Learning Record Provider Professional Certification Recommendations

17 May 2018

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Under contract #W911QY-16-C-0109 by

Advanced Distributed Learning

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Executive Summary

This document summarizes what solicitors and contract performers need to know to effectively execute xAPI projects that generate data. This begins with:

- A knowledge of xAPI's fundamentals,
- The development and maintenance of an xAPI data strategy
- A knowledge of market-available Learning Record Provider solutions and their capabilities.

The document is organized by how these knowledge, skills and abilities (KSAs) apply in different phases within the processes for contract solicitation and verification/validation. Similarly, these KSAs are organized by different phases in a general Performer's development process.

I. Introduction

"An issue I run into, skewing data, has to do with how many times a statement is sent. I've had videos, buttons, and other things sending statements onClick; sometimes a statement will be sent multiple times.

In the case of videos, if someone is experiencing lag they might click play/pause multiple times and each time it is going to send a statement. It would be good to create verbs for play/pause, etc. If you don't want multiple statements to be sent, you have to write some code so it only happens once.

However, then you won't know if something is going wrong in terms of lag or other issues.

Aren't there best practices that IDs and developers should know?"

- **Melissa Milloway, Instructional Designer at Amazon**

Professionals who work with the Experience API (xAPI) need a formal body of knowledge to generate high quality data with xAPI. Some of this knowledge can be sourced directly from xAPI's specifications and the multitude articles, documents, reports and books devoted to applied research and development with xAPI. Practice leaders, even in these early days for xAPI, can identify hard-won lessons from working with xAPI despite a gap in tools and maturity in commercial, off-the-shelf implementations of xAPI within authoring tools and other learning technologies.

This document identifies what professionals need to know to work effectively with Learning Record Providers and identify in what roles are the dimensions of this xAPI know-how relevant.

A. What challenge is addressed by Learning Record Provider Professional Certification Recommendations?

The competencies herein directly address a broad but common set of needs expressed by US Military and US Government stakeholders and professionals. These needs are extracted from interviews and facilitated discussions conducted over a six year period.

The issuance of Department of Defense Instruction 1322.26 imparts an imperative for the Armed Services to implement the Experience API (xAPI) in

ways that generate data with inherent semantic interoperability. This is to say the Armed Forces, as would any organization, derives the most value from xAPI when the data generated by a given Learning Record Provider aligns with similar data from other Learning Record Providers. In practice, the tools and content widely available in the commercial, off-the-shelf market are capable of producing data that capably follows the structure required of xAPI statements, but the ways in which the xAPI specification is implemented by these different tools and content reflect the flexibility with which xAPI may be applied. This results in data sets collected by the Armed Services (like other organizations adopting xAPI today) where the data itself is technically interoperable in terms of its data structure, but lacks semantic interoperability, meaning two activity statements captured from two different Learning Record Providers that should be treated as the same (like a "completion" statement) are not recognized as similar.

With much research and analysis since 2013, the xAPI Community vetted that the most effective means to ensuring the semantic interoperability of xAPI data is to ensure the knowledge, skills and abilities related to generating xAPI data are consistent, reinforcing the same best practices for all talent responsible for generating xAPI data. Such talent serves within the Armed Forces in the *solicitation* and implementation of technology, media, hardware, software and/or content. As well, there is a need to ensure similar and related knowledge, skills and abilities are present among *performers* who design, develop, manage and deliver technology that generates xAPI data.

B. How much value is saved or gained by addressing this challenge?

Interviews of stakeholders across US Military & US Government illustrate the high cost of accountability to standards when professionals with inconsistent degrees of competence in areas related to such standards are responsible for supporting or even enforcing those same standards.

The Department of Defense Strategic Plan for Advanced Distributed Learning[1] (1999) defines ADL's strategy:

> *"In short, the strategy is to: pursue emerging network-based technologies; create common standards that will enable reuse and interoperability of learning content; lower development costs;*

[1] Department of Defense Implementation Plan for Advanced Distributed Learning. Office of the Deputy Undersecretary of Defense (Readiness & Training), 1999, prhome.defense.gov/portals/52/documents/rfm/readiness/docs/adl_stratplan.pdf.

