Agenda Item: 7.6

Source: Convenor

Title: Vodafone and T-Mobil joint contribution to TSG-RAN3

Document for: WG5

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relating to UTRAN O & M requirements.

It captured the Convenor's attention that Vodafone and T-Mobil have submitted to the February 2-5 Bonn meeting of the TSG-RAN3 WG a joint contribution regarding to UTRAN O&M requirements, which, the Convenor believes, is a subject matter of TSG-SA5 WG's direct concern. So, the Convenor would like to make the text of the said contribution by Vodafone and T-Mobil also available to TSG-SA5 WG meeting for discussion.

1 Acronyms and Abbreviations

API	Application Programming Interface
BTS	Base Transceiver Station
CORBA	Common Object Request Broker Architecture
GDMO	General Description of Managed Objects
GUI	Graphical User Interface
IIOP	Inter ORB Protocol
IP	Internet Protocol
Iub	Interface between RNC and Node B
NE	Network Element
NM	Network Management
O&M	Operation and Maintenance
OMG	Object Management Group
OMC-B	Operation & Maintenance Centre for Node B
ORB	Object Request Broker
IDL	Interface Description Language
JVM	Java Virtual Machine
RDF	Resource Description Format
RNC	Radio Network Controller
Stub	Interface to a CORBA bus
TCP	Transmission Control Protocol
UML	Unified Modelling Language
UTRAN	UMTS Terrestrial Radio Access Network
XML	eXtended Mark up Language

2 Introduction

History shows that the introduction of a Standard Interface for FM and CM before launching the GSM-Project did not fully succeed. Therefore vendor specific OMC's were necessary to manage the GSM network. These OMC's do not support an open interface for management purposes. So no computer supported network management or higher level management was possible. A first attempt to close this gap was to force the standardisation body to pass the standard GSM 12.20 to realise a unique management interface for all BSS suppliers.

The goal of this paper is to introduce a new management approach describing the over all architectural principals for an open Iub Interface. Also, this approach shall give every party, supplier and operators of UMTS networks, a framework that supports on the one hand the rules for inter-working and gives on the other hand the flexibility needed.

2.1 Non-functional Requirements of an open Management Architecture

Mr. Cabrera wrote in his document *Proposal of Procedure for UTRAN Management*, ETSI-Nr TDoc SMG6 98u006:

In order to select that Architectural Principle, it is proposed to identify the functionality that needs to be managed in both nodes, and identify which management areas need coordinated and/or consistent operation in both nodes.

It is as important, to devote attention to the non-functional aspects, such as openness for multi-vendor environment, simplicity, support to independent evolution of Node B and RNC etc.

- *performance requirements on NM actions on UTRAN Nodes*
- *security*
- *cost efficiency and simplicity*
- *openness for multi-vendor*
- *cleanliness for independent evolution of UTRAN Nodes*

We agree with the above and would identify the following additional requirements exist, which should be included:-

- the architecture of the management system must support an evolution of refinements of the functional requirements and their implementation, as well as the refinement of the architecture itself
- the architecture has to ensure that the management capability can be accessed even if the functionality is not standardised
- the management architecture has to provide easy mechanisms to integrate legacy systems into an overall management architecture
- the management architecture should build on common and proven techniques that are already frequently used, so that a wide area of know how can be used
- the chosen architecture should provide a robust and distributed management system

2.2 Management Approach for UMTS

For the reasons mentioned above, a new approach to standardise an O&M interface should take into account the following items:

- rapid specification of a standard framework which demonstrates the conceptual principles
- different levels of abstraction to reduce complexity
- use of common and proven methods and tools to specify the standard for easy implementation
- choosing an approach that gives the network element supplier the opportunity for bespoke design but allows the operator open access to all data

One of the most modern and powerful methods to describe and implement distributed systems and their interfaces is the object oriented approach incorporated in CORBA. Therefore, in the following chapter a way will be conceptualised that shows how the above mentioned requirements can be specified and implemented using CORBA.

