

Network Management & Monitoring Overview

Network Design and Operations

July 24, 2009
Eugene, Oregon, USA

hervey@nsrc.org



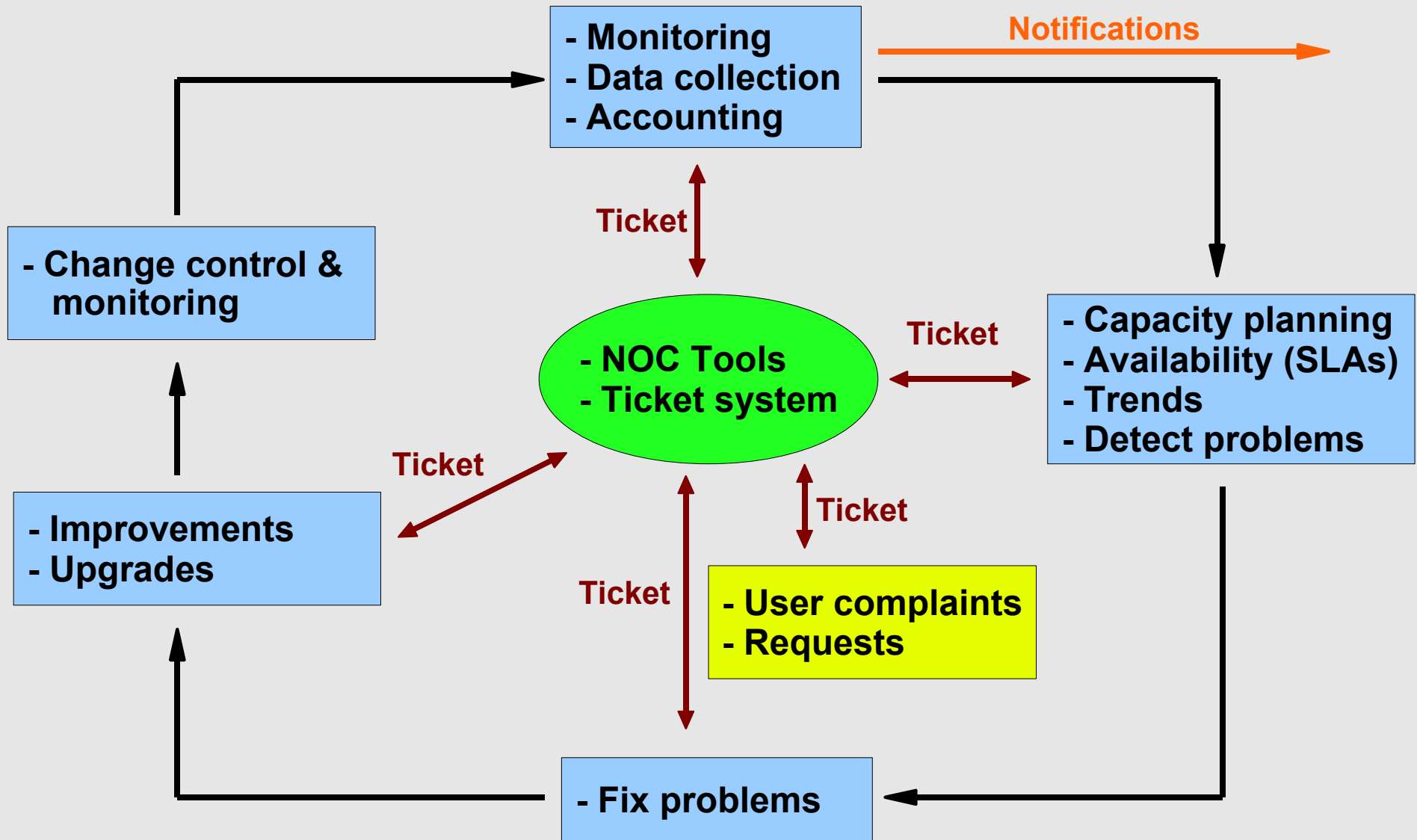
Introduction

- This is a *big* topic...
- There are a lot of tools to choose from:
 - Open Source
 - Commercial
 - Linux/Unix-based
 - Windows-based
 - Network Vendor tools (Cisco, Juniper, others)
- No one combination of tools is correct for everyone.
- What you need to know about your network will drive your choice of tools.

