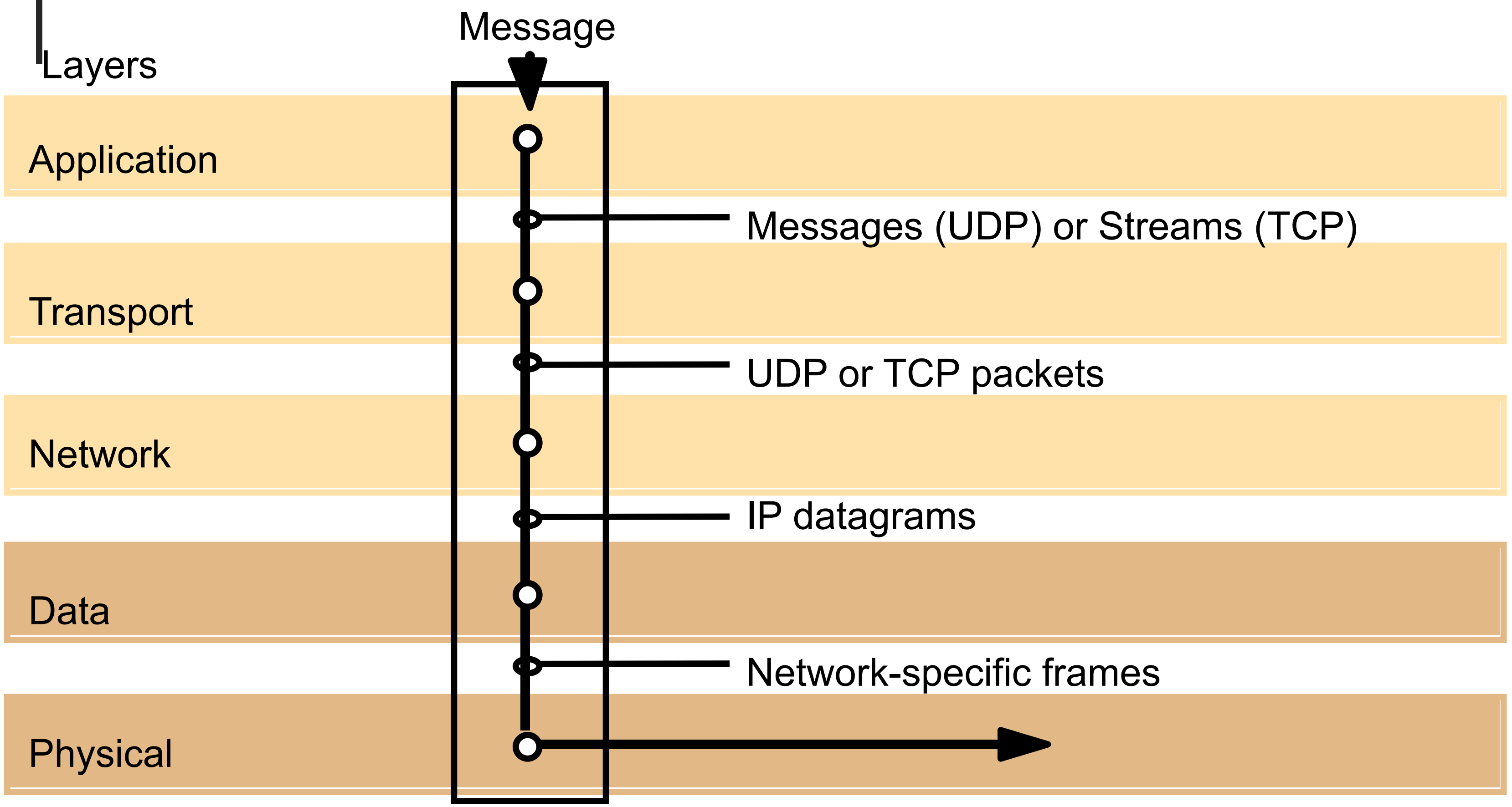
A typical Intranet



A typical portion of the Internet



TCP/IP layers



WWW

- World Wide Web
- Started for Hypermedia sharing over the Internet (Tim Burners-Lee, CERN, ???)
- Based on
  - URI (uniform resource identifier)
  - TCP/IP (Internet protocol)
  - HTML (hypertext markup language)
  - HTTP (hypertext transfer protocol: client-server)