2.3 The Framework

Figure 1 illustrates the principles of the required architecture of a new O&M interface for UMTS.

The basic issues are:

- Using the object oriented method for the modelling of the service components. The specification of the object model should be done in UML (Unified Modelling Language, or any other appropriate language).

pro:

- object oriented modelling is a state of the art modelling technique
- UML is a frequently used syntax to describe object oriented models
- tools available
- compiler from UML into program skeletons for C++ or Java are part of software engineering environments
- UML has been submitted to the OMG for standardisation in January 1997

contra

- no implicit mechanism for notification handling by comparison with GDMO
- may be extra time required for UML specifications

 using CORBA for transparent object distribution and communication

pro

- standardised in OMG
- many implementations available
- wide utilisation in different domains (not restricted to the telecommunications market)
- many components specified or implemented
- service component for notifications under standardisation

 strict delineation between service components, describing one model of the network and applications or GUI's, completing a management tool

pro

- open interface (API) for the Service Component "O&M Functionality" in a standardised environment
- no constraints on realising the management model except the use of UML and IDL
- open access to all data

contra

- possible mediation between an operator specific view and the vendors object model has to be initiated by the operator
- the vendor has to follow constraints of the design pattern

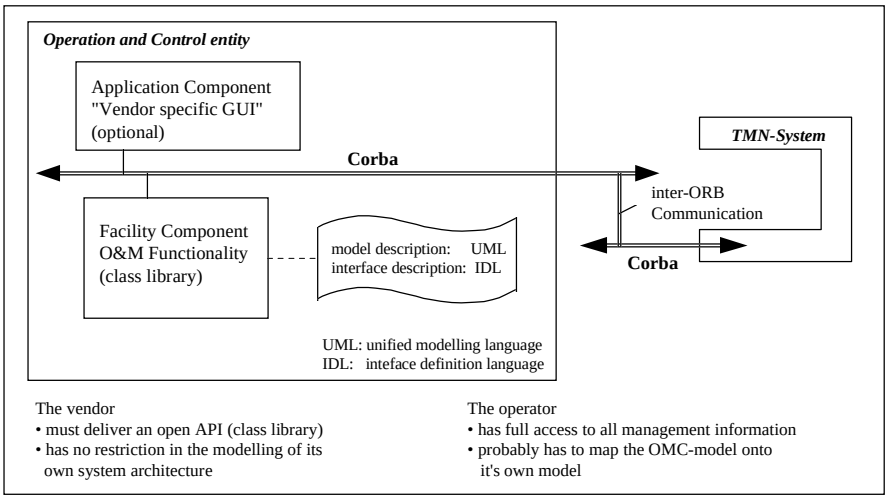

Figure 1 Conceptual Architecture of an O&M-Transformer

All aspects of the conceptual model are chosen to facilitate specification and implementation of a system for management purposes. Therefore, only well-proven and widespread technologies are recommended. In addition, an appreciation should be given to the importance of the modelling

techniques applied. These should be selected such that full benefit can be obtained from the opportunity to standardise and re-use common functions across the management network.

In addition to the conceptual model, other issues can be identified as worthy of standardisation:

1. how to use Java to implement a mediation device located at the operation and control system (chapter 3.1)
2. how to realise a mechanism to distribute management capability in the overall system (chapter 3.2)
3. how to realise the interfaces between the system components (chapter 3.3)

3 Management System Architecture and Supporting Technologies

3.1 Use of Java to implement a Mediation Device located on the Operation and Control System

In most cases the vendor specific model would not match the operator's view of the Network, therefore mediation might be necessary. The operator has to model and implement such a mediation device as a facility component of the CORBA bus. From an engineering point of view there will not be any problems. Nevertheless, to increase the performance of the UMTS management system it could be valuable for the operator to download such a mediation facility component to the operation and control system. As a reflection, this requirement will cause some security requirements from the provider of the operation and control system to insure that this will not have any impact on the existing system. A currently popular technology used in many Internet applications can be adopted to solve the problems of security and compatibility - Java and the Java Virtual Machine (JVM). For that, each operation and control system is required to support a JVM and the necessary API's. Figure 2 illustrates how the operator can create and download an operator-specific mediation component into the operation and control system.

