SUPA
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W.Liu
J. Strassner
G. Karagiannis
Huawei Technologies
M. Klyus
NetCracker
J.Bi
Tsinghua University
C. Xie
China Telecom
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**SUPA policy-based management framework**
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Abstract

Simplified Use of Policy Abstractions (SUPA) defines a set of rules that define how services are designed, delivered, and operated within an operator's environment independent of any one particular service or networking device. This document describes the SUPA basic architecture, its elements and interfaces.

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## 1. Introduction

The rapid growth in the variety and importance of traffic flowing over increasingly complex enterprise and service provider network architectures makes the task of network operations and management applications and deploying new services much more difficult. In addition, network operators want to deploy new services quickly and efficiently. Two possible mechanisms for dealing with this growing difficulty are the use of software abstractions to simplify the design and configuration of monitoring and control operations and the use of programmatic control over the configuration and operation of such networks. Policy-based management can be used to combine these two mechanisms into an extensible framework.

Policy rules can be used to express high-level network operator requirements directly, or from a set of management applications, to a network management or element system. The network management or element system can then control the configuration and/or monitoring of network elements and services.

Simplified Use of Policy Abstractions (SUPA) will define a generic policy information model (GPIM) [SUPA-info-model] for use in network operations and management applications. The GPIM defines concepts and terminology needed by policy management indepednent of the form and content of the policy rule. The ECA Policy Rule Information Model (EPRIM) [SUPA-info-model] extends the GPIM to define how to build policy rules according to the event-condition-action paradigm.

Both the GPIM and the EPRIM are targeted at controlling the configuration and monitoring of network elements throughout the service development and deployment lifecycle. The GPIM and the EPRIM will both be translated into corresponding YANG [RFC6020] modules that define policy concepts, terminology, and rules in a generic and interoperable manner; additional YANG modules may also be defined from the GPIM and/or EPRIM to manage specific functions.

The key benefit of policy management is that it enables different network elements and services to be instructed to behave the same way, even if they are programmed differently. Management applications will benefit from using policy rules that enable scalable and consistent programmatic control over the configuration and monitoring of network elements and services.

