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Technical Report

3rd Generation Partnership Project;
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3GPP / TM Forum concrete model relationships and use cases
(Release 11)

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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Ready for Converged Management

This specification is part of a set that has been developed for converged management solutions.

Introduction

On-going industry convergence and pressure to reduce cost is placing ever-increasing emphasis on the need to rationalize and align various network management aspects across boundaries of standards/specifications producing organizations. The cost, resulting from integration and management challenges, of the lack of a coherent treatment of the whole network is becoming increasingly apparent to the point where operators of networks are demanding action.

To drive for action the operators are developing requirements that articulate aspects of the problem to be tackled. In addition ISV and equipment vendors are also developing requirements. The intention from these two activities is to develop a consistent and complete set of requirements to cover the problem space. Analysis of these requirements led to the identification of a number of use cases that highlight detailed examples of the problems and enable solutions to these problems to be explored (noting that during the process described here the use cases were confirmed appropriate valuable cases to cover). It is intended that through these on-going explorations:

- Specific relationships between 3GPP model elements and TM Forum model elements can be identified
- Overlaps of the 3GPP and TM Forum models can be highlighted
- Gaps in modelling, where neither 3GPP nor TM Forum provide suitable capability, can be plugged

This document:

- Captures the use cases considered explaining them in the context of:
  - The requirements and scenarios that occur as a result of FMC
  - Real application needs described in terms of an operator activity context
- Develops the use cases to the form of detailed scenarios
  - Explaining a stylised network diagram
  - Homing in on the critical area of interaction
- Provides pictorial forms for the model interaction
  - Showing the essence of the model relationships
  - Offering a familiar and penetrable form
- Provides detailed formal views of the model interactions
  - These are in UML form
- Offers a specific solution
  - Resulting from an evaluation of various proposals not captured in the document
- Uses the use cases and requirements to validate the recommendation
- Provides views of the interrelationship between models to achieve the support for the solution in 3GPP and TM Forum

The work covered by this document was carried out as part of the Umbrella model activity [2], as there is interplay between these two areas. Both activities drew from and fed into each other.

Through the progression described above there was close and appropriate engagement of operator as well as the wider 3GPP and TM Forum community. This involved engagement in the process of:

- Choosing the cases for analysis with focus on the relationship to operator requirements
- Confirming the appropriateness of the detailed scenarios especially in the context of the pictorial form of the model interactions

- Validating the solution proposals at both a high level and a detailed level especially in the context of the solution phasing

This led to focus on areas of the model for intense alignment and to the development of mechanisms for model interrelationship. The proposal set out in this document supports the Objectives set out in [1].

This document proposes some specific structure of model and realisation of that structure across 3GPP and TM Forum.

The proposal takes advantage of the TM Forum Information Framework (SID) [3] and the TM Forum Integration Framework (MTNM/MTOSI) [4] and 3GPP SA5 group work [5] (NRM IRPs etc.).

The proposal provides an initial pragmatic solution for reduction in cost of integration and improvement of degree of integration for the purpose of End-to-End management for a specific aspect of the problem.

1 Scope

This document sets out a number of independent operator activity contexts where each context has been chosen to exercise one or more of the operator requirements and to lead to points of intersection of the network model work of 3GPP and TM Forum where some degree of harmonisation would consequently seem valuable.

Each context description focuses on one or more use cases that suitably describe the relevant details of that operator activity with respect to an expected area of intersection. The use cases are first explained and then depicted via one or more stylized network and model diagrams. The model diagram is then developed to a formal model structure.

Finally the set of changes proposed cumulated from all context analyses are provided as a coherent recommendation. Respective concrete models must use this model to support the FMC use cases to claim FMC network management compliance.

It should be noted that the UIM cannot be used directly for implementation. Implementation classes must be derived from those in the UIM by Inheritance or some other appropriate mechanism. Classes derived from those in the UIM (e.g. for the fixed environment) must use different names from those used in the UIM.

This content of this document has been jointly developed by 3GPP and TM Forum as part of the Joint Working Group on Resource Model Alignment [11].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 32.107: "Fixed Mobile Convergence (FMC) Federated Network Information Model (FNIM)"

[2] 3GPP TS 28.620: "Fixed Mobile Convergence (FMC) Umbrella Information Model (UIM)"

[3] TM Forum GB922: "Information Framework (SID) Suite, Release 9.0" (http://www.tmforum.org/browse.aspx?catID=9285&artf=artf2048)

[4] TM Forum: "MTOSI 2.0" (http://www.tmforum.org/MTOSIRelease20/MTOSISolutionSuite/35252/article.html)

[5] 3GPP TS 32.622: "Generic network resources IRP: NRM"

[6] 3GPP TS 32.156: "Fixed Mobile Convergence (FMC) Model Repertoire"

[7] NGMN: "NGCOR Next Generation Converged Operations Requirements", V1.3

[8] 3GPP TR 32.833: "Study on Management of Converged Networks"

[9] 3GPP TR 32.853: "3GPP SA5 - TM Forum TIP Fault Management Harmonization Final report from the Joint Work Group ad hoc"

[10] 3GPP TS 32.712 Transport Network (TN) interface Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)

3 Definitions and abbreviations

For the purposes of the present document, the terms and definitions given in TR 21.905 [12] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [12]. For definitions, symbols and abbreviations not found here see also [1], [2] and [6].

3.1 Definitions

No specific terms were defined during the generation of this document.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [12] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [12].

