STARMAN

Final Report

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Table of Contents

Table of Figures

Abstract

The purpose of this project was to design, develop and deliver a production grade software application that would enable line managers to manage their staff access to specific Active Directory (AD) resources. The need for this application was determined through the personal experience of the developer, and was based on the observed delays in delivery of access to staff.

Managing users and their access in Active Directory is a crucial aspect of any Windows Server-based network. The security and efficiency of use of systems is dependent on ensuring that users have the rights access they need, and only that access, when they need it.

This solution, as delivered, will provide users with an easy-to-use interface to monitor and manage AD group membership of staff within the operator's department or functional area. By using Azure's secure authentication methods (single sign-on), the application will be a secure platform for end users.

Once implemented, this application will extend AD group membership management to the edge of the network, removing the dependency on helpdesk resources to provide routine levels of support.

Introduction

This is the final report on the outcome of the STaff Active directory Resource MANagement (STARMAN) project. The final goal of this project was to design, develop and implement a system to allow identified operators to manage access to resource sets in the Carlow branch of the South-East Technological University (SETU) Active Directory (AD) infrastructure.

This report will provide a description of the project, the issues and pitfalls, successes and failures and lessons learned during the completion of the project.

Project Description

The design and planning phase of the project determined that the finished product would consist of three distinct elements:-

1. A web-based front end for both operators and administrators to interact with the system
2. A console-based back-office tool to complete all requests submitted by operators and administrators
3. A set of web-based APIs to process the requests and interactions with any databases and AD

Web front-end

Each of the three main elements of the project were developed using Microsoft C# and the Microsoft Visual Studio 2022 platform. The web interface uses ASP.net technology with additional features provided by the inclusion of the Ajax Toolkit for ASPX. The application runs on the Microsoft Internet Information Server (IIS) platform. The website is secured using a 2048-bit certificate and uses https protocols.

User access to the web front-end is managed through Azure AD single sign-on authentication. Access is achieved using existing SETU credentials. Access to the system is restricted to a specific group of users. Each user must be a member of a local AD group (synched to Azure AD). The user's role in the system is determined based on their credentials.

For ease of use, and also for security reasons, the system is point-and-click. Other than when providing login credentials and specifying filter dates, there is no keyed data entry into the system by users.

There are two types of user for the front-end system:- Operators and Administrators. Each of the two user types have a different experience within the system.

An operator uses the system to grant and remove user access to specific AD resources.

An administrator manages the users and groups within the system

Back-office console application

The back-office console application was developed using Microsoft C# and Visual Studio 2022. The console application runs on a Windows 10 platform. The application runs in a constant loop, set to a 5-minute interval.

Web service APIs

The webservice APIs run on an IIS platform. They are secured using a 2048-bit certificate and uses https protocols. All requests to the webservices are also secured using session tokens. Each request must be accompanied by a valid session token. Any request that is received without a valid token, results in a blank response from the service.

Access to the website hosting the APIs us restricted by IP address.

System database

Underpinning the functionality of all three aspects of the system is a Microsoft SQL database. This database sits on a Microsoft SQL 2019 Server, running on a Microsoft Windows Server 2022 platform.

All database requests are made through APIs and use parameterized SQL statements to reduce the risk of SQL injection attacks.

Challenges

Throughout this project, there were a number of challenges. While not necessarily document in the design phase, there were a number of issues identified early in the project. It was important for the overall success of the project that these issues were identified and planned for.

This section of the report outlines the major challenges that arose in the project and give an overview of how each challenge was dealt with.

Security

As with all computer system in general, security was important for this project. When distributing privileged functionality to the edges of an environment, it is vital to ensure that there is no increase in risk to any aspect of the system.

The following aspects of system security were of specific concern.

Elevated User Privileges

For an AD user to be able to change group memberships, they need a level of elevated privileges in the AD environment. As this is an obvious security risk, I decided early in the project design that this would not be possible.

Based on previous experience of this type of situation, I determined that the best way to simulate a user having elevated privileges was to separate out the operation into two stages.

- The first stage, generating a request to change group memberships, would be submitted by the operator and become an entry in a database table.
- The second stage, making the change in AD, would be carried out by a secured back-office application.

To ensure that the back-office application also did not need elevated privileges, I decided to use a number of web APIs to carry out the privileged tasks. This ensured that the only point in the process where elevated privileges were required was within the API application itself.

SQL injection

As with any front-facing application with a back-end database, there is a high risk of database corruption and exposure. One common form of SQL corruption is the use of SQL injection attacks. This involves altering any application input data strings to construct valid SQL statements to impact the database in the background.

There are a few ways to reduce the risk of this type of attack. Primarily, the use of parameterised SQL statements is the first line of defence. By using parameters in SQL statements, there is no need to insert constant values at any time.

Another option to reduce the risk of SQL injection attack, is to carefully control the amount and content of any text entered by an operator or third party. If an operator or attacker cannot enter text, it is much harder to mount an attack against a site.

As the web front-end part of this application is all click driven, there are not text entry opportunities for a potential hacker to use.

Web service API security

As the web service APIs provide access to a number of privileged functions, it was vital to ensure their security. A number of different practices were employed to ensure maximum security and reduce any risk of exposure when possible.

> The web service was hosted on a Microsoft IIS server, using secure HTTP with a 2048 bit certificate. Access to the web service was restricted to just one machine, the IIS server. This was achieved by using IP restrictions for the web site through IIS.
>
> As the existing physical University network uses VLAN structures and port security, the risk of IP address spoofing is significantly reduced.
>
> All API requests require the provision of a session token to ensure authenticity of the calling device. Each application generates a unique session token at startup. This is stored in the application database and each API call is then authenticated using this token. The initial request to store a token is secured using a separate token process.
>
> Scheduled processes on the database server remove session tokens once they are more than one hour old. This ensures that a session cannot be kept alive indefinitely.
>
> The APIs use a specific user account in AD with elevated privileges to manage the AD Organisational Unit assigned for the project. The credentials for this user are stored in a specific registry key on the hosting web server. At any time, these credentials can be changed without any need to alter the application code. In future, this process can be automated to conform to any service account password policy that the University may introduce.

RESTful APIs

To date, my experience of API development was limited to a range of SOAP APIs. As SOAP is a dated technology, I decided to use RESTful API technologies instead. It was necessary for me to learn how to develop these APIs.

I discovered very quickly that there were limits to the types of data to be returned from RESTful APIs, as opposed to SOAP options. With a SOAP API request, it is possible to return a C# DataTable type. However, it is not possible to do this with RESTful APIs. There was a learning curve based around learning to convert JSON data string to DataTable types.

Due to their nature, debugging APIs can be a challenge. By their nature, an API is designed to receive a request, process it and return a result. It is not easy to interact with the API during execution.

To facilitate the initial development and testing of each API, I used a simple Windows Forms application. This allowed me to easily interact with each API. By controlling the point at which each API returned to the calling code, I was able to monitor the progress of each API. This technique allowed me to ensure that my inputs arrived as expected. It also allowed me to check simulate the use of checkpoints to ensure that variable values were what they should be at each stage.

Test platform

As the finished product is designed to manage AD users and groups in a live environment, testing was always going to be a concern.

