

UNIVERSITY OF LIÈGE · EU CUSTOMS DIGITALISATION · INTRODUCTION

Setting the Scene

The Digital Transformation of Customs

Welcome. Before we open the machinery, one question for the whole day — *and why the world has made it unavoidable.*

Walter Van der Meiren Director, Customs Brokerage — UPS Europe

Collaborateur, Faculté de Droit · Université de Liège · 12 June 2026 · 09:00

Opening session of a six-module course on EU customs digitalisation.



Last week's takeaways



We mapped the disruption

From a stable B2B world to 5.8 bn fragmented low-value parcels.



We secured the border

AEO, ICS2, VAT, the Green Agenda and sanctions as the protective layer.



We followed enforcement

OLAF, EPPO and the cost of Member-State divergence.



We built the defences

A six-element model, representation, screening and competency.



We reached the reform

Five pillars and the 1 July 2026 turning point.



THE THREAD FOR THE WHOLE DAY

One question, six answers

“How does raw trade data become trusted, automated, and interoperable customs governance?”

Every session today answers one part of this question. **By the end of the day, you should be able to answer all of it — and to see the single thread that connects six very different experts.**

HOW TO LISTEN TODAY

You know the UCC and the new UCC. Today we connect that law to the machinery that delivers it. The logic runs *“the law requires X — here is how the technology makes X possible”*, never the other way round.



WHY NOW

The old model is breaking under its own success

Trade has changed shape. Customs was built for a world of relatively few, large consignments accompanied by documents. That world is gone.

5 bn+

low-value parcels enter the EU each year — on the Commission's figures

12 m+

arriving every single day, the vast majority low-value B2C e-commerce

1 July 2026

the €150 de minimis exemption is removed — every parcel becomes a customs event

THE CONSEQUENCE

A customs built on documents and desks cannot scale to billions of events. **The only viable answer is to govern by data — captured early, shared once, and assessed automatically.** Everything in today's course follows from that single pressure.



THE SHIFT IN ONE IDEA

From paper, to electronic, to data-driven

1

Paper

Forms, stamps and physical files. The document is the unit of customs.



2

Electronic

The same documents, digitised and transmitted. Faster — but still document-shaped.



3

Data-driven

A continuous supply-chain data flow, assessed in near real time. The declaration dissolves into data and events.

The conceptual core of the whole reform: the unit of customs moves from the document to the data element and the event. Hold that idea — every module is a consequence of it.



The EU is not acting alone

The EU reform is the regional expression of a worldwide movement toward data-driven, facilitative customs:



WCO

World Customs Organization

SAFE Framework, Revised Kyoto Convention and the WCO Data Model. The 2025–2028 Strategic Plan puts technology, e-commerce and green customs first.



WTO

Trade Facilitation Agreement

In force since 2017: single window, risk management, advance rulings and paperless trade as binding commitments.



OECD

Evidence & indicators

Trade Facilitation Indicators and analysis of the digital economy and low-value e-commerce flows that shape the debate.

The WCO's 2026 theme says it plainly: *“Customs protecting society through vigilance and commitment.”* Protection at this scale is only possible through data and advance information — exactly the capability the EU reform is building.



THE EU'S ANSWER

The Customs Reform — the spine of today

From the 2023 Commission proposal to the **political agreement of 26 March 2026** — the most significant overhaul of EU customs law since 1968. Its aim: a Customs Union that is at once **simpler and stronger**.

EU Customs Data Hub

One shared digital environment — give data once, re-use it everywhere.

EU Customs Authority

The body that builds, operates and governs the Hub and EU-level risk.

A tailor-made e-commerce regime

Rules fit for billions of low-value parcels, not just containers.

The deemed importer

Platforms and sellers — not the consumer — carry the customs obligations.

This reform is the spine of the course. Modules 1 to 5 each take one part of it apart; Module 6 puts it back together.



The UCC and its Work Programme

THE LAW SAYS: GO ELECTRONIC

The Union Customs Code

Regulation (EU) No 952/2013

Mandates that all exchanges between customs and economic operators take place electronically, on harmonised, reusable data.



THE WORK PROGRAMME SAYS: HERE IS THE BUILD ORDER

The UCC Work Programme

the legal-technical roadmap

Sequences the EU IT systems and their deadlines — ICS2, AES, AIS, NCTS Phase 6 and the rest — turning the legal obligation into running infrastructure.

This is the bridge from law to machinery — and the hand-off to Module 2. The law requires electronic, data-based customs; the Work Programme is how the EU actually builds it.

WHAT IS ACTUALLY CHANGING

Three forces reshaping customs

Underneath the legislation, three technological forces are doing the real work — and they run through every module today:



Data analytics

From manual selection to risk scoring and AI. Intelligence is drawn from the data itself — the subject of Module 3.



Interconnectivity

Systems and authorities that talk to each other. The single data set, re-used — Modules 1, 2 and 4.



Automation

Straight-through, event-based processing. People where judgement is needed; machines for the rest.

Keep these three in view. Every speaker today is, in the end, talking about analytics, interconnectivity or automation — or how the law governs them.



WHY IT MATTERS

Three missions, changed at once

Digitalisation is not an end in itself. It reshapes the three things customs exists to do — and the reform is judged on all three together:



Compliance

Data quality becomes a precondition of clearance, and obligations move earlier — onto platforms, via the deemed importer.



Enforcement

Risk-based, real-time and at EU level — better protection of the Single Market and society.



Trade facilitation

Give data once; faster, more predictable clearance for the compliant. Trust is rewarded with simplicity.

The balance is the whole point. A reform that strengthens enforcement but burdens legitimate trade — or vice versa — has failed. The art is doing both at once.



A LENS FOR THE DAY

What “good” looks like — six pillars

As each module presents a piece of the reform, it is worth asking what it is for. The Vilnius Manifesto (2025) offers a useful scorecard — six pillars of a modern Customs Union:

1

Unified

one Union acting as one at the border

2

Cooperative

authorities and trade working together

3

Simplified

lower burden, clearer procedures

4

Digitised

data-driven by default

5

Resilient

robust to shocks and volumes

6

Professionally competent

skilled people, modern tools

A simple habit for today: *after each module, ask which of these six pillars it advances — and which it leaves unfinished.*

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Setting the Scene

Use Case: From Broken Networks to Trusted Networks

A new Architecture for Global Trade

Based on Keynote Speech by Evan Smith – April 2026





A \$150 MILLION WAKE-UP CALL

47 shipments. One broken system.

A respected American retailer imported the same staple product, from the same supplier, year after year — until it was detained under the US forced-labour law.

47

shipments detained in a row — the same facts proven over and over.

\$150 m

in detention costs, delays and legal fees for a single importer.

Months

to release each shipment — every time, the goods were ultimately cleared.

THE REAL PROBLEM

This was not a bad actor — it was a responsible company doing things by the book. **The customs process simply had no channel to share a product's credentials. The system was broken, not the company. We return to this case — and the system built to fix it — in Module 5.**



From interrogation to pre-validation

1

Map & gather

Map the value chain, engage suppliers, gather the data and documentation.



2

Package it

Bundle it all into one shared digital format — a Digital Product Passport.



3

Pre-validate & flow

Share it with customs before goods ship.
Detentions stop; trade flows.

The result: pre-validation replaced interrogation, trust replaced suspicion — and the trusted network grew, upstream to cotton and downstream to other brands. Module 5 shows how.



Two paradigm shifts, at once

THE OLD ORDER IS COLLAPSING

Globalisation 1.0

- Outsourced, opaque supply chains
- Just-in-time, lowest-cost sourcing
- Built for a world that no longer exists

AI CHANGES WHAT'S POSSIBLE

A technological breakthrough

- The most rapid technological revolution in history
- It destroys old ways of working
- It frees us — and compels us — to design a better system — the arc Modules 2 and 3 trace for the EU



THE PROBLEM TO SOLVE

Three contradictions in modern trade

1

Security vs. prosperity

Voters demand maximum security and maximum prosperity at the same time.



2

Shipments vs. networks

Customs screens a shipment at the border; modern laws target whole networks.



3

Sharing vs. sovereignty

The need to share intelligence collides with demands for data and AI sovereignty.

The generational question:

how do we get more enforcement, more sovereignty, more collaboration and more trade — all at the same time? Module 6 returns to it.

Network-shaped laws at the border

Customs was built to screen a shipment as it reaches the border — not to manage transnational networks. Yet today's laws are network-shaped.

UFLPA

FORCED LABOUR

Provenance of inputs back to their origin (19 U.S.C. § 1307).

Tariffs

UNITED STATES

Shifting duties tied to origin and ownership.

CBAM

EU CARBON

Embedded emissions across the value chain (Reg (EU) 2023/956).

Minerals

CRITICAL / CHINA

Licensing across critical-mineral networks.

Old logic breaks down: “trust the company, trust its shipments” no longer holds — these laws care about the network behind the goods. Modules 4–5 show how data meets them at the border.



THE ANSWER

Trusted trade, reimagined

1

Built on networks

Screen and pre-validate entire value chains — not single shipments.

2

Powered by AI

Map and screen networks, and translate compliance across jurisdictions.

3

Public + private

One shared network across businesses, logistics providers and governments.

The product passport becomes a “Global Entry for goods”: shared, screened and approved across multiple customs authorities at once. The EU analogue: Trust & Check (Art. 25 nUCC) — Module 3.



A federated public-private network

1

Hub-and-spoke

A federated network connected by product passports — not a central database.

2

Local & sovereign

Each nation keeps absolute control of its data, technology and borders.

3

Shared intelligence

AI learns across the network without ever pooling the data.

The skeleton key: federated data plus AI delivers shared intelligence without compromising sovereignty. Compare the EU: federated systems (Module 2), one Data Hub (Module 3; Arts 29–37 nUCC).



One network, three roles

1

Importers

Map the value chain to raw materials; AI surfaces risk and automates workflows — teams work 8× faster, by exception.

2

Governments

CBP reviews the supply chain before goods ship; AI screens; the passport reaches pre-validated status. Audits in minutes, not months.

3

Logistics

Maersk, FedEx, UPS and Kuehne+Nagel become stewards of the network — cleansing risk at booking, feeding screened data into customs.



WHAT THE AI DOES

Risk detection across multi-tier chains

The same network powers continuous, AI-driven compliance — not a snapshot at the border, but a live view across every tier. Module 5 takes this engine apart.

1 Forced-labour screening

UFLPA — trace inputs to their origin.

2 Sanctions compliance

Screen ownership and counterparties.

3 Tariff & classification

Manage volatility, duties and HS codes.

4 Export controls

Flag controlled goods and destinations.

5 Anomaly detection

Surface the unexpected across tiers.

6 Continuous monitoring

Watch the whole network, live.



BEYOND AI

Traceability & emerging tech

WHAT TRACEABILITY DEMANDS

Network-shaped regulation

- CBAM — embedded carbon across the chain (Reg (EU) 2023/956)
- Deforestation-free products (EUDR, Reg (EU) 2023/1115)
- Forced-labour rules — provenance to source
- All require visibility end to end

THE EMERGING TOOLKIT

More than one technology

- Digital Product Passports as the data backbone (ESPR, Reg (EU) 2024/1781)
- IoT for real-time, verifiable provenance
- Blockchain explored for tamper-evident records
- Interoperability with the EU Customs Data Space

A balanced view:

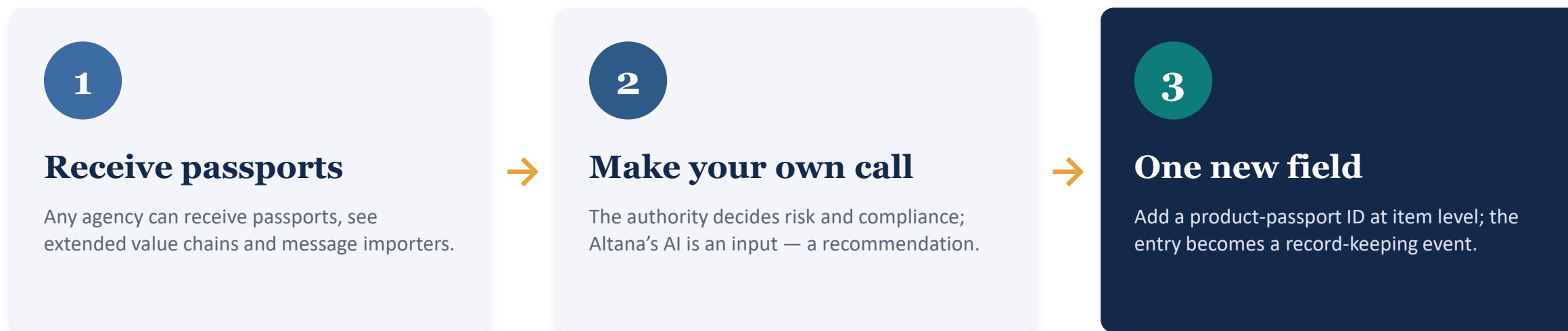
Focus on AI and federated data rather than blockchain alone — but all of it points the same way: provenance, end to end. Modules 4 and 5 pick up these threads.



SCALING GLOBALLY

The Altana Passport Manager

The missing piece for global trusted trade is customs-authority adoption — so any government can join the network on its own terms.



“Global Entry for goods”: a bridge from the private sector into customs, with a sovereign instance for every nation. Module 5 demonstrates the platform.



The hard questions



Public-private collaboration

Network challenges demand network solutions — regulators and industry on one system.



Privacy by design

Federated data, no central pooling; each nation keeps control of its own (Reg (EU) 2016/679).



Algorithmic accountability

AI recommends; authorities decide. The human stays in the loop (cf. Reg (EU) 2024/1689).



Cross-border data sharing

Shared intelligence across borders, with sovereignty kept intact — Module 6 debates these.



THE INVITATION

WHAT AI SHOWS

- Regulate networks, not just shipments
- AI + federation reconcile sharing with sovereignty
- Product passports as a “Global Entry for goods”
- Security and prosperity can coexist

FOR EU CUSTOMS

Build the network

The **EU Customs Data Hub** is the chance to do this at Union scale — federated, AI-powered, and shared across the public and private sectors. Six modules, one story — let’s begin.

“Network challenges demand network solutions. The era of trusted networks begins now.”



THE DAY AHEAD

Six modules, one story

M1

Noha Bayoumi

The common language

What is the shared data? — the EU Customs Data Model.

M2

Jérôme Lorig

Where it lives & flows

The IT architecture — ICS2, AES, AIS, NCTS Phase 6.

M3

Walter Van der Meiren

Who learns from it

The EU Customs Data Hub — data into intelligence.

M4

Frank Janssens

Beyond customs

Single Window & CERTEX — all border authorities.

M5

Scott Friedman

Private innovation

AI, Altana and Product Passports — the commercial mirror.

M6

Frank Heijmann

Bringing it together

Mapping one real process across every layer.

Each module hands something to the next. Follow the thread and the day reads as one argument, not six talks.



THREE IDEAS TO TRACK

Listen for these all day

1

Trust

The ability to predict compliant behaviour from verified data — about an operator, a shipment or a supply chain — in order to focus enforcement where risk is highest.

2

Single submission

Give the data once; re-use it many times. The principle that makes interoperability, the Single Window and Product Passports possible.

3

The public / private tension

Especially on AI: where should public infrastructure end and private innovation begin? Modules 3 and 5 deliberately take opposite sides.



ONE PARCEL, ALL DAY

The thread we will follow to the very end



The shared scenario: a B2C e-commerce parcel (distance sale), originating outside the EU, entering through a consolidation hub at Charles-de-Gaulle, Paris, with final destination Eindhoven, Netherlands — under the legislation applicable from 1 July 2026.

The same parcel will reappear in every module — and we will map its whole journey in Module 6:

M1

Which data fields are required, and how are they harmonised?

M2

Which systems handle it — ICS2, AIS — and how do they interact?

M3

How is it risk-profiled? What triggers a flag?

M4

Does it trigger non-customs formalities — health, safety, CITES?

M5

Could AI or a Product Passport have pre-cleared it before arrival?

M6

Where are the integration points, the pain points, the opportunities?



LET'S BEGIN

Over to Module 1

WHAT THIS INTRODUCTION ESTABLISHED

- Scale has broken the document-based model
- Customs is shifting from documents to data and events
- The EU reform sits inside a global, WCO-led current
- The UCC Work Programme turns that law into systems



MODULE 1 — NOHA BAYOUMI

The EU Customs Data Model

We have the shift to data — now the first structural question: **what is the common data language every system must share?** That is where we begin.

“How does raw trade data become trusted, automated, and interoperable customs governance?”

The EU Customs Data Model

The foundation of data exchange in EU customs

The common language that lets every customs system understand the same data — and the principle of submitting it only once.

Noha Bayoumi Senior Team Lead, Customs & Security — CHAMP Cargosystems

University of Liège guest lecture · 12 June 2026



YOUR SPEAKER FOR THIS MODULE

Noha Bayoumi



Senior Team Lead, TGC

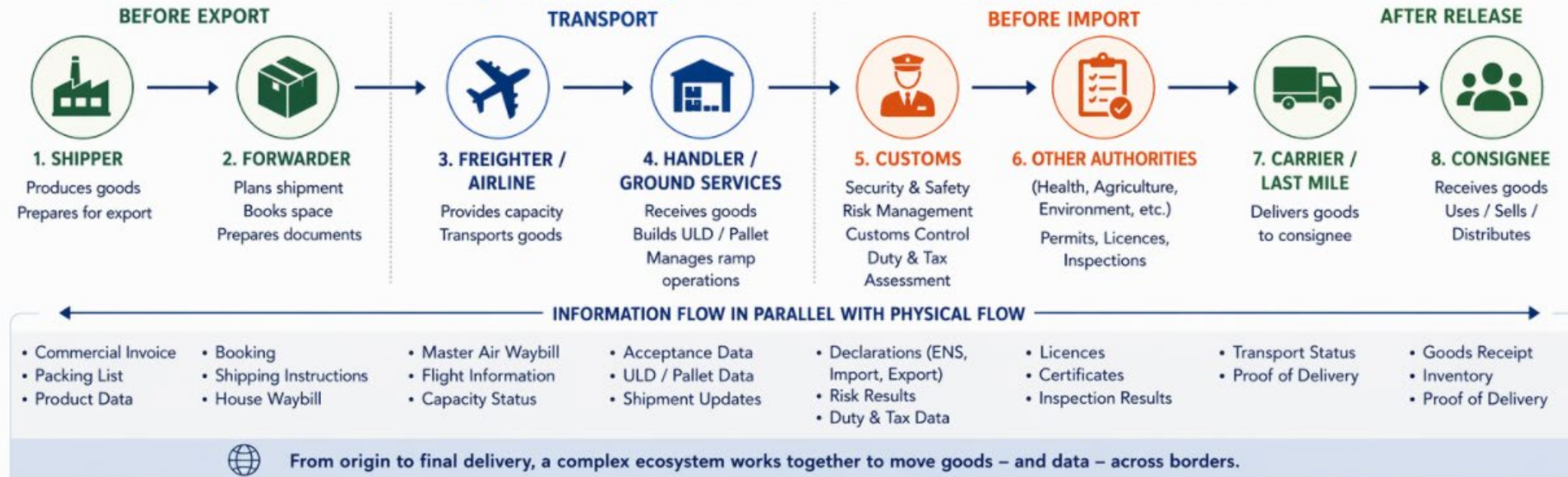
CHAMP Cargosystems

ABOUT

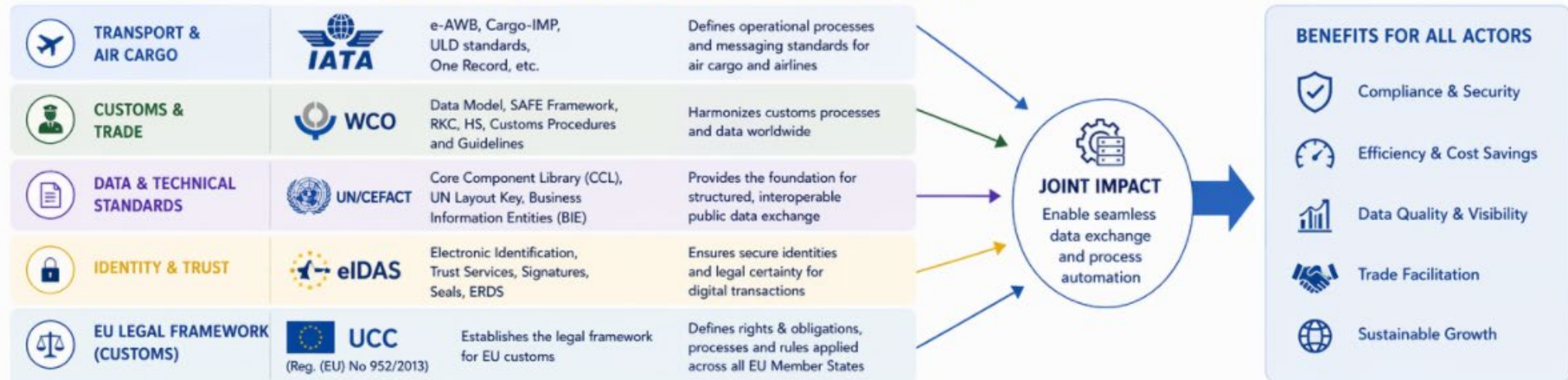
Noha Bayoumi is Senior Team Lead at CHAMP Cargosystems, specialising in customs system integration and data exchange between airlines and customs authorities. She plays a key role in implementing EU initiatives such as ICS2 and Single Window environments, ensuring interoperability and compliance across multiple jurisdictions. Her expertise lies in operationalising customs IT requirements and enabling seamless data flows across the air cargo ecosystem.

THE GLOBAL TRADE & SUPPLY CHAIN LIFECYCLE

Many actors – Many handoffs – One flow of goods and information



WHERE STANDARDS & LEGAL FRAMEWORKS FIT IN





It starts with the UCC

The Union Customs Code is the EU's customs constitution — it requires customs to be digital and data to be harmonised.



In short: the data model, ICS2 and single submission all exist because this law requires them.



THE PROBLEM IT SOLVES

Why a Customs Data Model?

THE PROBLEM

The same data, again and again

- Many declarations: ENS (ICS2), import/export (DECO), transit, security, duty & tax
- The same data resubmitted in different formats
- No standardisation; data inconsistencies
- High integration and compliance costs; weaker risk analysis

THE OBJECTIVE

Harmonise it, once

- One harmonised structure across all customs processes
- Reusable across systems and messages
- Consistent, higher-quality data
- Stronger basis for risk analysis



THE CONCEPT

What is a Customs Data Model?

A structured, standardised set of data elements used across customs processes and systems.

1

Common vocabulary

Shared terms — Consignor, Consignee, HS Code — meaning the same thing everywhere.

2

Standardised structure

Defined datasets, data elements and attributes.

3

Reusable

The same elements reused across systems and messages.



THE GLOBAL STANDARD

Built on the WCO Data Model

The EU CDM is based on the World Customs Organization Data Model — the global standard for customs data.

CORE PRINCIPLES

Why it works globally

- Data harmonisation
- Interoperability between systems
- Standard message structures

COMPONENTS

What it provides

- Data elements
- Business processes
- Information packages
- Message implementation guidelines



The EU Customs Data Model

1

Purpose

Fulfil the UCC and enable a fully electronic customs environment.

2

Scope

All processes: ENS (ICS2), import/export (DECO), transit and operators' data.

3

Key principle

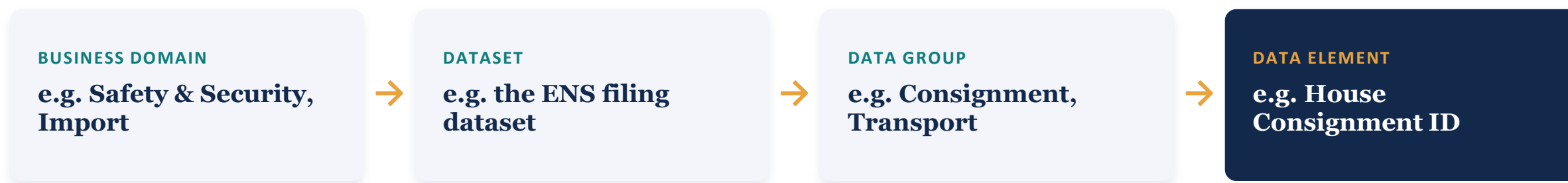
Single Data Submission — provide it once, reuse it everywhere.



HOW IT'S BUILT

The structure of the Data Model

The model is a hierarchy — from broad business domain down to the individual data element.



EXAMPLE — AN ENS FILING

ENS Filing → Consignment → House Consignment → Consignee & Consignor details → HS code & goods description.



Annex A & Annex B — where the data is written down

Art. 6(2) UCC empowers the Commission to lay down common data requirements. It does so in two annexes — each kept, in parallel, in the Delegated and the Implementing Act.

ANNEX A — APPLICATIONS & DECISIONS

The data behind authorisations

- Common data requirements for applications and decisions — AEO, BTI, guarantees, simplifications, special procedures
- UCC-DA (Reg (EU) 2015/2446), Art. 2 & Annex A — which data elements each application or decision requires
- UCC-IA (Reg (EU) 2015/2447), Art. 2 & Annex A — the formats and codes for those elements
- Operationalised in the Customs Decisions System (CDS)
- **Function:** one harmonised application file, understood by every Member State and every authority

ANNEX B — DECLARATIONS & NOTIFICATIONS

The data behind every filing

- Common data requirements for declarations, notifications and proof of Union status — ENS, temporary storage, import, export, transit
- UCC-DA, Art. 2 & Annex B — which data, per process (recast by Reg (EU) 2021/234)
- UCC-IA, Art. 2 & Annex B — formats, codes & cardinality (recast by Reg (EU) 2021/235)
- Published technically as the EUCDM — the EU Customs Data Model
- **Function:** one column = one dataset — the complete data grammar of a filing

How they divide the work: the DA annex defines WHAT data is required; the IA annex defines HOW it must look — format, codes, cardinality. Same annex letter, two acts, one model.



Using the annexes — pick the column, get the dataset

Annex B holds one table: a row per data element (groups 11–99), a column per process. The column you file under is your dataset — three worked examples.

