Standardizing the Semiconductor Manufacturing Backend

Taming the Wild West of Semiconductor Backend Manufacturing

Webinar | February 22, 2024

Our Agenda & Presenters

Opening Remarks
3:00 pm – 3:05 pm

Alan Weber
Vice President, New Product Innovations
Cimetrix

SECS / GEM
3:05 pm – 3:15 pm

Brian Rubow
Director of Solutions Engineering
Cimetrix

EDA / Interface A
3:15 pm – 3:25 pm

Albert Fuchigami
Senior Software Developer
PEER Group

RITdb
3:25 pm – 3:35 pm

Stacy Ajouri
Senior Member of Technical
Texas Instruments

Mark Roos
CEO
Roos Instruments

Traceability and E142
3:35 pm – 3:45 pm

Dave Huntley
Product Manager Assembly Products
PDF Solutions

Putting it all together
3:45 pm – 3:55 pm

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Opening Remarks

Welcome, Introductions, Objectives, Challenges

Alan Weber, Long-time SEMI Standards Participant/Cheerleader

Webinar objectives

- Introduce attendees to the key SEMI Standards that address current and future backend automation challenges
- Highlight the work that is underway to apply and evolve these standards
- Recruit standards program participants for those who want to help drive and accelerate this activity
- Leave you hungry for more information… and show you where to find it

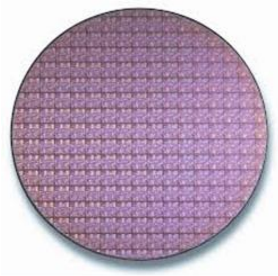
Backend automation challenges

In contrast to wafer fabrication

- Multiple material transformations
- Flow shop manufacturing operations
- High product variety and velocity
- Significant manual intervention
- Complex unit product traceability
- Wide range of equipment cost, low automation budget
- Supplier un-familiarity with SEMI Standards
- Handling multiple data source types/protocols

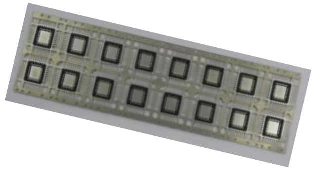
Backend material/carrier forms

And related processes

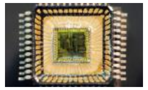


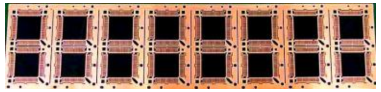
- Incoming wafer
  - Wafer mounting

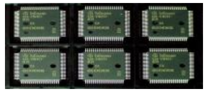
- Mounted wafer
  - Saw / singulation



- Strip (lead frame)
  - Die bond
  - Wire bond
  - Mold
  - Cure
  - Trim and form
  - Plating
  - Mark







- Individual packages
  - Final test and burn-in
  - Pack and ship

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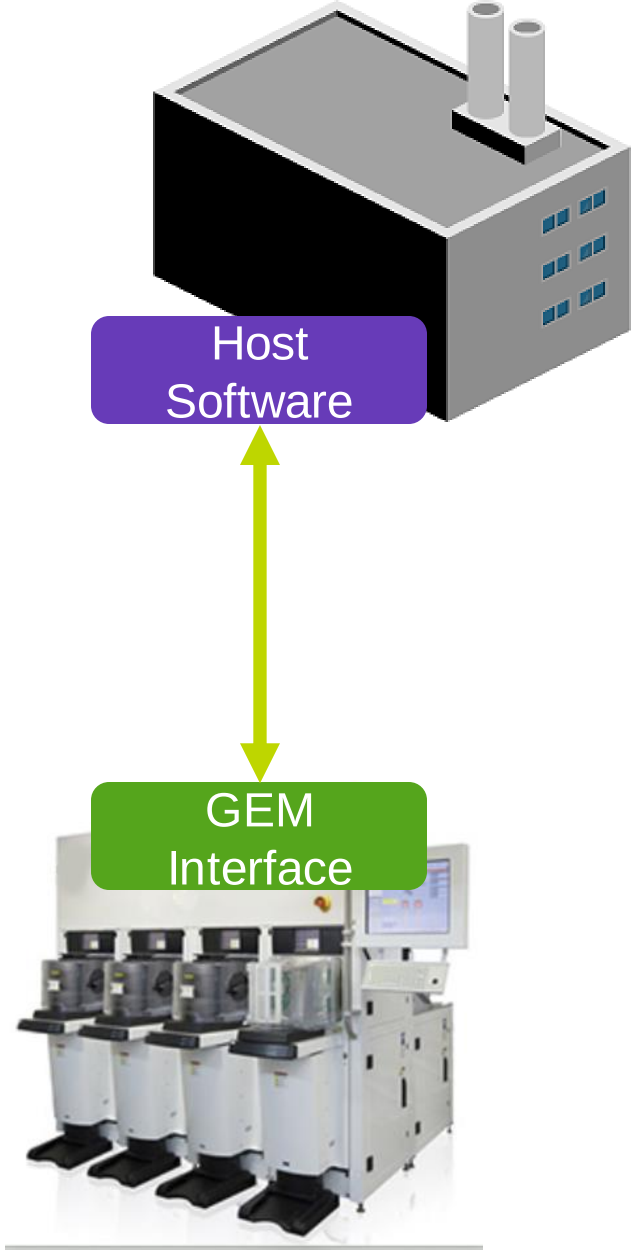
Brief Summary of the GEM Standard

The GEM standard has benefits for all manufacturing equipment in many industries.

Brian Rubow, GEM 300 Task Force Co-Leader

What is a “GEM Interface”?

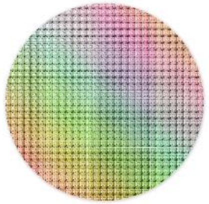
- Software running on manufacturing equipment that complies with the GEM standard
  - SEMI E30
  - Specification for Communication and Control of Manufacturing Equipment
  - Generic Equipment Model (GEM)
  - Binary messages over TCP/IP
- A GEM interface allows external entities to connect to control, monitor and collect data from the equipment
  - External entity is called a “host”
  - Can be factory, equipment supplier, other equipment supplier software

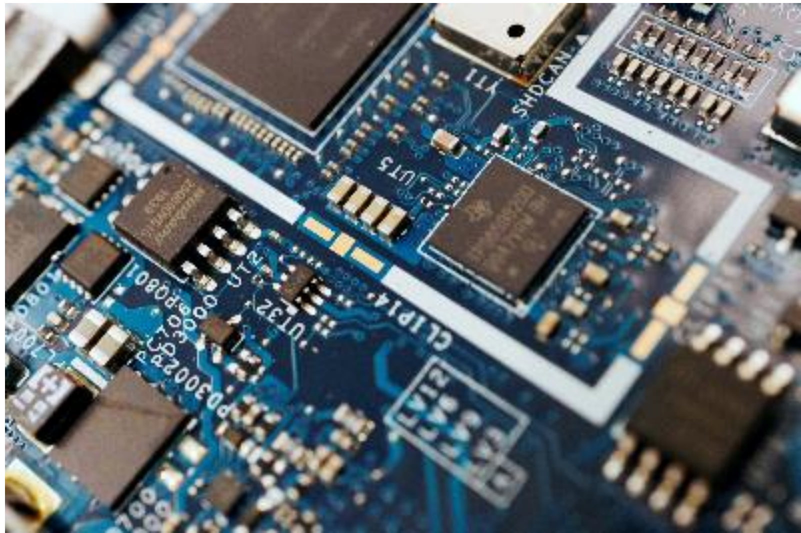


GEM is a Popular Standard in Multiple Industries

- 100% of Semiconductor Frontend (Wafer Fabrication)
  - 300 mm equipment have GEM interfaces
  - Often called a “GEM 300” interface
  - Most 200 mm and older equipment do, too
- Semiconductor Backend (Packaging, Assembly, Test)
  - Expanding implementations from GEM to GEM 300
- Photovoltaic (see PV2)
- High-Brightness LED (see SEMI HB4)
- Printed Circuit Board (PCB) fabrication (see SEMI A3)
- PCB Assembly/Surface Mount Technology (SMT)
- Flat Panel Display
- **Adoption is growing across industries…**



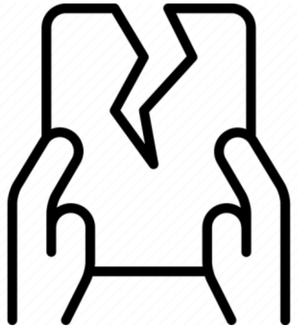




How GEM Saves Time and Money

- Equipment Suppliers Save Time and Money
  - Investing in one remote interface technology for all customers
  - Same GEM interface can be used to meet all end user requirements
    - Much better than using different technologies with custom interfaces for each end user
    - Allows for a quality investment into the GEM interface
    - Easy to adapt to any manufacturing equipment of *any* type in *any* industry
    - Easy to upgrade a GEM interface while maintaining backward compatibility
    - Easy to implement GEM in phases
  - GEM can be implemented on any operating system, with old/new technology
  - Third-party commercial software packages are available
- End Users Save Time and Money
  - One technology to integrate the equipment from different suppliers
  - Allows for a quality investment into the host software
  - Low bandwidth requirements
    - Messages are binary
    - Data collection is subscription based and highly configurable (choose message content)

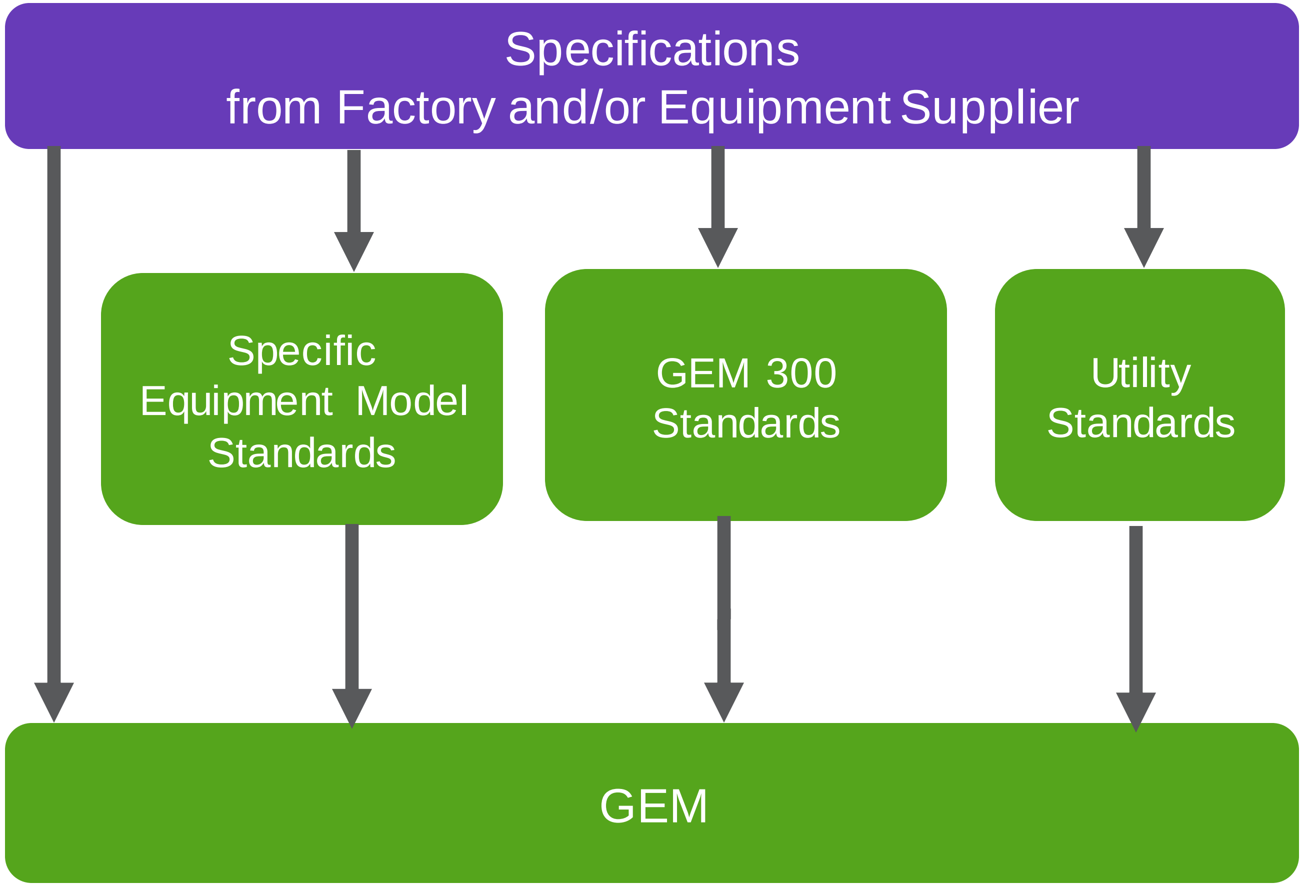
Challenges Integrating GEM technology



- Misinformation, Misunderstandings, and Misperceptions
- Equipment-Side
  - Some factories don’t follow the standards, requiring features that violate the standard
- Factory-Side
  - Some equipment don’t follow the standards, forcing the factory to adapt to noncompliance
  - Equipment software is not well tested
- The biggest challenges integrating GEM technology have nothing to do with the standard itself
  - Learn the technology
  - Follow the standards
  - Implement professional software practices

