Comparing Roster Data Models

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bardic systems

Access 4 Learning
Community
Simple. Secure. Scalable. Standard.

Contents

Overview: Why Compare Roster Data Models?

In education, rosters are one of the most ubiquitous data structures used by academic institutions.

Learners must be listed on a roster as a member of a class, often with a username and password or a token representing the Single Sign-on (SSO) of the user, for every service in order to receive personalized and secure services, not simply access to generic content.

The expanding ecosystem of educational services (devices, applications, and websites) that students must access on a daily basis requires a simplified roster exchange solution.

In practice, rosters have many similarities, but across organizations, the specific ways that data structures, data content, and data values are defined do not adhere to a single standard, thus making seamless transfer of roster information still far from a reality.

The Access 4 Learning (A4L) Community commissioned Bardic Systems, Inc. to study these rosters and develop a "Roster Comparison Workbook," a cross-walked comparison of the most common Roster Data Models used by educational institutions and educational technology software developers.

This document represents the results of the study and some initial conclusions based on what was discovered. The value of this document is to help educators, data model providers, and vendors to review the Roster Data Models and participate in planning for improvements in roster development.

A Case Study: Automating Class Roster Exchange

In education, the Roster is a fundamental building block of instruction, assessment, and administration.

Class Rosters in Use
Typically, a roster specifies the teacher and the list of students in a program, class, or section of an organization.

Rosters are important because they enable teachers to manage and teach students as members of a group. For example, by giving privileges to a roster, then all students listed on the roster may automatically access the materials and assessments assigned to the class.

In educational software programs, instructional and administrative applications require a link between the students in a class/section and the teacher.

Ideally, the teacher can then create a class roster once, identify the required software assets that the class may access, and update the software applications with the roster information easily and automatically.

Logistical Challenges

In today's environment, however, many educational organizations face frustrating, time-consuming processes when setting up software applications for classrooms of students.

Roster lists often have to be exported from one application, modified, uploaded to the next application, modified again, and then the process is repeated for every software program the teacher wants the class to access. If there are changes in the class roster during the school session, such as the addition of a new student, the teacher may then have to update every software application separately. This frustration further compounds with the increasing number of apps being leveraged in classrooms for personalized learning, each of which requires class roster information.

Educational institutions need an easy way to transfer roster information to educational applications and keep them up-to-date.

Multiple Data Models Used for Rostering

Many organizations understand this challenge and want to help schools simplify their systems integration. Please note that some of these solutions may be trademarked and owned by their creating organizations.

1. The CEDS model is a comprehensive open standard which accounts for the majority of educational data in academic institutions at present.

2. The Access 4 Learning Community's Schools Interoperability Framework (SIF) has had an entity object orientation to support roster functioning for many years. Several years ago, the A4L Community developed a simpler SIF xPress Roster for an easier to use data model.
3. IMS Global (IMS) began a process in 2013 to create a roster inside its LIS specification, called OneRoster.
4. The Clever software platform is a proprietary solution, not an open standard. However, the company sells a service that that moves roster data into the cloud, which they then connect to vendors.
5. Lastly, the Ed-Fi Alliance (Ed-Fi) is looking to build a roster structure. They do not have one at present.

Each approach has its advantages and disadvantages and each has been adopted by a number of educational institutions and educational technology vendors.

Who Can Benefit From Roster Data Model Comparison

Bardic Systems and the A4L Community are publishing the roster data model comparison to provide both a high level and more detailed view of the multiple approaches and to look at how educational stakeholders can make decisions around this complex matter in a way that will serve their current interests and be sustainable over time.

Our intended audience is:

- Educational Organizations
- Roster Data Model Providers
- Educational Technology Vendors

The Comparison Workbook is designed for more technical- and data- savvy users, and is built so users can crosswalk from one data model to another and have a more holistic map of how each roster structure relates to the others.

This document by Bardic Systems, Inc. offers high-level conclusions and includes recommendations for moving forward for the standards bodies and roster consumers.

A Deeper Dive: Data Model Standards

Common Education Data Standards (CEDS)

CEDS is not a roster model in itself but defines the fundamental components needed for a roster. It is a collaboration of State Departments of Education, the National Center for Education Statistics, large and small school districts, and other key education organization constituents. CEDS is a series of data elements and definitions which account for the majority of student data present in P-20W institutions. Due to the cross sectional nature of CEDS as well as its comprehensiveness, all rosters being organized need to map to this key standard.

