Digital Threads
for Quality Control

UUID Conference Call

May 10, 2023

Manufacturing Digital Threads
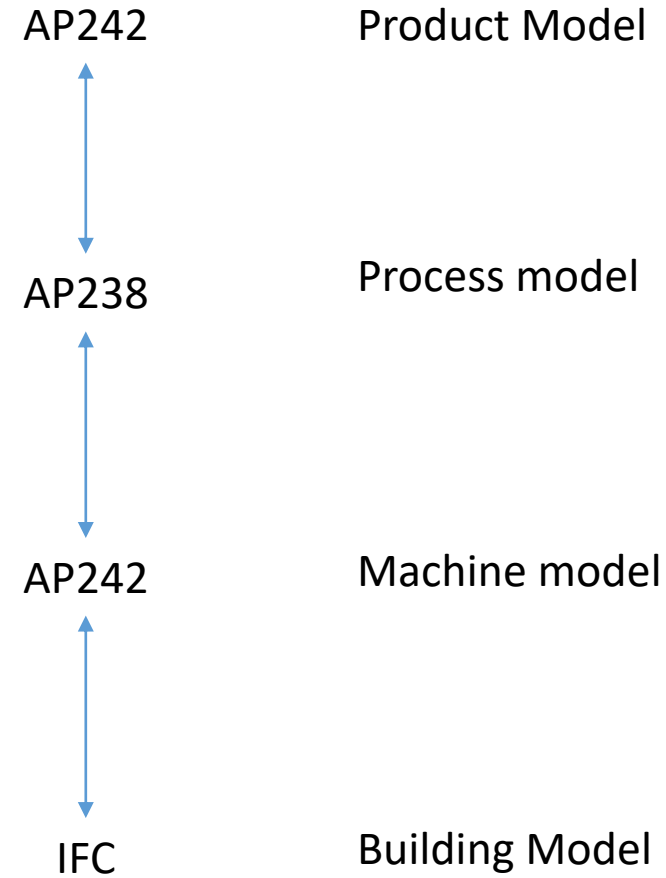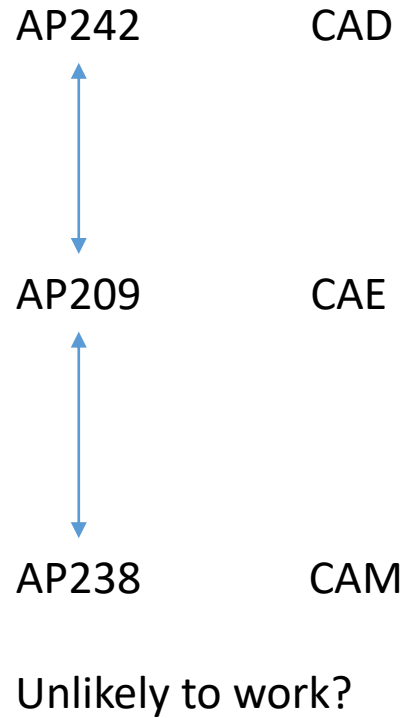
AP238 CAD/CAM

