

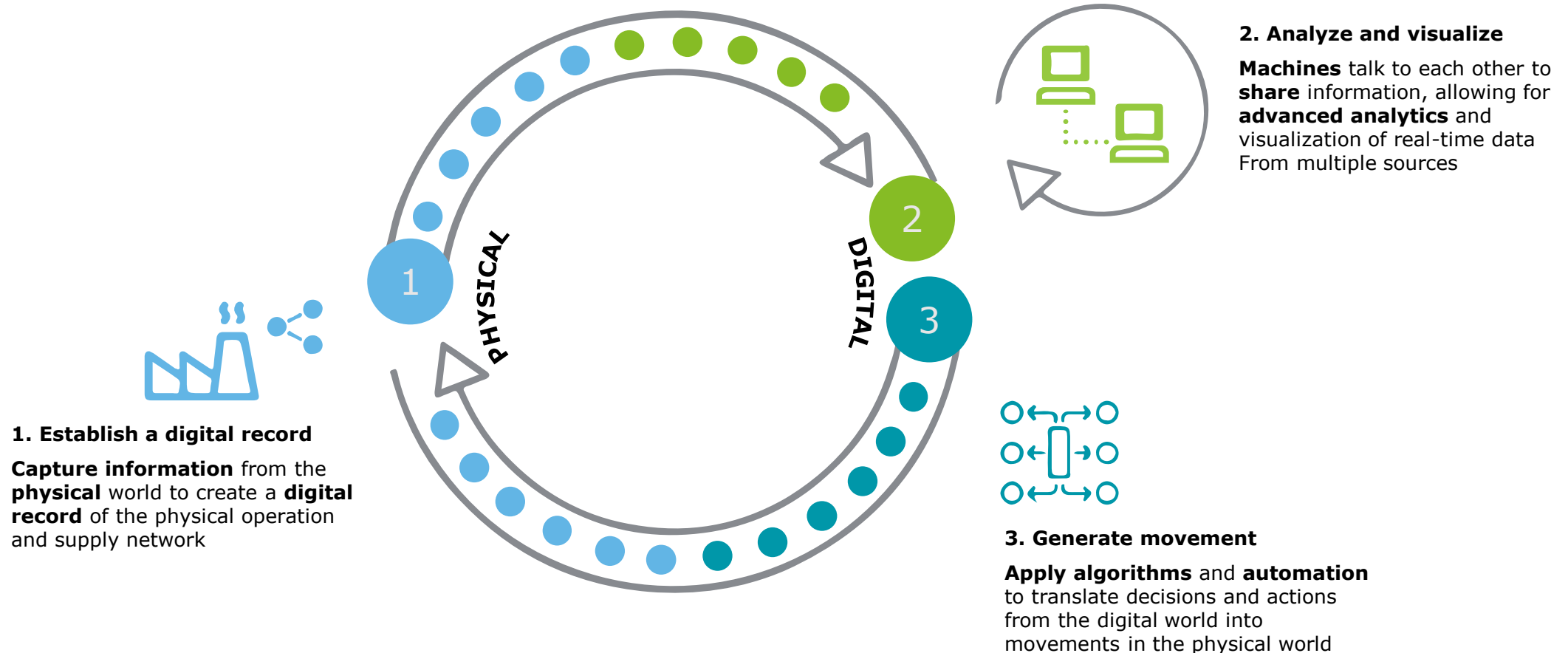


## Digital Thread in Additive Manufacturing

Tying it all together

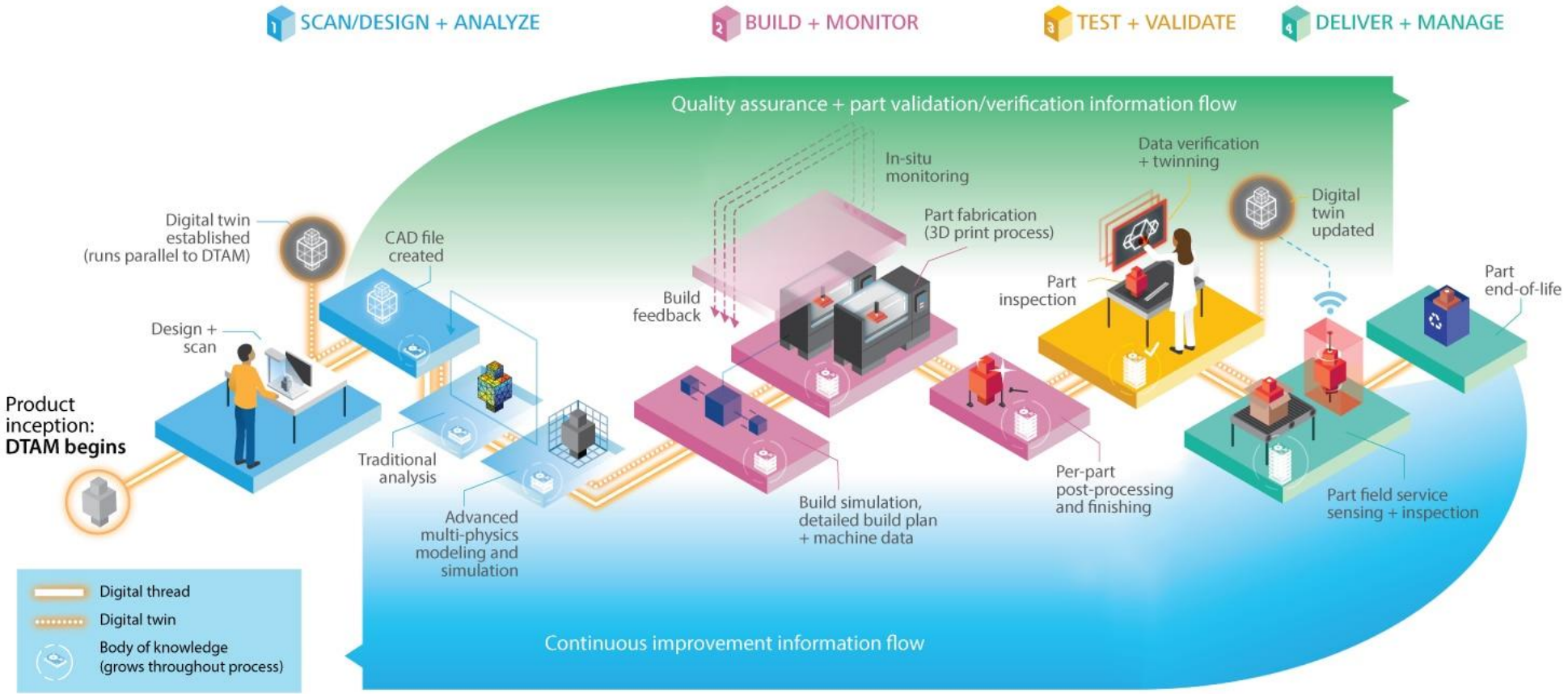
# The physical-digital-physical loop

Industry 4.0 integrates digital information from many different sources to drive the physical act of doing business



