

# LOGISTICHUB



01.11.2012

## Requirements Specification

The Norwegian Oil and Gas Association (Norwegian Oil and Gas) has, together with major operators on the Norwegian Continental Shelf, initiated work on a common event database called LogisticHub for cargo carrying units. This document provides a specification of the user and system requirements for this solution.

# LOGISTICHUB

## REQUIREMENT SPECIFICATIONS

### Executive Summary

This document is the Requirements Specification for the first phase of the LogisticHub solution that shall serve the needs of the Norwegian offshore industry for managing tracking information of cargo carrying units (CCU) and their content. The solution will be implemented by developing and deploying a common solution for managing data received from automatic identification and data capture (AIDC) of CCUs events in the supply chain for the Norwegian offshore industry.

The users of LogisticHub are operators of production licenses, suppliers to these operators, CCU owners, and supply bases. In the future the transport companies onshore and offshore may also become users of LogisticHub as well. All of these actors have to implement an AIDC system within their own organisation for communication with LogisticHub. Detailed information how to do that is provided in Chapter 3.

Note that LogisticHub does not interfere with the business relationships between its users – all contract and other business issues are managed in exactly the same way as before. LogisticHub is just an efficient instrument for sharing tracking events from logistic operations among relevant stakeholders in the offshore industry.

The user requirements specification, including use cases, priorities, functional and non-functional requirements is provided in Chapter 4.

The proposed solution for LogisticHub is based on ISO standards and W3C recommendations, in compliance with the Norwegian Oil and Gas Guideline 112 Deployment of Radio Frequency IDentification (RFID) in the oil and gas industry. The system architecture is based on the high level architectures described in Part 2 of this Guideline. The terminology and ontology is structured according to ISO 15926 and harmonised to large degree with GS1's terminology.

The overall solution for LogisticHub is in line with recommendations from Norwegian Oil and Gas and E&P Information Management Association (EPIM) for Integrated Operations.

### Document history

Version:	Date:	Comment:
1.0	November 5. 2012	First version, released with RFI document

## FOREWORD

*The expected readership of this document is:*

- |                                |   |
|--------------------------------|---|
| ✓ LogisticHub customers/users  | Specify the requirements and to check that they meet their needs. Prepare for internal solutions for deploying LogisticHub. |
| ✓ Managers                     | Solution providers to plan for a bid for LogisticHub  |
| ✓ System engineers             | Use the requirements to understand how to develop LogisticHub   |
| ✓ System test engineers        | Use the requirements to develop validation tests for LogisticHub  |
| ✓ System maintenance engineers | Use requirements to understand the operations of LogisticHub and the relationship between its parts                         |

*This document is based on:*

- ✓ A sequence of workshops in Norwegian Oil and Gas with some major stakeholders in offshore industry
- ✓ DNV's report on concept and data model for LogisticHub (partly included in this document)
- ✓ DNV's Standard for certification No. 2.7-1 Offshore containers, April 2006
- ✓ DNV's Standard for certification No. 2.7-2 Offshore service containers, December 1995
- ✓ DNV's Standard for certification No. 2.7-3 Portable Offshore Units, May 2011
- ✓ GS1 EPCglobal Core Business Vocabulary Standard
- ✓ GS1 Global Local Number (Norway)
- ✓ IEEE standard for requirement documents
- ✓ IMDG Code, Annex Guidance on the continued use of existing IMO type portable tanks and road tank vehicles for transport of dangerous goods (IMO tank types)
- ✓ ISO/IEC 15459 Issuing Agency Codes – List of certified organizations
- ✓ ISO 15926 and PCA's Reference Data Service (RDS)
- ✓ NORSOK Z015 Temporary equipment
- ✓ Norwegian Oil and Gas Guideline No. 091 Securing Suppliers and Materials in the Oil and Gas Industry
- ✓ Norwegian Oil and Gas Guideline No. 112 Deployment of RFID in the oil and gas industry
- ✓ Norwegian Oil and Gas Guideline No. 116 Packing, securing and transport, as well as user inspection of load containers
- ✓ Unified Modelling Language (the tool deployed is Magic Draw)
- ✓ Web Ontology Language (tool deployed is TopBraid Composer - TBC)

*The document is structured as follows -*

- Chapter 1 gives an overview of the complete RFID value chain for CCUs in the oil and gas industry.
  - Chapter 2 contains a list of common terms and definitions related to movement and tracking of CCUs.
  - Chapter 3 describes work process sequence, technology and site preparations for the system and site(s).
  - Chapter 4 outlines use cases and gives detailed lists of functional and non-functional requirements.
  - Chapter 5 reviews the information, system, software engineering and data event architectures.
  - Chapter 6 contains detailed requirements to overall master data and event data for various system tasks.
  - Chapter 7 describes overall data flow, the common logistic ontology and an initial RFID ontology example.
  - Chapter 8 summarizes the W3C technology stack, system maintenance, and planned extensions.
- Three appendices contain details about RFID technology pilots run by Conoco-Philips, Statoil and SWIRE, and describe the issuing agency codes for ISO-15459 from GS1 and Odette.

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# 1. INTRODUCTION

This chapter gives an overview of the complete system and value chain for RFID tracking of CCUs in the offshore oil and gas industry.

The Norwegian Continental Shelf (NCS) has a substantial oil and gas activity with more than 500 active production licenses with high exploration activity and more than 80 fields in production. Less than 40 operators have a yearly total budget close to 200 billion NOKs.

More than 80% of this budget is spent on products and services delivered by the suppliers. All the goods offshore - bought or hired - are managed by the offshore supply bases spread along our long coastline.

Figure 1.1 Logistics on the Norwegian Continental Shelf

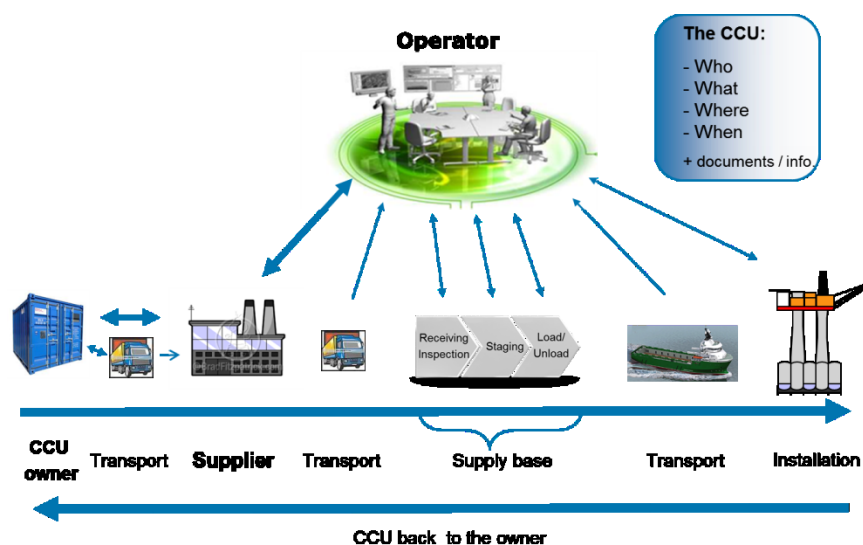


The need for an efficient and effective tracking and tracing solution of the goods in the offshore supply chain is overdue - hundreds of millions of NOKS can be saved by such a system every year.



The most typical case of an offshore delivery of goods is illustrated in Figure 1.2 below where a supplier is delivering a CCU with goods to an operator of an offshore installation. First the supplier gets an order from an operator on what to deliver where and when. The supplier hires a CCU from a CCU owner and has it transported to the supplier site where it is moved around by a forklift. The CCU is user checked and packed according to Norwegian Oil and Gas' Guideline No. 116 and sent to the operators' chosen supply base by a transporter. If the supplier has an security agreement with the operator and has used Norwegian Oil and Gas' security seal on the CCU according to Guideline No. 091, and, uses a transporter that have either an security agreement with the supplier or with the operator (or both), then the operator can, after receiving and inspecting the CCU, send it direct to the ISPS area in the supply base for outbound staging. The operator shall have accessibility to inspect the certification of the CCU, the security agreements of the supplier and transporter and necessary documentation if the

Figure 1.2 Supplier delivering goods to offshore installation



CCU is a NORSOK Z015 unit. If the CCU is not sealed then the operator has to inspect the CCU and repack it according to Norwegian Oil and Gas' Guideline No. 116 before sending it to the ISPS area for uploading on a ship by a crane. The CCU is moved around on the supply base by a forklift truck.

When the ship arrived at the offshore installation, the CCU is lifted on board by a crane and stays there until it is emptied, packed again and sent back to the supply base. If the CCU also contained some renting equipment they may stay on the installation for some time or sent back with another CCU next time the installation is visited by a ship.

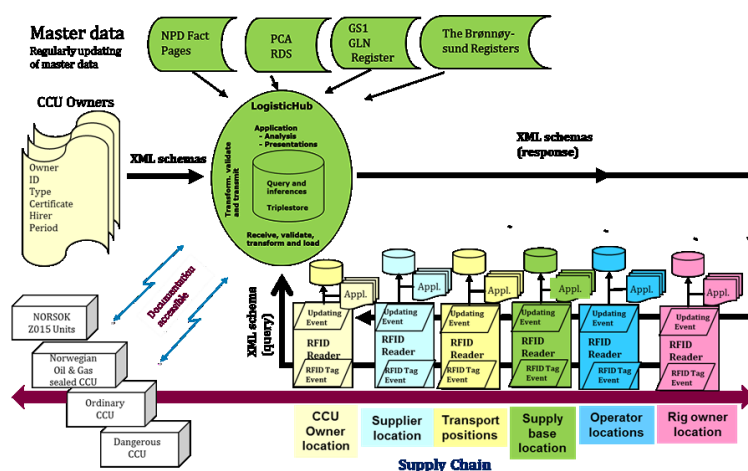
Depending on the agreements between CCU owner and the supplier and the supplier and the operator, it may take some time before the CCU is back to its owner. Without automatic tracking of the CCU, the time may become unnecessary long.

The most cost efficient way for the offshore industry logistics to achieve automatic tracking of the CCUs and their contents, is to develop a standardised solution for automatic identification and data capture of CCUs and other items events and a common solution for managing this information for the whole Norwegian Continental Shelf.

The purpose of **LogisticHub** is to provide a solution for managing tracking information of cargo carrying units (CCU) and their content in the Norwegian offshore industry. The important elements in this solution are:

- Each CCU has implemented a RFID tag with a global unique identification number
- Information about the CCU and the hiring status is provided by the CCU owner
- Each user site has an RFID reader that is in direct communication with LogisticHub where each event is sent as an XML file
- LogisticHub transmit information about each event as an XML file to relevant stakeholders according to agreed rules
- To simplify maintenance of master data most of it is automatic updated regularly
- The LogisticHub database is a flexible RDF triplestore with queries and inferences based on SPARQL
- LogisticHub will have a simple GUI for administration and simple analysis and reporting/presentations

Figure 1.3 ReportingHub – A schematic overview



The proposed solution is based ISO standards and W3C recommendations. The content and structure of terminology/ontology shall be according to ISO 15926 and harmonised with GS1's terminology.

The system architecture and models for integration, software development and information management shall be in compliance with Guideline 112: Deployment of RFID in the oil and gas industry, Part 2 of Guideline: Architecture and integration (revised version)

This requirements specification of LogisticHub is in line with Norwegian Oil and Gas' recommendations for Integrated Operation Generation 2.

## 2. GLOSSARY

This chapter contains a list of common terms and definitions for important concepts related to movement and tracking of CCUs in the offshore oil and gas industry. These, and other, terms will be important parts of the ontologies required to operate LogisticHub.

<b>Concept</b>	<b>Definition</b>	<b>Example</b>
Accepting	Denotes a specific activity within a business process where an object (i.e. product, shipment or asset) arrives into a location causing a change of possession and/or responsibility	A parcel carrier drops off two containers at Distributor Y's DC. A person on the Receiving Dock signs that they accept the two containers from the parcel carrier
Arriving	Shipment is arriving at a location	Lorry load or shipload of a shipment arrives a yard or supplying base. Shipment has not yet been received or accepted
Assembling	Denotes an activity within a business process whereby one or more trade item(s) or identifiable component parts are combined with other objects creating a new finished product.	
Attribute	A description of a characteristic of an entity	The entity "Organization" describes the attribute "name". An instance of "Organization" may have name set to "Statoil"
Collecting	Denotes a specific activity within a business process where an object (i.e. product, asset, shipment or container) is picked up and collected for future disposal, recycling or re-used	
Commissioning	Process of associating an EPC with a particular object (product, shipment, asset or container). A tag may have been encoded and applied in this step, or may have been previously encoded	
Composition Event	An event type representing aggregation/disaggregation (named packed/unpacked) of traceable items	An example is packing of multiple boxes (traceable items) on a pallet, where the pallet represents a new traceable item
Conceptual model (for traceability)	A conceptual model represents concepts (entities) and relationships between concepts	The conceptual model express the meaning of terms and concepts used by domain experts to discuss traceability, and to find the correct relationships between different concepts within traceability



Data model (for traceability)	A data model for traceability is an abstract model that documents and organizes the business data to support traceability through communication between stakeholders in a traceability chain	
Data quality	Quality of data is defined as a function (measure) of syntactic, semantic and pragmatic quality	Data quality shall have a clear and concise definition and shall be measurable, following the principles of Part 8 and Part 9 in the emerging ISO 8000 standard
Decommissioning	Process of disassociating an EPC with an object (i.e. product, shipment, asset or container). EPC may be re-commissioned at some point in the future and read again – however only with new information	
Departing	Shipment is leaving a location on its way to a destination	Truckload of a shipment departs a yard, typically through a gate and begins transit to another location
Destroying	Process of terminating an object (i.e. product, shipment, asset or shipping container) The object and its EPC should not be the subject of subsequent events that require a physical observation; subsequent physical observations are likely indicative of error (such as a stray read of a tag inside an incinerator)	
Disassembling	Denotes a specific activity within a business process where a trade item is broken down into separate, uniquely identified component parts	
Encoding	Process of writing an EPC code to a tag. EPC is not associated with an object (i.e. product, shipment, asset or container) at this step in the process	
Entering_exiting	Denotes a specific activity within a business at the Entrance/Exit door of a facility. Customers are either leaving with purchased product or entering with product to be returned to the facility	
Event	Represents predefined actions that create trace information regarding a Traceable Item required to support chain traceability, or internal traceability	
Event data	Recorded data representing events	

External /chain traceability	External traceability is defined by the events where an item move between organizations, or 3 <sup>rd</sup> party logistics providers	
Hiring	CCU owner is contracting a CCU for hirer and provide relevant information to the LogisticHub	Relevant data is provided in Table 6.1
Holding	Denotes a specific activity within a business process where an object (i.e. product, shipment, asset, or containers) is being segregated for further review	Shipper Z is told by operator to move a container to a special area until Inspector can inspect and clear the container
Identifiable Item	Defines a physical or virtual item which must be uniquely identified	
Identifiable Item owner	Legal owner of an identifiable item	
Individual	Represents a view of interest of an Individual	A product with a serial number (source: Stepmod)
Individual View	Role based insight to information relating an individual	Information relevant when doing support or tracing
Information/data-owner	Organizations which produces information regarding the identifiable item	Can be an owner, hirer or a custodian of the identifiable item
Initial population	Representation of data in the traceability solution supporting (minimum) chain traceability	For LogisticHub to work: <ul style="list-style-type: none"> <li>✓ Master data in Chapter 6</li> <li>✓ CCU information in Table 6.1</li> </ul>
Inspecting	Process of reviewing product to address potential product or documentation defects	Quality inspection or control of Z-015 or lifting equipment
Installing	Denotes a specific activity within a business process where part or component is put into a composite product or piece of equipment or machinery	
Internal_moving	Ad hoc movement of CCUs inside an organization	Truck operator pick up a CCU at position A and place it at location B
Internal traceability	Traceability of a traceable item within an organization	
Killing	Process of terminating an EPC RFID tag previously associated with an object. The object and its EPC code may continue to exist and be the subject of subsequent events (via a bar code, manual data entry	

Life cycle event	An event type representing birth, death or change of state for a traceable item	
Loading	Denotes a specific activity within a business process where an object (i.e. product, shipment, asset, or container) is loaded into shipping conveyance	Loading vessel (ship or lorry)
Master data	Master data is the core data that is essential to operations in a specific business or business unit	The kinds of information treated as master data varies from one industry to another and even from one company to another within the same industry (source WhatIs.com)
Movement event	An event type representing movement of traceable items between organizations or recourses.	Movement between organizations represents chain traceability. Movement between resources within an organization represents internal traceability.
Organization	A stakeholder who handles an identifiable item	Organization has an ID. A stakeholder owns and/or produces traceability data/information about these Items
Other	A business step not identified by any of the values listed in the core business vocabulary	
Packing	Denotes a specific activity within a business process that includes putting product (individuals, inners, cases, pallets) into a larger container – usually for shipping. Aggregation of one unit to another typically occurs at this point	Item is packed in a container
Part	Represents a product design (type description) (source: Stepmod)	
Picking	Denotes a specific activity within a business process that includes the selecting of product to fill an order	Manufacturer A pulls three pallets from its racks to fulfill a purchase order
Post-population	Representation of data in the traceability solution which is not mandatory for chain traceability, but can be of interest to support internal traceability (various business processes)	Post-population can also be population upon request to support business processes
Receiving	Denotes a specific activity within a business process that indicates that an object (i.e. product, shipment or asset), is being received	A shipment from a manufacturer factory site to manufacturer distribution center is matched

	at a location and is added to the receiver's inventory	against the transaction record then added to local inventory
Removing	Denotes a specific activity within a business process where a part or component is taken out of a composite product, or piece of equipment or machinery	
Repacking	Denotes a specific activity within a business process where an object's packaging configuration is changed	
Repairing	Denotes a specific activity within a business process where a malfunctioning product is repaired, without replacing it by a new one	A container is brought to a repair center to fix a problem
Replacing	Denotes a specific activity within a business process where an object (part, product, asset, container) is substituted or exchanged for another object	
Reserving	Process for an EPC number manager to provide a set of EPC numbers for use by another party	
Resource	A resource is an identifiable item, and defines a place where a traceable item is located for a shorter or longer period	Resources are uniquely identified and can be hierarchical. Resources can be fixed or mobile. A fixed resource with a given ID is located with an address, or a geo-coordinate. A mobile resource with a given ID is located with an address, one, or several geo-coordinates
Shipping	Indicates the overall process of picking, staging, loading and departing. It may be used when more granular process step information is unknown or inaccessible. It may indicate a final event from a shipping point. The use of shipping is mutually exclusive from the use of departing, staging, or loading	At Distributor Y, the truck containing racks full of totes pulls away from the shipping dock or staging area. - Manufacturer A completes loading product into trailer and seals door. The trailer is ready for pickup. The generation of a Dispatch Advice / ASN triggers a "shipping" event
Staging_outbound	Denotes a specific activity within a business process associated with the movement of an object to an area where it will await transport pick-up	
Stocking	Denotes a specific activity within a business process within a location to make a product available to the customer or for order fulfillment within a DC	

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Storing	Denotes a specific activity within a business process where objects are moved into and out of storage within a location	
Traceability	Traceability is the ability to trace the history, use and localization of an entity through recorded identification (NS-ISO 8402)	
Traceable Item	Defines the identifiable item that can be traced	
Transforming	Denotes a specific activity within a business process where one or more objects are an input into a process that irreversibly changes that object / those objects into a new object or objects; the output has a new identity and characteristics	
Unloading	Denotes a specific activity within a business process where an object (i.e. product, shipment, asset, or container) is unloaded from shipping conveyance	Unloading vessel (ship or lorry)
Unpacking	Denotes a specific activity within a business process that includes taking out units (individuals, inners, cases, pallets) from a container. Disaggregation of one unit to many units typically occurs at this point	

### 3. AUTOMATED TRACKING OF CARGO CARRYING UNITS (CONTAINERS)

This chapter describes the work process sequence, technology and site preparations that users must implement in their own organization and site(s) in order to capture data and communicate in real time with LogisticHub.

