MOBILE VISUAL SEARCH USING SMART-M3

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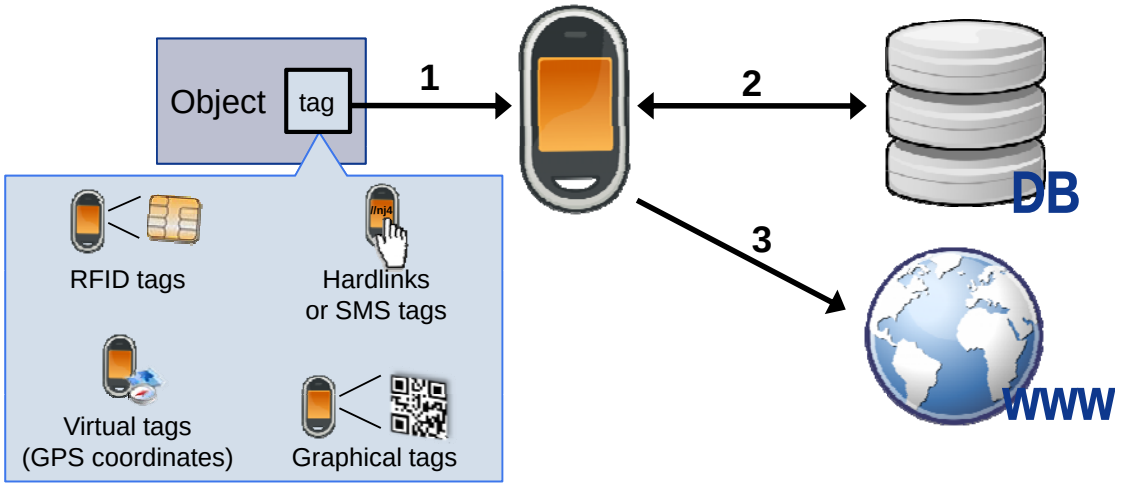
Summary

- Object Hyperlinking
- Mobile Visual Search
- Smart-M3 platform
- MVS Architecture
- Sample Applications and Demo

European Commission
ARTEMIS JU SP3 SOFIA project
(http://sofia-project.org/)

Object Hyperlinking

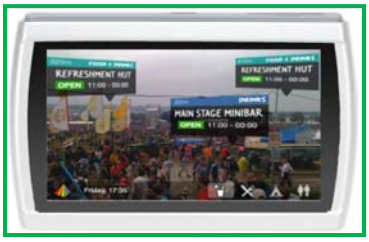
- Process of linking real-world objects to related digital content by using some form of tag
- Tags can then be read by a wireless mobile device and information about objects and locations retrieved and displayed to the user



Object Hyperlinking

- Applications:
  - Link an audio CD to an online website where the songs can be previewed
  - Enhancing a physical document (e.g. a newspaper) with multimedia content (e.g. a virtual tour of a property linked to a real estate advertising)
  - Cultural heritage and tourist information
  - …

