



“Hybrid” API-Led Approach

RESTful Code-Gen with connectCenter
SME Manufacturing connectKit Demo

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Agenda

- Quick Overview of RESTful techniques for real-time transactional integration
- Attractive to younger workforce
 - Mobile/ Websites integration
- Working with connectCenter over the years
- Objectives of connectCenter advancements
- “Hybrid” API-led approach
- Small, Medium-sized Enterprise challenges
- SME connectKit
- Demonstration of OpenAPI document assembly and code generation

RESTful Direction

- HTTPS centric to leverage capabilities of the Internet
- Uniform Resource Location and Identification (URI-centric)
- Resources are the business objects
- Verbs and Resources reflect interaction behavior on those resources
 - GET – query ; query and path parameters
 - POST – create new
 - PUT – replace;
 - PATCH – update
 - DELETE
- Version Strategy to take rapid, evolving changes
- RESTful patterns and RESTless Anti-Patterns

JavaScript Object Notation

- Simple tagged approach with limited data types
- Objects { }
- Key-value pairs {"key":"value"}
- Arrays of objects [{"key1":"value"}, {"key2":"value"}]
- Aggregation of types into Payloads sent over HTTP / RESTful
- Schema specification representations
 - JSON Schema (IETF) – JSON file
 - OpenAPI (Initiative) – YAML file
 - RAML (proprietary) – YAML file

URI Conventions (Backus-Naur Form)

<uri> ::= https://<baseURI>/<domain>[/<subdomain>]/<majorVersion>/<resource>[/<id>]

<baseUri> ::= <environment>/<serverName>

<domain> ::= microservice name/ business capability

<subdomain> ::= business process within the business capability

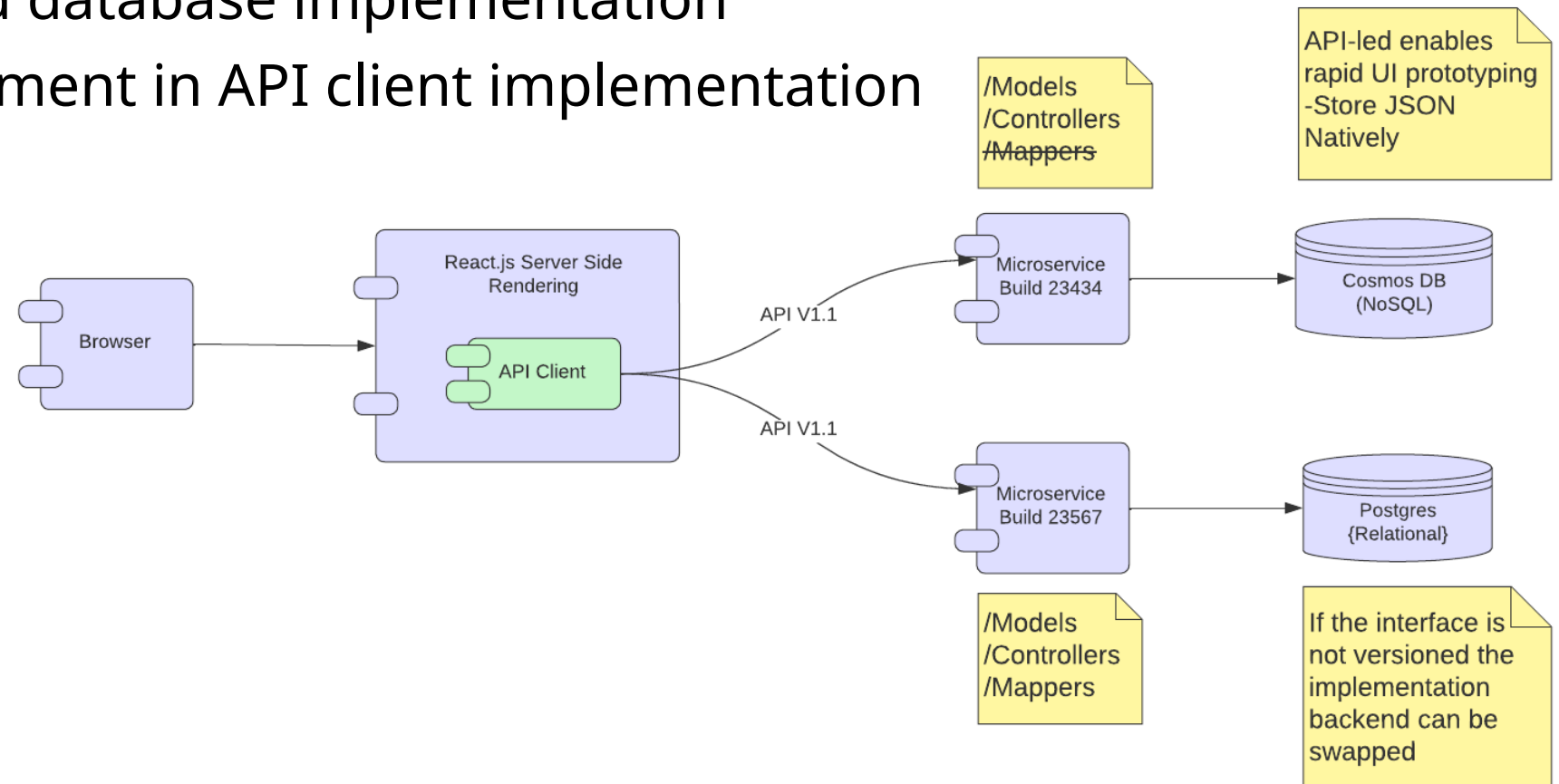
<majorVersion> ::= **version of the resource definition**

<resource> ::= business object in context of the business process

API-led Value Proposition – Façade Pattern

Using the API Definition to hide Implementation Details

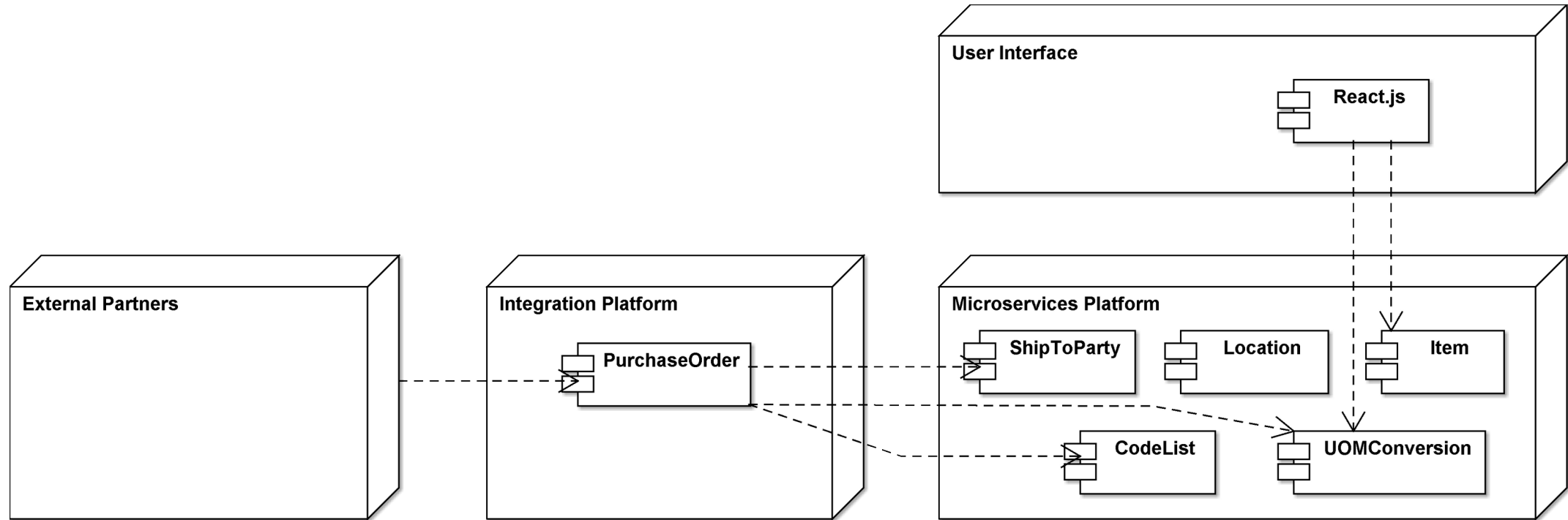
- API-led enables rapid UI prototyping; 'fail fast' storing JSON natively
- Hides back-end database implementation
- Protects investment in API client implementation