$\updownarrow$

MTConnect CNC

$\updownarrow$

QIF CMM
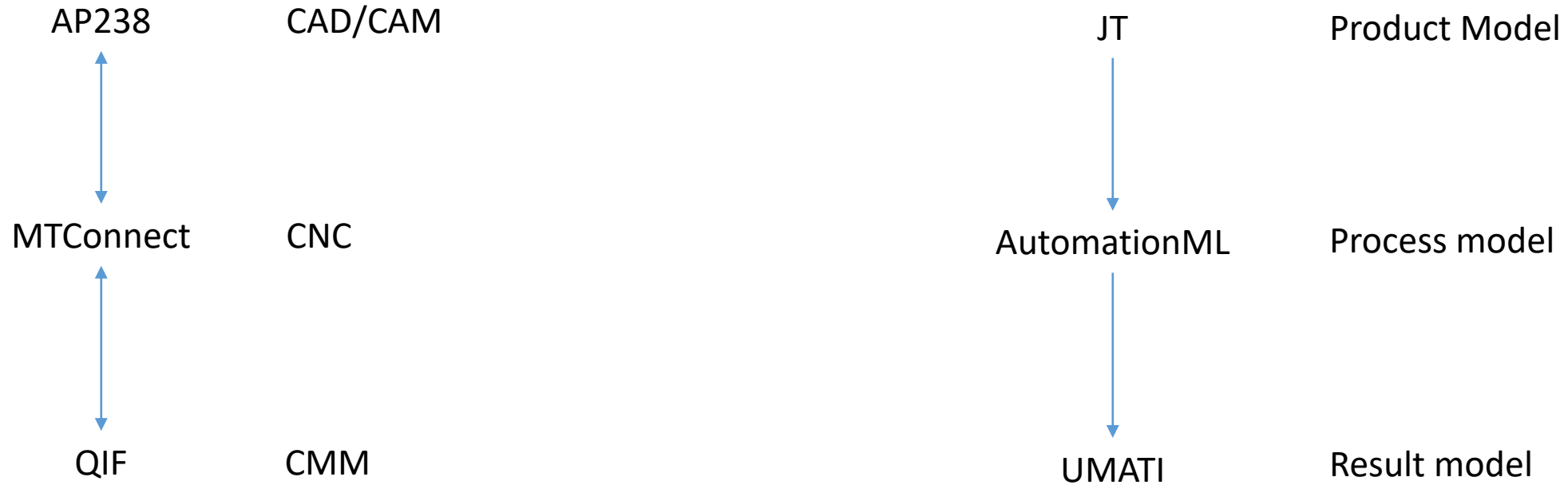
Is this 23247-2 or a thread?

Links bi-directional because of UUID's?

JT Product Model

$\downarrow$

AutomationML Process model

$\downarrow$

UMATI Result model

Is this the Asset Administration Shell solution?

Digital Threads

AP242   CAD

AP209   CAE

AP238   CAM

Unlikely to work?

AP242   Product Model

AP238   Process model

AP242   Machine model

IFC   Building Model

Common geometry   CHIPS business case?