> *promote widespread collaboration that can satisfy common needs; enhance performance with next-generation learning technologies; work closely with industry to influence the COTS product development cycle; and establish a coordinated implementation process."*

The competencies documented herein may provide the most value supporting a coordinated implementation process. This document assumes it is during the acquisition process where most efficiencies may be gained in pursuit of semantic interoperability. If competencies are present in various phases of acquisition, evidenced through interactions with/transactions among Solicitor and Performer, onboarding new Learning Record Providers into a training environment and/or military operations should result in vastly improved semantic interoperability and lower operating and maintenance costs.

C. How was this document researched and authored?

Several interviews were conducted among professionals representing different roles and stakeholders in xAPI-related acquisitions. These interviews were used to expand upon the authors' particular expertise in the software development lifecycle[2] (SDLC) of xAPI efforts.

D. What is the scope of the Learning Record Provider Professional Competencies?

This document should be regarded as a reference for knowledge, skills and abilities required of professionals who work with Learning Record Providers. While there may be overlaps with other sets of competencies for multiple professional roles addressed herein, this document presents competencies related to xAPI that are highly relevant and necessary to support uniform, high quality data generation.

[2] "Systems Development Life Cycle." Wikipedia, Wikimedia Foundation, 30 Apr. 2018, en.wikipedia.org/wiki/Systems_development_life_cycle.

II. Knowledge, Skills & Abilities Required of Learning Record Provider Professionals

In consideration of the knowledge, skills, and abilities (KSAs) required of Learning Record Provider Professionals, this document references the definitive work on designing for outcomes with xAPI, Investigating Performance by Janet Laane Effron and Sean Putman.[3] Distilled below are relevant KSAs drawn from the work (previously edited and published by the authors of this document).

Any professional working with xAPI to produce quality data would do well to reflect on the following questions: (1) Do I currently have these KSAs? (2) If not, what am I willing and able to do to obtain these KSAs?

Learning Record Provider Professional Knowledge, Skills & Abilities

Knowledge	Skill/Ability	Performance Measure
Knowledge of xAPI's Fundamentals	**Understands/Explains** ● required elements of an xAPI activity statement ● optional elements of an xAPI activity statement **Describes** ● Verbs, Activities, Activity Types, Attachment Usage Types, Document Resources, Extensions that may be required of the Design **Determines** ● a well written activity statement from poorly written statements ● what should go into extension **Actively Participates In** ● relevant information and educational opportunities to stay current on the xAPI specification	● Observed by Supervisor to a) engage in educational opportunities and b) explaining xAPI fundamentals
Development and Maintenance of an xAPI Data Strategy	**Understands/Explains** ● established ontology and/or taxonomy used in the organization	● Observed by Supervisor to produce or maintain a conformant xAPI Profil.

[3] Effron, Janet Laane, and Sean Putman. Investigating Performance: Design and Outcomes with xAPI. Edited by Megan Bowe, MakingBetter, 2017.

	Identifies ● key interactions in the Design ● key performance indicators in the Design ● established xAPI vocabulary, activities and Profiles required in the Design **Defines** ● xAPI activity statements related to key interactions ● groupings or patterns of xAPI activity statements that evidence key performance indicators ● a maintenance plan that addresses evolutionary changes and graceful retirement of vocabulary no longer used **Develops/Maintains** ● an xAPI Profile conformant to the xAPI Profile specification.	● Observed by Enterprise-level Data Architecture Stakeholders that the xAPI Profile conforms to or supports required taxonomy/ontology conventions
Knowledge of Market-available Learning Record Provider Solutions and Capabilities	**Understands/Explains** ● commercial, off-the-shelf tools on the market that potentially support the Design requirements ● open-source code libraries that potentially support the Design requirements **Identifies** ● activity statements and any other xAPI-related capabilities generated by the given Learning Record Provider **Evaluates** ● generated activity statements against defined needs	● Validated by third-party services that the activity statements generated by the Learning Record Provider conform to the xAPI specification ● Confirmed by Enterprise-level Data Architecture Stakeholders that the generated activity statements support or conform to Design requirements

III. Learning Record Provider Professional KSAs in the Acquisition Process

For US Government and Military work with xAPI, it is critical to have the right talent, in the right places, at the right times. An effective approach requires a competency framework that reflects the knowledge, skills and abilities needed by professionals to achieve success in the implementation of xAPI towards explicit business objectives.

