

UBUNTU – RADIO READY

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Abstract - *Linux has been used by Radio Free Asia's (RFA) technical staff for over a decade; during that time, different flavors of Linux found their place here including Red Hat, openSUSE, and Debian. At the start, Linux was limited to servers and desktop computers of RFA's system administrators; not any more. RFA's Help Desk and Master Control staff now use Ubuntu and Ubuntu Studio. Audacity and the Rivendell Open Source Radio Automation system are the foundations of our Washington DC-based broadcast network. We will discuss RFA's migration to Linux and why we did it, then look at challenges we have overcome to make Ubuntu work. By learning from RFA's successes and failures others can learn from our experiences 'in the trenches.'* Lastly, we will evaluate five applications that help make Linux, hence Ubuntu, business ready, and radio ready.

5. Fedora
6. openSUSE
7. Arch Linux
8. CentOS
9. PCLinuxOS
10. Slackware Linux

According to DistroWatch: “**Ubuntu, Linux Mint** and **PCLinuxOS** are considered the easiest for new users who want to get productive in Linux as soon as possible without having to master all its complexities. On the other end of the spectrum, **Slackware Linux, Arch Linux** and **FreeBSD** are more advanced distributions that require plenty of learning before they can be used effectively.”[1]

10 Years and Counting

RFA is a nonprofit company; as such, RFA does not have a huge budget. We must always be mindful of what we are buying, how much we are spending, how it is going to affect current and future operations. All companies must make payments on many recurring expenses: power, plumbing, office supplies, and more. One recurring expense is licensing for Microsoft products. Early in this decade we hit a turning point where everything was ‘on the table’ for evaluation and cuts when possible; we went looking for alternatives to everything. For example, we ditched our commercial audio system in favor of the Rivendell Open Source Radio Automation system. Rivendell is a complete radio automation system for use in professional broadcasting and is available at no cost under the GNU General Public License; it enables RFA to use Linux for audio recording, processing, playback, schedules, and more.

A computer operating system (OS) tells the hardware how to act, interact and react. As an OS, Linux is known for being a stable OS and free. Other benefits of any Linux distribution is you can download the entire OS, manipulate the source code to suit your needs, and it requires fewer computer resources than computers using Microsoft's Windows operating system. Therefore an older computer can run Linux efficiently whereas it struggles when running Windows. This is a good point to review the popular Linux releases. As of this writing, here are the top-10 versions of Linux reported by DistroWatch.Com:

1. Linux Mint
2. Ubuntu
3. Debian
4. Mageia

As a fairly recent newcomer to the Linux distribution arena, Ubuntu was first announced in 2004. Even some of RFA's system administrators were abuzz with the news about Ubuntu and looking forward to loading it on some spare PCs. The interesting thing is we also had some technicians resist changing from one Linux distribution to Ubuntu; some were all-aboard with Debian and others with Red Hat or openSUSE. Only over time did Ubuntu show its ease for installation and use. Not to take away from any of the other Linux distributions, but my experience with openSUSE was more challenging; I unsuccessfully loaded it a few times on a test PC. It was a commercial version of openSUSE purchased at CompUSA but the CDs eventually collected dust before moving into the trash bin. By 2011, Ubuntu gained popularity in RFA because of its ability to compete with Microsoft Office; not only because of its being zero-cost, but many of our system administrators and audio engineers were now using Ubuntu, or Linux Mint (based on Ubuntu) for their everyday work.

Some reasons Ubuntu has grown in popularity is it was created by millionaire Mark Shuttleworth, a former Debian developer whose company, the Isle of Man-based Canonical Ltd, is financing the Ubuntu project, Ubuntu has avoided the errors of other projects and created a web-based infrastructure using Wiki-styled documentation, excellent bug reporting procedures, and lastly, Ubuntu ships a free CD of the OS to anyone who is interested.

Ubuntu is based on Debian Sid with some good packages, like GNOME, Firefox and LibreOffice. Ubuntu has a custom graphical user interface (GUI) called Unity and a regular 6-month release schedule, with an occasional Long Term Support (LTS) release that is supported with security updates for 3-5 years. Ubuntu provides ease-of-use by

including an installable Live CD, migration assistant for Windows users, installation of proprietary drivers for Wi-Fi and for ATI and NVIDIA graphics cards, and on-demand support for commercial or patent-encumbered media codecs. Some stay away from Ubuntu because of its Debian incompatibility, major changes being released more often than other Linux distributions, and the Unity GUI is better suited for mobile devices.

