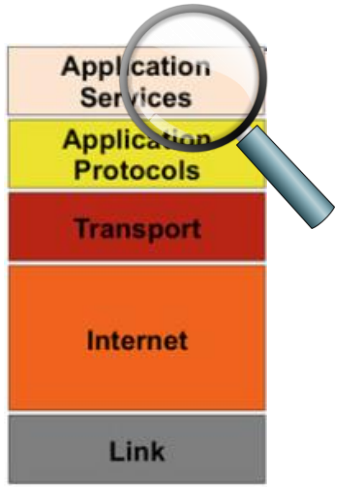
Ch. 13 - IoT Application Service Layer

Sec 6 – Interoperability

COMPSCI 147

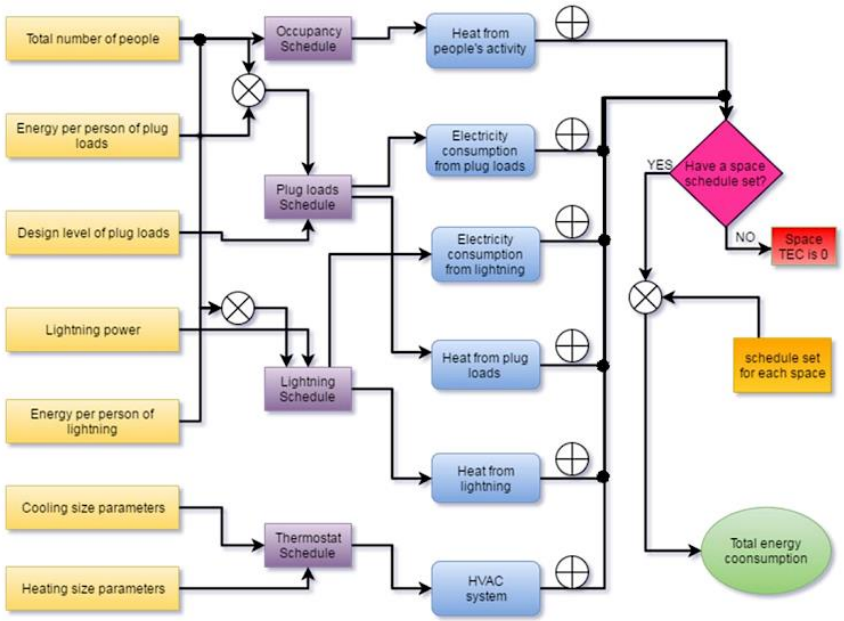
Internet-of-Things; Software and Systems



INTEROPERABILITY ISSUE

One of the great challenges we encountered in the SIMHome project was to integrate ***various sensing, actuating, networking, and processing devices*** *which had been* ***developed*** *by* ***different companies*** *or research teams* ***using different communication protocols*** *(sometimes ad-hoc),* ***hardware platforms***, ***operating systems*** *(sometimes bare metal),* ***data semantics***, *etc.*

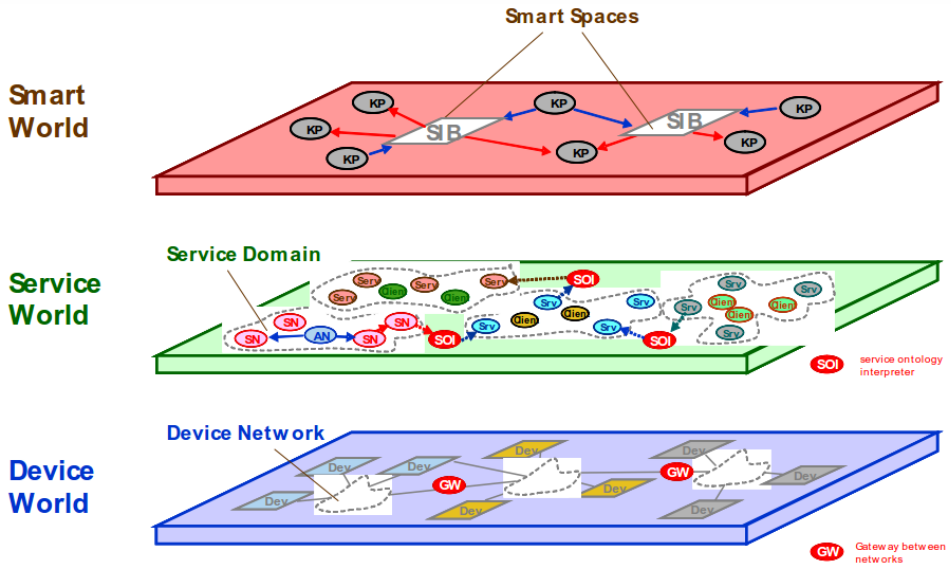
- Interoperability of a system or a device is the **ability to exchange information** with another system or device, be able to **understand** and **use** the exchanged information.



