

WISHI: Workshop on IoT Semantic/Hypermedia Interoperability

IRTF T2TRG: Thing-to-Thing Research Group
July 15/16, 2017, Prague, CZ
Hosted by Ericsson

Chairs: Carsten Bormann & Ari Keränen



Welcome to Prague,
Europe :-)

Note Well

- You may be recorded
- The IPR guidelines of the IETF apply: see [**http://irtf.org/ipr**](http://irtf.org/ipr) for details.

Administrivia (I)

- Pink Sheet
 - Note-Takers
 - Off-site (Jabber, Hangout?)
 - **<xmpp:t2trg@jabber.ietf.org?join>**
 - Mailing List: **t2trg@irtf.org** — subscribe at:
<https://www.ietf.org/mailman/listinfo/t2trg>
- Repo: **<https://github.com/t2trg/2017-07-wishi>**

Agenda (Sat)

| Time | Presenter(s) | Topic |
|-------|----------------------|---|
| 9:00 | Chairs | Welcome & Introduction. T2TRG/IETF work. |
| 9:30 | Padmakumar Subramani | OMA DM (LwM2M) |
| 9:55 | Jaime Jimenez | IPSO Smart Objects |
| 10:20 | Milan Milenkovic | IPSO Semantic Working Group |
| 10:45 | | break |
| 11:00 | Michael Koster | iot.schema.org |
| 11:25 | Matthias Kovatsch | W3C Web of Things |
| 11:50 | Dave Thaler | Open Connectivity Foundation (OCF) |
| 12:15 | Tim Carey | oneM2M |
| 12:40 | | lunch |
| 13:40 | Teresa Zotti | Fairhair Alliance |
| 14:05 | Milan Milenkovic | Haystack |
| 14:30 | Alex Pelov | YANG of Things |
| 14:40 | Chairs, all | Discussion |
| 15:00 | | break |
| 15:20 | Abdulkadir Karaagac | Challenges for Semantic LWM2M Interoperability in Complex IoT Systems |
| 15:45 | Andreas Harth | Rule-based Orchestration of Networked Components |
| 16:10 | Victor Charpenay | WoT Thing Description |
| 16:35 | Michael Jacoby | Approaches to Semantic Interoperability and Semantic Mapping |
| 17:00 | Milan Milenkovic | Semantic Interop PoC |
| 17:25 | Klaus Hartke | Hypermedia for Long-Term Semantic Interoperability |
| 17:50 | Chairs, all | Breakout planning, plenary wrapup |
| 18:10 | | Closing |

Agenda (Sun)

| Time | Leader(s) | Topic |
|-------|-------------|-------------------------------|
| 9:00 | Chairs | Sunday overview, planning |
| 9:30 | (multiple) | Breakouts |
| 11:00 | | coffee break |
| 11:15 | (multiple) | Breakouts |
| 12:45 | | lunch |
| 13:45 | (multiple) | Breakouts |
| 15:15 | | break |
| 15:25 | (many) | Workshop reports, way forward |
| 15:45 | Chairs, all | Plenary wrapup |
| 16:00 | | Closing |

T2TRG scope & goals

- Open research issues in turning a true "Internet of Things" into reality
 - Internet where low-resource nodes ("things", "constrained nodes") can communicate among themselves and with the wider Internet
- Focus on issues with opportunities for IETF standardization
 - Start at the IP adaptation layer
 - End at the application layer with architectures and APIs for communicating and making data and management functions, including security

Administrivia

- Big thanks to Ericsson for sponsoring the meeting
- Those who registered in time get a T-Shirt
 - Thanks to Matthias Kovatsch for the great design
- Lunch self-hosted (hint: look at the Hackathon!)
- Dinner 19:00 @ Pivovarský klub (which google)
 - Default menu + opt-out choices — see your mail

Sat Dinner: Pivovarský klub

- Křižíkova 17°, Praha 8 - Karlín 180 00
- “Default menu”:
 - Beer and Sauerkraut soup
 - Smoked Breast of Duck, Sauerkraut or Spinach, Dumplings
 - Beer cake
- Opt out of that now, if you don't want to eat that...

