

VMS is VMS is VMS is VMS
-VAX Alpha IA64 +x86-64

Moving User Mode Application(s) To x86-64

(spoiler alert: c'est du gâteau)

VMS is VMS ...

agenda

application environment

x86-64 porting (EAK V9.0)

after one hour

after eight hours

x86-64 code specifics

x86-64 porting (EAK V9.1)

development platforms

cross compiling

x86-64 performance

questions?

Application Environment

WASD HTTP services package

- First developed early '90s on VAX - 32 bit
- Initially VAX C, now DEC / VSI C
- Ported to Alpha ('95) and Itanium ('04)
- 32 bit with necessary 64 bit data as adjacent longwords
- Uses SYS\$ services extensively
- Uses LIB\$ routines (less) extensively
- All USER MODE code

Application Environment

WASD HTTP services package

- server code / comment counts

----- OVERALL -----										
-----Total-----		-----Code-----				-----Comment-----				
Lines	Chars	Lines	Chars	Lines	Chars	Lines	Chars	Lines	Chars	
0172	237768	7861504	163085	77%	4388885	72%	21976	10%	1650720	27%

code: 163,000 lines 77% of total

comment: 21,976 lines 10% of total

x86-64 Porting

EAK 9.0 (September 2020)

- BXNUC10i7FNH4 6 core i7 1.10GHz 32GB
(thanks to Jeremy Begg of VSM Software Services)

- After approximately one hour

```
$ mcr wasd_root:[x86_64]httpd /version
%HTTPD-I-SOFTWAREID, HTTPd-WASD/11.5.1 OpenVMS/X86
WASD VMS Web Services, Copyright (C) 1996-2020 Mark G.Daniel.
8< snip 8<
-HTTPD-I-SYSTEM, VBOX VBOXFACP 1 CPU 15361MB VMS V9.0-D
-HTTPD-I-TCPIP, Not (yet) for x86-64!
-HTTPD-I-TLS, none
```

all the “core” code was built and running

- architecture-specific had hard-wired output (e.g. “Not (yet)...”)

<https://wasd.vsm.com.au/info-WASD/2020/0099>

x86-64 Porting

EAK 9.0 (September 2020)

- Approximately eight hours (excluding chasing bugs in the EAK) filled in the majority of the architecture specifics

```
%HTTPD-I-SOFTWAREID, HTTPd-WASD/11.5.1 OpenVMS/X86 SSL
WASD VMS Web Services, Copyright (C) 1996-2020 Mark G.Daniel.
8< snip 8<
%HTTPD-I-SYSTEM, VBOX VBOXFACP VMS V9.0-D
8< snip 8<
%HTTPD-I-SSL, OpenSSL 1.1.1g 21 Apr 2020 (0x1010107F)
-SSL-I-PROTOCOL, TLSv1,TLSv1.1,TLSv1.2,TLSv1.3
-SSL-I-OPTIONS, 0x80410854
-SSL-I-SNI, Server Name Indication enabled
-SSL-W-DH, no ephemeral DH param
%HTTPD-I-HTTP2, enabled
8< snip 8<
%HTTPD-I-SERVICE, http://x86v1.vsm.com.au:7080
%HTTPD-I-SERVICE, https://x86v1.vsm.com.au:7443
%HTTPD-I-SSL, x86v1.vsm.com.au:7443
Generate x86v1.vsm.com.au 2048 bit private key:
.....+++++++
.....+++++++
%HTTPD-I-DEMO, demonstration mode
8< snip 8<
%HTTPD-I-BEGIN, 18-SEP-2020 15:48:59, WASD:7080 accepting requests
```

x86-64 Porting

EAK 9.0 (September 2020)

- 163,000 code lines
X86 code specifics: 8
- each of these paralleled existing
__VAX, __ALPHA, __ia64 specifics

```
$ search *.c "#ifdef __x86

*****
WASD_ROOT:[src.HTTPDX]httpd.c;6

#ifdef __x86_64
#ifdef __x86_64
#ifdef __x86_64

*****
WASD_ROOT:[src.HTTPDX]net.c;17

#ifdef __x86_64

*****
WASD_ROOT:[src.HTTPDX]sysplus.c;3

#ifdef __x86_64

*****
WASD_ROOT:[src.HTTPDX]tcpip.c;7

#ifdef __x86_64
#ifdef __x86_64

*****
WASD_ROOT:[src.HTTPDX]version.c;3

#ifdef __x86_64
```

