

Solaris

Crash Dump Analysis 2015/2016



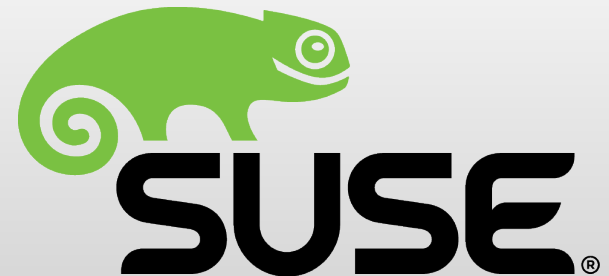
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Solaris overview

- **UNIX derivative (System V Release 4)**
 - 32-bit and 64-bit
 - IA-32, [AMD64](#), SPARC (V7 - V9)
 - Unofficial PowerPC port
 - Solaris 8, 9, 10, [11](#)
 - OpenSolaris
 - Open sourced parts of Solaris (ca. 2005 – 2010)
 - Last open source state forked as project [OpenIndiana](#)
 - Still developed as [illumos](#) and other projects

System debugging

- **Variety of problems → Variety of tools**
- Problems
 - Crashes
 - Crash dumps
 - Core dumps
 - Bad behavior
 - Performance
 - Hangs
 - Oddities
- Tools
 - mdb, kmdb, Solaris CAT
 - dbx, gdb
 - Debug kernels
 - DTrace
 - Command line tools

Crashes

- **Crashing application**

- Can produce a **core file**
- Configure using the *coreadm* utility

- **Crashing kernel**

- Produces a **crash dump**
- Configure using the *dumpadm* utility

- **Both types contain**

- Snapshot of the application/kernel, memory and other essential state information for later post-mortem debugging session

Crashes (2)

- **If the application does not crash**
 - We can still get a core file of the running process using the *gcore* utility
- **If the system does not crash**
 - We can still get a crash dump of the (running) kernel using the *savecore* utility

Crashes (3)

- **Core file analysis tools**

- **mdb**

- Assembly-level debugger
- Standard part of Solaris distributions
- http://docs.oracle.com/cd/E18752_01/html/816-5041/intro-27.html

- **dbx**

- Source-level debugger similar to gdb
- Part of Oracle Solaris Studio
- <http://www.oracle.com/technetwork/server-storage/solarisstudio/overview/index.html>

Crashes (4)

- **Core file analysis tools**
 - gdb
 - Source-level debugger similar to dbx
 - Standard part of Solaris distributions
 - Optionally need to install the package
 - <http://www.gnu.org/software/gdb/>

Crashes (5)

- **Crash dump analysis tools**

- mdb

- Solaris CAT

- Solaris Crash Analysis Tool (a.k.a. S-CAT)

- “Heuristic” and automated analysis of crash dumps

- <https://blogs.oracle.com/solariscat/>

- Debug kernels

- Special support for debugging

- E.g. TRAPTRACE – tracing of all traps

Reasons for crash

- **BAD TRAP (or other *bad* trap)**
 - Registers from the time of the crash saved in the trap frame
- **Failed assertions**
- **Panic states**
 - `cmn_err()`
- **XIR / NMI**
- **Voluntary crashes initiated by the user**

Reasons for dumping core

- **Bad memory access**
 - SIGSEG, SIGBUS
- **Bad operation**
 - SIGFPE (Arithmetic Exception)
- **Application abort()**
 - SIGABRT
- **User request via *gcore***

Bad behavior

- **Performance issues**

- DTrace

- Dynamic tracing framework
- Can provide insight into what is going on in the whole software stack
- Standard part of recent Solaris distributions
- <http://dtrace.org>

Bad behavior (2)

■ Command line tools

- vmstat
 - Monitoring memory load
- iostat
 - Monitoring I/O load
- mpstat
 - Monitoring CPU load
- ps, prstat, top
 - Monitoring process activities

Bad behavior (3)

- **Hangs**

- “No or diminishing forward progress”
- mdb -k
 - mdb attached to the live system
- mdb -K
 - Single stepping using **kmdb**
- mbd, dbx, gdb
 - Attach to a running process

Bad behavior (4)

- Command line tools
 - pstack
 - Display the user stack of a running process

● Oddities

- “Software does something else”
- DTrace
- mbd -k, mdb -K
- Command line utilities
 - truss