

No locked doors, no windows barred: hacking OpenAM infrastructure

No locked doors, no windows barred: hacking OpenAM infrastructure - George Noseevich, Andrew Petukhov, slideshare.net.

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Content

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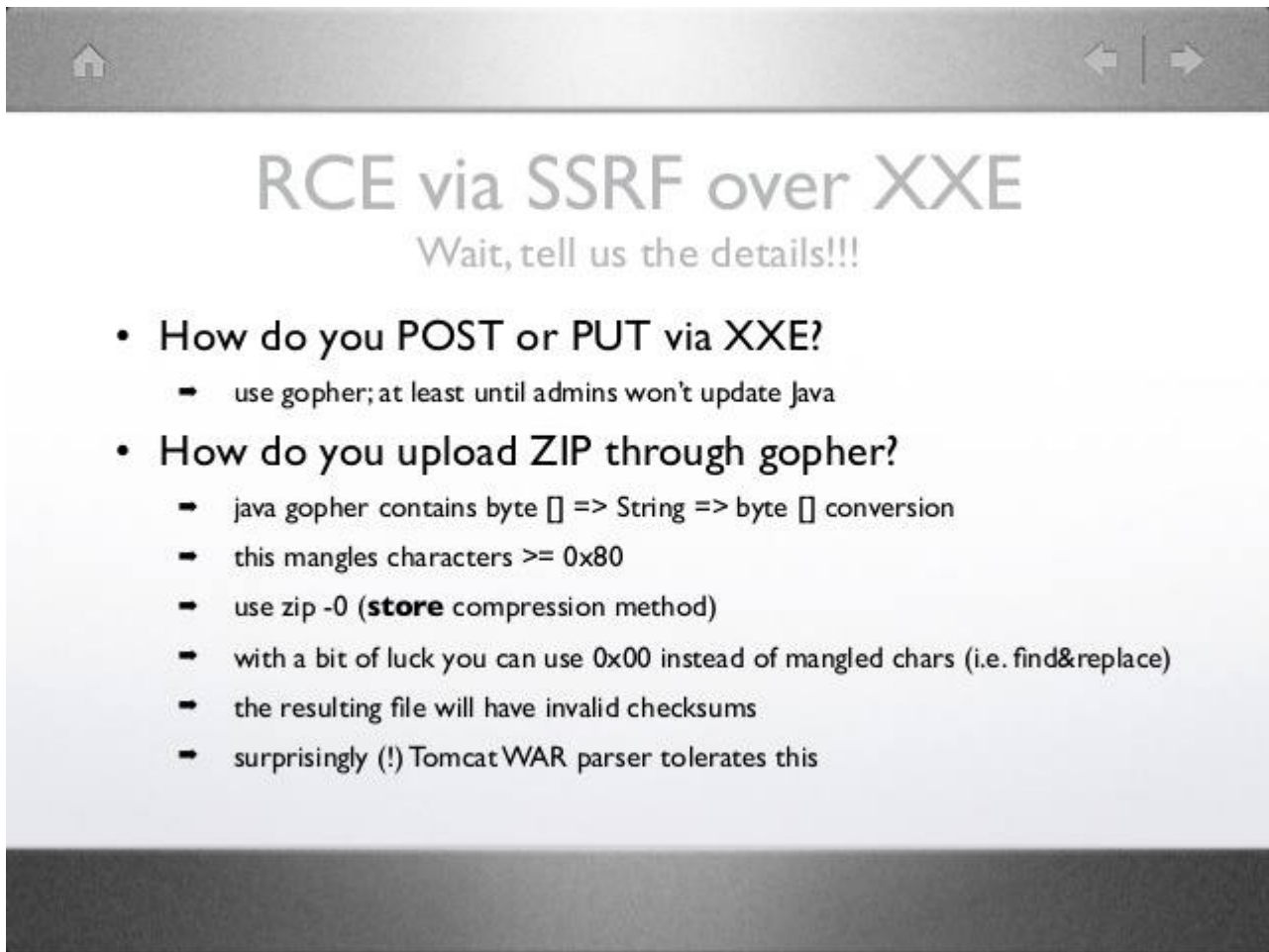
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A presentation slide with a dark grey header bar containing a home icon on the left and navigation arrows on the right. The main content area is white with a light blue gradient background. The title 'RCE via SSRF over XXE' is in a large, bold, grey font, followed by the subtitle 'Wait, tell us the details!!!' in a smaller, grey font. Below this is a bulleted list of two main points, each with several sub-points. The first point is 'How do you POST or PUT via XXE?' with a sub-point 'use gopher; at least until admins won't update Java'. The second point is 'How do you upload ZIP through gopher?' with sub-points: 'java gopher contains byte [] => String => byte [] conversion', 'this mangles characters >= 0x80', 'use zip -0 (**store** compression method)', 'with a bit of luck you can use 0x00 instead of mangled chars (i.e. find&replace)', 'the resulting file will have invalid checksums', and 'surprisingly (!) Tomcat WAR parser tolerates this'.

