International Telecommunication Union

Interoperability & QoS Implications of ISO TC215 WG2.1

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Overview

- ISO TC215 Interoperability & QoS
- TC215 WG 2.1 X73 Standards
- QoS for Point-of-Care Medical Device Communication

ISO TC 215 Interoperability

- Interoperability : ability of two or more systems or components to exchange information and to use the information that has been exchanged.

  source : IEEE Standard Computer Dictionary : A Compilation of IEEE Standard Computer Glossaries, IEEE, 1990

- Functional interoperability

  Shared Architectures, Methods & Frameworks

- Semantic interoperability

  Shared data types, terminologies, codings

ISO TC 215 Interoperability

- WG 1: EHR architecture and modeling
- WG 2: Messaging architecture & methods
- WG 3: Terminology Methods
- WG 4: Shared security architecture
- WG 5: Shared health card framework

ISO TC 215 Interoperability

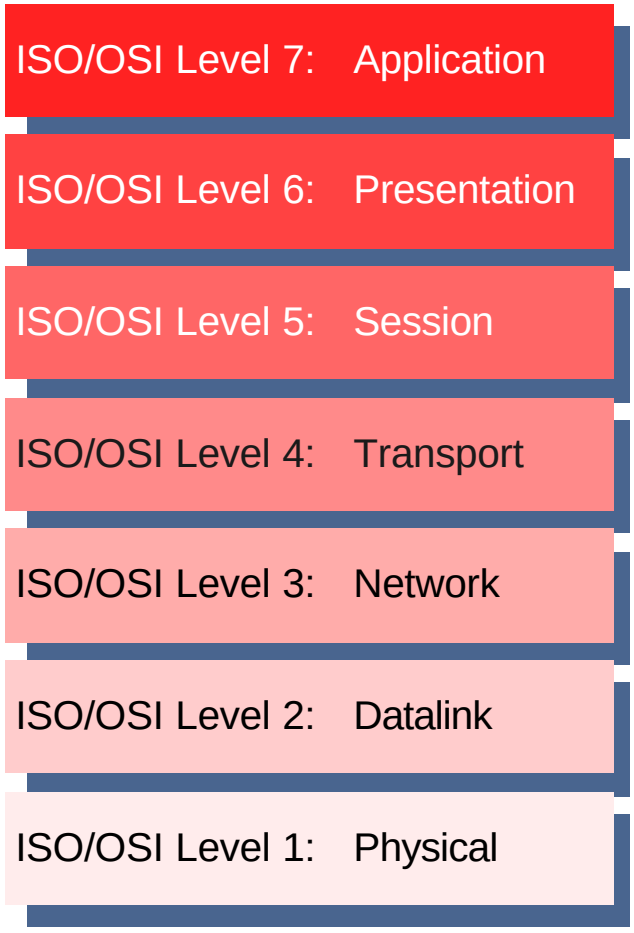
- For Quality of Service :

  WG 1 - Health indicators conceptual framework

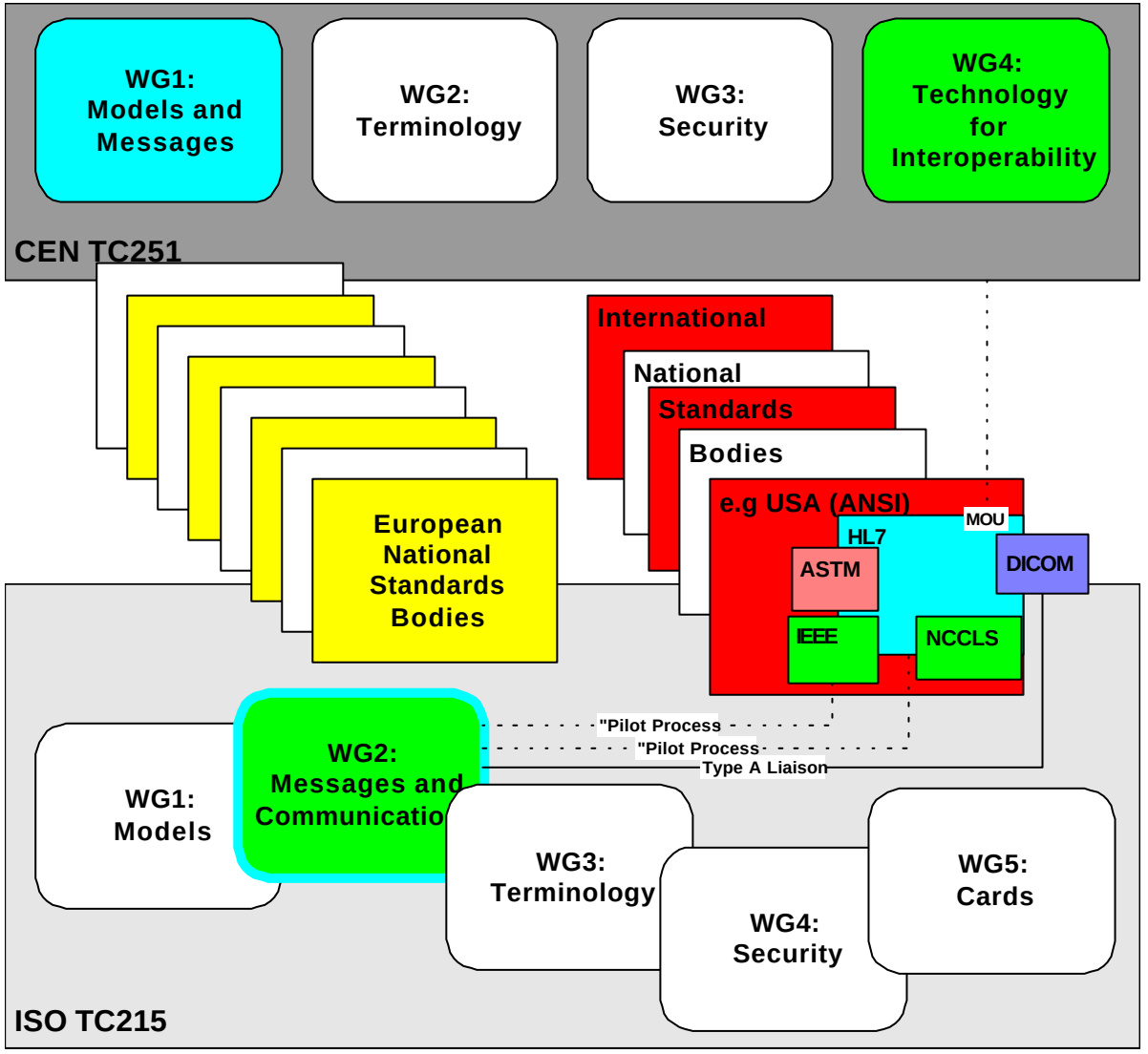
  WG 2 - Quality indicators for health information made available on the Internet

