

# National Cybersecurity Center of Excellence

Manufacturing Supply Chain Traceability – Traceability Chain MVP

IoT Advisory Board

Wed 17 May 2023

# TRACEABILITY FOCUS

- NCCoE project
  - <https://www.nccoe.nist.gov/projects/manufacturing-supply-chain-traceability-using-blockchain-related-technologies>
  - In Soliciting Comments phase
- Applies to any manufacturing supply chain
  - And to any assets flowing within
- Focus of this presentation is on Smart and Critical Infrastructure end uses
  - CISA defines 16 critical infrastructures: <https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/critical-infrastructure-sectors>
- Applicable to many critical manufacturing domains, including:
  - IoT supply chain
  - Chip-to-OT

This project will produce an MVP (Minimum Viable Product) as a starting point

# KEY TRACEABILITY CHALLENGES

- From NIST IR 8419 (Apr 2022)
  - Section 2.5: “Prior NIST documents treat each supply chain tier as having a ‘per acquirer’ perspective which provides risk analysis context and highlights the challenge of establishing pedigree and provenance across multiple tiers. This document builds on that approach with an ecosystem perspective, and it recognizes the importance of certain acquirers who establish foundational traceability requirements for a subset (ecosystem) of the supply chain.”
- Challenge #1
  - Which acquirers have stringent traceability requirements?
  - Who drives the traceability requirements?
- Challenge #2
  - With current per acquirer perspective, how to trace through tiers?
  - How are supply chains ‘illuminated?’

# TRACEABILITY SHIFT IN PERSPECTIVE

NIST SP 800-161r1

CYBERSECURITY SUPPLY CHAIN RISK MANAGEMENT PRACTICES FOR SYSTEMS AND ORGANIZATIONS

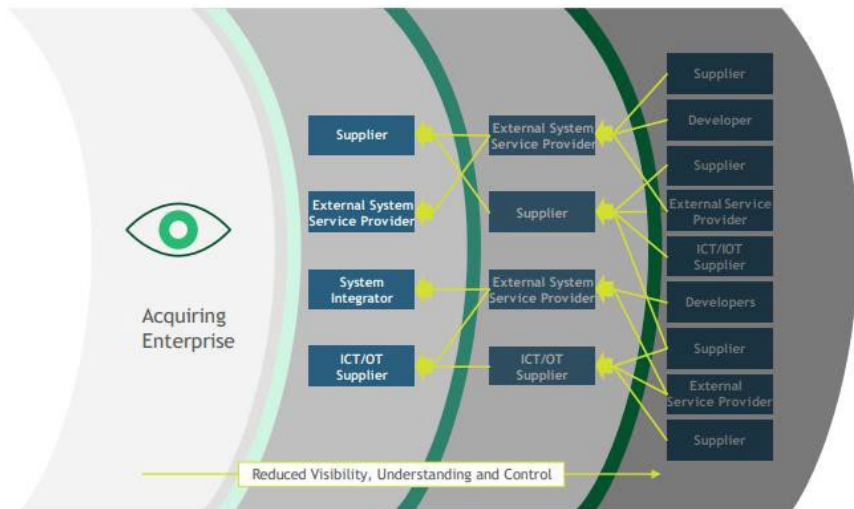


Fig. 1-2: An Enterprise's Visibility, Understanding, and Control of its Supply Chain

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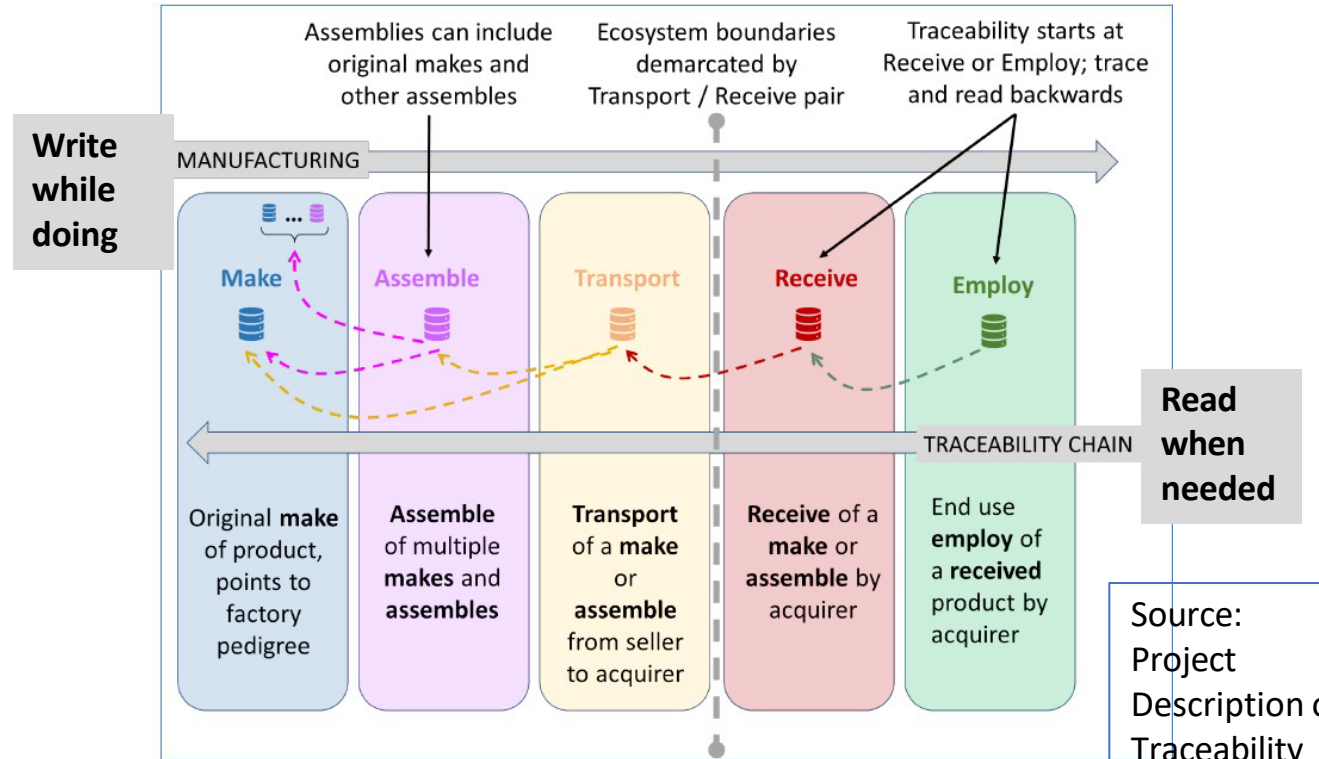


