Network Management & Monitoring Overview

Unix & Network Management

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Introduction

- This is a *big* topic...
- We'll try to respond to what you would like to hear.
- 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.

Overview

- What is network management and monitoring?
- Why network management?
- The Network Operation Center
- Network monitoring systems and tools
- Statistics and accounting tools
- Fault/problem management
- Ticket systems (more tomorrow)
- Configuration management & monitoring
- The big picture...

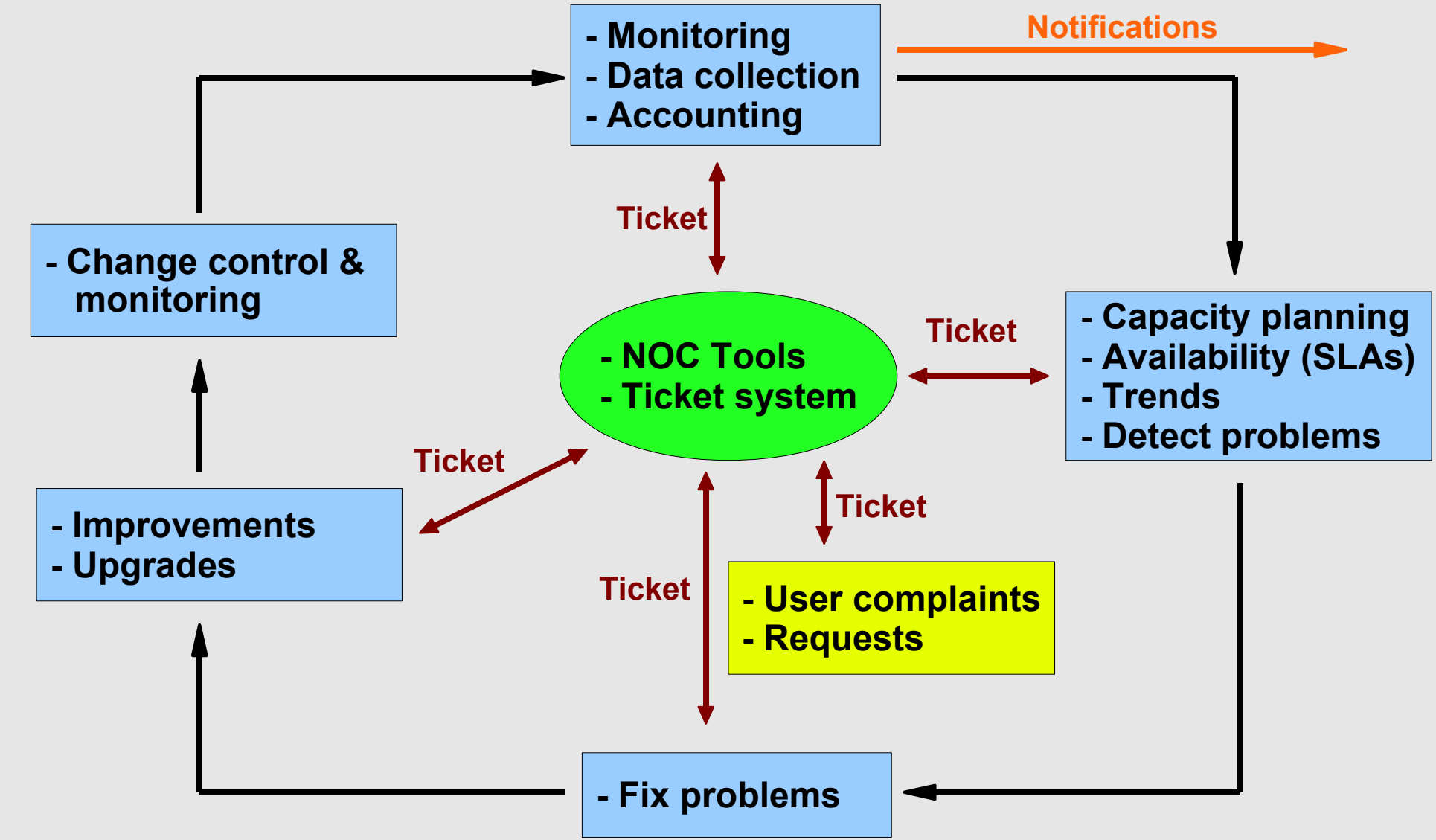
What is network management?

