



# A<sup>3</sup> framework

Aggregation and Archiving of Artifacts

“A Repository of Reliable Resources for Academia”

FEASIBILITY PRESENTATION

CS 410, SPRING 2020

TEAM CRYSTAL

# TEAM CRYSTAL

Team Crystal, comprised of computer science students at Old Dominion University, is developing the A<sup>3</sup> framework.



**Stephen Ayers**  
*Algorithms Developer/Testing*



**Joshua Murphy**  
*Documentation Manager/ Database Developer*



**Joshua Harris**  
*UI/UX Developer-Testing*



**Mike Campbell**  
*Database Architect/Testing*



**Aaron Berman**  
*Team Lead/Webmaster*



**Noah Jennings**  
*Algorithms Developer-UI/UX Developer*



**Rosalie Oliva**  
*UI/UX Developer*

# TEAM MENTORS

Janet Brunelle and Thomas Kennedy are both serving as mentors to Team Crystal in developing the A<sup>3</sup> framework. Our mentors contributed heavily, explaining their needs and how other services have not been able to fill those needs. A<sup>3</sup> seeks to fulfill those needs.



**Janet Brunelle**



**Thomas Kennedy**

# OUTLINE

- Problem Statement
- Traditional Shortcomings
- Current Process Flow
- Solution Statement
- Solution Characteristics
- Solution Process Flow
- User Roles
- Major Functional Components
- Competition
- Development Tools
- Work Breakdown Structure: Overview
- Site Map
- Work Breakdown Structure: Algorithms
- Work Breakdown Structure: Retrieval
- Work Breakdown Structure: Analysis
- Work Breakdown Structure: Security
- Work Breakdown Structure: Filtering
- Work Breakdown Structure: Database
- Work Breakdown Structure: External Interfaces
- Work Breakdown Structure: Testing
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- Agile Sprints
- GUI Mockups
- Risk Matrix
- Conclusion
- References
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- Appendix B: Glossary
- Appendix C: Additional Material

# PROBLEM STATEMENT

Educators and students lack a framework to aggregate and archive fragmented and domain-specific artifacts for the purpose of academic knowledge management.

# TRADITIONAL SHORTCOMINGS: Knowledge Repositories

- Formal artifact aggregation in traditional academic environments does not exist [3]
- The aggregation that does currently exist does not support tracking of changes [2]
- Current aggregation is not strong enough to be considered centralized



Image Credit:  
[Medium.com 2020](https://Medium.com)

# TRADITIONAL SHORTCOMINGS: Knowledge Accessibility

- Knowledge is isolated by specialization [16]
- Access is often restricted by course or major [16]
- Format preference by instructor can vary wildly and may not be functional to others [17]



Image Credit:  
[Vecteezy.com](https://Vecteezy.com) 2020

# TRADITIONAL SHORTCOMINGS: Knowledge Asset Management

- Instructor materials are often created in variety of formats
- Individual instructors must often be petitioned for information [\[17\]](#)
- Loss of artifacts from reassignment of responsibilities [\[16\]](#)
- ODU CS department syllabi collection once took two months [\[17\]](#)



Image Credit:  
[Freepik.com 2020](https://www.freepik.com)

# TRADITIONAL SHORTCOMINGS: Knowledge Environment Enhancement

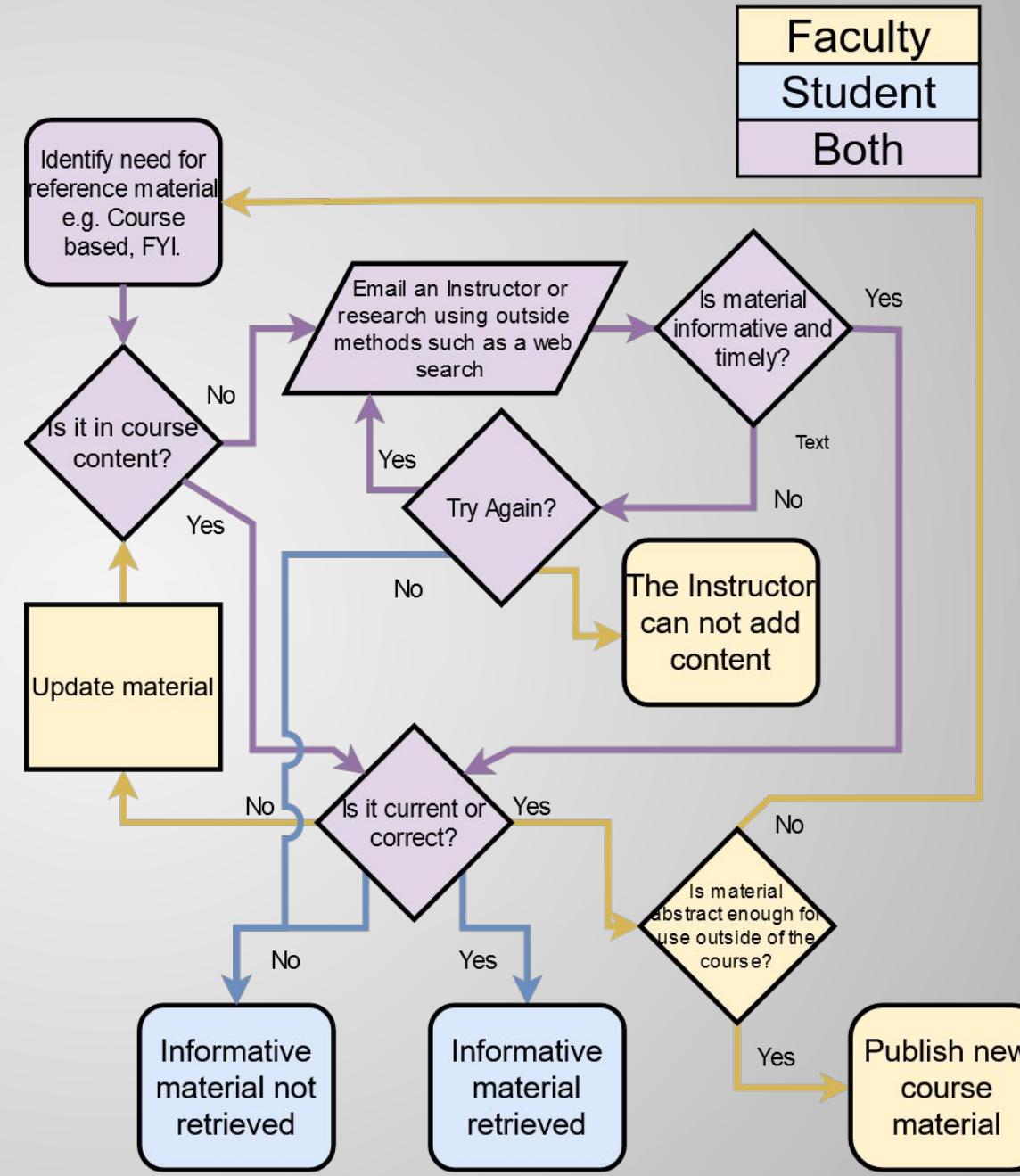
- Reference materials are specific to each course
- ODU instructors use a variety of platforms (Bb, PLE, CoWeM) [\[17\]](#)
- Special needs and distance learning lack proper support [\[3\]](#)
- Shared reference material can benefit organizations on a fundamental level [\[16\]](#)

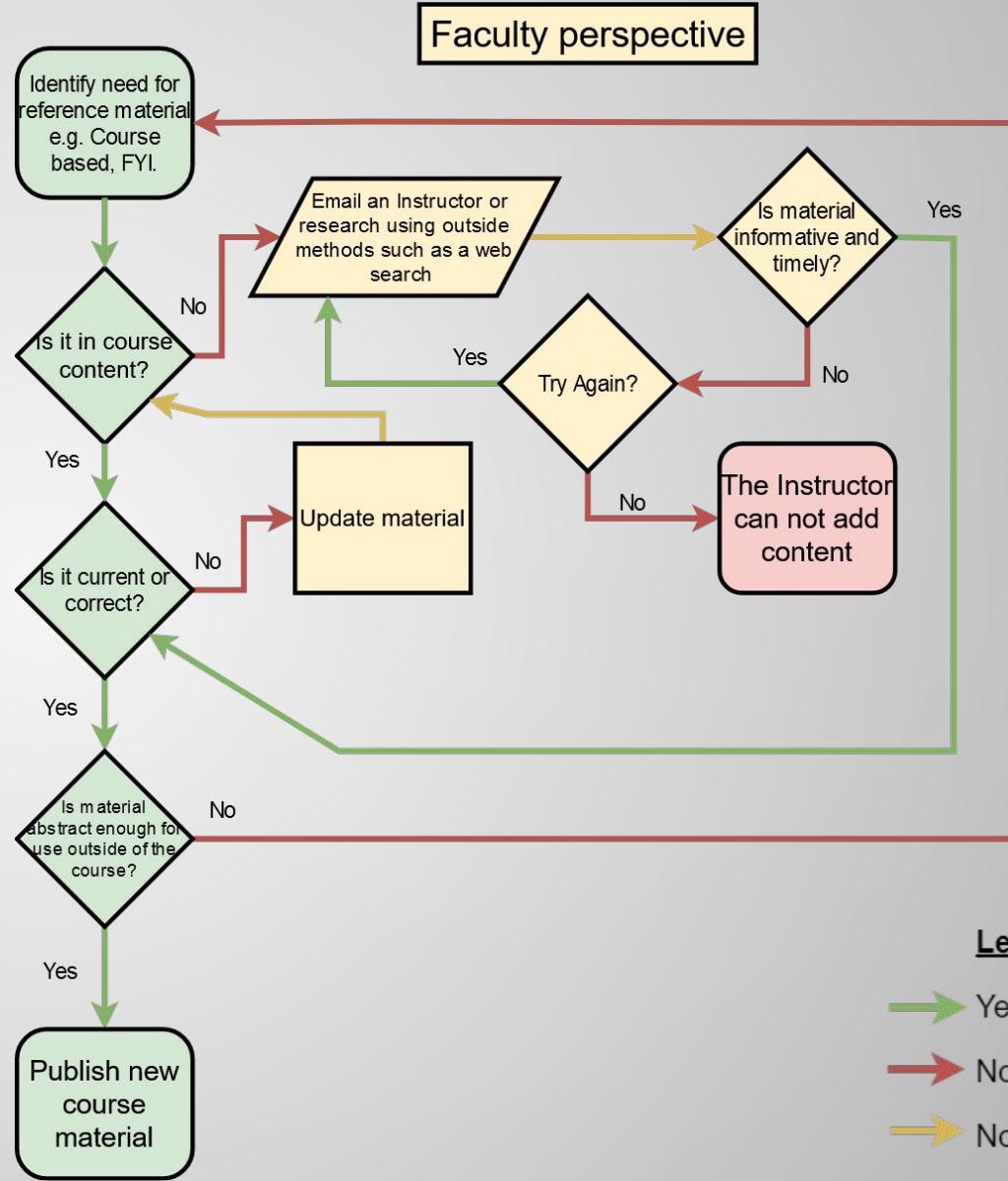
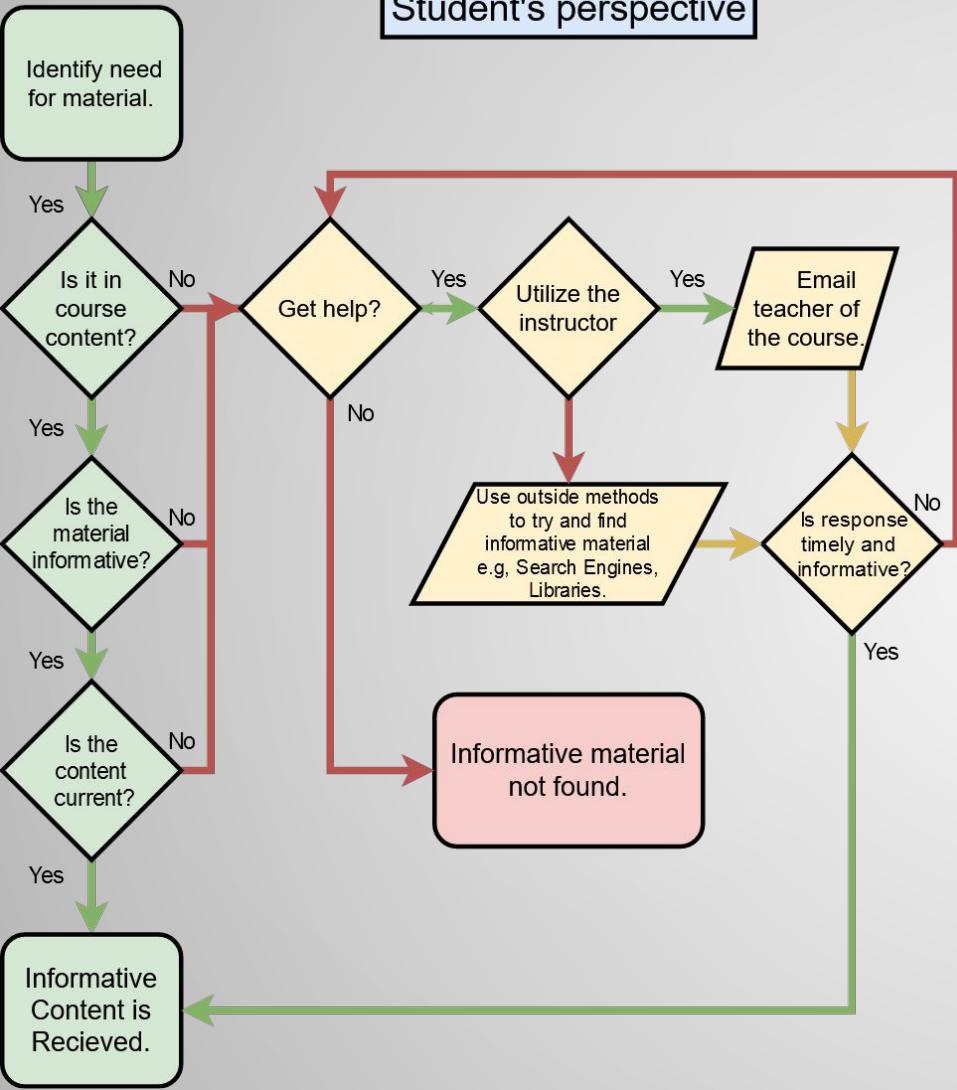


Image Credit:  
[shutterstock.com](https://shutterstock.com) 2020

# CURRENT PROCESS FLOW

The process flow when viewed from a comprehensive standpoint





**Legend**

- Yes
- No
- No choice

# SOLUTION STATEMENT

A<sup>3</sup> is a framework for aggregating and archiving artifacts for educators, researchers, and students. A<sup>3</sup> seeks to overcome the challenges of individualization, location, and formatting in academic knowledge management by keeping information available, normalized, and centralized while being enhanced by a robust user interface.

# SOLUTION CHARACTERISTICS:

## Creating Formal Knowledge Repositories

- Create a robust infrastructure for artifacts
- Support change logs of artifacts and knowledge assets
- Centralize information concisely and effectively



Image Credit:  
[Medium.com 2020](https://Medium.com/2020)

# SOLUTION CHARACTERISTICS: Improve Knowledge Accessibility

- Create knowledge artifacts that are widely applicable
- Create a cross course accessibility
- Normalize information from varied platforms (Blackboard, PLE, etc.) into translatable formats

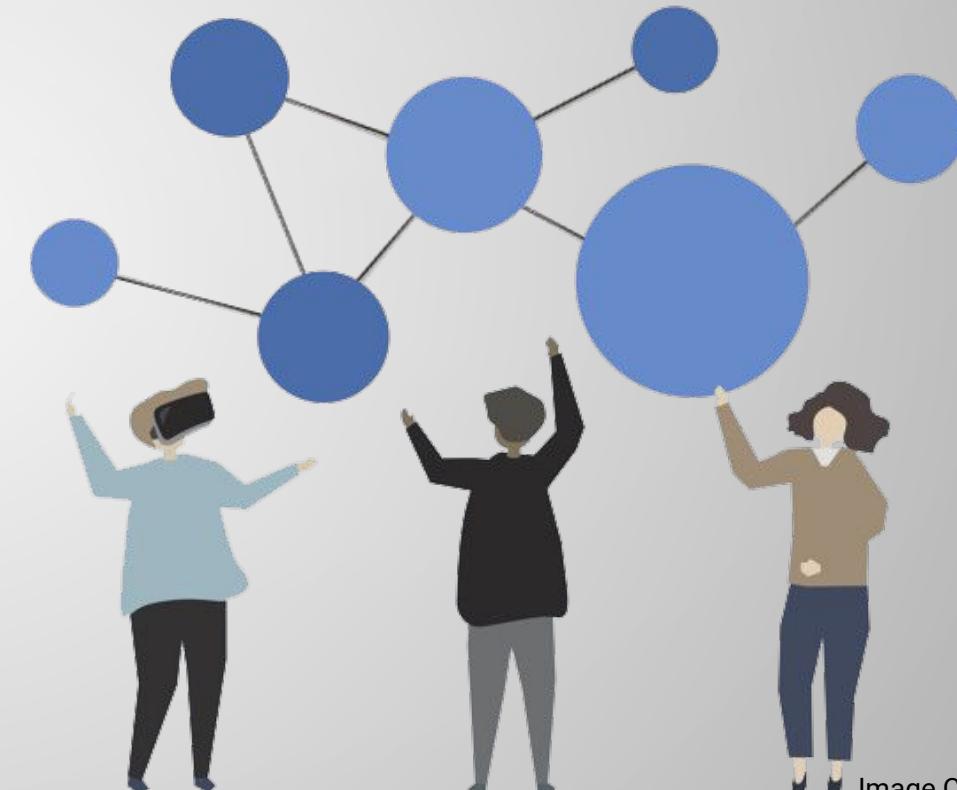


Image Credit:  
[Vecteezy.com 2020](https://Vecteezy.com)

# SOLUTION CHARACTERISTICS: Knowledge Asset Management

- Unify formatting among instructors through normalization
- Remove necessity of individual asset request
- Create systematic storage of vital course information
- Automate collection of standard reference materials



Image Credit:  
[Freepik.com 2020](https://www.freepik.com)

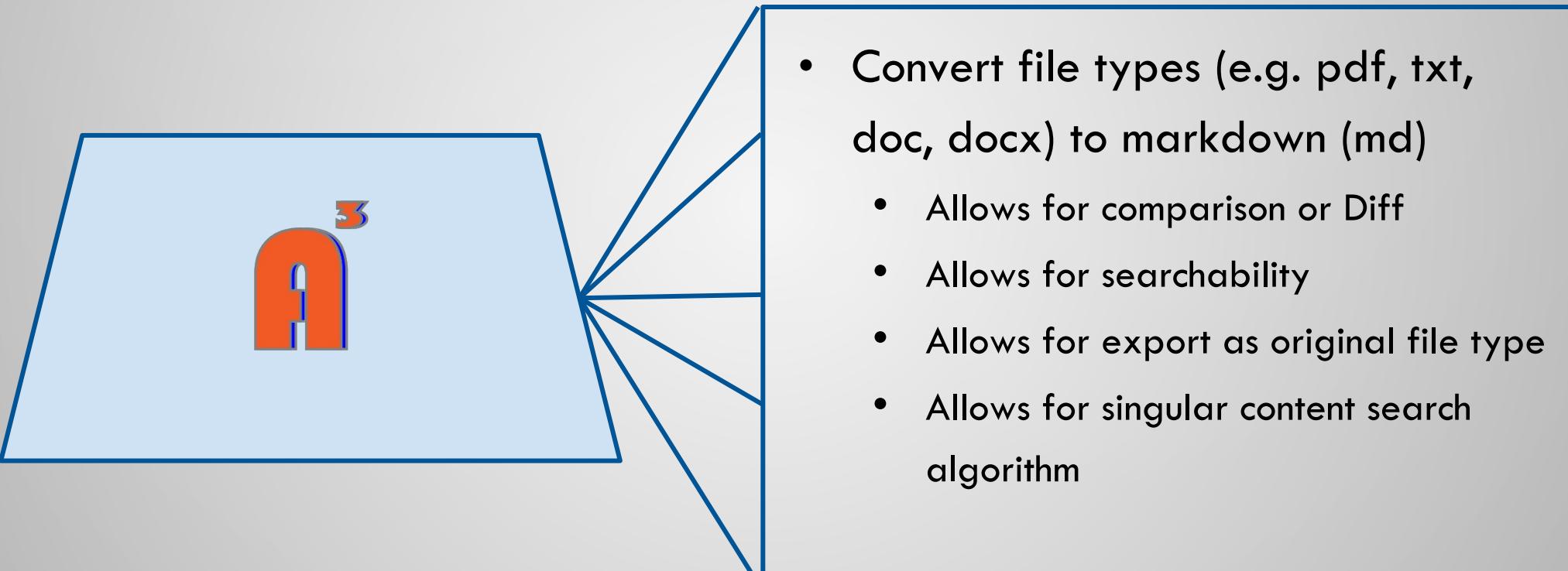
# SOLUTION CHARACTERISTICS: Knowledge Environment Enhancement