RCE via SSRF over XXE

Wait, tell us the details!!!

- How do you POST or PUT via XXE?
 - use gopher; at least until admins won't update Java
- How do you upload ZIP through gopher?
 - java gopher contains byte [] => String => byte [] conversion
 - this mangles characters >= 0x80
 - use zip -0 (**store** compression method)
 - with a bit of luck you can use 0x00 instead of mangled chars (i.e. find&replace)
 - the resulting file will have invalid checksums
 - surprisingly (!) Tomcat WAR parser tolerates this

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[[image: Andrew Petukhov](#)]

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Andrew Petukhov

, Security consultant at Internal Security

Uploaded on Nov 19, 2012

One of the main functional components of enterprise applications and Internet portals is an authentication and access control system (AuthC/Z). In this presentation, we describe a popular access ... **

One of the main functional components of enterprise applications and Internet portals is an authentication and access control system (AuthC/Z). In this presentation, we describe a popular access control system called ForgeRock OpenAM from the external security point of view. We show the scenarios of full enterprise application compromise through complex attacks which employ both LFI and SSRF.

More in: [Technology](#)

- 1. No locked doors, No windows barred Hacking OpenAM Infrastructure George Noseevich Andrew Petukhov ZeroNights 2012
- 2. WTF OpenAM?• Open source Access Management, Entitlements and Federation server platform successor of Sun OpenSSO Enterprise• Written in Java, very Enterprisey hard to configure and maintain securely• Rather popular inurl:/amserver/UI/Login or inurl:/openam/UI/Login• Common use case: SSO across legacy apps• Usually extended via custom code
- 3. Motivation, Positioning & Layout• Not just another hack via XXE• Wanted to share our knowledge on how to develop an attack on OpenAM given an LFR and SSRF abilities• Attack vectors on different OpenAM instances will start from the simplest one and steadily proceed to the worst case scenario (a security hardened one)• Several interesting tricks data retrieval in blind XXE cases zip upload via HTTP PUT over gopher• What is the proper way to fix XXE in Java?
- 4. Problem Statement• OpenAM infrastructure• Tomcat as a web container• An ability to read local files and do SSRF e.g. XXE with gopher protocol enabled• Goal: get an Admin in OpenAM Management Panel• A side note: will not focus on general SSRF elaboration methodology, which is still valid here
- 5. To begin with: Loot da FileSystem!
- 6. Looting the FileSystem• Gotta traverse directories Luckily possible to list them with XXE How would you tell a directory listing from a file contents?• Gotta read files Special chars and

binary are a problem as usual• Would like to use GREP (General Resource Enumeration Protocol) and other posix tools

