

Getting Started for ADF App Developers

Introduction

The Singapore Student Learning Space (SLS) is a learning portal to support new ways of learning for students.

In the SLS, students and teachers interact in the Virtual Learning Environment (VLE). The Application Development Framework (ADF) was conceptualised to allow the VLE to be extended with external, specialised tools. This is achieved by allowing the integration of external web applications with the SLS, with data exchange facilitated through API.

The ADF concept is backed by IMS Global **Learning Tool Interoperability (LTI) v1.3** industry standards. For more info on LTI 1.3, visit <https://www.imsglobal.org/spec/lti/v1p3/>.

This document is intended to provide the technical documentation for integration with the SLS ADF. The ADF currently only supports the integration of web applications that are maintained independently by third-party developers and supports LTI1.3 standards.

Key Concepts

Each ADF app is:

- A web application with a web server to make API calls to SLS;
- Allowed to be installed into group(s) that is either a class taking a subject in a level (e.g. Secondary 2 Biology) or a group created in SLS without a subject/ level;
- Able to make API calls using a valid Access Token (e.g. get information about groups that have the app installed);
- Launched by users from SLS as a standalone app, within a lesson, or in the context of a VLE group; and
- Displayed either in a new tab or iframe within the SLS VLE application when launched.

Sample Use Case Walkthrough

For a sample use case of how an app is integrated into SLS through ADF, please refer to [Sample Screens](#).

ADF APIs

API Specifications

For LTI integration, please refer to [Adopting LTI v1.3](#).

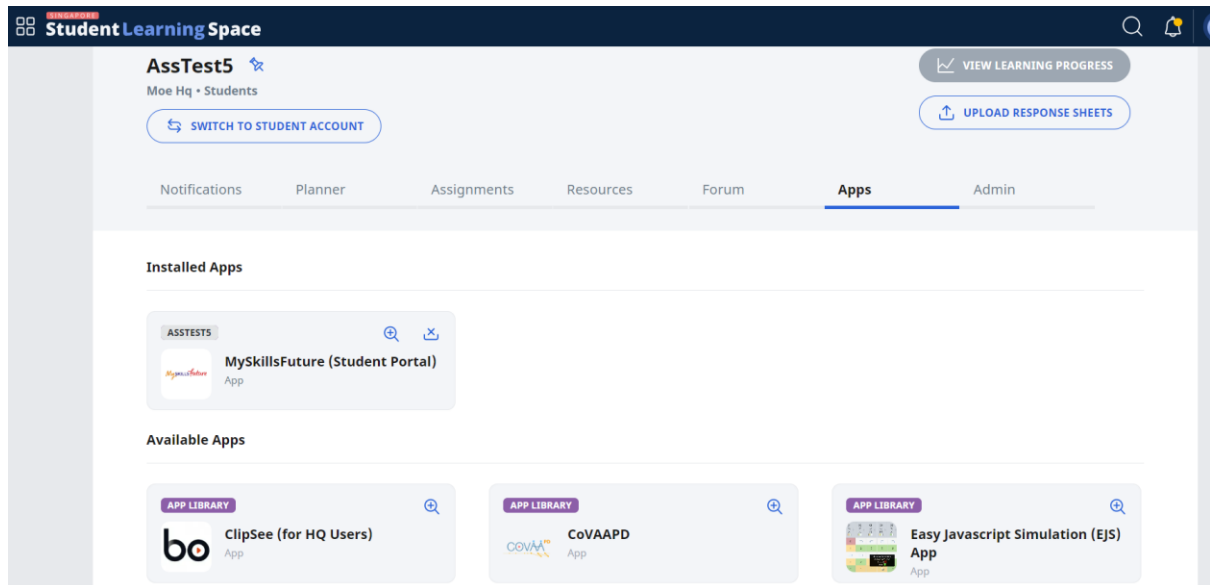
What's Next

Please contact us to discuss potential integration opportunities. We provide a few tools/details to help with integration:

