SPARC Systems

Crash Dump Analysis 2015/2016

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ORACLE

SUSE

redhat
Motivation

```
$ uname -a
SunOS t7-1 5.11 11.3 sun4v sparc sun4v
```

- OS name
- SunOS version
- Platform
- Host name
- Solaris version
- ISA
Workstation and Server

**Graphical) Workstation**
- Desktop computer with lots of RAM and CPU power
- High-resolution color monitor
- Storage: SCSI tape (LTO), Fibre Channel...

**Enterprise) Server**
- Rackmount computer with lots of RAM and CPU power
- No monitor
- Storage: Lots of disks, tape, ...
Timeline (continued)


Java WS + Ultra
Fire
Fire
Blade
T Series

Oracle M Series

M68xx SPARC x86
Motorola 68xx
- sun1, sun2, sun3

32-bit SPARC
- sun4, sun4c, sun4m, sun4d...

64-bit SPARC
- sun4u (u for UltraSPARC)
- sun4v (v for Virtualization) – T Series and current M Series
T Series

- **UltraSPARC T1**
  - Sun Fire/Sun SPARC Enterprise T1000, T2000

- **UltraSPARC T2**
  - Sun SPARC Enterprise T5120/5140/5220/5240/5440

- **SPARC T3**
  - SPARC T3-1, T3-2, T3-4

- **SPARC T4**
  - SPARC T4-1, T4-2, T4-4

- **SPARC T5**
  - SPARC T5-2, T5-4, T5-8

- **SPARC M7**
  - SPARC T7-1, T7-2, T7-4
M Series

- **SPARC64**
  - Sun SPARC Enterprise M3000, M4000, M5000, M8000, M9000

- **SPARC M5**
  - M5-32

- **SPARC M6**
  - M6-32

- **SPARC M7**
  - M7-8, M7-16
Reliability, Availability, Serviceability

- **ISA Features**
  - Defined behavior in different error scenarios

- **CPU Features**
  - Register content protection
  - Instruction restarting

- **System Features**
  - Redundant components
  - Hot-replacable components
  - Service Processor (monitoring, alerts)

- **OS Features**
  - Predictive self-healing (FMA)
  - Hot-replacable components
Hardware Partitioning

- **System consist of modules**
  - C (Compute), M (Memory), IO (I/O)
  - CU+MU+IOU, CMU+IOU, CMIOU
  - Older systems use different terminology

- **Can be partitioned into domains**
  - Electrically isolated
  - Configured by service processor
  - Can be changed dynamically at run time
  - Typically on module boundaries
IEEE 1275-1994 (Open Firmware, OpenBoot, OBP)

- IEEE standard (now considered withdrawn)
- Used with POWER/PowerPC (incl. Mac) and SPARC
- Based on Forth language interpreter
- 'OK' prompt
- Can be used to examine HW, debug the OS kernel
- FCode – architecture-independent driver/plugin residing on an add-on card or board
- Workstations use a graphical console
  - Solaris now does something similar on x86, too
Concurrent Multi-Threading

1 core – 8 concurrent instruction streams

- Called strands
- Eliminates waiting for memory
- Alternative to out-of-order execution
- Works well for parallel workloads
- Intel's HT is somewhat similar (but only 2 streams)
- e.g. M7 has 32 cores, 32 x 8 = 256 strands
- Static vs. dynamic scheduling
- Later combined with out-of-order
Hyperprivileged mode

- Extra privilege level
  - Unprivileged -> Privileged -> Hyperprivileged

- Extra level of addressing
  - Virtual -> Real -> Physical

- Hypervisor
  - Part of platform firmware, always present
  - Address translation, resource partitioning

- Used with different V18n technologies
  - Logical Domains (Oracle VM for SPARC)
  - Solaris Kernel Zones
Logical Domains (Oracle VM for SPARC)

- **Hardware Partitioning**
  - CPU, Memory, I/O (buses, slots, virtual functions)
  - More flexible than hardware partitions

- **I/O Virtualization**
  - Network, Disk, HBA
  - Virtualized domains can be live-migrated

- **OS-independent**
  - Different OS versions and possibly even brands
Logical Domains continued

- **Domain roles**
  - Control (a.k.a. primary), Service, I/O, Root, Guest

- **Initial configuration**
  - Initially all resources belong to a single domain
  - Remove some resources (CPUs, memory)
  - Create new domain
  - Assign resources to new domain

- **Many possible configurations**
  - Partitioning only, fully virtual, HW-virtualized
Logical Domains Partitioning Only

Domain 1

Domain 2

Memory
CPUs
Buses
Logical Domains Virtualized

Virtual service

Virtual service

Virtual device

Virtual device

Virtual device

Virtual device
Kernel Zones (Solaris)

**Solaris Zones**
- Framework for creating virtual OS instances
- Simple user interface
- Support resource control
- Standard zones use OS-level virtualization

**Branded Zones**
- Linux brand (defunct)
- S8, S9, S10

**Kernel Zones**
- Use HW-based virtualization
- Intel-VT/AMD-V on x86
- sun4v virtualization on SPARC
- live migration