BVCC General Meeting

February 8, 2021

Introduction to Linux
Joel Ewing, BVCC President

(presentation slides will be posted on
bvcomputerclub.org web site)

Why Linux?

- **Free license, open software, no limit on usage**

- **Supported on more hardware platforms**

- **Many more free items available than on Windows – desktop interface designs, user applications, server applications; multiple scripting languages and programming languages (interpreted or compiled), if you want to learn those skills; built-in virtual machine support; emulators for other computer architectures; games …**

- **More control over when updates are done and when to jump to a new release**

- **Supported by cadre of thousands of dedicated volunteers world-wide – serious problems tend to be resolved quickly**

Linux Issues

- **To get the most functionality does require a willingness to do some research**
- **Problems that are not regarded as that serious or that require close coordination between independent development groups can take years to resolve**
- **There is a means to report problems and research solutions for some distros (e.g, Redhat/Fedora bugzilla), but may require some knowledge of terminology and conventions, and solutions depend on volunteers – there are some options for support subscriptions (RHEL), but priced for enterprises with more systems and money than individuals.**
- **There are some Windows apps that don't have a good equivalent under native Linux (Quicken) – some Windows apps will run decently under WINE (creates a partial Windows environment within Linux) or in a Virtual Machine under Linux (requires a full Windows install on the virtual machine with corresponding licensing issues)**
- **Some distro releases have a shorter Life-Cycle (duration of maintenance period) than others – Fedora pretty much forces an upgrade after only two years (two releases per year and only lastest 3 have updates), Ubuntu can last five years. A new release may not be a radical change, but there are no guarantees.**

WINE (a recursive acronym) Wine Is Not an Emulator. Provides basic Windows Interfaces, appearance of Windows drives (as a Linux sub directory), and part of .NET functionality, and approximate font equavalents. For some applications this is sufficient, for others not.

Because of need for release updates every two years to keep receiving security updates for Fedora, Ubuntu with a five-year limit may be a better match for many users,

Operating Systems

- **Operating Systems**
  - **Simplifies building applications by providing functions that make complex hardware appear simpler to applications – processor, memory, file-storage, user interface and device management. Applications and utility programs use that support to provide functionality for end users.**
- **Operating Systems for "small" computers – major contenders today:**
  - **Linux**
  - **mac/OS**
  - **Windows**

There have been other Operating Systems, but they failed to achieve a significant market share, and without a significant market share hardware manufacturers wouldn't supply necessary device drivers, which depressed market share further.

Mainframe computers have their own set of Operating Systems, although some flavors of Linux have also been ported to mainframes.

Linux Lineage

- **Original concepts from AT&T Unix (1970's). Modular, portable. UNIX was proprietary, but developed a tradition of freely shared applications.**

- **Linux kernel is Unix-like but independently developed by Linus Torvalds and released as open source in 1991**

- **Has evolved into a family of Linux systems based on the Linux kernel and various selections of many open-source applications**

Tux

In the UNIX world, many major applications are associated with some specific species of animal. Torvalds liked penguins, so a penguin has become associated with the Linux kernel. Others have even given the penguin a name, TUX, for Torvald's UniX.

Mac/OS Lineage

- **a successor to OS Introduced with Apple Macintosh in 1984 – borrowed from UNIX kernel**

- **iOS used by Apple mobile devices – a variant of macOS**

Windows Lineage

- **Microsoft proprietary code, non-free**
- **Started as a GUI shell under MS-DOS (1985)**
- **Evolved to Windows 95 (1995), eventually to Windows 10**
- **Packaged with Nucleus code (counterpart to UNIX kernel) plus standard applications, device drivers**
- **For-profit applications**

Windows Design & Maintenance

- – **Operating System with integrated utilities a single unit maintained together by MS**
- – **Additional major applications from MS or other parties maintained at application level**
- – **Maintenance procedures tend to hide from user the difficulty of the change or which actual pieces of Windows are changed.**
- – **One of the pains of Windows maintenance is the infamous "percent" indicator which not only does not represent time percentage, but frequently freezes for long periods with no obvious evidence of progress.**

Linux Design

- **Early Linux used only a command-line interface (like PC DOS, but with more powerful shell scripting tools and ability to feed the output of one command as input to the next ("piping"). Command line execution is still an important tool in Linux.**