# Digital Thread for Additive Manufacturing (DTAM)

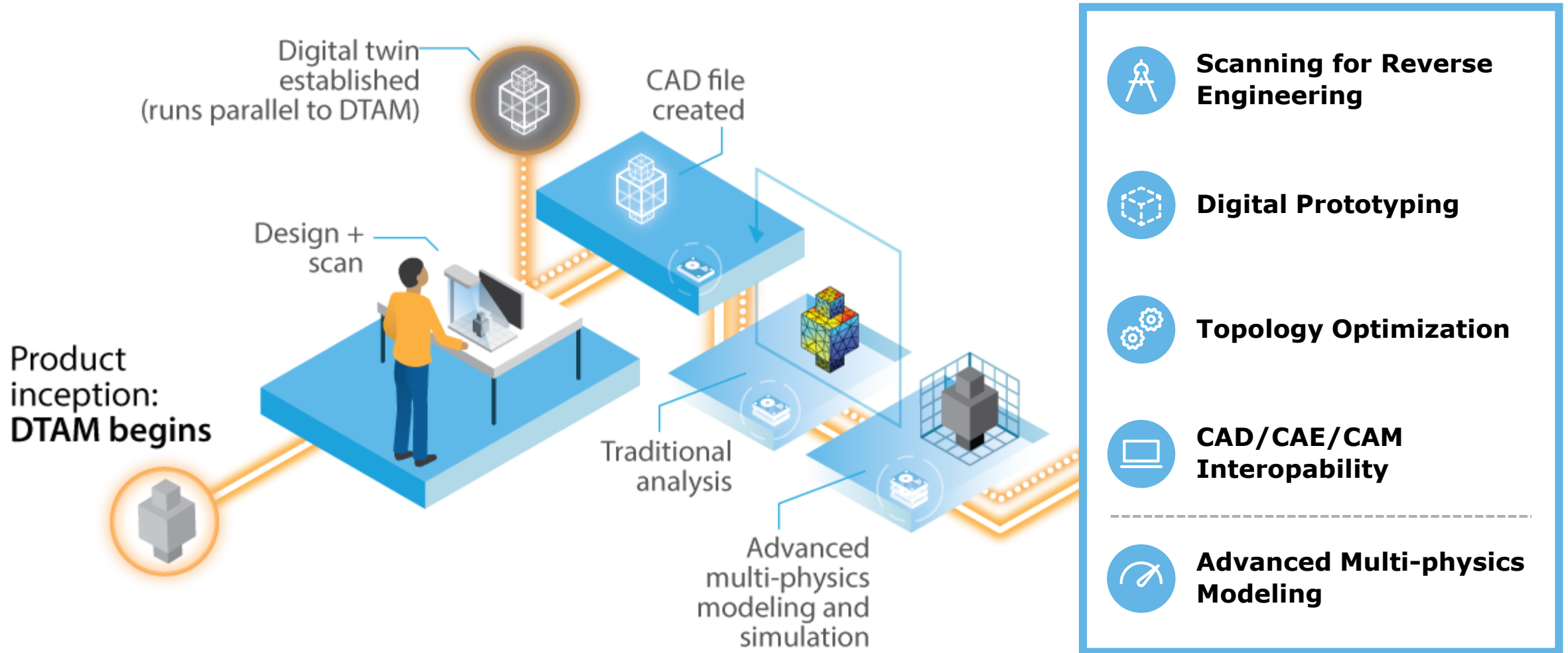
## Connecting the entire product lifecycle



**Digital Thread** – “A single, seamless strand of data that stretches from the initial design concept to the part end-of-life”