ICS2 — ENS, AIR

Pre-loading & pre-arrival

- **Pre-loading (PLACI minimum):** column F24, or F23 + F25 — F32 for express consignments
- **Pre-arrival:** F21 master + F22 / F26 house filings — or one complete filing (F20 / F28)
- **Other modes:** maritime F1x · express F3x · postal F4x · road F50 · rail F51
- **Legal:** Arts 127–128 UCC; deadlines Arts 105–111 UCC-DA; datasets Annex B UCC-DA/IA

H7 — LOW-VALUE CONSIGNMENTS

Super-reduced dataset

- **Use:** release for free circulation of low-value distance-sale consignments — Art. 143a UCC-DA (inserted by Reg (EU) 2019/1143)
- **Dataset:** HS6 commodity code, intrinsic value, consignor / consignee, IOSS number where applicable
- **From 1 Jul 2026:** de minimis relief removed — EUR 3 flat duty per item (Reg (EU) 2026/382); H7 conditions adapted accordingly

H1 — STANDARD IMPORT

The full dataset

- **Use:** standard declaration for release for free circulation and end-use — Arts 158 & 162 UCC
- **Dataset:** full commodity code (CN8 / TARIC), valuation (group 14), parties (13), documents (12), transport (19)
- **When:** whenever H7 conditions are not met — restricted goods, special procedures, full duty & VAT calculation

The method in one line: find your process → find its column → the cells marked A / B / C are your dataset — then Annex B UCC-IA gives each element's format and codes.



THE KEY PRINCIPLE

Submit once, reuse everywhere

1

The concept

Economic operators provide data once; it is reused across multiple processes.

2

An example

Consignee details given in the ENS (ICS2) are reused in the import declaration.

3

The benefits

Less duplication, better data quality and faster processing.

The link: Single Data Submission is what the Customs Data Model makes possible.



CLEARING UP A MYTH

What “submit once” really means

IT DOES NOT MEAN

Only one message, ever

- There is still more than one message
- Each process still has its own filing
- “Once” is about the data — not the messages

IT DOES MEAN

No re-typing, no duplication

- Data is entered once, never re-typed
- It is shared and reused across systems
- Later filings reference what was already submitted



WORKED EXAMPLE

Data reuse in practice

1

Airline files ENS

Pre-arrival: consignor / consignee, goods description and HS code are submitted.

2

Data is captured

The customs system stores it against a reference (the MRN).

3

GHA references it

For the TSD and PN, the GHA sends the MRN — no resubmission of details.

Seen in practice: the Czech ENS and PNTS reporting flow shows exactly this reuse.