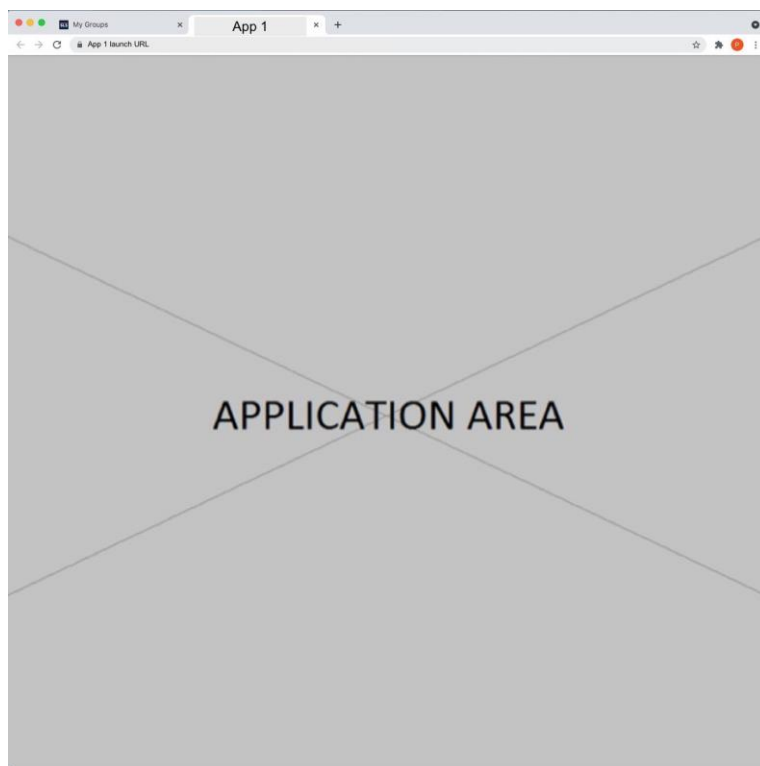
- Sample credentials for testing LTI integration such as clientId, OIDC authorisation URL, etc.; and
- Sample SLS accounts to view VLE as a student and teacher.

Sample Screens

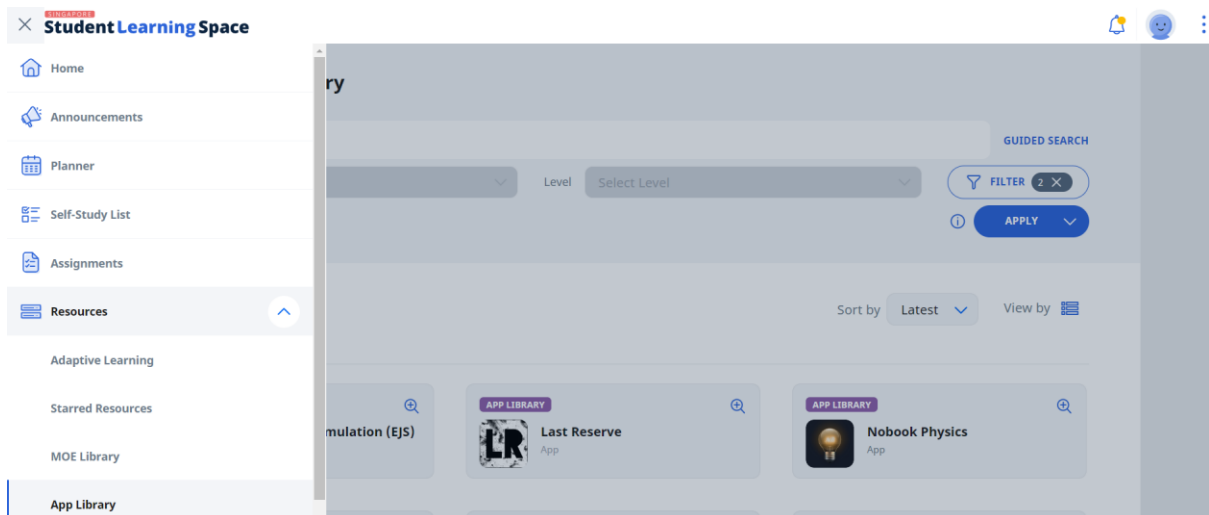
Using an SLS teacher account, click the Apps tab in the class group to access the applications. A list with installed and available applications will be listed.



