Mobile Device Management

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Prof. Ju, Hong Taek

Computer Network Lab.
Keimyung University

juht@kmu.ac.kr, comnet.kmu.ac.kr/~juht

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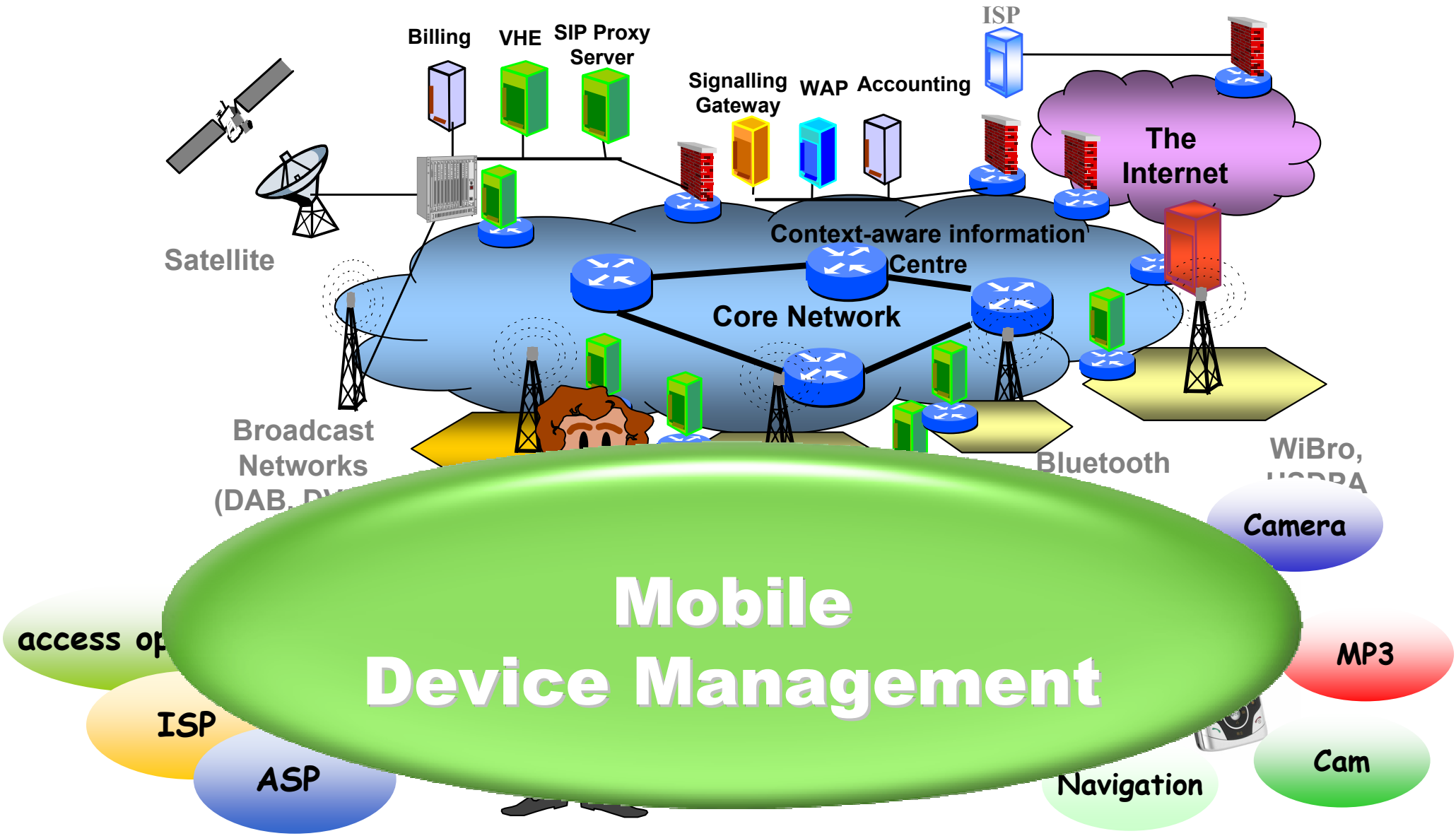
Future Network Environment



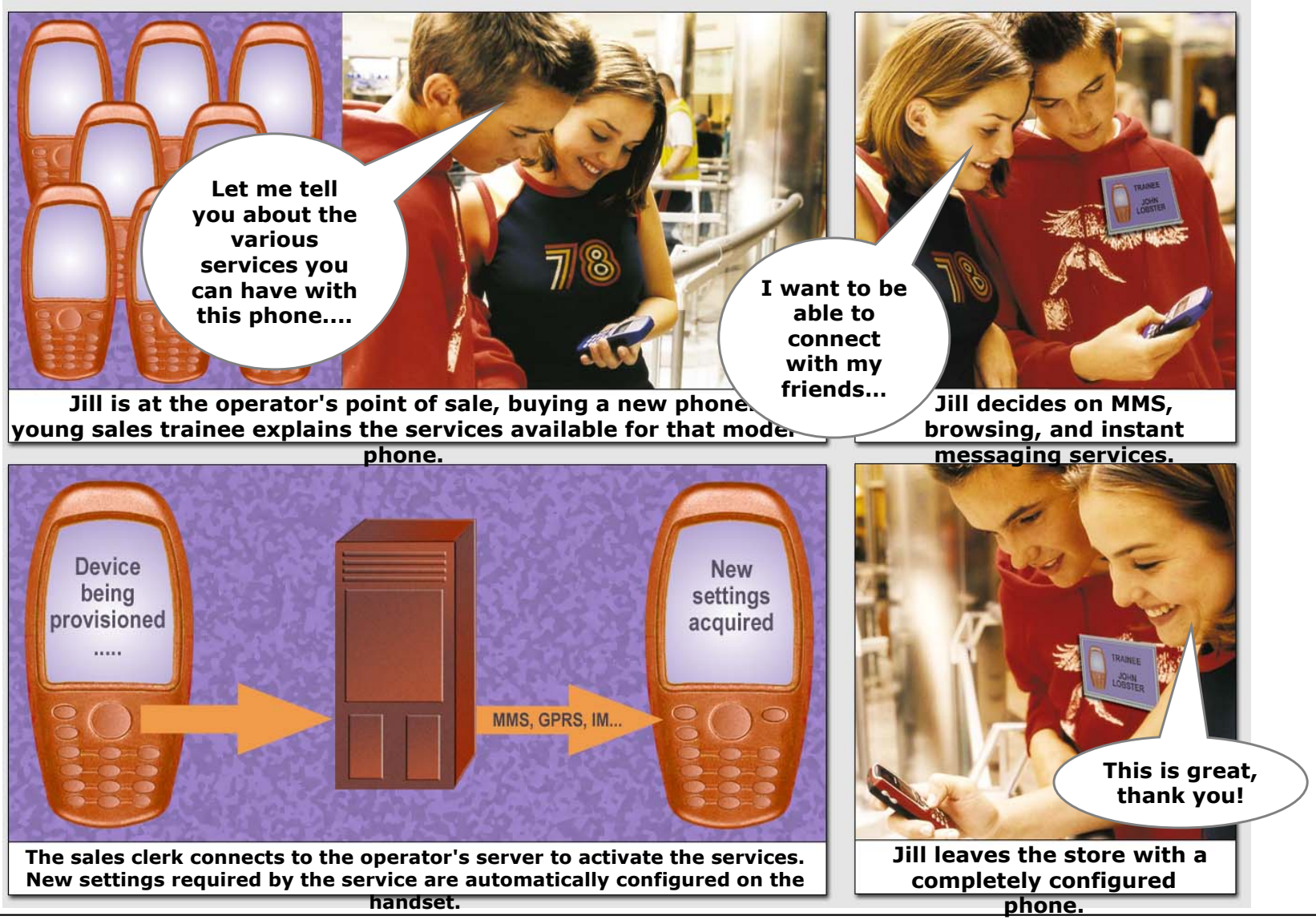
Motivation of MDM

- Problems
  - Increased mobile device complexities
  - Increased numbers of mobile devices
  - Increased stratification of the value-chain
  - More difficulties to manage the growing complexity of h andsets to the end-users
  - Need and demand for managing the fleet of advanced mobile handsets to operators, xSPs, and corporate IT departments

Management for complex device is required

Provisioning a new phone upon purchase

Easy use of new services with new device



Help desk problem resolution

Improved maintenance

John is having problems with his GPRS phone:
he can't get the browser working.

The helpdesk officer uses the device management server to check the configuration in the handset. She finds the problem and sends the solution.

Extending the service package

New services proposed to the user

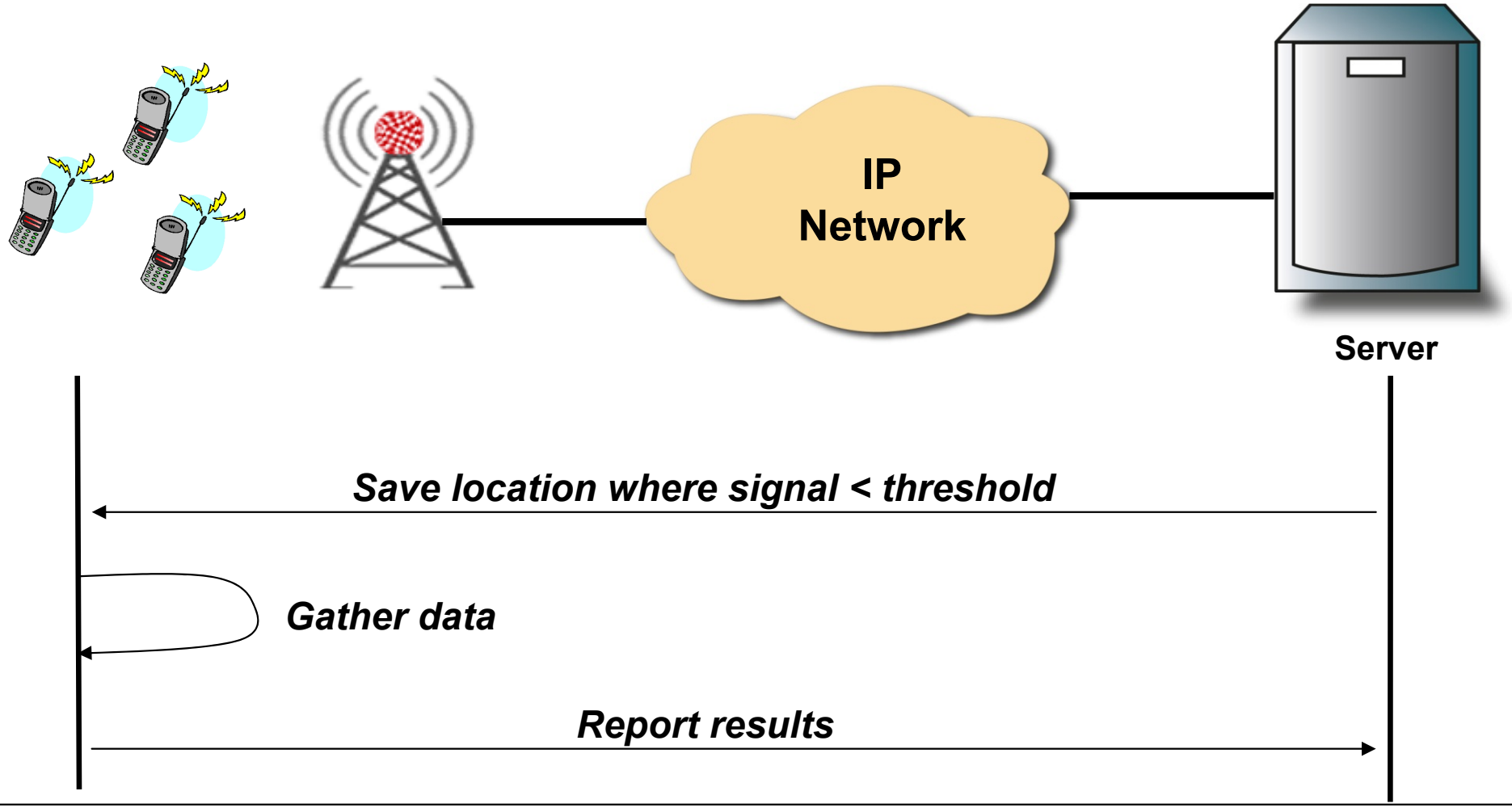
Jane's operator is launching their MMS service and sends an SMS to all their subscribers with MMS-capable handsets.

Jane receives the SMS and chooses to subscribe to the new service.

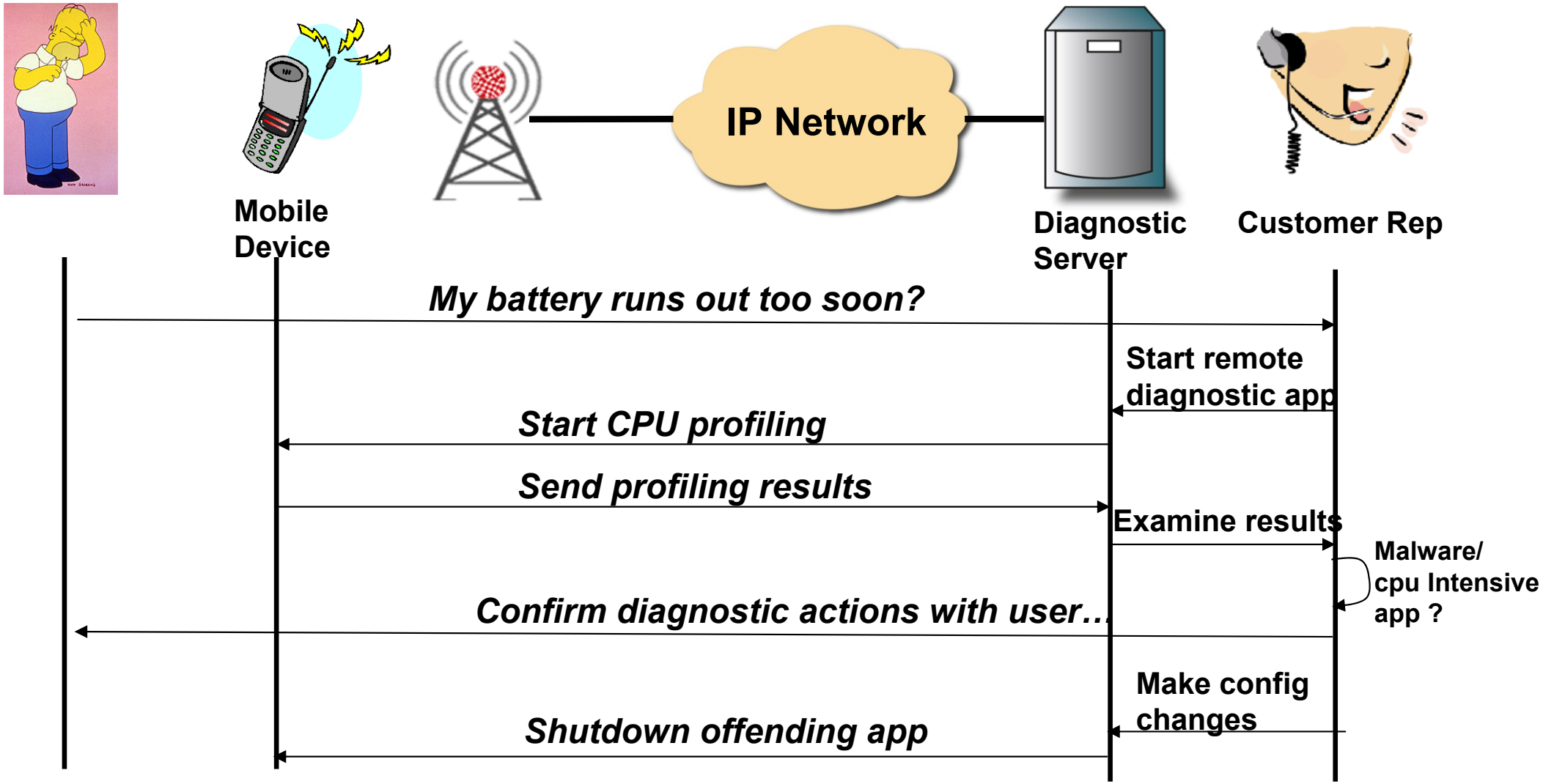
Upon receiving Jane's reply, the operator updates the subscriber database and extends Jane's current device configuration to cover the MMS service.

Jane can now send MMS messages. She sends her first MMS message to her boyfriend.

Bad Network Coverage Detection



Fixing Abnormal Battery Consumption Problem



What is MDM?

For the end-users

- ”These new products and services are so easy to use.”
- ”If I have a problem, my operator can find and solve the situation for me.”
- ”It is easy to get new services to work in my terminal.”
- ”Now, I can focus on using the services, not configuring them.”

For operators and service providers

- We can
  - identify, diagnose, and remedy end-users’ problems before they even notice them
  - provision and troubleshoot new services remotely.”
- We benefit via
  - cost savings in customer care
  - increased revenues from new services
  - reduced churning due to service quality.”

•**Mobile Device Management** is a tool to alleviate operators’ and end-users’ problems and consequently improve a) Product quality, b) operator satisfaction, and c) end-user satisfaction.

•**Mobile Device Management** is a technology which enables the customization, personalization, and servicing of personal devices such as wireless phones, personal digital assistants, and embedded technology in cars, houses, clothes, etc.

2. OMA DM

Standardization of OMA DM

- The shortage of standardization
  - Until the end of 2001, there were no standardized mobile DM technologies
  - WAP Forum and CDG had developed Spec but, they were not generic enough
- Released version 1.1.2 of the OMA DM Specification in Dec. 2003
- Version 1.2 is currently under gathering public comment and interoperability validation
- Earlier similar work in the IT domain
  - IETF has released SNMP
  - DMTF has worked around PC system and products management, especially focused on XML technology: WBEM
- OMA has leveraged this work but adjusted them to the domain of wireless and embedded devices

OMA DM vs. SNMP

- OMA DM
  - Judicious use of bandwidth
    - The use of WBXML to transmit messages
    - Incremental change synchronization
  - Combating network latency
    - The batching of data items and operations in one message
  - Addressing low reliability
    - Partitioning of a logical package into smaller physical messages
  - Addressing the resource limitations of a device
    - Thin client and fat server

- SNMP
  - P-Protocol limited
    - Data and functionality limited to what can be accomplished using gets,sets and notifies
  - AS-Agent Specific
    - Assume “dumb” agents and “smart” managers
    - Targeted at low level instrumentation
  - T-Telnet dilemma
    - Focus on reading data
    - Methods are force-fit and a “side-effect”
    - Telnet (CLI) is commonly used for configuration

Benefits of OMA DM to Interest Groups

- End-users
  - Be convenient for using device
    - Automatic configuration, Invisible performance
  - Remote troubleshooting
- Wireless operators and enterprises
  - These group face the same challenge, maintaining all the devices in their network
  - DM enables to manage complex device efficiently and smoothly, without problems
  - Reducing the costs associated with customer support
- Service providers
  - DM enables always to have right configuration and software to use their services

Benefits of OMA DM to Interest Groups

- Device manufactures
  - Gains indirect benefits – results in good user experiences that users associate with the device brand
  - The overall code size requirement for a device is reduced
    - Because DM standard allows to implement only one DM protocol in a device
- Software Vendor
  - Requirement for new service and software
  - Consequently, this demand provide a business item to software vendor

OMA DM Usage Models

❖ The most common usage models for DM functions

Usage Model	Example/Description
Provisioning a new device	A brand new device is configured according to the customer's preferences
Remote service management	After the activation of a service, the configuration for the service is added to a device.
Personal management	A user runs a DM application in desktop PC. This application enables the management of settings in a device communicating with the PC through local connectivity, such as Bluetooth
Troubleshooting	A help desk person remotely verifies the operating parameters. If necessary, the help desk person can change the parameters remotely

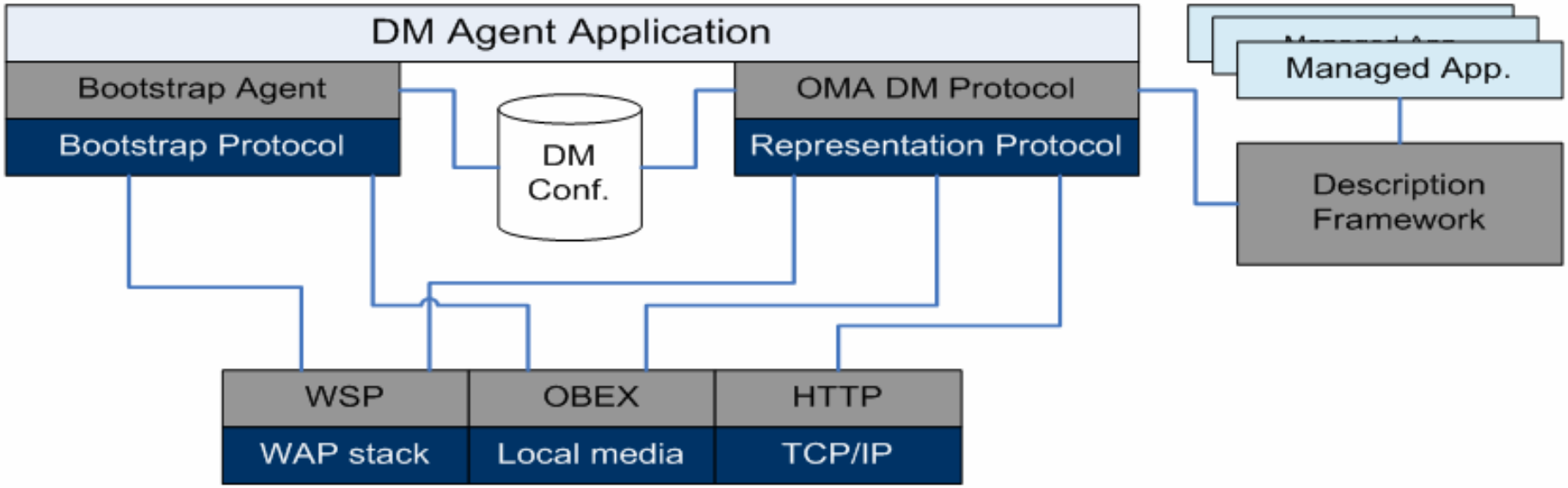
OMA DM Usage Models

Usage Model	Example/Description
Back up and restore	The content of a device is periodically stored on a local PC or backup server in the network. Later, this content can be restored on the device.
Mass configuration	An operator changes a configuration in all the devices in its networks. For instance, this configuration could be the settings of a access point
Automatic status reporting	A DM server automatically requests status information from a device, which can be manned (e.g., a mobile phone) or unmanned (e.g., an alarm system in a remote location)
Software download	A new software module is installed, or an installed software model is replaced or deleted on a device

