Collaborative Alliance for Semiconductor Test (CAST)

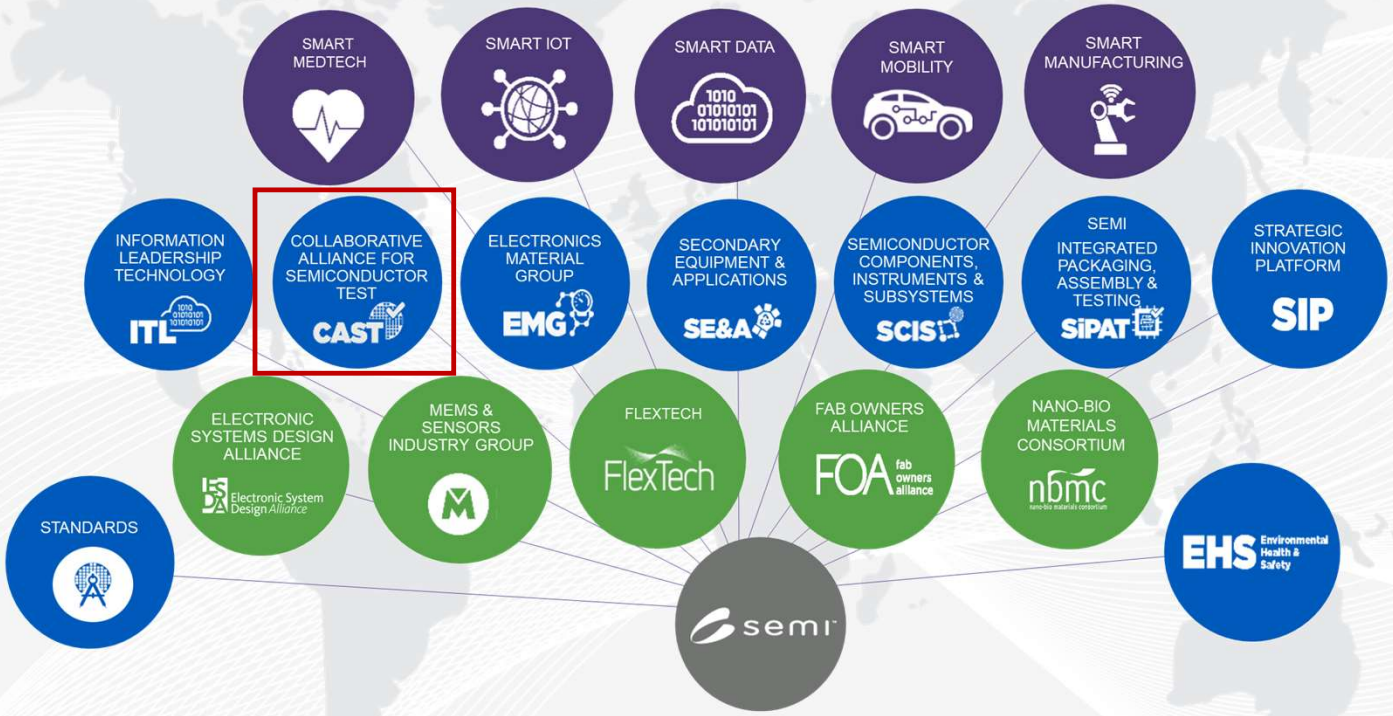
Technology Community

TEMS Overview | September 2020

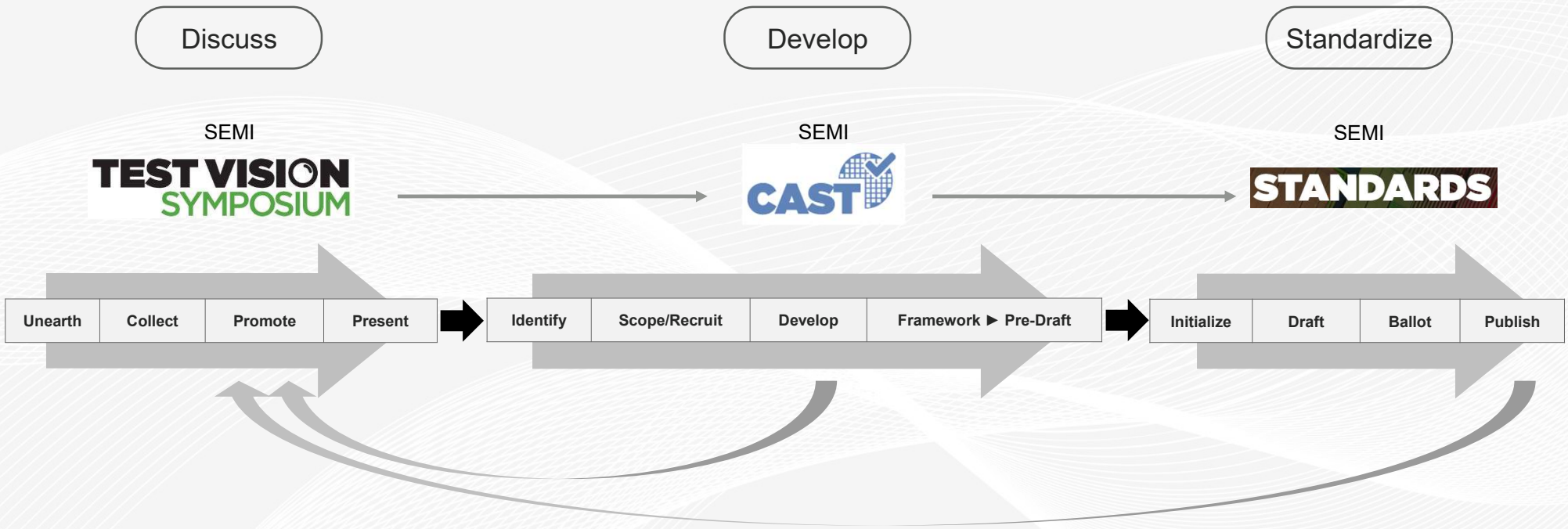
SEMI speeds the time-to-better business results for its members across the global electronics design and manufacturing supply chain.

