Developing Burp Suite Extensions

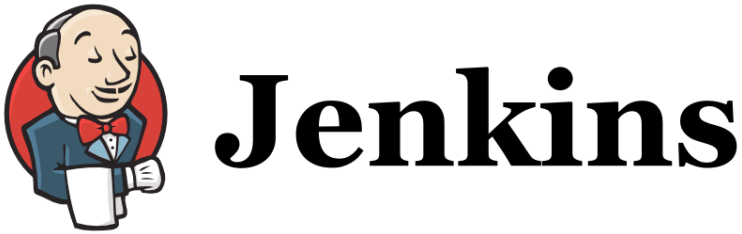
From manual testing to security automation

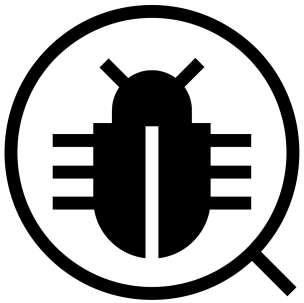
Luca Carettoni - luca@doyensec.com

Welcome

- This is a brand-new class!
- Hands-on and highly interactive
- We have 14 hours to go from manual testing to security automation

Ingredients





Agenda - Day 1

1. Intro
2. A quick recap of Burp Suite's tools
3. Understanding Burp's Extensibility APIs
4. IDE setup and templates
5. *Hello Burp* extension
6. Customer logger

Agenda - Day 2

7. Replay tool
8. Passive check for the scanner
    Detect pages missing SRI attribute
9. Active check for the scanner
    Detect EJL vulnerabilities
10. Security automation toolchain integrated in Jenkins
11. Intruder payload generator case study (Bradamsa)

About me

- ♡ AppSec since 2004
- Doyensec Co-founder
- Former AppSec @LinkedIn, Director of Security (Addepar), Senior Security Researcher (Matasano), ….

Relevant work

- First edition of **Instant Burp Suite Starter**
  - Packt Publishing, 70 pages, ISBN-10 1849695180
- Numerous extensions:
  - Bradamsa - https://github.com/ikkisoft/bradamsa
  - Blazer https://github.com/ikkisoft/blazer
  - ParrotNG https://github.com/ikkisoft/ParrotNG
  - etc..
- Burp Suite's anti-debugging patch me
  - http://blog.nibblesec.org/2013/01/anti-debugging-techniques-and-burp-suite.html

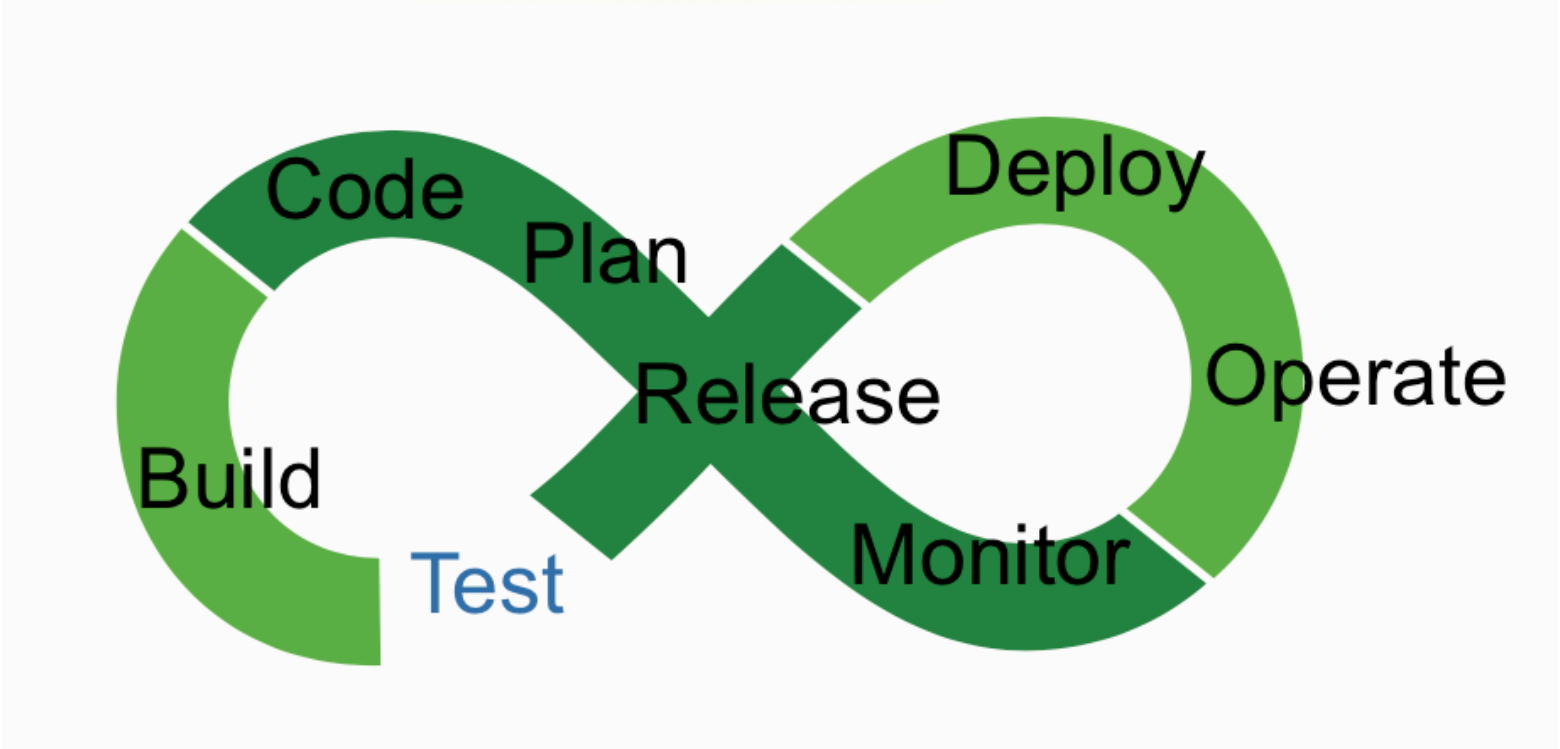
Contact Details

- If you have questions, problems - even after the training:
  - Email: luca@doyensec.com
  - Twitter: @lucacarettoni

Getting to know you

- Builder or Breaker
  - How many pentesters?
  - How many software engineers?
  - …
- Have you ever used Burp? How often?
- Let’s talk about coding in Java
  - *Hello World* or *Cocktail Shaker Sort* algorithm?

Tactical Testing



Setup

Getting all ready…

Java / Python / Ruby

- I will be coding in Java with Netbeans
- You can follow examples in any of the three languages
- For hands-on exercises, I would highly recommend coding in Java too!

What you need

- Laptop :)
- Recent Java JDK installed
- Oracle Netbeans IDE installed
  - You can use Eclipse or IDEA (if you're very familiar with those)
- Git command line installed

Burp Suite Professional

- Since we're building Scanner extensions, **this training requires a Pro license**
- You can either use your own license, or I can provide a temporary license kindly offered by

Burp Setup

- Configure your browser to use the Burp Proxy listener as its HTTP proxy server
- *Firefox* is probably the best browser for security testing

Setup Proxy in Internet Explorer

- Go to the Tools menu, select Internet Options, go to the Connections tab, and click on the "LAN settings" button. Make sure the "Automatically detect settings" box is unchecked. Make sure the "Use automatic configuration script" box is unchecked. Make sure the "Use a proxy server for your LAN" box is checked. Enter your Burp Proxy listener address in the "Address" field (by default, 127.0.0.1). Enter your Burp Proxy listener port in the "Port" field (by default, 8080). Make sure the "Bypass proxy server for local addresses" box is unchecked. Then click on the "Advanced" button. Make sure the "Use the same proxy server for all protocols" box is checked. Delete anything that appears in the "Exceptions" field. Then click "OK" to close all of the options dialogs.

Setup Proxy in Chrome

- The Chrome browser picks up the HTTP proxy settings configured on the host computer. If you are using Chrome, you can open your computer's built-in browser and follow the instructions for configuring that. If you aren't sure where the built-in proxy settings are, open Chrome, go to the Customize menu, select Settings, click on "Show advanced settings", and click the "Change proxy settings ..." button. This will open the relevant configuration options for your host computer.

Setup Proxy in Firefox

- Go to the Firefox menu, click on Options, click on Advanced, go to the Network tab, and click on the Settings button in the Connection section. Select the "Manual proxy configuration" radio button. Enter your Burp Proxy listener address in the "HTTP proxy" field (by default, 127.0.0.1). Enter your Burp Proxy listener port in the "Port" field (by default, 8080). Make sure the "Use this proxy server for all protocols" box is checked. Delete anything that appears in the "No proxy for" field. Then click "OK" to close all of the options dialogs.

Setup Proxy in Safari

- Go the Safari menu, click on Preferences, click on Advanced, and by the Proxies label click the "Change Settings" button. This will open the Network configuration settings for your current network adapter. In the Proxies tab, check the "Web Proxy (HTTP)" box, and enter your Burp Proxy listener address in the "Web Proxy Server" field (by default, 127.0.0.1), and your Burp Proxy listener port in the (unlabeled) port field (by default, 8080). Ensure the "Bypass proxy settings for these Hosts & Domains" box is empty. Repeat these steps for the "Secure Web Proxy (HTTPS)" checkbox. Click "OK" and "Apply" and close the open dialogs.

Clone the training repo

1. Open the terminal
2. From your working directory, clone using

```
$ git clone https://github.com/doyensec/burpdeveltraining.git
```

Training Repo Structure

- BurpExtensionTemplate
  - Eclipse
  - IDEA
  - Netbeans
- Bradamsa
- DetectELJ
  - Java
  - Python
  - Ruby
- DetectSRI
  - Java
  - Python
  - Ruby
- HelloBurp
  - Java
  - Python
  - Ruby
- ReplayAndDiff
  - Java
  - Python
  - Ruby
- SiteLogger
  - Java
  - Python
  - Ruby

Each extension includes **Work In Progress** versions:

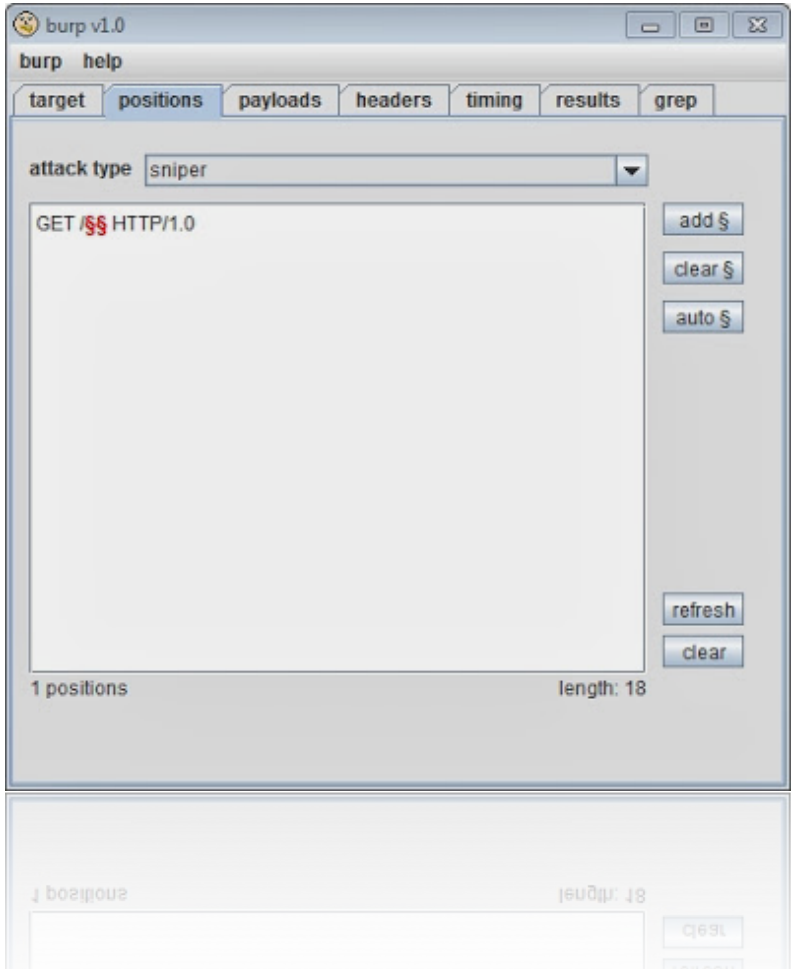
- /WIP1/
- /WIP2/
- /Final/

Burp Suite Intro

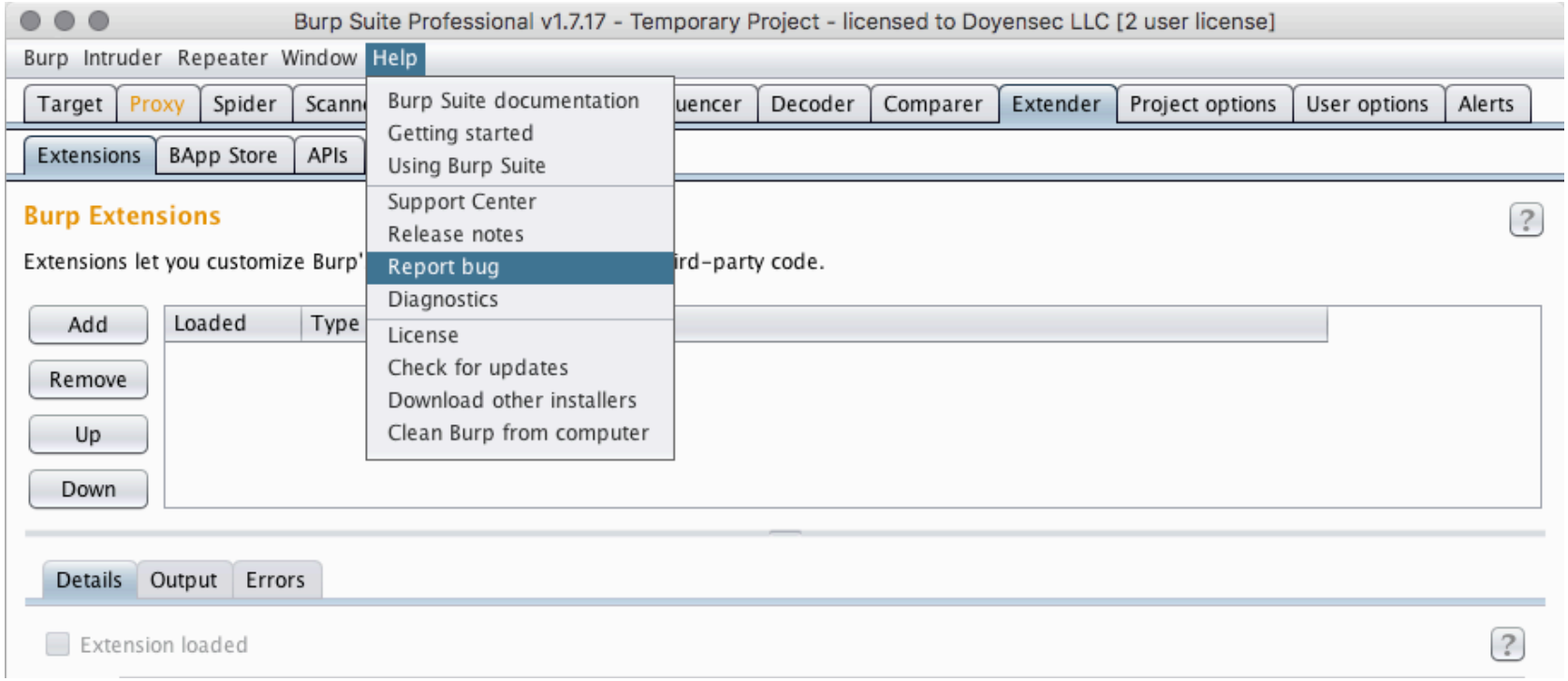
Overview

- Burp is the Swiss-army knife of Web Application Security
- Multiple tools, seamlessly integrated
  - Proxy
  - Spider
  - Scanner (Pro version only)
  - Intruder
  - Repeater
  - Sequencer
  - Decoder
  - Comparer