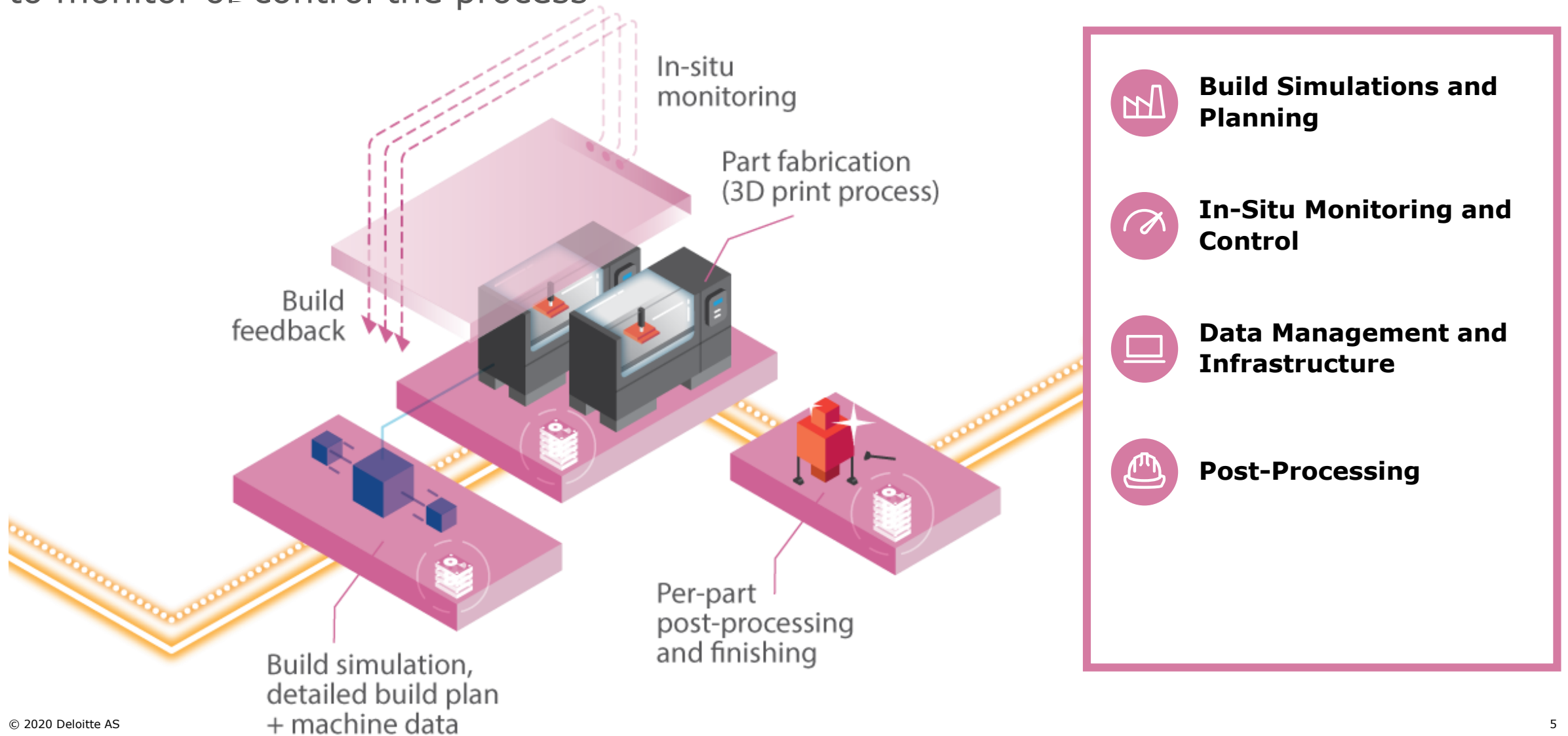
# 1. Scan/Design + Analyze

The physical part or part concept is converted into a 3D computer model, analyzed and refined