semi™ CONNECT - COLLABORATE - INNOVATE - GROW - PROSPER

SEMI TECHNOLOGY COMMUNITIES



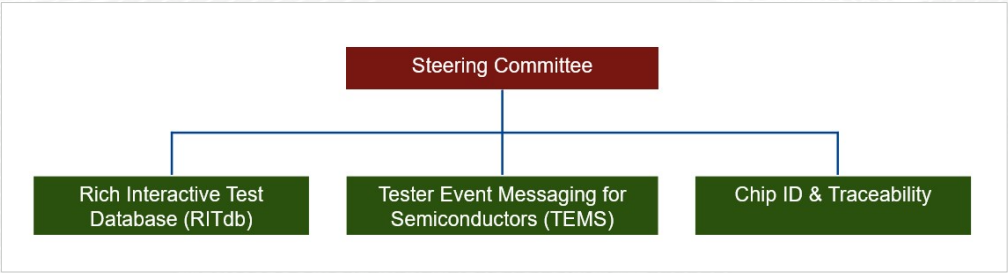
Activity Flow



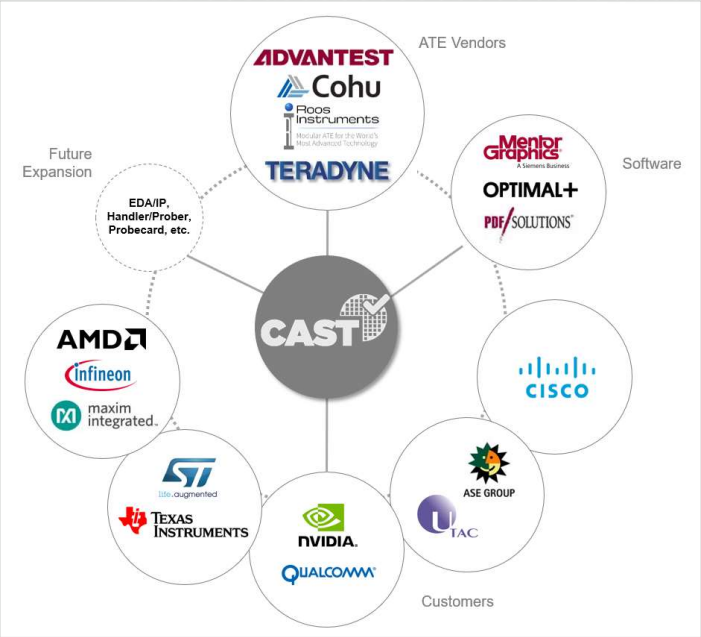
COLLABORATIVE ALLIANCE FOR SEMICONDUCTOR TEST (CAST)

CAST develops, coordinates, and directs all SEMI services for the semiconductor test community.

