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TOWARDS SERVICE BASED RADIO ACCESS NETWORK

***Digest of paper*[1]**

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Abstract: Service Oriented Architecture (SOA) capture the idea of network composed of services. SOA enables service virtualization and it is applied to the fifth generation (5G) core network design. In this paper, we propose an approach to define 5G Radio Access Network functionality as a set of services. The paper focus is on functions related to transferring of Non Access Stratum (NAS) signalling between the user equipment and the core network.
Key words: Radio Resource Management, Representational State Transfer, Service Oriented Architecture, State Models.

1. INTRODUCTION

Future fifth generation (5G) networks are expected to be flexible and programmable. The 5G core network design is service-based and the communication between services uses HTTP based Application Programming Interfaces (APIs) replacing telecommunication protocols. The APIs enable service exposure to third parties which in turn may provide innovative applications. These applications may improve network utilization by customization of the behaviour of resources [1], [2]. One of the main challenges of network programmability is to identify elementary functions which compose network functionality [3], [4]. In this paper, we propose an approach to design function of Next Generation Application Protocol (NGAP) as services. The NGAP is defined between 5G Radio Access Network (RAN) and AMF (Access and mobility Management Function) in the core network [5], [6].

The focus of this paper is on RAN functionality for transferring of Non Access Stratum (NAS) signalling between a User Equipment (UE) and Core Network (CN)

[1] The full paper is proposed for including in the IEEE Xplore Digital Library

which is presented as a service. First, we describe the proposed service by typical use cases. Then, the resource structure and the supported HTTP method are presented. Service implementation aspects are considered in terms of modelling the resource state as supported by RAN and CN.

2. SERVICE DESCRIPTION BY TYPICAL USE CASES

The proposed RAN service enables NAS message transfer. The interaction between the service and the AMF follows the REpresentational State Transfer (REST) architectural style. The interaction between the proposed RAN service and AMF supports “request-response” and “subscribe-notify” mechanisms.

In order to receive notifications from the RAN node, the AMF need have a subscription. The AMF may subscribe for receiving Initial UE messages, uplink NAS messages and for receiving indications about non NAS delivery (Fig.1).

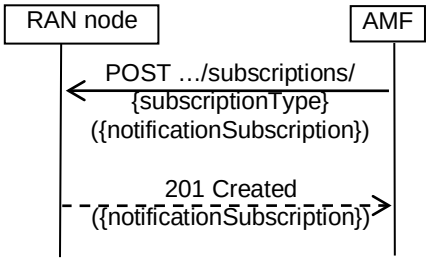

Fig. 1. Flow of subscribing to NAS transfer related events

In order to respond to paging message, or to initiate outgoing communications, the UE uses the Initial UE Message procedure which transfers the first uplink NAS message dedicated to the AMF. Fig.2 illustrates the flow for initial UE message transfer, downlink and uplink NAS message transfer.

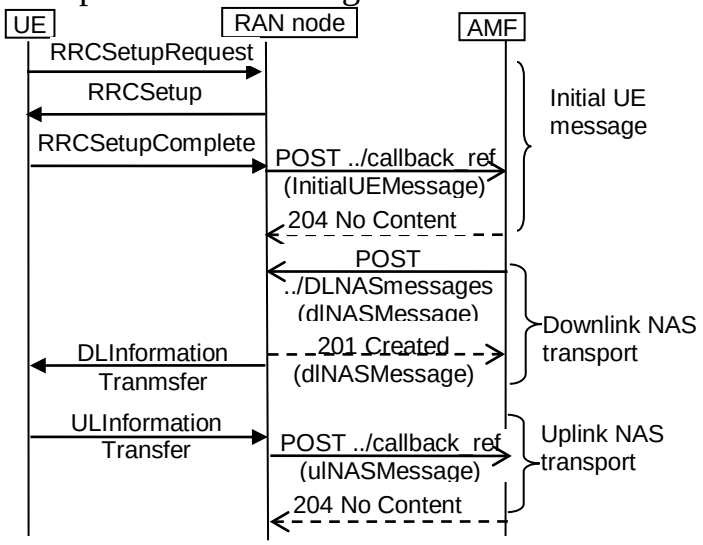

Fig. 2. Initial UE transfer message and subsequent downlink and uplink transport of NAS messages

3. RESOURCE STRUCTURE AND SUPPORTED HTTP METHODS

Fig.3 shows the proposed resource structure, where all resources follow the same root. The container resources support HTTP GET method which retrieves a list of their children resources, and HTTP POST method, which creates a new child resource. The leaf resources support HTTP GET method which retrieves information about current resource, HTTP PUT method, which modifies the existing resource and HTTP DELETE method, which deletes the respective resource.