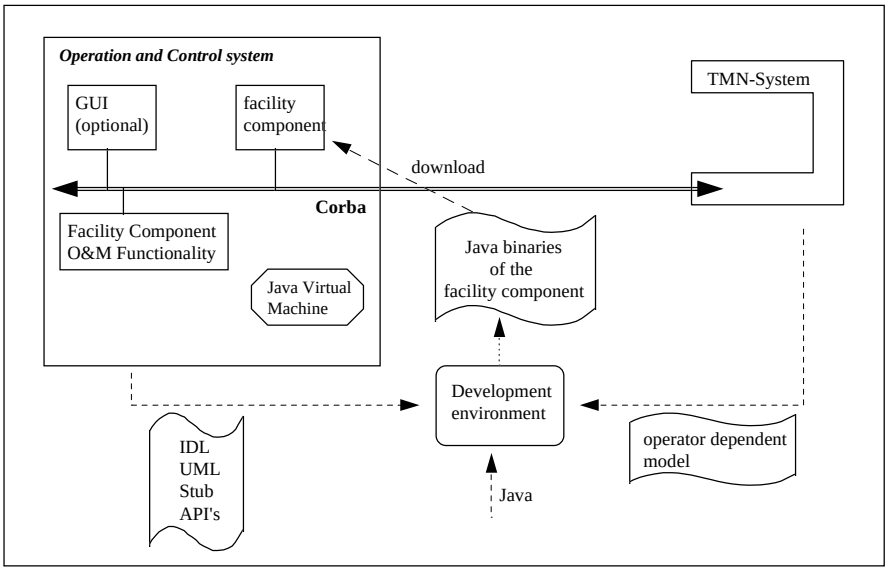

Figure 2 Use of Java to realise a secure "down load mechanism"

As input, the operator gets the IDL, the UML-description of the vendors model, the CORBA Stub to access the service component "O&M Functionality" and the standard Java API library. Additionally, the operator has knowledge of his own internal model and its requirement of the O&M-Functionality. With this knowledge, the operator is easily able to develop a Java facility component realising all personal requirements. After downloading onto the Operation and Control System, the UMTS management-system can communicate with the facility component to realise the operator's specific management task. However, where facility components are downloaded to run on NE's care must be taken to ensure the NE is capable of fully supporting the portable facility component. Proper definitions will need to be made relating to resource and performance requirements to ensure the facility component and core functions of the NE operate satisfactorily.

3.2 Use of Java to realise a flexible distribution of Management Capability in a Management Network

Whereas the conceptual model implies an operation and control system gathering all management related data, the model can be evolved by dropping the dedicated operation and control system. Then, all the management functionality (components) must be distributed to the network elements themselves. This can be realised by using CORBA. In such an approach, an image of the management facility components will be created on the UMTS management-system where users or applications can access the management components.

If some of the management functions, offered by the vendors, are more in the sense of management applications it could be valuable to download them onto the UMTS management system. This can be realised in analogy to chapter 3.1 by using the concept of Java. Figure 3 illustrates this approach.

The network element supplier will probably support the operator only with raw data excess components or additionally with sophisticated management components. In fact, this approach will allow the realisation of a “tool box” that allows the vendor to offer different kinds of management capabilities and the operator the establishment of a specific management solution [image of the real network].

