The digital transformation of the air cargo industry and its impact on cargo loss

Dr Sonia Ben Hamida, Project Manager Interactive Cargo, International Air Transport Association (IATA)

Outline

Introductions

- About me
- IATA in brief

The value of air cargo

- Global trade
- Air cargo theft

How to protect cargo?

- IATA ONE Record standard: Supply chain visibility with secured data sharing
- IATA Interactive Cargo: Making cargo talk

About me

Education in Aviation, Systems Engineering and Innovation.

11 years of experience in Innovation Management in Aviation and Aerospace.

EDUCATION

PhD / INNOVATION
CentraleSupélec, Paris-Saclay University, France, 2017

MSc / AVIATION & COMPUTER SCIENCE
The French Civil Aviation University (ENAC), France, 2011

EXCHANGE PROGRAM / COMPUTER SCIENCE
University of Illinois at Urbana -Champaign (UIUC), USA, 2010

BSc / MATHS & PHYSICS
Lycée Hoche, France, 2008

AWARDS

EXEMPLARY DOCTORAL DISSERTATION AWARD 2018
Omega Alpha Association

AFIS PHD THESIS AWARD
French Council on Systems Engineering, 2018

SWISSED STUDENT PRIZE
SSSE Swiss Society of Systems Engineering, 2017

WINNER OF CALTECH SPACE CHALLENGE
California Institute of Technology, 2017

Requirements and System Architecture expert, 2011-2014

Research Engineer in Innovation, 2014-2017

Innovation Manager, 2017-2018

Project Management Officer, 2018-2019

Researcher - Sustainable Space Logistics, 2019-2020

Lecturer - Innovation Management, 2019-Present

Project Manager Interactive Cargo, 2020-Present

IATA

The global trade association of the world's airlines

IATA in brief

The International Air Transport Association (IATA) is a trade association with **290** airlines in **120** countries, representing **82%** of global air traffic.

IATA supports aviation with global standards for airline safety, security, efficiency and sustainability.

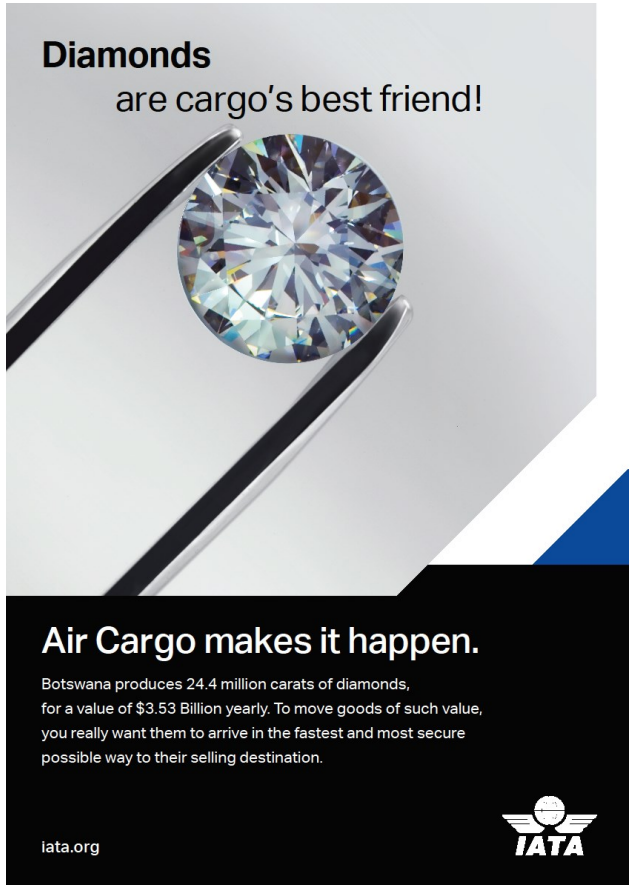
The value of air cargo

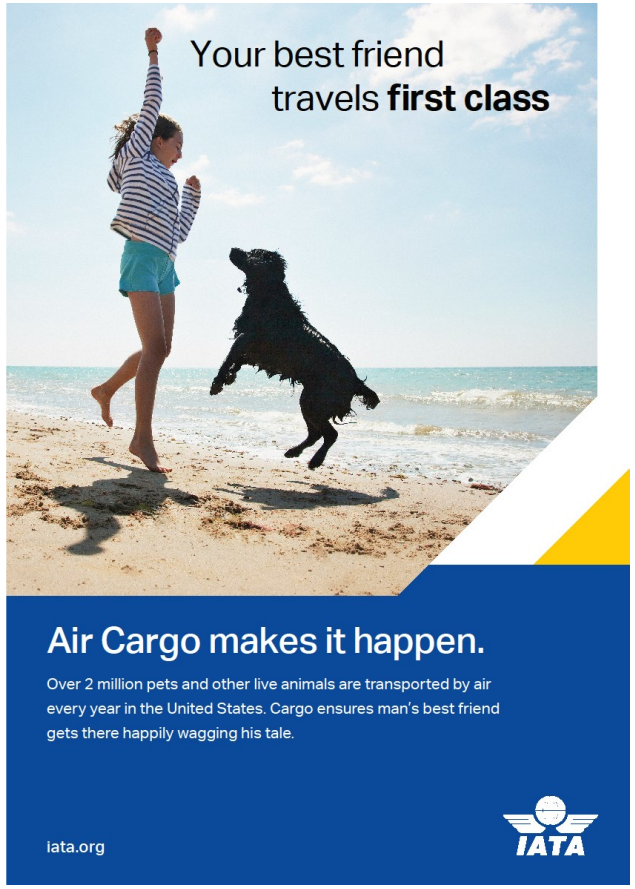
Value of Air Cargo – Enabling global trade

