Latest News on OPC UA and PubSub
OPC UA over MQTT Enhancements

Matthias Damm
Executive Director, Unified Automation matthias.damm@unifiedautomation.com

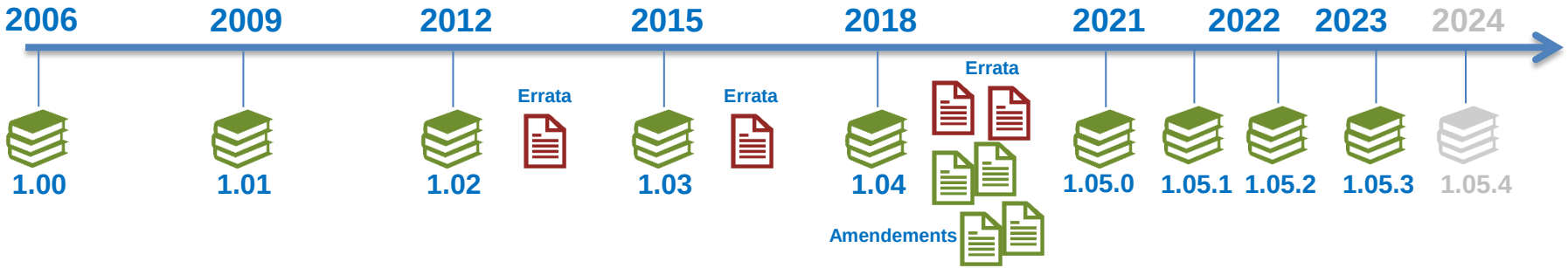
Editor OPC UA Part 4 – Services & Part 14 – PubSub
Chairman MQTT subgroup of OPC UA WG
Chairman OPC UA for Devices WG
OPC Foundation Technical Control Board
OPC Foundation Board of Directors

News on OPC UA platform, PubSub and MQTT

- Status OPC Unified Architecture
  - Optimized release process
  - 1.05.03 release
- OPC UA over MQTT Enhancements
  - New dedicated MQTT working group (subgroup of OPC UA WG)
  - First results for OPC UA 1.05.03
    - MQTT topic tree and meta-data discovery
    - JSON header layouts with pre-defined header settings for different use cases

→ OPC Foundation continuously improves the OPC UA platform

Transition to Agile OPC UA Specification Development



- OPC UA (OPC 10000) Specification Release Cycle was three years
- Errata handled as additional document since OPC UA 1.02
- Amendments introduced with OPC UA 1.04
  - Enhancements as feature releases between major spec releases
  - Dedicated Amendment per feature to speed up support for companion working groups
- Change to new release model with OPC UA 1.05
  - Shorter regular release cycle with a duration of six months
  - All parts with changes (clarification, errata, feature) get released as 1.05.XX batch
  - **Next release is 1.05.03 in December 2023**

OPC UA 1.05 Release Status

1.05.00 release completed (10/2021)

1.05.01 release completed (03/2022)

1.05.02 release completed (11/2022)

1.05.03 release expected 12/2023

- Release candidate distributed July 2023
- All Parts will have a 1.05 version, including Part 11: Historical Access
- Part 14 with first enhancements from new MQTT working group

OPC Number	Title	1.03	1.04	1.05.00	1.05.01	1.05.02	1.05.03
10000-1	Part 1: Overview and Concepts	☑	☑	☐	☐	☑	☐
10000-2	Part 2: Security	☑	☑	☐	☐	☑	☐
10000-3	Part 3: Address Space Model	☑	☑	☑	☑	☑	☑
10000-4	Part 4: Services	☑	☑	☑	☐	☐	☑
10000-5	Part 5: Information Model	☑	☑	☑	☑	☑	☑
10000-6	Part 6: Mappings	☑	☑	☑	☑	☐	☑
10000-7	Part7: Profiles	☑	☑	☐	☐	☑	☐
10000-8	Part 8: DataAccess	☑	☑	☑	☐	☐	☑
10000-9	Part 9: Alarms and Conditions	☑	☑	☐	☑	☑	☑
10000-10	Part 10: Programs	☑	☑	☑	☐	☐	☐
10000-11	Part 11: Historical Access	☑	☑	☐	☐	☐	☑
10000-12	Part 12: Discovery and Global Services	☑	☑	☐	☐	☑	☐
10000-13	Part 13: Aggregates	☑	☑	☐	☐	☑	☐
10000-14	Part 14: PubSub	☐	☑	☐	☑	☑	☑
10000-15	Part 15: Safety	☐	☑	☑	☐	☑	☑
10000-16	Part 16: State Machines	☐	☐	☑	☐	☑	☐
10000-17	Part 17: Alias Names	☐	☑	☑	☐	☐	☐
10000-18	Part 18: Role-Based Security	☐	☐	☑	☑	☑	☑
10000-19	Part 19: Dictionary References	☐	☐	☑	☐	☑	☑
10000-20	Part 20: File Transfer	☐	☐	☑	☑	☑	☑
10000-21	Part 21: Device Onboarding	☐	☐	☐	☐	☑	☐
10000-22	Part 22: Base Network Model	☐	☐	☐	☑	☑	☑
10000-23	Part 23: Common ReferenceTypes	☐	☐	☐	☑	☑	☐
10000-24	Part 24: Scheduler	☐	☐	☐	☐	☑	☐