Figure 3: Traceability Records Form a Traceability Chain

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Complement present tracing methods through tiers  
 → with linked traceability records (traceability chain)

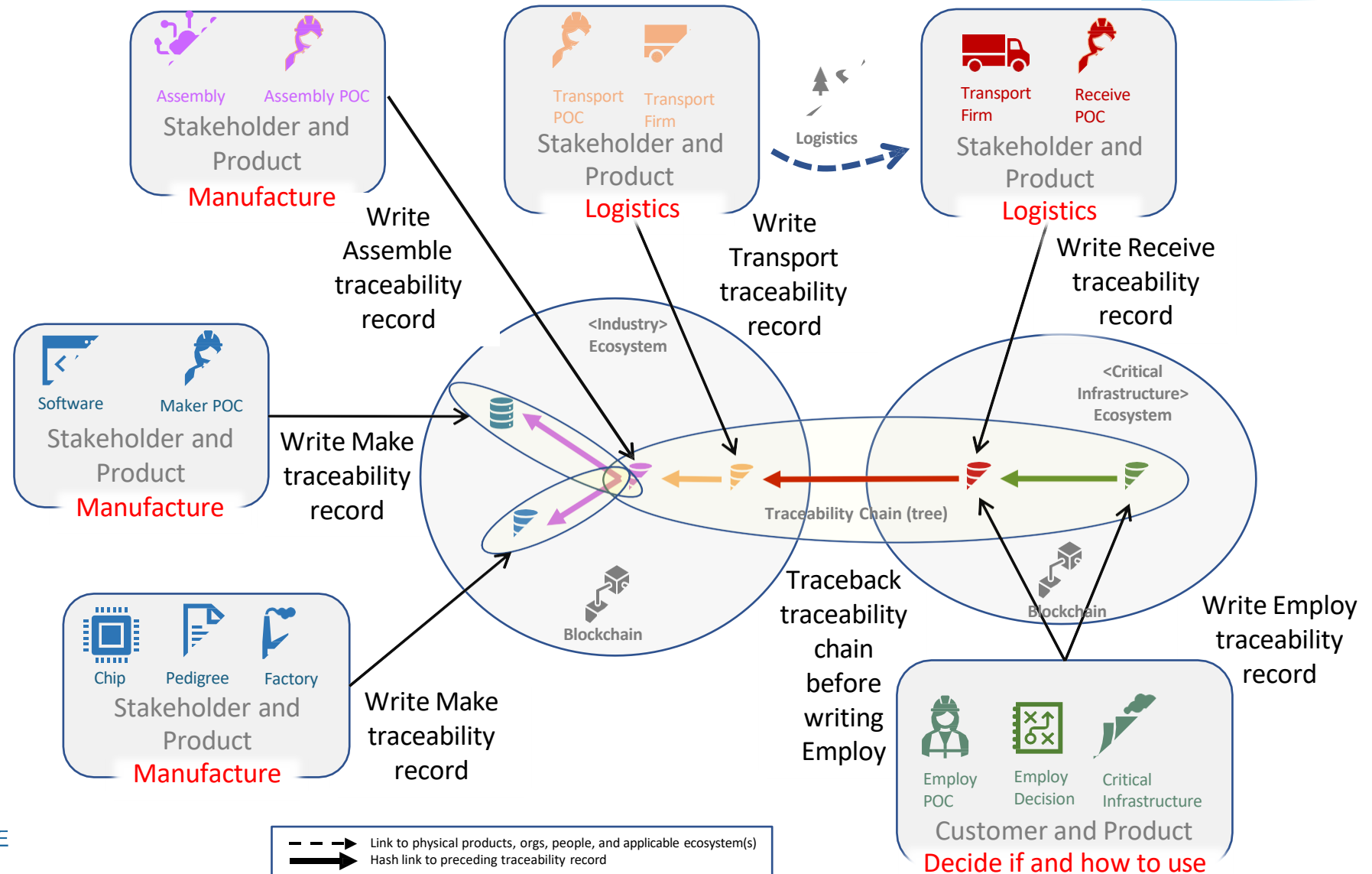
Source: Project Description of Traceability Chain: [Manufacturing Supply Chain Traceability with Blockchain Related Technology \(nist.gov\)](#)

# TRACEABILITY CHAIN

- Traceability Records written as components are made and assembled → linked into a Traceability Chain (tree)
  - Applies to any manufacturing supply chain (e.g., Mediledger [Pharma] in operation)
  - Traceability Record types: Make, Assemble, Transport, Receive, Employ
  - Durable regardless of company lifecycle (merger, acquisition, closure)
- Read Traceability Chain in reverse to validate components
  - The final Traceability Record 'Employ' links the purchased components to where they are installed, and where they are connected to enterprise IT
- Applicability
  - Disaggregated supply chains
  - Adoption can be modular, incrementally implemented where needed
  - Can be used among industry affinity groups even prior to becoming a standard
  - Traceability records can accommodate HBOM, SBOM, DBOM

# TRACEABILITY CHAIN WORKFLOW

- The traceability chain is created one blockchain transaction at a time by the relevant actors.
- The pedigree and provenance data in the traceability record is the same that would typically be exchanged bi-laterally in supplier-customer exchange.





# EXAMPLE CHAIN – MINIMUM DATA FIELDS

- Each Traceability Record is recorded in a blockchain transaction by a user with an ID
- A primary purpose of the Traceability Record is to memorialize supply chain activities and capture IDs of products, users, factories, etc.

