



Standards in M&S: Governance Processes
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***Technical Characteristics
and Governance Processes
in Military M&S Standards***

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Presentation outline

- Studying military M&S standards
 - Motivation
 - Methodology
 - Categories and attributes
- Survey of military M&S standards
 - Distributed simulation interoperability
 - Live training
 - Object modeling
 - Conceptual modeling
 - Synthetic environment
 - Simulation development
- Concluding remarks
 - Preliminary findings
 - Open questions

Studying military M&S standards

Motivation

- Overall project research questions
 - What M&S standards exist?
 - How effective are existing standards?
 - How do governance processes affect their effectiveness?
 - How should current and future standards be governed?
- Military M&S standards
 - Standards as “data”: information about standards may help answer project’s research questions
 - Military M&S standards important and well-documented

Methodology

- Process
 - Identify military M&S standards
 - Identify attributes of standards to examine
 - Collect information regarding standards
 - Analyze to determine correlation between governance and effectiveness
- Comments
 - “Standard” understood broadly
 - List of attributes evolving

Categories

- Distributed simulation
 - SIMNET
 - ALSP
 - DIS
 - HLA
 - TENA
- Live training
 - MILES
 - CTIA
- Object model
 - RPR FOM
 - Base Object Models
- Conceptual modeling
 - UML
 - DoDAF
- Synthetic environment
 - SEDRIS
- Simulation development
 - FEDEP
 - DSEEP
 - VV&A Overlay
 - VV&A RPG
- Enumerations
 - DIS Enumerations

Which standards should be added or deleted from this list?

Attributes

- Name; e.g., High Level Architecture
- Status; i.e., pending, active, inactive
- Category; e.g., distributed simulation
- Year first “standardized”
- Type; i.e., official (de jure), unofficial (de facto, proprietary)
- Form; i.e., rec practice, tech specification, product line
- Ubiquity; i.e., number of applications and users
- Investment; i.e., total and annual support spending
- Governance; i.e., standards body, management group
- **Governance formality**; formality of process to change
- **Technical specificity**; degree implementation prescribed
- **Utility**; usefulness and effectiveness

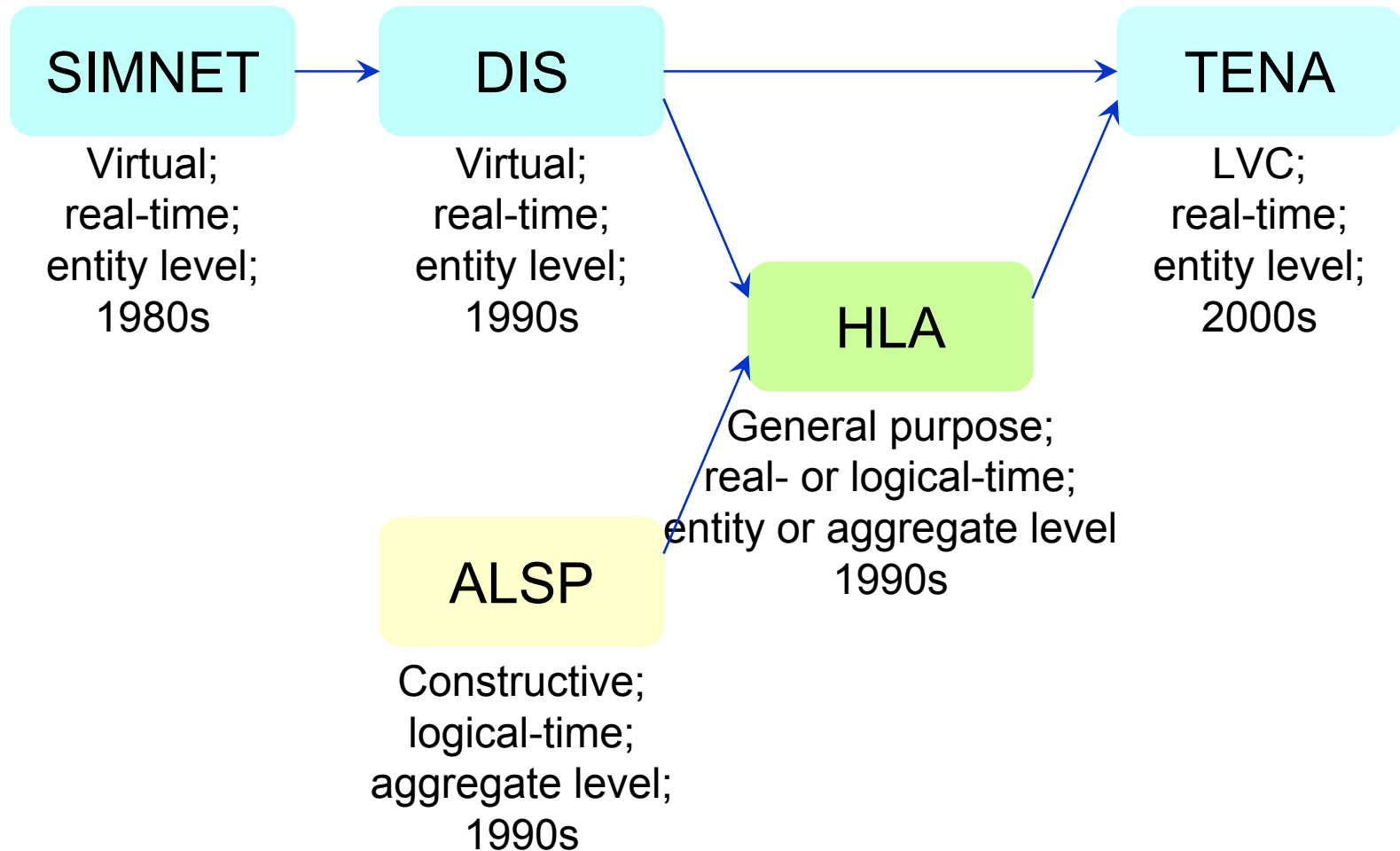
Are these the right attributes to study standards?