What is network management?

- System & Service monitoring
 - Reachability, availability
- Resource measurement/monitoring
 - Capacity planning, availability
- Performance monitoring (RTT, throughput)
- Statistics & Accounting/Metering
- Fault Management (Intrusion Detection)
 - Fault detection, troubleshooting, and tracking
 - Ticketing systems, help desk
- Change management & configuration monitoring

The Big picture



Why network management?

- Make sure the network is up and running. Need to monitor it.
 - Deliver projected SLAs (Service Level Agreements)
 - Depends on policy
 - What does your management expect?
 - What do your users expect?
 - What do your customers expect?
 - What does the rest of the Internet expect?
 - Is 24x7 good enough ?
 - There's no such thing as 100% uptime

Why network management? - 2

- Since you have switches that support SNMP...
- Use public domain tools to ping every switch and router in your network and report that back to you
 - Nagios – <http://nagios.org/>
 - Sysmon - <http://www.sysmon.org/>
 - Open NMS - <http://www.opennms.org/>
- Goal is to know your network is having problems before the users start calling.

Why network management ? - 3

- What does it take to deliver 99.9 % uptime?
 - $30,5 \times 24 = 762$ hours a month
 - $(762 - (762 \times .999)) \times 60 = 45$ minutes maximum of downtime a month!
- Need to shutdown 1 hour / week?
 - $(762 - 4) / 762 \times 100 = 99.4 \%$
 - Remember to take planned maintenance into account in your calculations, and inform your users/customers if they are included/excluded in the SLA
- How is availability measured?
 - In the core? End-to-end? From the Internet?)

Why network management? - 4

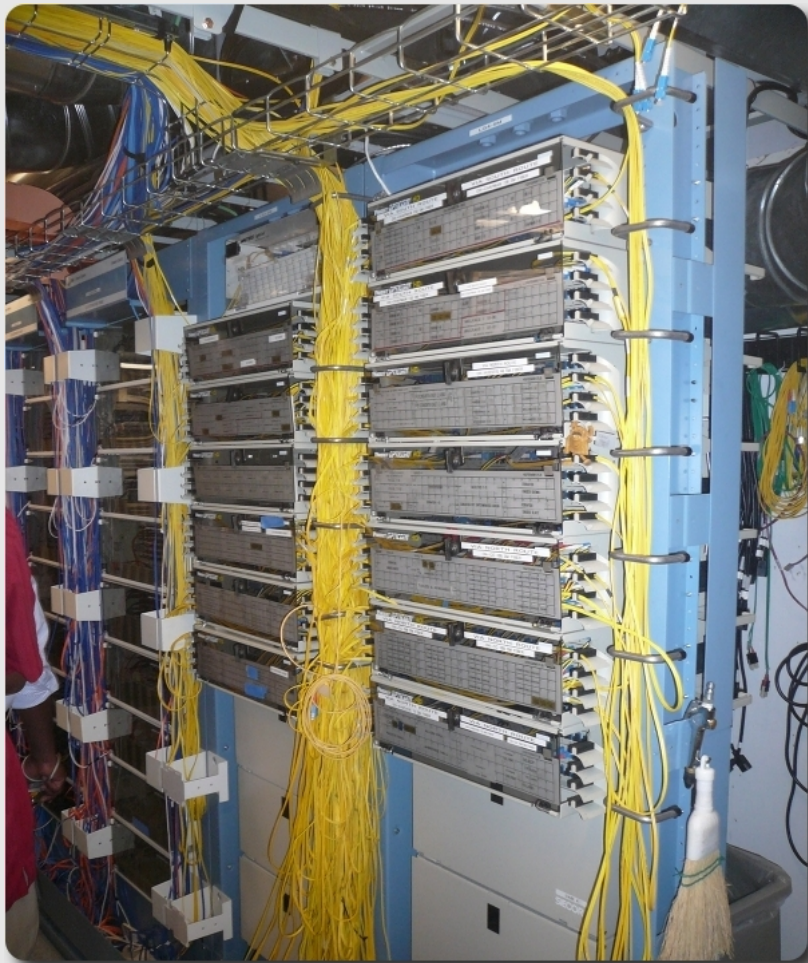
- Know when to upgrade
 - Is your bandwidth usage too high?
 - Where is your traffic going?
 - Do you need to get a faster line, or more providers?
 - Is the equipment too old?
- Keep an audit trace of changes
 - Record all changes
 - Makes it easier to find cause of problems due to upgrades and configuration changes
- Where to consolidate all these functions?
 - In the Network Operation Center (NOC)

