APRICOT 2010

Kuala Lumpur, Malaysia

Introduction to Networking Monitoring and Management

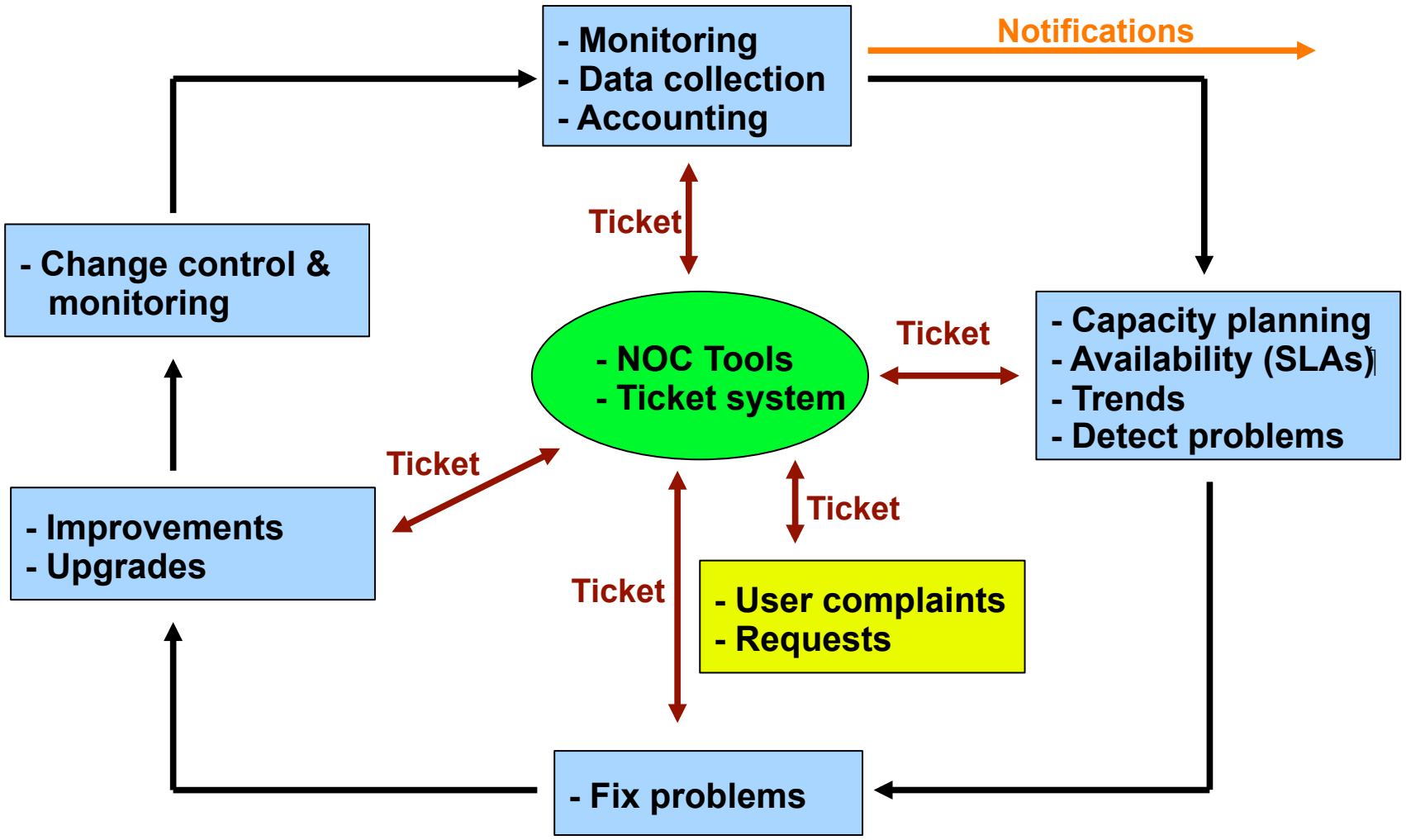
Introduction

- 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 and configuration monitoring**

The big picture



Why network management?

Make sure that the network is up and running.