CPE	Customer Premises Equipment
CTP	Connection Termination Point
EMS	Element Management System
Eth	Ethernet
ME	Managed Element
NE	Network Element
NMS	Network Management System
NOC	Network Operations Center
NW	Network
OC	Operations Center
OSS	Operations Support System
PTP	Physical Termination Point
SDH	Synchronous Digital Hierarchy
SLA	Service Level Agreement
TP	Termination Point
TPE	Termination Point Encapsulation

4 Assurance – Fault Location Context

4.1 Operator Activity Context description

This operator activity context focuses on the location and repair of a fault. A number of fault examples are used. Each fault example is chosen at a point in the network where it will cause an effect in both the wireless and wire-line part of the network. The examples are used together to demonstrate improvements in the operations characteristics that could be achieved by interconnecting and harmonizing the TM Forum and 3GPP models.

The descriptions focus on the detection of the alerting of the presence of a fault. The descriptions assume a fault location and repair process but do not impose any particular detail on that process.

The primary focus is on the relating of reports of problems from the two network fragments (3GPP Concrete Model and TM Forum Concrete Model) rather than the rationalisation of the specific report details (covered by the other harmonisation activity [9]).

4.2 Operator requirements covered

A key focus is quality of alarms and ease of interrelationship of those alarms (see [8]).

4.3 Specific use cases

- Scenario

  A converged Radio/Transport network is operated from a single Network Management System (NMS), being part of a Network Operations Center (NOC). The scenario is as follows:

  - Problem occurs in the network
  - Alarms are generated by systems managed via the 3GPP model and the TM Forum model

- Network Context

  The OC manages all Network Elements (NE) of both the radio network and transport network. The network is operational

  The radio network elements are managed using a 3GPP management approach and the transport network is managed using a TM Forum management approach. The radio network element includes transport network terminations.

- Description

  - Fault location system in the NMS receives alarms from both the radio NE and the transport NE and interrelates them using network and temporal information
  - Fault location system identifies the Primary/Root Cause alarm(s)/event(s)
  - Service impact system identifies degree of impact and criticality of repair
  - Repair action initiated
  - Alarms clear and services are restored

- Implications

  In a normal network there will be several/many simultaneous problems and work activities to be balanced. The network operator will want to prioritise scarce maintenance resource to fix the problems and to choose the right sequence of actions to maximise return. Therefore knowing both the root cause and location of the fault and the degree of impact from each fault is vital.

In order to solve the root cause for the radio network problem efficiently the OC needs to get information on the alarms in the underlying transport network and radio networks in a consistent and inter-connected model form so as to be able to easily interrelate the alarms.

4.4 Stylized network

A basic network has been chosen to simplify the consideration and a simple fault in the optical network has been chosen to highlight the case.

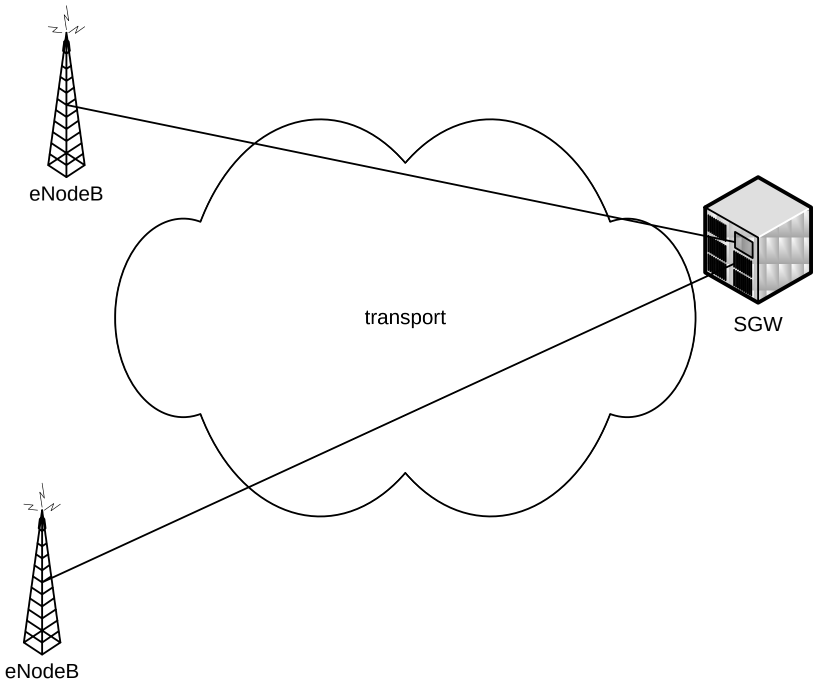

Figure 1: Example network configuration – high level

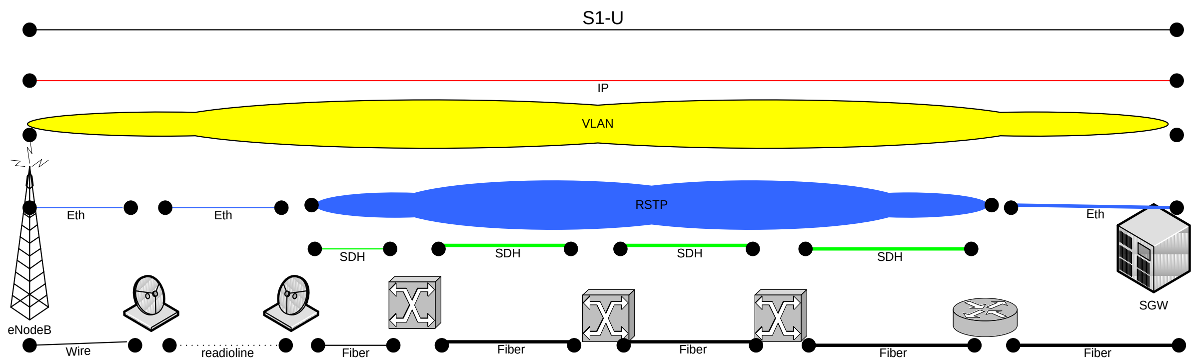

Figure 2: Example network configuration – detailed – layered view [9]

