Campus Network Design Workshop

Introduction to Network Management & Monitoring

UNIVERSITY OF OREGON

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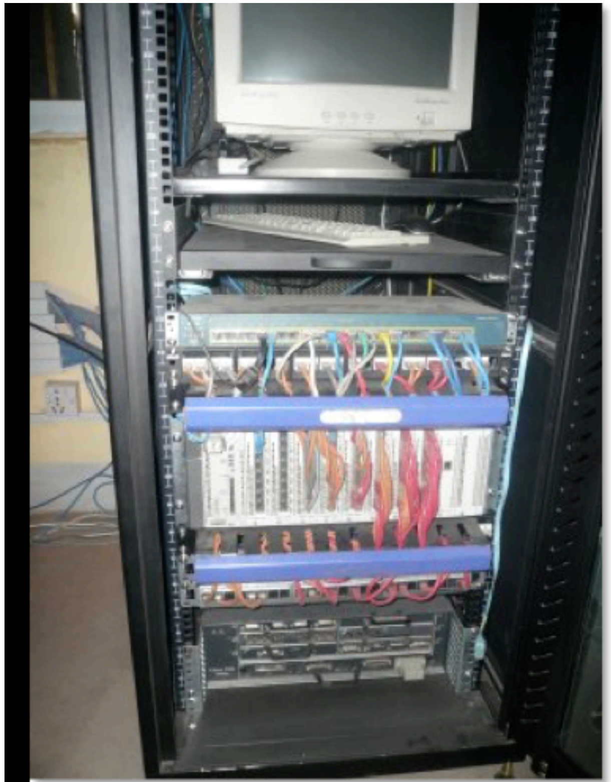
NSRC
Network Startup Resource Center

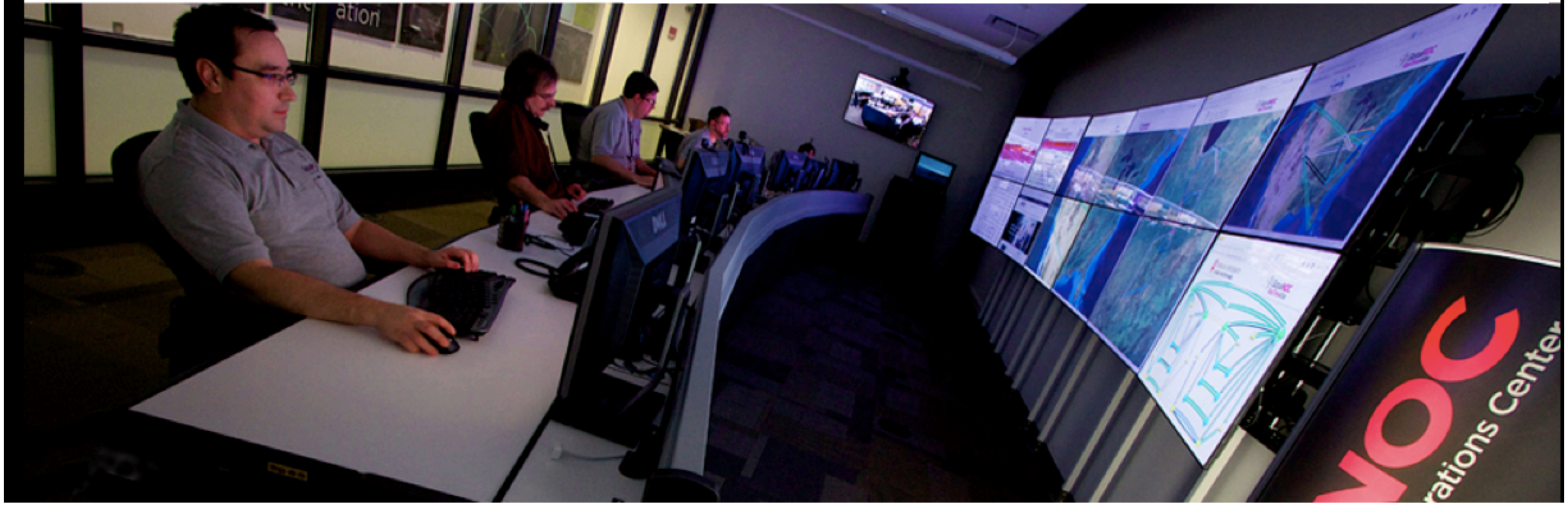
Objectives

- Introduce Core Concepts & Terminology
  - Network Monitoring & Management
  - What & Why we Monitor
  - Uptime Expectations & Calculations
  - Baseline Performance & Attack Detection
  - What & Why we Manage
  - Network Monitoring & Management Tools
  - The NOC: Consolidating Systems