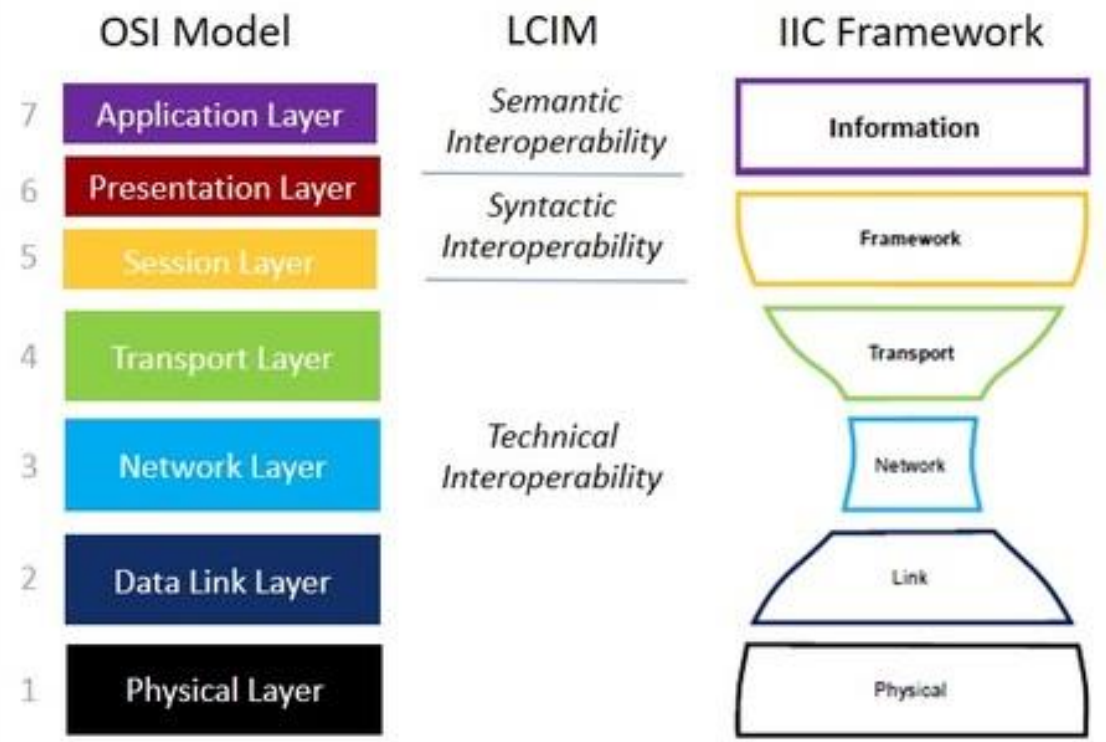
The SIM Home – UCI - Southern California Edison

DIFFERENT LEVELS OF INTEROPERABILITY

- IoT systems hold a layered interoperability requirements:
  Levels of Conceptual Interoperability Model (LCIM):
  1. Technical
  2. Syntactical
  3. Semantic
  4. Organizational