New MQTT sub group of OPC UA working group

- PubSub MQTT transport protocol mapping defined since first release (1.04)
- PubSub JSON message mapping defined since first release (1.04)
- Prototyping and use case discussions very OT centric (UADP with UDP or Ethernet) with many experts from FLC / OPC UA FX working groups

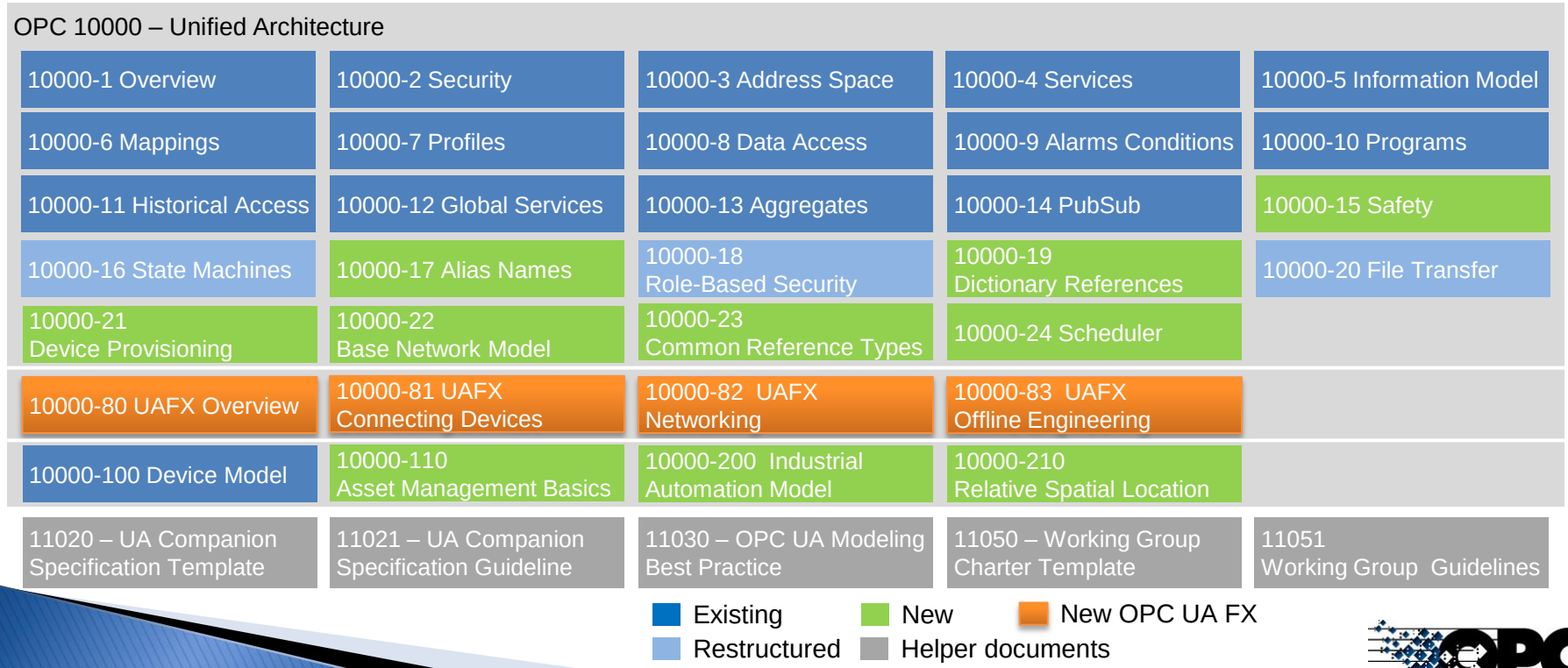
MQTT sub group started to get more IT experts to discuss IT messaging

