Network Management & Monitoring Overview

PacNOG 6

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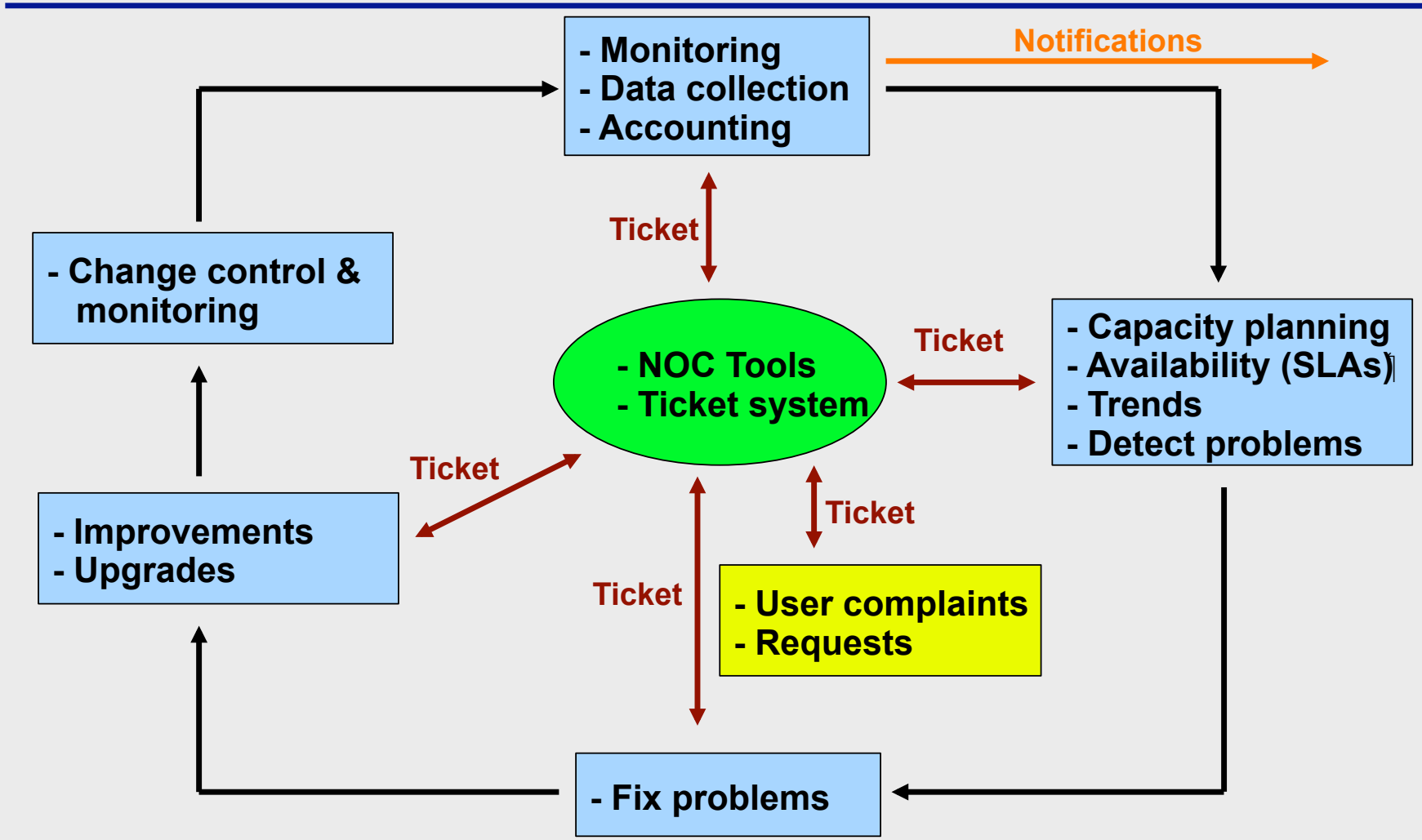
Introduction

- 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?

- 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 ?

What does it take to deliver 99.9 % uptime?

- 30,5 x 24 = 762 hours a month
- (762 – (762 x .999)) x 60 = 45 minutes maximum of downtime a month!

Need to shutdown 1 hour / week?

- (762 - 4) / 762 x 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?

