

A³ framework

Aggregation and Archiving of Artifacts

Joshua S. Murphy
Old Dominion University

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Janet Brunelle
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1. Introduction

Students and teachers need a framework that allows teachers to share specific knowledge that they expect a student to know, and for students to reference, without having to rely on outside sources. Currently, there lacks a framework to aggregate, and archive, knowledge artifacts. *Knowledge Management Support for Teachers* (Carroll, 2003) states that Knowledge repositories are one of the five sets of methods and tools found to help in successful implantation of knowledge management. The user lacks the ability to track changes over the live time of an artifact, not knowing if a certain piece of knowledge is out of date. The current aggregation used cannot be considered centralized, and accessible in one location for the user. Artifacts are often isolated by specialization (J. Brunelle, personal communication, March 2, 2020), which makes accessing that knowledge difficult if outside of that specialization for a student. A teacher may have artifacts that relate to a specialization but could also be useful to those outside of it, but not know how to share it, or have a good platform with which to share said artifacts. (T. Kennedy, personal communication, February 12, 2020) Artifacts may vary in formats, not allowing for the comparison of said artifacts. If a teacher leaves their position for any reason, then it is also possible that the artifacts they own are lost. Lastly, they may be abandoned entirely.

Aggregation and Archiving of Artifacts framework, from here on called A³, is a centralized repository that can be utilized by both teachers and students to reference knowledge artifacts. A³ will track changes, allowing the user to see when and how often an artifact has been updated. When an artifact is updated, a report will be supplied to the user, detailing what has changed in the artifact. A³ will be deployed on single instanced server, allowing for repositories and artifacts to be in a central location. Allows for abstract data, which would otherwise be

locked away by specialization, to be useful to users that would otherwise have more difficulty finding said information. A³ will normalize artifacts, compare them, and then send a report back to the user detailing the differences between said artifacts. If the artifact is unable to be normalized, then a simple comparison of the two, i.e. file size, date created, etc. will be done instead. Artifacts, once uploaded to the central A³ repository, will be archived. Artifacts and repositories will be taggable, allowing for users who upload them to select a relevant term to associate them, and allow other users to search based on said tags.

2. Product Description

A³ framework is a repository designed to allow teachers to upload artifacts for the use of students and other faculty for reference. It will allow for the normalization of artifacts, in accepted formats, to be compared using a Diff command, which will output to the user the differences between the two artifacts. A³ also allows for the tagging of artifacts and repositories, to help filter when searching through the system.

2.1. Key Product Features and Capabilities

A³ will connect the user to a single, centralized repository. The user will be able to create their own repositories, from which they can then upload and store their own artifacts to. Both repositories and artifacts may be tagged with a string of characters that may then be used to filter when searching the entire repository for other artifacts or repositories. The user may also filter based on the artifacts last known update date. The User will set up an account that they will then decide a username and password to use to login to the repository. They will be able to set their account to be public or private by default and be able to set any artifacts or repositories they own to be public or private, and which level of user can access them. Through their account, may

bookmark artifacts or repositories, to later revisit. Only the user of said bookmarks will be able to see and access these bookmarks. The owner of the artifact, if in a valid format, may compare differences between an artifact, and an updated version of said artifact, through normalization. The two artifacts will be normalized into mark-down text, which will then be compared line by line, using the Difference command. A³ will then save a copy of the differences and display them to the user. Also, through their account, the user may set up to be notified when an artifact or repository that they have bookmarked is updated. Lastly, the owner of an artifact or repository may set up through their account if they want to be notified after a set amount of time has passed since they have last touched or updated an artifact or repository.

2.2 Major Components

A³ consist of major components: the front-end, which will consist of the Command Line Interface and User Interface/User Experience, from which the user will use to interact with A³; the server with which A³ will be housed; and the Database portion of A³, which will consist of all of the functionality needed.

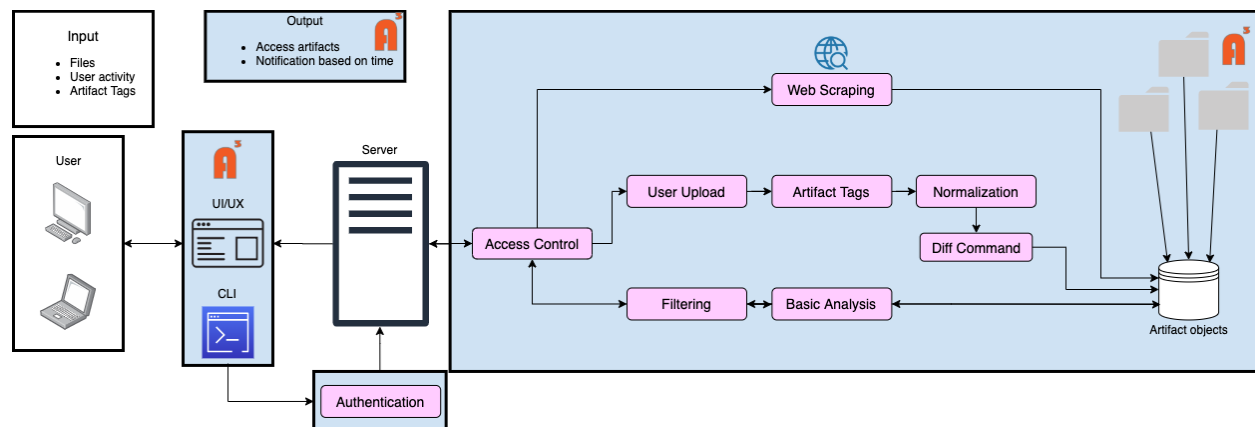


Figure 1: Major functional components of A³

Figure 1 illustrates the major functional components of A³. The user must first enter their username and password, which will then go through authentication and either allow the user access to a specific account level, based on the credentials provided. From there, the user may upload or download artifacts, manage their account settings, or tag specific artifacts and repositories, if they are the owner. Through the UI/UX and CLI, the artifacts and notifications, if set up, will be displayed to the user.