Example from CZ ENS and PNTS reporting

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <IE3F29 xmlns:pl="urn:wco:datamodel:eu:ics2:2" xmlns:b="http://www.champ.aero/broker" xmlns:xsi=
3 <pl:LRN>LYDELY260609114470607</pl:LRN>
4 <pl:documentIssueDate>
5 <pl:DateTime>2026-06-09T06:56:10Z</pl:DateTime>
6 </pl:documentIssueDate>
7 <pl:SpecificCircumstanceIndicator>F29</pl:SpecificCircumstanceIndicator>
8 <pl:reEntryIndicator>0</pl:reEntryIndicator>
9 <pl:splitConsignment>
10 <pl:splitConsignmentIndicator>0</pl:splitConsignmentIndicator>
11 </pl:splitConsignment>
12 <pl:activeBorderTransportMeans>
13 <pl:ModeOfTransport>4</pl:ModeOfTransport>
14 <pl:actualDateAndTimeOfDeparture>
15 <pl:DateTime>2026-06-09T06:06:00Z</pl:DateTime>
16 </pl:actualDateAndTimeOfDeparture>
17 <pl:estimatedDateAndTimeOfArrival>
18 <pl:DateTime>2026-06-09T10:51:00Z</pl:DateTime>
19 </pl:estimatedDateAndTimeOfArrival>
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21 <pl:countriesOfRoutingOfMeansOfTransport>
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36 <pl:country>IL</pl:country>
37 <pl:street>TLV AIRPORT</pl:street>
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39 <pl:number>0</pl:number>
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41 </pl:carrier>
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47 </pl:placeOfAcceptance>
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49 <pl:name>CARGO PARTNER CR S R O</pl:name>
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51 <pl:address>
52 <pl:city>PRAHA</pl:city>
53 <pl:country>CZ</pl:country>
54 <pl:street>P O BOX 20 AIRPORT AVIATICK 1048</pl:street>
55 <pl:postCode>1048</pl:postCode>
56 </pl:address>
57 </pl:consignee>
58 <pl:goodsItem>
59 <pl:goodsItemNumber>1</pl:goodsItemNumber>
60 <pl:commodity>
61 <pl:descriptionOfGoods>HCA NIC ADAPTER</pl:descriptionOfGoods>
62 <pl:commodityCode>
63 <pl:harmonizedSystemSubHeadingCode>847160</pl:harmonizedSystemSubHeadingCode>
64 </pl:commodityCode>
65 </pl:commodity>
66 <pl:weight>
67 <pl:grossMass>96.0</pl:grossMass>
68 </pl:weight>
69 <pl:packaging>
70 <pl:shippingMarks>Package</pl:shippingMarks>
```

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <IE3R01 xmlns="urn:wco:datamodel:eu:ics2:2">
3 <LRN>LYDELY260609114470607</LRN>
4 <MRN>26CZ02000SXED5AT7</MRN>
5 <registrationDate>
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7 </registrationDate>
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9 <declarant>
10 <identificationNumber>DE464972358340831</identificationNu
11 </declarant>
12 <customsOfficeOfFirstEntry>
13 <referenceNumber>CZ521060</referenceNumber>
14 </customsOfficeOfFirstEntry>
15 </IE3R01>
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```

Example from CZ EN and PNTS reporting (Cont'd)

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ICS2 architecture & trader interfaces

The trader interfaces feed a central repository that links filings, drives risk management and connects the Member States.

1

Interfaces → CR

The STI / NTI trader interfaces connect to the Common Repository, which manages the ENS lifecycle, links filings (PLACI, complete ENS, updates) and orchestrates risk.

2

CR ↔ Member States

The CR talks to the National Entry Systems over CCN2ng — secure, standardised exchange between the EU hub and national authorities.

3

Security & delivery

UUM&DS for identity and access; CEF eDelivery, eIDAS and AS4 access points (run by the operator or an ITSP) for trusted exchange.



THE PLUMBING

ICS2 architecture & trader interfaces

Technical Integration

System-to-System

Based on **CEF eDelivery building block**

Aligned with **eIDAS regulation**

ERDS – Electronic Registered Delivery Service

Key Technology

Secure exchange backbone

AS4 Access Points that guarantee:

- ▶ Secure message exchange
- ▶ Traceability and non-repudiation

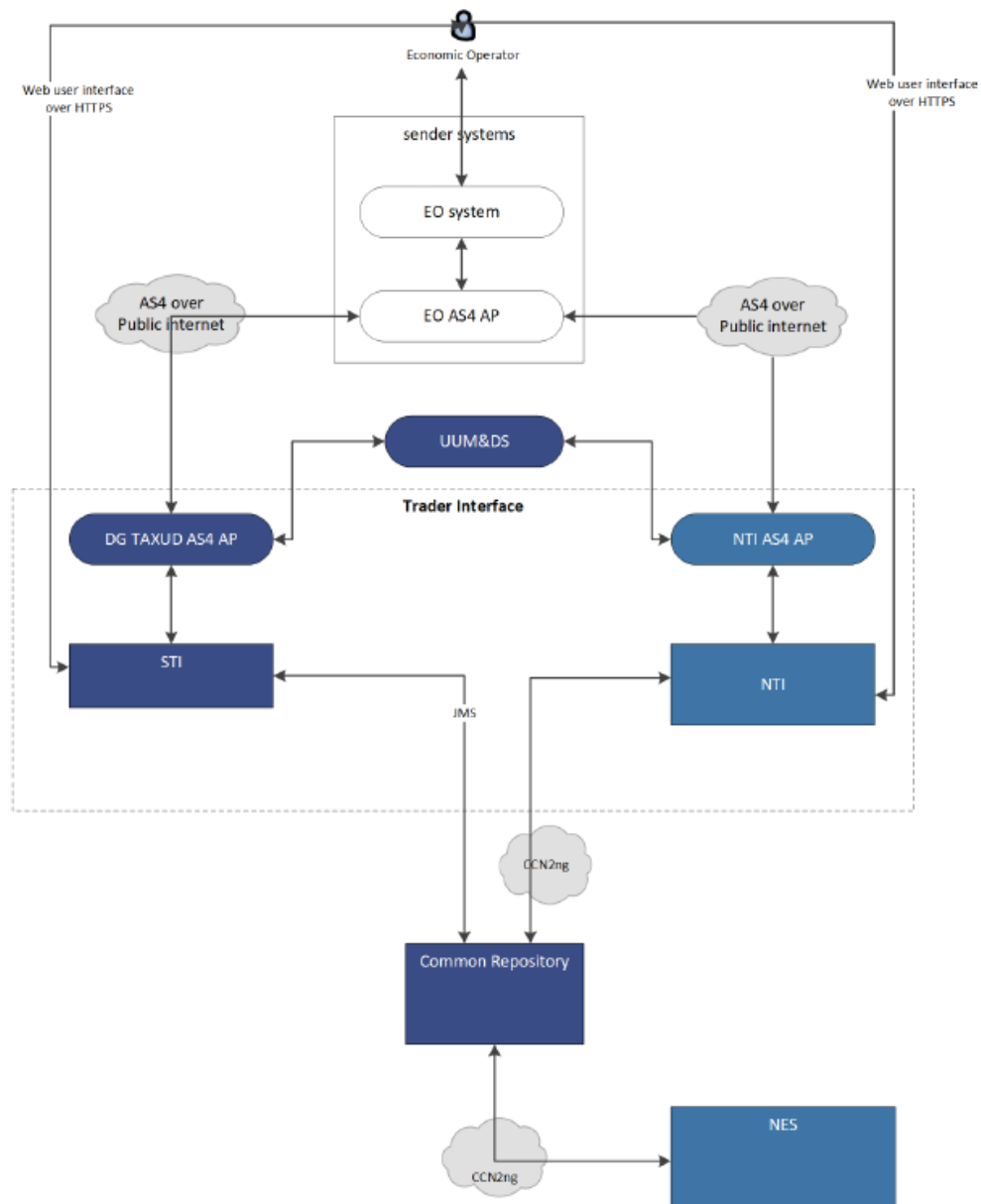
Operational Setup

Flexible deployment options

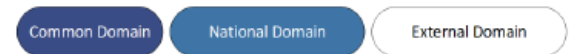
AS4 Access Points can be:

- ▶ Operated **directly by the Economic Operator**
- ▶ Provided by an **IT Service Provider (ITSP)** as a managed service

Flexible model to support different business sizes



Legend :





Not Just Air — also for Sea

Same as EU CDM, EMSWe is in place to apply harmonized rules for the provision of the information that is required for port calls, by ensuring that the same data sets can be reported to each Maritime National Single Window in the same way.

Principle	Air	Maritime
Single Data Submission	✓	✓
Harmonised Data Model	EU CDM	EMSWe Data Set
Central Coordination	ICS2 CR	SafeSeaNet
System-to-System	AS4/eDelivery	RIM
Legal Basis	UCC	Reg. 2019/1239



WHY IT MATTERS

The impact of digitalisation

1

Compliance

EU CDM standardisation, automated validation, single submission — fewer errors, higher quality.



2

Enforcement

Pre-loading risk analysis (ICS2), a central risk engine (CRMS2) and targeted controls — smarter, risk-based.



3

Trade facilitation

System-to-system integration and data reuse — faster, more predictable flows.



THE PAYOFF

Benefits for everyone



For authorities

Better risk assessment, improved data quality and cross-border data sharing.



For economic operators

Less administrative burden, fewer errors and faster clearance.



For IT systems

Easier integration and reusable data structures.



Applicable UCC recitals & articles

The EU Customs Data Model rests on the Code's electronic-data principle and its common data requirements.

IN THE CODE — REG (EU) 952/2013

Recitals & articles

- Recital (17) — a paperless environment; all customs transactions handled electronically
- Recital (18) — delegated power for common data requirements
- Art. 6(1) — exchange & storage of information by electronic data-processing
- Art. 6(2) — common data requirements: the legal hook for the EU CDM
- Art. 6(3)–(4) — limited exceptions and derogations
- Arts. 127–128 — ENS particulars & risk analysis (the ICS2 dataset)

IN THE IMPLEMENTING & DELEGATED ACTS

Where the data is defined

- UCC-DA (Reg 2015/2446) — Art. 2 & Annex B: data requirements
- UCC-IA (Reg 2015/2447) — Art. 2 & Annexes A–B: formats & codes (EUCDM)
- Reg (EU) 2021/234 & 2021/235 — the recast Annex B (data · formats & codes)
- Reg (EU) 2019/1143 — Art. 143a UCC-DA: the H7 dataset
- Reg (EU) 2025/512 — technical arrangements (repeals Reg 2023/1070)
- Reg (EU) 2016/341 — transitional data rules (TDA)



THANK YOU

Questions & discussion

WHAT THIS MODULE ESTABLISHED

- The data model is the common customs language
- Built on the WCO Data Model, required by the UCC
- Single submission: enter once, reuse everywhere
- It is the data layer beneath ICS2 and every system

NEXT — THE WORK PROGRAMME

From data language to systems

We now have the common **data language**. Next: the **UCC Work Programme** and the IT architecture that turn it into running systems (Module 2) — then Module 3 shows where the model will live: the EU Customs Data Hub (Art. 36 nUCC).

“Get the data right, and every system above it can finally understand the same thing.”

UNIVERSITY OF LIÈGE · EU CUSTOMS DIGITALISATION · GUEST LECTURE

The UCC Work Programme

The IT Architecture of the Customs Union

How the European Union is building a digital customs ecosystem — the legal roadmap, the systems it defines, and how they connect.

Jérôme Lorig Head of Product Regulatory Compliance — CHAMP Cargosystems S.A.

University of Liège guest lecture · 12 June 2026 · jerome.lorig@champ.aero



YOUR SPEAKER FOR THIS MODULE

Jérôme Lorig



Head of Product Regulatory Compliance

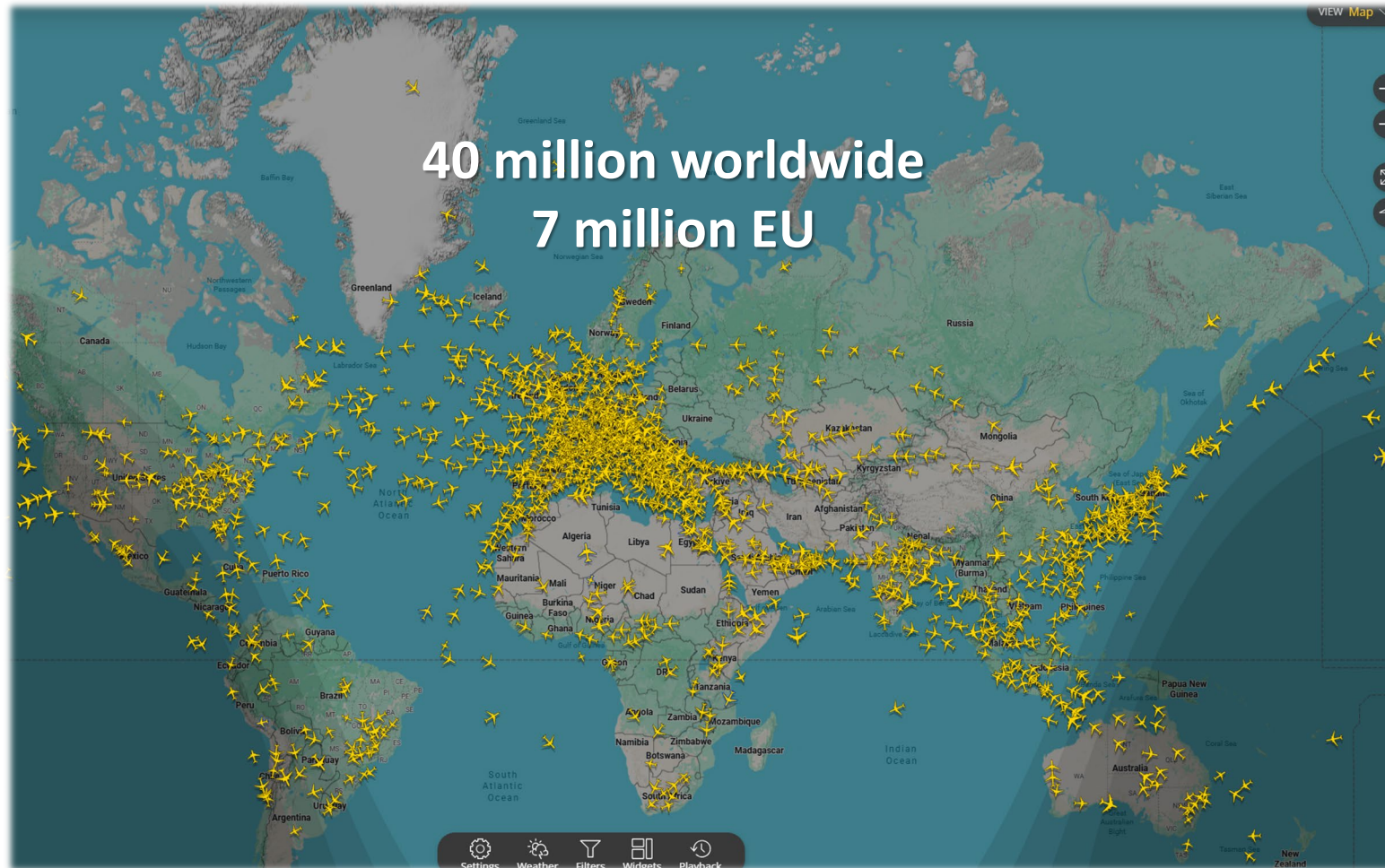
CHAMP Cargosystems · Luxembourg

ABOUT

Jérôme Lorig is Head of Product Regulatory Compliance at CHAMP Cargosystems, where he leads regulatory alignment of air cargo IT solutions with global customs requirements. Based in Luxembourg, he specialises in translating regulatory developments into scalable IT system solutions, supporting airlines and logistics stakeholders. His work focuses on customs digitalisation, data exchange, and initiatives such as ICS2 and cross-border data integration.

Question

- How many flights are there worldwide per year. ?
- How many flights into / out of the EU per year?





WHY IT MATTERS

Why customs IT matters

Customs delivers security, trade facilitation, revenue and compliance at once — and the volumes are vast.

2 bn+

customs declarations processed every year across the European Union.

40 m

commercial flights worldwide each year carrying goods across borders.

7 m

flights into or out of the EU each year — every one a customs event.

THE POINT

Digital systems identify high-risk shipments while facilitating legitimate trade. **At this scale, only IT can do the job — e-commerce has multiplied the volume, and businesses gain faster, more predictable clearance in return.**



From paper, to electronic, to data-driven

1

Before — paper

Paper declarations, manual checks and limited information sharing between authorities.

2

Now — electronic

Electronic declarations, automated validation and real-time communication.

3

Next — data-driven

AI-supported controls, predictive analytics and the EU Customs Data Hub.

The UCC objectives drive the shift: harmonisation, simplification, digitalisation and security.



The Union Customs Code (UCC)

The UCC is the primary legal framework governing customs procedures across the EU — in force since May 2016.

BEFORE THE UCC

Fragmented & paper-based

- Different national practices across Member States
- Paper-based procedures and manual processing
- Limited interoperability between systems

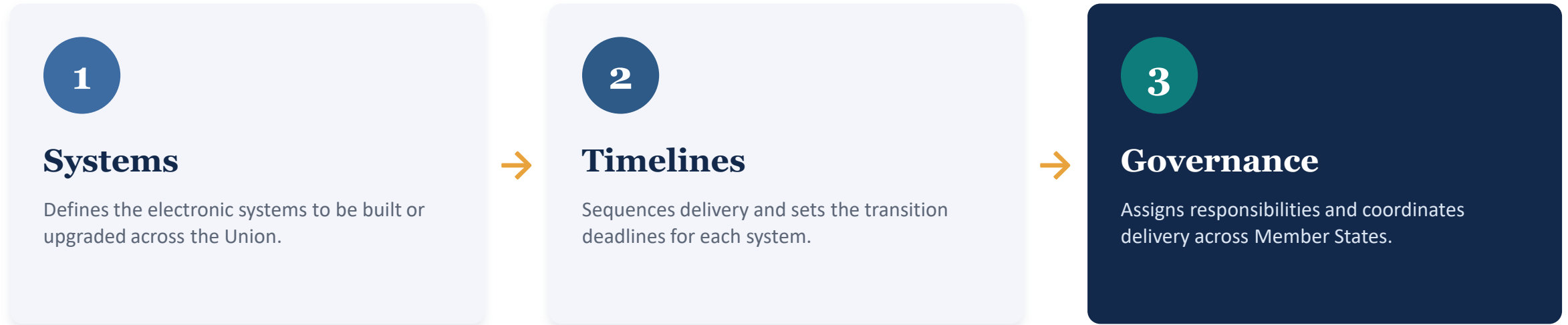
THE UCC RESPONSE

One framework, made digital

- A common legal framework for all Member States
- Standardised data requirements
- Fully electronic customs
- Objectives: harmonisation, simplification, digitalisation, security

The UCC Work Programme

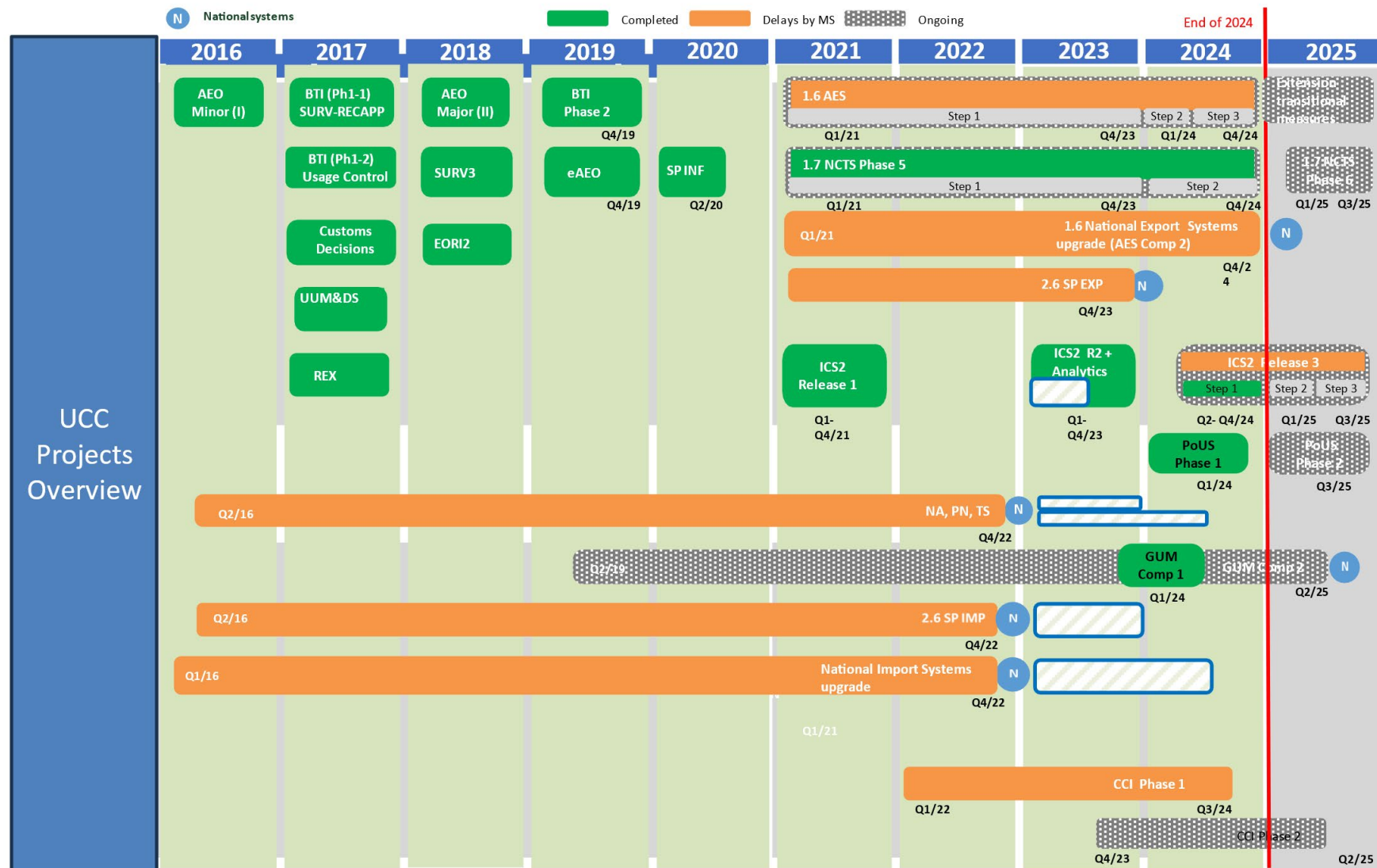
The Work Programme is the implementation roadmap for customs digitalisation. It turns the UCC into concrete systems and deadlines.



In short: the law sets the destination; the Work Programme is the route and the timetable.



The UCC Work Programme





WHAT IT BUILDS

Main deliverables of the Work Programme

Eight core electronic systems span the full customs lifecycle — import, storage, transit and export.

ICS₂

Import security & advance cargo data

AIS

Automated import declarations

AES

Automated export declarations

NCTS

Transit management (Phase 6)

CDS

Customs Decisions System

BTI

Binding Tariff Information

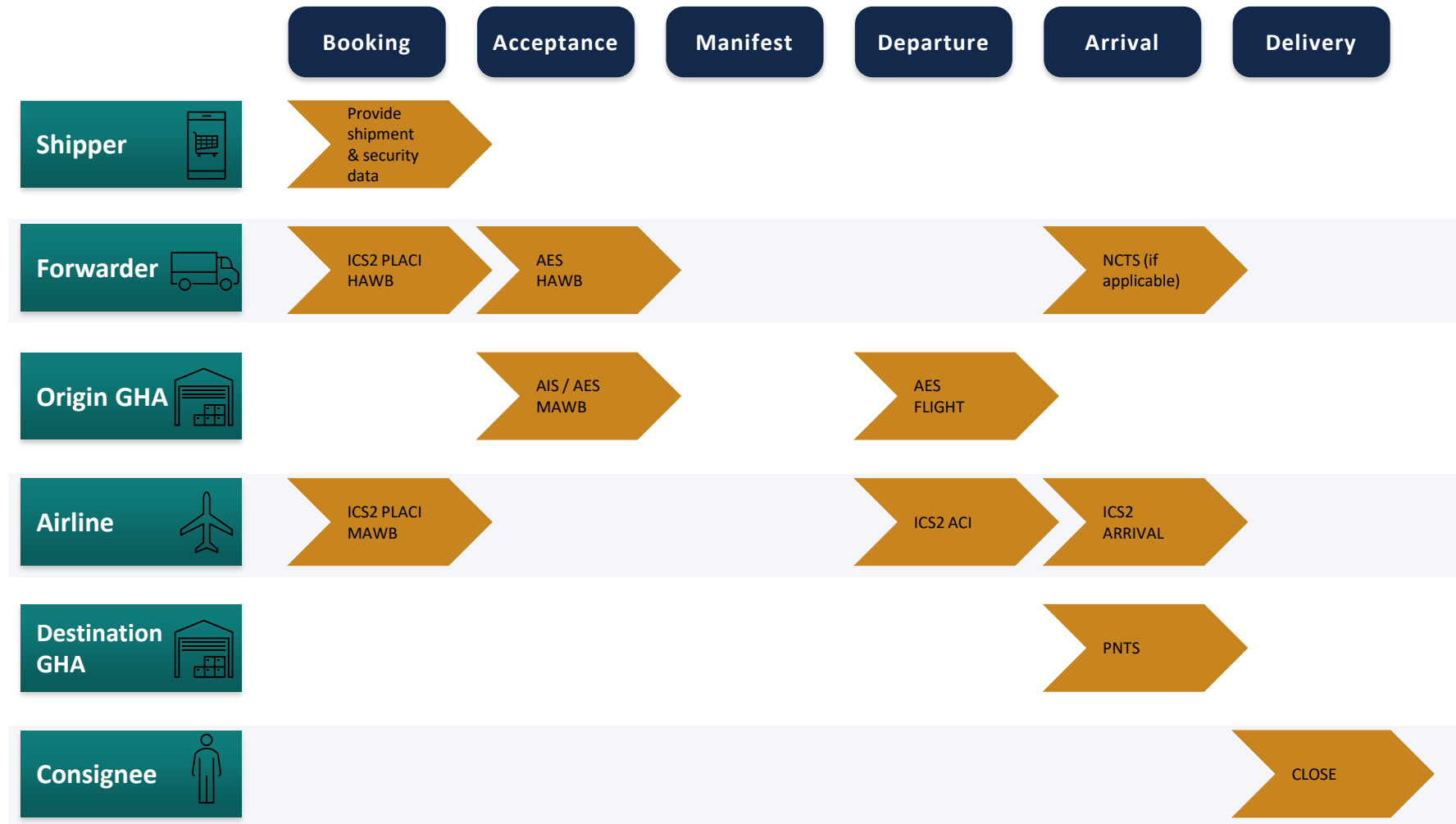
PoUS

Proof of Union Status

PNTS

Temporary storage & presentation

Who and When to Comply?





A federated EU customs IT architecture

Member States run national systems while EU-level systems enable interoperability — four layers, working together.

Business

WHO

Economic operators — traders, carriers and representatives.

Application

WHAT

The customs systems that process declarations.

Integration

HOW

Data exchange and messaging between systems.

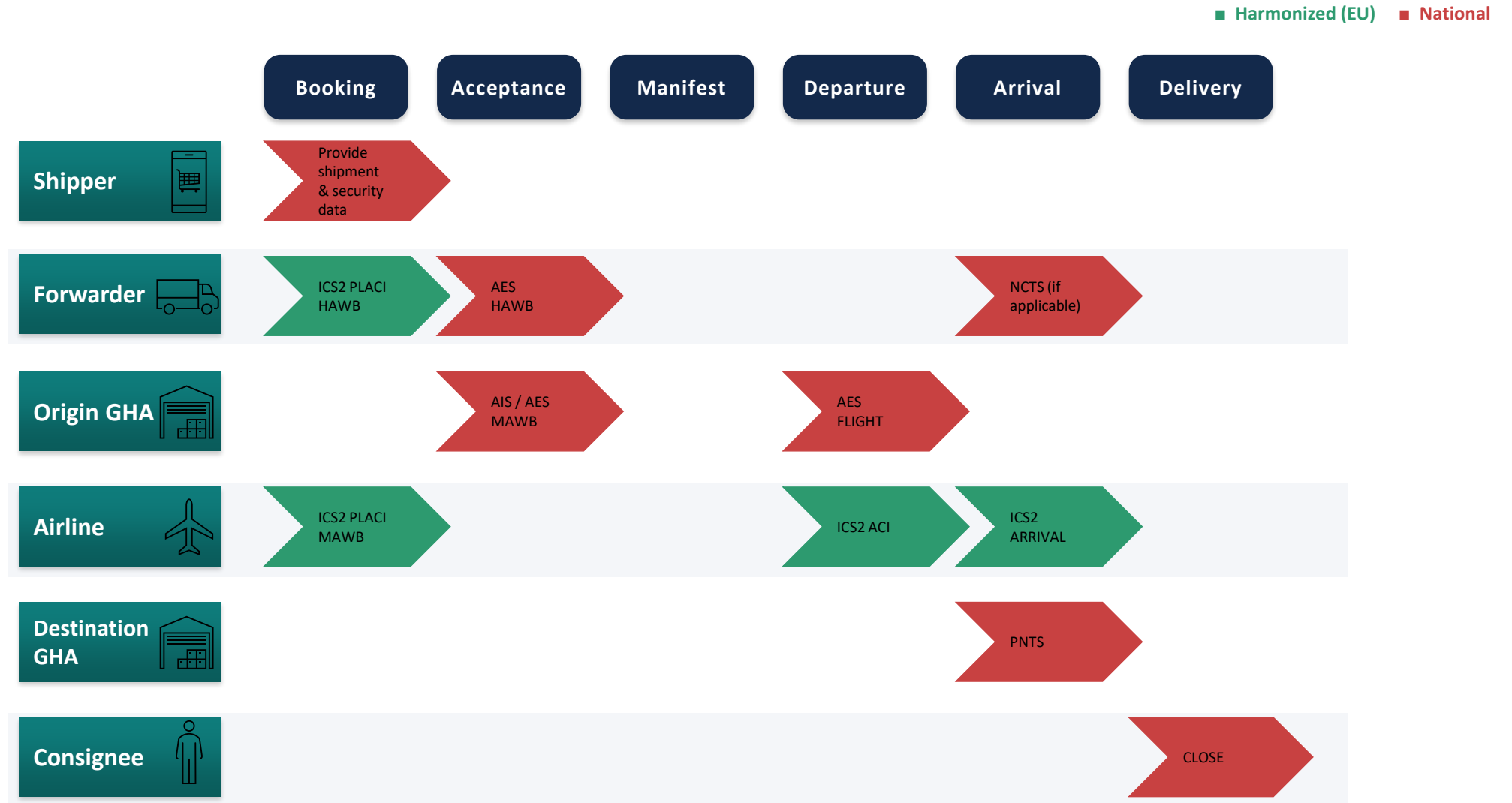
Governance

BY WHOM

DG TAXUD and the Member States, steering jointly.



Harmonized vs. National





ARCHITECTURE

Architecture Layers

Four layers structure the customs IT architecture — from business operators to governance.

Business

Economic operators interacting with customs — traders, carriers and declarants.

Application

Customs systems handling declarations, risk and clearance processes end to end.

Integration

Data exchange between systems and stakeholders through common interfaces.

Governance

DG TAXUD and Member States steering policy, standards and oversight.



The systems that run the lifecycle

Four systems carry the bulk of the flow — from advance security data to final export release.

ICS₂

Advance cargo information, security risk analysis and detection of high-risk consignments.

AIS

Import declarations: validation, duty calculation, regulatory checks and release decisions.

AES

Export declarations: harmonised procedures, better monitoring and improved data quality.

NCTS 6

Transit management: real-time tracking, better visibility and reduced fraud.

How the systems work together

Information is exchanged across the customs lifecycle — each system hands off to the next.



ICS2 Data flow

Carrier → Freight Forwarder → Postal Operator → Customs Authority
Submission → Risk Analysis → Decision → Clearance

WORKED EXAMPLE — A CHINA → BELGIUM SHIPMENT

ICS2 advance data → risk analysis → AIS declaration → duty calculation → release or inspection.



ICS2 — the role model of the harmonised half

One system shows what the EU-level architecture looks like at its best. Four design choices made ICS2 the reference point.

01 · PLACI

Pre-loading security

A minimum dataset filed before the goods are loaded — aviation security risk analysis moves ahead of the aircraft.

02 · MESSAGE STANDARDS

One canonical grammar

Advance cargo information simplified into well-defined, standardised messages — the same structure for every actor.

03 · STI

One trader interface

The Shared Trader Interface: a single connection point through which all stakeholders exchange with all Member States.

04 · HS CODE

Mandatory classification

The Harmonized System code became mandatory — structured, machine-readable input for automated risk analysis.

Why it matters here: everything that follows — standards, one interface, structured data — is what the rest of the landscape still lacks.



PLACI — screening before the aircraft is loaded

WHERE IT COMES FROM

Born from the Yemen incident

- 2010: the Yemen cargo plot exposes the gap — the US responds with pre-load filing under its ACAS programme
- The EU adapts the pre-load requirement into ICS2 — a major step toward streamlined international security standards
- Others follow: the UAE, Canada and the UK introduce comparable pre-loading regimes — international air cargo exchange becomes more secure

HOW IT WORKS

The “7+1” minimum dataset

- For every shipment moving into or through the EU by air, the “7+1” PLACI data must be filed before loading
- Customs runs aviation-security risk analysis on that minimum dataset — the security screening is requested pre-loading
- **The outcomes:** assessment complete — or a referral: additional information, high-risk cargo & mail screening, or Do Not Load



The side effect — a new burden on the ground

THE NEW BURDEN

GHA's can no longer just load

- For decades, ground handling agents simply loaded what was delivered to them
- Under PLACI they must not load goods that have not received their security release
- An operational liability shifted onto a party that never owned the data

HOW THE INDUSTRY COPED

Two pragmatic fixes

- **Bilateral agreements:** carriers and GHAs agree to continue loading unless and until a HOLD is notified
- **Service providers:** specialised ITSPs track filing status and security releases on the GHA's behalf
- Together they kept cargo moving while the new discipline bedded in



One message grammar — the ENS filing types

FILING MESSAGES — THE TRADER SPEAKS

IE3F... — the filings

- IE3F20** — complete ENS — pre-loading & pre-arrival (consolidated)
- IE3F21 / F22** — multiple filing — MAWB / HAWB data, pre-arrival
- IE3F23** — PLACI minimum — pre-loading, without MAWB reference
- IE3F24** — PLACI minimum — pre-loading, with HAWB + MAWB references
- IE3F25** — MAWB reference — pre-loading (completes an F23)
- IE3F26** — additional HAWB information — pre-loading
- IE3F27** — complete ENS — pre-arrival (consolidated)
- IE3F28 / F29** — complete ENS, direct AWB — pre-loading / pre-arrival
- IE3F42** — postal — partial master-level dataset (air mail)

LIFECYCLE RESPONSES — THE SYSTEM ANSWERS

IE3R / N / Q... — the replies

- IE3R01** — ENS registration response — the MRN is assigned
- IE3N01 / N02** — lifecycle validation error · ENS not complete
- IE3N03** — assessment complete
- IE3N10** — amendment notification
- IE3R07** — invalidation acceptance response
- IE3Q01** — Do Not Load request
- IE3Q02** — additional information request
- IE3Q03** — high-risk cargo & mail screening request
- IE3N99** — technical error notification

Read it as a conversation: the trader files IE3F..., the system answers IE3R / N / Q... — one message grammar for every actor in the chain.



Well-defined formats, a single point of connection

THE FORMATS

Everything in one grammar

- All messages in XML — one syntax across the whole system
- All structures defined by XSD schemas — validation before transmission
- All documentation published centrally on CIRCABC
- Common reference data, rules and code lists — maintained once, used by everyone

THE INTERFACE

STI — one of its kind

- The Shared Trader Interface (system-to-system) and Shared Trader Portal (user access): a single data interface to which all stakeholders connect
- File once, reach every Member State — no per-country connections for ENS
- Exchange runs over a secure, high-performance AS4 messaging interface



Why the HS code became mandatory

THE PROBLEM

Free text tells you nothing

- Many countries rely on free-text goods descriptions — vague, inconsistent, multilingual or deliberately generic
- “Parts” · “Accessories” · “Samples” · “Electronics” · “Machine components”
- A risk engine cannot reliably separate low-risk from high-risk shipments on descriptions like these

THE ANSWER

Structure the input

- The HS code is language-independent, structured, machine-readable and globally recognised — it transforms automated risk targeting
- **Sharper sight on high-risk groups:** dual-use goods, lithium batteries, chemicals, precursors, weapons components, sanctioned goods
- The link back to Module 1: structured data elements are exactly what the EU CDM exists to define



A role model — not a perfect one

Four lessons from implementation: even the best-designed harmonised system meets reality.

WHERE IT FALLS SHORT OF 100%

Lessons from the field

- **Default values survived:** for consolidations, “Consolidation” simply became “Goods Description as provided per HAWB” — one placeholder replaced by another
- **A design trade-off:** one canonical XML with a use-case flag, rather than multiple message types — elegant for the system, demanding for the implementer
- **Performance of the STI:** a single shared interface concentrates load — e-commerce volumes test its throughput
