ISO Report AIDC 2014

Automatic Identification & Data Capture

Report on continued standardization of Bar Code, RFID & Data Communication

Fig. 1) Attendees at ISO/IEC JTC 1/SC 31 Meeting 2014, host: The Netherlands

Member Nations of ISO/IEC/JTC 1/SC 31 (partial list)

Australia	Austria	Belgium	China	Canada	Switzerland	Germany	Finland	France
Japan	Singapore	S. Africa	S.Korea	Sweden	NL	Russia	UK	USA

.. and contributing organizations like

AIM	**CEN TC225**	**DOD**	**EDC**	**ETSI**	**GS1**	**IATA**	**HIBC**	**ISO TC122**	**ISO SC17**	**ITU**	**UPU**

and others such as JTC1/SWG5, IEEE, etc.

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AIDC - Automatic Identification & Data Capture

Report on the continued standardization of Bar Code, RFID & Data structures

ISO/IEC JTC 1/SC 31 Plenary & Highlights

This report will focus on the ISO/IEC JTC 1/ SC 31 meeting sessions in Delft but will include highlights of AIDC technologies and applications as subject of the meetings or discussions and exchanges outside the sessions as noted by the author.

- Key role of AIDC – engaged experts
- The 20th SC 31 meeting June 23 – 27, 2014
- Extracts from reports of the working groups
- New Chairman for ASC DIMC, new DIs and link to DI list
- Contributions from the National Institutes and new developments
- Internet of Things (IoT) and "IoT light"
- Attachments with a quick guide, Issuing Agencies and selection of AIDC Standards

Obituary for Craig Kenneth Harmon

Key role of AIDC – engaged experts move it forward

Craig Kenneth Harmon (Fig. 2) wrote in 1990 the book "Reading between the lines" an intensive introduction to Bar Code and Data Collection technologies. With this book and his subsequent innumerable publications he predicted very early that AIDC would get a key role for data communication directly associated with material flow. In fact it became true, now AIDC connects materials to computers and even items to the Internet (IoT). Without AIDC no shipment would reach its destination in a timely manner.

***Craig K. Harmon** passed away on July 3, 2014 just after the ISO/IEC JTC 1/SC 31 took place, the last meeting of SC 31 where the co-founder was able to contribute to the proceedings. He left his "hand writing" not only in the publications of SC 31 but also in most of the AIDC application standards. Working groups in industries and healthcare will miss his pro-active, sometimes controversial, but always productive discussions leading to the one target "common standards for global use". Craig will be missed. Successors are required to fill the chairs again for different working groups not only within SC 31 AIDC but also within ISO TC 122 and others.

*Fig. 2) **Craig Harmon** (1947-2014) [source: CM]*

Nevertheless the structure of ISO is securing continued development and long term maintenance of standardization processes. Any individual person is important but the strength of ISO is always the group work. National standardization institutes send experts from industry and healthcare to the meetings for moving the projects forward. The ISO standards are referenced in branch standards and become part of other standards where elements from ISO are inserted into application standards as in the Global Transport Label (GTL) of the Automotive Industries, the Serial Shipping Container Code (SSCC) of GS1 and the "Set Label" of the Electronic Industry (EDIFICE) just to mention some of many examples. Even governmental entities like Food & Drug Administration (FDA) of the US recognize the key role of the ISO standards by referencing to ISO/IEC 15459 Unique Identification.

Pieter de Meijer and Lucas Schouten (EHIBCC) wrote the book 1992 "No Barcode, No Business", but today it should read "No AIDC, No Business" and even more precise "No AIDC ISO Standards, No Business".

