Internet Applications

ITS323: Introduction to Data Communications

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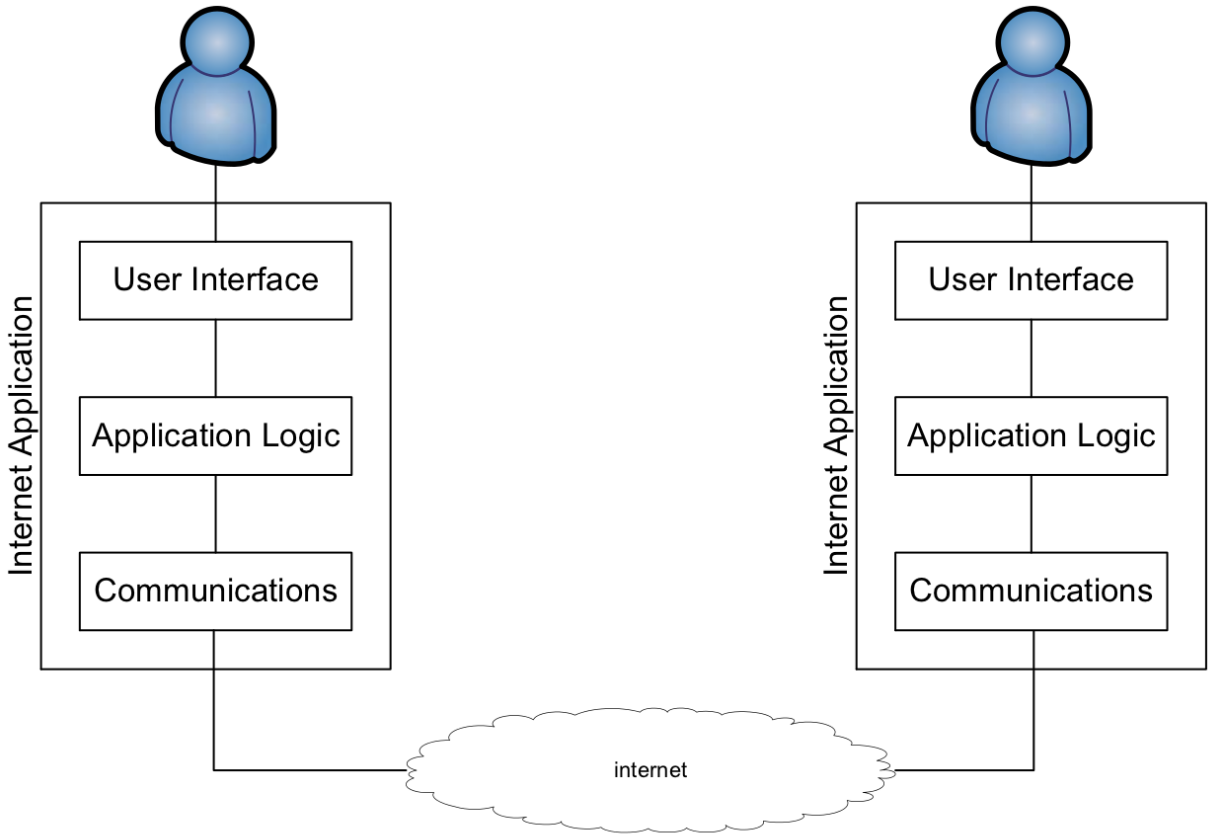
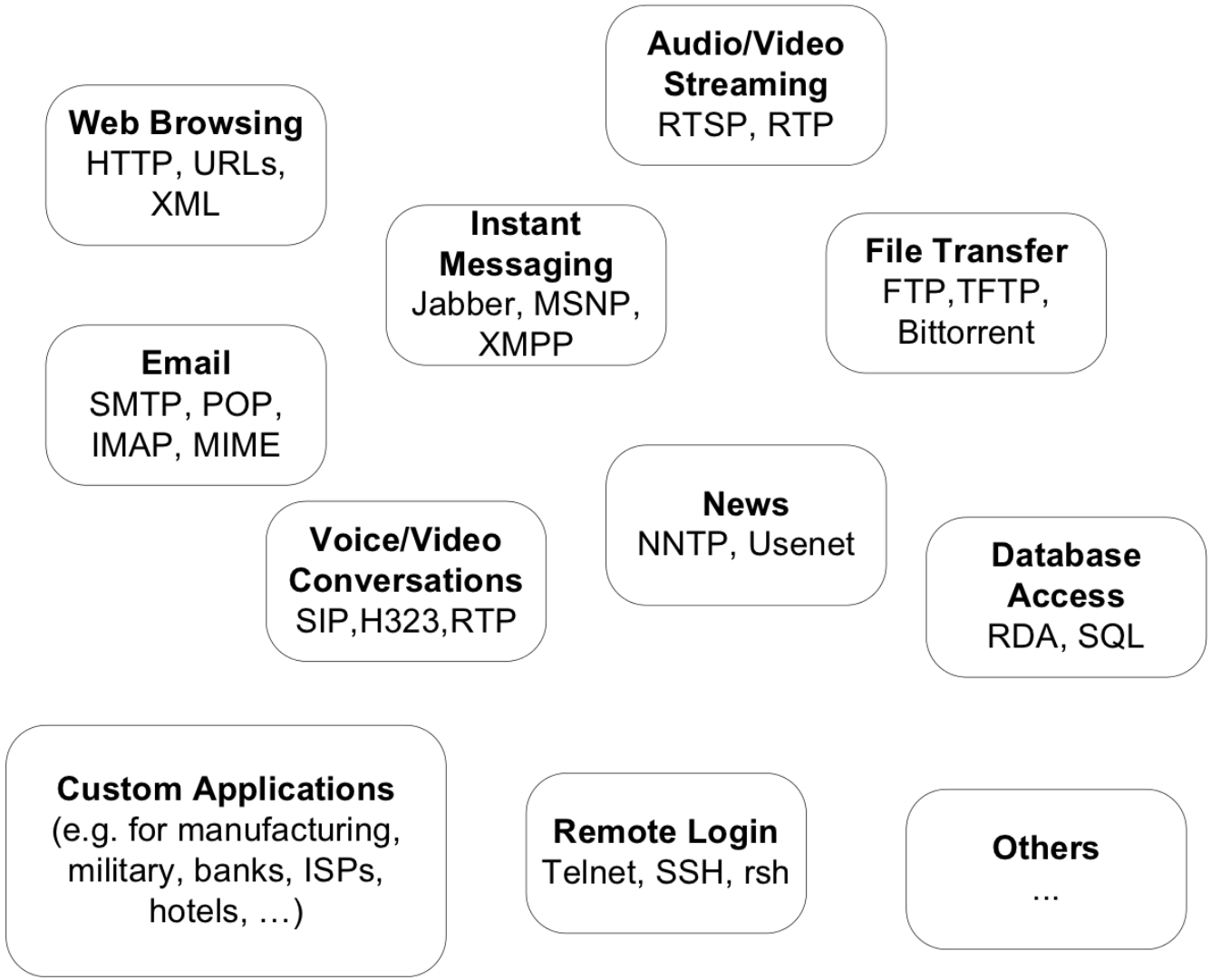
Contents

