Connection Management

- Multiple connections
- Mosaic
- Parallel HTTP connections
- Netscape
- Persistent connections
- Http/1.0 & 1.1
Early Suggestions on Connections

- **Http/1.0**
  
  - **Connection:** Keep-Alive

    Request: GET /home.html HTTP/1.0
    ...
    Connection: Keep-Alive

    Response: HTTP/1.0 200 ok
    ...
    Connection: Keep-Alive
    ...
    <response body>
Early Suggestions on Connections

- Attempts of evolution
  - New http methods:
    - MGET
    - GETLIST
    - GETALL
  - Parallel connections approach
Persistent Connections in HTTP/1.1

- Reusing transport connection
- Reducing TCP connection cost (fewer setups and teardowns)
- Reducing latency by avoiding multiple TCP slow-starts
- Avoiding bandwidth wastage and reducing overall congestion
- Making modest changes
Persistent Connections in HTTP/1.1 (con)

- The connection header
  - Connection: keep-alive (absorbed)
  - Connection: close
- Pipelining on persistent connections
  - Potential problems:
    - Head of line blocking
    - Unexpected closes in a pipelined requested stream
- Closing persistent connections
  - Timeout/Max/State (dropped)
  - Decided by server according to factors
Message Transmission

- Exchanging messages for Transmission integrity
- Http/1.0
  - Content-length header
  - Dynamic response
    - Latency
    - Indicate by Closing the connection
Message Transmission (con)

- HTTP/1.1
  - Chunk
    - Transfer-encoding: chunked
    - End: zero-length chunk
    - Example:
      HTTP/1.1 200 OK
      ...
      Transfer-Encoding: chunked
      691
      <bytes of chunk data>
      76
      <bytes of chunk data>
      0
Message Transmission (con)

- **Trailer**
  - Checksum for dynamical responses
  - TE: trailers header / Splinfo header
  - Example:
    - Request: ...
      - TE: trailers
    - Response: Trailer: Splinfo
      - Transfer-encoding: chunked
      - CRLF
      - ...
      - Splinfo: vol=7; pe="u4, 895527629,5465"
      - CRLF
Extensibility

- Learning about the server
  - The OPTIONS method
    - Abilities of servers
    - Max-forwards header: targeting the proxy and detecting loops
  - The TRACE method
    - Request contents returned totally
Extensibility (con)

- Learning about intermediate servers
  - Via header
  - Example:
    Via: 1.0 M-PROXY3:8080 (Squid/2.1.PATCH2)
    1.1 qd.us ircache.net:3128 (Squid/2.3.DEVEL1)

- Upgrading to other protocols
  - Upgrade header (hop-by-hop)
  - Example:
    Upgrade: SafeBank/1.0
    Connection: Upgrade
Internet Address Conservation

- **Http/1.0**
  - GET bar.html HTTP/1.0
- **Http/1.1**
  - GET /bar.html HTTP/1.1
  - Host: www.foo.Com
Content Negotiation

- Http/1.1 (more than Accept header):
  - Agent-driven
  - Server-driven
  - Accept header
    - Qvalue (0.0~1.0)
    - Accept-Encoding: vdelta;q=1.0, gzip;q=0.5, compress;q=0.1, identity;q=0
  - Cache
    - Vary response header
    - Content-Location entity header
Security, Authentication & Integrity

- Challenge-Response
- Security & authentication
  - Userid & password
    - End-to-end encryption
  - Limiting the scope of the credential
    - Request method / URI / lifetime
  - Checksum involves:
    - URI, request method, username, password, one-time nonce value
Security, Authentication & Integrity (con)

- **Integrity**
  - Content-md5 entity header
    - 128-bit checksum
    - End-to-end mechanism: restricted to clients and origin servers
    - Detecting modification
    - CANNOT help: malicious alterations
  - Denial of service (DOS) attack
    - Knowing the message length (chuck encoding)
Proxies

- Types of proxies
  - Intermediary to other systems, speaking a variety of protocols such as WAIS, FTP, or Gopher – no new requirement
  - Speaks HTTP, intermediary between HTTP sender and receiver – reply or pass the request, cache before sending response
  - Proxy/client/tunnel based on the request
Proxies (con)

- Syntactic requirements
  - Forwarding messages
  - Modifying/adding headers
- Semantic requirements
  - Caching: Age header
  - Connection: lifetime & numbers
  - Bandwidth
  - Security
    - Proxy-Authenticate
    - 407 Proxy Authorization Required
Other Changes

- **Methods**
  - Head, Put, Delete, Connect

- **Headers**
  - General headers
  - Response headers
  - Entity headers

- **Response status codes**
  - 2xx/3xx/4xx/5xx response status codes