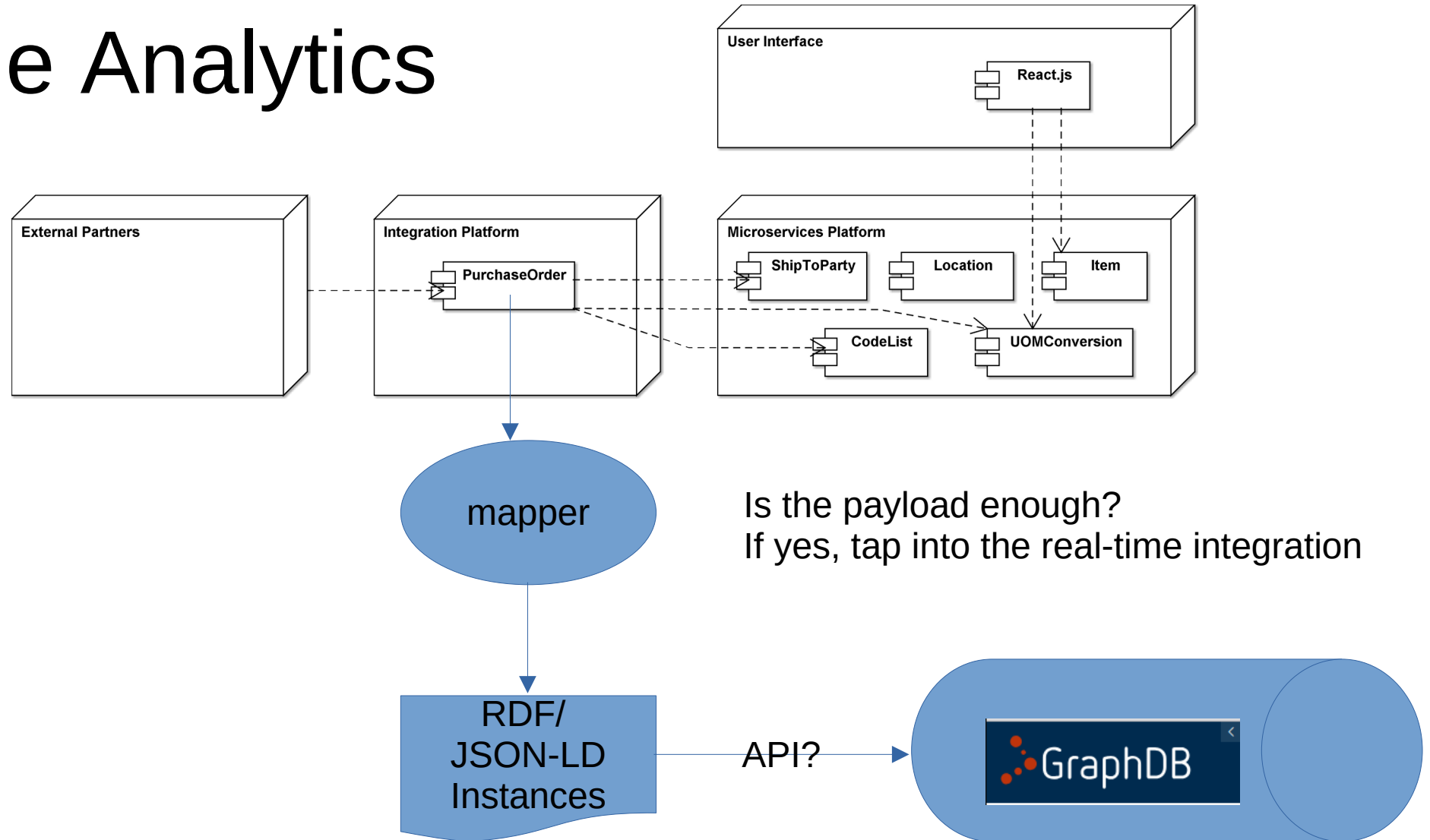
API-led facade hides DB challenges

- Direct access to ORM for SQL-injection challenges
- Changes to data models; e.g.,
 - Changing table relationships from 1 -< m to m >-< m
 - API does NOT need to changes as it supports a single facet
- Uplift from one database technology to another
- Change of vendors
- Arcane table and column naming found in many ERPs
- Simpler payloads to support business context (subsets)