SIF and SIF xPress Roster

The SIF Specifications, with both its Enterprise and xPress models, is a comprehensive set of data standards supported by the Access 4 Learning (A4L) Community which align with the Common Education Data Standards and are used in North America, the United Kingdom, and Australia. They include an exhaustive list of data objects and elements from Student, Staff, and Contact Persons to LEAs, SEAs, and schools as well as calendar and incident related data objects.

After many years developing the SIF Enterprise model, a project in Australia was begun as an effort to create a Student Baseline Profile that was simpler for applications to ingest and to utilize. At the same time, the New York BOCES began a project to use a "flattened" version of the SIF data model to populate its multiple applications with student data. This became the original work that culminated in the xPress Roster.

IMS Global OneRoster

OneRoster is designed for grade and student enrollment reporting. It is a subset of a larger Learning Information Services (LIS) specification which is meant to be a web services infrastructure and connected to the Lightweight Directory Access Protocol (LDAP). It is included in this crosswalk due to its being a non-profit, consortium-developed data standard which is leveraged by a number of Educational Technology products, particularly Learning Management Systems (LMS), throughout the sector.

Ed-Fi Alliance

The Ed-Fi Alliance, a Michael and Susan Dell Foundation Project that emerged from a dashboard project done by three districts in Texas, is considering building a roster. The Ed-Fi standard is included in this document because it is licensed by districts to help them bridge the gap between otherwise isolated data systems and their dashboards and reports, and they are considering building a roster specification.

Clever

Clever is not a standard but it is a commonly used proprietary data exchange structure in the education sector. Clever operates using tokens in its data structure instead of keys being used for authentication. The use of tokens is meant to simplify single district access over other, more expansive data structures.

Rosters Data Model: Crosswalk Comparison Methodology

How to Use the Comparison Workbook

The companion "Roster Comparison Workbook" contains visible and hidden columns to allow technical and non-technical readers various "views" of the roster information.

Readers can select columns to display or to hide, depending on the audience. The 'Column Key' outlines the various columns – both hidden and visible – to help guide the right audience to the best view.

As shown in the summary below, each roster is subdivided into the different roster "entity objects" based on how different elements relate to data in an educational institution.

Additionally, the mapping uses the SIF xPress Roster as the comparison starting point, since the xPress roster is the most comprehensive in the total number of elements present across all the different entity object categories.

Mapping Solution Element Summary

Entity Object Category	CEDS v5.0	xPress	Clever v1.1	Ed-Fi v2.0	OneRoster v1.0
Calendars	11	18	5	8	10
Contacts	46	53	17	37	12
Courses	10	13	7	10	12
LEAs	19	20	2	14	5
Rosters	36	46	21	27	13
Schools	23	33	15	21	11
Staffs	27	35	16	22	19
Students	139	164	56	101	65
Totals	311	**382**	139	240	147

The above table indicates the data elements by area that appear in the combined mapping workbook.

Notes on the Comparison Workbook: Optional Attributes

Initially, readers may be surprised by the number of data elements in the mapping that are considered optional, or "non-mandatory." Experience dictates that this is necessary and desirable.

As an example, the element 'middleName' is a non-mandatory element. As a non-mandatory data element, it may be used by one district, but not by another district, with no risk of compromised or incomplete data while reporting.

Additionally, there are elements related to specific incidents such as discipline, emergency, or special education which would absolutely need to be recorded in some circumstances and would be completely erroneous in others.   In the most fundamental use case for a roster, the only necessary identifiers are for students, the organizing structure (class, program, group, or school), the institution, and possibly

the educator. In other cases, the application or service may need more data to provide the services, content, or information it serves up.

Mandatory elements and attributes of objects are those which are of vital importance to the object's understanding and independence. For example, the attribute of 'startDate' for the object 'Term' is mandatory in order to identify and differentiate one specific 'Term'.

Gaps Between Roster Data Models

Additionally, the workbook holds insights into elements present in one standard but not another.

Data points that seem absent from SIF xPress Roster are included at the end of each section. However, they may represent a different level of normalization. If an element/attribute contains a '1' in the "Prospective Match" column, that element/attribute will require further consideration by the standards bodies to determine alignment.

The workbook could be updated and leveraged by end users and marketplace providers to create a minimal viable roster or to enable development of simplified adapters between solutions for greater functionality and interoperability between applications.

