IT3010

NETWORK DESIGN MANAGEMENT

Lecture 1
Introduction to Network Design & Management

Syllabus Overview

Week	Lecture
1	Introduction to Network Design & Management
2	Network Mapping & Baselining
3	Network Servers
4	Network, Server and OS Monitoring
5	Fault Tolerance and Disaster Recovery
6	Network Security
7	Lightweight Directory Access Protocol (LDAP)
9	Simple Network Management Protocol (SNMP)
10	Introduction to World Wide Web (WWW)
11	Introduction to Virtualization and Cloud Computing

Method of delivery

Lecture   2 hours/week

Tutorial   1 hour/week

Lab Practical   2 hours/week

__Important__

Do not miss any lecture, tutorial or lab session as both the mid-term and semester end examination will be based on all 3 components of delivery.

Assessment Criteria

- Assessments   50%
    - Assignment: 30%
    - Spot Test: 10%
    - Lab Reports: 10%
- Semester end examination   50%

Personal

Lecturer-in-charge

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IMPORTANT : Students who needs to meet the lecturer/s or the instructor/s out of the normal allocated hours are required to send an email to the above mentioned mail addresses and get a date and time. Please make a note that the lecturers will only consider mails sent from their SLIIT mail addresses.

Learning Resources

Principal References

➢ Lienwand, A. and Fang, K. C., Network Management: A Practical Perspective (2nd Edition), ISBN: 0-201-60999-1, Addison Wesley, 1996 – **Available in library.**

➢ Howes, T., Smith, M. C., Good, G. S., Understanding and Deploying LDAP Directory Services, ISBN: 1-56870-070-1, 1999 – **Available in library.**

➢ Stalling W., SNMP SNMP2 and RMON Practical Network Management (2nd Edition), ISBN: 0-201-63479-1, Addison Wesley, 1996

Enrollment Key

IT3010@19R

Academic Integrity Policy

Are you aware that following are not accepted in SLIIT???

- Plagiarism - using work and ideas of other individuals intentionally or unintentionally
- Collusion - preparing individual assignments together and submitting similar work for assessment.
- Cheating - obtaining or giving assistance during the course of an examination or assessment without approval
- Falsification – providing fabricated information or making use of such materials

From year 2018 the committing above offenses come with serious consequences !

See General support section of Courseweb for full information.

Today's lecture overview

- Design Methodology and Considerations

- Rationale for Network Management

- Network Management Process

- Network Management Systems

Introduction

Definition of a Data Network: A collection of devices and circuits for transferring data from one computer to another (or device, e.g. printer).

Purpose:

It enables users at different locations to share the resources of a computer stationed elsewhere.

E.g. : Automated Teller Machine (ATM)

Goals

Why bother about the network design..?

Primary goal of network design is to meet the organizations communication needs.

❑ Productivity

❑ Budget

Considerations

Achieving the goal..

Need to develop a comprehensive plan. Must take into account the following:

- ❑ Suitability
- ❑ Reliability
- ❑ Scalability
- ❑ Durability

Network Engineers

Role of a Network Engineer

Network engineers have the responsibility for installing, maintaining, troubleshooting, optimizing and expanding the network.

❑ As a network expands, so too the size and number of potential problems.

❑ The overall goal of network management is to help network engineers deal with the complexity of data networks.

❑ Design based on Network Management principles.

The Network Management Process

Network Management is the process of controlling complex data networks to maximize its efficiency and productivity.

ISO Framework for Network Management

- Configuration management
- Security management
- Performance management
- Accounting management
- Fault management

Configuration Management

Configuration management is the process of

- **Gathering** information about the current network environment.

- Using that data to **modify** the configuration of network devices.

- **Storing** the data, maintaining an up-to-date inventory of all network components and producing various reports.

Bridge Configuration Management Information	
Name	Software Version
Payroll Mainframe Subnet	A
Terminal Server Subnet	B
Engineerig Computer subnet	A

Data Collection, Modification and Storing

Data Collection

Two methods..

- **Manual collection**
  - ❑ Tedious, error prone, time consuming
- **Auto-discovery/Auto-mapping**
  - ❑ ICMP (ping, traceroute)
  - ❑ Network Management Protocol

Data Collection, Modification and Storing

Data Modifications

- Once configuration management information has been obtained, it will usually need to be updated.

- Network devices usually contain many pieces of modifiable parameters.
  - ❑ E.g. – routers (routing tables, network interfaces), servers (application services, operating systems).

Data Collection, Modification and Storing

Storing Information

Methods of storage:

- **Unstructured** (e.g. ASCII files)

  - ❑ Advantages:
    - ➢ Easily read.
    - ➢ Easily accessed from remote locations.
    - ➢ Easy to administer.