#### 3.1 Introduction

The AIDC system shall enable the operators of forklift trucks and cranes onshore and cranes offshore to:

- I. Visualize all CCUs at the site/resource
- II. Display loading/unloading documents together with CCU information
- III. Collect and update CCU information
- IV. Integrate with supplier end-to-end solutions

The key elements of the AIDC system are:

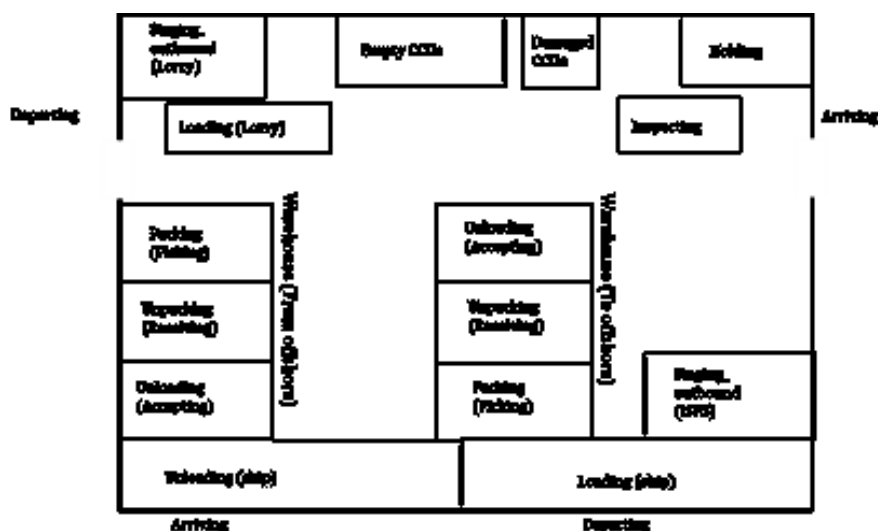
1. RFID tagging of CCUs
  - ✓ RFID reader
  - ✓ GPS coordinates
  - ✓ Weight
  - ✓ Temperature
3. Communication with back office systems and LogisticHub

#### 3.1.1 Zones in a supply base

A supply base is typically divided into zones where different business process events takes place as depicted in Figure 3.1 below:

- ✓ Arriving (with lorry)
- ✓ Inspecting
- ✓ Holding
- ✓ Unloading (Accepting)
- ✓ Unpacking (Receiving)
- ✓ Packing (Picking)
- ✓ Staging\_outbound (ISPS)
- ✓ Loading
- ✓ Departing
- ✓ Arriving (with ship)
- ✓ Unloading (Accepting)
- ✓ Unpacking (Receiving)
- ✓ Packing (Picking)
- ✓ Staging\_outbound (Lorry)
- ✓ Loading
- ✓ Departing

Figure 3.1 Typical layout for a supply base



Based on such layout for a site it might be possible to use GPS to identify automatically several business process events by locating where the events happened. Operators and supply base owners on the different sites have to consider in close collaboration with the supplier of the RFID equipment if this is an appropriate way of automatically record business process events.

### 3.1.2 Sequence of work processes on a supply base

In spite of many different layouts at supply bases and several different management systems, we may talk of a typical work process as illustrated in Figure 3.2 and 3.3.

In Figure 3.2 a CCU is coming from a supplier passing through a supply base with some of its most important business process events on its way to an offshore installation.

The business process event “inspecting” may stop, change or delay the route to its final destination offshore. The red diamonds in the figure illustrate decision points. It is important the all relevant stakeholders get information about these decisions so necessary steps can be taken.

A damaged CCU has to be taken out of circulation and replaced by a similar empty and certificated CCU. Lack of necessary documentation will require action either from the CCU owner and/or the supplier hiring the CCU.

The business process event “holding” should have special attention since this event should be avoided as much as possible and may lead to significant delays in delivering the content of the CCU to the final receiver.

In Figure 3.3 a CCU is coming from an offshore installation and passing through a supply base with some of its most important business process events on its way back to a supplier hiring the CCU. The business process events is simpler due to more limited inspection processes – no checking of documentation, just physical inspection of the CCU - but the four main processes - arriving, unloading, loading and departing are always present.

### 3.1.3 Technology and automatic data capture

Different aspect of the technology can be deployed such that automatic identification and data capturing of several business process events are possible. Furthermore, making it possible for the RFID reader to communicate with internal systems necessary data to be communicated with other relevant stakeholders should be available such that next location, transporter and final destination.

Figure 3.2 Typical sequence of business process events at a supply base for CCUs going offshore

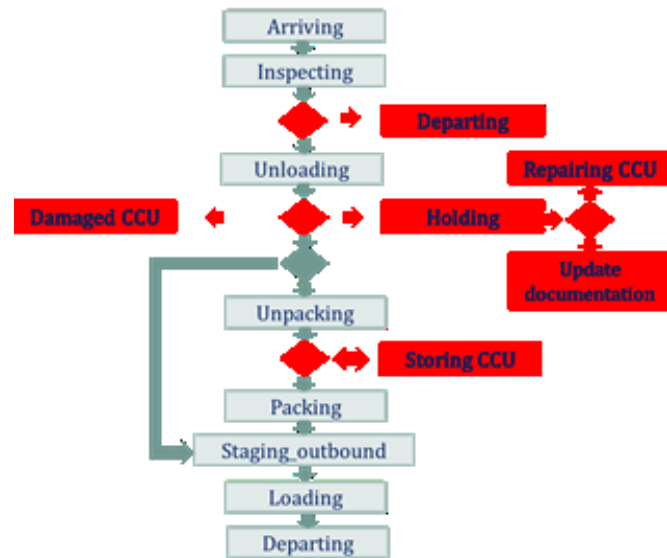
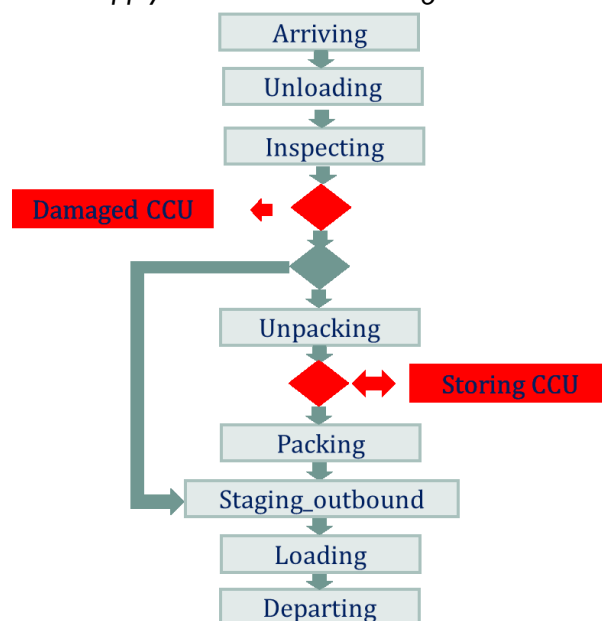


Figure 3.3 Typical sequence of business process events at a supply base for CCUs coming in from offshore



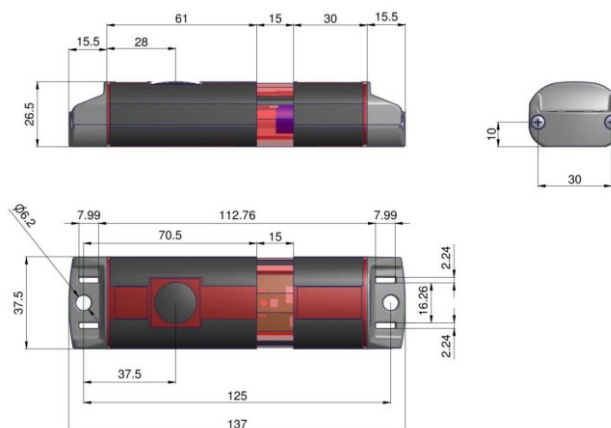
### 3.2 RFID tagging of the CCUs

The CCU owners with units in circulation on the NCS have to provide a RFID tag with a global unique identification (GUID) number on each of them. (Regrettable, to avoid delays in starting up the LogisticHub one may have to choose tag with a proprietary unique serial number and a proxy with global unique identification (GUID), but next version of tags shall have proper GUID.)

Requirements to the RFID tag for a CCU is defined in OLF Guideline No. 112, Part 6, and based on extensive testing the offshore industry has recommended that RFID tags with similar capacity and quality as Identec Solutions' i-Q350 FL sensor shall be installed on the CCUs.

RFID tag has to be approved for ATEX Zone 0, IIR air protocol robust, and has long range and durable batteries that can be monitored. More technical information of the RFID tag including data sheet, used in the pilots are available in Appendix A below in this document.

Figure 3.4 Picture of the sensor used in test



The CCUs have many different shapes and installing the RFID tag requires consideration of:

- Safety
  - ✓ Should not a potential falling object
- Optimal readability
  - ✓ High up/ forward side of the CCU
  - ✓ Opening in steel
- Protection
  - ✓ Must resist daily use offshore
  - ✓ Must resist usual loading/unloading operations
  - ✓ Protected against blow
- Flexibility
  - ✓ Attachment arrangement that can be used even if tag format changes
- Availability
  - ✓ Replacement should be easy

Figure 3.5

Different shapes of CCUs and placement of the RFID tag outside/inside the CCU



Each RFID tag has to be installed with a global unique identification (GUID) number (the first version of tags may regrettable have only a link to a GUID). OLF Guideline No. 112, Parts 4, requires that the GUID shall be based on ISO/IEC 15459 and provided by one of 30+ ISO authorized organization as Issuing Agency Codes (IAC) for the ISO/IEC 15459 standard.



The purpose of a GUID is to uniquely identify a physical item in its full lifecycle, from initial from initial creation of the item to the final disposal of the item. This implies in general that a GUID should be agnostic to changes in:

- Ownership / management / logistics of the item
- Operational usage / business purpose / logic of the item
- Technology used to carry the GUID on behalf of the item

**The OLF Guideline No. 112, Part 4, presents the data model for the GUID as a three level model:**

#### 1. Business level view

- ✓ Model 1: Serialization of an item within an Enterprise
- ✓ Model 2: Serialization of an item within a part within an Enterprise

#### 2. Information standard level view

- ✓ ISO/IEC 15459-2: Representation of the Enterprise of the business level model
- ✓ ISO/IEC 15418: The standardized data elements by which the business level can be represented
  - GS1: Application Identifiers
  - ANSI: ASC MH 10 Data Identifiers
- ✓ ISO/IEC 15459-4: Definition of a GUID using selected standardized data elements from ISO 15418

Combining two business level views and two sets of standard data elements (GS1 and ANSI) provide four different models of generating the GUID number as defined in this ISO standard.

#### 3. Encoding standard level view

This standard level view focuses on the standards for encoding of the ISO 15459-4 based GUID for storage on physical carriers. In this document, focus is solely on the ISO 15961-1/4 family of standards on RFID carriers which present efficient hierarchical object oriented information architecture for highly flexible read/write devices.

#### **Example 1**

Issuing Agency Codes GS1 with business model 2 and GS1 Application Identifiers The data format in this case will be:

IAC + GTIN (includes EID) + Serial Number within GTIN

More technical details are provided in the Appendix B by GS1.

#### **Example 2**

Issuing Agency Codes Odette with business model 2 and ANSI MH10.8.2 Data Identifier

Data format: (IAC)(CIN)(PartNumber)+(PartSerialNumber)

More technical details are provided in the Appendix C by Odette.

**Comments:**

- *The users of LogisticHub have decided to use business model 1 and GS1 Application Identifiers above and thus go for GS1's GIAI standard for the CCUs. That was also recommended by GS1*
- *For the content of the CCUs, the GUID shall also be based on ISO/IEC 15459 and provided by one of 30+ ISO authorized organization as Issuing Agency Codes (IAC) for ISO/IEC 15459 standard, reference is made to example 1 and 2 above*
- *A very critical element for achieving GUIDS is the quality of managing the serialization of the produced items by the producers*
- *Only if business/operational processes potentially break down due to lack of information should item related attributes beyond the GUID be stored on RFID carriers*
- *For interoperability and cross-domain business support perspective, additional attributes related an identifiable item that multiple actors will use/maintain needs to be well defined in an agreed ontology*

### 3.3 Data capture and software

This section provides a technical description of all the elements that are necessary for establishing an AIDC environment at any location – CCU owner, supplier, supply base and installation offshore.

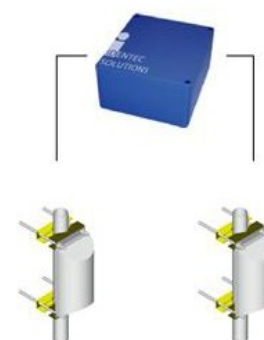
The descriptions provided here are based instruments used in pilots run by ConocoPhillips, Statoil and Swire and the technology was provided by Identec Solutions. However, any technology with same functionality and at least the same quality and capacity may be used. There is also an expressed commitment by Identec Solution make this technology open and standardized according to the recommendation in Norwegian Oil and Gas Guideline No. 112.

#### 3.3.1 Onshore site gates

An RFID reader with antenna shall be installed at the gates of the CCU owners' and suppliers' sites and at supply bases, to register arriving/departing CCU units. If the same gate is used for both arrival and departure instrumentation and logic have to be used for deciding which direction the CCU is moving.

Recommended equipment in the gates is RFID reader and antenna with at least the same capacity and quality as Identec Solutions 2-WAY Main Cabinet (Backbone dependent of the site availability) and 10dB Yagi antenna. Data sheet for equipment used in the pilot available in Appendix A. An Ethernet connection should be deployed if available. The RFID reader will be communicating with back office system and LogisticHub. A site survey is always recommended to ensure the best possible system functionality.

Figure 3.6 Portal at the sites' gates



#### 3.3.2 Onshore forklift trucks

Tracking of CCUs onshore is heavily based on the assumption that a forklift truck is involved in all movements of the CCUs onshore. The truck is equipped with:

1. RFID reader with antenna

2. GPS receiver
3. PC
4. Software

Recommended equipment for the forklift truck is equipment at least the same capacity and quality as used in the pilot <sup>1)</sup>:

1. Identec Solutions' RFID reader i-PORT 350 ETH with a small panel antenna Laird S8655PL
2. GPS receiver: Garmin GPS 16 LVS
3. Truck-mounted PC needs a full version of Windows. The preferred unit is a LXE VX9 that runs on Windows CE/Mobile and have free CF card slot, SSD disk drive.
4. A crane is used for lifting the CCU on the ship
5. Local Awareness System (LAS)
  - ✓ Local TrailBLAZER and/or eHUB for data collection that will communicate with back office and LogisticHub (send and queries) but operates in periods without external communication (synchronies when contact)
  - ✓ Provide overview (map) of trucks and CCUs where the site has been divided in separate regions - or similar equipment with the same capacity and quality.

Some suppliers' sites might choose to use simpler equipment as handheld PDAs or cellular phones with apps for communication with LogisticHub.

<sup>1)</sup> Data sheet for the equipment mention above is available in the Appendix A.

### 3.3.3 Offshore cranes

Still discussion between the operators how to install tracking equipment offshore. Ideally, the cranes should be equipped as the forklift truck onshore but with today's technology that is expensive. Three possible solutions have been suggested/tested:

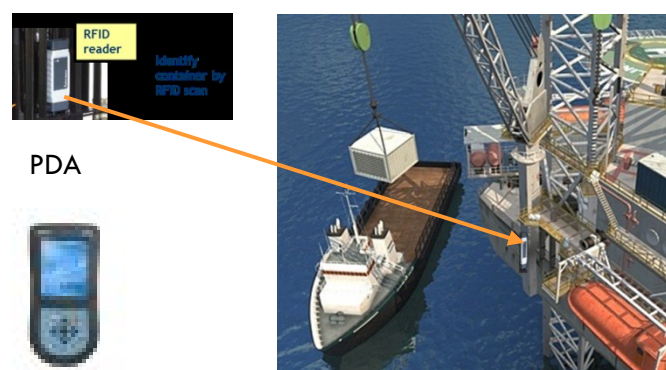
1. RFID reader with antenna outside the platform/rig as shown in Figure 3.8
2. Using a PDA manually by an operator monitoring the lifting operation
3. Using a PDA manually by an operator on the ship before the lifting operation. The PDA can be synchronized with LogisticHub just after the lifting process

All three solutions will secure registration of CCUs arriving and departing at offshore installations.