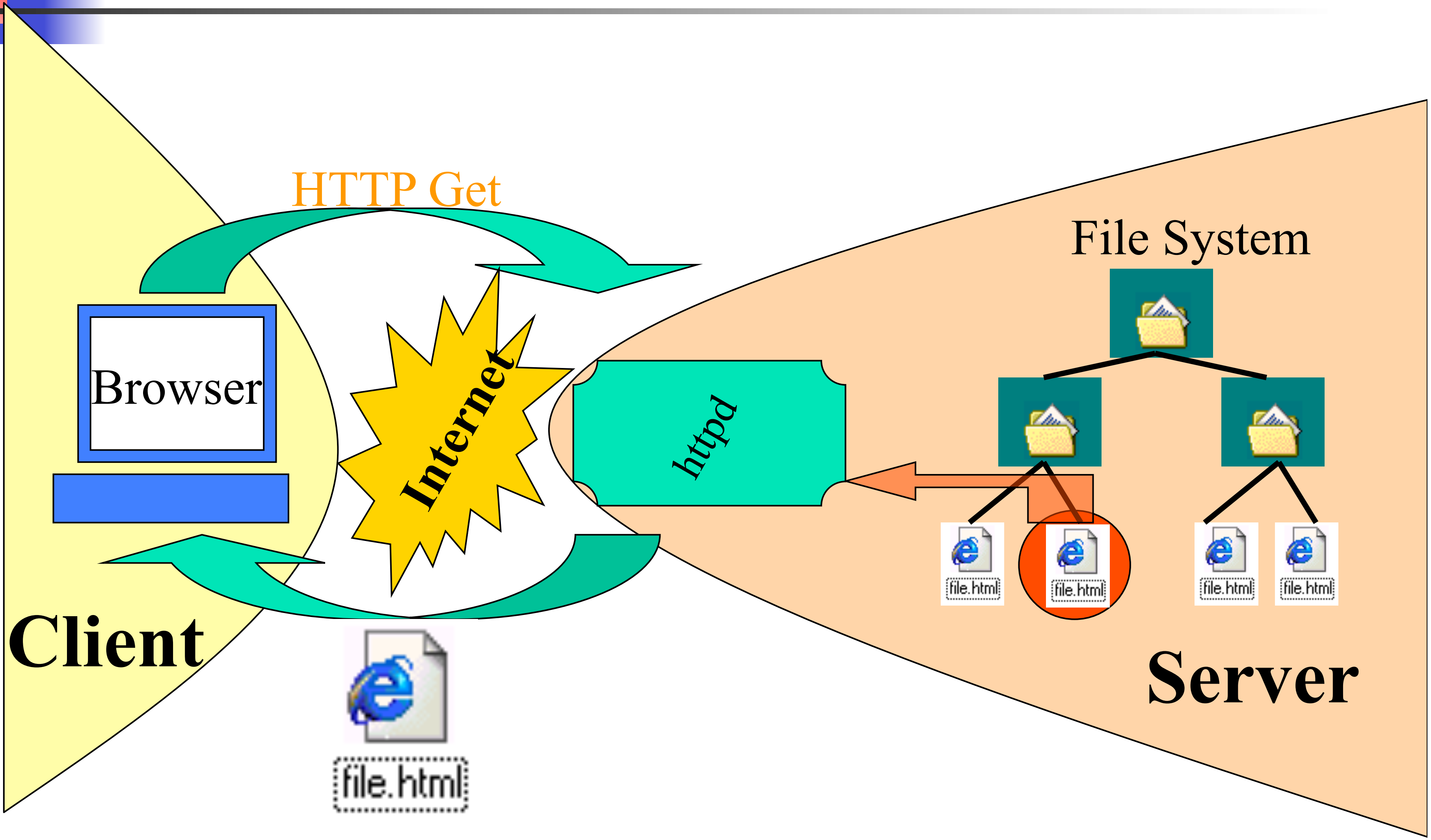
Brief History of HTTP

- 1989, the Http protocol was proposed by Tim Bernes Lee and was used at CERN

- Summer of 1991, the http protocol was released to the public.
- 1993: Marc Andreessen (then a grad student at NSCA) posts Mosaic on an ftp site. New features include:
  - Hyperlinks
  - Embedded images

- December 1993: Mosaic growth makes the front page of New York Times
- 1994: Marc Andreessen and colleagues leave NSCA to form Mosaic Corp. (later renamed “Netscape”)

The primitive Web Model



WWW

- Based on
  - URI (uniform resource identifier)
  - TCP/IP (Internet protocol)
  - HTML (hypertext markup language)
  - HTTP (hypertext transfer protocol: client-server)

URI = URL+URN

- URI *Uniform Resource Identifier* is a standard mechanism to identify electronic resources
- URI =*Uniform Resource Locator + Uniform Resource Name*
- Syntax:

  <scheme> : <scheme dependent info>

- Example:

  http : //www.isoc.org/internet/history/

URI: examples

- Hyper Text Transfer Protocol **(HTTP)** for Web

  `http://<host>:<port>/<path>?<searchpart>`

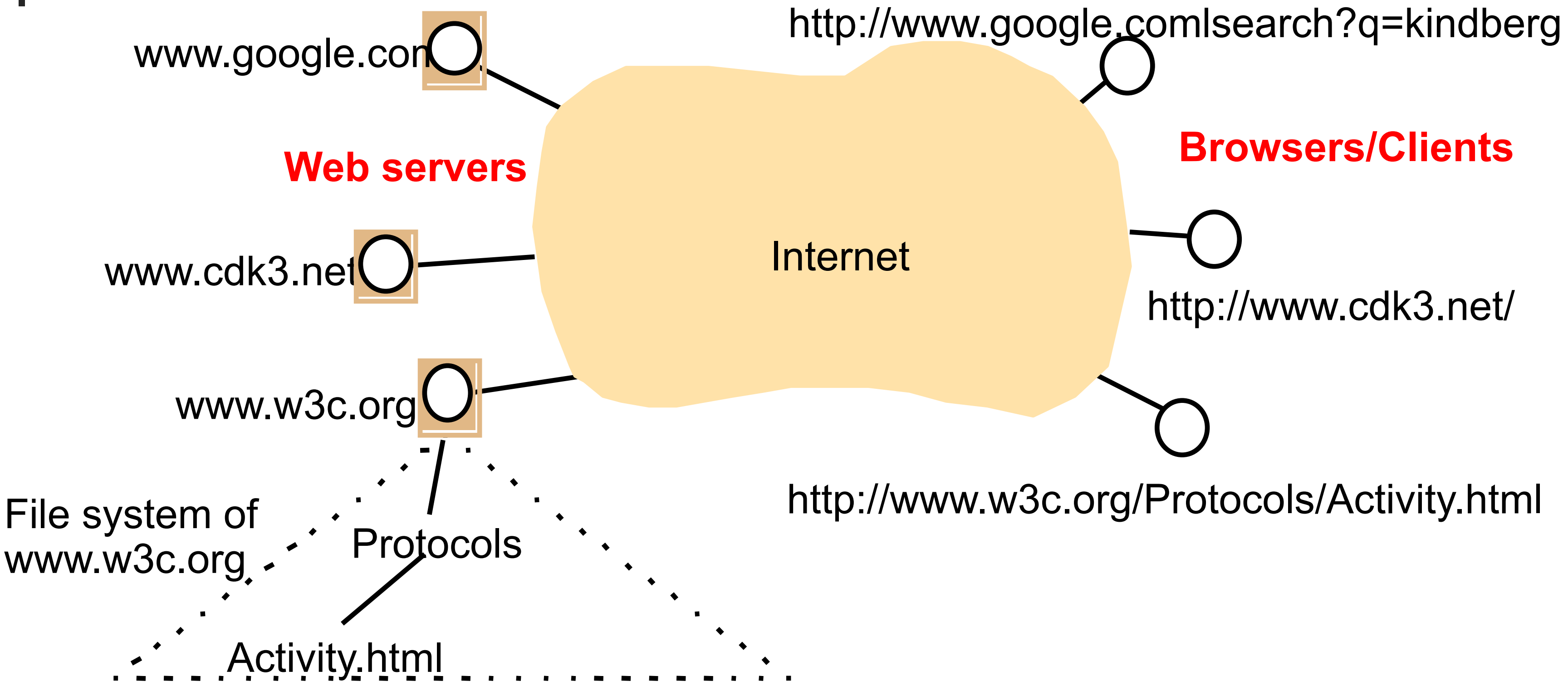
- email **(mailto)**

  `mailto:<account@site>`

- FileTransferProtocol **(FTP)**

  `ftp://<user>:<password>@<host>:<port>/<cwd1>/<cwd2>/.../<cwdN>/<name>;type=<typecode>`

URI + TCP/IP


www.google.com
http://www.google.comlsearch?q=kindberg
Web servers
Browsers/Clients
www.cdk3.net
Internet
http://www.cdk3.net/
www.w3c.org
File system of
www.w3c.org
Protocols
Activity.html
http://www.w3c.org/Protocols/Activity.html

