What's new in Apache HTTP Server 2.2

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ApacheCon

Leading the Wave of Open Source

About me

- Longtime active contributor (July/Aug 1995)
- ASF Co-founder
- Other ASF titles as well
- CTO of Covalent Technologies
- Husband, father, all around nice guy

How did we get here?

- A short history of Apache HTTP Server (at least regarding 2.2)
  - Apache 1.3.0 released in June 1998
  - Apache 2.0a1 released in March 2000 (at ApacheCon!)
  - First GA version of Apache 2.0 released on April 2002: Apache 2.0.35
  - Apache 2.2.0 released on Dec. 2005
  - We are now at 2.2.6 (2.2.7 soonish)

Apache 2.0

- Apache 2.0 was designed to address shortcomings in 1.3
  - MPM
  - Module ordering dependencies
  - Hooks
  - Filters
  - Protocol modules
  - Sub-module concept
  - APR
  - IPV6

So Apache 2.0 was...

- Basically a rewrite of Apache 1.3
- An opportunity to rethink how Apache works
- An opportunity to make setup and config more elegant
  - de-merge proxy and cache
  - better authen. and authorz

Did we succeed?

- To a great extent yes
- But some things lagged behind
- Or didn't quite turn out the way we hoped

Why 2.2 ?

- Despite advances in 2.0.x tree, improvements needed to be made
- But those improvements would break the API
- Plus, many of them required later versions of APR

Apache 2.2 Goals

- Bring all functionality up to parity
- Be an evolutionary step from 2.0
- Incremental, logical steps
- 2.0 modules require (for the most part) just a simple recompilation
- Keep what 2.0 did right, and improve on remaining features

So what’s new in 2.2?

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- Nothing

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- Nothing
- Thanks!

So what's new in 2.2?

- Nothing
- Thanks!
- Be sure to tip your waiters!

No, really...

- Large file support
- Graceful stop
- mod_dbd
- mod_filter
- Better Debugging and info
- Caching
- Event MPM
- Authn/Authz
- Proxy

Large file support

- 2GB is no longer a stupid limit
- Much better 64 bit awareness
- And much better behavior on 32 bit systems
- Thanks to APR

Graceful stop

- We all know about graceful restart
- Now Apache will also gracefully stop
  - when shutting down, Apache will let existing requests finish
  - But what about really, really long or nasty requests?
    - `GracefulShutdownTime`
      - # == number of seconds grace time
      - 0 == forever

Graceful start

- We have:
  - graceful restart
  - graceful shutdown
- How about a graceful start?

Ha ha

- Very funny

mod_dbd

- The problem
  - Lots of modules...
  - ... using lots of SQL connections
  - EG: authn/authz, logging, PHP...
- Even worse with threaded MPMs
- mod_dbd manages all that for you
  - ap_dbd_open, ap_dbd_prepare, ...
- Connection pooling comes to the party

mod_filter

- The problem:
  - filters are basically inserted "unconditionally"
  - Blunt tool approach - bad w/ dynamic content
  - Admins want more flexibility
- The solution:
  - A dynamic chaining of filters
  - Filters inserted based on req headers, resp headers and env-vars.

Better Debugging

- mod_dumpio
  - Dumps all IO to the error log
  - Yep, all of it
    - DumpIOInput On
    - DumpIOOutput On
    - DumpIOLogLevel Notice
  - What about SSL?
    - Dumping is done right after decryption or right before encrypting

mod_dumpio

```
mod_dumpio: dumpio_in [getline-blocking] 0 readbytes
mod_dumpio:  dumpio_in (data-HEAP): 16 bytes
mod_dumpio:  dumpio_in (data-HEAP): GET / HTTP/1.1\r\n
mod_dumpio: dumpio_in [getline-blocking] 0 readbytes
mod_dumpio:  dumpio_in (data-HEAP): 13 bytes
mod_dumpio:  dumpio_in (data-HEAP): Accept: */*\r\n
…
mod_dumpio: dumpio_out
mod_dumpio:  dumpio_out (data-HEAP): 291 bytes
mod_dumpio:  dumpio_out (data-HEAP): HTTP/1.1 200 OK\r\nDate:
Thu, 12 Oct 2006 15:35:52 GMT\r\nServer: Apache/2.2.4-dev (Unix)
DAV/2\r\nLast-Modified: Fri, 10 Dec 2004 14:17:55 GMT\r\nETag:
"7b3e83-2c-9eedeac0"\r\nAccept-Ranges: bytes\r\nContent-Length:
44\r\nKeep-Alive: timeout=5, max=98\r\n
Connection: Keep-Alive\r\nContent-Type: text/html\r\n\r\n
mod_dumpio: dumpio_out
mod_dumpio:  dumpio_out (data-FILE): 44 bytes
mod_dumpio:  dumpio_out (data-MMAP): <html><body><h1>It works!</
h1></body></html>
mod_dumpio:  dumpio_out (metadata-EOS): 0 bytes
```

Better Debugging

- mod_log_forensic
  - forensic logging of each request
  - Each request results in 2 log lines
    - Initial request with unique ID
      - `+yQtJf8AB4AAFNXQY|GET /manual/...`
    - Response done "tag"
      - `-yQtJf8AB4AAFNXQY`
  - track and trace requests

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Better debugging

- mod_info:
  - ?config : Just the configuration directives, not sorted by module
  - ?hooks : Only the list of Hooks each module is attached to
  - ?list : Only a simple list of enabled modules
  - ?server : Only the basic server information