As a result of the fault in the optical network delivery there is either:

– Degradation of service due to errors

  – Assumes that the failures are soft so as not to cause the protection schemes to activate but sufficient to cause errors and low level impact on the service sufficient to push it outside SLA

– Degradation of service due to reduced capacity

  - Where an optical system has failed and although there are other systems providing alternative feed the network is loaded at peak such that under this failure scenario there is some degree of overbooking of the network during peak usage
- Loss of resilience
  - Where the network has capacity to carry all necessary traffic even with the specific optical failure but there is now insufficient capacity to enable engineering works on other optical systems and the overall network is at risk of degradation or loss of service if there are any further failures
- Loss of service
  - Where there has been a failure in one or more optical systems as a result of shared risk or misfortune such that the capacity of the network has dropped to a point where some service is lost.

Based upon the work prioritisation consideration noted in an earlier section the operator will need to understand both the location of a fault and its impact for each of the above cases. Clearly any ambiguity especially the appearance of two separate faults where there is actually one fault and a consequence will waste valuable maintenance resource. It is therefore vital that in each case location clarity can be achieved.

4.5 Problem statement using stylized network model examples

The position of the fault highlighted on the earlier network diagram is magnified in the following diagrams. Prior to highlighting the fault positioning it is important to show an example of the arrangement of management solution components in the mixed wireless-wire-line solution and the positioning of some of the key model entities.

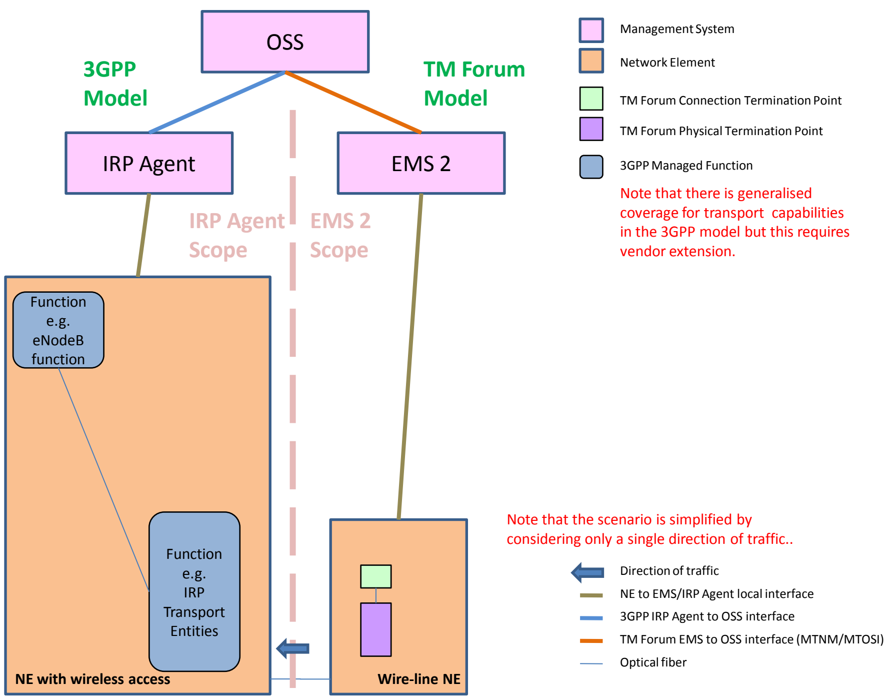

Figure 3: Example of current deployment context using unrelated concrete models

The figure above shows a deployment scenario using unrelated concrete models. The figure shows two NEs, one wireless and one wire-line being managed by two separate management solutions, one based upon 3GPP and one based upon TM Forum, both feeding to a single OSS where some form of network management is being performed that includes fault localisation. The figure shows the unrelated TM Forum and 3GPP classes that would represent aspects of behaviour of the respective NEs. There would be many other classes in the models for the NEs but only the classes shown are considered relevant in the following cases. It should be noted that the TM Forum Physical Termination Point and Connection Termination Point combination represents the optical port, its layers/protocols and its flexible connection termination capability.

This scenario can be generalised to emphasise the model differences as below. The figure intentionally does not show the management structure, as this is NOT the focus of this document.

