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The Standards Landscape - SISO Standards for Operations, Systems and Ontologies

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The Standards Landscape; SISO Standards for Operations, Systems and Ontologies

What is Interoperability?

Joint Publication 1-02:

- “The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces, and to use the services so exchanged to enable them to operate effectively together.”

Wikipedia:

- "Interoperability is a property referring to the ability of diverse systems and organizations to work together (inter-operate)."

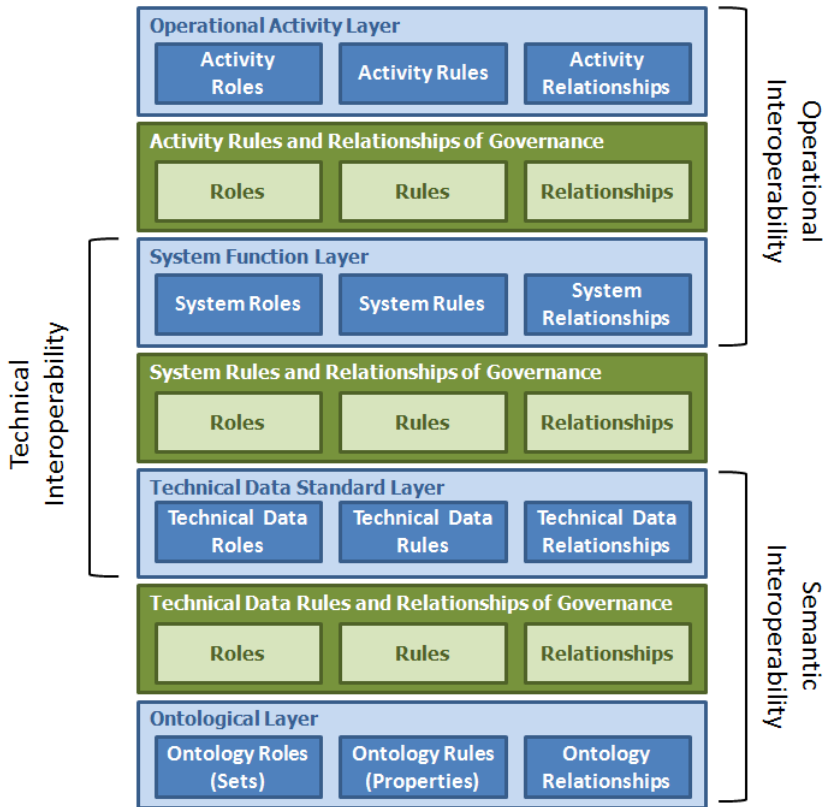


The Levels of Conceptual Interoperability

- **Level 0, No Interoperability:** Stand-alone systems have no interaction with other systems.
- **Level 1, Technical Interoperability:** A communication infrastructure is established allowing the exchange of bits and bytes.
- **Level 2, Syntactic Interoperability:** A common structure for the exchange of data is used.
- **Level 3, Semantic Interoperability:** A common information exchange reference model is used, allowing the meaning of the data to be shared.
- **Level 4, Pragmatic Interoperability:** The systems are aware of the methods and procedures each is employing to process the information.
- **Level 5, Dynamic Interoperability:** The systems automatically adapt to changes that occur in assumptions and constraints each is making over time.
- **Level 6: Conceptual Interoperability:** The systems are fully aligned, sharing common understanding of both data (purposeful abstraction of reality) and processing.

Conceptual Interoperability

An ontology is an explicit specification of a conceptualization. The term is borrowed from philosophy, where an ontology is a systematic account of Existence. For knowledge-based systems, what “exists” is exactly that which can be represented.



Operational Interoperability

- Operational interoperability is the ability of organizations/groups to provide services to and accept services from other organizations/groups and to use the services so exchanged to enable them to operate effectively together.
- Operational interoperability involves the mixing of standards.

Technical Interoperability

- Technical interoperability is a more common mainstream view of interoperability. This view generally involves the linking up of computer systems and services. In modeling and simulation technical interoperability applies to many standard protocols to include DIS, HLA, Link 16, and TENA.
- Technical interoperability is generally viewed as singular standard protocol.

Semantic Interoperability

- Beyond the ability of two or more computer systems to exchange information, semantic interoperability is the ability to automatically interpret the information exchanged meaningfully and accurately in order to produce useful results as defined by the end users of both systems.
- To achieve semantic interoperability, both sides must refer to a common information exchange reference model.