Powder Bed Digital Threads

Threed — Product model with requirements   STL — Facets

Twod — Operations associated to geometry   CLI — Contours and in-fills

Oned — Scan paths associated to operations   Gcode — Machine instructions

Zerod — Measurements associated to scan paths   TSeries — Machine commands

All AP238   AAS?
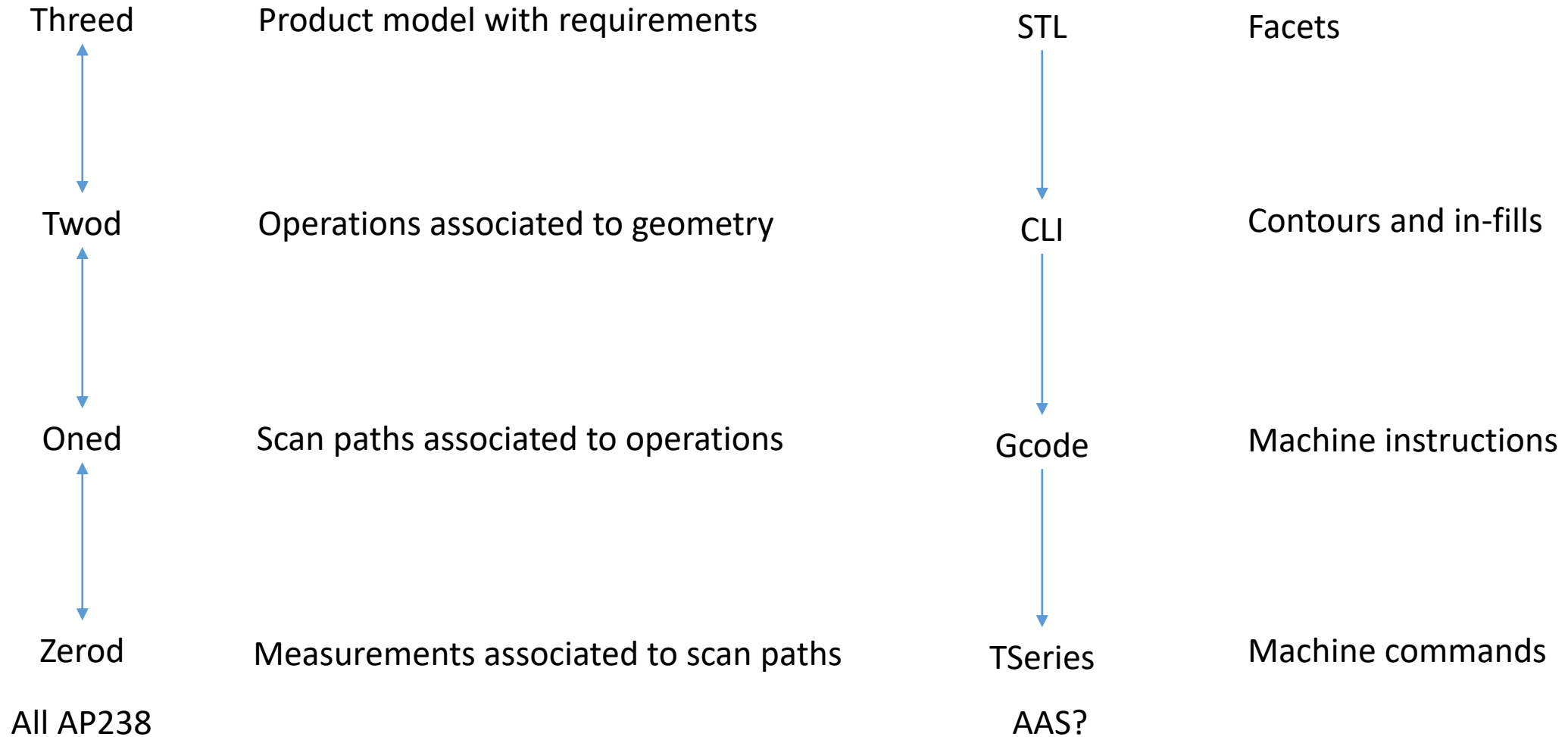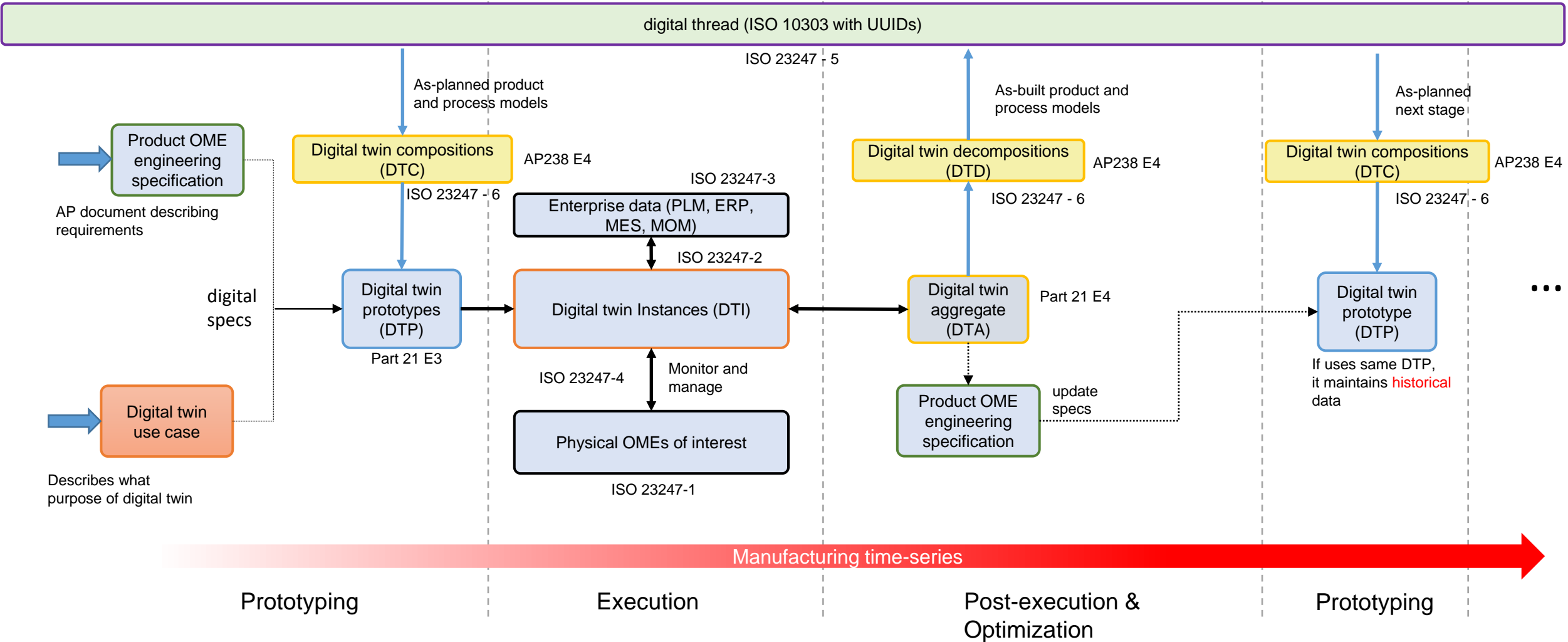
What is a digital thread?