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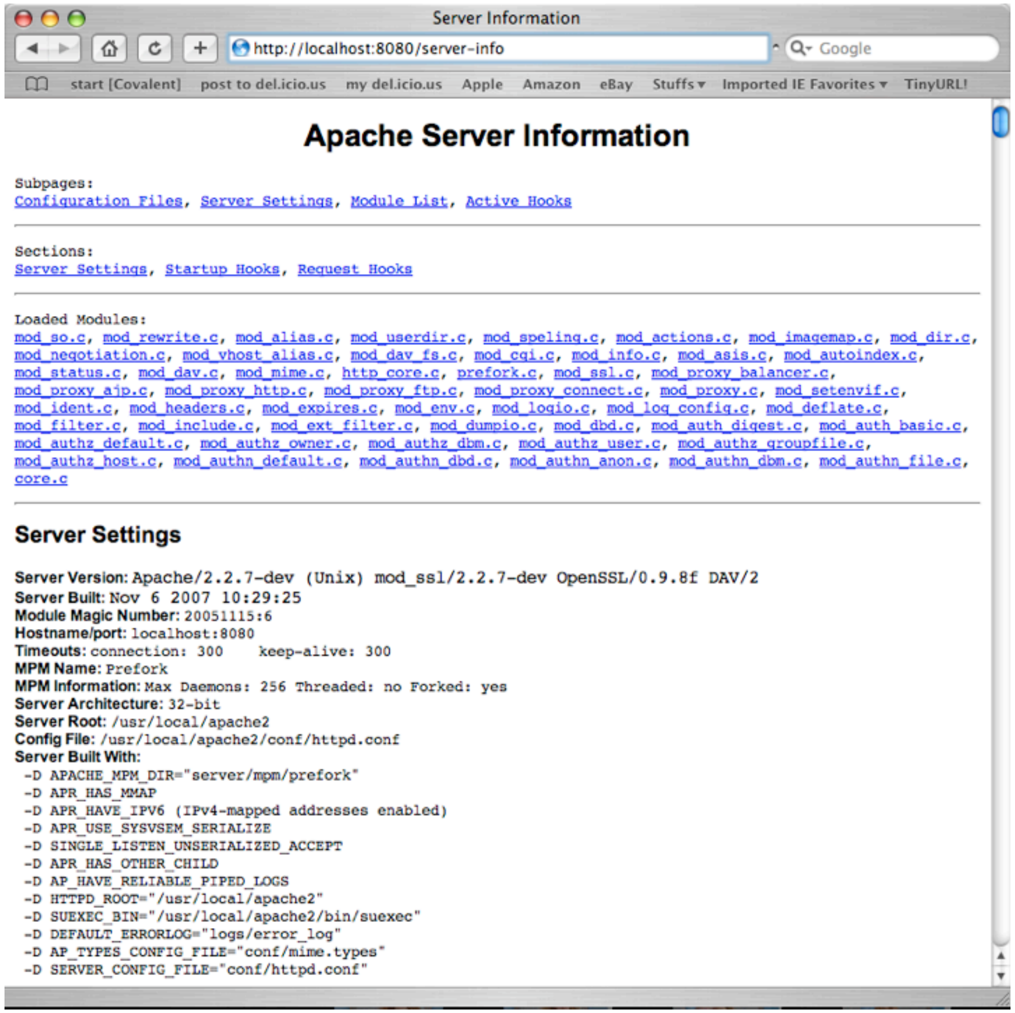
mod_info screensnap



Apache Server Information

Subpages:
Configuration Files, Server Settings, Module List, Active Hooks

Sections:
Server Settings, Startup Hooks, Request Hooks

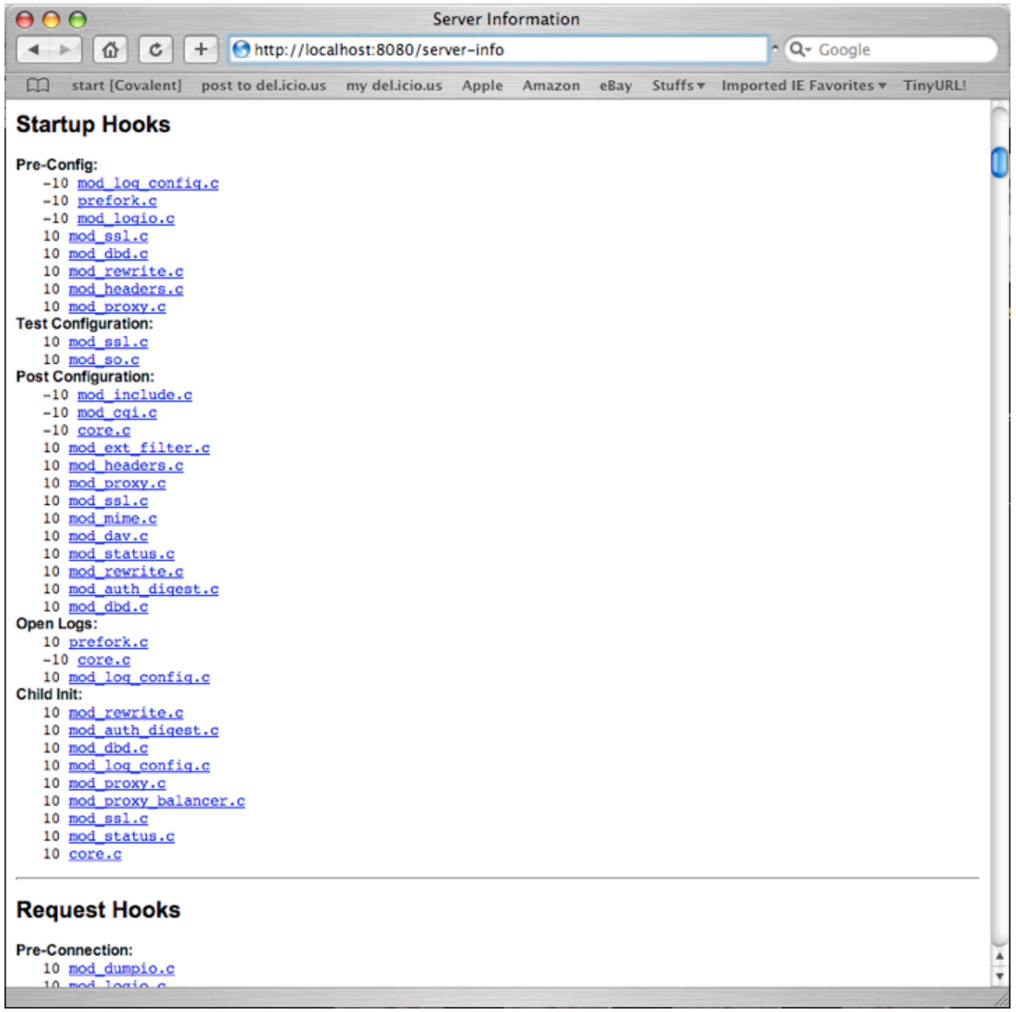
Loaded Modules:
mod_so.c, mod_rewrite.c, mod_alias.c, mod_userdir.c, mod_speling.c, mod_actions.c, mod_imagemap.c, mod_dir.c, mod_negotiation.c, mod_vhost_alias.c, mod_dav_fs.c, mod_cgi.c, mod_info.c, mod_asis.c, mod_autoindex.c, mod_status.c, mod_dav.c, mod_mime.c, http_core.c, prefork.c, mod_ssl.c, mod_proxy_balancer.c, mod_proxy_ajp.c, mod_proxy_http.c, mod_proxy_ftp.c, mod_proxy_connect.c, mod_proxy.c, mod_setenvif.c, mod_ident.c, mod_headers.c, mod_expires.c, mod_env.c, mod_logio.c, mod_log_config.c, mod_deflate.c, mod_filter.c, mod_include.c, mod_ext_filter.c, mod_dumpio.c, mod_dbd.c, mod_auth_digest.c, mod_auth_basic.c, mod_authz_default.c, mod_authz_owner.c, mod_authz_dbm.c, mod_authz_user.c, mod_authz_groupfile.c, mod_authz_host.c, mod_authn_default.c, mod_authn_dbd.c, mod_authn_anon.c, mod_authn_dbm.c, mod_authn_file.c, core.c