Early in the project planning process, I determined that using an area of the existing IT Carlow AD environment with fictional users and groups might be feasible. Following discussions with my project supervisor, I made written requests to the Computing Services Manager on the Carlow campus for the following:-

1. Access to an Azure AD authenticated application to support the single sign-on requirements of my product
2. Access to a separate area of the ITCARLOW AD environment, complete with a user account configured to manages objects within the provided container.

My application, by email, for both requirements was duly granted, allowing all my development and testing to be carried out in the ITCARLOW environment.

Throughout the entire development and testing process, all operations were carried out within the retiring ITCARLOW AD platform. The application was designed in a way that a transition to the live SETU AD environment would be quite straightforward and would not require any further software development.

Learning Outcomes

As part of this project, I expected some learning outcomes. I considered that these would fall into more than one technical area.

Technical learning

The two main areas of technical learning that I achieved as a result of this project were:-

- RESTful API development
- User Interface/Experience skills

RESTful API development

As outlined earlier, this project provides operators, who are standard users within AD, the ability to carry out some basic administrator-level tasks. As this was an area I had no prior experience of, I had the challenge of learning how to write RESTful API functions and process same.

Microsoft SQL triggers and procedures

In the past, I had some limited exposure to SQL procedures and triggers. In most cases, this involved working with procedures someone else had developed. I also had some limited experience in writing triggers of my own.

For this project, I used some SQL procedures to create my own UPSERT SQL functionality to deal with user and group data in my database. With the knowledge I have gained in these areas, I will be revisiting some of my existing applications with a view to improving their functionality by harnessing more of the features of the SQL server platform.

User Interface/Experience skills (UI/UX)

Prior to undertaking this program of study, I had no formal training in any aspect of UI/UX design. While I was personally aware of such vision issues as colour blindness and the need to ensure proper colour selection, I had no real experience of skills in the area.

I chose to take the elective module in UI/UX design on the program of study to address this knowledge void.

During this module, I learned a number of things that led to significant changes in the original interface design. While this meant that my design documents and finished product did not align, I believe that the finished interface is easier to use for the operator.

Personal learning

From a personal perspective, I have learned that change is not a bad thing. It is important to always learn from and apply new experiences to what you do. This does not just apply to work, but to all aspects of life in general.

Project Review

As with any project, there are a series of expectations at the outset. These expectations are added to and taken from as the project design and planning progresses. This section of the report will outline the details of the main elements of the project that were achieved, and any that were not.

Elements achieved

I believe that I have delivered the functional requirements detailed in the Functional Specification for this project. While the user interface elements do not match the original design document, I believe that the finished product is easier to use and more robust.

An operator of the system can review existing, add or remove AD group memberships for users they manage. The operator can also monitor any outstanding requests to determine whether they were accepted and processed or not.

Elements not achieved

I believe that, with more time and knowledge, there are more enhancements to the UI/UX that could be achieved. I believe that what has been delivered is an improvement on what was outlined in the initial design. However, I also feel that there are functionalities out there that could have also been applied.

Other enhancements identified

During the development of this product, I identified other areas of functionality that could be added. There are a number of technical aspects of the “configuration” of an end-user that could have been included in this system

For example, telephone access requests are also managed through the same helpdesk process as file access requests. Also, some departments have requirements for access to specific software resources. The management of this access could also have been included.

Personal Reflection

If I was starting again, I feel that I would look at what could be achieved with this type of platform in more detail.

As with all new systems and processes, it is important to get buy-in from all stakeholders. While it makes sense for a helpdesk service to be able to divest some of its role to edge users, it is important that the edge users get enough from a system to encourage them to engage with it in the first place.

Two existing call management and processing tools within the helpdesk environment provide details of the types of requests submitted. A review of these data sets would be a good starting point to look at additional functionality for this type of system.

From a technology usage perspective, I would give a good deal of consideration to using database triggers to manage some of the background record creation. For example, I would look at the feasibility and sustainability of using triggers to generate email notification requests when a department move request was generated, rather than handling it through C# Code.

While the use of triggers might not end up being the best option, investigating the option would improve my understanding of their functionality and use and could lead to a greater implementation of them in future. A change in my design processes could be beneficial for new projects and for revisiting existing ones.

Differences

The main plans for this product remained throughout. The original development platform (C#), delivery platforms (web front-end, console back-office and web APIs) were also used as planned. Also, the original plan to Microsoft SQL Server as the application database platform came to fruition.

As the project progressed, and as my knowledge and skills improved, I decided to make significant changes to the appearance and operation of the user interface. While the same overall features and functionality remained, the appearance of the interface and the types of controls were different. So, too, was the original colour scheme.

These differences came about due to an improvement in my understanding of interface design and requirements. I discovered that there were better ways to make an interface intuitive and easy to use for an infrequent user, in particular.

Also, during the life of the project, some operational changes appeared within the potential customers' area. Changes to how data is maintained within the existing Active Directory platform for the original IT Carlow users are under consideration at this time.

It is being proposed that the existing CORE HR system is going to become the authoritative source for all non-student user object data. As a result, some non-critical user details in Active Directory would be updated automatically and without the knowledge of system administrators. Amongst the changing data would be user departments and job titles/roles.

As a result of this potential change, I decided to take the manual elements out of the management of user details with the application database. With automated data maintenance, it would be very easy for the application database to fall out of step with actuality. This would have the potential to lead to two significant and concerning situations:-

1. After moving departments, users could appear to be in still in their old departments, having access to resources and data they should not have
2. Managers would not have the ability to update new staff to grant resource access as necessary.

The second situation above would bring the process back to the potential for delays that currently exist in the process as it is.

Change process

As I identified the potential for improvements in functionality, I discussed them with my project supervisor and also with my project change manager (me). I assessed each change to determine the following:-

1. What is the risk to the overall project of making/not making the identified change
2. What level of enhancement of functionality and experience would be achieved for the end-user
3. Will the change increase/reduce of risk of system underperformance or failure?

Once I had determined that the proposed changes satisfied these criteria, I implemented and tested the changes as appropriate.

Summary of differences

The following is a list of the main changes made to the functionality of the application suite from the original specification and design documents.

- Elements of the end-user interface were changed to better reflect standards of current application interfaces
    - Arrow images to indicate direction of movement of group assignments, instead of text buttons
    - Use of more neutral colour schemes to make the system appropriate for more users
- Maintaining Active Directory objects in the application database was automated, rather than manual
- The ability to or need for an administrator to change the departments of users and groups within the application database was removed
- Automated addition of new departments and job titles/roles to the application database as they are encountered in Active Directory

Conclusions

Throughout the SETU Carlow campus, line managers have responsibility for sets of specific resources associated with their departments. These resources include file storage areas and printer. At present, these line managers have to request changes to these access levels through the IT Services Carlow helpdesk.

The goal of this project was to develop a simple-to-use software platform that would allow these managers to control aspects of resource access within their own areas of responsibility. The system would need to be easy to use, robust and resilient. The ability to monitor see what resources individuals have access to was also deemed important.

I believe that the product I have developed meets the requirements of managers and administrators. The developed platform was tested fully and is robust and accurate in what it does. Operators are not able to make changes to any resources they do not manage, ensuring resource security at all times.

In time, with the growth of the merged SETU resource management process, the way resource access is managed will change. In the meantime, to ensure timely access to resources, managers will have STARMAN to rely on.