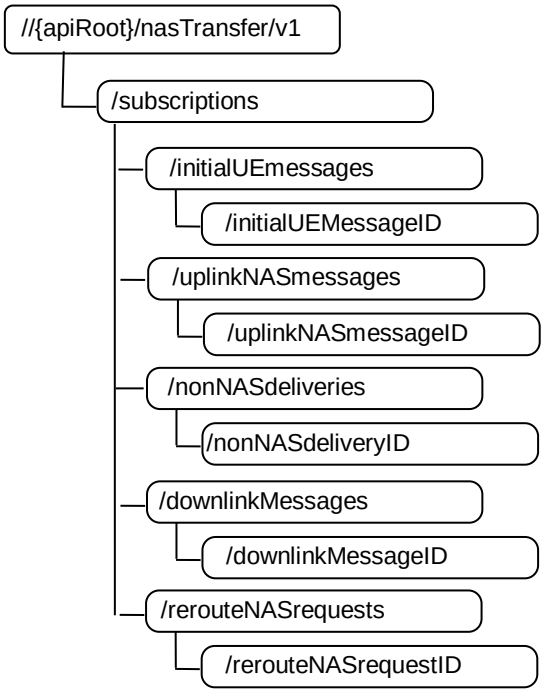

Fig. 3. Resource structure supported by the proposed service

4. STATE MODELS

The implementation of the proposed service requires modelling the state of NAS message transfer as seen by the RAN node and by the AMF. Both models need to be synchronized. Fig.4 and Fig.5 show the simplified NAS transfer state model supported by the AMF and RAN node respectively.

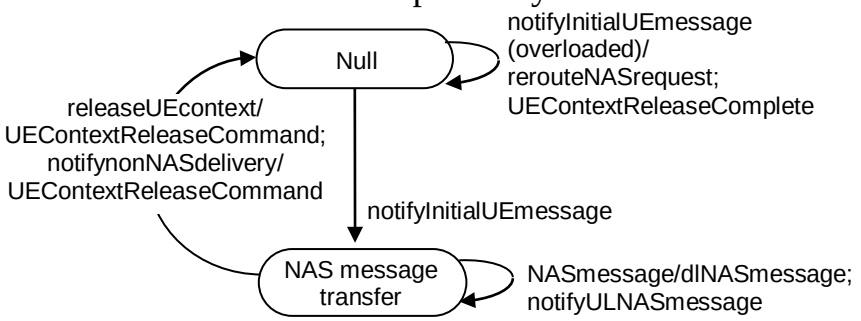

Fig. 4. Simplified NAS transfer state model supported by the AMF

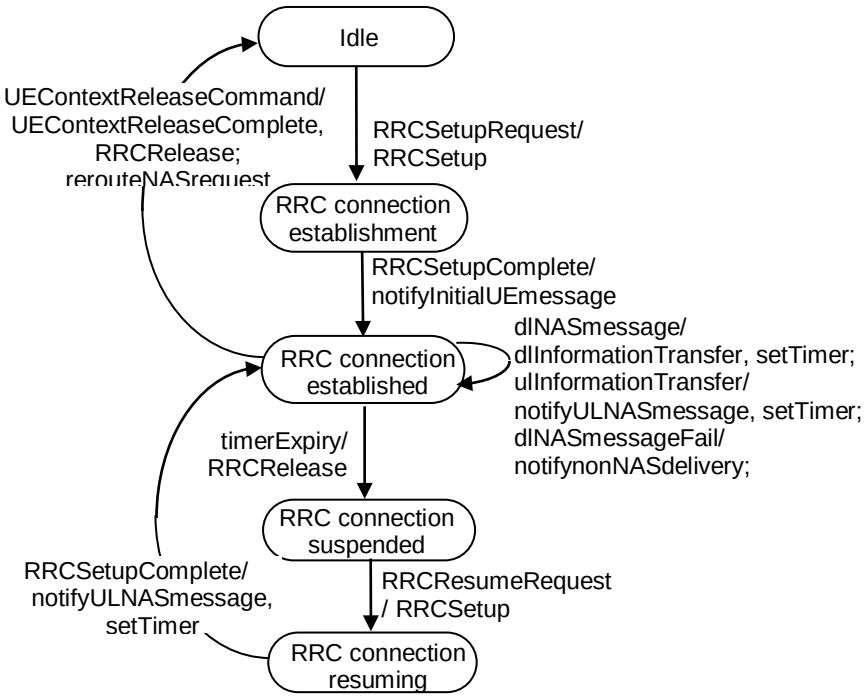

Fig. 5. Simplified NAS transfer state model supported by the RAN node

By formal model description and using the mathematical concept for weak bisimulation it may be proved that both models expose equivalent behaviour, i.e. they are synchronized.

ACKNOWLEDGEMENT

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