Clicking the App card will launch the application in a new tab.



Another way to access an App is through "App Library" from the left-hand menu



Adopting LTI v1.3

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1. What is LTI

Learning Tools Interoperability is a learning standard from IMS. It defines how a Learning Management System (LMS, or Platform) can interact with third-party content provider (Tool).

In a nutshell, it is an e-learning standard.

LTI 1.3 Core Specs (<http://www.imsglobal.org/spec/lti/v1p3/>)

LTI Deep Linking 2.0 Specs (<https://www.imsglobal.org/spec/lti-dl/v2p0>)

IMS Security Framework 1.0 (<https://www.imsglobal.org/spec/security/v1p0/>)

2. How LTI works

There are a lot of materials to read and watch. For the start, just check out some YouTube videos.

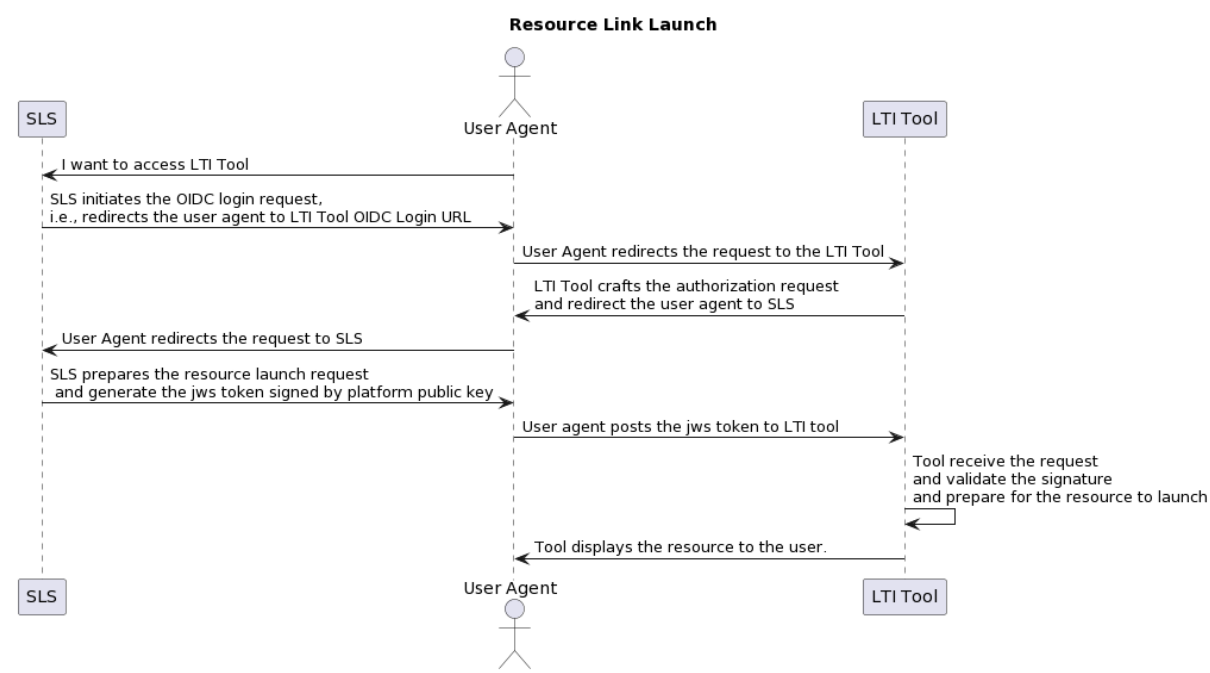
YouTube: LTI 1.3 Security and OpenID Connect (https://www.youtube.com/watch?v=d_Otmti7xKA)

YouTube: LTI 1.3 Resource Launch and OIDC (<https://www.youtube.com/watch?v=g3y4vwtP6vQ>)