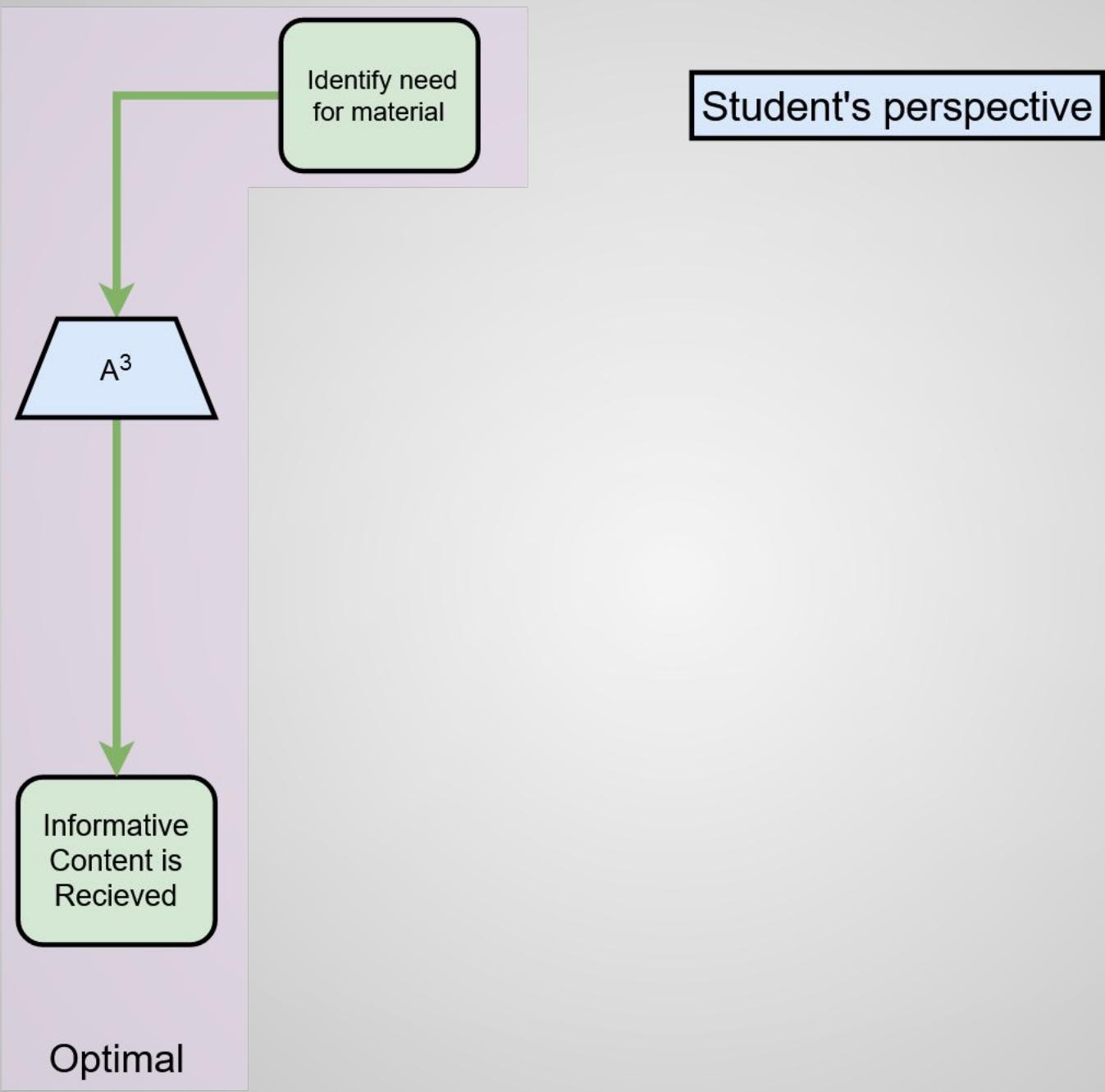
- Create universal reference material standards
- Core organizational improvements through a cooperative environment
- Normalization to allow cross platform functionality
- Special needs and distance learning accessibility



Image Credit:  
[shutterstock.com](https://shutterstock.com) 2020

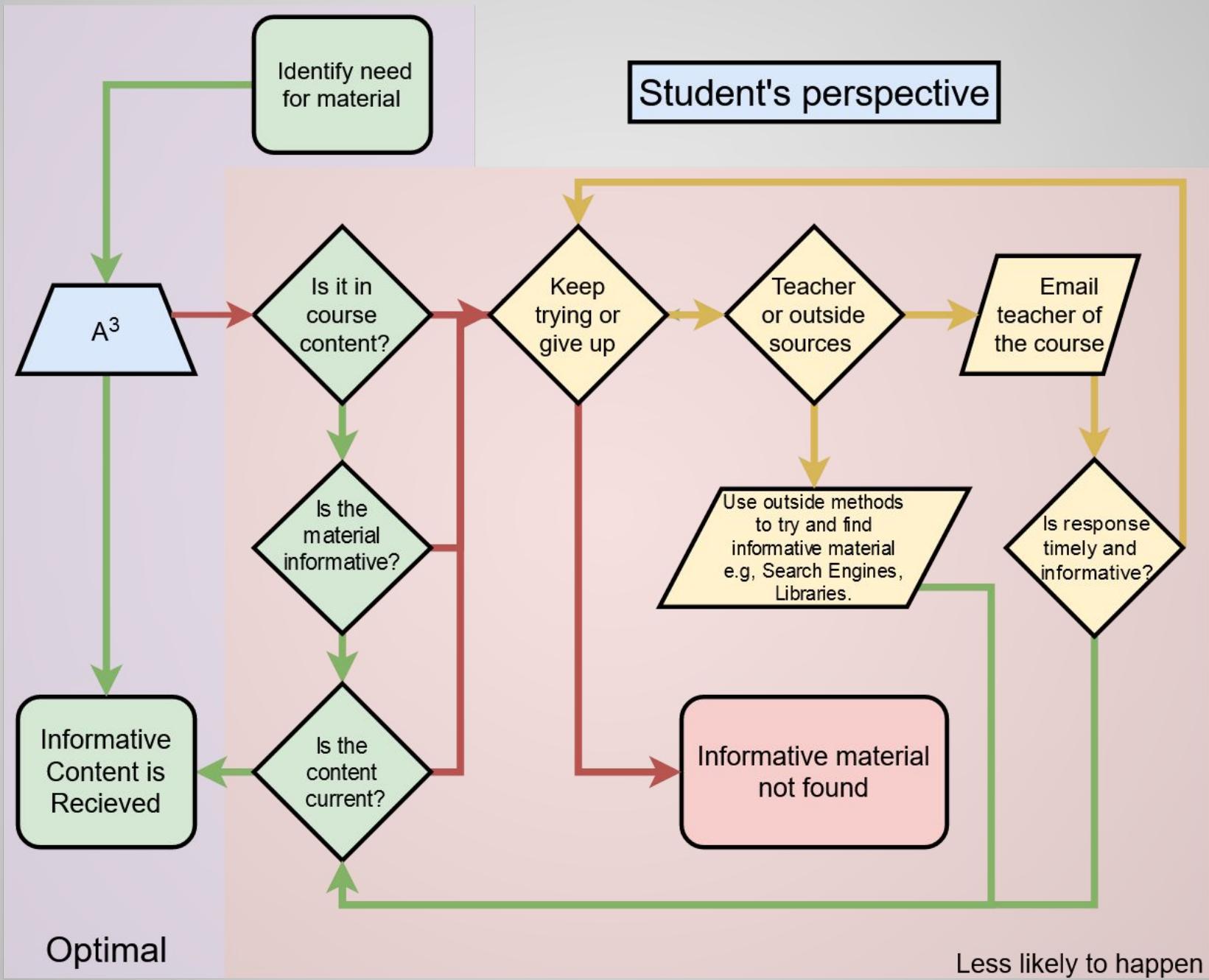
# Normalization



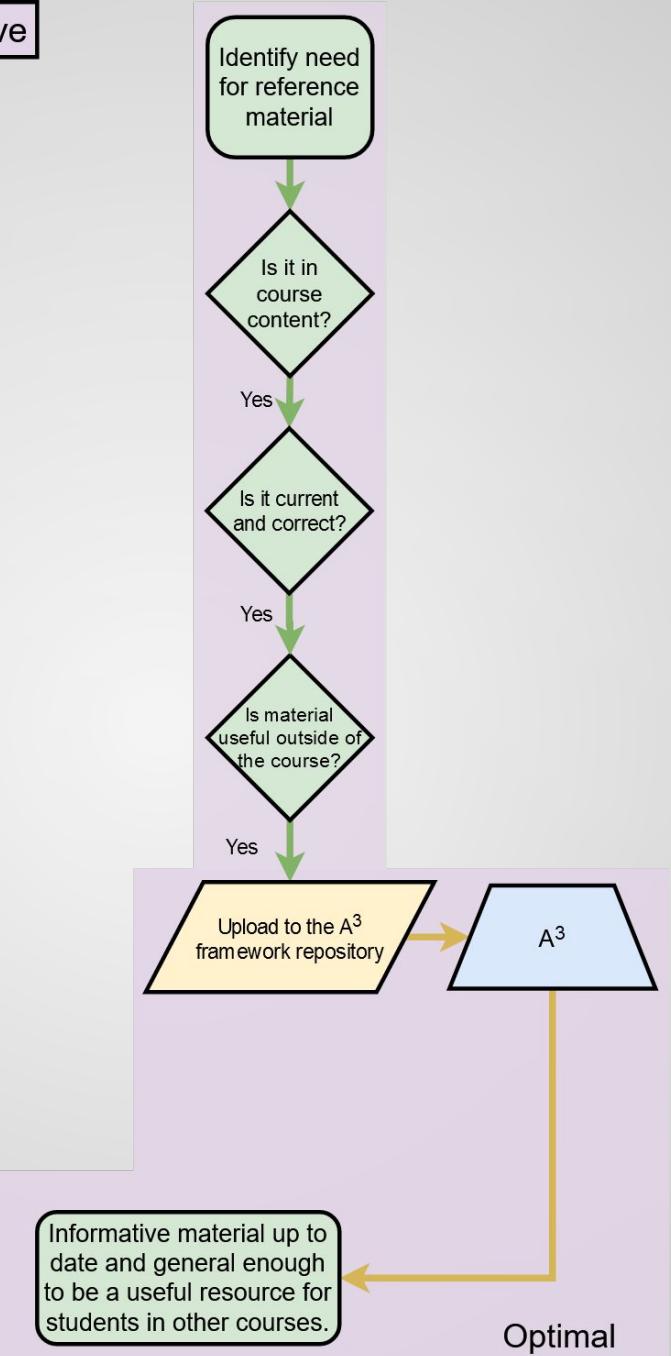


Legend

- Yes
- No
- No choice



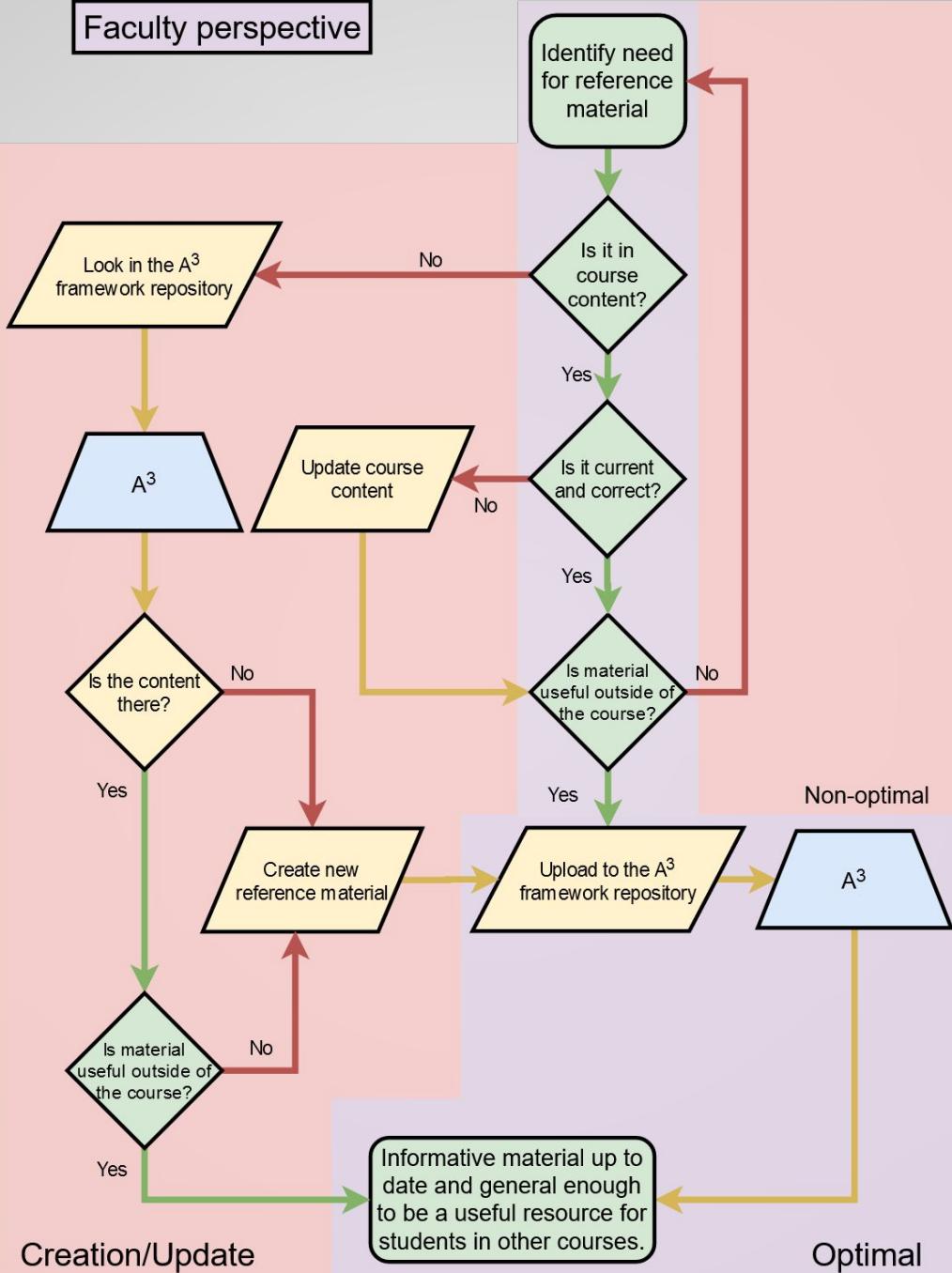
Faculty perspective



Legend

- Yes
- No
- No choice

## Faculty perspective



Legend

- Yes
- No
- No choice

# POTENTIAL USER BASE (Worldwide)

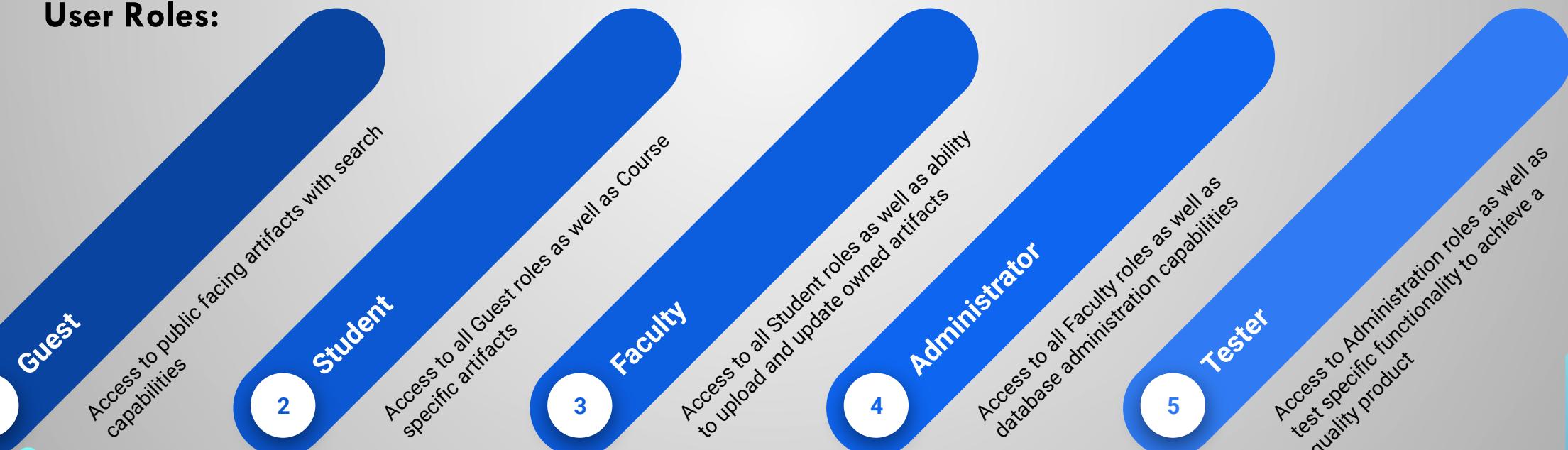
All Enrollments and Online Enrollments, 2016 and 2017					
	2016	% of 2016 total	2017	% of 2017 Total	% Change, 2016 - 17
All Students	20,224,069		20,135,159		-0.44%
Enrolled Exclusively Online	2,974,836	14.71%	3,104,879	15.42%	4.19%
Enrolled in Some Online Courses	3,325,750	16.44%	3,552,581	17.64%	6.38%
Enrolled in No Online Courses	13,923,483	68.85%	13,477,699	66.94%	-3.31%

Lederman, D. (2018, November 7). Inside Higher Ed. Retrieved March 10, 2020, from  
<https://www.insidehighered.com/digital-learning/article/2018/11/07/new-data-online-enrollments-grow-and-share-overall-enrollment>

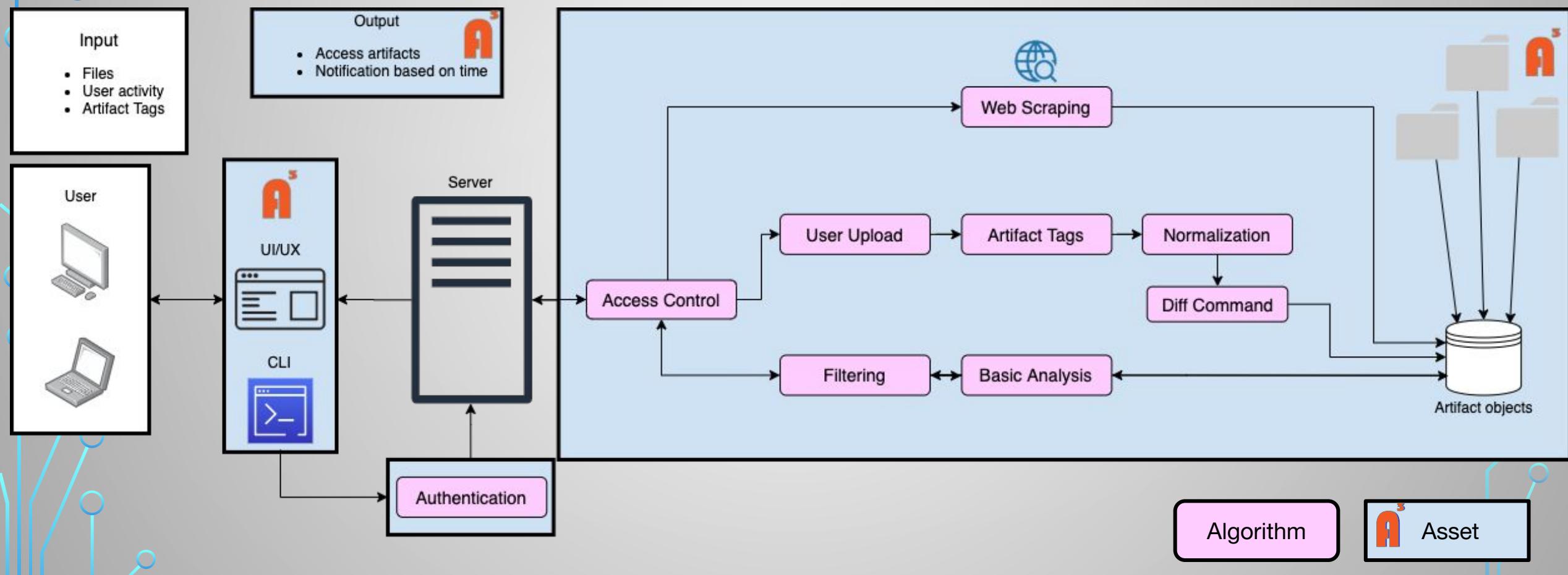
# STAKEHOLDERS & USER ROLES

**Stakeholders** - Academic institutions, Faculty, Researchers, Students (current and former), and any person who has a desire to learn from the content which has been stored.

