Sensors, Identifiers, Digital Twins

Tracking Identity on the Supply Chain

PURPLE TORNADO

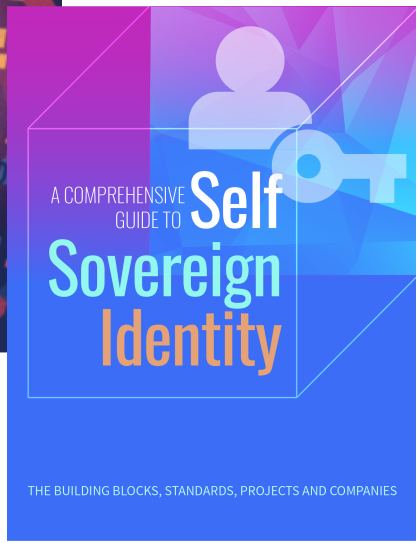
Heather Vescent

CEO, The Purple Tornado

Who am I

Heather Vescent

- CEO/Researcher,
  The Purple Tornado
  Strategic Intelligence Consultancy
- Author, 3 DHS Funded ID Reports
- Author, Cyber Attack Manual
- Author, SSI Report
- M.S. Strategic Foresight, U.H.
- Filmmaker, 14 Films

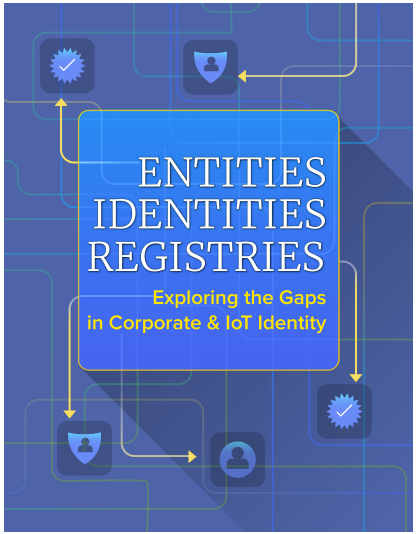


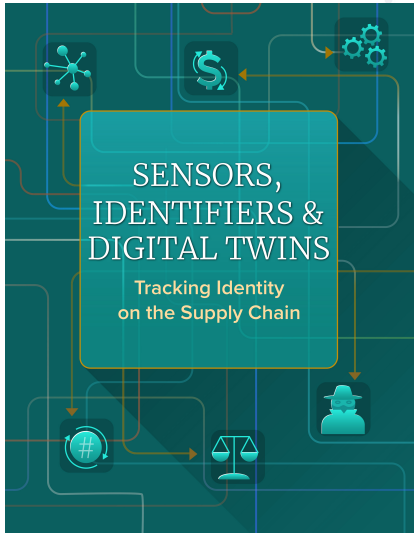
PURPLE TORNADO

Research Background

- Private Sector Digital Identity
- Funded by DHS Science & Technology Cybersecurity Division
- **Gaps: bit.ly/NPEreport**
- **Supply Chain: bit.ly/GSCreport**

Objective: To understand digital identity technology used to track goods on the supply chain, including identifiers, sensors and data associated with a physical object.





PURPLE TORNADO

BILLIONS OF IDENTITIES

PURPLE TORNADO

Billions of Identities

- Humans

PURPLE TORNADO

Billions of Identities

- Humans
- Companies
- IoT objects (smart things)
- Tracking (dumb things)
- Robots
- Data
- Information

PURPLE TORNADO

128+ Billion Identities by 2030?

7.7 Billion Humans
34-48% online
2 Gov + 5 Online ID
18-26+ billion identities
(FB: 2.38B, G:2+B users)

25-75 billion IoT devices
(by 2021)

180 Million Companies
2 Gov + 3 Business IDs
900 million identities

35 million packages
daily shipped/tracked
(UPS & FedEx)
9 billion yearly

PURPLE TORNADO

What is a Non-Person Entity Identity?

Company
(legal entity)

PURPLE TORNADO

What is a Non-Person Entity Identity?

Company
(legal entity)

Thing
(IoT device)

PURPLE TORNADO

What is a Non-Person Entity Identity?

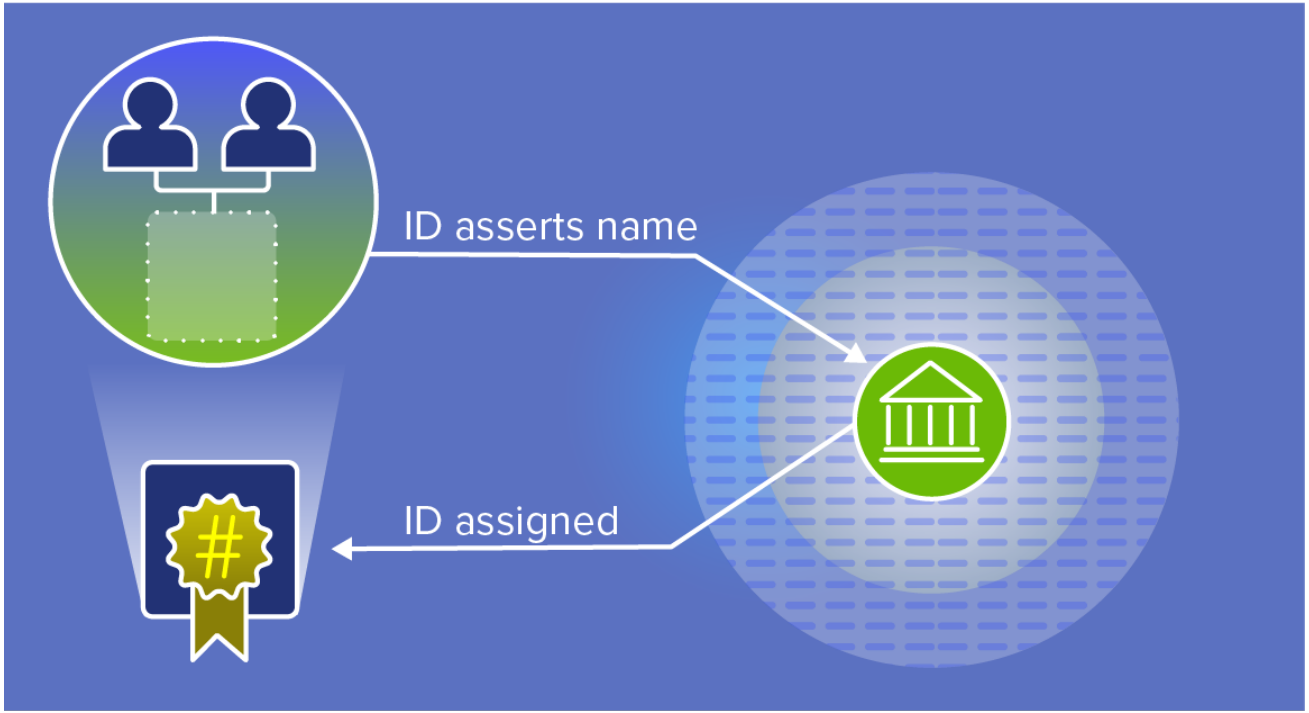
Company
(legal entity)

