Hackathon, v105

- Bill Munyan
- Carl-Heinz Genzel (remotely)
- Henk approves of this hackathon

Objectives

- Determine a data model representing “what to collect”
- Determine a data model representing “what was collected”
- Implement a simple collector
- Do cool things with XMPP
    - Use XMPP’s eXtensible <iq> stanza to orchestrate collection
    - Use various XMPP features (IQ’s and PubSub) to push collected information between XMPP entities
- Do cool things with concise map
    - Translate collected information to MAP CBOR data
    - Publish translated CBOR data to MAP
    - Extract CBOR data from MAP and reconstruct collected XML data

Data Model(s)

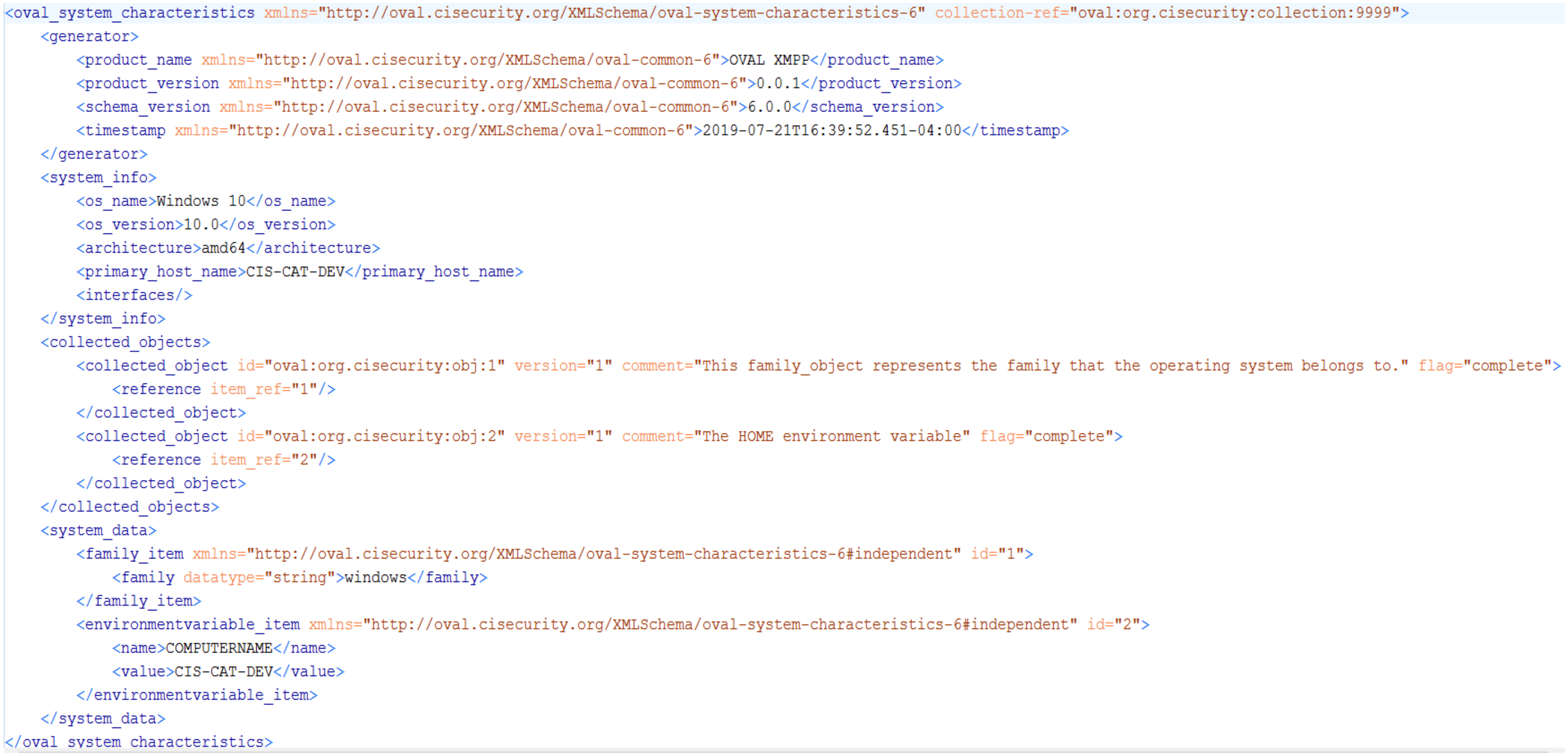
- Prior to hackathon, Bill worked on some (quick & dirty) modifications to OVAL
  - Current OVAL structure couples collection and evaluation
  - There's no way to indicate collection only
- Redefined some namespaces, and created a new "OVAL collections" schema
  - Allows for OVAL XML to only specify collection activities
  - The <oval_objects> element
  - Reduced scope (for this hackathon) to just the core and platform-independent schemas