Polls

1. Who wants to opt out of the default menu
2. Who will join us for dinner and hasn't said so
3. Who will stay on for IETF 99
4. Who hasn't been at an IETF before
5. 3 && 4
6. Who has written I-D or RFC

WISHI: Introduction

Interoperability

- **Semantic** Interoperability
 - I understand what the data/actions mean
- **Structural** Interoperability
 - I understand the structure of the data/actions
- **Syntactic** Interoperability
 - I can parse/generate data/actions

Self-Description, Introspection

- Self-Description: Assets (Devices), Resources make available enough information to use them without a manual and without “intelligent guessing”
- Introspection: Interfaces for exposing the self-description

Models

- A way to represent the self-description information
 - (Best case; really often just a manual)
- Words also used:
 - Schema



Semantic Level
Vocabulary
Taxonomy
Meaning
Ontology

Information Model

Data Model

Abstract
Syntax

Serialization

Encoding

Message
Transport
Format

Concrete
Syntax
Marshaling
Scheme

Representation frameworks

- Modeling languages (optional!):
ASN.1, W3C Schema/Relax-NG, _____, CDDL...
- Generic Data Models (what can you represent):
Base types, Containers, ...
- Serializations (BER, XML/EXI, JSON, CBOR)

RDF: Resource Description Framework

- Extremely simple data model: set of **triples**, Subject Predicate Object, each a **statement**
 - Items can be literals, IRIs, or “blank nodes”
 - Information model: labeled, directed multi-**graph**
- Half a dozen **serialization** formats (RDF/XML, JSON-LD, Turtle, N3, ...), none dominant
- Tools like GRDDL (extracting RDF from XML), SPARQL (SQL-like query language), SHACL (validation/description)
- Can add languages on top, e.g. RDFS, OWL for developing **ontologies** — constraints on sets of individuals (“classes”) and the types of relationships permitted between them.

Data/Information Models
vs.
Interaction Models



Semantic Interaction Model

— know what the interactions mean

Structural Interaction Model

— know how to construct interactions

Protocol Mapping

— can send interactions over the wire

Interaction Patterns

- Property: Can **retrieve** information/observe it
- Action: Can somehow initiate, control, and abort **effects**
- Event: ??? Something about time series, or maybe a sequence/collection of discrete happenings?
Commands vs. indications?
- Actually, Interaction Patterns can be much more complex (e.g., how do they *combine*?)

Hypermedia

- **Resources** (“media”) offered by **servers**
- Can contain **links**
 - Special kind of link: form (construct parameters)
- **Client** decides how to navigate this offering (“non-linear”): what media to obtain or effects to — cf. REST “HATEOAS”

What does the IETF have?

- CoRE: Constrained RESTful environments
 - CoAP protocol
 - Link-Format (and its JSON/CBOR variants)
- JSON and CBOR Serializations
 - CDDL for structural interoperability

