Martin Hardwick, STEP Tools, USA
Hyman Duan, PERA, China
Jin Lee, ETRI, Korea
Hilemet Hussain, SIS, Sweden
Suk-Hwan Suh, Postech, Korea
Fumiki Tanaka, Hokkaido University, Japan
Jung Hei Kim, ETRI, Korea
Hyun Jeong Lee, ETRI, Korea
Dukki Chung, Rockwell Automation, USA
Aydin Nassehi, University of Bristol, UK
David Odendahl, Boeing, USA
Liming Li, JSL Inoovations, USA
JIngmei Gao, Rockwell Automation, China
Bengt Olsson, Sandvik, Sweden
Charlotta Johnsson, Lund University, Sweden
Rainer Adolf, Siemens, Germany
Jean-Ives Delaunay, Airbus, France
Fumikho Kimura, University of Tokyo, Japan
Richard Martin, Tinwisle, USA
Chiaki Sakamoto, MEL, Japan

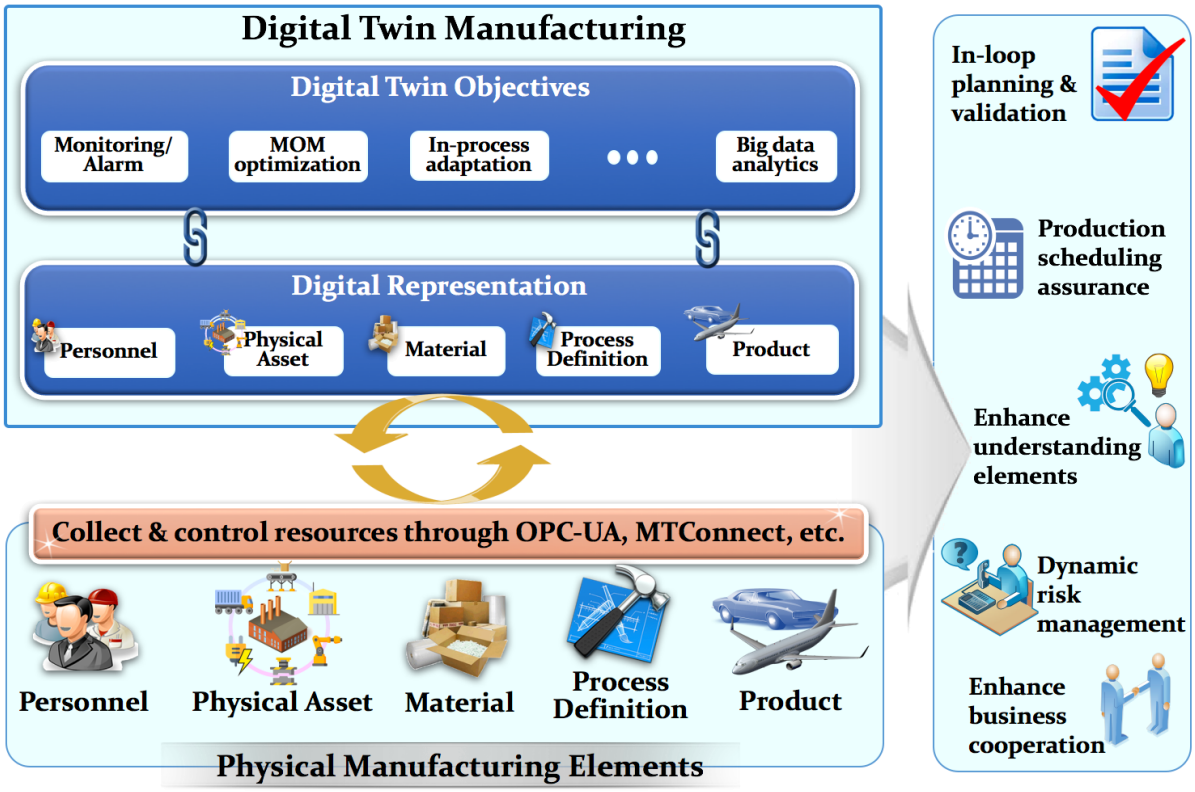
1. We reviewed and resolved the comments from the successful NWI for ISO 23247 Digital Twin manufacturing framework.
2. We reviewed the second edition of STEP-NC AP238 and agreed on a method for referencing the AP242 modules from with AP238 with WG12.
3. We submitted QIF as a New Work Item to SC4.
4. We agreed to prototype new MTConnect commands for tracing operation status on systems with a slow speed MTConnect (<10Hz).
5. We reviewed the second edition of ISO 14649 with SC1 and agreed to present Part 17 to the additive manufacturing team of AP242.
6. We agreed to submit a Request for Input (RFi) for digital twin manufacturing examples to the member countries and liaisons of SC4 (see attachment).
7. We reviewed the Smart Manufacturing meta-model of JWG21.
8. We decided to initiate a digital twin implementors forum at the SC4 meeting in Chicago.

