Chapter 1 Solaris Overview

—— Feature and architecture

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Outline

- Introduction to Solaris
- Solaris Kernel Features
- Solaris Kernel Architecture
- Solaris 10 Features
- Performance and Tracing Tools
Introduction

- **What is Solaris?**
  - Sun Microsystems, Inc.
  - A complete operating environment, built on a modular, dynamic kernel

- **SOE- Solaris Operating Environment**
  - 3 major components:
    - SunOS- the kernel
    - Windowing – desktop environment, CDE default, OpenWindows still included. Gnome, KDE
    - Open Networking Computing
A brief history

- BSD UNIX
- 1982, Sun UNIX 0.7
- 1983 SunOS 1.0
- 1992 SunOS 4.1.3
- 1992 Solaris 2.0
- 1998 Solaris 7
- 2000 Solaris 8
- 2001 Solaris 9
- 2005 Solaris 10
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Solaris Kernel Features

- Dynamic
- Multithreaded kernel
- Preemptive kernel
- Multithreaded Process Model
- Multiple Scheduling Classes
  - Including real-time support
Solaris Kernel Features (Cont’d)

- Tightly Integrated File System & Virtual Memory
- Virtual File System
- 64-bit kernel
  - 32-bit and 64-bit application support
- Resource Management
- Service Management & Fault Handling
- Integrated Networking
The 64-bit Revolution

Solaris 2.6
- ILP32 Apps
- ILP32 Libs
- ILP32 Kernel
- ILP32 Drivers
- 32-bit HW

Solaris 7, 8, 9, 10, ...
- ILP32 Apps
- ILP32 Libs
- ILP32 Kernel
- ILP32 Drivers
- 32-bit HW

- LP64 Apps
- LP64 Libs
- LP64 Kernel
- LP64 Drivers
- 64-bit HW

* Solaris 10: 64-bit kernel only on SPARC
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Solaris kernel Architecture

System Call Interface

Processes & Threads

Kernel Services
Clocks & Timers etc

Scheduler

Resource management & controls

Memory Management
Virtual Memory
Kernel Memory Allocation

Hardware Address Translation (HAT)

Hardware – SPARC / x86 / x64

Networking framework & services

Virtual File System
Framework

UFS
NFS
ProcFS
SpecFS

TCP/IP

Bus & Nexus Drivers

sd
ssd
...
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Solaris 10 (The headline grabbers)

- Solaris Containers (Zones)
- Solaris Dynamic Tracing (dtrace)
- Predictive Self Healing
  - System Management Framework
  - Fault Management Architecture
- Process Rights Management
- Premier x86 support
- Optimized 64-bit Opteron support (x64)
- Zetabyte File system (ZFS)
- ... and much, much more!
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Performance and tracing Tools

- **Process stats**
  - cputrack - per-processor hw counters
  - pargs – process arguments
  - pflags – process flags
  - pcred – process credentials
  - pldd – process's library dependencies
  - psig – process signal disposition
  - pstack – process stack dump
  - pmap – process memory map
  - pfiles – open files and names
  - prstat – process statistics
  - ptree – process tree
  - ptime – process microstate times
  - pwdx – process working directory

- **Process control**
  - pgrep – grep for processes
  - pkill – kill processes list
  - pstop – stop processes
  - prun – start processes
  - prctl – view/set process resources
  - pwait – wait for process
  - preap – reap a zombie process
Performance and tracing Tools (Cont’d)

- **Process tracing/debugging**
  - abitrace – trace ABI interfaces
  - dtrace – trace the world
  - mdb – debug/control processes
  - truss – trace functions and system calls

- **Kernel tracing/debugging**
  - dtrace – trace and monitor kernel
  - lockstat – monitor locking statistics
  - lockstat -k – profile kernel
  - mdb – debug live and kernel cores
Performance and tracing Tools (Cont’d)

- System stats
  - acctcom – process accounting
  - busstat – Bus hardware counters
  - cpustat – CPU hardware counters
  - iostat – IO & NFS statistics
  - kstat – display kernel statistics
  - mpstat – processor statistics
  - netstat – network statistics
  - nfsstat – nfs server stats
  - sar – kitchen sink utility
  - vmstat – virtual memory stats
Dtrace – Dynamic Tracing

- Seamless, global view of the system from user-level thread to kernel
- Not reliant on pre-determined trace points, but dynamic instrumentation
- Data aggregation at source minimizes post-processing requirements
- Built for live use on production systems
Ease-of-use and instant gratification engenders serious hypothesis testing

Instrumentation directed by high-level control language (not unlike AWK or C) for easy scripting and command line use

Comprehensive probe coverage and powerful data

management allow for concise answers to arbitrary questions
Modular Debugger - mdb(1)

- Solaris 8 mdb(1) replaces adb(1) and crash(1M)
- Allows for examining a live, running system, as well as post-mortem (dump) analysis
- Solaris 9 mdb(1) adds...
  - Extensive support for debugging of processes
  - /etc/crash and adb removed
  - Symbol information via compressed typed data
  - Documentation

- MDB Developers Guide
  - mdb implements a rich API set for writing custom dcmds
  - Provides a framework for kernel code developers to integrate with mdb(1)
References

- Solaris 10 What’s New, Sun Microsystems Press, December 2005
End

- Last.first@Sun.COM