On the Database side of things, the Access Control determines what the user has permission to see and do within A³. There are five different levels. Guest being the default, which may only view artifacts that are made public. Student, which may bookmark artifacts and repositories. Faculty, which may upload artifacts and create repositories, and set whether they wish for them to be viewable by students or not, as well as invite students to have access to a specific artifact or repository. Administrator, access all artifacts on the repository, manipulate said artifacts, and manipulate user accounts on the database. Lastly, Tester, which is only used during development of A³ to ensure reliability. Every role has the same capabilities as the one below it, for example every student has the same capabilities as a guest, as well as capabilities allowed to that of a student account.

The User, if permitted, may upload an artifact, which they will then be required to at least add one tag to that artifact. If the artifact is in a valid format, then the artifact may be normalized. If this is an update to an artifact already in the A³ repository, and is able to be normalized, then a Diff command may be executed and the results will be saved to a file and displayed to the user, which will contain a line by line comparison of the two different versions.

Web Scraping will be set up either to happen at a specific time and date or done via a command. When called, the web scrapper will be told a specific location to search for the artifact desired and proceed to pull the resource. It will then hand the process over to update, and the Diff command will be performed.

3. Identification of Case Study

A³ is targeted towards Faculty and Students of higher academia. Faculty, specifically teachers, would be able to upload and share artifacts with other students and faculty of a university. This would allow for the sharing of knowledge that a student might not have previously but is expected for a class. Students would be able to access artifacts allowed to them, to be able to find information that may be harder to find on their own, and know that they are not wasting their time hoping that the information they are getting is correct.

The specific case will involve faculty uploading artifacts to the repository, being able to create their own repositories, and being able to normalize and compare artifacts, as well as look at other user's artifacts and then export them out of the system.

4. A³ Product Prototype Description

4.1. Prototype Architecture (Hardware/Software)

4.2. Prototype Features and Capabilities

4.3. Prototype Development Challenges

5. Glossary

- **Aggregate:** Data that is composed of smaller pieces that form a larger whole.
- **Algorithm:** Set of instructions designed to perform a specific task.
- **Angular:** A framework for dynamic web apps. Allows for the use of HTML as a template language.
- **Application Programming Interface (API):** Set of functions and procedures allowing the creation of applications that access features of an operating system, applications, etc.

- **Archive:** Contains multiple files and/or folders. May be created by several different utilities and may be saved in different formats.
- **Artifact:** Combination of arte, “by skill”, and factum, “to make”. A file or document.
- **Backlink:** A hyperlink that links from a web page, back to your own web page or website.
- **Blackboard:** A tool that allows faculty to add resources for students to access online.
- **Centralized:** Type of network where all users connect to a central server.
- **Course Websites from Markdown (CoWeM):** A system for building course websites, including notes, slides, and organizational pages, from Markdown documents.
- **Cascading Style Sheet (CSS):** Used to format the layout of web pages. Defines text styles, table sizes, among other things that previously could only be defined in HTML.
- **Database:** Collection of information, that is organized for rapid search and retrieval.
- **Data Loss:** An instance in which information is destroyed by failures or neglect.
- **Diff:** A line by line comparison of normalized artifacts.
- **Docker:** Tool to create, deploy, and run applications by using containers. Allow developers to package up an application, with all parts needed, to be deployed in one package.
- **Export:** Taking data from one program or computer to another.
- **GitLab:** Used to provide internal management of git repositories. Is a self hosted Git-repository management system that keeps the user code private.
- **Graphical User Interface (GUI):** User interface that contains graphical elements. Examples include windows, icons and buttons.
- **Hypertext Markup Language (HTML):** A language used to create web pages. “Hypertext” refers to hyperlinks in a page, and “Markup language” refers to the way tags are used to define page layout.
- **Hyperlink:** An element that links to another file or object.
- **JavaScript (JS):** A language used in web development. While influenced by Java, It’s syntax is more similar to C.
- **Knowledge Management:** The management process of creating, capturing, sharing, retrieving, and storing data, information, knowledge experiences and skills by using appropriate information and network technology.
- **Markdown:** A markup language that can be used to format plain text. Can be converted into another language.
- **Markup:** A language that uses tags to define elements within a document.
- **MySQL:** Open source SQL database management system. Developed and distributed by Oracle Corporation.
- **Normalization:** Converting ingested objects into a small number of pre-selected formats.
- **Python:** An interpreted, object-oriented language.
- **Personal Learning Environment (PLE):** An interface used in flexible online courses. Designed by ODU’s Center for Learning and Teaching.
- **pydoc:** Automatically generates documentation from Python modules. Can be presented as pages of text on the console, served to a web browser, or saved to HTML files.

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- **Pylint:** A Python static code analysis tool. Looks for programming errors and warnings from within the code, as well as from an extensive configuration file.
- **React:** A JavaScript library that is used to create User Interfaces for web applications.
- **reStructuredText:** A plaintext markup syntax and parser system. Useful for in-line program documentation.
- **Secure File Transfer Protocol (SFTP):** Secure version of File Transfer Protocol. Facilitates data access and data transfer over a Secure Shell data stream
- **Sphinx:** A Python documentation generator. Converts reStructuredText files into HTML websites and other formats.
- **Tags:** Is a keyword or term assigned to a piece of information.
- **tox:** Aims to automate and standardize testing in Python. Is a generic virtualenv management and test command line tool.
- **Visual Studio Code:** A source code editor that runs on Mac, Linux, and Windows.

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