INTERNATIONAL STANDARD

ISO 17261

First edition
2012-09-01

Intelligent transport systems — Automatic vehicle and equipment identification — Intermodal goods transport architecture and terminology

Systèmes intelligents de transport — Identification automatique des véhicules et des équipements — Architecture et terminologie du transport intermodal des marchandises

Reference number
ISO 17261:2012(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17261 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, in collaboration with Technical Committee CEN/TC 278, *Road transport and traffic telematics*.

This first edition of ISO 17261 cancels and replaces the first edition of ISO/TS 17261:2005, including ISO/TS 17261:2005/Cor. 1:2005, which has been technically revised.

Introduction

This International Standard prescribes the overall parameters within which subsidiary International Standards are constructed. The architecture description defined in this International Standard is a consistent extension to ISO 14814 (AVI reference architectures and terminology).

ISO 14814 provides an architecture context for AVI/AEI for road transport. This International Standard extends this architecture context to include intermodal and multimodal movements.

This International Standard is part of a series of International Standards defining AVI/AEI in the Intelligent Transport Systems/Road Transport and Traffic Telematics (ITS/RTTT) environment. The following documents have been issued from ISO TC 204 to form a family of International Standards for the sector:

ISO 14814 AVI/AEI Reference architectures and terminology;

ISO 14816 AVI/AEI Numbering and data structures;

ISO 14815 AVI/AEI System specification;

ISO 17261 AVI/AEI Intermodal goods transport reference architectures and terminology;

ISO 17262 AVI/AEI Intermodal goods transport: Numbering and data structures;

ISO 17263 AVI/AEI Intermodal goods transport: System parameters;

ISO 17264 AVI/AEI Intermodal goods transport: Interface requirements;

An AVI/AEI interaction in an ITS/RTTT environment comprises an identification of On-Board Equipment (OBE) by a reader/interrogator and can transfer additional data.

The data component in an ITS/RTTT environment provides the basis for unambiguous identification of the OBE, and may also share a medium for a bi-directional interactive exchange of data between the host and OBE and to other equipment (such as smart cards etc.).

The principles of data presentation determined in ISO 17262 have been adopted to provide an interoperable architecture within an International Standard framework. The use of Abstract Syntax Notation One (ASN.1) PER is therefore an integral part of the data architecture determined in this International Standard.

The numbering and data structure are capable of operation both by read/write devices, and by read only devices where there is no requirement (and sometimes no possibility) to write to the OBE.

A key feature of the structure is to provide interoperability of data constructs.

Within the ITS/RTTT sector, applications can range from simple vehicle and equipment identification to complex international systems.

The reference architecture model and the data construct schemes described in this family of International Standards/Technical Specifications extend the approved AVI conceptual architecture to provide a comprehensive conceptual and logical system architecture to describe the relationships and functionality for a wide range of media so that the currency of the International Standard remains good for both existing and future technologies. This International Standard recognises that there are existing AVI/AEI applications and provides a means of supporting such data constructs within this International Standard.

In many cases it is necessary or desirable to use one air carrier frequency and protocol, but this is not always possible or even desirable in all situations.

In accordance with the resolutions of ISO TC 204 and CEN TC 278 the use of Abstract Syntax Notation One (ASN.1) from ISO 8824 as a data definition structure is adopted. Its usage provides maximum interoperability and conformance to existing ITS/RTTT and related International Standards and Technical Specifications.

Intelligent transport systems — Automatic vehicle and equipment identification — Intermodal goods transport architecture and terminology

1 Scope

This International Standard describes the conceptual and logical architecture for automatic vehicle and equipment identification (AVI/AEI) and supporting services in an intermodal/multimodal environment.

It presents a high level view of AEI intermodal and multimodal system architecture, and describes the key sub systems, their associated interfaces and interactions and how they fit into system wide functions such as management, security and information flow.

This International Standard identifies the context of intermodal/multimodal AEI within the overall AVI/AEI context and key external inter-dependencies and interfaces to the intermodal/multimodal sector IT infrastructure. These include interfaces to the external and internal users of the intermodal/multimodal system services and their associated IT systems, interfaces to intermodal/multimodal management systems, existing intermodal/multimodal networks and system operations, and specifically interfaces to item identification and the domain of JTC 1/SC 31, item logistics International Standards. As an architecture it is designed to be complementary and interlocking to that domain.

This International Standard is intended to be complementary and consistent with the work of ISO/TC 104, Freight containers.

It extends the conceptual and communication AVI architecture determined in ISO 14814 and is neither frequency nor air interface protocol specific. It provides maximum interoperability, has a high population capability, and provides the possibility of upwards migration to more capable systems.

It does not include the air interface nor any implementation aspect, only the reference architectures. Subsequent International Standards define data structures for general AVI/AEI and for specific sectors of application.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 8824-1, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO/IEC 8824-2, *Information technology — Abstract Syntax Notation One (ASN.1): Information object specification*

ISO/IEC 8824-3, *Information technology — Abstract Syntax Notation One (ASN.1): Constraint specification*

ISO/IEC 8824-4, *Information technology — Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications*

ISO/IEC 8825-2:1996, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

ISO 14813-6, *Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 6: Data presentation in ASN.1*

ISO 14816, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

ISO 17262, *Intelligent transport systems — Automatic vehicle and equipment identification — Numbering and data structures*

ISO 17263, *Intelligent transport systems — Automatic vehicle and equipment identification — System parameters*

ISO 14817, *Transport information and control systems — Requirements for an ITS/TICS central Data Registry and ITS/TICS Data Dictionaries*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8824-1, ISO 8824-2, ISO 8824-3, ISO 8824-4, ISO 14816 and the following apply.

3.1
address
data element designating the originating source or destination of data being transmitted

3.2
Automatic Equipment Identification
AEI
process of identifying equipment or entities that uses the surface transportation infrastructures by means of OBE's combined with the unambiguous data structure defined in these International Standards

NOTE Within this series of International Standards, "Equipment" indicates large equipment that is carried in, or forms an integral part of, a trailer or trailer mounted unit.

3.3
air interface
conductor-free medium between an OBE and the reader/interrogator through which the linking of the OBE to the reader /interrogator is achieved by means of electro-magnetic signals

3.4
application identifier
one item of a data element construct (usually the first octet) that uniquely identifies the domain of an ITS/RTTT information exchange at an explicitly defined reference point, usually at reference points "Alpha", "Beta" or "Zeta"

NOTE 1 This octet identifies that the message is a specific RTTT message.

NOTE 2 See Figure 5.

3.5
ASN.1
Abstract Syntax Notation One
International Standard for representing data types and structures

NOTE The encoding rules for this abstract syntax notation are defined in ISO 8825-2.

3.6
Automatic Vehicle Identification
AVI
process of identifying vehicles using OBE combined with the unambiguous data structure defined in these International Standards

3.7
AVI/AEI system operator
commercial operator of an AVI/AEI/RTTT system that uses OBE(s) for the purposes defined in this International Standard

3.8
bi-directional dialogue
two way communications between fixed equipment and OBE(s)

3.9
bill of lading
document which evidences a contract of the carriage and the taking over or loading of the goods by the carrier, and by which the carrier undertakes to deliver the goods against surrender of the document

NOTE A provision in the document that the goods are to be delivered to the order of a named person, or to order, or to bearer, constitutes such an undertaking. The document has the following functions:

— a receipt for goods, signed by a duly authorised person on behalf of the carriers;
— a document of title to the goods described therein;
— evidence of the terms and conditions of carriage agreed upon between the two parties.

3.10
communication control
fixed equipment function to control the communication between fixed equipment and OBE

3.11
compatibility
capability of two or more items or components of equipment or material to exist and/or function in the same system or environment without modification, adaptation or mutual interference

3.12
consignment
separately identifiable amount of goods (available to be) transported from one consignor to one consignee via one or more than one modes of transport and specified in one single transport document

3.13
consignor
goods providor
party that provides goods to another party

NOTE A consignor can be a manufacturer, trader, agent, or individual.

3.14
container
receptacle for the transport of goods, especially one readily transferable from one form of transport to another

NOTE See also non-ISO Container.

3.15
Dedicated Short Range Communication
DSRC
means of effecting local (short range) transactions between fixed equipment and OBE(s) using an “air interface” comprising inductive or propagated signals between the fixed equipment and OBE(s)

3.16
data element structure
framework comprising a number of data elements in a prescribed form

NOTE Also known as a “message”.

3.17
Electronic Data Interchange
EDI
passing of a data message, or series of messages, between computers and/or between different software systems

NOTE Within this context an EDI message is normally compatible with the form specified in ISO 9897. EDI is an instance of an EDT transaction.

3.18
Electronic Data Transfer
EDT
passing of data sets comprising an entire message from one computer to another or from one software system to another

3.19
goods provider
party that provides goods to another party

NOTE A goods provider can be a manufacturer, trader, agent, or individual. More commonly known as a “consignor”.

3.20
information
data, documentation, and other relevant knowledge organized to inform and describe

3.21
information manager
function of managing information in a system

NOTE The role of information manager can be provided by one or many actors. The role of information manager can be performed internally by one or more of the system principal actors, or can be formed commercially or altruistically by one or more third parties.

3.22
interchangeability
condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, and without selection for fit and performance

3.23
intermodal transport
movement of goods in one or more loading unit(s) or vehicle(s) which uses successively several modes of transport without handling of the goods themselves when changing modes

[ISO 17262, ISO 17263]

3.24
interoperability
ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together

3.25
interrogator
device that performs the functions of a reader, but in addition has the ability to write new data to an OBE, or change data held in the OBE memory via an air interface

3.26
ISO Container
large boxlike receptacle of standard design for the transport of goods

[ISO 668]
3.27
item
item of goods to be moved

NOTE An item can be a single unit, such as a letter, a bundle or box of units or other units that will be bundled into a receptacle which will be carried in equipment (such as an ISO intermodal container) as a sub component of an AEI item. Items are not defined in this family of International Standards and are defined by the International Standards of JTC 1/SC 31, Automatic identification and data capture techniques.

3.28
journey
within the AVI/AEI context, the physical movement of goods from the goods provider to the receiver

3.29
load
that which is to be transported from the consignor to the receiver and which comprises the consignment, packaging, pallets and or containers that are smaller than an ISO container

3.30
manifest
document which lists complete specifications of the goods loaded for transport to various destinations by a vessel or other means of transport

NOTE As a rule cargo manifests are drawn up by the agents in the ports of loading and are based upon the bills of lading. For shipping, a manifest represents a cumulating of bills of lading for official and administrative purposes.

3.31
media adaptation
function to adapt the communication media (air interface propagated modulation) to communication and computing equipment

3.32
monologue
one way communication between the fixed equipment and OBE(s)

3.33
multimodal transport
carriage of goods by at least two different modes of transport.

NOTE In contrast, intermodal transport implies changing from mode to another using the same form of loading unit. Multimodal transport implies that either there is more than one modal shift, or that loads can be broken into partial loads as part of a modal change.

3.34
non ISO container
container used in the transport of goods that does not comply with any ISO container International Standard (e.g. non compliant with ISO 668 and ISO 10374)

3.35
non returnable unit
one trip pallets, containers or packaging which is not returned to the consignor or returnables manager

3.36
On Board Equipment
OBE
device on board or attached to the vehicle/equipment to perform the functionality of AVI/AEI

3.37
operator
commercial operator of an AVI/AEI/RTTT system that uses OBEs for the purposes defined in this International Standard

3.38
Packed Encoding Rules
PER
encoding rules for an abstract syntax specification in ASN1

NOTE There are alternate forms of encoding such as “Basic Encoding Rules” (BER). Within TICS International Standards, reference to ASN.1 implies also the use of PER as specified in ISO 8825-2 unless otherwise stated.

[ISO 8825-2]

3.39
packet
collation of goods to be moved

NOTE A packet can be a single unit, or a collection of smaller packets and items that will be bundled into a receptacle which will be carried in equipment (such as an ISO intermodal container) as a sub component of an AEI item. Packets are not defined in this family of International Standards and are defined by the International Standards of JTC 1/SC 31, Automatic identification and data capture techniques.

3.40
pallet
wooden, plastic or metal platform that enables a bundle of goods to be moved around by a fork lift truck or similar platform moving device that will be carried in equipment (such as an ISO Intermodal Container) as a sub component of an AEI item

NOTE Pallets are not defined in this family of International Standards and are defined by the International Standards of JTC 1/SC 31, Automatic identification and data capture techniques. See also “AEI”, “items”, “packets”, and “receptacles”.

