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
• 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 Network Reference Model
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 3\textsuperscript{rd} 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

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

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

- Data Definition IRPs
  - State Management IRP
  - 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

PM IRPs
CM IRPs
Service IRPs
FM IRPs
Common IRPs

Network Manager

Network & System Management Processes

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

Network Data Management

NE = Network Element
PSA = Product Specific Application
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 NRMs
    • 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 s 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