- **Even early Linux supported remote network access and multi-user concurrent usage.**

- **Modern Linux supports many possible GUI desktops designs that can give Linux a look and feel very similar to a Windows desktop**

- **Compilers and interpreters for many different programming languages are freely available, and a some of the interpretive languages can be used as powerful scripting languages when capabilities beyond the default command shell scripting is needed.**

Linux can still be run without a GUI desktop, especially in cases where the system is being used to provide services over a network rather than directly support a human user at its console.   In some cases that means Linux can be run on hardware that is inadequate for other uses.

Linux Design & Maintenance

- The kernel, individual utilities, desktop GUI support, utility libraries used by applications, and applications, are each generally supported by different groups of dedicated volunteers. All the different pieces are distributed as "packages" with versioning and dependency information. A typical application is built to use utility libraries and interfaces created by others.

- Different Distributions (Distros) available from many sources. Installation includes Linux kernel plus some subset of packages. Additional repositories (Repos) are available containing many additional packages and all current updates.

Linux Design & Maintenance

- **A distribution includes one or more update tools to install updates or new applications.**
  - **determines what updates are available, resolves dependencies, downloads all the new packages, and installs new versions. Same process also be used to install additional packages or even to install additional repos to use as a source of packages (RPMFusion: packages not shipped with RedHat/Fedora)**
  - **Updating process shows total number of steps and progress at the package level – better indicator of progress**
  - **Two main package formats: .rpm (used by Red Hat Linux and its derivatives with the dnf utility), and .deb (used by Debian Linux and its derivatives with the apt utility)**

Why Many Linux Disto's

- **Different goals**
  - **Workstation vs server. Servers may not require GUI desktop, email clients, and office apps; workstations may not require server applications (web server, email server, database server, etc.)**
  - **Support for older vs state-of-art hardware**
  - **10 year life cycle vs shorter life cycles**
  - **Commercial vs non-commercial. Business use may require formal maintenance subscription with support (costs $$)**
  - **Security considerations may require SELinux (Security Enhanced Linux, developed by NSA), avail in Fedora in 2004, and now also in RHEL, Debian, Ubuntu, openSUSE, SUSE Linux Enterprise, and others.**
  - **Ease of maintenance by less technical users**

Major Distros

- **Slackware – oldest still existing (est 1993)**
- **Red Hat Linux, now RHEL & Fedora**
- **SUSE & SUSE Linux Enterprise**
- **CentOS**
- **Debian**
- **Ubuntu (Debian-based)**
- **Linux Mint (new-user-friendly desktop)**
- **Peppermint OS (minimal hardware requirements)**
- **Literally 100's of others**

  - **In 1990's with slow Internet one would usually choose to borrow or purchase Linux Distro installation CDs. With higher-speed Internet all can now be downloaded for free.**

The Application Interfaces (API's) provided by the kernel and the many utility libraries tend to change over time, so Linux application packages are designed to specify by meta-data what versions of required supporting packages must also be installed.

Choice of Desktop/Windowing Support

- **X11 – original simple bitmap graphic window support. Used as foundation for Desktops like GNOME and KDE.**
- **GNOME (classic & Wayland) – works best with modern graphics hardware – known for stability**
- **KDE – more control and customizability than GNOME**
- **LXDE (Lightweight X11 Desktop Environment)**
- **Xfce – doesn't support as many features as next two**
- **MATE – faster, less resources, more stable than Cinnamon**
- **Cinnamon – more features and faster development than MATE**

