OIIE Scenario 29 – Publish Current Operational Data and State Events from CONTROL to O&M

Many ORM (Operational Risk Management) systems need a near real-time measurement, alarm, and event feed from CONTROL systems which are publishing near real-time current operating data, alarms, and events associated with functional locations or serialized assets. Commonly, the CONTROL system is provided by an OPC UA server. The ORM is used as a typical example of an O&M system(s) that make use of such near real-time data. This scenario encompasses the use of OPC UA and MIMOSA CCOM measurement, alarm, and event data in a variety of configurations.

Actors

CONTROL System	Publishes near real-time current operating data, alarms, and events related to "tags" (measurement location, asset, device/transducer, functional location, etc.)
Operational Risk Management System	Subscribes to current operating data, alarms, and events for pre-selected "tags" (measurement location, asset, device/transducer, functional location, etc.)

Data Content

The data sent from the CONTROL System to the ORM System comprises near real-time measurement data including:

- The measurement/data value
- The timestamp at which the value was acquired
- The data quality
- Any associated events
- Any associated alarms

Additionally, contextual data must be provided, which may comprise any of the following:

- The physical/virtual measurement location at which the measurement was taken
- The functional location
- The serialized asset
- The device/transducer that took the measurement
- The measurement source/data collector from which the measurement data was published
- Any Agent(s) and/or AgentRole(s) associated with an event/alarm (e.g., person who acknowledged an alarm)

MIMOSA CCOM Reference Types

For the purposes of reference data management, the following MIMOSA CCOM types may be referenced:

- AgentRoleType
- AgentType
- AssetType
- CalculationType
- DataQualityType
- EventType
- HighlightType (for alarm visualization)
- MeasurementLocationType
- MeasurementSourceType
- PostScalingType
- RegionType (for alarming)
- SegmentType
- SeverityLevelType (for alarm regions)
- TransducerAxisDirectionType
- TransducerType
- UOMQuantity/UnitOfMeasurement

OPC UA Reference Types

For the purposes of reference data management and mapping, the following OPC UA types may be referenced:

- AggregateFunctionType – OPC UA Parts 5, 8, & 13
- BaseVariableType – OPC UA Parts 5 & 8
- EUInformation – OPC UA Part 5 & 8
- BaseEventType (where the type is not one of the more specific types listed below) – OPC UA Part 5
- LimitAlarmType – OPC UA Part 9
- DiscreteAlarmType – OPC UA Part 9
- DiscrepancyAlarmType – OPC UA Part 9
- RoleType – OPC UA Part 5

NOTE Due to the diversity of OPC UA information models, subtypes of the above will need to be mapped to common reference data on a per information model basis.

NOTE The Transformation Rules section below describes only an abstract mapping between OPC UA and MIMOSA CCOM: a more detailed mapping may be realized by the OPC UA / MIMOSA CCOM companion specification.

System Interoperability Events

This scenario the requires the sending/receipt of the following Events:

- Publish Measurement Data
- Publish Alarm and State Event Data

Data Formats

The measurement, event, and alarm data ***received*** by the O&M systems must conform to MIMOSA CCOM BODs (XML or JSON, preferring the latter).

The measurement, event, and alarm data ***published*** by the CONTROL system (either directly or via an adapter) must conform to one of the following:

- MIMOSA CCOM BODs (XML or JSON, preferring the latter); or
- OIIE BODs for OPC UA content in OPC UA XML or OPC UA JSON format according to OPC UA Part 6 Mappings 1.04 specification as described in the IEC 62541-6:2020 standard. Depending on the type of data the content will comprise:
    - Published measurement data must comply with OPC UA Part 8 - Data Access 1.04 specification as described in the IEC 62541-8:2020 standard.
    - Published event and alarm data must comply with OPC UA Part 9 - Alarms and Conditions 1.04 specification as described in the IEC 62541-9:2020 standard.

Infrastructural Components

ISBM

The communication between all systems occurs via the ISBM using publish-subscribe services via the REST interface. In the case of the CONTROL system, this refers to the CONTROL system itself or an independent adapter acting as a gateway.

