
LFNETWORKING
2020 Year In Review
.io
ONAP
OPEN NETWORK AUTOMATION PLATFORM
OPNFV
OPEN DAYLIGHT
Open Switch
pnda
SNAS.io
tungsten fabric

Table of Contents

2020 LFN Technical Community Metrics

The Linux Foundation has now launched a comprehensive project community metrics dashboard built to facilitate every aspect of open source development: LFX Insights. We invite you to browse this new toolkit to discover new insights about the LFN communities.

LF Networking Overview

LF Projects Overview (2020)

LFN Project*	Lines of Code Changed	Commits	Contributors	Repos	Changesets	Builds
FD.io	2.25M	4.21K	134	10	4.47K	4.38K
ONAP	8.25M	16.89K	493	208	14.85K	307.84K
OpenDaylight	1.65M	7.44K	120	50	5.17K	201.54K
OPNFV**	431.86K	2.86K	69	28	1.33K	216.66K
CNTT**	42.80K	903	61	1	714	24.82K

*Does not include all LFN Projects
**In early 2021, CNTT will merge with OPNFV

Message from the LFN Board

Dr. Junlan Feng, Chief Scientist & General Manager of AI and Intelligent Operation R&D Center, China Mobile; LFN Board Chair

By now it seems clear that 2020 was a year featuring crisis after crisis.

Thanks to the technologies built by the Telecom industry that we serve, LFN as an open source community has invented new ways to work together efficiently worldwide. The results of our efforts have exceeded expectations. For example, the scale of participation in online conferences and discussions has reached a historic high.

But we are not only forced to face external challenges, we are also committed to reform our ways of collaboration within the community and with SDOs and other related organizations. The End User Advisory Group (EUAG) has strengthened the guiding role of operators in R&D for projects like ONAP with a series of surveys and while papers. The Technical Advisory Council (TAC) continuously leads the individual projects through updating infrastructure, proposing new ways of testing, and improving development efficiency via DevOps. ONFV and CNTT formally merged to form a new key project, Anuket, with a clear mission defined. Closely working with CNCF and ETSI, ONAP has steered technological innovation towards cloud native.

We are standing at the corner to welcome 2021 with new opportunities and challenges. With global scale deployments, 5G networks require further intelligence beyond automation to improve the efficiency of operations and optimizations. 5G applications for businesses and individuals are dramatically increasing. This will call for our closer collaboration with the Edge and AI communities. We are also tuned to experimentally support some key features proposed in SDOs for 6G.

Through this year, the LFN Board has seen that all members, no matter what area they represent and which countries or regions they reside, have worked in harmony to keep up with the changing

needs of ever-evolving technologies that impact networking. We also have new key members from the cloud-computing industries. Projects are working together, both within and outside of the LFN, in a collaborative manner and in a more efficient way.

The LF Networking team would like to thank all of our members for their efforts during this past year. We also want to thank our developers and leaders of all levels. We believe by working together and by fostering collaborations and innovations across the entire open networking stack, that we all can benefit from the innovations that we co-create. We believe we will deliver more exciting work in 2021.

2020 Governing Board

Amol Phadke
Google Cloud

Andre Fuetsch
AT&T

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Telecom Italia

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Orange

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2020 LFN Members

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accenture

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wipro

Silver


A10

Aarna Networks

ADTRAN

ADVA

affirmed

AMANTYA

AMD

ARISTA

arm

ats

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SPIRENT Communications
Sprint
solutions by sic
STL
SUSE
swisscom
TATA COMMUNICATIONS
TIM
Tencent 腾讯
ULAK
VoerEir
WIND
Windstill Enterprises
XILINX

Associate


CENGN
CAICT 中国信通院
LIONS Center
MEF
OKINAWA OPEN LABORATORY
ONF
OPEN AIR INTERFACE
SDN-IV INDUSTRY ALLIANCE
SDNLAB
iol
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A Year Like No Other: Open Source Networking Now Stronger Than Ever

