# **Logo, company name Description automatically generatedPreliminary Report**

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Description automatically generated**Project Name:** Friendly Fedora

## **Project #:** 22-302

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## **Faculty Mentor:** Professor Vokkarane

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# **Introduction**

The goal of this project is to develop a Fedora distribution based on the existing Fedora operating system. This Fedora distribution should be easily installable as well as include applications that are universally used by UMass Lowell’s students and faculty. Last year's team continued the progress of this project from the first group who worked on this project. Their major contributions included surveying UML students to better understand what are their preferred qualities of a Linux distribution and assess the Fedora Operating System’s relative popularity, used Linux club documents created in 2020 to start and maintain an official UMass Lowell Open-Source Club (OSC), continued to build and modify packages in preparation for a successful distribution of the Friendly Fedora OS, and worked with UML Computer Science Lab management to promote the use of Fedora OS on their Linux machines [2].

In this report, we provide the following information: an introduction to the project, client information, project information, a problem statement, an objective statement, research pertaining to the differences between popular Linux distribution, a summary of our report context, and a list of references used.

# **Client Information**

This project is sponsored by Red Hat. Red Hat is the world’s leading provider of enterprise open-source solutions—including Linux, cloud, container, and Kubernetes [2]. They deliver established and reliable software solutions that make it easier for global companies to work across platforms and environments, from the core datacenter to the network edge. The open-source development model used by Red Hat allows interested developers to contribute to open-source projects alongside the Red Hat software team [3].

Red Hat has partnered with UMass Lowell on the Friendly Fedora project to develop an understanding of what features are needed to develop the best Fedora distribution for UMass Lowell students and faculty. Their goal is to provide a better Linux experience at the university level and allow Capstone students to gain experience developing, testing, and supporting kernel software [2].

# **Project Information**

## **3.1 Initial Project Description:**

After meeting with our faculty advisor and our industry sponsor, we have been asked to build a “friendly” Fedora Linux system to better serve the students and faculty in the UMass Lowell community. The Fedora distribution should support popular student applications and other features needed for a reliable and full-featured laptop.

This multiyear project has been worked on by two previous capstone teams. The first team made significant research contributions and last year's team added to the progress made on this project by surveying UML students to better understand what are their preferred qualities of a Linux distribution and assess the Fedora Operating System’s relative popularity, using Linux club documents created in 2020 to start and maintain an official UMass Lowell Open-Source Club (OSC), continuing to build and modify packages in preparation for a successful distribution of the Friendly Fedora OS, and working with UML Computer Science Lab management to promote the use of Fedora OS on their Linux machines [3].

## **3.2 Expected Deliverables:**

The following deliverables are expected this semester:

1. Gain a thorough understanding of Fedora Linux distribution.
2. Become familiar with the GitHub source control features.
3. Research the differences between Fedora and other popular Linux distributions with specific emphasis on the Graphic User Interface (GUI).
4. Using previous teams' documentation, design a Fedora distribution that meets the requirements of the UMass Lowell student and faculty community.
5. Design and develop requirements and technical documentation for the Friendly Fedora.

## **3.3 Benefits:**

The following benefits will be established during this project:

1. The packages in this Fedora Distribution will contain features that will enhance the user experience for UMass Lowell students and faculty.

# **Problem Statement**

According to the research done by the first team to work on this project, “Most students and faculty at UMass Lowell do not use Linux as their primary operating system” [1]. It was established that the primary reason why students do not frequently use Linux as their primary operating system is due to the limited applications and features available on Linux operating systems in comparison to other more popular operating systems such as Windows. Fedora and Ubuntu are among the most popular Linux distributions, but students at University of Massachusetts Lowell who use Linux on their laptops usually choose Ubuntu as their primary distribution due to ease of installation [3]. *Therefore, the problem is that out of all the UMass Lowell Linux users, the majority prefer to use an Ubuntu distribution rather than a Fedora distribution. The fundamental characteristic that needs to be implemented to improve the usage rate of Fedora in the UMass Lowell student and faculty community is to meet their operating system needs.*

# **Objective Statement**

The objective of this project is to build a “Friendly Fedora” open-source Linux distribution that enhances the user experience of UMass Lowell’s students and faculty by meeting their operating system needs.

# **Research**

Below is a detailed comparison between Fedora and several other leading Linux distributions. The objective of these comparisons is to identify the positive and negative characteristics of Fedora as well as identifying positive characteristics that other Linux distributions have that could be incorporated into Fedora to improve the user experience.

