iotschema.org

Community Teleconference

February 18, 2020

Agenda

- Discuss iotschema re-charter
- AOB

Re-charter

- We have come to a check point in this work
- schema.org extension is unlikely in the current form
  - The iotschema focus on affordances is not aligned with schema.org use cases
  - Data types may be an integration point but will not drive schema.org integration
- Roll up some conclusions and publish a report
- Drive the work forward with new alignment

Re-charter – re-alignment

- There is still a need for a common web entry point for IoT semantic models in RDF
- Align with W3C WoT, OneDM, and semantic graphs
- Build out ontology to include quantities and features of interest
- Become a common public set of RDF models for IoT system integration – one stop shop and entry point
- Develop the browser around the new integration patterns
- Conversion and shape validation tools
- Contribute directly or from e.g. SDF conversions

Re-charter - logistics

- Develop a consortium of interested parties from W3C WoT, OneDM, OneM2M, and other prospective organizations
- Discuss at WoT VF2F
- Agree on a venue – W3C CG?
- Define priorities, deliverables, and work streams
- Discuss contributions and license

Venue

- Existing mailing list/interest list for outreach
- W3C Community group chartered for schema.org extensions – currently no activity
- Google group and 2017 discussions (archive)
- Discussion on use of the W3C WoT CG
- Move toward a W3C activity

Conclusion

- Next steps/meeting
- AOB

Backup

- Interaction model survey
- Thing Class
- OneDM Integration
- schema.org integration

Meta-model survey – Common Affordance Semantics

Information	OneDM SDF	WoT TD	iotschema	ZCL/dotdot	OCF	SmartThings	LWM2M	Weave	Vorto	UPnP	BLE Mesh	Azure DTDL	oneM2M	OPC UA
Governing body	OneDM Liaison	W3C	W3C/schema.org	Zigbee Alliance	OCF	SmartThings	OMA SpecWorks	Google/Nest	Eclipse	OCF	BT Sig	Microsoft	oneM2M	OPC
Tools License	BSD	Many		Proprietary	BSD	Proprietary		Apache2	Eclipse			MIT	Apache2.0	
Models License	BSD	No Models		BSD	BSD	Proprietary	OMA	Apache2				CC Attr. 4.0		
representation language	JSON	LSON-LD	JSON-LD	XML	JSON	JSON	XML	WDL	vortolang	XML	XML	JSON-LD	XML	XML
Content Format	sdf+json	td+jsonld	jsonld	zcl+xml	swagger+ json	json	mod+xml	text	text	upnp+xml	xml	jsonld	sdt+xml	
Reference	https://github.com/one-data-model/language	https://www.w3.org/TR/wot-thing-description/	https://github.com/iot-schema-collab/iotschema	https://zigbeealliance.org/wp-content/uploads/zip/dotdot-ip-package.zip	https://openconnectivity.org/developer/specifications/	https://docs.smartthings.com/en/latest/capabilities-reference.html	http://www.openmobilealliance.org/wp/omna/lwm2m/lwm2mregistry.html	https://openweave.io/guides/weave-primer/schema	https://github.com/eclipse/vorto/tree/development/docs	https://openconnectivity.org/developer/specifications/upnp-resources/upnp/	https://www.bluetooth.com/specifications/mesh-specifications/	https://github.com/Azure/IoTPlugandPlay/tree/master/DTDL	http://www.onem2m.org/tr-0039/ipe-and-sdt	https://opcfoundation.org/developer-tools/specifications-unified-architecture

