**Bright Idea Team Software**

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| Prepared for American Video Game Company |
| CRM Proposal |
| C188 – Software Engineering Performance Assessment |

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# Introduction

Bright Idea Team Software (BITS) welcomes the opportunity to collaborate with American Video Game Company and provide a forward-thinking solution to an aging CRM system. Our goal was to build a CRM solution constructed around specific requirements outlined by AVGC, package that functionality and deliver it in a simple and intuitive, yet sleek interface. Our proposed solution is designed to perform seamlessly at workloads triple the current metrics to provide 5+ years of service before expansion consideration. Requirements, methodologies, design, and testing discussions are found in the following sections.

# A.1. Purpose

The purpose of this document is to provide an overview of the BITS CRM solution, uniquely tailored to AVGC.

# A.2. Overview of the Problem

AVGC boasts 2000 total users and reports that 500 are online during peak times. The current CRM is quickly becoming outgrown. Current metrics provided by AVGC show a 42% increase over the past 2 years, meaning AVGC will have more than double the number of users in 4 years. With such rapid growth, the current CRM is not scalable to meet demands.

AVGC currently employs several disconnected manual and automated processes that utilize valuable resources that are needed elsewhere. The efficiencies of these processes could be greatly increased with automation and integration.

The existing CRM lacks the ability to log user activity and manipulate the data into quantifiable metrics to promote user accountability and auditing capabilities. User activity can provide invaluable insights and opportunities for growth and refinement.

The current AVGC CRM supports a limited number of operating systems and browsers, which limits the number of users that can access the system, also limiting growth. Since the existing CRM is accessed from all over by users with various of devices, lack of portability is a concern.

Growth leads to new users, who inevitably encounter a learning curve, resulting in a high likelihood of user errors. The existing CRM lacks a system archive necessary to mitigate these errors. A system archive serves a dual function as a means to restore deletion mistakes or permanently delete an unwanted entry, streamlining database maintenance.

# A.3. Goals and Objectives

BITS has created a CRM custom tailored to AVGC designed to meet current and future business needs. Our goals are outlined below:

Scalability – Must be able to manage current workload of 2000 total users with 500 active users during peak times and be easily scalable and upgradable.

Datatypes – Existing data must be refined to create custom datatypes tailored specifically to AVGC needs. This consolidates all contact and business information.

Accountability – Must be able to track individual user activities, generate individual unprivileged user daily/weekly reports as well as privileged summary and detailed reports according to user privilege level.

OS/Browser support – Must be compatible with most popular OS and browser combinations (see B.2)

Integration – The BITS CRM is designed to reflect and refine current processes to increase efficiency and enable integration with existing infrastructure.

Security – Obsolete elements must be replaced to establish enhanced security measures.

# A.4. Prerequisites

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| Number | Prerequisite | Description | Completion Date |
| 1 | Project Charter | Acquire Project Charter authorizing project initiation. | December 4, 2023 |
| 2 | Verify Requirements | AVGC to verify BITS CRM meets all requirements in contract | December 9, 2023 |
| 3 | Approve budget | AVGC to confirm budget proposal for BITS CRM creation | December 11, 2023 |
| 4 | Provide access to AVGC database | AVGC to provide access to current database to allow data to be integrated into BITS CRM. | December 13, 2023 |

# A.5. Scope

The following elements are in the project scope:

* System hosted internally and integrates with current infrastructure; will be able to meet current workloads and effectively scale up to manage 3x current workloads without performance degradation or instability.
* BITS CRM portability and compatibility with multiple OS and browser combinations defined in B.2
* System archive with soft delete, hard delete, and restore functionality.
* Individual user activity log with individual, summary, and detailed reporting availability based on user privilege levels.
* Custom tailored datatypes that effectively manage all contact and business information.

The following elements are NOT in the project scope but can be considered in future releases:

* Repair, replace, or upgrade of individual user devices.
* Repair, replace, or upgrade of network cabling and connections.
* Repair, replace, or of upgrade current systems.
* Ticketing system
* Forecasting system
* Contracting capabilities
* Quoting system

# A.6. Environment

The BITS CRM offers OS support for Windows 10+ and Mac OS Big Sur+ as well as mobile support for iOS 11+ and Android 8.0+. Multiple browsers including mobile and tablet versions are supported including Safari, Microsoft Edge, Google Chrome, Mozilla Firefox, and Chromium.

