[Black Text: Host, Nicole Huesman]

Welcome to Open Source Voices. My name is Nicole Huesman.

Since its origin, the very nature of open source has lent itself to high levels of customization based on specific needs and requirements. As a result, Linux has emerged in every size, shape and color. With this myriad of distros comes real complexities.

Here with us today to talk about these challenges, and how we might tackle them, are Kelly Hammond, Open Source Software Engineering Director at Intel, and Michael Larabel, Founder of Phoronix Media.

Before we dive in, Kelly, can you start us off by introducing yourself and what you do at Intel.
Kelly: Sure, I'm a Software Engineering Director here in Intel's Open Source Technology Center. I manage the engineering for some of the Clear Linux software stacks particularly for vertical segments, like IoT, industrial applications, and a few others.

And Michael, tell us a little bit about yourself and your background in Linux.
Michael: Back in 2004, I started Phoronix.com, which is basically a Linux hardware review website where at the time it was very difficult getting different computer peripherals from computer mice to modems and graphics cards working under Linux and basically documenting that experience over the years. As the Linux hardware support has improved, focusing more upon the performance and other features of the Linux support, rather than just 'does it work or not'. And then the process for the past ten years, developing the Phoronix Test Suite as an open source, automated, cross-platform benchmarking framework for conducting hundreds of different tests.

Q: Linux powers 90% of public clouds, 82% of smartphones and 62% of IoT devices. And it has benefitted developers and businesses of all types and shapes. Certainly, there are advantages to highly custom distros. Michael, can you talk about some of the challenges?
Michael: Certainly. One of the strengths of Linux is certainly the ability for anyone and everyone to spin up their own Linux distribution so they can cater the packages to their own needs for themselves personally or for their organizations. But as time has gone on with the growing number of security concerns regarding Linux and all of these different vulnerabilities these days, it's becoming much more difficult for particularly the smaller businesses to maintain their own Linux distributions that are derived from others. It's a full-time job keeping up with security updates, package updates, making sure that you have the packages that all of your users need. And then, it's also difficult for application developers to ensure their own software works across all these different Linux distributions. So, certainly a much greater maintenance burden these days for people to produce their own Linux distributions.

Q: Kelly, can you tell us a little about what you've observed?

Kelly: Well, when you look at what's happening, where Linux has really grown, one of the biggest areas has definitely been servers. And, as cloud and Linux have grown it's really driven changes not only in content but in the way that Linux operating systems are built. So, it's not just about little pieces, it's about building in things like security and ways to get security and have that be ongoing. And also the need to deploy new features, the need to update is built into Linux and built into some of these modern use cases. You can't do that without having a modern continuous integration development model. Constant change isn't the exception, it's the norm. One of my favorite quotes around security is that it's like the laundry or the dishes, it's something that you always need to do, it's a job that's never done, and I think security and the need for updates is really the way that the industry is going. Then you think about some of the growth areas for Linux and they're really trying to build on not more of the PC-centric but more of the cloud-centric model. I've seen a lot of the architectures and the interest in growth areas like IoT are looking more cloud-like in their architecture rather than PC-centric, and that requires a modern OS development model to go with it.

Q: That evolution really makes sense. Can you talk about Intel's approach to modern OS development and what we're seeing there?

Kelly: When you think about modern OS development in Linux, Clear Linux is Intel's implementation of a modern Linux OS. We use it to provide an industry blueprint for implementing performance-tuned Intel features and optimizations in a single, security-driven Linux distribution. That's kind of a lot but it's also for going cloud to edge so there's the modularity built into it to be able to scale especially when you start thinking about things at the edge that are building off of a more cloud-like architecture. The things that we're really targeting to have this provide is to reduce complexity for others out there. A big part of that modularity and that ability to scale is taking away some of that rote work, the security work, the things that are just ongoing and allowing companies to customize and implement on top of Linux.

Q: Michael, as the lead developer of the Phoronix Test Suite, you test a lot that's out there. Did Clear Linux surprise you when you started to test it?

Michael: When I first started Clear Linux benchmarking, I was certainly very surprised at that point for being performant compared to the other Linux distributions at the time. As time has gone on, I continue to be very impressed by its performance quarter after quarter, or even month after month, with the number of optimizations that the Clear Linux developers have been continuing to push with one of the benefits of Clear Linux being their rolling release model where nearly every day you can see new performance optimizations or updated packaging. And then, I've certainly been surprised as well with the attention to detail in their optimizations with them simply not targeting the most common workloads but pretty much anything they can get after from the boot time performance to different scientific computing packages. So, it's been a very interesting journey watching the performance evolve.