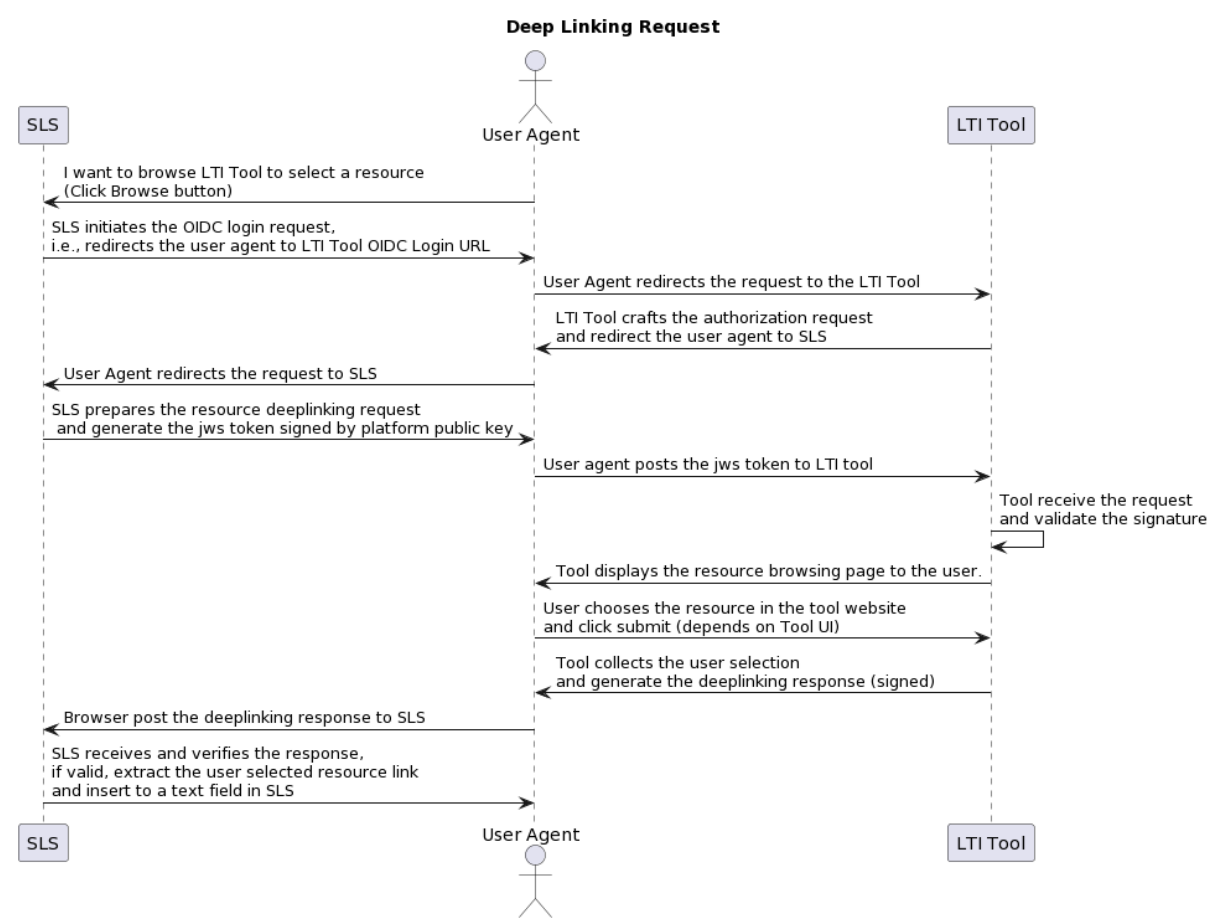
YouTube: LTI 1.3 Deep linking (<https://www.youtube.com/watch?v=e5aano-h5Co>)

SLS has developed its LTI interface using the standard specifications published online from IMS Global, it has been tested with a “dummy” app from GitHub (<https://github.com/1EdTech/lti-1-3-php-example-tool>). Referencing to the codes from GitHub, App may be developed in similar aspects of LTI 1.3.

