

Pivotal®

Apache Tomcat 9

Preview

Mark Thomas, September 2015

Introduction

- Apache Tomcat committer since December 2003
 - markt@apache.org
- Tomcat 8 release manager
- Member of the Servlet, WebSocket and EL expert groups
- Consultant Software Engineer @ Pivotal
- Currently focused on Apache Tomcat 9

Agenda

- Specification mandated new features
- Tomcat specific new features
- Tomcat features removed
- Internal changes

Tomcat versions

Tomcat	JavaEE	Minimum Java SE	Servlet	JSP	EL	WebSocket	JASPIC	1 st Stable Release	EOL
5.x	4	1.4	2.4	2.0	N/A	N/A	N/A	08 2004	09 2012
6.x	5	5	2.5	2.1	2.1	N/A	N/A	02 2007	12 2016
7.x	6	6	3.0	2.2	2.2	1.1	N/A	01 2011	TBD
8.x	7	7	3.1	2.3	3.0	1.1	N/A	02 2014	TBD
9.x	8	8	4.0	2.4?	3.1?	2.0?	1.1?	Q4 2016?	TBD

Specification changes

Specifications

JavaEE 8

- Key elements
 - HTML 5.0
 - HTTP/2
 - Simplification
 - Better integration for managed beans
 - Better infrastructure for the cloud

Specifications

Servlet 4.0

- Work started, stalled and is now starting again
 - Driven by JavaOne
- HTTP/2
- Ease of use improvements
 - HttpFilter, default methods
- Clarifications
 - Starting to make progress

Specifications

Servlet 4.0

- Enhancement requests
 - Very little progress
- Default context root
 - Tomcat will be ignoring this

Specifications

Servlet 4.0: HTTP/2

- HTTP/2 requires some TLS features
 - Server Name Indication (SNI)
 - Application Layer Protocol Negotiation (ALPN)
- Work in progress
 - not yet considered stable
- h2c available with all connectors
- h2 requires APR/native due to ALPN requirements

Specifications

Servlet 4.0: HTTP/2

- Basic HTTP requests work
- Async support mostly implemented
 - Just timeouts left to implement
- Non-blocking I/O support in progress
- Server push has not been implemented yet

Specifications

Servlet 4.0

- Java EE 8 must run on Java 8
- Java EE 8 requires Servlet 4.0
- Servlet 4.0 requires HTTP/2
- HTTP/2 requires ALPN
- Java 8 does not, and will not, support ALPN
- ALPN support should be available from Java 9

Specifications

WebSocket 2.0

- Work has not started
- Assuming 2.0
 - Could be 1.2
- Standardize extension support
 - Compression
 - Multiplexing

Specifications

EL 3.1

- Work has not started
- Nothing obvious to do here
- Most issues opened against UEL are implementation bugs
- Expect minor changes and clarifications

Specifications

JSP 2.4

- There is no JSP expert group
- Just an other maintenance release
- Issues to resolve with EL 3.0 and JSPs
 - Imports (definition and resolution)

Specifications

JASPIC 1.1

- Java Authentication Service Provider Interface for Containers
- Not much demand
- There are benefits (e.g. drop-in support for OAuth)
- Unsuccessful GSoC 2015 project to implement
- I intend to complete the JASPIC work for Tomcat 9

Specifications

Other

- Tomcat 9 isn't going to implement the web profile
 - Lack of demand
 - TomEE
- JACC
 - Java Authorization Contract for Containers
 - Zero demand
 - Might be useful
 - On the 'have a look if there is time' list

Tomcat New Features

Tomcat 9 New Features

- Major overhaul of TLS support
- Tomcat 8 supports
 - one TLS virtual host per connector
 - one certificate per virtual host
- Tomcat 9 supports
 - multiple virtual hosts per connector (SNI)
 - multiple certificates per virtual host
- TLS configuration has changed to support this

Tomcat 9 New Features

- SNI and multiple certificates supported by all connectors
 - APR/native support via the OpenSSL API
 - JSSE support via parsing the initial handshake
- ALPN supported by APR/native
 - JSSE support is currently TBD
- Common (where possible) configuration for all connectors
 - Some JSSE / OpenSSL differences remain

Tomcat 9 New Features

- OpenSSL engine option for NIO and NIO2
- JSSE supports pluggable providers
 - OpenSSL based provider?
- Simpler to replace the SSLContext implementation
 - Netty's approach
 - Uses same native library as APR/native connector
- Allows OpenSSL performance with NIO/NIO2 APIs
- Not yet tested with HTTP/2 & ALPN

Tomcat 9 New Features

- Other possibilities
 - HTTP upgrade support for AJP
 - Needs help with the C code
- Suggestions welcome
 - Suggestions with patches are even better ;)

Tomcat 9 New Features

- With OpenSSL engine support for NIO and NIO2 why bother with the APR/native connector?
- NIO and NIO2 are very similar in performance
 - NIO is more stable
 - NIO2 API is (arguably) better suited to WebSocket and HTTP2
- Do we need both NIO and NIO2?
- Is a single connector implementation viable?
 - Maybe...

Removed Features

Removed Features

BIO HTTP and BIO AJP connectors

- Both WebSocket and Servlet 3.1 require non-blocking IO
- BIO connectors currently pretend to be non-blocking
 - Creates complexity
 - No scalability benefits
 - Opportunity for things to break
- Therefore decided to remove them

Removed Features

BIO HTTP and BIO AJP connectors

- NIO implementation remains the default
 - HTTP and AJP
- NIO2 introduced in Tomcat 8
- APR/native still available
 - Requires native library

Removed Features

Comet

- Proprietary interface for asynchronous I/O
- Users are moving (have moved) to WebSocket
- Adds complexity to all the connectors
- Therefore decided to remove it

Internal Changes

Internal Changes

Connectors

- HTTP 2.0 support adds complexity
- Connectors were already complex
- Connector code was fragile in some areas
- Cleaned up the code up before starting on HTTP 2.0

Internal Changes

Connectors

- Removed
 - BIO
 - Comet
- Implementation specific per connector code
 - Move to Endpoint
- Implementation specific per connection code
 - Move to SocketWrapper

Internal Changes

Connectors

- Used to have connector specific HTTP, AJP and upgrade implementations
- Reduce duplication
 - HTTP upgrade reduced to 3 classes from 12
 - Removed ~400 loc (of ~120,000)
 - HTTP 1.1 removed ~50% / 2500 loc
 - AJP 1.3 removed ~30% / 400 loc
- No connector specific HTTP/2 code

Internal Changes

WebSocket

- Refactored I/O implementation
 - Direct to Tomcat's I/O layer
 - Not via Servlet 3.1 non-blocking API
- Simpler
- Faster
- Extension support likely to require further refactoring

Internal Changes

Other

- Remove use of system properties for configuration
 - Move to per Context / Host / Server / Connector
 - May keep the system property for one version as a default
- Made RFC 6265 CookieProcessor the default
 - Note UTF-8 extension

Get Involved

Get Involved

- Ask questions
 - users@tomcat.apache.org
- Report bugs
 - <https://issues.apache.org/bugzilla>
- Provide patches
 - <https://issues.apache.org/bugzilla>
 - GitHub pull request

Get Involved

- Development
 - <https://svn.apache.org/repos/asf/tomcat/trunk> (9.0.x)
 - dev@tomcat.apache.org
- Update the wiki
 - <https://wiki.apache.org/tomcat>
- You don't need to be an expert
- Documentation needs patches too

Questions

Pivotal®