OWASP
Open Web Application
Security Project

Securing REST APIs with SSL/TLS

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Personal Introduction

- Youssef Oujamaa
  - Software Engineer
    - Full-stack Java SE/EE, JavaScript, AngularJS
    - Software system design
  - Computer Security Enthusiast
    - Secure code analysis
    - Web, Linux, OpenBSD

Contents

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REST APIs

- Client-Server
- HTTP
  - GET, POST, DELETE, PUT
  - http://securityevents.com/api/resource
- Stateless
- JSON

```
{
   "ticketId": 12,
   "eventName": "Security Conference 2020",
   "price": 41.95,
   "presentations": [
      "0days",
      "buffers"
   ]
}
```

SSL/TLS

- Secure Sockets Layer (SSL)
- Transport Layer Security (TLS)
- OSI Model

Application Layer	**HTTP**
Presentation Layer	SSL/TLS
Transport Layer	TCP
Network Layer	IP

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SSL/TLS

- Symmetric Cryptography
- Key Exchange
  - RSA
  - Diffie-Hellman
  - ECDH
- Cipher
  - AES
- Certificate Authority
  - Commercial solutions
  - Self-signing

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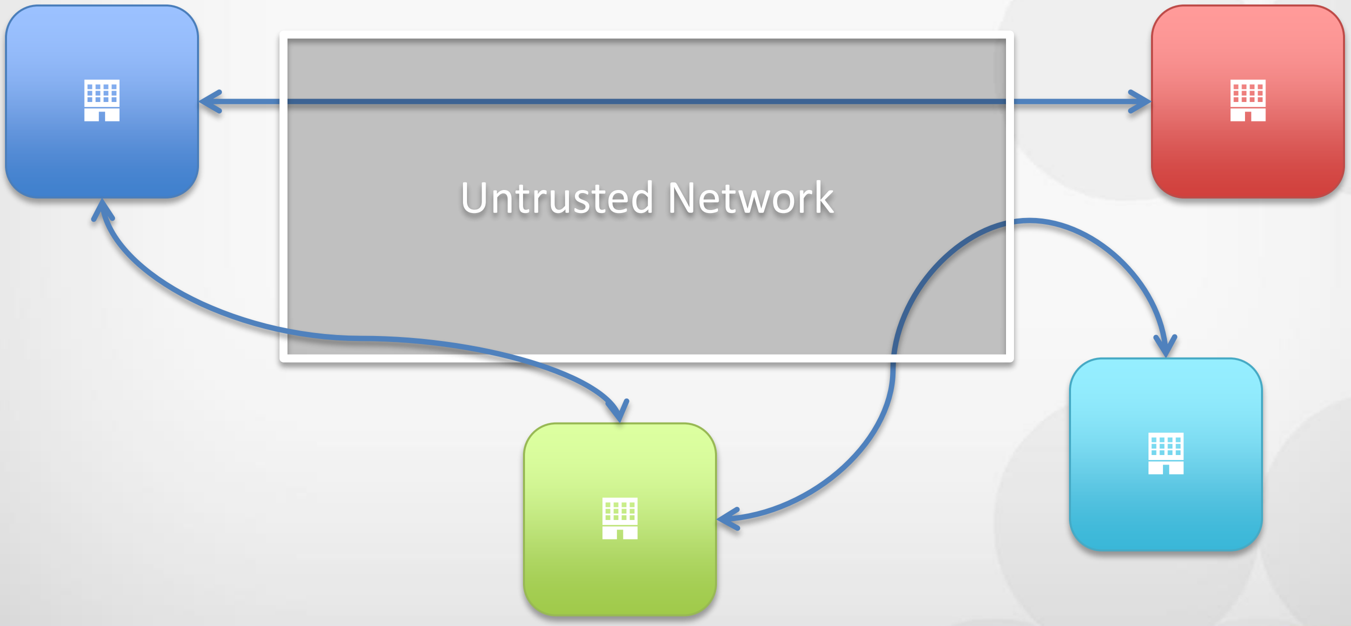
HTTPS

- HTTP over TLS
- Securely transfers
  - URL, Headers, Cookies and Body
- Insecurely transfers
  - Hostname and Port Number (TCP/IP)
- One and two way TLS authentication

