

A System Framework for LTE SON

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Abstract. To meet the requirements of reducing human intervention and operational expenditures (POEX) of LTE SON (Self-organization Networks), a system framework for LTE SON is designed in this paper. In order to match the standard IRP (Integration Reference Point), the framework is divided into six layers, and then functions of some layers are presented.

Introduction

Different from the traditional network management system, SON require to reduce the manual operation as much as possible [1,2], so we must take various influence into account when we design the network management system. At the same time, the complexity of LTE networks is much higher than existing wireless networks. There are more and more network parameters in LTE networks, variability and uncertainty of these parameters also become much larger, so SON must have powerful functions for data storage and data processing.

As a part of network management system, especially the network management system which developed base stations into eNodeBs in LTE networks, SON must establish reliable interface between eNodeBs and connection between SON system and eNodeBs, so we should use logical connection when the physical connections are not available. In addition, dedicated channels between SON and eNodeBs must be established for transferring management information.

Design of system Framework

LTE benefit from the flat network framework, eNodeBs have more and more functions, but also increasingly load[3], so network management need to monitor and control more exactly and more quickly. Because there are unity interfaces X2 between eNodeBs, network management information of SON can be transmitted through X2. As shown in figure 2, SON can be divided into six layers: measurement layer, control layer, solution set layer, application layer, transport layer and network layer. The purpose of using this layered method is mainly to be compatible with IRP structure in 3GPP. An example of the IRP is shown in figure 1[4]. The functions of these six layers can be realized through network entities which integrated a larger number of algorithms and protocols for completing the communication of layers. SON also can be divided into three functional modules: self-configuration, self-optimization and self-healing [5,6]. In order to maintain the global control and optimization, boundaries of those three modules are blurred. From the functional point of view, the purpose of SON is to execute, control, manage and optimize the function of eNodeBs. The practical operation is dependent on monitoring the specific modules, receiving various report information and a larger number of algorithms and protocols.