Many Additional Standards using GEM, SECS-II

- Specific Equipment Models
  - GEM for a specific types of equipment
  - Operational state models
  - Specific set of alarms, collection events, data, remote commands
- GEM 300 Standards
- Utility Standards Built on GEM, SECS-II technology
  - Standardized Logging (E173)
  - Standardized Documentation (E172)
- Equipment Specifications from End Users



GEM Requirements and Capabilities

Fundamental Requirements

- Communication State Machine
- Control State Machine
- Processing State Machine
- Collection Event Notification
- Identification
- Error Messages
- Documentation

Additional Capabilities

- Dynamic Collection Event Reports
- Variable, Trace, Status Data
- Self-Description
- Alarms
- Remote Control
- Equipment Constants
- Recipe Management
- Material Movement
- Terminal Services
- Clock
- Spooling

The GEM Standard is Feature Complete for Factory Automation and Smart Manufacturing

Event Notification
real-time notification of equipment activities

Alarm Notification
real-time notification of equipment alarms

Data Variable Collection
real-time equipment data

Recipe Management
download, upload, delete, select

Remote Control
start, stop, abort, custom

Adjust Settings
change equipment settings

Operator Interface
exchange messages with operators

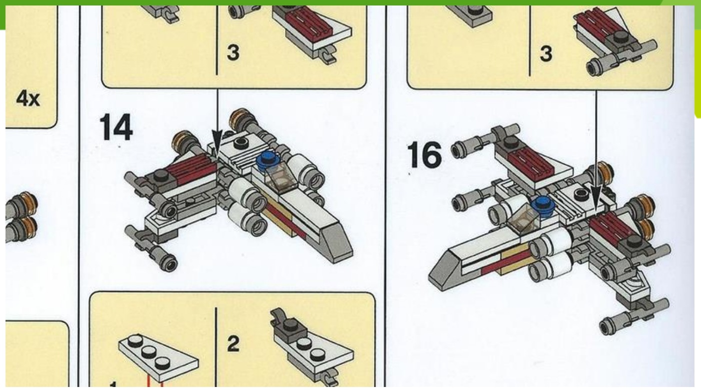
Equipment → Host GEM Notification Messages

- Three Types
  - Collection Events
  - Alarms
  - Trace Reports
- The GEM standard and other standards built on GEM technology require
  - Specific collection event and alarm notifications to be supported
  - Specific status data for trace reporting
- End user specifications typically require additional collection event and alarm notifications, and status data for trace reporting
- The GEM interface for each type/model of equipment is typically unique

Three Classifications of Data

- Status Variables
  - Equipment software and hardware status information
  - Available for reports in collection event notifications, trace reports and ad-hoc queries
- Data Variables
  - Equipment data available only for reports in collection event notification messages
  - Information about the associated collection event notification message
- Equipment Constants
  - Equipment configuration settings
  - Factory or equipment operator host can change the value
  - Available for reports in collection event notifications and ad-hoc queries
- All data types allowed, including arrays and structures
  - Integers, Floating Point, ASCII, Multibyte Strings
  - Binary, Boolean
  - Arrays
  - Structures

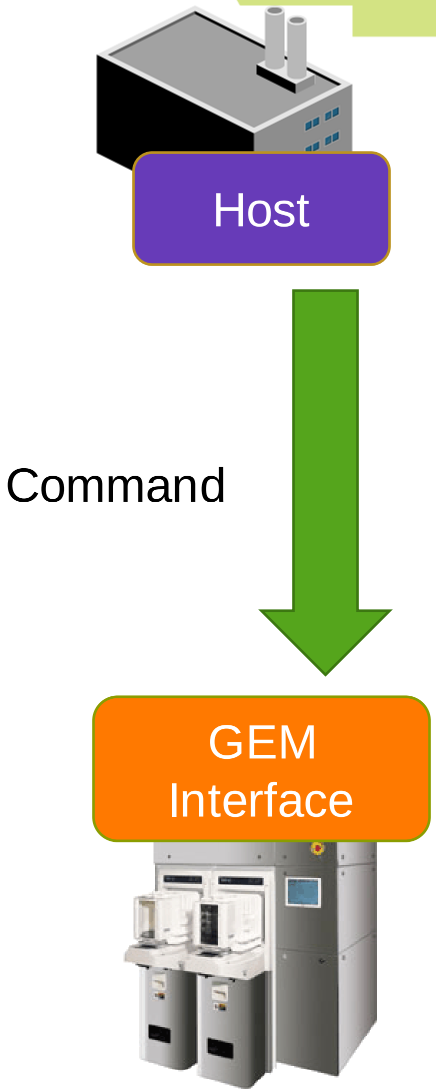
Recipe Management



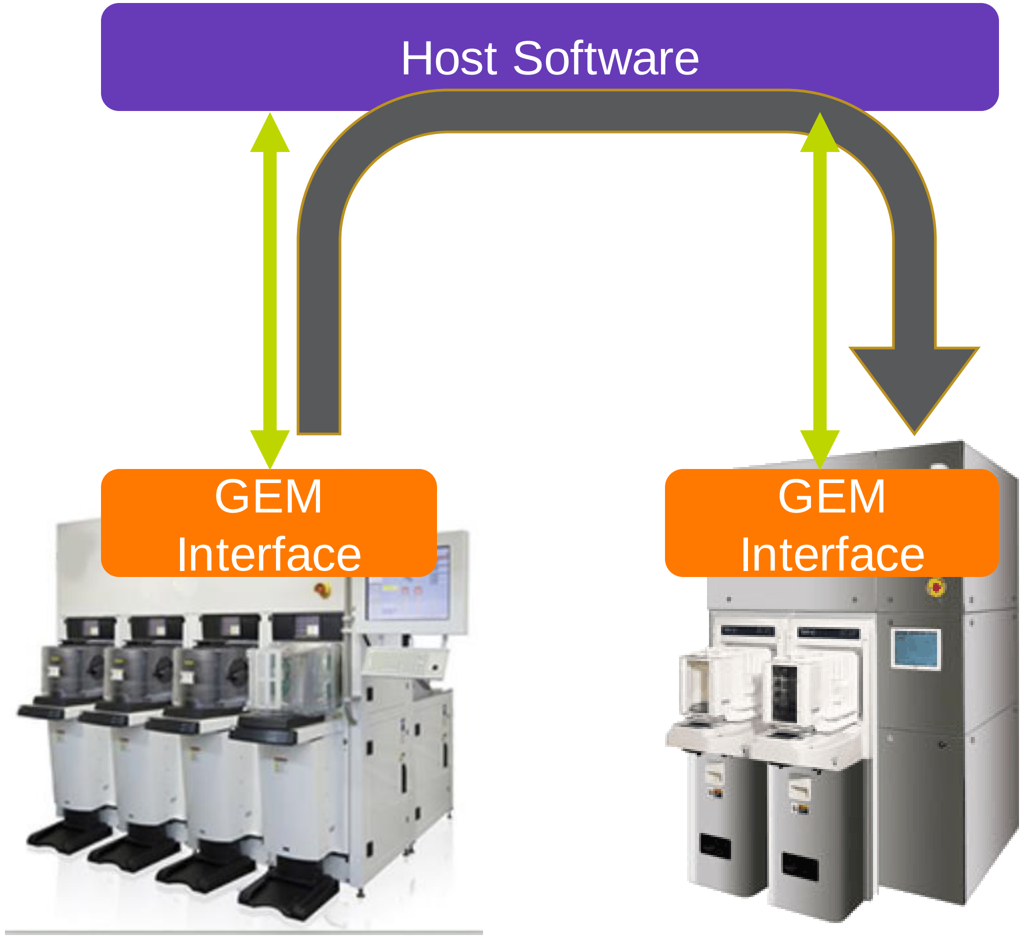
- Recipe or process program: equipment instructions
  - Binary or ASCII
- Upload/download recipes
  - Host or operator initiated
- Query the current recipe
- Query list of available recipes
- Delete recipes on the equipment
- Notification when the operator makes any recipe changes
  - Edit, create, or delete

Remote Control

- A GEM command includes
  - Command Name
  - Optional list of name/value pairs
  - Optional object name
- Defined by GEM
  - START, STOP, ABORT, PAUSE, RESUME
  - PPSELECT (select recipe)
- Custom commands
- Benefits
  - Allows for remote control of the equipment
  - Allows for data to be passed to the equipment
    - List of material or slots to process

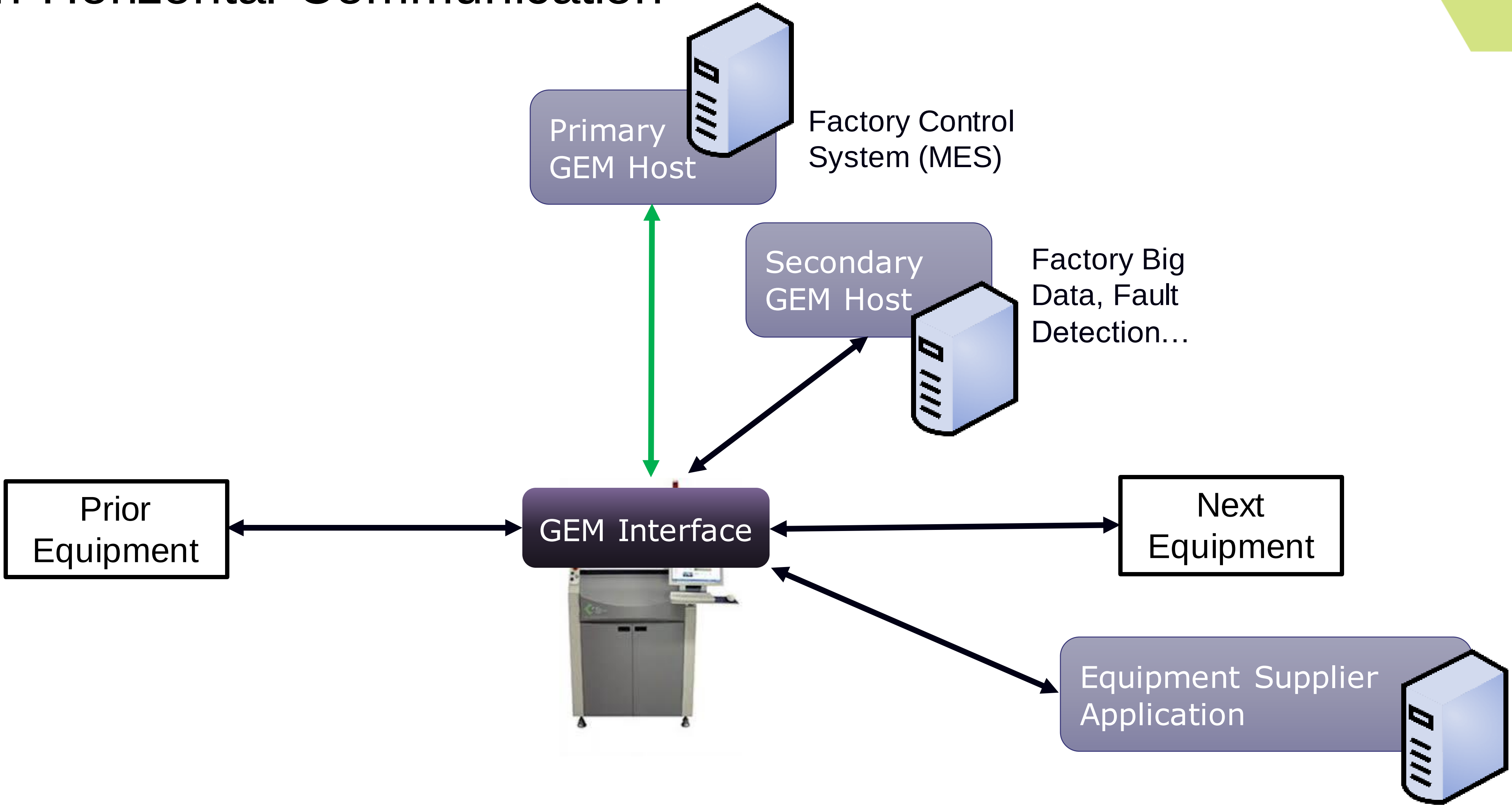


Top-Down Connectivity



- Equipment-to-equipment information typically passes through the host
  - Direct equipment-to-equipment connectivity is not prohibited, yet not normally used
- Benefits
  - Equipment-agnostic scenarios
  - Easier for both equipment
  - Gives more control to the factory