Standards as data

Name	Domain	Type	Form	Governance	Year	Status	Technical specificity	Governance formality
DIS	Distributed simulation	Official	Technical specification	Standards body	1990	Active	3	5
HLA	Distributed simulation	Official	Technical specification	Standards body	1996	Active	3	5
TENA	Distributed simulation	Unofficial	Product line	Architecture management group	1997	Active	4	3
CTIA	Live training	Unofficial	Product line	Architecture management group	2001	Active	4	3
RPR FOM	Object model	Official	Technical specification	Standards body	1999	Active	3	5
UML	Conceptual modeling	Unofficial	Technical specification	Architecture management group	1996	Active	2	3
SEDRIS	Synthetic environment	Official	Technical specification	Standards body	1994	Active	4	5
DSEEP	Simulation development	Official	Recommended practice	Standards body	2006	Pending	2	5
VV&A Overlay	Simulation development	Official	Recommended practice	Standards body	2007	Active	2	5

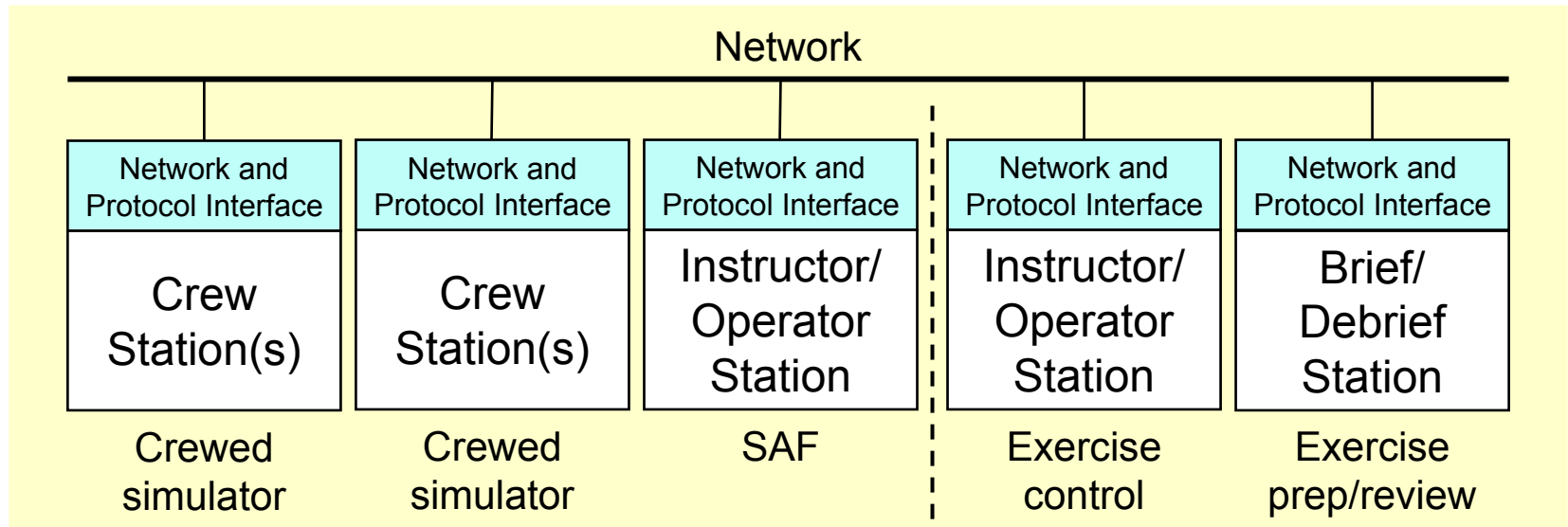
***Survey of military M&S standards:
Distributed simulation interoperability***