50 million tons
of cargo a year

US $6 trillion
worth of goods

Air Cargo Makes it happen





IATA

24 hours in air cargo

80’000
flowers transported

1.1M
smartphones transported

$18.6B
value in cargo shipped

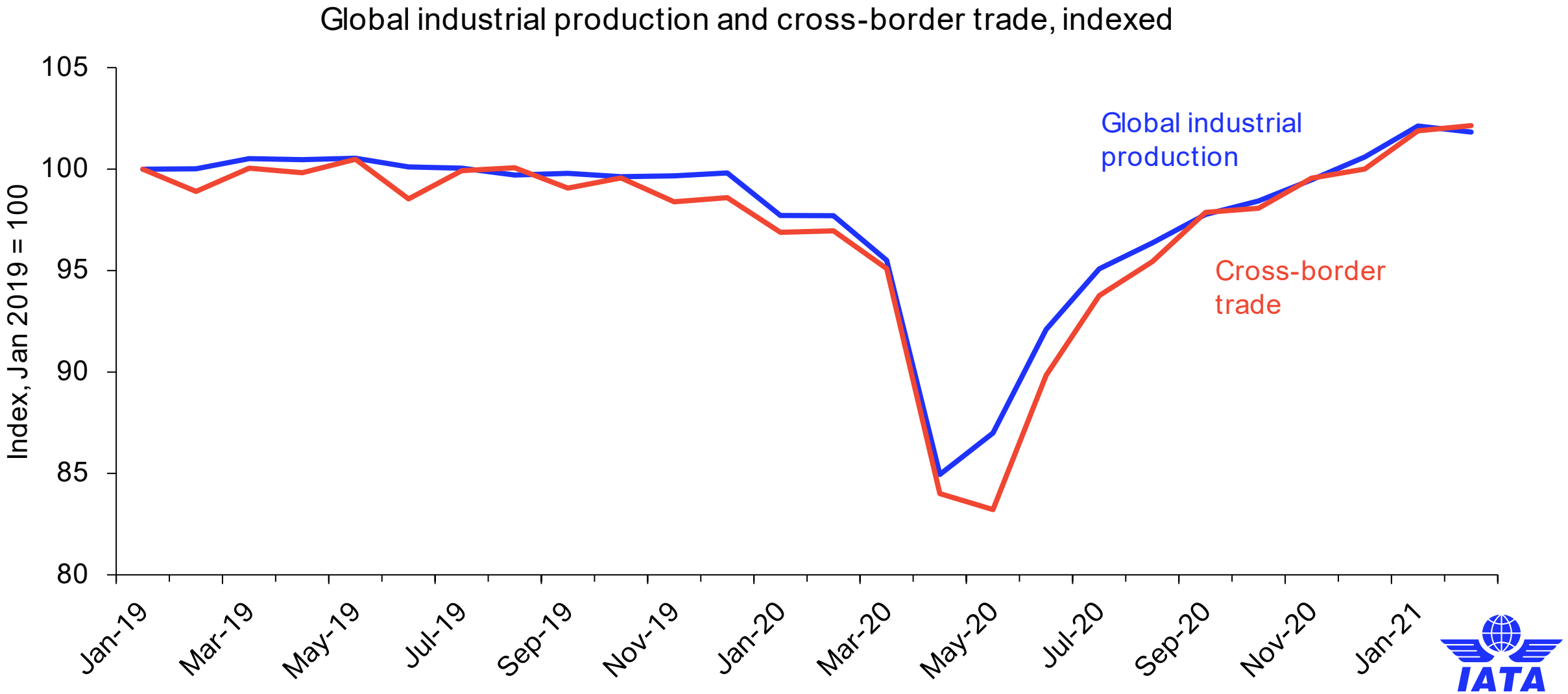
20M
parcels sent

6’849
lives saved

IATA

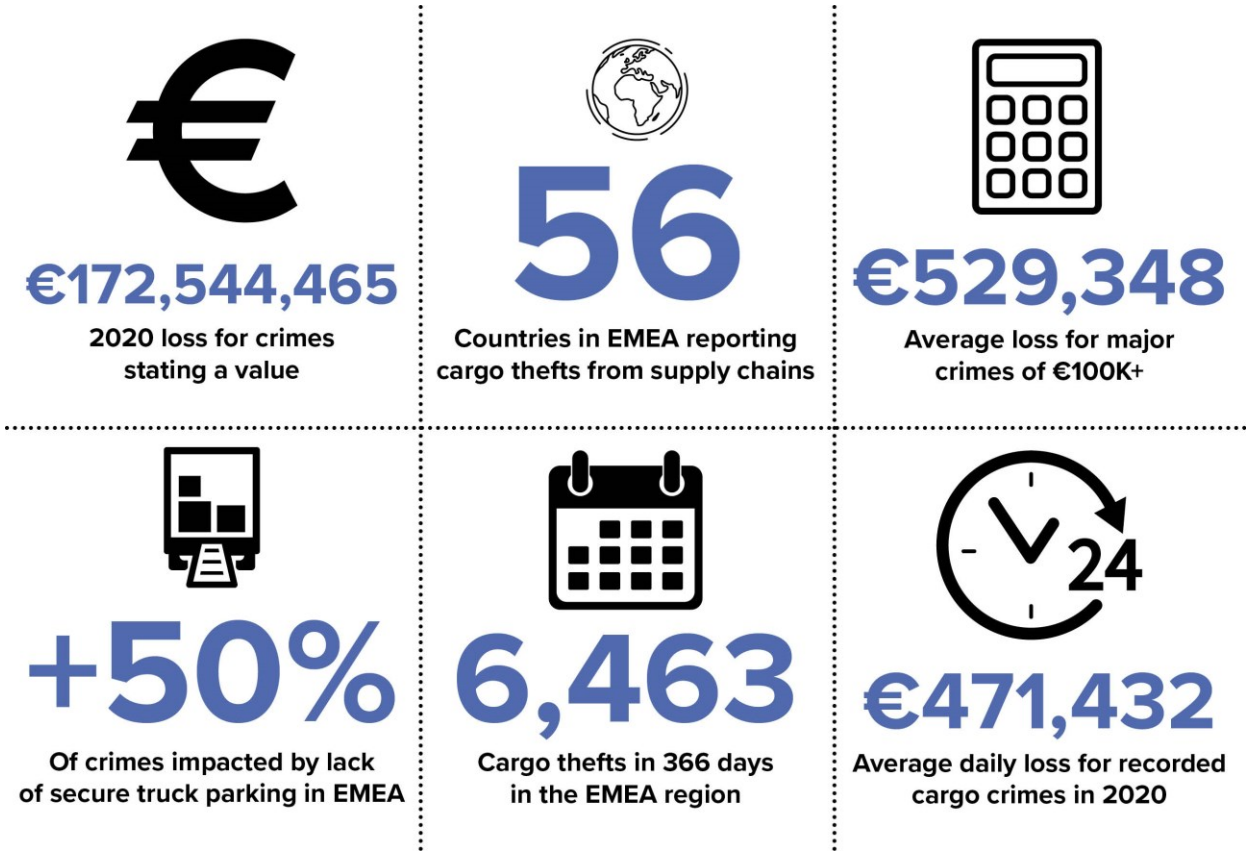
Strong global economic rebound positive for air cargo

'V-shaped' recovery increasing demand for air cargo services



Source: IATA Economics using data from Netherlands CPB

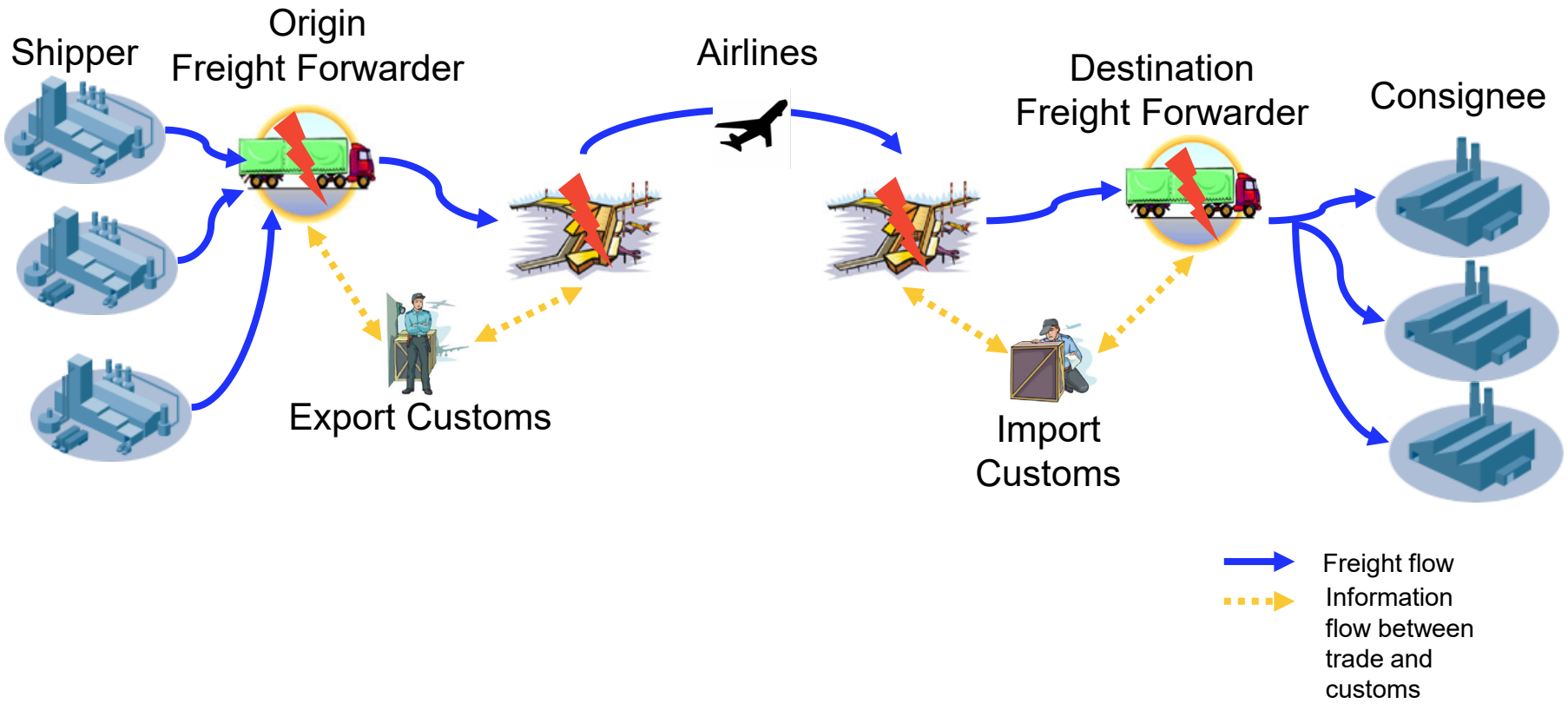
Cargo crime remains high in 2020 despite Covid lockdowns



