3GPP Network Management
CS7012 Unit 3 Telecoms Management
Part 1: Architecture IRPs, Solution Sets, FCAPS in 3GPP, Itf-N
3GPP Management Objectives 1

• Capable of managing a multi-vendor network (inc OSs)
• Minimise mgt costs, maximise mgt simplicity
• Define standard interfaces between NE/OS/OS
• Enable rapid service deployment via flexible config mgt
• Provide integrated fault mgt
• Support remote mgt operations
• Enable Operator interoperability for charging/mgt info
• Support a growing network
• Re-use existing standards
3GPP Management Objectives 2

- Support security management of PLMN
- Standardise performance measures to allow comparison
- Expose any management information only once ie 1 action should be enough to change all occurrences of an attribute
- Support restoration of an OS (eg resynchronisation and atomic transactions)
- Have one global, unambiguous name convention
3GPP Management Infrastructure Requirements 1

• Every PLMN Organisation:
  – provides services to its customers
  – needs an infrastructure to fulfil them (advertise, ordering, creation, provisioning,...)
  – assures them (Operation, Quality of Service, Trouble Reporting and Fixing,...)
  – bills them (Rating, Discounting,...)

• Some of these management services may be provided by 3rd parties

• 2G networks really had little integration of management systems, need to fix this
3GPP Management Infrastructure
Requirements 2

• NMS’s are expensive => cannot be scrapped every time requirements change
  – Service n/w changing, mgt tech changing, scalability req changing
• Goal: Move from NE mgt -> Information mgt
• Flexibility to meet the various topological conditions as the physical distribution and the number of NEs
• Flexibility of OS location and structuring
3GPP Management Reference Model

3GPP Mgt specifications (IRPs) focus, Itf-N

Type 2 is primary area standardised, some work on type 1. 3 & 5 FFS. 6 & 4 out of scope.
Itf-N

• Between the NE OSFs and NM/SM OSFs
  – Enables NM/SM communication to NEs via EM
• This interface has 2 perspectives:
  – the management information model (NRM)
  – the management information exchanges
• The latter are identified by examining TOM process interfaces at the EML-NML boundary => IRPs
• Each IRP is technology independent (UML)
• Create 1+ tech dept models (SS) from IRP
IRP Specification Approach

Requirements / Use Cases

IS Definition (UML)

Interface IRPs
- Notification IRP
- Alarm IRP
- BulkCM IRP
- KernelCM IRP
- BasicCM IRP
- etc

Data Definition IRPs
- State Management IRP
- etc

NRM IRPs
- Generic NRM
- CoreNW NRM
- UTRAN NRM
- GERAN NRM
- etc

Solution Set Definitions (CORBA)

Solution Set Definitions (other/future)

Relative stable over long period of time
Changes only with respect to addition and extensions
Changes with new/better Technologies
3GPP Mgt Specification Approach

• Top-down
  – Requires some proprietary work for full functionality in short term
• Interfaces concentrate on tech-indpt information/service models which can be mapped to particular protocols
  – Allows new tech to be included as it appears
  – Information flow life cycle 10-20yrs, protocol life cycle 5-10yrs
• Logical Models
  – Network Resource Models (NRM)s
  – IRP Information Services
• Solution Sets = mapping an info service to a protocol/tech
  – CORBA/IDL and CMIP/GDMO generally supported
IRPs for Mgt Application Integration

Network Manager

Network & System Management Processes

- Network Planning & Development
- Network Inventory Management
- Network Provisioning
- Network Maintenance & Restoration
- Network Data Management

Element Manager

PSA

NE

Network Provisioning

Service IRPs
(Bulk, Inventory, State ….)

CM IRPs
(Notification, File Xfer, Log…)

Common IRPs

FM IRPs
(Alarm, Test..)

PM IRPs

PSA = Product Specific Application
NE = Network Element
3GPP Mgt Functional Architecture

• Uses TMF-TOM to define business processes/requirements
• Extends FCAPS to:
  – Performance management;
  – Roaming management;
  – Fraud management;
  – Fault management;
  – Security management;
  – Software management
  – Configuration management;
  – Accounting management;
  – Subscription management;
  – Quality of Service (QoS) Management;
  – User equipment management.
Performance Mgt

• Networks change
• Need data on which to base decisions
• Performance measurements are taken at NEs, transfer to OS for further analysis
  – Need to describe data collection mechanisms and the definition of the data itself. ie Define:
    • Admin of measurement schedules by the NE Manager
    • Generation of measurement results in the NEs
    • Method for bulk transfer of results to one or more OSs
    • A standard set of measurements
Fault Management