Ubuntu

While openSUSE and Linux Mint are running on computers in RFA, Ubuntu is the primary Linux version in use. As with any new software, or OS, there is always a learning curve; we also had that with Ubuntu but what really forced the issue was moving everyone in our technical division to Ubuntu; they could have Windows only running as a virtual system on their computer. Yes, many people just continued to use their virtual system until, over time, it just became a matter of convenience to do audio productions, emails, spreadsheets, letters, and memos, all in Ubuntu. The transition took about a year but eventually the majority jumped on board.



Fig 1 Ubuntu logo

As mentioned earlier, Linux is known for being free, but Ubuntu was not absolutely free in all aspects. You can download the source code for free, study it, and modify it. You can redistribute Ubuntu and can even re-distribute your own modified version. Unfortunately some RFA systems required RAM upgrades, larger hard drives and in a few cases new motherboards; basically, things any computer requires. Ubuntu is free but it does need support and there is where the costs come in. There must be a support system for even minor issues like a power supply or cooling fan failures. If there is some development to be done, somebody has to be paid for that work. With the premise that Ubuntu is free, or at least very low cost, there is another piece of freeware that is critical to RFA's broadcasts, Audacity.

There has been some resistance to move to Linux outside of our technical division and for good reasons. Frankly, there are some things that Windows does better than Linux. For example, we require a usable font for our Tibetan broadcasters. In Windows the font is called Himalayan. Use of any Tibetan font in Linux has been a challenge but there are plenty of links online that discuss use of Tibetan in Linux and there is also a development community working towards a Tibetan version of Ubuntu. Within our operations we work with Tibetans but also eight other language services; generally each has its own font with characters they must work with; this complicates our work

even more at RFA. Yes, we have Linux PCs in our broadcast and production studios.

The future for RFA will be challenging and interesting as we are not just about radio anymore, but we are now producing broadcast TV- and web video programs. For example, we broadcast 30-minutes of Burmese television news from satellite every day at 1400 UTC with a few repeats. Additionally our Mandarin Chinese service creates a daily 30-minute program that is broadcast on satellite into China for a two hour segment. This is comprised of one original, 30-minute program then immediately repeated 3 times to complete the broadcast block. RFA's Cantonese, Tibetan, and Uyghur services are also gearing up for television broadcasts. So, in addition to our 30-minute Burmese program, we are also ramping up to an additional 8 1/2 hours a day of RFA television programming on satellite. 30 minutes for the Mandarins, 30-minutes for the Tibetans, 30-minutes for the Cantonese, and eventually 30-minutes daily for the Uyghurs; we are looking at a total of 2 1/2 hours original video programming every day, Monday through Friday, using Windows computers with Adobe's Creative Suite while trying to incorporate Ubuntu, or some other flavor of Linux, as much as possible into our operations. We do not see the use of Windows completely going away but we do see it coexisting with Ubuntu peacefully, helping RFA keep costs down, and milking more life out of systems at the end of their life cycles.

Ubuntu Studio

Ubuntu Studio, like Ubuntu, is a free and open operating system. Ubuntu Studio is simply packaged with a wide variety of multimedia content creation applications suited to a variety of different, but related career fields, including photography, publishing, audio and video. Canonical, which leads the Ubuntu project, officially recognizes Ubuntu Studio as a derivative of Ubuntu and therefore supports it.



Fig 2 Ubuntu Studio logo

When you install Ubuntu Studio, it comes preloaded with software for recording, mastering, and a suite of audio applications. Ubuntu Studio gives any user some of the most up-to-date software available in Linux. For example, JACK provides real-time, low latency connections, of less than 5 msecs, for both audio and MIDI data between applications that implement its application programming interface (API). The API is a set of routines, protocols, and tools used for building software applications.

Graphic and modeling software provided with Ubuntu Studio includes GIMP which is an excellent replacement for Photoshop, Inkscape which is a vector graphics editor like Illustrator, and Blender for creating 3D content. For video

work (remember, at RFA we are doing video too) it comes with the Openshot video editor and lets you add videos, photos and music to create DVD's, YouTube clips and a range of other materials. Besides GIMP for photography, Ubuntu Studio also comes with Shotwell and Darktable. Shotwell is a photo library for organizing your ever-growing library of photos. Darktable is a light-table and darkroom for photographers. It manages your pictures in a database and allows you to view them through a zoomable, light-table. It lets you to develop and enhance raw images. To assist with publishing and other needs, Ubuntu Studio also comes with LibreOffice (good replacement for Microsoft Office), Scribus to create PDF files, and Calibre which provides templates for common publishing formats, like Kindle, various types of tablets and other hardware readers.