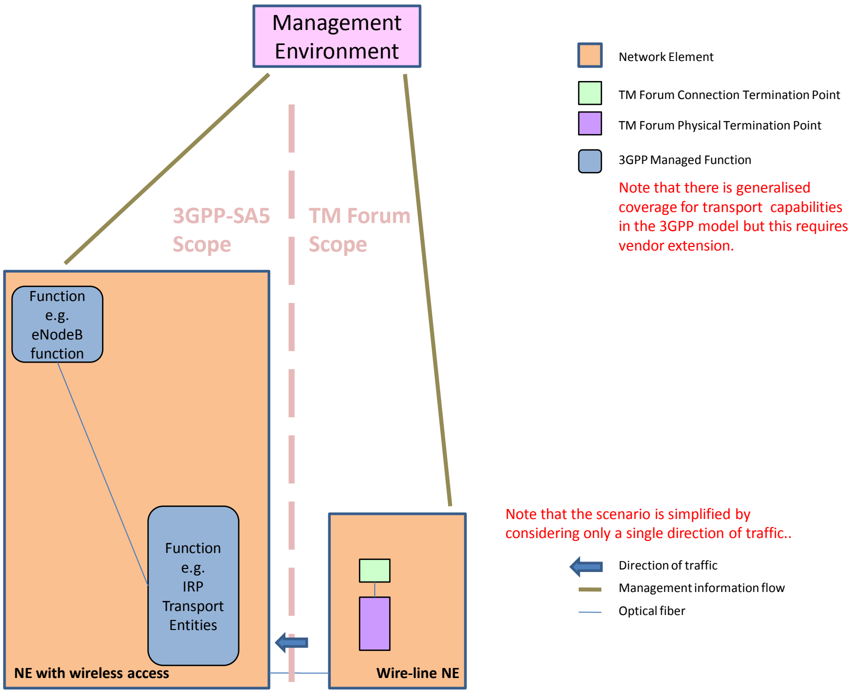

Figure 4: Generalised form of current deployment context using unrelated concrete models

The next two figures show the location of alarms in the models under two different fault scenarios. The first is a unidirectional fibre break and the second is a laser fail.

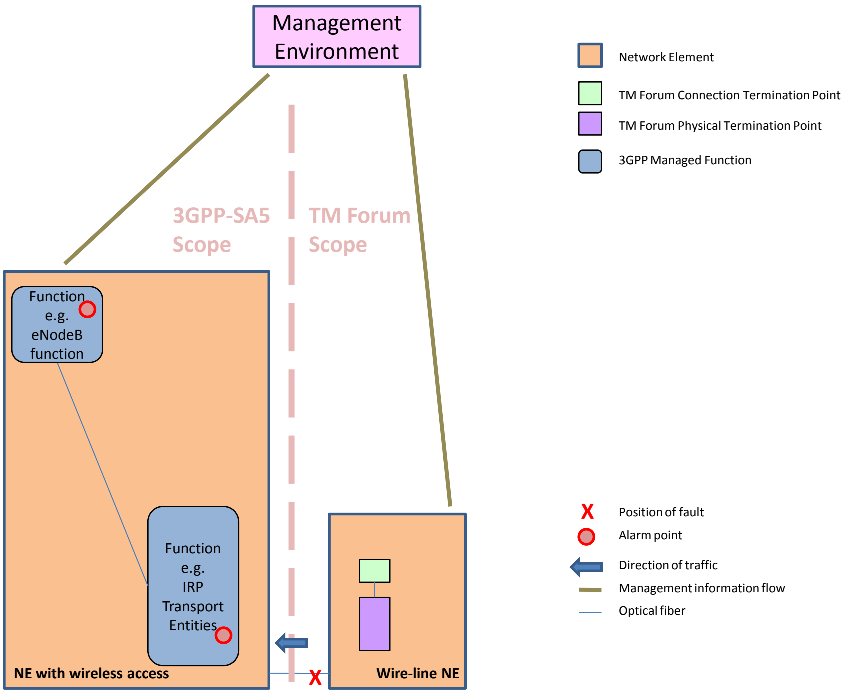

Figure 5: Alarm positioning for "Fibre Break" case

Note: With respect to the red circle in the eNodeB function it is recognised that under some conditions there will be no alarm either due to resilience or due to the alarm on the eNodeB function will be suppressed in the NE with wireless access by the alarm on the Transport Entities. However there are often more subtle scenarios where degradations could not be suitably apportions. In addition the indication may be necessarily exposed not suppressed to indicate a service impact.

In the fibre break case shown above, one indication of the problem is from the NE with wireless access. It should be noted that there is no standardised entity in the 3GPP NRM against which to report the fibre fail.

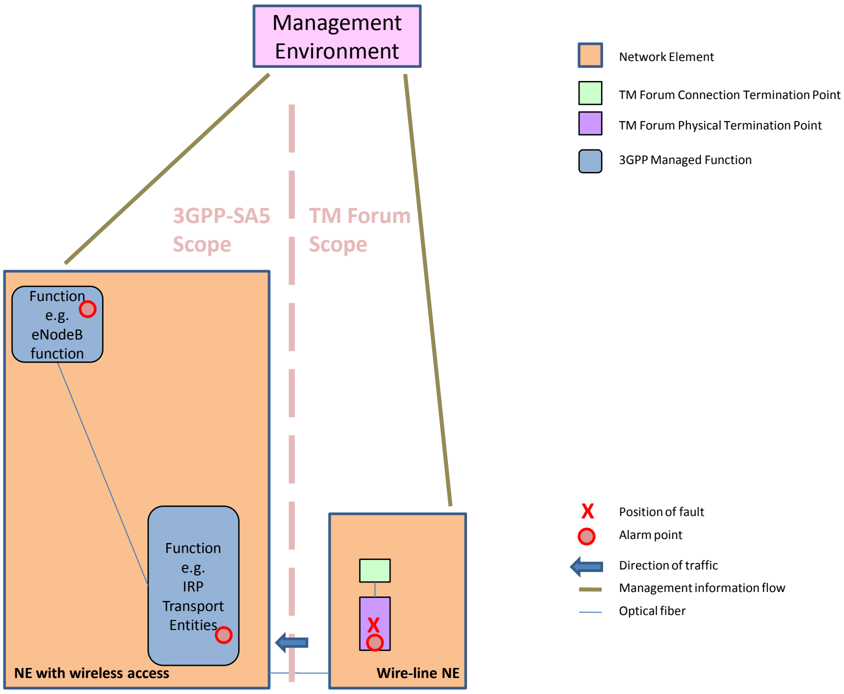

Figure 6: Alarm positioning for “Laser Fail” case

In the laser fail case shown above there is an indication of a problem from the NE with wireless access that is identical to the indication in the fibre break case, and there is also an indication of a problem from the wire-line NE that is raised against the port represented by the TM Forum Physical Termination Point.