Cloud based solutions were evaluated, however due to project constraints and the current infrastructure already being in place BITS concluded the proposed CRM servers remain on site. This allows for total control of customer data and use of existing hosting software agreements.

# Requirements

Our proposal CRM system will meet the following 5 requirements listed in the CRM\_Requirements document provided by AVGC:

1. Scalability to meet current and future needs.
2. Contacts, businesses, and stakeholders will each have their own datatype.
3. Soft and hard delete capabilities.
4. Individual user activity recording.
5. Up to date OS and Browser Support.

# Business Requirements

Current trends show 25% of the 2000 total AVGC users are accessing the system during peak times. The rate at which current systems are being outgrown correlates with user growth. Current numbers show a 42% increase over the past two years and the existing system will quickly become outgrown. Rapid growth places scalability as a top priority when developing a CRM system. AVGC needs a system to not only accommodate their current number of users, but also to accommodate future needs as well. BITS proposes to solve scalability concerns by bringing in-house hosting capabilities to next level performance using current generation hardware capable of accommodating 6000 total and 1500 users during peak times upon launch with expansion capabilities as business demands. Hosting in-house results in no service provider connectivity issues, SLAs, or mandatory upgrades that are common with cloud solutions. The proposed hardware will manage current and future volumes based on projected growth up to 5+ years before expansion options should be considered.

Recording and logging individual user activity provides incredibly functional tools that are valuable assets during auditing efforts. User activity such as logins, orders, sales, customer account creation and/or modification, will be logged and timestamped to a txt file which will only be accessible by privileged users.

# User Requirements

To increase portability and decrease the need for new or upgraded hardware and software, the BITS CRM offers OS support for Windows 10+ and Mac OS Big Sur+ as well as mobile support for iOS 11+ and Android 8.0+. Multiple browsers including mobile and tablet versions will also be supported including Safari, Microsoft Edge, Google Chrome, Mozilla Firefox, and Chromium.

# Functional Requirements

The BITS CRM leverages the power of object-oriented programming to efficiently manage and organize AVGC provided data. By implementing OOP, we will create a robust and flexible system that will house AVGC data in three distinct data types: Stakeholders, Businesses, and Contacts. Each respective data type is represented as objects with their own AVGC predefined attributes and methods. This ensures a structured and scalable approach to data management while enabling BITS to model each datatype after the real-world entities involved with AVGC. This approach allows for seamless data retrieval, manipulation, and reporting, improving overall efficiency and functionality of the BITS CRM.

Also incorporated into the BITS CRM are methods to perform “hard” and “soft” deletions based on user privilege settings. Unprivileged users will be able to perform soft deletions of the Stakeholders, Businesses, and Contacts datatypes. Performing a soft delete changes the status to Archived which filters that entry from being displayed or considered for transactions in the Contacts tab. A soft deleted entry remains in the database but is accessible only by a privileged user via the Archives section found in the Reports & Archives tab. Access to this tab is exclusive to privileged users and provides hard delete and restore capabilities to each entry. Hard deleting an entry removes that entry from the database completely. The restore function changes the status of a soft deleted entry from Archived to Active, returning the entry to full functionality. Section D.1 depicts the differences in User and Privileged User interface and highlights exclusive privileged user access to privileged elements.

# Software Development Methodology

For development of this solution, BITS considered the agile and waterfall software development methods. Each method has its own advantages, but ultimately the waterfall method was selected as the best fit for this project. Advantage and disadvantages are discussed in further detail followed by selection justification in subsections C.1-C.4 (Hoory & Bottorff, 2022):

# Advantages of the Waterfall Method

Waterfall advantages:

1. Provides a concrete plan of the project from start to finish.
2. Project requirements are defined and agreed upon early on, which can save time.
3. Each phase of the project requires a deliverable to progress to the next phase, making the workflow more structured.