Thing
(IoT device)

System
(network)

PURPLE TORNADO

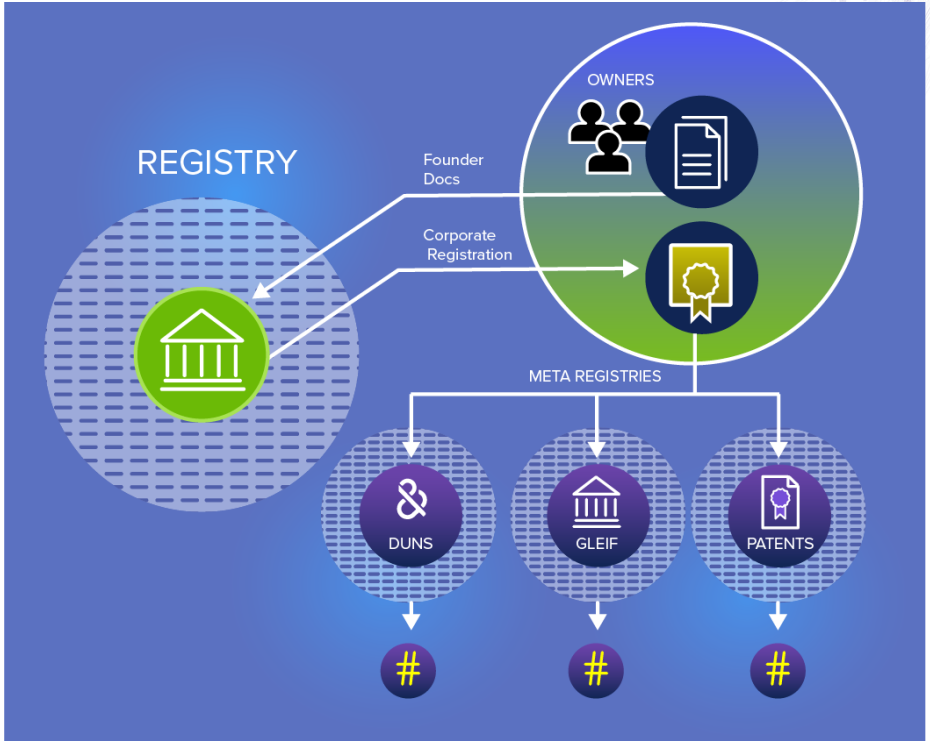
NPEs are given identity (Registries)



PURPLE TORNADO

Web of Organizational Trust

- Identity is used to create more identifiers



PURPLE TORNADO

NPE is complex

NPE Identities

- **Relate** to each other
- **Interact** with each other
- **Depend** on each other

PURPLE TORNADO

Why important to Government/DHS?

- Governments give legal entities identity
- Legal identity is important in many industries
  - Banking & Finance (KYC, AML, UBO, Beneficiary)
  - Global Trade
    - Customs
  - Internet of Things is growing exponentially
    - Security of sensors
    - Authenticity of sensor collected data
- Who is responsible/liable when things go wrong?

Gap: NPE Responsibility

- **PROBLEM:** A company (which is an NPE) owns robots (which are NPEs) that work in a factory. A company (an NPE) manufactures an autonomous vehicle (an NPE). A company (an NPE) manufactures a pacemaker (an NPE) and also collects data about the pacemaker's system as well as data about the human system whose the device is embedded in.

- **IMPACT:** This could become an issue in the future, for example the case of liability of self-driving car, or a factory robot, that isn't directly mapped to an individual supervisor or "driver" but under corporate or algorithmic control.

Responsibility falls on the human

- Who owns it?
- Who is liable when something goes wrong?

- Humans take actions for NPEs (wire transfer)
- NPEs take action for humans (Nest)

- Data collection (Smart home)
- Data sharing (Ring)

PURPLE TORNADO

MARKET GAPS

PURPLE TORNADO

11 Market Gaps

Corporate NPE Gaps	IOT NPE Gaps
1. Legal Identity of Corporations	1. Legal Identity of IoT Things
2. Conclusive Ultimate Beneficial Owner	2. Tracking and Auditing in the Supply Chain
3. Conclusive Verified Corporate Data	3. IoT Security Standards
4. Corporate Delegation	4. IT Self-Authentication
5. Real-Time Verified Identity	5. Data Integrity from IoT Sensors
6. NPE Responsibility	

PURPLE TORNADO

Five IoT Market Gaps

	IoT NPE Gaps	Opportunity
1	Legal Identity of IoT Things	Consistent, standard identifiers
2	Tracking and Auditing Goods in the Supply Chain	Better data collection & sharing
3	IoT Security Standards	Increase hardware security
4	IT Self-Authentication	Trust the device
5	Data Integrity from IoT Sensors	Trust the data from the device

PURPLE TORNADO

1: Legal Identity of IoT Things

Identity is built into very few IoT devices. There are no universal standards or regulations around which IoT objects have an identity assigned at “birth,” unlike a baby registry or corporate registry.

- Some companies give IoT devices an identity – but legal identity is not required.
- Some companies keep registries for devices like pacemakers or jet engines.

GAP: Legal IoT Identity

PURPLE TORNADO

2: Tracking & Auditing on the Supply Chain

- **PROBLEM:** Many goods are tracked and audited as they flow from manufacturer through the supply chain to the destination. While many goods are tracked with a barcode or serial number, there is the desire to more thoroughly track goods in the supply chain, including their components, sources of raw material, and the chain of custody.

- **IMPACT:** Lost income due to IP theft. Lost tax revenue. Potential terrorist financing.

3: IoT Security Standards

- **PROBLEM:** Smart homes, surveillance devices, connected appliances, and vehicles have persistent and structural vulnerabilities that makes them difficult to secure for many real-world situations. Many tools are designed with weak security and are vulnerable to “IoT takeovers.”

- **IMPACT:** The liability ramifications are largely a matter of speculation, however we can get an idea of some economic impacts by the size of the ransomware market estimated at $1b in 2016 and $2b in 2017.

> ***“Securing IoT devices is a major challenge, and manufacturers tend to focus on functionality, compatibility requirements, and time-to-market rather than security.”***
> —Interagency Report on Status of International Cybersecurity Standardization

PURPLE TORNADO

3. IoT Security Standards

> “One of the major reasons the Internet+ is so insecure today is the absence of government oversight. Government is by far the most common way we improve our collective security, and it is almost certainly the most efficient.”
>
> -Bruce Schneier, Click Here to Kill Everyone

PURPLE TORNADO

4: IoT Self-Authentication

- **PROBLEM**: The technical process of authenticating the veracity of the IoT device and any data collected by the IoT device.
- **IMPACT**: Limits utility to high-exposure IoT applications, due to economic cost. Attack surfaces remain due to high cost to implement broadly.