Sooooo, we 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

only 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)

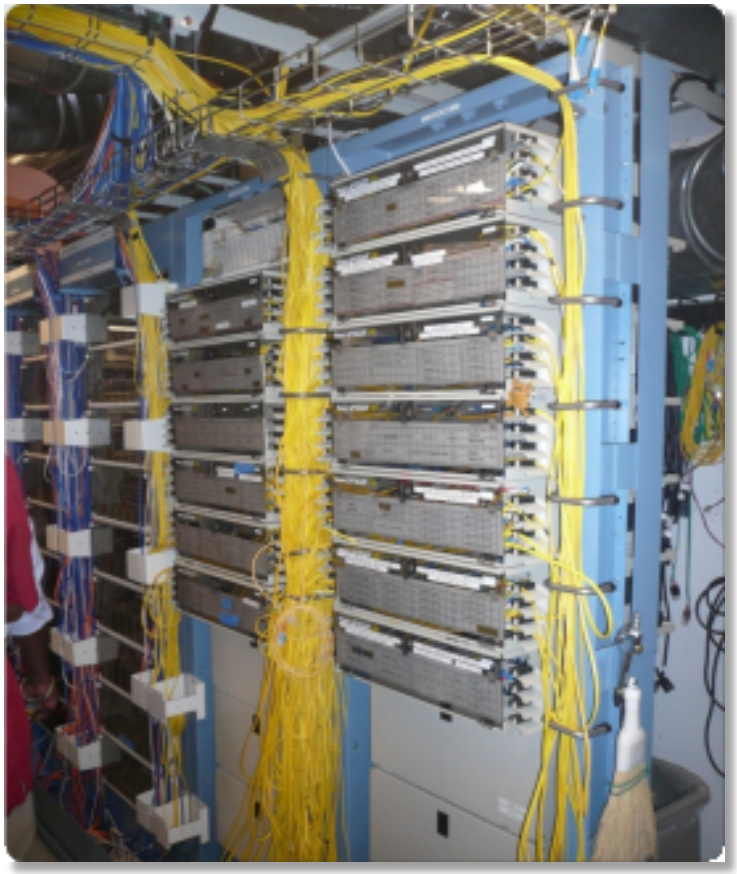
The Network Operations Center (NOC)

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

Maybe you've asked, "*How do you keep track of it all*?"...



...In the end, "we" wrote our own software...

{net.}
NETwork DOcumentation Tool

Netdot!

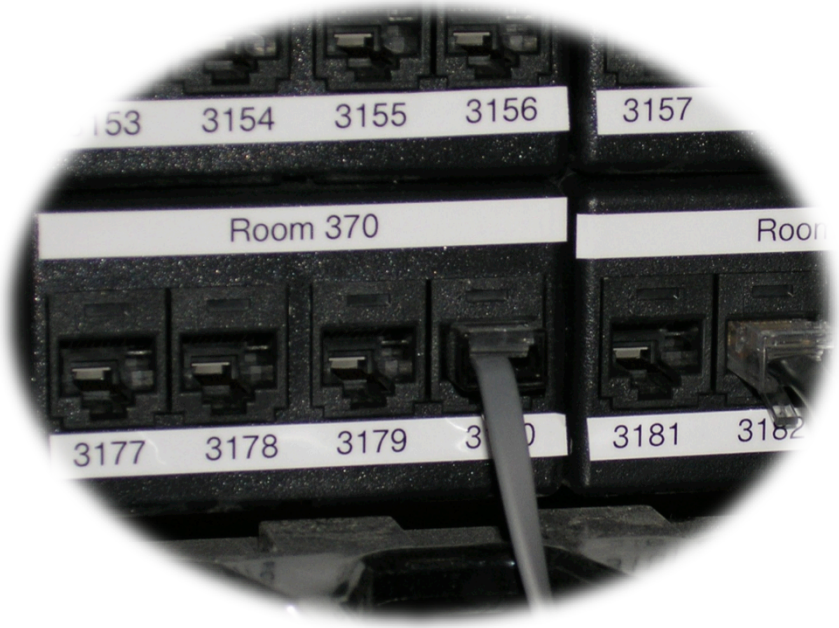
Documentation

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 Discovery

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

Maintain powerful network management to manage DHCP and DNS entries.