- **Master vs house:** the meaning of the MAWB is still widely misunderstood across the chain, with filing errors to match

The lesson: harmonisation works — but data quality and operator understanding decide how well.



Beyond the harmonised core — a national patchwork

For handling-related procedures — temporary storage, presentation, release — each Member State still speaks its own language.

ONE SAMPLE OF THE MESSAGE LANDSCAPE

FI510A	IE525	DMSGRR	CZ375C
FI316A	IE507	DMSGRE	CZ385C
FI326A	IE590	DKA54A	CZ087C
FI350A	CC557C	DKA62A	CZ094C
FI514A	TS313	DKD44A	C527A
FI526A	TS315	DKD87A	C538A
FI590A	TS316	DKA84A	NOMAC
FI615A	TS328	G4G3QR	NOHAC

FI · IE · DK · CZ · NO — a fraction of the real list.

WHAT THIS MEANS

Five countries, five vocabularies

- Each Member State names the same handling steps differently — there is no common message set
- No shared naming, no shared lifecycle: a code means nothing outside its own administration
- Every national connection is a bespoke integration project — multiplied across 27 Member States



No common standard, no common interface

NO MESSAGE STANDARDS

Formats & content diverge

- XML, JSON and EDIFACT side by side — syntax differs per country
- Different definitions for the same data elements
- Documentation of varying depth — and in various languages
- Country-specific rules, conditions and references on top

DIFFERENT INTERFACES

A decentralised landscape

- For handling-related procedures, every Member State runs its own system, security model and processes
- Digital certificates · web services, APIs, MQ · SMTP, SFTP — a different stack at every border
- Push vs poll, synchronous vs asynchronous — even the conversation pattern changes
- The contrast with the STI could not be sharper — this is the integration cost the reform targets



THE HARD PART

Interoperability is the real challenge

TECHNICAL

Making systems talk

- Legacy national systems
- Data-quality issues
- Integration complexity
- Standards: EORI, commodity codes, CPCs, country codes

ORGANISATIONAL

Making people align

- Different national priorities
- Resource and budget constraints
- Governance and coordination
- Legislative change mid-delivery

Why standards matter: shared data definitions are what let a federated system behave as one.

Examples: EORI numbers, commodity codes, customs procedure codes and country codes



WHO RUNS IT

Governance of the customs ecosystem

1

DG TAXUD

Policy leadership and coordination across the Union.

2

Member States

Implementation, national systems and day-to-day operations.

3

Economic operators

Data submission and compliance with the rules.

Coordination is the recurring friction: budgets, varying maturity, project delays and cross-border alignment — and a fourth de-facto player matters: service providers can heavily help to shape a standard.



WHAT COMES NEXT

Toward the EU Customs Reform & Data Hub

The reform points to a single environment with smarter analysis and a lighter burden on trade.

1

Submit once

Single data submission feeding every authority that needs it.



2

Smarter risk

AI, machine learning and big-data analytics for risk scoring and fraud detection.



3

Less burden

Lower compliance cost and far better end-to-end visibility.

This is the bridge to Module 3: the EU Customs Data Hub is where this single, data-driven model is built.



Key takeaways — and what still stands in the way

KEY TAKEAWAYS

Four things to keep

- **The UCC is the foundation** — the legal basis for every customs procedure in the Union
- **The Work Programme is the roadmap** — the systems to build and the deadlines to meet
- **Interoperability is critical** — standards and clean data exchange make the federation work
- **Customs is becoming data-centric** — AI-supported, event-driven and increasingly consolidated

OPEN CHALLENGES

What still slows it down

- Many processes remain too complex and too decentralised — more data centralisation is needed
- Legacy systems must be replaced; local budgets, resources and knowledge can slow implementation
- Security and data-protection requirements keep growing; e-commerce has made data volume itself a challenge
- **The way forward:** AI can simplify procedures and assist compliance — and the move to the Data Hub (Module 3) can help



Applicable UCC recitals & articles

The Work Programme and the federated IT architecture are mandated — and scheduled — by the Code itself.

IN THE CODE — REG (EU) 952/2013

Recitals & articles

- Recital (17) — ICT and the paperless customs environment
- Art. 6(1) — electronic data-processing for all information
- Art. 16(1) — Member States & Commission develop, maintain & operate the systems
- Art. 17 — technical arrangements for those systems (the IT architecture)
- Art. 278 & 278a — transitional measures (to 2025) + annual progress report
- Art. 280 & 281 — the Work Programme, adopted by implementing act

IN THE IMPLEMENTING ACTS

How it is enacted

- Impl. Decision (EU) 2023/2879 — the current UCC Work Programme (after 2019/2151 · 2016/578 · 2014/255)
- Reg (EU) 2019/632 — extended the Art. 278 transition to 2025
- Reg (EU) 2025/512 — technical arrangements for the electronic systems (repeals Reg 2023/1070)



DISCUSSION

Questions & discussion

WHAT THIS LECTURE ESTABLISHED

- The UCC gives the legal foundation
- The Work Programme turns it into systems & deadlines
- Eight systems span the lifecycle, federated by design
- Interoperability and data standards hold it together

ONE QUESTION TO DEBATE

Centralised or federated?

Should the EU move toward a **centralised** customs data architecture — or keep refining the **federated** model?

The EU Customs Data Hub (Module 3; Title III nUCC, Arts 29–37) is the test case.

“The law sets the destination; the systems are how we get there — and how fast.”

The EU Customs Data Hub

From Data Collection to Smart Enforcement

How does raw trade data become trusted, automated and interoperable customs governance? *This session shows where that data is consolidated — and how it begins to think.*

Walter Van der Meiren Director, Customs Brokerage — UPS Europe

Collaborateur, Faculté de Droit · 12 June 2026



YOUR SPEAKER FOR THIS MODULE

Walter Van der Meiren



Customs Director

UPS Europe

ABOUT

Walter Van der Meiren currently serves as Director for Customs Brokerage at UPS Europe, dealing with regulatory, training, systems and compliance. He is the vice-chair of the Customs and Trade Facilitation Committee at AmCham EU and is a member of the European Express Association.

Walter represents trade at the DG Taxud's Trade Contact Group and is a well-respected subject matter expert in different customs working groups from the European Commission.

He is the winner of the ICC's Customs Professional Award 2020 and received the WCO's Certificate of Honor for rendering exceptional service to the international Customs Community.

He is a collaborator at the University of Liege, Belgium.



WHERE WE ARE IN THE STORY

From systems that route data, to a hub that learns from it



THE HAND-OFF YOU ARE RECEIVING — FROM MODULE 2 (JÉRÔME L.)

The operational systems produce vast volumes of structured data. **The question this raises — and the question this hour answers — is: who consolidates that data, and who turns it into intelligence?** The EU Customs Data Hub is that answer.

A note on framing. You know the law — the UCC and the new UCC. Throughout this hour the logic runs *“the law requires X — here is how the IT makes X possible”*, never the other way round.



What the new UCC actually mandates

On **26 March 2026** the Council and Parliament reached political agreement on the most significant overhaul of EU customs law since 1968. The text is being finalised and awaits formal adoption and publication in the Official Journal; numbering below follows the agreed text.

Art. 9

Establishes the EU Customs Data Hub

A single EU-level environment for submitting, storing and processing customs-relevant data — personal and non-personal.

Art. 159

Single point of submission & re-use

Data is given once and re-used to the highest extent possible across procedures and authorities.

Art. 162

Access, governance & data protection

Defines who may see, use and modify data — the legal basis for the “rights” dimension of the Hub.

TWO ENABLERS, ONE REFORM

EU Customs Data Hub the shared digital infrastructure + **EU Customs Authority (EUCA)** the body that builds and governs it

Together they pursue reinforcing objectives: a **simpler** Customs Union (lower compliance cost, a tailor-made e-commerce regime) and a **stronger** one (EU-level risk management, one Union acting as one at the external border).



THE PARADIGM SHIFT

From the declaration to the supply-chain data flow

TODAY — DECLARATION-BASED

- A discrete document, lodged per consignment, in 27+1 fragmented national systems.
- Each filing re-states the same facts.
- Batch reporting; intelligence assembled after the event.
- The consumer is the importer of record.



NEW UCC — DATA-DRIVEN

- Goods are described by a continuous supply-chain data flow, not a one-off form.
- Data is submitted once to one Hub and re-used across procedures and authorities.
- Event-based supervision: the Hub reacts in near real time as events occur.
- The platform / distance seller is the deemed importer, responsible for formalities and payment.

Frank Heijmann's framing for this module: we are replacing the concept of the “declaration” with a *dynamic, progressive-entry data flow*. The single-data-set principle from Module 1 is exactly what makes that flow possible.



A single, scalable and secure data environment



Consolidated interfaces

One gateway for trade, customs and other authorities — no fragmented entry points.



Integrated functions

No system silos: a holistic view across customs, taxation, safety and compliance.



Event-based supervision

From batch reporting to event-driven exchange — adaptable, near real-time.



Centralisation

One central EU Hub replaces “27 + 1” national systems — consistency and scale.



Integrated EU data

Secure use, re-use and sharing across authorities; analytics and risk at EU level.



Trader accounts & identity

eIDAS-based IDs and credentials (wallets) for trusted, simplified interactions.



Cybersecurity — a zero-trust spine. Granular access controls protect sensitive trade and customs data end-to-end. This is not a feature bolted on; it is the precondition for centralising the data of an entire Customs Union in one place.



UNDER THE HOOD

An event-driven architecture

What it is. The Hub reacts to *events* — a sale registered, a consignment lodged, an arrival at the border. Small, independent *microservices* respond to each event; there is no single monolithic system. The event flow defines when and how data is ingested and processed.

WHY IT MATTERS — BENEFITS

- Real-time processing by default
- Resilience — small, decoupled services
- Flexibility & agility to add new services
- Scalability by design, for billions of items

THE HARD PART — CHALLENGES

- Higher technical complexity “under the hood”.
- **Data quality**
— incomplete, inconsistent or fraudulent data.
- **Data rights**
— who provides, sees or modifies the data.

Hold on to “data quality” and “data rights”. *They are the two hinges on which smart enforcement — and the public-governance limits on AI — will turn later in this hour.*



A TRADE-USER VIEW

Give data once — choose the channel that fits

Traders give data to one Hub, one time, instead of many systems many times. Three access channels are foreseen:



SMEs

Data Portal

A guided web front-end for occasional and smaller filers.



Large filers

Message Channel

System-to-system messaging for high-volume operators.



Trusted traders

Push · Pull · AI

Advanced, automated exchange for the most reliable operators.

EU Customs Authority

Builds the service apps and interoperability; connects traders to customs; manages security, data protection and a single EU process.

Member States

Operational decisions, supervision and controls; trade relationships; multi-agency co-operation with a full supply-chain view.

Market surveillance & enforcement

Other competent authorities collaborate administratively on the same data — the seed of Module 4.



The Hub does not stand alone



ONE CARRIER FOR MANY REGIMES

The same data flow carries **customs, VAT, excise, CBAM, EUDR, sanctions and market-surveillance** requirements. Data quality — the Product Identifier, an acceptable goods description, valuation traceability — therefore becomes a **precondition of clearance for every regime at once**.



The sales line item — and a debt that moves

In e-commerce the Hub does not think in “declarations”. The core business object is the **sales line item** — a single ordered article. Each line item on an order can carry its own classification, value, origin and policy measures (P&R). The debt incurred and the measures applicable are tracked at that level.

1

Debt INCURRED

on acceptance of payment

An economic-operator-side event — the customs debt arises when the consumer pays, not at a border desk.

2

Measures APPLIED

per sales line item

Classification, value, origin and P&R are resolved line by line; data for the procedure is provided at that granularity.

3

Debt CONFIRMED

on notification of availability

Line-item data connects to the transport layer for processes and release decisions.

Legal hook: this is the data-model expression of the deemed-importer regime — the operator, not the consumer, owns the debt, and the Hub tracks it from the moment of sale.



THE CORE OF THIS MODULE

From data collection to smart enforcement

Consolidated, high-quality, event-based data is the raw material. **AI and machine learning are what turn it into intelligence.**

Risk profiling

Selectivity that targets enforcement where risk is highest, rather than inspecting at random.

Fraud detection

Cross-consignment, cross-operator patterns — undervaluation, mis-description, IOSS abuse.

Anomaly analytics

Near real-time detection of the outlier in a flow of billions of items.

Trust, defined for this course: *the ability to predict compliant behaviour from verified data — about an operator, a shipment or a supply chain — in order to focus enforcement where risk is highest.*

THE PUBLIC / PRIVATE TENSION — HOLD THIS THOUGHT FOR MODULE 5

We approach AI here from the side of **public governance**: accountability, the nUCC legal basis, data protection (Art. 162), and the “rights” question — who may see and act on the data. Module 5 will meet the same technology from the **commercial** side. The interesting question for a law faculty is where public infrastructure should end and private innovation begin.



WHO IS THE OPERATOR?

Five e-commerce business models — and the Trust & Check edge

1 Trust & Check operator, using a CWDS, IOSS-registered

2 Trust & Check operator, NOT using a CWDS, IOSS-registered

3 Other operator, IOSS-registered, with deferred-payment authorisation

4 Other operator, IOSS-registered, without deferred-payment authorisation

5 Non-IOSS operator

TRUST & CHECK PRIVILEGES (E-COMMERCE)

Supervised by its Member State of establishment, which takes the release decisions. May be authorised to:

- Periodic (monthly) notification of the customs debt — receipt of the communication serves as notification of the debt by customs
- Release goods to free circulation
- Carry out certain control activities, at certain places
- Operate a Customs Warehouse for Distance Sales (CWDS)

The lesson: the Data Hub does not treat all operators alike. Verified trust buys real operational privilege — and that is the incentive structure the reform is built on.



CASE STUDY

The IOSS “Right-to-Use” (RTU) pilot

The problem. IOSS lets a registered seller collect VAT at the point of sale, so a parcel clears import VAT-paid. But how does customs know, at the border, that the IOSS number quoted on a given shipment is genuinely being used by the party entitled to it? Misuse of IOSS numbers is a known leak in cross-border e-commerce VAT.

STEP 1

Token issued

Each shipment is linked to a digitally signed “right-to-use” token bound to the IOSS registration.



STEP 2

Token travels

The token accompanies the consignment data into the Hub as part of the data flow.



STEP 3

Validated in real time

Customs validates the legitimacy of the IOSS usage at transaction level — instantly, per consignment.

WHY THIS IS THE HUB IN MINIATURE

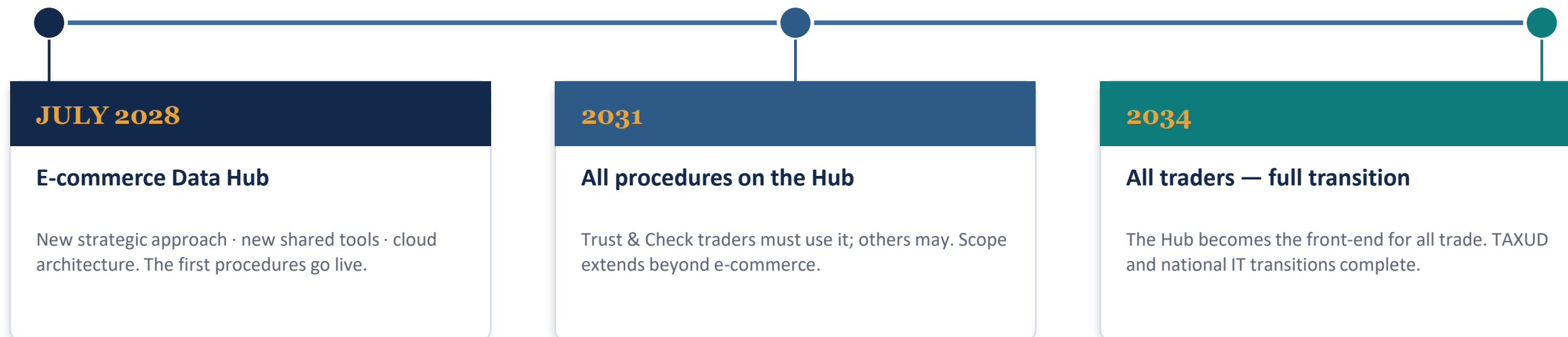
The RTU pilot is a working preview of every principle in this hour: **transaction-level** (the sales line item), **event-based** (validated as the shipment moves, not in a monthly batch), **identity-anchored** (a signed token, an eIDAS cousin), and **enforcement by data, not by inspection**. It also connects to the three-identifier / Product Identifier model you will recognise from the de minimis reform.



NOT A BIG BANG

A phased transition, not a switch

The Hub is delivered in layers. Each layer widens scope while the previous national systems are phased out in parallel — a managed transition running to 2034.



In your compliance course this is the “EUR 3 today → Data Hub tomorrow” horizon. The EUR 3 flat duty (1 July 2026 – 1 July 2028) is the transitional bridge that holds the e-commerce flow together until the July 2028 layer is live.



The Future: One parcel, every layer — see you in Module 6



The shared scenario: a B2C e-commerce parcel (distance sale), originating outside the EU, entering through a consolidation hub at Charles-de-Gaulle, Paris, with final destination Eindhoven, Netherlands — under the legislation applicable from 1 July 2026.

What Module 3 contributes to that parcel's journey:

How is it risk-profiled?

Consolidated, line-item data feeds CRMS2; AI scores the consignment against patterns of undervaluation, mis-description and IOSS misuse.

What triggers a flag?

An anomaly relative to the operator's profile, an inconsistent value or description, or a failed RTU-token / IOSS validation.

Who decides?

The operator's Member State of establishment takes the release decision (Trust & Check), on Hub data — not a manual desk.

What is different vs today?

Today: a declaration in a national system, checked after the fact. Tomorrow: a data flow, scored before arrival.