The Network Operations Center (NOC)

- Where it all happens
 - Coordination of tasks
 - Status of network and services
 - Fielding of network-related incidents and complaints
 - Where the tools reside ("NOC server")
 - Documentation including:
 - Network diagrams
 - database/flat file of each port on each switch
 - Network description
 - Much more as you'll see a bit later.

Documentation

Some of you asked, “*How do you keep track of it all?*” ...



...In the end, “we”
wrote our own
software...

{net.}
NETwork DOcumentation Tool

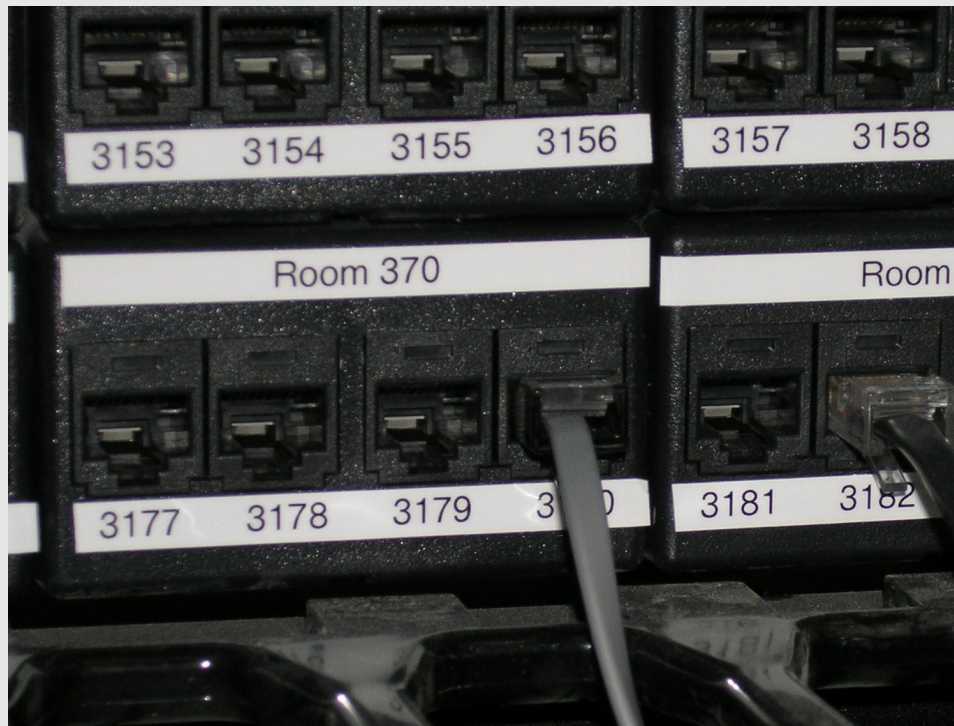
Netdot!

Documentation

- Some basics, such as documenting your switches...
 - What is each port connected to?
 - Can be simple text file with one line for every port in a switch:
health-switch1, port 1, Room 29 – Director's office
health-switch1, port 2, Room 43 – Receptionist
health-switch1, port 3, Room 100 – Classroom
health-switch1, port 4, Room 105 – Professors Office
.....
health-switch1, port 25, uplink to health-backbone
 - This information might be available to your network staff, help desk staff, via a wiki, software interface, etc.
 - Remember to label your ports!



