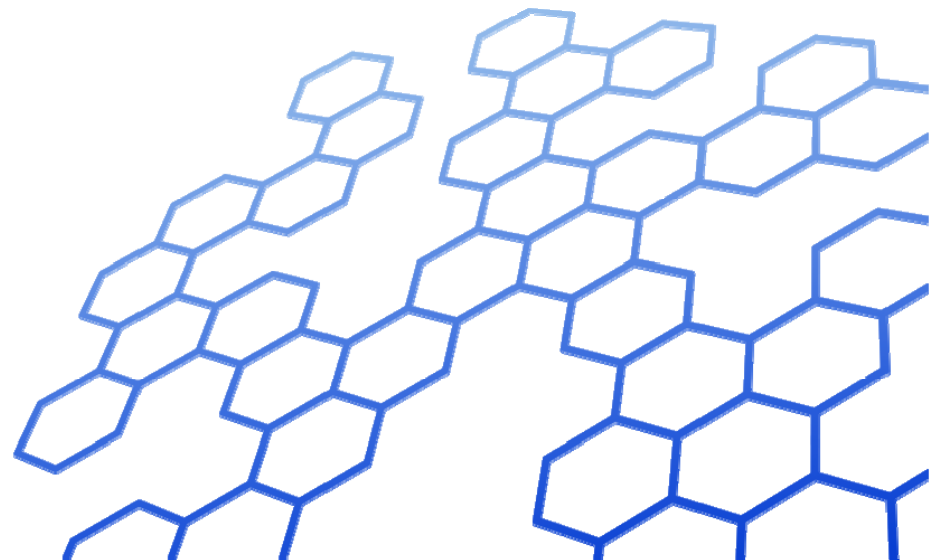# Service Space Portability Validation
Modeling the Vehicular Context

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Nokia Research Center

Outline

1. Service interoperability
2. Portability study
3. Collaborating-software approaches
4. Prototypes
5. Portability Validation
6. Conclusions

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Service interoperability

- Smart Space environment
  - multi-device, multi user, interoperability
- Smart world
  - Semantic Information Broker access
- Service word
  - service interconnect protocols
- Device world
  - Device discovery, connectivity

User

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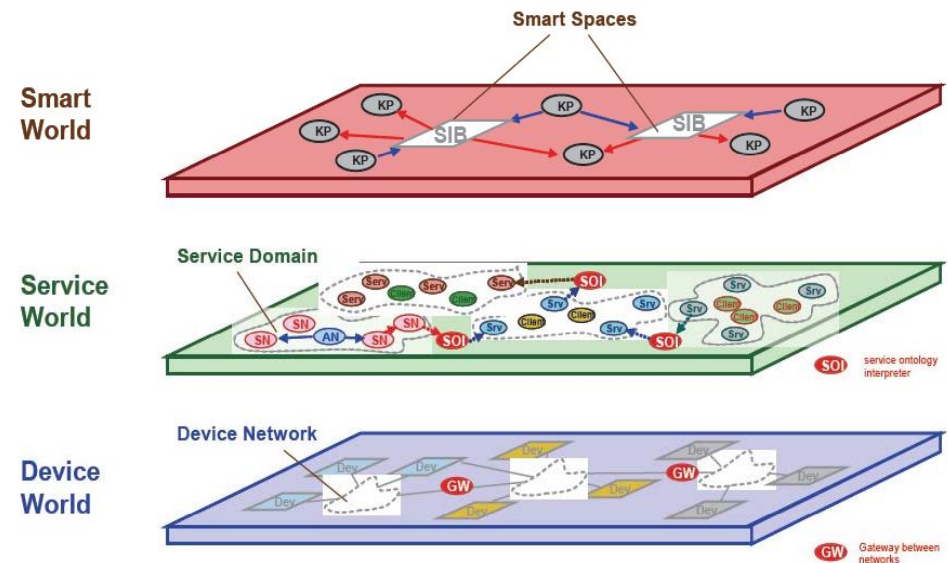
Introduction to portability study

How service orchestration may
change?