Collection Example

```xml
<?xml version="1.0" encoding="UTF-8"?>
<oval_objects collection-id="oval:org.cisecurity:collection:9999"
    xmlns="http://oval.cisecurity.org/XMLSchema/oval-collections-6"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:ind-def="http://oval.cisecurity.org/XMLSchema/oval-definitions-6#independent"
    xmlns:oval="http://oval.cisecurity.org/XMLSchema/oval-common-6"
    xmlns:oval-coll="http://oval.cisecurity.org/XMLSchema/oval-collections-6"
    xmlns:ind-coll="http://oval.cisecurity.org/XMLSchema/oval-collections-6#independent"
    xsi:schemaLocation="http://oval.cisecurity.org/XMLSchema/oval-collections-6 oval-collections-schema.xsd http://oval.cisecurity.org/XM
    <generator>
        <oval:product_name>OVAL Collections Generator</oval:product_name>
        <oval:product_version>0.0.1</oval:product_version>
        <oval:schema_version>6.0.0</oval:schema_version>
        <oval:timestamp>2019-07-20T10:41:00-05:00</oval:timestamp>
    </generator>
    <objects>
        <ind-coll:family_object id="oval:org.cisecurity:obj:1" version="1"
            comment="This family_object represents the family that the operating system belongs to."/>

        <ind-coll:environmentvariable_object id="oval:org.cisecurity:obj:2" version="1" comment="The COMPUTERNAME environment variable">
            <ind-coll:name>COMPUTERNAME</ind-coll:name>
        </ind-coll:environmentvariable_object>
    </objects>
</oval_objects>
```

System Characteristics Example



```xml
<oval_system_characteristics xmlns="http://oval.cisecurity.org/XMLSchema/oval-system-characteristics-6" collection-ref="oval:org.cisecurity:collection:9999">
    <generator>
        <product_name xmlns="http://oval.cisecurity.org/XMLSchema/oval-common-6">OVAL XMPP</product_name>
        <product_version xmlns="http://oval.cisecurity.org/XMLSchema/oval-common-6">0.0.1</product_version>
        <schema_version xmlns="http://oval.cisecurity.org/XMLSchema/oval-common-6">6.0.0</schema_version>
        <timestamp xmlns="http://oval.cisecurity.org/XMLSchema/oval-common-6">2019-07-21T16:39:52.451-04:00</timestamp>
    </generator>
    <system_info>
        <os_name>Windows 10</os_name>
        <os_version>10.0</os_version>
        <architecture>amd64</architecture>
        <primary_host_name>CIS-CAT-DEV</primary_host_name>
        <interfaces/>
    </system_info>
    <collected_objects>
        <collected_object id="oval:org.cisecurity:obj:1" version="1" comment="This family_object represents the family that the operating system belongs to." flag="complete">
            <reference item_ref="1"/>
        </collected_object>
        <collected_object id="oval:org.cisecurity:obj:2" version="1" comment="The HOME environment variable" flag="complete">
            <reference item_ref="2"/>
        </collected_object>
    </collected_objects>
    <system_data>
        <family_item xmlns="http://oval.cisecurity.org/XMLSchema/oval-system-characteristics-6#independent" id="1">
            <family datatype="string">windows</family>
        </family_item>
        <environmentvariable_item xmlns="http://oval.cisecurity.org/XMLSchema/oval-system-characteristics-6#independent" id="2">
            <name>COMPUTERNAME</name>
            <value>CIS-CAT-DEV</value>
        </environmentvariable_item>
    </system_data>
</oval_system_characteristics>
```

Who did what?