## 2. Framework for Generic Policy-based Management

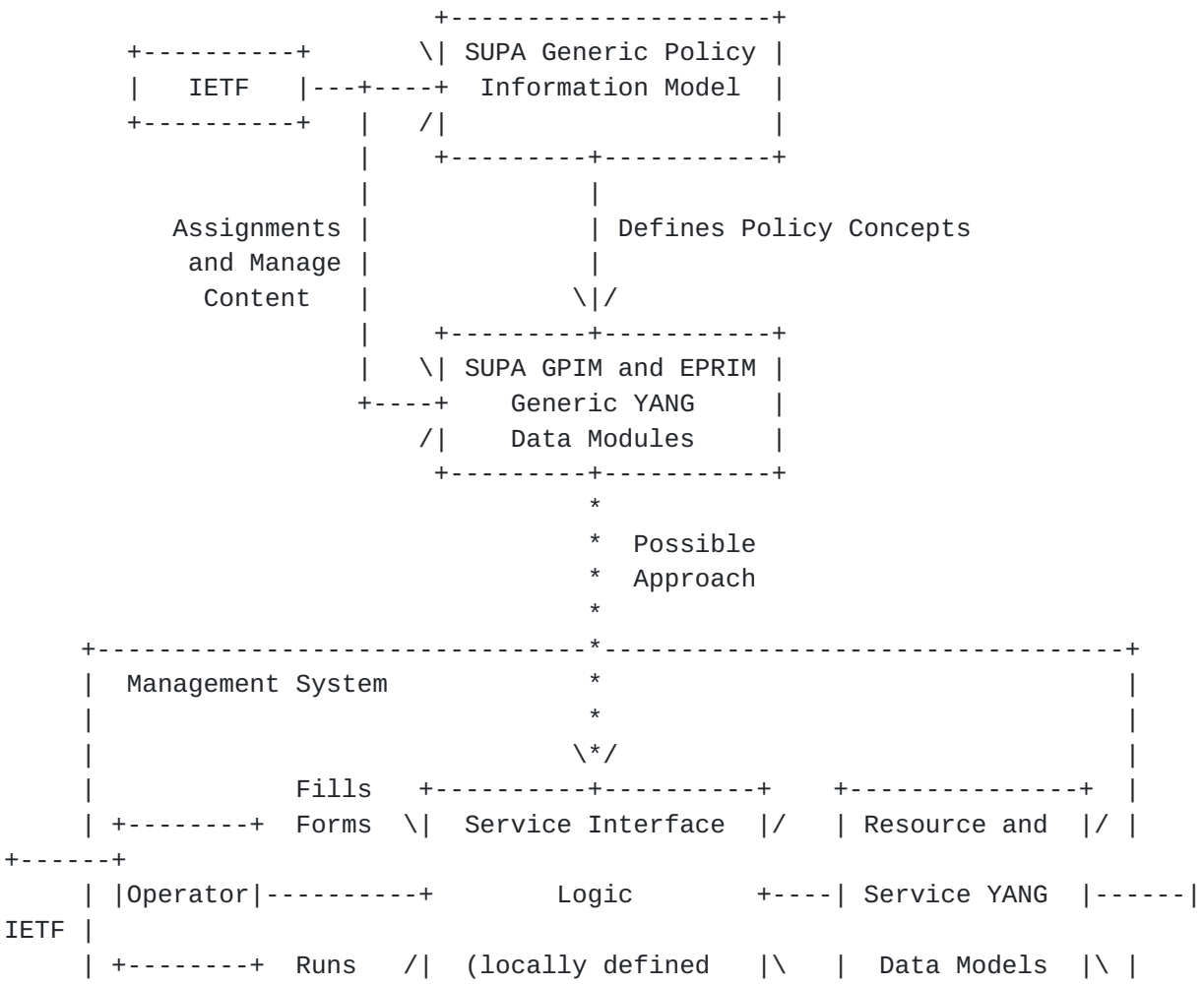
This section briefly describes the design and operation of the SUPA policy-based management framework.

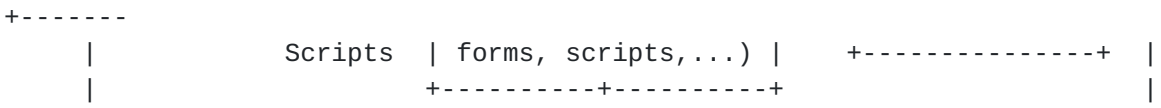
### 2.1. Overview

Figure 1 shows a simplified functional architecture of how SUPA is used to define policies for creating network element configuration and monitoring snippets. SUPA uses the GPIM to define a consensual vocabulary that different actors can use to interact with network elements and services. The EPRIM defines a generic structure for imperative policies. The GPIM, as well as the combination of the GPIM and EPRIM, are converted to generic YANG data modules. The IETF produces the modules, and IANA is used to register the module and changes to it.

In one possible approach, SUPA Generic & ECA Policy YANG Data modules together with the Resource and Service YANG data models specified in IETF (which define the specific elements that will be controlled by policies) are used by the Service Interface Logic. This Service Interface Logic creates appropriate input mechanisms for the operator to define policies (e.g., a web form or a script) for creating and managing the network configuration. The operator interacts with the interface, which is then translated to configuration snippets.

Note that YANG models may not exist. In this case, the SUPA generic policy YANG data modules serve as an extensible basis to develop new YANG data models for the Service Interface Logic to create appropriate input mechanisms for the operator to define policies. This transfers the work specified by the Resource and Service YANG data models specified in IETF into the Service Interface Logic, which is then translated to configuration snippets.