Three logical components

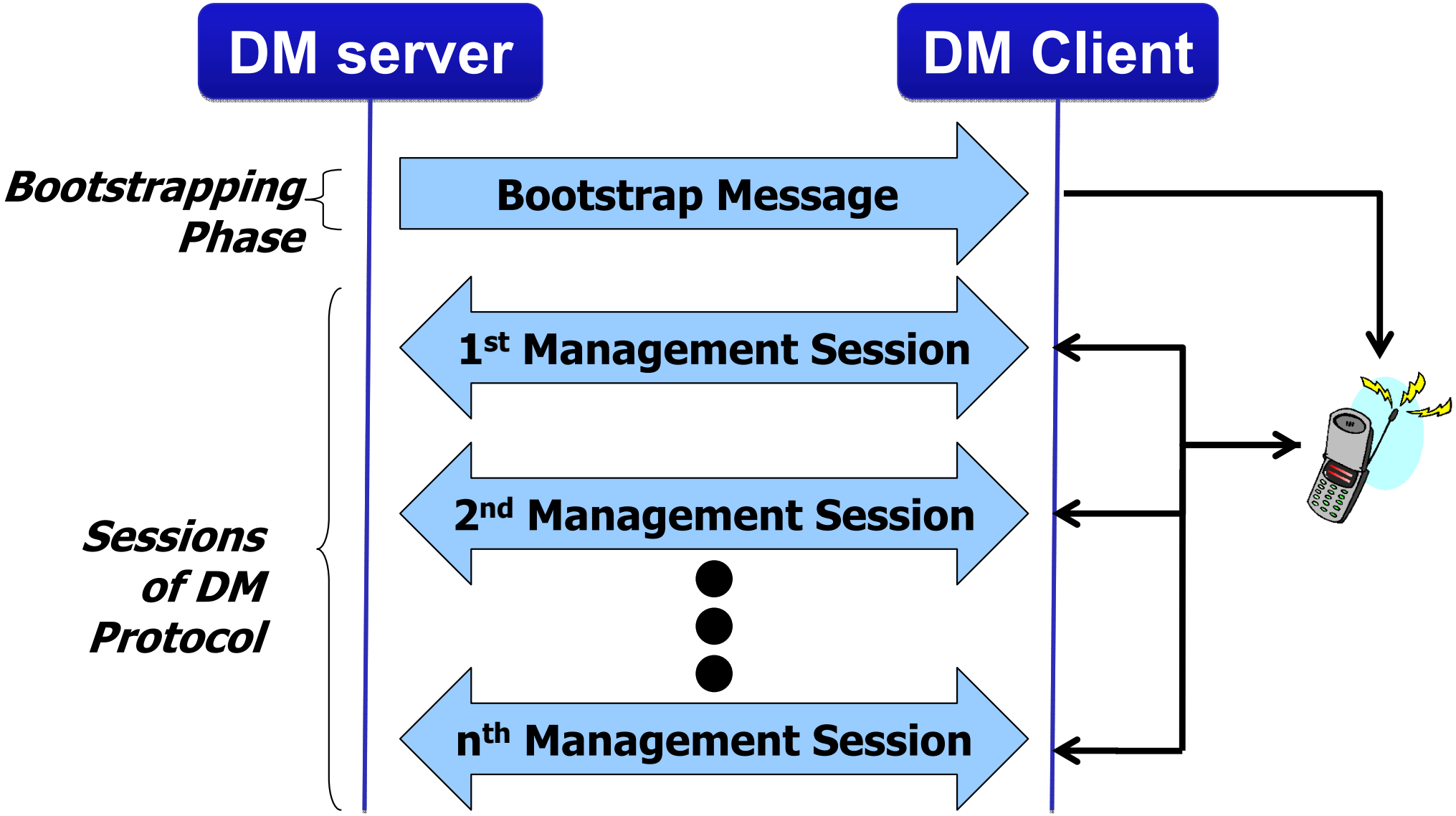
- Device Description Framework (DDF)
  - Providing necessary information about management objects in device for the server
- OMA DM Protocol
  - Defining the order of communicated packages by the server and client
- Bootstrapping
  - Configuring initiative setting of device

OMA DM Architecture



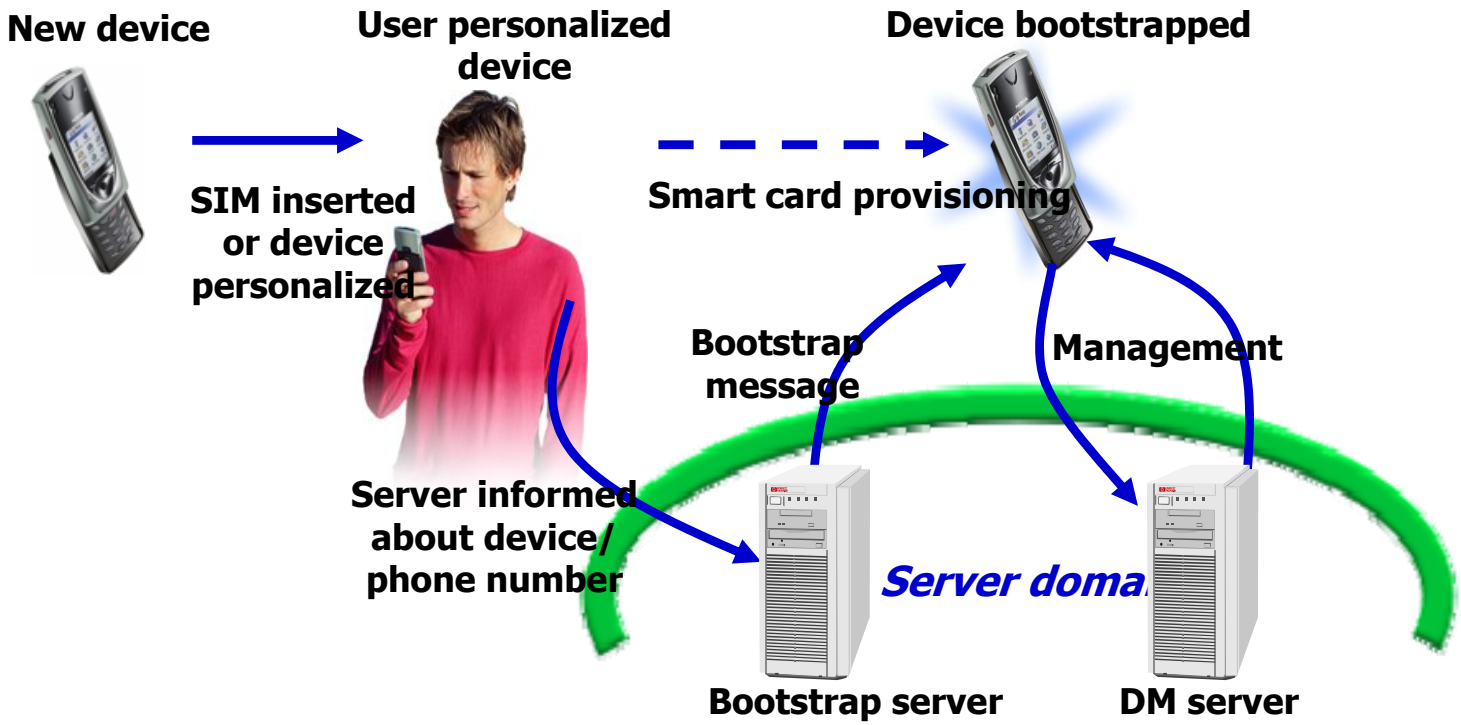
- Transport protocols used in bootstrapping and by the DM protocol
- The DM agent application provides the necessary application logic and UI
- The DM Configuration Database
  - Include all the necessary information for authenticating and communicating with a DM Server
  - Bootstrap components insert this info and the DM protocol uses the info

OMA DM defines bootstrap and management session between server and client.



Bootstrapping

- Provides a trusted relationship with a management server
  - security needs to be guaranteed
  - device to know: server address, credentials, etc.
- Based on WAP Forum client provisioning bootstrap mechanism
  - provide also application settings



DM Protocol

- Within the DM Protocol, Management Object
  - A set of configuration parameters for a device
  - The run-time environment for S/W application on a device

Node type	Action
configuration parameters for device	reading and setting parameter keys and values
run-time environment for S/W application	installing, updating or uninstalling S/W elements

- Provided two management functionality
  - Managing Functionality
    - Functionality to management object within a device
  - User interaction Functionality
    - Functionality to enables communication with the user
    - provides information about management operation
    - requested confirmation for a management operation from user

DM Protocol

Feature	Description	OMA DM command
Reading MO content	The server retrieves the content from the DM Client	***Get***
Reading a MO list	The list of MOs residing under a node in a management tree is read	***Get***
Adding a MO or MO content	A new dynamic MO is inserted	***Add***
Updating MO content	Existing content of an MO is replaced with new content	***Replace***
Removing MO(s)	One or more MOs under a node are removed from a management tree	***Delete***
Management session start	Convey notification of device management session	***Alert***
Executing a process	New process is invoked and return a status code or result	***Exec***

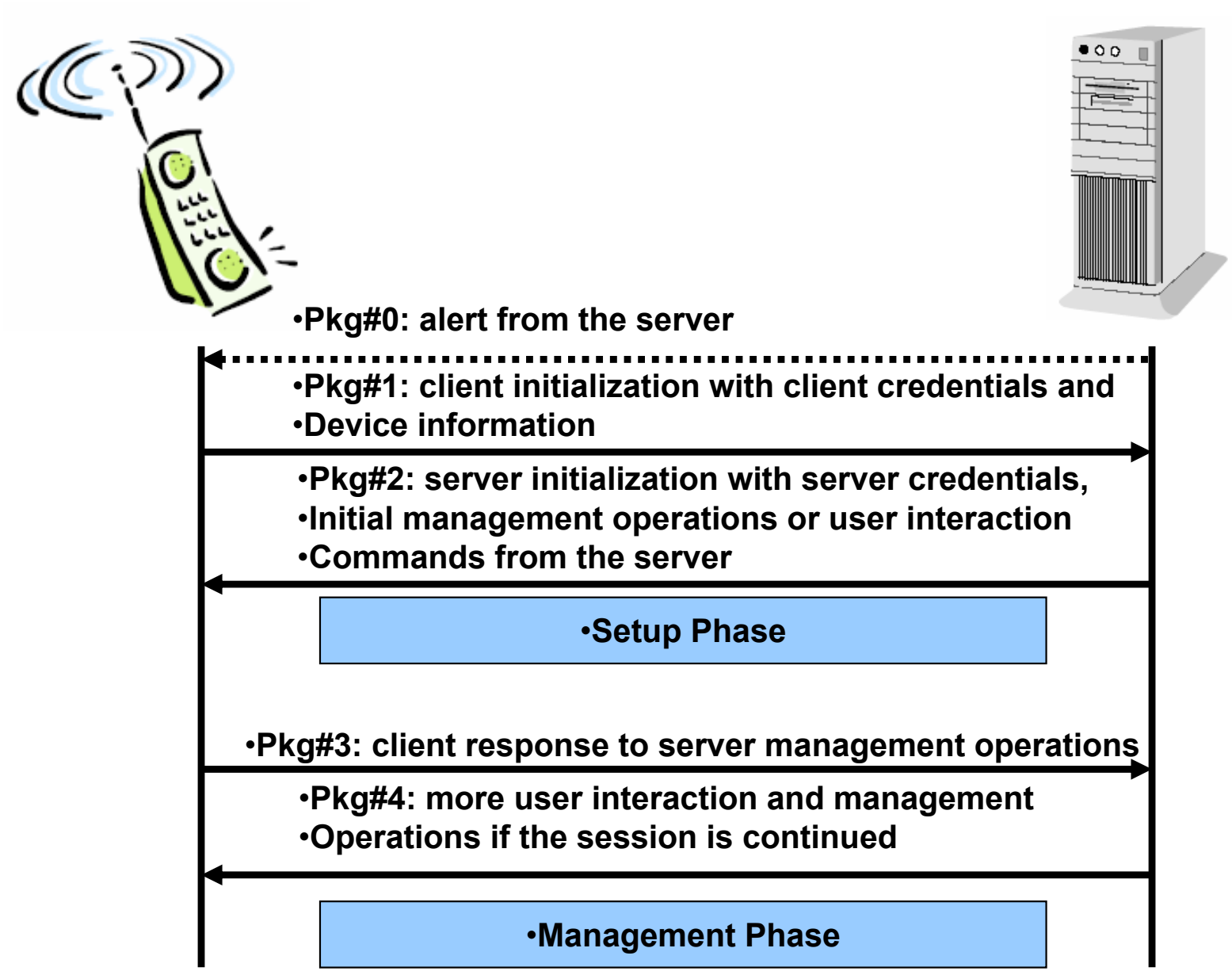
DM Protocol

❖ User Interaction

Feature	Description
Display	A notification or additional information about management can be shown to the user.
Confirmation	A confirmation question (yes or no) can be asked of the user.
User input	Input in a text form can be requested from the user
User choice	One or more selections from a set of options can be requested from the user

This functionality is needed for certain management operations but, should not be over used, since such overuse is counter to automatic and background device management, the fundamental goal of OMA DM

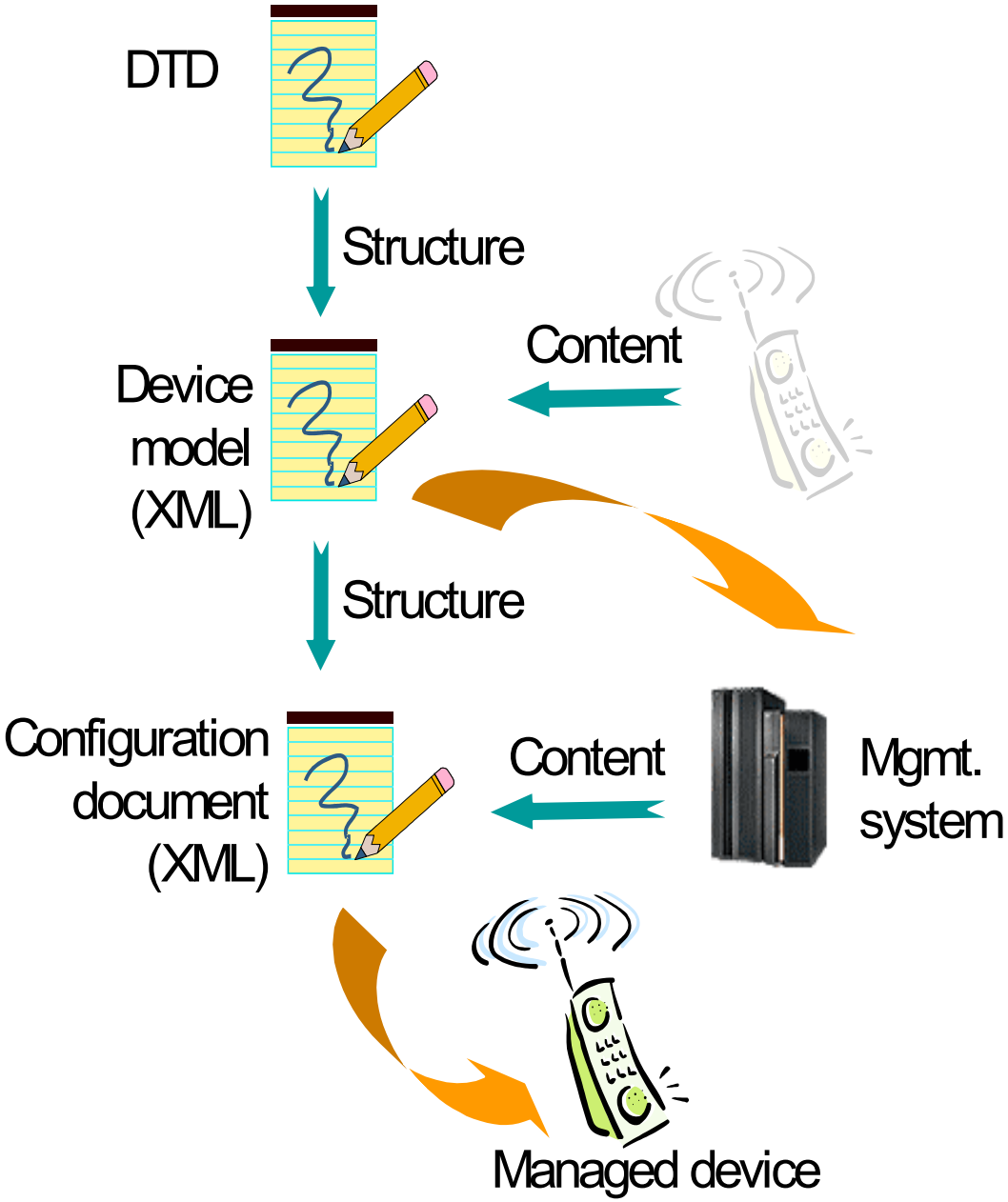
DM Protocol


•Pkg#0: alert from the server
•Pkg#1: client initialization with client credentials and
•Device information
•Pkg#2: server initialization with server credentials,
•Initial management operations or user interaction
•Commands from the server
•Setup Phase
•Pkg#3: client response to server management operations
•Pkg#4: more user interaction and management
•Operations if the session is continued
•Management Phase

Device Description Framework

- The device description framework provides server with necessary information about the managed objects in the device
- Addressing scheme and data structure for managed entities in the device
- The device manufacturer can publish the device description
  - New functions can be added to the device
- DDF functionality is quite similar to MIB, defined by IETF for the network management
- This is different from the run-time properties of an instantiated node in the device

Device Description Framework



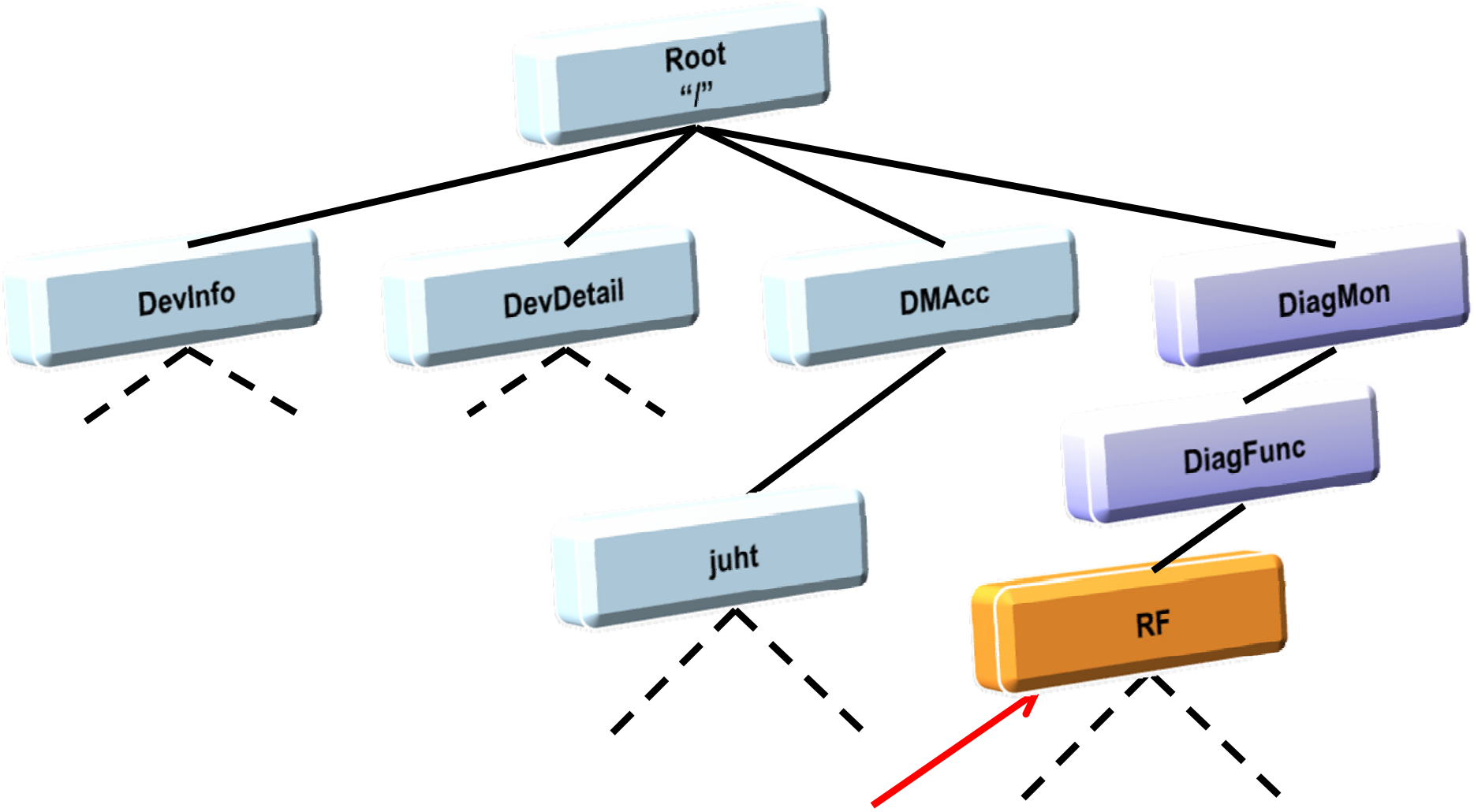
Device Description Framework

Element/Property	Explanation	Usage
AccessType	**Specifies which commands are allowed on the node.**	**MUST**
DefaultValue	**The node value used in a device unless specifically set to a different value.**	**MAY**
Description	**The human readable description of the node.**	**MAY**
DFFormat	**The data format of the described node.**	**MUST**
Occurrence	**Specifies the number of instances that MAY occur of the node.**	**MAY**
Scope	**Specifies whether this is a permanent or dynamic node.**	**MAY**
DFTitle	**The human readable name of the node.**	**MAY**
DFType	**For leaf nodes, the MIME type of the node value. For interior nodes, `null` or a DDF document name.**	**MUST**

Representing the tree using DDF

```
<MgmtTree>
  <Node>
    <NodeName>Vendor</NodeName>
    <DFProperties>…</DFProperties>
    <Node>
      <NodeName>ISP</NodeName>
      <DFProperties>…</DFProperties>
      <Node>
        <NodeName>GWInfo</NodeName>
        <DFProperties>…</DFProperties>
        <Node>
          <NodeName>GWName</NodeName>
          <DFProperties>…</DFProperties>
          <Value>gw.halebop.com</Value>
        </Node>
      </Node>
    </Node>
  </Node>
</MgmtTree>
```

Device Management Tree represents all available information of device.



