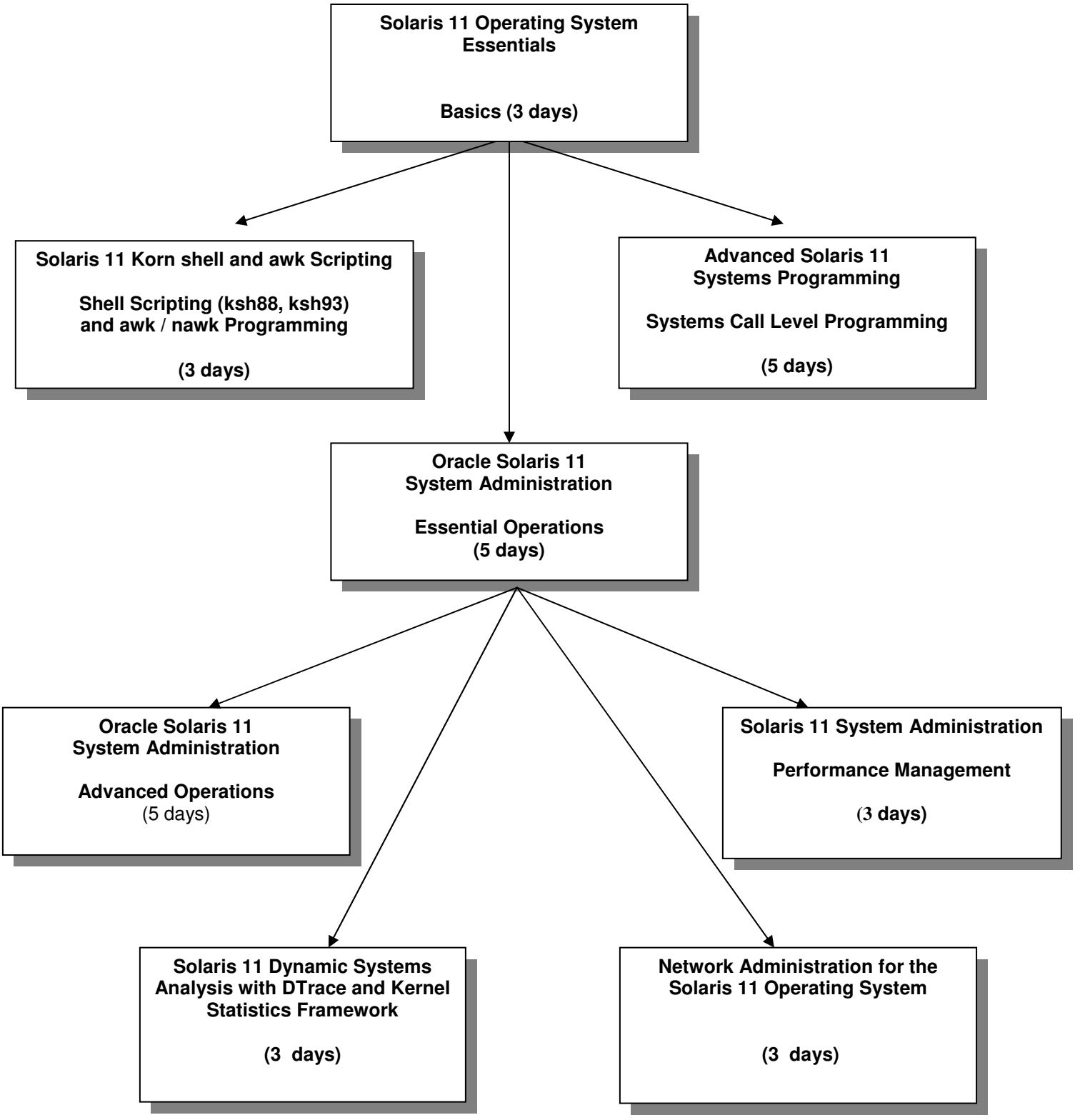
Solaris 11 Operating Environment Courses

(Platforms: Oracle SPARC and Oracle x86 / x64 based)



Solaris 11 Operating System Essentials

COURSE DESCRIPTION

This course teaches the basic working environment of a **Solaris 11** system. It introduces commonly required operations that can be performed by entering commands interactively in a command terminal, along with functions available in the **GNOME** Desktop Environment. This course is taught for the following platforms: **Solaris 11.2 SPARC and x86 / x64 platforms.**

COURSE OBJECTIVES

Each participant will be able to use **BASH** and **Korn Shell** techniques and commands to maintain collections of files, create files using interactive editor utilities, create and execute basic command procedures, communicate with other users, and tailor the interactive environment to meet their needs. Environment control using the **GNOME** graphical utilities will also be shown.

