NIST Workshop: Improving Trust in the Online Marketplace

Revocation Process

Ryan Koski
rkoski@godaddy.com

Reasons for Revocation

- Security
  - Key Compromise
  - Malicious or fraudulent usage
- Business
  - Existing certificate replaced with a newer one
  - Subscriber no longer needs the certificate
  - Failure to uphold some portion of the Subscriber Agreement

Distribution of Certificate Status

- Certificate Revocation List (CRL)
  - RFC 5280
  - Digitally signed list of serial numbers of revoked certificates
  - Can contain reason for revocation and a revocation date for each serial number
  - URI in the CDP extension in certificates
  - Serial number listed = Revoked
  - Serial number NOT listed = Valid

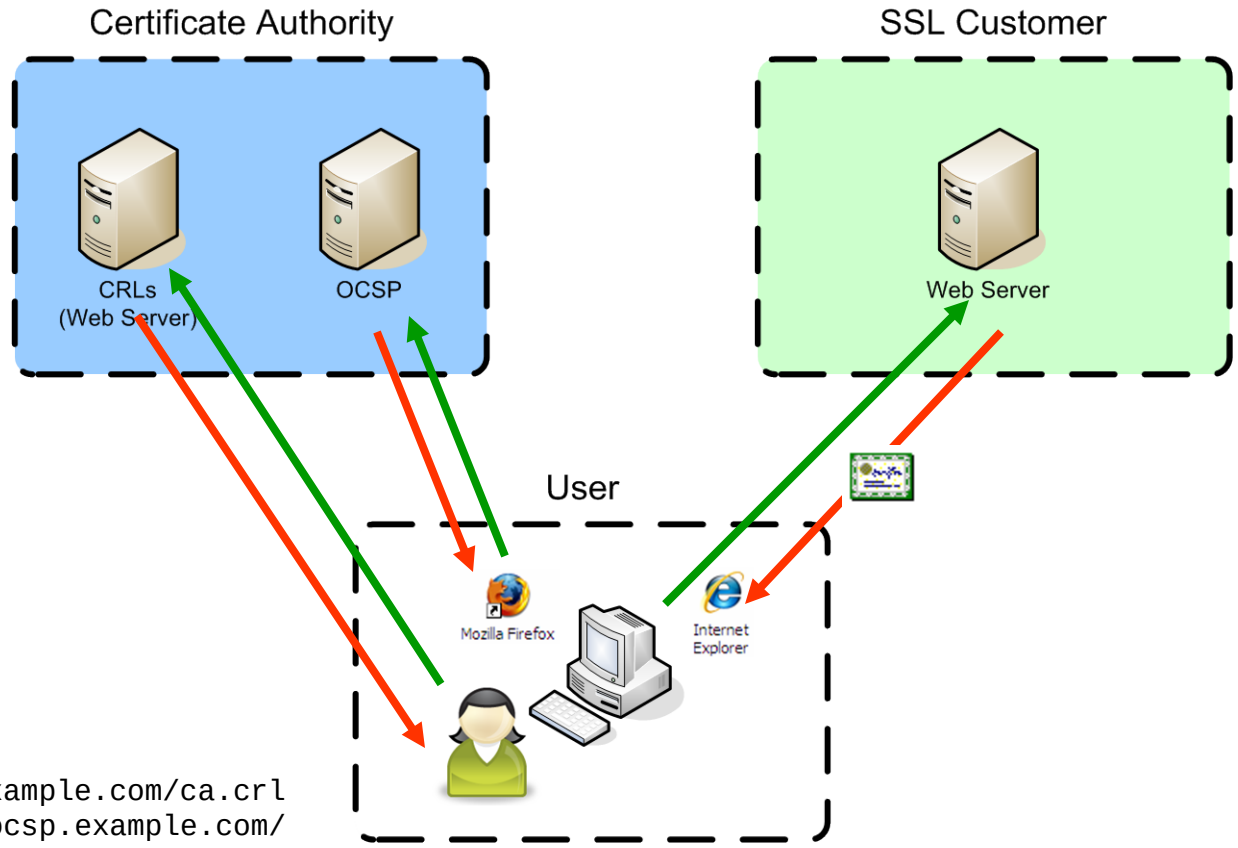
Distribution of Certificate Status

- Online Certificate Status Protocol (OCSP)
  - RFCs 2560, 5019
  - Client requests status of one or more specific serial numbers
  - Server response is a digitally signed message stating ‘good’, ‘revoked’, or ‘unknown’, OR an unsigned error code.
  - URI to OCSP service in AIA extension

SCVP

- Server-Based Certificate Validation
  - RFC 5055
  - Client outsources path construction and/or validation to a trusted server
  - Not commonly used on the Internet

Revocation and Validation




```
CRL: http://example.com/ca.crl
OCSP: http://ocsp.example.com/
```

CRL Pros / Cons

- Con
  - Grow over time
    - 2007: 158KB
    - 2013: 41MB
  - Single list of “problematic” customers
  - No positive confirmation
- Pro
  - Potentially more efficient for CAs that issue very few certs that are unlikely to be revoked.