- 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

What we'll cover today...

- SNMP
- Configuration & Change Management
- Logging
- Flows
- RRDTool/MRTG
- Nagios
- Documentation
- Ticketing
- Cacti and Smokeping

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 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? - 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

Documentation

- Document 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

…..

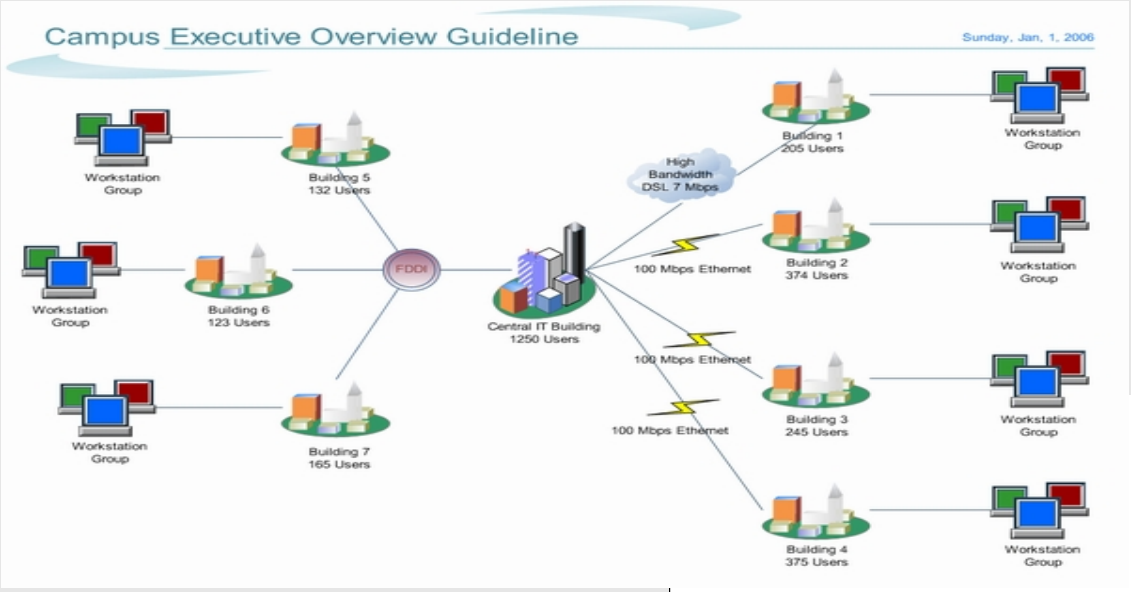
health-switch1, port 25, uplink to health-backbone