COURSE TOPICS

Understanding the User Environment

- **Unix / Solaris** Software Overview
- Process Concepts
- The **GNOME** Desktop Environment GUI

Getting Started with the Command Language

- Logging Into a **Solaris 11** System
  - Graphically through the **GNOME**
  - Non-graphically thru telnet or emulation
- Shell Syntax Rules
- Command Line Editing
- Obtaining help using **man** and **GNOME help**
- Basic Network Operations
- Defining and using **ssh** keys

Solaris 11 Operating System Essentials

COURSE TOPICS

Managing Files
- File Specification Syntax
- Device Specifications
- Directory Specifications
- Using the **GNOME Nautilus** file manager
- Regular Expressions and Special Characters
- **Unix** / **Solaris** Commands to Manipulate Files
  - **GNOME** utilities to manipulate files
- File Protection Mechanisms
  - Standard Permission Code Scheme
  - Access Control Lists (**ACL**s)

Creating and Editing Text Files: Part 1
- Using GUI-based editors (**gedit**)
- **vim** Editor
- **ex** Editor (commands within **vim**)

Creating and Editing Text Files: Part 2
- Advanced Features of the **vim** Editor
  - abbreviations
  - mapping keys

Improving the User Interface
- Saving History Commands
- Creating Command Aliases
- Redirection of Input and Output
- Using Hard and Symbolic Links
- Process Control Commands

Shell Script Procedures
- Rules for Creating Procedures
- The .profile Procedures

Solaris 11 Operating System Essentials

COURSE TOPICS

Print and Batch Mechanisms

- The **lp** command and options
  - Using the **GNOME** print manager
- The **at** command and options
- The **crontab** command and options

User Level Tape Operations

- **tar** utility syntax
- **tar** commands for product access
- Using compression/uncompression commands
  - **compress** / **uncompress**
  - **gzip** / **gunzip**

COURSE DURATION

This course normally requires **three** (3) days, approximately 50% lecture and 50% lab time.

COURSE PREREQUISITES

This course is considered to be the basic **Unix** / **Solaris 11** course. Experience with any (other) interactive system is helpful.

Solaris 11 Shell and awk Scripting

COURSE DESCRIPTION

This course teaches the **Solaris 11** professional (user, systems administrator, application/system programmer) the techniques needed to develop advanced shell and reporting type procedures under **Solaris 11**. Techniques in the major shells will be shown. **All Solaris 11 platforms support the techniques in this course.**

COURSE OBJECTIVES

Each participant will be able to use **Solaris 11**, **awk**, **nawk**, **BASH** and **Korn** shell commands to maintain collections of files, control usage of shell command scripts, and generate reports using the **(n)awk** facility.

COURSE TOPICS

Basics of Shell Scripting

- Types of shell scripts
  - driver
  - complex
- Available shells in Solaris 11
- Developing a template
- Adding documentation to shell scripts

Writing Shell Scripts

- **BASH** and **Korn** Shell environment variables
- User-defined variables
- Substitution of variables
- Command substitution in variables
- Decision statements
- Looping statement constructs
- typesetting variables for output
- typesetting integer and floating point variables

Solaris 11 Shell and awk Scripting

COURSE TOPICS

Writing Shell Scripts (continued)

the **select** construct (for menus)
using and defining functions
accessing files' records using pipes
handling signals with **trap**
defining and using indexed arrays

Writing Advanced (Korn) Shell Scripts

defining and using active variables
nameref variables (references)
defining and using associative arrays
accessing files' records directly with exec
special parameter/variable substitutions
parent / co-process communications
adding option processing in shell scripts
accessing socket level **TCP/IP** connections

Using the awk Utility to Generate Reports

awk utility calling techniques
Patterns and actions
Using the **BEGIN** and **END** patterns
Using **awk** built-in variables
Procedure-defined variables in **awk**
Formatted output using **printf**

COURSE DURATION

This course normally requires **three** (3) days, approximately 50 % lecture, and 50 % lab time.