## **6.1 Fedora vs Ubuntu**

Fedora Linux is a Linux distribution which has been developed by the Fedora Project []. There are several well know Linux distributions which are broadly used throughout industry and academia, each of which poses their own unique characteristics and user experience. Fedora is one of the most popular Linux based distributions. It contains software distributed under various sources, including free and open-sources, and is currently identified as a distribution which is a leader in open-source technologies [2]. Fedora is also a fundamental source for Red Hat Enterprise Linux and every six months a new version of Fedora Linux is released [3]. Additionally, Fedora can be installed and run on a desktop or laptop, but also can be installed and run on a virtual machine which ensures that the Linux distribution can be utilized by users across several types of operating systems.

The Ubuntu Linux distribution is composed of free and open-source software. It is based on the Debian Linux based distribution and as a result some of its characteristics resemble Debian [4]. Specifically, the Ubuntu architecture and infrastructure has primarily been built off Debian architecture and infrastructure. Ubuntu packages are also based on the packages of the Debian Linux distribution with both distributions utilizing deb package format as well as package management tools [4]. However, this does not mean that the packages of these two Linux distributions are compatible. Ubuntu is known for having three active editions, namely the desktop, server, and core editions. The core edition is a popular Linux distribution in the robotics community and is often used for Internet of Things (IoT) devices [4]. Other popular uses of Ubuntu include cloud computing. Furthermore, Ubuntu can be installed and run on a desktop or laptop, but also can be installed and run on a virtual machine which ensures that the Linux distribution can be utilized by users across several types of operating systems.

Both Fedora and Ubuntu distributions possess positive and negative characteristics that were observed while during user interaction. These differences were primarily observed at the Graphical User Interface (GUI) level of the distributions. However, while installing and setting up the distributions on a virtual machine, several characteristics were observed that are important to mention in this comparison since the installation process is the first point of contact between the user and the distribution. When installing Fedora and Ubuntu on a desktop or in a virtual machine, the entire process takes between 5 – 10 minutes [5]. This is a positive characteristic as it ensures that the wait time for the user to begin engaging with the distribution is short. Additionally, the installation process also ensures that all updates are included in the installation process to ensure that users begin with the most up to date version of the distribution [5]. This is a very positive quality that both distributions possess and is a great starting point for user interaction with these distributions as it ensures maximum chance of a positive user experience.

The Graphical User Interface (GUI) of Ubuntu and Fedora both use the GNOME desktop environment by default [5]. However, Fedora uses the standard GNOME GUI whereas Ubuntu has customized the GNOME GUI so that it resembles a Unity desktop. Upon initializing the Ubuntu and Fedora Linux distributions, several differences on the desktop are observed. Namely, the activities bar on the left-hand side of the desktop is much larger for Ubuntu than it is for Fedora. Using a larger activities bar may be desirable for users because it helps to clearly track activities across several applications at once. However, Fedora has a search bar present at the top of the desktop and Ubuntu does not have a visible search bar. This search bar is a very positive feature since it allows the user to navigate the system a lot more freely. Additionally, the fact that the search bar is almost in alignment with the users' eyes is great because it directs the user straight to the search bar to find anything they need. Another difference that was observed was that Ubuntu had the ability to minimize applications once they were opened. The method was similar to the method used on a windows operating system. However, Fedora did not have an intuitive method of minimizing applications once they were opened. Thus, making it difficult to navigate between applications while using the system.

The Ubuntu distribution supports a variety of applications which helps ensure that the user is comfortable with the accessibility standpoint of the Ubuntu distribution [15]. For example, users have access to commonly used integrated development environments, communication applications for instant messaging, internet access through a variety of applications such as Firefox and Chromium, as well as music streaming applications such as Spotify. Similarly, Fedora possesses the same accessibility characteristics as Ubuntu. Both GUI’s support the ability to customize the desktop experience which helps ensure that the user experience can be tailored to the user's needs. The terminal is easily accessible while working on Ubuntu and Fedora. This is a fundamental characteristic as the entire system can be accessed through the terminal and most Linux users require terminal access.

Other superficial differences between the Fedora and Ubuntu distributions were observed when becoming familiar with the two distributions. Some of these differences included the theme color of the desktop and the slightly different locations of the applications. While these differences do not yield a specific positive or negative trait, it is worth mentioning due to the fact that it may become more relevant at a later stage in the project. Overall, it would appear that the Ubuntu and Fedora Linux distributions have many similarities in terms of graphical user interface and user experience. This aligns well with the fact that these two Linux distributions are among the most popular Linux distributions.

**6.2 Fedora vs OpenSUSE**

**6.3 Fedora vs Linux Mint**

Comparison between Microsoft Windows, Fedora Linux, and Linux Mint Operating Systems.

When we compare Linux to other ecosystems like those from Microsoft and Apple, we find that Microsoft’s Windows and Apple’s macOS are closed source systems and Linux is an open source system. Windows and macOS do not have their source codes readily available for others to use and build upon, but Linux source codes are officially available for others to copy, modify and improve. We will be comparing the Graphical User Interfaces of Fedora Linux with that of Linux Mint, using Windows GUI as a frame of reference.

