THE LINUX FOUNDATION

Annual Report 2021

New Horizons
for Open Source

www.linuxfoundation.org

The First Dawn
(August 1991)

"Hello everybody out there ..."

I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since April, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat(same physical layout of the file-system (due to practical reasons) among other things).

I've currently ported bash(1.08) and gcc(1.40), and things seem to work. This implies that I'll get something practical within a few months, and I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)

Linus

PS. Yes — it's free of any minix code, and it has a multi-threaded fs. It is NOT portable (uses 386 task switching etc), and it probably never will support anything other than AT-harddisks, as that's all I have :-(.

In Its 30th Year, Linux is Everywhere

Since Linux founder Linus Torvalds' first email in 1991, the last 30 years have seen a dramatic explosion in usage and adoption — everywhere on Earth and beyond. You can't wake up in the morning or go through your day without experiencing an environment supported by Linux.

85% of all smartphones run on Linux using the Android operating system.

96% of the world's top 1 million servers run on Linux.

100% of the world's top 500 super-computers run on Linux.

90% of all cloud infrastructure operates on Linux.

TUX TURNS 30!

Contents

**A note about the images
in this Annual Report:**

On the cover: An orbital sunrise is pictured
from the International Space Station as it
orbited 264 miles above Shenzhen, China.
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Letter From Our Executive Director

In 2021 the Linux Foundation ("LF") emerged from the worst pandemic in a century and embraced new horizons. The collaborative activities in our project communities weathered the COVID-19 crisis exceptionally well, and many communities are now pushing forward with a renewed sense of purpose.

The journey from our first horizon has been a momentous one. This organization's namesake project, the Linux kernel, has reached an amazing milestone: its 30th birthday. Over the years, more than 55,000 people have contributed code to improve Linux, and today, Linux can be found everywhere. Over 5.4 billion people rely on Linux as it powers the vast majority of smartphones, the world's largest cloud environments, and the world's fastest computers. It's also assisting in scientific discovery on Mars. After three decades of development, the project continues to ship new code, features, and performance enhancements.

As we continue to seek new horizons across open source and shared innovation accelerates, the rising tide of cybersecurity threats has planted itself firmly on our shores. We all rely on software supply chains that are constantly under attack by an increasingly sophisticated adversary, causing us to reflect on our role and responsibility in securing the world's critical technology infrastructure.

In 2021 we saw much progress in our quest to "harden" the software supply chain. The Software Package Data Exchange® (SPDX®) community received formal recognition as an international ISO/IEC standard (5962:2021), making it easier for organizations to require a Software Bill of Materials (SBOM) with suppliers and customers. This came on the heels of OpenChain receiving ISO/IEC approval as an international standard (5230:2020) for open source licensing compliance. We also saw new

"As new organizations, new industries, and policymakers have approached the LF for guidance on open source, we recognize there is a need for modern insights into why and how open collaboration works."

collaborations emerge this year, like sigstore, which is on its way to becoming a de facto standard for signing packages and digital artifacts used throughout a supply chain.

We expanded our cybersecurity horizons this year by elevating the Open Source Security Foundation (OpenSSF) to a funded project in October 2021 with over $10 million received from member contributions. This endeavor brought together a community of experts focused on software supply chain security challenges. Its amazing start included: publishing guidance for best practices (e.g., badges and scorecards), creating new tools and frameworks (e.g., SLSA), establishing and collecting metrics, developing free, globally accessible training materials, and publishing research, such as the findings of its FOSS Contributor Survey in collaboration with Harvard's Laboratory for Innovation Science. The LF could not have done this without significant support from our members, including OpenSSF's premier members 1Password, AWS, Cisco, Citi, Dell Technologies, Ericsson, Fidelity,

GitHub, Google, Huawei, Intel, IBM, JP Morgan Chase, Meta, Microsoft, Morgan Stanley, Oracle, Red Hat, Snyk, and VMWare.

The importance of open source in the world's cybersecurity efforts highlights its importance to our modern society. As new organizations, new industries, and policymakers have approached the LF for guidance on open source, we recognize there is a need for modern insights into why and how open collaboration works. There is a need to understand the dynamics of communities, where and how value is derived, and the intersection of supply chains and open source collaboration. To that end, this year, we embarked on a new horizon, by launching Linux Foundation Research to explore the role of open source software, standards, and communities as a framework for mass innovation, collaboration, and problem-solving.

Research into important topics such as cybersecurity and Software Bill of Materials (SBOM) readiness is already underway, along with project-specific insights sought by our

project communities. We think this investment will provide actionable data and insights supporting more informed decision-making across technology and industry ecosystems. Finally, while most research organizations hoard data privately, our research approach has an open flair — we're making all non-personally identifiable data available under the Community Data License Agreement — Permissive, Version 2.0, a revised data-sharing framework our legal community worked to release this year.

Having a research capability also provides new opportunities to more deeply explore challenges and opportunities in community collaboration. For example, this year LF Research partnered with AWS, CHAOSS, Comcast, Fujitsu, GitHub, GitLab, Hitachi, Huawei, Intel, NEC, Panasonic, Renesas, Panasonic, Red Hat, and VMware to examine the state of diversity, equity, and inclusion (DEI) in open source communities. To nurture and grow open source, we need to understand better how DEI is practiced and encouraged in open source communities. We hope this

research will also support other collaborative efforts supporting DEI goals, such as the Inclusive Naming Initiative, the Software Developer Diversity and Inclusion Project (SDDI), Fair Change, and Open Sentencing.

We have also expanded our open source horizons with industry partners, such as Microsoft and Accenture. Together, we've launched several new projects and foundations that are meaningful to humanity. For example, the Green Software Foundation seeks to add sustainability to software engineering efforts, and the AgStack Foundation is building an open source digital infrastructure for agriculture to accelerate that industry's digital transformation and address climate change.

Open source is finding new horizons of innovation and collaboration across industries. Let me share a few examples of this here. The LF helped launch several new collaborations focused on driving 5G and telecommunications, including the 5G Super Blueprint, a partnership with Next Generation

Mobile Network Alliance (NGMN), Magma Foundation, and the new Mobile Native Foundation. Our members also expanded open source innovation in the media and entertainment industry with the launch of Open 3D Engine (O3DE), a new open source AAA 3D engine for gaming, simulation, and storytelling. The O3DE ecosystem complements our existing Academy Software Foundation (ASWF) which added a new project for shading materials in graphics this year called MarterialX. As moviegoers, you and your families may have experienced the special effects delivered by this project in Star Wars: The Force Awakens.

Our project communities' ambitions often lead to a focus on building communities. We've seen many experts continue to collaborate on community engagement in the highly active TODO Group. However, there comes a time when our communities need tools to help scale and support their growth. In 2020, the LF embarked on a journey with key community leaders to build tools that enable those leaders and others to better

understand and more effectively engage with a project community, and to understand and reach its members. The results of these investments are now starting to roll out in our LFX platform which debuted in November at our Member Summit. I'd like to thank all those in our community who provided feedback, guidance, suggestions, and sometimes the raw critiques we needed to build something better.

The LFX platform started with tools we knew would make maintainers more efficient on tasks they really did not want to invest undue time on, such as processing Contributor License Agreements (CLAs) electronically in EasyCLA. Many maintainers were also interested in understanding their community dynamics leading to the creation of LFX Insights, which aggregates, analyzes, and contextualizes data across all of a community's repositories, communication channels, and contributors. Conversations about community health led to requests for tools to recruit and engage new project participants, particularly from diverse sources,

"In 2020, the LF embarked on a journey with key community leaders to build tools that enable those leaders and others better understand and more effectively engage with a project community. The results of these investments are now starting to roll out as the LFX platform."

and LFX Mentorship was born. Once engineers on our projects saw what LFX could do, they requested additional capabilities to configure and manage their projects. LFX Project Control Center now promises to enable engineers to provision and configure resources online in minutes with API-driven automation for common open source project tasks such as provisioning new cloud resources, managing DNS, and more.

The LF also heard the needs of our corporate members to have better visibility into how their organization is engaged in our communities. We've developed the LFX Organizational Dashboard to help managers assess their enterprise's participation in communities, find paths to collaborating in projects, exercise the benefits available to them as members, and more — all from a single system. All of these tools are now available to our communities and members through lfx.linuxfoundation.org.

Journeys in open source require a wide diversity of skills and training. The LF's 2021 Jobs Report, released in October with edX, shows trained and certified open source professionals, particularly with cloud and container expertise, are in high demand and are in short supply. Such data points highlight the need to train people and enable new opportunities to grow their careers in open source. Our training and certification efforts continued to gain steam this year. Over 68,000 individuals registered for new certifications in the past year, a 50% increase over 2020. At the same time, we reached a new milestone: 2 million people enrolled in the LF's free training courses via our collaboration with edX.

Finally, I'll wrap up by saying we sincerely missed seeing our communities in person. The last two years have been difficult — to harrowing — for many suffering from the lingering pandemic. However, this year we have seen hope on the horizon. We produced dozens of successful virtual conferences throughout 2021 and the feedback was clear: people wanted to meet in person again.

Our events team did a thorough job researching and soliciting advice from experts and public health authorities. That preparation enabled us to welcome our communities back together, in-person, this fall at events like Open Source Summit in Seattle, Open Source Strategy Forum and OSPOCon Europe in London and KubeCon+CloudNativeCon North America in Los Angeles, the latter of which gathered over 3,000 community members in person. These events would not have been possible without our commitment to attendee safety by requiring vaccinations and using vaccine verification technologies, diligent on-site health checks, and strict enforcement of the use of masks and social distancing protocols. With borders opening up shortly, we are ecstatic to see even more of our community, live and in-person, again in 2022.

On behalf of the entire Linux Foundation team, I congratulate our communities for their exceptional outcomes under another extraordinarily challenging year, and wish all of you a happy and prosperous 2022, when I hope we get to see you in person once again.

Jim

Jim Zemlin
Executive Director,
The Linux Foundation

Update From the Chair of the Board of Directors

Welcome to the 2021 Linux Foundation Annual Report. I am a Comcast Fellow and Head of the Open Source Program Office at Comcast. Our technologists work with open source every single day to innovate and deliver connectivity, media, and entertainment experiences to millions of people. I have also been on the Linux Foundation board since 2016 and the Board Chair of the Linux Foundation since 2019.

The last two years have demonstrated even more clearly that technology is the crucial fabric that weaves society and the economy together. From video conferencing to online shopping and delivery to remote collaboration tools for work, technology helped society continue to function throughout the pandemic in 2020 and the continuing uncertainty of 2021. All that technology (and more) is powered, quite literally, by open source, in one way or another.

Software is eating the world and open source software is becoming the dominant part of software, from the operating system to the database and messaging layer up to the frameworks that drive the user experience. Few, if any, organizations and enterprises could run operations today without relying on open source.

Not surprisingly, as it becomes more pervasive and mission-critical, open source is also proving to be a larger economic force. Public and private companies focused on selling open source software or services now have a collective market value approaching half a trillion dollars. There is no easy way to account for the total economic value of open source consumed by all businesses, individuals, nonprofits, and governments; the value enabled is likely well into the trillions of dollars. Open source powers cloud computing, the Internet, Android phones, mobile apps,

cars — even the Mars helicopter launched by NASA. Open source also powers much of consumer electronics on the market today.

With prominent positions in society and the economy comes an urgent imperative to better address risk and security. The Linux Foundation is working with its members to take on these challenges for open source. We launched multiple new initiatives in 2021 to make the open source technology ecosystem and software supply chain more secure,

> "Not surprisingly, as it becomes more pervasive and mission-critical, open source is also proving to be a larger economic force."

"Open source brings out the best in people by encouraging them to work together to solve great challenges and dream big. "

transparent, and resilient. From the Software Bill of Materials to the Open Source Security Foundation, the LF, its members, and its projects and communities are collaborating with paramount importance to secure the open source supply chain.

Behind risk management and security considerations — and technology development in general — are real people. This is also why the Linux Foundation is making substantial investments in supporting diversity and inclusion in open source communities. We need to take action as a community to make open source more inclusive and welcoming. We can do this in a data-driven fashion with research on what issues hinder our progress and develop actions that will, we hope, drive measurable improvements.

Working together on collective efforts, beyond just our company and ourselves, is not just good for business; it is personally rewarding. Recently one of our engineers explained that he loves working with open source because he feels it gives him a global network of teachers, all helping him become better. I believe this is why open source is one of the most powerful forces in the world today, and it is only growing stronger. Through a pandemic, through economic challenges, day in, day out, we see people helping each other regardless of their demographics. Open source brings out the best in people by encouraging them to work together to solve great challenges and dream big. This is why in 2021, I am excited to see all the new collaborations, expanding our collective efforts to address truly global problems in agriculture, public

health, and other areas that are far bigger than any one project.

After a successful 2021, and hopefully, with a pandemic fading into our rearview mirrors, I am optimistic for an even more amazing 2022. Thank you for your support and guidance, and I hope to see you again soon.

Nithya Ruff
Chair of the Board of Directors,
The Linux Foundation

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Thank You to Our Members and Communities

We could not imagine what laid on the horizon ahead of us as we saw COVID peek its head in late 2019. Locally and globally, we've weathered many challenges, adjusted our sails, and applied new tools and approaches to continue our momentum. As we now approach 2022, our hopes aim even higher as we pursue new horizons and strengthen our established communities. We're emerging stronger and better equipped to tackle these great challenges and your help has made it all possible.

Your willingness to engage in our local, virtual, and large-scale in person events were invaluable. These meetings demonstrated that the bonds within our hosted communities and families of open source foundations remain strong. Thank you for coming back to the events and making them successful.

In 2021, we continued to see organizations embrace open collaboration and open source principles, accelerating new innovations, approaches and best practices. Not only have we seen compelling new project additions this year, but these projects are bringing new organizations into our community. In 2021,
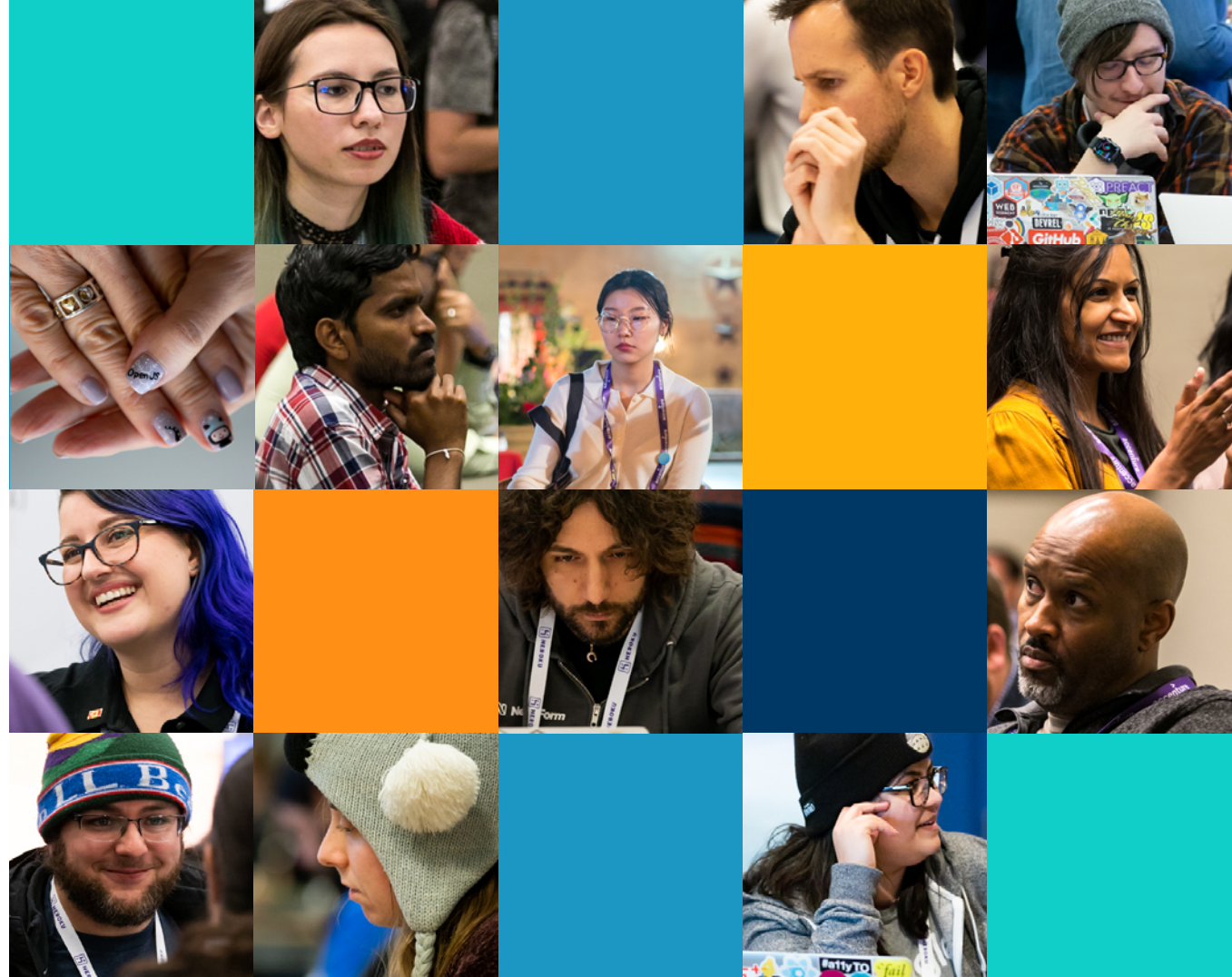
the LF welcomed a new organization nearly every day.

As we look to 2022, we see a diverse and growing pipeline of new projects across open source and standards. We see new demand to guide and develop projects in 5G, supply chain security, open data, and open governance networks. Throughout the continuing challenges of 2021,

we remain focused on open collaboration as the means for enabling the technologies and solutions of the future.

We thank our communities and members for your continued confidence in our ability to navigate a challenging business environment and your lasting and productive partnerships. We wish you prosperity and success in 2022

Communities Open New Horizons

This year the Linux Foundation has seen continued growth in contribution and engagement across the hundreds of open technology communities it supports while improving delivery quality and velocity.

2,300 LF and project members span the globe.

APAC 21%

Americas 48%
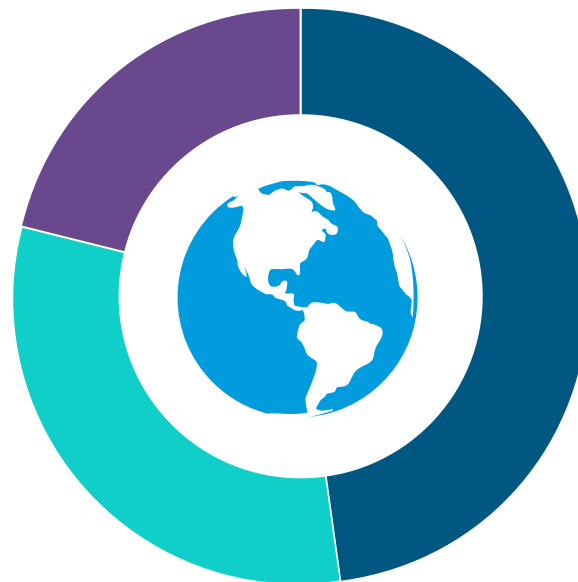
EMEAR 31%

In the last five years, the LF experienced...

1,000 additional members.

+280% growth in membership.

80%+ member renewal rate.

Linux Foundation Members

Platinum Members

AT&T

ERICSSON

FUJITSU

HITACHI
Inspire the Next

HUAWEI

intel.

Meta

Microsoft

NEC

ORACLE

QUALCOMM

Red Hat

SAMSUNG

Tencent 腾讯

vmware

Gold Members

accenture

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BLACKROCK

CISCO

citrix

DELL Technologies

Google

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RENESAS

SONY

TOSHIBA

TOYOTA

Uber

verizon

WeBank 微众银行

Silver Members

(As of 10/25/2021)

#

0Chain
1Kosmos Inc.
1NCE GmbH
2 Twelve Solutions
23 Technologies GmbH
3-Shake Inc
3K Technologies
6WIND S.A.
99Cloud Inc.

A

A10 Networks
Aarna Networks
ABB Ltd
ACC ICT
AccelByte Inc
Accuknox
Accurics
acend gmbh
Acnodal, Inc.
Acornsoft
ACTIA Group
Acumatica Inc.
Adafruit
Adaptive Financial
    Consulting Limited
Adfolks LLC
Adobe Inc.
Adva Optical Networking
    SE

Advanced Driver
    Information Technology
    Corporation
Advanced Micro Devices
    (AMD)
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aeolabs
Aerospike
Affinidi Pte Ltd
Afi Technologies
AfterShip Limited
Agenda d.o.o.
Agree Technology Co., Ltd.
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aicas GmbH
AIFRICA
Airbiquity
Airbnb
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Aiven Inc
Akatsuki inc.
Akenes SA (Exoscale)
Alauda,Inc
Alcide
Alerant Zrt.
Algorand
AllCloud Platforms Ltd
Allianz Deutschland AG
Alluxio, Inc.
Allwinner Technology, Co.
    Ltd.
Alpha Networks Inc.
ALPS ALPINE
Altair
Alter Way Cloud
    Consulting
Altinity

Altoros
Altran Technologies
Amantya Technologies,
    Inc
Amazon Web Services, Inc.
Ambassador Labs (f/k/a
    Datawire)
Amdocs Limited
American Express Banking
    Corp.
American Superconductor
Ampere Computing
Anchnet
Anchore, Inc
Anheuser-Busch InBev
    SA/NV
Animal Logic Pty Ltd
Anjuna Security, Inc.
Anonyome Labs, Inc.
Anqlave Pte Ltd
Ant Small and Micro
    Financial Services
    Group Co., Ltd.
Antares Vision SpA
Anthem, Inc.
ANTMICRO LTD
anynines GmbH
APE FACTORY
Apiiro
Apocalypse Studios Inc
Apolicy.io, Inc.
Apollo GraphQL
Appddiction Studio
Apple Inc.
APPLIED PRIVACY
Apptio
Appvia Ltd.