Distributed simulation standard overview



Overview: DIS

- Real-time virtual distributed simulation
- Simulations exchange standard-defined data
- Standard defines message format, content, protocol
- Network and protocol interface not part of standard



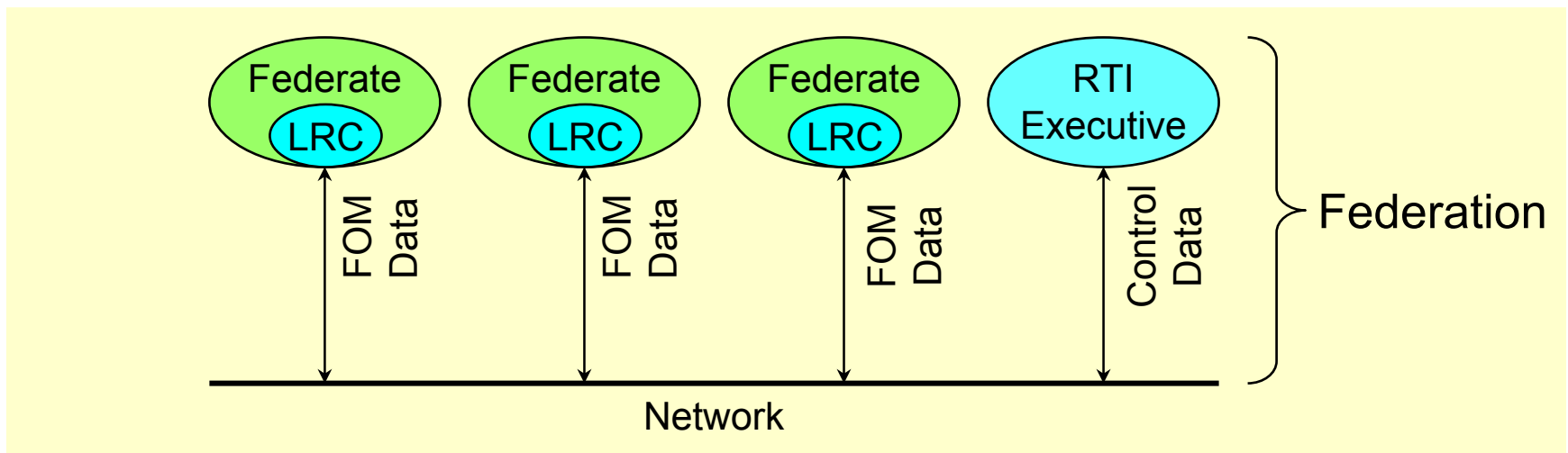
SAF=Semi-Automated Forces

Attributes: DIS

- Name: Distributed Interactive Simulation
- Domain: Distributed simulation
- Type: Official
- Form: Technical specification
- Governance: Standards body (IEEE)
- Year: 1990
- Status: Active
- Technical specificity: 3
- Governance formality: 5
- Utility: ?

Overview: HLA

- General purpose distributed simulation
- Federates exchange federation-defined data
- Standard defines interface services
- RTI implementation not part of standard



