Part III.C: Internet protocols

- Overview
- HTTP/1.1
- HTTP-NG
- WebDAV
- Push
- Protocols and security
- XML-based protocols

What's a protocol?

- Two or more computers connected on a network
- Rules for interaction:
  - what can a system send?
  - What can it expect to get back?

Design criteria for protocols

- performance (make it faster)
- bandwidth (amount of data sent in a particular time)
- reliability (entire system is stable even if some things go wrong)
- extensibility (can new features be added and still work with old implementations)
- security (doesn’t let others mess with you)

Internet protocols for different purposes

- Electronic mail **(SMTP, POP, IMAP)**
- Web**(HTTP)**
- Network news **(NNTP)**
- directory access **(LDAP)**
- interactive sessions **(TELNET)**
- … and many many more...

HyperText Transfer Protocol (HTTP)

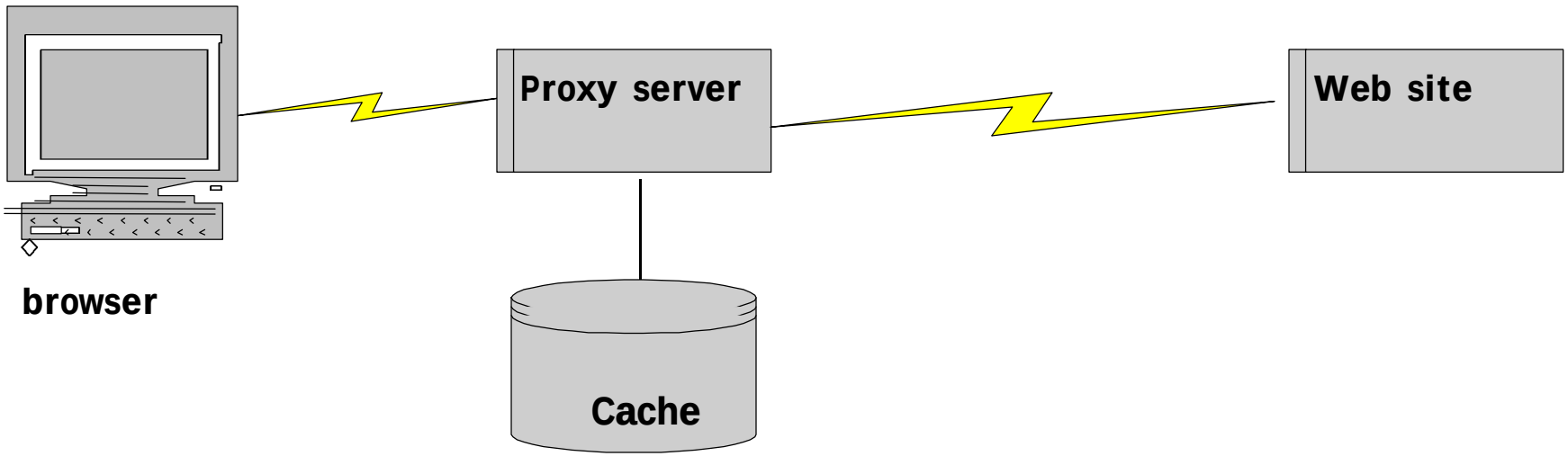
- A simple protocol, designed for the 1990 vision of the World Wide Web
- **`http://widget.com/product.html`**
  - open connection to widget.com
  - send "**`GET /product.html`**"
  - read headers
  - read body
  - close connection

HTTP/1.0 added features

- More kinds of content
  - Accept, language, charset, content-type
- More information about client & server
  - User-Agent, From, error codes
- Simple caching
  - last-modified, if-modified-since
- Basic Authorization

Proxy cache

- Between client and server
- Remembers what was retrieved before
- Don’t retrieve again unnecessarily



HTTP/1.1 Improvements

- Performance
  - pipelining: send several requests together
  - persistent connections:
    - don’t open and close connections all the time
  - better caching
- Reliability
  - clearer semantics for many headers
- New features

HTTP/1.1 Draft Standard

- Resolved over 100 “issues” with RFC 2068
  - problems discovered during implementation and deployment
  - each a serious design problem
- Additional features
- Improved security

Content Negotiation

- Different recipients have different capabilities
  - Cellphone
  - reading machine
  - print vs. display
- How to tune content for recipient?
- How to describe recipients

HTTP Content Negotiation

- Language (**`Accept-Language`**)
- Character set (**`Accept-Charset`**)
- Capabilities to handle media (**`Accept`**)
- Brand of software (**`User-Agent`**)

need more: active working group

HTTP is *not* a good protocol

- HTTP/1.0 didn't work well as web evolved
- HTTP/1.1 fixed some problems
  - backward compatibility was more important
- It still has lots of problems!
  - Don't copy it for new protocols
  - Session Initiation Protocol, Real Time Streaming Protocol do
  - See RFC 2324: HTCPCP

HTTP-NG: “Next Generation”

- New design
- Not required to interwork with HTTP/1.1
- Design goals:
  - simple
  - performance
  - asynchronous operation
- uses distributed object technology
  - Compatibility with CORBA, RMI, DCOM

WebDAV: Distributed Authoring and Versioning

- Locking
- Compound objects
- Version management
- Directory management

WebDA nearly finished, versioning, search language in progress

XML-based application protocols

- Define data exchange in terms of XML
- controlled extension with core interoperability
- E-commerce applications
  - Internet Content & Exchange (ICE)
  - Open Buying on the Internet (OBI)
  - Trading Protocol (OTP)

Internet Security

- Everyone connected
  - including people you should not trust
  - security is easy: disconnect the net
  - “firewall”: selective disconnection
- “Security” provides assurance against threats
  - must analyze the threats!
- Encryption: scrambling the data
  - sometimes only “locking the front door”

Internet security: threat analysis

- Someone will access my private files...
- Someone will modify my files...
- Someone will discover my password and later pretend to be me...
- Someone will watch what I am reading...
- Someone will pretend to be someone that I trust...

Hard to predict, to protect against threats

Security measures

- Authentication: prove you are you
  - passwords
  - scrambled passwords (digest authentication)
- Protected channel: keep connection secret
  - “SSL” (Secure Socket Layer)
  - TLS (Transaction Level Security)
  - VPN (Virtual Private Network)

Protected objects

- use “insecure” network to transmit encrypted objects
- S/MIME (Secure MIME)
- PGP (Pretty Good Privacy)
- S-HTTP (Secure HTTP)

Standards are difficult because of patents

Large amount of ongoing work

- Internet Payment
- Content Rating (PICS)
- “Push”: broadcasting
- Messaging
- Real-time multimedia

Tutorial Review

- Part I: Internet and Digital Libraries
- Part II: Standards and Organizations
- Part III: Technology for
  - Content
  - Naming
  - Protocols

Key points

- The Internet is evolving
- Many different elements are used to weave each application
- Digital library applications will use these … and more