



Road to Chiplets: Data & Test

November 9 - 11, 2021



Quality Protection for Chiplet-based Modules

A Practical Approach

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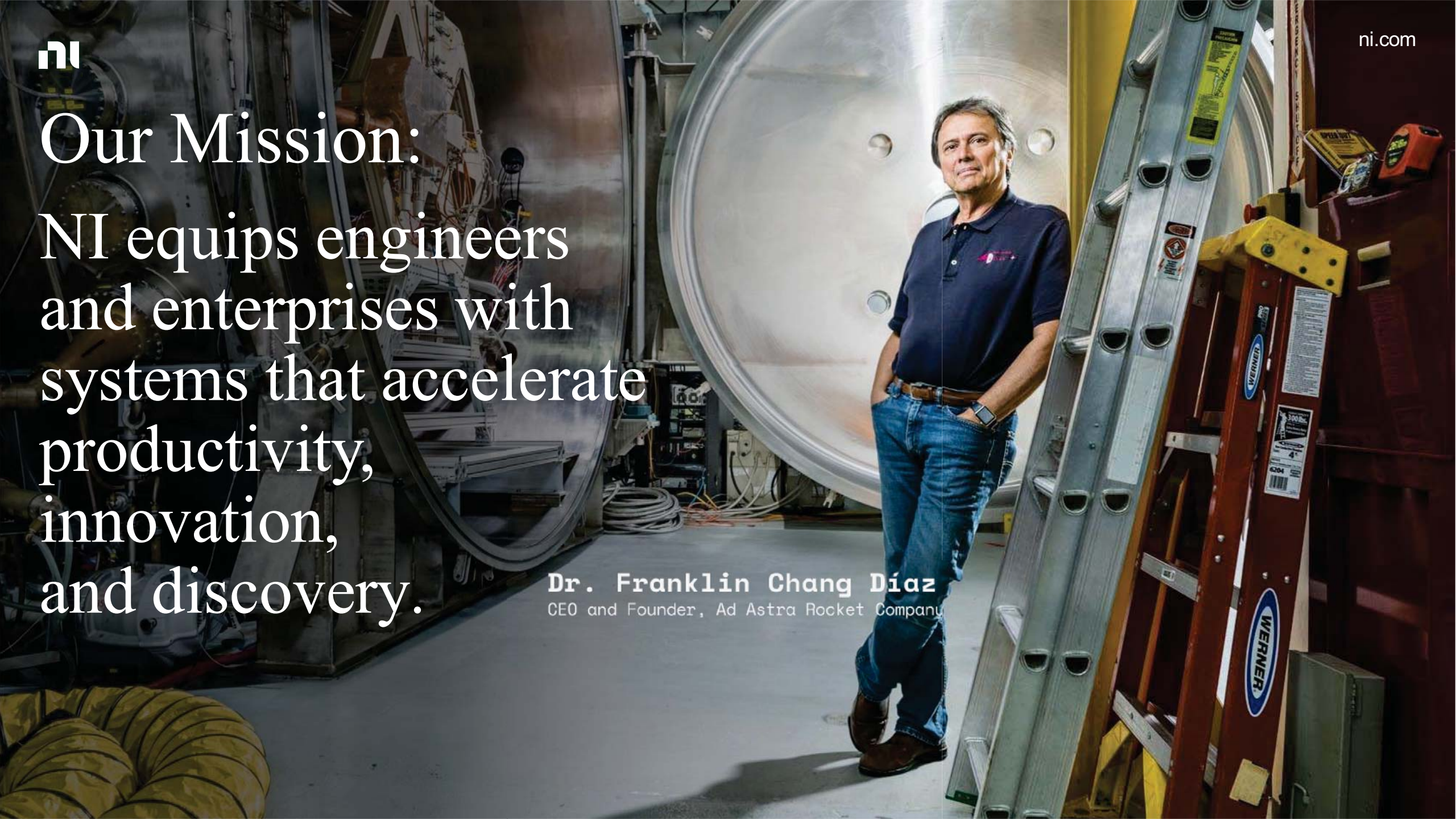
NI Fellow



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NI equips engineers and enterprises with systems that accelerate productivity, innovation, and discovery.

Dr. Franklin Chang Díaz
CEO and Founder, Ad Astra Rocket Company





NI SOFTWARE-CONNECTED SOLUTIONS

ENABLING INNOVATION AND PRODUCTIVITY ACROSS THE PRODUCT DEVELOPMENT CYCLE

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SystemLink™

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Design and Validation

Production

Deployment and Maintenance

APPLICATION AND DEVELOPMENT SOFTWARE

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TestStand

VeriStand

C#/.NET

Python

FlexLogger™

DIAdem

...

MODULAR HARDWARE

PXI

CompactDAQ

VST

CompactRIO

USRP

...

