

# Modelling in a Collaborative Context

GLOBAL PRODUCT DATA  
INTEROPERABILITY  
**S U M M I T**  
2022



# Abstract

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Collaborating across unknown participants over an indefinite period of time brings a variety of challenges. Some of these challenges are addressed with the STEP AP243 standard recently released in December 2021. By using standard formats with well defined attributes and data, a baseline of understanding and expectation is established among collaborators. In this talk we will explore the new standard, identify how collaboration is improved, and look forward to implementations in various lifecycle management solutions.

# Presenters Bio

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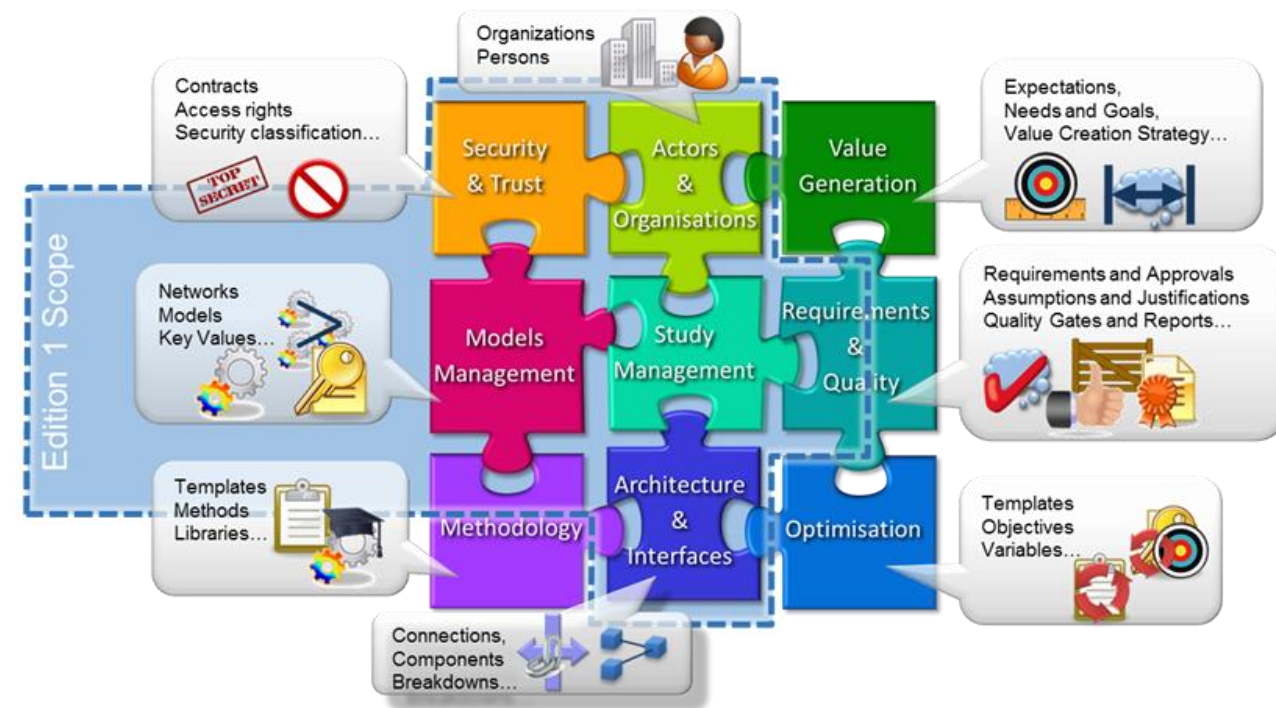
Mike Crist is a recent add to the Siemens Digital Industries Software Division after spending 16 years at Raytheon Technologies. His focus is on Model Based System Engineering, enabling the Aerospace, Defense, Federal and Marine customers to adopt these technologies. Mike is working on his PhD in Systems Engineering from Colorado State University and his dissertation material addresses ISO 10303-243 / STEP AP243.



