Applications

COS 460 / 540

Applications

Infrastructure Applications

- **DNS** - Doman Name Service
- SNMP - Network management

Traditional Applications

- SMTP, MIME, IMAP - email
- **HTTP** - Hyper Text Transfer Protocol

DNS

Expand…

usm.maine.edu

http://usm.maine.edu

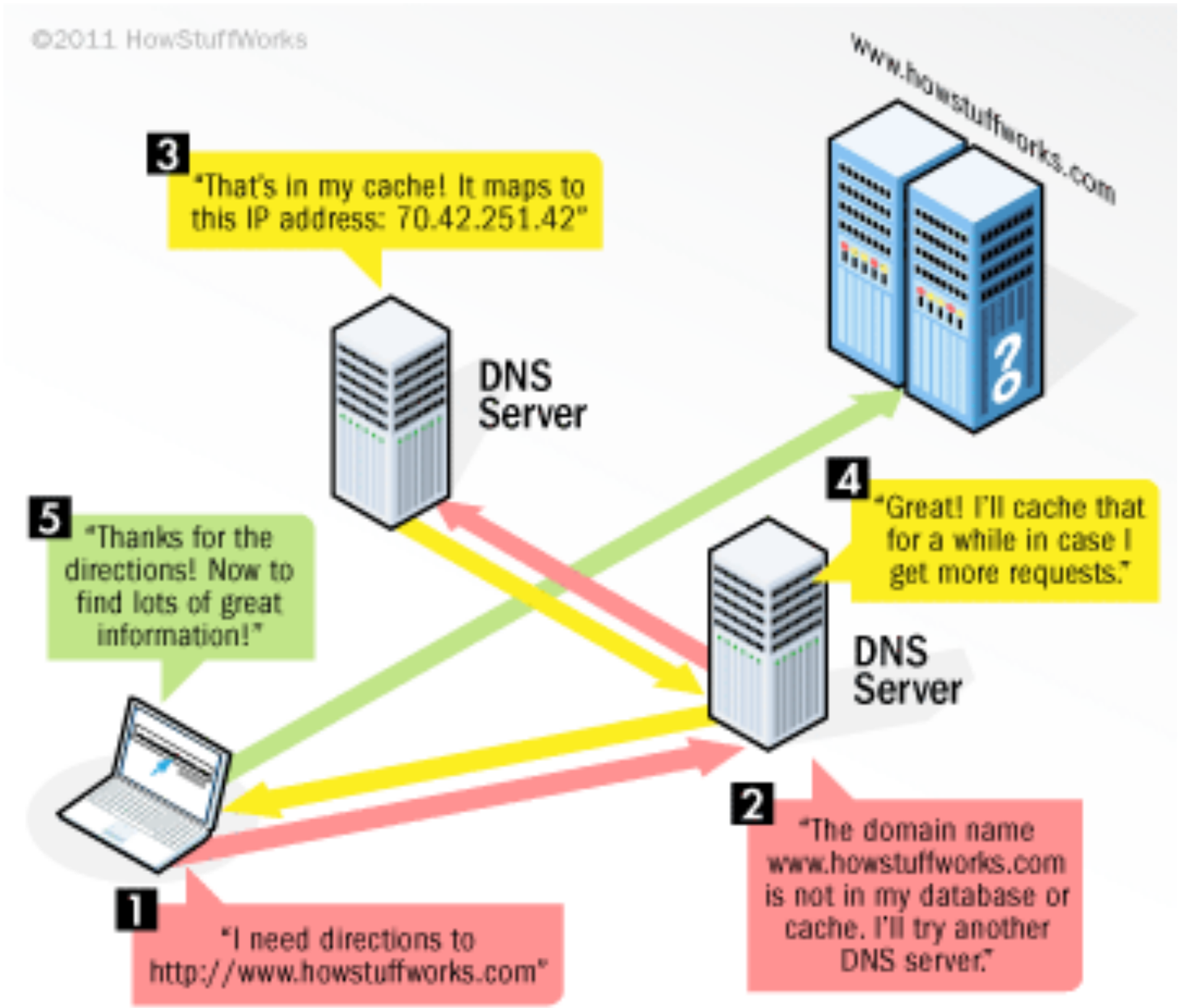
http://usm.maine.edu:80

http://usm.maine.edu:80/index.html

http://130.111.135.26:80/index.html