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Device Diagnostics

- What is Device Diagnostics?
  - Using mobile device for collection and retrieval of information useful for diagnostics and performance measurements
- Entities that provide diagnostics information
  - OS → State, configuration parameters network interfaces, radio, battery storage, cpu, processes, memory
  - VMs → State, configuration parameters, processes, memory
  - Libraries → State, configuration parameters
  - Applications → State, configuration parameters

DM Diagnostics Work Item

- **Diagnostics Policies Management**
  - Support for specification and enforcement for policies related to the management of diagnostics features and data
- **Fault Reporting**
  - Enable the device to report faults to the network as the trouble is detected at the device
- **Performance Monitoring**
  - Collecting and reporting key performance indicators(KPIs) data

DM Diagnostics Work Item

- **Device Interrogation**
  - Enable the network to query the device for additional diagnostics data in response to a fault
- **Remote Diagnostics Procedure Invocation**
  - Enable operators to invoke specific diagnostics procedures embedded in the device
- **Remote Device Repairing**
  - Enable operators to invoke specific repairing procedures based on the results of diagnosis precedure

Device Diagnostic Functions

- Internal Display
- External Display
- Keys
- Vibrate Function
- Camera
- Earpiece Audio
- Speakerphone Audio
- Internal Memory
- External Memory
- Touch Screen Interface
- Battery Charge Cable
- USB Data Cable
- Abnormal Power Off
- Battery Drain
- Voice Network
- Data Network
- Voice Service
- SMS Service
- Browser
- Video Share

Diagnostic Function Details (1/3)

Test Name	Action	Data Output	Notes
Internal Display	Display color bar & prompt user to confirm display	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
External Display	Display color bar & prompt user to confirm display	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
Keys	Display graphic of key & prompt user to press indicated key	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
Vibrate	Application vibrates phone & requests user to confirm	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
Camera	Prompt user to activate camera and capture an image, then confirm that the processed image is correct/acceptable	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
Audio	Prompt user to speak into phone's microphone, then echo speech back to user thru earpiece & have user verify playback	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
Speakerphone	Prompt user to speak into phone's microphone, then echo speech back to user thru speakerphone & have user verify playback	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction

Diagnostic Function Details (2/3)

Test Name	Action	Data Output	Notes
Internal Memory	Read a partition in internal memory & store in RAM, write a test value to partition, re-read & compare, restore original, repeat	Pass/Fail	
External Memory	Read a partition in external memory (e.g., MMC or SC card) & store in RAM, write a test value to partition, re-read & compare, restore original, repeat	Pass/Fail	
Touch Screen Interface	Display an 'X' on screen & prompt user to touch, repeat over screen	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
Battery Charge Cable	Prompt user to connect battery charge cable to power source, verify that battery is being charged	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
USB Data Cable	Prompt user to connect USB cable from device to PC, verify USB connection	Pass (yes)/ Fail (no)/ Not executed	Requires user interaction
Abnormal Power Off	Device will keep a log of abnormal power-off or reboot incidents	Pass/Fail Number of incidents	Device must trap & store incidents
Battery Drainage	Device will record time between battery charges, incremental talk & data time, battery strength level & determine if operation time is greater or less than expected	Incremental operation time (or Pass/Fail if expected operation time stored on device)	Requires counters to capture talk/data time & battery strength

Diagnostic Function Details (3/3)

Test Name	Action	Data Output	Notes
Voice Network	Measure RSSI on serving channel & record in log vs. band	RSSI log	Device must store RSSI vs. band & timestamp
Data Network	Device establishes & tears down an active PDP context & verifies success	Pass/Fail	
Voice Service	Device places call to special test number & verifies detection of traffic channel layer protocol	Pass/Fail	Device must store test phone number
SMS Service	Device sends pre-defined SMS to a test number. Network returns message. Device verifies receipt of response & content and records round-trip latency	Pass/Fail Round Trip Latency	Device must store test phone number & test message
Browser Service	Device will invoke a browser session to a pre-defined URL & download contents of URL & verifiy content downloaded & displayed	Pass/Fail	Device must store URL
Video Share	Verifiy an always-on PDP context	Pass/Fail	

DiagMon Usage Scenario-1

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Use-case name: **Diagnostics**
  - Brief description
    - A subscriber calls the operator's customer care facility or corporate help desk complaining that their mobile device is reporting an error, or a service is failing to work.
    - Help desk can query the fault of the mobile device and resolve it.
  - Actors
    - Subscriber (user): A subscriber may be able to specify aspects of the configuration and issue resolution procedures for the mobile device
    - Mobile device: The mobile device protects its configuration from unauthorized access
    - Management Authority: The Management Authority can access the Device configuration, and change it
  - Pre-conditions
    - Mobile device supports Device Management queries and actions from the management server
    - The network operator has a Device Management server supporting Device Management queries and actions
  - Post-conditions
    - N/A

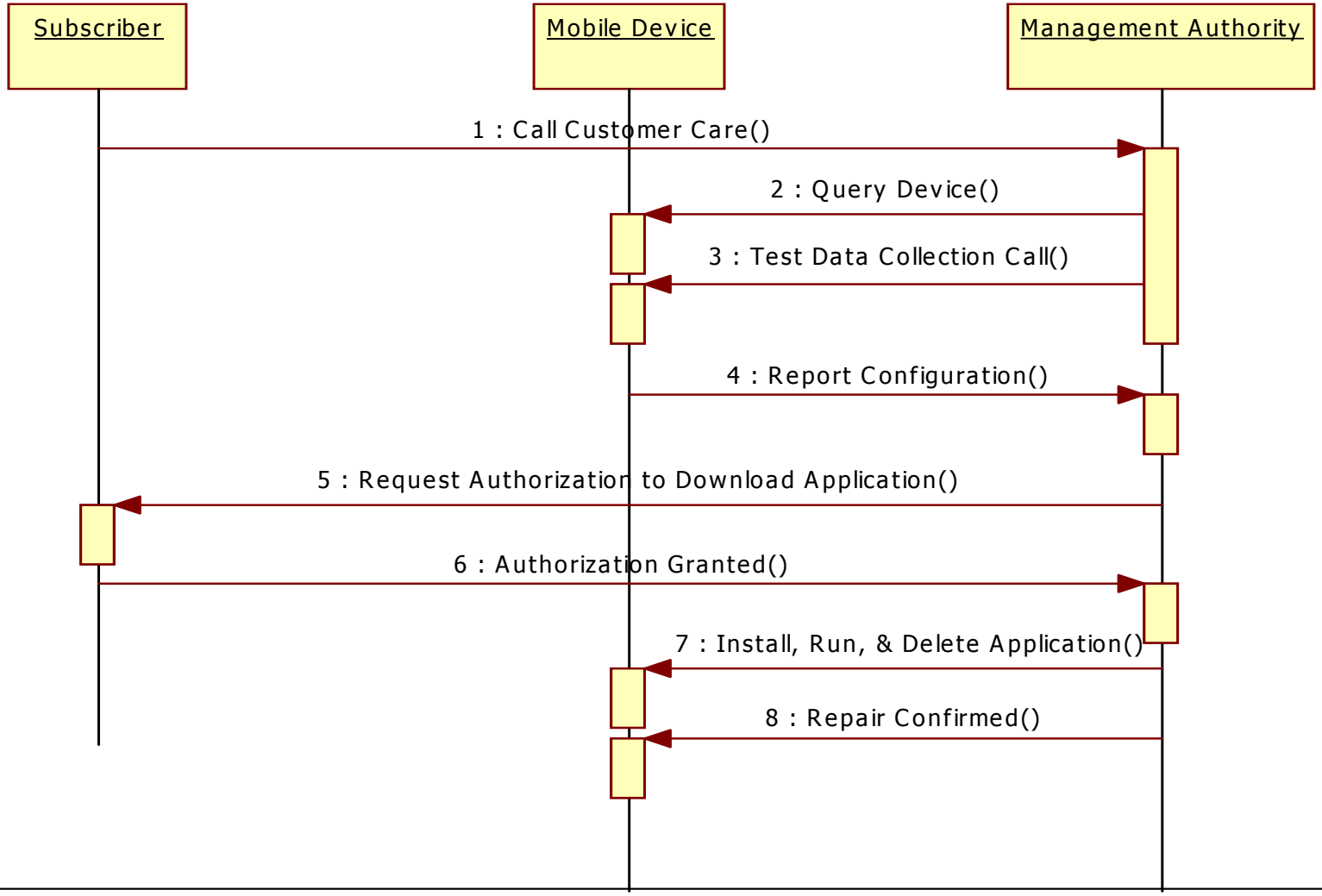
DiagMon Usage Scenario-1

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow

1. User calls Customer Care.
2. Management Authority (Customer Care/DM Server) sends a query to Device for configuration or other reporting information
3. The device then gathers performance and QoS related information.
4. Device reports its configuration information and/or performance data to the Customer Care/DM server
5. Customer Care sends request to User for authorization to download application to Device
6. User grants authorisation
7. Customer Care downloads application to device, installs and executes it
8. Device sends acknowledgement to Customer Care/DM server

DiagMon Usage Scenario-1

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow



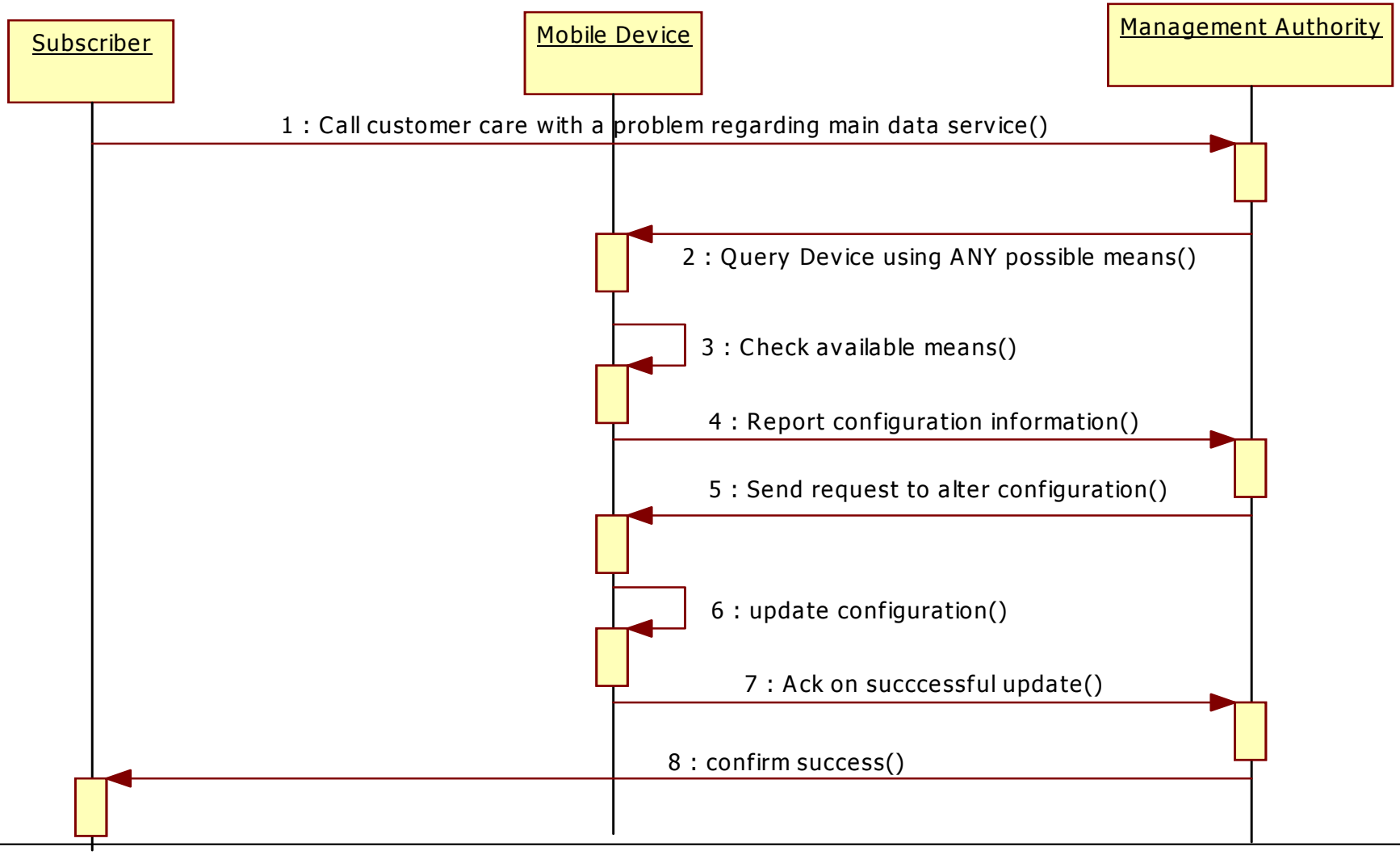
DiagMon Usage Scenario-1

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Alternative Flow

1. User calls Customer Care with a problem regarding main/ primary data service
2. Customer Care sends a query to Device for retrieving and returning configuration or other reporting information using ANY communication means possible
3. The device identifies at least one available communication means and selects one for communicating requested configuration
4. Device reports its configuration information to the Customer Care server using the available/selected communication means
5. Customer Care sends request to Device to alter configuration (as necessary)
6. Device updates configuration
7. Customer Care receives acknowledgement from device on successful update
8. Customer Care Representative confirms success to the user

DiagMon Usage Scenario-1

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Alternative Flow



DiagMon Usage Scenario-2

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Use-case name: **Self-diagnostics**
  - Brief description
    - Subscriber is playing some services.
    - During the process, one error occurs.
    - When this fault occurs, mobile device would collect some error information and report it to the Management Authority automatically
  - Actors
    - Mobile device: Mobile device can support fault auto report mechanism
    - Management Authority: Receiving the fault information reported from the device
    - External Manager: as 3rd party vendor, it can work out the corresponding solution
  - Pre-conditions
    - The mobile device is proper configured
    - Management authority should configure the mobile device to report the failure back
    - The mobile device can access the Management the authority by an available communication employing appropriate authentication
    - Management Authority can access external manager, if necessary, to transfer corresponding information
  - Post-conditions
    - DM server can collect the fault report which includes required information for error diagnostic. Operator or device manufacturer can have additional information to work out corresponding solution for the fault

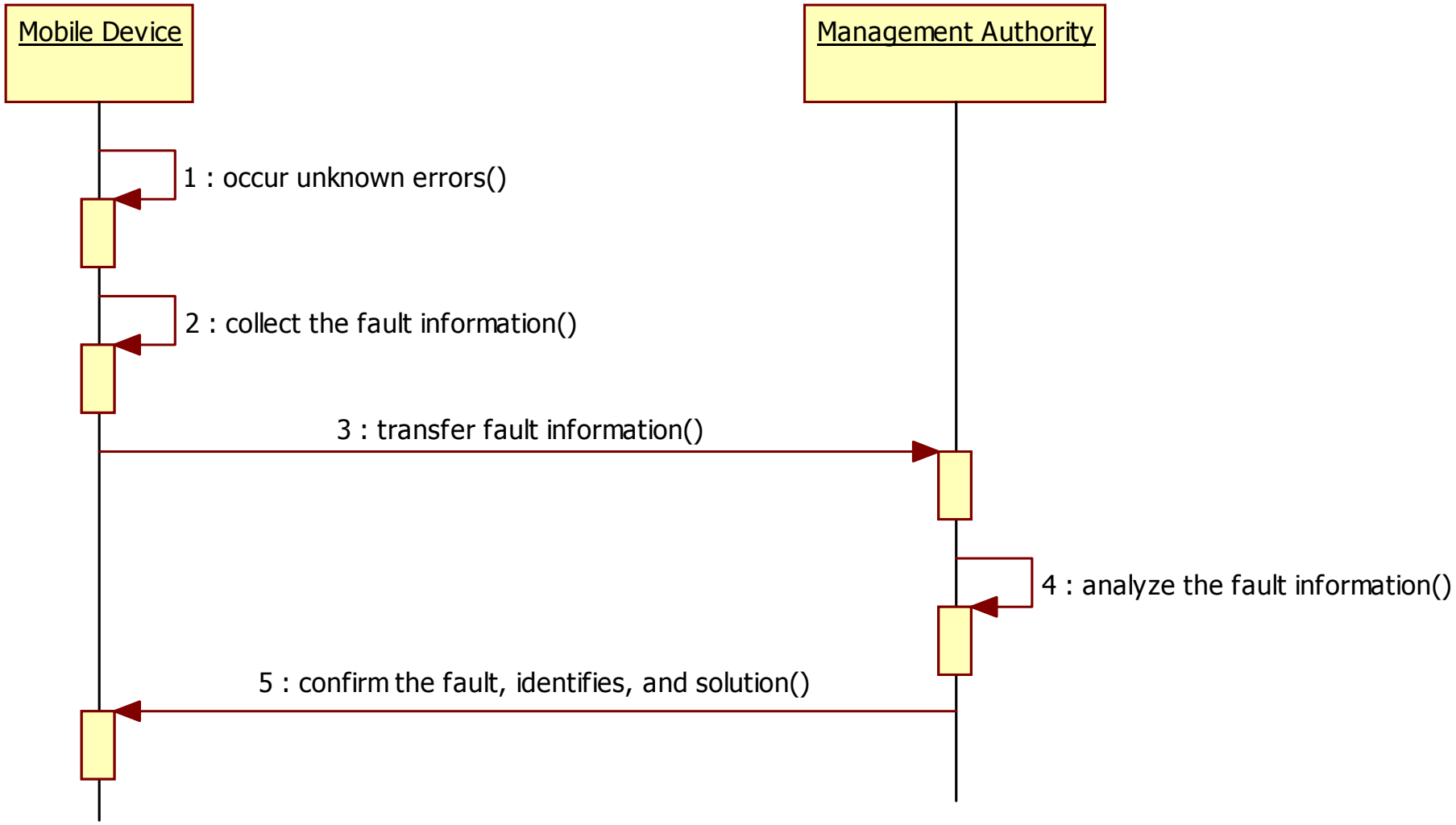
DiagMon Usage Scenario-2

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow

1. A mobile device is used to access a service, an unknown error occurs
2. Mobile device collects the fault information, such as memory dump, error code, application type, vendor etc
3. Device transfers this information to the Management Authority
4. Management authority analyzes the fault information
5. Management authority may get additional information from the external manager
6. The Management Authority confirms the fault, identifies, solution, if available, and provides the solution (executes management operations as necessary)