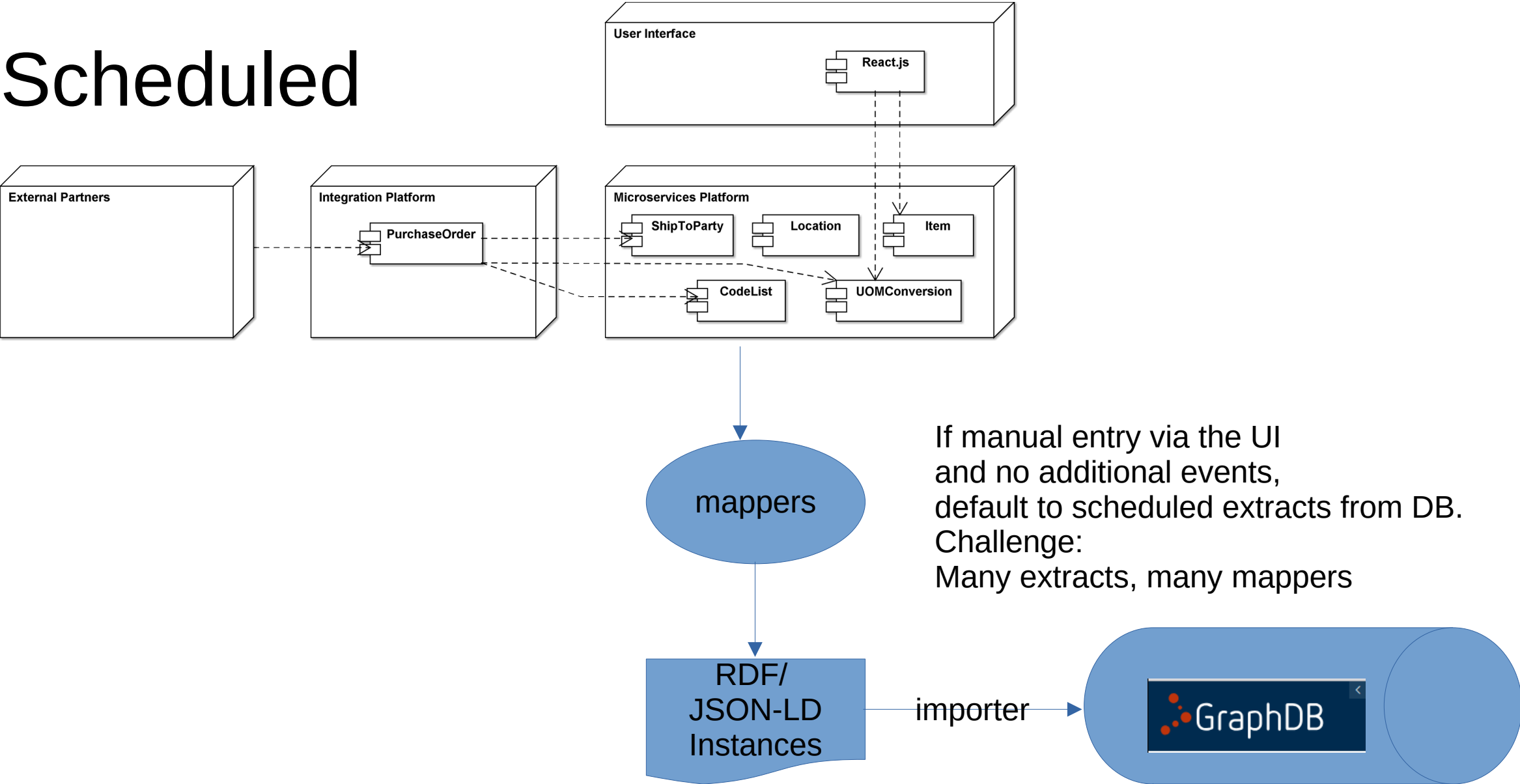
Enabling Microservice Architecture



Real-time Analytics



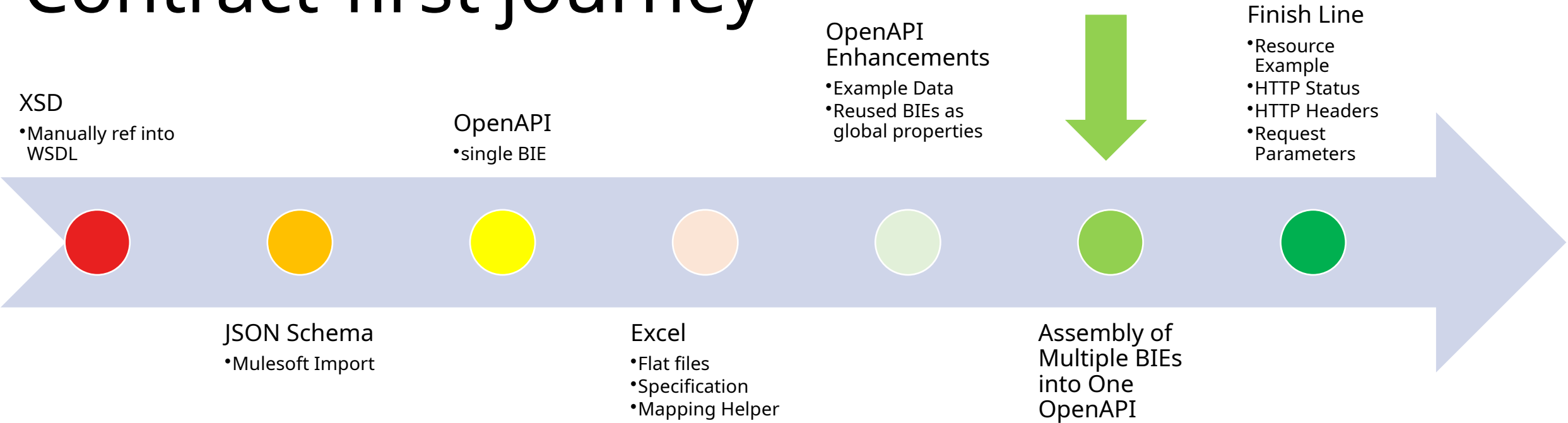
Scheduled



Objectives

- Accelerate our microservice and integration development efforts and time to delivery
- Expand current code gen approach for function app and microservices
 - Models, Controllers
 - Leverage NSwag Libraries
- Import OpenAPI yml into Mulesoft
- Manage components / schema object in Score
 - Reuse standard components where applicable
 - Assemble new components fit for purpose at Land O'Lakes
 - Express to OpenAPI
 - Continue to work with OAGi/ NIST (US Department of Commerce) for feature enhancements
- Add important changes to the OAGi standard component library
- Ability to rapidly take feature changes via pipelines and Code Generation
- Mentor and educate in AgGateway for agricultural API standards