Acknowledgements

At this point, I wish to acknowledge the support of a number of people. These people had different, but impactful, inputs to this project.

Dr Joseph Kehoe – Project Supervisor

From day one, as I joined the program quite late, Joseph provided me with great support and guidance. This help included supporting my project choice and helping guide me around the different issues that arose along the way.

Mr Colm O'Connor – Computing Services Manager, Carlow Campus SETU

As the manager with responsibility for Active Directory for IT Carlow and the Carlow branch of SETU, Colm ensured that any reasonable requests I made were granted. Colm assigned a liaison technical officer to provide me with access to resources as required.

While I already have access to these resources through my full-time role in Colm's department, I felt it was important to submit formal requests for resource access. Colm agreed with my plan and supported it from day one.

Mr Ronan Devoy – Technical Officer, Computing Services Carlow Campus SETU

Ronan was appointed to provide me with any reasonable technical assistance that I required. At all times Ronan met my requests with great efficiency.

Declaration

- I declare that all works submitted in the completion of this project are of my own preparation and production
- Where relevant, I have cited all external sources and included a Bibliography of terms as appropriate
- I understand that failure to comply with the University's regulations governing plagiarism constitutes a serious offence

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Appendix I – Testing Strategies

Introduction

The purpose of this appendix is to describe some of the strategies used to track the testing of each element of the STARTMAN software application.

> **NB:** Please note that the figures in this appendix are for reference purposes only and do not reflect a real testing situation.

Web Front End (WFE)

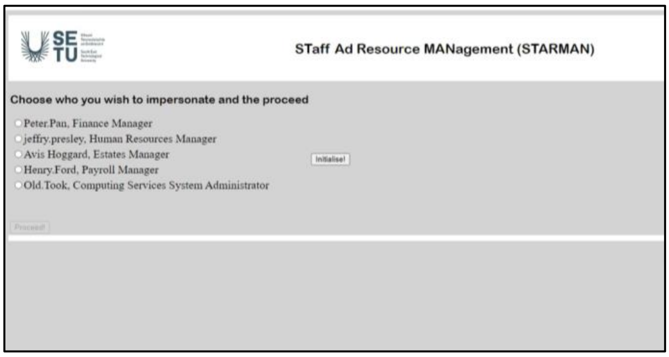
The following tests will be carried out on the Web Front End element of the application.

Function	Test	Ref
Application Startup	Browse to website and ensure page prompts to select user to emulate	WFEU001
User Emulation	Select each user and ensure that the system loads as this individual. When an operator is selected, the next screen should load and display a list of the users that are managed by the specific operator. This list should be checked manually in the database to ensure that all the users listed are correct.	WFEU002
Managed User selection	Select a user from the list of managed users and ensure the lists of Unassigned and Assigned resources for the selected individual are displayed. This will involve manually checking Active Directory (AD) to see that the Assigned Groups displayed for the selected user correspond to what is assigned in AD.	WFEU003
Select Unassigned Resource	Click on a resource in the *Unassigned Resources* list. The item should be highlighted and the *Move Right* button should appear between the two lists of resources. The *Move Right* button should not be visible.	WFEU004
Assign selected resource	Click the Right Arrow button. The selected resource should now appear in the *Assigned Resource* column and disappear from the *Unassigned Resource* list	WFEU005
Select Assigned Resource	Click on a resource in the *Assigned Resources* list. The item should be highlighted and the *Move Left* button should appear between the two lists of resources. The *Move Right* button should not be visible.	WFEU006
Process Resource Assignments	Click on the *Process!* Button to process the request changes made. This process will review the two resource lists Unallocated and Allocated) and determine whether the selected user is assigned to the resources already. The Unallocated Resources list is checked first. Each resource currently in the list is compared to what was originally there (stored in memory). If there is a change in the list, a record is written to the requests database table to either Add or Remove the resource from the selected user.	WFEU007

Select Administrator	For testing purposes, when the system starts for the first time, the only operator that can be chosen is the Administrator. Click the radio button for the Administrator and click the *Proceed!* Button.	WFEA001
Review User List	Click on the ***Users*** tab on the screen. A list of current users in the system should be displayed and their department should appear beside them. This data should be checked against the database in the background to ensure that all users are listed and that the correct department is associated with them.	WFEA002
Review Activities List	Click the **Activities** tab at the top of the screen. Review the list of activities displayed and compare them to the entries in the database in the background. Ensure all activities are being displayed.	WFEA003
Filter by Date	Select From and To dates to filter by and click the **Filter** button. Check that all the records in the database for the selected date range are displayed.	WFEA004
Clear Filter	Click the **Clear** button. This should reset the Activities list. Review the list of activities displayed and compare them to the entries in the database in the background. Ensure all activities are being displayed.	WFEA005
Filter by User	Click the User radio button. Click the **Select** button on the row that you want to filter for the User. Review the list of activities displayed and compare them to the entries in the database in the background. Ensure all expected activities are being displayed.	WFEA006

WFEU001 – Application Start-up

The WFE has been prepared with a selection screen that allows the tester to select which user they wish to be.



STaff Ad Resource MANagement (STARMAN)

Choose who you wish to impersonate and the proceed

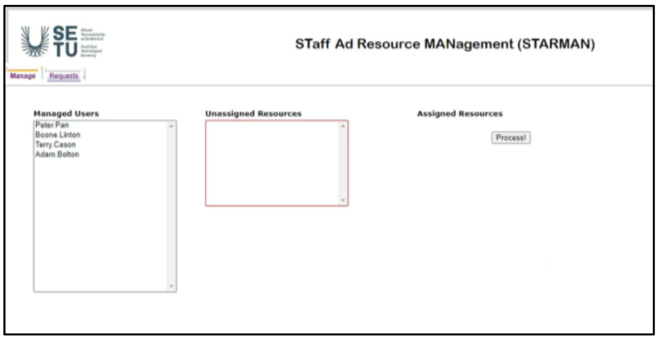
○ Peter.Pan, Finance Manager
○ jeffry.presley, Human Resources Manager
○ Avis Hoggard, Estates Manager
○ Henry.Ford, Payroll Manager
○ Old.Took, Computing Services System Administrator

Figure 1: Test WFEU001 - Check application loads

When selected, the application should perform as if it is logged in as the selected user.

WFEU002 – User Emulation

As each user is selected from the front page, the application should continue to the next screen as that user. The list of Managed Users for the selected operator should be displayed. In the case of the System Administrator being chosen, the Administrator interface should be displayed. Figure 2: Test WFEU002 - Check emulation of selected user.Figure 2 shows the screen presented when the Finance Manager (Peter Pan) is selected.