PURPLE TORNADO

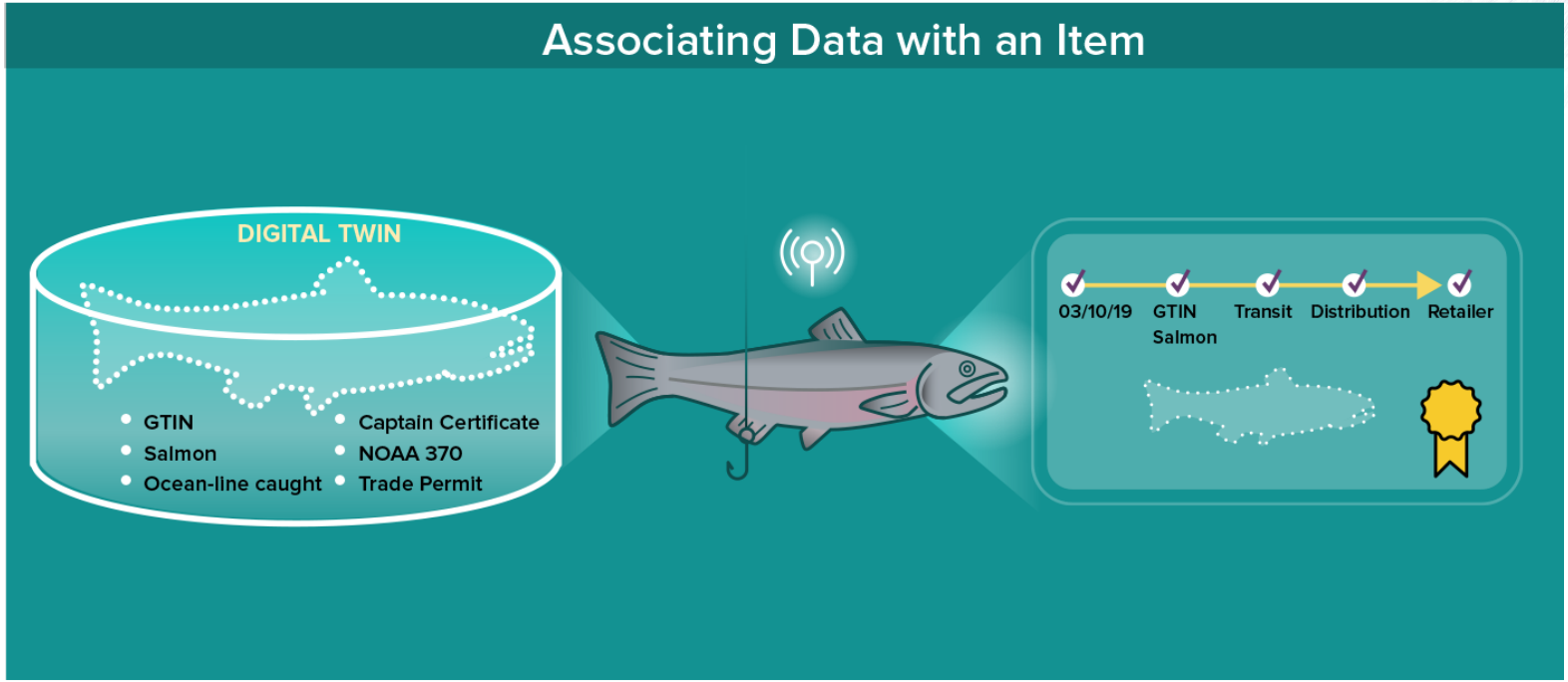
5: Data Integrity from IoT Sensors

- **PROBLEM:** How do I know the data coming off the sensor data is accurate? There needs to be mechanisms to know data coming off sensors, drones, and other IoT data-generating devices is reliable for high-security applications.
- **IMPACT**: Contamination or distortion of data from smart city sensors, lightweight devices that control utility grids or operations, and other cyber-physical systems could do serious real-world damage if an attack occurred and it took significant time to detect due to failed monitoring sensors.

NPE AND THE SUPPLY CHAIN

PURPLE TORNADO

Digital Twins & Asset Passports



Current Trends

- Digitization
- Standards
- Regulations

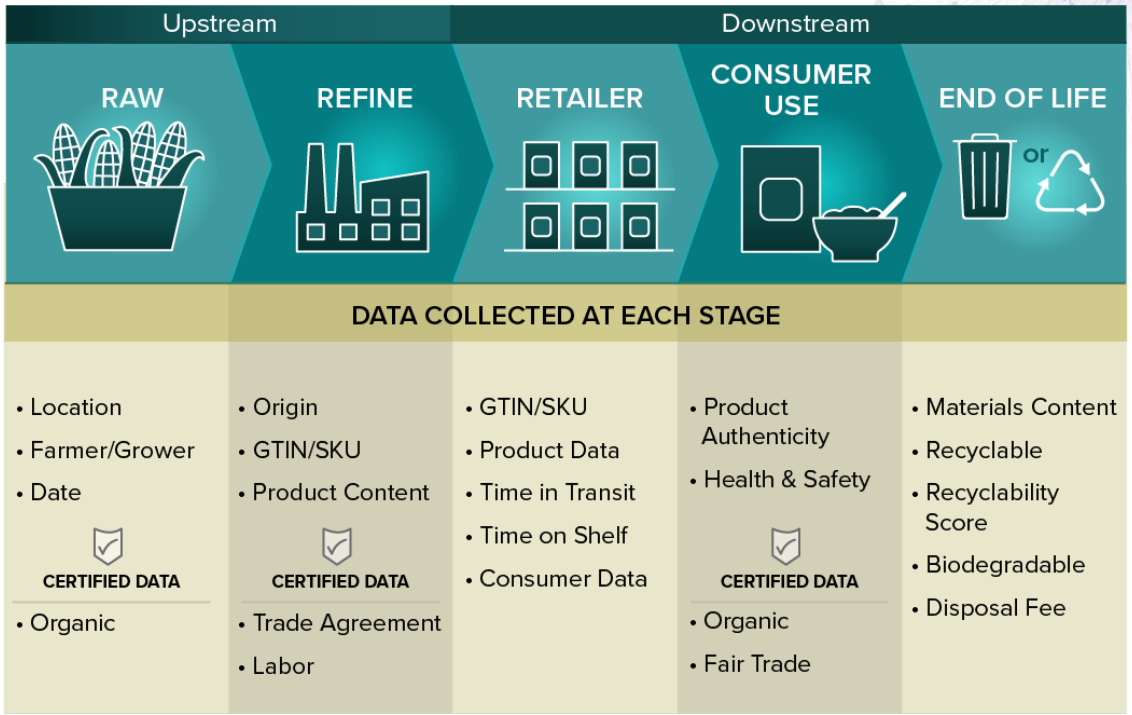
Shanzhai: Culture of Counterfeiting

1. Design nothing from scratch.
2. Buy low, sell high.
3. Innovate for speed & small scale savings.
4. Don’t make what you can buy for less.
5. Cash flow is king.
6. Don’t make it till you have a buyer.
7. There is no proprietary, only results.
   - IP takes up an invoice line item ($$), but there is no inventory in a factory for it. So why pay?