HTML
Hyper Text Markup Language

- Standard
- Tag based

Chi lo conosce ?

```
<!doctype html public "-//w3c//dtd html 4.0 transitional//en">
<html>
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1">
  <meta name="GENERATOR" content="Mozilla/4.7 (Macintosh; I; PPC) [Netscape]">
  <title>marchese.it
  </title>
</head>
<BODY TEXT="#000000" BGCOLOR="#FFFFFF" LINK="#3333FF" VLINK="#3366FF" ALINK="#CC3232">
<center><a href="users.html"><img SRC="images/marchese.gif
" ALT=“marchese.it" BORDER=0 height=400 width=400></a>
<br>&nbsp;
<br>&nbsp;
<br>&nbsp;
<a href="http://www.apple.com/macosx"><img SRC="PoweredByMacOSX.gif"
                                           ALT="PoweredByMacOSX.gif" BORDER=0></a>
</center>
</body>
</html>
```

HTTP
Hyper Text Transfer Protocol

- Request-reply protocol
- Different content types (txt, jpg, mov, …)
- One resource per request (one page may imply many request: e.g., one for the html and one for every image)
- Support a simple access protocol (URL)

- Example:

```
http://<host>:<port>/<path>?<searchpart>
```

Distributed System Models

Modelli di Sistemi Distribuiti:
architettura, interazione

System Models

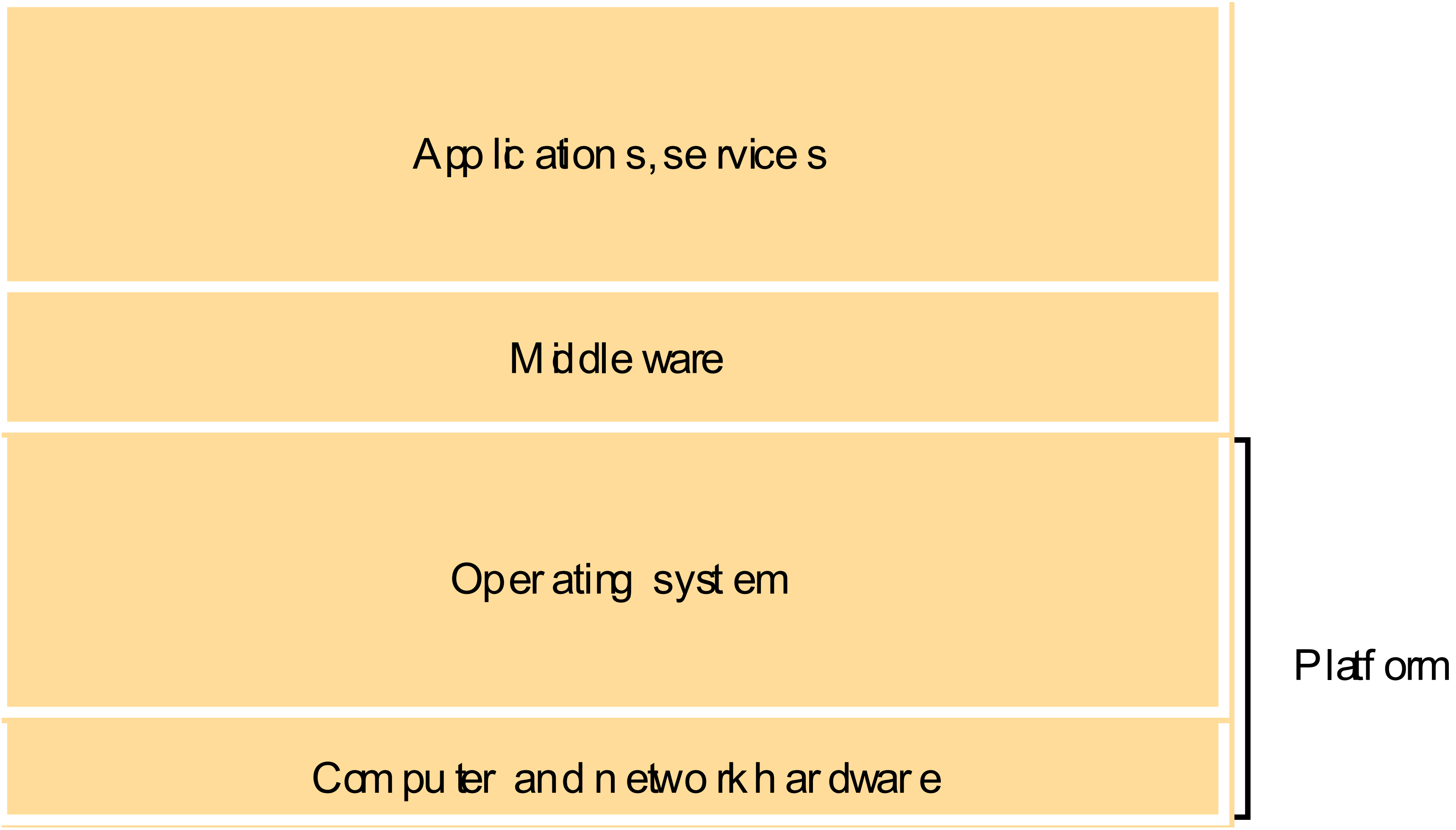
- A **system model** is necessary to precisely and uniquely specify the relationship between different components of a distributed system and its behaviour as a whole.
- Different aspects of a distributed system need to be model:
  - **Architecture (e.g., client-server)**
  - **Interaction (e.g., syncronus messages)**
  - Failure (e.g., types of channel exceptions)
  - Security (e.g., types of attacks to a host)

Architecture: software layers

- A distributed system can be modeled in terms of different layers:
  - Application layer
  - Middleware
  - OS layer

- Lower layers are more heterogeneous
- Higher layers give the feeling of the distributed system as a whole