AQSACOM
Aqua Security Software,
    Inc.
ArangoDB
Arcadyan
Arcontech Group PLC
Arctiq Inc.
Arduino
Argon Security
ARIMA
Arista Networks, Inc.
Arkamys
Arm Limited
ARMO (Cyber Armor)
Armory Inc.
Arrikto, Inc.
Ascensio System SIA
ASG Technologies Group,
    Inc.
AsiaInfo Technologies
    (China) Co., Ltd.
Aspecto Inc
Aspen Mesh
ASRock Rack
    Incorporation
Astra Linux
ASUS Cloud Corporation
ATB Ventures
ATIX AG
Atlassian Inc
Atos
ATS (a KGPCo Company)
Audiokinetic Inc.
AuriStor Inc.
Autodesk
Automatic Data
    Processing, Inc. (ADP)

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Avanza Innovations IT
    Solutions LLC
Avesha
Aviz Networks
AVL Software and
    Functions GmbH
AVSystem sp. j.
Axelerant Technologies,
    Inc.
Axiata Digital Labs
Axis Communications

B

b-nova Schweiz GmbH
Backtrace I/O
Baidu USA LLC
Balena, Inc.
Bamboo Systems Group,
    Inc.
Bank of America
    Corporation
Bank of New York Mellon
Banma Information
    Technology
basysKom GmbH
Baumer Management
    Services AG
BayLibre Inc.
BearingPoint GmbH
BedRock Systems Inc.
Beechwoods Software,
    Inc.
Beijing Big Data Co.,Ltd.
Beijing Dosec Technology
    Co., Ltd
Beijing Huijun Technology
    Co. Ltd. (JD Cloud)

Beijing Kingsoft Cloud
    Internet Technology
Beijing Proinsight
    Technology Co., Ltd.
Beijing Shengxin Network
    Technology Co., Ltd.
    (QINGTENG)
Beijing Sup-info
    Information Technology
    Co. Ltd
Beijing Xiaomi Mobile
    Software Co., Ltd
Beijing Zhiling Haina
    Technology Co., Ltd
    (SmartX)
Bell Canada
BeOpenIt
BetterCloud
Biqmind Pte Ltd
BitDefender
Bitrock
Blameless Inc
Blockchain Labs, Inc.
Blockchain Technology
    Partners
Blockforce
Bloomberg Finance L.P.
Blue Sentry
BMC Software, Inc
BMW
BNP Paribas
BONbLOC Inc
BondEvalue Pte. Ltd.
Bonifii
Booz Allen Hamilton Inc
Bosch
BoxBoat Technologies

Brickdoc (Ningbo) Cloud Computing Technology co., ltd.

Bridgecrew

Brison Inc.

Broadcom Corporation

Broadridge Financial Solutions

Brobridge

BS Company Srl

build security

Bunnyshell

Buoyant, Inc.

Business Distribution Blockchain Solutions S.L.

Business-intelligence of Oriental Nations Corporation Ltd

Bytedance Ltd

bytesatwork

C

CA Technologies

Cable Television Laboratories Inc.

Cachengo

Caiyun Technology (Caicloud)

Calyptia

Camptocamp

CanaryBit

Candera GmbH

Canonical Group Limited

Capital One Financial Corporation

Capitalonline Data Service Co., Ltd

Capsule8

Carbonated

Cast AI Group, Inc.

Catalyst Cloud

Caylent Inc

Centilytics

Certizen Limited

CertusNet Inc.

Chainyard

Change Healthcare

Changzhou Citos Software Co., Ltd.

Charter Communications

Chef Software Inc.

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China Systems Holdings Limited

China Telecommunications Corporation

China Unicom

China-ASEAN Information Harbor Co., Ltd

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Cinemo GmbH

CINQ ICT

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Cirrus Logic

CISEL Informatique SA

Citi

Civo Ltd.

Clear Blockchain Technologies Pte Ltd

Cloocus

Cloud CMX Pty Ltd

Cloud9 Technologies LLC

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Cloudbase Solutions S.R.L

CloudBees, Inc.

CloudBolt Software

CloudControl, Inc.

CloudCover Pte. Ltd.

Cloudeasier

Cloudera, Inc.

Cloudical

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CloudNatix, Inc.

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Cloudreach

Cloudsmith Ltd

Cloudsoft Corporation Ltd

Cloudstratex

Cloudthread

Cloudyuga Technologies Private Limited

CloudZero

CLS Bank International

Clyso GmbH

CME Group Inc.

Cockroach Labs

Codasip s.r.o.

Codefresh, Inc.

Coder

Codethink

Cog Systems

Cognizant Technology Solutions

Colder Products Co

Collabora Ltd.

Comcast Cable Communications, LLC (Xfinity)

comforte AG

CommScope Inc.

Commvault Systems, Inc.

Component Soft Kft.

Concept Reply

Concurrent Real-Time Inc.

Conductor Technologies, Inc

Connect 5G, Inc.

Conoa AB

ConsenSys AG

ConsenSys Health

Container Solutions BV

ContainIQ

Continental Automotive Systems

Contino

Continuum Loop Inc.

Contrast Security

ControlPlane.io

CORE 24/7 LLP

CoreHive Computing LLC

CoreStack

Cosaic, Inc.

Cosmonic

CoSoSys S.R.L.

Couchbase, Inc.

Cox Communications, Inc.

crave

Creationline, Inc.

Creativehill

credativ international GmbH

croit GmbH

CrowdStrike

Crunchy Data Solutions, Inc.

Crust Network

Cryptape Technology Co., Ltd.

CSEngineering

CubeIGX

cuegee it

Cuemby Inc.

Cumulus Networks, Inc.

CVS Health

CyberArk Software Ltd

Cybertrust Japan Co., Ltd.

Cybozu

Cycloid

CYSEC SA

D

D2iQ, Inc. (f/k/a Mesosphere)

DAIMLER TSS GmbH

Dalian Hi-Think Computer Technology, Corp.

DaoCloud Network Technology Co., Ltd.

Daon Inc

Darumatic Pty Ltd

DATA AHEAD AG

Data Essential

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Datadog, Inc

Datadrivers

Datagrate, Inc.

DataStax, Inc.

Datto, Inc.

Daynix Computing LTD

DB Systel GmbH

DBE Core

Debricked

Decipher Technology Studios

Deepdive Digital Technologies International Inc.

DeepFactor

Deepfence, Inc

Deepshore GmbH

Dellfer, Inc.

Deloitte Consulting LLP

Delta Electronics Worldwide

Dembach Goo Informatik GmbH & Co. KG

DENSO CORPORATION

DENX Software Engineering GmbH (DENX)

DeployHub, Inc.

Depository Trust and Clearing Corporation (DTCC)

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Design Barn Inc

Desotech srl

Deutsche Bank AG

Deutsche Telekom AG

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DevOps Institute

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DevsOperative

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Dianomic

Diffblue Ltd

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Dito

DLT Global Inc.

DNEG

Docker, Inc.

DoiT International

DornerWorks, Ltd.

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Edgecore Network Corporation

Edgeless Systems

Educational Testing Service (ETS)

efabless Corporation

effx inc.

Eficode Oy

EGAR Global NoCode

Elasticsearch, Inc.

Elastisys AB

Elastx AB

Electronics and Telecommunications Research Institute

Elektrobit Automotive GmbH

Elementl

Elotl, Inc

emlix GmbH

EMQ Technologies Co., Ltd.

EngineerBetter Ltd

Enterprise DB Corporation

Entigo OÜ

env0

Enveil

Eolinker

EPAM Systems, Inc

Epic Games, Inc

Epsagon

Equinix, Inc.

ernst and young

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extrimian

F

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Fauna, Inc.

Federal Express

Federal National Mortgage Association (Fannie Mae)

Federated Wireless

Fidelity Investments

Filecoin Foundation

FireHydrant

Flanksource

FLANT EUROPE OÜ

Flexera

Flow Security

Flowchain

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FOSSA

FossID

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Foursquare Labs, Inc.

Foxconn Industrial Internet Co. Ltd.

Freddie Mac

FreedomFi

ftrack AB

Fugue

Fullstaq

Futurewei Technologies, Inc.

G

Gaia Information Technology

GAMEPOCH CO., LIMITED

Garden Technologies Inc.

Gatsby Inc

Gemini Open Cloud Computing Inc.

General Electric Company

Genesis Global Technology Limited

Genesys

Genvid Technologies Inc

GenX

German Edge Cloud GmbH

Ghost Locomotion Inc.

Giant Swarm GmbH

GitHub, Inc.

GitLab Inc.

GitLab Information (Hubei) Co., LTD

Gitpod GmbH

Global Peersafe Technology Corp

Globo

GoDaddy Operating Company, LLC

Goldman Sachs & Co. LLC

Golioth

GramLabs, Inc. (d/b/a StormForge)

Granulate Cloud Solutions Ltd

Grape Up Sp. z.o.o.

GraphCDN

GraphCMS

Gravitational, Inc ?DBA? Teleport

GRAVITI TECHNOLOGIES INC

Green Hills Software LLC

Gremlin, Inc.

GSI Technology

GT Software, Inc. d/b/a Adaptigent

Guangdong OPPO Mobile Telecommunications Corp., Ltd.

Guangxi Tidu Technology Co., Ltd. (TIDU)

Guida

Guide-Rails ? Calculi Corporation

H

Hacken

HackerOne

Hadean Supercomputing Ltd

Hammerspace

Hangzhou FIT2CLOUD Information Technology Co., Ltd

Hangzhou Harmony Cloud Technology Co., Ltd.

Hangzhou Langhe Technology Co. Ltd. (Netease)

Hangzhou Launcher Technology Co., Ltd

Hangzhou WOQU Technology Co., Ltd.

Hanover Insurance Group

HAPI - on-chain cybersecurity protocol

HAProxy Technologies

Harness Inc.

Harpoon Corp

Hartford Financial Services Group Inc.

HashiCorp Inc

Hasura, Inc.

HCL Technologies Ltd.

Healthvana

Hedera Hashgraph LLC

Helium Systems, Inc.

HENSOLDT Cyber GmbH

HERE Global B.V.

Hermes Fund Managers Limited (Federated Hermes)

Herron Tech

Hewlett Packard Enterprise Development LP

High Plains Computing LLC

Highway9 Networks

HomeAway.com, Inc.

Honda R & D Co. Ltd.

Horizon Robotics

HP Inc.

HSA Foundation

HSBC

Huayun Data Holding Group Co., Ltd

Hub Security

Humio

HX Security
Hyperloop One
Hyundai Mobis Co., Ltd.
Hyundai Motor Company

I

Iauro Systems
IDnow GmbH
IdRamp
iExec Blockchain Tech
IFS World Operations AB
Igalia, S.L.
IGNW
iguazio
IHS Markit
IITS Consulting
ILKI FRANCE
Imageware
Imagination Technologies Group Ltd.
Imperas Software Ltd
IN-COM Data Systems
Indeed, Inc.
Index Analytics
IndyKite Inc.
InfluxData Inc
Infoblox Inc.
InfoCert
Information Data Systems
Infosys Limited
Infracloud Technologies INC
InfraLight
infranics
ING
Innablr Pty Ltd

inovex GmbH
Input Output HK Limited
Inspur Group
Instaclustr
IntellectEU
intelletive
Intelligent Systems Services
InterCloud
Intrinsyc Software, Inc.
Intuit, Inc.
Intuitive Technology Partners, Inc.
InwinSTACK
Io-Tahoe
Ionir Inc.
IoT.bzh
IOTech Systems Limited
IPChain Association
IPwe
Isovalent Inc.
ITAU BBA USA SECURITIES, INC.
Itera Technologies a.s.
ITRenew
IVIS Automotive Solutions

J

JD.com, Inc.
Jeli.io
Jetstack Ltd
JFrog, Inc
Jiangxi Yumin Bank Co., Ltd
Jimdo GmbH
Joby Aero
Joisto Group Oy

JPMorgan Chase
Jump Operations, LLC
Juniper Networks, Inc.
JVC KENWOOD Corporation

K

Kaleido
Kaloom Inc.
Kasten, Inc
KatRisk LLC
KBSYS Inc
KDDI Corporation
Kentik
kerlink
Kernkonzept GmbH
Keyless technologies LTD
Keysight Technologies Inc.
Kingdee Software (China) Co., Ltd.
Kinvolk GmbH
KINX
Kioxia Corporation
Kiratech SpA
KitBash3D
Kloia
KNS Group LLC (trademark YADRO)
KodeKloud
Komodor Inc.
KompiTech
Kong Inc.
Konsulko Group
KPIT Technologies Limited
KPMG
Kry10 Limited
Krypc Corporation

kt NexR
KubeMQ Ltd.
Kubermatic GmbH
Kubernative GmbH
Kubernetes Innovation Labs LLC (KubeShop)
Kublr
KUKA Deutschland GmbH
Kumina B.V.
KylinSoft Coporation (Beijing)
Kythera AI

L

L4B Software GmbH
Lablup Inc.
Lacework
Laird Connectivity, Inc
Lawrence Livermore National Laboratory (LLNL)
Layer5
LeanIX GmbH
Lear Corporation
Ledger Leopard
LedgerDomain Inc
Lenovo (United States) Inc.
LG Electronics
Li Auto Inc.
Lightbend Inc
Lightspin
Lightstep, Inc.
Linaro Limited
LINBIT HA-Solutions GmbH
Lineo Solutions, Inc.
LinkedIn Corporation

Linklogis Inc
Linode LLC.
Linutronix GmbH
Liquid Avatar Operations Inc.
Liquid Reply
LMAX Exchange Ltd
Loft Labs, Inc. (DevSpace Technologies)
LogDNA, Inc
Logiq.ai Inc.
Logshero Ltd.
LPI.org
LSD OPEN
Lumedic Acquisition Corp
Luxoft Global Operations GmbH

M

MacStadium
Mail.Ru Cloud Solutions
MakinaRocks
Man Technology
Marelli Corporation
Marvell International Ltd
MasterCard Incorporated
Matrix I.T CloudZone LTD
MATRIXX Software
Mattermost, Inc.
Mavenir Systems, Inc.
Maxon Computer GmbH
MayaData Inc. (f/k/a CloudByte, Inc)
Mazda Motor Corporation
MBDA Italia S.p.A
McKinsey & Company
MediaTek USA Inc.

MediConCen Limited
MegaEase, Inc.
MegazoneCloud
Meinberg Funkuhren GmbH & Co KG
Mellanox Technologies, Ltd
Memfault Inc
MERA
Merck & Co., Inc.
Metrics Design Automation Inc.
MetroStar Systems
MIA s.r.l.
Micro Focus International plc
Micron Technology
Micware Co. Ltd.
Milligan Partners
mimik Technology Inc
Mindtree Limited
Minio, Inc
Mirantis, Inc.
Mission:data Coalition
Mitsubishi Electric Corporation
Mitsubishi Motors Corporation
Mobilise Cloud Services
Moment Technologies, Inc.
Momenton
Monax Industries, Ltd
Monetago Inc
Monostream AG
MontaVista Software, LLC
Morgan Stanley

Morpheus Data

Moscow Exchange (MICEX-RTS)

MotionMobs

MotoJeannie

Moxa Inc.

MSys Technologies

MTX Group Inc

N

UFG Union Bank

NNAMUTECH Co., Ltd.

Nanjing eCloud Technology Co., Ltd.

National Instruments Corporation

Navitas Business Consulting Inc.

NCC Group

NCSOFT Corporation

ndustrial

NearForm Ltd

Nebulon

Neo4j, Inc.

NEOS

NetApp, Inc

Netdata

Netflix, Inc.

NetFoundry

Netgate

Netis Technologies Co., LTD

Netris, INC.

Neuroglia

NeuVector Inc.

Nevexis

New Context, A Copado Co.

New H3C Technologies Co., Ltd

New Relic, Inc.

nexB Inc.

NexCloud

NGINX International Limited

Niantic

Nikon Corporation

NIO

NIPA

Nippon Seiki Co. Ltd.

Nirmata, Inc.

Nissan Motor Co. Ltd.

Nokia Corporation

Nomura Group

Nordic Semiconductor ASA

noris network AG

Novetta Solutions

NSONE, Inc.

NTC IT ROSA LLC

NTT Corporation

NTT DATA MSE CORPORATION

Numbers

Nutanix, Inc.

NVIDIA Corporation

NXP Semiconductors Netherlands B.V.

O

OBSS

Occentus Network

Octo Consulting Group

OctopusDeploy

OGIS-RI Co., Ltd.

Okta Inc.

OPEN CERT

Open Raven

Open Source Automation Development Lab (OSADL) eG

Open Source Consulting Inc.

Open Source Security, Inc.

OpenNebula

OpenSynergy GmbH

Opsani

opscruise

OpsMx

Orange SA

Ori Industries

Origoss Solutions Ltd

Ortec Finance

Osaka NDS Co., Ltd.

OSIsoft

OSNEXUS

Oteemo Inc.

Oticon A/S

OurSci

OVH Groupe SAS

Ovoo Spó?ka z o. o.

Ozone

P

Padok

Palo Alto Networks

PANTHEON.tech s.r.o

Paramount Software Solutions Inc.

Parasoft

Particule

PayPal Holdings, Inc.

Pegasystems Inc.

Peloton Interactive

Penten

Persistant Studios

phala network

Phoenix Software International

pileus

Ping An Technology (Shenzhen) Co., Ltd

PingCAP

Pinterest Inc.

Pioneer Corporation

Pionix GmbH

PJSC "MMC" Norilsk Nickel

PlanetScale, Inc.

Plat'Home Co., Ltd

Platform9 Systems, Inc.

Platformer Cloud Pty Ltd

plural

Polar Squad

Polyverse Corporation

Portainer.io

Poste Italiane SPA

Postman

Pravici LLC

Precisely Holdings, LLC

Precision Innovations Inc

Prefect

Pricewaterhouse Coopers LLP

Prisma Data, Inc

PRODYNA

Profian

Proofcraft Pty Ltd

ProsperOps

proteanTecs

PT Boer Technology (BTech)

Public Mint Inc

Pulumi

Puppet, Inc.

Pure Storage

Puzzle ITC GmbH

Q

Qamcom Group AB

QAware GmbH

QingCloud Technologies Corp.

Qovery

Quant Network

Quanta Cloud Technology Inc.

QuickLogic

Quobyte Inc.

R

RR3 LLC

Rackner

Radisys Corporation

RADTONICS

Rafay Systems, Inc.

Raft

Raintank, Inc. ? Grafana Labs

Rakuten Group, Inc.

Rancher Federal

RANDA Solutions

RapidAPI

Ratio

Raytheon Technologies

RBC Capital Markets, LLC

ReadMe

ReadySpace Network Pte Ltd

Rebaze

Reblaze

Recurve

Red Date (Hong Kong) Technology Limited

Red Kubes BV

Red Reply

Redeploy

Redis Labs

Refinitiv

Reliance Jio Infocomm Limited

replex GmbH

Replicated, Inc.

Resilient Scale

Revelry Labs

ReversingLabs

Revolgy

Ribbon Communications Operating Company, Inc.

Ricker Lyman Robotic Company, Inc. (Hivecell)

Ricoh Company, Ltd.

Ripple, Inc.

Robin Systems, Inc

Rocket Software, Inc.

RodeoFX

Rookout Ltd.

Rootchain Technology Co., Ltd

RStudio PBC

RTE (Reseau de Transport dElectricite)

RunX Labs Inc

RX-M, LLC

S

S&P Global Inc.

Saaras, Inc.

SADA Systems

SAIC Motor Corporation Ltd

Saleor Commerce

Salesforce.com, inc.

Salsify

SANCLOUD LTD

SAP

Sartura

SAS Institute Inc.

Sauce Labs Inc

Savoir-faire Linux

SBERBANK

Scalably Co.,Ltd.

Scaleway

Scality Inc.

Scarf Systems, Inc

Schneider Electric

Schwarz IT GmbH & Co. KG

Science Applications International Corporation

SCOIR, Inc.

Scott Logic Ltd

Seagate Technology LLC

Searce

Second State

section.io Inc

SecureKey Technologies, Inc.

Selective Insurance Group

Sempre.ai

Senofi

Sensu, Inc

Sentara Healthcare, Inc.

Serverless

ServeTheWorld AS

servicememe

Services4-IT

Shanghai Fusion Fintech Co. Ltd

Shanghai Jibu Technology Co., Ltd.

