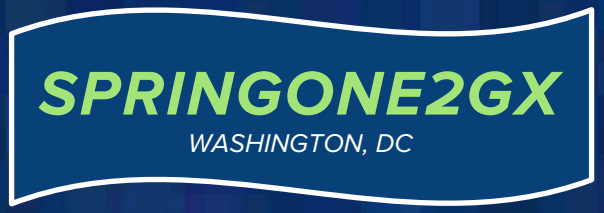


The State of Securing RESTful APIs with Spring

By Rob Winch

@rob_winch





TOUCHING WIRES CAUSES
INSTANT DEATH
$200 FINE
Newcastle Tramway Authority

Authentication

Naïve approach...

https://api.example.com?
username=rob&password=secret

Futurama

> *Come on Bender. It's up to you to make your own decisions in life. That's what's separates people and robots from animals .. and animal robots!*

Fry

RFC-7231 Sensitive Information

> *Authors of services ought to avoid GET-based forms for the submission of sensitive data ...*
>
> *- RFC-7231: Section 9.4*

Basic Authentication

```
HTTP/1.1 401 Access Denied
WWW-Authenticate: Basic realm="Rest"
Content-Length: 0
```

Basic Authentication

```
GET /messages/100 HTTP/1.1
Authorization: Basic cm9iOnNlY3JldA==
```

Digest Authentication

```
HTTP/1.0 401 Unauthorized
WWW-Authenticate: Digest realm="rest@example.com",
                         qop="auth,auth-int",
                         nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
                         opaque="5ccc069c403ebaf9f0171e9517f40e41"
Content-Length: 0
```

Digest Authentication

```
GET /messages/ HTTP/1.0
Authorization: Digest username="rob",
                      realm="rest@example.com",
                      nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
                      uri="/messages/",
                      qop=auth,
                      nc=00000001,
                      cnonce="0a4f113b",
                      response="460b693843cc6d2c3b9bde8ec1eef505",
                      opaque="5ccc069c403ebaf9f0171e9517f40e41"
```

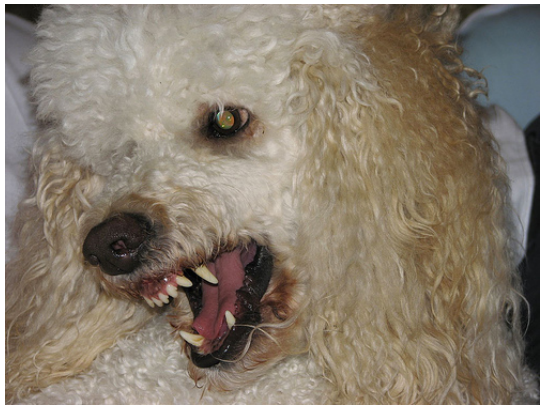
Digest Authentication

```
HA1 = MD5( "rob:rest@example.com:secret" )
    = 8ff99f404047cfbf7a5973437dd9453b

HA2 = MD5( "GET:/messages/" )
    = b3b2c648e81657249f8e940c9aa7a121

Response = MD5( "8ff99f404047cfbf7a5973437dd9453b:\
                 dcd98b7102dd2f0e8b11d0f600bfb0c093:\
                 00000001:0a4f113b:auth:\
                 b3b2c648e81657249f8e940c9aa7a121" )
         = 460b693843cc6d2c3b9bde8ec1eef505
```

Transport Layer Security (TLS)

- *Confidentiality*
- *Integrity*

goto fail;



Checking TLS

https://www.ssllabs.com/ssltest/

https://shaaaaaaaaaaaaaa.com/

TLS Performance

- *Computational overhead*
- *Latency overhead*
- *Cache*

> *On our production frontend machines, **SSL/TLS accounts for less than 1% of the CPU load**, less than 10 KB of memory per connection and less than 2% of network overhead.*
>
> *- Adam Langley, Google*

https://goo.gl/IYJrqv

> *We have found that modern software-based TLS implementations running on* ***commodity CPUs are fast enough to handle heavy HTTPS traffic load*** *without needing to resort to dedicated cryptographic hardware.*
>
> - *Doug Beaver, Facebook*
>
> *https://goo.gl/pf8Xwh*

> *HTTP keepalives and session resumption mean that most requests do not require a full handshake, so* ***handshake operations do not dominate our CPU usage****.*
>
> *- Jacob Hoffman-Andrews, Twitter*
>
> *https://goo.gl/Re0ijb*