Call for input

Digital Twin Manufacturing

What is it?

Digital Twin in manufacturing is a virtual representation of manufacturing elements such as personnel, products, assets and process definitions, in a living model that updates and changes as the physical counterpart's status, working conditions, product geometries, and resource states change in a synchronous manner.



What do we get?

Digital Twin manufacturing aims to achieve real time data collection and resource control in manufacturing. The data is collected in historia and its analysis enhances understanding of manufacturing elements, which in turn enables in-loop planning and validation of manufacturing processes. In addition, the data gives management the opportunity for dynamic risk balancing, for production optimization, scheduling assurance and business cooperation with various industries. Ultimately, Digital Twin

manufacturing is expected to increase business profit by optimizing cost efficiency and increasing production and product quality.

What should we do?

In order to realize Digital Twin manufacturing, a framework or frameworks will be defined in ISO 23247. Each framework will provide a standard way to build digital twins in real time for a particular type of manufacturing process. The team defining ISO 23247 is looking for examples of how digital twins are being built today, or which you plan to build in the near future. We would like to know the data protocols that you are using in your twinning, and how you are integrating them to make an accurate model.

If you would like to submit your ideas please send a white paper, or presentation, to the ISO project leader at hardwick@steptools.com by August 27, 2018. In return, we will arrange in person and phone interviews during the International Machine Tool Show 2018 in Chicago from September 10 to 15. We want to explore your ideas in detail and our aim is to discuss each input over a morning or afternoon session. The ideas we gather will be used in an Implementor's Forum to be held at the DMDII in Chicago in early November. An example of input for a digital twin machining framework is attached. Inputs to ISO must be in the public domain, and any underlying patents or restrictions must be disclosed.