Arpit Joshipura, General Manager, Networking, Edge & IOT, Linux Foundation

The COVID-19 global pandemic has certainly challenged us all—and throughout all the hardship—I'm extremely proud of the way the LFN community has demonstrated versatility and resilience in the face of adversity. Open source project communities, already primed for remote collaboration, proved even more valuable this year for innovation and advancement across many verticals. For our industry in particular, we've seen how vital the networks and tools that keep us all connected are to our societies and economies. In fact, the Network with new technologies like 5G, Edge, Automation, Cloud Native etc. are an integral part of our daily lives.

In the three years since LF Networking has formed, it's become quite clear that the only way our networks can continue to meet the needs of our global community is through software-defined networking and a hybrid model for network functions and cloud native applications running increasingly over the edge and private, public, and hybrid clouds. In this time, we've also seen tremendous support for open source in network automation, 5G, AI, Edge, and RAN. This is now a global, collaborative effort across telecommunications providers, cloud service providers, their vendors, and system integrators that is further harmonized by implementing standards from ETSI, MEF, 3GPP, TMF, GSMA, O-RAN, and several more SDOs.

Leveraging the power of open source to accelerate software development, while collaborating and harmonizing with networking standards bodies, releases for telecommunications software platforms are now coming every 6-9 months vs. 3-6 years from just a decade ago. What's more, this is truly end-user driven innovation; in fact, 4 of the top 10 contributors to the ONAP project are network operators. A vibrant End User Advisory Group (EUAG) in LFN is also actively mapping LFN outputs to industry requirements by developing surveys, exploring various consumption models, writing whitepapers, producing webinars, and more.

In 2020 we made a dedicated effort to quantify the value of LFN open source software and estimate the capital investment required to replicate the LFN software platforms and codebases. Using LFN developer analytics and industry standard estimates for labor costs, we conducted research using the COCOMO methodology that calculated an estimated manual effort of over 700K person-months and an investment north of US $7.3 billion. This substantial savings is better spent by our members on their unique and proprietary products and services development that enhances the bottom line and keeps the telecom ecosystem humming.

Estimated manual replication of LFN open source platforms

Manual Effort: 700K person months
Investment: $7.3 billion +

We're pleased to start 2021 with the launch of Anuket, a new LFN project that brings together OPNFV's proven testing and integration foundation with the considerable progress made under the Cloud iNfrastructure Telco Taskforce (CNTT). Anuket delivers standardized reference infrastructure specifications and conformance frameworks for virtualized and cloud native network functions. For the industry, this means faster, more robust onboarding into production environments that reduces costs and accelerates telecom digital transformation.

As we wrap up 2020 and take stock of what we've learned, here is a glimpse of what I think we'll see in 2021:

1. Telecom & Cloud 'Plumbing' based on 5G Open Source will drive accelerated investments from top markets (Government, Manufacturing, and Enterprises)

2. The Last piece of the "open" puzzle will fall in place: Radio Access Network (RAN)

3. "Remote Work" will continue to be the greatest positive distraction, especially within the open source community

4. "Futures" (aka bells and whistle features & future-looking capabilities) will give way to "functioning blueprints"

5. AI/ML technologies become mainstream

Over the next three years, we expect to see 5G, cloud networking, edge, and access networks align using open source solutions and fuel a new wave of innovation, apps, and cost savings. No matter what the future has in store, what's certain is that the lessons of 2020 have made us a stronger community and better prepared to face the networking challenges of tomorrow.