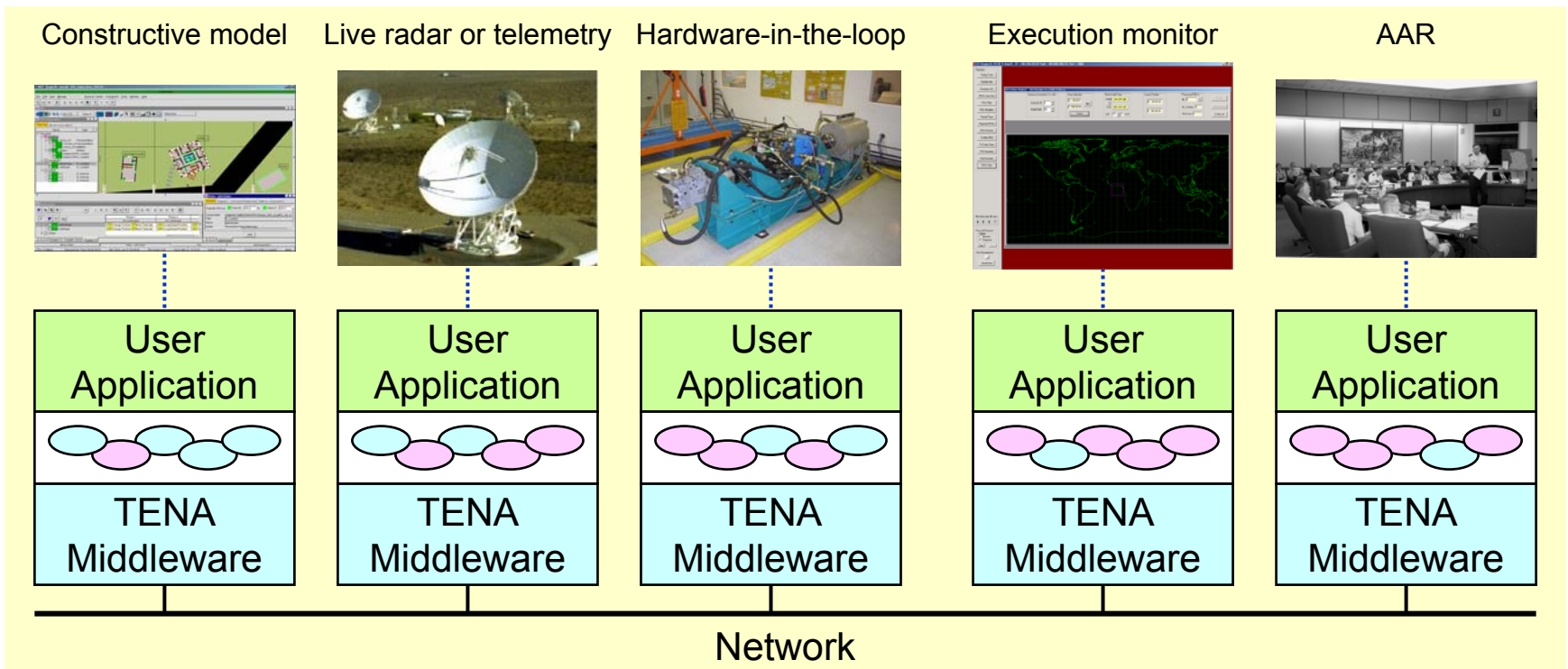
RTI=Run-Time Infrastructure; LRC=Local RTI Component; FOM= Federation Object Model

Attributes: HLA

- Name: High Level Architecture
- Domain: Distributed simulation
- Type: Official
- Form: Technical specification
- Governance: Standards body (IEEE)
- Year: 1996
- Status: Active
- Technical specificity: 3
- Governance formality: 5
- Utility: ?

Overview: TENA

- Test and training range distributed simulation
- Applications exchange standard-defined data
- Standard includes middleware software



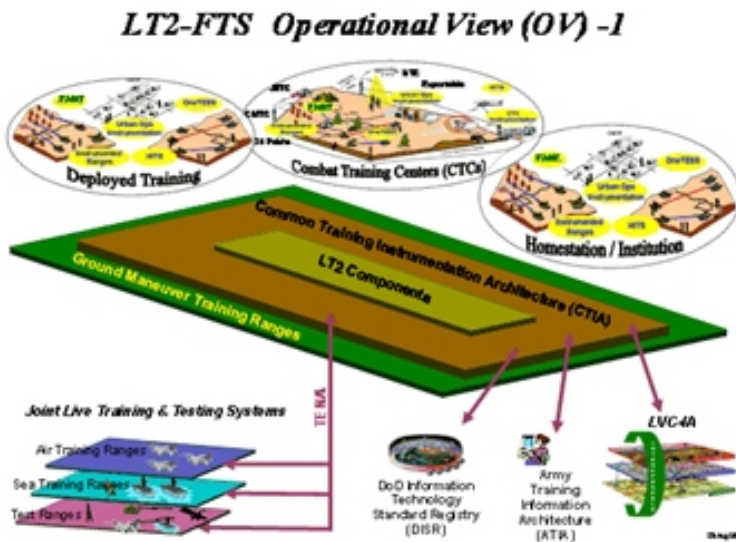
Attributes: TENA

- Name: Test and Training Enabling Architecture
- Domain: Distributed simulation
- Type: Unofficial
- Form: Product line
- Governance: Architecture management group
- Year: 1997
- Status: Active
- Technical specificity: 4
- Governance formality: 3
- Utility: ?

