IHS Apache for z/OS
How to Implement and exploit

Edward McCarthy

edwardmc@au1.ibm.com

Insert Custom Session QR if Desired.

#SHAREorg

SHARE is an independent volunteer-run information technology association that provides education, professional networking and industry influence.

SHARE in Seattle 2015

Agenda

- Discussing IBM HTTP Server powered by Apache on z/OS

Why is a guy from Australia giving this session ?

- Mainly because worked on the redpaper
- And have used IBM HTTP Server on distributed and z/OS to some extent
- And I was in the neighbourhood
  - this conference was on the week after the IBM Interconnect conference

1. IBM HTTP Server on z/OS: Migrating from Domino-powered to Apache-powered, REDP-4987-01
   Redpapers, published 2 February 2015
2. WebSphere Business Integration Server Foundation V5.1 for z/OS, SG24-6382-00
   Redbooks, published 23 November 2004
3. WebSphere for z/OS V6 Connectivity Handbook, SG24-7064-02
   Redbooks, published 28 December 2005
4. Best Practices for Implementing WebSphere Extended Deployment, SG24-7343-00
   Redbooks, published 23 February 2007, Rating: ★★★★★★ (based on 2 reviews)
5. WebSphere on z/OS - Optimized Local Adapters, REDP-4550-00
   Redpapers, published 31 August 2009, last updated 9 September 2009, Rating: ★★★★★★ (based on 2 reviews)
6. WebSphere Application Server for z/OS V5 and J2EE 1.3 Security Handbook, SG24-6086-01
   Redbooks, published 14 June 2005, last updated 22 June 2005, Rating: ★★★★☆ (based or reviews)

Document Number	Document Title	Last Update	Doc Author or Owner
WP101788	Beginners Guide to Coding Java Batch Jobs	01/18/2011	Edward McCarthy
WP102356	WebSphere Application Server on z/OS Command GUI	11/01/2013	Edward McCarthy
WP102348	Rexx and the WebSphere Optimized Local Adapter APIs	10/01/2013	Edward McCarthy
WP101858	Classify URL requests in Apache IHS using WLM on z/OS	02/15/2011	Edward McCarthy
WP101787	Accessing WAS Batch Feature Pack	01/18/2011	Edward McCarthy
TD106087	Using IBM HTTP Server and Rexx to view z/OS STC output via SDSF	03/22/2013	Edward McCarthy
WP102197	Demystifying calling a remote type 3 EJB in WebSphere Application Server on z/OS	10/18/2012	Edward McCarthy
WP102204	Using security domains in WebSphere Application Server on z/OS	10/30/2012	Edward McCarthy
WP101612	Getting started with analysis of GC, Heapdumps and Javacores For WebSphere on z/OS	08/31/2010	Don Bagwell
WP101225	Extending the IBM HTTP Server for z/OS Powered by Apache with custom modules	03/25/2008	Mike Cox
PRS3657	WebSphere on z/OS like Thunder and Lightening it Ain't so Frightening	05/22/2009	Don Bagwell
WP101783	IBM WebSphere Java Batch z/OS - Compute Grid and WAS V8.5	11/21/2013	Don Bagwell

IBM Redpaper

Information in this presentation based on IBM Redpaper:

IBM HTTP Server on z/OS
Migrating from Domino-powered to Apache-powered

Available from:

http://www.redbooks.ibm.com/abstracts/sg246716.html

The above redpaper contains more detail on the information in this presentation.

Updated version published Dec 2014

History

- IBM HTTP Server powered by Domino
  - Shipped with OS/390 in the early 1990's
    - Stabilised for a long time
  - Also referred to as:
    - Domino Go Webserver
    - DGW
    - IHS
- IBM HTTP Server powered by Apache
  - Ships with each version of the WebSphere Application Server product on all supported platforms
    - Which IBM developed around 2000

It's time to migrate

- IHS powered by Domino
  - Functionally stabilised
    - No development for a long time
  - **Will no longer be present in z/OS after V2.1**
  - Does not support:
    - IPv6
    - 64 bit execution

- For those clients who are using an IBM product that uses the Domino powered server, you should be aware that IBM is working to upgrade these products to replace the use of IBM HTTP Server powered by Domino with IBM HTTP Server powered by Apache.
  - Look for documentation on each product as those changes are made or contact that product team for current information about HTTP Server support.

This is not new news ;-)

- From the z/OS 2.1 Infocenter
  - http://www-01.ibm.com/support/knowledgecenter/SSLTBW_2.1.0/com.ibm.zos.v2r1.e0zm100/ibmhttpserversod.htm?cp=SSLTBW_2.1.0%2F1-6-4-11-0-0&lang=en

Plan for the removal of support for IBM HTTP Server

z/OS Migration
GA32-0889-02

Description: z/OS V2R1 is planned to be the last release to include the IBM HTTP Server Powered by Domino (IHS powered by Domino).

Element or feature:	IBM HTTP Server
When change was introduced:	Announced April 2013 for z/OS V2R1.
Applies to migration from:	z/OS V1R13 and z/OS V1R12.
Timing:	Before installing z/OS V2R1.
Is the migration action required?	No, but is planned to be a requirement in the release after z/OS V2R1.

z/OS 2.2 Preview Announcement

- Details at:
  - http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?subtype=ca&infotype=an&supplier=897&letternum=ENUS215-006
  - In the fine print…

    In z/OS V2.2, IBM HTTP Server Powered by Apache is planned to replace IBM HTTP Server powered by Domino®. IBM HTTP Server powered by Apache is based on the IBM HTTP Server powered by Apache that is part of WebSphere Application Server and is at a higher level than the IBM HTTP Server 8.5.5 powered by Apache that was previously available as part of IBM Ported Tools (5655-M23).

  - Means that plan is that IBM HTTP Server powered by Apache will ship with z/OS 2.2
    - No more IHS Powered by Domino

Why IHS Apache?

