

OpenVMS SDA Extensions

OpenVMS Spring Event
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OpenVMS SDA Extensions

- ▶ What are SDA Extensions ?
- ▶ OpenVMS Examples
- ▶ Freeware Examples

SDA ...

- ▶ SDA = System Dump Analyzer
 - ANALYZE/CRASH_DUMP – system or process dump
 - ANALYZE/SYSTEM – analyze running system
- ▶ Look at and display/format system internal data structures
- ▶ OpenVMS System Analysis Tools Manual

... Extensions

- ▶ API for extending SDA
- ▶ Available since at least OpenVMS VAX V5.5-2
- ▶ API documented since OpenVMS Alpha V7.2 for OpenVMS Alpha and I64 only

... Extensions

- ▶ SDA> *xxx command*
- ▶ Invokes SYS\$SHARE:xxx\$SDA.EXE
 - \$ DEFINE xxx\$SDA dev:[dir]xxx\$SDA.EXE
- ▶ SDA> *DO xxx command*
 - Can replace SDA command xxx

... Extensions

- ▶ Executive Debug Images
- ▶ `SYS$LOADABLE_IMAGES:xxx$DEBUG.EXE`
- ▶ Dynamically loadable/unloadable – no reboot
- ▶ Hooks in OpenVMS executive - `xxx$GQ_DEBUG`
- ▶ Collect trace and debug information
- ▶ Shipped with OpenVMS (starting with V7.2-1)

... Extensions

- ▶ Developed and used by OpenVMS engineering
- ▶ Ready-to-use, available on-site, no reboot
- ▶ Can be used by system analysts
- ▶ Tool to examine and format OpenVMS or application internal data structures – without RISK !
- ▶ Automate certain SDA tasks

Generic Commands

- ▶ SDA> xxx or xxx HELP
 - display brief HELP for SDA extension xxx

SDA> flt

Alignment Fault Tracing Utility FLT commands:

FLT LOAD

FLT UNLOAD

FLT START TRACE [/BUFFER=pages]

 [/BEGIN=pc_range_low] [/END=pc_range_high]

FLT STOP TRACE

FLT SHOW TRACE [/SUMMARY]

Generic Commands

- ▶ SDA> xxx LOAD
 - Loads XXX\$DEBUG execlct
- ▶ SDA> xxx START TRACE
 - Starts trace function
- ▶ SDA> xxx STOP TRACE
 - Stops trace
- ▶ SDA> xxx UNLOAD
 - Unloads/disconnects xxx\$DEBUG execlct
 - Don't panic, it takes some seconds to complete !

Generic Commands ...

```
SDA> sym
%CLI-W-SYNTAX, error parsing 'SYM,
SDA> spawn def/job sym$sda dsa64:<tools.sym>sym$sda.exe
SDA> sym
SYM X0.2 (c) 2006, Volker Halle (halle@encompasserve.org) built on VMS V8.2
Symbols for Process PID 3B00138A name SYSTEM
```

```
SYM addr Symbol
```

```
-----
7AD1E598 SNMPI == "$SYS$SYSTEM:TCPIP$SNMPI.EXE"
7AD1D0A8 NDC == "write sys$output "ndc is obsolete; use rndc""
```

```
...
```

WARNING !

- ▶ Most of these tools are undocumented, unsupported and subject to change without notice

Documentation

- ▶ **OpenVMS System Analysis Tools Manual**
 - Chapter 5 SDA CLUE Extension
 - Chapter 6 SDA Alpha OCLA
 - Chapter 7 SDA Alignment Fault Utility (FLT)
 - Chapter 8 SDA Spinlock Tracing Utility (SPL)
 - Chapter 9 SDA Extended File Cache Extension (XFC)
 - Chapter 10 SDA Callable Routines Extension

OpenVMS Examples

- ▶ Source code examples:
- ▶ `SYS$EXAMPLES:MBX$SDA.C`
- ▶ `SYS$EXAMPLES:RDB$SDA.C` and `.EXE`

The OpenVMS SDA Extensions

- ▶ CLUE V6.2 Crash data extraction
- ▶ CNX V7.2-2 Connection Manager
- ▶ DKLOG V7.3-1 DK (SCSI class driver)
- ▶ EXC V8.2 Exception Handling
- ▶ FC V7.2-1 Fibre Channel
- ▶ FLT V8.2 Alignment Fault Tracing
- ▶ IO V7.3-2 IO subsystem
- ▶ LAN V7.2-2 LAN Network Driver

The OpenVMS SDA Extensions...