Figure 3.7 Tracking equipment on the forklift truck including LAS



Figure 3.8 Tracking equipment on the crane



### 3.3.4 Server on each site/resource

One server need to be installed on each site/resource. In the pilot a MS SQL Server 2000 (or higher) with Windows 2003 (or higher) was deployed and, regrettable, the described solution above is locked into MS solutions for OS and RDB and not able to work with open systems like Linux and RDF triple-stores this should be changed in the future.

### 3.3.5 Communication

Wireless local area network (WLAN) has to cover the whole site and it should either be a standard WIFI or a GRPS/3G. Internal antennas or external antennas can be used if poor coverage is experienced. Before deciding to install the GRPS/3G unit it is advised to do a site survey first.

Through the WLAN, LAS on the forklift truck/crane can communicate with the local server and with back office system and through a web service portal communicate with LogisticHub on SOIL.

Either a local TrailBLAZER server and/or an eHUB that will communicate direct with back office system and with LogisticHub.

### 3.3.6 Application stack

LogisticHub containing information on the status of the CCU fleet on the NCS.

ERP containing work orders loading/unloading lists and where the CCUs are bound for.

Other relevant systems as transport systems have information about transport units.

LAS communicates with relevant systems above and provides:

- ✓ Read RFID tags, GPS coordinates, weight, temperature (inside freezer), ...
- ✓ Send XML data to LogisticHub
- ✓ Receive error messages (due to validation) and confirmation from LogisticHub
- ✓ Query CCUs information from LogisticHub
- ✓ Query amount of and total CCUs on site from LogisticHub and display it on local site map
- ✓ Query amount CCUs and total CCUs
- ✓ Centralized position from all truck at site
- ✓ Centralized registration on tags

Figure 3.9 Simple system overview

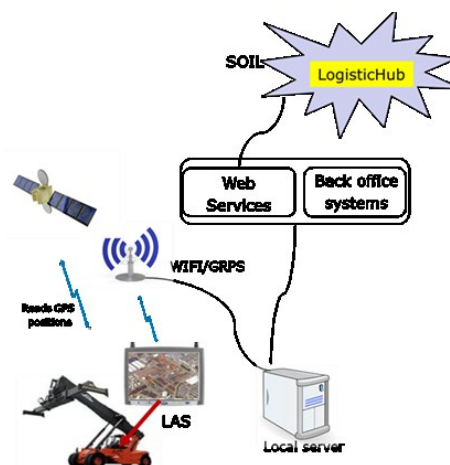


Figure 3.10 An example RDID application stack



### 3.3.7 Supply base/operator

The major operators have their own site within the supply base using their own equipment and ICT systems, and have their own personnel to monitor and guide the operations on the base executed by people employed by organization of the owner of the supply base. However, there are several deviations from this model. One major operator also executes the operations on the base itself. In some cases several operators work together on logistic operations on the supply base where one of the operators has a leading role. In other cases the owner of the supply base manages the logistics for one or more operators (the operators have no site of their own).

However, for all these different management models, the requirement to RFID tag, RFID reader, GPS equipment and IT hardware and software are the same.

## 3.4 Automatic capturing of event data

The operators require that the tracking process has to be automatic. There seems to be at least three different ways of achieving this:

- ✓ Define areas within the site where specific business process events find place – inspecting, unloading, unpacking, packing, loading, staging, etc. (ref. Figure 3.1)
- ✓ Build in logic in the sequence of the logistic process – arriving, inspecting, unloading, ...
- ✓ Build in logic in the technology to handle automatic registration

For all three alternatives above some information has to be available from internal system (like SAP) to the RFID reader before sending in the query to LogisticHub. A combination of these three alternatives might be the best way forward or there might even be more alternatives not yet identified.

Anyway, for phase I of LogisticHub, the stakeholders have agreed that it shall be possible to track the CCU across organizations having custody for the CCU. Furthermore, all users of LogisticHub have to handle the business process events **arriving, inspecting, unloading, loading and departing** in phase I.

## 4. USER REQUIREMENTS DEFINITIONS

This chapter provides a description of the requirements from users and administrators of the LogisticHub solution, with use cases and detailed lists of functional and non-functional requirements.

### 4.1 Introduction

A CCU moving through the supply chain, as shown in Figure 4.1 and Table 4.1, creates several events at each user's location. Each event consist of at least five attributes :

- ✓ **Who** - organization creating the event
- ✓ **What** - type of CCU (& content phase II)
- ✓ **Where** - location of the CCU
- ✓ **When** - timestamp yyyy.mm.dd.hh.mm.ss
- ✓ **Why** - to some degree the business reason

In digital communication all concepts have to be well defined and have a unique address.

**The Who's:** All organizations that have custody of a CCU are defined in the master data in Chapter 6 by name, organization number, GLN legal number and, if relevant, by NPD ID number.

**The What's:** The CCUs are identified by GUID on the RFID tag. This will uniquely identify each container. When entered into the system for the first time, all CCUs are classified according to the class hierarchy as defined in Table 4. Note that classification in Table 4 is limited to the class of Offshore CCUs. If a CCU for some reason is rebuilt, it will be re-classified. Historical data about the container's previous classes will be kept and is traceable.

The class hierarchy has been defined partly based on CCU owners own classification and partly to the needs of the offshore industry. Only this schema will be allowed used in LogisticHub.

Figure 4.1 RFID tracking of CCU in the offshore supply chain

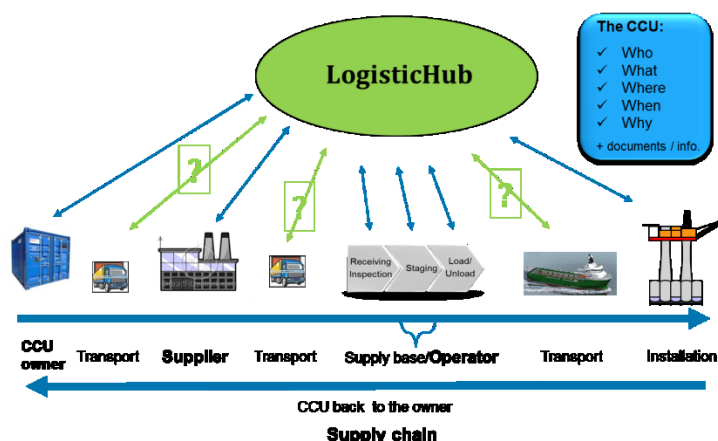


Table 4.1 The CCUs are classified to class and subclass

Basket	Container	Tank	Service Container	Waste Handling Units
<ul style="list-style-type: none"> <li>• Half High Basket</li> <li>• Side Door Basket</li> <li>• Special Basket</li> <li>• Heavy Lift Basket</li> <li>• Standard Basket</li> <li>• Toolbox Basket</li> </ul>	<ul style="list-style-type: none"> <li>• Standard Container</li> <li>• Food Container</li> <li>• Reefer Container</li> <li>• IBC Carrier</li> <li>• Mini Container</li> <li>• Open top Container</li> <li>• Laundry Container</li> <li>• Gas Rack</li> <li>• Special Container</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical Tank</li> <li>• Jet fuel Tank</li> <li>• Heated Tank</li> <li>• Cryogenic Tank</li> <li>• Lined Tank</li> </ul>		<ul style="list-style-type: none"> <li>• Cuttings container</li> <li>• Waste bin carrier</li> <li>• Waste compactor</li> <li>• Waste container</li> <li>• Waste skip</li> </ul>

**The Where's:** All locations are related to organizations and defined by name, GLN location number and GPS coordinates onshore and by name, NPDID number and GPS coordinates offshore in Chapter 6.

**The When's:** Just the timestamp yyyy.mm.dd.hh.mm.ss will be used in LogisticHub.

**The Why's:** All the business process events defined in GS1 EPCglobal Core Business Vocabulary (CBV) Standard will be allowed used in LogisticHub and they are listed in Table 4.2. In addition one extra concept has been added - *internal\_moving* – to handle undefined movements within a supply base and offshore. The events in bold font are expected to be most important for phase I of LogisticHub.

Table 4.2 GS1 EPCglobal Core Business Vocabulary

accepting <b>arriving</b> assembling collecting commissioning decommissioning	<b>departing</b> destroying disassembling encoding entering_exiting <b>holding</b> <b>inspecting</b>	installing <b>internal_moving</b> killing <b>loading</b> other packing picking	receiving removing repackaging repairing replacing reserving shipping	staging_outbound stocking storing transforming <b>unloading</b> unpacking
--	--	--	---	--

**Comments:**

- *In relation to the conceptual model in Chapter 5, the concept “loading” and “unloading” will inherit “packing”/“unpacking” with respect to possible change of identifiable item (from CCU to lorry/ship or the other way around) and “accepting” with respect to change of custody (change of organization) of the CCU.*
- *As illustrated in Figure 4.1, the transport companies (onshore and offshore) are not directly involved in the LogisticHub solution per today but that may change in the future.*

## 4.2 Access to information in LogisticHub

Generally, the rules for access to information in LogisticHub are:

- ✓ CCU owner has access to all events generated by her/his CCUs where there are change of custody (loading/unloading) and events of the CCU on the way to her/his custody (loading and departing previous site)
- ✓ The hirer has access to all events generated by her/his hired CCUs
- ✓ The operator has access to all events generated by CCUs in her/his custody and events of the CCU on the way to her/his custody (loading and departing previous site)
- ✓ The supply base owner has access to all events generated by CCUs in her/his custody and events of the CCU on the way to her/his custody (loading and departing previous site)

### 4.3 Use cases

Use case diagrams describe what LogisticHub does from the standpoint of the user. The emphasis is on what a system does rather than how. Users are simply roles that people/organizations play.

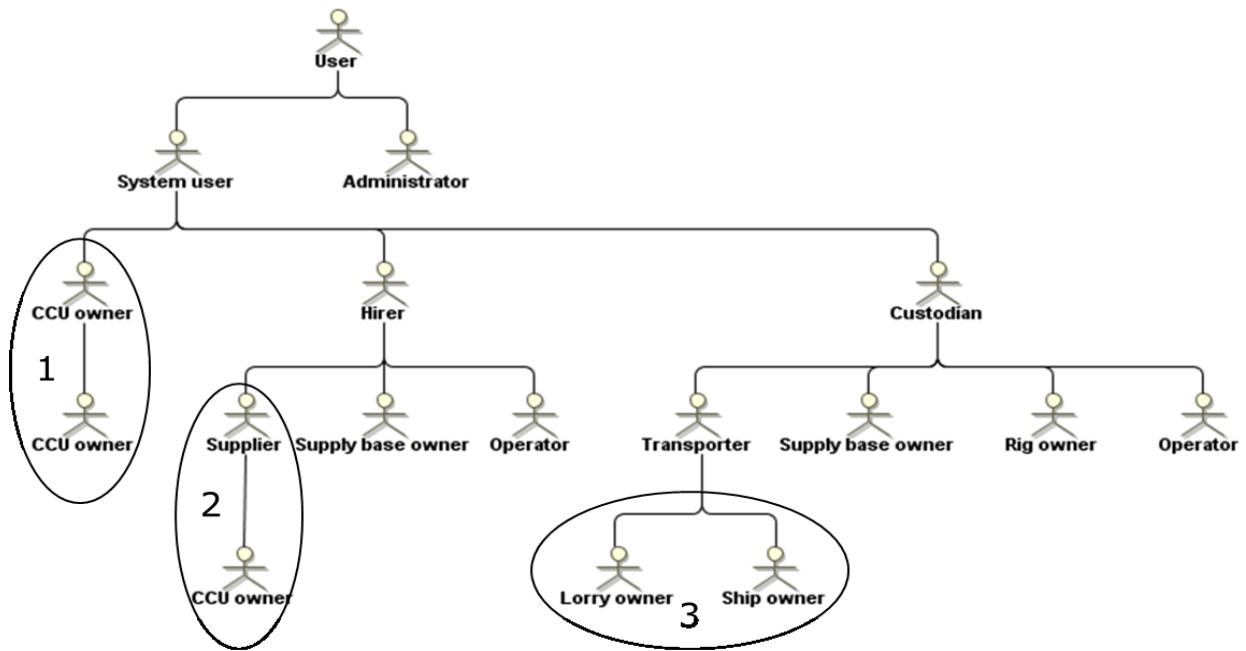
In LogisticHub the following roles have been defined:

Administrator	A company accountable for operation of the system including maintenance of master data and necessary support to system users
CCU owner	A company owing a CCU that has been hired by a system user
Custodian	A system user or a transporter that has custody for a CCU
Hirer	A system user that has hired a CCU
Lorry owner	An onshore transport company providing CCU transport service for a system user
Operator	An oil company with operatorship for one or more production licenses on The NCS and a system user
Rig owner	A company owning a drilling rig, accommodation vessel or similar moveable facilities offshore that receives hired CCUs and is a system user
Ship owner	An offshore transport company providing CCU transport service for a system user
Supplier	A service company contracted by one or more operators and a system user
Supply base owner	A supply base owner that has custody of a hired CCU on behalf of supplier or an operator
System user	A user of the services provided by LogisticHub
Transporter	A company providing CCU transport service on- or offshore for a system user

In Figure 4.2 the users of LogisticHub are defined.

*Figure 4.2 Users of LogisticHub*



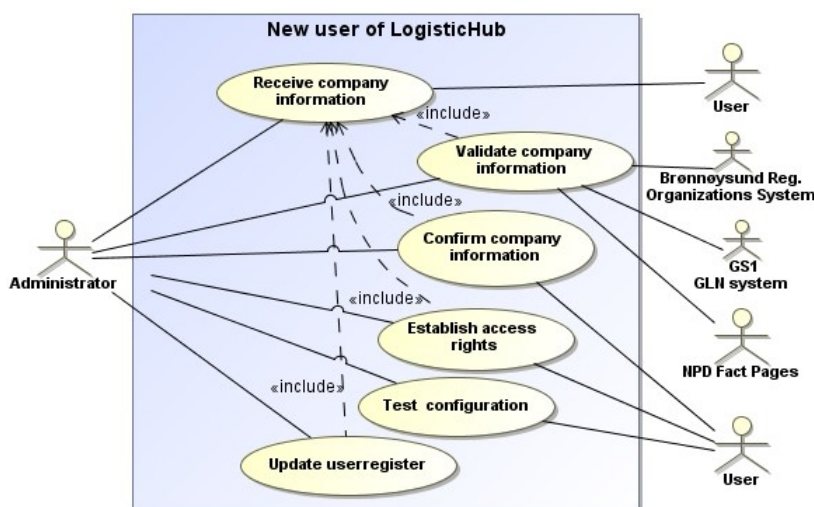


Comments to figure 4.2:

1. In some cases a CCU owner may hire a CCU from another CCU owner before hiring it out to a supplier or operator. Both CCU owners shall in these cases be managed as CCU owners in LogisticHub.
2. In some cases where the CCU is tailor-made to the service provided by the supplier, the CCU may then be owned by the supplier herself/himself. The supplier shall in these cases be managed as the hirer of the CCU in LogisticHub.
3. The transporters have no access to LogisticHub. Information about the transporters has to be provided by the users of their services. (This might be changed in due time.)

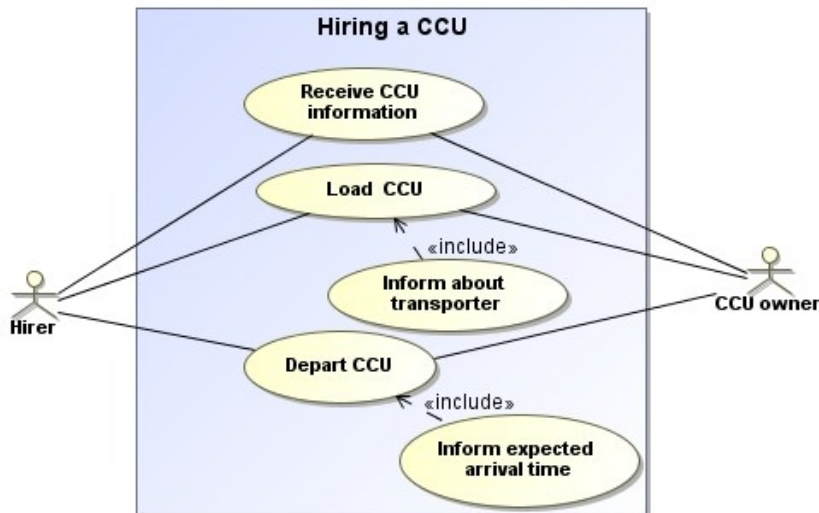
The administrator will have responsibility for defining a new user in LogisticHub as illustrated in Figure 4.3 and the master data and the communication the new user with has to be validated and tested.

Figure 4.3 Add a new user to LogisticHub



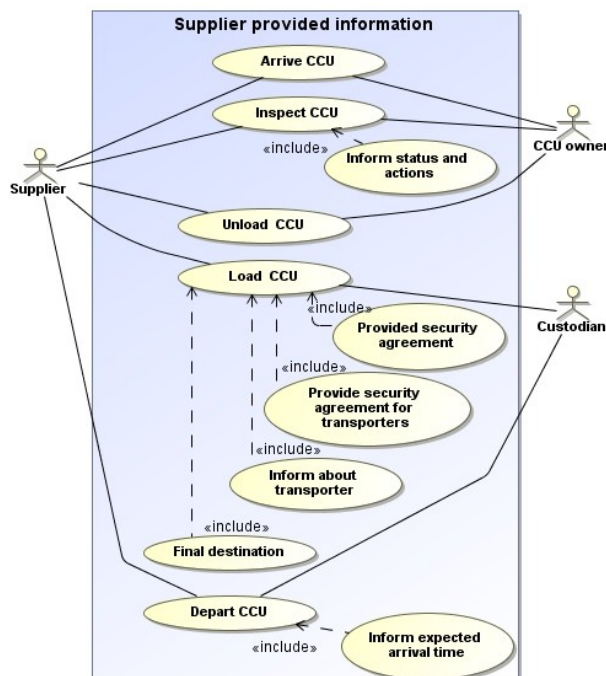
The CCU has to provide information about the hired CCU and the hirer to LogisticHub according to Table 6.1 below before the event process for that CCU starts.