There is enough commonality among the desktop API interfaces that many applications are supported, or can be made to support multiple desktops.   Some applications are more sensitive than others. For example, TeamViewer has a native Linux version, but some of its functions are only available with GNOME Classic, not with the GNOME Wayland desktop.
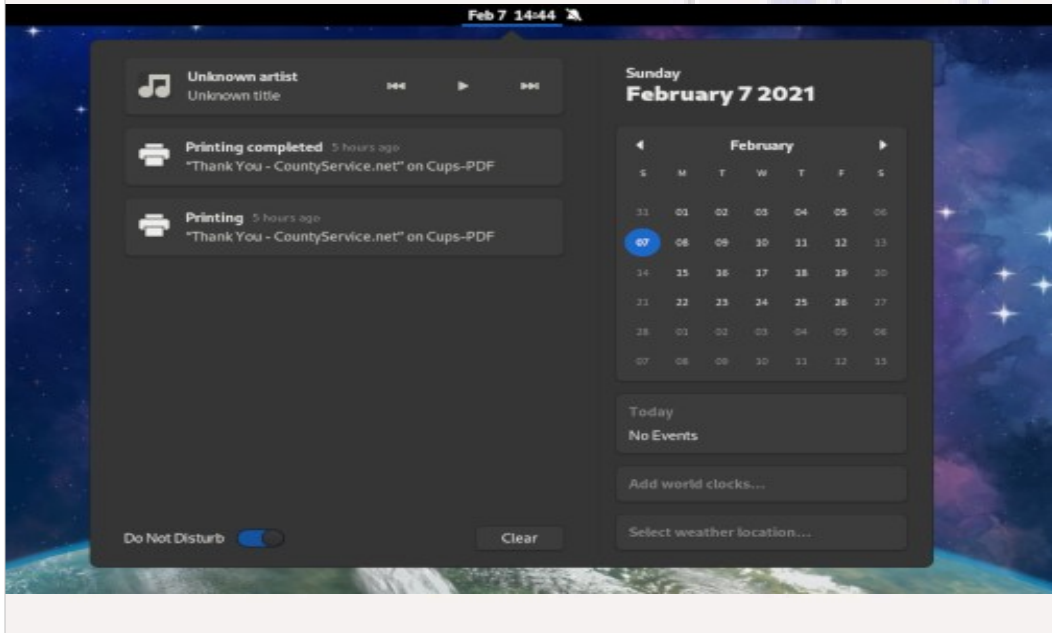
Fedora 33, Gnome Desktop
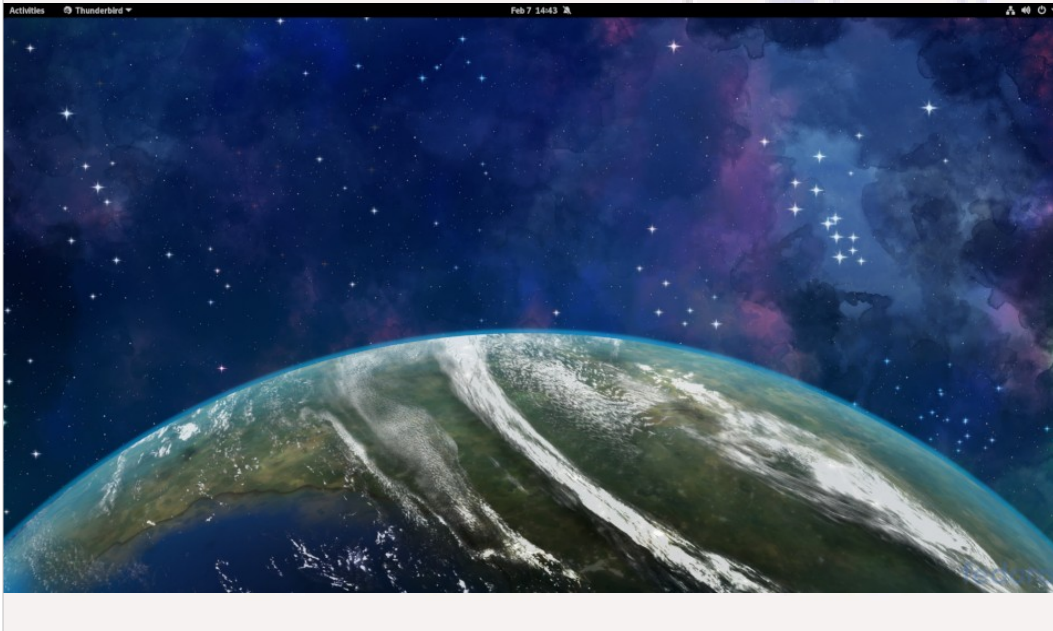
By default, no icons on desktop space itself, but selectable items on top bar provide for additional selectable items.
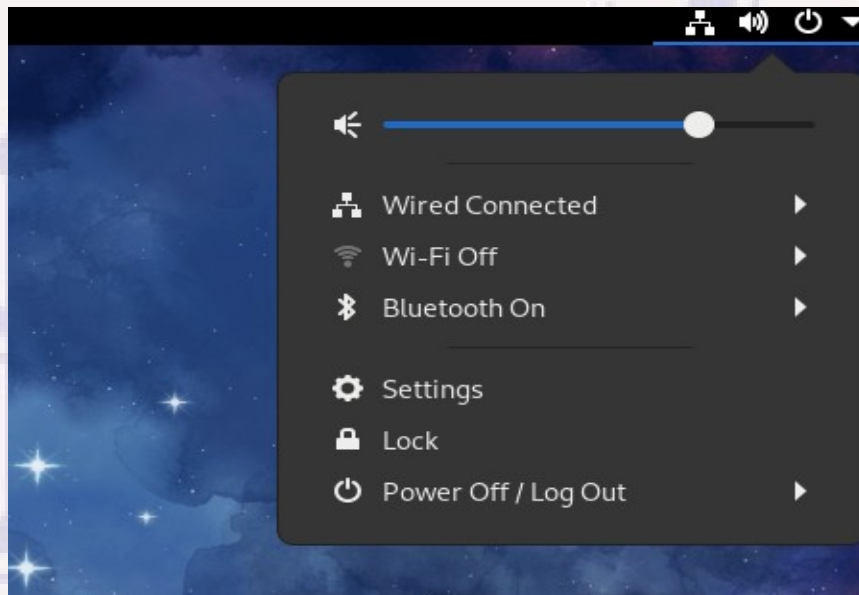
Fedora 33, Gnome, Activities
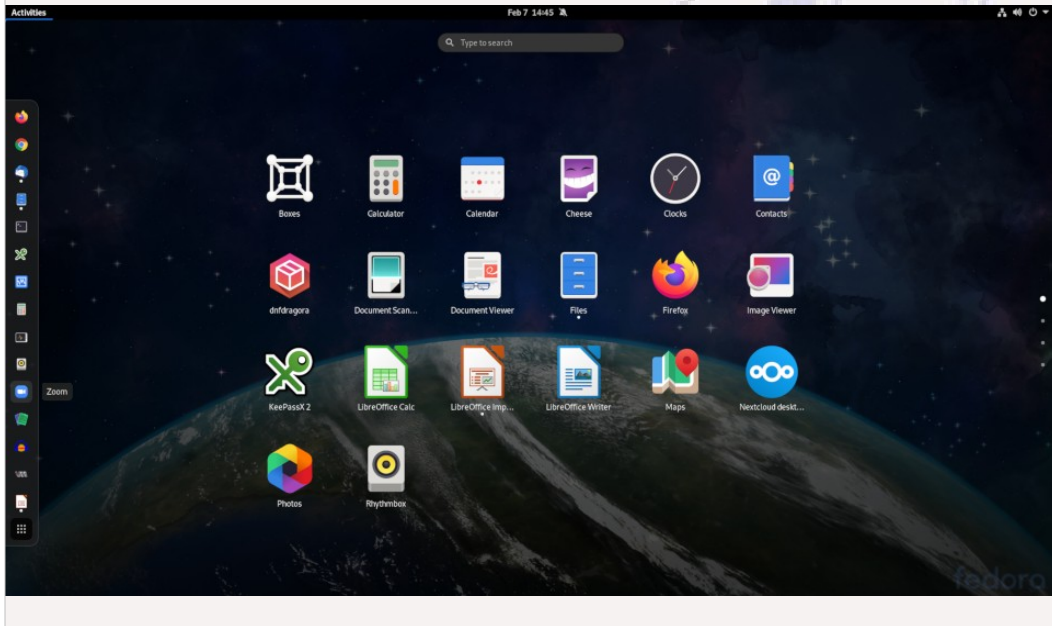
Fedora 33, Gnome, Calendar

