

# Medical Information Bus

Andreas Schleifer

Seminar Kommunikationsstandards in  
der Medizintechnik

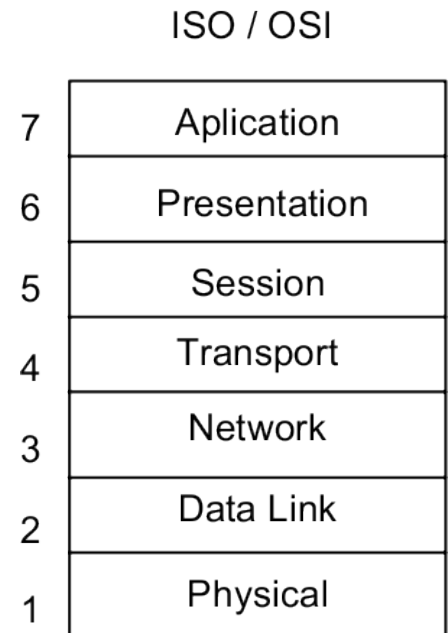
29.06.2010



- What is the Medical Information Bus / ISO/IEEE 11073
- Development Timeline of ANSI/IEEE 1073
- Development Timeline of ISO/IEEE 11073
- Content of ISO/IEEE 11073
- Why isn't it widely used?

# What is the MIB / ISO/IEEE 11073

- At the beginning:
  - Medical Information Bus was a standard for connectivity between medical devices
- Today:
  - Medical Information Bus is part of the ISO/IEEE 11073
  - ISO/IEEE 11073 is a standard for communication and interaction between medical devices of different vendors
  - Modeled after the OSI layer model
  - Synonym: X73 family



Source: [1]

# Development Timeline of ANSI/IEEE 1073

- 1982 – Professionals from leading medical institutions define requirements for acute care data communications
- 1984 – Formation of the IEEE 1073 MIB committee
- 1994 – ANSI/IEEE 1073.3.1 (Transport Profile) and ANSI/IEEE 1073.4.1 (Physical Layer) approved by IEEE
- 1995 – ANSI/IEEE 1073.2 (Medical Device Application Profile (MDAP) Framework and Overview) approved by IEEE
- 1996 – ANSI/IEEE 1073 (Medical Device Communications Framework and Overview) approved by IEEE

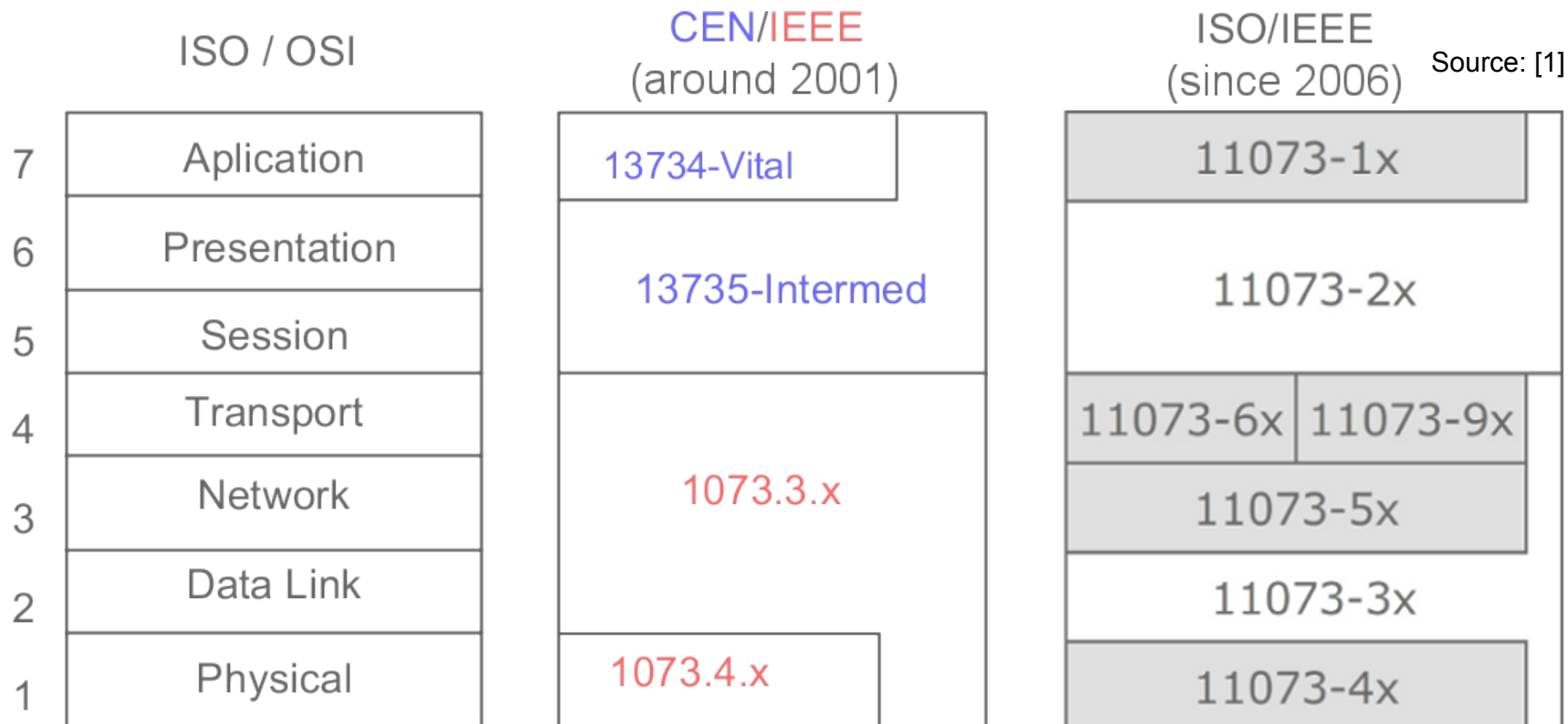
- Substandards have been approved through the last 15 years