Implementation Requirements

The CONTROL system must implement a REST client for the ISBM Provider Publication and Channel Management (only the GetChannel operation) Services.

The O&M system(s) must implement a REST client for the ISBM Consumer Publication and Channel Management (only the GetChannel operation) Services. The O&M system may implement the ISBM Notify Listener Service for message notification.

Suggested Channel/Topic Configuration

A channel should be created for publications and should conform to the following format:

```
/Enterprise/Enterprise Subdivision/.../ISO18435:D1.1/Publication
```

For example:

```
/Demo Enterprise/Refinery A/Area A/Light Ends Area/ISO18435:D1.1/Publication
```

As outlined in the document ISBM Guidelines, topics should match the message content. Correspondingly, the following topic format should be used:

```
OIIE:S29:V1.2/StandardSchemaName{:Version}
```

For example:

```
OIIE:S29:V1.2/OPCUA-XML:SyncDataAccess:V1.04
OIIE:S29:V1.2/OPCUA-JSON:SyncAlarmsAndConditions:V1.04
```

```
OIIE:S29:V1.2/CCOM-XML:SyncMeasurements:V1.0
OIIE:S29:V1.2/CCOM-JSON:SyncActualEvents:V1.0
OIIE:S29:V1.2/CCOM-JSON:SyncMeasurementLocationTriggeredRegions:V1.0
```

SDAIR

The Scenario may require the use of an SDAIR in the following capacities:

- Registry of contextual data including any or all of the following: functional location tags, serialized assets, measurement locations, measurement device/transducer tags, and measurement sources/data collectors

Transform Engine

A transform engine *MAY* be used in this Scenario to convert the measurement, event, and alarm data from OPC UA format from the CONTROL system to MIMOSA CCOM format for the receiving O&M systems. Only a one-way mapping from OPC UA to MIMOSA CCOM is required for this Scenario. Identifier transformation is only required if the OPC UA NodeIds and EventIds do not conform to MIMOSA CCOM UUIDs.

NOTE Although the CONTROL system is part of the O&M Execution Environment, the measurement, event, and alarm data will already be shared within the OPC UA environment; therefore, there is no need to consider a bi-directional transformation between OPC UA and MIMOSA CCOM for this Scenario as the CONTROL system is unlikely to be receiving the data published to the ISBM.

NOTE It is also possible for the OPC UA / MIMOSA CCOM Adapter to implement the transformation rules directly rather than utilize a distinct Transform Engine.

Transformation Rules

The following is a general set of rules describing the required transformation of OPC UA data to MIMOSA CCOM.

- The CONTROL system and/or individual OPC UA servers will be identified with InfoSource objects.
- OPC UA Variables of interest become MeasurementLocations.
    - If the origin of the Variable/MeasurementLocation is the CONTROL system, a UUID will need to be generated and the NodeID of the Variable will become placed in the IDInInfoSource field (with an InfoSource corresponding to the CONTROL system or OPC UA server).
    - Otherwise, the mapping to the MeasurementLocation from the Engineering Data or Asset Data will need to be retrieved.
    - Depending on the parent of the Variable, the MeasurementLocation may be for an Asset or a Segment.
- Variable Data Change Events become Measurements with the EventID placed in the IDInInfoSource field and a new UUID generated for the Measurement object.
- Alarm Types, i.e., subtypes of LimitAlarmType, DiscreteAlarmType, and DiscrepancyAlarmType, should map to EventTypes defined by common reference data.
- The limit configuration variables of LimitEventTypes (e.g, HighLimit, LowLimit, etc.) become Region and RegionType configurations of the parent MeasurementLocation.
- Discrete Alarm Events become ActualEvents with the EventID placed in the IDInInfoSource field and a new UUID generated for the ActualEvent object.
- Limit Alarm Events and Discrepancy Alarm Events become MeasurementLocationTriggeredRegions, with the EventID placed in the IDInInfoSource field and a new UUID generated for the MeasurementLocationTriggeredRegion event.

- EUInformation maps to UnitOfMeasure and UOMQuantity objects

NOTE More detailed transformation rules may be available in an OPC UA / MIMOSA CCOM Companion Specification.