Source: APA EMEA - 2020 cargo theft data

Air cargo supply chain and main theft risks

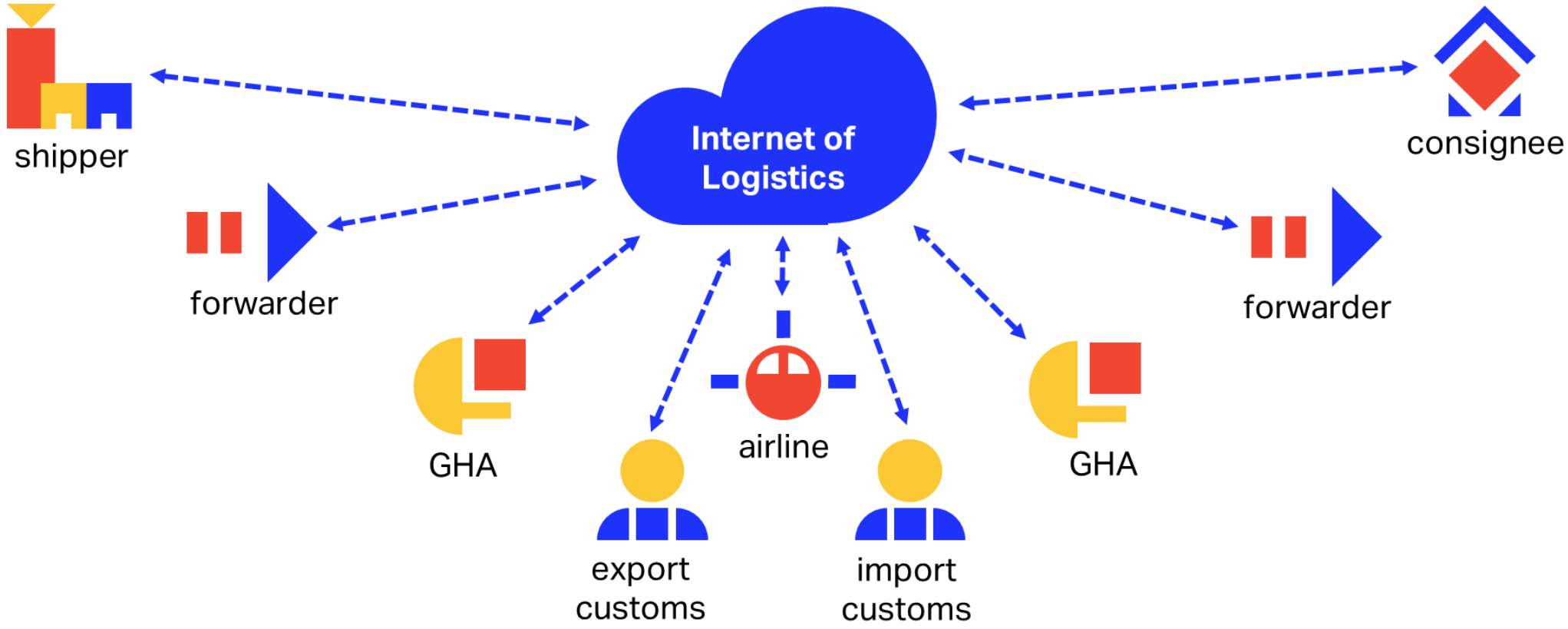
Air cargo strengths are shipment **transit times** and the **security during moves**



Most thefts occur during the **loading or unloading** phase

How to protect cargo?

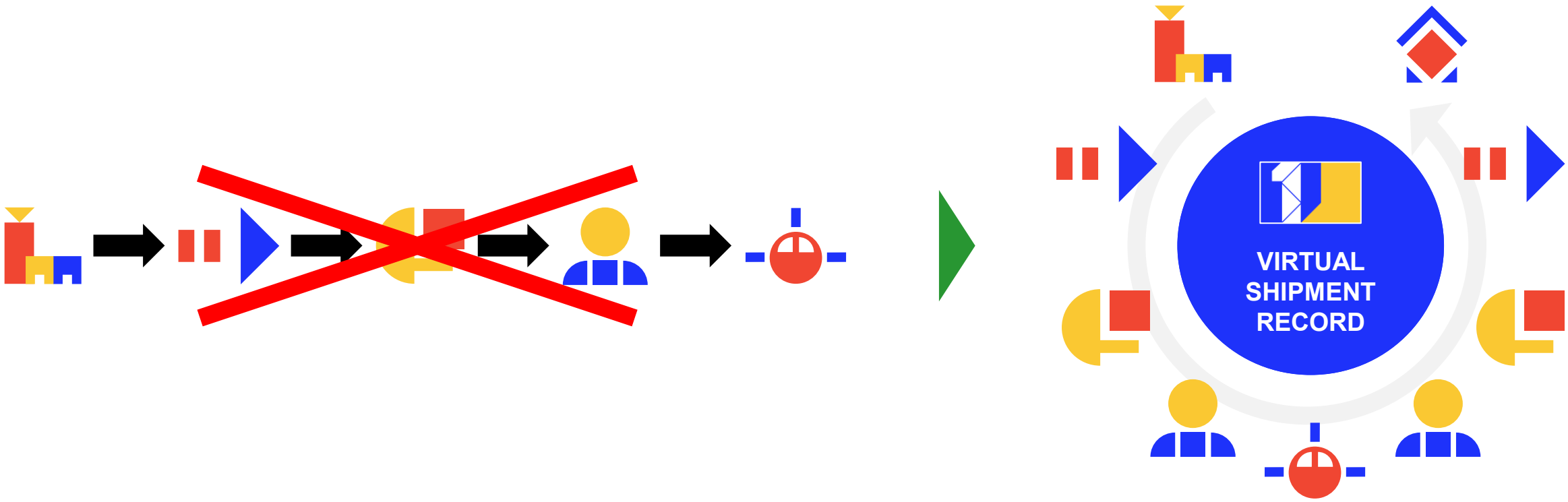
Internet of Logistics for supply chain visibility



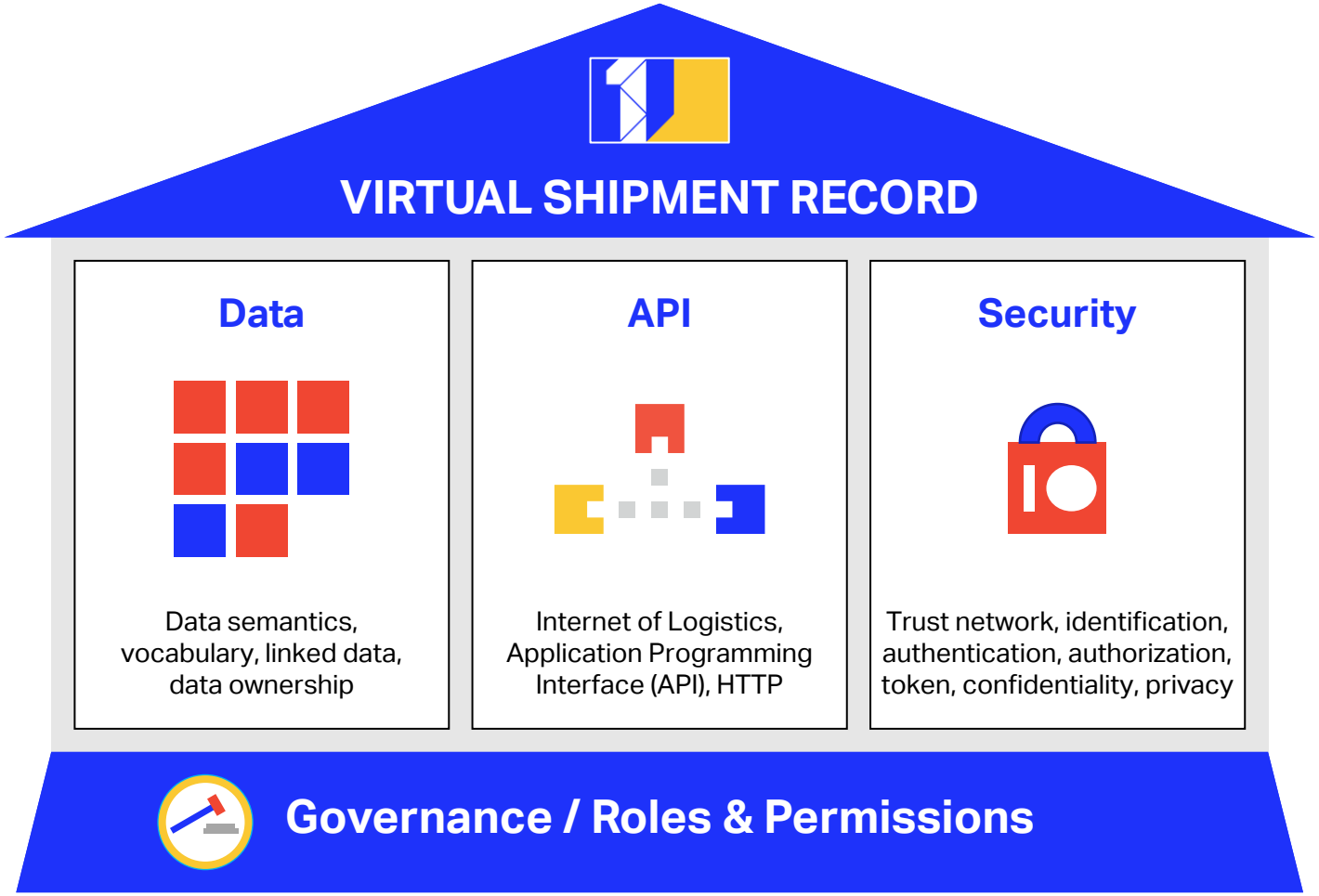
Internet of Logistics (IoL) - contains ONE Record Servers and Clients representing all types of stakeholders from the supply chain and it is governed by the ONE Record Data Model, API and Security specifications.