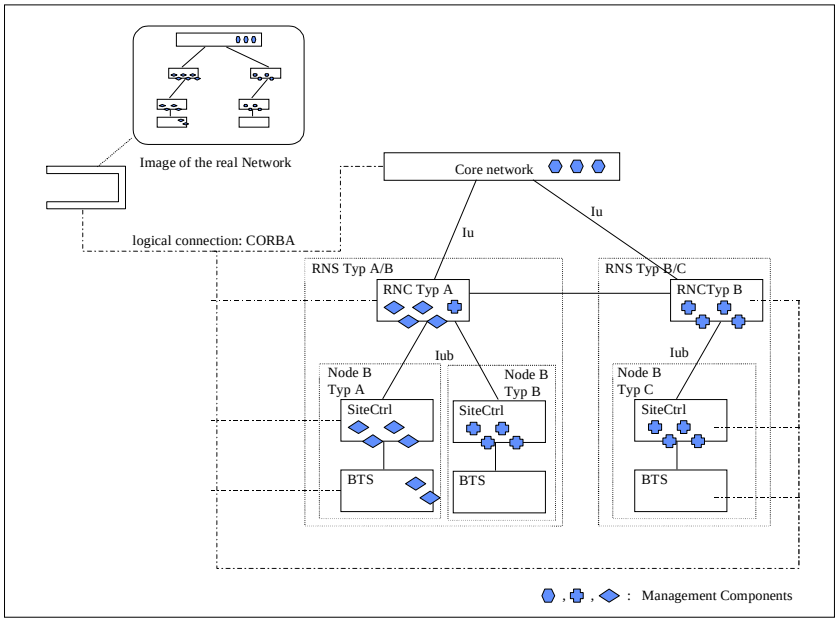

Figure 3: A management architecture without dedicated Operation and control systems

By using this management approach other IT-Technologies coming from the internet like XML could be used to browse the management network for e.g. the actual configuration of the network elements. Figure 4 shows the concept. Each network element will have an XML document describing the offered management functions, their interfaces and data types.

In addition, the use of RDF (Resource Description Framework) incorporated in XML documents should be evaluated. RDF is designed for the description of semantically aspects. This could be the base for intelligent agents.