Deeper Dive: Ubuntu vs Ubuntu Studio

Ubuntu Studio is an officially recognized spinoff of Ubuntu with an emphasis on the creation of multimedia. Ubuntu Studio comes packaged with Ubuntu and a suite of open-source applications aimed at audio, video and graphics enthusiasts and professionals. The only limit is your imagination. Some differences between them both are obvious. For example, the look and feel of Ubuntu Studio is vastly different than Ubuntu. Ubuntu Studio has a pretty slick looking blue and gray GUI while Ubuntu's brown and orange GUI emphasizing simplification. Ubuntu Studio is also pre-loaded with a variety of multimedia applications including JACK, Ardour, and GIMP. There are also differences in their real-time kernels, use of limit.conf, and the use of JACK versus PulseAudio.

The real-time kernel in Ubuntu Studio has been changed from that in Ubuntu with a preempt patch that significantly reduces the latency; this is a boon to audio production. If your audio work receives priority attention by your computer's processor.

Limit.conf is the configuration file for the pam_limits module. The pam_limits module sets limits on the system resources you can use during any session. When editing the limit.conf file, here is the syntax:

```
<domain> <type> <item> <value>
```

Here are sample lines you might find in /etc/security/limits.conf:

```
*          soft  core           0
root       hard  core          100000
*          hard  rss            10000
@student  hard  nproc          20
@faculty  soft  nproc          20
@faculty  hard  nproc          50
ftp        hard  nproc          0
@student  -     maxlogins      4
```

For most of us, it is OK to view the file contents but changing limits.conf may cause conflicts with the JACK settings.

PulseAudio is a sound server preloaded with Ubuntu and Ubuntu Studio. PulseAudio lets you perform advanced processes on your audio as it moves between software and hardware. Things like transferring the audio to a different machine and changing the sample format are done with ease when using PulseAudio. JACK is another sound server that is part of Ubuntu Studio that was specifically created for audio professionals, but worth noting, it is not preloaded with Ubuntu. JACK's power comes from its ability to send audio to any application requesting it, and JACK does this with such low latency that it does this more efficiently than the Mac and Window's operating systems.

When installing Ubuntu or Ubuntu Studio, the best way to know if your system with handle the load is to run the Ubuntu as a Live CD without making any changes to your hardware. If you download the Ubuntu Studio ISO, plan on using a DVD. The Ubuntu CD or DVD can also be used as the installation media once you have successfully tested Ubuntu on your computer. Note, the live mode is a default option when you boot from the media.

Most broadcasters will want to install Ubuntu Studio. Below are the minimum system specifications that let newcomers to Linux install a usable system with enough overhead to run the OS and applications. By the way, a good "rule of thumb" is that any computer able to run Windows XP-7 will almost always be faster with Ubuntu even if they are using lower specifications than described below.

- 700 MHz processor
- 512 MB RAM (the RFA standard is 2 GB for 32-bit systems and 8 GB for 64-bit systems)
- 5 GB of free hard-drive space
- VGA monitor capable of 1024x768 screen resolution
- A CD/DVD drive or a USB port
- Not mandatory, but Internet connectivity is helpful

There are currently two versions of Ubuntu Studio available for downloading. First is Ubuntu Studio 14.04.1 Trusty Tahr LTS, or Long Term Support, which will remain supported and available until 2019. The LTS versions of Ubuntu Studio are released every 2 years with April 2016 the target for 16.04 LTS. The second version is Ubuntu Studio 14.10 Utopic Unicorn and is the most recent non-LTS version; it was released in October 2014 and is only supported for 9-months before the next non-LTS version replaces it. Intermediate versions like 14.10 only receive security updates for those 9 months; LTS versions receive them for five years. The next non-LTS version is 15.04 Vivid Velvet and is scheduled for release on April 23, 2015. The Ubuntu Release Timeline is found on page 6. [2]

The 32-bit version of Ubuntu and Ubuntu Studio runs on most computers today. Some consider 32-bit systems outdated and that 64-bit systems are the new standard. The downside is that for 64-bit systems there may fewer applications available but nonetheless, Ubuntu Studio is also available for 64-bit machines and works well in our broadcast environment. Note, that if you have 2 GB of

RAM, or less, your best bet is to install Ubuntu Studio 32-bit since a 64-bit system will likely demand more from your computer hardware than it is able to deliver.