ISO TC215 Health Informatics

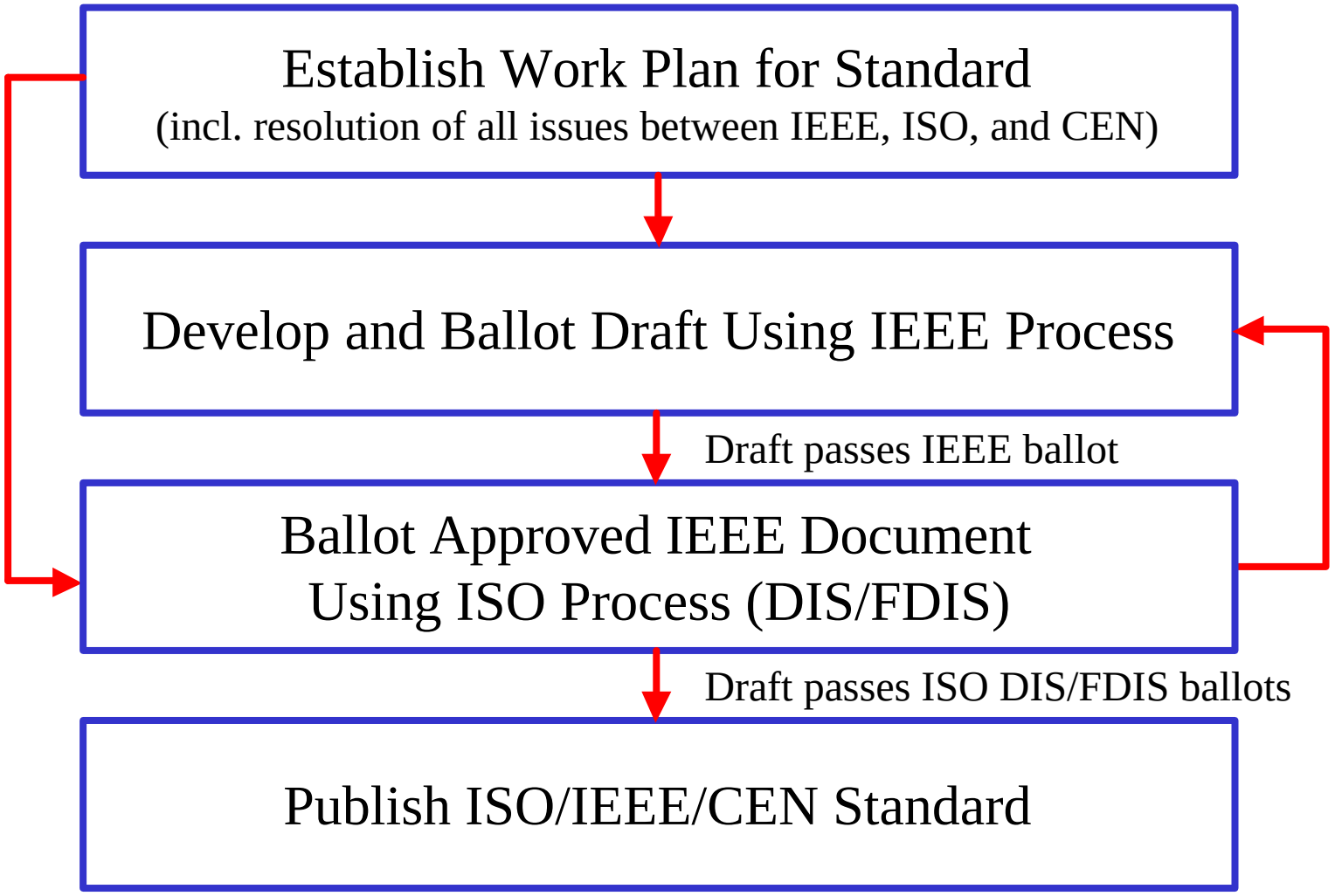
- Focus is primarily on Level 7 Interoperability
- Medical Device Communications covers all 7 layers.



ISO TC215 Health Informatics



ISO / IEEE / CEN X73 Process



ISO / IEEE 11073 Standards

X73 Charter:

- ***Provide real-time plug-n-play interoperability for patient-connected medical devices***
- ***Facilitate the efficient exchange of vital signs and medical device data, acquired at the point-of-care, in all health care environments***

…leveraging off-the-shelf technologies, scaling across a wide range of system complexities, and supporting commercially viable implementations.