COURSE PREREQUISITES

This is an advanced **Solaris 11** course. It is assumed that participants either have attended the **Solaris 11 Operating System Essentials** course, or have equivalent experience with a **Solaris 11** system.

Advanced Solaris 11 Systems Programming

Course Description

This course introduces the participants to system level programming in the **C language** in a **Solaris 11** environment. The course focuses on **Unix** system calls and library functions, how to use them, and their underlying mechanisms. The course deals with many facets of the Unix operating system, including: introduction to UNIX kernel structure, I/O, Signals, Signal handlers, Timers, Processes, Multi-Tasking, Inter-Process Communication (IPC) Pipes, Shared memory, Message Queues, Semaphores, Networking, Sockets, using TCP/IP and UDP/IP**.**Throughout the course the information presented is related to the participant through: the execution of common **Solaris 11** user/administrator commands, and writing, compiling, and executing example **C language** programs which demonstrate the use of system routines and accessing system data structures on a live **Solaris 11.2** system.

Course Objectives

Upon completion of this course the participant will be able to:

- Explain the various mechanisms available to the programmer in a **Solaris 11** environment
- Write a wide variety of applications using standard **Unix** system calls and library functions

Course Topics

System Programming Environment of the Solaris 11 Operating Environment

- Environment of a **C** language program
- System level programming requirements:
  - **C** compiler issues
  - Header files and libraries
  - Special data types used
  - Useful functions
  - Error handling (basic)
- Documentation
- Security Issues

File Systems

- Types of file I/O
- File I/O structures
- File I/O access types
- Dealing with STDIN, STDOUT, STDERR
- Creating and using temporary files
- Directory file access and manipulation
- Permissions

Process Creation and Control

- Attributes (username, UID, PID, Groups)
- Creation methods
- Multi-tasking
- Shells
- Synchronization
- An introduction to threads

Advanced Solaris 11 Systems Programming

Course Topics

Synchronization and System Information

- Time issues:
  - how time is maintained
  - timers
- General synchronization
  - semaphores
  - mutexes
  - signals (generation and handling)
- System information:
  - uname
  - hostname
  - load averages

Interprocess Data Communication Facilities

- Overview of Unix IPC Facilities
- Memory Mapped files
- Pipes and Named Pipes
- Messages Queues
- Creating and Using Shared Memory structures
- Programming the **Solaris 11** contract data system

Sharing Code Between Processes

- Building shared object (libraries)
- Static Linking
- Dynamic Linking

Networking

- Concepts and basic requirements
- Socket creation and usage
- TCP/IP level connections
- UDP/IP level connections

Course Duration

This course normally requires five (5) days, 60% lecture, 40% hands on lab exercises.

Course Prerequisites

It is assumed that the participant has a solid background in basic **Unix** utilities and editors (such as **vi**), and a working knowledge of the **C** (or **C++**) programming language(s). The material in this course applies to all major **Unix** variants (**Oracle Solaris, HP-UX, IBM AIX, and all Linux types**). Environmental or execution differences will be shown when applicable.

Oracle Solaris 11 System Administration

Essential Operations

COURSE DESCRIPTION

This course will teach the commands and methods needed to setup and manage a **Solaris 11** system. The course will also use a problem solving approach in the lab exercises to teach system administrators advanced topics, for long-term mangement of the system.

Systems: **thru Solaris 11.0 thru 11.2 SPARC and x86/x64 platforms.**

COURSE OBJECTIVES

On completion of this course, a systems administrator should be able to install, update, and boot the **Solaris 11** operating system; set up user accounts and directories; prepare queues for use; perform backups for integrity and performance reasons; monitor the system for performance and do basic setup of network software and capabilities.

