

Learning Technology Standards: The Next Wave

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IEEE Learning Technology Standards Committee

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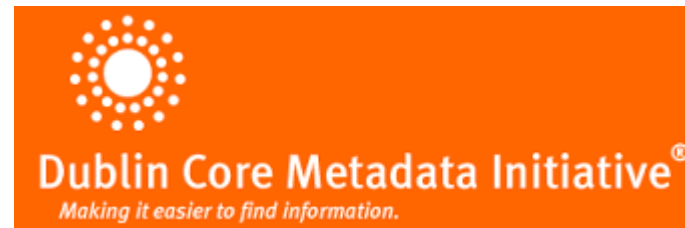
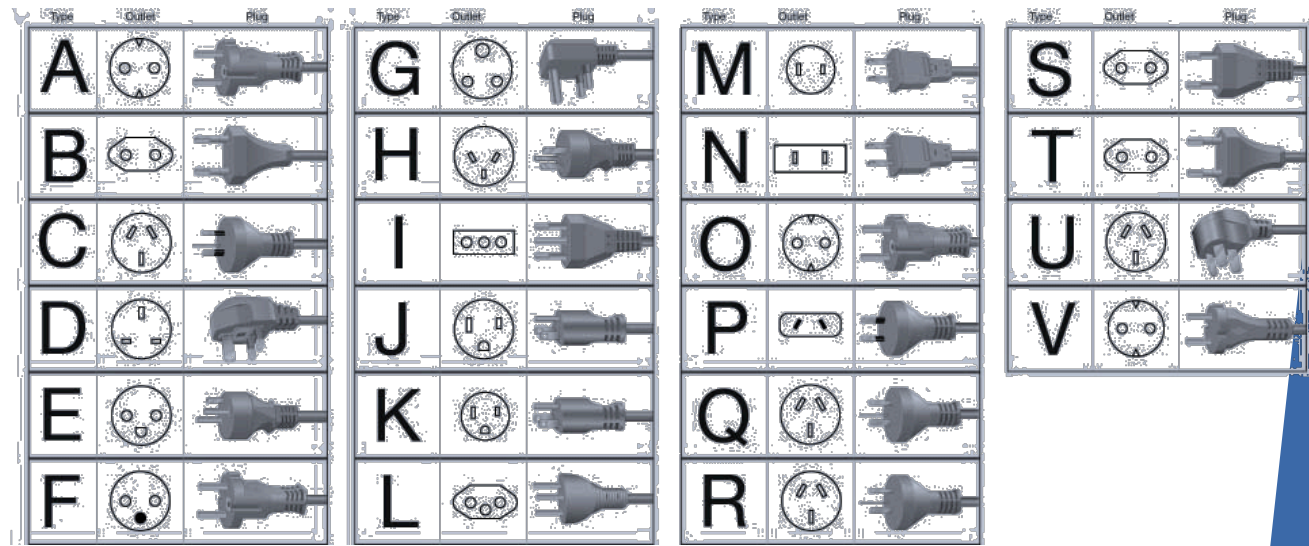


Topics for Today

- What standards do and how they are made
- The first wave of learning technology standards – content portability
- The new wave of learning technology standards

Why Standards?

- Foster interoperability
 - Enable systems to work together and share data
 - Ensure that data can be properly interpreted
- Enable supply chains
 - Enable third-party and after-market manufacturing
 - Facilitate substitution of components, avoid vendor lock-in
 - Lower barriers to entry and for new/innovative products
- Codify practice, best practices
- Facilitate market expansion, remove friction, lower costs, ensure safety, add stability, or otherwise positively impact their target market₃



Three Types of Standards Projects

- A **standard**, containing mandatory requirements,
- A **recommended practice**, outlining preferred procedures, or
- A **guide**, offering suggestions for working with a technology.
- Examples:
 - Lists of terms, definitions, or symbols
 - Measurement/tests of the performance of any device or system
 - Characteristics, performance, and safety requirements
 - Recommendations reflecting current state-of-the-art in the application of principles

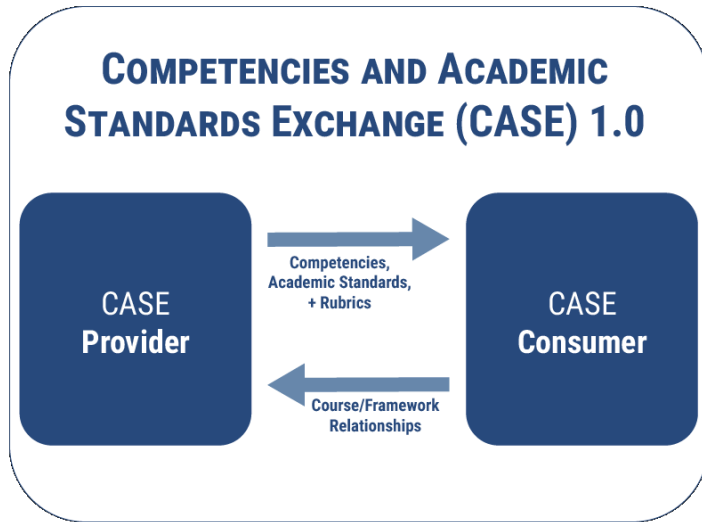
The First Wave (1997 – 2010)

