SIP
Session Initiation Protocol
HTTP

• Hypertext Transfer Protocol
  – For transfer of web pages encoded in html: Hypertext Markup Language

• Our interest: primarily as model for SIP

• HTTP is message-oriented.
  – Messages are ASCII text.
http: Hyper Text Transport Protocol

• Statelessness
  – The original intent, inherited from hypertext implementations, was that the server would serve up pages without knowing or caring who is viewing them or what pages a user had already visited.

• At first, a TCP connection was established every time a link was clicked and torn down when the page was delivered.
http Requests

• Client sends an http message to server.
• Content of message:
  1. Method line
     – Method
     – Requested URL
     – HTTP version
  2. Blank Line
  3. Message body
     – Content varies, depending on method
  4. Blank Lines
Specific Methods

• **GET**
  – Requests a representation of the specified resource.

• **HEAD**
  – Like GET request, but requesting only header in response.

• **POST**
  – Submits user data (e.g. from a HTML form). The data is included in the body of the request.

• **PUT**
  – Uploads a representation of the specified resource.

• **OPTIONS**
  – Asks what HTTP methods the server supports. “What do you support?”

• & More
http Responses

- Server sends back to client.
- Content of message:
  1. Status line
     - HTTP version
     - Status code
     - Status explanation
  2. Headers
  3. Blank Line
  4. Message body
     - Content varies, depending on method
  5. Blank Line
Then…

• In the early days, TCP connection was then severed.
• In later versions of http, the TCP connect is kept open.
Similarities between SIP & HTTP

• SIP addresses look like email addresses:
  – sip:john_doe@acme.com

• DNS is available to resolve domain names:
  – sip:john_doe@123.123.123.123

• SIP uses text messages.
User Agents

• Clients
  – Make requests

• Servers
  – Send responses
Let’s Set Up a Call

Alice's softphone

Bob's SIP phone

INVITE

180 Ringing

ACK

200 OK

Both Way RTP Media

200 OK

BYE
sip Requests

- Client sends a sip message to server.
- Content of message:
  1. Method line
     - Method
     - Requested URI
     - SIP version
  2. Message Header
     - Content varies, depending on method
  3. Blank Line
  4. Message body
     - Content varies, depending on method
     - Important: Session Description Protocol, SDP (RFC2327 and RFC1890)
Specific sip Methods

- **INVITE**
  - Establishes a session
- **ACK**
  - Confirms an INVITE request
- **BYE**
  - Ends a session
- **CANCEL**
  - Cancels establishing of a session
- **REGISTER**
  - Communicates user location (host name, IP)
- **OPTIONS**
  - Communicates information about the capabilities of the calling and receiving SIP phones
- & More
sip Responses

• Server sends back to client.
• Content of message:
  1. Status line
     - sip version
     - Status code
     - Status explanation
  2. Headers
     - Content varies, depending on method
  3. Blank Line
  4. Message body
     - Content varies, depending on method
Types of sip Status Codes

• 1xx = informational responses
• 2xx = success responses
• 3xx = redirection responses
• 4xx = request failures
• 5xx = server errors
• 6xx = global failures
A Few Status Codes

- 100: Trying
- 180: Ringing
- 181: Call Is Being Forwarded
- 182: Queued
- 183: Session Progress
- 200: OK
- 202: Accepted
- 301: Moved Permanently
- 302: Moved Temporarily
Great Site

- www.tech-invite.com/
  - Search for “sip”
Don’t Know Address of Destination UA?