	ISO / OSI	ANSI/IEEE 1073
7	Application	1073.1.x
6	Presentation	1073.2.x
5	Session	
4	Transport	1073.3.x
3	Network	
2	Data Link	
1	Physical	1073.4.x

Source: [1]

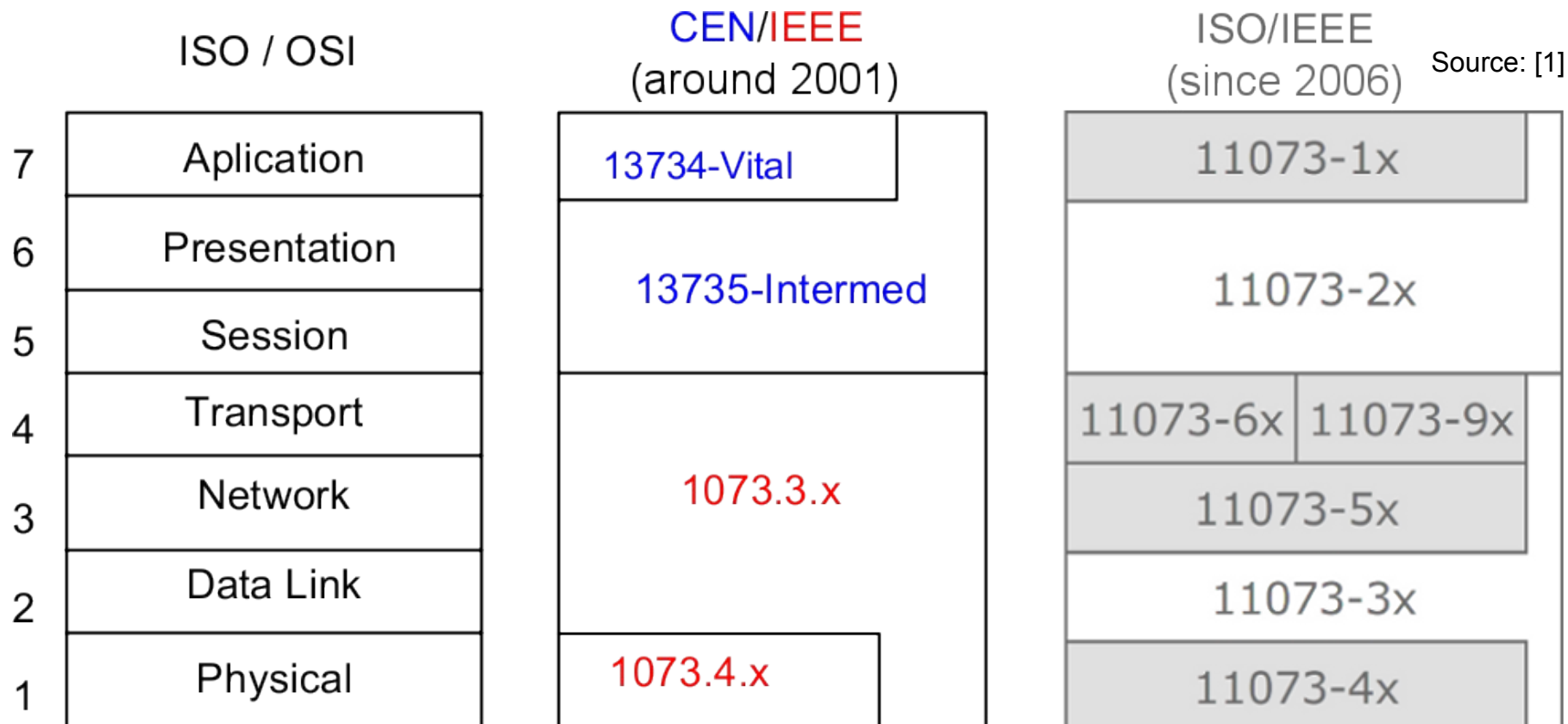
# Development Timeline of ISO/IEEE 11073

- 2000/2001 – IEEE and ISO start to work together on a standard for device connectivity and interaction; CEN later joined this group
- Around 2001 – ENV 13734 (VITAL), ENV 13735 (INTERMED), 1073.3, 1073.4 are absorbed and integrated into the X73 family
- 2006 – naming unified to ISO naming norms