Using the current solution as depicted above there is no relationship between the alarmed IRP Transport entity (of the wireless NE) and the alarmed TM Forum Physical Termination Point (of the wire-line NE) and as a consequence analysis (e.g. correlation) of the alarms will prove difficult. Hence it can be argued that the quality of the alarm reporting in these scenarios can be improved from the perspective of fault isolation (a primary process of the Management Environment) by better interrelationship of the model representations of the two NEs.

4.6 Solution proposal

The following solution proposal introduces key model interrelationships that would better enable fault isolation. This solution description incorporates further classes from the current models, the 3GPP Link and the TM Forum Topological Link, and show how they can be interrelated. The solution also show the introduction of necessary aspects of the Physical Termination Point concepts and Connection Termination Point concepts into the NE with wireless access in recognition of the fact that the wire-line protocols terminate in that NE and hence a representation of those protocol termination is required.

The necessary aspects of these Termination Point concepts support the capabilities and relationships highlighted by the use case depicted in Figure 7:

- Topological Link between the two NE's with wireless access
- Topological Link between one of the two NE's with wireless access to this edge node of the transport network;
  - Where this Topological Link is supporting the Link between the two NE's with wireless access.
- Relationship to physical port

– Relationship to a function in the NE with wireless access e.g. ENBFunction

– Place against which to raise transport alarms

In both fault cases shown in the figures below the signal fail alarm on the NE with wireless access will be raised against enhanced IRP Transport entities (that have incorporated the Physical Termination Point concept) and in the Laser Fail case the alarms at both ends of the fibre can be related via an understanding of the TopologicalLink between the Physical Termination Point and the enhanced IRP Transport entity. The TopologicalLink between the two NEs may be discovered from the network if appropriate discovery protocols are enabled or may be operator provisioned. The specific approach to this is not considered further here. The adjacency information related to the TopologicalLink will be conveyed to the Management Environment using the foreign TP capability (3GPP term for this is ExternalXyz). This will not be discussed further here as the solutions that are already used in the 3GPP managed environment [10] and in the core of the wire-line environment [4] are suitable.