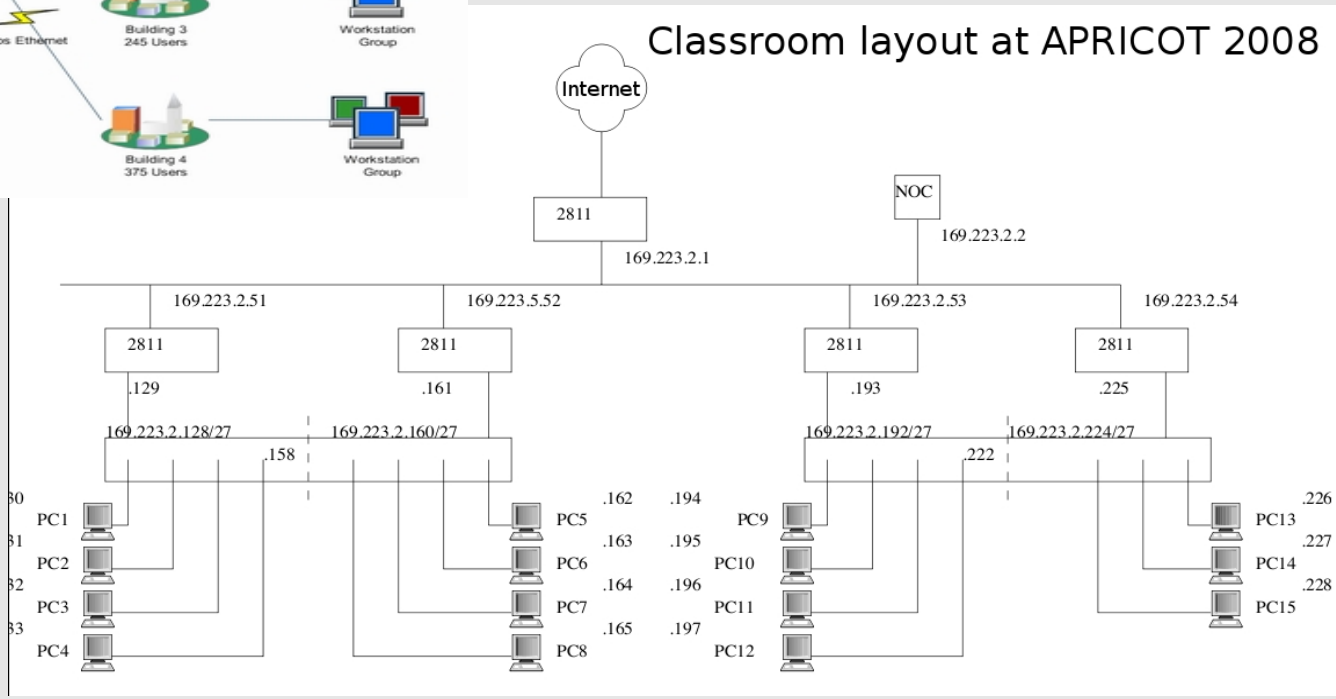
  - Make this file available for all networking and help desk staff. Possibly available via your NOC, or on a wiki, such as Trac.
  - Remember to label your ports!

Documentation:
Labeling

Nice :-)

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/

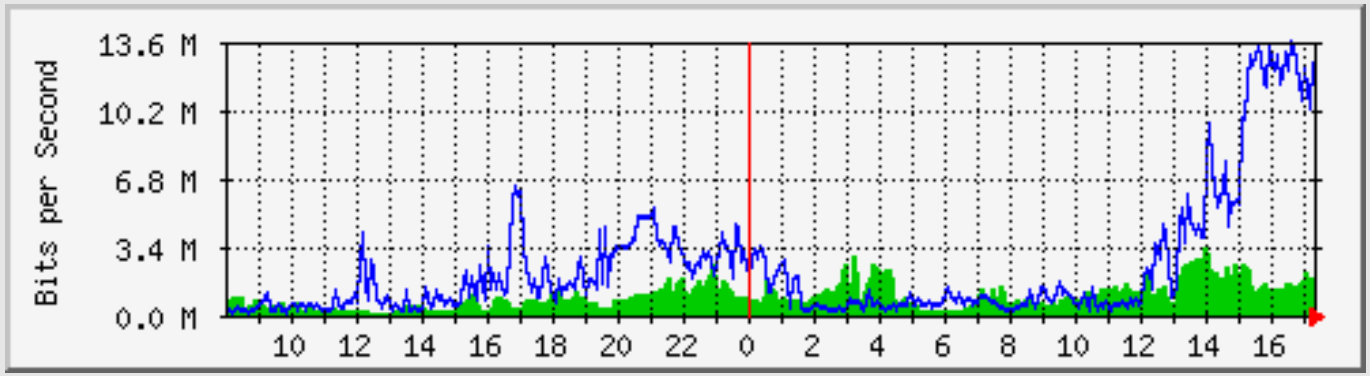
Network monitoring systems and tools

- 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 shapshots 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
    - ...