- Transition of the control

- Change in the control behavior

- Boundaries between the User and the
service space interaction

How are the principle of multi-user,
multi device dynamic interaction
remain?

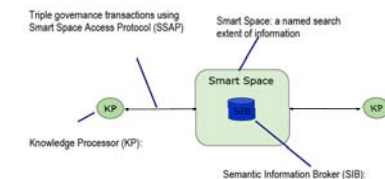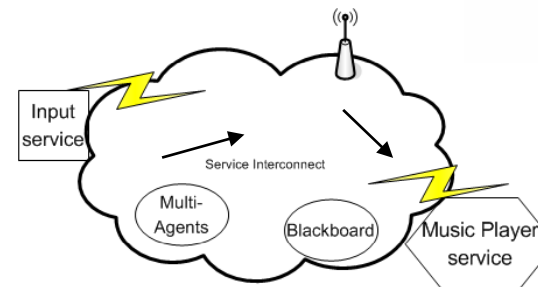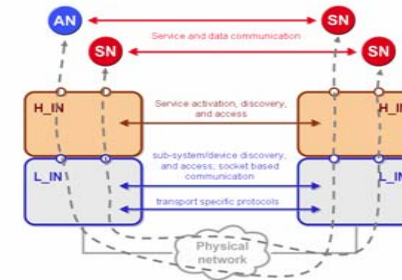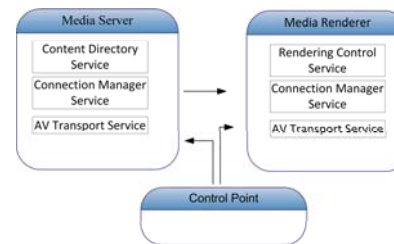- Enabling additional nodes to join

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Collaborating-software approaches

Interconnect method overview:

- ## UPnP AV

  - Audio / Video device interconnect

- ## NoTA

  - AN/SN Logical interconnect

- ## M^3

  - Knowledge Processors, SIB Access

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Comparison of Architectures

- Music player service

    - Rendering audio

- Input service

    - Control the rendering

	UPnP	NoTA	M³ concept
Underlying protocol	Http	BSD sockets	HTTP or NoTA
Addressing	Dynamic (requires discovery)	Interconnect Address (RM - SID) and depends on underlying transports	SSAP
Power Saving	UPnP low power –since 2007	By design principles	Depends on the underlying transport, priorities allows suspension
Input Service	Not standardized, Control point is a kind of input service	Custom keyboard service	Activity instance
Audio player service	Media Renderer	Custom audio player	Subscriber to an activity
User authentication	Only at radio access point level	With custom made authentication service	Via Local policies
Dependency on external components	TCP/IP, UDP, HTTP, XML, and SOAP	Bluez (SDP, HCI, L2CAP, RFCOMM), or DHCP, TCP/IP	Same as NoTA and DBus, Expat, Uuid, Avahi, Python