Fedora 33, Gnome, Settings

Linux Mint 20.1 Desktop

Linux Mint by default has Desktop icons plus items on a bottom task bar including approximate equivalent of Windows "Start" on the bottom left.   Additional items can be added to the desktop, to the bottom task bar, or to a "favorites" list.

Wide Influence of Linux

- All Android mobile devices run on a variant of Linux

- Chomebooks use a variant of Linux

- All routers use a Linux operating system internally

- Roku boxes and probably all smart TV controllers run on a variant of Linux

- Many devices that employ complex logic implemented in computer software, especially if they need to communicate via WiFi or Ethernet, are probably running Linux under the covers.

- The fact that there are no licensing or patent costs associated with the base software of Linux, and that its open source status allows customization and porting to many different hardware platforms, makes it an attractive choice for devices needing complex computer controls.

Basic Linux Concepts

- **Linux File system – has evolved – partitions now commonly formatted as "ext4", but others exist. Linux can also understand Windows FAT, FAT32, and NTFS partitions but they must first be "mounted" at a Linux Directory point.**
- **All file paths are reachable from the "root" represented as "/". Root has sub-directories, using "/" is used the directory delimiter, as in "/home/jcewing/Documents".**
  - **One disk partition is created at installation as the root partition. Other Linux partitions may also be defined on the same or other drives and mounted at boot time at various directory points within the root partition.**
  - **There are also special paths, like /dev/sda1 that are defined by the system at initialization to refer to physical hard drive partitions, USB devices, etc. that can be used to talk directly to hardware devices by programs with suitable authority, and special paths like /proc/sys that are used to record information about attributes of the hardware/software environment (for example, "/proc/sys/kernel/ostype" contains the value "Linux" and "/proc/sys/kernel/osrelease" contains the package version info for the running Linux kernel)**
- **Each user owns and can create files under a home directory corresponding to their user name (like the jcewing example above). By default a user's access to other files and directories may be restricted**
- **There is a superuser called root that is implicitly defined with broader access rights: typically "root" cannot directly login to the system, but users with administrative rights can temporarily run as root, after supplying the appropriate password.**

Basic Linux Concepts

- **When Linux is installed, one user with the ability to do Linux admin tasks is created, with a "real name" and a login "username" with a unique user ID (UID). This user should be given a login password. This user will also be associated with a unique usergroup, with a unique group ID (GID). After installation, additional users and groups may be defined, and it is also possible to connect a user to multiple groups.**

- **All files and directories are owned by one user and one group (usually the creator's). By default, read/write/execute access is controlled by 3 sets of permission bits (user/group/other) set when the file or directory is created. The user set used if the accessing party is the owning user, the group set used if the accessing party is not the owning user but belongs to the owning group, else the other set used.**

If greater security is desired, a non-administrative user can be created that doesn't have the authority to become a superuser. Action done by a non-administrative user or under than user's authority can only damage that users files, not those of the system or other users.
The administrative user login would only be used when it were needed to install Linux updates or install new applications.

Basic Linux Concepts

- **File/Directory permissions have limitations that in the past have forced many system services to run with root privileges.   SELinux was designed to support more complex access rules and policies to make root access no longer necessary and improve Linux security by reducing the need for root superuser access.**

- **Fedora Linux was one of the earliest adapters of SELinux and by default for several years has SELinux installed and activated and gradually extended to more parts of Linux. Linux Mint by default doesn't have SELinux installed. It can be installed and enabled, but based on early experiences with SELinux in Fedora, the fact that SELinux policies and rules for Linux Mint are not used by default probably means it is less widely used and there are more bugs that have not been reported and fixed.**

A Look at Linux Mint

- **https://linuxmint.com/download.php – 3 download options Linux Mint 20.1 (Cinnamon, MATE, or Xfe desktop) – will choose 1.9GB MATE iso image for "stability". Arbitrarily choose one of the USA download mirrors (save .iso file)**
- **Instructions to verify iso image file integrity and authenticity are recommended but not 100% required. Utilities for that are on Linux by default, but requires more work on Windows.**
- **Can use the ISO file to burn a DVD, or mount directly if creating Mint on a virtual machine**
- **This is Ubuntu-based, so presumably the minimum Ubuntu requirements of 4GiB RAM and 25 GB disk space apply. (Initial install took about 8GB, but "Timeshift" backup of system took another 7GB+ – obviously need much more space if there will be user files or additional installs).**
- **If enough unallocated disk space is available to create a Linux system on a primary drive, Linux installs are generally smart enough to create a multi-boot drive and co-exist with an existing Operating system (but backup first). The reverse sequence (installing Windows after installing Linux) is likely to result in a Windows-only boot, even if the Linux partitions are not altered by the Windows install process.**
- **The Linux Mint ISO will actually boot to a run-able Linux Mint system that runs off the ISO image or DVD. This gives a chance to try out some of the user interfaces and applications without actually installing Linux Mint; although it will run slower. One of the desktop icons when running in this mode can be used to initiate the Installation process.**

