Network Operations and Network Management

SANOG 10 Workshop
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Overview

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

What is network management ?

- System & Service monitoring

  Reachability, availability

- Ressource measurement/monitoring

  Capacity planning, availability

- Perf. monitoring (RTT, throughput)
- Statistics & Accounting/Metering
- Fault Management

  Fault detection, troubleshooting, and tracking

  Ticketing systems, helpdesk

- Change management & configuration monitoring

What we don't cover...

- Provisioning
  (processes associated with allocation and configuration of resources)
- Security aspects
  Basic security is proper administration and management!

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

- What does it take to deliver 99.9 % ?

  30,5 x 24 = 762 hours a month

  (762 – (762 x .999)) x 60 = 45 minutes max 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 ? - 3

- 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 on network and services
  - Fielding of network-related incidents and complaints
  - Where the tools reside ("NOC server")
- One of the goals of this workshop...
  - Build a NOC box
  - It will be the most important machine on your network
  - We will do this during the week, by installing, and configuring, various tools to help in network monitoring and management.

Network monitoring systems and tools

- Two 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.

Network monitoring systems and tools - 2

- Active tools
  - command line tools
  - Ping - test connectivity to a host
  - Traceroute - show path to a host
  - MTR - combination of ping + traceroute
- Automated tools
  - SmokePing - record and graph latency to a set of hosts, using ICMP (Ping) or other protocols
  - MRTG - record and graph bandwidth usage on a switch port or network link, at regular intervals

Network monitoring systems and tools - 3

- 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 - 4

- 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

Statistics & accounting tools

- Traffic accounting

  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 ressource 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:

```
         (ticket system)
                  T
    query         |
    from  ------->|
    customer      |-------- to support --------> support
                  |<--- discuss internally -->   support
                  |                              tech ---> fix problem
                  |<-------- report fix -------- tech
                  |<-- respond to customer ---   support
    customer  <---|
                  |
```

Ticketing systems - 4

- Some ticketing software systems:
  - Trac
  - RT
- We'll be looking at using Trac later in the workshop

Configuration management & monitoring

- Record changes to equipment configuration, using *revision control* (also for configuration files)
- Inventory management (equipment, IPs, interfaces, ...)
- Use version control!

  As simple as:

  "cp named.conf named.conf.20070827-01"
- For plain configuration files:

  CVS

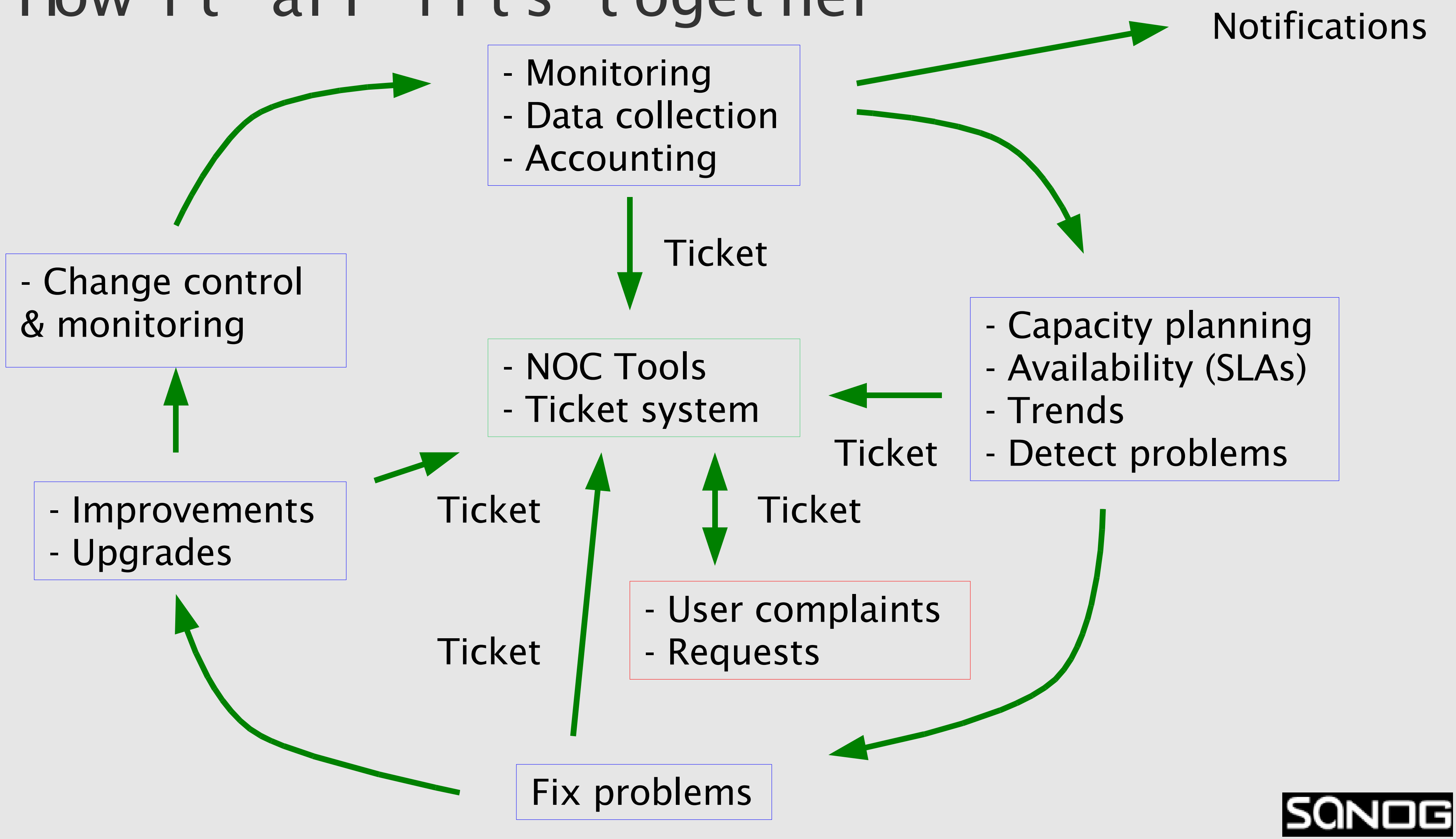
  Mercurial

Configuration management & monitoring - 2

- Traditionnally, 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)

Big picture

- How it all fits together



Notifications

- Monitoring
- Data collection
- Accounting

Ticket

- Change control & monitoring

- NOC Tools
- Ticket system

- Capacity planning
- Availability (SLAs)
- Trends
- Detect problems

Ticket

- Improvements
- Upgrades

Ticket

Ticket

Ticket

- User complaints
- Requests

Fix problems

Questions ?

?