Strategic Planning Committee Chair Update

Jonne Soininen, Head of Open Source Initiatives, Nokia; LFN Strategic Planning Committee Chair

What a strange year has this been! In addition to managing the impacts wrought from a global pandemic, 2020 was the first year the SPC established Key Performance Indicators (KPIs) for LFN and we have been following them throughout the year. The key areas were:

- Enable development, cooperation, and growth
- Evolve IT infrastructure
- Support the communities
- Facilitate adoption of the LFN technologies in the industry

One of our key strategic targets is the focus on developers and software development. A key action in this target is to have developer focused forums to ensure efficient development in LFN. That all started very well with our first technical event in the beginning of the year. And then with COVID-19, all in person meetings stopped. This could have been devastating to a community—but not for LFN as the community rose to the challenge! Hence as an organization, we were able to continue the pursuit of great development work by moving to virtual meetings and doing it well. These meetings have been organized by the community from the bottom up with strong support from LFN staff. This is most likely the reason why they have been so successful.

On other targets, there has been a lot of work from the LF staff on the IT infrastructure, focusing both on usability and cost. In addition, there is more visibility on what services are available for the projects and the community and how they are leveraged. I'm sure there is work left to do around this in the future—there always is—but we've gotten off to a good start. In the support to the communities category, we can see (or at least hear!) new resources for the community on conference calls. Last, but definitely not the least, is the target on adoption of LFN technologies in the industry. I think it is evident from the different project releases during the year that this is the case and there has been a lot of work to make sure the software is even more mature, stable, secure, well documented, and usable by the industry—both by people in the projects and people not yet in our community who have interest for the software that we create.

Going forward, the SPC has been looking at the principles with which LFN can grow and prosper in a scalable manner. This work, like so many other tasks, has been done together with the Technical Advisory Council (TAC). In addition, the SPC took upon itself to start looking at the future economic model of LFN to make sure we use our financial resources well and to ensure that we can scale in a sustainable manner and continue to provide world class project support—both current and future. In the end, the important thing for LFN is that the projects continue to prosper. To achieve that, LFN needs to enable the community to have the best possible environment to work in. In the end, this is all about the community!

EUAG Update: Voice of the End User

Lei Huang, Researcher, AI and Intelligent Operation R&D Center, China Mobile Research Institute; LFN End User Advisory Group Chair

As the voice of end user, the End User Advisory Group (EUAG) supports the vision of LFN projects and their adoption in the industry as well as contributes use cases and requirements to the projects that deliver maximum value to the industry as a whole. We also collect and analyze feedback from global network operators to help ensure that the LFN project outputs are in line with industry needs. I'm pleased to report that group productivity in 2020 has reached its highest level to date.

In order to dig deeper into the relevant requirements of operators and vendors, we've designed and organized four surveys this year, including:

- ONAP Consumption Models
- Automated Testing Survey
- SDN Adoption Survey
- Intelligent Network and AI for CSPs, Vendors, and AI communities

Upon processing the survey results, we shared the key findings and insights with LFN Project TSC communities and developed whitepapers and webinars in order to publicize them with the telecom ecosystem overall. In order to gather industry consensus and expand the influence of operators, we have proposed multiple white papers this year based on what we've surveyed, including:

- ONAP Consumption Models Whitepaper: The EUAG's ONAP working group developed this paper, sharing views on the most important considerations, opportunities, and impediments towards a seamless end user adoption of ONAP. This paper casts light on the consumption aspects of ONAP—the challenges, key considerations, models and references—as well as the opportunities for CSPs looking at projects like ONAP.

- NFV Testing and Automation White Paper: In this white paper, you can not only find CSP requirements for NFV testing automation, but also CSP recommendations on testing tools and frameworks, automated testing process, testing platform and architecture, case scenarios, and more. This white paper is scheduled to be released early 2021.

- 5G Adoption Experience White Paper: The new era of global digital transformation which will be primarily enabled by use of futuristic 5G technology combined with new software architectures like network disaggregation, Edge, Open RAN networks, etc. is upon us. In this white paper, we will cover sections around operator requirement for 5G, case scenarios, AI/ML in 5G, etc. And in terms of what we've analyzed, we will put forward deployment models and also list recommendations from the CSP perspective. This white paper is scheduled to be released in April, 2021.

