Liquid Prep intelligent watering solution now hosted by the Linux Foundation as a Call for Code project

Over the past several decades farmers have been depending increasingly on groundwater to irrigate their crops due to climate change and reduced rainfall. Farmers, even in drought-prone areas, continue to need to grow water-intensive crops because these crops have a steady demand.

In 2019, as part of Call for Code, a team of IBMers came together and brainstormed on ideas they were passionate about — problems faced by farmers in developing countries due to more frequent drought conditions. The team designed an end-to-end solution that focuses on helping farmers gain insight into when to water their crops and help them optimize their water usage to grow healthy crops. This team, Liquid Prep, went on to win the IBM employee Call for Code Global Challenge.

Liquid Prep provides a mobile application that can obtain soil moisture data from a portable soil moisture sensor, fetch weather information from The Weather Company, and access crop data through a service deployed on the IBM Cloud. Their solution brings all this data together, analyzes it, and computes watering guidance to help the farmer decide whether to water their crops right now or conserve it for a better time.

To validate the Liquid Prep prototype, in December 2019, one of the team members traveled to India and interviewed several farmers in the village Nuggehalli, which is near the town Hirisave in the Hassan district of Karnataka, India. The interviews taught the team that the farmers did not have

detailed information on when they should water their specific crops and by how much, as they didn't know the specific needs on a plant-by-plant basis. They also just let the water run freely if the water was available from a nearby source, like a river or stream, and some were entirely dependent on rainfall. The farmers expressed a great interest in the described Liquid Prep solution as it could empower them to make more informed decisions that could improve yields.

A prototype is born

After winning the challenge the Liquid Prep team took on the opportunity to convert the concept to a more complete prototype through an IBM Service Corps engagement. The team was expanded with dedicated IBM volunteers from across the company and they were assigned to optimize Liquid Prep from August through October 2020. During this time the team developed the Minimum Viable Product (MVP) for the mobile solution.

The prototype consists of three primary components:

- A hardware sensor to measure soil moisture
- A highly visual and easy-to-use mobile web application, and
- A back-end data service to power the app.

It works like this: the mobile web application gets soil moisture data from the soil moisture sensor. The app requests environmental conditions from The Weather Company and crop data from the plant database via the backend service deployed on the IBM Cloud. The app analyzes and computes a watering schedule to help the farmer decide if they should water their crops now or at a later time.

Partners

Liquid Prep has a developed a great working relationship with partners SmartCone Technologies, Inc., and Central New Mexico Community College. Students in the Deep Dive Coding Internet of Things (IoT) Bootcamp at CNM are designing, developing, and producing a robust IoT sensor and housing it in the shape of a stick that can be inserted into the soil and transfer the soil moisture data to the Liquid Prep mobile app via Bluetooth. The collaboration gives students important real-world experience before they enter the workforce.

"SmartCone is honored to be part of this project. This is a perfect example of technology teams working together to help make the world a better place, " said Jason Lee, Founder & CEO, SmartCone Technologies Inc.

Additionally, Liquid Prep will work together with J&H Nixon Farms, who largely grow soybeans and corn crops on about 2800 acres of agricultural land in Ottawa, Canada. They have offered Liquid Prep the opportunity to pilot test the prototype on several plots of land that have different soil conditions, which in turn can expand the breadth of recommendation options to a larger number of potential users.

Now available as open source

Liquid Prep is now available as an open source project hosted by the Linux Foundation. The goal of the project is to help farmers globally farm their crops with the least amount of water by taking advantage of real-time information that can help improve sustainability and build resiliency to climate change.

Participation is welcomed from software developers, designers, testers, agronomists/agri experts/soil experts, IoT engineers, researchers, students, farmers, and others that can help

improve the quality and value of the solution for small farmers around the world. Key areas the team are interested in developing include localizing the mobile app, considering soil properties for the improvement of the watering advice, updating project documentation, software and hardware testing, more in-depth research, and adding more crop data to the database.

Get involved in Liquid Prep now at Call For Code

The post Liquid Prep intelligent watering solution now hosted by the Linux Foundation as a Call for Code project appeared first on Linux Foundation.

Linux Foundation Support for Asian Communities

The Linux Foundation and its communities are deeply concerned about the rise in attacks against Asian Americans and condemn this violence. It is devastating to hear over and over again of the attacks and vitriol against Asian communities, which have increased substantially during the pandemic.

We stand in support with all those that have experienced this hate, and to the families of those who have been killed as a result. Racism, intolerance and inequality have no place in the world, our country, the tech industry or in open source communities.

We firmly believe that we are all at our best when we work together, treat each other with respect and equality and without hate or vitriol.