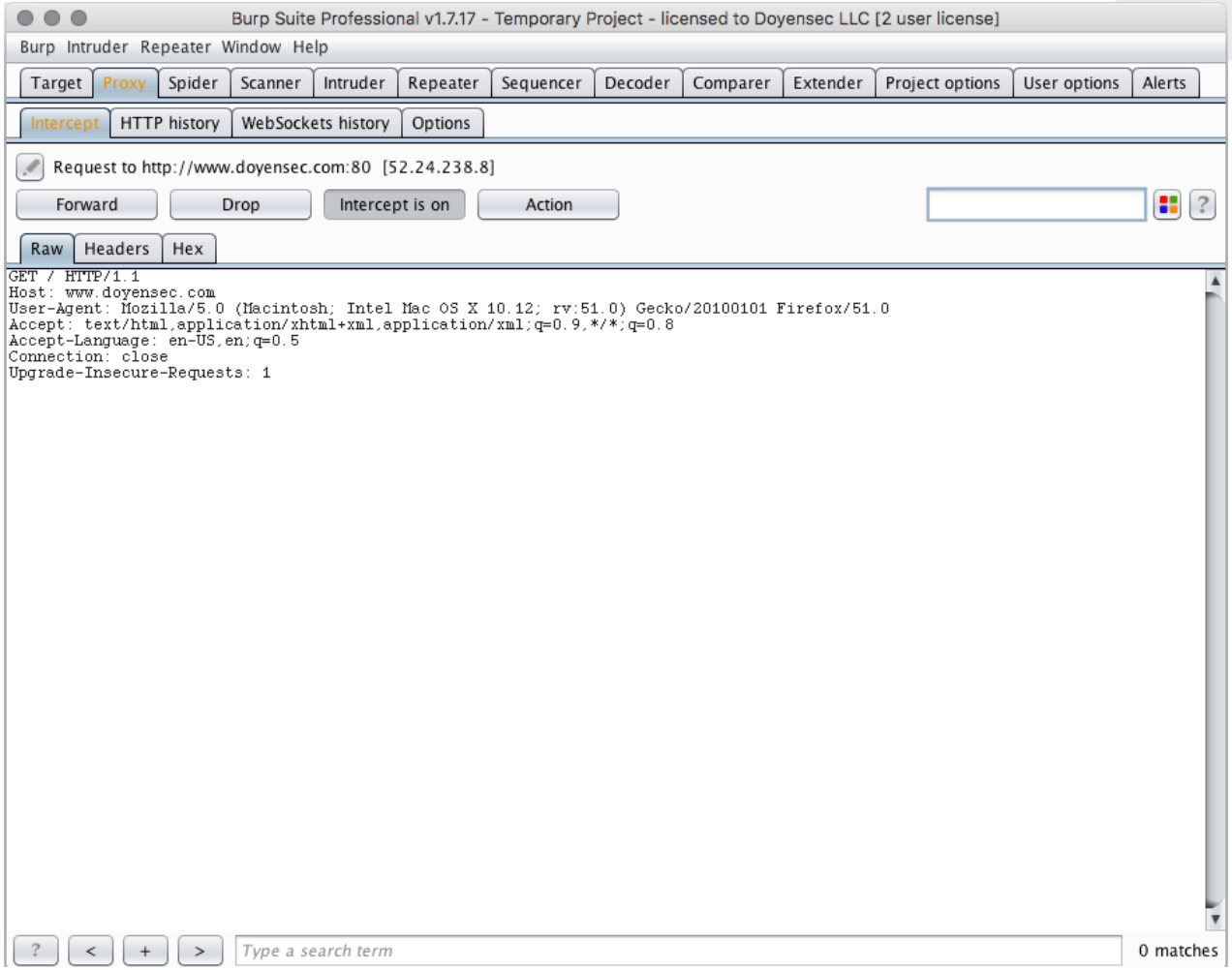
From Burp v1.0 - June 2003



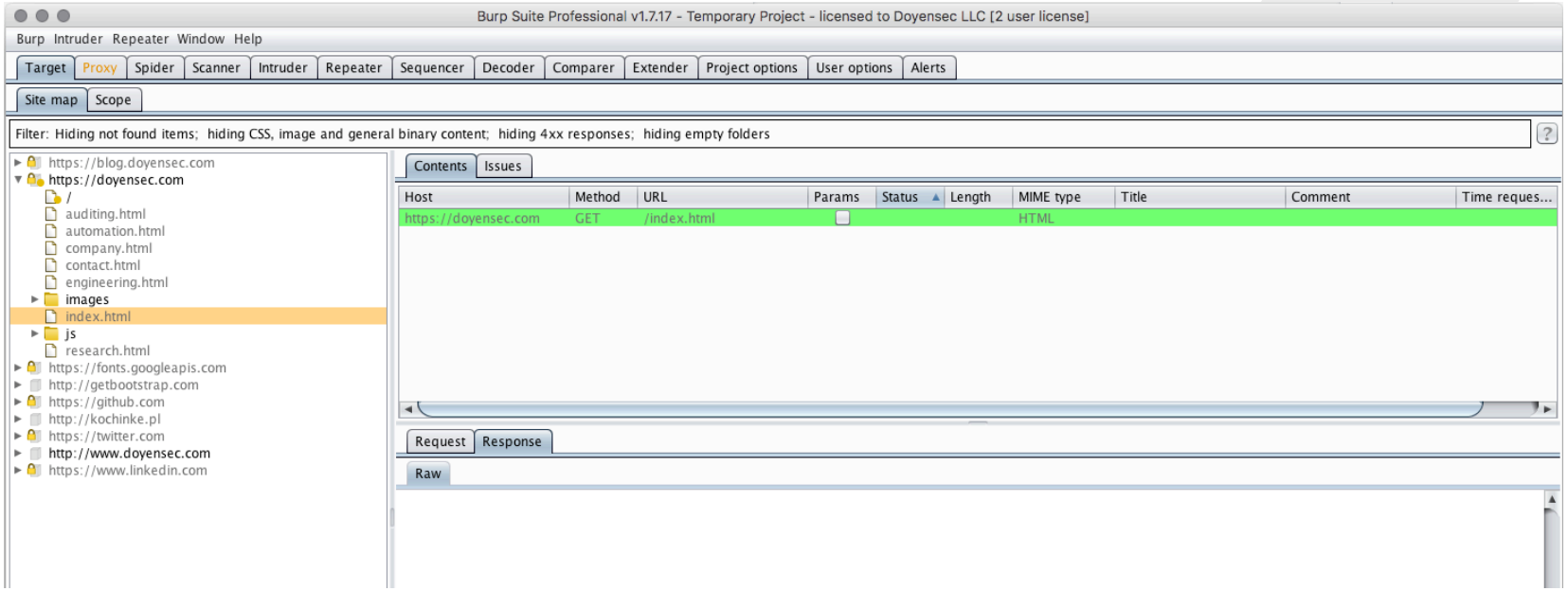
To v1.7.17 and counting…



Proxy


Burp Suite Professional v1.7.17 - Temporary Project - licensed to Doyensec LLC [2 user license]
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
Intercept HTTP history WebSockets history Options
Request to http://www.doyensec.com:80 [52.24.238.8]
Forward Drop Intercept is on Action
Raw Headers Hex
GET / HTTP/1.1
Host: www.doyensec.com
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:51.0) Gecko/20100101 Firefox/51.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Connection: close
Upgrade-Insecure-Requests: 1
Type a search term
0 matches

Target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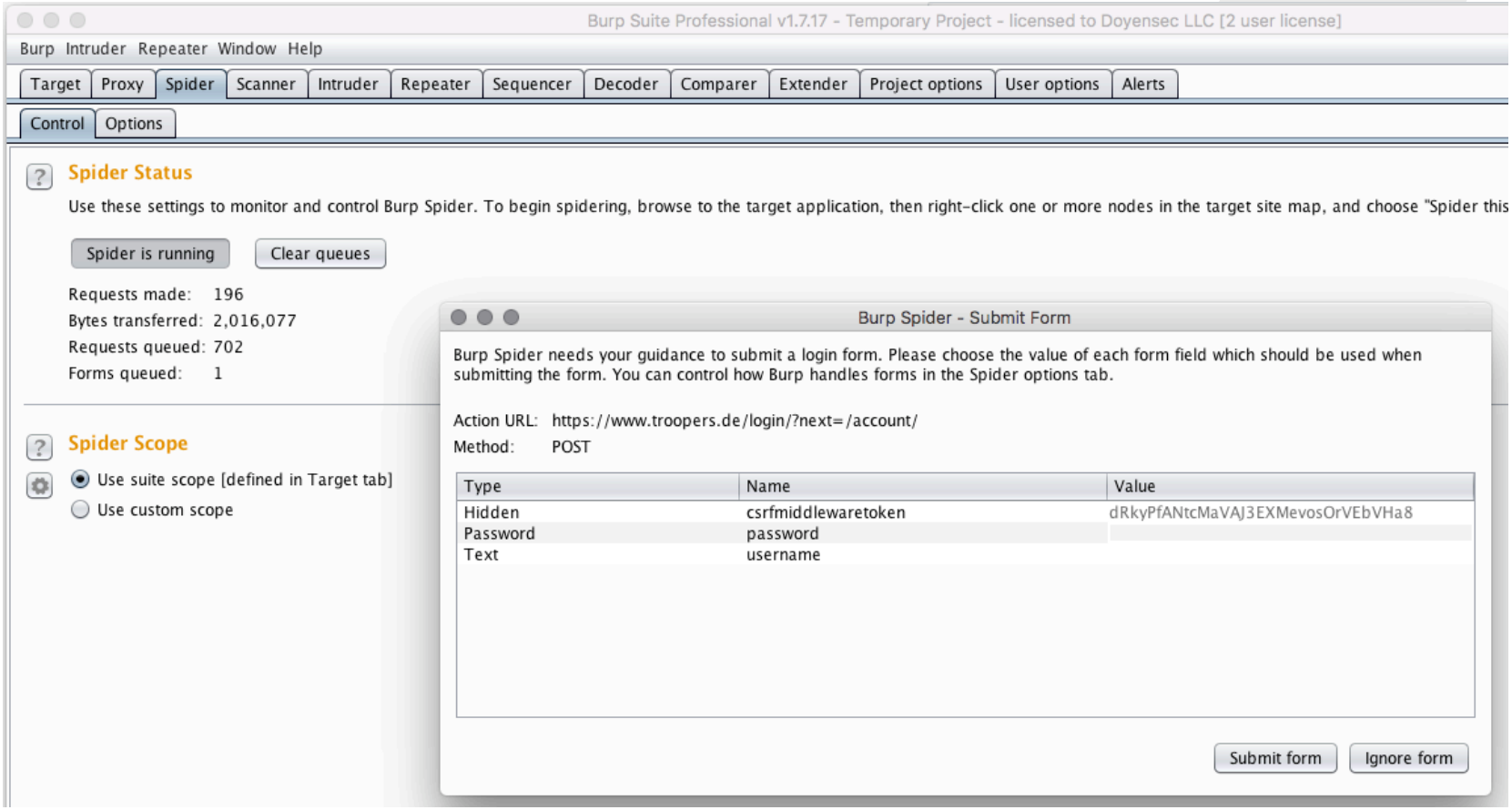
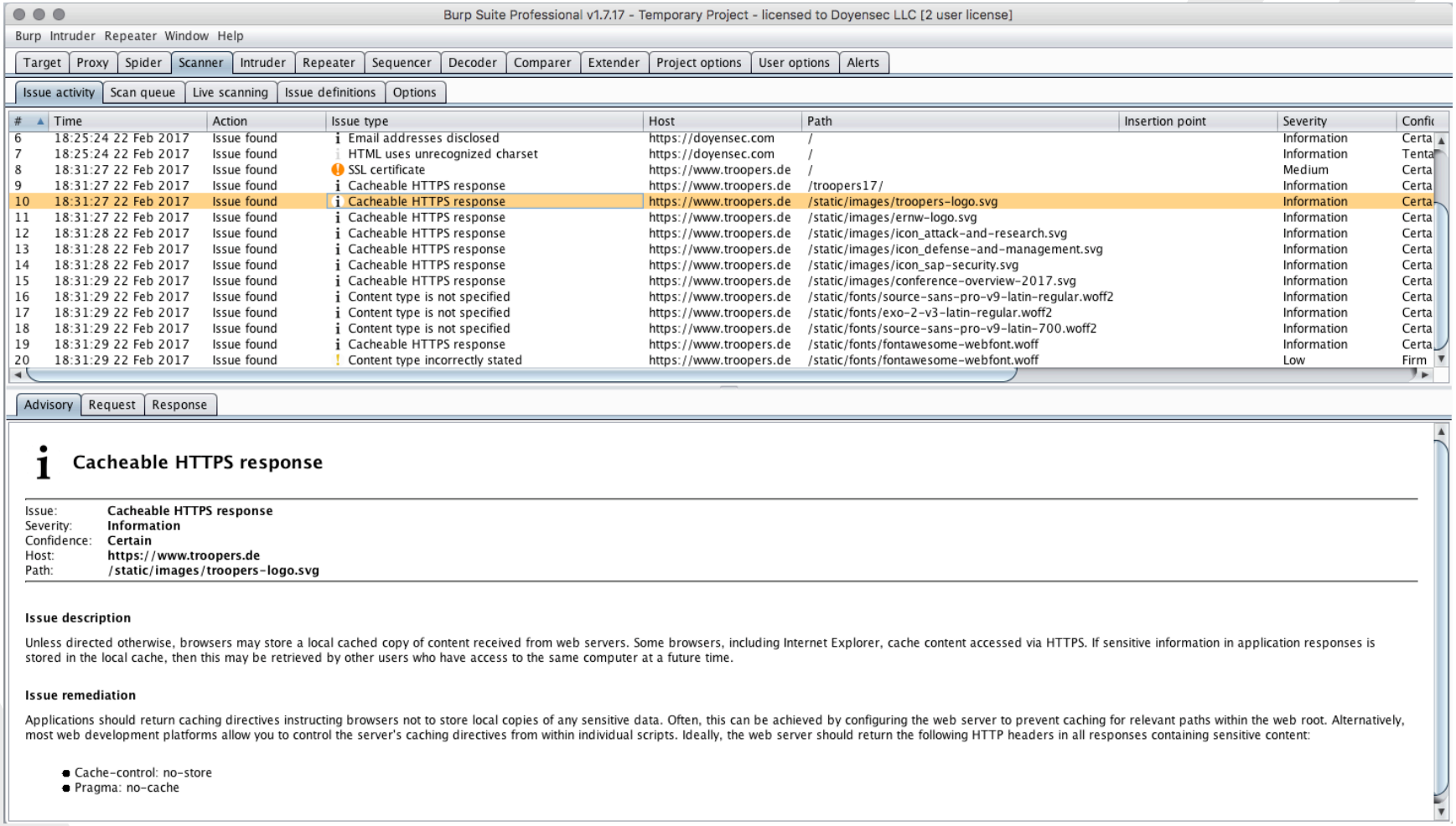
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
Site map Scope
Filter: Hiding not found items; hiding CSS, image and general binary content; hiding 4xx responses; hiding empty folders
https://blog.doyensec.com
https://doyensec.com
/
auditing.html
automation.html
company.html
contact.html
engineering.html
images
index.html
js
research.html
https://fonts.googleapis.com
http://getbootstrap.com
https://github.com
http://kochinke.pl
https://twitter.com
http://www.doyensec.com
https://www.linkedin.com
Contents Issues
Host Method URL Params Status Length MIME type Title Comment Time reques...
https://doyensec.com GET /index.html HTML
Request Response
Raw

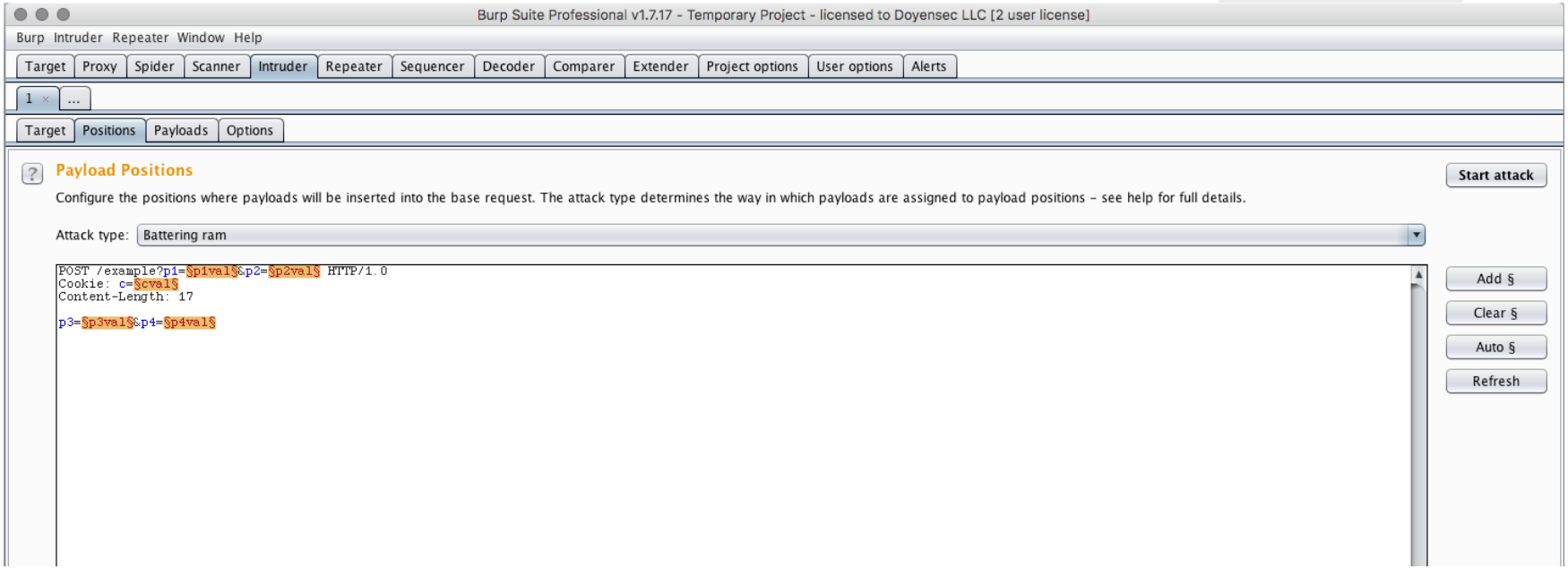
Spider


Burp Suite Professional v1.7.17 - Temporary Project - licensed to Doyensec LLC [2 user license]
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
Control Options
Spider Status
Use these settings to monitor and control Burp Spider. To begin spidering, browse to the target application, then right-click one or more nodes in the target site map, and choose "Spider this
Spider is running
Clear queues
Requests made: 196
Bytes transferred: 2,016,077
Requests queued: 702
Forms queued: 1
Spider Scope
Use suite scope [defined in Target tab]
Use custom scope
Burp Spider - Submit Form
Burp Spider needs your guidance to submit a login form. Please choose the value of each form field which should be used when submitting the form. You can control how Burp handles forms in the Spider options tab.
Action URL: https://www.troopers.de/login/?next=/account/
Method: POST
Type
Name
Value
Hidden
csrfmiddlewaretoken
dRkyPfANtcMaVAJ3EXMevosOrVEbVHa8
Password
password
Text
username
Submit form
Ignore form

Scanner


Burp Suite Professional v1.7.17 - Temporary Project - licensed to Doyensec LLC [2 user license]
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
Issue activity Scan queue Live scanning Issue definitions Options
Time Action Issue type Host Path Insertion point Severity Confic
6 18:25:24 22 Feb 2017 Issue found Email addresses disclosed https://doyensec.com / Information Certa
7 18:25:24 22 Feb 2017 Issue found HTML uses unrecognized charset https://doyensec.com / Information Tenta
8 18:31:27 22 Feb 2017 Issue found SSL certificate https://www.troopers.de / Medium Certa
9 18:31:27 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /troopers17/ Information Certa
10 18:31:27 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /static/images/troopers-logo.svg Information Certa
11 18:31:27 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /static/images/ernw-logo.svg Information Certa
12 18:31:28 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /static/images/icon_attack-and-research.svg Information Certa
13 18:31:28 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /static/images/icon_defense-and-management.svg Information Certa
14 18:31:28 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /static/images/icon_sap-security.svg Information Certa
15 18:31:29 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /static/images/conference-overview-2017.svg Information Certa
16 18:31:29 22 Feb 2017 Issue found Content type is not specified https://www.troopers.de /static/fonts/source-sans-pro-v9-latin-regular.woff2 Information Certa
17 18:31:29 22 Feb 2017 Issue found Content type is not specified https://www.troopers.de /static/fonts/exo-2-v3-latin-regular.woff2 Information Certa
18 18:31:29 22 Feb 2017 Issue found Content type is not specified https://www.troopers.de /static/fonts/source-sans-pro-v9-latin-700.woff2 Information Certa
19 18:31:29 22 Feb 2017 Issue found Cacheable HTTPS response https://www.troopers.de /static/fonts/fontawesome-webfont.woff Information Certa
20 18:31:29 22 Feb 2017 Issue found Content type incorrectly stated https://www.troopers.de /static/fonts/fontawesome-webfont.woff Low Firm
Advisory Request Response
Cacheable HTTPS response
Issue: Cacheable HTTPS response
Severity: Information
Confidence: Certain
Host: https://www.troopers.de
Path: /static/images/troopers-logo.svg
Issue description
Unless directed otherwise, browsers may store a local cached copy of content received from web servers. Some browsers, including Internet Explorer, cache content accessed via HTTPS. If sensitive information in application responses is stored in the local cache, then this may be retrieved by other users who have access to the same computer at a future time.
Issue remediation
Applications should return caching directives instructing browsers not to store local copies of any sensitive data. Often, this can be achieved by configuring the web server to prevent caching for relevant paths within the web root. Alternatively, most web development platforms allow you to control the server's caching directives from within individual scripts. Ideally, the web server should return the following HTTP headers in all responses containing sensitive content:
Cache-control: no-store
Pragma: no-cache