PURPLE TORNADO

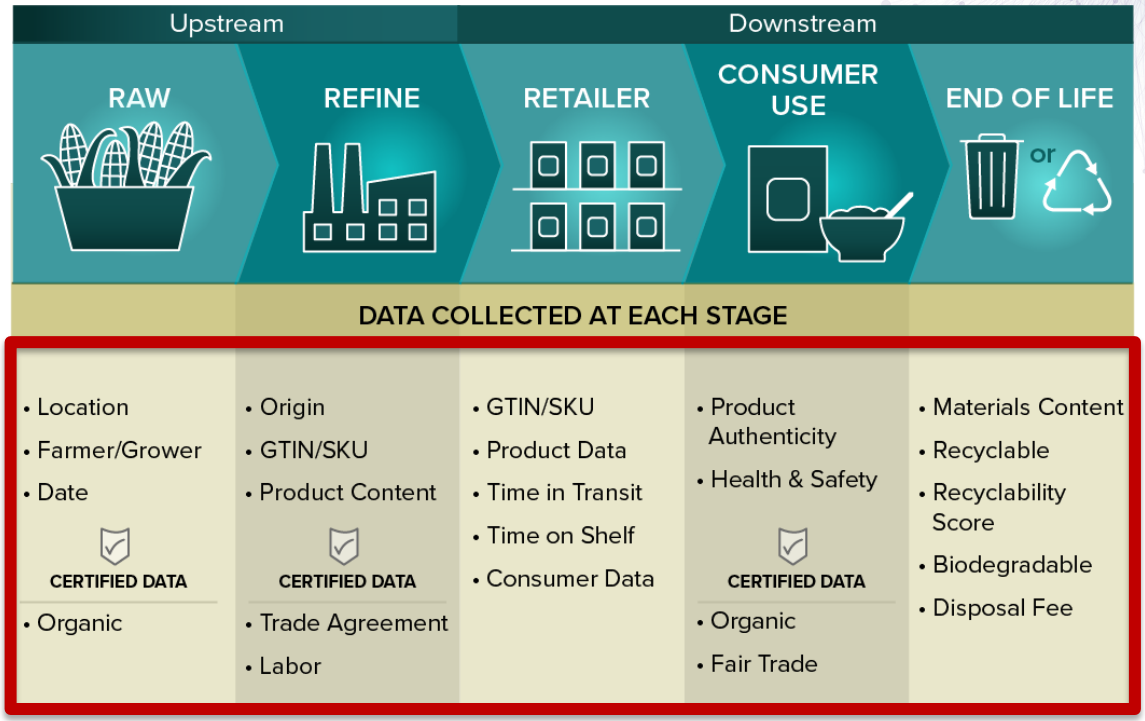
Linear Supply Chain

- High level
- Can be 20+ steps between Raw + Refine depending on suppliers and manufacturers
- Data is collected and shared along the way
- Consumption is the assumption (but there are always things left over)



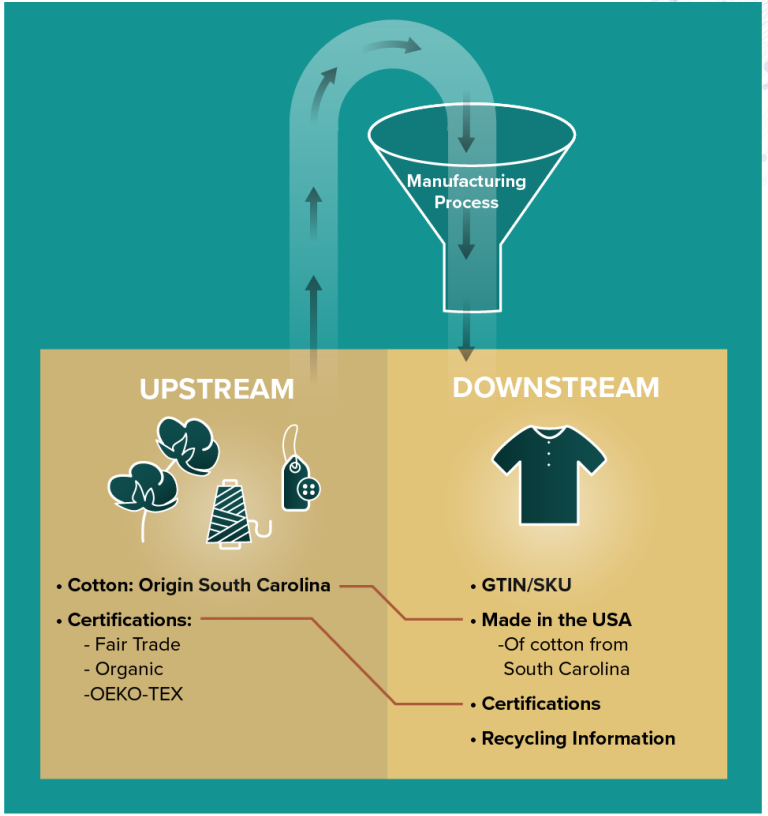
Linear Supply Chain

- High level
- Can be 20+ steps between Raw + Refine depending on suppliers and manufacturers
- Data is collected and shared along the way
- Consumption is the assumption (but there are always things left over)



Upstream/Downstream

- Different identifiers for up and downstream
- Difficult to connect upstream to downstream
- Increasing trend for transparency of upstream materials



Circular Supply Chain

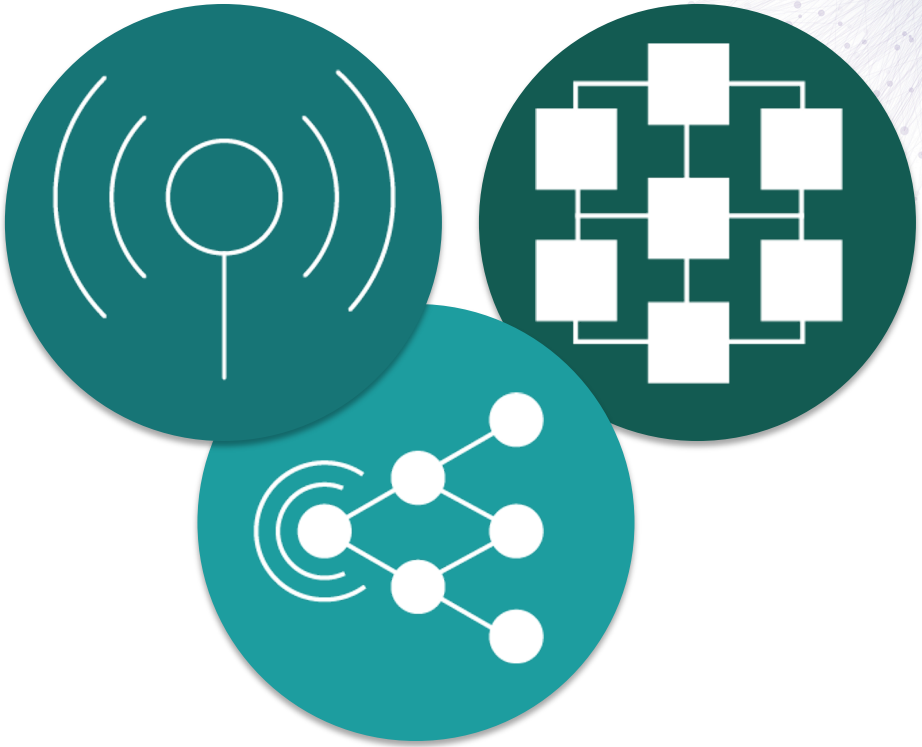
- A shifted view of the supply chain
- Enabling recycling, reusing, and responsible disposal

"We are going to run out of virgin materials at some point."