- Sub-processes like fault detection (alarms), fault localisation, fault reporting, fault correction, fault repair, etc
- Functionality concentrated at NE, NEM layers
- FM at NE, NEM layers is reactive, proactive at higher layers
- Fault management must protect QoS by:
  - detect failures in the network as soon as they occur and alert the operating personnel as fast as possible
  - isolate the failures and limit the effect of the failure as much as possible by reconfiguration of the faulty NE/adjacent NEs
  - determine the cause of the failure using diagnosis and test routines
  - repair/eliminate failures through maintenance procedures
- Layer B uses standard IP security mechanisms
- Layer A has:
  - User authentication
  - Single log-on
  - Single point of administration
  - Authorisation (Access Control)
  - Action Logging
Software Management

- Two processes identified:
  - Main: requesting, acceptance, installation, monitoring, documenting, database updating and feedback to the vendor for managing software. This covers patches and full releases.
  - Fault management

- Thus this Topic is really a subset of Configuration Management and Fault Management
• **Objective**: to control and monitor the actual configuration on the Network Elements (NEs) and Network Resources (NRs) such that capabilities and integrity are maintained.

• Used for:
  – Network expansion/contraction
  – Network optimisation
  – Maintenance of QoS

• CM may be:
  – Single actions on a single NE, or
  – Complex actions on many resources on many NEs
CM - Typical tasks

• System up-date (no new functionality)
  • the network shall not be disturbed in its function until the required modification is activated

• System up-grade (new features/facilities implemented)
  • Minimal disturbance of network
  • Ability to handle sequence of dependencies in upgrades
  • Ability to create logical NE/NR without having physically installed it and vice versa
  • Methods to prevent a partially configured NE/NR being put into service
  • Ability to revert to previous configuration
CM – Maintaining data consistency in a distributed MIB

• Standard NRM only applies at NM-EM interface, EM-NE can have a different model
  – Consistency between NE and NM (OSS) relies on:
    • Which information is exchanged between EM-NE (proprietary)
    • How information is exchanged between EM-NE (proprietary)
    • How information is locally represented/mapped to stnd NRMss
    • Where information is kept – locally in NEs or cached/mirrored in one or more OSs

• Network level (overall) data consistency also a concern
  • NM maintains this by comparing all MOIs/attributes in network
  • Also: awareness of re-configuration, reversion, audit-trails
  • Ability to force MIB re-synchronisation
CM Service Components

• System modification
  – Can affect 1 NE, 1 EM, many EMs, other NMs
    => Need to retain system integrity, data consistency
  – Functions
    • Create/Delete/Modify NE/NR

• System monitoring
  – provides the operator with the ability to receive reports (on request or spontaneously) on the configuration of the entire network or parts of it from managed NEs
  – Functions
    • Information Request/Information Report/Reporting config.
      – Eg Object creation/deletion, Attribute value change, State change;
CM Itf-N Interface

- 2 Types of CM functions:
  - Passive: browsing, synchronising
  - Active: changing the configuration
- 2 Approaches to CM:
  - Basic CM: mgt operations on individual or groups of NEs
  - Bulk CM: file-oriented config data retrieval/download to single NEs, groups of NEs, EMs or the whole network
    - Also operations to activate a downloaded config + fallback from it
- Implemented by Kernel, Basic & Bulk CM IRPs plus NRM and name convention
Accounting Management

• Need to record usage of network so we can generate bills.
• Hence specify:
  – Layout and formats of charging data records (CDRs)
  – Data generation dependent on call states, chargeable events and service requirements
  – Formal description of the CDRs format in ASN.1 and definition of a file transfer mechanism (FTP).
Subscription Management

- Permits operators to provision services for a specific customer subscription
- 2 aspects:
  - Service/Customer
  - Network configuration
- Proprietary in 2G networks
QoS Management

• 2 aspects:
  – QoS policy provisioning: configuring/maintaining NEs with QoS policies based on customer SLAs and observed n/w performance
  – QoS monitoring: collecting QoS performance statistics and alarms
• Mainly important for IP networks
OSI Mgt Comparison to 3GPP

• Question:
  What are the similarities and differences between the OSI and 3GPP Network management models?
  • Scope
    • High level model of management domain
  • Specification approach
  • Management protocols
  • Languages for modelling managed objects