***Survey of military M&S standards:
Live training***

Overview: CTIA

- Live training
- Product-line software components and protocols
- Commonality promotes interoperability



U. S. Army PEO STRI



U. S. Army RDECOM

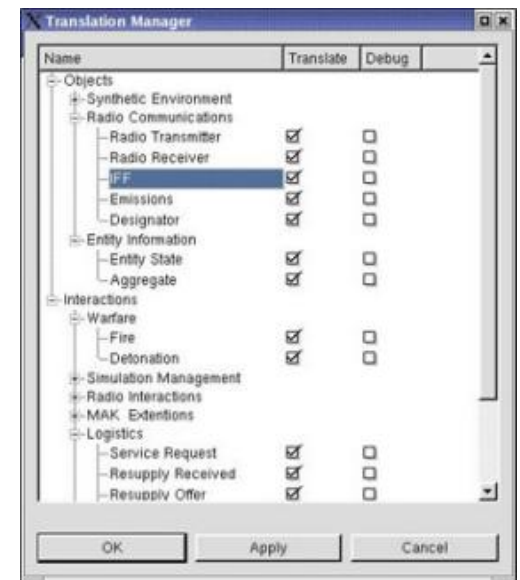
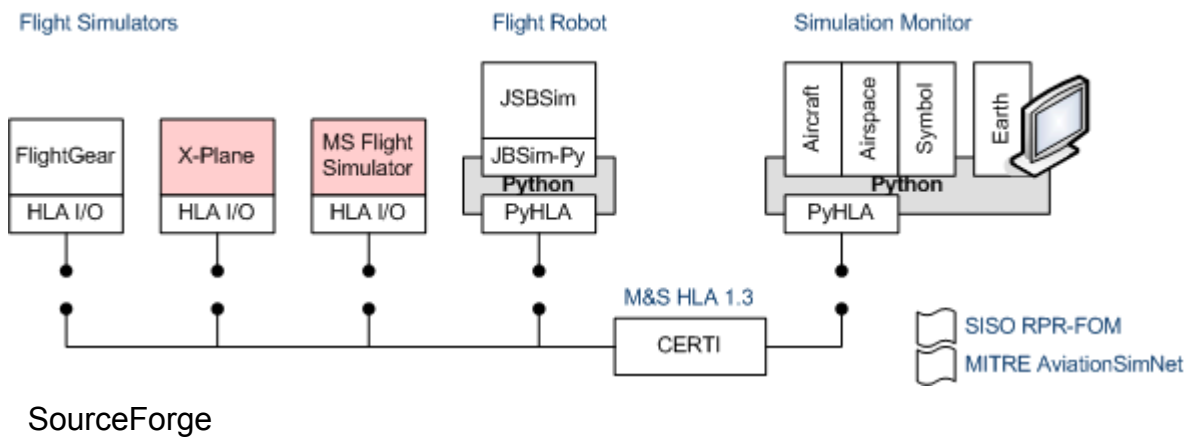
Attributes: CTIA

- Name: Common Training Instrumentation Architecture
- Domain: Live training
- Type: Unofficial
- Form: Product line
- Governance: Architecture management group
- Year: 2001
- Status: Active
- Technical specificity: 4
- Governance formality: 3
- Utility: ?

Survey of military M&S standards: Object modeling

Overview: RPR FOM

- Entity-level HLA Object Model
- HLA “equivalent” to DIS PDU content
- Widely used and extended



