Digital Twin Messaging

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What is Digital Twin Messaging?

- Synchronize state of manufacturing with digital twin
  - Use name spaces defined by International Standards
  - Use MQTT or similar as transport
- Examples
  - Update tool wear
  - Update form, fit and location
  - Update completions
  - Detect anomalies
  - Adjust feeds and speeds
  - Correct tool paths

Why Digital Twin messaging?

Data exchange

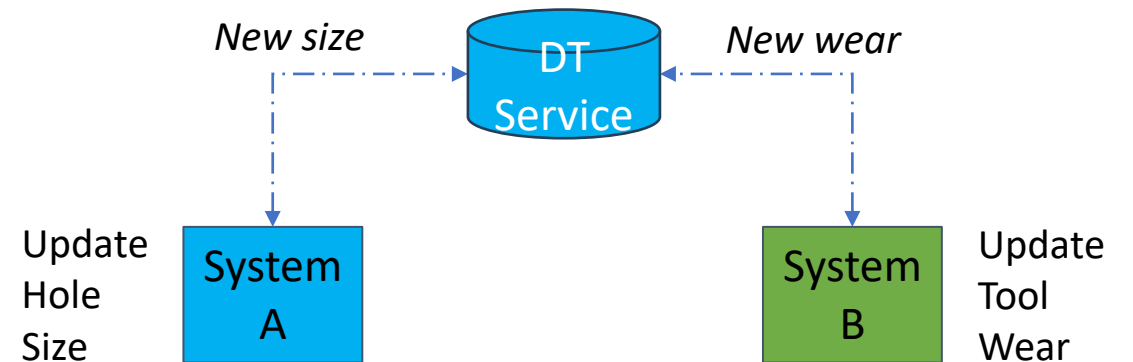- Exchange complete and unambiguous data set
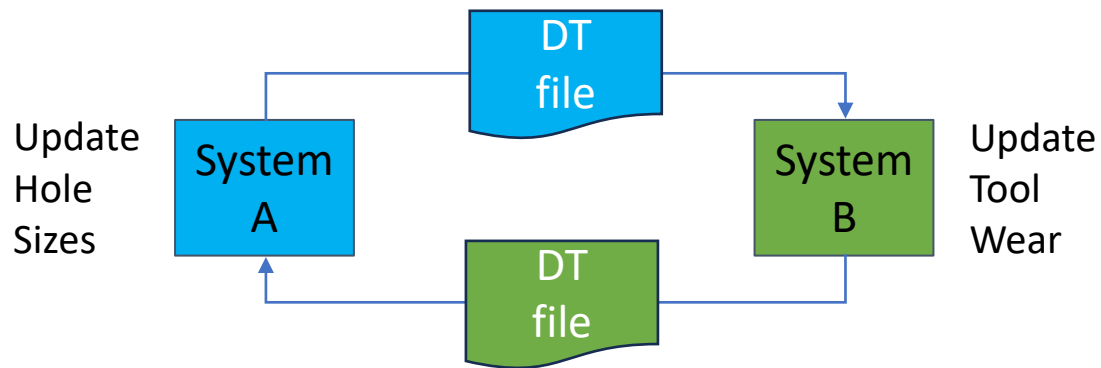
Data Exchange Method

Messaging

- Update data set to latest state of manufacturing

Messaging Method

How?

- Python script messages?

- Messages that are easy to parse?

- New EXPRESS language?

- JSON or YAML

{"AP238-action": "tool wear",
"workingstep": "UUID"
"wear": {"value":120.5, "unit":"s"}}

{"AP238-action": "tool wear",
"tool": "UUID"
"wear": {"value":120.5, "unit":"s"}}

{"AP238-action": "measured hole diameter",
"hole": "UUID"
"diameter": {"value":0.51, "unit":"in"}}

{"AP238-action": "measured hole diameter",
"workingstep": "UUID"
"diameter": {"value":0.51, "unit":"in"}}

{"DT-action": "measured hole diameter",
"target": "UUID"
"diameter": {"value":12.2, "unit":"mm"}}

Messaging, Exchange and Composition

- Messaging updates digital twins

- Exchange shares digital twins

- Composition builds digital twins

Thread Connection	Drill and Fill	Composites	PBF
Messaging	Update tool wear	Update feed speed	Start 0D
Exchange	Drill and Fill project	New ply	New material
Composition	Reorder for new robot	Update edge allowance	Rework overhang