## User Roles:



# MAJOR FUNCTIONAL COMPONENTS



# CURRENT COMPETITION

eFileCabinet - A centralized location for all documents and files. Allows for up to 5 TB of storage. The service can break files down into separate departments and folders. eFileCabinet also lacks in the ability to be locally hosted and controlled by system administrators.

Localized Databases - Databases can contain much of the same information. These are generally not easily accessible by many people due the difficulty included creating SQL queries and data retrieval.

FileCloud - A cloud-based solution to sharing files among students, faculty and administrators. Lacks the ability to be locally hosted and controlled a University.

# CURRENT COMPETITION

GitHub - A cloud-based repository system for contributing to projects. This is an all-to-one system where the users all contribute to one project. Useful for Programming and its associated documentation.

SharePoint - A web-based platform that contains the tools of Microsoft Office while allowing collaborative work. Sharepoint is often presented as a document storage and management system, but is fairly customizable.

# COMPETITION MATRIX

Features		FileCloud	Localized Databases	eFileCabinet	GitHub	SharePoint
File Storage	X	X	X	X	X	X
Change Tracking	X	X	X	X	X	X
Content Search by Filename	X	X	X	X	X	X
File Sharing	X	X		X	X	X
Change Reporting	X	X			X	X
Content Search by Subject	X			X	X	X
Notifications	X				X	X
Reports	X					X
Format Normalization	X					
Automation	X					
Mandatory Configuration		X	X	X	X	X

# WHAT A<sup>3</sup> WILL DO AND WILL NOT DO

## A<sup>3</sup> **will...**

- Allow users to view changes to an artifact
- Link artifacts to the original source
- Allow users to convert documents to markdown for normalization
- Automate the update of artifacts

## A<sup>3</sup> **will not...**

- Allow users to edit archived artifacts
- Provide server hosting
- Require document templates
- Provide continuous integration

# DEVELOPMENT TOOLS

## Software Requirements:

- Language: Python 3.8 or newer
- GUI language: HTML, CSS, and JS
- JS frameworks: Angular and React
- IDE: Visual Studio Code (VS Code)
- Documentation: pydoc and Sphinx

- Code Repository with Version Control: GitLab
- Containerization: Docker and Docker Compose
- Database: MySQL
- APIs: REST
- Configuration management: tox
- Analysis: pycodestyle (formerly PEP 8) and Pylint

## Hardware Requirements:

Single instance server

# DEVELOPMENT MODEL - AGILE

- Small team with distributed knowledge
- High quality product
  - Known customer who can provide immediate feedback
  - Fast return on investment (ROI)
- After the first sprint, the A<sup>3</sup> deliverable will be actively used for future sprint development.

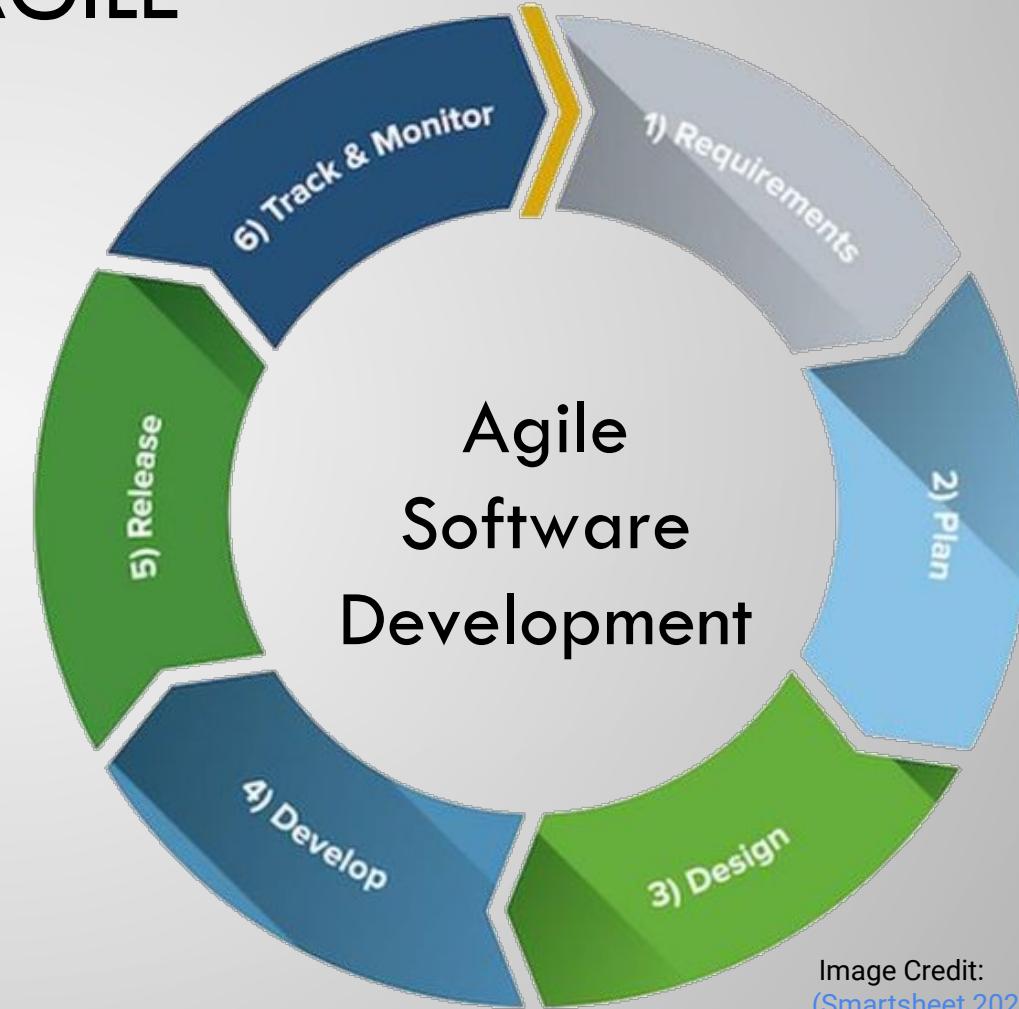
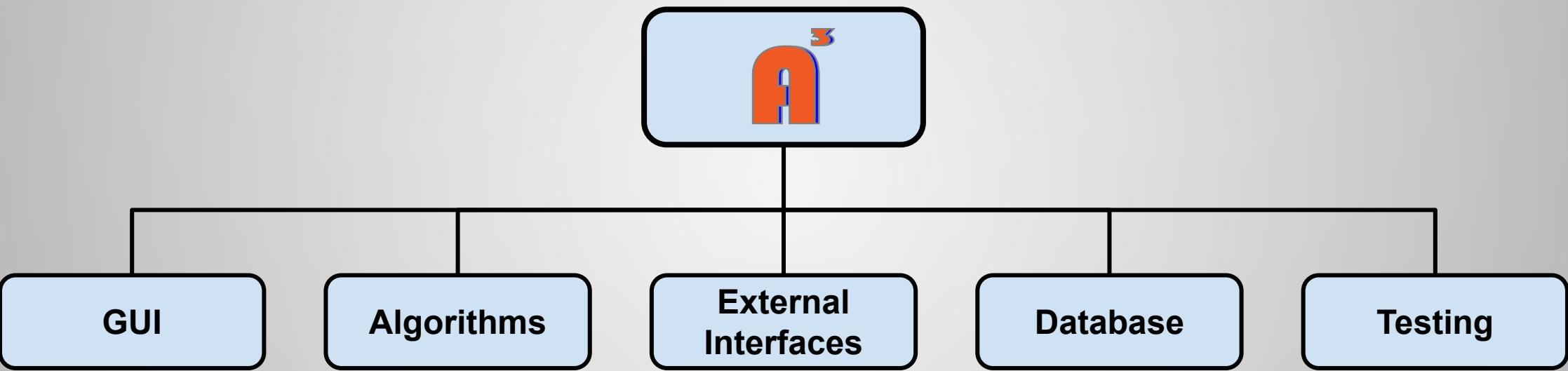


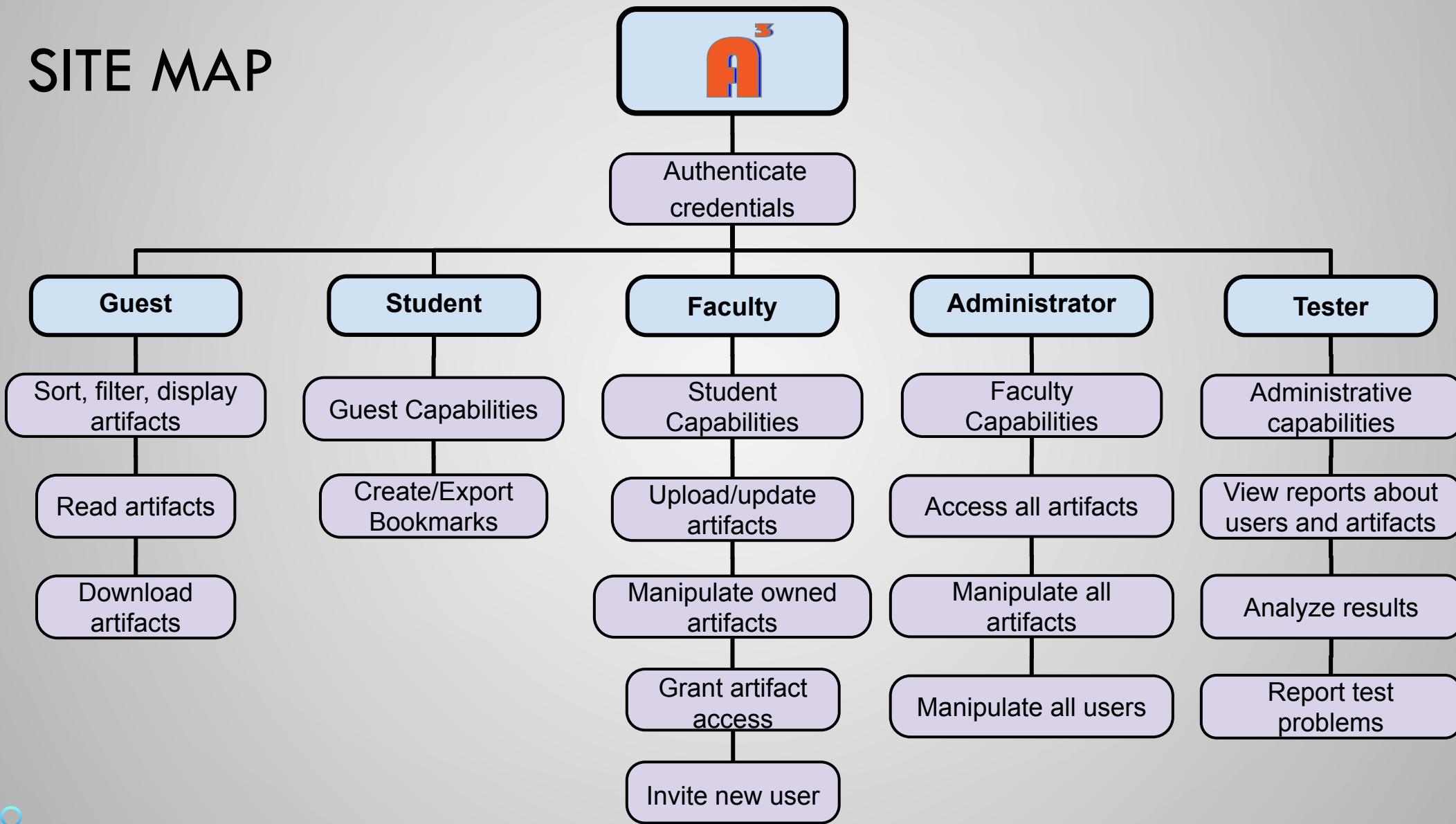
Image Credit:  
[\(Smartsheet 2020\)](#)

