Lecture 1: Introduction to System Administration

- **Reading:** ESA Chapter 1; SAGE Job Descriptions (LAH pp13-16)
- Go over syllabus
- Introduction to System Administration: SAGE levels, Microsoft certifications (MCSE/MCSA) and Red Hat certifications (RHCE/RHCT/RHCA/RHSS)
- Mark Burgess' Principles of System Administration

Lecture 1: Introduction to System Administration (cont.)

- Financial and presentation aspects
- SUM CRUD model
- Evard's 5 states of machines
- Video of Thunderbird HPC build

Syllabus

- See:
  - syllabusF10.html
  - 4417SyllabusFall2010.doc

SAGE

- **SAGE (Systems Administrators Guild) - organized with the following goals:**
  - Advance the status of computer system administration as a profession
  - Establish standards of professional excellence and recognize those who attain them
  - Develop guidelines for improving the technical and managerial capabilities of members of the profession
  - Promote activities that advance the state of the art or the community

SAGE – Systems 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 or equivalent education or experience

SAGE Level I - Novice (cont.)

Other desirables:

- A degree or certificate in computer science or a related field
- Previous experience in customer support, computer operations, system administration or another related area; Motivated to advance in the profession

Appropriate responsibilities:

- Performs routine tasks under direct supervision
- Acts as a front-line interface to users, accepting trouble reports and dispatching them to appropriate system administrators

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 II - Junior (cont.)

Other desirables:

- A degree in computer science or a related field
- Familiarity with networked/distributed computing environment concepts; for example, can use the route command, add a workstation to a network, and mount remote file systems
- Ability to write scripts in some administrative language (Perl, VBScript, shell, etc.)
- Programming experience in any applicable language

Appropriate responsibilities:

- Administers a small site alone or assists in the administration of a larger system; Works under general supervision

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 III - Intermediate (cont.)

Other desirables:

- A degree in computer science or a related field
- Significant programming background in any applicable language

Appropriate responsibilities:

- Administers a mid-sized site alone or assists in administration of a large site and manages novice system administrators or operators
- Initiates some new responsibilities and helps plan for the future
- Evaluates/recommends purchases; has strong influence on purchasing

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 Level IV - Senior (cont.)

Other desirables:

- A degree and publications in computer science or a related field
- Extensive programming background in any applicable language

Appropriate responsibilities:

- Works under senior management to design/implement complex networks of machines or manage a large site or network
- Establishes/recommends policies on system use and services
- Supervises system administrators, system programmers, or others of equivalent seniority
- Has purchasing authority and responsibility for purchase justification

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; Experience with passwords, uids/gids, permissions, file system integrity, security packages

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

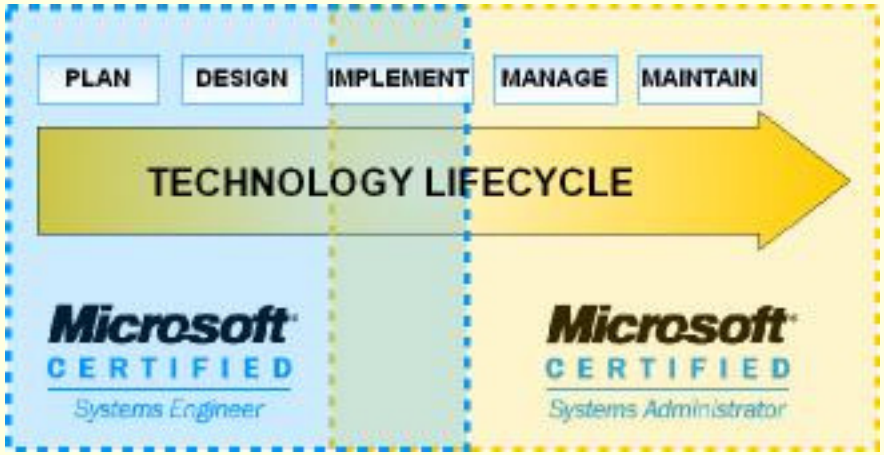
Management

- 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

Microsoft Certifications



- MCSE – **7 Exams (4 networking, 1 client, 1 design, 1 elective)**
- MCSA – **4 Exams (2 networking, 1 client, 1 elective)**