DiagMon Usage Scenario-2

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow



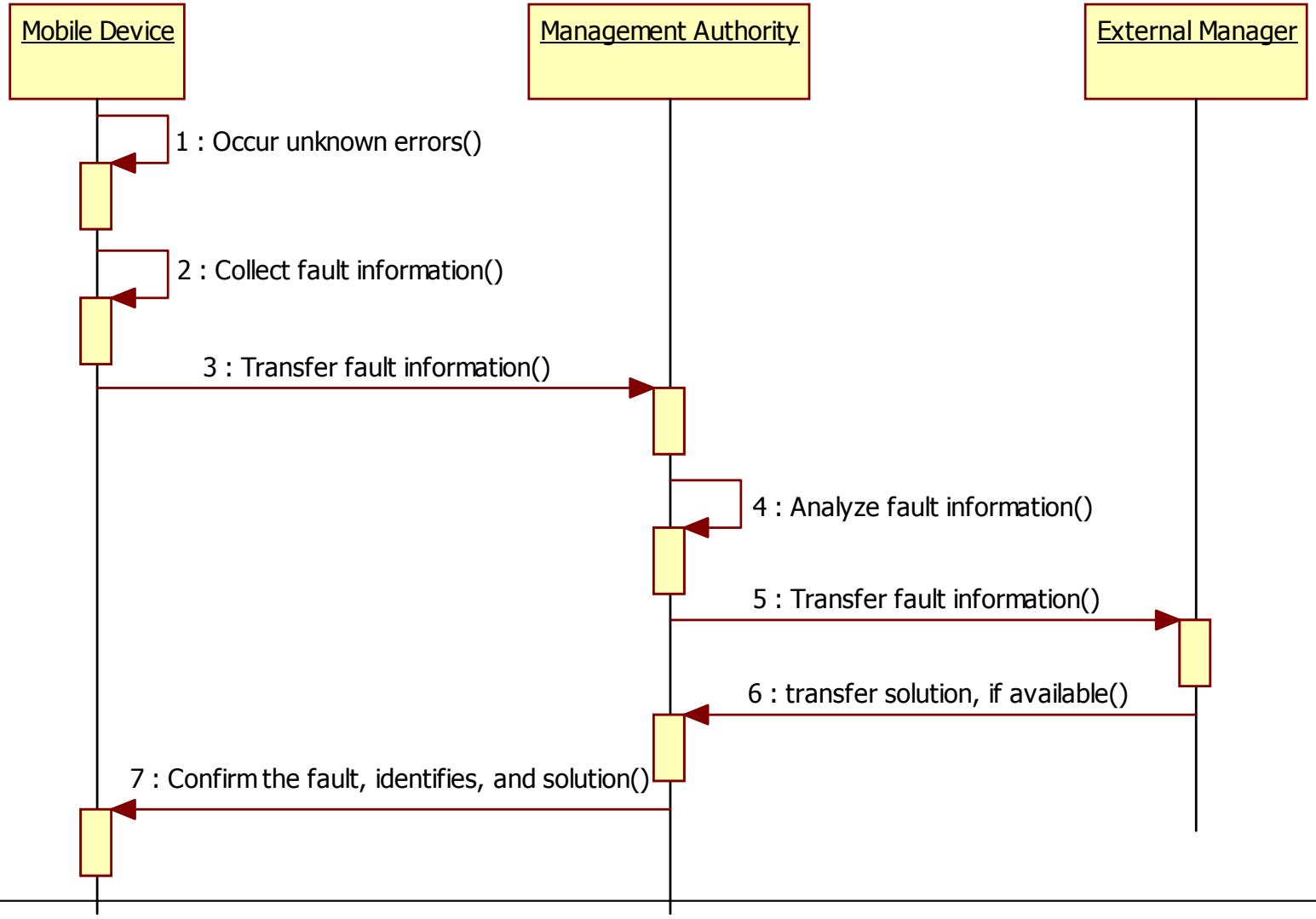
DiagMon Usage Scenario-2

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Alternative Flow

1. A mobile device is used to access a service, an unknown error occurs
2. Mobile device collects the fault information, such as memory dump, error code, application type, vendor etc
3. Device transfers this information to the Management Authority
4. Management authority analyzes the fault information
5. If Management Authority cannot resolve the problem, the fault information is transferred to tan External Manager such as device vendor, software provider, or other related 3rd party to work out one solution
6. The solutions transferred back to Management Authority
7. The Management Authority confirms the fault, identifies, solution, if available, and provides the solution (executes management operations as necessary)

DiagMon Usage Scenario-2

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Alternative Flow



DiagMon Usage Scenario-3

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Use-case name: **Performance Monitoring**
  - Brief description
    - Network performance monitoring is used to perform bulk or system wide data collection.
    - This information may be subsequently leveraged to build coverage maps, traffic distribution, service quality statistics and/or maps as well as update device or network parameters.
    - Specifically this can include call setup failures, call release causes such as RF loss indication of forward link, QoS attributes at high/low gauge levels (low throughput, high delay), mobility handoff threshold gauge level, RF conditions such as sudden loss of RF signal or service or time
  - Actors
    - Mobile device: Mobile device can support queries of performance data monitoring from management authority
    - Management Authority: Management authority can access the performance data of the mobile device using queries
  - Pre-conditions
    - The mobile device supports Device Management queries and actions from the management server
    - The Network Operator has a Device Management server supporting Device Management policy configuration control and report collection
  - Post-conditions
    - DM server may be configured to share the information with post processing or operations for additional analysis

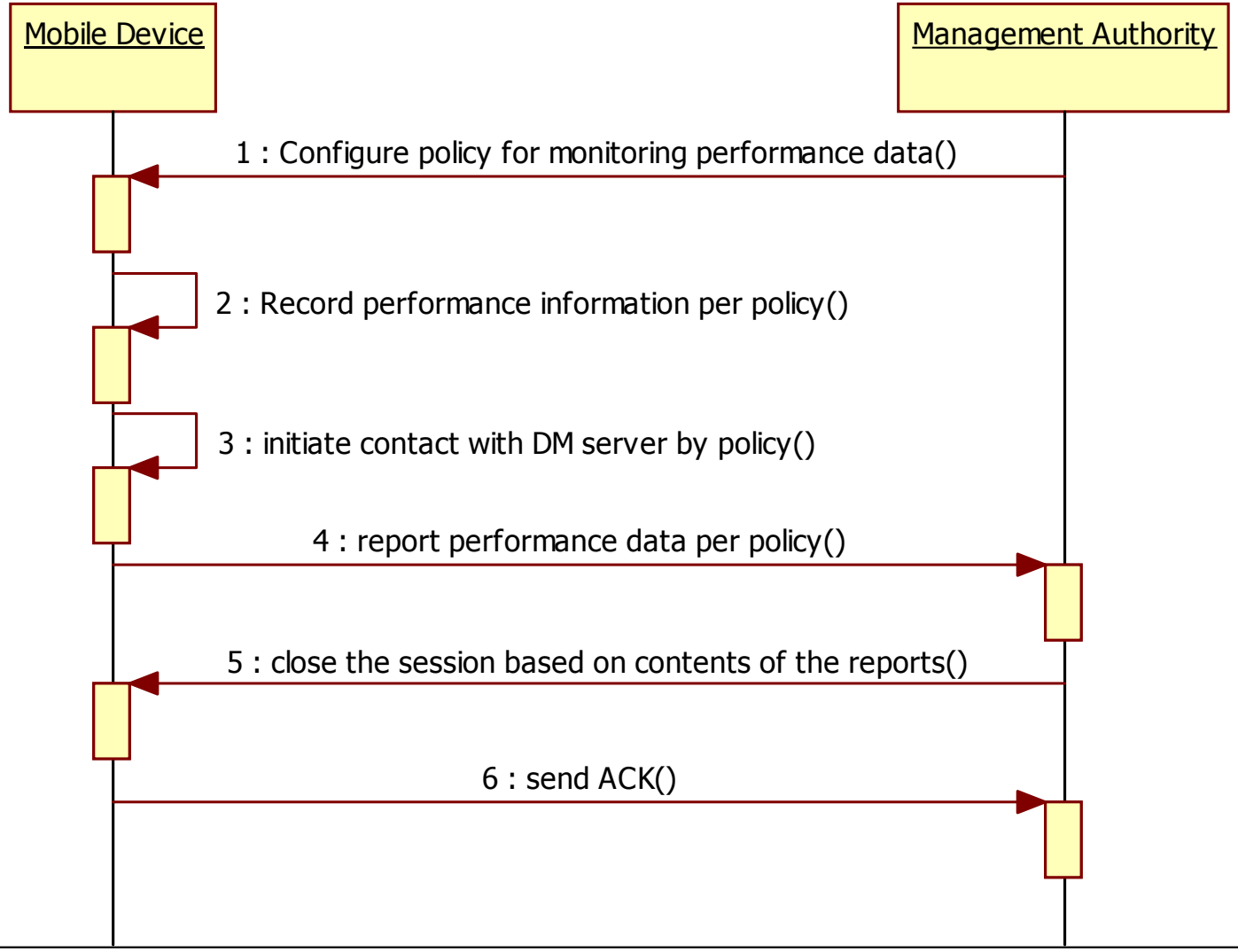
DiagMon Usage Scenario-3

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow

1. DMS configures device with policy(s) for recording information and reporting information
2. The device starts recording performance information per policy
3. According to reporting policy, the device initiates contact with DM Server.
4. Device reports its performance data (and device information) per policy
5. DMS closes the session or requests additional details based on contents of the reports
6. Device sends acknowledgement to the DM server

DiagMon Usage Scenario-3

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow



DiagMon Usage Scenario-4

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Use-case name: **Event Monitoring**
  - Brief description: The mobile device events requested for monitoring may include,
    - User changing service parameters on the device
    - User updating firmware/software manually without interaction with Management Authority
    - Device changes some settings indicated by installed applications
    - Application usage statistics such as, start & stop time
  - Actors
    - User: User can change parameters and update firmware manually
    - Management Authority: The management authority can send firmware
    - Mobile device: The mobile device can change settings of applications
  - Pre-conditions
    - Mobile device has been properly configured and is capable of interacting with the Management Authority
    - Mobile device is capable of receiving and executing a monitoring task
  - Post-conditions
    - The Management Authority discovers the device events and may take further management operations

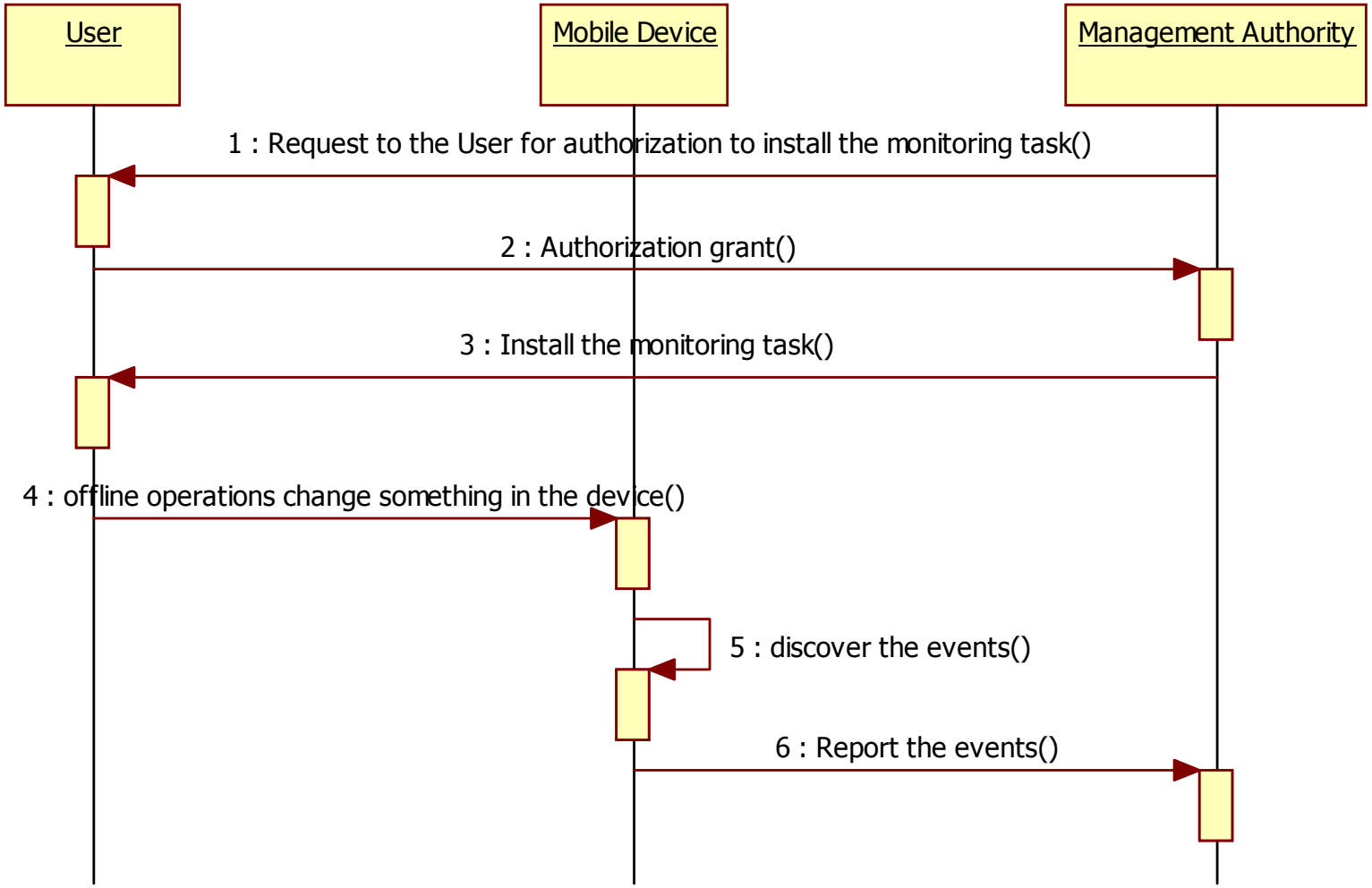
DiagMon Usage Scenario-4

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow

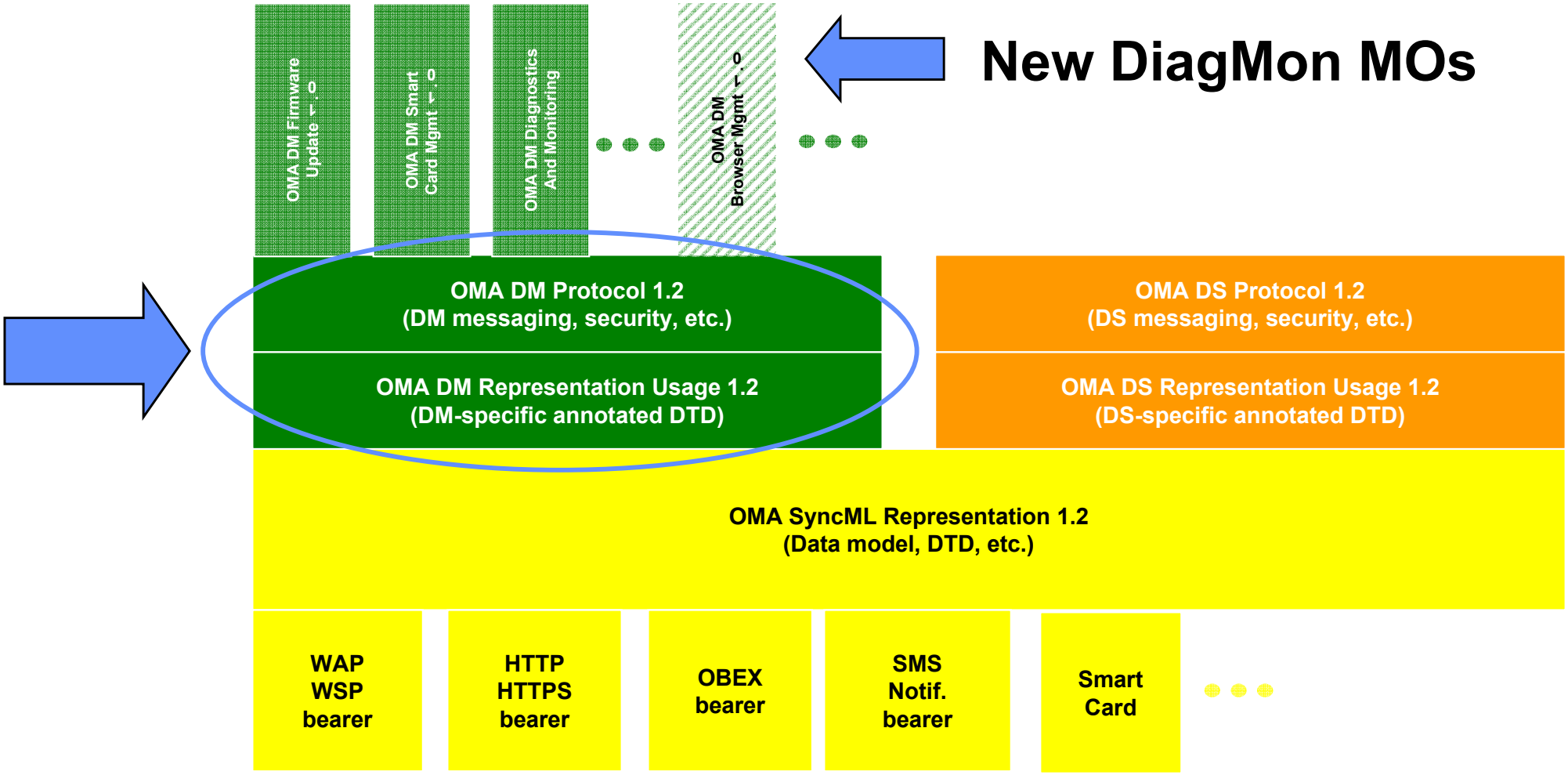
1. Management Authority sends a request to the User for authorisation to install the monitoring task to the Device.
2. User grants authorisation.
3. Management Authority installs the monitoring task configured wit h recording and reporting conditions to the Device.
4. User does some offline operations to his device or applications c hange something in the device.
5. Device discovers the events according to configured recording co ndition.
6. Device reports the events to the Management Authority accordin g to configured reporting condition

DiagMon Usage Scenario-4

- Use-case Specification (based on RUP (Rational Unified Method), OMG)
  - Normal Flow