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)

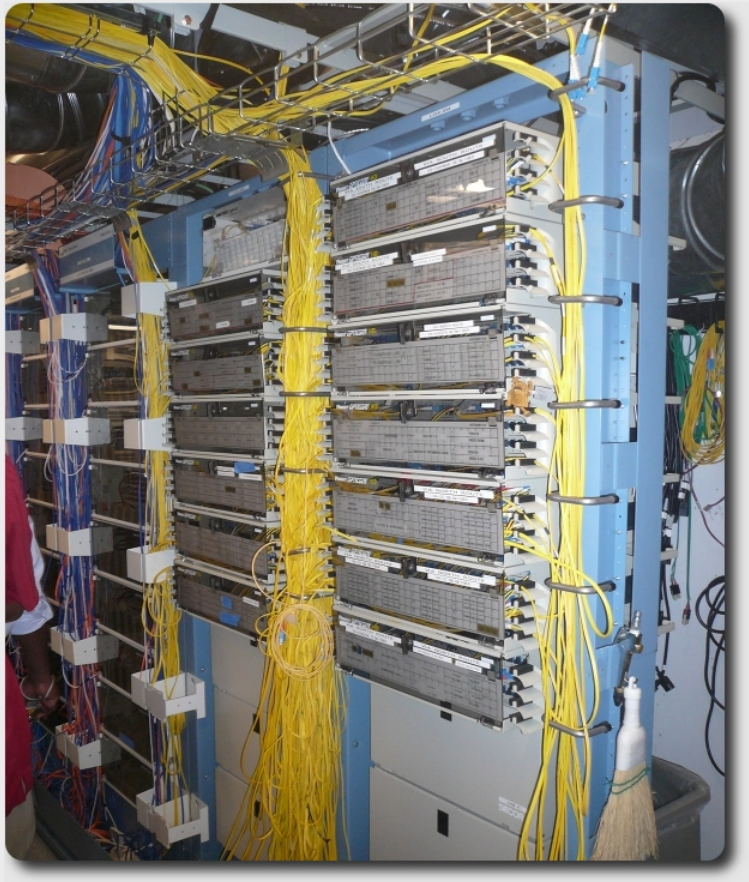
The Network Operations Center (NOC)

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

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

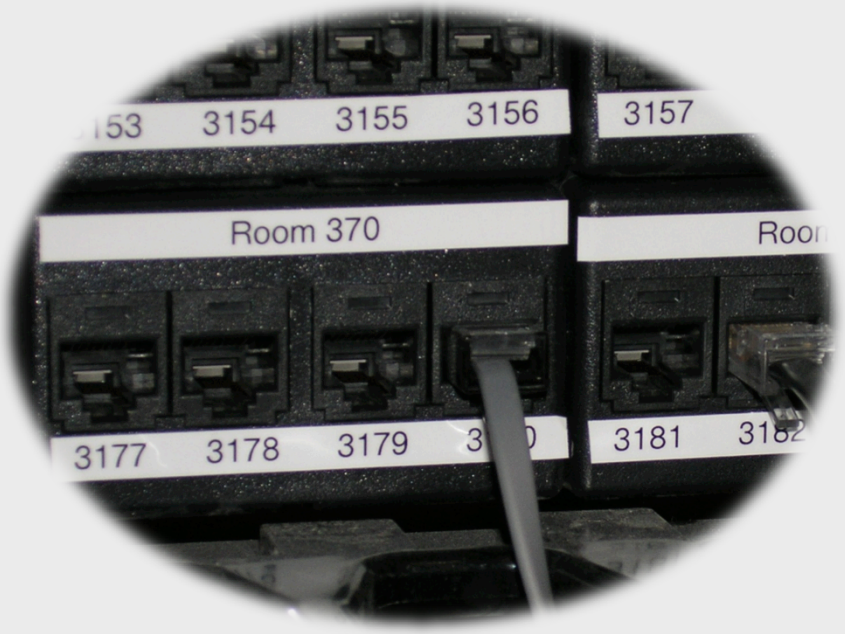
  health-switch1, port 4, Room 105 – Professors Office

  …..