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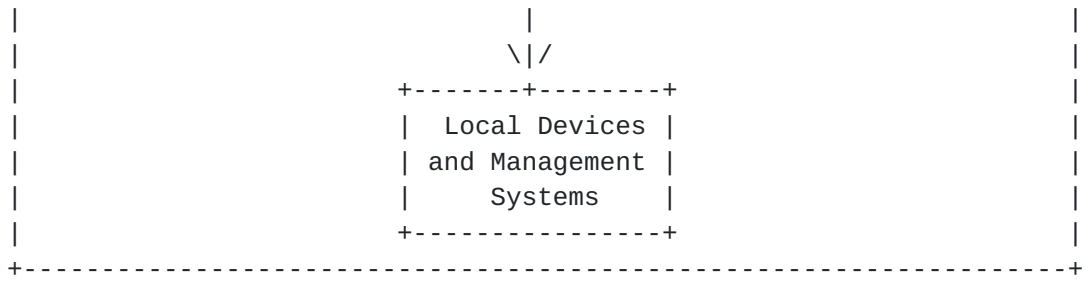


Figure 1 SUPA Framework

Figure 1 is exemplary. The Operator actor shown in Figure 1 can interact with SUPA in other ways not shown in Figure 1. In addition, other actors (e.g., an application developer) that can interact with SUPA are not shown for simplicity.

The EPRIM defines an Event-Condition-Action (ECA) policy as an example of imperative policies. An ECA policy rule is activated when its event clause is true; the condition clause is then evaluated and, if true, signals the execution of one or more actions in the action clause. Imperative policy rules require additional management functions, which are explained in section 2.2 below.

Figure 2 shows a SUPA Policy Model creating and communicating policy rules to two different Network Manager and Network Controller elements.

The Generic Policy Information Model (GPIM) was used to construct policies. The GPIM defines generic policy concepts, as well as two types of policies: ECA policy rules and declarative policy statements.

An ECA policy rule is activated when its event clause is true; the condition clause is then evaluated and, if true, signals the execution of one or more actions in the action clause. This type of policy explicitly defines the current and desired states of the system being managed.

A set of Generic Policy Data Models are then created from the GPIM. These YANG data model policies are then used to control the configuration of network elements that model the service(s) to be managed using policy.

