Identity Atheneum: Combining User Management, Analytics and Gamification in a Multi Tool Hub

Jun Zheng
Dept. of Computer and
Mathematical Sciences
University of Toronto Scarborough
jun.zheng@mail.utoronto.ca

Brian Harrington
Dept. of Computer and
Mathematical Sciences
University of Toronto Scarborough
brian.harrington@utsc.utoronto.ca

ABSTRACT

Modern active learning course structures and a desire for enhanced student analytics has given rise to a wide variety of tools and systems to help students read & write code, track student progress, create groups, manage assignments, and gamify course experiences. However, these tools are often developed as siloed systems that require separate authentication and user management, and do not support easy cross-tool data sharing and analysis.

Identity Atheneum (IA) grew out of our desire to reward students for participating in and interacting with the variety of tools we have developed, coupled with our wish to track students progress not only within, but between these tools.

Rather than each tool having its own user and data management back-end, IA can act as a central hub that either integrates with existing learning management systems, or provides a single point of contact for instructors to create, update, and track student accounts. It also provides unified authentication, and allows for a wide variety of gamification protocols, calculating and managing points from multiple tools within a course, and even between multiple courses.

KEYWORDS

User Management, Gamification, Data Collection

1 INTRODUCTION

Identity Atheneum (IA) was developed to solve two simultaneous problems: Firstly, each tool we developed for use in our courses required separate user management, authentication, and analytics components, which not only increased production time, but made the tools less user friendly, and prevented cross tool data analysis. Secondly, we wished to expand our TrAcademic gamification tool[3]

to allow points to be awarded not only by teaching assistants, but by other tools and even students.

By using IA as a central user management and data storage hub, we have simplified tool development, streamlined data collection and analysis, and developed a software ecosystem where tools can easily share data. This has led to a course-wide gamification based system that integrates into a variety of tools, promotes student engagement, and simplifies research tasks.

2 SYSTEM DESIGN

IA is designed to be a central hub for data storage and user management. Student data can be retrieved through an interface with an institution's learning management system (LMS), or managed directly within the tool by the course instructor. IA also facilitates easy user authentication through either local passwords, or integration with an institution's identity provider. Standard authentication protocols are supported, such as SAML and OAuth2. This means that for a course instructor, there is a single point of control and management of student data. Rather than each tool having a separate user list and login system, either the institution's LMS, or IA itself is responsible for adding and removing students, instructors and teaching assistants and managing their permissions.

Once a user is authenticated through IA, tools will receive a token which can then be used to retrieve user information that includes basic meta-data and user permissions. The individual tools can then use this data to control access internally. This takes the burden off of tool developers, as they don't have to worry about registering their tool directly with identity providers, nor do they have to implement protocols such as SAML and OAuth 2 directly within their application.

When a tool is registered with IA, it is assigned a NoSQL database which can be accessed via a REST API. Data can be shared across tools with privacy control administered by the central IA control module. AI provides simple APIs to facilitate data sharing between tools as well as to allow tools to log usage and other helpful data. Researchers and course instructors can easily access data from IA using its built-in data analytics tools, or directly export CSV files for use in external applications.

IA is a powerful abstraction layer on top of an organization's authentication protocol and LMS. It enables rapid development of new tools, provides a central hub for user permission management, and allows for easy data sharing between tools and cross-tool data amalgamation and analytics.