ENGINEERING EXPERTISE

NI Services

NI Partner Network

Software

Hardware

Education


Consulting + Integration

Solutions

Integration

Distribution/Resell

Chiplet Quality Challenges

- 3nm sweet spot for Chiplets
 - Highly customized chips / Heterogenous integration
 - Complex chiplet-system susceptible to use-conditions
 - End-to-end collaboration on design/manufacturing/test and use
- 
- Unprecedented sensitivity to process variability
 - Performance and interoperability variances – compound yield
 - In-field testing, repair and tuning
 - Open business model to enable feedback loop via test

Going Broader and Connecting the Value Chain

Design & Eng.

Manufacturing

Customer

Design

Chip(let)

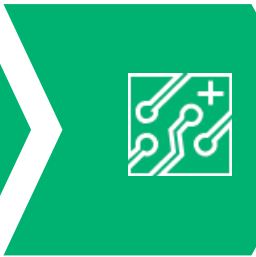
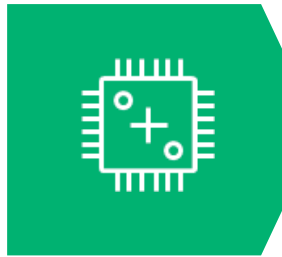
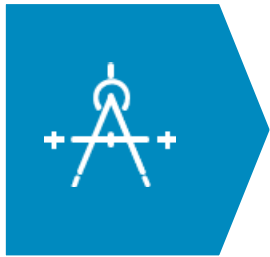
Board

Module

Product

In Field

Returns



Design spec • Machine • Process • Metrology • Test • Rework • Genealogy • Performance • Reliability • Usage • Warranty



Visibility • 24x7 Analytics • Alerts • Automated Action



The level of data sharing across the value chain impacts the ability to solve key industry challenges