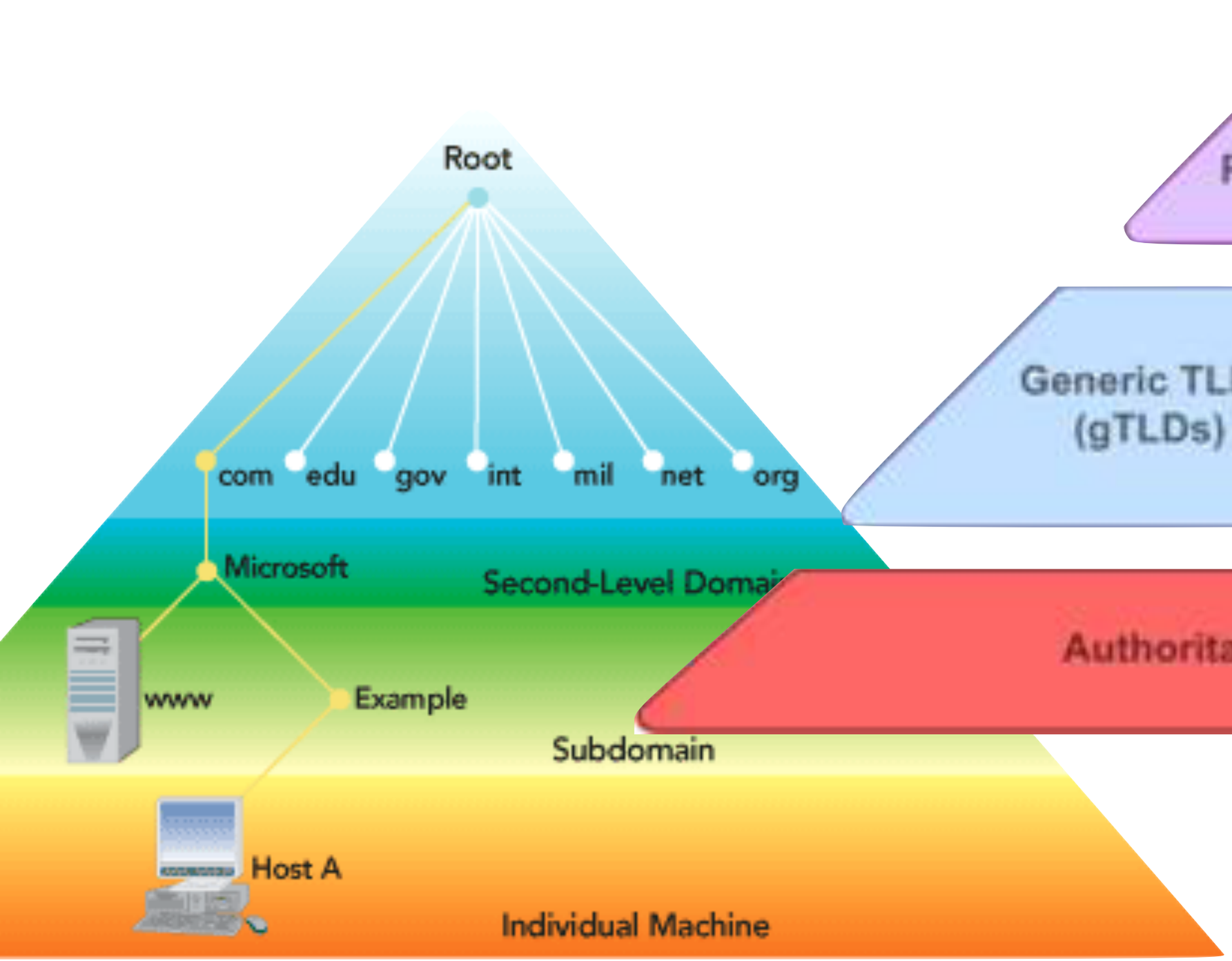
… 130.111.135.26

DNS in Action



http://computer.howstuffworks.com/dns.htm

DNS Hierarchy



Root Servers

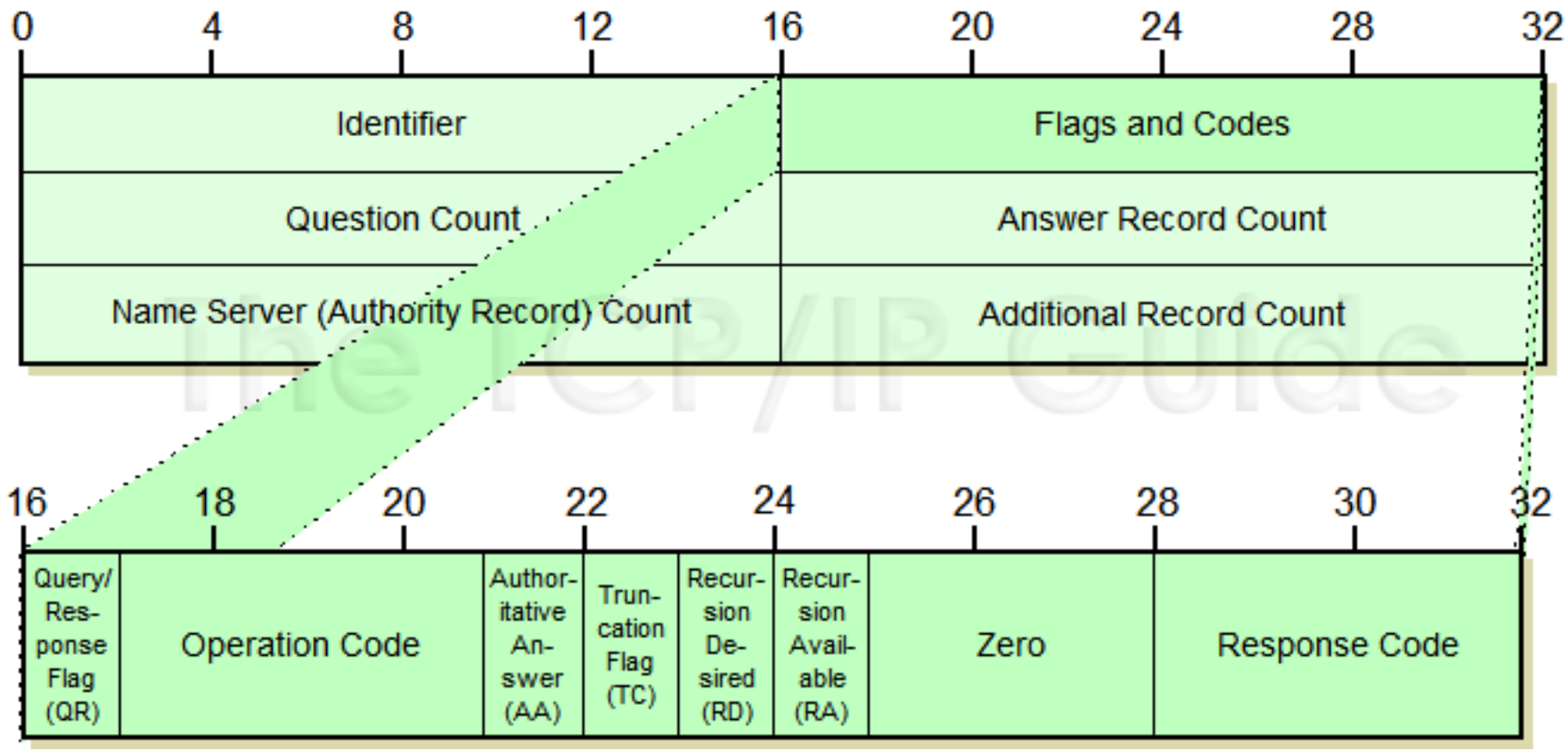
Generic TLDs (gTLDs)

Country-code TLDs (ccTLDs)

ccTLD Subdomains

Authoritative Domain Servers

DNS Packet



Opcode Value	Query Name	Description
0	*QUERY*	A standard query.
1	*IQUERY*	An inverse query; now obsolete. RFC 1035 defines the inverse query as an optional method for performing inverse DNS lookups, that is, finding a name from an IP address. Due to implementation difficulties, the method was never widely deployed, however, in favor of reverse mapping using the IN-ADDR.ARPA domain. Use of this Opcode value was formally obsoleted in RFC 3425, November 2002.
2	*STATUS*	A server status request.
3	(reserved)	Reserved, not used.