Mark Shuttleworth, Ubuntu's Project Lead, says, "Our working assumption is that the latest interim release is used by folks who will be involved, even if tangentially, in the making of Ubuntu, and LTS releases will be used by those who purely consume it." [3]

Audacity

Audacity is an open source audio recorder and editor that works with multiple platforms; Windows, Mac and Linux. Audacity is well known throughout the general computing community and amongst broadcasters as a good, reliable piece of software where you can do multi-track, or even single track, recordings. Audacity is the foundation of RFA's broadcast efforts. It is used in our studios, networked to virtually all desktop PCs, and likely in most homes. It is easily the most valuable postproduction pieces of software we use. For example, when we provide tours of RFA's facility in Washington DC, we make it a point to show off Audacity in use. More times than not, the majority of the people in the tour group are all shaking their heads up-and-down because they are also using the program for similar broadcast or personal media projects.

While it is not pre-loaded with Ubuntu or Ubuntu Studio, Audacity works and plays well with Linux. The control surface has been translated into dozens of languages, which is a huge bonus for international broadcasters like RFA. With the ability to record from multiple sources in your computer, Audacity is also a powerful post-production tool capable of processing all audio types (webcasts and podcasts too) by adding effects such as normalization, ducking, and fades. With all its features, Audacity does have limits. For example, Audacity only supports 32-bit VST audio effect plug-ins but does not support 64-bit or instrument VST (VSTi) plugins. There are no real-time effects and no dynamic equalizer control. Ffmpeg library is an option with Audacity but in reality, it is required. It is difficult to remove vocals from recording, and lastly it does not import or export WMA, AAC, AC3 or other proprietary file formats. Thankfully these limitations have little effect on our work at RFA.

Ubuntu in Action

There was a time when Linux was not even a contender as an OS in computing much less in broadcasting. That changed as Red Hat and openSUSE emerged on the office computing scene and for little-to-no money, older computers saw new life as the lower computing demands of Linux allowed IT and broadcast technicians to keep them around longer, effectively lowering costs and contributing to daily broadcast operations in and outside of the studio.

RFA is not the only radio station or radio network that is using Ubuntu and Ubuntu Studio. Here are a few other

examples, or case studies, provided by Ubuntu showing the OS has been embraced by other broadcasters. You only need to search the Internet to find stories of other stations successfully using Ubuntu and staying on air.



Fig 3 KRUU logo

In the case of KRUU FM Radio in Fairfield, Iowa, Ubuntu proved the right choice. KRUU at 100.1 FM is a "solar-powered, open source, independent, non-commercial, listener-supported, grassroots community low power radio station, broadcasting" 24/7 "since launching on September 30th, 2006...100% of the programs at KRUU are produced by up to 100 volunteer hosts who create 70 shows a week...KRUU operates at 100 watts from a 60-foot tower with a coverage area that reaches the entire city. The broadcast radius is approximately 10 miles..." [4] KRUU's programming covers everything from news to theater and a variety of music.

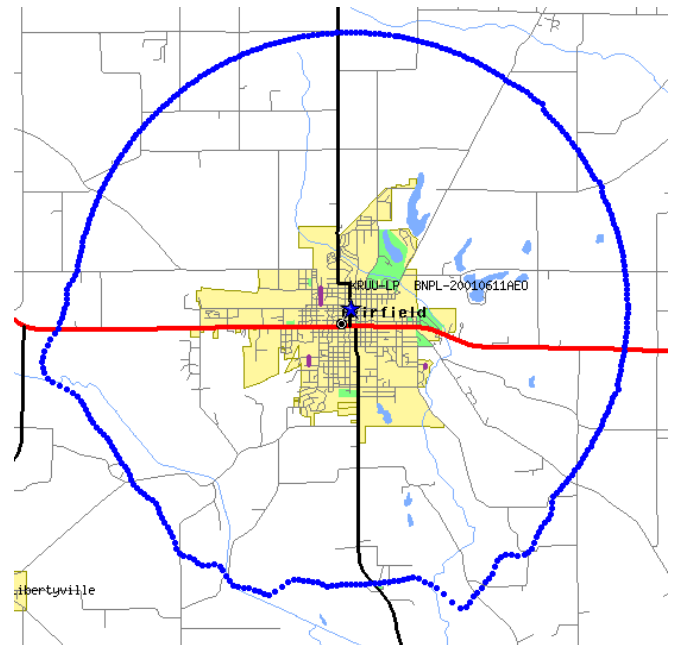


Fig 4 KRUU coverage map

At one point, KRUU needed to update their studio systems and needed something that was easy to use, generally appealing to users, and had a familiar feel for Macs or Windows users so they could start broadcastings right away. Additionally it needed to be managed remotely and locally and above all else, be reliable. Lastly, the new system had to support audio software and hardware. Ubuntu became the operating system of choice. According to KRUU host Sundar Raman, "Our requirements were quite