At the same time, in order to fully expand the influence of operators in the industry ecosystem, we have organized a series of industry activities, including:

- LFN Webinar for reporting the ONAP Consumption Model White Paper.

- LFN virtual technical event: An arrangement of cross-community EUAG topics, to collect and analyze operator ONAP Honolulu top priorities, and guide the expansion of EUAG collaboration with various open source communities. This includes the Compliance and Verification Committee (CVC) automated test survey and white paper cooperation, CNTT requirements and architecture input, collaboration with FD.io around SDN adoption and deployment, and more.

In 2021, we will continue to strengthen collaboration and communication with various open source communities through project TSC engagement around requirements and common issues from CSPs and continue to share this feedback with the industry.

I would like to express my sincere appreciation for our EUAG members' support this year and cannot be more proud of what we have achieved as a community. As a result, the community is seeing heightened activity from all corners of the globe. The white papers are shaping up extremely well and we have set ourselves an ambitious target of their release. I would like to make a big shout out to, amongst others, Saad from STC; Javier from Telecom Argentina; Ryan, Brian and Scott from AT&T; Beth and Fred from Verizon; Marc from Bell; David from Swisscom; Cecilia from TIM; Lingli from China Mobile—as well as to our LFN facilitators Jim, Kenny, and Brandon for being ever helpful.

Technical Advisory Council Update

Jason Hunt, Software Architect, IBM; TAC Chair

LFN's Technical Advisory Council (TAC) comprises senior technical leaders from our member companies as well as a representative from each of the TAC projects (FD.io, ONAP, OpenDaylight, and now Anuket). Our goal is to facilitate communication and collaboration among all the projects that comprise LFN.

In 2020 the TAC, under the leadership of vice-chair Ranny Haiby, developed a technical whitepaper about open source networking. This whitepaper provides an overview of the LF Networking projects and how they may be used to build a modern network. It describes how open source projects complement industry standards. The paper explains the role of each project and the part they play in building a complete network solution. This comprehensive work is a must-read for anyone who would like to understand the current state of open source networking and standards. You can download the paper here.

The TAC has also been actively involved in promoting the continued growth and collaboration of the LFN projects. The TAC conducts regular health reviews with the LFN projects to provide coaching and guidance on any technical or governance issues the projects might be facing. We are also evaluating all of the services provided to LFN projects to ensure they fit the needs of the projects while maintaining financial discipline. Once completed, this work will highlight the value of LFN membership to new projects with the aim of further expanding our project portfolio.

TAC members regularly participate in the planning of LFN events, a task that has taken on particular importance this year with the move to virtual events. These members focus our event planning on promoting cross-community collaboration via a dedicated collaboration track at our technical events and via ONES demonstrations that showcase integration of LFN projects with each other and outside project groups and standards. We continuously improve the tools and platforms used for the events to encourage more interactive collaboration.

A new initiative that the TAC has undertaken this year is to look more closely at the language we use in our documentation and our code. We want to ensure that this language is inclusive and does not contain any implicit or explicit bias. We have formed a working group to provide guidance to LFN projects on potentially problematic terms, recommended replacements, and processes to do the replacement. As LFN projects rely heavily on other open source projects and standards, our work will be closely informed by these external efforts. Notably, we will be coordinating with the broader Inclusive Naming Initiative originating from CNCF.

The TAC is looking forward to a strong 2021 as our projects continue to grow. In addition to the work effort mentioned previously, we will be looking at ways to better recruit and recognize contributors across our projects.

Now, we'd like to share updates from the LFN Project TSC Chairs themselves.

"Through these unquestionably challenging times, 2020 has been a year of outstanding innovation in the Cloud for the FD.io community. 2020 saw FD.io becoming the first low-latency, linearly scalable, Secure and Terabit qualified networking technology building upstream support in both Network Service Mesh (a Cloud Native Computing Foundation (CNCF) Project) and Calico for Kubernetes. FD.io continues to relentlessly push the performance curve, adding new intelligence to seamlessly optimize FD.io for heterogeneous Cloud environments. Cumulating to make FD.io without question the 1st choice for savvy Cloud network builders."