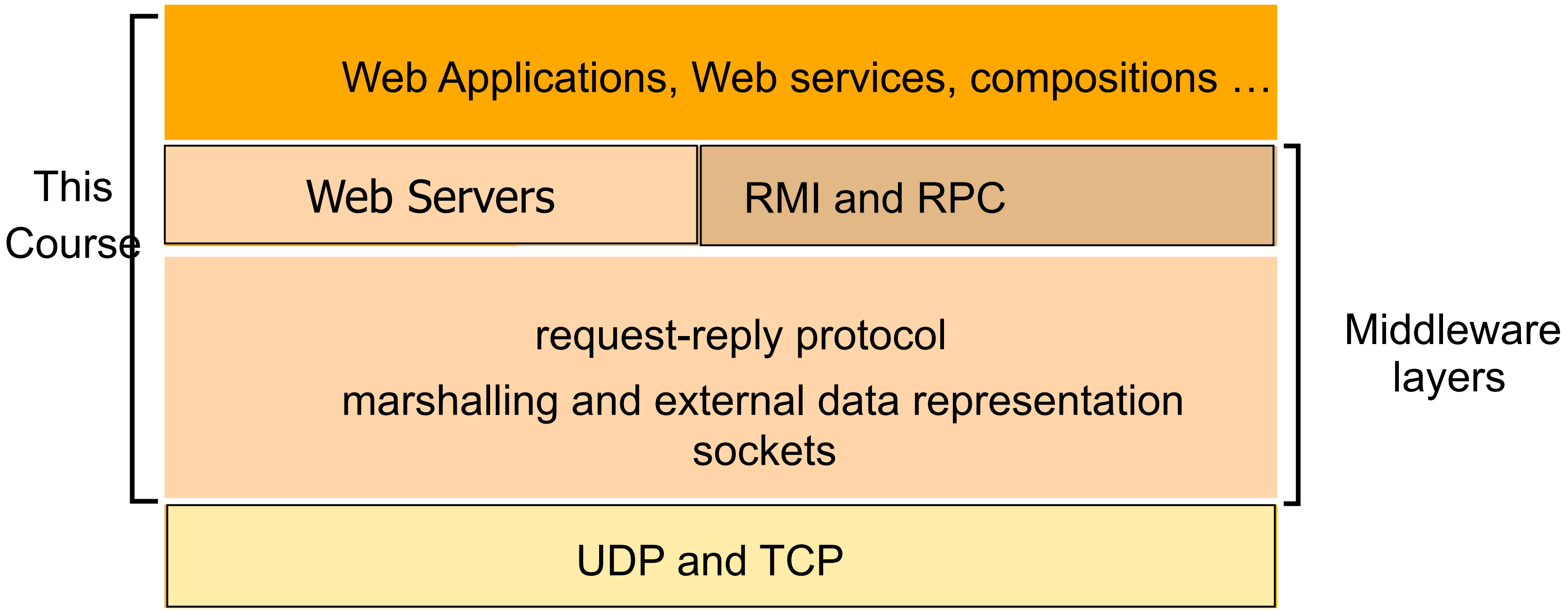
Software and hardware service layers



Middleware

- **Middleware**: software layer which abstracts from network hardware, computing hardware, operating systems, programming languages and different implementations providing a uniform computational model
  - Examples:
    Sockets API, CORBA, Java RMI, DCOM, J2EE, .NET, Web Services protocol stacks,..

This course


Web Applications, Web services, compositions …
Web Servers
RMI and RPC
request-reply protocol
marshalling and external data representation
sockets
UDP and TCP
This Course
Middleware layers

Architectural models

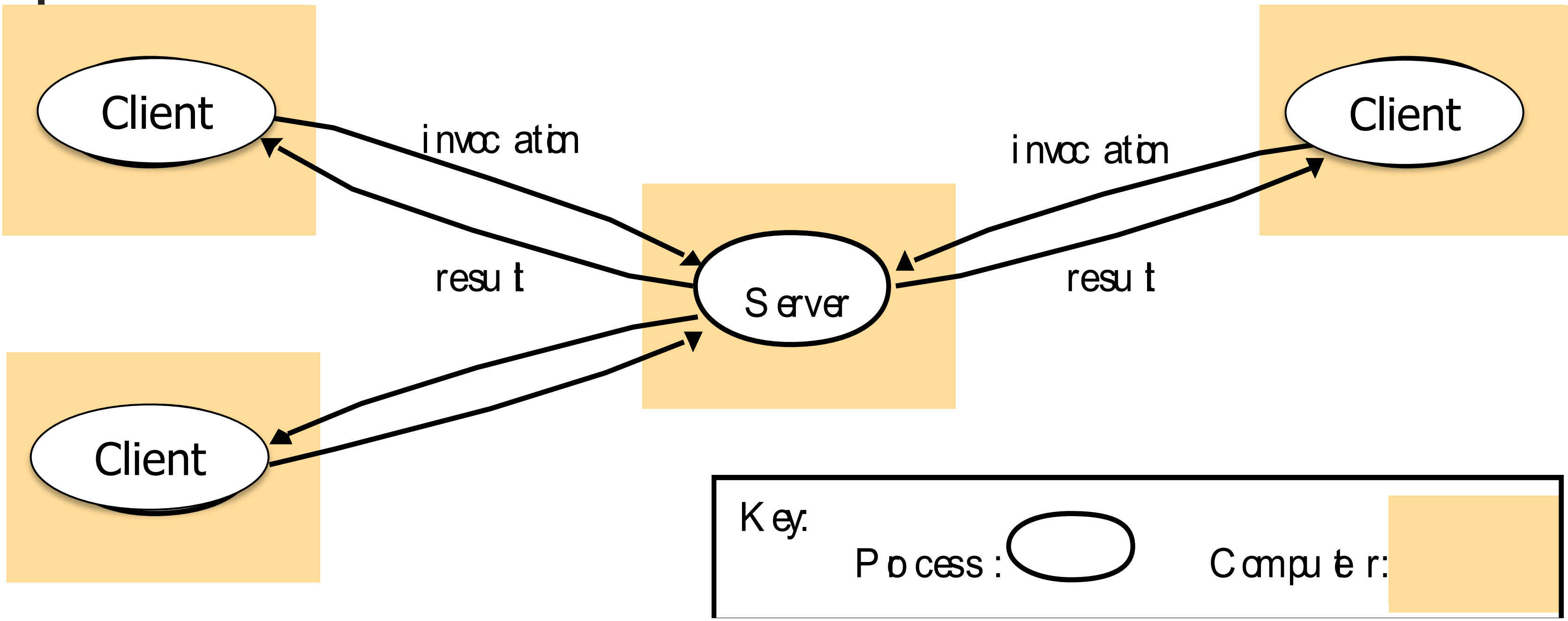
1. Client-server
   - Architectural variations:
     - One server-many clients
     - Many servers-many clients
     - Intermediaries: proxies, load balancing mediators
   - Computational load variations
     - Mobile code (applets, scripts)
     - Mobile agents