- IHS Powered by Apache
  - Supports:
    - IPv6
    - 64 bit execution
  - **This is only IBM HTTP Server product that IBM is investing in**
  - Based on Apache HTTP Server 2.2.8
    - Open source community
    - C code
    - Widely used on many operating systems
    - Wide user community
    - Lots of public information, examples, books
    - Easier to get people with Apache skills
  - If you do not have WAS for z/OS then IHS V8.5 available at no charge as part of IBM Ported Tools
    - http://www-03.ibm.com/systems/z/os/zos/features/unix/ported/ihs/index.html

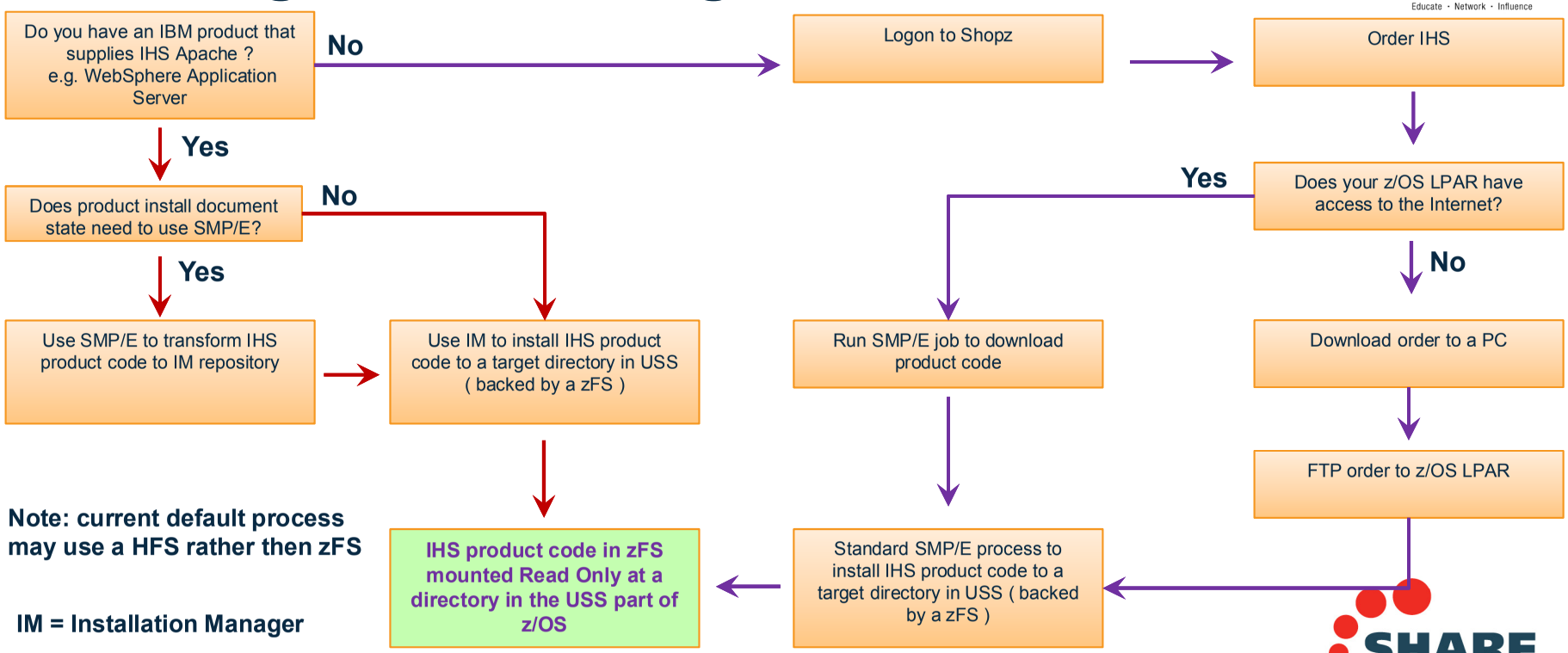
Apache directives

- Apache 2.2
  - Approximately 420 directives
    - http://httpd.apache.org/docs/2.2/mod/directives.html
- Apache 2.4
  - Over 600 directives
    - http://httpd.apache.org/docs/2.4/mod/directives.html
- IHS Powered by Apache on z/OS 2.1 and earlier
  - Currently based on Apache 2.2
  - Supports approximately 380 directives
    - http://publib.boulder.ibm.com/httpserv/manual70/mod/directives.html

Performance

- IBM Techdoc from 2006 compared IHS Domino and Apache performance
  - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101170
- At that time, IHS Apache had moderate performance advantage
  - Since IBM has been continually investing in IHS Apache since then (and none in IHS Domino), performance may be even better now with later versions

Obtaining and installing overview



Space requirements

- IHS Product Order
  - About 200MB
- On z/OS need space to store:
  - The product code
  - SMPPTS to store product code when do Receive
  - zFS to store the product code
  - Each of the above about 200MB

Setting up your first IBM Apache

- Regardless if IHS obtained as part of WAS or from Ported Tools, end result is product code will be fully contained in a zFS file
  - Mounted at a directory
    - Recommend this is mounted as Read Only
  - Note: some install processes if followed explicitly may allocated a HFS rather then a zFS
    - Recommend you replace the step that creates HFS with equivalent step that creates a zFS
- For each IHS Apache server you want to create
  - You will execute supplied install shell program
  - This will create a new directory structure which will only be used by that new instance of the IHS Apache server