  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 :-)

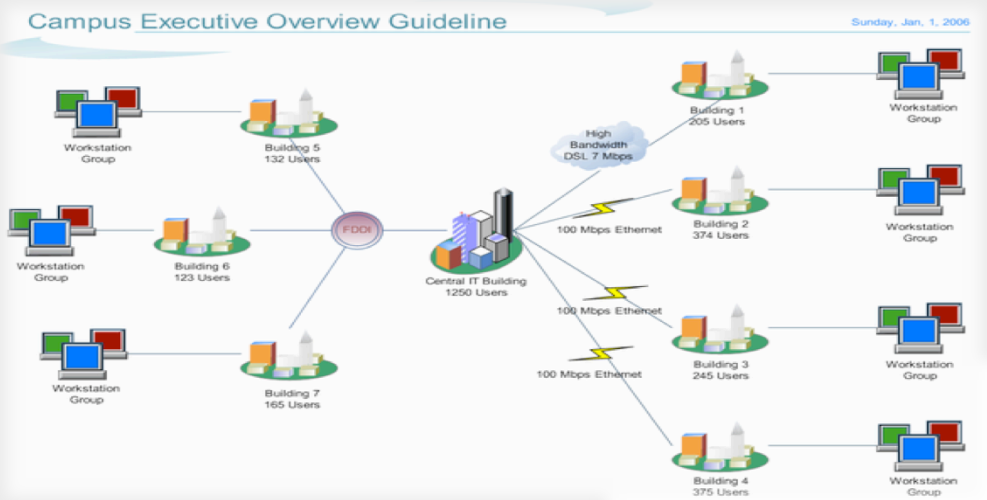


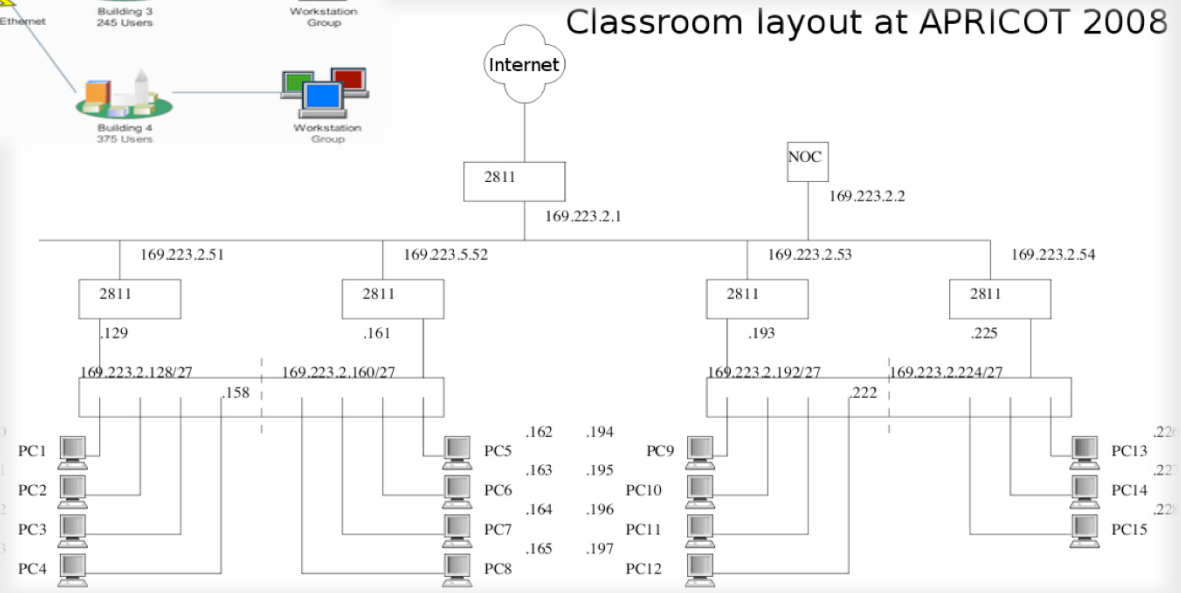
Documentation:
Software and Discovery

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/

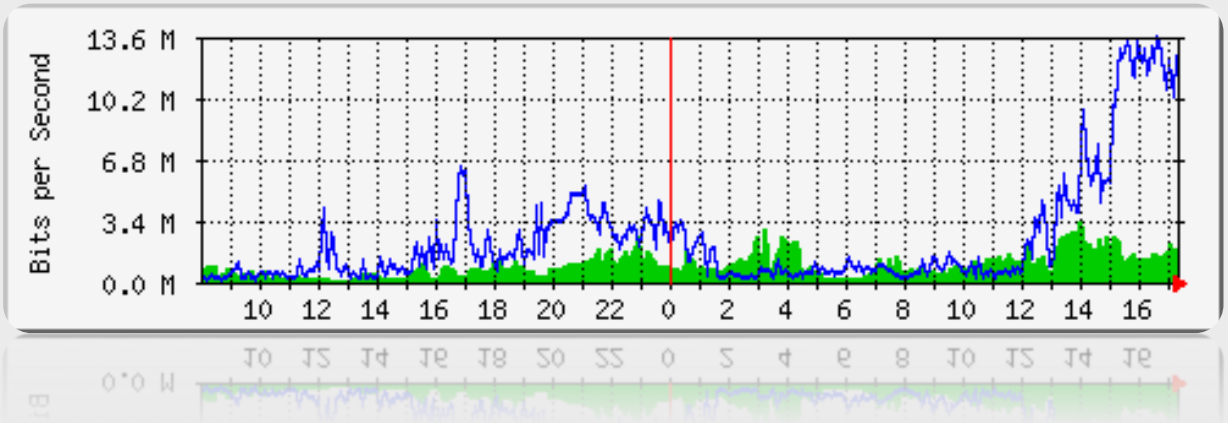
Network monitoring systems & tools

- 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 & tools

Performance Tools

- Key is to look at each router interface (probably don't need to look at switch ports).
- Two common tools:
  - Netflow/NfSen: http://nfsen.sourceforge.net/
  - MRTG: http://oss.oetiker.ch/mrtg/



MRTG = "Multi Router Traffic Grapher"

Network monitoring systems & tools

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 & tools

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, Shell scripts, php, etc...