Insights and Next Steps

After a thorough evaluation of the Data Model rosters and research on education rostering, Bardic Systems has concluded:

1. The fundamentals of rostering are mostly present in all the various rosters. There is no additional value-add for five (5) roster data models to exist to serve the market.
2. There is more adoption among Student Information Systems (SISs) of the SIF structures and more adoption among the Learning Management Systems (LMS) of the IMS Global structures.
3. The SIF xPress Roster is the most comprehensive roster across all entity objects and represents the most thorough roster with the closest alignment to the CEDS standard.

Some elements are present in Ed-Fi, OneRoster, and Clever which are not represented in xPress roster. This provides an opportunity to look at these "gap" elements and develop further alignment between these systems as they are "prospective matches." Further alignment would more effectively serve academic institutions.

Recommendations

Data Model Standards bodies should combine efforts: Since there is no obvious use case calling for differentiated rosters, IMS Global and Access 4 Learning should work together to develop a combined, minimum viable roster. The reason proprietary, private companies are developing rosters is due to the inability of standards bodies to work together.

> "These commercial options are a market response to the
> failure of the open standards to gain strong traction.[1]"

Educators using these methods, which have less sophisticated underlying entity models, will find additional work down the road when they need to migrate to a more robust model.

Instead, the educational landscape should combine efforts rather than support many differentiated rosters which add no additional value for educational institutions.

With the above realities in mind, it is clear to Bardic Systems that a collaboration between IMS and A4L which creates a shared minimum-viable-product roster with IDENTICAL structures that combines xPress Roster with OneRoster would serve the education ecosystem best. At that point Ed-Fi, Clever and anyone else can use that single Roster structure and developers of new apps and interfaces can all write to that one data structure.

Note: If it does not have IDENTICAL, or at least fully equivalent, structures it will be a collaboration in name only since exact alignment is required for computers to speak to each other.

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[1] Dan Ingvarson, Considerations and discussion for collaboration: Open standards and Rostering?

Education Technology Vendors Should Standardize on SIF: If the standards bodies do not collaborate to create a Common Roster, then vendors ought to move toward an xPress Roster framework either in place of, or in addition to, their current framework. This is because of 1) the prevalence of applications which currently pull the student rosters from Student Information Systems (SIS) using the SIF xPress Roster data model and 2) the SIF xPress Roster is the most complete and vetted roster standard.

Vendors interfacing with Learning Management Systems (LMS) may want to build an LTI tool consumer and/or provider interface to handle an IMS OneRoster framework connection point since LMS systems are more frequently built with LTI Connectors already in place to handle content presentation.

Appendix A: Link to Roster Data Models

[SIF xPress Roster: Technical Handbook](#)

[Common Education Data Standards (CEDS)](#)

[Clever](#)

[Ed-Fi](#)

[IMS OneRoster](#)

[SIF Data Model Implementation Specification (North America) 3.3](#)

Appendix B: Who We Are

About Bardic Systems

Bardic Systems (www.bardicsystems.com) is an Enterprise Systems consulting firm for the education marketplace, offering expertise in data standards, data storage management, software and infrastructure services, systems analysis, and customized application development. Alex Jackl is the CEO of Bardic Systems and is nationally known expert on data standards and complex system implementations. He worked as the Director of Technology for a state education agency, as an IMS Global specification developer, was a key collaborator on the National Education Data Model and CEDS, and has been the Chair of the A4L Community (North America) Technical Board since 2006.   He is a strong advocate for government, standards bodies, and vendors working together to do what is right for education.

About the Access 4 Learning Community

The Access 4 Learning Community (A4L, previously the SIF Association) is made up of schools and regional authorities, government agencies including ministries of education, and marketplace providers collaborating to address the identification, management, movement and usage of educational information. Leveraging collective volunteers across the globe, and with established communities in North America, United Kingdom and Australia, the A4L Community identifies and as a collaborative address educational "pain points" in policy and marketplace products used in institutions each day.

The A4L Community for 20 years has been "powered by the SIF Specifications" – the most comprehensive technical blueprint for data exchanges with a comprehensive data model, infrastructure, and quality control Certification Program. The newly branded "A4L" Community reflects the maturing roles of practitioners in educational institutions in not just addressing data issues but also larger usage issues including privacy, policies, learning resource alignment, etc. that are being addressed by the entire marketplace and partners.

The re-branded A4L Community is committed to the development of marketplace-supported solutions for educational information management "pain points" – no matter where they originate. To this end, the Community has indicated support in using the right solution for the right use case required by end users. It is the hope

that work done by all standards developing organizations either converge for the marketplace or simplified mappings exists to use stand-alone standards or multiple standards together.

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