Organizational Structure



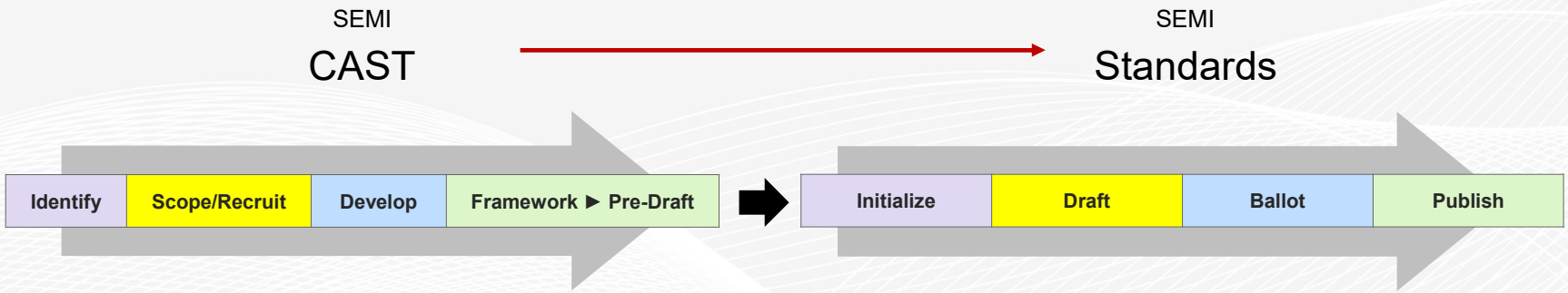
Participating Companies



CAST Activities

- **Rich Interactive Database (RITdb)**
  - Focus: Develop the next-generation format following STDF to allow more flexibility in data types and support for adaptive test.
    - RITdb enables a real-time streaming model that provides the ability to collect and monitor data/systems from sand to landfill
  - Rationale: While Standard Test Data Format (STDF) is widely used in the semiconductor industry, there is a need for more efficient and flexible format to manage "big test data."
- **Tester Event Messaging for Semiconductors (TEMS)**
  - Focus: Establish a vendor-neutral way to collect test cell data by standardizing ATE data messaging system based on industry-standard internet communication protocols between a test cell host and a server.
  - Rationale: Address surging demand for real-time data analysis, real-time ATE input and control of the test flow to improve test yield, throughput, efficiency, and product quality.
- **Chip ID & Traceability**
  - Focus: Develop a standardized approach for enabling traceable die-level identification (ID) throughout the IC manufacturing, test, and assembly processes to the point of use in the final system.
  - Rationale: Many product types representing significant volumes that do not provide ID traceability. Without component-level traceability, it is extremely difficult to analyze failures and drive corrective action

Activity Process Flow [1/3]



Activity Process Flow [2/3]

SEMI
CAST

SEMI
Standards

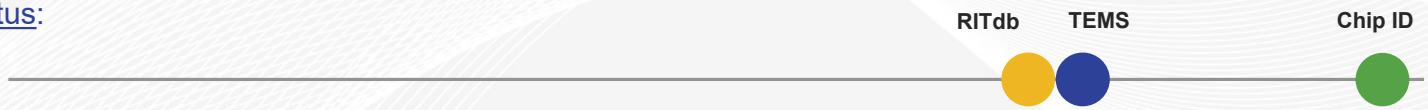
Identify	Scope/Recruit	Develop	Framework ► Pre-Draft	Initialize	Draft	Ballot	Publish

CAST:
- RITdb WG
- TEMS WG
- Chip ID & Trace WG

ATE Standards Committee:
- RITdb TF
- TEMS TF

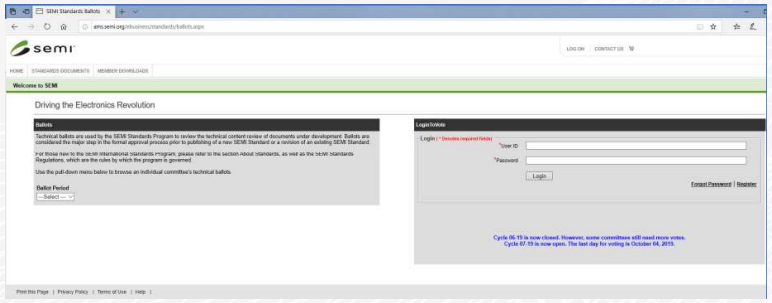
Traceability Standards Committee:
- Single Device Traceability TF

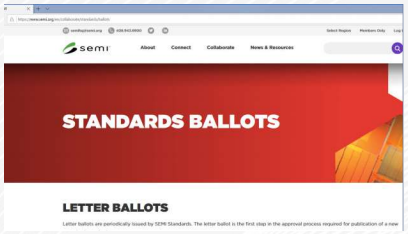
Status:



Standards Balloting

- **Letter Ballots**
  - The first step in the approval process required for publication of a new or revised standard
  - Electronic system, hosted on the SEMI website
  - Multiple voting cycles / year
  - 30-day voting period