# WORK BREAKDOWN STRUCTURE:

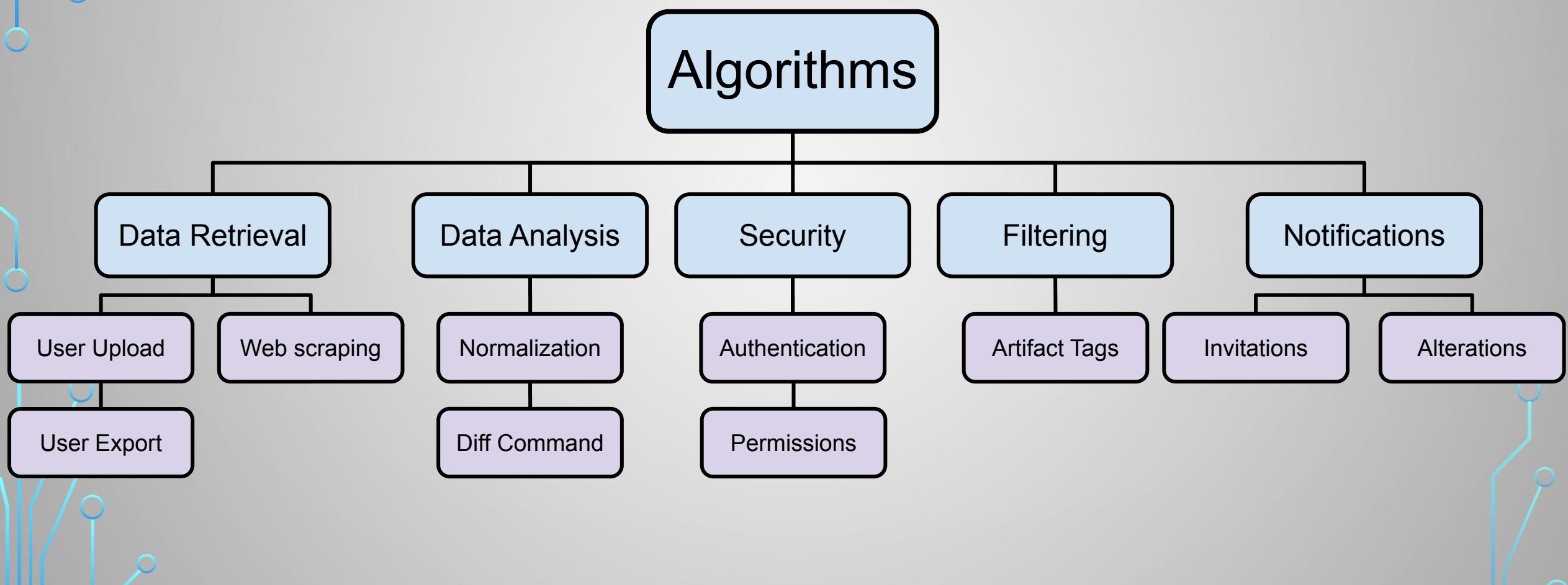
## Overview



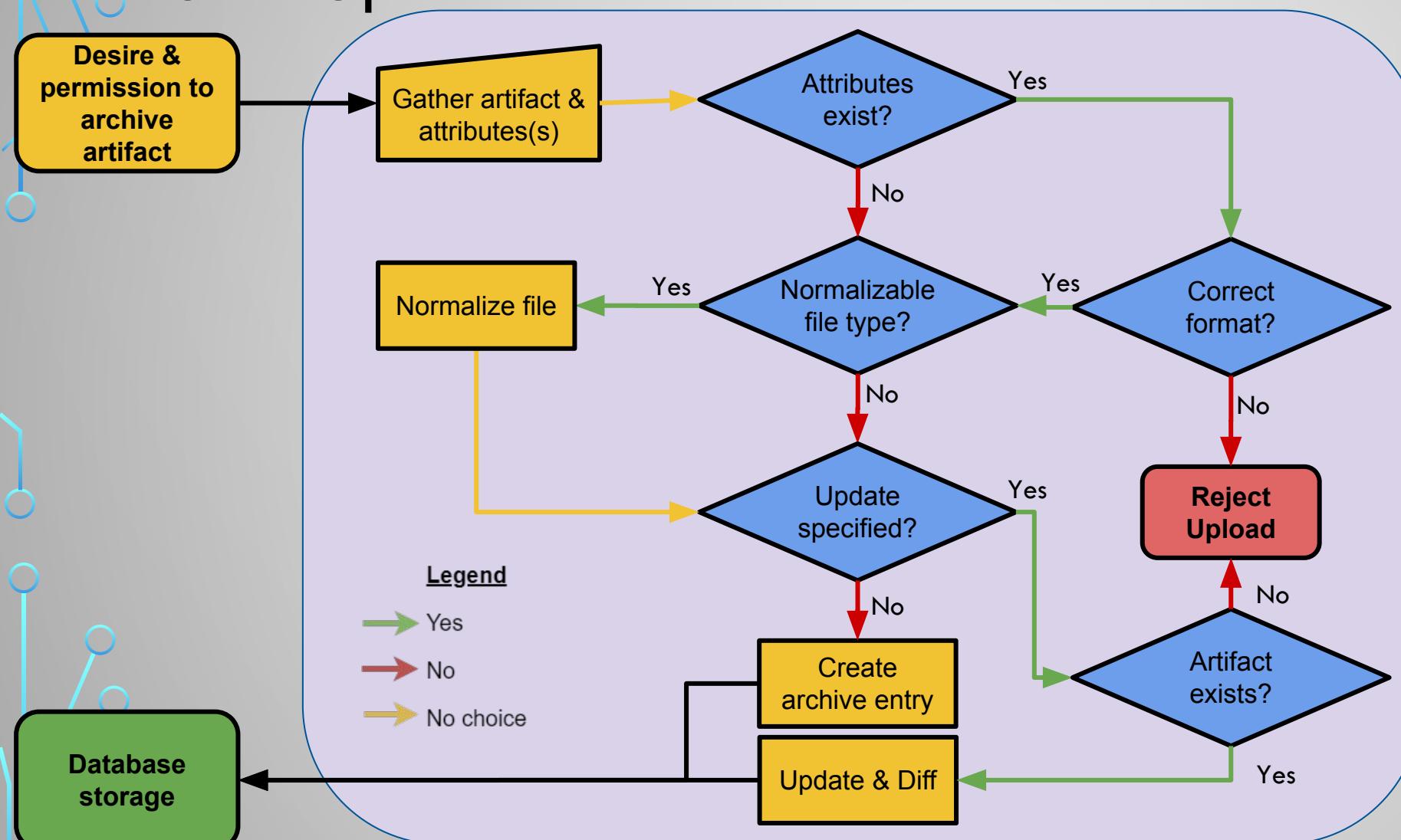
# SITE MAP



# WORK BREAKDOWN STRUCTURE:



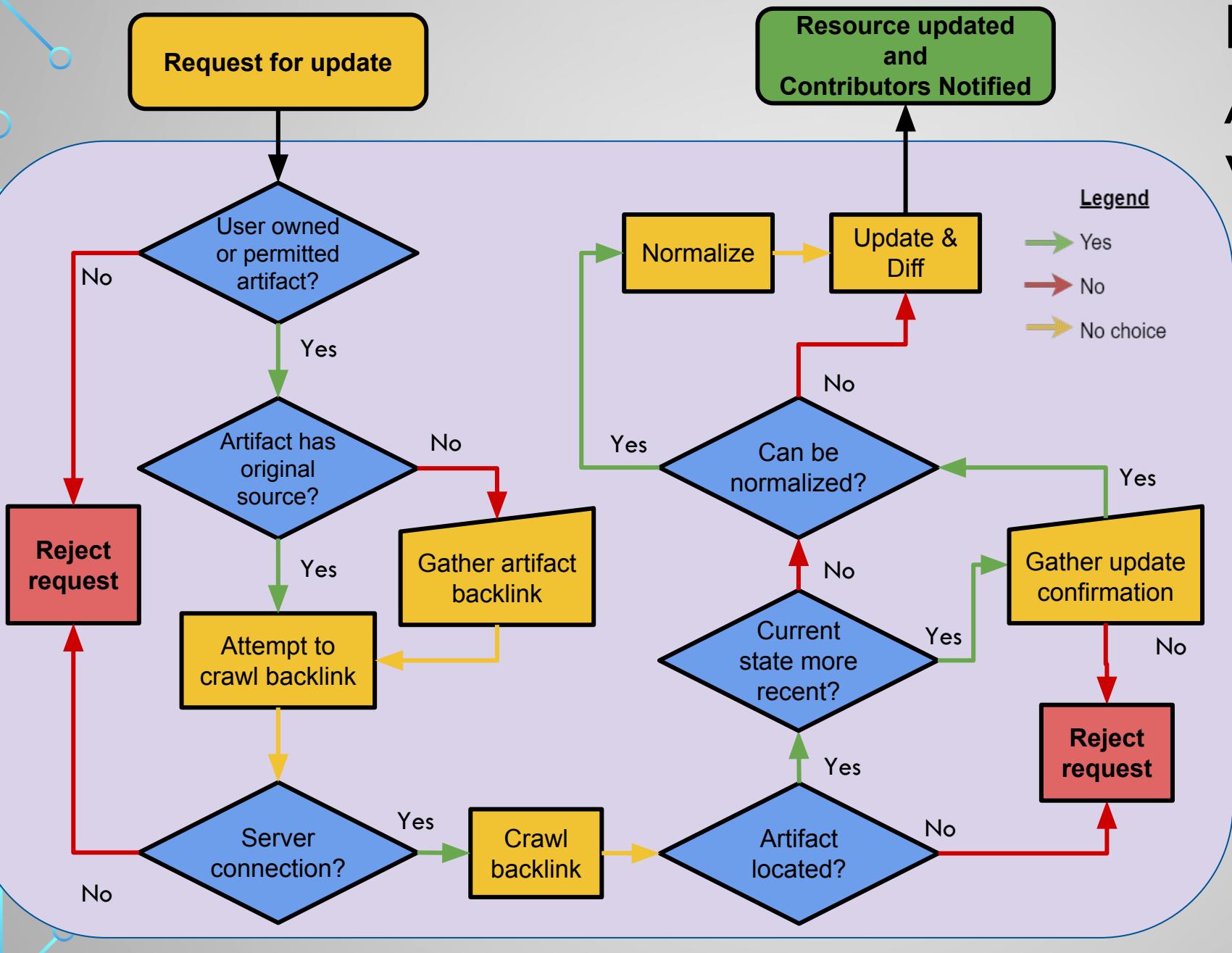
# Data Retrieval Algorithm: User Upload



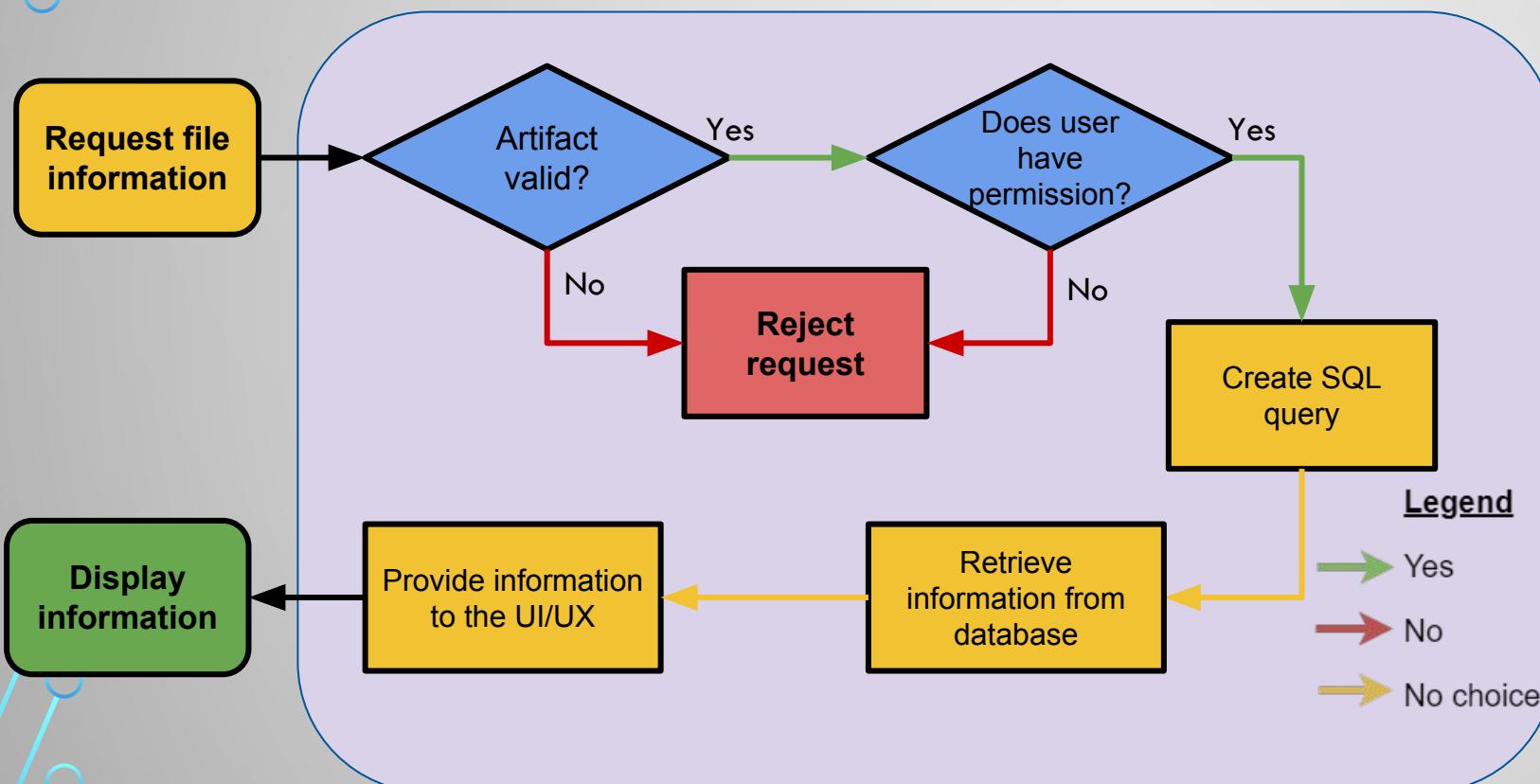
- User upload is available upon request to authenticated users
  - SFTP
- Normalizes specified file types (e.g. .txt, .pdf, .doc)
- Creates new entries or updates existing ones

# Data Retrieval Algorithm: Web Scraping

- Web Scraping is issued on a set interval
- Allowed after backlink has been established
- Pulls resources from URL, checks update tags, converts to .md, calculates Diff, and updates



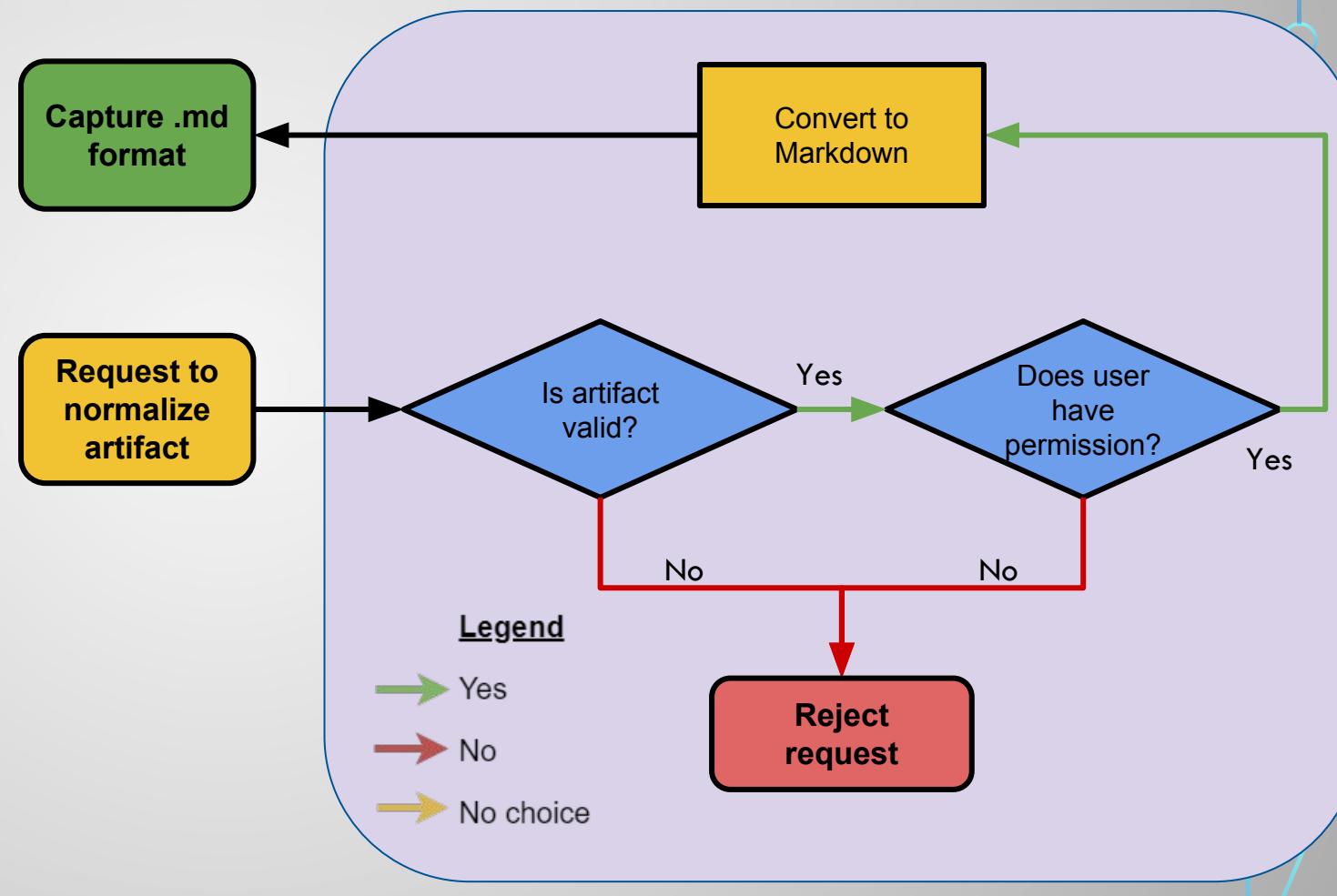
# Data Analysis Algorithm: Basic Analysis



- Provides basic artifact information, i.e., upload date, file type, owner ID, past versions
- Is only available to instructor and above levels of permissions
- Used to track artifact resources from a management perspective

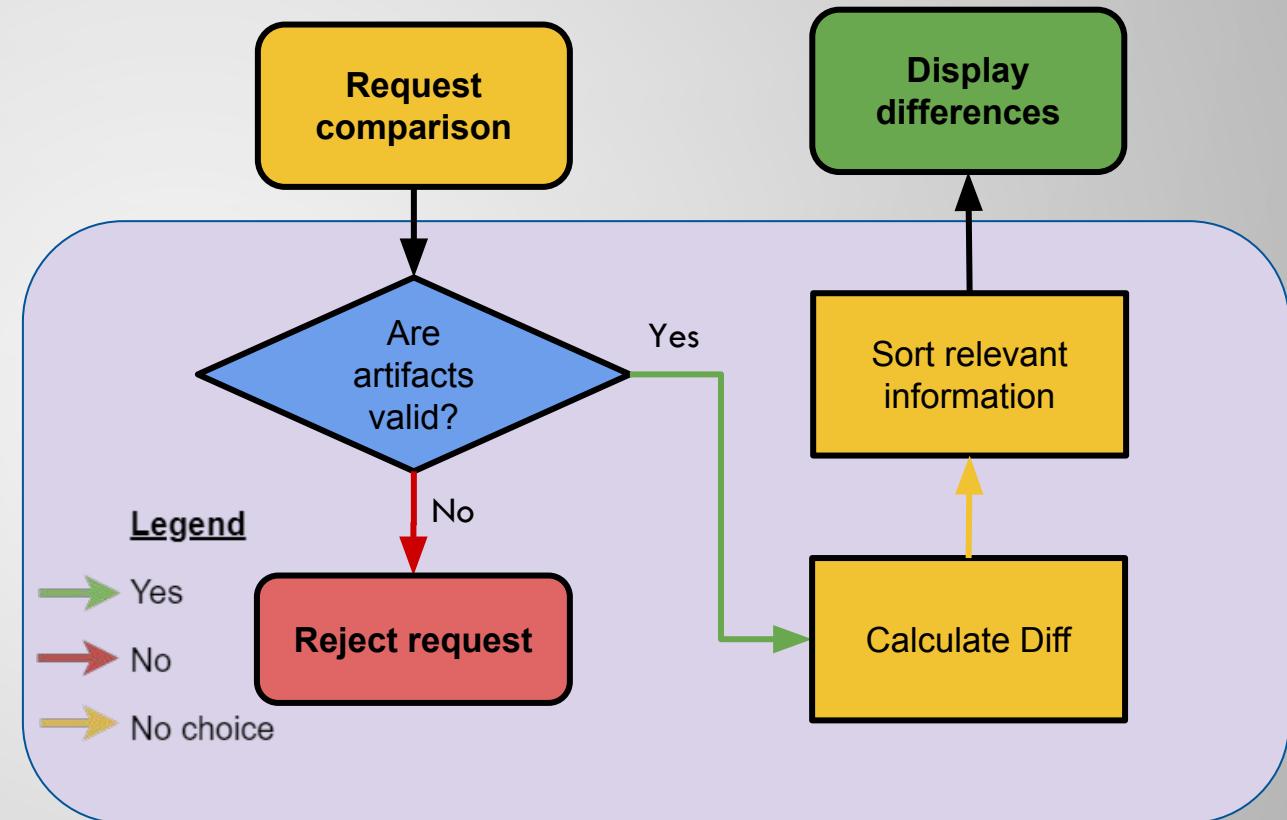
# Data Analysis Algorithm: Normalization

- Artifacts are normalized before being stored into A<sup>3</sup>
- Certain file types cannot be normalized, but may still be stored
- Pandoc can be used to create markdown files that can be easily compressed



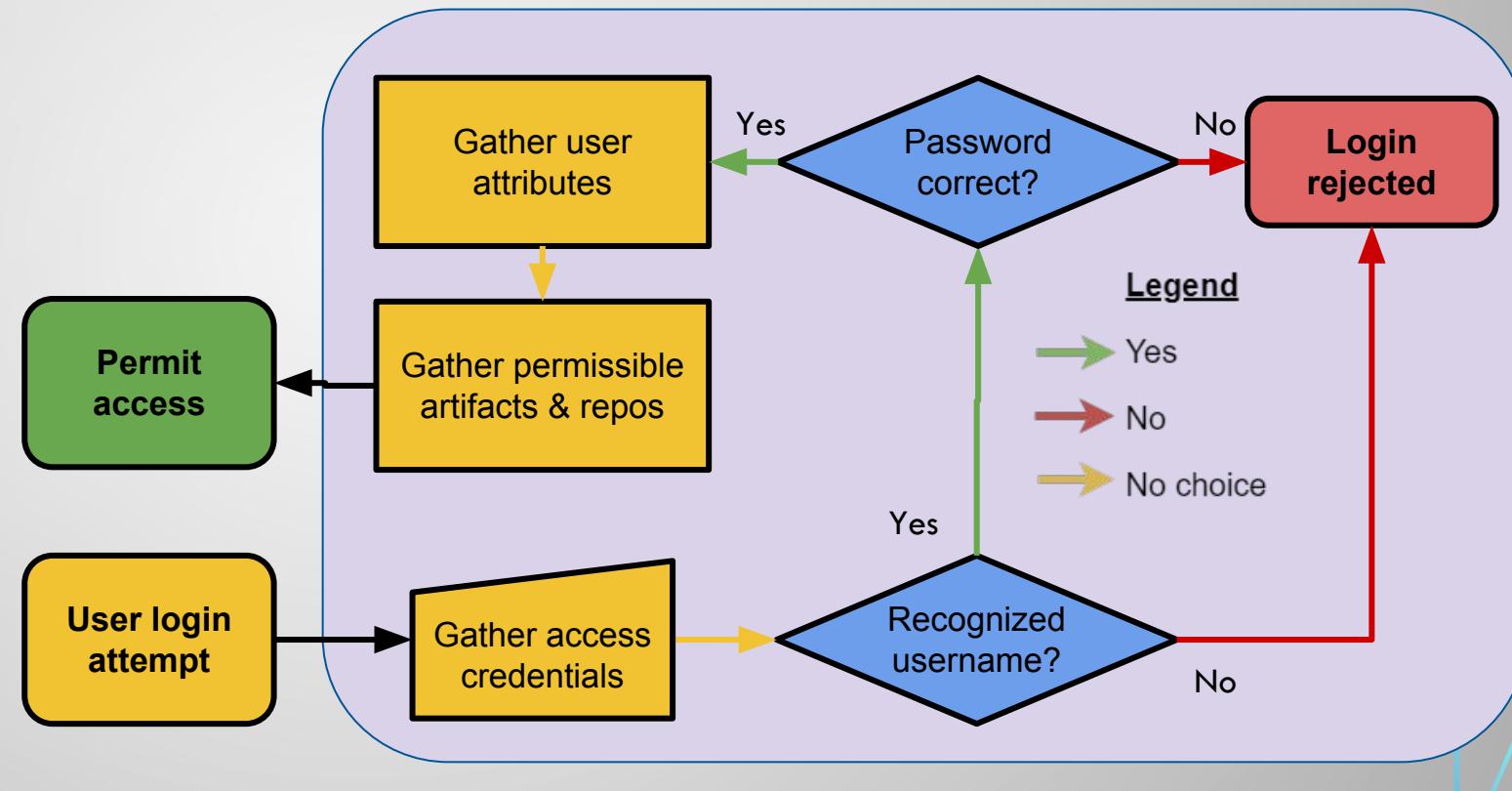
# Data Analysis Algorithm: Diff Command

- Used to show changes in artifacts over iterations
- Files must be normalized into Markdown to be compared
- Available to all levels above guest



