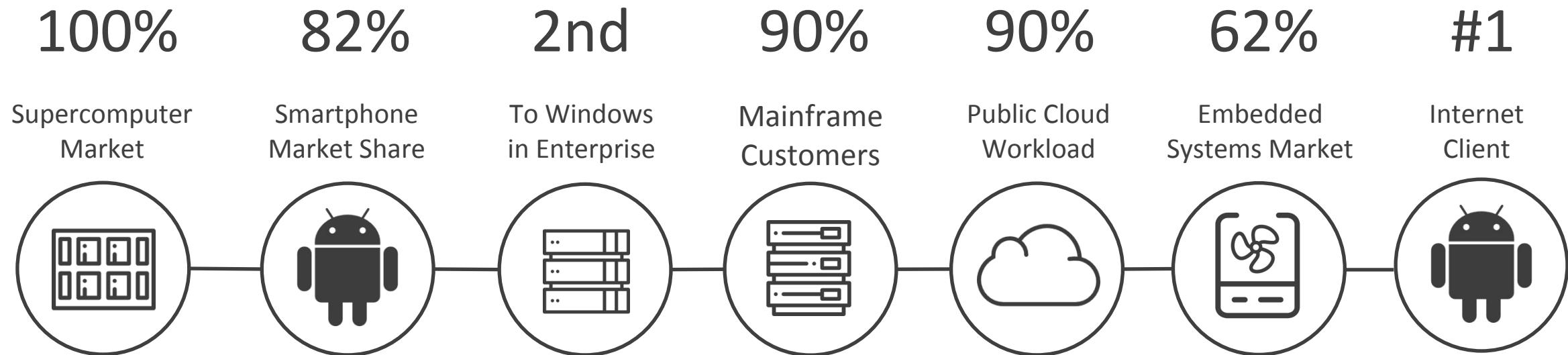


# WBG and LF Workshop

Ibrahim Haddad, Ph.D.  
VP, Strategic Programs  
Executive Director, LF AI  
[Ibrahim@LinuxFoundation.org](mailto:Ibrahim@LinuxFoundation.org)  
[@IbrahimAtLinux](https://twitter.com/IbrahimAtLinux)



# Linux has grown into the most important software platform in the world



Linux eventually dominates every market it enters

# The Linux kernel continues to grow

**4,300**

Contributors From 450

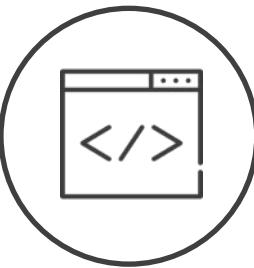
Organizations



**2,000**

Lines of Code

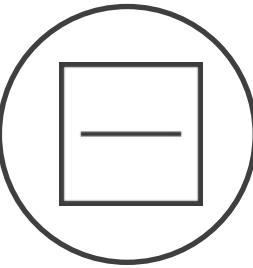
Modified Daily



**8.5**

Changes Per

Hour



**10,000**

Lines of Code

Added Daily

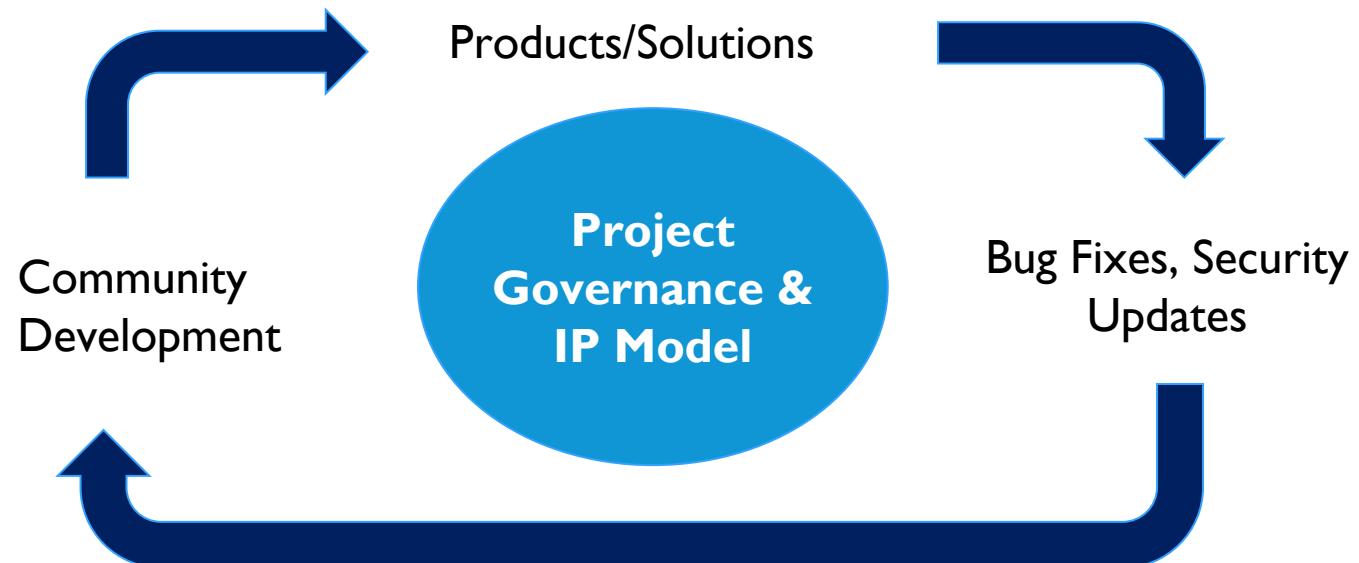
**2,500**

Lines of Code

Removed Daily

# Technologies like Linux don't succeed randomly; they are part of a continuous, sustainable ecosystem model

Sustainable projects have a developer community whose technology is used in commercial solutions that profit businesses, who in turn participate and reinvest back into the project and hire developers to work in the community.



Commercial dependency drives a virtuous cycle of commercial and community engagement based on accepted governance and IP models

# Today the Linux Foundation is much more than Linux



## Security

We are helping global privacy and security through a program to encrypt the entire internet.



## Networking

We are creating ecosystems around networking to improve agility in the evolving software-defined datacenter.



## Cloud

We are creating a portability layer for the cloud, driving de facto standards and developing the orchestration layer for all clouds.



## Web

We are providing the application development framework for next generation web, mobile, serverless, and IoT applications.



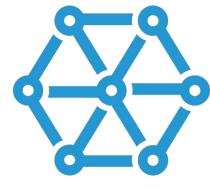
## Blockchain

We are creating a permanent, secure distributed ledger that makes it easier to create cost-efficient, decentralized business networks.



## Automotive

We are creating the platform for infotainment in the auto industry that can be expanded into instrument clusters and telematics systems.



## AI

We are creating a sustainable open source AI ecosystem that makes it easier to create AI products and services using open source technologies.



