M2M 네트워크와 서비스를 위한 Policy 컴파일러와 Policy 에디터

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Towards Policy Compiler and Policy Editor for M2M Networks & Services

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요 약

In this paper, we have proposed policy compiler and policy editor for M2M (Machine to Machine) network. The system provides configuration management based policy management for M2M network and services. M2M networks of sensor mote and smart-phone are connected to our policy compiler and policy editor. This system uses the M2M monitoring information gathered from M2M monitoring software.

1. Introduction

With advancement of both internet technology and high-tech user-end devices, M2M networks [1] and services are growing popular. M2M networks provide services without or with the least involvement of human interaction. Policy based network management [2] is a condition-action response mechanism to provide an automatic response to conditions in the network according to pre-defined policies. For this, policy based network management can add more autonomous characteristics in M2M networks.

We have proposed a policy based management of M2M networks based on it configuration management. In a M2M network, its policy compiler provides autonomic services based on the policy rules written over it by it are a policy editor. This product considers M2M network specific policy specification and compilation. It also provides M2M service specific policy specification and compilation. It fully utilized the M2M monitoring information obtained from M2M monitoring software.

This paper is organized as follows. In section 2, we have discussed the impact of policy based configuration management in M2M networks. We have presented our proposed architecture for policy compiler and policy editor in section 3. Our implementation details with use-cases, example scenario with ubiquitous health monitoring system and design constraints are presented in section 4. Section 5 discusses the relative works. We have concluded with our future works in section 6. .

2. Policy Based Configuration Management in M2M networks

A policy based configuration management simplifies tedious steps (consistently and properly configure large number of M2M devices and applications in M2M networks) involved in configuration management.

Simplified Configuration Management
It simplifies configuration tasks by using policies to define configurations at higher level of abstraction and by using policy transformation to convert into lower-level M2M device configurations. One way of simplification is to specify the goals and objects to be met for the configuration changes. An automated software system of the policy based configuration management converts performance, desired goal to the configuration of M2M devices. Policy makers define the desired goal and objective. Network administrators verify whether desired goal is met or not. The automation process is dependent on the specific environment and topology of the M2M network being monitored.

Automated adjustment of configuration settings
It automatically adjusts system configuration based on current conditions. It first provides higher-level of descriptions of user-end devices. Then low level system configuration is developed by policy translation for each of the corresponding higher class. These low level configurations are installed on M2M devices and user is asked to classify the M2M device on their first login.

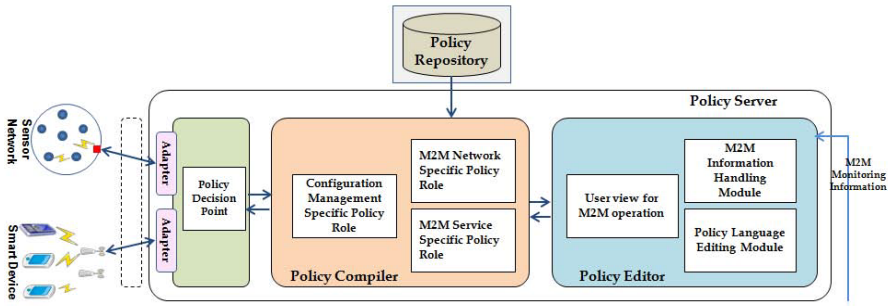

Figure 1: Architecture of proposed policy compiler and policy editor in M2M networks & services

When the user classifies M2M device, its configuration is changed according to policies so that it can follow high level definitions.

Best way for configuration best practices
It uses policies to enforce configuration best practices that work against improver configuration. Policy based configuration checking is better than manual inspection or hardcoded way of configuration best practices. It downloads the latest configuration policies from a central repository. This repository can be updated by events like availability of new product version, introduction of new business target or remote change. System administrator can deploy subset of policies applicable to corresponding M2M network, among all available policies.

3. Proposed Architecture

Proposed architecture (Fig.1) consists of a policy compiler and a policy editor dedicated for configuration based policy management in M2M network.

Policy compiler
Policy compiler consists of separate modules for M2M network and service specific policy rules. Configuration management module is in the compiler. There are also separate adapter modules for sensor and smart-phone platform.

Configuration management module
Its configuration management module allows policy compiler to react to events like installation of M2M devices, update of M2M software etc

M2M network specific compilation module
Its M2M network specific compilation module works with variations on M2M devices like sensor-mote, smart-phones, variations on M2M network parameters like network bandwidth and communication or variations on M2M device operation system.

M2M service specific compilation module
Its M2M service specific compilation module works with a broad-range of M2M services or the integration and upgrading of new M2M service.