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Device, service level interoperability - UPnP
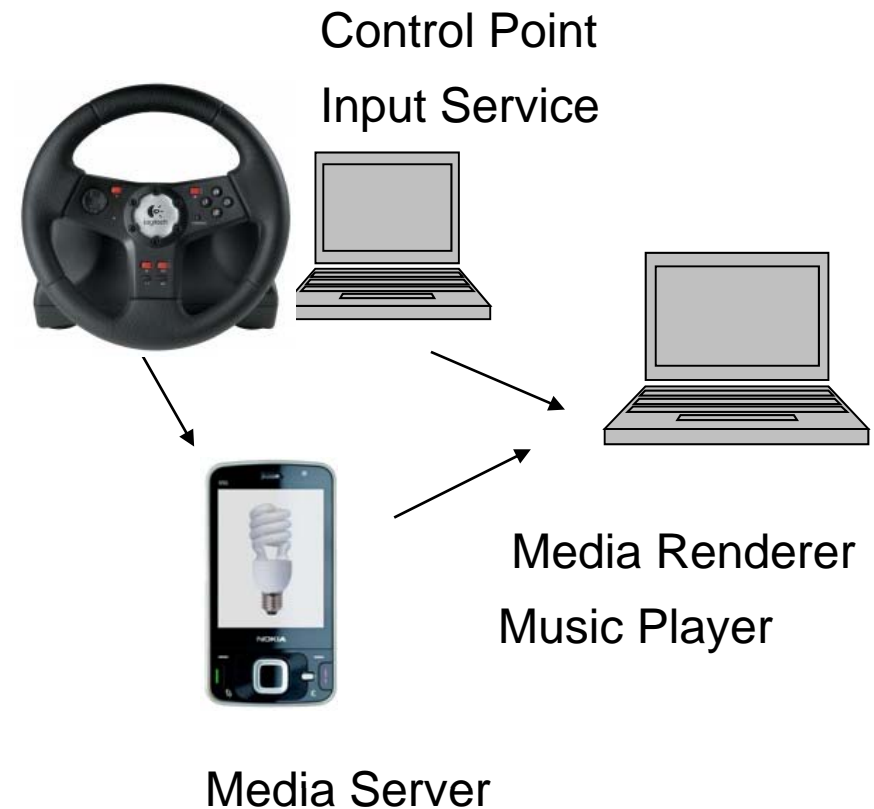
Mobil Environment

- Home Network application
- Custom UPnP AV control point
  - proprietary API
  - network setup
  - choosing the media server
    - sharing audio content
  - select a renderer device

  - Play, Pause, Seek
    - Via AV Transport service
  - Equalizer
    - Available at Local rendering

Wireless Radio

Control Point,
Local rendering

Media Renderer

Media Server

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Device,service level interoperability - UPnP

Ported Environment

- Initial Network setup
  - Start media renderer and server
- Wheel Input application
- custom UPnP AV control point
  - Open API, GUPnP
  - Any media server,
    - Any content
  - Any renderer device
  - Control point as such have no service dependency
  - Ported control point limited to act as media renderer
    - Connection manager
    - Rendering control - Equalizer
    - Optional AV transport optional - *Play, Pause, Seek*
      - Only later support Fast Forward.
   - Support only versions available at implementation time

Control Point
Input Service

Media Renderer
Music Player

Media Server

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Service level interoperability - NoTA

Mobil Environment

- Selecting the input application

  - Starts button service

  - Initial Network setup
    - Starting the RM, Audio SN, Translator SN

  - Searching for RM

  - Query services

  - Connecting to translator service

  - Translator connecting to Audio Player SN

  - Play, Pause, Seek
    - Via Translator SN
    - For remote content additional services needed

  - Equalizer
    - Available, when both Translator SN and Audio Player SN supports it

Node communication

Button Service AN

Audio player SN

3

2

4

Resource Manager

5

1

6

Translator SN

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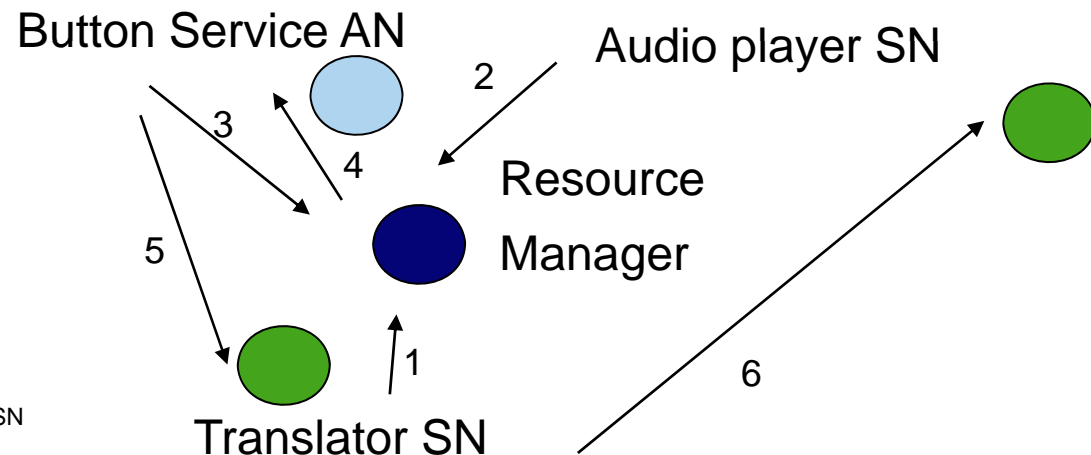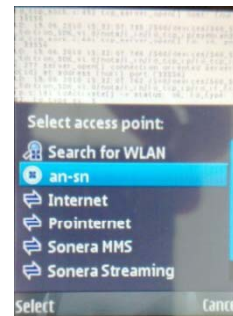
Service level interoperability - NoTA