# The Linux Foundation and its Umbrella Foundations Continue to Grow

**1400+**

Members From  
41 Countries

**80%**

of Fortune 100  
Tech & Telecom

**35,000+**

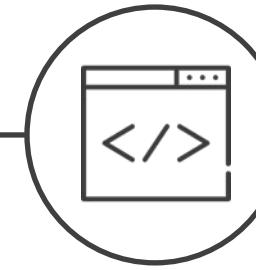
Developers Contributing Code

**160+**

Open Source  
Projects

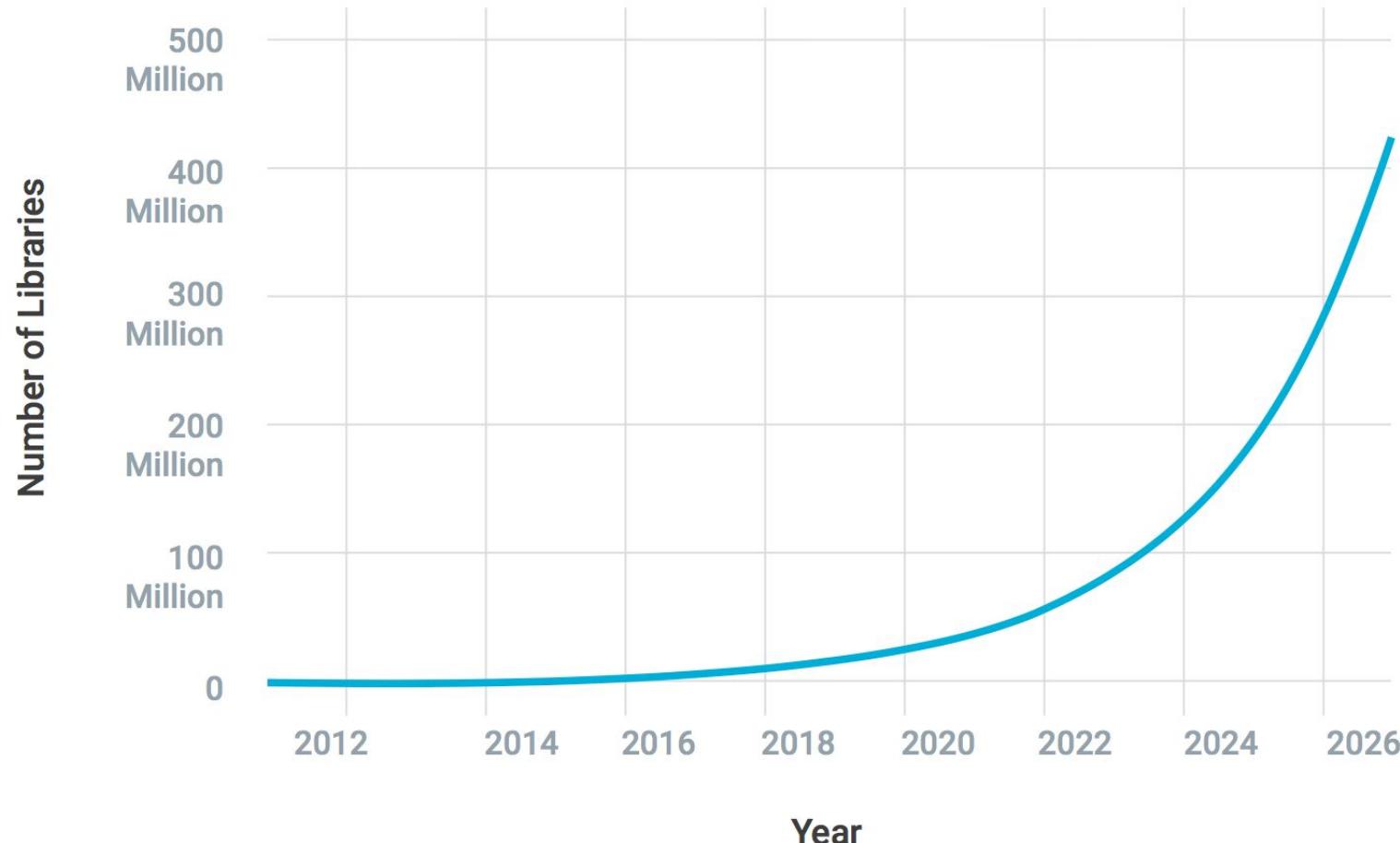
**\$16B**

Shared  
Value



We have seen unprecedented growth in our projects

# Open Source Isn't Slowing Down Any Time Soon



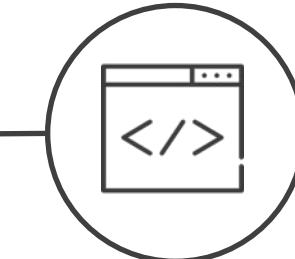
[:] SourceClear

# The Open Source Ecosystem is Still Accelerating

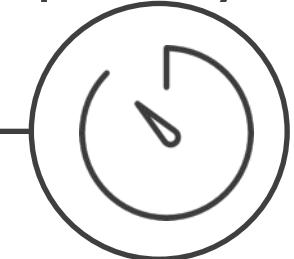
**31M+**  
Open Source  
Developers



**41B+**  
Lines of Code



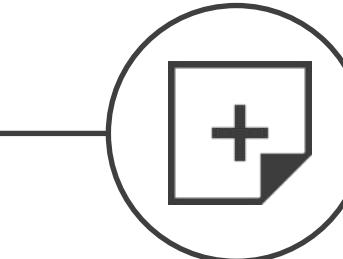