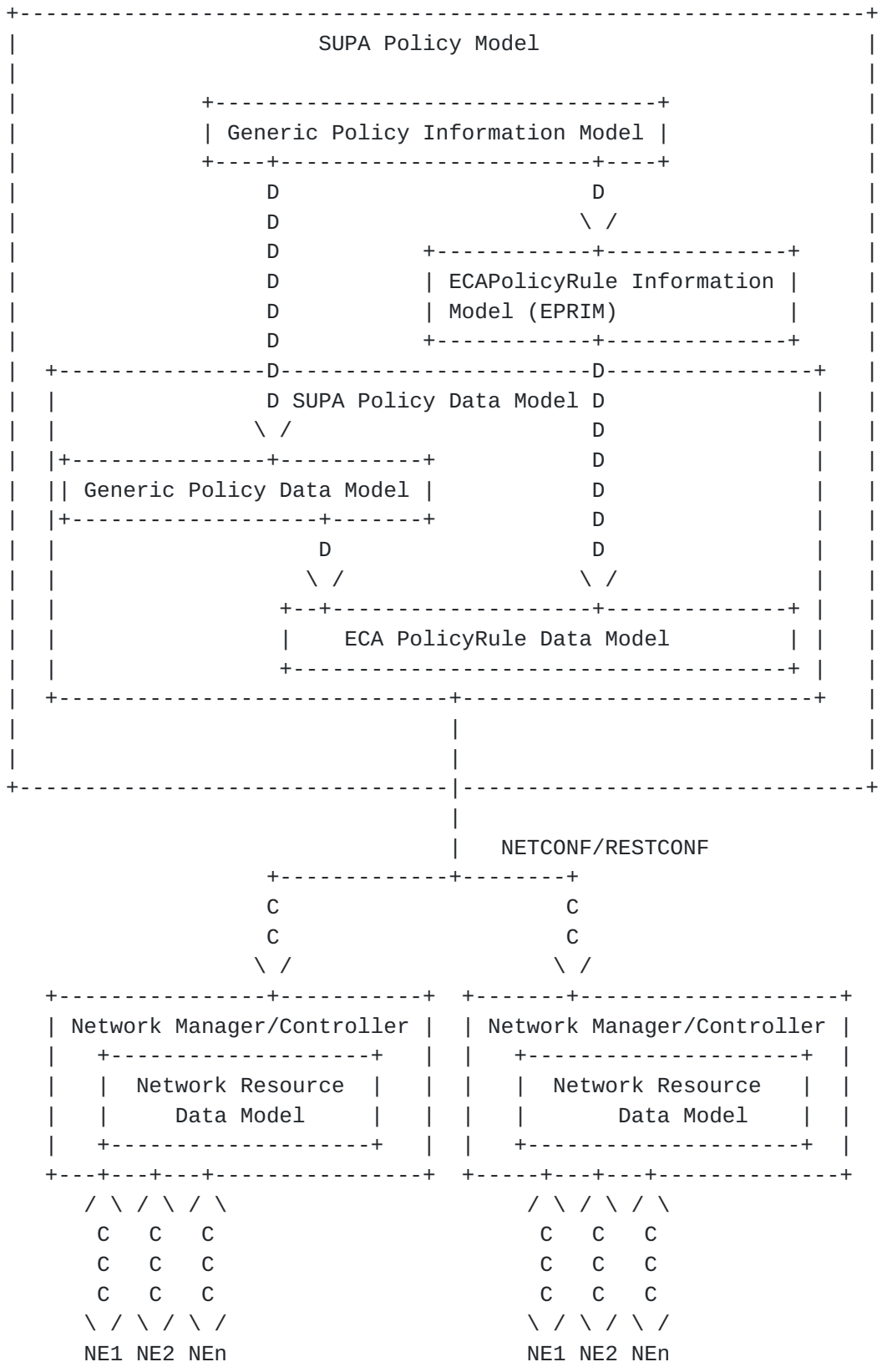
SUPA Policy Model
Generic Policy Information Model
ECAPolicyRule Information Model (EPRIM)
SUPA Policy Data Model
Generic Policy Data Model
ECA PolicyRule Data Model
NETCONF/RESTCONF
Network Manager/Controller
Network Resource Data Model
Network Manager/Controller
Network Resource Data Model
NE1 NE2 NEn
NE1 NE2 NEn

Figure 2 SUPA Policy Model Framework

In Figure 2:
A double-headed arrow with Cs means communication;
A double-headed arrow with Ds means derived from.

The network elements used in this framework are:

SUPA Policy Model: represents one or more policy modules that contain the following entities:

Generic Policy Information Model: a model for defining policy rules that are independent of data repository, data definition, query, and implementation languages, and protocol. This model is abstract and is used for design; it MUST be turned into a data model for implementation.

Generic Policy Data Model: a model of policy rules for that are dependent of data repository, data definition, query, and implementation languages, and protocol.

ECA Policy Rule Information Data Model (EPRIM): represents a policy rule as a statement that consists of an event clause, a condition clause, and an action clause. This type of Policy Rule explicitly defines the current and desired states of the system being managed. This model is abstract and is used for design; it MUST be turned into a data model for implementation.

ECA Policy Rule Data Model: a model of policy rules derived from EPRIM, consist of an event clause, a condition clause, and an action clause.

NM/NC: Network Manager / Controller, which represents one or more entities that are able to control the operation and management of a network infrastructure (e.g., a network topology that consists of Network Elements).

Network Resource Data Model: a model of the physical and virtual network topology including the resource attributes (e.g., data rate or latency of links) and operational parameters needed to support service deployment over the network topology. An example of a network resource data model can be found in [ID.draft-contreras-supa-yang-network-topo].

Network Element (NE), which can interact with local or remote NM/NC in order to exchange information, such as configuration information, policy enforcement capabilities, and network status.