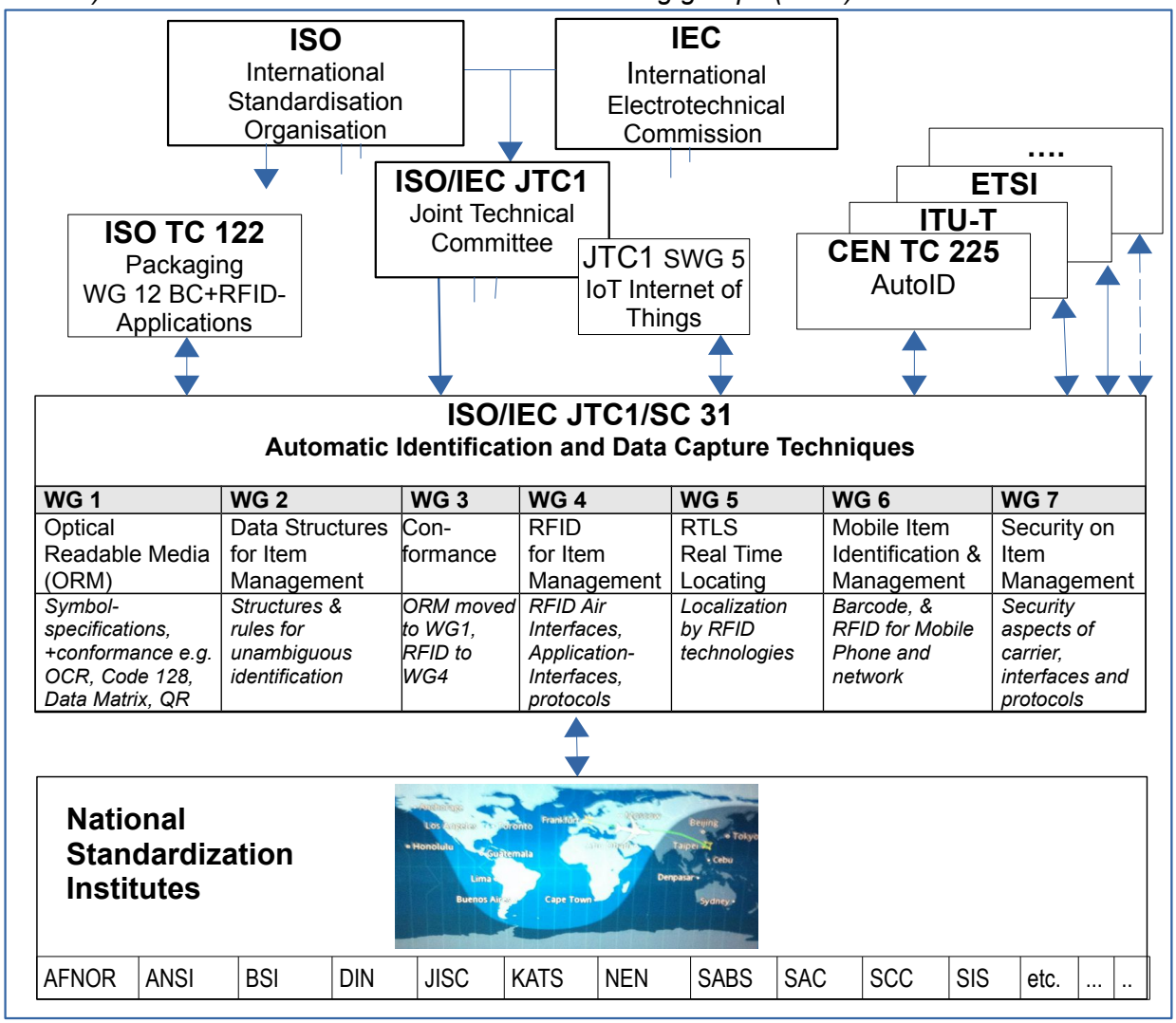
Fig. 3) Maho Takahashi + Dan Kimball

The structure of ISO/IEC JTC 1/SC 31

Sub Committee 31 (SC 31) was established in 1996 under JTC 1 the Joint Technical Committee combining ISO and IEC for standardization of AIDC technologies. The current

Chairman is Mr. Dan Kimball until the end of 2016. Central ISO Secretary contact in Geneva is Mme. Maho Takahashi (see Fig. 3).
Between 1996 and this year 109 AIDC standards have been published. Some are already in the review process and new projects are also in the pipeline. The work is undertaken by expert delegates from national standardization institutes and liaison organization. The projects are dedicated to responsible working groups (see table 1) being chaired by one expert each and open for delegates of the national members. For taking new work items a simple rule applies: 5 nations shall name one expert for active contribution.

Table 1) ISO/IEC JTC 1/SC 31 AIDC links and working groups (WGs)



The 20th SC 31 meeting sequence June 23 – 27, 2014

Prior to the Plenary Meeting, other meetings took place, usually taking advantage of the presence of the experts. This year, meetings of the following groups took place: WG4/SG6 RFID Performance (34 participants of 12 countries), WG 2 Data Structures (39 participants, 12 countries), WG 7 Security (46 participants, 23 countries), WG 4 RFID (51 participants, 13 countries), Head of Delegation (HoD) meeting (23 participants, 12 countries) and ISO training session for editors. The SC 31 full Plenary Meeting (51 participants,16 countries) finalized the meeting sequence. The full plenary meeting was chaired by Dan Kimball. Conveners of the Working groups reported about the success of the projects, liaison officers about co-operational issues and national delegates about national highlights on AIDC. Printing the resolutions SC 31 does not produce any meeting report. The report you are now reading has been written from the prospective of the author

Next Plenaries:
2015 CANADA, June
2016 JAPAN
2017 EMEA
2018 Americas
2019 Asia/Pacific

with the intention to allow insight into discussion points, actual AIDC issues and further developments.

Fig. 5) Hang Xin Code

Optically Readable Media (ORM), WG 1

Convener Sprague Ackley, USA

WG1 is responsible for linear symbols, 2-dimensional symbols and OCR; it is also responsible for their quality measurement specifications. All major Bar codes and matrix codes are under the responsibility of this group, e. g. ISO/IEC 15417 Code 128, ISO/IEC 16022 Data Matrix, ISO/IEC 18004 QR Code, etc. One of WG1's current tasks is to update the specification for the OCR font set (Optical Character Recognition) continuously used in large applications like for passports.

Convener Sprague Ackley can imagine some new projects, e. g. a request from China for normalization of the Han Xing Code (Fig.5), an optical Code belonging to the matrix code family developed in 2010/2011. In conjunction with the 5 years maintenance process specific symbols may get an addendum; Data Matrix is one candidate. Requirements for increasing features for marking surfaces of very small height have arisen already (see DMRE).

DMRE - Data Matrix Rectangular Extension for item marking of very small height

Data Matrix solves many marking problems but not all of them. There are gaps where none of the defined formats of Data Matrix matches with the given surface to be marked. This has been reported to be the case with items of smallest height like electronic components, medicinal products, medical devices, etc. A consortium of AIM, IFA, EHIBCC, EDC and DIN took the initiative to investigate the problem and to develop the solution. The solution found was “DMRE” with 13 rectangular matrix formats that match to the immediate demand. E. g. the new format 8x64 dots for 48 numerics (n) or 34 (an) will amount to just 1.6x13mm with dot size 0.2mm (8mil) or 2x16mm with dot size 0.25mm (10mil). ISO/IEC 16022 Data Matrix is delivering the base where the 13 new rectangular formats (sizes) can be added easily to device software just by adding size tables. This would mean that printing engines for Data Matrix as decoding devices can be updated quickly by the predefined size tables rather than by re-programming the devices. Experts estimate about half a day for a software engineer for a one time update. Meeting members in Delft supported the idea spontaneously. The chairman of WG 1 suggested to treat DMRE as a new symbology rather than to treat it as an update of Data Matrix to make sure that it will be understood that devices not having the new formats included will not read it. Meanwhile AIM DACH declared being prepared to complete the specification in Sept. 2014 prior to submission to SC 31 through the National Normalization Institute DIN. On its way to ISO the solution is still open for additional optimization. The initiative is proofe that Data Matrix is a highly accepted and widely used Medium for carrying tracking & tracing information and worth an update for even more extensive use. Figures 4 to 7) illustrate some applications for DMRE (not to scale).

