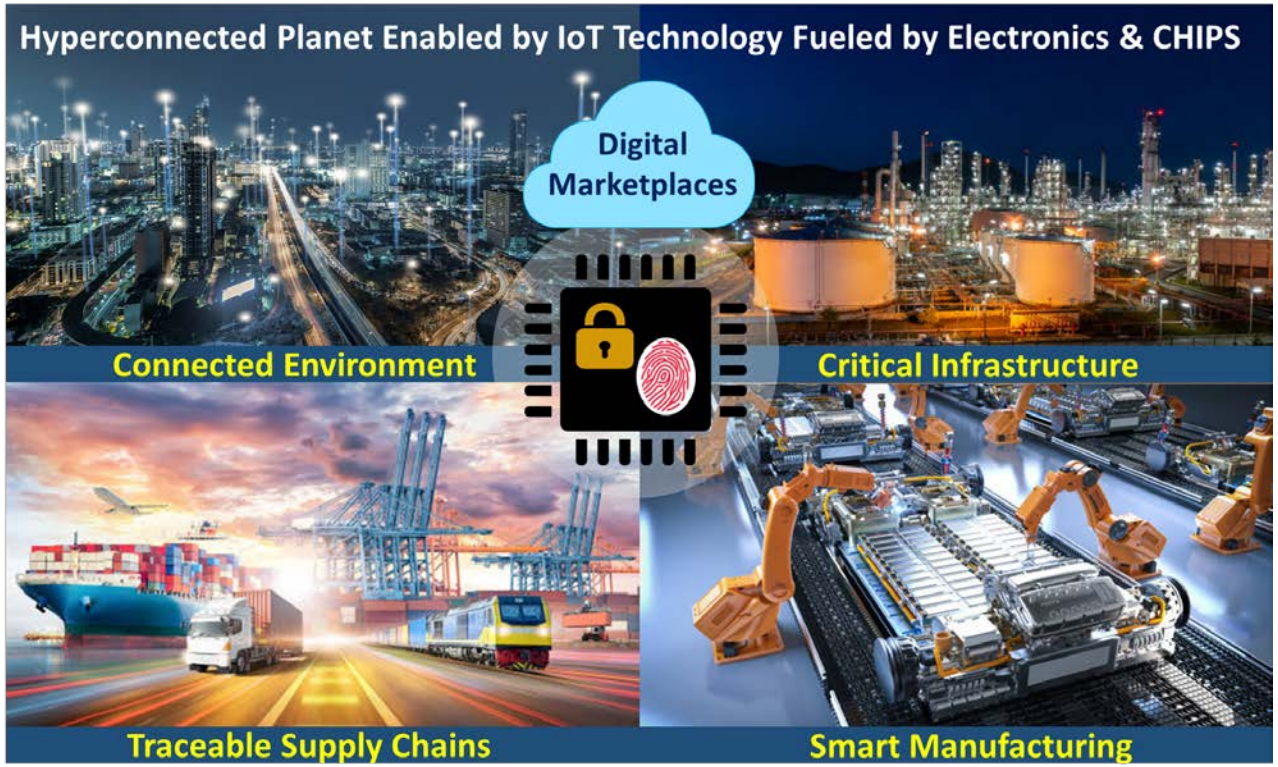
Trusted Value Chains and Digital Business Ecosystems
from CHIPS to Edge



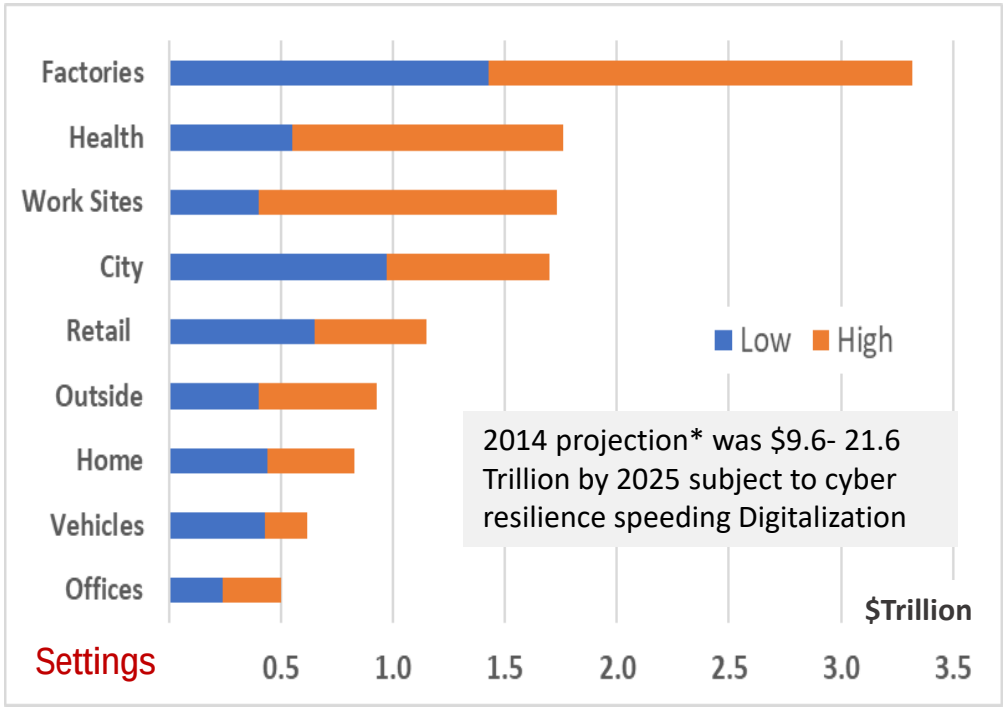
October 2023
HETiA Emerging Tech Conference
Edge Intelligence

Tom Katsioulas
President & CEO, Archon Design Solutions
Member of the IoT Advisory Board, U.S. Dept. of Commerce
tomkat@archon-ds.com

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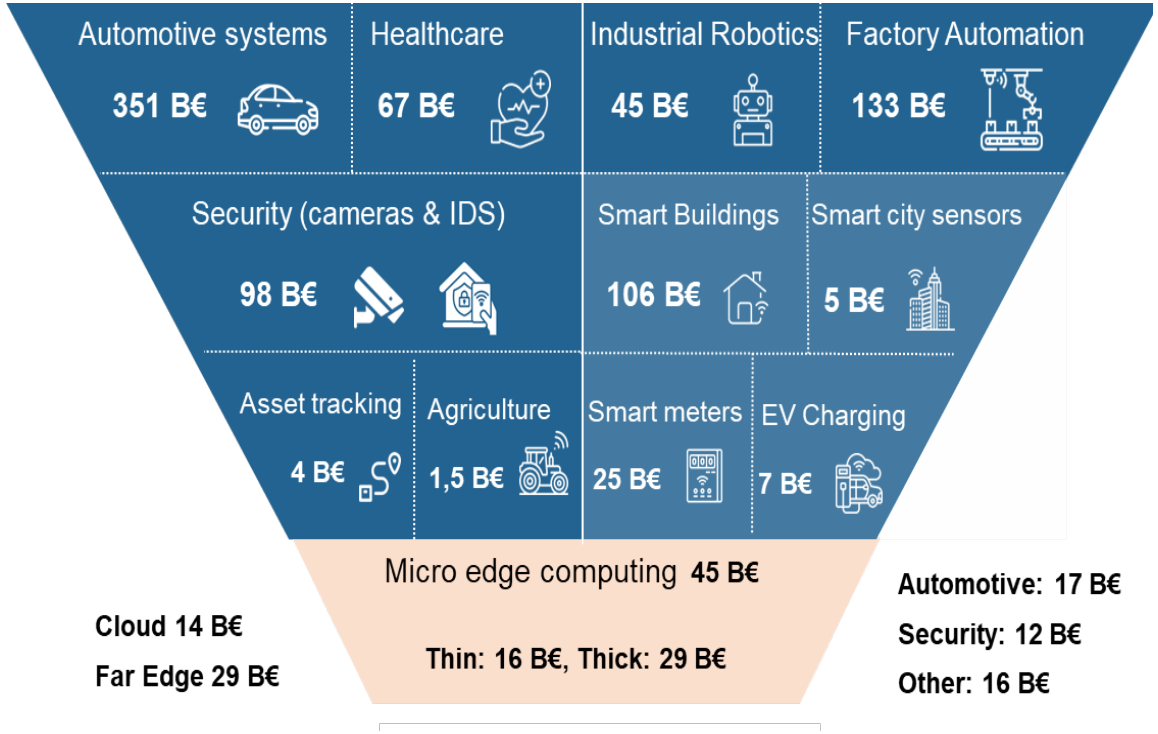
Hyperconnected Applications and the IoT Global Economy

