**Agenda Item:** 7.2

**Source:** ARIB

**Title:** NM-relevant section (Chapter 7) of ARIB work for 3G

**Document for:** WG5

ARIB's Document Volume 1 (Spec. No.5), "Requirements and Objectives for a 3G Mobile Services and System", in particular Chapter 7, is related to the works of WG5. The version 0.8, which is subject to final comments and approval by the parent committee to become version 1.0 targeted for sometime in February, is now available on the ARIB WWW home page. You can download it from;

"http://www.arib.or.jp/IMT-2000/ARIB/Document/"

for use by 3GPP studies.

ARIB would like to make the attached section of the above-mentioned document available to 3GPP so that the material may be incorporated in the 3G NM work. So, the attached section is submitted to 3GPP/TSG-SA/WG5 #1 meeting as a collective contribution by ARIB members.

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## 7 Network Management (ITU-R M.1168, Sec.7)

### 7.1 Recommendations for 3G Mobile System management standardization

**(ITU-R M.1168, Sec.7.1)**

#### 7.1.1 Objectives
**(ITU-R M.1168, Sec.7.1.1)**

3G Mobile System management should be defined in compliance with the following objectives:

1) To provide a management architecture, in order to support a multi-vendor 3G Mobile System environment.

2) To define management information to be exchanged across standardized interfaces in terms of OSI model.

3) To support the capability of controlling a 3G Mobile System itself as far as possible.

4) To address the management and assessment of system performance and operation through the use of measurements, etc.

Note:

- *This would enable a 3G Mobile System operator to make comparisons with its service quality criteria and objectives.*

5) To improve service assistance and interaction with customers.

6) To address a flexible billing and accounting administration, so as to support charging across a

3G Mobile System and non- 3G systems.

7) To support the capability of geographical dispersion of control functions

8) To provide common methods for the provisioning of 3G Mobile System services by 3G Mobile System management.

9) To provide the capability to report events and reaction in a common way, in order to enable remote control and to simplify maintenance interventions.

10) To minimize the complexity of 3G Mobile System management.

11) To minimize the load caused by management traffic when the telecommunications network is used to carry it.

12) To define methods and control to be employed to effect as quick as possible set up and changes to the system.

Note:

- *This would enable a safe, continuing extension and enhancement of offered 3G Mobile System services.*

13) To enable the support and control of a growing number of resources. This would allow the system to start from a small and simple configuration and to grow as needed both in size and complexity.

14) To support the system to be configured for the condition of not only a high traffic area but also a low traffic area, e.g. rural remote area.

15) To allow for enough flexibility in the configuration of the system such that particular 3G Mobile System operator requirements concerning the availability of 3G Mobile System services may be met.

16) To address the convergence of 3G Mobile System management for the operation of terrestrial and satellite components of a 3G Mobile System.

17) To allow also the management of 3G Mobile System radio-connected 'infrastructure' (e.g. mobile base stations).

18) To address interworking between 3G Mobile System operators, whether public or private, covering overlapping or adjacent areas.

Note:

- *This will allow 3G Mobile System services provision by more than one operator in any area of coverage, and a continuity of service between 3G Mobile System environments.*

19) To specify standards to support the exchange of necessary and/or desirable management information between 3G Mobile System operators, whether public or private.

Note:

- *This would support inter-operators roaming from mobile users.*

20) To reuse the existing relevant standardization work on management of PLMN, IN, ISDN/B-ISDN, etc. already carried out by other standardization bodies.

21) To address 3G Mobile System interworking with a wide range of existing or future partner networks and services such as other mobile networks, ISDN, B-ISDN, PSTN, UPT.

22) To support and control the management of the security aspects in a 3G Mobile System such

as cryptographic key administration and access control management.

23) To facilitate the evolution of existing and developing mobile telecommunication networks and systems towards a 3G Mobile System.

### 7.1.2 General Requirements for 3G Mobile System Management

**(ITU-R M.1168, Sec.7.1.2)**

The objectives for 3G Mobile System management must now be analyzed from different viewpoints (e.g. service quality aspects, Management Functional areas) to identify general requirements for 3G Mobile System management.