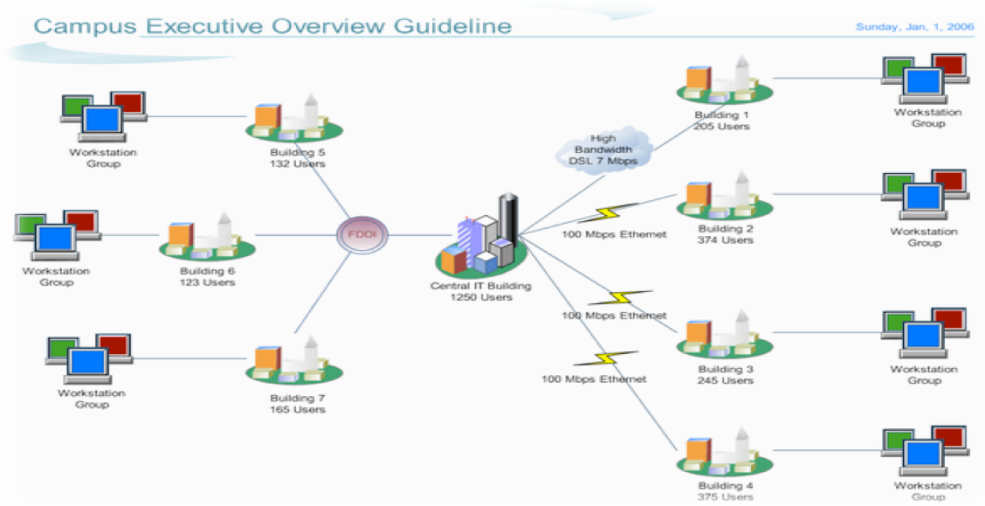
- *See http://maintainproject.osuosl.org/about for a humorous history.*

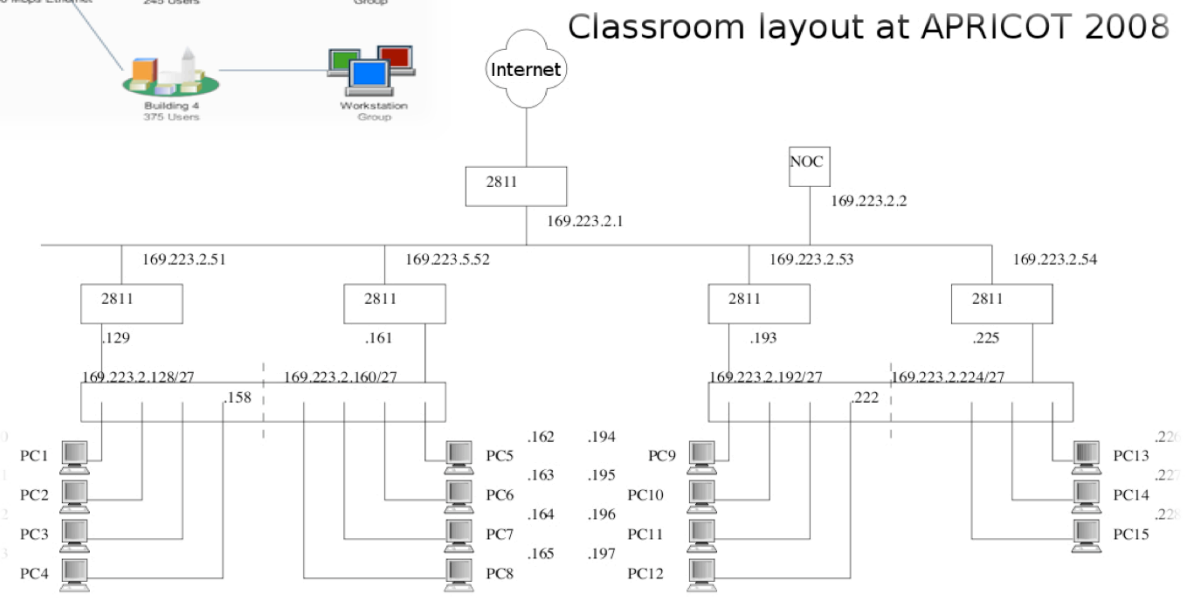
Netdisco:

- 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

1. **Diagnostic tools** – used to test connectivity, ascertain that a location is reachable, or a device is up – usually active tools
2. **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.
3. **Performance tools** – tell us how our network is handling traffic flow.