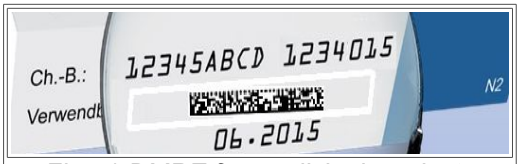


Fig. 4) DMRE for medicinal products

Fig. 5) DMRE with HIBC Unique Device Identifier (UDI) 2x12mm

Fig. 6) DMRE 8x64, 34 characters (an) for cable marking

Fig. 7) DMRE 1.6x13mm for edge sides of components

Data Syntax, WG 2

Convener Toshihiro Yoshioka, Japan

All key standards for ensuring the uniqueness of Barcode & RFID are under the responsibility of WG 2. At the top of the projects stands “ISO/IEC 15459 Unique Identification” with specific parts for uniquely identifying items, transport units, returnable containers. The basis of the standard originated from the European Norm EN 1572. Notable is that the standard defines the hierarchy of unambiguity by shared responsibility for the parties involved: ISO, Registration Authority (RA), Issuing Agency and Labeler (see Annex 1), Fig. 12). Other base standards under WG 2 are ISO/IEC 15418, 15434 and 29161 (see below).

DIMC Chairman, new ASC Data Identifiers & and new link to list of DIs and AIs

The ASC Data Identifier Maintenance Committee (DIMC) had to get an immediate successor to Craig Harmon who led the committee since 1992 up to July 3, 2014 continuously. Interim Chair of DIMC is Bill Hoffman, HOFFMAN SYSTEMS LLC. The DIMC is consisting of experts of different industries and nations across the world. Bill Hofman's first act was it to process open ASC DI requests through the committee e. g. the ASC Dis 27Q to 31Q for monetary values, discounts and tax values. Those have been required for the “PaperEDI” system capturing data by „one scan only“ from delivery notes and from invoices as well. ASC DI “52P” Color of an item and “29B” Globally Unique Returnable Packaging Item (RPI) have been approved as well being applied by automotive industry, where 2 more DIs (27B, 28B) are for additional discussion intended to enable filter function for automated goods entry processes .
The link to the „Standard under Continuous Maintenance ANS MH10.8.2“, which contains the list of DIs + AIs is now hosted by Material Handling Institute (MHI) Charlotte, NC, USA at his URL: http://www.mhi.org/standards/di

The standard ISO/IEC 15418 is a base document for AIDC applications. It refers to the maintenance committees each for the ASC Data Identifiers and for the GS1 Application Identifiers. Due to the passing away of Craig Harmon, a successor will take over the chair for the committee (see box DIMC).

ISO/IEC 15434 Syntax for High Capacity media is primarily used in areas of industry, transportation and healthcare for encoding higher data volume such as user data. Examples of applications are medicinal products applied with extended product information (PPN+Exp. Date+LOT+SN+...) and are transport labels as shipment papers applied with encoded shipment content (“PaperEDI”) but also item codes with “Item Unique Identifier – IUID” use the syntax efficiently.
(Note: Data Matrix identifies the syntax by one control character only)

Project ISO/IEC 29161 Data structure - Unique identification for IoT
mirrors the development of AIDC toward compatibility to the Internet of Things projects (see also chapter “IoT”). Mikael Hjalmarson (SIS) was appointed as convener for the project at the plenary meeting. ISO/IEC 29161 addresses unambiguous identification using SC31 standards but also numbering schemes coming from other technologies like sensors. Following the very efficient scheme of ISO/IEC 15459 and its registry of Issuing Agency Codes (IAC) 29161 developed a list of “BINARY IACs – BIAC” in digital interpretation. WG 2 is looking for an appropriate place for maintenance of the BIACs. The representative of AIM, Chuck Evanhoe, declared prepared to check whether AIM could take it as an addendum to the ISO/IEC 15459 IAC Registry. AIM has been appointed Registration Authority (RA) taking over the function of the Netherlands Normalization Institute (NEN) in 2014. ISO/IEC 29161 was originated by SC 31 “MIIM” and by ISO TC 122/WG 12 IoT to make unique IDs of different technologies interoperable for Internet of Things communication like sensors with tagged items.

RFID, WG 4

Convener Henri Barthel, Belgium

WG 4 is responsible for the technological ISO/IEC standards for RFID. This includes the Air Interfaces and data protocols for Low Frequency (LF), High Frequency (HF), Ultra High Density(UHF) and Microwave. The standards are published as ISO/IEC 18000-xx series as the base for establishing RFID technology in the markets. The standards for RFID conformance, RFID data protocols and Guidelines for RFID implementation complete the work. Recent projects included standardization of sensor interfaces and battery support of tags and software

system infrastructure. The Data Constructs Steering Committee of WG 4 is responsible for handling registration of Application Family Identifiers (AFI). *AFIs identify application relevant categories (families) of RFID Tags data content, e. g. application of RFID for products or transport units conforming to the RFID application standards ISO 17363 to 67. Other AFIs indicate application of card technology, RFID on Air baggage and containers (IATA), library books (EDItEUR) or on Blood products (ISBT). The registered AFI values being under the responsibility of SC 31 are listed in the standing document ISO/IEC 15961-2 Data Construct Register accessible via the SC 31 internet page.

Artifact Demonstration Rules

WG4/SG 3 RFID Conformance suggested that Artifact Demonstration should be implemented not only for RFID but for all AIDC categories as well being subject to conformance testing. An ad hoc group was created in order to widen the scope of the Artifact Demonstration and Conformance document so as to make it become valid for any technology and device. The ad hoc result shall be communicated to the next upper level JTC 1 as a proposal for general rules. Not every delegate was happy about that proposal because specifically ORM with linear and 2D Bar codes and its performance testing is working efficiently without any artifact demonstration.