ISO / IEEE 11073 Standards

Primary focus is on…

- ☞ ***Point-of-Care (POC)…***
- ☞ ***Medical Device…***
- ☞ ***Communications***

ISO/IEEE 11073 Health informatics –

Point-of-care medical device communications - …

ISO/IEEE 11073 Standards

X73's architecture ensures...

- True interoperability across all 7-layers:

  From the connector to the end application!

- QoS mechanisms designed to support the strong requirements placed on regulated medical devices

- Maintainability as communications technology and applications change

ISO/IEEE 11073 Standards

1073.1.x	Device Data & Services
1073.2.x	General Application Services
1073.3.x	Transport & Physical Layers
1073.5.x	Internetworking Support
1073.6.x	Application Gateways

ISO/IEEE 11073 Standards

1073.1.x | **Device Data & Services**

Medical Device Data Language (MDDL):

Semantics needed to communicate a device's application status and control information.

Consists of three main components:

- Nomenclature (1073.1.1.1)
- Domain Information Model (DIM) (1073.1.2.1)
- Device Specializations (1073.1.3.x)

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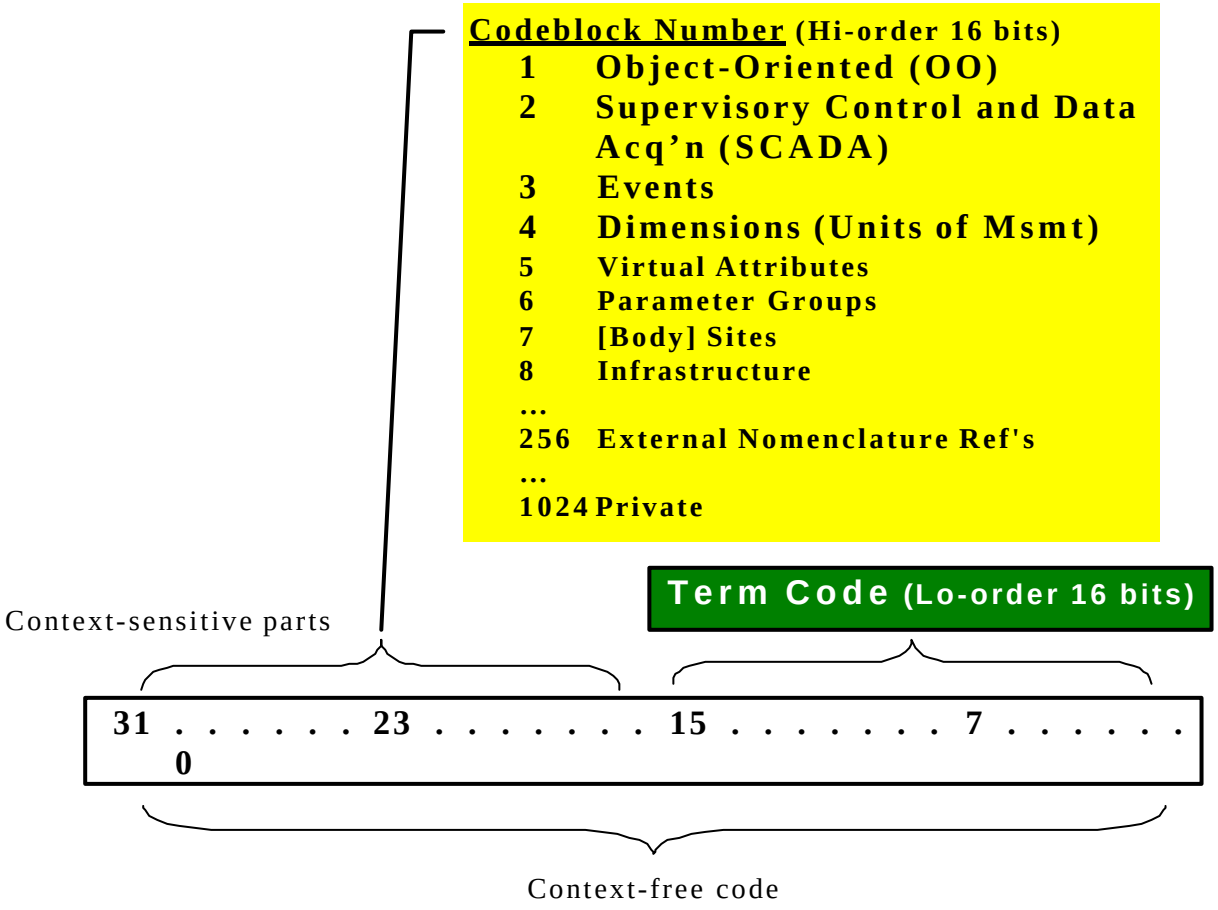
Nomenclature:

A set of numeric codes that identify every item that is communicated between systems.