COURSE TOPICS

Advanced System Concepts for System Administrators

- Process concepts
- Shell command usage and review
- Optimizing system help information
- System administrator functions
- Using the **root** account (role)
- Introduction to Role Based Access Control **(RBAC)**
- Using the **GNOME** administrative graphical interfaces
- Manipulating system default environment files

System Installation and Updating

- Installation types and methods
- Installing the **Solaris 11** operating system
- Maintaining the system via **SRU**s
- Adding additional products to the system (packages)
- Reconfiguring the **Solaris 11** kernel via parameters (**mdb**)

Oracle Solaris 11 System Administration

Essential Operations

COURSE TOPICS

Startup and Shutdown

- Components involved in the **Solaris 11** boot
- **GRUB** loader stages and configuration
- Manipulating **EEPROM** commands and parameters
- Default bootstrap
- Boot to single-user mode
- Solaris fail-safe boot features
- **SMF** startup methods, tools, and procedures
- Understanding **milestones**
- Adding procedures to the startup mechanisms
- Shutdown methods and control

Managing of System Users

- **UID** and **GID** concepts
- Creation of a user account
- Security through **password aging**
  - password lifetime and composition
  - using password history and dictionaries
- Controlling access by groups
- Login sequence
- Setting up user environment files
- Using and maintaining user login files
- Viewing and controlling running processes

- Basic setup and control of the **GNOME**
  - **gdm-binary** (login manager)
  - **.gnome*** files and directories (menus and layouts)

- Remote graphical environments
  - **vncserver** / **vncviewer**
  - **/etc/X11/gdm/gdm.conf**

Oracle Solaris 11 System Administration

Essential Operations

COURSE TOPICS

Managing Disk and Backup Volumes

- Commands to manipulate **ufs** disks/filesystems
  - partitioning disk surfaces with **format**
  - creating **ufs** file systems (**newfs**)
  - manipulating file system structures
  - verifying file system structures with **fsck**
  - making file systems available to software (**mount**)
- Creating and using **zfs** file systems
- Commands to manipulate archival volumes:
  - **tar** utility
  - **ufsdump** and **ufsrestore** utilities
  - **ufs** snapshots
  - **zfs** snapshots
  - **zfs** send and receive utilities

Monitoring System Activity

- Informational Utilities
- The **vmstat** utility
- The **iostat** utility
- The **sar** utility
- The **netstat** utility
- Maintaining swap and paging space(s)
- Building and using the **top** facility
- An Introduction to **kstat** and **DTrace**

Introduction to Solaris 11 Virtualization

- Zones concepts
- Configuring and installing a zone
- Basic zone administration

Oracle Solaris 11 System Administration

Essential Operations

COURSE TOPICS

Network Setup and Configuration (via NWAM)

- **TCP/IP** address selection
- Host names and related files
- Configuring network devices
- Network testing with **ping**
- Network utilities: **telnet, rlogin, rcp, rsh, ssh**
- Controlling network services via **SMF (inetadm)**

Maintaining System Integrity

- Login and user accounting
- Command/process level accounting
- Using **cron** tables
- Managing core and crash dump files

COURSE DURATION

This course normally requires five (5) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Solaris 11 Operating System Essentials** course, or has equivalent system time as a user.

Oracle Solaris 11 System Administration

Advanced Operations

COURSE DESCRIPTION

The **Oracle Solaris 11 (Advanced) System Administration** course introduces participants to: virtualization (**zones**), configuring access to networked directories and file systems (**NFS**), dynamic system tracing for system analysis (**DTrace**), core dump analysis, an introduction to the usage of access control lists (**ACL**) and the implementation of privileges in **Solaris 11**. In many areas of discussion, emphasis will be placed on writing tools for monitoring and/or access. These tools will include **Korn shell** scripts, **Perl** procedures, and **C language** programs.

Systems: **Oracle Solaris 11**, **SPARC** or **x86**/**x64** hardware platforms.