**Note: Application Family Identifiers (AFIs) are also used for "filtering" specific RFID tagged objects like filtering just baggage to pass a specific RFID gate and to stop any other objects at this gate like product packages or other tagged items.*

RAIN promoting UHF RFID

The speaker of the liaison AIM Steve Halliday presented news about foundation of RAIN (RAdio frequency IdentificatioN, RAINRFID.org) an initiative for promoting UHF RFID (ISO/IEC18000-63). The foundation is hosted by AIM, president is Steve Halliday. First members are parties like Bluetooth Alliance, Google, Impinj, Intel and SMARTEC. RAIN is planning alliance with different industries and associations. The group is estimating 35% growth for UHF tags per year. IoT might be the key enabler for RFID in the future. RAIN will act as a marketing association to identify opportunities, education, training and promotion.

Fig. 5) RFID Emblem for UHF devices

Security & File Management, WG 7

Convener Josef Preishuber-Pflügl, Austria

Working Group 7 is responsible for the architecture of RFID Security and file management for RFID air interfaces series ISO/IEC 18000. Focus is on encryption methods for data communication with RFID transponders. Target is not to develop new encryption methods but to identify common encryption schemes suitable for adoption with AIDC applications specifically with for RFID.

The first standard "ISO/IEC 29167-1 Automatic identification and data capture techniques -- Part 1: Air interface for security services and file management for RFID architecture" was published already in 2012. Now focus is on completion of parts 10 to 19 with different cryptography methods like "Part 15: Crypto suite XOR" and "Part 19: Crypto suite RAMON". Encryption will surely be useful for securing user segments of RFID Tags. However, for simple Tag IDs, encryption might be too much (or too excessive) and less encryption or even no encryption may be appropriate for Unique Item Identifiers (UII). Nevertheless encryption might be required even for single data elements and non RFID as reported from South Africa (see below "Secured QR-Code").

Fig. 4) Secured QR Code scanned by smart phone from License plate

Secured QR-Code (and RFID)

The South African delegates Bertus Pretorius and Steyn Geldenhuys demonstrated the functionality of the newly developed standard “SANS1368-Automatic Identification and Data Capture Techniques – Data Structures – Digital Signature Meta Structure” (ISBN 978-0-626-30059-3). This standard provides a method to encrypt data as carried in barcodes and on RFID. This encryption is a compacted digital signature which uses the ITU-509 key management standard. This allows for the offline verification and extraction of data into tagged fields (for example XML). One application shown was a draft Australian plate which contained both an secured QR and RFID tag. The QR Code and RFID is read with a smart phone. This standard is intended to become a new project for WG 7 Security. This standard provides inter technology (within AIDC) and inter domain (data owners) interoperability.

Internet of Things (IoT)

The concept of IoT includes many facets. There are many different groups working on IoT projects. These groups include organizations working on Machine to Machine (M2M) connection and Smart Grid. The Joint Technology Committee 1 (JTC 1) founded the committee ISO/IEC JTC 1/SWG 5 IoT in order to bring transparency in the jungle of different interpretations and views on IoT but not necessarily to develop IoT standards. An ad hoc is investigating IoT drivers and market requirements for Internet of Things. The report is under development and will include a chart from the analyst Gartner Inc. “Hype Cycle for the Internet of Things”. The chart is showing a mixture of technologies and applications seen as drivers for IoT and includes a time scale of more than 10 years (see fig. 8).

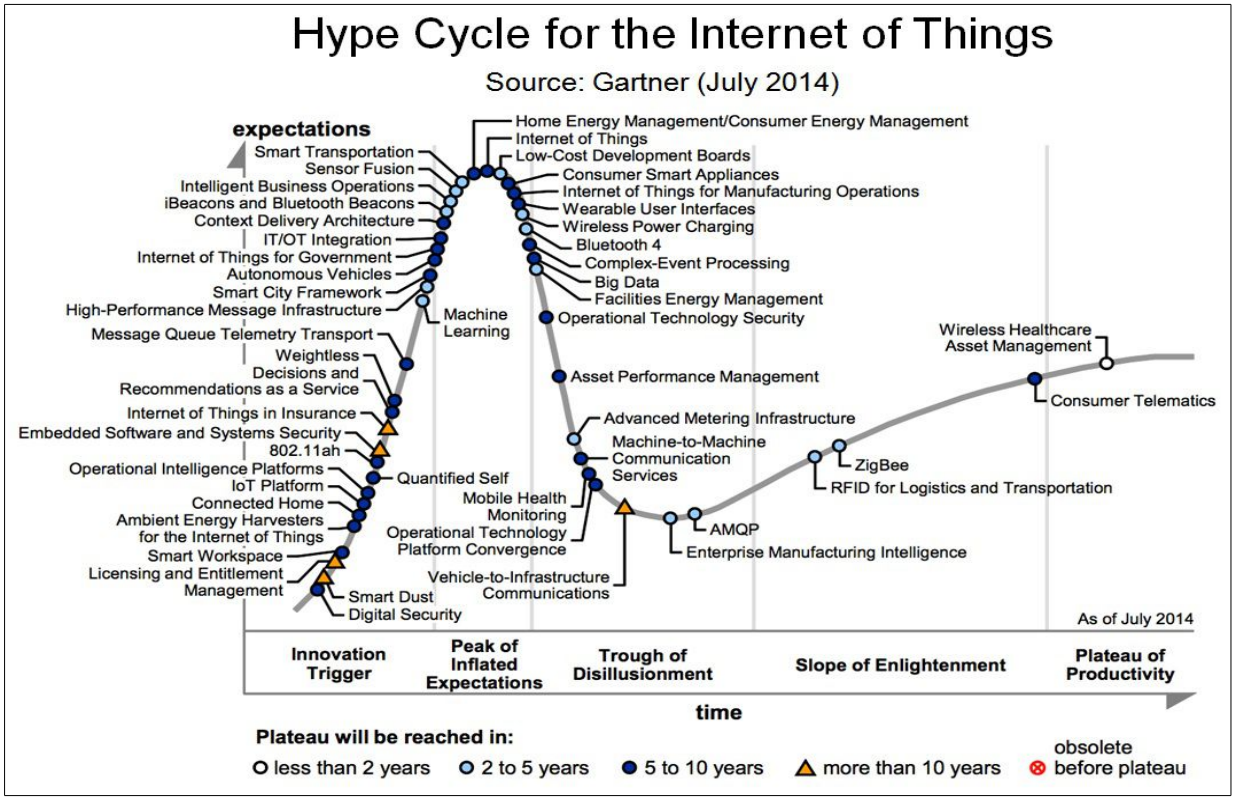


Fig 8) Chart Hype of IoT, source JTC1/SWG 5, Gartner Inc., Aug. 2014

IoT and AIDC

“RAIN” estimates major growth of UHF RFID due to IoT developments but there are not many qualified mark points where AIDC would fit into IoT systems at least those which have been standardized. Nevertheless ISO TC 122WG 12 started 4 projects already in 2012 addressing IoT in the Supply Chain:

- NP 18574 Internet of Things (IoT) in the Supply Chain – Containerized Cargo
- NP 18575 Internet of Things (IoT) in the supply chain -- Products & product packages
- NP 18576 Internet of Things (IoT) in the supply chain -- Returnable transport items (RTIs)

- NP 18577 Internet of Things (IoT) in the supply chain -- Transport units.

The 4 projects complete the multiple level scheme of ISO 17363 to 17367 for AIDC applications for:
> Products & Packages – Transport Units – Returnable Transport Units – Containers <

SC 31 is delivering the technology modules for TC 122 for example the key standard for unambiguity of item IDs which is ISO/IEC 15459 Unique Identification but also the new work project ISO/IEC 29161 Data structure - Unique identification for IoT.

"IoT light" for products by P2P DI
QR Code shows how easy it is to get information stored somewhere in the net. On the other hand an Internet link in a QR does not allow unique identification nor tracking & tracing nor secured functionality. The [1]Joint AIDC Experts Group of Industries and Healthcare took the initiative to develop a "light IoT" system not by replacing a unique item code by a URL (as done in regular QR) but by combining item data with a portal URL. That URL shall allow "pointing to a process" for immediate internet response dedicated to a specific item. The response can enable automatic access to Material Safety Data Sheets (MSDS) to maintenance instructions and it could even link to a dialog for a specific process like maintenance.

Fig. 9) IoT light: Data Matrix supplies on-board product data AND link to IoT in one

ASC Data Maintenance Committee (DIMC) registered two ISO/IEC 15418 ASC Data Identifiers for the purpose, the URL DI "33L" just for adding a URL to a unique item code and as second the Point to Process (P2P) DI "34L". DI "34L" involves a process after scanning the code for splitting the URL from the item data then forming and generating a "new URL" out of the item data and the P2P URL. This after scan generated URL then will point to the intended process e. g. linking straight to information e. g. dedicated to a specific serial number of a product. "IoT light" can be built by any labeller on its own IoT Information System without any assistance of service providers in the net. The application can be designed and run in house for servicing any customer or partner by opening information sources determined by the item data.
DIN found this "IoT light Barcode" (Fig. 9) interesting enough to apply for sponsoring a project with the help of the German Ministry of Economy and Technology. Meanwhile Elmicron.de got charged with developing a pilot system as a base for a potential application standard for "Light IoT". Already the solution has been adopted by DIN 66277 Electronic Name Plate completing the 2d + RFID hybrid solution with a link to Internet sources for object relevant information.

Product verification & identification - The IFA Coding System
The national report of Germany included information about the IFA Coding System developed to combine two functions of a code: Unique identification for logistical handling and Verification for anti-counterfeiting purposes. The IFA Coding System features both using modules of SC 31 purely like ISO/IEC 16022 Data Matrix (Fig. 10), ISO/IEC 15434 Syntax and ISO/IEC 15418 Data Identifiers. The core is the "Pharma Product Number (PPN)" having got the assigned individual ASC Data Identifier "9N". The PPN offers capacity for any National Trade Identification Number (NTIN) by use of a globally unique flag. Each variable data element is flagged by an ASC Data Identifier like "S" for Serial Number and "1T" for the LOT, etc. Verification is enabled by a

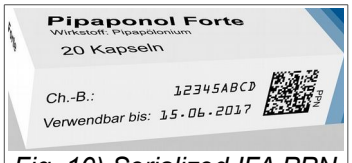


Fig. 10) Serialized IFA PPN Data Matrix

[1]Joint AIDC Experts Group of AIM DACH, EDC, EDIFICE, EHIBCC

central data base where the manufacturer stores the (randomized) serial numbers for packages being sent to the market. The Pharmacy verifies the package as authentic by scanning and automatic look up into the data bank. If the serial numbers (SN) is present, then the package can be sold (green light) and the SN will be deleted out of the data bank. If the same or another Pharmacy were to get a package with that SN again they would get “red light”. Since medicinal product packages can be very small IFA is seeking for extension of Data Matrix for small height codes (see DMRE).
The IFA Coding System serves to be a sample for an international concept for product identification and verification in one (see: http://www.ifaffm.de/en/ifa-codingsystem.html)

Creative discussions and synergy effects during and aside the meetings
Face to face meetings ease the work on complex projects like AIDC standards where the human factor of learning and understanding each other is an important element. Even social events or joined dinners look like amusement at the first look but in real fact they enable synergy effects and open creativity. The sketch (Fig. 11) is one example of efforts and engaged interest to teach each other and to learn from each other even late at night. Delegates may forget technical details but never personal experiences and group dynamics.

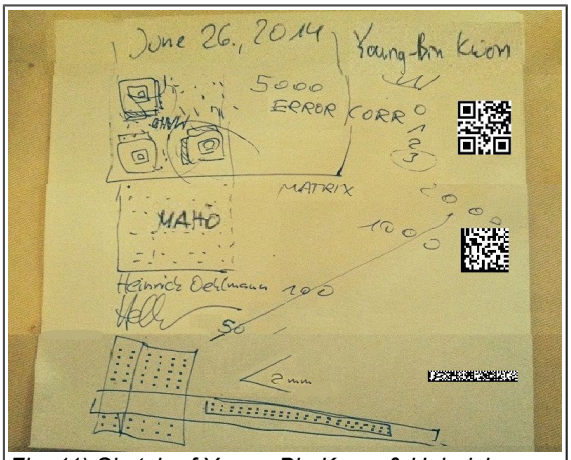


Fig. 11) Sketch of Young-Bin Kwon & Heinrich Oehlman for Maho Takahashi (ISO) explaining QR, Data Matrix and DMRE (Photo M.T., edited H.O.)