TLS Optimize

- *TLS Resumption*
- *Latency*
- *Online Certificate Status Protocol (OCSP)*
- *Cloudflare*

Optimizing TLS

Is TLS Fast Yet.com

HTTP Basic over HTTPS?

oclHashcat

Hash Type	Speed
SHA1	42.408 Bh/s
SHA256	16.904 Bh/s
SHA512	5.2 Bh/s

Ubuntu 14.04, 64 bit
ForceWare 346.29
X NVidia Titan X

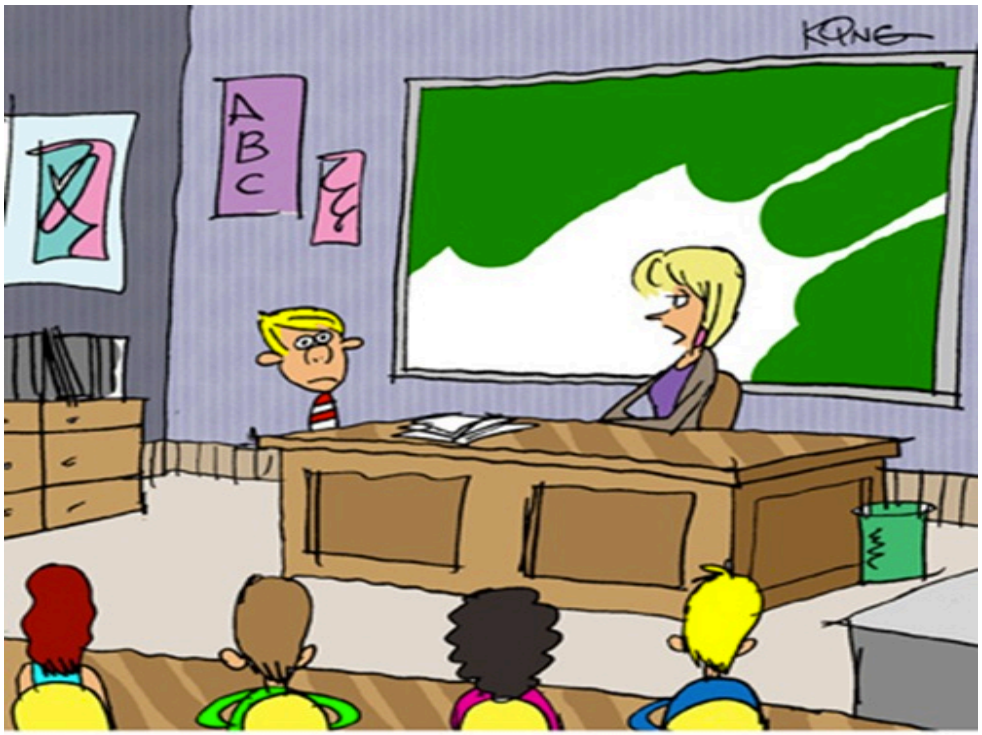
Introduce Session

```
username=winch&name=Rob+Winch
```

Encrypting the Session

```
Base64(IV,
       aes_cbc(k,IV,plainText))
```

- **k** – a secret key only known to server
- **aes_cbc** – encrypts the plainText using AES/CBC with the provided IV
- **plainText** – format of username=winch&name=Rob+Winch



Your handwriting is atrocious, not encrypted

Introduce Session

Can change [1] properly encrypted value below:

```
username=winch&name=Rob+Winch
```

To have the following Plaintext

```
username=admin&name=Rob+Winch
```

[1] https://goo.gl/2Uio0W

Tony Arcieri
@bascule

Follow

JOSE/JWT considered harmful and dangerous (ask me why!)