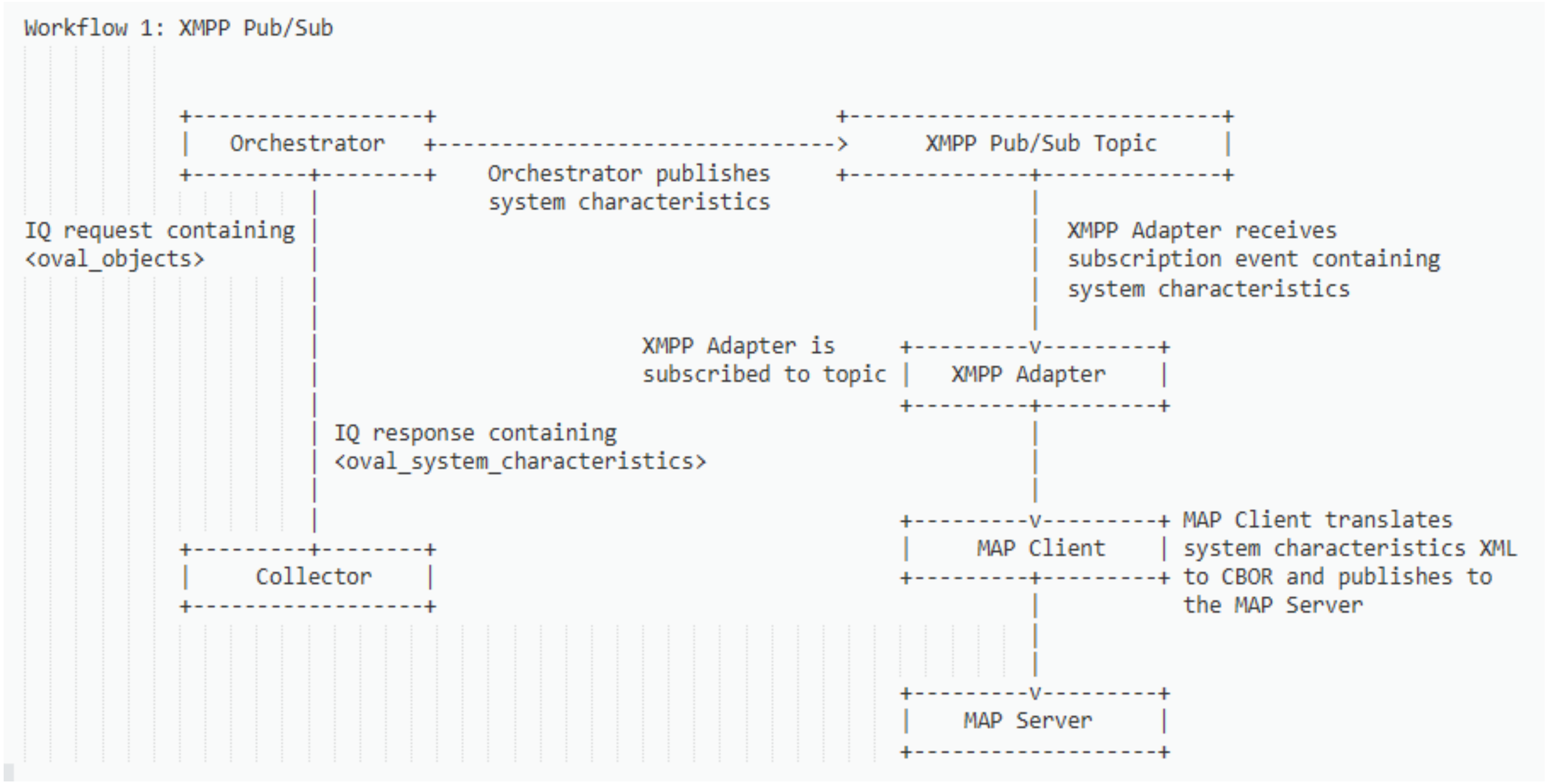
- Bill was again joined (remotely from Germany) by **Carl-Heinz**
  - CH is a MAP ninja and a java wizard

- Bill
  - Create/Enable XMPP extensions to handle collection requests (OVAL objects) and collection results (OVAL system characteristics)
  - Trigger collection through XMPP IQ stanzas
  - Collect Items at an endpoint via OVAL collection implementation
  - Push collected OVAL system characteristics to CH (2 methods)
    - Publish OVAL system characteristics to XMPP pub/sub topic
    - Enable OVAL system characteristics to be sent directly to CH via XMPP IQ stanzas
- Carl-Heinz
  - Receive collected system characteristics via XMPP adapter (pub/sub, <iq>, <message>)
  - Translate OVAL system characteristics to MAP CBOR data
  - Publish translated CBOR data to MAP
  - Search via MAP Client for Data
  - Translate Data from MAP to XML and see if it is the same as original OVAL Results

Who did what? Bill Edition

- Create/Enable XMPP extensions to handle collection requests (OVAL objects) and collection results (OVAL system characteristics)
- Trigger collection through XMPP IQ stanzas
- Collect Items at an endpoint via OVAL collection implementation
- Push collected OVAL system characteristics to CH (3 methods)
    1. Publish OVAL system characteristics to XMPP pub/sub topic
    2. Enable OVAL system characteristics to be sent directly to CH via XMPP <iq> stanzas
    3. Enable OVAL system characteristics to be sent directly to CH via XMPP <message> stanzas