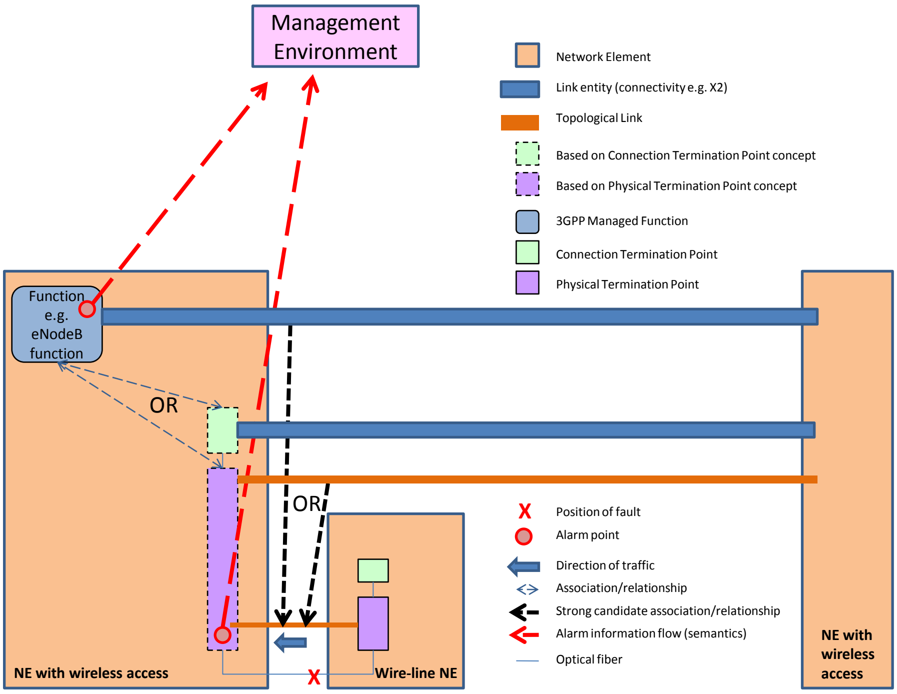

Figure 7: Alarm positioning for "Fibre Break" case using related concrete models

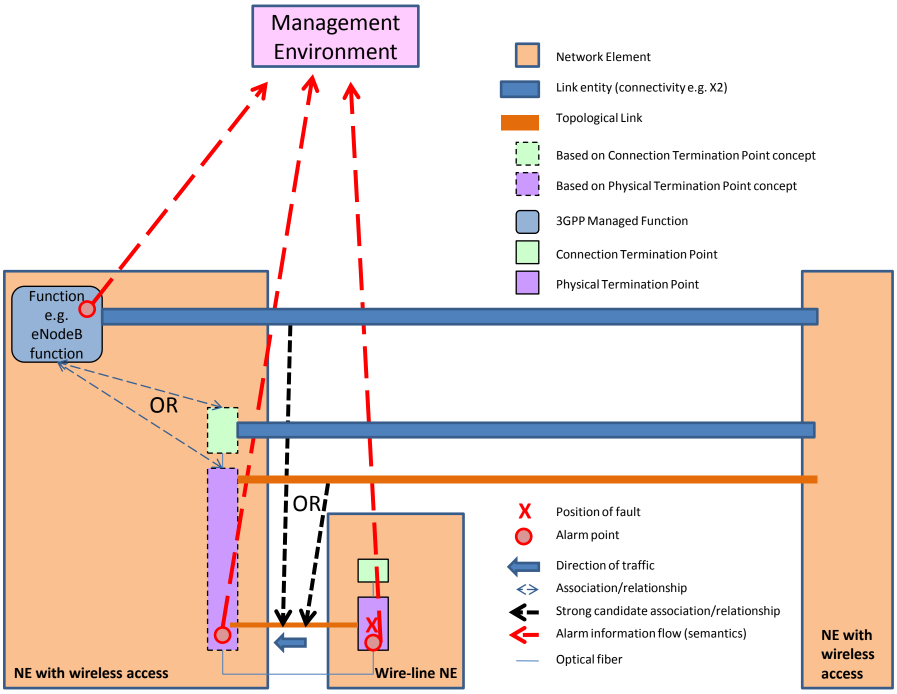

Figure 8: Alarm positioning for "Laser Fail" case using related concrete models

4.7 Potential management environment solution forms

Although, as emphasised earlier, the scope of this document is information model convergence and resolution of the management environment solution is out of scope it is considered important to highlight some management environment deployment considerations that will require further resolution.

It is clear that there are several potential management environment implementation forms that will cater for the introduction of Physical Termination Point/Connection Termination Point concepts to describe the wire -line ports of NEs with wireless access. One potential form is shown in the following figure where the Physical Termination Point, Connection Termination Point and TopologicalLink model concepts built into the 3GPP NRM IRPs and exposed via 3GPP IRP Agent using external references to link the two NEs.

Regardless of the structure of the management environment solution, the solution proposal in section 5.6 is considered appropriate and sufficient.

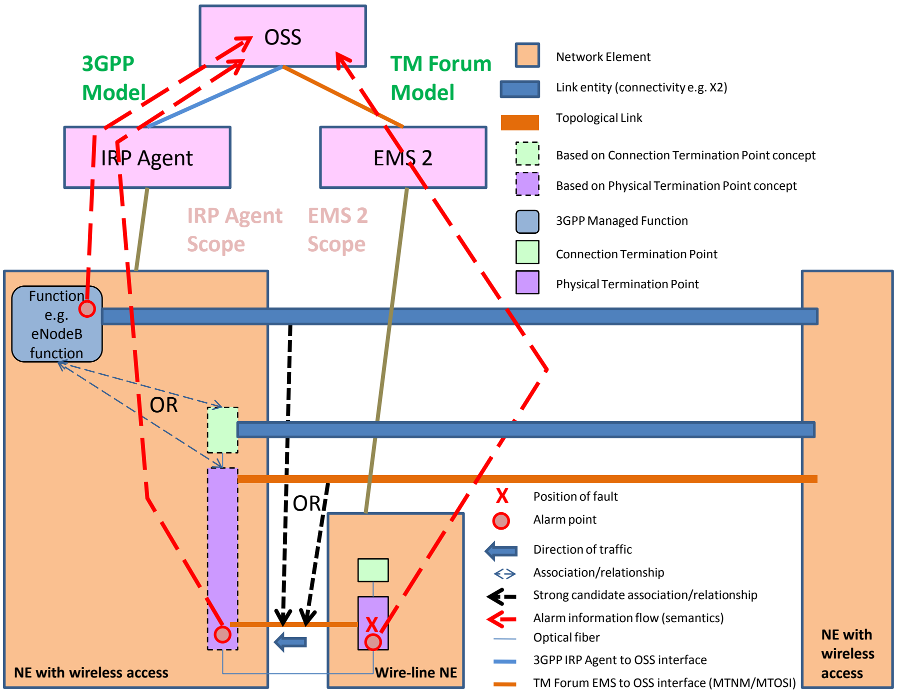

Figure 9: Alarm flow through IRP Agent for NE with wireless access

5 Fulfilment – Service construction context

Editor's note: This section is for future consideration and will provide details on another context and will be laid out in the same flow as the Assurance context. It may be considered appropriate to move this into a separate document.

6 Fulfilment – Engineering works context

Editor’s note: This section is for future consideration and will provide details on another context and will be laid out in the same flow as the Assurance context. It may be considered appropriate to move this into a separate document.

7 Complete model proposal

Editor's note: This section provides the accumulation of the changes from the three contexts discussed above. If the contexts are moved into separate documents this section may be yet another document or may be deemed unnecessary.

7.1 Navigable link from mobile to backhaul network

An alarm correlation Use Case is defined Figure 8 (Alarm positioning for "Laser Fail" case using related concrete models).

- One IRPAgent is managing the wireless NE.
- Another agent is managing the wireline transport network including the edge node of transport network but excluding the CPE (namely, the wireless NE).
- These two agents would receive alarms from their managed elements;
- The two agents forward their received alarms to NMS.
- NMS can then correlate the alarms (e.g. alarm-1 from a wireless NE, the CPE, is correlated with alarm-89 from transport network edge node)

In Figure 8, the two agents and NMS are 'lumped' together in a box called "Management Environment".

