CIT 470: Advanced Network and System Administration

Introduction

Who am I?

James Walden
Email: waldenj@nku.edu
Web: http://faculty.cs.nku.edu/~waldenj
Phone: (859) 572-5571
Office Hours: T 2:50-4:00
W 2:30-3:30
R 9:00-10:00

Topics

1. What is system administration?
2. What do sysadmins do?
3. Principles and First Steps
4. Organizations and Certifications
5. Maturity and Complexity
6. Ethics
What is a system?

System: An organized collection of computers interacting with a group of users.

System State

System policy: specification of a system’s configuration and its acceptable usage.

System state \( S(t) \): the current configuration (files, kernel, memory or CPU usage) of a system.

Ideal states \( S^*(t) \): states of the system that match the system policy. Over time, the system state shifts away from the ideal state.

System administration: modifying the system to bring it closer to \( S^*(t) \).

What do sysadmins do?

Small org: sysadmin can be entire IT staff
- Phone support
- Order and install software and hardware
- Fix anything that breaks from phones to servers
- Develop software

Large org: sysadmin is one of many IT staff
- Specialists instead of “jack of all trades”
- Database admin, Network admin, Fileserver admin, Help desk worker, Programmers, Logistics
Common Activities

1. Add and remove users.
2. Add and remove hardware.
3. Perform backups.
4. Install new software systems.
5. Troubleshooting.
7. Auditing security.
8. Help users.

User Management

Creating user accounts
- Consistency requires automation
- Startup (dot) files

Namespace management
- Usernames and UIDs
- Multiple namespaces or SSI?

Removing user accounts
- Consistency requires automation
- Many accounts across different systems

Hardware Management

Adding and removing hardware
- Configuration, cabling, etc.

Purchase
- Evaluate and purchase servers + other hardware

Capacity planning
- How many servers? How much bandwidth, storage?

Data Center management
- Power, racks, environment (cooling, fire alarm)

Virtualization
- When can virtual servers be used vs. physical?
Backups

Backup strategy and policies
– Scheduling: when and how often?
– Capacity planning
– Location: on-site vs. off-site.

Monitoring backups
– Checking logs
– Verifying media

Performing restores when requested

Software Installation

Automated consistent OS installs
– Desktop vs. server OS image needs.

Installation of software
– Purchase, find, or build custom software.

Managing software installations
– Distributing software to multiple hosts.
– Managing multiple versions of a software pkg.

Patching and updating software

Troubleshooting

Problem identification
– By user notification
– By log files or monitoring programs

Tracking and visibility
– Ensure users know you’re working on problem
– Provide an ETA if possible

Finding the root cause of problems
– Provide temporary solution if necessary
– Solve the root problem to permanently eliminate
System Monitoring

Automatically monitor systems for
- Problems (disk full, error logs, security)
- Performance (CPU, mem, disk, network)

Provides data for capacity planning
- Determine need for resources
- Establish case to bring to management

Helping Users

Request tracking system
- Ensures that you don’t forget problems.
- Ensures users know you’re working on their problem; reduces interruptions, status queries.
- Lets management know what you’ve done.

User documentation and training
- Policies and procedures

Schedule and communicate downtimes

Communicate

Customers
- Keep customer appraised of process.
  - When you’ve started working on a request with ETA.
  - When you make progress, need feedback.
  - When you’re finished.
- Communicate system status.
  - Uptime, scheduled downtimes, failures.
- Meet regularly with customer managers.