Server Settings

Server Version: Apache/2.2.7-dev (Unix) mod_ssl/2.2.7-dev OpenSSL/0.9.8f DAV/2
Server Built: Nov 6 2007 10:29:25
Module Magic Number: 20051115:6
Hostname/port: localhost:8080
Timeouts: connection: 300   keep-alive: 300
MPM Name: Prefork
MPM Information: Max Daemons: 256 Threaded: no Forked: yes
Server Architecture: 32-bit
Server Root: /usr/local/apache2
Config File: /usr/local/apache2/conf/httpd.conf
Server Built With:

```
 -D APACHE_MPM_DIR="server/mpm/prefork"
 -D APR_HAS_MMAP
 -D APR_HAVE_IPV6 (IPv4-mapped addresses enabled)
 -D APR_USE_SYSVSEM_SERIALIZE
 -D SINGLE_LISTEN_UNSERIALIZED_ACCEPT
 -D APR_HAS_OTHER_CHILD
 -D AP_HAVE_RELIABLE_PIPED_LOGS
 -D HTTPD_ROOT="/usr/local/apache2"
 -D SUEXEC_BIN="/usr/local/apache2/bin/suexec"
 -D DEFAULT_ERRORLOG="logs/error_log"
 -D AP_TYPES_CONFIG_FILE="conf/mime.types"
 -D SERVER_CONFIG_FILE="conf/httpd.conf"
```

mod_info screensnap



Startup Hooks

```
Pre-Config:
    -10 mod_log_config.c
    -10 prefork.c
    -10 mod_logio.c
    10 mod_ssl.c
    10 mod_dbd.c
    10 mod_rewrite.c
    10 mod_headers.c
    10 mod_proxy.c
Test Configuration:
    10 mod_ssl.c
    10 mod_so.c
Post Configuration:
    -10 mod_include.c
    -10 mod_cgi.c
    -10 core.c
    10 mod_ext_filter.c
    10 mod_headers.c
    10 mod_proxy.c
    10 mod_ssl.c
    10 mod_mime.c
    10 mod_dav.c
    10 mod_status.c
    10 mod_rewrite.c
    10 mod_auth_digest.c
    10 mod_dbd.c
Open Logs:
    10 prefork.c
    -10 core.c
    10 mod_log_config.c
Child Init:
    10 mod_rewrite.c
    10 mod_auth_digest.c
    10 mod_dbd.c
    10 mod_log_config.c
    10 mod_proxy.c
    10 mod_proxy_balancer.c
    10 mod_ssl.c
    10 mod_status.c
    10 core.c
```

Request Hooks

```
Pre-Connection:
    10 mod_dumpio.c
    10 mod_logio.c
```

Caching

- Dirty little 2.0 secret
  – When we separated mod_proxy and mod_cache, mod_cache didn’t get a lot of TLC
- Code was not clean
- Nasty performance
- disk cache lacked good maintenance
- Lacked RFC compliance

Apache 2.2 Caching

- No longer experimental!
- Caching stores copies of static or dynamic content (if possible) for quick access
- mod_cache:
  - The caching framework
- mod_disk_cache / mod_mem_cache
  - Determines cache implementation

Caching modules

- mod_disk_cache
  - Stores cached material on file system
  - Key based access
- mod_mem_cache
  - Stores cached material in shared memory cache.
  - Caches open file descriptors.
  - Caches content object.

disk vs. mem

- Lots of work done on both
- mem
  - fast because it uses shared memory
  - locking
  - restarts make cache go bye bye
- disk
  - long term storage
  - zero-copy transfer

Simple Config

- Just cache CSS files

```
LoadModule cache_module modules/mod_cache.so
LoadModule mem_cache_module modules/mod_mem_cache.so

CacheEnable mem /css

MCacheSize 1024
MCacheMaxObjectCount 100

MCacheMinObjectSize 1
MCacheMaxObjectSize 2048
```