Contract-first journey

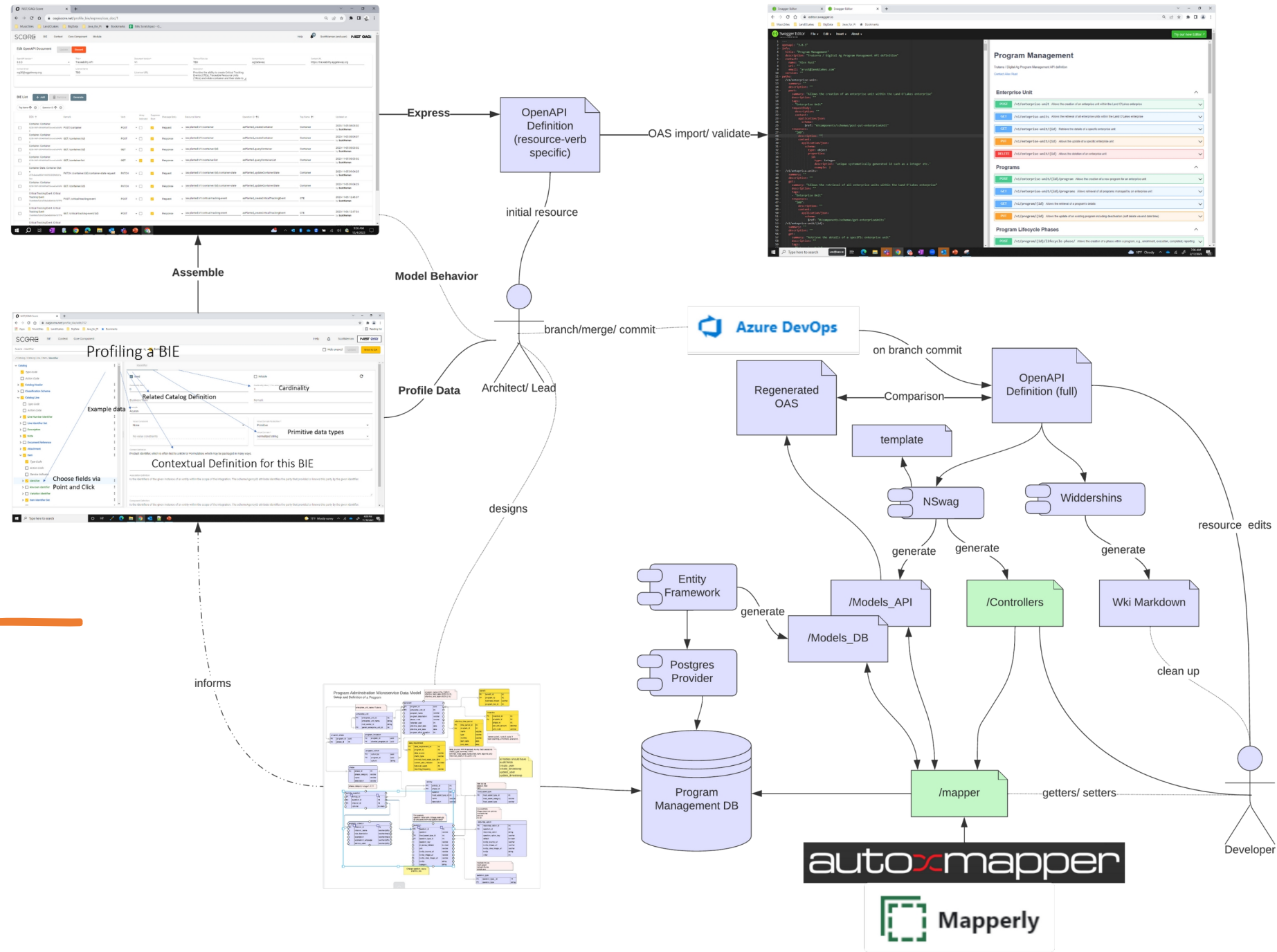


Developer Productivity



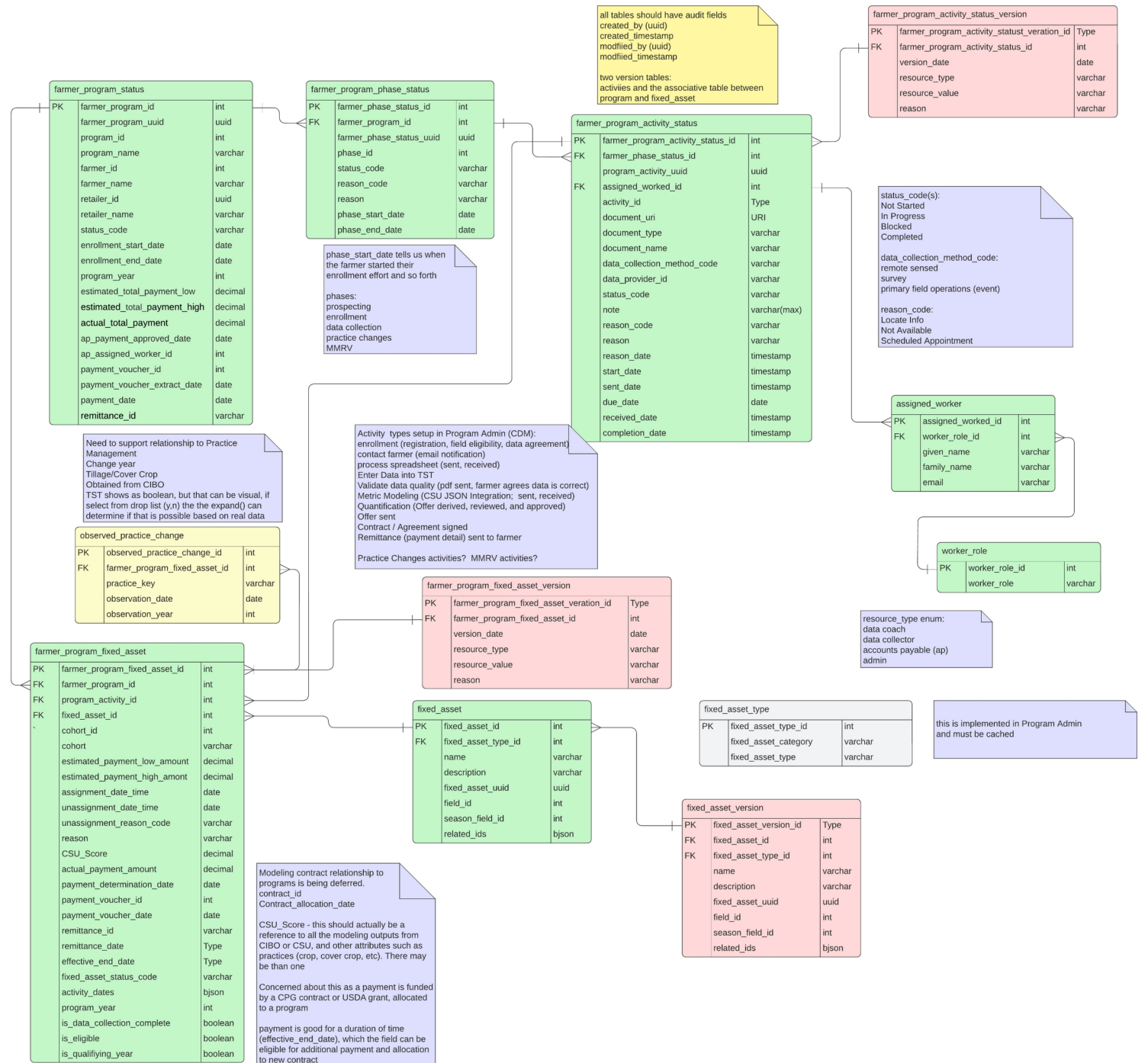
'Hybrid' API-led Approach

Goal:
85-90% code complete off yml and DB



Entity Framework Core

- create Model classes off the database
- changes to the data model trigger Model updates



connectCenter Process

- Define Context
 - Business Capability
 - Business Process
 - Business Information Entities needs
- Profile BIEs to that context
- Assemble into an OpenAPI Document definition
- Generate YML
- Generate code in appropriate programming language

Profiling a BIE

Search > Last Modification Date Time / WIP Status / Last Modification Date Time

- WIP Status 1..1
 - Type Code 0..1
 - Action Code 0..1
 - Identifier 0..1
 - Revision Identifier 0..1
 - Variation Identifier 0..1
 - Document Identifier Set 0..∞
 - Language Code 0..1
 - Last Modification Date Time 0..1
 - Document Date Time 0..1
 - Description 0..∞
 - Note 0..∞
 - Document Reference 0..∞
 - Attachment 0..∞
 - Security Classification 0..∞
 - Status 0..1
 - Type Code 0..1
 - Action Code 0..1

Cardinality Min* 0

Cardinality Max* 1

Remark

Example
2020-06-01T09:35:00-05:00

Value Constraint
None

No value constraints

Value Domain Restriction*
Primitive

Value Domain*
date time

Facets

| Minimum Length | Maximum Length | Pattern | Pattern Test |
|----------------|----------------|---------|--------------|
| | | | |

Context Definition
Last update timestamp for the WIP Status for a specific production order and production run.

Example data

Related Catalog Definition

Cardinality

Remark

Primitive data types

Lengths

Regex Patterns

Choose fields via Point and Click

Contextual Definition for this BIE

Use Remark to guide when Adding BIE to OpenAPI document



BIE

Branch: 10.10.1 | Published | State: | Deprecated |

Owner: | Updater: | Updated start date: | Updated end date: |

DEN | Business Context: Express Pack

Search

| <input type="checkbox"/> | State | Branch | DEN | Owner | Business Contexts | Version | Status | Business Term | Remark | Updated on ↓ |
|--------------------------|-------|---------|---|-------------|-------------------|---------|----------|--------------------------|---|------------------------------------|
| <input type="checkbox"/> | QA | 10.10.1 | Operation. Operation 25ea851e80f1446dac475726f931a049 | ScottNieman | Express Pack | V2 | WIP | Operation | POST /location/{locationId}/operation request | 2023-11-15 20:09:31 by ScottNieman |
| <input type="checkbox"/> | QA | 10.10.1 | BOM Header. BOM Header ea3d38b8a7d444afbd71e3a85d581230 | ScottNieman | Express Pack | V2 | WIP | BOM List | GET /location/{locationId}/bom-list | 2023-11-15 17:27:04 by ScottNieman |
| <input type="checkbox"/> | QA | 10.10.1 | Status. Status d5fed0e5ad6e4d5a8353a85474c7b5da Uplifted from Status. Status in 10.9 at 2023-11-15 16:48:56 | ScottNieman | Express Pack | V2 | UPLIFTED | | Global Property | 2023-11-15 17:24:48 by ScottNieman |
| <input type="checkbox"/> | QA | 10.10.1 | WIP Status. WIP Status bce7462b32d549e48a4f029c4e46f102 Uplifted from WIP Status. WIP Status in 10.9 at 2023-11-15 16:54:29 | ScottNieman | Express Pack | V2 | UPLIFTED | Manufacturing Visibility | POST /location/{locationId}/wip-status response | 2023-11-15 16:57:37 by ScottNieman |
| <input type="checkbox"/> | QA | 10.10.1 | Results. Results dc97f140be434606afde539101427519 Uplifted from Results. Results in 10.9 at | ScottNieman | Express Pack | V2 | UPLIFTED | | POST /location/{locationId}/results response | 2023-11-15 16:43:46 by ScottNieman |

Generate OpenAPI from Assembled BIEs

Edit OpenAPI Document

3.0.3 Traceability API V1 TBD AgGateway <https://traceability.aggateway.org>

Contact Email: wg20@aggateway.org License Name: TBD License URL: Description: Provides the ability to create Critical Tracking Events (CTEs), Traceable Resource Units (TRUs) and relate container and their state to

BIE List + Add Remove Generate

Tag Name ↑ × Operation ID ↑ ×

| DEN ↑ | Remark | Verb | Array Indicator | Suppress Root | Message Body | Resource Name | Operation ID ↑2 | Tag Name ↑1 | Updated on |
|--------------------------|--|---|-----------------|-------------------------------------|--------------|---|---------------------------------------|-------------|---------------------------------------|
| <input type="checkbox"/> | Container. Container 625b106f1d934b95af33acee0ad4dfd3 | POST /container | | <input checked="" type="checkbox"/> | Request | /as-planted/V1/container | asPlanted_createContainer | Container | 2023-11-05 08:03:02 by ScottNieman |
| <input type="checkbox"/> | Container. Container 625b106f1d934b95af33acee0ad4dfd3 | GET /container/{id} | | <input checked="" type="checkbox"/> | Response | /as-planted/V1/container | asPlanted_createContainer | Container | 2023-11-05 08:04:07 by ScottNieman |
| <input type="checkbox"/> | Container. Container 625b106f1d934b95af33acee0ad4dfd3 | GET /container/{id} | | <input checked="" type="checkbox"/> | Response | /as-planted/V1/container/{id} | asPlanted_queryContainer | Container | 2023-11-05 08:03:02 by ScottNieman |
| <input type="checkbox"/> | Container. Container 625b106f1d934b95af33acee0ad4dfd3 | GET /container-list | | <input checked="" type="checkbox"/> | Response | /as-planted/V1/container-list | asPlanted_queryContainerList | Container | 2023-11-05 08:03:02 by ScottNieman |
| <input type="checkbox"/> | Container State. Container State e57bdeeb863416685623239d2d1a5aa | PATCH /container/{id}/container-state request | | <input checked="" type="checkbox"/> | Request | /as-planted/V1/container/{id}/container-state | asPlanted_updateContainerState | Container | 2023-11-05 09:04:25 by ScottNieman |
| <input type="checkbox"/> | Container. Container 625b106f1d934b95af33acee0ad4dfd3 | GET /container/{id} | | <input checked="" type="checkbox"/> | Response | /as-planted/V1/container/{id}/container-state | asPlanted_updateContainerState | Container | 2023-11-05 09:04:25 by ScottNieman |
| <input type="checkbox"/> | Critical Tracking Event. Critical Tracking Event 73a66b6cf2494f25a3ebb698e707f799 | POST /critical-tracking-event | | <input checked="" type="checkbox"/> | Request | /as-planted/V1/critical-tracking-event | asPlanted_createCriticalTrackingEvent | CTE | 2023-11-06 12:46:37 by ScottNieman |
| <input type="checkbox"/> | Critical Tracking Event. Critical Tracking Event 73a66b6cf2494f25a3ebb698e707f799 | GET /critical-tracking-event/{id} | | <input checked="" type="checkbox"/> | Response | /as-planted/V1/critical-tracking-event | asPlanted_createCriticalTrackingEvent | CTE | 2023-11-06 12:47:34 by ScottNieman |

