Data Standards in the Production System

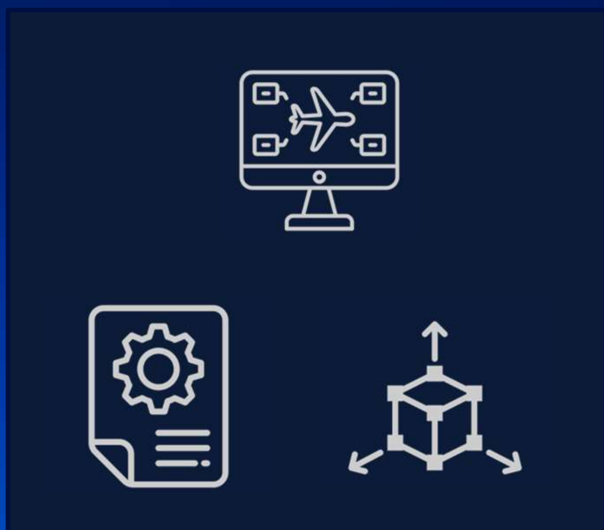
Ben Nimmergut
Vice President
Functional Chief Engineer – Production Engineering

Carla Reynolds
Senior Technical Fellow
Digital Manufacturing Systems and Simulation

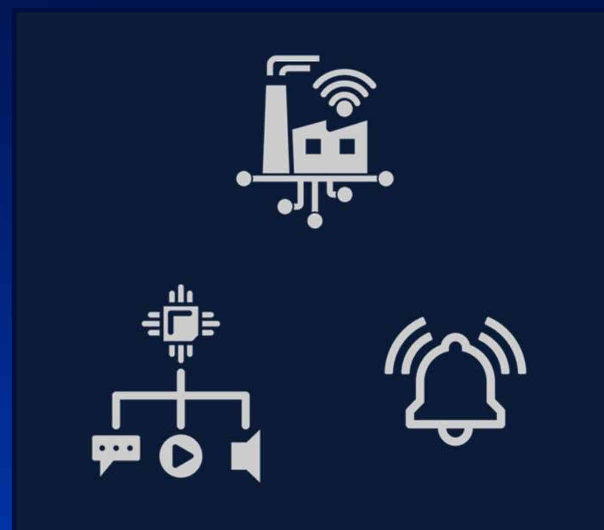
September 23 2025

Beyond Product Data Standards–
Unlocking Broader Value in the Production System

Defining the Product
Static data configuration



Unlocking Production Insights
Dynamic data flow



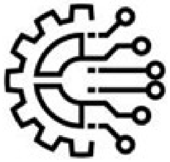
To truly understand our products, we must also understand the conditions, processes, and contexts that create them. That means going beyond Product Data Standards.

Standards in Production must capture Context

How

When

Where



As an **Equipment Engineer**, I would like equipment asset data to enable preventative maintenance and quantification of equipment stability.

Contextualization: Signals tagged to asset → cell → site; aligned to maintenance & build schedules

Context turns raw measurements into decision ready insights

As an **Industrial Engineer**, I need real time part flow data to enable discrete event simulations to optimize and understand production rates and bottlenecks.

As a **Materials & Process Engineer,** I need telemetry data from our equipment and factories to ensure compliance with requirements defined in our materials and process specifications.

As a **Supply Chain Analyst,** I need materials utilization actuals to compare back to our MBOM estimates to enable efficient forecasting and ordering of material for my fabrication facilities.

As a **Quality Engineer**, I would like data from multiple steps in the fabrication process to be captured in a single instance of an “As-Built” data model to enable analysis of root cause in quality defect formation.