complex and our decision to go with Ubuntu was based on three factors and Ubuntu won hands down. We did not want to get stuck in the world of managing different binary distributions based on what was supported and what was not. The Synaptic package manager is more elegant than the RPM-based solutions in some paid-for Linux distros and can be used by just about anyone. Critically we wanted a distro that would be usable by the average user.”

The outcome was good; Ubuntu was easy to launch and the daily technical support of their non-technical, volunteer staff was made easier by the simplicity of Ubuntu and the support of the Ubuntu community who provided advice and assistance in getting Ubuntu and KRUU systems working together. “Ubuntu worked out great technically. However, where it was truly remarkable was in the area of community support. Since Ubuntu is so popular, our decision to go 100% Linux-based, including for our recording and mixing consoles, was well supported. The existence of the Ubuntu-Studio community helped us make our decision to drop Pro-Tools, and go with Ardour and Audacity on all our workstations” [5] according to Sundar.



Fig 5 Global Radio logo

Global Radio in London is home to some of the United Kingdom’s popular radio stations. As of late 2014, they serve an audience of 23.1 million listeners weekly. As they say on ThisIsGlobal.Com, “Simply put, we’re obsessed with radio, music and entertainment - welcome to our world.” Global Radio is home to Heart FM, Capital FM and Classic FM, and others. Their use of Ubuntu is less about broadcasting than it is about running their IT infrastructure and data servers with Ubuntu. With a diversified list of radio stations, and a need to cut costs and bring all the brands under one system of management, Global Radio installed Ubuntu as its web infrastructure. Every layer of Global Radio’s web framework runs on Ubuntu. Any hardware incorporated into their workflows simply worked out of the box. With Ubuntu’s stability, Global Radio is able to add and remove real and virtual servers on demand with little notice and no downtime.

Linux for Business

Two years ago Jack Wallen of TechRepublic.Com [6] posted a blog listing 5 applications that make Linux ready for business. They are Google Chrome, Thunderbird, Scribus, LibreOffice, and Oracle VM VirtualBox. Chrome is the

Google browser that works well and is the most used web browser worldwide because of its excellent features including speed and security; it is an RFA standard. Mozilla’s Thunderbird is an email client that works in ways very similar to Outlook. Thunderbird is also known for its security with a community of developers continually devising new features. Scribus is not just an option for creating PDFs but is it a desktop publishing application that can do layouts, typesetting and to prepare files for professional quality imaging equipment. LibreOffice is a much like Microsoft Office without the cost. Some functions are accessed differently so there is a learning curve. LibreOffice lets you do it all; word processing, spreadsheets, slideshows, diagrams and drawings, databases, and composing mathematical formulae. VirtualBox is the connection between your Ubuntu, or Linux, desktop and a virtual installation of Windows. If you cannot cut the ties between your work on Ubuntu and Windows, VirtualBox will give you both worlds. I run the VirtualBox too as there are some tasks I must do on a Windows 7 computer. Four out of these 5 are in use on my Ubuntu Studio box and I find them quite easy to work with, and use, in the business of broadcasting.

Summary

Microsoft Windows is still used for our broadcaster’s computers in RFA, but in our studios, Linux is king. Linux has successfully integrated into our operations and, for the foreseeable future, will remain a part of our broadcast toolbox. A powerful contender for your computer’s OS is Ubuntu in the form of Ubuntu Studio. It is free and works out-of-the-box and can get you and your staff creating broadcast products in little to no time. Our work is not done, but the future looks bright.