3.41
programmable device/OBE
device where all or part of the identity and memory can be reprogrammed many times by an external device, but not during a normal “on the fly” read/write cycle

3.42
Returnable Container Unit
RCU
unit (container) used as part of a load, which is returned to the consignor or a returnables manager

3.43
reader
device that transmits a signal as a means of initiating a response in a compatible OBE

NOTE It subsequently receives the modulated electro-magnetic response and decodes the data. See also “interrogator”.

3.44
read only device/OBE
device which is programmed at the time of manufacture or prior to use and thereafter can only be read, with no further opportunity to change any of the data held on the device nor its core identification

3.45
read/write device/OBE
data mode corresponding to an OBE in which data content can be changed by means of a compatible interrogator via the air interface

3.46
read/write cycle
complete sequence of interaction by the reader/interrogator where the OBE is unambiguously identified and new data, comprising either whole or part of the full data set, is written onto the OBE by means of the air interface

3.47
receiver
within the AVI/AEI context, one who receives goods as a result of a journey from a consignor

3.48
receptacle
single unit, or a carrier of items and of smaller packets and items

NOTE A receptacle will normally take the form of a bag, box or roller cage, which will be carried in equipment (such as an ISO Intermodal Container) as a sub component of an AEI item. Packets are not defined in this family of International Standards and are defined by the International Standards of JTC 1/SC 31, Automatic identification and data capture techniques.

3.49
reference point
data flow between two function blocks, where protocols define the information flow across the reference point

3.50
returnable unit
units (such as pallets, trays etc.) used as part of a load, which are returned to the consignor or a returnables manager

3.51
returnables
returnable units, reject or surplus goods to be returned through the system to the consignor or returnables manager

3.52
returnables manager
function that manages the supply, maintenance, and returns cycle of returnable units

NOTE The returnables manager function can be performed by one or more of the principle actors in the system or by an independent third party.

3.53
Radio Frequency Identification
RFID
common term describing an automatic identification system comprising one or more reader/interrogator(s) and one or more OBE(s) in which communication and data transfer is achieved by wireless means of electro-magnetic signals.

NOTE It varies from low frequency (inductive) to microwave frequencies.

3.54
smart card
device of credit card size incorporating an integrated circuit with microprocessor and memory

3.55
tag
equipment fitted to the unit, vehicle or item to be identified and containing the unambiguous identification, and if required some further data

NOTE 1 For special purposes the TAG can be installed in a fixed position with a mobile reader.

NOTE 2 See transponder.

3.56
transaction
within the context of AVI/AEI, a completed exchange of information between the fixed equipment and an OBE

3.57
transponder
electronic transmitter/responder which responds to the receipt of suitable modulated or unmodulated downlink signals and transmits predetermined information according to predefined protocols at a predetermined frequency

NOTE The transmissions can be powered from energy obtained from the downlink or can be assisted by an on-board power supply. Forms the core, but not necessarily the only, function of an OBE. Within the AVI/AEI context it is fitted to AVI/AEI vehicle or equipment and its prime function is to provide the identity of the item, but can also contain additional information. In some special purposes transponders can be installed in fixed positions and read by mobile equipment.

3.58
transport
within the context of AVI/AEI, the vehicles/aircraft/ships used to move a consignment from the consignor to the receiver or returnables back through the system

3.59
transport means
vehicles, trailers, vessels, aircraft, or combination thereof, to perform the journey to deliver the consignment to the receiver or return returnables, together with the driver/pilot/crew physically conducting the journey

3.60
transport documentation
legal and commercial documents that accompany the transport means during a journey

3.61
transport manager
function that organizes the journey

NOTE The transport manager can be performed by one of the principal actors in the system or by a third party.

3.62
transport operator
function that owns and or manages the transport means

3.63
transport unit
combination of the load, transport means, and transport documentation

[ISO 17687]

3.64
Unit Load Device
ULD
container, designed to fit within the fuselage of an aircraft, used primarily for airfreight or freight loads where part of the trip uses airfreight

3.65
user
vehicle/equipment or person carrying the OBE through the point of identification with the objective of unambiguous identification of the OBE being carried

4 Requirements

This International Standard relates to AVI/AEI units, but not to smaller containers and items being transported. Whilst the architecture described within this International Standard shows the inter-relationship to the item identification domain (see Annex A), for smaller items (pallet loads, trays, parcels etc.), Standardization will be undertaken by JTC 1/SC 31. Supporting International Standards developed by ISO/TC 204 will be limited to vehicle, trailer and AVI/AEI unit identification, whereas JTC 1/SC 31 International Standards will work from units of pallet (and equivalent) size down to item level.

4.1 General requirements

This International Standard determines an architectural framework for automatic equipment Identification (AEI) in an intermodal or multimodal environment by means of an air interface link using electromagnetic signals such as near-field inductive, radio, microwave, or infrared light.

The architecture herein described is shown in a simplified, object oriented modelling form, using the principles of the Unified Modelling Language (UML) as its base.

Relevant parts of this International Standard, and especially requirements for ASN.1 have been developed in accordance with the requirements of the International Standards and Technical Specifications developed by ISO/TC 204(CEN TC 278).

4.2 Conceptual architecture

This International Standard provides an “enabling” reference architecture model for intermodal/multimodal AEI. The reference architecture model International Standard is designed to accommodate, within the framework, a wide and diverse variety of ITS/RTTT applications from simple AVI/AEI to more complex transactions with a wide variety of uses, including the transfer of data relating to the manifest of loads and part loads and means of identification of loads and part loads, in an ITS/RTTT environment.

This International Standard is designed to consider the requirements for data to be transferred from on board equipment to fixed equipment at the road or way side. As such it does not seek to determine precise load information which may be determined by International Standards emanating from JTC 1/SC 31 or ISO/TC 104. however, where such data is to be carried across the air interface between a tractor, vehicle, trailer, or the equipment/load/part load itself in an ITS/RTTT environment, it provides a Technical Specification means for data transactions across an ITS/RTTT interface. As such the syntax notation conforms to that defined in ISO14813-6. Standard data schemes are also envisaged to complement those defined in ISO 14816, and data containers are provided for local or private data schemes. Where IC cards are used as part of, or in conjunction with, on board equipment, the data schemes determined in ISO 14816, ISO 17262, and ISO 14817 shall be respected and a transfer means provided. Where item identifications schemes are provided by JTC 1/SC 31, these are supported so long as they are defined in ASN.1 as determined in ISO 14813-6, or in a standardized form supported by ISO 8824.

This International Standard accommodates the operation of systems of different capability. It enables the interoperability of OBEs in an international environment, even though the operator systems themselves may be significantly different, as long as there is a common air interface (at reference point “Delta” - see Figure 5) and communication protocol. Even where information has to be collected by different air interfaces, the data, once collected, is in a commonly interoperable format, and so may be used accurately and effectively within an EDI/EDT environment.

Within the clauses immediately following, this reference architecture provides definition of following perspectives required by ISO 14813:

a) conceptual description;

b) logical definition;

c) object identification;

d) object interaction structure;

e) information (data) architecture ;

f) physical definition;

g) system security;

h) resilience issues;

i) performance issues;

j) disaster recovery;

k) migration issues (future proofing).

4.2.1 Conceptual architecture overview

Annex A provides an overview (repeated in Figure 1) and a number of different views of transport, manufacturing, distribution and supply chains. Annex A shows all the principal views likely to be encountered in such manufacturing/logistics/distribution/supply cycles. Each view represents different granularity according to the importance of classes to that view. Whilst all views have interdependence with each other and the overview, and are shown in the Annex for completeness. Two of the detailed views (Transport and Information) have particular relevance to AVI/AEI.

Figure 1 provides a conceptual high-level overview of a transportation logistics system. It is important to understand this context in order to comprehend the requirements for intermodal AVI/AEI.

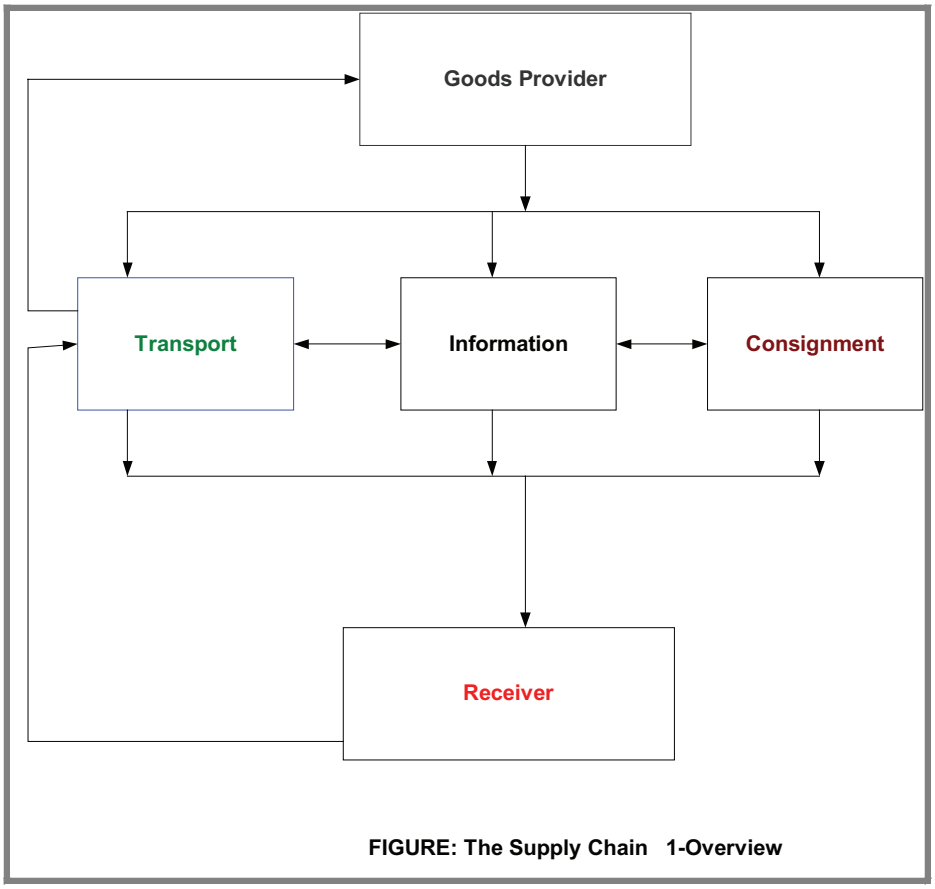

Figure 1 — Conceptual overview of logistics/distribution chain

In Figure 1, the classes (objects) are shown with their key class relationships. Here at the highest level we can see that for a consignor (goods provider), it is necessary to combine interactions of the consignment with Transport and Information in order that they achieve the object of delivery, and there may be returns path (hopefully returnable containers rather than rejected product), which provides a transport path back to the sender or an equipment pool.