<https://wasd.vsm.com.au/info-WASD/2020/0102>

<https://wasd.vsm.com.au/other/WASD%20x86-64%2019-SEP-2020.html>


```

if (ExitStatus != SS_W_CONTROLY)
{
    /* add traceback information */
    int SanityCheck = 100;
#ifdef __ALPHA
    lib$get_curr_invo_context (&icb);
    while (lib$get_prev_invo_context (&icb),
        !icb.libicb$v_bottom_of_stack && SanityCheck--)
        fprintf (stdout, "-HTTPD-F-TRACE, %08.08X%08.08X\n",
            icb.libicb$q_program_counter[1],
            icb.libicb$q_program_counter[0]);
#endif
#ifdef __ia64
    lib$i64_init_invo_context (&icb, LIBICB$K_INVO_CONTEXT_VERSION);

    lib$i64_get_curr_invo_context (&icb);
    while (lib$i64_get_prev_invo_context (&icb),
        !icb.libicb$v_bottom_of_stack && SanityCheck--)
        fprintf (stdout, "-HTTPD-F-TRACE, %08.08X%08.08X\n",
            ((ULONGPTR)&icb.libicb$ih_pc)[1],
            ((ULONGPTR)&icb.libicb$ih_pc)[0]);
#endif
#ifdef __x86_64
    lib$x86_init_invo_context (&icb, LIBICB$K_INVO_CONTEXT_VERSION);

    lib$x86_get_curr_invo_context (&icb);
    while (lib$x86_get_prev_invo_context (&icb),
        !icb.libicb$v_bottom_of_stack && SanityCheck--)
        fprintf (stdout, "-HTTPD-F-TRACE, %08.08X%08.08X\n",
            ((ULONGPTR)&icb.libicb$ih_ip)[1],
            ((ULONGPTR)&icb.libicb$ih_ip)[0]);
#endif
    /* list current and history list requests */
    RequestDump ();
}

```

WASD x86v1.vsm.com.au:7080

Server Administration

Configuration												
	Report		Revise		Action							
Server	Statistics	Log	Site-Log		Edit	Zero						
Configuration	Server	File	Server	File	Edit							
Services	Server	File	Server	File	Edit	Purge	All					
Messages	Server	File	Server	File	Edit							
Path Mapping	Server	File			Edit	Reload						
Path Authorization	Server	File			Edit	Reload						
User Authentication	Server		HTA	HTL		Purge						
Secure Sockets	Service	CA			Edit-CA	Load-CA						
Other Reports	AlnFit	Cache	Cluster	DCL	DECnet	Host						
	HTTP	Lock	Match	Memory	Process	Proxy						
	Request	System+	Throttle	WATCH	WebDAV	WebSocket						
	1	2	4	8	16	24	72	168	336	504	672	hours activity

Control	
<p>RESTART</p> <p>RESTARTNOW</p> <p>RESTARTQuiet</p> <p>EXIT</p> <p>EXITNOW</p>	<p>Log On Off Flush</p> <p>Cache On Off Purge</p> <p>Proxy Adjust Zero</p> <p>Instance Max CPU 1 2</p> <p>3 4 5 6 7 8</p> <p>Active Passive</p> <p>/DO= <input type="text"/></p>

<p>Friday, 18-SEP-2020 15:56:41</p> <p>Fri, 18 Sep 2020 19:56:41 GMT (-04:00)</p> <p>default-gateway (61.69.242.235)</p> <p>HTTP/1.1</p> <p>Time X86V1:: 5 04:06:09.64</p> <p>Process: 0 00:07:46.03</p> <p>Image: 0 00:07:44.27</p> <p>CPU: 0 00:00:02.13</p> <p>Connect Current: 1</p> <p>Peak: 3</p> <p>Total: 8</p> <p>Request Current: 1</p> <p>Peak: 1</p> <p>Total: 18</p> <p>Bytes: 289,920</p>

WASD x86v1.vsm.com.au:7080

Server Statistics

Friday, 18-SEP-2020 15:56:50

Environment
Version: HTTPd-WASD/11.5.1 OpenVMS/X86 SSL Build: 18-SEP-2020 14:05:37.08 VMS 8.4-2L1 DECC 70430342 SSL: OpenSSL 1.1.1g 21 Apr 2020 (Mon Jun 29 11:31:26 2020 UTC) ZLIB: %HTTPD-W-GZIP, shareable image not found TCP/IP: Not (yet) for x86-64! System: VBOX VBOXFACP with 1 CPU and 15361MB running VMS V9.0-D Startup: /DEMO /SERV=HTTP:*:7080,HTTPS:*:7443 WASD_ROOT: X86V1\$DKA200:[WASD_ROOT]

Instances	
Node	Cluster
X86V1::WASD:7080	(n/a)
Node instances are currently ACTIVE.	