  - ❑ Disadvantages:
    - ➢ Inefficient storage.
    - ➢ Slow to search.
    - ➢ Unable to provide complex data relationships.

Data Collection, Modification and Storing

Storing Information

Methods of storage:

- **Structured** (e.g. DBMS)
  - ❑ Advantages:
    - ➢ Stores data efficiently.
    - ➢ Enables users to relate various types of information to one another.
    - ➢ Versioning.
  - ❑ Disadvantages:
    - ➢ Need to learn query language to access data (e.g. SQL).
    - ➢ Administrative overheads.

Configuration Management - Benefits

- Automatically gather and update data on network devices.

- Allows devices to be configured remotely.

- Provides central storage location for configuration data.

- Facilitates the production of network inventory and other reports.
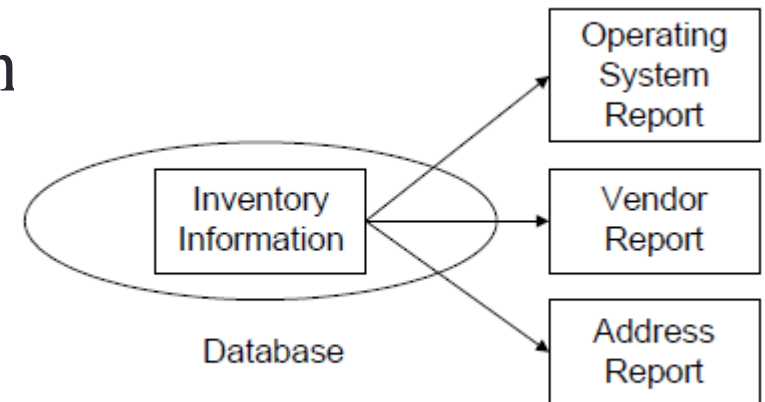
Security Management

- Security management involves protecting sensitive information on devices attached to a data network by controlling access points to that information.

- Security management consists of the following aspects:

  - ❑ Identifying the sensitive information to be protected.
  - ❑ Finding the access points (vulnerabilities).
  - ❑ Securing the access points.
  - ❑ Maintaining the secure access points.

Security Management - Benefits

- Increases confidence in utilizing the network.

  ❑ A lack of security may force drastic measures, such as eliminating network access of sensitive information altogether.

  ❑ Properly set up and maintained security management can offer more practical alternatives.

- Some examples:

  • 1988: Internet worm
  • More recently: ICMP and TCP-based DoS attacks

Performance Management

Performance management involves ensuring that networks remain accessible and free from congestion:

- ❑ Monitoring network devices and their associated links to determine utilization and error rates.

- ❑ Helping the network provide consistent quality of service (QoS) by ensuring that the capacity of devices and links is not over taxed to the extent of adversely impacting performance.
  - ▪ Context-specific

Performance Management

Performance management entails the following steps:

1. Collecting data on current utilization of network devices and links.

2. Analyzing relevant data.

   ❑ Statistical analysis
   ❑ Workload modeling

3. Setting utilization thresholds.

4. Using simulation to determine how the network can be altered to maximize performance.

Performance Terms

- Availability

- Bandwidth/Throughput

- Propagation

- Congestion

- Latency

- Threshold

- Utilization

Performance Management - Benefits

- Reduces probability of network congestion and inaccessibility so as to provide a consistent level of service to users.

  - E.g. – Knowing the network's utilization workload can help one schedule large data transfers for non-peak times.

- Assist in examining network trends:

  - Content Creators
  - Content-hosting companies
  - Network operators
  - Networking researchers

Accounting Management

Accounting management is the process of gathering network statistics to help the network engineer make decisions about the allocation of network resources.

Accounting management involves the following tasks:

- ❑ Gathering data about the utilization of network resources.
  - ▪ Need to establish metrics -RFC 1272: "Internet Accounting Background"
    - ➢ E.g. Application layer – per-transaction, network layer – number of packets.
- ❑ Setting usage quotas using metrics.
- ❑ Billing users for their use of the network.

Accounting Management - Benefits

- Allows effective measurement and reporting of accounting information.

- Increases the engineer's understanding of user utilization.

  - ❏ Helps the network engineer make informed decisions about the allocation of network resources.

  - ❏ Ensure that users have a fair share of the network.

