Necessity of Digital Twin Configuration and Digital Thread Traceability
Industries Changing & Being Disrupted Rapidly

Materials Advancements & Additive Manufacturing

Connected & Autonomous

Data Collection & Handling
Smart Connected Future = Even More Changes

New Technologies + Next Gen Capabilities + New Business Models


Introduction of Artificial Intelligence / Machine Learning
Data Streaming from Factory & Field
Efficiency Improvements
Performance Optimization
True Predictive Maintenance
Many Initiatives Focused on Infrastructure

Sensors

Datacenter & Cloud

Analytics
Time Series Data
Analyze, Interpret, Act
Knowledge = Information in Context
Future Without Digital Twin + Digital Thread Context

Ramifications
- Misdirected Actions
- Inaccurate Conclusions
- Misinterpretations

Risks
- Loss of Life
- Safety Issues
- Liability
- Brand Damage
- Regulatory Actions
- Operational Shutdowns
- Lost Revenues
- Customer Frustration
- Unnecessary Rework / Repairs

Risks increase exponentially with artificial intelligence
What is the Digital Twin Configuration?

General representation of a family of products?

Just Mechanical?

As-Designed?
Digital Twin Configuration

exact digital representation of the physical thing right now
What is the Digital Thread?

Relationship Connections

Meaningful relationship connections between all of a product’s digital assets – and their revisions over the lifecycle – including (but not limited to) versions of BOMs, parts, software, electronics, CAD models, documents, requirements, process plans, service manuals, etc.
Digital Thread = Meaningful Relationships

Context

Bill of Materials?  FFF Alternates?  Other?

Dependency

Floating Relationship

Fixed Relationship

Rev A
Part 123
Rev A
Part 987
Rev A
Part 987

Rev B
Part 987
Rev B
Part 987
Rev B
Part 987

Rev C
Part 987
Rev C
Part 987
Rev C
Part 987
Are Digital Twin & Thread Achievable?

Thousands of Existing Systems & Petabytes of Data
Users around the World

Source: Boeing

RIP & REPLACE
NOT REALISTIC
Platform Overlay Approach

Concept → Development → Manufacturing → Service

Platform Applications

Platform Services

MBSE → Simulation → ALM → ECAD PDM → MCAD PDM → ERP → MES → Maint. Mgt. → IOT
System-of-Systems Architecture
also called Platform for the PLM Backbone

Not just Links, but Relationships
Avoids Risk & Disruption
Move Agile, Fast, Bi-modal IT
Platform Requirements for Digital Twin & Thread

**PLATFORM REQUIREMENTS**

- **Ability to ingest data** through API and Services
- **Integration** ability to manipulate processes and data through exposed API / Services
- **Extensibility** ability to build / extend functionality leveraging COTS framework
- **Ability to exfiltrate data** out of API / Services

**CANNOT HAVE**

- Proprietary APIs
- Incomplete or Hidden API Function Calls
- Proprietary Data Models
- Static / Hard Coded Data Model
- Obfuscated Data

**MUST HAVE**

- Transparent & Interrogatable APIs
- FULL API Capabilities Exposed
- Open Data Model
- Dynamic Data Model
- Open Data Access

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Data Model Requirements for Digital Twin Configuration

CUSTOMER DEMANDS

- Highly Adaptable & Extensible
- Link / Federate with Legacy
- Continuously Upgradable

BUSINESS MODEL

SUPPLY CHAIN PERSPECTIVE

Digital Twin Data Model
Metadata (Persistent & Derived)

TARGET SCENARIO

- IN-PRODUCT CAPABILITY PURCHASE
- POWER BY THE HOUR
- PAAS (PRODUCT AS A SERVICE)
- USAGE-BASED BILLING
- PREDICTIVE MAINTENANCE
- PERFORMANCE OPTIMIZATION
- SOFTWARE UPDATES
- REMOTE OPERATION

OEM
OWNER OPERATOR
TIER SUPPLIER
Why are Digital Twin & Thread Required?

Context is Critical for Interpretation & Action

Smart Connected Technology

Industrial Internet & Industry 4.0

Artificial Intelligence / Cognitive Computing

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CALL TO ACTION

Aras is actively engaging in proof of concept initiatives for open reference architecture development

Please share your use cases & best practices

Digital Twin and Digital Thread

To collaborate & contribute, please contact:
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