CIR

The CIR is used to keep track of the object mappings between all systems for contextual data.

Additionally, the CIR is used to keep track of measurement, event, and alarm object mappings for ***historized*** measurement, event, and alarms data. Non-historized data may not require tracking of the mappings as it will not be possible to query the CONTROL system for the non-historized data later. Refer Scenario 31.

Suggested Categories Configuration

The following CIR categories are suggested:

OPC UA Categories	MIMOSA CCOM Categories
Equipment	Segment
Device	Asset
Variable	Measurement Location
Variable Data Change Events	Measurement
Event Types	Event Type
Discrete Alarm Event	Actual Event
Limit Alarm Event	Measurement Location Triggered Region
Discrepancy Alarm Event	Measurement Location Triggered Region
User Identities/Clients	Agent / Agent Role
Role Type	Agent Role Type

In general, the identifiers of the OPC UA Nodes will be the NodeID, and the identifiers of OPC UA Events will be the EventID field.

OIIE Adapter for OPC UA

An independent OIIE adapter may be used as a gateway between the OPC UA environment of the CONTROL system and the ISBM. Such an adapter may directly implement the transformation rules described for the Transform Engine or call on the services of the Transform Engine.

Communication between the independent OIIE adapter and the CONTROL system occurs via OPC UA Part 4 Services, while communication between the OIIE adapter and the O&M system(s) occurs via the ISBM using publish-subscribe services via the REST interface.

Implementation Requirements

The independent OIIE adapter must implement an OPC UA Part 4 Services compliant client, specifically the subset of services required by OPC UA Part 8 Data Access and OPC UA Part 9 Alarms and Conditions, and subscribe to the appropriate OPC UA servers available from the CONTROL system.

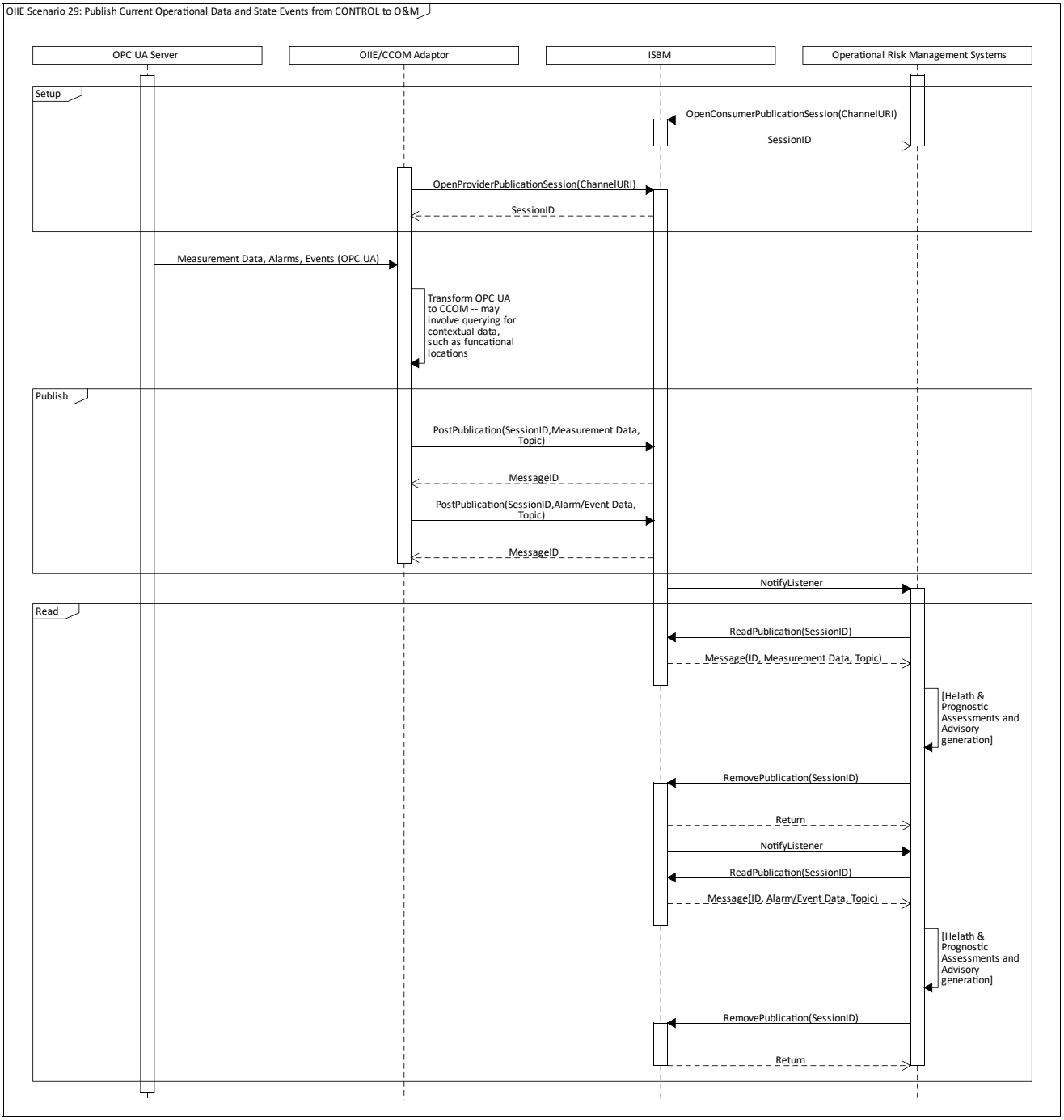
The independent OIIE adapter will subscribe to the Variable and Event nodes of interest from the CONTROL system and may be read-only.