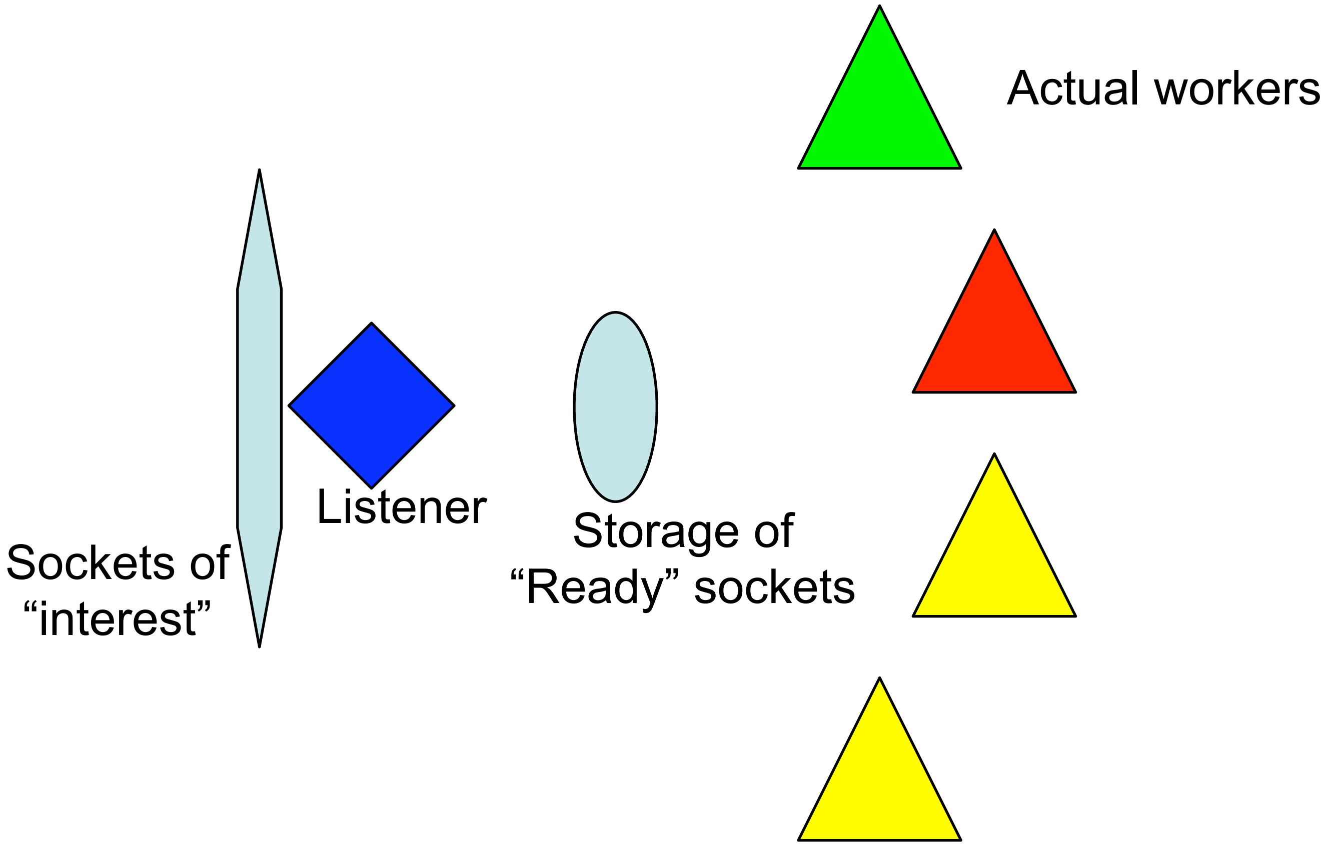
htcacheclean

- mod_disk_cache places no limits on disk usage
- htcacheclean cleans up and limits utilization
  - run manually or in daemon mode
  -
    ```
    htcacheclean -p/var/db/httpd/cache \
                 -l250M -d30
    ```

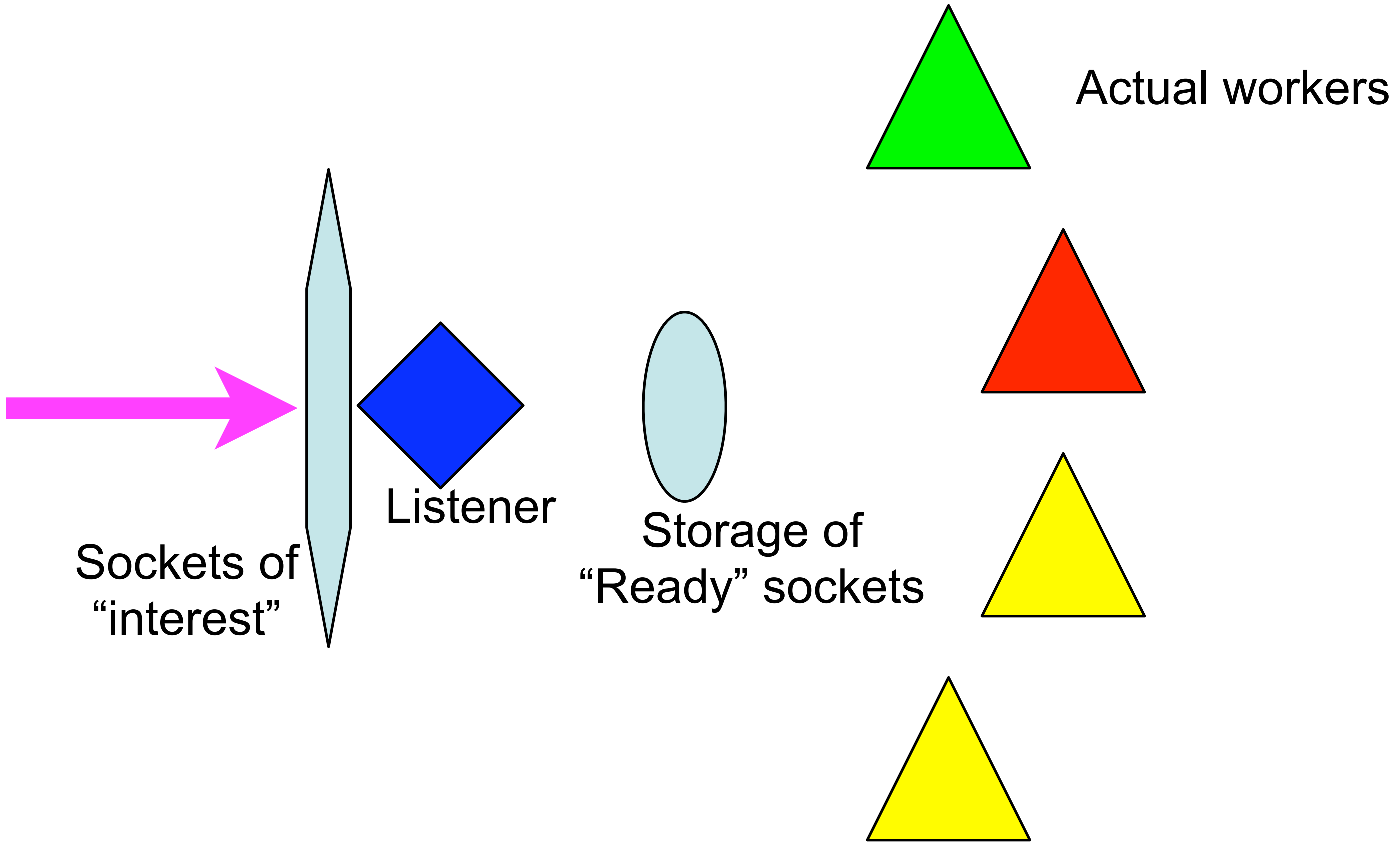
Event MPM

- Still considered experimental
- Seeing some extensive use
- The problem:
  - Those nasty keepalives
  - The worker thread is stuck waiting for the next persistent request
- The solution:
  - Pop that “waiting” connection back into the listener thread’s domain

An illustration to help



An illustration to help



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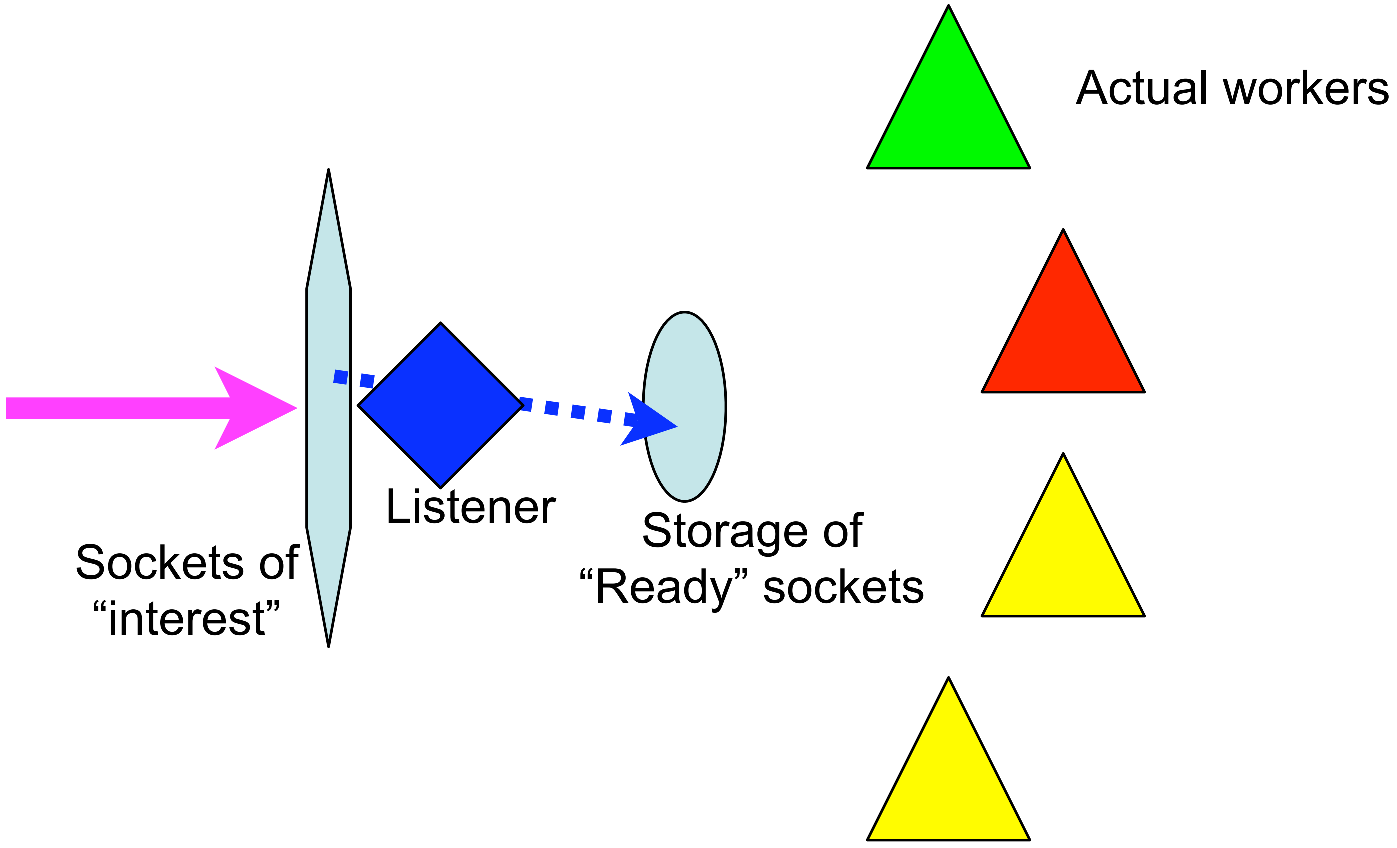