Bring up Linux Mint Live and/or installed Linux Mint.
Show basic Desktop techniques
Show basic apps, Files, Terminal, Firebox, LibreOffice
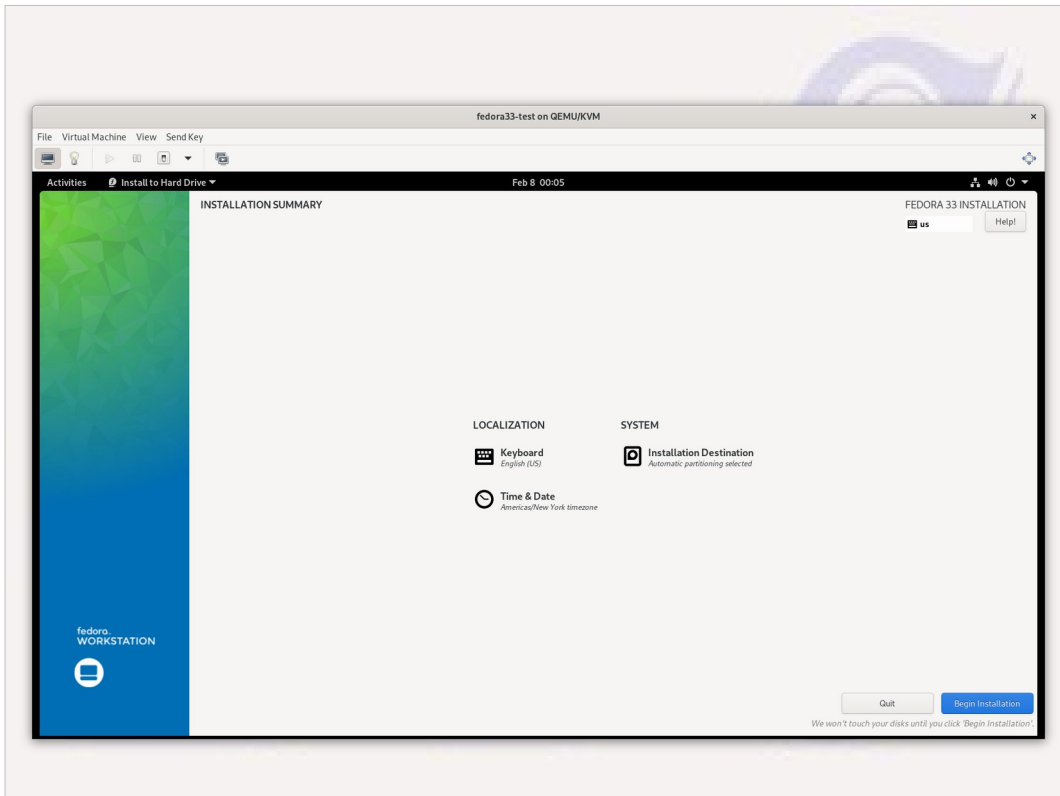Text Editor, or lack thereof.   Installation of gedit

A Look At Fedora Linux

- **Choice of Fedora Workstation or Server (64bit   2.0GB) https://getfedora.org/en/workstation/download/**

- **After Install, need to check for and install updates (probably many 1st time).   Use Terminal app and   sudo dnf update   (runs "dnf" as superuser) After installing updates restart**

