



Curtin College

in association with



Curtin University

Introduction to System Administration

Computer Systems (CS2000)

Trimester 2 2020

Who am I?

- ▶ Courtney Cowling Graduated Curtin in 2016
- ▶ Systems Engineer (CCNP, MCSE, various other certs)
- ▶ Lecturer and Unit Coordinator for Computer Systems
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Unit Details

- Unit focuses on System Administration
 - Scripting forms a large part of this work



Unit Summary



- Introduction to System Administration
- Network Operating Systems
- Network Services (Web, FTP, and DNS)
- Linux Administration, Permissions and File Systems
- User Administration
- Backup and Archiving, Disaster Recovery Planning
- Intro to BASH
- Scripting (advanced BASH) AWK, SED GREP - Regular Expressions
- Virtualization, Remote Services & Cloud Computing
- Network Security
- Big Data



Resources



- All material used in this course is available via Moodle
- Virtual machine images must be backed up to USB/hard disk or cloud
- All downloads (updates, patches, packages etc.) will be available from lab servers or via Moodle



What does Sysadmin really mean?

- Sysadmin is not just installing OS
 - Planning and designing a community of computers that **enable** users to get their job done
 - Logical and efficient network **design**
 - Equipment deployment
 - Planning of services
 - Security planning
 - Methodologies for repair and maintenance



SAGE – System administrator levels

- First, some definitions

- “Small uniform site”: <50 computers, all running the same operating system, and 20 or fewer users (A computer used by only the administrator does not qualify as a site)
- “Complex site”: up to 100 systems, running more than 2 different operating systems, and up to 100 users
- “Large complex site”: >100 computers, potentially running more than one operating system, and >100 or more users



SAGE Level I - Novice

➤ Skills:

- Can explain simple procedures in writing or verbally, has good phone skills
 - Familiar with OS commands/utilities at a user level
 - can edit files, use a shell, find users' home directories, navigate through the file system use i/o redirection, etc.
 - Is able to follow instructions well

➤ Background:

- Two years of college (TAFE) or equivalent education or experience




SAGE Level II - Junior

- Skills:

- Can train users in applications and OS fundamentals, and writing basic documentation
- High skill with OS commands/utilities
 - Can boot/shutdown a machine, can add/remove user accounts; also understands soft and hard links, distinctions between the kernel and the shell, etc.

- Background:

- One to three years of system administration experience



SAGE Level III - Intermediate

► Skills:

- Can write purchase justifications, train users in complex topics, make internal presentations, and interact positively with upper management.
 - Independent problem solving; self-direction
- Is comfortable with most aspects of OS
 - can configure mail, install/configure systems, setup printing, manage basic security, install software, use nslookup/dig
 - also understands paging and swapping, process communication, devices and drivers, file systems, basics of routing, etc.
- Can write scripts in some administrative language and do minimal debugging and modification of C programs

► Background:

- Three to five years systems administration experience



SAGE Level IV - Senior

➤ Skills:

- Can write proposals or papers, acts as vendor liaison, makes presentations to customers/clients/peers, and works closely with upper management
- Ability to solve problems quickly, often by use of automation
- Understands all aspects of OS
 - system tuning, client/server programming, design of consistent network-wide file system layouts, etc.
- Ability to program in an administrative language, to port C programs from one platform to another, and to write small C programs

➤ Background:

- More than five years previous systems administration experience



SAGE – Other skills to consider

- Heterogeneity Experience
 - *Experience working in an environment with more than one operating system*
- Networking Skills
 - *Experience configuring file systems, synchronization, automounters, license managers, NIS/NIS+, TCP/IP, high-speed networking, routers, modem pools/terminal servers, etc.*
- Security
 - *Experience building firewalls, deploying authentication systems, or applying cryptography*



SAGE – Other skills (cont.)

- Site Specialities

- Experience at sites with over 1000 computers, users, or disk space
- Experience coordinating multiple independent computer facilities (for example, working for the central group at a large company or university)
- Experience with high uptime requirements, disaster recovery, etc.