Global IoT Economic Value $5.5-12.6 Trillion by 2030



Sources: 2014 World Economic Forum*, 2021 McKinsey & Company

Global Market Professional IoT Platforms 841 B€ in 2021



Source: www.decision.eu/en/report/far-edge/

IoT growth depends on upgrading legacy infrastructure and accelerating partner ecosystem collaboration

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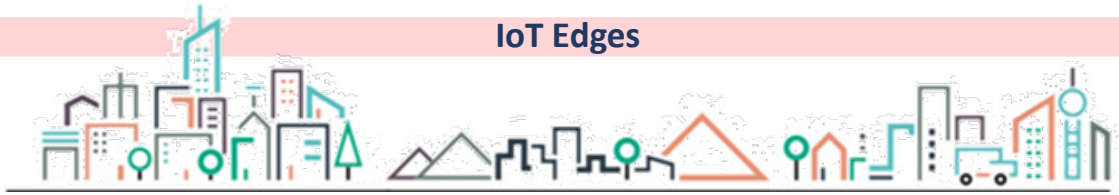
How Connectivity Changes the Value Chain Economics

Industrial | Aerospace | Automotive | Consumer | Communications | Healthcare | Data Centers

OT Edges — **IoT Edges** — **IT Edges**

*Operational Technology

*Information Technology



Billions of Connected Devices

Powered by trillions of chips

Smart Cities, Supply Chains, and Critical Infrastructure

Smart Connected Product Supplier*

Secure & Trusted IoT Device

Field Use Analytics

Fragmented Supply Chain

Product as a Service

Digital Marketplaces

IoT Edge Devices

- Better visibility on product field use
- Remote lifecycle management (OTA)
- Reduced support costs and RMAs
- Lower OPEX, higher differentiation
- Growth of XaaS* revenue streams
- Security, trust and data sharing

*Sources: HBR, HPE

*XaaS – Anything as a Service

How to leverage connectivity across value chains and data to boost global security & economic growth?

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How Connectivity Changes Product and Business Ecosystems

Product | **Smart Product** | **Connected Product** | **Product System** | **System of Systems → Platform Marketplaces**



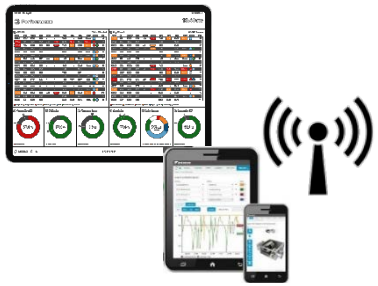




Navigation, Fuel



Aviation Equipment





Engine, Speed, Temp Sensors

Weather Data System

Weather Maps and Forecasts

Aviation Equipment

Flight Management System

Route Opt System

Air, Altitude Engine Sensors

Navigation System

Flight Database And Analytics

Criticality

Supply Chain







Systems connect to other systems to form ecosystems

Farm Equipment

Planters Tillers





Humidity and Temp Sensors

Weather Data System

Weather Maps and Forecasts

Farm Equipment

Farm Management System

Seed Opt System

Field Sensors Irrigation Nodes

Irrigation System

Farm Database And Analytics

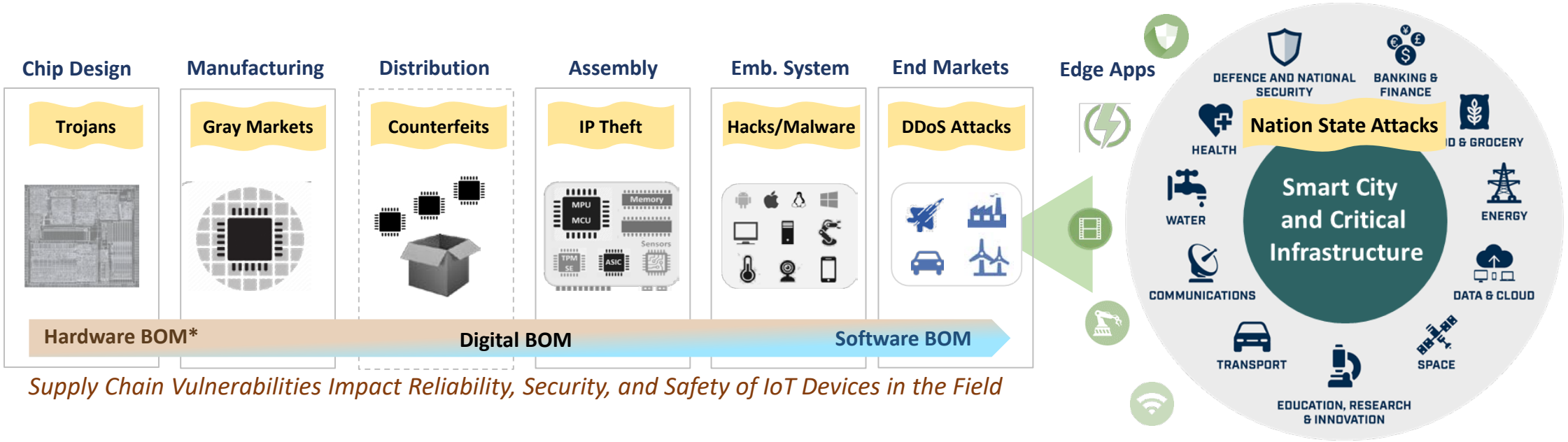
Complexity

Business Transformation → Customer, Benefits, Retention, Differentiation, Complexity, Ecosystem Partners

*Source: HBR How Smart Connected Products Are Transforming Competition

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IoT Supply Chain Vulnerabilities, Risks and Opportunities



Supply Chain Vulnerabilities Impact Reliability, Security, and Safety of IoT Devices in the Field

- Lack of visibility in fragmented supply chain
- Over 65% of electronics assembled in Asia
- Ineffective sanctions and customs controls
- Costly support, liabilities, and loss of value

Opportunity for Ecosystem Solution

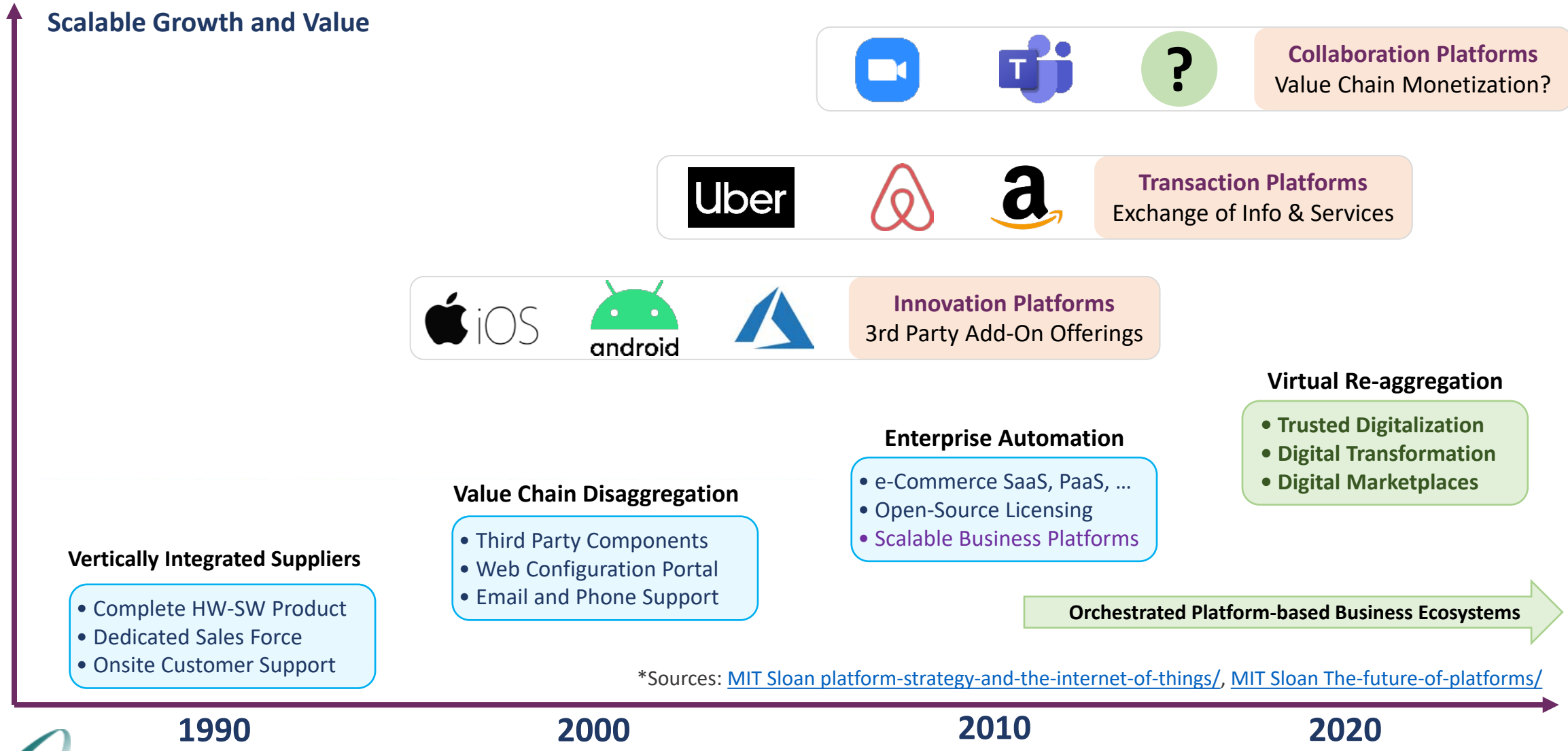
- No security in IIoT Systems & Process Sensors
- Silos and no visibility affects IT/OT convergence
- Nation state attacks start in supply chains
- Compromised equipment and human safety

