Using X3D, H-Anim, and SCORM to Create Reusable, Interactive 3D Instruction

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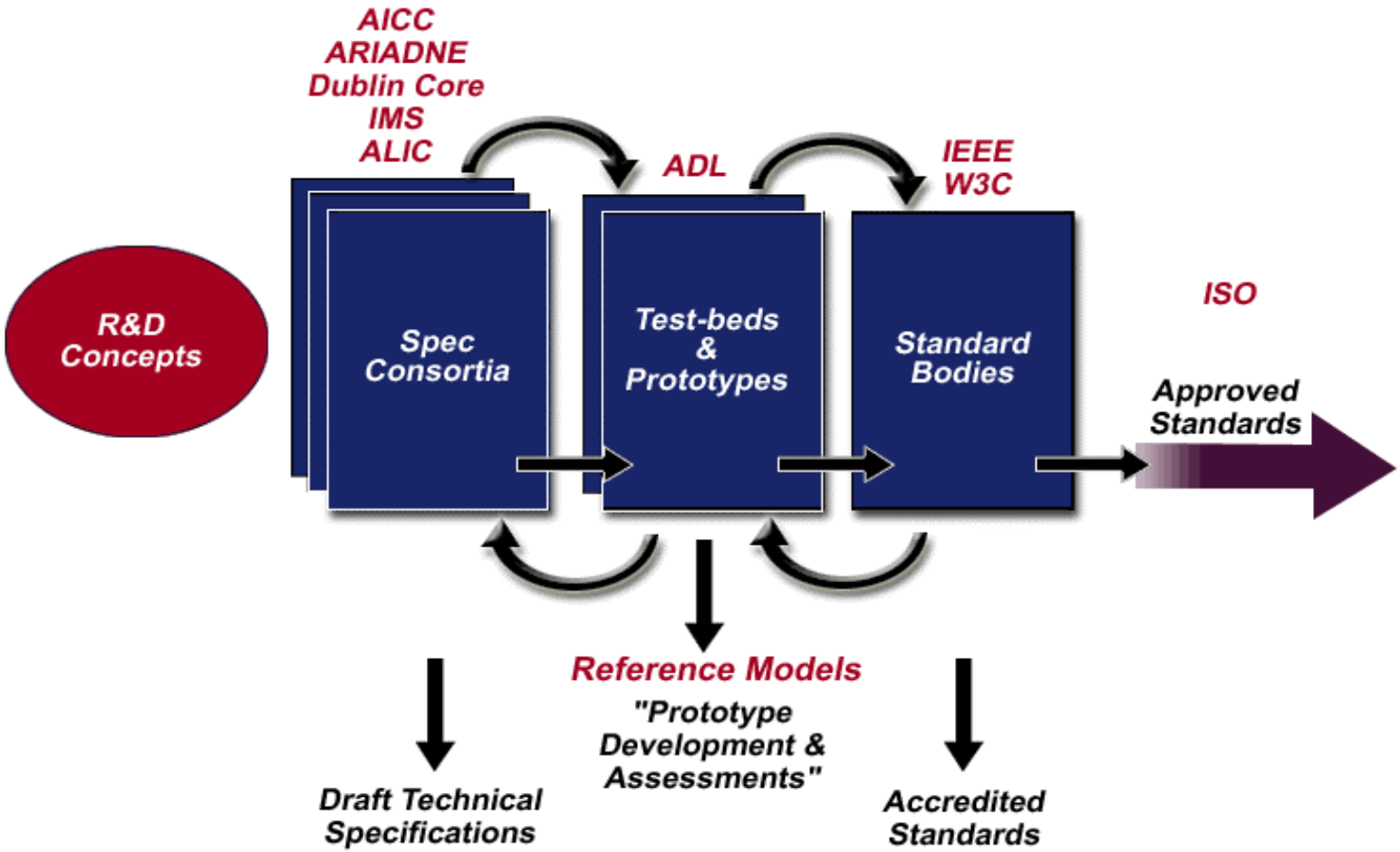
Agenda

- Advanced Distributed Learning
- Reusable Learning Objects
- Shareable Content Object Reference Model (SCORM)
- Shareable Simulation Assets
- An Approach to Creating Reusable Simulation Components

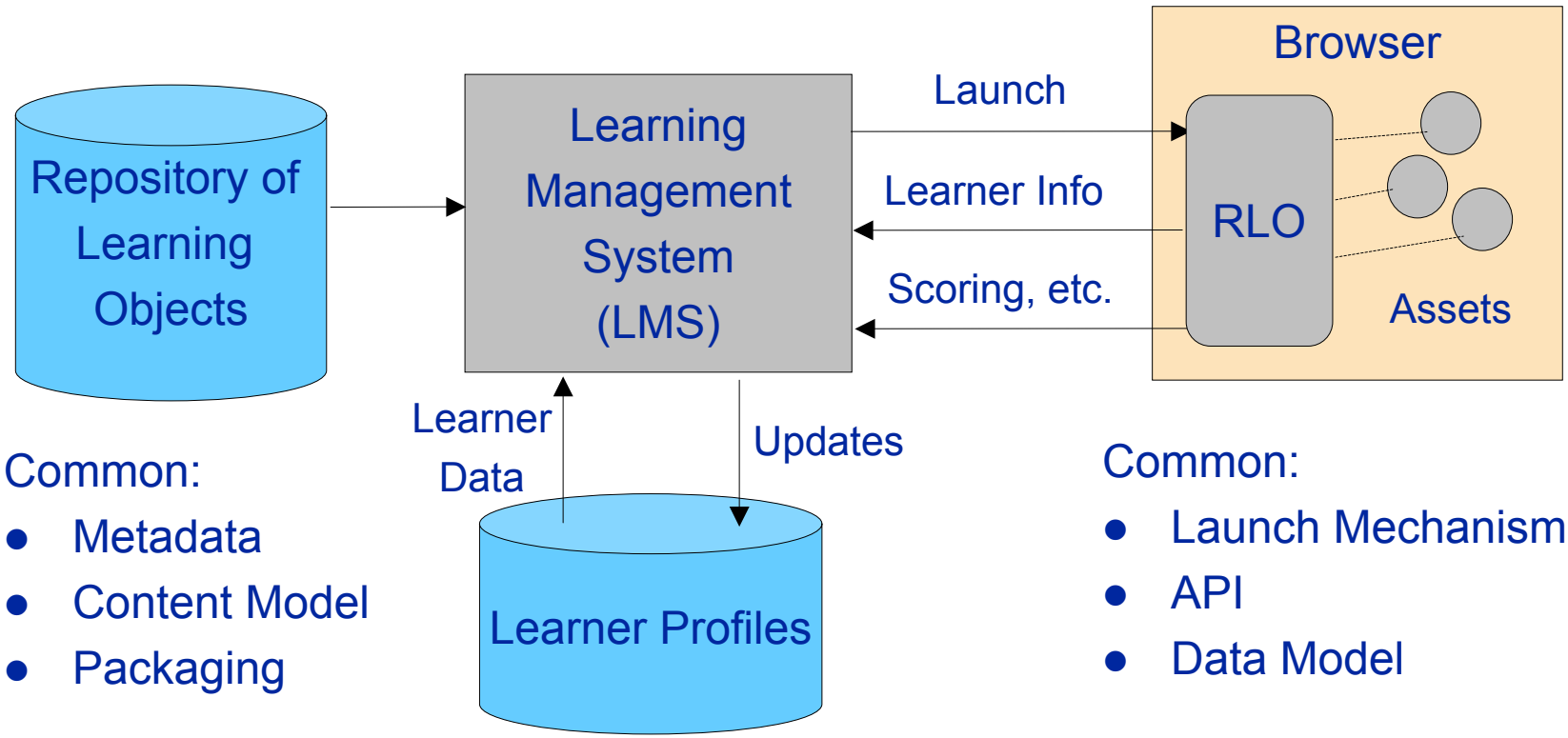
Advanced Distributed Learning (ADL)

