RTC-Web Security Considerations

IETF 80

Eric Rescorla

ekr@rtfm.com

The Browser Threat Model

Core Web Security Guarantee: "users can safely visit arbitrary web sites and execute scripts provided by those sites." [HCB+10]

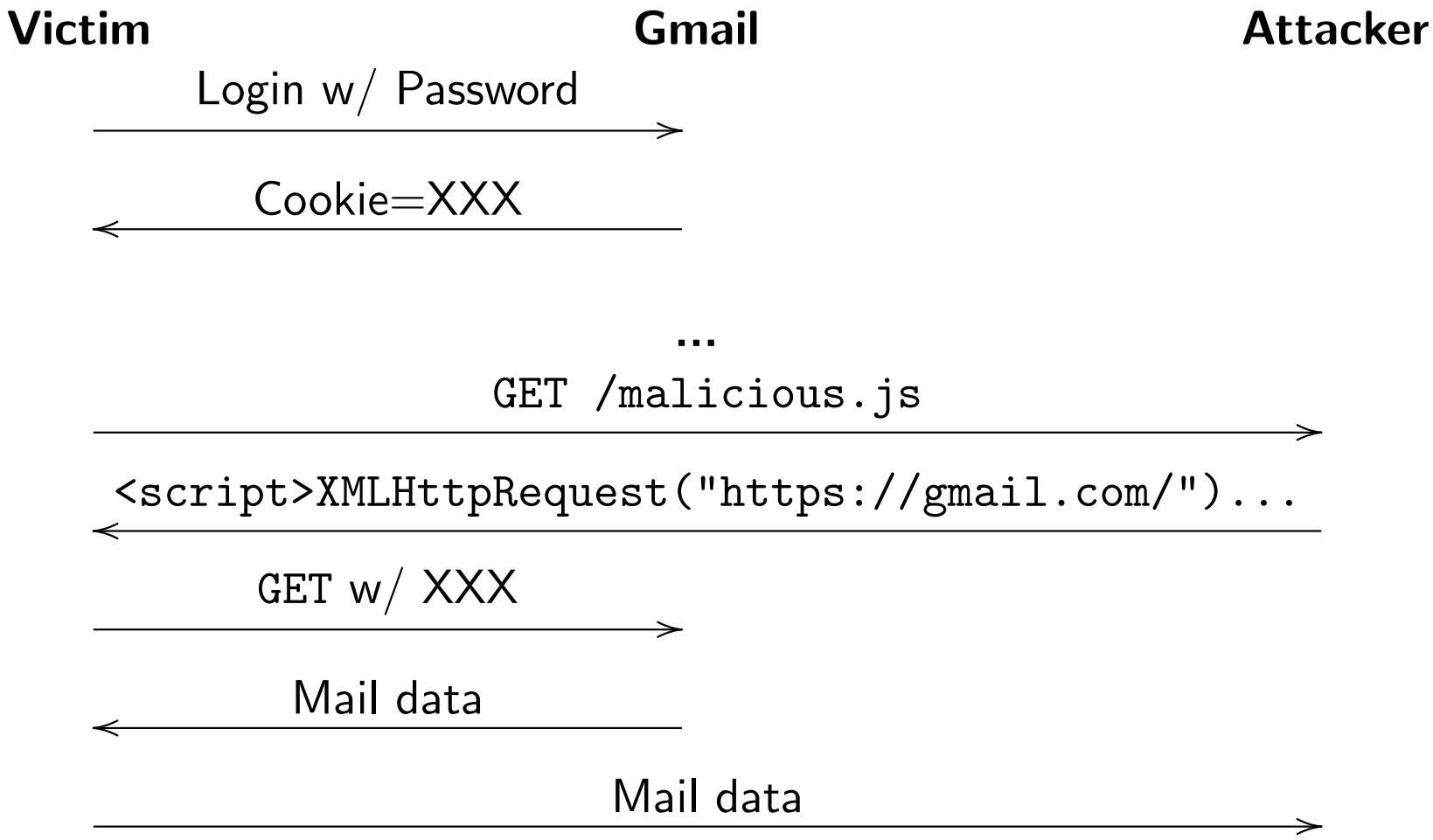
- This includes sites which are hosting malicious scripts!
- Basic Web security technique is isolation/sandboxing
  - Protect your computer from malicious scripts
  - Protect content from site A from content hosted at site B
  - Protect site A from content hosted at site B
- In this case we're primarily concerned with JavaScript running in the browser

The browser acts as a trusted computing base for the site

List of Issues to Consider

- Consent to communications
- Access to local devices
- Communications security

In an alternate universe: Cross-Site Requests



Obviously this is bad... and it's a problem even w/o cookies

The Same Origin Policy (SOP)

- A page's security properties are determined by its *origin*
  - This includes: protocol (HTTP or HTTPS), host, and port
  - All these must match for two pages to be from the same origin
- Each origin is associated with its own security contet
  - Scripts in origin A have only very limited access to resources in origin B
- *Important:* the origin is associated with the page, *not* where the script came from
  - Scripts loaded via `<script src="">` tags are associated with the origin of the page, not the URL for the script!