Generating a Software Bill of Materials (SBOM) with Open Source Standards and Tooling

Every month there seems to be a new software vulnerability showing up on social media, which causes open source program offices and security teams to start querying their inventories to see how FOSS components they use may impact their organizations.

Frequently this information is not available in a consistent format within an organization for automatic querying and may result in a significant amount of email and manual effort. By exchanging software metadata in a standardized software bill of materials (SBOM) format between organizations, automation within an organization becomes simpler, accelerating the discovery process and uncovering risk so that mitigations can be considered quickly.

In the last year, we've also seen standards like OpenChain (ISO/IEC 5320:2020) gain adoption in the supply chain. Customers have started asking for a bill of materials from their suppliers as part of negotiation and contract discussions to conform to the standard. OpenChain has a focus on ensuring that there is sufficient information for license compliance, and as a result, expects metadata for the distributed components as well. A software bill of materials can be used to support the systematic review and approval of each component's license terms to clarify the obligations and

restrictions as it applies to the distribution of the supplied software and reduces risk.

Kate Stewart, VP, Dependable Embedded Systems, The Linux Foundation, will host a complimentary mentorship webinar entitled **Generating Software Bill Of Materials** on Thursday, March 25 at 7:30 am PST. This session will work through the minimum elements included in a software bill of materials and detail the reasoning behind why those elements are included. To register, please click here.

Register for webinar
There are many ways this software metadata can be shared. The common SBOM document format options (SPDX, SWID, and CycloneDX) will be reviewed so that the participants can better understand what is available for those just starting.

This mentorship session will work through some simple examples and then guide where to find the next level of details and further references.

At the end of this session, participants will be on a secure footing and a path towards the automated generation of SBOMs as part of their build and release processes in the future.

The post Generating a Software Bill of Materials (SBOM) with Open Source Standards and Tooling appeared first on Linux Foundation.

How open source communities are driving 5G's future, even

within a large government like the US

In mid-February, the Linux Foundation announced it had signed a collaboration agreement with the Defense Advanced Research Projects Agency (DARPA), enabling US Government suppliers to collaborate on a common open source platform that will enable the adoption of 5G wireless and edge technologies by the government. Governments face similar issues to enterprise end-users — if all their suppliers deliver incompatible solutions, the integration burden escalates exponentially.

The first collaboration, Open Programmable Secure 5G (OPS-5G), currently in the formative stages, will be used to create open source software and systems enabling end-to-end 5G and follow-on mobile networks.

The road to open source influencing 5G: The First, Second, and Third Waves of Open Source

If we examine the history of open source, it is informative to observe it from the perspective of evolutionary waves. Many open-source projects began as single technical projects, with specific objectives, such as building an operating system kernel or an application. This isolated, single project approach can be viewed as the first wave of open source.

We can view the second wave of open source as creating platforms seeking to address a broad horizontal solution, such as a cloud or networking stack or a machine learning and data platform.

The third wave of open source collaboration goes beyond isolated projects and integrates them for a common platform

for a specific industry vertical. Additionally, the third wave often focuses on reducing fragmentation — you commonly will see a conformance program or a specification or standard that anyone in the industry can cite in procurement contracts.

Industry conformance becomes important as specific solutions are taken to market and how cross-industry solutions are being built — especially now that we have technologies requiring cross-industry interaction, such as end-to-end 5G, the edge, or even cloud-native applications and environments that span any industry vertical.

The third wave of open source also seeks to provide comprehensive end-to-end solutions for enterprises and verticals, large institutional organizations, and government agencies. In this case, the community of government suppliers will be building an open source 5G stack used in enterprise networking applications. The end-to-end open source integration and collaboration supported by commercial investment with innovative products, services, and solutions accelerate the technology adoption and transformation.

Why DARPA chose to partner with the Linux Foundation

DARPA at the US Department of Defense has tens of thousands of contractors supplying networking solutions for government facilities and remote locations. However, it doesn't want dozens, hundreds, or thousands of unique and incompatible hardware and software solutions originating from its large contractor and supplier ecosystem. Instead, it desires a portable and open access standard to provide transparency to enable advanced software tools and systems to be applied to a common code base various groups in the government could build on. The goal is to have a common framework that decouples hardware and software requirements and enabling adoption by more groups within the government.

Naturally, as a large end-user, the government wants its suppliers to focus on delivering secure solutions. A common framework can ideally decrease the security complexity versus having disparate, fragmented systems.