       } load towards the client
     - Network computers
     - Thin clients

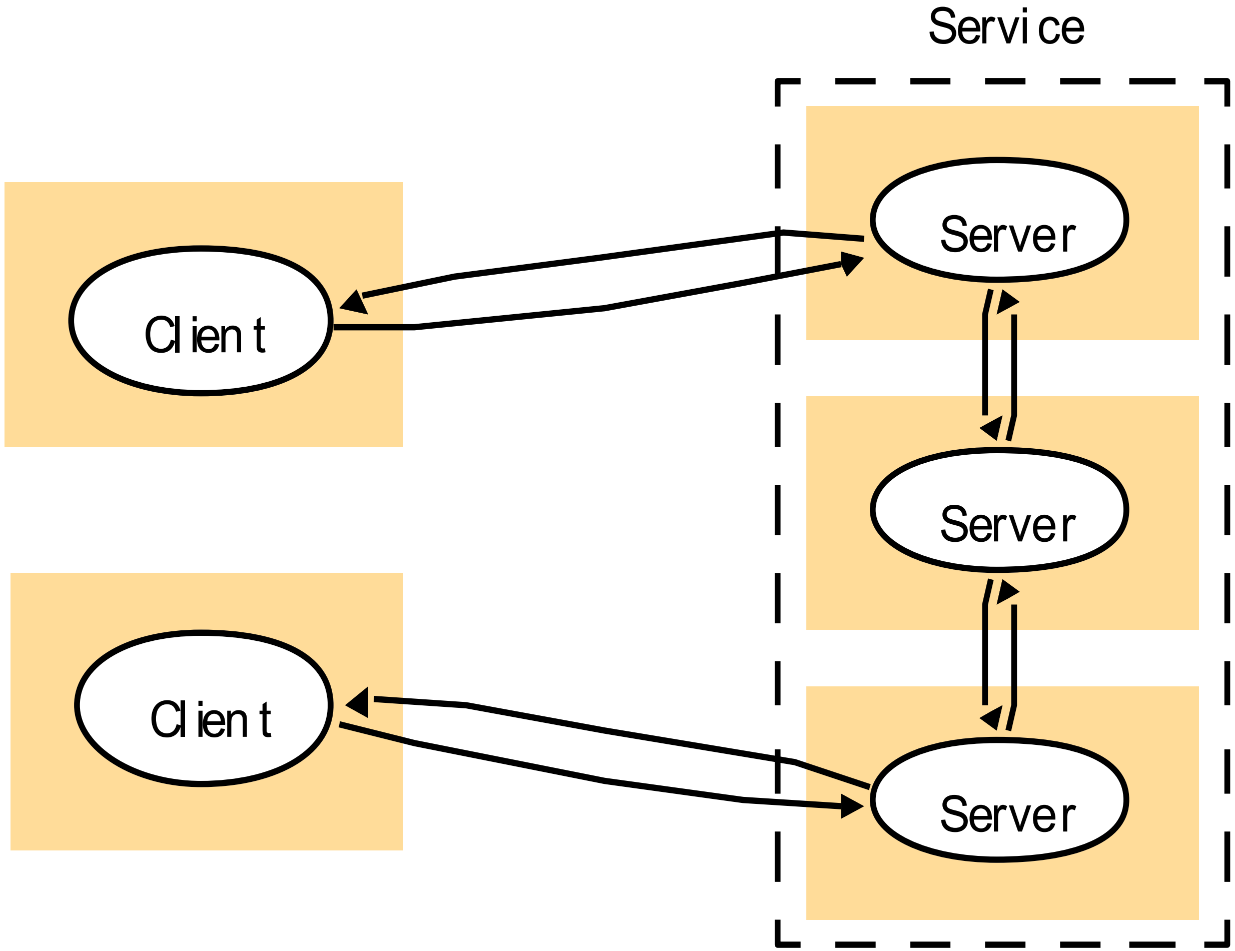
       } load towards the server

2. Peer-to-peer

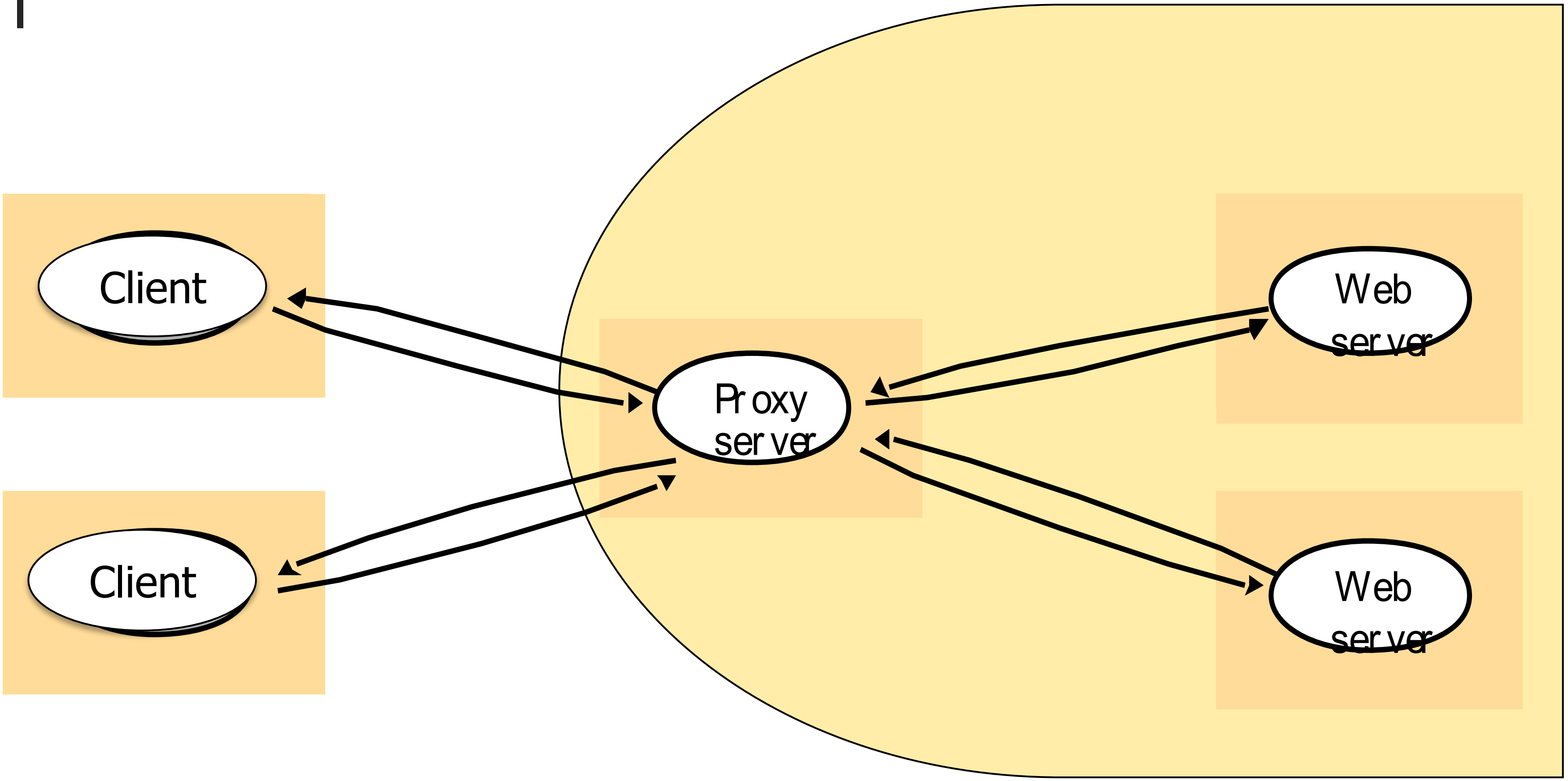
Architectural model: one server-many clients