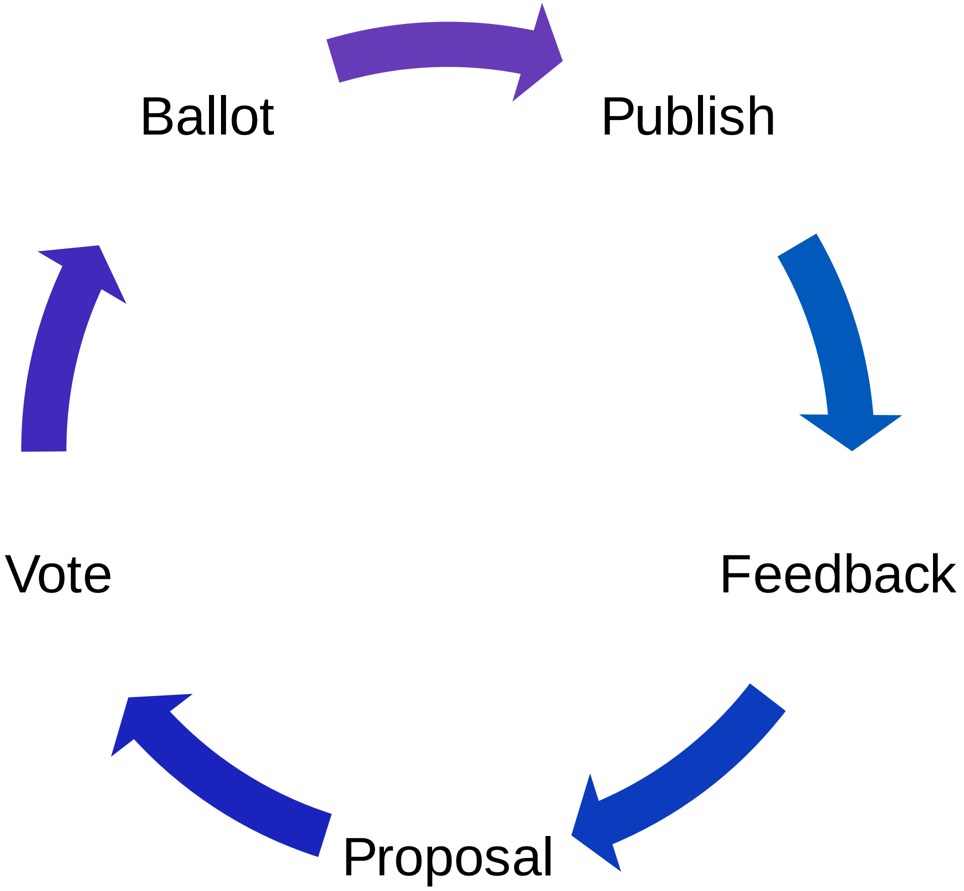
Contrary to Myth, GEM *Can* Support Multiple Connections, even Horizontal Communication



“GEM 300” Standards

- SEMI Standards, Augmenting a GEM Interface
  - Assumes compliance to GEM (SEMI E30)
  - SEMI E39 Object Services
  - SEMI E40 Process Job Management
  - SEMI E87 Carrier Management Services
  - SEMI E90 Substrate Tracking
  - SEMI E94 Control Job Management
  - SEMI E157 Process Module Tracking
- Each explicitly defines
  - State models
  - Objects with attributes
  - GEM collection events, data variables, status variables, and alarms
  - Service messages
- Many of these apply to backend equipment

New Features in the April 2023 Version



Unique Equipment Identification

- New required data for supplier identification, serial number, host assigned ID

Simplified Large Recipes

- Adopted Stream 21 messages

Access to the GEM Documentation through the interface

- Using Stream 21 messages

Improved access to the GEM interface setup

- New Stream 1 messages

Standardized logging (XML Schema)

Standardized implementation documentation (XML Schema)

Applications Possible Using GEM

Run-to-Run (R2R) Control	• Using data collection and recipe management to implement feedback/feedforward control
Fault Detection [and Classification] (FDC)	• Using Alarms and Collection Events/Data Variables
Predictive Maintenance	• Using Trace Reports, Alarms and Collection Events/Data Variables
Fingerprinting	• Using data collection and recipe management to characterize equipment mechanisms
Full Factory Automation (no operators)	• GEM, GEM 300
Many more…	

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EDA / Interface A Standards Suite

Albert Fuchigami (PEER Group)
North America DDA Task Force co-leader

What is EDA?

The Equipment Data Acquisition (EDA) / Interface A Standards are a collection of SEMI Standards that enable high-speed data publication from any equipment to any data consumer through web services.

Direct, **dedicated** channels to each consumer.

- Separate from control messages.

Each consumer has their **own set of data collection plans** (DCP) tailored for their needs.

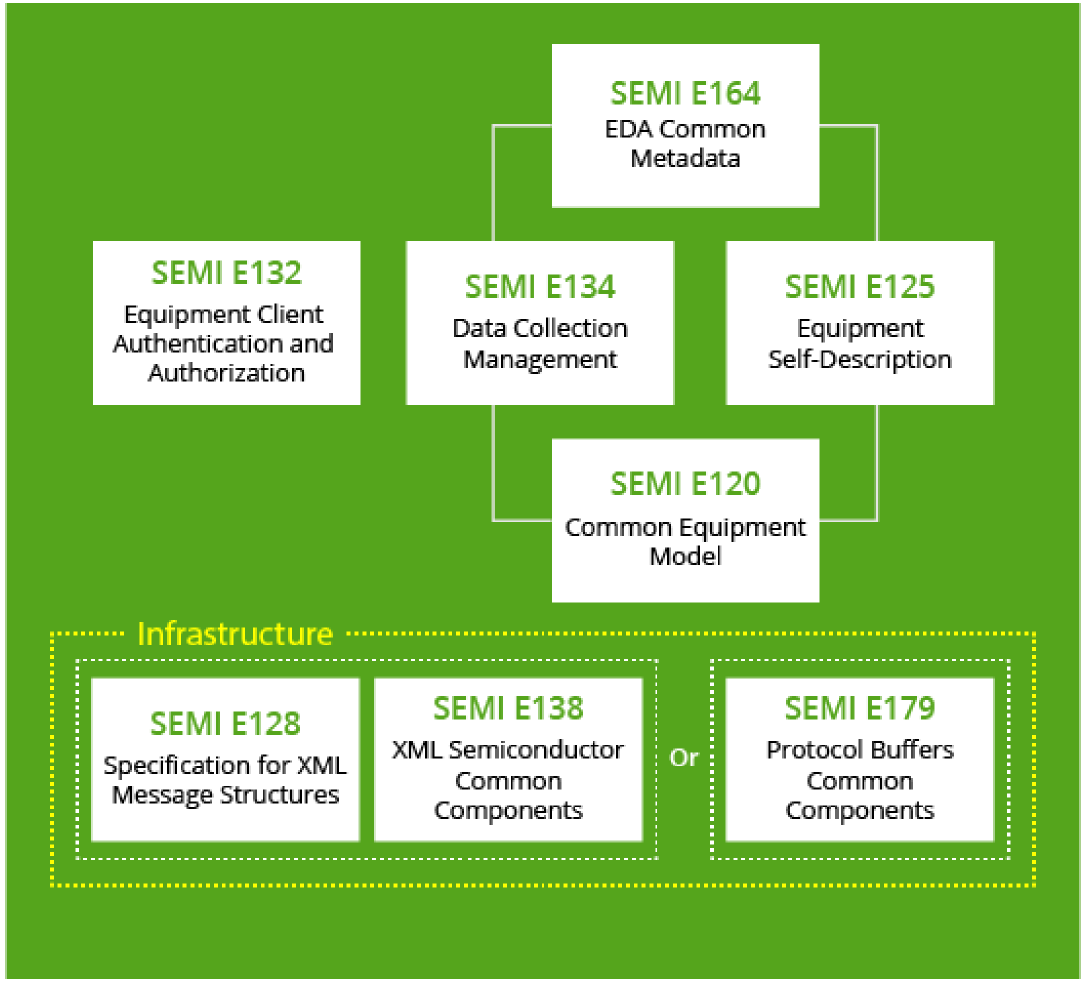
- Only authenticated and authorized users can collect data through EDA.
- DCPs support a sophisticated set of data collection triggers and techniques.

Focused on **real-time** data collection

- Cannot control the equipment or access historical data.

Self-contained framework that defines access control, DCP management and metadata organization.

EDA Standards Suite



SEMI E178
Guide for EDA Freeze Version

Freeze Version	Release Date	Notes
Freeze 1 (1105)	November 2005	HTTP/1.1 with SOAP/XML
Freeze 2 (0710)	July 2010	HTTP/1.1 with SOAP/XML (with SEMI E128, E138)
Freeze 3	Under Development	HTTP/2 with gRPC/Protocol Buffers (with SEMI E179)

EDA in the Factory

Increased global interest from Industry and Fabs

- Slow adoption → gaining momentum.
  - Referenced in Fab purchase specs (as well as SEMI E164)
- Frequent topic at Smart Manufacturing / APC conferences.
- Common scenario is to use EDA to get data for APC/FD/Digital Twin, then use those analysis results to tweak settings through the control channel (e.g., SECS/GEM).
- Industry is demanding more data, faster → the need for Freeze 3.

Freeze 3 – Next Generation EDA

Freeze 3 will integrate HTTP/2 with gRPC and Protocol Buffers technology to deliver:

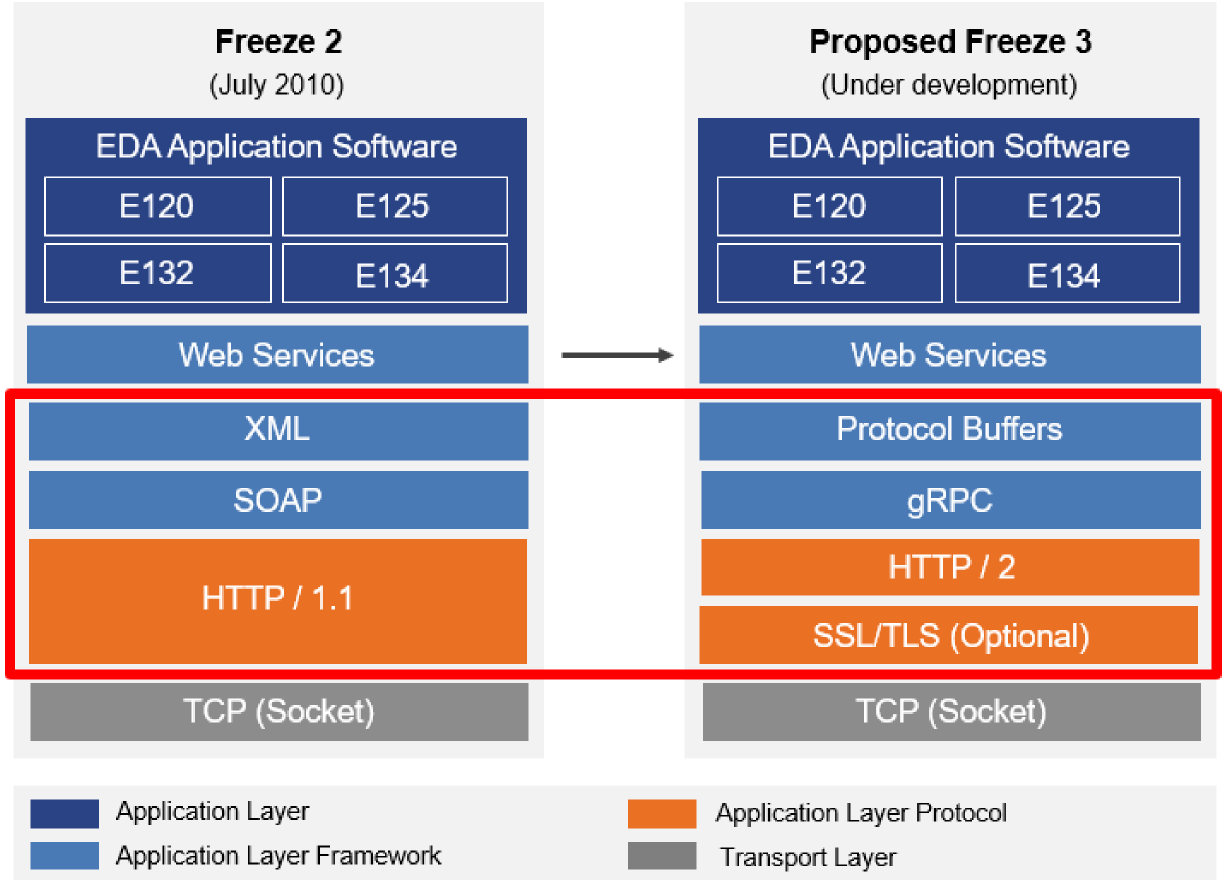
- higher performance and more efficient data transfers
- better network security to protect data exchanged
- ease of adoption with multiple platforms and programming language support

Freeze 3 will also streamline functionality to better reflect actual customer use cases

- Clarify Client/Consumer deployment scenarios
- Better security and authentication support
- Added cached data support to trace collection

In development by the DDA TF since 2017.