2:03 PM - 27 Jul 2015

https://goo.gl/Hs383Z

Thomas H. Ptacek
@tqbf

Follow

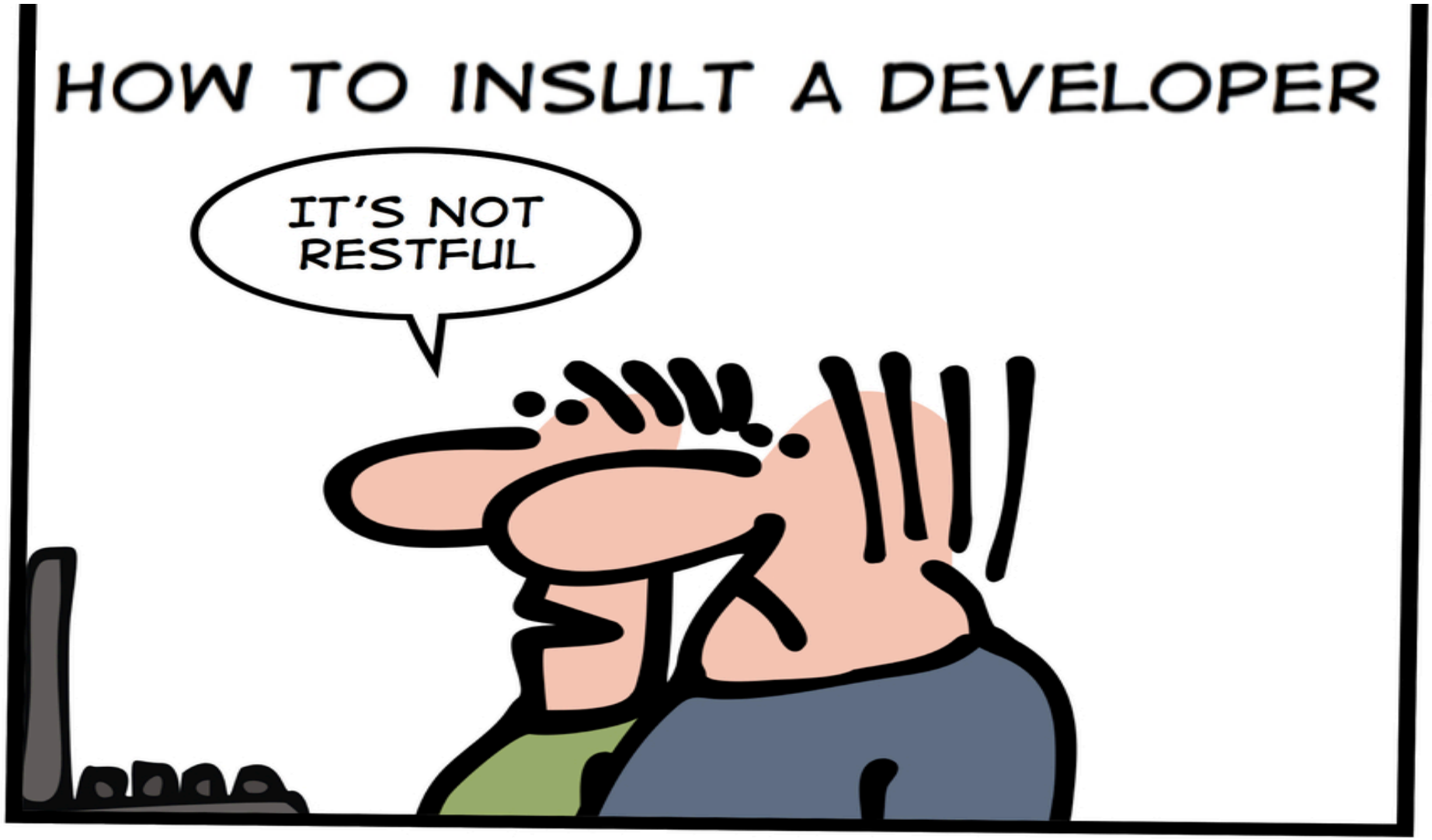
Thinking about securing an API with JWT? First, punch yourself in the face. Then: just use a 256 bit random token, and a database.

10:54 AM - 28 May 2015

https://goo.gl/ZbP9Yp

JWT Header

```
{"alg":"HS256","typ":"JWT"}
```


HOW TO INSULT A DEVELOPER
IT'S NOT RESTFUL

> *... each request from client to server must contain all of the information necessary to understand the request, and* ***cannot take advantage of any stored context on the server****.*

- Roy Fielding, Architectural Styles and the Design of Network-based Software Architectures

http://goo.gl/MzVy0V

Representational STATE transfer

> “... ***session state can be transferred by the server to another service*** *such as a database to maintain a persistent state for a period and allow authentication*
>
> - *Wikipedia*
>
> *http://goo.gl/bd33t7*