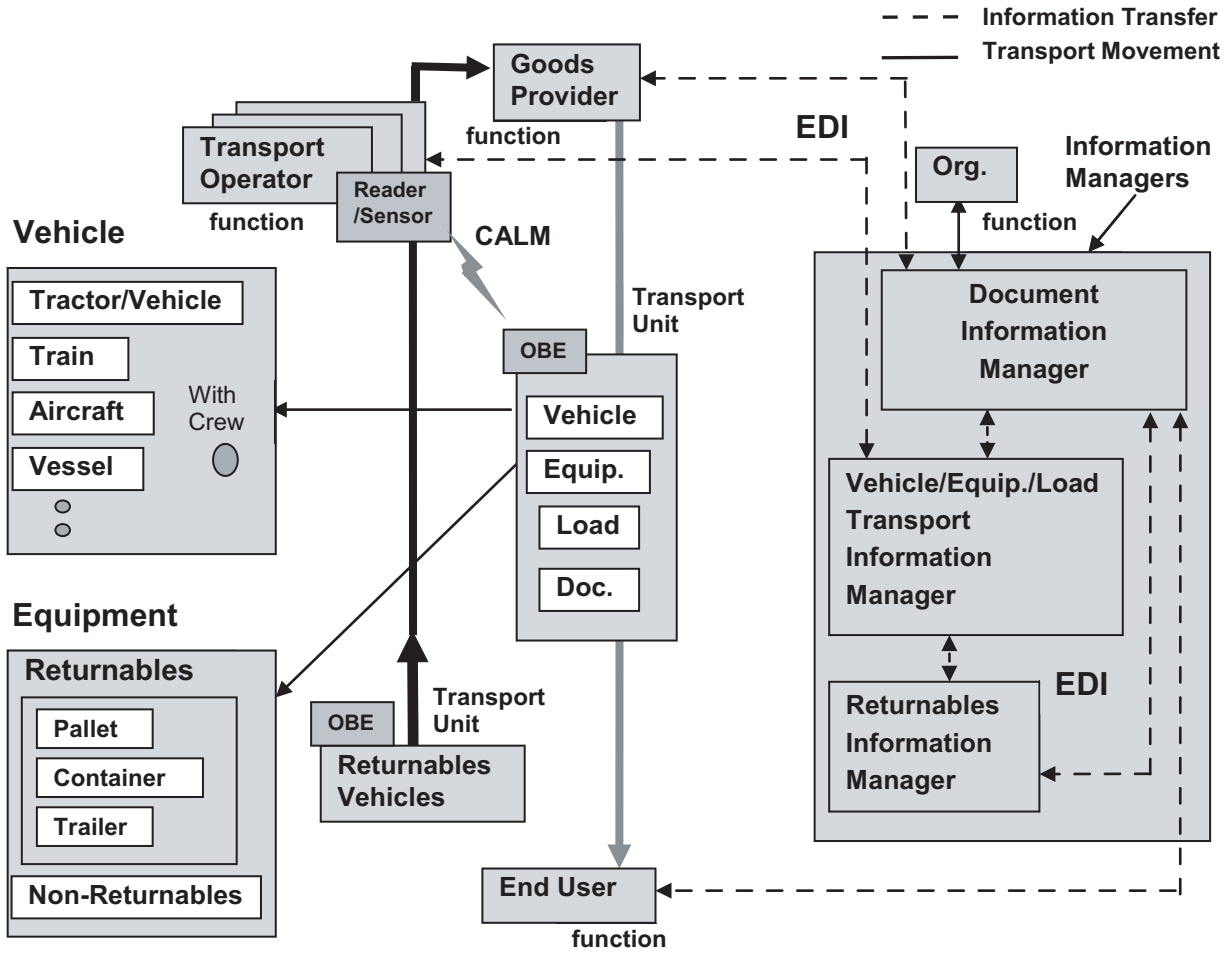

Figure 2 — Conceptual view of AVI/AEI system

Figure 2 expands the classes to show their key attributes. This shows key common attributes and is by way of example, rather than a complete list for every class. Actual attributes may differ according to specific implementations, and not all attributes may be present in all implementations. Figure 2 therefore represents an instantiation of a typical AVI/AEI system representing both physical and information interactions.

This figure shows the relation of two (2) functions, the movement of the transport units (basic elements) and the transport related various kinds of information managed by information manager.

This overview provides the context of 'The manufacturing/Logistics/ Distribution/Supply Cycle' and can be viewed with greater granularity from the context of 'Transport', providing the context for intermodal AVI/AEI. Figure 3 shows the view from the view of "Transportation". Figure 3 is extracted from Annex A.

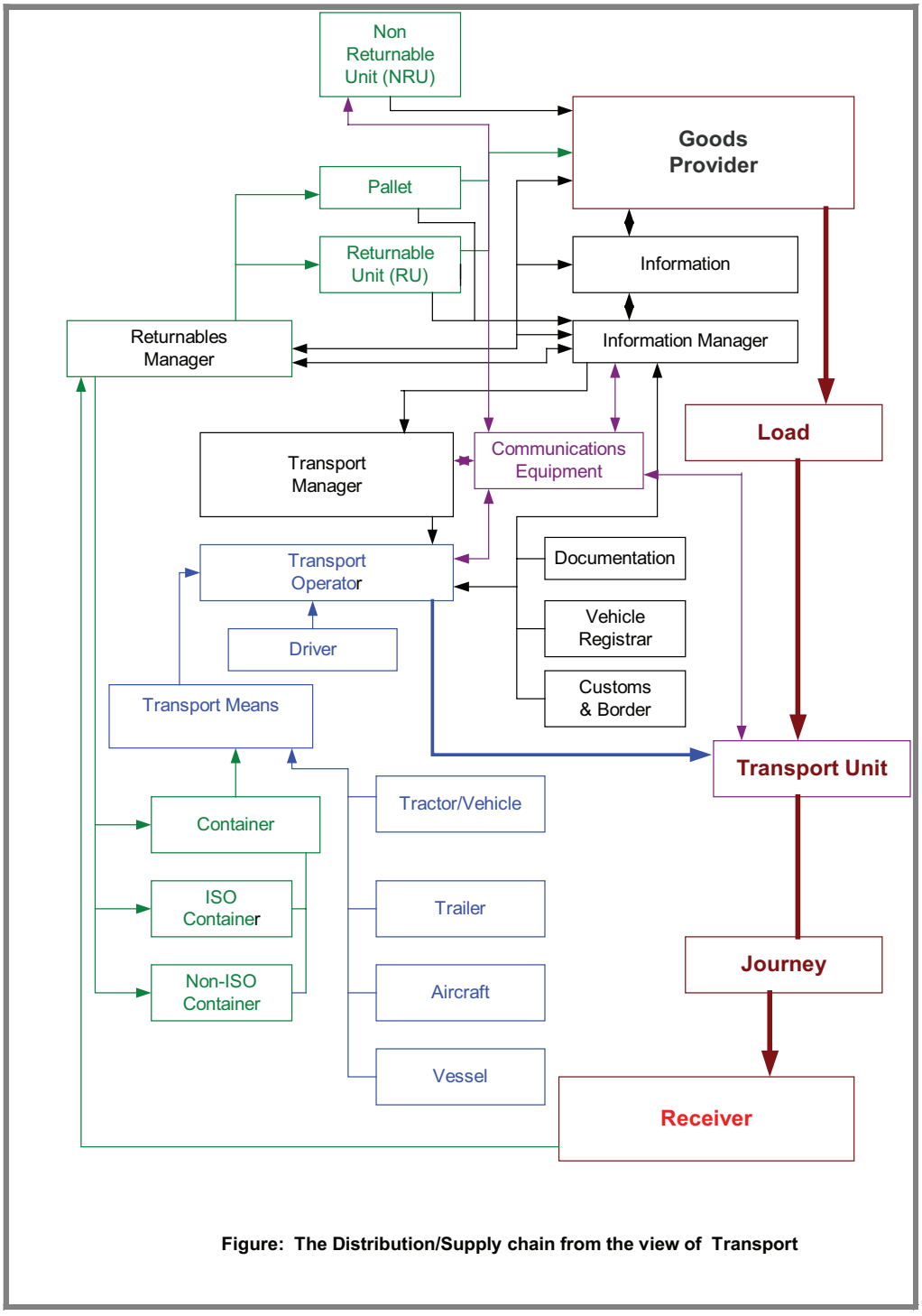

Figure 3 — The distribution cycle from the view of the transport manager

As AVI/AEI is primarily about information, it is also important to view the architecture from the view of the information manager. Figure 4, also extracted from Annex A shows the view from the information manager.

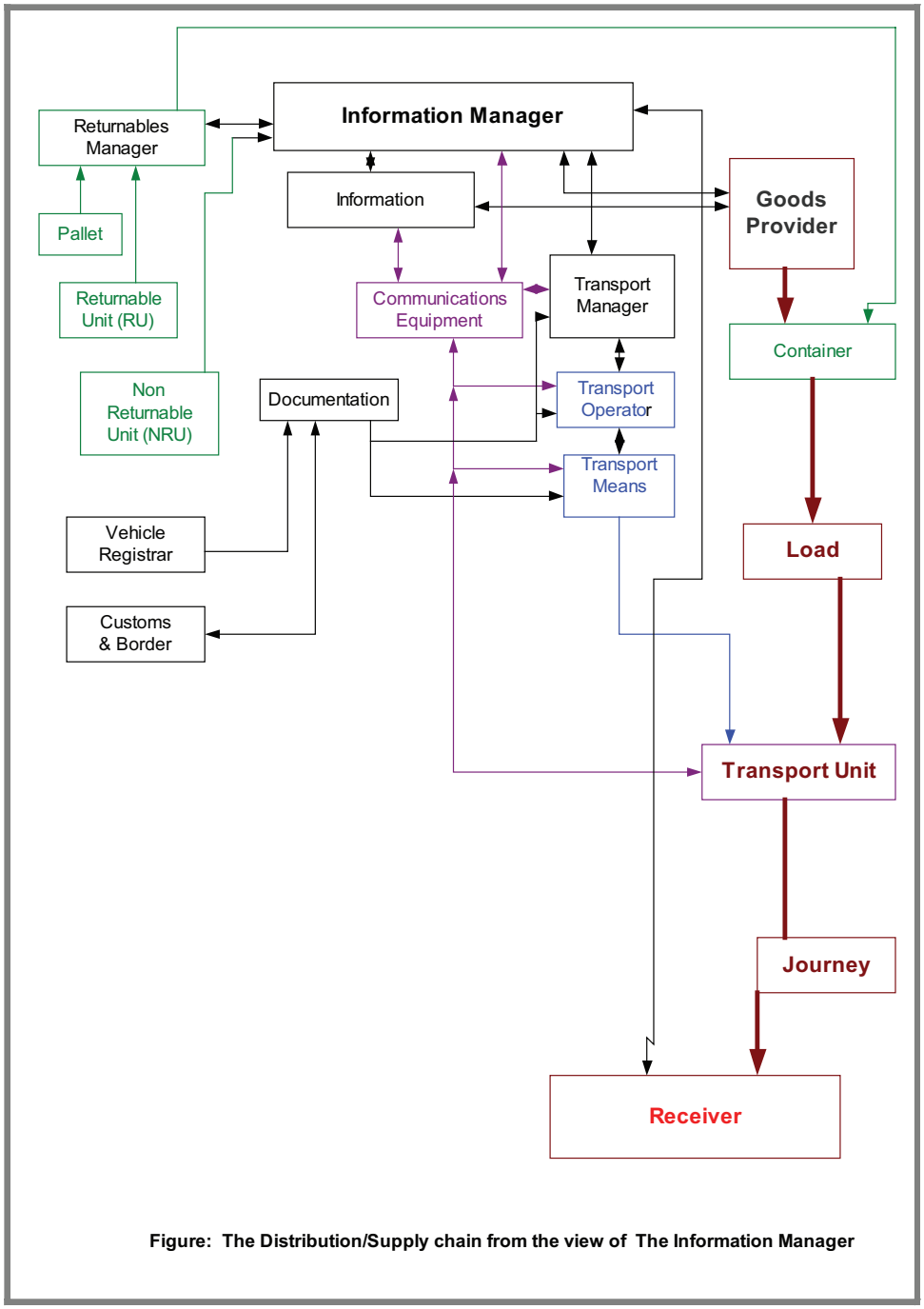

Figure: The Distribution/Supply chain from the view of The Information Manager

Figure 4 — The logistics / distribution / supply chain from the view of the information manager

4.3 Logical definition

The purpose of the Systems architecture specification (logical) is

— to provide Intermodal/multimodal with a logical product independent framework that can be used to help identify and select the best in class technical components for inclusion into a coherent overall solution. This selection process will occur both during procurement and afterwards when upgrading or replacing technical products and or services,
— to provide Intermodal/multimodal with a road map for seamlessly evolving the Intermodal/multimodal system IT infrastructure in line with the anticipated regional to global deployment of Intermodal/multimodal system services,
— to provide potential suppliers of Intermodal/multimodal system technology and services with a logical overview of the Intermodal/multimodal preferred architecture,
— to provide Intermodal/multimodal with a tool for maintaining (to the extent appropriate) overall design control over

the technical solution during the procurement, development , acceptance testing and live operational phases of the project, and

— to provide the architecture definition on which the underlying physical system design specification will subsequently be based. The latter design document will need to be produced after the product selections have been made and before the start of development and implementation phase.

The architecture is not intended to be prescriptive. It is simply put forward as a candidate for becoming the intermodal/multimodal preferred architecture and presents the associated reasoning behind it. Suppliers however are free to present solutions based on alternative models which will be considered on their merits by intermodal/multimodal.

The conceptual architecture defined within this International Standard provides an 'enabling' reference architecture model for generic AVI/AEI.