The need to improve quality FAST

Consistent Performance

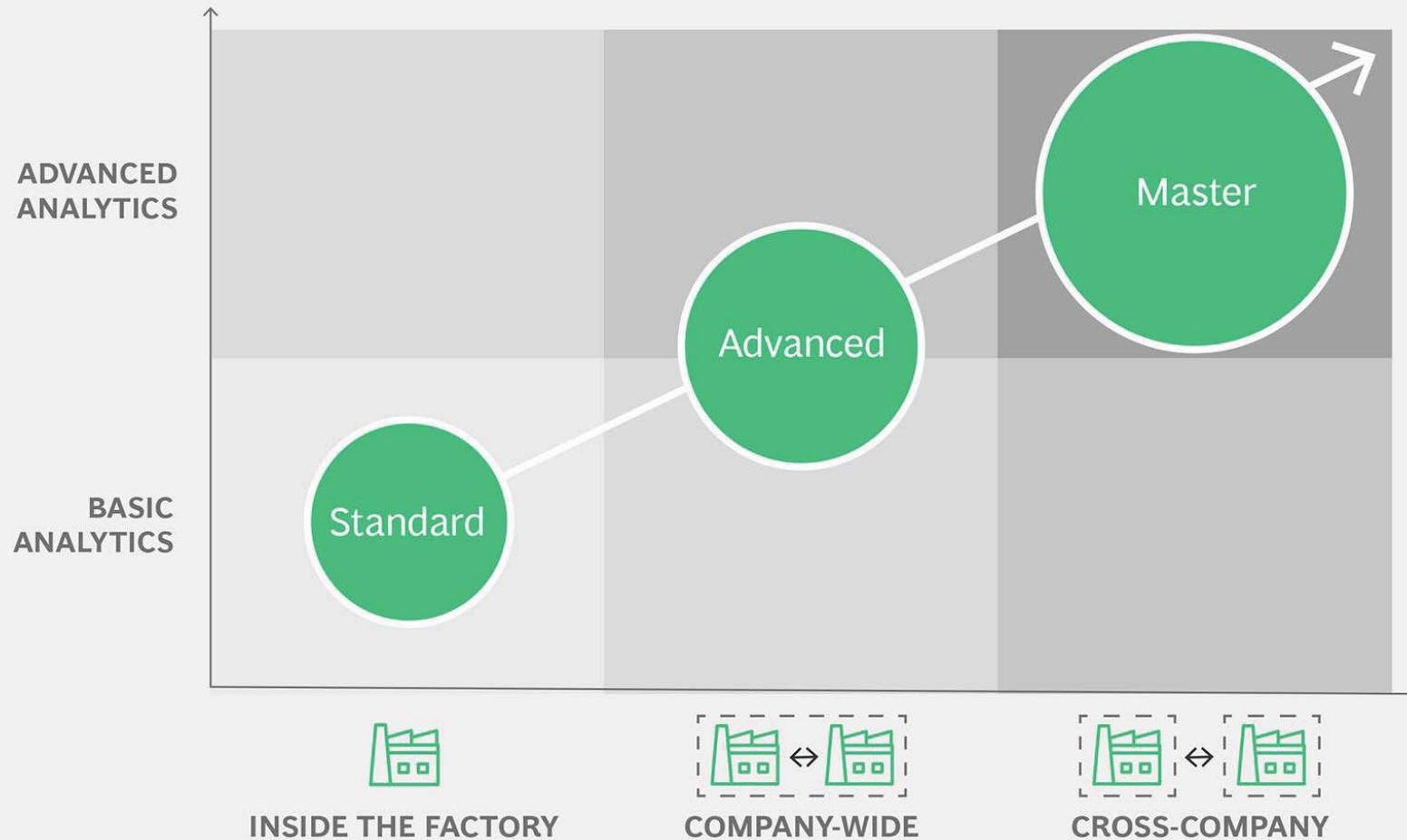
Warranty Costs

Recalls

Liability

Data Sharing Enables Largely Self-Controlled Factories

What is data used for?



5

application domains that clearly demonstrate the value proposition

72%

of managers surveyed say they are considering data sharing to improve operations

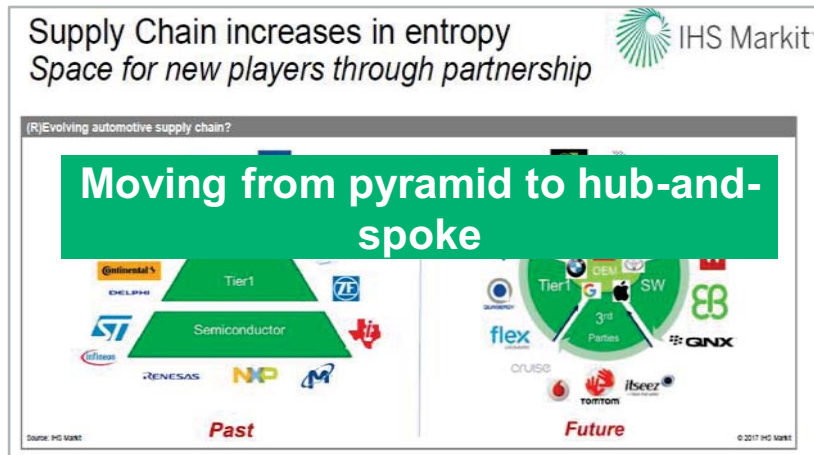
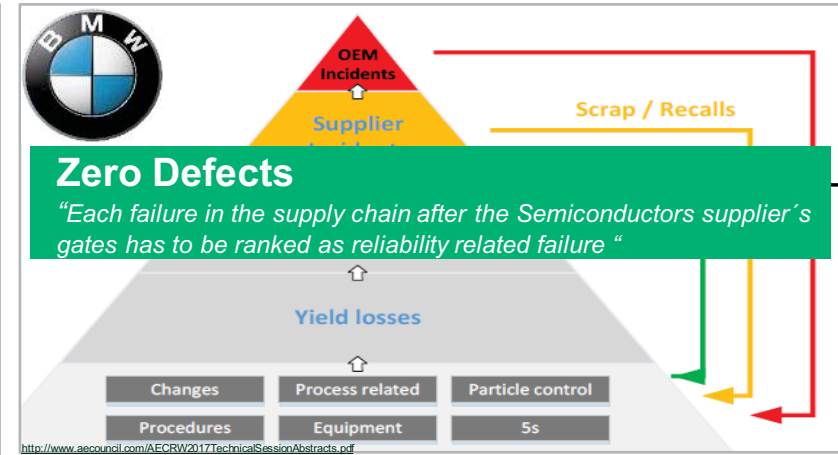
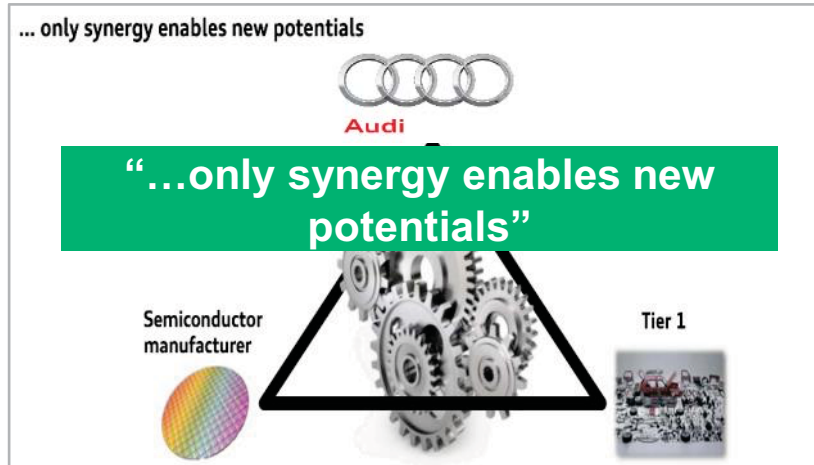
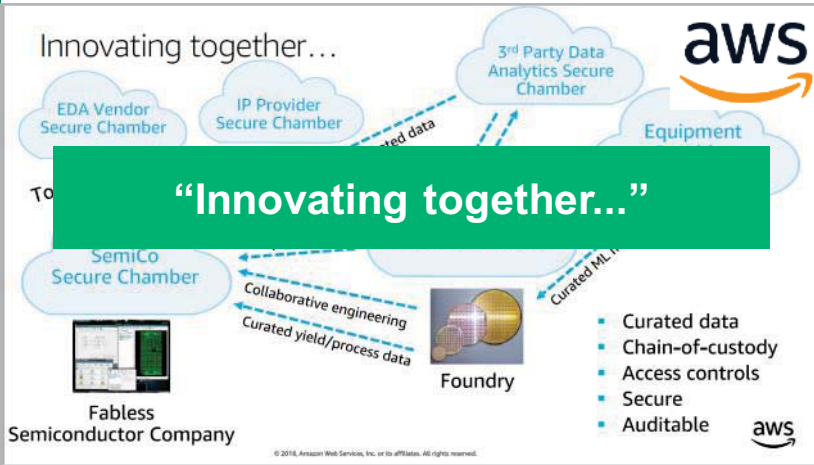
\$100B+