Where organizations often stumble in any competency-based approach is in the execution of such an approach that fails to account for the maintenance and evolution of the competency model, required to reflect changes to operational conditions, organizational goals, and workforce demands over time.

With that in mind, the following suggests a model to *start* the work of establishing professional competence expectations for the professionals charged with providing learning records -- that is to say, the people charged with the generation of xAPI data. What follows applies such competencies in terms of knowledge, skills and abilities identified as critical in the solicitation of contracts requiring xAPI implementation, as well as such competencies required of professionals charged with successful performance on such contracts.

A. Solicitors

Both US Military and US Government are poised to acquire technology, tools, software, media and content rather than develop such themselves. As a result, various roles serve a purpose in the validation[4] and verification of a given acquisition. When competencies are present among the actors involved in solicitation, appropriate rigor will be applied to the quality checks that determine acceptance of a product or service responsible for generating xAPI data.

[4] "Validation and Verification." AcqNotes, AcqNotes, 17 July 2017, acqnotes.com/acqnote/careerfields/validation-and-verification.

The Job Families, as defined by the Office of Personnel Management, and common job titles involved in different phases of an acquisition are highlighted below:

OPM General Service (GS) Job Families & Titles
GS-1750: Instructional Designer[5]
GS-1102: Contract Specialist
GS-0854: Systems Engineer
GS-0343: Business Analyst
GS-0340: Project/Program Manager[6]
GS-2210: Information Systems Security Officer[7]

1. Validate

As described in the United States Air Force (USAF) Space and Missile Systems Center (SMC) Systems Engineering primer, the Validation Process answers the question, "Is it the right solution to the problem?" The Validation process works in conjunction with the Stakeholder Requirements, Requirements Analysis and Architecture and Design processes. The process includes evaluating requirements, functional and physical architectures and ultimately the implementation.

In the early stages of the system development, validation may involve independent evaluation of the system requirements, development of prototypes and simulations all with the purpose of validating the system concept.

There are three main processes that constitute validation[8]:

[5] "All Professional Engineering Positions, 0800." All Professional Engineering Positions, 0800, www.opm.gov/policy-data-oversight/classification-qualifications/general-schedule-qualification-standards/0800/files/all-professional-engineering-positions-0800.pdf.

[6] "Program Manager (PM)." AcqNotes, 16 July 2017, acqnotes.com/acqnote/careerfields/program-manager.

[7] "Classification & Qualifications General Schedule Qualification Standards." U.S. Office of Personnel Management, www.opm.gov/policy-data-oversight/classification-qualifications/general-schedule-qualification-standards/0300/gs-2210-information-technology-management-series/.

[8] "SMC Systems Engineering Primer & Handbook: Concepts, Processes & Techniques." SMC Systems Engineering Primer & Handbook: Concepts, Processes & Techniques, 15 Jan. 2004,

1. Review documentation by an operational authority other than the user to confirm the operational capability.

2. Test, by the Performer, a publication/technical manual for technical accuracy and adequacy.

3. Evaluate a system or software component during, or at the end of, the development process to determine whether it satisfies specified requirements.

2. Verify

Verification confirms that Design Synthesis has resulted in architecture that satisfies the system requirements. There are three main processes that constitute verification.[9]

1. Develop a verification plan[10] which defines
    a. The relationships between the specified requirements method and level of verification,

    b. All verification tasks with each task addressing one or more requirements,

    c. The technical configuration, resources, including people, and environments needed to support a given verification task,

    d. The schedule for the performance of the verification tasks and determines which verification tasks are in sequence or in parallel and the enabling resources required for execution of the verification tasks.

2. Execute the given verification plan with the supporting resources

www.acqnotes.com/Attachments/SMC%20System%20Engineering%20Handbook.pdf.

[9] "Verification Process." AcqNotes, acqnotes.com/acqnote/careerfields/verification-process.

[10] "Chapter 3 - Systems Engineering." Defense Acquisition Guidebook, Defense Acquisition University, 2017, www.dau.mil/tools/dag/Pages/DAG-Page-Viewer.aspx?source=https://www.dau.mil/guidebooks/Shared Documents HTML/Chapter 3 Systems Engineering.aspx.