- Content Portability
 - Develop once, deliver in any LMS
 - Definition of eLearning: architecture, vocabulary
 - Learner Information: Demographics, credentials
- The Shareable Content Object Reference Model
 - Metadata (IEEE&IMS) and Packaging (IMS)
 - Results Reporting (IEEE)
 - Sequencing (IEEE)
- Content Portability standards were successful
 - Active world-wide participation from LMS vendors, educators, industry, and researchers
 - Adopted via DoD requirement for SCORM conformance



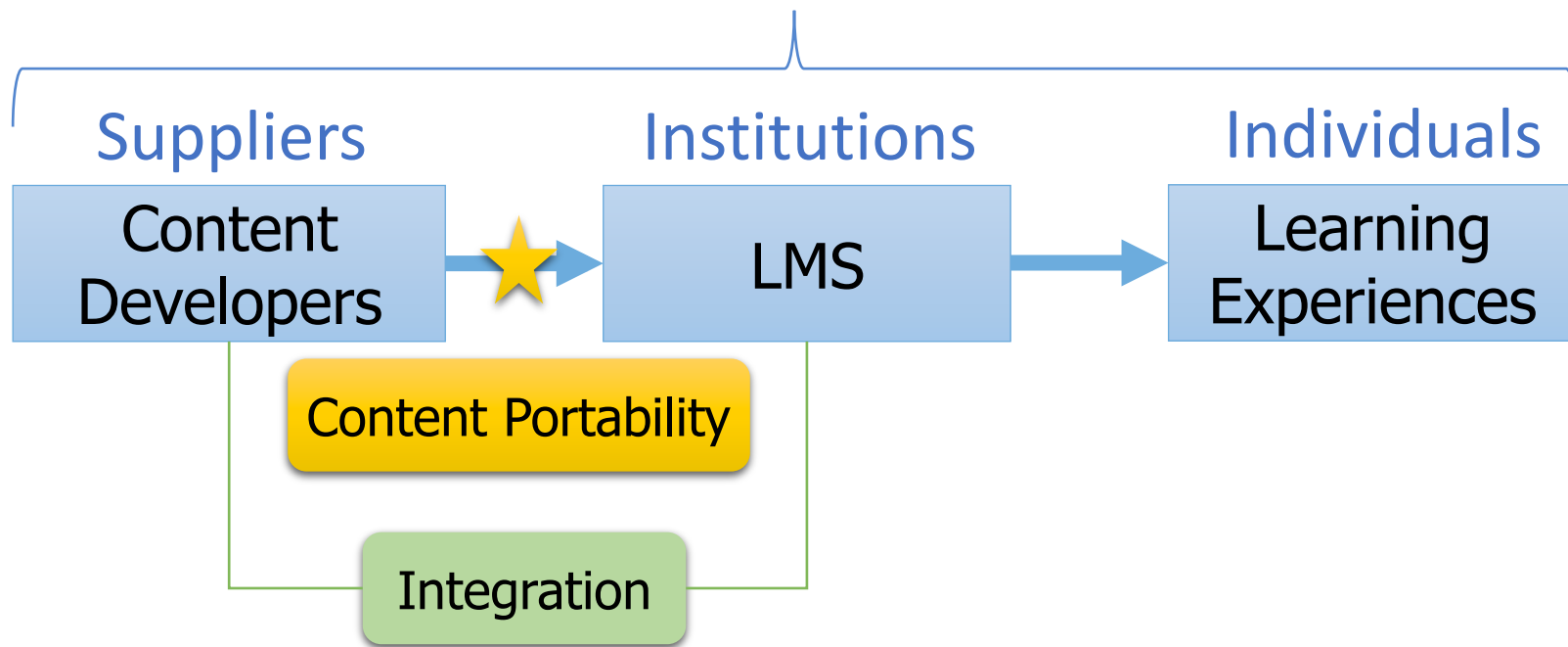
and many more

Competency & Credentialing Standards



The First Wave of Learning Technology Standards

The Learning Technology Supply Chain



Content
Formats

Simulation
Federation

Metadata and
Packaging

Sequencing
and Reporting

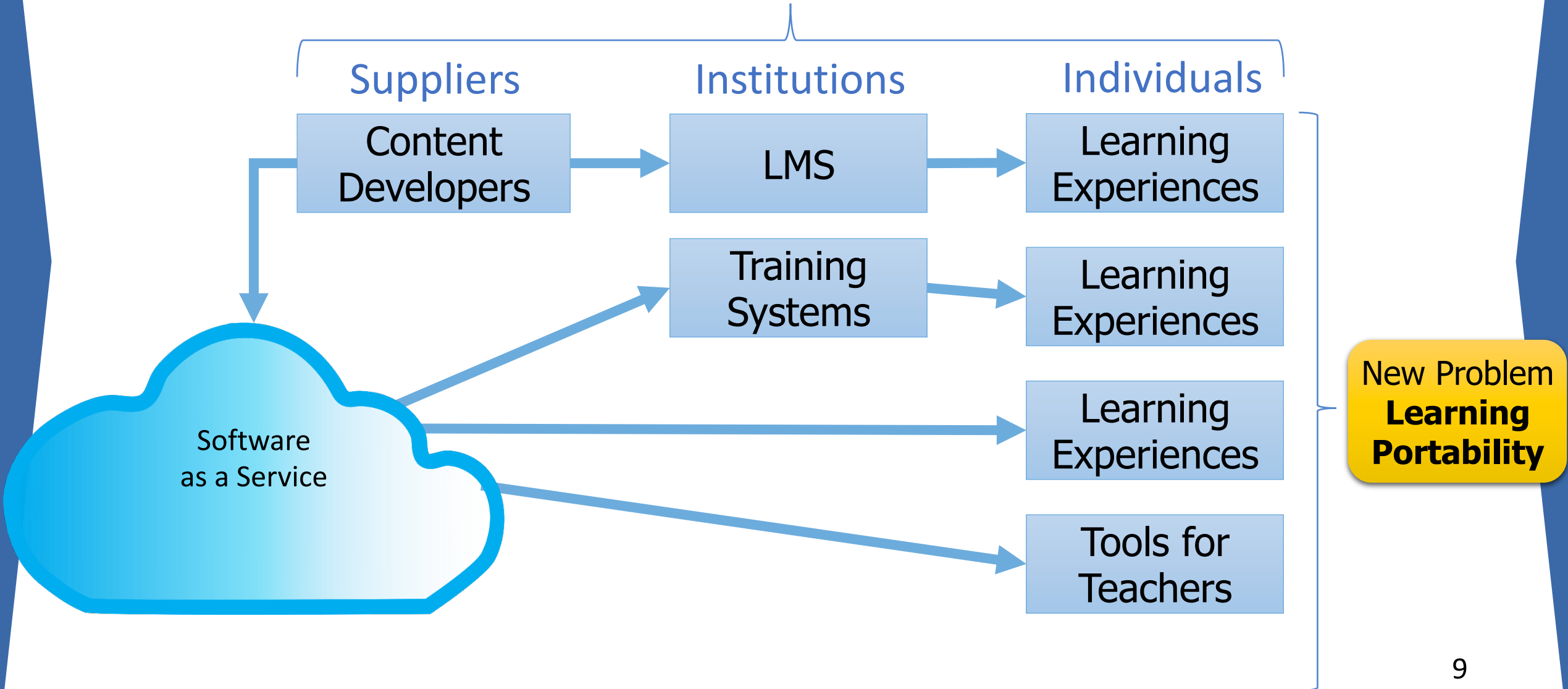
Tools
Integration

Things Have Changed

- Today's learners...
 - Work simultaneously with multiple institutions and online vendors
 - Expect immersive, interactive experiences, not just browser-based
 - Expect some degree of control of their learning
 - Use mobile, social, games, and other modern technologies
- And educators have some new ideas as well
 - Competency-based training, certificates, and badges
 - Dashboards and real-time management of learning
 - Linking training with job performance and vice versa
 - Mastery-based Education
 - Life-Long Learning

Deep Disruptions

The New Learning Technology Supply Chain



Infrastructure To Support an Open Ecosystem

Innovation

AI & Personalization
Cloud & Non-LMS Activity
Credentials
Life-Long Learning

Dashboards & Analytics
Competency-based Training
Job Performance Feedback
Mastery-based Education

Ecosystem Management Tools

Identity, State,
Goals, Prefs

History

Competencies

Activity and
Affect

Content
Metadata

Infrastructure

Secure Data and Network Backbone

Learning Engineers Needed!

- Using technology in education (at all levels) will require a workforce of specialized systems engineers, as in other industries
- Several graduate programs have been started (e.g., CMU METALS) to teach tomorrow's engineers
 - Learning science, systems design, new technologies, products' strengths and weaknesses, government regulations, standards, project management, examples of successes and failures, ...