ONE Record concept

The essence of ONE Record is to move from a peer-to-peer messaging model to a data sharing model relying on a Virtual Shipment Record



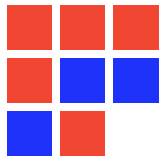
ONE Record pillars



The ONE Record concept is based on 3 pillars enabling to define:

WHAT, HOW, with WHOM data can be shared

ONE Record Standard



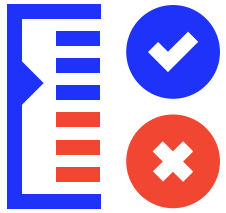
Data model specification: provides the air cargo industry with a standard data structure for data exchange using JSON-LD that facilitates data integration with existing and new data services;

API specification: specifies the interface and interaction of the web API (Application Programming Interface) that allows airlines and their partners to connect their system directly using best in class web technologies;

Security specification: uses an industrywide and federated trust network to manage identification and authentication of data sharing systems and ensures data privacy and confidentiality for all parties.

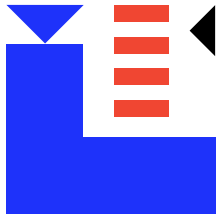
https://github.com/IATA-Cargo/ONE-Record

Industry benefits



Data quality and control

- Data shared by data owner
- Full control of data
- Data stays at the source
- Owner determines data access

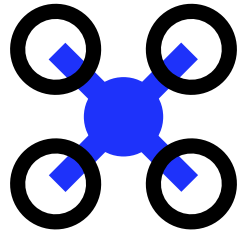


Visibility and transparency

- End-to-end transportation chain
- Share data of the shipment with relevant parties
- Enhanced visibility and transparency

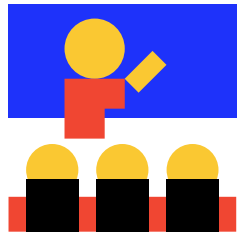
Plug & Play Connectivity

- Facilitate the direct connectivity between all the stakeholders
- Use of web API
- New cooperative IT solutions and innovation



Future of digital cargo

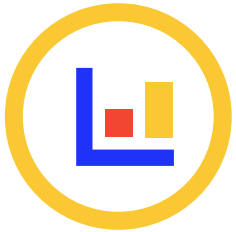
- Foundation for true digital air cargo
- Develop collaborative and automated digital services



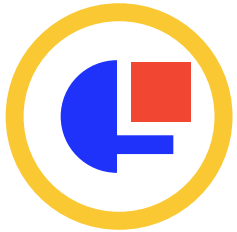
Welcome a new generation

- Technology platform that is ready for a new generation of digital natives

Design principles

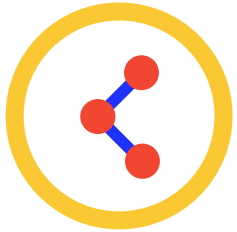


Piece-centric



Physics-oriented: the digital twin concept

One single source of truth



Data-driven

Piece-centric

- The Air Cargo industry is shifting from Shipment-level management to **Piece-level management** starting with Piece-level tracking

- The **Piece** is at the center of the model and deeply linked to the other elements of the cargo supply chain

What is a piece?

" A uniquely identified physical single unit which may form all or a part of a shipment "

Physics-oriented

- Physical entities have **digital twins** in the Data Model (e.g. Airplane, ULDs, etc.)
- Easy understanding of the Data Model and how it interacts with actual operations
- Easy **sharing** and **transparency** of the data throughout the supply chain

Digital twins

"digital twin is the "digital replica" of a physical entity"

One single source of truth

Clear ownership of data that remains at the source

Data integrity and **accuracy** is ensured

A strong trust is implied and in favor of replacing paper-based documents

Data-driven

Data, not documents!

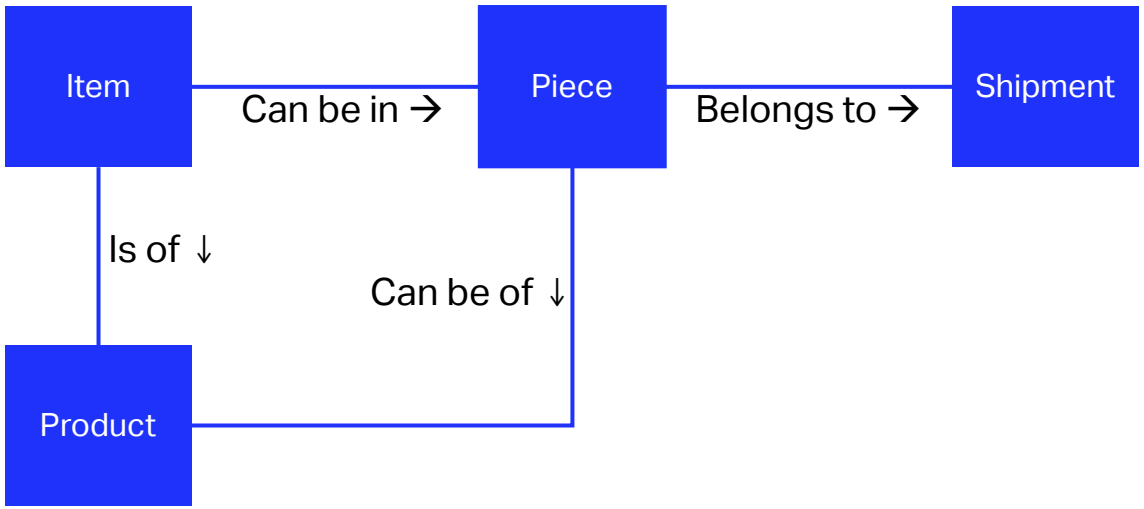
- Data is the **core** of ONE Record
- Documents will be the results of **data aggregation**
- Proper **APIs** and **security mechanisms** allow to cover the legal requirements of documents in the current world

Combined with **Semantic Web** and **Linked Data** principles

- **All objects are linked**, directly or indirectly, that is Linked data
- No **redundancy** of data required
- The Semantic is described easily in machine-readable **ontologies**