Electronics supply chain provenance & traceability is key for international security and economic growth

*BOM – Bill of Materials

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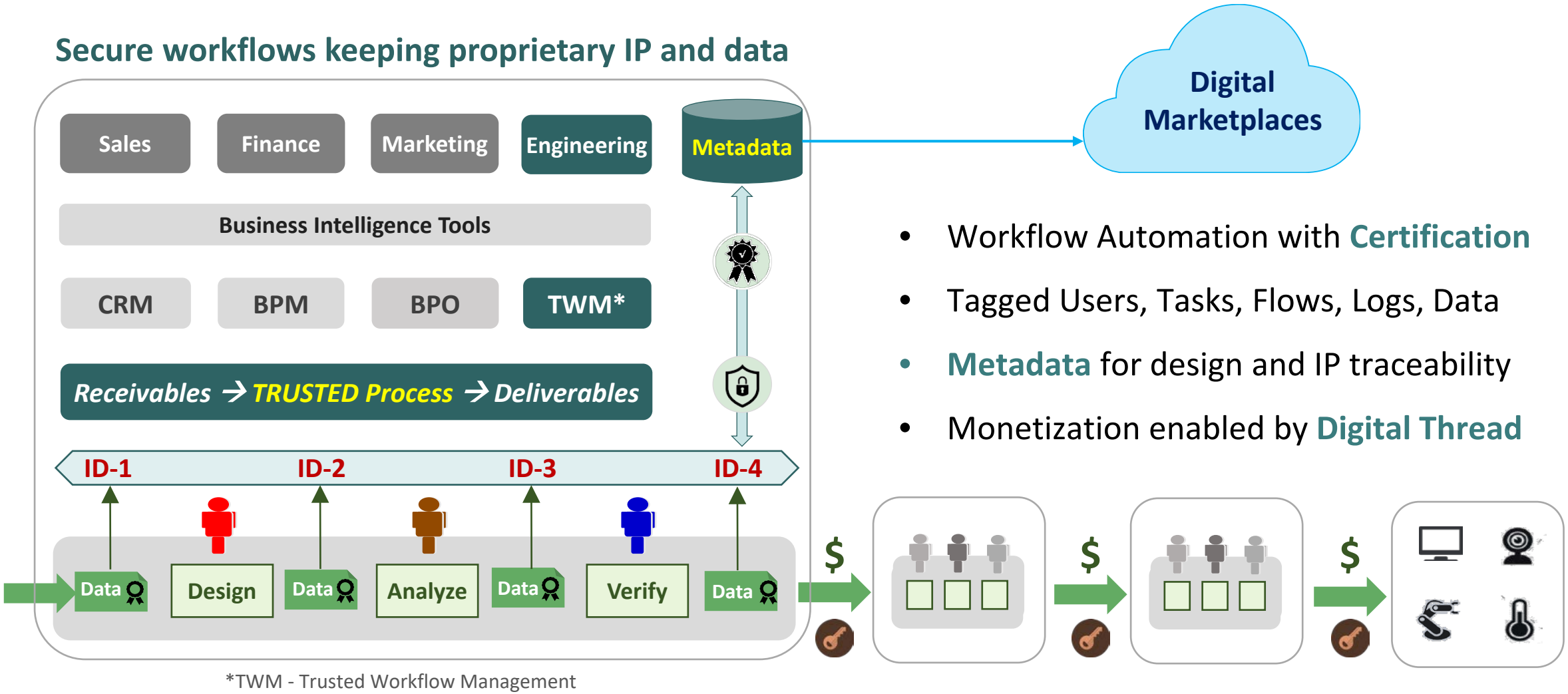
Evolution of Platform Based Business Ecosystems



*Sources: MIT Sloan platform-strategy-and-the-internet-of-things/, MIT Sloan The-future-of-platforms/

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Trusted Digitalization for Supply Chain Traceability



- Workflow Automation with **Certification**
- Tagged Users, Tasks, Flows, Logs, Data
- **Metadata** for design and IP traceability
- Monetization enabled by **Digital Thread**

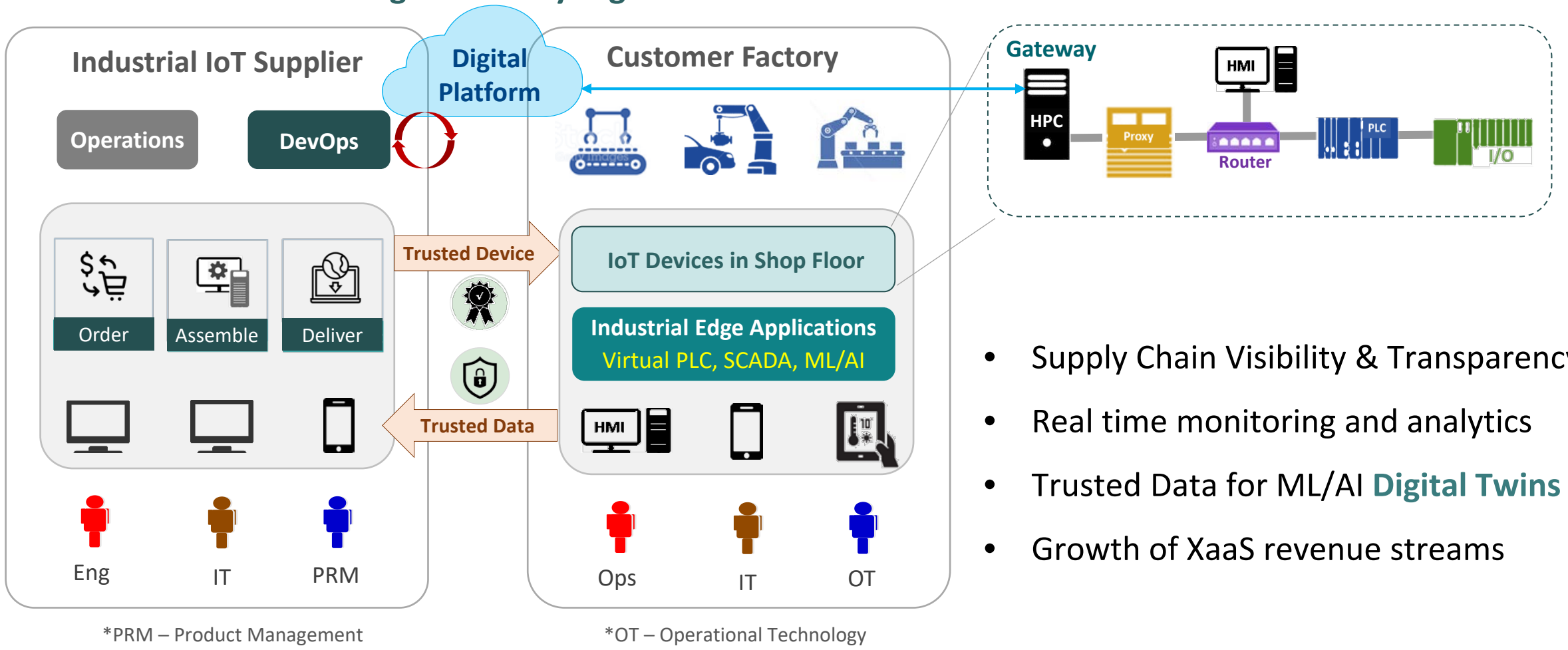
*TWM - Trusted Workflow Management

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Trusted Digital Transformation for IoT Edge Applications