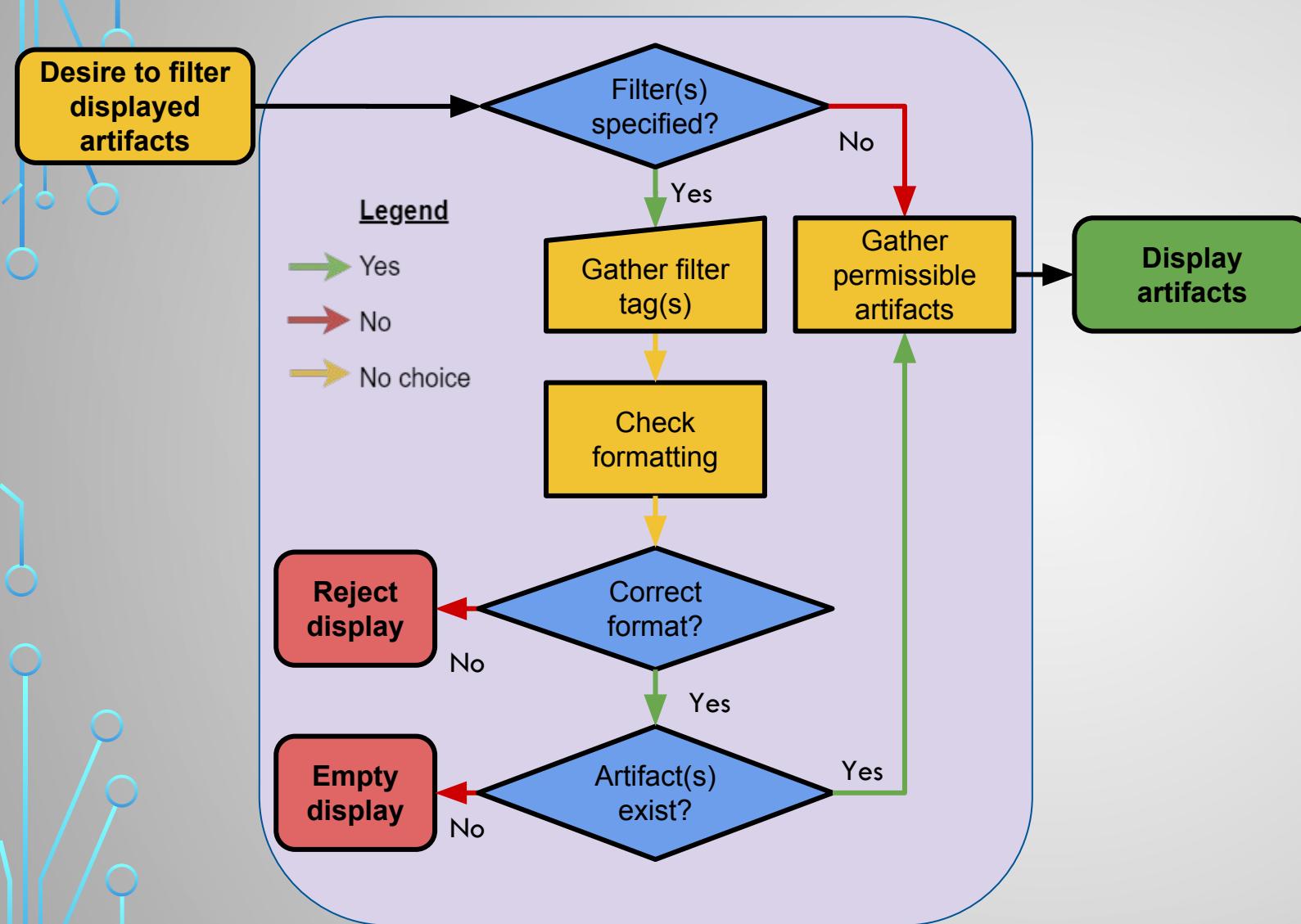
# Security Algorithm: Authentication/Access Control

- Authentication is a simple handshake when a user of any level accesses A<sup>3</sup>
- Verifying permission levels is coupled with what individuals can view, e.g., which private and public files

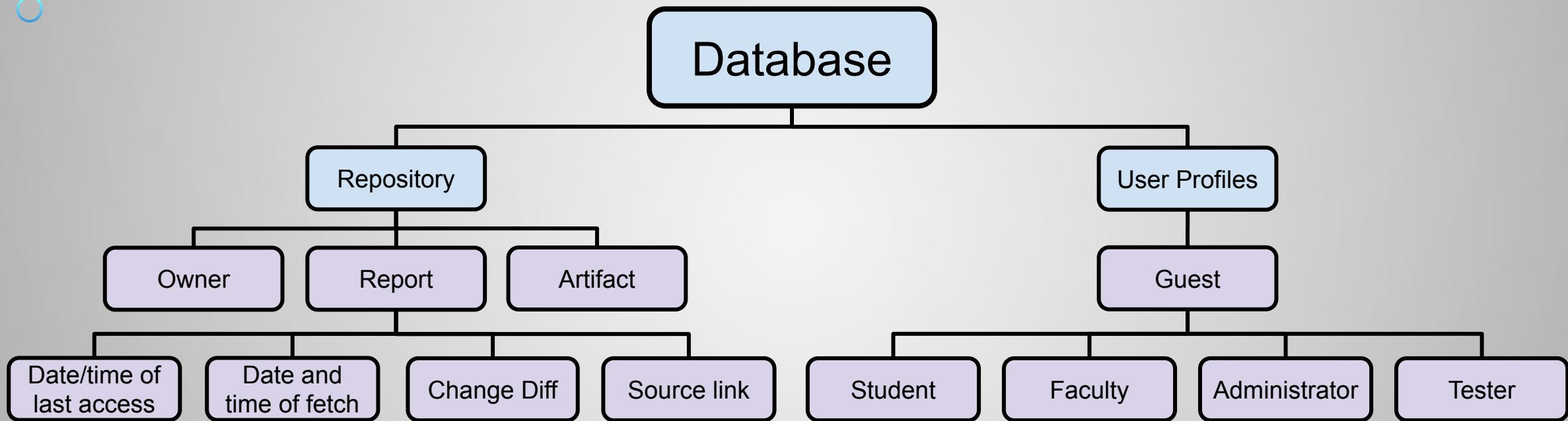


# Filtering Algorithm: Artifact Tags

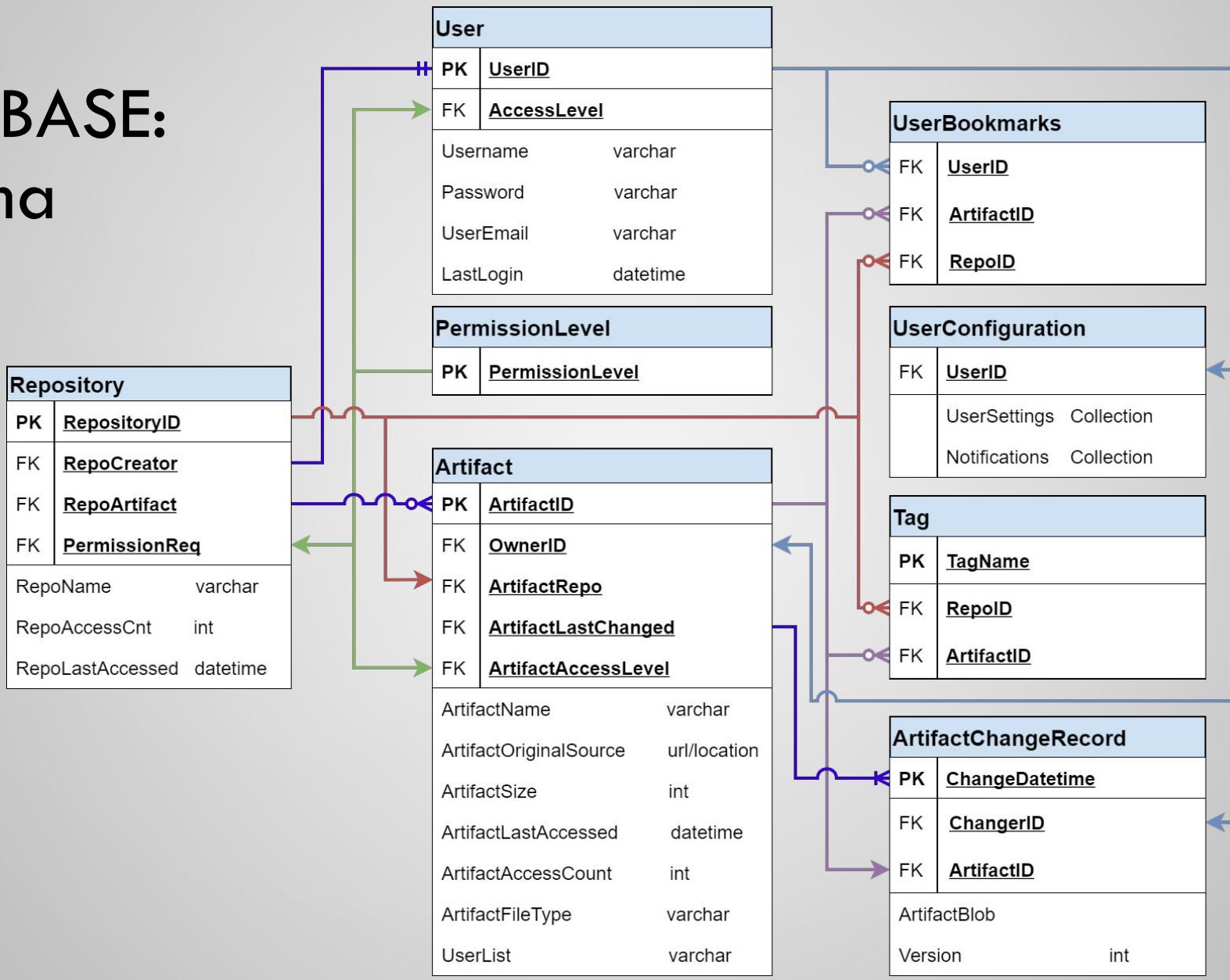
- Request to filter tags during search
- Gather and analyze tags/accessibility before display



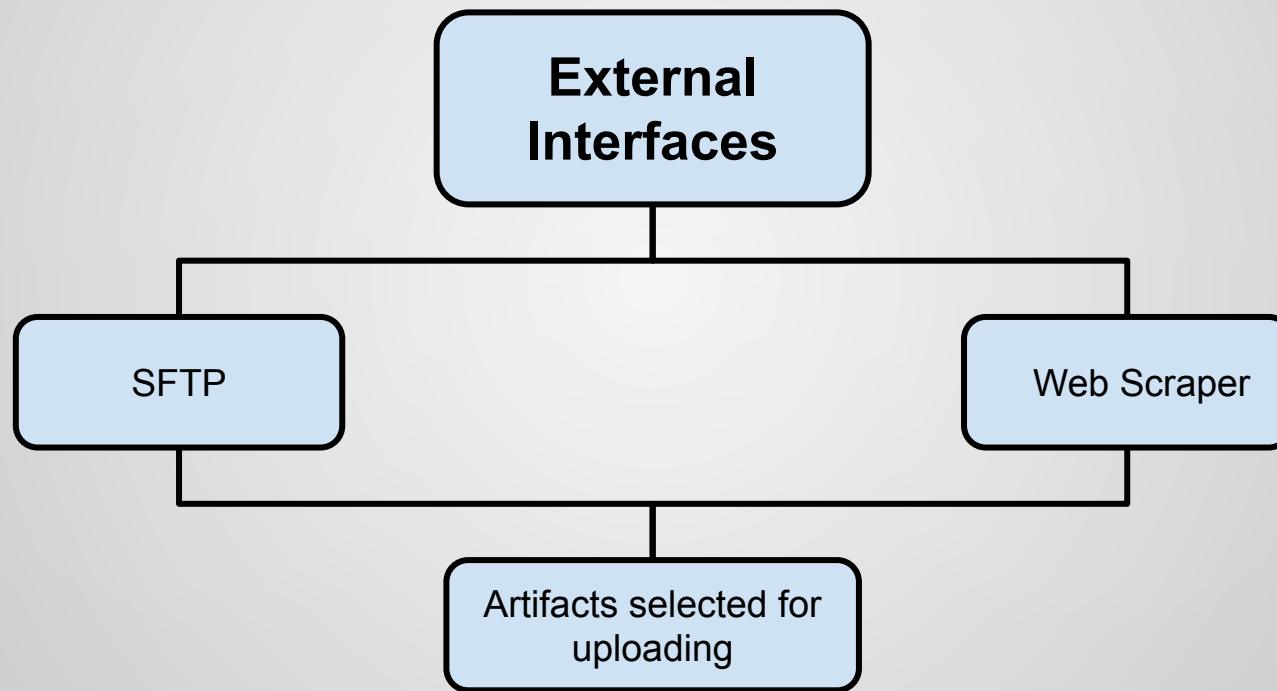
# WORK BREAKDOWN STRUCTURE:



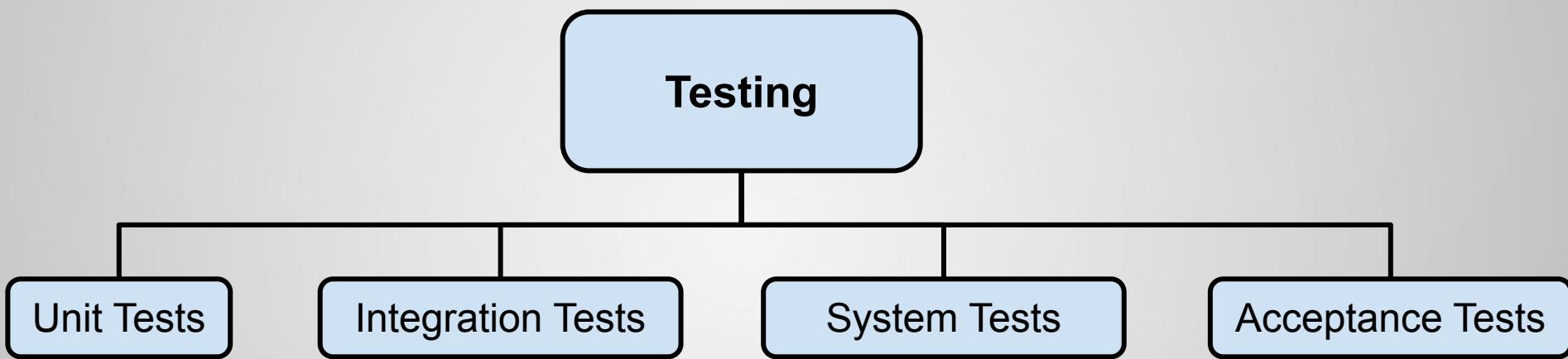
# DATABASE: Schema



# WORK BREAKDOWN STRUCTURE:



# WORK BREAKDOWN STRUCTURE:



# DATA MANAGEMENT:

- User Authentication
  - Username and password combination
- Access control
  - Role-Based Access Control (RBAC)
- Data Availability
  - Storage of artifacts for archival purposes

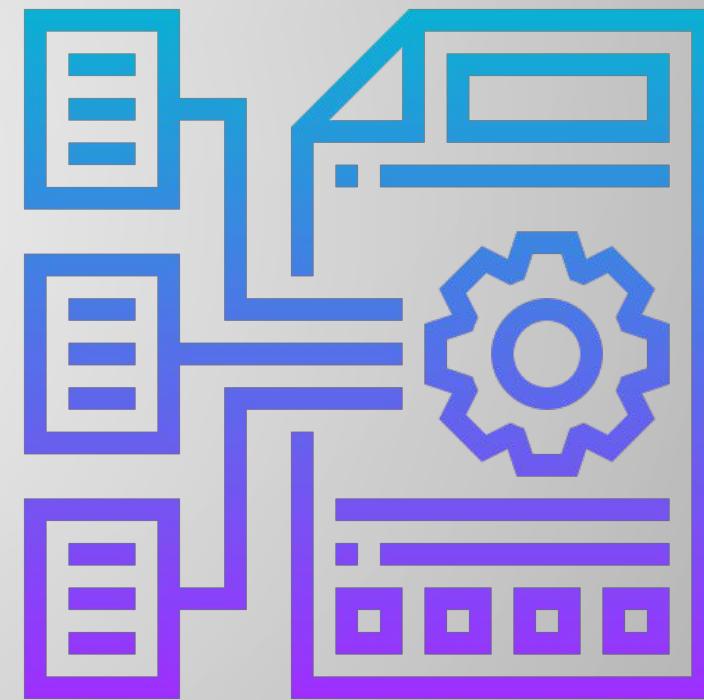


Image Credit:  
[flaticon.com 2020](https://flaticon.com)

# AGILE SPRINTS



- Sprint 1
  - Database framework
  - CLI functionality
  - Normalization function(s)
  - Simple comparison function
  - Authentication
  - Testing
- Sprint 2
  - Diff function (line-by-line)
  - Analysis function(s)
  - Testing
- Sprint 3
  - Guest accounts
  - Student accounts
  - Testing
- Sprint 4
  - UI/UX
  - Additional features, e.g., notifications
  - Testing

# GUI MOCKUP: A<sup>3</sup> Homepage/ Login

Browser https://

Home Register Popular Repos Log In Search...

# A<sup>3</sup> framework

Aggregation and Archiving of Artifacts

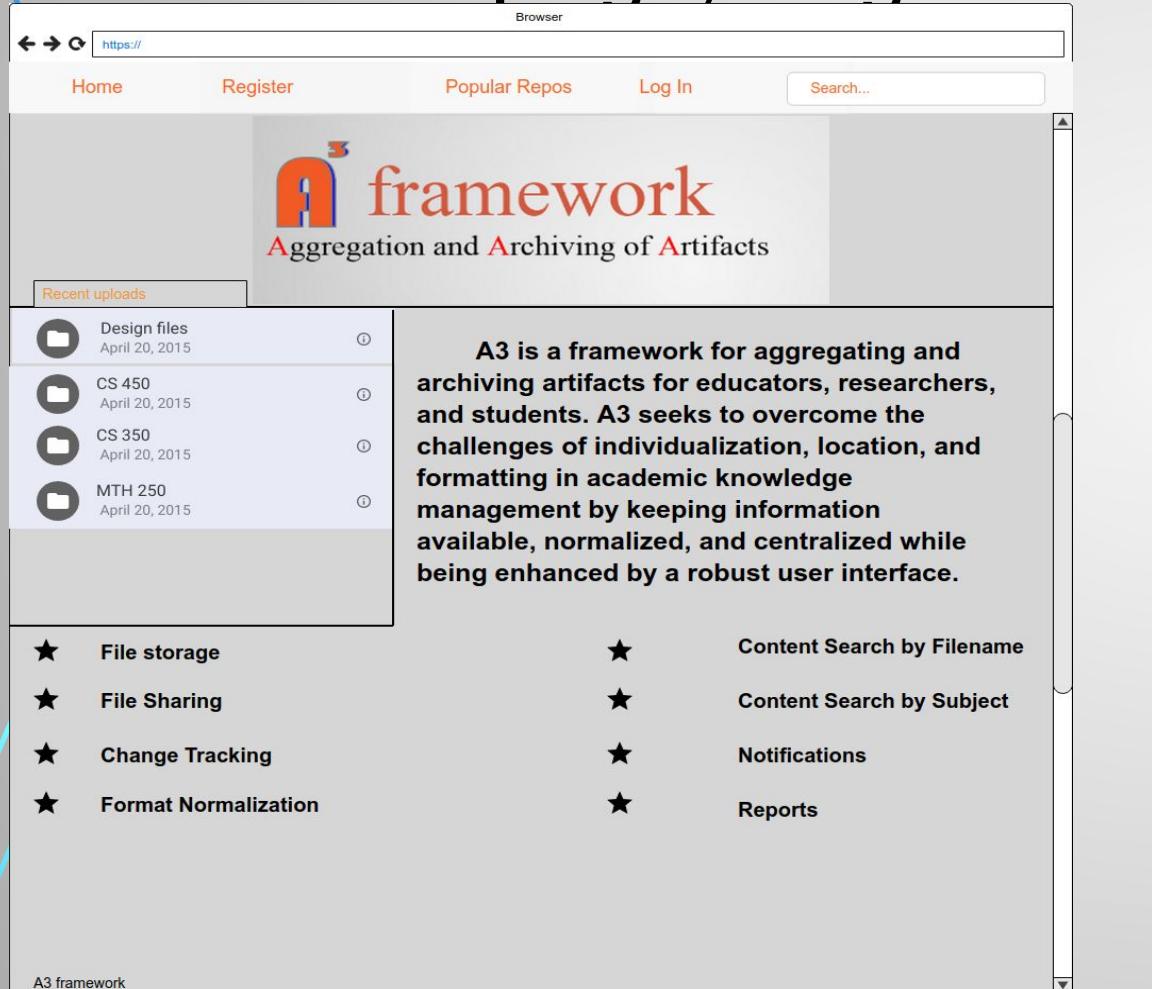
Recent uploads

- Design files April 20, 2015
- CS 450 April 20, 2015
- CS 350 April 20, 2015
- MTH 250 April 20, 2015

A3 is a framework for aggregating and archiving artifacts for educators, researchers, and students. A3 seeks to overcome the challenges of individualization, location, and formatting in academic knowledge management by keeping information available, normalized, and centralized while being enhanced by a robust user interface.