NOC: Consolidating NMM Systems

- NOC = Network Operations Center
  - Coordination of tasks, handling of network related incidents (ticketing system)
  - Status of network and services (monitoring tools)
  - Where the tools are accessed
  - Store of Documentation (wiki, database, repository ==> network documentation tool(s))
- NOC Location
  - NOC is an organizational concept
  - Does not need to be a place, or even a single server
  - Remote / Distributed NOC is valid with OOB Management

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NOC
rations Center

Network Monitoring & Management

- Monitoring
  - Check the status of a network
- Management
  - Processes for successfully operating a network

Monitoring Systems & Services

- Systems
  - Routers
  - Switches
  - Servers
- Services
  - DNS
  - HTTP
  - SMTP
  - SNMP

Why do we Monitor?

- Are Systems and Services Reachable?
- Are they Available?
- What's their Utilisation?
- What's their Performance
  - Round-trip times, throughout
  - Faults and Outages
- Have they been Configured or Changed?
- Are they under Attack?

Why do we Monitor?

- Know when there are problems − before our customers!
- Track resource utilisation, and bill our customers
- To Deliver on Service Level Agreements (SLAs)
  - What does management expect?
  - What do customers expect?
  - What does the rest of the Internet expect?
- To prove we're delivering
  - Have we achieved Five Nines? 99.999%
- To ensure we meet SLAs in the future
  - Is our network about to fail? Become congested?

Uptime Expectations

- What does it take to deliver 99.9% uptime?
  - Only 44 minutes of downtime a month!
- Need to shut down one hour a week?
  - That's only 99.4% uptime ((732-4)/732 = .9945355...)
- Maintenance might be negotiated in SLAs
- What does it mean that the network is up?
  - Does it work at every location? Every host?
  - Is the network up if it works at the Boss's desk?
  - Should the network be reachable from the Internet?

Establishing a Baseline

- Monitoring can be used to Establish a Baseline
- Baseline = What's normal for your network?
  - Typical latency across paths
  - Jitter across paths
  - Load on links
  - Percent Resource Utilisation
  - Typical amounts of noise
    - Network scans & random attacks from the Internet
    - Dropped packets
    - Reported errors or failures

Detecting Attacks

- Deviation from baseline can mean an attack
- Are there more flows than usual?
- Is the load higher on some servers or services?
- Have there been multiple service failures?

These things could mean an attack

What do we Manage?

- Asset management: What equipment have we deployed?
  - What software is it running
  - What's its configuration (hardware & software)
  - Where is it installed
  - Do we have spares?
- Incident management: fault tracking and resolution
- Change management: Are we satisfying user requests?
  - Installing, moving, adding, or changing things
- Staff management

Why do we Manage?

- To ensure we meet business requirements for service level, incident response times etc
- To make efficient use of our resources (including staff)
- To learn from problems and make improvements to reduce future problems
- To plan for upgrades, and make purchasing decisions with sufficient lead time

Network Monitoring Tools

- Availability: Nagios
  - for servers, services, routers, switches, environment
- Reliability: Smokeping
  - connection health, rtt, service response time, jitter
- Performance: LibreNMS
  - traffic, port utilisation, cpu, RAM, disk, processes

- *Integration & overlap exists between these programs!*

Network Management Tools

- Ticket Systems: RT
  - Manage provisioning & support
- Configuration Management: RANCID
  - Track router configurations
- Network Documentation: Netdot
  - Inventory, Location, Ownership of Network Assets

- *Integration & overlap exists between these programs!*

A few Open Source NMM Tools

Performance	**Change Management**	**Net Management**
Cricket	Mercurial	Big Brother
flowc	RANCID	Cacti
mrtg	CVS	Hyperic
NetFlow	Subversion	LibreNMS
NfSen	git	Nagios
ntop	Security/NIDS	OpenNMS
perfSONAR	Nessus	Sysmon
pmacct	OSSEC	Zabbix
RRDTool	Prelude	Documentation
SmokePing	Samhain	IPplan
Ticketing	SNORT	Netdisco
RT	Untangle	Netdot
Trac		**Utilities**
Redmine		SNMP, Perl, Ping

NMM Review

- Network Monitoring & Management
- What & Why we Monitor
- Uptime Expectations & Calculations
- Baseline Performance & Attack Detection
- Network Attack Detection
- What & Why we Manage
- Network Monitoring & Management Tools
- The NOC: Consolidating Systems

Questions?