Approaches to Semantic Interoperability and Semantic Mapping

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Motivation
Motivation

Native Applications A

API Platform A

Internal Information Model A

IoT Platform A

Interoperability

IoT Platform B

Internal Information Model B

API Platform B

Native Applications B
Motivation

Different Information Models

Incompatible APIs

Interoperability
Motivation

Interoperability

Native Applications A

API Platform A

Internal Information Model A

IoT Platform A

Different Information Models

Syntactic Interoperability

Interoperability

Native Applications B

API Platform B

Internal Information Model B

IoT Platform B
**Motivation**

- **Native Applications A**
- **API Platform A**
- **Internal Information Model A**
- **IoT Platform A**

**Syntactic Interoperability**

- **Native Applications B**
- **API Platform B**
- **Internal Information Model B**
- **IoT Platform B**

**Semantic Interoperability**

**Interoperability**
Approaches to Semantic Interoperability

- Core Information Model
- Core Information Model with Extensions
- Mapping between Platform-Specific Information Models
- Multiple Pre-Mapped Core Information Models
- Multiple Pre-Mapped Best Practice Information Models
Approaches to Semantic Interoperability

- Core Information Model
- Core Information Model with Extensions
- Mapping between Platform-Specific Information Models

- Multiple Pre-Mapped Core Information Models
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Approaches to Semantic Interoperability

Core Information Model

Core Information Model with Extensions

Mapping between Platform-Specific Information Models

Multiple Pre-Mapped Core Information Models

Multiple Pre-Mapped Best Practice Information Models

IoT Platform A

Core Information Model

IoT Platform B

IoT Platform C

Usage of Information Model

Mapping between Information Models
Approaches to Semantic Interoperability

Usage of Information Model

Mapping between Information Models
Approaches to Semantic Interoperability

Core Information Model

Core Information Model with Extensions

Mapping between Platform-Specific Information Models

Multiple Pre-Mapped Core Information Models

Multiple Pre-Mapped Best Practice Information Models

IoT Platform A

Platform-Specific Information Model A

Platform-Specific Information Model B

Platform-Specific Information Model C

IoT Platform B

IoT Platform C

Usage of Information Model

Mapping between Information Models
Interoperability in symbIoTe

Native Applications

API Platform A

Internal Information Model A

IoT Platform A

Interoperability

Native Applications

API Platform B

Internal Information Model B

IoT Platform B
Interoperability in symbIoTe

Syntactic Interoperability

Resource Access API

Interoperability

Native Applications

API Platform A

Internal Information Model A

IoT Platform A

API Platform B

Internal Information Model B

Native Applications

IoT Platform B

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Interoperability in symbIoTe

- **Semantic Interoperability**
  - SPARQL Query Re-Writing
  - Interoperability
  - Core Information Model
  - Meta Information Model
  - Platform-Specific Information Model A
  - Platform-Specific Information Model B

- **Syntactic Interoperability**
  - Resource Access API

- **Native Applications**
  - Native Applications
  - API Platform A
  - Internal Information Model A
  - IoT Platform A
  - API Platform B
  - Internal Information Model B
  - IoT Platform B

Mapping between models and APIs for interoperability.
Semantic Interoperability in symbIoTe

![Diagram showing Resource Access API and IoT Platform connections]

- **Search**
- **Registry**

**IoT Platform A**
- Resource Access API

**IoT Platform B**
- Resource Access API

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Semantic Interoperability in symbIoTe

Register
- platform
- information model
- resources
- mappings

Search

Registry

IoT Platform A
- Resource Access API

PIM A

IoT Platform B
- Resource Access API

PIM B
Semantic Interoperability in symbIoTe

Search for resources

Registry

Register
- platform
- information model
- resources
- mappings

Resource Access API

IoT Platform A

PIM A

PIM B

Resource Access API

IoT Platform B

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**Search for resources**

**PIM C**

**Search**

**SPARQL query re-writing**

**Registry**

**Register**
- platform
- information model
- resources
- mappings

**PIM A**

**Resource Access API**

**IoT Platform A**

**PIM B**

**Resource Access API**

**IoT Platform B**
Semantic Interoperability in symbIoTe

Access resources

Search for resources

SPARQL query re-writing

Registry

Register
- platform
- information model
- resources
- mappings

Data Transformation

PIM C

Resource Access API

IoT Platform A

PIM B

Resource Access API

IoT Platform B

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Challenges

• Mapping language
  – EDOAL (Expressive and Declarative Ontology Alignment Language)

• Definition of mappings quite complex
  – Automatic pre-alignment (ontology matching)
  – Visual editors for mapping definitions

• Execution of mapping
  – SPARQL Query Re-Writing
  – Data Transformation
Conclusion & Next steps

• Standardization of vocabularies not enough → additionally use Semantic Mapping

• Next steps (within symbIoTe)
  – Analysis & classification of ontology mismatches
  – Pick some mismatches with high occurrence and easy to resolve
  – Implement proof-of-concept
    • Mapping definition
    • SPARQL Query Re-Writing
    • Data transformation
Thank you!

Questions?

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