- Documentation

- Background in technical publications, documentation, or desktop publishing

- Databases

- Experience using relational databases, a database query language, or as a DBA



SAGE – Other skills (cont.)

- Hardware
 - Experience installing and maintaining network cabling, boards and memory, SCSI devices, peripherals, etc
 - Experience with board or component level diagnosis and repair
- Management
 - Budget responsibility
 - Experience in writing personnel reviews, and ranking processes
 - Experience in interviewing/hiring
- Local Environment Experience
 - Experience with the specific OS, applications, languages or with the work done by the users



Certifications



- Employers place great value on these
 - Many can be gained by simply reading a book
- Some are excellent, some of little or no value
 - Academically, commercially or relevance
- Some examples
 - Microsoft
 - CompTIA
 - Cisco
 - Novell
 - –RedHat
 - + hundred of others



CompTIA A+

- The CompTIA A+ certification is the industry standard for computer support technicians. The international, vendor neutral certification proves competence in areas such as installation, preventative maintenance, networking, security and troubleshooting.
- CompTIA A+ certified technicians also have excellent customer service and communication skills to work with clients.



CompTIA Server+

- CompTIA Server+ is an international, vendor-neutral certification for server support professionals with 18 to 24 months of experience with Industry Standard Server Architecture (ISSA) technology. Companies such as CDW Computer Centers and CompuCom require it of their IT employees. CompTIA Server+ certifies technical knowledge in areas such as RAID, SCSI and multiple CPUs, as well as capabilities with disaster recovery.



CompTIA Linux+

- CompTIA Linux+ is a vendor-neutral certification, generic across distributions, targeted to individuals with a minimum of six to 12 months of practical Linux experience. The CompTIA Linux+ exam covers fundamental management of Linux systems from the command line, user administration, file permissions, software configuration and management of Linux-based clients.
 - *May not cover everything, but should get close*



CompTIA Network+

- This is an international, vendor-neutral certification that proves a technician's competency in managing, maintaining, troubleshooting, installing and configuring basic network infrastructure.
 - *Will cover some in this unit, rest in following units that incorporate CCNA*



MCSA/MCSE

- ▶ These are internationally recognised, vendor-specific certifications that prove a technician's understanding and mastery of various products in the Microsoft family such as Microsoft 365, Server 2008-2019, and Azure
- ▶ Different levels of mastery from MCP up to MCSE
- ▶ This has very recently changed model to role based certifications



Cisco



- These certifications are internationally-recognised, vendor-specific certifications that prove a technician's ability to understand, design, configure and troubleshoot various Cisco products such as Routing & Switching
- Out of the scope of this unit
- Learn this later if you continue to the BTech (Computer Systems and Networking) at Curtin



Mark Burgess' Principles of System Administration

1. Policy is the foundation
2. Predictability (is the goal)
3. Scalability (is often important)
4. Minimum privilege (restriction of unnecessary privilege protects a system from accidental and malicious damage)
 - Corollary: don't work as Administrator/root
5. Communities (each member needs to consider ramifications of actions)
6. Uniformity (increases predictability – may decrease costs)



Mark Burgess' Principles of System Administration (cont.)

7. Variety (is a method of risk management and higher flexibility, may increase costs)
8. Delegation, aka 'Specialisation' (specialisation allows experts to develop, who can then do tasks more efficiently and more cost effectively)
9. Resource map: A resource map of a site aids the predictability of the system by allowing an administrator to learn about the parts of the system, understand inter-relationships and prepare a contingency plan for expected problems with the specific elements
 - Resource map: removes ambiguity and increases knowledge of the environment for administrators, users, and manager



Mark Burgess' Principles of System Administration (cont.)

Good ideas for students:

- Learn to learn independently
- Systematic and organised work habits
- Balance between reality (problems happen) vs. Utopia

Bad ideas for students:

- Expect a single right answer to every problem
- Get stuck due to frustration
- Expect the textbook/manual/instructor/guru to be able to accurately and completely answer every question

Evard's Life Cycle Model

Defines 5 states and 7 processes

- **New:** A completely new machine, just delivered etc.
- **Clean:** A machine with only the OS installed on it.
- **Configured:** A machine with all configuration and software on it.
- **Unknown:** A polluted machine. Extra applications installed, extra files etc. The machine has an unknown state in the administrator's perspective.
- **Off:** A retired machine.