Intruder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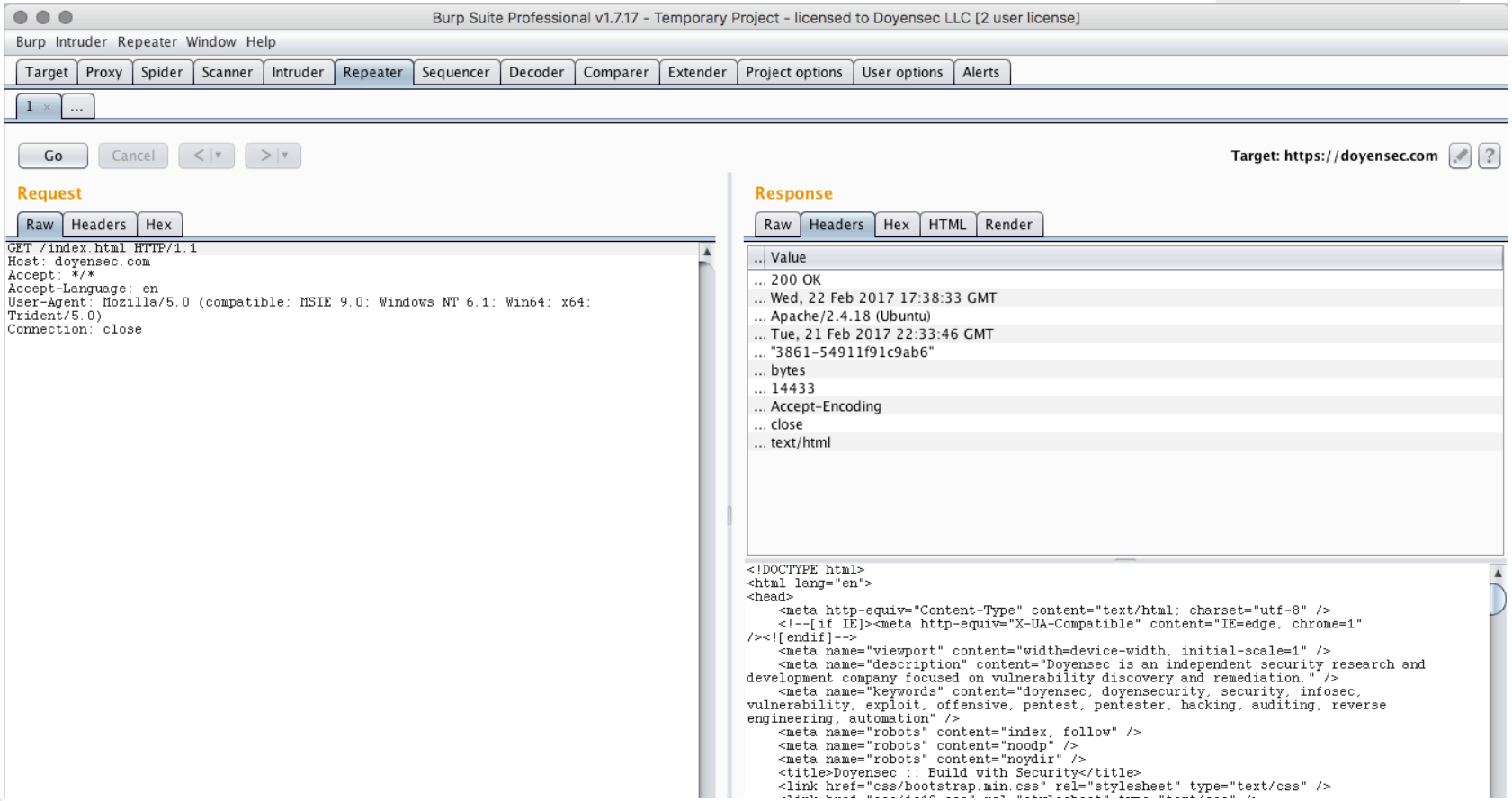
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
1 ...
Target Positions Payloads Options
Payload Positions
Configure the positions where payloads will be inserted into the base request. The attack type determines the way in which payloads are assigned to payload positions - see help for full details.
Attack type: Battering ram
POST /example?p1=$p1val$&p2=$p2val$ HTTP/1.0
Cookie: c=$cval$
Content-Length: 17
p3=$p3val$&p4=$p4val$
Start attack
Add §
Clear §
Auto §
Refresh

Repeater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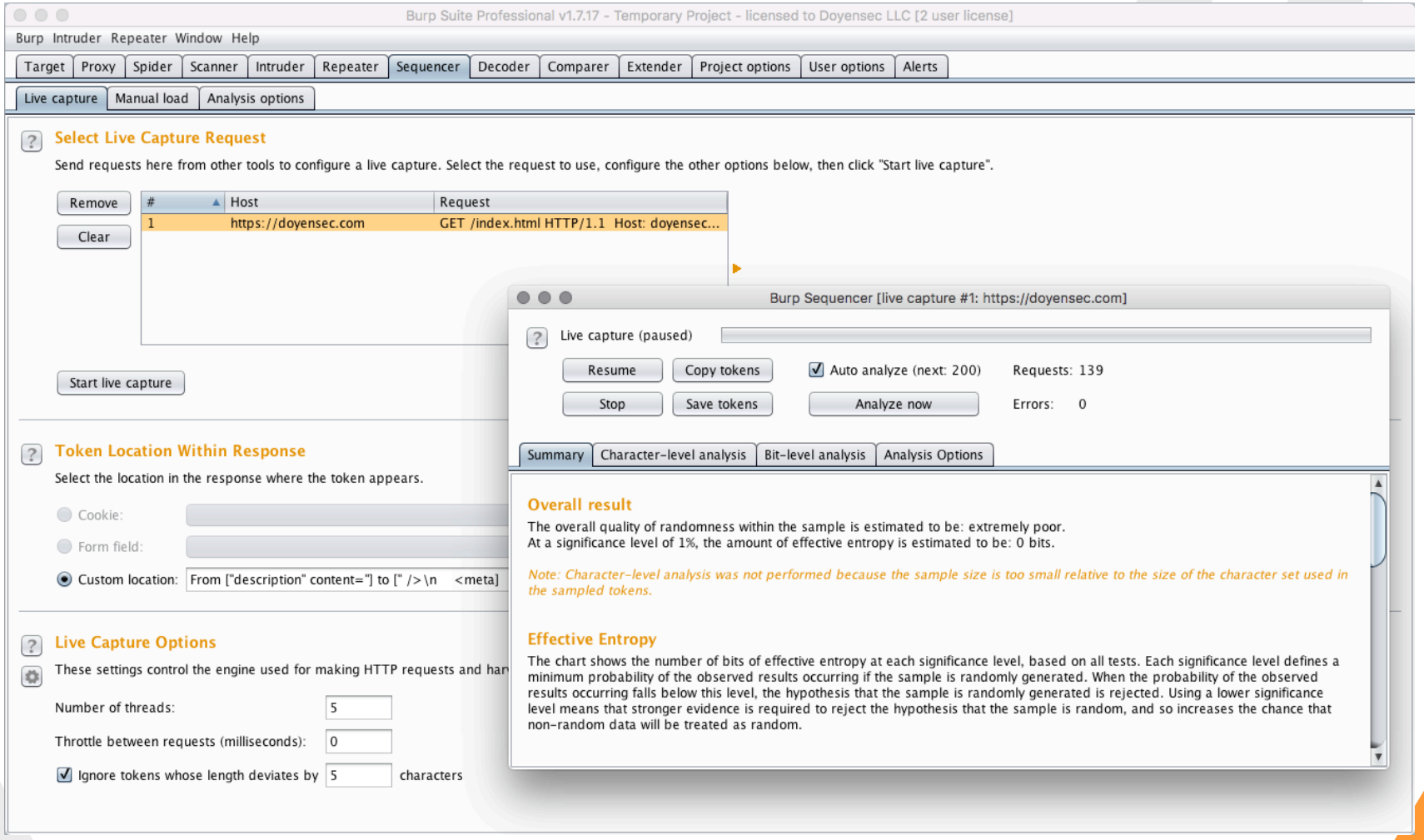
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
1 ...
Go Cancel < > Target: https://doyensec.com
Request
Raw Headers Hex
GET /index.html HTTP/1.1
Host: doyensec.com
Accept: */*
Accept-Language: en
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; Win64; x64; Trident/5.0)
Connection: close
Response
Raw Headers Hex HTML Render
Value
200 OK
Wed, 22 Feb 2017 17:38:33 GMT
Apache/2.4.18 (Ubuntu)
Tue, 21 Feb 2017 22:33:46 GMT
"3861-54911f91c9ab6"
bytes
14433
Accept-Encoding
close
text/html
<!DOCTYPE html>
<html lang="en">
<head>
<meta http-equiv="Content-Type" content="text/html; charset="utf-8" />
<meta name="viewport" content="width=device-width, initial-scale=1" />
<meta name="description" content="Doyensec is an independent security research and development company focused on vulnerability discovery and remediation." />
<meta name="keywords" content="doyensec, doyensecurity, security, infosec, vulnerability, exploit, offensive, pentest, pentester, hacking, auditing, reverse engineering, automation" />
<meta name="robots" content="index, follow" />
<meta name="robots" content="noodp" />
<meta name="robots" content="noydir" />
<title>Doyensec :: Build with Security</title>
<link href="css/bootstrap.min.css" rel="stylesheet" type="text/css" />

Sequencer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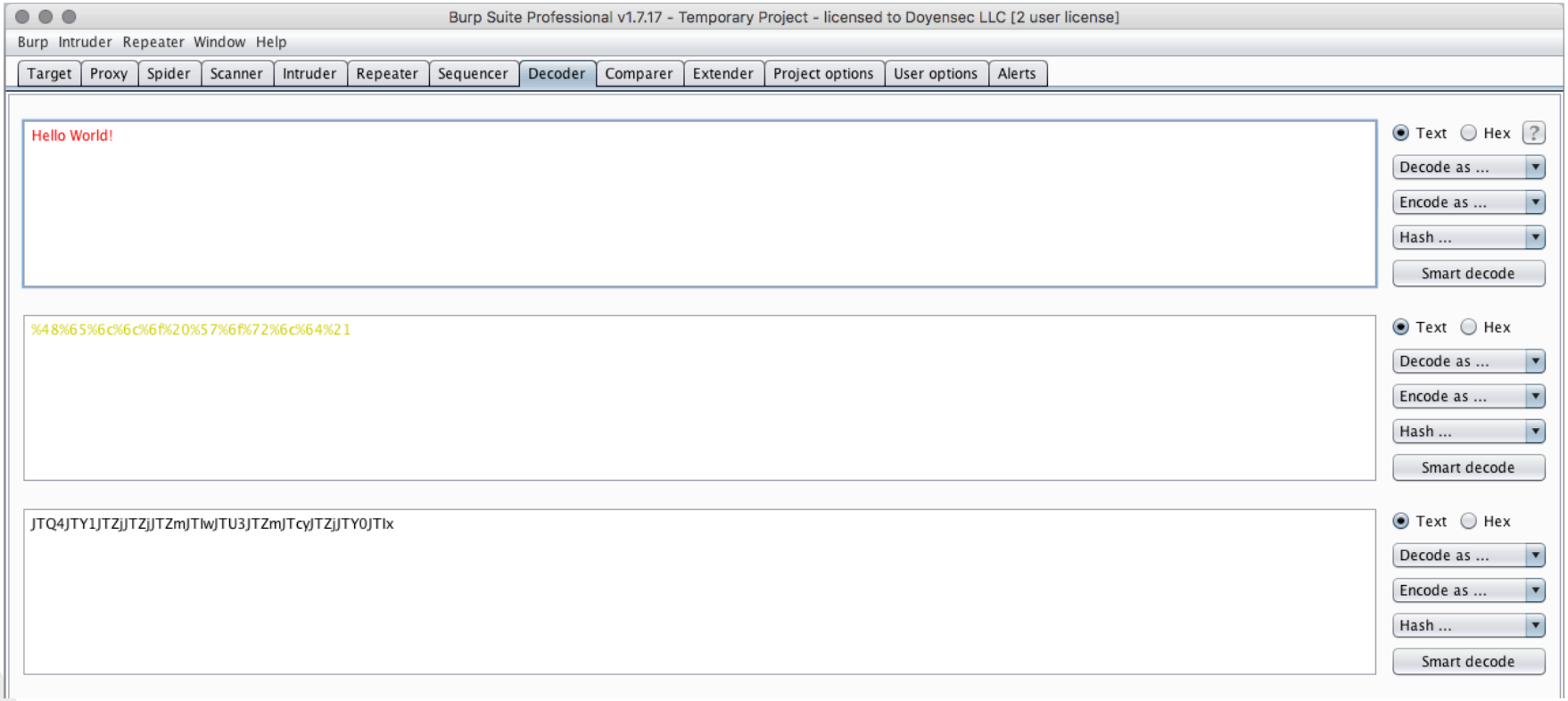
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
Live capture Manual load Analysis options
Select Live Capture Request
Send requests here from other tools to configure a live capture. Select the request to use, configure the other options below, then click "Start live capture".
Remove
Clear
Host Request
1 https://doyensec.com GET /index.html HTTP/1.1 Host: doyensec...
Start live capture
Token Location Within Response
Select the location in the response where the token appears.
Cookie:
Form field:
Custom location: From ["description" content="] to [" />\n <meta]
Live Capture Options
These settings control the engine used for making HTTP requests and har
Number of threads: 5
Throttle between requests (milliseconds): 0
Ignore tokens whose length deviates by 5 characters
Burp Sequencer [live capture #1: https://doyensec.com]
Live capture (paused)
Resume
Copy tokens
Auto analyze (next: 200)
Requests: 139
Stop
Save tokens
Analyze now
Errors: 0
Summary Character-level analysis Bit-level analysis Analysis Options
Overall result
The overall quality of randomness within the sample is estimated to be: extremely poor.
At a significance level of 1%, the amount of effective entropy is estimated to be: 0 bits.
Note: Character-level analysis was not performed because the sample size is too small relative to the size of the character set used in the sampled tokens.
Effective Entropy
The chart shows the number of bits of effective entropy at each significance level, based on all tests. Each significance level defines a minimum probability of the observed results occurring if the sample is randomly generated. When the probability of the observed results occurring falls below this level, the hypothesis that the sample is randomly generated is rejected. Using a lower significance level means that stronger evidence is required to reject the hypothesis that the sample is random, and so increases the chance that non-random data will be treated as random.

Decoder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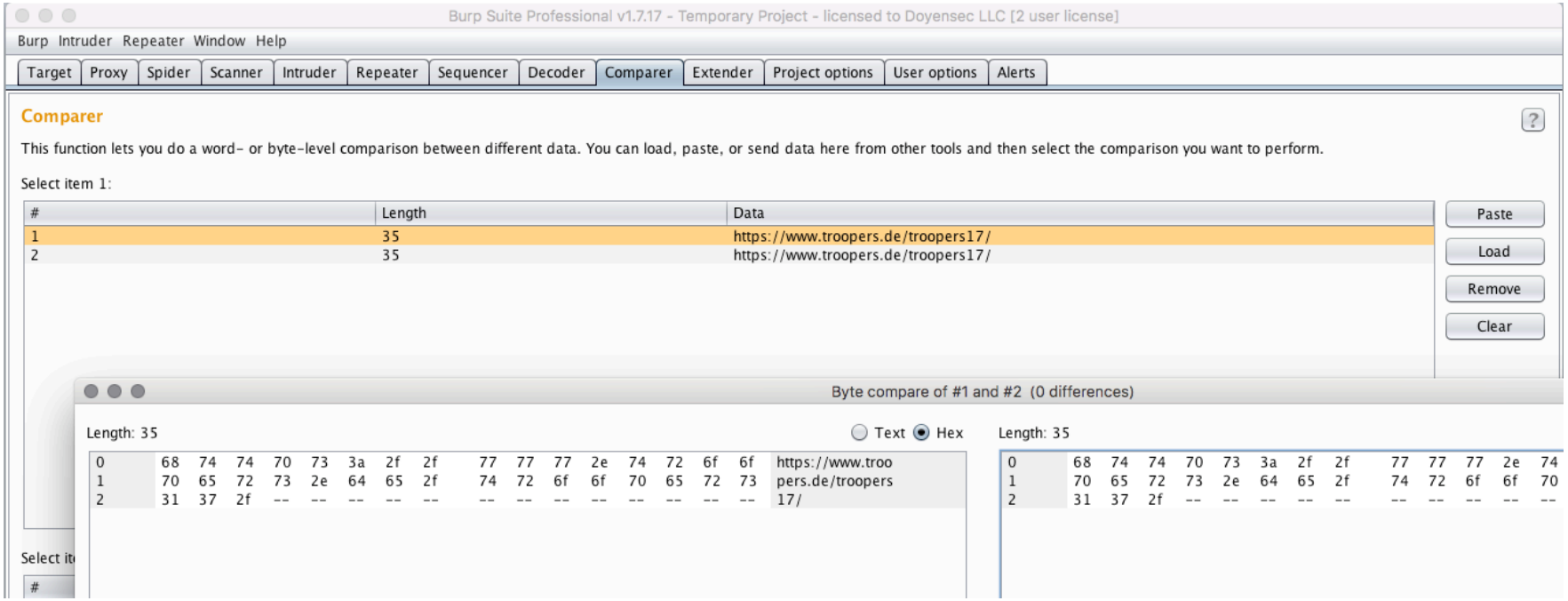
Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
Hello World!
%48%65%6c%6c%6f%20%57%6f%72%6c%64%21
JTQ4JTY1JTZjJTZjJTZmJTIwJTU3JTZmJTcyJTZjJTY0JTIx
Text Hex
Decode as ...
Encode as ...
Hash ...
Smart decode

Comparer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Burp Intruder Repeater Window Help
Target Proxy Spider Scanner Intruder Repeater Sequencer Decoder Comparer Extender Project options User options Alerts
Comparer
This function lets you do a word- or byte-level comparison between different data. You can load, paste, or send data here from other tools and then select the comparison you want to perform.
Select item 1:
Length Data
1 35 https://www.troopers.de/troopers17/
2 35 https://www.troopers.de/troopers17/
Paste
Load
Remove
Clear
Byte compare of #1 and #2 (0 differences)
Length: 35
Text Hex
Length: 35

Burp Suite Trivia 1/2

- One question, twenty seconds and win Burp Suite merchandise!
- No Googling!

- What's the default name used by Burp for form submissions?

and the two answers are…

- Peter Wiener
- Peter Winter

- Also, don’t spider network devices!