Microsoft Certifications - MCSE

- The MCSE certification is appropriate for: Systems engineers, Technical support engineers, Systems analysts, Network analysts, Technical consultants
- The Typical Computing Environment of an MCSE is a complex computing environment of medium to large organizations
- Candidates should have one year of experience implementing and administering a network operating system that has:
  - 200 to 26,000 supported users
  - Five to 150 physical locations
  - Network services and applications (file and print, database, messaging, firewall, desktop management, webs, etc.)
  - Individual offices/users connecting remotely to the corporate network and connecting corporate networks to the Internet
- Additionally , candidates should have one year of experience:
  - Implementing and administering a desktop operating system
  - Designing a network infrastructure

Microsoft Certifications - MCSA

- The MCSA certification is appropriate for: Network administrators, Network engineers, Systems administrators, Information technology professionals, Information systems administrators, Network technicians, Technical support specialists
- The typically complex computing environment of an MCSA is a medium to large company
- Candidates should have 6 to 12 months of experience administering systems in environments that have the following characteristics:
  - 250 to 5,000 or more users
  - Three or more physical locations
  - Three or more domain controllers
  - Network services and resources such as messaging, database, file and print, proxy server, firewall, public key infrastructure (PKI), Internet, intranet, remote access, and client computer management
  - Branch offices/users connecting remotely to the corporate network and connecting corporate networks to the Internet

Microsoft Certifications - MCSE Exams

- Networking
  - Exam 70–290: Managing and Maintaining a Microsoft Windows Server 2003 Environment
  - Exam 70–291: Implementing, Managing, and Maintaining a Microsoft Windows Server 2003 Network Infrastructure
  - Exam 70-293: Planning and Maintaining a Microsoft Windows Server 2003 Network Infrastructure
  - Exam 70-294: Planning, Implementing, and Maintaining a Microsoft Windows Server 2003 Active Directory Infrastructure

Microsoft Certifications - MCSE Exams (cont.)

- Client
  - Exam 70–270: Installing, Configuring, and Administering Microsoft Windows® XP Professional
    OR
  - Exam 70-210: Installing, Configuring, and Administering Microsoft Windows 2000 Professional
- Design
  - Exam 70-297: Designing a Microsoft Windows Server 2003 Active Directory and Network Infrastructure
    OR
  - Exam 70-298: Designing Security for a Microsoft Windows Server 2003 Network
- Electives – Any of a dozen or so exams on topics such as SMS, SQL, Exchange, etc.

Microsoft Certifications - MCSA Exams

- Networking
  - Exam 70–290: Managing and Maintaining a Microsoft Windows Server 2003 Environment
  - Exam 70–291: Implementing, Managing, and Maintaining a Microsoft Windows Server 2003 Network Infrastructure
- Client
  - Exam 70–270: Installing, Configuring, and Administering Microsoft Windows® XP Professional
    OR
  - Exam 70-210: Installing, Configuring, and Administering Microsoft Windows 2000 Professional
- Electives – Any of a half dozen or so exams on topics such as SMS, SQL, Exchange, etc.

Red Hat Certifications - RHCE

- Red Hat Certified Technician
  - The entry-level **Red Hat Certified Technician** (**RHCT**) certification focuses on single-system administration.
- Red Hat Certified Engineer
  - The **Red Hat Certified Engineer** (**RHCE**) program expands the RHCT with a focus on services and security.
- Red Hat Certified Architect
  - The **Red Hat Certified Architect** (**RHCA**) requires an additional five endorsements to the RHCE that adds an enterprise-level focus. From clustering to deploying systems, these five exams ensure the student can deploy systems at the Enterprise level.
- Red Hat Certified Security Specialist
  - The **Red Hat Certified Security Specialist** (**RHCSS**). This certification includes two endorsement exams from the RHCA plus an SELinux exam.