- Advanced Distributed Learning is:
  - Learning that takes place anywhere and at any time it is required.
  - A term used to describe any of a number of initiatives aimed at promoting the accessibility, interoperability, reusability, and durability of instructional content.
- Consortia developing ADL specifications:
  - Instructional Management System (IMS) Global Learning *Int'l*
  - IEEE Learning Technology Standards Committee (LTSC) *Int'l*
  - Aviation Industry CBT Committee (AICC) *Int'l*
  - ARIADNE *EU*
  - PROMETEUS *EU*
  - ADL Initiative *US*

Relationship of ADL to Specification Consortia and Standards Bodies



Reusable Learning Objects



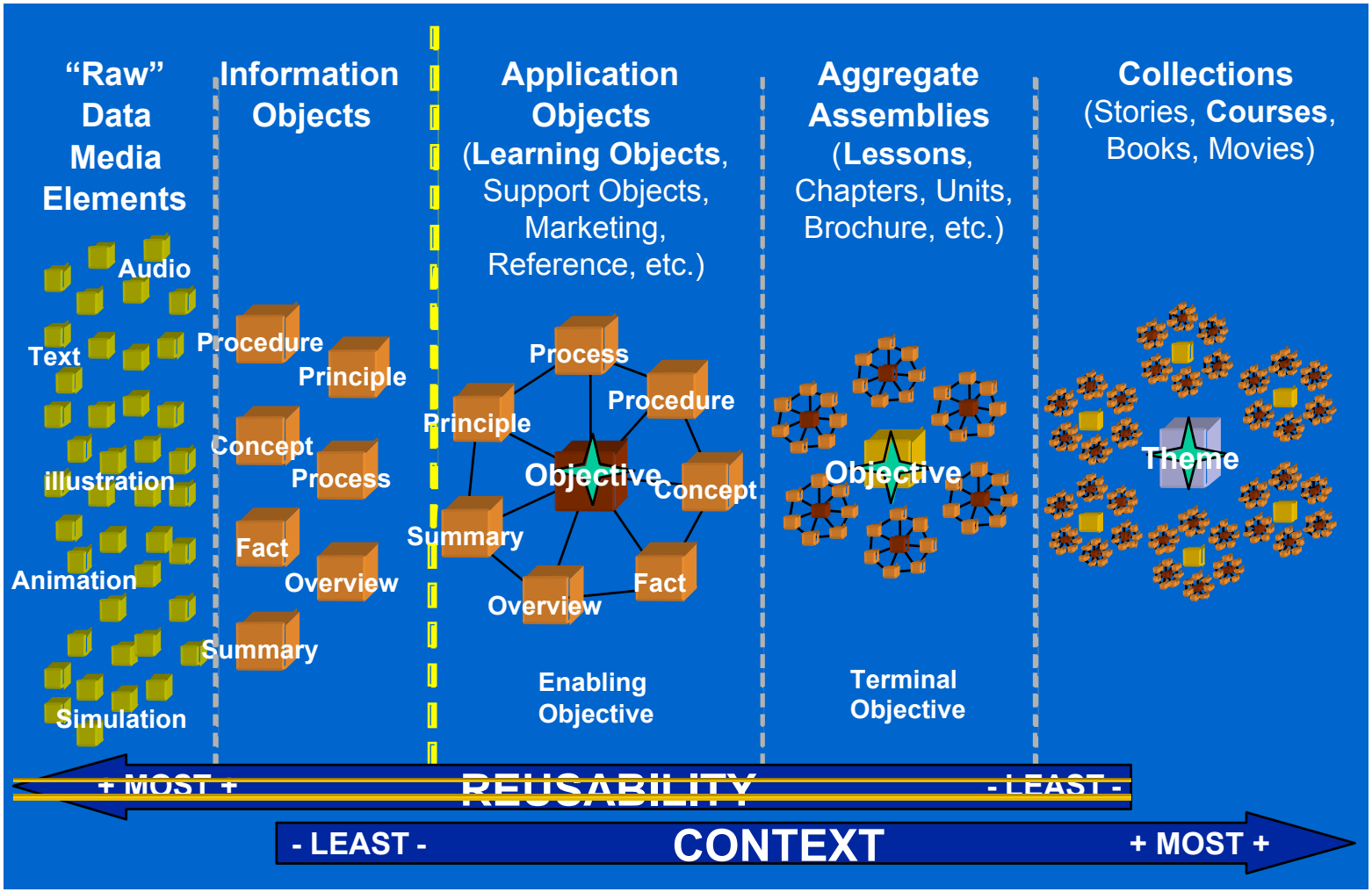
Common:

- Metadata
- Content Model
- Packaging

Common:

- Launch Mechanism
- API
- Data Model

Instructional Content: Reusability and Context



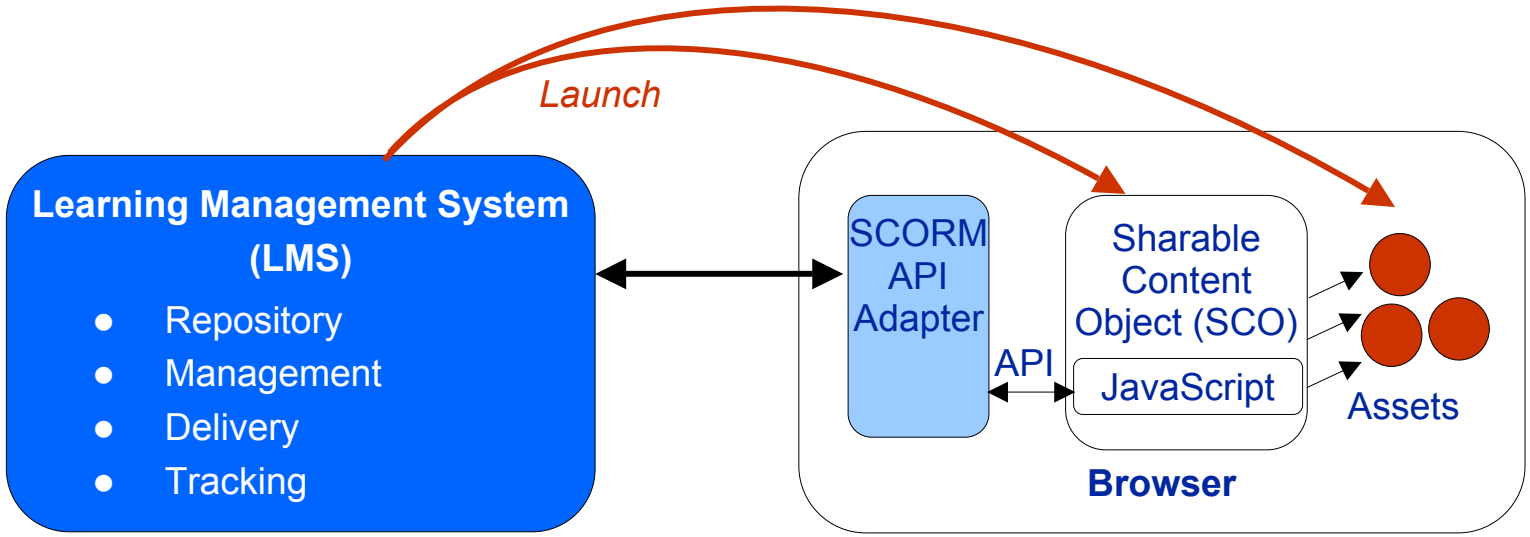
Source: Autodesk

Web-based Learning Content Issues

What problems are we trying to solve?

- Can't move a web-based course from one Learning Management System (server) to another
- Can't reuse web-based content pieces (objects) across different LMS systems
- Can't create searchable learning content libraries or media repositories

Sharable Content Object Reference Model (SCORM)



SCORM Run Time Environment

- Data Model (from AICC)
- Launch, Communication API (from AICC)

SCORM Content Aggregation Model

- Meta-data Dictionary (from IEEE)
- Content Packaging (from IMS)
- Content Structure (derived from AICC)
- Meta-data XML Binding and Best Practice (from IMS)
- Sequencing and Navigation (IMS & ADL)

Source: Adpated from ADLNET.org

ADL "ilities": Functional Requirements for Learning Objects Under ADL

- Learning content should have the following characteristics:
  - –Accessibility
  - –Interoperability
  - –Reusability
  - –Durability

SCORM Content Aggregation Model

- Content Model
  - Nomenclature defining the content components of a learning experience
- Meta-data
  - A mechanism for describing the components of the content model
- Content Packaging
  - Defines how to represent the intended behavior of a learning experience and package resources for movement between systems
- Sequencing and Navigation (Introduced in 2004)
  - Defines predictable, consistent ordering and delivery of learning activities

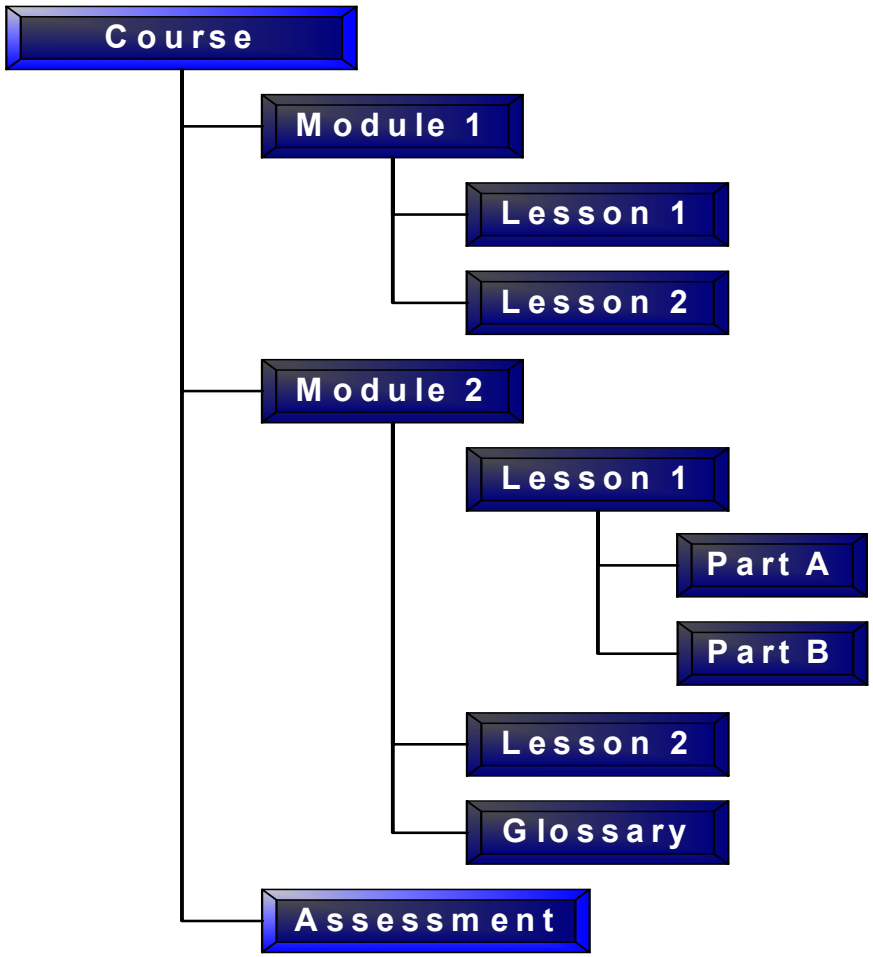
Shareable Content Components

- Asset
- Sharable Content Object (SCO)
- Content Aggregation

Introduced in SCORM 2004

- Sharable Content Asset (SCA)