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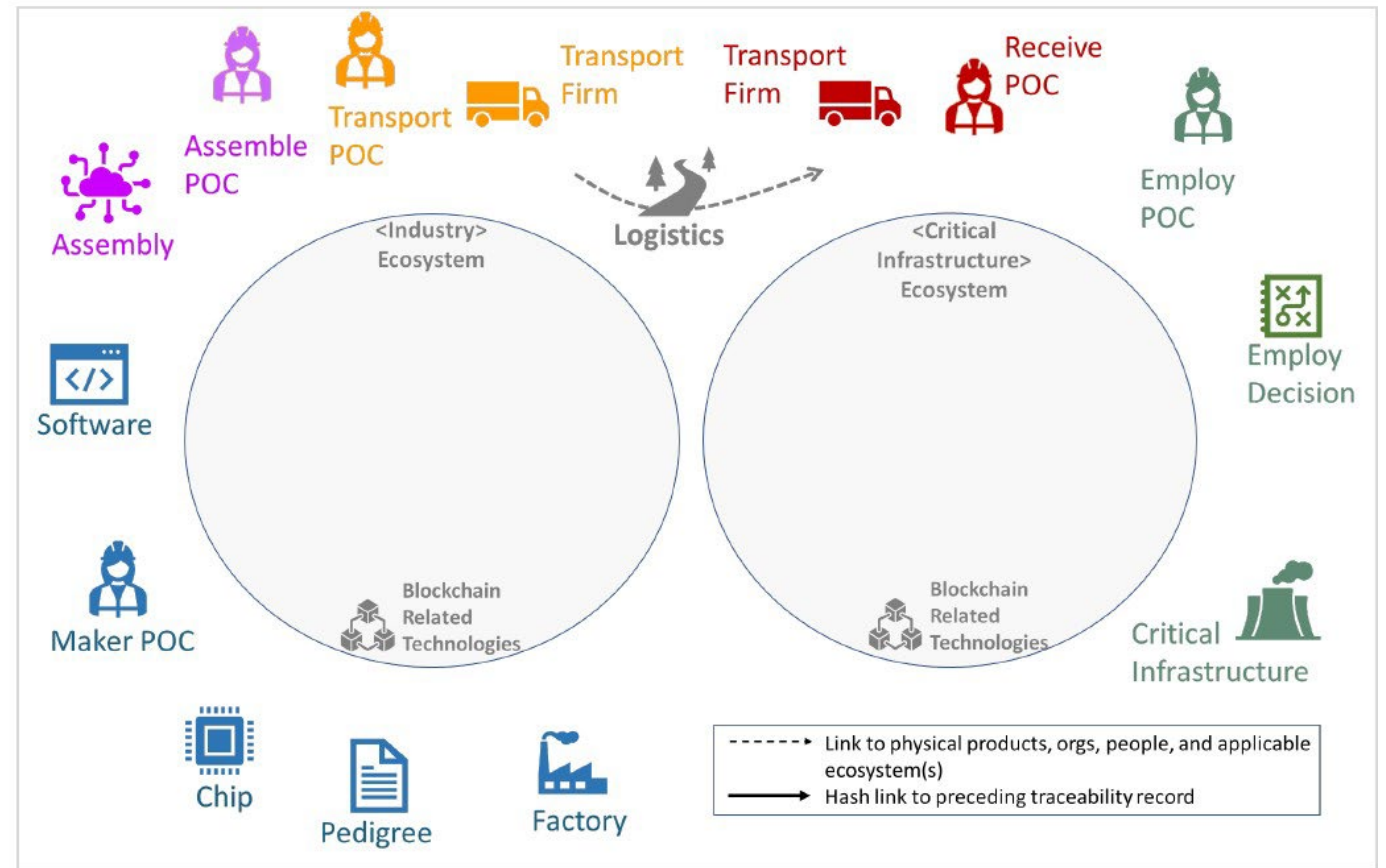


Figure 6: Traceability Chain Lifecycle - Actors

# MAKE

- Ecosystem ID (origination)
- Factory ID (organization)
- Product ID
- Maker POC ID
- Pedigree Statement ID

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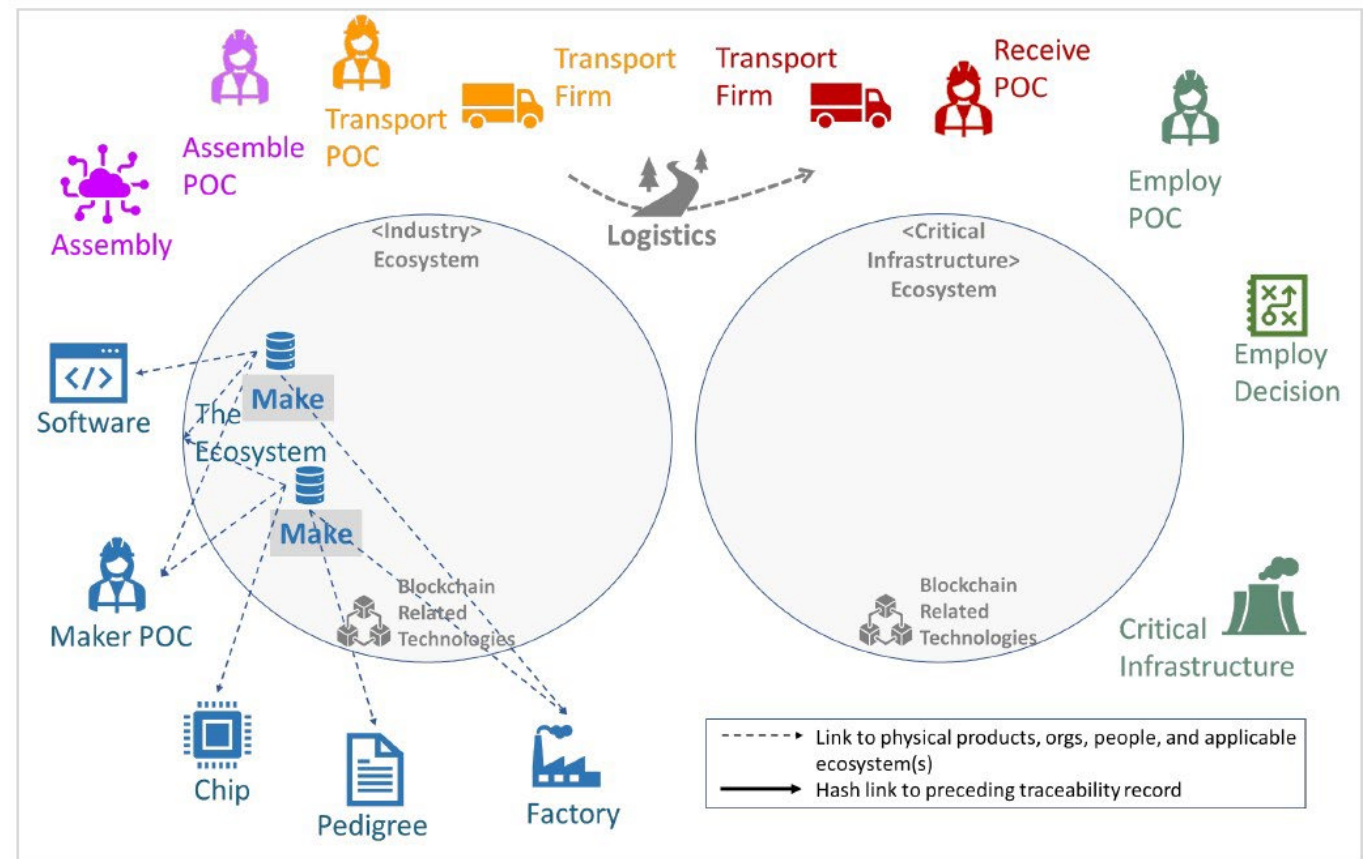


