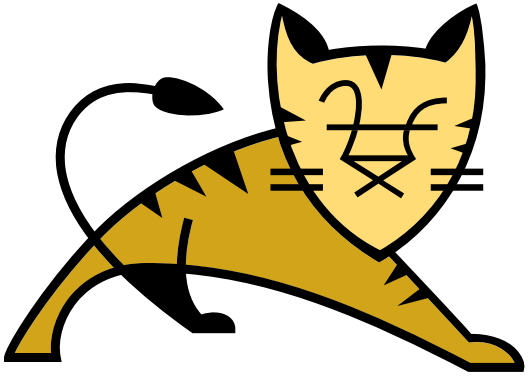
Migrating from AJP to HTTP

It’s About Time



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QR for Slides:

https://people.apache.org/~schultz/presentations/ApacheCon NA 2020/Migrating from AJP to HTTP.pdf

Apache JServ Protocol: Overview

- Originally developed in 1997
- Often claimed to be “*the* way” to proxy Apache httpd to Tomcat
- Current version is 1.3 (ajp13), released ca. 2001
- Extension proposal exists; some elements have been implemented
- v1.4 proposal exists; essentially a dead proposal (and mostly a copy of the 1.3-extension proposal)

Apache JServ Protocol: Overview

- Packet-oriented binary protocol
- Encodes data with multiple tags
  - Proxy info (method/protocol/URI, remote IP/port, server IP/port, “Secure” flag)
  - HTTP Headers
  - Request attributes
  - Request/response body

Apache JServ Protocol: Overview

- Has HTTP header name optimization à la h2
  - Accept = 0xA001, Content-Length=0x008, etc.
- Has similar attribute name optimization
- Lots of proxy information is sent as request attributes
  - TLS info (protocol, cipher suite, key size, client cert, etc.)

Apache JServ Protocol: Overview

- Connections are expected to be long-lived

mod_jk

- A module for Apache https (and Microsoft IIS!)
- Provides proxying using AJP (!)
- Long history
- Very reliable
- Good runtime status and (re)configurability options
  - Change worker state, etc.

AJP Strengths

- When using default mod_jk configuration
  - All proxy info sent (method, protocol, client IP:port, etc.)
  - All TLS info sent (protocol, cipher suite, cert, etc.)
- HttpServletRequest is populated with the above
  - Just like a direct-request to Tomcat (without a proxy)

AJP Shortcomings

- AJP is a poor choice for non-HTTP/1.1
  - Websocket
  - HTTP/2
- No security
  - No authentication (“secret” isn’t a secret)
  - No encryption

Aside: AJP (lack of) Security

- Connections are unencrypted
  - Cannot stress this enough

Aside: AJP (lack of) Security

- “Secret” isn’t a secret
  - It’s a cleartext string sent across an unencrypted connection
  - An attacker who can see the AJP traffic can read the secret
  - Therefore the secret provides (virtually) no protection

Aside: AJP (lack of) Security

- AJP connections are inherently trusted
  - No authentication
    - Client
    - Server
  - All status information is accepted without question
    - Like client IP:port
    - Like “secure” flag

Aside: AJP (lack of) Security

- AJP connections are inherently trusted
  - All *other* information is accepted without question
    - Like request attributes
    - Some request attributes have (*very*) special meaning (!)
    - CVE-2020-1938

Practical AJP

- Protect your endpoints
  - Only bind to `localhost`
  - `stunnel`
    - provides authenticated, encrypted connections
- Websocket, h2
  - Just have to live without it

Why Suffer?

- No advantages of AJP over other options
  - Except out-of-the-box configuration
  - ...and industry inertia

Aside: Do you need a proxy?

- Is a reverse proxy really necessary?
  - Bad reasons for a proxy
    - Performance! (“Tomcat is slow”)
    - Serving static content (see above)
    - Security! (“Tomcat is less-secure then $proxy)

Goals

1. Eliminate the need for mod_jk to exist
   - mod_jk is not bundled with Apache httpd
     - (e.g. win32/64 builds from Apache Lounge have a separate download; some Linux repos have a package available)
   - mod_proxy_ajp exists, comes bundled
2. Eliminate the need for AJP to exist
   - Use HTTP instead

Methodology

- Switch from mod_jk to mod_proxy_ajp
  - Requires extensive changes to httpd configuration
  - Requires minor changes to Tomcat configuration
    - Possibly no changes
  - Requires some improvements to mod_proxy and mod_proxy_balancer

Methodology

- Switch from mod_proxy_ajp to mod_proxy_http
  - Requires minor changes to httpd configuration
  - Requires more extensive changes to Tomcat configuration

Using mod_proxy

- Lots of changes to directives
  - JkMount → ProxyPass/ProxyPassReverse
  - Worker properties → Directives
  - Load balancer workers → use mod_proxy's balancer system
  - Might want to consider using ProxyErrorOverride

Using mod_proxy

mod_jk	mod_proxy
JkMount /app/*.jsp	ProxyPass /app/ ajp://host/app/ ProxyPassReverse /app/ ajp://host/app/
worker.host/worker.port/worker.type	(in ProxyPass URL)
worker.max_packet_size	ProxyIOBufferSize