DNS Query

No.	Time	Source	Destination	Protocol	Length	Info
9	0.067913	192.168.10.10	192.168.10.1	DNS	82	Standard query 0x8cfd A…
10	0.094891	192.168.10.1	192.168.10.10	DNS	98	Standard query response…
1845	9.449215	192.168.10.10	192.168.10.1	DNS	73	Standard query 0x0a06 A…
1866	9.577234	192.168.10.1	192.168.10.10	DNS	89	Standard query response…

```
▶ Frame 1845: 73 bytes on wire (584 bits), 73 bytes captured (584 bits) on interface 0
▶ Ethernet II, Src: Apple_3f:17:74 (c8:2a:14:3f:17:74), Dst: 02:70:a4:ed:3c:00 (02:70:a4:ed:3c:00)
▶ Internet Protocol Version 4, Src: 192.168.10.10, Dst: 192.168.10.1
▶ User Datagram Protocol, Src Port: 50938, Dst Port: 53
▼ Domain Name System (query)
    [Response In: 1866]
    Transaction ID: 0x0a06
  ▶ Flags: 0x0100 Standard query
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
  ▼ Queries
    ▼ usm.maine.edu: type A, class IN
        Name: usm.maine.edu
        [Name Length: 13]
        [Label Count: 3]
        Type: A (Host Address) (1)
        Class: IN (0x0001)
```

```
0000  02 70 a4 ed 3c 00 c8 2a  14 3f 17 74 08 00 45 00   .p..<..* .?.t..E.
0010  00 3b 27 09 00 00 ff 11  00 00 c0 a8 0a 0a c0 a8   .;'..... ........
0020  0a 01 c6 fa 00 35 00 27  95 94 0a 06 01 00 00 01   .....5.' ........
0030  00 00 00 00 00 00 03 75  73 6d 05 6d 61 69 6e 65   .......u sm.maine
0040  03 65 64 75 00 00 01 00  01                       .edu.... .
```