Figure 7: Notional Traceability Chain Lifecycle - Make



# ASSEMBLE

- Ecosystem ID (origination)
- Assembly ID
- Assemble POC ID
- For each product included in the assembly
  - Hash-link to Make traceability record
  - Product ID in Make traceability record

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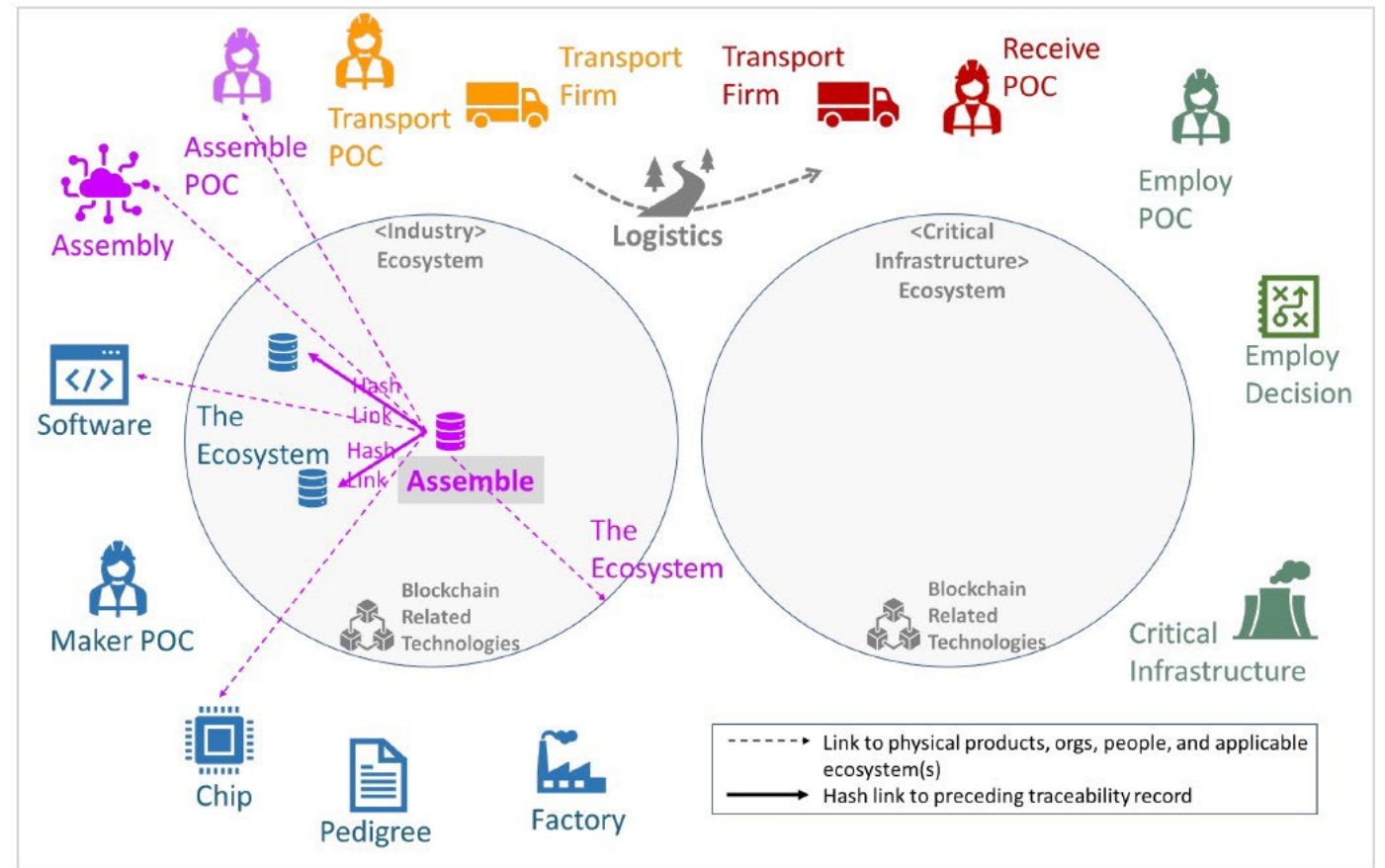


Figure 8: Notional Traceability Chain Lifecycle – Assemble

# TRANSPORT

- Ecosystem ID (origination)
- Factory ID (origination)
- Transport POC ID
- Transport Firm ID
- Ecosystem ID (destination)
- Consuming ID (destination organization)
- Hash-link to Assemble or Make traceability record
- Product ID (assemble or simple make)