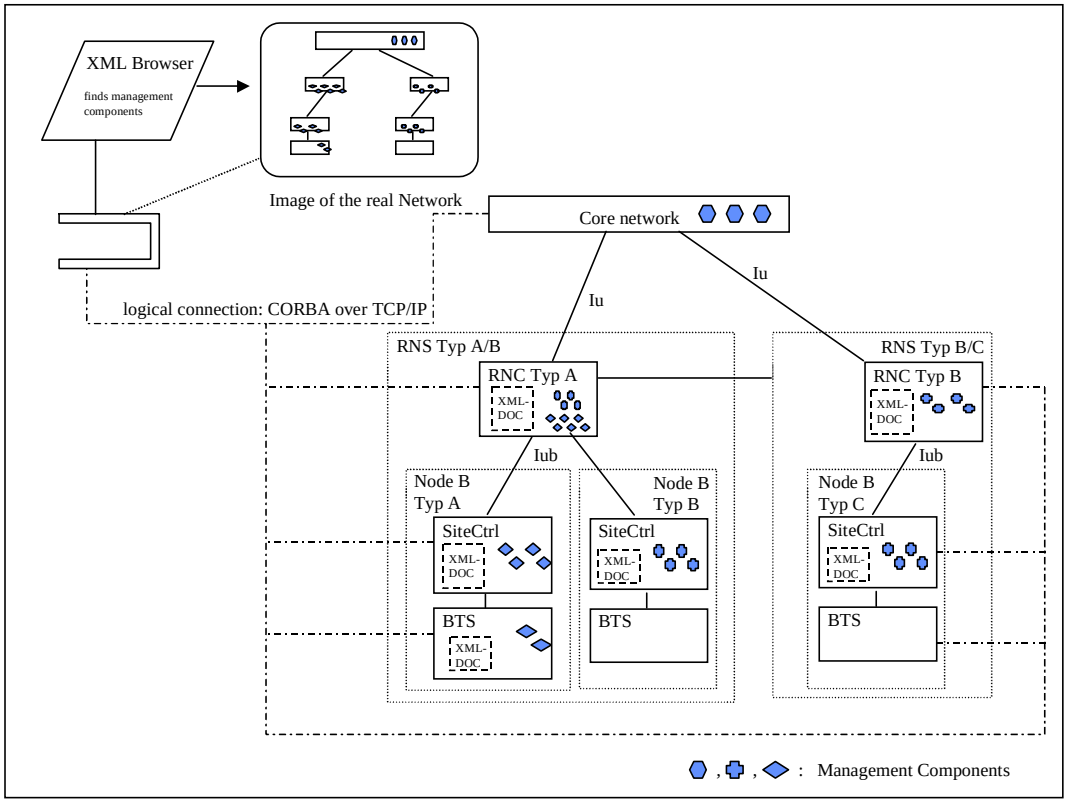

Figure 4: Use of an XML Browser

3.3 Requirements on the Iu and Iub Interfaces from a Management perspective

The management network architecture mentioned in chapter 2 requires a “CORBA-connection” to all network elements. Figure 5 illustrates a more detailed view of the system architecture. The picture shows two levels of abstraction, the logical structure and the system architecture. In the logical view the management components or objects are transparently communicating via the CORBA bus to realise their management tasks.

The system architecture shows that at least three different systems are identified. A management system that is responsible for the co-ordination of the management tasks. The RNC and the SiteCtrl/BTS system that realise UMTS functionality. For the required management architecture each system has to provide a CORBA system where its management components are connected too. The communication between the CORBA processes will be realised via the inter-orb-protocol IIOP over a TCP/IP stack.

Derived requirements for the Iu/Iub interfaces for management aspects:

at the system architecture level: CORBA, IIOP over TCP/IP

at the logical level: Definition of the service components, see chapter 2.1.

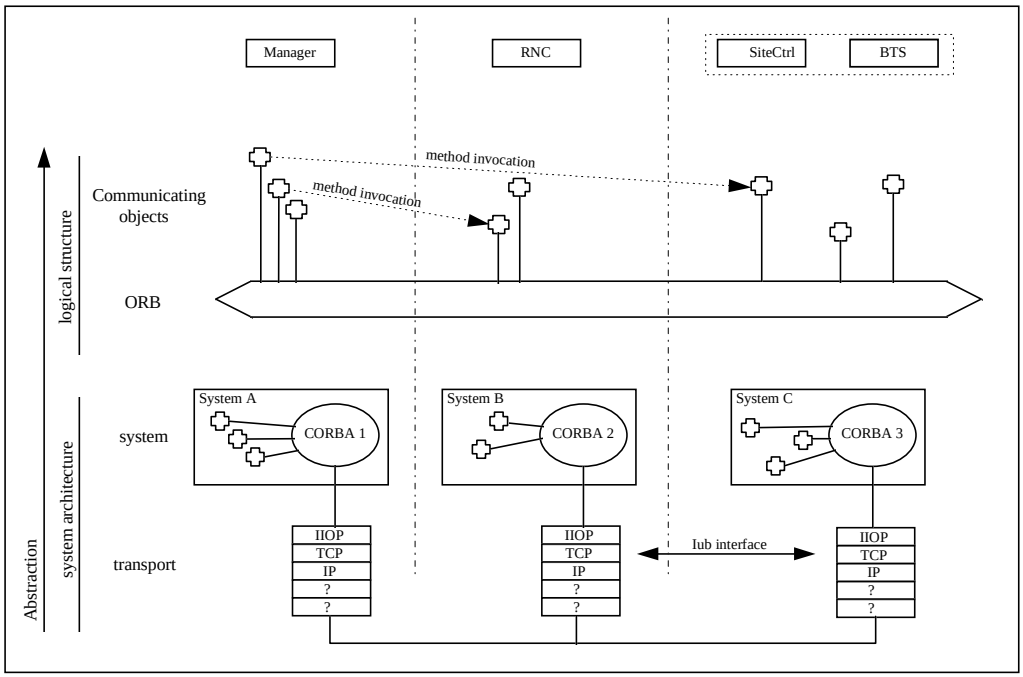

Figure 5: Structure of the Management Network

3.4 Iub Facility Components

From a functional perspective, the O&M facility components for the Iub (Node B/RNC) must be defined to allow the architecture of the UTRAN to be determined. To define these facility components, the functions performed by the Node B and RNC must be envisaged and a functional model standardised. To this end, the list below provides a high level functional model for the facility components supported on the Iub.