Terminology	OneDM SDF	WoT TD	iotschema	ZCL/dotdot	OCF	SmartThings	LWM2M	Weave	Vorto	UPnP	BLE Mesh	Azure DTDL	oneM2M	OPC UA
Composed Instance	Thing/Thing	Thing	Thing/Thing	Device/EP	Platform/Device	Fingerprint	Registration	Device	Info Model	Device	Device	Capability Model	Device	Device, Server
Atomic Functionality Unit	Object	(Thing)	Capability	Cluster	Resource	Capability	Object	Trait	Function Block	Service	Model	Interface	ModuleClass	Object
Externalized state item	Property	Property	Property	Attribute	Property	Attribute	Resource	Property	Config, Status	State Variable	Attribute	Property	Data Point	Attribute, Variable
External method accepted	Action	Action	Action	Command	POST	Command	Executable Res.	Command	Operation	Action	Write	Command	Action	Method, Program
External signal emitted	Event	Event	Event	Report	Observe data	Device Event	Observe data	Event	Event	Event	Report	Telemetry	Event	Event, Alarm
Reusable data type	Datatype	Datatype	Datatype	Datatype	OAS definition	Datatype	Reusable Res.	Datatype	Datatype	Datatype	Datatype	schema	xsd types	register types

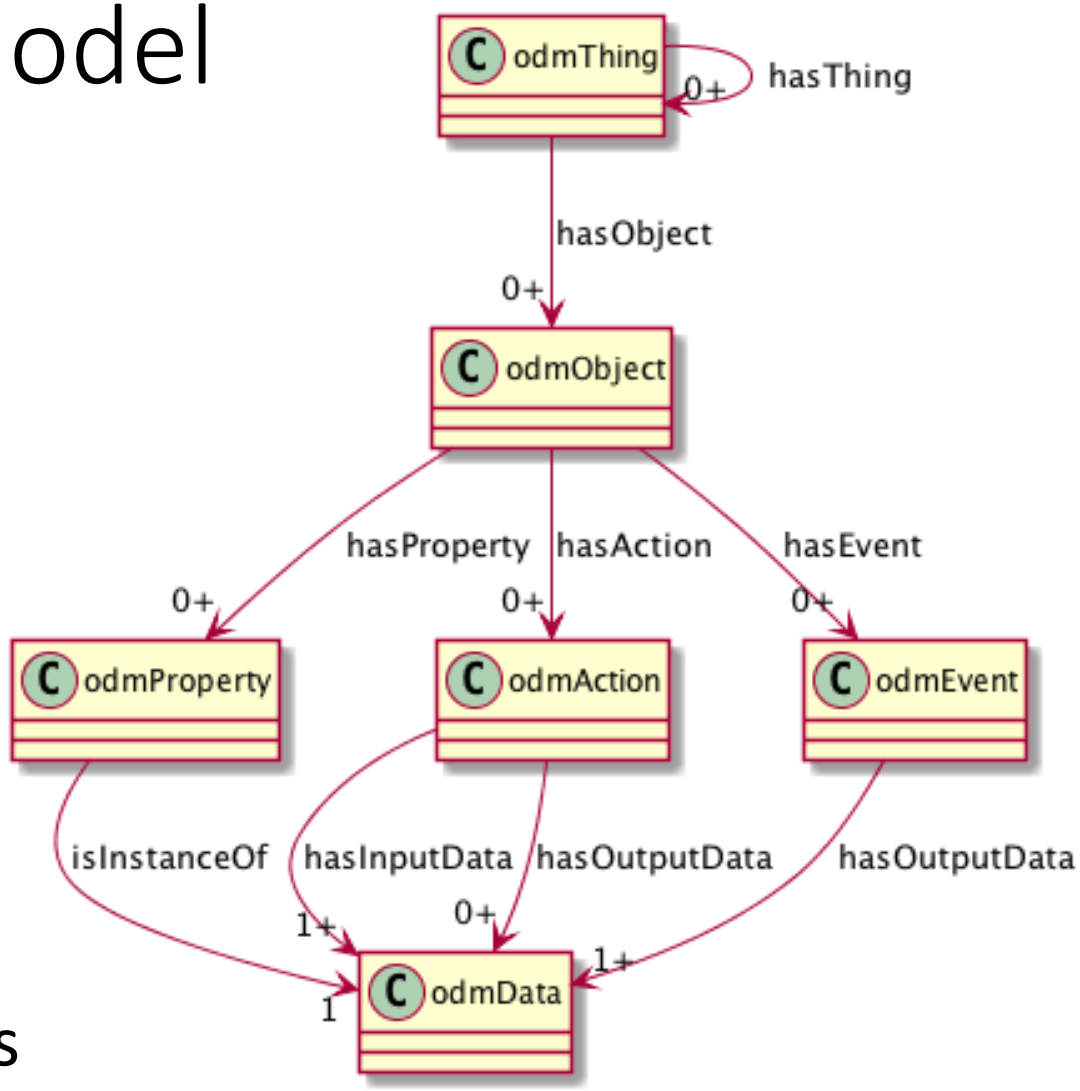
Network Binding	OneDM SDF	WoT TD	iotschema	ZCL/dotdot	OCF	SmartThings	LWM2M	Weave	Vorto	UPnP	BLE Mesh	Azure DTDL	oneM2M	OPC UA
Data Schema	JsonSchema	JsonSchema	External	XML	OAS 2.0	Mapping Files	SenML	WDL	External	XML	XML	DTDL	XSD	
Protocol Binding	External	TD Forms	External	ZCL Commands	OAS 2.0	Device Handlers	CoAP	WDM	External	UPnP defined	BLE GATT	External	External	
Protocols		MQTT,HTTP, CoAP		Zigbee Pro, CoAP	CoAP	Many	CoAP	WDM		HTTP	BLE			