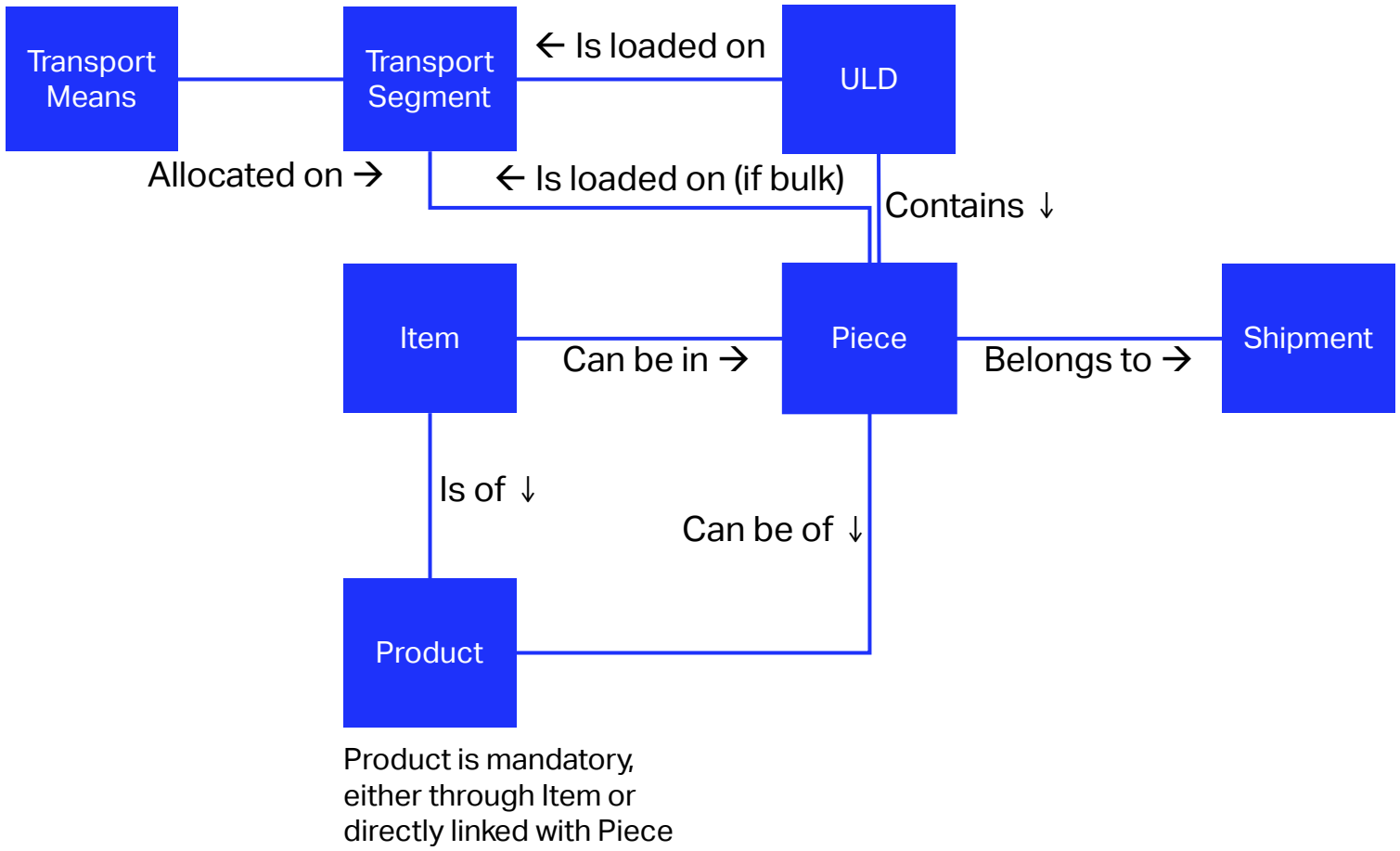
IATA

The ONE Record Data Model focuses on the goods …

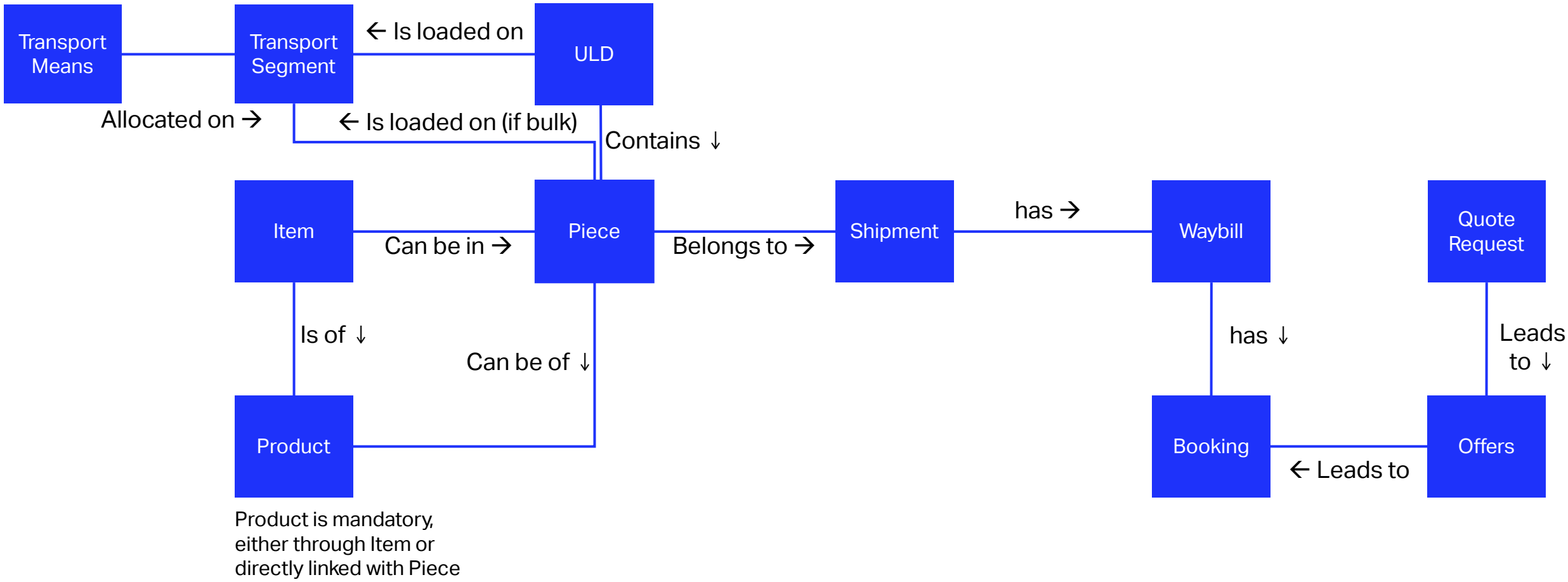


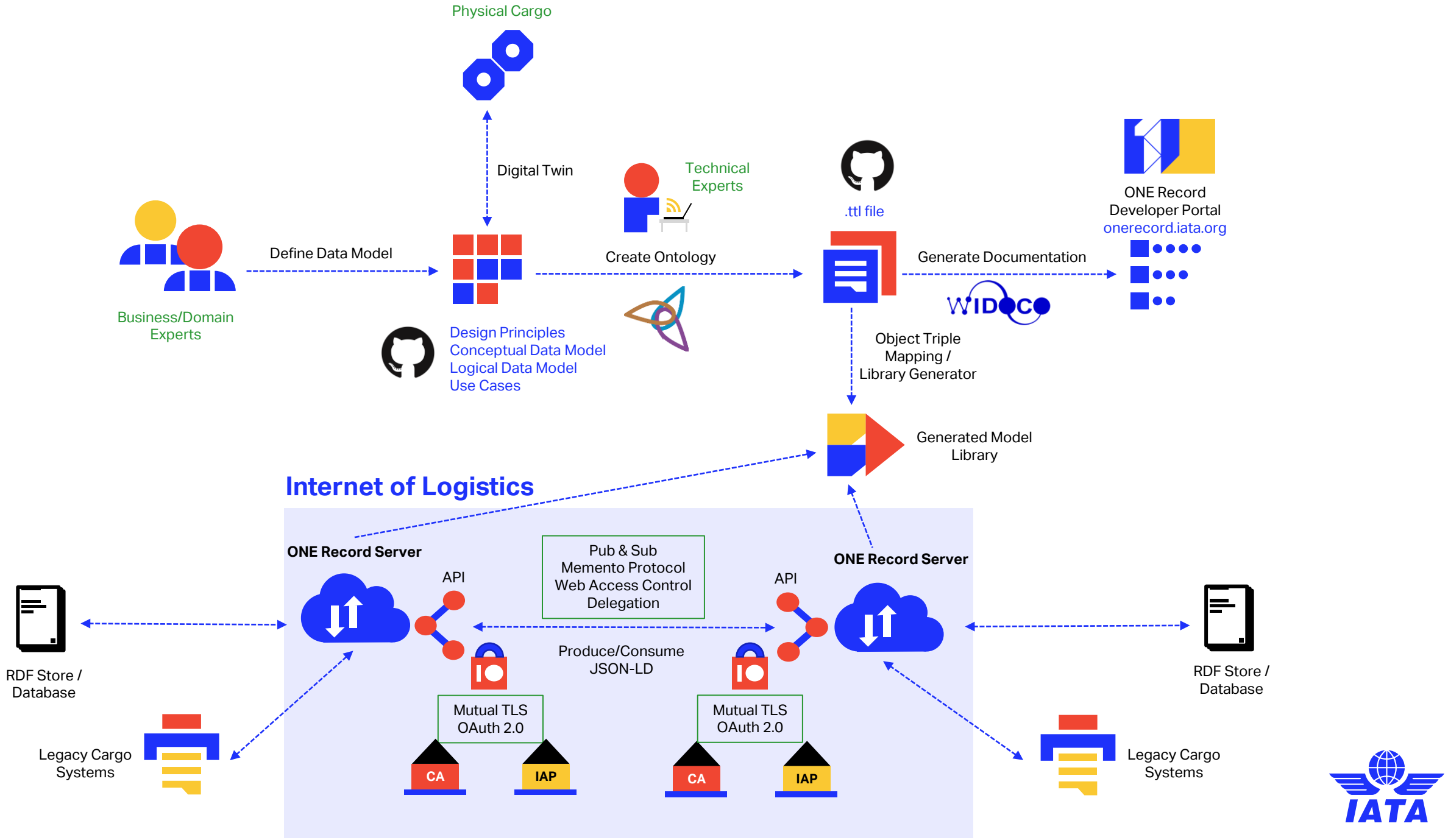
Product is mandatory,
either through Item or
directly linked with Piece