# Disadvantages of the Waterfall Method

Waterfall disadvantages:

1. Because each project phase requires completion before progressing to the next stage, the process can take longer.
2. Stakeholders may not see the product until the end and have little to no involvement after completion of the initial stages. As a result, stakeholders are not able to offer feedback until verification. Any late changes or revisions would be a very costly and timely endeavor.
3. Waterfall methodology focuses on being proactive in risk identification and management but is less adaptable in dealing with risk occurrences outside of those predictions. Dealing with an unplanned event or mistake could result in a delay until completion and added expenses.

# Advantages of Agile

Agile advantages:

1. Agile adds flexibility and allows changes throughout development. Approved change requests can be incorporated into the following iteration(s).
2. Increased stakeholder involvement results in increased feedback incorporated into the process, which can lead to more refined deliverables.
3. Short term deadlines encourage productivity and efficiency.

# Disadvantages of Agile

Agile Disadvantages:

1. Agile lacks a linear view of progression. Deliverables are not required to progress to the next phase, often muddying the measure of progress.
2. Increased stakeholder involvement can result in increased change requests, which can prolong the project timeline and increase costs.
3. Agile team members work on multiple phases at a time, creating a potential for overlap or unnecessary effort spent on later stages if an early phase needs to be modified.

# Best Suited

The BITS CRM incorporates the Waterfall method (Figure 1.1) for the following reasons:

1. Clearly defined phases with quantifiable progress promote accountability. Progression to the next phase is only possible after completion of the current phase.
2. Well defined deliverables with a thoroughly documented end goal will help stakeholders focus on reaching the end goal while maximizing cohesive efforts efficiently.
3. Concrete deadlines are established and agreed upon early. This minimizes the chances of scope creep and provides a clear end date for project completion.

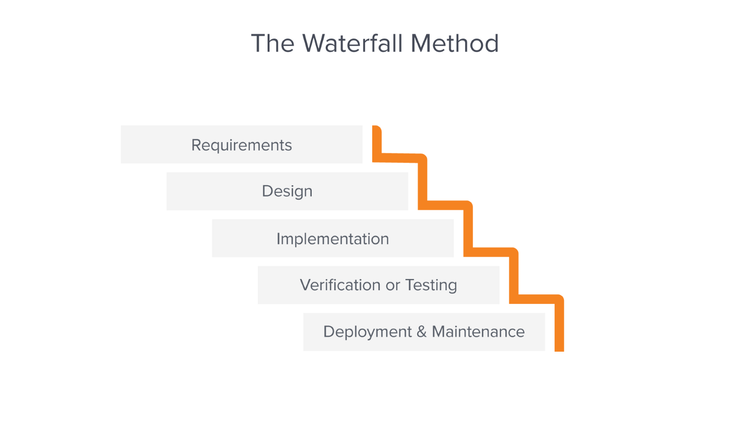


Figure .1: Waterfall methodology — a complete guide (Adobe Communications Team, 2022)

# Design

The user interface (GUI) of the BITS CRM boasts a sleek and intuitive design that users of varying skill levels can navigate effortlessly. Post login, the screen and tab options are dynamically displayed based on the user’s assigned privileges. This tailored approach streamlines user experience by removing inaccessible and extraneous elements from view based on assigned user privilege and making privileged menu options accessible exclusively by users with corresponding privileges.

# Storyboard for Privileged Information

Login:

Login

Privileged User Dashboard

User Dashboard

Privileged User Dashboard Tabs:

Privileged User Dashboard

Sales Tracking

Reports & Archives (Privileged)

Contacts

Unprivileged User Dashboard Tabs:

User Dashboard

Sales Tracking

Individual User Daily/Weekly Reports   
(Unprivileged)

Contacts

Privileged Reports & Archives Options:

Reports & Archives (Privileged)

Detailed Reports

Archives (with hard delete and restore capabilities)

Summary Reports

# Mockups of GUI Login Screens

Mockup login screen for mobile and tablet applications:

A screenshot of a login box

Description automatically generated

**4.**

**3.**

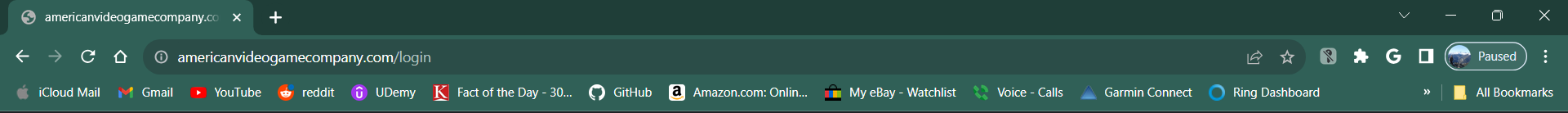
**2.**

**5.**

**1.**

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| --- | --- | --- | --- |
| GUI Control Mapping | | | |
| ID | Control | Property | Data Source |
| 1 | Textbox | On application open text = “Enter the name associated with your AVGC account” | Internal Variable |
| 1 | Textbox | On click change text of textbox 1 to “” | NA |
| 2 | Textbox | On application open text = “Enter your AVGC password” | Internal Variable |
| 2 | Textbox | On click change text of textbox 2 to “” | NA |
| 3 | Checkbox | On click enable checkbox and reveal password | Internal function |
| 4 | Button | On click verify login credentials with values in database | Internal function |
| 5 | Button | On click open “Forgot password” dialog box | Internal function |

Mockup login screen for browsers (example shown in Google Chrome Version 119.0.6045.106)



A screenshot of a login box

Description automatically generated

**5.**

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|  |  |  |  |
| --- | --- | --- | --- |
| GUI Control Mapping | | | |
| ID | Control | Property | Data Source |
| 1 | Textbox | On application open text = “Enter the name associated with your AVGC account” | Internal Variable |
| 1 | Textbox | On click change text of textbox 1 to “” | NA |
| 2 | Textbox | On application open text = “Enter your AVGC password” | Internal Variable |
| 2 | Textbox | On click change text of textbox 2 to “” | NA |
| 3 | Checkbox | On click enable checkbox and reveal password | Internal function |
| 4 | Button | On click verify login credentials with values in database | Internal function |
| 5 | Button | On click open “Forgot password” dialog box | Internal function |

# Testing

The BITS CRM has been rigorously evaluated to ensure reliability and consistent performance. Outlined below are just 3 examples of testing addressing browser compatibility, scalability, and soft/hard delete functions, respectively.

# Testing Types: Cross-Platform/Cross-Browser, Stress, & Gorilla Testing

The BITS solution boasts portability as a pillar of value. A CRM solution should not require mandatory upgrading of all software and/or devices. Our solution was designed to operate across multiple platforms and on multiple browsers for maximum portability. Cross-platform testing was utilized to ensure the BITS solution functions correctly with Windows 10+ and Mac OS Big Sur+, mobile support for iOS 11+ and Android 8.0+ while cross-browser testing confirmed compatibility with current desktop/laptop, mobile, and tablet versions of Safari, Microsoft Edge, Google Chrome, Mozilla Firefox, and Chromium. Testing includes confirming the proposed solution exhibits full functionality on each platform and web browser combination.

AVGC is experiencing tremendous growth. A CRM solution must be scalable to accommodate future needs. Stress testing is a type of performance testing that assesses the performance and response time of a software application under extreme workloads. It helps to identify the system’s breaking point and ensure that it can manage unexpected workloads (Doshi, 2023). Stress Testing the BITS solution consisted of testing loads simulating current conditions (2000 users total, 500 users during peak times) to measure baseline functionality. After obtaining baseline measurements, the load is increased to stress the system and test functionality at future predicted levels (according to AVGC provided metrics) by simulating workloads with 6000 total users and 1500 users online during peak hours.

Gorilla testing is a software testing technique where the tester performs testing of a particular module or component of the software system rigorously and extensively to identify any issues or bugs that may arise. In other words, Gorilla testing focuses on evaluating a single module or component in depth to ensure that it can manage high loads and perform optimally under extreme conditions (Doshi, 2023). In the third example, Gorilla Testing methods were applied to the soft and hard delete capabilities of the BITS solution.