Shanghai Mandao Technology Co., LTD

Shanghai Pudong Development Bank

Shanghai Qiniu Information Technology Co., Ltd.

Shanghai Tianji Network Co., Ltd.

Shanghai UCloud Information Technology Co., Ltd.

Shanghai Vonechain Information Technology Co., Ltd

Shenzhen Forms Syntron Information Co. Ltd

Shenzhen Goodix Technology Co.,Ltd.

Shenzhen Jiangxing Intelligence Inc.

Shenzhen Wise2C Technology Co.,Ltd

Shenzhen Yunduan Software Ltd.

Shenzhen ZhiLiu Technology Co., Ltd.

ShiftLeft

SHINESOFT

Shipa

Shoelace Wireless Inc

Shopify Inc.

Shoreline

Sibros Technologies

SICPA SA

SideFX (Side Effects Software Inc)

Sidero Labs

Siemens AG

SiFive

SIGHUP, Inc

Silicon Laboratories Inc.

SIMBA Chain

SingleStore, Inc.

Sirius XM Radio Inc.

SiteWhere LLC

Sivantos GmbH

SkyWater Technology

Slim.AI

Smallstep

Smart Block Laboratory

SmartBear Software, Inc.

Smartiful, Inc.

SMBC Americas

Snapper Future Tech Pvt Ltd

Snapt, Inc.

Snow Software AB

Snyk Limited

Softax SP.j.

SoftBank Corp.

Softchoice LP and Softchoice Corporation

SoftIron Inc

SOFTWARE ENGINEERING GmbH

Software Mind

SoftwareONE AG

SoKube

Solo.io

Solutions by STC

Sonatus, Inc.

Sonatype, Inc.

SORAMITSU CO., LTD.

Sosivio

Sparkfabrik srl

Spectral

Spectro Cloud, Inc.

Spirent Communications Inc

Splunk Inc.

Spotify AB

Sprint Corporation

Squarespace, Inc.

stackgenie

StackHawk

Stacklet

StackRox, Inc.

Stackwatch Inc

Starburst Data

Stark & Wayne LLC

State Farm Mutual Automobile Insurance Company

Sterlite Technologies Limited

STMicroelectronics International N.V.

StorageOS Ltd

Storm Reply GmbH

StorPool Storage AD

Strategic Blue

Stratox Cloud Native

StreamNative

Structsure, LLC

Styra Inc

Submer

Sumo Logic, Inc.

SuperOrbital, LLC.

Surge

SUSE LLC

Suzhou Beyondcent & Software Co., Ltd. (BoCloud)

Suzuki Motor Corporation

SVA System Vertrieb Alexander GmbH

SWIFT, INC.

Swisscom

Symbridge LLC

Symphony Communication Services LLC

Synax GmbH

Synopsys, Inc

Sysdig, Inc.

SysEleven Gmbh

SYSGO GmbH

T

Tafi

Talend, Inc.

Talino Venture Labs

Tangem AG

Target Brands, Inc

Tata Communications Limited

TDT AG

Teal Communications, Inc.

Tech Mahindra Limited

technative

Technology Innovation Institute

Tectonic Labs Ltd.

teenage engineering

Telechips, Inc.

Telecom Italia Mobile (TIM) S.p.A.

Telefonica

Temporal Technologies Inc

TenneT

TensorSecurity Technology Ltd

TenxCloud

TeraSky

Ternary

Testlio

Tetrate.io

Teuto.net Netzdienste GmbH

Texas Instruments Incorporated

Thales

The Constant Company, LLC / Vultr

The Foundry Visionmongers Limited

The Guild

The Medium

The Qt Company Oy

The Scale Factory Limited

The Walt Disney Studios

Thebes Cloud Management Limited

Thought Machine Group Limited

ThoughtWorks, Inc

Thunder Software Technology Co. Ltd.

Tick42

Tidelift, Inc.

Tigera, Inc.

Timescale

Timspirit

TLM Partners

TmaxA&C

Tokentrust AG

TORO Cloud

Toyota Tsusho Corporation

Traceable

Traefik Labs SAS

Trail of Bits

Translucent Computing

Transposit Corporation

Transwarp Technology (Shanghai) Co., Ltd

Travelers

Travelping GmbH

Trenchant Limited (G-Research)

Trend Micro Incorporated

TriggerMesh Inc.

Trilio Data

Truepic, Inc.

Tufin Technologies

Turk Telekomünikasyon A.S.

Turnium Technology Group Inc

Tuxera Inc.

Twitter Inc.

Tyk Technologies Ltd.

TYNYBAY Inc

U

Ubiquitous AI Corporation

UBS AG

ULAK HABERLESME A.S.

UMB AG

UNA Blockchain

Unbound Tech Ltd.

Unicorn systems a.s.

UnionTech Software Technology Co., Ltd.

Unisys

Unity Technologies

UP9

Upbound

Upsolver, Inc.

US Navy

USAA

V

VA Linux Systems Japan K.K.

Valve Corporation

Vapor IO

Vattenfall Eldistribution AB

Vaxowave

vectorized

Veea Inc.

Vela

Velocity

Ventus Cloud AG

VeriSilicon, Inc.

Vertiv

VES LLC

VEXXHOST, Inc.

Viable Data

Vicom Infinity, Inc.

Virtasant

Virtual Power Systems

Visa Inc.

VitalHub Corp.

vivo Mobile Communication Co., Ltd.

Vlingo LLC

VNC Automotive Limited

Vodafone Group Plc.

VoerEir AB

Volkswagen Aktiengesellschaft

Vonage Holdings Corp.

Vorteil

VSHN AG

W

Wallarm

Walmart Inc.

Wanclouds Inc.

Wandelbots

Wangsu Science & Technology Co., Ltd.

Wargaming.net Limited

Wavelabs

We.Trade Innovation DAC

Weaveworks Inc.

Wegmans Food Markets

WeHealth Solutions PBC

WeScale SAS

Western Digital Corporation

Weta Digital Limited

WhaTap Labs Inc

White Source Ltd.

Whitestack LLC

WhizUs GmbH

Wind River Systems, Inc.

Windmill Engineering

Wipro Limited

WISeKey SA

Wistron NeWeb Corp.

Witekio Holding

Witz Corporation

WSO2 Inc.

Wuhan Deepin Technology Co.,Ltd

WuHan Lotus Cars Technology Co.,Ltd

X

x-cellent technologies GmbH

x-ion GmbH

Xcalibyte

Xenit AB

XenonStack Inc.

Xevo Inc.

Xi'an Tieke Jingwei Information Technology Co.,Ltd. (CARS)

Xi'an Zhigui Internet Technology Ltd.

Xiaoju Science Technology (Hong Kong) Limited

Xilinx Inc

XSKY (Beijing) Data Technology Co.,Ltd.

Y

Yahoo Japan Corporation

Yellowbrick Data

YLD! Limited

Yoppworks

Yotascale

Z

Zafin Labs Americas Inc.

Zebrium, Inc.

ZEDEDA, Inc.

Zenlayer Inc

Zero ASIC

Zerto, Inc.

Zettabytes, Inc.

Zettaset, Inc.

ZF North America, Inc.

Zhejiang Dahua Technology Co., Ltd

Zilliz

Zoss Team, LLC

ZTE Corporation

ZutaCore

NEW HORIZONS

In 2021, the Linux Foundation set our sights on new horizons by reaching new developers, serving large and small communities, launching a community platform, starting a new research division, expanding our training offerings, and resuming in-person events.

Serving Over 750 Open Source Project Communities

Over the last 20 years, the Linux Foundation has expanded from supporting a single project, the Linux kernel, to many distinct project communities. Over 1,900 members and hundreds of thousands of developers are engaged in some of the most important and active open source projects, collaborating in cross-industry technology domains, such as cloud, security, blockchain, and the web.

LF communities cover a range of technical segments.

LF communities have expanded into open standards, open data, and open hardware.
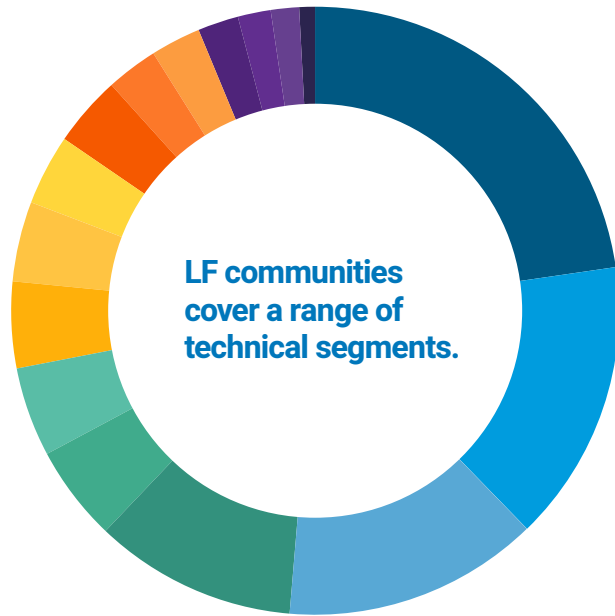
- Cloud, Containers & Virtualization **22.7%**
- Networking & Edge **15%**
- Web & Application Development **13.6%**
- AI, ML, Data & Analytics **10.8%**
- Privacy & Security **5.1%**
- Cross-Technology **4.8%**
- IoT & Embedded **4.6%**
- Blockchain **4.3%**

- DevOps, CI/CD & Site Reliability **3.8%**
- Open Source & Compliance Best Practices **3.8%**
- System Administration **2.8%**
- System Engineering **2.7%**
- Linux Kernel **2.2%**
- Safety-Critical Systems **1.8%**
- Open Hardware **1.5%**
- Visual Effects **.8%**
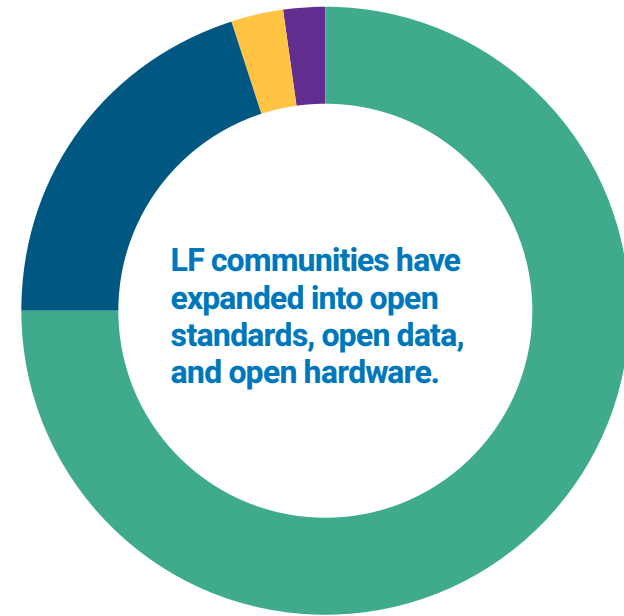
- Open Source Hardware **75%**
- Open Standard / Specification **20%**
- Open Data **3%**
- Open Hardware **2%**

Fostering Growth, Quality, and Velocity

This year the Linux Foundation has seen continued growth in contribution and engagement across the hundreds of open technology communities it supports while improving delivery quality and velocity. The insights provided by the LFX Platform clearly tell the story.

1B+ lines of code
are supporting the most business critical and groundbreaking innovations.
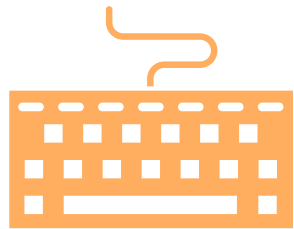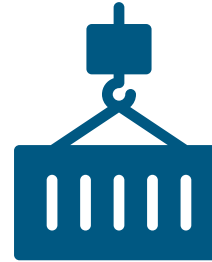
29M+ lines of code
are added weekly to support ongoing development of active projects.

11.5B+ containers
have been released and downloaded to deliver open source technologies to the world.

The average count was
28,443 active contributers
during the last year.

Commits by
new contributors increased by 336%
during the last year.

3,631 organizations
participated in commits in 2021.

In 2021, an average of
2,082 issues were closed within one day
of being submitted.

An average of
80.6K successful builds
were executed per month in 2021.

The total number of builds per day have **increased by 68%** during the last year.

12.9K+ repositories
are holding the valuable code that is powering the development of open source.

In 2021, commits were made by:

77%
affiliated contributors

16%
unaffiliated contributors

7%
individual contributors

An average of
14,831 emails
were sent per month by community members in 2021.

Sanath Ramesh, founder of the RareCamp Project, speaks atthe 2021 Open Source Summit in Seattle.

Powering Many Initiatives in Communities Large and Small

While Linux and Kubernetes are perhaps the most visible of Projects at the Foundation, hundreds of other projects are making a lasting impression on their communities. Here are some examples of those efforts:

▶ The **RareCamp Project** provides source code and open governance for the OpenTreatments software platform that enables patients to create gene therapies for rare diseases. Sanath Ramesh founded the project following a rare genetic disease diagnosis for his son.

▶ To better support its 220 million weekly customers, Walmart can now trace the origin of over 25 products from 5 different suppliers using a system powered by **Hyperledger Fabric.**

▶ **Hyperledger Besu** is used in the Palm NFT Studio Palm chain, as a layer 2 blockchain protocol, with an almost 0% carbon footprint. Recent NFT mints include DC Comics FanDome 2021 NFT comic cover collectibles.

▶ **MaterialX**, which originated at Lucasfilm in 2012, has grown into the central format for material description at Industrial Light and Magic (ILM) and is used in production for movies such as Star Wars: The Force Awakens.

▶ The Mars Helicopter, Ingenuity, runs on the LF's **Yocto Project** — a (now multiplanet) Linux distribution designed for custom device development.

▶ Private LTE networks powered by the **Magma Project** now allow tribal nations in North America to control their internet access — supporting critical communications, monitoring cultural resources, and enabling distance learning during the pandemic.

▶ The **Prometeo Project** was created by a nurse, a firefighter, and developers as a system that uses artificial intelligence and IoT to guard the safety of firefighters. The Project recently improved its integration with mobile phones and watches to provide two-way alerts and capture toxin exposure averages over time.

▶ Oticon More™, the world's first hearing aid that allows users to hear all relevant sounds thanks to an onboard Deep Neural Network, is powered by **Zephyr RTOS.**

NASA/JPL-CALTECH/AS

Above: NASA's Ingenuity Mars helicopter in a close-up taken by Mastcam-Z, a pair of zoomable cameras aboard the Perseverance rover.

Right: A Prometeo monitoring device is worn by a firefighter during prescribed burn of the forest in Olivella, south of Barcelona, Spain in 2020.

REUTERS/ALBERT GEA

LFX Platform: Growing and Sustaining Open Source

Our mission is to support the world's most important shared technology collaborations. But there are many challenges in scaling to meet the requirements of serving open source communities and innovation. Over the past two decades, we've learned that ecosystem building is complex.

Open source ecosystems need access to better tools to scale, make code commits, scan for security vulnerabilities, and deploy. Community managers need to facilitate meetings, host meet-ups online or in-person, support governing boards, and decide on proper governance structures. Open source projects need to be responsive, provide support, engage in training, and promote their latest developments.

Our aim is to help reduce the complexity of building and managing open source ecosystems by delivering a new platform that brings people, information, tools, and

services. We imagined and built this digital toolbox and launched it at our Member Summit in November. We'd like to invite you to explore LFX. First, create your LFID needed to login. Then jump into experiencing LFX elements like your Individual Dashboard, Mentorship, EasyCLA, Insights, or Security.

LFX Provides:

Funding
• Crowdfunding
• Member Enrollment

Growth & Adoption
• Organization Dashboard

Talent Management
• Mentorship
• Training & Certification

Application Security
• Security (Code Secrets, Non-Inclusive Language, Vulnerablities)

Community Identity
• Individual Dashboard

Community Management
• Branded Meetup/Events
• Community Analytics
• Meeting Management

Health & Analytics
• Insights (Technical, Ecosystem, Marketing)

Community Operations
• Project Control Center

IP Management
• EasyCLA
• SBOM Generator

The LFX platform is designed to address these issues and more. LFX aggregates dozens of data sources and commonly used management tools. It provides visualization tools with an added layer of intelligence to reveal best practices for numerous open source stakeholders, including: developers, project leaders, open source program offices, legal, operations and even marketing.

LFX is a suite of elements engineered to grow and sustain and grow the communities of today and build the communities of tomorrow. By automating and consolidating many of the most critical activities needed by open source projects and stakeholders, our hope is to reduce complexities that sometimes hinder innovation and progress.

The LFX platform provides our members and project with tools to support every stage of an open source project, and as we head into 2022, our plan is to release even more functionality to support our growing community.

Learn more about the LFX Platform at lfx.linuxfoundation.org.
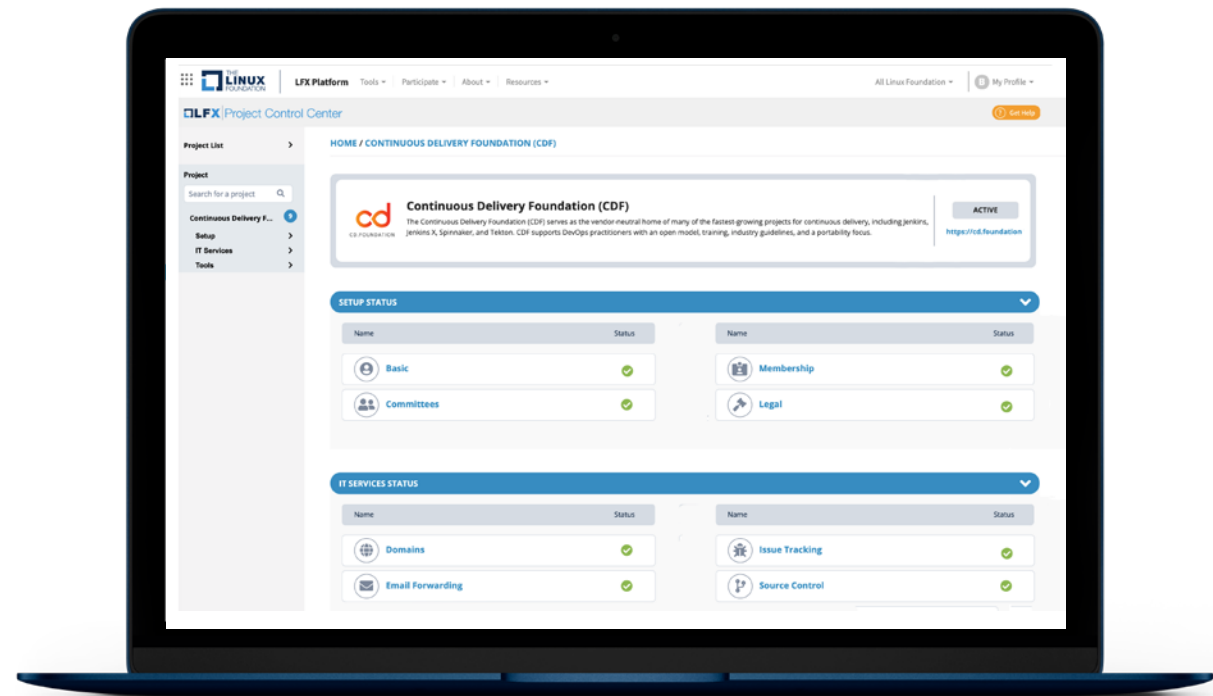
Cloud Native Computing Foundation

CLOUD NATIVE
COMPUTING FOUNDATION

The Evolution of "Us"

The Cloud Native Computing Found-ation crossed new horizons in 2021 as we journey towards making cloud native ubiquitous. We achieved record growth across all areas, from projects, events, and the cloud native ecosys-tem to membership and community. Most importantly, this year the defini-tion of "Us" has evolved to encompass a truly global, welcoming community of doers, working collaboratively to change computing fundamentally.

CNCF is the vendor-neutral hub of cloud native computing. We host cutting-edge projects and are dedicated to making cloud native universal and sustainable. Today, CNCF has more than 740 members, making it one of the most success-ful open source foundations ever. In 2021, we welcomed more than 190 new vendor members, up 7% from 2020. Alongside, we saw a 17% year-on-year rise in end-user mem-bership. New Relic and Grafana Labs upgraded to Platinum membership, while American Express and New H3C Technologies joined us at Gold.

Throughout 2021, CNCF underscored its commitment to making cloud native ubiquitous by hosting 16 **graduated** projects, 26 **incubating** projects, and 78 **sandbox** projects, driven by more than 137,000 contrib-utors representing 186 countries.

CNCF is nothing without our incredible community, #TeamCloudNative, span-ning contributors, members, meet-ups, and ambassadors. This year, our flagship KubeCon + CloudNativeCon events drew attendees from 168 coun-tries across six continents. And our contributors significantly advanced the broader understanding of cloud native projects through the launch of the **Cloud Native Glossary**, driven by the **Business Value Subcommittee** and the **Cloud Native Maturity Model**, spearheaded by the **Cartografos Working Group**.

Kubernetes and Beyond

2021 was the year that solidified Kubernetes' place as the de facto container orchestration tool. In fact, **Red Hat's Kubernetes adoption, security, and market trends report**

2021 noted that: "Kubernetes is used by nearly everyone... (and) is living up to its title as the de facto con-tainer orchestrator."