The Figure 8 is redrawn below as Figure 10. Figure 10 introduces names (including Link A and Link B). The named items in the Use Case diagram (Figure 10) identify the objects that would be represented by classes (see Figure 11).

It should also be noted that in Figure 10 the:

- Link is shown in two possible positions on this and previous diagrams. The Link is shown between CTPs or eNodeB. The eventual positioning of the Link will be a 3GPP responsibility.
- Remote NE has had detailed items added that aid model explanation

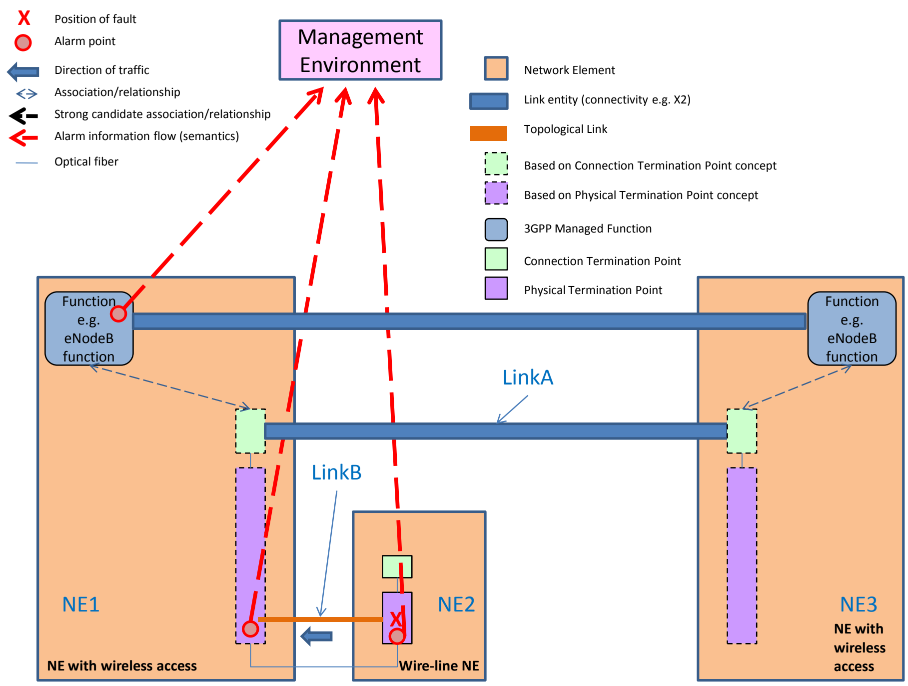

Figure 10: Introduce names for two objects of Figure 8 and other enhancements

The proposed model solution depicted in Figure 11has the following characteristics/properties:

- It supports the alarm correlation Use Cases described in this document.
- It models wireless nodes that would use IP-based transport services;
- It supports navigation from modeled elements of wireless node (a customer premise equipment (CPE) from view of the transport network) to modeled elements of the edge node of the transport network;
- It models the link(s) between CPEs; and
- It models the link between CPE and the transport network edge node.

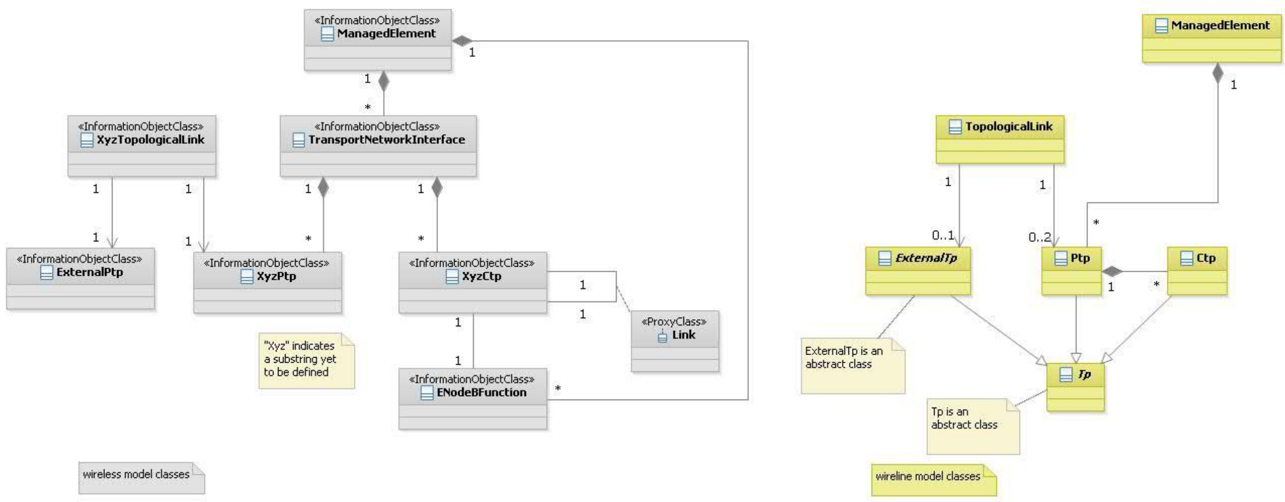

Figure 11: Class diagram for both wireless and wireline cases

Note: A wireless ExternalCTP is intentionally not shown in the class diagram. Definition of this class is a 3GPP matter.

Using the class diagram above an instance diagram for the network case in Figure 10 can be constructed as shown in Figure 12 below.