Setting up an IHS Apache server example

This command…

cd /ihs/usr/lpp/IHSA/V8R5/bin
./install_ihs /ihsconfig/ihs/ihsae001 8230

Uses supplied files in the product source…

```
EDMCAR @ SC55:/ihs/usr/lpp/IHSA/V8R5>ls -lrt
total 242
-rw-r--r--   1 HAIMO    SYS1       16667 May 10  2011 notices
drwxr-xr-x   3 HAIMO    SYS1        8192 May 23 00:52 error
drwxr-xr-x   3 HAIMO    SYS1        8192 May 23 00:52 icons
drwxr-xr-x   4 HAIMO    SYS1        8192 May 23 00:53 man
drwxr-xr-x   2 HAIMO    SYS1        8192 May 23 00:53 conf
drwxr-xr-x   3 HAIMO    SYS1        8192 May 23 00:53 modules
drwxr-xr-x   2 HAIMO    SYS1        8192 May 23 00:53 lib
drwxr-xr-x   2 HAIMO    SYS1        8192 May 23 00:54 readme
drwxr-xr-x   2 HAIMO    SYS1        8192 May 23 00:54 include
drwxr-xr-x   3 HAIMO    SYS1        8192 May 23 00:54 htdocs
drwxr-xr-x   2 HAIMO    SYS1        8192 May 23 00:54 example_module
drwxr-xr-x   2 HAIMO    SYS1        8192 May 23 00:54 build
drwxr-xr-x   2 HAIMO    SYS1        8192 May 23 00:54 bin
-rwxr-xr-x   1 HAIMO    SYS1          24 Jun 13 17:52 version.signature
```

To create a unique runtime configuration for the new server.

```
EDMCAR @ SC55:/ihsconfig/ihs/ihsae001>ls -lrt
total 210
-rwxr-xr-x   1 IHSAE001 IHSRB13       24 Jun 13 21:20 version.signature
lrwxrwxrwx   1 IHSAE001 IHSRB13       29 Jun 13 21:20 readme -> /ihs/usr/lpp/IHSA/V8R5/readme
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jun 13 21:20 properties
lrwxrwxrwx   1 IHSAE001 IHSRB13       30 Jun 13 21:20 notices -> /ihs/usr/lpp/IHSA/V8R5/notices
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jun 13 21:20 modules
lrwxrwxrwx   1 IHSAE001 IHSRB13       26 Jun 13 21:20 man -> /ihs/usr/lpp/IHSA/V8R5/man
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jun 13 21:20 lib
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jun 13 21:20 include
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jun 13 21:20 icons
lrwxrwxrwx   1 IHSAE001 IHSRB13       37 Jun 13 21:20 example_module -> /ihs/usr/lpp/IHSA/V8R5/example_module
drwxr-xr-x   3 IHSAE001 IHSRB13     8192 Jun 13 21:20 error
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jun 13 21:20 build
drwxr-xr-x  13 IHSAE001 IHSRB13     8192 Jun 18 06:21 Plugins
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jun 18 08:53 bin
drwxrwxr-x   2 IHSAE001 IHSRB13     8192 Jul 15 05:38 conf
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jul 15 05:51 cgi-bin
drwxr-xr-x   5 IHSAE001 IHSRB13     8192 Jul 28 20:38 htdocs
drwxr-xr-x   2 IHSAE001 IHSRB13     8192 Jul 28 20:46 logs
```

Complete your session evaluations o

Operation

Set up JCL in a PROCLIB...

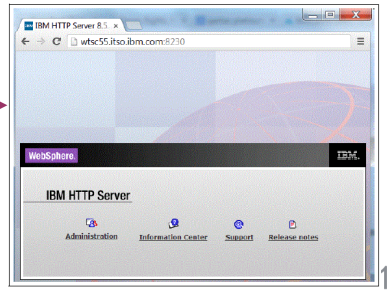
```
//*-------------------------------------------------------------
//IHSAE001 PROC ACTION='start',
// DIR='/ihsconfig/ihs/ihsae001',
// CONF='conf/httpd.conf'
//*-------------------------------------------------------------
//IHS EXEC PGM=BPXBATCH,
// PARM='SH &DIR/bin/apachectl -k &ACTION -f &CONF -DNO_DETACH',
// MEMLIMIT=512M
//STDOUT DD PATH='&DIR/logs/proc.output',
// PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
// PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP)
//STDERR DD PATH='&DIR/logs/proc.errors',
// PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
// PATHMODE=(SIRUSR,SIWUSR,SIRGRP,SIWGRP)
// PEND
```

Issue command to start it: S IHSAE001

What you see in SDSF

```
SDSF DA SC55     SC55     PAG  0  CPU/L/Z   3/  2
COMMAND INPUT ===>
NP   JOBNAME  StepName ProcStep JobID    Owner
     IHSAE001 STEP1             STC18072 IHSAE001
     IHSAE001 STEP1             STC18068 IHSAE001
     IHSAE001 IHSAE001 *OMVSEX  STC18082 IHSAE001
     IHSAE001 STEP1             STC18086 IHSAE001
     IHSAE001 STEP1             STC18094 IHSAE001
     IHSAE001 STEP1             STC18092 IHSAE001
```

Issue URL to access home page:
http://wtsc55.itso.ibm.com:8230



Note: normal RACF rules required, see Redpaper sg246716

Complete your session evaluations online at www.SHARE.org/Seattle-Eval

Operator Commands

- Stop server:
  - s IHSAE001,action='stop‘
- Graceful stop of server, waits for current processing to complete:
  - s IHSAE001,action=‘graceful-stop‘
- Restart server without waiting for current processing to complete:
  - s IHSAE001,action='restart‘
- Graceful restart of server waits for current processing to complete:
  - s IHSAE001,action=‘graceful‘
- Modify command support
  - Can add this line to the httpd.conf
    - LoadModule zos_cmds_module modules/mod_zos_cmds.so
  - And can then use these modify commands:
    - P IHSAE001
    - F IHSAE001,appl='graceful-stop'
    - F IHSAE001,appl='graceful'
    - F IHSAE001,appl='restart'