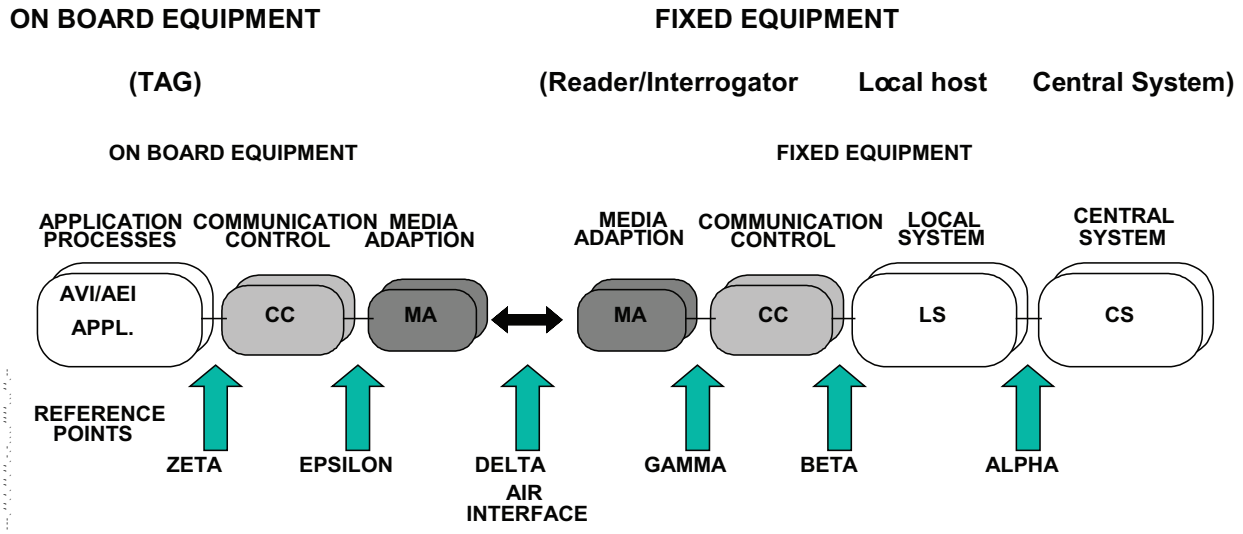

Figure 5 — Simple conceptual reference architecture model showing the context of AVI/AEI

Figure 5 describes, at a conceptual level, a generic system architecture in which AVI/AEI may be effected. It labels the boundaries between functional entities as reference points. It is important to be aware that functions and reference points do not necessarily correspond to discrete physical boxes or interfaces, but are used to define 'entities' of a system that is being described. Taken together, the reference points provide a structure to form a generic reference architecture model that is relevant to most ITS/RTTT environments that involve data exchanges between on board equipment and fixed equipment.

4.3.1 Entity blocks

— **Central system**. This block contains all centralised functions of AVI/AEI applications.
— **Local system.** This is the local (roadside) Entity that handles the "real-time" and distributed parts of the AVI/AEI application.
— **Fixed communication control**. Communication block that handles the medium independent part of the communication link.
— **Media adaptation.** The medium dependent Entity
— **On-board communication control**. Communication control that handles the medium independent part of the communication link .
— **Application processes.** This Entity symbolises several in-vehicle applications, of which AVI/AEI may be only one application process.

4.3.2 Reference points

— **ALPHA.** Alpha is the reference point which delimits the functions of the central system and the local system.
— **BETA.** The reference point where data, commands, etc. are passed from the fixed communication control to the local system function, and vice-versa.
— **GAMMA.** Between fixed communication control and media adaptation.
— **DELTA.** Between on-board and fixed equipment. This reference point usually corresponds with an air interface in the nature of Dedicated Short Range Communication.

— **EPSILON.** Between media adaptation and on-board communication control.
— **ZETA.** Reference point between on-board communication control and application processes.

4.4 Functional architecture

The AVI/AEI function is to provide an unambiguous identification at an appropriate time. For AVI/AEI the information flow is a simple monologue where, on receipt of an appropriate signal, the OBE returns its identity, and possibly also additional information. However in an intermodal/multimodal AEI transaction, whilst the transaction may be a monologue, it may also be a bi directional dialogue (interaction).

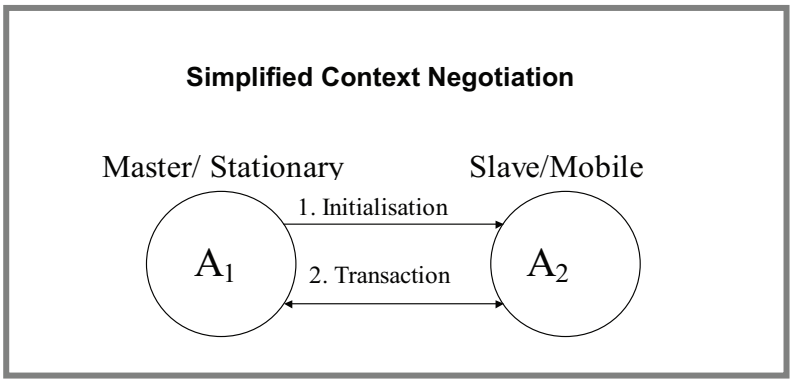

Figure 6 — Simplified context negotiation (typical tag transaction)

In Figure 6, a simplified context negotiation is described. The communication starts with the master A1 downloading a message to the slave A2, referring to a list of predetermined contexts defined by (protocol, encoding, applications) triplets. The slave, if prepared to handle any of these, can start the transmission referring to the chosen application.

4.5 Application architecture

4.5.1 Application architecture description

AVI/AEI is a technique to make an identification using an air interface. The technique can use a variety of media, and - most importantly - can be used in a wide variety of applications. The application architecture can therefore only be defined in very general terms. Figures 7a-7c provide views from the point of the information interactions, the physical architecture to support those interactions, the physical application overview, and a physical architecture to support that view.

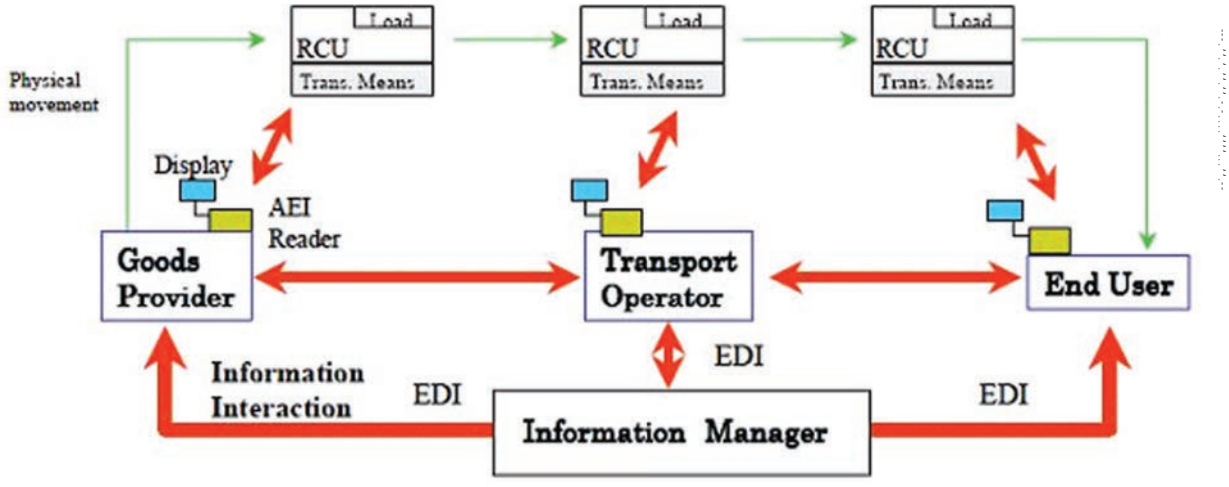

Figure 7a — Overall application information architecture

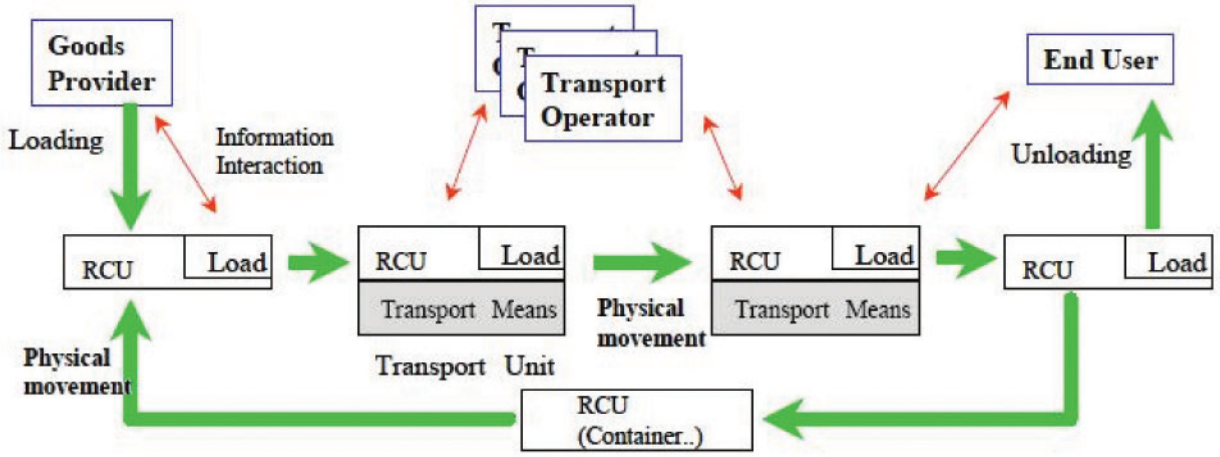

Figure 7b — Physical movement of transport unit

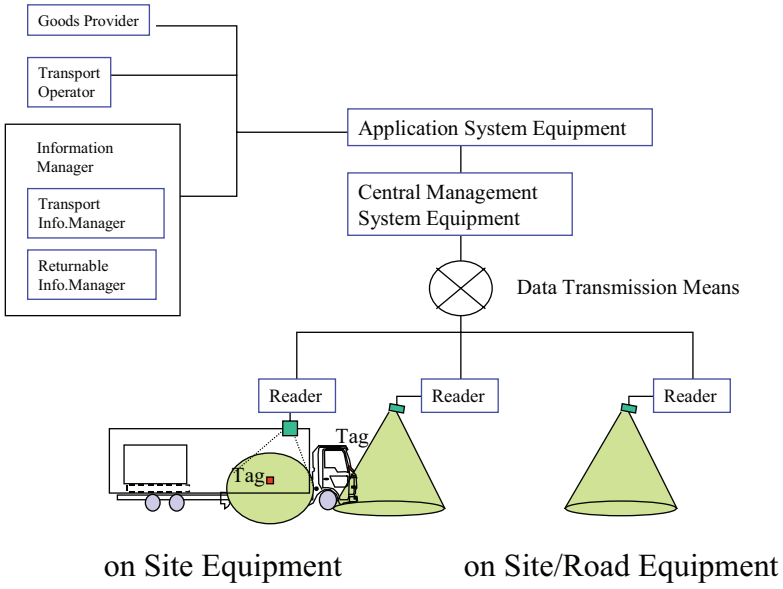

Figure 7c — Physical architecture

In the majority of situations the objective of the AVI/AEI process is to uniquely identify vehicles or equipment. In some circumstances the situation may be reversed such that it is the task of a moving vehicle or equipment to identify a static or moving object. This can be a location identifier or another moving vehicle or equipment.

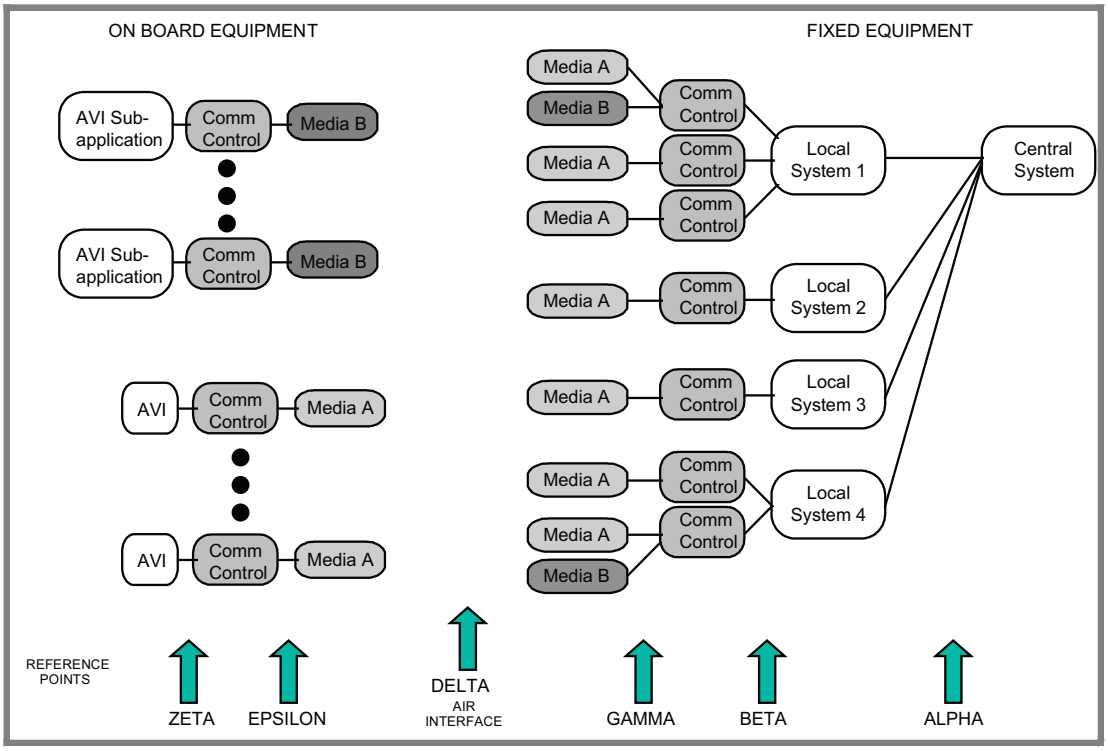

Figure 8 — Example application architecture model

Figure 8 shows an example of how the 'conceptual' model appears at the application level. In this application example there is one central system with four local systems. Local systems 1 and 4 have multiple communication controllers/media adaptations connected. This example also shows OBEs of two different types, without indication of the exact number of each.

