Internet of Logistics

E2E digital collaboration in Supply Chains

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https://faboulustrucks.com/AH320UX
4000 Years Of Logistics Innovation

Year 2000 BC

Year 2019
Digitization in logistics status
Called by experts, the logistics “Black Hole”

Avocado journey from Kenya to retail store in The Netherlands

To unpredictable
- Nobody really knows where the avocados are
- Uncertainty leading to low reliability

To Long
- ½ time is waiting time (34 days in total)

To costly
- Administration cost double the physical transport costs
- 100 Documents across
- 30 organizations

Source: Thomas Jensen – Copenhagen Business School.
Sharing Data in real-time across E2E Chains Demanded by Consignees and Shippers and benefitting all

What problem to solve?

Limited visibility and predictability in supply chains
- Multiple stakeholders not connected, paper based data
- Deliveries unpredictable, planning difficult, surprises many, safety stocks high, lead times long, costs high

Poor quality control.
- Goods stolen, damaged, lost etc.
- Regulatory compliance not automated and problematic
- Lack of accountability for Logistics Service Providers

Requirements for a data exchange solution:

- unique identifier
- common language
- common platform

Who benefits?

Consigees feels problem, Shippers pays and feels the pressure from the consignees, all will benefit
Internet of Logistics focus on data exchange between actors and IT systems with existing business relations.
Industry Initiative to create an open standard
Bottom up (Just do it) and Top down (standardize) approach

The Standardization journey

2017
Kick-off April 2017

2018
- June IATA Hosting
- Sep IATA Hackathon IoL
- Dec 1RTF 1st Release

2019
- Nov IRU World Congress
- March-19 TIACA Board endorsement

The Standardization journey includes:
- Logistics - Highly Fragmented Industry
- Use case: Basic transportation execution and Collaboration Layer
- Use case: Collaboration Layer
- Use case: Identification, Authorization and Authentication
- Use case: Dangerous Goods
- Innovation & Trials

2018-June IATA Hosting
Internet of Logistics
You Decide to share what, when, and to whom

Everything Is A URL

Everything has a shared Unique ID (web address)

Giving access to its data (digital twin)

Publish & Subscribe

Between objects/digital twins

Each actor is in control of their own data

Semantics & Ontology

Dictionary bridging dialects, enabling everyone to talk to everyone

Describing relations between objects
Unique ID for Logistics Objects – URL
Re-usable for all in the chain

https://<LDI Domain>/  <Company ID on LDI Domain>/  <LO Identifier>

- Internet Standard for uniquely identifying resources
- Logistics Objects are on-line (digital twin)
- One record of a Logistics Object which can be referenced in processes and documentation
- No need for re-labeling
- No limitation for number of Identifiers
- No central registry of unique IDs
- Without additional context you have an integration endpoint to retrieve information about the Logistics Object
Publish & Subscribe Between Digital Twins
Each Actor Is In Control Of Their Own Data

Objects With Own Home Publishing Their Data
And Subscribing To Relevant Data

Publish and subscribe

www.trucker.com
LDI 2

ericsson.net
CLC

www.airline.com
LDI 3
Semantics & Ontology
Dictionary bridging dialects, enabling everyone to talk to everyone

Allow for complex structures to support business processes that can be unique.

Standardize the interface to avoid point to point integrations. Discovery and Inference of new relationships

Automatic discovery of new relationships for richer analysis

- graph:
  - most flexible data structure
  - best suited to capture relationships between highly connected data
- RDF graph: ready for open, distributed world (motivate why distribution is important/present)
- integrate custom sources and data models
- extensibility by 3rd party vocabs
- collection/integration of (in-company) data
  - LOs synthesize information from various (internal) sources
- exploration of linked data
- ...