Complementing this maturation in CNCF's graduated projects, in 2021, the **Technical Oversight Committee** continued to sharpen focus on app delivery and the ease of creating Kubernetes applications, as well as bolstering the range of increasingly-mature storage projects.

With security coming under increased global scrutiny this year, the **CNCF**

Security Technical Advisory Group published **Software Supply Chain Security Best Practices** to provide a holistic approach to supply chain security. Sarah Allen, then co-chair of the CNCF Security TAG, stated: "It's exciting to see CNCF projects, like **in-toto** providing a key part of supply chain security."

The CNCF community has continued to push the boundaries of exper-imental technology, and in 2021 projects exploring the bleeding edge of cloud native have stormed onto the scene. **wasmCloud** was just one

Program co-chairs Stephen Augustus, Constance Caramanolis, and Jasmine James present a keynote at KubeCon + CloudNativeCon in Los Angeles in November.

of 42 new sandbox projects accepted into CNCF last year, a 20% year-on-year increase in new projects. Meanwhile, we hosted our first **eBPF day**, bringing together leading eBPF practitioners to help drive technologies evolving Linux networking, observability, and performance.

Responding to Our Changing World

Despite all our hopes, the COVID-19 pandemic continued to shape 2021. To ensure the safety of our growing cloud native community, CNCF doubled down on digital last year, launching a suite of programs to bring #TeamCloudNative together and encourage continued collaboration, learning, and networking from every corner of the globe.

KUBECON + CLOUDNATIVECON

May saw **KubeCon + CloudNativeCon EU Virtual** once again set record-breaking registration and attendance, with 26,648+ registrants (a 42.5% increase on 2020). It was fantastic to host our first hybrid event in October at KubeCon + CloudNativeCon North America, where 3,531 attendees joined us in-person in Los Angeles, and 19,633 logged onto our virtual event platform, setting a new standard in hybrid events.

KUBERNETES COMMUNITY DAYS

In response to the community's evolving needs and geographies, CNCF relaunched the **Kubernetes Community Days (KCD)**, a series of community-organized events that gather adopters and technologists to learn, collaborate, and network. In the first eight months of the program, 12 KCDs took place in 12 countries, with more than 7,000 attendees.

ONLINE PROGRAMS

In addition to bolstering our virtual event roster in 2021, we launched CNCF online programs, a series of on-demand, livestream, and live webinars. April saw the launch of our End User Lounge, a live stream showcasing how end users navigate the cloud native ecosystem, including CERN's Ricardo Rocha, who explained how **CERN manages 600+ Kubernetes clusters**.

Evolution of the End-User Ecosystem

This year has underscored robust and continued interest in cloud native technologies. Our end-user community grew to more than 164 members, up from 145 in 2020, the largest community of any open source foundation. Our **2021 end user survey** revealed 100% of

respondents would recommend CNCF to other companies, with an average satisfaction rate of 94%.

TECHNICAL OVERSIGHT COMMITTEE

In 2021, we welcomed **five new members** to the TOC, one of CNCF's **three central bodies**, in addition to the Governing Board (GB) and the End-User Community (EUC).

New members appointed by the GB are:

▸ **Erin Boyd** — Engineer, Apple (**@erinaboyd**)

▸ **Cornelia Davis** — Product Management, Amazon (**@cdavisafc**)

▸ **Lei Zhang** — Engineer, Alibaba (**@resouer**)

New members appointed by the **EUC** are:

▸ **Dave Zolotusky** — Software Engineer, Spotify (**@dzolotusky**)

▸ **Ricardo Rocha,** — Computer Engineer, CERN (**@ahcorporto**)

END USER STORIES

This year we introduced CNCF's End User Stories beta program, empowering our fast-growing community to tell their stories through a self-service partnership model with CNCF. Through this, we discovered incredible stories from organizations like **Entain Australia** and **Seagate.**

Committed to Empowering "Us"

CNCF doubled down on our commitment to #TeamCloudNative in 2021, sharpening our focus on diversity, equity, and inclusion (DEI), expanding our globally recognized certifications, and bolstering the Jobs Board.

CAREER CERTIFICATIONS

This year we launched the **Kubernetes and Cloud Native Associate (KCNA)**, a pre-professional certification for candidates interested in working with cloud native technologies.

Alongside this initiative, CNCF's training and certification offering continued to grow, with notable interest in:

▸ **Kubernetes Massively Open Online Course (MOOC)** hit 229,000 enrollments (39% YOY increase).

▸ **Certified Kubernetes Administrator (CKA) exam** hit 70,000 enrollments (89% YOY increase).

▸ **Certified Kubernetes Application Developer (CKAD)** hit 34,000 exam registrations (86% YOY increase).

JOBS BOARD

Since 2020, listings on the CNCF Jobs Board have doubled from 1,000 job postings from 2,000+ employers to more than 2,400 job postings from 3,700+ employers in 2021. To date, more than 4,800 job seekers have applied for a job via email or the site.

DIVERSITY, EQUITY, AND INCLUSION

In 2021, we continued our deep commitment to ensuring the cloud native community is a welcoming place for people of all backgrounds. Women and gender non-conforming speakers made up 43% of the **KubeCon + CloudNativeCon EU Virtual** keynotes and 46% at **KubeCon + CloudNativeCon North America Hybrid**. We offered scholarships to 675 diversity applicants from traditionally underrepresented and marginalized groups and 788 need-based applicants in 2021 to attend KubeCon + CloudNativeCon, and CNCF hosted co-located events.

Community-Driven Initiatives

This year CNCF has continued to underscore our commitment to the ongoing success of cloud native projects, investing in community-driven initiatives to ensure sustained momentum, expansion, growth, and adoption.

KUBERNETES API ENDPOINT TESTING

2021 saw the update of **APISnoop**, a visual insight into Kubernetes test coverage, to run e2e tests on Kubernetes 1.23.0. APISnoop is a community-driven project spearheaded by long-time CNCF contributor and community leader **Hippie Hacker,** who tracks the testing and conformance coverage of Kubernetes by analyzing the audit logs created by e2e test runs.

TELECOM ADVANCES

This year, the **Cloud Native Network Function (CNF) Working Group** launched as the newest CNCF Telecom Initiative, with telecom and cloud native communities representatives. By the end of 2021, the **CNF Test Suite**, maintained by CNCF's strategic partner **vulk.coop** with contributions from 16 organizations, had more than 60 tests across many important categories.

CLOUD CREDITS

Many organizations sponsor CNCF projects for their business to succeed. In October, CNCF launched the **Cloud Credits** program to provide a public, self-service, and automated access to Cloud Infrastructure for hosted projects.

Fintech Open Source Foundation

FINOS (Fintech Open Source Foundation) was founded in 2018 to accelerate collaboration in the financial services industry through open source software, standards, and development practices. The nonprofit has become the trusted forum for open source collaboration among major financial institutions, including 7 of the top ten investment banks globally. FINOS became part of the Linux Foundation in 2020. FINOS hosts over 40 projects and special interest groups and is supported by a growing community of over 40 Members and over 1,000 contributors over time.

In 2021 FINOS has seen growth in contributions from financial institutions across the industry, with 8 of the top 10 contributors from leading global investment banks like Goldman Sachs, Deutsche Bank, JPMorgan Chase, and Morgan Stanley. The first annual State of Open Source in Financial Services Report demonstrated this unprecedented growth of open source awareness and contribution. While still identifying gaps in open source governance, the industry leadership has clearly awakened to the strategic value of open collaboration to drive innovation, increase interoperability, and reduce technology TCO.

Notable accomplishments by the FINOS Community in 2021 were:

▸ The outstanding growth of the flagship Legend project as industry-wide data modeling platform

▸ Increased engagement by regulators in the Open RegTech initiative

▸ Cross-pollination of the FSI industry in other LF initiatives like the Open Source Security Foundation (OpenSSF)

▸ Becoming the open source enabler for existing industry consortia like ISDA

Fintech
Open Source
Foundation

Gabriele Columbro, Executive Director of FINOS, speaks at the 2021 Open Source Strategy Forum in New York.

Hyperledger Foundation

HYPERLEDGER FOUNDATION

In 2021, after six years of community building and expanding from two projects to 18 projects, to over 50 labs, 16 Special Interest and Working Groups, and over 200 members, Hyperledger became a Foundation.

This newfound identity arches over all of its projects, labs, regional chapters, and community groups. Hyperledger Foundation is now leading the collective effort to advance enterprise blockchain technology and fulfill its mission to foster and coordinate the premier open source enterprise blockchain community.

At **Hyperledger Foundation**, being open is core to what we do. We're here to lead an open, global and welcoming enterprise blockchain ecosystem—a community where no contribution is seen as too small or insignificant. Our foundation comprises organizations, developers, executives, students, teachers, government leaders, and more. It's supported by the Technical Steering Committee, various working groups, special interest groups, and Meetup communities all across the globe,

now numbering more than 80,000 participants.

According to LFXInsights, there has been a 53% growth in the total commits in the last three years, and new code contributors increased by 37%. A total of 366 organizations from both large and small companies have made code commits since 2016. And the pace of activity among new community members is accelerating as commits by new contributors have increased by 286% in the last year.

Some of the largest and most important production enterprise blockchain projects today are built using Hyperledger technologies. They include:

▶ Supply chain networks, like IBM and **Walmart's Food Trust** (Hyperledger Fabric)

▶ **Circulor's mine to manufacturer traceability** of a conflict-mineral for automobile sustainable supply chains (Hyperledger Fabric)

▶ Top trade finance platforms such as TradeLens (Hyperledger Fabric), which has more than 300 orgs,

across 600 ports and terminals and has tracked over 42 million container shipments, with close to 2.2 billion events

▶ **we.trade,** who have already onboarded 16 banks across 15 countries to join their blockchain-enabled trade finance platform (Hyperledger Fabric)

Over 13 Central Bank Digital Currency production and pilots using multiple Hyperledger **projects have been identified** this year alone.

With this transition, Hyperledger Foundation also gained new leadership with the appointment of Daniela Barbosa as its new Executive Director. Barbosa is a seasoned veteran of the open source community with over 20 years of enterprise technology experience, including previously serving as Hyperledger's Vice President of Worldwide Alliances, where she was responsible for the project's community outreach and overall network growth.

New Growth in Hyperledger Technologies

According to **research** from Blockdata, Hyperledger Fabric is used by more of the top 100 public companies in the world than any other blockchain platform.

Hyperledger-based networks are used by some of the largest corporations around the world, including more than half of the companies on the **Forbes Blockchain 50**, a list of companies with revenue or a valuation of at least $1 billion that lead in employing distributed ledger technology.

As an ever-growing **library of case studies** shows, Hyperledger technologies are already transforming many market spaces, including supply chains, trade finance, and healthcare. Hyperledger technologies are used in everything from powering global trade networks and supply chains to fighting counterfeit drugs, banking "unbanked" populations, and ensuring sustainable manufacturing.

In addition, Hyperledger technologies are being applied to a number of

new markets and business models. These include digital identity and payments, Central Bank Digital Currencies (CBDCs), and NFTs like **Damien Hirst's The Currency project** and DC Comics powered by Palm NFT with a near-zero carbon footprint using Hyperledger Besu.

Digital Identity

Hyperledger technologies are being adopted to put individuals in charge of their own identity. People often need to verify their status, prove a birthdate, board a plane, comply with vaccine mandates, prove their education, or access money. Leveraging Hyperledger Aries and Hyperledger Indy, organizations worldwide are reshaping how digital information is managed and verified to increase online trust and privacy. These digital identity solutions create verified credentials that are effective, secure, accessible, and privacy-preserving.

▸ The Aruba Health App makes it easy for visitors who have provided required health tests to the Aruba government to share a trusted traveler credential — based on their health status — privately and securely on their mobile device. Launched initially as a trial, the Aruba Health App is built using

Cardea, an open-source code base that has since been contributed to the Linux Foundation Public Health (LFPH) project. Cardea leverages Hyperledger Indy, Hyperledger Aries, and Hyperledger Ursa.

▸ IDUnion addresses the demand for migrating centralized identity systems towards decentralized self-sovereign management of digital identities for people, organizations, and machines. The service has 39 cross-sector partners building production-level infrastructure to verify identity data in finance, manufacturing, the public sector, and healthcare. IDunion has launched a Hyperledger Indy test network, built components for allocating, verifying, managing digital identities, and more. This consortium includes Hyperledger member companies Siemens, Bosch, Deutsche Telecom, and others.

▸ The International Air Transport Association IATA Travel Pass, built in partnership with Evernym using Hyperledger Indy and Hyperledger Aries, is a mobile app that helps travelers store and manage their verified certifications for COVID-19 tests or vaccines.

▸ MemberPass, built on Hyperledger Indy by Bonifiii, is the first global digital identity ecosystem for cred-

it unions and their members. It provides consumer identity while protecting personal information. Adopted by more than seven credit unions and counting, 20,000+ credentials issued.

Digital Currency

Blockchain technology has already helped rewrite some of the rules for currencies and payments. Governments worldwide are now moving towards Central Bank Digital Currencies (CBDCs) or digital forms of their official currency. These will give central banks a more flexible, more secure form of their national currencies and lower the risks from alternative cryptocurrencies. Backed by a central bank, any CBDC, whether developed for wholesale or retail use, will be legal tender with the stability that regulation confers.

Governments are moving carefully, but many of the early projects are using Hyperledger platforms. The goals range from modernizing payment processes to removing barriers and costs associated with back-end settlement to boosting financial inclusion.

This **fireside chat from Hyperledger Global Forum on CBDCs** by experts from Accenture and DTTC offers a

great overview of the benefits and different approaches to these new currencies and a look at the current landscape of CBDC research and experimentation across the globe.

▸ The Eastern Caribbean Central Bank **launched DCash**, built on Hyperledger Fabric, as a mobile phone app for person-to-person and merchant payments. ECCB stated at an OECD event in 2020 that it selected Hyperledger Fabric because of its strong security architecture (a private permissioned blockchain with strong identity management) and open source code, contributing to its security, flexibility, and scalability, among other desired attributes.

▸ The **National Bank of Cambodia created Bakong**, a fiat-backed digital currency, using Hyperledger Iroha to promote its national currency use, giving the large percentage of its population without bank accounts a mobile payment system and cutting costs for interbank transfers.

▸ Additionally, a mix of retail and wholesale CBDCs trials using Hyperledger Besu has helped several other countries, including **Thailand** and **Spain**, to advance planning for new digital fiat currencies.

Launching Linux Foundation Research

Through LF Research, the Linux Foundation is uniquely positioned to create the definitive repository of insights into open source. By engaging with our community members and leveraging the full resources of our data sources, including a new and improved LFX, we're not only shining a light on the scope of the projects that comprise much of the open source paradigm, but contextualizing their

impact. In the process, we're creating both a knowledge hub and an ecosystem-wide knowledge network. Because, after all, research is a team sport.

Taking inspiration from research on open innovation, LF Research explores open source amidst the challenges of the current era. These challenges include the COVID-19 pandemic, climate risk, and accelerating digital transformation — all changing what it means to be a technology company or an organization that deeply relies on innovation. By publishing a new suite of research deliverables that aid in strategy formation and decision making, LF Research creates shared value for all stakeholders in our community and inspires greater levels of participation in it.

Completed Research

The Fourth Annual Open Source Program Management (OSPO) Survey, produced In collaboration with the TODO Group and The New Stack, examines the prevalence and outcomes of open source programs, including the key benefits and barriers to adoption.

The 2021 Data and Storage Trends Survey, produced in collaboration with the SODA Foundation, identifies the current challenges,

gaps, and trends for data and storage in the era of cloud native, edge, AI, and 5G.

The 2021 State of Open Source in Financial Services Report produced in partnership with FINOS, Scott Logic, Wipro, and GitHub, explores the state of open source in the financial services sector. The report identifies current levels of consumption and contribution of open source software and standards in this industry and the governance, cultural, and aspirational issues of open source among banks, asset managers, and hedge funds.

The 9th Annual Open Source Jobs Report, produced in partnership with edX, provides actionable insights on the state of open source talent that employers can use to inform their hiring, training, and diversity awareness efforts.

Core Research in Progress

The Software Bill of Materials (SBOM) Readiness Survey, produced in partnership with the Open Source Security Foundation, OpenChain, and SPDX, is the LF's first project in a series designed to explore ways to better secure software supply chains. With a focus on SBOMs, the findings are based on a worldwide survey of IT professionals who understand their organization's approach to software development,

procurement, compliance, or security. An important driver for this survey is the recent U.S. Executive Order on Cybersecurity.

The 2021 Diversity, Equity, and Inclusion in Open Source Study, produced in partnership with AWS, CHAOSS, Comcast, Fujitsu, GitHub, GitLab, Hitachi, Huawei, Intel, NEC, Panasonic, Red Hat, Renesas, and VMware, seeks to understand the demographics and dynamics concerning participation in open source communities and to identify gaps, all as a means to advancing inclusive cultures. This research aims to drive data-driven decisions on future programming and interventions to benefit the people who develop and ultimately use open source technologies. The research comprised a survey and a series of qualitative interviews, identifying barriers for community members who do not feel a sense of inclusion and belonging for various reasons.

Hilary Carter, VP Research at The Linux Foundation, speaks at the 2021 Open Source Summit in Seattle.

The 2021 State of Open Source in Financial Services

This first-annual survey of 300 respondents evaluated key aspects of open source adoption in the financial services industry across leadership, consumption, contribution, governance, and culture. The survey underscored that despite widespread open source adoption in financial services, there remains an opportunity to leverage it to improve efficiency and innovation. Key insights included:

▶ **Innovation and reduced time-to-market are key motivators for financial services to engage in open source.** 80% of respondents agreed or strongly agreed that innovation, reduced time-to-market and total cost of ownership are now recognized as key reasons for financial services firms to engage in open source.

▶ **Financial services need more open source leadership.** Only half of respondents had a single leader for various open source activities, such as contribution and consumption.

▶ **Open source consumption policies are becoming more prevalent.** 58% of respondents attested they have a policy that encourages open source consumption.

▶ **Inner source contributions are significant.** 59% indicated that they or their colleagues contribute to work-related software projects that are open to their business unit or to their entire company.

▶ **Governance policy education around open source is needed.** 32% of the respondents either don't know if their organization has a policy or assert that it does not.

▶ **Cultures of innovation can be realized.** Respondents indicated that they want to contribute to open source because "it's fun" (53%) or they "learn to code" (54%). Although only some (40%) contribute to open source projects at work, most (66%) spend some personal time on this activity.

▶ **Financial open source communities are becoming more diverse.** While still far from ideal, women are better represented (7%) in the financial open source community than in the open source community at large (3%) when compared to the FOSS contributor study.

Enabling Training and Certification

This year, vendor-neutral training and certification grew in importance as demand for professionals with critical skills in open cloud technologies and DevOps increased. Over 2 million individuals have enrolled in free Linux Foundation training courses, providing them a great way to explore different open source technologies and decide which is the best fit for them; this includes over a million students who have enrolled in our Introduction to Linux course on the edX platform. To date, over 50,000 individuals have been certified for their technical competence through Linux Foundation programs.

PHOTO BY CHRISTINA @ WOCINTECHCHAT.COM ON UNSPLASH

New Training and Certification Offerings Launched in 2021

- ▶ Building a RISC-V CPU Core
- ▶ Certified Kubernetes and Cloud Native Associate (KCNA)
- ▶ Certified TARS Application Developer (CTAD)
- ▶ FinOps for Engineering
- ▶ Generating a Software Bill of Materials
- ▶ GitOps: Continuous Delivery on Kubernetes with Flux
- ▶ Hyperledger Besu Essentials: Creating a Private Blockchain Network

- ▶ Kubernetes and Cloud Native Essentials
- ▶ Kubernetes Security Essentials
- ▶ Kubernetes Security Fundamentals
- ▶ Implementing DevSecOps
- ▶ Introduction to Cloud Foundry
- ▶ Introduction to FDC3 Standard
- ▶ Introduction to GitOps
- ▶ Introduction to Kubernetes on Edge with K3s
- ▶ Introduction to Magma: Cloud Native Wireless Networking

- ▶ Introduction to Node.js
- ▶ Introduction to RISC-V
- ▶ Introduction to WebAssembly
- ▶ Open Source Management and Strategy
- ▶ RISC-V Toolchain and Compiler Optimization Techniques
- ▶ WebAssembly Actors: From Cloud to Edge

Explore the full catalog of courses at **training.linuxfoundation.org/full-catalog.**

This year, our Training & Certification team launched over 20 new offerings. We now host over 70 eLearning courses, deliver over 20 instructor-led courses, and offer more than a dozen certification exams which enable certified professionals to demonstrate their skills, with more being released regularly.

New Exams

This year saw the addition of exam simulators to our Kubernetes certification exams, enabling exam registrants to familiarize themselves with the exam environment before sitting for their exam. In November 2021 we launched the new Kubernetes and Cloud Native Associate (KCNA) certification exam, which serves as an entry-level certification for new cloud professionals.

Scholarships

In 2021, The Linux Foundation directly awarded 500 scholarships for free training and certification to individuals worldwide. Hundreds more were awarded via partnerships with nonprofits, including Blacks in Technology, TransTech Social Enterprises, and Women Who Code.