3. Report the results of the executed verification plan, confirming the acquisition can be used in a safe and environmentally compliant manner.

3. Relevant LRP Professional KSAs

Quality control summarizes the purpose of Verification and Validation. As a process, verification ensures needs have accurately been analyzed, translated into requirements that can measurably be followed. The Validation process ensures the work acquired by the Armed Services to support that need measurably meets the requirements.[11] These processes, like Lean/Six Sigma, ISO 9001 and other quality processes, have controls. It is in the execution of these controls where LRP competency will be critical.

Validation Controls, Relevant LRP KSAs & Solicitor Roles

Controls	LRP KSAs	Solicitor Roles
Analyses properly identified and defined prior to start	• Development and Maintenance of an xAPI Data Strategy	• Instructional Designer • Systems Engineer • Business Analyst • Project/Program Manager
Analysis results documented and cataloged for traceability	• Development and Maintenance of an xAPI Data Strategy	• Instructional Designer • Contract Specialist • Systems Engineer • Project/Program Manager • Information Systems Security Officer
Analysis results disseminated to design/ specialty disciplines	• Development and Maintenance of an xAPI Data Strategy	• Instructional Designer • Systems Engineer • Business Analyst • Project/Program Manager
Design decisions traceable to associated analyses	• Development and Maintenance of an xAPI Data Strategy	• Instructional Designer • Systems Engineer • Business Analyst • Project/Program Manager

[11] Author's Note: A meta-level value proposition for xAPI could be applied to the traceability and accountability of the verification and validation process, but that is for its own research & analysis.

Verification Controls, Relevant LRP KSAs & Solicitor Roles

Controls	LRP KSAs	Solicitor Roles
Document preparation properly supervised and approved.	● Knowledge of xAPI's Fundamentals	● Contract Specialist
Documents are under configuration control.	● Knowledge of xAPI's Fundamentals	● Contract Specialist
Non-conformance identified and analyzed.	● Development and Maintenance of an xAPI Data Strategy ● Knowledge of Market-available Learning Record Provider Solutions and Capabilities	● Instructional Designer ● Contract Specialist ● Systems Engineer ● Project/Program Manager ● Information Systems Security Officer
Measuring/test equipment calibrated to traceable standard.	● Knowledge of Market-available Learning Record Provider Solutions and Capabilities	● Systems Engineer ● Business Analyst ● Project/Program Manager ● Information Systems Security Officer

B. Performers

"An instructional designer should really have an idea about what actions to take once they get the data they plan for and a data scientist to help them. For example, in a natural disaster training, a data analyst shows that people in x region are all skipping a section on tornadoes. But why is that? Interviewing some of those learners revealed there are no tornadoes in that region, so that's why they are skipping it."

- **Melissa Milloway, Instructional Designer at Amazon**

In contract performance, various roles serve a purpose in the management, design, development and delivery of a given technology for military acquisition. When competencies are present among the actors involved in contract performance, appropriate rigor will be applied that expedite the acceptance of a product or service responsible for generating xAPI data.

Agile is increasingly important in government and military solicitation as digital expectations of performers rise. As US government and military IT teams and digital projects need to be more nimble, exible and reactive, Agile methodology,

which works iteratively and more incrementally, allows projects and services to be tested by citizens as they are developed, then tweaked and xed throughout the process. Versions of the product are released early and often, and the process is more efficient and reduces costs.

Assuming a given performer is employing Agile processes, the common roles involved in different phases of contract performance around a typical xAPI project are highlighted below:

Role	Manage	Design	Develop	Deliver
GS-2210: Product Owner				
GS-0343: Business Analyst				
GS-1750: Instructional Designer				
GS-1550: User Experience (UX) Designer				
GS-0854: Engineer (Back-end)				
GS-0854: Engineer (Front-end)				
GS-0854: Engineer (QA)				
GS-2210: Delivery Manager				

1. Manage

Project management tends to apply reliably for solicitations where a known scope of work is repeated. Project management is focused on the process of production. When tasked to deliver digital solutions where the need for discovery is greater and the scope of work at the onset of a project is ambitious and/or ambiguous, product ownership focuses on ensuring the delivery of value to the Solicitor.