▶ LCK	V7.2-1H1	Lock Manager
▶ LNM	V7.3-1	Logical Names
▶ MTX	V7.3-1	Mutex tracing
▶ NET	V7.3-1	DECnet-OSI/-Plus
▶ OCLA	V7.3-2	EV7 On-chip logic analyzer
▶ PCS	V7.3-2	PC Sampling
▶ PE	V7.3	PEdriver (SCS via LAN)
▶ PRF	V8.2 (I64) V8.3 (Alpha)	Performance Tracing

The OpenVMS SDA Extensions...

▶ PTHREAD	V7.2-1	DECthreads
▶ PSH	V8.2-1	Pshared debug utility
▶ RMS	V8.2-1	RMS indexed file tracing
▶ SPL	V7.2-1H1	Spinlock Tracing
▶ TCPIP	V7.2-1	TCPIP
▶ TQE	V7.3-1	Timer Queue Elements
▶ TR	V7.3-1	Debug Tracing Utility

The OpenVMS SDA Extensions...

▶ USB	V7.3-1	USB
▶ XFC	V7.3	eXtended File Cache
▶ XX	V8.3	LAN Exerciser

PCS – PC Sampling

- ▶ Where does system/process spend most of it's execution cycles ?

```
SDA> pcs load
```

```
PCS$DEBUG load status = 00000001
```

```
SDA> pcs start trace
```

```
Sampling started...
```

```
SDA> pcs stop trace
```

```
Sampling stopped...
```

PCS – PC Sampling

```
SDA> pcs sho trace/stat
```

```
PC sampler information:
```

```
-----
```

PC	IPL	Pid	Count	Routine	Module
0003001A	0	46C000B1	1154	SYS\$K_VERSION_03+0001A	EXAMPLE_7
83ACB832	8	46C000B1	1	TCPIP\$INTERNET_SERVICES+03832	TCPIP\$INTERNET_SERVICES
805FCF90	8	46C000B1	1	LAN\$RETURN_RCV_VCRP_C+00060	SYS\$LAN
8015A65C	8	46C000B1	1	AMAC\$EMUL_CALL_NATIVE_C+0007C	PROCESS_MANAGEMENT
80921E84	0	46C000B0	1	SCRSHR+21E84	SCRSHR
8005DD1C	8	46C000B0	1	EXE_STD\$KP_STARTIO_C+0009C	SYSTEM_PRIMITIVES_MIN
80012F3C	21	46C000B0	1	IOC\$CRAM_IO_C+0007C	SYS\$CPU_ROUTINES_0402
001D1832	15	46C000AF	1	TDC\$LIBSHR\$A_V820-0105+AB832	TDC\$LIBSHR\$A_V820-0105
80130668	0	46C0009D	1	PROCESS_MANAGEMENT+20668	PROCESS_MANAGEMENT

FLT – Alignment Fault Tracing

```
SDA> flt load
FLT$DEBUG load status = 00000001
SDA> flt start trace
Tracing started...
SDA> flt stop trace
SDA> flt show trace/summ
```

```
Fault Trace Information: (at 19-APR-2006 09:10:45.24, trace time
00:00:01.379162)
```

```
-----
```

Exception	PC	Count
00000000	.0015A8B0	81920
00000000	.00176510	81919
00000000	.00167F80	40959

```
-----
```

FLT – Alignment Fault Tracing...

