

Modern Grade Pass Back

Recent updates to the SIF Specification have changed the landscape for automated grade pass back from instructional tools such as learning management systems to gradebooks and student information systems. The SIF Data Model Specification (North America)¹ 4.3 – also known as *Unity* - enhances SIF's ability to share assignment level score data and standardizes the delivery of competencies, including objectives-based performance data. Similarly, the SIF Infrastructure Specification (global) 3.5² enables fully asynchronous operation as well as adding the ability to notify an LMS when a score or competency has actually been recorded in the gradebook database.

Data Model

Data Model Advancements: Score Types

Unity goes beyond commonly used older standards when reporting assignment results. This includes advancements in reporting scores as well as support for other types of student progress reporting.

Object Updated (backwards-compatible)

SIF Data Object	GradingAssignmentScore
Added Elements	ScorePointsFloat, ScoreEmptyReason
Object's Condition	One or more of ScorePoints, ScorePercent, ScoreLetter, ScorePointsFloat or ScoreEmptyReason must be present.

¹ SIF Data Model Specification (North America): <https://data.a4l.org/sif-specifications-north-america/>

² SIF Infrastructure Specification (global): <https://data.a4l.org/sif-infrastructure/>

Decimal Scores

Unity supports decimal (floating point) numbers as score results in addition to the common types available in previous standards—integers, letter grades and percentages.

SIF Data Object	GradingAssignmentScore
New Element	ScorePointsFloat
New Element Type	Conditional
Allowable values	Floating-point value

Empty Score Reasons (with CEDS)

Unity lets the LMS or other grade provider (such as an instructional program) tell the gradebook why a student doesn't have a score. This allows an empty score to be processed by the grades consumer, rather than being ignored.

SIF Data Object	GradingAssignmentScore
New Element	ScoreEmptyReason
New Element Type	Conditional
Allowable values	Excused Unexcused Late -or- Any one of the 30 action types from the CEDS standard (000934 LearnerActionType)

Standards-based Outcomes (Competencies)

New in Unity is the ability to support learning standards and competencies in assignment results. Each result can be linked to one or more LearningStandardItems. The list of LearningStandardItems can be locally defined, defined by a vendor, or taken from a public standard such as a state agency objectives bank or the Common Core. It's equally easy to define a set of competencies as LearningStandardItems.

Unified Score and Standards

Scores and references to LearningStandardItems are sent in the same SIF Data Object, so a single message encapsulates all the relevant information about the student's performance. This allows Unity to support all types of evaluation approaches for student assignments using logic that's already worked for

years in real-world applications. This allows for both “mixed” solutions where traditional and standards-based results are included in the same GradingAssignmentScore and “pure” solutions featuring only LearningStandardItems.

Usage note: for a “pure” competency or standards-based solution, where traditional scores aren’t wanted, A4L recommends for each GradingAssignmentScore object:

- Set EmptyReason to “completed” (from CEDS 000934) or other appropriate value.
- Specify one or more LearningStandardItems as in the table below.
- Leave the other score elements empty.

SIF Data Object	GradingAssignmentScore
New Element	LearningStandardItems
New Element Type	Optional
Allowable values	List of RefIds, each one being the RefId of a LearningStandardItem

Performance and Traceability

Even with the added data in Unity, the SIF Specification is amazingly fast at delivering grade results. This speed arises from the SIF REST infrastructure. Older versions of the SIF Specification were fast, but the modern SIF Infrastructure is hundreds to thousands of times faster. See *A4L Community release ‘Performance Tested’ SIF Infrastructure Specification To Standardize Data And Privacy On The Wire*³

Even very large school districts can return results data in a reasonable time. At the other end of the scale, the smallest districts save IT employee time using SIF automation for results. And when grades appear in the gradebook this quickly, teachers, parents and students are all much happier.

For vendors, the efficiency of SIF grade pass back can lower cloud costs relative to other standards.

Simultaneous with the recent Unity data model release, the SIF Infrastructure Specification adds notification tools that enhance the grade pass back experience. See the infrastructure section below for details.