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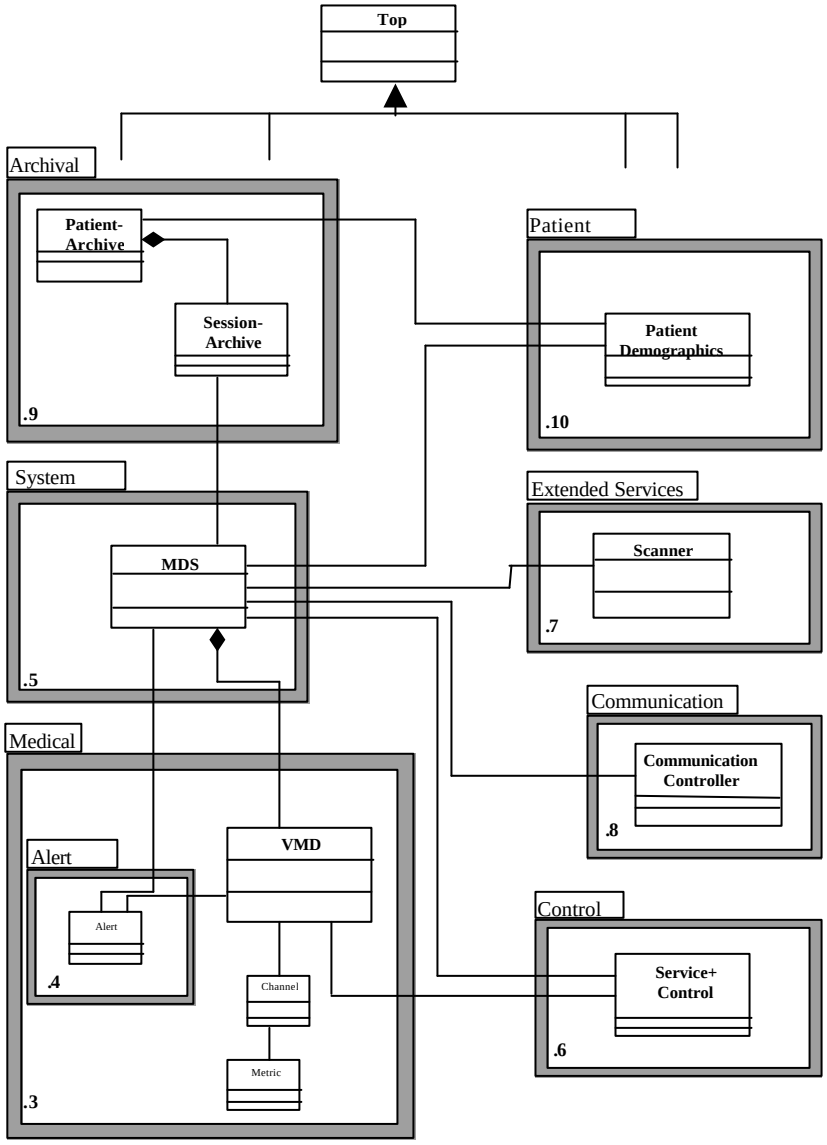
Domain Information Model:

An object oriented data model that specifies objects, attributes, attribute groups, event reports, and services that may be used to communicate device data and to control / configure the reporting of information.

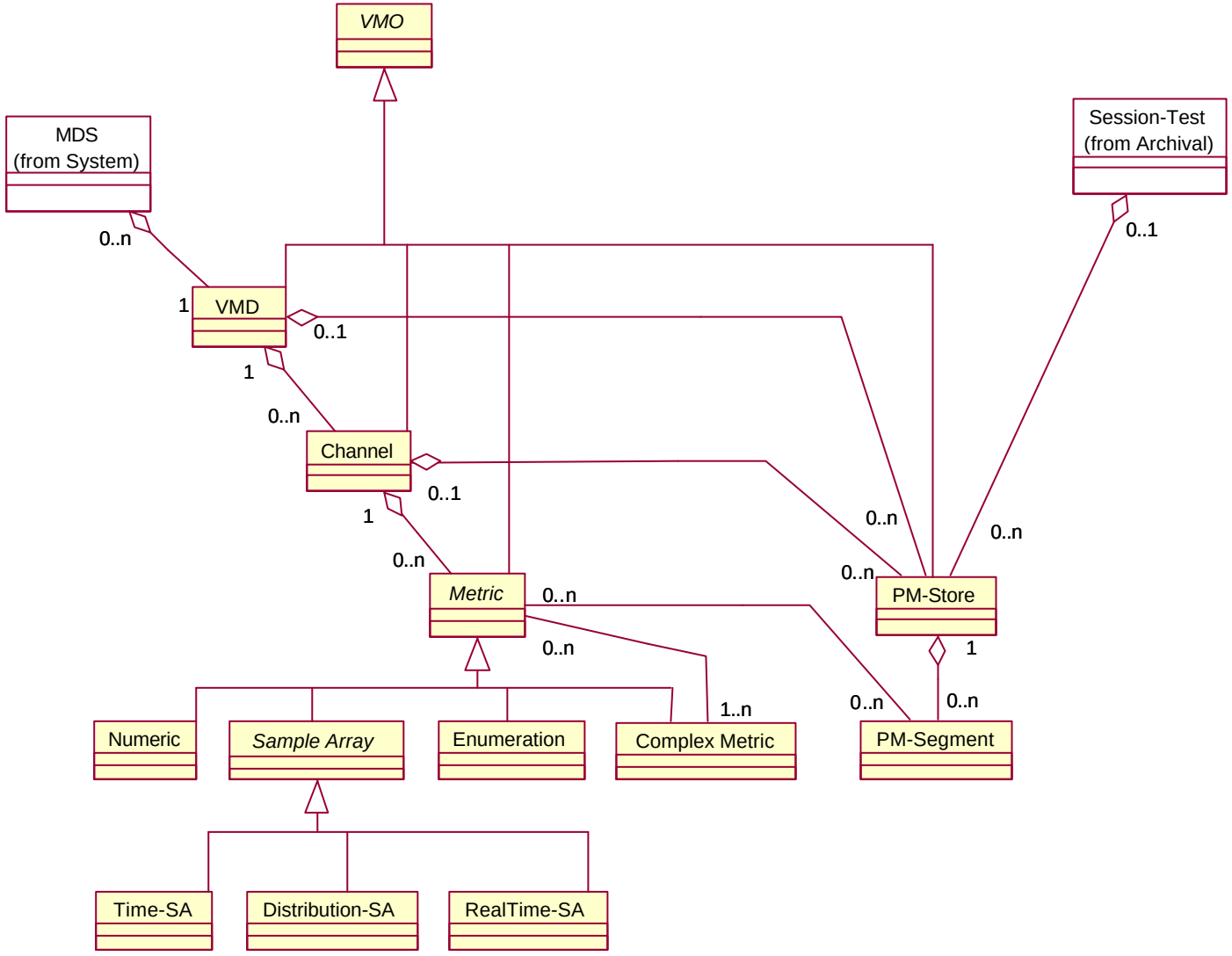
- ✓ Does not imply a specific implementation technology
- ✓ Objects include Medical Device System, Virtual Medical Device, Numeric, Enumeration, Real-Time Sample Array, Battery, Scanners, Alert Monitor, …