References

- [1] “Top Ten Distributions”. <http://distrowatch.com/dwres.php?resource=major>, Jan 20, 15.
- [2] “Ubuntu Release Timeline”. <http://around-technology.blogspot.com/2014/04/ubuntu-release-timeline.html>, Jan 20, 15
- [3] Shuttleworth, Mark. “Let’s go faster while preserving what works best.” www.markshuttleworth.com/archives/1246, Mar 12, 13.
- [4][5] “Ubuntu Proved the Optimal Choice for a NonProfit Radio Station”. www.ubuntu.com/products/casestudies/KRUU, Jan 20, 15
- [6] Wallen, Jack. “Five apps to make the Linux desktop business-ready.” <http://www.techrepublic.com/blog/five-apps/five-apps-to-make-the-linux-desktop-business-ready>, Jun 14, 13.

Ubuntu Release Timeline

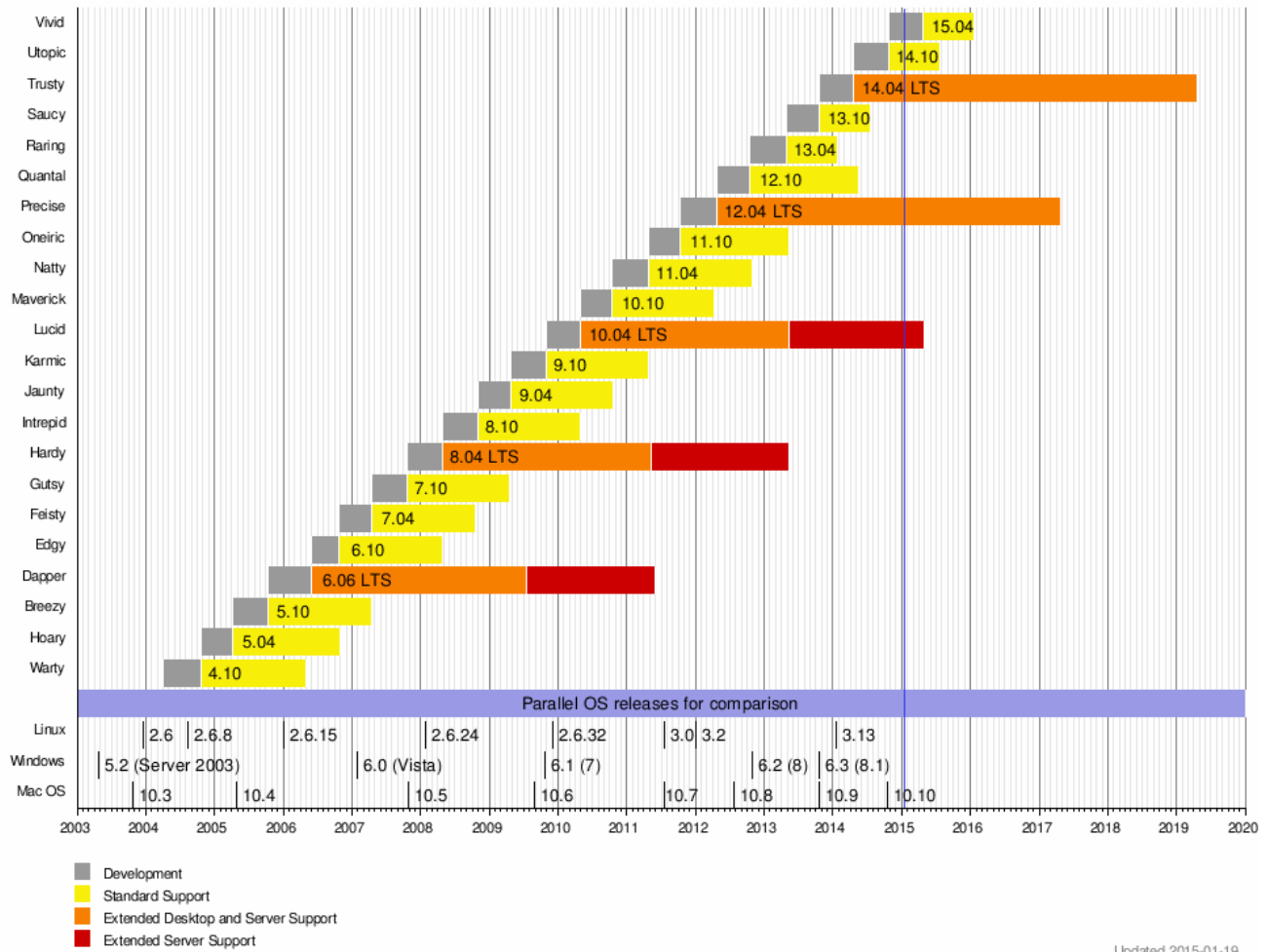


Fig 6 Ubuntu Release Timeline