Internet Applications

- Software applications that involve communication with other applications over the Internet
- Internet applications have three basic functions: user interface; application logic; communications
- Communications follow an application layer protocol



Types of Internet Applications



Internet Applications

- Most Internet applications are client/server based
- Internet applications are implemented as user-level software processes
- Application layer protocols make use of Transport layer for communications
- Sockets interface is commonly used to allow user-level applications to use transport protocol in OS

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Identifying Computers and Files on the Internet

- IP addresses are used to identify computer (interfaces)
- Domain names are user-friendly way to identify computers
- Domain names follow a hierarchical structure: an organisation manages a domain, and can allocate sub-domains to other organisations
- Top Level Domains (TLDs) are managed by Domain Name Registrars .com .biz .org .net .name .info . . .
- Country Code TLDs managed by national registrars (.th, .us, .au, .de)
- Typically ccTLDs are divided into sub-domains and sub-managed by registrars

Identifying Files on the Internet

- Uniform Resource Locators (URLs) are used to identify files (resources) on the Internet
- URLs are a specific form of Uniform Resource Identifier
- `scheme : user @ host : port path ? query`
  - scheme: identifies the application protocol used to access the resource, e.g. http, ftp, https, dns, ipp, news, sip, ...; often followed by //
  - user: identifies the user that is accessing the resources; password is optional
  - host: identifies the host that stores the resources; typically a domain name or IP address
  - port: identifies the port number of the application on the host; if not given, the default value for the scheme will be used, e.g. http (80); https (443)
  - path: pathname of the file where the resource is located
  - query: additional identification information for the resource location; typically in attribute-value pairs, e.g. key=value
- Most parts are optional and there are exceptions!

Example URLs

Web Browsing

```
http://www.example.com/dir/file.html
http://73.16.0.4:40240/dir/file.html
https://www.example.com/dir/file.html
http://example.com/dir/file?id=6&name=steve
```

Email

```
mailto:steve@example.com
mailto:steve@example.com?subject=test
```

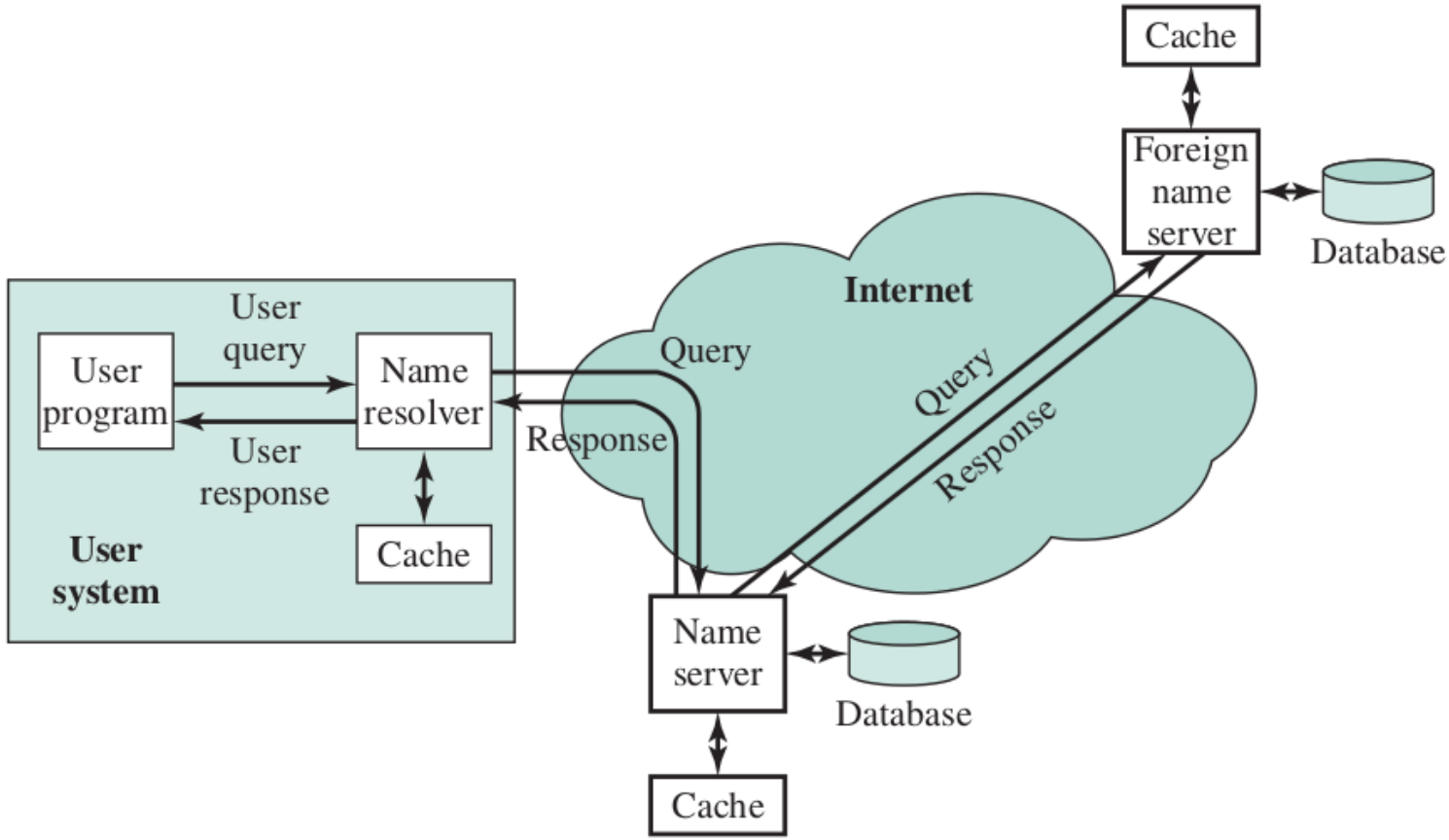
Remote Login

```
telnet://steve@example.com
telnet://steve:mypassword@example.com:46
ssh://steve@example.com
```