Ported Environment

- Initial Network setup
- Wheel input application
  - Starts keyboard service
  - Searching for RM
  - Query services
  - Connecting to translator service
  - Translator2 connecting to Audio Player SN

  - Play, Pause,
    - Via Translator2 SN
  - Seek
    - Via Translator2 SN
- Equalizer
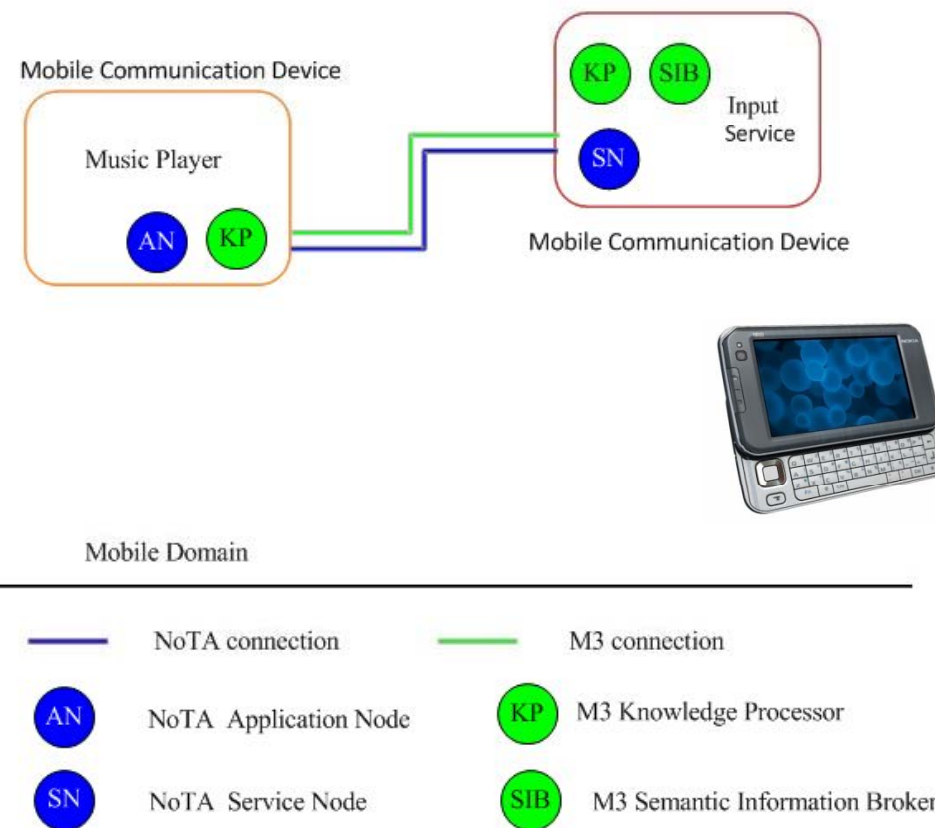 - Available, when any Translator SN and Audio Player SN supports