# MoSSEC – STEP AP243

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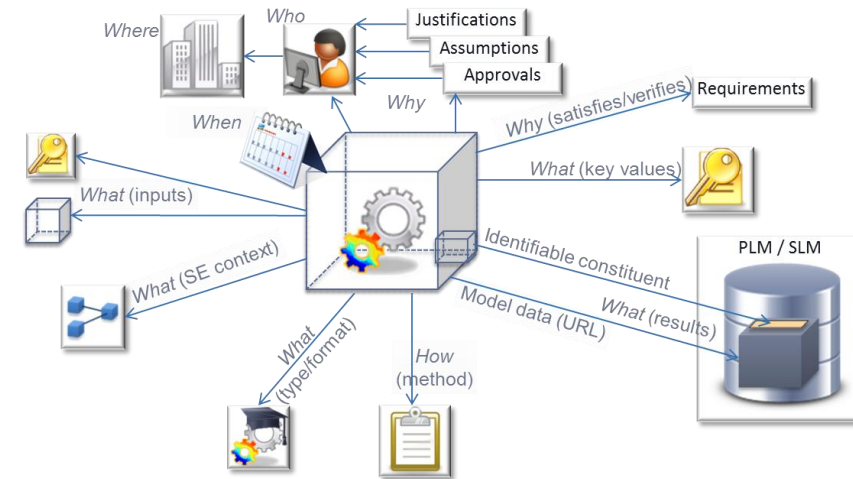
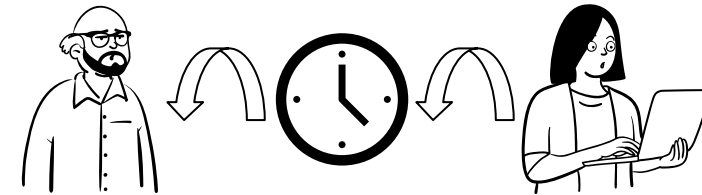
- The ISO 10303-243 standard (also known as STEP AP243 and Modelling and Simulation information in a collaborative Systems Engineering Context (MoSSEC)) was released in December 2021
- The purpose of this standard is to normalize the metadata, context and environmental descriptions of simulations, analysis and models
- The standard also requires the use of REST protocols to exchange information



# How is collaboration improved?

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- No “tool” can eliminate the need for engineers to communicate
  - What happens when the engineer you need to communicate with is not available? Engineering work may span years or decades.
  - What if you don’t know who the engineer is that you need to collaborate with? Models and data may just be published by a company.
- By documenting aspects of engineering work, collaboration can begin
  - “Document” editing tools don’t provide the richness of connectivity that leads to understanding
  - “What” and “Where” to document is just as important as “How” to document
- MoSSEC standardizes the “what”, “where” and “how” to use a model for documentation



# Relationship to PLM / SLM

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- The MoSSEC standard is intended to work with data traditionally stored in Product Lifecycle Management and Simulation Lifecycle Management tools
- The standard augments the type of data traditionally stored with information about the rationale, system context, decisions supported, and other details on how, when, and why the data exists
- The standard also defines formal methods of communicating the information managed to allow global teams (possibly with differing PLM / SLM products) to collaborate within the same product
- To facilitate the communication methods and context descriptions, MoSSEC defines concepts such as **part, part instance, person, organization, requirement, lifecycle state, document and file**, which are common objects in PLM
- However, a PLM system may have a better representation of these objects, which is what we will explore

# Siemens Xcelerator

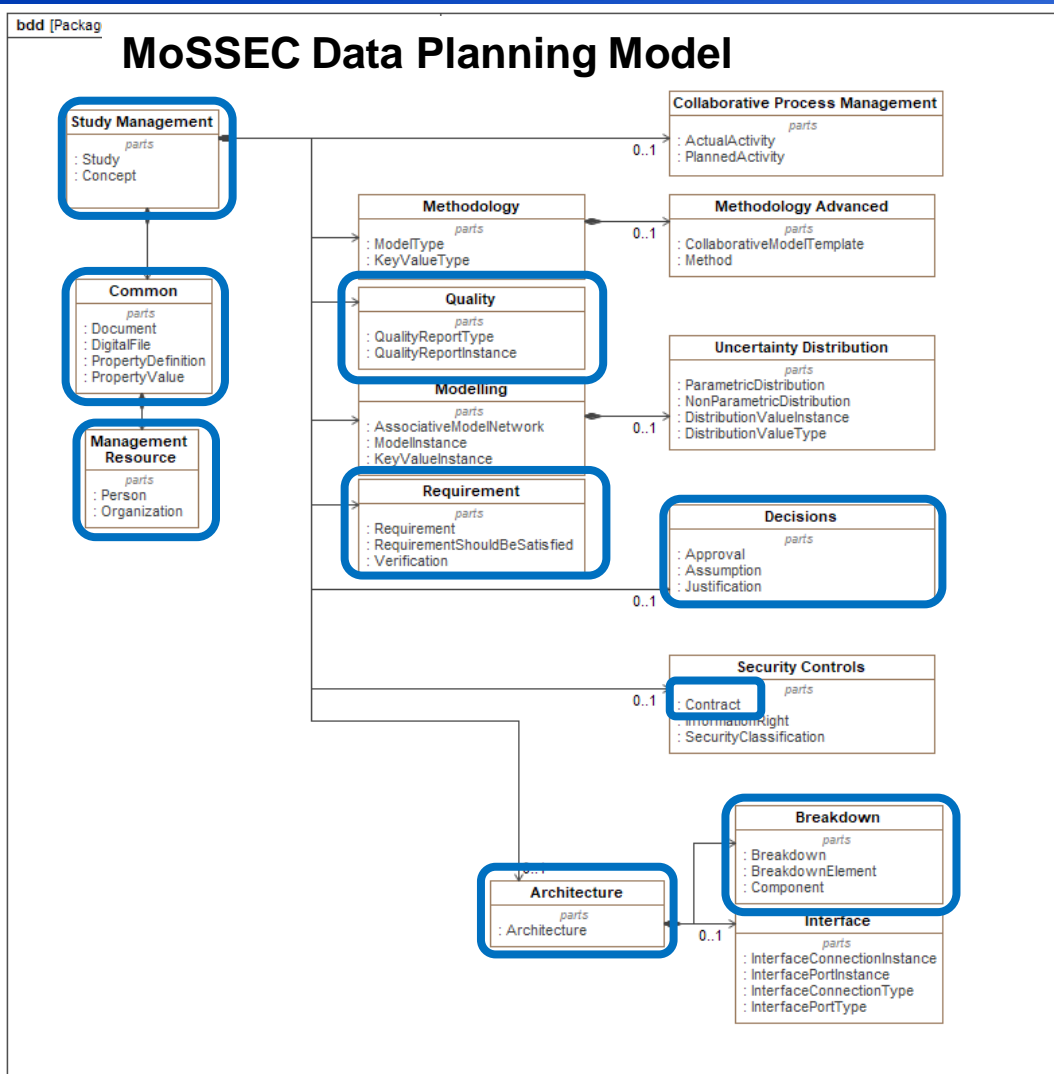
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- The Siemens Xcelerator platform is a portfolio of products that enable companies to conduct digital business
- Xcelerator builds upon Teamcenter and Polarion to enable a broader set of use cases to interact with traditional PLM / ALM data and lifecycle management features
- Modules are configured in or out of an Xcelerator deployment, allowing the platform to flex with the size and scope of the company