Harmonized Vocabulary 5 languages (en, fr, de, kr, ru) ISO/IEC 19762

The Harmonized Vocabulary has been completed and approved. It was developed under the leadership of the editor Craig Harmon editor. About 900 terms have been applied with a brief definition each in 5 different languages (English, French, German, Korean and Russian). The multiple language vocabulary will be an ideal reference guide for all those who work with AutoID in different languages.
Note: Due to passing away of the editor Craig Harmon it will be difficult to find a successor to coordinate the maintenance in the future.

Enclosures:

Annex 1) Global unambiguity for items
Annex 2) How to get to globally unambiguous product codes and quick guide
Annex 3) Issuing Agencies support different data formats
Annex 4) List of available Issuing Agencies with their IACs
Annex 5) Selection of AIDC Standards

Annex 1) Global unambiguity for items

ISO/IEC 15459 sets the commonly agreed hierarchy for generating unambiguous codes under the lead of WG 2 Data Structures (chart see fig. 12). The hierarchy was taken by ISO from CEN EN 1572 but extended from transport units to validity for all levels of items. The rules are rather simple; ISO accredits a Registration Agency (A) to interested institutions B) assigning unique Company Identification Codes (C) on request. Companies having got a CIN are in the position to label any item globally unambiguously like products, packages, transport units, containers, but also as papers, equipment, locations and even persons identified by unique wrist bands or ID Cards.

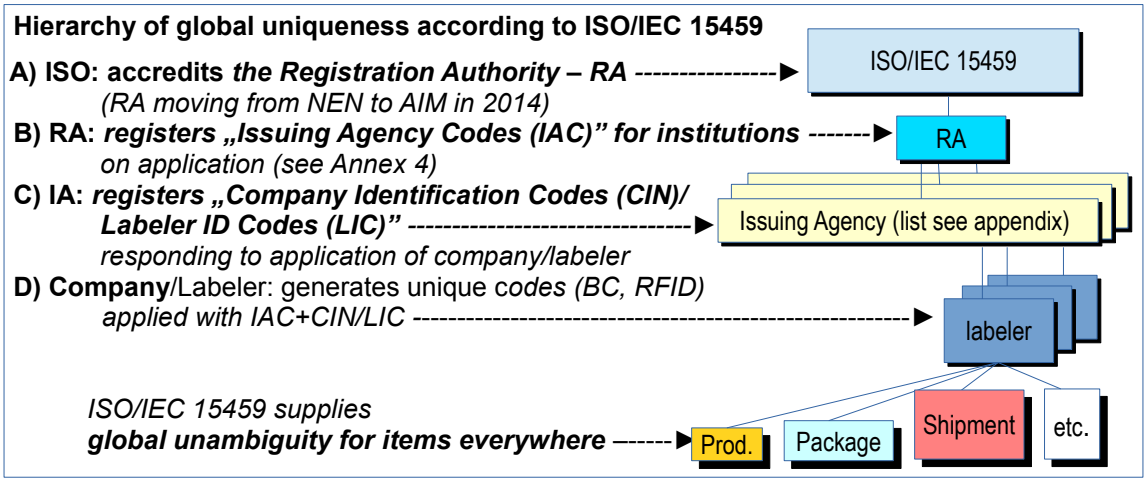


Fig. 12) Shared responsibilities for unique marking and identification

Annex 2) How to get to globally unambiguous product codes

The prerequisite for labeling an item unambiguously is the availability of a registered CIN from one of the Issuing Agencies. As next the characteristic of the item number to be encoded uniquely determines the syntax to be used. E. g. the ISO/IEC 15418 ASC DIs are for alphanumeric product reference used on average for 10 characters or up to 20 where the ISO/IEC 15418 GS1 Application Identifiers define a product reference as a Global Trade Item Number (GTIN) country related with typical 3, 4, or 5 digits max. and the Health Care Bar Code system sets a max. of 18 alpha numeric characters.

A quick guide for labellers

How to get a globally unique product code (e.g. for M4215R73)

I) Check the format of your product number (e.g. for M4215R73) for choosing one of the ISO/IEC 15418 formats as syntax for the code
  a) if numeric 5 digit max – go for ISO/IEC 1514 ASC Data Identifiers or GS1 Application Identifiers or HIBC (depending of the customers)
  b) if more than 5 digits or alphanumeric – go for ASC Data Identifiers

II) if you have chosen an Issuing Agency enabling to encode e. g. M4215R73 by ASC DIs than
  a) apply for a CIN, e. g. "COMP" from E.D.C. (IAC "QC")
  b) chose the appropriate DI "25P" for the sequence <DI><IAC><CIN><REF>
  c) build a sample sequence for your product reference M4215R73:
  <25P><QC><COMP>< M4215R73> for encodation as: 25PQCCOMPM4215R73
  d) if a serialized product add Serial Number 1234567 headed by DI "S": <S><1234567>
  for encodation as: 25PQCCOMPM4215R73+S1234567
  e) if required add other data elements like LOT (DI "1T", Expiry Date "D", etc) and use Syntax ISO/IEC 15434 for 2D symbols or RFID
  f) chose a symbology depending on data volume, available size and customer, e.g. Code 128 or Data Matrix (Fig 13).

Fig. 13) Unambiguous Code 128 versus Data Matrix

Fig. 13) shows the relationship of appr. 1:10 between sizes of Code 128 and Data Matrix (not to scale). Other symbologies might be chosen according to individual selection criteria but the trend is towards Data Matrix for size and security reasons (Data Matrix has an automatic error correction feature).