Figure 4.4 Information provided by the CCU owner



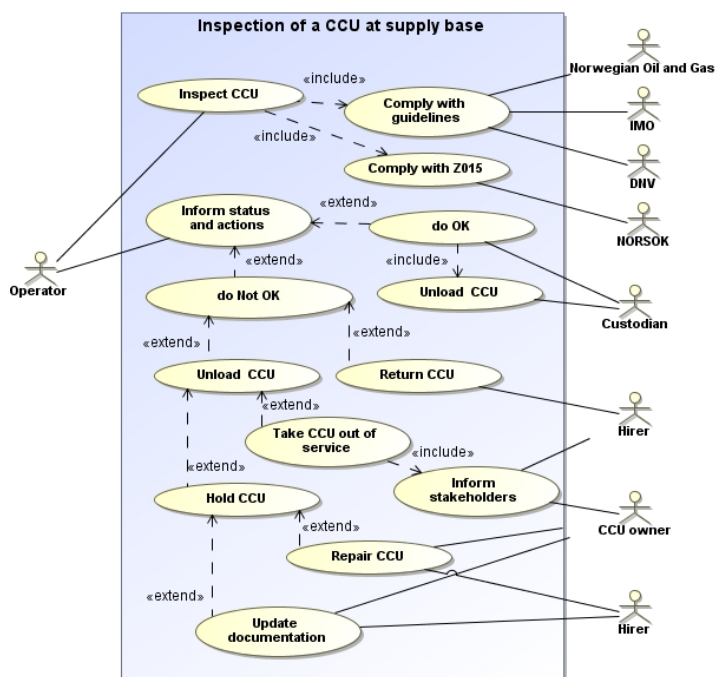
The supplier as hirer has to provide information to the LogisticHub about receiving the CCU from the CCU owner and to whom it will be sent, expected arrival time, necessary documentation and, if sealed, final destination of the content of the CCU.

Figure 4.5 Information provided by the supplier



The business process event “inspecting” at the supply base is a critical operation that may stop, change or delay the CCU on its way to final destination.

Figure 4.6 Inspection of the CCU by the operator at the supply base



### 4.4 Priority definition

The priority of the requirements should be listed according to the table below.

Priority	Definition
0	No opinion
1	Shall be a candidate
2	Should be a candidate
3	Less likely a candidate
4	Not a candidate

### 4.5 Functional requirements

The functional requirements are based on the descriptions in chapters 1 and 3, and sections 4.1-3. Master data and event data is described in detail in Chapter 6.

F001	CCU information
Description	CCU owner shall provide information about the CCU according to Table 6.1 to LogisticHub using an XML schema to be developed as part of LogisticHub. Certificates and all required documentation (NORSOK, IMO, DNV, etc.) shall be available in or accessible from LogisticHub. The CCU information has to be available in LogisticHub before registration of any events.
Rationale	Required information to be in service in the offshore supply chain
Source	Hirer of CCU
Priority	1

F002	Hiring period
------	---------------

Description	Hiring of a CCU shall have start date and an end date
Rationale	Cost efficient management of the CCU pool
Source	CCU owner
Priority	1

F003	CCU hiring
Description	A CCU owner may hire CCUs from other CCU owners, but both shall be managed as CCU owners in LogisticHub
Rationale	Efficient deployment of the available CCU pool
Source	CCU owner
Priority	1

F004	Change of custody
Description	The CCU owner shall be informed each time a new organization gets custody of the CCU (i.e. every time the CCU is unloaded or loaded).
Rationale	Improves management of the CCU pool
Source	CCU owner
Priority	1

F005	Damaged CCU
Description	The CCU owner shall be informed immediately about defects with a CCU
Rationale	To improve future services for the customers and to reduce costs
Source	CCU owner
Priority	1

F006	Hirer
Description	All events related to the CCU shall be accessible for hirer in the hiring period.
Rationale	Improves planning and operations for the customer
Source	Hirer of CCU
Priority	1

F007	Supplier
Description	In some cases where the CCU is tailor-made to the service provided by the supplier, the CCU may then be owned by the supplier herself/himself. The supplier shall in these cases be managed as the hirer of the CCU in LogisticHub.
Rationale	Improves planning and operations for the customer
Source	Supply base/Operator
Priority	1

F008	Operator
Description	The operator has access to all events generated by CCUs in her/his custody and events of the CCU on the way to her/his custody (loading and departing previous site)
Rationale	Improves planning and operations for the customer
Source	Hirer of CCU

Priority	1
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F009	Supply base
Description	The supply base has access to all events generated by CCUs in her/his custody and events of the CCU on the way to her/his custody (loading and departing previous site)
Rationale	Improves planning and operations for the customer
Source	Hirer of CCU
Priority	1

F010	Expected arrival
Description	All system users receiving a CCU shall be informed who is the sender, the transporter and expected arrival time as soon as possible and at the latest when the CCU is loaded on the lorry/ship for transportation to their location/site
Rationale	Improved planning and operations for the customer
Source	System users
Priority	1

F011	Packing
Description	When packing the CCU, the suppliers shall inform if the content is dangerous or not. Furthermore, if the CCU is sealed according to Norwegian Oil and Gas, the supplier has to provide necessary document for security agreement herself/himself and for all the transporters of the CCU. If the sealed has been broken on the way to the supply base/operator, necessary security agreements from those that have broken the seal have to be provided. For sealed CCU information of the final destination is also required.
Rationale	Required by the Port Facility Security Officer (ISPS code)
Source	Supply Base owner/ Operator
Priority	1

F012	Inspection
Description	The CCU owner shall provide necessary documentation for the CCU (certificate, Z015 documentation) and the supplier shall provide necessary security agreements for herself/himself and all the companies that had custody for the CCU after sealed by the supplier. The operations shall at least be in compliance with Norwegian oil and gas Guidelines No. 091 and 116 and NORSOK Z015.
Rationale	To reduce the offshore industry risk level as much as practical possible
Source	Supply base/Operator
Priority	1

F013	Norwegian Oil and Gas Sealed CCU
Description	If inspection reveals no defects, Sealed CCU is brought direct for outbound staging in ISPS area
Rationale	Efficient and secure management of sealed CCUs

Source	Supply base/Operator
Priority	1

F014	Transporter
Description	The transporters have per today no access to LogisticHub. Information about the transporters has to be provided by the users of their services (This might be changed in the future.)
Rationale	To reduce the complexity in phase I - they ought to be involved in later phases
Source	Supply base/Operator
Priority	1

F015	Statistics
Description	Relevant statistics daily (8AM), weekly (Monday 8AM), monthly (1 <sup>st</sup> workday 8AM every month) and yearly (1 <sup>st</sup> workday 8AM every year)
Rationale	Efficient deployment of existing CCU pool, identify challenges and reveal opportunities
Source	System users
Priority	1

## 4.5 Non-functional requirements

NF001	Access rights
Description	The solution shall use access rights to determine which information and features the user is allowed to see and manipulate. This also includes limitation of what activities a user can do on a content (e.g. view, download, print, etc.)
Rationale	To secure acceptable confidentiality for all users deploying LogisticHub
Source	Users
Priority	1

NF002	Analysis
Description	The solution shall provide an inference engine for reasoning and functions for mathematics (calculate statistics)
Rationale	The users shall be able to query the content and provide appropriate statistics
Source	Users
Priority	1

NF003	Data store
Description	All received data shall be transformed to ISO 15926 Part 8 (RDF) and stored in a triple store and the solution shall provide the possibility to convert data of some form (tables, XML) to RDF and vice-versa based on standard transformation mechanisms like XSLT
Rationale	The recorded data per CCU will be of different length (graphs) more appropriate for triplestore then relational database

Source	Users / Administrator
Priority	1

NF004	Deployment
Description	The solution shall be provided as Software as a Service (SaaS), operated in a Service Oriented Architecture (SOA) and be able to push data
Rationale	Efficient operation of the solution
Source	Users/Administrator
Priority	1

NF005	Logging
Description	The solution shall support transmittal logging, e.g. data transmission receipt and storage of it within the solution
Rationale	Documentation of what has been received and sent
Source	Users
Priority	1

NF006	Notification
Description	The user may configure the solution to send alerts to the user (e.g. external email address, SMS, etc.) when defined events occur (e.g. broke/repair/non-functional)
Rationale	To increase the likelihood for awareness asap
Source	Users
Priority	1

NF007	Operation
Description	The system has to be in operation 24/7
Rationale	CCU documentation has to be available for inspection anytime
Source	Operator
Priority	1

NF008	Performance
Description	The solution shall be able to manage 120 million event per 3 year, i.e. 82 000 events per day in almost real time
Rationale	Estimated CCUs in the Norwegian offshore industry today are 30 000 and on average each is lifted 1000 times per year.
Source	Users
Priority	1

NF009	Presentation
Description	The various elements of the web pages shall be customizable during the solution implementation so that the web pages can be build up most intuitive for the user and

	support multiple languages including Norwegian letters
Rationale	Make the solution user friendly
Source	Users
Priority	1

NF010	Querying
Description	The solution shall include a library of standard queries
Rationale	Simple and efficient use of the solution
Source	Users
Priority	1

NF011	Reporting
Description	The solution shall support dynamic report generation through web services based on standard templates and provide reports with advanced reporting functionality like drill down and filtering
Rationale	Provide information for improving the logistic supply chain
Source	Users
Priority	1

NF012	Security
Description	<ul style="list-style-type: none"> <li>✓ The solution shall provide a login page that links authentication (must be time-out based) with an LDAP-based user directory or internal user verification</li> <li>✓ The solution shall support password expiration after a predefined number of days</li> <li>✓ The solution shall support W3C standards related to secure SOAP/RESTFULL web services, e.g. WS-Security</li> <li>✓ Solution supports changing ACL's over time</li> <li>✓ The solution shall check the network for vulnerabilities in all software exposed to the Internet or any external users</li> <li>✓ User information is stored in a secure way and can only be changed by a user with administrative rights</li> </ul>
Rationale	Very important that the users have trust in the solution
Source	Users
Priority	1

NF013	Standard support
Description	<ul style="list-style-type: none"> <li>✓ The triple store shall be based on recommendations from World Wide Web Consortium (W3C) and ISO standards</li> <li>✓ The solution shall provide possibilities for receiving, viewing, storing and sending XML data, supporting multiple versions of the same xml report data</li> <li>✓ The solution shall provide possibilities for receiving, storing, viewing and graphically visualizing RDF data</li> <li>✓ The solution shall be enabled for Linked data</li> <li>✓ The solution shall be able to handle time zone conversion of data and store data in e.g. UTF time</li> </ul>



Rationale	Solution shall be based on Semantic technology and global deployment
Source	Administrator
Priority	1

NF014	Standards support
Description	<ul style="list-style-type: none"> <li>✓ Norwegian Oil and Gas guidelines No. 091, 112 and 116</li> <li>✓ NORSOK Z015 Temporary equipment</li> <li>✓ IMO tank types</li> <li>✓ DNV's Standards for certification No. 2.7-1-3</li> <li>✓ ISO/IEC 15459 Issuing Agency Codes</li> <li>✓ Recommendations of W3C shall be supported</li> <li>✓ ISO15926 Part 2, Part 7 and Part 8 shall be supported</li> <li>✓ The concepts in GS1 EPCglobal Core Business Vocabulary Standard</li> </ul>
Rationale	The solutions shall be based on standards as far as practical possible
Source	Users
Priority	1

NF015	Support
Description	<ul style="list-style-type: none"> <li>✓ The solution shall provide end-users with on-screen help and guidance in using the solution</li> <li>✓ The solution shall provide updated and easily accessible end-user and solution administration documentation</li> </ul>
Rationale	To make the solution user friendly
Source	Users
Priority	1

NF016	System accessibility
Description	<ul style="list-style-type: none"> <li>✓ The solution shall have capabilities that enable users to access the solution from any country/time zone (global reach) at any time of the day</li> <li>✓ The solution operate on SOIL <a href="http://www.rignet.com/Solutions/SOIL/">http://www.rignet.com/Solutions/SOIL/</a></li> <li>✓ It shall be possible to submit data to LogisticHub from the Internet through a secure internet gateway or directly from SOIL</li> <li>✓ The solution shall at least provide SOAP and RESTFUL web services for user administration, data submission, report generation, data querying, data analysis and data validation</li> <li>✓ The solution shall be possible to use as an archive for some users</li> </ul>
Rationale	Standard way of operation in EPIM
Source	Users/Administrator
Priority	1

NF017	Task scheduling
Description	It shall be possible to schedule pushing of data with a regular occurrence. (For example push statistics at regular times and get a receipt on the delivery)
Rationale	Requested functionality of the solution
Source	Users
Priority	1

NF018	User groups
Description	<ul style="list-style-type: none"> <li>✓ User groups shall contain both individual users and other user groups</li> <li>✓ All sites share a common set of default user groups</li> <li>✓ User groups may be multipurpose used for several purposes (e.g. ACL, routing groups, workflows etc.)</li> <li>✓ The super-user can create, modify and delete user groups for each, or all, site(s) the super-user has access to</li> </ul>
Rationale	Common requirements
Source	Administrator
Priority	1

NF019	Users
Description	<ul style="list-style-type: none"> <li>✓ The solution shall allow users and groups to be configured through an external API such as web services</li> <li>✓ Defined administrators shall be able to add super users and any super user shall be able to list, add, delete and change a user account</li> <li>✓ Users can be associated with one or more user groups</li> <li>✓ The solution shall allow user rights to be configured by means of wizards (e.g. provide one user with read and write access to all/ unique sites that the user's company is involved in)</li> <li>✓ The users of the solution shall be able to change their own passwords</li> </ul>
Rationale	Efficient management of the users
Source	Users
Priority	1

NF020	Validation
Description	<ul style="list-style-type: none"> <li>✓ The solution shall provide syntactical validation of XML data with version support, meaning that xml schemas are evolving and it shall be possible to validate data against a given xml schema base on context and version</li> <li>✓ The solution shall support business rule validation</li> </ul>
Rationale	Improve quality of the data
Source	Users
Priority	1

---

NF021	Versioning
Description	<ul style="list-style-type: none"><li>✓ The solution shall handle versioning of native, transformed and inferred data</li><li>✓ The solution shall handle tracking of changes to native, transformed and inferred data</li></ul>
Rationale	The users' needs changes over time and different versions have to be handled
Source	Users
Priority	1

## 5. SYSTEM ARCHITECTURE

This chapter contains a description of the LogisticHub architecture in the form of an overall information model, a system architecture model, a software engineering model and a set of data event models.

### 5.1 Information architecture for LogisticHub

Figure 5.1 illustrates the overall information system and flow in LogisticHub.

The LogisticHub database will be a triplestore that will communicate with its various users through XML schemas, using standard Web Services such as SOAP and/or Restful.

All XML files shall be validated before the content is stored as triples in LogisticHub. In general, every received XML file requires a response to be sent to a set of users, as defined by the various work processes (to be detailed as part of the proposal and solution) and detailed message content (defined in Chapter 6).

The CCU owner shall provide XML files with information about their CCUs before any event is sent to LogisticHub. This XML file shall also be validated upon entry.

The necessary master data for LogisticHub is also defined in Chapter 6. Some of the master data is available from public web sites, while other data will be bought as a service. All of the required data will be regularly (and automatically) updated in LogisticHub, and thus only a minor part of the master data has to be provided by the users of LogisticHub.

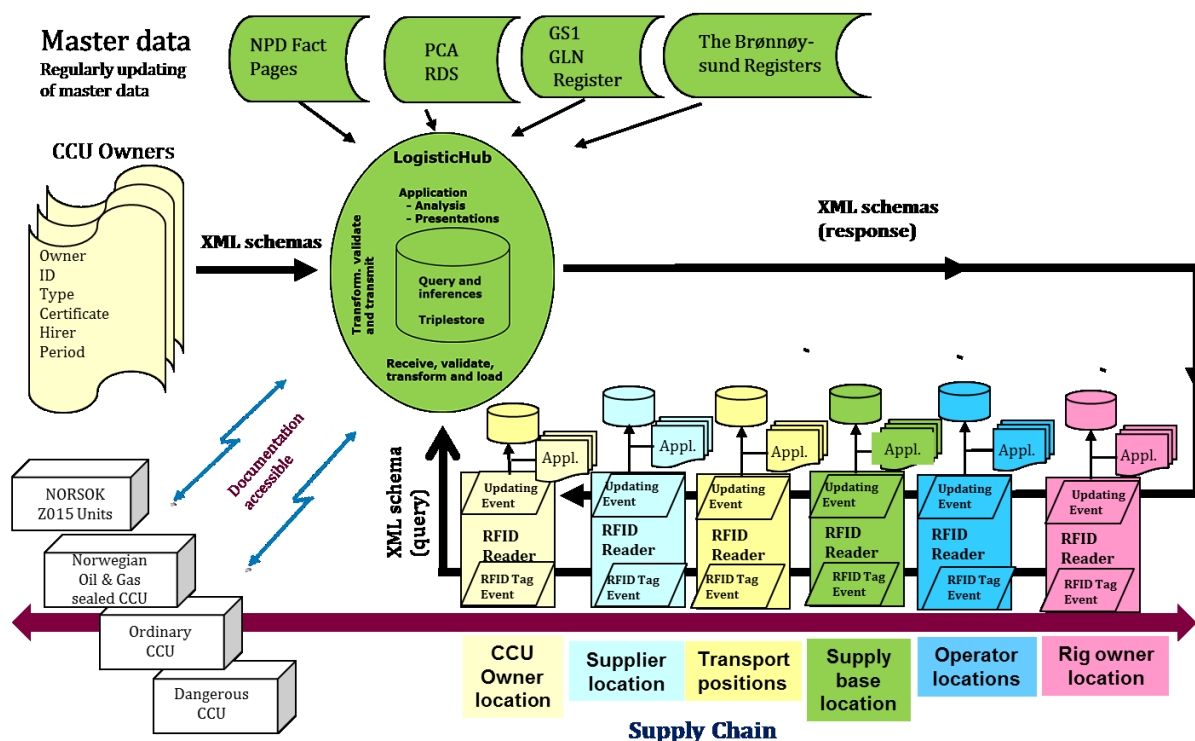


Figure 5.1: The overall information model for LogisticHub

## 5.2 System architecture for LogisticHub

Figure 5.2 shows the RFID Architecture Model for the Oil and Gas industry defined in Part 2 “Architecture and Integration” of Guideline 112 from Norwegian Oil and Gas, with defined levels 0 through 4 covering RFID hardware, sensors, devices and interfaces, middleware and end user applications that utilize RFID data for monitoring, analysis and decision making.