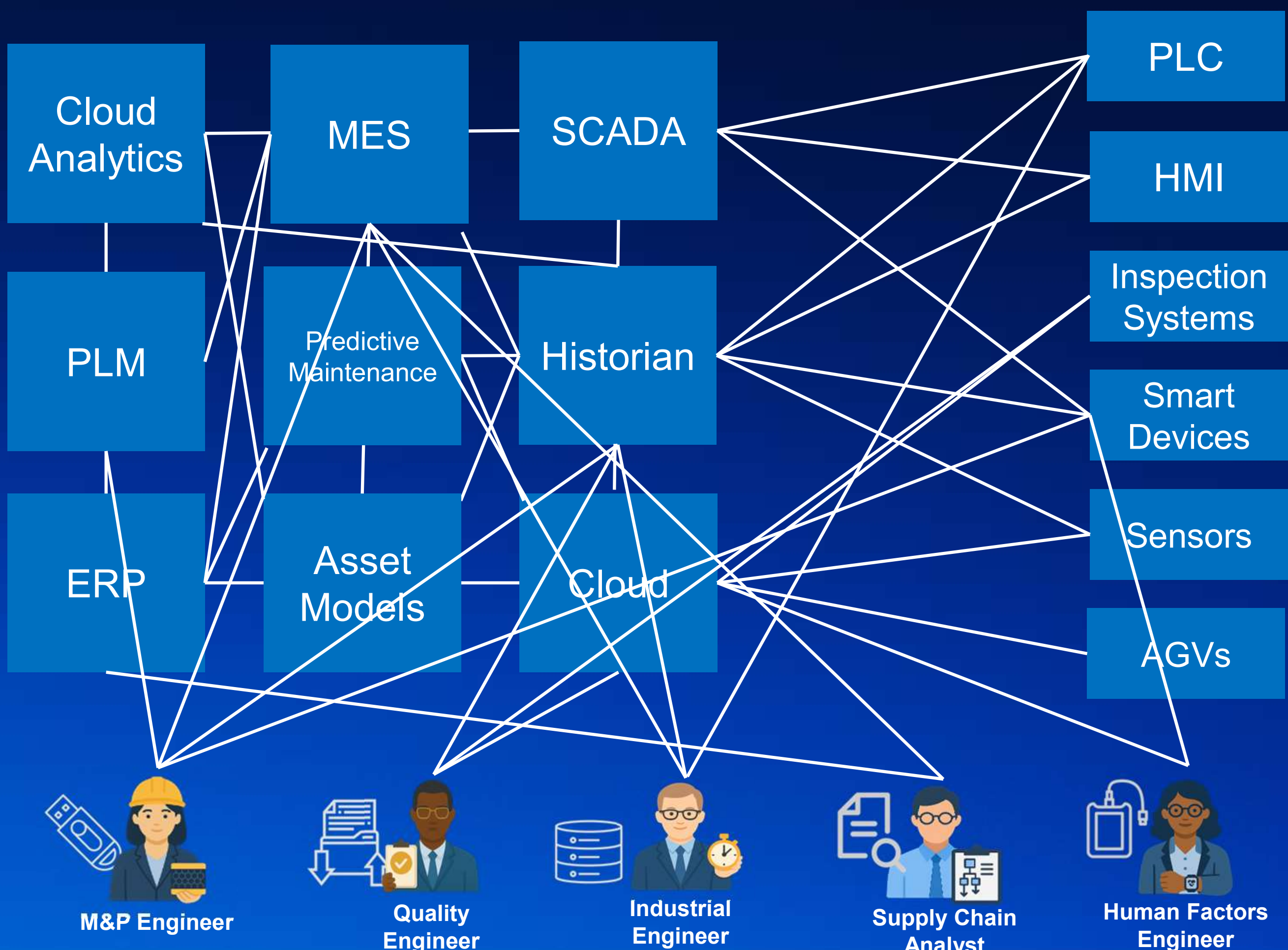
As a **Human Factors Engineer,** I need access to wearables data in context with manufacturing process being executed to assess ergonomic and safety challenges for our workforce.