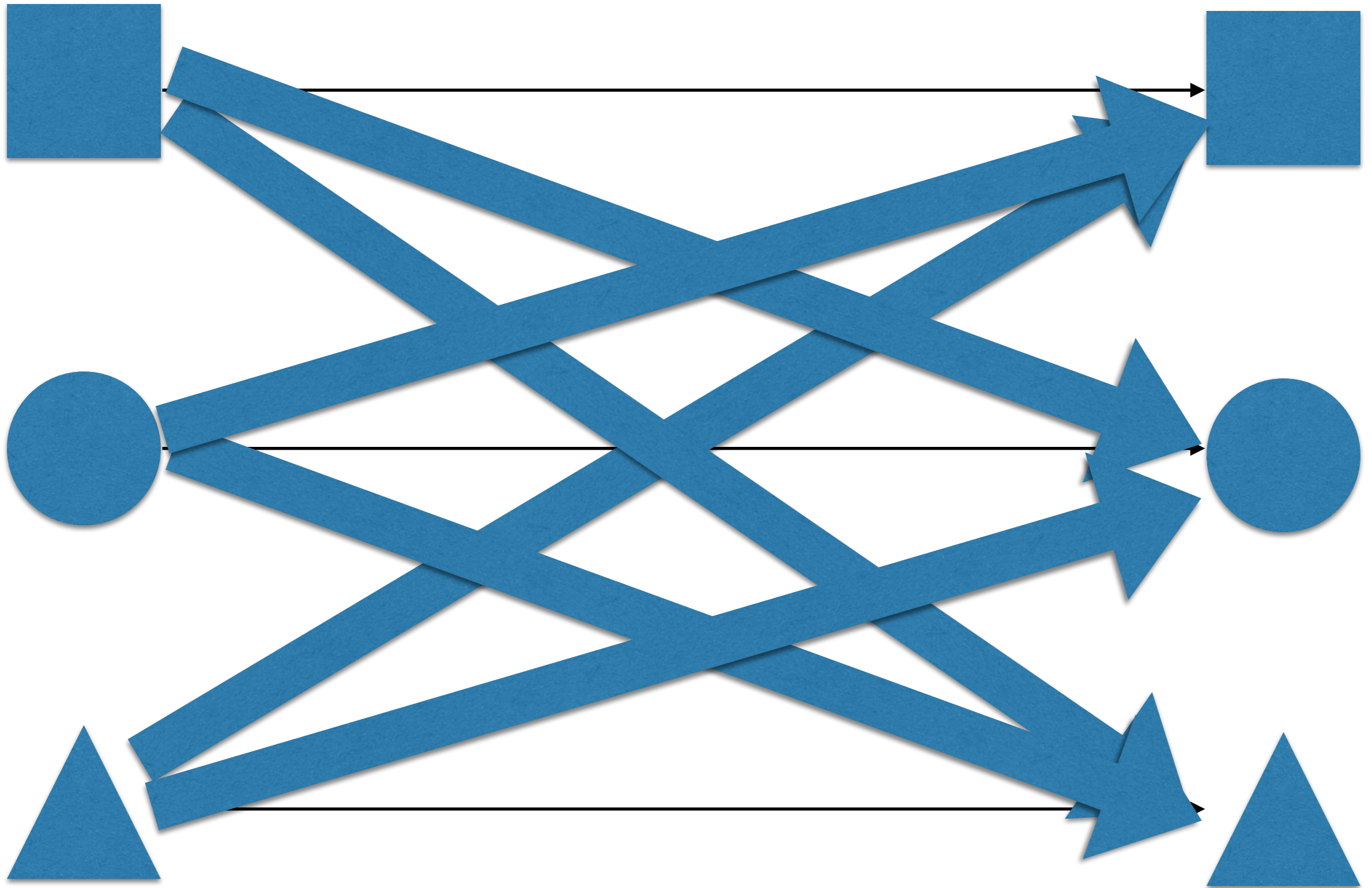
What does the IETF have?

- Management domain:
 - Has been in this boat for a while (RFC 3444!)
 - Has been misusing ASN.1 as SMIv2 (MIBs)
 - Now has YANG for its data models