Command line operation

- Can issue commands from a telnet or OMVS session
  - Commands act upon the server of the directory you are in
- Starting a server:
  - ./apachectl -k start
- Stopping a server
  - ./apachectl -k stop
  - ./apachectl -k graceful-stop
- Restarting a server
  - ./apachectl -k restart
  - ./apachectl -k graceful

Configuration

- IHS Apache configuration stored in httpd.conf
  - Located in conf sub-directory
  - Configuration achieved by using:
    - directives that are native to the original Apache
    - and directives available due to additional modules and features added by IBM
- Some key directives:
  - The TCPIP port the server listens on:
    - Listen 8237
  - Virtual Hosting
    - <VirtualHost *:80>
    - ServerName www.ibmitsosite1.com
    - DocumentRoot /www/ibmitsosite1
    - DirectoryIndex index.html index.htm
    - ErrorDocument 404 /www/ibmitsosite1/error404_1.html
    - ErrorDocument 500 /www/ibmitsosite1/error500_1.html
    - ErrorLog logs/ibmitsosite1_80_error.log
    - TransferLog logs/ibmitsosite1_80_access.log
    - Loglevel error
    - </VirtualHost>

```
EDMCAR @ SC55:/ihsconfig/ihs/ihsae65/conf>pwd

/ihsconfig/ihs/ihsae65/conf

EDMCAR @ SC55:/ihsconfig/ihs/ihsae65/conf>ls -lrt | grep httpd.conf

-rw-r--r--   1 EDMCAR   SYS1       32683 Dec 30 23:19 httpd.conf
```

When config changes go wrong ☹

- You make a change to the conf file
- You issue start command
  - Or restart command
- Your server starts and terminates
  - Or if already started, no change happens
- Look in the proc.errors file in log sub-directory

```
 EDIT       /ihsconfig/ihs/ihsae65/conf/httpd.conf
Command ===>
000943 SetEnvIf Request_URI  /bookmgr/(lookat/inde
000944
000945 ThisIsBadDirective
000946
```

Adding this

Do start (or restart) …

```
 BROWSE    /ihsconfig/ihs/ihsae65/logs/proc.errors
Line 00000000 Col 001 080
 Command ===>
Scroll ===> CSR
******************************** Top of Data
********************************
Syntax error on line 945 of
/ihsconfig/ihs/ihsae65/conf/httpd.conf:
Invalid command 'ThisIsBadDirective', perhaps
misspelled or defined by a module
```

Produces this

Apache Server Status page

http://wtsc55.itso.ibm.com:8265/server-status?showmodulestate

Apache Server Status for wtsc55.itso.ibm.com

Server Version: IBM_HTTP_Server/8.5.5.4 (Unix)
Server Built: Oct 20 2014 15:49:10

Current Time: Tuesday, 20-Jan-2015 17:46:09 EST
Restart Time: Tuesday, 20-Jan-2015 17:42:58 EST
Parent Server Generation: 0
Server uptime: 3 minutes 11 seconds
Total accesses: 7 - Total Traffic: 26 kB
CPU Usage: u0 s0 cu0 cs0
.0366 requests/sec - 139 B/second - 3803 B/request
2 requests currently being processed, 48 idle workers

_____R_____W_____.....
.....

Scoreboard Key:
"_" Waiting for Connection, "S" Starting up, "R" Reading Request,
"W" Sending Reply, "K" Keepalive (read), "D" DNS Lookup,
"C" Closing connection, "L" Logging, "G" Gracefully finishing,
"I" Idle cleanup of worker, "." Open slot with no current process

Srv	PID	Acc	M	Module	State	CPU	SS	Req	Conn	Child	Slot	Module Info	Client	VHost	Request
0-0	131281	0/1/1	_	_	_	0.00	23	0	0.0	0.01	0.01		9.190.237.30	wtsc69.itso.ibm.com	GET /server-status?showmodulestate HTTP/1.1
0-0	131281	0/1/1	_	_	_	0.00	5	0	0.0	0.01	0.01		9.190.237.30	wtsc69.itso.ibm.com	GET /server-status HTTP/1.1
0-0	131281	0/0/0	W	mod_status.c	_	0.00	0	0	0.0	0.00	0.00		9.190.237.30	wtsc69.itso.ibm.com	GET /server-status?showmodulestate HTTP/1.1

Migration Advice

- Make a plan !
  - Identify:
    - What needs to be done
    - Who will be involved
    - Who has responsibility for the various tasks
    - How long it will take

Migration – determine what needs to be done

- Identify what your current IHS Domino is doing:
  - Is security being used
  - Is multiple host support being used
  - Listening on multiple ports
  - GWAPI modules being used
  - SMF recording being used
  - Running in scalable mode
  - What business area “owns” the server
  - Use of SSL
- Determine where IHS Apache code will be obtained from
- Find relevant documentation
- Plan installation and configuration of new servers
- Plan how switch over from old to new servers will be done

Security

- IHS Apache has comprehensive security support
  - Independent security environment can be set for each thread running under HTTP Server
    - Can run request in the IHS Server under the authority the user authenticated with
  - Full support for SSL
    - Including client certificate authentication
  - LDAP Support
  - Can be run as a proxy