The Linux Foundation is also the home of nearly all the important open source projects in the 5G and networking space. Out of the $54B of the Linux Foundation community software projects that have been valued using the COCOMO2 model, the open source projects assisting with building a 5G stack are estimated to be worth about $25B in shared technology investment. The LF Networking projects have been valued at $7.4B just by themselves.

The support programs at Linux Foundation provide the key foundations for a shared community innovations pool. These programs include IP structure and legal frameworks, an open and transparent development process, neutral governance, conformance, and DevOps infrastructure for end-to-end project lifecycle and code management. Therefore, it is uniquely suited to be the home for a community-driven effort to define an open source 5G end-to-end architecture, create and run the open source projects that embody that architecture, and support its integration for scaling-out and accelerating adoption.

The foundations of a complete open source 5G stack

The Linux Foundation worked in the telecommunications industry early on in its existence, starting with the Carrier Grade Linux initiatives to identify requirements and building features to enable the Linux kernel to address telco requirements. In 2013, The Linux Foundation's open source networking platform started with bespoke projects such as OpenDaylight, the software-defined networking controller. OPNFV (now Anuket), the network function virtualization stack,

was introduced in 2014-2015, followed by the first release of Tungsten Fabric, the automated software-defined networking stack. FD.io, the secure networking data plane, was announced in 2016, a sister project of the Data Plane Development Kit (DPDK) released into open source in 2010.
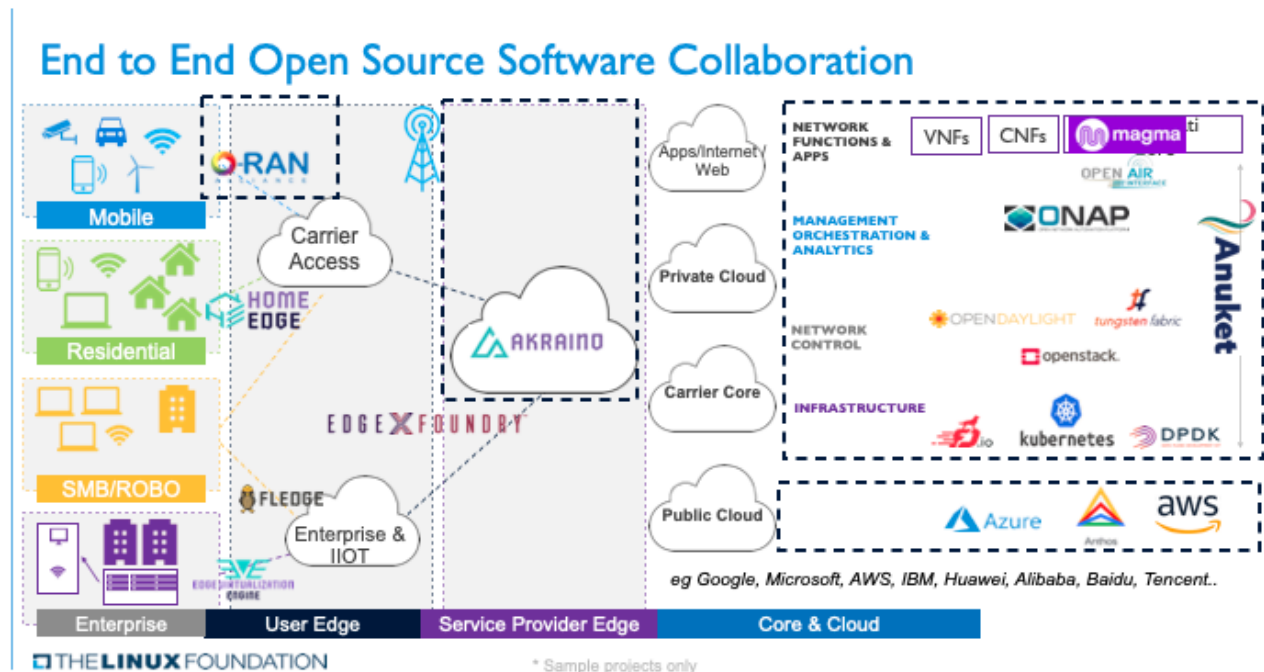
Linux Foundation & Other Open Source Component Projects for 5G
At the time, the telecom/network and wireless carrier industry sought to commoditize and accelerate innovation across a specific piece of the stack as software-defined networking became part of their digital transformation. Since the introduction of these projects at LFN, the industry has seen heavy adoption and significant community contribution by the largest telecom carriers and service providers worldwide. This history is chronicled in detail in our whitepaper, Software-Defined Vertical Industries: Transformation Through Open Source.