**10,000+**  
New Versions  
per Day



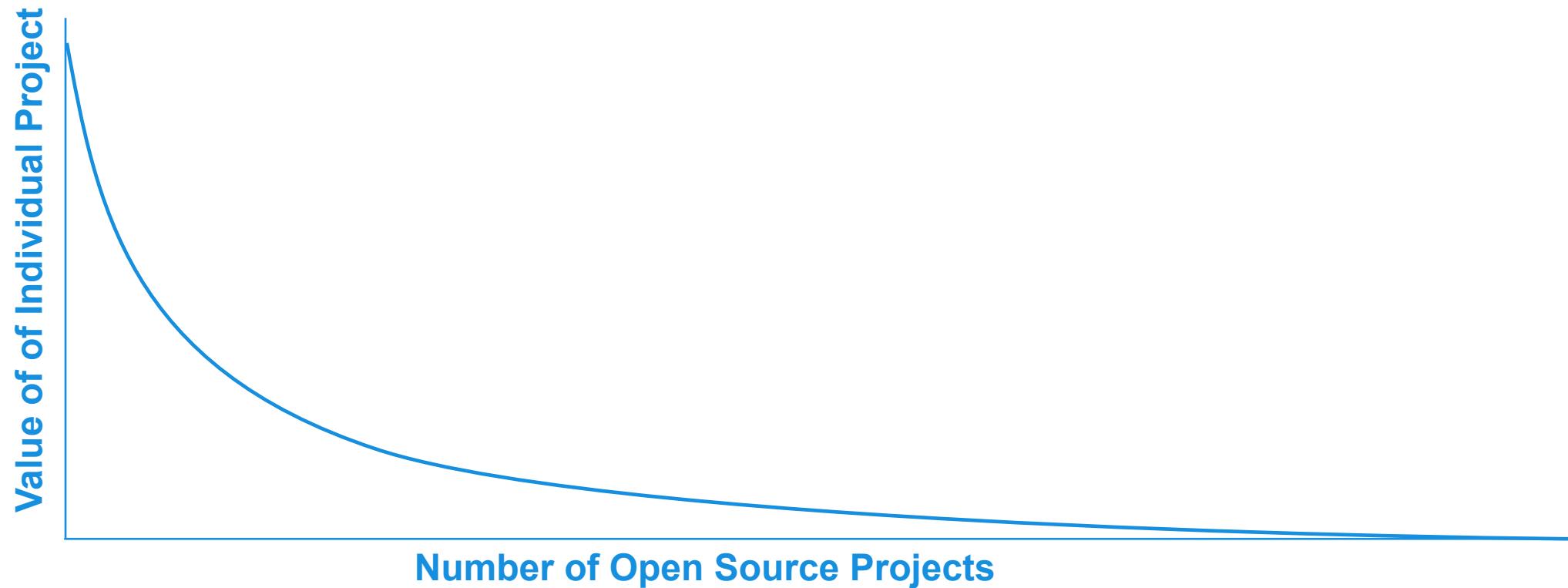
**96M+**  
Repositories on  
GitHub



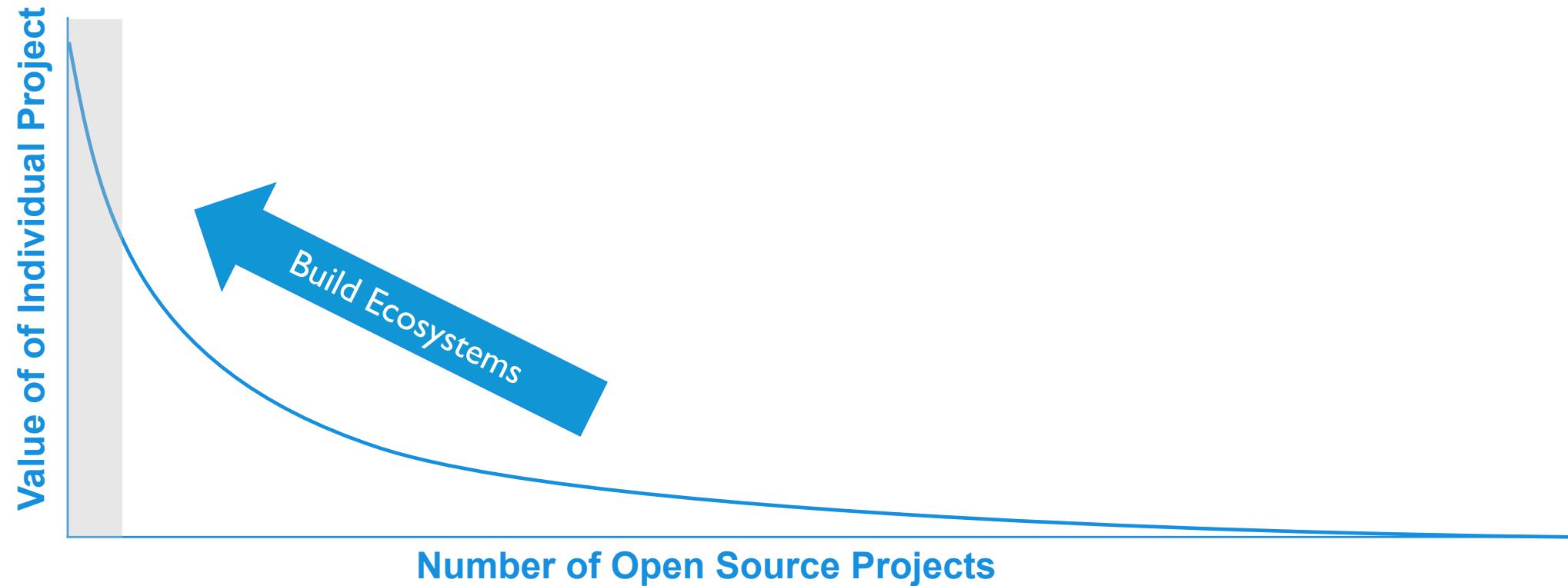
**1,100**  
New Projects a  
Day



# The Real Question is Which Projects Matter?

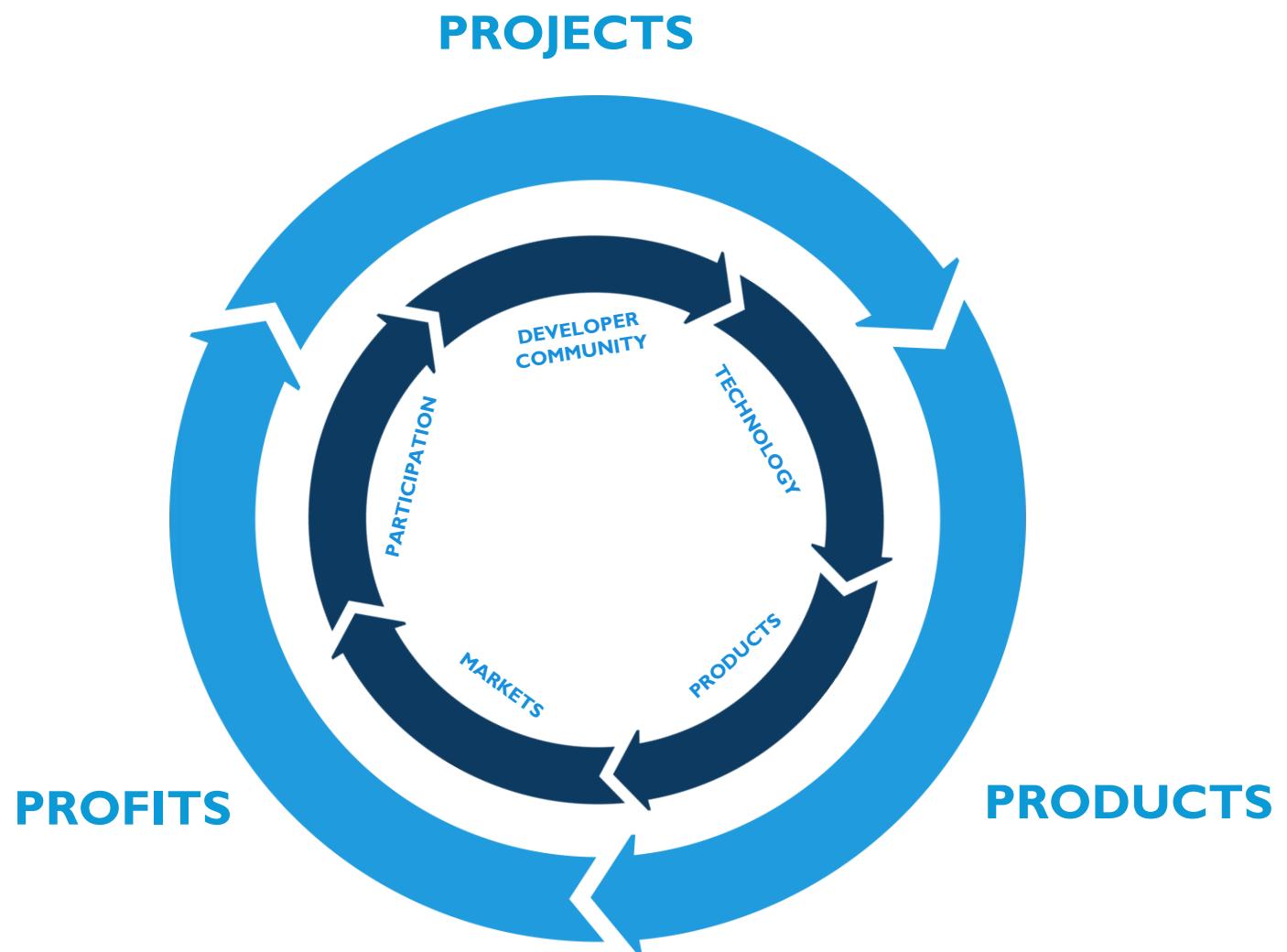


LF seeks to accelerate new projects to adoption and sustainability

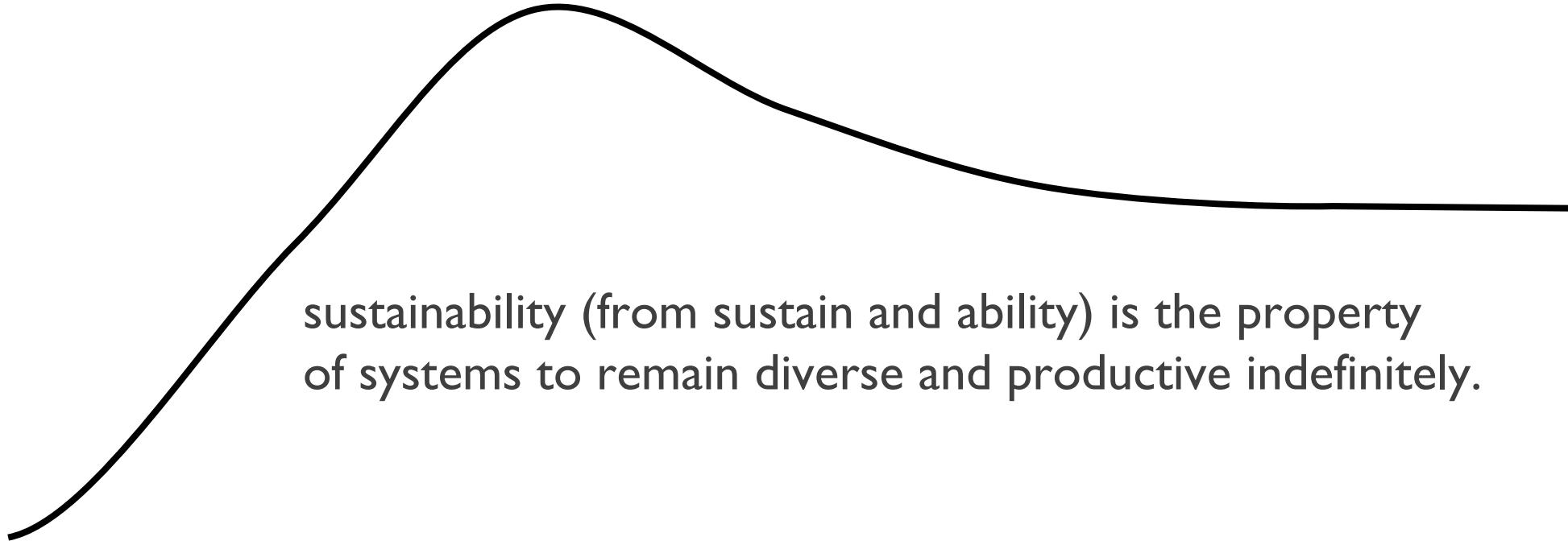


# The Answer: Projects With Sustainable Ecosystems

Sustainable projects have a developer community whose technology is used in commercial solutions that profit businesses, who in turn participate and reinvest back into the project and hire developers to work in the community.