- Works At
  - Company X
- Works At
  - Company X
- Colleague Of

- RDF is a basic model to the point where it can be considered schema-less
- W3 Internet Standard
- Multiple ontologies can be supported
- Collaborative Agile Governance for standards
- Enhance possibilities for (real-time) analytics and optimization
Stardog in context

- what features are used currently (cluster, reasoning?) → Mohan/Liam
- what features would make sense
  - ICV / Constraint validation
  - (Full text indexing) because of many “String” attributes..?
- add further standard Stardog content here
Shared Vocabularies
Collaborative development

Source: Digital Cargo Forum
Graph-based Data Representation

Graph is an entirely different manner of organizing data than what most data management tools employ.

Knowledge graphs are designed to highlight relationships between concepts.

And allow for multiple points of view of the data.
Stardog at a Glance

About Stardog

Stardog helps you say “yes” to data requests.

Our knowledge graph platform helps you:
- Connect to any database virtually or via ETL
- Easily incorporate new data sources
- Slice and dice data for multiple applications

Stardog = Graph + AI + Virtualization
Stardog Coverage

How Stardog Works

The flexible foundation for the data-driven enterprise.

- Connect to any database via ingestion or virtualization
- Easily incorporate new data sources
- Slice and dice data for multiple applications

Stardog’s graph - based data unification platform i.e. **Knowledge Graph**
Stardog Architecture
Main goal for shipper:
- Reliable and RT updated ETA to Sales (at Shipper) and Customers (Consignees)

Goal for all in chain
- Better service and improve efficiency in full chain due to RT update and more granular information across the chain
Shipper publishing shipment information

Main goal for shipper:
• Reliable and Real Time updated Estimated Time of Arrival to Sales (at Shipper) and Customers (Consignees)

Goal for all in chain
• Better service and improve efficiency in full chain due to Real Time update and more granular information across the chain

ERP/ Transport Management System

Logistic process activities
• Production
• Packing in Container
• Placing on Industrial Site @ Shipper

Publishes:
• Shipment
• Container
• Products
• Event data

Method:
• Pre-integrated to IoL API’s
• Jason message with rdf content

Describing shipment instruction details

Describing linked relations (e.g. item A in package B, on pallet C owned by X)

Describing attributes of objects (relevant information and relations) in rdf
Forwarder retrieves and adds data

Main goal for shipper:
- Reliable and Real Time updated Estimated Time of Arrival to Sales (at Shipper) and Customers (Consignees)

Goal for all in chain
- Better service and improve efficiency in full chain due to Real Time update and more granular information across the chain

IoL (CLC)

How Shipper and Forwarder are connected
- Shipper mentions Forwarder in shipment information
- Forwarder receives shipment in inbox/ERP
- Commercial relation not managed within IoL

Retrieving from IoL
- Shipment
- Container
- Events

Publishing to IoL
- CMR/Transport order
- Events

Method:
- Pre-integrated to IoL API's
- JSON-LD message with RDF content

Example message
```
"@context": {
  "schema": "https://schema.org/",
  "dcf": "http://clcassociation.com/schema/",
  "xsd": "http://www.w3.org/2001/XMLSchema",
  "clc": "http://ontology.clic.ericsson.net/",
  "geodc": "https://geodc.org/"
},

"Bid": "https://onboard.clic.ericsson.net/geodcse/BoLNo-0002",
"@type": "dcf:BillOfLading",
"dcf:billofLadingReference": "BoLNo-0002",
"dcf:carrierBookingReference": "RefNo",
"dcf:carrierBookingOffice": "QARON - Doha",
"dcf:origin": "SEGOT - Gothenburg",
"dcf:destination": "INMAA - Chennai (Madrass)",
"dcf:portOfLoad": "SEGOT - Gothenburg",
"dcf:portOfDischarge": "INMAA - Chennai (Madrass)",
"dcf:placeOfReceipt": "SEGOT - Gothenburg",
"dcf:placeOfDelivery": "INMAA - Chennai (Madrass)",
"dcf:shipperReference": "TCP",
"dcf:forwarderReference": "005576343",
"dcf:carrierContractNumber": "8979454",
"dcf:handlingInformation": "Handle with Care!",
"dcf:shipper": {
  "@type": "schema:Organization",
  "dcf": "https://onboard.clic.ericsson.net/geodcse/BoLNo-0002/shipper",
  "schema:legalName": "GOODS SWEDEN AB",
  "dcf:agentOf": "AGENT OF CARGO CONTAINER LINE LTD",
  "dcf:ioLIdentifier": {
    "@id": "https://onboard.clic.ericsson.net/geodcse/BoLNo-0002/shipper"
  }
},
```