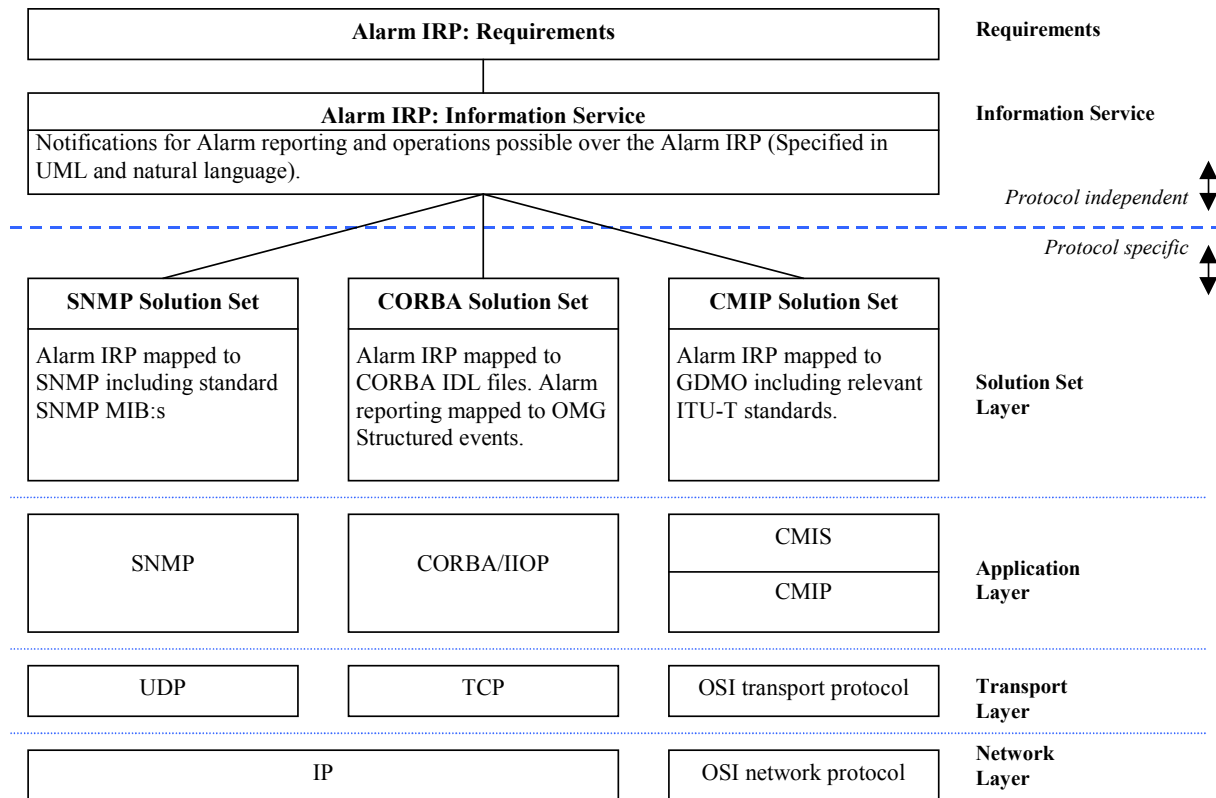


Figure 1. Example of an IRP (Alarm IRP)

The overall framework.