- A digital thread enhances quality control by enabling better comparisons between as-planned data and as-executed results
- A digital thread links data, instead of transforming data, so it does not require a translation of the master model
  - AP238 & AP242 link at the common entity level
  - STEP & IFC link at the common geometry level
  - STEP, MTC and QIF link at the common concept level
  - AAS links at the common application level

threads connecting necessary and sufficient life cycle data
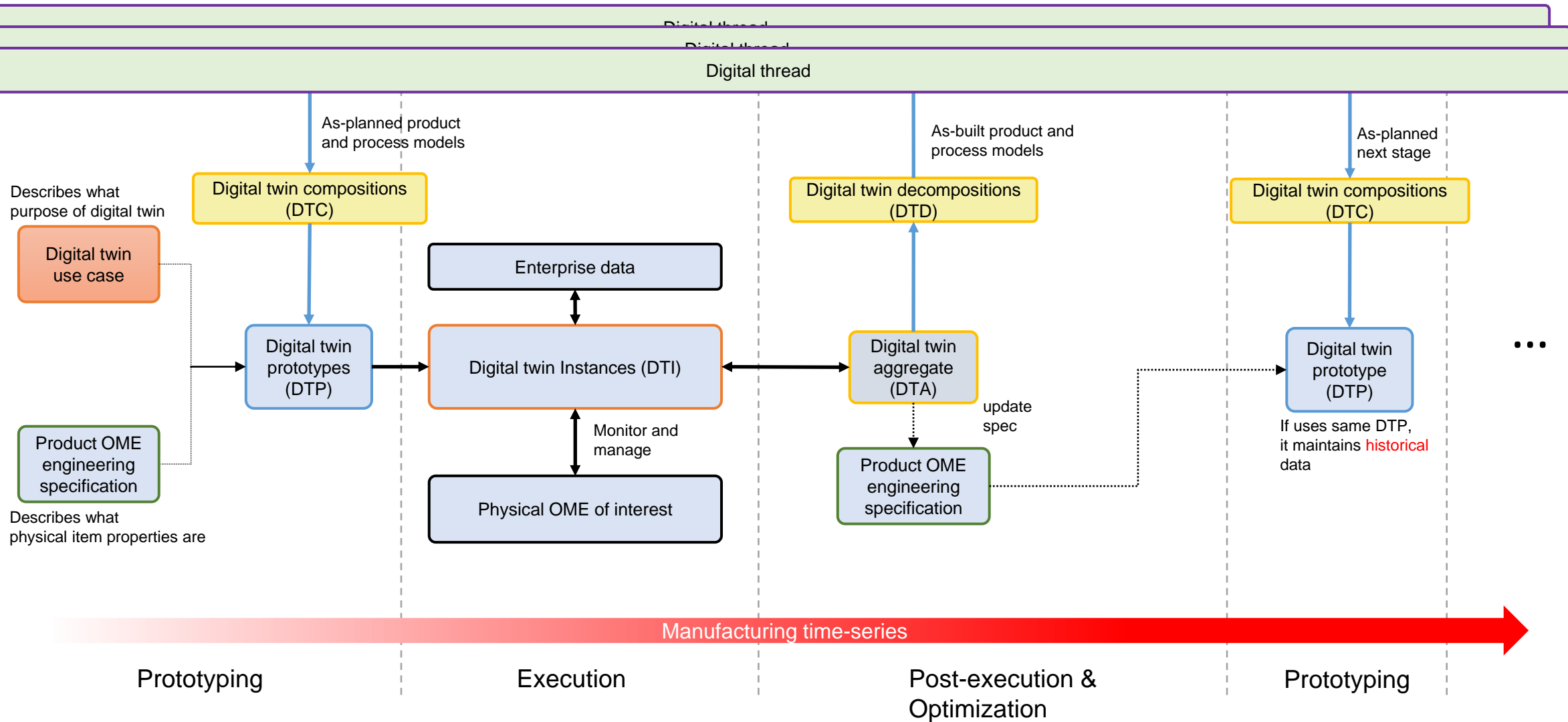
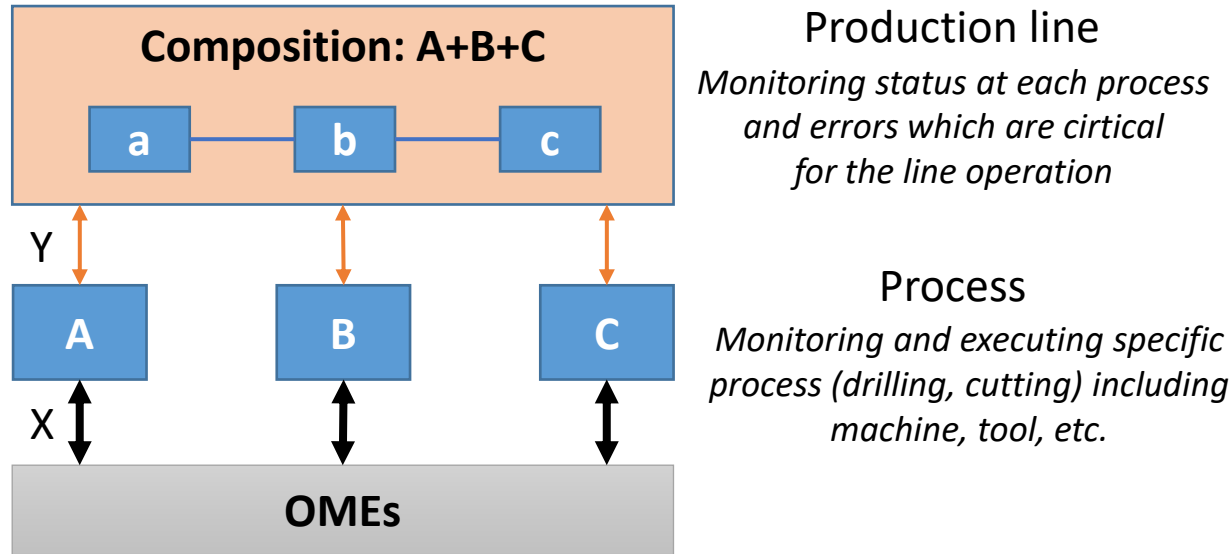Roadmap for digital twin – digital thread manufacturing