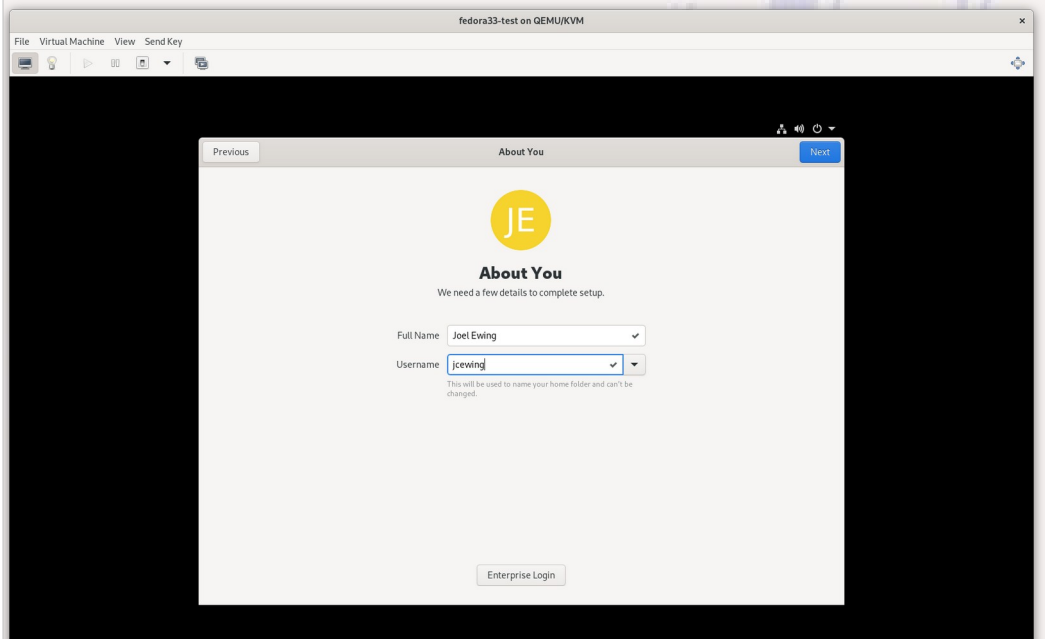- **Default screen inactivity lock 5min, raise for sanity.**
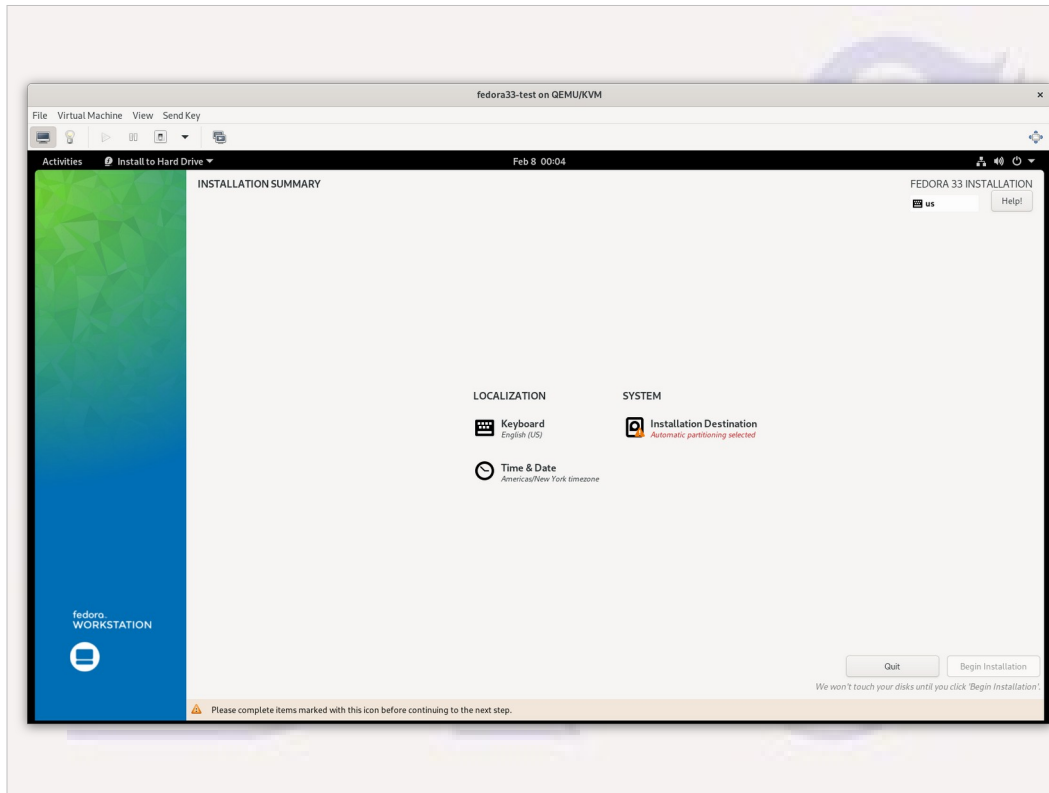
Installation destination allows you to set the disk or partitions to be used by the install. On an empty disk, auto determination is fine. If you want to force specific partitions to be used or delete specific partitions to make space, then custom selections can be made. If unfamiliar with Linux designations for disk partitions, can use the Disks application under Fedora Live to view the existing hard drive "names", which will be something like /dev/sda (entire drive) or /dev/sda1 (a specific partition on drive sda).

