

# Click and connect: solving integration issues with LTI (learning tools interoperability)

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## Abstract

Digital transformation has already happened for many universities. The shift to massive use of digital tools, whether this was an acceleration of existing strategy or an emergency response, has taught us some important lessons that need to be carried forward into future strategy.

Students and tutors don't just need digital tools: they need digital tools that work well together. Universities need the flexibility to create an ecosystem that works for all of their learners. This paper explores how open standards make this possible.

We take a general look at what is meant by open standards and the benefits they deliver for institutions and for suppliers. We then take a deeper dive into the LTI (learning tools interoperability) standard. LTI is already the lifeblood of much of the learning tools ecosystem (most universities will be using it whether or not they realise this). New developments make it easier to support a range of integrations 'out of the box' and take some of the administrative work out of aspects of GDPR compliance.

## 1 Introduction

Digital transformation of our learning and teaching practice has happened. The pandemic created a situation where even the most traditional 'bricks and mortar' universities had to make use of digital tools to enable learning, teaching and assessment to continue. Some universities were already on a digital transformation path which had to be accelerated (EUNIS members have stories to tell ranging from moving a degree course online over a weekend to trying to implement a five-year strategy in as many weeks).

In other cases, institutions initially viewed online learning as an emergency response yet grew to identify benefits. Student attainment levels were unexpectedly high. When forced to move away from

traditional unseen exams to more authentic assessment scenarios, many students, especially those from disadvantaged backgrounds, performed better (Knight 2022). Some students felt better supported by, and connected to, their teachers in the digital sphere than in large, impersonal lecture settings. Analytics helped track engagement and progress.

Some organisations were better prepared than others to make the pivot, generally those who had already invested in their digital infrastructure and who took a strategic approach to selecting tools based on open standards, but all have learned lessons and few, if any, institutions will be going back to doing things exactly as they did before.

Use of digital learning tools on a massive scale revealed key messages for strategic leaders. The tools themselves are no longer the problem: the digital learning tools market is thriving with offerings available from start-ups, scale ups, open-source communities and global corporations. The key areas to focus on are:

- developing the digital capabilities of staff and students
- creating the right digital ecosystem

Digital capabilities are a prerequisite for anyone in the world of higher education. Senior managers need the understanding to make the right investment decisions. Teachers need to work out which digital tools support good pedagogic practice for their learners. Administrative staff need to be able to design effective business processes that are 'digital first'. Moreover, we need to abandon the myth that learners are 'digital natives' who know instinctively how to use digital tools to support effective learning.

If we can create the right digital ecosystem, all of the above will fall readily into place. People don't just need digital tools: they need digital tools that work well together. A survey of UK universities by Jisc (Ferrell and Knight 2022) identified interoperability as the main technical challenge affecting assessment and feedback practice, with 83% of respondents having issues in this area.

The more we rely on technology to enhance learning, the more we need to be able to use the tools we need, when we need them, integrated into our workflows in a seamless way.

Digital tools can enable learners to interact with one another and their teachers but, as well as that, the technology also needs to allow them to interact with learning resources, undertake assessed assignments, exchange grades and feedback and, ultimately, demonstrate success by means of a verifiable digital credential.

Hardware, software and data need to work together seamlessly in order for this ecosystem to function and this is where standards are important.

Using products that are certified against recognised open standards allows learning providers to be confident they are investing in products that will work together and that they meet requirements as regards accessibility or privacy.

It allows you to build the ecosystem that meets your needs so you can combine products from major international suppliers with niche products from small start-ups and get them to work together 'out of the box'.

## 2 What do we mean by open standards?

Conformance to prescribed norms or standards is important for quality and consistency in many aspects of our lives. It is particularly important in relation to interoperability. Some standards we take for granted - you can buy AA batteries anywhere in the world and they work in any device that takes AA batteries. Try finding someone at a conference who can lend you the right charger for your phone and it might be a different matter.