Node communication

Translator2 SN

Keyboard service AN   6   Audio Player SN

5

4   2

1

3

Resource Manager
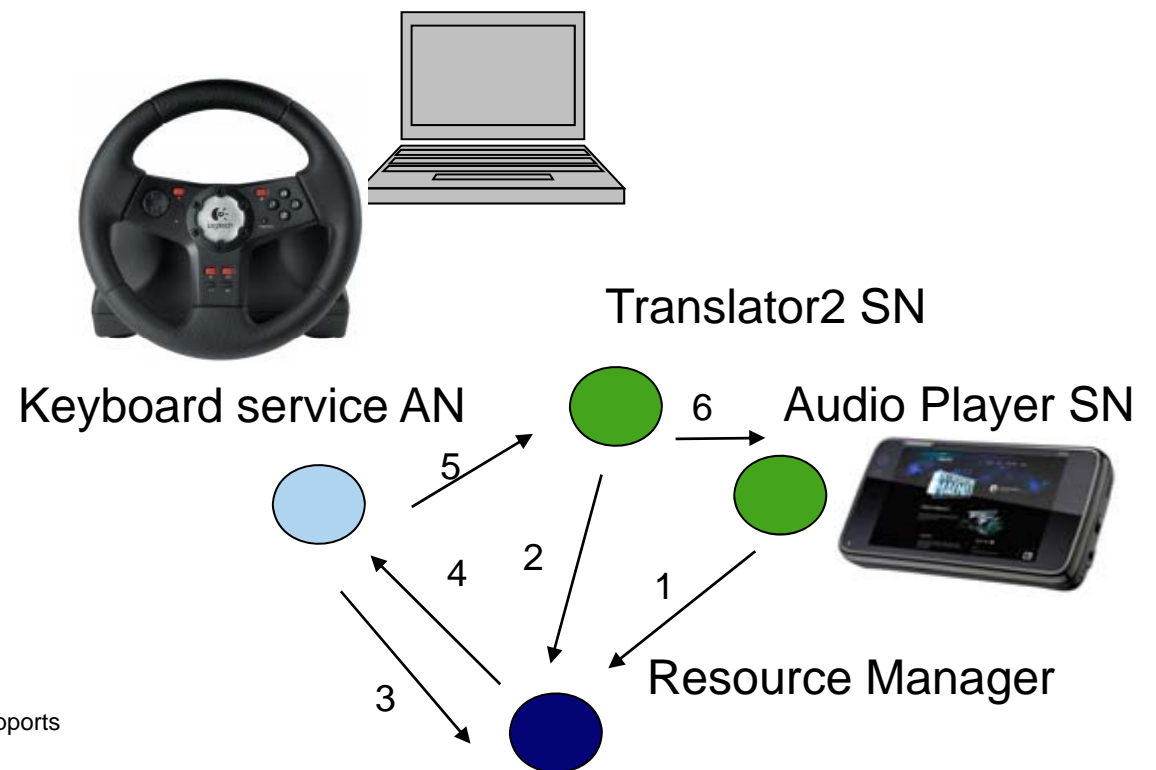
Smart Space level interoperability – M^3

Mobil Environment

- Initial Network setup

  - ### SIB start

- input application

  - ### Input KP join the SIB

  - ### Start audio application

    - Audio KP Join the SIB
    - Subscribe to input activity

  - ### Play, Pause, Seek, Equalizer

    - Insert operation for Input service
    - Result indication for music player
    - Not consumed triplets - key pressed - can be removed by input KP