Burp Suite Extension APIs

Overview

Extender

- Lets you extend the functionalities of Burp in many ways
- Available since v1.1 (although radically different). Starting from v1.5.01, as known today
- Extensions can be written in *Java*, *Python* (*Jython*) or *Ruby (jRuby)*

Free vs Pro

- Extensions are compatible for both Burp Suite Free and Professional versions

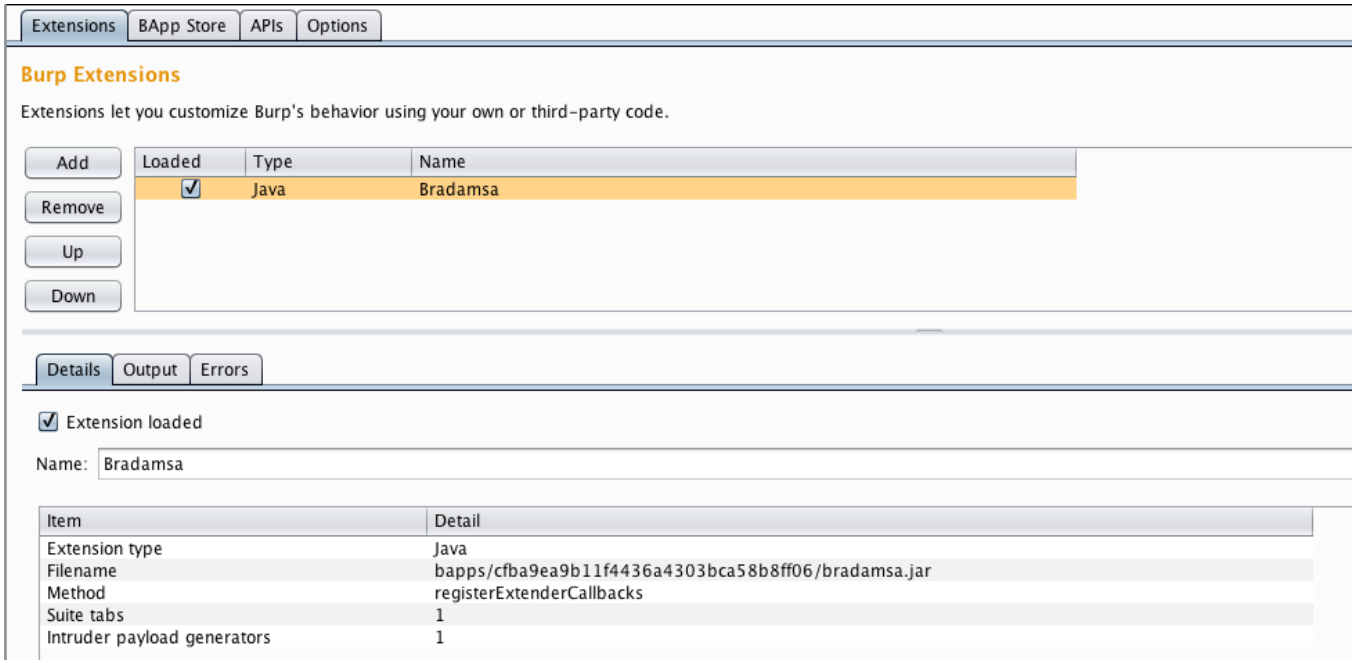
Core Principles

- Allow multiple extensions to run simultaneously
- Support dynamic loading and unloading of extensions at runtime
- Support languages other than Java
- Provide a much, much richer API that allows extensions to really integrate with Burp's internals
- Use a more future-proof API design, to allow easier enhancements in future
- As far as possible, ensure backwards compatibility with legacy extensions

From http://blog.portswigger.net/2012/12/new-burp-suite-extensibility.html

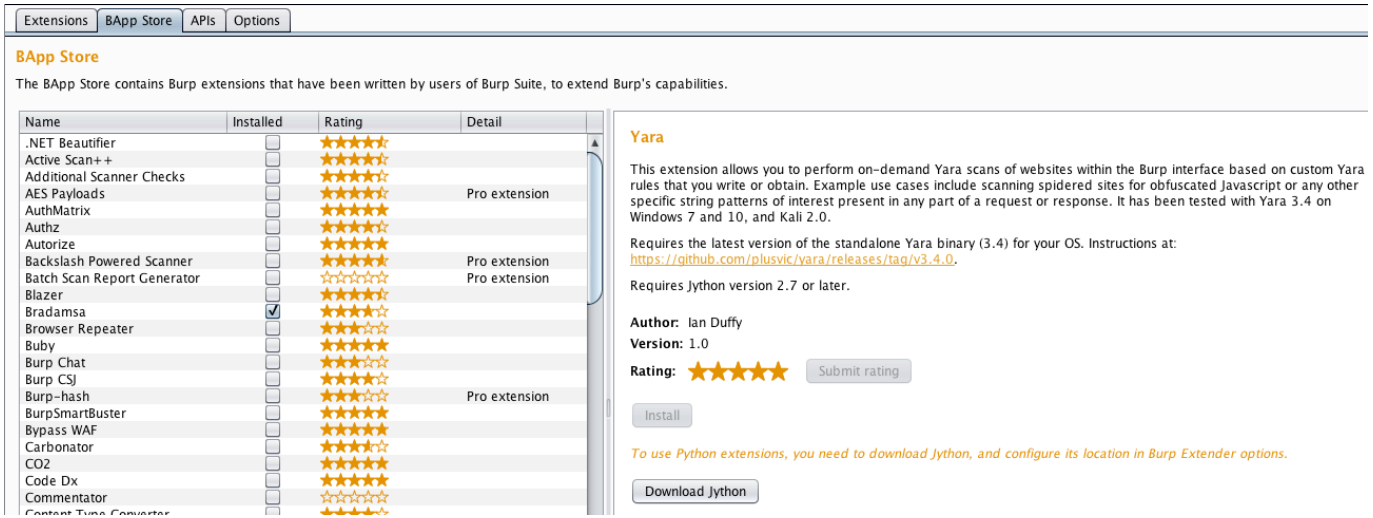
Extender GUI 1/4

- Load/Unload extensions
- StdIn and Stdout (Console, File, Show in UI)



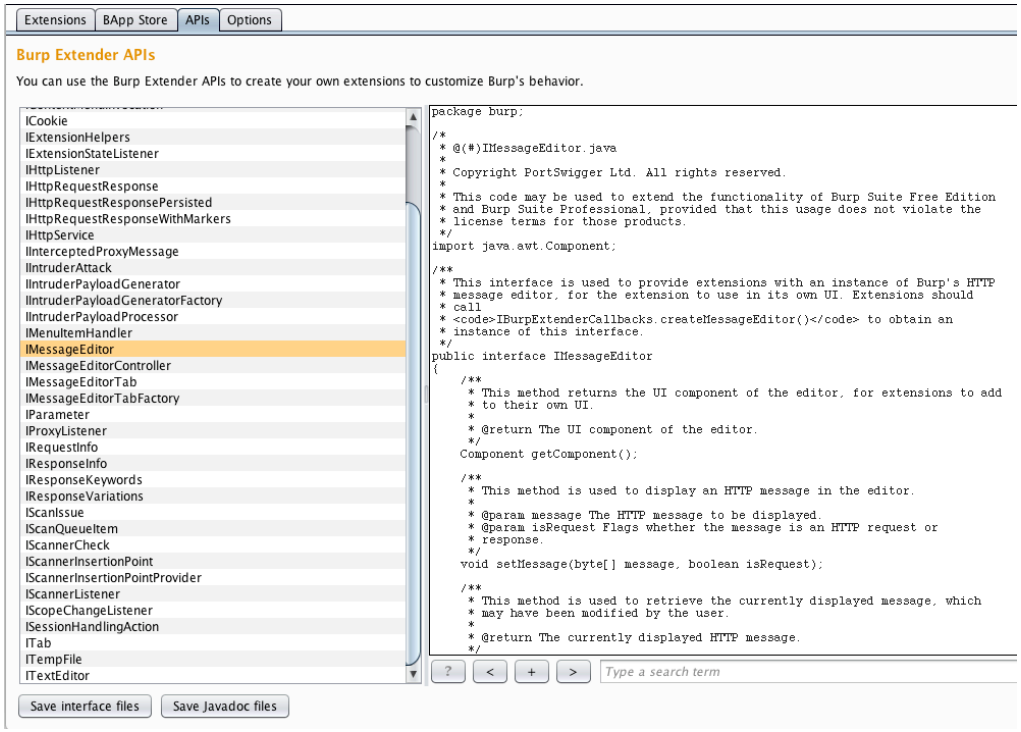
Extender GUI 2/4

- Burp App Store (BApp)
- Available since March 2014
- All BApp extensions source code is available on Github - see https://portswigger.net/bappstore/



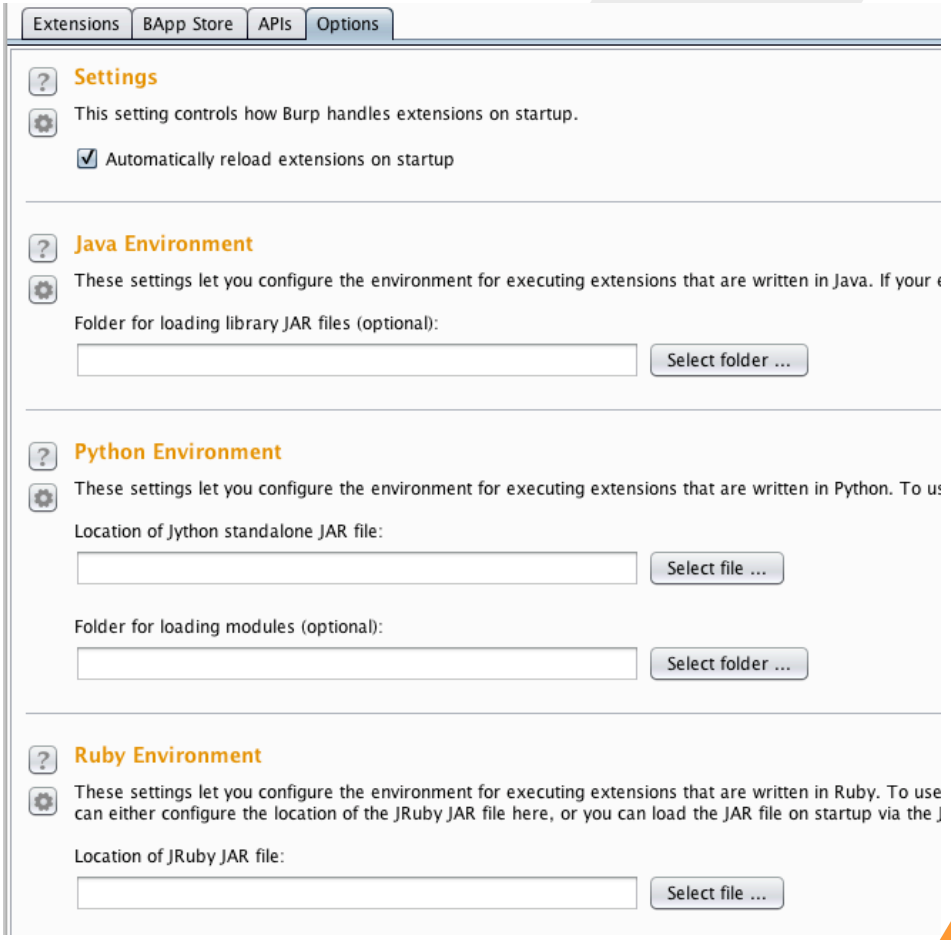
Extender GUI 3/4

- Java APIs reference
- https://portswigger.net/burp/extender/api/



Extender GUI 4/4

- Runtime settings
  - Automatic reload
  - Execution environments, dependencies, etc.



In a nutshell, we can write code to:

- Analyze, tamper and reply HTTP requests/ responses for all Burp tools
- Customize Intruder and Scanner payloads
- Modify Burp Suite's configuration
- Initiate actions like scanning and spidering
- Access runtime data
- Create custom UI tabs and context menu items

Java Interfaces Summarized 1/2

Core

- IBurpExtender
- IBurpExtenderCallbacks
- IExtensionStateListener
- IHttpListener
- IScopeChangeListener
- ISessionHandlingAction

Helpers

- IExtensionHelpers
- ITempFile

System-wide UI

- IContextMenuFactory
- IContextMenuInvocation
- IMenuItemHandler
- IMessageEditor
- IMessageEditorController
- IMessageEditorTab
- IMessageEditorTabFactory
- ITab
- ITextEditor

HTTP objects

- ICookie
- IHttpRequestResponse
- IHttpRequestResponsePersisted
- IHttpRequestResponseWithMarkers
- IHttpService
- IParameter
- IRequestInfo
- IResponseInfo
- IResponseKeywords
- IResponseVariations

Java Interfaces Summarized 2/2

Collaborator

- IBurpCollaboratorClientContext
- IBurpCollaboratorInteraction

Intruder

- IIntruderAttack
- IIntruderPayloadGenerator
- IIntruderPayloadGeneratorFactory
- IIntruderPayloadProcessor

Scanner

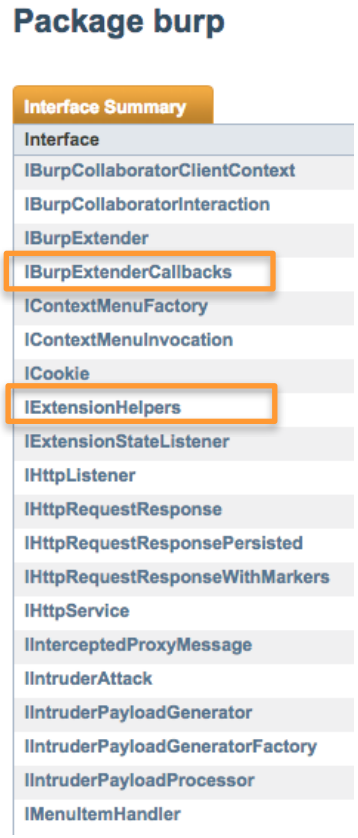
- IScanIssue
- IScannerCheck
- IScannerInsertionPoint
- IScannerInsertionPointProvider
- IScannerListener
- IScanQueueItem

Proxy

- IInterceptedProxyMessage
- IProxyListener

Javadoc for the win

- https://portswigger.net/burp/extender/api/



Package burp

Interface Summary

Interface
IBurpCollaboratorClientContext
IBurpCollaboratorInteraction
IBurpExtender
IBurpExtenderCallbacks
IContextMenuFactory
IContextMenuInvocation
ICookie
IExtensionHelpers
IExtensionStateListener
IHttpListener
IHttpRequestResponse
IHttpRequestResponsePersisted
IHttpRequestResponseWithMarkers
IHttpService
IInterceptedProxyMessage
IIntruderAttack
IIntruderPayloadGenerator
IIntruderPayloadGeneratorFactory
IIntruderPayloadProcessor
IMenuItemHandler

public interface *IBurpExtender*

- All extensions must implement this interface
- Implementations must be called **BurpExtender**, in the package **burp**, must be declared **public**, and must provide a **default (public, no-argument) constructor**
- The following method is invoked when the extension is loaded and provides callbacks

```
void registerExtenderCallbacks(IBurpExtenderCallbacks callbacks)
```

Extension Templates

Netbeans, Eclipse, IDEA

Project Templates 1/2

- To facilitate development and debugging, you can use our empty extension template:
  - https://github.com/doyensec/burpdeveltraining/tree/master/BurpExtensionTemplate
  - Available for Netbeans, Eclipse and IDEA

Project Templates 2/2

- The template includes:
  - *burp.BurpExtender* class
  - Setup for executing Burp's Main (*burp.StartBurp*) together with our extension - which makes debugging make better!
  - No need to import all *Interfaces*
    - Since we are referencing the original Burp's JAR

Netbeans

1. Open NetBeans
2. *File —> Open Project* and select the */BurpExtensionTemplate/Netbeans* folder from git repo. Click *Open*
3. Click *Resolve Problems*. Then *Resolve* and select your local copy of the Burp's JAR. Click *Close*.
4. You can now click *Run*

Eclipse 1/2

1. Open Eclipse
2. *File —> Open Project* (or *Import…*)
3. Choose “Select an import source:” *Existing Projects into Workspace*. Click *Next*
4. Click *Browse*, and select the */BurpExtensionTemplate/Eclipse* folder from git repo. Click *Ok* and then *Finish*
5. On the project Name (top left), right click and select *Properties*. Go to *Java Build*

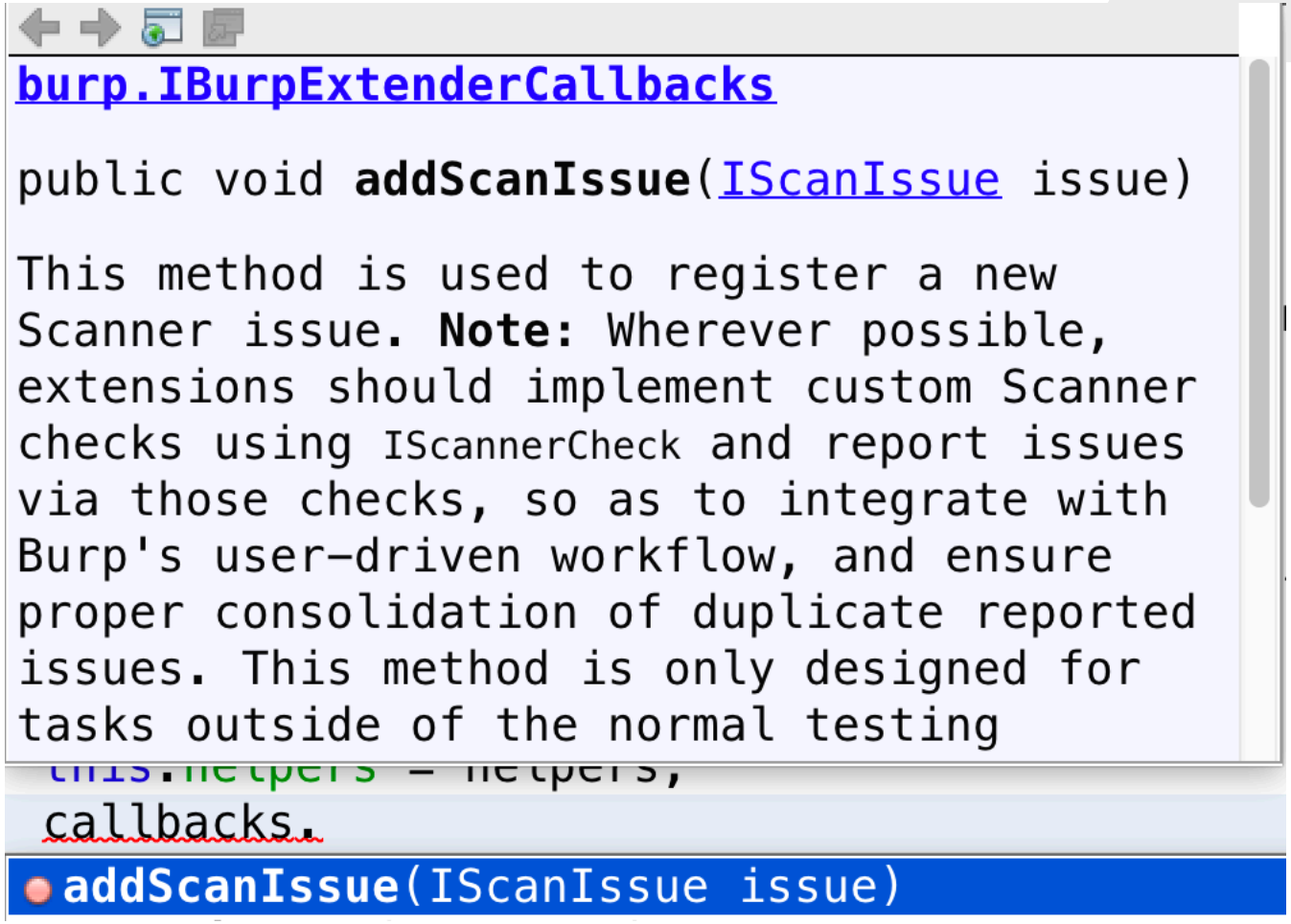
Eclipse 2/2

6. In the *Libraries* tab, click on the Burp JAR reference and click on *Edit*. Then, select your local copy of the Burp's JAR and click *Ok*
7. **If you're NOT using JavaSE-1.8**, you may also need to fix the runtime environment. In the *Libraries* tab, remove the *JRE System Library [JavaSE-1.8]*. Then, click on *Add Library —> JRE System Library —> Workspace Default JRE*. Click *Ok* and *Finish*
8. You can now click *Run*

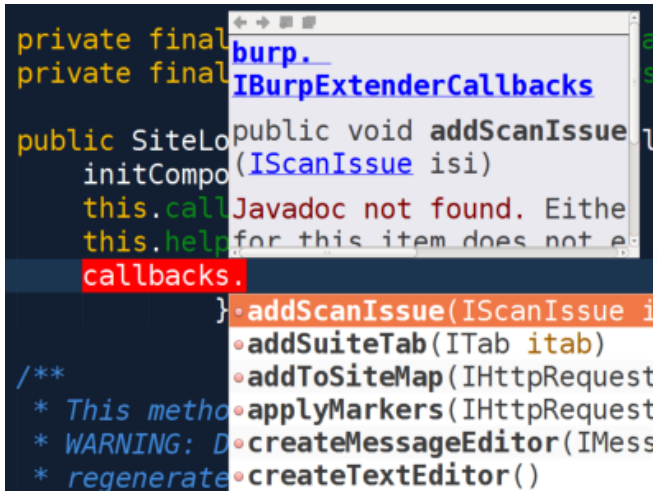
IDEA

1. Open IntelliJ IDEA
2. Select *Open* and choose the */BurpExtensionTemplate/IDEA* from git repo. Click *Open*
3. *File —> Project Structure*. Select the Burp's JAR reference (in red). Right-Click and choose *Edit*..
4. Click *+* and select your local copy of the Burp's JAR. Click Ok. Select the old reference (in red) and Click - to remove the item
5. You can now click *Run*