– Patagonia CEO

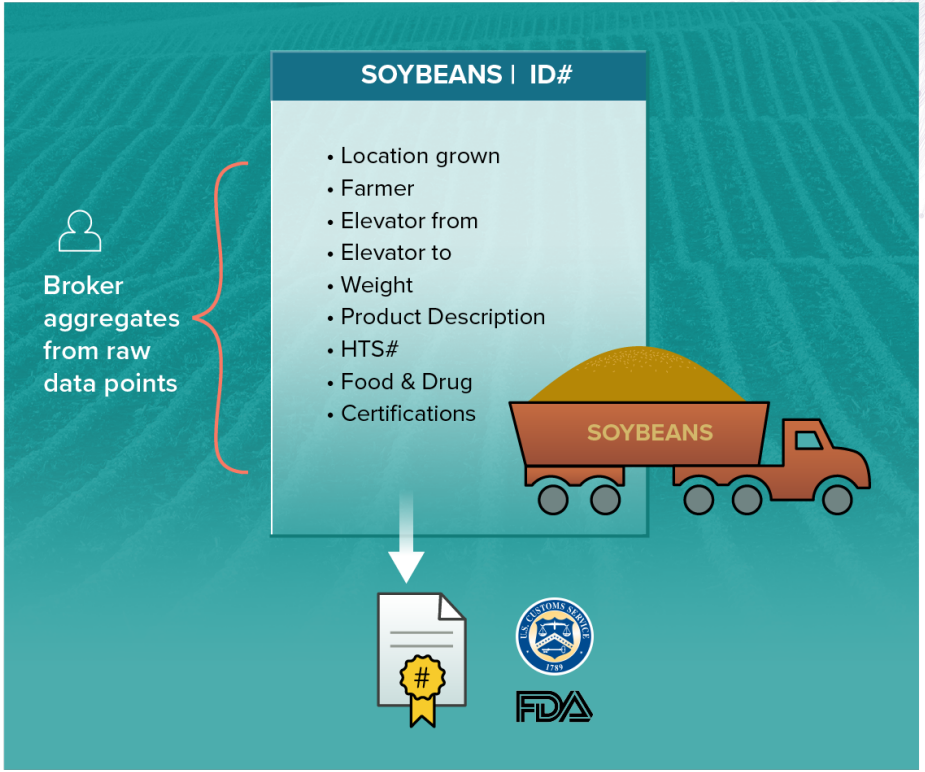
Tracking Technology

- Sensors
  - Tracking
  - RFID
  - QR Codes
  - IoT Devices
- Distributed data structures
- Data infrastructure



Data & Identifiers

- Linking Data
- Data Governance
- Data Harmonization
- Data Aggregation



Systemic Problems & Innovations

Problems	Innovations
Many Jurisdictions	Persistent Identifiers
Industry Collaboration	Data Interoperability
Technology Interoperability	Time for Adoption
Economic Problems	Shift Economic Incentives

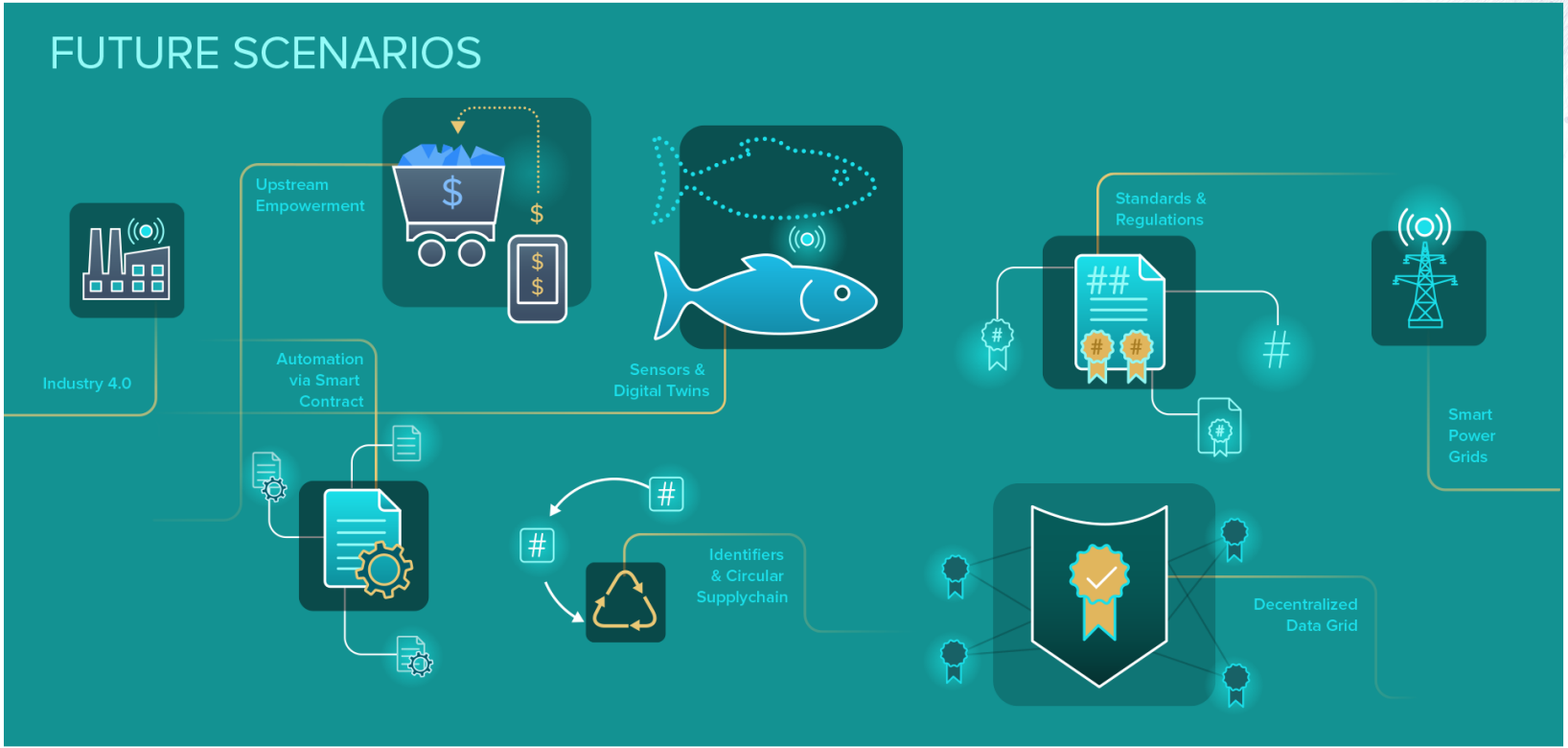
Quotes

“We spend a lot of time maintaining our corporate identity to ensure that no one’s stealing it.”
—21 Century Customs Meeting