Example use of security related directives

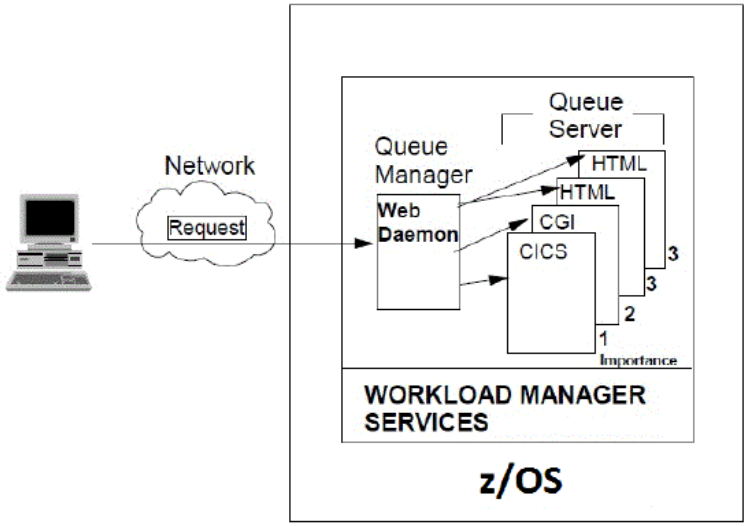
```
<Location /waslogs/>
  CharsetSourceEnc ISO8859-1
  AddEncoding x-gzip gz tgz
  Header set Content-Disposition "attachment;"
  AuthName zosSdsfViewer
  AuthType Basic
  AuthBasicProvider saf
  Require saf-group E1CFG
  SAFRunAS %%CLIENT%%
  AuthSAFExpiration "EXPIRED! oldpw/newpw/newpw"
  AuthSAFReEnter "Enter new password one more time"
</Location>
```

New features in IHS Apache V8.5.5 for z/OS

- Scalability Improvements
  - Use of Event MPM
- Integration with WLM
- Logging to SMF
- Support for operator commands
- FIPS140-2 support
- MVS Dataset support
- HTTP Response translation improvements
- 31-bit runtime support
- Support for zEnterprise Data Compression

IHS Domino – Scalable Mode

- Provided way to allow IHS Domino to have multiple started tasks handle large and variable amounts of activity
  - Heavily integrated with WLM



IHS Apache and WLM – new in V8.5.5

- Directive to enable support:
  - #LoadModule rewrite_module modules/mod_rewrite.so
  - #LoadModule deflate_module modules/mod_deflate.so
  - # WLM
  - LoadModule wlm_module modules/mod_wlm.so

httpd.conf

```
wlmSubSysType CB
wlmCollectionName IHSE01
wlmTranClass IHSEWLM1

<VirtualHost wtsc55.itso.ibm.com:8235>
<LocationMatch "/IBMTools/*">
 wlmTranClass IHSEWLM2
</LocationMatch>
</VirtualHost>

<VirtualHost w3.sc55.itso.ibm.com:8235>
<LocationMatch "/ItsoTools/*">
 wlmTranClass IHSEWLM3
</LocationMatch>
wlmTranClass IHSEWLM4
</VirtualHost>
```

WLM ISPF Panel

```
Subsystem Type . : CB <-------- Fold qualifier names?   Y  (Y or N)
          --------Qualifier--------     -------Class--------
Action     Type       Name     Start     Service     Report
  ____  1  TC         IHSEWLM2           WASLOW      IHSEWLM2
  ____  1  TC         IHSEWLM3           WASHI       IHSEWLM3
  ____  1  TC         IHSEWLM4           WASMED      IHSEWLM4
  ____  1  CN         IHSE01             WASMED      IHSE01
  ____  2    TC         IHSEWLM1         WASMED      IHSEWLM1
```

/Seattle-Eval

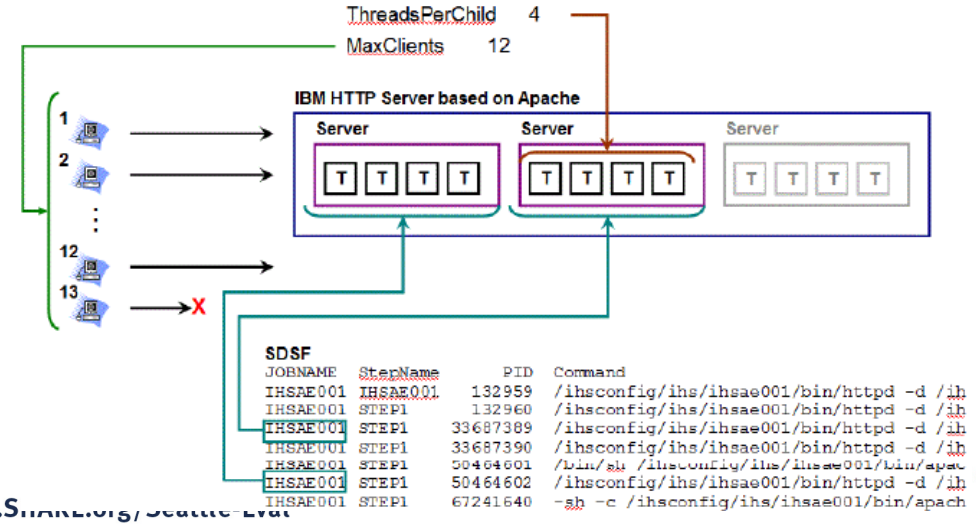
Example of how to classify requests

```
                    ------- Goals versus Actuals --------  Trans --Avg. Resp. Time-
                    Exec Vel  --- Response Time ---  Perf  Ended  WAIT EXECUT ACTUAL
Name     T  I  Goal Act  ---Goal--- --Actual--  Indx  Rate   Time   Time   Time
WASHI    S  1       0.0  0.200 90%        84%  ****  9.450 0.000  0.316  0.317
WASLOW   S  3       0.0  5.000 90%       100%  0.50  0.270 0.004  2.011  2.015
WASMED   S  2       0.0  1.000 90%        11%  4.00  0.650 0.006  1.793  1.799
DDF      R          0.0                             0.730 0.000  0.001  0.001
IHSEWLM1 R          0.0                             0.350 0.006  1.606  1.612
IHSEWLM2 R          0.0                             0.270 0.004  2.011  2.015
IHSEWLM3 R          0.0                             0.320 0.007  2.009  2.016
IHSEWLM4 R          0.0                             0.300 0.007  2.010  2.017
```

Corresponding activity in RMF MON III

IHS Apache - scalability

- Simpler to set up then IHS Domino
  - Controlled by directives
  - No requirement for WLM
  - Key directives:
    - *MaxClients* specifies the maximum number of simultaneous client connections allowed to the server.
    - *ThreadsPerChild* specifies how many threads exist in each child process (server).