- First set of updates published
- Further updates and interoperability testing underway.



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E183 RITdb

ATE Standard

ATE Committee and RITdb Task Force co-leads

Stacy Ajouri, Texas Instrument

Mark Roos, Roos Instruments

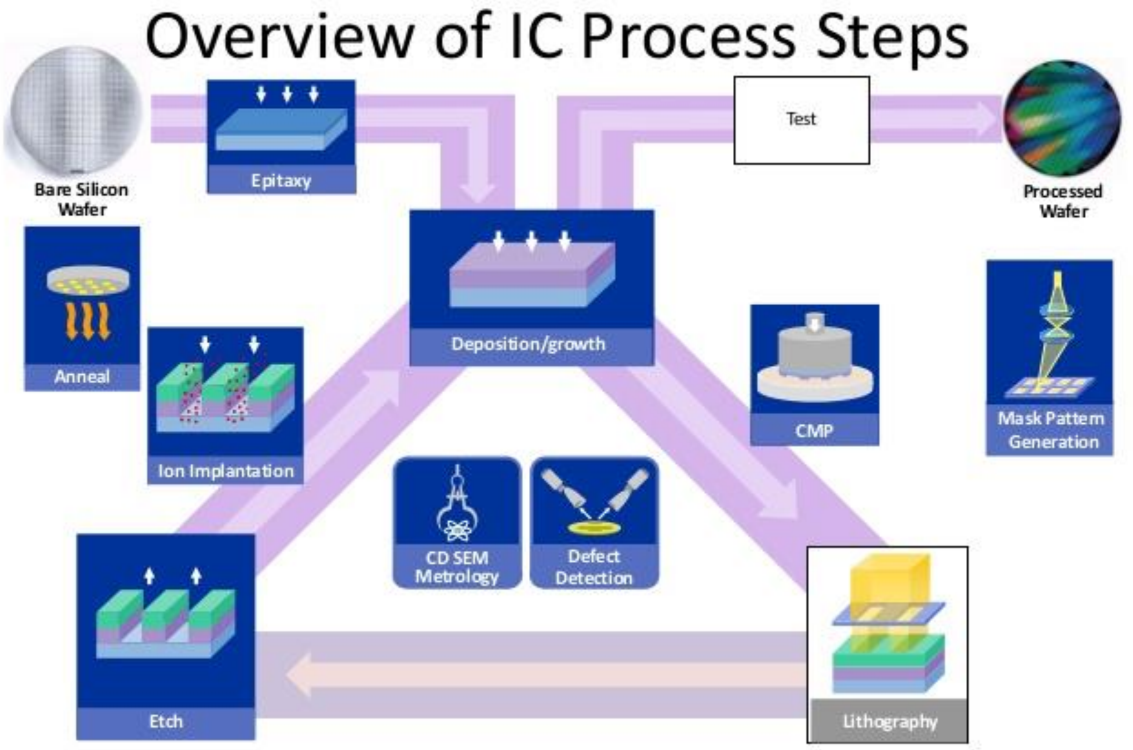
What is RITdb (E183)?

SEMI is developing a suite of standards for test which is built upon the SEMI E183 – Specification for Rich Interactive Test Database (RITdb). The RITdb Standard defines a data and event sharing and streaming methodology enabling real-time messaging.

- Enables high-speed communication machine to machine using **MQTT protocol, publish-subscribe (pub/sub) model**.
- Supports a **collaborative decision-making model** that enables different rule engines to contribute to a decision rather than relying on a single point of expertise, such as the Host/MES.
- Publishes **real-time data and events** with *no predefined data collection plan*.
- Supports messaging to **control** the equipment/test cell.
- Supports **historical data** collection and access to history via pub/sub model.
- Defines data containers for equipment information, events, logging, and data (**product and equipment**).
- Can be supported natively by equipment or as add-on for **legacy equipment** (RITdb features may be limited due to equipment capability).

Today's Standards are optimized for Fabs

- Process and Equipment Focus
- Regular flows
- Batch => wafers
- Predictable scheduling



Courtesy of Dr. Bill Flounders, UC Berkeley Microlab

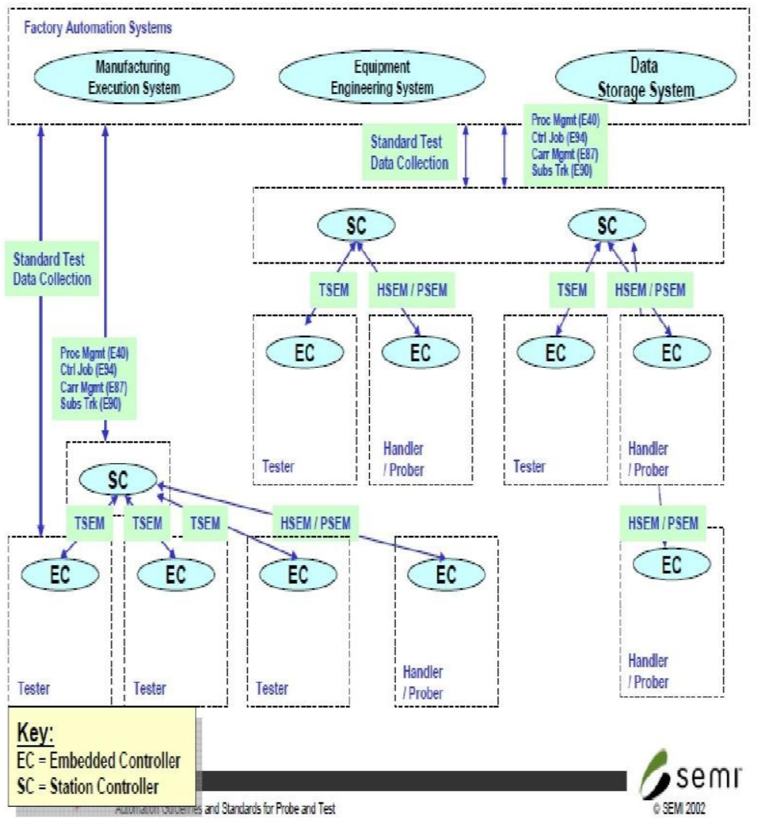
The Test Floor is Different

- Device centric
- Small lots
- Conditional flows
- Retest (in lot, end of lot, next day…)
- Data Feed Forward/Back
  - Local
  - Across facilities/entities
- Low utilization
- Interruptions – holds
- Priority changes

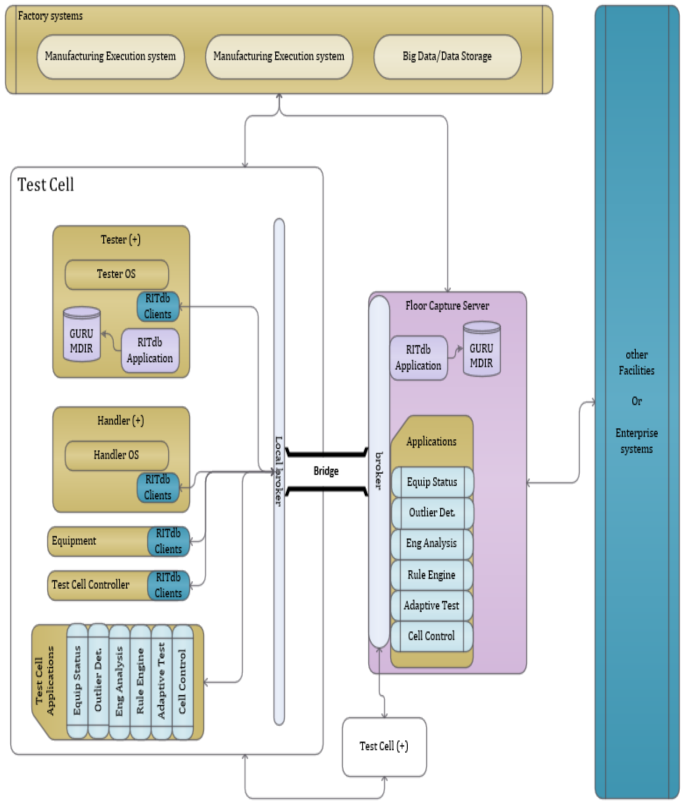
Test Requires Collaborative Communications

- Point to point vs Host-Client
- Dynamic Roles
- Many Hosts – many Clients
- Data and Control separate
- Both high and low Latency

Historical Model for ATE (Host-Client)



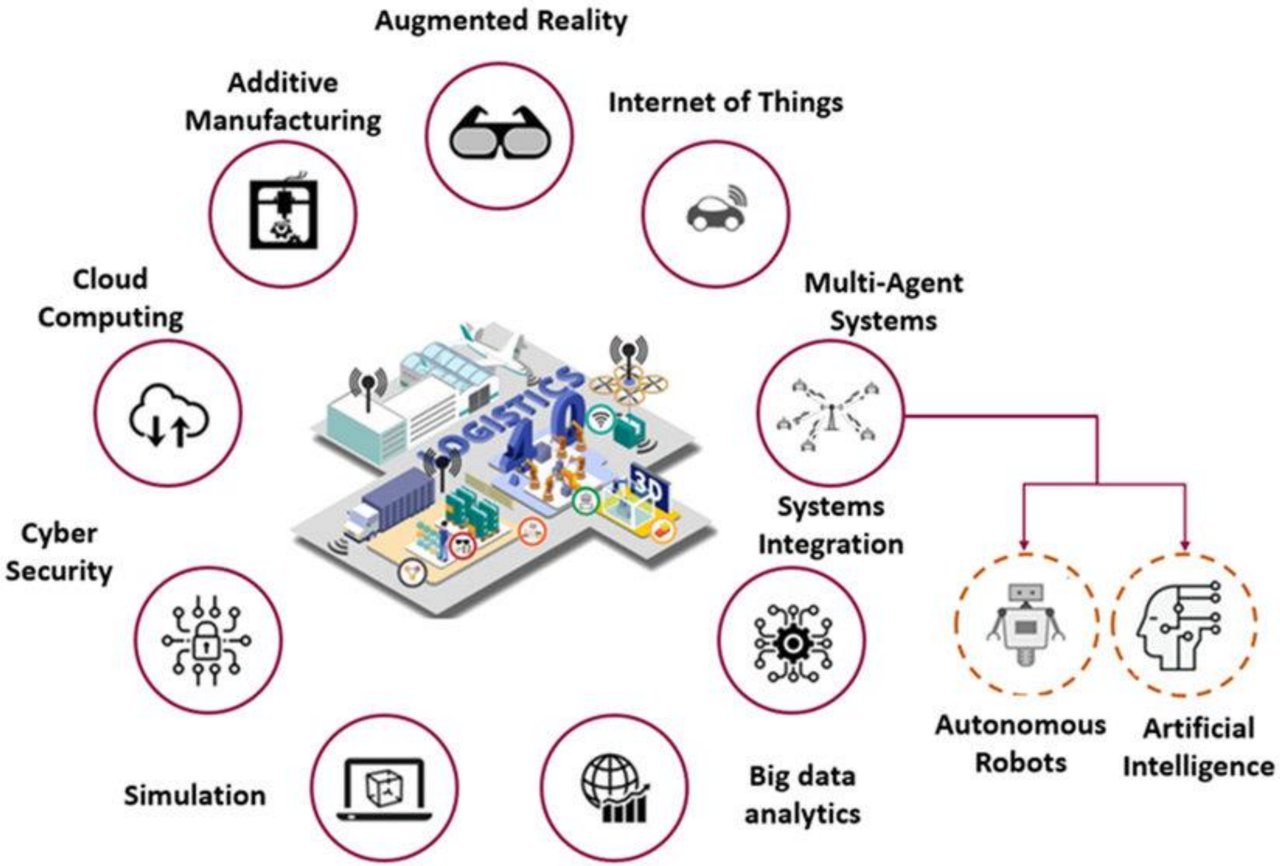
RITdb Model for ATE (point to point)



SEMI E183 – Designed For Test

Smart Factory = ever changing pool of Actors

- Focus on dynamic Material Flows
- Monitoring with **Events**
- Decisions based on **Rules**
- Control via **Actions**
- History using **Containers**



Something for every Need

Tester

RITdb deployment:
Fan out – platforms/Facilities
Migrate to Native RITdb implementations
Add non-RITdb compliant testers using Reflectors.