Documentation: Labeling

Nice :-)

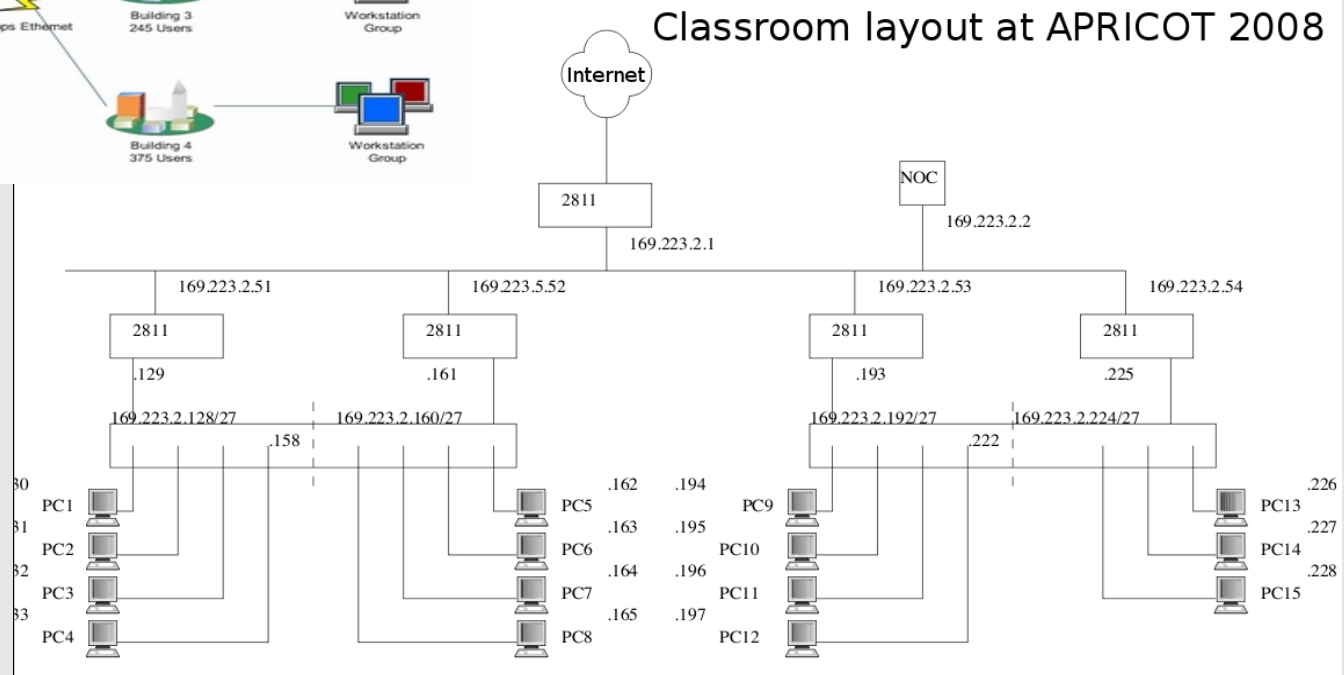
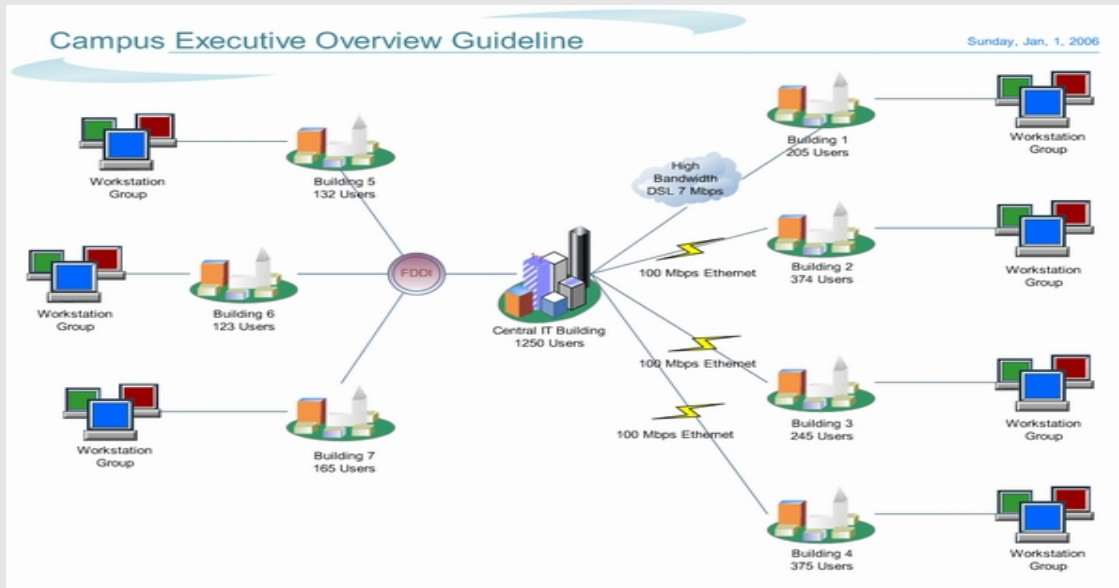