- Signalling Link Management
- Timing and Synchronisation
- Cell Configuration
- Dedicated Resource Management
- Common Channel Management
- Radio System Management
- Software Management
- Node B Initialisation
- Node B Hardware Configuration
- Performance Monitoring
- Site Maintenance
- Security and Access Control
- External Interface Management

The facility components for the functions above must then be distributed to the appropriate controlling entity, and this will determine a management architecture for the UTRAN O&M. However when establishing a suitable architecture an appreciation should be given to the functions described above and their dependency and impact on each other.

3.5 Requirements for UTRAN Management Architecture

When considering the UTRAN O&M management, a number of high level architectural requirements exist which should be satisfied.

- The chosen management architecture must ensure the RNC performs an integral role in O&M procedures
- The architecture must support multiple vendor implementations which support a multi-vendor Node B environment
- The chosen architecture must provide a robust and therefore distributed management system
- The hardware platform requirements of the management system must be minimised

Many O&M processes will have a direct impact on the traffic handling ability of the Node B radio site, therefore to satisfy the level of functional interaction necessary an architecture where the traffic and O&M are co-ordinated by a single entity is essential. The facility components described in section 3.4 illustrate the special requirements of the UTRAN with regard to O&M procedures. It can be seen from the components identified that there will be a close relationship between O&M and traffic related processes within the UTRAN, and it is therefore necessary to ensure these two functional areas are closely co-ordinated. Without an architecture which reflects this requirement, additional messages and/or additional interfaces will need to be standardised to support the co-ordination of the management entity for Node B (OMC-B) and RNC. Figure 6 shows an architecture where the RNC performs the O&M management of the Node B, thus satisfying the first architectural requirement above. This will allow the UTRAN to be carefully managed, and the impact of O&M procedures on the end user minimised.

The management architecture must also be capable of supporting multiple vendor implementations, to provide a multi-vendor environment while still ensuring product differentiation. Therefore the RNC must be capable of supporting different vendors implementations of Node B, and this could be achieved through the use of platform independent vendor specific code. This would then manage the implementation specific aspects of the Node B. Where possible, all messaging should be standardized, thus allowing the RNC to perform the necessary management functions in a multi-vendor environment. However where implementation specific information or actions are required (and standardisation of message content beyond a given layer is not possible), vendor specific code on the RNC platform would manage such functions. This enables the RNC to perform both traffic and O&M management as discussed above, but ensures support of multi-vendor implementations is achieved. However, the level at which the message content becomes non-standard should be beyond the point where the related information will impact on traffic. This will allow the RNC full access to all messaging which might impact on traffic, enabling the UTRAN (and most importantly the traffic supported) to be carefully managed.

The third architectural requirement above indicates the need to maximise the integrity of the UTRAN O&M management system, and again the architecture proposed in figure 6 satisfies the requirement. By incorporating the O&M management into the RNC the need for a separate OMC-B is removed, thus reducing the number of controlling entities (and associated links) which might fail and impact on traffic. In addition, the impact of any failure is significantly reduced since if an RNC were to fail only the Node B's under it's control would be affected. If a separate OMC-B were introduced, this would most likely serve a far greater number of Node B's (possibly network wide), thus resulting in a far greater loss of service. This distributed approach to the O&M management will provide a more robust UTRAN.

All the requirements discussed above are of great importance, however the final architecture should also be cost effective. This cost effectiveness must apply not only to the initial purchase, but also to the implementation and maintenance on the management system. For this reason, it is essential that the number of hardware platforms required is kept to an absolute minimum, and again we see the architecture in figure 6 satisfies this requirement by avoiding the need to deploy multiple (vendor specific) OMC-B platforms.