Domain Name System

- Domain Name System (DNS) specifies: format and structure of domain names; and how to map domain names to IP addresses
- Domain names and their corresponding IP address are registered at DNS servers
- Application uses DNS protocol to retrieve the corresponding IP address from the DNS server; request from application goes to name resolver
- DNS servers are structured in hierarchical manner to provide fast and accurate responses
  - DNS servers may be authoritive server for domains within its portion of domain name space; domain and corresponding IP address are stored in a database
  - DNS servers may cache other domain names (and their IP)
  - DNS servers may know IP address of other DNS servers for recursive or iterative requests
  - Root DNS servers know the IP address of authoritve DNS servers for TLDs and ccTLDs

DNS Name Resolution



DNS Example

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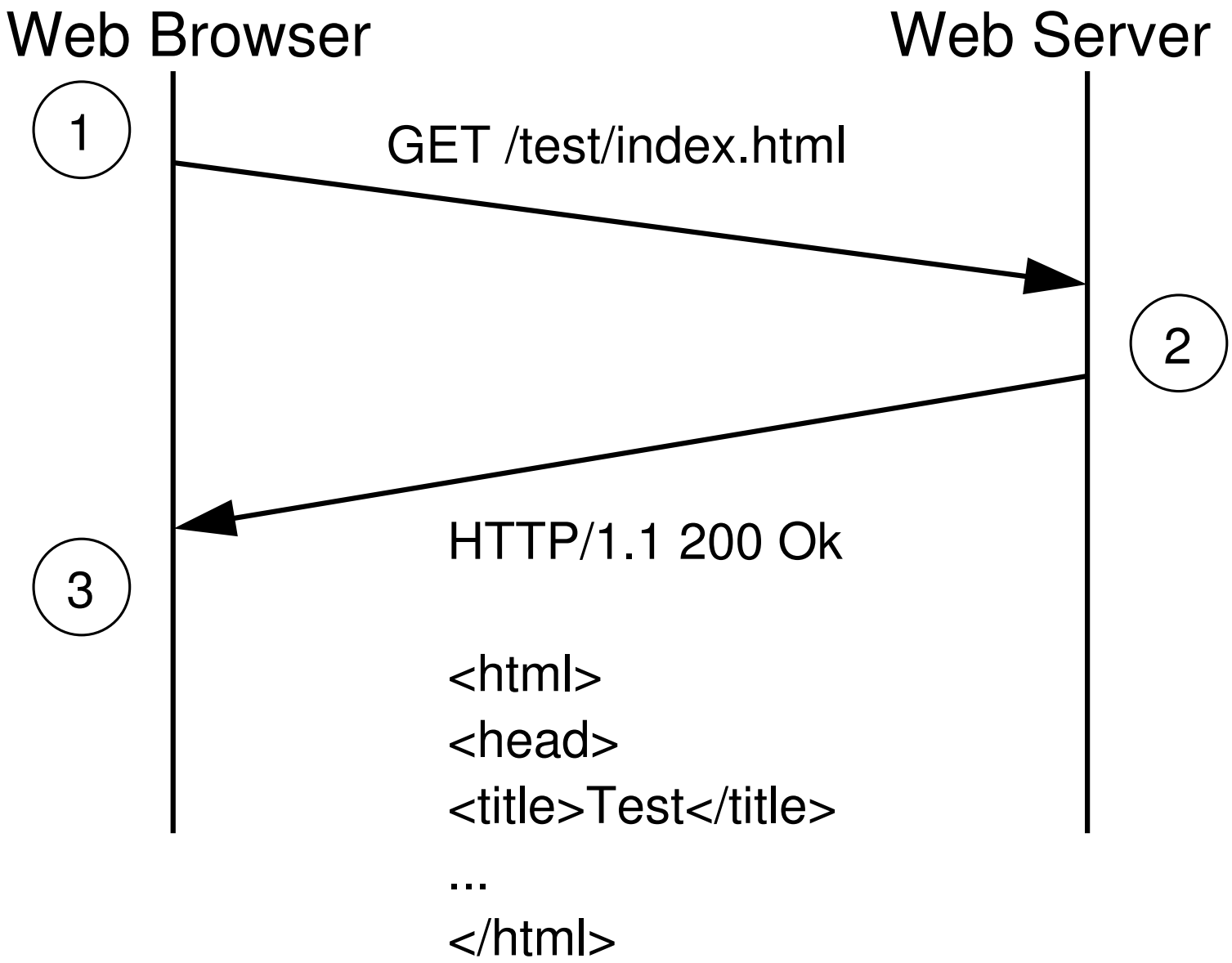
Web Access with Hypertext Transfer Protocol

- HTTP is a request/response protocol for web browsing
- HTTP is stateless; no dependence between a request and previous request
- User Agent (client) sends HTTP Request message
- Server responds with HTTP Response message
- Default server port number: 80
- Generic HTTP message format:

```
Start line
Optional header lines
<empty line>
Optional message body
```

- Start line differs for request and response
- Header format: `field-name: value`

HTTP Example



HTTP Request Messages

- Start line: `Method URL Version`
- Methods:
  - GET: retrieve the resource at the specific URL
  - HEAD: same as GET, except do not return message body (only header)