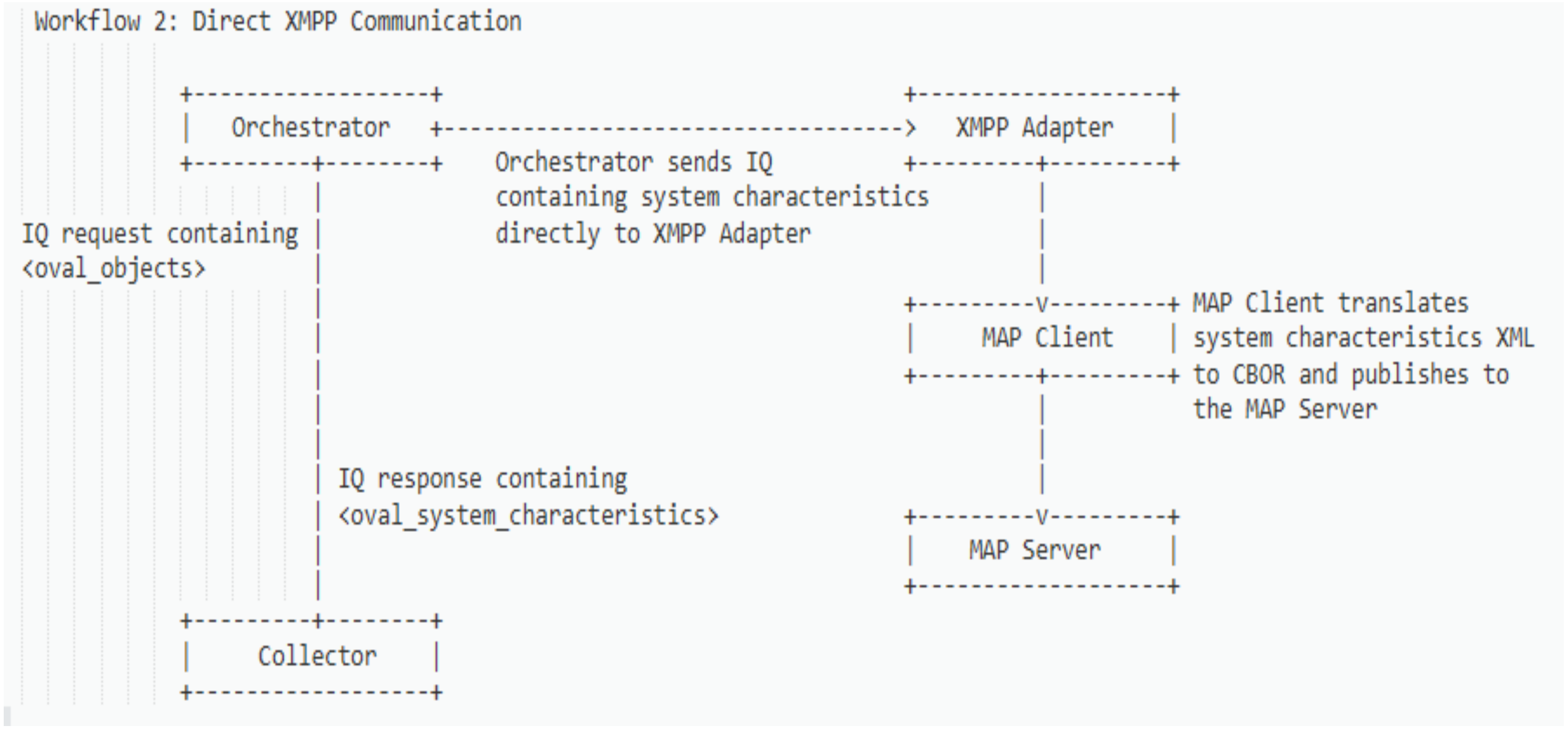
Workflow 1: Pub/Sub



```
Workflow 1: XMPP Pub/Sub


            +-------------------+                                                   +-------------------------------+
            |    Orchestrator   +--------------------------------->       XMPP Pub/Sub Topic       |
            +----------+--------+    Orchestrator publishes      +---------------+---------------+
                       |             system characteristics                       |
IQ request containing  |                                                          |  XMPP Adapter receives
<oval_objects>         |                                                          |  subscription event containing
                       |                                                          |  system characteristics
                       |                                                          |
                       |                         XMPP Adapter is     +----------v----------+
                       |                         subscribed to topic |     XMPP Adapter    |
                       |                                             +----------+----------+
                       | IQ response containing                                 |
                       | <oval_system_characteristics>                          |
                       |                                                        |
                       |                                             +----------v----------+ MAP Client translates
            +----------+--------+                                    |      MAP Client     | system characteristics XML
            |     Collector     |                                    +----------+----------+ to CBOR and publishes to
            +-------------------+                                               |            the MAP Server
                                                                                |
                                                                                |
                                                                     +----------v----------+
                                                                     |      MAP Server     |
                                                                     +---------------------+
```