OCSP Pros / Cons

- Pro
  - Small, constant size
  - Can provide real-time status
  - Can provide positive confirmation
    - CA/Browser Forum Baseline Requirements: 8/1/2013
- Con
  - Requires a request/response cycle for each certificate encountered by a client
    - Adds latency to TLS handshake
    - Significant load on OCSP service

Criticisms

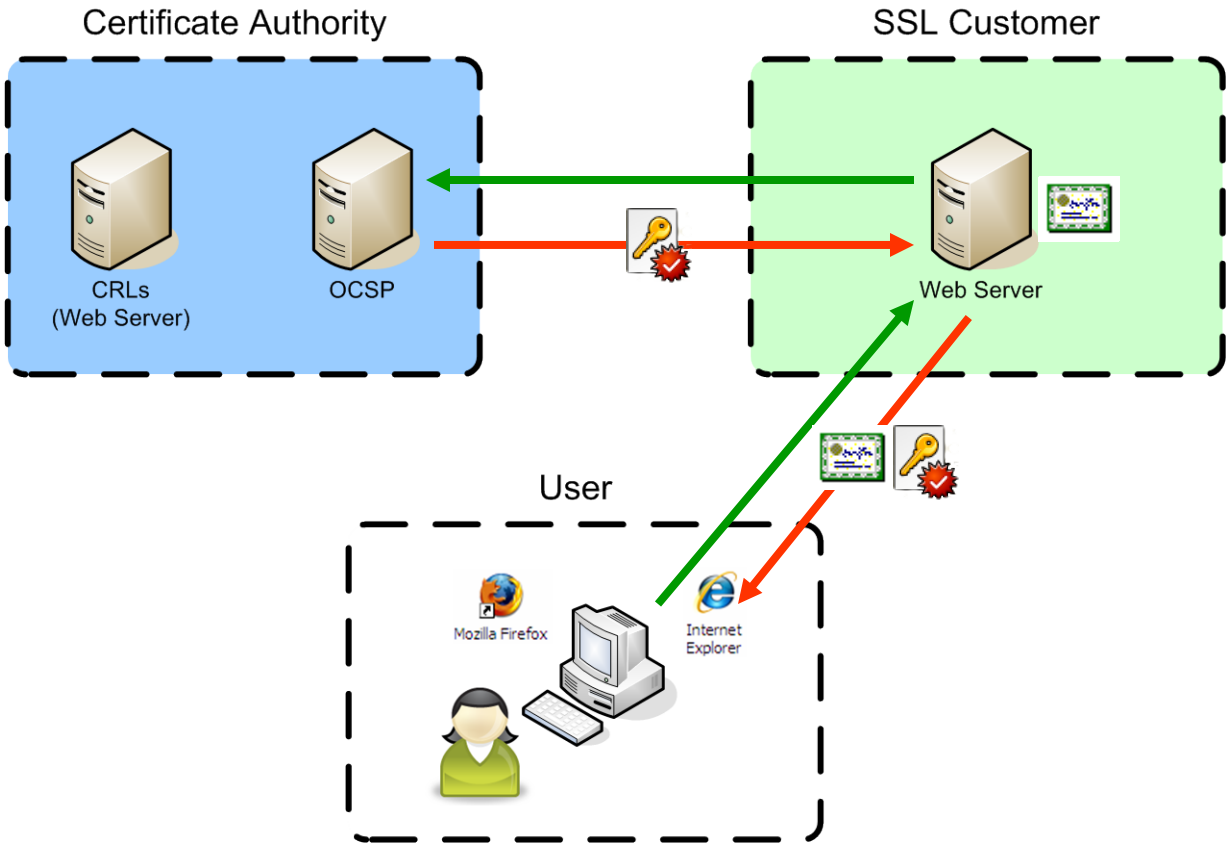
- Performance impact
  - https://revocation-report.x509labs.com/
- Privacy
- Client not always able to obtain status
  - Captive portals
  - Egress filtering
  - Random network failures
- “It only works when you don’t need it.”

OCSP Stapling

- RFC 6066 (Certificate Status extension)
- Server retrieves and caches OCSP response for its certificate
- Server provides OCSP response to client in TLS handshake

OCSP Stapling

```
OCSP: http://ocsp.example.com/
```



OCSP Stapling

- Performance Impact
  - No separate connection to OCSP service
  - However, potentially adds additional round trips
- Privacy
  - CA only receives requests from its customers
- Client not always able to obtain Status
  - Client receives OCSP response from the web server
- “It only works when you don’t need it”
  - Attacker has to block web server from getting updated OCSP response

OCSP Stapling: Issues

- Performance
  - Overflow initial congestion window
- Limited to single OCSP response
  - https://datatracker.ietf.org/doc/draft-ietf-tls-multiple-cert-status-extension/
- Server support
  - IIS 7, Apache httpd 2.4+, nginx 1.3.7+
- Client support
  - Varies based on platform/library/toolkit

No-Fail vs. Soft-Fail vs. Hard-Fail

- No-Fail: Don’t even check for revocation
- Soft-Fail: Client allows TLS handshake to proceed if unable to determine certificate status
- Hard-Fail: Client allows TLS handshake to proceed IFF it can determine the certificate is still valid

Why not Hard-Fail?

- Client priorities and competition
  - Performance
  - “Show the page”
- Potentially creates new DoS vector
- Transition to OCSP Stapling
  - “Must-Staple” extension

Varied Levels of Support

- Clients have differing behaviors
  - Different versions of the same client
  - Same client running on different platforms
- Behavior may depend on version of underlying library/toolkit
- Some clients have implemented their own solutions
- Many non-browser clients do no revocation checking at all

Recommendations

- OCSP Stapling (multiple certificate status)
- CAs should avoid delegated OCSP signing
- Libraries/Toolkits should provide high-level APIs for applications
- Better education/awareness