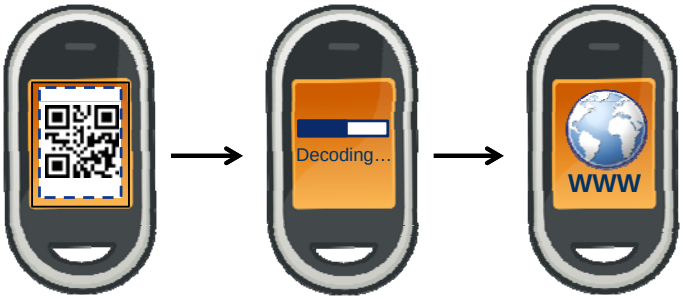
Virtual tag



Graphical tags

Mobile Tagging

- Linking method: 2D barcodes

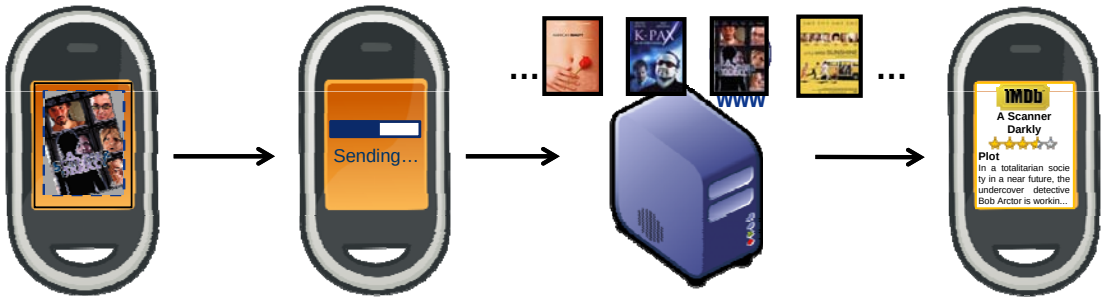


Take a picture Decode Website

- Pro:
  - Fast recognition, even in mobile environments
  - Cheap to produce
  - The tag can directly encode an URL without the need of a central database to store the link
- Cons:
  - Requires to instrument the environment with artificial visual patterns
- Examples:
  - Quick Response (QR), DataMatrix, Semacode, Microsoft Tag…

Mobile Visual Search

- Linking method: “natural” visual tag
- No artificial tagging required!



Take a picture of an object | Send picture to processing server | Process image | Display linked content

- Examples:
  - Google Goggles, SnapTell, Nokia Point & Find iCandy, Doog, kooba…

MVS principles

- Conventional principles
  - **Usability**: object identification should be fast, easy and reliable
  - **Unobtrusiveness** and **productivity**: deployment should be as unobtrusive and inexpensive as possible
- Additional principle
  - **Interoperability** and **information sharing:** the information deduced by the tag should be stored in a shared and interoperable information search extent to the benefit of third party applications, which do not need to be aware of the connectivity nor of the identification technology used by the identification engine

Smart-M3

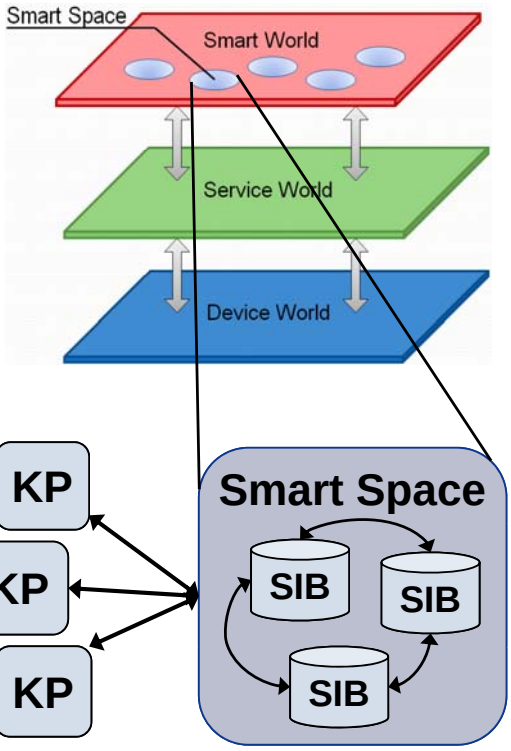
- Interoperability platform deployed within SOFIA (Smart Objects For Intelligent Applications)
- Purpose:
  - Enabling seamless interoperability between devices of many kinds and different manufacturer, operating in different business domains

    Multi-domain **M**ulti-device **M**ulti-vendor
- Main concepts:
  - Shared tuple space mechanism for information exchange
  - The interpretation of information is based on common ontology models

Smart-M3

Architecture

- The M3 functional architecture (Smart World) works on top of one or multiple concurrent SOA service networks (the Service World)