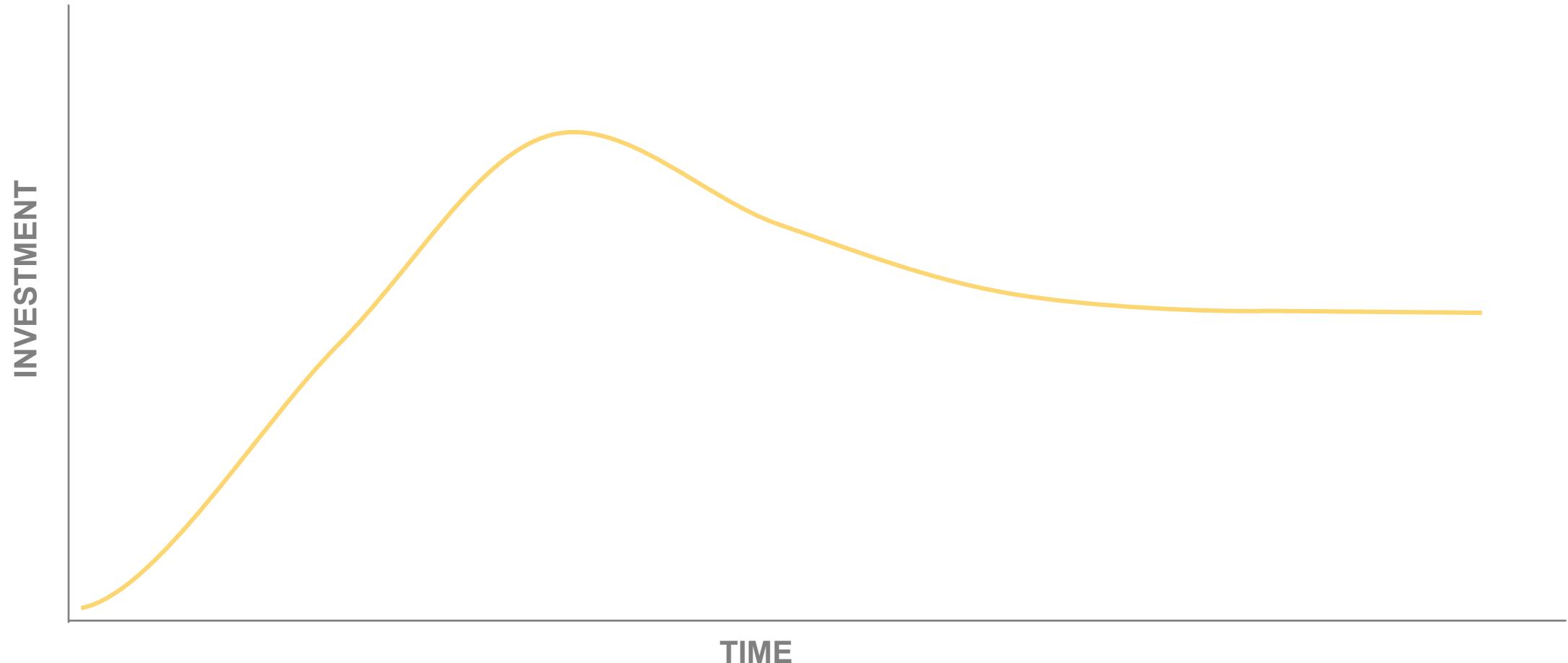
# Sustainability is about longevity



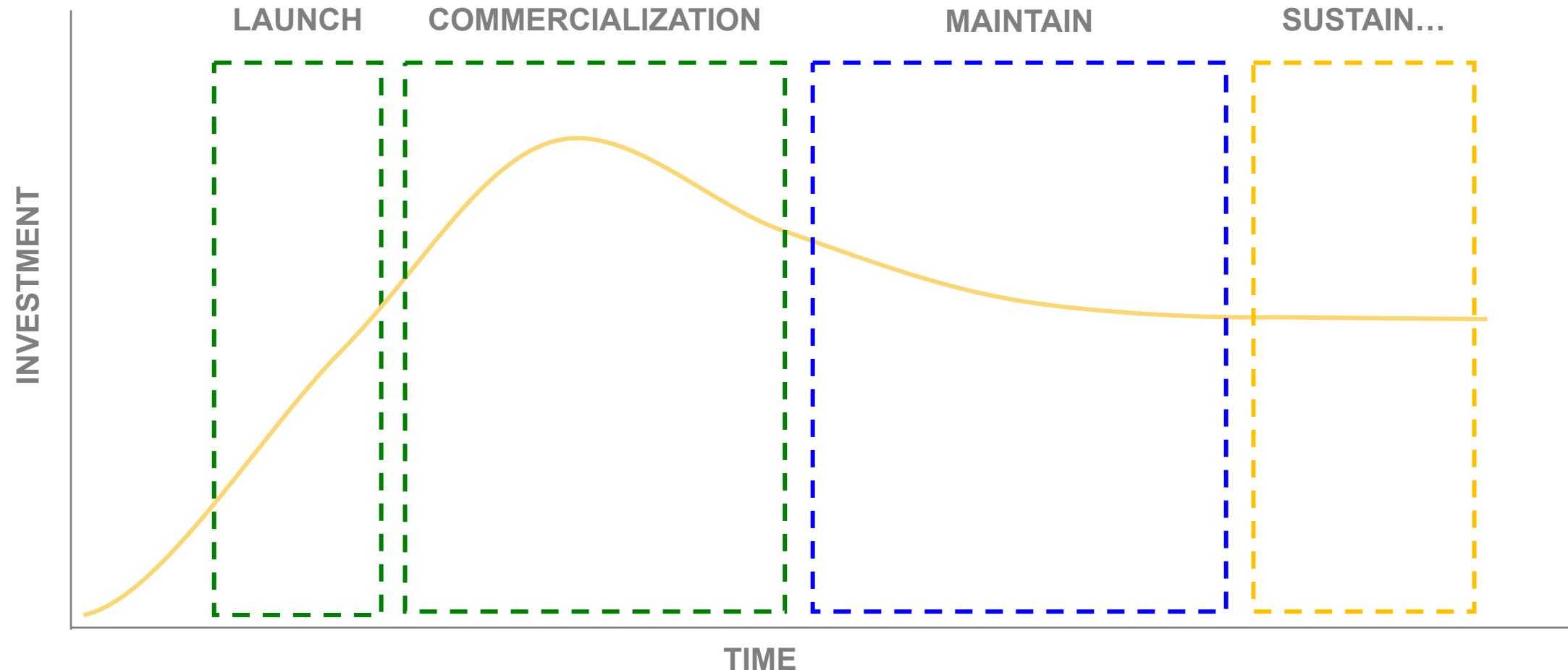
# Products have a lifecycle



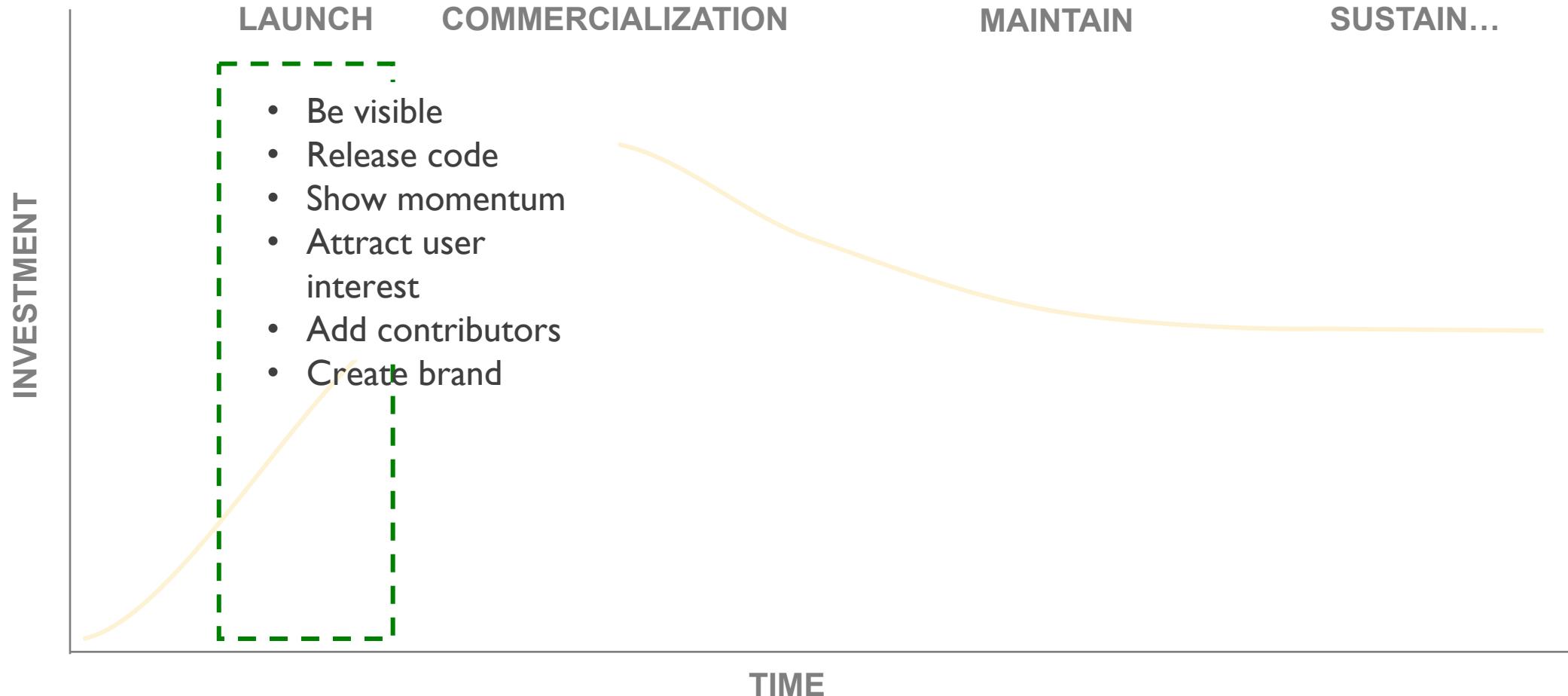