… has digital twins of physical assets …

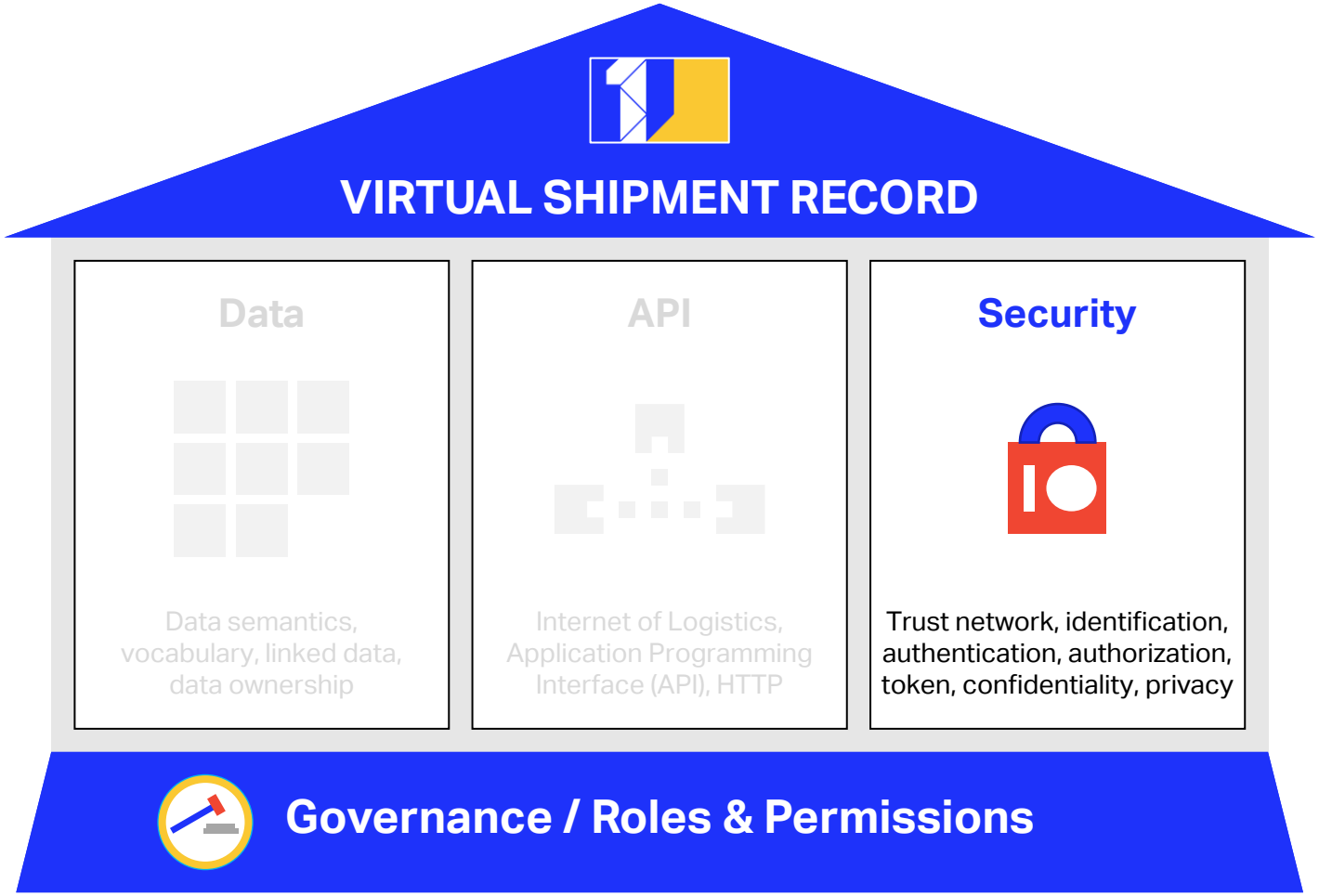


… and covers the booking process




Physical Cargo
Digital Twin
Technical Experts
.ttl file
ONE Record Developer Portal
onerecord.iata.org
Define Data Model
Create Ontology
Generate Documentation
Business/Domain Experts
Design Principles
Conceptual Data Model
Logical Data Model
Use Cases
WIDOCO
Object Triple Mapping / Library Generator
Generated Model Library
Internet of Logistics
ONE Record Server
API
Pub & Sub
Memento Protocol
Web Access Control
Delegation
ONE Record Server
API
Produce/Consume JSON-LD
RDF Store / Database
Mutual TLS
OAuth 2.0
CA
IAP
Mutual TLS
OAuth 2.0
CA
IAP
RDF Store / Database
Legacy Cargo Systems
Legacy Cargo Systems
IATA

ONE Record Pillars

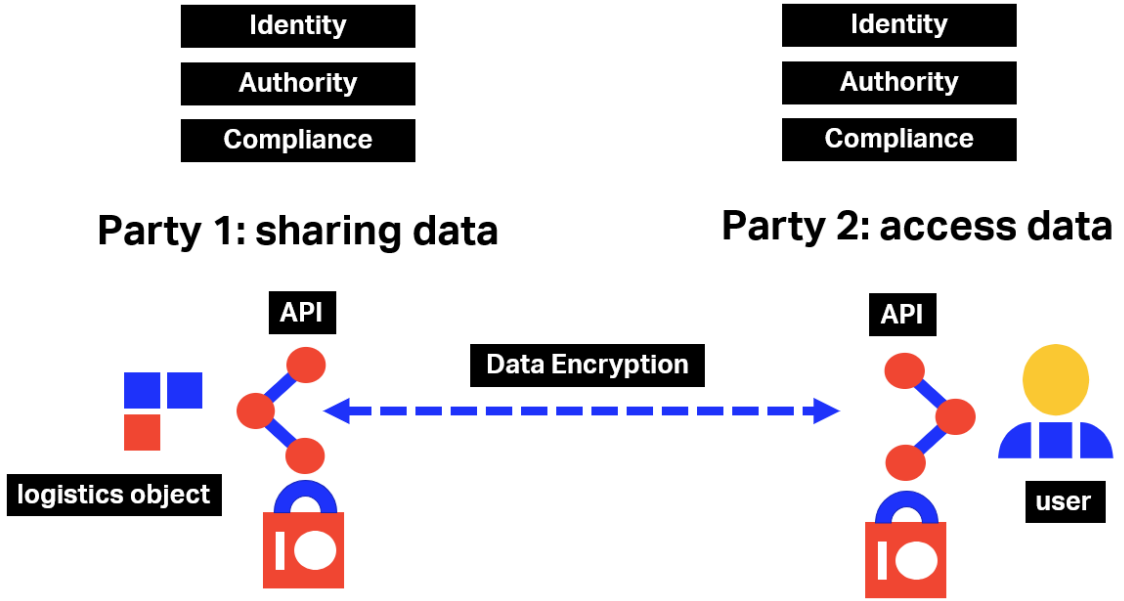


The ONE Record concept is based on 3 pillars enabling to define:

WHAT, HOW, with **WHOM** data can be shared

What is the purpose of the ONE Record data security framework?

When exchanging data, each party needs to know with certainty the true identity of the other party and that they have the authority to receive or share the data. They also need to be certain that the data being shared is private, secured and confidential and cannot be intercepted or changed by any unauthorized third party. The ONE Record security framework has to work globally and for all stakeholders in the full logistics and transport supply chain, and in compliance with corporate and local data security requirements.