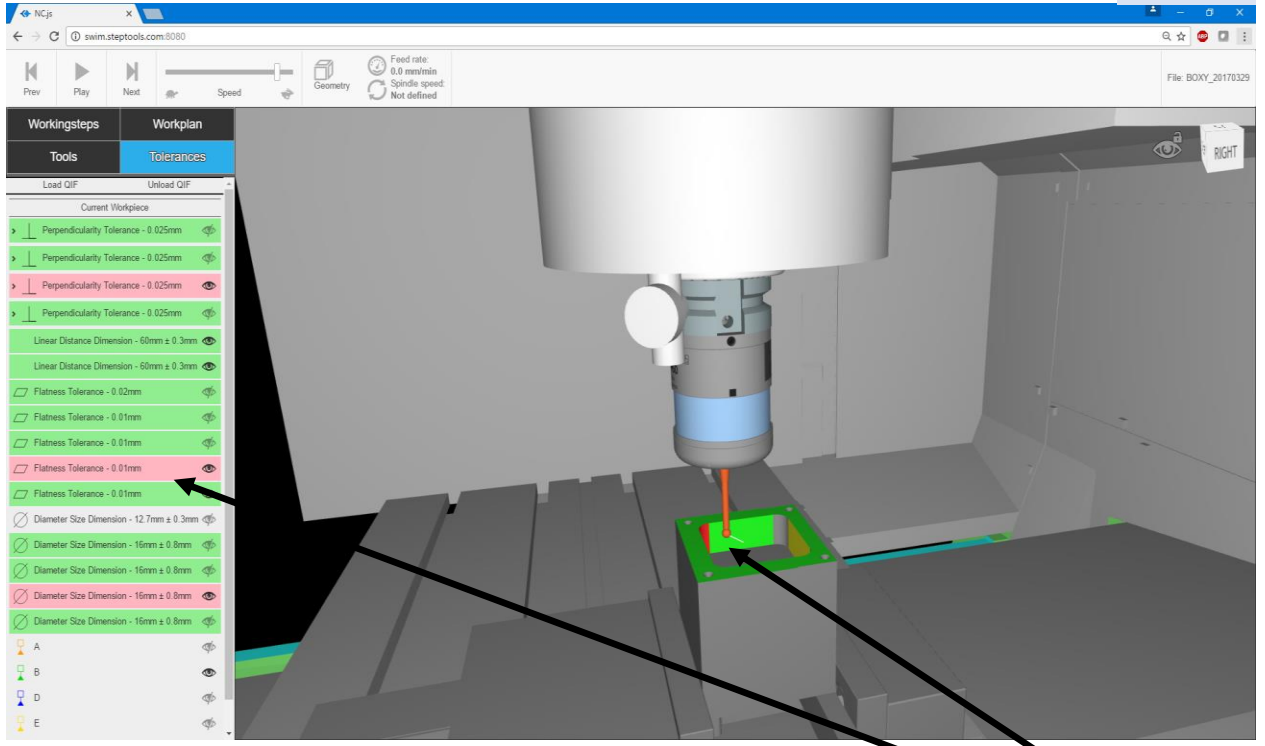
Digital Twin machining

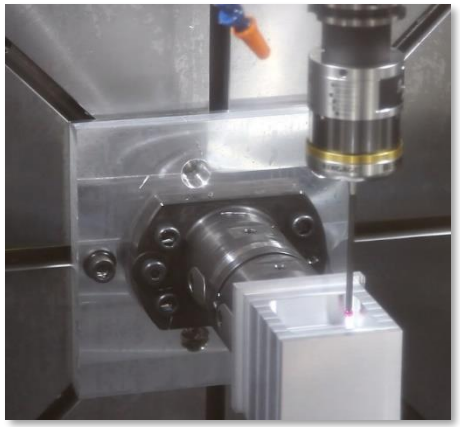
DMDII
a UI LABS Collaboration
"Mind the Gap"14-02-02

- Real time twinning from MTConnect
  - <10Hz trace the plan data
  - >30Hz model the run data
- Open stack
  - STEP in Node.js
  - View in Three.js
  - UI in React.js