# Open Source Projects **ALSO** follow a life cycle



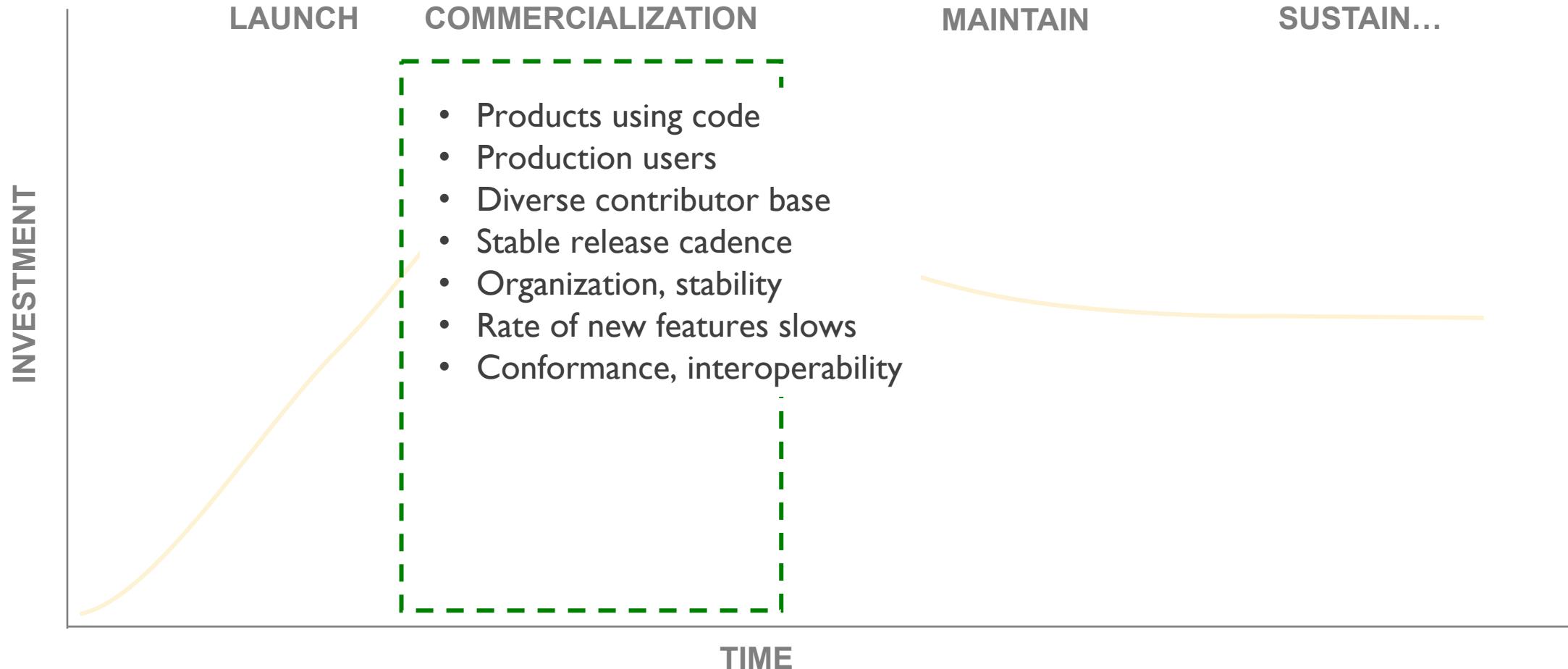
# Project lifecycles often map to commercial lifecycles