- 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 & tools

Monitor your critical Network Services

- DNS/Web/Email
- 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 shapshots of which Ethernet addresses exist on which port on which switch.
- Query remote RAID array for state.
- Query server, switches and routers for temperatures.
- Etc…

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

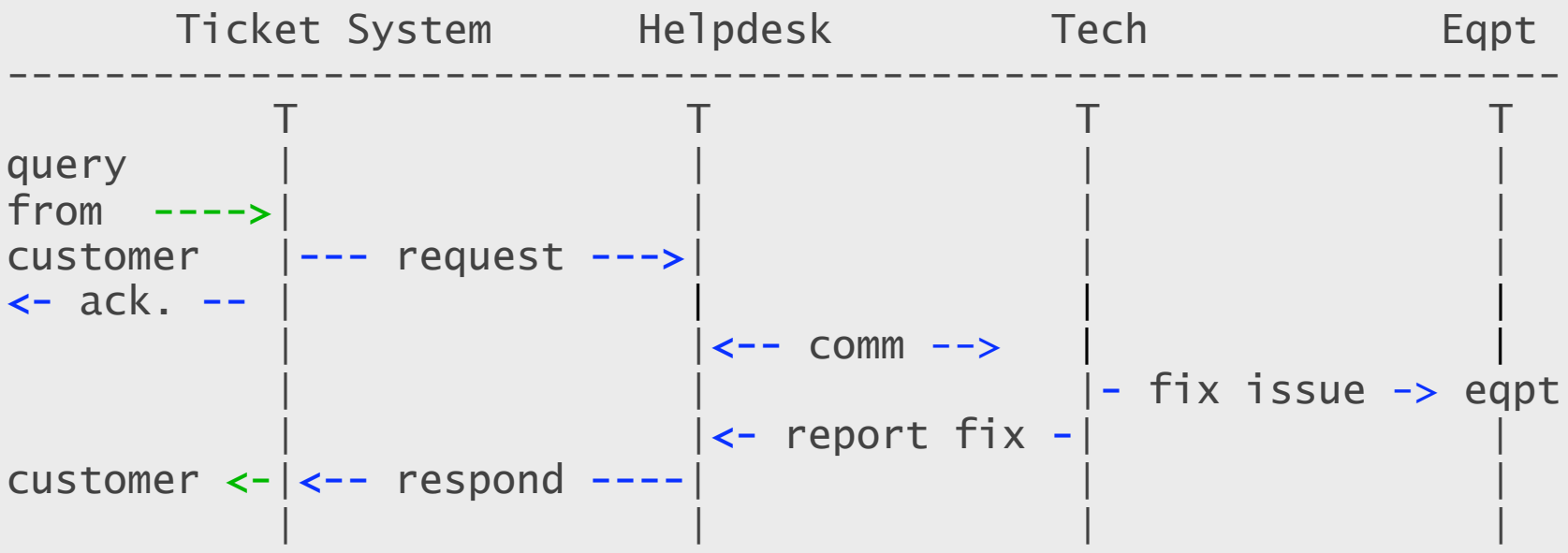
- Why are they important?
  - Track all events, failures and issues
- Focal point for helpdesk communication
- Use it to track all communications
  - Both internal and external
- Events originating from the outside:
  - customer complaints
- Events originating from the inside:
  - System outages (direct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