- Subgroup started December 2022
- Input completed for 1.05.03 OPC UA Part 14 release
  - JSON header layouts with pre-defined header settings for different use cases
  - MQTT topic tree and meta-data discovery
- Current and upcoming work items
  - Commands through PubSub messaging (1.05.04)
  - OPC UA address space information availability through MQTT
  - Optimization of DataSet metadata

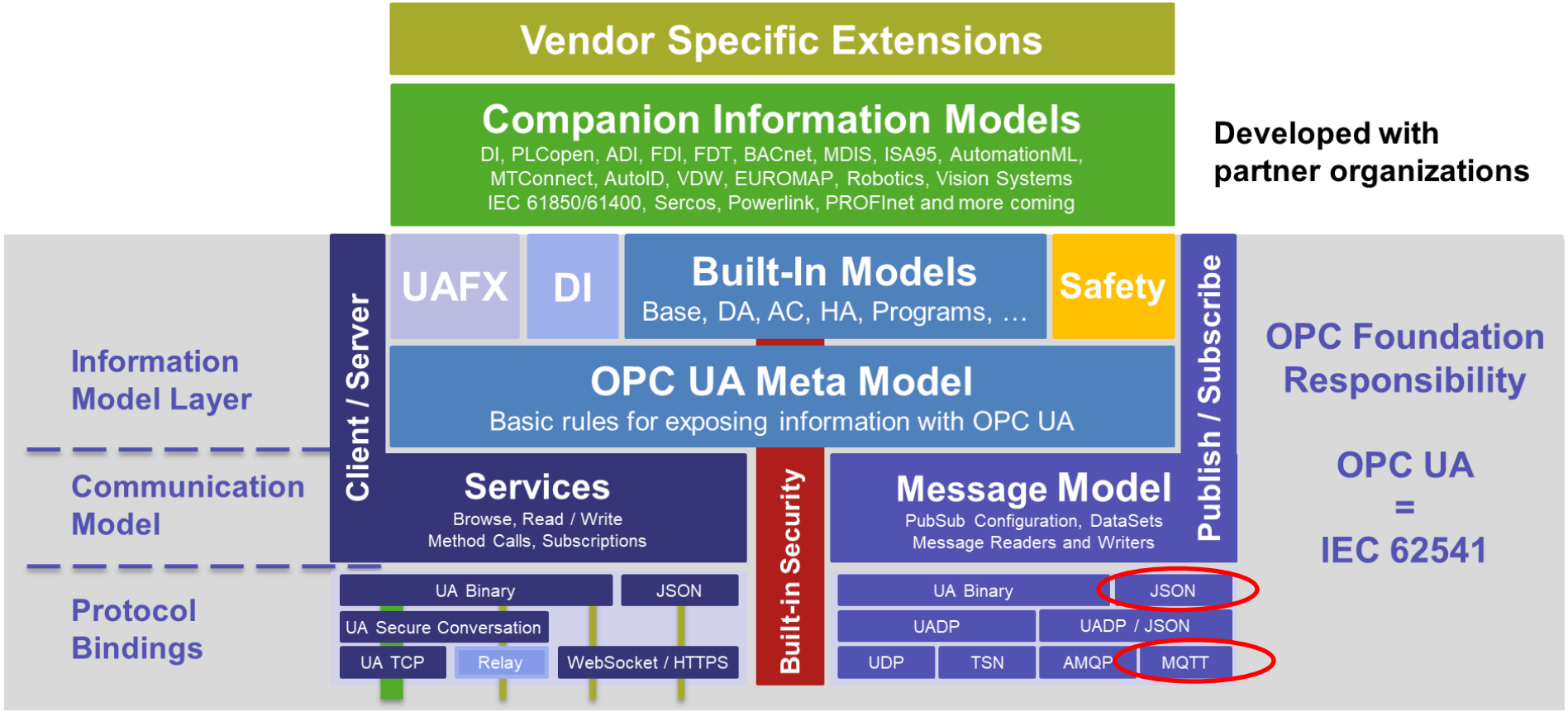
OPC FOUNDATION

OPC UA Ecosystem

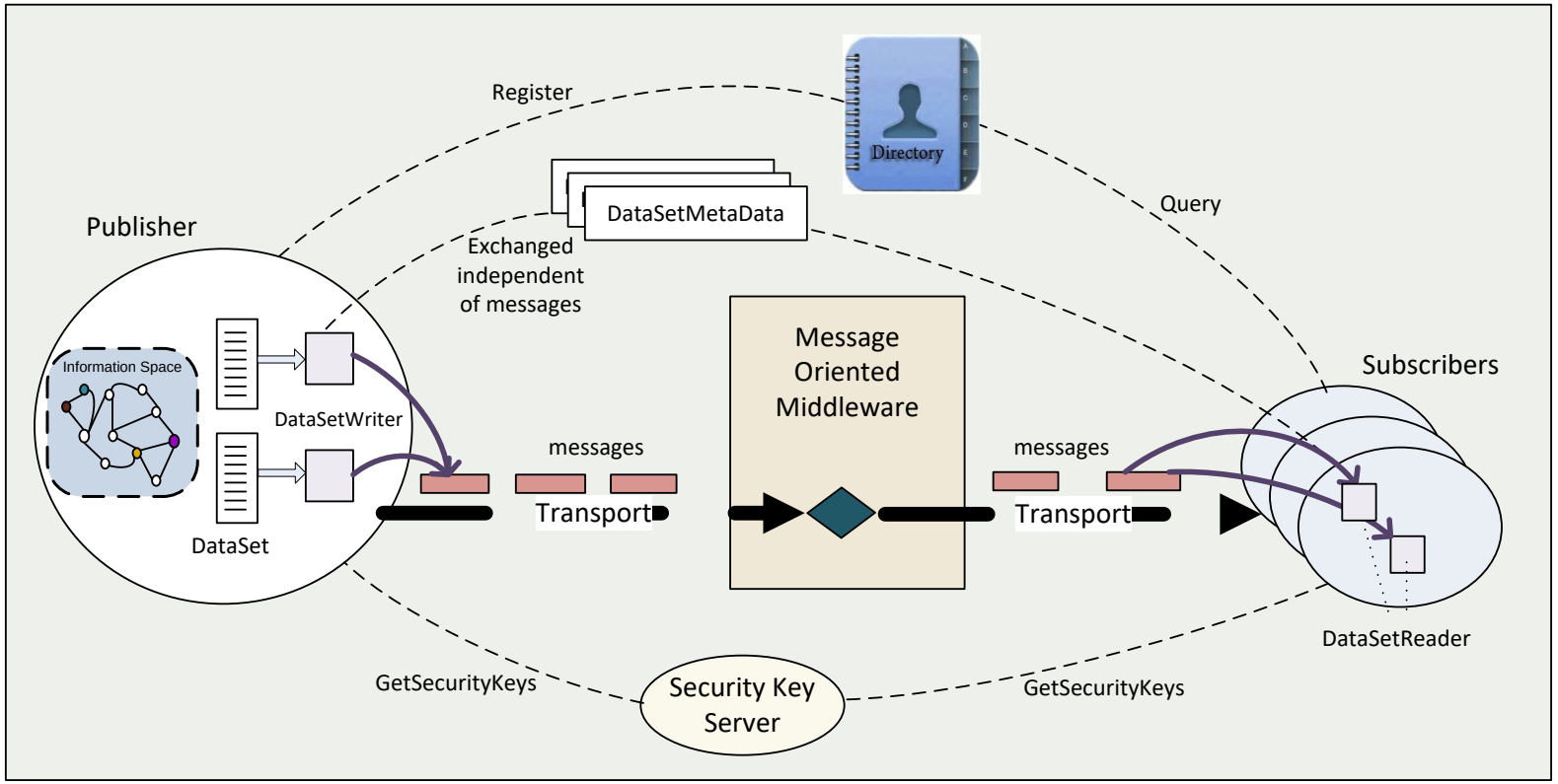
- Stable and established IIoT platform as base for many information model WGs
- Continuous improvement based on feedback and input from information model WGs