- Standards exist for interoperability and reuse, but the benefits of standards do not end there.
- Interoperability and the reuse interoperability provides enable implementations to compete for utilization.
- Standards enable the value or return on investment (ROI) to be objectively measured.
 - Consider Image Generators
 - Standards of format, scene density, update rate,

Transportation Systems

- Horse-drawn carriages were long the norm for travel until the railway system was created.
 - Slow and expensive to cross the US
- The Central Pacific Railroad and the Union Pacific Railroad companies had to agree on standards of railroad construction.
 - One working from the east and the other from the west to span the continental US.
- Today the railroad has been largely replaced with roadway infrastructure, airfreight, and seaports
 - This replacement was not necessarily a predictable outcome.
- Railroad companies created monopolistic empires growing out of the great depression.
 - The US Government regulated railroad companies to provide for fair competition.
- This governance enabled roadway transport and air transport to flourish and compete with the railroad.



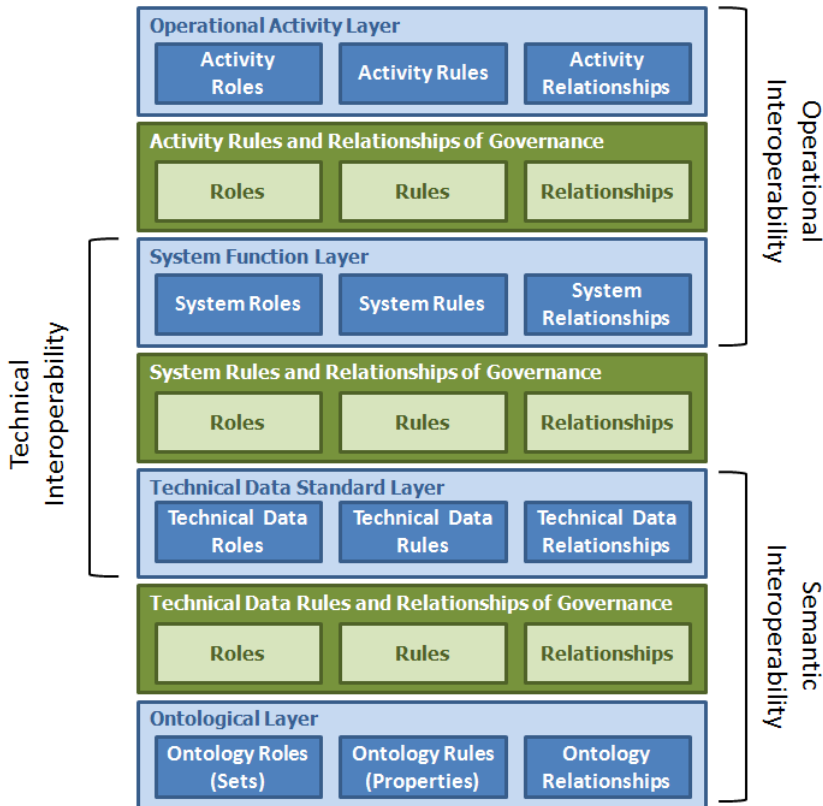
- Today people have choices
- Transport of people and goods combine/cooperate transportations standards to move from one location to another.

- Bookstores have experienced tremendous change over the last 10 to 15 years, driven by technological innovation
 - New companies with new business models grew out of the new technologies, such as Amazon.com.
 - New product standards also appeared, such as **electronic books**.
- Other companies like Borders did not adapt to the new e-book standards and thus, are now closing their doors.
- Barnes and Noble realized the market was splitting between paper-based books and e-books.
 - Offering both formats they were able to retain their market share.
 - People had choices; they could choose to purchase e-books or paper books.
- Borders, which held fast and chose to compete paper against electronic books is now going out of business.
 - Held fast to a purist, one-size-fits-all approach to business.
- Barnes and Noble provided their customers with the freedom to compete the standards by offering both paper and e-books.
 - Used these standards cooperatively to retain market share.