Documentation: Software and Discovery

There are some other Open Source network documentaiton projects, including:

-  **Maintain** powerful network management to manage DHCP and DNS entries.
 - See <http://maintainproject.osuosl.org/about> for a humorous history.
-  **Netdisco:**
 - Locate a machine on the network by MAC or IP and show the switch port it lives at.
 - Turn Off a switch port while leaving an audit trail. Admins log why a port was shut down.
 - Inventory your network hardware by model, vendor, switch-card, firmware and operating system.
 - Report on IP address and switch port usage: historical and current.
 - Pretty pictures of your network.
- **[[IPplan]]** is a web based, multilingual, TCP IP address management (IPAM) software and tracking tool.

Documentation: Diagrams



Documentation: Diagramming Software

Windows Diagramming Software

- Visio:
<http://office.microsoft.com/en-us/visio/FX100487861033.aspx>
- Ezdraw:
<http://www.edrawsoft.com/>

Open Source Diagramming Software

- Dia:
<http://live.gnome.org/Dia>
- Cisco reference icons
<http://www.cisco.com/web/about/ac50/ac47/2.html>
- Nagios Exchange:
<http://www.nagiosexchange.org/>

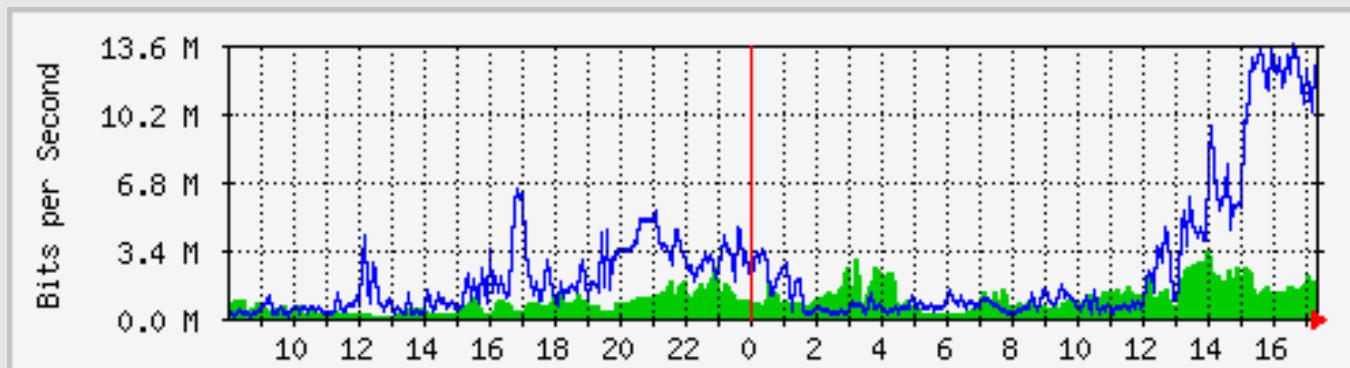
Network monitoring systems and tools

- Three kinds of tools
 - **Diagnostic tools** – used to test connectivity, ascertain that a location is reachable, or a device is up – usually active tools
 - **Monitoring tools** – tools running in the background (“daemons” or services), which collect events, but can also initiate their own probes (using diagnostic tools), and recording the output, in a scheduled fashion.
 - **Performance tools** – tell us how our network is handling traffic flow.