MÄK

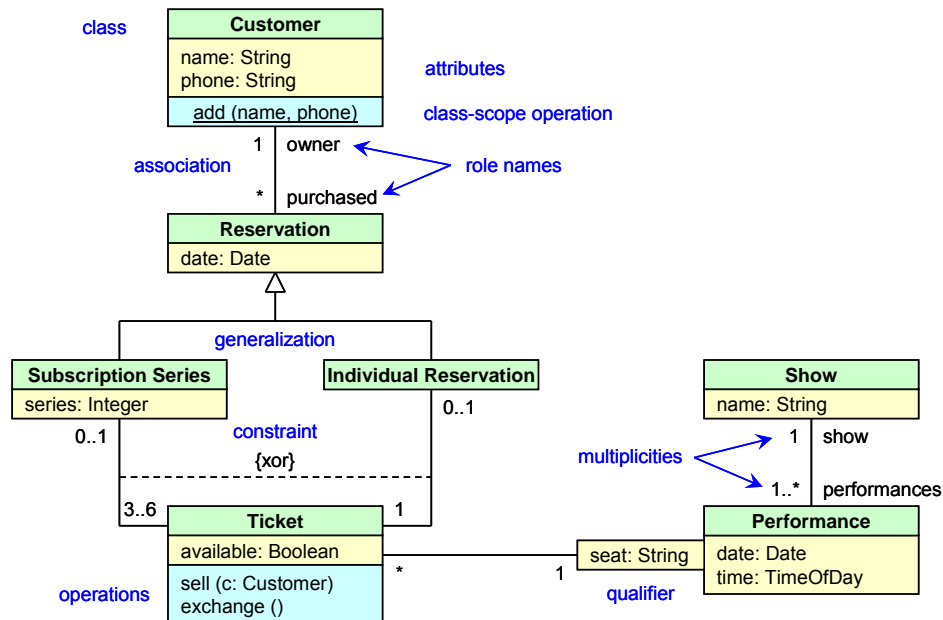
Attributes: RPR FOM

- Name: Real-time Platform Reference FOM
- Domain: Object modeling (in distributed simulation)
- Type: Official
- Form: Technical specification
- Governance: Standards body (SISO)
- Year: 1999
- Status: Active
- Technical specificity: 3
- Governance formality: 5
- Utility: ?

***Survey of military M&S standards:
Conceptual modeling***

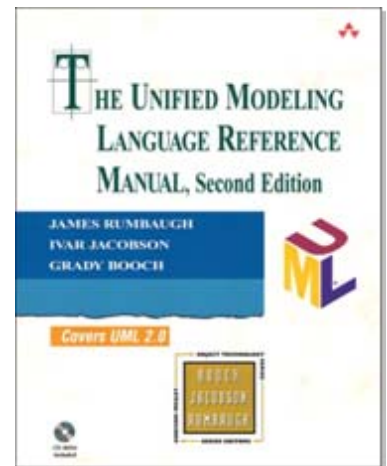
Overview: UML

- Generalized diagrammatic “modeling language” for software engineering
- Standard governed by Object Management Group
- Often used in M&S for conceptual modeling



Attributes: UML

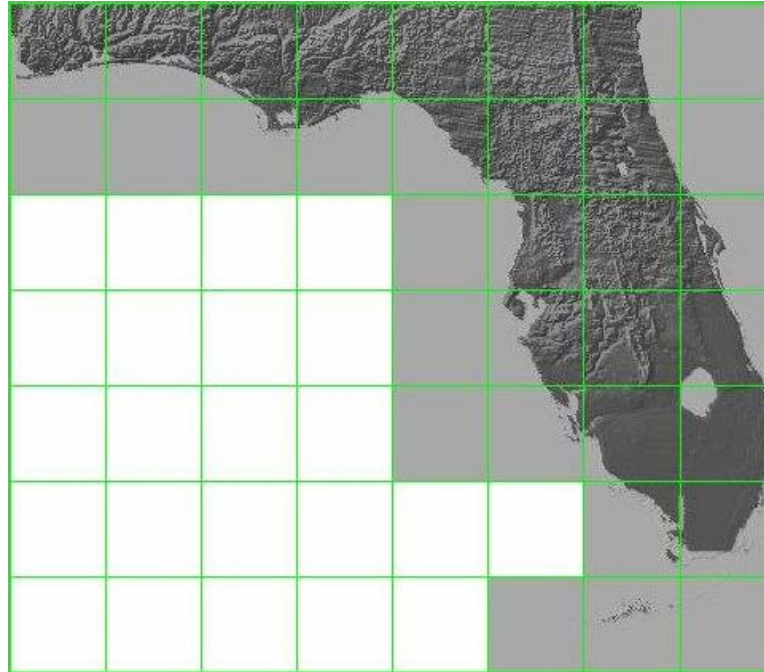
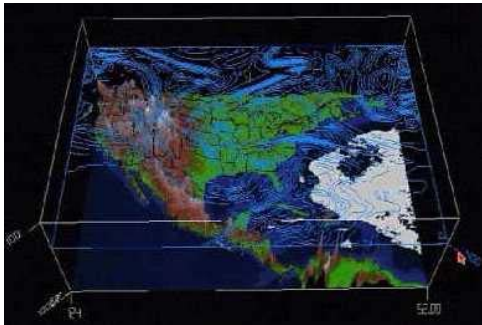
- Name: Unified Modeling Language
- Domain: Conceptual modeling
- Type: Unofficial
- Form: Technical specification
- Governance: Architecture management group
- Year: 1996
- Status: Active
- Technical specificity: 2
- Governance formality: 3
- Utility: ?