Content Aggregation



SCORM 2004 Metadata

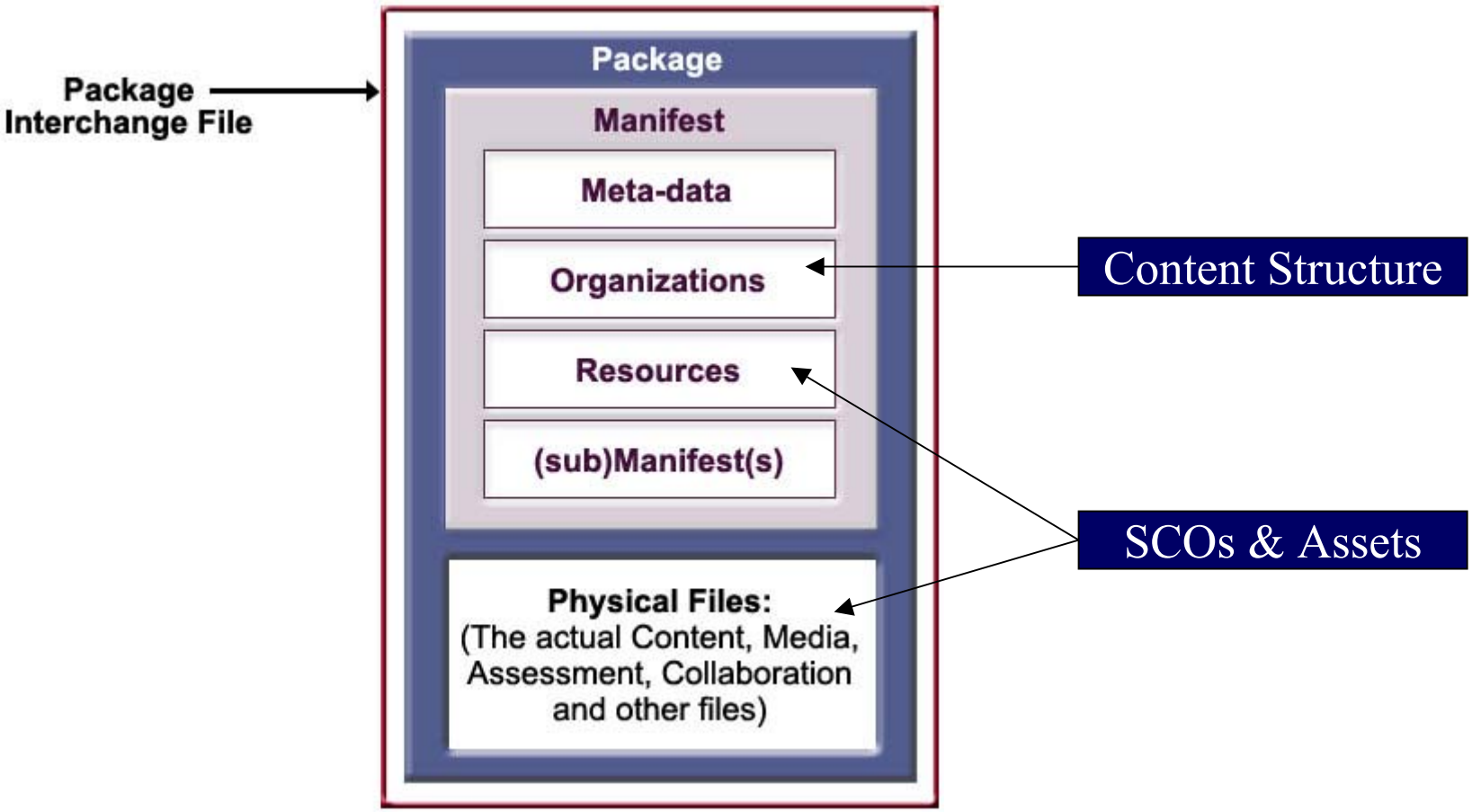
- Directly references the IEEE 1484.12.1-2002 LTSC* Learning Object Meta-data (LOM) Standard
- SCORM defines which data elements are mandatory for describing:
  - Assets
  - SCOs
  - Content Aggregations
  - SCAs
  - Packages

Meta-data Information Model

- Describes the available data elements permitted to build SCORM conformant meta-data records
- Broken into nine categories based on definitions found in the LOM Information Model

  - General
  - Lifecycle
  - Meta-metadata
  - Technical
  - Educational
  - Rights
  - Relation
  - Annotation
  - Classification

Content Information Package



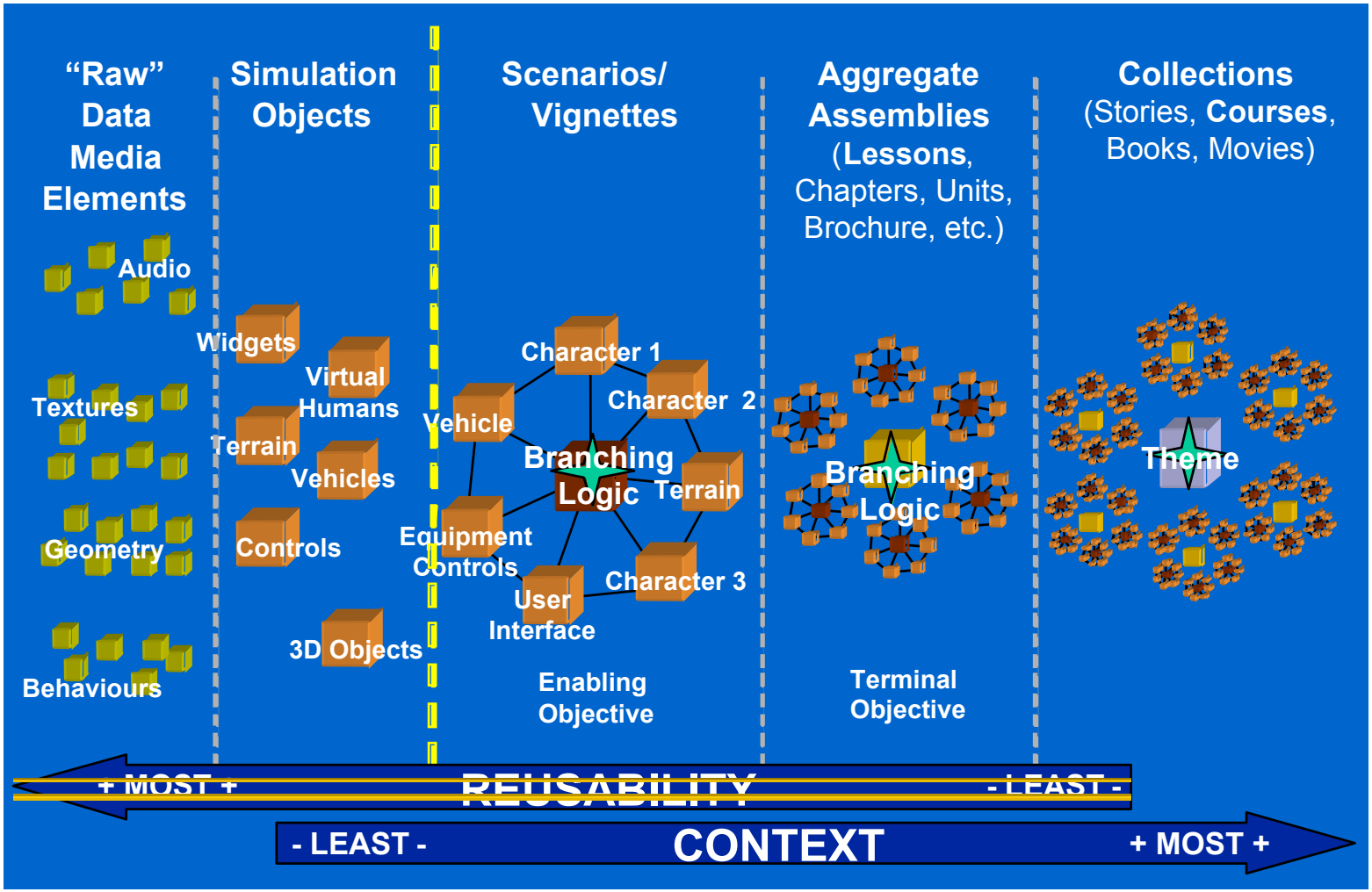
How do we extend this for Web3D?