The first application aspect refers to providing an identity to the transponder. Once set, the identity remains the same and this step is omitted from subsequent cycles.

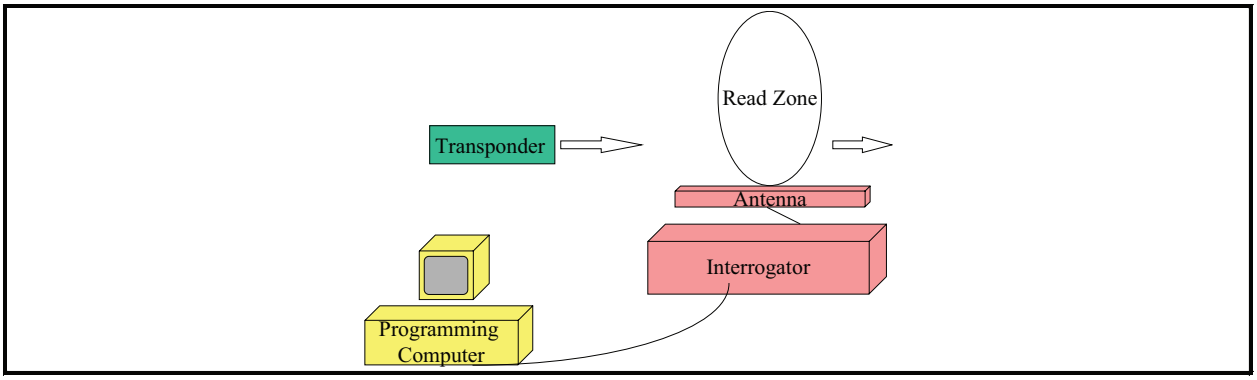

Figure 9 — Application and physical architecture for programming transponders

a) The programming computer sends a programming instruction to the Interrogator (reference point "Beta"), providing it with a data construct to be programmed onto the next passing transponder.

b) A transponder is introduced into the reading zone of the antenna (reference point "Delta") connected to the interrogator

c) The interrogator excites or by other means awakens the transponder (reference point “Epsilon”) and writes the data into its memory (across reference point “Delta”).

d) The transponder is turned off (reference point “Epsilon”).

e) The transponder is reawakened with the interrogator in read mode (reference point “Epsilon”).

f) The transponder data is received by the reader (via reference point “Delta”) and passed to the computer (reference point “Alpha”) and validated as being correct, and is recorded on the screen for the benefit of the operator, and the programming recorded.

See Figure 9.

4.6 Information architecture

4.6.1 Overall data architecture

The form of data used by systems claiming conformance to this International Standard shall be defined within a numbering and data structure operating in conformance with the ISO 14813-6 definition of ISO 8824 (ASN.1) for the ITS/RTTT sector. This family of International Standards shall not extend to the creation or management of a data model for the sector.

4.6.2 Information architecture

This subclause provides a high level model of the logical data structures required to support the process and information flows defined in the intermodal / multimodal system services architecture.

The form of data used by systems claiming conformance shall be defined within a numbering and data structure operating in conformance with ISO 8825-2 ASN.1 encoding rules.

4.6.3 Numbering and Data Structure Architecture

The reference model architecture provides a framework for the exchange of data in this environment. In order to provide interoperable or compatible exchanges of data there is a requirement to standardize the data element constructs. However, if these data element constructs are for a wide variety of different purposes, it is not possible to have a single fixed data structure to cater for all requirements. The ASN.1 Encoding rules standardized in ISO 8825-2 provide an interoperable framework in which otherwise incompatible messages can co-exist.

Whilst many of these numbering and data structures shall provide only supporting data element constructs there will be a requirement for an unambiguous Automatic Vehicle (or Equipment) Identification at the core of most data element constructs. Such schemes are determined in detail in ISO 17262.

This architecture definition requires that numbering and data structures shall be capable of operation both by read/write devices, and by read only devices where there is no requirement (nor possibility) to write to the OBE.

The AVI numbering and data structures determined in ISO 17262 is a compact data element construct, and provides a country/issuer/identification structure, where the numbering structure element provides the capability of in excess of 4 thousand million identifications per issuer.

The numbering and data structure standard recognises the existence of AVI/AEI systems already deployed prior to the issue of the International Standard and provides a means of using such ‘private’ numbering within the framework of the scheme so that such systems are not rendered obsolete by the introduction of the International Standard. In order to comply with the systems installed prior to the issue of the International Standard it shall only be required to use the full data constructs if data is passed beyond the local system (reference point Alpha) and may be constructed at that point. For installations deployed after the introduction of the International Standard, fulfilment of the demands of the International Standard is required in order to claim conformance, but an option to enable ‘private’ schemes to operate within the Technical Specification according to ISO 8825-2 shall always remain.

The data element constructs shall allow combinations of data elements to be used in ‘composite’ messages.

4.7 Object interactions

The means by which AVI/AEI function is to provide an unambiguous identification at an appropriate time.

“Object interaction diagrams” provide time related description of interactions between classes.

For AVI/AEI the information flow is simple and as described in Figure 10.

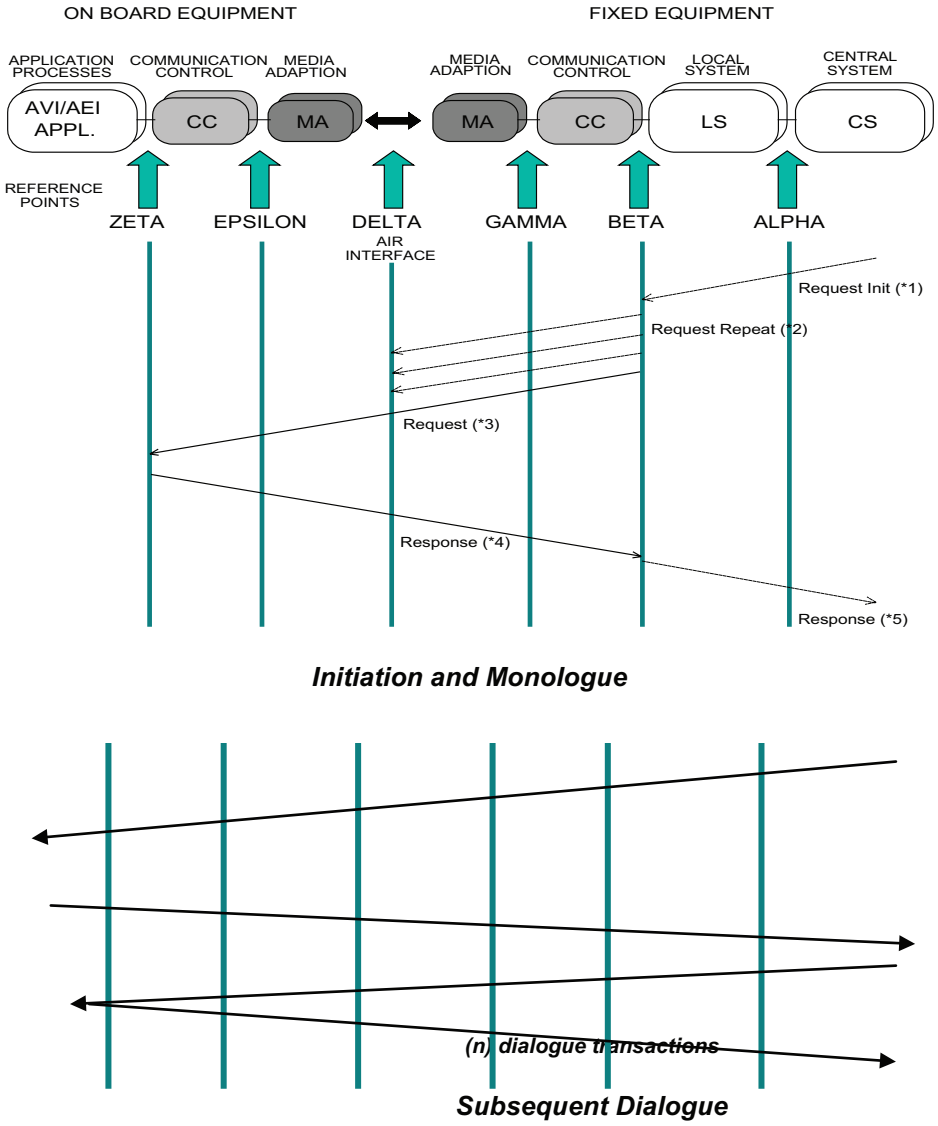

Figure 10 — Object interaction diagram for generic AVI system

EXAMPLE Application information flow :

The following description shows how the information flow for AVI/AEI applications may typically be achieved. This description is for illustrative purposes and does not necessarily prescribe the form of the communication protocol.

*1 - Request Init: An optional Information flow phase where central or local system initiates communication subsystem to start single or repeated request cycling.

*2 - Request repeat: An optional information flow phase where communication control repeatedly sends out requests.

*3 - Request: fixed system polling on-board system for identity. A ‘request’ may simply be the presence of a signal, or may be a more complex process depending on the nature of the AVI/AEI system.

*4 - Response: On-board system reply to earlier request. Reply may be initiated either in the application or communication control part of the on-board system. The ‘data construct’ shall be in accordance with ISO 17262.

*5 - Response: An optional information flow phase where fixed communication control transfers received information to local system and/or central.

In Figure 2, *conceptual view of AVI/AEI System*, key typical interactions are numbered on the diagram. Any of these interactions may be required to be passed across the AVI/AEI interface or be related to AVI/AEI data.

Examples of such interactions are shown in Annex B.

4.8 System security architecture

In the majority of situations the objective of the AVI/AEI process is to uniquely identify a vehicle or equipment. In the intermodal/multimodal AEI environment, there may be, in addition, the monologue transfer of additional data (for example a manifest) or there may be a bi-directional exchange of data, or a fixed equipment initiated interrogation where all or part of the available data may be accessed.

The limits to such access may be to increase transaction efficiency, or the ‘interrogator’ may only be authorised to access certain parts of the data available. Security authorisation and encryption may form part of such data transfer.

System integrity is also an important part of security for many applications.

This International Standard allows for security mechanisms, both at the physical layer and the application layer. Standardization is therefore relevant for interface and specific application International Standards rather than this International Standard.

In some circumstances the position may be reversed and it may be for a moving vehicle or equipment to identify a static or moving object, such as a location identifier, timestamp, customs clearance authorisation or another moving vehicle or equipment (for example to provide a record of which tractor units a trailer has been married with).

Where information (such as that described above) is confidential, the implication is therefore that this should be achieved by local encryption of this data.

In some cases it is necessary to protect the identity of a vehicle, equipment or load detail for reasons of privacy or security. In these cases a multimodal / intermodal AEI system shall provide an ‘unambiguous identification’ that does not necessarily identify the true permanent identification of the vehicle or equipment. It may, for example, identify a smart card temporarily located in an on board unit. However, such identifications are to be supported within the International Standard.

It is important to remember, however, that the equipment used may provide the functions of more than one entity, or indeed the entity may be performed by a combination of equipment (such as an interrogator plus an antenna).

System integrity is a process to ensure that the information received is the same as information that has been sent and has not been corrupted, created nor tampered with en route. Integrity may be achieved by cryptographic means by sending a message authentication code (MAC) or digital signature attached to the information.

Issues of access limits imposed by interrogators are concerned; this should be addressed in the relevant air interface Standard.

4.9 Resilience issues

AVI/AEI may occur using a number of different air interfaces. Issues of ability to cope with a wide range of interfaces should be addressed in the relevant air interface International Standard. See ISO 17264.