Red Hat Certifications - RHCT

- RHCT – One exam, with two parts:
  - Section I: Troubleshooting and System Maintenance (1 hour)
  - Section II: Installation and Configuration (2 hours)
  - Passing the RHCT exam requires the following:
    - Successful completion of all troubleshooting problems in Section I
    - A score of 70 percent or higher on Section II

Red Hat Certifications - RHCE

- RHCE – One exam, with two parts:
  - Section I: Troubleshooting and System Maintenance (2.5 hours)
  - Section II: Installation and Configuration (3 hours)
  - Passing the RHCE exam requires the following:
    - a score of 80 or higher on Section I, consisting of five compulsory and five optionals problems
    - successful completion of Section I compulsory problems within 1 hour
    - 70 percent or more on the RHCT-level skills in Section II
    - 70 percent or more on the RHCE-level skills in Section II

Red Hat Certifications - RHCA

- RHCE, plus the following exams:
  - EX333 Security: Network Services
  - EX401 Deployment, Virtualization, and Systems Management
  - EX423 Directory Services and Authentication
  - EX436 Clustering and Storage Management
  - EX442 System Monitoring and Performance Tuning

Red Hat Certifications - RHCA

- RHCE, plus the following exams:
  - EX333 Security: Network Services
  - EX423 Directory Services and Authentication
  - EX429 SELinux Policy Administration

Other Certification/Training

- Linux Professional Institute (LPI)
- CompTIA
- Novell
- O'Reilly School of Technology

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)

4- 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 'Specialization' (specialization 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

9b- Resource map: removes ambiguity and increases knowledge of the environment for administrators, users, and managers

Mark Burgess' Principles of System Administration (cont.)

Good ideas for students:

* learn to learn independently
* systematic and organized 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

Financial and presentation aspects

- Software licensing models
- Capital vs. recurring
- Pie charts
- One pagers
- Some choice is good (Small/Medium/Large, Bronze/Silver/Gold)
- Paper copies beat powerless (lack of) PowerPoint every time
- Technical vs. non-technical audiences

SUM CRUD model

- Software
- Users
- Machines

- Create
- Read
- Update
- Delete

Evard's 5 states of machines

- New - A new machine
- Clean - A computer with the OS installed, but not configured to work in the environment
- Configured - A computer that is configured correctly according to the requirements of the computing environment
- Unknown - A computer that has been misconfigured, or has gotten out of date, or perhaps been borrowed by an intern and returned with stains on it
- Off - Retired/surplussed