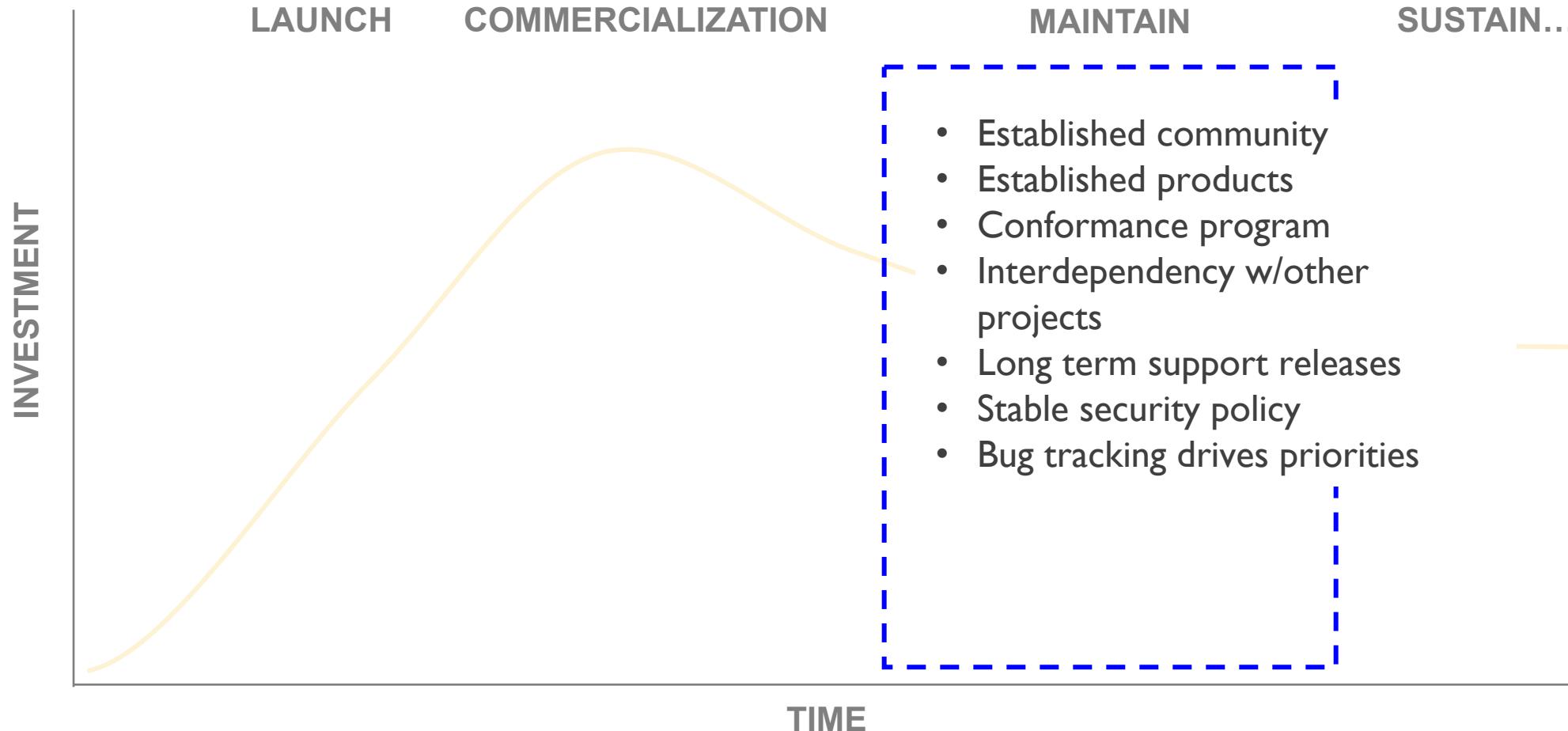
# Project needs change in each lifecycle stage



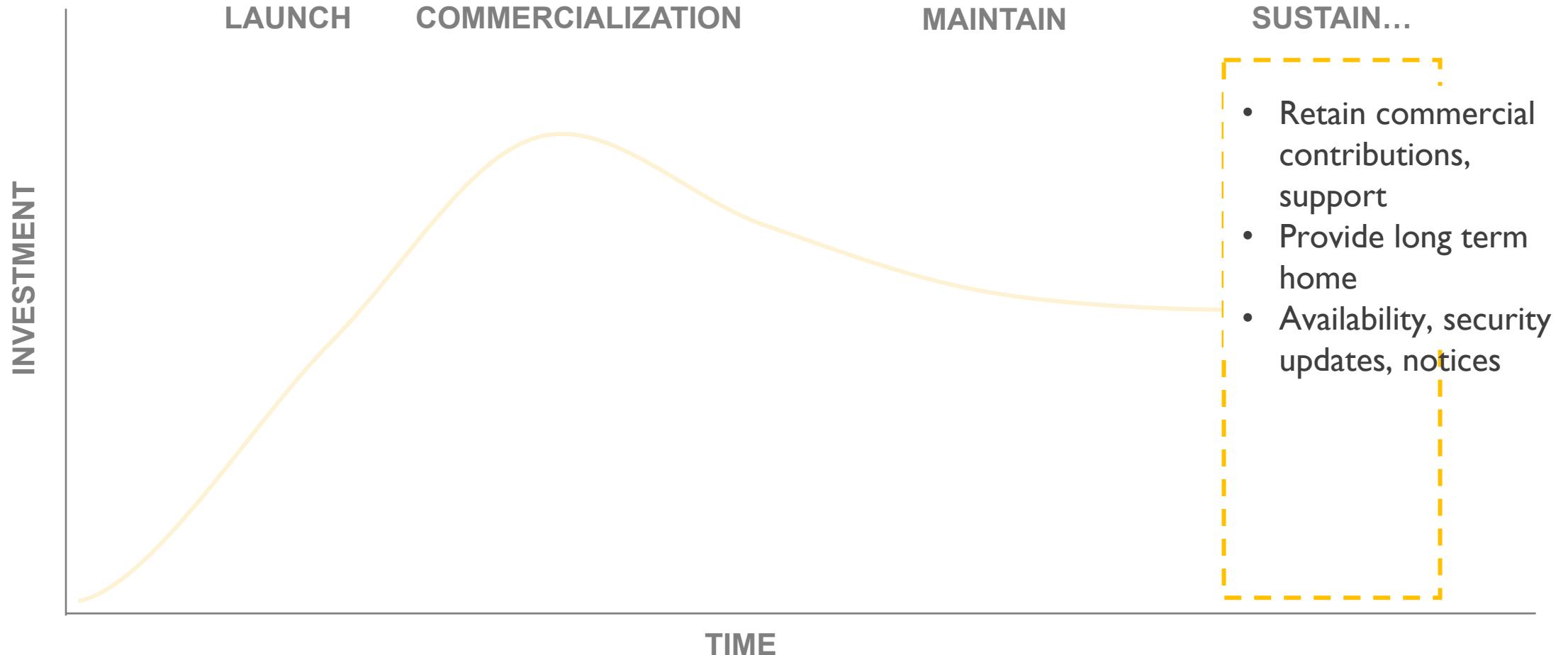
# Project needs change in each lifecycle stage