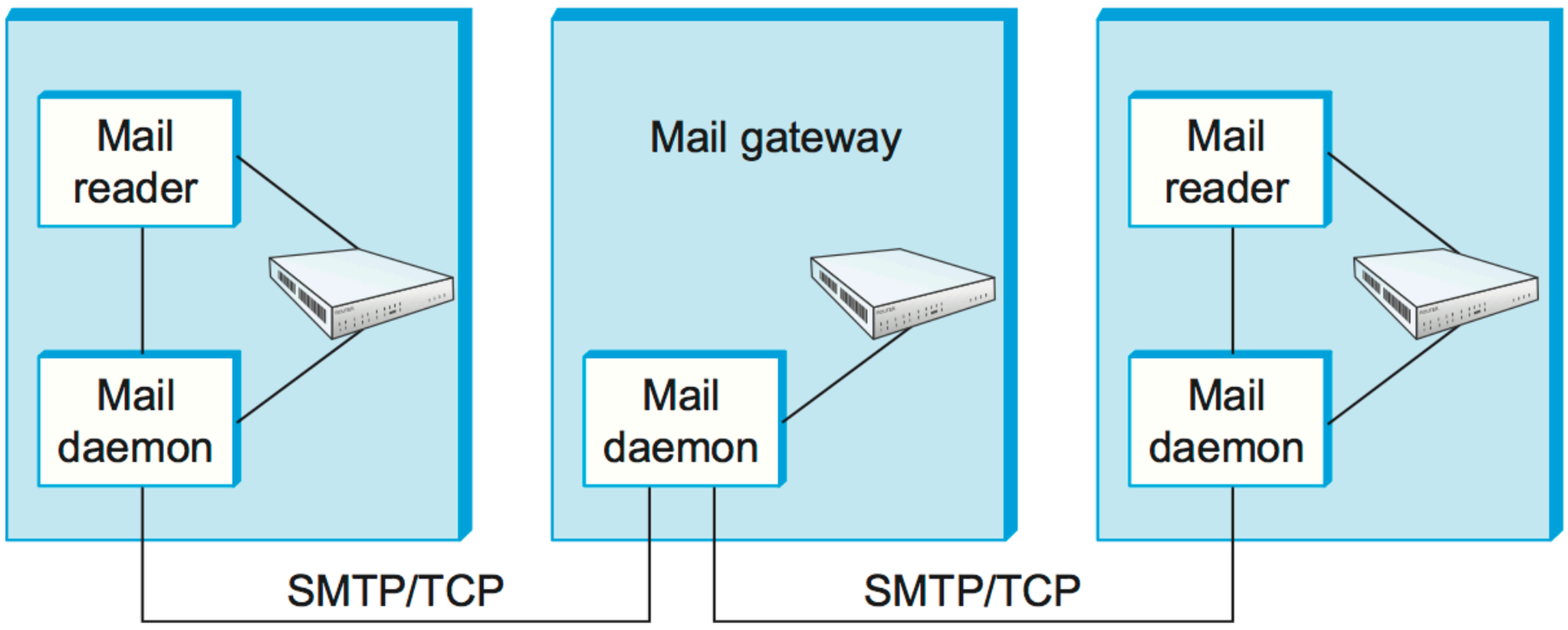
No.	Time	Source	Destination	Protocol	Length	Info
9	0.067913	192.168.10.10	192.168.10.1	DNS	82	Standard query 0x8cfd A…
10	0.094891	192.168.10.1	192.168.10.10	DNS	98	Standard query response…
1845	9.449215	192.168.10.10	192.168.10.1	DNS	73	Standard query 0x0a06 A…
1866	9.577234	192.168.10.1	192.168.10.10	DNS	89	Standard query response…

```
▼ Domain Name System (response)
    [Request In: 1845]
    [Time: 0.128019000 seconds]
    Transaction ID: 0x0a06
  ▶ Flags: 0x8180 Standard query response, No error
    Questions: 1
    Answer RRs: 1
    Authority RRs: 0
    Additional RRs: 0
  ▼ Queries
    ▼ usm.maine.edu: type A, class IN
        Name: usm.maine.edu
        [Name Length: 13]
        [Label Count: 3]
        Type: A (Host Address) (1)
        Class: IN (0x0001)
  ▼ Answers
    ▼ usm.maine.edu: type A, class IN, addr 130.111.27.33
        Name: usm.maine.edu
        Type: A (Host Address) (1)
        Class: IN (0x0001)
        Time to live: 300
        Data length: 4
        Address: 130.111.27.33
```

```
0000  c8 2a 14 3f 17 74 02 70  a4 ed 3c 00 08 00 45 00   .*.?.t.p ..<...E.
0010  00 4b 7d 25 00 00 40 11  68 21 c0 a8 0a 01 c0 a8   .K}%..@. h!......
0020  0a 0a 00 35 c6 fa 00 37  92 14 0a 06 81 80 00 01   ...5...7 ........
0030  00 01 00 00 00 00 03 75  73 6d 05 6d 61 69 6e 65   .......u sm.maine
0040  03 65 64 75 00 00 01 00  01 c0 0c 00 01 00 01 00   .edu.... ........
0050  00 01 2c 00 04 82 6f 1b  21                       ..,...o. !
```

SMTP - eMail

Simple Mail Transport Protocol
for sending mail — store and forward
(not for accessing/reading email)



SMTP: Text-based

Client starts

```
HELO cs.princeton.edu
250 Hello daemon@mail.cs.princeton.edu [128.12.169.24]

MAIL FROM:<Bob@cs.princeton.edu>
250 OK

RCPT TO:<Alice@cisco.com>
250 OK

RCPT TO:<Tom@cisco.com>
550 No such user here

DATA
354 Start mail input; end with <CRLF>.<CRLF>
Blah blah blah...
...etc. etc. etc.
<CRLF>.<CRLF>
250 OK

QUIT
221 Closing connection
```