Sizing your server

- MaxClients
  - First decide on the maximum number of clients that you expect to connect at any point in time
  - Use mod_mpmstats or mod_status
  - Example: assume the maximum need to support is 600. Code directive as:
    - MaxClients 600
- ThreadsPerChild
  - Next, determine the maximum number of threads that each server process can handle.
  - This may vary depending on your system capacity
  - Let us assume that a maximum value of 100 is reasonable. Code directive as:
    - ThreadsPerChild 100
- MaxSpareThreads
  - Specifies the maximum number of spare threads
  - These are threads waiting to handle new requests
  - If set to low, and get a lot of new requests, then get delay while new threads created
  - Set to some multiple of ThreadsPerChild value, e.g.:
    - MaxSpareThreads 300
- MinSpareThreads
  - A value equal to 10% of *MaxClients* is recommended
  - In this example, we would chose a value of 60 and would code the directive as follows:
    - MinSpareThreads 60
- Tuning advice at:
  - http://publib.boulder.ibm.com/httpserv/ihsdiag/ihs_performance.html

Note: MaxClients divided by ThreadsPerChild = Max number of child processes that can be started

Dynamically change config to handle increased demand

Update values in httpd.conf

from

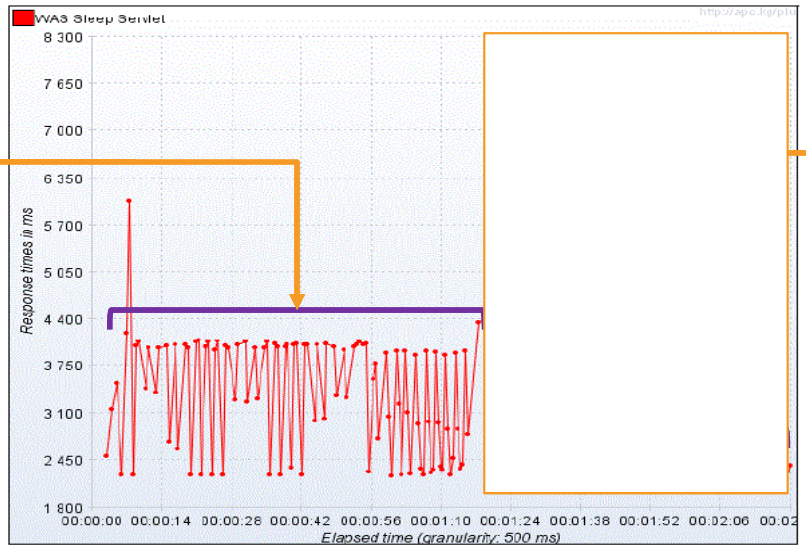
to

Issue modify command to dynamically refresh settings

Current settings…

```
ThreadLimit          8
MaxClients           12
ThreadsPerChild      4
```

… but poor response time



Updated settings…

```
MaxClients       24
ThreadsPerChild  8
```

… good response time ☺

SMF

- IHS Domino
  - writes SMF records of type 103, two available subtypes:
    - Subtype 1 contains configuration information
    - Subtype 2 contains performance information
- IHS Apache
  - New in V8.5.5, can now write SMF records of type 103, two new available subtypes:
    - Subtype 13 containing thread statistics
    - Subtype 14 containing information on each request

Subtype 14 content: →

Field	Offset
process ID	0-3
method length (from start of data buffer)	4-7
domain length (from end of method)	8-11
uri length (from end of domain)	12-15
remote_ip length (from end of remote_ip)	16-19
cpu time	20-27
lapsed time (string)	28-35
variable length buffer	26+

Support for zEnterprise Data Compression (zEDC)

- zEDC
  - Hardware and software chargeable feature that provides very efficient compression capability
- Apache
  - Supplies a default module that does software compression
- APAR PI24424
  - Supplies mod_deflate_z.so
- Example usage
  - Send large text files to end users in compressed format
- Small scale testing done for Redbook update showed CPU savings of 85%

Preview z/OS Health Check

- IBM has developed prototype Rexx program
  - Update your HZSPARM to enable execution of this Rexx
- Rexx checks if any running STC's are IHS Servers powered by Domino
  - Writes message to syslog

```
F HZSPROC,ADD,PARMLIB=(02)
IEE252I MEMBER HZSPRM02 FOUND IN SYS1.PARMLIB
HZS0400I CHECK(IBMZMIG,ZOSMIG_HTTP_SERVER_DOMINO_CHECK): 769
ADD PROCESSING HAS BEEN COMPLETED
HZS0403I ADD PARMLIB PROCESSING HAS BEEN COMPLETED
D OMVS,ASID=ALL
BPXO070I 04.03.22 DISPLAY OMVS 772
OMVS     0011 ACTIVE             OMVS=(1A)
USER     JOBNAME  ASID        PID       PPID STATE   START     CT_SECS
OMVSKERN BPXOINIT 002C          1          0 MR------ 08.46.23    22.8
  LATCHWAITPID=         0 CMD=BPXPINPR

  SERVER=Init Process                     AF=    0 MF=00000 TYPE=FILE
STC      RESOLVER 0015     131074          1 1R---B-- 08.46.23     1.7
  LATCHWAITPID=         0 CMD=EZBREINI
IHSDE001 IHSDE001 0025   33686057          1 HK------ 04.02.44      .0
  LATCHWAITPID=         0 CMD=IMWHTTPD
HZS0002E CHECK(IBMZMIG,ZOSMIG_HTTP_SERVER_DOMINO_CHECK): 773
DOMCHK8 One or more IBM HTTP Server(s) Powered by Domino were found.
IHSDE001
```