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- If you happen to be in Washington DC next week: ICICLE'19
<https://www.ieeeicicle.org/2019-conference>

IEEE Learning Technology Standards Committee

- SCORM's 10-year renewal
- Augmented Reality (content portability)
- xAPI 2.0 (learning activity & LRS)
- Mobile platform functionality
- Sharable competency definitions
- Student data governance
- Digital Literacy, Skills, and Readiness
- Security of cyber-physical learning systems*
- Adaptive Instructional Systems (AIS)
- Federated machine learning

PAR Number	Title
P1484.11.3	Standard for Learning Technology Extensible Markup Language (XML) Schema Binding for Data Model for Content Object Communication
P1484.12.3	Standard for Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata
P1484.20.1	Standard for Learning Technology-Data Model for Reusable Competency Definitions
P1484.21	Task Model for Project-based Learning
P1589	Standard for an Augmented Reality Learning Experience Model
P2247.1	Standard for the Classification of Adaptive Instructional Systems
P7004	Standard for Child and Student Data Governance
P7919.1	Requirements for eReaders to Support Learning Applications
P9274.1.1	JavaScript Object Notation (JSON) Data Model Format and Representational State Transfer (RESTful) Web Service for Learner Experience Data Tracking and Access

P2247– Adaptive Instructional Systems (AIs)

- Enable consumers to compare current and future products
- Inform purchasing and deployment decisions
- Inform subsequent data exchange standards
- Promote “ethically aligned design” for AI
- Three standards projects
 1. Conceptual model and definitions (reduce market confusion)
 2. AIS component interoperability
 3. Best practices for evaluating an AIS



Federated Machine Learning: Enabling AI in a GDPR World



- **Project:** Guide for Architectural Framework and Application of Federated Machine Learning (Proposed by WeBank)
- **Problem:** Modern AI systems need data from multiple sources to find actionable patterns
Increased concern about student data privacy will limit access to data
- **Relevance:** AI is used in many types of learning technologies
Privacy and protection of data is of great concern



ETHICALLY ALIGNED DESIGN

A Vision for Prioritizing Human Wellbeing with
Artificial Intelligence and Autonomous Systems



- **P7000 - Model Process for Addressing Ethical Concern**
- P7001 - Transparency of Autonomous Systems During System Design
- **P7002 - Data Privacy Process**
- **P7003 - Algorithmic Bias Considerations**
- **P7004 - Standard for Child and Student Data Governance**
- P7005 - Standard for Transparent Employer Data Governance
- **P7006 - Standard for Personal Data Artificial Intelligence (AI) Agent**
- P7007 - Ontological Standard for Ethically Driven Robotics and Automation Systems

Open Stand Principles (IEEE, W3C, IETF)

- Cooperation
 - Respectful cooperation among standards organizations
- Adherence to Principles
 - Due process, Broad consensus, Transparency, Balance, Openness
- Collective Empowerment
 - Chosen and defined based on technical merit
 - Provide global interoperability, scalability, stability, and resiliency
 - Enable global competition, support further innovation
 - Contribute to the creation of global communities
- Availability
 - Varies from free to “Fair, Reasonable, and Non-Discriminatory”
- Voluntary Adoption
 - Success is determined by the market

<https://open-stand.org/>

<https://standards.ieee.org/develop/govern.html>



SDOs can't actually make a standard!

Only the market can make a standard

Pre-standards Activities

- Principles
- Requirements
- Early Specs
- Prototypes

Standardization

- Compromises
- Consensus
- Prototypes
- Plugfests

Early Adoption

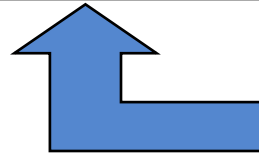
- Publication
- First Products
- Promotion

Rude Awakening

- User feedback
- Revisions

Real Adoption

- Stabilization
- Test Suites
- Products
- Conformance
- Compliance



Useful Links

- IEEE LTSC: <http://sites.ieee.org/sagroups-ltsc/home/>
- TLA: <https://www.adlnet.gov/tla>
- SCORM: adlnet.gov/scorm/ and scorm.com
- xAPI: experienceapi.com or adlnet.gov/xAPI
- IMS: imglobal.org
- ICICLE <https://www.ieeeicicle.org/>
- IEEE Standards University: <http://www.standardsuniversity.com>

Additional Resources

- Smith, B., Schatz, S., Gallagher, P. S., Vogel-Walcutt, J. (2018) Total Learning Architecture: Moving to the future. Proceedings of I/ITSEC 2018.
- Robson, R., & Barr, A. (2018). Learning Technology Standards - the New Awakening. In R. Sottolare, K. Brawner, A. Sinatra, & B. Goldberg (Ed.). Proceedings of the Sixth Annual GIFT Users Symposium: US Army Research Laboratory. <https://www.gifttutoring.org>
- Barr, A. & Robson, R. (2019) Missing pieces: Infrastructure Requirements for Adaptive Instructional Systems. Proceedings of the Workshop on Adaptive Instructional Systems, at HCI International 2019, Orlando.