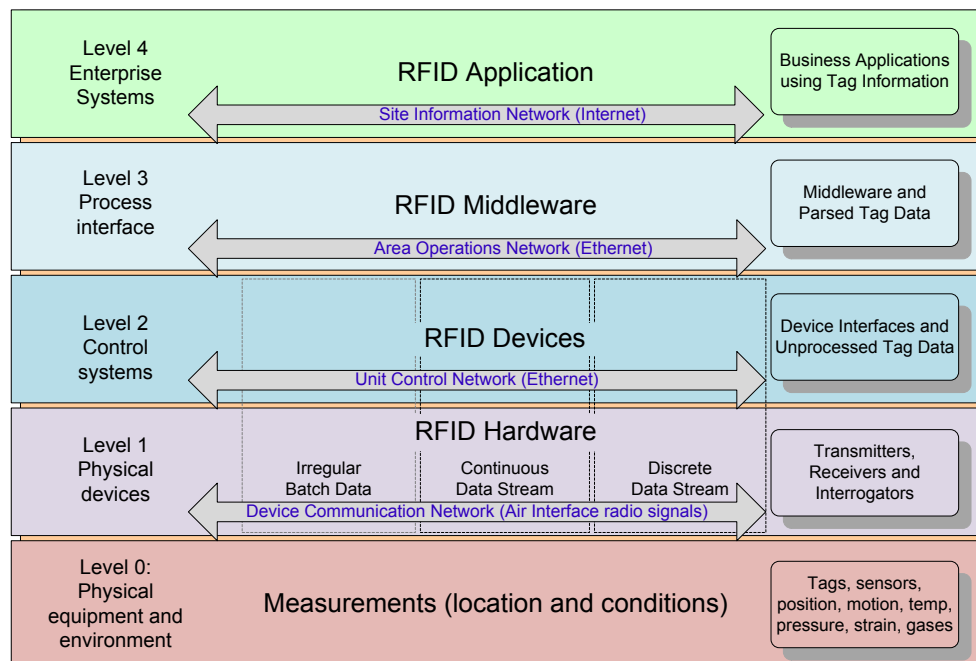


Figure 5.2: The RFID Architecture Model for RFID Deployment in the Oil and Gas industry

The major part of the LogisticHub implementation will be defined at Level 4, but the system architecture (description) of the implemented system should in conformance with the general RFID Architecture Model.

## 5.3 Software engineering architecture for LogisticHub

Figure 5.3 shows the RFID Software Engineering Model from Part 2 of Guideline 112, which promotes extendibility of the RFID System through a Service Oriented Architecture (SOA) design paradigm, with loose coupling between diverse applications connected and communicating via an Enterprise Service Bus (ESB) and use of common Reference Data.

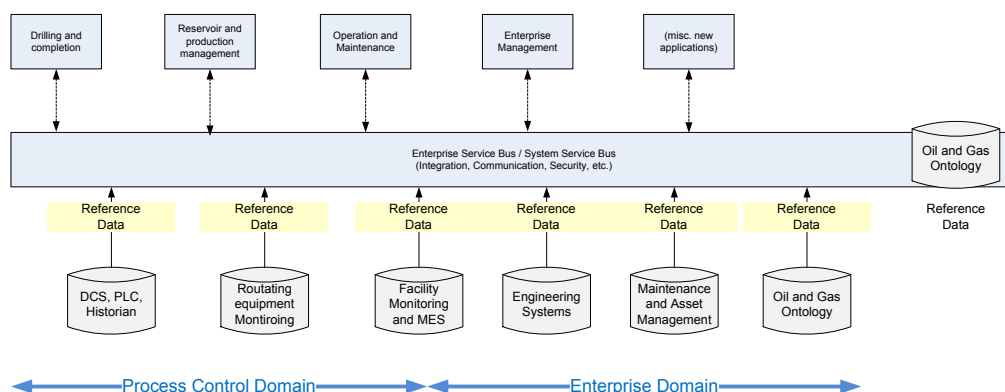


Figure 5.3: The RFID Software Engineering Model for RFID Deployment in the Oil and Gas industry

## 5.4 Data architecture for LogisticHub

Det Norske Veritas (DNV) has kindly provided the Norwegian OIL and Gas with a generic model for traceability including elements of configuration. This model will be deployed for LogisticHub, with a few exceptions that are commented below.

The conceptual data model visualizes the concepts:

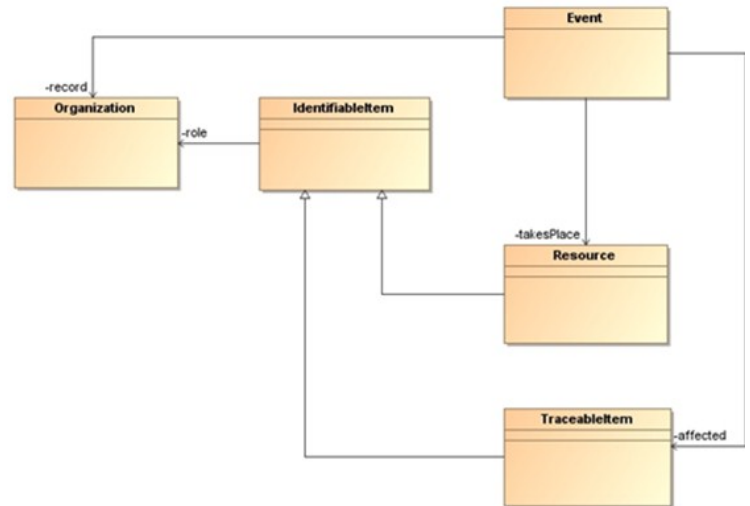
- ✓ event
- ✓ identifiable item
- ✓ resource
- ✓ traceable item
- ✓ organization

Organizations record events effecting traceable items (CCUs) as they takes place at resources (location/sites).

An identifiable item is either a resource (location/site) or a traceable item (for phase 1 a CCU).

An organization plays different roles with respect to identifiable items.

Figure 5.4 Conceptual data model for LogisticHub



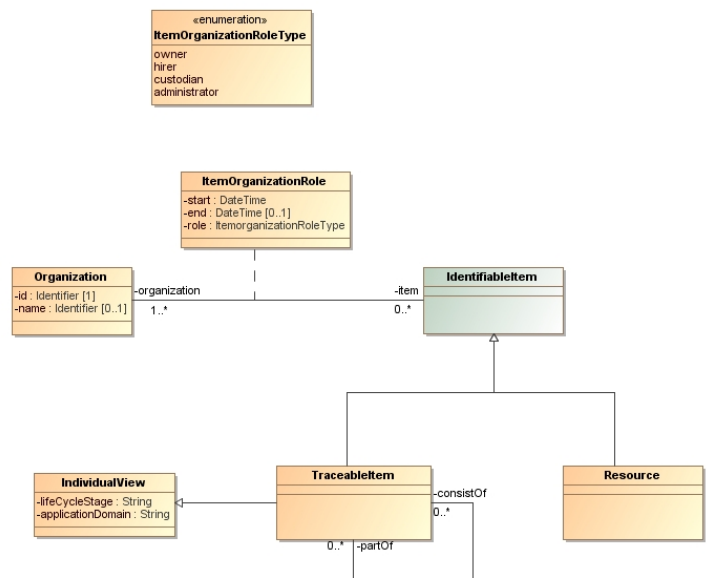
The generic data model is really presented as a subset seven models - Figure 5.5 to Figure 5.11.

The life cycle information and configuration of traceable items will not be taken into consideration in phase I of this project.

So the class IndividualView in Figure 5.5 and the subset of models related this class will not be discussed further in this project, but should be part of the data model for LogisticHub so it may eventual be extended in phase II or later phases.

All identifiable items are owned by and/or hired by, and in custody of an organization. Organizational connection has associations to a time period.

Figure 5.5 Generic data model for LogisticHub



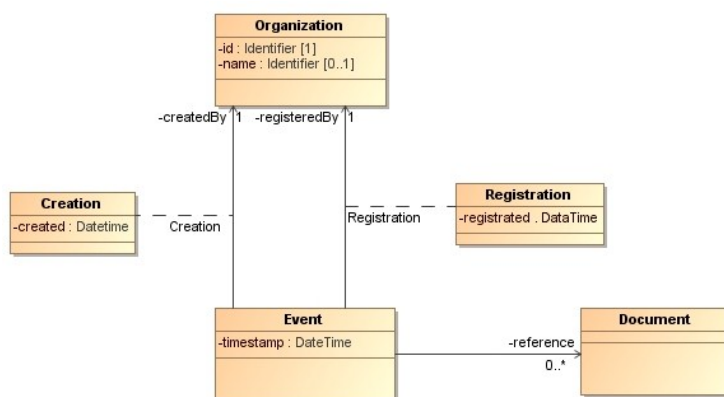
As shown by Figure 5.6, an event will be created by an organization. This event can be recorded by the organization that created the event, or by another organization on behalf of the organization creating the event. Both creation and registration of the event have timestamps associated to them.

When populating an event, zero or more documents can be referenced. A document reference must be made to a document ID.

In Figure 5.7 events are modelled into three main groups (in a class hierarchy); Life Cycle Event type, Movement Event type, and Composition Change Event type.

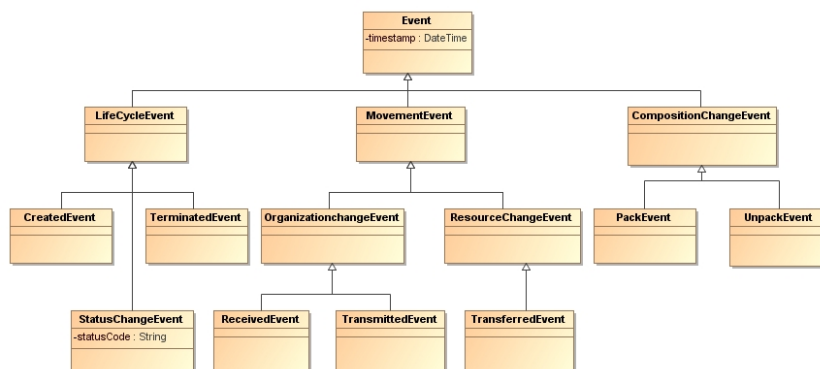
- Life Cycle Event type: an event type representing birth, death or change of state for a traceable item. (The only events used in phase I in this group are “damaged” and “repairing”).
- Movement Event type: an event type representing the movement of traceable items within or between organizations (and/or resources)
- Composition Event type: an event type representing an assembling/dis-assembling of a traceable item, for instance when several traceable items are packed into a pallet, where the pallet represents a new traceable item.

Figure 5.6 Event model for LogisticHub



All events take place at a certain time and each of the event types can have subclasses of events.

Figure 5.7 Event hierarchy for LogisticHub



The specific events of the oil and gas industry are defined in this document and/or in Guideline No. 112, Part2.

In Figure 5.8 the traceable item is moved from organization to another. The most important process events in Phase I of LogisticHub are related to

organization change event. The process events loading, unloading and accepting will be linked up to change of organization.

In Figure 5.9 the traceable item is move between resources within one organization. Some operators have decided that not all CCU movements within their supply base need to tracked with respect to business reasons. They just want to record “internal\_moving” and the position of the CCU after it has been moved. Only the users of LogisticHub that deploy a complete registration of the business processes as defined by DNV and GS1 will experience the benefits of resource change event.

Figure 5.8 Organization change event

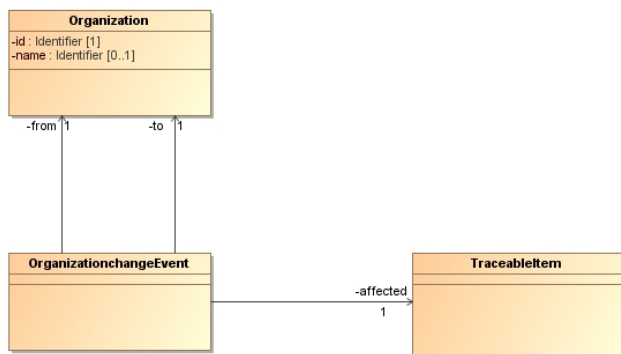
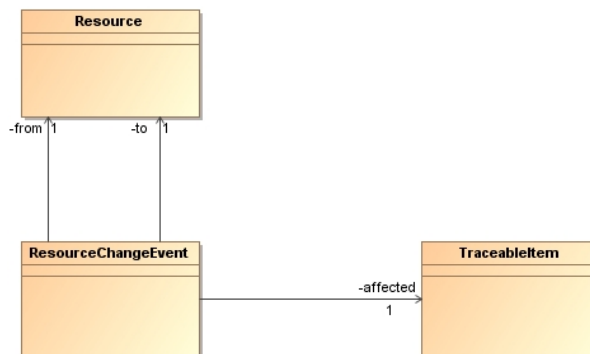


Figure 5.9 Resource change event



In Figure 5.10 the composition of a traceable item is changed. If the traceable item is packed (Figure 5.9), one or more traceable items are assembled into one new traceable item. For example a CCU might be loaded on a lorry or a ship, and then the transport unit might become the new traceable item. (Note that here we also have a change of organization since the custody of the traceable item is moved over to the transport organization.)

Similarly, if the traceable item is unpacked (Figure 5.11), one or more traceable items are disassembled into new traceable items. The business processes related to packing and unpacking becomes very important in phase II of the LogisticHub were also the content of the CCU shall be traced.

Figure 5.10 Composition change event and resource

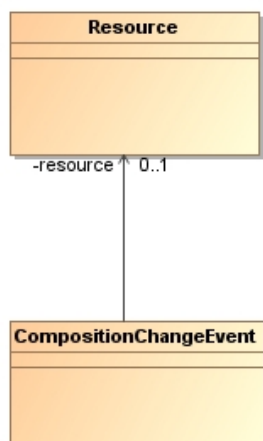
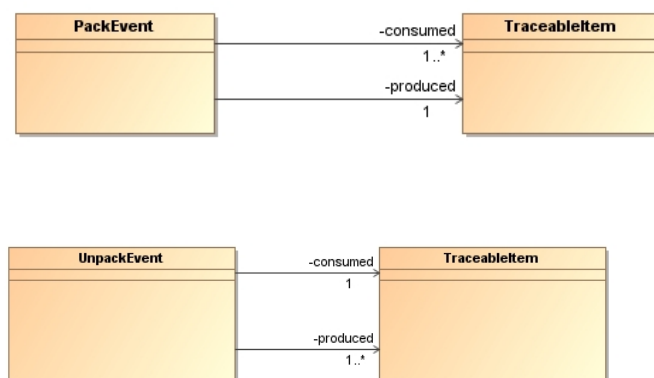


Figure 5.11 Pack and unpack events in LogisticHub





## 6. SYSTEM REQUIREMENTS SPECIFICATION

This chapter provides a detailed specification of requirements to master data for all parts of the system, event data for various system tasks and requirements for reporting of system activity.

### 6.1 CCU information

The owner of the CCU shall provide information about the hired CCU as an XML file to LogisticHub according to Table 6.1 below. This information shall be available in LogisticHub before the CCU is leaving the site of the CCU owner.

Table 6.1 CCU master data information

Attribute	Definition	Comment/example
tag_id	RFID unique identification code (GS1 GIAI)	3-002125-25654-12554
org_no	CCU owner org. number	Brønnøysund reg.
GLN_location	CCU owners GS1 location id. number	
ccu_class <sup>1)</sup>	Class of CCU	Basket, Container, ...
ccu_subclass <sup>1)</sup>	Subclass within the class	AnchorBasket, MiniContainer, ...
ccu_sizeclass	Classification of the CCU according to its size	Container_8ft, Basket_2m, ...
ccu_owner_prod_type	The product number is used to find specific information about the product or object.	Article or material number with information in ERP system or database
ccu_owner_id	CCU_Id given by the owner	Alphanumeric serial number or CCU: KA-567
ccu_manufacture_date	Date of manufacturing the CCU	yyyy.mm.dd
payload	Max payload	4300k
tara	Tara weight	1700kg
max_gross_weight	Max gross weight for CCU	6000kg
length	Length of CCU	4m
with	With of CCU	4m
height	Height of CCU	2.8m
tag_installation_date	RFID tag installation date – Timestamp of RFID tag installation	yyyy.mm.dd Will be used to schedule ordering of new RFID tags and organize replacement of tag
battery_status	Status of RFID tag battery	Will be used to replace RFID tag before battery expires
certificate_number	Original certificate number	44677/003
certificate_exp_date	Expire date for certification	yyyy.mm.dd
certificate_doc	PDF documents or a URI to the PDF documents	
CCU_doc	PDF documents or a URI to the PDF documents	Z015, IMO or DNV depending on CCU class
org_no	Hiring company org. number	Brønnøysund reg.
GLN_location	Hiring company GS1 location id	

	number	
start_date	Start date for the hiring period of the CCU	yyyy.mm.dd
end_date	End date for the hiring period of the CCU	yyyy.mm.dd

<sup>1)</sup> The only acceptable concepts to be used here are defined in Table 4.1.

## 6.2 Master data

The required functionality of LogisticHub is to a large degree depending on very high quality on the extensive and dynamic set of master data. These data has to be regularly updated and maintained. This section defines the necessary master data for LogisticHub and who will be in charge for providing this information.

### 6.2.1 Master data - onshore sites for CCU owners, suppliers and operators

All users of LogisticHub have to be registered by organization name and number as defined in the Brønnøysund Registers and GLN\_legal number as defined by GS1. Furthermore, all organizational units of an organization that have custodian of CCUs shall be defined by local organizational name, GLN\_location number, location name, visiting address and GPS coordinates. The information in Table 6.2 has to be provided by the companies themselves or by GS1 that provides such services for onshore sites based on a fee per year. The information has to be updated regularly and maintained.