³ *‘Performance Tested’ SIF Infrastructure Specification To Standardize Data And Privacy On The Wire*: <https://home.a4l.org/a4l-community-release-performance-tested-sif-infrastructure-specification-to-standardize-data-and-privacy-on-the-wire/>

Multiple Recipients

SIF's architecture means that a single set of grade results can be sent to multiple applications easily and with minimal performance impact to the LMS or SIS. Districts with external gradebooks, dashboard systems, and data warehouses connected by a well-built Unity ecosystem will find those systems updated as quickly as the SIS gradebook.

SIS Friendly

The changes in the SIF Infrastructure Specification (detailed below) make life much easier for SIS vendors. For example, asynchronous processing allows the SIS to fully signal any problems that arise in grade processing. This feedback mechanism helps educators identify and correct problems early so the SIS can display accurate information in its parent portal and help educators calculate final grades in a timely manner.

LMS and Instructional Tool Friendly

One of the hardest problems for an LMS or other grade provider is knowing when the grade actually is available to SIS users, as opposed to being delivered to a connector. The SIF Infrastructure Specification includes a notification system that was developed specifically to address this issue. Now systems that publish grades can receive additional information from the SIS or gradebook about when the actual SIS or gradebook database record was updated.

Infrastructure

Real world Grade Pass Back poses a significant challenge due to the complexities involved in its workflow. The most notable challenge is the need for both a positive and negative feedback loop. The negative loop lets educators know when errors have occurred, and they must take action in one of the applications involved. The positive loop lets educators know when every grade transaction has been completed successfully, so that reports may be run and accurate analysis done on the results. The simple nature of many existing integration architectures means they often fall short in meeting these requirements. Unity brings all the needed components together to serve teachers, administrators, and ultimately learners. This section will focus on the flow of the data along with the additional signalling to accomplish these and other positive outcomes.

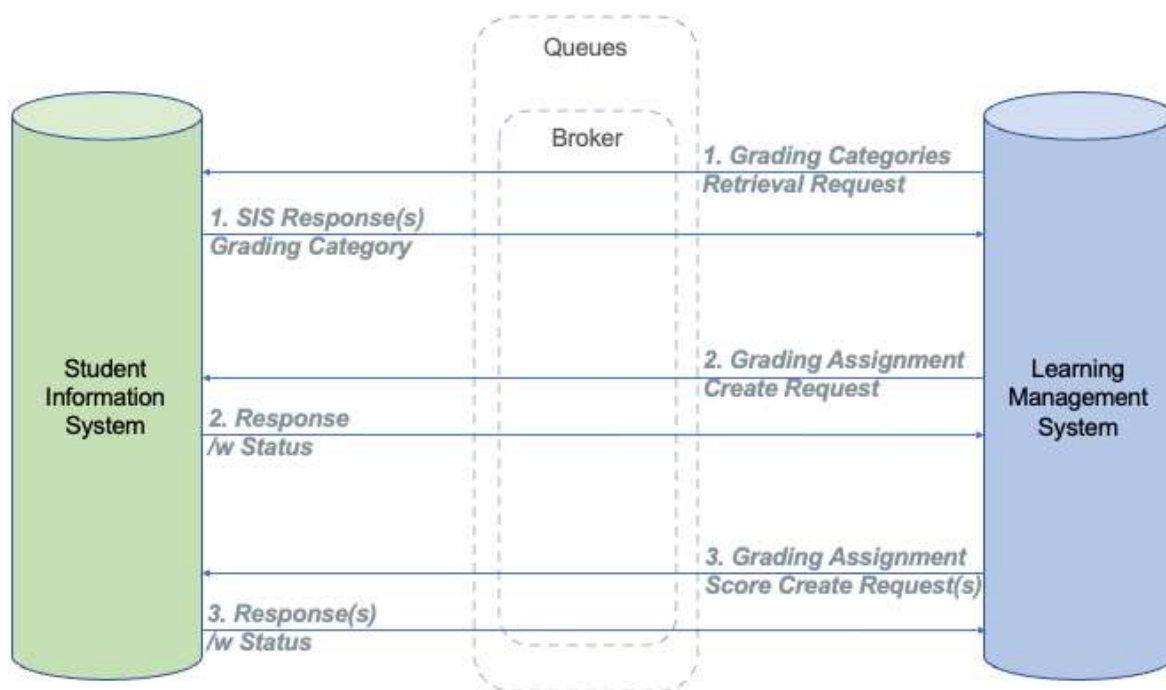
Architecture: Broker Queues and Delayed Choreography