The independent OIIE adapter must implement a REST client for the ISBM Provider Publication and Channel Management (GetChannel operation only) Services.

Event Sequence

The following diagram represents a simplified set of exemplar interactions between the systems required to achieve this Scenario. The ORM actor is assumed to have OIIE/ISBM adapter implemented as required, with services according to the ISBM Implementation Requirements described above. For simplicity, it is assumed that each system/adapter implements the optional Notify Listener service.

The example illustrates the CONTROL system as an OPC UA client with an OIIE adapter publishing MIMOSA CCOM data to the ISBM (using services according to the ISBM Implementation Requirements above). The OIIE adapter is also an OPC UA server subscribed to relevant measurement, event, and alarm nodes in the OPC UA environment and which performs the OPC UA to MIMOSA CCOM mapping internally. Other configurations are also supported by this Scenario, for example, the OIIE adapter publishing OIIE BODs for OPC UA content with an explicit Transform Engine performing the transformation from OPC UA to MIMOSA CCOM.



Version Applicability/Alignment

Scenarios describe general data requirements and, hence, they are aligned to specific versions of CCOM and/or other MIMOSA standards. For example, older versions of CCOM may not include the data elements required by newer Scenarios, while older Scenarios may become obsolete or have their data requirements change over time.

This Scenario is applicable to the following versions of CCOM:

- CCOM 3.x (part of OSA-EAI 3.x)
- CCOM 4.x

NOTE Use of 'x' in the version number indicates a variable version. For example, "4.x" indicates applicability to all versions of CCOM with the MAJOR version '4', regardless of MINOR and PATCH versions.

This Scenario is applicable to the following OPC UA Parts and versions (and their normative references):

- OPC UA Part 4 – Services v1.04 (IEC 62541-4:2020)
- OPC UA Part 6 – Mappings v1.04 (IEC 62541-6:2020)
- OPC UA Part 8 – Data Access v1.04 (IEC 62541-8:2020)
- OPC UA Part 9 – Alarms and Conditions v1.04 (IEC 62541-9:2020)

Document Versioning

Version	Date	Major Changes
1.2	2020-12-11	Updated to use OpenO&M template. Added detail to the OPC UA aspects and its general mapping to CCOM.
1.1	2019-02-16	Updated to revised Use Case Architecture. Expanded definition of the scenario to encompass both OPC UA and CCOM data.
1.0	2019-02-09	Imported from old draft use case documentation.