Statistics & accounting tools

- Non-netflow based tools
  - ipfm
  - pmacct

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

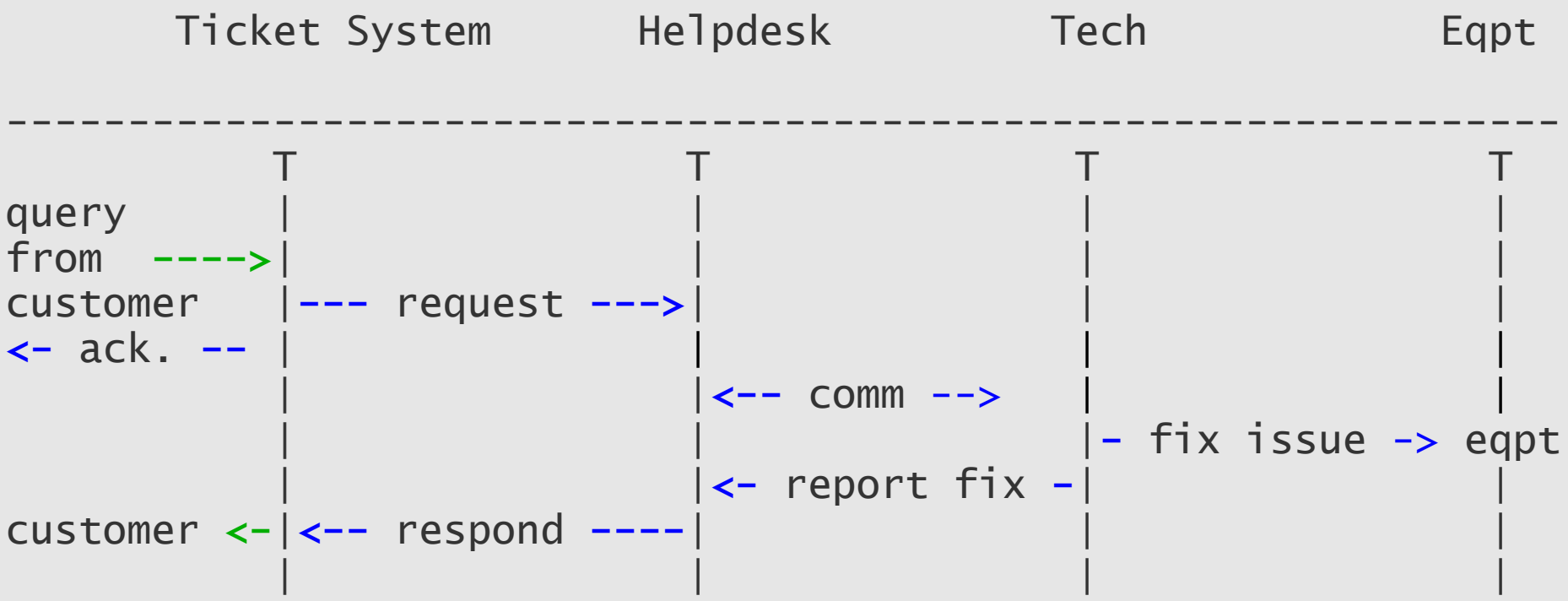
- Why are they important ?
  - Track all events, failures and issues
- Focal point for helpdesk communication
- Use it to track all communications
  - Both internal and external
- Events originating from the outside:
  - customer complaints
- Events originating from the inside:
  - System outages (direct 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 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.