**Graphical User Interface**:

The Graphical User Interfaces of Microsoft Windows 10, Fedora Linux 36, and Linux Mint Operating Systems have some similarities and some differences. When we discuss about the similarities regarding some aspects of the Graphical User Interface, we understand that some features are similar in two out of the three Operating Systems, and are different in the third Operating System, whereas some features might be different in all the three Operating Systems.

Here are some of the aspects of the Graphical User Interface and the similarities and differences between the Operating Systems.

**1. Desktop / Home Page**:

The default Desktop or Home Page is usually the first landing page that gets displayed when a user boots up the computer and signs into the Operating System. After careful observation of the Desktops of the three Operating Systems, we realize that Microsoft Windows and Linux Mint have a similar Desktop Layout, with the Start Button at the bottom left, and the expanded menus getting displayed when the Start Button is clicked. Windows 11 brought the Start Button towards the center of the taskbar at the bottom of the display, but traditionally, from Windows 95 to Windows 10, the Start Button has been present at the bottom left of the display, with Windows 8 being the only exception. However, Fedora Linux seems to be different here as the ‘Activities’ Button at the top left of the display works like the equivalent of a Start Button. Clicking on the Activities button expands the menu, and we can search for more apps in the ‘Type to search’ field which is at the top of the display. In addition to this, while Windows and Linux Mint have the names of actively running programs displayed at the bottom on the taskbar as a minimized window, Fedora has the names of actively running programs next to the Activities Tab at the top. Even system related icons like volume, network, battery etc. are displayed at the bottom right in Windows and Linux Mint, and at the top right in Fedora. Some apps are also displayed at the bottom center of the display in Fedora, but the structure equivalent to a taskbar is at the top.

A screenshot of a computer

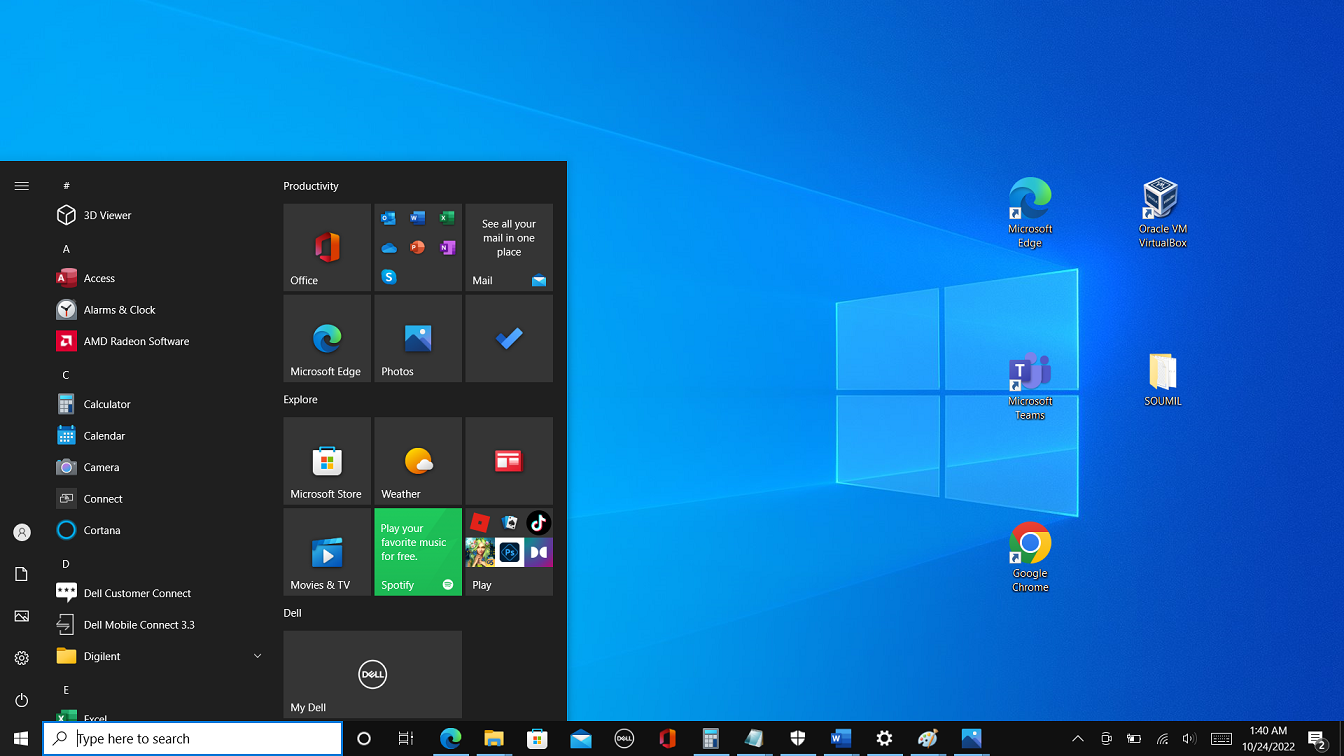
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The screenshot shown above is a Fedora 36 Desktop.