“At some point in time, Chinese or Asian companies will become a source of creativity. This will be interesting for the European market development. At some point, they will realize that they are not [limited to] the Western bias.”
—Interviewee

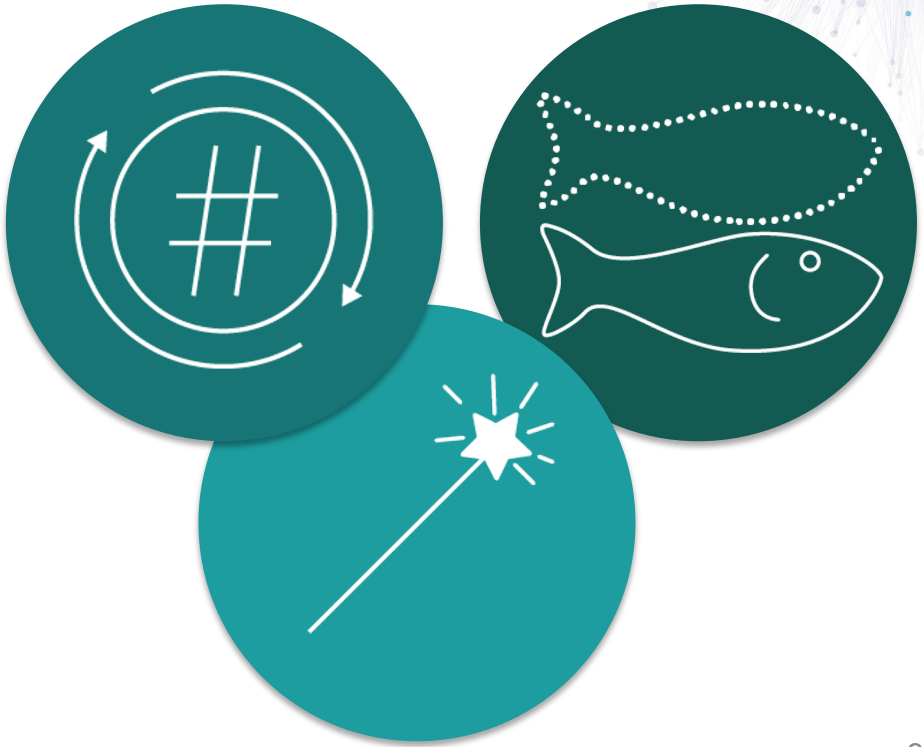
“A cryptographically, verifiable, secure, physical identity, on a physical product that can be digitally validated that doesn’t intrude with product performance, or interfere in consumer privacy. This identity provides the benefits of supply chain efficiency, customer delight, post purchase engagement, warranty repair, replenishment, transfer of ownership, and lastly would support end of life.” —Interviewee

Pockets of the Future in the Present



Report recommendations

1. Persistent Identifiers
2. Identifier and Data Model Standards
3. Digital Twin
4. Data Portability & System Interoperability
5. Harmonize Global Regulations
6. Industry Collaboration
7. Activate the Private Sector



PURPLE TORNADO

DECENTRALIZED IDENTITY?

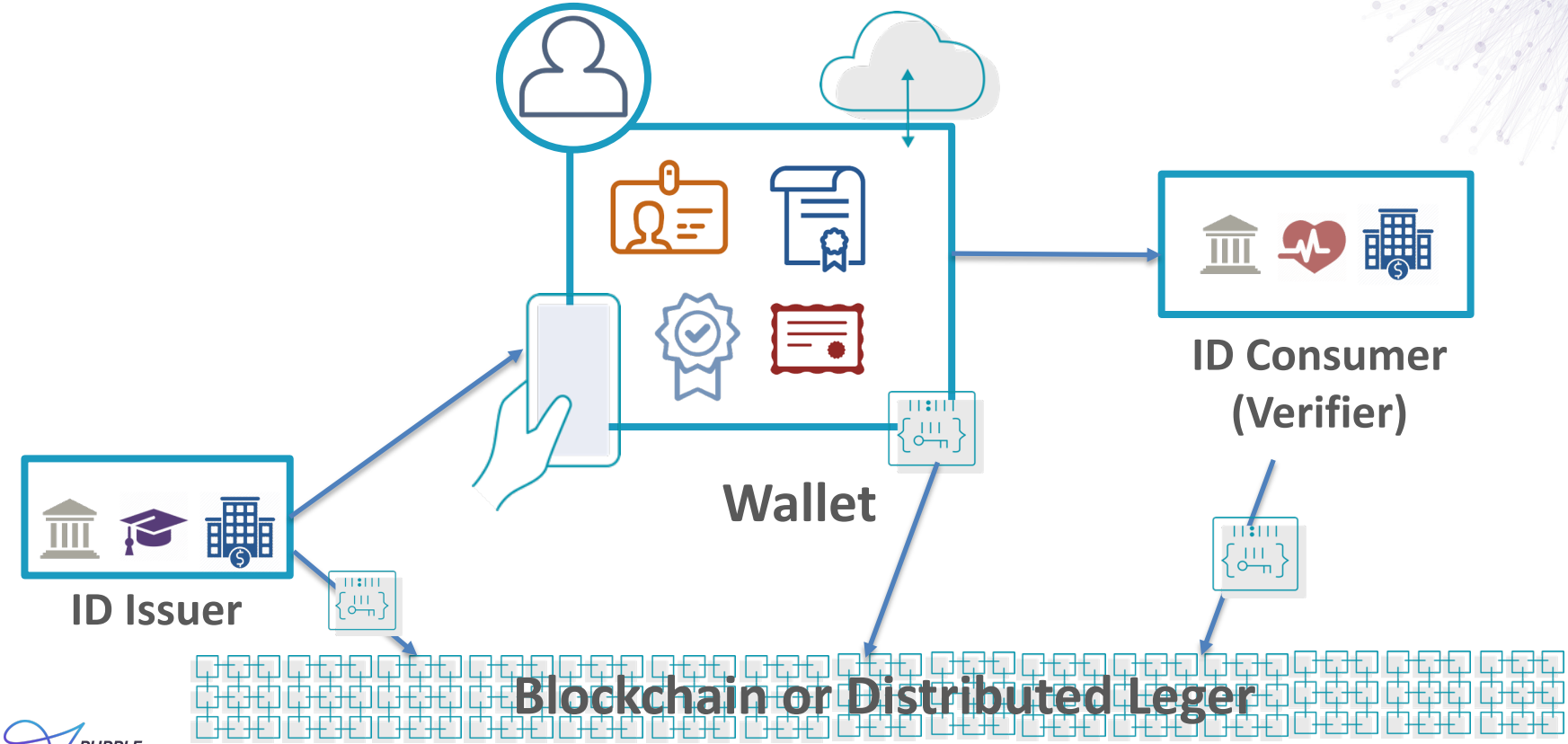
PURPLE TORNADO

The Vision: A Global Digital Rail

- Technology standards for interoperability
- Trans-National, goes beyond borders
- Governments supported development of new infrastructure by private sector
  - Government of Canada
  - DHS investments
- Citizens access Government services without being tracked or correlated
- Identity issuance and verification
- Digitally native identity and credentials
- What else is possible? IoT??