Open Source Career Opportunities are Strong

Our recently published **Open Source Jobs Report** examined the demand for open source talent and trends among open source professionals. What did we find?

The good news is that hiring is rebounding in the wake of the pandemic, as organizations look to continue their investments in digital transformation. This is evidenced by 50% of employers surveyed who stated they are increasing hires this year. There are significant challenges though, with 92% of managers having difficulty finding enough talent and struggling to hold onto existing talent in the face of fierce competition. Other key findings from this year's report included:

▶ **CLOUD IS ON THE RISE.** Cloud and container technology skills are most in-demand by hiring managers, surpassing Linux for the first time, with 46% of hiring managers seeking cloud talent.

▶ **DEVOPS HAS BECOME THE STANDARD METHOD FOR DEVELOPING SOFTWARE.** Virtually all open source professionals (88%) report using DevOps practices in their work, a 50% increase from three years ago.

▶ **TRAINING IS INCREASINGLY HELPING CLOSE SKILLS GAPS.** 92% of managers report increasing requests for training. Employers also report that they prioritize

training investments to close skills gaps, with 58% using this tactic.

▶ **DEMAND FOR CERTIFIED TALENT IS SPIKING.** Managers are prioritizing hires of certified talent (88%).

▶ **DISCRIMINATION IS A GROWING CONCERN IN THE COMMUNITY.** Open source professionals having been discriminated against or made to feel unwelcome in the community increased to 18% in 2021 — a 125% increase over the past three years.

PHOTO BY MIKHAIL FESENKO ON UNSPLASH

Embarking on a New Era of Live and Hybrid Events

The year started with a lot of hope for returning to in-person gatherings. However, with extended border closures and the rise of the Delta variant, getting to host events in person took longer than we'd anticipated. We took our first step back to live events this fall at our Open Source Summit (and other co-located events) and then, in quick succession, KubeCon + CloudNativeCon, Open Source Strategy Forum, OSPOCon, and more. It was amazing to see our community together in person again, and we were overjoyed to be able to facilitate bringing people back together safely.

We spent the year fine-tuning virtual offerings, getting back to in-person events, and launching a hybrid event approach to keep in-person events accessible to all. These investments paid off. The LF Events team and Projects hosted over 90,000 people from 192 countries for learning and community building, with 6,000 of those joining us in person.

"It was great to reconnect with people, including people I had not even realized I had lost touch with until I bumped into them at the conference. The LF did a great job creating a safe environment for attendees to collaborate effectively yet safely. It was great. Thank you!"

Looking Forward to 2022

As we move into 2022, we have two goals. The first is to continue getting back to in-person events, which we know provide the best opportunity for our communities to grow together sustainably. Based on the proof of concept we were able to establish with in-person events this fall, alongside border reopenings and vaccines being widely available, we are confident that we can continue to do so in a safe way with even more of our community than this year.

The second is to take our learnings from this year's virtual and hybrid events and apply those in the future to make these opportunities even more accessible and beneficial than before. This means using the virtual format to extend our reach in regions and countries where we don't yet have physical events. It also means that we create virtual versions of some of our in-person events, making the learning style and length of the event more specific to our virtual audience and just as valuable as an in-person event.

We continue to evolve and reshape our event offerings to provide the greatest benefit to as many people as possible.

Open Source Summit

Open Source Summit + Embedded Linux Conference + OSPOCon 2021 was a monumental event. Held in September in Seattle, WA, it was the first set of in-person events the Linux Foundation held in nearly two years. We've held more than a dozen in-person events since, but this one was the proof of concept that we could meet together again, in person, and do so safely.

With the rise of the Delta variant a couple of months before the event, it almost didn't happen — but the desire and need of our community to join together in person again pushed us to do whatever we could to ensure this event could happen successfully.

We consulted with a former CDC epidemiologist for months leading up to the event. To ensure attendees felt safe joining, we required vaccinations and masks, conducted daily temperature checks and health surveys of all attendees, and updated room and venue layouts to ensure social distancing.

While a smaller number of attendees joined than originally planned (just under 2,000 with over 480 of those joining in person), the event was still enormously successful, delivering timely and applicable content, opportunities to connect with community members globally, and unique experiences for both virtual and in-person attendees, plus of course, giving our in-person attendees the ability to finally once again meet face to face, for important discussions, problem-solving, and collaboration.

Attendance

1,944 attendees:
482 in person and 1,462 virtual

Attendees from **68** countries

Attendees from **760** organizations

55% of attendees in technical positions

Speakers & Content

737 submissions

370 speakers

296 talks across 18 tracks

Diversity and Inclusion*

30% of speakers identified as women or non-binary

31% of speakers were people of color

23% of attendees identified as women or non-binary

15% of identified as a person of color

*These are optional questions on our registration form that also include 'prefer not to answer' as an option or can be skipped entirely; thus, these numbers may be higher than reflected here.

THE RISE OF SOFTWARE SUPPLY CHAIN SECURITY

Increasing attacks by threat actors and the exposure of software vulnerabilities threaten the stability of open source software supply chains. We have a shared responsibility to improve and protect the world's critical technology infrastructure.

Open Source Security Foundation

The Open Source Security Foundation (OpenSSF) was elevated to a funded project at the LF in October 2021. The OpenSSF is a cross-industry collaboration that brings together leaders to improve the security of open source software (OSS) by building a broader community, targeted initiatives, and best practices. The OpenSSF premier members include: 1Password, AWS, Cisco, Citi, Dell Technologies, Ericsson, Fidelity, GitHub, Google, Huawei, IBM, Intel, JPMorgan Chase, Meta, Microsoft, Morgan Stanley, Oracle, Red Hat, Snyk, and VMware.

The OpenSSF began many initiatives in 2021, including:

▶ **Security Scorecard:** automatically assesses many security-related heuristics to help estimate project security

▶ **Allstar:** an automated tool to enforce some security policies

▶ **Security Reviews:** collects security reviews of OSS

▶ **Security Metrics Dashboard:** provides easy access to security metrics/info about OSS projects

▶ **OSS Vulnerability Guide:** a guide to coordinated vulnerability disclosure for open source software projects

▶ **Open Source Vulnerability (OSV) Schema**

▶ **Supply-Chain Levels for Software Artifacts (SLSA):** security framework for software security and supply chain integrity

▶ **Package Feeds / Package Analysis:** analyzes uploaded packages to identify potentially malicious ones

The OpenSSF also continued to refine its existing work, including its **free courses** on how to develop secure software (over 4,000 registrants combined) and the **CII Best Practices Badge Program** (over 4,000 participating projects and over 600 passing projects).

David Wheeler, LF Director of Open Source Supply Chain Security, and Kate Stewart, LF VP of Dependable Systems, who participate in OpenSSF and SPDX, respectively, speak at the Open Source Summit in October.

Defending the Global Software Supply Chain From Cyberattacks

Attackers are increasingly targeting software supply chains (the processes, repositories and toolchains used for developing and delivering software). The European Union Agency for Cybersecurity, ENISA, estimated in **"Threat Landscape for Supply Chain Attacks"** that there would be four times as many software supply chain attacks in 2021 as compared to 2020. The report states due to ."..more robust security protection that [many] organizations have put in place [today], attackers successfully shifted towards suppliers."

Governments around the world have noted and responded to this growing risk to the software supply chain. In May 2021, the US released an **Executive Order on Improving the Nation's Cybersecurity** to enhance software supply chain security, including providing software purchasers with a Software Bill of Materials.

In 2021, our communities rose to the challenge of providing tools and best practices for the security hardening of the global software supply chains. Our efforts included launching Open Source Security Foundation (OpenSSF) as a funded project, expanding Let's Encrypt — the world's largest certificate authority, ensuring the ISO standardization of SPDX as the SBOM standard, directing funds to identify and fix vulnerabilities in critical open source software, and building new training curriculum to improve secure coding practices.

Establishing Projects and Conferences to Improve Security

In addition to the projects listed earlier, the LF funds various projects to improve open source security. Some notables among them include:

▸ **sigstore** — development work on this technology suite to enable developers to sign software artifacts securely. Signing materials are stored in a tamper-resistant public log. (The project is managed by Google, Red Hat, and Purdue University)

▸ Alpine Linux — vulnerability processing for this security-oriented, lightweight Linux distribution.

▸ Alpine Linux, Arch Linux — reproducible builds for these two Linux distributions.

▸ OpenSSH, RPKI — development of infrastructure "plumbing"

▸ Clang, Linux kernel — compiling Linux kernel with clang and fix warnings found during the compiling process

▸ Linux kernel — security audits for signing/key management policies and vulnerability reporting modules, respectively)

The LF also fostered approaches to discuss and address supply

chain attacks online and in virtual venues, including Building Cybersecurity into the Software Supply Chain Town Hall and SupplyChainSecurityCon.

Shepherding Software Standards

The Linux Foundation strongly supports efforts to build and drive adoption of open source standards and infrastructure. These efforts include:

▶ SPDX — an international standard for representing the metadata for SBOMs (ISO/IEC 5962).

▶ OpenChain — a standardized process management approach to identify inbound, internal, and outbound open software. It is primarily designed for compliance and has clear secondary use cases in security (ISO 5230).

▶ Compliance tooling from Automating Compliance Tooling projects (including OSS Review Toolkit, FOSSology, Tern), and the OpenChain reference workflow, extended to add new use cases.

▶ Training on software transparency topics, including "Generating an SBOM."

PHOTO BY LUKAS BLASKEVICIUS ON UNSPLASH

ISRG

Let's Encrypt

PROSSIMO

Internet Security Research Group

Internet Security Research Group (ISRG) is a 501c3 nonprofit providing the digital infrastructure for a more secure and privacy-respecting world. They operate **Let's Encrypt**, the world's largest certificate authority, securing traffic for more than 250 million websites.

In late 2020, ISRG launched **Prossimo**, a project whose goal is to move the Internet's security-sensitive software infrastructure to memory-safe code. Many of the most critical software vulnerabilities are memory safety issues in C and C++ code. While deploying fuzzing, static analysis, and code reviews can catch vulnerabilities, such mitigations do not eliminate all risks. Moreover, these security mitigation tactics consume considerable resources on an ongoing basis. In contrast, using memory-safe languages eliminates the entire class of issues. This year, Prossimo worked with Linux kernel, cURL, and Apache maintainers to introduce new memory-safe code to these critical, widely-used pieces of software.

ISRG's latest project effort, Prio, is to operate a **privacy-preserving metrics** service. Prio uses a system that enables the collection of aggregate statistics such as application metrics. Apple and Google's Covid-19 Exposure Notification Express app uses this service. ISRG Prio has processed over two billion metrics and is helping operators optimize the user experience based on aggregate, privacy-respecting telemetry metrics.

The Linux Foundation's communities and members create centers of gravity for open collaboration across technology and vertical segments such as Entertainment, Agriculture, 5G, the Edge, AI Voice, and Next-gen APIs.

PHOTO BY YANNIS PAPANASTASOPOULOS ON UNSPLASH

Driving Innovation Across Key Industry Verticals

Our members in the automotive, motion picture, financial services, telecommunications, energy, and public health verticals have transformed and differentiated their business through open source innovations. In 2021, the Linux Foundation expanded into new industries including agriculture and AAA-class 3D engines for gaming and entertainment.

While vertical industries have unique open source projects and communities, they also share a common thread. They realize that open collaboration presents opportunities to reduce costs, cut time to market, increase quality, and open new areas of competition. The ability to achieve these results on a collective basis pushes innovation forward across respective industries.

PHOTO BY YULIAN ALEXEYEV ON UNSPLASH

COMMUNITY HIGHLIGHT

AgStack

In May 2021, the Linux Foundation announced the launch of the AgStack Foundation, the open source digital infrastructure project for the world's agriculture ecosystem. Thirty-three percent of all food produced is wasted, while nine percent of the people in the world are hungry or malnourished. These societal drivers are compounded with legacy technology systems that are too slow and inefficient and can't work across the growing and more complex agricultural supply chain. AgStack Foundation will improve global agriculture efficiency by creating, maintaining, and enhancing free, reusable, open, and specialized digital infrastructure for data and applications. AgStack will use collaboration and open source software to build the 21st-century digital infrastructure that will be a catalyst for innovation on new applications, efficiencies, and scale.

AgStack consists of an open repository to create and publish models, free and easy access to public data, interoperable frameworks for cross-project use, and topic-specific extensions and toolboxes. It will leverage existing technologies such as agriculture standards (AgGateway, UN-FAO, CAFA, USDA, and NASA-AR); public data (Landsat, Sentinel, NOAA and Soilgrids; models (UC-ANR IPM), and open source projects like Hyperledger, Kubernetes, Open Horizon, Postgres, Django and more.

Founding members and contributors include leaders from both the technology and agriculture industries and across sectors and geographies. Members and partners include Agralogics, Call for Code, Centricity Global, Digital Green, Farm Foundation, farmOS, HPE, IBM, Mixing Bowl and Better Food Ventures, NIAB, OpenTeam, Our Sci, Produce Marketing Association, Purdue University / OATS and Agricultural Informatics Lab, the University of California Agriculture and Natural Resources (UC-ANR) and University of California Santa Barbara SmartFarm Project.

AgStack
A Linux Foundation Project

ASWF /* ACADEMY
SOFTWARE
FOUNDATION

Academy Software Foundation

The Academy Software Foundation (ASWF) continues to make an impact on the open source technologies that empower the motion picture and visual effects industries. To date, ASWF boasts 32 members and hosts 14 projects and working groups.

Key milestones in 2021 include:

▶ **MaterialX** being contributed as a project by Lucasfilm. MaterialX originated at Lucasfilm in 2012. It has grown into the central format for material description at Industrial Light and Magic (ILM) since the production of Star Wars: The Force Awakens.

▶ The launch of the **ASWF Assets Repository** that gives open communities access to production-grade digital assets for testing, demonstration, and education purposes.

▶ **The launch of OpenColorIO v2.0**, delivering more accurate GPU and faster CPU renderers, more accurate ACES transforms, and better support for display color spaces and ICC monitor profiles. These and other features are cementing OpenColorIO as an industry standard.

ASWF has seen the collaboration and sustainability of each of the projects and working groups it hosts increase, with each project seeing increases in organizational diversity and contributions in 2021 compared to the year before joining the ASWF.

ASWF looks forward to 2022 as it focuses on addressing new technology spaces such as virtual production.

PHOTO BY BRANDS&PEOPLE ON UNSPLASH

O3DE

COMMUNITY HIGHLIGHT

Open3D Foundation and Open3D Engine

The Linux Foundation welcomed the Open 3D Foundation into its community of families in July of 2021. The first project in the foundation was the Open 3D Engine known as O3DE. Amazon Web Services donated it under an Apache 2.0 and MIT licensing model. The mission of the Open 3D Engine is to make an open source, fully-featured, high-fidelity, real-time 3D engine for building games and simulations available to every industry.

Since its inception, it has raised $2.7 million in commitments from 26 partners in over two years, including Adobe, Intel, AWS, Niantic, Huawei, SideFX, and HERE. It has also grown to over 3,600 stars, 1,100 forks of the repository, 1,500 Discord users, and 500+ active members online. It has increased to over 130 authors of code, 7,000 file changes, 2 million changes to lines of code, and a vibrant and active self-sustaining support community averaging 500 messages per day.

The foundation is focused on industries that utilize 3D technologies. This includes video games, automotive, simulation, robotics, energy, real estate, training, film, special effects, machine learning, aerospace, and many other verticals.
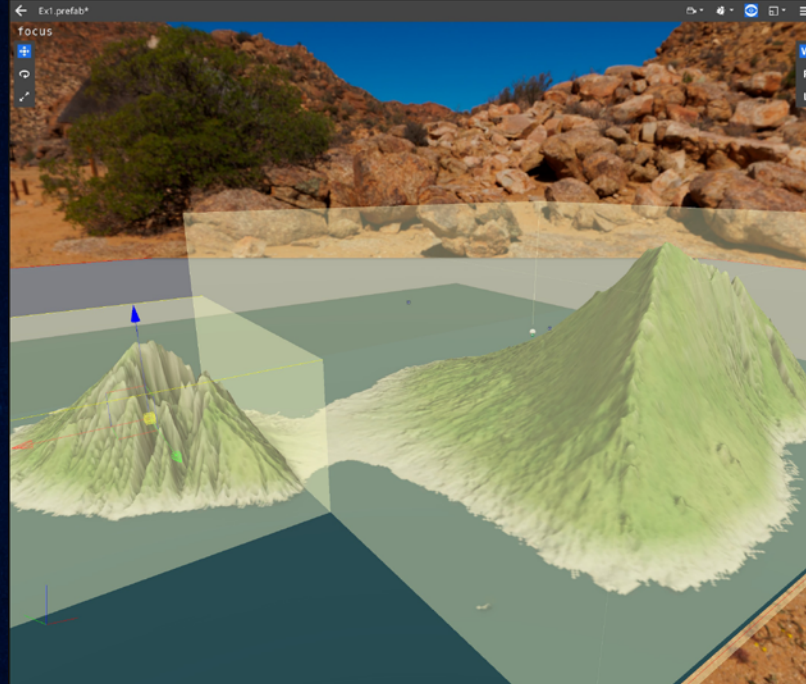
A collection of renders and screenshots from the OD3E project.

OPEN VOICE NETWORK
Voice worthy of user trust

COMMUNITY HIGHLIGHT
Open Voice Network

In June, the Linux Foundation announced the Open Voice Network, an open source association dedicated to advancing open standards that support the adoption of AI-enabled voice assistance systems. Founding members include Target, Schwarz Gruppe, Wegmans Food Markets, Microsoft, Veritone, and Deutsche Telekom.

Organizations are beginning to develop, design and manage their own voice assistant systems independent of today's general-purpose voice platforms. This transition is being driven by the desire to manage the entirety of the user experience — from the sound of the voice, the sonic branding and the content — to integrating voice assistance into multiple business processes and brand environments from the call center, to the branch office and the store. Perhaps most importantly, organizations know they must protect the consumer and the proprietary data that flows through voice. The Open Voice Network will support this evolution by delivering standards and usage guidelines for voice assistant systems that are trustworthy, inclusive and open.

Voice is expected to be a primary digital interface going forward and will result in a hybrid ecosystem of general-purpose platforms and independent voice assistants that demand interoperability between conversational agents of different platforms and voice assistants. To accomplish this, voice assistance depends upon technologies like Automatic Speech Recognition (ASR), Natural Language Processing (NLP), Advanced Dialog Management (ADM) and Machine Learning (ML).

Open Voice Network is dedicated to supporting this transformation with industry guidance on the voice-specific protection of user privacy and data security.

The Open Voice Network will initially be focused on the following areas:

▶ **STANDARDS DEVELOPMENT:** research and recommendations toward the global standards that will enable user choice, inclusivity, and trust.

▶ **INDUSTRY VALUE AND AWARENESS:** identification and sharing of conversational AI best practices that are both horizontal and specific to vertical industries, serving as the source of insight and value for voice assistance.

▶ **ADVOCACY:** working with and through existing industry associations on relevant regulatory and legislative issues, including those of data privacy.

AUTOMOTIVE GRADE LINUX

COMMUNITY HIGHLIGHT
Automotive Grade Linux

Over the last decade, the Linux Foundation worked with industry leaders like Toyota and others to launch **Automotive Grade Linux (AGL).** AGL was established to build a common open source software platform to eliminate the fragmentation plaguing the automotive industry. AGL is the only organization with a mission to address all in-vehicle software, including infotainment, instrument cluster, telematics, heads-up display, advanced driver assistance systems (ADAS), and autonomous driving.

The AGL community is reducing that fragmentation by combining the best of open source to create the **AGL Unified Code Base (UCB),** a single, shared, open source software platform for the entire industry. The UCB includes an operating system, middleware, and application framework and can serve as the de facto industry standard for infotainment, telematics, and instrument cluster applications. Sharing an open source platform allows for code reuse and a more efficient development

process as developers and suppliers can build their solution once and deploy that same solution for multiple automakers.

Supported by **eleven major automotive manufacturers**, including the top three producers by worldwide volume (Volkswagen, Toyota, Daimler), AGL is deployed in production vehicles today:

▶ **Toyota's AGL-based infotainment system** is now in Toyota and Lexus vehicles globally.

▶ The **2020/2021 Subaru Outback and Subaru Legacy** use open source software from the AGL UCB for the Subaru Starlink infotainment platform.

▶ **Mercedes-Benz Vans is using AGL** as a foundation for a new onboard operating system for its commercial vehicles.

Amazon AWS joined AGL as a Platinum member in January 2021 and is leading AGL initiatives around IoT and Connected Car.

In early 2021, AGL announced a new Expert Group for Container and Service Mesh, led by Amazon AWS. The Container and Mesh Expert Group are developing an in-vehicle container solution for AGL and **creating a service mesh and orchestration framework** that can be deployed as part of AGL.

The IVI Production Readiness Expert Group, led by Toyota, has made significant progress in 2021. This EG is focused on bringing AGL closer to a production-ready state. By early 2022, major code contributions are expected from Toyota on Flutter for embedded IVI, a new cutting edge UI and App development framework for infotainment systems. This will allow manufacturers to cut the development time and cost of deploying innovative new applications in the vehicle.

