Smart-M3: platform for smart environments

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M3 – revolution in application development

With M3 your environment knows what’s happening!

M3 makes it possible to mash-up and integrate information between all applications and domains spanning from embedded domains to the Web.
Background

- Distribution of computation into environment
- Distribution of responsibility of user experience into objects in environment

Solutions

- Mobile phones
- Smart phones
- Web services
- Networked peripherals
- Networked services
- Objects with digital information
- Objects with computation capabilities
- Smart Cards, Java Cards, etc.

Information world

- PC
- Browsers
- Yahoo, Google, Amazon
- UPnP, DLNA, NoTA

Intelligence into real world

- Real world objects
- Embedded systems
- Camera, printer, TV, etc.
- Distributed systems
- Ubiquitous computing
- RFID, NFC

Distributed systems

- Ambient Intelligence
- Internet of Things
- Zigbee, BT, etc.

Vision: fusion of physical and information worlds

Information from physical world...

- Easily available for devices and novel applications...
- And linking it to services and solutions in Internet

M3 smart space

- And doing all this vendor independently, device independently and domain independently
Mission

Open embedded data in various devices to applications to create local services in millions of places...

... and monetize it by using the web tools and business models

“Smart Environment Axioms”

- Interoperability is unavoidable step in the evolution of information world
- There is no single technology that can master the variety of needs
- World can not be built/changed instantaneously
- The cost of interoperability agreements increases when moving towards implementations
- A single company can not build the world
What is needed for smart environments

- **Sharing information** from the objects and devices in the physical space
- **Possibility to build** the environment and services **gradually**
- **Support for use of new innovations**
- **Open solutions for interoperability**
- **Exploitation of Web services**
- **Intuitive use and development of services**

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M3 interoperability layers

- **Information World**
- **Service World**
- **Device World**

![Diagram of M3 interoperability layers](attachment:image.png)
M3 principles

- Voluntary sharing of information by objects in physical space
  - Publish-subscribe/query architecture
  - It is up to information owner only to decide what and how information is published
  - Respecting the integrity and independence of devices
- Interoperability agreements on information level
  - Common ontology model and data presentation format are the main requirements
  - Exploitation of existing service and device world solutions
- Enabling cross-domain use cases
  - Means and techniques must be use case independent
  - Support for enforcement to device and smart object manufacturers

M3 functional information level architecture

- Knowledge processor
- Local information storage with RDF-store and information governance functionality
- Access protocol (SSAP), with basic operations, e.g., join, leave, insert, remove, subscribe, etc.
- Semantic information broker
- Knowledge processor
- Application logic and interface supporting the use of common use case ontology and access to information broker
- Device with embedded system
- Common ontology models for use cases as information interoperability enabler
A great idea involving two programmable devices that need to share information!

Create a common ontology model for your use case (or preferably take an existing one)

Generate a convenience library for your target environment that hides the ontologies and data formats

Write M3 KPs using generated libraries

Use M3 for sharing the information and create "The Bling!"

1) Published in Open Source
M3 based applications

Traditional application model

Application using the information

Information providers (publishers)

Independent applications creating a combined functionality

Social application model

Predesigned set of applications creating the desired functionality

Control application model

The same types can be implemented with multiple and distributed SIBs

The applications can be enhanced using service level interoperability (e.g. direct use services from other devices)

M3 enforcement support

- M3 will distributed as Open Source under BSD licence
  - Maximum flexibility, simple availability
  - Minimum dependencies between organisations and companies
- M3 use will be supported with tools
  - Reference implementations to ease up the first experiments
  - Convenience library generators for hiding the ontologies and data storage formats from embedded system developers
- M3 application development support under development
  - Ontology model based application development
  - Domain dependent supporting function libraries
Architecture of M3 smart environment

SIB1
- Smart space
- Information storage
- Ontology interpreter and governance

KP1
- use case logic

KP2
- KPI
- Ontology (use) support

KP3-N
- Application in smart environment

Optional

Information level

Common solution

Service and communication level

Existing service and communication solutions (service discovery, service registry, resource manager, protocols, physical layers, etc.)

VTT & Nokia

M3 – Value Offering

- USERS: Freedom of choice
  - I want to select my device freely from any vendor knowing that it works with all devices I already have. - M3 = multi vendor
- DEVICE MANUFACTURERS: Seamless operation with all devices
  - I want to create innovative products that consumers want to buy because they work seamlessly with other devices wherever he goes. - M3 = multi device
- SERVICES COMPANIES: Gaining competitive edge
  - My company develops novel services using mash-up approach and we want seamless data portability to effortlessly create winning solutions for cross domain user experience. - M3 = multi domain
- APPLICATION DEVELOPERS: Focus on consumer ‘wow’
  - As an application developer I want to focus on creating consumer ‘wow’ instead of porting my code to all different platforms. I also want develop cross-domain mash-up services as easy as internet services are created today! – M3 = multi domain
Smart-M3 status

- Smart-M3 solution in SourceForge.net
  - Software architecture and service interface
  - Reference implementations
- M3 tool support
  - Convenience library generator (Open source distribution)
  - Application development environment
- OpenM3 demonstration example (available 11/09 in SourceForge.net)
  - SIB implementation for ASUS Linux WLAN access point
  - KP implementation for Crossbow sensor network netbridge
  - KP implementation examples for iPhone, Nokia Internet tablet (N810) and S60 phone (N97)
  - Ontology model for the demonstrator use case

OpenM3 Smart Environment Demonstration

Terminal devices

- Nokia N810
- Nokia S60 phone
- iPhone

Crossbow – wireless sensors

- ASUS – WLAN access points
- Crossbow

Sensors write information into SIB
AP hosts the SIB
Different terminal devices can read the SIB
Open Source and Ecosystem

Projects
- DIEM
- Sofia
- Others

Domain
- Consumer Electronics
- Automotive Building Automation
- Mobile

Entry

Platform
- iTRON
- T-Kernel
- WinCE
- Linux
- Java
- Qt
- Android
- iPhone

Commercial Activities

Path to success

M3 Open Information Platform

Smart environments to everywhere...

...with local information to be exploited

...with new kind of emerging experiences

...with energy and resource saving reuse

Mobile devices will evolve...

...to multi-part devices (with dynamically changing parts)

Interaction with spaces instead of devices

...to information sensing extension of humans
Summary

- M3 – multi-vendor, multi-device, multi-domain solution for information interoperability
- Link between physical and information worlds
- Open source distribution with maximum flexibility and easy access and adaptation
- First demos available – portfolio of projects using M3 exists
- M3 does to smart environments what the HTTP/TCP/IP did for Internet

Thank you

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