THE HAND-OFF YOU ARE PASSING

Customs has intelligence — but customs is only part of the border

WHAT MODULE 3 ESTABLISHED

- A single EU environment consolidates the data the systems produce
- Event-based, line-item data feeds AI-driven risk profiling
- Trust = verified predictive compliance → privilege
- Data quality and data rights are preconditions, not afterthoughts



MODULE 4 — FRANK JANSSENS

Single Window & EU CSW-CERTEX

The same interoperability logic — single submission, re-use — extends **beyond customs to every competent authority at the border**: health, safety, environment, agriculture (TRACES, CITES, FLEGT, F-gas...). CERTEX is the central component that verifies non-customs formalities automatically against the same data.

The bridge in one line: *interoperability is not only between customs IT systems — it is between customs and every other authority that has a say over the goods.*



KEY TAKEAWAYS

Five things to carry into the rest of the day

1

The Hub is the answer to “who learns from the data?” It consolidates what the systems (M2) route, using the language (M1) of the EU CDM.

2

The unit of thought is the sales line item, not the declaration A continuous, event-based data flow replaces the one-off form — the deemed-importer regime in data.

3

Trust buys privilege Verified predictive compliance earns Trust & Check operators monthly debt notification, self-release and a CWDS.

4

It is one carrier for many regimes Customs, VAT, CBAM, EUDR, sanctions, market surveillance — so data quality (the PID) is a precondition of clearance.

5

It arrives in layers to 2034 July 2028 e-commerce → 2031 all procedures → 2034 all traders. EUR 3 is the bridge.



GO DEEPER

Managing Customs Compliance in E-Commerce

Part V maps the five pillars of the reform — EUCA, Data Hub, Trust & Check, deemed importer, governance — and the 1 July 2026 operational reality (EUR 3, H1/H6/H7, the PID, no automatic refunds).



STRATEGIC OBJECTIVES

A simpler and a stronger Customs Union

SIMPLER Customs Union

reinforcing objectives

STRONGER Customs Union

Reduced compliance costs

through simpler procedures

A tailor-made e-commerce regime

fit for billions of low-value parcels

Better Single Market protection

through EU-level risk management

A true Customs Union

acting as one across the external border

KEY ENABLERS

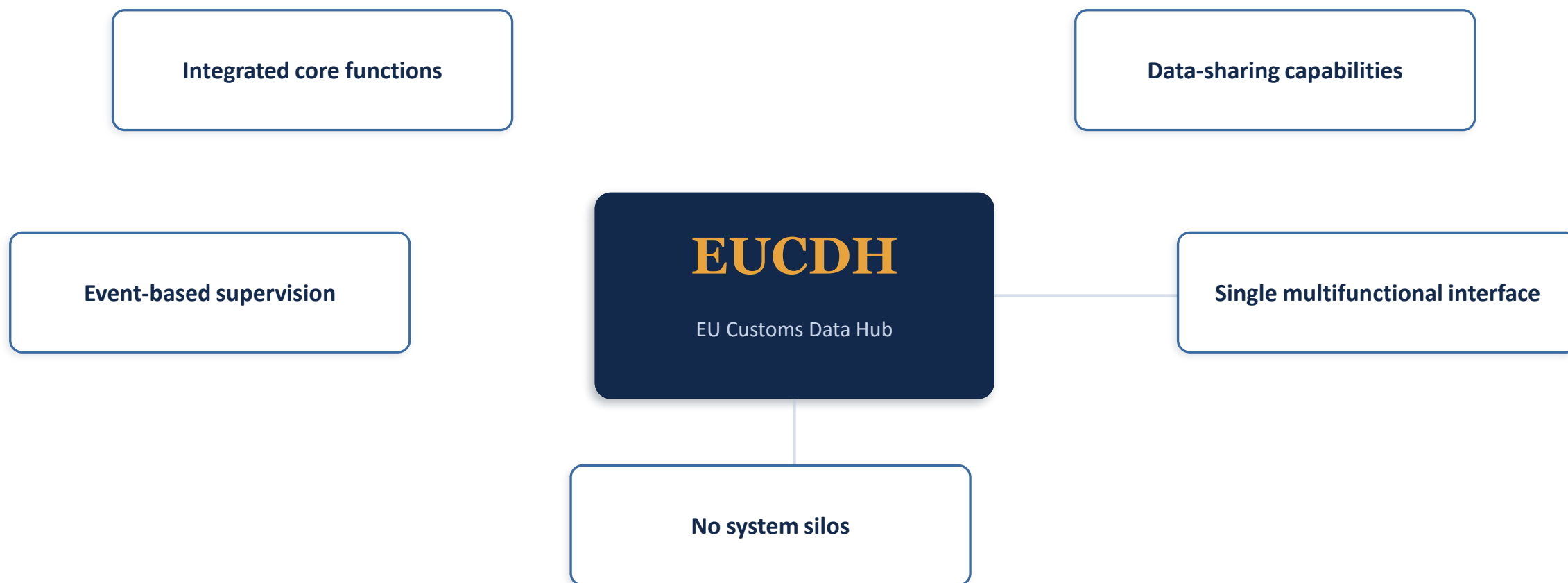
EU Customs Data Hub + EU Customs Authority — the shared infrastructure, and the body that builds and governs it.

Adapted from DG TAXUD ECCG/TCG — “Strategic objectives and reform pillars”.



A DEFRAGMENTED VIEW

One integrated environment — no system silos



The point: one environment replaces the “27 + 1” fragmented national systems — integrated functions, shared data, event-based supervision and a single interface, with no silos between them.

Adapted from DG TAXUD ECCG/TCG — “A defragmented view”.



Procedures for goods sold in distance sales

PROCEDURES FOR GOODS SOLD IN DISTANCE SALES TO CONSUMERS

- 1** Release to free circulation *of direct B2C sales*
- 2** Release to a Customs Warehouse for Distance Sales (CWDS) *conditions attached...*
- 3** Release to free circulation, in B2C distance sales *from a CWDS*



MAIN PROCESS / PROCEDURE GROUPS

- Data for the procedure
- Notification — arrival of transport
- Notification — arrival of goods
- Temporary storage
- Notification — availability of goods
- Control / mitigation measures

High-level focus on certain key operational procedures and processes — not a full description of scope.

Adapted from DG TAXUD ECCG/TCG — “Understanding Scope (high-level)”.



THE DATA, IN TWO LAYERS

Data for the procedure · data for the process

DATA FOR THE PROCEDURE

Sales line items

the core business object — with amendments / invalidations

Consignments / shipments

the transport layer the line items connect to

DATA FOR THE PROCESS

Notifications

arrival of transport · arrival of goods · temporary storage · advance cargo information · availability of goods

Control / mitigation measures

the risk and control cycles applied to the flow

→ **RELEASE DECISIONS** both layers connect here — the customs debt is incurred on acceptance of payment and confirmed on notification of availability.

Read it this way: the procedure layer answers “what is owed and why” (per sales line item); the process layer answers “where are the goods and what has happened to them”. The Hub joins the two to make the release decision.

Adapted from DG TAXUD ECCG/TCG — “Some data concept reflections”.



How the architecture becomes user-facing

CORE EVENT GROUPS — ON THE ROAD TO RELEASE (RFC)

- Data required for the procedure / process
- Calculating & confirming duties and the handling fee
- Risk and control / mitigation cycles
- Prohibitions & restrictions (P&R) cycles
- Notifications — arrival of transport & goods
- Temporary storage · availability of goods
- Release decision · returns · alerts to customs

CAPABILITIES

IN THE BACKGROUND

Manage accounts, organisation, roles, data governance, authorisations, notifications, reference data, integrations, data quality.

IN LIVE OPERATIONAL PROCESSES

Procedure / process workflow, amendments, invalidations, risk and control / mitigation, monitoring and troubleshooting.

Objective: *events can arrive in different orders. The Hub connects them, re-uses the data, and serves each user exactly what they need.*

Adapted from DG TAXUD ECCG/TCG — “From process & procedure events to user experience via capabilities”.



HOW IT GETS BUILT

Key ingredients in the work

Legal & governance

- UCC final text
- Delegated & Implementing Acts

Business concepts

- Account-based & back-office processes
- Live operations — processes & procedures
- Transitional integrations

Design, build & test

- Build
- Transitional integrations
- Piloting (testing)
- Specifications & guidance

Operational deployments

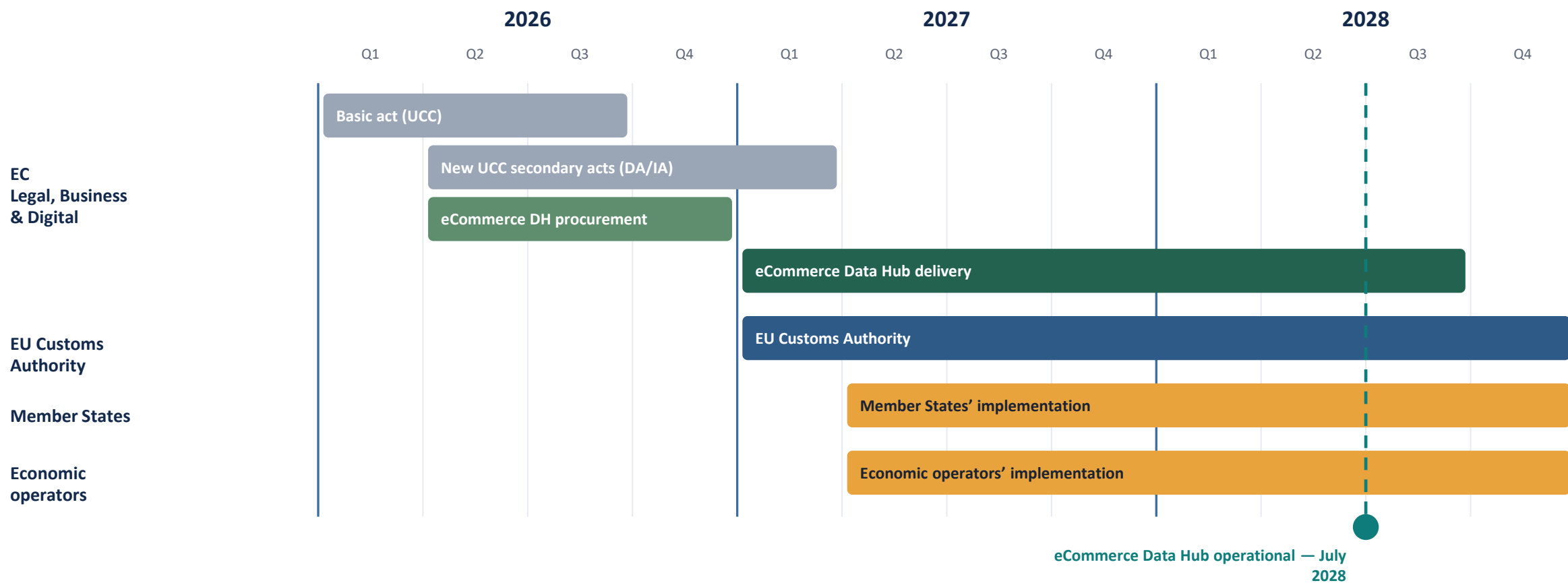
- Accounts, authorisations, onboarding
- Piloting
- Live processes — July 2028
- Service evolutions (incl. national)

FOUNDATION Data Model (required data) and data processing — the bedrock every workstream above depends on.

Adapted from DG TAXUD ECCG/TCG — “Key ingredients in our work”.



Indicative delivery timeline, 2026 – 2028



EUCA takes over

Illustrative view, subject to change.

Adapted from DG TAXUD ECCG/TCG — “High-level roadmap”.



The EU Customs Data Hub

Where it is anchored in the new Union Customs Code — recitals & articles

A reference map of every place the EU Customs Data Hub appears in the recast UCC — its legal basis, the Title III architecture, the data-protection and access regime, and the cross-cutting empowerments.

Sources. Commission proposal COM(2023) 258 final (complete recitals) and the Council Presidency compromise on Title III, doc. 7694/25 (refined article structure). Numbering is provisional pending formal adoption and OJ publication.

Adopted in principle — not yet in the Official Journal

17 May 2023 Commission proposal COM(2023) 258 final — the recast UCC, the EU Customs Authority and the Data Hub.	Mar 2024 Parliament — 1st reading EP adopts its first-reading position (rapporteur D. Clune).	Jun 2025 Council general approach Member States agree a negotiating mandate; Title III refined.	26 Mar 2026 Provisional agreement Trilogue political deal between Parliament and Council.	16 Apr 2026 IMCO endorsement Internal Market committee backs the provisional agreement.	Pending Formal adoption → OJ EP plenary & Council sign-off, then publication in the Official Journal.
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Why this matters. Until OJ publication, article and recital numbers are not final. This annex cites the two most authoritative public texts: the 2023 proposal for the complete recitals, and the 2025 Council compromise for the refined Title III article structure.

Why and what — the Hub in the preamble

The concept introduced

(4)

A modern, integrated set of interoperable electronic services for collecting, processing and exchanging customs information — the “EU Customs Data Hub” — established alongside the EU Customs Authority.

Centralised, secure, cyber-resilient

(18)

The Hub is established as centralised secure services and systems; it must ensure quality, integrity, traceability and non-repudiation. Commission and Member States jointly design it; the Commission governs, implements and maintains it (and may delegate).

Automation does not remove responsibility

(19)

Automated exchange through the Hub does not exclude the responsibility of authorities or operators; a measure taken via the Hub is treated as adopted by the authority itself.

In one line. Recitals (4), (18) and (19) define what the Hub is, who builds and runs it, and that acting through it never dilutes legal accountability.

How data moves — re-use, analytics, national apps

Interoperability & advanced analytics

(20)

The Hub exchanges data with other systems and offers advanced analytics, including artificial intelligence; it draws on RASFF, Safety Gate, ICSMS and the IP Enforcement Portal, and works with the EU Single Window.

Member-State applications

(21)

Member States may build their own applications on Hub data — or entrust the EU Customs Authority to develop shared, open-source ones under the Share-and-Reuse approach.

The single data flow

(22)

Operators submit data once → it is processed at Union level and enriched with Union-wide risk analysis → made available to national customs → and the control results are reported back to the Hub.

In one line. Recitals (20)–(22) describe the give-once / re-use-many flow, the analytics layer, and how national systems plug in — the heart of the single-data-submission principle.

Who may see the data — and for how long

- (23) Mostly non-personal data, but includes personal data — hence specific access, confidentiality and use rules.
- (24) Access for OLAF, EPPO, national tax, food-safety and market-surveillance authorities, Europol; non-personal data for all other Union/national bodies including Frontex.
- (25) Without prejudice to the Customs Information System (CIS) and to Frontex reporting obligations.
- (26) The Commission sets access modalities by implementing rules, after assessing each authority's safeguards.
- (27) Personal data stored for a maximum of 10 years (aligned to the debt-notification window); retention suspended for proceedings.
- (28) Data-subject rights may be restricted where needed to protect enforcement, risk analysis and customs controls.
- (29) All processing under the GDPR (2016/679), the EUDPR (2018/1725) or the Law-Enforcement Directive (2016/680).

The Hub beyond Title III

Recital (40)

Transition

From customs declarations to providing information to the central Hub.

Recital (60)

International cooperation

Exchange of customs data with third countries, e.g. through the Hub.

Recital (65)

Performance evaluation

The EU Customs Authority evaluates customs-union performance using Hub data.

Recital (67)

Delegated acts

Categories of data subjects and personal data processed in the Hub.

Recital (69)/(70)

Implementing acts

Which systems federate with the Hub; access rules; advisory procedure for non-customs access.

Recital (74)

Phased rollout (proposal)

Voluntary from 2032, fully developed by end-2037 — superseded by the agreed timeline (see final slide).

Title III — “EU Customs Data Hub” (Arts 29–37)

Art 29	Functionalities, purposes & features The 'engine': services a–k incl. AI-enabled analysis.	Art 29-a	Responsibility for the Hub Commission develops & operates; may entrust EUCA.
Art 29a	Business continuity Redundancy, failover, recovery procedures.	Art 30	National applications Member-State apps connecting to / using Hub data.
Art 30a	Confidentiality of data Confidential data kept confidential; limited disclosure.	Art 31	Purposes of processing Why personal & other data may be processed.
Art 32	Personal data in the Hub Categories of personal data processed.	Art 33	Retention of personal data Max 10 years; suspended during proceedings.
Art 33a	Retention — non-personal data Rules set by implementing acts.	Art 34	Roles & responsibilities Controllers / joint controllers for the data.
Art 35	Restriction of data-subject rights Case-by-case, necessary & proportionate.	Art 35a / 35b	Data Auditor · EDPS supervision Access-security control; coordinated oversight.
Art 36	EU Customs Data Model The data the Hub carries — this module’s subject.	Art 37	Technical means for cooperation Mandatory use of the Hub; Single Window interop.

Read this for Module 1. Article 36 places the EU Customs Data Model inside the Data Hub title: the Model is the data the Hub is built to carry — the bridge from this module to Module 3.

Article 1 — the Hub is one of three things the Regulation creates

Article 1(1), second subparagraph — *“This Regulation also establishes the European Union Customs Authority and the rules, common standards and a governance framework for the establishment of the European Union Customs Data Hub.”*

1 The Code

The general rules and procedures for goods brought into or taken out of the customs territory of the Union.

2 The EU Customs Authority

A central operational capacity (EUCA) to coordinate the governance of the customs union.

3 The EU Customs Data Hub

The rules, common standards and governance framework for the Hub — named in the very first article.

The point. The Hub is not a side-feature. It is named in the subject-matter article alongside the Code itself and the Authority — the Regulation’s three structural pillars.

What the articles actually require

Art 29(1)

The functionalities, a–k

Electronic implementation of customs law; data quality & non-repudiation; AI-enabled risk, economic and data analysis; interoperability; Single Window certificates exchange; real-time tracking and data distribution; built-in information-security management.

Art 29-a

Who runs it

The Commission develops, operates and maintains the Hub; once the EU Customs Authority is fully operational, the Commission may entrust these responsibilities to it.

Art 31

Purposes of processing

Sets out the purposes for which personal and other data may be processed in the Hub — the gateway provision the access and retention rules hang from.

Art 33

Retention

Personal data retained for a maximum of 10 years, with suspensive events (Art 48 cases, OLAF/EPPO/national investigations, infringement and judicial proceedings).

Art 35

Restriction of rights

Data-subject rights (access, restriction, breach notification) may be restricted case-by-case where necessary and proportionate to protect investigations and controls.

Art 37

Mandatory use

Commission, EUCA and customs authorities must use the Hub when exchanging data; interoperability with non-customs systems runs via the EU Single Window.

Article 36 — the Data Model lives inside the Data Hub

Article 36 (Title III) — the Commission, by delegated act, determines the personal and non-personal data required for the Hub's purposes. *"Those data requirements shall constitute the EU Customs Data Model."*

The Model defines the data (this module). The Hub is where that data is collected, processed and shared (Module 3).

THE AGREED ROLL-OUT

1 Jul 2026

Interim measure

Flat €3 customs duty per item on low-value e-commerce consignments.

1 Jul 2028

Hub opens

EU Customs Data Hub becomes available for e-commerce consignments.

1 Mar 2034

Hub mandatory

Use of the Data Hub becomes mandatory for all goods.

Customs / Trade Single Window

One entry point for trade and government

What a Single Window is, how the EU builds one through CSW-CERTEX, and what it takes for a country to implement its own.

- **EU Customs Single Window (CERTEX)**
- **National Single Window**

Frank Janssens Consultant, CBRA.Services — former Head of Unit, DG TAXUD

VP ODASCE · World Bank Trade & Transport Facilitation · 12 June 2026 · Frank.Janssens@CBRA.Services



YOUR SPEAKER FOR THIS MODULE

Frank Janssens



Senior Trade Facilitation Expert

World Bank · VP, ODASCE

ABOUT

Frank is an experienced international expert on Trade Facilitation, Customs and Border Management. He works as a senior international Customs and Border expert for the World Bank where he currently supports the regional Trade and Transport Facilitation Programme for the Western Balkans countries. Frank has participated in Customs digitalisation related studies for the European authorities.

In addition Frank is Vice-Presidents of ODASCE, the French trade facilitation organisation which supports economic operators on compliance with Customs ICT systems and legislative changes. Frank is also the coordinator of 2 EU Horizon Research and Innovation projects: PARSEC and the BORDERLINK projects (<https://www.parsec-project.eu/> www.Borderlink.eu).

Frank holds a master's degree in economics and international trade and studied in Europe and in the USA. Frank holds a certificate of advanced project management (by PMI).

He worked previously as Head of Unit in DG TAXUD on customs modernisation projects, linked to the UCC implementation and electronic customs (e.g. Customs Single Window development)



THE ROUTE

What this session covers

From the concept, to the EU system, to building one nationally — and the road ahead.

1 What is a Single Window?

The concept, criteria and types.

2 The EU SW Environment

CSW-CERTEX and what it connects.

3 Implementing a national SW

Vision, strategy and design.

4 Challenges for accession

What candidate countries face.

5 Next steps

Toward a fully digital trade environment.

6 Conclusions

Key messages to carry forward.

01

What is a Single Window?



What is a Single Window?

1

The WTO and UNECE define it as a single entry point for all import, export and transit requirements.

1

Single entry point

Lodge standardised information and documents through one channel.

2

Submit once

Individual data elements are provided only a single time.

3

Coordinated controls

A lead agency — usually Customs — coordinates checks and may handle payments.

Source: UN/CEFACT and the UNECE Single Window Recommendation (2020 edition).



Definition