Ticketing systems

- 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

Workflow:



Ticketing systems

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 a common open source tool: http://www.snort.org/
- Another is Bro: http://bro-ids.org
- You can scan for vulnerabilities with a product like Nessus: http://www.nessus.org/download/

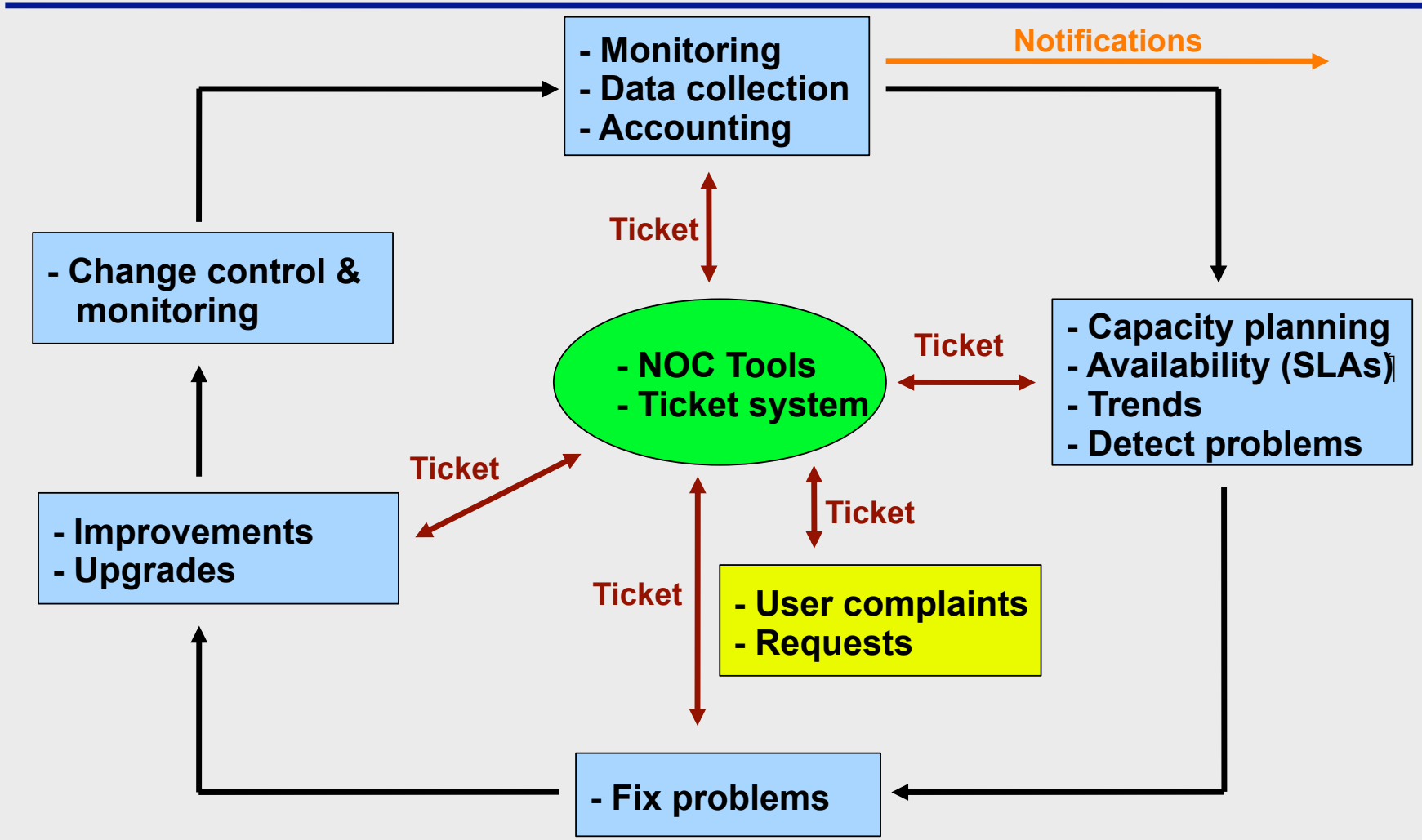
Configuration management & monitoring

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

Configuration management & monitoring

- 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)
- Built-in to Project Management Software like:
  - Trac
  - Redmine
  - And, many other wiki products. Excellent for documenting your network.

The Big picture - Again



Some 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?