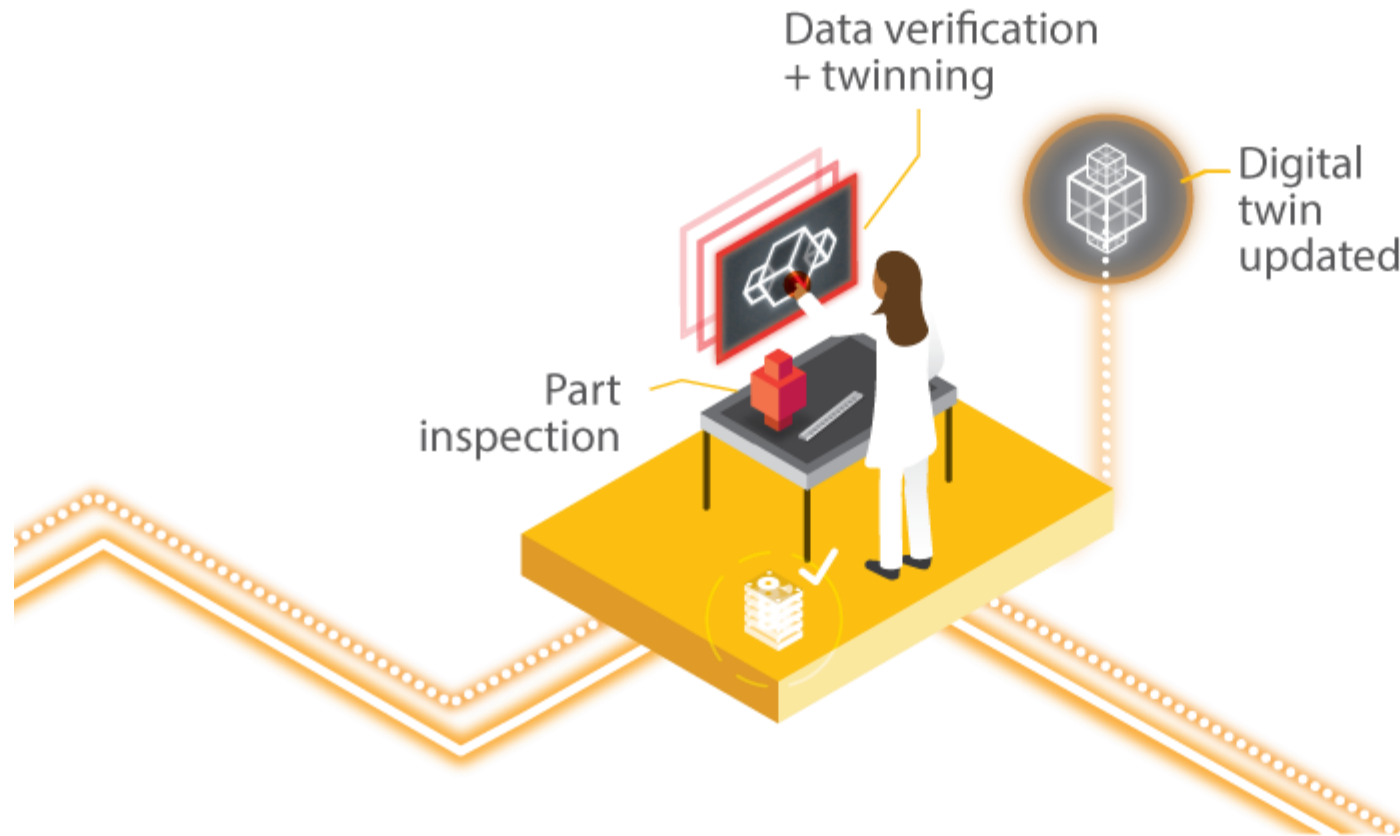
## 2. Build + Monitor

The build is planned and simulated using the 3D model, then executed using sensor data to monitor or control the process



### 3. Test + Validate

Testing and validation builds on previous process data, enriched with topographic and NDT data