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/

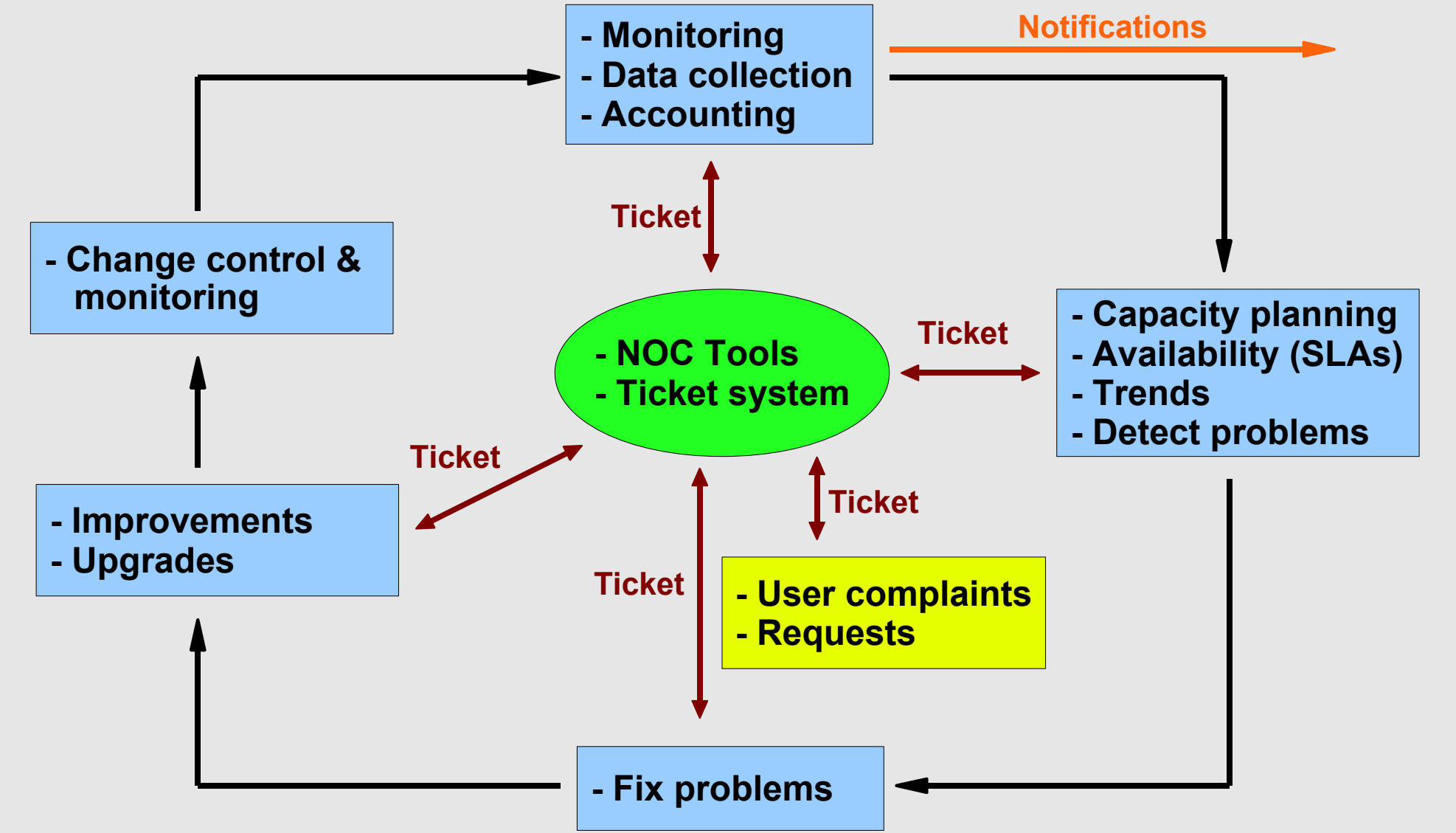
Configuration management & monitoring

- 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
- OpenNMS
- Sysmon
- Zabbix
- ZenOSS

Change Mgmt

- Mercurial
- Rancid (routers)
- RCS
- Subversion

Security/NIDS

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

Ticketing

- RT & Trac

Questions ?

?