M2M adapter module
Its M2M adapter module operates to integrate policy compiler to M2M devices of different platforms. Separate adapters are used to integrate compiler with sensor motes and smart-phone.

Policy editor
Its policy editor has M2M monitoring information handler, user view for M2M operation and policy language editing module.

M2M monitoring information handler
M2M monitoring information is important for development of policy information model, policy language- and policy roles. M2M monitoring information can be integrated to a semantic module to give ontology in policy compiler.

User view for M2M operation
Its user view module allows user to watch M2M operation. The M2M device configuration, compiled output all is visible through its graphical user interface.

Policy language specification module
This module allows to edit policy language according to the policies set by policy makers.M2M policy language has to be developed following the PIM (Policy Information Model) suitable for specific M2M network and services.

Policy Repository
Policy repository contains the policies to be run by policy compiler. Policies are written thorough policy language specification module.

Monitoring Information
M2M monitoring information is an external component of the system. It carries information fetched from M2M monitoring software.

M2M Operation Service
M2M operation service is another external component connected to policy editor. It allows sending policy compiled information to external component.

4. Implementation

Implementation Details
M2MPolicyCompilerController,M2MPolicyEditorControll

er,ConfigurationManagementController,M2MPolicyRepositoryController and M2MServiceOperationManager are major modules of our architecture (Fig. 2).

M2MPolicyCompilerController implements proposed policy compiler. It is connected to M2MNetworkSpecificPolicy-RoleManager, M2MService-SpecfificPolicyRoleManager,ConfigurationManagementController,M2MAdapterForSmartPhone,M2MAdapterFor-SensorMote, M2MPolicyRepositoryController. M2M-NetworkSpecificPolicyRoleManager and M2MService-Specific- PolicyRoleManager implements M2M network and service specific policy rules respectively. ConfigurationManagementController implements configuration based policy management in the system. It is connected to M2MConfiguration- RepositoryController that works as a policy repository of configuration policy checking system. M2MAdapterForSensor, M2MAdapterFor- SmartPhone work as the sensor-adapter and smart-phone adapter respectively. They are also connected to M2MPolicyRepositoryController implements policy repository of the system. It is connected to both policy compiler and policy editor modules.

M2MPolicyEditorController implements policy editor module of the system. It consists of M2MUserViewController, M2MMonitorInfoHandler, PolicyLanguageEditController and M2MServiceOperationManager. M2MUserViewController creates a graphical user interface for users so that they can watch M2M operation. M2MMonitorInfoHandler creates interface for the M2M monitoring information fetched from M2M monitoring software. PolicyLanguageEditController is an interface where user can define, edit policy language. M2MServiceOperationManager is an interface that sends policy compiled information to remote user.

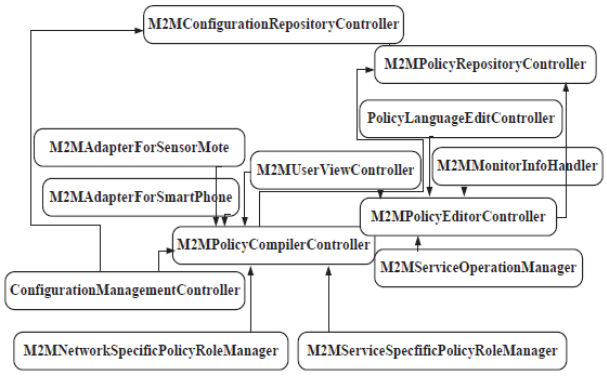

Figure 2: Modular diagram of the proposed system

User Classes and Characteristics

Policy makers and editors

They make decision about what would be done for certain events. They have the authority to create, remove or change policies

System monitors

They can monitors the overall system at the server or remotely

System administrators

They manage the whole system. Only required at the time of system implementation and initialization or at a unpredictable error occurrence.