Interoperability between different software packages is something that hasn't always been easy to achieve. Billions of euros a year are spent on creating point-to-point interfaces between different IT

systems. For many years, the response to this problem was for systems to become increasingly monolithic, expanding their range of functions (often into areas that weren't their natural specialism and which they didn't serve well). The corollary of this was institutions increasingly 'locked in' to a single vendor generally accompanied by inflating licence costs.

Open standards turn a 'plug and play' architecture into reality.

### 3 What is LTI (learning tools interoperability)?

The Learning Tools Interoperability (LTI) standard prescribes a way to easily and securely connect learning applications and tools with platforms like learning management systems (LMS), portals and learning object repositories.

LTI works across systems hosted on-premise or in the cloud, in a secure and standard manner and without the need for expensive custom programming. LTI moves the user (such as a student) from the learning platform into the tool while maintaining a high level of security for passing data about the user, the place they come from, and their role (e.g., tutor, student, etc.). The tools can range from simple communication applications such as chat to domain-specific learning environments such as publisher products.

Using LTI, if you have an interactive assessment application or virtual chemistry lab, it can be securely connected to your LMS in a standard way, with a few clicks, without having to develop and maintain custom integrations for each platform and tool. LTI consists of a central core and optional services to add optional features and functions. The LTI core establishes a secure connection and confirms the tool's authenticity while the extensions add features like the exchange of assignment and grade data between an assessment tools and your LMS gradebook.

If you are using any of the major learning platforms (Blackboard, Canvas, D2L, Itslearning etc) you will already be using LTI, even if you didn't realise it. However, ensuring that all of your tools are fully LTI compliant will bring enormous benefit in terms of system administration and user experience.

### 4 Trusted and secure interoperability using LTI 1.3

In today's technology landscape, there is an increasing need to secure sensitive and personal information across the institution's digital ecosystem. The latest version of LTI (LTI 1.3) responds to market concerns about protecting the security and privacy of student data. It leverages a new security model (Smythe 2021) which adopts the industry standard protocol IETF OAuth 2.0 for authentication services along with JSON Web Tokens (JWT) for secure message signing and adopts the Open ID Connect workflow paradigm. For those who want the technical detail, its main characteristics are that it is:

- **Agile**—Tools and platforms can leverage up-to-date OAuth 2.0 libraries and common industry standard practices in their implementations, which accelerates their development.
- **Flexible**—A modernized security model that is independent of the core spec, allowing for the evolution of security without driving change into the core. Likewise, core changes can evolve without impacting security. It introduces multiple **authorization grant types**, each with its own protocol flow that makes OAuth 2.0 adaptable for multiple use cases and client types.
- **Protected Launch**—OAuth 2.0 is an established industry model leveraging HTTPS (using TLS) encryption and uses a protocol to protect against on-path or in-transfer attacks.

- **Mobile Ready**—The model is independent of web browsers, a better solution for server-to-server, native desktop and mobile applications. It distinguishes between **confidential and public clients**, making it easier to secure implementations that suit the specific needs of client applications.
- **Scalable**—OAuth 2.0 scales better, supporting separate roles and servers for authorization versus resource servers handling API calls. It splits the server into **two logical roles**: (1) authorization server and (2) resource server. This separation fits naturally with enterprises where authorization concerns are spread across many servers responsible for different types of resources.
- **Robust**—OAuth 2.0 libraries are actively maintained and have a strong user community and stability. It is designed to be extensible with new access token types, grant types, and protocol parameters.