- 3D Objects with Embedded Simulations as Assets
- Using Virtual Humans as Mentors and Role-playing Actors
- Example

Reusable 3D Simulation Objects

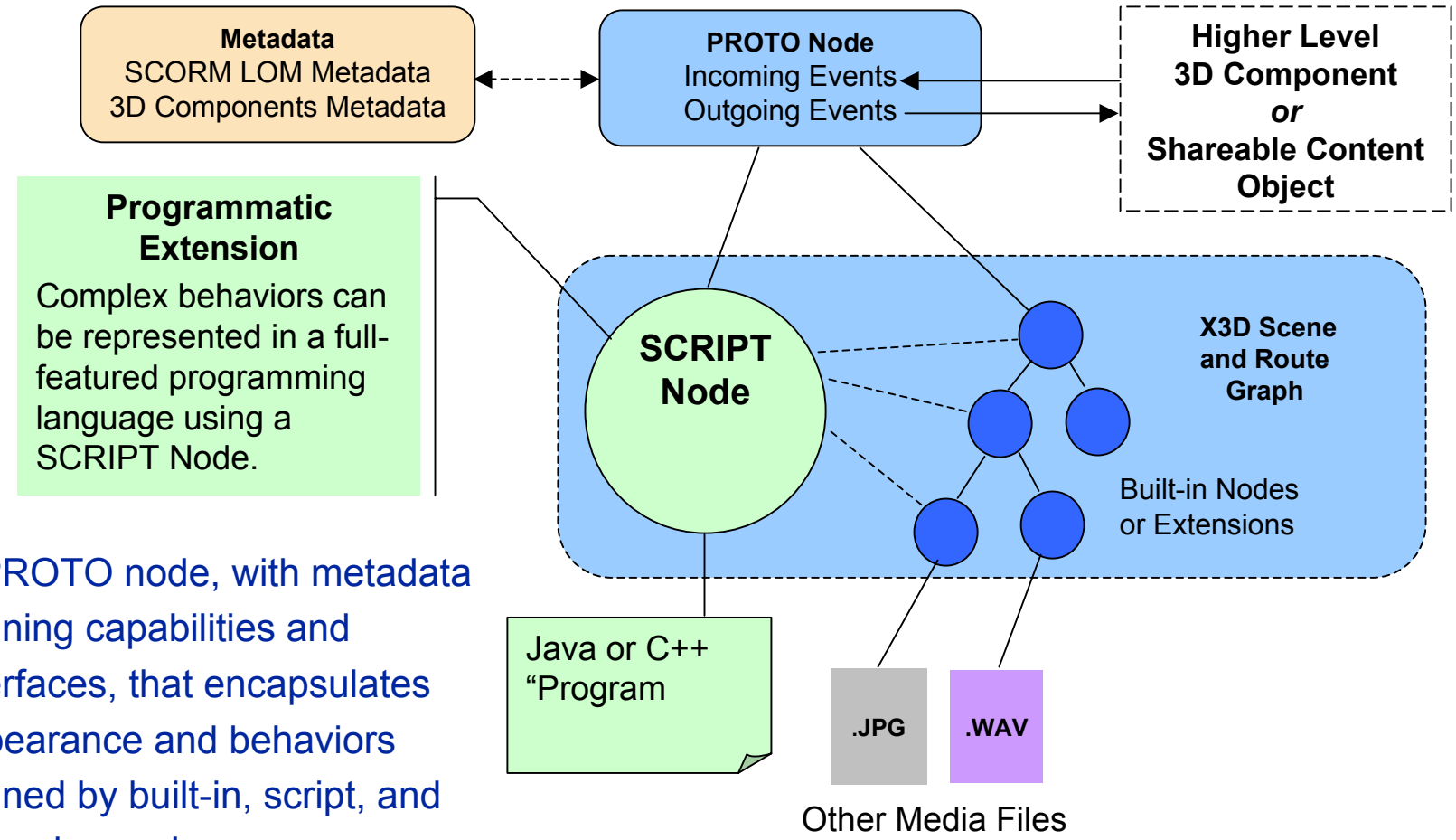
- In simulation-based e-Learning, a single, complex simulation object may cost more to develop than any of several Learning Objects that embed it.
- We wish to create 3D Simulation Objects that can be aggregated as SCORM assets, and re-used among many Shareable Content Objects.