Code Slide

```
public interface HttpSession {

    …

}
```

```
GET /messages/ HTTP/1.1
Host: api.example.com
Cookie: JSESSIONID=AS348AF929FK219CKA9FK3B79870H; HttpOnly; secure;
Accept: application/json
```

Customizing the Cookie

```
<session-config>
    <cookie-config>
        <name>SESSION</name>
    </cookie-config>
</session-config>
```

Spring Session

```
@Configuration
@EnableRedisHttpSession
public class Config {

    @Bean
    public JedisConnectionFactory connectionFactory() {
        return new JedisConnectionFactory();
    }
}
```

Spring Session

```
public class Initializer extends
          AbstractHttpSessionApplicationInitializer {

    public Initializer() {
        super(Config.class);
    }
}
```

Spring Session

```
public class Initializer extends
          AbstractHttpSessionApplicationInitializer {

    public Initializer() {
        super(Config.class);
    }
}
```

Spring Session

```
<filter>
  <filter-name>
    springSessionRepositoryFilter
  </filter-name>
  <filter-class>
    org.springframework.web.filter.DelegatingFilterProxy
  </filter-class>
</filter>

<filter-mapping>
  <filter-name>springSessionRepositoryFilter</filter-name>
  <url-pattern>/*</url-pattern>
</filter-mapping>
```

```
GET /messages/ HTTP/1.1
Host: api.example.com
x-auth-token: AS348AF929FK219CKA9FK3B79870H
Accept: application/json
```

Spring Session

DEMO

SessionRepositoryFilter

```
public void doFilter(ServletRequest req,
                     ServletResponse resp,
                     FilterChain chain {

    ServletRequest request =
        new SessionRepositoryRequestWrapper(req);
    …

    chain.doFilter(request, response);
}
```

SessionRepositoryRequestWrapper

```
public HttpSession getSession() {

    // return custom HttpSession
}
```

OAuth 2.0?

- *When working within a sandbox*
- *Limiting liability*

Authorization

```
http
    .authorizeRequests()
        .antMatchers("/public/**").permitAll()
        .antMatchers("/admin/**").hasRole("ADMIN")
        .anyRequest().authenticated()
```

Authorization

```
@PostAuthorize("returnObject?.to?.id == principal.id")
Message findOne(Long id);
```

Authorization

```
@PreAuthorize("#message?.from?.id == principal.id")
<S extends Message> S save(Message message);
```

Permissions

```
@PostAuthorize("hasPermission(returnObject,'read')")
Message findOne(Long id);
```

Permissions

```
@PreAuthorize("hasPermission(#message,'write')")
<S extends Message> S save(Message message);
```

```
public interface PermissionEvaluator … {
  boolean hasPermission(Authentication authentication,
                        Object targetDomainObject,
                        Object permission);
  boolean hasPermission(Authentication authentication,
                        Serializable targetId,
                        String targetType,
                        Object permission);
}
```

Queries?

```
@Query("select m from Message m where m.to.id = ?
#{principal.id}")
Iterable<Message> inbox();
```

Queries?

```
@Query("select m from Message m where m.to.id = ?
#{principal.id}")
Page<Message> inbox(Pageable pageable);
```

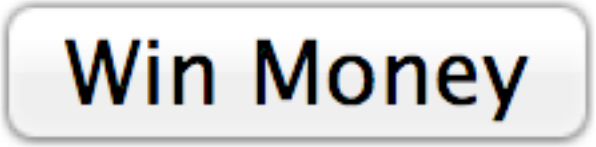
Future Work?

```
@EnableAclSecurity
public interface SecuredMessageRepository
    extends MessageRepository {}

// Vote for it! DATACMNS-293 SEC-2409
```

CSRF

DEMO

CSRF Protection



CSRF Protection

```
POST /messages/100 HTTP/1.1
Host: localhost:8080
Content-Type: application/x-www-form-urlencoded
Cookie: SESSION=7bb7792b-b640-45a3-bec8-bacb3ca95cbb

_method=delete
```

CSRF Protection

```
POST /messages/100 HTTP/1.1
Host: localhost:8080
Content-Type: application/x-www-form-urlencoded
Cookie: SESSION=7bb7792b-b640-45a3-bec8-bacb3ca95cbb
X-CSRF-TOKEN: 322c2de6-00ab-4bb3-8a97-ab3c7291d4ad

_method=delete
```

CSRF Protection

> When do I use CSRF protection?