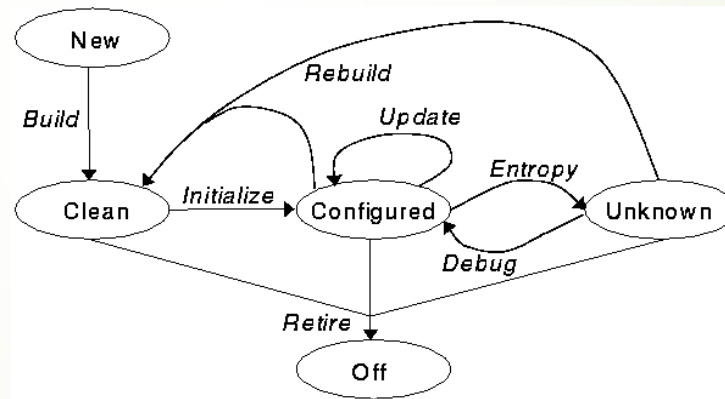
State	Process
New	Build
Clean	Initialise
Configured	Update
Unknown	Entropy
Off	Retire
	Debug
	Rebuild

Evard's Life Cycle Model (cont.)

- **Build:** The process of installing the Operating System for the first time.
- **Initialise:** Could also be called Configuring, installing required software and configurations.
- **Update:** Applying patches, configuration updates, extra software etc. Moving to a new known state
- **Entropy:** The process of polluting a system.
- **Debug:** The process of removing the pollution from the system.
- **Rebuild:** The same as build, but from another state than "New".
- **Retire:** Removing a machine from the system

State	Process
New	Build
Clean	Initialise
Configured	Update
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Evard's Life Cycle Model