Modules

- Use modules to add required functionality to the IHS Server
- In IHS Domino
  - Could use Go Webserver Application Programming Interface (GWAPI)
    - C Code or Rexx
- In IHS Apache
  - C code
  - Many open source modules that can be used with IHS Apache on z/OS
  - Open source community where you can get help and advice
- Redpaper sg246716
  - Examples:
    - how a simple HelloWorld module is coded and deployed
    - Running the supplied sample Apache module
    - Using an open source module with IHS Apache on z/OS
- IBM Techdocs:
  - Extending the IBM HTTP Server for z/OS Powered by Apache with custom modules
    - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101225
  - Classify URL requests in Apache IHS using WLM on z/OS
    - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101858

CGI

- Common Gateway Interface (CGI) provides a standard method to allow HTTP Servers to invoke a program which will process the received request and generate a reply
- In IHS Apache CGI programs can be written in:
  - C, perl, php, and Rexx.
- In IHS Domino, Rexx used to write CGI (and GWAPI) programs
  - Used supplied routines such as cgiutils, cgiparse
- Redpaper sg246716 provides some simple examples and advice on how to migrate code

CGI – additional modules

- APAR PI07665
  - http://www-01.ibm.com/support/docview.wss?uid=swg1PI07665
  - Provides cgiutils and cgiparse modules
    - Compatible to DGW versions
  - Should mean no need to updated existing CGI programs that use these modules to work in IBM HTTP Server powered by Apache
  - Became available in V8.5.5.2
    - About Mar 2014
  -

New features in IHS planned for z/OS 2.2

- z/OS 2.2 planned to be available in Sept 2015
- planned to be called:
  - IBM HTTP Server V9
    - Note: name may change ☺
  - Based on Apache HTTP Sever 2.4

- New features that are planned are…

Complex Authorization Logic

- Can combine authorization directives to express complex logic
  - http://httpd.apache.org/docs/2.4/mod/mod_authz_core.html#logic
- Example:

```
<Directory /www/mydocs>
    <RequireAll>
        <RequireAny>
            Require user superadmin
            <RequireAll>
                Require group admins
                Require ldap-group cn=Administrators,o=Airius
                <RequireAny>
                    Require group sales
                    Require ldap-attribute dept="sales"
                </RequireAny>
            </RequireAll>
        </RequireAny>
        <RequireNone>
            Require group temps
            Require ldap-group cn=Temporary Employees,o=Airius
        </RequireNone>
    </RequireAll>
</Directory>
```

Support for LUA

- You may be asking what is LUA ?
- Read all about it at:
  - http://www.lua.org
  - http://www.modlua.org
- LUA is a powerful, fast, lightweight, embeddable scripting language
  - A bit C like
  - Used in many different ways:
    - Popular for games coding
      - World of Warcraft, Angry Birds, Wireshark
- Better way to do CGI
  - CGI programs spawned off by Apache to run on own thread
  - Can use LUA to in effect run CGI type processing on thread Apache is using to process the request
    - More efficient

Conditional control

- New directives to provide way to support conditional control
  - If, elseif, else, expressions
- Examples at:
  - http://httpd.apache.org/docs/2.4/expr.html#examples
- Better approach then Rewrite directive

```
# Compare the host name to example.com and redirect to www.example.com if it matches
<If "%{HTTP_HOST} == 'example.com'">
    Redirect permanent / http://www.example.com/
</If>

# Force text/plain if requesting a file with the query string contains 'forcetext'
<If "%{QUERY_STRING} =~ /forcetext/">
    ForceType text/plain
</If>

# Only allow access to this content during business hours
<Directory "/foo/bar/business">
    Require expr %{TIME_HOUR} -gt 9 && %{TIME_HOUR} -lt 17
</Directory>
```

Basic SNI support

- What is SNI ?
  - Server Names Indication
  - An extension to the Transport Layer Security (TLS) and it's predecessor SSL
- What problem is it solving?
  - When do SSL to a site
    - The server can only provide one SSL server side certificate
  - Problem is that if trying to host multiple sites with different DSN names on the one TCPIP address
    - The end user gets the same certificate for all of them
- With SNI
  - During initial SSL handshaking the client sends the DNS name
  - Allows server to send a certificate that matches that DNS name
  - More flexible approach
    - Easier to add new DNS names

Support for Macros

- Mod_macro
  - Supported third party module
  - Allows you to set up macros in your httpd.conf file
  - To simplify conf file

```
## Define a VHost Macro for repetitive configurations

<Macro VHost $host $port $dir>
  Listen $port
  <VirtualHost *:$port>

    ServerName $host
    DocumentRoot $dir

    <Directory $dir>
      # do something here...
    </Directory>

    # limit access to intranet subdir.
    <Directory $dir/intranet>
      order deny,allow
      deny from all
      allow from 10.0.0.0/8
    </Directory>
  </VirtualHost>
</Macro>

## Use of VHost with different arguments.

Use VHost www.apache.org 80 /projects/apache/web
Use VHost www.perl.com 8080 /projects/perl/web
Use VHost www.ensmp.fr 1234 /projects/mines/web
```

New Trace capability

- IHS Server powered by Domino
  - Able to issue command that enabled tracing
    - Which showed how a request was processed
    - Very handy
- Till now, IHS Powered by Apache on z/OS had no equivalent
- Version to be shipped with planned z/OS 2.2 will have new trace capability
  - Provided by Apache 2.4
  - http://httpd.apache.org/docs/current/mod/core.html#loglevel
- Detailed discussion in:
  - http://people.apache.org/~trawick/AC2014-Debug.pdf

Trace level settings

- Trace level controlled by value on LogLevel directive
  - trace* values are the new ones