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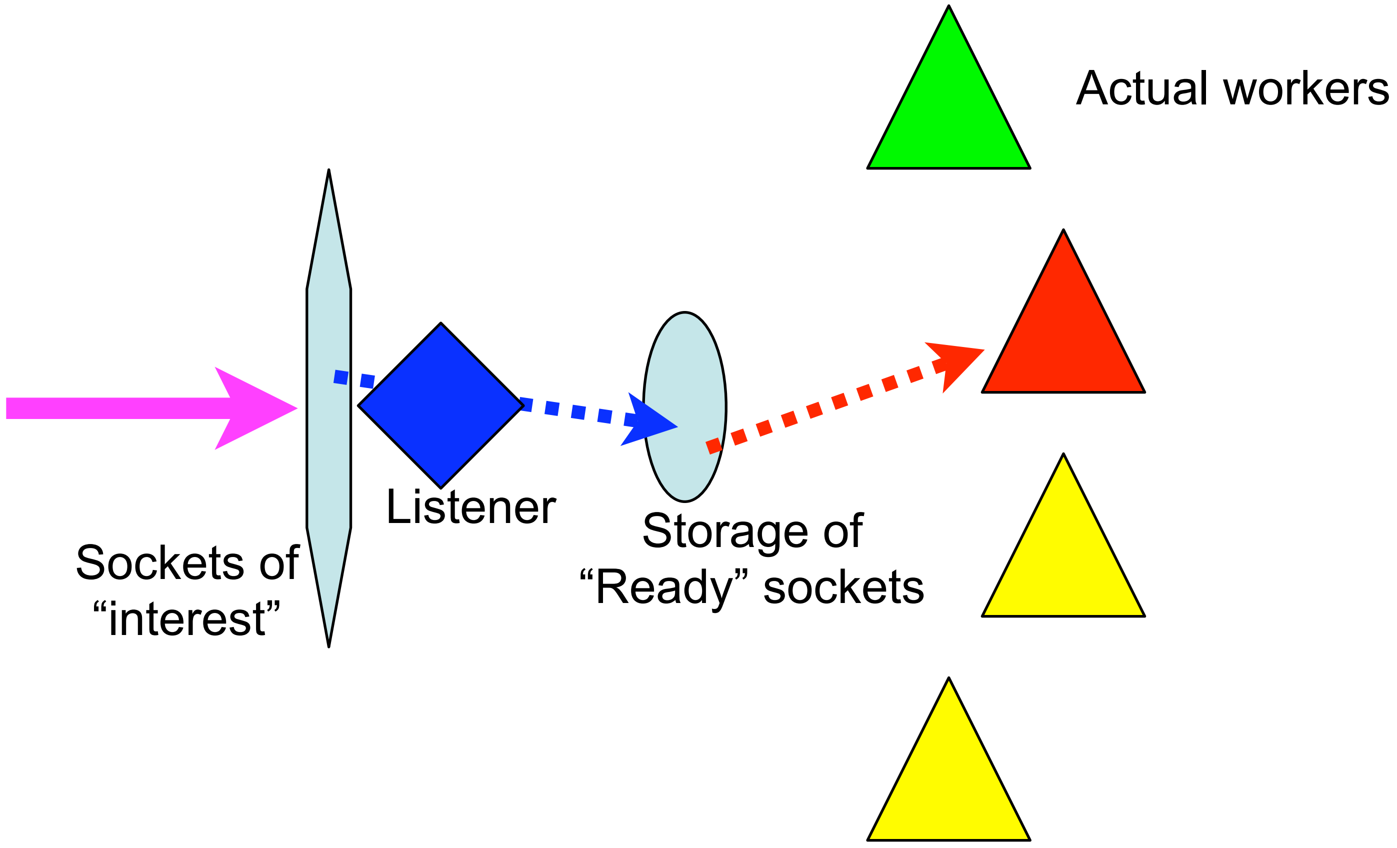

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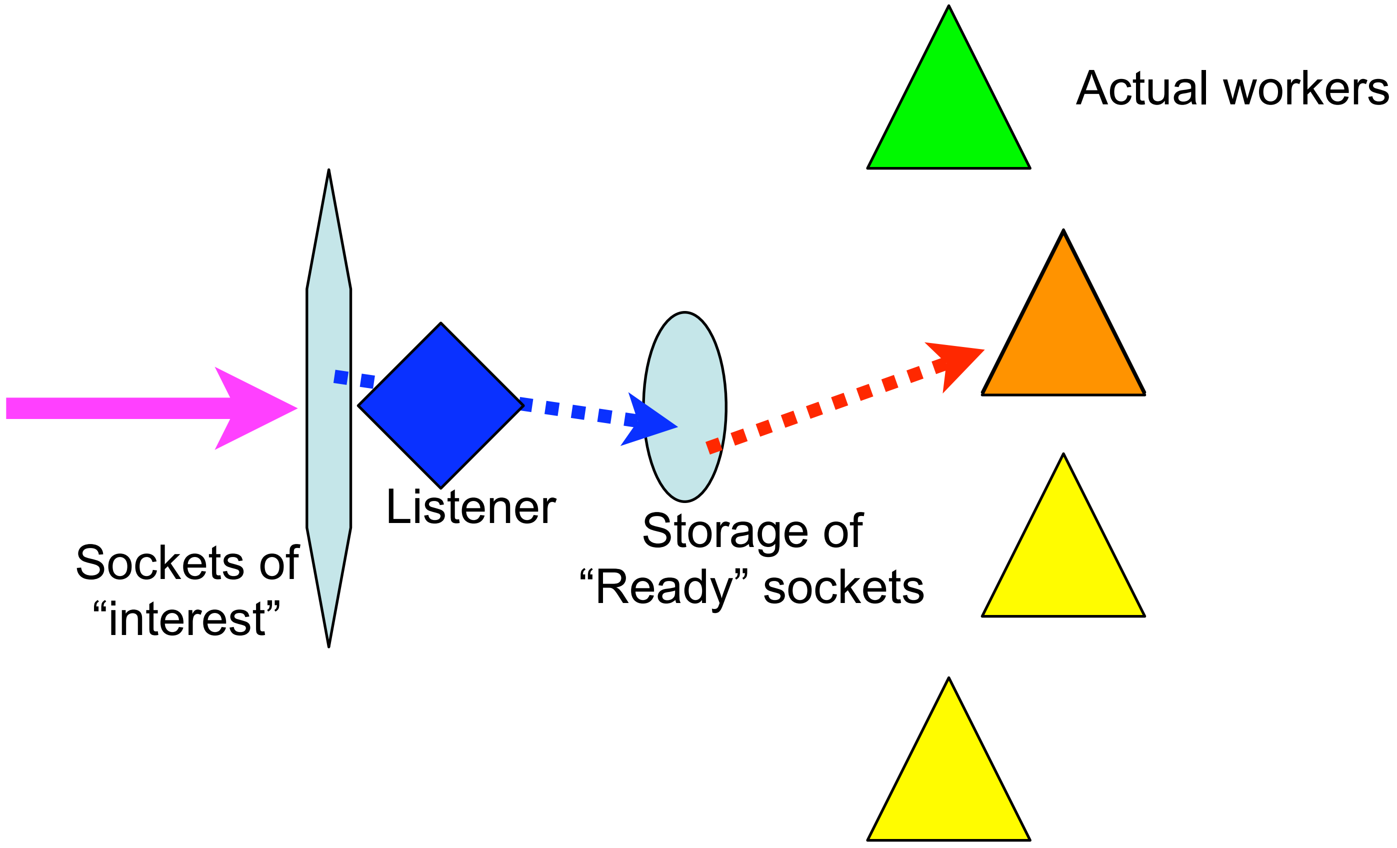

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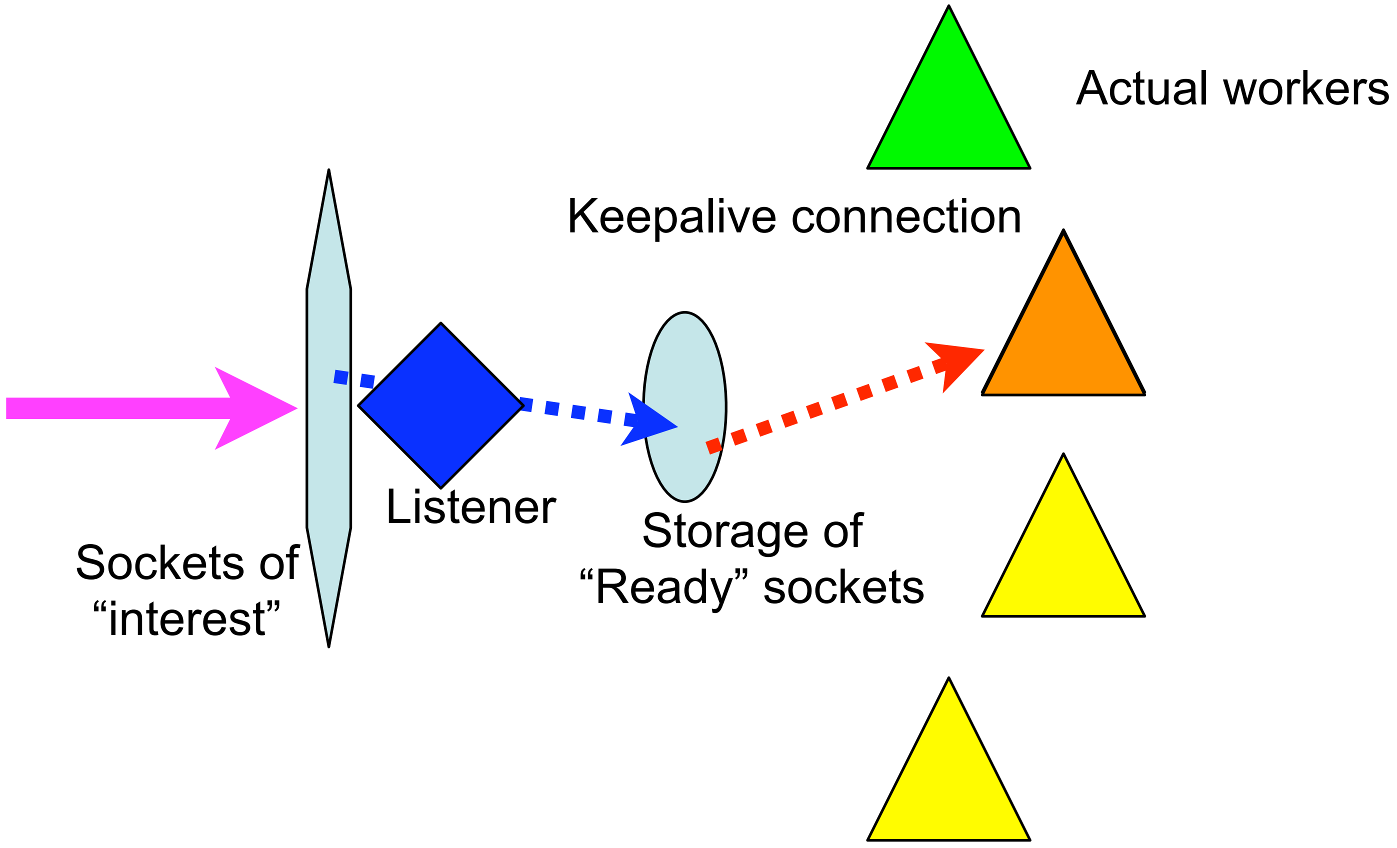

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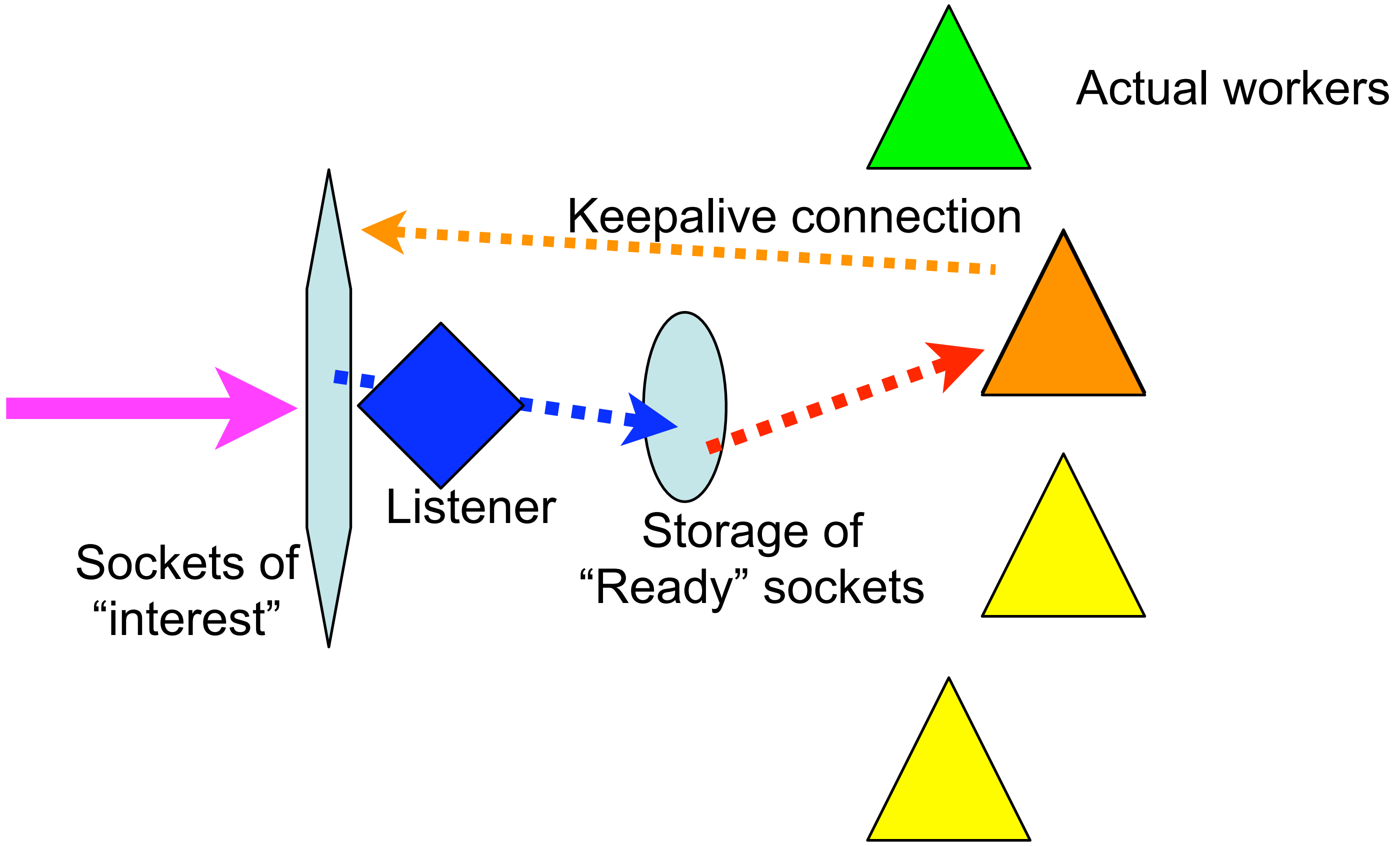

Authn / Authz

- Authorization
  - Permit access to a resource based on who/what/where/why/when
- Authentication
  - Determine who/what/where/why/when
- Two different concepts – 2.2 divides them.

Two implementations

- mod_auth_basic
  - Speaks PLAIN TEXT user and password over the wire – not secure
- mod_auth_digest