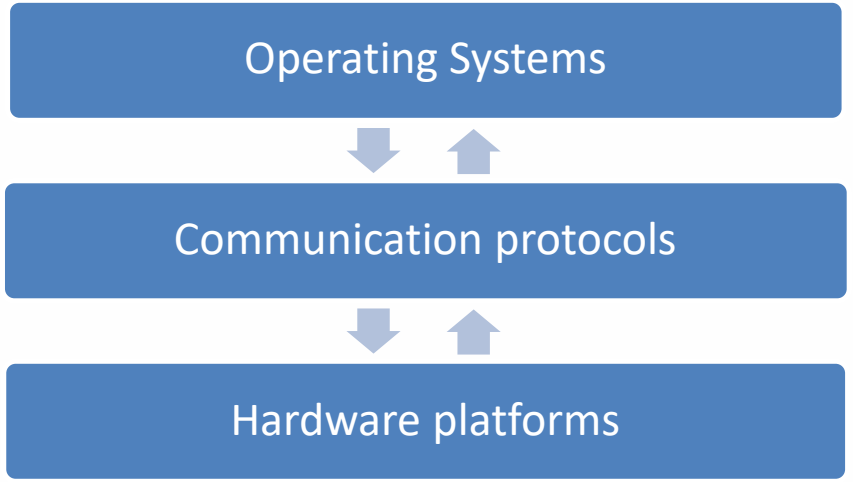


Industrial Internet Consortium

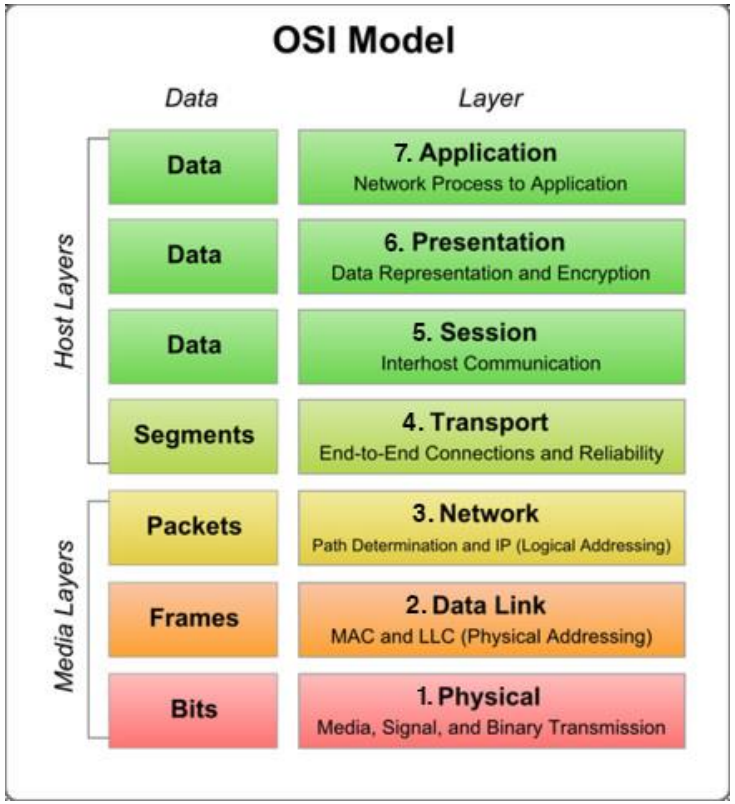


1.- TECHNICAL INTEROPERABILITY

- Associated with **hardware/software** components, **systems** and **platforms** that enable **machine-to-machine** communication to take place.
- This kind of interoperability is often centered on
  - **(communication) protocols** and
  - the **infrastructure** needed for those protocols to operate.