Worker parameters are listed in the documentation for ProxyPass:
https://httpd.apache.org/docs/2.4/mod/mod_proxy.html#proxypass

Using mod_proxy

mod_jk	mod_proxy

worker.sticky_session=true	ProxyPass parameters:
	`stickysession=JSESSIONID|jsessionid`
	`scolonpathdelim=On`

worker.type=lb	<Proxy “balancer://lb-name”> BalancerMember “ajp://host:port” </Proxy> ProxyPass /app/ balancer://lb-name/app/
worker.route	BalancerMember parameter: `route`

Worker parameters are listed in the documentation for ProxyPass:
https://httpd.apache.org/docs/2.4/mod/mod_proxy.html#proxypass

Using mod_proxy

- ProxyPass is both more and less flexible than JkMount
  - Always uses prefix-matches
  - … unless you are using ProxyPassMatch
  - Sometimes require many more ProxyPass directives than JkMounts
- Same url-remapping caveats as with mod_jk
  - Bottom line: don’t do it

Using mod_proxy

- jk-status worker is replaced by Balancer Manager
- Similar to jk-status console

Switching to mod_proxy_ajp

- Allows you to remove a component: mod_jk
- Retains most everything else
  - Protocol
  - Some configuration
- Evolution, not revolution

Switching to mod_proxy_ajp

- Apache httpd
  - LoadModule (mod_proxy, mod_proxy_ajp, mod_proxy_balancer, mod_lbmethod_byrequests)
  - Replace workers.properties + JkMounts with <Proxy>, ProxyPass, ProxyPassReverse, and various attributes
    - Using ajp:// as your proxy protocol

Switching to mod_proxy_ajp

- Tomcat
  - No changes (!)
  - Tomcat is still using AJP, httpd is simply using mod_proxy_ajp module instead of mod_jk

Switching to mod_proxy_ajp

- Other considerations
  - Monitoring
  - Scripting
    - Worker state changes (e.g. ACT → DIS → STO)
  - Detecting degraded workers
    - To encourage faster draining of Tomcat nodes
    - https://bz.apache.org/bugzilla/show_bug.cgi?id=64338

Switching to mod_proxy_http

- New security options
  - TLS
  - Granular acceptance of proxy-info (e.g. X-Forwarded-*, etc.)
- Better protocol support
  - HTTP/1.x (plaintext easier to debug)
  - Websocket (okay, mod_proxy_wstunnel)
  - ~~h2~~ (not yet: support added in httpd 2.5+)

Switching to mod_proxy_http

- Apache httpd
  - Change ajp:// to http(s)://

Switching to mod_proxy_http

- Tomcat
  - Enable HTTP <Connector>
  - Pick-up proxy info
    - RemoteIPValve
      - Provides request info such as isSecure, getProtocol, getRemoteHost, etc. (affects access logs)
    - SSLValve
      - Provides TLS handshake info such as TLS session id, chosen cipher suite, client certificate, etc.

Switching to mod_proxy_http

- Other considerations
  - Monitoring (Tomcat <Connector>s)
  - Mutually-authenticated TLS (httpd presents client-cert to Tomcat)
    - httpd: SSLProxyMachineCertificateFile
    - Tomcat: <SSLHostConfig caCertificateFile / truststoreFile

Using mod_proxy

- Offers some interesting new capabilities
  - Heterogeneous protocols in balancers (!)

```
<Proxy “balancer://lb-name”>
    BalancerMember ajp://host1:port
    BalancerMember ajp://host2:port
    BalancerMember http://host3:port
    BalancerMember http://host4:port
</Proxy>
```

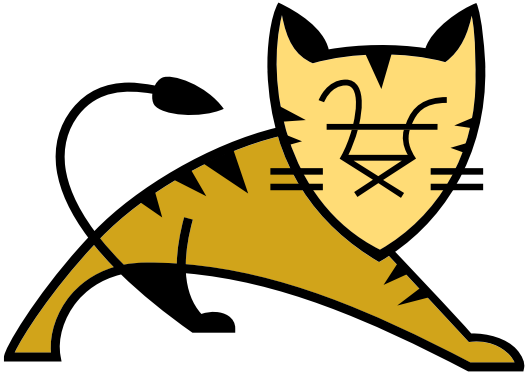
Using mod_proxy

- Offers some interesting new capabilities
  - Fallback to static content \O/

```
<Proxy “balancer://lb-name”>
    BalancerMember http://host1:port
    BalancerMember http://host2:port
    BalancerMember http://127.0.0.1/down-pages/ status=+H
</Proxy>
```

Migrating from AJP to HTTP

- Migrate from mod_jk → mod_proxy_ajp
- Migrate from mod_proxy_ajp → mod_proxy_http
- Reduce complexity of deployment
  - Remove mod_jk (a “third-party” module)
- Improve security of proxy connections
  - Authenticated TLS



Questions

https://people.apache.org/~schultz/presentations/ApacheCon NA 2020/Migrating from AJP to HTTP.pdf
Sample code available in the same directory.