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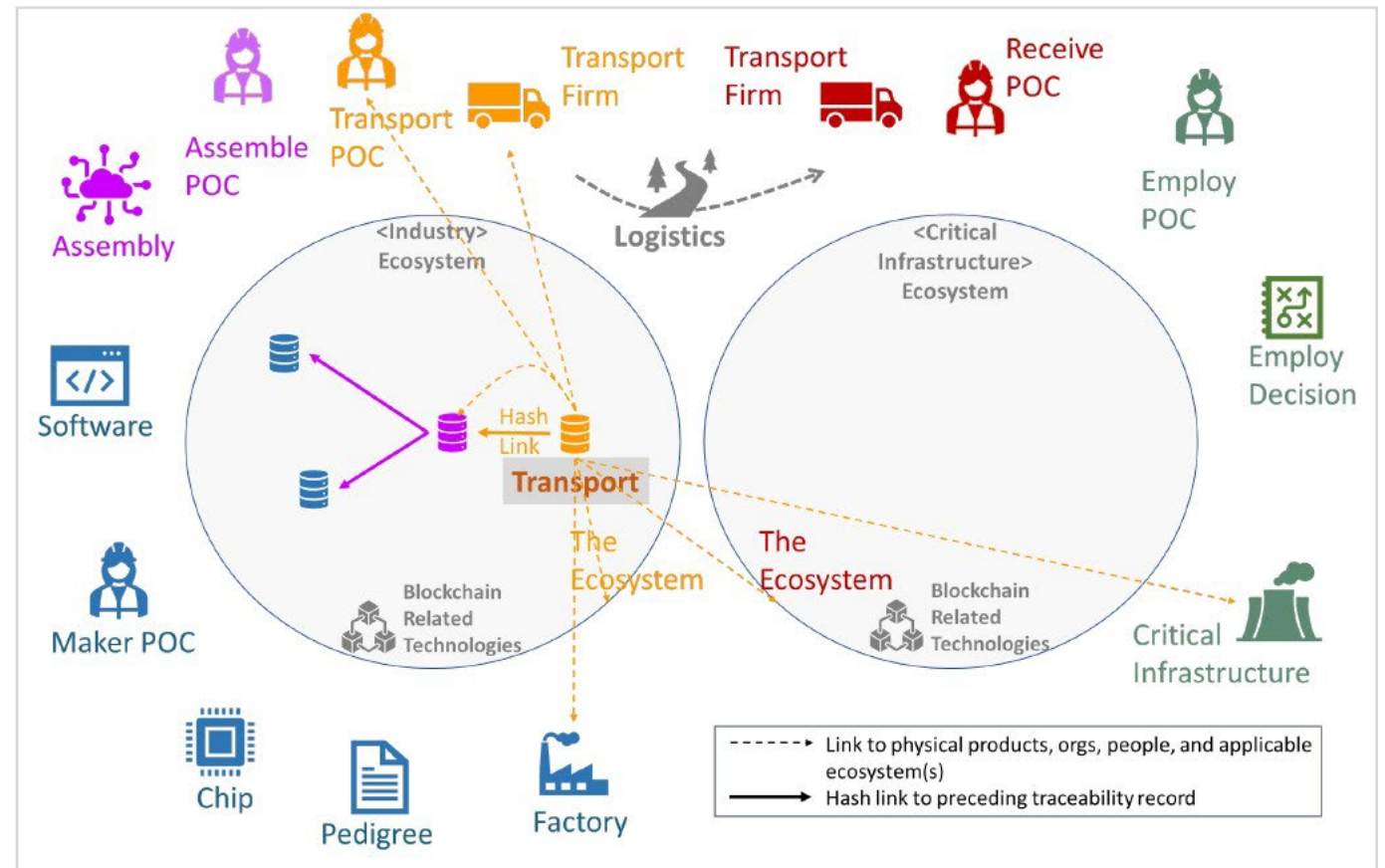


Figure 9: Notional Traceability Chain Lifecycle – Transport

# RECEIVE

- Ecosystem ID (origination)
- Ecosystem ID (destination)
- Transport Firm ID
- Receive POC ID
- Hash link to transport record
- Product ID (assemble or simple make)
- Consuming ID (destination organization)

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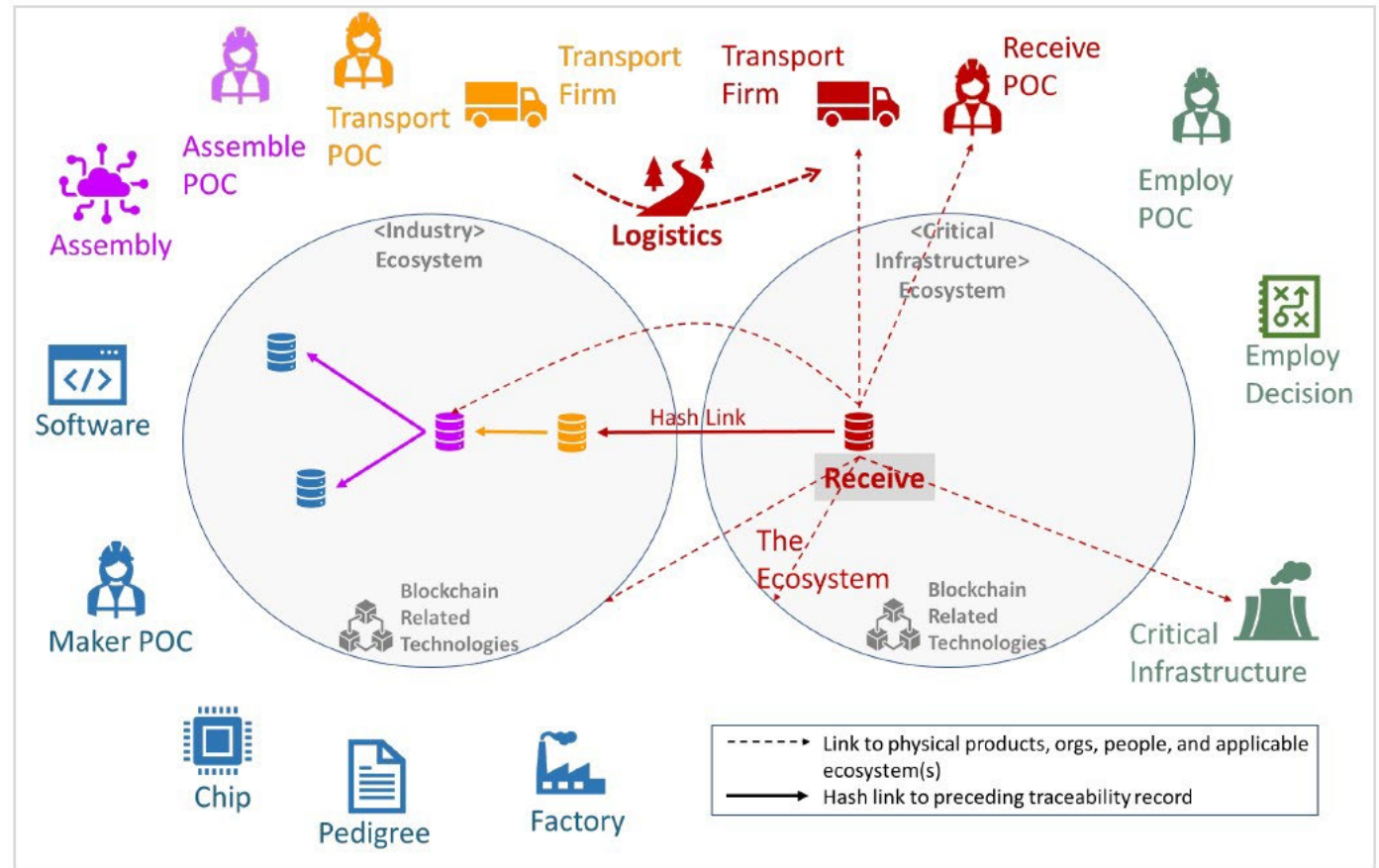