CSRF Protection

> ... but my application uses JSON

CSRF Protection

```
<form ... method="post" enctype="text/plain">
  <input type='hidden'
     name='{"summary":"Hi", … "ignore_me":"'
value='test"}'
  />
</form>
```

CSRF Protection

```
{
  "summary": "Hi",
  "message": "New Message",
  "to": "luke@example.com",
  "ignore_me": "=test"
}
```

CSRF Protection

> … but my application is stateless

CSRF Protection

```
POST /sample/100 HTTP/1.1
Host: localhost:8080
Content-Type: application/x-www-form-urlencoded
Authorization: Basic cm9iQGV4YW1wbGUuY29tOnBhc3N3b3Jk

_method=delete
```

CSRF Protection

> …and I use a custom header for authentication and ignore cookies

CSRF Protection

- Use proper HTTP Verbs
- Configure CSRF Protection
- Include the CSRF Token

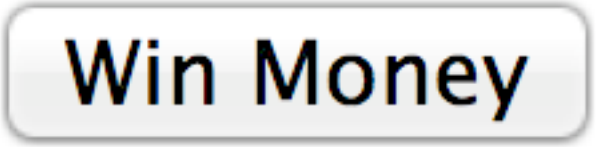
Including the CSRF Token

```
@RequestMapping("/csrf”)
public CsrfToken csrf(CsrfToken token) {
    return token;
}
```

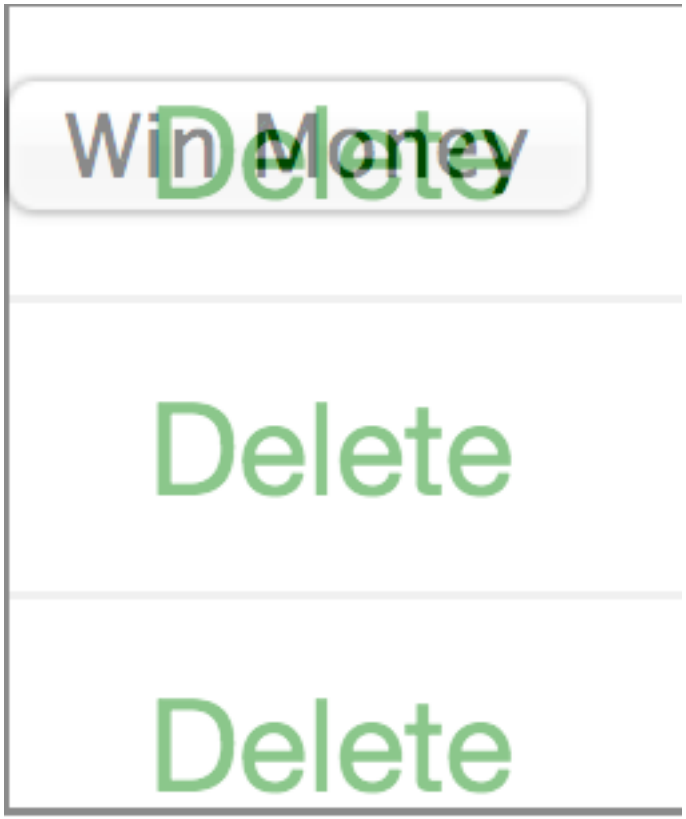
Clickjacking

DEMO

Security HTTP Response Headers



Security HTTP Response Headers



Security HTTP Response Headers

```
HTTP/1.1 200 OK
X-Content-Type-Options: nosniff
X-XSS-Protection: 1; mode=block
Cache-Control: no-cache, no-store, max-age=0, must-revalidate
Pragma: no-cache
Expires: 0
X-Frame-Options: DENY
Strict-Transport-Security: max-age=31536000 ; includeSubDomains
```

Related Talks

- ***Hands on Spring Security 4.1*** *– Wed at 8:30am*
- ***Spring MVC 4.2: New and Noteworthy*** *– Wed at 10:30am*
- ***A How to Guide to Security in the PAAS Cloud*** *– Wed at 4:30pm*
- ***Securing Microservices with Spring Cloud Security*** *– Thurs at 10:30am*

Learn More. Stay Connected.

- *Use TLS*
- *Authentication Should Have State*
- *Use Proper Authorization*
- *Use a Framework Because Individuals Cannot Provide Good Security*

Twitter: @rob_winch

YouTube: spring.io/video

LinkedIn: spring.io/linkedin

Google Plus: spring.io/gplus