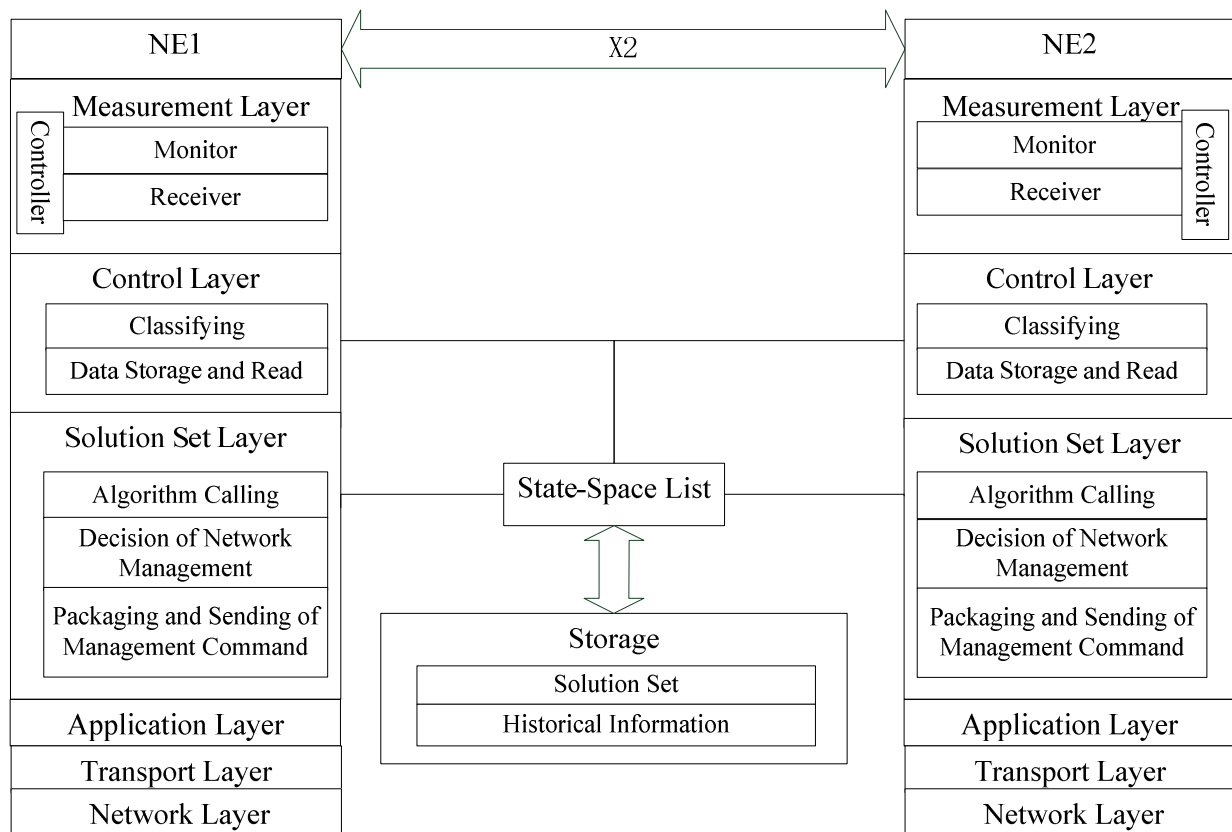


Figure 2. The Overall Framework

The framework for SON can be divided into six layers: measurement layer, control layer, solution set layer, application layer, transport layer and network layer which correspond to requirements layer, information service layer, solution set layer, application layer, transport layer and network layer of IRP respectively. Measurement layer mainly will control, monitor and receive some reporting and signaling; control layer mainly will classify and store the information from upper layer, then package this information into standard pattern, historical information also can be found in this layer; solution set layer will receive standard data packets from upper layer and seek all possible solutions, in these solutions, optimum solutions(global optimum is pivotal) must be selected, and the specific approaches for implementation also should be provided. The approaches usually can be classified into two groups: adjusting or resetting some parameters and replanning the networks; application layer, transport layer and network layer accomplish these operations from upper layer. In this paper, we only present the three former layers.

Measurement layer.

Measurement layer consists of controller, monitor and receiver, as shown in figure 3.

Controller's main function is to select monitoring targets and specific parameters of these targets and decide the priority of monitoring, scanning frequency of monitor also should be decided by controller.

Monitor will scan specified parameters actively to detect the status of the networks, these parameters include: wireless network parameters, safety parameters, information of software updated and so on, scanning frequency depends on how busy the network is. After a fixed number the monitor scanned, it will send a report which includes the changes of monitoring parameters and the status of the networks in this period to the control layer.

Receiver's main function is to receive failure reports, updated reports, status reports from current NE (network element) and requirement reports from other NEs. Failure reports include: hardware failure, software failure, load overflow, security issue and so on. Because failure reports related to the normal running of the networks, they have the highest priority, this means measurement layers must send the failure reports to control layer immediately when they received failure reports, sometimes it is necessary to send the failure report to neighbor NEs or users under the control of current NE. Requirement reports from other NEs include failure reports who's priority are higher and status reports and other requirement reports who's priority are lower. After received these reports, receiver will send them to control layer, if it is necessary, these reports will be sent to other NEs.

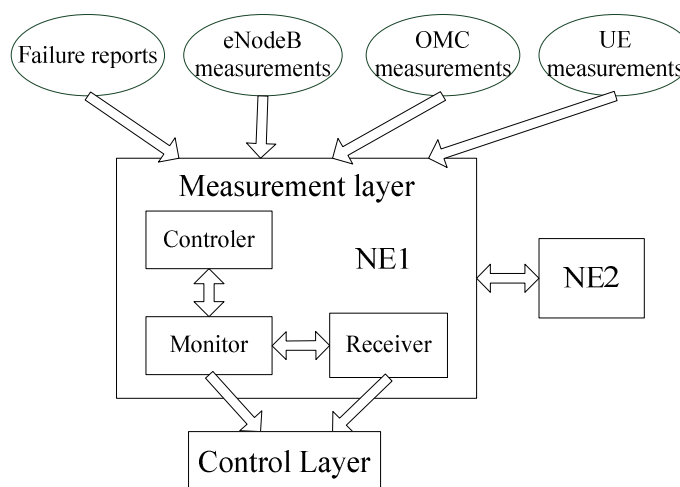


Figure 3. Framework of Measurement Layer

Sources of parameters in measurement layer are failure reports, eNodeB measurements, OMC measurements and UE measurements.

Control layer.

Control layer will classify the requirements from measurement layer and set priority for them. The purpose of classifying the requirements is easy to call history data and history algorithms in lower layer. These requirements can be classified failure reports, update information, status reports, also can be classified blocked calls, dropped calls, QoS, traffic load, new site, cell outage and so on according to the source of requirements. The main purpose of setting priority is to avoid conflict and confusion when adjusting the network parameters in lower layer.

Other two functions of control layer are data storage and data read. It is necessary for SON to store a mass of algorithms, regulation and historical data, so storage is required. We also can set up a state-space list to address these data. One of the most important functions of control layer is to store the necessary data into storage, and update the state-space list. In addition, control layer will read some data in storage through state-space list and package this data into standard data packets which will be sent to the solution set layer.