2020

Cycle 1

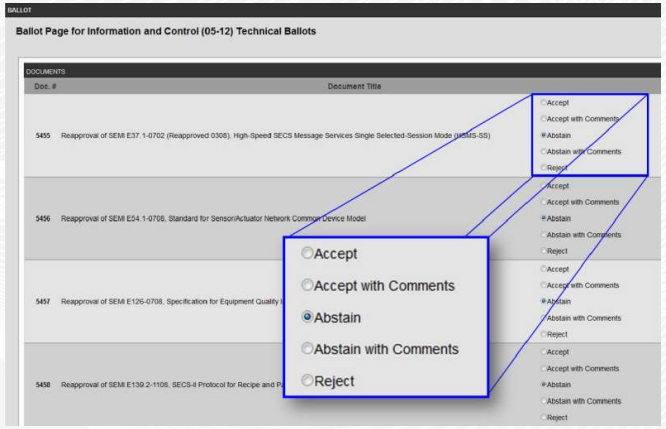
Ballot Submission Date: Monday, January 6, 2020
Voting Period Starts: Wednesday, January 15, 2020
Voting Period Ends: Friday, February 14, 2020

Cycle 2

Ballot Submission Date: Thursday, January 30, 2020
Voting Period Starts: Tuesday, February 11, 2020
Voting Period Ends: Thursday, March 12, 2020

Cycle 3

Ballot Submission Date: Wednesday, March 11, 2020
Voting Period Starts: Wednesday, March 25, 2020
Voting Period Ends: Friday, April 24, 2020

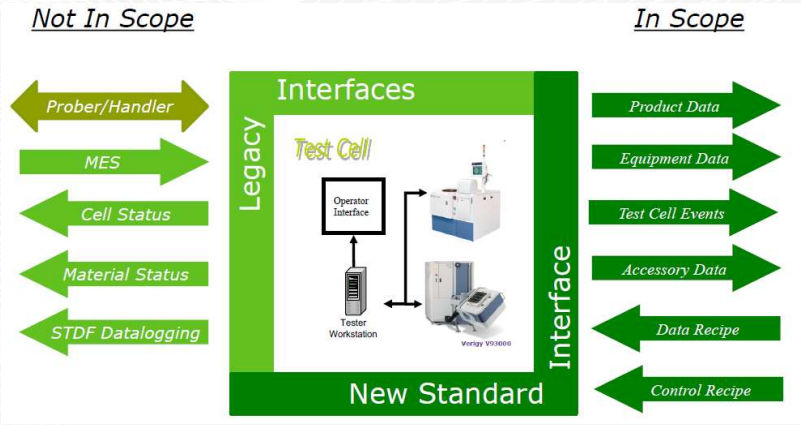


TEMS Update

semi

Tester Event Messaging for Semiconductor (TEMS)

- This activity aims to establish a specification for ATE data messaging system based on standard internet communication protocols between a Test Cell host and a server.
- The activity will map the services and data of the specification to HTTP/JSON streams, URLs, and data payload definitions.
- The specification is designed to co-exist with current implementations of the different communication methods and allow for easy implementation of client-server-based functionality services for ATE operations.



Tester Event Messaging for Semiconductors (TEMS) Standards Task Force

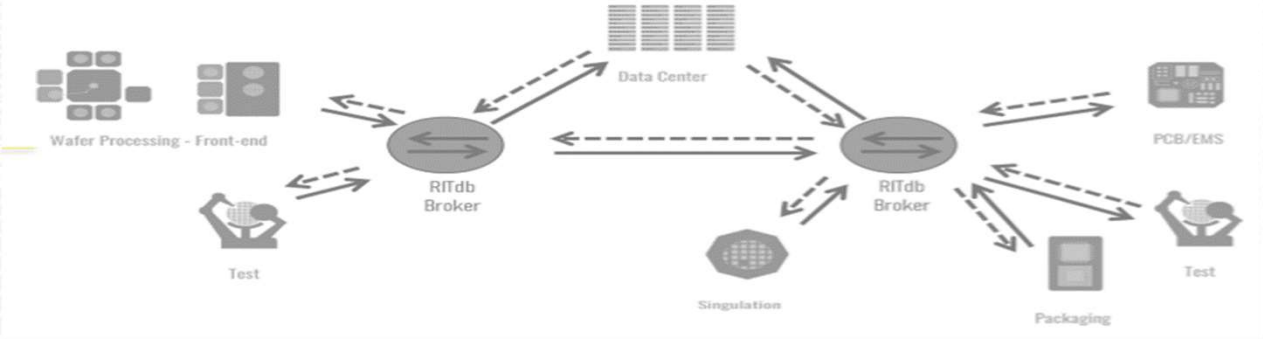
- Established under the North America Chapter of the Automated Test Equipment Technical Committee
- Charter:
  - To develop a standardized ATE data messaging system based on standard internet communication protocols between a Test Cell host and a server.
- Activity
  - New Specification for the Automated Test Equipment Tester Event Messaging for Semiconductors (TEMS) [Document #6580]
    - Semiconductor test operations involving ATE today are experiencing increasing use of data for real-time data analysis and real-time ATE input and control to improve test yield, throughput, efficiency, and product quality. At the same time, test equipment and test operations around the world utilize a diverse range of data formats, specifications, and interface requirements that create significant customer service and application engineering costs for ATE vendors, OSAT companies, IDM test operations, software providers, and handler equipment. The goal of this specification is to create a vendor neutral way to collect test cell data.
    - This document:
      - Describes the data communication between the Test Cell and an external server.
      - Covers Test Cell data and operating condition collection.
      - Describes the minimum interface requirements along with methods for adding custom
- Status: Balloting

