T2TRG: Thing-to-Thing Research Group

W3C WoT joint meeting
September 2016, Lisbon, Portugal

Chairs: Carsten Bormann & Ari Keränen

Note Well

- You may be recorded
- The IPR guidelines of the IETF apply:
  see **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/2016-09-w3c-wot**

Agenda (1)

Overview, Beyond REST

10:00	Chairs	Welcome, Meeting overview, T2TRG Status
10:20	(all)	News and Surprises from W3C WoT, Agenda Bashing
10:40	Klaus Hartke	CORAL vs. HSML – way forward?
11:00	Michael Koster	HSML vs. CORAL – way forward?
11:20	(all)	way forward?
11:40	Carsten Bormann	Impulse talk “events and time series”
12:00	(all)	Structure into breakouts
12:15	Lunch	(lunch by breakout)
13:30	(all)	Space for breakouts
14:15	(all)	breakout reports, Wrapup “Beyond REST” discussion

Agenda (2)

Type Systems, Models, Model Translation

14:40 Jaime Jiménez “Mapping from LWM2M model to CoMI YANG model”
15:00 Ari Keränen Bluetooth URIs
15:20 Coffee break
15:50 Daniel Lux “Seluxit REST-ful open API for Lemonbeat devices”
16:10 Carsten Bormann Impulse talk “type systems”, discussion
16:40 (all)other experience on models/translation, discussion
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17:45 (all)breakout reports, Wrapup “Type Systems” discussion

Agenda (3)

Security

09:00 Daniel Lux“IoT Proxy scheme for secure constrained devices”
09:30 Aaron Yi Ding “Securebox and IoT research at TUM Connected Mobility”
10:00 Carsten Bormann Impulse talk “security models”
10:30 (all) Structure into breakouts
10:45 (all) Space for breakouts
11:30 (all) breakout reports, Wrapup “Security” discussion
11:50 Chairs official farewell

Breakouts

13:15 (all) Structure into breakouts
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Next meetings

- **SDOs: Co-locate with W3C WoT meeting @ TPAC in Lisbon (Thu/Fri Sep 22/23): Sat/Sun Sep 24/25**
- Open-Source (CoAP Implementers): October 27 near EclipseCon
- Meet with ICNRG in Seoul before IETF97 (Sun Nov 13)?
- Academic: February @EWSN?

Lunch

- Table of 15 booked at 12:15 at:

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WEB OF THINGS

T2TRG View: Surprises, Actions

September 2016, Lisbon, Portugal

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HSML

https://tools.ietf.org/html/draft-koster-t2trg-hsml-00

Media Types for Machine Interaction

Why HSML

- Develop the REST and hypermedia design style for machine interaction
- Build on IETF CoRE standards
- Standardized data model and interaction model for interoperability – like HTML
- Introduce new design patterns to extend REST for machine control applications

What is HSML

- Serialization
  - JSON, CBOR
- Data models
  - CoRE Link-Format, SenML => HSML Collections
- Interaction model optimized for machine workflow
  - Machine comprehensible hyperlinks and forms
  - Link embedding and transclusion
  - Separate or combined data and hypertext
- Transfer layer abstraction
  - Generalizes forms and other message based controls
  - Enables REST and Pub/Sub protocol binding

Design Patterns

- Extensions to the REST design style
- Enable machine control and asynchronous interaction using stateless client and REST
  - Hypermedia based discovery
  - RESTful actuation
  - RESTful asynchronous notification
  - Machine proxy, "device shadow" interaction
- Servient Client + Server integration
  - Consume and expose resources at the same time
- Link annotation for application semantics

CoRAL and HSML

Media Types for Machine Interaction

Klaus Hartke and Michael Koster

Comparison

- Similarities
  - Collections of links and items
  - Forms to drive resource state updates
  - Interoperable data models
- Differences
  - CoRAL uses a data model derived from HAL
  - HSML uses CoRE Link-Format and SenML
  - CoRAL uses media types to define application semantic vocabulary and data serialization
  - HSML uses link annotation to embed application semantics