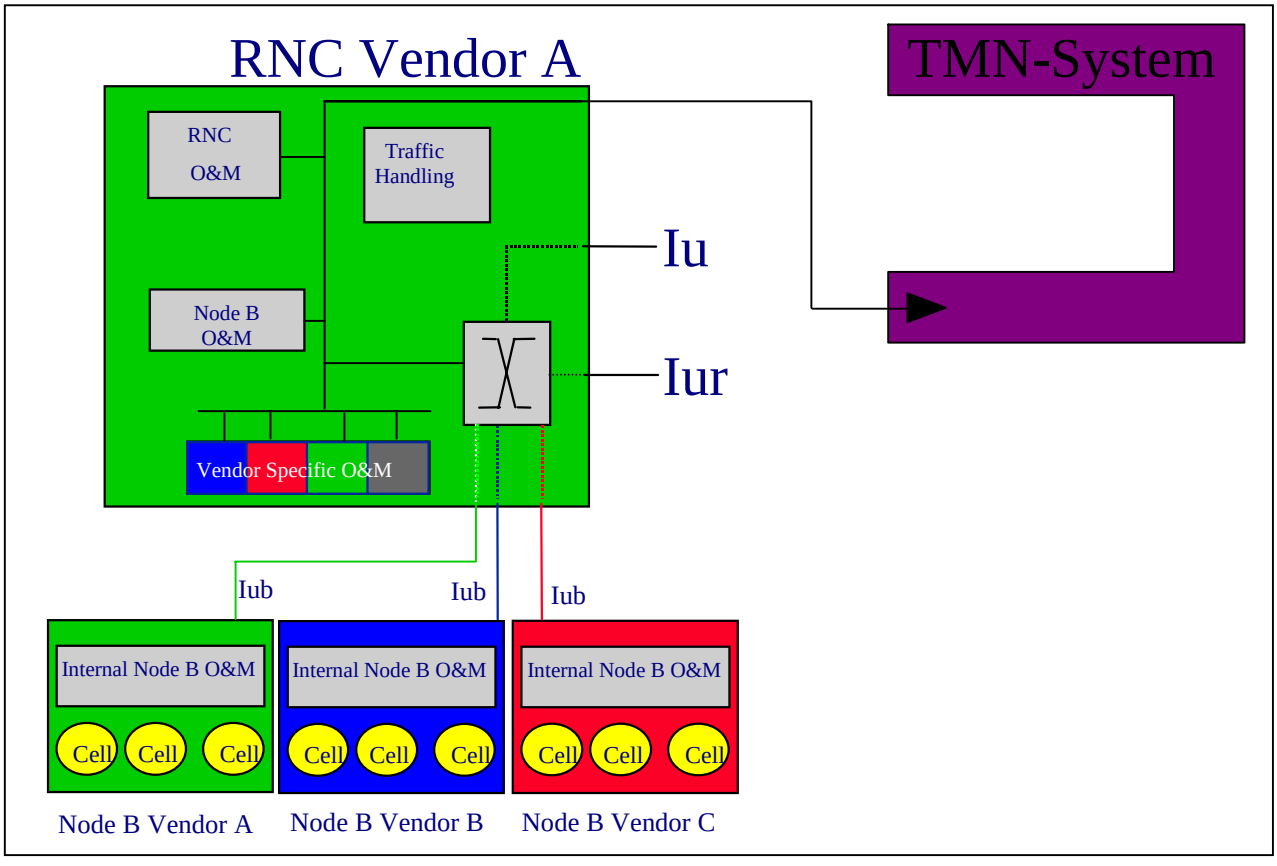

Figure 6: UTRAN O&M Management Architecture

4 Summary

- Agreement of management system architecture (framework), including UTRAN
- Prove the capability of the notification service component
- Standardisation of Node B functional model and resultant management facility components
- Standardisation of the Iu and Iub Interface