Table 6.2 Master data - onshore sites for CCU owners, suppliers and operators

Attribute	Definition	Comment/example
comp1_legal_org_name	Company 1 legal org. name	Brønnøysund reg.
comp1_org_no	Company 1 org. number	Brønnøysund reg.
comp1_GLN_legal	Company 1 GLN number	GS1
comp1_loc1_org_name	Company 1 location 1 org. name	GS1
comp1_loc1_GLN_location	Company 1 location 1 GLN number	GS1
comp1_loc1_location_name	Company 1 location 1 name	GS1
comp1_loc1_street_address	Company 1 location 1 street address	GS1
comp1_loc1_zip_code	Company 1 location 1 zip code	GS1
comp1_loc1_zip_place	Company 1 location 1 zip name	GS1
comp1_loc1_lat	Company 1 location 1 GPS latitude	GS1
comp1_loc1_long	Company 1 location 1 GPS longitude	GS1
.....		
comp1_locn1_org_name	Company 1 location n <sub>1</sub> org. name	GS1
comp1_locn1_GLN_location	Company 1 location n <sub>1</sub> GLN number	GS1
comp1_locn1_location_name	Company 1 location n <sub>1</sub> name	GS1
comp1_locn1_street_address	Company 1 location n <sub>1</sub> street address	GS1
comp1_locn1_zip_code	Company 1 location n <sub>1</sub> zip code	GS1
comp1_locn1_zip_place	Company 1 location n <sub>1</sub> zip name	GS1
comp1_locn1_lat	Company 1 location n <sub>1</sub> GPS latitude	GS1
comp1_locn1_long	Company 1 location n <sub>1</sub> GPS longitude	GS1
.....		
.....		

compN_legal_org_name	Company N legal org. name	Brønnøysund reg.
compN_org_no	Company N org. number	Brønnøysund reg.
compN_GLN_legal	Company N GLN number	GS1
compN_loc1_org_name	Company N location 1 org. name	GS1
compN_loc1_GLN_location	Company N location 1 GLN number	GS1
compN_loc1_location_name	Company N location 1 name	GS1
compN_loc1_street_address	Company N location 1 street address	GS1
compN_loc1_zip_code	Company N location 1 zip code	GS1
compN_loc1_zip_place	Company N location 1 zip name	GS1
compN_loc1_lat	Company N location 1 GPS latitude	GS1
compN_loc1_long	Company N location 1 GPS longitude	GS1
.....		
compN_locnN_org_name	Company N location n <sub>N</sub> org. name	GS1
compN_locnN_GLN_location	Company N location n <sub>N</sub> GLN number	GS1
compN_locnN_location_name	Company N location n <sub>N</sub> name	GS1
compN_locnN_street_address	Company N location n <sub>N</sub> street address	GS1
compN_locnN_zip_code	Company N location n <sub>N</sub> zip code	GS1
compN_locnN_zip_place	Company N location n <sub>N</sub> zip name	GS1
compN_locnN_lat	Company N location n <sub>N</sub> GPS latitude	GS1
compN_locnN_long	Company N location n <sub>N</sub> GPS longitude	GS1

### 6.2.2 Master data - onshore transport

Some information about the onshore transport companies transporting CCUs for the users of LogisticHub have to be included in the master data. Information is limited to organization name and number as defined in the Brønnøysund Registers and GLN legal number provided by GS1. The transport company should provide license plate and mobile phone number for each transport to the user of transport service and the latter have to secure that this information is provided to LogisticHub. Required master data for onshore transport organization is listed in Table 6.3. The information has to be updated regularly and maintained.

Table 6.3 Master data – onshore transport

Attribute	Definition	Comment/example
trans1_name	Transport company 1 name	Brønnøysund reg.
trans1_org_no	Transport company 1 org. number	Brønnøysund reg.
Trans1_GLN_legal	Transport company 1 GLN legal number	GS1 Transport company 1 GLN id number
.....		
.....		
transN_name	Transport company N name	Brønnøysund reg.
transN_org_no	Transport company N org. number	Brønnøysund reg.
TransN_GLN_legal	Transport company N GLN legal number	GS1

### 6.2.3 Master data – fixed offshore surface facilities

Information about fixed offshore surface facilities is available on NPD Fact Pages in CSVformat. This information is updated by NPD every morning 6 AM. EPIM converts this information to RDF data every morning in ReportingHub. Required information from NPD Fact Pages is listed in Table 6.4. The information has to be updated regularly and maintained.

Table 6.4 Master data – fixed offshore surface facilities

Attribute	Definition	Comment/example
oper1_org_name	Operator 1 org. name	Statoil Petroleum AS
oper1_org_no	Operator 1 org. number	990888213
oper1_NPDID	Operator 1 NPD id number	
oper1_fac1_name	Operator 1 facility 1 name	Gullfaks A
oper1_fac1_id	NPD ID number for the facility	271833
oper1_fac1_lat	Operator 1 facility 1-latitude	6782834.61 NS (Note - has to be converted to GPS coordinates)
oper1_fac1_long	Operator 1 facility 1-longitude	456386.09 EW
.....		
.....		
oper1_facn1_name	Operator 1 facility 1 name	
oper1_facn1_id	NPD ID number for the facility	
oper1_facn1_lat	Operator 1 facility 1-latitude	
oper1_facn1_long	Operator 1 facility 1-longitude	
.....		
.....		
operN_org_name	Operator N org. name	
operN_org_no	Operator N org. number	
operN_NPDID	Operator N NPD id number	
operN_fac1_name	Operator N facility 1 name	
operN_fac1_id	NPD ID number for the facility	
operN_fac1_lat	Operator N facility 1-latitude	
operN_fac1_long	Operator N facility 1-longitude	
.....		
.....		
operN_facnN_name	Operator N facility nN name	
operN_facnN_id	NPD ID number for the facility	
operN_facnN_lat	Operator N facility nN -latitude	
operN_facnN_long	Operator N facility nN -longitude	

### 6.2.4 Master data – mobile offshore surface facilities

Information about mobile offshore surface facilities is available on NPD Fact Pages. This information is updated by NPD every morning 6 AM. However, position of these facilities are only available for drilling rigs in operations. Operators have to provide location information for accommodation vessels and any other mobile facility in their logistic supply chain. EPIM converts some of this information to RDF data every morning in ReportingHub. This information has to be updated regularly and maintained.

Table 6.5 Master data – mobile offshore surface facilities

Attribute	Definition	Comment/example
fac_own1_org_name	Facility owner 1 org. name	Transocean Offshore Europe Ltd
fac_own1_org_no	Facility owner 1 org. number	980865797
fac_own1_NPDID	Facility owner 1 NPDID number	2050195
fac_own1_fac1_name	Facility owner 1 facility 1 name	TRANSOCEAN ARCTIC
fac_own1_fac1_id	NPD ID number for the facility	294382
fac_own1_fac1_lat	Facility owner 1 facility 1- latitude	6521648.76 NS Note - has to be converted to GPS coordinates)
fac_own1_fac1_long	Facility owner 1 facility 1-longitude	479959.23 EW
.....		
.....		
fac_own1_facn1_name	Facility owner 1 facility n1 name	
fac_own1_facn1_id	NPD ID number for the facility	
fac_own1_facn1_lat	Facility owner 1 facility n1-latitude	
fac_own1_facn1_long	Facility owner 1 facility n1-longitude	
.....		
.....		
fac_ownN_org_name	Facility owner N org. name	
fac_ownN_org_no	Facility owner N org. number	
fac_ownN_NPDID	Facility owner N NPDID number	
fac_ownN_fac1_name	Facility owner N facility nN name	
fac_ownN_fac1_id	NPD ID number for the facility	
fac_ownN_fac1_lat	Facility owner N facility nN-latitude	
fac_ownN_fac1_long	Facility owner N facility nN-longitude	
.....		
.....		
fac_ownN_facnN_name	Facility owner N facility nN name	
fac_ownN_facnN_id	NPD ID number for that facility	
fac_ownN_facnN_lat	Facility owner N facility nN-latitude	
fac_ownN_facnN_long	Facility owner N facility nN-longitude	

### 6.2.5 Master data – offshore transport

Some information about the offshore transport companies transporting CCUs for the users of LogisticHub have to be included in the master data. Information is limited to organization name and number as defined in the Brønnøysund Registers and GLN legal number provided by GS1. The transport company should provide IMO number and mobile phone number for each transport to the user of the transport service and the latter have to secure that this information is provided to LogisticHub. Table 6.6 shows required master data in LogisticHub for offshore transport. This information has to be updated regularly and maintained.

Table 6.6 Master data – offshore transport

Attribute	Definition	Comment/example
trans1_org_name	Ship owner 1 org. name	Ship register?
trans1_org_no	Ship owner 1 org. number	Ship register?
Trans1_GLN_legal	Ship owner 1 GLN legal number	GS1
.....		
.....		
transN_org_name	Ship owner N org. name	
transN_org_no	Ship owner N org. number	
TransN_GLN_legal	Ship owner N GLN legal number	GS1

### 6.3 Event data

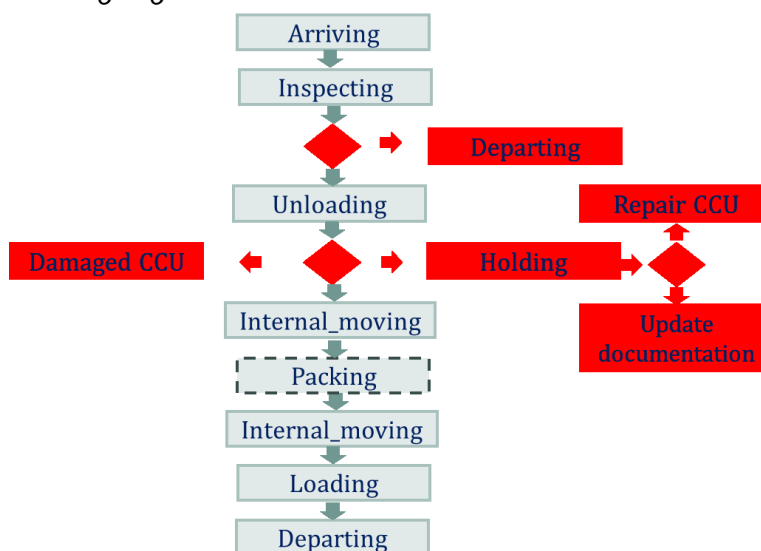
This section defines data that is communicated between LogisticHub and the users of LogisticHub. The users are the CCU owners, suppliers, supply base owners, operators, rig owners and transport companies on- and offshore.

The most interesting tracking information is related to the where’s and the why’s (business process events) so hopefully most users of LogisticHub will in due time be using the complete list of process events in GS1 EPCglobal Core Business Vocabulary Standard. Reference is made to Figure 3.2 and 3.3 above.

However, for phase I of the LogisticHub project, we will have focus on five business process events: **arriving, inspecting, holding, unloading, loading, and departing**. A process event called **internal\_moving** has been created to be able to handle internal movements not identified by ordinary business process events. In addition, it turns out that some information from the packing process is also needed for informing the receiver of the CCU at next location.

For each of them, a complete documentation of the communication between LogisticHub and the relevant stakeholders will be provided in the tables below. This communication has been standardized and is independent of organization and location. They are defined in Tables 6.7a – 6.14b below and will be the basis for development of the XML schemas.

Figure 6.1 A typical registration of events at a supply base for a CCU going offshore



The information sent to relevant stakeholders from LogisticHub should be limited to what is needed for the stakeholders with special focus on the truck/crane drivers. However, it should also be possible to validate important parts of the information.

### 6.3.1 Arriving

The situation that a CCU is arriving at a location is depicted in Table 6.7a and 6.7b. The query sent to LogisticHub from the RFID reader is given in Table 6.7a.

Table 6.7a Arriving at a location - event data to LogisticHub

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	
org_no	Org. number at arriving	In the RFID reader - org. number of the location owner
GLN_location/NPDID_location	GLN/NPDID number at arriving	In the RFID reader
arriving	Process event - arriving	
date_time	Process event - time	2012.10.22.17.15.10

Note that by the arriving at a supply base by a lorry, the RFID reader might be placed at the entrance of the base and the organization might be the owner of the supply base not the receiver of the CCU.

The response from LogisticHub sent to relevant (defined in section 4.2) stakeholders is provided in Table 6.7b. This information is also available in LogisticHub on request and then it should be presented in a more human readable way – names on organization and location instead of numbers and may be more information connected to the response XML file. This remark is valid for all response tables below.

Table 6.7b Arriving at a location - event data from LogisticHub to relevant stakeholders

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	
org_no	Org. number at arriving	In the RFID reader - org. number of the location owner
GLN_location/NPDID_location	GLN/NPDID number at arriving	In the RFID reader
arriving	Process event - arriving	
date_time	Process event - time	2012.10.22.17.15.10

### 6.3.2 Inspecting

The objective of Norwegian Oil and Gas Guideline No. 091 and No. 116 are to establish a coordinated and uniform practice of the companies' requirements for securing supplies and materials for the oil and gas industry and to achieve a correct and uniform practice within packing, securing and transport of cargo, as well as user inspection of load CCUs.

These guidelines represent the industry's common foundation for securing equipment and supplies that are used in the oil and gas activities on the Norwegian Continental Shelf and should be adopted by all users of LogisticHub.

Operating oil companies shall ensure that the principles laid down in these guidelines are incorporated in the security plans and professional security supervision, and that any agreements that are formulated on the basis of these guidelines are made binding through contracts, etc.

The business process event “inspecting” might be quite complicated as depicted in Figure 4.5 above depending on the results of the inspection. We have chosen to divide this activity into two steps; first provide necessary information to an operator executing the inspection process (Tables 6.8a and 6.8b) on a location and second provide information to the relevant stakeholders about the result of the inspection (Tables 6.9a and Tables 6.9b).

Table 6.8a *Inspecting at a location - event data to LogisticHub*

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	
org_no	Org. number at inspecting	In the RFID reader - org. number of the location owner
GLN_location/NPDID_location	GLN/NPDID number at inspecting	In the RFID reader
inspecting	Process events – inspecting involves the process of reviewing product to address potential product and documents defects	
date_time	Process event - time	2012.10.22.17.15.10
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	

Table 6.8b *Inspecting at a location - data from LogisticHub to the operator of the inspection*

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at inspecting	In the RFID reader - org. number of the location owner
GLN_location/NPDID_location	GLN/NPDID number at inspecting	In the RFID reader
inspecting	Process events – inspecting involves the process of reviewing product to address potential product and documents defects	
date_time	Process event - time	2012.10.22.17.15.10
weight	Weight of the CCU	Last available information
temp	Temperature if relevant	Last available information
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	
dangerous_goods	If dangerous goods – type danger by code	
doc_dangerous_goods	PDF documents or a URI to the PDF documents	
ccu_class	Class of CCU	Basket, container, etc.
ccu_sub_subclass	Sub-subclass within the subclass	Mini Offshore Container 8 ft.
ccu_owner_prod_type	The product number is used to find specific information about the product or object.	Article or material number with information in ERP system or database
ccu_owner_id	CCU_Id given by the owner	Alphanumeric serial number or CCU: KA-567



ccu_manufacture_date	Date of production	yyyy.mm.dd
payload	Max payload	4300k
tara	Tara weight	1700kg
max_gross_weight	Max gross weight for container	6000kg
length	Length of container	4m
with	With of container	4m
height	Height of container	2.8m
tag_installation_date	RFID tag installation date – Timestamp of RFID tag installation	yyyy.mm.dd Will be used to schedule ordering of new RFID tags and organize replacement of tag
battery_status	Status of RFID tag battery	Will be used to replace RFID tag before battery expires
certificate_number	Original certificate number	44677/003
certificate_exp_date	Expire date for certification	yyyy.mm.dd
certificate_doc	PDF documents or a URI to the PDF documents	
CCU_doc	PDF documents or a URI to the PDF documents	Z015, IMO or DNV depending on CCU class
suppl_security	PDF security agreement document for supplier or link to the PDF doc.	
trans_security <sup>1)</sup>	PDF security agreement document for transport com. or link to the PDF doc.	

<sup>1)</sup> Note that there may be more than one Transport Company involved in the transport of the CCU.

Possible results of the inspection are described in Table 6.9a below.

Table 6.9a Inspecting result at a location - event data to LogisticHub

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	
org_no	Org. number at inspecting	In the RFID reader - org. number of the location owner
GLN_location/NPDID_location	GLN/NPDID number at inspecting	In the RFID reader
inspecting_result	CCU is OK or NOT OK	
date_time	Process event - time	2012.10.22.17.15.10
inspecting_comment	If not ok, the messages should be: <ul style="list-style-type: none"> <li>✓ CCU has been returned to previous location</li> <li>✓ CCU damaged - of circulation and/or</li> <li>✓ CCU on holding due to <ul style="list-style-type: none"> <li>• dangerous goods</li> <li>• CCU need repair</li> <li>• awaiting the following documentation <ul style="list-style-type: none"> <li>▪ CCU certificate</li> <li>▪ Security agreements</li> </ul> </li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>▪ 2015, DNV or IMO documentation</li> </ul>	
--	--	--

Information sent to relevant stakeholders is provided in Table 6.9b. This message should/might also be sent direct to the CCU owner's own system and/or the hirer's own system.

Table 6.9b Inspecting result at a location - data from LogisticHub to relevant stakeholders

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	
org_no	Org. number at inspecting	In the RFID reader - org. number of the location owner
GLN_location/NPDID_location	GLN/NPDID number at inspecting	In the RFID reader
inspecting_result	CCU is OK or is NOT OK	
date_time	Process event - time	2012.10.22.17.15.10
inspecting_comment	Relevant comment	

### 6.3.3 Unloading

Information exchanged between RFID reader at the location and LogisticHub for the business process event "unloading" is provided in Table 6.10a and Table 6.10b.

Table 6.10a Unloading at a location - event data to LogisticHub

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at unloading	In the RFID reader - org. number of the location owner
GLN_location/NPDID_location	GLN/NPDID number at unloading	In the RFID reader
unloading	Process events- unloading lorry or ship, unpacking lorry or ship and accepting change of organization custody	
date_time	Process event - time	2012.09.01.17.15.10
weight	Process event-weight of the CCU	
temp	Process event-temperature if relev.	
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	

The response from LogisticHub sent to relevant stakeholders is provided in Table 6.10b.

Table 6.10b Unloading at a location - data from LogisticHub to relevant stakeholders

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at unloading	In the RFID reader - org. number

		of the location owner
GLN_location/NPDID_location	GLN/NPDID number at unloading	In the RFID reader
unloading	Process events - unloading lorry or ship, unpacking lorry or ship and accepting change of organization custody	
date_time	Process event - time	2012.09.01.17.15.10
weight	Process event-weight of the CCU	
temp	Process event-temperature if relev.	
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	

### 6.3.4 Internal-moving

The process event “internal\_moving” is created to simplify the reporting to LogisticHub and reduce insight to the internal processes at the supply base. Hopefully, someday all users of LogisticHub will see the benefits of having registered the complete set of business process events.

As agreed will the users, Table 6.11a provides the information sent to LogisticHub for this event.