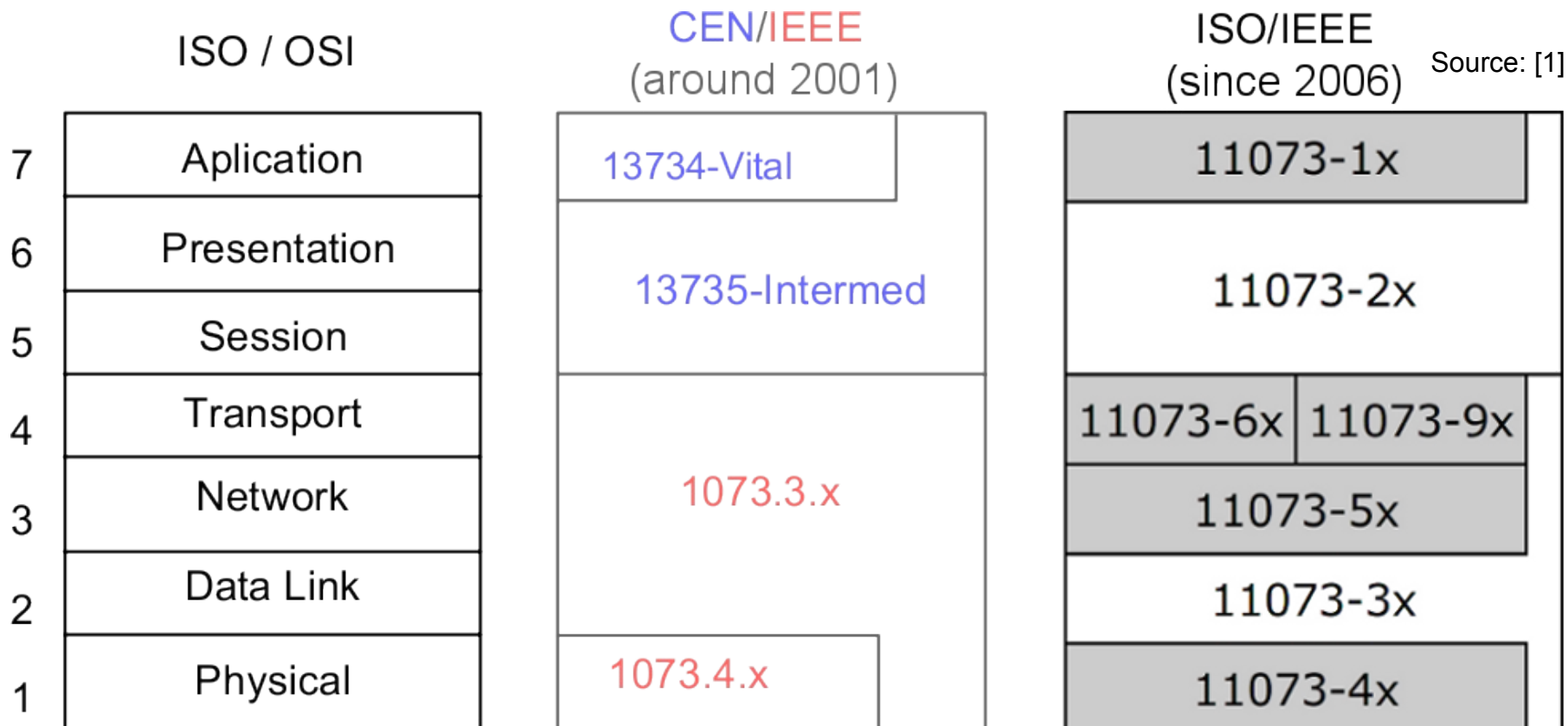
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# X73-1xxxx – Medical Device Data Language

- Defines the Medical Device Data Language (MDDL)
- MDDL is based on the Domain Information Model (DIM)
- DIM also defined in this section
- 11073-103xx defines specializations for concrete devices
- Examples:
  - *Infusion device (withdrawn)*
  - Vital signs monitor
  - *Ventilator (withdrawn)*
  - Pulse oximeter
  - Defibrillator
  - ECG

7	11073-1x	
6	11073-2x	
5		
4	11073-6x	11073-9x
3	11073-5x	
2	11073-3x	
1	11073-4x	



# 10101: MDDL – Nomenclature

- Defines the syntax for messages between medical devices and computers
- Defines the codification of messages (unique code as name)
- Contains terms, description and codes; e.g. for:
  - Units of measurement
  - Medical devices and device systems
  - Alerts

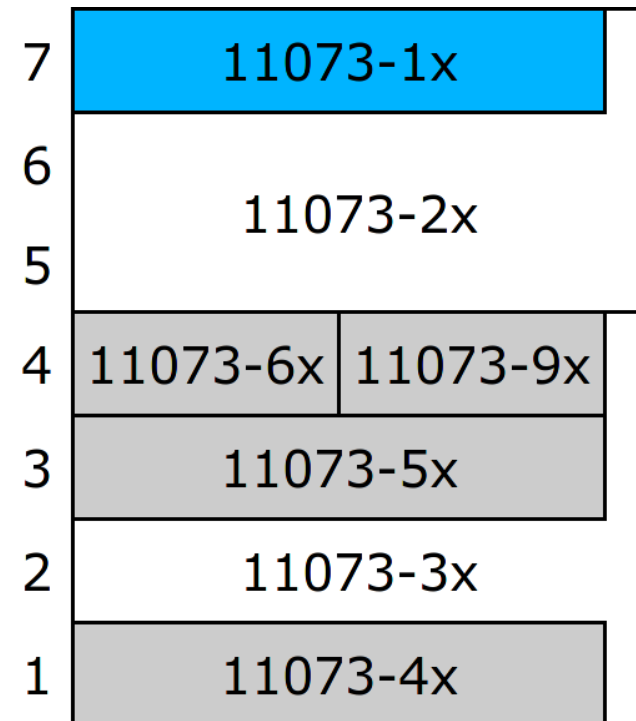
Code	Reference	Description
150324	MDC_SAT_O2_ART	Arterial oxygen saturation
150302	MDC_PRESS_CUFF_DIA	Non-invasive diastolic blood pressure
150303	MDC_PRESS_CUFF_MEAN	Non-invasive mean blood pressure
150301	MDC_PRESS_CUFF_SYS	Non-invasive systolic blood pressure
149546	MDC_PULS_RATE_NON_INV	Pulse rate
147842	MDC_ECG_HEART_RATE	Heart rate
28716	MDC_CONC_GLU_ART	Glucose Concentration in arterial blood
28868	MDC_CONC_GLU_PLASMA	Plasma Glucose Concentration
28948	MDC_CONC_GLU_GEN	Glucose Concentration in general