# Project needs change in each lifecycle stage



# Project needs change in each lifecycle stage



# Creating Open Source Ecosystems Requires Real Effort



# 3 Core Factors Enabling Highly Successful Open Source Communities

## › Open Governance Do-ocracy

- › The most successful projects that have stood the test of time have neutral, open governance models where those who do the work make the decisions

## › IP Clarity

- › Removal of IP uncertainty enables anyone to get involved as a contributor or implement as a user

## › Commercial Support Ecosystem

- › Encouraging commercial engagement in the project leads to jobs, faster adoption, new contributions and features that address new use cases



The Linux Foundation is creating the greatest shared technology investment in history by enabling open source collaboration across companies, developers, and users.

# The LF offers its communities services and capabilities unique to open collaboration

- › Project governance and formation
  - › Open source, governance and licensing experts to guide formation and business development
- › Developer Community Support
  - › Development process and governance, CI/CD systems, release engineering, test infrastructure, security audits, code of conduct support
- › Leadership Capabilities
  - › Staffing industry, community or technical expertise to work on the project
- › Program Management
  - › Facilitating collaborative development
- › Events
  - › From enabling local meetups to large scale industry events - and everything in between
- › Marketing and Advocacy
  - › Tell the world about the project through PR/AR, social, curated content, websites
- › Legal Coordination
  - › License scanning and provenance best practices, trademark management, export compliance
- › Ecosystem Development
  - › Individual professional training and certification, compliance programs for solutions

Our communities have grown in number and size of face to face engagements

**35,000+ Attendees**

FROM

**11,000+ Organizations**

ACROSS

**113 Countries**

AT

**103 Events Worldwide**

PLUS

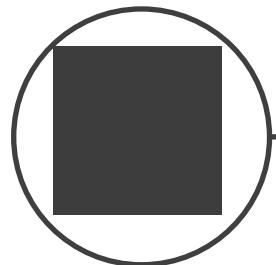
**160,000+ Views**

OF ONLINE CONFERENCE SESSION RECORDINGS

**Over 40,000 Attendees will join our 120+ Events in 2019**

We've seen the ecosystem of professionals trained on our open source projects increasing commensurately as companies seek out specific skills and expertise

**1.3M**  
Educated Through  
Free Courses



**250**  
Annual Scholarships  
for Students



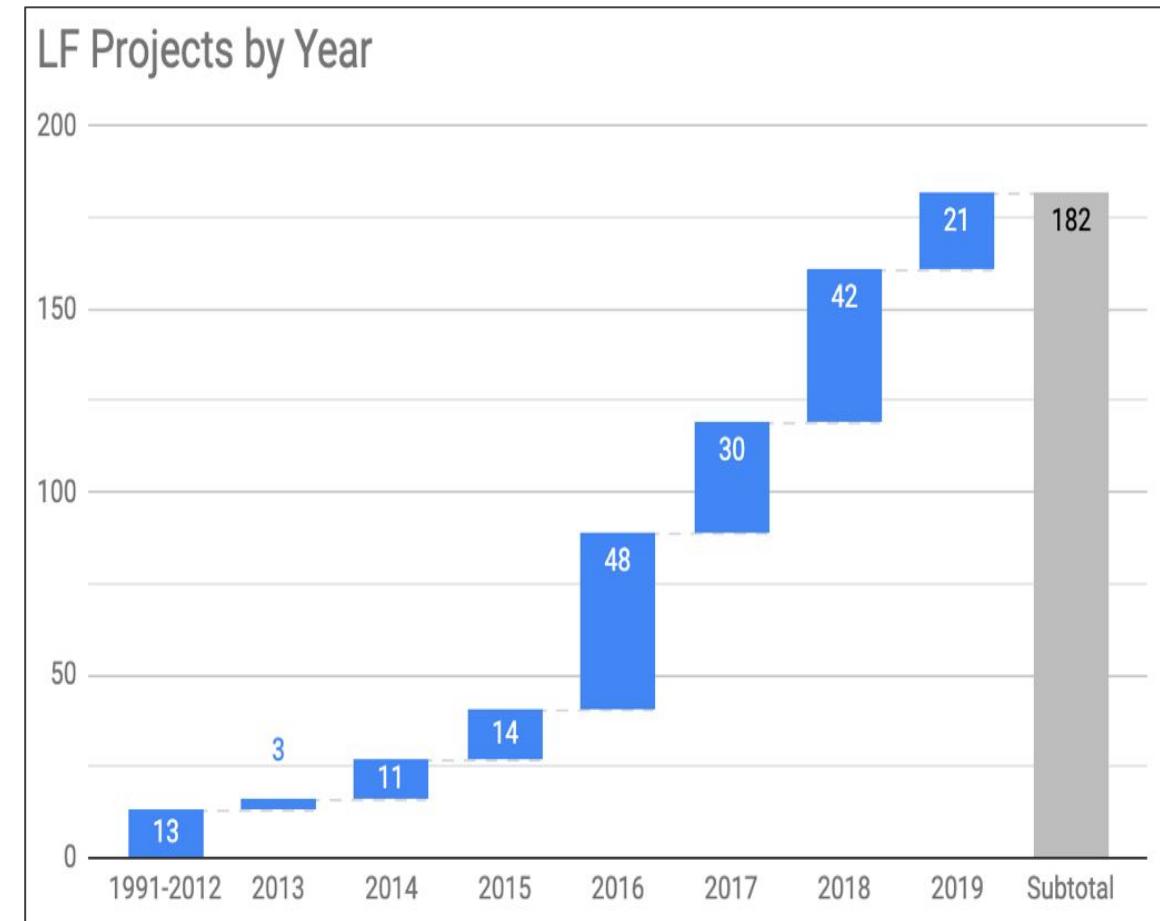
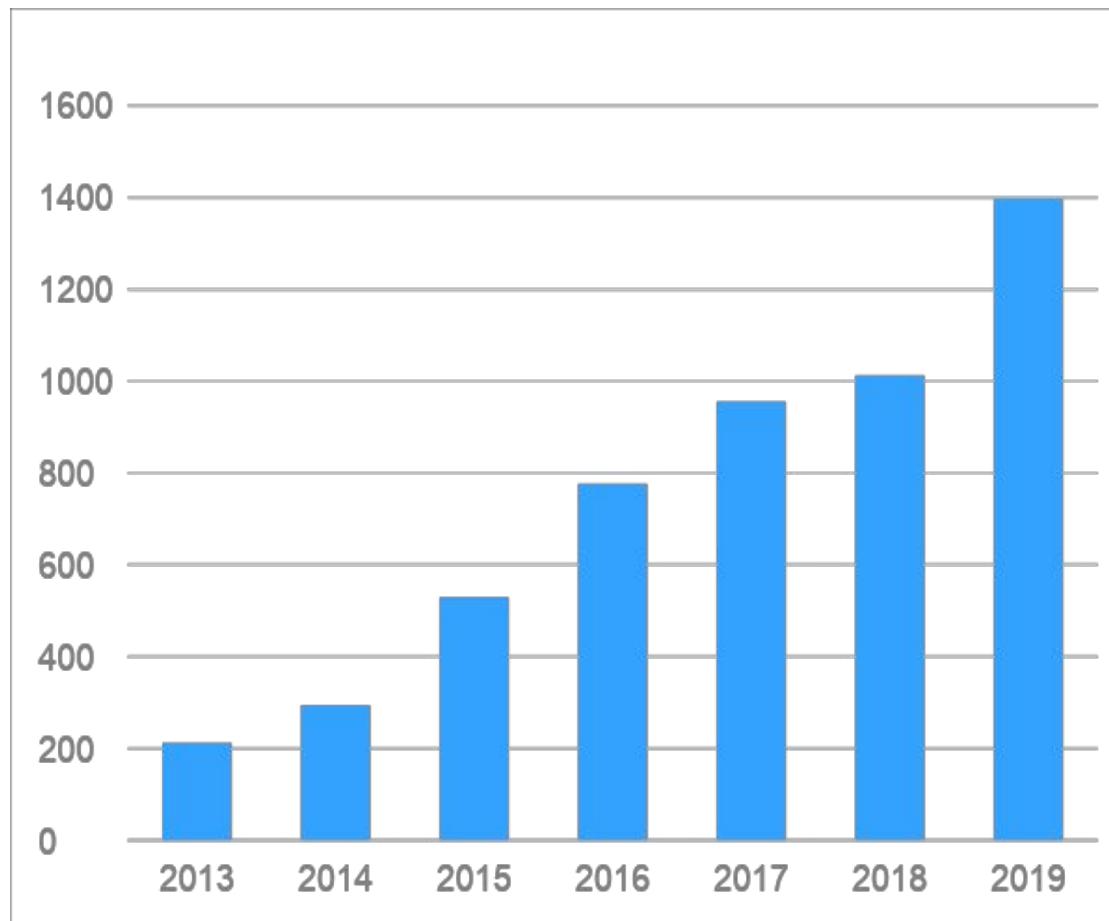
**Dozens**  
Diversity Interns  
in 2017