Table 6.11a *Internal\_moving in a location - event data to LogisticHub*

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at internal_moving	
GLN_location/NPDID_location	GLN/NPDID number at internal_moving	
Internal_moving	Process events – internal_moving – the process of moving the CCU within the location for optimizing operations	
date_time	Process event - time	2012.09.01.17.15.10
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	

Table 6.11b provides the “internal\_moving” information with relevant stakeholders.

Table 6.11b *Internal\_moving in a location - data from LogisticHub to relevant stakeholders*

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at internal_moving	
GLN_location/NPDID_location	GLN/NPDID number at internal_moving	
Internal_moving	Process events – internal_moving – the process of moving the CCU within the location for optimizing operations	
date_time	Process event - time	2012.09.01.17.15.10

loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	

### 6.3.5 Loading

Most likely there will be several internal\_moving on the location with the CCU between the business process events “unloading” and “loading”. Some of them, may be all, will be addressed in phase II of the LogisticHub project.

The communication between the RFID reader at the location and LogisticHub for the process event “loading” is presented in Table 6.12a and 6.12b below.

Table 6.12a Loading at a location - event data to LogisticHub

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at loading	In the RFID reader
GLN_location/NPDID_location	GLN/NPDID number at loading	In the RFID reader
loading	Process events- loading on lorry, packing on lorry and accepting (change of organizational custody)	From local system
date_time	Process event - time	2012.09.01.17.15.10
weight	Process event-weight of the CCU	
temp	Process event - temperature if relev.	
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	
trans_org_no	Org. number transport company	From internal system
Trans_GLN_legal	Transport company legal GLN	From internal system
ns_org_no	Org. number to org. next location	From internal system
ns_GLN_location/NPDID_location	GLN location number or NPDID number next location	From internal system
exp_arriv_time	Expected arrival time next location	From internal system or calculated by LogisticHub - yyyy.mm.dd.hh
final_destination	The site where the seal is broken	Gullfaks A

Table 6.12b Loading at a location - data from LogisticHub to relevant system users

Attribute	Definition	Comment/example
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tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at loading	In the RFID reader
GLN_location/NPDID_location	GLN/NPDID number at loading	In the RFID reader
loading	Process events- loading on lorry, packing on lorry and accepting (change of organizational custody)	
date_time	Process event - time	2012.09.01.17.15.10
weight	Process event-weight of the CCU	
temp	Process event-temperature if relev.	
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	
trans_org_no	Org. number transport company	
Trans_GLN_legal	Transport company legal GLN	
ns_org_no	Org. number to org. next location	
ns_GLN_location/NPDID_location	GLN location number or NPDID number next location	
exp_arriv_time	Expected arrival time next location	yyyy.mm.dd.hh
final_destination	The site where the seal is broken	Gullfaks A

### 6.3.5 Departing

The business process event “departing” shall be registered automatically when a CCU is leaving a location. Table 6.13a and 6.13b describe the communication between RFID reader at location and LogisticHub.

Table 6.13a Departing from a location - event data to LogisticHub

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	
org_no	Org. number at departing	
GLN_location/NPDID_location	GLN/NPDID number at departing	
departing	Process event - departing	
date_time	Process event - time	2012.09.01.17.15.10

Table 6.13b Departing from a location - data from LogisticHub to relevant stakeholders

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	
org_no	Org. number at departing	
GLN_location/NPDID_location	GLN/NPDID number at departing	
departing	Process event - departing	
date_time	Process event - time	2012.09.01.17.15.10
exp_arriv_time	Expected arrival time next site	yyyy.mm.dd.hh

#### Comments:

1. “unloading” and “loading” With reference to the  
 With reference to the conceptual and data model in Chapter 7, these two business process events may cover three types of events – unloading, unpacking and accepting; and loading, packing,

accepting, respectively. Unloading the CCU from a vessel, will mean “unpacking” if the vessel has been the traceable item and the CCU become the traceable item. And unloading means also “accepting” the custody of the CCU for the local organization. Similar interpretation for the process event “loading”.

## 2. CCU owner

A typical sequence for the CCU owner with respect to LogisticHub is loading, departing, arriving and unloading since there is an agreement that internal operations including certification and maintenance of the CCUs shall not be a part of LogisticHub.

The CCU owner needs to consider how to prove information about transporter, next location and expected arrival under loading. This information is generated under the business process event “packing” as defined for the supplier under item 3 below.

## 3. Supplier

The business process event “packing” should be included in phase I of the LogisticHub project secure that important information and all necessary documentations are included in LogisticHub before sent the supply base/operator. The supplier has to provide information about:

- ✓ If the CCU has dangerous goods, the necessary documentation shall be available as PDF or link.
- ✓ If the CCU is sealed with a Norwegian Oil and Gas seal, the necessary security agreements for supplier and the transport companies shall be available as PDF or link.
- ✓ In all cases, the final destination of the content of the CCU. For a Norwegian Oil and Gas sealed CCU this is usually some offshore installation and for an unsealed CCU some supply base where it has to be checked and repacked before sent offshore.

Table 6.14a and 6.14b describe the communication between the supplier’s RFID reader and LogisticHub.

Table 6.14a Packing at supplier’s location - event data to LogisticHub

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	tag_id
org_no	Org. number at departing	org_no
GLN_location/NPDID_location	GLN/NPDID number at departing	GLN_location/NPDID_location
packing	Process events – packing, picking and staging (moving the CCU in line for loading)	
date_time	Process event - time	2012.09.01.17.15.10
weight	Process event-weight of the CCU	
temp	Process event-temperature if relev.	
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	
dangerous <sup>1)</sup>	If dangerous - type danger by code	
supp_security	PDF security agreement document	

	for supplier or link to the PDF doc.	
trans_org_no	Transport company org. number	
trans_org_name <sup>2)</sup>	Transport company org. name	
trans_security	PDF security agreement document for transport com. or link to the PDF doc.	
ns_org_no	Org. number to org. next location	
ns_GLN_location/NPDID_location	GLN location number or NPDID number next location	
exp_arriv_time	Expected arrival time at next site	yyyy.mm.dd.hh
final_destination	The site where the seal is broken	Gullfaks A

<sup>2)</sup> Note that there might be more than one Transport Company involved in transport of the CCU

Table 6.1 4b Packing at supplier's location - data from LogisticHub to relevant stakeholders

Attribute	Definition	Comment/example
tag_id	RFID unique identification code	3-002125-25654-12554
org_no	Org. number at departing	org_no
GLN_location/NPDID_location	GLN/NPDID number at departing	GLN_location/NPDID_location
date_time	Process event – time	2012.09.01.17.15.10
packing	Process events – packing, picking and staging (move the CCU in line for loading either ISPS or pick up by lorry )	
weight	Process event-weight of the CCU	
temp	Process event-temperature if relev.	
loc_lat	GPS - latitude at location	
loc_long	GPS – longitude at location	
dangerous	If dangerous - type danger by code	
supp_security	PDF security agreement document for supplier or link to the PDF doc.	
trans_org_no	Transport company org. number	
trans_org_name	Transport company org. name	
trans_security	PDF security agreement document for transport com. or link to the PDF doc.	
ns_org_no	Org. number to org. next location	
ns_GLN_location/NPDID_location	GLN location number or NPDID number next location	
exp_arriv_time	Expected arrival time next site	yyyy.mm.dd.hh

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final_destination	The site where the seal is broken	Gullfaks A
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## 6.4 Reports from LogisticHub

The users of LogisticHub shall be able to query any part of master data (organization information) and all event information that they have access to according to the rules provided in section 4.2. A set of standard queries should be established in close collaboration with the users of LogisticHub.

Statistical reports should include, but are not limited to:

- ✓ Daily number of lifts last 24 hours (6AM-6AM)
  - Onshore and offshore
  - North Sea, Norwegian Ocean and Barents Ocean
  - CCU classes (basket, container, ...)
- ✓ Monthly
  - Per operator
    - Number of lifts - onshore and offshore
    - Number of lifts - per base and platform
    - Number of damaged CCUs
    - Number of CCUs on holding
    - Turnover in days per location
    - Number of CCUs per base
  - Per CCU owner
    - Number of CCUs per type per base
    - Turnover in days per type and base



## 7. SYSTEM MODELS

This chapter describes aspects of the required solution from an information systems perspective. It outlines a high level data flow model, a common logistics ontology, and a preliminary and incomplete example of an RFID-ontology.

### 7.1 Data-flow model for LogisticHub

The data flow between users and the LogisticHub system is presented in Figure 7.1 below.

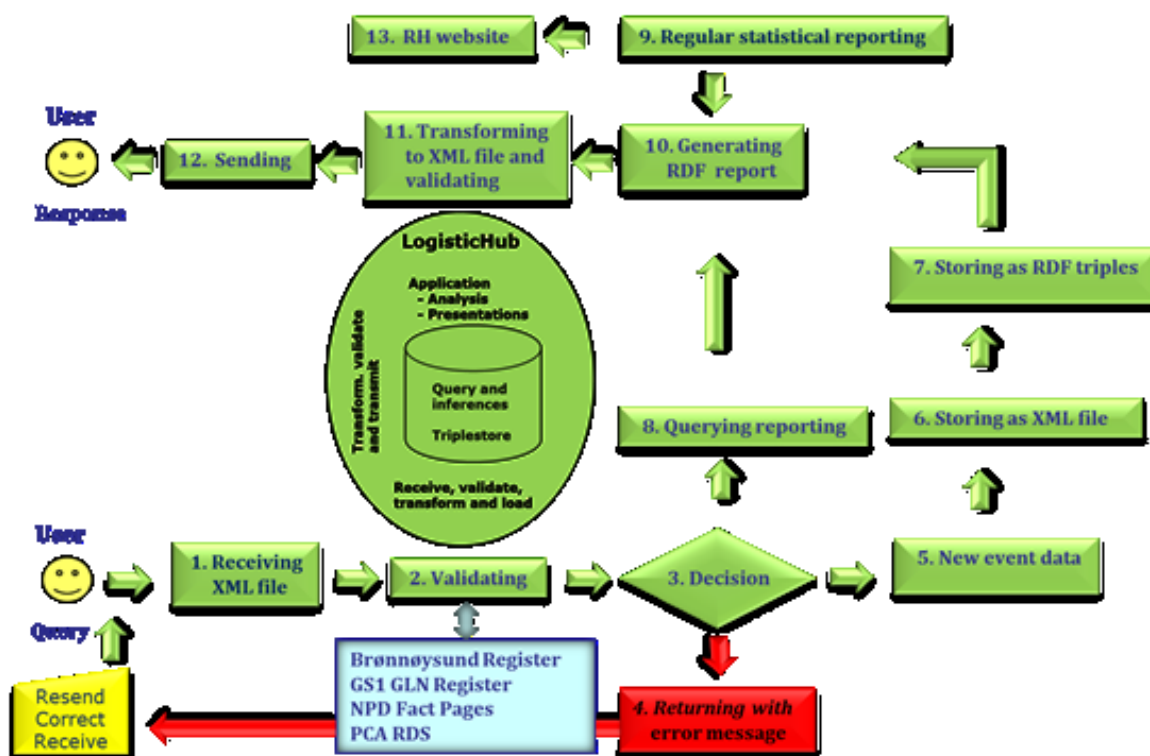


Figure 7.1: Data flow in LogisticHub

### 7.2 Common logistic model

The common logistic model is an ontology that represents the logistics on the Norwegian Continental Shelf (NCS). It shall be developed according to ISO15926 Reference Data, as well as selected parts of NPD fact pages, relevant parts of the GS1 GLN register and company identifications from the Brønnøysund Registers.

Brønnøysund, GS1 and NPD provide metadata like legal IDs and names for companies, locations, installations and rigs. They are continuously updated and published on the Internet by Brønnøysund and NPD. GS1 provide similar service based on business terms. In the LogisticHub, this information must be available on RDF format according to ISO 15926, and an appropriate converter mechanism has to be established. How the different ontologies, reference data and metadata contribute to the definition of the content in LogisticHub has been illustrated in Figure 7.2 below.

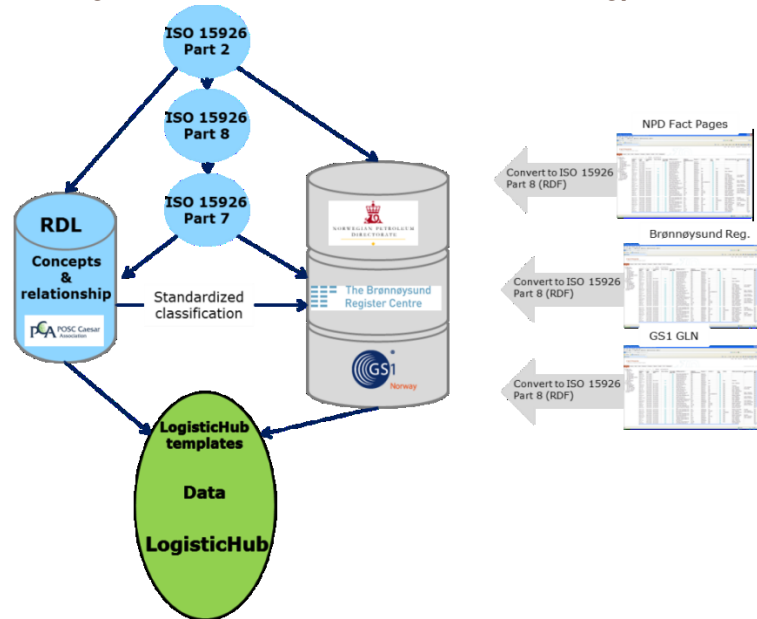
The ontology representing the information in LogisticHub shall be represented according to ISO15926 Part 2, Part 7 and Part 8 including taxonomies of concepts and relationships between these. All concepts and relationships shall be integrated in PCA's RDL according to PCA's procedures, including approval by PCA's Special Interest Groups (SIGs).

Figure 7.2 LogisticHub metadata and standard ontology

The development of this ontology is listed as an option in non-functional requirements in Chapter 4.

The RDF serialization should conform to ISO 15926 Part 8. This entails:

- ✓ Using available reference data libraries where applicable. In particular the PCA RDL.
- ✓ Defining a set of ISO 15926 templates to be used in the serialization
- ✓ It will not be expected that the contractor provides full axiomatization of the templates.



### 7.3 RFID ontology model

Figure 7.3 below illustrates how a set of terms that describe AIDC systems are represented as Reference Data classes in the PCA RDL according to ISO 15926 Part 4, instantiated from data model entities in ISO 15926 Part 2, and how they are connected to each other through various relationships into an RFID-ontology.

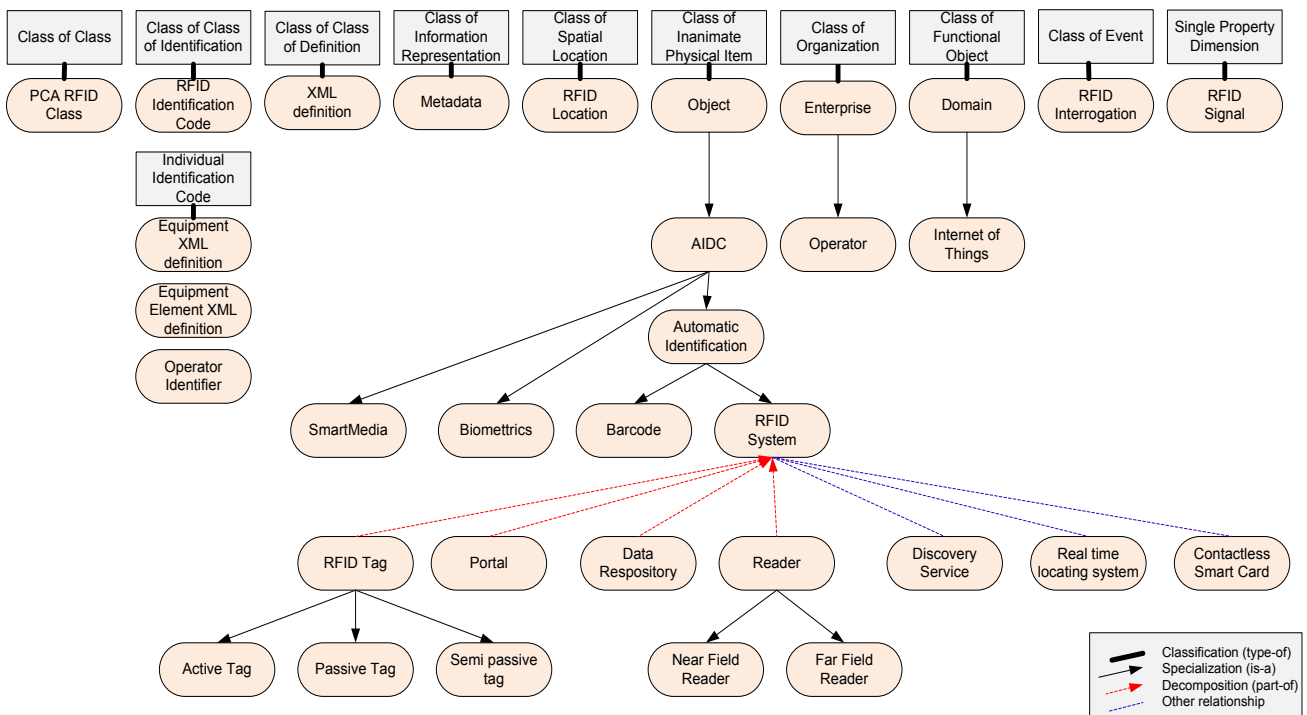


Figure 7.3: The RFID Ontology Model (note that this is an illustrative example only)

## 8. SYSTEM TECHNOLOGY AND EVOLUTION

This chapter describes the W3C semantic technology stack, lists functional and non-functional system qualities (characteristics) required to ensure that LogisticHub can be properly supported, maintained and extended in accordance with actual usage and upcoming requirements, and also illustrates plans for future extensions.

### 8.1 RDF triplestore implementation

An RDF triplestore is a database based on Semantic Web technology that can handle a complex and changing environment. In addition, an RDF triplestore has the following three important benefits:

1. Easy to merge data and/or add new data
2. Can do reasoning (requires ontologies and rules –OWL/ISO 15926)
3. Easy to transfer data between databases, without loss of information

First a very short introduction to the Web and the most important concepts of Semantic Web. The Web is in continuous evolution:

- ✓ Web 1.0 - Pages and documents
- ✓ Web 2.0 - Social networking
- ✓ Web 3.0 - Semantic Web
- ✓ Web 4.0 - Operating system for applications and data system

Also Semantic Web has an evolution as illustrated by the recommended technology stacks from 1999 and 2012, shown in Figures 8.1 and 8.2 below.