Next Steps

- Create a common use case prototype to evaluate both approaches
  - Cross-domain interoperability
  - How does the difference in semantic annotation impact application design?
  - Discovery, resource construction, application interaction
- Converge to a single representation format and interaction model over time

Project

- Take CoRE Apps lighting example and translate to HSML
- Implement BB in HSML
- Implement RD as an alternate discovery to BB
- Compare HSML and CoRAL
- Compare RD and BB
  - HSML + BB
  - HSML + RD
  - CoRAL + BB

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Events, time series, streams, pub-sub, low-latency data, …

- Lots of names, each used by different people for very different things
- Differences at many levels:
  Semantics, representation, transport, …
- Can we get a taxonomy?

Levels

- transport (as in TCP, UDP, …)
  e.g., sending several packets within one RTT

- transfer (as in HTTP, CoAP, XMPP, AMQP)
  e.g., handling data sequences in the transfer primitives

- serialization (as in ASN.1, XML, JSON, CBOR, TS, MKV)
  e.g., streaming serialization

- data modeling (talk about modeling later)
  e.g., modeling the time series

“Streamy” aspects

- transport/transfer: possibly more than one packet per RTT
- periodicity: possibly regular intervals
- data volume/“heavy streams”: may require special handling
- separation of setup and data
  - once set up, producer and consumer are coupled

Interaction, Latency

- Conversational interaction: Latency is highly important (< 150 ms), extra low latency even below that
- “Streaming” interaction: Latency still important, but a few seconds tolerable
- Reliable transfer: Reliability takes priority over latency

“Time Series” aspects

- A sensor can make a series of measurements
    - … or an actuator can be operating on a time base
- Each measurement/actuator setting is attached to a time

Example: Web Streaming

- Web video streams usually use HTTP to transfer
    - A control file (e.g., m3u8) containing links to snippets
        - may continue to grow
    - A sequence of snippets (e.g., MPEG TS)
- Receiver can change quality dynamically by selecting appropriate snippets per slot

Example:
Enterprise Service Bus

- Processes Events
  - Generally MUST NOT be lost
- The Bus is not infrastructure, but part of the application ("programmable bus")
  - Bus **processes** events and distributes to appropriate receivers
- Permissionless innovation is **not** a goal

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Type Systems

- **Data** are what stays!
- Model the data
  - During specification time
  - To control behavior at runtime
- Self-describing vs. separate metadata
- Modeling languages

Why model

- The promise of code generation
- For conformance checking
- To attach semantics to data received at runtime
- As a way for humans to interact at specification time (discussion, documentation)

What is being modeled

- Data being interchanged (XML, JSON, …)
  - Syntax (what can/cannot be there)
  - Semantics (what do the parts mean)
- Data at rest (e.g., netconf datastore ➔ YANG)
  - Often implies derived interchange specification
    - Interactions need inputs and outputs
  - Interaction model implied and/or explicit
    - Extreme case: RPC
describes interactions, not data (just for I/O)

Models

- Language vs. interchange format
  - Optimized for humans vs. for machine interchange
  - Tool vendor view vs. common language
- Syntax model vs. data model vs. information model
- Underlying theory (if at all well-defined!)
  - Tree grammars/production systems (~BNF)
  - Constraint systems
  - Collection of predicates

Language considerations

- Evolvability
  - of the language
  - of the models written in the language
- Modularization

Models vs. Serialization

- Is the model tied to a serialization?
  - What can be expressed (e.g., graph vs. tree)
  - Do detail semantics depend on serialization? (YANG!)
  - If cross-serialization: What is the common/ generalized data model?

Example: CDDL

- Define **structure** of data for **interchange**
- Model at data model level (close to information model)
  - Abstraction based on CBOR/JSON data model
- Production system, based on tree grammars
  (plus some minimal constraints)
- Language: Readable by humans
- Tool support: instance validation, generation
  - (+ Some information extraction for code generation)

Model translation

- What can be translated?
  - e.g., at-rest ≠ in-motion; tree vs. graph
- Expressibility limitations
- Up-Conversion issues (recognizing structure)

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