# Cross-Platform/Cross-Browser Testing

## Windows, Mac, iOS, Android, Edge, Safari, Chrome, Chromium, Firefox

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| Requirement to be tested:  Adding a contact on each combination of OS and browser to ensure BITS solution compatibility with Windows 10+ and Mac OS Big Sur+, mobile support for iOS 11+ and Android 8.0+ as well as browser compatibility including current desktop/laptop, mobile, and tablet versions of Safari, Microsoft Edge, Google Chrome, Mozilla Firefox, and Chromium. |
| Preconditions:   1. Ensure the BITS CRM solution is installed and properly configured on Windows 10+ and Mac operating systems. 2. Have access to mobile devices with iOS and Android platforms where the BITS CRM mobile app is installed. |
| Steps:  Windows 10: Microsoft Edge – Log in and Add Contact   1. Open the BITS CRM software on Windows 10. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   Windows 10: Chrome - Log in and Add Contact   1. Open the BITS CRM software on Windows 10. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   Windows 10: Firefox - Log in and Add Contact   1. Open the BITS CRM software on Windows 10. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   Mac: Safari - Log in and Add Contact   1. Open the BITS CRM software on Mac. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   Mac: Chrome - Log in and Add Contact   1. Open the BITS CRM software on Mac. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   Mac: Firefox - Log in and Add Contact   1. Open the BITS CRM software on Mac. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   iOS: Safari - Log in and Add Contact   1. Open the BITS CRM mobile app on iOS. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   iOS: Chrome - Log in and Add Contact   1. Open the BITS CRM mobile app on iOS. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   Android: Chrome - Log in and Add Contact   1. Open the BITS CRM mobile app on Android. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab.   Android: Firefox - Log in and Add Contact   1. Open the BITS CRM mobile app on Android. 2. Log in with valid credentials. 3. Navigate to the section for adding a new contact. 4. Fill in the required contact information and save. 5. Verify that contact information is present, and all fields are correct in Contacts tab. |
| Expected results:  The login is successful, the contact is added without errors, the contact is present in the Contacts tab and all fields are correct. |
| Pass/Fail:  Windows 10: Microsoft Edge – Log in and Add Contact   * PASS   Windows 10: Chrome - Log in and Add Contact   * PASS   Windows 10: Firefox - Log in and Add Contact   * PASS   Mac: Safari - Log in and Add Contact   * PASS   Mac: Chrome - Log in and Add Contact   * PASS   Mac: Firefox - Log in and Add Contact   * PASS   iOS: Safari - Log in and Add Contact   * PASS   iOS: Chrome - Log in and Add Contact   * PASS   Android: Chrome - Log in and Add Contact   * PASS   Android: Firefox - Log in and Add Contact   * PASS |

# Stress Test

## Scalability

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| Requirement to be tested:  Scalability |
| Preconditions:   1. Ensure the existing CRM system is running with its current user capacity. 2. Ensure the proposed BITS CRM solution is installed and properly configured for testing. 3. Identify the hardware specifications and network infrastructure to simulate a realistic testing environment. 4. Coordinate with the IT department to monitor system performance during the stress test. |
| Steps:   1. Prepare the Existing CRM System:    * Ensure the existing CRM system is running with its current user capacity.    * Collect baseline performance metrics, including response time, resource utilization, and system stability. 2. Deploy the BITS CRM Replacement:    * Install and configure the BITS CRM according to the system requirements.    * Ensure that the hardware and network configurations are set to simulate a production environment. 3. Define Stress Test Scenarios:    * Identify scenarios that mimic real-world usage during peak hours.    * Create test scripts to simulate simultaneous access by a large number of users. 4. Execute Stress Test:    * Gradually increase the user load on the BITS CRM to reach and surpass its peak capacity.    * Monitor performance metrics continuously during the test.    * Introduce scenarios that involve data-intensive operations, such as querying large datasets or generating complex reports. 5. Observe System Behavior:    * Monitor the CRM replacement for any signs of performance degradation, system crashes, or response time increases.    * Check for resource bottlenecks, such as CPU and memory usage, and ensure they remain within acceptable limits. 6. Capture Performance Metrics:    * Record performance metrics, including response time, throughput, and error rates, at different load levels.    * Analyze the data to identify breaking points, stress levels, and areas for improvement. 7. Gradual Load Reduction:    * Gradually reduce the user load on the system to ensure a smooth transition back to normal operating conditions.    * Monitor how well the system recovers from the stress test. |
| Expected results:   1. Within Capacity Limits:    * The existing CRM system should operate within its established user capacity, showing stable performance during regular operations. 2. BITS CRM Stress Test:    * The BITS CRM manages the increased load of 6000 total users and 1500 during peak hours without significant performance degradation.    * Response times should remain acceptable, and the system should not crash or become unstable. 3. Performance Metrics Analysis:    * Performance metrics analysis indicate the BITS CRM's behavior under stress exceeds minimum requirements.    * The system should recover gracefully when the load is reduced. 4. Comparison with Baseline:    * Performance metrics from the stress test with baseline metrics of the existing CRM system confirm the BITS CRM exceeds existing AVGC CRM performance metrics. |
| Pass/Fail:  BITS Proposed solution stress test:   * PASS |