IoT Semantic Interoperability: Research Challenges, Best Practices, Solutions and Next Steps, IERC AC4, 2012 - 2014



2.- SYNTACTICAL INTEROPERABILITY

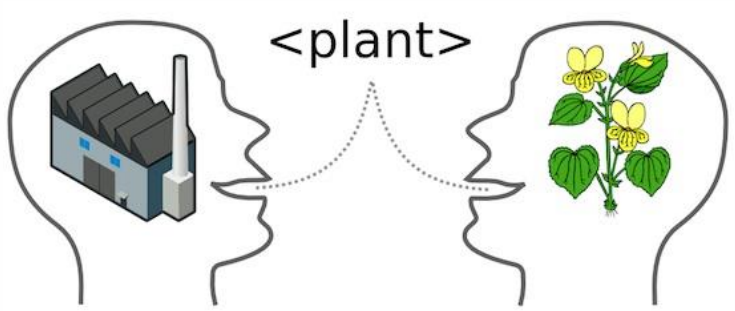
- Syntactical Interoperability is usually associated with **data formats**.
- Messages transferred by communication protocols need to have **a well-defined syntax and encoding**, even if it is only in the form of **bit-tables**.
- Many protocols carry data or content, represented using **high-level transfer syntaxes** such as HTML, XML or ASN.

3.- SEMANTIC INTEROPERABILITY

- Semantic Interoperability is associated with the **meaning of content** and concerns **humans** rather than machine interpretation of the content.

- Interoperability on this level means that **there is a common understanding** between people of the meaning of the content (information) being exchanged.

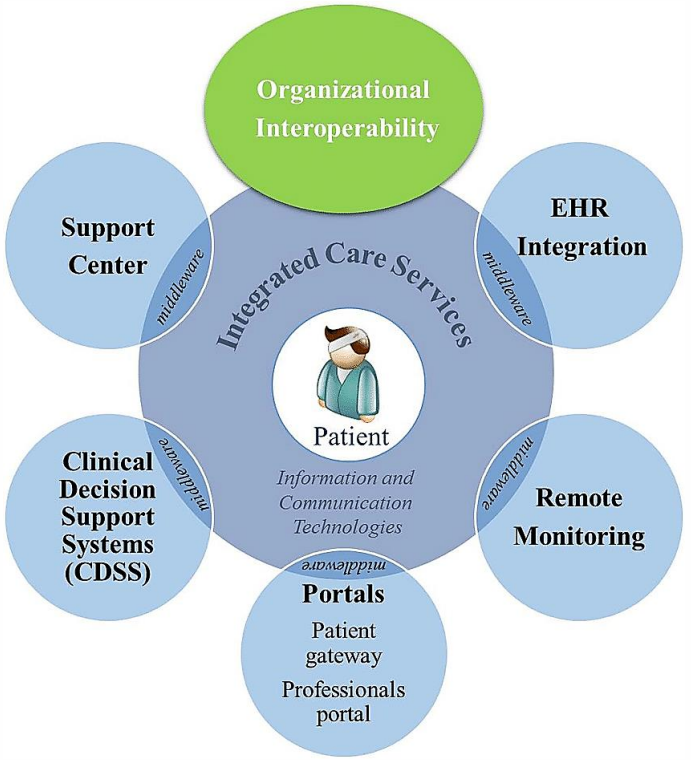
- Standards such as HL7 and IEEE X73 are examples that cover semantic interoperability of health-related data.



4.- ORGANIZATIONAL INTEROPERABILITY

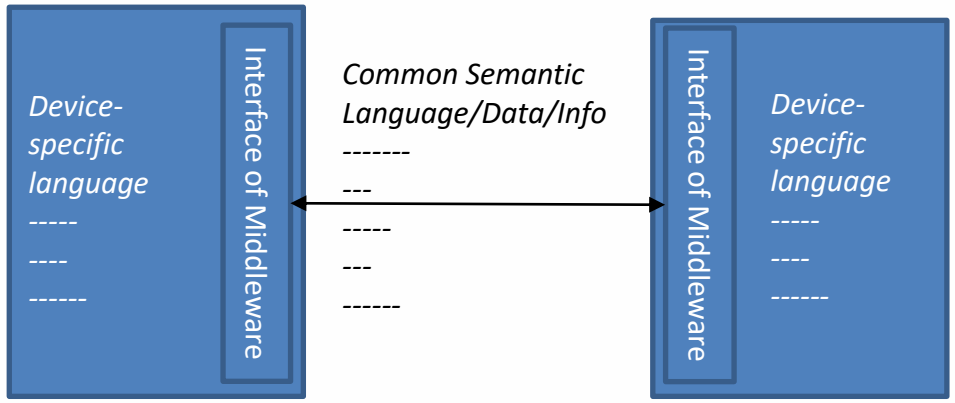
- Integration of **business process**
  - beyond the boundaries of a single organization
  - possibly across different geographic regions and cultures