7	11073-1x	
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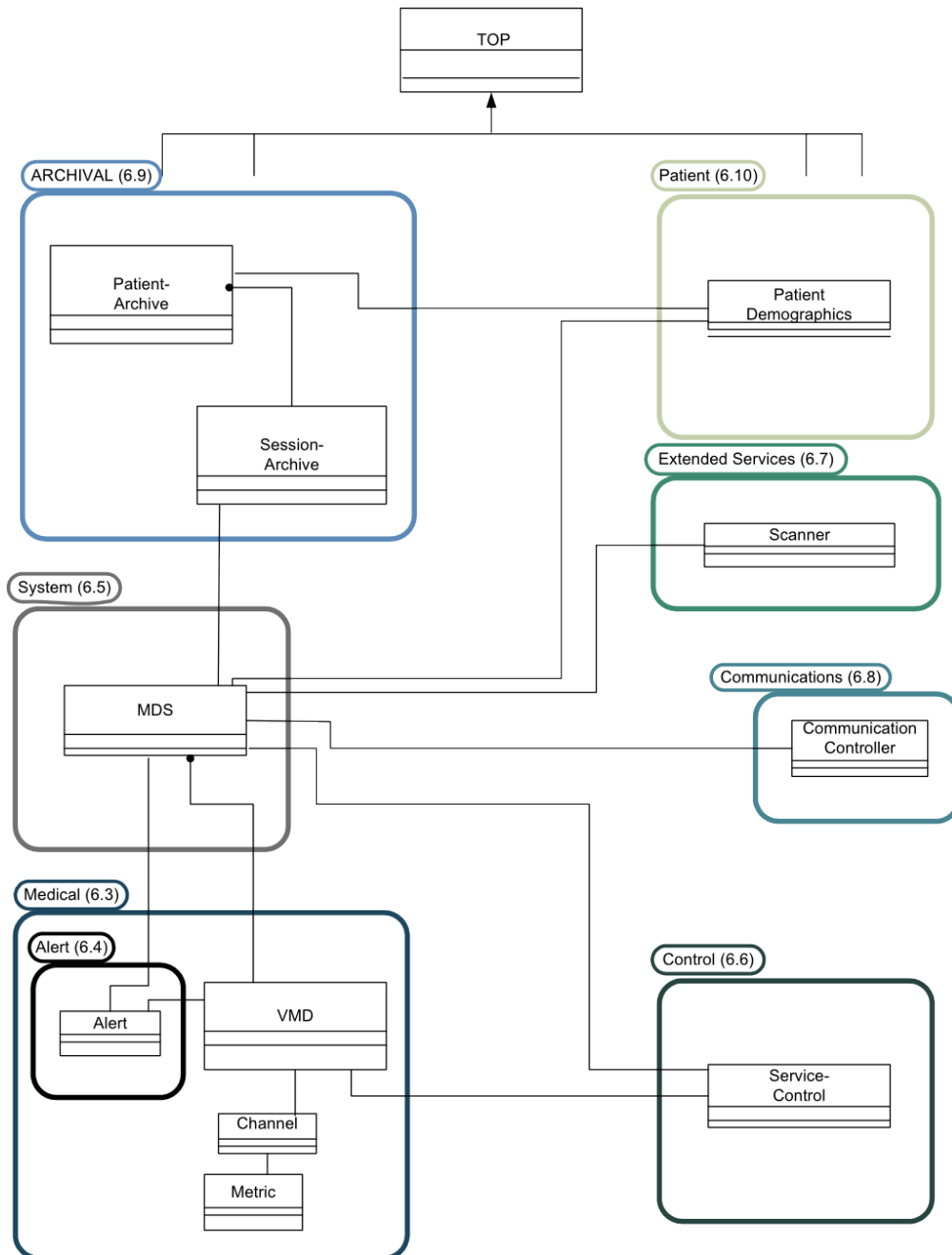


# 10201: Domain Information Model

- An object-oriented model which provides abstract representation of real world entities
- Consists of two parts:
  - Static Model
  - Dynamic Model