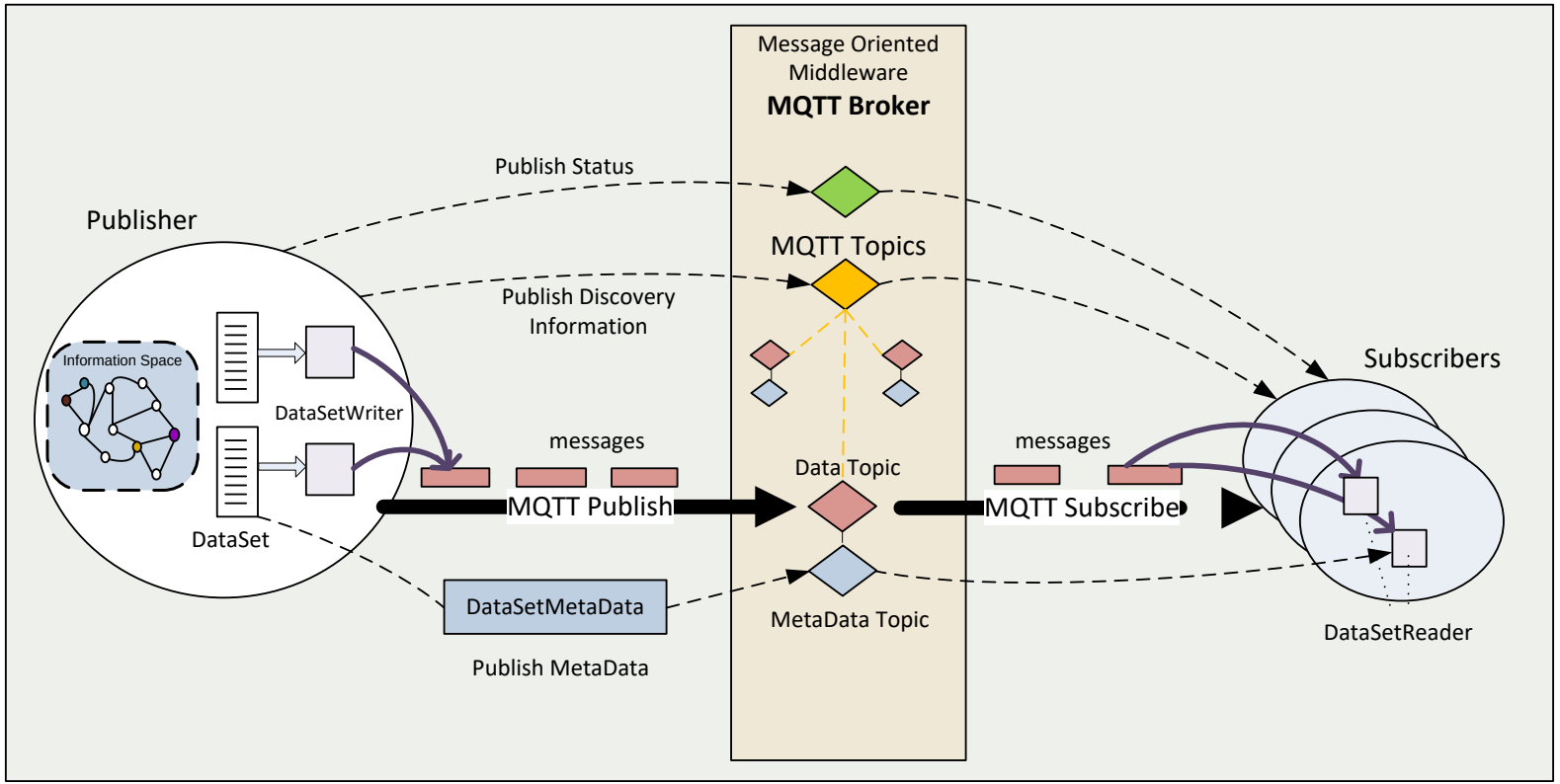
OPC Unified Architecture Overview



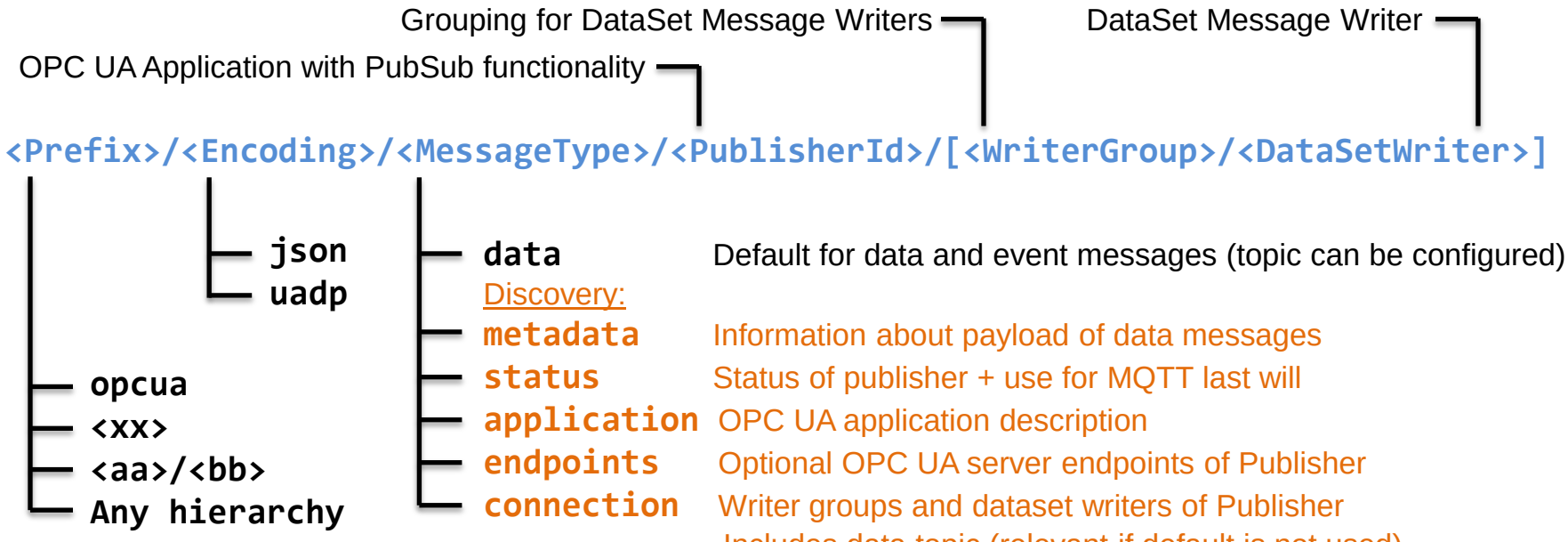
OPC UA PubSub Communication Model



OPC UA PubSub Broker Model



OPC UA PubSub MQTT Topic Namespace (1.05.03)