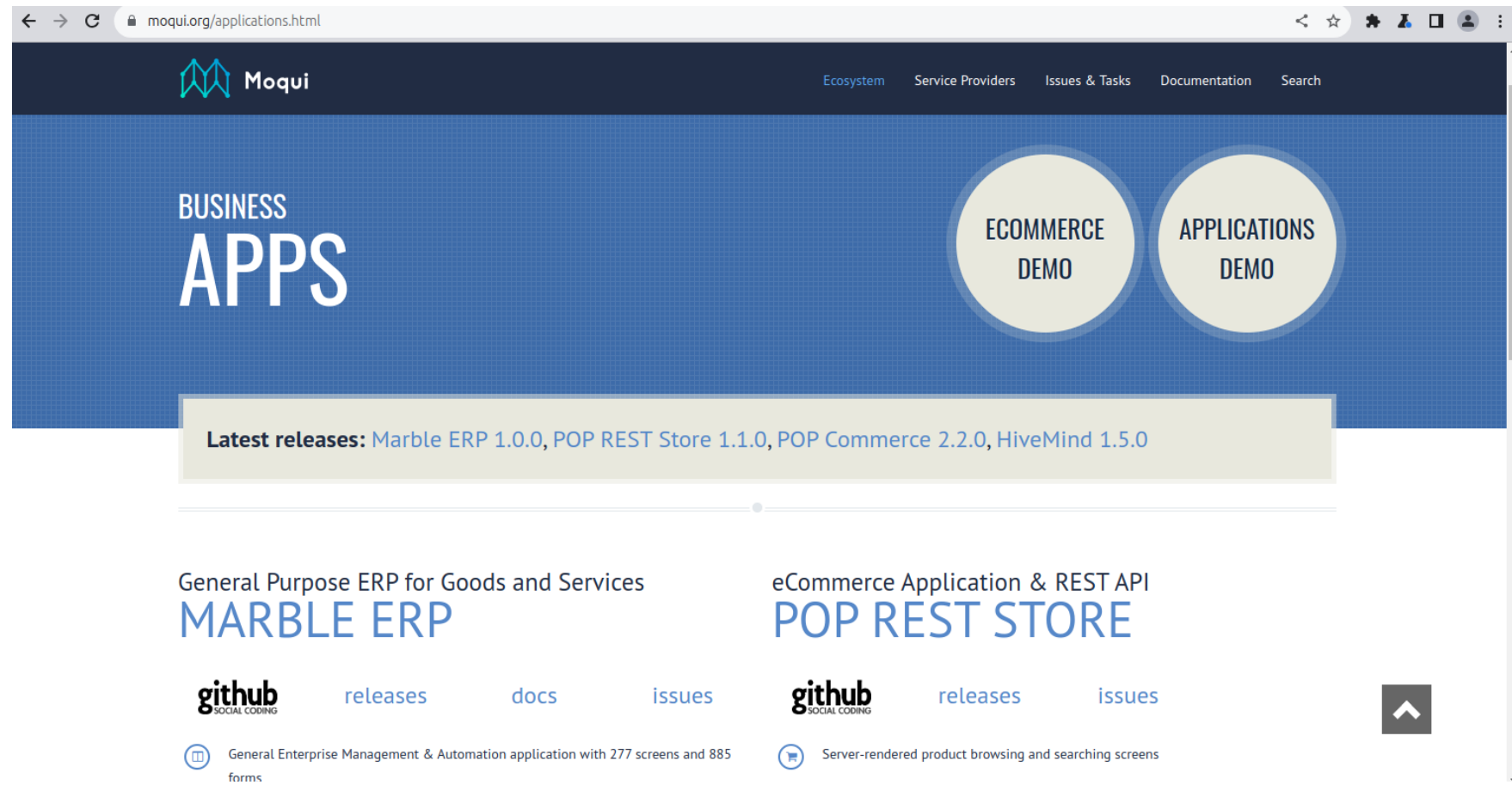
Small, Medium-Sized Enterprise connectKit

SME Challenges

- Resources are slim
 - Top talent attraction and retention
 - Cash-flow
 - Limited affordable business applications
 - Access to Advanced Technology
- Geographic Region
- Geo-political pressures
- Large Company Pressures

Business Application Offerings

- MS Power Platform
- QuickBooks
- Marble ERP (open source, Moqui Framework)



The screenshot shows the Moqui website at moqui.org/applications.html. The page features a dark blue header with the Moqui logo and navigation links for Ecosystem, Service Providers, Issues & Tasks, Documentation, and Search. The main content area has a blue background with the text "BUSINESS APPS" and two circular buttons labeled "ECOMMERCE DEMO" and "APPLICATIONS DEMO". A light green banner below the main content lists "Latest releases: Marble ERP 1.0.0, POP REST Store 1.1.0, POP Commerce 2.2.0, HiveMind 1.5.0". The page is divided into two columns. The left column is titled "General Purpose ERP for Goods and Services" and features "MARBLE ERP" with a GitHub logo and links for "releases", "docs", and "issues". Below this, a circular icon and text describe it as a "General Enterprise Management & Automation application with 277 screens and 885 forms". The right column is titled "eCommerce Application & REST API" and features "POP REST STORE" with a GitHub logo and links for "releases" and "issues". Below this, a circular icon and text describe it as a "Server-rendered product browsing and searching screens". A dark blue button with a white upward-pointing arrow is located in the bottom right corner.

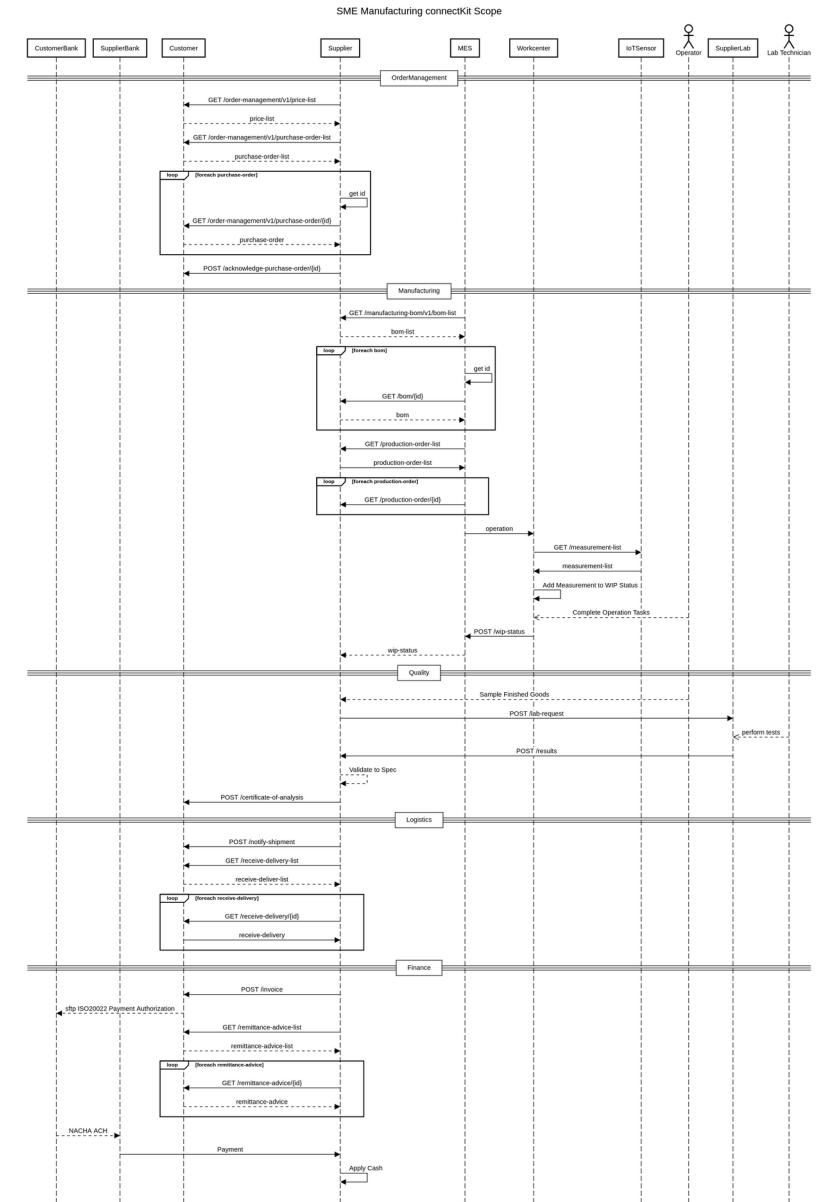
SME connectKit; an Enabler

- Pre-defined BIEs, quick starter
- OpenAPI references
- Code-generation
- Speak the same language as younger workforce
- Fits agile mentality and product team focus