Business Process change driven by Digitalization and IoT



- Supply Chain Visibility & Transparency
- Real time monitoring and analytics
- Trusted Data for ML/AI **Digital Twins**
- Growth of XaaS revenue streams

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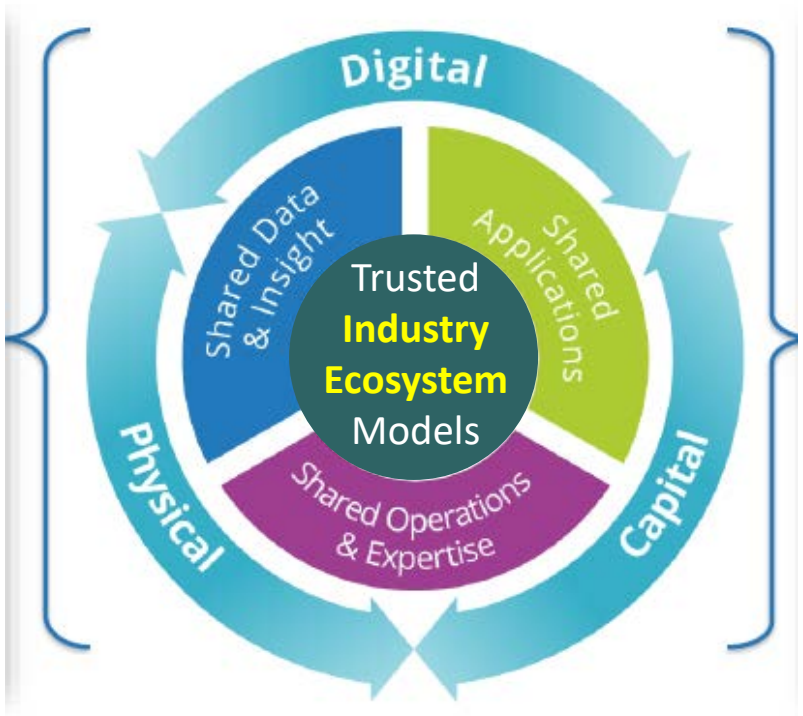
Scaling the Value & Growth With Industry Ecosystems

DX 1.0 The Digital Transformation (DX) Era **DX 2.0** The Digital Business Era **Digital-first**

Testing Digital Use Cases → **Transform Business and ROI** → **Sustainable Digital Business**

Resources & Data

- Business Networks
- Alliances & Consortia
- Gov Organizations
- Trusted Supply Chains
- Cloud Services
- Producers / Consumers
- Digital Marketplaces



*Source: IDC

Methodology & Technology

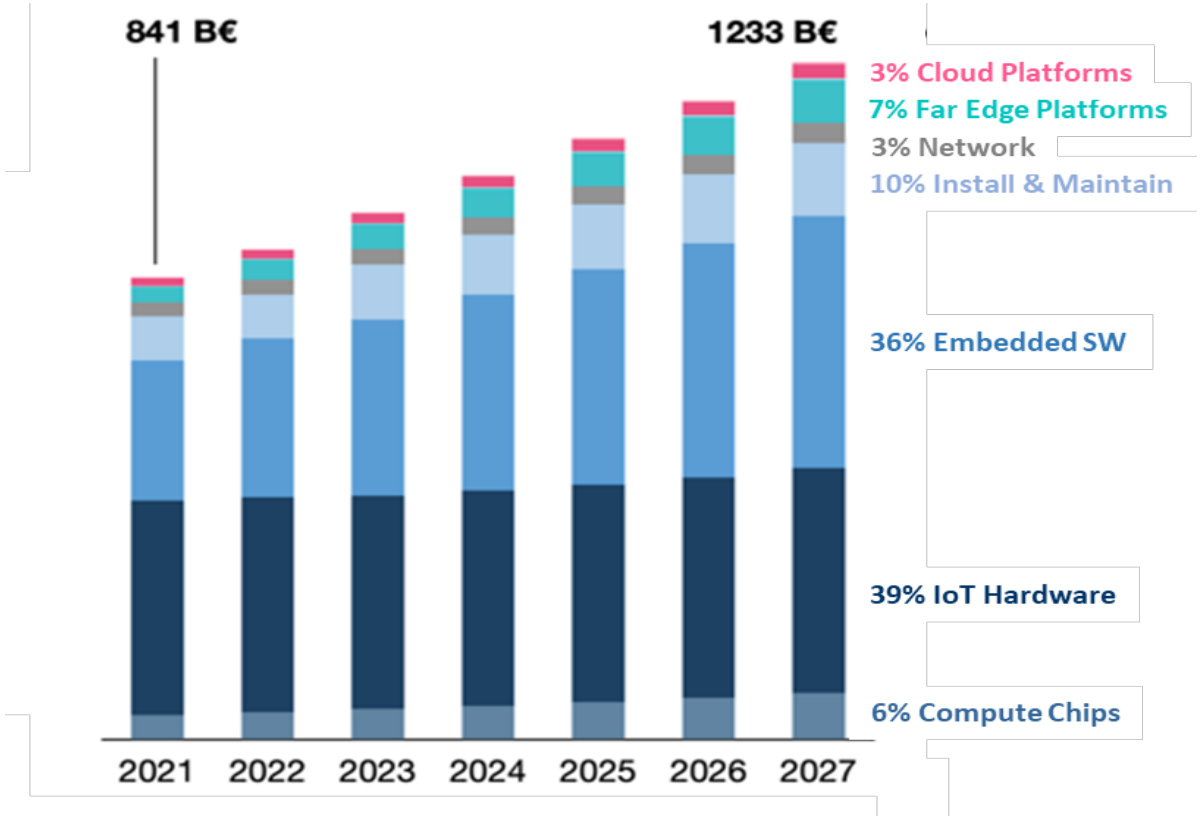
- Value Chain Orchestration
- Team Collaboration
- Enterprise Data Sharing
- Cybersecurity & Trust
- Blockchain, ML, AI
- Simulation Analytics
- Trusted Digital Twins

Orchestrated ecosystem collaboration across the electronics and IoT value chain will drive growth

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Accelerating IoT Growth from CHIPS to IoT Edge Apps

Cloud to Edge Professional IoT Platforms



Source: www.decision.eu/en/report/far-edge/

2030: 125B IoT devices, 570 ZB of data, $1T chip industry

- IoT can grow in ways that are transformative for our environment and future digital economies*
- Adoption & growth is hindered by supply chain disaggregation, geopolitics, silos, security risks…
- A ***Trusted Digital Thread**** from chips to IoT edge is key creating a connected business ecosystem
- Data is the "new oil" requiring infrastructure and standards to pump it out and extract value