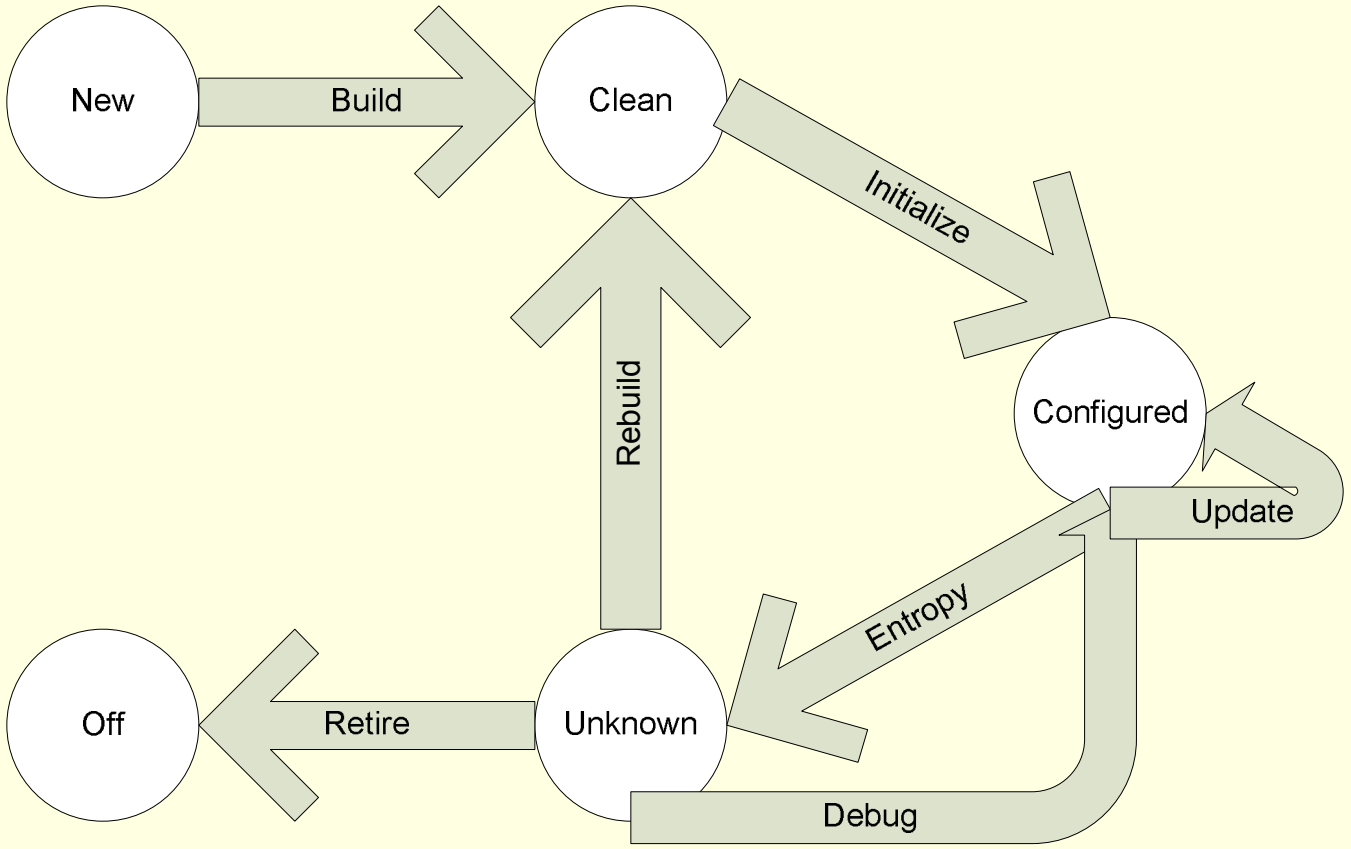
Evard's 5 states of machines (cont.)

- Moving between states:
  - Build - During the build process, the operating system is installed on the machine
  - Initialize – Often directly after, or part of, build the process; This will typically include things like network configuration, naming, and may include OS patches and other changes
  - Update - At some point after the initialization, the computer will probably have to be modified in order to bring the machine into conformance with the current requirements; In most cases, this will happen continually for the lifetime of the computer

Evard's 5 states of machines (cont.)

- Entropy - This refers to the gradual process of change that results in a computer that has an unknown state; The causes for this are numerous; they include, for example, undisciplined changes made to the machine, major changes in the environment, or unexplained problems
- Debug - This refers to the process of debugging an ``unknown'' machine, and getting it back into spec
- Rebuild - In some cases, a machine will need to be rebuilt, either because of some kind of problem or for large scale change
- Retire - This is the process of turning a machine off; In some sites, there is an official process for this, in others, it merely involves turning the computer off or forgetting it exists

Evard's 5 states of machines (cont.)



Time for Video?

- TBirdTLFast1280.wmv

  (on cscidc\i)

Up Next

- Before next class
  - HW1 – assigned
- Next class
  - (Lab) Present hw1 and class vote -- each group gets 10 minutes; Discussion questions: who is cheapest? who would you hire to do the next job? Are those different?
  - User Management