Additional streams:
Expanded tester events
Tester diagnostics/Calibration
datalog.* event/container
Test Cell Controller events
Prober/handler logs/settings

Tester Control:
Test Quality
Operational Controls
Adaptive Test

Test Cell/ Floor

Implement FT Rule to verify test quality and feedback to tester while lot is still loaded.

Implement Real-Time Adaptive Test at final test.

Integrate device traceability.

Integrate with FT Lot Dispatching system.

Integrate with MES automation

Add sensor data stream

Add handler logs (setup, recipe, …)

Analytics

Publish to Big Data

Integrate with Industry 4.0

Real-Time (RT) or Near RT OEE applications/Tools

Test Cell MTBF Monitor

Tester Monitor (Calibration/ diags/…)

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SEMI Backend Standards

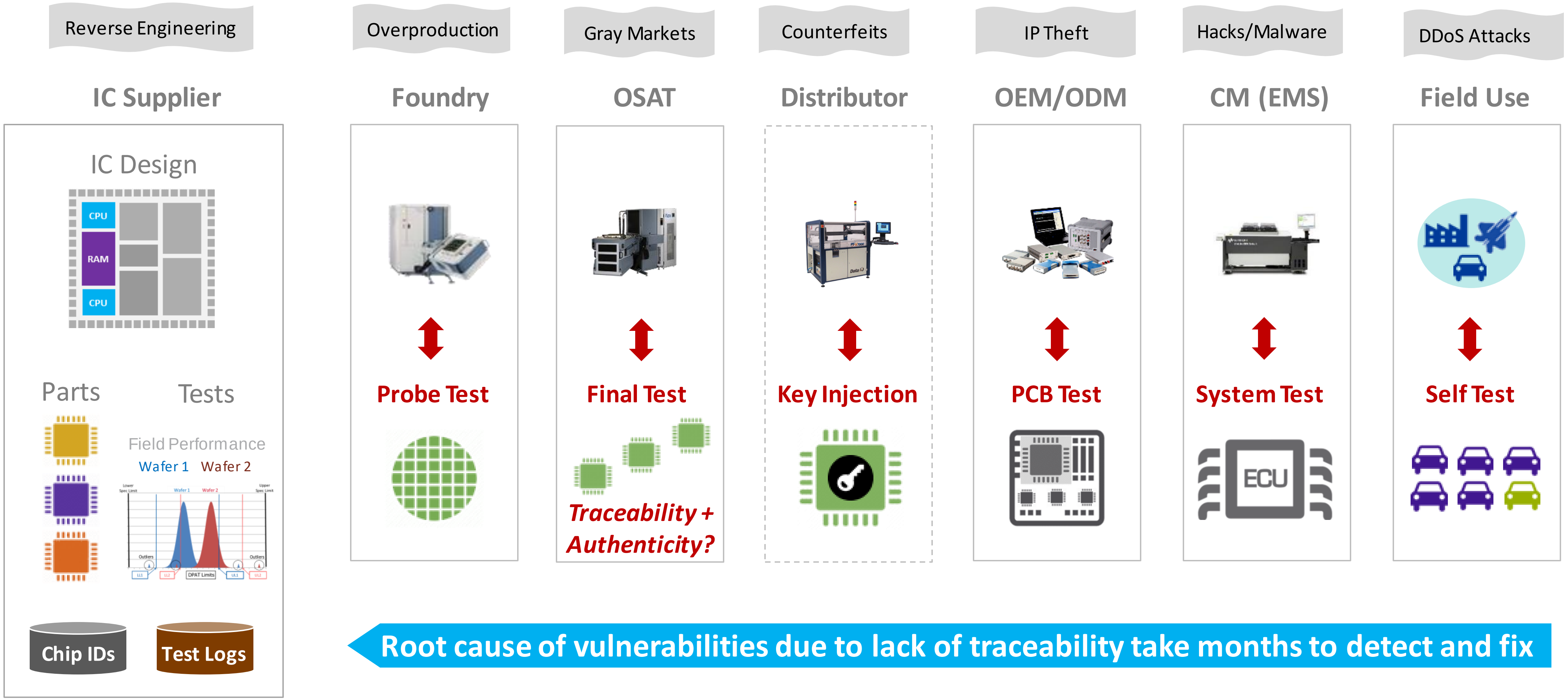
Traceability and E142

Dave Huntley, PDF Solutions, ABFI and SDT Task Force co-leader

Traceability and E142

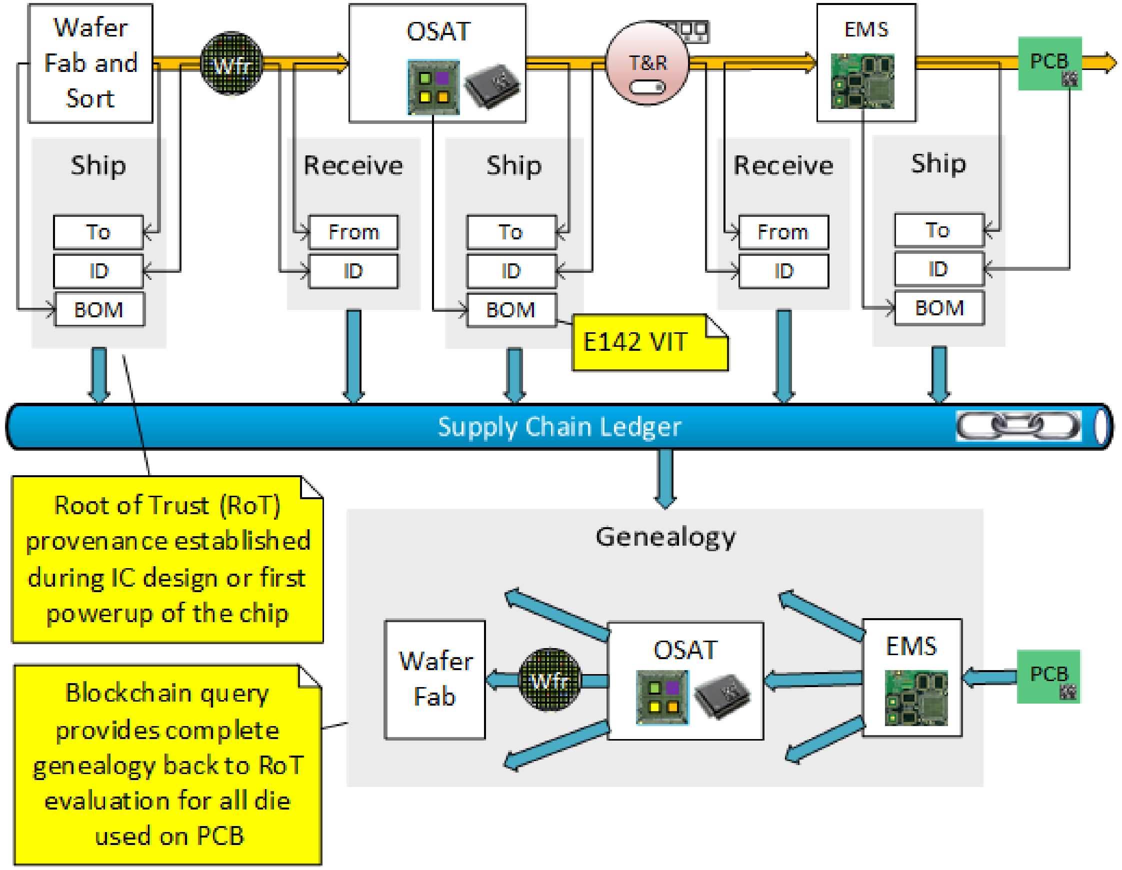
- Supply Chain Traceability (SCT)
  - Assurance and Reliability
- Single Device Traceability (SDT)
  - Capturing the virtual identifier thread through assembly and beyond
- SEMI Standards
  - SCT: Ballot 6504: SPECIFICATION FOR ELECTRONIC SUPPLY CHAIN TRACEABILITY USING DISTRIBUTED LEDGER TECHNOLOGY
  - SDT: SEMI E142: SPECIFICATION FOR SUBSTRATE MAPPING

Supply Chain Traceability (SCT) for Assurance and Reliability



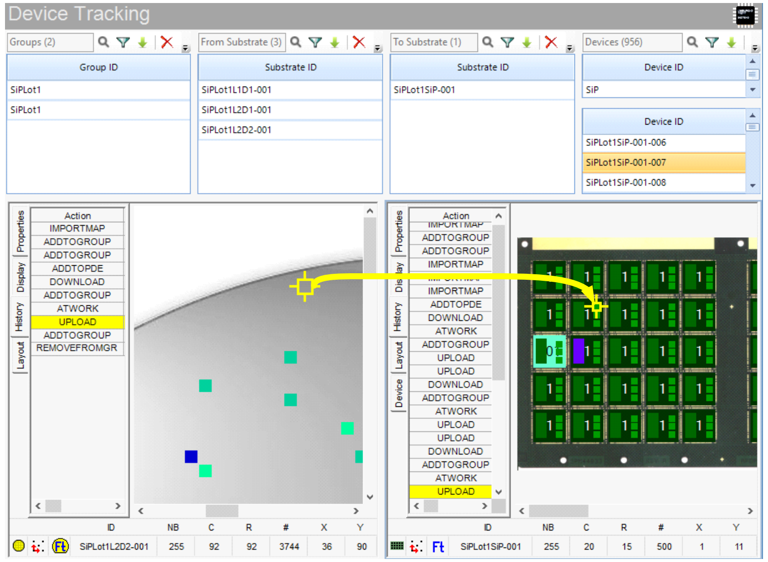
SEMI 6504: SPECIFICATION FOR ELECTRONIC SUPPLY CHAIN TRACEABILITY USING DISTRIBUTED LEDGER TECHNOLOGY

