Computer Programming

Network Programming

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Agenda

- Lecture Goal(s)
- Protocols
- java.net.URL
- Sockets
- Examples
- Conclusion

Lecture Goal(s)

Lectures Overview

Java

- 8: Summarizing Example
- 9: Standard library
- 10: GUI – AWT
- 11: GUI – Swing
- 12: IO programming
- 13: Network programming
- 14: Java archives and JavaBeans
- 15: Conclusions

LECTURE GOALS

Today's Goal

To provide programming knowledge about network programming in Java

Protocols

Standard Definition

Something established by authority, custom, or general consent as a model or example

Standard Examples

- Any idea?
- Postscript
- PDF
- HTTP
- HTML
- JPEG
- MPEG
- ...

Two Kinds of Standards

- De facto
  - General consent
- Established by standardization authorities
  - IETF *(Internet Engineering Task Force)*
  - W3 Consortium
  - ITU *(International Telecommunication Union)*
  - EBU *(European Broadcasting Union)*
  - ANSI *(American National Standards Institute)*

Why Are Standards Important?

- Precise specifications
  - Based on API
- Ease interoperability
  - Better modularity
- Vendor-independence
  - Not locked to one vendor

Protocol Definition

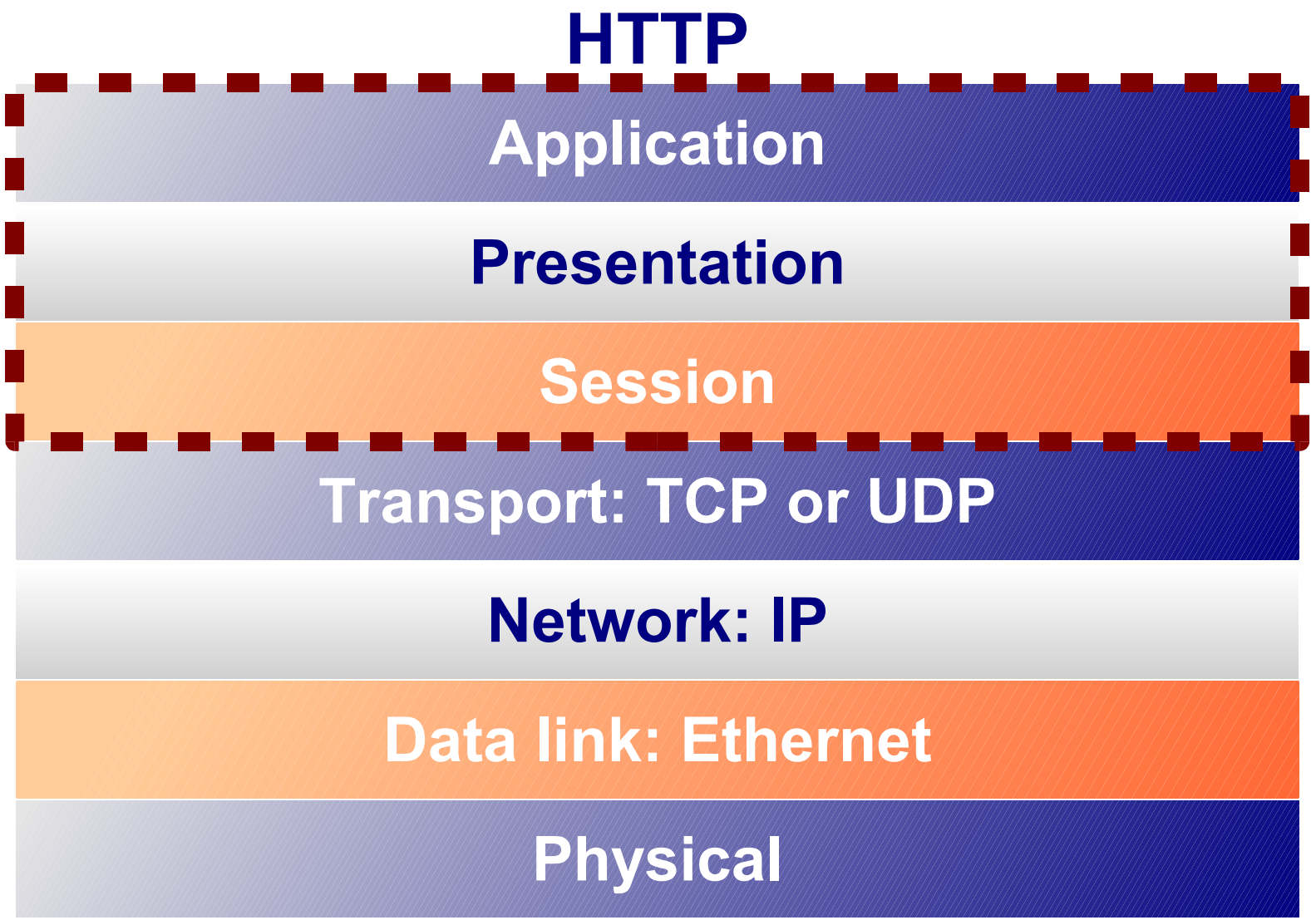
A computer language enabling computers that are connected to each other to communicate