- **Smart Spaces (SS)**
  - Individual search extents
- **Semantic Information Brokers (SIB)**
  - Entities for storing the information
- **Knowledge Processors (KP)**
  - Entities capable of inserting, removing and querying information from the Smart Space

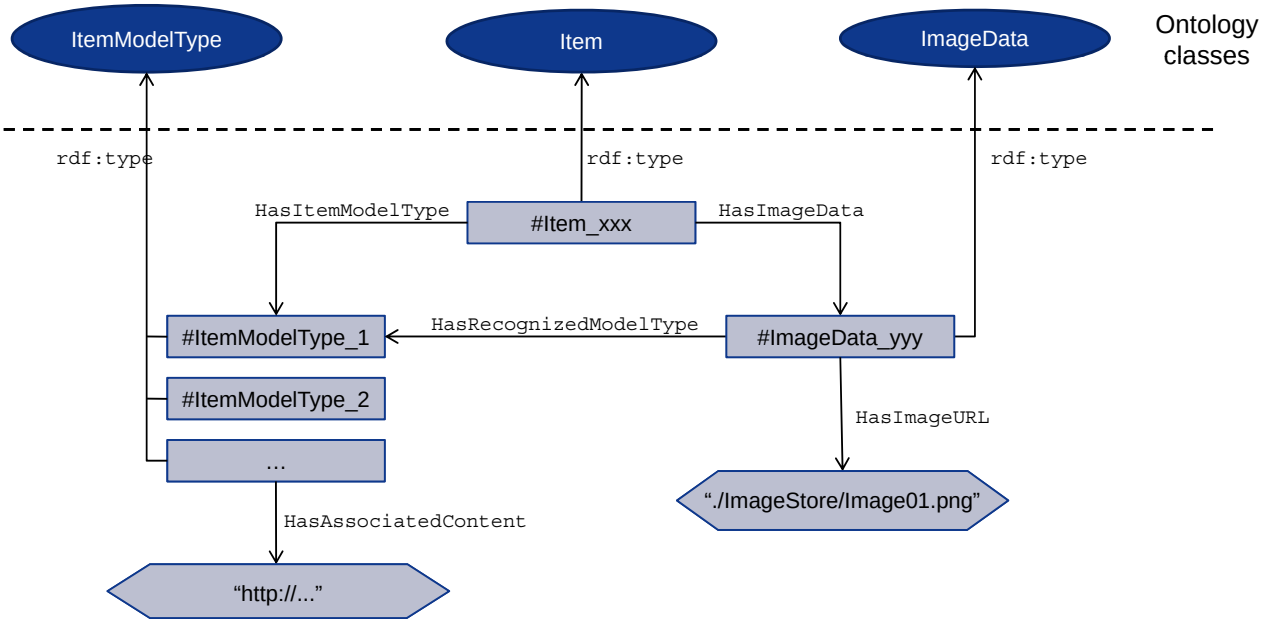
MVS Architecture

- M3 Application:

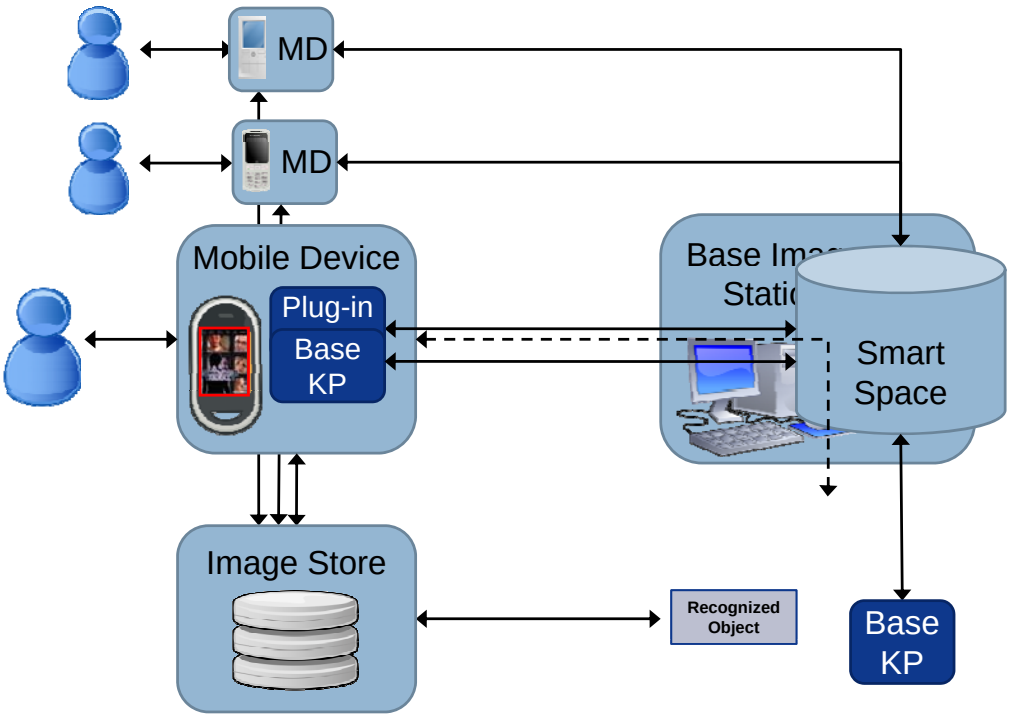
  "*a scenario enabled by a set of collaborating KPs*"

- Modular architecture
  - **Base module**
    - Basic recognition scenario
    - Uses computer vision algorithms to identify objects in pictures
  - **Plugin modules**
    - Address different visual search scenarios

Ontology



MVS Architecture



Sample Application: Maintenance scenario

Take a picture of the device that needs to be repaired

Object is recognized and…

…the application displays a web page with related content such manual, most recent drivers etc…