The Virtualization EG, led by Panasonic, has been busy working on cutting-edge VirtIO technology. This allows consolidation of vehicle cockpit systems such as IVI, Instrument Cluster, and Heads-Up-Display to run on a single processor. It also enables innovative use cases such as using Android for infotainment and AGL for Instrument Cluster on a single virtualized CPU. The consolidated cockpit is a vision of the future, and it's being developed today at AGL.

AGL also had two milestone platform releases this year, Unified Code Base (UCB) 11.0 Kooky Koi in February and 12.0 Lucky Lamprey in July. These releases included several updates to graphics, audio, speech recognition, application and security frameworks, web apps, and Chromium. Both releases are based on the Yocto 3.1 Long-Term-Support board support packages.

A New Open Source Horizon for 5G Ecosystems

The Linux Foundation is the home of nearly all the important open source projects in the 5G and networking space. The open source projects assisting with building a 5G stack are estimated to be worth about **$25 billion in shared technology investment**. The LF Networking projects have been valued at $7.4 billion 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.

LF Open Source Component Projects for 5G
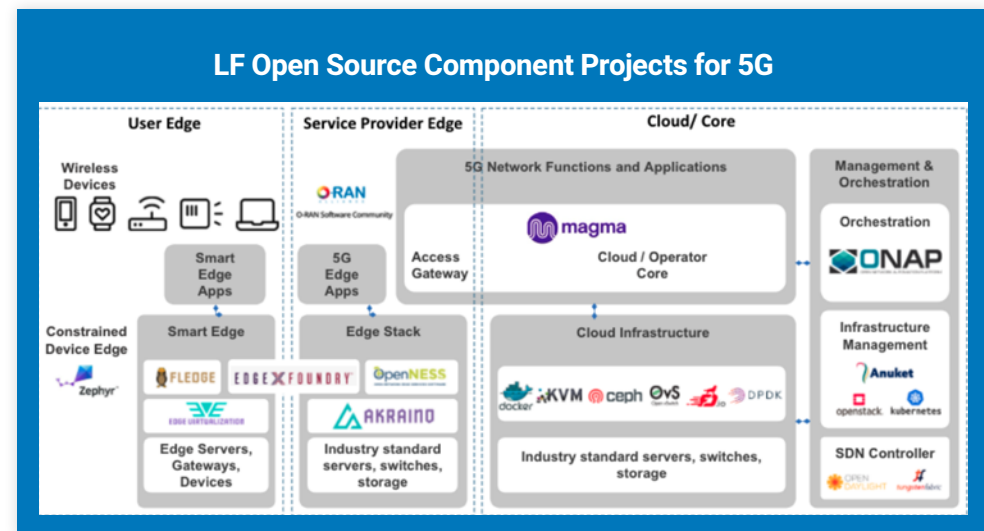
LF Networking's Super Blueprint

There is an exciting convergence in the networking industry around open source, and the energy is palpable. At LF Networking, we have a unique perspective as the largest open source initiative in the networking space with the broadest set of projects making up the diverse and evolving open source networking stack.

LF Networking is leading a new initiative to develop 5G Super Blueprints for the ecosystem. Major integrations between the building blocks are underway between ONAP and ORAN, Akraino and Magma, Anuket and Kubernetes, and more.

"Super" means that we're integrating multiple projects, umbrellas (e.g., LF Edge, Magma, CNCF, O-RAN Alliance, LF Energy) with an end-to-end framework for the underlying infrastructure and application layers across edge, access, and core. This end-to-end integration enables top industry use cases, such as fixed wireless, mobile broadband, private 5G, multi-access, IoT, voice services, network slicing, and more. In short, 5G Super Blueprints are a vehicle to collaborate and create end-to-end 5G solutions.

Government Networks

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 enables adoption by more groups within the government.

In order to achieve these goals, the US Government has to leverage a common open source principle of "upstream first," contributing patches directly into the upstream communities like every other contributor. 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.

FinOps Foundation

FinOps for Cloud Financial Operations

The FinOps Foundation joined the LF's family of communities in June of 2020. Its mission is to advance the discipline of cloud financial operations ("FinOps") through best practices, education, and standards among individuals responsible for cloud billing and operations.

FinOps is shorthand for "Cloud Financial Operations" or "Cloud Financial Management" or "Cloud Cost Management." It is the practice of bringing financial accountability to the variable spend model of cloud, enabling distributed teams to make business trade-offs between speed, cost, and quality.

At its core, FinOps is a cultural practice. It's the way for teams to manage their cloud costs, where everyone takes ownership of their cloud usage supported by a central best-practices group. Cross-functional teams in IT, Finance, Product, etc work together to enable faster product delivery, while at the same time gaining more financial control and predictability.

The FinOps Foundation includes 4,000 individual members worldwide and 40 corporate vendor members, including Google, VMware, Accenture, Deloitte, McKinsey, and others. In the same way that DevOps revolutionized development by breaking down silos and increasing agility, FinOps increases the cloud's business value by bringing together technology, business, and finance professionals with a new cultural set, knowledge skills, and technical processes.

magma

Mobile Networks at Scale With Magma

In February, the Linux Foundation announced that it would launch an open source industry collaboration focused on enabling a converged cellular core network stack, starting with the **Magma** open source software platform. Previously **open sourced by Meta (as Facebook) in 2019,** Magma is now managed under a neutral governance framework at the Linux Foundation.

Arm, Deutsche Telekom, Meta, FreedomFi, Qualcomm, the Institute of Wireless Internet of Things at Northeastern University, the OpenAirInterface Software Alliance, and the Open Infrastructure Foundation joined the collaboration as founding members to accelerate the path to production use cases at scale.

Magma enables operators to build and augment modern and efficient mobile networks at scale. Magma features an access-agnostic mobile packet core, advanced network automation, and management tools, and the ability to integrate with existing LTE networks with use cases across both virtual and container Network Functions (xNFs), including fixed wireless access, carrier Wi-Fi, private LTE, and 5G, network expansion, and mobile broadband. Several Magma community members collaborate in the Telecom Infra Project (TIP)'s Open Core Network project group to define, build, test, and deploy core network products that leverage Magma software alongside disaggregated hardware and software solutions by the TIP Open Core ecosystem.

NGMN

End-to-End 5G Collaboration With NGMN

In May, the LF and the **Next Generation Mobile Network Alliance (NGMN),** signed a Memorandum of Understanding for formal collaboration regarding end-to-end 5G and beyond.

PHOTO BY JACK SLOOP ON UNSPLASH

NGMN's mission is to provide impactful industry guidance to achieve innovative and affordable mobile telecommunication services for the end-user, placing a particular focus on Mastering the Route to Disaggregation, Sustainability, and Green Future Networks and on 6G and the continuous support of 5G's full implementation.

Creating and providing open, scalable building blocks for operators and service providers is critical to adopting 5G and beyond. Therefore, the collaboration between NGMN and the Linux Foundation will focus on end-to-end 5G architecture and beyond 5G. Specific areas of alignment may include sustainability,

network automation, and network autonomy based on Artificial Intelligence, security, edge cloud, virtualization, disaggregation, cloud native, and service-based architecture, to name a few.

The Linux Foundation's vision of harmonizing open source software with open standards has been in effect for several years, including collaborations with ETSI, TMF, MEF, GSMA, the O-RAN Alliance, and more. NGMN also maintains long-standing co-operations with all of these organizations. The alignment between The Linux Foundation and NGMN represents the latest in a longstanding effort to integrate open source and open standards across the industry.

⊏LF EDGE

Accelerating Edge

As a natural extension of cloud computing, the edge cloud construct is increasingly viewed as a key enabler for the "Fourth Industrial Revolution" in which the widespread deployment of the Internet of Things (IoT), the global sharing economy, and the increase of zero marginal cost manufacturing deliver unprecedented communication-driven opportunities with massive economies of scale. **The Linux Foundation's LF Edge,** launched almost three years ago, continues to see massive global industry support accelerating the adoption and deployment of edge applications across sectors like telco, cloud, edge, IoT, IIoT, enterprise, AI, and more. Key tenets of growth this year include:

▶ LF Edge has solidified its role in generating vendor/analyst-neutral terminology and creating the open source edge market. Together with the Glossary of Edge Computing (which is part of LF Edge), the creation of the annual State of the Edge Report serves as an ongoing and evolv-

ing industry resource to define how we view innovation at the edge.

▶ Continued unification of previously fragmented edge communities across telecom, IoT, enterprise, industrial, cloud edge, and more. Membership growth across industries and more projects to address market needs are just some of the ways LF Edge is enabling innovative collaboration, cross-market integration, scalability, interoperability, and more.

▶ Adoption and deployment of open source edge solutions are accelerating, with even more Akraino blueprints addressing AI, automotive, Smart Cities, Smart Classrooms, IoT, gaming, cloud edge, 5G, and more being used in trials and production. Concurrently, EdgeXFoundry's 2.0 release up-levels the framework with 4+ years of development to offer a more stable, secure, and user-friendly experience.

With the lightning-fast growth of the need for scalable edge computing, LF Edge is poised to be the center of gravity for open edge computing.

Extending to Communities Building API Ecosystems

Lura

AsyncAPI

High-Performance API Gateways With Lura and AsyncAPI

In May of 2021, The Linux Foundation announced the hosting of the Lura Project, formerly the KrakenD open source project. Lura is a framework for building Application Programming Interfaces (API) Gateways that goes beyond simple reverse proxy, functioning as an aggregator for many microservices and is a declarative tool for creating endpoints.

API Gateways have become even more valuable as the necessary fabric for connecting cloud applications and services in hybrid environments. KrakenD was created five years ago as a library for engineers to create fast and reliable API Gateways. It has been in production among some of the world's largest Internet businesses since 2016. The Lura Project is a stateless, distributed, high-performance API Gateway that enables microservices adoption.

Partners include 99P Labs (supported by Honda and The Ohio State University), Ardan Studios, Hepsiburada, Openroom, Postman, Skalena, and Stayforlong.

Back in March of 2021, we also announced that we would host the AsyncAPI Initiative. AsyncAPI is a specification and a suite of open source tools that work with asynchronous APIs and event-driven architectures. According to a recent **developer survey,** it is the fastest-growing API specification, tripling in production usage from 2019 to 2020.

AsyncAPI helps unify documentation automation and code generation and manage, test, and monitor asynchronous APIs. It provides language for describing the interface of event-driven systems regardless of the underlying technology and supports the full development cycle of event-driven architecture. AsyncAPI is considered a sister project of the OpenAPI Initiative, which is focused on synchronous REST communication and is also hosted by the Linux Foundation.

Founding sponsors of the AsyncAPI Initiative include Ably Realtime, Apideck, Bump, IQVIA Technologies, MuleSoft, Slack, Solace, and TIBCO, and AsyncAPI recently announced a **partnership with Postman.** Today, AsyncAPI is in production at Adidas, PayPal, Salesforce, SAP, and Slack, among other enterprise environments.

PHOTO BY LAGOS TECHIE ON UNSPLASH

Surfacing Best Practices Through Peer Groups

// TODO

OSPO Collaboration

TODO is an open group of organizations that collaborate on practices, tools, and other ways to run successful and effective open source projects and programs. TODO Group functions as a community to bring the people managing Open Source Program Offices (OSPO) together in a meaningful way; check out ospolandscape.org for some examples, or the materials found at github.com/todogroup/ospo101.

TODO Group publishes guides on collected best practices from the leading companies engaged in open source development. These guides aim to help organizations successfully implement and run an open source program office. The TODO Group also hosted the first OSPOCon in North America and Europe this year.

TODO published its 2021 Annual OSPO Survey results in September.

The findings indicated there are many opportunities ahead to educate companies about how OSPOs can benefit them.

▶ **OSPO Structure:** Professionalization continued among OSPOs, with 58% formally structured programs up from 54% the previous year. Prospects for more funding brightened compared to 2020.

▶ **OSPO Benefits and Responsibilities:** OSPOs had a positive impact on their sponsors' software practices, but their benefits differed depending on the size of an organization.

▶ **Organizations Without an OSPO:** Almost half of the survey participants without an OSPO believed it would help their company, but of those that didn't think it would help, 35% said they haven't even considered it.

▶ **Value of Open Source Participation:** 27% of survey participants said a company's open source participation is at least very influential in their organization's buying decisions.

The Importance of Neutrality at The Linux Foundation

OSPOs at our member organizations recognize the importance of neutral governance in the projects they choose to take a dependency on for themselves. They also recognize the importance of "doubling down" on engineering investment.

These organizations typically are past the stage where they want to be strictly consumers of open source software; they're ready to be participants (hopefully among many) in the actual development process of the software and tools they are using. They ultimately recognize that the ancillary benefits are significant even if the technical vision might change from their internal priorities.

There are clear benefits to having their projects work under an open governance model designed to encourage other organizations to participate and contribute under a "do-ocracy" where the people doing the work make the decisions for the project community.

A neutral home for projects can bring stability and trust, such as the community not worrying about the parent pulling back the source code or somehow acting against the community's interests. It also eliminates any distinction between "Commercial Open Source Software," where some permissions in the software are limited, and fully open versions of the software.

EFFORTS IN DIVERSITY, EQUITY, AND INCLUSION

In 2021, we continued on our commitment to enact positive change for underrepresented and marginalized people by introducing new and progressing existing programs for inclusivity, racial justice, and diversity.

LF Committed to Building Diverse and Inclusive Communities

Unique ideas and contributions — that originate from a diverse community, from all walks of life, cultures, countries, and skin colors — are vital for building sustainable and healthy open source communities. Individuals from diverse backgrounds inject new and innovative ideas to advance an inclusive and welcoming ecosystem for all.

Creating diverse communities requires effort and commitment. The Linux Foundation is addressing the need to build inclusive and welcoming spaces through various initiatives, including some of those expanded upon below.

LF Research Launches 2021 Open Source Diversity, Equity, and Inclusion Study

The Linux Foundation has put diversity, equity, and inclusion (DEI) at the top of its inaugural research agenda, and for a good reason. It is the social imperative of our time. New research aims to identify the state of DEI in open source communities, identify challenges
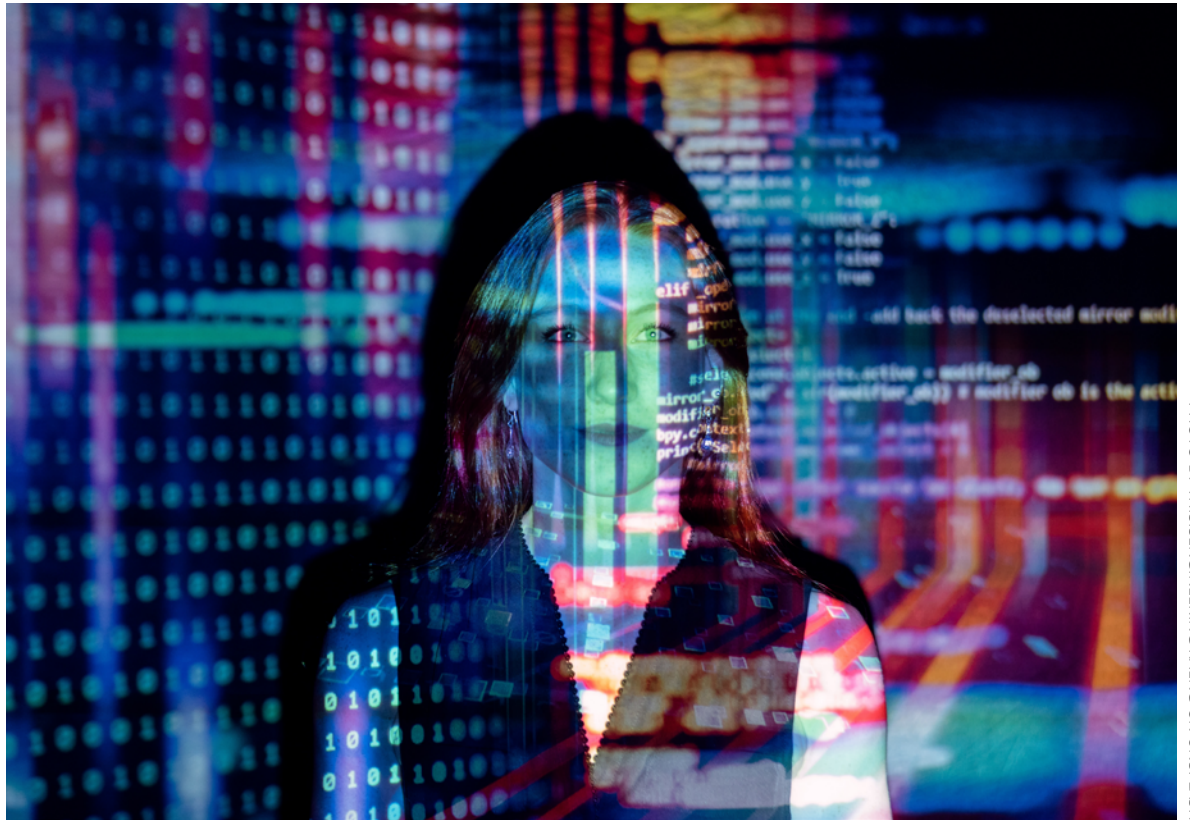
and opportunities within them, and draw conclusions around what initiatives are helpful and where we need to do more collectively.

Earlier this year, we engaged member organizations from the Linux Foundation Board to provide financial support for survey translation into ten different languages and enable further qualitative research to be conducted for a richer perspective. LF Research is grateful to AWS, CHAOSS, Comcast, Fujitsu, GitHub, GitLab, Hitachi, Huawei, Intel, NEC, Panasonic, Red Hat, Renesas, and VMware for their

support and leadership in this important piece of research.

We are also grateful to the 2,350 members of our community who participated in the DEI survey. In addition, more than two dozen individuals across the open source community participated in interviews with the research team adding further insight to the survey findings.

The research shows that while a majority of respondents feel welcome in open source, many in underrepresented communities do not. We

hope that the data and insights that this project provides will be a catalyst for strengthening existing DEI initiatives and creating new ones.

Inclusive Language Efforts

Communities that adopt inclusive language and actions will be able to attract and retain individuals from diverse backgrounds. The Linux kernel community adopted inclusive language in the Linux 5.8 release, showing its commitment to Diversity and Inclusion.

For other projects, the Inclusive Naming Initiative launched at KubeCon North America to standardize inclusive language across the industry. It released a training course, LFC103: Inclusive Strategies for Open Source Communities, to support this.

Software Developer Diversity and Inclusion Project

We are also focusing on Science and Research to Advance Diversity and Inclusion in Software Engineering. Our new Software Developer Diversity and Inclusion (SDDI) project will draw on science and research to deliver resources and best practices that increase diversity and inclusion in software engineering.

Open Hardware Diversity Alliance

The Open Hardware Diversity Alliance is a RISC-V incubating project with the mission of

PHOTO BY LAGOS TECHIE ON UNSPLASH

bringing together the open hardware community to provide programs, networking opportunities, and learning to encourage participation and support to the professional advancement of women and underrepresented individuals in open source hardware.

Diversity, Equity, and Inclusion Micro-Conference

Creating diverse communities requires effort and commitment to creating inclusive and welcoming spaces. Recognizing that communities that adopt inclusive language and actions

attract and retain more individuals from diverse backgrounds, the Linux kernel community adopted inclusive language in the Linux 5.8 release. Understanding if this sort of change has been effective is a topic of active research. The Diversity, Equity and Inclusion Micro-Conference at Linux Plumbers Conference 2021 took the pulse of the Linux kernel community as it turned 30 this year and discussed some next steps. Experts from the DEI research community shared their perspectives and preliminary research with Linux community members.

A multifaceted discussion on various research topics related to diversity was informative. A few takeaways are:

▶ Diversity spans geography, gender, and language.

▶ Inclusive language efforts have to take language barriers into account.

▶ Implicit and explicit mentoring efforts help attract developers from diverse backgrounds.

▶ Mentoring programs with opportunity to work with experts are successful in attracting developers from diverse backgrounds.

The challenges to work on:

▶ How do we retain new developers?

▶ How do we evolve new developers into maintaining code?

LFX Mentorships

As we look back at the year, the LFX Mentorship program will wrap 2021 with 23 new Linux kernel developers, 181 new open source developers across all LFX projects, and 5285 received applications. We started the LFX Mentorship program in 2019 with just three new developers, and we've come a long way since then. As we look back at the year, the LFX Mentorship program will wrap 2021 with 23 new Linux kernel developers and 181 new open source developers across all LFX projects, with 5285 applications received.

The LF Mentorship program, with the help from the Event teams, reached out to Historically Black Colleges (HBCUs) and colleges with a larger number of Hispanic students before the Summer session and to all 2021 applicants to get feedback on the programs and platform.

We have had limited success from the first reach out in attracting and selecting applicants, and the second one was successful. Here is what people had to say about what attracted them to our program:

The top two responses tied at 83%:

▶ Ability to learn to contribute effectively to current open source projects.

▶ Opportunity to experiment and ability to

learn to contribute effectively to current open source projects.

The opportunity to facilitate jobs and internships came in second place with 55%, and paid opportunities came in third place at 49%.

The important takeaways are that the program offers the ability to work with experts and the opportunity to experiment. A few mentioned that the program's emphasis on support for students and developers who are entirely new to open source is why they applied, aligning with the program's goals and objectives.