Product owners or product managers are responsible for managing the work required to deliver a solution that meets a business need, and for ensuring that the project's objectives are met while balancing the project factors including scope, budget, schedule, resources, quality, and risk. Product managers are instrumental in establishing the business requirements of the customer for the product or service being produced.

Business analysts analyze, transform, and report broad sets of information. It is information of any kind—at any level of detail—that is used as an input to, or is an output of, business analysis work. Examples

of business analysis information include elicitation results, requirements, designs, solution options, solution scope, and change strategy.

2. Design

A design is a usable representation of a solution. Design focuses on understanding how value might be realized by a solution when built. The nature of the representation may be a document (or set of documents) and can vary widely depending on the circumstances.[12]

Instructional Designers follow a systematic process by which instructional materials are designed, developed, and delivered. Design decisions are predicated on an analysis of learning needs with a systematic development of instruction. Instructional designers often use Instructional technology as a method for developing instruction. Instructional design models typically specify a method, that if followed will facilitate the transfer of knowledge, skills and attitude to the recipient or acquirer of the instruction.

User Experience (UX) Designers follow a systematic process of creating products that provide meaningful and relevant experiences to users. This involves the design of the entire process of acquiring and integrating the product, including aspects of branding, usability, and function. In lieu of a recognized role for learning experience design, a UX Designer will contribute information vital to translating business requirements into technical requirements for development.

3. Develop

Engineers (Back-End) have development activities on the server side, focused on how an application works. Making updates and changes in addition to monitoring functionality of the application are their primary responsibility. This type of development usually consists of three parts: a server, an application, and a database. Code written by back end engineers is what communicates the database information to the browser. Anything that can't easily be seen with the eye such as databases and servers is the work of a back end developer. Back-end engineers know front-end languages such as HTML and CSS and need to use languages such as Java, PHP, Ruby on Rails, Python, and .Net to enable dynamic content within an application. After meeting the

[12] IIBA Global Business Analysis Core Standards. International Institute of Business Analysts, 2017, publications.iiba.org/public/IIBA_Global_BusinessAnalysis_CoreStandard.pdf+.

requirements of what the application does, back-end engineers are most focused on an application's responsiveness and speed.

Engineers (Front-End) focus on the "client side" of development. Front-end engineers engage in analyzing code, design, and debugging applications along with ensuring a seamless user experience. They are responsible for the look, feel and ultimately design of the site. Front-end languages include HTML, CSS, and Javascript, though there are multiple development frameworks (JQuery, Angular, React as examples) that may be employed.

4. Deliver

Quality Assurance (QA) Engineers generally monitor every phase of the software development process so as to ensure design quality, making sure that the software adheres to the standards set by the Performer. QA engineers make sure that new products work before they are released to the Solicitor. QA engineers are involved in tasks that include control of source code, reviewing code, configuration management, change management, program testing, integration of software, and release management process. They typically break up the entire process into goals such as verifications, activities, measurements, abilities, and commitments. By doing this QA engineers not only keep the task from becoming overwhelming, but maintain complete control over the entire release process.

Delivery Manager is responsible for the delivery of projects and products, particularly using Agile methods. They need to work closely with the **Product Manager** and the rest of the team to define the vision, keep everyone on the right track and ensure common priorities feeding this into the prioritisation of work ensuring that all products are built to an appropriate level of quality for the stage (alpha/beta/production). A Delivery Manager tracks the various Scrum teams' efforts, both reporting on progress and obstacles to successful delivery (reporting up the command chain) and empowered to alter the flow of work, breaking down tasking and remove barriers to successful workflow for the development team(s).

5. Relevant LRP Professional KSAs

The ultimate goal for a Performer is to deliver software or service that conforms to the Solicitor's requirements and is accepted by that Solicitor, ultimately meeting the business need. While Agile is popular, there are many interpretations of how a given Performer's workflow is organized.

Nevertheless, there are handoffs orchestrated across the management, design, development and delivery of a Performer's work. Such handoffs have controls, similar to the controls that are part of a Solicitor's verification and validation processes. And, like Solicitors, it is in the execution of these controls where LRP competency will be critical.