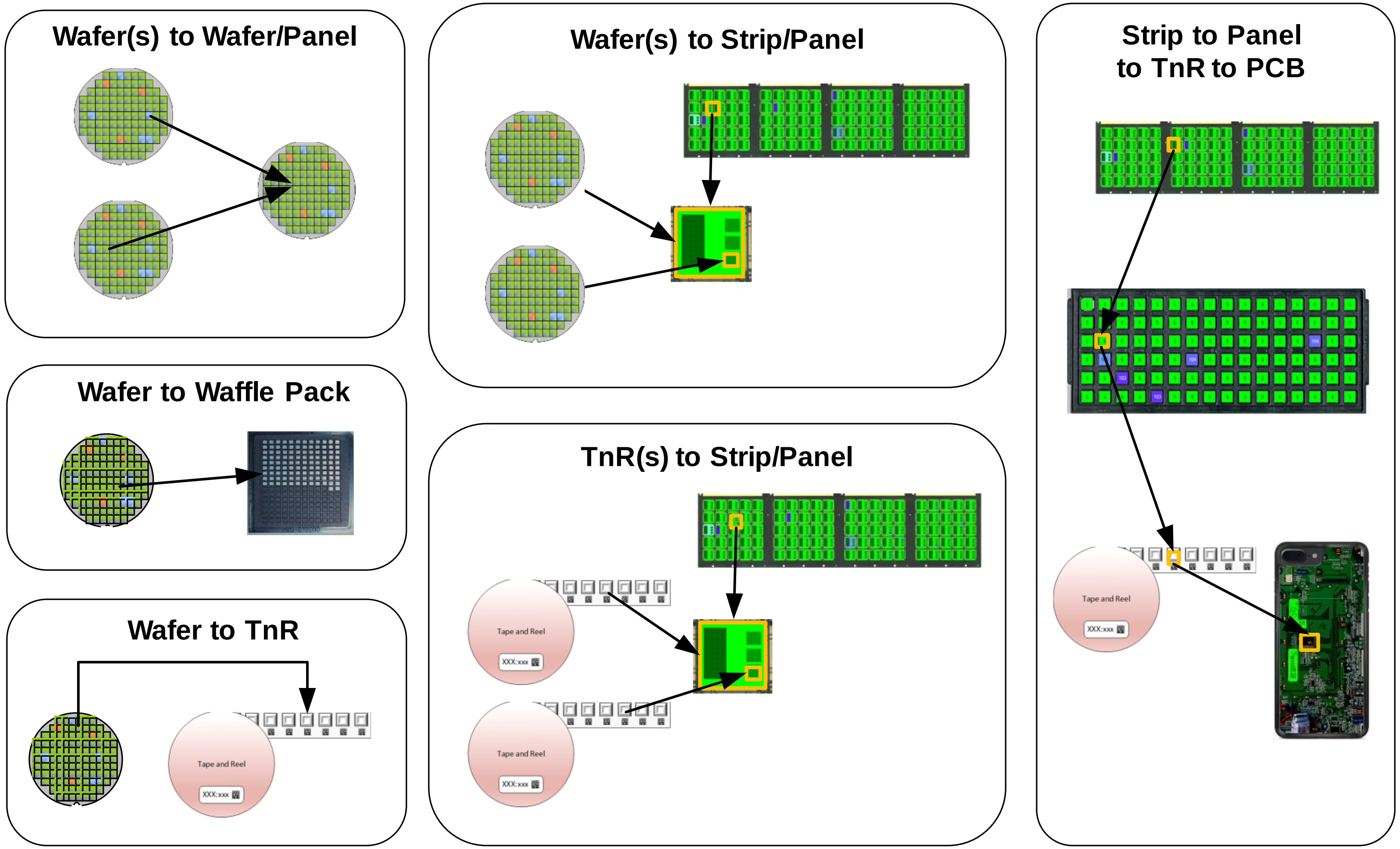
- Record chain of custody, ownership and provenance on a distributed ledger technology (DLT)
- Referenced in white paper "Using the Virtual Identifier Thread for Security and Reliability"
- Work on 6504 has resumed in 2024 at the Single Device Tracking Task Force (SDT TF)
- Please contact dave.huntley@pdf.com if you are interested in participating



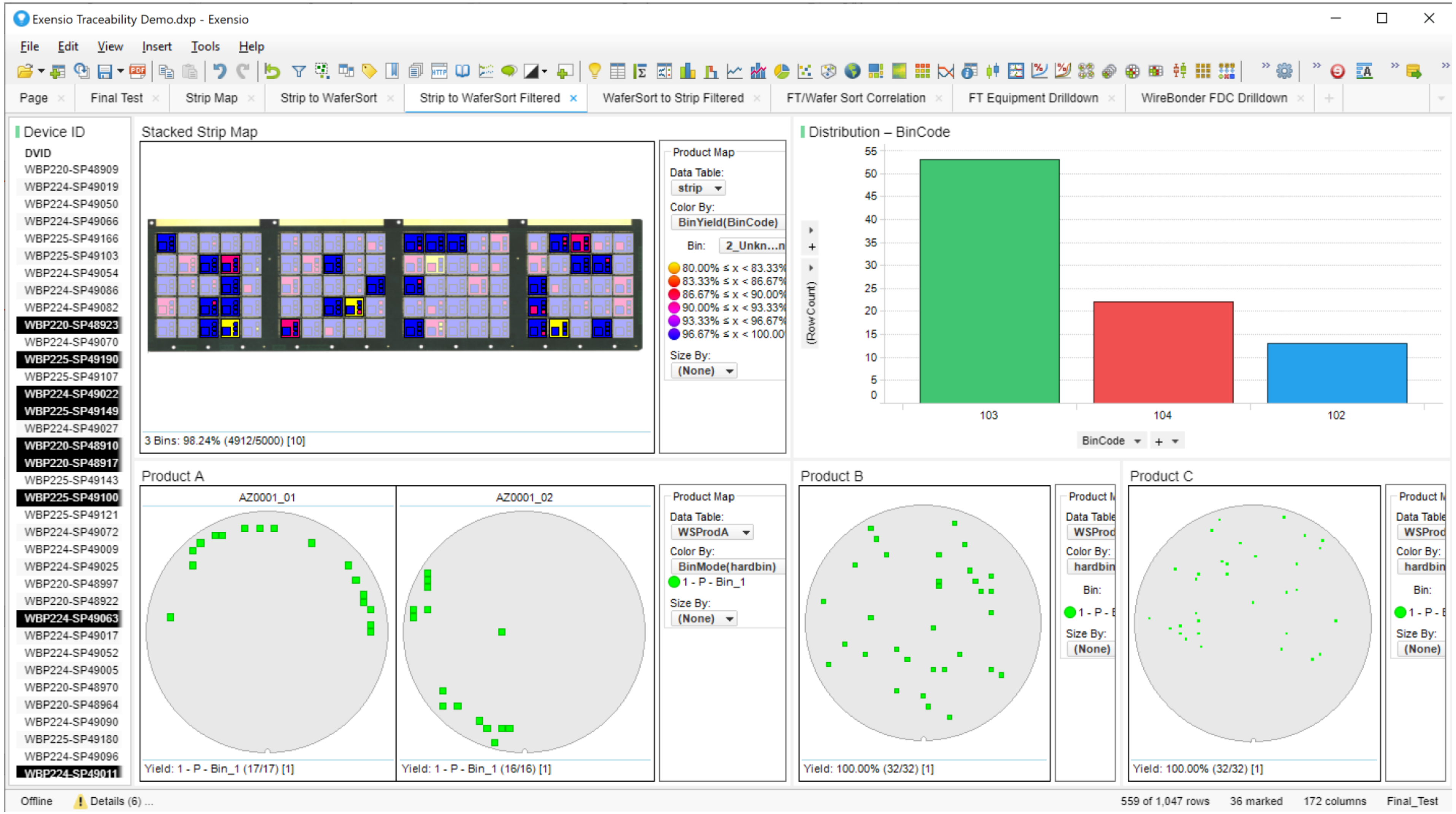
SEMI E142: Single Device Traceability (SDT) in Assembly

- Data types per device
  - Transfer: Wafer to strip, tray, waffle pack, tape & reel, Panel, PCB, etc.
  - DeviceId: RoT, ECID, 2DID, RFID
  - Bin code assigned at test to determine which die to pick
  - DeviceData for other process data fields



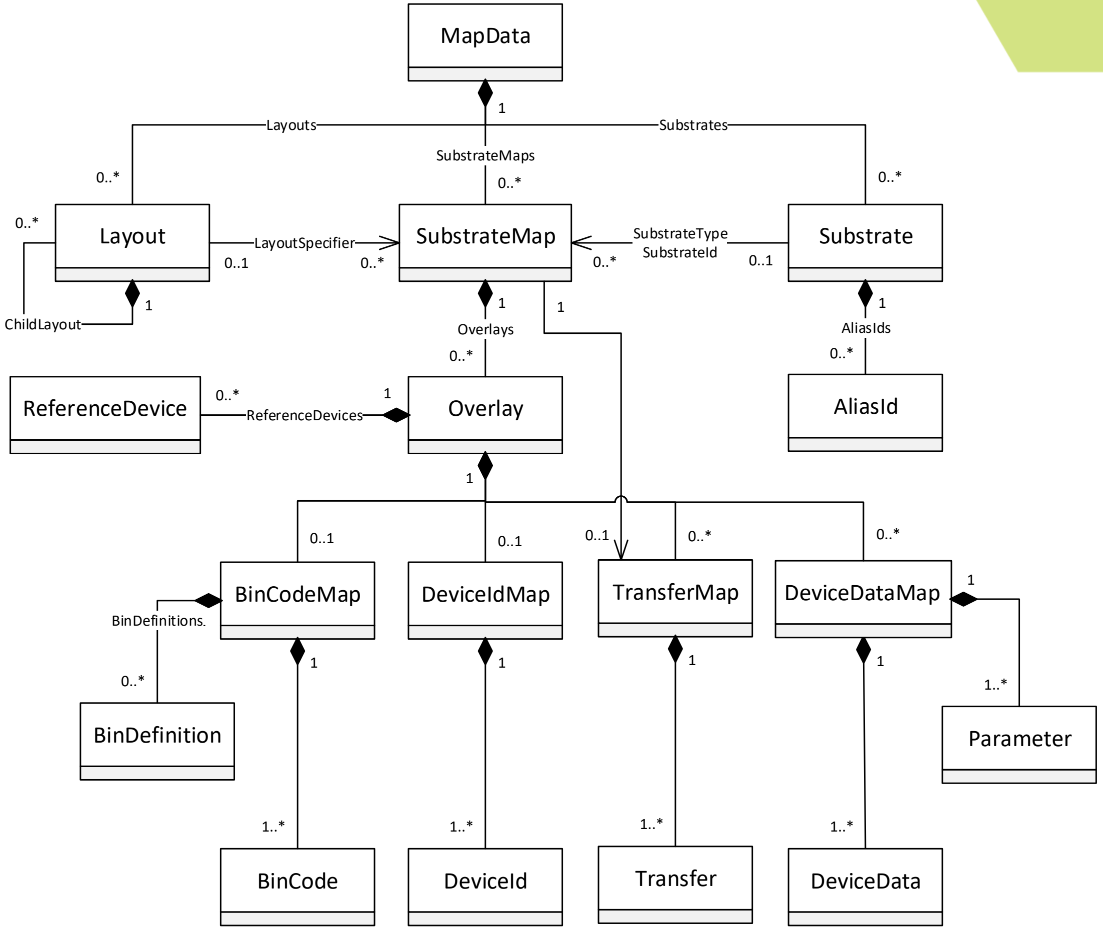


SDT Use Case: Correlating RMA with Manufacturing and Test Data



SEMI E142: SPECIFICATION FOR SUBSTRATE MAPPING

- E142 MapData defines Layouts with X, Y and Z dimensions for multiple SubstrateMap Overlays
- Device level data types assigned to an Overlay
  - Transfer; From To Layout+XY
  - BinCodeMap; e.g. wafer map
  - DeviceIdMap; e.g. ECID, 2DID, RoT, …
  - DeviceData; Other process data
    - Defined by a Parameter schema
    - Parameters may be simple, structured or arrays and may be nested



VIRTUAL IDENTIFIER THREAD BASED ON SEMI E142

- SEMI E142 Substrate Mapping Specification
  - Latest revision 0224 published in February 2024
  - Offers a standardized data model to record the virtual identity thread in a generic and recursive way such that it can be applied to all process steps throughout the supply chain
- SEMI E142 defines…
  - ***Substrate*** as a wafer, strips, tray, panel, tape and reel or PCB containing devices arranged in a set of 2D arrays each with a Z coordinate.
  - ***Device*** as any standalone electronic part including active die, passives, multi-die packages, PCBs or systems consisting of multiple PCBs.
- SEMI E142 virtual identifier…
  - Composite key of SubstrateType, SubstrateId, Layout, X and Y.
  - 2D maps capture data for a single layout.

Our Agenda & Presenters

Opening Remarks
3:00 pm – 3:05 pm

Alan Weber
Vice President, New Product Innovations
Cimetrix

SECS / GEM
3:05 pm – 3:15 pm

Brian Rubow
Director of Solutions Engineering
Cimetrix

EDA / Interface A
3:15 pm – 3:25 pm

Albert Fuchigami
Senior Software Developer
PEER Group

RITdb
3:25 pm – 3:35 pm

Stacy Ajouri
Senior Member of Technical
Texas Instruments

Mark Roos
CEO
Roos Instruments

Traceability and E142
3:35 pm – 3:45 pm

Dave Huntley
Product Manager Assembly Products
PDF Solutions

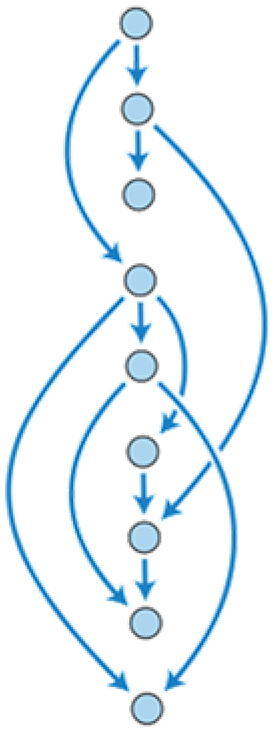
Putting it all together
3:45 pm – 3:55 pm

Alan Weber
Vice President, New Product Innovations
Cimetrix

Putting it all together…

Vision, Innovations, Requirements, Integration

Call to Action!