in value can be unlocked through manufacturing-process optimization alone

Sources: World Economic Forum; BCG.

Note: Based on a global BCG survey of 996 manufacturing managers.

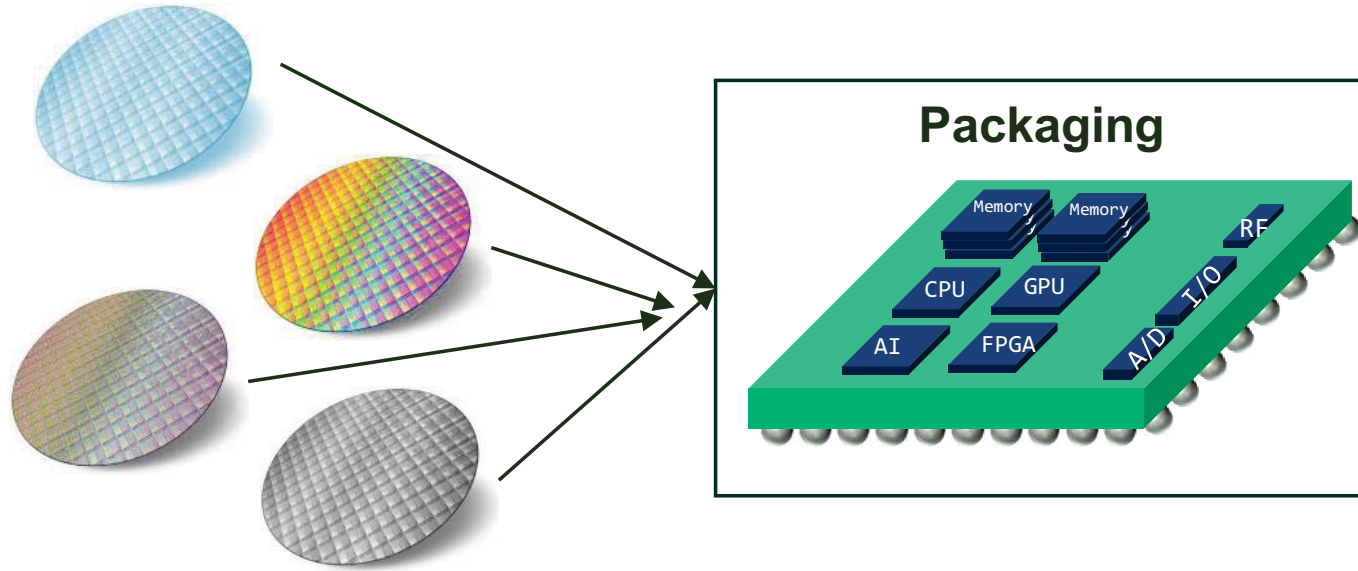
Voices Across the Industry



Europe is Leading the Charge...