Content Model for 3D Simulation Objects



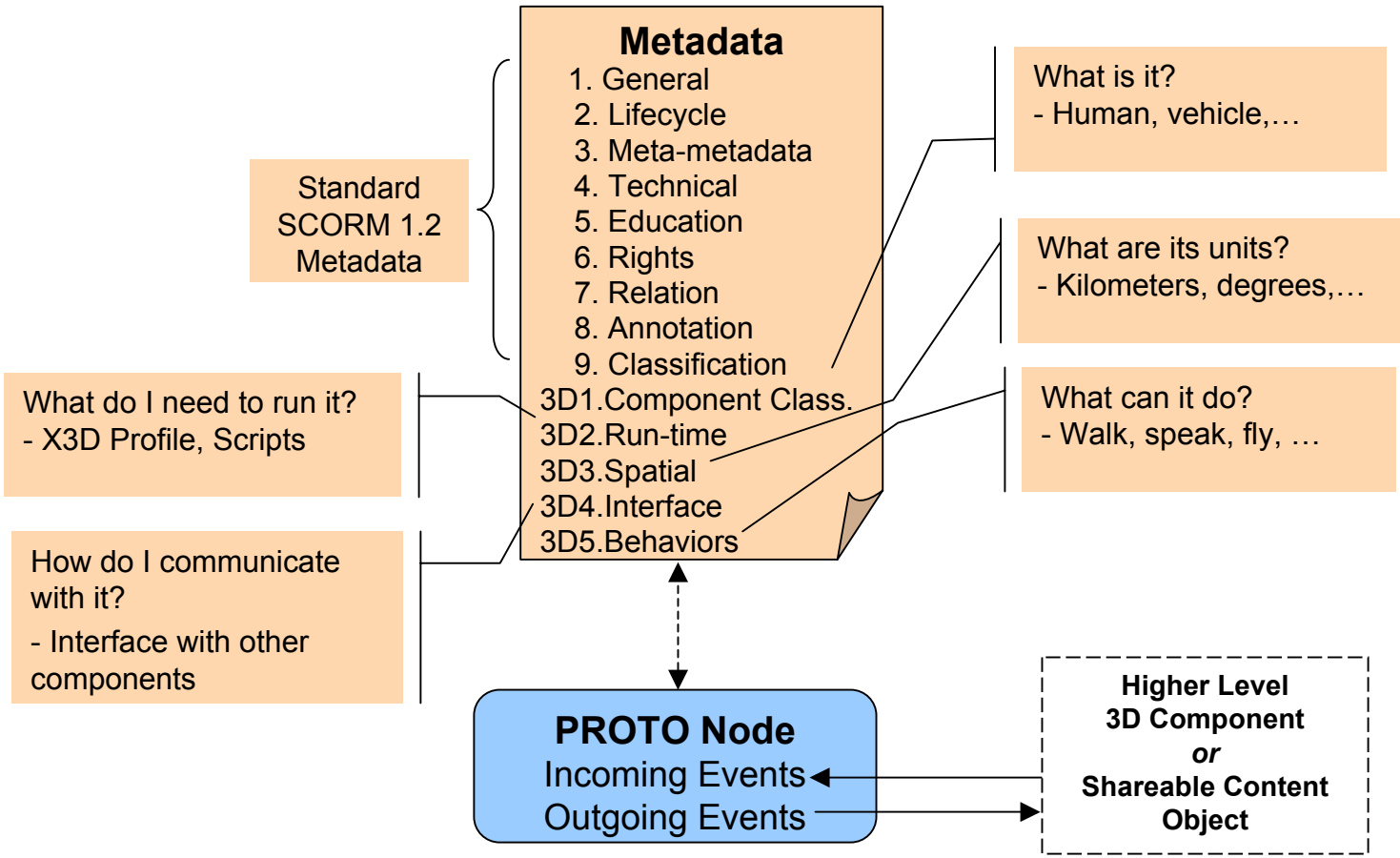
Adapted from: Autodesk

Implementation of 3D Components



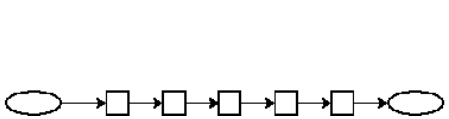
A PROTO node, with metadata defining capabilities and interfaces, that encapsulates appearance and behaviors defined by built-in, script, and extension nodes.

Metadata for 3D Components

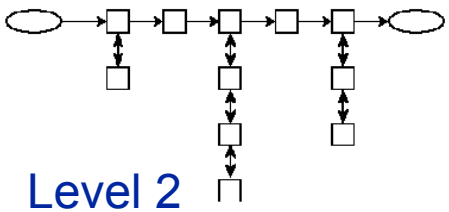


Interactive Multimedia Instruction

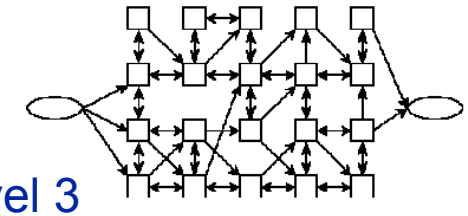
- Interactive Multimedia Instruction (IMI) is the most prevalent type of e-Learning today.
- Content (usually Web pages) sequencing may be linear, simple, or complex.



Level 1
(Linear)



Level 2
(Simple Branching)



Level 3
(Complex Branching)

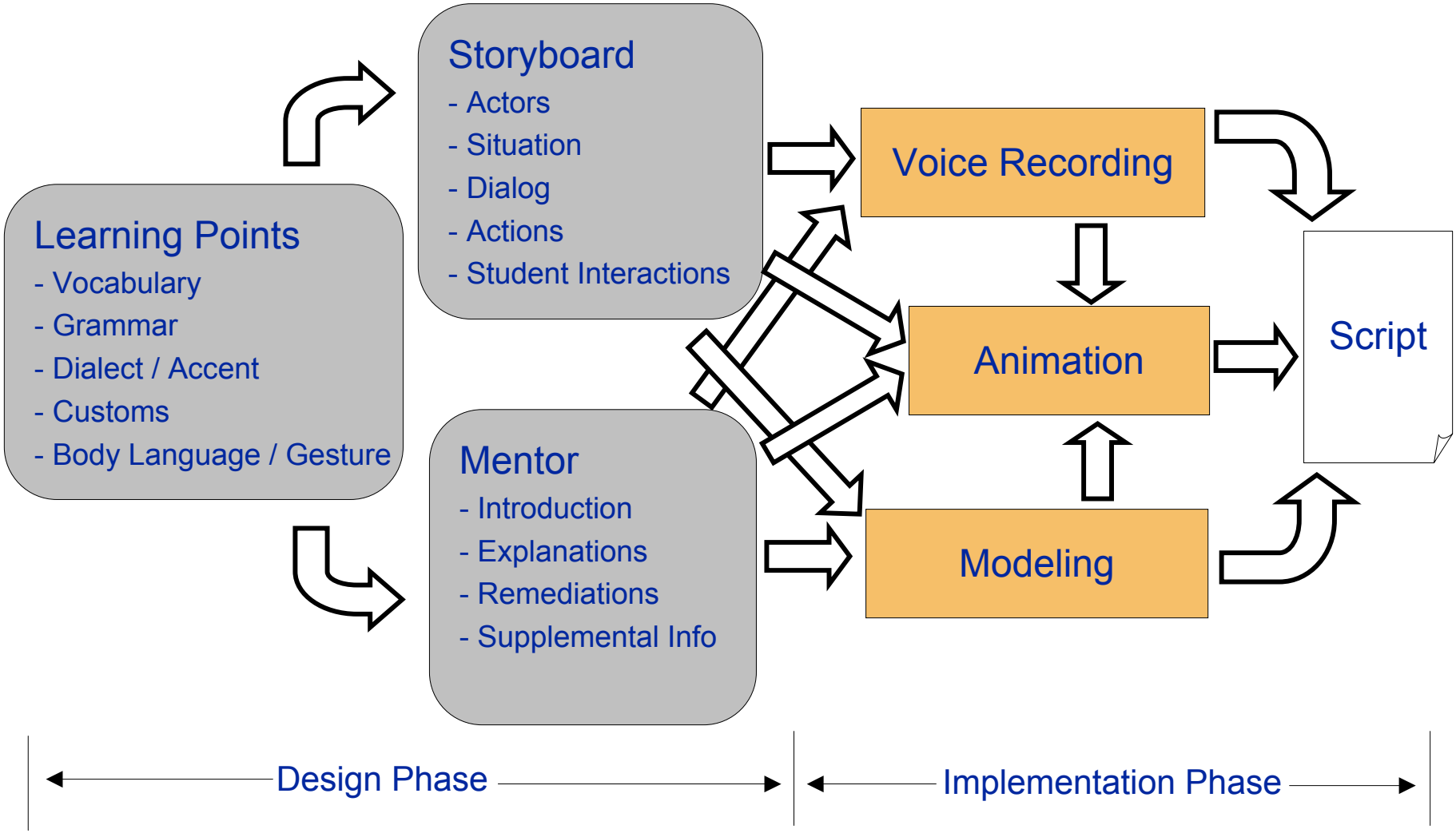
Using X3D in IMI

- Why use interactive 3D instead of video?
  - Lower bandwidth
  - Higher interactivity
  - Navigation and exploration
- Why use X3D?
  - XML syntax integrates easily with Learning Content Management Systems (LCMSs)
  - Significant content repositories available
  - Extensible to provide simulation APIs.