**Non-Destructive Evaluation**



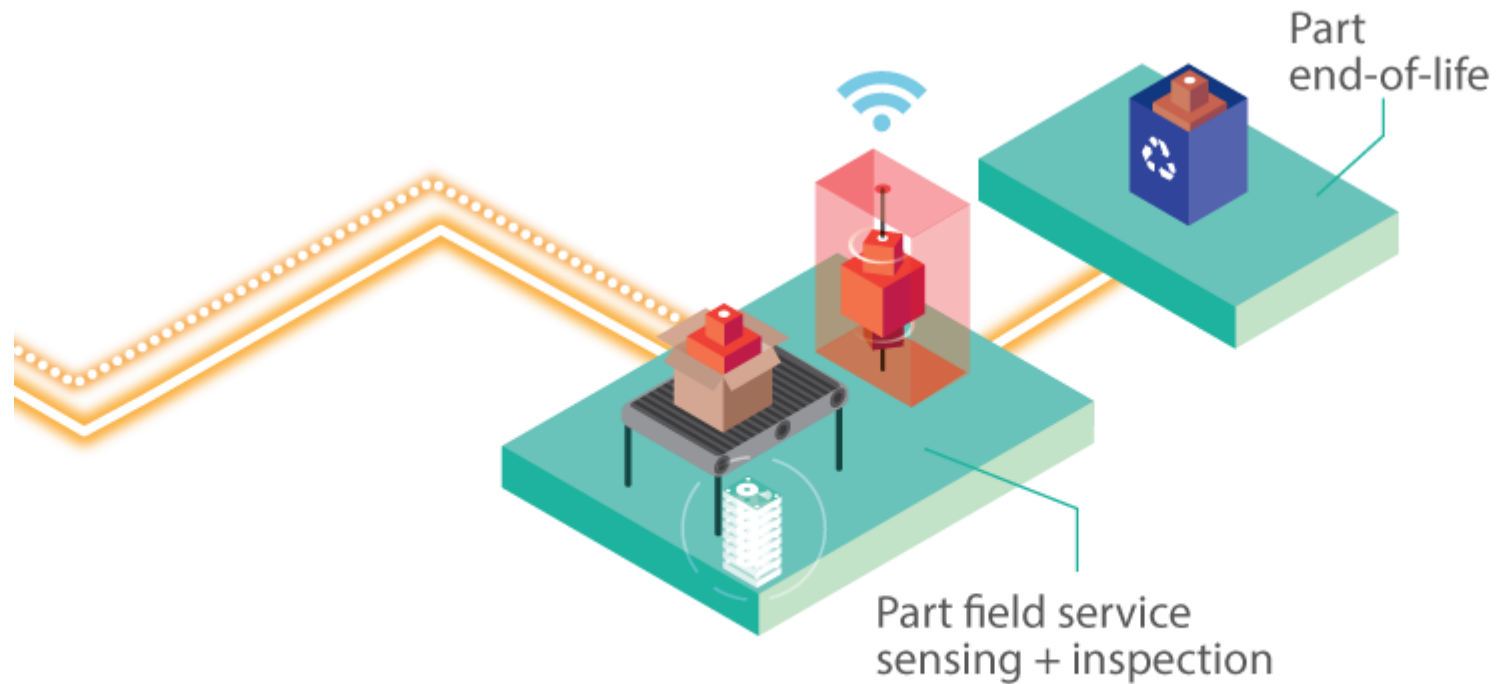
**Coordinate Measurement Machines**



**Data Verification and Twinning**

## 4. Deliver + Manage

Once the products are released for delivery, the products sensor data updates the digital twin and thread with the operational and sustain history



**Analytics and Lifecycle Modeling**



**Digital Feedback to the Design Process**



**Connected Sensors in Field Service**

# Digital thread value proposition

## Unlocking value across the product lifecycle



### Potential value



#### Better outcomes:

- Enhances part **performance**
- Allows **customization** to mission requirements
- Improves part **reliability**



#### Improved processes

- **Institutionalizes** acquired **knowledge** for repeatability
- Enables **quality assurance**