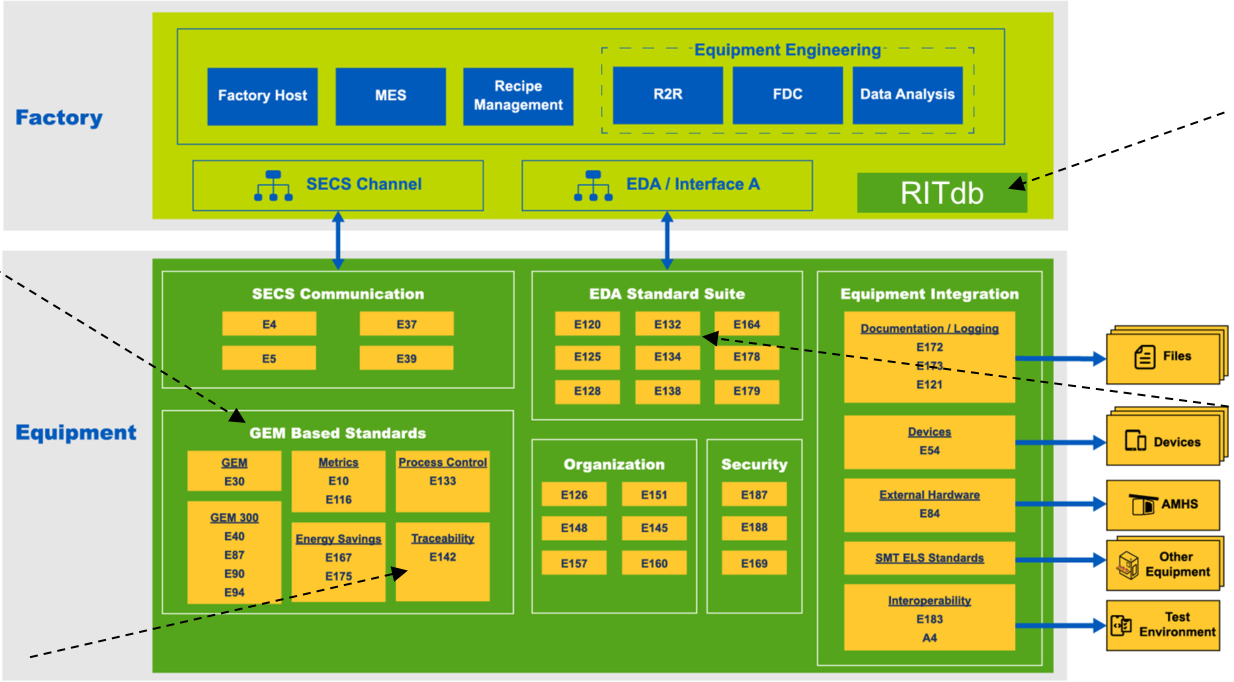


Alan Weber, Long-time SEMI Standards Participant/Cheerleader

Equipment/Factory Automation Standards

Fitting the pieces together

GEM/GEM 300
- Command and control
- Recipe handling
- Basic data collection
- Productivity monitoring



RITdb
- Test results management
- Test cell integration

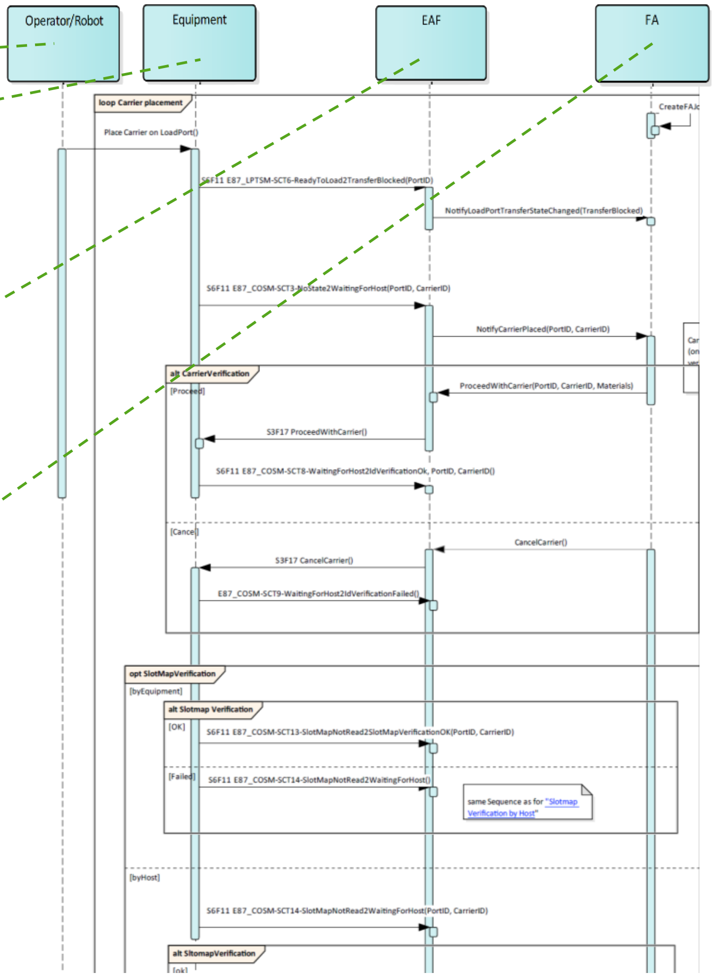
EDA/Interface A
- Dense data collection
- FDC/PM support
- AI/ML applications

E142
- Single device traceability
- Supply chain data tracking

Vision: End-to-end Integration Sequence

Expression: Ladder diagram of system communication partners

- Operator/robot/AGV
  - Load/unload material
  - [Occasionally] provide input
- Equipment
  - Perform process, inspection, and testing operations
  - Communicate principally with EAF component
- EAF – Equipment Automation Framework
  - Implement SEMI Standards and Integration Sequence
  - Provide bridge to generic Backend Factory Host
  - May include site-specific automation logic
- FA/EA – Factory/Equipment Automation
  - Backend Factory Host system(s)
  - Provide MES, OEE, APC, and other application functions

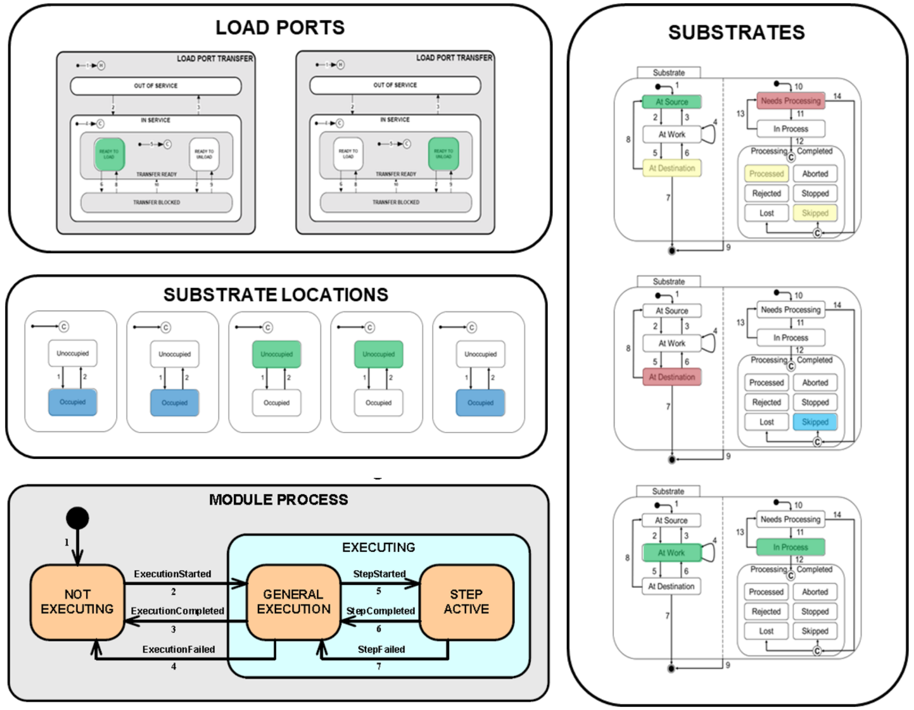


Segment of Ladder Diagram with all communication partners

Adaptation of mature automation standards

GEM, GEM 300, E142, others TBD

- Specific messages/objects from the GEM/GEM 300 standards are woven together in the Integration Sequence
- This concept was a major success factor in the definition and use of SEMI's automation standards at the 300mm wafer size transition in the mid-90s
- This results in significant reuse of existing factory and equipment connectivity software
- This also enables equipment suppliers unfamiliar with SEMI Standards to implement a subset of GEM 300
- The only modifications made to the standard GEM 300 message set were those needed to support carrier/tray ID and content verification
- Easily accommodates new functionality/standards, such as consumables and durables management

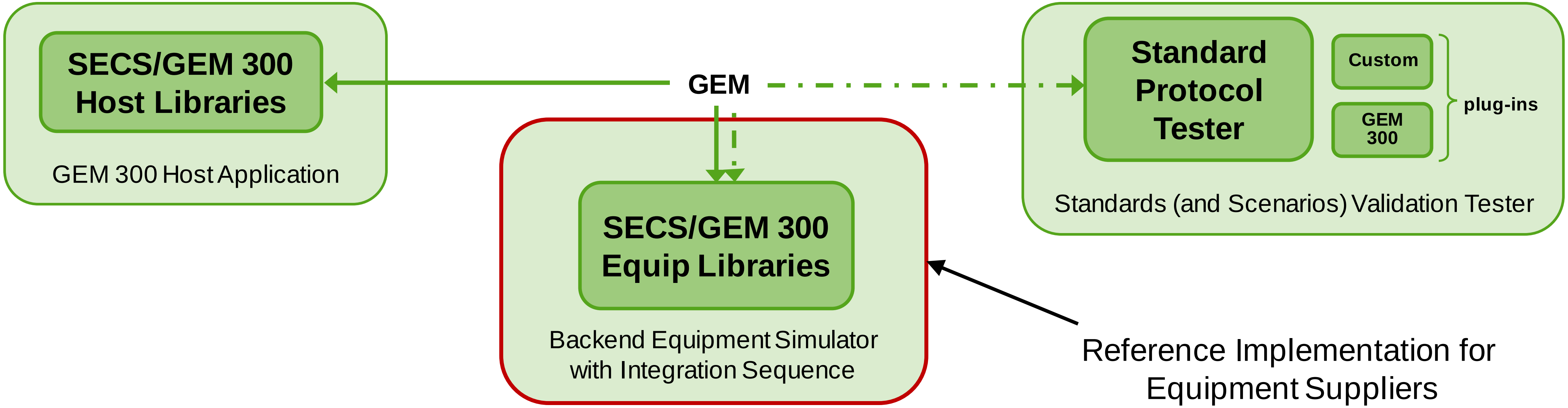


Synchronized View of Multiple GEM 300 State Machines

Reference implementation/validation test software

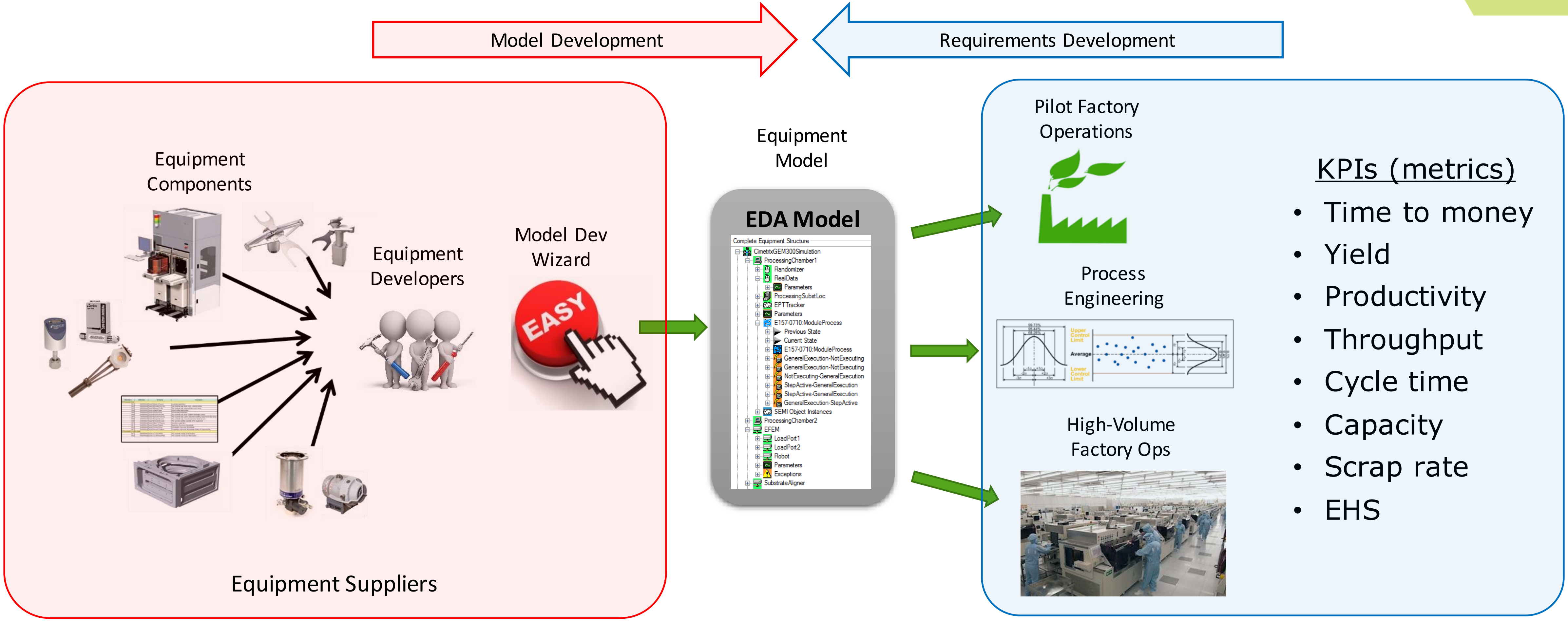
Support "both ends of the wires"