Note: Some regulations may accredit specific Issuing Agencies only as a choice for generating unique codes, e. g. the FDA US accredited the Issuing Agencies GS1, HIBC and ICCBBA starting the Unique Device Identifier (UDI) system.

Annex 3) Issuing Agencies determine different data formats for codes

ISO/IEC 15459-2 accredited Issuing Agencies do supply not only a unique Company Identification Code (CIN) but with it they determine the AIDC data structure as well which has effect to data elements specifically for product and transport unit codes. In consequence the choice of an Issuing Agency it is also a choice for the structure of key codes.
Table 2) shows a selection of typical Issuing Agencies of industry and healthcare areas supporting the data structures for either alpha numeric or numeric only product codes and transport codes.

Table 2 Issuing Agencies, IAC's and support of data structures

Excerpt of the list of Issuing Agencies for Company ID's (CIN) ▼	***IAC*** ▼	***Length of a CIN*** ▼	***typical CIN, e.g.*** ▼	***[2]Support for structure & code capacity***		
				Data structure ▼	***Product code 2-20an*** ▼ ***(max. 50)***	***Transport code 2-20an*** ▼ ***(max. 35)***
Eurodata Council	QC	4an	CPRO	ASC	YES	YES
DUN Dun & Bradstreet	UN	9n	123456789	ASC	YES	YES
GS1 and EPC Global	0-9	3-7	1212345	GS1 (EPC)	3-5n	9n
EDIFICE European Electronic Industries Association	LE	3an	IBM	ASC	YES	YES
EHIBCC European Health Industries Assoc.	LH	4an	ELMI	ASC, HIBC	18	YES
ODETTE European Automotive Industry	OD	4an	A2B3	ASC	YES	YES
TELCORDIA ANSI ATIS-0300220 Telecom. Equipment	LB	4an	CSCO	ASC	YES	YES
UPU Universal Postal Union, etc.	J	6an	D00001	ASC	YES	YES

Note: The complete list of registered Issuing Agencies and its codes see Annex 4

Table 2 illustrates that the majority of Issuing Agencies is supporting a data structure for alpha numeric codes for products and transport units whereas only one Agency restricts users to numeric reference codes. Support of data structures might be one decisive selection criteria for choosing a specific Agency.

[2] to “YES” for 2-20 characters: This is the general recommendation but the maximum length is 50 for product codes and 35 for Transport ID codes. Exceptions are the shorter codes of the GS1 structure.

Annex 4) List of available Issuing Agencies with their IACs

Excerpt of the REGISTER of ISSUING AGENCY CODES for ISO/IEC 15459
Source: NEN revision 2014-02-13

	Register ordered by Issuing Agency Name	IAC
1	ABOL SOFTWARE INC. 413 Creekstone Ridge, Woodstock GA 30188, USA	LN
2	Bosch und Siemens Hausgeräte GmbH, Carls-Wery-Strasse 34, D-81739 MUNCHEN, DE	VBS
3	Ghana Revenue Authority, PMB, TUC Post Office, Accra, GHANA	GH
4	DALO, Danish Defence Acquisition & Logistics Organization, Box 220, Arsenalvej 55, 9800 Hjorring, DK	KDK
5	DHL Express Benelux Terminalweg 36 3821 AJ AMERSFOORT, NL	VGL
6	DHL Freight GmbH, c/o Deutsche Post AG, Finance Operations, SSC Accounting, 44113 Dortmund, DE	ND
7	DOD-DLIS, Department of Defense - Defence Logistics Information Service, 74 Washington Avenue N 7 BATTLE CREEK, MI 49037-3054 USA	LD
8	Dun & Bradstreet 103 JFK Parkway Short Hills, NJ 07078, USA	UN
9	Federal State Unitary Enterprise “NIISU”, Sokolnichesky Val str. 37/10, 107113 Moscow, RUSSIA	VDS
10	GS1 AISBL, Avenue Louise 326, bte 10, BE 1050 Brussels, BELGIUM	0-9
11	ECRI Institute, 5200 Butler Pike Plymouth Meeting PA 19462-1298, USA	VEC
12	EDIFICE, Electronic Data Interchange for Companies with Interest in Computing and Electronics, Tiensestraat 2/12, B-3320 Hoegaarden, BELGIUM	LE
13	EHIBCC, Jozef Israelsplein 8, 2596 AS DEN HAAG, NL	LH
14	Eurodata Council, Koesener Str. 85, 06618 Naumburg, DE	QC
15	FIATA, International Federation of Freight Forwarders Ass. Schaffhauserstr. 104, 8152 Glattbrugg, CH	LF
16	Försvarets Materielverk (Swedish Defence Materiel Administration), Myndighetsuppgifter / MS 520, Försvarsstandardisering, 11588 Stockholm, SE	KSE
17	GTF, Group of Terrestrial Freight Forwarders, 50, rue de Châteaudun, 75009 PARIS, FRANCE	VGT
18	Health Industry Business Communications Council 2525 East Arizona Biltmore, Phoenix, AZ 85016 USA	RH
19	IBM Deutschland Management & Business Support GmbH Wilhelm-Fay-Str. 32, D-65936 Frankfurt, DE	VIB
20	ICCBBA, International Council for Commonality in Blood Bank Automation Inc. P.O. Box 11309, San Bernandino, CA, 92423-1309, USA	LI
21	IFA, Informationsstelle für Arzneimittel GmbH, Hamburger Allee 26-28, 60486 Frankfurt am Main, DE	PP
22	JIPDEC, Japan Information processing Development Corporation / Electronic Commerce Promotion Center, Roppongi First Building 9-9 Roppongi 1-chome, Minato-ku TOKYO, 106-0032, JAPAN	LA
23	KIDL, Korea Institute of Distribution and Logistics, 17F KCCI Bldg. 45 Namdaemunno 4-Ga Jung-Gu SEOUL 100-743, KOREA	KKR
24	Ministerie van Defensie, Commando Diensten Centra IVENT Dienstverlening Postbus 90004, 3509 AA UTRECHT, NL	KNL
25	NSPA (Nato Support Agency), 11, Rue de La Gare L-8302 CAPELLEN G.D., LUXEMBOURG	D
26	Odette International Limited, 71 Great Peter Street LONDON SW1P 2BN, UK	OD
27	Post NL, Prinses Beatrixlaan 23 2595 AK 's-GRAVENHAGE, NL	NL
28	Namsa, 11, Rue de la Gare, 8302 Capellen, G.D., LUXEMBOURG	VNA
29	SIEMENS AG, Industry Automation Division I IA IT D SR, Gleiwitzer Str. 555, 90475 Nürnberg, DE	SI
30	Siemens Enterprise Communications GmbH & Co. KG, Hofmannstr. 51, 81379 MUNCHEN, DE	VEG
31	TCJ5/4-I, United States Transportation Command, 508 Scott Drive, Scott AFB IL 62225-5357, USA	KUS
32	Telcordia Technologies, Inc. 1 Telcordia Drive RRC-6C137 PISCATAWAY, NJ 08854-4151, USA	LB
33	Telefonaktiebolaget LM Ericsson Torshamnsgatan 23 Kista SE-16483 STOCKHOLM, SWEDEN	LM
34	Xifrat Daten AG Poststrasse 6 6300 ZUG, SWITZERLAND	RG