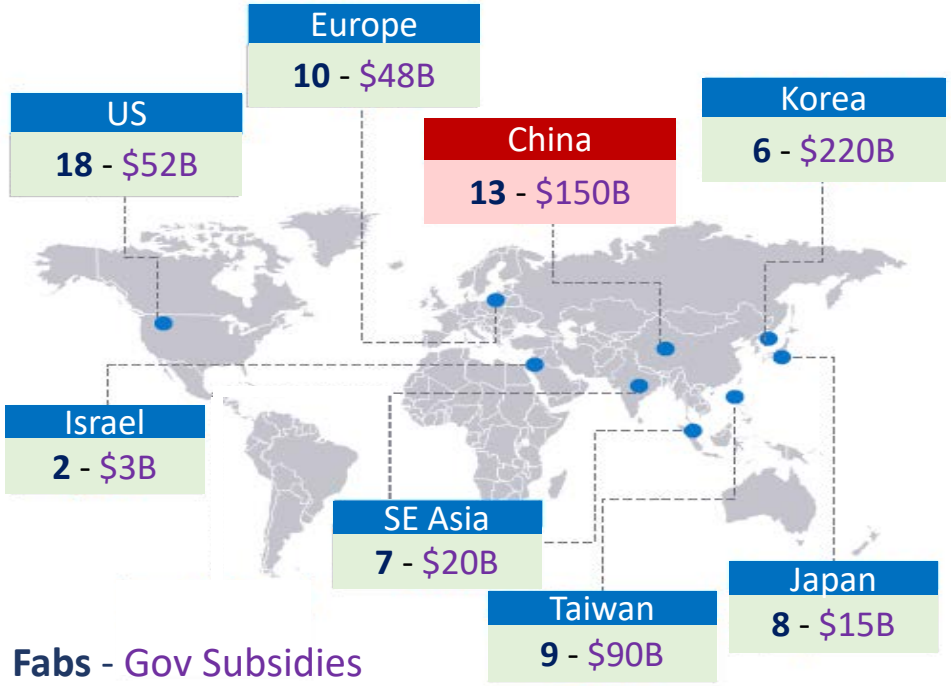
*Digital flow of data connecting business processes, products, and assets in a value chain

Chip manufacturing produces huge volumes of data used to improve quality, reliability, assurance

*Sources: Semiconductor Device Digest, The future of Good Data, A trillion-dollar industry, McKinsey & Co (Security)

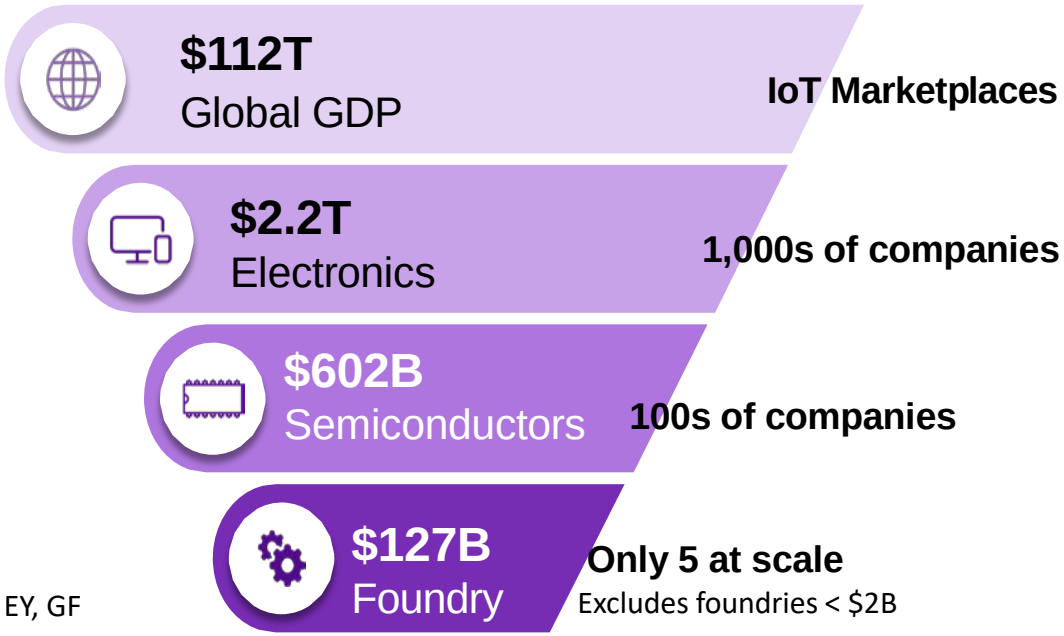
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Supply Chain Provenance Starts From Trusted Chips



Fabs - Gov Subsidies

Market Size (2023)



Sources: SEMI, EY, GF

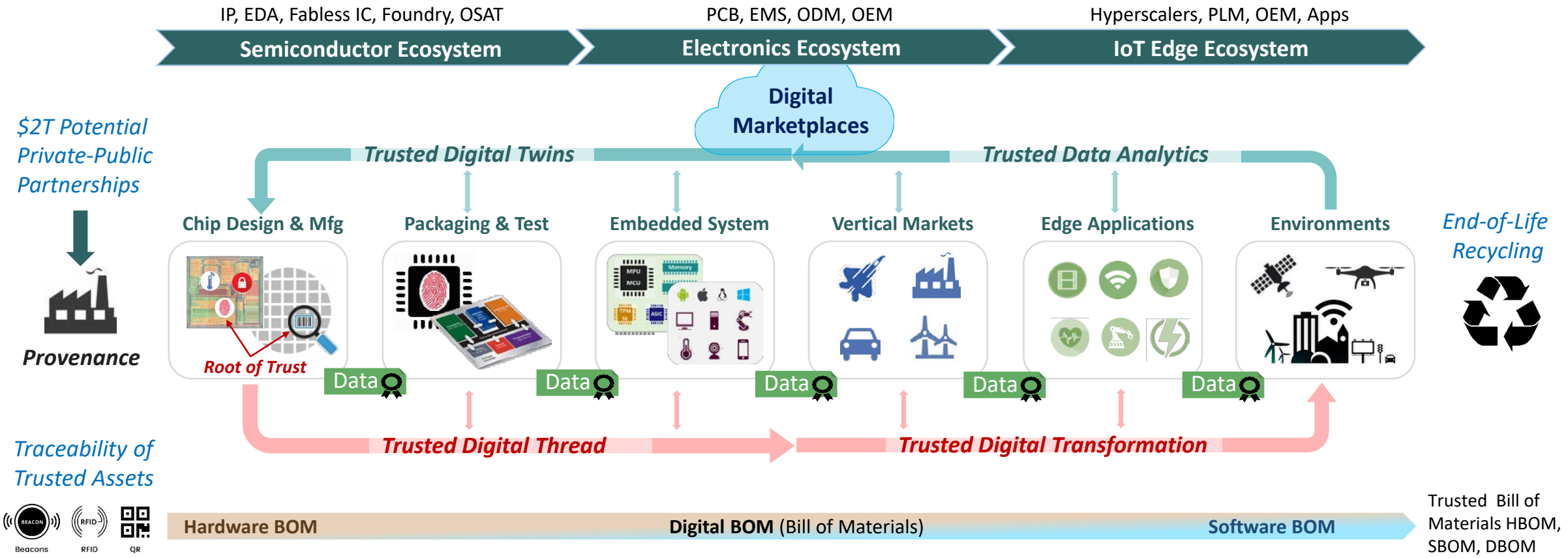
- **~71 new fabs are being built worldwide in 2022-2025 driven by >$600 Billion* in government incentives**
- **Over 80% of the global fab capacity that fuels IoT is controlled by a handful of allied nations (incl. Taiwan)**
- **Investment in traceability infrastructure is small compared to volume of chips produced during fab lifecycle**

Unprecedented geopolitical opportunity to start a digital thread from chip design & manufacturing

* Potential for $2 trillion with private investments

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Digitalization Across the Electronics and IoT Value Chain



- **Establish a trusted digital thread of provenance and traceability starting from chip design & manufacturing**
- **Use IoT technology and ML/AI to track and monitor BOM assets across the electronics and IoT value chain**
- **Incentivize enterprises to digitalize operations* and join digital marketplaces of producers and consumers**

*Receivables, workflows, deliverables

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Examples of Trusted Digital Thread and Data Enabled Apps

Semiconductor Value Chain Apps

Design Chip
- *Trusted IP Compliance*
- *Design for Security*
- *Vulnerability Analysis*

IP and Design Data

Manufacture
- Secure Chip Enrollment
- Config Secure Access
- Create Digital Thread

Metrology & Test Data

Package
- *Authenticate Supply*
- *Configure SKUs + Keys*
- *Install SoC Firmware*

Asset & SKU Data

Distribute
- *Activate Chip Supply*
- *Contract Asset Use*
- *Register Chip Asset*

Config & Keys Data

Test / Certify
- Authenticate Assets
- Cross Reference DBOM
- Add Digital Certificate

Distributor & Parts Data

PRODUCERS provide asset/data info & services

Digital Marketplaces

CONSUMERS provide field use info data & services

What is Your High Value App?