RITdb Update

semi

Proposed Standard – Specification for Rich Interactive Test Database (RITdb)

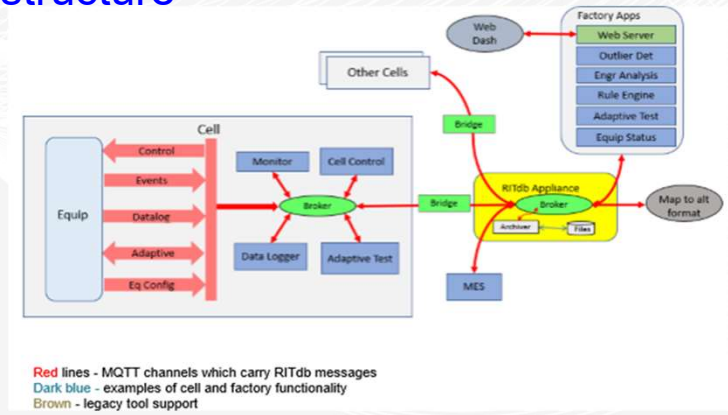
- Standardized approach for data sharing and consumption of data throughout the IC manufacturing processes from fab to final user and back across the whole ecosystem –Applies to all data collected in the production, assembly, and testing of semiconductors
- Supports SMART adaptive test with ability to feed back/forward –Deploy ML algorithms to enhance yield
- Addresses challenges of data sharing between internal and external facilities and stakeholders
  - Security and provenance of the RITdb data - critical to enable integrity of data pipeline



RITdb – A foundation for SMART manufacturing Test Data

- RITdb Features
  - RITdb Containers and/or streams of data
  - Capable of integrating batch data with individual streams
- RITdb bi-directional messaging
  - Exchange information between Test cell and anything else connected to RITdb (data or control)
  - Enables operational control and data analytics
- Build upon IoT architecture using MQTT messaging protocol
  - Modern open source message-based communication enables plug and play tools and applications
  - Adds layer of security with private/public key sharing rules
  - Easily integrates into Big Data infrastructure

Logical Model for a Test Cell RITdb Environment



Benefits and Industry Adoption of RITdb Solution

- RITdb enables a data driven environment for Semiconductor Manufacturing
  - Simple standards-based data capture, transport and relationship model
  - Supports multiple data use cases (datalog, cell events, equipment logs, diagnostics, IoT sensors, MES events)
- Streaming RITdb is based on open source SW and enables easy exchange of information between systems
  - Aligned with HIR Adaptive Test Model
  - Enables IoT integration into SMART Facility
  - Model supports real-time control based on events
- Industry deployment of RITdb standard proposal
  - COHU implemented RITdb datalogs on Roadmap testers in 2019
  - RI and TI implemented case studies and prototype of RITdb system
  - Advantest - Development ongoing, TI in house demo in 3Q2020