STaff Ad Resource MANagement (STARMAN)

Managed Users

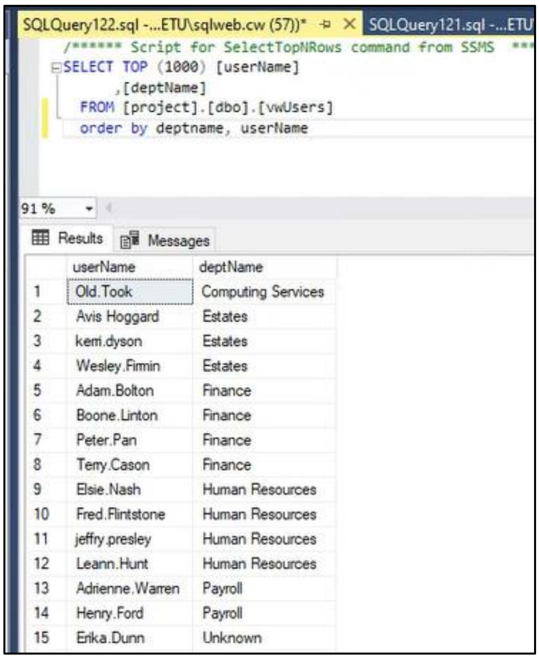
Peter.Pan
Boone.Linton
Terry.Cason
Adam.Bolton

Unassigned Resources

Assigned Resources

Figure 2: Test WFEU002 - Check emulation of selected user.

The second part of this test is to check the Users table in the SQL database to ensure that the staff managed by the Finance Manager are correct. Figure 3 shows the list of staff members in the Finance Department.

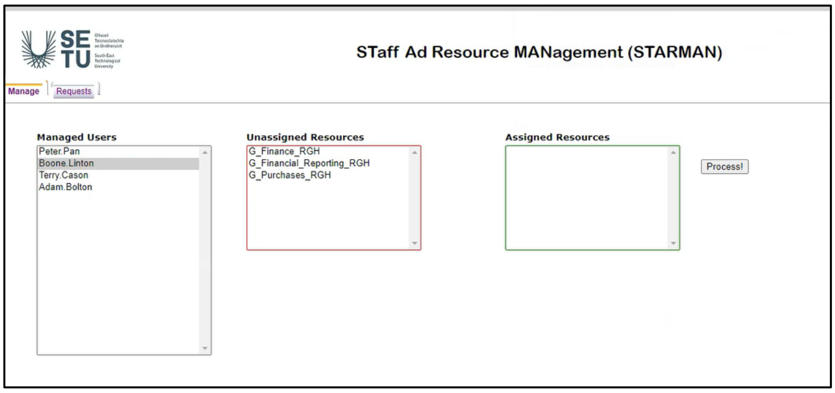


```
/****** Script for SelectTopNRows command from SSMS ***
SELECT TOP (1000) [userName]
      ,[deptName]
  FROM [project].[dbo].[vwUsers]
  order by deptname, userName
```

	userName	deptName
1	Old.Took	Computing Services
2	Avis Hoggard	Estates
3	kerri.dyson	Estates
4	Wesley.Firmin	Estates
5	Adam.Bolton	Finance
6	Boone.Linton	Finance
7	Peter.Pan	Finance
8	Terry.Cason	Finance
9	Elsie.Nash	Human Resources
10	Fred.Flintstone	Human Resources
11	jeffry.presley	Human Resources
12	Leann.Hunt	Human Resources
13	Adrienne.Warren	Payroll
14	Henry.Ford	Payroll
15	Erika.Dunn	Unknown

Figure 3: Test WFEU002 - List of users by department for verification

WFEU003 – Managed User Selection



STaff Ad Resource MANagement (STARMAN)

Managed Users

Peter.Pan
Boone.Linton
Terry.Cason
Adam.Bolton

Unassigned Resources

G_Finance_RGH
G_Financial_Reporting_RGH
G_Purchases_RGH

Assigned Resources

Figure 4: Test WFEU003 - Select user and review resource assignment

WFEU004 - Select Unassigned Resource

When an item in the *Unassigned Resources* list is selected, the ***Move Right*** button should appear to allow the resource to be assigned. Figure 5 shows the outcome of this test.

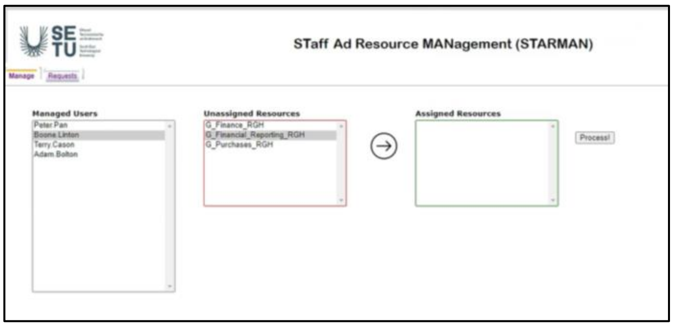


Figure 5: Test WFEU004 - Select Unassigned Resource

WFEU005 – Assign a Resource

When the ***Move Right*** button is clicked, the selected resource should disappear from the *Unassigned Resources* list and appear in the *Assigned Resources* list. Figure 6 shows the result of this test.

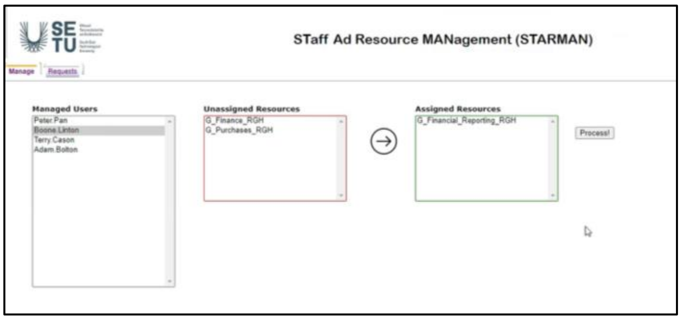
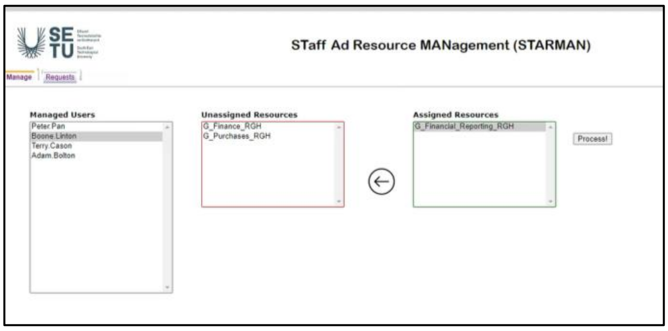


Figure 6: Test WFEU005 - Assign a Resource

WFEU006 – Select Assigned Resource

When an item in the *Assigned Resources* list is selected, the ***Move Left*** button should appear. Figure 7 shows the result of this test.



Managed Users

- Peter.Pan
- Boone.Linton
- Terry.Cason
- Adam.Bolton

Unassigned Resources

- G_Finance_RGH
- G_Purchases_RGH

Assigned Resources

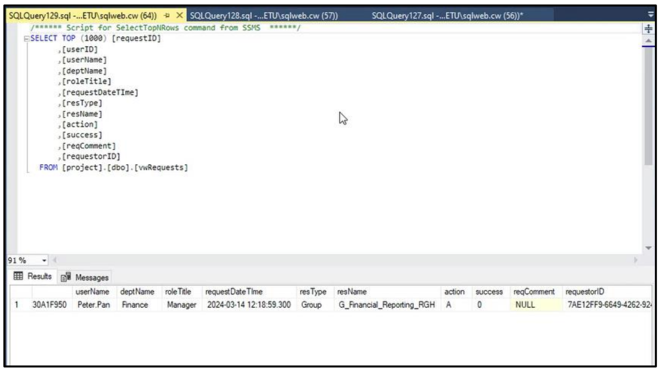
- G_Financial_Reporting_RGH

Figure 7: Test WFEU006 - Select Assigned Resource

WFEU007 – Process Resource Assignments

Once a resource (un)assignment choice has been made, it needs to be processed. Clicking the ***Process*** button submits the request. The process reviews the original entries in both lists and determines if any changes have been made.