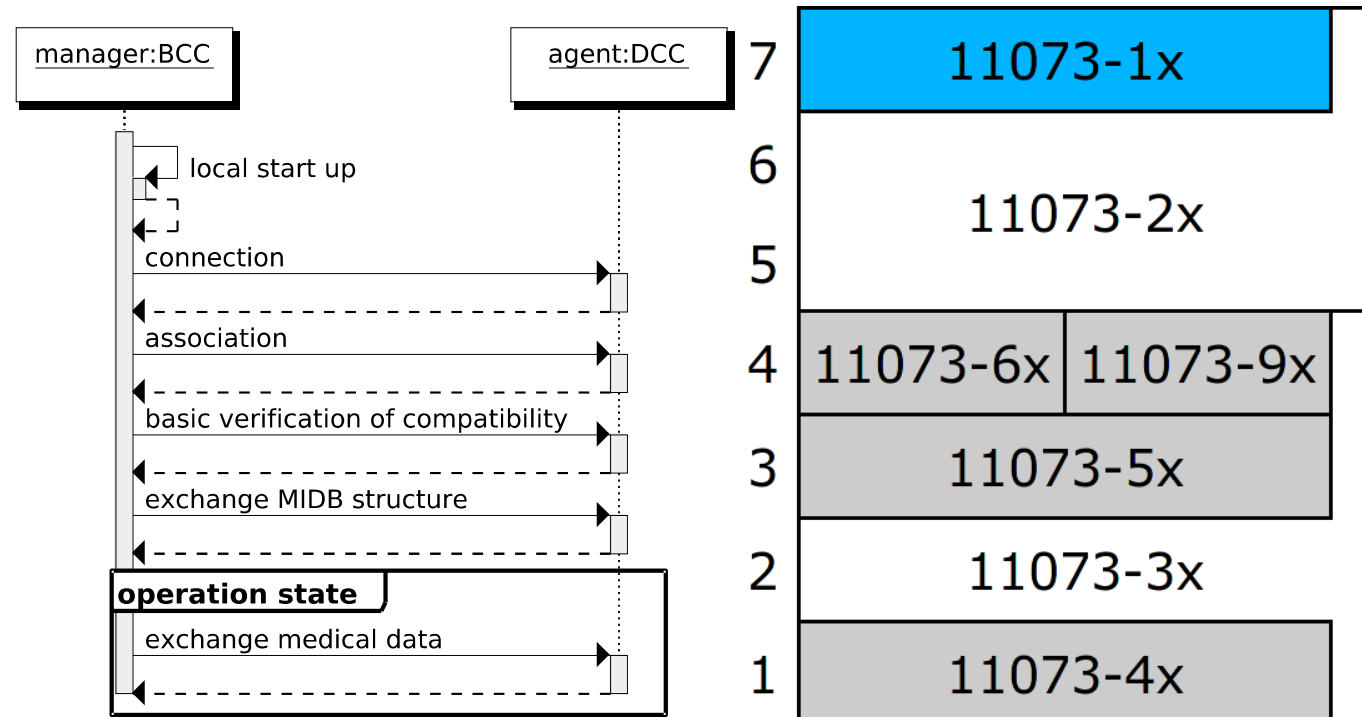
# 10201: DIM – Static Model



Source: [1]

7	11073-1x	
6	11073-2x	
5		
4	11073-6x	11073-9x
3	11073-5x	
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- Provides a communication services model based on ISO agent-manager concept
  - Agent has a Device Communication Controller (DCC)
  - Manager has a Bedside Communication Controller (BCC)
- Four steps needed for two devices to work together:
  1. Connection
  2. Association
  3. Configuration
  4. Operation



# 103xx – Virtual Medical Device (VMD)

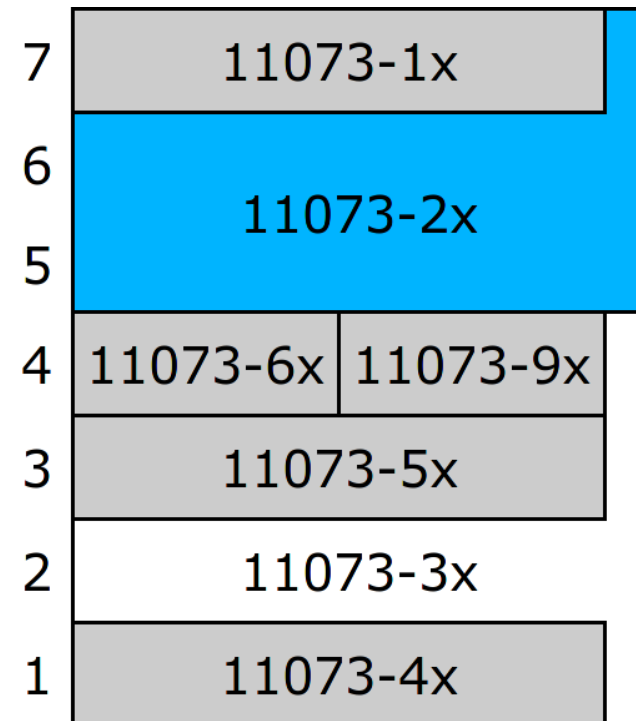
- Collection of specializations for concrete devices
- Some documents have been withdrawn at the moment
- Example for infusion pump