# Gorilla Test

## Soft/Hard Delete Capabilities

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| Requirement to be tested:  Soft and Hard Delete capabilities. |
| Preconditions:   1. Ensure the BITS CRM is installed and properly configured with the necessary user roles (unprivileged and privileged). |
| Steps:   1. Log in as an unprivileged user. 2. Soft Delete a Database Entry:  * Verify Reports & Archives tab is unavailable. * Navigate to a contact or record that is currently in an "Active" status. * Execute the soft delete action on the selected entry.  1. Confirm Soft Deletion:  * Verify the deleted contact is absent in the Contacts tab and can no longer be considered for transactions. * Check the database and verify the deleted entry’s status changed from “Active” to “Archived.”  1. Login as Privileged User:  * Log out from the unprivileged user account. * Log in as a privileged user.  1. Access the Reports & Archives Tab:  * Navigate to the Reports & Archives tab, specifically designed for privileged users. * Confirm that only privileged users can access this tab.  1. Restore a Soft Deleted Entry:  * Navigate to the Archives section. * Identify the previously soft-deleted entry within the Archives. * Verify the entry status as “Archived.” * Select the previously deleted entry. * Execute the Restore feature on the selected entry.  1. Confirm Restoration:  * Verify the restored entry no longer appears in the Archives section. * Navigate to the Contacts tab. * Verify the restored entry is present in the Contacts tab. * Verify the restored entry’s status has changed from “Archived” to “Active.” * Verify the entry can be selected for transactional processes.  1. Hard Delete an Entry:  * Identify a soft-deleted entry within the Archives tab. * Execute the hard delete action on the selected entry.  1. Confirm Hard Deletion:  * Verify the entry is no longer found in the Archives section or Contacts tab. * Check the database to ensure that the entry was permanently removed after the hard delete action. |
| Expected results:   1. Soft Deletion by Unprivileged User:  * The unprivileged user should be able to soft delete an entry. * The status of the entry should change from "Active" to "Archived."  1. Database Status After Soft Deletion:  * The soft-deleted entry should no longer appear in the Contacts tab. * The soft-deleted entry should be viewable in the Archives tab by Privileged users exclusively. * The database should correctly reflect the entry's status as "Archived."  1. Restoration by Privileged User:  * The privileged user should be able to access the Archives tab. * The privileged user should successfully restore a soft-deleted entry. * The entry's status should change from "Archived" to "Active." * The restored entry should no longer appear in the Archives tab. * The restored entry should only appear in the Contacts tab viewable and selectable by privileged and unprivileged users.  1. Database Status After Restoration:  * The database should correctly reflect the entry's status as "Active."  1. Hard Deletion by Privileged User:  * The privileged user should be able to hard delete an entry from the Archives tab. * The entry should be permanently removed from the database and no longer appear in the Archives section or Contacts tab.  1. Database Status After Hard Deletion:  * The hard-deleted entry should not be present in the database. |
| Pass/Fail:   1. Soft Deletion by Unprivileged User:  * PASS  1. Database Status After Soft Deletion:  * PASS  1. Restoration by Privileged User:  * PASS  1. Database Status After Restoration:  * PASS  1. Hard Deletion by Privileged User:  * PASS  1. Database Status After Hard Deletion:  * PASS |

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