Mentorship + Events

The LFX Mentorship program and the LF Events teams collaborated with 22 experts in the open source communities to provide unstructured self-learning resources under the LF Live Mentorship Series umbrella. The series provides expert knowledge and valuable interactive discussion across various topics related to the Linux Kernel and other OS projects, primarily development. We made these 22 webinars available for free, and we will conclude this year with two more. We thank all our mentors for taking the time to share their knowledge and expertise.

Let's take a look at how these programs enable new developers to find jobs and career opportunities. You can read the stories of Linux

PHOTO BY CHRISTINA @ WOCINTECHCHAT.COM ON UNSPLASH

Kernel Mentorship program graduates breaking the open source glass ceiling by Nithya Ruff and Jennifer Cloer.

We are also planning to reach out to all our graduates since the inception of this program in 2019. The goal is to see where their open source journeys took them after graduating, and we will share the results.

The LFX Mentorship and LF Events team collaborated on a Mentee Showcase to connect our graduates with prospective employers from our member companies. In this virtual event, mentees will share their accomplishments with others. There are plenty of open source jobs, and employers are looking for talent. Additionally, this event allows us to thank our mentors who share their knowledge to train new talent. Some of our mentors do this in their spare time without expectations. We are hoping to make this an annual event.

A recent Linux kernel community research confirmed the busy maintainer problem we talked about for a couple of years. Next year, this is one area of focus to add mentorship projects and webinars to provide resources to develop maintainer talent within open source communities.

As we talk about the stats and numbers, let's not lose sight of the big picture. It's all about:

▶ Making a difference and empowering people by offering both structured and unstructured learning opportunities.

▶ We are paying them to learn and making the resources available for free and accessible to all.

▶ Developing new talent and making the new talent available to the Linux ecosystem.

▶ Helping build communities to continue developing open source code to keep the Linux ecosystem healthy and sustainable.

Addressing Racial Justice Efforts Through Code

In February of 2021, the Linux Foundation announced it would host seven Call for Code for Racial Justice projects, an initiative driven by IBM and Creator David Clark Cause to urge the global developer ecosystem and open source community to contribute to solutions that can help confront racial inequalities. These include two new cloud-based Solution Starter applications:

▶ **Fair Change** is a platform to help record, catalog, and access evidence of potentially racially charged incidents to help enable transparency, reeducation, and reform as a matter of public interest and safety.

▶ **TakeTwo** aims to help mitigate bias in digital content, whether overt or subtle, focusing on text across news articles, headlines, web pages, blogs, and even code.

In addition to the two new apps, the Linux Foundation now hosts five evolving open source projects from Call for Code for Racial Justice:

▶ **Five Fifths Voter:** This web app empowers minorities to exercise their right to vote and helps ensure their voice is heard by determining optimal voting strategies and limiting suppression issues.

▶ **Legit-Info:** Local legislation can significantly impact areas as far as jobs, the environment, and safety. Legit-Info helps individuals understand the legislation that shapes their lives.

▶ **Incident Accuracy Reporting System:** This platform allows witnesses and victims to corroborate evidence or provide additional information from multiple sources against an official police report.

▶ **Open Sentencing:** To help public defenders better serve their clients and make a stronger case, Open Sentencing shows racial bias in data such as demographics.

▶ **Truth Loop:** This app helps communities understand the policies, regulations, and legislation that will most impact them.

Communities are not just about building ecosystems of monetary value and shared investment — many are also invested in changing society for the good, expanding the well-being of humanity, and charting a future for the health of our planet, a dependency on which we all rely.

A Trusted Resource for Public Health and Industry Partners

⊡LF PUBLIC HEALTH

Combatting COVID With LFPH

Linux Foundation Public Health (LFPH) hosts, supports, and nurtures open source technology to benefit public health initiatives.

Since its founding a little over a year ago, the organization has become a go-to resource for governments and industry partners to get advice on the latest technologies coming to market. Over 50 jurisdictions worldwide have come to trust LFPH for unbiased, clear guidance on how to take advantage of technologies within our program areas of exposure notification and COVID credentials. National and global institutions such as the WHO, CDC, UN, and GAO have also invited LFPH to present at meetings, contribute to reports, and assist them in their own understanding of this technology.

Meanwhile, LFPH projects and initiatives continue to grow. **The Global COVID Certificate Network** and standard development happening at the **COVID Credentials Initiative** are

becoming some of the leading groups solving the challenges of interoperability between divergent systems and standards emerging around the world. The organization's leadership role in the Good Health Pass Collaborative has established LFPH's voice as one of the leads in the ethical, privacy-first design of public health software. With the addition of **Herald**, **Cardea**, and **MedCreds**, the foundation's projects are now used in over a dozen states, provinces, and countries worldwide to help fight COVID-19 and safely reopen borders.

While COVID is not going anywhere, LFPH is charting a path forward beyond pandemic response. The pandemic has highlighted the need to overhaul public health infrastructure worldwide to create better ways to share data within and across borders. Open source software will be a crucial piece of solving that puzzle.

RARE CAMP   Open Treatments

Advancing Treatments for Rare Diseases With RareCamp and Open Treatments Foundation

In March, the Linux Foundation announced that it would be hosting RareCamp and the OpenTreatments Foundation. RareCamp enables treatments for rare genetic diseases regardless of rarity and geography.

[Four hundred million](#) patients worldwide are affected by more than 7,000 rare diseases, yet treatments for rare genetic disorders are underserved. [More than 95 percent](#) of rare diseases do not have an approved treatment, and new treatments are estimated to cost more than [$1 billion.](#)

The RareCamp open source project provides open governance for the software and scientific community to collaborate and create software tools to aid in creating treatments for rare diseases. The community includes software engineers, UX designers, content writers, and scientists who are collaborating now to build the software that will power the OpenTreatments platform. The project uses the open source Javascript framework NextJS for frontend and the Amazon Web Services (AWS) Serverless stack — including AWS Lambda, Amazon API Gateway, and Amazon DynamoDB — to power the backend. The project uses the open source toolchain [Serverless Framework](#) to develop and deploy the software and is licensed under Apache 2.0 and available for anyone to use.

The project is supported by individual contributors and collaborations from companies that include Baylor College of Medicine, Castle IRB, Charles River, Columbus Children's Foundation, GlobalGenes, Odylia Therapeutics, RARE-X, and Turing.com.

PHOTO BY RABIH SHASHA ON UNSPLASH

Our Biggest Challenge Yet: Saving the Planet

The transition from centralized fossil-fuel generation to renewable and distributed energy resources will mark the most significant reimagining of power systems in over 140 years, and it will fundamentally transform our economies. Approximately 75% of carbon emissions can be mitigated through the electrification of energy, transportation, and the built environment. By adopting an open source strategy that maximizes flexibility, agility, and interoperability, we can innovate at the speed of the urgency needed to decarbonize and save our planet.

We have the tools to support solving these problems together within the global open source collaboration that The Linux Foundation fosters.

LF ENERGY

Accelerating Decarbonization With LF Energy

Several Linux Foundation projects are already working on various climate initiatives. For example, LF Energy is accelerating the decarbonization of the global economy through the

transformation of power system networks and delivering a full interoperability stack for EVs and vehicles to grid (V2G) to onboard intermittent and renewable energy at scale.

LF Energy now encompasses **20 open source projects**. Its **44 members**, now include Microsoft, Hitachi ABB, and **Savoir-Faire Linux**.

LF Energy software projects in development are innovating on substations and multi-protocol gateways, electrifying transportation, improving grid automation, reducing grid congestion, creating flexible markets, enabling avoided energy markets, increasing grid resilience, improving data monitoring and analysis, and optimizing network operations.

Via the collaboration that forums like LF Energy provide, innovative technologies can get to market faster. As LF Energy members grow to include traditional utility OEMs like GE and Hitachi ABB, those technologies are more likely to be adopted and spread faster throughout the energy ecosystem.

OS-C

Addressing Climate Change With OS-Climate

OS-Climate is developing a platform of data and analytics to close the $1.2 trillion gap in financing and investment required to achieve

PHOTO BY BIRGER STRAHL ON UNSPLASH

Paris Climate Accord goals. Avoiding catastrophic global warming levels and ensuring resilience to climate impacts requires rapidly closing the $1.2 trillion gap in investment for climate solutions each year. But pension funds, asset managers, banks, corporations, and regulators lack the data and analytics required to reallocate financing toward decarbonization.

At COP-26 in Glasgow in November, OS-Climate rolled out its **prototype Data Commons** and **AI-enhanced tools for climate-alignment** and **physical risk analysis of portfolios** — key for transitioning the global economy to Net Zero emissions and a sustainable future. In the last year, membership and number of active contributors have grown by more than 300% and more than 600%, respectively.

The rest of the Linux Foundation ecosystem can play a substantial role going forward by enabling that power quality and power consumption — so that one day, every device running Linux or embedded Linux on the edge which draws energy from power networks can provide arbitrage to the grid by accepting a price signal.

On that day, every project at the Linux Foundation will address some part of the decarbonization of the global economy. Linux helped build the world we see today. The Linux Foundation will be central to transforming the world so that future power systems will enable our grandchildren's children to inherit a healthier planet.

Reducing Carbon Emissions With Green Software Foundation

In May of 2021, the Linux Foundation, with Joint Development Foundation Projects LLC, along with its partners Accenture, GitHub, and Microsoft, announced the formation of the Green Software Foundation to build a trusted ecosystem of people, standards tooling, and leading practices for building green software.

As we think about the software industry's future, we believe we have a responsibility to help build a better future — a more sustainable future — both internally at our organizations and in partnership with industry leaders around the globe. With data centers worldwide accounting for 1% of global electricity demand, and projections to consume 3-8% in the next decade, we must address this as an industry.

The Green Software Foundation comes from a mutual desire to collaborate across the software industry. Organizations with a shared commitment to sustainability and an interest in green software development principles are encouraged to join the Foundation to help grow the field of green software engineering, contribute to standards for the industry, and work together to reduce the carbon emissions of software.

PHOTO BY HEATHER SUGGITT ON UNSPLASH

COMMUNITY HIGHLIGHT

Build Change ISAC-SIMO Project

In June of 2021, the Linux Foundation announced it would host the Intelligent Supervision Assistant for Construction (ISAC-SIMO) project, which Build Change created with a grant from IBM as part of the **Call for Code** initiative. **The Autodesk Foundation,** a Build Change funder, also contributed pro-bono expertise to advise the project's development.

Build Change helps save lives in earthquakes and windstorms. Its mission is to prevent housing loss caused by disasters by transforming the systems that regulate, finance, build and improve houses worldwide.

ISAC-SIMO packages necessary construction quality assurance checks into a convenient mobile app. The tool harnesses the power of machine learning and image processing to provide feedback on specific construction elements such as masonry walls and reinforced concrete columns. Users can choose a building element check and upload a photo from the site to receive a quick assessment.

ISAC-SIMO was imagined as a solution to gaps in technical knowledge that was apparent in the field. The app ensures that anyone can more easily identify quality issues with a phone instead of solely relying on technical staff. It does this by comparing user-uploaded images against trained models to assess whether the work done is broadly acceptable (go) or not (no go) along with a specific score. The project is built on open source software, including Python through Django, Jupyter Notebooks, and React Native.

Linux Foundation members continue to recognize the high value of communication among in-house attorneys and the special role knowledgeable open source counsel plays in developing the larger open source ecosystem.

Global Collaboration Regulatory Updates

At its core, The Linux Foundation exists to enable open and transparent collaboration between and among diverse participants in the global community. This collaboration occurs across organizational boundaries, such as academic, company, non-profit, and individual contributors, each of whom may have different goals and motivations. It also occurs across national borders: open collaboration brings together participants from around the world to build technology together for the benefit of everyone. Open source has been and will be a global endeavor.

The LF tracks and monitors for changes in laws or regulations that may impact how our communities and ecosystems function to support this global collaboration. We have in the past followed and tracked topics such as the **impact of GDPR** in the EU on open source communities and projects. In August, China enacted a similar national privacy statute ("PIPL"), and

the LF will be updating its materials to include similar guidance as was done for GDPR.

In 2020, the LF provided guidance for open source communities struggling with questions about United States Export Administration Regulations and their impact on global open source collaboration. In 2021, the United States published updates to its export controls regulations. The Linux Foundation likewise revised its white paper, **"Understanding Open Source Technology and US Export Controls"** (available in English and Chinese), for the 2021 changes.

Previously, for publicly available encryption software under ECCN 5D002 to be not subject to the EAR, email notifications to the United States BIS and NSA were required regardless of whether or not the cryptography it implemented was standardized. Following the change in 2021, email notifications are only required for software that

implements "non-standard cryptography." The paper goes into further detail.

We continue to believe and communicate to our communities

that global cooperation in transparent, open source development is permitted, should be encouraged, and leads to the benefit of all countries and participants involved.


PHOTO BY ALIN ANDERSEN ON UNSPLASH

Enabling Easier Collaboration on Open Data

While many are familiar with open source software licenses, open data is different. Various laws and regulations treat data differently from software or other content. Additionally, data may be consumed, transformed, and incorporated into Artificial Intelligence (AI) and Machine Learning (ML) models in different ways from how software and other creative content are used. Because of all of this, assumptions made in commonly-used licenses for software and creative content might not apply in expected ways to open data.

In June of 2021, we worked with a group of companies to update the **Community Data License Agreement — Permissive, Version 2.0.** Unlike version 1.0, the new CDLA-Permissive-2.0 is less than a page in length. The only obligation it imposes when sharing data is to "make available

Machine Learning eXchange (MLX)

Machine Learning eXchange (MLX) is an open source data and AI assets catalog and execution engine contributed by IBM to LF AI and Data Foundation this year. The MLX community also curates large datasets made available under the CDLA-Permissive-2.0 and CDLA-Sharing-1.0. The datasets range from English sentences in financial reports, to C code snippets, weather data, and spoken language samples. These datasets are useful in training AI and ML models and anyone can get involved, use, and contribute to the MLX open data collaboration.
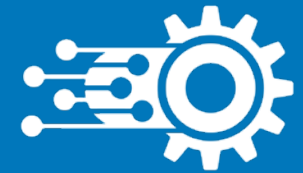
the text of this agreement with the shared Data," including the disclaimer of warranties and liability.

Removing terms transformed the CDLA-Permissive-2.0 into a concise, easy-to-read format that we believe will be appreciated by data scientists, AI/ML users, lawyers, and users worldwide where English is not the first language. We hope and anticipate that open data communities will find it easy to adopt it for releases of their own data sets and appreciate the clarity it brings to the use of open data for artificial intelligence and machine learning models.

LF Legal Community Collaboration

Protecting Linux and Open Source

Two years ago, the Linux Foundation partnered with Open Invention Network, IBM, and Microsoft to **announce an ambitious plan** to fund an **Open Source Zone within Unified Patents.** The Open Source Zone further protects Linux and open source software (OSS) from non-practicing entities ("patent trolls") who use low-quality patents to threaten users of OSS. The ambition was compelling enough that Meta, Daimler, and

CableLabs joined to support the Open Source Zone.

Fighting patent trolls takes time, typically measured in years. Unified Patents uses the funding it receives to detect, disrupt, and deter patent trolls from targeting users of OSS. Unified Patents provided an update on its successes.

To date, Unified Patents has challenged 43 patents that trolls were using to target OSS users. In just two years, 12 patents were

invalidated, two had the scope of the patent narrowed, the PTAB has granted 26 a review, and six are pending a decision to review. Unified's primary goal is ultimately to deter patent trolls from targeting users of OSS. As you can see from the list of open source software they've helped defend, Unified's work has been a success for the OSS ecosystem.

Patent trolls claimed their weak patents gave them exclusive rights to functionality users find in OSS packages and tools, including Apache Ambari, Apache Cassandra, Apache Cocoon, Apache Hadoop, Apache modules mod_evasive and fail2ban, Apache Traffic Control, Apache Zookeeper, Automotive Grade Linux, Ceph, ClamAV, DigiKam, Linux kernel "ip" command, Linux kernel NFS module, iptables, KVM, Nagios, OAuth, OpenACH, OpenSwan, frredesktop.org's OpenWFD, QEMU, Quagga, Redis, Rygel, sedutil, and Varnish Cache.

Legal Summit

The annual member counsel Legal Summit was held on November 15, 17 and 19, 2021, as a virtual event for the second time. Lawyers, open source program officers, and compliance experts discussed various open source-related legal topics during the three-day event.

Recognizing that open source has evolved:

▶ From joint development of code assets to establishing enabling infrastructure for massive shared investment and dependency, and

▶ From isolated components to constellations of projects forming new platforms; and

▶ Beyond software to include hardware and data and other artifacts;

The member counsel discussed all of these trends and celebrated significant achievements for Open Chain, our collaboration around supply chain management, and for SPDX, our longstanding software bill of materials project.

Education

Linux Foundation members continue to recognize the high value of communication among in-house attorneys supporting open source use and the special role knowledgeable in-house open source counsel plays in developing the larger open source ecosystem. Through Linux Foundation Member Counsel conferences and regular communications behind the scenes, attorneys new to open source are provided access to mentors, role models, and best practices. The Member Counsel has also tackled new regulations and participated in other

collaborative projects intended to reduce redundancy to make compliance with open source license obligations more efficient.

With each new industry vertical that comes to the Linux Foundation to launch a project, this process of supporting lawyers as they acquire the knowledge necessary to guide their clients across the chasm of open source adoption begins again. In offline conversations with the lawyers in-house at the Linux Foundation and in gatherings of those experienced and first-time Member Counsel related to the new project, in-house counsel have opportunities to ask questions and spark discussions. In this way, we all work together to preserve trust in the process and enable a smoother launch for the project that our employers are investing in and will depend upon.

The Linux Foundation fosters new growth by introducing new standards and best practices for safety and content provenance, creates new communities for open hardware, real-time embedded, AI/ML & Data, and seeds a new generation of mainframe programmers.

Addressing Functional Safety Challenges With ELISA

ELISA (Enabling Linux in Safety Applications) has been active now for over a year. The project aims to create a shared set of tools and processes to help companies build and certify Linux-based safety-critical applications and systems whose failure could result in the loss of human life, significant property damage, or environmental damage.

As Linux continues to be a key component in safety related applications like: autonomous vehicles, medical devices, and even rockets, ELISA will make it easier for companies to build, test and analyze these safety-critical systems. As a show of support for this business-critical initiative, several new members have joined the ELISA project. New members include Premier Member Intel/Mobileye, General Members ADIT, Elektrobit, Mentor, SiFive, Suzuki, Wind River, and Associate Members Automotive Grade Linux and Technical University of Applied Sciences Regensburg.

In parallel to incredible member growth, ELISA has established several workgroups to further the cross-industry project's crucial work toward advancing open source in safety-critical systems. These groups include Kernel Development Process, Safety Architecture, Medical Devices and an Automotive working group. The project just completed it's fifth workshop, and even though the last two had to be held virtually, the number of participants continues to grow, and participant satisfaction is high as we collaborate together to identify ways to bridge the gap between existing functional safety standards and the Linux kernel's development velocity.

Addressing Stability and Growth for JavaScript With OpenJS Foundation

As a global leader in business and financial information, data, news, and analytics, Bloomberg has a long-term investment in JavaScript through contributions to core projects and ongoing participation in standards, notably for the JavaScript language itself. Bloomberg has more than 10,000 frontend apps and tens of millions of lines of JavaScript code that cover both consumer web and the Bloomberg Terminal, the desktop application core to Bloomberg's business. Furthermore, more than 2,000 software engineers are writing JavaScript at Bloomberg, another testament to the company's innovation and commitment to the programming language and the open source community.

The global pandemic brought the OpenJS Foundation closer to the end-users and contributors of its hosted JavaScript projects. With more than 97 percent of the world's websites using JavaScript, it is the foundation for online commerce, economic growth, and innovation.

Netflix has been an end-user and contributor of the Node.js project since 2013 and one of the largest-scale Node.js deployments in production. As platforms grow, so do their needs. However, the core infrastructure is often not designed to handle these new challenges as it was optimized for a relatively simple task. Netflix, a member of the OpenJS Foundation, had to overcome this challenge as it evolved from a massive web streaming service to a content production platform. Netflix runs a serverless Node.js platform that powers all the devices' user interfaces and use cases for web applications supporting content production.

Following the 25th anniversary of JavaScript, the OpenJS Foundation continues to see an exciting future for the number one programming language, evidenced by the diverse, multi-stakeholder communities that make up OpenJS.

OpenJS is a global community created two years ago by the merger of the Node.js and JS Foundations. The OpenJS Foundation hosts 38 JavaScript projects, including Node.js, AMP, Electron, jQuery, webpack, Node-RED, and Appium.

OpenJS is a member-supported organization, with companies like IBM, Google, Joyent, Microsoft, GoDaddy, and Netflix, and more

OpenJS Foundation Executive Director Robin Ginn speaks at an Open Source Summit + Embedded Linux Conference in Europe.

providing financial support and active involvement in our governance process.

In 2021 OpenJS welcomed new members: American Express, Bloomberg, Coinbase, NodeXperts, Sentry, and Stream. JavaScript is core to each of these companies' leadership positions in the market, and by supporting OpenJS, they support the infrastructure and long-term growth of key open source projects on which they rely.