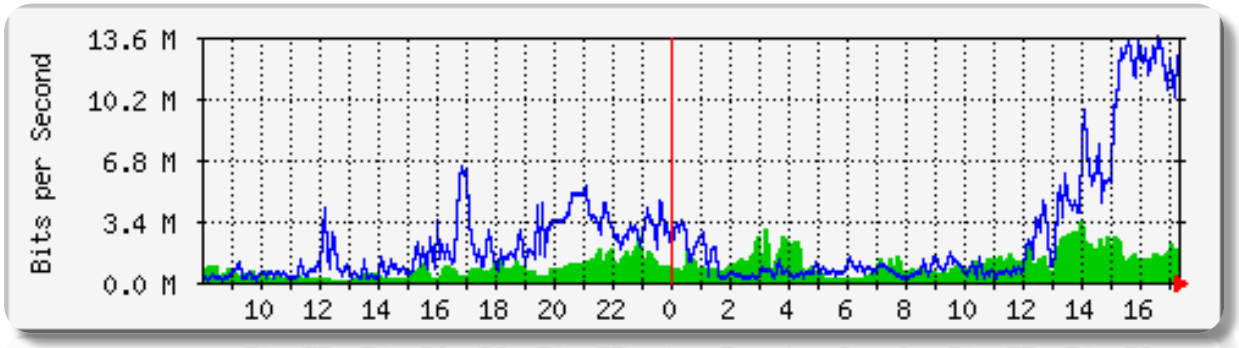
Network monitoring systems & tools

3. 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 is 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 and 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 and 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:

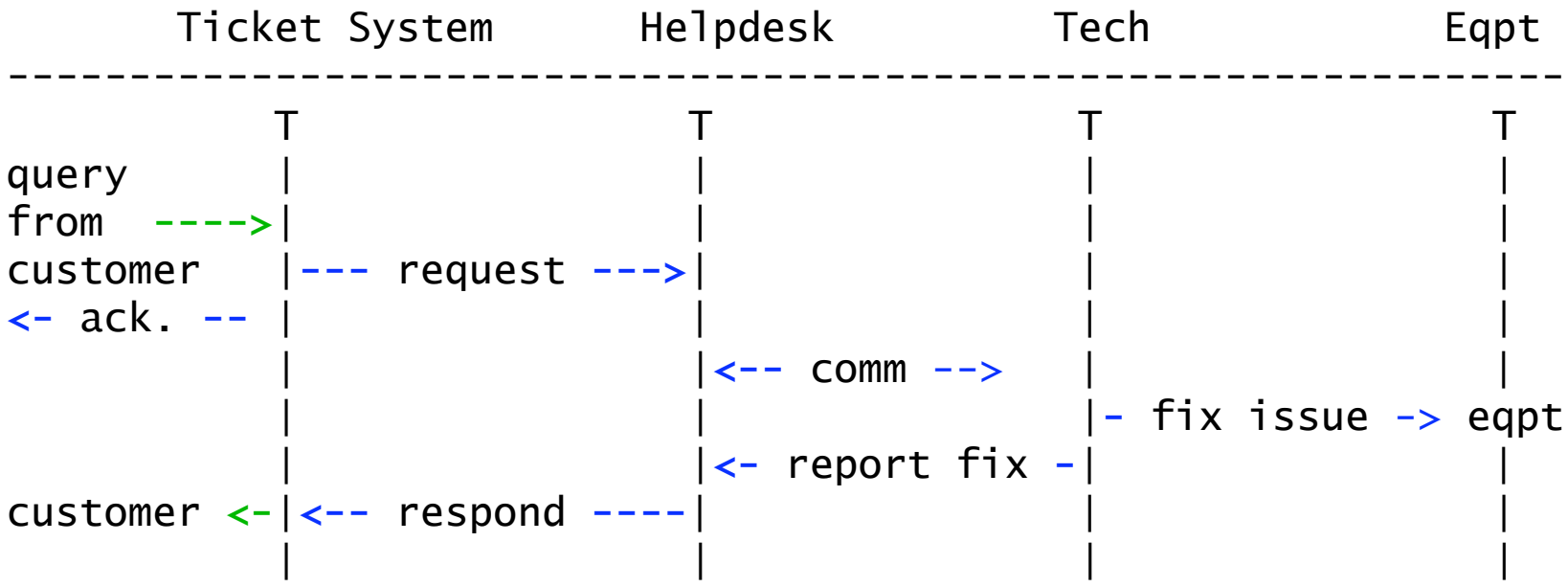
- System outages (direct or indirect)
- Planned maintenances or upgrades – Remember to notify your customers!

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: examples

rt (request tracker)

- 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, such as:

- hosts that are infected or are acting as spamming sources.