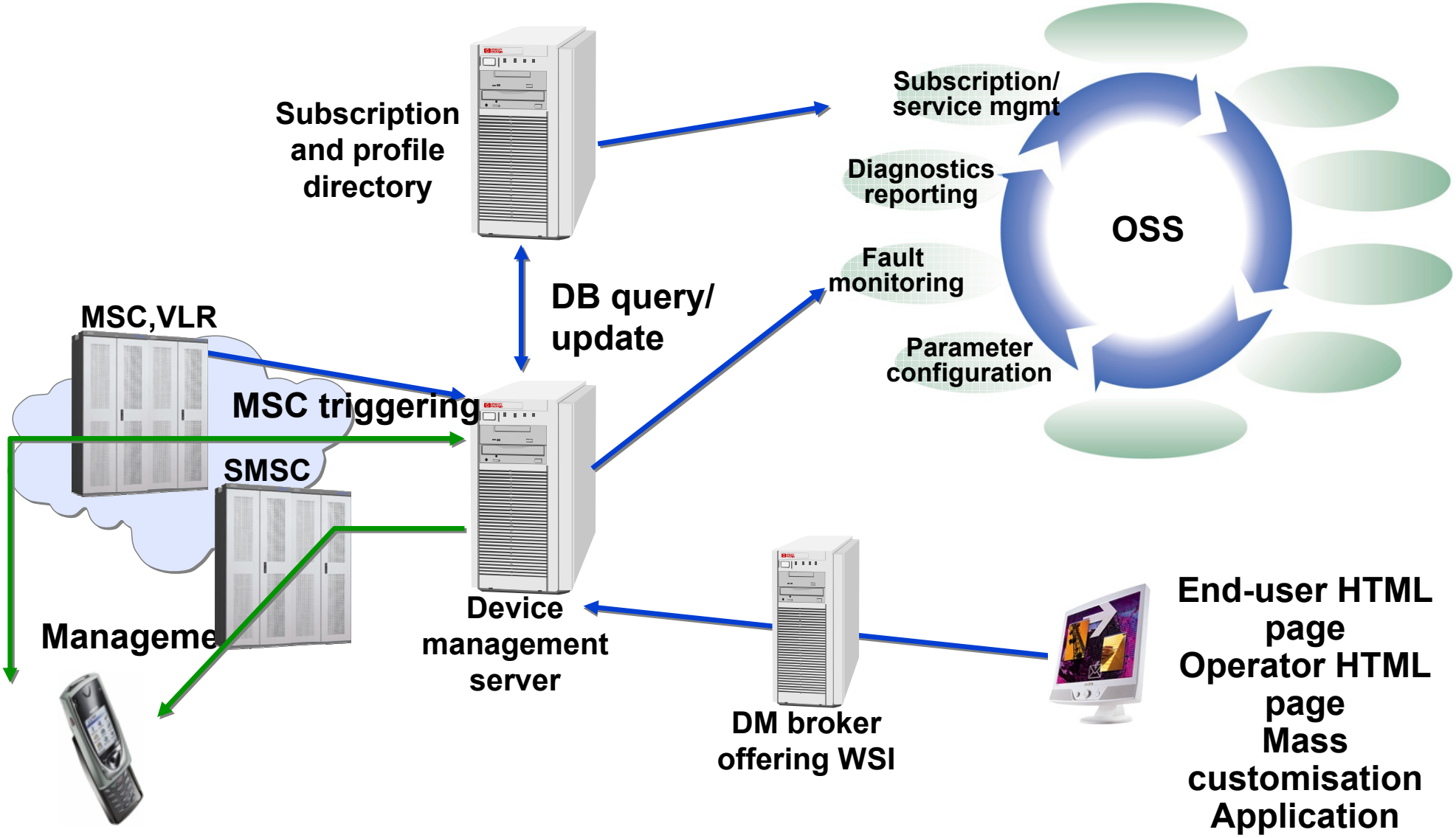


Architecture: OMA DM Reuse

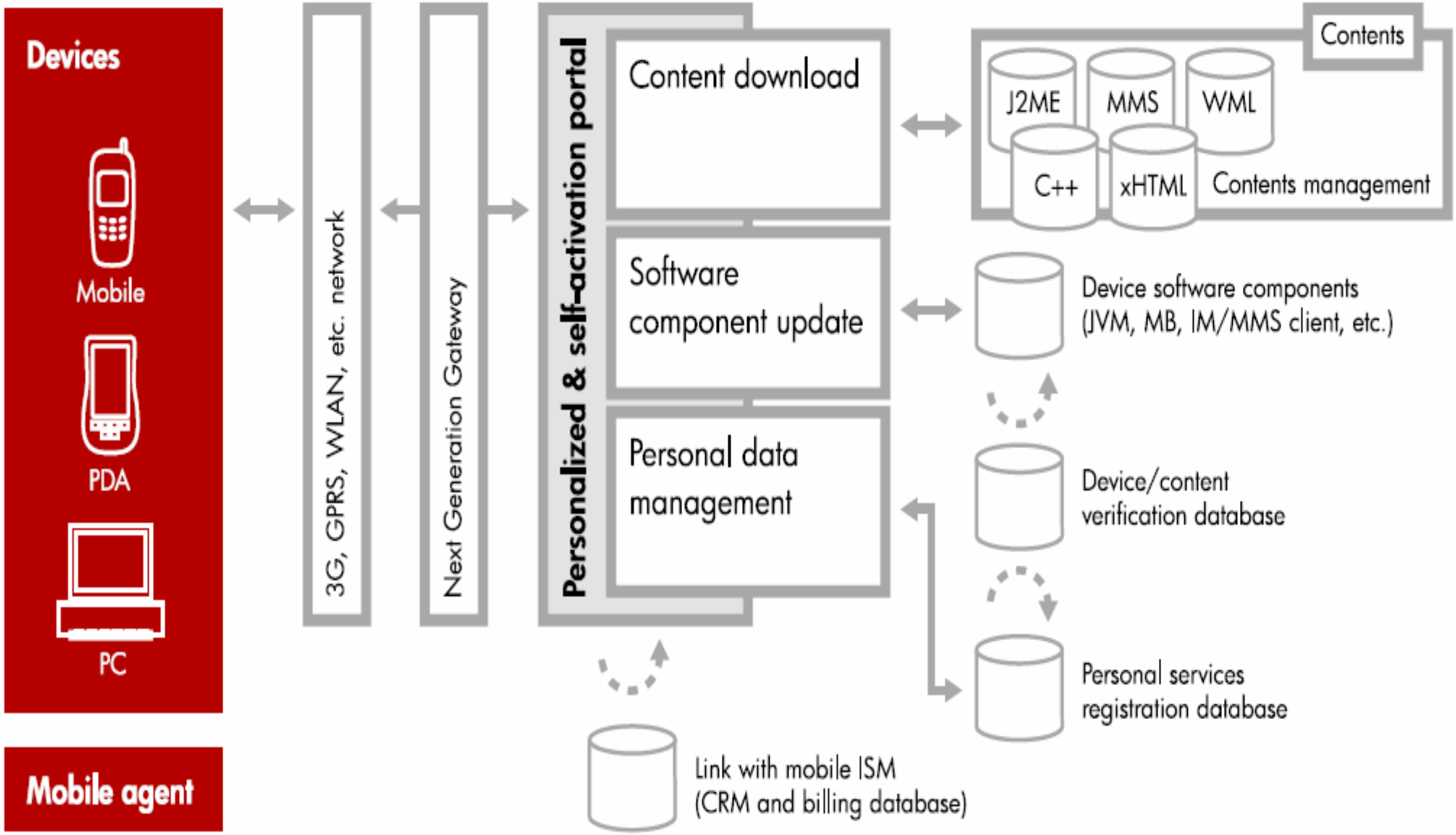


3. Research Work (Industry)

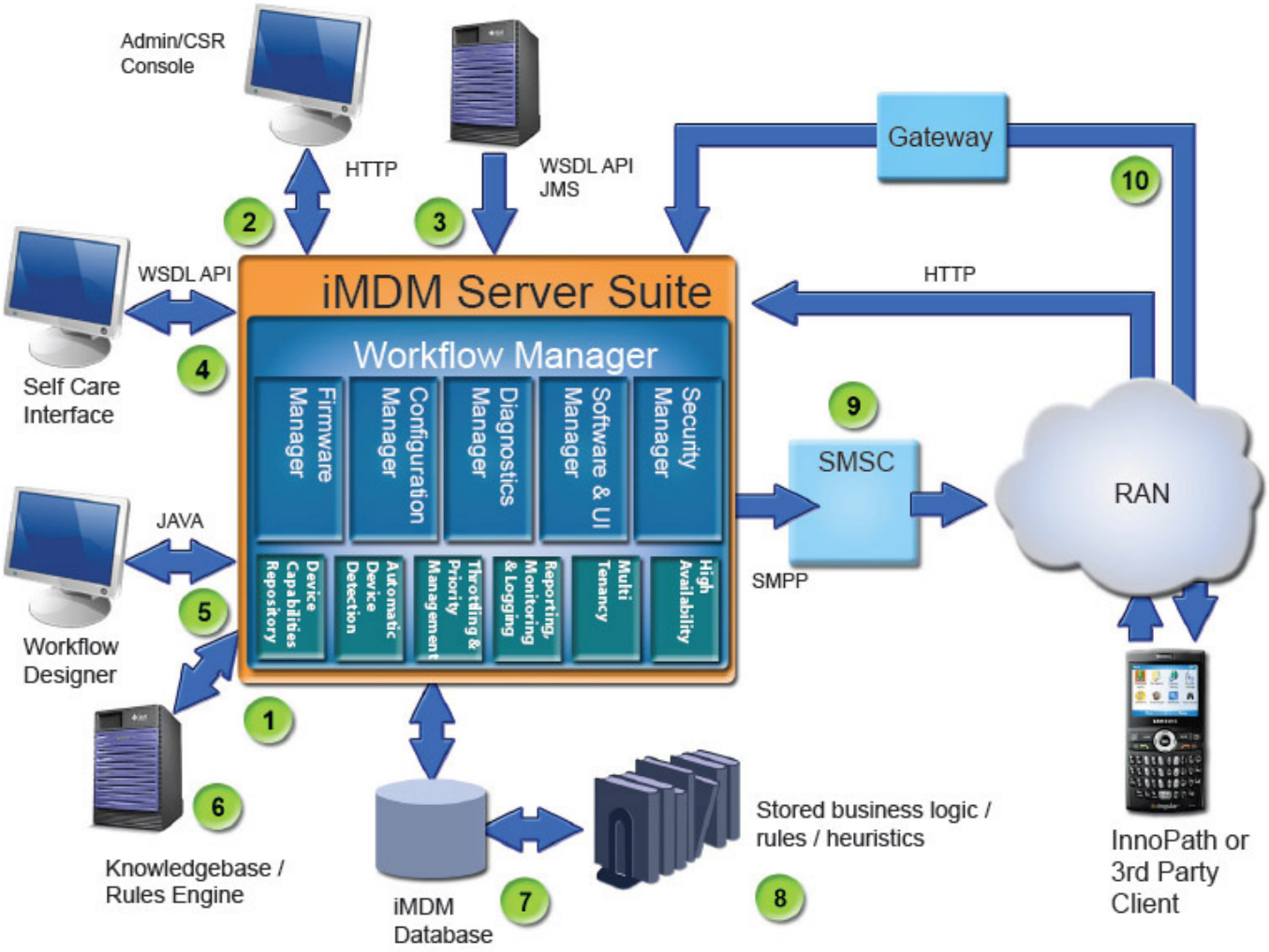
Nokia Mobile Device Management



HP Mobile Device Management



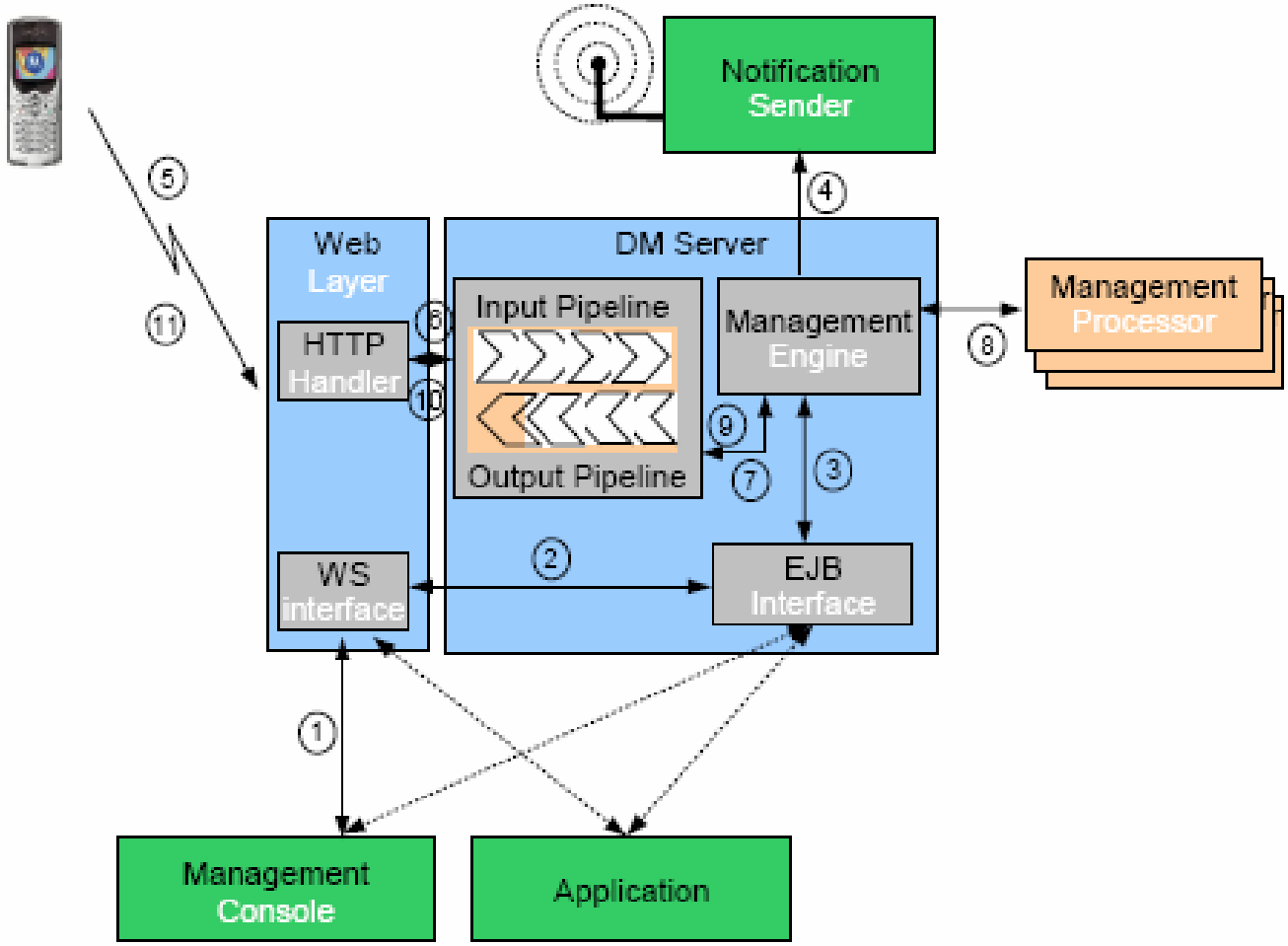
InnoPath Mobile Device Management



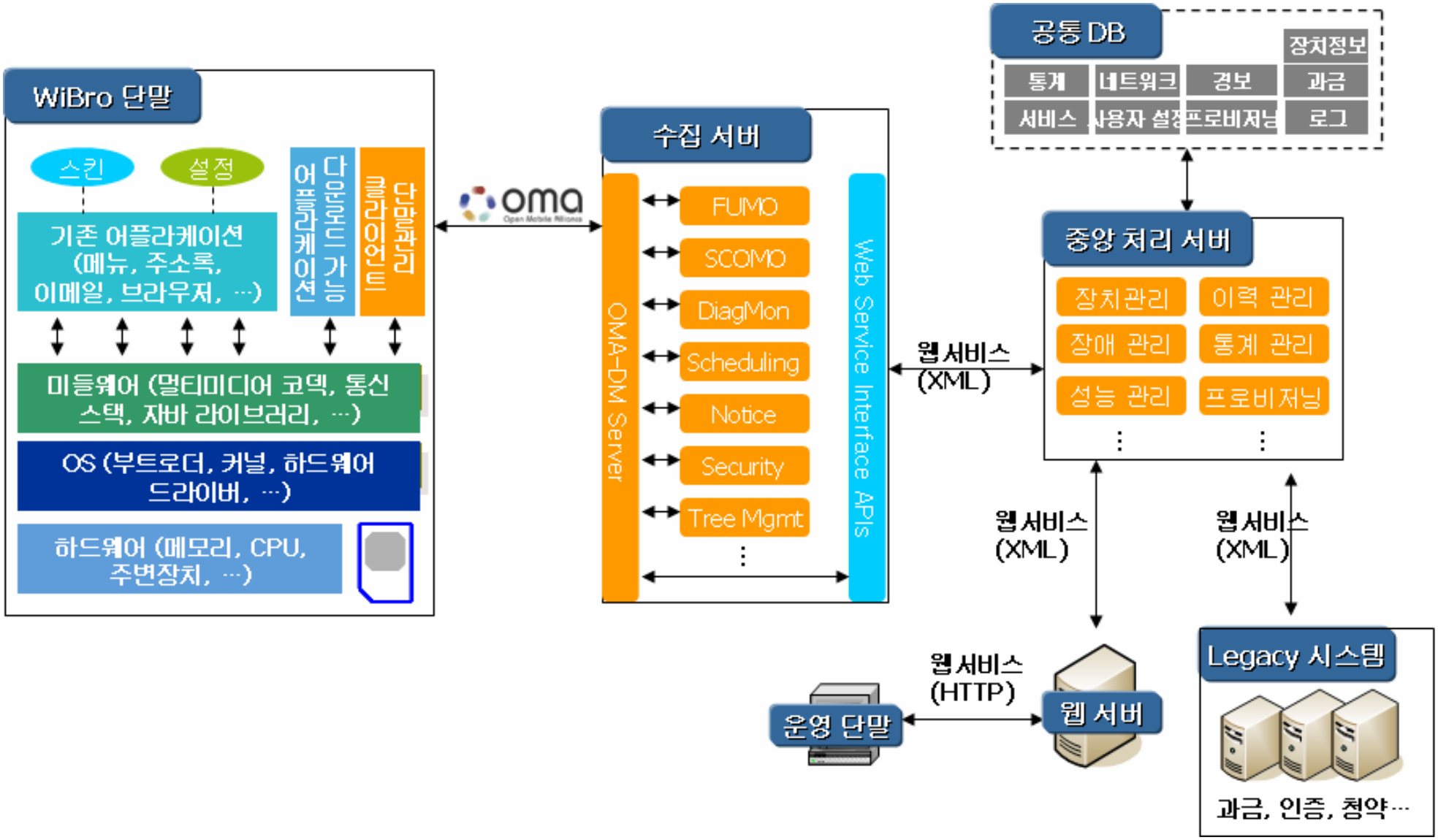
1. iMDM Server Suite ("Server")
2. iMDM Console is the interface to Server for administrative and customer care tasks.
3. Any carrier server can interface with Server WSDL APIs and JMS.
4. Self-Care portals can be developed by carriers using server APIs.
5. Workflows can be created or modified using Worldflow Designer.
6. Hand off to knowledge base for configuration and diagnostics
7. Database Repository
8. Stored business logic / workflow rules
9. Push for configuration messages or notifications done over SMPP
10. Device and Server communicate over http.

Funambol Mobile Device Management

❖ Open source based project



KT WiBro MDM


WiBro 단말
스킨
설정
기존 어플라케이션 (메뉴, 주소록, 이메일, 브라우저, …)
다운로드 가능 어플라케이션
단말관리 클라이언트
미들웨어 (멀티미디어 코덱, 통신 스택, 자바 라이브러리, …)
OS (부트로더, 커널, 하드웨어 드라이버, …)
하드웨어 (메모리, CPU, 주변장치, …)
oma
수집 서버
OMA-DM Server
FUMO
SCOMO
DiagMon
Scheduling
Notice
Security
Tree Mgmt
Web Service Interface APIs
공통 DB
통계
네트워크
경보
장치정보
과금
서비스
사용자 설정
프로비저닝
로그
웹서비스 (XML)
중앙 처리 서버
장치관리
이력 관리
장애 관리
통계 관리
성능 관리
프로비저닝
웹서비스 (XML)
웹서비스 (XML)
웹서비스 (HTTP)
운영 단말
웹 서버
Legacy 시스템
과금, 인증, 청약…

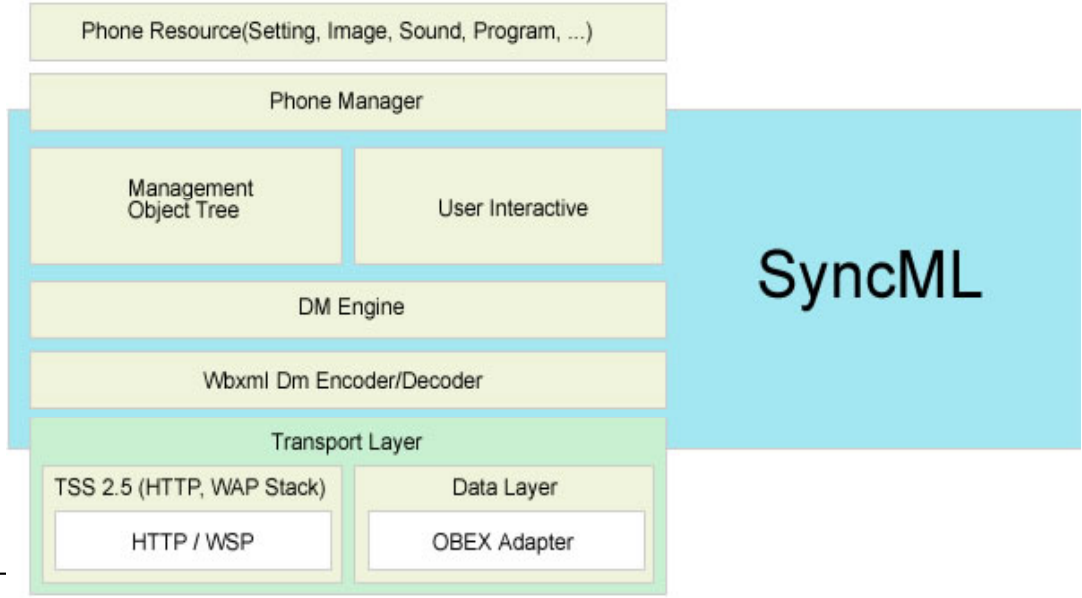
SKT Mobile Device Management

- ❖ OMA DM ver 1.2
- ❖ 기능
  - 펌웨어 업데이트
  - 단말에 탑재된 소프트웨어에 대한 Upgrade 및 구성요소를 관리할 수 있는 Scomo (S/W Component Management Object)
  - 원격 문제진단 및 모니터링
  - 단말 기능에 대한 잠금 데이터 삭제 (Lock & Wipe)를 수행
  - 서비스 및 네트워크의 환경변화에 대해 단말의 설정값을 변경할 수 있는 CP (Client Provisioning)

WebSync Mobile Device Management

❖ 기능

- 새로운 무선 단말기 설정
- 무선 단말기의 S/W 업그레이드
- 새로운 응용프로그램의 업로드
- 백업 및 복구
- 트랙하드웨어 관리
- 무선단말기 장치 정보 수립
- 무선단말기 제어
- 무선단말기 복구 및 등록 서비스 권한 제공