Electronics IoT Value Chain Apps

Assemble System
- Source HBOM + SBOM
- Get Digital Trust Score
- Perform Electrical Test

System & BOM Data

Procure / Provision
- *Provision Device SKUs*
- *Configure Use Scope*
- *Register Asset & Owner*

Config & Apps Data

Onboard /Deploy
- Create Security Policy
- Config License Rights
- Secure Device Onboard

Security & ID Data

Operate (OTA*)
- *Trace & Monitor Use*
- *Update HW or SW*
- *Debug and Fix RMAs*

Field Access-Use Data

Decommission (OTA)
- *De-register Asset (EOL)*
- *Perform Factory Reset*
- *Re-register Asset*

Product Lifecycle Data

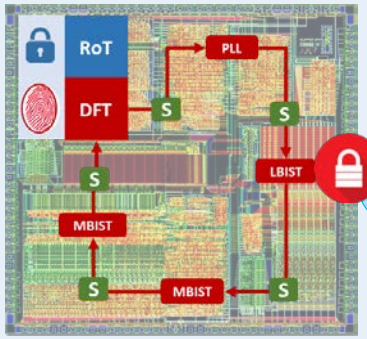
*Over-The-Air

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Examples of Use Cases, Benefits and Value Proposition

Automotive - Silicon Lifecycle Management



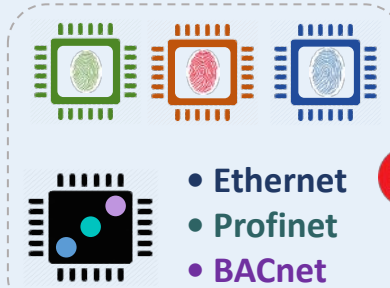
Functional Safety

Fleet Monitoring



*Source: Semiconductor Eng

Industrial - Chip Licensing* Multi Market Products

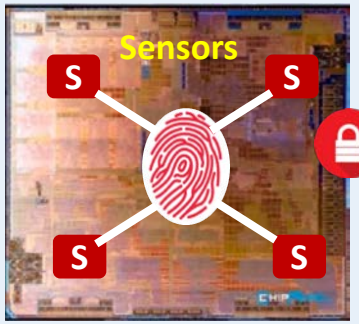


HW + SW Provisioning



*Source: Intel Pay-as-you-go

Aerospace & Defense - Manufacturing Integrity

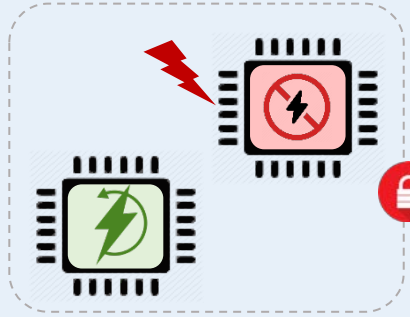


Failure Prevention



*Source: ERI Summit 2020

Supply Chain - Monitoring & Regulating Field Use



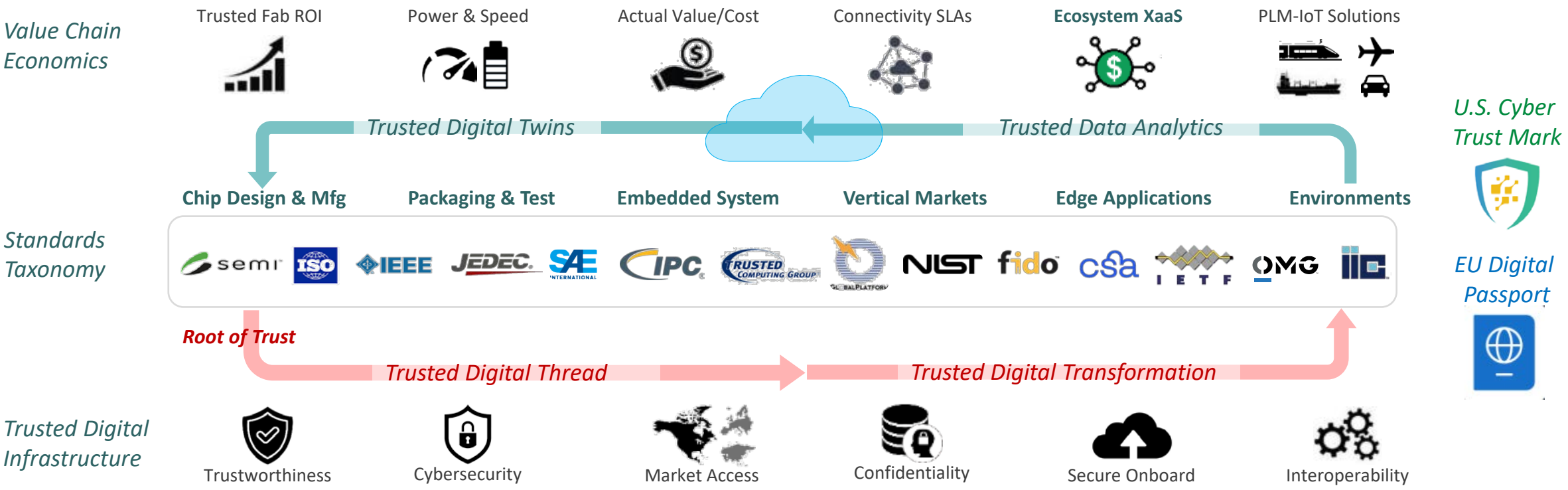
Disable Adversary



*Source: Reuters Technology (Western Chips on Russian Weapons)

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Accelerating Supply Chain Resilience and Economic Value



- **Trusted infrastructure:** Facilitate market preference and regulate market access and use of chips & electronics
- **Standards Taxonomy:** Align SDOs* and national standards strategy for assurance, provenance, and traceability
- **Value Chain Economics:** Support trusted business ecosystems and marketplaces with traceable transactions

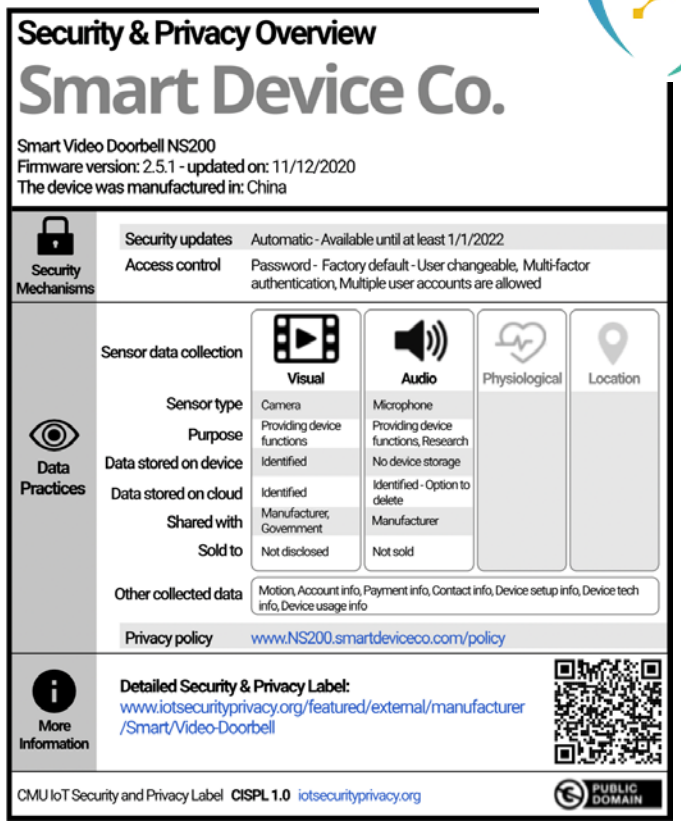
*Standards Development Organizations

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U.S. Cyber Trust Mark and EU Digital Product Passport

IoT Market Awareness

Consumer → Industrial



Security & Privacy Overview

Smart Device Co.