Notes:

- *3G Mobile System operator refers to a 3G Mobile System network operator or a 3G Mobile System service provider or to both of them, according to how the responsibility is shared between the network operator and the service provider.*
- *A direct assignment of O&M functions and activities to functional blocks is not possible before the definition of network architecture. This statement is at the moment valid for all network components of a 3G Mobile System.*

#### 7.1.2.1 Service Quality **(ITU-R M.1168, Sec.7.1.2.1)**

3G Mobile System operators should be able to select criteria for the evaluation of the 3G Mobile System service quality. The following requirements, from an operator's perspective, have been identified:

- to recognize the kind of service and related service quality,
- to monitor the service quality,
- to be able to recognize the different kinds of terminal,

- to support handover between networks while maintaining the appropriate quality,
- to support the demand of users to communicate in every network with the appropriate service quality,
- to support the functionality to indicate degraded service quality to the user/terminal,
- to cooperate on service quality issues with other network management systems.

#### 7.1.2.2 Service and Business Areas (ITU-R M.1168, Sec.7.1.2.2)

This section provides the general 3G Mobile System management requirements, from a 3G Mobile System operator point of view, for the following aspects:

- subscriber and user administration,
- charging and billing (e.g. collection of charges from subscribers),
- inter-operator accounting (e.g. collection of charges from other operators),
- service management.

##### 7.1.2.2.1 Subscriber and User Administration (ITU-R M.1168, Sec.7.1.2.2.1)

3G Mobile System management should include the management functions associated with the administration of data (possibly distributed over several databases), related to the provision of 3G Mobile System services to subscribers and users. The use of a unique user identification and of a unique equipment identification needs to be foreseen.

Every user is associated with a subscription. Every subscription is associated with a service provider.

##### 7.1.2.2.2 Charging and Billing (ITU-R M.1168, Sec.7.1.2.2.2)

In a 3G Mobile System there will exist different possibilities to charge for calls:

a) Normal case

In this case usage records are created by the network operators. These usage records will be collected by the appropriate service providers for billing.

b) Hot billing after the call (credit card callings)

In this case the network operator bills card agency for the call after collection of all relevant usage records.

c) Hot billing during the call (prepaid cards or cash)

In this case the network operator deducts units from the prepayment while the call is in progress.

3G Mobile System management should provide the means to apply proper charging according to case a) - c).

Usage records are transferred to the Service Provider of the involved users.

Originating, transit and terminating 3G Mobile System operators should be able to do usage metering.

Usage metering of network resources for the purpose of billing shall be the responsibility of the network operator.

3G Mobile System management should enable 3G Mobile System operators to register certain kinds of handovers, in order to be able to charge differently depending on handover cases (e.g., terrestrial/satellite).

3G Mobile System management should enable 3G Mobile System operators to charge for the usage of location management procedures.

In order to enable different charging techniques during the call (e.g. directly to the user), 3G

Mobile System management should provide mechanisms to manage the exchange of charging information, e.g., when a handover is invoked.

#### 7.1.2.2.3 Inter-Operator Accounting (ITU-R M.1168, Sec.7.1.2.2.3)

Inter-operator accounting should be verifiable. This implies that when traffic over a given connection or link between two 3G Mobile System operators is to be charged, usage metering needs to be done on both sides: outgoing (Operator A) and incoming traffic (Operator B).

The service provider will be able to collect usage records relating to use of resources from all involved network operators.

Inter-operator accounting should result in an exchange of usage metering information based on the actual route.

Usage metering of signalling traffic (out of call procedures: e.g. interrogation, location updates) for the purpose of inter-operator accounting might be needed.

#### 7.1.2.2.4 Service Management (ITU-R M.1168, Sec.7.1.2.2.4)

3G Mobile System management should allow the use of a 3G Mobile System for the purpose of providing its services to fixed users.

3G Mobile System management should support the use of a 3G Mobile System for the purpose of providing its services to fixed users, as well as to mobile users.

3G Mobile System management should allow service management even in the case of shared infrastructure.

3G Mobile System management should support 3G Mobile System operation (interworking) with a wide range of existing or future partner networks and services (e.g. other mobile networks, ISDN/B-ISDN, PSTN, UPT). This should allow the desired services to be offered in a cost effective way.

### 7.1.2.3 Security Management Area (ITU-R M.1168, Sec.7.1.2.3)

This section provides the general 3G Mobile System management requirements for the following aspects:

- management of 3G Mobile System specific security mechanisms and algorithms,
- key management,
- encryption management,
- authentication management,
- access control management,
- service barring list management,
- security audit management,
- management of subscriber related credential information,
- information exchange regarding security management.