— Ed Warnicke, FD.io TSC Chair

“On behalf of the ONAP TSC, I want to thank our energetic Community for their tremendous 2020 participation.

We delivered two major releases (Frankfurt, Guilin) and two maintenance releases this year enabling Multi-Domain Optical Network Service, new 5G scenarios such as Network Slicing, Self-Serve Control-Loop for RAN operations, ONAP/O-RAN Interworking, and seamless orchestration of Cloud Native Network Functions (CNFs).

Additionally, three new task forces have been established to review the ONAP projects' maturity, to deep dive new 5G and CNF scenarios, and to improve our time to market. The Honolulu release will follow our new release cadence strategy as well as reap the benefits of the new task force findings.”

— Catherine Lefèvre, ONAP TSC Chair

OPNFV’s primary challenge this year was to “catch the ball” from CNTT, in terms of their reference model, architecture, infrastructure, and conformance requirements. OPNFV immediately revised its mission to emphasize that role, and developed a new release process to manage and provide fast feedback on the large number of development requirements among two cooperating players.

Meanwhile, development continued at a rapid pace, with some projects like Functest utilizing the Self-Release model and Orange leading those contributions. Growth continued, with new projects like Kuberef starting-up, and others like SampleVNF, CIRV, Barometer, and VSPERF expanding their participants. OPNFV projects hosted many LFN-Interns and Student Volunteers; giving back to our community more than ever before.

I am very proud to see how OPNFV stepped up to lead aspects of the merger with CNTT and define our partnership. In the new LFN project, Anuket, we have every perspective needed to produce a conformance and badging program that saves network operators and vendors time and effort.

As the *Last* OPNFV TSC Chair, I am humbled by the volunteerism in OPNFV. Our tenth/final release, OPNFV-Jerma is the summation of over 6 years of development efforts, integration, testing, weathering the test of time, and more testing! It has been an honor to serve OPNFV’s goals in many capacities, and a privilege I hope to continue in Anuket.

— Al Morton, OPNFV TSC Chair

"2020 was another important year for OpenDaylight in terms of its longevity as the world's most pervasive open source SDN controller. This year, OpenDaylight delivered two important releases — Magnesium and Aluminum.

The releases had several improvements to the controller platform and Incremental Data Recovery makes it faster to recover and reduce the overall storage requirements. The releases also include new features added in key projects like TransportPCE, BGPCEP, etc. that help with service provider use cases, cross-project collaboration, and improvements in S3P (stability, security, scalability, performance).

The last 3+ years as the OpenDaylight TSC Chair have been an immensely rewarding and enriching experience for me and I hope I have served the community well. I feel it is a good time now to pass the mantle. I would like to take the opportunity to congratulate and welcome Guillaume Lambert to the role. I believe he will do a great job—OpenDaylight TSC leadership is in very capable hands."

— Abhijit Kumbhare, OpenDaylight TSC Chair

"Tungsten Fabric received great traction and community support amidst a difficult situation due to the pandemic, making 2020 a landmark year for achieving multiple community milestones. We have improved governance and operations documentation and processes—paving the way for better collaboration, developer onboarding, and participation from the community at large.

We have established a community release plan and process with a 6 month release cadence (May and November) and provisions to incubate new projects, thus enhancing the footprint of Tungsten Fabric. The user manual and documentation have been improved allowing better consumption of features and delivery of use cases.

We are committed to offering a feature rich, production grade SDN controller and continuously working on stabilizing and improving on the core functionalities offered in each release. Our key focus area is adapting the operator framework to enable easy lifecycle management in Kubernetes environments and extending Tungsten Fabric features to cloud native use cases. We expect to see many of these made available in 2021."