★ File storage ★ Content Search by Filename  
★ File Sharing ★ Content Search by Subject  
★ Change Tracking ★ Notifications  
★ Format Normalization ★ Reports

A3 framework



Browser https://

# A<sup>3</sup>

Log In

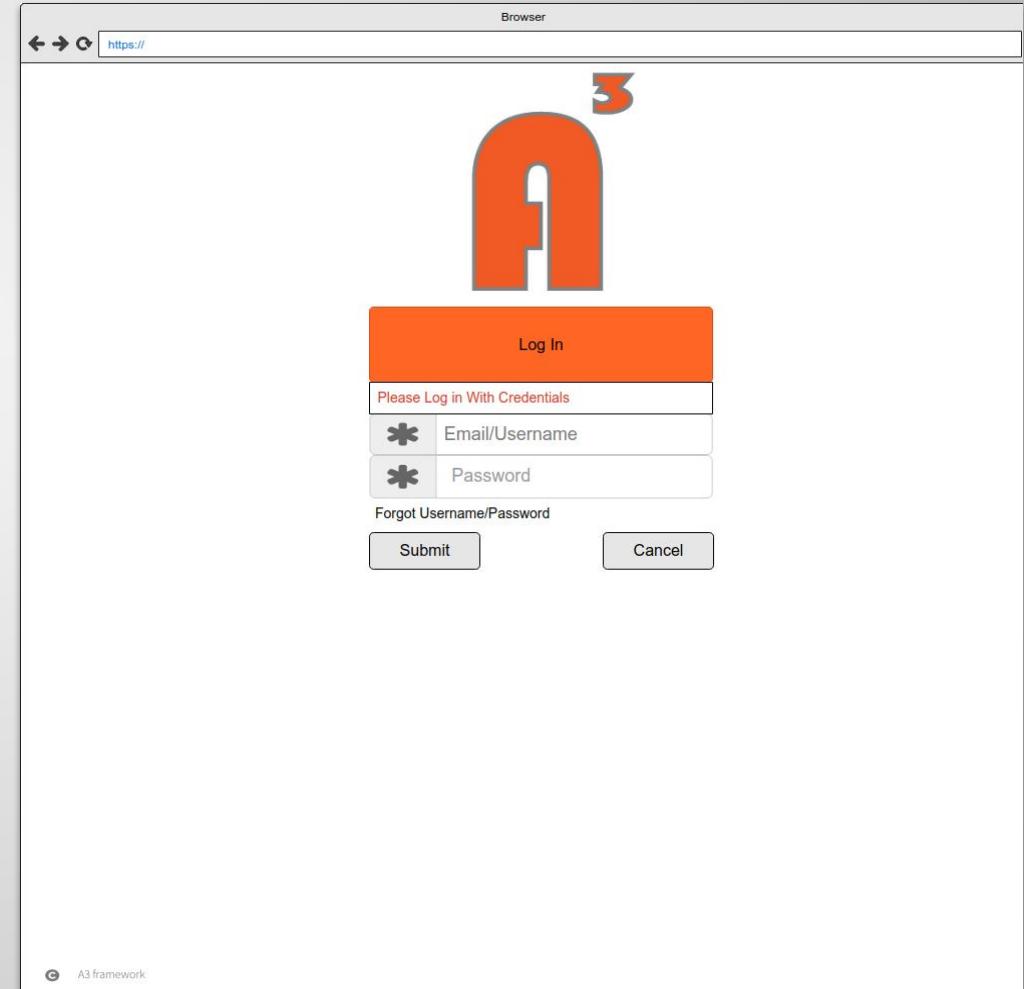
Please Log in With Credentials

\* Email/Username  
\* Password

Forgot Username/Password

Submit Cancel

A3 framework



# GUI MOCKUP: User Homepage/Repo View

Browser

Notifications BookMarks Invite Users

RENEE MCKELVEY  
User ID: 1900335 Faculty

## My Repo

Search Filters

File Type	File Name	Uploader	Date Uploaded
CS250	CS250	Renee Mckelvey	April 25, 2015
CS350	CS350	Renee Mckelvey	April 20, 2015
CS411	CS411	Renee Mckelvey	April 21, 2015
CS410	CS410	Renee Mckelvey	April 20, 2015
MTH450	MTH450	Renee Mckelvey	April 22, 2015

A3 framework

Browser

Notifications BookMarks Invite Users

RENEE MCKELVEY  
User ID: 1900335 Faculty

## My Repo

File Name	Date Uploaded	Last Updated
CS250 2015 Syllabus	April 20, 2015	April 20, 2015
CS250 Module 1 Lecture Notes	April 20, 2015	April 22, 2015
CS250 Module 2 Lecture Notes	April 20, 2015	April 22, 2015
CS250 Module 3 Lecture Notes	April 20, 2015	April 22, 2015
CS250 Module 4 Lecture Notes	April 20, 2015	April 25, 2015

Delete Selected + Back

A3 framework

# GUI MOCKUP: Upload / Invite New User

Browser

https://

Notifications BookMarks Invite Users

RENEE MCKELVEY  
User ID: 1900335 Faculty

Upload

Upload

Artifact Name: cs\_webpage

File Type: HTML

Original source: https://cs.odu.edu/~

Contributors: None

Update?: Y

Permissions: Guest

Browse Computer Submit Cancel

A3 framework

Artifact Name:	cs_webpage
File Type:	HTML
Original source:	https://cs.odu.edu/~
Contributors:	None
Update?:	Y
Permissions:	Guest

Browser

https://

Notifications BookMarks Invite Users

RENEE MCKELVEY  
User ID: 1900335 Faculty

Invite User To cs\_webpage

a<sup>3</sup>

Email Address/User ID

Contributors List

User ID: 1900235	Student
User ID: 1900135	Student
User ID: 1900345	Student
User ID: 1950335	Student
User ID: 1920335	Student

A3 framework

User ID: 1900235	Student
User ID: 1900135	Student
User ID: 1900345	Student
User ID: 1950335	Student
User ID: 1920335	Student

# GUI MOCKUP:

## Update Failed/Success

Browser https://

Notifications BookMarks Invite Users RENEE MCKELVEY User ID: 1900335 Faculty Artifact ID: 1900335-1A

**Upload**

Update Successful

Archived artifact Last Updated: 04202020 Last Accessed: 04282020 Size: 4kb	Updated artifact Last Updated: 04282020 Last Accessed: 04282020 Size: 3kb
Index.md	Index.md

```

1 <html>
2
3 <head>
4   <meta charset = "UTF-8">
5
6 <title>
7   Sample Index
8 </title>
...

```

```

1 <html>
2
3 <head>
4   <meta charset = "UTF-8">
5   <title>Sample index </title>
...

```

```

1 <html>
2
3<head>
4 <meta charset = "UTF-8">
5
6<title>
7   Sample Index
...

```

```

1 <html>
2
3 <head>
4   <meta charset = "UTF-8">
5   <title> Sample Index </title>
...

```

Index.md

A3 framework

Browser https://

Notifications BookMarks Invite Users RENEE MCKELVEY User ID: 1900335 Faculty Artifact ID: 1900335-1A

**Upload**

Update Failure

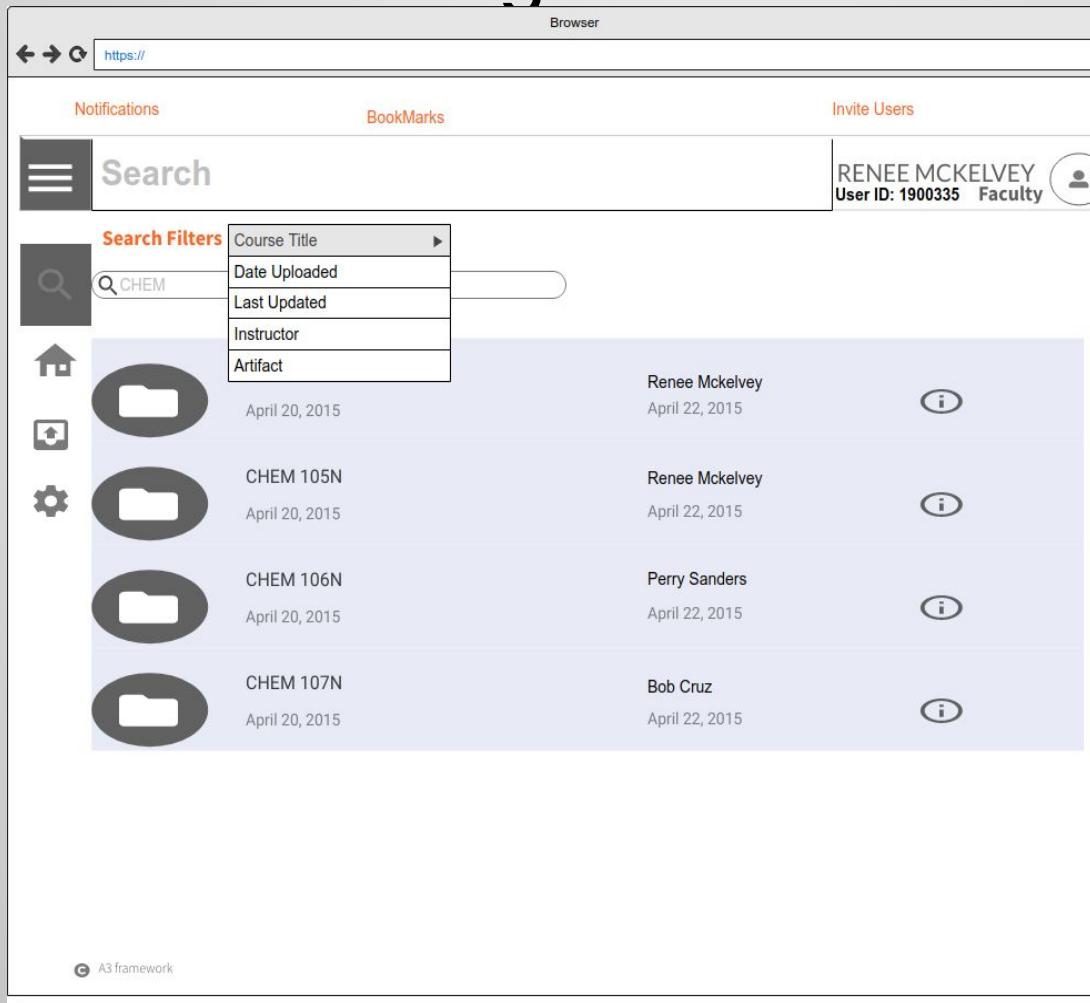
1 <html>  
2  
3 <head>  
4 <meta charset = "UTF-8">  
5 <title>Sample index </title>

Artifact Name: cs\_webpage File Type: HTML Original source: https://cs.odu.edu/~ Contributors: None Update?: Y Permissions: Guest

i 1. Update tag specified.  
2. Artifact does not already exist.

A3 framework

# GUI MOCKUP: Search/Search Filtering



# GUI MOCKUP: Artifact Deletion

Browser

https://

Notifications BookMarks Invite Users

RENEE MCKELVEY  
User ID: 1900335 Faculty

## My Repo

Search Filters

Icon	Name	Owner	Date	Action
CS250	Renee Mckelvey	Renee Mckelvey	April 25, 2015	i
CS350	Renee Mckelvey	Renee Mckelvey	April 20, 2015	i
CS411	Renee Mckelvey	Renee Mckelvey	April 21, 2015	i
CS410	Renee Mckelvey	Renee Mckelvey	April 20, 2015	i
MTH450	Renee Mckelvey	Renee Mckelvey	April 22, 2015	i

A3 framework

Open...  
Delete Repo  
Export  
Print  
Exit

Browser

https://

Notifications BookMarks Invite Users

RENEE MCKELVEY  
User ID: 1900335 Faculty

## My Repo

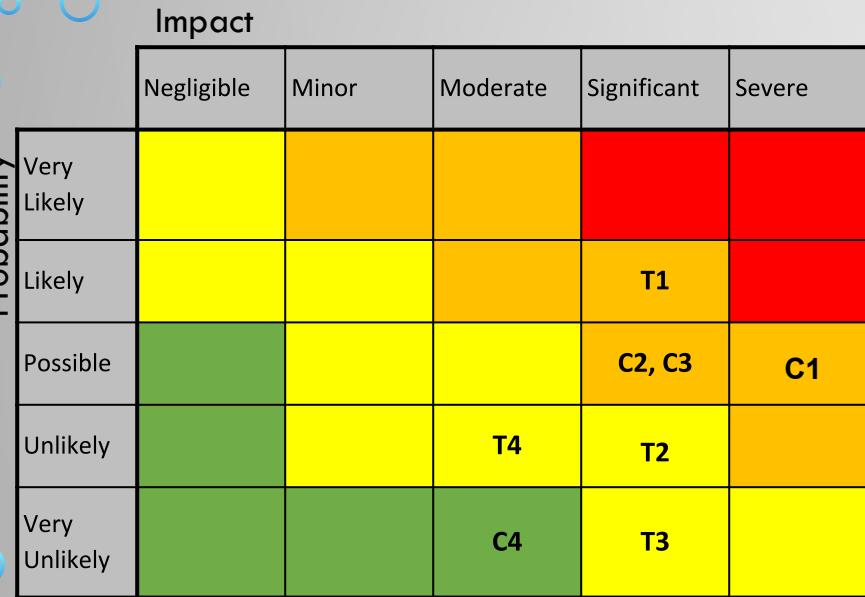
✓ MTH450 Successfully Deleted

Icon	Name	Owner	Date	Action
CS250	Renee Mckelvey	Renee Mckelvey	April 20, 2015	i
CS350	Renee Mckelvey	Renee Mckelvey	April 20, 2015	i
CS411	Renee Mckelvey	Renee Mckelvey	April 20, 2015	i
CS410	Renee Mckelvey	Renee Mckelvey	April 20, 2015	i

A3 framework

# RISK MATRIX:

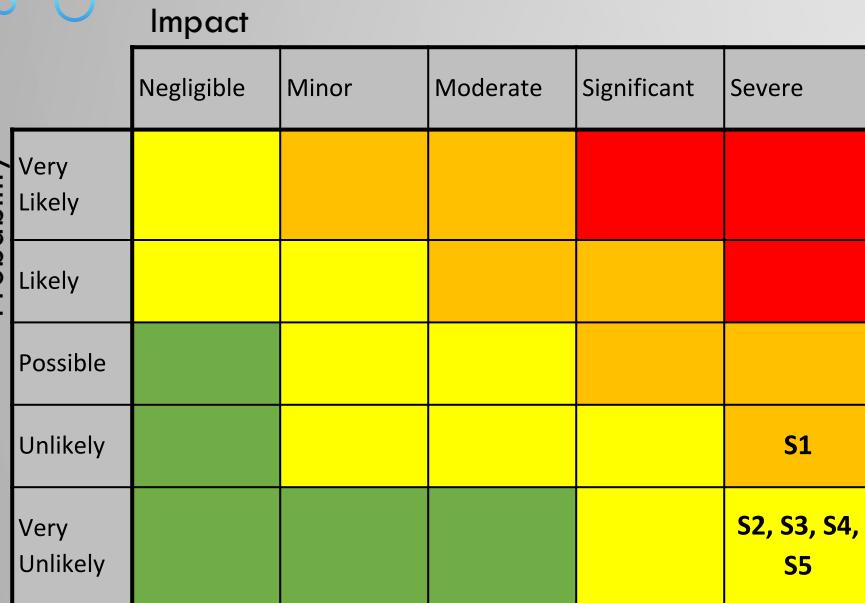
## Customer & Technical



Risk ID	Title	Impact	Probability	Mitigation
T1	Integration with Blackboard - scraping	Significant	Likely	Use of a tool similar to the Blackboard Archive Extractor. Will periodically scrape Blackboard for material and update archive. <a href="#">[1]</a>
T2	Loss or corruption of data	Significant	Unlikely	Will adhere to best practices, as defined by the National Institute of Standards and Technology. <a href="#">[12]</a>
T3	Information changes are not reported to the user	Significant	Very Unlikely	Unit Testing during development to ensure user is notified of changes.
T4	File type are not supported	Unlikely	Moderate	List of supported file types provided and unsupported file types are stored in binary BLOB format, media will be linked to the source file and reports will be generated from a limited data set (E.g. MD5 sum, size, modified data, etc.)
C1	Faculty does not upload material	Severe	Possible	Will make UI/UX easy to use and understand. School encourage use of A <sup>3</sup> .
C2	Does not update material/reference	Significant	Possible	Will allow users to notify the owner if something has not been updated as well as automated notifications after a prescribed amount of time. Will allow user to see when last updated.
C3	Inputs incorrect information	Significant	Possible	System will use backup snapshots allowing information to be reuploaded with minimal loss.
C4	Too difficult to use	Moderate	Very Unlikely	Will utilize both a CLI and UI/UX.

# RISK MATRIX:

## Security



S# - Security Risk

Risk ID	Title	Impact	Probability	Mitigation
S1	Database breach	Significant	Unlikely	The use of input validation techniques as well as input scrubbing will minimize injection and overflow style attacks from the UI.
S2	User obtains unauthorized permission levels	Significant	Very Unlikely	The use of notifications and reports generated to notify the owner of the file upon changes made.
S3	User uploads inappropriate material	Significant	Very Unlikely	Media will not be hosted on the A^3 server. Common terms to illicit material can be checked during report generation for obvious illicit materials.
S4	Denial of Service	Significant	Very Unlikely	We will rely on the Host network for mitigation of DoS.
S5	Masquerade - Replay attacks	Significant	Very Unlikely	The use of notifications and reports generated to notify the owner of the file upon changes made.
S6	Man-in-the-middle - Intercept and forward attacks	Significant	Very Unlikely	The use of end-to-end security for the upload and download of various file types would decrease available information an attacker could obtain.

# CONCLUSION

 is a framework and tool set for Aggregation and Archiving of Artifacts.

- Configurable for different environments
- Extensible to integrate useful tools as needed

## Utilizing

- Normalization
- Automation
- Web-scraping
- Archival Processes



A repository of reliable resources.  
Our goal is simplicity.

# REFERENCES

1. Blackboard Archive Extractor. (2016, December 15) cs.odu.edu. Retrieved March 10, 2020, from <https://www.cs.odu.edu/~cpi/old/411/crystals17/>.
2. Carroll, J., Choo, C. W., Dunlap, D., Isenhour, P., Kerr, S., MacLean, A., & Rosson, M. (2003). Knowledge Management Support for Teachers. *Educational Technology Research and Development*, 51(4), 42-64. [www.jstor.org/stable/30221184](http://www.jstor.org/stable/30221184)
3. Davenport, T., Long, M. & Beers, M.. (1997). *Building Successful Knowledge Management Projects* [Working Paper]. Retrieved March 8, 2020, from [https://www.researchgate.net/publication/200045855\\_Building\\_Successful\\_Knowledge\\_Management\\_Projects](https://www.researchgate.net/publication/200045855_Building_Successful_Knowledge_Management_Projects).
4. Document Management Software | eFileCabinet. (2020). eFileCabinet. Retrieved February 20, 2020, from <https://www.efilecabinet.com>.
5. Domes, S. (2017). *Progressive Web Apps with React: Create lightning fast web apps with native power using React and Firebase*. Packt Publishing Ltd.