Link to the “Register for Issuing Agencies” may change due to transfer to Registration Authority from NEN to AIM.
The NEN link to the REGISTER:
http://www.nen.nl/Normontwikkeling/Certificatieschemas-en-keurmerken/Schemabeheer/ISOIEC-15459.htm
type “REGISTER” to get the list

Annex 5) Selection of AIDC Standards

Documents of ISO/IEC JTC 1/SC 31/WG 1 Optically Readable Media (ORM)
ISO/IEC 15417 Code 128
ISO/IEC 16022 Data Matrix
ISO/IEC 18004 QR Code
ISO/IEC 15415 Bar code symbol print quality test specification-Two-dimensional symbols
ISO/IEC 15416 Bar code symbol print quality test specification-Linear symbols
ISO/IEC CD 30116 OCR Quality Testing
Documents of ISO/IEC JTC 1/SC 31/WG 2 Data Structure“
ISO/IEC 15418 GS1 Application Identifiers and ASC Data Identifiers
ISO/IEC 15459 Unique Identification, Part 1 to 6
ISO/IEC 29162 Guidelines for using ADC Media (Barcode & RFID)
Documents of ISO/IEC JTC 1/SC 31/WG 4 RFID for Item Management
ISO/IEC 18000-1 REV 1 (including Battery Assistants, Sensor functions)
ISO/IEC 18000-2 AMD 1 (including Battery Assistants, Sensor functions)
ISO/IEC 18000-6, part 61 to 64, rev. 2 (incl. Battery Assistants, Sensor functions)
ISO/IEC 18000-7 REV 1 (including Battery Assistants, Sensor functions)
ISO/IEC 15963 Tag ID: applied with the list of IC manufacturer ID‘s
ISO/IEC 29160 RFID Emblem
Documents of ISO/IEC JTC 1/SC 31WG 4/SG 1 RFID Data Protocol
24791-Part 1 to 6 Software System Infrastructure (SSI)
ISO/IEC 24753: RFID & Sensors with reference to IEEE 1451.7
ISO/IEC 15961, 15962: RFID Data protocol – Update
ISO/IEC 15961-4: Sensor commands (NP)
Documents of ISO/IEC JTC 1/SC 31WG 5 MIIM
ISO/IEC 29172-19179 Mobile item identification and management
ISO/IEC 29143 Air Interface Specification for Mobile Interrogators
Documents of ISO/IEC JTC 1/SC 31WG 7 Security on Item Management
ISO/IEC 29167 Air Interface for file management and security services for RFID
ISO/IEC 29167 part 10-19 crypto suites
Documents of the Liaison ISO TC122/WG 10 for BC&RFID applications
ISO 22742 Linear bar code and two-dimensional symbols for product packaging
ISO 28219 Labeling and direct product marking with linear bar code and 2d- symbols
ISO 15394 Bar code and 2d- symbols for shipping, transport and receiving labels
ISO 17363 Supply chain applications of RFID – Freight containers + NP 18574 IoT
ISO 17364 Supply chain applications of RFID – Returnable transport items + NP 18576 IoT
ISO 17365 Supply chain applications of RFID – Transport units + NP 18577 IoT
ISO 17366 Supply chain applications of RFID – Product packaging +NP 18575 IoT
ISO 17367 Supply chain applications of RFID – Product tagging
Documents of the Liaison ISO/IEC JTC 1/WG 7 Sensor Networks (under work)
ISO/IEC CD 29182 Sensor Network Reference Architecture (SNRA), 7 parts
ISO/IEC WD 30101 Sensor Network and its Interfaces for Smart Grid System
ISO/IEC WD 30128 Generic Sensor Network Application Interface
DIN standards
DIN 66401 Unique Identification Mark – UIM
DIN 66401 System Identifiers
Other standards, application related
Global Transport Label V3, www.odette.org
Global Guideline for Returnable Transport Item Identification, www.aiag.org
GS1 Global Specifications, www.gs1.com
HIBC Health Industry Bar Code, www.hibc.de
PaperEDI Standard, www.eurodatacouncil.org
Set Label Standard, www.edifice.org (June 2011)

Note 1: ISO, CEN and DIN standards are available via www.din.de or other ISO or national bodies
Note 2: For more information please contact the author or DIN NA 043-01-31

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EDIFICE – Electronic Industries, Europe, USA, Asia, www.edifice.org
EHIBCC – European Health Industry Business Communication Council, www.ehibcc.com
DIN NA 043-01-31 – Normalization Institute Germany, www.din.de
JTCH AIDC – Joined Technical Committee Healthcare AIDC, www.vddi.de

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Fig. 14) A snapshot of the ISO/IEC JTC1/SC 31 meeting with NEN in Delft

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