— Prabhjot Singh Sethi, Tungsten Fabric TSC Chair

Marketing Advisory Group Update: If You Want To Go Far, Go Together

Bryan Madden, Global Head of Industry Marketing, Data Platforms Group, Intel Corporation; LFN Marketing Advisory Council (MAC) Chair

2020 has of course been an extremely challenging year for our global village. In the grand scheme of things, countries, cities, and localities have needed to enact measures to help keep citizens safe representing an oftentimes drastic change in people's daily lives. Whole lives have been impacted immeasurably. The term 'new normal' sprung up and we all needed to adapt. Global communications networks and tools have proven pivotal in this adaption, keeping us connected—to loved ones, medical professionals, business, helping ourselves and our families remain as productive as possible in an uncertain time.

After 3 full years since its founding, LF Networking (LFN) continues to make a significant impact, supporting the foundation and evolution of these networks with open source software. But perhaps less widely understood is the important role of LFN to develop and foster collaborative communities across the networking ecosystem. And it's at times like this, during a global pandemic, that the importance of working productively across countries, languages, cultures, time zones, and platforms on common network building blocks cannot be overstated. However, its much more than just being productive. Its the ability to go further together, to ideate, to collaborate and to innovate as one community, regardless of culture, background and industry.

The LFN Marketing Advisory Council, composed of members from leading companies across our industry, aims to drive awareness, engagement, and support of the diverse group of projects within LFN. Together, we develop strategies, campaigns, content, and events to help accelerate the availability and deployment of commercial solutions. We do this by telling compelling stories about users and successes, increasing developer engagement, and positioning LFN as the nexus point for open source networking.

In 2019, we began shifting our focus away from physical events and toward digital marketing in order to maximize our content utility, overall reach, and ROI to our community. Although we didn't know it at the time, this decision proved especially prescient as COVID-19 put a stop to all industry events. This digital foundation enabled us to hit the ground running in 2020 with a full pipeline of content and end-to-end, automated, campaigns in our 3 primary areas of focus: 5G, Cloud Native, and Edge. New resources have been developed to help the industry understand LFN's role in each area while customer journeys provide new contacts with multiple intersections to the LF technical communities and access to support. I'm pleased to report that these three campaigns alone have attracted more than 400 new community members and that these guides have been downloaded more than 700 times.

With physical events not possible at present, the community accomplished the formidable task of converting to a wholly virtual event format while not delaying roll outs or community engagements. We saw an opportunity to create a new channel for thought leadership with the LFN Webinar Series where community members and technical experts shared their innovative work with the border ecosystem. Ten webinars in 2020 have achieved more than 1.2K live views and nearly 5K views on demand. We also successfully evolved our flagship event, the Open Networking and Edge Summit, to a fully virtual format, with more than double the average number of physical event attendees and a 95% event satisfaction rating. After a face to face event in chilly Prague at the start of the year, our technical community also embraced the virtual format and hosted 3 more events in 2020 with over 1,300 attendees.

Our success in 2020 under difficult circumstances was only made possible by great community participation and support. The End User Advisory Group (EUAG), Technical Advisory Council (TAC), and working groups all contributed compelling, user-generated content for the community. We will continue to engage with these groups and others in 2021 to ensure that our marketing remains in tight alignment with our technical leadership and project priorities. Another priority, and an exciting one at that, will be the launch of Anuket—the merger of OPNFV with the Cloud iNfrastructure Task Force (CNTT). This will provide the industry with a north star around reference architectures, testing and conformance, and cloud computing integration.

I would like to thank all the LFN MAC members for helping us to collectively overcome adversity in 2020, collaborating on and delivering open source marketing excellence.

After two years in the role, I'm stepping down as MAC Chair. It has been my pleasure to lead this group. A special thanks to Heather, Brandon and Jill for their unending support, counsel and encouragement. I have every confidence that this dedicated group of marketers on the MAC will continue to navigate these rough waters into a new world of possibilities in 2021. Just always remember, if you want to go quickly, go alone. If you want to go far, go together.