There are two key factors critical to the elegant and powerful data flow expressed by the SIF Grade Pass Back architecture. First, the use of a Broker to provide SIF Queues allows both of the applications to

participate as pure network clients. Second, designing the SIF connectors to run “Delayed” allows them to receive the necessary end-to-end feedback required while avoiding timeouts from long running processes. Together these choices empower robust communications without overly burdening any one component, vendor, or development team.

Data Flow

The diagram and description refer to SIS and LMS as these are the most common components of a Grade Pass Back implementation. However, a grade book or data warehouse application might take the place of the SIS, and any learning application that generates performance data might take the place of the LMS.



Learning Management System (LMS)

1. The first step for Grade Pass Back to be successful is for the SIS and LMS to get on the same page when it comes to Grading Categories. The authoritative source of truth for these categories is typically the SIS, so here we see the LMS requesting the categories.
2. After receiving grading categories from the SIS it is the LMS' turn to supply data, but it does it proactively through a create request. Keep in mind that with our choreography the systems always function as clients, greatly simplifying their implementation requirements.

3. Once the SIS knows about all of our grading assignments, we can provide scores that the SIS can both record and share without additional steps from the teacher. Through parent portals, this can not only help with school procedures but conversations in students' homes.

Student Information System (SIS)

1. Having received the request from the LMS your SIS must be built to service the call for the Grading Categories so that assignments can be typed and grouped consistently between the two systems.
2. When the LMS sends create requests for one or more Grading Assignments it is critical that the SIS listens, allowing the LMS to create assignments in the SIS' grade book. However, through the response the SIS will signal any problems such that the LMS can know and communicate to the educator any issues with the data.
3. The final step is where the SIS being a delayed provider really pays off. As the SIS processes incoming scores through the asynchronous exchange, both sides of the wire may take their time accepting data, providing feedback, and ultimately gaining the knowledge that processing is done for a particular student or group. This empowers reports and final grades that don't shift in the future because they're based on the most accurate data possible.

Integration

One of the requirements for using the delayed choreography is to use SIF's batch operations. In order to help reduce overhead and take the first step towards scalable software, we highly encourage developers to take advantage of the natural opportunity to send multiple instances of the same object in each of these operations. This will help the integration perform well and start to overcome the challenges often faced by integrations. These include workload and volume management; timely processing of data; and ensuring end-to-end guarantees. It is not uncommon for large integrations to manage millions of operations a day, every day, sometimes even all-at-once. So please do your part to optimize your software's use of operations.

Security

Some other integration approaches require the SIS or LMS to expose endpoints to the Internet, leaving software vulnerable to security and service attacks. Before writing software, please weigh your organization's liability against your ability to address and maintain a secure network service. Or adopt our approach, leveraging a broker and allowing all participating systems to participate as network clients, simplifying traversing firewalls through greatly reduced rules, and centralizing the on the wire security risk to one component and one responsible organization filled with the needed expertise.

Further Reading

As of the SIF Infrastructure Specification 3.5 release, providers of data no longer need to be network services. Instead, systems may receive requests off a queue to service them. The signalling and timing allowed by this asynchronous approach is critical to the proper function of the final two steps for the above choreography.

Please have your development team familiarize themselves with delayed providers, before beginning work: <https://a4ldocumentation.atlassian.net/wiki/spaces/ARCHITECTU/pages/56000581>