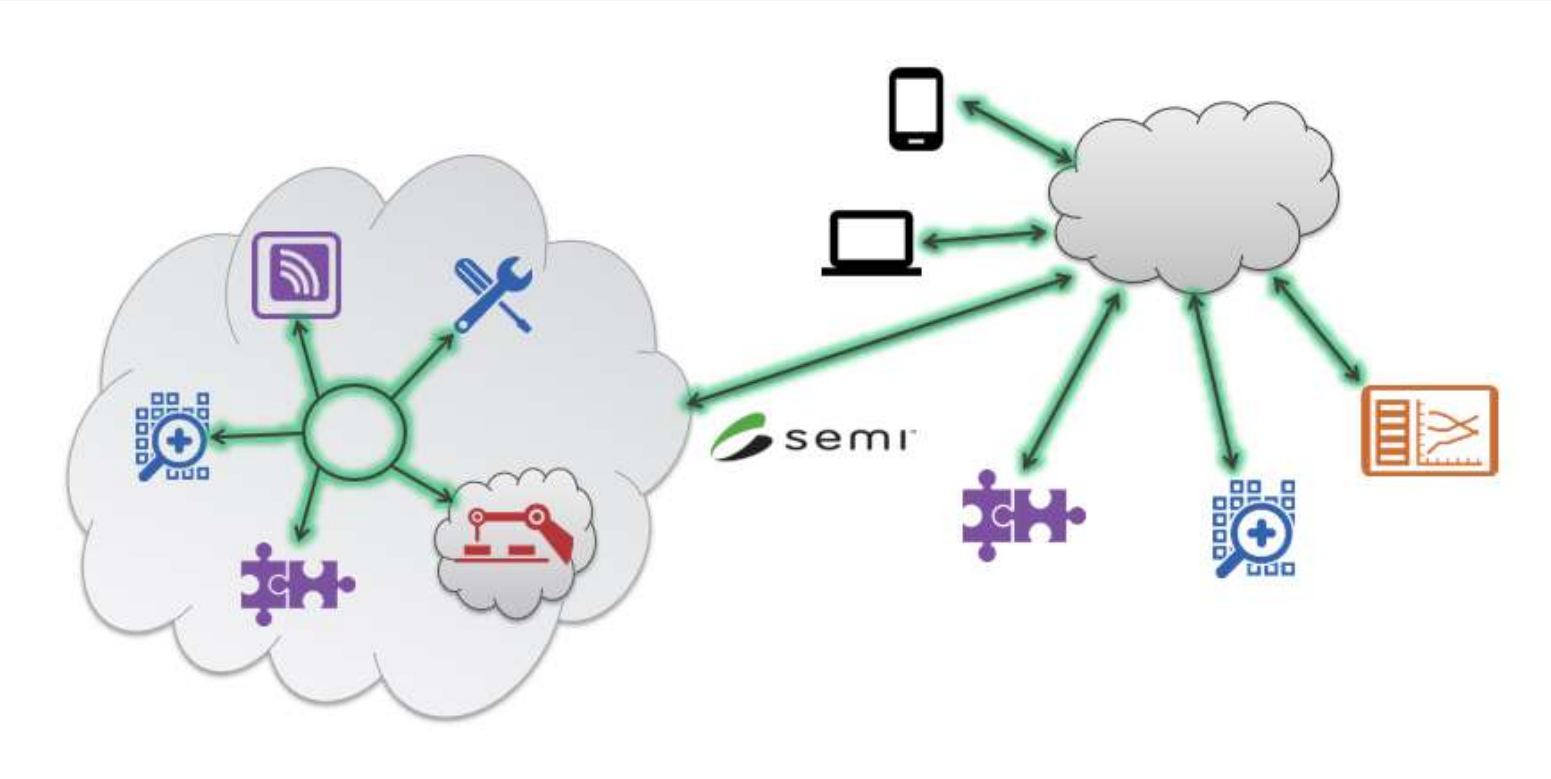
Cohu

Texas Instruments

Roos Instruments
Modular ATE for the World's Most Advanced Technology

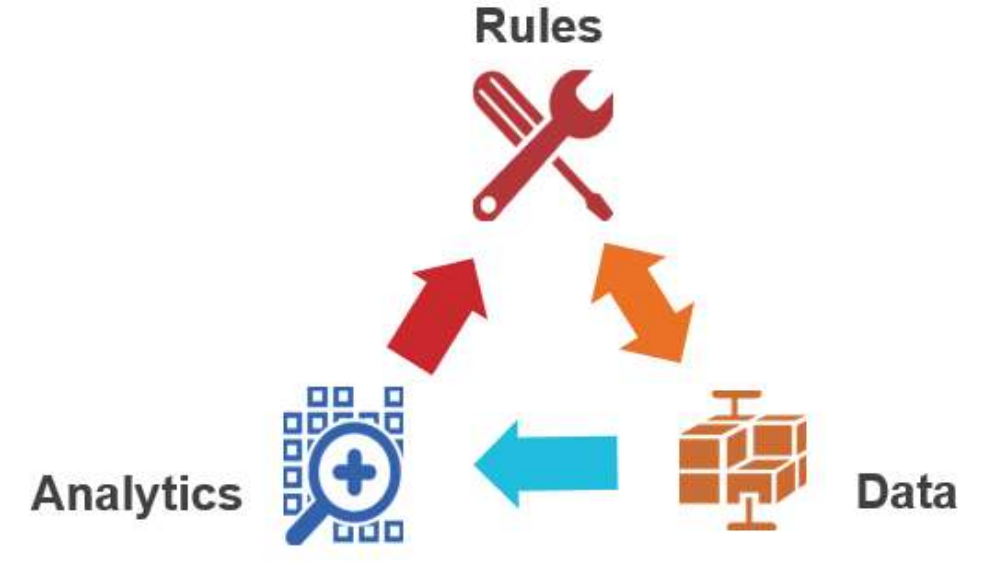
ADVANTEST

Streaming RITdb supports the integration of IIoT smart test strategies to solve quality and cost problems



Rule Manager - Can combine Real-Time data/Events, Windowed Data, & historical Data