Architectural model: many servers-many clients



Architectural model: web proxy server



Architectural models

1. Client-server
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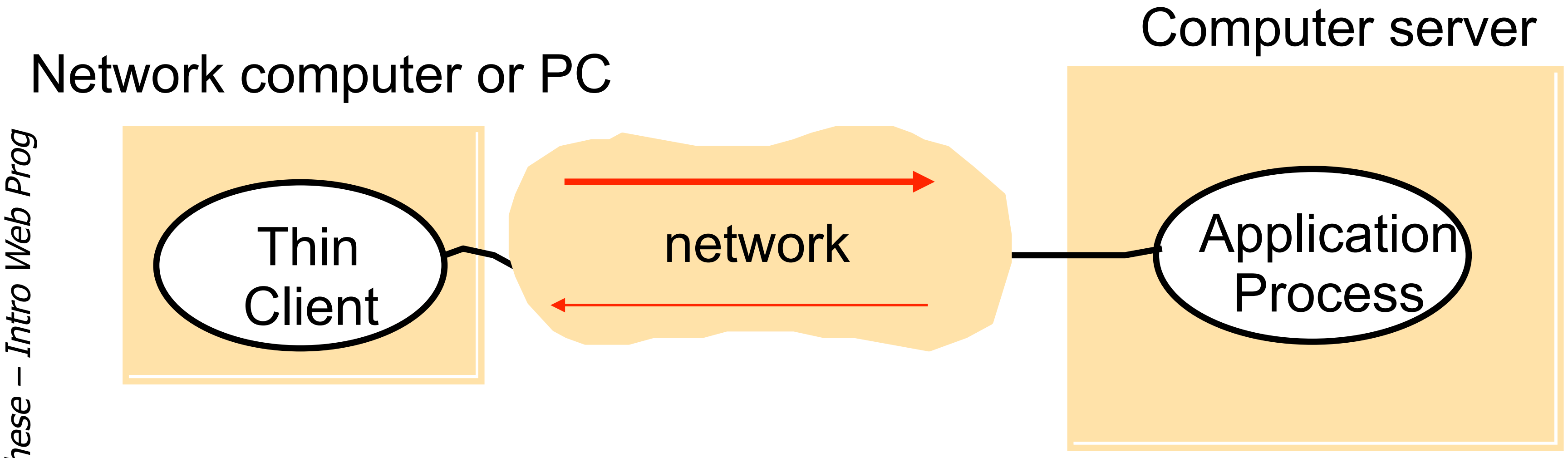
Network computers, Thin clients } load towards the server