Use Case

- Cross network communication
- Transactions between organizations



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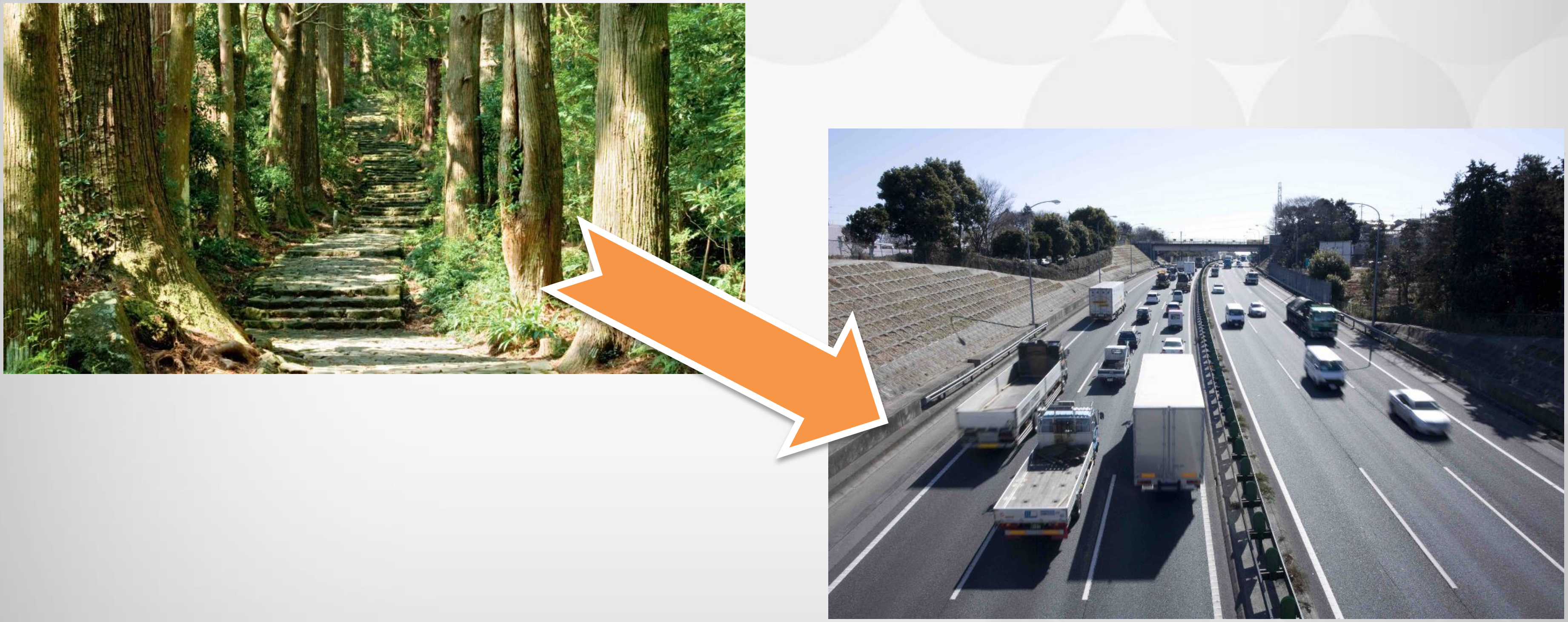
Let’s do it!

We know there is a short road, so lets pave it!

CONNECT. LEARN. GROW.



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Cons and pros

- Proper Key Infrastructure
  - Investment
- Network Infrastructure
  - Proxies, Firewalls, Load Balancers
- Distribution of server and client certificates
- The initial handshake is still slow
- Possible single point of failure

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Java EE 6 Working Example

https://github.com/youjamaa

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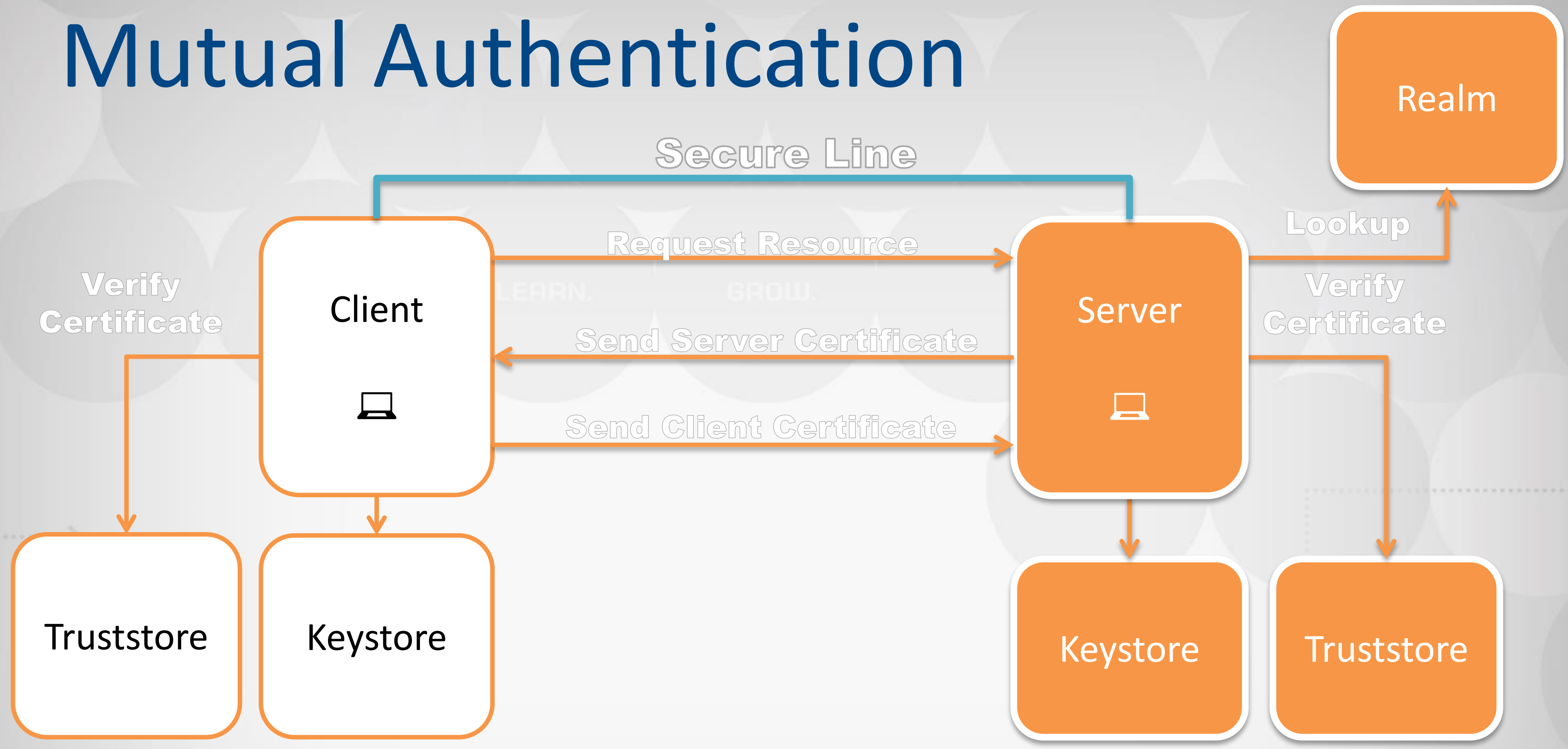
Mutual Authentication