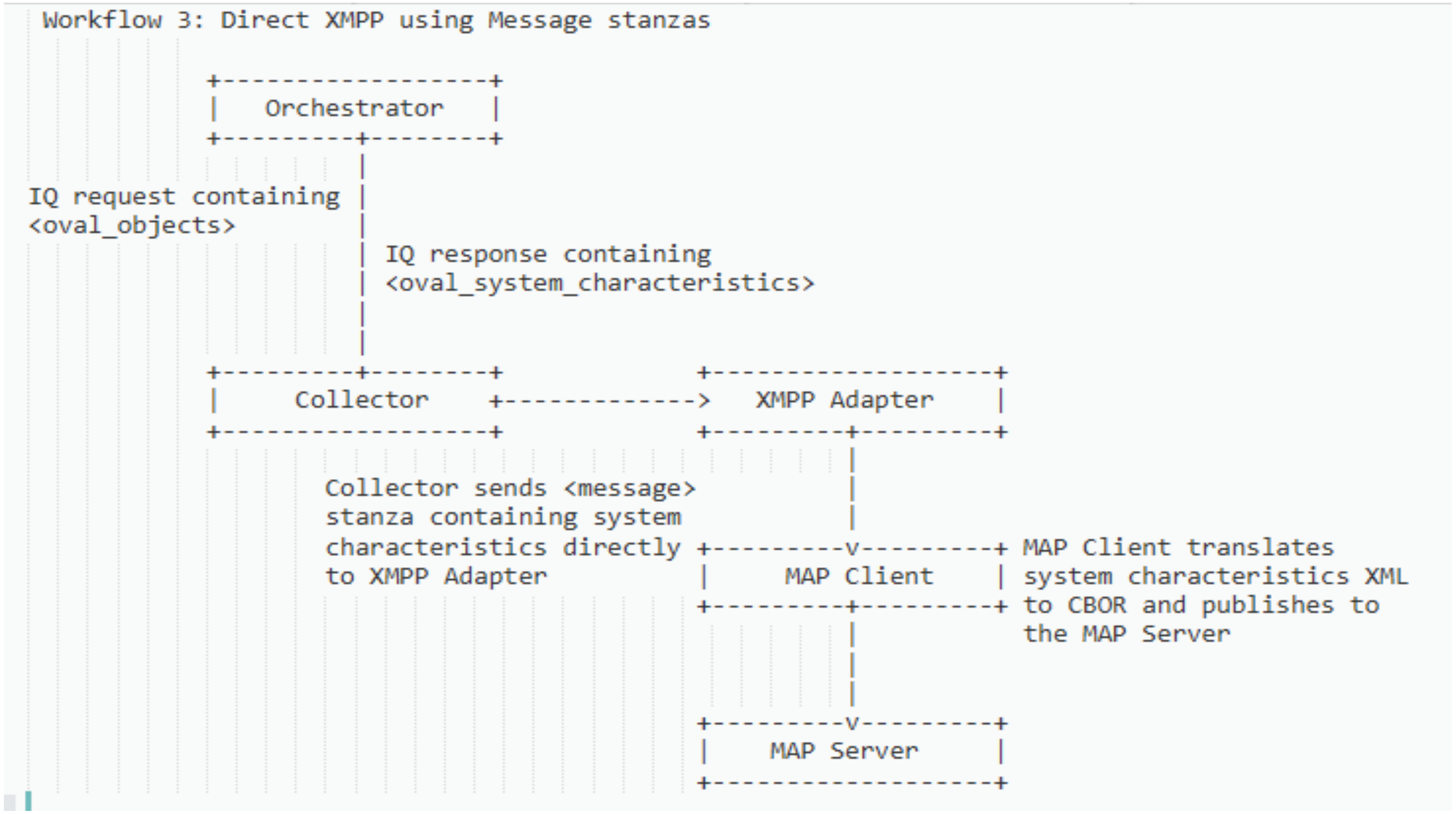
Workflow 2: Direct XMPP <iq>



```
Workflow 2: Direct XMPP Communication

            +------------------+                                   +--------------------+
            |   Orchestrator   +----------------------------------->   XMPP Adapter     |
            +---------+--------+    Orchestrator sends IQ          +----------+---------+
                      |             containing system characteristics         |
IQ request containing |             directly to XMPP Adapter                  |
<oval_objects>        |                                                       |
                      |                                            +----------v---------+ MAP Client translates
                      |                                            |     MAP Client     | system characteristics XML
                      |                                            +----------+---------+ to CBOR and publishes to
                      |                                                       |           the MAP Server
                      |                                                       |
                      | IQ response containing                                |
                      | <oval_system_characteristics>              +----------v---------+
                      |                                            |    MAP Server      |
                      |                                            +--------------------+
            +---------+--------+
            |     Collector    |
            +------------------+
```