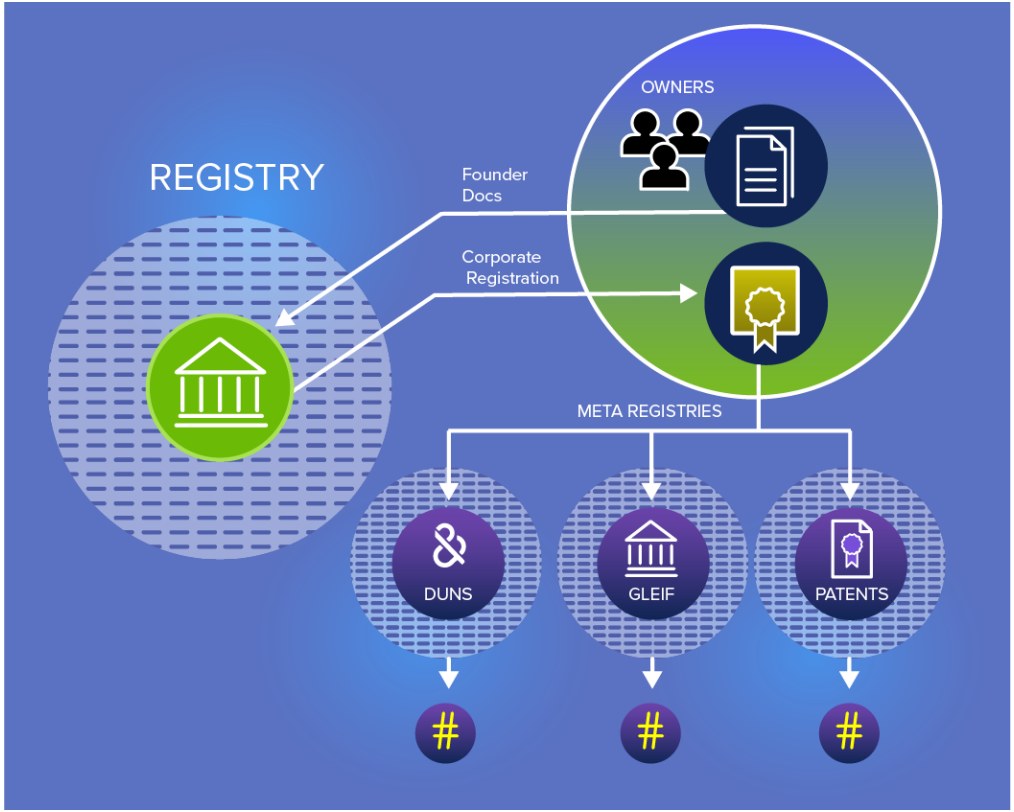
PURPLE TORNADO

3: Decentralized Identity



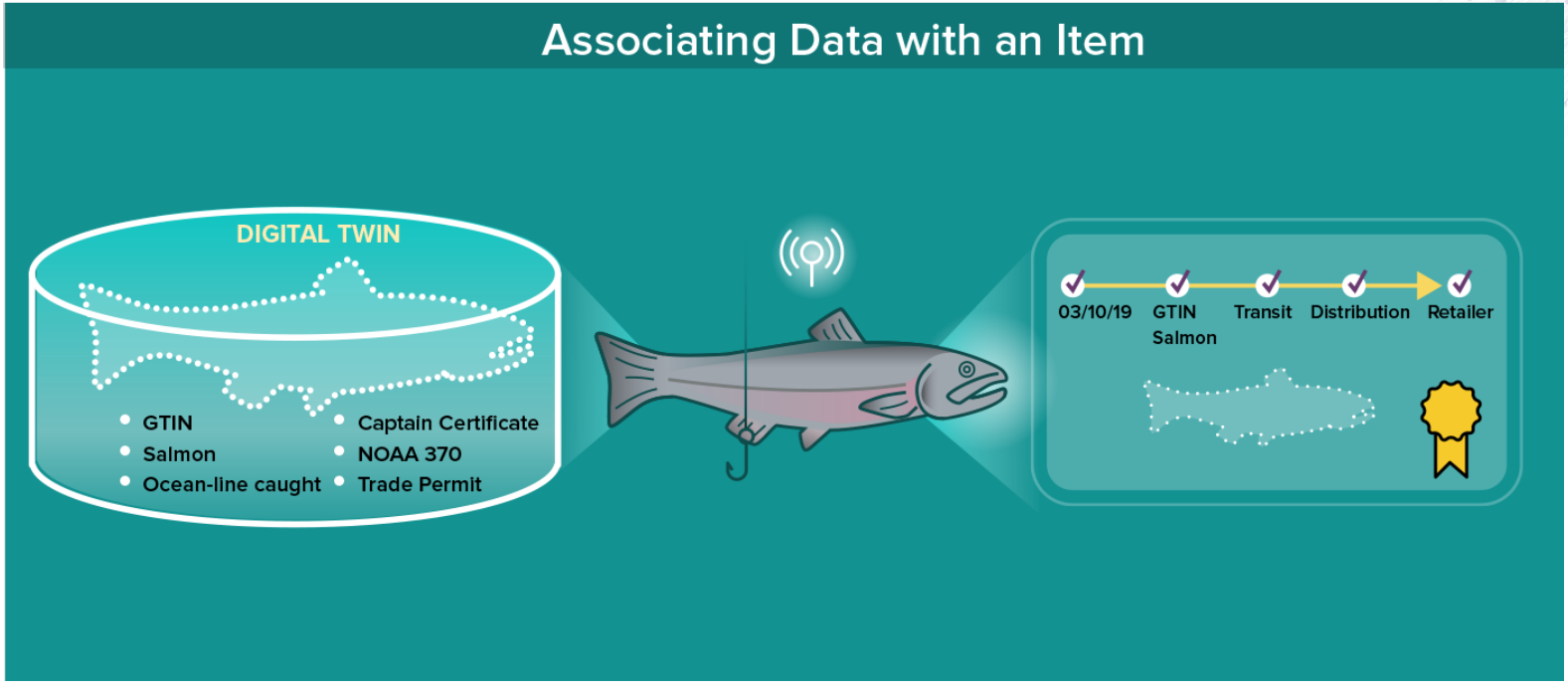
PURPLE TORNADO

Legal Identity



PURPLE TORNADO

Things Identity

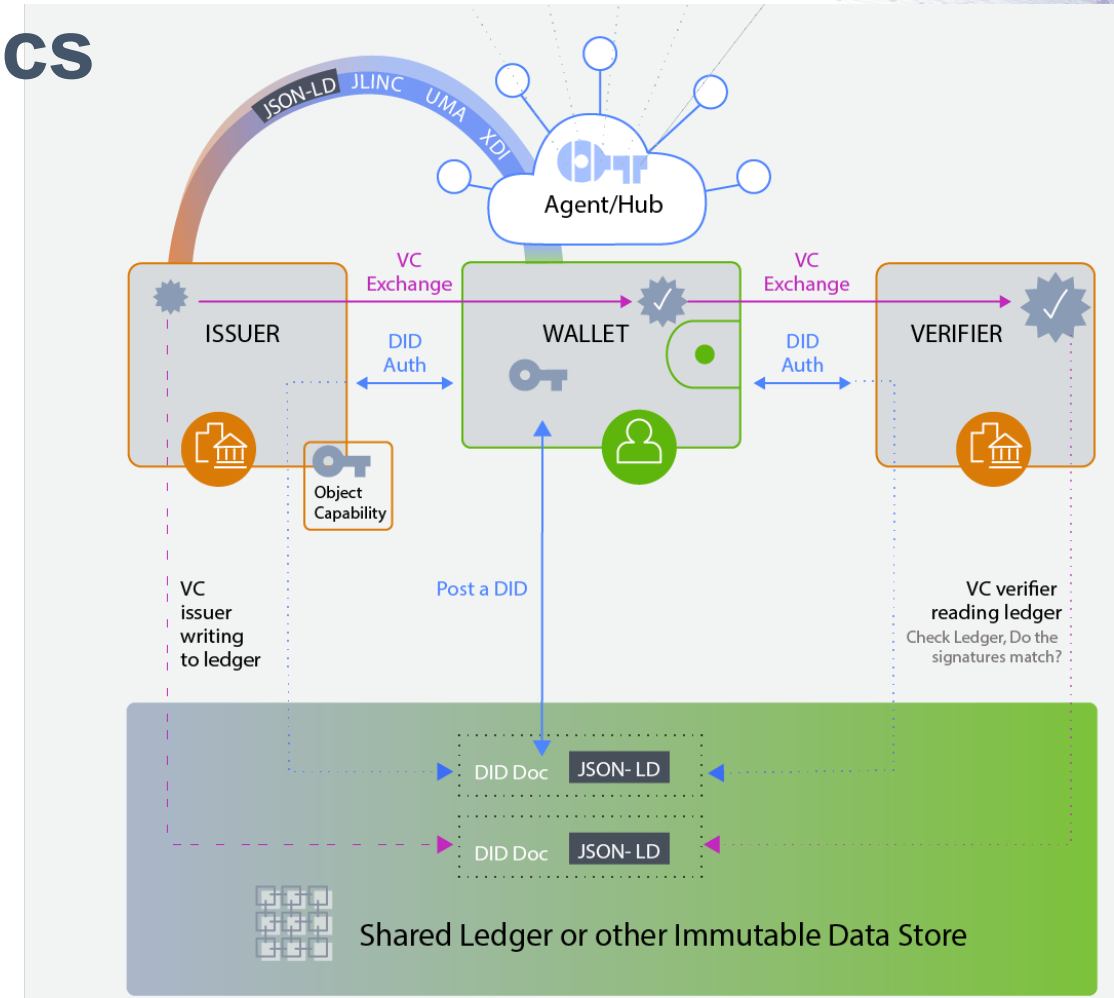


PURPLE TORNADO

Standards & Specs

Interoperable standards to implement a common technology stack.

- DID Spec
- DID Methods
- Universal Resolver
- DID Auth
- Verifiable Credentials



PURPLE TORNADO

OPPORTUNITIES TO COLLABORATE

PURPLE TORNADO

Current IoT Vulnerabilities – M3AAWG

- Abuse, takeover
- Sensor data, military and government applications
- IoT built fast, lacks security, out of date quickly
- But in the wild forever, sunsetting is rare
- Other vulnerabilities like electronics components
- Potential new vulns & other unintended consequences
  - We can't necessarily predict what new vulns will be, but we know there will be new ones! So we need to have the mindset that this won't be fixed forever.

PURPLE TORNADO

Designing for IoT identity

- What can we borrow from human ID? Corporate ID?
- What are new problems to consider?
- Data sharing
  - machine to machine
  - machine to human
  - human to machine.
- How is authentication, verifying, assigning, communicating, sharing, changing, delegation different