Challenges in Data Centric Problem Solving in the Production System

Boeing

Siloed Systems & Data	Data is seen as single use, systems are siloed
Context Collapse	Data from the production floor lacks context required to make it valuable at point of use
Inconsistent Definitions	Metrics, Units, & Naming Conventions differ from cell to cell, and site to site
Subject Matter Experts are a limited resource	There are limited resources available that understand and can identify the useful data in our production systems

Point-to-Point
Manufacturing Digital Ecosystem



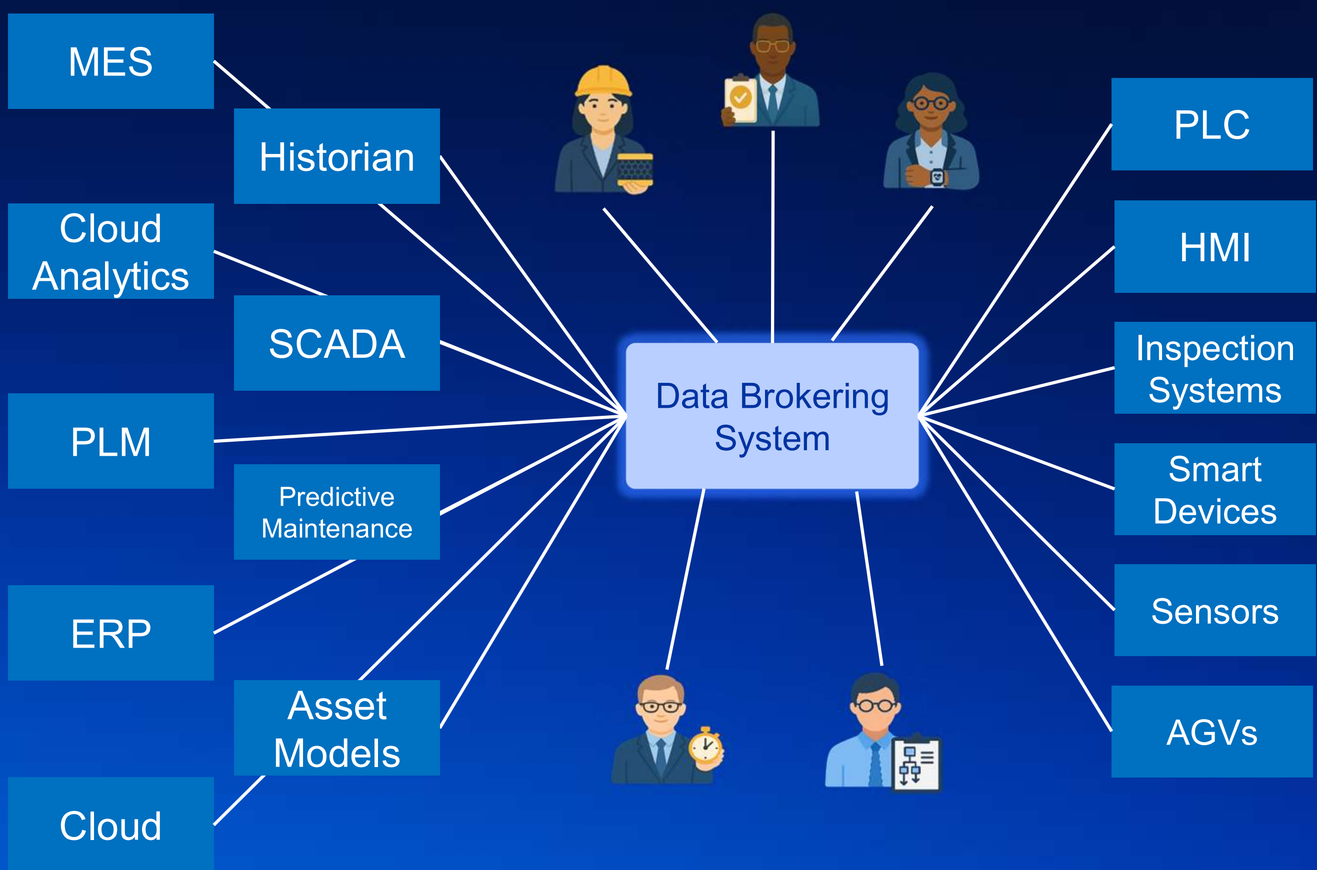
Creates data silos

Creates rework for each user to identify and use data to solve problems

Lacks Standardization

Inefficient

Hub-and-Spoke
Manufacturing Digital Ecosystem



Enables Standardization

Reduces Data Silos

Enables scalability

Decentralizes Ownership of Data Use

Enables a culture of continuous improvement through Data Access and Use

Our Philosophy

Eliminate Point-to-Point
Drive out technical debt through the use of a hub-and-spoke architecture.