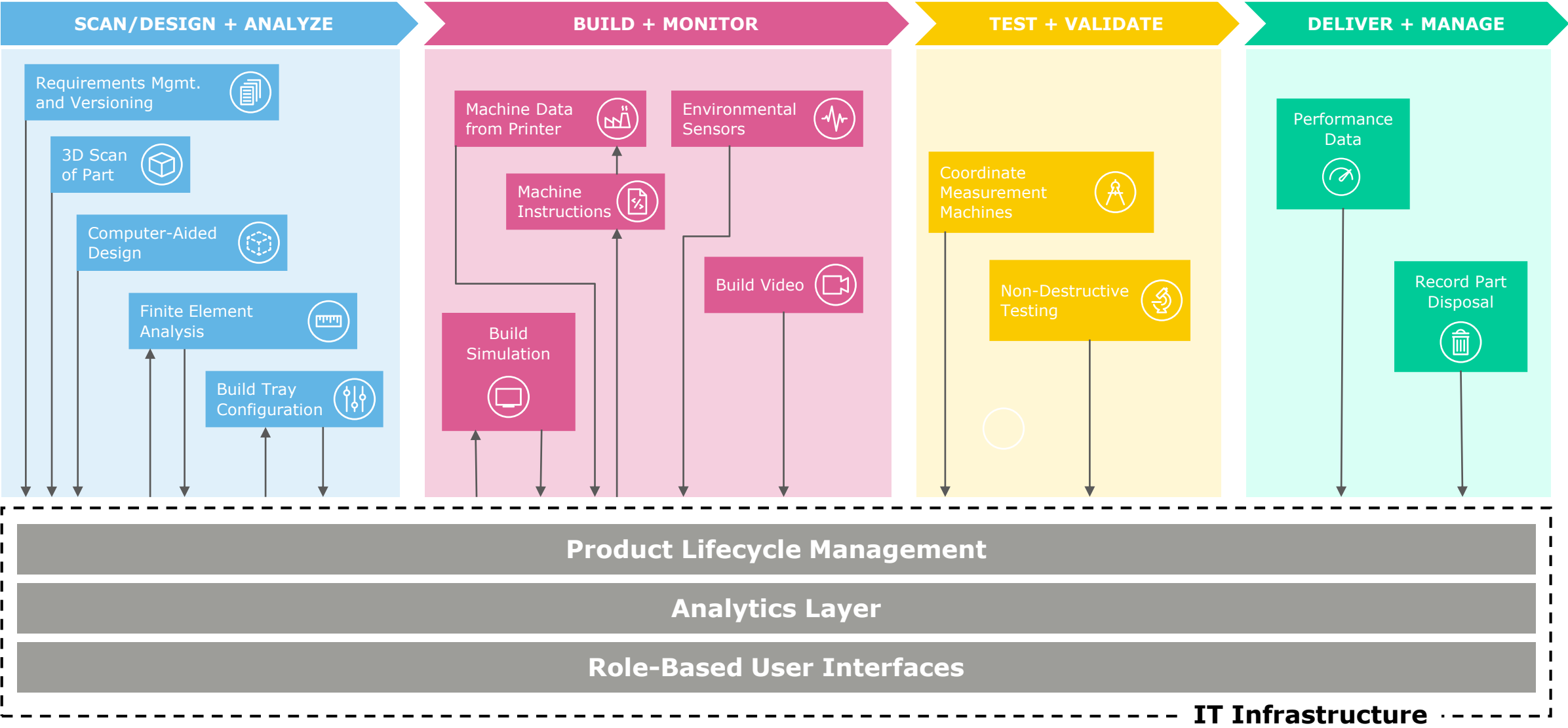
#### Reduced lead times

- **Facilitates shift** from physical to digital inventory
- Supports **geographically