Thing Class

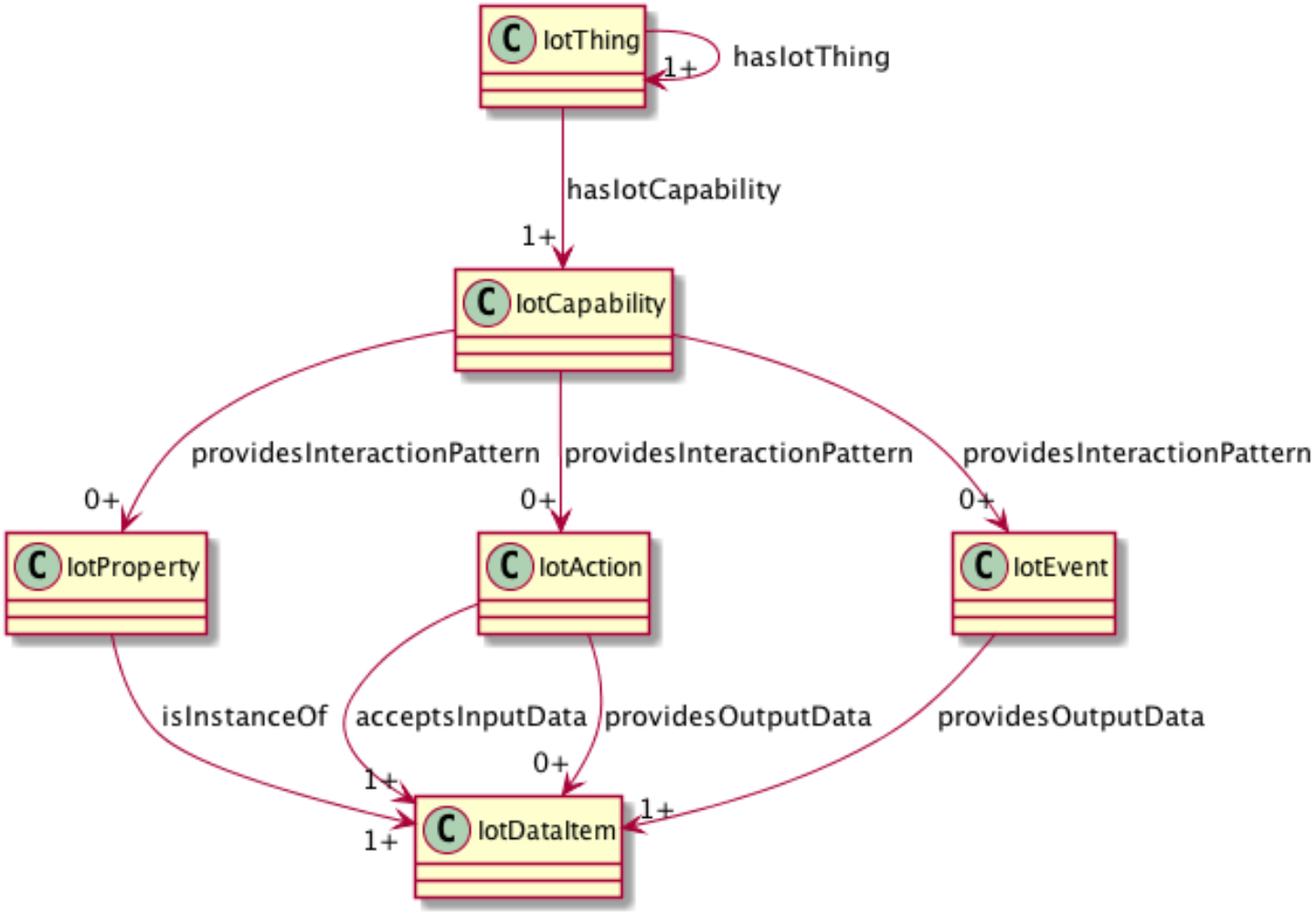
- Encapsulate reusable Capabilities
  - On/Off with state Property, Commands, and Events
  - Compose Air Conditioner Thing from OnOff, Mode, Speed, etc. as reusable Capabilities
- Reusable compositions of Capabilities
  - An Outlet unit for a multi-outlet strip
  - Each Outlet has OnOff, Energy Monitor, Overcurrent and Overtemperature protection Capabilities
  - Multiple Outlets are composed into an outlet strip
  - Outlet unit can be a Thing
  - Outlet Strip can also be a Thing