## 5 LTI Advantage

LTI Advantage extends the LTI 1.3 core by adding new features that enable deeper integration of any tool with any platform. **LTI Advantage** makes it easier for your teachers to innovate and meet the unique needs of their students whilst dramatically reducing integration times. LTI Advantage is a set of three services based on the core LTI 1.3 specification that make it easier to build, manage, and offer courses with an optimum (and secure) user experience. The availability of specific features depends on the particular platform and tools in use but the services include:

### 5.1 Assignment and Grade Services

Enables staff to sync grades and comments from third-party tools into a single place, such as the platform gradebook, which gives students and tutors a clearer picture of learning progress in one place, greatly reducing staff effort and the chance of errors. With Assignment and Grade Services you get:

- Gradable assignments shared with a tool
- Numeric scores returned to the platform gradebook
- Assessor's comments returned if provided
- Multiple results supported in a single exchange
- Instructor override and history of attempts allowed

### 5.2 Deep Linking

Simplifies the arduous task of selecting and adding links to content when developing a course, including deep integration to collections of content such as playlists and a table of contents. With Deep Linking you can:

- Select and add course content in a few clicks
- Add playlists and tables of content
- Enable links and other HTML content
- Add pre-registered tools with a few clicks

### 5.3 Names and Role Provisioning Services

Automates course enrolment into a third-party tool in a safe and secure manner and allows staff to receive reporting on student activity within the tool. With Names and Role Provisioning Services you can:

- Exchange a list of users and their roles
- Provision a learner using LTI's secure exchange
- Learn who has not yet accessed a tool

Each of these services requires the new and improved security model, enabling the foundation for a better, more secure user experience.

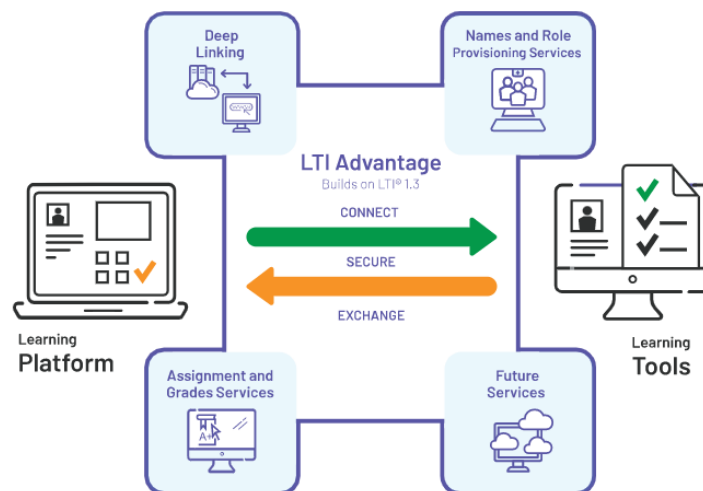


Figure 1: The services of LTI Advantage built on the LTI core.

## 6 Supporting GDPR compliance through LTI

The European General Data Protection Regulation (GDPR) has far-reaching consequences for the development and administration of IT systems. European regulations are amongst the most stringent in the world and all suppliers, whether local start-ups or global corporates, must comply with the requirements. The European community has an important role to play in helping ensure that open standards help compliance.

During 2021, the IMS European Task Force worked on the LTI Data Privacy Launch specification, which allows LTI-enabled tools to assist administrative users to manage and execute requests related to data privacy.

Take the example of a student invoking their right to be forgotten and requesting that their data be removed. Your university may make use of many hundreds of digital tools and apps that could have been used by that student. The task of searching through each of those individually, and identifying

records to be deleted, is incredibly resource-intensive. The LTI Data Privacy Launch specification allows you to automate that process. The specification makes the process of actioning data privacy requests simpler for administrative staff by giving them a centralized point within a platform to action a request on behalf of a user across all LTI tools that the user may have interacted with. Hours (or possibly days) of work are reduced to a few clicks. The specification has been designed to allow future updates to include support for additional use cases, either related to GDPR or other data privacy regulations in other locales.

## 7 Anyone for cookies?

It seems that not everyone loves cookies.

Various web browsers (such as Chrome, Firefox, Safari etc) are adapting their security policies to ensure their users aren't subject to inappropriate tracking via use of cookies. These changes can impact integrations between platforms and tools that rely on cookies for legitimate purposes.