Rendering infrastructure

Mobile Communication Device

Music Player

AN   KP

KP   SIB

SN

Input Service

Mobile Communication Device

Mobile Domain

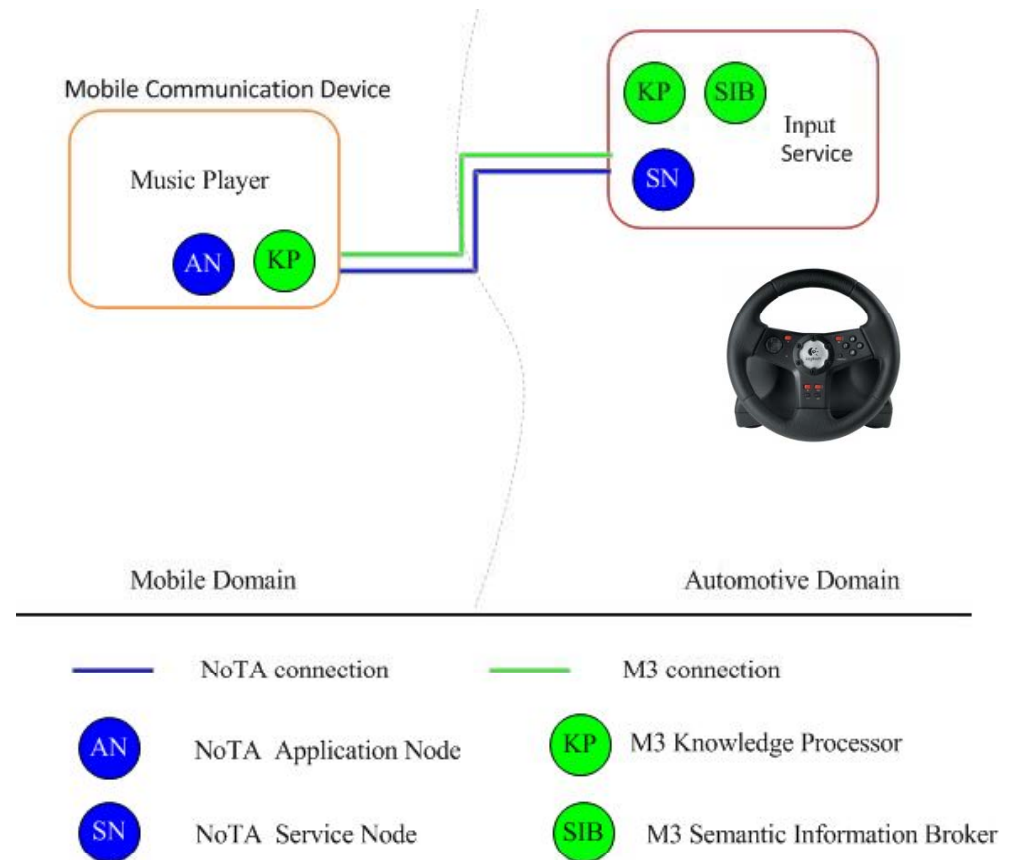|			
———	NoTA connection	———	M3 connection
AN	NoTA Application Node	KP	M3 Knowledge Processor
SN	NoTA Service Node	SIB	M3 Semantic Information Broker

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Smart Space level interoperability – M^3

Ported Environment

- Initial Network setup
  - SIB start
- input application
  - Input service join the SIB
  - Start audio rendering application
    - Join the SIB
    - Subscribe to input activity
  - Play, Pause, Seek, Equalizer
    - Insert operation for Input service
    - Result indication for music player

Rendering infrastructure

Mobile Communication Device

Music Player

KP   SIB

Input Service

SN

AN   KP

Mobile Domain   Automotive Domain

——— NoTA connection	——— M3 connection
AN NoTA Application Node	KP M3 Knowledge Processor
SN NoTA Service Node	SIB M3 Semantic Information Broker

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Portability Validation

multiple device in vehicular environment

- UPnP AV
  - Control points can't subscribe to other control points
    - Keyboard have to be implemented as a UPnP input device otherwise invisible for other UPnP devices

- NoTA
  - One Application node can connect multiple Service node
    - Service nodes which consume the keyboard have to be aware of each other

- M^3
  - Any Knowledge processor knowing the key ontology can join
    - Vehicular context can enable deployment of new functionalities

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Conclusions

Service remapping

- Network setup still take significant part of interconnect

    - Ip connectivity is optional

        - NoTA, M^3 allows non-ip based protocols

    - Energy consumption is relevant for vehicular environment

        - Limiting service discovery

- Developer friendliness

- User input is more than a definition of state changes

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Thank You

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