# Mapping MoSSEC to Xcelerator Objects

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Language	•	Language
LocalizedString	•	
ManagedObject	•	BusinessObject
Method	•	CAEAnalysis
MethodInputAssignment	•	CAEModel, CAEGeometry
MethodResourceAssignment	•	
MethodologyObject	•	ImanFile
ModelInstance	•	CAEModelRevision
ModelInstanceHasQualityReport	•	
ModelInstanceIsDerivedFrom	•	
ModelType	•	CAE Analysis Types
ModelTypeHasQualityReport	•	
ModelTypeIsDerivedFrom	•	
NonParametricDistribution	•	CAELoad
ObjectWithApprovals	•	
ObjectWithPropertyDefinitions	•	
ObjectWithPropertyValues	•	
Organization	•	Group
ParametricDistribution	•	CAELoad
Person	•	Person
PlannedActivity	•	Mfg0MESimStudy
PlannedMethod	•	CAE Analysis Types
PortInstanceRelationship	•	
PortTypeRelationship	•	
PreferredMethod	•	CAE Analysis Types
Programme	•	TC_Project
ProgrammeObject	•	Item
PropertyDefinition	•	
PropertyValue	•	Fnd0ParamReqment
QualityReportInstance	•	
QualityReportType	•	
Requirement	•	Requirement
RequirementObject	•	Arm0RequirementElement
RequirementRelationship	•	Arm0DerivedFrom

About 40% of the required data objects may already be satisfied by out of the box capabilities

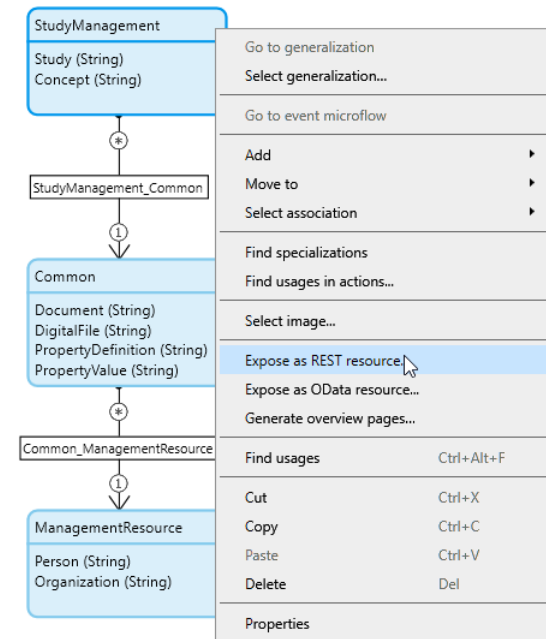


# Accessing the Data

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- Another requirement of MoSSEC is accessing the data through a specific set of REST calls
- A major feature of Xcelerator is a no-code / low-code platform called Mendix
- Through Mendix we are able to expose connected data through REST very simply

```
"ActualActivityReference": {
  "properties": {
    "Reference": {
      "allof": [
        {
          "$ref": "#/components/schemas/commonRef"
        },
        {
          "properties": {
            "objectType": {
              "enum": [
                "ActualActivity"
              ],
              "type": "string",
              "xml": {
                "attribute": true
              }
            }
          },
          "required": [
            "objectType"
          ],
          "type": "object"
        }
      ]
    },
    "required": [
      "Reference"
    ],
    "type": "object"
  },
  "ApplicableMethod": {
    "properties": {
      "ApplicableMethod": {
        "properties": {
          "$href": {
            "$ref": "#/components/schemas/uri"
          }
        }
      }
    }
  }
}
```