***Survey of military M&S standards:
Synthetic environment***

Overview: SEDRIS

- Synthetic environment (terrain, ocean, air, space)
- Environmental data representation and interchange
- Software development kit available



Wizards of the Coast

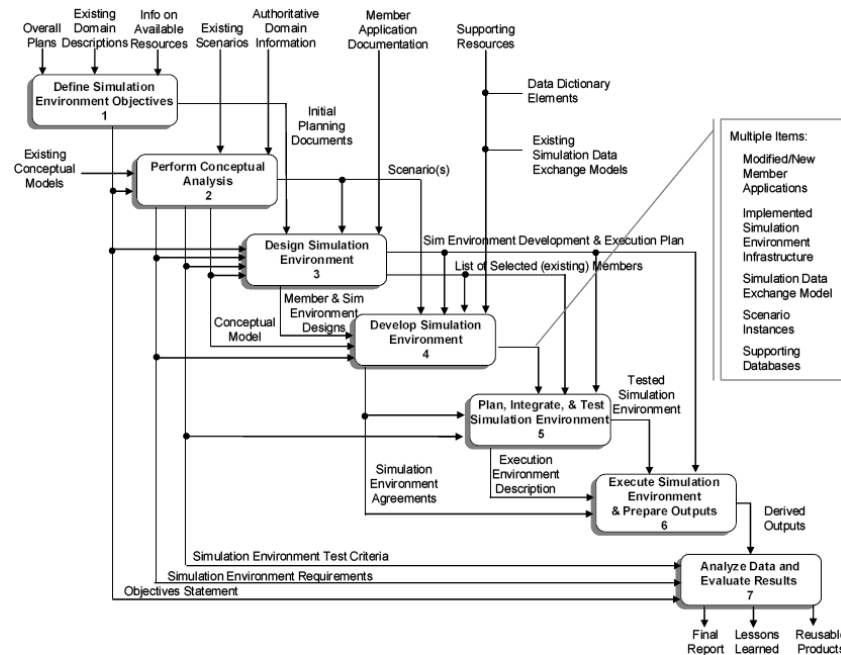
Attributes: SEDRIS

- Name: Synthetic Environment Data Representation and Interchange Specification
- Domain: Synthetic environment
- Type: Official
- Form: Technical specification
- Governance: Standards body (ISO/IEC)
- Year: 2006
- Status: Active
- Technical specificity: 4
- Governance formality: 5
- Utility: ?

Survey of military M&S standards: Simulation development

Overview: DSEEP

- Systems engineering process for developing distributed simulation systems
- Evolved from earlier FEDEP
- Architecture (DIS, HLA, TENA) neutral



Attributes: DSEEP

- Name: Distributed Simulation Engineering and Execution Process
- Domain: Simulation development
- Type: Official
- Form: Recommended practice
- Governance: Standards body (IEEE)
- Year: 2008
- Status: Pending
- Technical specificity: 2
- Governance formality: 5
- Utility: ?