Fault Management

Fault management is the process of locating problems or faults, on the data network.
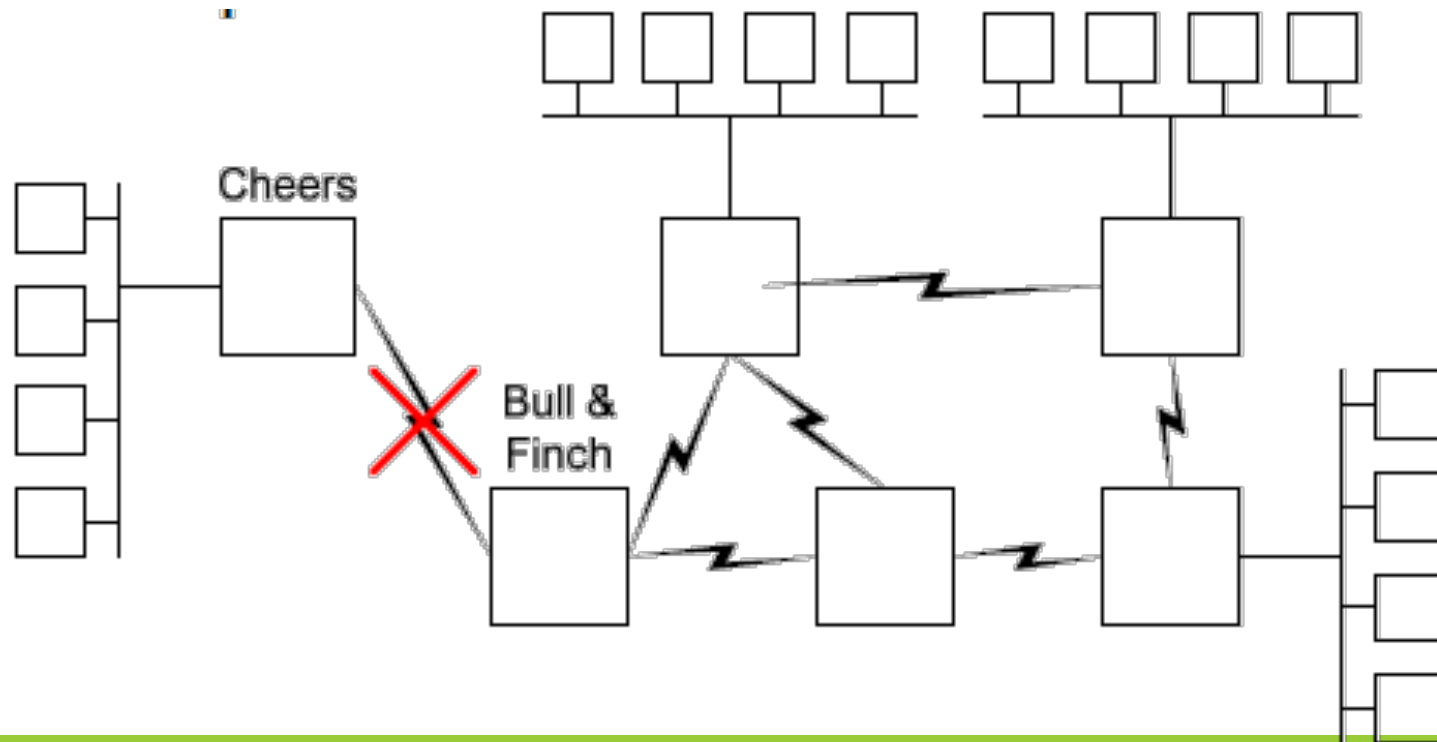
Fault Management

The fault management process involves:

- Detecting symptoms that may lead to a problem/fault

  in the network.

- Isolating the cause of the symptoms.

  - ❑ Find correlations between symptoms and potential problems.

    - ➢ Alarms do not usually include explicit information regarding the exact location of the fault.

- Correcting the problem if possible.

Gathering Information for Fault Management

Two methods..

- ## Interrupt driven

  - ❏ Critical events (e.g. link failure).

  - ❏ Solely relying on such events may not facilitate effective fault management.

- ## Polling

  - ❏ Finds faults in a timely manner.

  - ❏ Higher bandwidth consumption.

  - ❏ Polling can be implemented using ICMP messages (ping).

Fault Management - Benefits

❑ Enhances network reliability by providing tools to aid/facilitate rapid fault detection, isolation and recovery.

❑ Maintains the illusion of complete and continuous connectivity between the users and the network.

Network Management Systems

A Network Management System (NMS) comprises:

- An underlying architecture (aka platform).
  - A software package that provides generic/basic functionality of network management for managing a variety of network devices.

- A set of applications built on top of the platform.

Network Management Systems

Example NMSs

- Commercial implementations
  - HP Openview
  - SunConnect SunNet Manager
  - IBM Netview
- Freeware implementations
  - Net-SNMP (formally UCD-SNMP, CMU-SNMP)
  - OpenNMS

Next Lecture…!!!

Network Mapping and Baselining

Thank You