COURSE OBJECTIVES

On completion of this course, a system administrator should be able to:

- configure and setup **NFS** server and client systems
- create and control virtualization features (**zones**)
- configure a basic **Automated Installer (AI)** server
- use both file and directory **ACL**s
- distinguish between privilege and non-privilege aware programs
- control privileges at the executable and user process levels

COURSE TOPICS

Advanced Solaris 11 Installation Setup - part 1
IPS (Image Packaging Service) setups
local and remote
multiple boot environments
Updating **Solaris 11** via **SRU**s

Oracle Solaris 11 System Administration

Advanced Operations

COURSE TOPICS

Advanced Solaris 11 Installation Setup - part 2
- Configuring **Solaris 11** installation methods
  - text installer
  - Automated Installer (**AI**)
    - default
    - basic manifest customization
    - installadm service setup
    - multiple boot environments

Virtualization in Solaris 11
- virtualization types
  - hardware based
  - software based
- benefits of software virtualization
- overview of **Solaris 11** implementation (**zones**)

Features of Solaris Zones
- types (**whole root**) and templates
- creation and usage of control daemons
- networking capabilities
- operating states
- the **global** zone
- branded zones

Initial Operations on Solaris Zones
- configuring zones (features)
- booting zones
- installing zones (identification and attributes)
- using the zone virtual console
- zone shutdown
- zone deletion

Oracle Solaris 11 System Administration

Advanced Operations

COURSE TOPICS

Administrative Operations on Solaris Zones

- package management
- patch control, addition, removal
- **Solaris 11** update considerations with active zones
- renaming, moving, cloning, migrating zones
- backup and recovery mechanisms

Storage Access in Solaris Zones

- accessing **UFS** data
- sharing **zpool**/**zfs** global zone data
- **NFS** client/server capabilities

Security Features in Solaris 11

- File and Directory (**ZFS**) **ACL**s
- Using Role Based Access Control (**RBAC**)
- Principle of Least Privilege
- Assigning privileges to users and programs
- Using **Extended Policy** privilege assignment

Advanced Networking Features

- **NFS** client and server setup
- **automounter** setup and configuration
- **DNS** client setup
- **LDAP** client setup
- Introduction to **LDAP** structure and server
- Configuring local and remote **syslog**
- Configuring link failover via IPMP
- Link aggregation

Oracle Solaris 11 System Administration

Advanced Operations

COURSE TOPICS

Managing the Service Management Facility (SMF)

Implement a plan to configure services
Generating manifests with **svcbundle**
Configure **SMF** services
Recover a service from a snapshot
Troubleshoot **SMF** services

COURSE DURATION

This course normally requires **four** (4) **days**, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Oracle Solaris 11 System Administration** course, or has equivalent system time as a user, and is comfortable with basic systems administration functions.

Solaris 11 Systems Administration

Performance Management (Monitoring,Analysis,Modifications)

COURSE DESCRIPTION

The **Solaris 11 Systems Administration: Performance Management** course introduces participants to performance management principles, monitoring utilities / tools, and analysis for the **Solaris 11** Operating Environment. The course includes a review of Solaris subsystems, along with the utilities provided to monitor system efficiency including **sar** and the ***stat** family of tools. This revision also presents tools new to **Solaris 11**, including **dtrace** and **kstat**. In each area of discussion, emphasis will be placed on writing tools for monitoring and analysis. These tools will include **Korn shell** scripts, **Perl** procedures, and **C language** programs.

Systems: **Solaris 11**, **SPARC** or **x86/x64** hardware platforms.

COURSE OBJECTIVES

On completion of this course, a systems administrator should be able to:

- Describe performance management fundamentals
- Use the **Solaris 11 OS** and third-party tools to analyze performance
- Write tools in various languages
- Use **Solaris 11** performance data extensions (**kstat**, **dtrace**)
- View and set kernel-based tuning parameters
- Monitor and report on process and thread activity
- Modify **CPU** scheduling and virtual memory operations

COURSE TOPICS

Performance Basics

Describe the principles of performance analysis
Describe the performance management process
Terms used to describe performance aspects
Factors affecting system performance
Performance metrics
Virtual system caching

Solaris 11 Systems Administration

Performance Management (Monitoring,Analysis,Modifications)