The “.” ends

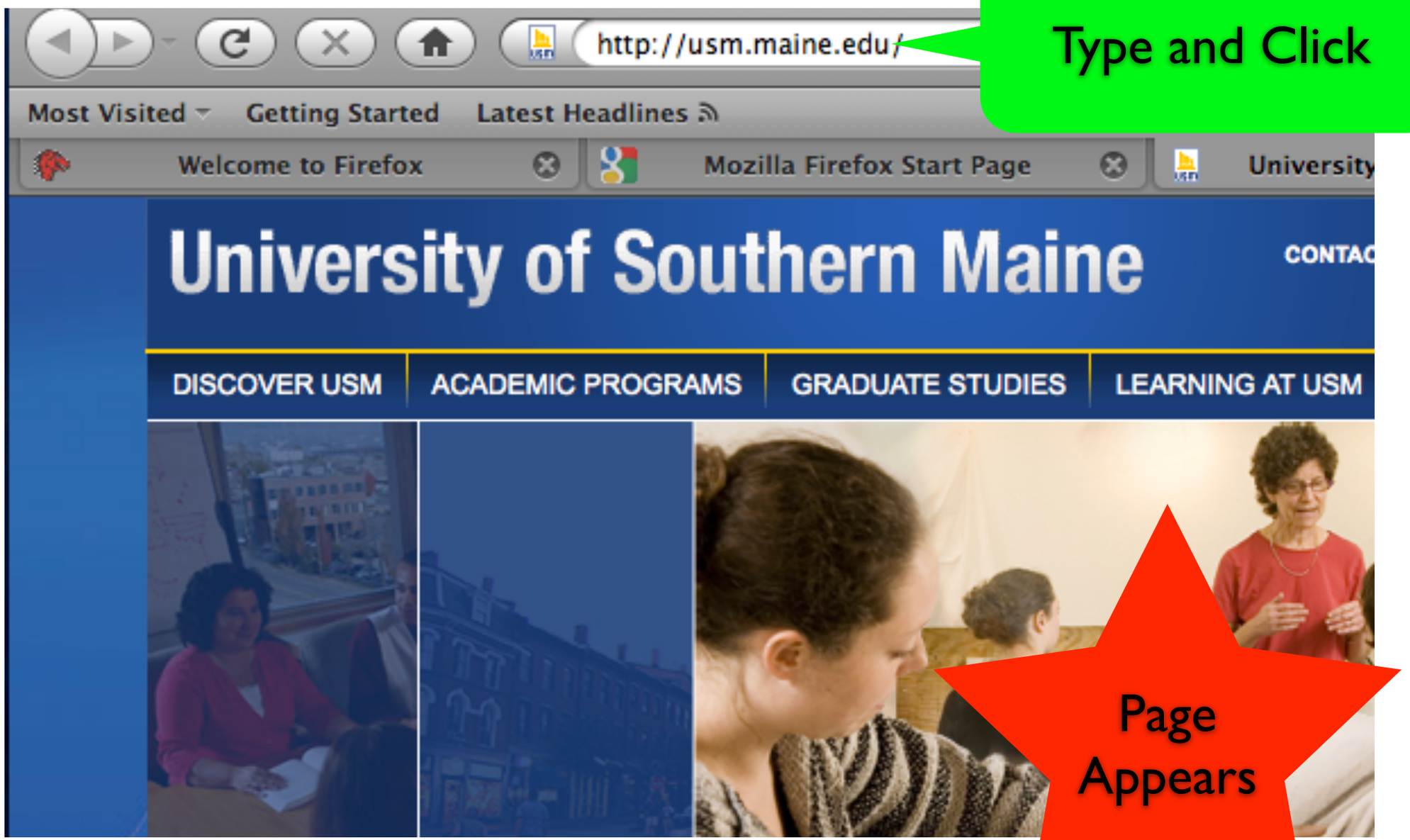
IMAP - Mail Access

Internet Mail Access Protocol

- Text-based, <CRLF> commands
- Uses TCP for transport
- Authentication (LOGIN / LOGOUT)
- SELECT, EXAMINE, FETCH messages
- To send messages use SMTP.

Example: HTTP

- HyperText Transfer Protocol
- HTTPS is “secure” HTTP
- Request for Comment (RFC) 2616, 2068, and1954
- Utilizes TCP/IP (Internet Architecture)



How does this work?