Figure 8.1 Semantic Web stack in 1999 (Tim Berners-Lee)

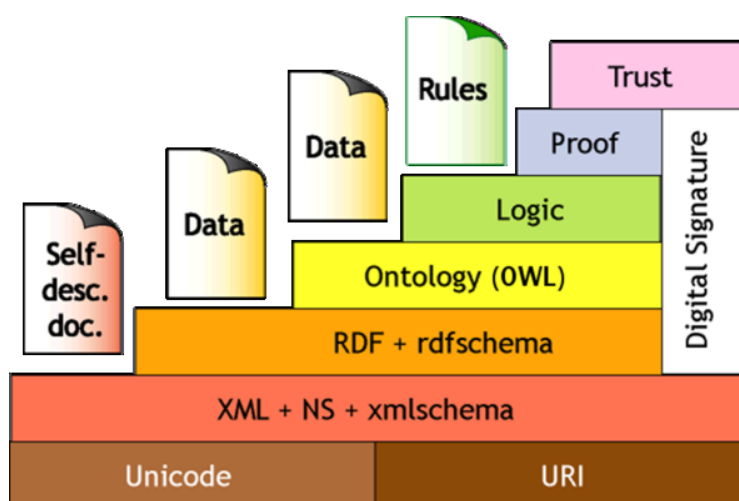
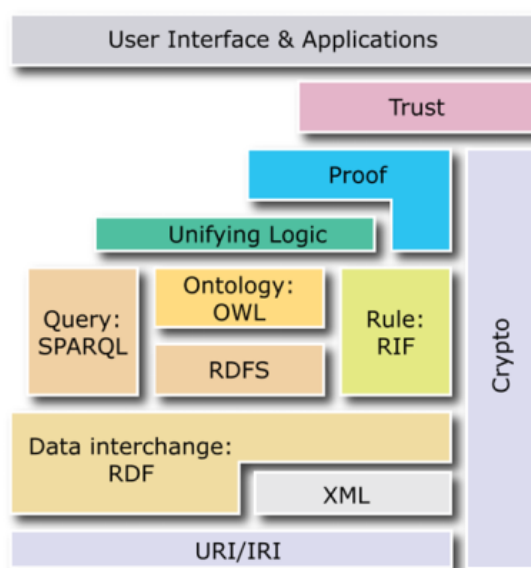


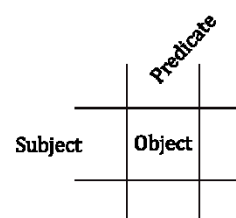
Figure 8.2 Semantic Web stack in 2012



The fundamental concepts in Semantic Web are:

- ✓ **Resource<sup>1)</sup> Description Framework (RDF)**  
is a distributed data model on the Semantic Web consisting of a triple:  
*Subject – Predicate – Object*
- ✓ **Web Ontology Language (OWL)**  
is an expressive language and provides bases for reasoning – all written as RDF triples
- ✓ **Simple Protocol and RDF Query Language (SPARQL)**  
is a query language on RDF triples - similar to SQL for relational database (RDB)

Figure 8.3 Structured data expressed as RDF



Any table of data might be expressed as RDF triples where

- ✓ the row number is the subject
- ✓ the column content is the predicate
- ✓ and the cell value is the object

Subject and Predicate are always resources, but an object might be a literal or a resource.

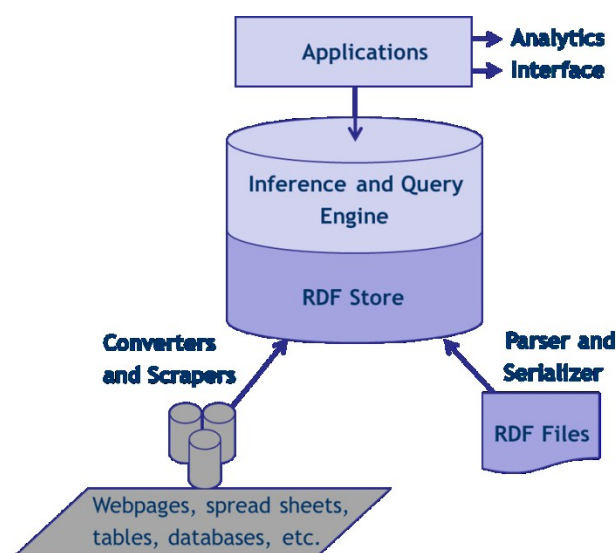
<sup>1)</sup> A resource is anything that someone want to talk about and that has a unique address through a Uniform Resource Identifier (URI) which is a specialization of Uniform Resource Location (URL).

RDF is the base technology for the Semantic Web. OWL and ISO 15926 statements are all expressed as RDF triples and the RDF query language SPARQL may be used to retrieve information from the datastore.

The schematic presentation of an RDF triplestore is provided in Figure 8.4 and the concepts in the figure are defined below.

- ✓ **Application interface**  
The part of the application that uses the content of an RDF store in an interaction with some user
- ✓ **RDF store**  
A database that works in RDF. One of its main operations is to merge RDF stores
- ✓ **RDF query engine**  
This provides access to an RDF store similar as an SQL engine provides access to a relational store
- ✓ **SPARQL**  
The W3C standard query language for RDF
- ✓ **SPARQL endpoint**  
Any application that can answer a SPARQL query (where the native coding of information is not in RDF)
- ✓ **RDF parser**  
A system component for reading RDF file and creating RDF store
- ✓ **RDF serializer**  
A system component for generating a RDF file from a RDF store

Figure 8.4 A schematic presentation of an RDF triplestore



- ✓ **Scraper**  
A tool that extracts structured information from webpages

- ✓ **Converter**  
A tool that converts data from some form (excel, relational database, etc.) into RDF

## 8.2 System qualities

The design specification for LogisticHub should be based on a sound understanding of the fundamental principles of system design, with attention to both functional and structural (non-functional) quality, including the 5 major desirable structural characteristics to provide business value defined by the Consortium for IT Software Quality (CISQ): *Reliability, Efficiency, Security, Maintainability* and (adequate) *Size*. In addition we propose to add *Extendibility* to characterize how easy/hard it is to reconfigure, extend and apply the software in new functions/applications.

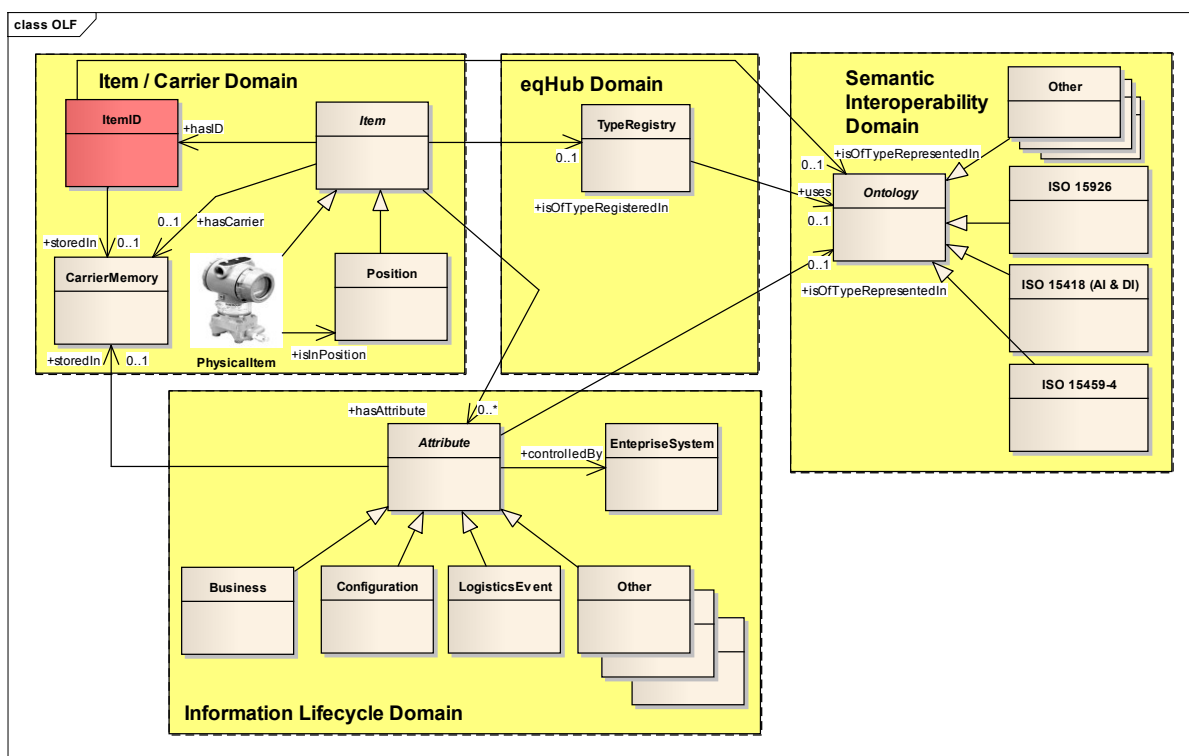
## 8.3 Continued development

LogisticHub will be developed in several phases. Phase I will cover tracking of CCUs on the NCS and this described in this document.

Phase II will cover tracking of the content of the CCU. In the generic data model provided by DNV, the concepts of packing and unpacking will be very important for this phase were focus on traceability will shift from lorry/ship to CCU to each item within the CCU.

In phase II, the offshore industry has to agree on list mobile equipment so that all items in the CCU can be characterized / identified. For standard equipment LogisticHub will be linked up to the content of EqHub as shown in Figure 8.5 below.

Figure 8.5: Integrating information in LogisticHub with EqHub using the DNV generic data model



## APPENDIX A: AIDC TECHNOLOGY

Conoco-Phillips, Statoil and Swire have run pilots to test AIDC technology at several supply bases with good results. The instrumentation choices made in these pilots are listed below. Note however that the users of LogisticHub are free to deploy any technology that has at least the same capacities and qualities as the technology listed below.

- Gate onshore
  - ✓ Cabinet with reader  
[Modular 2-Way Main Datasheet.pdf](#)
  
  - ✓ RFID antenna for gate  
[YBS800.pdf](#)
  
- RFID tag
  - ✓ [i-Q350X FL.pdf](#)
  
- ATEX approved PDA for identification of RFID tag
  - ✓ [i-Roc x62 Datasheet.pdf](#)
  
- Truck
  - ✓ PC  
[LXE VX9.pdf](#)
  
  - ✓ GPS receiver  
[GPS 16 17 spec. sheet 0805.pdf](#)
  
  - ✓ RFID reader  
[D EN i-PORT M350 2 v1.11 F.pdf](#)
  
  - ✓ RFID antenna  
[Laird.pdf](#)
  
- Gate Offshore
  - ✓ Cabinet with reader  
[GA Main cabinet Model.pdf](#)
  
  - ✓ RFID antenna  
[Av-2091.pdf](#)

## APPENDIX B. ISSUING AGENCY CODES FOR ISO 15459 - GS1

ISO 15419 shows AI's for barcodes:

- ✓ AI 01 corresponds to GTIN – Global Trade Item Number and AI 21 is the serial number. This is relevant if serial numbers are to be used for product labeled with GTIN + serial number. This code may be barcoded with e.g. GS1-128.
- ✓ For identification of containers (CCUs) GS1 Norway recommends using GIAI – Global Individual Asset Identifier with alpha-numeric serial number (AI 8004).
- ✓ The recommended structure is GS1 Company Prefix + CCU identification. The owner of the CCU allocates the GIAI. A GIAI for a CCU should not be changed throughout the lifetime of the CCU. Since the GIAI will be used in RFID, the corresponding EPC-code GIAI-202 should be used.

Enclosed you find EPC Tag Data Standard version 1.6 with a detailed description of GIAI-202.

- ✓ [EPC Tag Data Standard version 1.6.pdf](#)

Enclosed you also find the document GS1 Norway EPC code syntax 121105 that describes coding of GIAI-202 in Norway.

- ✓ [GS1 Norway EPC code syntax 121105.pdf](#)

## APPENDIX C: ISSUING AGENCY CODES FOR ISO 15459 – ODETTE

Norwegian Oil and Gas Guideline 112: Deployment of RFID in the oil and gas industry, Part 4 “Unique identification number” is based on latest input you have received from Odette.

Odette International has published an updated recommendation, “RFID for Tracking of Parts and Assemblies, Version No 2, Doc Ref: LR03, December 2011”. The major reason for this revision is the creation of a new Data Identifier (DI) 37S documented in ANSI MH10.8.2 Data Identifier and Application Identifier Standard.

The new DI was initiated by us. The original version of our recommendation used DI 25S, which has a concatenated Serial Number composed of the Part Number with a fixed length of 17 alpha-numeric characters, filled with leading zero(s) if required, and the Part Serial Number stored in the Serial Number field of the DI. Whereas 37S uses two dedicated fields, one for the Part Number and one for the Part Serial Number separated by a + (plus) sign.

The new DI 37S is now approved with the following definition:

**Data format:** (IAC)(CIN)(PartNumber)+(PartSerialNumber)

Maximum length of this data construct is 40 6-bit characters, or 240 bits maximum, including the DI.

<b>IAC:</b>	Issuing Agency Code, as defined in ISO/IEC 15459
<b>CIN:</b>	Company Identifying Number, as defined in ISO/IEC 15459
<b>Part Number (PN):</b>	Part Number, assigned by owner of the Part
<b>+:</b>	Separator character
<b>Part Serial Number (PSN):</b>	Globally unique serial number for the Part, managed by the owner / manager of the Part.

This DI gives us flexibility in defining the length of PN and PSN given that the combined length of DI, IAC, CIN, PN, +(separator) and PSN is not exceeding 240 bits.

Concerning the detailed coding scheme it is not possible to answer exactly in line with the present wording on the OLF document. This table describes the detailed coding scheme in our recommendation:

37s Odette encoding scheme for parts in MB01<sub>2</sub>

Bit Location (HEX)	Data Type	Value	Size	Description
MB01 <sub>2</sub> : CRC + Protocol Control Word				
00 –0F	CRC-16	Hardware assigned	16 bits	<b>Cyclic Redundancy Check</b>
10 – 14	Length	Variable	5 bits	<b>Represents the number of 16-bit words excluding the PC field and the Attribute/AFI field.</b>
15	PC bit 0x15	0b0 or 0b1	1 bit	<b>0 = No valid User Data, or no MB11<sub>2</sub></b>



Bit Location (HEX)	Data Type	Value	Size	Description
				<b>1 = Valid User Data in MB11<sub>2</sub></b>
<b>16</b>	PC bit 0x16	0b0	1 bit	<b>0 = "Extended PC word" not used</b>
<b>17</b>	PC bit 0x17	0b1	1 bit	<b>1 = Data interpretation rules based on ISO</b>
<b>18 – 1F</b>	AFI	0xA1	8 bits	<b>Application Family Identifier used according to ISO/IEC 15961 and ISO/IEC 17367. For hazardous Parts use A4.</b>
	<b>Subtotal</b>		<b>32 bits</b>	
MB01 <sub>2</sub> : UII				
All UII data use 6 bit encoding values from Table 2 according to ISO/IEC 17364				
<b>Start at location 20</b>	DI	<b>"37S"</b>	3 an	<b>Data Identifier 37S for Part Identification</b>
<b>Go to end of data / end of available memory</b>	Issuing Agency Code (IAC)	<b>"OD"</b>	2 an	<b>Issuing Agency Code, i.e. Odette</b>
	Company Code (CIN)	As defined by the IAC	4 an	<b>Company Identification Number</b>
<b>NOTE: The sum of the X length of OT and the Y length of OSN cannot exceed 180 bits</b>	Object Type	Part Number	1...X an	<b>X alphanumeric characters for the Part ID assigned by the owner</b>
	Separator between OT and OSN	+	1 an	<b>+ sign separator (2B<sub>n</sub>)</b>
	Object Sequence Number	Part Serial Number	1...Y an	<b>Up to Y an characters in capital letters</b>
	Bit Padding	0b10, 0b1000 or 0b100000	2, 4 or 6 bits	<b>Optional padding according to ISO/IEC 15962 Annex E.4 if appropriate. (4-bit-padding needed)</b>
	Word Padding	0b00000000	8 bits	<b>Optional padding to end of 16 Bit Word. (Not needed in</b>

Bit Location (HEX)	Data Type	Value	Size	Description
				<b>this example)</b>
	<b>Subtotal</b>		<b>Variable</b>	Up to 240 bits
	TOTAL MB01 <sub>2</sub> BITS:		VARIABLE	UP TO 272 BITS

**Table 5: 37s Odette encoding scheme for parts marking in mb01<sub>2</sub>**

Additional comments on OLF GUIDELINE No. 112 PART 4

I have the feeling that your paper from certain aspects is influenced by GS1/EPC recommendations and thus not clearly stating other alternatives within ISO standards.

### Model 1

As an example your Model 1 as formulated assumes the usage of the GS1/EPC Application Identifier GIAI (Global Individual Asset Identifier) 8004.

The intention with Model 1 as I understand it is simply making a list of whatever (potentially various) items an organisation might possess.

What could be used in the DI world I believe is one or both of these:

Machine, cell, or tool ID code **10S**

Fixed asset ID code **11S**

### Model 2

Also the wording of Model 2, "Serialization of an item within a Part within an Enterprise" could be expressed in a simpler way: "Unique part serial number".

### Encoding example and comments related to encoding

Your document does not fully reflect potential usage of solutions based on DI:s as opposed to AI:s and connected GS1/EPC recommendations.

I enclose encoding examples for Model 2, including detailed technical assumptions behind the example. There are two examples, one based on using Odette as an Issuing Agency and another one based on using DUNS:

✓ [UniversalOdeEncodingSchemeVers.xls](#)

I hope this answers your questions and I am happy being in touch with you on this subject.

Kind regards

Sten Lindgren, VD

Odette Sweden AB

Box 26173, SE-100 41 Stockholm, Sweden

T +46 8 700 41 20, M +46 70 495 3723, F +46 8 791 23 11

[sten.lindgren@odette.se](mailto:sten.lindgren@odette.se)