Server Process		
Name: WASD:7080	PID: 00000119	User: XXXXXXXXXX
AuthPriv: WARNING	ImagPriv: as expected	CurPriv: as expected
Last Exit:	Exit Time: (none)	Exit PID: (none)
Image: 0 00:07:52.92	Process: 0 00:07:54.68	CPU: 0 00:00:02.14
Pg.Faults: 3097	Startup: 1	Mode: INTERACTIVE
WsSize: 126352 (61MB)	WsPeak: 49568 (24MB)	VirtPeak: 407776 (199MB)
AST: 291 / 300 (3%)	BIO: 148 / 150 (1%)	BYT: 993472 / 997888 (0%)
DIO: 150 / 150 (0%)	ENQ: 3982 / 4000 (0%)	FIL: 126 / 128 (2%)
PGFL: 410976 / 512000 (200/250MB 20%)	PRC: 8 / 8 (0%)	TQ: 98 / 100 (2%)
Input: TERMINAL		
Output: TERMINAL		

System Resources

8 hours

8 X86 specifics

163,000 code lines

x86-64 Porting

native 64 bit storage

- After the relative ease of the initial port (EAK 9.0)
 - it was decided to retire VAX support (not a difficult decision)
 - and remove all VAX 32 bit accommodations
 - using native 64 bit data storage (e.g. [long][long] to [int64])
- This design decision was totally unrelated to X86 support
- Lots of fairly dry hack work and six months incremental field testing
 - across 4 sites and 3 platforms later ... v12.0.0

x86-64 Porting

EAK V9.1 (June 2021) and V9.1-A (September 2021)

- Deciding I needed some further hands-on, deployed existing
MacBook Pro, Intel Core i5, 2.7 GHz, 8GB
a basic laptop
- Then a AU\$300 (~€200) eBay purchase
Dell Optiplex 9020 SFF i7-4770 QC 3.4Ghz 16GB Windows 10 Pro
a basic desktop
- I now have fairly cost-effective VMS development systems

<https://wasd.vsm.com.au/info-WASD/2021/0063>

<https://wasd.vsm.com.au/info-WASD/2021/0091>

x86-64 Porting

cross compiling

- All compilation (currently) requires an Itanium host

```
IA64$ product show history X86_XTOOLS
```

PRODUCT	KIT	TYPE	OPERATION	VAL	DATE
VSI I64VMS X86_XTOOLS V9.1-A_XG1K	Full	LP	Install	Val	27-OCT-2021
VSI I64VMS X86_XTOOLS V9.0-H_XFX8	Full	LP	Remove	-	27-OCT-2021
VSI I64VMS X86_XTOOLS V9.0-H_XFX8	Full	LP	Install	Val	18-APR-2021
VSI I64VMS X86_XTOOLS V9.0-F_XFRZ	Full	LP	Remove	-	18-APR-2021
VSI I64VMS X86_XTOOLS V9.0-F_XFRZ	Full	LP	Install	Val	18-DEC-2020
VSI I64VMS X86_XTOOLS V9.0-C_XFN5	Full	LP	Remove	-	18-DEC-2020
VSI I64VMS X86_XTOOLS V9.0-C_XFN5	Full	LP	Install	Val	13-SEP-2020

```
7 items found
```

```
$ @SYS$MANAGER:X86_XTOOLS$SYLOGIN.COM
```

x86-64 Porting

cross compiling

- Parallel source code trees

```
IA64$ SET DEFAULT WASD_ROOT:[000000]
```

```
IA64$ ZIP "-V" disk:[directory]file.ZIP [...OBJ_X86_64]*.OBJ
```

```
...
```

```
X86$ SET DEFAULT WASD_ROOT:[000000]
```

```
X86$ UNZIP disk:[directory]file.ZIP
```

- a minor embuggerance
- Alternatively; use clustered IA64-X86 nodes and MSCP-shared volume
Clustering works very effectively
- native X86 compilers promised incrementally during V9.2 releases

x86-64 Performance

V9.1-A (December 2021)

