New !

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New and upcoming features in Apache Tomcat ™

Remy Maucherat

Software engineer at Red Hat

Tomcat committer since 2000

ASF member

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NIO2

HTTP/2

OpenSSL support

Cloud clustering

And more ...

NIO 2 - Why ?

Alternative API to NIO

Experiment as NIO poller code was complex

Very clean API, nice blocking and asynchronous semantics

Allows using advanced scatter and gather IO using optional low level API

New Java IO API and brand new JVM IO code

NIO 2 - Implementation

Included as experimental in 8.0.x

Fully supported in 8.5 and 9, by Mark Thomas and myself

Good actual performance !

Easier to read IO code in Tomcat

Async gather IO improved HTTP/2 performance and reduced latency

NIO 2 - Issues

State handling is very complex

Using scatter IO is difficult

GC amount is significant

Different buffering strategy

SSL use can mitigate gain

NIO 2 - Future work

Refine low level API

Attempt some scatter input for HTTP/2

Additional uses of the low level NIO 2 API

Password encryption - Why ?

Often requested feature

Obvious use cases

Password encryption - Implementation

Uses an extension hook in Tomcat's Digester

Not real security

Inclusion of the feature in Tomcat was blocked

Available as a third party component: tomcat-vault in github.com

HTTP/2 - Why ?

Next version of the HTTP protocol

Great industry adoption

Lower latency

Better scalability

HTTP/2 - Implementation

Integrated and fully supported in 8.5 and 9

Needs extra configuration

Good performance with unencrypted h2c

Works transparently for end user browsers using ALPN

Direct h2 connection is supported

HTTP/2 - Issues

ALPN and TLS configuration is demanding

Some blocking IO used

Encryption lowers performance with JSSE

Very high GC

Overall resource use compared to HTTP/1.1

HTTP/2 - Future work

Use NIO 2 to reduce blocking IO code

Java 9 and its ALPN support will become ubiquitous

Scatter IO for more efficient asynchronous frame parsing

Further performance tuning

More HTTP/2 features

OpenSSL - Why ?

JSSE was thought to be slow

Easy ALPN support, more supportable than Java 8 ALPN hacks

Reduction of native code footprint over the APR connector

Experiment with OpenSSL as a SSLEngine rather than using JCE

Requires NIO or NIO 2, will not work with classic java.io

OpenSSL - Implementation

Great performance !

Provides ALPN for the NIO and NIO 2 connectors

Setup is similar to the APR connector

Code for handling keystore and truststores is complex

Full OpenSSL configuration capabilities

OpenSSL - Issues and future work

Sometimes a crash bug is found

Possible removal of APR

Support of OpenSSL clones

Modernization of native code

Reactive IO - Why ?

Ability to pause input

Not included in Servlet 3.1 API

Useful if the backend cannot process IO events quickly enough

Reactive IO - Implementation and future

Suspend / resume included for websockets

Allows suspending and resuming Servlet 3.1 input events

NIO 2 style async IO also addresses the issue

Cloud clustering - Why ?

Multicast needed for cluster member discovery

Static membership is not flexible

Need something ready to use

Cloud clustering - Implementation and future

Uses Kubernetes API

JSON list of members

Parsing using a special implementation of the membership service

Integrates with Tomcat embedded only at this time

Better Tomcat standalone integration needed

Experimental implementation available: tomcat-in-the-cloud in github.com

Modularization - Why ?

Mavenize Tomcat

Java 9 modules

Easier Tomcat embedded use

Modularization - Implementation

Could happen in Tomcat 10

No community agreement on this yet

Future major features

Your ideas go here !