Relationship among Policy, Service and Resource models can be illustrated by the
figure below.

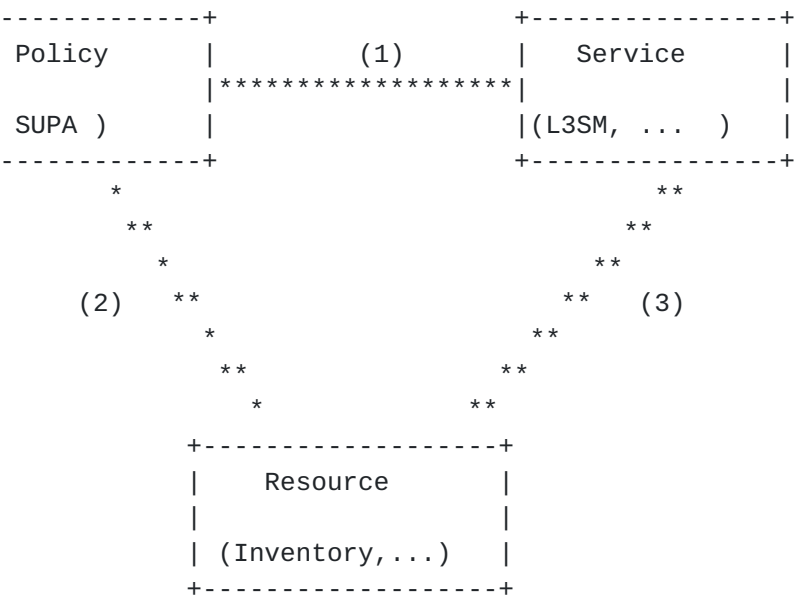


Figure 3 Relationship among Policy, Service and Resource

In Figure 3:
(1) policy relies on and is able to adjust service
(2) policy relies on network ability provided by resource and is able to adjust resource
(3) resource relies on network ability and is able to reserve and consume/occupy resource

## 2.2. Operation

SUPA can be used to define various types of policies, including policies that affect services and/or the configuration of individual or groups of network elements. SUPA can be used by a centralized and/or distributed set of entities for creating, managing, interacting with, and retiring policy rules.

The SUPA scope is limited to policy information and data models. SUPA will not define network resource data models or network service data models; both are out of scope. Instead, SUPA will make use of network resource data models defined by other WGs or SDOs.

Declarative policies that specify the goals to achieve but not how to achieve those goals (also called "intent-based" policies) are out of scope for the initial phase of SUPA.

## 2.3. The GPIM and the EPRIM

The GPIM provides a common vocabulary for representing concepts that are common to expressing different types of policy, but which are independent of language, protocol, repository, and level of abstraction.

This enables different policies at different levels of abstraction to form a continuum, where more abstract policies can be translated into more concrete policies, and vice-versa. For example, the information model can be extended by generalizing concepts from an existing data model into the GPIM; the GPIM extensions can then be used by other data models.

The SUPA working group develops models for expressing policy at different levels of abstraction. Specifically, two models are envisioned (both of which are contained in the Generic Policy Information Model block in Figure 1:

1. a generic model (the GPIM) that defines concepts and vocabulary needed by policy management systems independent of the form and content of the policy

2. a more specific model (the EPRIM) that refines the GPIM to specify policy rules in an event-condition-action form

## 2.4. Creation of Generic YANG Modules

An information model is abstract. As such, it cannot be directly instantiated (i.e., objects cannot be created directly from it). Therefore, both the GPIM, as well as the combination of the GPIM and the EPRIM, are translated to generic YANG modules.

SUPA will provide guidelines for translating the GPIM (or the combination of the GPIM and the EPRIM) into concrete YANG data models that define how to manage and communicate policies between systems. Multiple imperative policy YANG data models may be instantiated from the GPIM (or the combination of the GPIM and the EPRIM). In particular, SUPA will specify a set of YANG data models that will consist of a base policy model for representing policy management concepts independent of the type or structure of a policy, and as well, an extension for defining policy rules according to the ECA paradigm.