The WTO and UNECE* define a Single Window as a facility that allows parties involved in trade and transport to lodge standardized information and documents with a single entry point to fulfill all import, export, and transit-related regulatory requirements. Individual data elements are only submitted once.

The Single Window is generally managed by a lead agency, usually Customs, enabling the appropriate governmental authorities to access relevant information.

In addition, participating authorities and agencies should co-ordinate their controls through the Single Window.

It may provide facilities for payment of relevant duties, taxes and fees. In practical terms, it aims to expedite and simplify information flows between trade and government and to bring meaningful gains to all parties involved in cross-border trade.



02

The EU Single Window Environment for Customs



The EU Single Window Environment for Customs

2

It improves information sharing and digital cooperation between customs and the authorities enforcing non-customs rules.

1

The law

Regulation (EU) 2022/2399 of 23 November 2022, amending the UCC.

2

The system

EU CSW-CERTEX — the Customs Single Window Certificates Exchange System.

3

The purpose

Clear non-customs formalities — health, safety, environment, agriculture — more easily.

In effect: one digital bridge between customs systems and the EU's non-customs authorities.



Five criteria — and three types

FIVE CRITERIA — UN/CEFACT REC. 33

What makes it a Single Window

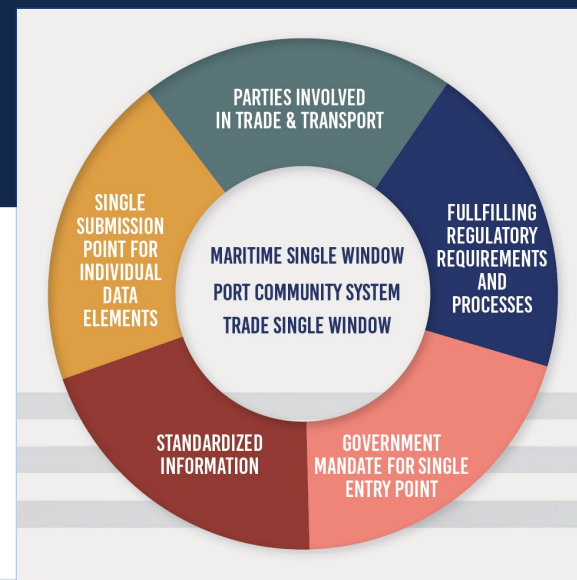
- A single entry point for submissions
- Data submitted only once
- Standardised data requirements
- A controlled vocabulary
- Coordinated controls between authorities

THREE TYPES IN PRACTICE

Not all of them are equal

- TSW — Trade / Customs Single Window
- MSW — Maritime Single Window
- PCS — Port Community System (private sector)

Note: customs clearance, VTMS or TOS alone are NOT a Single Window

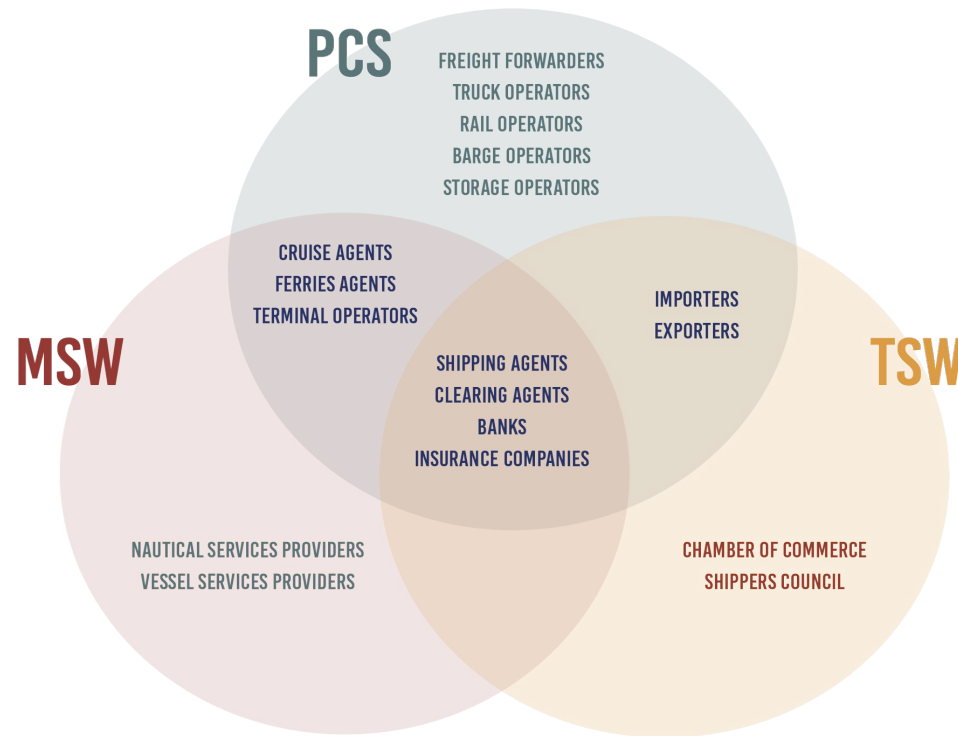




TYPES

Trade/Customs Single window (TSW) vs Maritime Single Window (MSW) vs Port Community System (PCS)

PRIVATE
SECTOR





In common language:

NSW enable traders and clearing agents to submit documentation and/or data requirements related to licenses, permits, certificates, and other trade documents for the importation, exportation, or transit of goods through a single-entry point to the participating authorities or agencies.



Legal basis of the EU SW environment for Customs

- The EU Single Window Environment for Customs finds its legal basis in **Regulation (EU) 2022/2399** of the European Parliament and of the Council of 23 November 2022 establishing the European Union Single Window Environment for Customs and amending Regulation (EU) No 952/2013(UCC).
- The system is known as the **EU Customs Single Window Certificates Exchange System (EU CSW-CERTEX)** and its legal framework improves information sharing and digital cooperation between customs administrations and other government authorities in charge of enforcing non-customs formalities at the EU border.
- This concerns areas such as **health and safety, environmental protection, food and product safety, agriculture, etc.**

This will allow economic operators to clear certain customs formalities more easily.



WHAT IT DOES

Three core functions of CSW-CERTEX

1

Data uniformity

Harmonises information formats across the partner competent authorities (PCAs).

2

Automated validation

Instantly verifies health, agri and environmental certificates at declaration.

3

Quantity management

Tracks balances on digital licences to prevent fraud and double use.



What it covers — and why it helps

REGULATED GOODS & SYSTEMS

Linking the Union databases

- Health & agriculture — CHEDs
- Organic products — Certificates of Inspection (COI)
- Environment — F-gas portal & Ozone-Depleting Substances
- Carbon & industry — CBAM and cultural goods

STRATEGIC BENEFITS

Faster, leaner, safer

- Faster clearance — fewer manual border inspections
- Reduced redundancy — no duplicate data entry
- Enhanced safety — real-time enforcement tools



HOW IT FITS TOGETHER

Three components, one framework

Cooperation and interoperability between customs and non-customs authorities rest on three parts.

The result: administrative checks done electronically at the moment of customs clearance.

1

Union non-customs systems

The EU databases for health, environment, agriculture and more.

2

National SW environments

Each Member State's single window for customs.

3

EU CSW-CERTEX

The exchange hub that connects the two, electronically, at clearance.





Mandatory and voluntary systems

MANDATORY UNION SYSTEMS

Connected by obligation

- DG GROW · DG TRADE
- DG ENV · DG CLIMA
- DG SANTE · DG TAXUD
- Used as required by EU sectoral legislation

VOLUNTARY UNION SYSTEMS

Connected by choice

- TRACES (DG AGRI)
- COI — organic products (TRACES module)
- ICG — import of cultural goods
- ODS 2 licensing system



WHERE IT STANDS

Live today — and expanding to 2031

1

Live today

CBAM entered into force on 1 Jan 2026 — an additional mandatory CSW-CERTEX function.



2

Operational now

Real-time exchange for health, organic, F-gas and CBAM. Rollout speed varies by country.



3

Dec 2031 — B2G

Phase 2: one integrated declaration; a single entry point; no duplicate data.

Union non-customs systems will be connected to EU CSW-CERTEX to exchange information with the national single window environments for customs.

These systems are used on a mandatory or voluntary basis depending on the requirements of EU sectoral legislation for each policy domain.

 Mandatory Union non-customs systems	 Voluntary Union non-customs systems
DG SANTE TRACES DG AGRI Control system for the certification of organic products (COI – module in TRACES) DG TAXUD Import of cultural goods (ICG system – module in TRACES) DG CLIMA Ozone Depleting Substances (ODS 2 Licensing System) Fluorinated Greenhouse Gases (F-gas Portal & HFC Licensing System)	DG GROW Information and Communication System on Market Surveillance (ICSMS) DG TRADE Union regime for the control of exports, brokering, technical assistance, transit, and transfer of dual-use items (DuES e-Licensing system) DG ENV The forest law enforcement, governance, and trade licenses for imports of timber licensing scheme (FLEGT – module in TRACES) Trade in wild fauna and flora licensing scheme EU CITES – module in TRACES



The Carbon Border Adjustment Mechanism (CBAM) successfully entered into force on 1 January 2026. CBAM is an additional mandatory functionality for the [EU CSW CERTEX](#).

If you import goods subject to CBAM (such as iron, steel, cement, aluminum, fertilizers, electricity, and hydrogen) into the EU and exceed the 50-tonne annual exemption threshold, you are legally required to be an Authorized CBAM Declarant.

When filing your customs declarations, the system uses CSW CERTEX to automatically verify your required CBAM documents and certificates.



BENEFITS

Overall benefits of the EU Single Window Environment for Customs

Creates a framework for interoperability

Improves digital cooperation and ensures interoperability between customs and non-customs systems.

Ensures consistent use of data

Ensures the consistent use of customs and non-customs data to fulfill border formalities.

Ensures compliance with EU law

Contributes to the effective implementation of EU law.



Reduces costs and administrative burden

Generates cost savings and reduces the administrative burden for all stakeholders.

Reduces the scope for fraud and error

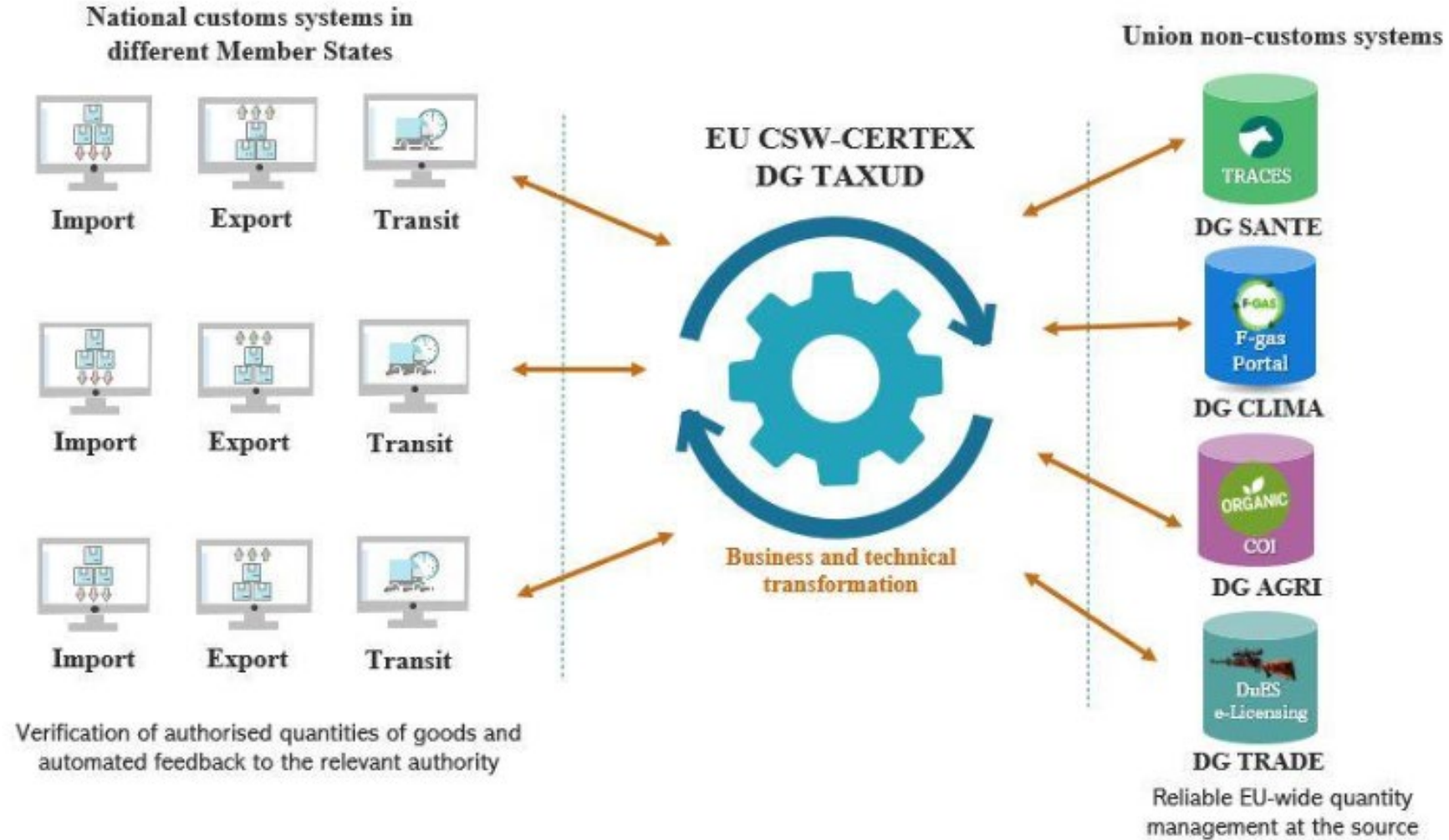
Enables effective monitoring of authorised quantities of goods through automated EU-wide quantity management.

Streamlines processes for economic operators

Establishes a level playing field for economic operators, thus furthering the objectives of the Customs Union.

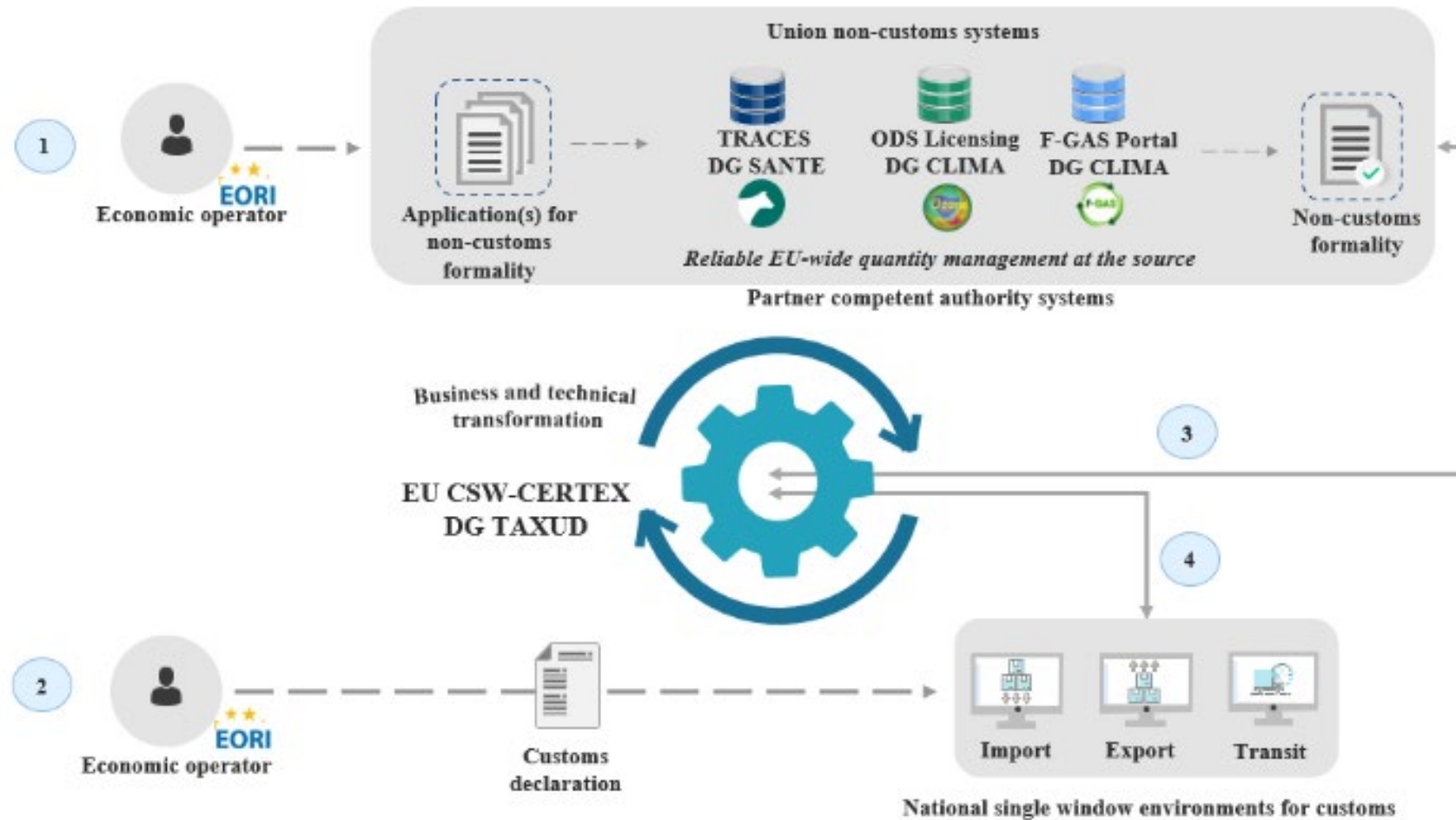


EU CSW CERTEX high-level architecture





EU CSW CERTEX architecture (2)



Is the CSW-CERTEX fully operational at this moment ?

Current Operational Status:

The system is successfully handling automated, real-time data exchange for multiple non-customs formalities, including various health, safety, and environmental documents (such as those for organic products and F-gases), the Carbon Border Adjustment Mechanism (CBAM), fluorinated greenhouse gases (F-gases), and common veterinary documents.

National Rollout:

Actual deployment speed varies by country, as individual member states connect their national customs environments to the centralized EU CSW-CERTEX hub at their own pace.



Phase 2: Business-to-Government (B2G) Scheme (December 2031)

The portal's rollout is mandated to expand systematically.

The final statutory implementation deadline is **December 13, 2031**.

This final phase expands the national single windows to act as an integrated communication channel for businesses

- Single Entry Point:** Economic operators will no longer submit distinct datasets to both customs and specialized partner authorities.
- Integrated Declarations:** Traders submit an "integrated declaration" containing both customs parameters and regulatory non-customs data through their local Member State portal, completely removing duplicate data-entry lines.



03

Implementing a National Single Window



Implementing a National Single Window

3

1

Vision

Define target users, scope, key features and the outcomes to achieve.

2

Strategy

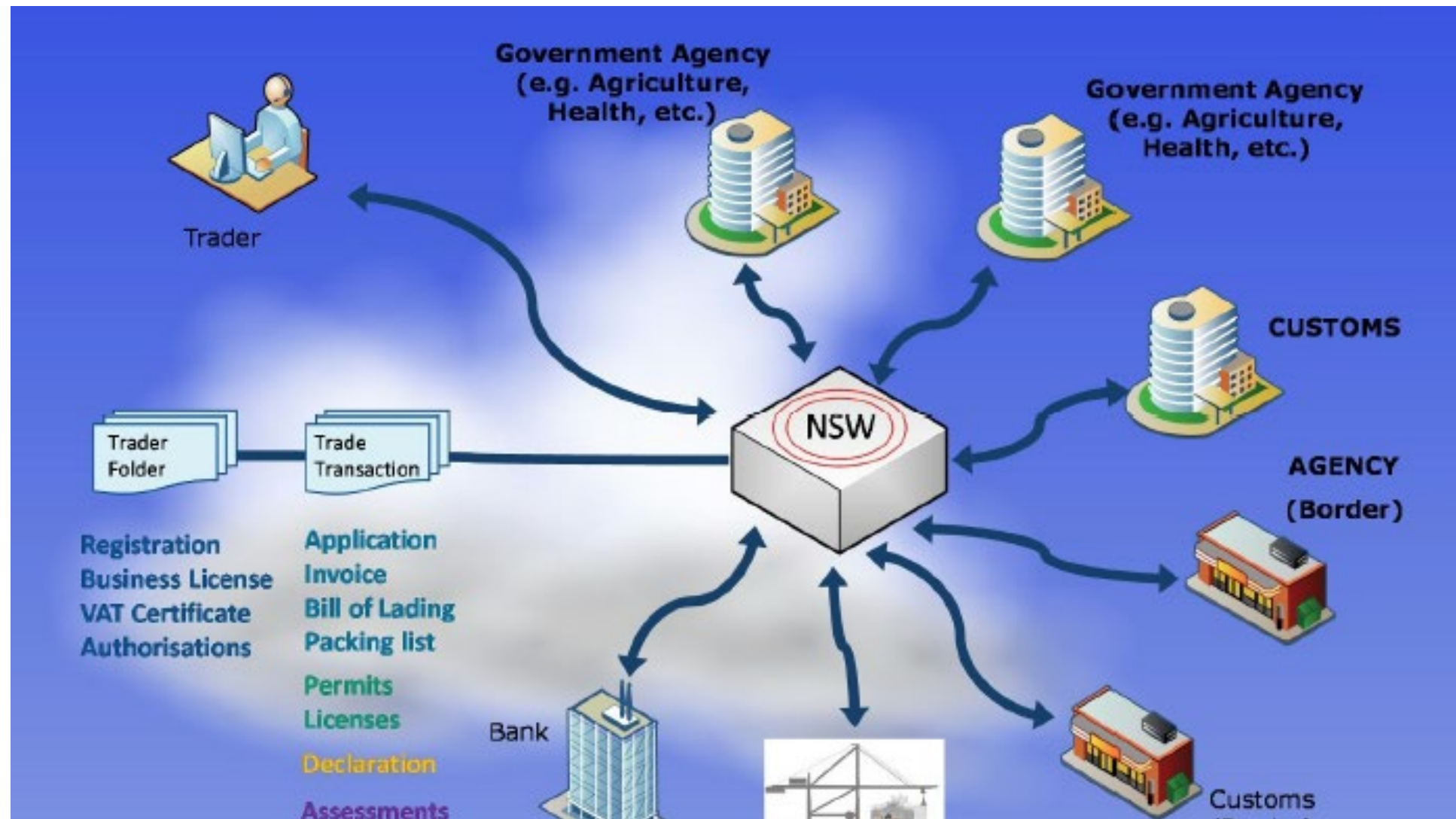
Set the path, the governance and the phasing to get there.

3

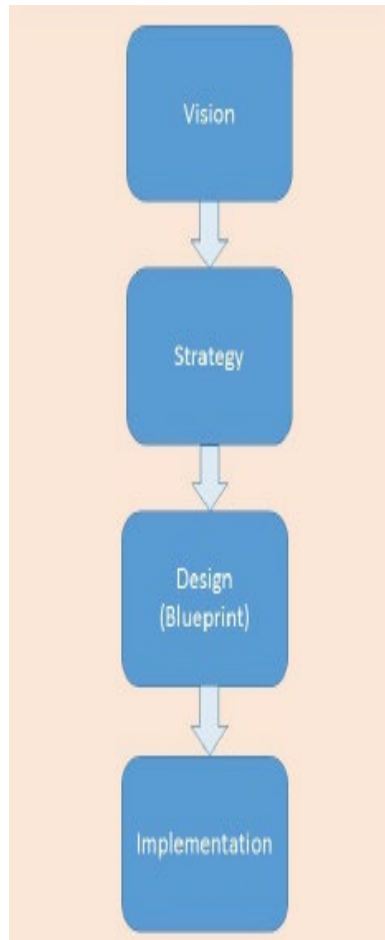
Design

WCO Data Model, technical architecture, service specs, legal framework and business model.

It is a complex undertaking: cooperation between public and private stakeholders is decisive throughout.



Overview of main steps



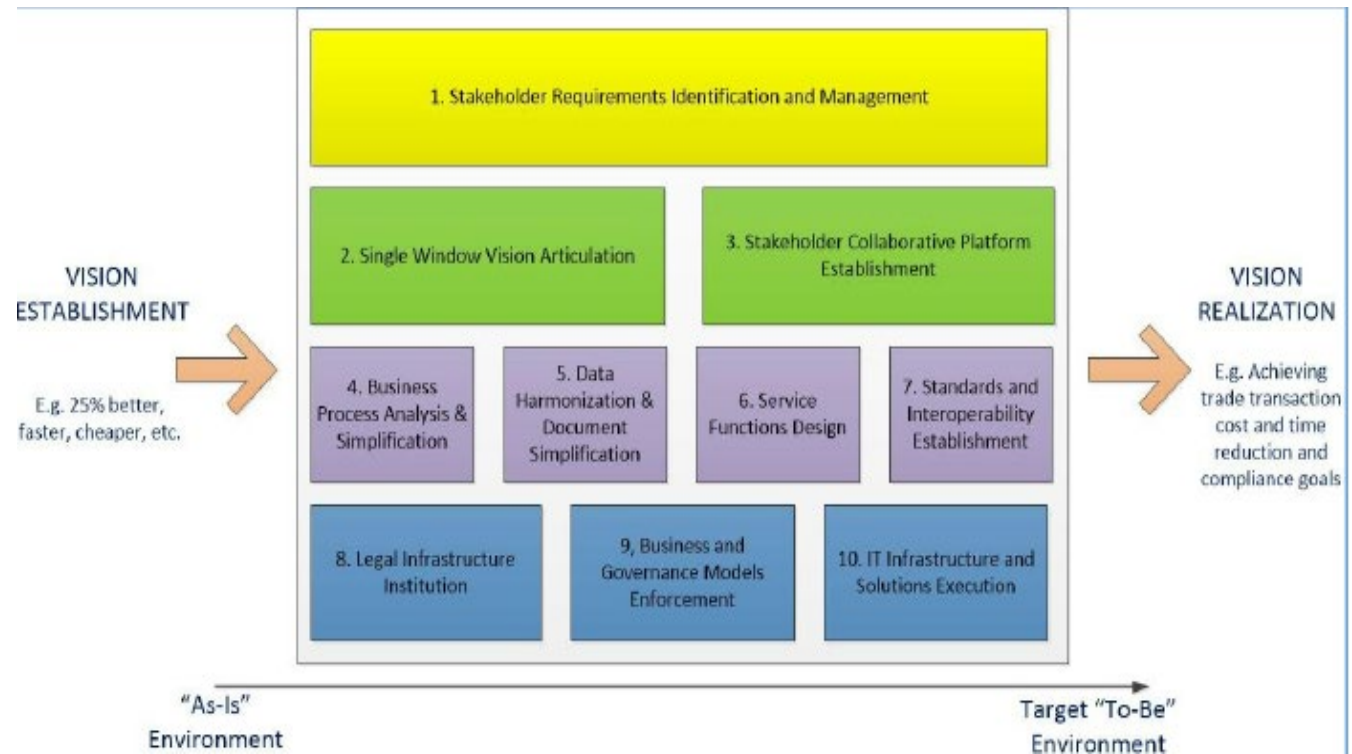
Step 1 Vision

It is good practice in the design of a national Single Window to establish a high-level vision at the outset.

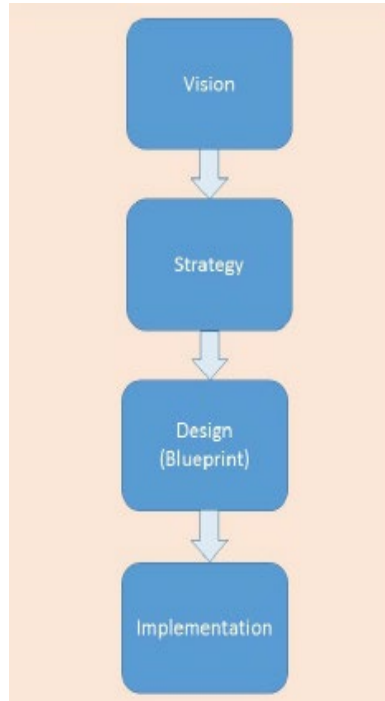
The overall vision should be a starting point defining:

- The target users/beneficiaries
- The scope
- The key features
- The key outcomes

Step 2 – Strategy

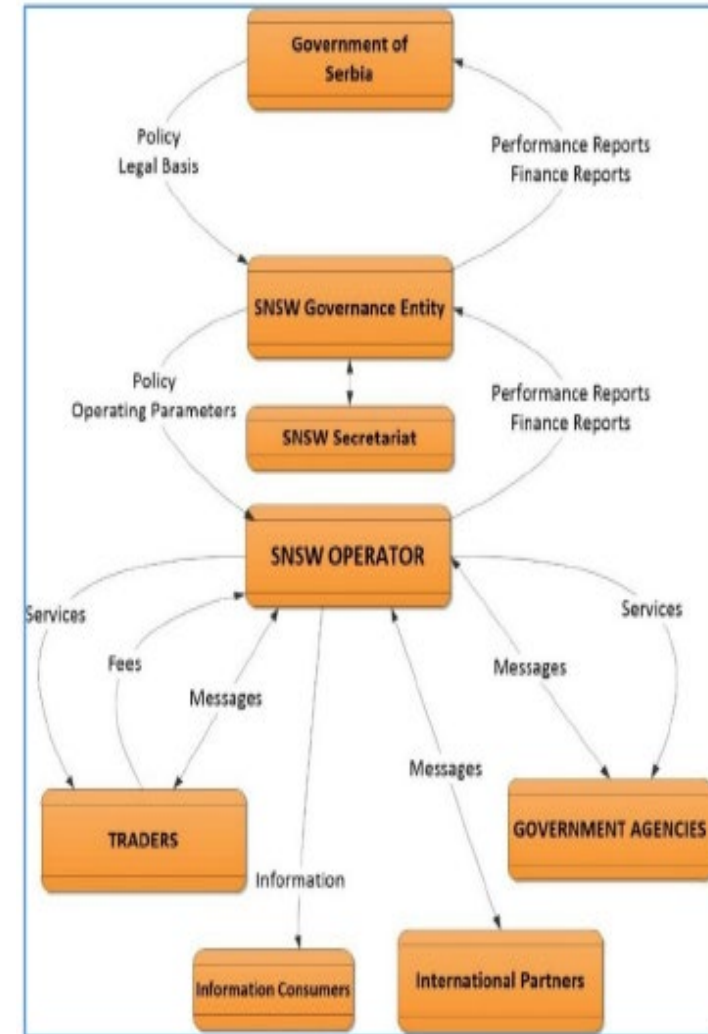


Overview of main steps



Step 3 Design

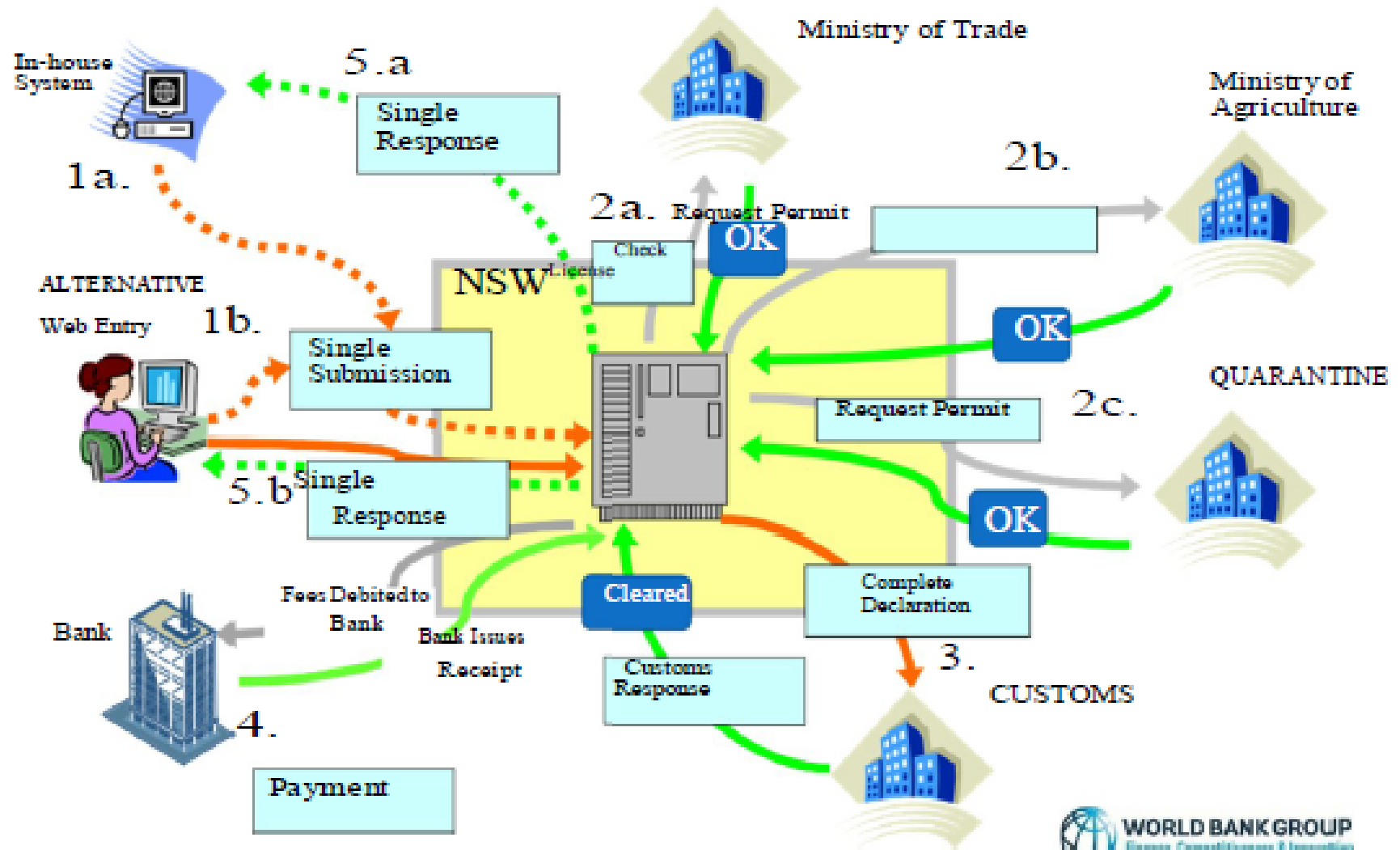
- Data Harmonization using WCO Data Model
- Technical Architecture including: Application Architecture, Data Architecture, End User Architecture and Technical Infrastructure.
- Service Specifications: Service Level Framework (agreements and monitoring), Capacity Building Strategy and Communications Strategy
- Legal Framework: NSW Law and bylaws (secondary legislation)
- Business Model: Operational Model, Financial Model and Governance Model.



Example of a business model

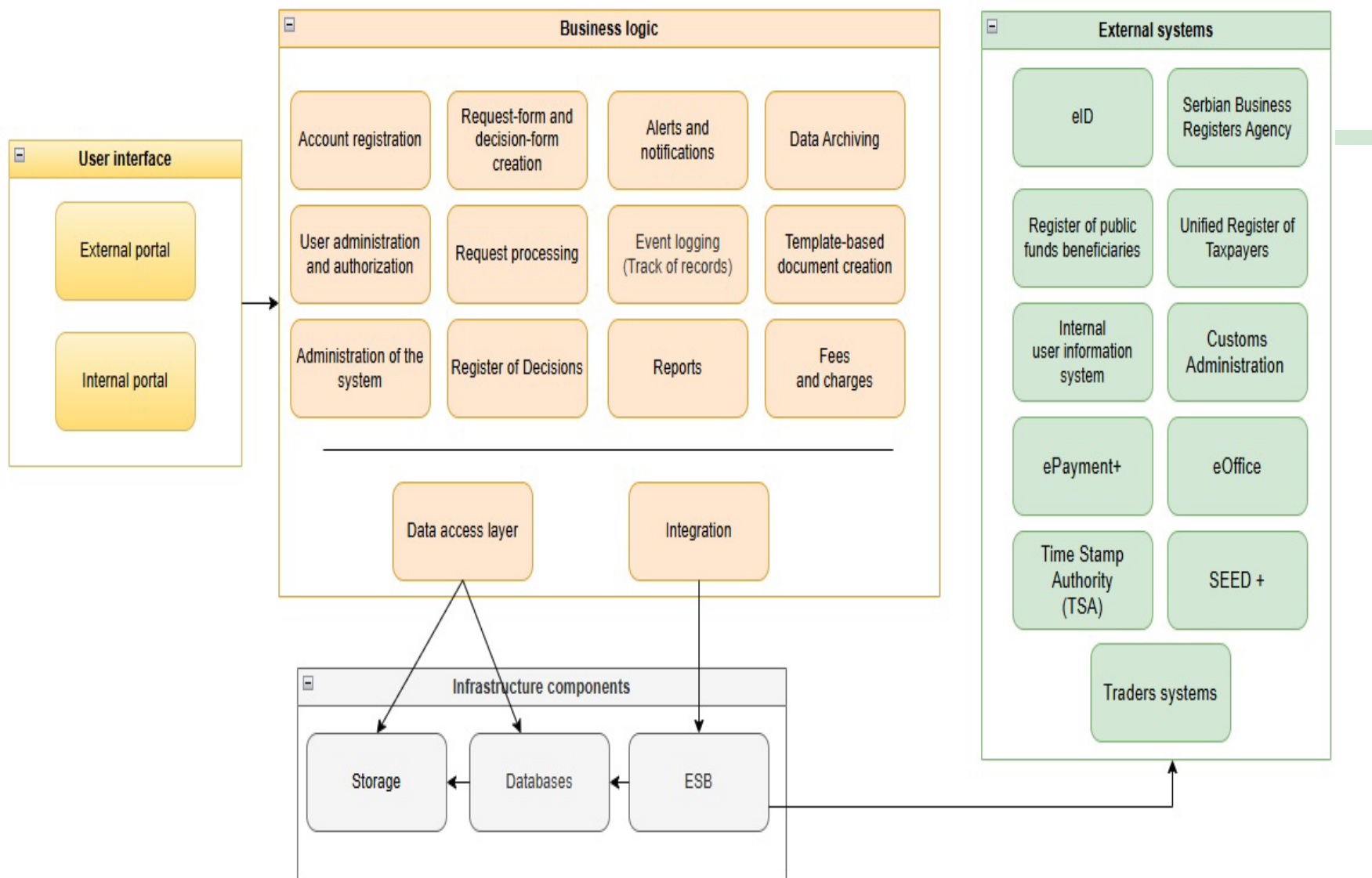


Concept of Single Window





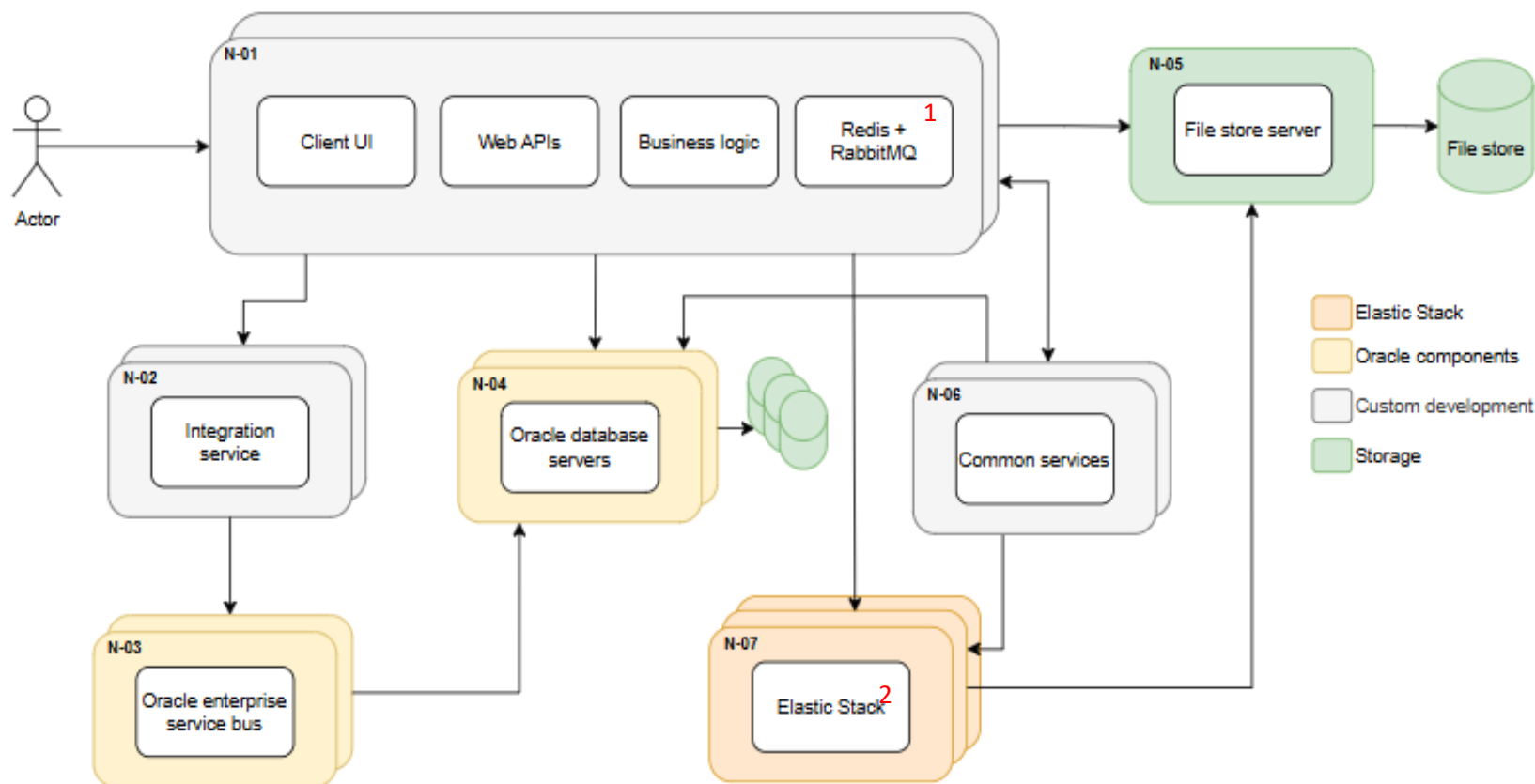
NSW Functional architecture





NSW ICT architecture

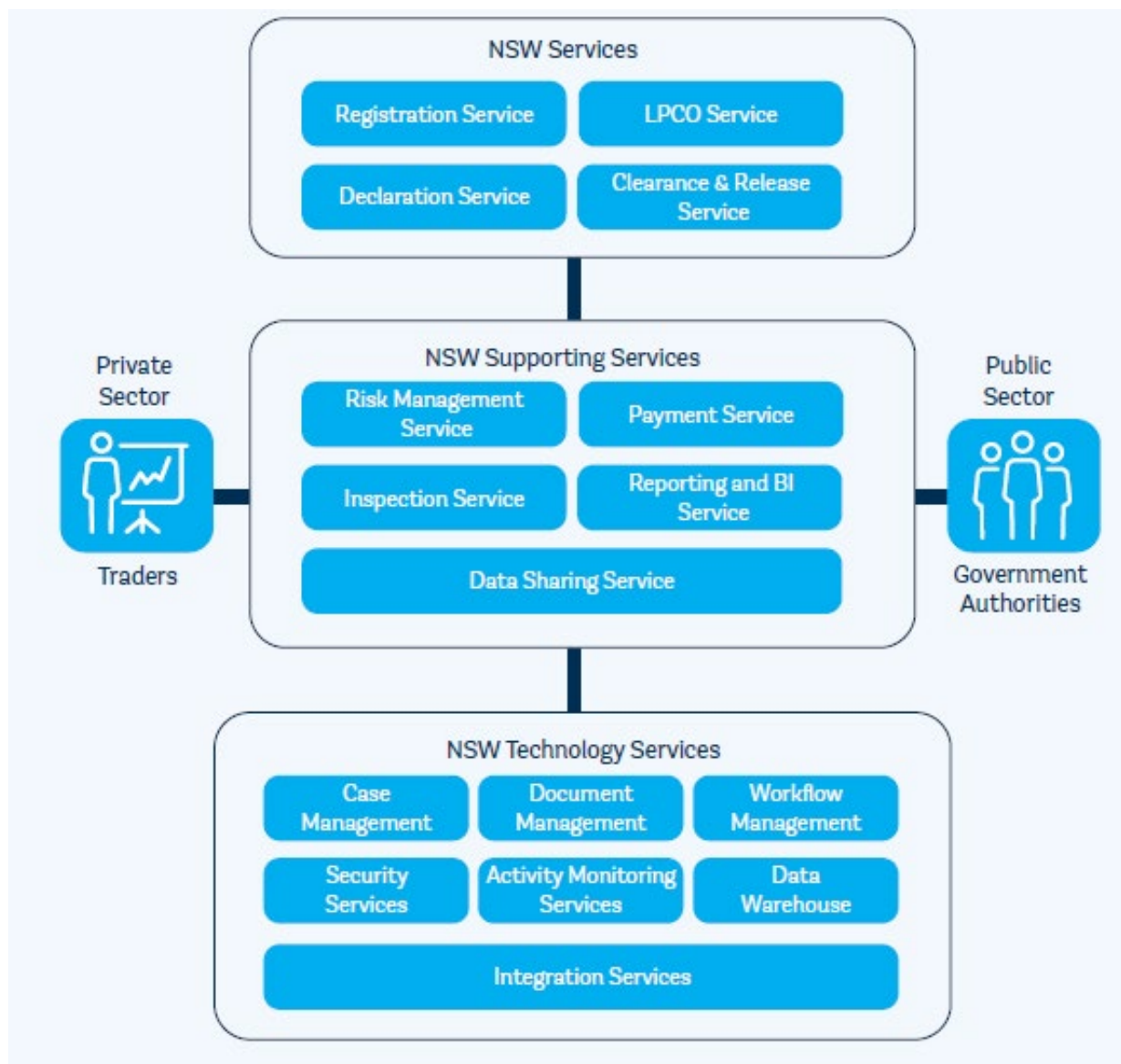
Operational environment



1. **RabbitMQ** is a message broker, while **Redis (Remote Dictionary Server)** is an in-memory key-value data store. Both can be used to create a publish-subscribe messaging system.
2. **Elastic Stack** is a powerful suite of open-source and proprietary tools used for searching, analysing, and visualizing data in real-time. It is widely utilized for centralized log management, infrastructure monitoring, and security analytics.



Technical Architecture overview



04

Key Challenges for EU Accession Countries



Key challenges for accession countries

CUSTOMS & TRADE

Systems and capacity

- Build ~22 EU-compatible systems under time pressure
- Complex tariff management (ITMS); connect declarations to the NSW
- Quality infrastructure: market surveillance, metrology, accreditation
- Sustained fight against corruption

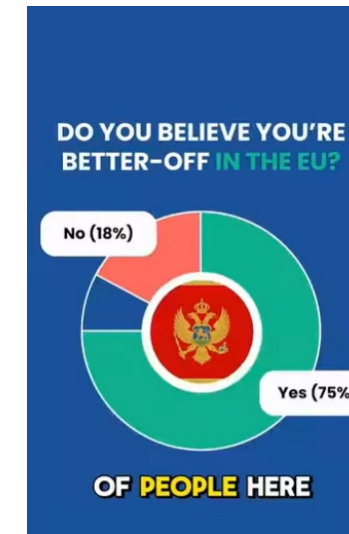
TRANSPORT

Infrastructure gaps

- Poor road and rail infrastructure
- Border-crossing capacity and equipment
- Limited sea access; no Maritime SW, little PCS
- Procurement irregularities

Key challenges in the Customs and Trade domains

- Customs services need to prepare EU accession and develop 22 EU compatible systems
 - Time is a real challenge for Montenegro and Albania
 - Integrated Tariff Management system (ITMS) is complex
 - Need to connect Customs declaration system to the NSW (ITMS and EORI are important)
 - Emphasis on fight against corruption needs to be maintained.
 - Draft laws on EU acquis need to be submitted to the EU for review prior to adoption.
- Border crossings need capacity increase
 - Customs are the most important players here!
 - Infrastructure needs to be upgraded (lanes, parkings, inspection halls, buildings, networks, etc.
 - Trained staff required ready to use modern electronic tools
 - Equipment (Detection Equipment, Customs laboratoria, etc.
- Missing 'Quality Infrastructure' services
 - Market Surveillance
 - Metrology (checking of standardization of weights, volumes, etc.
 - Accreditation (mainly for recognition of different types of laboratoria.)



Key challenges in the Transport domain

- Poor road transport infrastructure
 - Main roads need upgrading
 - Motorways needed, especially on agreed **Green Lanes**.
 - Road safety remains an issue (including lack of data)
 - Border crossings need capacity increase (infrastructure and equipment)
- Railroad network at a very low level
 - Few and outdated railroad lines
 - Mainly passenger traffic and not much used for cargo transport
 - Rail crossings remain unsafe
- Only Montenegro and Albania have direct access to the sea and operational ports (Neum in Bosnia has coastal limited access)
 - All port need urgent extension and modernization (4 new ports planned in Albania)
 - No Maritime Single Window
 - No (or very limited) Port Community System
 - VTMIS under preparation
- Problem of irregularities with public procurement
 - Tenders fail, staff replaced due to corruption investigations, some accidents, ...





ON THE GROUND

NSW projects across accession countries

Progress is uneven — each candidate country connects at its own pace.

● **Albania**
Under implementation

● **Montenegro**
Under implementation

● **Kosovo**
Under preparation

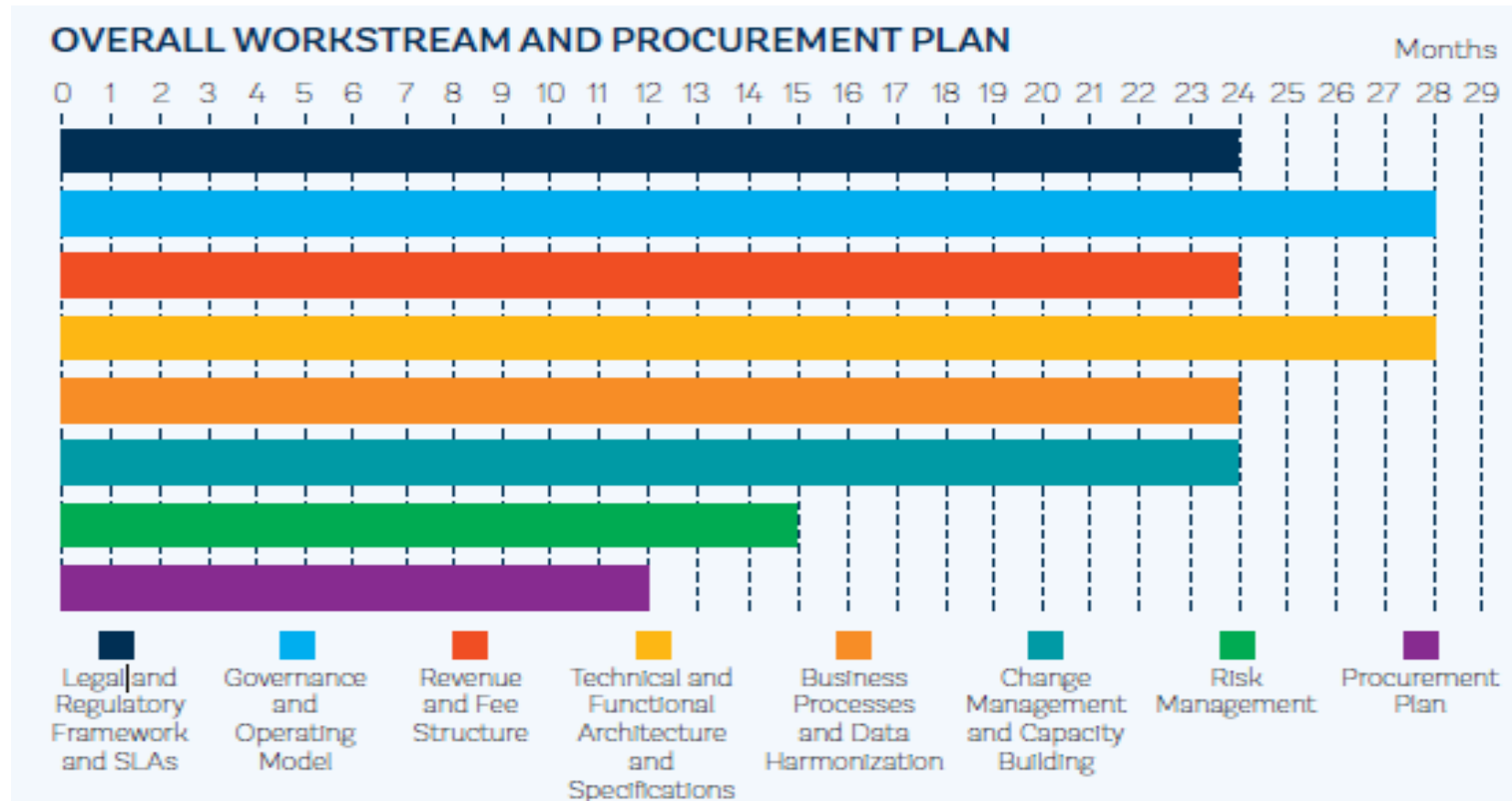
● **Bosnia & Herzegovina**
Not yet started

● **North Macedonia**
Re-developed

● **Serbia**
Under implementation



NSW Implementation time plan



05

Next Steps

Next steps

- Complete all functionality of the EU Customs Single Window – CERTEX, including B2G
- All Member States and Accession countries to complete the NSW, including the digitalization of all non-customs functions by other services
- Prepare a fully digital trade and logistics environment, covering all trade (customs and non-customs) and transport functionality (e.g. MSW, PCS, etc.)
- Look for opportunities of simplification/facilitation, such as connection to European Freight Transport Instrument (eFTI), offer support to multi-modal transport, support use of Digital Product Passport as part of Green Customs.
- Etc.

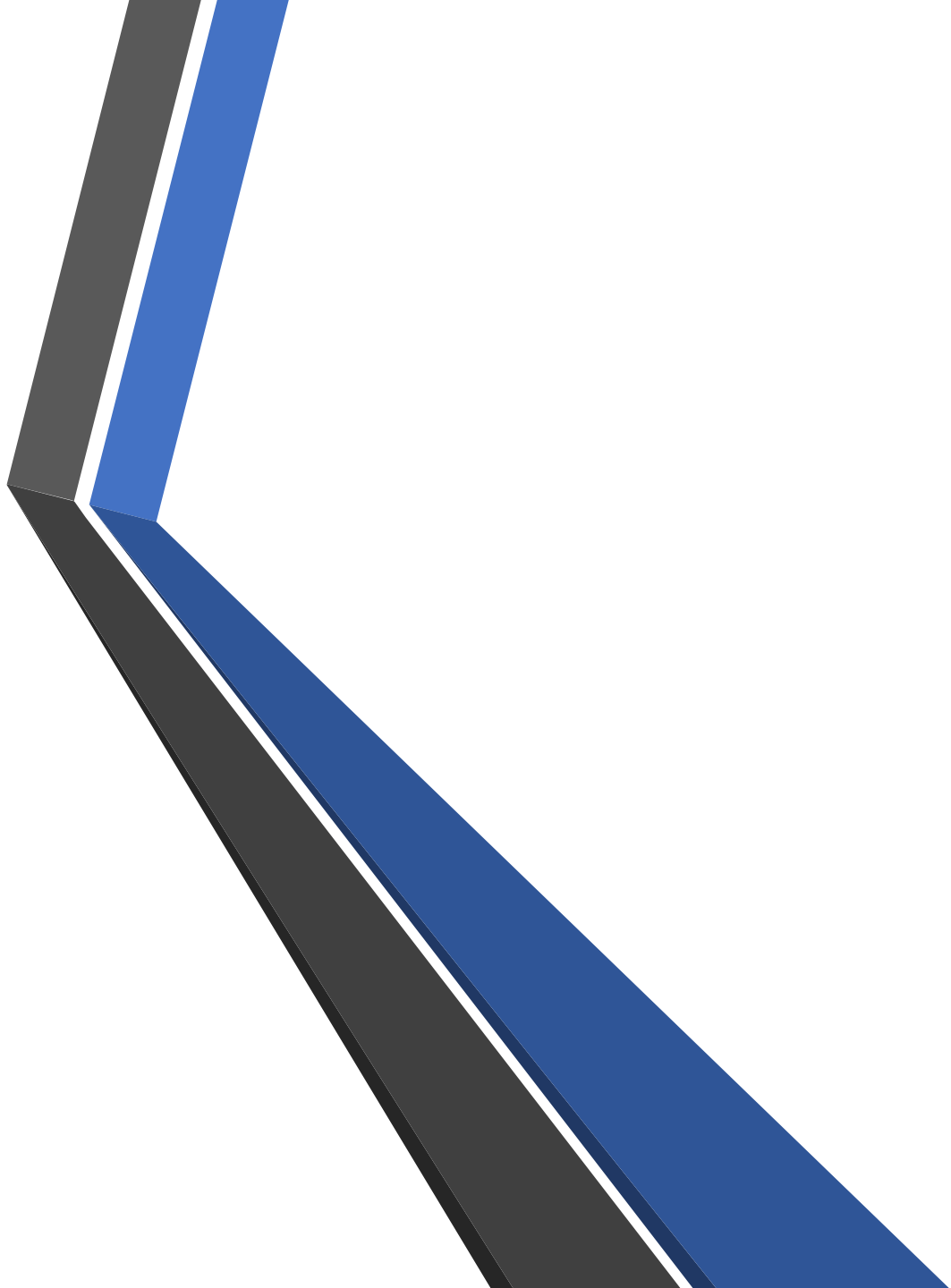


5



06

Conclusions & Key Messages





IN ONE BREATH

Conclusions & key messages

6



Beyond customs

The Single Window spans trade and transport — not customs alone.



Shared values

Different SW types use the same vocabulary and the five common criteria.



A G2G instrument today

CSW-CERTEX is G2G, reaching trade via the National SW as a mandatory feature.



Cooperation is everything

Building an NSW is complex; public-private cooperation makes or breaks it.



Key Messages

Stakeholder engagement is key

**Creating a Single Window is a unique opportunity to
reengineer business processes !**





THANK YOU

Questions & discussion

WHAT THIS SESSION COVERED

- A Single Window: one entry point, submit once
- The EU system: CSW-CERTEX, connecting customs & non-customs
- Building one nationally: vision, strategy, design
- The road ahead — and the challenges for accession

NEXT STEPS

Toward a fully digital trade environment

Complete CSW-CERTEX (incl. B2G) and the national single windows; **then connect trade and transport** — eFTI, MSW, PCS and the Digital Product Passport — the thread Module 5 picks up next.

“Creating a Single Window is a unique opportunity to reengineer business processes.”

AI & Emerging Tech

Future innovations and policy implications

Case study drawn from the Altana keynote · ULiège · 12 June 2026



YOUR SPEAKER FOR THIS MODULE

Scott Friedman



Vice President, Government Affairs

Altana

ABOUT

Scott Friedman is Vice President of Government Affairs at Altana, a supply-chain intelligence company leveraging artificial intelligence to enhance global trade visibility. He works with government authorities including U.S. Customs and Border Protection and UK agencies on customs modernisation and data-driven regulatory innovation. He previously held senior roles in the U.S. Department of Homeland Security, where he led the Office of Trade and Economic Security, and served as senior staff in the U.S. Congress.

AI & Trade

Technology and the restructuring of customs governance

Lecture overview

- | | | |
|----|--|---------|
| 01 | Why Architecture is Destiny - The Federated Knowledge Graph | ~13 min |
| 02 | Risk Detection in Practice - The UFLPA Case Study | ~12 min |
| 03 | From Shipment to Value Chain - The Product Passport | ~15 min |
| 04 | Traceability as a Universal Compliance Layer | ~13 min |
| 05 | From Adversarial Entry to Trusted Networks - Reimagining the Trade Bargain | ~13 min |
| | Discussion & Questions | ~9 min |

01

Why Architecture is Destiny

The federated knowledge graph

"Border management is undergoing two disruptions: the end of the current era of globalisation and the rise of modern AI systems that enable far more sophisticated border management than previously possible."

An Inflection Point: Two Converging Forces

Outram & Swartz (2026) identify the structural tension defining modern customs: borders are simultaneously becoming more strategically important — as economic ties are assessed for resilience and national advantage, not just efficiency — and uniquely tractable for the first time, as AI systems emerge capable of mastering the complexity that overwhelms legacy inspection-and-declaration models. Architecture is not a technical choice; it determines whether this inflection point is seized or missed.

The Visibility Crisis: A Structural Problem