The Same Origin Policy for Page Data

- Scripts can only access page data from their own origin
  - Contents of the DOM
  - JavaScript variables
  - Cookies
  - Important exception: JavaScript pointer leakage [BWS09]
- Scripts can access any other page data from their origin
  - Includes other windows and IFRAMEs
- Frame can navigate their own children
  - This is used for cross-site communication (e.g., FaceBook Connect)

The Same Origin Policy for HTTP Requests

- JavaScript can be used to make fairly controllable HTTP requests with `XMLHttpRequest()` API
  - But only to the same origin
- Origin A can make partly controllable requests to origin B via HTML forms
  - But cannot read the response
  - *Cross-Site Request Forgery* (CSRF) defenses depend on this
- Origin A can read scripts from origin B
  - But they run in A's context
  - This is done all the time (e.g., Google analytics)

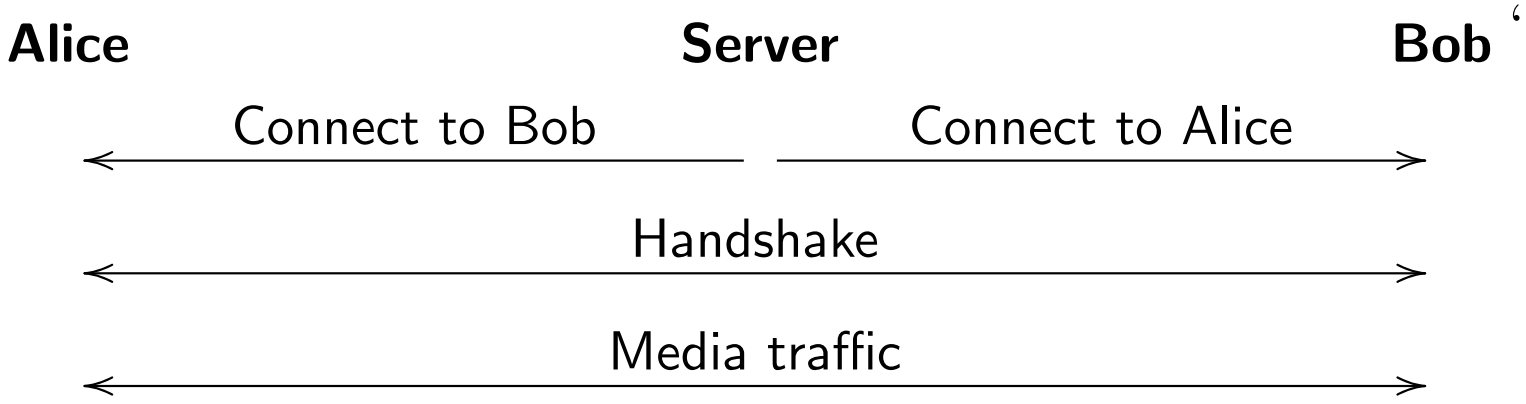
What does all this mean for RTC?

Consent for real-time peer-to-peer communication

- Need to able to send data between two browsers
  - Unless you want to relay everything
- But this is unsafe (and violates SOP)
  - Not OK to let browsers send TCP and UDP to arbitrary locations
- General principle: verify consent
  - Before sending traffic from a script to recipient, verify recipient wants to receive it from the sender
  - Familiar paradigm from CORS [vK10] and WebSockets[Fet11]

How to verify consent for RTC-Web

- Can't trust the server (see above)
  - Needs to be enforced by the browser
- Browser does a handshake with target peer to verify connectivity



- This should look familiar from ICE [Ros10]
- Restricts communication with that endpoint until handshake complete (**new**)

Access to Local Devices

- Making phone (and video) calls requires that your voice be transmitted to other side
  - But the *other side* is controlled by some site you visit
  - What if you visit `http://bugmyphone.example.com`?
- Somehow we need to get the user's consent
  - But to what?
  - And when?
  - Users routinely click through warning dialogs when presenting "in-flow"
- What is the scope of consent?
  - By origin?
  - What about mash-ups?

What about communications security?

- We've already addressed this in the context of SIP
  - Things aren't that different here–all the usual protocols work
- Open question: where is the keying material stored?
  - On the server?
  - In localstorage?
  - In the browser but isolated from the JavaScript? (probably best)

References

[BWS09] Adam Barth, Joel Weinberger, and Dawn Song. Cross-Origin JavaScript Capability Leaks: Detection, Exploitation, and Defense. In Fabian Montrose, editor, *In Proc. of the 18th USENIX Security Symposium (USENIX Security 2009)*, August 2009.

[Fet11] Ian Fette. The WebSocket protocol. `draft-ietf-hybi-thewebsocketprotocol-06.txt`, February 2011.

[HCB+10] Lin-Shung Huang, Eric Y. Chen, Adam Barth, Eric Rescorla, and Collin Jackson. Transparent Proxies: Threat or Menace, 2010. In submission.

[Ros10] J. Rosenberg. Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/Answer Protocols. RFC 5245, 2010.

[vK10] Anne van Kesteren. Cross-Origin Resource Sharing. `http://www.w3.org/TR/access-control/`, 2010.