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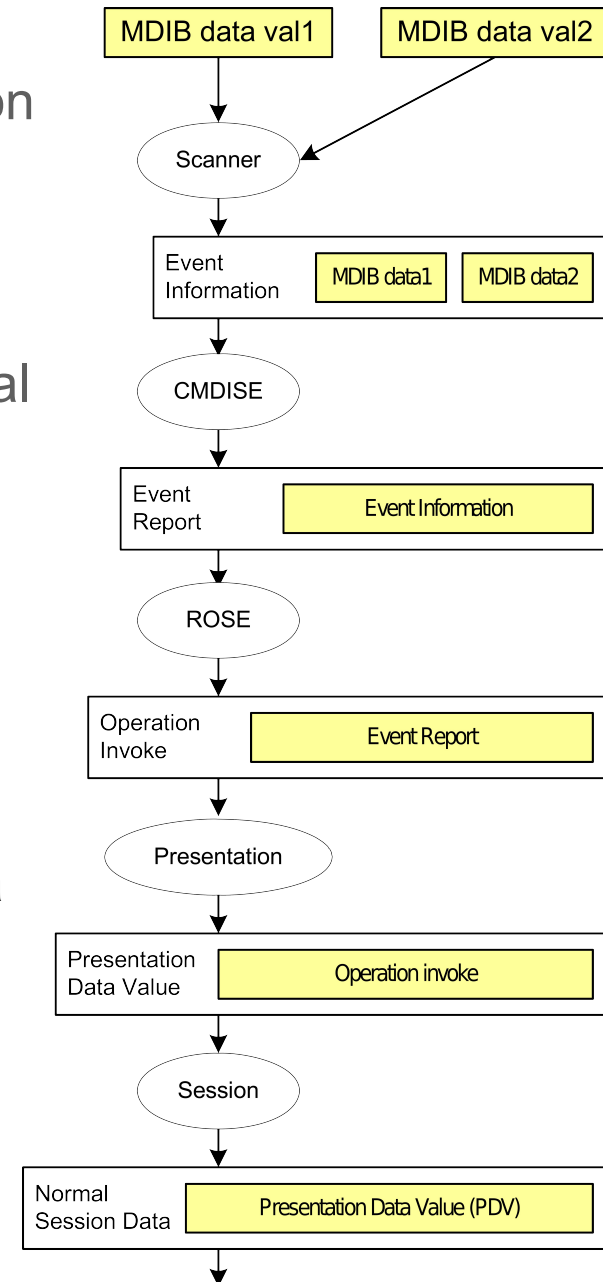
- <DIM xsi:schemaLocation="http://www.nist.X73.gov C:\CS\xsd\DIM.xsd">
- <Simple_MDS>
  <OBJECT_NAME Label="">Simple_MDS</OBJECT_NAME>
  <OBJECT_ID>MDC_MOC_VMS_MDS_SIMP</OBJECT_ID>
  <TERM_CODE>37</TERM_CODE>
  <Reference>clause 7.5.3</Reference>
  <MOC_RESTRICTIONS/>
  <MOC_APPLICATION_GUIDANCE/>
  <MOC_SERVICES_SUPPORTED/>
  <MOC_COMMENT/>
+ <Attribute_Info></Attribute_Info>
+ <Notification_Info></Notification_Info>
- <VMD>
  <OBJECT_NAME Label="">VMD</OBJECT_NAME>
  <OBJECT_ID>MDC_MOC_VMO_VMD</OBJECT_ID>
  <TERM_CODE>2</TERM_CODE>
  <Reference>clause 7.3.2</Reference>
  <MOC_RESTRICTIONS/>
  <MOC_APPLICATION_GUIDANCE/>
  <MOC_SERVICES_SUPPORTED/>
  <MOC_COMMENT/>
+ <Attribute_Info></Attribute_Info>
+ <Notification_Info></Notification_Info>
+ <Channel></Channel>
+ <Channel></Channel>
</VMD>
</Simple_MDS>
</DIM>

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- Defines the Medical Device Application Profiles (MDAP)
- Achieve Medical Device Communication data exchange based on MDDL
- Supports a large range of current and future medical devices

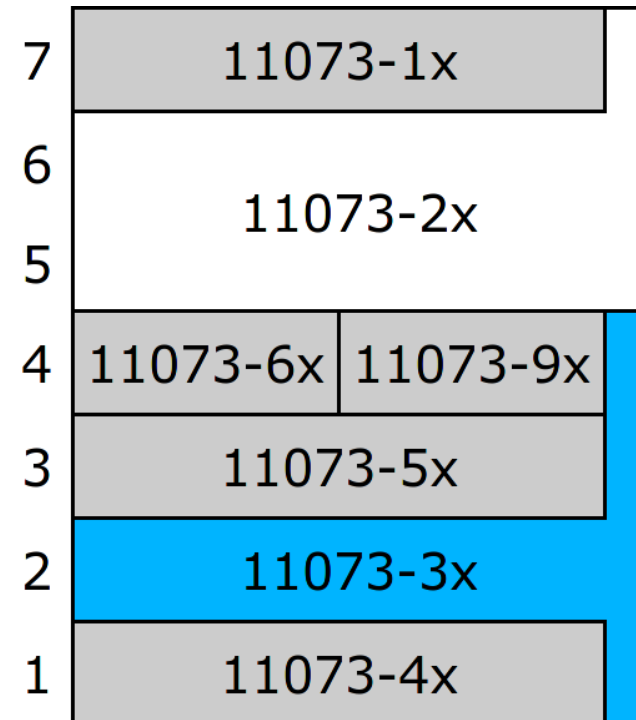


- Defines the three higher layers for communication between medical devices (i.e. exchange of data defined with MDDL)
- Provides collection of services to communicate information as MDDL messages between medical devices and between BCC and DCC
- The following is covered in the subsections:
  - Basic encoding
  - Abstract syntax for messages sent from device to host
  - Services for the host to request information from a device
- In each layer a header is added to a message



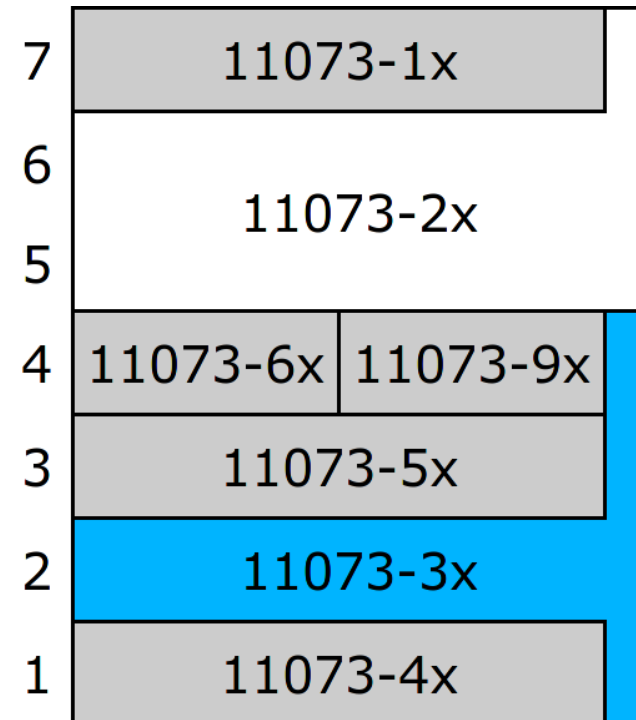
# ISO/IEEE 11073-3xxxx

- Specifies protocols and services for the connections and transport messages
- Uses existing international standards where possible, e.g.:
  - Infrared standards
  - Bluetooth standards
  - TCP/IP
- Establishes implementation of the transport and physical profiles
- Available transport standards:
  - Wired (IrDA-Based) [11073-30200]
  - Infrared (IrDA-Based) [11073-30300]
- Under development:
  - IP-Based [11073-30400]
  - RF WLAN (802.11x) [11073-30501]
  - wPAN (Bluetooth) [11073-30502]
  - Zigbee (802.15.4) [11073-30505]