  - Speaks a hash of the host digest domain, user and password, this is much more secure over http: connections!
- Most browser supports Digest today, many ‘custom clients’ don’t

Providers for info

- mod_authn_file
  - the classic, a flat list of users and slows quickly as the list grows
- mod_authn_dbm
  - the classic, faster solution, plug into Berkeley DB, GDBM, SDBM etc
- mod_authn_dbd
  - the newest solution, use an Oracle / MySQL table for your user store

Providers for info

- mod_authn_anon
  - – the Anonymous backstop, no password validation
- mod_authn_default
  - – the absolute backstop (not-authenticated result)
- mod_authn_alias
  - – Group the many directives of a provider into an <AuthnProviderAlias > block.

Authz

- mod_authz_user
  - Grant/restrict access based on Authenticated user
- mod_authz_groupfile
  - Store group -> users associations in a flat file
- mod_authz_dbm
  - Store user || group in a Berkley DB / GDBM flat database

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Authz

- mod_authz_owner
  - Access files by OWNER, either user or group
- mod_authz_host
  - What you knew as ‘access’, restrict by the client’s IP/hostname
- mod_authz_default
  - the ‘backstop’ when no authorization is matched.

Authn / Authz

- mod_authnz_ldap
  - Both authn user and authz group principals apply at once to users authorized against an LDAP data store.
  - Basically, it does both

Simple example