2.1. Resource Link Launch



2.2. Deep Linking Request



Key Concepts:

Context. LTI uses the term context where you might expect to see the word "course". A context is roughly equivalent to a course, project, or other collection of resources with a common set of users and roles. LTI uses the word "context" instead of "course" because a course is only one kind of context (another type could be "group" or "section").

Resource. Typically, within a context, users can integrate many LTI content items, or resources, sometimes arranging them into folders like "Week 1" or "Pre-Work". Conceptually, these platform integrations serve the same general purpose as any other type of item within the structure of a context's available content. In particular, commonly, users may scatter multiple LTI links through the content structure for a context that is linked to a particular resource. A platform **MUST** distinguish between each of these LTI links by assigning a resource_link_id to an LTI Link.

While all of the LTI links integrated within a single context will share the same context_id, each link within the context will have a unique resource_link_id. This allows the hosting tool to differentiate the content or features it shows on a resource-by-resource basis (within a context) by, for example, providing configuration options such as a resource picker to the instructor or administrator after launching from a particular link.

3. Place you can launch LTI app

There are three main entry points for LTI Apps in SLS.

Use Case	Description
Install to Class Group	Once an App is approved by Administrator, teachers will be able to install the App into Class Group, so that students can access it through App Library in Class Group.
Embed into Lesson	Teachers can embed a resource URL from the approved App directly into Lesson, so that students can access the resource through either Assignment or Self Study. If App supports the optional LTI Deep Linking 2.0 Specs, SLS also allows teachers to easily select the resource through Deep linking.
Launch from App Library	If App supports the option for an independent URL that can launch the App separately, this option can be set by the Administrator to allow an App to be globally searched and launched.

4. How to On-board a LTI App

4.1. What SLS needs from the App during registration

1. OIDC Login URL
2. Default Launch URL
3. Deep Linking URL (if applicable)
4. Public Key from the App
 - RSA, Key size: 2048 (500 max characters)
 - Base64 Encoded
 - Optional for basic resource launch

Sample Code

```
KeyPairGenerator keyPairGenerator = KeyPairGenerator.getInstance("RSA");
keyPairGenerator.initialize(2048);
KeyPair keyPair = SecurityUtils.generateRSAKeyPair();

PublicKey publicKey = keyPair.getPublic();
String publicKeyText = Base64.getEncoder().encodeToString(publicKey.getEncoded());
```

4.2. What SLS provides to the registered App

1. Client Id: this will be the audience claim in JWT sent from SLS
 - a. App UUID
2. OIDC Authorization URL
 - a. <https://<SLS URL>/lti/authorize/<app uuid>>
3. **[Future Build]** JWKS Endpoint: for app to retrieve SLS's public key **[NOT Available as of now]**
 - a. <https://<SLS URL>/lti/key-set/<app uuid>>
4. Issuer: SLS has development, staging, pre-production, sandbox, production environment. Different environment will have different issuer.
 - a. E.g. <https://vle.sandbox.sls.moe.edu.sg> (change according to environment)
5. User Identity: the following fields are provided.
 - a. Unique Id
 - b. Name
 - c. Role (Learner, Instructor or ContentDeveloper)
6. Deployment ID – The Deployment ID format will be <UniqueIdentifier>_<SchoolCode>
 - a. The <UniqueIdentifier> should be used to validate the Deployment ID against the SLS platform.
 - b. The <SchoolCode> is dynamic and reflects the current user's school allocation. Integrated applications can use the <SchoolCode> to determine access control based on the school's subscription to the app.

5. Optional LTI Parameter(s)

Client ID (https://www.imsglobal.org/spec/lti/v1p3#client_id-login-parameter)

1. SLS will send the optional client id during the OIDC login request.

Custom Properties (<https://www.imsglobal.org/spec/lti-dl/v2p0#custom-properties>)

1. When deeplinking an LTI Tool, SLS will store the "custom properties" provided by the LTI tool
2. When accessing an LTI tool, SLS will send back (Post) the "custom properties" to the LTI tool

6. Common Integration Issues



Because LTI integration involves multiple parties, it's very important to request App side to show some meaningful error information.