ODM Meta-Model

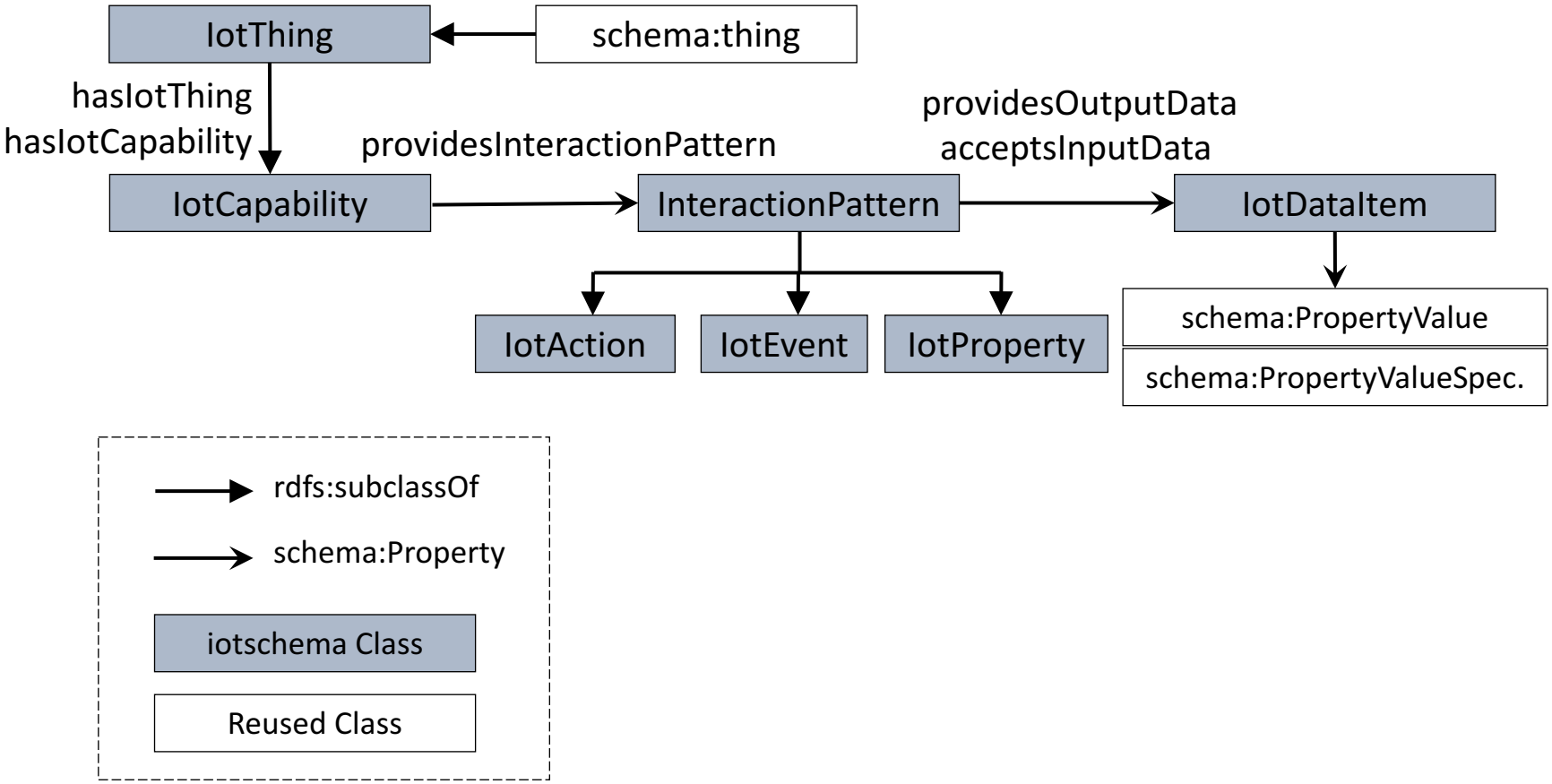
- Thing Class to compose Objects
- View (Interface) Class to virtualize affordances
- Reusable Objects
  - Property, Action, and Event Affordances
- Reusable Data Types