Network monitoring systems and tools - 2

Performance Tools

- Key is to look at each router interface (probably don't need to look at switch ports).
- Two common tools:
 - <http://cricket.sourceforge.net/>
 - <http://www.mrtg.com/>



Network monitoring systems and tools - 3

- Active tools
 - Ping – test connectivity to a host
 - Traceroute – show path to a host
 - MTR – combination of ping + traceroute
 - SNMP collectors (polling)
- Passive tools
 - log monitoring, SNMP trap receivers, NetFlow
- Automated tools
 - SmokePing – record and graph latency to a set of hosts, using ICMP (Ping) or other protocols
 - MRTG/RRD – record and graph bandwidth usage on a switch port or network link, at regular intervals

Network monitoring systems and tools - 4

- Network & Service Monitoring tools
 - Nagios – server and service monitor
 - Can monitor pretty much anything
 - HTTP, SMTP, DNS, Disk space, CPU usage, ...
 - Easy to write new plugins (extensions)
 - Basic scripting skills are required to develop simple monitoring jobs – Perl, Shellscript...
 - Many good Open Source tools
 - Zabbix, ZenOSS, Hyperic, ...
- Use them to monitor reachability and latency in your network
 - Parent-child dependency mechanisms are very useful!

Network monitoring systems and tools - 5

- Monitor your critical Network Services
 - DNS
 - Radius/LDAP/SQL
 - SSH to routers
- How will you be notified ?
- Don't forget log collection!
 - Every network device (and UNIX and Windows servers as well) can report system events using syslog
 - You **MUST** collect and monitor your logs!
 - Not doing so is one of the most common mistakes when doing network monitoring

Network Management Protocols

- SNMP – Simple Network Management Protocol
 - Industry standard, hundreds of tools exist to exploit it
 - Present on any decent network equipment
 - Network throughput, errors, CPU load, temperature, ...
 - UNIX and Windows implement this as well
 - Disk space, running processes, ...
- SSH and telnet
 - It's also possible to use scripting to automate monitoring of hosts and services

SNMP Tools

- Net SNMP tool set
 - <http://net-snmp.sourceforge.net/>
- Very simple to build simple tools
 - One that builds snapshots of which IP is used by which Ethernet address
 - Another that builds snapshots of which Ethernet addresses exist on which port on which switch.

Statistics & accounting tools

- Traffic accounting and analysis
 - what is your network used for, and how much
 - Useful for Quality of Service, detecting abuses, and billing (metering)
 - Dedicated protocol: NetFlow
 - Identify traffic "flows": protocol, source, destination, bytes
 - Different tools exist to process the information
 - Flowtools, flowc
 - NFSen
 - ...

Fault & problem management

- Is the problem transient?
 - Overload, temporary resource shortage
- Is the problem permanent?
 - Equipment failure, link down
- How do you detect an error?
 - Monitoring!
 - Customer complaints
- A ticket system is essential
 - Open ticket to track an event (planned or failure)
 - Define dispatch/escalation rules
 - Who handles the problem?
 - Who gets it next if no one is available?