Date and Time will be automatically determined, but time zone will need to be set. This can be done at installation or changed using Settings after install.

File Virtual Machine View Send Key

Activities   Install to Hard Drive   Feb 8 00:05

INSTALLATION SUMMARY   FEDORA 33 INSTALLATION
                                                                              us   Help!

LOCALIZATION   SYSTEM

Keyboard   **Installation Destination**
English (US)   Automatic partitioning selected

Time & Date
Americas/New York timezone

fedora.
WORKSTATION

                                                        Quit   Begin Installation

                                        We won't touch your disks until you click 'Begin Installation'.

Fedora Restart after Install
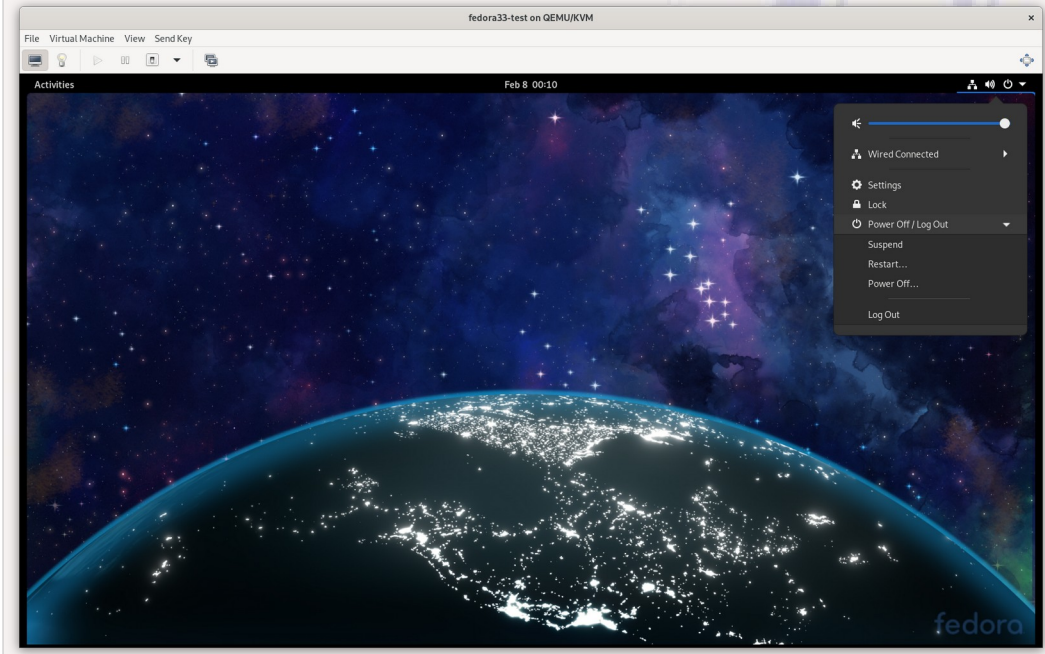
Create Admin Username

Will create a default username based on the FullName, but can specify a specific username if you have a different preference.   Then will be asked to supply a password.

After all first-time-user actions are complete, you have the option to few a short set of tips about the basic operation of the desktop.

Bring up Fedora system.

Demonstrate basics.

Questions?