ISO/IEEE 11073 Standards

Domain Information Model Subject Areas



ISO / IEEE 11073 Standards



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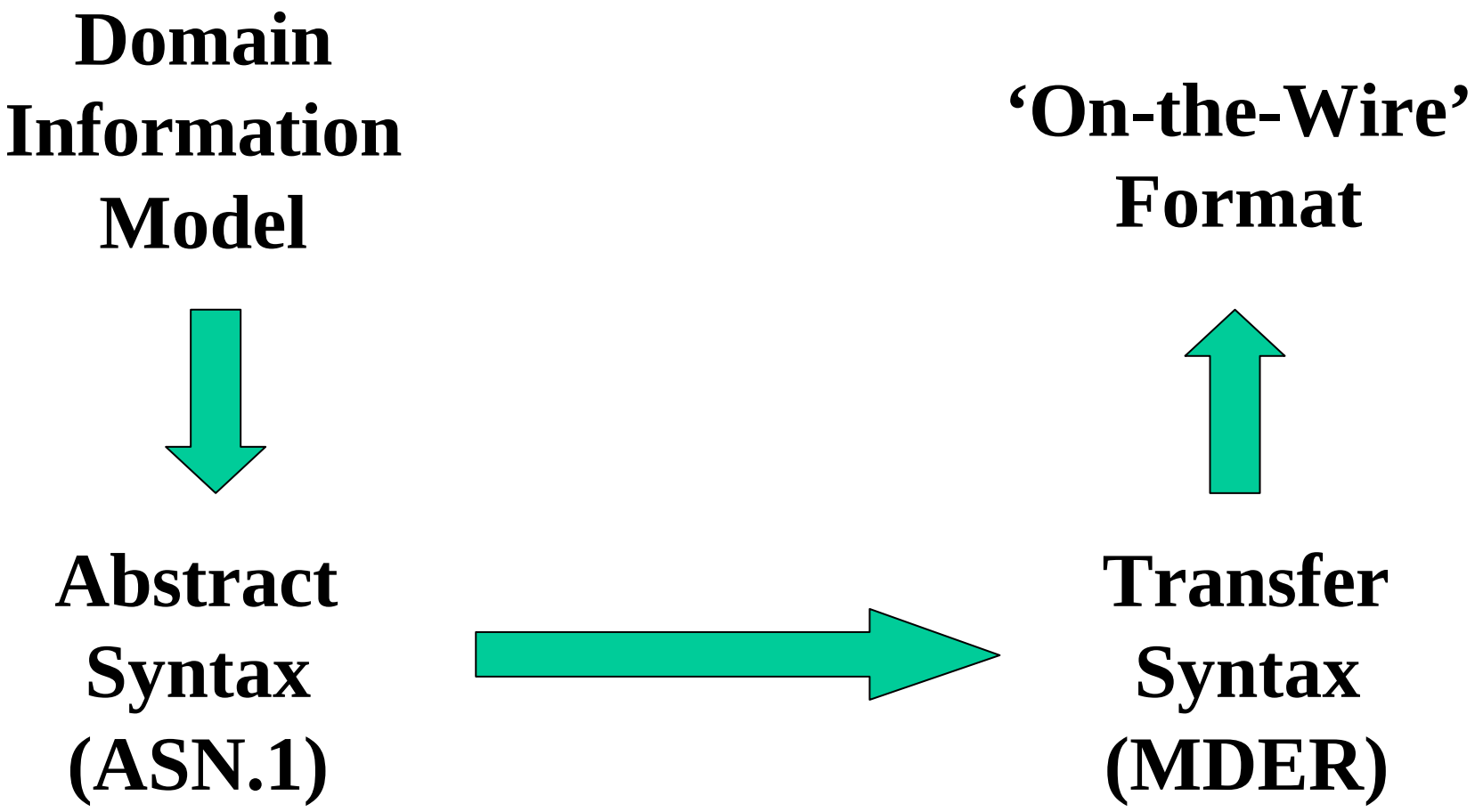
1073.2.x **General Application Services**

Generalized application profile standards …

- ✓ A generic (non-device specific) set of data and services needed to initiate, configure, and maintain communication.
- ✓ Connect ~ Disconnect, Create ~ Delete, Get ~ Set, Event Report, Invoke, etc.
- ✓ Standard Services: ACSE, ROSE, CMISE, ASN.1, MDER (based on BER+), Etc.
- ✓ Beginning work on XML & Web Services profile

ISO/IEEE 11073 Standards



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Generalized application profile standards ...

- ✓ Profiles:
  - Specific set of capabilities tailored for a class of communication needs / architectures
  - Limits the options that are available
  - Remaining options must be discovered and in some cases negotiated when a connection is made (enabling plug-n-play interoperability!)