A record is written to the database in the background for each change request action. Figure 8 shows the record displayed in the database for the assignment requested.



SQLQuery129.sql -...ETU\sqlweb.cw (64))
SQLQuery128.sql -...ETU\sqlweb.cw (57))
SQLQuery127.sql -...ETU\sqlweb.cw (56))*
91 %
Results
Messages

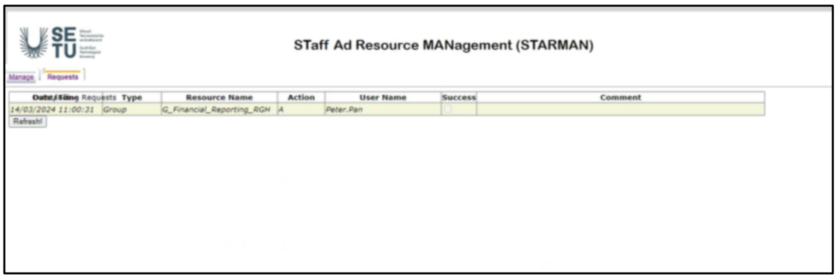
```
/****** Script for SelectTopNRows command from SSMS  ******/
SELECT TOP (1000) [requestID]
      ,[userID]
      ,[userName]
      ,[deptName]
      ,[roleTitle]
      ,[requestDateTIme]
      ,[resType]
      ,[resName]
      ,[action]
      ,[success]
      ,[reqComment]
      ,[requestorID]
  FROM [project].[dbo].[vwRequests]
```

		userName	deptName	roleTitle	requestDateTIme	resType	resName	action	success	reqComment	requestorID
1	30A1F950	Peter.Pan	Finance	Manager	2024-03-14 12:18:59.300	Group	G_Financial_Reporting_RGH	A	0	NULL	7AE12FF9-6649-4262-92

Figure 8: Test WFEU007 - Check request exists in database

WFEU008 – Review Outstanding Requests

Resource assignment requests are processed in the background by the console application. At any time, a manager can review their outstanding requests. Clicking the **Requests** tab will display the list of outstanding requests for the manager. Figure 9 shows the result of this check.



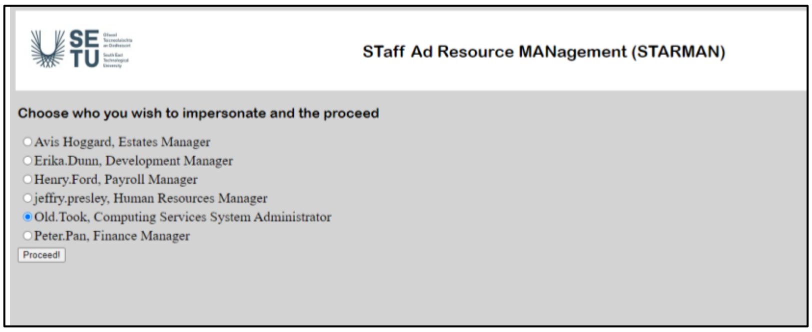
STaff Ad Resource MANagement (STARMAN)

Date/Time	Type	Resource Name	Action	User Name	Success	Comment
14/03/2024 11:00:31	Group	G_Financial_Reporting_RGH	A	Peter.Pan	□	

Figure 9: Test WFEU008 - List of outstanding requests

WFEA001 – Select Administrator

When the front-end application starts in test mode, a list of potential users is presented. To act as a system administrator, select ***Old.Took*** from the list of users presented and click the **Proceed** button.



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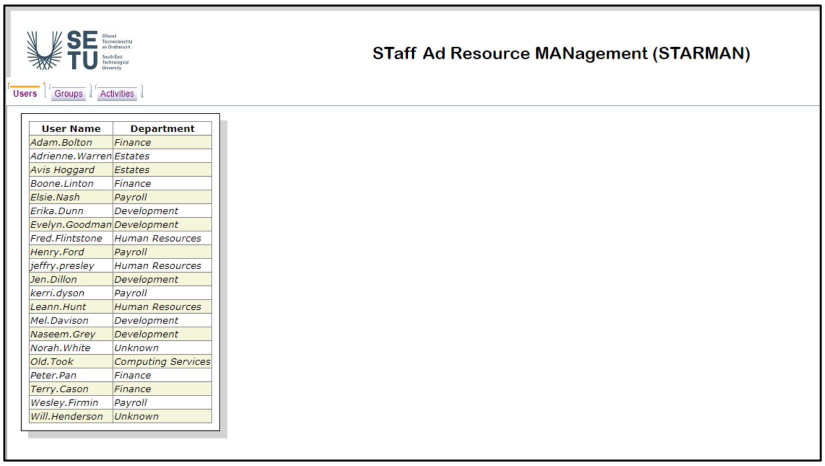
Choose who you wish to impersonate and the proceed

○ Avis Hoggard, Estates Manager
○ Erika.Dunn, Development Manager
○ Henry.Ford, Payroll Manager
○ jeffry.presley, Human Resources Manager
● Old.Took, Computing Services System Administrator
○ Peter.Pan, Finance Manager

Figure 10: Test WFEA001 - Select Administrator user

Once the **Proceed** button is clicked, the Administrator interface should appear. It should look something like the screenshot in Figure 11.



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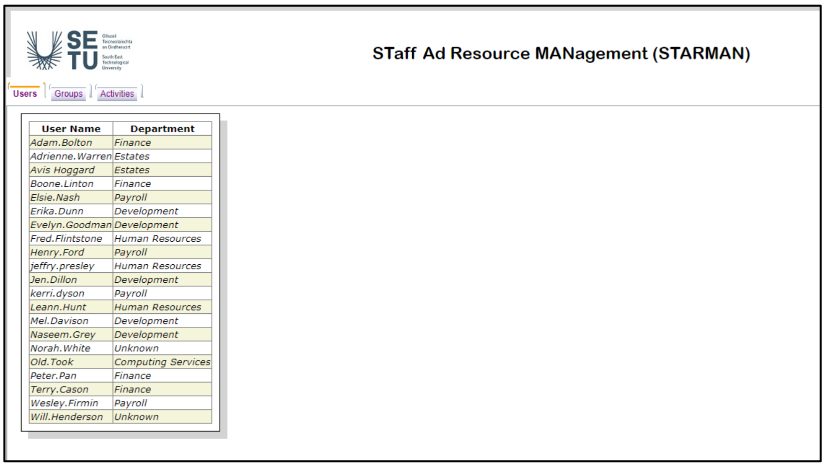
User Name	Department
Adam.Bolton	Finance
Adrienne.Warren	Estates
Avis Hoggard	Estates
Boone.Linton	Finance
Elsie.Nash	Payroll
Erika.Dunn	Development
Evelyn.Goodman	Development
Fred.Flintstone	Human Resources
Henry.Ford	Payroll
jeffry.presley	Human Resources
Jen.Dillon	Development
kerri.dyson	Payroll
Leann.Hunt	Human Resources
Mel.Davison	Development
Naseem.Grey	Development
Norah.White	Unknown
Old.Took	Computing Services
Peter.Pan	Finance
Terry.Cason	Finance
Wesley.Firmin	Payroll
Will.Henderson	Unknown

Figure 11: Test WFEA001 - The Administrator interface

WFEA002 – Review User List

On the ***Users*** tab on the administrator screen, a list of users should be visible. This list should show the name of each user in the system and their department. This list should be sorted in alphabetical order by name.