HTTP

Type and Click

GET /index.html HTTP/1.0
User-Agent: Zippo/0.9
Host: www.harpo.com:80

Request

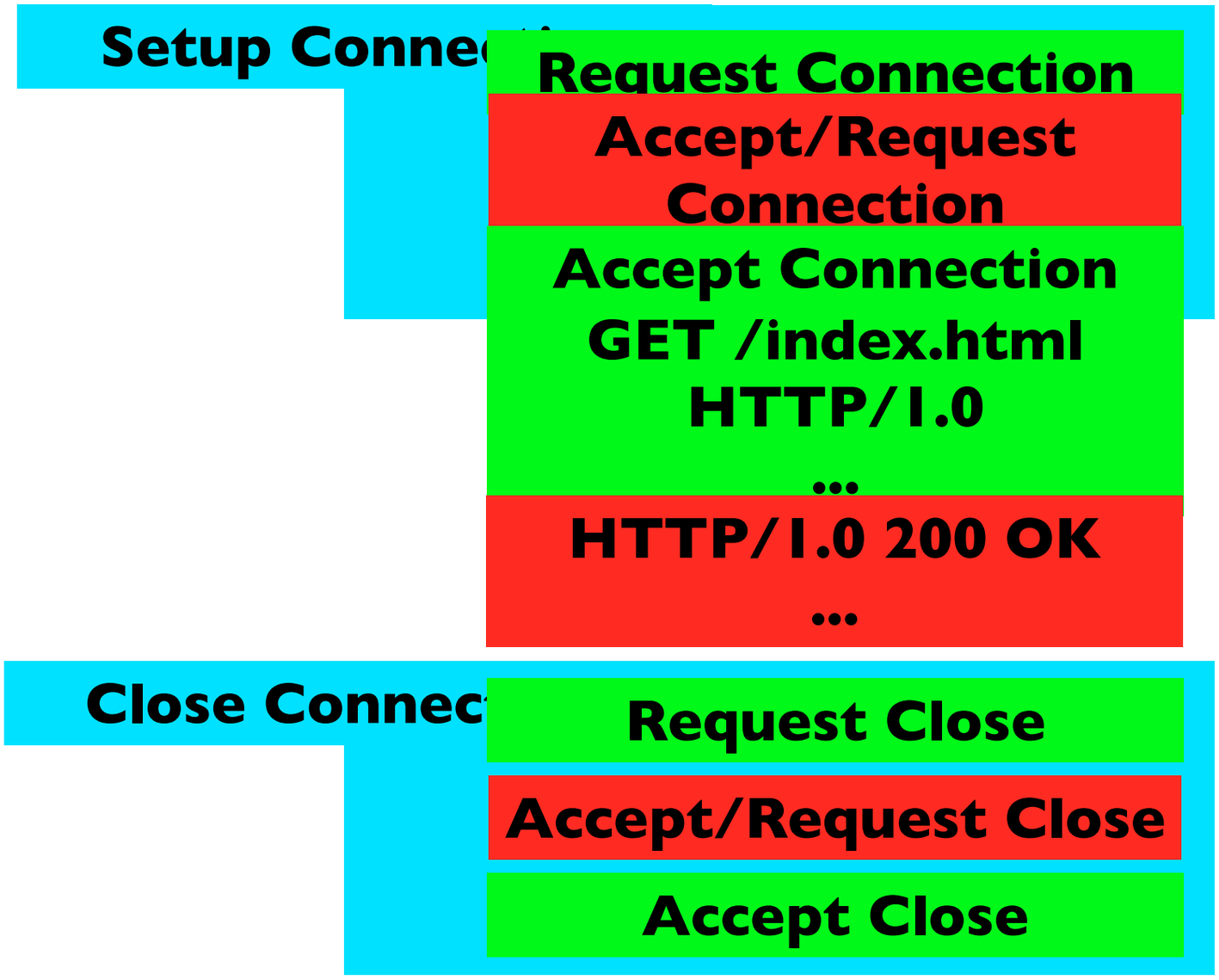
HTTP/1.0 200 OK
Date: Fri, 31 Dec 2009 23:0
Content-Type: text/html

<html>
<body>
...
</html>

Response

Page Appears

HTTP, TCP


Setup Connection
Request Connection
Accept/Request Connection
Accept Connection
GET /index.html HTTP/1.0
...
HTTP/1.0 200 OK
...
Close Connection
Request Close
Accept/Request Close
Accept Close

HTTP

- HTTP is essentially **file transfer**
- Every bit is important
- Similar to Email, Printing, File Servers...

Applications

fin