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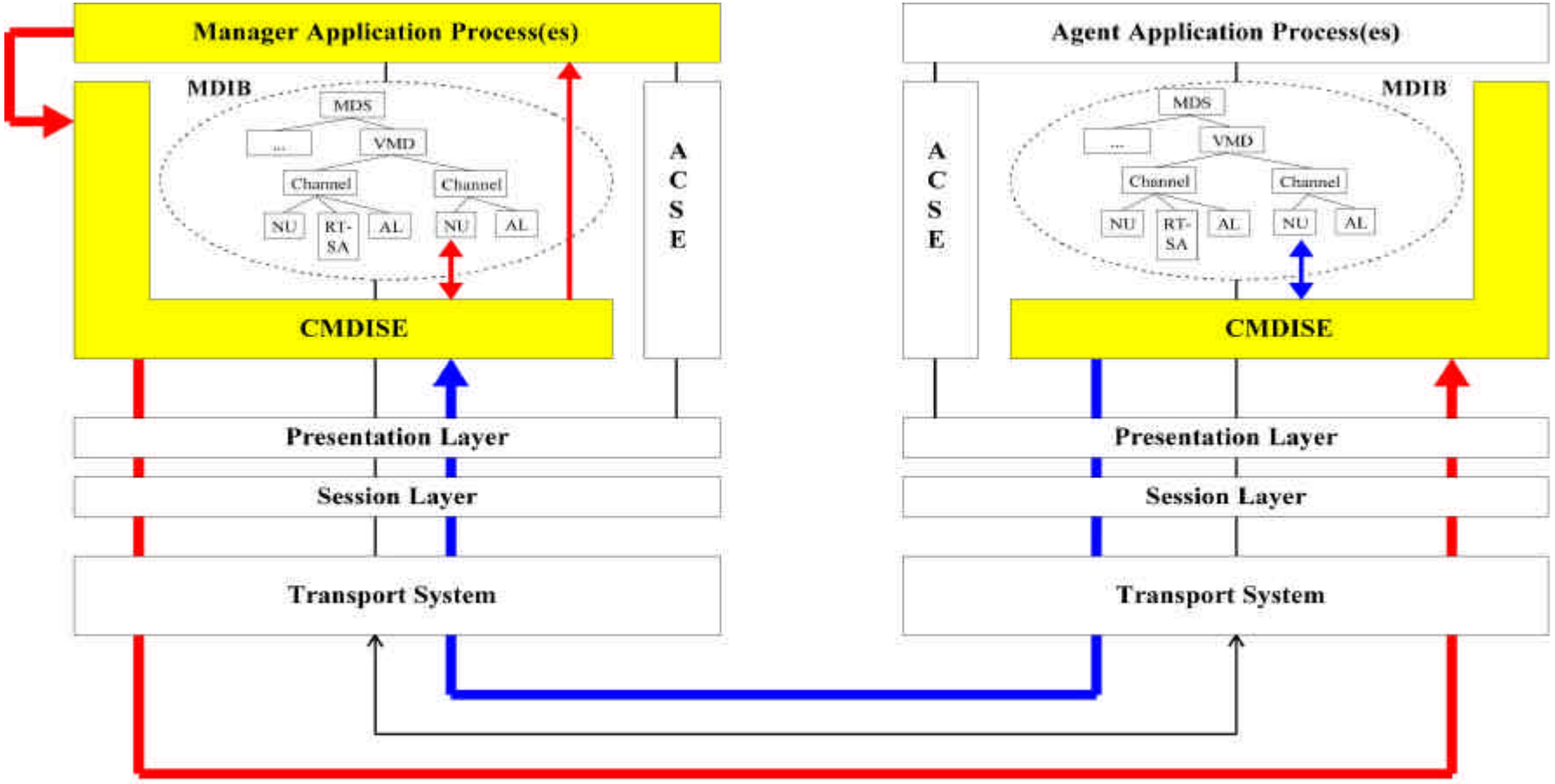

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1073.3.x | **Transport & Physical Layers**