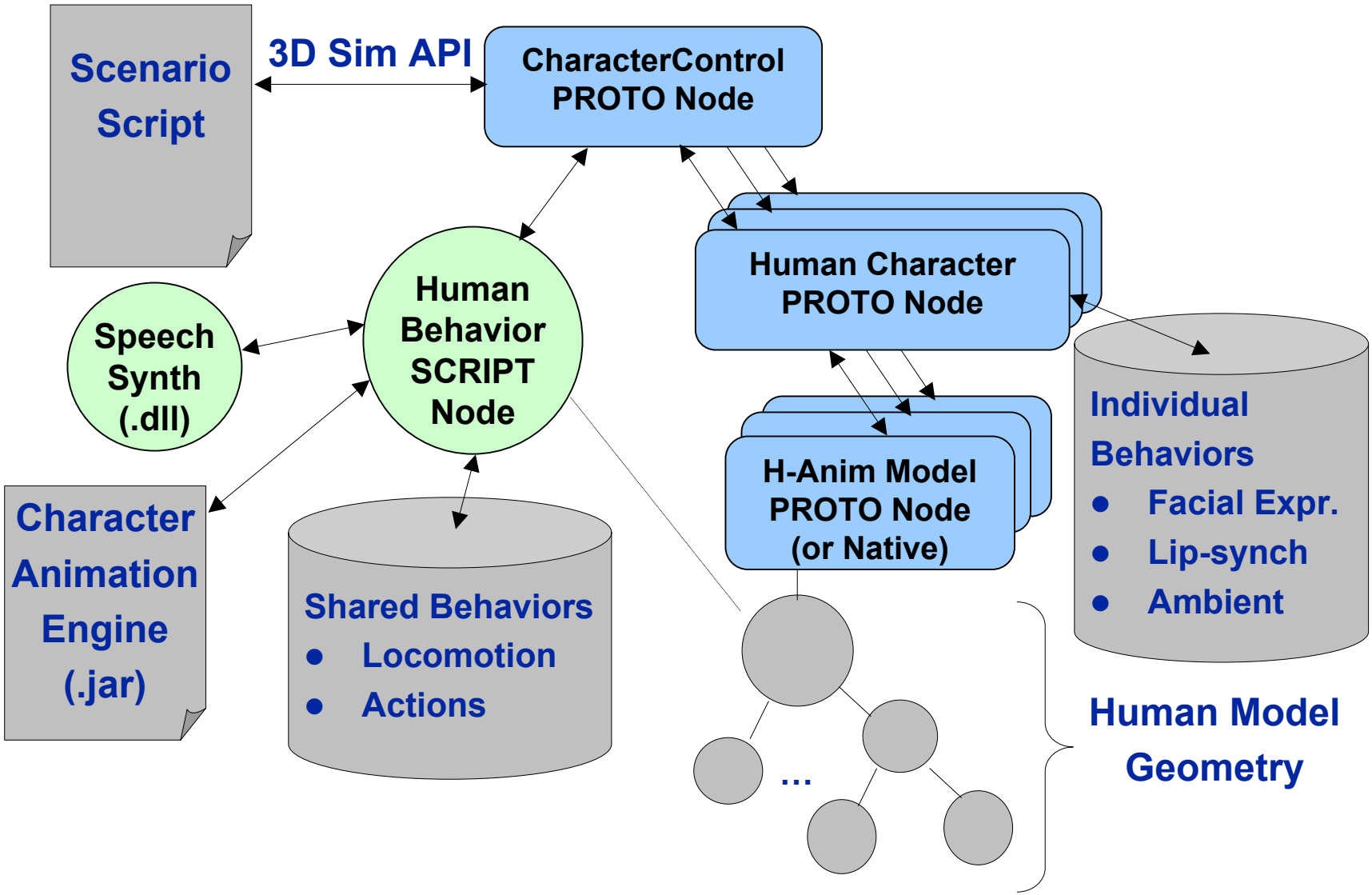
Using H-Anim in IMI

- Roles for Virtual Humans
  - Mentoring: More motivating that sound alone
  - Demonstrating: Can show complex procedures
  - Role-playing: Communication and human interaction skills
  - Interpreting: Sign-language
- Why use Animation?
  - Does not require live talent
  - Easy to edit
- Why use H-Anim?
  - Supports personalization and internationalization
  - Easy to upgrade models later