40+ companies involved in ONE Record

ONE Record pilots

If you are interested in joining or starting a pilot, contact us at onerecord@iata.org

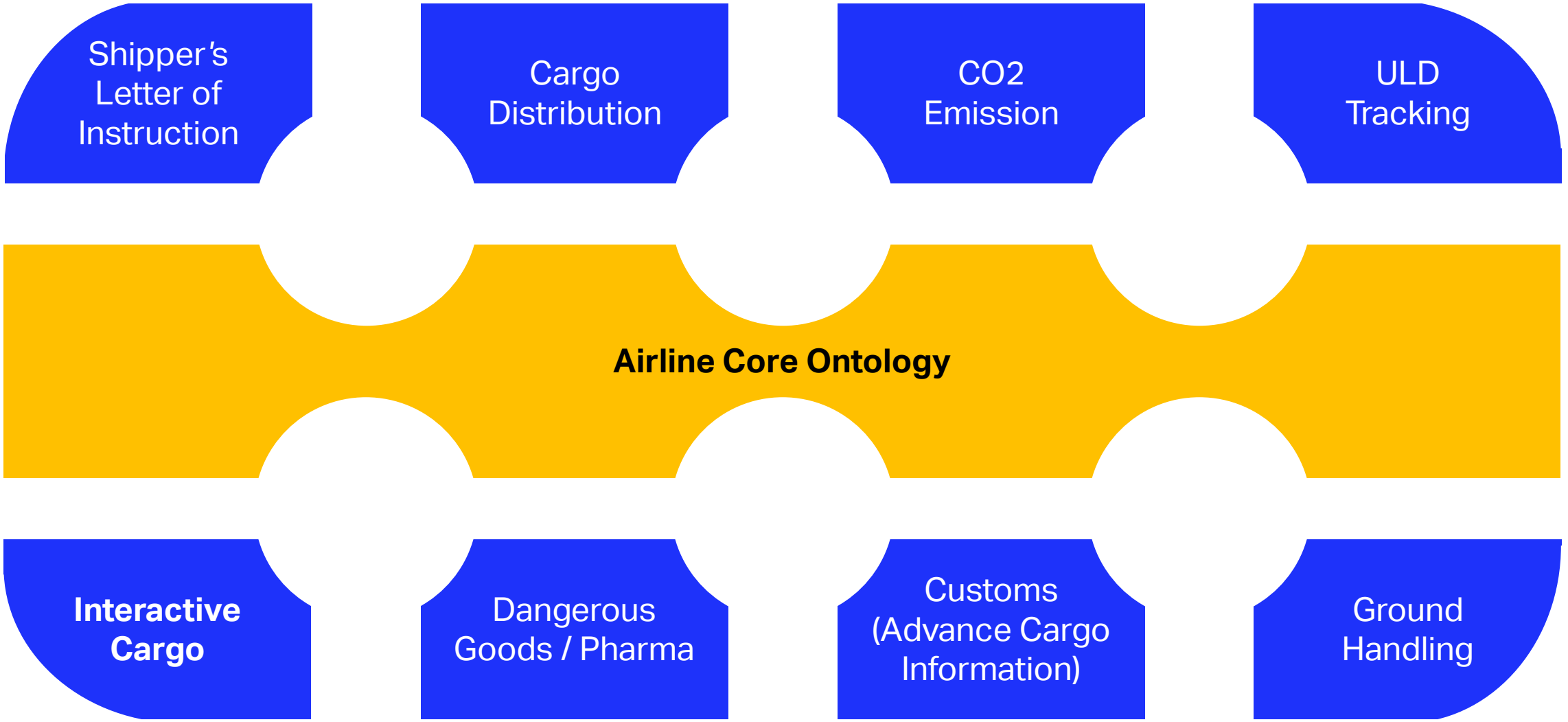
Click below for more information on the use cases:

- Cargo distribution (pdf)
- Customer integration (pdf)
- Enriching commercial documents (pdf)
- ONE Record Airport hub (pdf)
- ONE Record and Existing Messaging Standards (pdf)
- ONE Record node expansion (pdf)
- ONE Record prototyping (pdf)
- Pharmaceuticals (pdf)
- ONE Record for Road Transport (pdf)
- ONE Record Pilot 2019
- Truck-IoT border crossing (pdf)
- ONE Record Cargo Terminal hub (pdf)
- ONE Record Data enhancement (pdf)
- Cargo pre-advise for trucking (pdf)
- ONE Record - Data conversion (pdf)

Find all our ONE Record pilots at www.iata.org/one-record/#tab-7

IATA

ONE Record Data Model: the ambition



Interactive Cargo: Making cargo talk

By equipping airlines and the air cargo supply chain with responsive air cargo services based on intelligent systems able to:

- **self-monitor**;
- send real-time **alerts**;
- **respond** to deviation to meet customers' expectations;
- and **report** on the cargo journey to allow data-driven improvements.

IATA

Interactive Cargo project

Objectives and key deliverables

iata.org/interactive-cargo

The goal is to provide stakeholders in the air cargo supply chain with a set of standards and guidance documents to enable and ease the use of IoT devices for **interaction with cargo.**

Interactivity Characterization

- Policy Paper - Vision of Interactive Cargo data capture and sharing
- Recommended Practice - IoT device data sharing in air cargo
- Standard Operating Procedures – Implementation of the IoT device data model

Device Certification

- Policy Paper - Vision of the approval of the use of IoT devices in the air cargo industry
- Recommended Practice - Approval of the use of portable electronic devices onboard aircraft
- Standard Operating Procedures – Adoption and use of IoT devices

Data Use Agreement

- Amendment to the Recommended Practice Conditions of Carriage for Cargo

Interactive Cargo Handling

- Creation of a specific Label for Interactive Cargo
- Recommended Practice – Use of the Electronic Monitoring Device Special Handling Code
- Standard Operating Procedures – Interactive Cargo Handling Process

Pilots for Operational Validation

- Development of pilot projects
- Validation and update of Standard Operating Procedures

Ongoing Interactive Cargo Pilot Projects

Real-time cargo tracking for shipments requiring special handling

Visibility, tracking and alerts at the piece level

Smooth border crossing by data sharing and logistics transparency

Real-time tracking through a web platform compliant with ONE Record

Find all our pilot projects (pdf) at iata.org/interactive-cargo
Contact us at interactivecargo@iata.org if you wish to take part or propose your own pilot project.

Real-time cargo tracking for shipments requiring special handling

Pilot Description

- Track shipments requiring special handling, using Bluetooth Low-Energy (BLE) tags and sensors to capture real-time geolocation, temperature and humidity throughout the journey, except in-flight.
- Display the data in the carrier's platform and connect with supply chain actors using the One Record protocol.

Pilot Participants

- Shipper
- Freight Forwarder
- Airline
- Ground Handler
- Device Manufacturer
- IT Service Provider

CPSL
CATHAY PACIFIC SERVICES LTD

CATHAY PACIFIC CARGO

DESCARTES™

GLS HK
Global Logistics System (HK) Co., Ltd

Implementation roadmap

Identify participants DEC-20

Select airports and trade lanes DEC-20

Install receivers MAR-21

Monitor Shipments APR-21

Evaluate results JUN-21

Visibility, tracking and alerts at the piece level

Pilot Description

- Deploying OnAsset's SENTRY devices for consignment visibility and Sentinel BLE devices to extend the visibility to piece level on Air Canada Cargo shipments.
- Demonstrating autonomous delivery of in-shipment status messaging and sensor-based alerts with availability through OAInsight API. Also, to include CargoiQ milestone mirroring through AC Cargo facilities. Additionally, include the visibility and tracking of Unilode ULDs integrated with the OnAsset Sentinel BLE devices.

Pilot Participants

- Airline
- Ground Handler
- Device Manufacturer
- ULD Manufacturer

AIR CANADA CARGO

ONASSET INTELLIGENCE

unilode

Implementation roadmap

Deploy devices
JAN-21

Shipment tracking and alerts
APR-21

Evaluate results
JUN-21

Smooth border crossing by data sharing and logistics transparency

Pilot Description

- **Vedia is seeking One Record for air-road transport and especially focusing on IoT aspects and data sharing in multimodal logistics chains.**
  - Data collection from road transport via mobile app, IoT device and background systems
  - Data sharing between business and authorities
  - Data sharing between road and air transport
- Automated border crossing pilot between Norway and Finland is the first place where Vedia will adapt One Record
  - Data sharing between road transport, authorities and air cargo

Pilot Participants

Airline

IT Service Provider

Device Manufacturer

vedia CaaS

FINNAIR CARGO

FEDeRATED NETWORK OF PLATFORMS

Implementation roadmap

Vedia ONE Record server for border crossing pilot
Q1-21

Finland/Russia/China corridor collaboration
Q2-21

Real-time tracking through a web platform compliant with ONE Record

Pilot Description

The objectives of the pilot are to enable real-time tracking of shipments and validate the ONE Record data model for IoT devices:

- Visibility of tracking data for temperature-sensitive shipments using the ONE Record data model linking the air waybill and Cargo iQ events on a web platform.
- Display real-time information of temperature and geolocation information.
- Airport-to-airport (or door-to-door with freight forwarder participation).