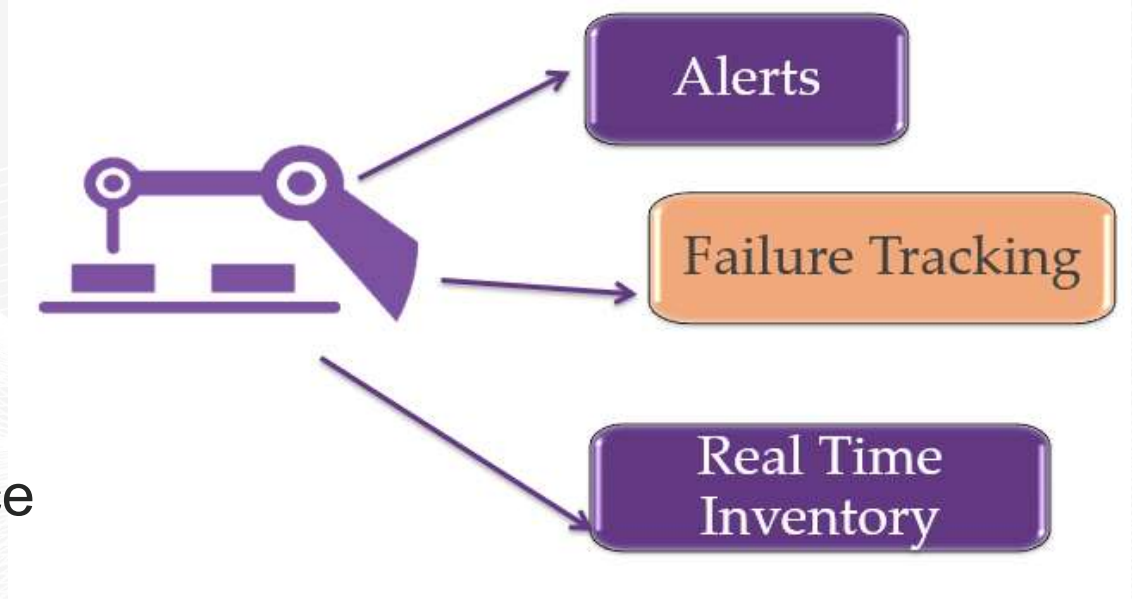
- Variable automated process rules
- Monitoring Rules
- Product engineering support



Rules Engine can run on or off tester
A system to incorporate historical data/stream with current event is necessary

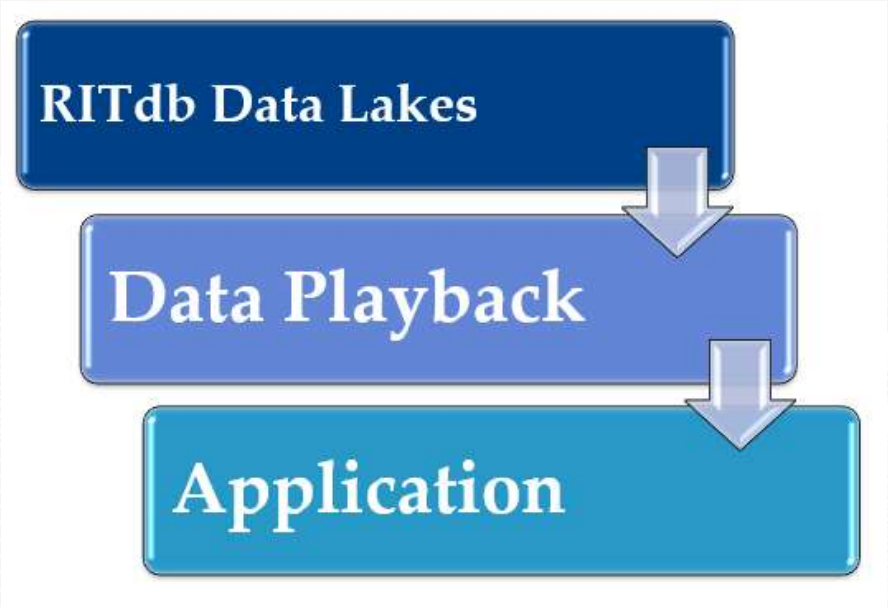
Resource Tracking improves quality, lowers cost

- Preventative diagnostics
- Reduce mean time between failures
- Improve planning efficiency
- Correlates problem to resource



Real Time Tracking System (RTLS):
Improve identity, align streams from different sources, support automation

Data Playback lowers cost of development



- Robust software updates
- Rule change impact assessment
- Low impact app development

RITdb Data Lake
System needs to be integrated to capture, manage, and store RITdb containers/streams

It's time to join!

Where are we now?

POC studies and test cases run

Implementation work has been done

Vendor integrations done or in progress

Tools and Examples available

Standard - SEMI ballot in 3Q

What can you do?