Smart Video Doorbell NS200
Firmware version: 2.5.1 - updated on: 11/12/2020
The device was manufactured in: China

Security Mechanisms

Security updates	Automatic - Available until at least 1/1/2022
Access control	Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed

Data Practices

	Visual	Audio	Physiological	Location
Sensor type	Camera	Microphone		
Purpose	Providing device functions	Providing device functions, Research		
Data stored on device	Identified	No device storage		
Data stored on cloud	Identified	Identified - Option to delete		
Shared with	Manufacturer, Government	Manufacturer		
Sold to	Not disclosed	Not sold		

Other collected data: Motion, Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info

Privacy policy: www.NS200.smartdeviceco.com/policy

More Information

Detailed Security & Privacy Label:
www.iotsecurityprivacy.org/featured/external/manufacturer/Smart/Video-Doorbell

CMU IoT Security and Privacy Label **CISPL 1.0** iotsecurityprivacy.org PUBLIC DOMAIN

*Sources: White House, Carnegie Mellon University

Considerations for Data Policies Across Value Chain

For Supply chain assurance, provenance, and traceability

1	Product Groups	Product by Product	Industry by Industry			
2	Company Size	All Sizes	Large First	Large Only		
3	Application Level	Item	Batch	Product Model		
4	Data Storage	EU Federated	Company	Centralized	Decentralized	
5	Data Carrier **IDs**	**QR Code**	**Barcode**	**RFID**	**NFC**	**Marker**	**Root of Trust**
6	Access Security	Full	Minimum	Differentiated		
7	Requirements	Standardization	Product Spec	Combination		
8	Governance	No Assurance	Limited	Reasonable		

*Sources: The EU Digital Passport WBCSD-BCG, Catena-X Automotive, Gaia-X Platform

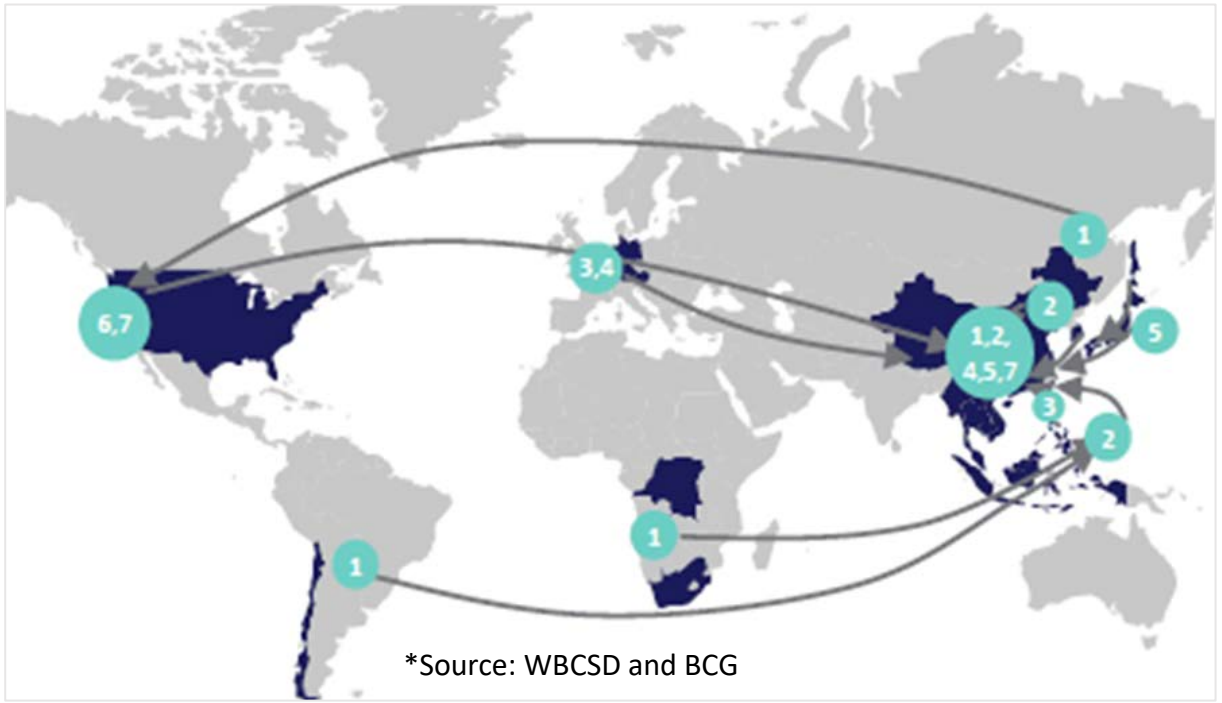
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Expanding Digital Thread Global Impact Beyond Borders

Journey of chips though untrusted environments assembled with other chips into electronics and IoT products

1. **China** Rare Earth Metals
2. **S. Korea** Flash Memory
3. **Germany** Accelerometer
4. **Netherlands** NFC Controller
5. **Japan** Camera, LCD Screen
6. **USA** Wi-Fi & Audio Chips
7. **Taiwan** CPU/GPU Manufacturing
8. **China** Final Assembly & Test



*Source: WBCSD and BCG

Digital Product Passport can have global impact as regulation is applied to imported electronics parts and may inspire cross border collaboration

U.S. Cyber Trust Mark can empower businesses, governments, and users to make informed decisions about IoT device security, privacy, etc.

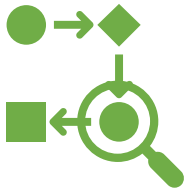
Global interoperability and identifier standards will help unify the approach* to supply chain transparency, traceability and monetization

*U.S. Customs and Border Protection Launches Global Business Identifier Pilot to Increase Supply Chain Visibility

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Draft Recommendations* of the IoT Advisory Board

*Report to FACA and the Congress planned for early 2024



Physical Supply Chain Traceability

- **Promote use of standards** for supply chain logistics, assurance provenance, and traceability
- **Support Root of Trust** based architectures tied to physical IDs for chip asset monitoring
- **Use IoT Technology to trace** chain of custody (with trusted certificates, blockchain, AI)



Trusted Digitalization Solutions

- **Drive digital thread** infrastructure for supply chain risk management and value chain monetization
- **Promote enterprise digitalization** of trusted receivables, workflows, deliverables across value chains
- **Incentivize digital marketplace** enablement of data producers, consumers, and related services.



Policy and Market Behavior

- **Drive demand tied to assurance** of supply on chip production capacity and incentives for market access
- **Facilitate orchestrated PPPs*** to reduce risk of supply disruption and drive XaaS revenue streams
- **Support business ecosystems** and platforms for monetization based on digital threads among value chains

*Private-Public Partnerships

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Proposed Strategy for CHIPS Acts Driven Digitalization

- **The DOC* can leverage the US & EU CHIPS Acts toward global collaboration for supply chain security**
  - Orchestrate business ecosystem* for digitalization and traceability for the electronics value chain
  - Drive multistakeholder initiatives on supply chain provenance starting from chip manufacturing

- **The U.S.-EU TTC* should lead allied nation orchestration and support for collaboration on standards**
  - Support low-cost pilot programs to prove trusted digitalization for driving economic growth
  - Expand collaboration across value chains with international allies and standards organizations

- **Global allies can speed adoption with initiatives like Digital Product Passport and Cyber Trust Mark**
  - Support creation of a “digital paper trail” for chips and IoT electronics assets and their data
  - Fuel economic growth by incentivizing digital marketplaces and XaaS business ecosystems