• In the SIP regime, what we generally call “Directory Servers” are **Proxies** or **Redirectors**.
Call Proxy Scenario

INVITE
100 - Trying
180 - Ringing
200 - OK
ACK
INVITE
180 - Ringing
200 - OK
BYE
200 - OK
Call Proxy Scenario – SIP Triangle

1. INVITE
2. INVITE
3. 100 - Trying
4. 180 - Ringing
5. 200 - OK
6. 180 - Ringing
7. 200 - OK
8. ACK
9. RTP
10. BYE
11. 200 - OK
Registrar

User Agent

REGISTER

200 OK

Registrar

User Agent

REGISTER

401 Unauthorized

REGISTER w/ Credentials

200 OK

Registrar
Location Service

User Agent

REGISTER

401 Unauthorized

REGISTER w/ Credentials

200 OK

Registrar

Location Service

User Alice
Call Proxy Scenario Revisited
Redirection Scenario

1. Alice sends an INVITE to the User Agent.
2. User Agent sends a REGISTER to the Loc'n Server.
3. Loc'n Server forwards the REGISTER to the Registrar.
4. Registrar sends a REGISTER-OK to the Loc'n Server.
5. Loc'n Server sends an INVITE to the User Agent.
6. User Agent sends a 200-OK to Alice.
7. Alice sends an ACK.
8. User Agent sends an RTP stream to Bob.
9. Bob sends an ACK.
10. User Agent sends an RTP stream to Alice.
11. Alice receives the RTP stream and sends an ACK.
12. User Agent receives the RTP stream and sends an ACK.
Gateway Scenario

User A

Proxy

Gateway

INVITE: sip:joe@MIT.EDU

“Calls” joe @MIT.EDU
Gateway Scenario

User A

"Calls" joe
@MIT.EDU

INVITE: sip:joe@MIT.EDU

Proxy

Gateway

INVITE: sip:38400@18.162.0.25

INVITE: sip:38400@18.162.0.25

Gateway Scenario

Monday, September 20, 2010
Gateway Scenario

INVITE: sip:joe@MIT.EDU
INVITE: sip:38400@18.162.0.25
100 - Trying

User A
Proxy
Gateway

“Calls” joe @MIT.EDU

Monday, September 20, 2010
Gateway Scenario

User A "Calls" joe @MIT.EDU

INVITE: sip:joe@MIT.EDU

100 - Trying

INVITE: sip:38400@18.162.0.25

180 - Ringing

180 - Ringing

Rings

Gateway Scenario

Monday, September 20, 2010
Gateway Scenario

User A

"Calls" joe @MIT.EDU

Proxy

Gateway

100 - Trying

180 - Ringing

180 - Ringing

200 - OK

INVITE: sip:joe@MIT.EDU

INVITE: sip:38400@18.162.0.25

Rings

Answers

Monday, September 20, 2010
Gateway Scenario

User A

"Calls" joe @MIT.EDU

Proxy

INVITE: sip:joe@MIT.EDU

INVITE: sip:38400@18.162.0.25

100 - Trying

180 - Ringing

180 - Ringing

200 - OK

ACK

ACK

Gateway

Attempts

Rings

180 - Ringing

200 - OK

Answers

Monday, September 20, 2010
Gateway Scenario

INVITE: sip:joe@MIT.EDU
INVITE: sip:38400@18.162.0.25
100 - Trying
180 - Ringing
180 - Ringing
200 - OK
200 - OK
ACK
ACK
Talking
RTP
Rings
Answers
Talking

User A
Proxy
Gateway

“Calls” joe @MIT.EDU

30161
Gateway Scenario

User A

"Calls" joe @MIT.EDU

INVITE: sip:joe@MIT.EDU

INVITE: sip:38400@18.162.0.25

100 - Trying

180 - Ringing

180 - Ringing

200 - OK

ACK

ACK

200 - OK

RTP

Rings

Answers

Talking

Hangs up

BYE

BYE

200 - OK

200 - OK

Talking

Monday, September 20, 2010
SIP Triangle in Gateway Scenario
SIP Trapezoid

- DNS Server
- Location Server
- Registrar
- Outgoing Proxy
- Incoming Proxy
- Originating User Agent
- Terminating User Agent

DNS
SIP
SIP
SIP
RTP

Originating User Agent

Terminating User Agent
SIP Trapezoid