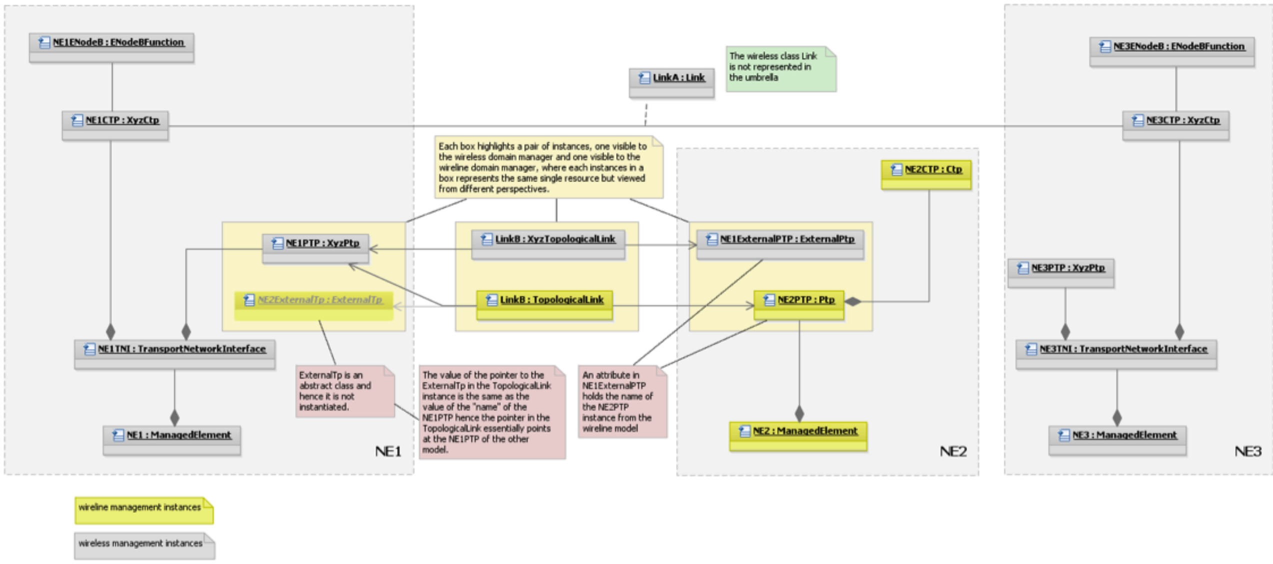

Figure 12: Instance diagram for case shown in Figure 10

Figure 13 (below) shows the derivation of the wireless and wireline classes from the Umbrella classes (where the inheritance relationship between the Umbrella and the other models is used to depict any appropriate derivation mechanism).

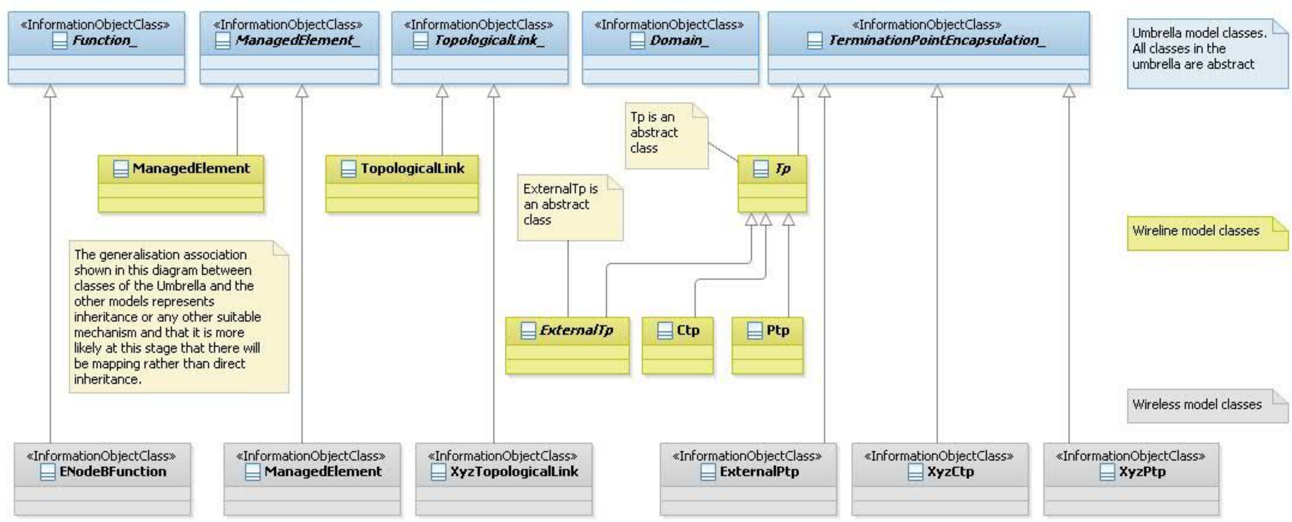

Figure 13: Diagram showing derivation of wireless and wireline classes

Annex A: Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2012-08					Initial Draft based on [11] V2.1	---	0.1.0
2012-09					Submitted to SA#57 for Information	0.1.0	1.0.0
2012-10					Update based on [11] V3.0	1.0.0	1.1.0
2012-12					Submitted to SA#58 for approval	1.1.0	2.0.0
2012-12					New version after approval	2.0.0	11.0.0
2013-01					Fixed layout problems	11.0.0	11.0.1
2013-03					Fixed title of the spec by removing a semi-colon	11.0.1	11.0.2