COURSE TOPICS

Solaris 11 Monitoring Capabilities
- Monitoring tools provided with **Solaris 11**
  - ***stat** family of programs
  - **sar** / **sadc**
  - **kstat** (command, modules, libraries)
  - **dtrace** (introduction to usage)
- Third party / freely available tools
  - **SE Toolkit** programs
  - **ManageEngine**
  - tools from **OpenSolaris**
- User-written tools methods and rules
- Kernel tunables (viewing, changing)

Memory Management
- Memory layout and distribution
- Memory usage by the kernel
- Process creation
- Process virtual address space
- Buffer Cache (and allocation control)
- Shared Memory / Page Caching
- Paging and Swapping
- Monitoring Tools

CPU Management
- Software priorities concepts
- Impact of the nice parameter
- Priority boosting
- Using **dispadmin** to adjust **CPU** mechanisms
- Tuning Java threaded applications
- Process states
- Monitoring tools

Solaris 11 Systems Administration

Performance Management (Monitoring,Analysis,Modifications)

COURSE TOPICS

I/O Management

- Breakdown of disk I/O
- Measuring Disk and I/O
- **UFS** performance
  - File system structure concepts
  - File system caching
  - Name Lookup Caching
  - Tuning the Paged Buffer Cache Size
  - Monitoring tools
  - File system performance statistics
  - **UFS** parameters to improve efficiency
  - Alternative write strategies to UFS buffering
- **ZFS** performance
  - **zpool** creation considerations
  - **ZFS** file system parameters
  - **ZFS** compression performance
  - **ZFS** deduplication
- Monitoring Tools

Network Management

- **TCP/IP** Layers
- Socket controls
- Controlling network services
- Setting network buffer values
- Monitoring tools

Summaries

- Memory management
- **CPU** management
- **I/O** management
- Network management
- User program management

Solaris 11 Systems Administration

Performance Management (Monitoring,Analysis,Modifications)

COURSE DURATION

This course normally requires **three** (3) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Oracle Solaris 11 System Administration** course, or has equivalent system time as a user, and is comfortable with basic systems administration functions.

Solaris 11 Dynamic Systems Analysis

Kernel Statistics Framework (KSTATs) / Dynamic Tracing (DTrace)

COURSE DESCRIPTION

The **Solaris 11 Dynamic Systems Analysis** course introduces participants to the new facilities: **DTrace** and **KSTATS**. Using these tools, a systems administrator / systems programmer / systems analyst is able to watch kernel and systems level activity as they are occurring.

Systems: **Solaris 11**, **SPARC** or **x86**/**x64** hardware platforms.

COURSE OBJECTIVES

On completion of this course, the participant should be able to:

- Describe system troubleshooting fundamentals
- Understand the components in Dynamic Tracing (**DTrace**)
- Learn the basics of the **D** scripting language
- Write **DTrace** one-line and scripted procedures
- Monitor system level activity
- Look at the modules that comprise the Kernel Statics Framework
- Write **C** programs to access the **KSTATS** cells
- Build system monitors using **KSTATS** with shell and **Perl** scripts

COURSE TOPICS

Dynamic Tracing (DTrace) Architecture
- **DTrace** Components
  - Providers
  - Probes
  - Functions
  - Built-in variables
- Required privileges
- Zone considerations

Solaris 11 Dynamic Systems Analysis

Kernel Statistics Framework (KSTATs) / Dynamic Tracing (DTrace)

COURSE TOPICS

DTrace Procedures
- The **D** Scripting Language
  - Components
  - Techniques
- Writing **D** based scripts
  - one - liners
  - programmatic

DTrace Kernel Level Tracing
- Commonly traced areas
  - system calls
  - **TCP/IP**
  - kernel variables
  - open files
- Writing **D** based scripts
  - one - liners
  - programmatic

DTrace Application Level Tracing
- Commonly traced process areas
  - system calls
  - environment variables
  - open files

DTrace Impact Considerations
- Anonymous tracing
- Speculative tracing
- Performance impact of **DTrace**
- Use and size **DTrace** buffers

Solaris 11 Dynamic Systems Analysis

Kernel Statistics Framework (KSTATs) / Dynamic Tracing (DTrace)