Mobile code (applets, scripts), Mobile agents } load towards the client

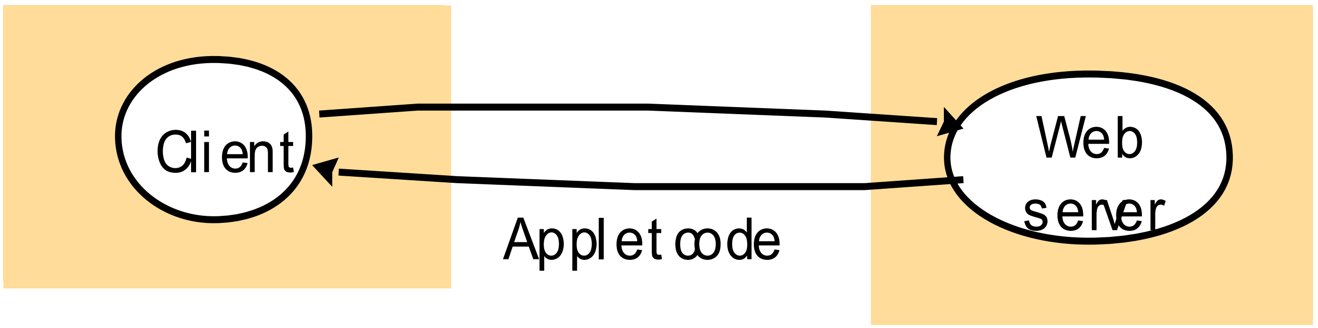
2. Peer-to-peer

Computational load variations: Thin clients and compute servers

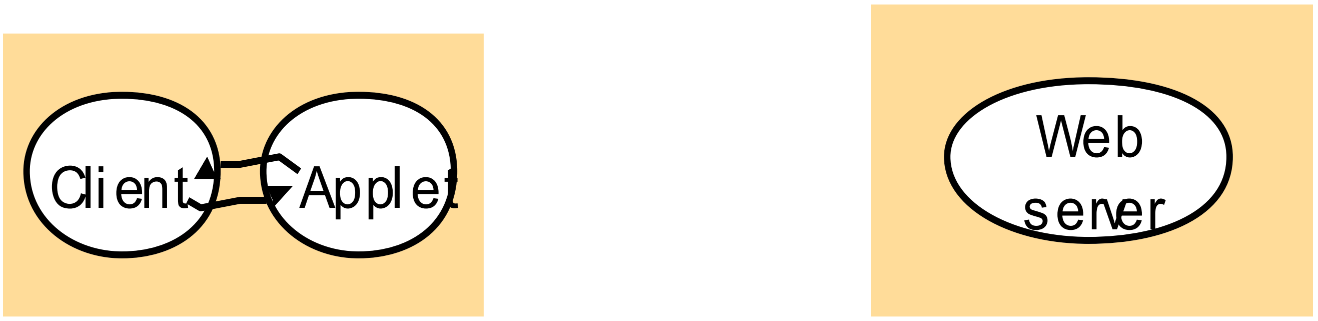


Computational load variations mobile code, e.g. Web applets

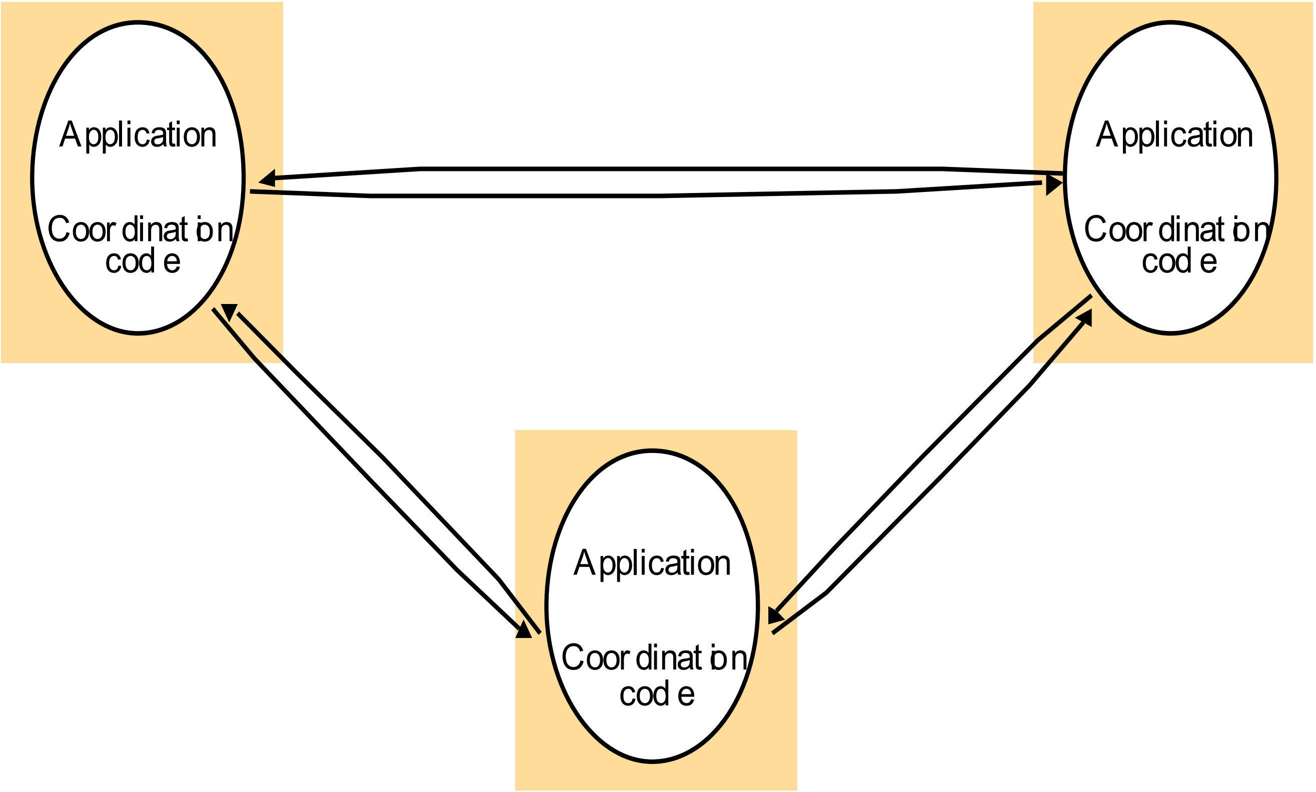
a) client request results in the downloading of applet code