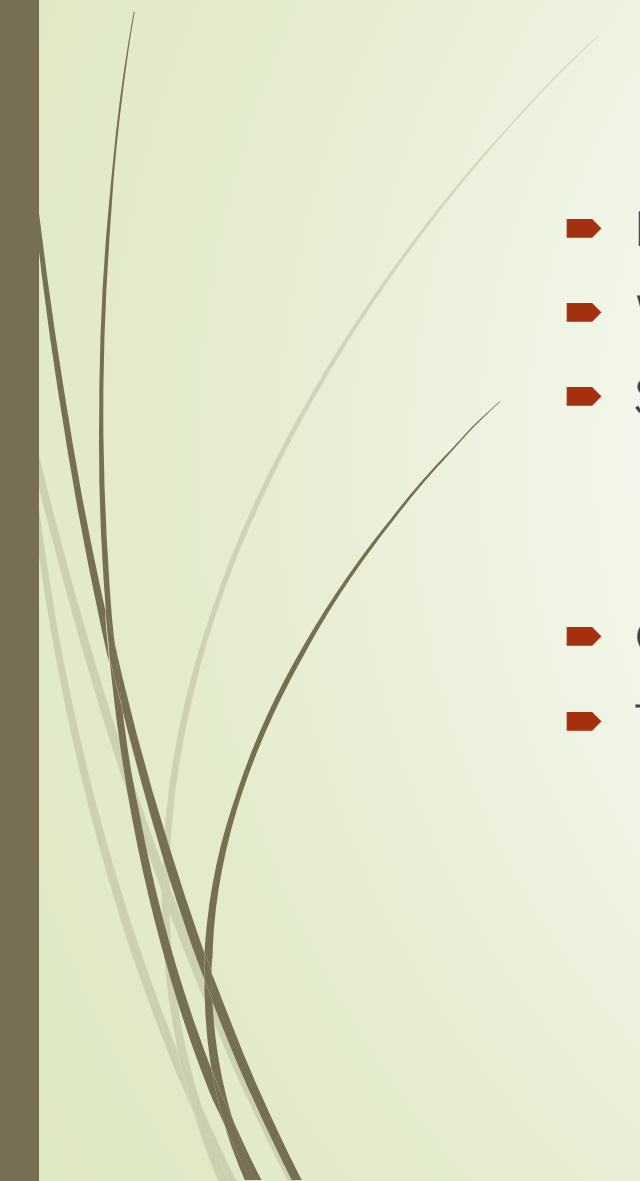


Server Fundamentals

- Examine Network Architecture
- Identify common server types and functions
 - Server refers to an application not necessarily the hardware
 - CompTIA Server + (2009 objectives)

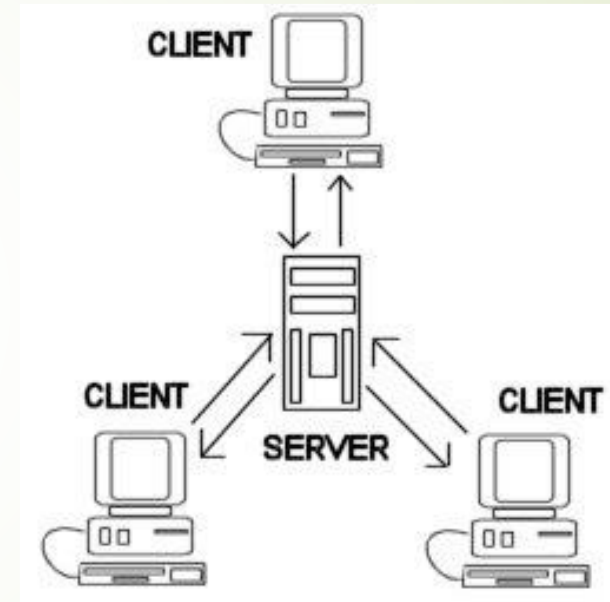


Network Architectures

- Desktop Computers
 - Workstations
 - Servers
 - High performance (ECC) memory, redundant network cards, power supplies etc.
 - Network OS
 - Computer Networks
 - Types of network Architecture
- 

Network Architectures (cont.)

- Client/Server networks
 - Server provides services to client
 - Mail, File, print, web etc
 - Most common configuration



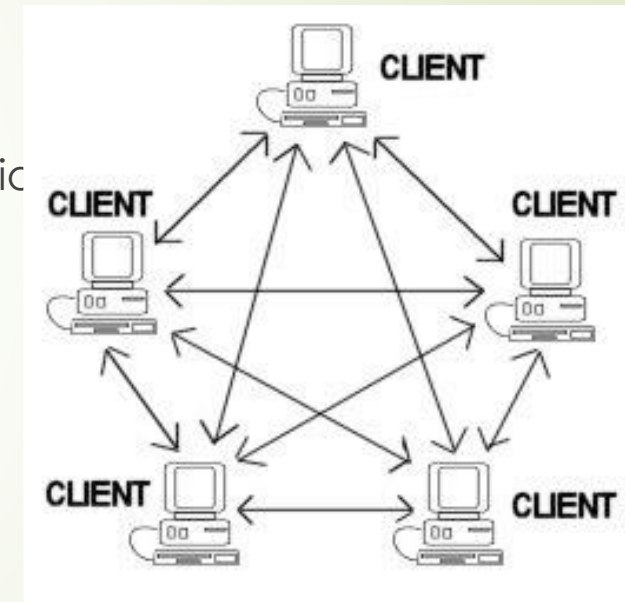


Network Architectures (cont.)

- Centralised Computer Network
 - Single computer provides all network comms and processing
 - Thin Client, mainframe etc
 - -Single point of failure
 - - High cost (arguable)
 - + Secure
 - + Central manageability
 - Well suited to certain applications eg. POS

Network Architectures (cont.)