Governance of Interoperability

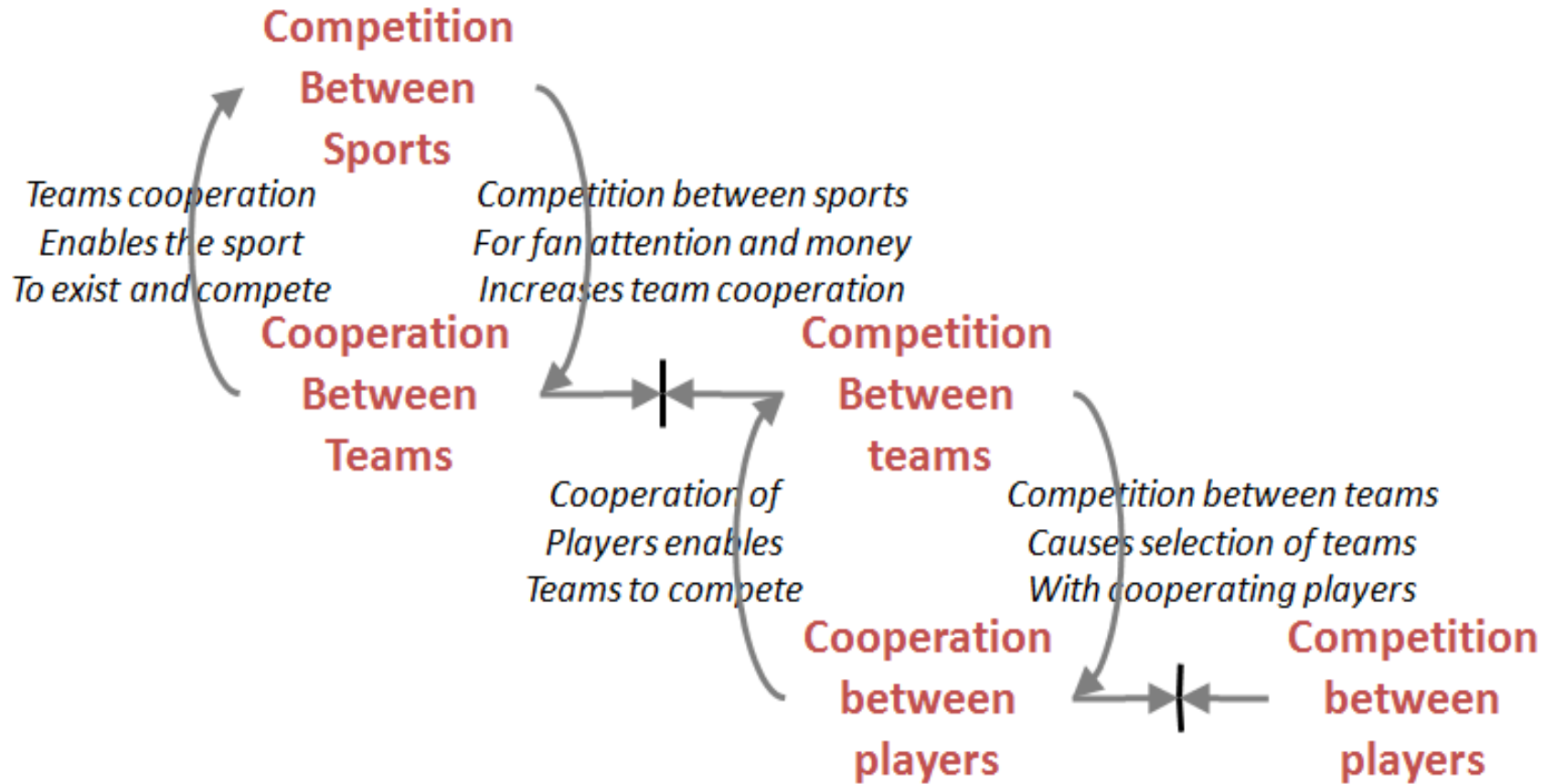
- Intra-Standards Governance
 - DIS, HLA, TENA, **or** others
 - SAC, PDG, PSG, and TADS actively provide governance
 - About Technology
- Inter-Standards Governance
 - DMAO, DSEEP, BOM
 - Passive governance group to group
 - About Process



- Inter-Standards governance is important for two reasons.
 1. It puts the responsibility for communicating between standards on SISO not the users.
 2. It provides a foundation for interoperability that, do date, has been rather ad hoc.
- SISO understands the value in promoting interoperability even though others would love to have their customers/users locked in.