b) client interacts with the applet



A distributed application based on peer processes

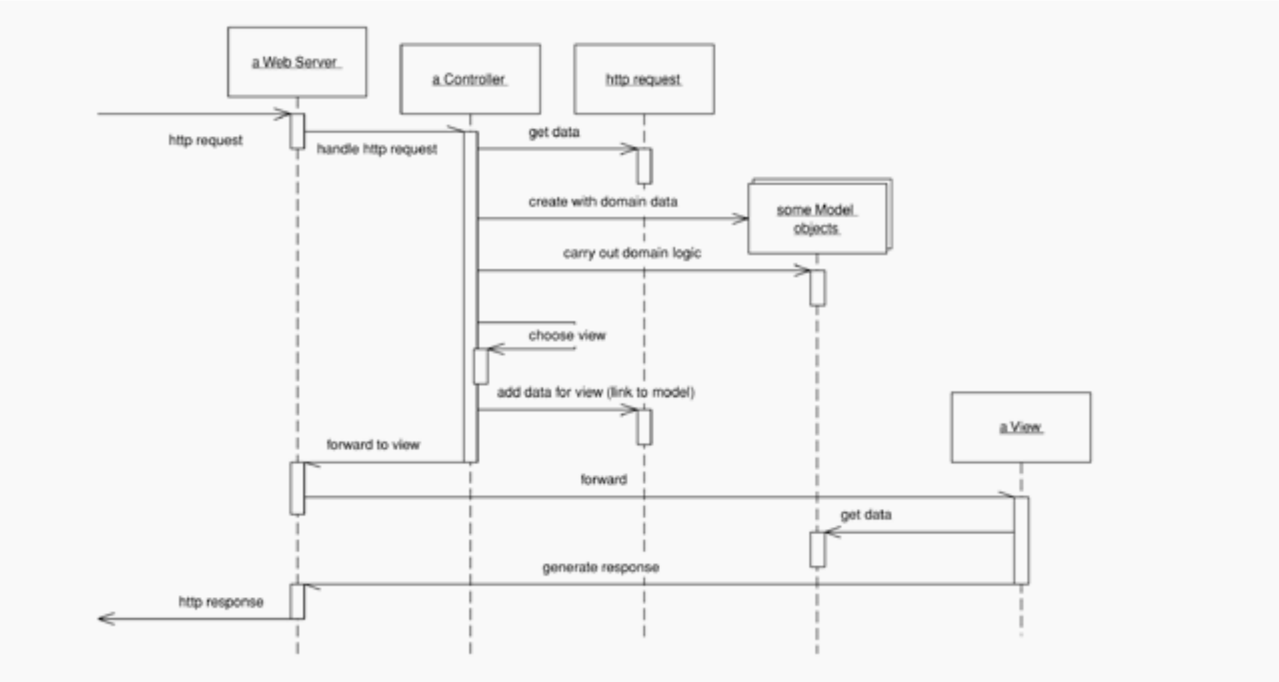


More in a“Distributed System” course …

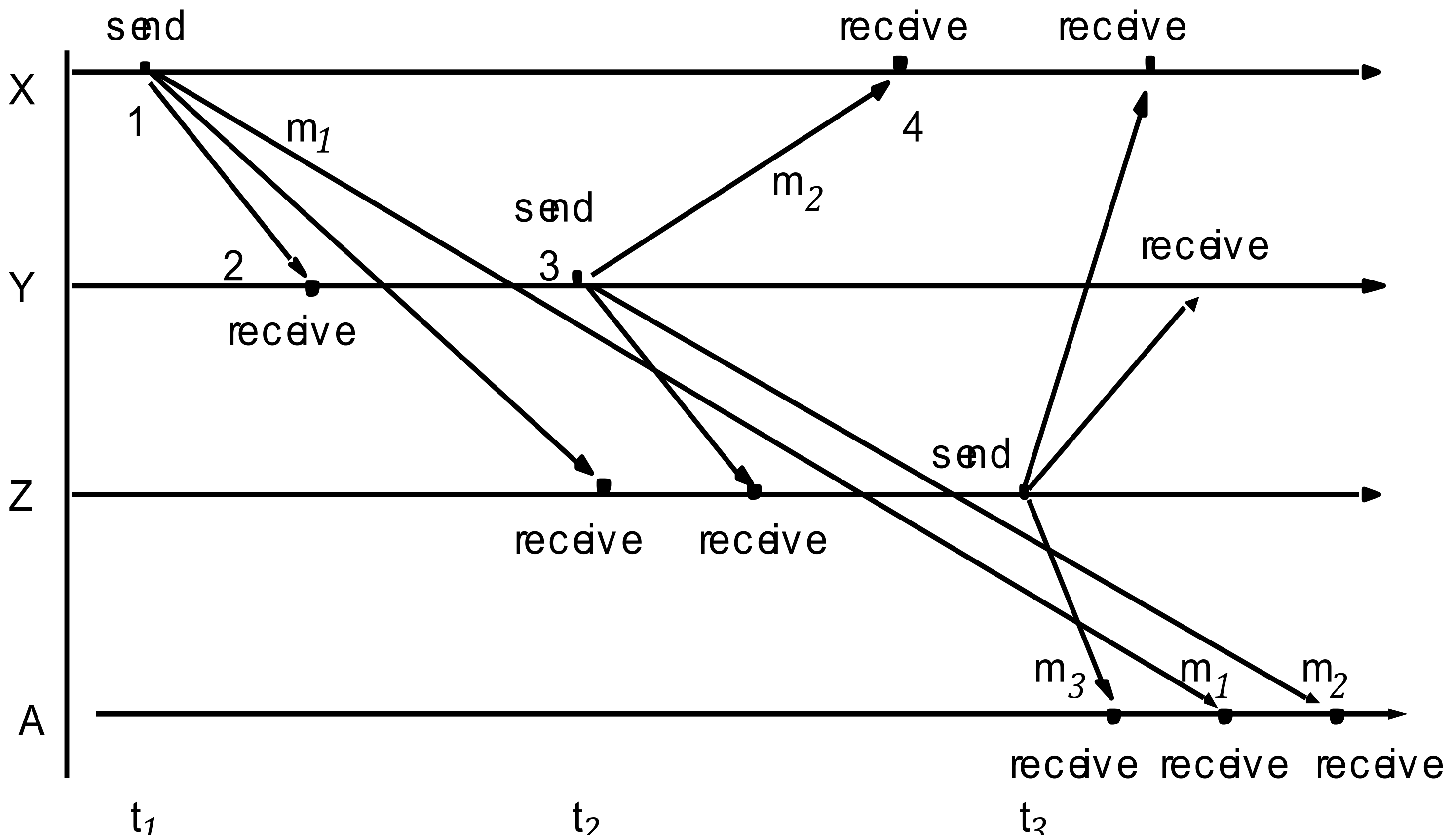
Interaction model

- Synchronous interactions
  - Time to execute a step has lower and upper bounds
  - Each message is received within a given time
  - Each process has a local clock with a given max drift
- Asynchronous interactions
  - No bounds on process execution time
  - No bounds on message receival time
  - Arbitrary clock drifts
- Hybrid interactions
  - AJAX: some processes are synchronous some are asynchronous

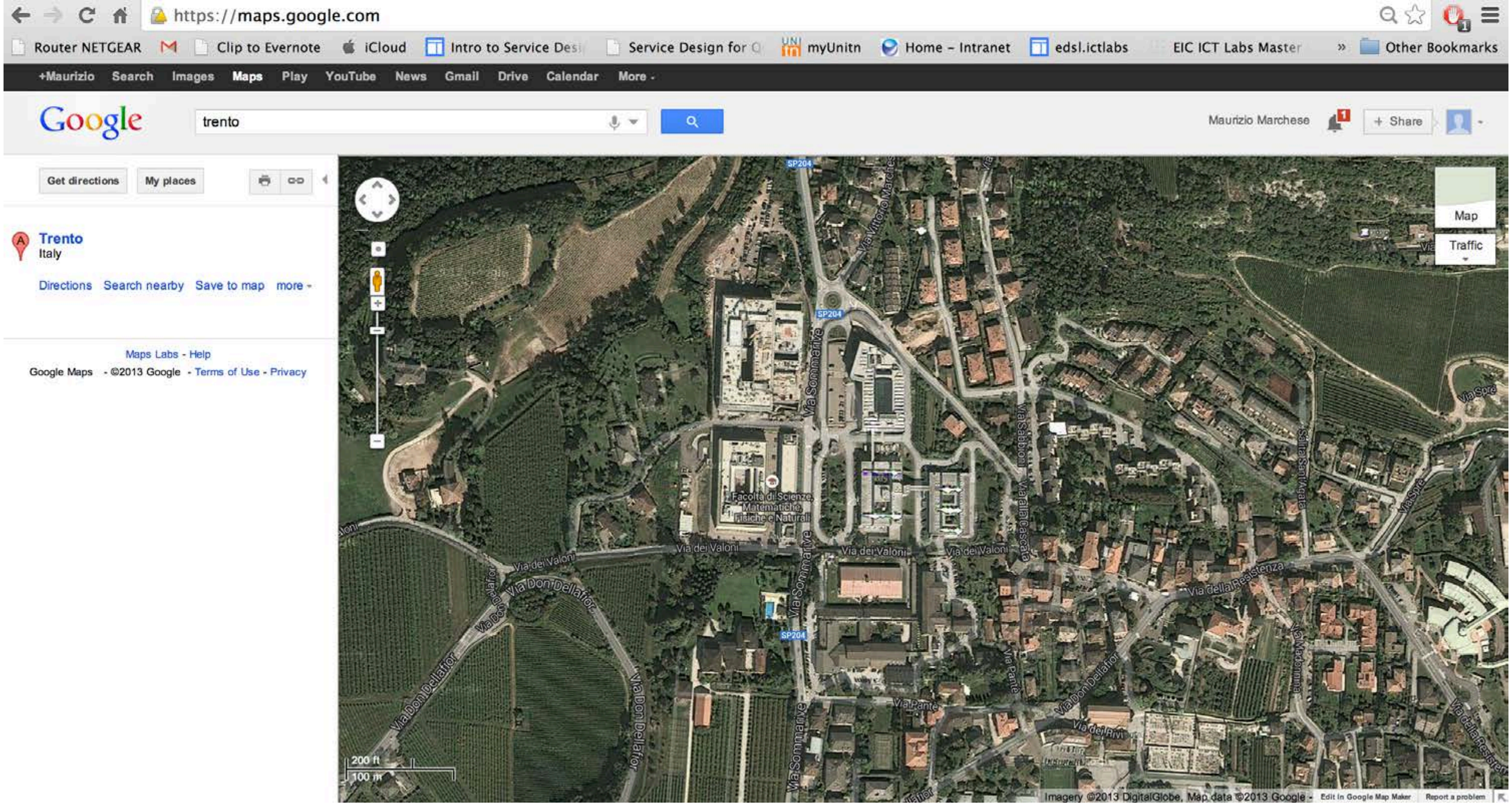
Example: synchronous activity



Example: asynchronous email



Example: hybrid interaction → google maps



https://maps.google.com
Router NETGEAR
Clip to Evernote
iCloud
Intro to Service Desi
Service Design for
myUnitn
Home – Intranet
edsl.ictlabs
EIC ICT Labs Master
Other Bookmarks
+Maurizio
Search
Images
Maps
Play
YouTube
News
Gmail
Drive
Calendar
More
trento
Maurizio Marchese
+ Share
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My places
Trento
Italy
Directions
Search nearby
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