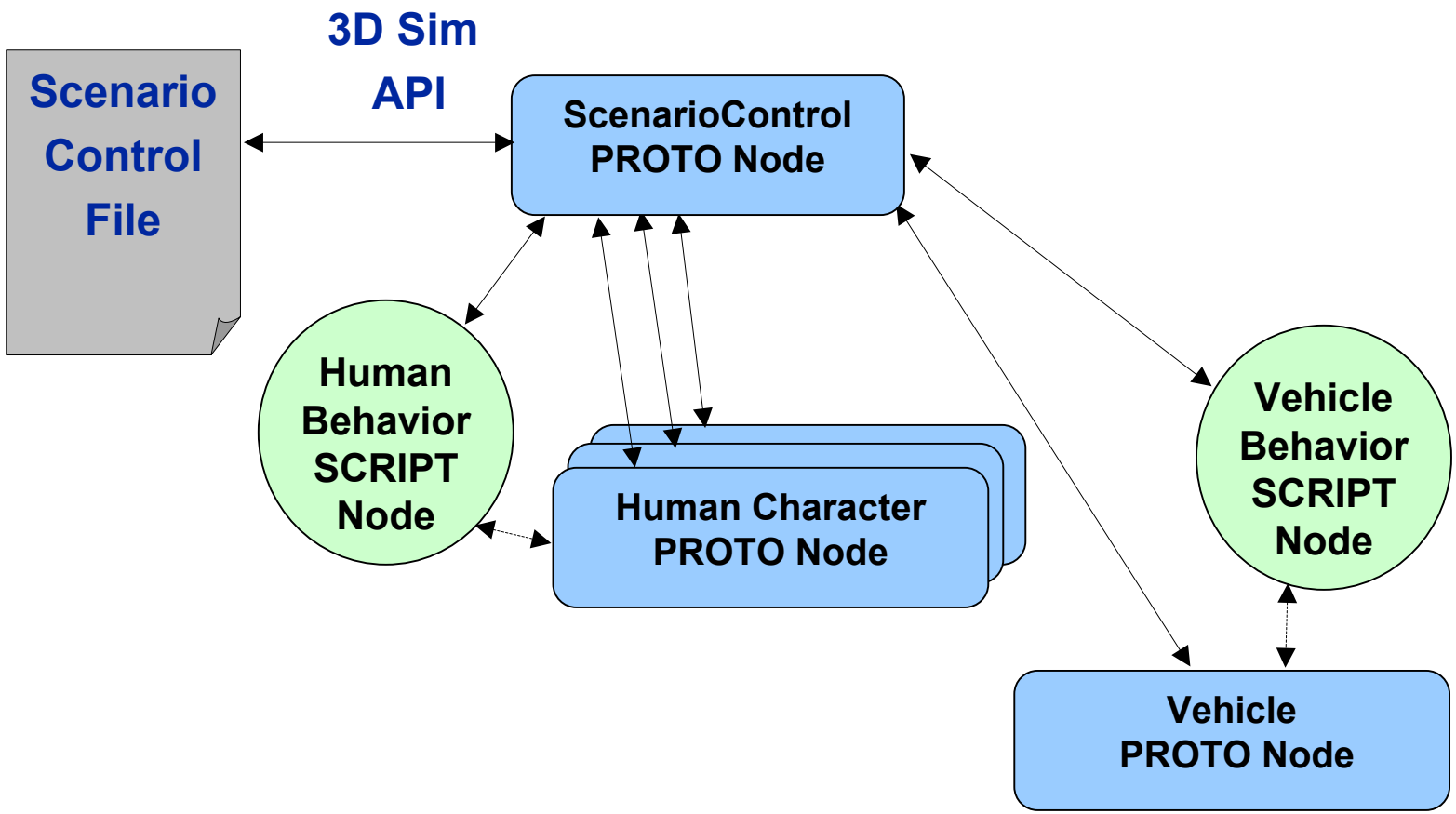
IMI Instruction Using Virtual Humans



Example 3D Component: Virtual Human

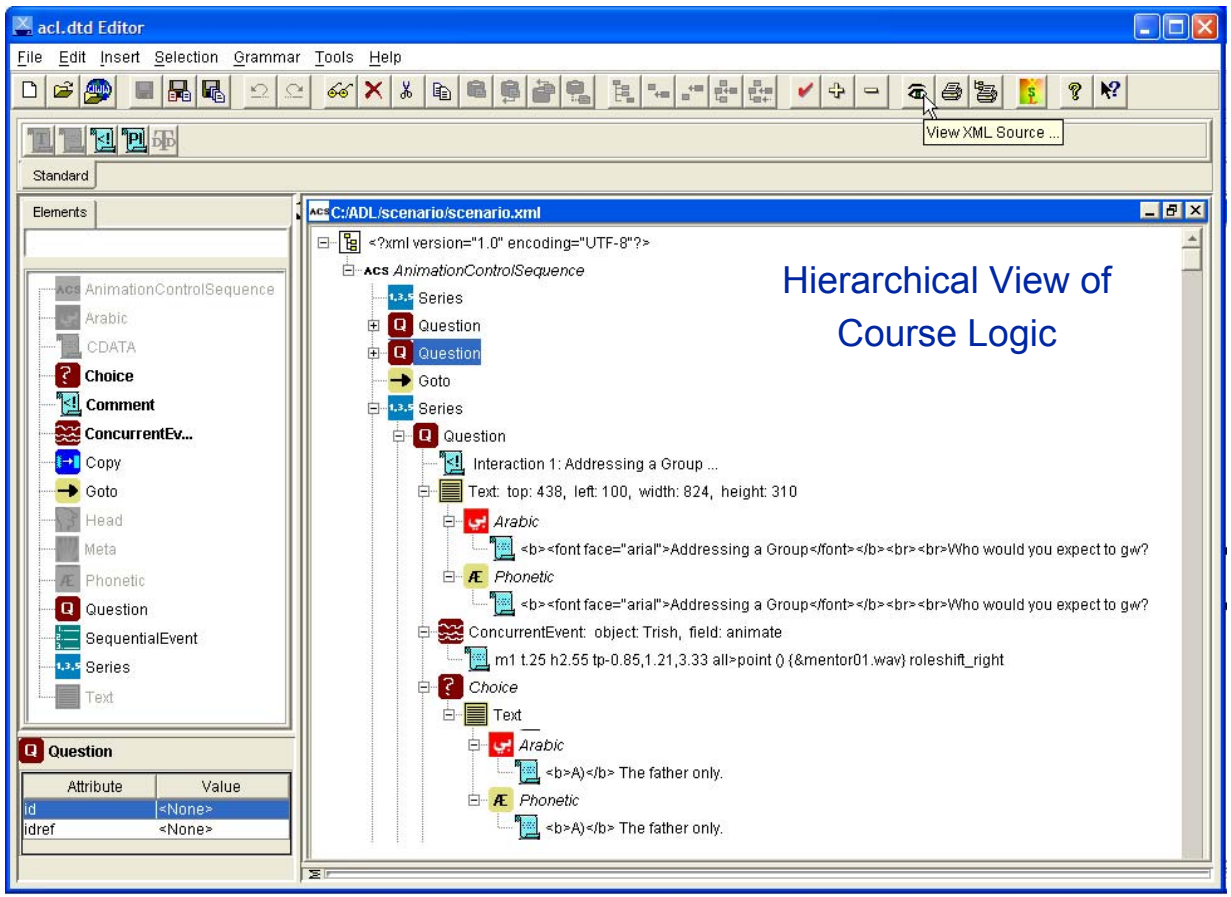


Scenario Control



SCL-Edit: IMI Authoring Tool

- Supports IMI Level 3-4 Course Design
- Uses Xeena: Same XML Editor as X3D-Edit



Example: Checkpoint Scenario

- Developed by Vcom3D in partnership with the U.S. Defense Language Institute and Naval Postgraduate School.
- Teaches elements of Iraqi Culture, Customs, and Dialect.

Iraqi Checkpoint Scenario

- Family of four approaches checkpoint on road to Baghdad
- Student, playing the role of soldier, must properly interact with each family member to:
  - Get Background Information
  - Check IDs
  - Conduct Search
- Student's actions influence outcome
- Mentor acts as guide and provides remediation

Scenario Development Methodology

- Identify learning objectives.
  - "Hot points", but subtle
- Map objects to context of checkpoint scenario.
- A priori write script/storyboard with "directions" (the cues, gestures, intonation, etc.)
- Videotape to verify and elaborate upon what was identified a priori.

Demo Caveats

- Work in progress
  - "Hot off-the-press"
- Rerecording narration
- Major role of mentor – scenario-specific
- Making other enhancements
- The real learners will have had approximately 2 semesters of Modern Standard Arabic language training at DLI

Demonstration

Video Recording

Non-Interactive

250KB / sec

3D Simulation

Interactive

5KB / sec