Notes:

- *Security management standardization is concerned with the management functions allowing 3G Mobile System operators to perform administration of the security features of the network (e.g. handling of security alarms).*
- *Security management standardization is not concerned with the definition of security features (e.g. cryptographic key generation and distribution).*

**7.1.2.4 Performance Monitoring Area (ITU-R M.1168, Sec.7.1.2.4)**

This section provides the general 3G Mobile System management requirements for the following aspects:

- performance data generation and collection (e.g. for QoS/GOS analysis),
- traffic measurements,
- subscriber activity tracing.

3G Mobile System management should support the use of measurements from, e.g. handover, user registration, location updating and paging, for performance and planning purposes.

The measurement data produced by the network could be used for:

- traffic measurements (e.g. successful/unsuccessful handovers per a group of base stations per hour);
- evaluation of current network configuration (e.g. ratio of handover attempts and successful handovers per cell). The measurement results can be further processed in the network planning and reconfiguration part of TMN;
- evaluation of possible fault situations around the 3G Mobile System network (e.g. number of successful and failed handovers per source/target cell).

**7.1.2.5 System Configuration Area (ITU-R M.1168, Sec.7.1.2.5)**

This section provides the general 3G Mobile System management requirements for the following aspects:

- spectrum management,
- system extension (e.g. introduction of a new network element or function),
- system reduction (e.g. removal of a network element or function),

- system modification (e.g. change of an existing network element or function),
- interworking with other systems.

3G Mobile System management should support:

- the flexibility to manage a wide range of cell types,
- reconfiguration of assigned frequency blocks (spectrum management) in response to changing traffic, service requirements or spectrum allocation, allowing efficient and economical use of the radio spectrum,
- provision of access to 3G Mobile System dependent on the mobile terminal type or location,
- provision of access to a 3G Mobile System for fixed users,
- reconfiguration of the system without disrupting the normal provision of services,
- the management of the relevant configuration information used by 3G Mobile System specific radio interface protocols, e.g. cell identities,
- the control of handover configuration e.g. by allowing the selection of the handover algorithm, the selection of the candidate cells for handover for each cell individually, the configuration of the handover function, and the management of handover mechanisms characteristics,
- operators' ability to initiate maintenance activities (e.g. to clear a cell by forced handovers or no admittance of new calls),
- the management of 3G Mobile System mobile network elements configuration (e.g. mobile base stations).

#### 7.1.2.6 Maintenance Area (ITU-R M.1168, Sec.7.1.2.6)

Operators need to maintain the system (telecommunication equipment) in a state where the quality of offered services to the subscriber is acceptable. Maintenance includes techniques that aim to minimize the loss of service caused by a failure.

This section provides the general 3G Mobile System management requirements for the following aspects:

- pro-active maintenance (e.g. routine maintenance activities, transmission relevant failure

information to manufacturers),

- detection/localization/isolation of failure (e.g. monitoring, analysis of operating trends, analysis of customer complaints),

- reactive maintenance (e.g. repair and restore the network functions).

Note: *It could be expected that most faults in terminals have no impact to the network, meaning they do not disturb the network. In this case fault detection and repair is not a concern of the network operator. On the other hand there may be faults in terminals which do disturb the network. In this case it is necessary for the network operator to have the capability to deal with these problems. This subject is for further study.*

#### 7.1.2.6.1 Pro-active Maintenance (ITU-R M.1168, Sec.7.1.2.6.1)

The main purpose of pro-active maintenance is to minimize failure occurrences. For example, the following mechanisms can be used:

- self tests, may be used to ensure correct functioning prior to operation;

- test loops, may be used to ensure correct communication prior to operation;

- a maintenance friendly design of the equipment, so that normal maintenance activities can easily be performed by the maintenance staff;

- provision of redundant units of equipment, (these units may be on hot or cold standby, depending on requirements): such units should be proved for all important units necessary to maintain the operation;

- arrangement of equipment of the network in such a way that, in case of a failure, the active part of the network can be switched to an equivalent circuit;

- establishment of a database of failure for forecasting purpose.

#### 7.1.2.6.2 Detection/Localization/Isolation of Failures (ITU-R M.1168, Sec.7.1.2.6.2)

Detection and localization mechanisms are necessary to recover from system failures. Isolation mechanisms are necessary to minimize the impact of these failures.