The process of developing the GPIM, EPRIM and the derived/translated YANG data models is realized following the sequence shown below. After completing this process and if the implementation of the YANG

data models requires it, the GPIM and EPRIM and the derived/translated YANG data models are updated and synchronized.

(1)=>(2)=>(3)=>(4)=>(3')=>(2')=>(1')

Where, (1)=GPIM; (2)=EPRIM; (3)=YANG data models; (4)= Implementation; (3')= update of YANG data models; (2')=update of EPRIM; (1') = update of GPIM

The YANG module derived from the GPIM contains concepts and terminology for the common operation and administration of policy-based systems, as well as an extensible structure for policy rules of different paradigms. The YANG module derived from the EPRIM extends the generic nature of the GPIM to represent policies using an event-condition-action structure.

## 3. Security Considerations

TBD

## 4. IANA Considerations

This document has no actions for IANA.

## 5. Contributors

The following people all contributed to creating this document, listed in alphabetical order:

TBD.

## 6. Acknowledgments

This document has benefited from reviews, suggestions, comments and proposed text provided by the following members, listed in alphabetical order: Andy Bierman.

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From "SUPA Value Proposition" [Klyus2016]

The following people all contributed to creating this document, listed in alphabetical order:

Vikram Choudhary, Huawei Technologies
Luis M. Contreras, Telefonica I+D
Dan Romascanu, Avaya
J. Schoenwaelder, Jacobs University, Germany
Qiong Sun, China Telecom
Parviz Yegani, Juniper Networks

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The authors of "SUPA Value Proposition" [Klyus2016] were:

Maxim Klyus, Ed. , NetCracker
John Strassner, Ed. , Huawei Technologies
Will(Shucheng) Liu, Huawei Technologies
Georgios Karagiannis, Huawei Technologies
Jun Bi, Tsinghua University

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The authors of "Problem Statement for Simplified Use of Policy Abstractions (SUPA)" [Karagiannis2015] were:

Georgios Karagiannis, Huawei Technologies
Qiong Sun, China Telecom
Luis M. Contreras, Telefonica
Parviz Yegani, Juniper
John Strassner, Huawei Technologies
Jun Bi, Tsinghua University

From "The Framework of Simplified Use of Policy Abstractions (SUPA)" [Zhou2015]

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Early version of this draft can be found here: https://tools.ietf.org/html/draft-zhou-supa-architecture-00
At the early stage of SUPA, we think quite some issues are left open, it is not so suitable to call this draft as "architecture". We would like to rename it to "framework". Later there may be a dedicated architecture document.

The authors of "The Framework of Simplified Use of Policy Abstractions (SUPA)" [Zhou2015] were:

Cathy Zhou, Huawei Technologies
Luis M. Contreras, Telefonica
Qiong Sun, China Telecom
Parviz Yegani, Juniper

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Authors' Addresses

Will(Shucheng) Liu
Huawei Technologies
Bantian, Longgang District, Shenzhen 518129
P.R. China

Email: liushucheng@huawei.com

John Strassner
Huawei Technologies
2330 Central Expressway
Santa Clara, CA 95138 USA

Email: john.sc.strassner@huawei.com

Georgios Karagiannis
Huawei Technologies
Hansaallee 205, 40549 Dusseldorf
Germany

Email: Georgios.Karagiannis@huawei.com

Maxim Klyus
NetCracker
Kozhevnicheskaya str.,7 Bldg. #1
Moscow, Russia

E-mail: klyus@netcracker.com

Jun Bi
Tsinghua University
Network Research Center, Tsinghua University
Beijing 100084
P.R. China

Email: junbi@tsinghua.edu.cn

Chongfeng Xie
China Telecom Beijing Research Institute
China Telecom Beijing Information Science&Technology Innovation Park
Beiqijia Town Changping District Beijing 102209 China
Email: xiechf@ctbri.com.cn