SDA> flt show trace

Unaligned Data Fault Trace Information:

```
-----
```

Timestamp	CPU	Unaligned VA	Exception PC	Access	EPID
19-APR 09:10:42.800631	00	00000000.04C5C806	0015A8B0	User	3B000D70
19-APR 09:10:42.800625	00	00000000.04C5C6FA	00176510	User	3B000D70
19-APR 09:10:42.800619	00	00000000.04C5C6EF	0015A8B0	User	3B000D70
19-APR 09:10:42.800615	00	00000000.04C5C6E6	00176510	User	3B000D70

...

SDA> set proc/id=3B000D70

SDA> show proc/ima

Process index: 0070 Name: CHARONVAX Extended PID: 3B000D70

```
-----
```

Image Name	Type	IMCB	GP
CHARON	MAIN	7FEB4C80	00000000.00A70000

...

FLT – Alignment Fault Tracing ...

```
SDA> exa/ins 0015A8B0
      { .mib
CHARON+0015A8B0:      1d4      r8 = [r23]
                    nop.i      000000
                    br.many     0000250 ;;
      }
```

```
SDA> exa/ins 00176510
      { .mib
CHARON+00176510:      1d4      r8 = [r29]
                    nop.i      000000
                    br.many     1FFF200 ;;
      }
```

```
SDA> exa/ins 00167F80
      { .mib
CHARON+00167F80:      1d2      r8 = [r15]
                    nop.i      000000
                    br.many     0000210 ;;
      }
```

```
SDA> flt unload
FLT$DEBUG unload status = 00000001
```

PTHREAD – memory leak

Example: Memory leak in a PTHREAD program

```
SDA> pthread vm
```

```
lookaside 0 (32 bytes; obj-name) 585866 in use, 1 free
```

```
lookaside 1 (256 bytes; hash-bucket) 187 in use, 0 free
```

```
lookaside 2 (384 bytes; rwb, mub, cvb) 586318 in use, 0 free
```

```
lookaside 3 (4096 bytes; tsd-array) 0 in use, 0 free
```

```
lookaside 4 (4288 bytes; mu-meter) 0 in use, 0 free
```

```
lookaside 5 (4352 bytes; cv-meter) 0 in use, 0 free
```

```
lookaside 6 (8192 bytes; tcb) 0 in use, 0 free
```

```
memory used: 32*585866 + 384*586318 = 243893824 = 250 MB
```

Examples

- ▶ FC – Fibre channel
- ▶ LCK – Lock Manager
- ▶ IO – IO Subsystem, BUFIO, DIRIO
- ▶ LNK – Logical Name Translations
- ▶ XFC - eXtended File Cache

Freeware Examples ...

- ▶ PWAIT\$SDA - process wait/hang analysis
- ▶ GBLSEC\$SDA - global section information
- ▶ PF\$SDA - Which processes are using a specified pagefile
- ▶ LN\$SDA – Show process and shared logical names
- ▶ PROCIO\$SDA - Show process file IO counters
- ▶ SYM\$SDA - Show process symbols

Freeware Examples

▶ CLUE\$SDA for OpenVMS VAX

- Supports OpenVMS VAX V5.5 up to V7.3
- Implements a subset of CLUE commands including
 - ▶ CLUE PROCESS/RECALL
 - ▶ CLUE PROCESS/LOGICALS
 - ▶ CLUE PROCESS/SYMBOLS
- Examples: [CLUE\\$SDA VAX](#)
- Author: Ferry Bolhár-Nordenkamp

Lock Remaster Example

- ▶ SDA> cnx start trace/fac=lck/func=remaster
- ▶ SDA> cnx start trace
/fac=lck/fun=(RM_Req,RM_Complete)
- ▶ SDA> CNX SHOW TRACE/FULL
- ▶ To view full Resource Names, dump trace buffers: SDA> EXA TraceBuf;D8
- ▶ Example

SDA Extension News

- ▶ FC PERFORMANCE available in I64 V8.2-1
- ▶ FC SHOW RING/FULL decoder added in VMS732_FIBRE_SCSI-V0800, VMS82I_FIBRE_SCSI-V0200
- ▶ FLT START TRACE crash fix in VMS82I_SYS-V0200 and VMS821I_SYS-V0200

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Questions ?