The screenshot shows the Gaia-X website homepage. At the top, there is a navigation bar with a logo on the left and menu items: 'What is Gaia-X', 'Who we are', 'News', 'Use cases', 'Publications', 'Members', 'Contact', and a search icon. A 'How to join' button is located on the right side of the navigation bar. The main content area has a dark blue background. The first section is titled 'What is Gaia-X?' and contains a paragraph: 'Gaia-X represents the next generation of data infrastructure: an open, transparent and secure digital ecosystem, where data and services can be made available, collated and shared in an environment of trust.' Below this is another section titled 'How does Gaia-X work?' with a paragraph: 'The architecture of Gaia-X is based on the principle of decentralisation. Gaia-X is the result of a multitude of individual platforms that all follow a common standard – the Gaia-X standard. Together, we are developing a data infrastructure based on the values of openness, transparency, and trust. So, what emerges is not a cloud, but a networked system that links many cloud services providers together.' A third section titled 'Who' is partially visible on the right side of the screenshot.

The screenshot shows the Catena-X website homepage. At the top, there is a navigation bar with the Catena-X logo (Automotive Network) on the left, a German flag, and a menu icon on the right. The main content area features a large image of two business professionals, a man and a woman, standing on a balcony and talking. Overlaid on this image is a white text box with the following content: 'Catena-X Automotive Network' followed by 'The gateway to a Digital Economy'. Below the text box, there is a downward-pointing arrow.

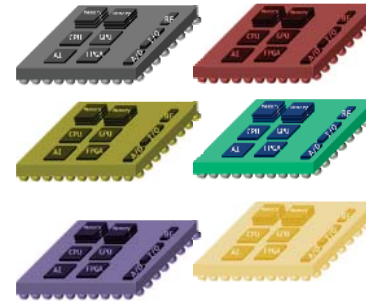


Wafer Test

10s of suppliers

Final Test

10s die types
100s of dies



System Test

10s-100s
System vendors



In-Field Test

100s OEMs
Different config.

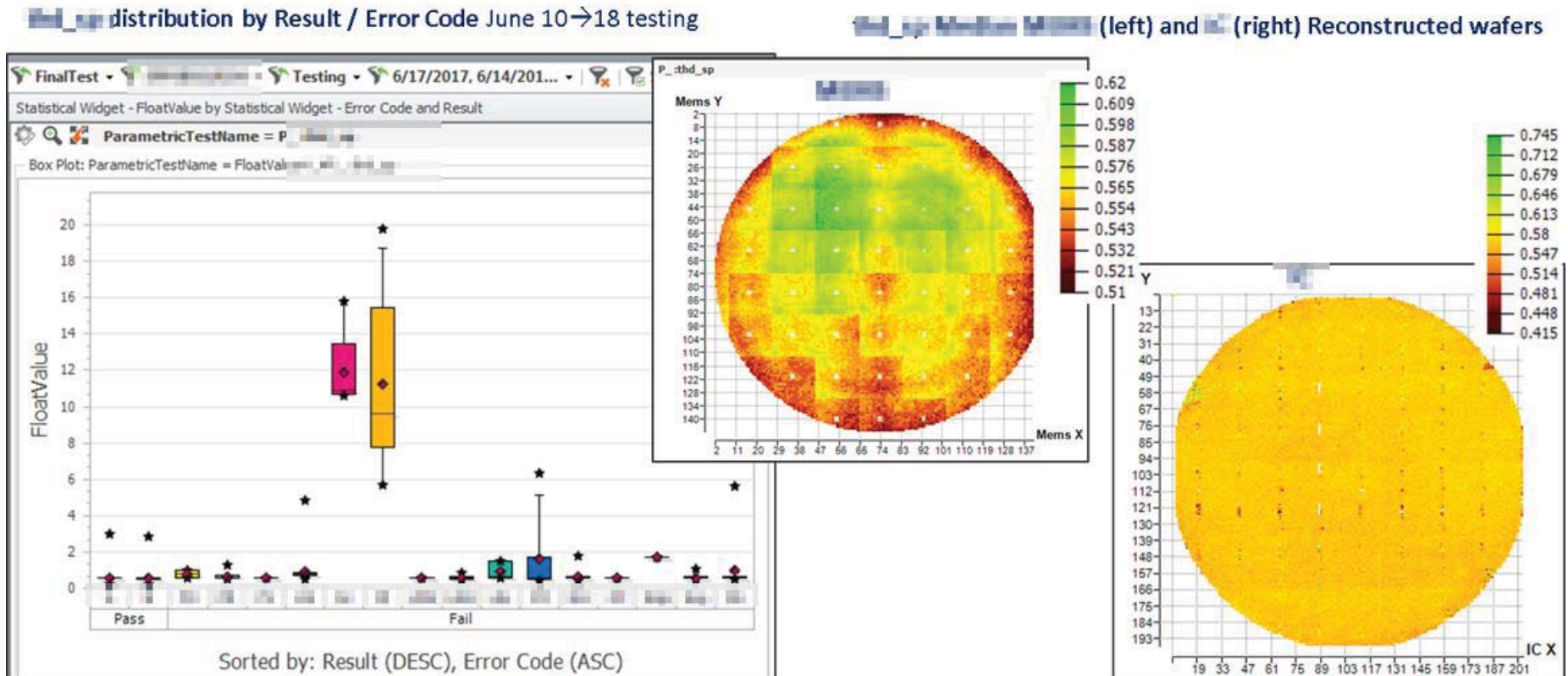
How do we enable Chiplet test-data-driven insights across supply-chain?