Ticketing systems

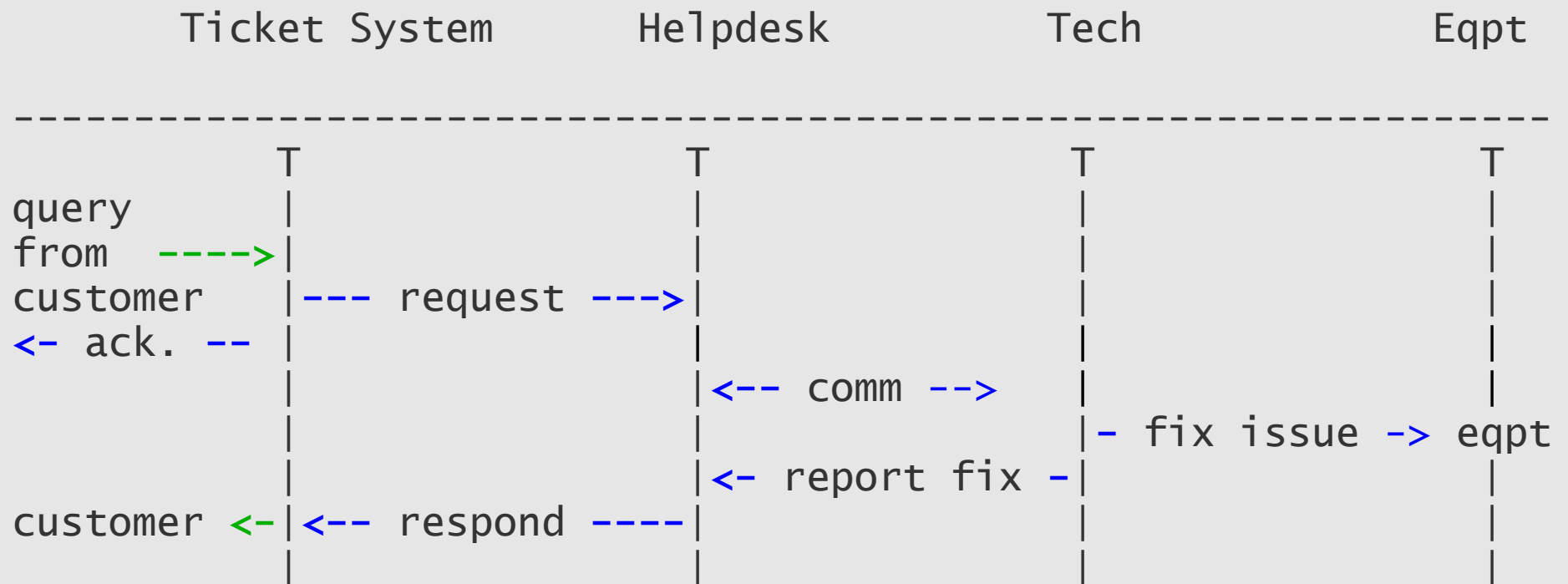
- Why are they important ?
 - Track all events, failures and issues
- Focal point for helpdesk communication
- Use it to track all communications
 - Both internal and external
- Events originating from the outside:
 - customer complaints
- Events originating from the inside:
 - System outages (direct or indirect)
 - Planned maintenance / upgrade – Remember to notify your customers!

Ticketing systems - 2

- Use ticket system to follow each case, including internal communication between technicians
- Each case is assigned a case number
- Each case goes through a similar life cycle:
 - New
 - Open
 - ...
 - Resolved
 - Closed

Ticketing systems - 3

- Workflow:



Ticketing systems - 4

Some ticketing and management software systems:

rt

- heavily used worldwide.
- A classic ticketing system that can be customized to your location.
- Somewhat difficult to install and configure.
- Handles large-scale operations.

trac

- A hybrid system that includes a wiki and project management features.
- Ticketing system is not as robust as rt, but works well.
- Often used for "trac"king group projects.

redmine

- Like trac, but more robust. Harder to install

Network Intrusion Detection Systems - NIDS

These are systems that observe all of your network traffic and report when it sees specific kinds of problems

- Finds hosts that are infected or are acting as spamming sources.
- SNORT is the most common open source tool
<http://www.snort.org/>