Figure 10: Notional Traceability Chain Lifecycle – Receive

# EMPLOY

- Ecosystem ID (final use in critical infrastructure, or equivalent)
- Critical Infrastructure (or equivalent) ID
- Employ POC ID
- Hash link to receive record
- Product ID (assemble or simple make)
- Link to employ risk assessment and decision

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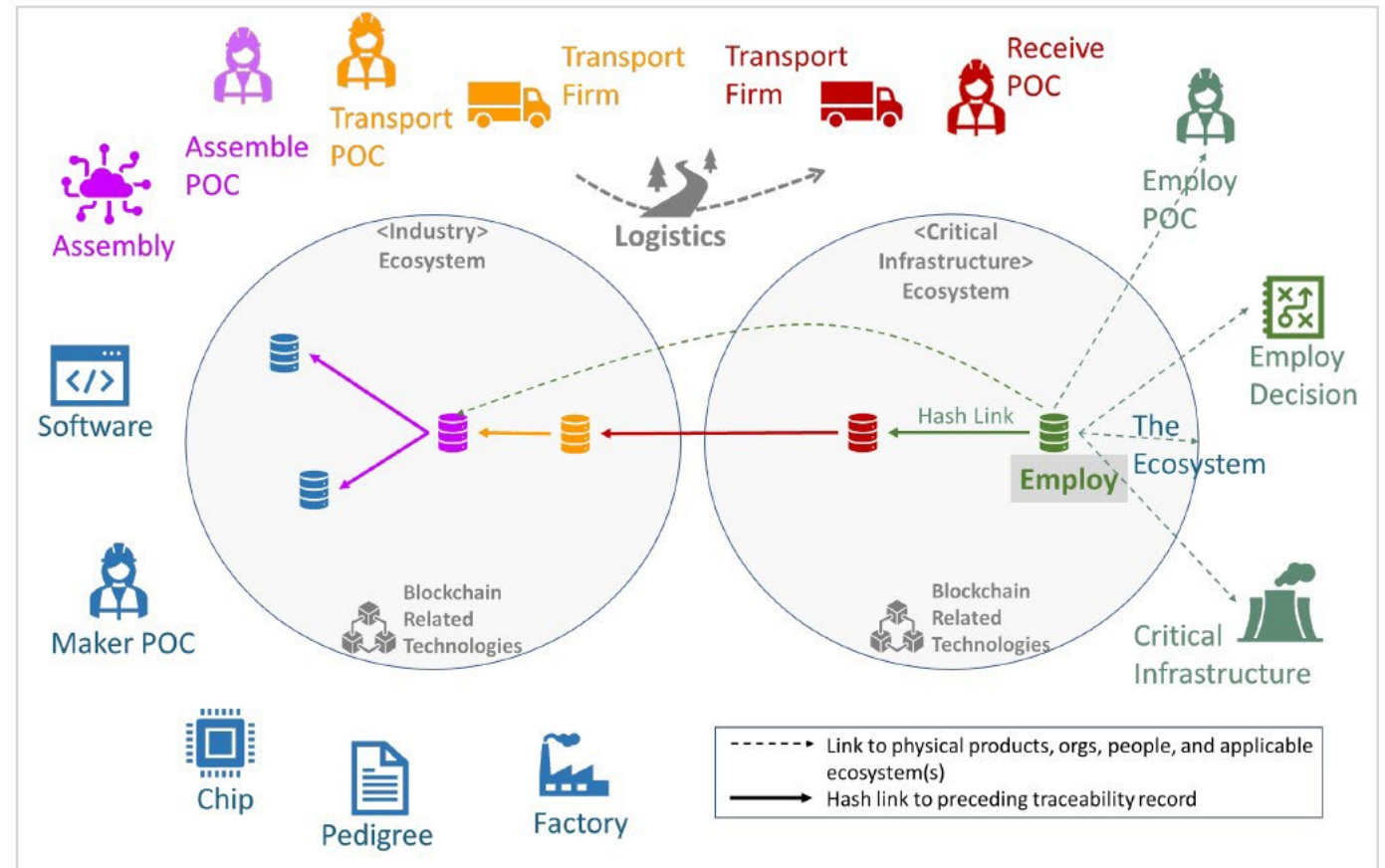


Figure 11: Notional Traceability Lifecycle – Employ



# SUMMARY

- The Make and other Traceability Records can be specialized to the products (e.g, Make-chip, Make-software)
- The Traceability chain can be read to inform an Employ decision
- The Traceability Chain can be read later for forensic purposes
  - Is protected from tampering
  - Survives the lifespan of the supplier company