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User Name	Department
Adam.Bolton	Finance
Adrienne.Warren	Estates
Avis Hoggard	Estates
Boone.Linton	Finance
Elsie.Nash	Payroll
Erika.Dunn	Development
Evelyn.Goodman	Development
Fred.Flintstone	Human Resources
Henry.Ford	Payroll
jeffry.presley	Human Resources
Jen.Dillon	Development
kerri.dyson	Payroll
Leann.Hunt	Human Resources
Mel.Davison	Development
Naseem.Grey	Development
Norah.White	Unknown
Old.Took	Computing Services
Peter.Pan	Finance
Terry.Cason	Finance
Wesley.Firmin	Payroll
Will.Henderson	Unknown

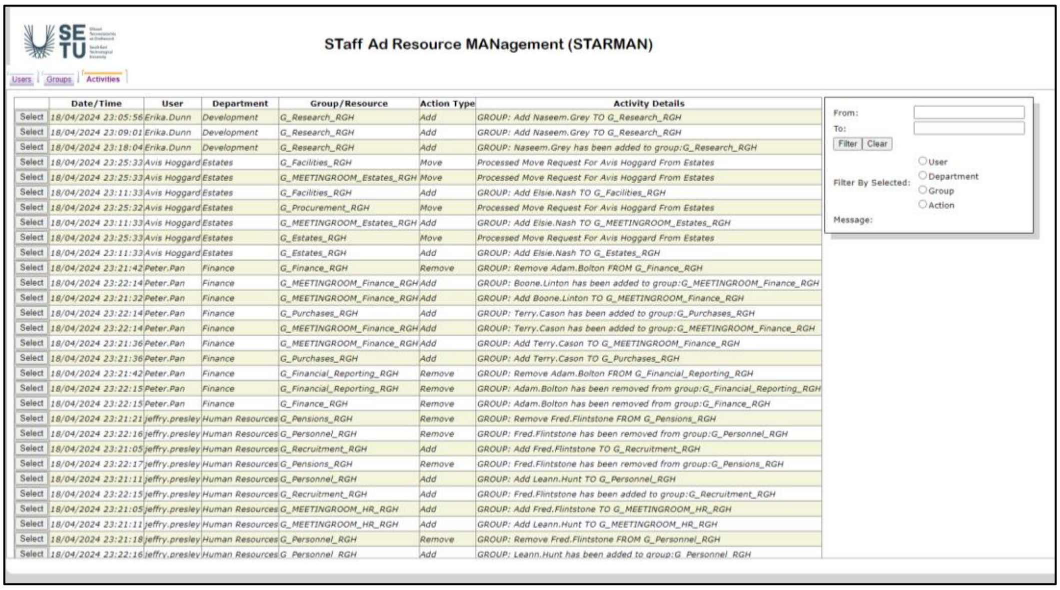
Figure 12: Administrator interface list of users in the application database

The accuracy of this list is checked by comparing the on-screen list to what is stored in the application database. **Error! Reference source not found.** shows the data found in the database,

Figure 13: User list in the application database

WFEA003 – Review Activities List

On the ***Activities*** tab on the administrator list, a list of all activities completed by users within the system is presented. This list should show all the activities recorded in the application database. The contents of the list should be compared to the data in the application database to validate.



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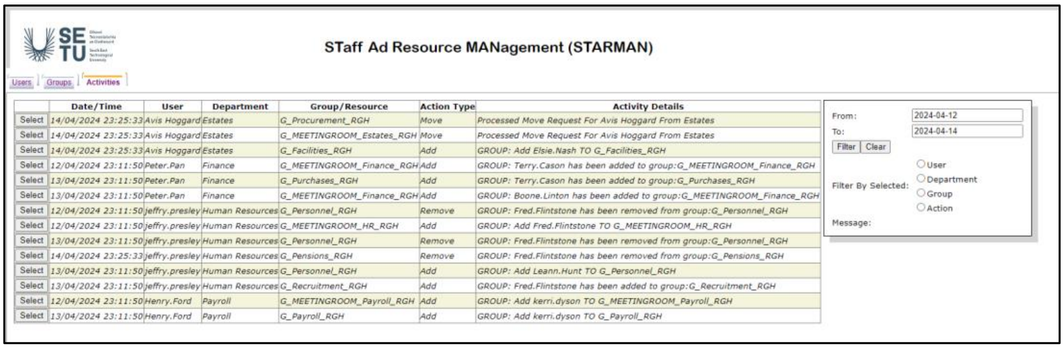
	Date/Time	User	Department	Group/Resource	Action Type	Activity Details
Select	18/04/2024 23:05:56	Erika.Dunn	Development	G_Research_RGH	Add	GROUP: Add Naseem.Grey TO G_Research_RGH
Select	18/04/2024 23:09:01	Erika.Dunn	Development	G_Research_RGH	Add	GROUP: Add Naseem.Grey TO G_Research_RGH
Select	18/04/2024 23:18:04	Erika.Dunn	Development	G_Research_RGH	Add	GROUP: Naseem.Grey has been added to group:G_Research_RGH
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_Facilities_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_MEETINGROOM_Estates_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_Facilities_RGH	Add	GROUP: Add Elsie.Nash TO G_Facilities_RGH
Select	18/04/2024 23:25:32	Avis Hoggard	Estates	G_Procurement_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_MEETINGROOM_Estates_RGH	Add	GROUP: Add Elsie.Nash TO G_MEETINGROOM_Estates_RGH
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_Estates_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_Estates_RGH	Add	GROUP: Add Elsie.Nash TO G_Estates_RGH
Select	18/04/2024 23:21:42	Peter.Pan	Finance	G_Finance_RGH	Remove	GROUP: Remove Adam.Bolton FROM G_Finance_RGH
Select	18/04/2024 23:22:14	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Boone.Linton has been added to group:G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:21:32	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Add Boone.Linton TO G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:22:14	Peter.Pan	Finance	G_Purchases_RGH	Add	GROUP: Terry.Cason has been added to group:G_Purchases_RGH
Select	18/04/2024 23:22:14	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Terry.Cason has been added to group:G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:21:36	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Add Terry.Cason TO G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:21:36	Peter.Pan	Finance	G_Purchases_RGH	Add	GROUP: Add Terry.Cason TO G_Purchases_RGH
Select	18/04/2024 23:21:42	Peter.Pan	Finance	G_Financial_Reporting_RGH	Remove	GROUP: Remove Adam.Bolton FROM G_Financial_Reporting_RGH
Select	18/04/2024 23:22:15	Peter.Pan	Finance	G_Financial_Reporting_RGH	Remove	GROUP: Adam.Bolton has been removed from group:G_Financial_Reporting_RGH
Select	18/04/2024 23:22:15	Peter.Pan	Finance	G_Finance_RGH	Remove	GROUP: Adam.Bolton has been removed from group:G_Finance_RGH
Select	18/04/2024 23:21:21	jeffry.presley	Human Resources	G_Pensions_RGH	Remove	GROUP: Remove Fred.Flintstone FROM G_Pensions_RGH
Select	18/04/2024 23:22:16	jeffry.presley	Human Resources	G_Personnel_RGH	Remove	GROUP: Fred.Flintstone has been removed from group:G_Personnel_RGH
Select	18/04/2024 23:21:05	jeffry.presley	Human Resources	G_Recruitment_RGH	Add	GROUP: Add Fred.Flintstone TO G_Recruitment_RGH
Select	18/04/2024 23:22:17	jeffry.presley	Human Resources	G_Pensions_RGH	Remove	GROUP: Fred.Flintstone has been removed from group:G_Pensions_RGH
Select	18/04/2024 23:21:11	jeffry.presley	Human Resources	G_Personnel_RGH	Add	GROUP: Add Leann.Hunt TO G_Personnel_RGH
Select	18/04/2024 23:22:15	jeffry.presley	Human Resources	G_Recruitment_RGH	Add	GROUP: Fred.Flintstone has been added to group:G_Recruitment_RGH
Select	18/04/2024 23:21:05	jeffry.presley	Human Resources	G_MEETINGROOM_HR_RGH	Add	GROUP: Add Fred.Flintstone TO G_MEETINGROOM_HR_RGH
Select	18/04/2024 23:21:11	jeffry.presley	Human Resources	G_MEETINGROOM_HR_RGH	Add	GROUP: Add Leann.Hunt TO G_MEETINGROOM_HR_RGH
Select	18/04/2024 23:21:18	jeffry.presley	Human Resources	G_Personnel_RGH	Remove	GROUP: Remove Fred.Flintstone FROM G_Personnel_RGH
Select	18/04/2024 23:22:16	jeffry.presley	Human Resources	G_Personnel_RGH	Add	GROUP: Leann.Hunt has been added to group:G_Personnel_RGH