Logistic process activities
- Organizing transport services
Carrier has easy access to data

Main goal for shipper:
• Reliable and Real Time updated Estimated Time of Arrival to Sales (at Shipper) and Customers (Consignees)

Goal for all in chain
• Better service and improve efficiency in full chain due to Real Time update and more granular information across the chain

IoL (CLC)

Looking in IoL
• CMR/Transport instruction in inbox
• Searching on container number

Updating in IoL
• Pickup event
• Delivery event

Method:
• Standard mobile device
• User credentials
• Browser GUI

Transport tasks and detailed information in browser

Logistic process activities
• Transport container from shipper site to sea port

Road Carrier

Driver phone browser

Container number
Camera automatically registering pick-up

Main goal for shipper:
• Reliable and Real Time updated Estimated Time of Arrival to Sales (at Shipper) and Customers (Consignees)

Goal for all in chain
• Better service and improve efficiency in full chain due to Real Time update and more granular information across the chain

IoL (CLC)

Method:
• Standard camera and ID recognition
• ID correlation with IoL ID
• Publishing event

Publishing to IoL
• Event, Container leaving gate

Example message
```
"@context": { 
  "dcterms": "http://purl.org/dc/terms/",
  "xsd": "http://www.w3.org/2001/XMLSchema#",
  "rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#",
  "schema": "http://schema.org/",
  "ioId": "http://idn.onboard.cic.ericsson.net/sandviknv/containernumber/00U1445659/"
},
"type": "Container",
"description": "Status reported by Camera placed at Outbound Gate,",
"schema:location": "http://idn.onboard.cic.ericsson.net/sandviksvm/",
"eventId": "2019-06-05T15:57:34.266000+00:00",
"eventId": "2019-06-05T15:57:34.266000+00:00"
```

Camera Back-end

Publishing to IoL
• Event, Container leaving gate

Container number translated into URL
www.ericsson.net/Carrier/LSQ

Logistic process activities
• Automated recognition container leaving
Going Forward – EU project DTLF - Federated Road, Rail & Sea

Phase 1 MMID

IVG – FR8HUB

MMID Phase 2

IoL (CLC)

Events & ETA

Rail Hub

Sea Traffic Hub

Events & ETA

Shipper
Forwarder
Carrier
Shipper

Rail Operator

Maritime Carrier 1

Maritime Carrier 2

Events: Loaded on Ship 1

Events: Offloaded from ship 2

Events: Leavin g Port

Sales Order

Events: Proof of Delivery

Carrier

Consignee

Events:

Loaded on Ship 1

Offloaded from Ship 1

Loaded on ship 2

Events: Going through gate

Events: Load ed on Train

Events:

Loaded on Train

Loaded on Ship 1

Offloaded from Ship 1

Offloaded from ship 2

Sweden

Germany

USA
Going Forward – EU project DTLF - Federated Road, Air

Project DCF (Digital Cargo Forum)

- Ospentos (Truck, GHA & RFS)
- Finnair / AirFranceKLM (Carrier)
- E// Factory
- TLL
- TLL
- HEL / CDG
- Any Destination

Ospentos - QStep
- AWB
- eCMR
- Status & Track Updates
- GHA Status
- Status Updates

AY/AFKLM System
- AWB
- Status Updates

Internet of Logistics (IATA - ONE Record/CLC)
- SLI
- SLI
- AWB
- Status Updates

Forwarder Systems
- Ericsson (Shipper)
- DHL
- Schenker

Abbreviations
- AWB – Air Way Bill (air consignment)
- e-CMR – electronic road consignment
- SLI - Shippers Letter of Instructions
- GHA – General Handling Agent
- RFS – Road Feeder Service
- TLL – Tallinn
- HEL - Helsinki