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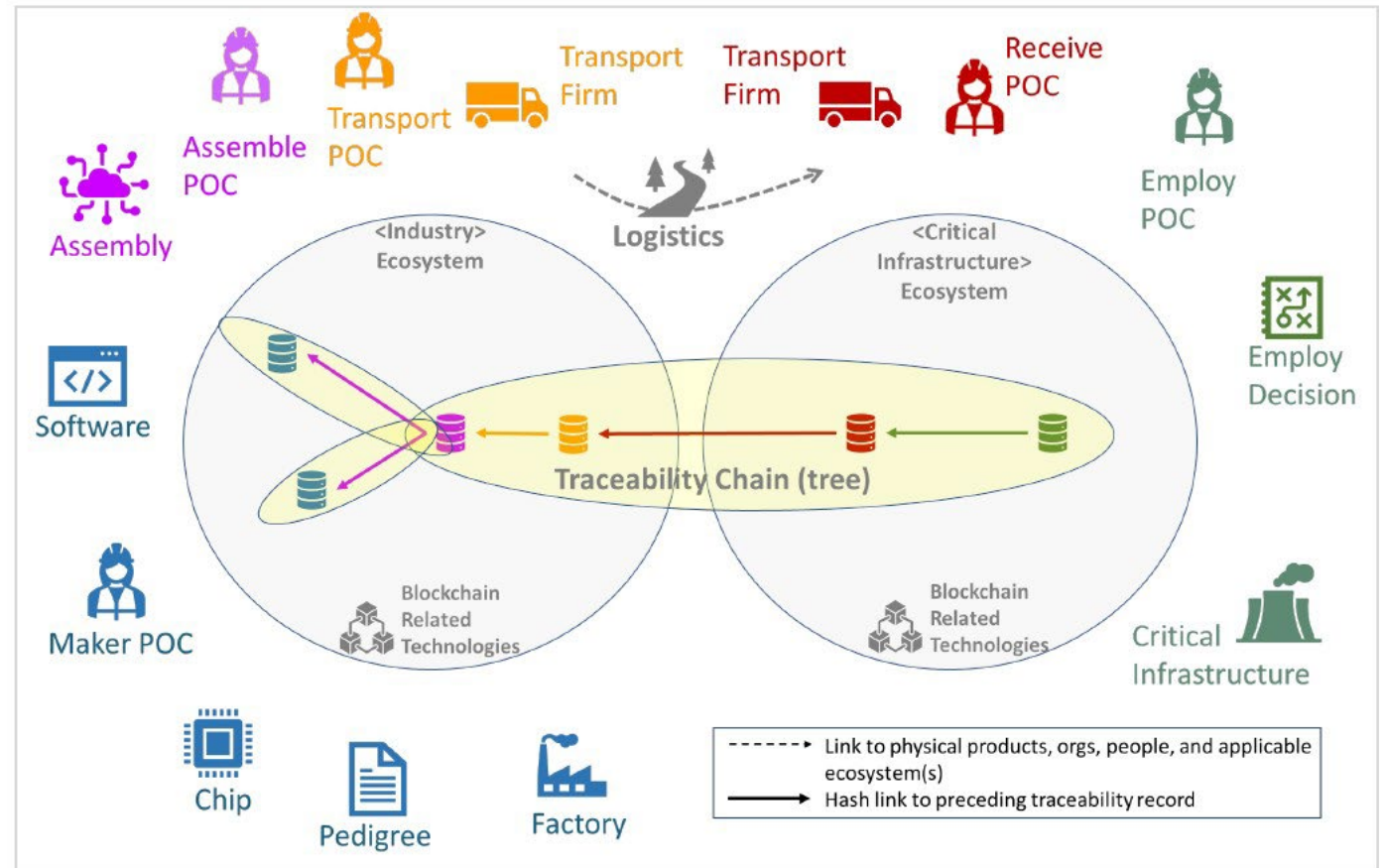
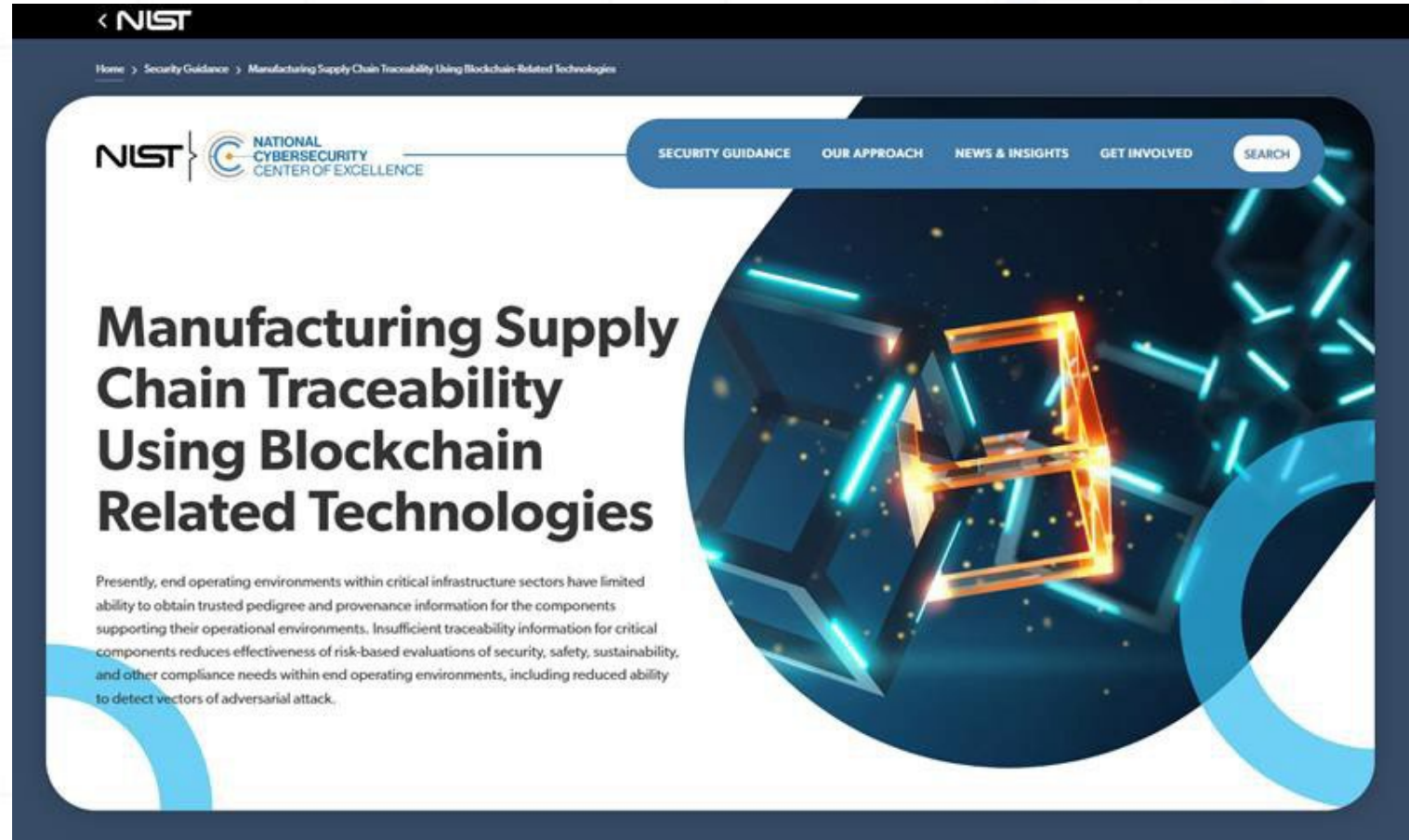


Figure 12: Notional Traceability Chain – Full Chain

# Current Project

Published Draft Project Description April 2023



The screenshot shows a webpage from the National Cybersecurity Center of Excellence (NCCoE). The page title is "Manufacturing Supply Chain Traceability Using Blockchain-Related Technologies". The page includes a navigation menu with links for "SECURITY GUIDANCE", "OUR APPROACH", "NEWS & INSIGHTS", "GET INVOLVED", and a "SEARCH" button. The main content area features a large, stylized graphic of a glowing blue and orange cube on a dark blue background with glowing lines. Below the title, there is a paragraph of text: "Presently, end operating environments within critical infrastructure sectors have limited ability to obtain trusted pedigree and provenance information for the components supporting their operational environments. Insufficient traceability information for critical components reduces effectiveness of risk-based evaluations of security, safety, sustainability, and other compliance needs within end operating environments, including reduced ability to detect vectors of adversarial attack."