[Cambridge Dictionary]

RFCs

- IETF
  (Internet Engineering Task Force)
- RFC
  (Request for Comments)
- Internet standards
  - IP RFC 791
  - TCP RFC 793
  - UDP RFC 768
  - HTTP RFC 2068

ISO/OSI Network Model



java.net.URL

URL Definition

URL is an acronym for
Uniform Resource Locator
and is a reference (an address)
to a resource on the Internet

URL Structure

- Two parts
  - Protocol identifier
  - Resource name
- Example
  - http://www.google.com/
  - http — Protocol identifier
  - //www.google.com/ — Resource name

HTTP URL Structure

- `http://<hostname>:<port><resource><ref>`
- Mandatory
  - Host name
  - Resource (“/” shortcut for `/index.html`)
- Optional
  - Port (by default `80`)
  - Ref
- Example
  - `http://www.myServ.org:8080/long.html#toc`

java.net.URL Constructors

- Absolute

```
new URL("http://www.google.com")
new URL("http", "www.google.com", "/")
new URL("http", "www.google.com", 80, "/")
```

- Relative

```
new URL(googleURL, "/ads/overview.html")
```

Accessing a java.net.URL

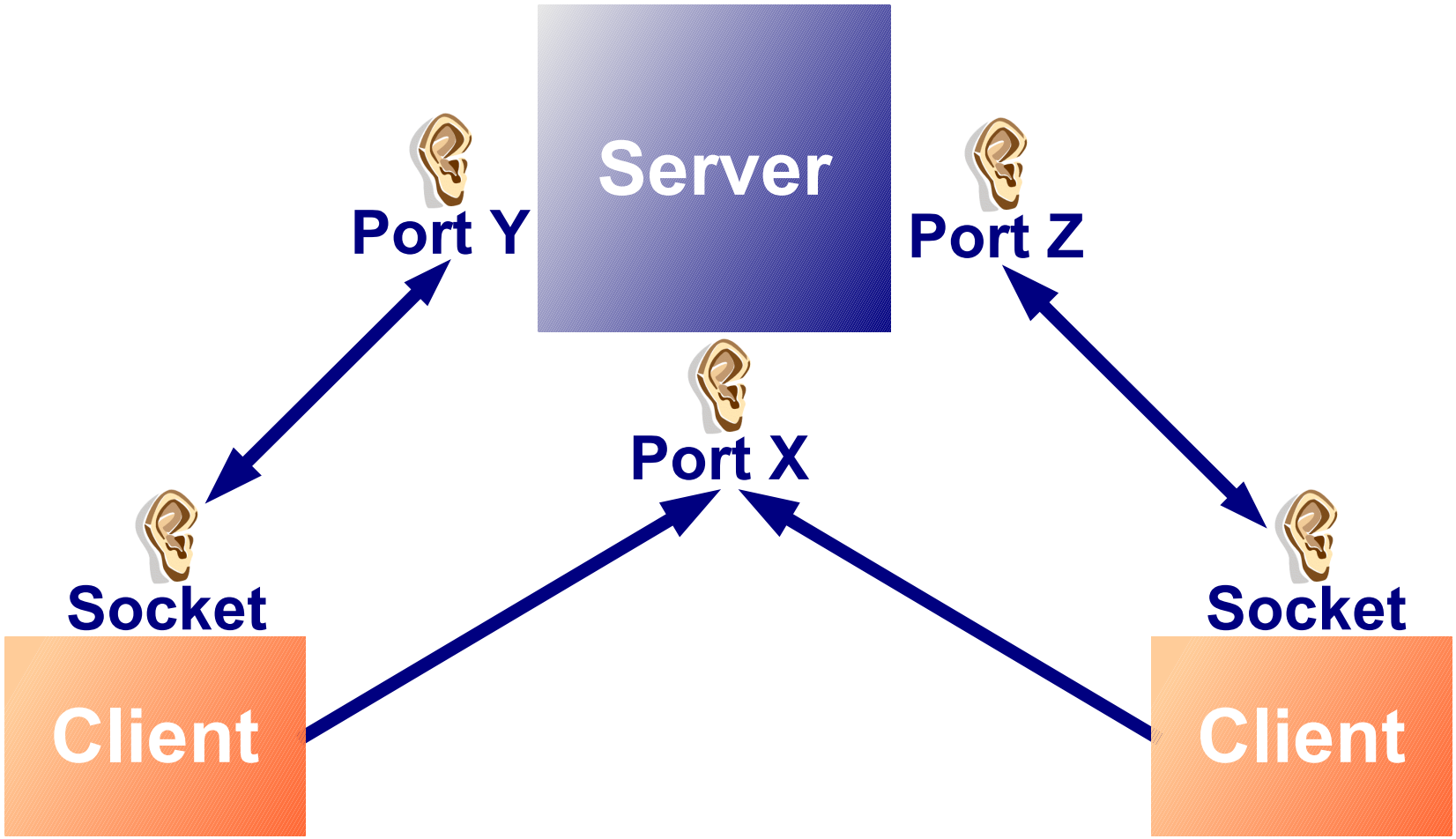
- Directly
  - The `URL.openStream()` method
- Complex
  - The `URL.openConnection()` method
  - The `java.net.URLConnection` class