*thread connecting necessary and sufficient life cycle data*

digital thread (ISO 10303 with UUIDs)

ISO 23247 - 5

As-planned product and process models

Product OME engineering specification

AP document describing requirements

Digital twin compositions (DTC) — AP238 E4

ISO 23247 - 6

Enterprise data (PLM, ERP, MES, MOM) — ISO 23247-3

digital specs

Digital twin prototypes (DTP) — Part 21 E3

Digital twin Instances (DTI)

ISO 23247-2

ISO 23247-4 — Monitor and manage

Digital twin use case

Describes what purpose of digital twin

Physical OMEs of interest — ISO 23247-1

As-built product and process models

Digital twin decompositions (DTD) — AP238 E4

ISO 23247 - 6

Digital twin aggregate (DTA) — Part 21 E4

Product OME engineering specification

update specs

As-planned next stage

Digital twin compositions (DTC) — AP238 E4

ISO 23247 - 6

Digital twin prototype (DTP)

If uses same DTP, it maintains historical data

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Manufacturing time-series

Prototyping   Execution   Post-execution & Optimization   Prototyping

Roadmap for digital twin – digital thread manufacturing

Composition by merger and/or orchestration

4 twins: A, B, C, Composition(A+B+C)

Production line
Monitoring status at each process and errors which are cirtical for the line operation

Process
Monitoring and executing specific process (drilling, cutting) including machine, tool, etc.

- Focus: gather information from different twins and using it to represent at a glance
- Need to define: how to select information and gather from other twins (protocol aspect)
- Operation/user oriented purpose
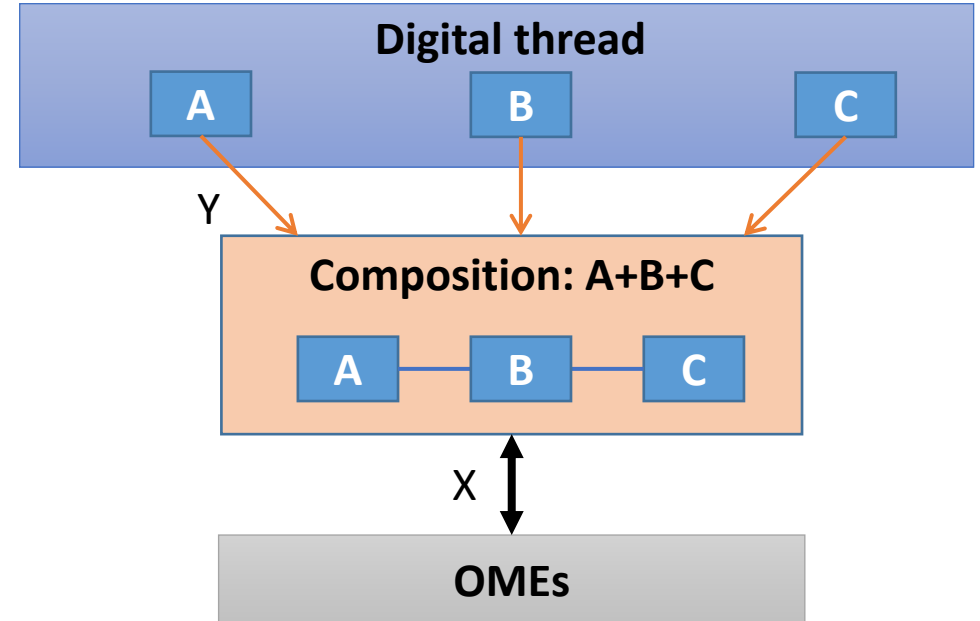
- Focus: gather information from different assets and merge data to create digital twin for specific purpose
- Need to define: how to construct digital twin information model from different data sources (information model aspects)
- Manufacturing/Product oriented purpose