1. Configuration issues By App side (App Side)
 - a. App side must configure the client id for SLS (the App UUID issued by SLS)
 - b. App side must configure SLS's authorization URL.
 - c. App side must ensure the issuer is configured.
 - d. App side must ensure all configurations are according to environment (Each environment will have different set of values)

Application Performance Guidelines

Suggested Service Level Agreement (SLA)

1. Concurrency: Expected concurrency based on App demographics; To be discussed with App Point-of-Contact (POC)
 - a. For reference: SLS supports approximately 100,000 users under normal concurrently with the ability to ramp up to 300,000 users during Full Home-Based Learning (FHBL)
2. Transaction Timeout: 10 Seconds for 95% of the time with system availability at 99.9% per connection
3. Uptime: At least 90% uptime with scheduled downtime aligned with SLS maintenance schedule (updated on SLS website from June 2022)
 - a. SLS Partnerships Team shall be notified of any scheduled downtime at least 4 weeks in advance. This applies to all environments, including non-production, to facilitate test plans on SLS side.
4. Service Support: 1st Level help desk support should be provided during school days from 9am to 9pm; POC should advise SLS Office on 1st and 2nd level service support details to allow SLS help desk to redirect appropriate calls to App.
5. App should maintain separate communications channel to users to inform them of downtime and also keep SLS Office informed through the POC.
6. Bug Fix is in alignment to SLS Business Impact Levels (BILs); refer to table:

Business Impact Level (BILs)	Response Time	Status Reporting	Resolution Time
BIL 1 (all days)	Within ONE hour	Every TWO hours	Within FOUR hours
BIL 2 (all days)	Within TWO hours	Every EIGHT hours	Within TWENTY-FOUR hours
BIL 3 (all days)	Within TWO hours	Daily	Within SEVENTY-TWO hours

Business Level Alignment with SLS Integration and Partnership Principles

1. SLS is not just a "gateway" for external Apps.
 - a. Once App is integrated, SLS will be seen as a gatekeeper/implicit endorser.
2. Integrated App **must not**:
 - a. Solicit further business in-app, especially from students; or
 - b. Promote undesirable content or teaching and learning behavior, e.g. test/exam drill and practice, game monetisation.
3. Generally, App should also not duplicate current or upcoming SLS core resources/features (but it can offer enhanced or customised content/tools).
4. App should be financially supported for a minimum of 3 years (excluding and after development work has concluded).
5. Cost to Ministry of Education Division should be clearly highlighted through the POC.

Change Log

v1.0.0-20180302

- Initial draft of documentation

v1.1.0-20180629

- Updated User object ID field to UUID

v1.2.0-20180904

- Changed SubjectGroup type to Group to support SLS Group

v1.3.0-20181216

- Added allGroups query to support retrieval of all groups installed with the app
- Added School object in User and Group types to return school information of a user and group respectively
- Updated descriptions and comments

v1.3.1-20190304

- Added openInNewTab field in Assignment type schema to support option to open App within iframe or new tab
- Updated in descriptions and comments

v1.4.1-20200309

- Added new EventType, i.e., LAUNCH_URL for Context to support embedding App in SLS Lesson
- Updated descriptions and comments

v1.5.1-20210805

- Deprecate Assignment, Task and Notification objects

v2.0.0-20220505

- Introduce LTI v1.3 specifications and sample use cases
- Removed GraphQL specifications
- Included App Performance Guidelines
- Included LTI v1.3 optional parameters
- Added App Library support

v2.0.1-20230105

- Updated Application Performance Guidelines SLA: Notify SLS for any downtime

v2.0.2-20241025

- Updated Sample Screens, removed GraphQL, added optional LTI parameter

v2.0.3-20250618

- Updated Deployment ID to include the MOE School Code as a suffix, enabling integrated applications to retrieve the user's School Code.