  - OPTIONS: retrieve options available for resource or server
  - POST: asks server to accept and process the attached data at the resource
  - ...
- Version: version of HTTP, e.g. HTTP/1.0, HTTP/1.1

HTTP Response Messages

- Start line: `Version StatusCode StatusReason`
- Status Codes and Reasons:
  - 100: Continue (the client should continue with its request)
  - 200: OK (the request succeeded)
  - 301: Moved Permanently (the requested resource has a new URL)
  - 304: Not Modified (resource hasnt changed since last request, client should use cached copy)
  - 401: Unauthorized (request must include user authentication)
  - 403: Forbidden (request was understood, but server refuses to process it)
  - 404: Not Found (server cannot find resource at requested URL)
  - 503: Service Unavailable (server currently unable to handle request, e.g. server is too busy)

HTTP Headers

- Date: data and time of message generation
- Host: domain name of host of resource (means relative URLs can be used)
- Accept-Charset, Accept-Encoding, Accept-Language: indicate the character sets, encodings and languages that client can accept
- Authorization: include user credentials (e.g. username, password) if authorization is required
- User-Agent: indicates information about the client (user agent), e.g. web browser
- Referrer: URL from which this request came from
- Content-Encoding: encoding or compression, e.g. gzip
- Content-Length: length of message body on bytes
- Content-Type: the type of content in message body
- Last-Modified: indicates data/time when content was last modified on server

HTTP Example