Cooperation and Competition Separation by Levels

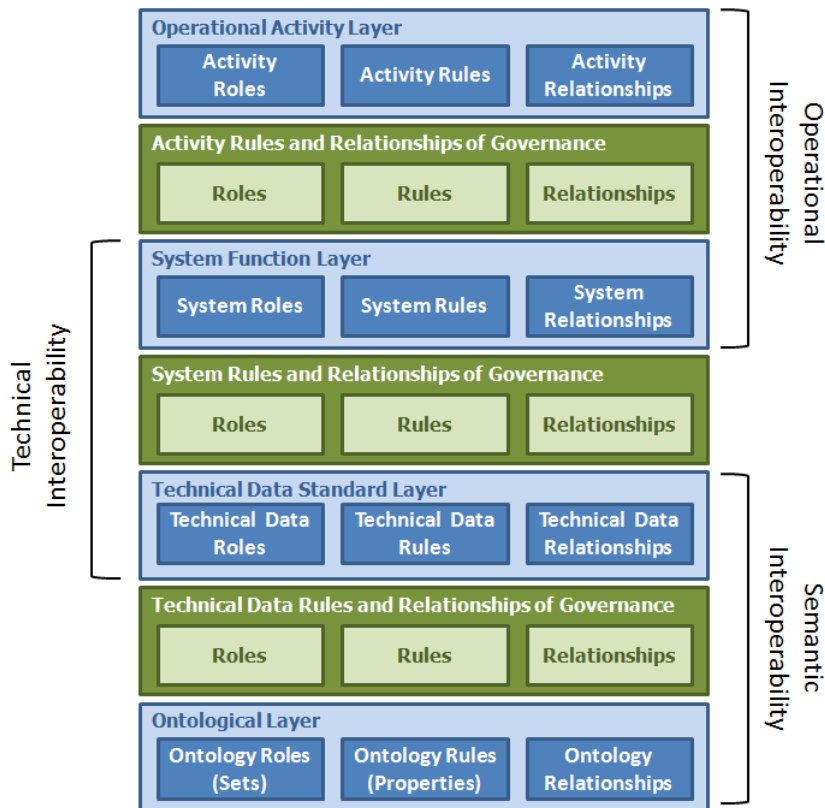


The basic point here is this:

- The interplay between competition and cooperation can only be understood by using a multilevel perspective.
- Competition and cooperation will tend to support each other when they occur at different levels of organization, but they will generally be in conflict if they occur at the same level.

- The layering of standards by levels of interoperability can enable SISO to:
 - More clearly define the role of standards in specific contexts of data, systems, and operations.
 - Simplify a stakeholder's understanding of best practices in the application of mixed standards.
- Example: DIS SIMAN, HLA MOM, where are the integrating standards?

Alignment of Standards in Layers



- The Figure takes on new meaning when we view it from a competition and cooperation perspective.
- The blue layers represent an intra-view of SISO standards and the rules/relationships that govern each standard individually.
- The green layers represent the inter-view of SISO standards and the rules/relationships that govern standards collectively.

- Vertical Alignment is Competitive in nature during:
 - Planning what functions of lower roles are focused on application to higher roles.
 - Players on a team compete for positions.
- Horizontal Alignment is Cooperative in nature during:
 - Run-time; lower roles serve as actors .
 - Players on the team cooperate to win.

Example of Vertical Alignment

- Mixed protocol environments use gateways to translate enumerations, etc.
 - Disruptive if one federate/perspective dictates the translations.
- Consider concepts and lessons of fair fight
 - I shoot you, you tell me the damage/affect.
- Gateways can be used to translate all enumerations to and from a common ontology.
 - Each federate specifies how their enumerations are translated to and from that common ontology.
- When one federate “shoots” an enumeration at another federate.
 - Receiving federate can assess the “damage” done by specifying the translated enumeration it will receive.
- This is an example the ***fair interoperability***.
 - The role of good inter-standards governance.

- SISO standards are each effective when considered alone, but not always when combined.
 - Exceptions exist such as with HLA.
 - In other areas, integration has been ad-hoc and opportunistic.
- The opportunity for SISO now is to change approaches
 - Mixed standards interoperability.
 - Active alignment of standards through inter-standards governance.
- SISO standards governance needs to evolve
 - Ensure standards (1) support one another, (2) integrate vertically and horizontally, and (3) support fair interoperability.
- SISO governance/alignment can make its standards:
 - Relevant across a growing base and scale of disciplines
 - Achieve the necessary expansion of standards usage, sponsorship, and SISO membership.