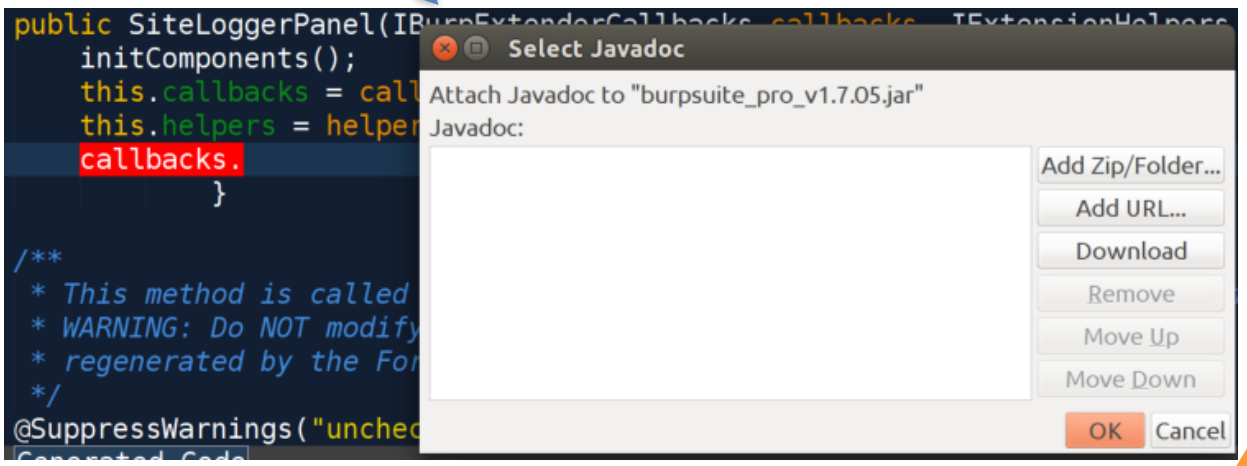
Pro Tip: Burp JavaDocs



Add Burp JavaDocs to Netbeans

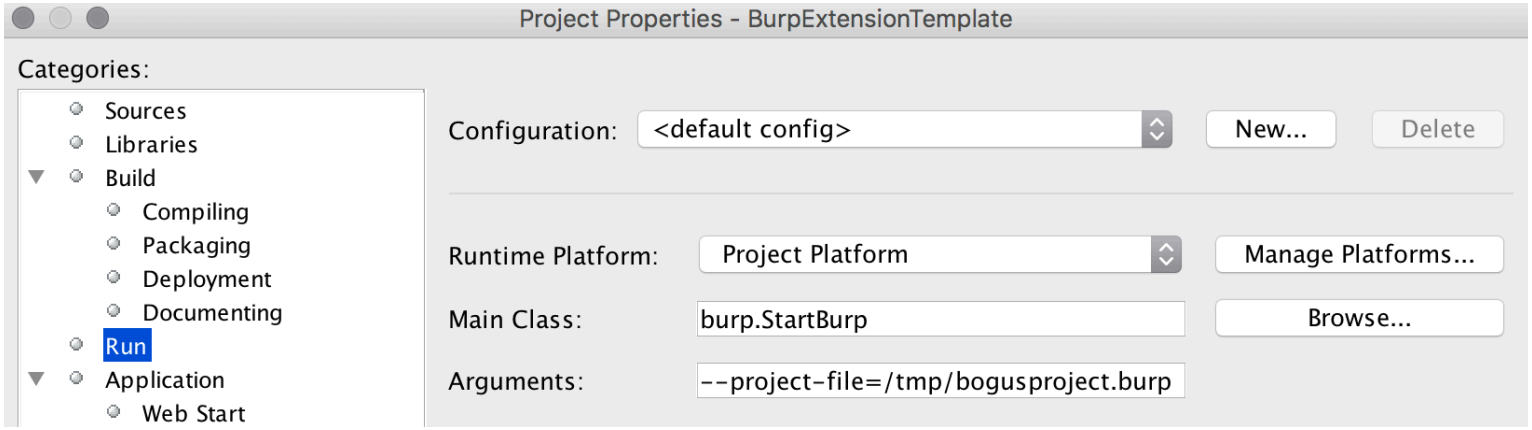


1. Click on “Attach Javadoc…”
2. Select Burp JAR



Pro Tip: Avoiding Project Options At Startup

- If you're debugging your extension, Burp startup project options will slow you down
- You can disable it, by adding the —project-file argument. Burp will generate a new project file with default configs



Our First Extension

Hello Burp!

Let's write some code…

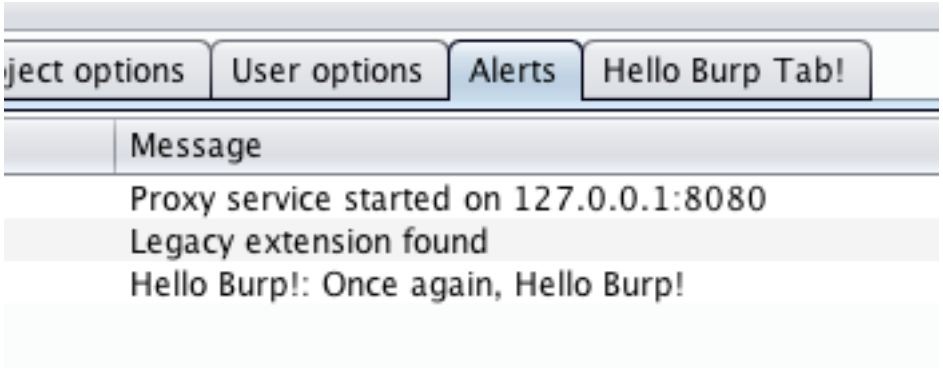
- In *BurpExtender.java*, let's customize the *registerExtenderCallbacks* method to implement our **Hello Burp!** extension

- We want to:
  - Issue an alert
  - Write to StdIn and StdOut
  - Create a new UI component (Tab)

Alerts

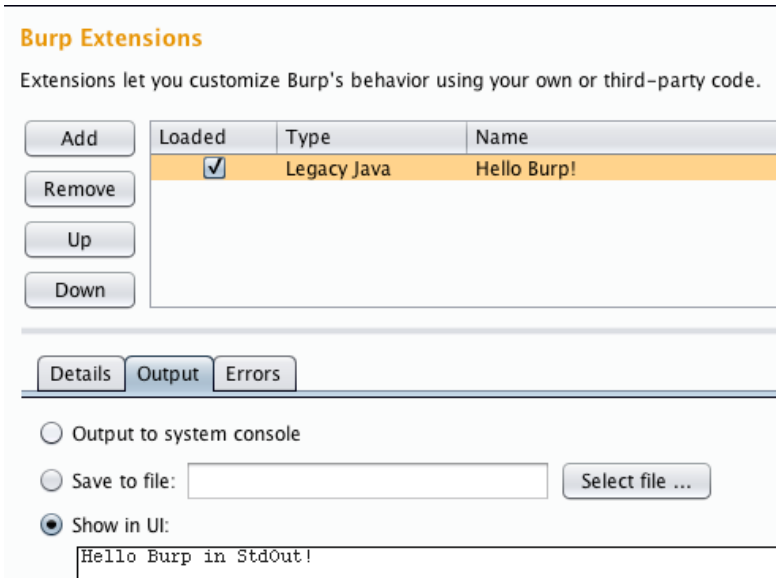
- Useful for info, error and other user notifications

```
callbacks.issueAlert("Hello Burp!");
```



Stdout and Stderr

- Stdout and Stderr can be customize from Burp's Extension UI, and it's transparent
- Simple use a *PrintWriter* on *callbacks.getStdout()*

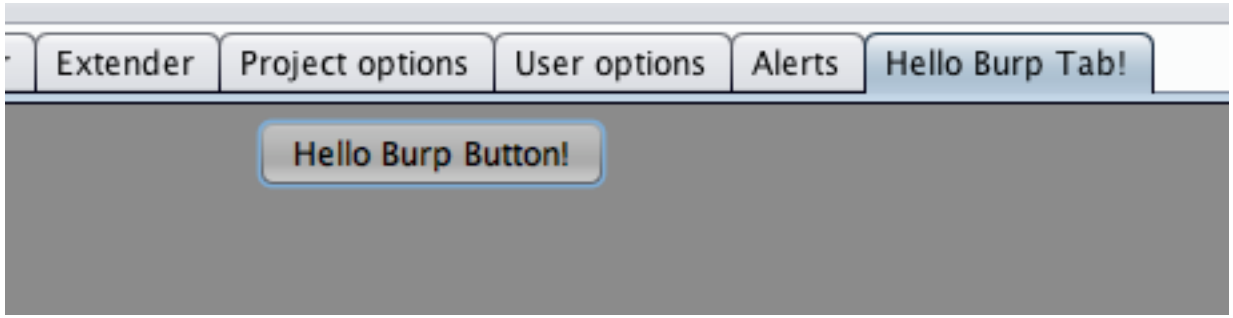


Custom Tab and UI Components

- Create a class that *implements ITab and* implement the *getTabCaption()* and *getUiComponent()*
- *Pro Tip:* Use *callbacks.customizeUiComponent()* to adjust your custom UI with Burp's style, including font size, colors, table line spacing, etc.

Our custom Hello Burp AWT Component

- AWT coding is fun!



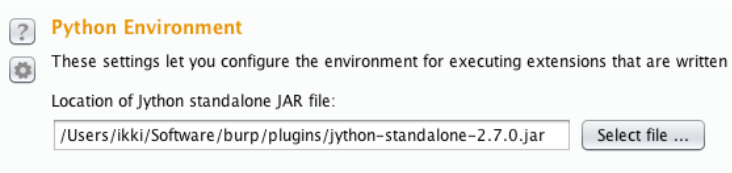
Coding Time!

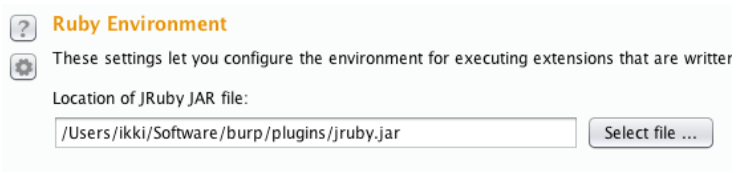
- We will do this together!

Code Complete Extension

- https://github.com/doyensec/burpdeveltraining/tree/master/HelloBurp

- To run this exercise in Python/Ruby, remember to set the *Environment* option





Exercise

- Consult https://portswigger.net/burp/extender/api/ and extend our HelloBurp extension:
  1. To issue an alert displaying Burp version number
  2. Unload the extension

Building a custom logger

SiteLogger

Requirements

- Save all HTTP Requests and Responses for a specific site
- Save all scan results (active and passive) for the same site
- Persistent storage using MongoDB
- Easy to use tool. It should be possible to setup and save from a UI

Plugin Structure

burp package

BurpExtender

registerExtenderCallbacks()

Your package

SiteLoggerTab implements ITab

getTabCaption()
getUiComponent()

SiteLoggerPanel

Note:
For Python/Ruby, a single file with three public classes is used.

getSiteMap and getScanIssues

- `IHttpRequestResponse[] getSiteMap(java.lang.String urlPrefix)`
- `IScanIssue[] getScanIssues(java.lang.String urlPrefix)`

- `urlPrefix` - This parameter can be used to specify a URL prefix, in order to extract a specific subset of the site map/findings

MongoDB

- There's a MongoDB instance running on **27017/tcp** (no authentication required)

- It's a shared environment - be nice!
- Please name your db **sitelogger_<yourName>**

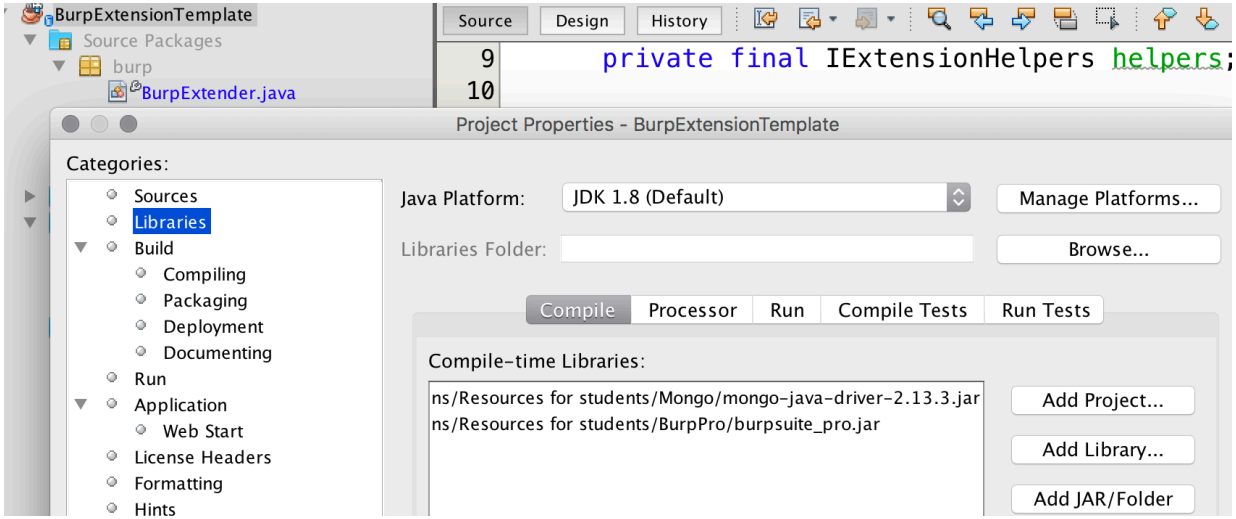
- For a quick intro to MongoDB with Java:
  - http://www.mkyong.com/mongodb/java-mongodb-hello-world-example/

MongoDB Driver

- **[Java]** Download *mongo-java-driver-2.13.3.jar*
- **[Ruby]** Set *Extender->Options->JavaEnvironment* “Folder for loading library JAR files” to a folder containing *mongo-java-driver-2.13.3.jar*
- **[Python]** Set *Extender->Options->PythonEnvironment* “Folder for loading modules” to a folder containing *pymongo*

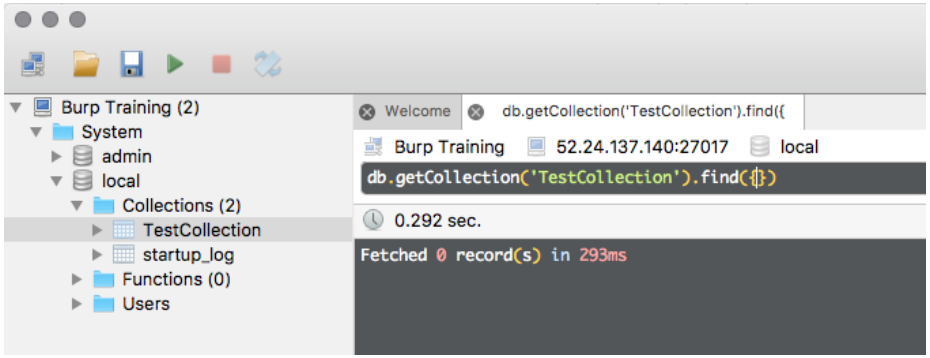
Add MongoDB Driver to the IDE

1. Select Project Name
2. Right-click on ‘Properties’
3. Select ‘Libraries’
4. Add JAR/Folder

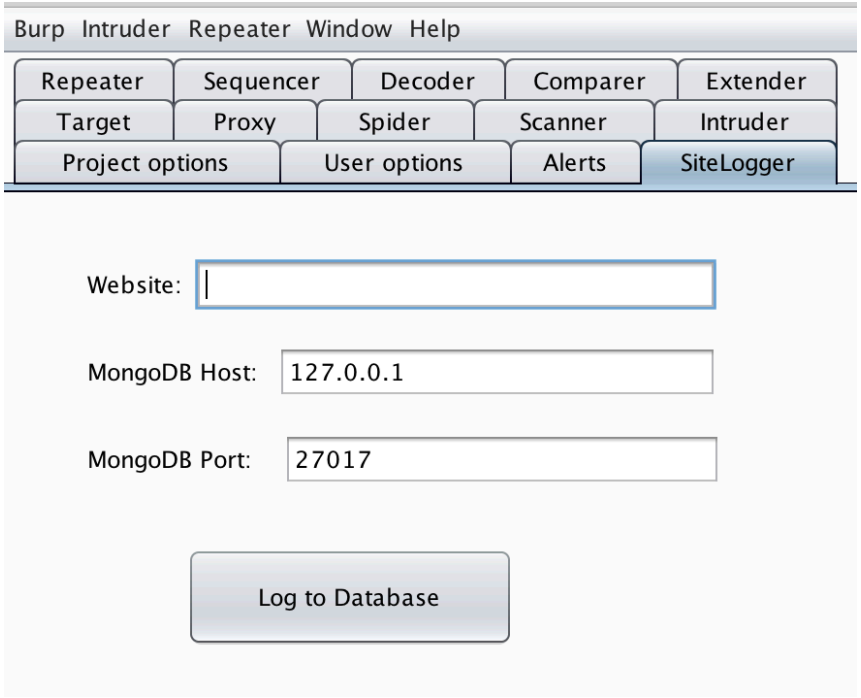


MongoDB Client

- You can use Robomongo



SiteLogger UI



Coding Time!