Workflow 3: Direct XMPP <message>



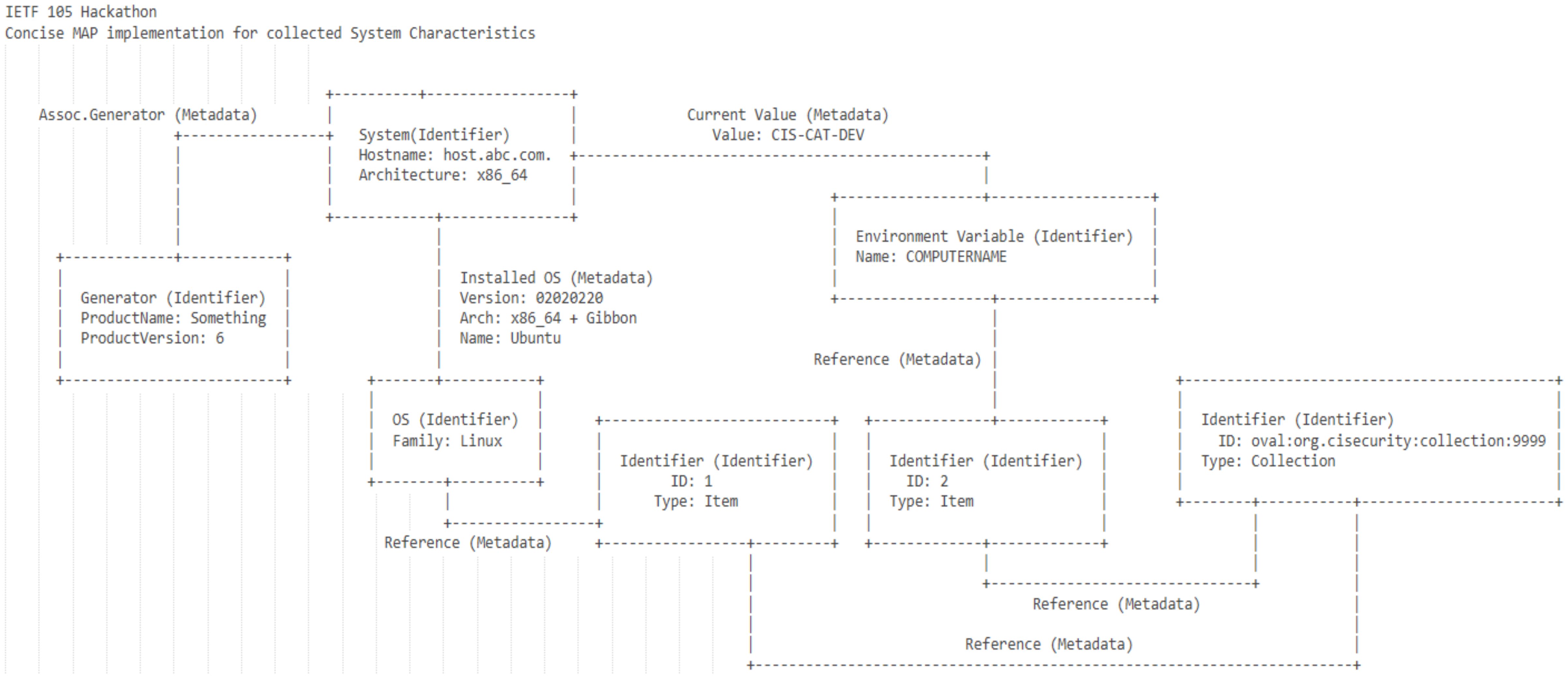
```
Workflow 3: Direct XMPP using Message stanzas

           +-------------------+
           |   Orchestrator    |
           +---------+---------+
                     |
IQ request containing |
<oval_objects>       |
                     | IQ response containing
                     | <oval_system_characteristics>
                     |
                     |
           +---------+---------+            +--------------------+
           |     Collector     +------------->  XMPP Adapter     |
           +-------------------+            +---------+----------+
                                                      |
                   Collector sends <message>          |
                   stanza containing system           |
                   characteristics directly +---------v----------+ MAP Client translates
                   to XMPP Adapter          |     MAP Client     | system characteristics XML
                                            +---------+----------+ to CBOR and publishes to
                                                      |            the MAP Server
                                                      |
                                                      |
                                            +---------v----------+
                                            |     MAP Server     |
                                            +--------------------+
```