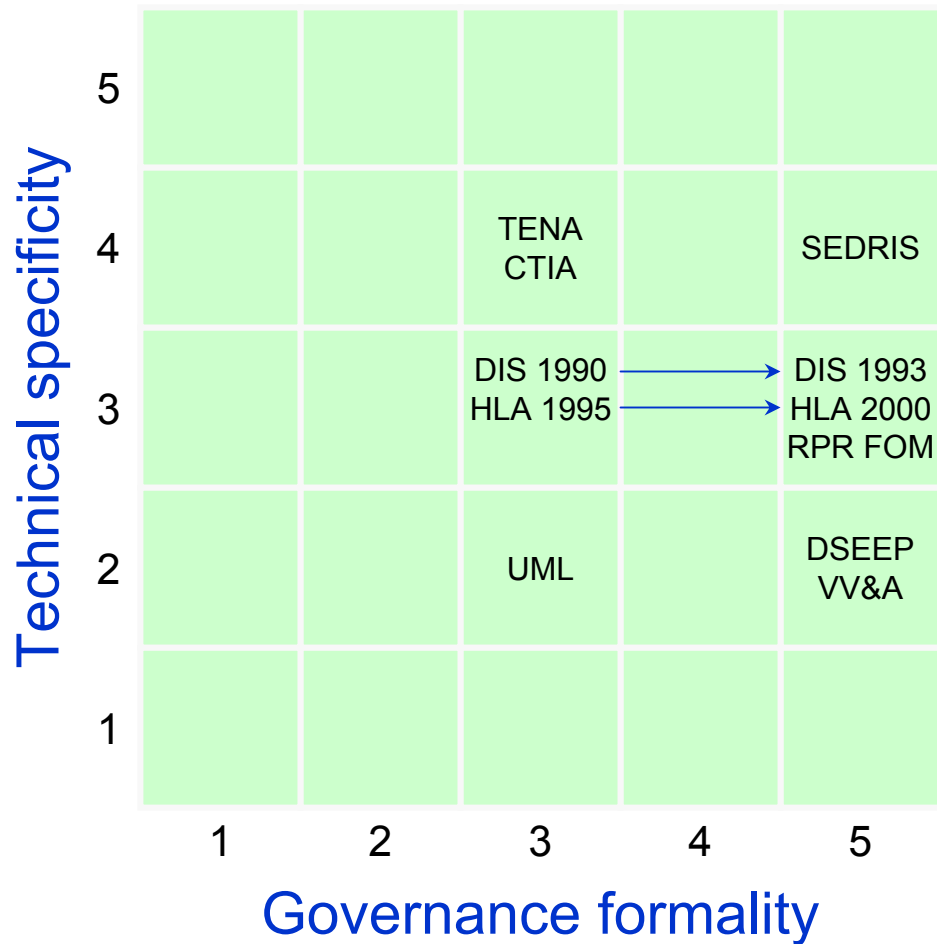
Concluding remarks

Preliminary findings

- Methodological difficulties to date
 - Observational bias; all standards studied “successful”
 - Measurement ambiguity; measuring utility uncertain
 - Causation vs correlation; cause-and-effect unclear
 - Confounding events; e.g., Kaminski HLA mandate
- Nevertheless, some observations
 - Longevity and formality correlated
 - Investment and utility correlated
 - Technical inertia significant factor
 - Purchase cost vs development cost weights disproportionate
 - Significant overlaps among military M&S standards

*What military M&S standards have not been successful?
How should the utility of a standard be measured?*

Standards phase space, with data



Is a standard's trajectory over time significant?

Open methodological questions

- Questions previously noted
 - What standards should be added/deleted from the study?
 - What standards attributes should be considered?
 - How should the utility of a standard be measured?
 - What military M&S standards have not been successful?
 - Is a standard's trajectory in phase space over time significant?
- Additional questions
 - Which of the attributes are the “independent variables”?
 - Should successive generations of the same standard (e.g., HLA) be considered separately or together?

Final notes

- Further reading

A. E. Henninger, K. L. Morse, M. L. Loper, and R. D. Gibson, “Developing a Process for M&S Standards Management within DoD”, *Proceedings of the 2009 Interservice/Industry Training, Simulation, and Education Conference*, Orlando FL, November 30–December 3 2009. (Paper)

K. L. Morse, A. E. Henninger, and M. L. Loper, “Fundamentals of Standards”, *Proceedings of the 2010 Interservice/Industry Training, Simulation, and Education Conference*, Orlando FL, November 29–December 2 2010. (Tutorial)

- Contributions, corrections, critiques, compliments
 - Mikel D. Petty, Ph.D.
 - UAHuntsville Center for Modeling, Simulation, and Analysis
 - 256-824-4368, pettym@uah.edu
- Slides available: <http://cmsa.uah.edu/?downloads>
- Questions?



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Backup

Special interest attributes

- Technical specificity
 - Degree to which the standard defines or provides content which is implementable or executable as written
 - 5-point Likert scale: 5=compilable/executable code, 3=detailed technical specification, 1=descriptive text
- Governance formality
 - Degree to which the process of setting and changing the standard is controlled by formally prescribed processes
 - 5-point Likert scale, 5=official standards body, 3=unofficial management group, 1=arbitrary
- Utility
 - Usefulness, effectiveness, ubiquity of the standard
 - Benefit (financial, social) of using the standard
 - 5-point Likert scale: 5=?, 3=? 1=?

Special interest attributes Likert values

- Technical specificity
 - 5=Universally used identical software (e.g., MS Word)
 - 4=Compilable/executable code integrated with user code
 - 3=Detailed technical specification
 - 2=Mixture of technical specifications and descriptive text
 - 1=Descriptive text
- Governance formality
 - 5=Standard approved and controlled by official standards body with formal procedures (e.g. IEEE or SISO)
 - 4=Standard pending with official standards body
 - 3=Standard controlled by unofficial management group, with some procedures (e.g., HLA AMG or TENA AMT)
 - 2=Unofficial management group with no procedures
 - 1=Arbitrary control by organization or individual