A few tools:

- **SNORT** - a commonly used open source tool: http://www.snort.org/
- **Prelude –** Security Information Management System https://dev.prelude-technologies.com/
- **Samhain –** Centralized HIDS http://la-samhna.de/samhain/
- **Nessus** - scan for vulnerabilities: http://www.nessus.org/download/

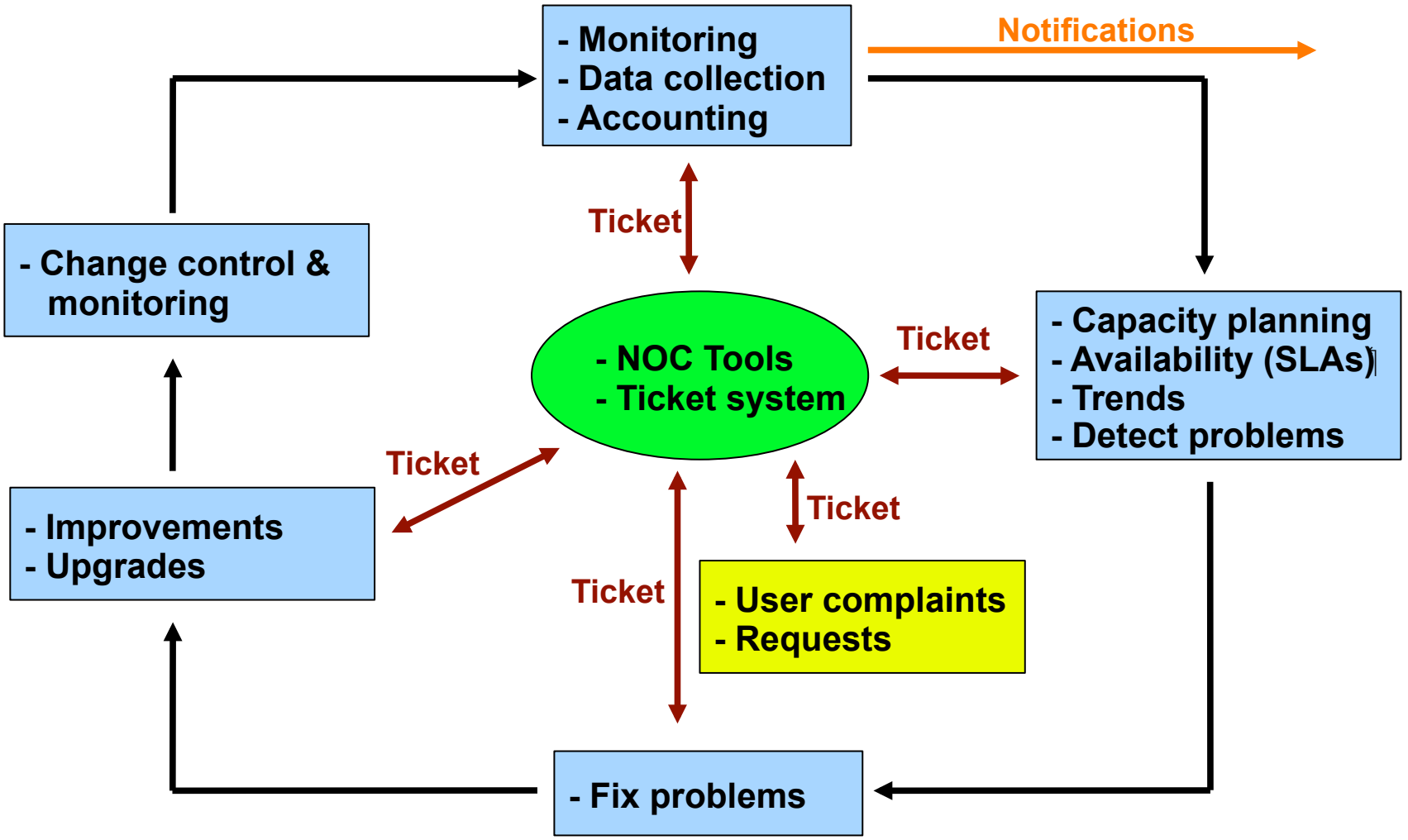
Configuration management and monitoring

- 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 (SVN)**
  - **Mercurial**
- For routers:
  - **RANCID**

Configuration management and 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 revisited



A *few* Open Source solutions…

Performance

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

SNMP/Perl/ping

- **Ticketing**
- RT, Trac, Redmine

Change Mgmt

- Mercurial
- Rancid (routers)
- RCS
- Subversion

Security/NIDS

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

Net Management

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

Questions?

?