The work that the member companies will focus on will require robust frameworks for ensuring changes to these projects are contributed back upstream into the source projects. Upstreaming, which is a key benefit to open source collaboration, allows the contributions specific to this 5G

effort to roll back into their originating projects, thus improving the software for every end-user and effort that uses them.

The Linux Foundation networking stack continues to evolve and expand into additional projects due to an increased desire to innovate and commoditize across key technology areas through shared investments among its members. In February of 2021, Facebook contributed the Magma project, which transcends platform infrastructure such as the others listed above. Instead, it is a network function application that is core to 5G network operations.

The E2E 5G Super Blueprint is being developed by the LFN Demo working group. This is an open collaboration and we encourage you to join us. Learn more here

Building through organic growth and cross-pollination of the open source networking and cloud community

Tier 2 operators, rural operators, and governments worldwide want to reap the benefits of economic innovation as well as potential cost-savings from 5G. How is this accomplished?

With this joint announcement and its DARPA supplier community collaboration, the Linux Foundation's existing projects can help serve the requirements of other large end-users. Open source communities are advancing and innovating some of the most important and exciting technologies of our time. It's always interesting to have an opportunity to apply the results of these communities to new use cases.

The Linux Foundation understands the critical dynamic of cross-pollination between community-driven open source

projects needed to help make an ecosystem successful. Its proven governance model has demonstrated the ability to maintain and mature open source projects over time and make them all work together in one single, cohesive ecosystem.

As a broad set of contributors work on components of an open source stack for 5G, there will be cross-community interactions. For example, that means that Project EVE, the cloud-native edge computing platform, will potentially be working with Project Zephyr, the scalable real-time operating system (RTOS) kernel, so that Eve can potentially orchestrate Zephyr devices. It's all based on contributors' self-interests and motivations to contribute functionality that enables these projects to work together. Similarly, ONAP, the network automation/orchestration platform, is tightly integrated with Akraino so that it has architectural deployment templates built around network edge clouds and multi-edge clouds.

An open source platform has implications not just for new business opportunities for government suppliers but also for other institutions. The projects within an open source platform have open interfaces that can be integrated and used with other software so that other large end-users like the World Bank, can have validated and tested architectural blueprints, with which can go ahead and deploy effective 5G solutions in the marketplace in many host countries, providing them a turnkey stack. This will enable them to encourage providers through competition or challenges native to their in-country commercial ecosystem to implement those networks.

This is a true solutions-oriented open source for 5G stack for enterprises, governments, and the world.

The post How open source communities are driving 5G's future, even within a large government like the US appeared first on Linux Foundation.

New open source project helps musicians jam together even when they're not together

Today, the Linux Foundation announced that it would be adding Rend-o-matic to the list of Call for Code open source projects that it hosts. The Rend-o-matic technology was originally developed as part of the Choirless project during a Call for Code challenge as a way to enable musicians to jam together regardless of where they are. Initially developed to help musicians socially distance because of COVID 19, the application has many other benefits, including bringing together musicians from different parts of the world and allowing for multiple versions of a piece of music featuring various artist collaborations. The artificial intelligence powering Choirless ensures that the consolidated recording stays accurately synchronized even through long compositions, and this is just one of the pieces of software being released under the new Rend-o-matic project.

Developer Diaries — Uniting musicians with AI and IBM Cloud Functions
Created by a team of musically-inclined IBM developers, the Rend-o-matic project features a web-based interface that allows artists to record their individual segments via a laptop or phone. The individual segments are processed using acoustic analysis and AI to identify common patterns across multiple segments which are then automatically synced and output as a single track. Each musician can record on their own time in their own place with each new version of the song available as a fresh MP3 track. In order to scale the compute needed by the AI, the application uses IBM Cloud Functions in

a serverless environment that can effortlessly scale up or down to meet demand without the need for additional infrastructure updates. Rend-o-matic is itself built upon open source technology, using Apache OpenWhisk, Apache CouchDB, Cloud Foundry, Docker, Python, Node.js, and FFmpeg.

Since its creation, Choirless has been incubated and improved as a Call for Code project, with an enhanced algorithm, increased availability, real-time audio-level visualizations, and more. The solution has been released for testing, and as of January, users of the hosted Choirless service built upon the Rend-o-matic project — including school choirs, professional musicians, and bands — have recorded 2,740 individual parts forming 745 distinct performances.

Call for Code invites developers and problem-solvers around the world to build and contribute to sustainable, open source technology projects that address social and humanitarian issues while ensuring the top solutions are deployed to make a demonstrable difference. Learn more about Call for Code. You can learn more about Rend-o-matic, sample the technology, and contribute back to the project at https://choirless.github.io/

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