- 7. And along comes... XXE Fuse Demo A team of specially trained monkeys are supporting this SaaS solution 24/7 Request a free trial! <http://www.youtube.com/watch?v=7GtPgavl-sl>
- 8. Looting the FileSystem XML-in-XML and OOB channels• The vulnerable servlet performs two rounds of xml parsing• In the first round we retrieve the data• In the second round we pass it to the attacker host
- 9. Looting the FileSystem Possible Targets and Outcomes1. Other apps on host especially management and monitoring2. Configs (& credentials) read container config and extract HTTP credentials if needed ldap.conf may be especially juicy3. Logs may contain private data (e.g. SQL query logs) may enable further attacks (see below)
- 10. Demo Time RCE via SSRF over XXE using Tomcat App Manager <http://www.youtube.com/watch?v=ZnsFhGYql3g>
- 11. RCE via SSRF over XXE Wait, tell us the details!!!• How do you POST or PUT via XXE? use gopher; at least until admins won't update Java• How do you upload ZIP through gopher? java gopher contains byte [] => String => byte [] conversion this mangles characters >= 0x80 use zip -0 (store compression method) with a bit of luck you can use 0x00 instead of mangled chars (i.e. find&replace) the resulting file will have invalid checksums surprisingly (!) Tomcat WAR parser tolerates this
- 12. Looting the FileSystem Configs & credentials• Container configs e.g. /usr/share/tomcat6/conf/• OpenAM configs /home/user/openam/{install.log, .configParam} /home/user/openam/config/xml/• Password file recommended way of configuring OpenAM is via ssoadm CLI tool: "In most ssoadm subcommands, the password file is required option. The password file is a simple file that contains the administrator password for the given task." may encourage admins to store passwords in plaintext
- 13. Exploring OpenAM Features• OpenAM uses custom Auth tokens web container session tokens are useless good targets to hijack privileged sessions• OpenAM does Encryption uses Password-Based Encryption (PBESWithMD5AndDES) with low iteration count admin pwd is encrypted with default key and stored in bootstrap file XXE won't let you read the bootstrap file other pwds and session tokens are encrypted using randomly generated instance key which is stored in binary data store instance key is shared across interconnected OpenAM instances (e.g. failover)
- 14. Juicy OpenAM Features• Debugging {CONFIG_DIR}/{INSTANCE_NAME}/debug/ If verbose debugging is enabled, we can read auth tokens and hijack sessions Quickly check via grep -r "AQIC" Admins do not log in too frequently Sessions expire Disabled by default =(• Monitoring HTTP/JMX/SNMP facility to monitor OpenAM instance OpenAM-specific MBeans do not seem to provide anything useful Also disabled by default
- 15. Wait, but we need the features!• Debugging Every single action in admin interface is CSRF-protected Debug.jsp is a quick page to control debug settings Devs didnt worry too much about CSRF there => you can CSRF verbose logging SSRF at Tomcat Shutdown Port to force admin login (or social engineer him)• Monitoring Enable monitoring using the hijacked session; it will have the default (i.e. known) password SSRF at Tomcat Shutdown Port again to force reload

- 16. Putting it All Together Dealing with the Worst Case• Enable debugging CSRF and then read admin session token from logs• Use admin session token to enable Monitoring SSRF at Tomcat Shutdown Port to force reload• Pwn Use HotSpotDiagnostic MBean to force a heap dump into DOC_ROOT Download and analyze the dump (strings util would do) Grep out the encryption key and encrypted admin password Decrypt the password and ruleem all
- 17. Demo TimeDebugging, Monitoring and Heap Dump
Scenario<http://www.youtube.com/watch?v=Fb2zEqwvbpw>
- 18. Wrap Up Fixing XXE
- 19. Fixing XXE in Java• Problem statement - devs want to: use a single class for all XML parsing (validating and not) use external DTDs from local jar files avoid being pwned• Most XML hardening guides recommend: turn off general and parameter entities:
setFeature("http://xml.org/sax/features/external-general-entities", false)
setFeature("http://xml.org/sax/features/external-parsed-entities", false) enable
XMLConstants.FEATURE_SECURE_PROCESSING to prevent entity expansion DoS• Not Enough!
- 20. Fixing XXE in Java• In Java, if validation is enabled, SSRF is still possible• Devs: okay, lets use our custom Entity resolver: documentBuilder.setEntityResolver(new XMLHandler())• Almost there! make sure that XMLHandler returns an empty InputStream on error if you return null, JAXP will fall back to default resolvers!
- 21. Wrap Up Conclusions• Specific advice Never store passwords in files (who may have thought...) Its good to change monitoring password even if you do not use the feature Update Java and OpenAM (fix is available in nightly builds) - this would prevent XXE and disable gopher• General advice: in SSRF world it is no longer safe to trust IP-based authentication could be subverted instantly Defying patching? Pwned! (think about delayed exploitation) Defying least privilege in DMZ? Very arrogant!
- 22. Question Time!• George Noseevich Twitter: @webpentest Email: webpentest@gmail.com• Andrew Petukhov Twitter: @p3tand Email: andrew.petukhov@internalsecurity.ru• Show us the Source! Tools: <http://internalsecurity.ru/media/resources/openam-xxe-tools.zip> Video: <http://www.youtube.com/playlist?list=PL1CBT43qUw294xCw79B01PbRQNKI6Qqdj> WWW: <http://internalsecurity.ru/research/>