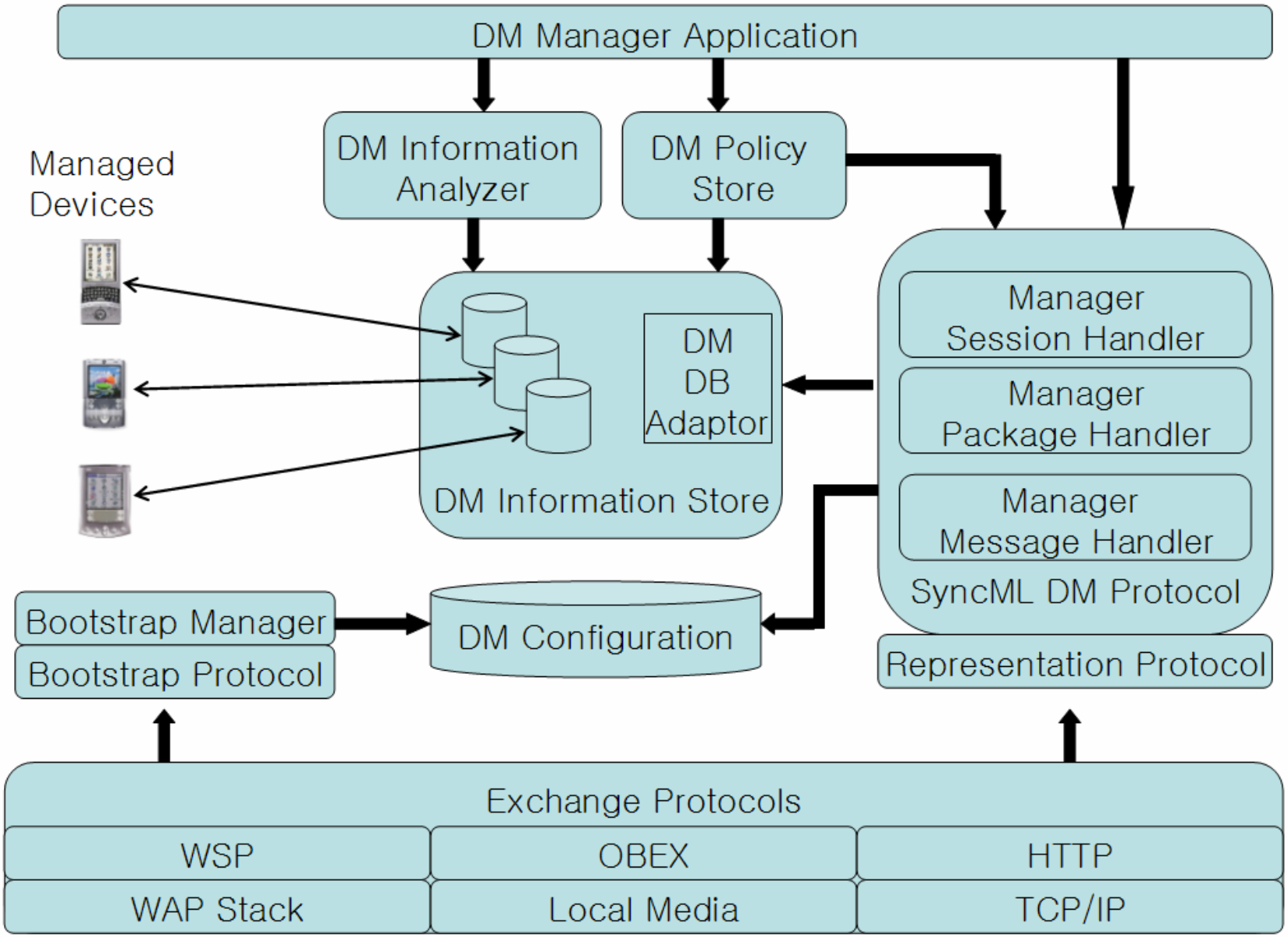


3. Research Work (Academia)

KMU-ComNet Work

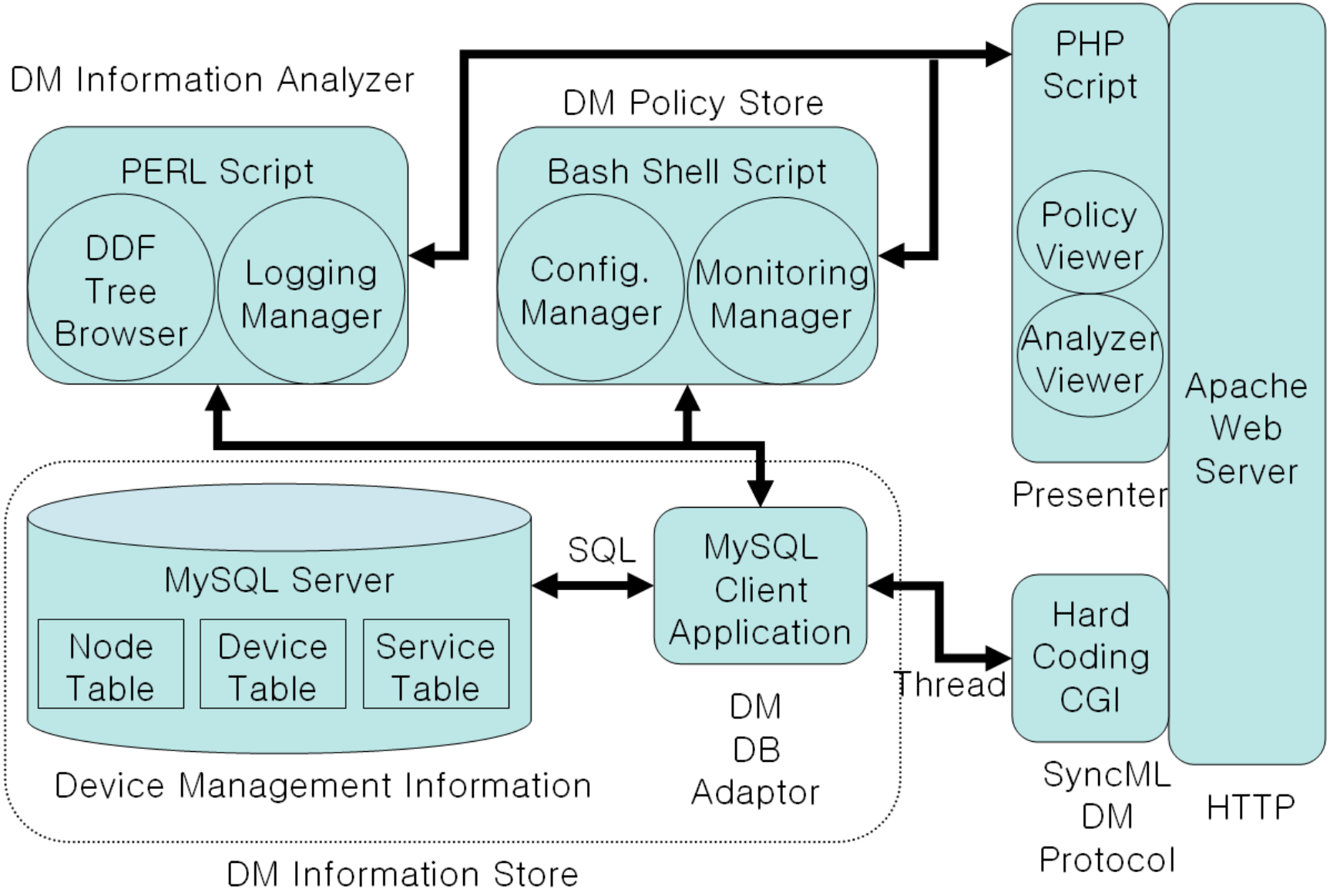
- ThinkSync
  - On going Project in computer network lab.
  - ThinkSync DS
    - Completed implementation of PIMS Data Synchronization client ported on Zaurus PDA and WinCE in C language
    - OMA Certified through the OMA TestFest
  - ThinkSync DM
    - Completed prototype implementation of DM Manager and Agent Core
    - Now implementing management systems for Smart Update , Auto Configuration, Self Diagnostics.

ThinkSync DM manager



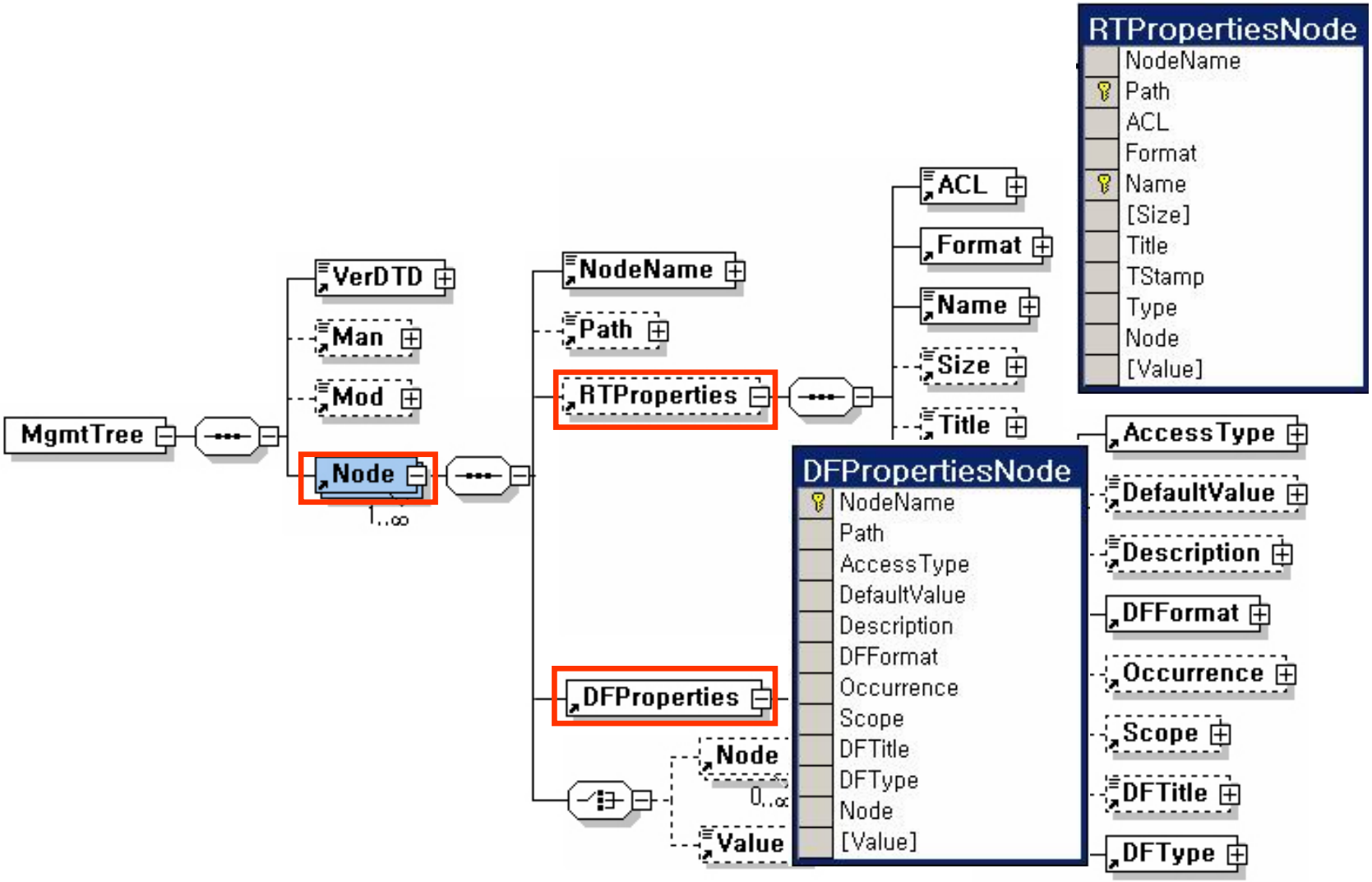
< ThinkSync DM manager design >

ThinkSync DM manager (Cont.)



< ThinkSync DM manager architecture >

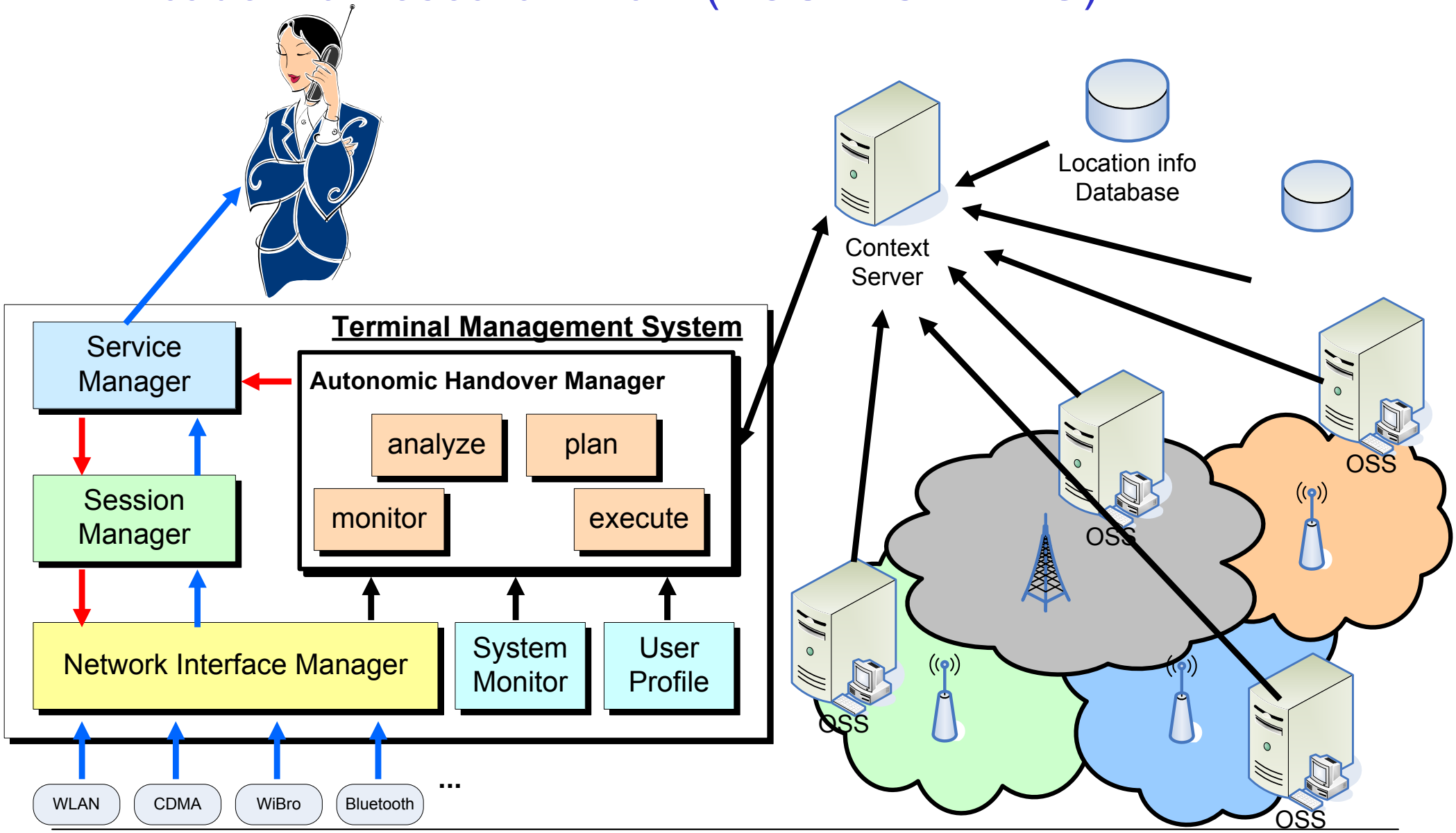
DDF Compiler



< DDF XML schema >

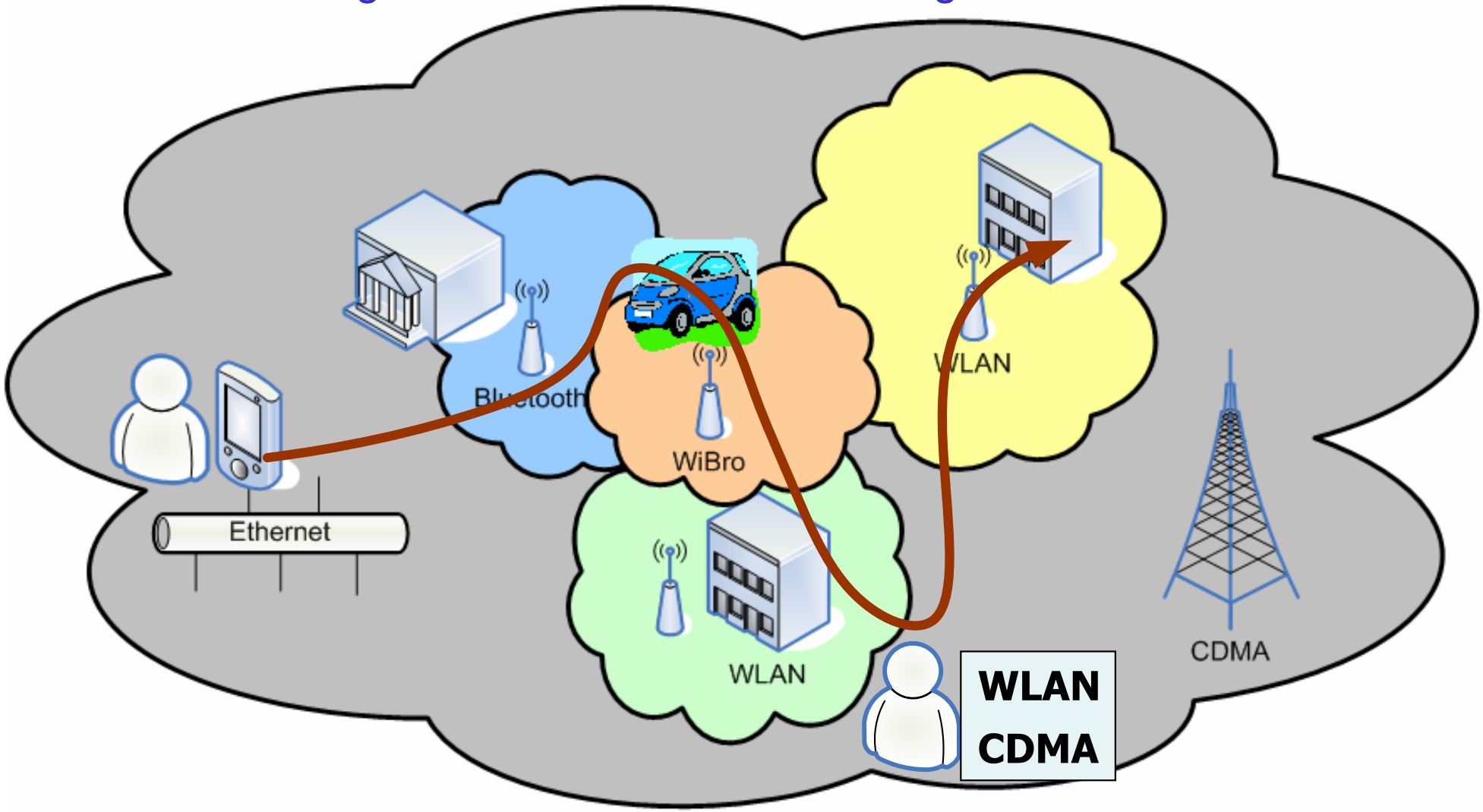
Autonomic Network Selection

❖ Academic Research Work (POSTECH-KMU)