Example 1: Connected Value Chain Analytics Hub for Chiplets

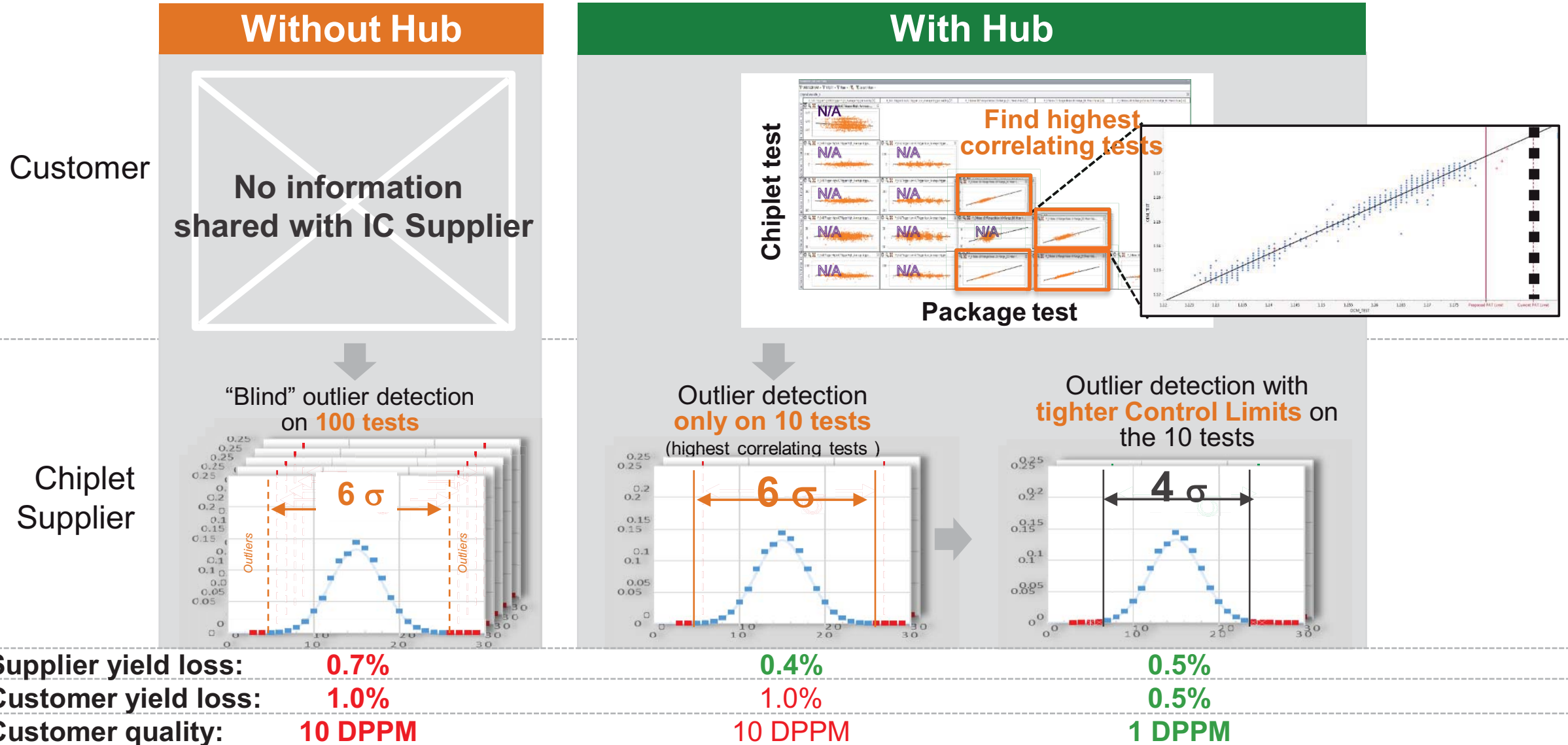
Box plot shows the statistical distribution of a single package test result split by bin

Cumulative reconstructed wafer maps of chiplets show:

- A wafer from one component with a clear pattern (looks mfg. related)
- A wafer from a second component with a random distribution



Example 2: Improving Quality and Yield for Suppliers and Customers



Concerns with Sharing Data

1

IP Protection/Commercial

- **Exposing IP** to potential competitors
- Data can be **leveraged against the other party**
- **“Win-Lose:”** Benefit for customer is clear, but what about the supplier?
- **Liability / legal / compliance / sovereignty** risks