- How different organizations collaborate to **achieve their mutually agreed goals**
  - agreement on **collaboration** and **synchronization**

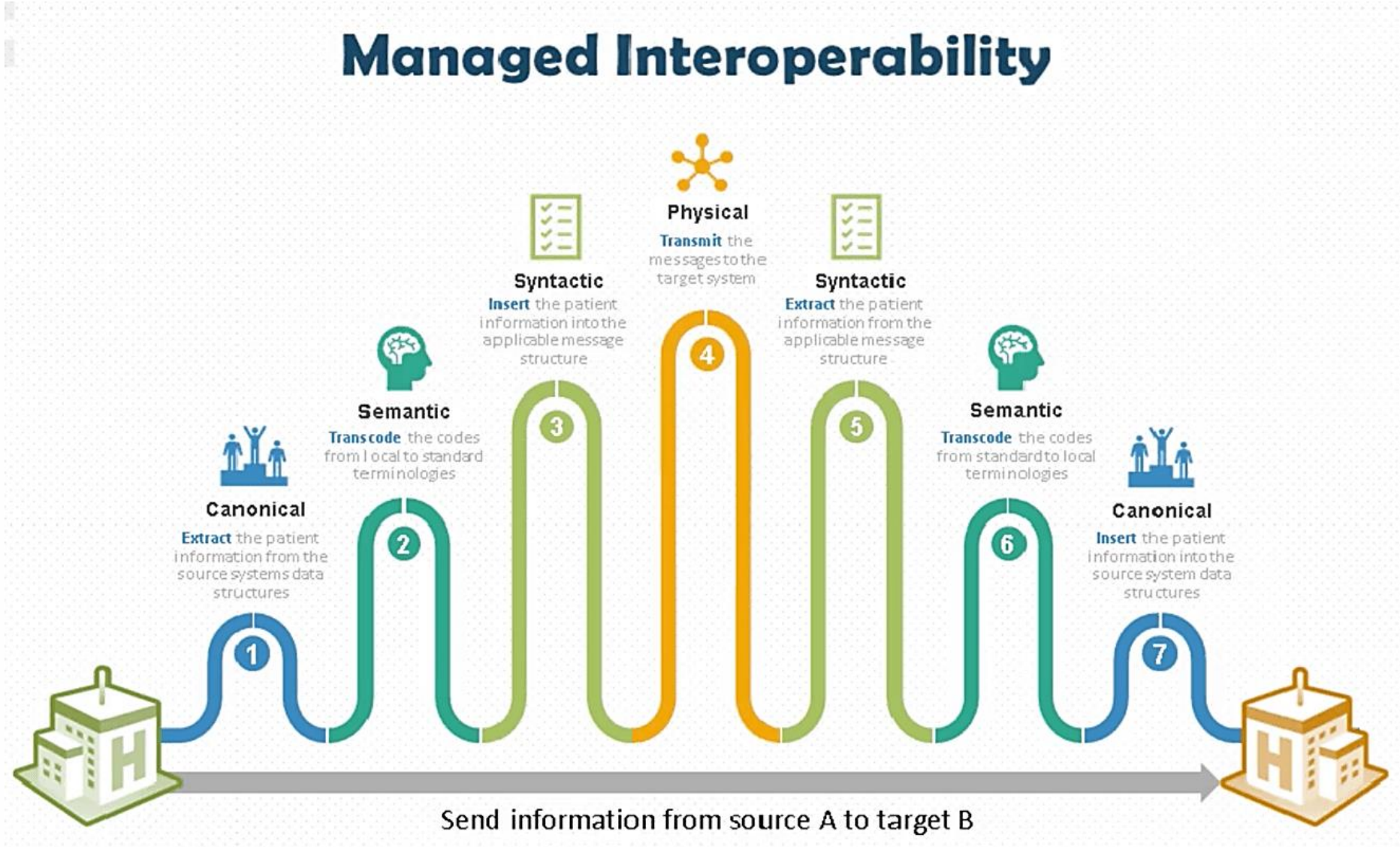


INTEROPERABILITY (MODULARITY)