Q: Who do you think will benefit the most from the Clear Linux project?
Michael: Well, pretty much anyone these days can benefit from greater performance. I think most Linux users would agree that any performance improvements are certainly better, especially at a time when different security vulnerabilities have impacted the CPU performance where Clear Linux still is able to outperform other unmitigated distributions.

In terms of specific areas where I've seen the performance really excel have been some of the modern deep learning and machine learning benchmarks from TensorFlow as well as interpreted languages like Java and Python and PHP. There's also been good performance within some of the statistical packages like the R language. And then everything down to what I mentioned before with the boot time performance being very competitive, which is useful for many companies that are scaling up in the cloud to meet demand or other areas where they want to respond dynamically in a very quick manner. So, overall, it's been a pretty diverse area where the performance has really dominated.

Q: Is there anything that's different about Clear Linux that folks may not be aware of?
Michael: Well, there's certainly a lot. Clear Linux's preference on optimized compiler flags by default. Their package management solution allows building some packages under GCC and others under the Clang compilers based upon how the performance is under those different compilers. And they've been pushing a lot of optimizations into areas like GCC and GNU's C library for being able to have link-time optimizations or different glibc optimizations and function multi-versioning to allow different CPU architectures to take a different generated code path. So, you can still have binaries that will run on the older CPU architectures but that will run even faster on modern CPUs while still having one binary so you're not worrying about producing a different ISO or just different packages for each CPU microarchitecture these days. And then just a lot of fine-tuning it seems from the Linux kernel patches to different areas.

Q: Wow, that's fantastic. Kelly, can you tell us a little bit about where it's being used today?
Kelly: Clear Linux is currently deployed in the cloud and it's available in places like the AWS, Azure, and Docker marketplaces, along with clearlinux.org. From a user or developer experience perspective, I think Artificial Intelligence is really a great application because it's so compute intensive so you can really measure the performance in terms of time savings. I might be a bit biased, because I used Clear Linux for some of my homework when I did an Udacity course for deep learning and I definitely noticed a difference.

When it comes to some of the edge use cases, I know automotive is an area where we've invested and are actively working through optimizations. One of the areas we've optimized is systemd boot time, and that really matters when you think about getting in your car on a Monday morning. You don't want to sit there for a minute waiting for your dashboard to come up with a little spinning sign on it. That's not acceptable in that industry, so we're working to address use cases like that so that we can have really quick responsiveness.

Q: It's amazing how often we just take these things for granted because they just work, and yet there's so much work being done underneath the hood. Michael, given all that you've said about the performance of Clear Linux, looking ahead, what are some of the things you'd like to see next from the Clear Linux team?

Michael: On the performance front, certainly their continued evolution in trying to squeeze out maximum performance as possible. But, in general, there are a few other minor details to get over the "final mile" of being able to offer great Linux distribution experience. Like, right now, their installer doesn't let you easily spin up a fully-encrypted disk or setting up RAID easily for multiple disks in your installer. And there are a number of small usability hurdles they could address to make the experience much easier, especially for newer developers that may be wanting to try out Clear Linux on their desktop or workstation so they can have the same distribution they're running on their own machine as they are developing for in the cloud or within containers. So, that's certainly one area. And then, another has been within the documentation improvements or just getting the word out about Clear Linux. There's still many in the community who seem to be confused over it or think that there's some secretive magic that Intel is pursuing to get such great performance numbers or that Intel is somehow making Clear Linux perform poorly on alternative CPU vendor systems, which isn't true. I've seen very great performance everywhere. And making it clear about all of the different optimizations their team is investing, I think would do a lot to clear up this confusion I see occasionally in forums or on Reddit and other places.

Q: Yep. You talked about usability and it's so important to ensure a great developer experience. And then, it's also so essential to clear up any misperceptions. Kelly, we talked earlier about Clear Linux's use among cloud vendors. As more compute is pushed to the edge, how do you anticipate the Clear Linux user base will evolve over time?

Kelly: You know, I think it's going to start being pushed into any devices that are connected and need security, or devices that have a lot of sensors including cameras, things that can benefit from Clear Linux's performance capability. Computer vision is a workload we're looking at adding that is compute intensive and could really benefit from a performance boost. I think computer vision is something that's rapidly growing in IoT. You see that in things like autonomous logistics robots, for instance. But there's quite a few others out there.

Q: Fantastic. So, one final question for you, Kelly. For developers who want to dive in, where can they download Clear Linux?

Kelly: That's easy. It's clearlinux.org, or you can try it in the cloud or in a container with AWS, Azure, or Docker. I definitely encourage developers to play with the code and send us their feedback and their content. What do they want? What fixes would they like to see? So, I'd really like to hear back from people.

Great! Kelly, Michael, thanks so much for joining us today. It's been an absolute pleasure to chat with you about the move to modern OS development. We're looking forward to hearing more about Clear Linux in the future. Until next time. Thanks for listening.