Who did what? Carl-Heinz Edition

- Subscribe to XMPP pub/sub topic to receive collected system characteristics
- Translate OVAL system characteristics to MAP CBOR data
- Publish translated CBOR data to MAP
- Search via MAP Client for Data
- Translate Data from MAP to XML and see if it is the same as original OVAL Results

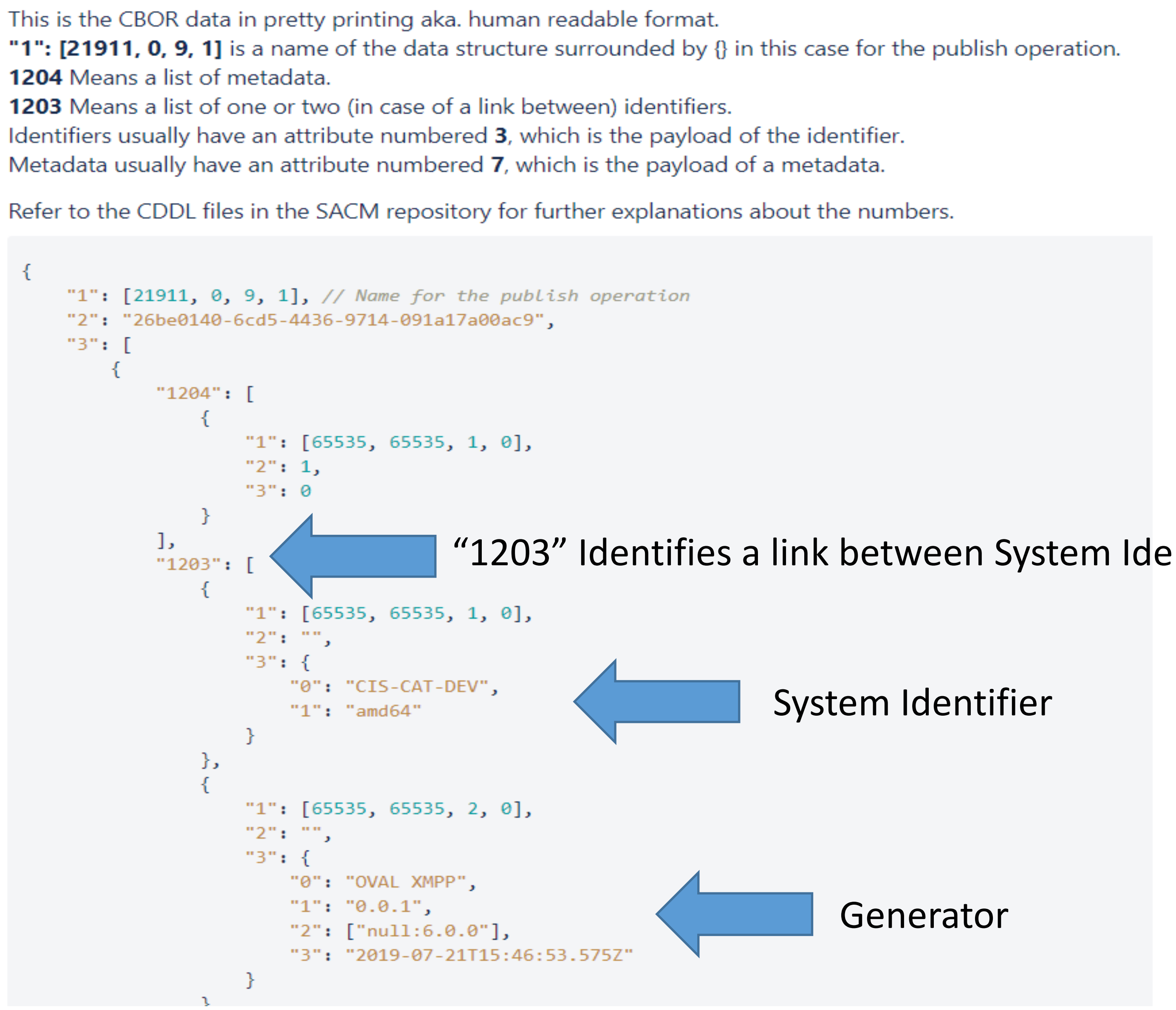
Storage: Concise Map



```
IETF 105 Hackathon
Concise MAP implementation for collected System Characteristics


                                    +----------+----------------+
  Assoc.Generator (Metadata)        |                           |        Current Value (Metadata)
               +--------------------+  System(Identifier)       |          Value: CIS-CAT-DEV
               |                    |  Hostname: host.abc.com.  +--------------------------------------+
               |                    |  Architecture: x86_64     |                                      |
               |                    |                           |                  +-----------------+-----------------+
               |                    +------------+--------------+                  |                                   |
               |                                 |                                 |  Environment Variable (Identifier) |
     +---------+------------+                    |                                 |  Name: COMPUTERNAME               |
     |                      |                    |  Installed OS (Metadata)        |                                   |
     |  Generator (Identifier) |                 |  Version: 02020220              +------------------+----------------+
     |  ProductName: Something |                 |  Arch: x86_64 + Gibbon                             |
     |  ProductVersion: 6   |                    |  Name: Ubuntu                                      |
     |                      |                    |                              Reference (Metadata)  |
     +----------------------+            +-------+---------+                                        |         +-------------------------------------+
                                         |                 |                                        |         |                                     |
                                         |  OS (Identifier)|  +------------------------+  +-----------+------+  |  Identifier (Identifier)            |
                                         |  Family: Linux  |  |                        |  |                  |  |    ID: oval:org.cisecurity:collection:9999 |
                                         |                 |  |  Identifier (Identifier) | | Identifier (Identifier) | | Type: Collection             |
                                         +--------+--------+  |      ID: 1             |  |   ID: 2          |  |                                     |
                                                  |           |     Type: Item         |  |  Type: Item      |  +--------+-------------+--------------+
                                                  +-----------+                        |  |                  |           |             |
                                      Reference (Metadata)    +-------------+----------+  +--------+---------+           |             |
                                                                            |                      |                     |             |
                                                                            |                      +---------------------+             |
                                                                            |                         Reference (Metadata)             |
                                                                            |                                                          |
                                                                            |                  Reference (Metadata)                    |
                                                                            +----------------------------------------------------------+
```