connectKit REST calls

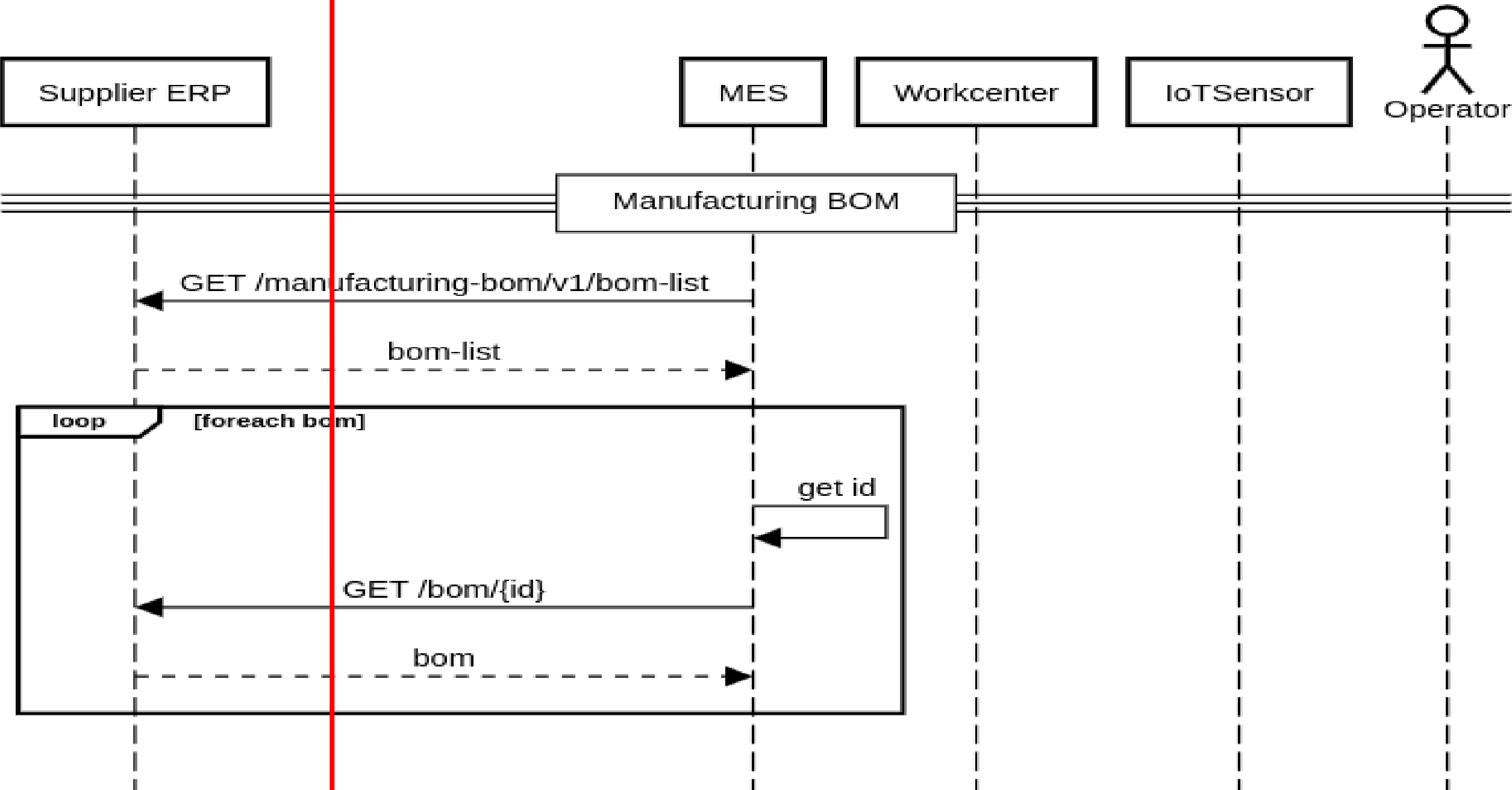
- Supplier's ERP must manage many manufacturing plants; rural areas
- Too many connections to manage
- Limit/*eliminate* Inbound Firewall requests (Fog reality check)
- Plants should initiate *outbound* requests
- Similar for Customer's ERP; many Suppliers managed in their ERP



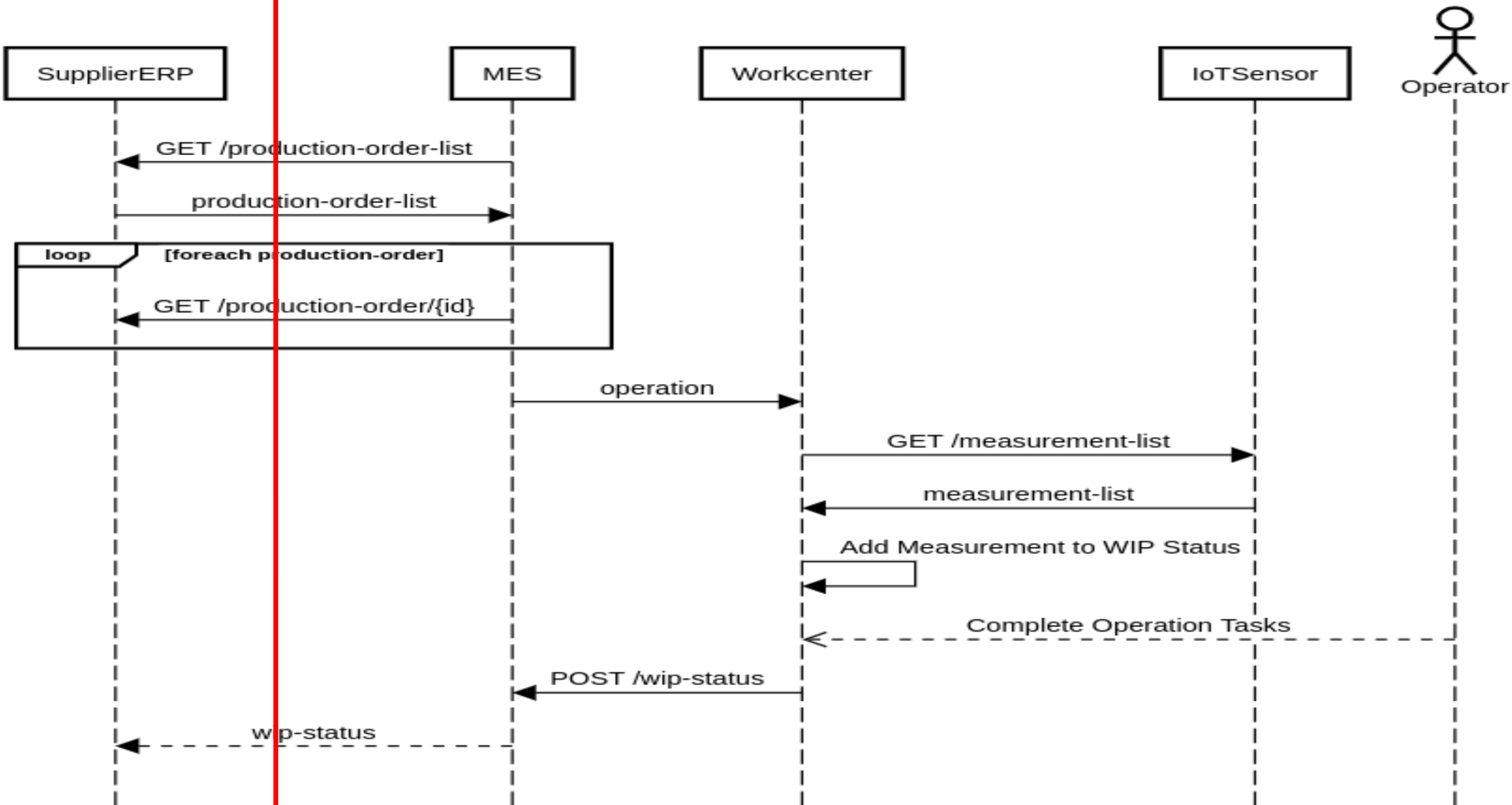
connectKit REST calls

- Order Management
- **Manufacturing**
 - BOM**
 - Operations**
- **Quality Management**
- Logistics Management
- Finance