Managers
- Meet regularly with your manager.
- Write weekly status reports.
Specialized Skills

**Heterogeneous Environments**
Integrating multiple OSes, hardware types, or network protocols, distributed sites.

**Databases**
SQL RDMS

**Networking**
Complex routing, high speed networks, voice.

**Security**
Firewalls, authentication, NIDS, cryptography.

**Storage**
NAS, SANs, cloud storage.

**Virtualization and Cloud Computing**
VMware, cloud architectures.

Qualities of a Successful Sysadmin

**Customer oriented**
- Ability to deal with interrupts, time pressure
- Communication skills
- Service provider, not system police

**Technical knowledge**
- Hardware, network, and software knowledge
- Debugging and troubleshooting skills

**Time management**
- Automate everything possible.
- Ability to prioritize tasks: urgency and importance.

First Steps to Better SA

**Use a request system.**
- Customers know what you're doing.
- You know what you're doing.

**Manage quick requests right**
- Handle emergencies quickly.
- Use request system to avoid interruptions.

**Policies**
- How do people get help?
- What is the scope of responsibility for SA team?
- What is our definition of emergency?

**Start every host in a known state.**
Principles of SA

Simplicity
- Choose the simplest solution that solves the entire problem.
- Work towards a predictable system.

Clarity
- Choose a straightforward solution that’s easy to change, maintain, debug, and explain to other SAs.

Generality
- Choose reusable solutions that scale up; use open protocols.

Automation
- Use software to replace human effort.

Communication
- Be sure that you’re solving the right problems and that people know what you’re doing.

Basics First
- Solve basic infrastructure problems before advanced ones.

Organizations

USENIX: Advanced Computing Systems Association
LISA: Large Installation System Administration
SAGE: System Administration Guild
LOPSA: League of Professional System Administrators

Types of Sites

Small
- 2-10 computers, 1 OS, 2-20 users.
- Small staff size requires outsourcing to obtain most specialized skills.

Midsized
- 11-100 computers, 1-3 OSes, 21-100 users.

Large
- 100+ computers, multiples OSes, 100+ users.
- Outsources to reduce costs, some specializations.
Certifications

- CCNA, CCNP, CCIE (Cisco)
- cSAGE (SAGE)
- MCSA (Microsoft)
- RHCE (Red Hat)
- SCSA (Sun)
- VCP (VMware)

SAGE Job Descriptions

Novice
- OS familiarity, help desk skills

Junior
- Can use OS system administration tools (370)

Intermediate
- Understanding of distributed computing, common servers, automate small tasks, independent action

Senior
- Understanding of scaling issues, including capacity planning, solve problems by addressing root cause, higher level programming abilities, write proposals for purchasing, data center planning, etc.

SA Maturity Model (SAMM)

1. Ad Hoc
   - Ad-hoc non-repeatable solutions, firefighting.

2. Repeatable
   - Some repeatable processes.

3. Defined
   - Documented standard processes

4. Managed
   - Process effectiveness measured, adapted.

5. Optimized
Maturity and Complexity

<table>
<thead>
<tr>
<th>Complexity: Increasing numbers of systems and/or services</th>
<th>Maturity</th>
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<tbody>
<tr>
<td>Constant firefighting, high downtime</td>
<td>Low downtime, high efficiency</td>
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<tr>
<td>Works, but hard to scale up</td>
<td>Scalable but time lost in process.</td>
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Tool Maturity Levels

1. Ad Hoc
   - OS GUI, CLI, or web administration interfaces.
2. Repeatable
   - Version control (RCS, SVN, GIT), request tracker
3. Defined
   - Automatic monitoring (Nagios, monit, god)
4. Managed
   - Configuration management (AutomateIt, cfengine)
5. Optimized

SAGE Code of Ethics

- Professionalism
- Personal Integrity
- Privacy
- Laws and Policies
- Communication
- System Integrity
- Education
- Social Responsibility

http://www.sage.org/ethics/
Terry Childs Case

Network administrator for San Francisco
– CCIE who built city’s FiberWAN network
Terry was only person with router passwords
– IT department acknowledges knowing that
– He was on-call 24x7x365 to resolve issues
Terry refused to give passwords to boss
– Cited fears that they would be misused by management, outside contractors.
What was the right thing for Terry to do?

Key Points
 Definitions
– System, system state, ideal state, administration
Principles of System Administration
– Simplicity
– Clarity
– Generality
– Automation
– Communication
– Basics First
System Administration Maturity Model
– Maturity and complexity, tools

References