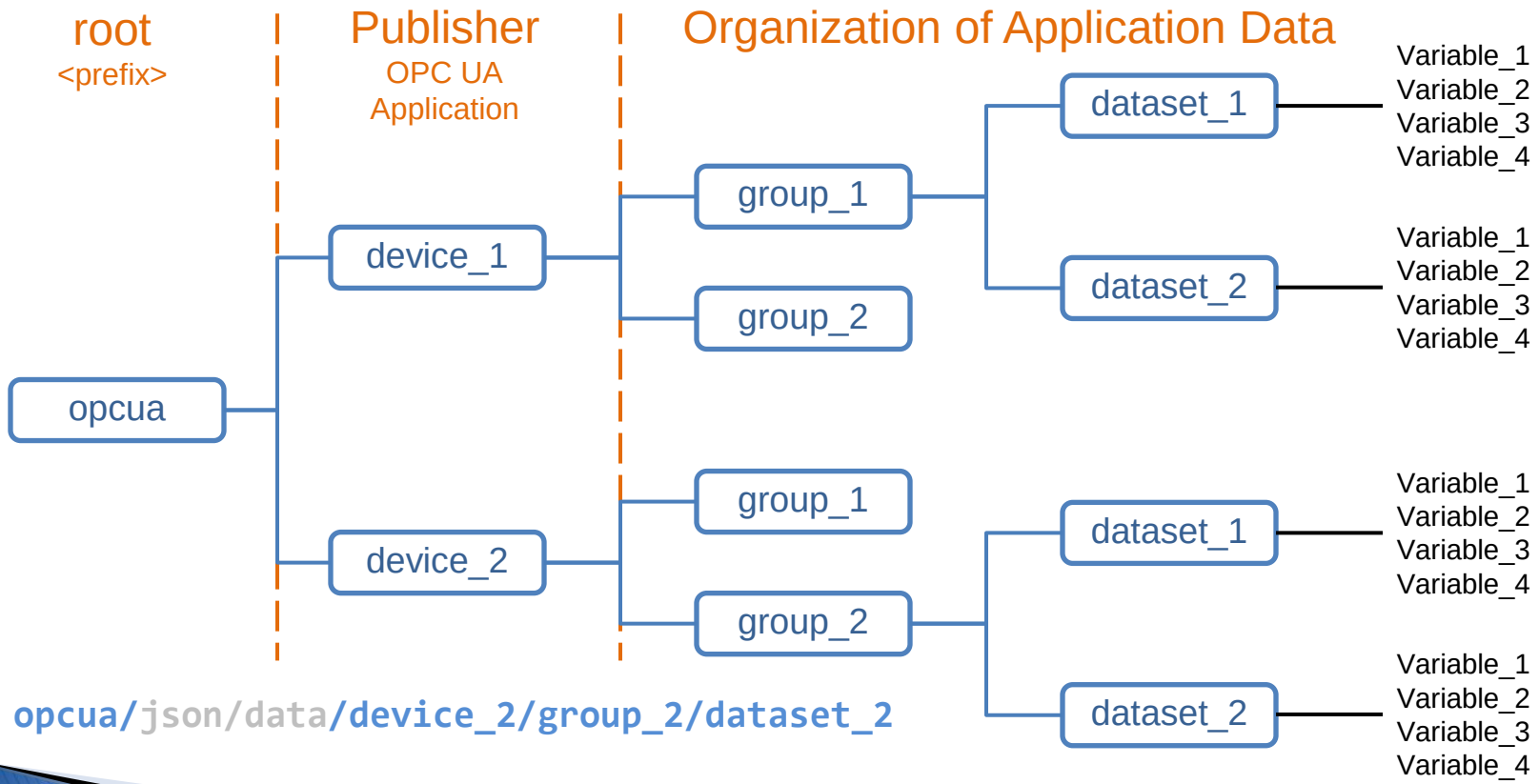


opcua/json/status/canning_line1

opcua/json/connection/canning_line1