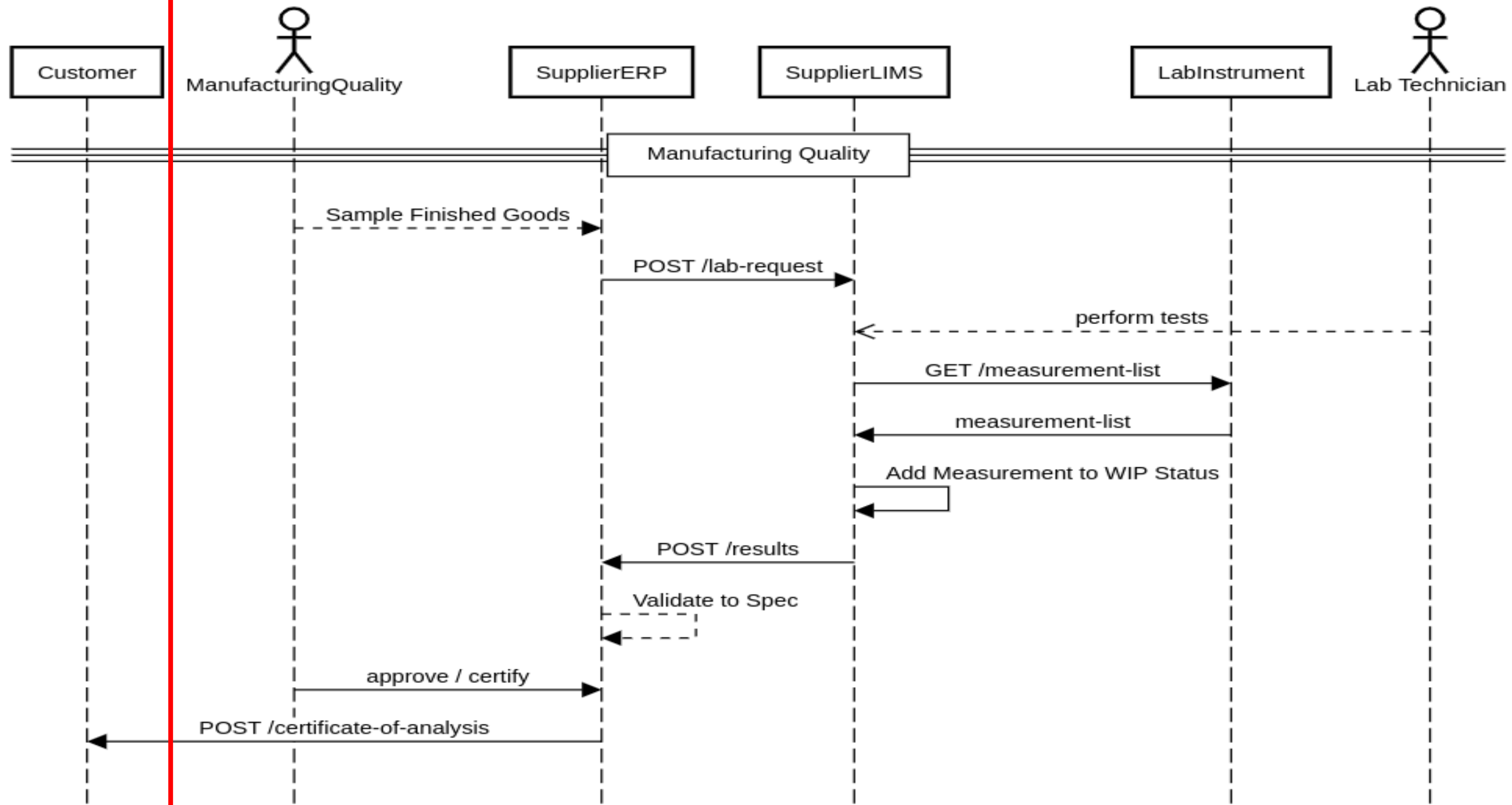
SME Manufacturing connectKit Scope



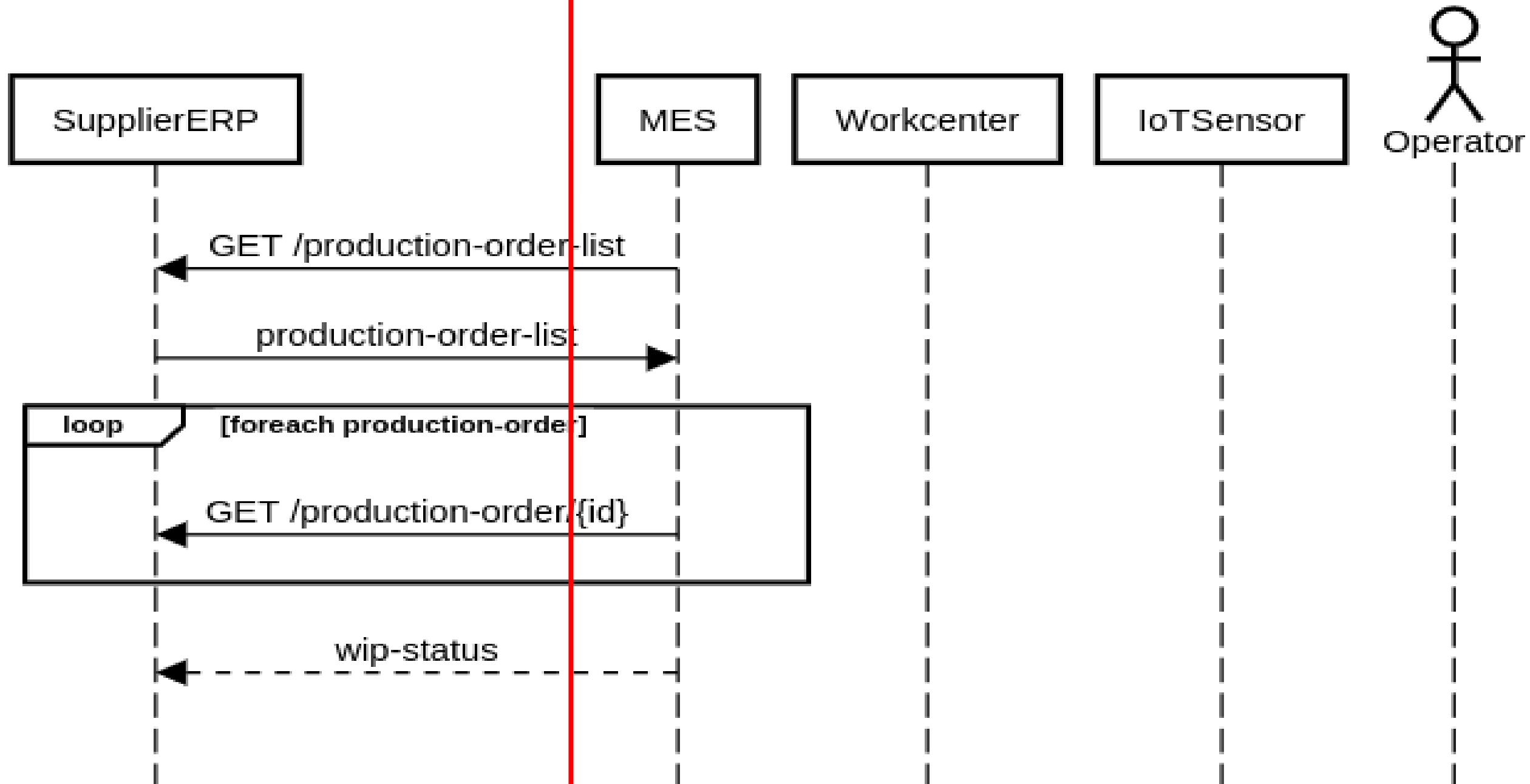
SME Manufacturing Operations connectKit Scope