Important airfreight messages
- PUP – Shipment Start
- RCS – Ready for Carriage
- FOH – Freight on Hand
- MAN – Manifested
- DEP – Flight Departed
- ARR – Flight Arrived
- RCF – Received from Flight
- NFD – Notified
- DLV – Delivered
Internet of Logistics
Connect once for easy data access to the whole ecosystem

Digitized, instant data collaboration
Open, distributed and standardized
Clear ownership of data
Connect once, connect with all
Linked data for richer insights

Endorsed by EU (DTLF), TIACA and DCF
Released ONE Record data standard for Internet of Logistics
4001 Years Of Logistics Innovation

Year 2000 BC

Year 2019

Year 2020

Internet of Logistics

https://clc.ericsson.net
Comparison: IoL $\leftrightarrow$ IDSA (Logistics)
First draft

<table>
<thead>
<tr>
<th>IoL</th>
<th>IDSA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business</strong></td>
<td><strong>Business</strong></td>
</tr>
<tr>
<td>- Main Use Case: <em>Visibility and optimization in supply chains</em></td>
<td>- Main Use Case: <em>Finding and sharing data</em></td>
</tr>
<tr>
<td>- Real-time data, process related <em>transactions</em></td>
<td>- Bulk data, sources of real time data</td>
</tr>
<tr>
<td>- Standardization bodies: DCF, IATA, IRU...</td>
<td>- Standardization bodies: DIN, IDSA Logistics community</td>
</tr>
<tr>
<td>- Main stakeholders: Shippers, LSP’s, Carriers, Consignees</td>
<td>- Main stakeholders: Business data providers and consumers</td>
</tr>
<tr>
<td>- Leveraging on <em>existing business relations</em></td>
<td>- Establishing <em>new (ad-hoc) business relations</em></td>
</tr>
<tr>
<td><strong>Architecture</strong></td>
<td><strong>Architecture</strong></td>
</tr>
<tr>
<td>- Open, distributed</td>
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</tr>
<tr>
<td>- Linked data</td>
<td>- Linked <em>meta</em>-data</td>
</tr>
<tr>
<td>- Logistic objects as shared Internet resources</td>
<td>- Catalogue driven data sharing</td>
</tr>
<tr>
<td>- Bottom up approach</td>
<td>- Top down approach</td>
</tr>
</tbody>
</table>
Some ideas for potential Cooperation: For discussion

Business
- Aligned standardization efforts
  - In logistics domain
  - Created larger common momentum
- Delegated trust and security
  - Onboard once to leverage 2 communities
- Ecosystem of added value services
  - “business-level” IDSA service brokering e.g. free capacity, storage, robot rental or last mile delivery services
  - “infrastructure-level” IDSA service brokering e.g. document management or data transformation services
- Easier supply chain visibility and optimization to IDSA customers

Architecture
- Shared approach to identity management
- “Enforcement of data usage rules”
- Data models (extension vocabs to IDSA from IoL and vice versa)
- **Catalog services** for looking-up related (meta)data and services
  - e.g. capacity, traffic info, etc.
.. compare goals of IDSA Logistics Community

<table>
<thead>
<tr>
<th>Goal 1</th>
<th>Goal 2</th>
<th>Goal 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption of IDS for Logistics domain</td>
<td>Networking among IDS users from Logistics domain</td>
<td>Exchange with current IDS research activities</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Possible activities and results</th>
<th>Specification of a „Logistics Data Space“</th>
<th>Best practice presentations (success stories, use cases)</th>
<th>Identification of practical requirements from Logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position papers, use cases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opportunities for IDSA members</td>
<td>Specific concepts &amp; implementations</td>
<td>Finding peers &amp; partners, exchange of experiences</td>
<td>Engage in topics &amp; consortia by funded research</td>
</tr>
</tbody>
</table>

Source: IDSA
CLC Components and APIs

- Logistics Object API (LOAPI)
- IoL Subscription Endpoint (IOLSE)
- Authentication and Authorization API (AA?)
- …?

What is the API to retrieve company info?

Deployment and cardinality of the AA service?

How do the individual IoL impls (CcLC') interact?