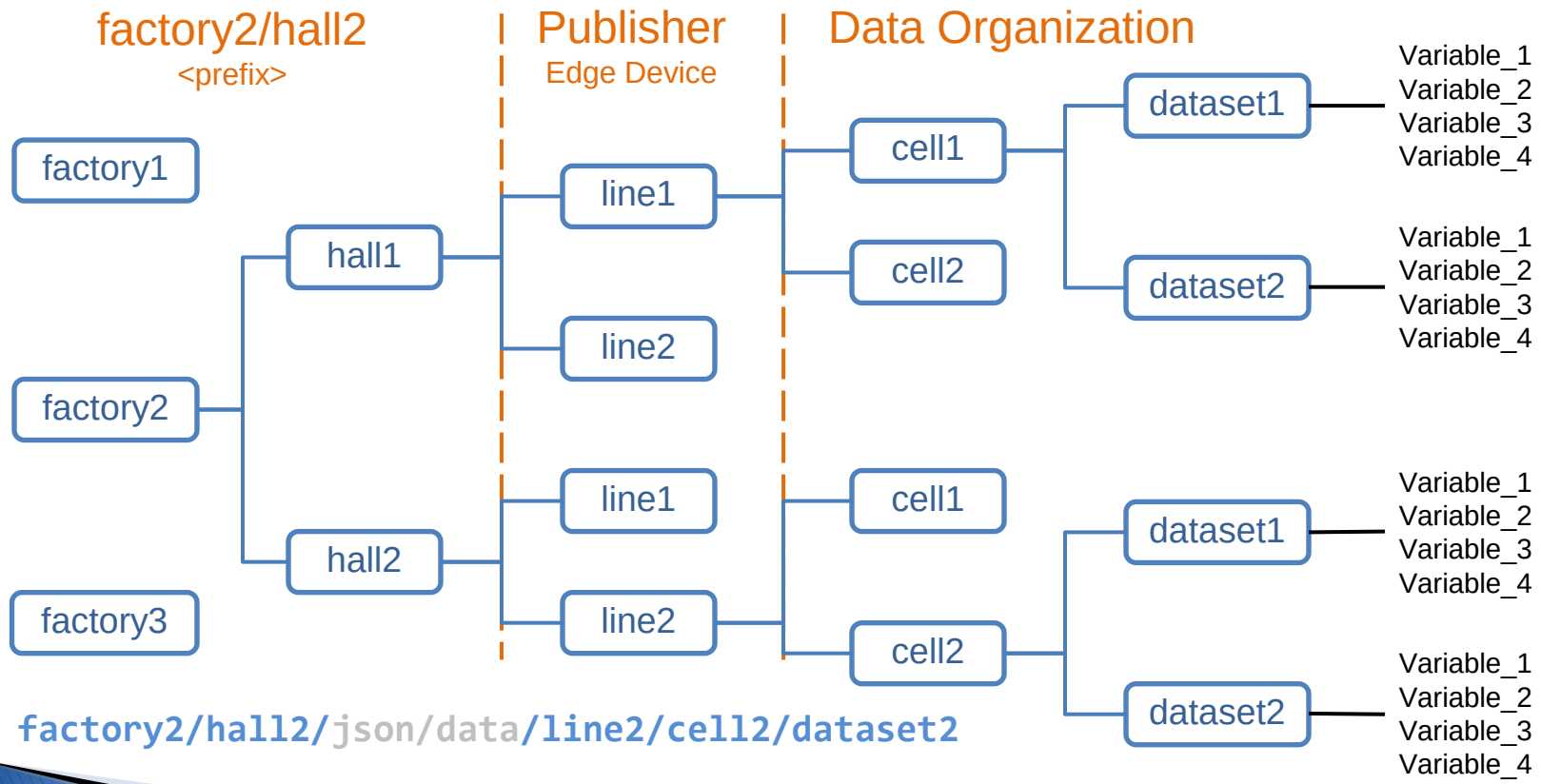
opcua/json/data/canning_line1/filling/machine_status