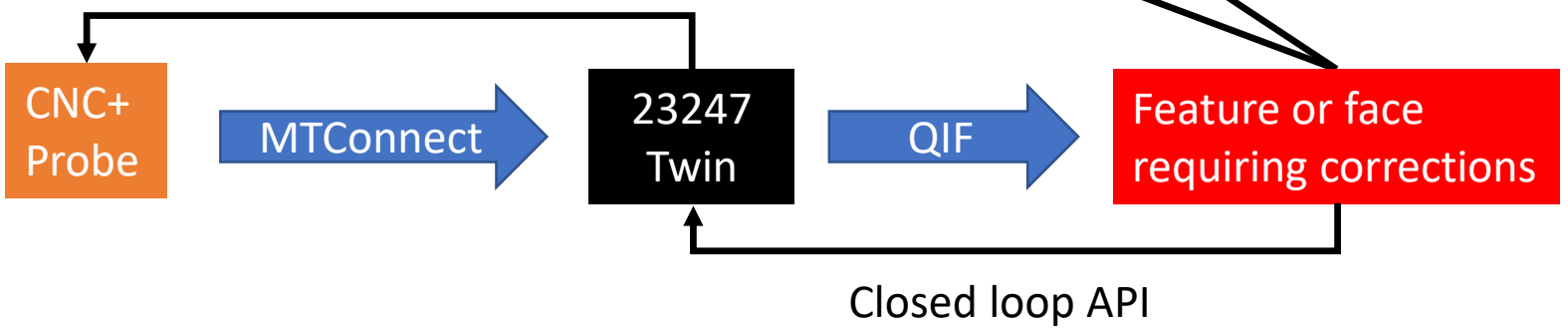
Digital Twin measurement

NC.js



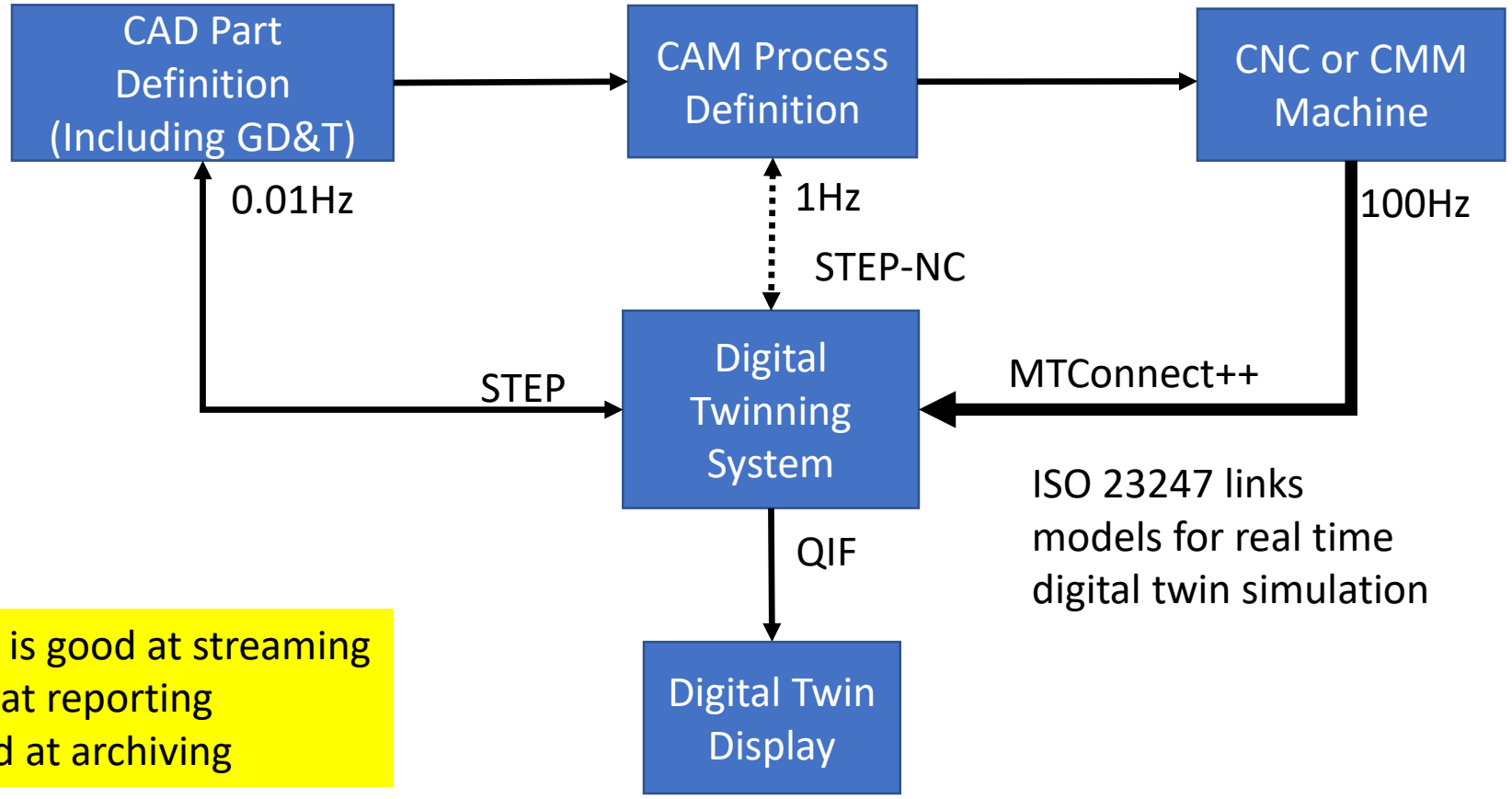


Just in time codes



- Green good
- Red bad
- Yellow good and bad

Digital Twin machining – a framework of open standards

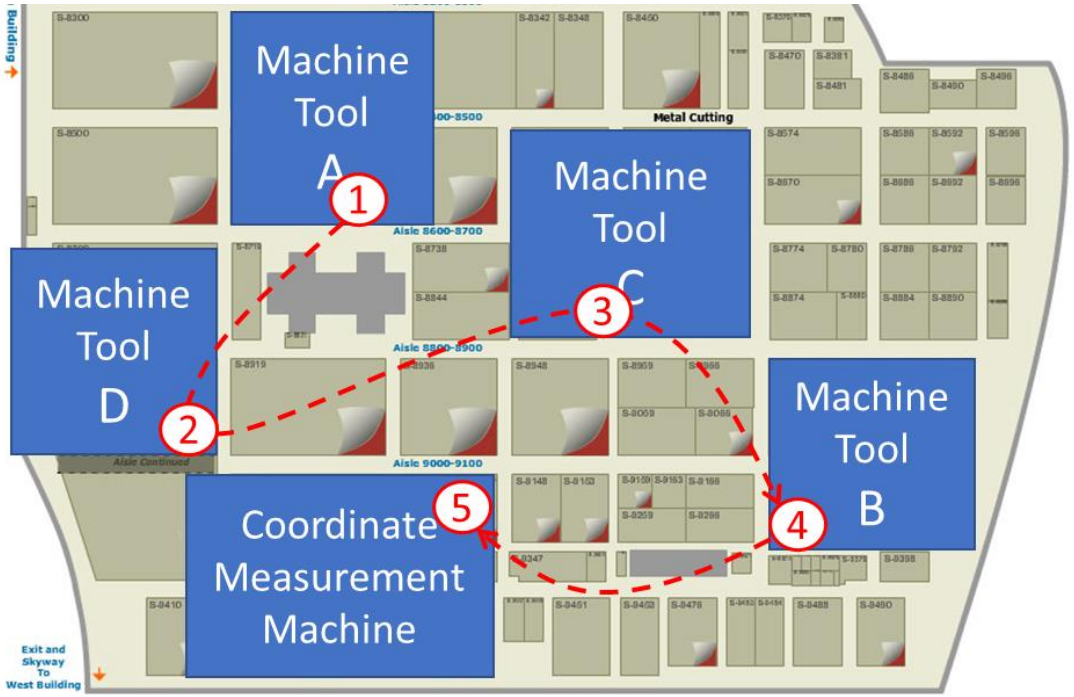


ISO 23247 links models for real time digital twin simulation

MTConnect is good at streaming
QIF is good at reporting
STEP is good at archiving

Applications for digital twinning in machining

- In-process measurement
  - Measure on the machine
- “Self driving” tools
  - Optimize feeds after tool changes
- Error free manufacturing
  - Prevent collisions on restarts
- Faster life cycle
  - Communicate issues and opportunities



Demonstration at IMTS 2018