2

Technical

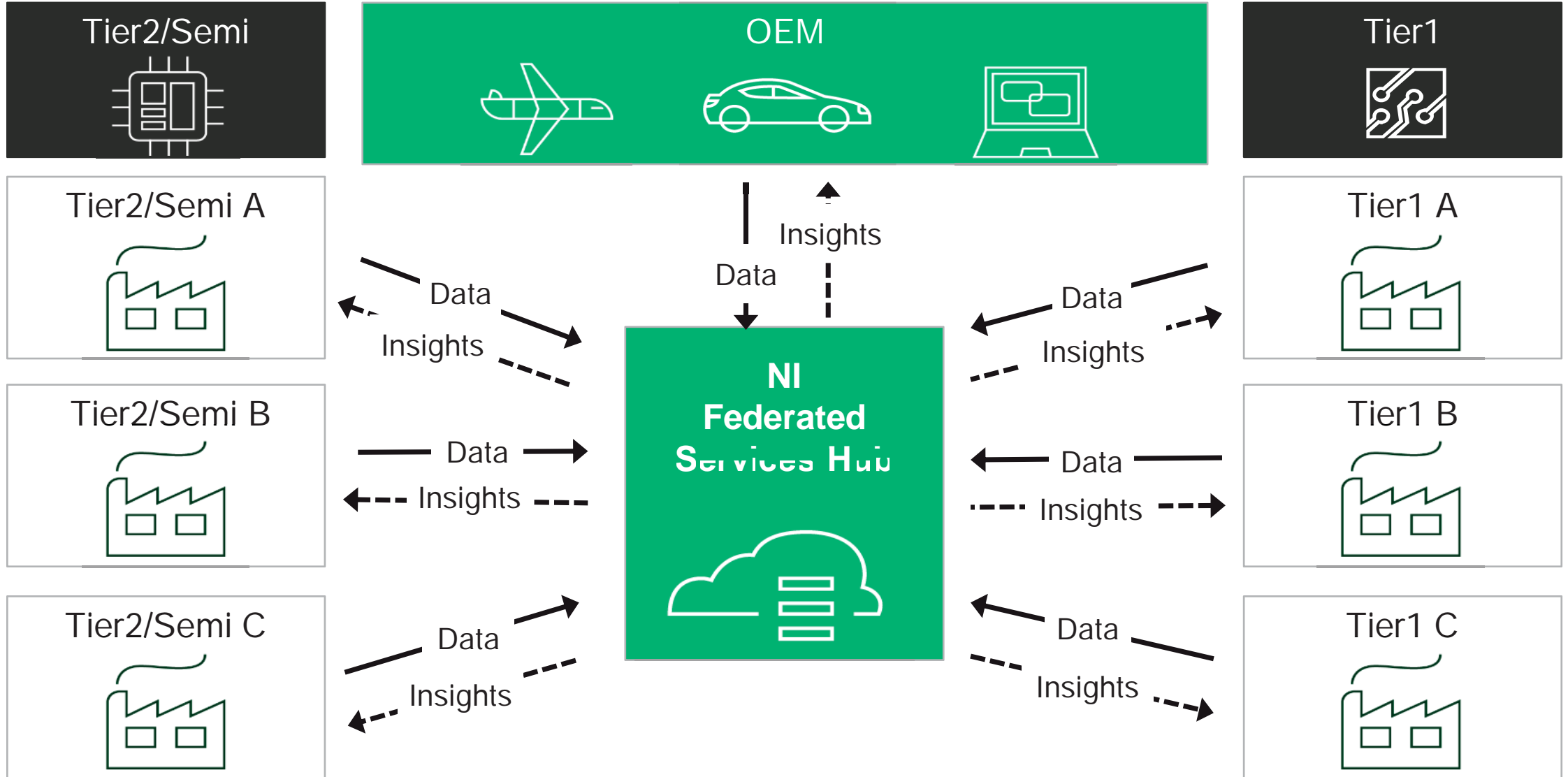
- Data flow / management
- **Security**
- Integration
- Complex many-to-many scenarios
- Lack of traceability
- Cost of doing it yourself

3

Expertise

- Complex correlations and analytics
- Cross-domain expertise is required

Trusted Quality Assurance Hub



How the Hub Addresses the Concerns



1

IP Protection/Commercial

- **Data owner** has **full control** over exposed data
- **Only data relevant** to resolving identified issues is exposed, and **only to the Hub**
- **Data** can be **obfuscated** while enabling analytics
- **Only agreed-upon Insights** are generated and shared
- All data movement is tracked on a **distributed block-chain ledger**