Figure 1: Overview of the Identity Atheneum System Architecture
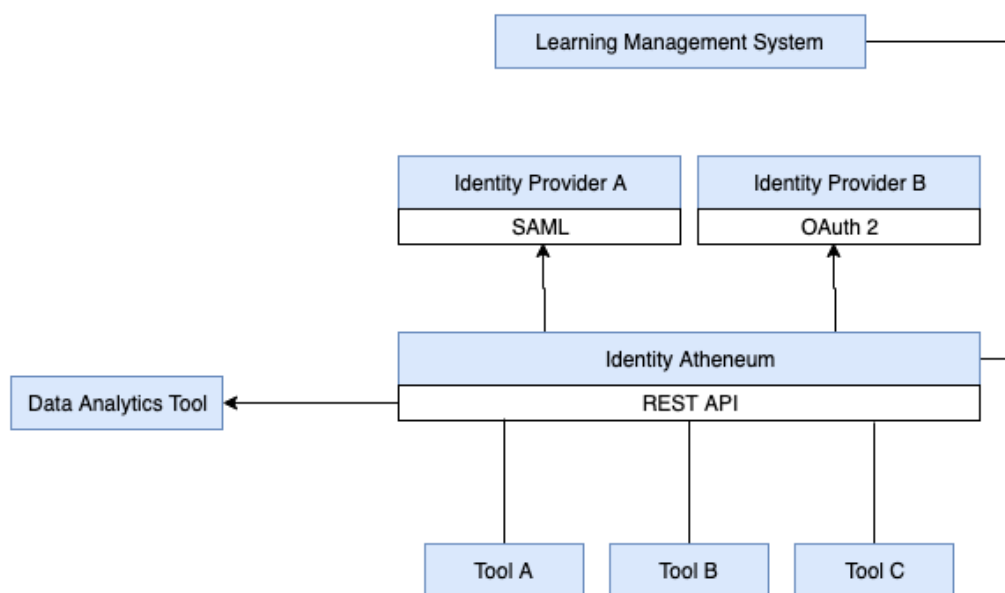
3 GAMIFICATION

The TrAcademic gamification system originally allowed teaching assistants to award points in a small number of categories. We found this simple system resulted in a drastic improvement in attendance and engagement[4]. However the tool itself relied on manual input of point allocations, and had no integration with other tools or with our learning management system.

A new version of TrAcademic, built on top of the IA infrastructure allows for a much broader range of gamification techniques. TAs and course instructors can still manually allocate points. However, it is now possible to manage allocation through either a web-based app, or a mobile phone application. Because IA provides simple user and data management, these applications can be simple stand-alone tools that require very little in the way of data management, and can focus simply on user interface.

The most significant development of IA to our gamification structure has been the ability for individual tools to track, award, and manage points. For example, IFCAT [5] is a tool which allows for group-based think-pair-share code tracing exercises. The tool can award experience points for completing exercises, and groups can award teaching points to the 'driver' of the group if they feel that they were particularly helpful in helping the group understand the problem and achieve consensus. Another tool, the Code Mangler [1] allows students to solve coding problems by un-scrambling lines of code on either a web or mobile interface. The Code Mangler awards experience points for completing a certain number of practice problems, but can also award challenge points for completing certain problems within a set number of moves.

The unified gamification system is also beneficial for research. The ability to develop simple tools to study student behaviours that can award points for task completion [2] provides additional motivation for study participation, and integrated user management and analytics.

4 HOW TO GET IDENTITY ATHENEUM

Identity Atheneum is available as an open source project and is under active development by the University of Toronto Scarborough CMS Undergraduate Research Group (https://cms-urg.github.io/). API documentation is also available to assist any developers who wish to interface with the tool and existing software.

Researchers, educators or tool developers who are interested in using or building upon IA are encouraged to contact the authors. The ultimate goal of the project is to develop a suite of plug-and-play tools that can be used in a variety of CS courses.

REFERENCES

[1] Nick Cheng and Brian Harrington. 2017. The Code Mangler: Evaluating Coding Ability Without Writing any Code. In *Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education*. ACM, 123–128.

[2] Rachel D'souza, Mahima Bhayana, Marzieh Ahmadzadeh, and Brian Harrington. 2019. A Mixed-Methods Study of Novice Programmer Interaction with Python Error Messages. In *Proceedings of the Western Canadian Conference on Computing Education*. ACM, 15.

[3] Brian Harrington. 2016. TrAcademic: experiences with gamified practical sessions for a CS1 course. In *Proceedings of the 21st Western Canadian Conference on Computing Education*. ACM, 25.

[4] Brian Harrington and Ayaan Chaudhry. 2017. TrAcademic: improving participation and engagement in CS1/CS2 with gamified practicals. In *Proceedings of the 2017 ACM Conference on Innovation and Technology in Computer Science Education*. ACM, 347–352.

[5] Jun Zheng, Sohee Kang, and Brian Harrington. 2019. Immediate Feedback Collaborative Code Tracing. In *Proceedings of the Western Canadian Conference on Computing Education*. ACM, 12.