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Configuring Mutual Authentication

- server.xml

```
<Connector port="7777" protocol="HTTP/1.1" SSLEnabled="true"
maxThreads="150" scheme="https" secure="true" clientAuth="false"
sslProtocol="TLS" />
```

- web.xml

```
<login-config>
    <auth-method>CLIENT-CERT</auth-method>
    <realm-name>owasprealm</realm-name>
</login-config>
```

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Configuring Mutual Authentication

- Realm configuration

```
<Realm className="org.apache.catalina.realm.MemoryRealm" />
```

- tomcat-users.xml

```
<tomcat-users>
 <role rolename="owasprealm" />
 <user username="CN=CertName,OU=Marketing,O=Company,L=Osaka,ST,S=Osaka,C=JP"
     password="null"
     roles="owasprealm" />
</tomcat-users>
```

- DataSourceRealm to use a database
- JNDIRealm to use an LDAP server

Securing Resource Paths

```
<security-constraint>

    <web-resource-collection>
        <web-resource-name>someName</web-resource-name>
        <url-pattern>/api/marketing/*</url-pattern>
        <http-method>GET</http-method>
        <http-method>POST</http-method>
    </web-resource-collection>

    <auth-constraint>
        <role-name>owasprealm</role-name>
    </auth-constraint>
    <user-data-constraint>
        <transport-guarantee>CONFIDENTIAL</transport-guarantee>
    </user-data-constraint>

</security-constraint>
```

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Certificate Management

- Enrollment
  - Creation and signing
- Provisioning
  - Uploading keystore and trustores
- Monitoring
  - Logging events and tracking certificates
- Revocation
  - Preparing for the worst

- Manual work and it's prone to errors
  - *i.e.* risk increases as each step requires human interaction
  - Possible mitigation by applying the four-eyes principle

We need to automate this!

Continues Integration & Delivery

- Ideal world – Zero Touch
- Automatic generation of certificates
  - Keys, certificates, stores and their passwords generated
  - Data is stored in a vault
- Signing
  - Uploading and signing
- Provisioning
  - Configuration based provisioning
- Revoking
  - Single source for revocation

Hardening Apache Tomcat

- sslEnabledProtocols (same as the sslProtocol option)
  - SSLv2 and SSLv3 are not secure
  - Use TLSv1.2, TLSv1.1, TLSv1
- Ciphers
  - Really old ciphers like Triple DES are enabled by default!
  - Explicitly specify secure ciphers and key exchange methods
- Configure a secure realm
  - MemoryRealm based updates require a restart
  - Use the LockOutRealm

Hardening Apache Tomcat

- Plain text password mess
  - truststorePass, keystorePass, keyPass all visible in server.xml
  - Mitigation
    - Password provisioning during application deployment
    - Secure access on operating/file system level
- Deciding between OpenSSL vs. JSSE
  - OpenSSL seems to be haunted with security issues
  - At first sight JSSE seems more secure but it could be obscurity
  - Performance wise; Java 8 supports hardware acceleration for cryptographic operations
    - *JEP 164: Leverage CPU Instructions for AES Cryptography*

Hardening Apache Tomcat

- Disable client-initiated renegotiation
  - Java 8 features a new option jdk.tls.rejectClientInitiatedRenegotiation

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That’s all for now! Questions? :)