distributed** activities



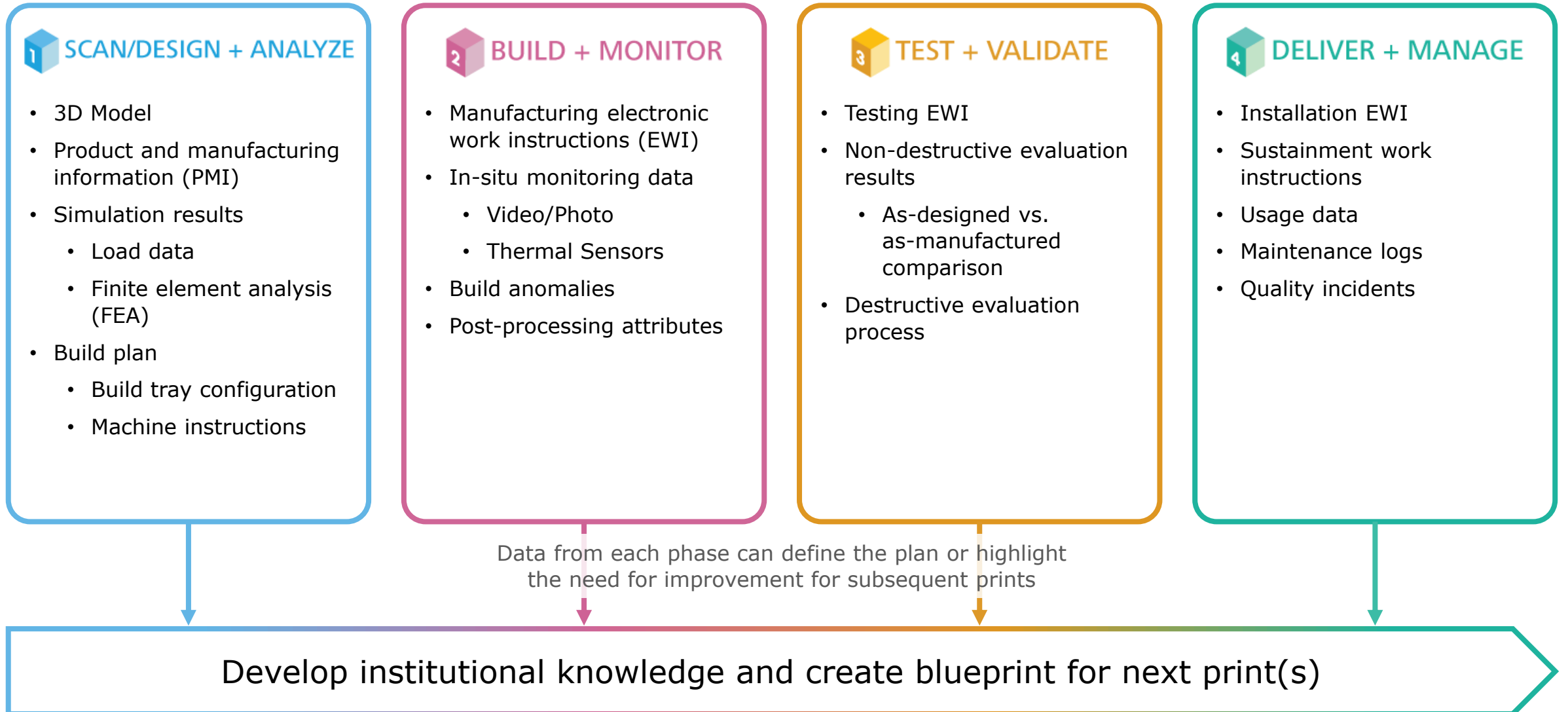
# An architecture for today's digital thread for additive manufacturing