At OpenJS World 2021, OpenJS Board President Todd Moore, VP of Open Technology and Developer Advocacy at IBM, joined OpenJS

Executive Director Robin Ginn for an opening keynote. They described how, through OpenJS, the industry could confidently enter a JavaScript ecosystem that prioritizes stability and openness in the shared technologies while recognizing the unique needs of individual participants.

OpenJS Foundation Executive Director Robin Ginn extended an open invitation: "Our goal at OpenJS is to incubate and sustain a healthy

OpenJS Foundation provides convening opportunities at Collaborator Summits for active contributors to the foundation projects.

JavaScript ecosystem. To get involved, go to our website at **openjsf.org/collaboration**. Through your participation, we know the best is yet to come for the future of JavaScript."

Todd Moore shared why IBM invests in the OpenJS Foundation and why so many of their employees actively participate among OpenJS communities: "IBM and our customers today rely upon many of the open source JavaScript projects hosted at the OpenJS Foundation — it's in all our economic interests to invest in that technology as it is the plumbing that creates the opportunity for all of us to share in."

Creating New Open Standards With JDF and C2PA

JOINT DEVELOPMENT FOUNDATION

In 2019, the Linux Foundation added the **Joint Development Foundation (JDF)** to its family of project communities to build upon its existing body of specification work. The addition of JDF to the Linux Foundation brought with it a unique but straightforward process that allows new projects to form quickly and collaborate under a standardized set of governance principles that ensure the resulting specification can be implemented with open source licenses.

Since our last update in the 2020 Annual Report, the Linux Foundation has steadily increased interest and new project formation under Linux Foundation Standards (LFS) across various technical disciplines. We have also seen an acceleration of members and contributions in our established projects.

"2021 can be characterized as a year of progress for LF Standards and JDF. We saw solid operational improvements in our traditional

specification efforts, steady uptake on the Community Specification program, and some new wins with the acceptance of the SPDX specification by JTC1. The ability to quickly wrap a specification project with an open source project using well-established governance and standards-making processes seems to have fulfilled an unmet need in our industry," said Seth Newberry, the General Manager of JDF.

"We reached out to the Linux Foundation because we wanted to create the Coalition for Content Provenance and Authenticity (C2PA. org) under a simple but formal project structure. Given our project goals of creating technical specifications for countering misleading information online through digital provenance, it was critical to get up and running quickly and with minimal complexity" said Andy Parsons of Adobe Systems.

"The JDF program is great for us. It has a simple set of templates we used to ensure we employ good standards practices, and it was very quick to set up the legal entity and the project. We've also enjoyed excellent support from an experienced team at the Linux Foundation since inception. We achieved a draft release of the specification in about eight months, which may be a record in standards-setting. We could not have done this without the LF and JDF."

Looking ahead, LF Standards expects to become more active and visible in the standards-setting community, especially leveraging the Community Specification as an entry point for new projects that need the established governance and process structure of a traditional standards project but with the low/no-cost project onramp. LF Standards will also begin to fully adapt the investment in project onboarding and reporting tools being developed in LFX, allowing the projects to bring on new contributors quickly, with low overhead, and gain insights about the engagement with the contributors and the progress of the specifications.

The **Coalition for Content Provenance and Authenticity (C2PA)** addresses the prevalence of misleading information online through the development of technical standards for certifying the source and history (or provenance) of media content. C2PA is a Joint Development Foundation project, formed through an alliance between Adobe, Arm, Intel, Microsoft and Truepic.

C2PA unifies the efforts of the Adobe-led **Content Authenticity Initiative (CAI)** which

focuses on systems to provide context and history for digital media, and **Project Origin,** a Microsoft- and BBC-led initiative that tackles disinformation in the digital news ecosystem.

The most significant improvement to the Linux Foundation Standards offerings is the breadth of options available to companies who want to create technical collaborations that can result in an important public specification. Traditional standards-making organizations are typically technology-specific, created for a specific purpose, and have highly customized bylaws that take time to develop, review and sustain with a bespoke legal entity.

Linux Foundation Standards have a harmonized set of standardized project charters with compatible governance and process rules that allow contributors to germinate an idea using the free repository-based Community Specification. This can ultimately be matriculated to a compatible traditional-mode standards effort with a formal corporate structure that can hold assets in common and raise funds. All of these efforts can ultimately be submitted to the JTC1/ISO/IEC for consideration and adoption as an internationally recognized standard using the Publicly Available Specification (PAS) process.

Creating Communities With The LF AI & Data Foundation

⊏LF AI & DATA

The LF AI & Data Foundation grows and supports an open community and a growing ecosystem of open source AI, data, and analytics projects by accelerating development and innovation, enabling collaboration, and creating new opportunities for all the community members. The Foundation provides a neutral, trusted hub for developers to code, manage, and scale open source AI and Data technology projects

Our community continues to grow both in terms of members and projects. On average, we're adding one new member and one new project per month. At the time of writing this report, LF AI & Data has 49 members and hosts 33 projects. The projects cover open source to open standards everyone in the world relies on for AI and data analytics systems. In addition to adding 8 new projects in the first half of 2021, LF

AI and Data launched the MLOps Committee to share best practices, bring technology awareness around MLOps across industries, and identify and contribute to the technological projects that address the challenges of industry and technology for the benefit of all participants.

▶ **Visit our landscape [URL] capturing the open source AI and Data ecosystem**

▶ **View the list of hosted projects**

▶ **View the list of top tech companies hosting projects with us**

PHOTO BY ADAM NOWAKOWSKI ON UNSPLASH

18K contributors

331K contributions

145K commits

299 repositories

10M lines of code

10.24 emails

1.66K pages

149K pull requests/ changesets

14K total mentions

9K messages

Creating Open Hardware Ecosystems With Open19

OPEN 19™

Open19 joined the Linux Foundation in April of this year, and we were pleased to announce that its founder, Yuval Bachar, joined the LF as a Fellow. The project focuses on hardware standards that enable compute, storage and network manufacturers and end-users to develop differentiated hardware solutions while protecting their competitive intellectual property. With the addition of Open19, The Linux Foundation is hosting data center hardware and software under one virtual roof.

Open19 provides a framework for accessing and deploying hardware innovation at any scale, from edge environments to large-scale custom clouds. With its unique intellectual property model and market-leading specifications with proven adoption, Open19 enables technology providers, supply chain partners, cloud service providers, telecoms and tech-forward enterprises to leverage shared

investments to address the exploding needs of modern compute and network deployments while minimizing risk. This reduces time to market for new solutions while substantially lowering the cost of operations.

Originally founded in 2016 by a community of cloud infrastructure innovators looking to solve the cost, efficiency, and operational challenges of modern data center deployments, solutions based on Open19 technology are now deployed at leading global providers. Open19 provides specifications for servers, storage and networking components designed to fit in any 19-inch data center rack environment.

The project features common elements to enable platform innovation: **Flexible server "bricks"** (server nodes with standard power supply and network delivery, plus cooling); **a mechanical cage** to house bricks; **a standardized power shelf;** and **blind mate power and data connectors**.

Creating Open Processor Architectures With RISC-V, OpenPOWER, and Chips Alliance

![RISC-V logo]

RISC-V is the strategic foundation and catalyst for open computing across industries and geographies, technical innovation and adoption, community engagement and strategic investment. The organization is driven through open collaboration, enabling freedom of design across all domains and industries, and cementing the strategic foundation of semiconductors.

RISC-V International is a non-profit organization supporting the free and open RISC instruction set architecture and extensions. It enables open community collaboration, technology advancements in the RISC-V ecosystem, and visibility of RISC-V successes.

RISC-V membership more than doubled in the first half of 2021, and continues its dramatic growth, reflective of industry growth coupled with low barriers to entry. RISC-V

RISC-V: Growth in Key Industries During 2021

Data Center, HPC, and Cloud

Intel introduced the Nios processor based on RV32IA, designed for performance, with atomic extensions, 5-stage pipeline, and AXI4 interfaces.

Tactical Computing Labs launched the HPC-centric software test suite for GCC and LLVM.

Telecom and Communications

Andes announced that SK Telecom has adopted its 64-bit RISC-V processor for the development of AI products.

Alibaba PLCT Lab ported Android 10 onto its in-house 64-bit RISC-V core emulated in QEMU.

Automotive

Imagination Technologies announced that a GPU can be linked together by a RISC-V core for ASIL-B level designs with ISO26262 safety-critical certification.

IAR Systems extended the functional safety version of its Embedded Workbench software toolchain to the 32-bit RISC-V core of Nsitexe, a subsidiary of automotive parts maker Denso.

Consumer and IoT

Zepp Health wearable manufacturer has announced an OS supporting RISC-V Reference Models for RISC-V P extension.

SiFive has released the world's fastest development board for RISC-V Personal Computers.

AI/ML

Esperanto emerged from stealth/startup with a 1,000-Core RISC-V AI Accelerator.

StarFive released the world's first RISC-V AI visual processing platform.

Edge Computing

Seeed Studio released the Sipeed MAIX, a RISC-V 64 AI board for Edge Computing, which allows embedding AI to any IoT device.

Micro Magic announced a high-speed 64-bit RISC-V core achieving 5GHz and 13,000 CoreMarks at 1.1V.

The RISC-V CPU core market will grow at 114.9% CAGR, capturing over 14% of all CPU cores by 2025.
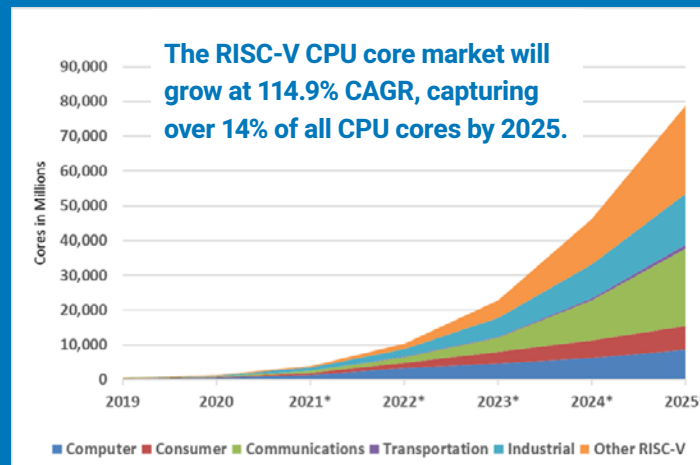
has accelerated numerous programs to spur industry adoption and community engagement:

▶ Ratification of 10+ technical extensions

▶ Launch of RISC-V compatibility programs for profiles and platforms

▶ Launch of RISC-V Development Partners and RISC-V Labs to build and support technical deliverables

▶ Surpassed visibility goals across press, analyst, social, events, and other programs

▶ Launch of RISC-V Exchange 2.0 showcasing hundreds of RISC-V solutions

▶ Launch of RISC-V online learning with 9,000+ enrollments

▶ Launch of RISC-V mentorships program and RISC-V Jobs

▶ Growth of RISC-V ambassador and alliance programs

▶ Collaboration and launch of Open Hardware Diversity Alliance

In 2021, The OpenPOWER Foundation successfully continued to execute its long-term strategy of accelerating the development of one of the most open, mature, and high-performance CPU architectures by creating the necessary community tooling and initiatives for building a vibrant community open source hardware ecosystem.

The OpenPOWER foundation co-developed an advanced computer architecture curriculum based on POWER ISA at Virginia Tech University, which provides the first-course curriculum that goes from undergraduate through to doctorate courses using the same fully open ISA. The Foundation expects other universities to follow suit in adopting this new curriculum.

The Foundation saw outstanding open source contributions from its community, including accepting the POWER-based Microwatt CPU core to be manufactured in the first fully open process design kit (PDK) shuttle program in partnership with Google and Skywater Foundry. This program allows open source semiconductor designs to be manufactured for free, providing a potential avenue for dramatic increases in experimentation and collaboration of hardware projects.

The Foundation also established new Special Integration Workgroups (SIGs), including the LibreBMC SIG, developing the first fully open baseboard management controller (BMC). BMC's are typically found in servers for remote management applications and historically run proprietary software. The LibreBMC project delivers a fully open stack of hardware based on POWER running openBMC software installed on OCP's open source DC-SCM module card. The LibreBMC project is getting significant traction within the data center community because it provides increased security and customization to an essential data center component.

Finally, the Foundation established the OpenPOWER HUB. This community-supported initiative has providers with POWER-based servers giving free remote access to developers working on porting software to POWER or developing POWER-based hardware. This initiative provides an easy and low barrier way for the community to develop on POWER, extending its already vast ecosystem of supported software.

The CHIPS Alliance is an active community of industry, university, and individual participants interested in creating and fostering an open source hardware development ecosystem, including design specifications, reference implementations, physical protocols, digital and analog design methodology, and associated tooling.CHIPS has seen its membership grow to 38 institutions so far this year, along with the creation of new special interest workgroups related to analog design, FPGAs, cache coherency, and SystemVerilog (IEEE 1800).

Some of the highlights of this year to note in CHIPS include

▸ AIB 2.0 Chiplet Specification was released

▸ OMNIXtend: Cache Coherency amongst devices, a collaboration project with RISC-V

▸ Expansion of the System Verilog tooling ecosystem with significant contributions from Antmicro and Google and participation by the community

▸ Establishment of an FPGA design exchange format enabling multiple vendors to participate

▸ Expansion and support of analog and digital open source EDA tooling

This year we have hosted two half-day workshops with good attendance from the community and have also started a monthly CHIPS Deep Dive Cafe, where a given topic of current interest is explored in depth and allows for detailed discussion after the presentation.

We look forward to initiating a collaborative, open source development project in the coming months and active participation from the community. CHIPS Alliance is open to all organizations interested in collaborating on open source hardware or software tools to accelerate the creation of more efficient and innovative chip designs.

COMMUNITY HIGHLIGHT
Zephyr

Zephyr RTOS unites companies, developers and end-users around the world to ensure balanced collaboration and feedback to evolve and meet the needs of its community. This innovative relationship among members advances the **Zephyr Project's** support of new hardware, developer tools, sensors, and drivers, while maximizing the functionality of devices that run applications on the RTOS.

This passionate community achieved several technical milestones this year, including:

▸ Celebrating more than 1,300 contributors and 26,845 commits, building advanced support for multiple architectures such as ARC, Arm, Intel, Nios, RISC-V, SPARC and Tensilica and more than 350 boards.

▸ Hosting its inaugural Zephyr Developer Summit, which consisted of 700 registrants, 5 mini-conferences, 28 sessions and 51 speakers who presented technical content, best practices, real-world use cases and more on a virtual platform. Videos are available on the **Zephyr Project Youtube Channel.**

▸ Release of the second Long Term Support (LTS) release in October, which will be the basis for 61508 safety certification. By basing a product on an LTS, a company can take advantage of the shared support providing security and severe functional fixes as issues are discovered over time.

▸ Creating **a set of rules for the code releases** that aims to increase reliability, readability, and maintainability. The group based the project guidelines on existing coding standards MISRA C:2012, which have a history of minimizing systematic fault in safety-critical systems. The guidelines were published as part of the project recommendations for collaboration.

One of the strengths of the Zephyr LTS is the ability to generate Software Bill of Materials (SBOMs) automatically during the build. It is one of the few open source projects that is a CVE Numbering Authority(CNA) and has an active Project Security Incident Response Team(PSIRT) that manages responsible disclosure of vulnerabilities. Product makers using Zephyr can register for free to receive **vulnerability notifications** under embargo.

Seeding the Next Generation of COBOL Programmers With Open Mainframe Project

OPEN MAINFRAME PROJECT

Open Mainframe Project has experienced record growth in contributions this year, with more than 105.31 Million Lines of Code written and over 9,600 commits submitted by Open Mainframe Project communities to date— a 100 percent increase across 20 project and working groups. These numbers will only increase as Open Mainframe continues to be the cornerstone of governance and innovation for modernizing the mainframe and its path to IoT, Cloud, and Edge Computing.

But the mainframe workforce is aging — in fact, many organizations employ mainframers who half or more of their staff will be eligible for retirement soon. The aging workforce will be a global issue as many schools have shifted from teaching mainframe skills and important languages like COBOL and assembler. Some students don't even know what a mainframe is or aren't aware they use one each day.

The mainframe isn't going away, so that means we need to get younger mainframers on board.

That's why the Linux Foundation chose to help close the skills gap through education and training. Through the Open Mainframe Project's Mentorship program, the project offered hands-on experience in an open source environment with leaders from member companies such as BMC/Compuware, Broadcom, IBM, Micro Focus, Rocket Software, and many others.

This year, the mentorship program welcomed its **largest mentee class** from around the globe that worked on popular projects such as ATOM, COBOL Programming Course, COBOL Working Group, Mainframe Open Education, Polycephaly, Software Discovery Tool, and Zowe. Through one-on-one conversations, collaborative community meetings, technical development, and accessibility to mainframe technology, Open Mainframe helped lay the groundwork for the next generation of mainframers.

Additionally, as COBOL continues to be on-demand this year, Open Mainframe continued to enhance resources:

▶ **The COBOL Programming Course,** which also became **the first Open Mainframe project to complete the lifecycle and graduate** to become a mature active project, went

through an extensive overhaul to provide more detailed content for a better experience and deeper understanding for students and developers looking for a refresher course.

▶ **COBOL Check** launched in March to improve the design, understandability, maintainability, and longevity of core business applications. It supports IBM's mainframe modernization program by enabling restructuring of existing applications of APIs. COBOL Check will complement the COBOL Programming Course and will leverage the support of the **COBOL Working Group.**

With its proven track record of success, Open Mainframe Project will continue to be the cornerstone of mainframe technology that offers training, accessibility, and resources to the next generation.

Financial Disclosures

Revenue

The Linux Foundation's revenue is derived from four main sources, Memberships and Donations, Project Support, Training and Certifications, and Event Registration and Sponsorship.
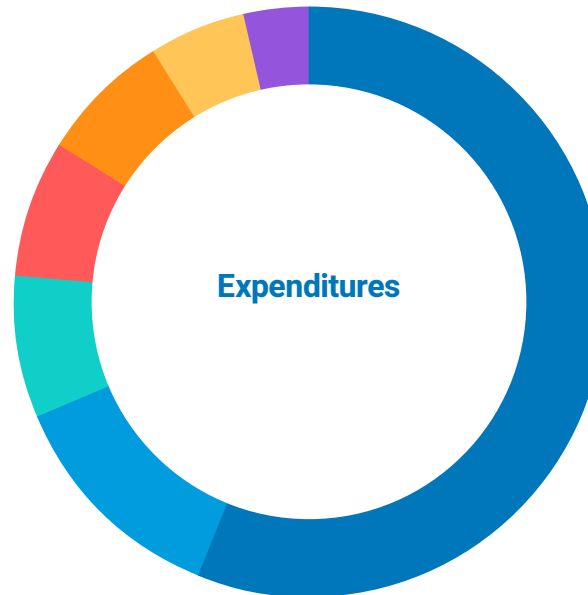
In 2021 we are forecasting revenues of $177M.

Revenue Sources
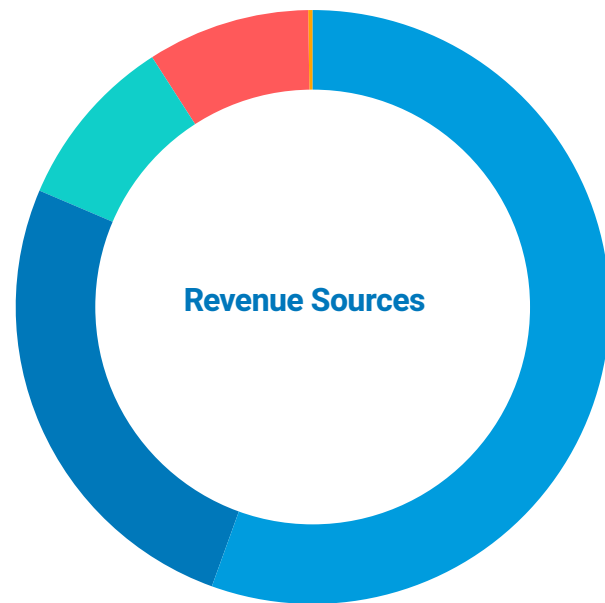
- Membership & Donations **55.5%**
- Project Support **25.9%**
- Training **9.5%**
- Event Sponsorships & Registrations **8.9%**
- Other **.2%**

Expenditures

In 2021 the Linux Foundation is forecasting to spend over $180M supporting our mission.

Expenditures

- Project Support **56.3%**
- Community Infrastructure **12.5%**
- Corporate Operations **7.8%**
- Community Training **7.4%**
- Community Tooling **7.2%**
- Community Events **5.4%**
- Linux Kernel Support **3.4%**

Linux Foundation Transparency

Our employees are located around the world, including the United States, Canada, Europe, Australia and Asia. Within the US, we have employees in 34 states. Of our 247 employees, 52% are women, substantially above the average 34.4% for major tech companies.

THE LINUX FOUNDATION

The Linux Foundation is the organization of choice for technologists, executives and other open source professionals who are building durable ecosystems to accelerate development as well as commercial adoption.

If you're new to open source, looking to step up your contributions or want to sharpen your technical skills, we want to hear from you. Similarly, if you have technology that would benefit from a neutral home and collaborative development, please contact us.

We invite you to be a part of our community and look forward to connecting with you.

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