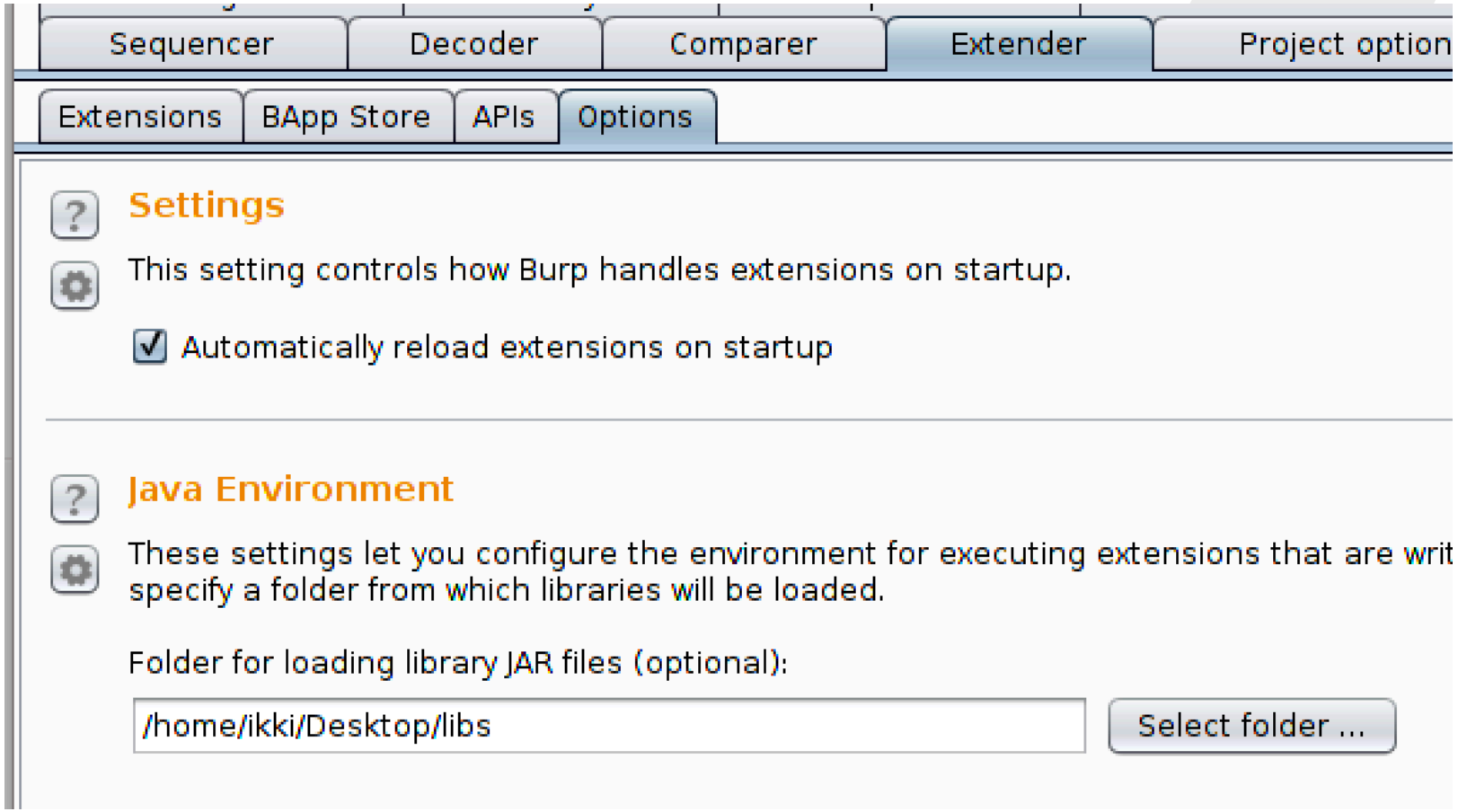
1. Let's review together the basic skeleton using WIP1 files
2. Let's build together the *swing.JPanel* using Netbeans WYSIWYG editor
3. Implement the remaining logic (~45 mins)
4. We will complete the exercise together

Extension dependencies

```
java.lang.NoClassDefFoundError: com/mongodb/MongoClient
 at
com.doyensec.sitelogger.SiteLoggerPanel.logButtonActionPerformed(SiteLogg
erPanel.java:121)
 at
com.doyensec.sitelogger.SiteLoggerPanel.access$000(SiteLoggerPanel.java:2
1)
…
```

- How can we import extension libs?
  - (a) Setup Burp Java Environment
  - (b) Embed libs within the extension JAR

(a) Burp Java Environment



(b) Embed libs within the extension JAR

- Build.xml for the rescue!

```
<target name="-post-jar">
    <copy file="resources/README.txt" flatten="true" todir="${dist.dir}"/>
    <jar jarfile="dist/${ant.project.name}_v0.3.1.jar">
        <zipfileset src="${dist.jar}" excludes="META-INF/*" />
        <zipfileset src="lib/mongo-java-driver-2.13.3.jar" excludes="META-INF/*" />
        <fileset dir="dist">
          <include name="README.txt"/>
        </fileset>
    </jar>
    <jar basedir="src" destfile="dist/${ant.project.name}_v0.3.1-sources.jar"/>
</target>
```

Code Complete Extension

- https://github.com/doyensec/burpdeveltraining/tree/master/SiteLogger

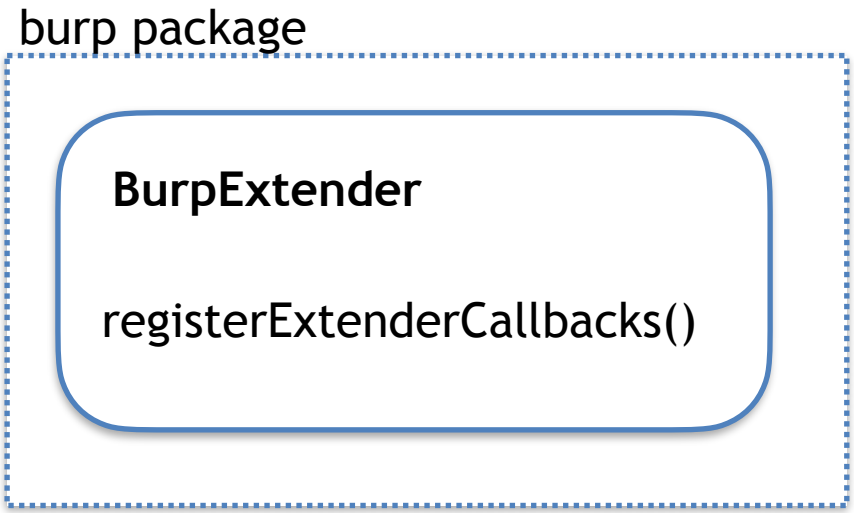
Building a replay tool

ReplayAndDiff

Requirements

- From the database, retrieve a login HTTP request with credentials in order to obtain a fresh session
- Issue the login request and add the new cookie to Burp's Cookies Jar
- Replay a scan on the site previously saved by SiteLogger
- Compare results and generate scan report, if the new scan includes new findings

Plugin Structure



- This extension should be executed in headless mode
- At startup, add the following JVM flag:
  `-Djava.awt.headless=true`

Parse Command Line Args

- `java.lang.String[] getCommandLineArguments()`
- `String[]` can be parsed with an external library (e.g. JSAP, Apache Commons CLI, etc.). For now, let's use a simple loop:

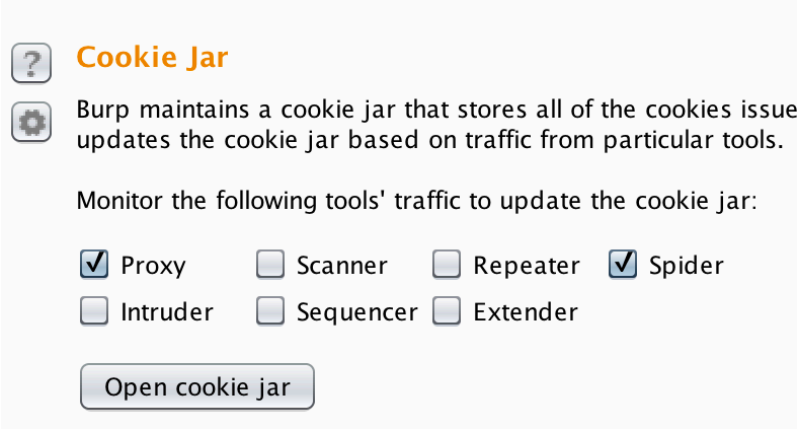
```
String[] args = callbacks.getCommandLineArguments();
for (String arg: args) {
 if(arg.contains("-h=") || arg.contains("--host=")){
     MONGO_HOST = arg.substring(arg.indexOf('=')+1);
 }else if {
 …
```

makeHttpRequest and analyzeResponse

- `byte[] makeHttpRequest(java.lang.String host, int port, boolean useHttps, byte[] request)`
- `IResponseInfo analyzeResponse(byte[] response)`
- `IResponseInfo` contains key details about an HTTP response including cookies, using `getCookies()`

Burp's Cookie Jar

- Burp maintains a cookie jar that stores all of the cookies issued by sites you visit
- The cookie jar is shared between all of Burp's tools
- `void updateCookieJar(ICookie cookie)`



Run a scan

- Two types of scan:
  - `IScanQueueItem doActiveScan(java.lang.String host, int port, boolean useHttps, byte[] request)`
  - `void doPassiveScan(java.lang.String host, int port, boolean useHttps, byte[] request, byte[] response)`
  - Passive checks are executed immediately on stored request/response pairs, while Active checks require live traffic
  - `IScanQueueItem` can be used to check the status of the queue items

Caveat

- When executing an active scan, Burp expects all target URLs to be in scope
- If the request is NOT within the current active scanning scope, the user will be asked if they wish to proceed with the scan
- Since we're running in headless mode, make sure to add:
- `void includeInScope(java.net.URL url)`

Diffing

- For this plugin, let's adopt a simple heuristic

```
for (IScanIssue finding : allVulns) {
    //Search in MongoDB for a finding with the
    same type, name and URL
    //If cursor.size() == 0, we have a new
   finding!
```

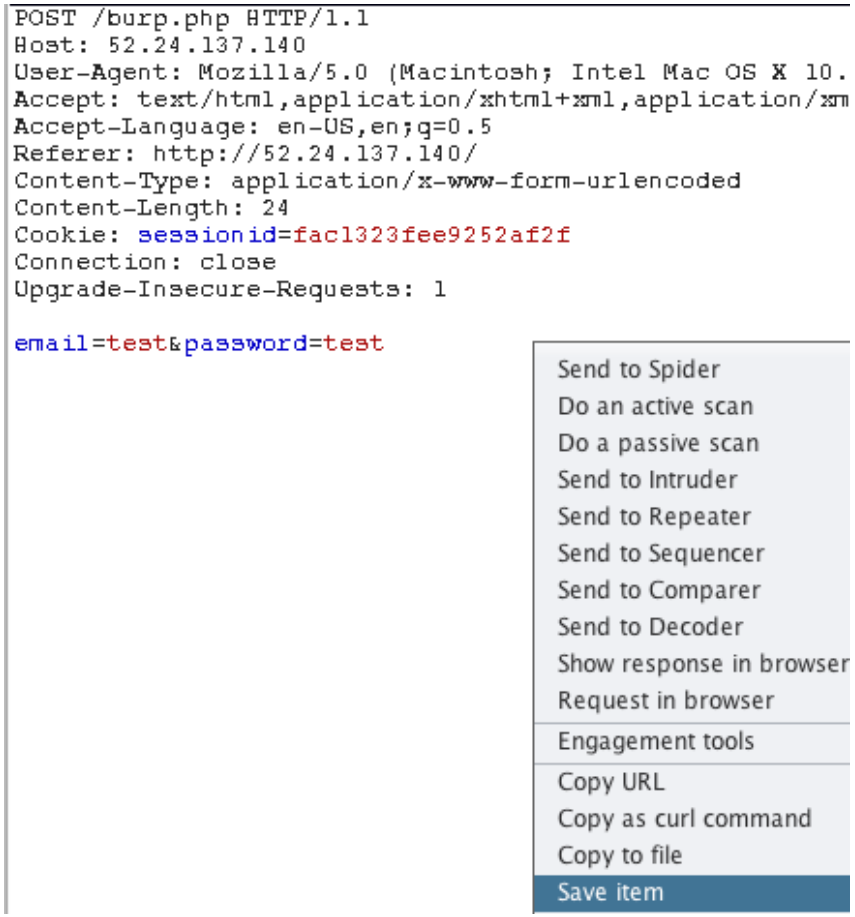
- If there is at least one new finding in the new scan, generate the report

```
void generateScanReport(java.lang.String format,
                        IScanIssue[] issues,
                        java.io.File file)
```

Login Request Setup 1/4

1. With Burp enabled, perform a login to the page
2. Go the request, and right-click to open the contextual menu. Select “Save Item”
3. Open the saved file, and copy the Base64 request

Login Request Setup 2/4



Login Request Setup 3/4

- <request base64="true"><![CDATA[UE9TVCAvYnVycC5waHAgSFRUUC8xLjENCkhvc3Q6IDUyLjI0LjEzNy4xNDANClVzZXItQWdlbnQ6IE1vemlsbGEvNS4wIChNYWNpbnRvc2g7IEludGVsIE1hYyBPUyBYIDEwLjEyOyBydjo1My4wKSBHZWNrby8yMDEwMDEwMSBGaXJlZm94LzUzLjANCkFjY2VwdDogdGV4dC9odG1sLGFwcGxpY2F0aW9uL3hodG1sK3htbCxhcHBsaWNhdGlvbi94bWw7cT0wLjksKi8qO3E9MC44DQpBY2NlcHQtTGFuZ3VhZ2U6IGVuLVVTLGVuO3E9MC41DQpSZWZlcmVyOiBodHRwOi8vNTIuMjQuMTM3LjE0MC8NCkNvbnRlbnQtVHlwZTogYXBwbGljYXRpb24veC13d3ctZm9ybS11cmxlbmNvZGVkDQpDb250ZW50LUxlbmd0aDogMjQNCkNvb2tpZTogc2Vzc2lvbmlkPWZhYzEzMjNmZWU5MjUyYWYyZg0KQ29ubmVjdGlvbjogY2xvc2UNCVwZ3JhZGUtSW5zZWN1cmUtUmVxdWVzdHM6IDENCg0KZW1haWw9dGVzdCZwYXNzd29yZD10ZXN0]]></request>

Login Request Setup 4/4

- Using Robomongo, create a new collection named “login”
- Then, insert the following entry:

```
use sitelogger
db.login.insert({
  host: '52.24.137.140',
  port: NumberInt(80),
  protocol: 'http',
  request:
'UE9TVCAvYnVycC5waHAgSFRUUC8xLjENCkhvc3Q6IDUyLjI0LjEzNy4xNDANClVzZXItQWdlbnQ6I
E1vemlsbGEvNS4wICChNYWNpbnRvc2g7IEludGVsIE1hYyBPUyBYIDEwLjEyOyBydjo1My4wKSBHZWN
rby8yMDEwMDEwMSBGaXJlZm94LzUzLjANCkFjY2VwdDogdGV4dC9odG1sLGFwcGxpY2F0aW9uL3hod
G1sK3htbCxhcHBsaWNhdGlvbi94bWw7cT0wLjksKi8qO3E9MC44DQpBY2NlcHQtTGFuZ3VhZ2U6IGV
uLVVTLGVuO3E9MC41DQpSZWZlcmVyOiBodHRwOi8vNTIuMjQuMTM3LjE0MC8NCkNvbnRlbnQtVHlwZ
TogYXBwbGljYXRpb24veC13d3ctZm9ybS11cmxlbmNvZGVkDQpDb250ZW50LUxlbmd0aDogMjQNCkN
vb2tpZTogc2Vzc2lvbmlkPWZhYzEzMjNmZWU5MjUyYWYyZg0KQ29ubmVjdGlvbjogY2xvc2UNClVwZ
3JhZGUtSW5zZWN1cmUtUmVxdWVzdHM6IDENCg0KZW1haWw9dGVzdCZwYXNzd29yZD10ZXN0'
})
```

Coding Time!

1. Let's review together the basic skeleton using WIP1 files
2. Implement the remaining logic (~1 hour)
3. We will complete the exercise together

Code Complete Extension

- https://github.com/doyensec/burpdeveltraining/tree/master/ReplayAndDiff

Building a custom Passive Scan check

DetectSRI

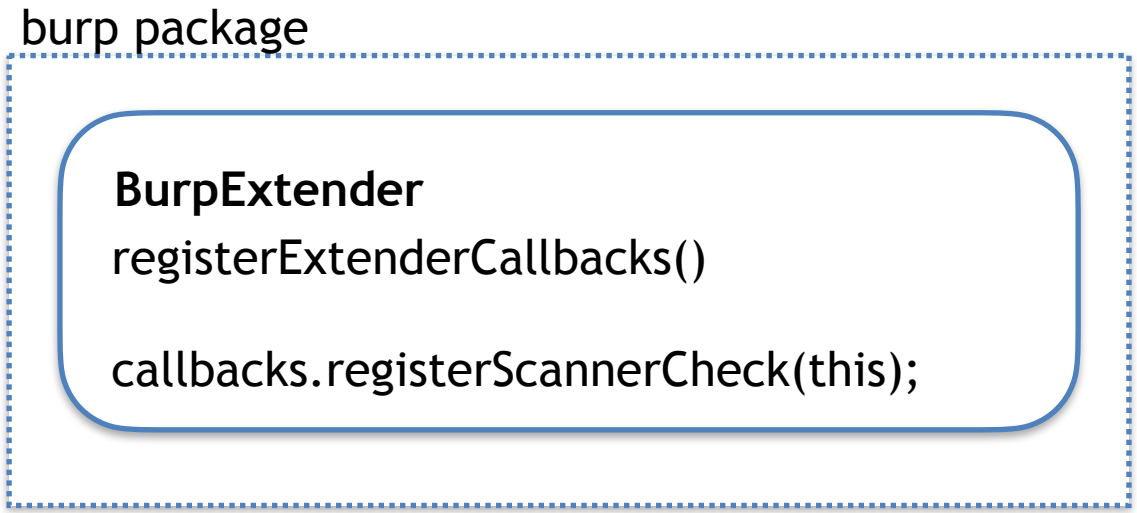
Requirements

- Create an extension that detects whether the specific HTTP response does not use SubResource Integrity (SRI)
  - “Subresource Integrity (SRI) is a security feature that enables browsers to verify that files they fetch (for example, from a CDN) are delivered without unexpected manipulation. It works by allowing you to provide a cryptographic hash that a fetched file must match”
  - https://developer.mozilla.org/en-US/docs/Web/Security/Subresource_Integrity

SubResource Integrity (SRI)

- Check the login page source

Plugin Structure



- In this simple passive check, we can include the heuristic code in the BurpExtender class itself

doPassiveScan

- `java.util.List<IScanIssue> doPassiveScan(IHttpRequestResponse baseRequestResponse)`

- Extensions should only analyze the HTTP messages provided during passive scanning

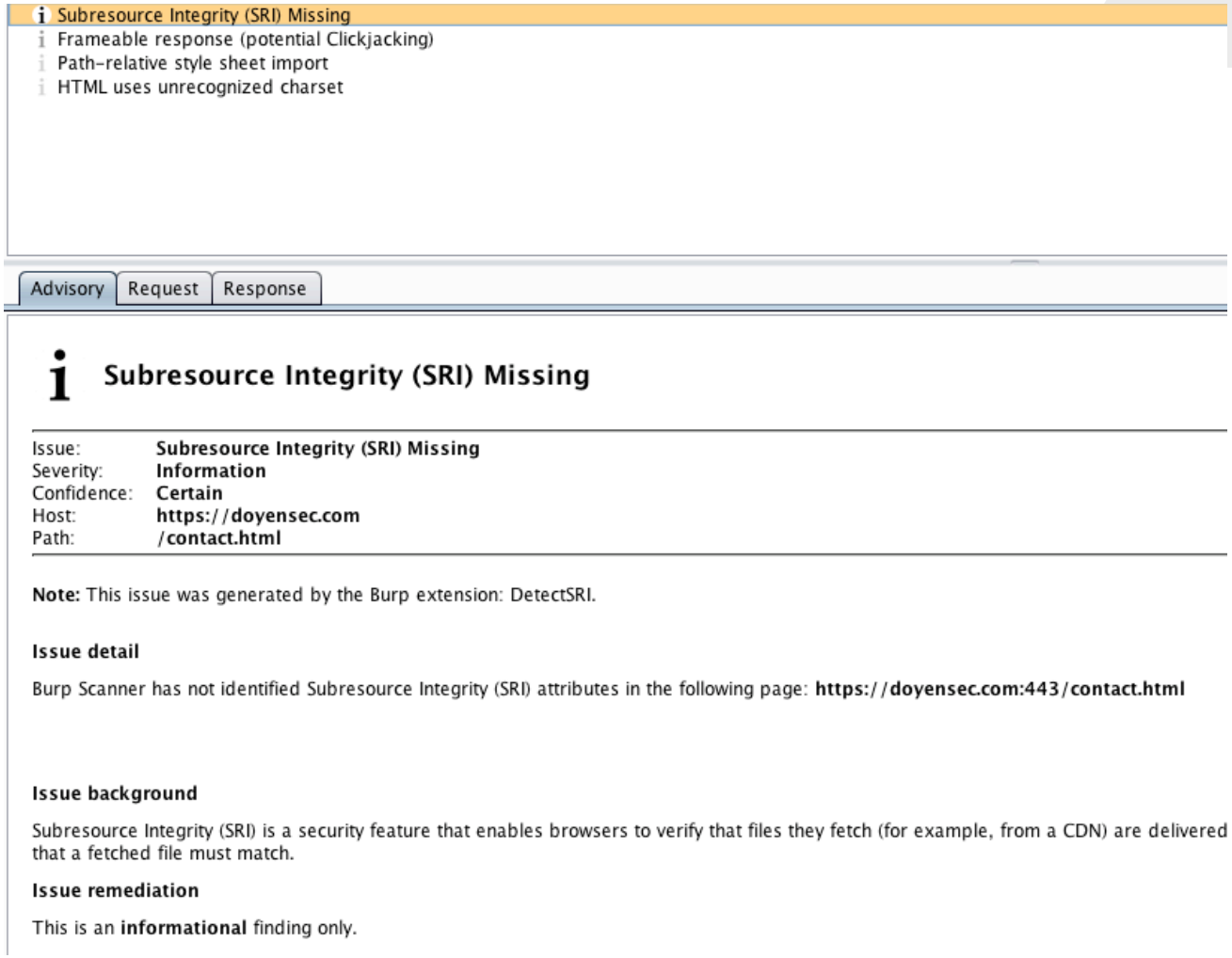
`IScanIssue` interface

- We will return our custom implementation
- `getConfidence()`
  - "Certain", "Firm" or “Tentative"
- `getSeverity()`
  - "High", "Medium", "Low", "Information" or "False positive”
- `getIssueType()`
  - 0x08000000

consolidateDuplicateIssues

- `int consolidateDuplicateIssues(IScanIssue existingIssue, IScanIssue newIssue)`
- It’s your responsibility to handle duplicates
- The Scanner will invoke this method if there are multiple issues for the same URL path

HTML Ascii Art anyone?