2

Technical

- The hub is **responsible** for the bulk of the **implementation and applications**
- Only one connection to maintain, no matter how many partners
- Consistent solutions for data security
- The hub has **more options** to maintain **traceability**

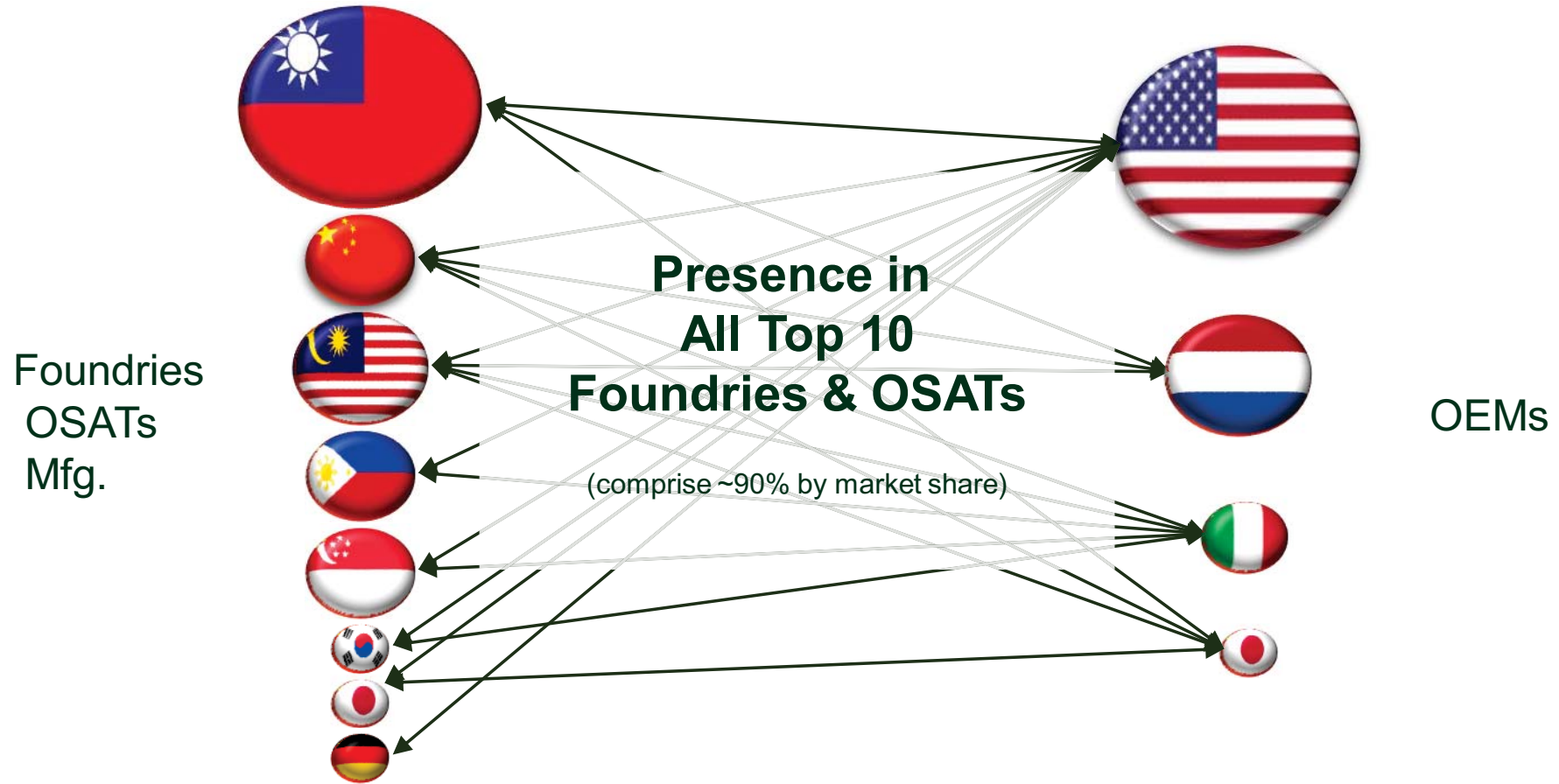


3

Expertise

- The hub provides the **analytics expertise**
- **Each party leverages its own expertise** when evaluating the issues identified by the hub

Practical to Deploy – Leverages Existing Infrastructure



Note: Size represents proportion of installations

Summary

Chiplets are just one example of an application where **data sharing is inevitable**

The **technical infrastructure** and **business relationships** required are complex

Test is the gatekeeper and thus the key ingredient

The solution HAS to support **many-to-many relationships** between suppliers and customers

A lot of **infrastructure already exists** and can be re-used

We're looking for design partners to join us on this journey

Thank you sponsors!

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— Risto Puhakka, President VLSIresearch

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