  - IoT to IoT world?
  - IoT to human world?
  - Human to human world?

PURPLE TORNADO

Future Identity System Goals

- Manage a trillion identities
  - And all their relationships
- Thrive in dynamic environment
- Enable delegation
  - Between humans & NPEs
- Involve automated systems
- Solve current data, privacy problems
- **+ Messaging**
- **+ Manage Abuse**

PURPLE TORNADO

Why should we care?

- **Liability**: who pays when something goes wrong?
- **Responsibility**: who is responsible at a particular time?
- **Regulation:** increasing trend for more regulation
- **Collaboration:** rising trend to work together
- **Future Proof**: envision the true scale of the problem

PURPLE TORNADO

Working together

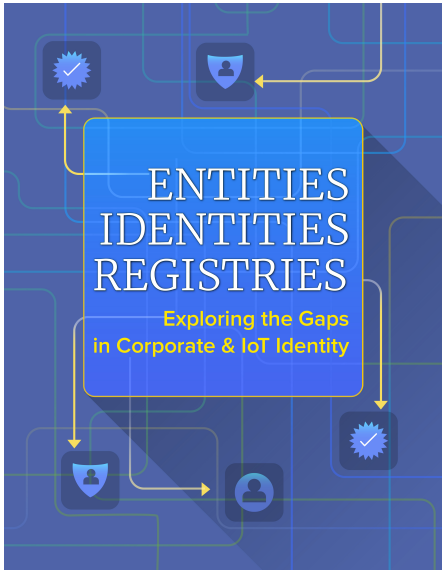
- Identity community mostly focused on human identity
- Identity community hasn’t thought much about messaging or abuse
- Industry 4.0 Vision
- Sensors + Data (Supply Chain)

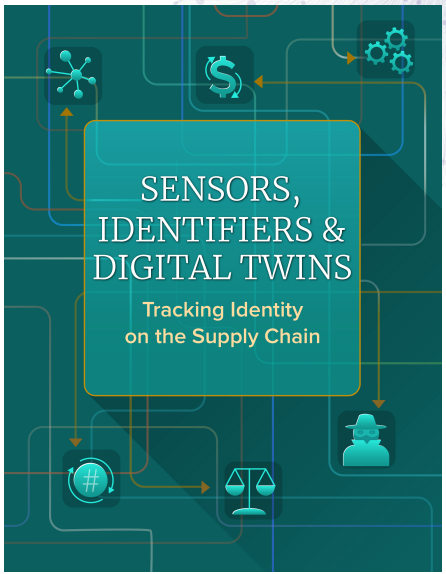
PURPLE TORNADO

Thank you

Heather Vescent

- www.thepurpletornado.com
- heathervescent@gmail.com
- vescent@thepurpletornado.com
- @heathervescent





Download NPE: bit.ly/NPEreport

Download Supply Chain: bit.ly/GSCreport

PURPLE TORNADO