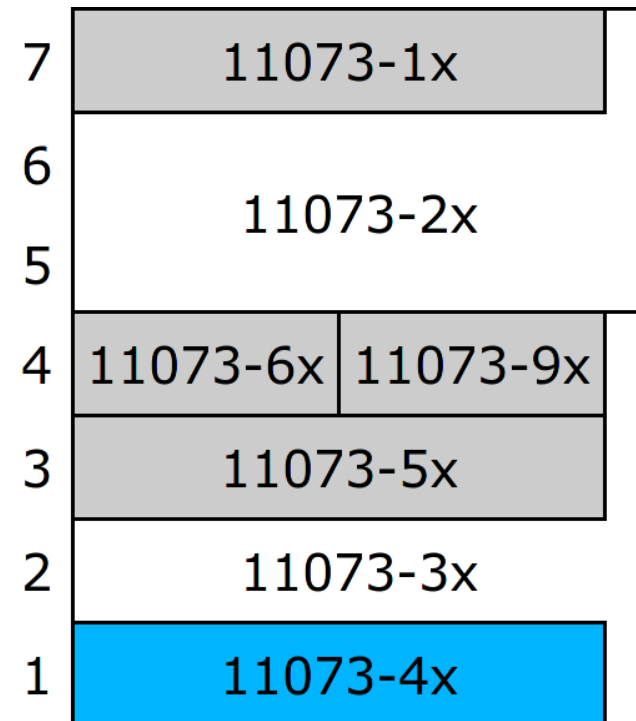


- Specifies the protocols and services for communications and transport messages using infrared connectivity
- Tries to provide connection oriented communication, services and protocols consisting of IrDA specifications
- Uses short-range infrared in the physical layer
- Maximum speed: 4 Mb/s
- Extends and complements 11073-30200 (IrDA cable connected)
- Defines:
  - Physical layer (power, transmission rates, parameters, ...)
  - Connection layer (negotiation, discovery, connection, ...)
  - Network layer
  - Transport layer
  - Time synchronisation
  - Cable to infrared adapters



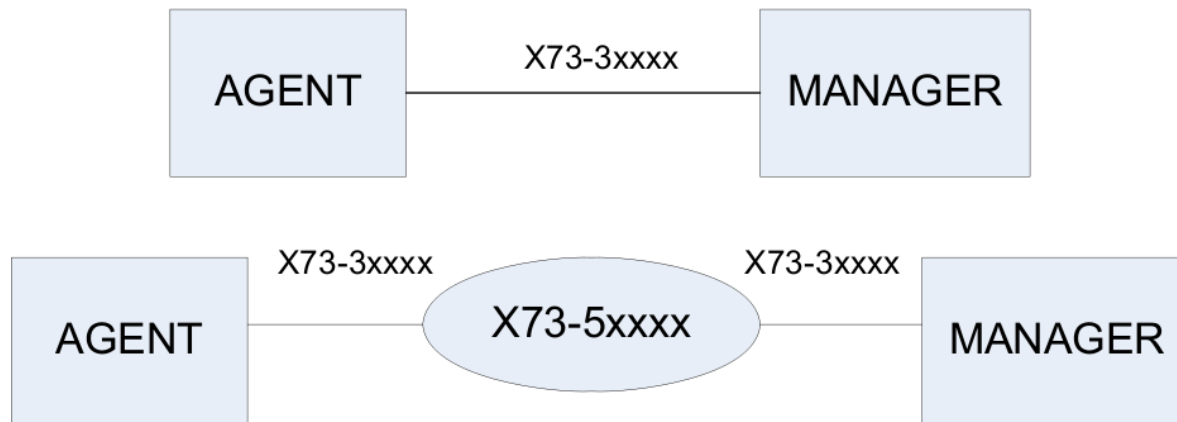
# ISO/IEEE 11073-4xxxx

- Defines the Physical Layer Interface Profiles
- Specifies services and protocols required by the physical layer
- Also a physical interface for interconnection of computers and medical devices via cable
  - Highly robust
  - Specifies physical and electrical characteristics of connector and signal
- It also includes:
  - Capabilities of the BCC and DCC
  - Service specifications
  - Operation modes
  - Electrical connection specifications
  - Specifications of connectors and cables



# ISO/IEEE 11073-5xxxx

- Refers to the interconnection support between networks
- Examples:
  - Several LANs of medical devices interconnected
  - Interconnection in a hybrid network (one cable one wireless)