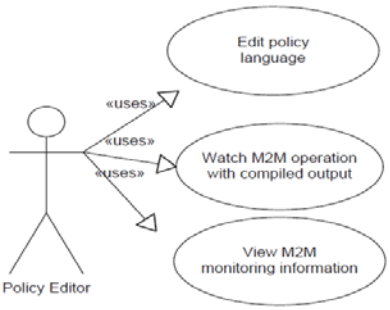

Figure 3: Use case of policy editor

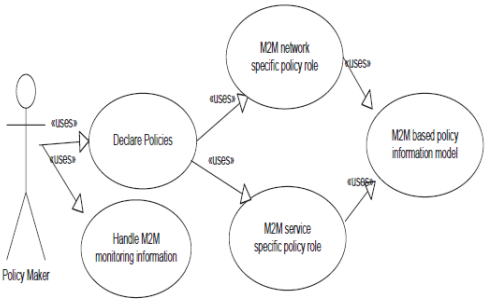

Figure 4: Use case of policy maker

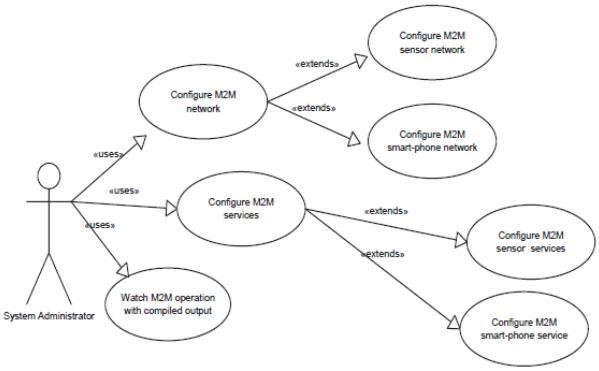

Figure 5: Use case of policy administrator.

Design constraints

Choosing a policy information model and policy language for policy compiler will be challenging. Based on the specific M2M services and their characteristics, we have to choose a policy information model and design our policy language for our compiler. Configuration management for M2M networks is also challenging. Planning and choosing configuration items are considerable are. Adapter modules for sensor mote and smart-phone have to be built with proper care. It has to be applicable with specified sensor mote, smart-phone and communication protocol we are using.

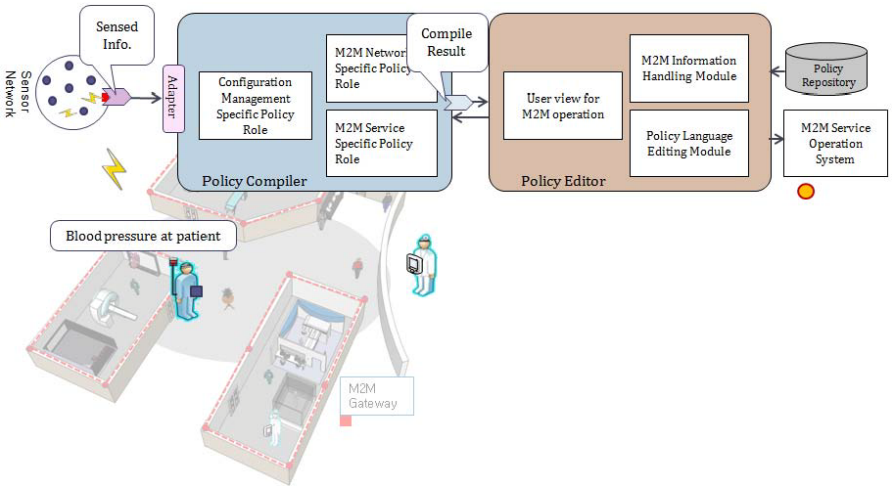

Figure 6: Implementation scenario of proposed system. Temperature is sensed by remote patient and specific policy rule is executed to send notification information to remote doctor in a ubiquitous health monitoring environment

Implementation Scenario

We have considered our proposed system in a ubiquitous health monitoring environment [Fig. 6].

A temperature sensor in remote user senses temperature and sends to adapter module of policy compiler. The temperature sensor has been configured using configuration module of the compiler. If the sensed temperature is above 37.5 degree Celsius, a policy rule (Sends notification to remote Doctor if sensed temperature is above 37.5 degree Celsius) is executed. M2M service operating connected to policy editor sends immediate notification to the remote doctor.

5. Related Works

[3]provides a policy management system for networked systems and application. It proposes platform-neutral and extensible specification of policies. (Keoh et all, 2007) is a policy-based architecture named Ponder2 that supports autonomic management for body sensor networks, based on the concept of a Self-Managed Cell (SMC). A SMC consists of an autonomous set of hardware and software components that represent an administrative domain such as a body area network of physiological sensors and controllers.[5] provides an architectural solution for a middleware that supports autonomic management of these distributed software systems (heterogeneous, dynamic and large-scale) through a policy-based approach. [6] is an improved M2M platform for multi-sensors agent application. It is able to collect and process data from a wide variety of sensors and exchange information supporting different communication networks and protocols. [7] proposes a service platform for M2M. It specially addresses vast differences in the capabilities of different M2M devices, as well as the requirements for scalability and flexibility. DASIMA [8] is a flexible management middleware for multi-scale contexts. It gives a new approach combining domain-based and architecture-based management in M2M network.

6. Conclusion

In this paper, we have presented policy compiler and policy editor for M2M network and services. We have focused on configuration based policy based management for M2M network. In future, we have plans to focus on performance based policy management of M2M network and services.

Acknowledgement

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