The root cause is architectural: supply chains "developed in a governance gap where no single actor, public or private, could fully control or understand them." Importers typically knew Tier 1 suppliers; governments were blind to goods crossing their borders at the pace of globalisation. COVID-19 and geopolitical disruption ended the era of low-cost opacity.

Scale, complexity, velocity

Scale

Global trade involves billions of annual transactions across hundreds of millions of entities. Traditional risk-based targeting operates on declared data at the border — a fundamentally limited observation window. Multi-tier supply chain analysis multiplies the data problem by orders of magnitude.

- ▶ Billions of transactions; hundreds of millions of entities
- ▶ No inspection regime can manually assess more than a fraction

Complexity

Modern regulatory risks are embedded in multi-tier supply chains across dozens of jurisdictions. Forced labour occurs at Tier 3–4 suppliers; carbon emissions accumulate across production networks; sanctions evasion routes through shell companies and transshipment hubs. These risks are invisible to systems designed around bilateral shipper-consignee relationships.

- ▶ Risks invisible to bilateral transaction-level systems
- ▶ Static rule sets cannot capture multi-hop network exposure

Velocity

The threat landscape shifts faster than traditional policy and targeting cycles can adapt. Criminal networks restructure in response to enforcement. New regulations — CBAM, UFLPA, EUDR — impose compliance requirements that did not exist five years ago. Agencies need systems that learn and adapt, not systems that encode yesterday's assumptions.

- ▶ Outram & Swartz (WCJ, 2026): "Velocity exceeds policy cycle speed"
- ▶ AI adaptive learning is a structural requirement, not a feature

Supply-chain data infrastructure

Centralised

Centrally controlled networks — the model promoted by China and some Western platforms. Offers scale benefits but requires data sovereignty concessions and creates systemic concentration risk.

- ▶ Economies of scale at the cost of sovereignty
- ▶ Incompatible with GDPR/CCPA and competing national interests

Decentralised

Driven by GDPR, CCPA, and interest in blockchain/Web3. Preserves privacy but produces fragmentation. Cross-actor intelligence — essential for multi-tier supply chain compliance — cannot be achieved when each actor's data remains isolated.

- ▶ Preserves privacy; prevents network intelligence
- ▶ Fragmentation incompatible with compliance at scale

Federated

A third way: shared intelligence without commingled data. Each participant maintains a private "spoke"; derived analytics shared across the network without transferring underlying data. Sovereignty preserved; intelligence compounds.

- ▶ Sovereignty-preserving network effects
- ▶ Foundation for cross-border compliance without data pooling

Observe, orient, decide, act

Observe (See)

- AI constructs a dynamic, intelligent map of the global supply chain — harmonising billions of multilingual, messy records. Each shipment is understood with either a probabilistic (inferred) value chain or a submitted Product Passport. Coverage: 500M+ companies, 3B+ shipments, 140M+ supply chain connections across all geographies.
- ▶ Product-level observation, not shipment-level declaration
- ▶ AI canonicalises entities across languages and jurisdictions

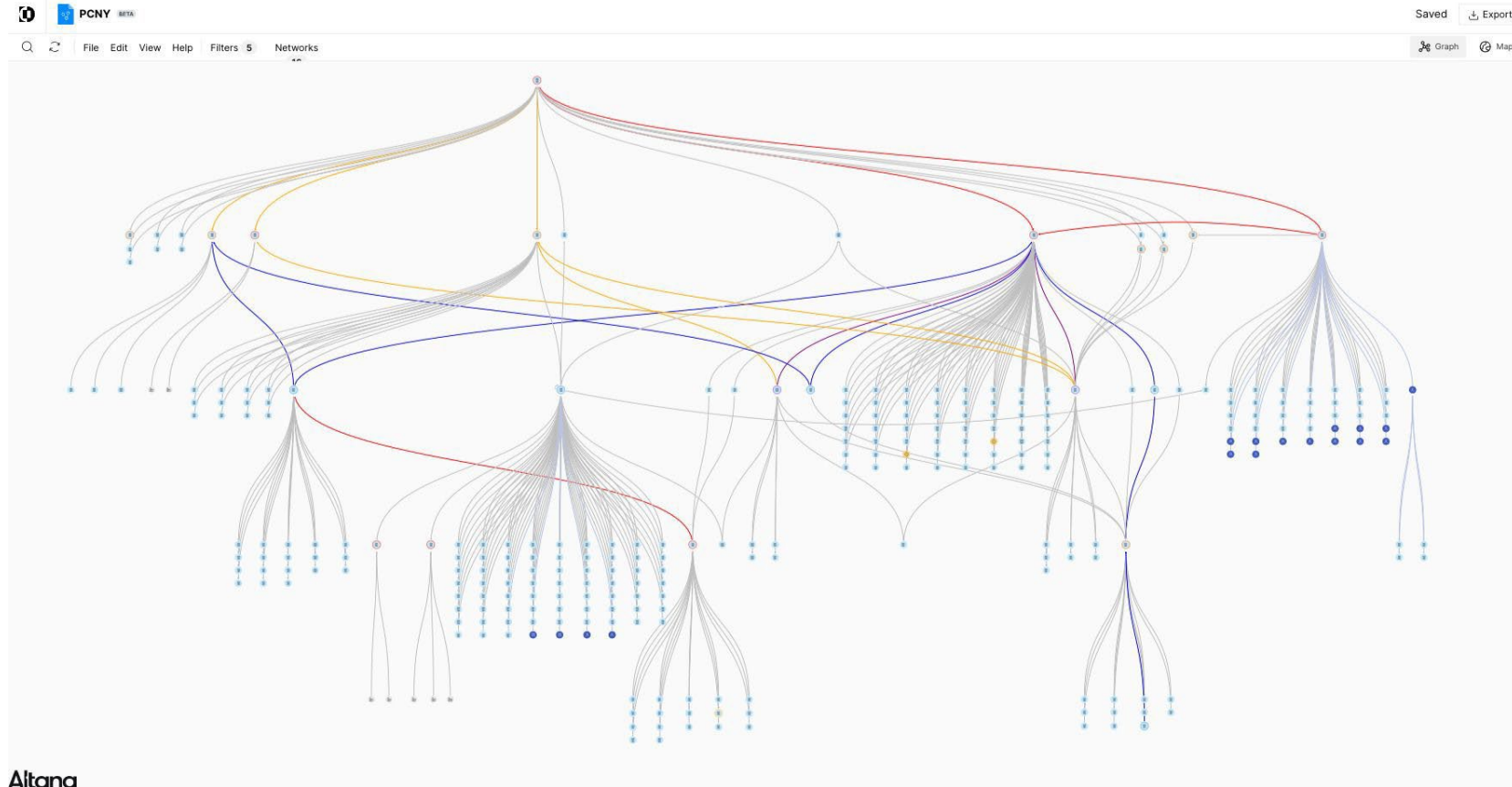
Orient (Focus)

- Using the constructed value-chain network, AI ranks and triages goods for expedited green-lane movement or targeted inspection. Network structure identifies critical nodes — narcotics supply chains, forced labour hubs, high-carbon producers — invisible to transaction-level analysis. Configurable to any regulatory mandate.
- ▶ In one major economy: 40% of goods moved via AI-expedited Green Lane
 - ▶ Simultaneous targeting of narcotics, forced labour, misclassification

Decide & Act

- Recommended actions — facilitation, inspection, denial of entry, request for documentation — are presented by the AI with evidentiary justification tied to the regulatory basis. Humans remain in the loop; high-performing systems surface explainable evidence that builds trust and satisfies due process. The loop restarts as outcomes feed back into the model.
- ▶ Explainability is a structural requirement, not a design choice
 - ▶ Outram & Swartz (2026): outcomes feedback enables continuous learning

Production relationships at scale



Source: Outram, M. & Swartz, P. (2026). *Modern Border Management: Leveraging AI Systems for Strategic Advantage*. *World Customs Journal*, 20(1), 167–189.

Outram & Swartz (WCJ, 2026) — A comprehensive map of production relationships — blue dots are corporate entities and facilities; links are ownership and trade relations. Companies and networks can be vetted for criminal activity and trust; unintended connections (diversion of narcotics precursors, counterfeit ingredients) can be cut.

From siloed data to federated intelligence

FROM	TO
Each government agency and enterprise maintains isolated data silos; cross-border sharing requires treaty-level instruments.	Private "spokes" enable participation in a trusted network; derived analytics shared without transferring raw data.
Enterprises treat supplier disclosure as competitive risk; share data only under legal compulsion.	Enterprises contribute data to their private spoke and gain network intelligence, pre-clearance benefits, and enforcement predictability.
Intelligence relies on public sources — incomplete, retrospective, and gameable by sophisticated actors.	Intelligence produced by federated learning across billions of data points — continuously updated, forward-looking, and resistant to gaming.
Each regulatory mandate requires a separate, costly data collection and compliance infrastructure.	One federated network architecture serves multiple compliance regimes simultaneously. The Product Passport is the universal compliance interface.

02

Risk Detection in Practice

The UFLPA Case Study

From transaction-based to network-level enforcement

TRANSACTION-BASED (legacy)

Risk assessment focused on "bad guys and bad boxes" — counter-terrorism and narcotics detection through inspection at physical checkpoints. Unit of analysis: the individual shipment crossing the border.

Compliance is a transactional determination: is this specific declared shipment admissible? Intelligence relies on bilateral shipper-consignee data — invisible to multi-tier supply chain risks.

Outram & Swartz (2026): "Existing paradigms centred on inspection at physical checkpoints are no longer sufficient to manage the complexity of 21st-century trade."

Enforcement covers fewer than 2% of cross-border shipments; adversarial posture incentivises minimum disclosure.

NETWORK-BASED (emerging)

Risk assessment traces multi-tier value chain properties — material origins, processing locations, ownership networks — across the full supply graph, not just the border transaction.

Compliance is a continuous network property: does this product's value chain meet applicable standards at all tiers? Exposure detected upstream, before manufacture or shipment.

UFLPA (2022): governments designate supply chain networks as presumptively non-compliant — shifting the full cost of network visibility and proof to the private sector.

Network intelligence enables simultaneous facilitation (Green Lane) and targeted enforcement — transforming the border from a bottleneck into a strategic asset.

"Goods mined, produced, or manufactured in Xinjiang — or by entities on the UFLPA Entity List — are presumed to have been produced with forced labour and are barred from U.S. import."

The Structural Innovation: Presumptive Network Guilt

Bersin, Swartz & Karlsson (2025) describe the UFLPA as "a seismic shift in regulatory logic." In the old paradigm, governments enforced specific acts of wrongdoing. In the new paradigm, governments designate supply chain networks as presumptively non-compliant, shifting the entire cost of network visibility and proof onto the private sector.

Network enforcement in practice

Key findings from CBP enforcement data (2022–2025):

~90% of UFLPA detention value is electronics. Xinjiang accounts for approximately 50% of global polysilicon production — the primary raw material for solar panels and semiconductors. The chain runs: Xinjiang mines → Chinese polysilicon producers → Southeast Asian wafer/cell manufacturers → U.S. importers. No detained shipments came directly from China; dominant countries of origin were Malaysia, Vietnam, and Thailand.

This is precisely the enforcement problem network-level visibility is designed to solve. The presumption attaches to upstream network connections (Tier 3–4 material origins), not the immediate trade transaction. Conventional transaction-level customs targeting cannot detect the relevant compliance signal.

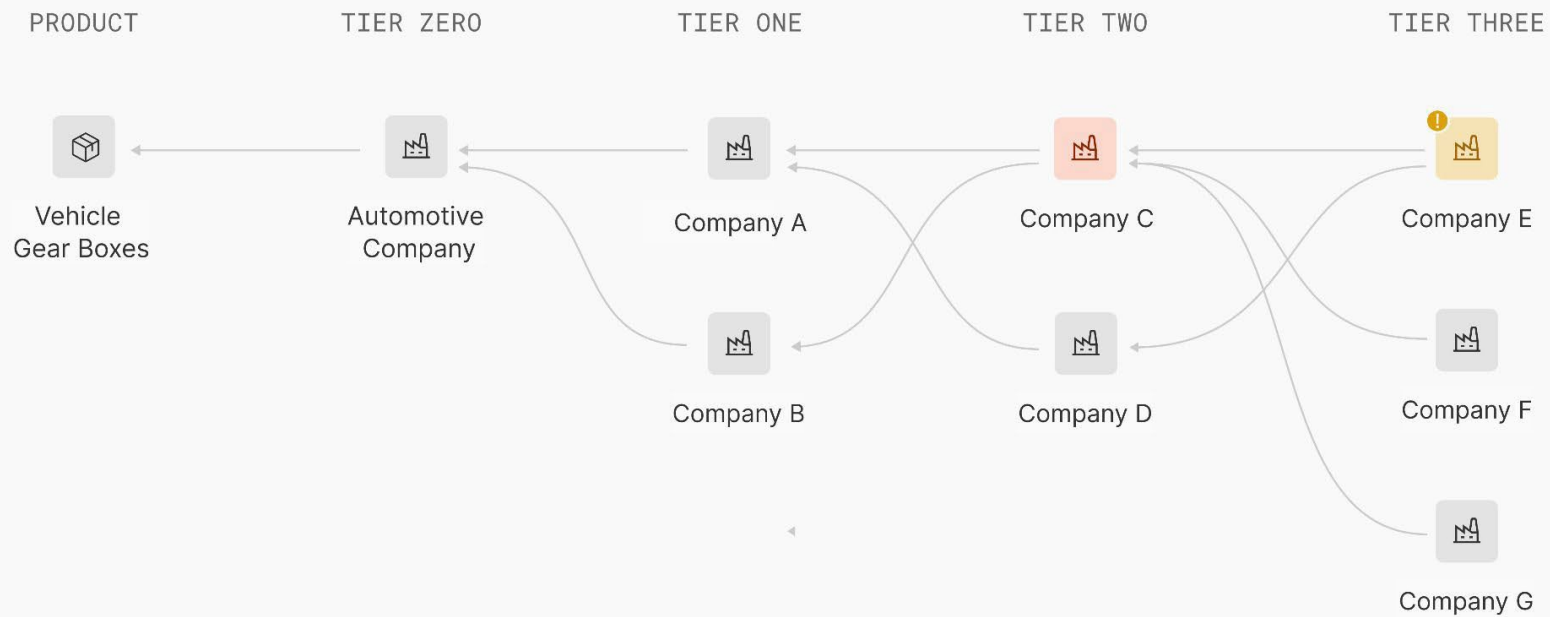
Altana's deployment allowed CBP to traverse the supply graph from detained electronics shipments through component manufacturers and wafer producers to polysilicon suppliers and Xinjiang mine operations. This multi-hop graph traversal, applied across billions of shipment records, was operationally impossible before networked supply chain data.

The system in action

Outram & Swartz (WCJ, 2026) — Use of AI to map extended connections to human rights abuses by screening goods crossing the border. Red nodes = known human-rights-abusing facilities; yellow = suspected. Multi-tier value chain traversal identifies exposure that is structurally invisible to bilateral transaction-level customs data. Public and private sectors then collaborate to confirm or deny forced labour connections.



Network View



Source: Outram, M. & Swartz, P. (2026). *Modern Border Management: Leveraging AI Systems for Strategic Advantage*. *World Customs Journal*, 20(1), 167–189.

Four enforcement mandates

Forced Labour	Counternarcotics	Revenue & Misclassification	Economic Security
UFLPA (2022) + EU FLR (2024; Reg (EU) 2024/3015): network graph traversal identifies Tier 3–4 material origins connected to designated forced labour regions. In one major economy, 40% of goods expedited via Green Lane while simultaneously targeting human rights violations.	The same graph traversal applied to illicit fentanyl supply chains — targeting precursor chemical flows across jurisdictions to identify manufacturing nodes, not just final distribution. AI decision support with explainable risk scoring of companies for likelihood of narcotics network involvement, backed by evidentiary shipment records.	AI identifies HS code misclassification, misvaluation, and transshipment fraud. \$1 billion in missed tariff revenue identified in a single major economy through reanalysis of shipments and value chains. Explanations tied to WTO Valuation Agreement methods — legally defensible and auditable.	Multi-tier supply chain visibility enables governments to understand critical dependencies in semiconductors, pharmaceuticals, rare earths, and defence inputs. AI maps the multi-tier impact of supply disruptions (hurricanes, export controls, war) propagating through production networks — enabling proactive rather than reactive resilience management.

03

The Product Passport

From Shipment to Value Chain

"The standard transactional customs entry cannot keep up with the complexity of component-based tariffs, or the demands of managing compliance across entire product value chains."

Why the Customs Entry is the Wrong Unit of Analysis

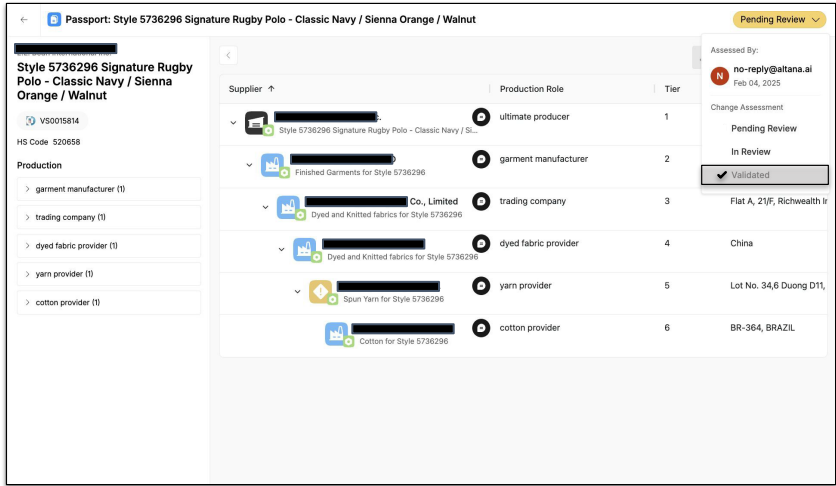
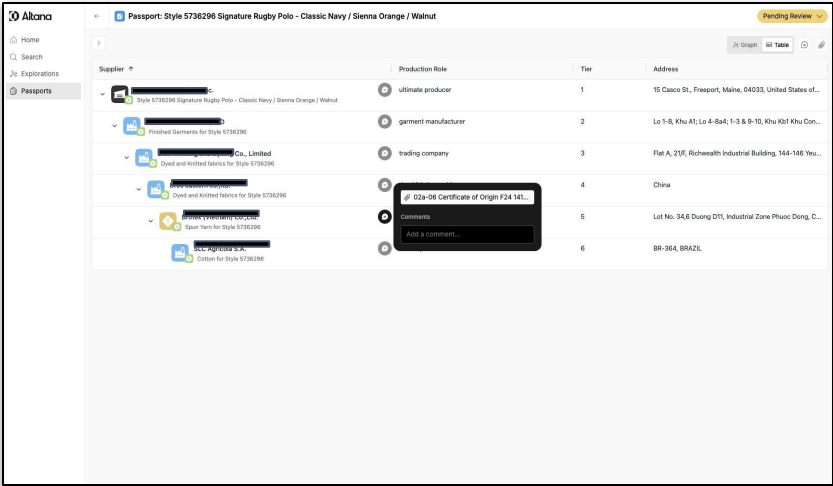
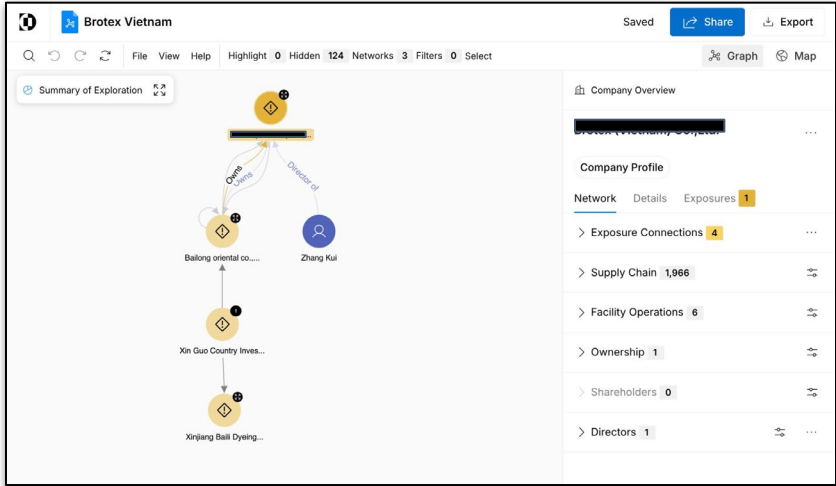
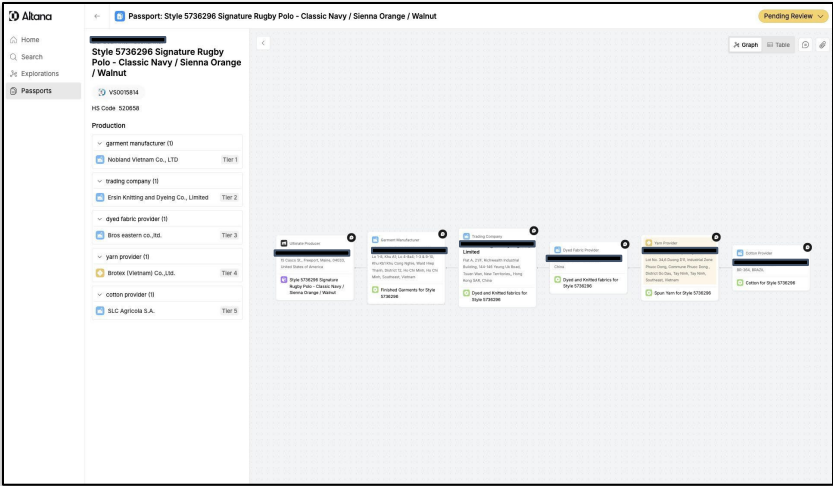
Modern regulatory obligations — forced labour statutes, CBAM carbon accounting, deforestation due diligence — are properties of products and their value chains, not of individual shipments. The customs entry encodes a transaction; a Product Passport encodes a production history. Any compliance system that cannot access that history will be systematically gamed.

The Product Passport: A Dynamic, Evidentiary Production Record

The customs entry encodes a transaction. The Product Passport encodes a production history — a persistent digital record of the full value chain from raw material to finished good, constructed automatically by AI and tied back to original transport and ownership documents. Any compliance obligation that is a property of how a product was made — carbon content, labour conditions, deforestation exposure — can only be enforced against a system that holds that production history. The customs entry cannot. The Product Passport can.

THE PRODUCT PASSPORT

Automated data capture across the value chain



Three layers of increasing certainty

Layer 1: Harmonised Data

AI canonicalises messy, multilingual raw data — company names, addresses, product descriptions — into a unified representation tied to canonical IDs. The system processes all representations of a company name across all major languages, robust to misspellings and transliteration. This harmonised layer is the evidentiary foundation; all inference and attestation are anchored to it.

- ▶ Tied back to original shipment documents — not synthetic
- ▶ Federated: each jurisdiction's data stays in its own spoke

Layer 2: AI Inference

Where disclosure is absent or incomplete, machine learning infers supply chain relationships from trade flow patterns and graph traversal. These outputs are probabilistic — a critical legal distinction. Inference fills the gap across opaque supply chains at Tier 3–4 where no Product Passport submission exists. Accuracy and error rates are key accountability questions for any regulatory framework using inferred data.

- ▶ Probabilistic inference ≠ verified evidence
- ▶ Inference accuracy improves with network scale and feedback loops

Layer 3: Regulatory

The passport maps its verified and inferred data against applicable legal requirements, generating structured attestations: UFLPA compliance, CBAM embedded carbon content, country of origin, HS classification, EUDR deforestation status. Attestations submitted pre-border allow CBP and partner agencies to screen passports before goods are shipped — converting the compliance burden from reactive to proactive.

- ▶ Legal status of AI-generated attestations varies by jurisdiction
- ▶ Pre-submission enables "Global Entry for Goods" pre-clearance

The CBP Global Business Identifier programme

Pre-Border

Value chain screened before manufacture

GBI Programme

BASF, L.L. Bean, Maersk enrolled

Phase 5 (2025)

Contract expanded to customs modernisation

BEFORE

The adversarial, asymmetric entry-contestation process

Importers facing UFLPA detention submit thousands of pages of supply chain documentation. CBP may respond with single-sentence rejections — a process adversarial, asymmetric in information, and unable to scale.

- ▶ 19 U.S.C. § 1517: no mechanism for proactive pre-validation
- ▶ Information asymmetry is total; incentives to disclose are negative

AFTER

"Global Entry for Goods": trust earned through verified supply chain data

Importers register product value chains as Product Passports. CBP screens passports before goods are shipped. Pre-validated goods receive expedited clearance; compliance gaps are identified collaboratively.

- ▶ Transforms the customs entry from adversarial declaration to a record-keeping event
- ▶ Product-level trust replaces entity-level trusted trader status

Uses and applications

Compliance

In the case of certain importers the need to have a lightweight and efficient mechanism to disclose and discuss the extended value chains of products is key not only for customs processes but to ensure a consistent operational posture to control logistics and go to market costs

- ▶ Digital payload creates highly efficient disclosure mechanism
- ▶ Allows for targeted remediation

Efficiency

Other importers, such as express carriers, need a mechanism to handle the volume of disclosures in the face of changing regulations. The “data first” approach provided by passports creates new digitally native options to handle massive filing requirements in ways that keep operations running

- ▶ Batch management of package information eases process bottlenecks
- ▶ Trend and pattern analysis reveal where human intervention is needed

Network Alignment

A mutually accepted data element amongst importers, carriers and sovereign customs authorities enables the rich transmission of detailed value chain information easily and quickly from the private sector to one or many jurisdictions while reducing the reporting burden

- ▶ A “translation layer” that quickly ports the same information into various single windows
- ▶ Transforms a physical logistics network into a digital compliance network

04

Traceability as a Universal Compliance Layer

The product-level view of trade compliance

"Regulatory obligations attach to products and their value chains — not to shipments, declarations, or trade transactions."

The Product as the Unit of Trade Compliance

If a compliance obligation — forced labour, carbon content, deforestation linkage — is a property of how a product was made, then the relevant evidence is the production history of that product. The customs entry cannot contain that evidence. Only a product-level record that travels with the good through its lifecycle can capture, verify, and communicate it to a customs authority. This is a structural requirement of modern trade governance.

Multiple regulatory regimes

CBAM (Carbon)

- The EU Carbon Border Adjustment Mechanism (Reg. 2023/956) requires reporting embedded carbon in imports of steel, cement, aluminium, fertilisers, and electricity. Carbon is a property of the full production process — the same federated network traces emission intensities through identical supply chain nodes.
- ▶ Full financial obligations from January 2026
- ▶ Carbon accounting requirement extends to all production tiers

EUDR (Deforestation)

- The EU Deforestation Regulation (Reg. 2023/1115) requires due diligence that commodities have not caused deforestation post-December 2020, with traceability "to the plot of land" as the standard.
- Geospatially-anchored, multi-tier supply chain data is the compliance infrastructure this regulation demands.