- Software architecture to satisfy the need for interoperability
- Interoperability can be achieved by
  - Middleware
  - Standards

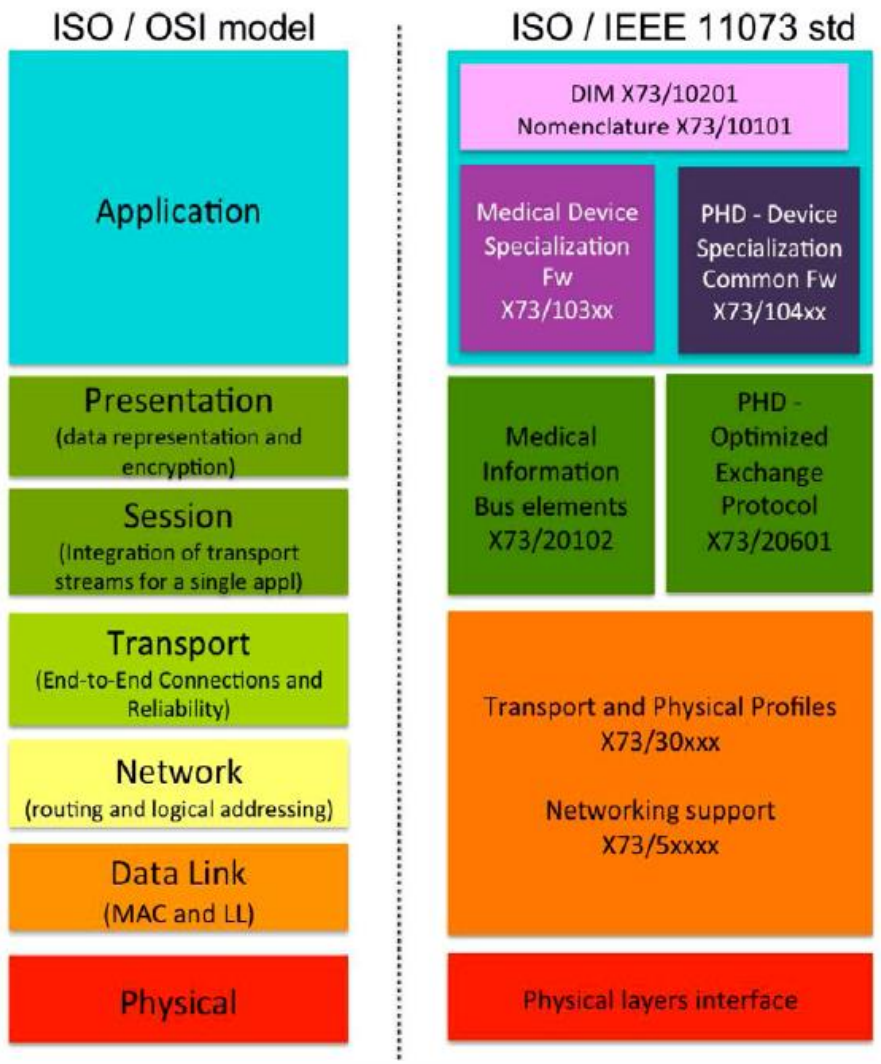


E.G.: PERVASIVE HEALTHCARE STANDARDIZATION



E.G.: PERVASIVE HEALTHCARE STANDARDIZATION

- Many international organizations are working on standards to enable **medical information exchange**.
- Some of them mainly address **application-layer data exchange** (e.g., **HL7** for the communication of medical information systems residing in different facilities).
- ISO/ IEEE 11073 (aka **X73**) proposes a set of standards corresponding to different layers of the protocol stack.



Source: Delmastro, F., Pervasive communications in healthcare, Computer Communications, Volume 35, Issue 11, 2012. (Full text)