- Implement entire Integration Sequence in a sample application suite
  - Equipment simulator, communication partner utilities, validation tester plug-ins
  - Brings the specification to life, accelerates equipment supplier development process



Importance of robust requirements specs

The equipment model value chain…



Additional backend automation topics

Lots of work still to be done…

- Integrating test cell operations into automation sequence
- Handling multiple carrier types
  - FOUPs, magazines, trays, carts
  - And carriers of carriers of …
- Augmenting equipment data with human input
  - Equipment fault codes, operator actions, settings selection
- Managing WIP buffers in “open corrals”
- Cost-effective integration of “simple” equipment
- Compliance testing for non-standard requirements
- Educating the supplier base

SEMI Standards Program

Call to action: join us!

SEMI Standards are an important element to ensuring tight and effective collaboration in the semiconductor manufacturing supply chain and Smart Manufacturing

For more information: https://www.semi.org/en/products-services/standards

To join: https://www.semi.org/en/products-services/standards/membership-application

To help develop the Standards discussed in this webinar, contact the appropriate Task Force leader(s) or SEMI Staff

Information & Control (I&C) Technical Committee

- GEM300 Task Force
- Diagnostic Data Acquisition (DDA) Task Force
- Advanced Backend Factory Integration (ABFI) Task Force

Automated Test Equipment (ATE) Technical Committee

- Rich Interactive Test Database (RITdb) Task Force

Traceability Technical Committee

- Single Device Traceability (SDT) Task Force

Advanced Backend Factory Integration Task Force

Lots of work still to be done…

- Charter
  - "To explore, evaluate, discuss, and formulate consensus-based specifications that, through voluntary compliance, will enhance assembly and test for semiconductor manufacturing"
  - Operating principle: ensure that any new backend standards are consistent with the existing body of connectivity standards *and* leverage as much of the current SEMI standards as possible, especially GEM / GEM 300
- Focus to date
  - Updating E142 (Substrate Mapping) to support single device traceability (tracking raw materials and process materials, adding new substrate types)
  - Identifying needed updates in existing standards (GEM, GEM 300, EPT, etc.)
  - Circulating draft ballot for Consumables Tracking
- Members (companies)
  - Energetic mix of major device makers, equipment and software suppliers

Thank You!

Webinar recording and presentations will be available to attendees within 48 hours including answers to questions received during the session.

Speaker Contacts

- Alan Weber | Cimetrix
  - alan.weber@cimetrix.com
- Brian Rubow | Cimetrix
  - brian.rubow@cimetrix.com
- Albert Fuchigami | PEER Group
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- Mark Roos | Roos Instruments
  - mroos@roos.com
- Stacy Ajouri | Texas Instruments
  - sajouri@ti.com
- Dave Huntley | PDF Solutions
  - dave.huntley@pdf.com

Resources

GEM Resources

- GEM Overview
  - An Overview of the GEM standard: Part 1
    - A high level overview of the GEM standard, its related standards and how it is used.
  - An Overview of the GEM standard: Part 2
    - An overview of GEM compliance, GEM message efficiency and state machines.
  - An Overview of the GEM standard: Part 3
    - An overview of GEM Collection Event notification, equipment identification, documentation, dynamic collection event reports and status data collection.
  - An Overview of the GEM standard: Part 4
    - An overview of GEM alarms, remote control, equipment constants, recipe management, material movement and terminal services.
  - An Overview of the GEM standard: Part 5
    - A review of frequently asked questions.
- https://connect.semi.org/home
  - GEM 300 Task Force - North America
- https://www.semiviews.org/user/login
  - Access to SEMI standards

EDA / Interface A Resources

- EDA Standards Suite

SEMI E120	SEMI E125	SEMI E128
SEMI E132	SEMI E134	SEMI E138
SEMI E164	SEMI E178	SEMI E179

- EDA Freeze 3
  - Articles in SEMI Standards Watch Newsletter
  - Big Data Transfers with the EDA / Interface A SEMI Standards Suite - Smart Manufacturing Pavilion presentation at the SEMICON West (December) 2021.

E183 RITdb Resources

Published Standard: SEMI E183-1121 - Specification for Rich Interactive Test Database (RITdb)

Blogs/Articles Online Forums

Modernized IC Test Using SEMI RITdb Standards

RITdb: The Interplanetary Database for Manufacturing

New Standards on Test Cell Data and Events

Online Forum:

RITdb LinkedIn Group

Material/Training:

Implementing the SEMI E183 Standard (Rich Interactive Test Database) Bundle

RITdb Translator:

https://github.com/RITdb/ritdb.Translator

SEMI Standards Member Content:

Join RITdb Task Force Community on SEMI Connect to obtain access to additional tools/utilities, proposed standard(s), discussion forum, and more…

Resources

- Standards
  - SEMI E142 Specification fo Substrate Mapping
- Task Forces
  - Single Device Traceability Task Force - North America
  - Advanced Backend Factory Integration (ABFI) Task Force – North America
- Dave Huntley, PDF Solutions, ABFI and SDT Task Force co-leader

Webinar Q&A

Webinar Q&A (1/3)

Q: Can the Test Floor be used as a remote resource (globally)?

A: Yes, using pub/sub model data/actions can be done anywhere given correct permissions and access. RITdb does have ability to fully encrypt data as needed if sharing the information to external entities.

Q: I saw there might be a million new workers needed in semiconductors. Could you use the test floor to train?

A: Interesting question. RITdb captures all events and data on a floor in a manner which allows replay at a high speed. I could envision using this as a simulation source for training folks on actual floor events without being on the actual floor.

Other factory applications could collect data using the other SEMI Standards (SECS/GEM/EDA) described for a similar replay/training functionality.

Comment: There is a lot of changes now in AI, machine learning with many new groups and education. They are poor in real lossless traceable data for algorithm development.

Response: Part of the POC is a rule based 'expert' system which in intended to augment test engineers watching for interesting events or data. We test this using the replay function. We have found this to be very powerful.

The ability to do replay allows for better application development, rules to apply to operations, training, better testing for new version deployment, etc.

Webinar Q&A (2/3)

Q: Can you please go more into detail with how you can make interrconnected visualizations using data?

A: E183 defines what we call a metadata indexed repository (MDIR). Think of this as a distributed file system where each file is a RITdb container bonded to a set of defined metadata. One can then access the containers much like a SPARK or Hadoop system would. Something we have noticed is that most data has locality which makes in cell or in facility queries very efficient.

Q: We are seeing a strong trend towards automated material handling systems (AMR robots) with a wide variety of vendors. Do any of these standards support managing a fleet of AMRs?

A: Part of the RITdb POC is to hook to a robotic product delivery system. The goal is to use history and current results to predict the time for the robot to arrive.

As well, there are some SEMI standards that handle communication between automated handline systems and hardware components (SEMI E84 is an example widely used in the front end).

Webinar Q&A (3/3)

Q: Regarding future technology elements like Digital Twins or AI control via on-prem or off-prem cloud services. Where would the factory comms interface with such future systems?

A: For RITdb, and given that cloud will have higher latency, it's likely that sharing the containers in the repository is a likely point. This could be as simple as a file sync function.

The various SEMI Standards discussed in this webinar can all be used to provide the data to feed into these systems. The discussion about on-prem vs off-prem are more business decisions about what the fab is comfortable with (sharing data outside the factory facility, data security, etc.)

Speaker Bios

Alan Weber

Cimetrix by PDF Solutions

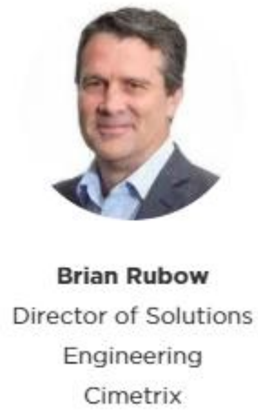
Alan Weber
Vice President, New Product Innovations
Cimetrix

Alan Weber is currently the Vice President, New Product Innovations for Cimetrix Incorporated. Previously he served on the Board of Directors for eight years before joining the company as a full-time employee in 2011.

Alan has been a part of the semiconductor and manufacturing automation industries for over 40 years. He holds bachelor's and master's degrees in Electrical Engineering from Rice University.

Brian Rubow

Cimetrix by PDF Solutions



Brian Rubow is the Director of Solutions Engineering for Cimetrix.

He is well-known within the industry due to his involvement with the SEMI standards committees. He currently serves as the co-chairs for the North America Information and Control Committee, the North America GEM300 Task Force, and the North America DDA Task Force.

Rubow has both a bachelor's and a master's in engineering from Brigham Young University.

Albert Fuchigami

PEER Group

Albert Fuchigami
Senior Software
Developer
PEER Group

Albert Fuchigami is a senior software developer at PEER Group Inc. and has spent more than 20 years helping semiconductor OEMs integrate their equipment into factories around the world.

He is a globally recognized leader in the SEMI Standards Program, co-leads the North America Data Diagnostic Acquisition (DDA) Task Force, and contributes to the Information & Control Technical Committee.

Albert enjoys demonstrating how standards can maximize data communication with factory host systems and is a champion for integrating HTTP/2 with gRPC and Protocol Buffers technology into the Equipment Data Acquisition (EDA) / Interface A standards.

He holds a Bachelor of Mathematics (Computer Science) degree from the University of Waterloo.

Stacy Ajouri

Texas Instruments

Stacy Ajouri
Senior Member of Technical
Texas Instruments

Stacy Ajouri is a Senior Member of Technical Staff at Texas Instruments in the Test Technology Group.

She is the co-chair of the North America Automated Test Equipment (ATE) Technical Committee and the RITdb Task Force.

She has over 30 years of experience across multiple disciplines related to test and test operations.

Pulling from that experience, she supports the implementation of RITdb proof of concepts (POCs) focusing what is needed by the manufacturing and engineering community.

Mark Roos

Roos Instruments

Mark Roos
CEO
Roos Instruments

Mark Roos is CEO of Roos Instruments, a longtime producer of semiconductor ATE.

He co-chairs the North America ATE Technical Committee and the RITdb Task Force. Roos has been involved in standards development for ATE for the past 20 years. He is currently heavily involved in the focus of RITdb POCs on scaling and latency.

Dave Huntley

PDF Solutions

Dave Huntley
Product Manager
Assembly Products
PDF Solutions

Dave Huntley was the founder and president of KINESYS Software in 1992 which developed the Assembly Line Production Supervisor (ALPS). PDF Solutions acquired the ALPS in 2017 and Dave now works in Strategic Marketing, Business Development & Standards Liaison focused on defect / process tracking and single device traceability across the supply chain.

He has a long history working with SEMI. He was co-lead of the Sort Map task force responsible for the SEMI E142 Specification for Substrate Mapping Standard. Dave is now the co-lead for the Traceability committee and two SEMI task forces; 1) Advanced Backend Factory Integration working on applying and extending wafer fab automation standards to assembly and test and 2) Single Device Traceability task force working on blockchain traceability for the supply chain.