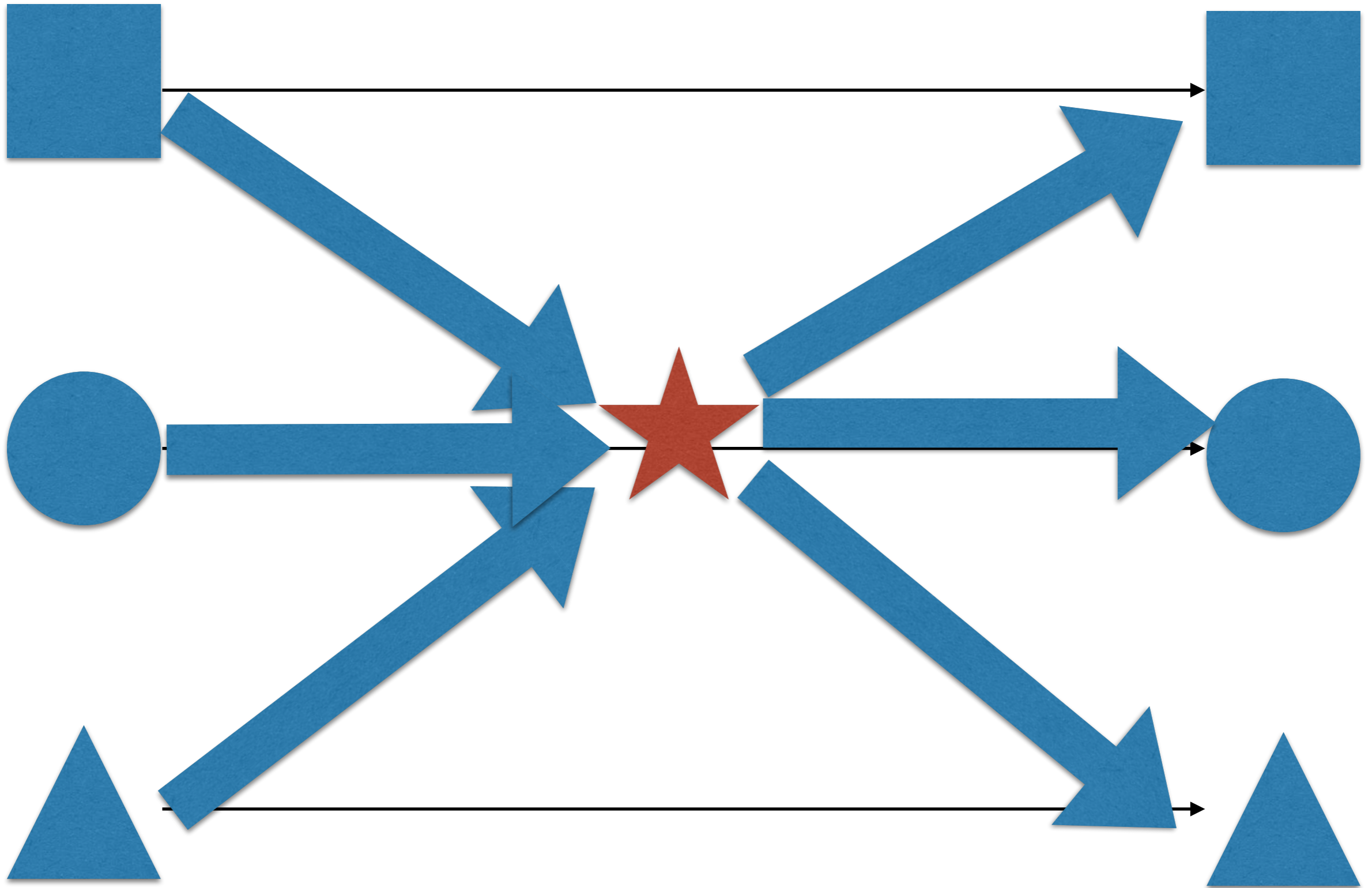
Goals

- Making things work together across a (eco)systems
 - Does your tech have discussed features that facilitate? How can they work together? Mapping and translation? Can reuse?
- Common building blocks
 - E.g., JSON, CBOR, CoAP, ...
 - New ones needed? Where to be done? IETF? Other orgs?
 - The more common we have, the easier to interoperate
- Improving communication across orgs
 - Notification of new things? Mailing list (e.g., IoTSI)?

