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OSI Model

Application Management

Configuration

Network Provisioning (making it available)

Provisioning of network resources

Design

Installation and maintenance

Circuit-switched network

Example: TIRKS (Trunk Integrated Record Keeping System)

E1 in TIRKS for equipment management

F1 in TIRKS for facilities management

Packet-switched network

Protocol

Performance

QoS

ATM networks

Inventory Management

Equipment

Facilities

Network Topology

Manual

Autodiscovery by NMS using

Broadcast ping

ARP table in devices

Mapping of network

Layout

Layering

Views

Physical

Logical

Database Considerations

Preformance

Tools

Protocol analyzers

RMON

MRTG

Performance Metrics

Macro-level

Throughput

Response time

Availability

Reliability

Micro-level

Bandwidth

Utilization

Error rate

Peak load

Average load

Data Monitoring

Normal behavior

Abnormal behavior (e.g., excessive collisions, high packet loss, etc.)

Set up traps (e.g., parameters in alarm group in RMON on object identifier of interest)

Set up alarms for criticality

Manual and automatic clearing of alarms

Problem Isolation

Manual mode using network and SNMP tools

Problems in multiple components need tracking down the topology

Performance Statistics

Traffic statistics

Error statistics

Used in

QoS tracking

Performance tuning

Validation of SLA

Trend analysis

Facility planning

Functional accounting

Fault

Fault is a failure of a network component and Results in loss of connectivity

Fault detection

Polling

Traps: linkDown, egpNeighborLoss

Fault location

Detect all components failed and trace down the tree topology to the source

Fault isolation by network and SNMP tools

Use artificial intelligence / correlation techniques

Restoration of service

Identification of root cause of the problem

Problem resolution

Accounting

Least developed application

Usage of resources

Hidden cost of IT usage (libraries)

Functional accounting

Business application

Policy-based management

Domain space consists of objects (alarms with attributes)

Rule space consists of rules (if-then)

Policy Driver controls action to be taken

Distinction between policy and rule; policy assigns responsibility and accountability

Action Space implements actions

Service Level Management

SLA (Service level agreement) management of service equivalent to QoS of network

SLA defines

Identification of services and characteristics

Negotiation of SLA

Deployment of agents to monitor and control

Generation of reports

SLA characteristics

Service parameters

Service levels

Component parameters

Component-to-service mappings

Reports

Planning and Management Reports

System Reports

User Reports