

Selecting a Data Format for an Endpoint Information Data Model

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Agenda

- Considerations (pertaining to data formats)
- Introductions
 - CBOR
 - JSON
 - XML
- Detailed Observations
- Next Steps

Considerations

- Meets SACM Requirements¹
- Supports SACM IM²
- Easy to document/understand examples?
- PROs and CONS *with respect to SACM*
 - Technical Features?
 - Compatibility Needs?
 - Others?

For example, some may complain that JSON doesn't do comments. But this isn't relevant unless SACM data formats need to have comments.

1. <https://datatracker.ietf.org/doc/draft-ietf-sacm-requirements/>
2. <https://datatracker.ietf.org/doc/draft-ietf-sacm-information-model/>

SACM Requirement Considerations

- SACM requirements which could affect choosing a data format
 - DM-003 Search Flexibility
 - DM-006 Data Cardinality
 - DM-016 Transport Agnostic
 - *There may be others...*
- Do we want a data model which supports relevant SHOULD requirements as well MUST requirements?
- Do we want to consider associated schema languages?

Concise Binary Object Representation (CBOR)¹

- CBOR is a compact, binary data format
- Potential PROs
 - Small footprint for encoding/decoding software
 - Data compactness
 - CBOR Data Definition Language (CDDL)² provides a way to express structures
- Potential CONS
 - Encoder/Decoder software availability?
 - Not human readable (i.e., more than a text editor is required)

1. <http://tools.ietf.org/html/rfc7049>

2. <https://datatracker.ietf.org/doc/draft-greevenbosch-appsawg-cbor-cddl/>

JavaScript Object Notation (JSON)¹

- JSON is a simple, text-based data interchange format
- Potential PROs
 - Simple
 - Rapid adoption taking place
- Potential CONs
 - Ambiguous data item ordering and name uniqueness (explained and addressed in I-JSON²)
 - Status of JSON Schema?

1. <https://tools.ietf.org/html/rfc7159>

2. <https://tools.ietf.org/html/rfc7493>

Extensible Markup Language (XML)¹

- XML is a text-based markup language for exchanging data
- Potential PROs
 - Established
 - Variety of standardized (and optional) capabilities
 - Namespaces
- Potential CONs
 - Verbose
 - Complex
 - Namespaces

1. <http://www.w3.org/XML/>

Relationship Between CBOR and JSON

- Underlying data model is an extension of the JSON data model
 - All JSON types map directly to CBOR
 - Some CBOR types do not have an analog in JSON
- An objective of CBOR is to support all JSON data types for conversion to and from JSON
 - JSON to CBOR conversion seems straightforward. The major question is what binary number representation(s) to use for translated numeric values.
 - CBOR to JSON conversion is more complex. Non-normative guidelines are given in the CBOR spec.
- Designing the data in JSON, and using CBOR as a compact, on-the-wire format, may be a useful strategy
 - CDDL may be leveraged to design the data structures we care about

Constraints on JSON Objects

- JSON Data Interchange Format (ECMA-404)¹ does not specify:
 - Whether or not the order of object members is significant
 - Uniqueness requirements for object member names (i.e., are duplicate names allowed?)
- JSON Data Interchange Format (RFC 7149)²
 - “JSON parsing libraries have been observed to differ as to whether or not they make the ordering of object members visible to calling software.”
 - “When the names within an object are not unique, the behavior of software that receives such an object is unpredictable.”
- Internet JSON (I-JSON) Message Format (RFC 7493)³
 - “The order of object members in an I-JSON message does not change the meaning of an I-JSON message.”
 - Objects in I-JSON messages **MUST NOT** have members with duplicate names.”

1. www.ecma-international.org/publications/files/ECMA-ST/ECMA-404.pdf

2. <https://tools.ietf.org/html/rfc7159>

3. <https://tools.ietf.org/html/rfc7493>

Impact of JSON Object Constraints on IM Data Models

- JSON Objects shouldn't be used to represent:
 - Ordered lists
 - Lists which use the same data item more than once
- An alternative is to employ JSON arrays to represent SACM lists
 - Order of array components is significant (spec is clear on that)
 - SACM data item names can be treated as data in JSON rather than as a data item

Constraints on XML Content Models

- There is mixed/limited support for open content models
 - DTD has no support for open content
 - XML Schema elements are considered closed unless special constructs are used (e.g., `xs:any`, `xs:opencontent`)
- A validating XML processor is supposed to fail when encountering an invalid XML instance

Impact of XML Content Model on IM Data Models

- Since open content cannot be assumed, neither can the extensibility of data elements
- Information element extensibility must be explicitly accounted for in the data model design
 - For instance, an XML schema would need to specify when/how extensibility is permitted

Next Steps

- Investigate YANG
 - Heavily used in the IETF
 - Can be serialized as XML, JSON, and CBOR
- Perform a detailed analysis of the SACM Requirements and how they influence the selection of a data format
- Work towards selecting a data format to develop an endpoint information data model
 - May involve prototyping a subsection of the IM with different data formats

References

Concise Binary Object Representation (CBOR)

- CBOR site (<http://cbor.io/>)
- RFC-7049 (<http://tools.ietf.org/html/rfc7049>)
- CDDL (<https://datatracker.ietf.org/doc/draft-greevenbosch-appsawg-cbor-cddl/>)

JavaScript Object Notation (JSON)

- JSON Site (<http://www.json.org/>)
- ECMA-404 (<http://www.ecma-international.org/publications/standards/Ecma-404.htm>)
- RFC-7159 (<https://tools.ietf.org/html/rfc7159>)
- RFC-7493 (<https://tools.ietf.org/html/rfc7493>)
- JSON Schema Site (<http://json-schema.org/>)
- JSON Schema in IETF (<https://tools.ietf.org/html/draft-zyp-json-schema-04>)

Extensible Markup Language (XML)

- W3C XML Site (<http://www.w3.org/XML/>)
- XML 1.0 (<http://www.w3.org/TR/2008/REC-xml-20081126/>)
- XML Schema 1.1 (<http://www.w3.org/XML/Schema>)
- Namespaces in XML 1.0 (<http://www.w3.org/TR/2006/REC-xml-names-20060816/>)
- Namespaces in XML 1.1 (<http://www.w3.org/TR/2006/REC-xml-names11-20060816/>)