$$n^2 - n$$

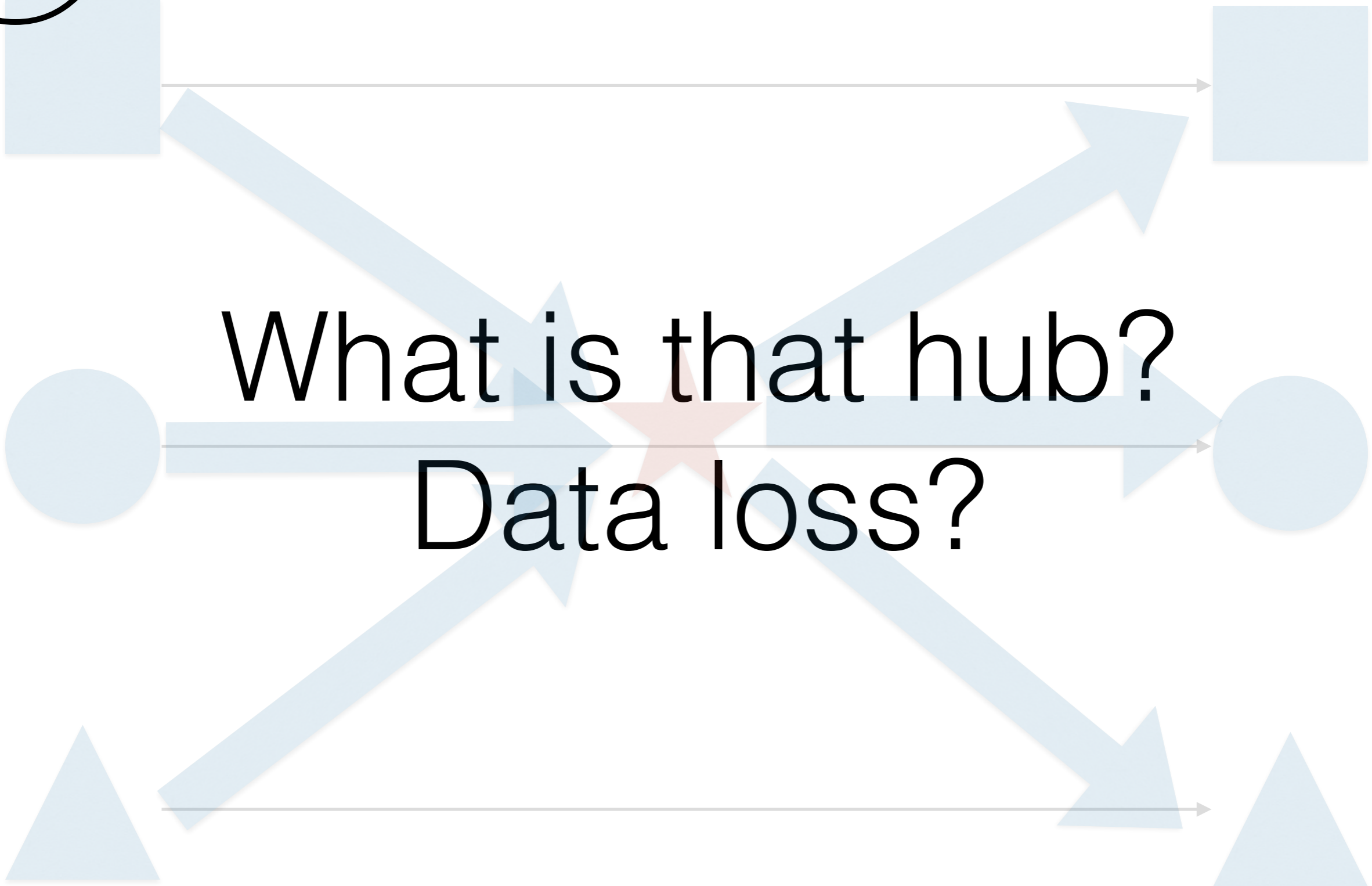


$2n$



①

$2n$



What is that hub?

Data loss?

②

Translating **data**
between data models

vs.

Translating data
models

⑤

How far can we get?

Limits to translation
(e.g., security?)