SME Manufacturing Quality connectKit Scope



SME Manufacturing - connectCenter Demo Scope



OpenAPI Assembly Demo

Edit OpenAPI Document

Update Discard

| | | | |
|---------------------------|--|---------------------------------------|--|
| OpenAPI Version* 3.0.3 | Title* SME Manufacturing connectKit | Document Version* V2 | Description This connectKit enables small manufacturing businesses to digitize their processes. |
| Contact Name OAGi | Contact URL | Contact Email connectKits@oagi.org | |
| License Name | License URL | Terms of Service | |

BIE List + Add Remove Generate

Tag Name ↑ × Operation ID ↑ ×

| Branch | DEN | Remark | Verb | Array Indicator | Suppress Root | Message Body | Resource Name | Operation ID ↑2 | Tag Name ↑1 | | |
|--------------------------|---------|--|--|-----------------|--------------------------|-------------------------------------|-------------------------------------|----------------------------|---|--|---------------------------------|
| <input type="checkbox"/> | 10.10.1 | BOM. BOM https://test.oagiscore.net/profile_bie/876 d0908e4b2bf34206bc723a872a621f30 | GET /location/{locationId}/bom/{id} | GET | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Response | /manufacturing/V2/bom/{id} | manufacturing_queryBOM | Manufacturing Bill of Materials | |
| <input type="checkbox"/> | 10.10.1 | BOM Header. BOM Header https://test.oagiscore.net/profile_bie/875 ea3d38b8a7d444afbd71e3a85d581230 | GET /location/{locationId}/bom-list | GET | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Response | /manufacturing/V2/bom-list | manufacturing_queryBOMHeaderList | Manufacturing Bill of Materials |
| <input type="checkbox"/> | 10.10.1 | WIP Status. WIP Status https://test.oagiscore.net/profile_bie/884 462f05ad0bf74ae283ef5cb786042556 | POST /location/{locationId}/wip-status request | POST | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Request | /manufacturing/V2/wip-status | manufacturing_createWIPStatus | Manufacturing Operations |
| <input type="checkbox"/> | 10.10.1 | WIP Status. WIP Status https://test.oagiscore.net/profile_bie/883 bce7462b32d549e48a4f029c4e46f102 | POST /location/{locationId}/wip-status response | POST | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Response | /manufacturing/V2/wip-status | manufacturing_createWIPStatus | Manufacturing Operations |
| <input type="checkbox"/> | 10.10.1 | Production Order. Production Order https://test.oagiscore.net/profile_bie/878 5f3943d43ef24caba9efd362208a382f | GET /location/{locationId}/production-order/{id} | GET | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Response | /manufacturing/V2/production-order/{id} | manufacturing_queryProductionOrder | Manufacturing Operations |
| <input type="checkbox"/> | 10.10.1 | Production Order Header. Production Order Header https://test.oagiscore.net/profile_bie/877 7d744620350444b5ad8c023f7b81963e | GET /location/{locationId}/production-order-list | GET | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Response | /manufacturing/V2/production-order-list | manufacturing_queryProductionOrderList | Manufacturing Operations |

```

1 ---
2 openapi: "3.0.3"
3 info:
4   title: "SME Manufacturing connectKit"
5   description: "This connectKit enables small manufacturing
6     businesses to digitize\
7     \ their processes."
8   contact:
9     name: "OAGi"
10    email: "connectKits@oagi.org"
11   version: "V2"
12   x-oagis-license: ""
13 paths:
14   /manufacturing/V2/bom/{id}:
15     summary: ""
16     description: ""
17     get:
18       summary: ""
19       description: ""
20       security:
21         - OAuth2:
22           - "bomRead"
23       tags:
24         - "Manufacturing Bill of Materials"
25       operationId: "manufacturing_queryBOM"
26       parameters:
27         - name: "id"
28           in: "path"
29           description: ""
30           required: true
31           schema:
32             type: "string"
33       responses:
34         "200":
35           description: ""
36           content:
37             application/json:
38               schema:
39                 $ref: "#/components/schemas/queryBom"
40   /manufacturing/V2/production-order/{id}:
41     summary: ""
42     description: ""
43     get:
44       summary: ""

```

SME Manufacturing connectKit V2 OAS 3.0

This connectKit enables small manufacturing businesses to digitize their processes.

[Contact OAGi](#)

Authorize

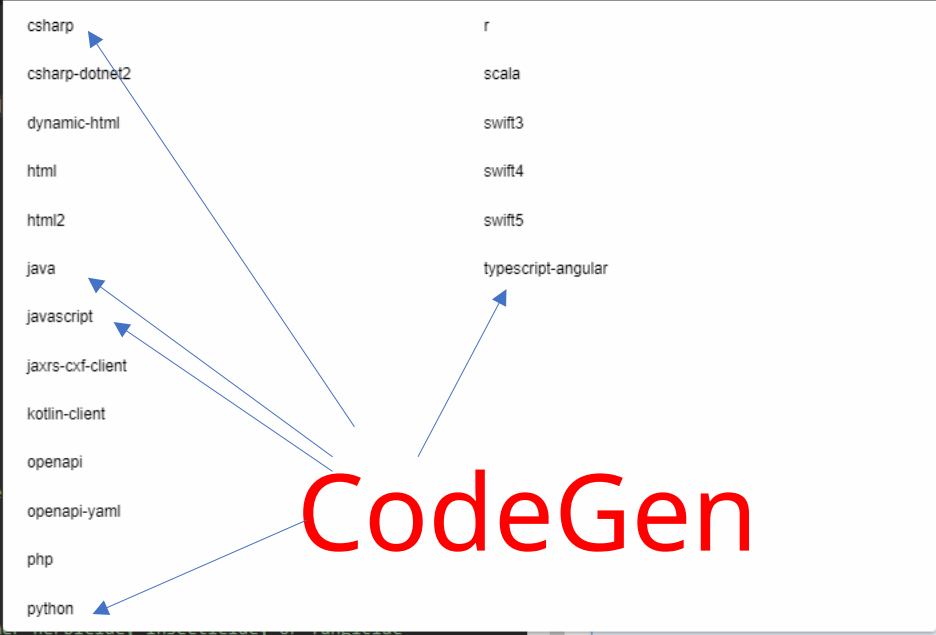
Manufacturing Bill of Materials

- GET /manufacturing/V2/bom/{id}
- GET /manufacturing/V2/bom-list

Manufacturing Operations

- GET /manufacturing/V2/production-order/{id}
- POST /manufacturing/V2/wip-status
- GET /manufacturing/V2/production-order-list


```
1 ---
2 openapi: "3.0.2"
3 info:
4   title: "Syngenta Product Catalog API"
5   description: "Retrieves an OAGIS catalog for a specific prod
6   contact:
7     name: "Tyler Johnston USGR"
8     url: "www.syngenta.com"
9     email: "Tyler.Johnston@syngenta.com"
10  version: "1.0"
11 paths:
12  /catalog:
13    summary: "Syngenta Product Catalog API"
14    description: "Retrieves a catalog for a get product type"
15    get:
16      summary: ""
17      description: ""
18      tags: ["AgGateway Product Catalog"]
19      parameters:
20        - name: "lastModificationDateTime"
21          in: "query"
22          description: "get all items in a catalog that are added or updates since this date time"
23          required: false
24          schema:
25            $ref: "#/components/schemas/date-time"
26        - name: "item.typeCode"
27          in: "query"
28          description: "get all items in a catalog that are either herbicide, insecticide, or fungicide"
29          required: true
30          schema:
31            $ref: "#/components/schemas/string"
32      responses:
33        "200":
34          description: ""
35          content:
36            application/json:
37              schema:
38                $ref: "#/components/schemas/get-catalog-oagis-id-ee565b7daa7e47569145abd4648f223c"
39  components:
40    schemas:
41      integer:
42        type: "integer"
43      normalizedString:
44        type: "string"
45      dateTime:
46        type: "string"
47        format: "date-time"
48      token:
49        type: "string"
```



Product Catalog API 1.0 OAS3

product category

catalog

Try it out

lastModificationDateTime string(\$date-time) (query) get all items in a catalog that are added or updates since this date time

item.typeCode * required string (query) get all items in a catalog that are either herbicide, insecticide, or fungicide

| Code | Description | Links |
|------|-------------|----------|
| 200 | | No links |

Thank you!