Many of the required capabilities already exist and can be integrated

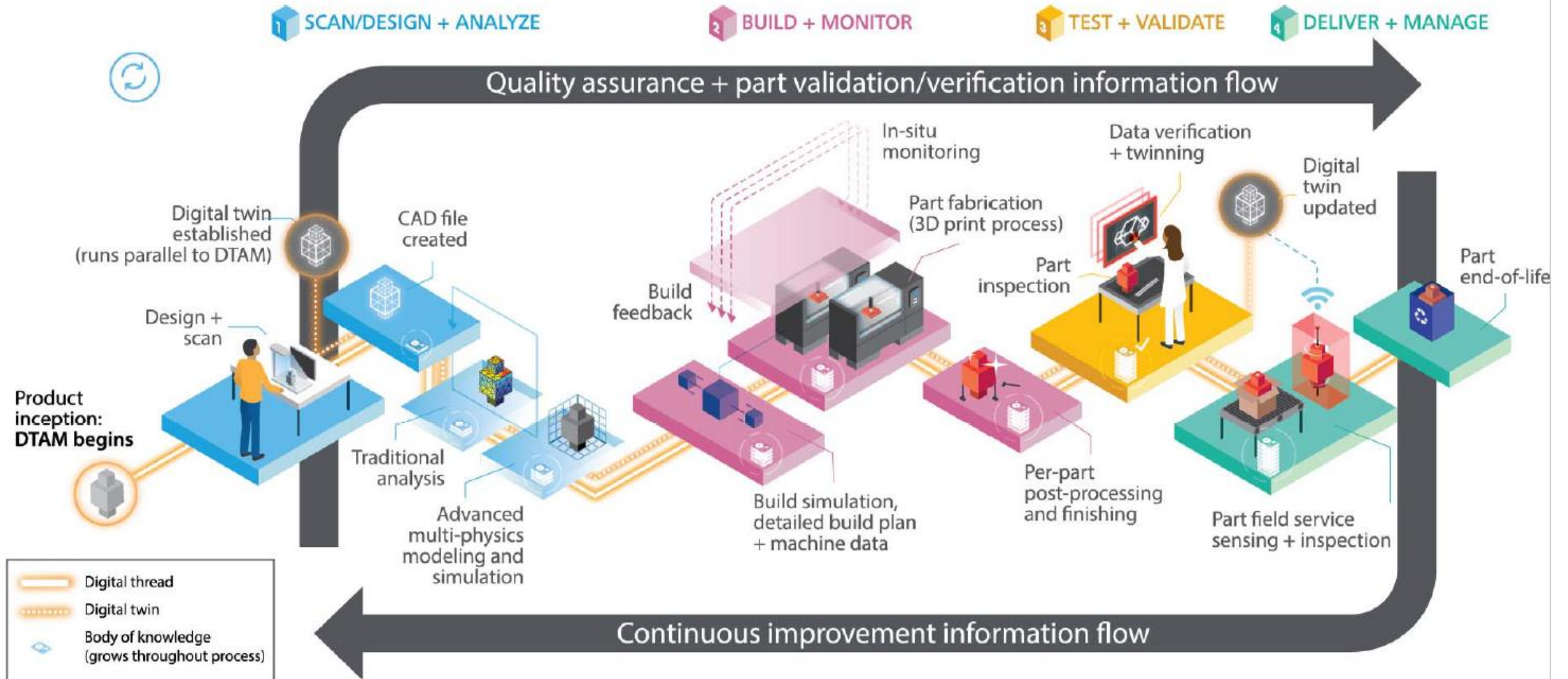


# Digital thread data institutionalizes acquired knowledge

## Capturing and managing data to be leveraged enterprise-wide



# DTAM – improving products life cycle and knowledge/leanifying processes





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