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The screenshot shown above is a Linux Mint Desktop.



The screenshot shown above is a Windows 10 Desktop.

**2. Scrolling and Scroll Bars**:

Scroll bars are used in almost every Desktop Operating System to handle content that does not fit in the viewable area of the screen. After scrolling through content on Windows and Fedora Linux Operating Systems, it is observed that in Windows, if we click anywhere on the vertical scroll line below the scroll bar, the page scrolls down just enough to show the user the next subset of the content. But in Fedora Linux, if we click below the scroll bar, the amount by which the content on the page scrolls down depends on where we clicked. If we clicked just below the scroll bar, the page would scroll down just enough to display the next subset of the content. But if we clicked on the vertical scroll line towards the bottom of the page, the page scrolls all the way towards the bottom most subset of the content.

In this aspect of the Graphical User Interface, Fedora Linux is similar to Linux Mint, with scroll bars responding identically to user clicks.

**3. File / Folder System**:

The Graphical User Interface of the File / Folder System in Fedora is similar to the one used in Linux Mint and Windows. The outermost structure is a rectangular window with buttons on the top right to minimize, maximize and close the window. The depth of nested folders within folders is large enough for users’ needs. However, Windows uses single letters for partitions on Hard Drive or Solid State Drive, with C: representing the Operating System partition, and subsequent letters representing other partitions.

**4. Hovering the mouse pointer on files with long names**:

In Fedora, when we hover the mouse pointer over the icon of an app whose name is partially displayed because of space limitations, the full name of the app appears. Whereas in Windows, when we hover the mouse pointer over the icon of a file with a long name, a temporary rectangular bubble appears and displays the full name of the file, in addition to its file size and last modified date. In Linux Mint, the files with long names have their entire names displayed.

**5. Downloading Apps**:

To download apps and software in Windows, we traditionally have started through a web browser, we visit the website of the software, and then download the software. But in more modern versions of Windows like Windows 10 and Windows 11, Microsoft has also provided a Microsoft Store that serves as a one-stop place to install apps.

In case of Linux distros like Fedora and Mint, Mint has the Software Manager which is equivalent to the Microsoft Store, where users can download and install apps through GUI. In Fedora, when we click ‘Activities’ on the Home Screen / Desktop, a few icons appear at the bottom, one of which is named as ‘Software’ but usually referred to as Software Center. Users can install apps here using GUI.

**6. Installation Process**:

The installation process of Windows, Fedora and Mint are usually similar. Typically, Windows users purchase their computers with Windows pre-installed, but they can perform a clean installation of Windows if they want to. The installation media previously used to be a .iso file burned to a CD/DVD, but today it is a .iso file burned mostly to a USB flash drive. If the OS being installed inside a Virtual Machine, then a .iso file can be mounted to the virtual optical drive of the Virtual Machine. The installation processes are usually GUI based, however light Fedora versions for devices with lower end specifications can be text based, for example, text, VNC or kickstart installations are preferred for low memory systems.

**6.4 Fedora vs Arch**

# **Summary**

Our objective for this project is to build on the work of the previous teams’ progress towards the on-going project of creating a more friendly Fedora distribution for UMass Lowell students and faculty. In this report we discussed the importance of the project, focusing on why a Fedora distribution supporting the operating needs of students and faculty in the UMass Lowell community is important. Along with information about the client of our project, Red Hat, who is the sponsor of the Friendly Fedora project. We also discussed the project’s expected deliverables and benefits, some of which included becoming experienced with Fedora OS and development tools. We also talked about our problem statement and objectives regarding the last team’s research who found that most students don’t use Linux as their primary OS and those who do use Ubuntu based on ease of installation. Our goals include developing a Fedora distribution which has the applications and features available on more popular operating systems, and which is easy to install. Finally, we also discussed the results of our research comparing the GUIs of four different Linux distributions with Fedora.

Last year’s team made significant progress towards the project goal. Our objective is to continue working on the expected deliverables towards a successful distribution of the friendly Fedora OS that would provide many benefits for students and faculty in the UMass Lowell community. Our objective includes sharing the results of our work with the open-source community as well.

# **References**

The references utilize IEEE format and have been listed in the order that they were used throughout this report.

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