Available (*point-to-point)* transport standards…

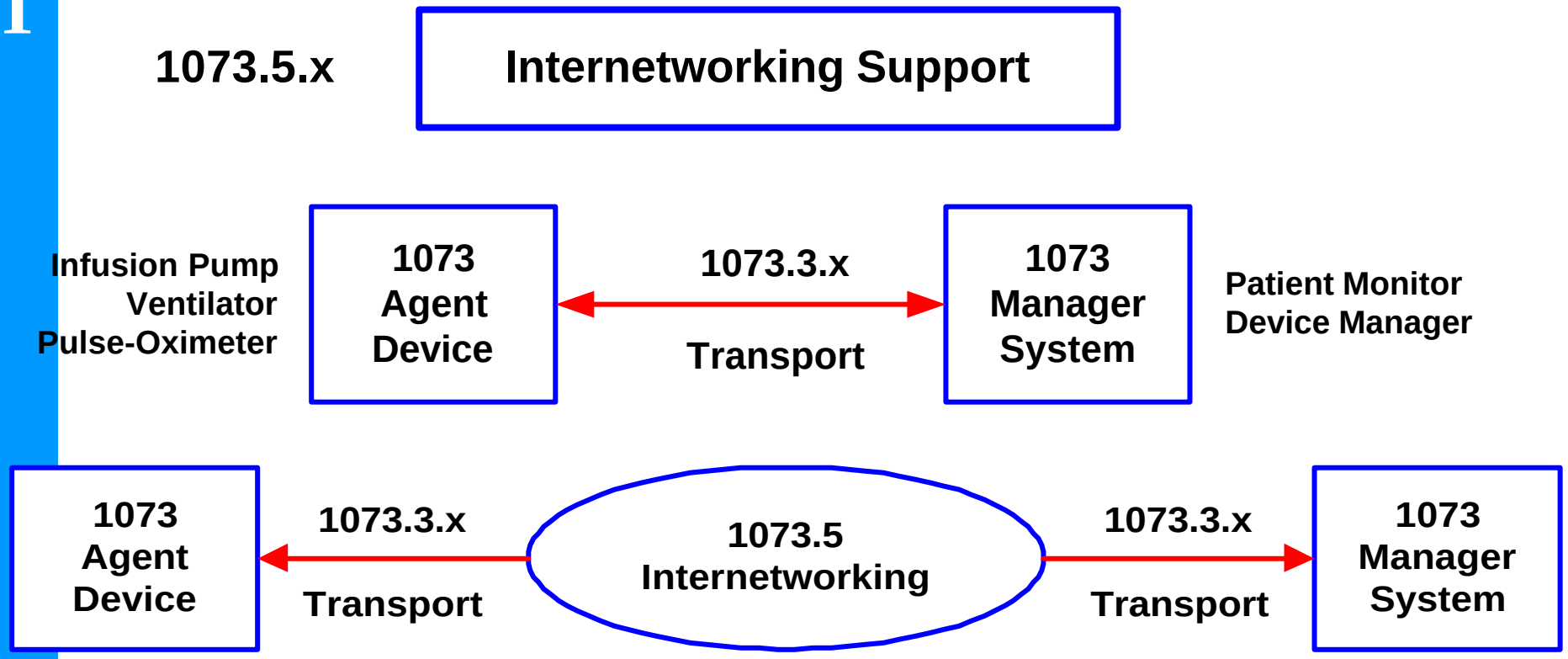
- IrDA-Based Cable Connected (1073.3.2)
- IrDA-Based Infrared Wireless (1073.3.3)

Transport standards (*LANs*) under consideration…

- RF Wireless – high emphasis on QoS!
- IP-Based (Ethernet)

Key: Shared IT infrastructure with guaranteed QoS

ISO/IEEE 11073 Standards



Examples: LAN Access Points,
Wired-to-Wireless Transport Gateways,

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1073.6.x **Application Gateways**

Objective: Interoperability between different application-layer protocols

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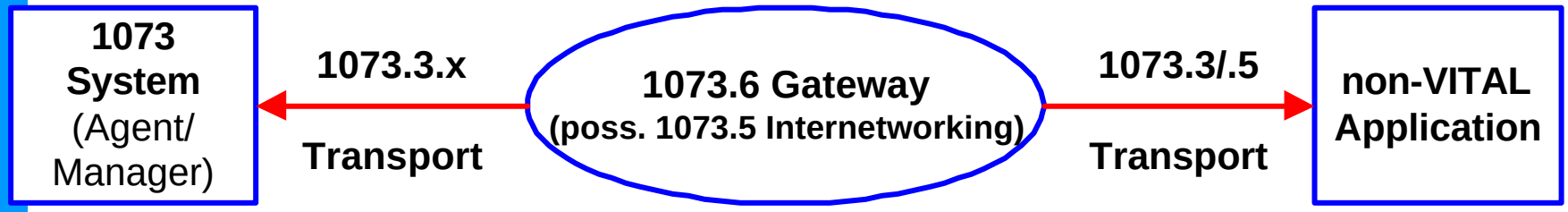
Bi-Directional Transparency



Example: HL7 / IEEE Gateway: IEEE 1073.6.1.1 ...

HL7 - Observation Reporting Interface!

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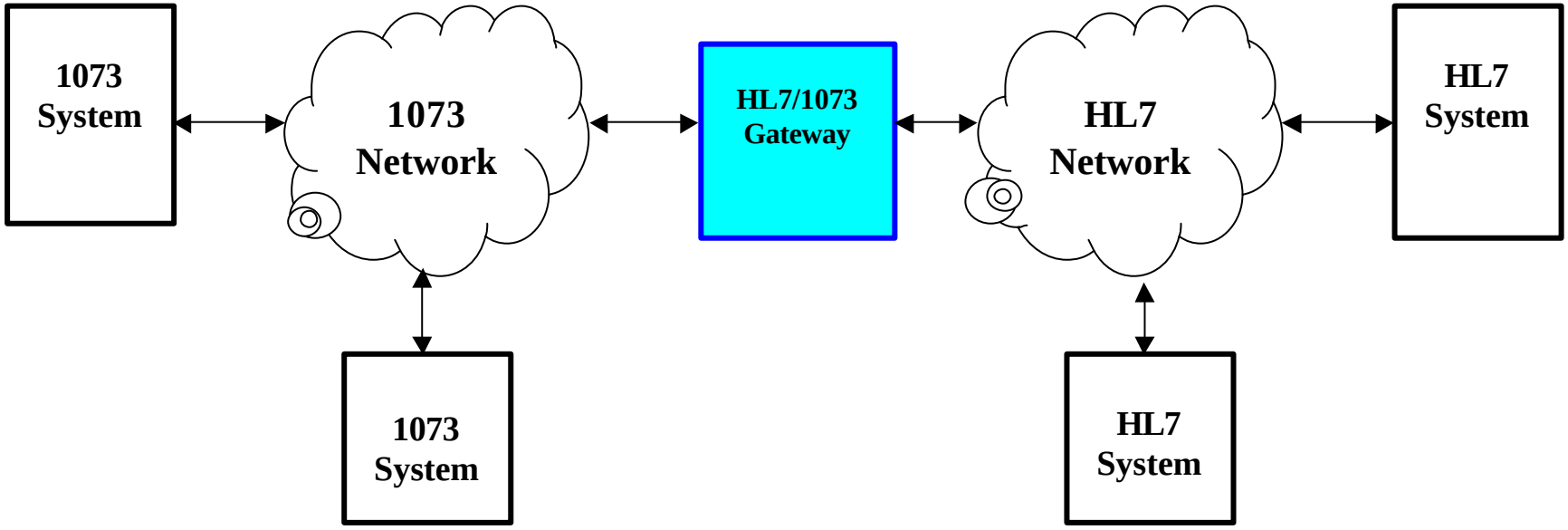

HL7-IEEE JWG Project Scope:

Identification and definition of interfaces to support interoperability between HL7 and 11073 based systems for Point-Of-Care testing / monitoring use cases.