Built to Scale
Our architecture is designed to scale seamlessly, decoupling data publishing, access, and consumption.

Context is Everything
Data is only valuable when it's in context. Context is different for everyone.

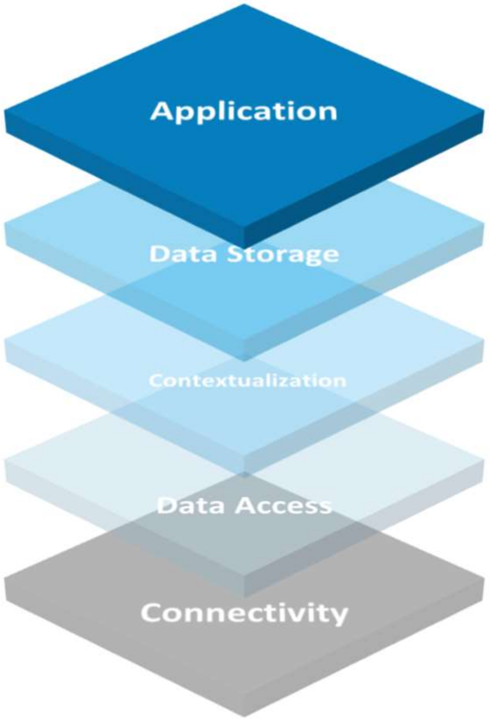
Discoverable & Collaborative
We prioritize data that can be easily found, understood, and shared — empowering teams to work together and drive insight.

Future-Proofed
What we build today should be adaptable tomorrow. Our tools evolve as the enterprise evolves.

Reusable by Design
Build on Standards. Reusability starts with structure.

Decentralized Ownership
Enable teams to solve their own problems in a data centric way.

Fast to Deploy
enables rapid development and deployment of solutions — ideal for emergent needs, pilots, and short-term wins.



A *data-centric* and *event-driven* approach where many partners, applications, and frameworks can exchange data in standards-compliant ways.

Standards + Modular Layers Enable Usability

- **Connectivity** – Standards ensure machines, sensors, and partners can speak the same language, reducing integration friction.
- **Data Access** – A governed, standards-based backbone makes data discoverable, trusted, and secure.
- **Contextualization** – Shared models and ontologies allow data to be meaningful beyond its source system.
- **Data Storage** – Standards define how data is organized and preserved, enabling long-term reuse and analytics.
- **Applications** – A stable foundation lets applications interoperate and scale without custom one-off integrations.

Equipment Engineer

As an **Equipment Engineer**, I would like equipment asset data to enable preventative maintenance and quantification of equipment stability.

Contextualization: Signals tagged to asset → cell → site; aligned to maintenance & build schedules

Process Engineer

As a **Materials & Process Engineer,** I need telemetry data from our equipment and factories to ensure compliance with requirements defined in our materials and process specifications.

Contextualization: Telemetry measurements linked to *requirements & specifications, part features, process step, and product instance*

Supply Chain Analyst

As a **Supply Chain Analyst,** I need materials utilization actuals to compare back to our MBOM estimates to enable efficient forecasting and ordering of material for my fabrication facilities.

Contextualization: Part & Workorder, Materials Management System, Rollup against BOM + NC Program; compare actual vs planned

Engineering & IT Co-Creation	Engineering frames the problem, IT maintains the systems – progress only comes when both build together.
From Ownership to Stewardship	Data isn’t a private asset; it’s a shard resource. We must be altruistic in our efforts
Standards as a Common Language	Shared Definitions let Engineers across disciplines and IT use data without translation or rework
Flow over Control	Success isn’t about locking down data, its about enabling smooth, reliable movement across teams and tools

We must work together to continue to build a digital ecosystem that allows us to truly understand the conditions, processes, and contexts within our factories and used create our products.