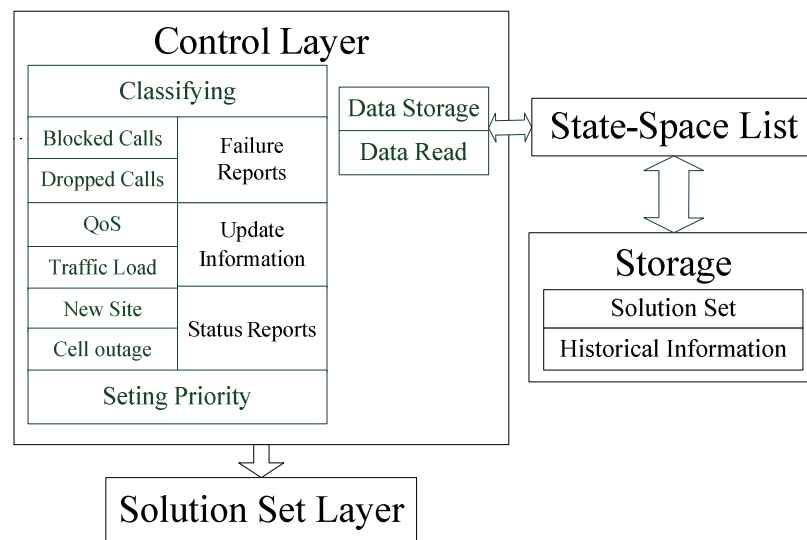


Figure 4. Framework of Control Layer

Solution Set Layer.

Solution set layer has three important functions: selection of algorithm, decision of network management, packaging and sending management command. After receiving the data packets which have been preprocessed in control layer, solution set layer will decide which algorithms or schemes are the best solutions, and call these algorithms and schemes from storage through state-space list.

Decisions of network management depend on the algorithms and schemes finally used. Which parameters need to be adjusted will be determined here, for example: radio emission parameters, cable transmission parameters, interface parameters, antenna parameters, software version and so on.

There are two kinds of management command, one kind is the requirements which will be sent to other NEs, so these commands will be sent out after solution set layer, and another is the adjustment of the current NE, in this situation, commands will be sent to specific part of the current NE.

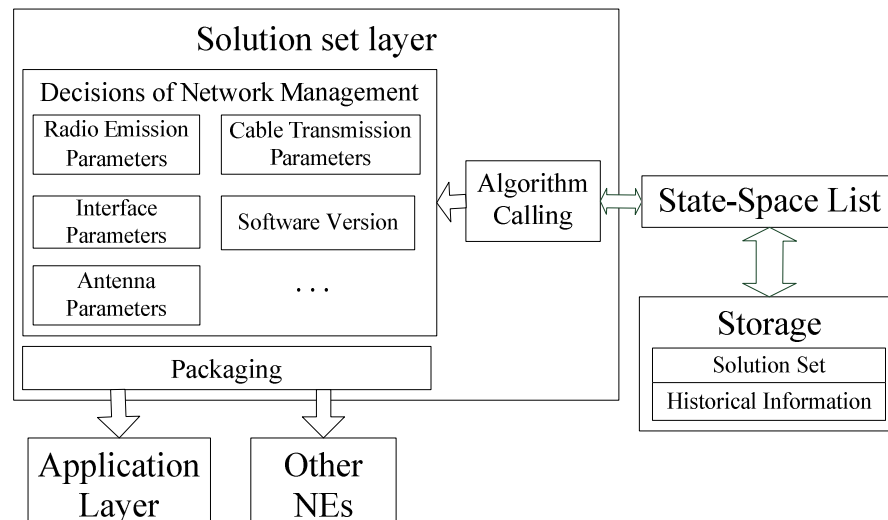


Figure 5. Framework of Solution Set Layer

Summary

We have explained the new system framework for LTE SON, and presented the functions of some layers. This framework still needs to be perfected, for example: algorithm of addressing the data in storage through the state-space list, method of setting priority, and so on, and all these problems will be researched in the future.

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