OPC UA MQTT Topic Namespace (local broker example)



opcua/json/data/device_2/group_2/dataset_2

OPC UA MQTT Topic Namespace (enterprise example)



OPC UA PubSub JSON Header Layout (1.05.03)

- PubSub message mappings have flexible configuration options for different use cases
- Header Layouts define standardized configuration for common use cases
- First three JSON Header Layouts added in 1.05.03

Header Layout for **Minimal** JSON messages

- Reduced to Name / Value pairs for DataSet Fields
- For IT applications without any OPC UA knowledge

```
{
  "Active":true,
  "Temperature":25.5,
  "Counter":0,
  "AdditionalInfo":"The system is running normally"
}
```

DataSet Examples

Field Name	DataType	ValueRank
Active	Boolean	Scalar
Temperature	Double	Scalar
Counter	UInt32	Scalar
AdditionalInfo	String	Scalar

```
{
  "LocationName":"Building A",
  "Coordinate":
  {
    "X":0,
    "Y":0.2
  },
  "Measurements":
  [
    20030,
    20020,
    20010
  ]
}
```

Field Name	DataType	ValueRank
LocationName	String	Scalar
Coordinate	MyStruct	Scalar
X	Float	Scalar
Y	Float	Scalar
Measurements	Int32	Array

OPC FOUNDATION

OPC UA PubSub JSON Header Layout DataSetMessage

```
{
  "PublisherId":"MyPublisher",
  "DataSetWriterId":101,
  "SequenceNumber":68468,
  "MinorVersion":672341762,
  "Timestamp":"2021-09-27T18:45:19.555Z",
  "Payload":
  {
    "Active":true,
    "Temperature":25.5,
    "Counter":0,
    "AdditionalInfo":"The system is running normally (1)"
  }
}
```

Header Layout for single **DataSetMessage** JSON messages

- DataSetMessage Header + Payload
- For applications where one DataSetWriter sends to dedicated MQTT Topic
- Used when Publishers provide data directly to multiple Subscribers

OPC UA PubSub JSON Header Layout NetworkMessage


```
{
  "MessageId":"9279c0b3-da88-45a4-af74-451cebf82db0",
  "MessageType":"ua-data",
  "PublisherId":"MyPublisher",
  "Messages":
  [
    {
      "DataSetWriterId":101,
      "SequenceNumber":68468,
      "MinorVersion":672341762,
      "Timestamp":"2021-09-27T18:45:19.555Z",
      "Payload":
      {
        "Active":true,
        "Temperature":25.5,
        "Counter":0,
        "AdditionalInfo":"The system is running normally (1)"
      }
    },
    {
      "DataSetWriterId":102,
      "SequenceNumber":25460,
      "MinorVersion":672341762,
      "T  nestar  ":"20  1-09-  T18:  :19.  55Z",
       us"  3  4,
```


Header Layout for JSON **NetworkMessage**s with multiple DataSetMessages

- NetworkMessage Header + Array DataSetMessages + DataSetMessage Header + Payload
- Used for streaming of multiple different data and event DataSets through one MQTT Topic
- For example used when Publishers stream data to Cloud applications

OPC FOUNDATION

OPC UA MQTT Working Group

- Work Items for OPC UA 1.05.04
  - Commands through PubSub messaging
  - Non-repudiation for PubSub messages
- More enhancement on the ToDo list for future releases
- Interested to contribute?
  Contact matthias.damm@unifiedautomation.com

Questions ?