- Peer to Peer
 - Fully Decentralised
 - Users authenticated by each individual workstation
 - - Insecure (often)
 - - Not scalable (not true see BitTorrent protocols)
 - - Poor manageability
 - + simple setup
 - + or - Managed by each user





Authentication Servers

- Remote Access Service (RAS)
 - Provides a subset of WAN services
 - Packet forwarding and remote connections for windows-based clients
 - Enables implementation of VPNs
 - Windows server 2003 and newer RAS is known as Routing and remote access services (RRAS)

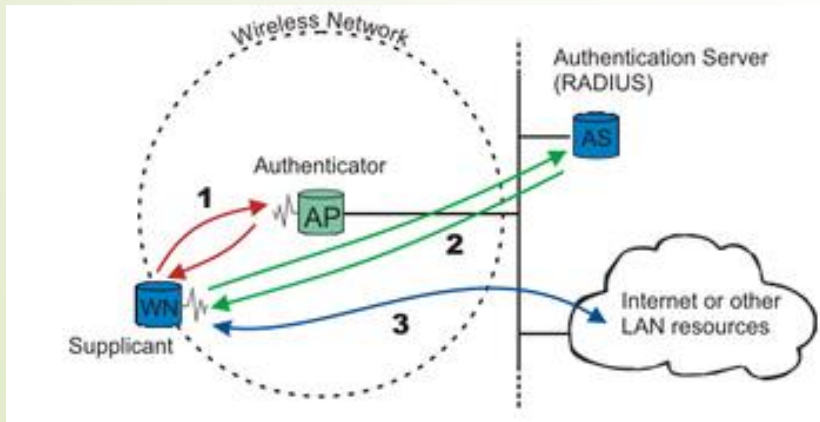


Authentication Servers (cont.)

- Remote Authentication Dial in User Service (RADIUS)
 - Stores permissions and configuration info to authenticate remote access network users
 - Scalable
 - 1 RADIUS server and several client Radius servers
 - Clients send authentication requests to main server
 - Alleviates the need for configuration on multiple servers
 - In Windows RADIUS is known as Internet Authentication Service/Network Policy Server (NPS from 2008)

Authentication Servers (cont.)

- 802.1x
 - Wireless authentication
 - Utilises one of several certificate-based mechanisms
 - Provides users with an encryption key
 - Static or dynamic
 - Provides port-based authentication, which involves communications between a supplicant, authenticator, and authentication server.



Wikipedia, a great first place to look but NEVER trust it!



Authentication Servers (cont.)

- Lightweight Directory Access Protocol (LDAP)
 - *Utilises Directory System Agents or Directory Services Server*
 - *DSAs supply the services that provide access to the data store*
 - *LDAP roughly equates to Active Directory in windows and NDS in Novell*
 - *Open source*
 - *Lots more on LDAP in 3rd year*



Other Services



- Web
- FTP
- DNS
- DHCP
- WINS
- NTP
- Proxy
- File
- Print (Cups etc)
- Mail
- Firewall
- Routing
- Quicktime streaming
- VoIP
-



Server Hardware

- What makes it a server?
 - Form factor?
 - Processor?
 - Memory?
 - Disk sub-system?
 - Usually low-end graphics, sound card and monitor
- The Operating System!

Processor Speed

- Not clock speed!!
 - Cache, pipeline length and many other factors influence performance
 - RISC vs CISC
 - Good article here, old but still relevant
<http://www.osnews.com/story/3997>

Notebook	Time to Calculate Pi to 2 Million Digits
Apple Powerbook (1.67 GHz G4)	1m 36s
Gateway 7426GX (AMD Athlon 3700+)	1m 39s
IBM ThinkPad T43 (1.86GHz Alviso Pentium M)	1m 45s
Fujitsu LifeBook N3510 (1.73 GHz Alviso Pentium M)	1m 48s
IBM ThinkPad T41 (1.6GHz Banias Pentium M)	2m 23s
Compaq R3000T (Celeron 2.8GHz)	3m 3s
Dell Inspiron 600m (1.6 GHz Dothan Pentium M)	2m 10s
Dell Inspiron 8600 (1.7GHz Banias Pentium M)	2m 28s



Next week Network Operating Systems

- Laboratory starts from next week