Making Web Faster and Real-Time

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Web Applications

- Web has evolved from “documents” and “sites” to “applications”
- HTML5 and new Javascript APIs will make web apps more powerful
  - As good as native for many purposes
- Strengths
  - Cross-platform
  - Updatability
  - Openness, component orientation
- Weaknesses
  - Capabilities
  - Performance
- Networking and communications on their way from a weakness to a strength!

Traditional Web App Networking Limitations

- Web apps communications limited to HTTP requests to their origin server over the default Internet connection
  - AJAX provided asynchronous requests by Javascript
  - TLS protected TCP connections rationed by the browser
- HTTP is a pure client-server protocol
  - Bidirectional communication and notifications difficult
  - HTTP long-polling based hacks
  - Heavy overhead for small payloads
  - Not good for interactive communications
- No visibility to underlying networking
- No access to local connectivity, e.g. Bluetooth

Improvements

- WebSocket API and protocol
  - Low-overhead bidirectional persistent communication
  - Good for asyncronous updates, messages etc.
- Network information API
  - Visibility to network characteristics
- Push API
  - Access to generic notification/push aggregation services
- HTTP 2.0 (a.k.a. SPDY)
  - More efficient replacement for HTTP 1.1
  - Faster, requires fewer TCP connections, header compression
- WebRTC APIs and protocols
  - Peer-to-peer real-time streams with security and NAT traversal
  - Video and audio over RTP, “data” over SCTP