4.10 Performance issues

AVI/AEI may occur using a number of different air interfaces. Performance will depend on a combination of the air interface protocols used, local regulations, and physical equipment. Issues of performance should be addressed in the relevant air interface International Standard. See ISO 17264.

4.11 Disaster recovery

AVI/AEI may occur using a number of different air interfaces. Issues concerning disaster recovery should be addressed in the relevant air interface International Standard. See ISO 17264.

4.12 Migration issues

Migration between different air interfaces and different generations of equipment reside largely in the use of common ASN.1 data definitions. See ISO 17262.

4.13 System specification

The supporting document for system specification is ISO 17263. The AVI/AEI system shall be constructed in accordance with ISO 17263, which defines, describes and specifies common user requirements (functional, operational and technical) related to a generic AEI multimodal/intermodal system.

The supporting document for interface specifications is ISO 17264. The AVI/AEI system shall be constructed in accordance with ISO 17264, which defines, describes and specifies interface(s) in physical and procedural terms.

The International Standard provides specifications for both fixed and mobile interfaces, and defines parameters to enable implementation of systems to meet relevant requirements.

The parameters within the scope of the interface specification standard include interface requirements on the air interface which are unique to AVI/AEI systems, including results (available at the time of issue of this International Standard), from “Dedicated Short Range Communication” (DSRC) standardisation, JTC 1/SC 31 interface specifications, and International Standards issued by ISO/TC 104 in respect of bi-directional air interface definitions.

The guiding principle of the Interface Specification Standard is to provide basic link specifications so that a service provider can choose an appropriate link system to meet his requirements for AVI, and so that he can freely mix several links and have them interoperate (as long as they do not interfere/contend with each other).

The application architecture International Standard does not determine the physical configuration of equipment. This is determined at the ‘implementation architecture’ level.

4.14 Implementation architecture

This family of International Standards provides assistance and guidance to those implementing AVI/AEI systems. The ‘implementation’ level of architecture is the mapping of functions into physical boxes at one or a number of locations. Such a determination is likely to form a major part of responses to tender calls. As such these are a function for commercial consideration, rather than Standardization, and the implementation architecture is specifically excluded from this family of International Standards. The standardization of the conceptual, functional, data and generic application aspects of architecture, however, are designed to assist in the preparation of specifications for specific implementations without interfering with the commercial aspects of implementation.

Annex A
(informative)

Architectural views of logistic and distribution systems

AVI/AEI most frequently forms a part of a logistics, supply or distribution system. Logistics, supply and distribution systems are an indispensable part of modern society. Such systems provide the means of moving material and product to manufacturing systems, moving materials, components, sub-assemblies and product through manufacturing systems, and get product and physical items to their end delivery points. They also include delivery services for non-manufactured items (such as post and parcel delivery systems). Such systems also manage returnable units, and provide information around the system (a function that we have described “The Information Manager”). Within such concepts, multi-modality (moving from one transport mode to another) and intermodality (the ability for equipment to operate in different transport modes) of AVI/AEI equipment will operate. Figure A.1, shows the conceptual relationships of logistics/supply/distribution systems at a high level.

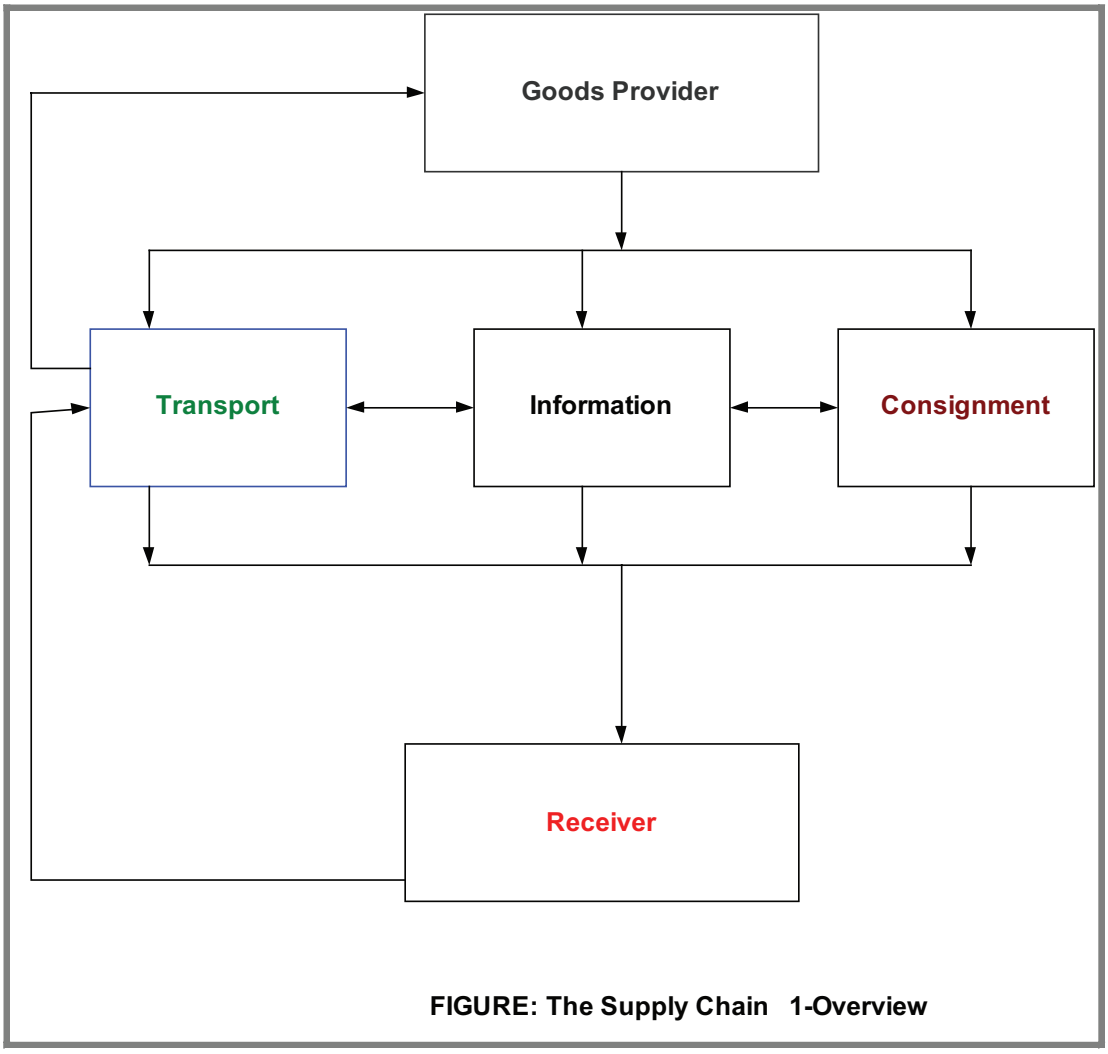

Figure A.1 — The supply chain overview

Figure A.1 shows that logistics/supply/distribution chains involve/interface with most aspects of modern society. The detail (relevant actors, classes (objects), interfaces and interactions) depends on the perspective from which they are viewed.

The following figures show the logistics/supply/distribution Chain from the perspective of the key classes shown in Figure A.1 and for particular logistic distribution systems (such as airline baggage distribution).

Figure A.2 shows the view from the view of the consignor.

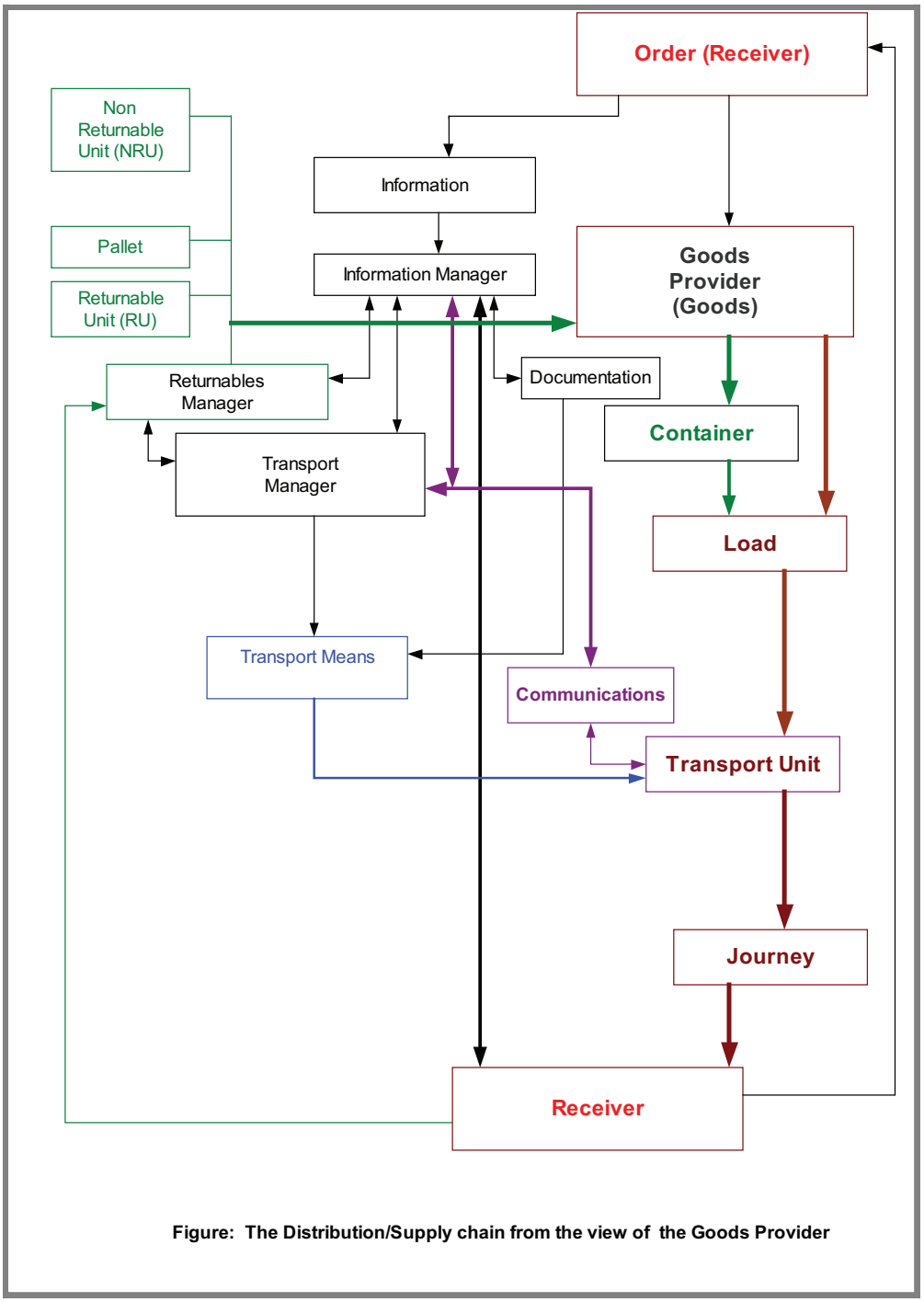

Figure A.2 — The distribution/supply chain from the view of the consignor

The consignor may simply be a distributor or agent, but may also be, or act in concert with, a manufacturer. Manufacturing is a specific view of the logistic/supply chain. It is a view whose complexity is often hidden from

much of the supply chain, but examination shows not only external involvement, but a complex internal logistic and supply chain requirement. Figure A.3 shows such a view.

NOTE In Figure A.3 The abbreviation “Q & A” is short for “Quality and Assurance”.