Management Controls, Relevant LRP KSAs & Performer Roles

Controls	LRP KSAs	Performer Roles
Develop the Business Case	● Knowledge of xAPI's Fundamentals	● Product Owner ● Business Analyst
Perform SWOT Analysis	● Knowledge of xAPI's Fundamentals	● Product Owner ● Business Analyst
Create the Opportunity Statement	● Knowledge of xAPI's Fundamentals	● Product Owner ● Business Analyst
Define Project Objectives	● Knowledge of xAPI's Fundamentals	● Product Owner ● Business Analyst
Develop the Project Scope	● Knowledge of xAPI's Fundamentals ● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Business Analyst
Complete Project Plan	● Knowledge of xAPI's Fundamentals ● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Business Analyst
Finalize Project Charter	● Knowledge of xAPI's Fundamentals	● Product Owner ● Business Analyst
Develop a Process Flowchart	● Knowledge of xAPI's Fundamentals ● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Business Analyst

Design Controls, Relevant LRP KSAs & Performer Roles

Controls	LRP KSAs	Performer Roles

Translate Solicitor Requirements into Critical-to-Quality (CTQ) components	● Development and Maintenance of an xAPI Data Strategy	● Business Analyst ● Instructional Designer ● UX Designer
Conduct Benchmarking	● Knowledge of Market-available Learning Record Provider Solutions and Capabilities	● Product Owner ● Business Analyst ● Instructional Designer ● UX Designer
Reduce the set of Potential Design concepts	● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Instructional Designer ● UX Designer
Evaluate Potential Design concepts	● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Business Analyst ● Instructional Designer ● UX Designer
Evaluate the prototyped design	● Knowledge of xAPI's Fundamentals ● Development and Maintenance of an xAPI Data Strategy ● Knowledge of Market-available Learning Record Provider Solutions and Capabilities	● Product Owner ● Business Analyst ● Instructional Designer ● UX Designer

Development Controls, Relevant LRP KSAs & Performer Roles

Controls	LRP KSAs	Performer Roles
Evaluate the work product functions to design specifications	● Knowledge of xAPI's Fundamentals ● Development and	● Product Owner ● Business Analyst ● UX Designer

	Maintenance of an xAPI Data Strategy	● Instructional Designer ● Engineer (Back-end) ● Engineer (Front-end) ● Engineer (QA)

Delivery Controls, Relevant LRP KSAs & Performer Roles

Controls	LRP KSAs	Performer Roles
Compare delivery approaches	● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Delivery Manager
Confirm work product meets Solicitor Requirements	● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Engineer (QA) ● Delivery Manager
Confirm work product achieves strategic goals and objectives	● Development and Maintenance of an xAPI Data Strategy	● Product Owner ● Business Analyst ● Delivery Manager

IV. Actionable Recommendations

Learning Record Provider Professional Certification is recommended to help ensure semantic interoperability. The demands of such a program may be reduced with other processes and supports to augment the work of Learning Record Provider Professionals. Such efforts would support efficiencies at scale for the Armed Services and US Government to accelerate adoption, reduce maintenance, improve data quality and continuously improve infrastructure for viable implementation of xAPI.

A. Documented SOPs and Requirements Regarding xAPI

For US Government and Military, their solicitors and contract performers, having a publicly available set of standard operating procedures and infrastructure requirements for xAPI would greatly enhance the likelihood of successful xAPI implementation and accelerate semantic interoperability of the data, which would yield further cost savings and maximize time utilization in the procurement and contract performance for xAPI-related work. Related, such explicit SOPs and Requirements would likely offer affordances in terms of encouraging commercial, off-the-shelf Learning Record Providers to implement xAPI in ways that conform and support such SOPs and Requirements.

B. Implementation, Support and Maintenance of xAPI Profiles

A robust adoption of xAPI Profiles would address several challenges with ensuring semantic interoperability of xAPI data at scale by centralizing systems for controlled, ongoing support of xAPI Profiles (vocabularies, significant patterns of learning activity, success criteria) with “change once, change everywhere” single-point-of-access, and deploying standard tools and services as quality control mechanisms to protect the integrity of the network. In short, the Services need to be working with xAPI Profiles to efficiently normalize an xAPI data set at the point of data generation. Working with xAPI Profiles will improve Data Quality Assurance functions and drive efficiencies for data processing throughout the data lifecycle.