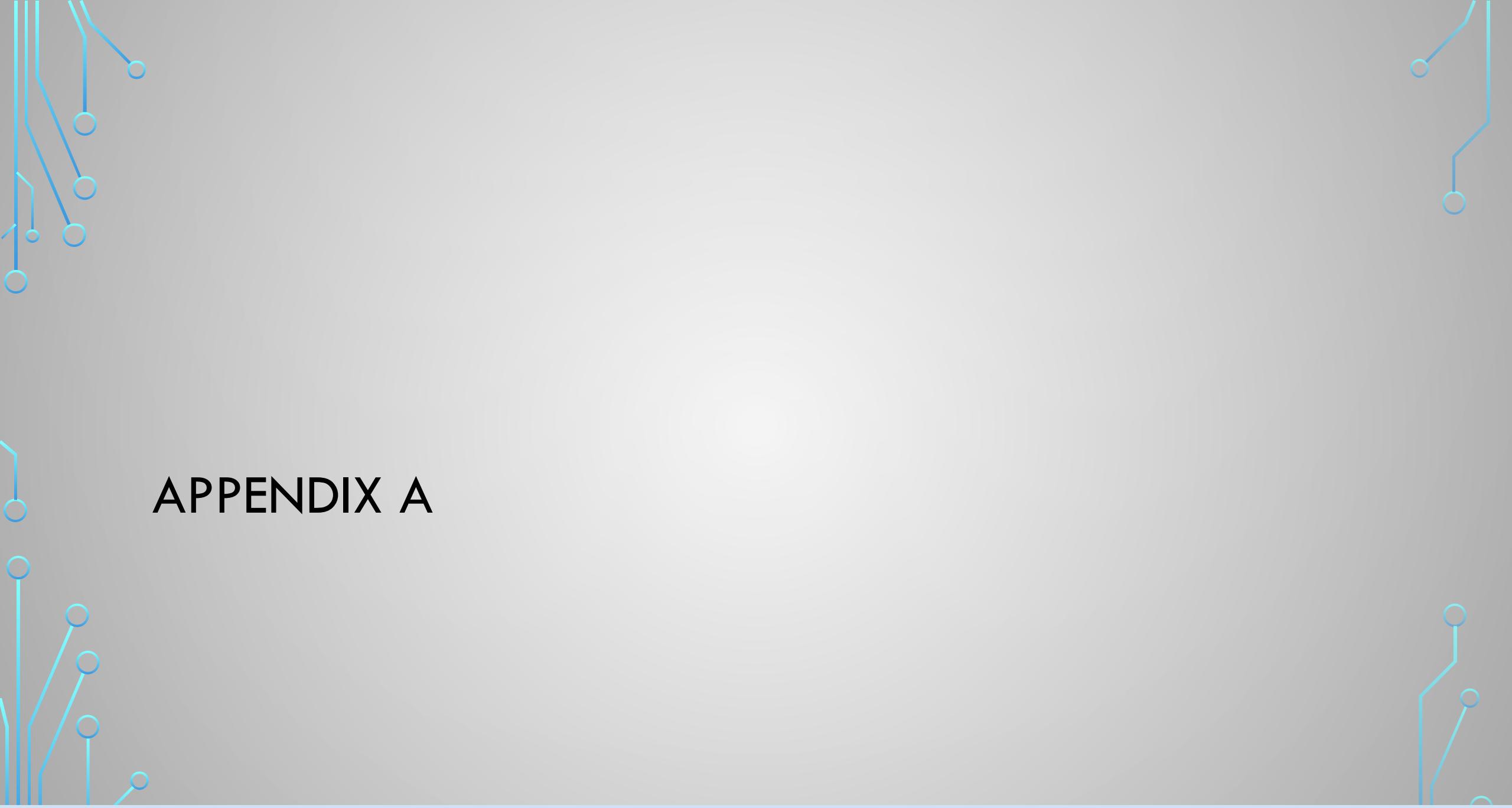
## REFERENCES cont.

7. *File Sharing and Sync For Education, Schools and Universities - FileCloud*. (2020). FileCloud. Retrieved February 20, 2020, from <https://www.getfilecloud.com/file-sharing-and-sync-for-education/>.
8. *GitHub Features: The right tools for the job*. (2020). GitHub. Retrieved March 10,il 2020, from <https://github.com/features#team-management>.
9. Kennedy, T. (2020, January 21). Home · Wiki · Thomas J. Kennedy / cs-roars-proposal. GitLab. Retrieved 26 April 2020, from <https://git-community.cs.odu.edu/tkennedy/cs-roars-proposal/-/wikis/home>.
10. Nvlpubs.nist.gov. (n.d.). *Glossary of Key Information Security Terms*. From <https://nvlpubs.nist.gov/nistpubs/ir/2013/NIST.IR.7298r2.pdf>.
11. MacFarlane, J. (2006). *Pandoc - About pandoc*. Pandoc.org. From <https://pandoc.org/index.html>.
12. Tsapps.nist.gov. (2020). *Data Loss Prevention*. From [https://tsapps.nist.gov/publication/get\\_pdf.cfm?pub\\_id=904672](https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=904672).
13. Xie, I., & Matusiak, K. K. (2016, July 29). Digital preservation. *Science Direct* (255-279). Retrieved March 10, 2020, from <https://www.sciencedirect.com/science/article/pii/B9780124171121000090>

## REFERENCES cont.

14. Zeil, S. (2019, December 26). *Building the Website*. cs.odu.edu. Retrieved 26 April 2020, from <https://www.cs.odu.edu/~zeil/cowem/Public/buildingTheWebsite/index.html>.
15. Zeil, S. (2020, January 21). *zeil / CoWeM - Course Websites from Markdown*. GitLab. From [https://git-community.cs.odu.edu/zeil/Course\\_Website\\_Management](https://git-community.cs.odu.edu/zeil/Course_Website_Management).
16. Brunelle J., personal communication, March 2, 2020.
17. Kennedy T. J., personal communication, February 12, 2020.

# APPENDIX A





# USER STORIES: Guest

I **must** be able to :

- Ability to login with MIDAS credentials
- be invited by administrators or other users
- obtain a student or faculty login and password
- filter and sort artifacts that belong to the database
- read the full material of a public artifact

I **wish** to be able to :

- request access to private material
- be notified of what type artifacts I can access (i.e. public/private)

I **must not** be able to :

- Access private artifacts
- Edit or update artifacts
- Access user accounts
- Modify or update public artifacts
- Invite other users
- Change a user's access level

# USER STORIES: Student

I **must** be able to :

- login with my MIDAS credentials
- filter and sort full content of a file
- access the database with my credentials off campus
- access the most up to date information
- search for content by keywords

I **wish** to be able to :

- create and upload resources
- Invite new users
- Flag artifacts for review by the owner or administrator
  - if they appear to conflict with other artifacts covering the same content
  - if they appear out-of-date
- Bookmark artifacts and repositories I will use again
- Tag artifacts with keywords describing their content

I **must not** be able to :

- Access private artifacts without invite
- Edit or update artifacts I do not own
- Delete user accounts
- Change a user's access level



# USER STORIES: Faculty

I **must** be able to :

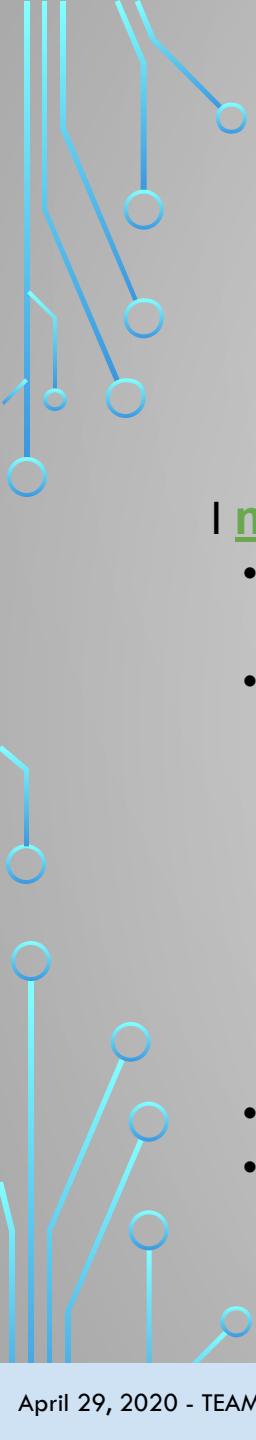
- login with my faculty credentials
- upload artifacts
- edit and update artifacts I own
- set access level requirement for artifacts I own
- access database off campus
- create notifications for myself regarding regular updates to artifacts
- request access to private resources

I **wish** to be able to :

- Bookmark artifacts I will use again
- Invite new users
- Access the source of any artifact
- See usage reports about artifacts I own
- Tag artifacts with keywords describing their content
- View information about the owner of an artifact

I **must not** be able to :

- Access, edit, or update artifacts I don't own
- Delete user accounts
- Change a user's access level



# USER STORIES: Administrator

I **must** be able to :

- Have all the capabilities of any other account type
- Manage the database including:
  - change attributes of any artifact, such as access level requirement
  - remove artifacts
  - create and change user accounts
- Test administration
- View reports about users and artifacts

I **wish** to be able to :

- Reactivate user accounts
- Recover deleted files

I **must not** be able to :

- Delete user accounts without documented
- Reset passwords

# USER STORIES: Tester

I **must** be able to :

- Access artifacts within my testing parameters
- View reports about users and artifacts
- Have administrative capabilities within my testing parameters
- Analyze results
- Report test problems and anomalies

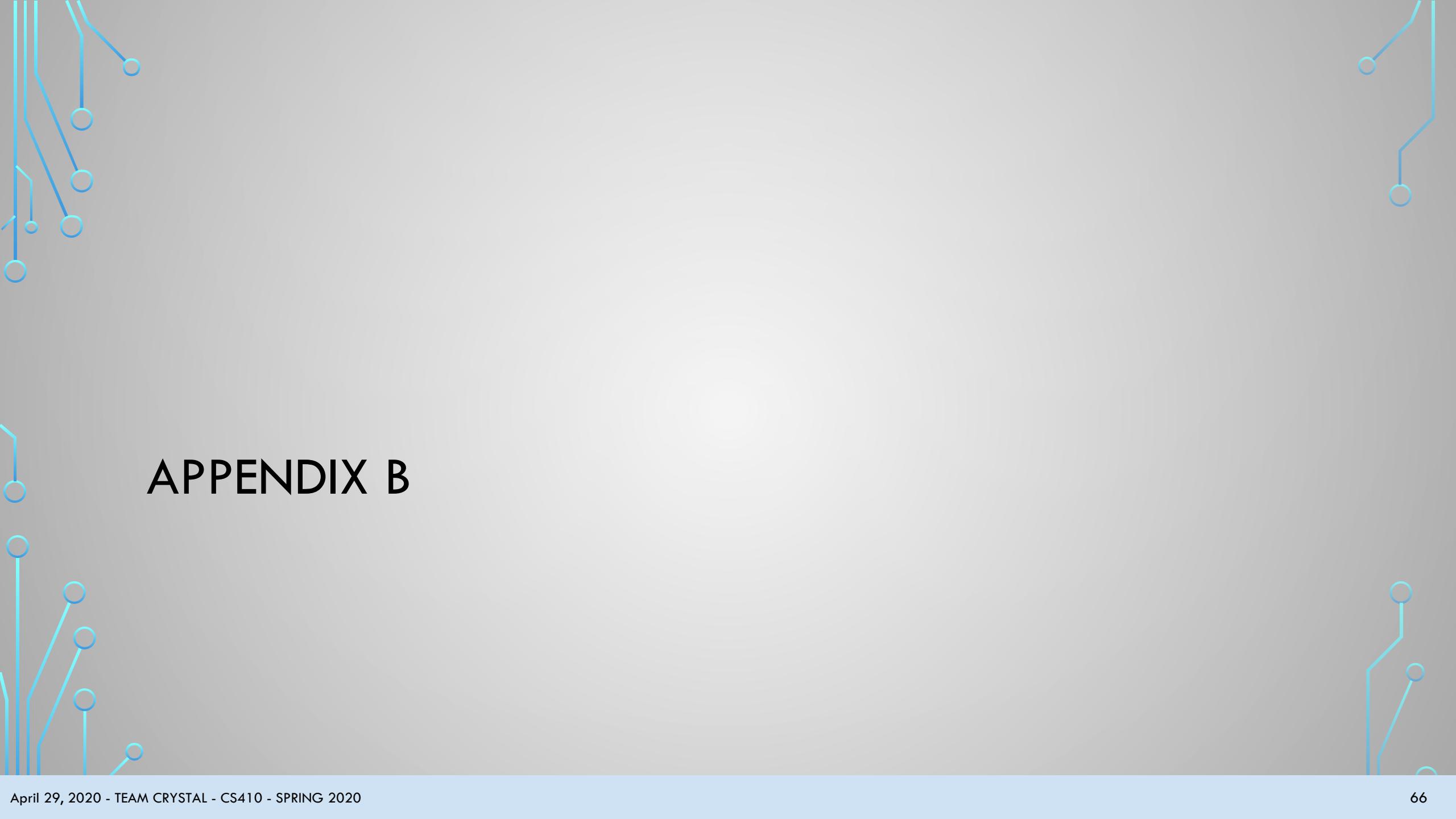
I **wish** to be able to :

- Improve software quality
- Capture user requirements

I **must not** be able to :

- Avoid testing their own products
- Make all the decisions and changes to assure a better quality

## APPENDIX B



# 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.

# Glossary:

**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.

# Glossary:

**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.

**GUI:** Graphical User Interface - 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.

# Glossary:

**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.

# Glossary:

**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.

**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.

# Glossary:

**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

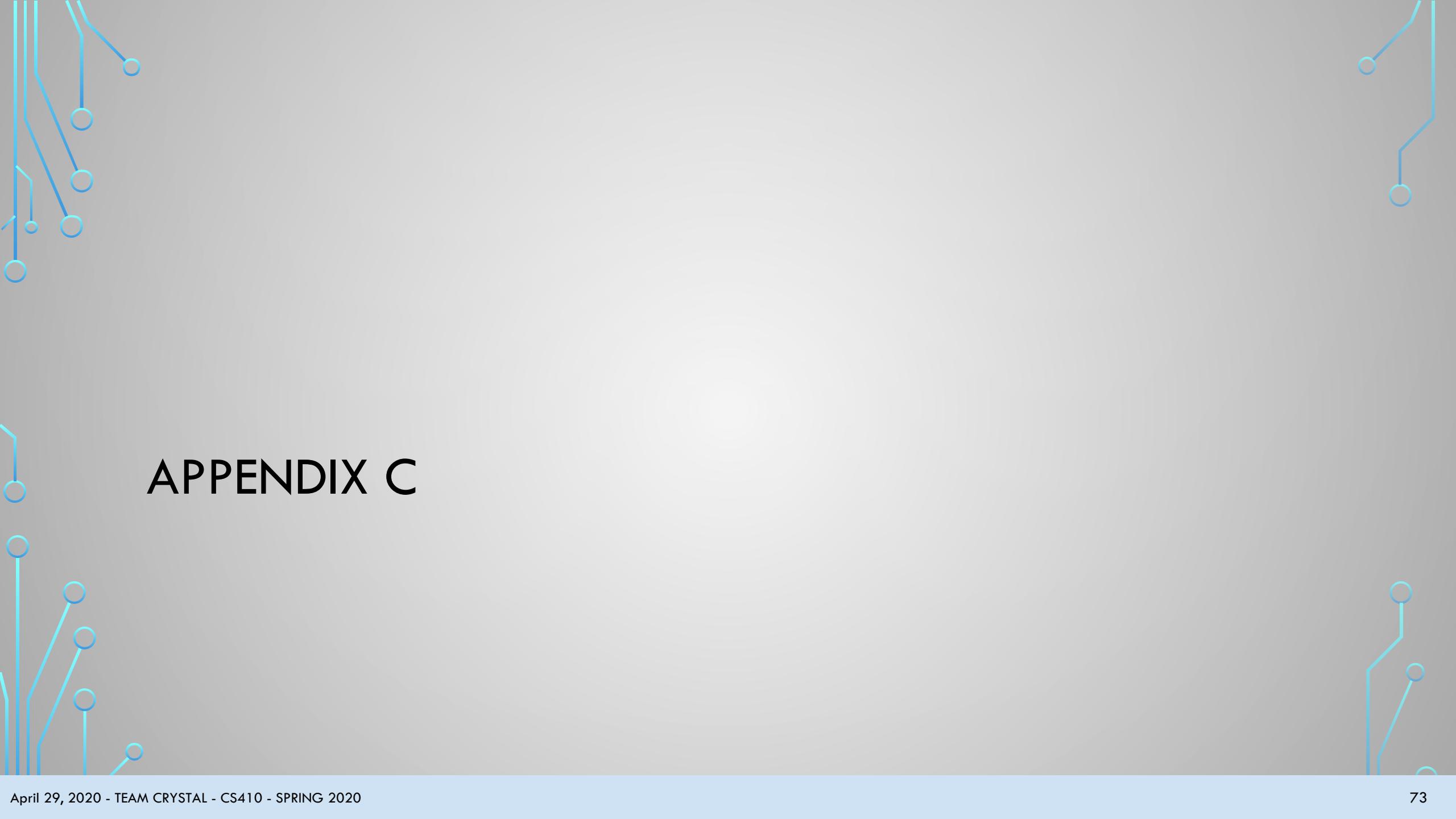
**Sphinx**: A Python documentation generator. Converts reStructuredText files into HTML websites and other formats.