# Mendix as a bridge

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- Since Mendix already has connectors to a variety of enterprise applications, the back-end source of data for the REST API can be abstracted out
  - This level of abstraction supports MoSSEC goals
  - The API remains fixed while the data access is handled through microflows
- Logic and details of accessing / combining the data are contained within the Mendix app

- Connectors are publicly available through the [Mendix Marketplace](#)

Connector Name	Category	Description	Rating
Database Connector	Connectors, Data	The Database connector can be used to seamlessly connect to external databases without limiting you in your choice of database or SQL dialect, enabling...	★★★★★ 97
OData Connector for SAP solutions	Connectors, SAP	The OData Connector for SAP solutions is a specific SAP connector for integrating with SAP back-end systems like SAP Business Suite (SAP ERP 6.0), SAP...	★★★★★ 61
Kafka	Connectors, Connectors	Fully revised Kafka module, including: - Easy to setup Kafka consumers and producers. - Full SSL support (using keystore and truststores). - Explorer ...	★★★★★ 16
AWS Services Connector	Connectors, AWS	This community-supported connector supports 3 AWS Services - Amazon S3 Amazon SQS Amazon SNS with 2 authentication flows - Static (access/secre...	★★★★★ 13
CSV	Connectors, Data	This module offers connector-style usage of CSV for imports and exports. Import or write CSV line by line. Export to a CSV based on an OQL or an SQL q...	★★★★★ 33
RazorPayConnector	Connectors, Connectors	This module can be used as a connector for the payment gateway - RazorPay	★★★★★ 2
MQTT Client	Connectors, Internet-of-Things	Connector for sending and receiving MQTT messages. This module uses the Eclipse Paho library and has been tested with AWS IoT, The Things Network, and...	★★★★★ 15
SFTP	Connectors, Connectors	A kit for connecting and performing actions on an SFTP server. It features multi-server, strict host key checking, a remote explorer, key generation, ...	★★★★★ 19

# Remaining Challenges

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- The standard document is difficult to understand and often conflicting
  - Properties are missing or assumed depending on accessors
  - Heavy use of tagged unions
- Very little community involvement
- No available reference implementation
  - A reference implementation was created, but the links no longer work

## Attribute definitions:

**MimeType:** the universal representation for Extension used to identify the type of the **DigitalFile**. The value is restricted by reference data. The value of this attribute need not be specified.

**Size:** the size of the **DigitalFile** in kilobytes. The value of this attribute need not be specified.

**Uri:** the uniform resource identifier for the **DigitalFile**. The value of this attribute need not be specified.

NOTE It need not be specified because the content of the file may be stored rather than referenced.

```
AssumptionContextItem = (  
  AccessibleModelInstanceConstituent,  
  ActualActivity,  
  Approval,  
  Architecture,  
  AssociativeModelNetwork,  
  Breakdown,  
  BreakdownElement,  
  CollaborativeModelTemplate,  
  ComponentRealizationAssociation,  
  Concept,  
  Contract,  
  Document,  
  ModelInstance,  
  PlannedActivity,  
  Programme,  
  Study,  
  ValueInstanceObject  
)
```

A **Contract** is a binding agreement among the [Parties](#) to whom the contract applies. It may point to instances of [Document](#) that are the contract.

NOTE 1 **Contracts** may be related to other contracts represented by [ContractRelationship](#)

NOTE 2 **Contracts** may have [Approvals](#); be the [Subject](#) of [Assumptions](#); or be the Support for a [Justification](#).

NOTE 3 **Contracts** may have [AssignedTo](#) references to the items under contract.

EXAMPLE **Contracts** may cover for example, the delivery of data as part of a collaborative [Study](#), or the execution of activity objects.

# Conclusion

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- Early implementation of a new standard comes with its own challenges
- Dedication and hardware work are still needed even with easy to use / easy to configure applications
- Community contribution is needed, but it is not obvious where the contribution should go
- Implementation of a new façade in Xcelerator is enabled by Mendix
- Abstraction of the data access / logic behind the API enables longevity in the implementation
- Work remains to build out the API calls and data model for full implementation