In the Solicitation and Operation of a Learning Record Provider, the following roles are likely to be impacted by xAPI Profiles:

OPM General Service (GS) Job Families & Titles
GS-1750: Instructional Designer
GS-1102: Contract Specialist
GS-0854: Systems Engineer
GS-0343: Business Analyst
GS-0340: Project/Program Manager
GS-2210: Information Systems Security Officer

In the Performance of delivering a Learning Record Provider, the above identified roles are likely to be impacted by xAPI Profiles

Job Family & Title	Manage	Design	Develop	Deliver
GS-2210: Product Owner				
GS-0343: Business Analyst				
GS-1750: Instructional Designer				
GS-1550: UX Designer				
GS-0854: Engineer (Back-end)				
GS-0854: Engineer (Front-end)				
GS-0854: Engineer (QA)				
GS-2210: Delivery Manager				

1. xAPI Profile for USDoD

For data to roll-up effectively across the Services, USDoD must have a data strategy across all learning, education and training. Such a data strategy accounts for courseware, simulations and other activities described within training commands. Based on interviews and research, data in the area of learning, education and/or training in the USDoD is not currently captured in a structured way oriented toward producing actionable learning analytics at scale. A research effort that produces a USDoD xAPI Profile would be beneficial to the Services so, for the most common and basic of learning technology implementations, USDoD

would track more useful data on which individual services can extend and roll up their data. With such an effort, the first task would be a research effort to identify what is currently tracked across USDoD as a prerequisite for the development of a USDoD xAPI Profile.

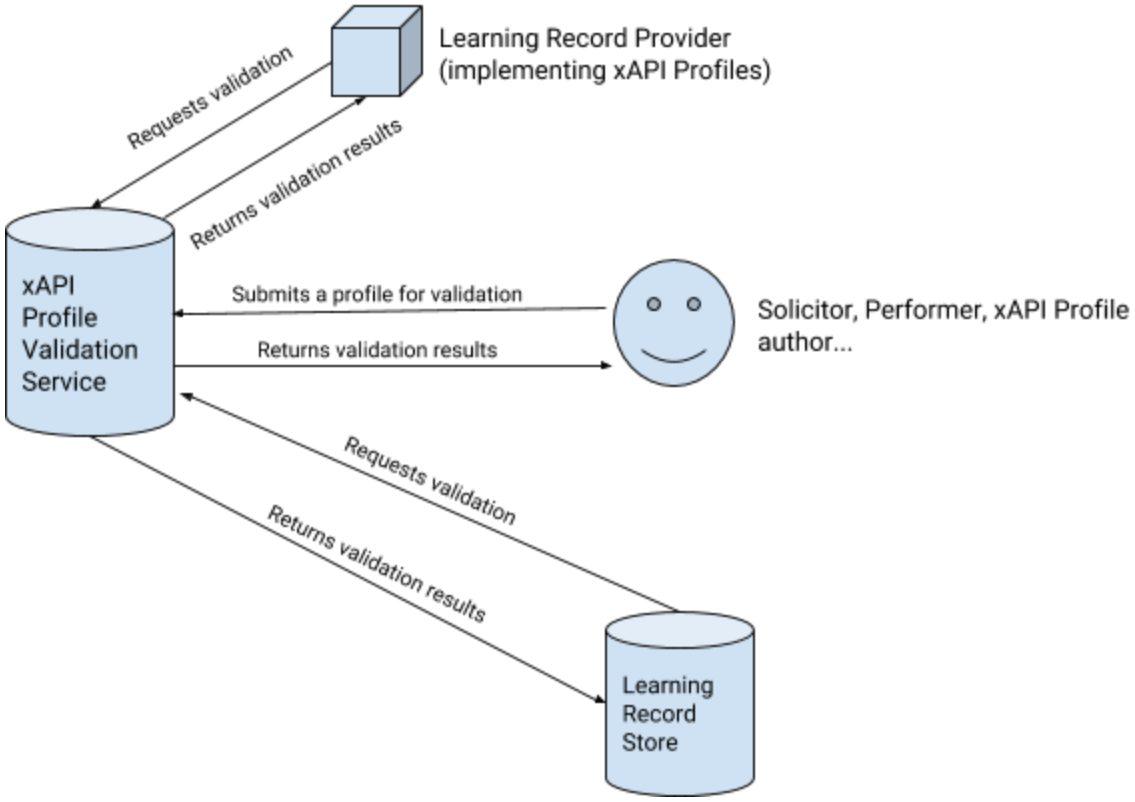
2. xAPI Profile Server(s)

   Based on RDF Stores, xAPI Profile Servers are specified in the xAPI Profiles specification. Production instances would enable curated, canonical sets of profiles to be available at varying levels of organizational granularity. This is the key to semantic interoperability for xAPI.