Participate in the RITdb Task Force and learn about the upcoming spec

Group Leads:
Mark Roos, Roos Instruments – mroos@ri.com
Stacy Ajouri, Texas Instruments – sajouri@ti.com

Chip ID & Traceability Update

semi

Chip ID & Traceability

SEMI
CAST

SEMI
Standards

Identify	Scope/Recruit	Develop	Framework ► Pre-Draft

Initialize	Draft	Ballot	Publish

CAST Chip ID & Traceability Framework Development Completed

SEMI Standards Activity Established:

- *Single Device Traceability (SDT) Task Force*
- New Standard: Specification for Single Device Traceability for the Supply Chain (#6450)

CAST Development Completed (Jun 2018)	Standards TF Formation (Jul 2018)	Standards Activity Start (Aug 2018)	Letter Ballot Issued (Sep 2018)	Technical Committee Adjudication (Nov 2018)	Procedural Review (Dec 2018)	Standard Published (Jan 2019)

SEMI T23

Single Device Traceability (SDT)
Task Force

- **New Standard Proposal – *Specification for Counterfeit Prevention for the Electronics Manufacturing Supply Chain***
  - Immutable and secure recording and authentication of parts as they flow between members of an electronics manufacturing supply chain
  - It is expected, but not required, that the standard will be based on the Blockchain and HyperLedger open source technologies to record the chain of custody between business entities in the supply chain.
  - The standard will not define how the assets are processed within a business entity in the supply chain, or what materials and other assets they contain. This standard will, however, be aligned with other standards that do address these topics.

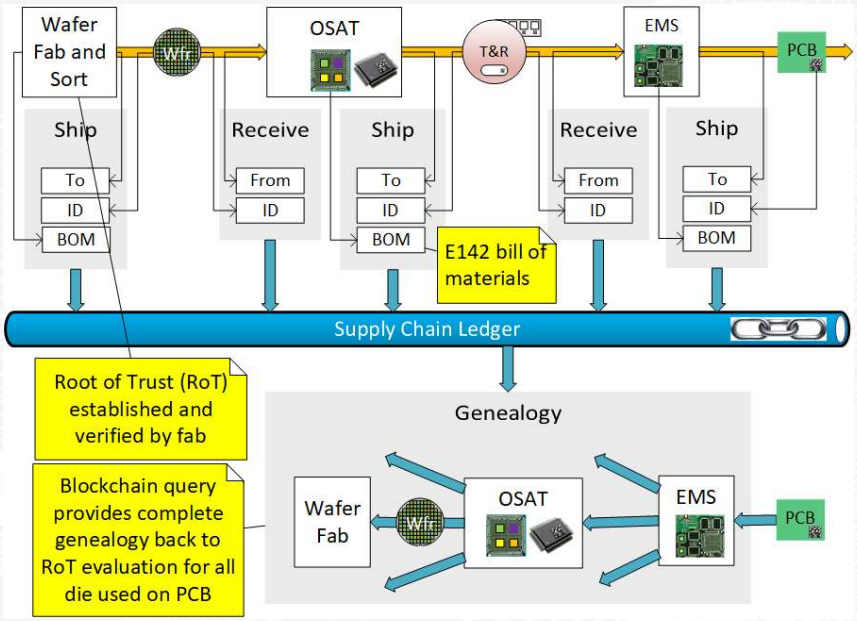


Image source: PDF Solutions

Single Device Traceability (SDT)
Task Force

- **Liaison with other standards activities**
  - Institute for Interconnecting and Packaging Electronic Circuits (IPC)
  - Collaboration between ISO TC 292 W4 and SEMI Traceability Committee
  - International Roadmap for Devices and Systems (IRDS) Factory Integration
  - Advanced Backend Factory Integration (ABFI) TF

- **DARPA - Liaison with AISS project**
  - To build a full out implementation of such a block chain based environment following on the DARPA SHIELD program's success
  - We will engage with the AISS project to benefit from their feedback on 6504. Our goal should be that the AISS project or a subset of it is compliant with the published standard.

Future CAST Activities

semi

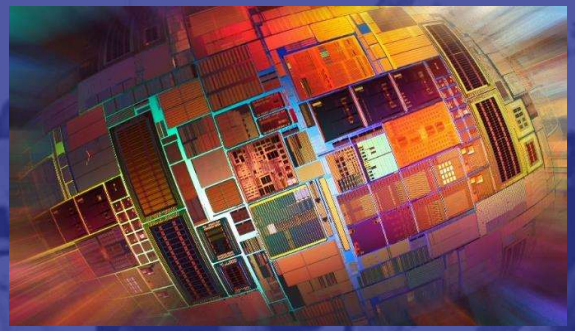
Future CAST Focus Areas

- Formation of dedicated Working Groups planned by YE 2020 in the following areas:
  - mmWave Technology
  - Smart Manufacturing

- Other topics being considered for future CAST work
  - Chiplets – Collaborating with ODSA on Test Challenges
  - Leveraging HIR Roadmap

SEMI CAST Members can propose new work topics.

Contact Information



Paul Trio
Senior Manager, Strategic Initiatives
673 S. Milpitas Boulevard
Milpitas, CA 95035
Phone: 1.408.943.7041
Email: ptrio@semi.org

semi