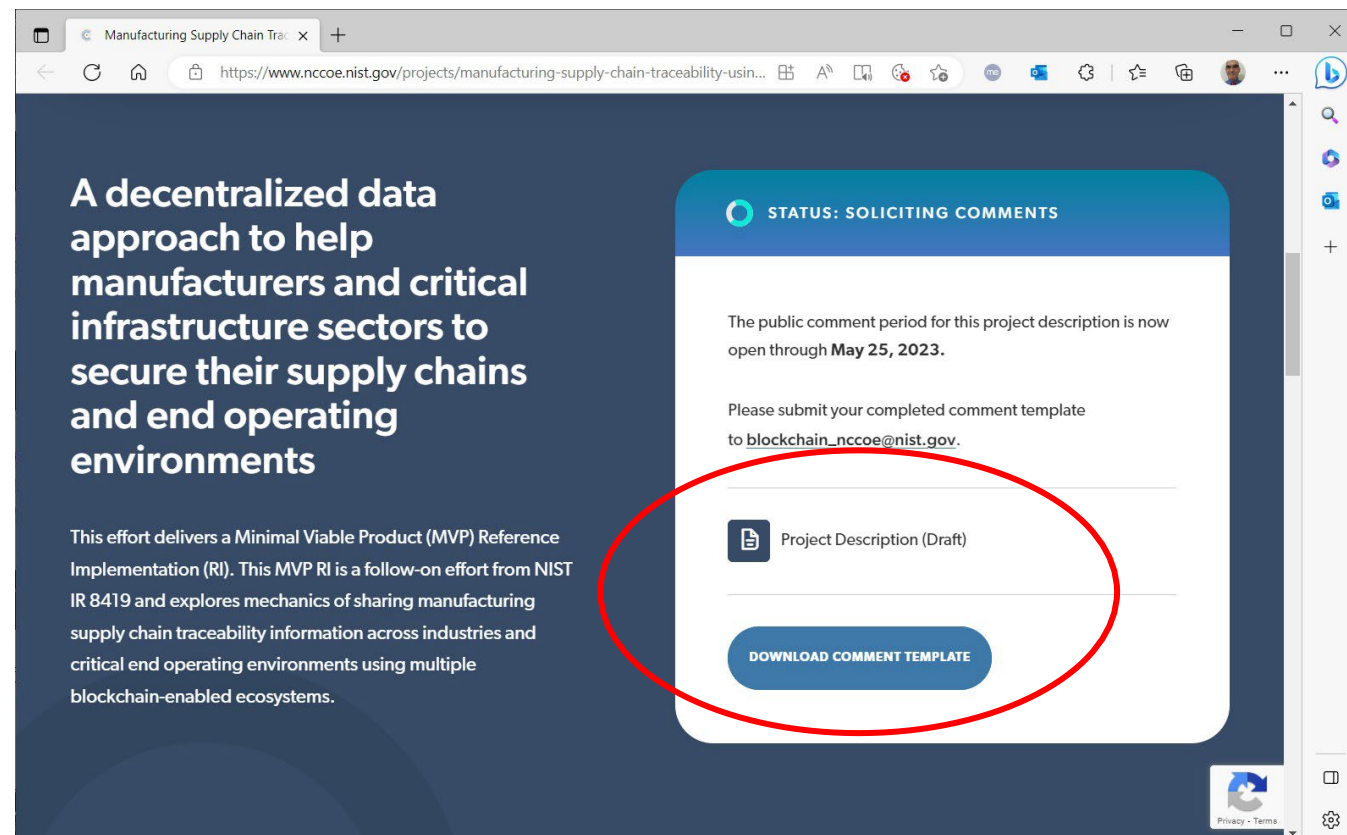
[Manufacturing Supply Chain Traceability Using Blockchain-Related Technologies | NCCoE \(nist.gov\)](https://www.nist.gov/manufacturing-supply-chain-traceability-using-blockchain-related-technologies)



# GOING FORWARD

- The project is in Soliciting Comments phase
- Please provide input, using the comment process
- Please join the community of interest

Scroll down...



The screenshot shows a web browser window with the URL <https://www.nccoe.nist.gov/projects/manufacturing-supply-chain-traceability-usin...>. The page content includes:

- Section Header:** "A decentralized data approach to help manufacturers and critical infrastructure sectors to secure their supply chains and end operating environments"
- Text:** "This effort delivers a Minimal Viable Product (MVP) Reference Implementation (RI). This MVP RI is a follow-on effort from NIST IR 8419 and explores mechanics of sharing manufacturing supply chain traceability information across industries and critical end operating environments using multiple blockchain-enabled ecosystems."
- Status Box:** "STATUS: SOLICITING COMMENTS". The text inside the box states: "The public comment period for this project description is now open through **May 25, 2023**. Please submit your completed comment template to [blockchain\\_nccoe@nist.gov](mailto:blockchain_nccoe@nist.gov)." Below this, there is a document icon labeled "Project Description (Draft)" and a blue button labeled "DOWNLOAD COMMENT TEMPLATE".

A red oval highlights the "Project Description (Draft)" and the "DOWNLOAD COMMENT TEMPLATE" button.



Michael Pease, [michael.pease@nist.gov](mailto:michael.pease@nist.gov)

National Institute of Standards and Technology Smart Connected System Division

Harvey Reed, [hreed@mitre.org](mailto:hreed@mitre.org)

The MITRE Corporation

<https://www.nccoe.nist.gov/projects/manufacturing-supply-chain-traceability-using-blockchain-related-technologies>



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