iotschema UML with iotThing class



schema.org IoT Extension Meta Model with Thing Class



One Data Model integration

- Re-shape One Data Model definitions as iotschema definitions
- One Data Model uses JSON object hierarchy vs. RDF links
  - JSON pointer fragment identifiers
  - odm:/#/sdfObject/onoff/sdfAction/turnon
- iot:onoffCapability => iot:providesTurnonAction => iot:turnonAction
  - iot:providesTurnonAction is a sub-class property from iot:providesInteractionPattern

iotschema from OneDM

- odm:/#/sdfObject/onoff/sdfAction/turnon
- sdfObject is "sameAs" iotCapability
- Create type names
  - odm:/#/sdfObject/switch => iot:switchCapability
  - odm:/#/sdfObject/switch/sdfAction/turnon => iot:turnOnAction (iot:switchTurnOnAction?)
- Synthesize the schema.org style property types
  - providesInteractionPattern subtypes
  - *providesSwitchTurnOnAction*

Path Construct in RDF

- source: odm:/#/sdfObject/onoff/sdfAction/turnon
  - iot:iotCapability/onoff/iotAction/turnon

  Contains the statement:
  - "@id": "odm:/#/sdfObject/onoff/sdfAction/turnon"

- What does the mapped property type look like?
  - iot:providesInteractionPattern
  - iot:providesTurnonAction
  - iot:providesiotCapability/onoff/iotAction/turnon