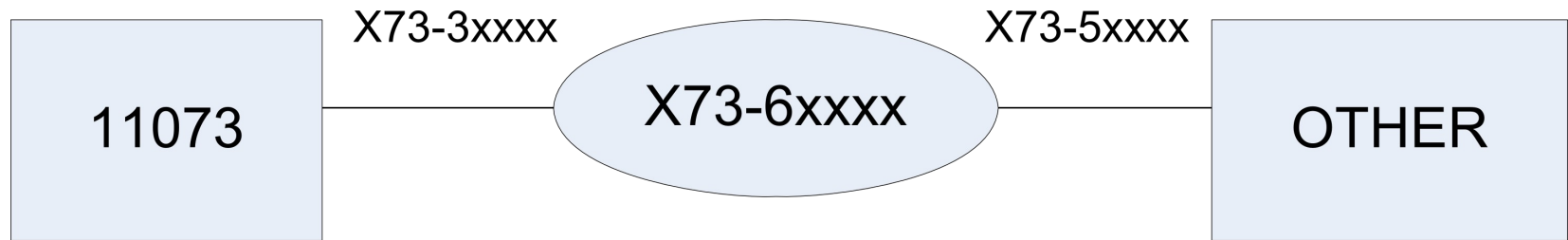
*Example of a manager-agent connection*

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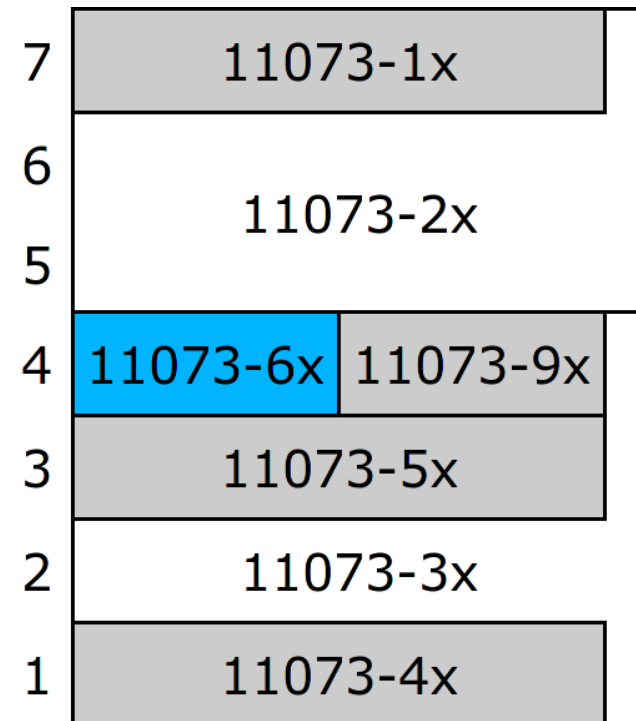
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# ISO/IEEE 11073-6xxxx

- Provides interoperability between different application-layer protocols
- Provides bidirectional transparency

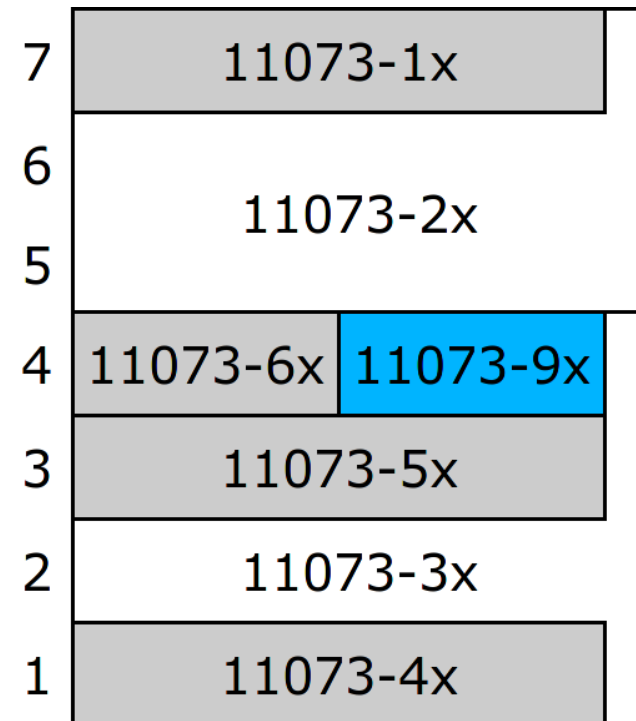


- Example:
  - Gateway between HL7 and X73



# ISO/IEEE 11073-9xxxx

- Related with POCT1-A (PoC multi-vendor connectivity)
- NCCLS POCT1-A:
  - Part 1: device interface: connection POCT device; transmission of data over established connections
  - Part 2: observation reporting interface: transfer of the data to the higher system
- Based on existing IEEE and HL7 standards and on specifications of the Connectivity Industry Consortium (CIC)
  - VITAL
  - POCT-1
- NCCLS POCT1-A2 published 2006 by CIC



- Part of the ISO/IEEE 11073 standard family but not of the Medical Information Bus
- Defines a communication standard for Personal Health Devices
- ISO/IEEE 11073-20601 framework; defines:
  - Generic data types
  - Message types
  - Communication model
- Support for different (small) Personal Health Devices
- Personal Health Devices defined in subsections 11073-104xx
- One subsection for each device



# Why isn't it widely used?

- Far too complex
- Many parts still under development, i.e.:
  - Virtual Medical Devices (11073-103xx)
  - Transport profiles (11073-3xxxx)
- No reference implementation
- Expensive to adapt medical devices

**Thank you for your attention.**

**Any questions?**



- [1] M. Galarraga, L. Serrano, I. Martinez Ruiz, P. de Toledo. "Review of the ISO/IEEE X73 - PoCMD C standard for medical device interoperability and its applicability in home and ambulatory telemonitoring scenarios".UPNA Press, pp.125-136 (ISSN: 978-1-59140-866-0). 1 cita. Septiembre. 2006.
- [2] [http://en.wikipedia.org/wiki/File:Continua\\_registered\\_logo.JPG](http://en.wikipedia.org/wiki/File:Continua_registered_logo.JPG)
- [3] <http://xw2k.nist.gov/medicaldevices/ICSGenerator/slides/HL7-x73-bocaraton-sep2006.ppt>