Level	Description	Example
emerg	Emergencies - system is unusable.	"Child cannot open lock file. Exiting"
alert	Action must be taken immediately.	"getpwuid: couldn't determine user name from uid"
crit	Critical Conditions.	"socket: Failed to get a socket, exiting child"
error	Error conditions.	"Premature end of script headers"
warn	Warning conditions.	"child process 1234 did not exit, sending another SIGHUP"
notice	Normal but significant condition.	"httpd: caught SIGBUS, attempting to dump core in ..."
info	Informational.	"Server seems busy, (you may need to increase StartServers, or Min/MaxSpareServers)..."
debug	Debug-level messages	"Opening config file ..."
trace1	Trace messages	"proxy: FTP: control connection complete"
trace2	Trace messages	"proxy: CONNECT: sending the CONNECT request to the remote proxy"
trace3	Trace messages	"openssl: Handshake: start"
trace4	Trace messages	"read from buffered SSL brigade, mode 0, 17 bytes"
trace5	Trace messages	"map lookup FAILED: map=rewritemap key=keyname"
trace6	Trace messages	"cache lookup FAILED, forcing new map lookup"
trace7	Trace messages, dumping large amounts of data	"| 0000: 02 23 44 30 13 40 ac 34 df 3d bf 9a 19 49 39 15 |"
trace8	Trace messages, dumping large amounts of data	"| 0000: 02 23 44 30 13 40 ac 34 df 3d bf 9a 19 49 39 15 |"

Co

Tracing examples

```
LogLevel warn

# Maximum trace for this URI
<Location /misbehavingApplication/>
    LogLevel trace8
</Location>

# Maximum trace from a specific client
<if "%{REMOTE_ADDR} == '10.1.2.3'>
  LogLevel trace8
</if>

# We're debugging mod_rewrite here, but we don't need all modules
tracing:
<LocationMatch ^/app2/controller.do$>
    LogLevel rewrite:trace8
</Location>
```

- Note: need to stop/start server to pick up changes to LogLevel directive

Log handling improvements

- Apache supplies program called: rotatelogs
  - Used to provide way to handle logs files created by Apache
- In Apache 2.4, new options
  - Described here:
    - http://httpd.apache.org/docs/current/programs/rotatelogs.html
  - Can spawn program with name of old log when new one created
    - Which could compress it
  - Use a circular list of output files
  - Cause new log file to be created as soon as rotation happens

WAS Plugin

- If you are using IHS Domino and the WAS Plugin
  - Then you can use IHS Apache and WAS Plugin
- In IHS Domino
  - Have to add numerous Service directive for requests to be processed by plugin
  - Meant could have many Service directives
- In IHS Apache
  - WAS plugin called first for all requests
  - Any requests it does not processed then passed back to IHS Apache to be processed

WAS Plugin configuration in IHS Domino

```
ServerInit
/usr/lpp/zWebSphereEM1_Plugins/V8R5/bin/ihs390WASPlugin_http.so:init_exit
/ihsconfig/dws/ihsde001/plugin/plugin-cfg-ihsde001.xml
Service /IBMTools/*
/usr/lpp/zWebSphereEM1_Plugins/V8R5/bin/ihs390WASPlugin_http.so:service_exit
ServerTerm
/usr/lpp/zWebSphereEM1_Plugins/V8R5/bin/ihs390WASPlugin_http.so:term_exit
```

WAS Plugin configuration in IHS Apache

```
LoadModule was_ap22_module
/ihsconfig/ihs/ihsae002/Plugins/bin/mod_was_ap22_http.so
WebSpherePluginConfig
/ihsconfig/ihs/ihsae002/Plugins/config/ihsae002/plugin-cfg.xml
```

Did you know…

- **z/OS**
  - Only operating system that customers can use IBM HTTP Server for whatever they want to
  - With full IBM support
- **On other operating systems**
  - Available in two forms:
    - Licensed and supported when bundled with an IBM product and used directly with it
      - Typically WebSphere Application Server
      - With WAS, supported usage limited to a proxy to WAS servers via the WAS plugin
    - Unwarranted/unsupported “trial” (free tool/download)

References

- Documentation for the IHS powered by Domino shipped with z/OS V1R13 can be found here:
  - http://publib.boulder.ibm.com/infocenter/zos/v1r13/index.jsp?topic=%2Fcom.ibm.zos.r13.dgw%2Fdgw.htm
- Documentation for the IHS powered by Apache documentation at the V8.5 level can be found here:
  - http://pic.dhe.ibm.com/infocenter/wasinfo/v8r5/index.jsp?topic=%2Fcom.ibm.websphere.ihs.doc%2Fihs%2Fwelcome_ihs.html
- Additional documentation on migration can be found here:
  - http://pic.dhe.ibm.com/infocenter/wasinfo/v8r5/index.jsp?topic=%2Fcom.ibm.websphere.ihs.doc%2Fihs%2Fwelc6top_mig_ihszos53_ihs_container.html

Other items that may be of interest

- **Using IBM HTTP Server and Rexx to view z/OS STC output via SDSF**
  - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD106087
- **WebSphere Application Server on z/OS Command GUI**
  - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP102356
- Techdocs Library > White papers >

- **Rexx and the WebSphere Optimized Local Adapter APIs**
  - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP102348

Questions ???

Advice for those faced with migration

- Remember:
  - Don't panic ;-)
- Apache HTTP Server has lots of advice, pointers, examples on the internet
  - Use that to assist with migration
- Your organisation may have people already experienced with IBM HTTP Server powered by Apache on distributed
  - Find them,
  - Buy them a coffee, donut etc
  - Get their help !

Take home message

- IHS Powered by Domino is leaving the building
  - z/OS 2.1 is last release that will have it
- IHS Powered by Apache
  - Available for free download from Shopz
- Planned z/OS 2.2 release
  - Will include IHS Powered by Apache

- IHS Powered by Apache
  - Very powerful and flexible HTTP Server for z/OS