- VMS itself boots in seconds
- ! Dell Optiplex 9020 4 core i7 3.4Ghz 16GB
X86VMS\$ @vups.com
innotek GmbH VirtualBox with 3 CPU and 4492MB running VMS V9.1-A
Approximate System VUPs Rating : 244.9 (min: 244.4 max: 245.4)

! BXNUC10i7FNH4 6 core i7 1.10GHz 32GB
innotek GmbH with 2 CPU and 7680MB running VMS V9.1-A
Approximate System VUPs Rating : 456.8 (min: 453.2 max: 459.2)

Digital Personal WorkStation with 1 CPU and 1536MB running VMS V8.4-2L1
Approximate System VUPs Rating : 161.3 (min: 161.2 max: 161.4)

AlphaServer DS20 500 MHz with 2 CPU and 1536MB running VMS V8.4-2L2
Approximate System VUPs Rating : 254.8 (min: 254.8 max: 254.8)

HP rx2660 (1.40GHz/6.0MB) with 4 CPU and 14335MB running VMS V8.4-2L1
INFO: Preventing endless loop (10\$) on fast CPUs
Approximate System VUPs Rating : 499.6 (min: 497.8 max: 501.4)

x86-64 Performance

V9.1-A (December 2021)

- X86VMS\$ TCPIP SHOW VERSION

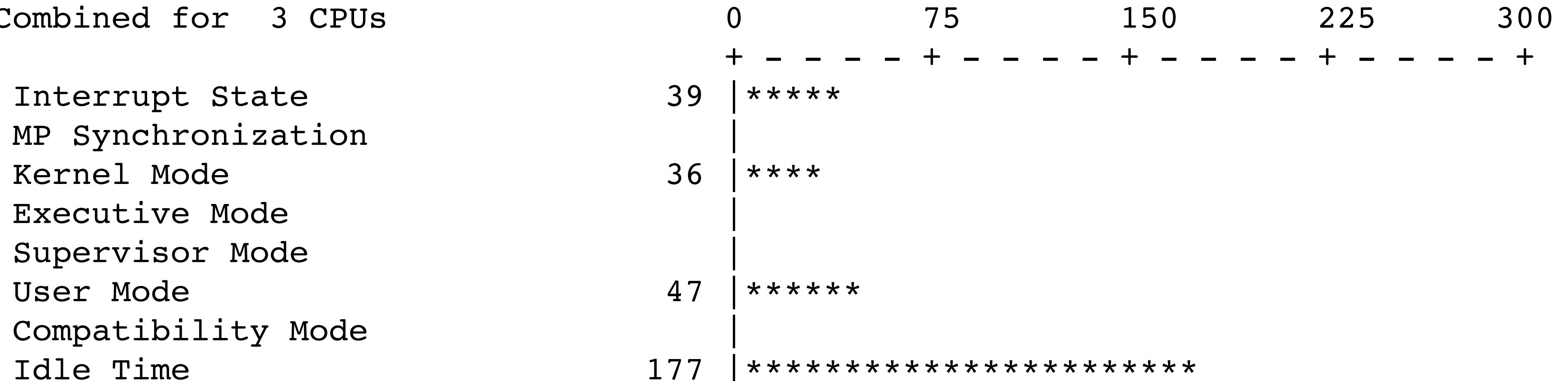
```
VSI TCP/IP Services for OpenVMS x86_64 Version X6.0
on an innotek GmbH VirtualBox running OpenVMS V9.1-A
```

- X86VMS\$ curl -ko nl: http://192.168.1.86/dka100/colossus.mp4

% Total	% Received	% Xferd	Average Speed	Time	Time	Time	Current				
			Dload	Upload	Total	Spent	Speed				
100	1398M	100	1398M	0	0	52.2M	0	0:00:26	0:00:26	--:--:--	52.7M

- X86VMS\$ MONITOR MODES

```
Combined for 3 CPUs
```



questions?

WASD development bench

- KLAATU the original Alpha PWS - 120W (regardless - and noisy!)
- BA356 storage shelf (courtesy Jeremy Begg) with 15k HDD - 25W
- X86VMS the Dell SFF (SSD x 2) - 20W (quiescent) 40-60W (active)



https://wasd.vsm.com.au/other/#WASD_x86-64

<https://vsmx86.vsm.com.au>

<https://wasd.vsm.com.au/wasd/>

<https://vmssoftware.com/about/roadmap/>

<https://vmssoftware.com/about/openvmsv9-1/>