Translation to CBOR



This is the CBOR data in pretty printing aka. human readable format.
"1": [21911, 0, 9, 1] is a name of the data structure surrounded by {} in this case for the publish operation.
1204 Means a list of metadata.
1203 Means a list of one or two (in case of a link between) identifiers.
Identifiers usually have an attribute numbered **3**, which is the payload of the identifier.
Metadata usually have an attribute numbered **7**, which is the payload of a metadata.

Refer to the CDDL files in the SACM repository for further explanations about the numbers.

```
{
    "1": [21911, 0, 9, 1], // Name for the publish operation
    "2": "26be0140-6cd5-4436-9714-091a17a00ac9",
    "3": [
        {
            "1204": [
                {
                    "1": [65535, 65535, 1, 0],
                    "2": 1,
                    "3": 0
                }
            ],
            "1203": [
                {
                    "1": [65535, 65535, 1, 0],
                    "2": "",
                    "3": {
                        "0": "CIS-CAT-DEV",
                        "1": "amd64"
                    }
                },
                {
                    "1": [65535, 65535, 2, 0],
                    "2": "",
                    "3": {
                        "0": "OVAL XMPP",
                        "1": "0.0.1",
                        "2": ["null:6.0.0"],
                        "3": "2019-07-21T15:46:53.575Z"
                    }
```

“1203” Identifies a link between System Identifier and Generator

System Identifier

Generator

Things we Learned

- We were able to move data between components using 3 methods supported by XMPP
  - Publish/Subscribe
  - Direct messaging via <iq> stanzas containing custom payload
  - Direct messaging via <message> stanzas containing custom payload
- Carl-Heinz was also able to query the MAP data and reconstruct the OVAL system characteristics from it.
  - May enable downstream operations if they require the XML data
- Right now there's no way to configure a MAP client with the things you want to know. There's only pre-configured clients.
  - Meaning, specific CDDL and implementation was required before the MAP client could translate the system characteristics.
  - This could fall under capability discovery, i.e. "what specific system characteristics can my MAP client handle?"

What’s next?

- Keep Going!
  - As we define operations, start to include them as part of the architecture draft and build a library of data models
  - Can we define a core set of operations, and build upon them with extension points?
    - (use XMPP as an example – there’s only 3 core operations, and XEPs build upon that)
    - Can we define an “architecture core” and enable “SACM extension protocols”?

- Continue to refine the OVAL collection models
  - More platform-specific schema migrations
  - Propose to SCAP 2.0 working groups (endpoint data collection, OVAL)
- Build more collection capabilities based on the models
- Evaluation (or other downstream) operations

Thanks

- **BIG THANKS** to Carl-Heinz for his contributions to the Hackathon
  - Especially for staying awake into the wee hours of the morning
- Also thanks to Henk for enabling collaboration between Bill and Carl-Heinz, and getting us going on various calls before Hackathon