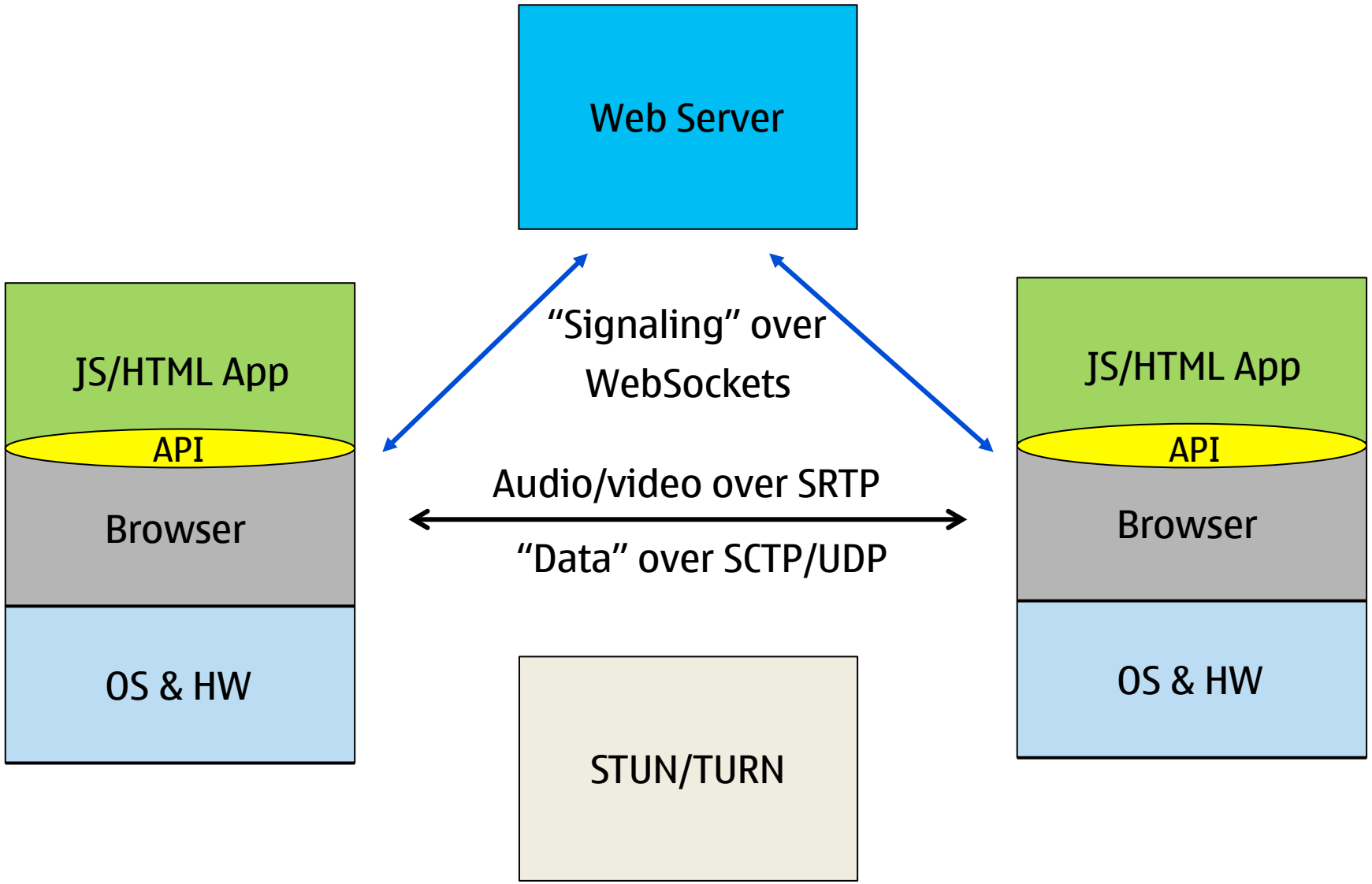
HTTP 2.0 & SPDY - Background

- Growing pains with HTTP/1.1
  - High overhead, no request/response multiplexing, even pipelining not working
  - Modern web sites composed of dozens of – mostly small - objects
  - Only way to get them fast over HTTP/1.1 is to use a large number of parallel TCP connections
- Google published SPDY in late 2009
  - Binary headers, Compression, pipelining, multiplexing
  - Does not change HTTP semantics, i.e., drop-in replacement possible
  - Can outperform HTTP/1.1 using a fraction of TCP connections
  - Now in use by Chrome, Firefox, Google services, Twitter, Amazon, Wordpress, ...
  - Open source implementations available

HTTP 2.0 in IETF

- BOF session held in March 2012
- Protocol proposals solicited
  - Two main candidates: SPDY vs. Microsoft “HTTP Speed+Mobility”
- SPDY chosen as baseline in July 2012
- Aiming to complete by the end of 2014
  - A new version of HTTP is not a light task…
  - A lot of infrastructure relying on HTTP: Browsers, other HTTP clients, libraries, servers, proxies, caches, firewalls, CDNs, load balancers, …
  - But remember SPDY is gaining ground even before the HTTP 2.0 completion, incremental deployment is possible
- Issues under discussion
  - HTTP 1.1 vs. 2.0 discovery
  - Header compression

WebRTC


Web Server
JS/HTML App
API
Browser
OS & HW
"Signaling" over
WebSockets
Audio/video over SRTP
"Data" over SCTP/UDP
STUN/TURN
JS/HTML App
API
Browser
OS & HW

WebRTC in IETF and W3C

- W3C works on the APIs
  - GetUserMedia to get access to camera and mic for real-time streams
  - PeerConnection to setup a peer-to-peer media streams
    - Negotiation based on SDP offer/answer
- IETF works on the protocols and codecs
  - RTP profile for real-time media
    - Secure RTP with DTLS-SRTP key exchange
  - Multiplexing audio and video into a single RTP session/stream
  - Data channel based on SCTP/DTLS/UDP
  - NAT traversal based on ICE, STUN and TURN
  - Congestion control
  - Opus and G.711 mandatory for voice
  - H.264 vs. VP8 still open for video
  - Identity assertions

WebRTC Outlook

- Standards to be completed during 2013
- Pre-standard implementations available in Chrome and Firefox
  - Many apps and demos on Chrome already
- Internet Explorer to follow at some timeframe
- Various use cases
  - Google+ hangouts
  - Skype
  - Facebook video chat
  - Customer service and e-commerce calling sites
    - “4 out of 10 biggest American banks have a WebRTC project”
  - Inside the enterprise
  - SIP/IMS and PSTN gateways
    - Ericsson, Alcatel Lucent, Acme Packet, …