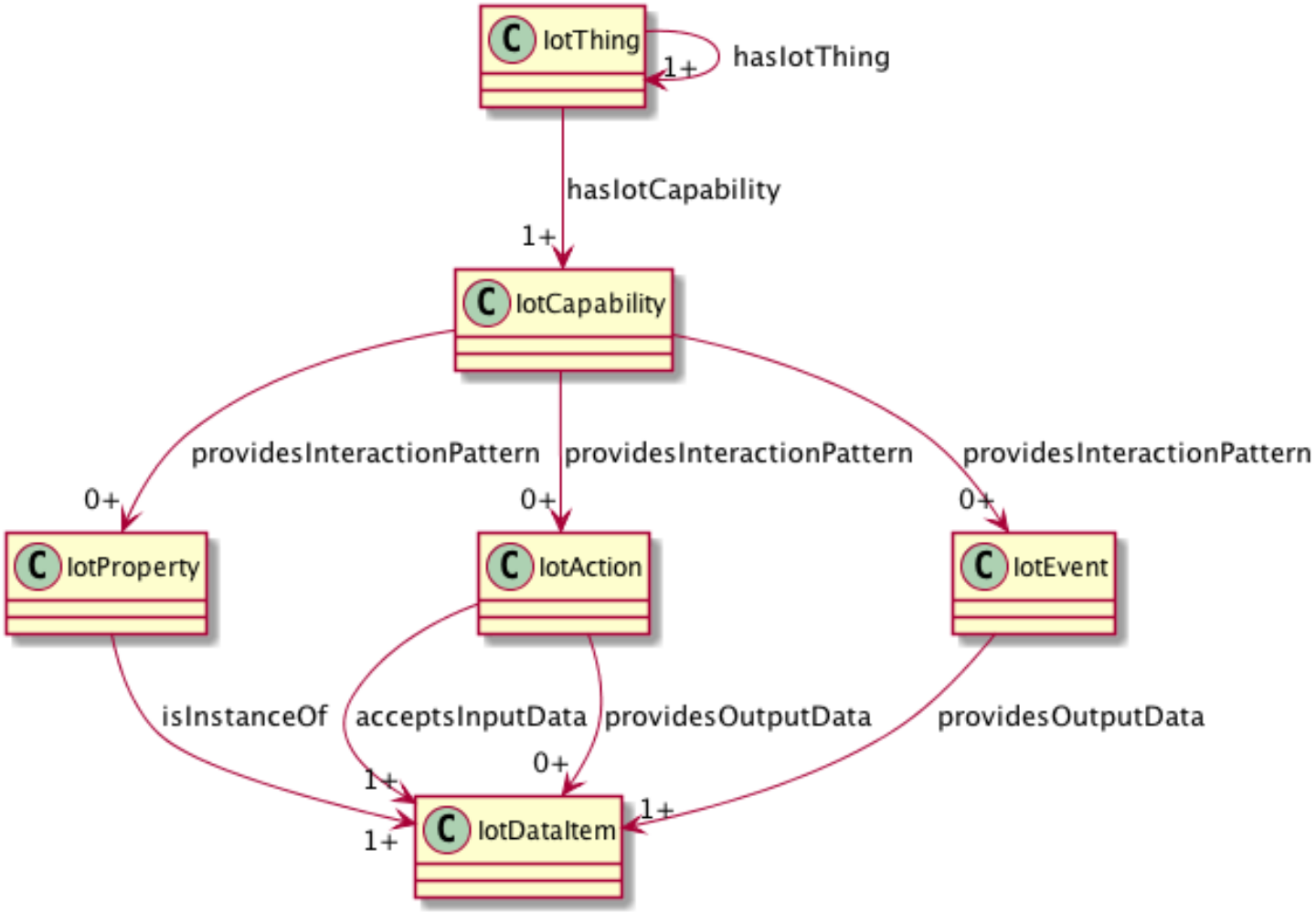
Schema.org Integration

- Class names Event, Action, Property conflict
- iotschema has diverse semantic types for objects, schema.org has diverse property types
- Property types could be synthesized from objects but…
- iotschema will potentially define hundreds of types for physical quantities (temperature, humidity, voltage, acceleration…), control affordances (open/close, brightness, color control, camera controls, operating modes…), and features of interest (rooms, machines…)

Schema.org Integration

- The WoT use case is based on annotation consisting of RDF @type statements that point to URIs of defined terms for specialized types that conform to the classes in the meta-model
- These meta-model classes would add 7 new iot types to schema.org
  - iotThing, iotCapability, iotEvent, iotAction, iotProperty, iotData, iotFeatureofInterest
  - new types like iotInterface as needed

iotschema UML



Schema.org Integration

- There is a potential example pattern in schema.org
  - MedicalEntity, with 7 property types
- Likewise, an IoT Schema instance would contain some set of iotThing, iotCapability, iotAction, iotProperty, iotEvent, iotFeatureOfInterest classes and associated Property Types
- Specialization of iot types would happen at the next level in the graph – hosted in a separate namespace
  - URIs that point to accepted specialized definitions in one or more specialized namespaces
  - lighting controls, thermostats, etc. that conform to the base types but have their own Property Types

Application Type Example