**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.

## APPENDIX C

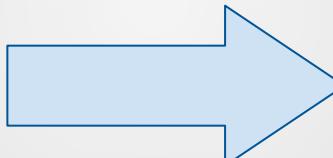


# Normalization Example:

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1" />
    <title>CS 410 Group Crystal - Home</title>
    <link rel="icon" href="./images/crystal2.png" />
    <link
      rel="stylesheet"
      href=".//styles/bootstrap-4.4.1-dist/css/bootstrap.min.css"
    />
    <link rel="stylesheet" href=".//styles/fixed.css" />
    <link rel="stylesheet" href=".//styles/base.css" />
  </head>

  <body>
    <!--Start Home Section-->
    <div id="references">
      <!--Start Navigation Section-->
      <nav class="navbar navbar-expand-xl navbar-dark bg-dark fixed-top">
        <a class="navbar-brand" href="home.html">
          
        </a>
        <button
          class="navbar-toggler"
          type="button"
          data-toggle="collapse"
          data-target="#collapsibleNavbar"
        >
          <span class="navbar-toggler-icon"></span>
        </button>
        <div class="collapse navbar-collapse" id="collapsibleNavbar">
          <ul class="navbar-nav ml-auto">
            <li class="nav-item dropdown">
```

From HTML



```
...
lang: en
title: 'CS 410 Group Crystal - Home'
viewport: 'width=device-width, initial-scale=1'
---

::: {#references}
[![]()]

[]{.navbar-toggler-icon}

::: {#collapsibleNavbar .collapse .navbar-collapse}
[Home]{.nav-link .dropdown-toggle}

::: {.dropdown-menu aria-labelledby="navbarDropdown"}
[Home Top][] [History][] [Problem Statement][] [Problem Characteristics][] [Solution Statement][] [Solution Characteristics]
:::

[Team]

[Presentations]{.nav-link .dropdown-toggle}

::: {.dropdown-menu aria-labelledby="navbarDropdown"}
[Presentations Top][] [Feasibility][] [Feasibility V2][] [Design][] [Prototype]
:::
:::
:::

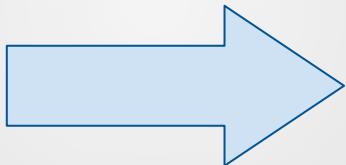
[1]: ./images/crystal.png
[![](): home.html {.navbar-brand}]
[Home Top]: home.html {.dropdown-item}
[History]: home.html#problem-history {.dropdown-item}
[Problem Statement]: home.html#problem-statement {.dropdown-item}
[Problem Characteristics]: home.html#problem-characteristics {.dropdown-item}
[Solution Statement]: home.html#solution-statement {.dropdown-item}
```

To Markdown

# Retrieval Example:

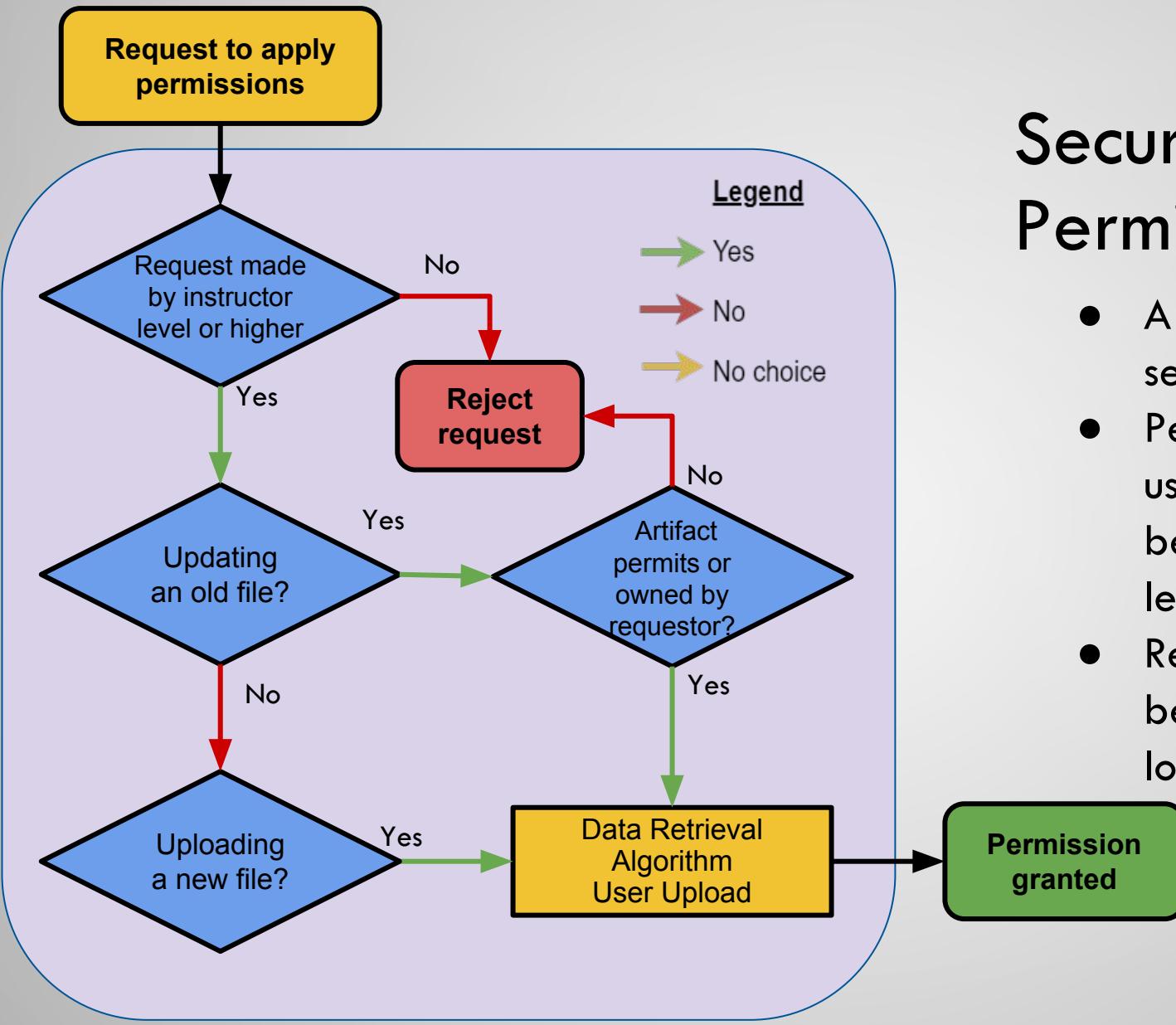
```
---  
lang: en  
title: 'CS 410 Group Crystal - Home'  
viewport: 'width=device-width, initial-scale=1'  
---  
  
::: {#references}  
[![][1]]  
  
[] {.navbar-toggler-icon}  
  
::: {#collapsibleNavbar .collapse .navbar-collapse}  
[Home]{.nav-link .dropdown-toggle}  
  
::: {.dropdown-menu aria-labelledby="navbarDropdown"}  
[Home Top][] [History][] [Problem Statement][] [Problem Characteristics][] [Solution Statement][] [Solution Characteristics]  
:::  
  
[Team]  
  
[Presentations]{.nav-link .dropdown-toggle}  
  
::: {.dropdown-menu aria-labelledby="navbarDropdown"}  
[Presentations Top][] [Feasibility][] [Feasibility V2][] [Design][]  
[Prototype]  
:::  
:::  
:::  
  
[1]: ./images/crystal.png  
[![][1]]: home.html {.navbar-brand}  
[Home Top]: home.html {.dropdown-item}  
[History]: home.html#problem-history /.dropdown_item
```

From Markdown



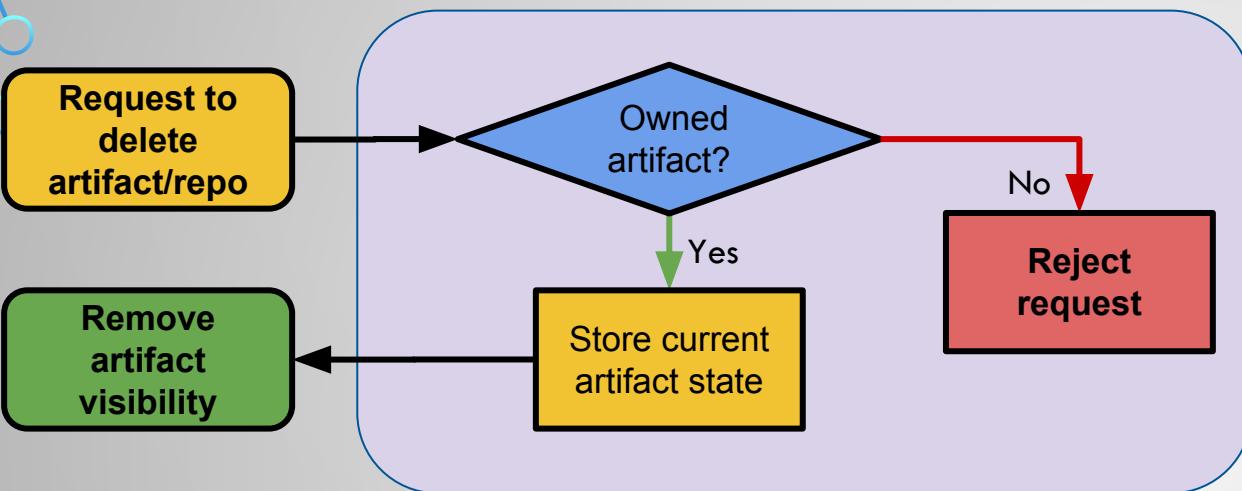
```
<!DOCTYPE html>  
<html xmlns="http://www.w3.org/1999/xhtml" lang="en" xml:lang="en">  
<head>  
  <meta charset="utf-8" />  
  <meta name="generator" content="pandoc" />  
  <meta name="viewport" content="width=device-width, initial-scale=1.0, user-scalable=yes" />  
  <title>CS 410 Group Crystal - Home</title>  
  <style>  
    code{white-space: pre-wrap; font-family: monospace; font-size: 1em; color: black; background-color: #f0f0f0; padding: 2px; border-radius: 4px; border: 1px solid #ccc; margin: 0; font-weight: normal; font-style: normal; font-variant: normal; font-size: inherit; font-family: inherit; line-height: 1.2; vertical-align: middle;}</style>  
  <!--[if lt IE 9]>  
    <script src="//cdnjs.cloudflare.com/ajax/libs/html5shiv/3.7.3/html5shiv.min.js"></script>  
  <![endif]-->  
</head>  
<body>  
  <header id="title-block-header">  
    <h1 class="title">CS 410 Group Crystal - Home</h1>  
  </header>  
  <div id="references">  
    <p><a href="home.html" class="nav-link navbar-brand"></a></p>  
    <p><span class="navbar-toggler-icon"></span></p>  
    <div id="collapsibleNavbar" class="collapse navbar-collapse">  
      <p><span class="nav-link dropdown-toggle">Home</span></p>  
      <div class="dropdown-menu" aria-labelledby="navbarDropdown">  
        <p><a href="home.html" class="dropdown-item">Home Top</a> <a href="home.html#problem-history" class="dropdown-item">History</a></p>  
        <p><a href="team.html" class="nav-link">Team</a></p>  
        <p><span class="nav-link dropdown-toggle">Presentations</span></p>  
        <div class="dropdown-menu" aria-labelledby="navbarDropdown">  
          <p><a href="presentations.html" class="dropdown-item">Presentations Top</a></p>  
        </div>  
      </div>  
    </div>  
  </div>
```

To HTML5



# Security Algorithm Permissions

- A generalized, basic security check
- Permission levels of each user, regardless of level will be checked before data level actions are taken
- Readability permissions will be checked and granted on login



#### Legend

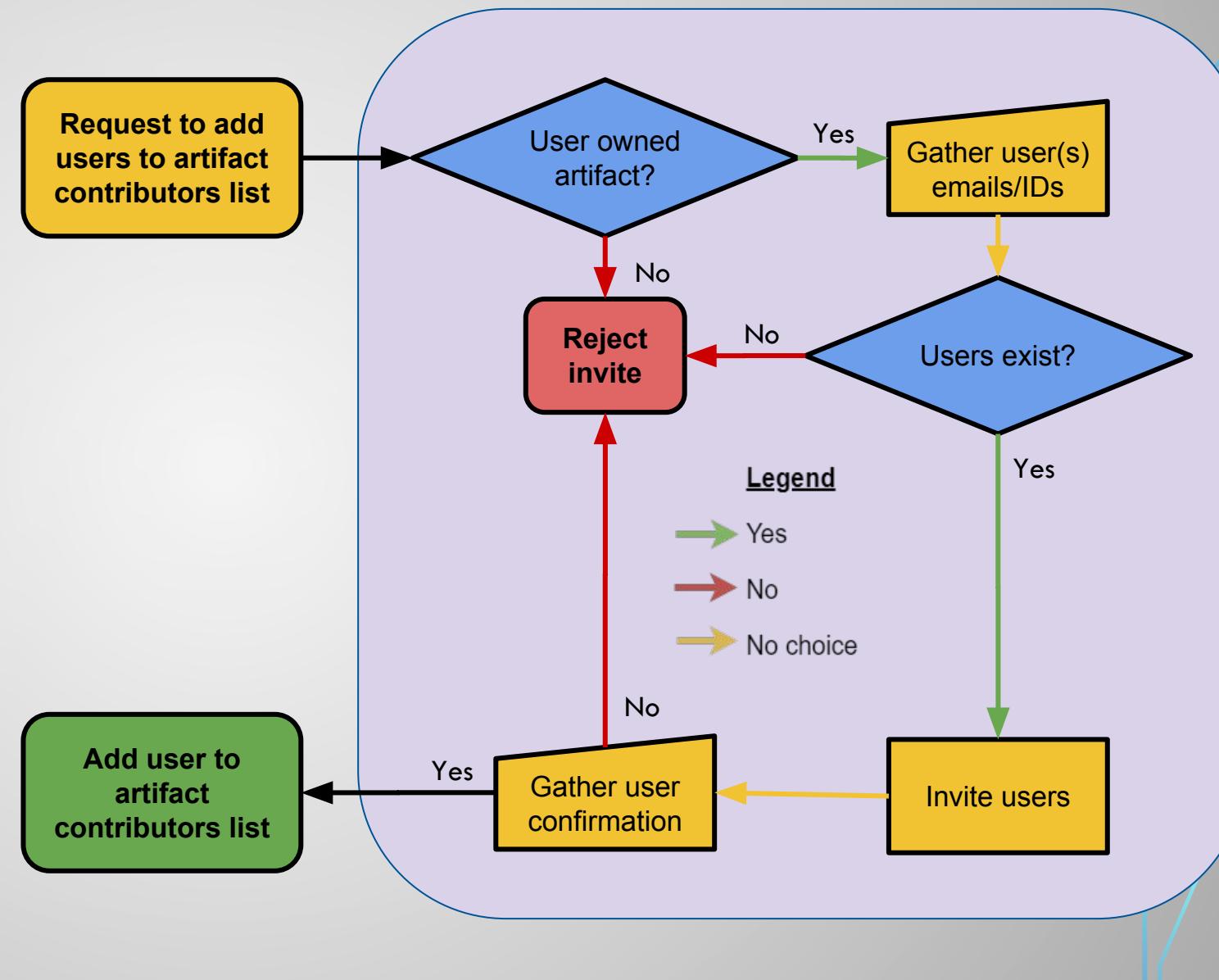
- Yes
- No
- No choice

## Deletion Algorithm

- Check deleter permissions
- Strip visibility from artifact
- Archive resource

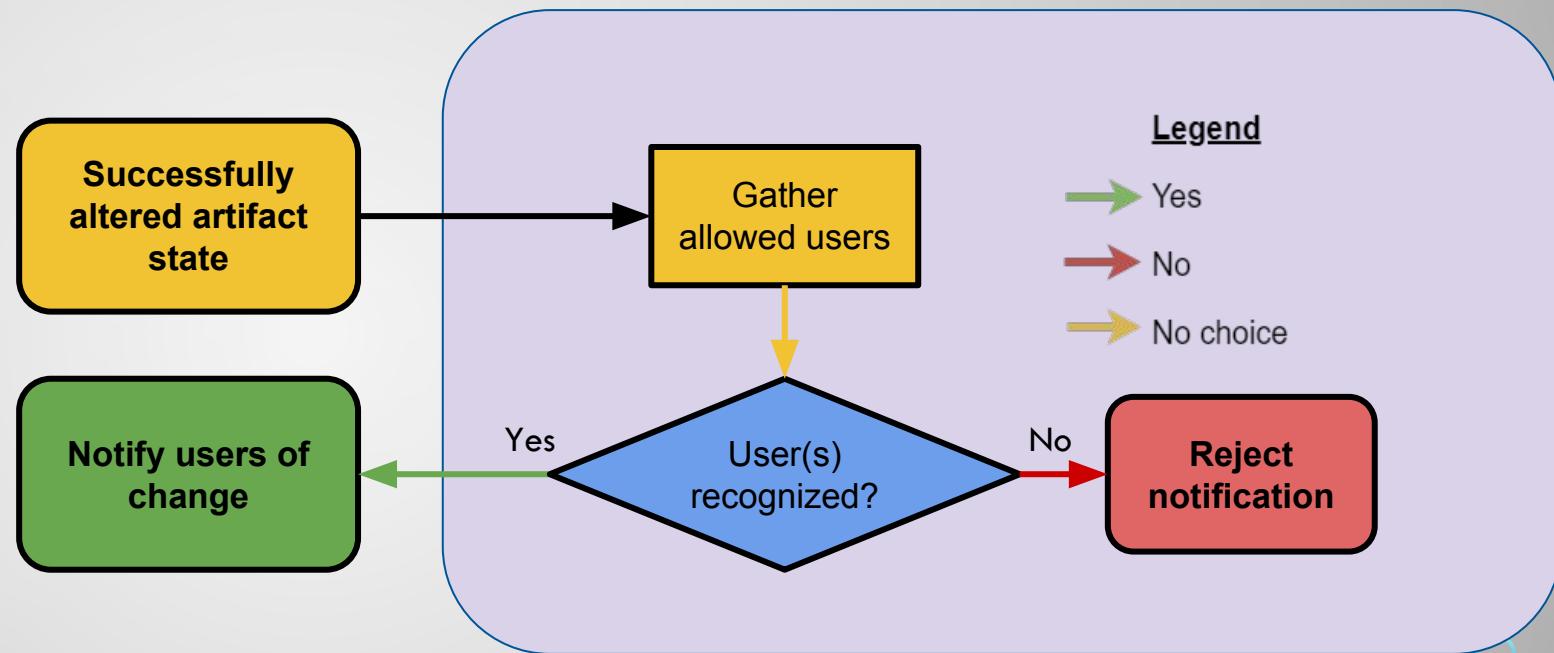
# Notification Algorithm: Invite

- Upon owners request
- Gather user emails and email interactive invitations
- Once accepted, they are added to the artifacts contributors
- Permitted further levels of access



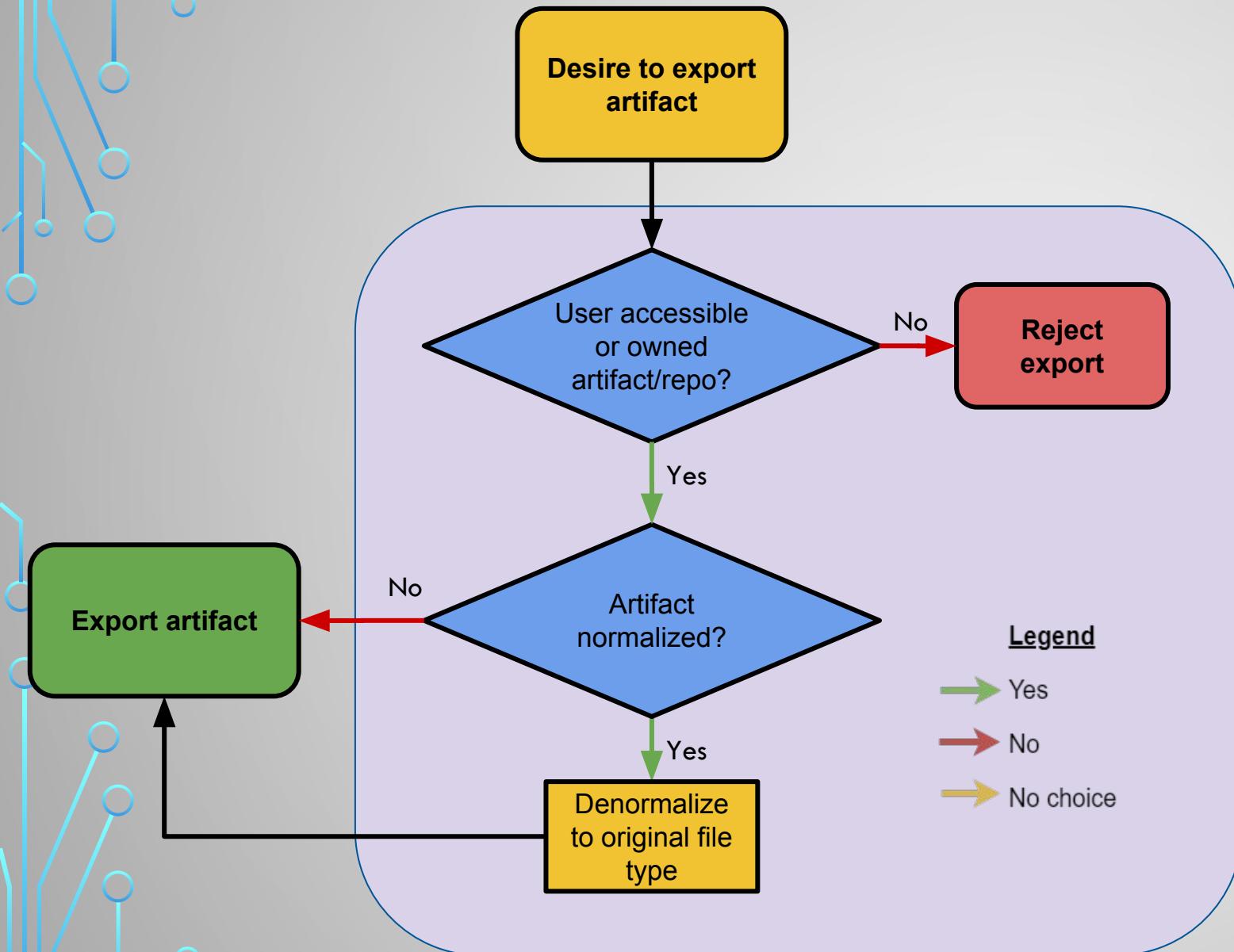
# Notification Algorithm: Alteration

- After a successful update/deletion of an artifact
- Gathers and notifies contributors
- Issues interactive email notification



# Data Retrieval Algorithm: User Export

- Creates ability for users of all levels to export needed artifacts
- Normalized artifacts will be converted to original formatting while non-normalized artifacts will be exported as original file type



# GUI MOCKUP & PROTOTYPE