This is another example of why the community needs to continue to evolve standards to adapt to the changing environment. The community is working on ways to address these issues for current implementations of LTI and find long-term solutions that avoid the use of cookies whilst maintaining high levels of security and integrity for LTI-enabled learning interactions.

The good thing about being part of a global community is that these working groups are in direct contact with many of the major browser providers to make them aware of the impact that their security setting changes are having on the world of education and to work directly with the browser architecture teams to solve the problems.

## 8 LTI Certification

What is the difference between “*IMS certified*” LTI and LTI Advantage platforms and tools, and those that claim to “conform” to the LTI and LTI Advantage standards?

Any system may claim to have adopted the current versions of LTI and LTI Advantage standards, however, this does not mean that the system has been tested and certified as conformant. IMS / 1EdTech is the global standards body that determines certification requirements for LTI and LTI Advantage to ensure that the integrations:

- Have successfully implemented LTI Advantage security policies,
- Are interoperable with other LTI Advantage certified tools and/or platforms, and
- Correctly implement LTI Advantage prescribed standards and services.

All certified products are issued a certification number and are listed in the official IMS Certified Product Directory at <http://imscert.org>. Products that are certified for LTI 1.3 and all of the above applicable services are identified as LTI Advantage certified. If you experience an interoperability issue with a product listed in the product directory IMS Global will work with the supplier to resolve the problem. If a product is not listed in the IMS product directory it has either not passed IMS certification testing or its certification has expired.

To ensure that your educational technology ecosystem is interoperable, it is recommended that you require conformance certification as part of your procurement process and tender documents.

## 9 What is 1EdTech?

1EdTech is the new name for the community that develops and maintains open standards for the learning ecosystem. Those community standards serve to accelerate digital transformation by enabling educational institutions to be more innovative, provide a better user experience and dramatically reduce the cost of integrating products into their enterprise architecture.

1EdTech is the new face of the IMS Global Learning Consortium. The origins of IMS date back to 1997 where it grew out of the EDUCAUSE Instructional Management Systems (IMS) project. In 1999 IMS became an independent non-profit organisation. Instructional management systems as a term fell out of use long ago to be replaced variously by learning management systems (LMS), virtual learning environment (VLE), course management systems (CMS) etc. IMS dropped the name but kept the acronym to represent a much larger body of work and now even that has been outgrown.

1EdTech better reflects the community nature of the endeavour: institutions, NRENs, government bodies, professional associations (such as EUNIS), and suppliers looking to the future together and creating better learning experiences through better connectivity.

1EdTech is all of us. We have a particularly active European community which includes a support group for LTI developers. Find out more from your local contact, Gill Ferrell [gill.ferrell@eunis.org](mailto:gill.ferrell@eunis.org)

## 10 References / Citations

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## 11 Author biographies



Xavi Aracil Diaz is a Software Engineer at the eLearn Center of the Universitat Oberta de Catalunya. His role is helping teachers and researchers with digital learning by providing: Technologic resources - Cloud resources with automatic provision; Developments - Integration of existing applications within LMS using LTI, developments using SCRUM methodology, etc. Data - data of the research and ways to visualize and explore it.

Xavi is co-chair of the 1EdTech European LTI Group.

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Martin is an integrations software engineer and educational standards expert for Turnitin.

He spends his time building and implementing educational software standards to help integrate Turnitin and other applications into educational platforms.

Martin is co-chair of the global LTI working group.

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Bracken Mosbacker is a Technical Standards Architect with IMS Global : 1EdTech. Bracken has worked most of his career in education and loves participating in the Open Education and technical standards communities. He is a frequent speaker at conferences and developer groups promoting technical integrations and open education.

Previously, Bracken worked at Lumen Learning and Instructure, where he worked on a broad range of products and led efforts in platforms and integration strategies. <https://www.linkedin.com/in/mosbacker/>



Gill Ferrell has led the EUNIS Learning and Teaching SIG since 2009. She also has an interest in data and information management. In 2021 she joined IMS Global / 1EdTech as Europe Program Director.

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