Sockets

Socket Definition

A socket is one endpoint of a two-way communication link between two programs running on the network

Socket Communication



Socket Programming in Java

- On the client side
  - `java.net.Socket`
  - `Socket.getInputStream()`
  - `Socket.getOutputStream()`
- On the server side
  - `java.net.ServerSocket`
  - `Socket serverSocket.accept()`
  - One thread by client

Examples

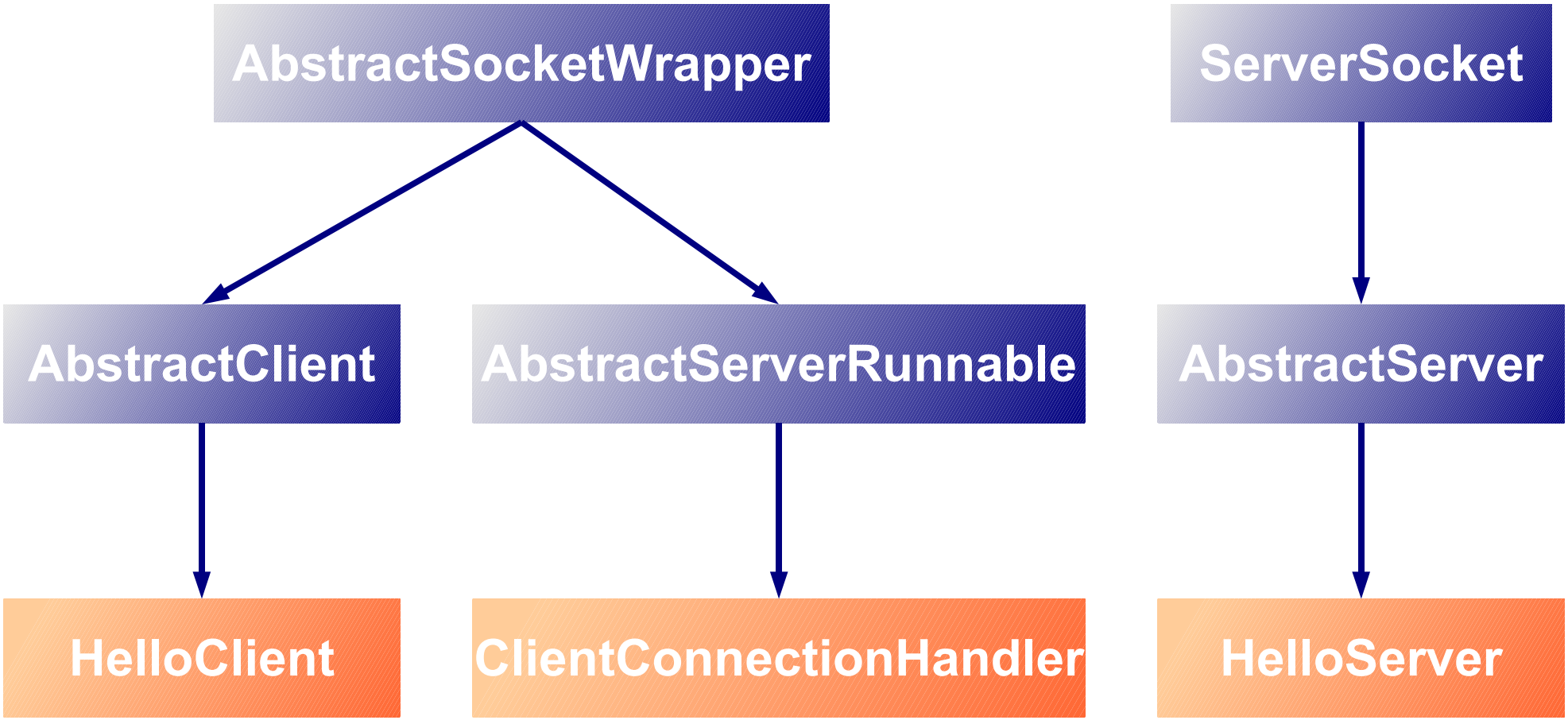
URL Example

The RFC Viewer

`RFCReader` class

Socket Example I

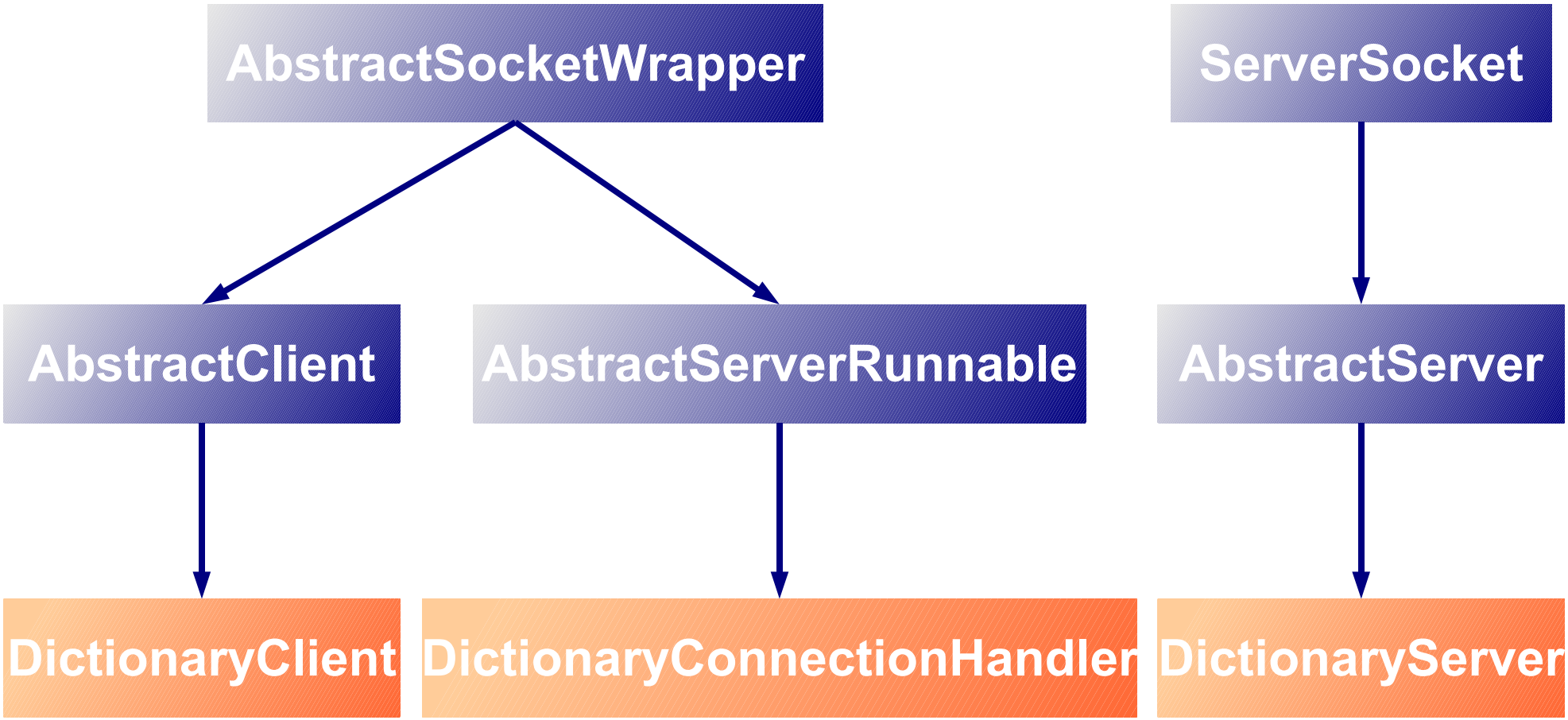
Socket Example I Hierarchy



Socket Example II

Dictionary Server
Example

Socket Example II Hierarchy



Conclusion

Network Programming

- Various level of abstraction
  - From sockets
  - To URL
- Other network techniques
  - CORBA
  - RMI
  - Servlets
  - etc.

See you next week