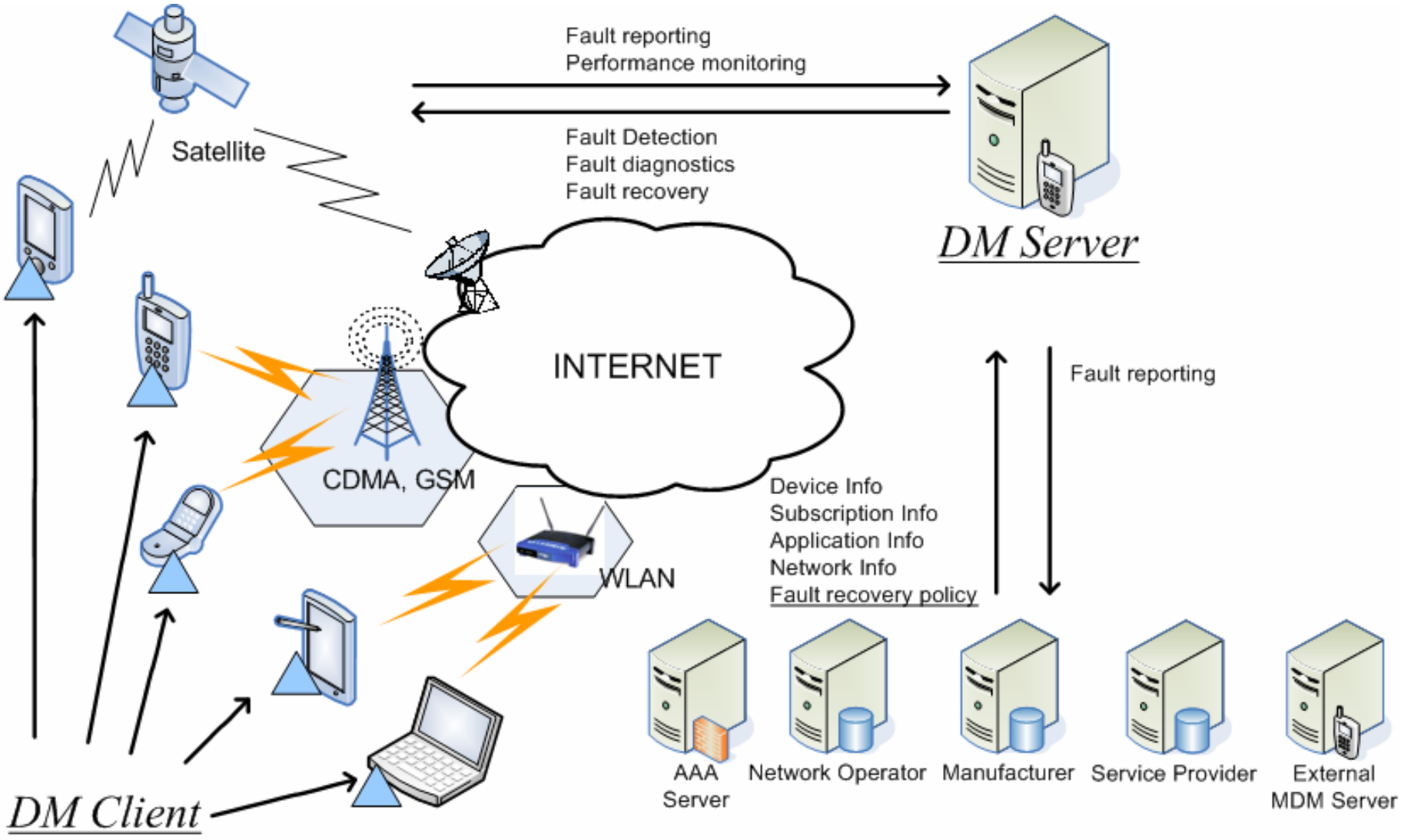
Autonomic Network selection

❖ Scenario using Autonomic Handover Manager

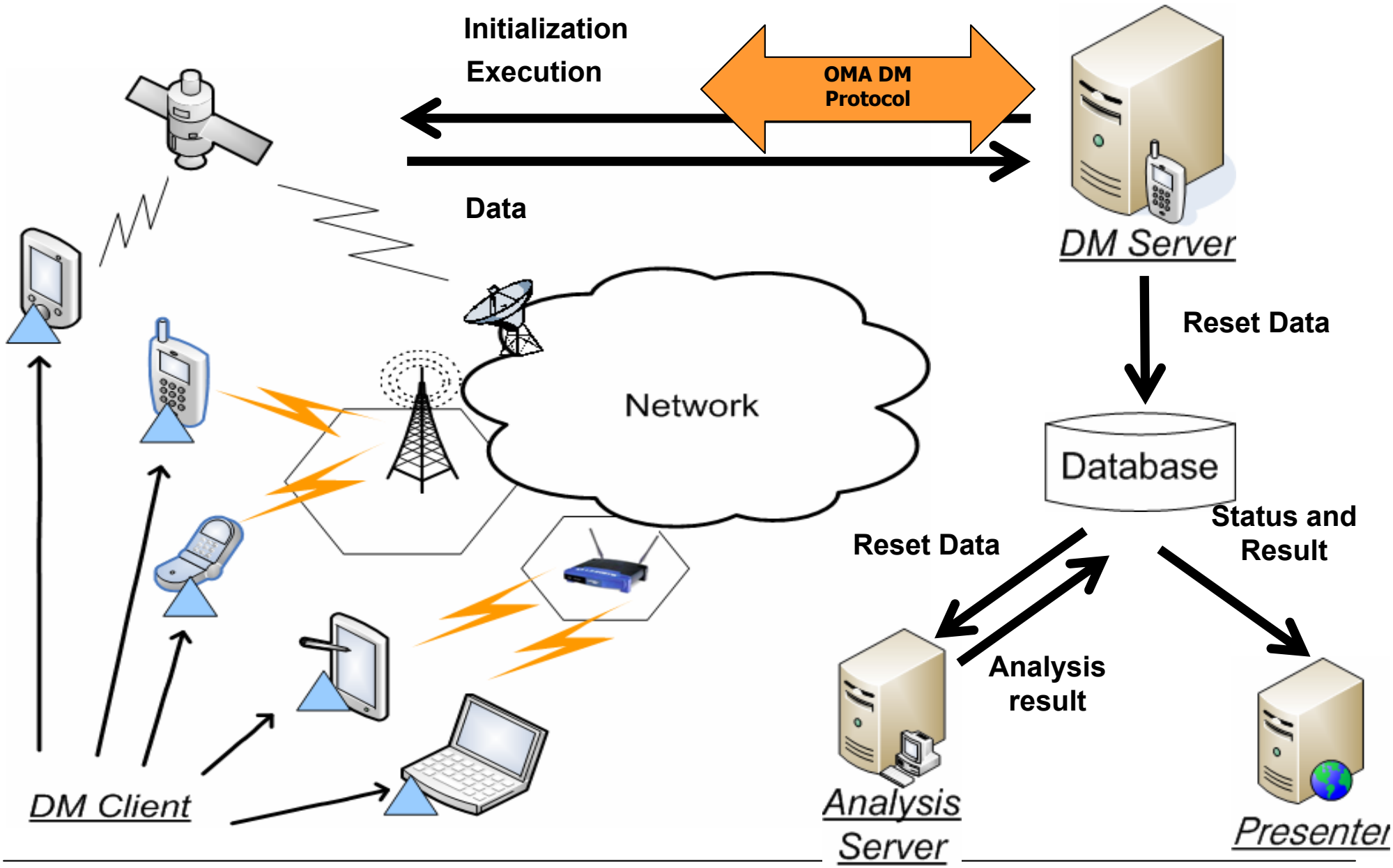


OMA DM Based DiagMon System

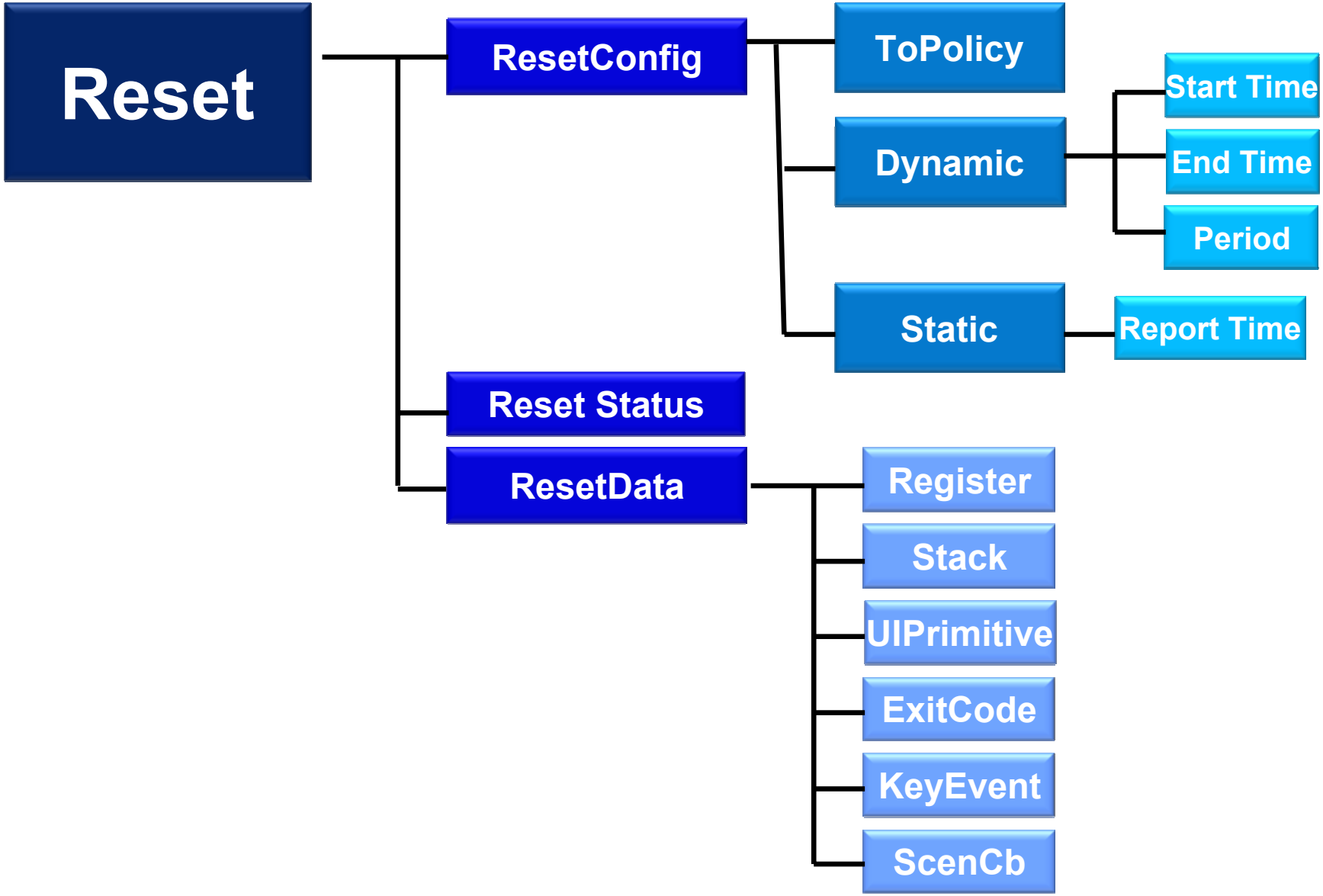
❖ Academic Research Work (POSTECH-KMU)