COURSE TOPICS

Kernel Statistics Framework (KSTATs) Architecture
- **C** library functions (from **Sun**)
- kstat command interface
- shell scripting interface
- Perl module interface

KSTATs Procedures
- Accessing system areas
  - **CPU**
  - virtual memory
  - disk I/O
  - network I/O

Case Studies
- **DTrace**
- **KSTATs**

COURSE DURATION

This course normally requires **three** (3) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Oracle Solaris 11 System Administration** course, or has equivalent system time as a user, and is comfortable with basic systems administration functions and scripting, preferably with either **Korn shell**, **awk**/**nawk** and **Perl**.

Network Administration for the Solaris 11 Operating System

COURSE DESCRIPTION

This course provides participants with the **concepts** and **tools** needed to understand and configure selected **network server components** in the **Solaris 11** Operating System.

COURSE OBJECTIVES

On completion of this course, a systems adminstrator should be able to

COURSE TOPICS

Networking capabilities (overview)
- Networking protocols
  - Transmission Control Protocol/IP (**TCP/IP**)
  - **UDP**
  - **ARP**
  - **ICMP**

Networking configuration (hardware)
- **LAN**s
- **NIC** devices

Networking utilities (hardware)
- **netstat**
- **ifconfig**
- **snoop**
- **kstat**
- **arp**
- **ping**
- **dladm**

Networking configuration (automated)
- **sysconfig**
- **NWAM**

Network Administration for the Solaris 11 Operating System

COURSE TOPICS

Interface configuration via NWAM
- **dladm**
- **ipadm**
- **netcfg**
- **nscfg**
- configuration of **NCP**s
  - **NCU** values
- **flows**
- static and **DHCP** setups

Creating virtual (VNIC) interfaces
- connections to different network links
- usage in **Solaris 11** Zones

NIC channel bonding (aggregation)
- advantages and types
- creation (**dladm**)
- monitoring
- persistence via networking files

IP Network Multipathing (IPMP)
- Features of **IP** multipathing
- types (probe-based / link-based)
- configuring **IP** multipathing
- **MAC** addresses (**SPARC**)
- /**etc**/**notrouter**
- **in.multipathd** daemon
- configuration via **dladm** and **ipadm**
- troubleshooting and testing **IPMP**

Network Administration for the Solaris 11 Operating System

COURSE TOPICS

Routing Configurations
- static
  - **/etc/networks**
  - **/etc/defaultrouter**
  - **/etc/norouter**
  - **/etc/inet/routing.conf**
  - **route** command
  - **routeadm** utility
- dynamic
  - **/etc/gateways**
  - **in.routed** daemon
  - **routeadm** utility
- routing tables
- multi-homed host setup
- troubleshooting and testing routing

Configuring a DHCP server
- components (**dhcpmgr** / **dhcpconfig** / **pntadm**)
- control files and logging (**dhtadm**)
- troubleshooting a **DHCP** server

DNS (Domain Name System)
- concepts and functions
- Configure **DNS** servers
  - Primary (files and utilities)
  - Secondary (files and utilities)
- troubleshooting and testing **DNS** services

Configuring NTP (Network Time Protocol)
- time management in **Solaris 11**
- Configure an **NTP** server **(/etc/inet/ntp.server)**
- Configure an **NTP** client **(/etc/inet/ntp.client)**
- troubleshooting **NTP**

Network Administration for the Solaris 11 Operating System

COURSE TOPICS

Networking Security

- secure by default (**netservices**)
- **inetadm** default (**SMF**) properties
- service-specific (**SMF**) properties
- local / remote restrictions
- **FTP** (inbound) security controls
- **TCP Wrappers** configuration and usage
- **Solaris11 IP Filter Firewall**
  - configuration **(/etc/ipf/ipf.conf)**
  - packet filtering control **(/etc/ifp/pfil.ap)**
  - control (**ipf** / **ipfstat** / **ipmon**)
  - **troubleshooting and testing IP Filter Firewall**

COURSE DURATION

This course normally requires **three** (3) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Oracle Solaris 11 System Administration** course.