2020 Industry Impact

By the Numbers

14K
Press Clips

9
Press Releases

3B
Potential Aggregate Reach

35+
Media/Analyst Briefings

576K
Twitter Impressions

Summary

LFN's projects have become de facto standards as telcos have embraced open source. Entering its third year, LFN is maturing—and with that, so is its narrative. With a strong cadence of reliable releases, project code drops no longer make headlines. Rather, we're seeing more focus on how LFN and its projects integrate across technologies to address the needs of expanding networks, namely cloud native, 5G, and edge. More evolved and mature, LFN projects, as Tech Radar noted, "are being used as a major component to create the technology that will drive the evolution of the next generation of mobile networks." We expect that narrative will continue to evolve in 2021, with even greater emphasis on areas like enterprise and cloud native.

Top Headlines

Forbes

[Open Networking & Edge Summit 2020 Delivers]

Light Reading

[5G's future includes a cloud-native architecture complete with containers]

SDxCentral

[CNTT Baldy release hastens container NFVi focus]

TechRadar

[Open Source—the key to unlocking the networks of the future]

ZDNet

[How open source software transformed the business world]

FierceTelecom

[OPNFV evolves and hitches its wagon to Common NFVi Telco Taskforce]

Light Reading

[Public cloud providers seek closer collaboration with telcos]

Top Quotes

TechRadar

"In the telecommunications sector, open source is not just a way to foster collaborative research and innovation, but more importantly, it is an opportunity to make real change to the telco ecosystem. Open source projects are being used as a major component to create the technology that will drive the evolution of the next generation of mobile networks."

Yves Bellego, TechRadar

ZDNet

"Today, over 70% of the world's mobile phone users are using services built on LFN's open-source projects. Altogether, the telecommunication companies' programmers have contributed 78 million lines of source code to LFN projects over the last six years."

Steven J. VAughaun-Nichols, ZDNet

Light Reading

"Google Cloud Platform's membership in LFN is an example of the evolution of the public cloud players and their role with telecom operators."

Sue Marek, Light Reading

Container Journal

"There are now more than 400 developers from 34 organizations making contributions to ONAP. As the percentage of those efforts increasingly focuses on Kubernetes, many IT vendors and enterprise IT organizations may need to consider whether they want to reinvent the wheel."

Mike Vizard, Container Journal

LFN on Stage at Industry Events

Big 5G Event

Cloud Native World

DSP Leaders World Forum

LFN Developer & Testing Forum (Prague)

LFN Technical Meetings (April)

LFN Developer & Testing Forum (Virtual) (June)

LFN Technical Meetings (October)

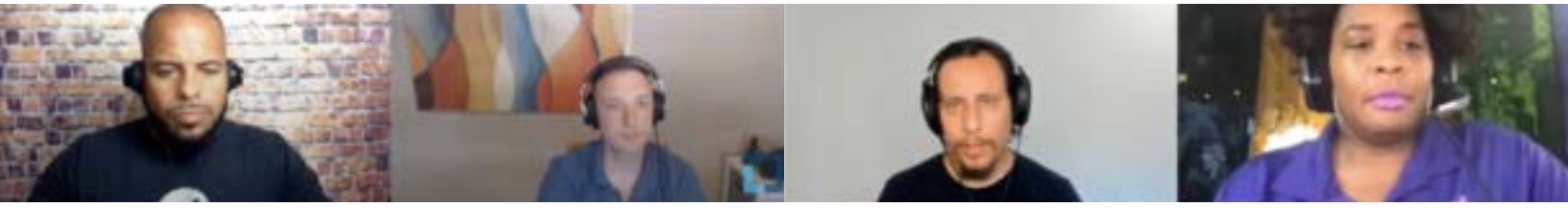
KubeCon + CloudNative Con Europe

Open Source Leadership Summit

Open Networking & Edge Summit

Open Source Summit North America

Open Source Summit Japan



Thank you for a successful 2020!

Learn more and get involved: **www.lfnetworking.org**