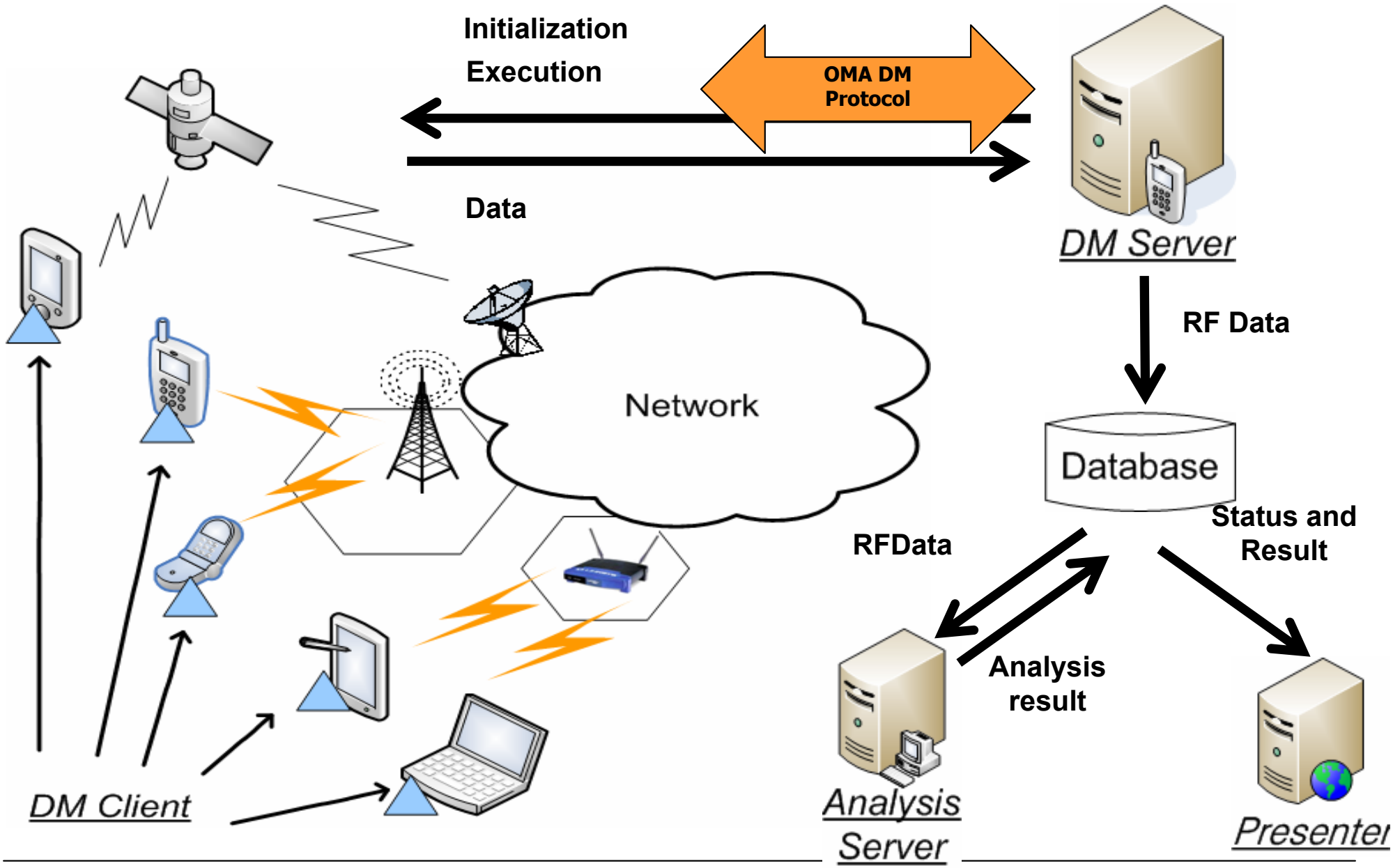
Case 1: Software Reset Diagnostics



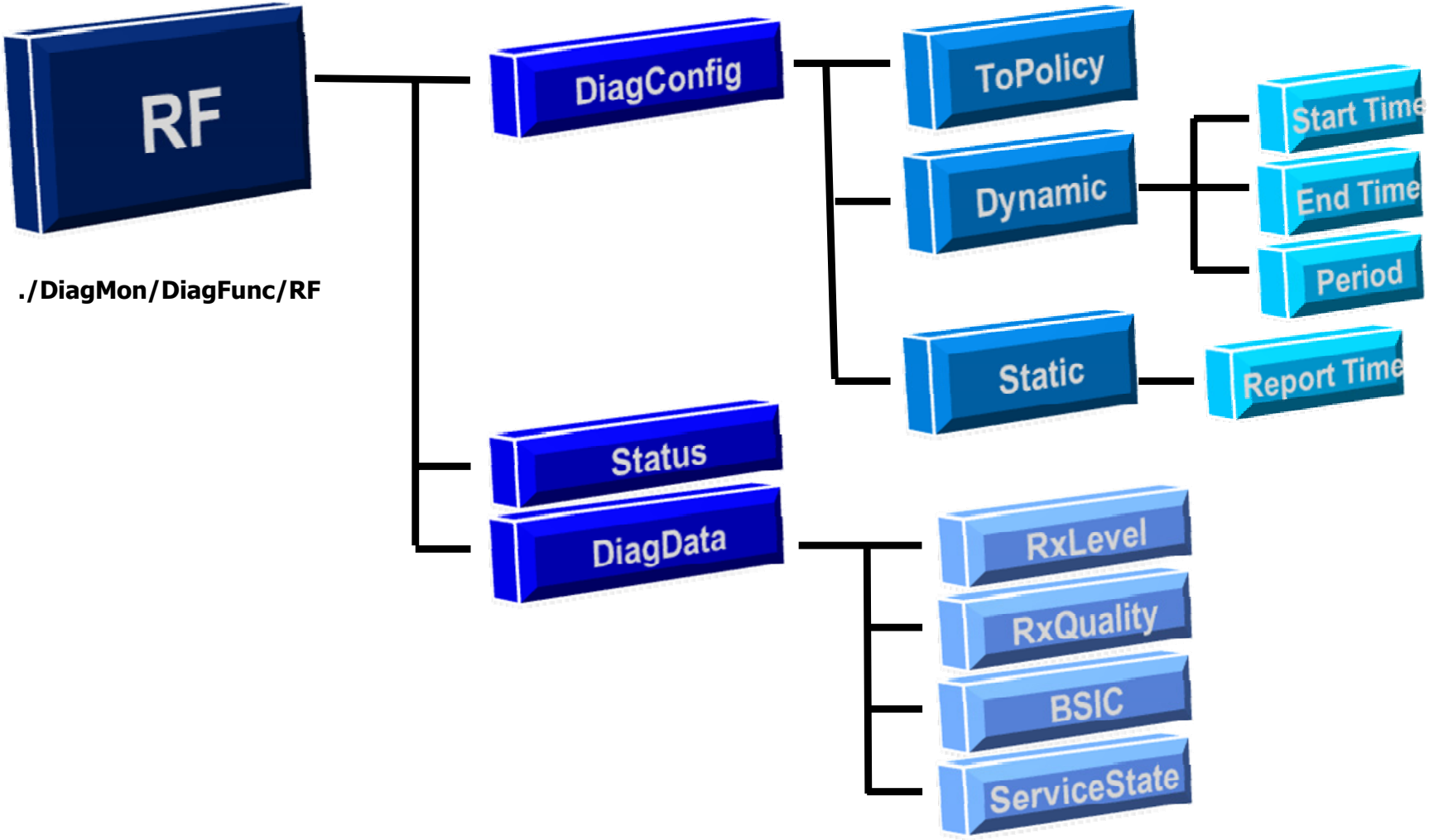
DM Tree for Software Reset Diagnostics



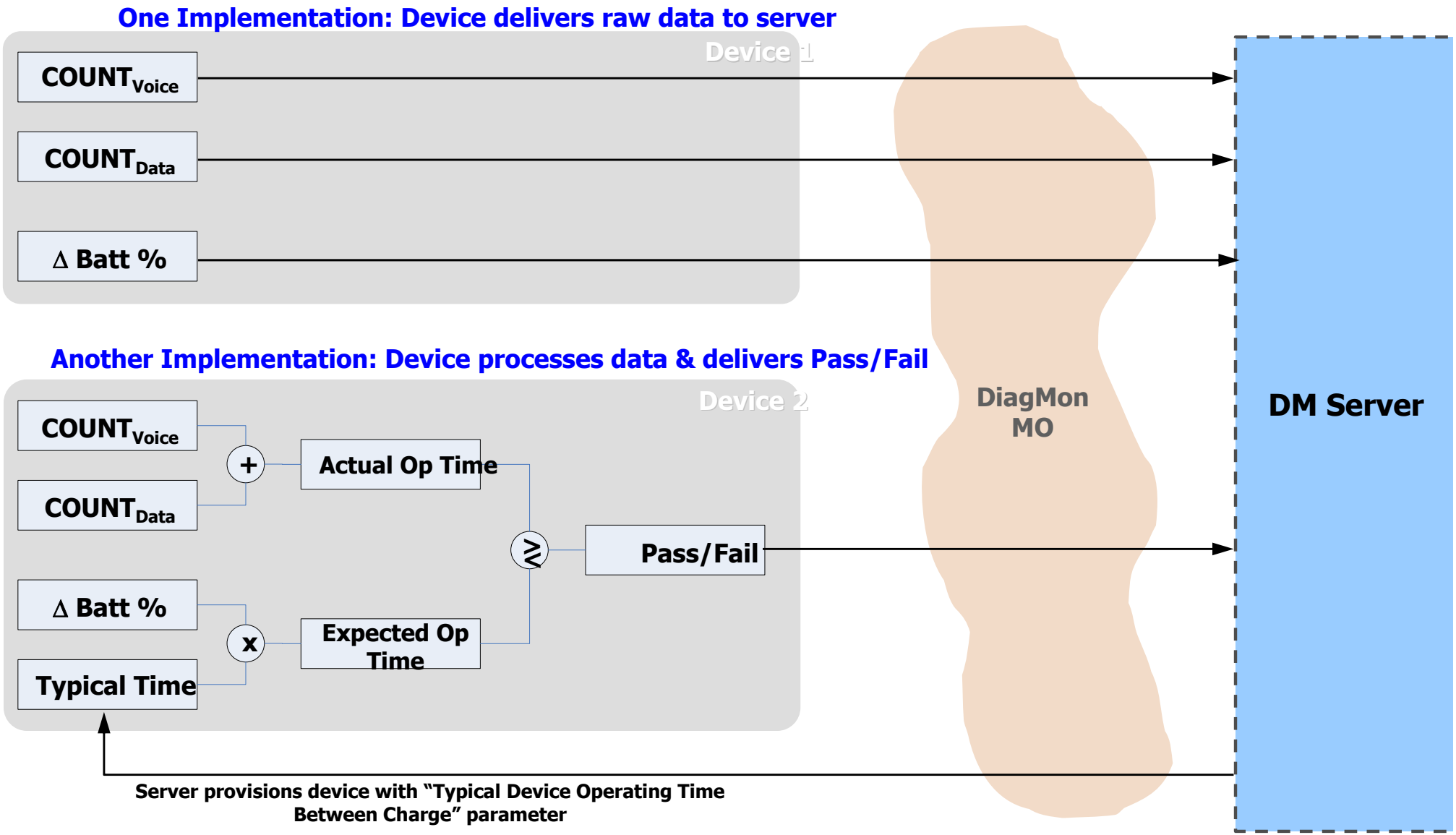
Case 2: RF Signal Monitoring



DM Tree for RF Signal Monitoring

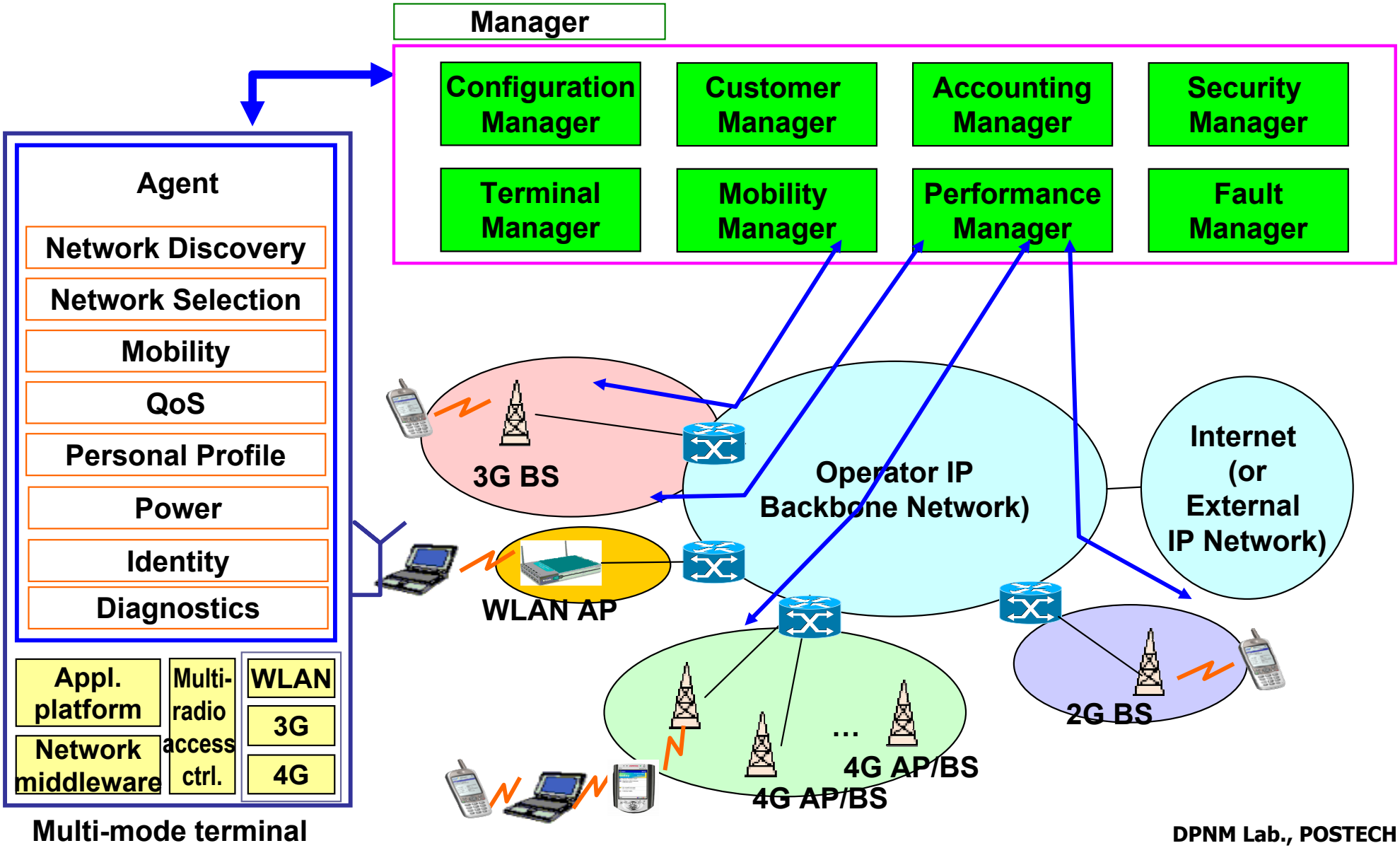


Case 3: Battery Drain Diagnostics



4. Future Research Challenges

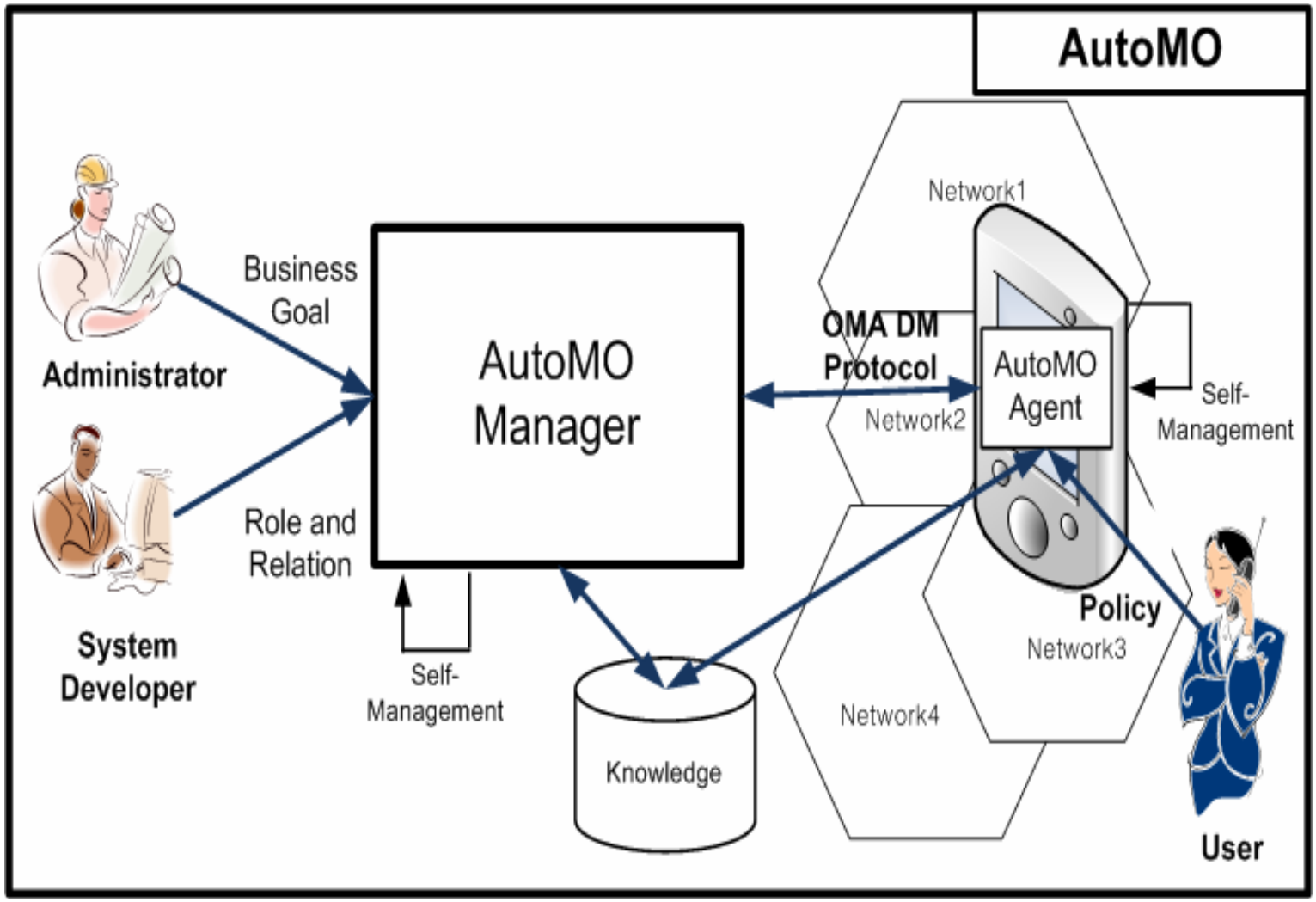
Mobile Device Management for Next-Generation Networks

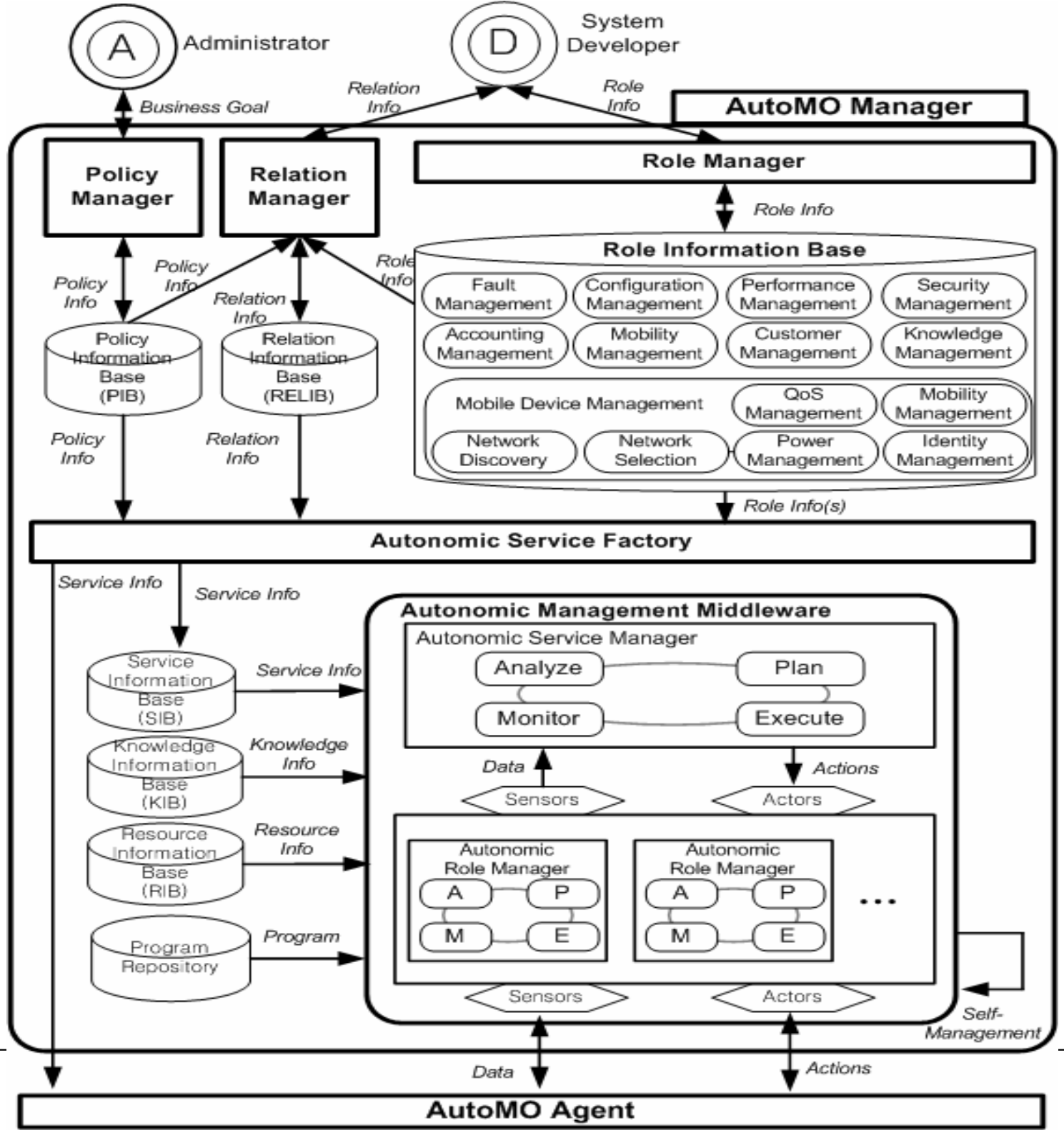


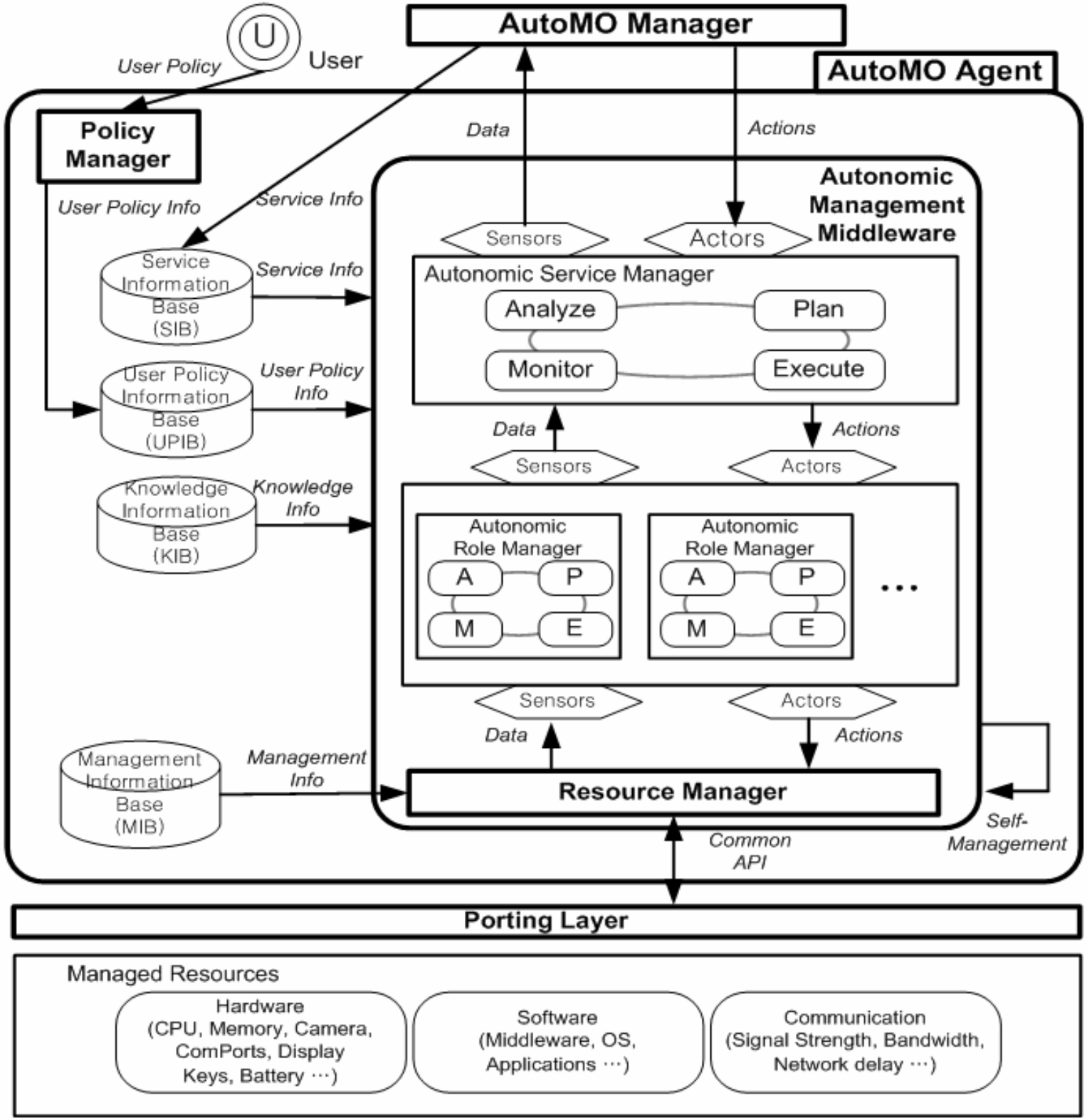
DPNM Lab., POSTECH

Autonomic Mobile Device Management

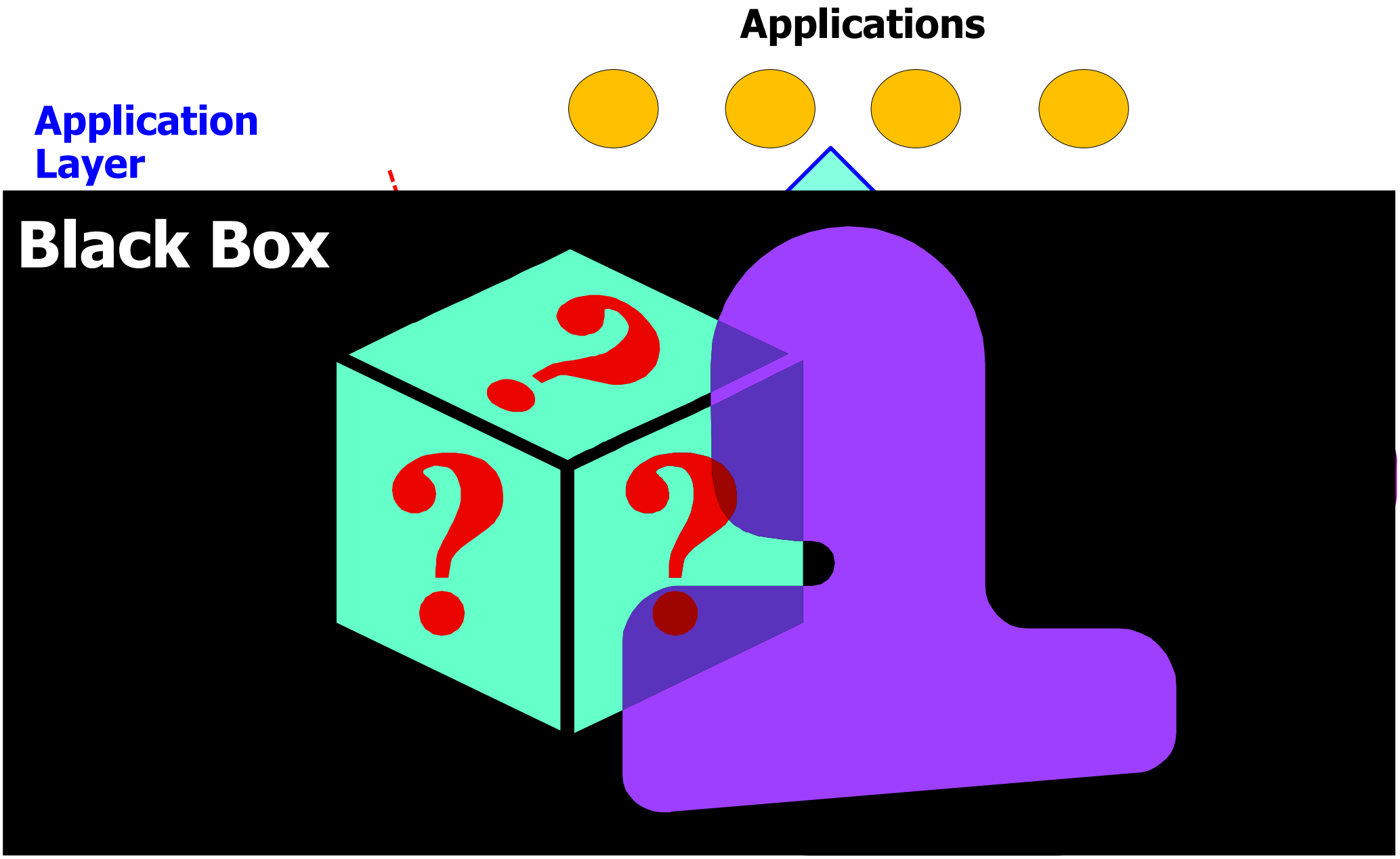
- AutoMO
  - Autonomic Management Framework for Mobile Devices




Administrator
System Developer
Business Goal
Relation Info
Role Info
AutoMO Manager
Policy Manager
Relation Manager
Role Manager
Role Info
Role Information Base
Fault Management
Configuration Management
Performance Management
Security Management
Accounting Management
Mobility Management
Customer Management
Knowledge Management
Mobile Device Management
QoS Management
Mobility Management
Network Discovery
Network Selection
Power Management
Identity Management
Policy Info
Policy Info
Relation Info
Relation Info
Policy Information Base (PIB)
Relation Information Base (RELIB)
Policy Info
Relation Info
Role Info(s)
Autonomic Service Factory
Service Info
Service Info
Autonomic Management Middleware
Autonomic Service Manager
Analyze
Plan
Monitor
Execute
Service Information Base (SIB)
Service Info
Knowledge Information Base (KIB)
Knowledge Info
Resource Information Base (RIB)
Resource Info
Program Repository
Program
Data
Actions
Sensors
Actors
Autonomic Role Manager
A
P
M
E
Autonomic Role Manager
A
P
M
E
...
Sensors
Actors
Self-Management
Data
Actions
AutoMO Agent


AutoMO Manager
User
User Policy
AutoMO Agent
Policy Manager
Data
Actions
Autonomic Management Middleware
User Policy Info
Service Info
Sensors
Actors
Service Information Base (SIB)
Service Info
Autonomic Service Manager
Analyze
Plan
Monitor
Execute
User Policy Information Base (UPIB)
User Policy Info
Data
Actions
Sensors
Actors
Knowledge Information Base (KIB)
Knowledge Info
Autonomic Role Manager
A
P
M
E
Autonomic Role Manager
A
P
M
E
...
Sensors
Actors
Data
Actions
Management Information Base (MIB)
Management Info
Resource Manager
Self-Management
Common API
Porting Layer
Managed Resources
Hardware (CPU, Memory, Camera, ComPorts, Display Keys, Battery ···)
Software (Middleware, OS, Applications ···)
Communication (Signal Strength, Bandwidth, Network delay ···)

Intelligent Mobile Device Management



Intelligent Mobile Device Management

❖ Virtualization

- Method to map the virtual resources and physical resources
- Abstraction method independent of underlying physical resources
- Virtual resource management method for QoS guarantee
- SLA-aware resource management using virtualization

❖ Autonomic Management

- Investigating the potential use of biologically-inspired algorithms and processes
- Method to apply human experience and ingenuity for managing network systems to autonomic management
- Monitoring and control in context-aware system
- Dynamic adaptation of resources and services based on changing context
- Decision Making Process for Dynamic Reconfiguration

Intelligent Mobile Device Management

❖ Service-Oriented Architecture

- Abstraction of system components in each layer
- Efficient service composition method
- Management of service repository

❖ Cross-layer Management

- Monitoring and control issues of cross-layer
- Defining an integrated cross-layer interface
- Performance improvement of cross-layer approach

Conclusions

- Summary
  - Mobile Device Management
  - Useful scenarios
  - OMA DM and OMA DM DiagMon Specification
  - Research Work of Industry and Academia
  - Research Challenges

- Lots of attention from software vendors and wireless network industry, even from home network industry
- Not pervasively used technology yet
- Enabling technology with great potential on use
- Lack of theoretical work from research institutes

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14. Joon-Myung Kang, Hong-Taek Ju, Mi-Jung Choi, and James Won-Ki Hong, " OMA DM Based Remote Software Debugging of Mobile Devices," 10th Asia-Pacific Network Operations and Management Symposium (APNOMS 2007), LNCS 4773, Sapporo, Hokkaido, Japan, October 10 ~ 12, 2007, pp. 51-61.
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Thank you