- ▶ Mandatory geolocation data; fine up to 4% of EU annual turnover
 - ▶ Multi-tier agricultural supply chain traceability required

Forced Labour

- The UFLPA (U.S., 2022) and EU Forced Labour Regulation (2024) impose due diligence obligations requiring multi-tier supply chain compliance evidence. The UFLPA deployment by CBP provides operational proof that the product-level, network-based approach can be enforced at border scale in real time.
- ▶ Rebuttable presumption (UFLPA); prohibition + withdrawal (EU FLR)
 - ▶ Multi-tier evidence requirement is identical across regimes

Federated compliance in practice

From Bersin, Swartz & Karlsson (2025) — a hypothetical illustrating the architecture:

A coalition of nations implements CBAM. A manufacturer routes goods through an intermediary country ("carbon laundering") — falsely claiming low-emission supply chains. Traditional methods cannot verify carbon compliance across complex multi-tier supply chains: documents are easily falsified, and physical inspection is insufficient. The same arbitrage dynamics that drove origin fraud under anti-dumping regimes now apply to carbon declarations.

A federated AI system resolves this: manufacturers integrate emissions data into their private spokes; AI cross-references with verified emissions reports and sustainability certifications. A manufacturer that historically sourced steel from a high-emission region but suddenly claims a low-carbon chain triggers scrutiny through network anomaly detection — its supply graph contradicts its attestation.

Outcome: compliant manufacturers receive expedited clearance; non-compliant actors lose the ability to manipulate supply chains through transit-country laundering. The same architectural logic applies identically to forced labour, deforestation, sanctions evasion, and export controls — one architecture, many compliance regimes.

Evidence from operational deployments

2,000+

CBP agents equipped with multi-tier network supply chain intelligence for UFLPA enforcement — an operation structurally impossible under pre-network customs architecture

95%+

Faster detection of critical supply chain vulnerabilities — UK Government Global Supply Chain Intelligence Programme (Tony Blair Institute for Global Change)

£188K→£5K

Cost per supply chain risk review in the UK GSCIP programme — a 97% reduction, assessment time from 6 months to under 1 month

~70%

Of global container shipping volume in scope of the Altana-Maersk digital trade network across 12 key international ports

05

Reimagining the Trade Bargain

From Adversarial Entry to Trusted Networks

"The traditional adversarial relationship between the private and public sectors is no longer tenable in this complex landscape." — WCJ 2025

The Failure of the Current System

The WCJ (2025) paper documents the structural failure: the Form 19 process for contesting UFLPA detentions "often involves the submission of thousands of pages of supply chain data, which frequently is rejected by the government with one-sentence replies." Incentives to disclose are negative; enforcement covers fewer than 2% of cross-border shipments.

From episodic entry to dynamic, network-based compliance

EPISODIC (current)

Compliance assessed at a single moment — the customs entry. Once goods are released, the compliance obligation is substantially extinguished.

The customs entry is the operative legal event: a snapshot declaration binding the importer at a point in time.

Trusted trader programmes (AEO) qualify the importer entity for security benefits — not the compliance of their specific goods.

Non-compliance detected after goods enter commerce — enforcement requires seizure, penalty, and restructuring under regulatory duress.

DYNAMIC (proposed)

Compliance assessed continuously across the product's value chain lifecycle — from upstream sourcing through manufacture, logistics, and delivery.

The Product Passport is the operative compliance record: a dynamic object updated across the product's lifecycle, subject to ongoing verification.

Trusted network programmes qualify specific products — "Global Entry for Goods" based on verified value chain compliance rather than entity-level trust.

Non-compliance detected before manufacture or shipment — supply chains restructured proactively; compliance converts from a cost into a competitive advantage.

A new framework for public-private collaboration

Private Sector Obligations

Full disclosure of entire supply chains from commodity origins to finished goods — a substantive, ongoing obligation. Continuous participation in a federated network with ongoing monitoring. Proactive disclosure of compliance gaps before enforcement action.

- ▶ Disclosure in exchange for facilitation and regulatory certainty

Government Obligations

Protection of data integrity and commercial confidentiality. Clear, specific responses identifying compliance gaps — not single-sentence rejections. Collaborative problem-solving rather than adversarial enforcement. Formal legal protections for good-faith disclosure.

- ▶ The reciprocal commitment the current system entirely lacks

Shared Benefits

- Pre-clearance and expedited movement for validated goods. More effective enforcement from network intelligence — beyond the current 2% inspection coverage. A positive-sum outcome: visibility for government, facilitation for compliant trade, and a mechanism for the "mushy middle."
- ▶ The "win-win" identified in Bersin, Swartz & Karlsson (WCJ 2025)
- ▶ From zero-sum enforcement to collaborative trade governance

Policy and legal design

The framework raises three foundational questions for students of trade law and governance (cf. GDPR, Reg (EU) 2016/679; AI Act, Reg (EU) 2024/1689):

Who governs the network? If pre-clearance decisions are effectively delegated to a private federated architecture, questions of accountability, market concentration, and public interest arise. Is a commercially-owned supply chain intelligence network — even a federated one — compatible with the principle that customs administration is a sovereign function?

What is the legal status of AI-generated compliance attestations? A Product Passport may rely on probabilistically-inferred, rather than verified, supply chain data. When such a passport is the basis for either pre-clearance or detention, what evidentiary standards apply? How should due process rights be designed for parties adversely affected by AI-inferred network connections?

Can the new trade bargain be made binding? The reciprocal obligations proposed by Bersin, Swartz & Karlsson (2025) — government protection of disclosed data; clear compliance-gap responses; collaborative problem-solving — are currently informal. What legal or international instruments would make them durable, and create the trust conditions necessary for widespread private-sector disclosure?

Thank you

NEXT · MODULE 6 — COURSE SYNTHESIS & OUTLOOK

Key Sources:

Bersin, A., Swartz, P., & Karlsson, L. (2025). "Managing Supply and Value Chains in a New Era of Global Trade: The Promise of Federated Learning." *World Customs Journal*, 19(1), 80–91.

Outram, M., & Swartz, P. (2026). *Modern Border Management: Leveraging AI Systems for Strategic Advantage*. *World Customs Journal*, 20(1), 167–189. <https://doi.org/10.55596/001c.159458>



THE HAND-OFF YOU ARE PASSING

Private intelligence meets public synthesis — the last hand-off of the day

WHAT MODULE 5 ESTABLISHED

- Network-level AI shortens the OODA loop from months to hours
- Product Passports turn compliance into portable, verifiable data
- Federated learning is the commercial mirror of the Data Hub (M3)
- A revised trade bargain: disclosure in exchange for facilitation



MODULE 6 — FRANK HEIJMANN · YVES MELIN

Course Synthesis & Outlook

Every layer is now on the table — **the data language (M1), the systems (M2), the Hub's intelligence (M3), the whole-of-border Single Window (M4) and the private AI mirror (M5)**. Module 6 maps our one parcel — CDG to Eindhoven, under the rules applicable from 1 July 2026 — across all of them, and opens the floor to you.

The bridge in one line: *five perspectives, one parcel — the synthesis turns six talks into a single argument.*

Course Synthesis & Outlook

Bringing it all together

An interactive wrap-up — discussion, reflection and shared takeaways, connecting six modules into one picture of the digital transition.

Walter Van der Meiren Course coordinator — with all lecturers & participants

Interactive synthesis session · ULiège · 12 June 2026



HOW THIS WORKS

An interactive synthesis

This session is a conversation, not a lecture — six short blocks of discussion, an exercise and a breakout, with the floor open throughout.

1 Legal foundations

Group discussion — reform & nUCC.

2 EUCA & governance

Participant Q&A.

3 Connecting the systems

Facilitated discussion.

4 Map a process

Interactive exercise.

5 Implementation challenges

Small-group breakout.

6 Open floor

Q&A, takeaways & feedback.



THE JOURNEY

Where we've been

Six sessions, one argument: customs is moving from documents to data, and from shipments to networks.

1 Setting the scene

Why the shift to data is unavoidable.

2 The Data Model

The common customs data language.

3 Work Programme & architecture

The systems, federated by design.

4 The Data Hub

Consolidation and smart enforcement.

5 The Single Window

One front door for trade.

6 AI & emerging tech

The trusted, networked future.



YOUR SPEAKER FOR THIS MODULE

Frank Heijmann



Counsellor Customs

Netherlands to the European Union

ABOUT

Frank Heijmann is a senior customs executive with over 40 years of experience in customs legislation, international trade, logistics, e-commerce and enforcement strategy. As Customs Counsellor at the Permanent Representation of the Netherlands to the EU, he serves as lead negotiator for the Netherlands on EU Customs Reform and is closely involved in e-commerce developments. He previously held senior leadership roles at Netherlands Customs, including Director Strategy and Innovation and Director of the National Trade Facilitation Committee, and is the author of “Customs, Inside Anywhere Insights Everywhere.”



The legal engine of the transition

THE QUESTION

How do the EU Customs Reform and the new UCC shape the digital transition — and where does the law lead, or lag, the technology?

1

Mandate or enable?

Where does the law require change — and where does it merely permit it?



2

Law vs. technology

Where is legislation lagging the systems already being built?



3

The 2034 horizon

Is the Data Hub endpoint realistic — and what happens if it slips?



EUCA and the governance question

THE QUESTION

What should the EU Customs Authority own — and what stays with the Member States?

1

IT coordination

Can EUCA steer the Data Hub and shared systems from the centre?

2

Risk management

Who runs risk — the centre, the States, or both together?

3

Cross-border cooperation

What makes joint governance succeed rather than stall?



How the pieces fit together

A common data language, a hub to consolidate it, a bridge to non-customs rules, and a layer of intelligence on top.



DISCUSS

Where do these layers genuinely connect — and where are the seams, the gaps and the duplication that still need solving?



Map the import declaration flow



AS YOU MAP, IDENTIFY

Integration points — where systems hand off. **Pain points** — where data is re-keyed or stalls. **Opportunities** — where “submit once” could finally apply.



Real-world implementation challenges

FOR MEMBER STATES

Building the systems

- Legacy national systems and integration
- Resourcing, budgets and varying maturity
- Meeting hard legal deadlines together
- Governance and cross-border coordination

FOR ECONOMIC OPERATORS

Living with the change

- Integration cost and compliance burden
- Data quality and the “submit once” gap
- Many systems, many deadlines at once
- Clarity on what is required, and when



Q&A, takeaways & feedback



Ask the lecturers

Open Q&A across all six modules — anything still unresolved.



Share your takeaway

One idea each that changed how you see the reform.



Key lessons learned

What we'll carry into our own work and organisations.



Course feedback

What worked, what to improve — and what to add next time.



Three ideas that ran through the course

1

Trust, verified

Trust as verified, predictive compliance — earned through data, not simply declared.

2

Submit once

Single data submission — provide it once, reuse it across every system.

3

Public, private & AI

The creative tension between public oversight and private, AI-driven networks.

If you remember three things: these are the threads that tied every module together.



The road ahead

1

1 July 2026

Interim measures begin — the €150 de minimis exemption removed; the flat-duty regime starts.

2

1 July 2028

The EU Customs Data Hub opens for e-commerce consignments.

3

1 March 2034

Use of the Data Hub becomes mandatory for all goods.

Dates as agreed in the March 2026 trilogue compromise. The reform is being built now — across this whole decade.



THANK YOU

Thank you — and onward

WHAT THIS COURSE COVERED

- Setting the scene · the Data Model
- The Work Programme & IT architecture
- The Data Hub · the Single Window
- AI, emerging tech — and this synthesis

THE WORK CONTINUES

From documents to data

The reform runs from **2026 to 2034**. You now have the map — the legal foundations, the systems, and the ideas that connect them. Stay in the conversation.

“From documents to data, from shipments to networks — the same idea, all the way down.”

Acronyms & Abbreviations

Reference annex — every term used today, in one place

From ACI to WTO: the acronyms and abbreviations used across the six modules — explained, with the regulation behind each where one exists.

Reference annex · for use across all modules

University of Liège · 12 June 2026



ACI — ENS

ACI — Advance Cargo Information
AEO — Authorised Economic Operator
AES — Automated Export System
AI — Artificial Intelligence
AIS — Automated Import System
AS4 — Applicability Statement 4 — secure messaging profile
B2B / B2C — Business-to-Business / Business-to-Consumer
B2G / G2G — Business-to-Government / Government-to-Government
BTI — Binding Tariff Information
CBAM — Carbon Border Adjustment Mechanism
CCN2ng — Common Communication Network 2, next generation
CDS — Customs Decisions System
CEF — Connecting Europe Facility
CIS — Customs Information System
CITES — Convention on International Trade in Endangered Species
CN — Combined Nomenclature (8-digit EU tariff code)

COM — Commission document (legislative proposal)
CPC — Customs Procedure Code
CR — Common Repository (ICS2)
CRMS2 — Customs Risk Management System 2
CWDS — Customs Warehouse for Distance Sales
DA / UCC-DA — UCC Delegated Act — Reg (EU) 2015/2446
DECO — Declaration processes (import / export) in the EU CDM
DG TAXUD — Directorate-General for Taxation and Customs Union
DPP — Digital Product Passport
ECCG — Electronic Customs Coordination Group
EDPS — European Data Protection Supervisor
eFTI — Electronic Freight Transport Information — Reg (EU) 2020/1056
eIDAS — Electronic Identification, Authentication & Trust Services — Reg (EU) 910/2014
EMSWe — European Maritime Single Window environment — Reg (EU) 2019/1239
ENS — Entry Summary Declaration



EORI — NCTS

EORI — Economic Operators Registration & Identification number

EP — European Parliament

EPPO — European Public Prosecutor's Office

ERDS — Electronic Registered Delivery Service

ESPR — Ecodesign for Sustainable Products Regulation — Reg (EU) 2024/1781

EUCA — European Union Customs Authority

EU CDM / EUCDM — EU Customs Data Model

EUCDH — EU Customs Data Hub

EU CSW-CERTEX — EU Customs Single Window — Certificates Exchange

EU DPR — EU institutions' data protection regulation — Reg (EU) 2018/1725

EUDR — EU Deforestation Regulation — Reg (EU) 2023/1115

FLEGT — Forest Law Enforcement, Governance and Trade

FLR — (EU) Forced Labour Regulation

GDPR — General Data Protection Regulation — Reg (EU) 2016/679

GHA — Ground Handling Agent

H1 — Standard import declaration dataset (Annex B)

H6 — Postal-traffic import declaration dataset (Annex B)

H7 — Super-reduced dataset for low-value consignments (Annex B)

HAWB / MAWB — House / Master Air Waybill

HS — Harmonized System (WCO, 6-digit commodity code)

IA / UCC-IA — UCC Implementing Act — Reg (EU) 2015/2447

ICG — Import of Cultural Goods (TRACES module)

ICS2 — Import Control System 2

ICSMS — Information & Communication System on Market Surveillance

IMCO — EP Committee on Internal Market & Consumer Protection

IOSS — Import One-Stop Shop

IoT — Internet of Things

ITSP — IT Service Provider

MRN — Master Reference Number

MSW — Maritime Single Window

NCTS — New Computerised Transit System



NSW — WTO

NSW — National Single Window

nUCC — The recast Union Customs Code (EU customs reform)

OJ — Official Journal of the European Union

OLAF — European Anti-Fraud Office

OODA — Observe – Orient – Decide – Act (decision loop)

PCS — Port Community System

PID — Product Identifier (three-identifier model, de minimis reform)

PLACI — Pre-Loading Advance Cargo Information

PN — Presentation Notification

PNTS — Presentation Notification & Temporary Storage

PoUS — Proof of Union Status

RASFF — Rapid Alert System for Food and Feed

RFC — Release for Free Circulation

RIM — Reporting Interface Module (SafeSeaNet)

RTU — Right-to-Use (IOSS token pilot)

STI / NTI — Shared / National Trader Interface (ICS2)

TCG — Trade Contact Group

TDA — Transitional Delegated Act — Reg (EU) 2016/341

TOS — Terminal Operating System

TRACES — Trade Control and Expert System

TSD — Temporary Storage Declaration

TSW — Trade Single Window

UCC — Union Customs Code — Reg (EU) 952/2013

UFLPA — Uyghur Forced Labor Prevention Act (US)

UN/CEFACT — UN Centre for Trade Facilitation & Electronic Business

UNECE — United Nations Economic Commission for Europe

UUM&DS — Uniform User Management & Digital Signatures

VAT — Value Added Tax

VTMIS — Vessel Traffic Monitoring & Information System

WCJ — World Customs Journal

WCO / WTO — World Customs Organization / World Trade Organization

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IN APPRECIATION

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