Coding Time!

- We will do this together!

Code Complete Extension

- https://github.com/doyensec/burpdeveltraining/tree/master/DetectSRI

Building a custom Active Scan check

DetectELJ

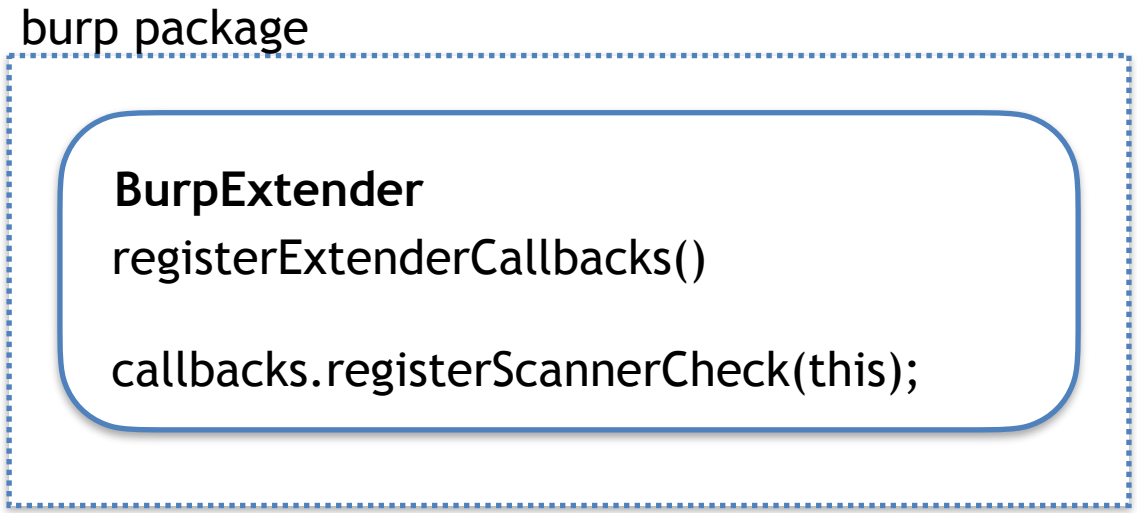
Requirements

- Create an extension that detects **Expression Language** injection vulnerabilities
  - Type of injection that occurs when attackers control data that is evaluated by an Expression Language (EL) interpreter

Expression Language (EL) injection

- Example:
  - `${1336+1} -> 1337`
- Think about Struts2 OGNL, Apache Jakarta, Spring's SPEL
- If interested, read https://www.mindedsecurity.com/fileshare/ExpressionLanguageInjection.pdf

Plugin Structure



- We can re-use the same passive scanner check skeleton, and instead implement `doActiveScan()`

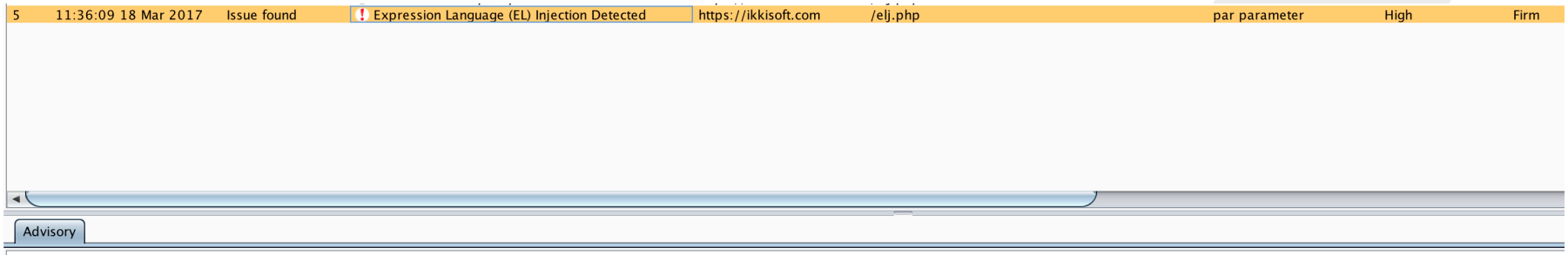
Understanding Response Changes

- Burp Extender APIs provides a useful helper method to analyze variations between two or more HTTP Responses
- `IResponseVariations analyzeResponseVariations(byte[]... responses)`
- `IResponseVariations` is a list of String representing the specific attributes that changed between those responses
  - `content_length`
  - `whole_body_content`
  - and so many others

IResponseVariations Attribute Types

- status_code
- input_image_labels
- page_title
- visible_text
- button_submit_labels
- div_ids
- word_count
- content_type
- outbound_edge_tag_names
- whole_body_content
- etag_header
- visible_word_count
- content_length
- header_tags
- tag_ids
- comments
- line_count
- set_cookie_names
- last_modified_header
- first_header_tag
- tag_names
- input_submit_labels
- outbound_edge_count
- initial_body_content
- content_location
- limited_body_content
- canonical_link
- css_classes
- location
- anchor_labels

Scan Issue


5 11:36:09 18 Mar 2017 Issue found Expression Language (EL) Injection Detected https://ikkisoft.com /elj.php par parameter High Firm
Advisory
Expression Language (EL) Injection Detected
Issue: Expression Language (EL) Injection Detected
Severity: High
Confidence: Firm
Host: https://ikkisoft.com
Path: /elj.php
Note: This issue was generated by the Burp extension: DetectELJ.
Issue detail
Burp Scanner has identified an Expression Language injection in:https://ikkisoft.com:443/elj.php?par=aaa
Issue background
Expression Language injections occur when input data is evaluated by an expression language interpreter. An attacker can read server-side data, such as the content of server-side variables, and some other inner configuration details.
Issue remediation
Apply input validation best practices, and reject ${, #{ and other variations.

Coding Time!

1. Let's review together the basic skeleton using WIP1 files
2. Implement the remaining logic (~30mins)
3. We will complete the exercise together

Pro Tip 1/2

- When creating a new issue, we can also specify markers to show specific strings within requests/responses
- This is done using the following callback method:

```
IHttpRequestResponseWithMarkers
applyMarkers(IHttpRequestResponse
httpRequestResponse,
java.util.List<int[]> requestMarkers,
java.util.List<int[]> responseMarkers)
```

Pro Tip 2/2

- Within our implementation of `IScanIssue`, we can customize the object returned by `getHttpMessages()`

```
@Override
public IHttpRequestResponse[] getHttpMessages() {
    String strRes = helpers.bytesToString(reqres.getResponse());
    int[] marks = new int[2];
    marks[0] = strRes.indexOf("1337");
    marks[1] = marks[0] + 4;
    List<int[]> marksList = new ArrayList<>(1);
    marksList.add(marks);
    IHttpRequestResponseWithMarkers reqresMark = callbacks.applyMarkers(reqres, null, marksList);
    IHttpRequestResponse[] rra = { reqresMark };
    return rra;
}
```

Scan Issue Improved

```
<div id="protected-page">
        <img src="assets/img/lock.jpg" alt="Lock"
        <h1>You are logged in</h1>

        <p>Dear Burp, I love you 1337 times!</p><a
2.168.100.111/burp.php?logout=true"
utton">Logout</a>                    </div>
```

Advisory | Request | Response

Expression Language (EL) Injection Detected

Issue:	**Expression Language (EL) Injection Detected**
Severity:	**High**
Confidence:	**Firm**
Host:	**http://192.168.100.111**
Path:	**/burp.php**

Note: This issue was generated by the Burp extension: DetectELJ.

Issue detail

Burp Scanner has identified an Expression Language injection in:**http://192.168.100.111:80/burp.php?elj=$%7b1336%2b1%7d**

Issue background

Expression Language injections occur when input data is evaluated by an expression language interpreter. An attacker can read server-side data, such as the content of server-side variables, and some other inner configuration details.

Issue remediation

Code Complete Extension

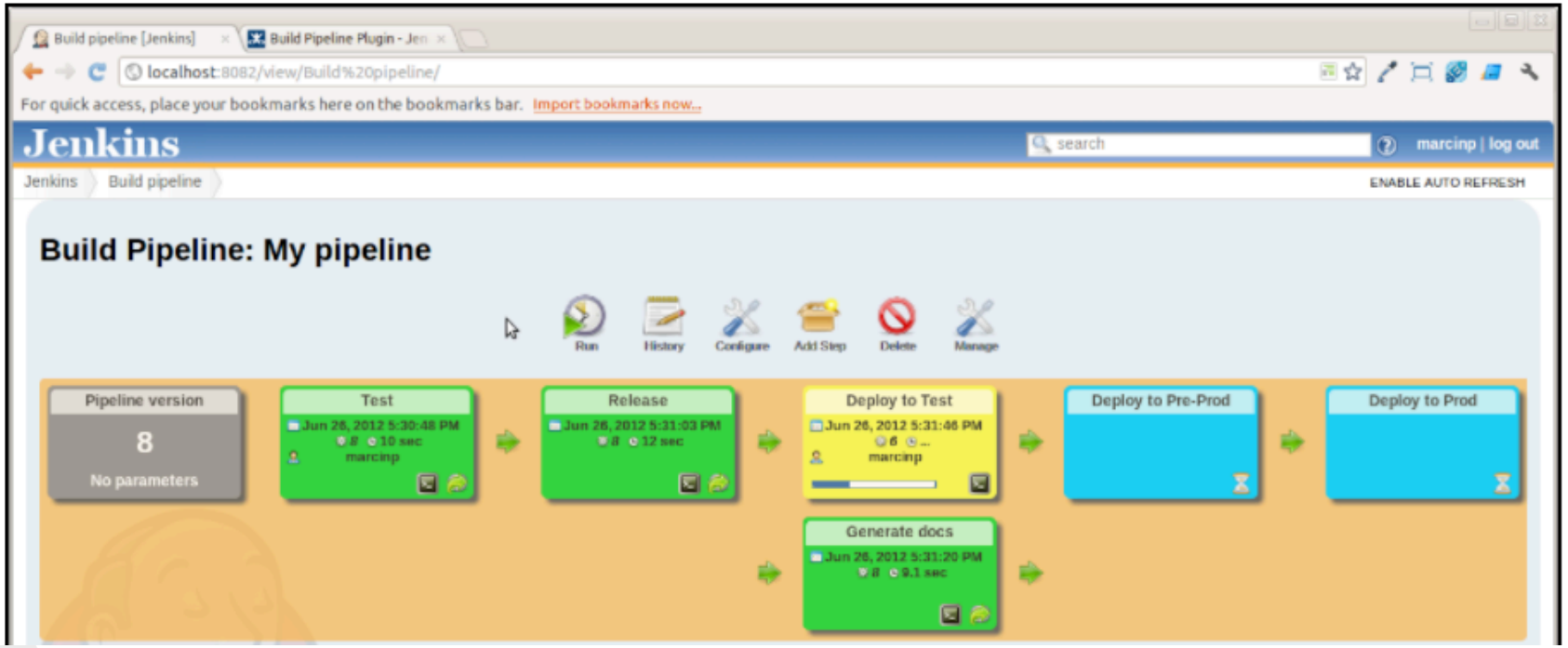
- https://github.com/doyensec/burpdeveltraining/tree/master/DetectELJ

Building a security automation toolchain

Jenkins + Burp

Typical CI Environment

- Continuous Integration has become a widely adopted practice



Moving fast means testing fast

- We have a site logger
- We have an headless replay tool
- We have custom Scanner checks
- Let's integrate all components in a new *Build Step (SecTesting)* using Jenkins and the Build Pipeline View plugin

Jenkins Setup 1/2

1. Download Jenkins - jenkins.war
2. Run it using `$java -jar jenkins.war`
3. Open the browser and visit https://<HOST>:8080
4. Type your auto-generated admin password
5. Select *Select Plugin to Install*
6. Search and install *Build Pipeline Plugin*

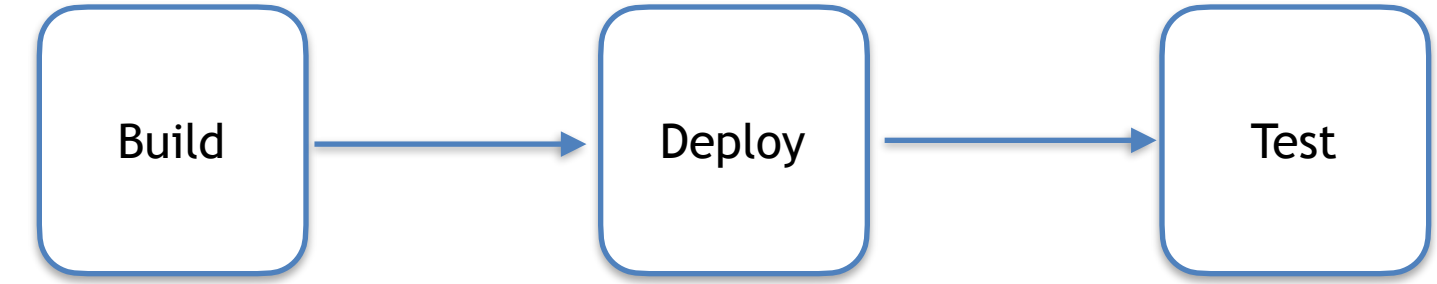
Jenkins Setup 2/2

7. Coffee Break 
8. Create your admin user
9. It’s time to create our build pipeline!

Training Environment

- Multiple Jenkins instances already setup and ready to go
- Login with *admin*:*admin*

Our pipeline plan

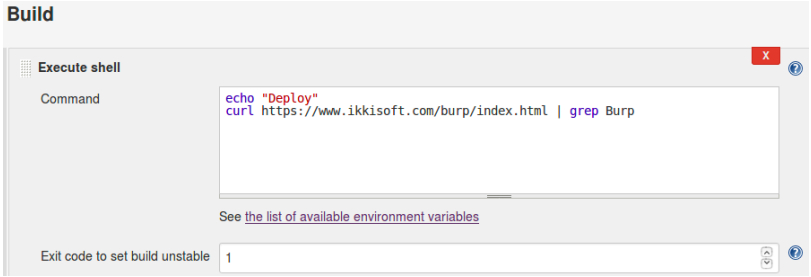


(1) Build

- To simplify our setup, build is just simulated using a simple execute shell
- Click on “New Item”->”Freestyle Project” named “Build”
- In the Build section, select “Add Build Step” -> “Execute Shell”
- Type echo “Build"
- Save

(2) Deploy

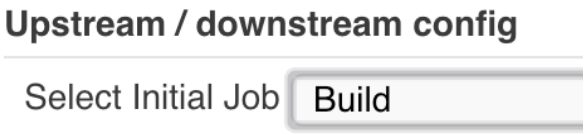
- To simplify our setup, deploy is also simulated
- Click on “New Item”->”Freestyle Project” named “Deploy”
- In the Build section, select “Add Build Step” -> “Execute Shell”
- Type echo “Deploy”; curl http://127.0.0.1/index.html | grep Burp
- Additionally, we can verify if the live endpoint is up and running with “Exit code to set build unstable”
  - If the exit code != 1 —> *Build Unstable*



- Finally, in “Build Triggers” select “Build after other projects are built” and type “Build”
- Save

Create New Build Pipeline View

- From the home, click on the +
- Select “Build Pipeline View” named “Security Pipeline” and then “Ok”
- (Optional) Type a description
- In the configuration “Select Initial Job”, pick “Build”
  - This is our first step for the overall execution

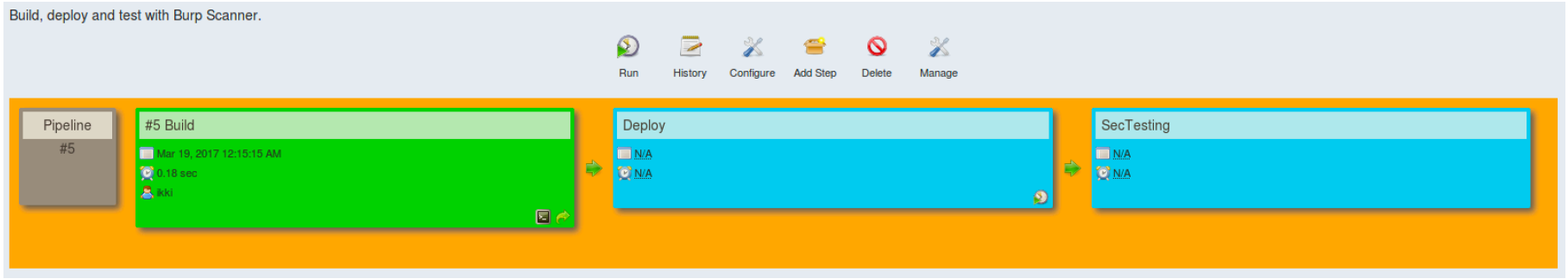


Our Security Pipeline (so far)

- It’s time to perform security testing on the “newly deployed code”

(3) SecTesting

- A new task where we will execute Burp and our extensions



SecTesting Plan 1/2

1. Using Burp and our *SiteLogger* plugin, we have already recorded the traffic to our deployed application
2. With *ReplayAndDiff*, we can run a scan in headless mode, performing diff and generating a new findings report
3. Using DetectELJ and DetectedSRI, we can enhance our scanners capabilities

SecTesting Plan 2/2

- Let’s just put all together so that our build step will execute Burp with our plugins
- Additionally, we want to fail the build if there’re new findings

SecTesting Setup 1/4

- First, let's start Burp with the GUI and load all extensions. Then, close it gracefully.
  - In this way, Burp will reload all previously-loaded extensions at startup
  - We can use **$ ssh -X** for X11 forwarding
    - *This step was already done by me*