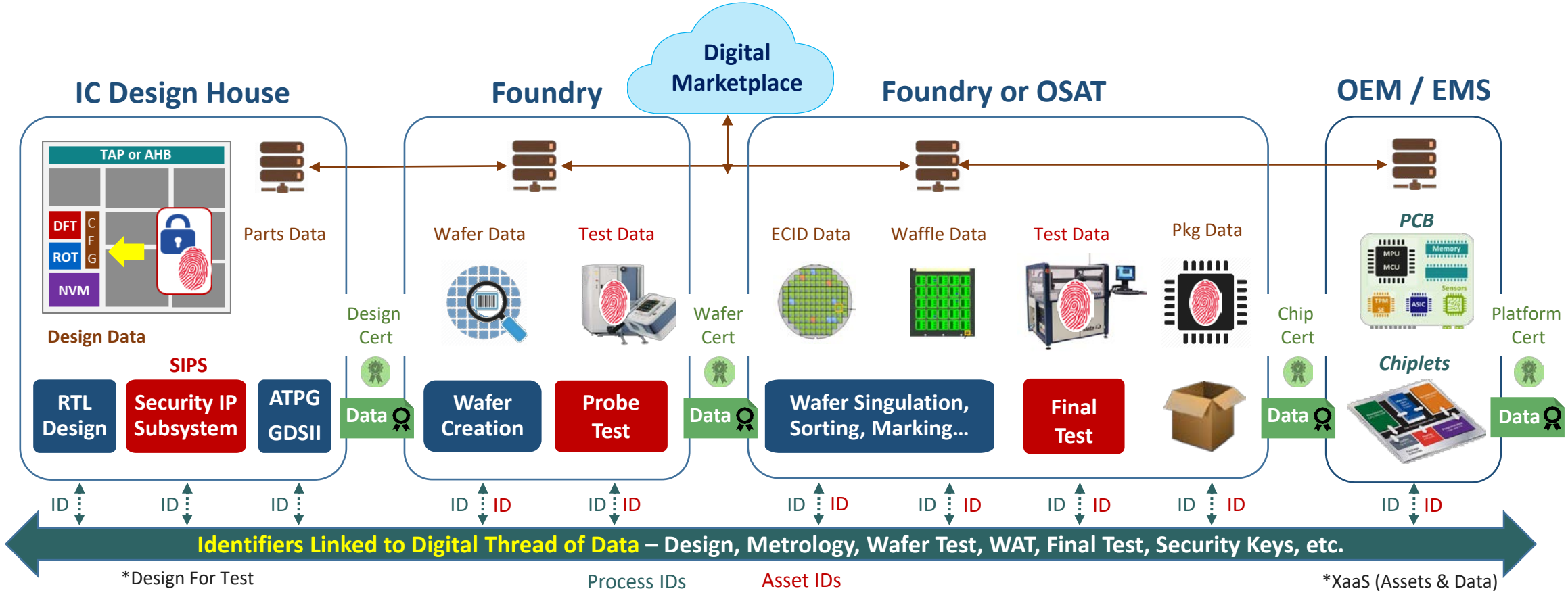
Promote trusted value chains to strengthen national security and drive trillions in economic growth

*U.S Department of Commerce, U.S.-EU Trade and Technology Council

*Proven to be viable with GSA pilot on Trusted IoT Ecosystem Security (TIES)

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Pilot Project on Digital Thread Provenance*



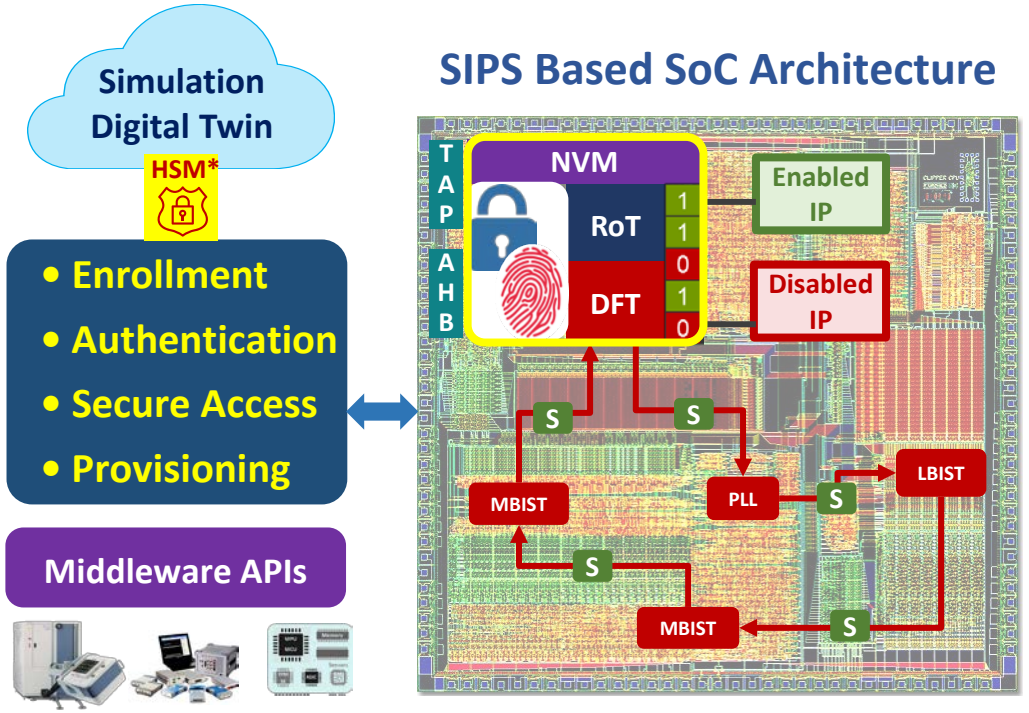
1. Insert SIPS with DFT*
2. Define Parts & SKUs
3. Add IDs to wafer & dies
4. Enroll chips during test
5. Provision SKUs at power-up
6. Link Die, Chip package IDs
7. Establish Trust Score
8. Create Platform ID

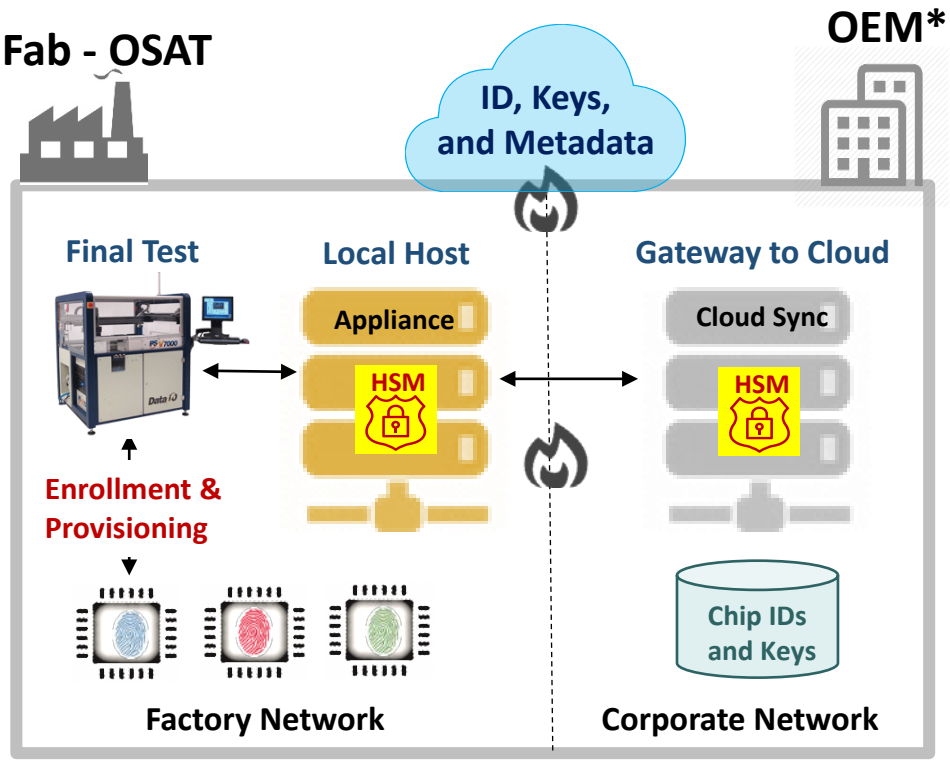
*Solution requires EDA, IP, Fabless IC, Foundry, Cloud Services, ATE, PLM, OEM suppliers

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PPP* Pilot Project Scope Considerations

*Private-Public Partnership





❖ Trusted SoC Design Infrastructure

- Trusted IP, Security IP Subsystem, BIST, ATPG
- Simulations of SKU & Feature Configurations
- VIPs & Middleware APIs for Fab, OSAT, Field…

❖ Trusted Fab/OSAT IT Infrastructure

- Secure Test Data from ATE to Local Host
- Secure Fab to OSAT Test & Provisioning
- Data Marketplace with ODMs & OEMs

*HSM - Hardware Security Module

*OEM- Original Equipment Manufacturer

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Call to Action for Greek Innovation Ecosystem

- **Assess how your company & offerings can be part of connected value chain ecosystem**
  - Track receivables, process, deliverables and data you can monetize with partners
- **Develop platform strategies linked to innovation ecosystem driven CHIPS Acts initiatives**
  - Pursue funded PPP pilots for Trusted Edge Platforms and PCB Assembly in Greece
- **Design IP, chips and systems with fingerprint & security keys tied to a Root of Trust**
  - Consider secure boot/storage and ensure secure data access is tied to chip fingerprint
- **Partner with foundries and OSATs to deliver trusted chip enrollment and provisioning**
  - Design SoC for secure enrollment during test and secure in-field OTA management
- **Collaborate with PLM software partners to develop end-to-end traceability solutions**
  - Combine design and IT expertise to digitalize workflows with DevOps for IoT Edge Apps

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