3. xAPI Profile Tool

   A major impediment to working with xAPI Profiles is the outlier set of skills required with regard to instruction, software engineering and semantic web technologies like JSON-LD and RDF. However, much of complexity could be automated so as to make the creation, publication and maintenance of xAPI Profiles available to a wider base of users who would not need to know how to engineer software nor the intricacies of the semantic web. Such a tool will help stakeholders express an xAPI Profile in valid, JSON-LD that conforms to the xAPI Profiles specification. To support the creation, maintenance and ongoing management of xAPI Profiles, a tool to help stakeholders express a profile in valid, JSON-LD that conforms to the xAPI Profiles specification would greatly accelerate the normalization of data generated by learning activities, resulting in better quality learning analytics.

4. xAPI Profile Services



With so much xAPI implementation by US Military and US Government sourced to contractors, there are numerous efficiencies to be gained, even in the procurement process, where validation to xAPI Profiles would accelerate contract performance and ongoing data quality assurance.

C. New, Formal Job Roles

"The data science person and the instructional designer should work closely in creating a plan for verbs and crafting entire statements initially, so that everyone is on the same page as to what means what. This only needs to be a close partnership until standards are created and things are defined. Then it can be more of a follow up."

- **Melissa Milloway, Instructional Designer at Amazon**

Considering the data generated with xAPI is an important deliverable, the following roles can play an important role in bridging the validation and verification of xAPI-related work and the delivery of the work product, by a Performer, to the Solicitor. The knowledge, skills and abilities for each of these roles merits further applied policy research and development.

1. Data Architects

   Data Architects define how the data will be stored, consumed, integrated and managed by different data entities and IT systems, as well as any applications using or processing that data. Data Architects organize data at the macro level (i.e. which subject areas are managed through which sources) as well as at the micro level (i.e. data models). Data Architects also establish business rules needed to support Data Quality.

2. Data Strategists

   Data Strategists help scope ideas and clarify use cases. Given a background in statistics and programming, their quantitative lens allows for ad-hoc assessment of project ideas. Similarly, as large projects oftentimes require data sources to be acquired from various sources, data strategists help to facilitate the process and directly impact the design of a solution.

3. Learning Activity Analysts

   Learning Activity Analysts align a designed learning activity with an existing xAPI Profile and can, when required, synthesize a new xAPI Profile. This is a role that potentially addresses several gaps in what an individual really needs to know and do for a unit to operationalize xAPI. Such a professional would have the skills needed to align a designed learning activity with an existing profile and the skills needed to develop profiles.

4. Learning Engineers

Learning Engineers focus on creating various kinds of learning experiences using knowledge accumulated by learning science and other areas of research focused on learning.[13] A Learning Engineer applies learning science and what is known about other relevant disciplines (user experience, for example) and pedagogy to problems developing learning environments. When designing for platforms that collect semantic data they understand the requirements of the materials they are creating and can ensure that the data collection that will be done will provide actionable results. A learning engineer works with content experts and guides their work and brings in other points of view as needed in order to best develop learning experiences.

Formal activities have begun within IEEE to establish Learning Engineering as a defined profession. This work is organized by the IEEE IC Industry Consortium on Learning Engineering (ICICLE)[14], which is an open forum and community-driven platform for defining and supporting the profession of Learning Engineering.

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VI. Acknowledgements

The authors would like to recognize the following people for edits, elaboration, feedback and insights that added value to this document.

Jesse Gusse, Navy
Mike Hernandez, ADL
Melissa Milloway, Amazon
Jennifer Murphy, QIC
Brent Smith, ADL
Tim Welch, Navy
Craig Wiggins, E3 Federal Solutions