```
AuthType Basic
AuthName "Restricted Files"
AuthUserFile /path-to/htpasswd
AuthBasicProvider file
Require user jim
```

Not so simple

```
<AuthnProviderAlias ldap ldap-alias1>
    AuthLDAPBindDN cn=youruser,o=ctx
    AuthLDAPBindPassword yourpassword
    AuthLDAPURL ldap://ldap.host/o=ctx
</AuthnProviderAlias>

Alias /secure /webpages/secure
<Directory /webpages/secure>
    Order deny,allow
    Allow from all
    AuthBasicProvider  ldap-alias1
    AuthType Basic
    AuthName LDAP_Protected_Place
    AuthzLDAPAuthoritative off
    require valid-user
</Directory>
```

Interested in more 2.2 auth?

- Attend Brad Nicholes' session
- Friday, 4pm

Interested in more 2.2 auth?

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Proxy

- Becoming a robust but generic proxy implementation
- Supports various protocols
  - HTTP, HTTPS, CONNECT, FTP
  - AJP, FastCGI (coming “soonish”)
- Load balancing
- Clustering, failover

mod_proxy_ajp

- Apache can now talk AJP with Tomcat directly
- Other proxy improvements make this even more exciting
- mod_jk alternative

Load Balancer

- mod_proxy can do native load balancing
  - weight by actual requests
  - weight by traffic
- LB algo's are impl as providers
  - easy to add
  - no core code changes required

Load Balancer

- Backend connection pooling
- Sticky session support
- Cluster set with failover
  - Lump backend servers as sets
  - balancer will try lower-valued sets first
- Hot standby
- Configurable in real-time

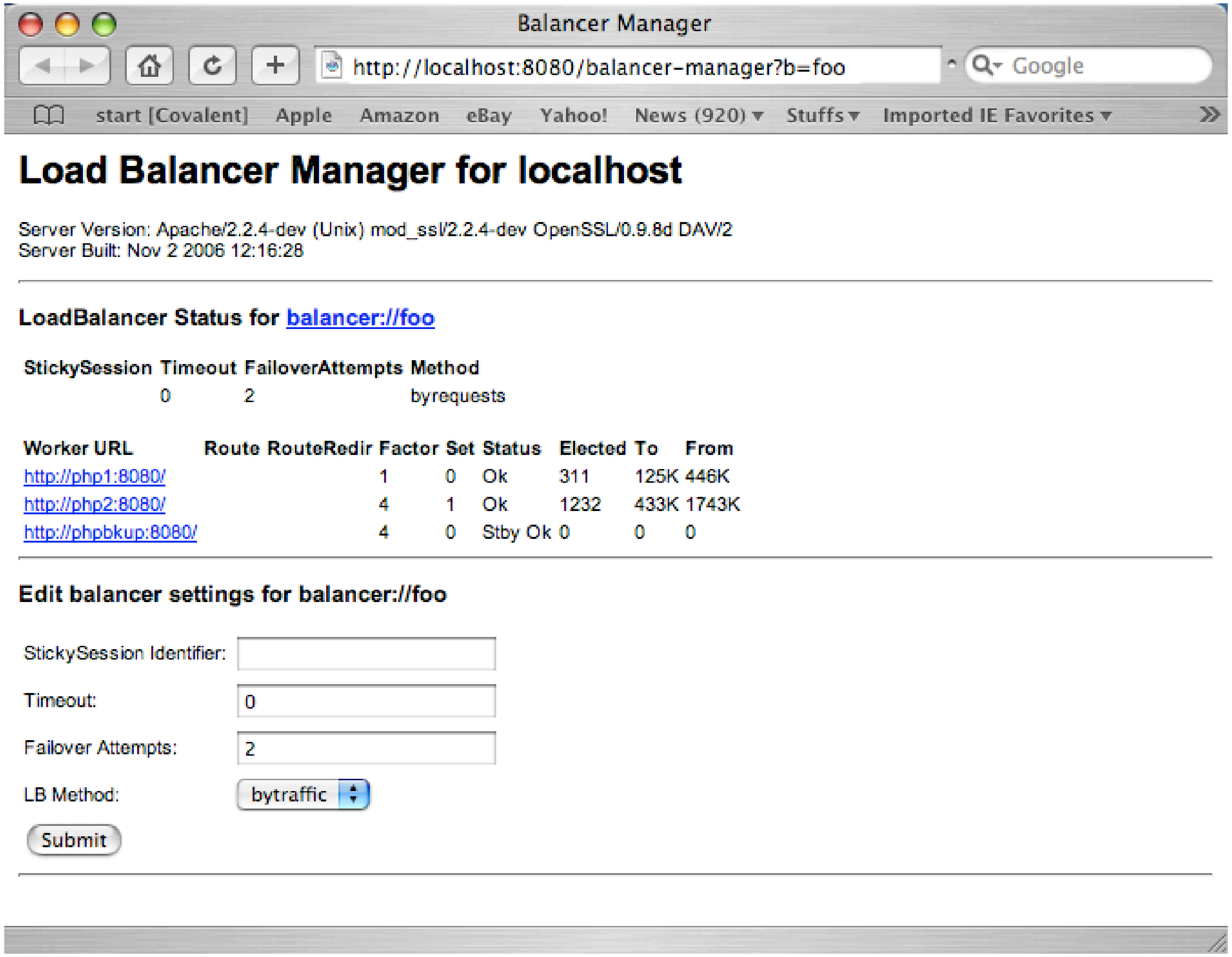
Example

```
<Proxy balancer://foo>
  BalancerMember http://php1:8080/     loadfactor=1
  BalancerMember http://php2:8080/     loadfactor=4
  BalancerMember http://phpbkup:8080/  loadfactor=4 status=+h
  ProxySet lbmethod=bytraffic
</Proxy>
<Proxy balancer://javaapps>
  BalancerMember ajp://tc1:8089/     loadfactor=1
  BalancerMember ajp://tc2:8089/     loadfactor=4
  ProxySet lbmethod=byrequests
</Proxy>

ProxyPass /apps/ balancer://foo/
ProxyPass /serv/ balancer://javaapps/

ProxyPass /images/ http://images:8080/
```

Admin


Balancer Manager
http://localhost:8080/balancer-manager?b=foo
Google
start [Covalent] Apple Amazon eBay Yahoo! News (920) Stuffs Imported IE Favorites

Load Balancer Manager for localhost

Server Version: Apache/2.2.4-dev (Unix) mod_ssl/2.2.4-dev OpenSSL/0.9.8d DAV/2
Server Built: Nov 2 2006 12:16:28

LoadBalancer Status for balancer://foo

StickySession	Timeout	FailoverAttempts	Method
	0	2	byrequests

Worker URL	Route	RouteRedir	Factor	Set	Status	Elected	To	From
http://php1:8080/			1	0	Ok	311	125K	446K
http://php2:8080/			4	1	Ok	1232	433K	1743K
http://phpbkup:8080/			4	0	Stby Ok	0	0	0

Edit balancer settings for balancer://foo

StickySession Identifier:	
Timeout:	0
Failover Attempts:	2
LB Method:	bytraffic

Submit

Oh yeah

- ProxyPassMatch
  - ProxyPassMatch ^(/.*\.gif)$ \
    http://backend.example.com$1

Want more 2.2 proxy info?

- Attend Jim Jagielski's session
- Friday, 3pm
- I hear he's pretty good...

What's on the horizon?

- Some additional potential backports
  - mod_substitute
  - FastCGI proxy module
- True async server support
  - serf: http://code.google.com/p/serf/ ?
- Code name: Amsterdam
  - tell us !

Thanks!

- Q&A
- Resources:
  - http://httpd.apache.org/
  - dev@httpd.apache.org
  - A certain Open Source support provider