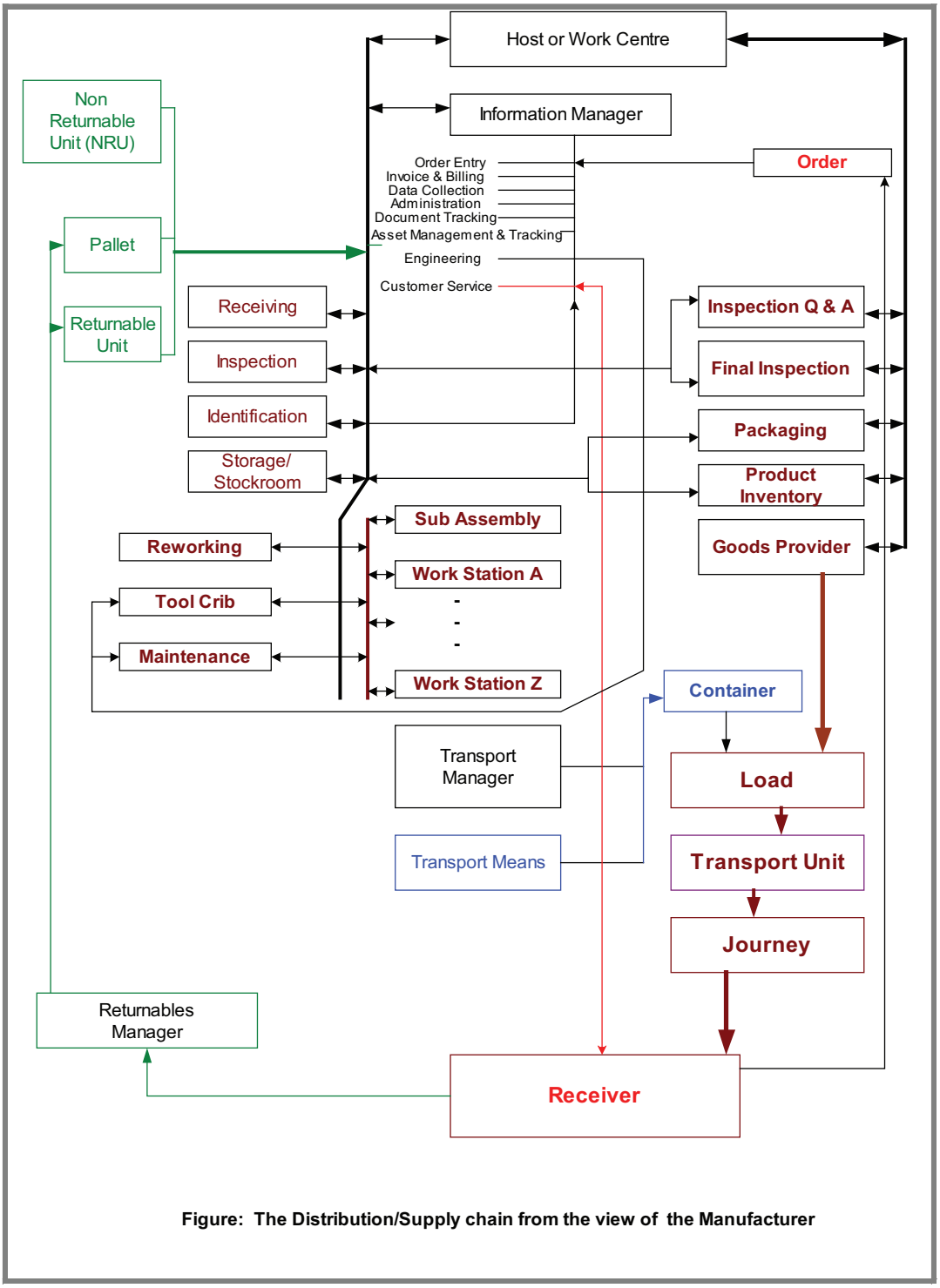

Figure: The Distribution/Supply chain from the view of the Manufacturer

Figure A.3 — The logistics/distribution/supply chain from the view of the manufacturer

Once manufactured, and placed through the hands of the consignor, the item(s) to be delivered become a consignment. Figure A.4 provides the logistics/distribution/supply chain, from the view of the consignment.

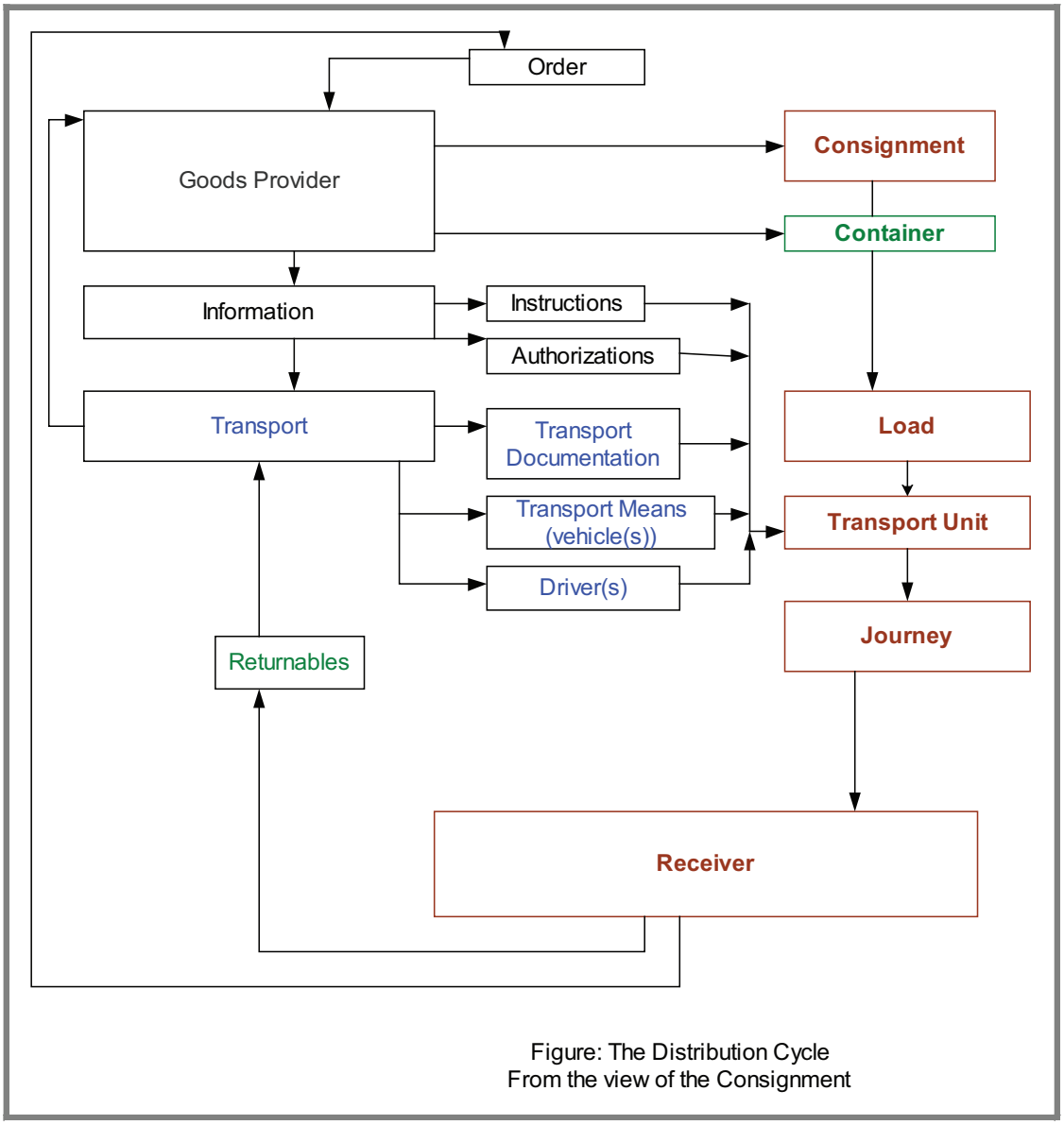

Figure A.4 — The distribution cycle from the view of the consignment

The objective of the logistic/supply/distribution chain is the receiver. The receiver may be an end user or a manufacturer or intermediary. Figure A.5 provides the chain from this point of view.

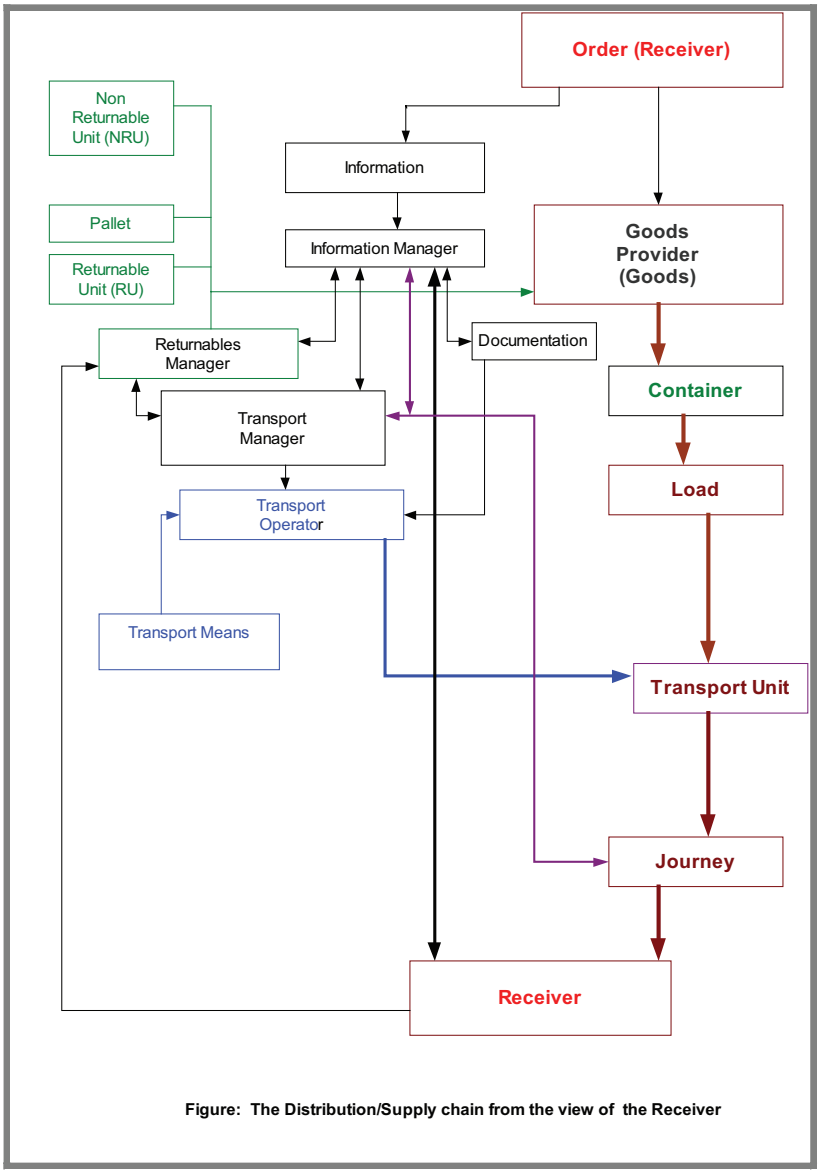

Figure A.5 — The logistic/supply/distribution chain from the view of the receiver

In order to get the item from its source to its destination it has to be moved. This is the transportation function. This may be performed in house, through single subcontract or through a subcontract chain. Who, or how many actors fulfil these transport aspects, the functional classes remain conceptually similar and divisible.

NOTE 1 There is an interface between “transport unit” identification and “item” identification. Within the context of this series of International Standards, the AVI/AEI components relate to vehicles, trailers, swap bodies etc., and are covered by this Specification, whereas “items” are the contents of a trailer “(pallet” items; “small container” items, packets, parcels, and individual items) and are Standardized through the ISO/IEC 18000 series of International Standards.

NOTE 2 This common description of units is in line with agreement between JTC 1/SC 31, TC 104 and TC 204.

ISO Containers are Standardized through ISO TC 104 (ISO 668 and ISO 10374). Railway and airline equipment are Standardized by other Standardization bodies.

While providing an understanding the overall context of the perspective of logistics/distribution/supply chain within which AVI/AEI is most frequently used, as this is an ITS International Standard, this International Standard is concerned primarily with the “Transport” perspective.

Figure A.6 shows the view of transportation.

NOTE 3 A view similar and consistent with A.6 also appears in ISO 18000, and in particular in ISO 18000-1.