Pilot Participants

Device Manufacturer
Freight Forwarder
Airline
IT Service Provider

SINGAPORE AIRLINES CARGO

CARGO COMMUNITY NETWORK

Implementation roadmap

Identify stakeholders
APR-21

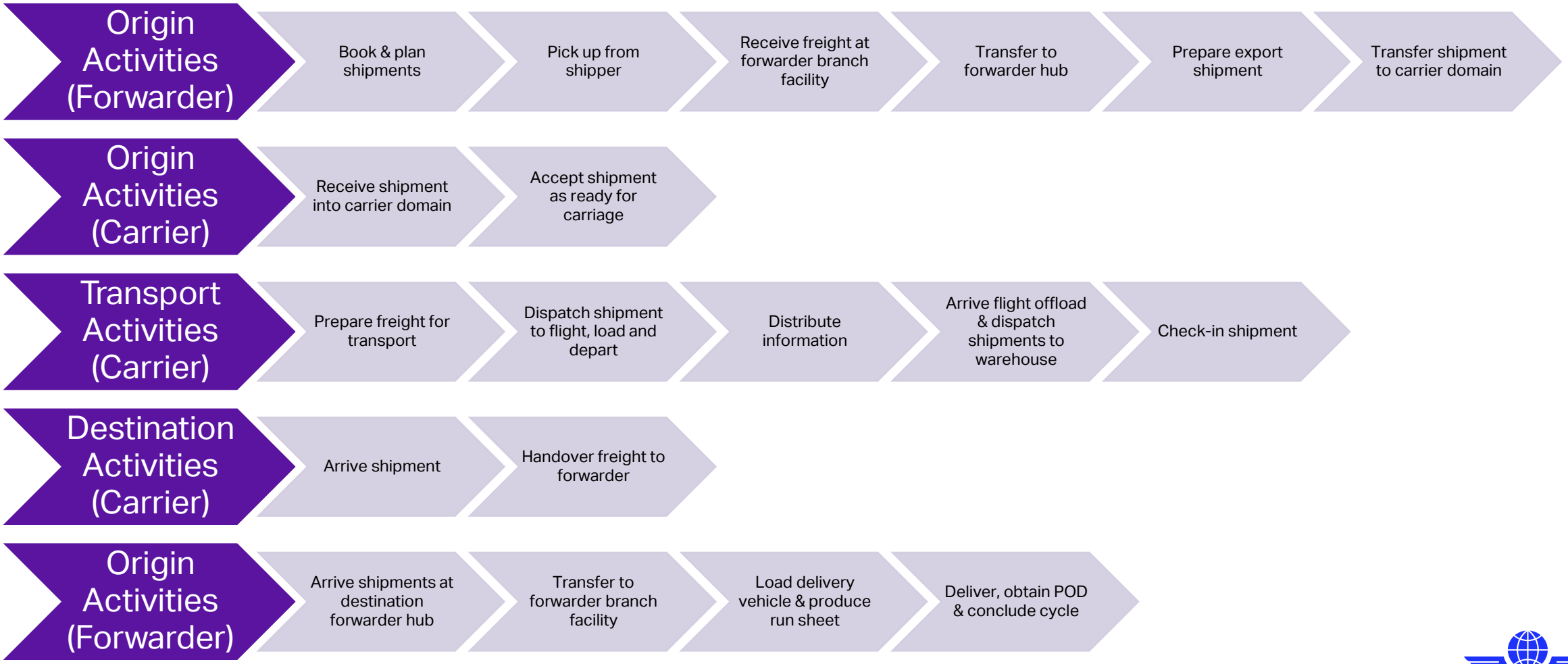
Interface data
JUN-21

Develop web platform
OCT-21

Test Proof of Concept
JAN-22

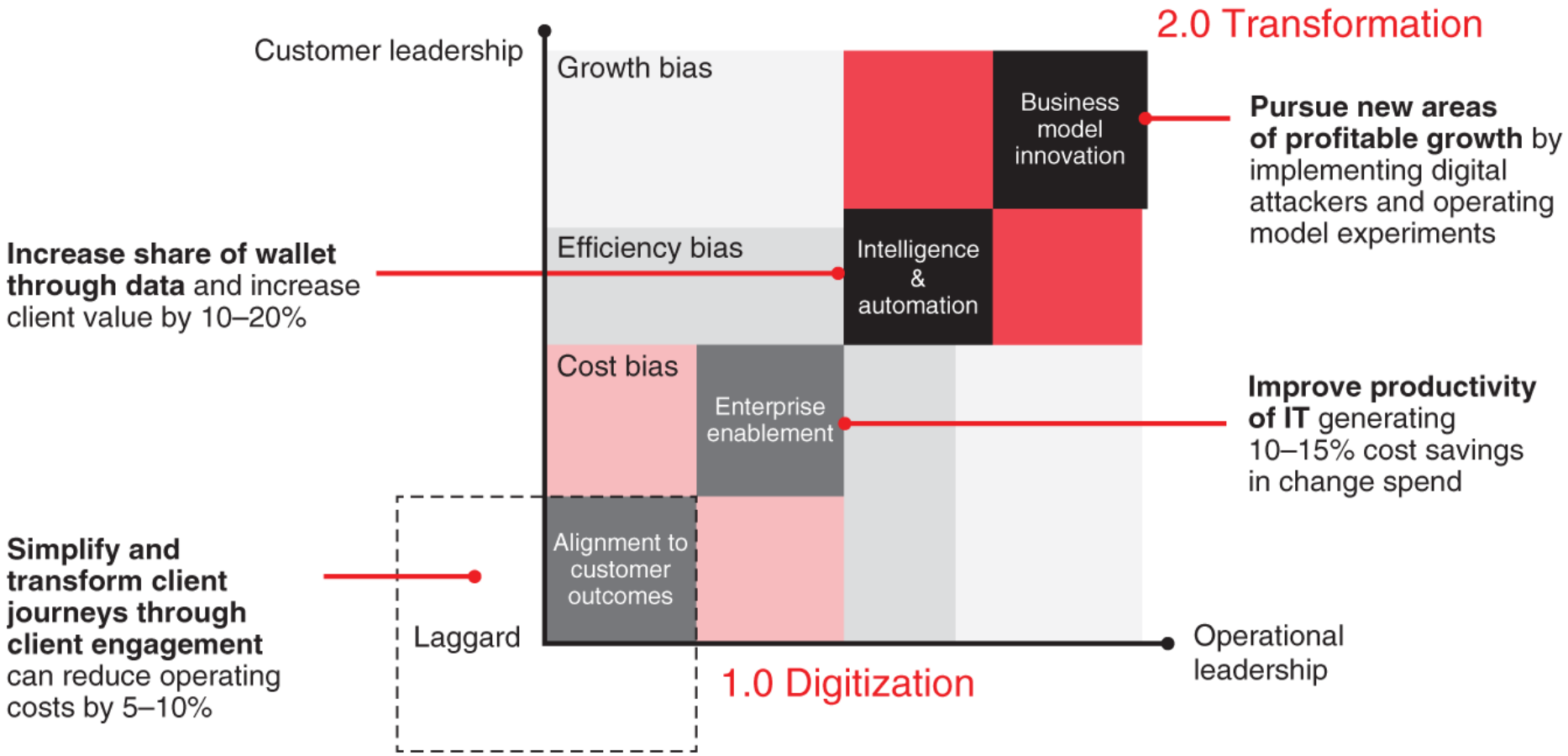
Completion
MAR-22

Updating the handling of interactive cargo



Source: IATA Air Cargo Industry Master Operating Plan

From *Now* to *Next*: Shaping a sustainable and digital future



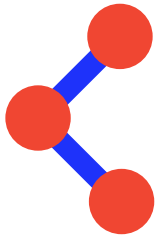
Vaz, Nigel. *Digital Business Transformation: How Established Companies Sustain Competitive Advantage From Now to Next*. 2021.

Key takeways

As the industry needs to embrace change to face the current and future business and regulatory challenges, these are our conviction about what will happen:

DIGITALIZATION

- Complete digitalization of the global supply chain will happen
- The Internet of Logistics is a likely scenario



AGILE SUPPLY CHAIN

- This will lead to new and dynamic supply chain configurations
- Speed and agility is key

REGULATORS & AUTHORITIES

- Regulators and authorities will get high visibility and transparency
- The focus will shift to intelligence & collaboration

Thank you

Sonia Ben Hamida
Project Manager Interactive Cargo
interactivecargo@iata.org
iata.org/interactive-cargo