Sample Application: Mobile Shopping scenario

Take a picture of an item

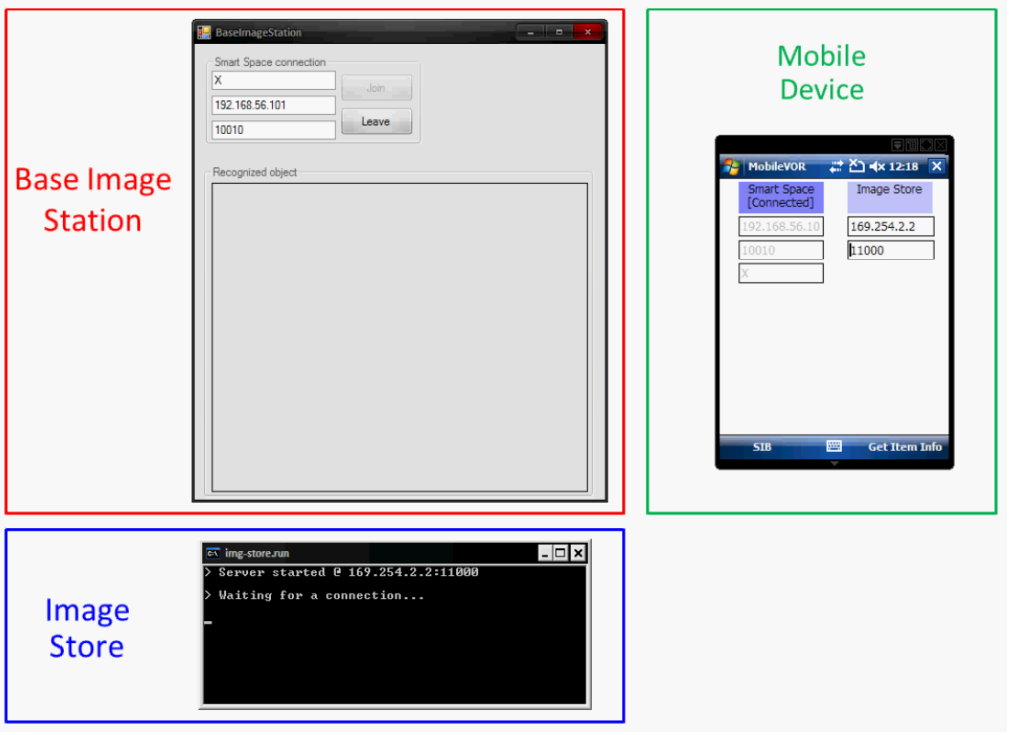
Object is recognized…

…and automatically added to remote shopping list

Add another item

When finished, confirm order

Demo

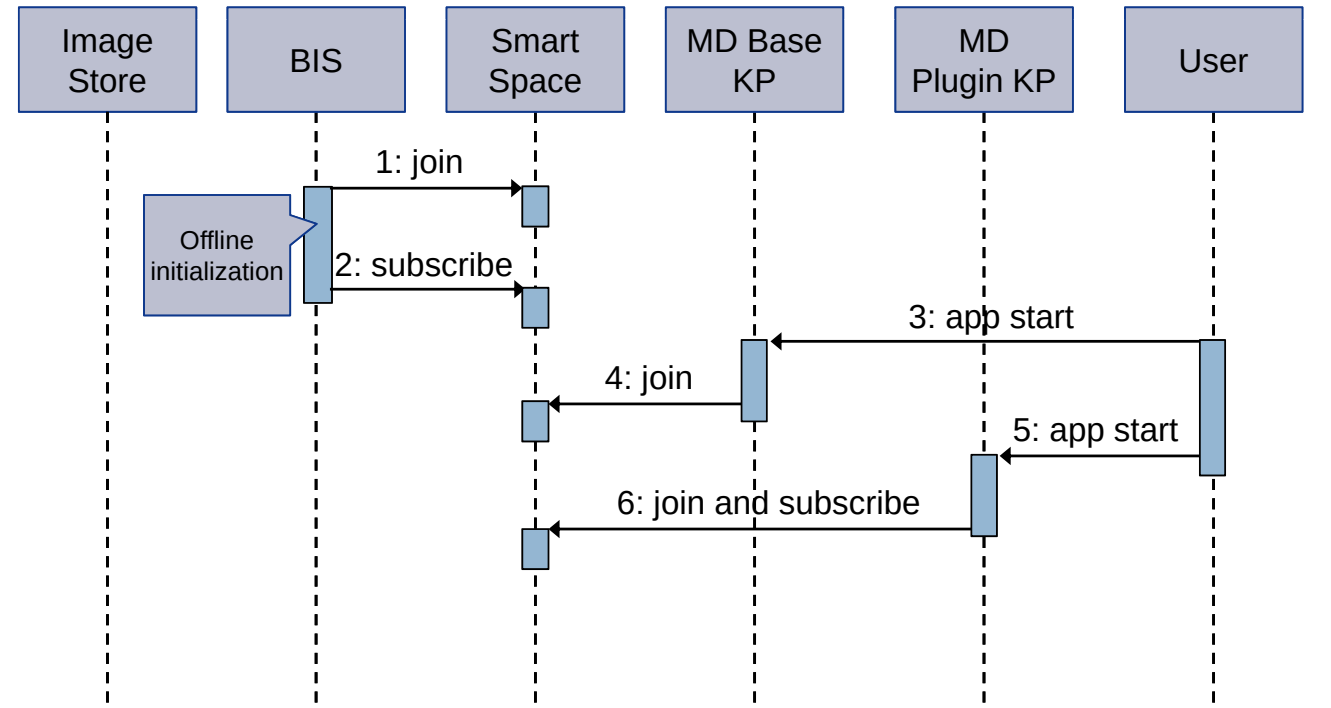


Conclusions

- Novel MVS engine that uses Smart-M3 as interoperability platform
- The adoption of Smart-M3 allows for higher interoperability between the interacting entities, regardless of execution environments and implementation languages, making the system easily extensible to previously unforeseen scenarios
- This system has been integrated in part of the Maintenance demo developed within SOFIA