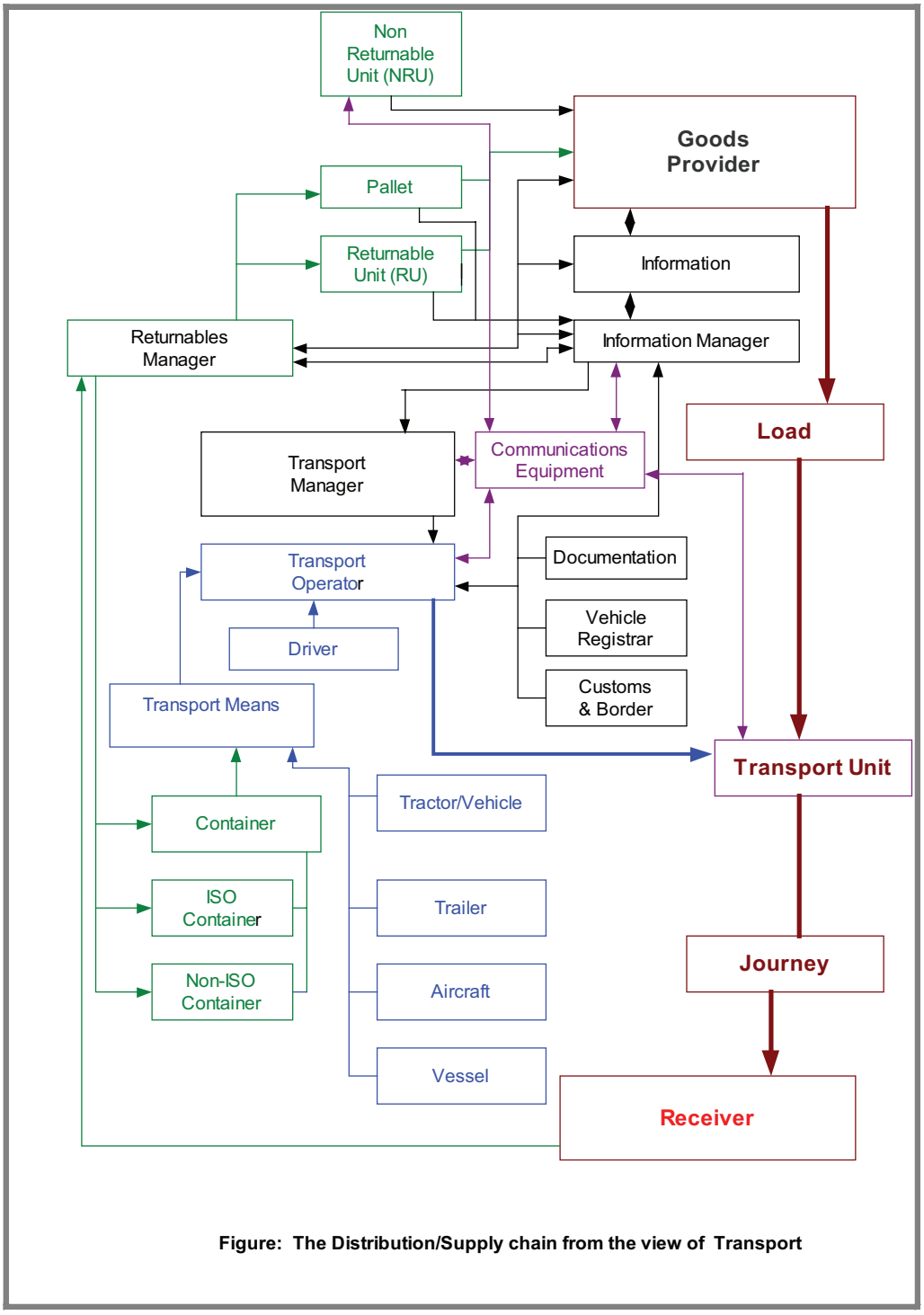

Figure: The Distribution/Supply chain from the view of Transport

Figure A.6 — The logistics / supply / distribution chain from the view of transport

Whilst most situations can be adequately from the views provided above, they describe most, but not all views. Some specialized views can also benefit from further description. One such example is airline baggage handling. Figure A.7 shows such a view.

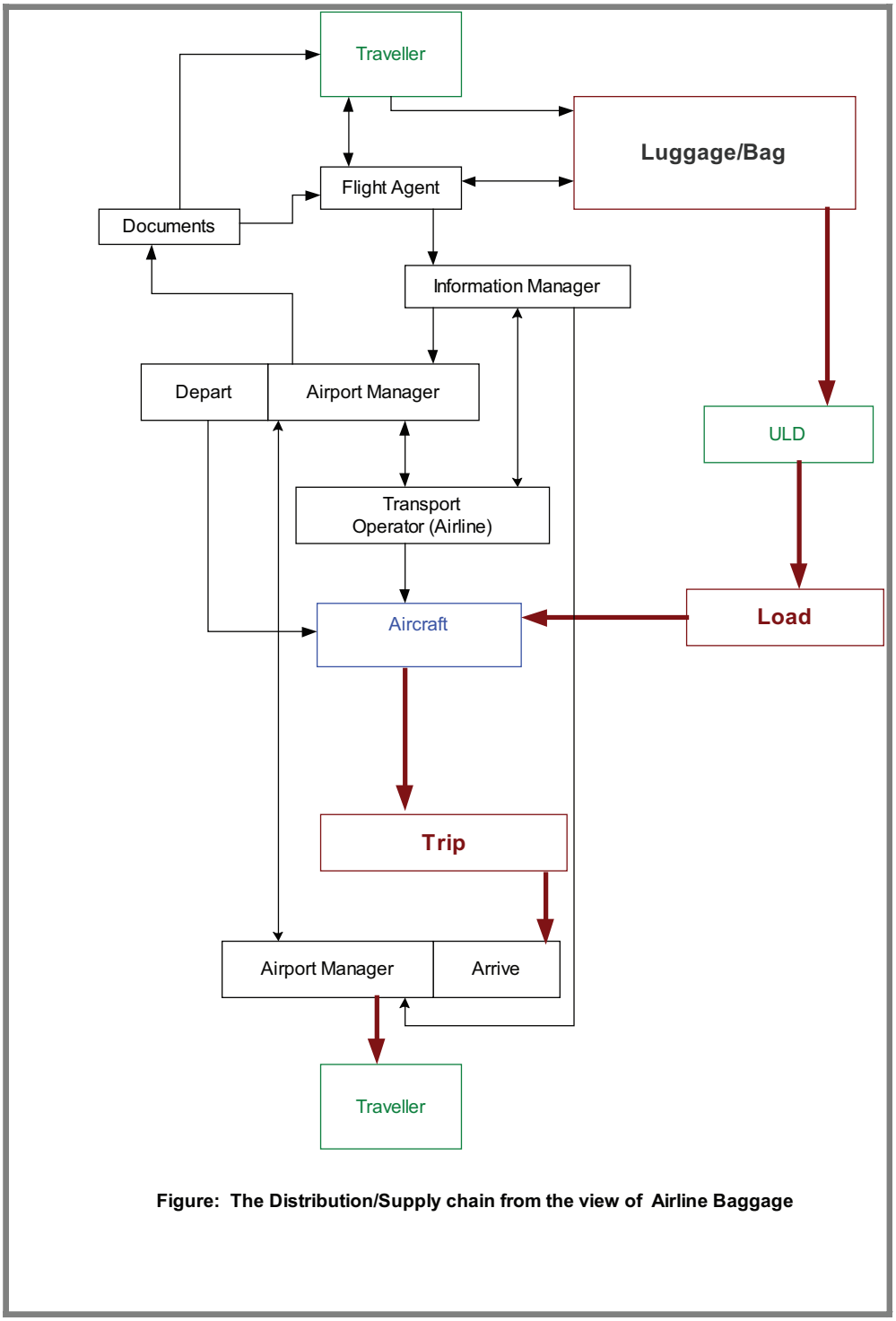

Figure: The Distribution/Supply chain from the view of Airline Baggage

Figure A.7 — The logistics / supply / distribution chain from the view of airline baggage handling

As far as a high level generic model is concerned, this can be seen as a subset of the general model, where the flight agent, airport manager, and airline is part of the “Transport Operator” class. Luggage is an instance of the class “non returnable container” or “item”.

AVI/AEI concern the collection and management of information (primarily identification) about AVI/AEI equipment. As such it is the “information” rather than the physical movement that lies at the heart of the work programme. Key classes, which appear in every one of the views described above are those of “information” and the “information manager” function.

Figure A.8 is therefore important to this series of International Standards. It provides the view of the "Information manager".

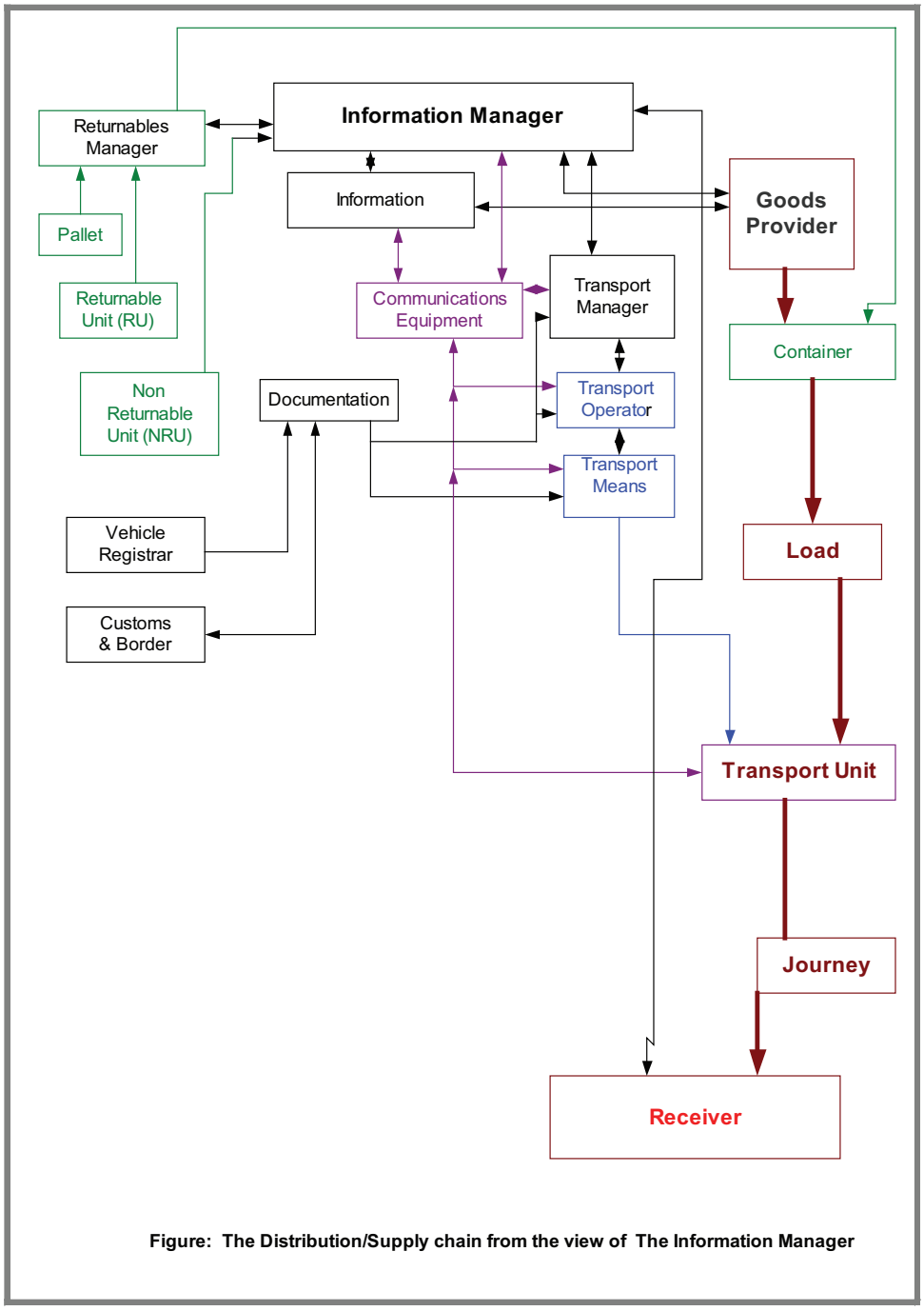

Figure: The Distribution/Supply chain from the view of The Information Manager

Figure A.8 — The logistics / supply / distribution chain from the view of the information manager

Bibliography

[1] ISO/IEC 8825-1, *Information technology — ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

[2] ISO/TS 10891, *Freight containers — Radio frequency identification (RFID) — Licence plate tag*

[3] ISO 11179, *Information technology — Metadata registries (MDR)*

[4] ISO 14815*, Road transport and traffic telematics — Automatic vehicle and equipment identification — System specifications*

[5] ISO/IEC 19501, *Information technology — Open Distributed Processing — Unified Modelling Language (UML) Version 1.4.2*

[6] ISO 9897, *Freight containers — Container equipment data exchange (CEDEX) — General communication codes*

[7] ISO 10374, *Freight Containers — Automatic identification*

[8] ISO 14814, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Reference architecture and terminology*

[9] ISO 17264, *Intelligent transport systems — Automatic vehicle and equipment identification — Interfaces*

[10] ISO/IEC 18000-1, *Information technology — Radio frequency identification for item management — Part 1: Reference architecture and definition of parameters to be standardized*

[11] ISO 668, *Series 1 freight containers — Classification, dimensions and ratings*

ICS 03.220.01; 35.240.60

Price based on 30 pages