Distributed Pervasive Services using Group Service communication supporting Body Area Networks

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Introduction

BANs produce critical data

This paper looks to how this data can be harnessed

Applied through a middleware (developed in the MORE project)

SOA based middleware

With a focus on service grouping and the management of these groups

With the aid of policy based approach

Objective: create services and service groups to support various types of BANs
(Upkar Varshney) - discusses the vision of pervasive healthcare through wireless technology and the associating research challenges

(E. Lupu et al) AMUSE project: looked at the adaptation of policies to implementing pervasive healthcare

(Feng Wang et al) - Services and Policies for Care at Home

(Tao Gu et al) - A service-orientated middleware for building context-aware services

Web Services Policy 1.5 Framework W3C Recommendation 04 – provides functional assurances of services
**Detailed Architecture**

MORE Proxy

**Core Management Service (CMS)**

MORE Middleware

**Application**

**Application Layer**

**Internal**

**Service Connectors**

MORE Embedded Node

**Application Layer**

**Proprietary**

**Sensors**

**Sensor A**

**µSOA**

**Inter-Node/Inter-Service Communication**

**Operating System**

**Hardware Layer**

**Implementation of Service Functionality (Service logic)**
MORE IST Project

2 End User Scenarios – Remote health management, mitigation management in the Environmental domain

Validation of experimental system by real end users

Fusion of sensors and Web Services
Group Types & Group Utility Services

Group Types
- Role Group
- Service Group
- Communication Group

Group Utility Services
- Group Management Service
- Group Communication Service
MORE – Policy controlled Groups

Based on PBNM approach to management of network entities

Group initialization and management controlled by policies

Policy Components
- Events
- Conditions
- Actions
- PolicyRule -> {Events, Conditions, Actions}

Configuration Policy
Behaviour Policy
Group Mgt Service

Disease
Diabetes
Cardiac
Type I
Type II
Case Study – Acute Health Care

Group Establishment

Emergency Detection and resulting Group Reconfiguration

Patient Monitoring Group

Patient

Diabetic Service

Nurse’s PDA

Physician Service

Doctor’s PDA

Hospital Management Service
Case Study – Group Establishment

PolicyRule:
{
  CommonName "PatientMonitoringGroupSetup",
  Events
    createGroup,
  Conditions
    MandatoryMember1 – Is member of DoctorsOnSite && Is Diabetologist && Is NotInSurgery
    MandatoryMember2 – Is member of NursesOnSite && not high Patient Allocation
    MandatoryMember3 - HospitalMgtService
  Actions
    initializeGroup
}
Case Study – Group Establishment

Nurse A
DeviceID = 10
CardiacMgt
Service
DiabeticMgt
Service

Doctor X
DeviceID = 12
Physician Service

BloggsJoe

Hospital Server

Patient Monitoring
Group

Nurse B
DeviceID = 11
CardiacMgt
Service

SmithJohn

Patient Monitoring
Group

Hospital Mgt
Service

StaffMgt
Service

Location
Service
PolicyRule:
{
  PolicyEvent:
  {CommonName "ECGMeasurement", ParameterList "PatientIdentifier", "ECG-Value"}
  PolicyCondition:
  {CommonName "ECGHighPriority", If ECG-Value is InDangerousRange}
  PolicyCondition:
  {CommonName "hasMemberDoctor", If Member == Doctor}
  PolicyCondition:
  {CommonName "memberTypeNurse", If Member == Nurse}
  PolicyAction:
  {CommonName "sendHighPriorityAlarm", TriggerMsg "SendNotifToGroup" Params "HIGH", "ECG values at dangerous levels"}
  PolicyAction:
  {CommonName "addMemberToGroup", TriggerMsg "addMemberToGroup" Params "{MemberType, Doctor}" & {BaseSelectionOn, {DoctorType, Cardiac} & {Load, !Busy} & {Location, Closest}}
}
PolicyRule:
{
    CommonName "RULE-ECG-MEAS-ECGHIGH",

    Events
    ECGMeasurementEvent

    Conditions
    ECGHighPriority && memberTypeNurse &&
    !(hasMemberDoctor)

    Actions
    sendHighPriorityAlarm && addMemberToGroup
}

Case Study – Reconfigured Group

BloggsJoe
DeviceID = 10
CardiacMgt Service
DiabeticMgt Service

Nurse A
Doctor X
DeviceID = 12
Physician Service

SmithJohn
CardiacMgt Service

Nurse B
DeviceID = 11
Patient Monitoring Group

Hospital Server
Patient Monitoring Group
Hospital Mgt Service
StaffMgt Service
Location Service
Conclusion / Future Work

- Policy controlled service groups which add value to the data produced by the BANs.

- Adaptable and reconfiguration of the groups which can aid efficiency with a pervasive healthcare environment.

- Objective: support efficient monitoring and usage of BANs,
  - e.g. home care monitoring
  - e.g. emergency disaster situation

Future Work

- Investigating a lightweight inference engine for policy processing
Questions ??

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