From:
To:
Filter | Clear
Filter By Selected: ○ User ○ Department ○ Group ○ Action
Message:

Figure 14: WFEA003 - Review Activities List

WFEA004 – Filter Activities by Date

To test filtering by date, a set of dates is entered and the filter applied to the database. To check accuracy, the verified (WFEA0003) unfiltered list can be checked for entries and compared to what is found when the list is filtered.



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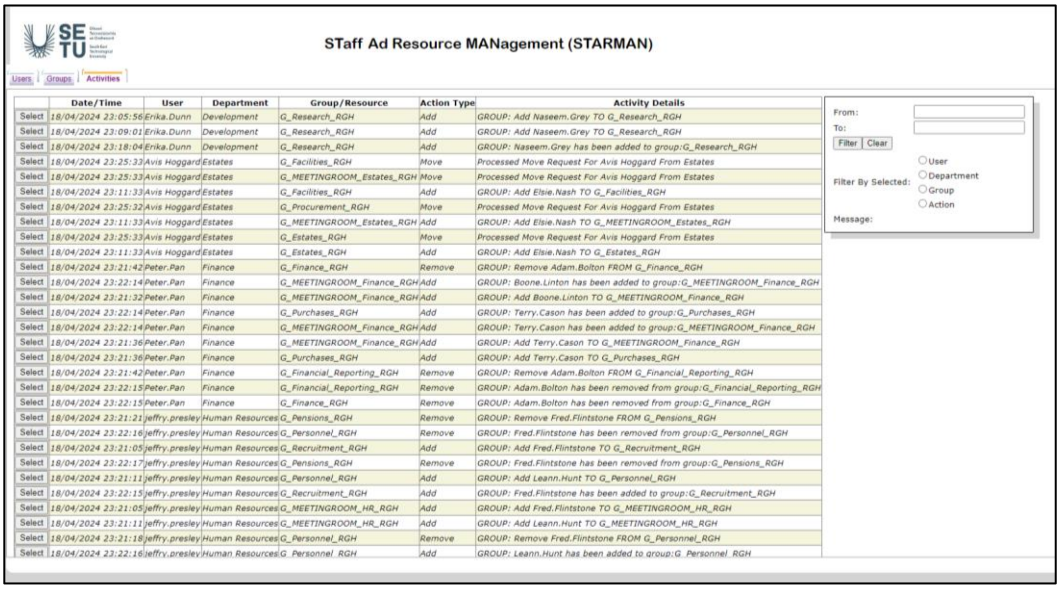
	Date/Time	User	Department	Group/Resource	Action Type	Activity Details
Select	14/04/2024 23:25:33	Avis Hoggard	Estates	G_Procurement_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	14/04/2024 23:25:33	Avis Hoggard	Estates	G_MEETINGROOM_Estates_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	14/04/2024 23:25:33	Avis Hoggard	Estates	G_Facilities_RGH	Add	GROUP: Add Elsie.Nash TO G_Facilities_RGH
Select	12/04/2024 23:11:50	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Terry.Cason has been added to group:G_MEETINGROOM_Finance_RGH
Select	13/04/2024 23:11:50	Peter.Pan	Finance	G_Purchases_RGH	Add	GROUP: Terry.Cason has been added to group:G_Purchases_RGH
Select	13/04/2024 23:11:50	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Boone.Linton has been added to group:G_MEETINGROOM_Finance_RGH
Select	12/04/2024 23:11:50	jeffry.presley	Human Resources	G_Personnel_RGH	Remove	GROUP: Fred.Flintstone has been removed from group:G_Personnel_RGH
Select	12/04/2024 23:11:50	jeffry.presley	Human Resources	G_MEETINGROOM_HR_RGH	Add	GROUP: Add Fred.Flintstone TO G_MEETINGROOM_HR_RGH
Select	13/04/2024 23:11:50	jeffry.presley	Human Resources	G_Personnel_RGH	Remove	GROUP: Fred.Flintstone has been removed from group:G_Personnel_RGH
Select	14/04/2024 23:25:33	jeffry.presley	Human Resources	G_Pensions_RGH	Remove	GROUP: Fred.Flintstone has been removed from group:G_Pensions_RGH
Select	13/04/2024 23:11:50	jeffry.presley	Human Resources	G_Personnel_RGH	Add	GROUP: Add Leann.Hunt TO G_Personnel_RGH
Select	13/04/2024 23:11:50	jeffry.presley	Human Resources	G_Recruitment_RGH	Add	GROUP: Fred.Flintstone has been added to group:G_Recruitment_RGH
Select	12/04/2024 23:11:50	Henry.Ford	Payroll	G_MEETINGROOM_Payroll_RGH	Add	GROUP: Add kerri.dyson TO G_MEETINGROOM_Payroll_RGH
Select	13/04/2024 23:11:50	Henry.Ford	Payroll	G_Payroll_RGH	Add	GROUP: Add kerri.dyson TO G_Payroll_RGH

From: 2024-04-12
To: 2024-04-14
Filter | Clear
Filter By Selected: ○ User ○ Department ○ Group ○ Action
Message:

Figure 15: WFEA004 - Filter Activities by Date

WFEA005 – Clear Filter

When the **Clear** button is clicked, any applied filters should be removed and the full list of activities should be displayed. The accuracy of this can be tested by clicking the **Clear** button and comparing the resulting list of activities to the checked list at WFEA001.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	Date/Time	User	Department	Group/Resource	Action Type	Activity Details
Select	18/04/2024 23:05:56	Erika.Dunn	Development	G_Research_RGH	Add	GROUP: Add Naseem.Grey TO G_Research_RGH
Select	18/04/2024 23:09:01	Erika.Dunn	Development	G_Research_RGH	Add	GROUP: Add Naseem.Grey TO G_Research_RGH
Select	18/04/2024 23:18:04	Erika.Dunn	Development	G_Research_RGH	Add	GROUP: Naseem.Grey has been added to group:G_Research_RGH
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_Facilities_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_MEETINGROOM_Estates_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_Facilities_RGH	Add	GROUP: Add Elsie.Nash TO G_Facilities_RGH
Select	18/04/2024 23:25:32	Avis Hoggard	Estates	G_Procurement_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_MEETINGROOM_Estates_RGH	Add	GROUP: Add Elsie.Nash TO G_MEETINGROOM_Estates_RGH
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_Estates_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_Estates_RGH	Add	GROUP: Add Elsie.Nash TO G_Estates_RGH
Select	18/04/2024 23:21:42	Peter.Pan	Finance	G_Finance_RGH	Remove	GROUP: Remove Adam.Bolton FROM G_Finance_RGH
Select	18/04/2024 23:22:14	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Boone.Linton has been added to group:G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:21:32	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Add Boone.Linton TO G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:22:14	Peter.Pan	Finance	G_Purchases_RGH	Add	GROUP: Terry.Cason has been added to group:G_Purchases_RGH
Select	18/04/2024 23:22:14	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Terry.Cason has been added to group:G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:21:36	Peter.Pan	Finance	G_MEETINGROOM_Finance_RGH	Add	GROUP: Add Terry.Cason TO G_MEETINGROOM_Finance_RGH
Select	18/04/2024 23:21:36	Peter.Pan	Finance	G_Purchases_RGH	Add	GROUP: Add Terry.Cason TO G_Purchases_RGH
Select	18/04/2024 23:21:42	Peter.Pan	Finance	G_Financial_Reporting_RGH	Remove	GROUP: Remove Adam.Bolton FROM G_Financial_Reporting_RGH
Select	18/04/2024 23:22:15	Peter.Pan	Finance	G_Financial_Reporting_RGH	Remove	GROUP: Adam.Bolton has been removed from group:G_Financial_Reporting_RGH
Select	18/04/2024 23:22:15	Peter.Pan	Finance	G_Finance_RGH	Remove	GROUP: Adam.Bolton has been removed from group:G_Finance_RGH
Select	18/04/2024 23:21:21	jeffry.presley	Human Resources	G_Pensions_RGH	Remove	GROUP: Remove Fred.Flintstone FROM G_Pensions_RGH
Select	18/04/2024 23:22:16	jeffry.presley	Human Resources	G_Personnel_RGH	Remove	GROUP: Fred.Flintstone has been removed from group:G_Personnel_RGH
Select	18/04/2024 23:21:05	jeffry.presley	Human Resources	G_Recruitment_RGH	Add	GROUP: Add Fred.Flintstone TO G_Recruitment_RGH
Select	18/04/2024 23:22:17	jeffry.presley	Human Resources	G_Pensions_RGH	Remove	GROUP: Fred.Flintstone has been removed from group:G_Pensions_RGH
Select	18/04/2024 23:21:11	jeffry.presley	Human Resources	G_Personnel_RGH	Add	GROUP: Add Leann.Hunt TO G_Personnel_RGH
Select	18/04/2024 23:22:15	jeffry.presley	Human Resources	G_Recruitment_RGH	Add	GROUP: Fred.Flintstone has been added to group:G_Recruitment_RGH
Select	18/04/2024 23:21:05	jeffry.presley	Human Resources	G_MEETINGROOM_HR_RGH	Add	GROUP: Add Fred.Flintstone TO G_MEETINGROOM_HR_RGH
Select	18/04/2024 23:21:11	jeffry.presley	Human Resources	G_MEETINGROOM_HR_RGH	Add	GROUP: Add Leann.Hunt TO G_MEETINGROOM_HR_RGH
Select	18/04/2024 23:21:18	jeffry.presley	Human Resources	G_Personnel_RGH	Remove	GROUP: Remove Fred.Flintstone FROM G_Personnel_RGH
Select	18/04/2024 23:22:16	jeffry.presley	Human Resources	G_Personnel_RGH	Add	GROUP: Leann.Hunt has been added to group:G_Personnel_RGH

From:

To:

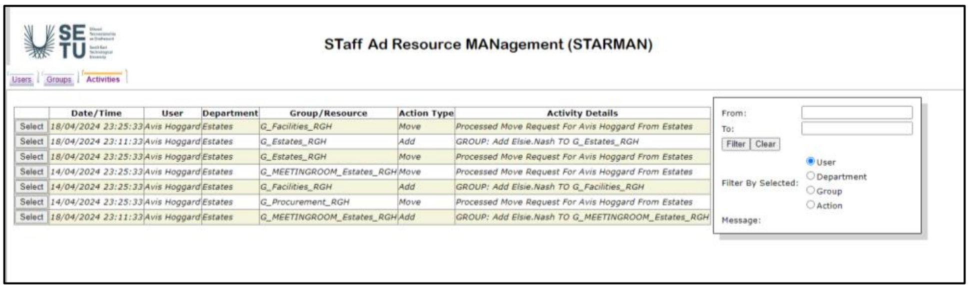
Filter By Selected: ○ User ○ Department ○ Group ○ Action

Message:

Figure 16: Test WFEA0004   Clear Filter test outcome

WFEA006 – Filter Activities by User

When filtering by user, the resultant filtered list should be compared to the unfiltered verified (WFEA001) list of activities to ensure that all expected users are present.


STaff Ad Resource MANagement (STARMAN)

	Date/Time	User	Department	Group/Resource	Action Type	Activity Details
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_Facilities_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_Estates_RGH	Add	GROUP: Add Elsie.Nash TO G_Estates_RGH
Select	18/04/2024 23:25:33	Avis Hoggard	Estates	G_Estates_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	14/04/2024 23:25:33	Avis Hoggard	Estates	G_MEETINGROOM_Estates_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	14/04/2024 23:25:33	Avis Hoggard	Estates	G_Facilities_RGH	Add	GROUP: Add Elsie.Nash TO G_Facilities_RGH
Select	14/04/2024 23:25:33	Avis Hoggard	Estates	G_Procurement_RGH	Move	Processed Move Request For Avis Hoggard From Estates
Select	18/04/2024 23:11:33	Avis Hoggard	Estates	G_MEETINGROOM_Estates_RGH	Add	GROUP: Add Elsie.Nash TO G_MEETINGROOM_Estates_RGH

From:

To:

Filter By Selected: ● User ○ Department ○ Group ○ Action

Message:

Figure 17: Test WFEA005 - Activities filtered by user