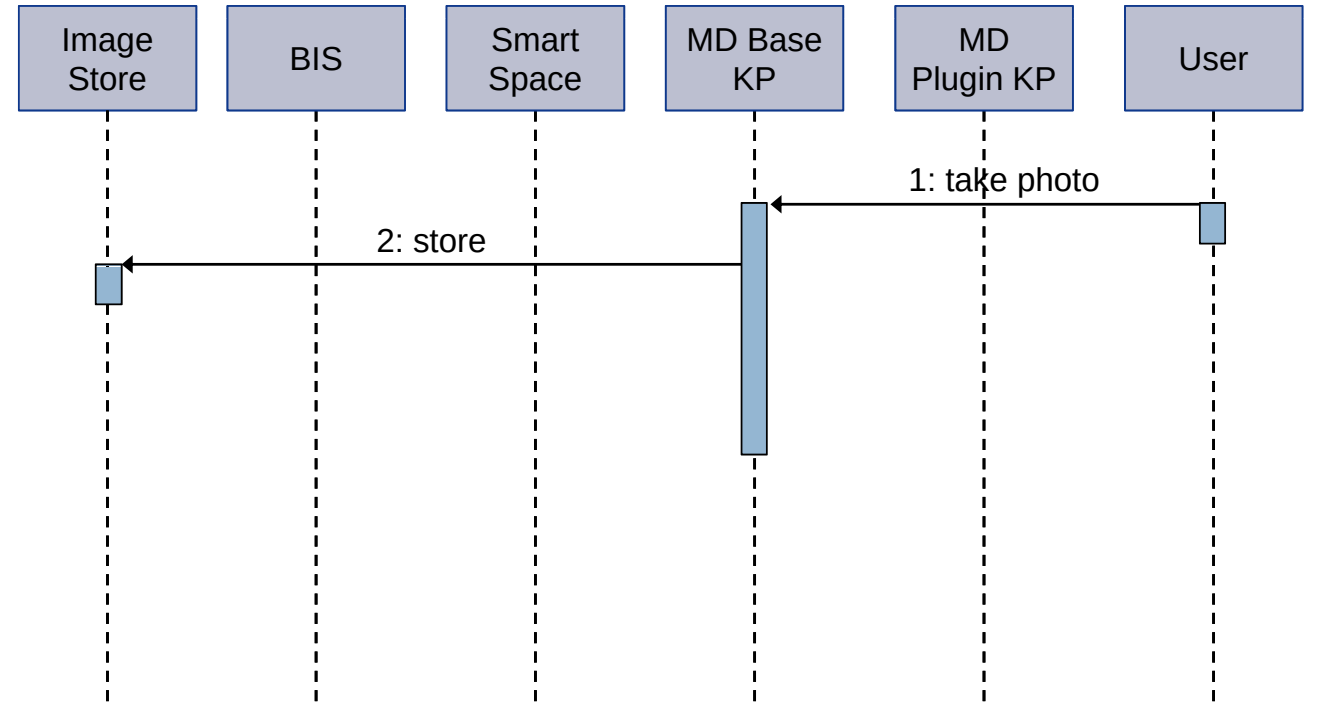
Sequence Diagram

Initialization



Sequence Diagram

Basic Object Recognition Scenario



RDF

(Resource Description Framework)

- Information is represented using the RDF format (W3C standard)
- Everything described in RDF is a “resource”
- Each resource is described by one or more statement in the form of triples Subject-Predicate-Object
  - Subject: the resource
  - Object: a value or another resource
  - Predicate: a property that ties the subject to the object.