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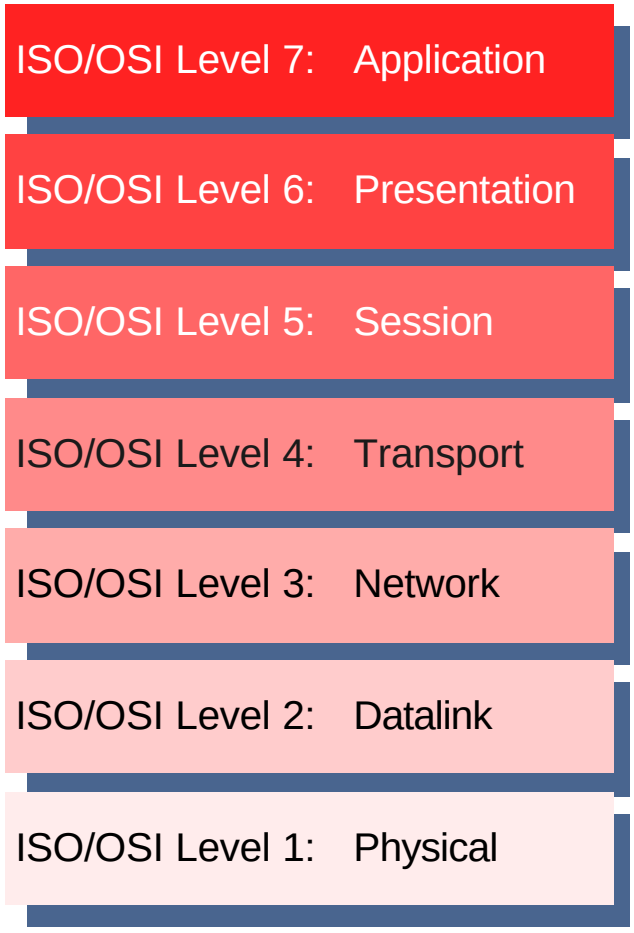
- X73 – Real-time plug-n-play interoperability across all 7-layers
- From

  Device-to-device up to

  Device-to-EMR



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X73 includes QoS management support:

- Negotiated Bandwidth at association
- Start-up configuration minimizes network usage to that which is needed for client applications.
- Management Information Bases (MIBs) provide dynamic visibility to communications performance
- State models and confirmed delivery provide a high level of reliability for medical data transfer

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Drivers of X73 QoS:

- Regulated industry: "Safe & Effective"
- Clinical Use Cases for devices – esp. real-time requirements: User needs & expectations!
- Transport and service profile technologies (LAN based vs. point-to-point)
- System wide topologies (local vs. wide area)
- Non-clinical stakeholders (…finance)

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Key X73 QoS considerations:

- Reliability – FMEA, error detection & mitigation
- Latency – from device detection to end annunciation for the data client
- Priority – Not all medical device data has the same communications priority
- Bandwidth – Allocation and dynamic management

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X73 Data Categorization:

- Alerts (both physiological & technical)
- Real-time Waveforms
- Real-time Parameters (Breath-to-breath)
- Non-RT Parameters (battery level, metric label)
- Non-RT Event (low battery)
- Controls
- History / Archival
- Web Browsing

Data Type	Bandwidth	Priority	Reliability	Latency
Alerts	Lo (64B/Al.), Intermittent	Highest	Hi	3 sec
RT-Waves	Hi (120 to 4KB/s/chan) Predictable	High	Hi	<RT> or CS=3 sec
RT-Param's	Lo-Med, Predictable	High	Hi	3 sec
Non-RT Param's	Lo (20B/p), Unpredict.	High	Hi	---
Non-RT Events	Lo-Med, Unpredict.	Medium	Hi	PoC: 3 sec CS: 5 sec
Controls	Lo, Unpredict.	Medium	Hi	PoC: 3 sec CS: 5 sec
History / Archive	Hi, Bursty, Unpredict.	Low	Med->Hi	Push: >5 sec; Pull: < 5 sec
Web Browsing	Hi, Bursty, Unpredict.	Low	Med->Hi	3-5 sec

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X73 QoS Issues:

- Latency:
  - Prioritization support
  - Shared Bandwidth management architecture (across multiple manufactures / devices)
- Reliability:
  - Prioritization policies – guaranteed B/W
  - Network fault detection & Annunciation
- Graceful system performance degradation
- Co-existence Management (esp. RF wireless)

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And what about…

- Remote Control: a virtual plug-n-play remote control network!
- Global access: Real-time vital signs viewing across the world (w/security, authentication, …)

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Conclusions...

- X73 are the only comprehensive point-of-care medical device communication standards on the horizon!
- Need additional pilot projects to show capabilities of X73 protocols
- Health care providers and management organizations must demand medical device interoperability using X73
- We welcome support in adding security, web services, and rigorous LAN-based QoS support to our standards