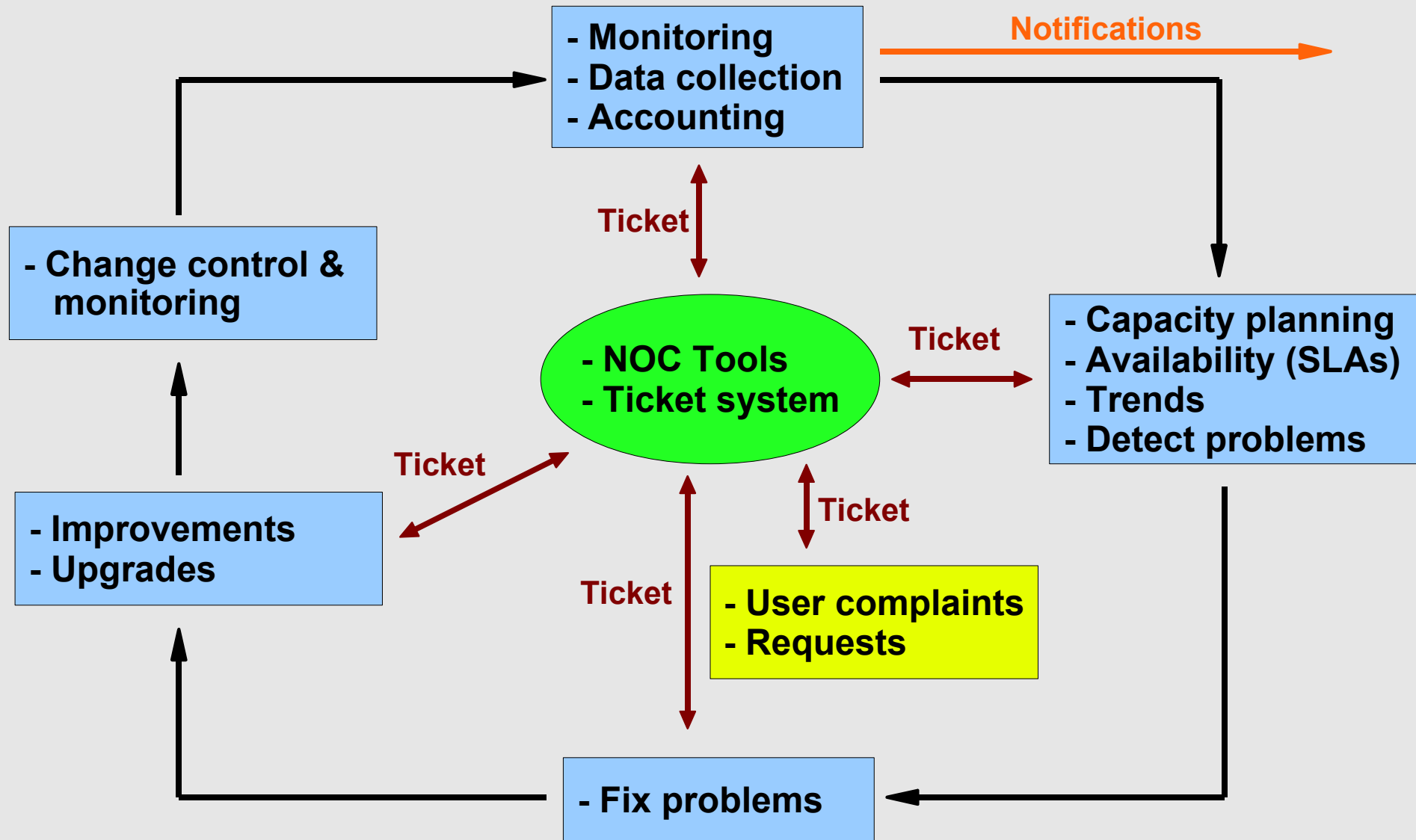
Configuration management & monitoring

- Record changes to equipment configuration, using *revision control* (also for configuration files)
- Inventory management (equipment, IPs, interfaces, etc.)
- Use versioning control
 - As simple as:
 "cp named.conf named.conf.20070827-01"
- For plain configuration files:
 - CVS, Subversion
 - Mercurial

Configuration management & monitoring - 2

- Traditionally, used for source code (programs)
- Works well for any text-based configuration files
 - Also for binary files, but less easy to see differences
- For network equipment:
 - RANCID (Automatic Cisco configuration retrieval and archiving, also for other equipment types)

The Big picture - Again



Summary of Open Source Solutions

Performance

- Cricket
- IFPFM
- flowc
- mrtg
- netflow
- NfSen
- ntop
- pmacct
- rrdtool
- SmokePing

SNMP/Perl/ping

Net Management

- Big Brother
- Big Sister
- Cacti
- Hyperic
- Munin
- Nagios*
- Netdisco
- Netdot
- OpenNMS
- Sysmon
- Zabbix

Change Mgmt

- Mercurial
- Rancid (routers)
- RCS
- Subversion

Security/NIDS

- Nessus
- OSSEC
- Prelude
- Samhain
- SNORT
- Untangle

Ticketing

- RT, Trac, Redmine

Questions ?