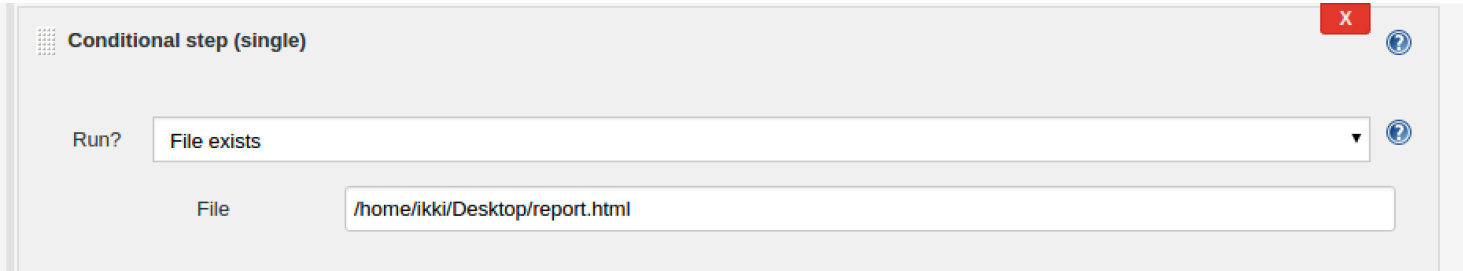
SecTesting Setup 2/4

- Create a new Freestyle project named “SecTesting”
- In the newly create SecTesting task, create a new “Execute Shell” with the following code:

```
echo "Launching Burp Pro..."

java -Xmx256m -Djava.awt.headless=true
-jar /home/ubuntu/burpsuite_pro.jar
-h=127.0.0.1 -p=27017 -o=/home/ubuntu/
reports/ -r=report.html -t=40
```

SecTesting Setup 3/4

- Click “Add Build Step” and select “Conditional Step (single)”
- File: */home/ubuntu/reports/report.html*



- Then, “Execute Shell” again

SecTesting Setup 3/4

- As shell script use:

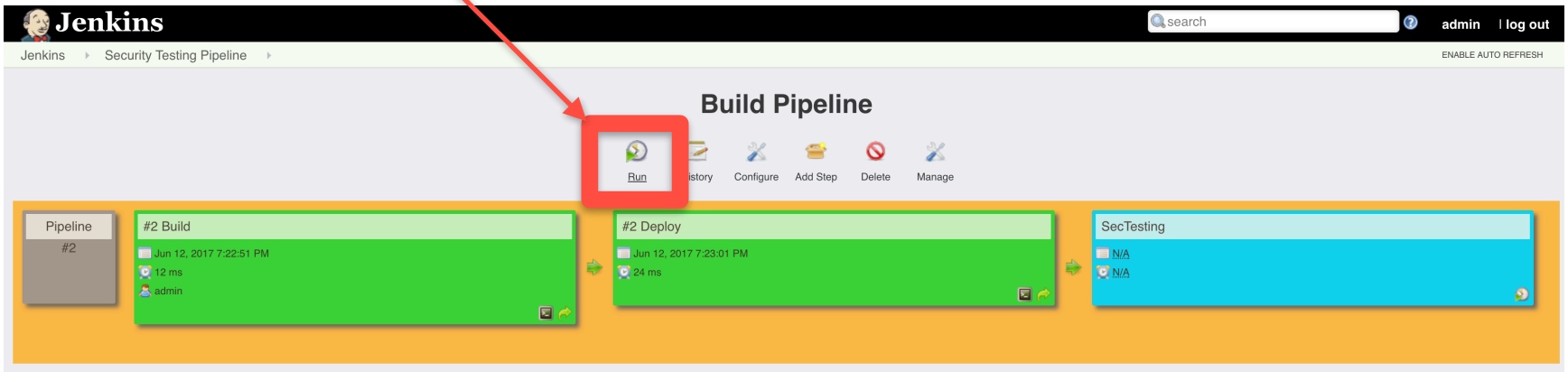
```
echo "New report - Send email out!";
echo "Burp ReplyAndDiff identified a new finding. See
attached report." | mail -A /home/ubuntu/reports/
report.html -s "Burp Scanner - New Finding" <email>
rm /home/ubuntu/reports/report.html
exit 1
```

  - *Exit 1* will force the build as 'unstable'
  - In a real-world scenario, you could use Jenkins' Email Notification to send a custom email to the developers

- In the configuration "Select Initial Job", pick "Build"
- Save

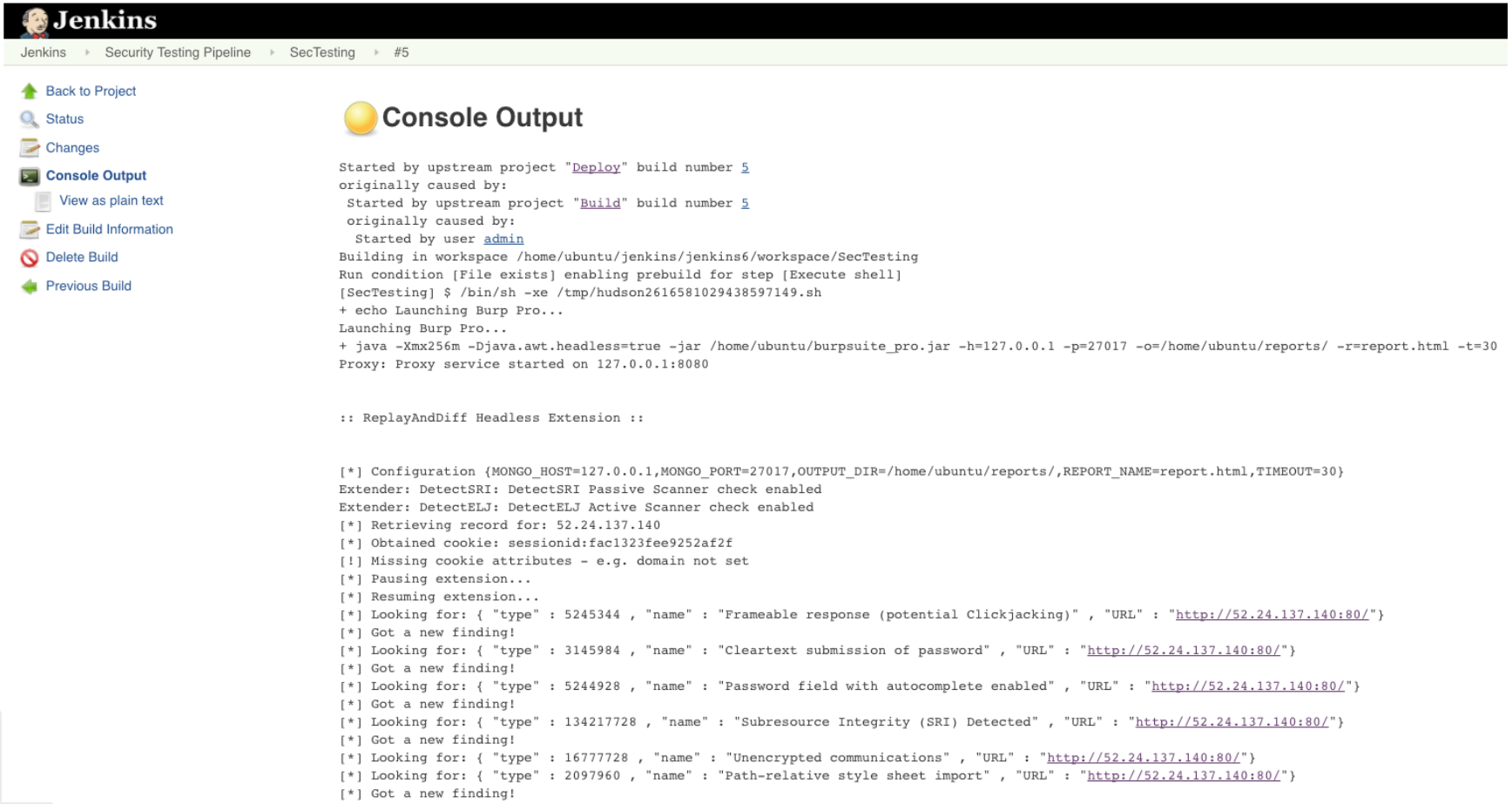
Ready To Go

- Click on Run to execute the entire pipeline



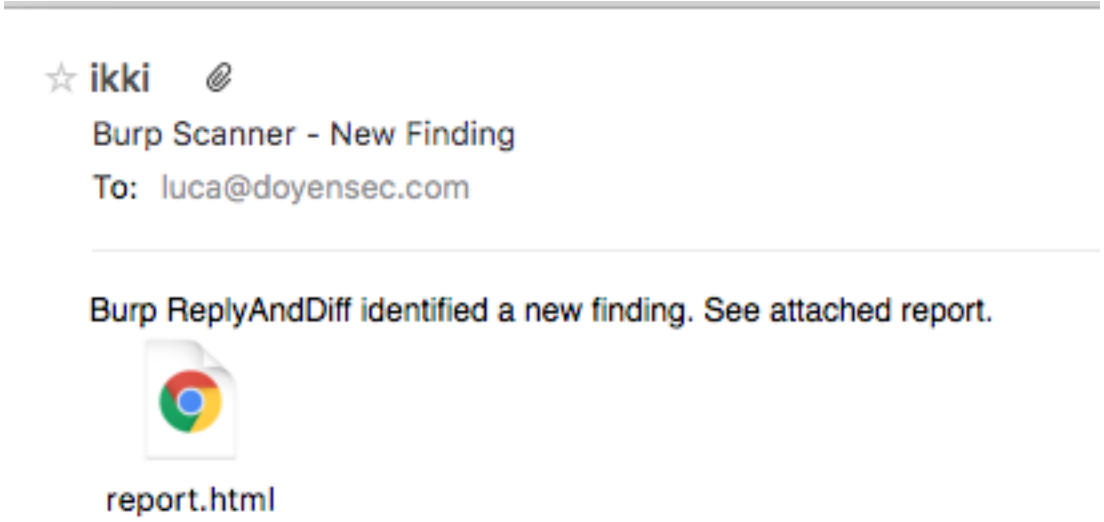
- Jenkins will display the progress. You can review the console output by clicking on the  symbol

SecTesting Console Output



Moment of Truth

- Wait for the email :)



** EXTRA MATERIAL **

Intruder Payloads Generator

Case Study: Bradamsa

Intruder payloads

- Let's study the implementation of **Bradamsa**
- Radamsa for Burp
  - Original project: https://github.com/ikkisoft/bradamsa
  - Simplified code to study: https://github.com/doyensec/burpdeveltraining/tree/master/Bradamsa
  - This extension provides a custom Intruder payload generator

What is Radamsa

- Radamsa is a command-line test case generator for fuzzing
- It is scriptable and super easy to use

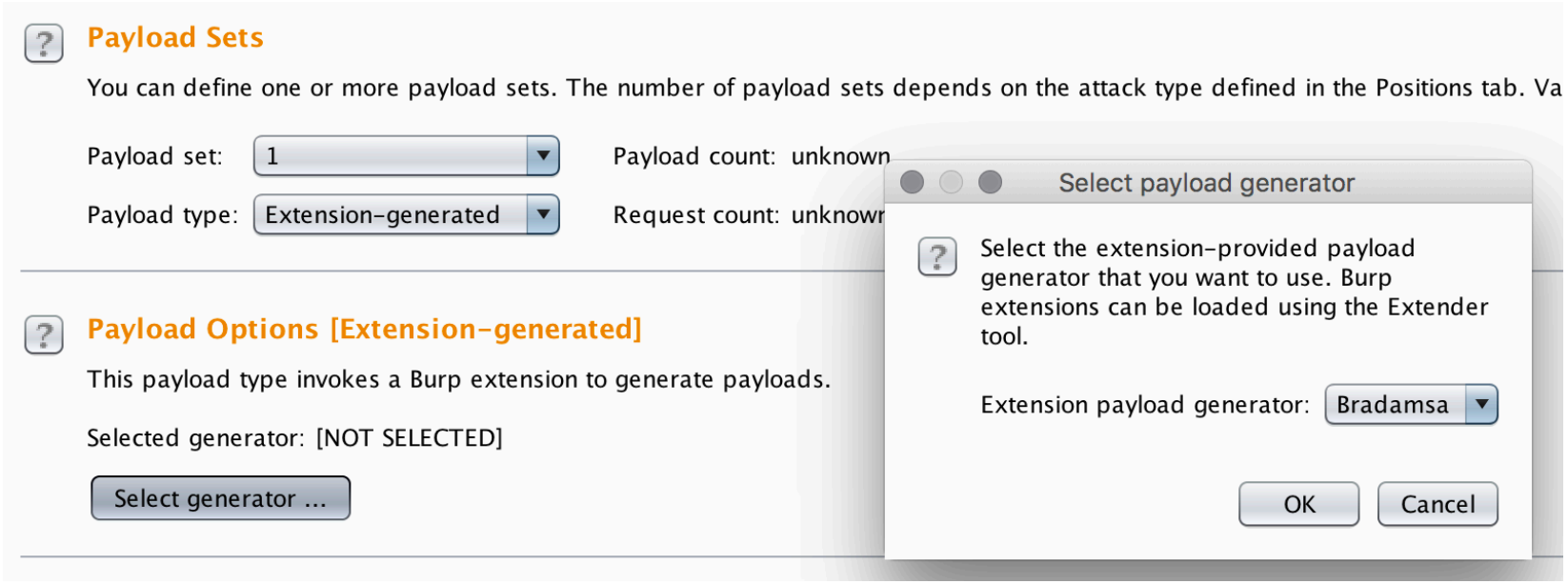
```
$ echo "aaa" | radamsa
 :aaa
```

Install Radamsa

```
$ git clone https://github.com/aoh/radamsa.git
$ cd radamsa
$ make
$ sudo make install
$ radamsa --help
```

- You need *gcc/clang*, *make* and *git*
- On Mac OS, change the Makefile to install in */usr/local/bin/*

What is a payload generator?



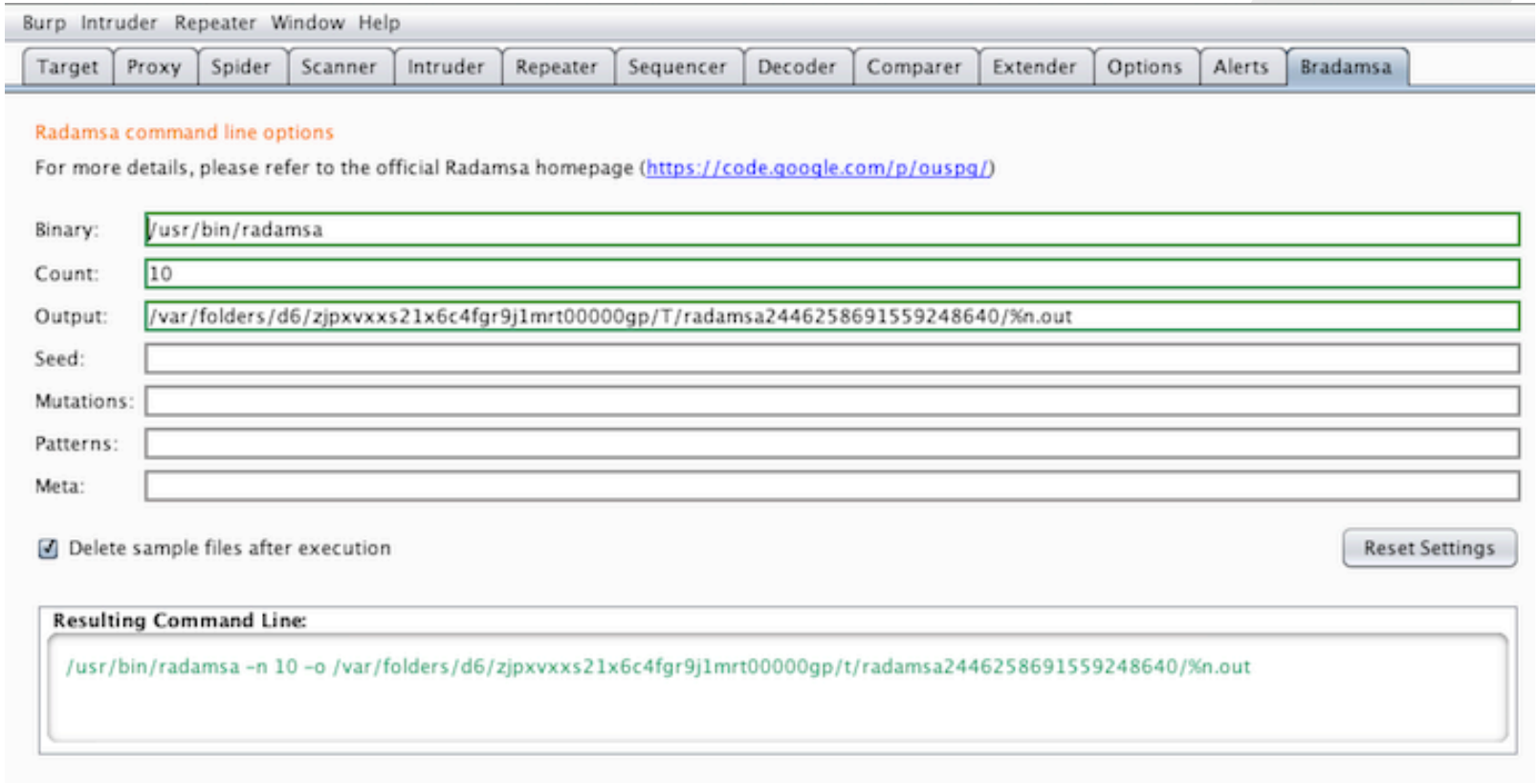
Generator and Processor

- Extensions can register themselves as `registerIntruderPayloadGeneratorFactory` or `registerIntruderPayloadProcessor`
- For payload generators, Burp expects the extension to return an implementation of the `IIntruderPayloadGenerator` interface

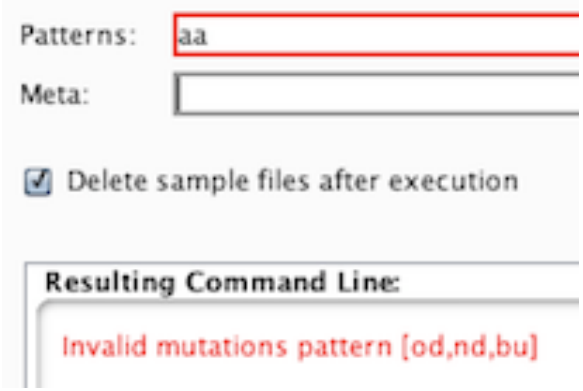
In pseudo-code

```
class myGenerator implements IIntruderPayloadGenerator{

        @Override
        public boolean hasMorePayloads()
        { ... }

        @Override
        public byte[] getNextPayload(byte[] baseValue)
        { ... }

        @Override
        public void reset()
        { ... }
}
```

Bradamsa Demo 1/2



Bradamsa Demo 2/2



Let’s have a look at the code

- https://github.com/doyensec/burpdeveltraining/tree/master/Bradamsa
- Focus on *RadamsaPayloadGenerator.java* and *BradamsaPanel.java*

Conclusion

Final Remarks

- Building extensions is **fun** and **useful** to improve efficacy and efficiency of security testing activities
- When analyzing custom protocols, Burp extensions make a big difference
- When Burp Scanner is integrated in the SDLC, creating custom check can ensure test coverage (regression, application-specific bugs, …)

What's next?

- Study the Burp API Javadoc
  - https://portswigger.net/burp/extender/api/
- Check the source code of BApp Store extensions on PortSwigger's Github
  - https://github.com/PortSwigger
- Build your extension!

Thank you!

Please email your feedback at
info@doyensec.com

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