If a failure occurs, this can have different effects on services depending where the fault occurs. Understanding the severity of the fault is necessary to determine the required speed of repair. For example, the following mechanisms may be used for detection, localization and isolation:

- failures have to be able to be reported in alarm messages, with information facilitating the localization and severity assessment;
- generation of alarms if 3G Mobile System performance, e.g. handover performance, is below a pre-defined threshold;
- detection and evaluation of discrepancies between two hot standby units;
- recording and evaluation of call characteristics (e.g. statistical surveys of calls to avoid or to detect faults);
- analysis of user complaints;
- the ability to perform regular and automatic testing, and test functions or facilities which can be activated on site;
- facilities to check status information of all units;
- analysis of operating trends to detect or describe failures using history databases;
- performance of alarm correction, e.g. using an expert system.

#### 7.1.2.6.3 Reactive Maintenance (ITU-R M.1168, Sec.7.1.2.6.3)

Once the detection, localization and isolation of the failure has been accomplished, the faulty unit (software or hardware) must be repaired or replaced.

In order to support effective maintenance, 3G Mobile System management should provide the following information:

- equipment/system status,
- load levels,

- trouble conditions,

- activated network management control.

When existing, the redundant units must overtake the operation.

In order to verify the repair, it is useful for the maintenance staff to have access to the management network to initiate tests.

In case of replacement, the consistency between software and hardware versions must be verifiable.

## 7.2 Principles and Guidelines for the specification of 3G Mobile System management

**Recommendations** **(ITU-R M.1168, Sec.7.2)**

### 7.2.1 General
**(ITU-R M.1168, Sec.7.2.1)**

The target of 3G Mobile System management is to offer a variety of functions such as planning, installation, provisioning, operation, maintenance, administration and customer services under a multi-vendor and multi-operator environment. The concept of TMN, which has been studied by ITU-T, is most beneficial for providing these functions. A 3G Mobile System should apply the TMN concept to its network management.

Hereafter are provided principles and guidelines for the specification of the 3G Mobile System management, particularly the 3G Mobile System specific TMN management service. These 3G Mobile System management recommendations should finally reflect the 3G Mobile System management objectives and requirements, as defined in this framework recommendation. In order to assist in achieving this goal, the scope of each planned 3G Mobile System management recommendation is clarified hereafter.

### 7.2.2 TMN Management Service for a 3G Mobile System

**(ITU-R M.1168, Sec.7.2.2)**

This Recommendation should follow the new template of ITU-T Recommendation M.3020 for the definition of a TMN Management Service. This includes the provision of: a management service description, management goals, a management context description, roles, resources, TMN Management Functions, management scenarios, and the architecture.

This Recommendation should take into account the need for the following 3G Mobile System specific management activities:

- 3G Mobile System subscriber, mobile equipment and service data administration,
- 3G Mobile System charging and accounting management,
- 3G Mobile System security management,
- 3G Mobile System performance management,
- 3G Mobile System configuration management and administration,
- maintenance of 3G Mobile System infrastructure.

The exchange of management information between 3G Mobile System operators (service providers or network operators) should be addressed, when relevant, for each of these management activities.

### 7.2.3 TMN Management Function Sets (ITU-R M.1168, Sec.7.2.3)

ITU-T Recommendation M.3400 "TMN Management Function Sets" will contain the specification of both generic and specialized functionality related to TMN Management Functions, and needed for all telecommunications activities.

ITU-T Recommendation M.3400 will provide the specification of the TMN Management Function Sets to be used for 3G Mobile System management, according to the specification of the 3G Mobile System TMN Management Service Recommendation. The description for TMN

Management Function Sets will follow the new template of ITU-T Rec. M.3020. This includes the provision of: management requirements, a functional model, summary description of each TMN Management Function, and detailed description of the management information.

### 7.2.4 3G Mobile System Management Information (ITU-R M.1168, Sec.7.2.4)

This Recommendation should provide the definition of 3G Mobile System Management Information which will be exchanged across standardized interfaces, according to the specifications of the Recommendation "TMN Management Service for FPLMTS".

This management information should be used to manage a 3G Mobile System, as required and specified in the relevant TMN Management Function Sets. The 3G Mobile System management information should be described using the object-oriented paradigm in the ISO/ITU-T GDMO (Guidelines to Define Managed Objects) formal style (see ITU-T Recommendation X.722). Related work from other standard groups will be reused whenever possible and discussed within the context of 3G Mobile System management.