**10,000+**  
Individuals Certified via  
performance based exams



The value proposition appears to be working. The number of unique members and total projects have grown significantly.



2019 figures are YTD as of March 31, 2019

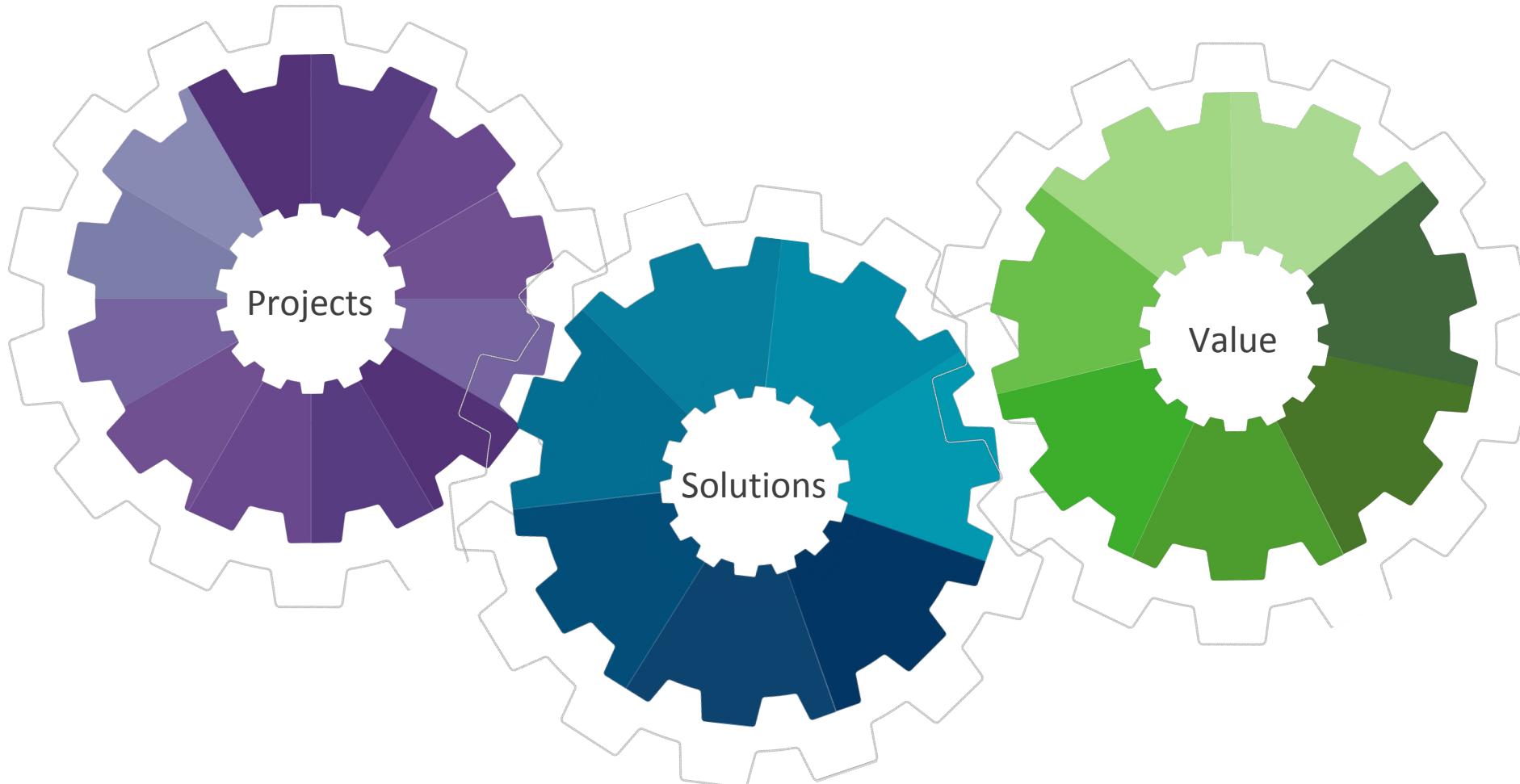
# As projects scaled, the LF entity structure evolved

- › The Linux Foundation (c6)
- › JDF, Inc. (c6) technical projects entity
  - › Customized Projects: LF Projects, LLC
    - › Series Entities
  - › Templatized Projects: Joint Development Projects, LLC
    - › Series Entities
- › Project Entities (LF is service provider to)
  - › The Linux Kernel Organization (c3)
  - › ISRG (Let's Encrypt) (c3)
  - › LF Summits (c4)
  - › JS Foundation (c6)
  - › OpenJS Foundation (c6)
  - › Cloud Foundry Foundation (c6)
  - › DroneCode Project (c6)
  - › ODPI (c6)
- › International Operations
  - › LF Asia, LLC for China operations (for profit)
  - › LF Japan for Japan operations
  - › Linux Labs Limited in the UK for European operations
  - › Peer entities in the US to support each

# What is LF's role in projects?

Governance and Membership	<ul style="list-style-type: none"><li>• Incorporation, Tax status, Bylaws, Member Agreements, Anti-trust, etc.</li><li>• Ongoing business development and membership recruitment</li></ul>
Development Process	<ul style="list-style-type: none"><li>• Technical Decision Making</li><li>• Project Life Cycle</li><li>• Release Process</li></ul>
Infrastructure	<ul style="list-style-type: none"><li>• Custom infrastructure using open source best practices</li><li>• Security and reliability</li></ul>
Ecosystem Development	<ul style="list-style-type: none"><li>• Marketing</li><li>• Events</li><li>• Training</li></ul>
IP Management	<ul style="list-style-type: none"><li>• Code Provenance</li><li>• Trademark management</li><li>• Legal defense and Collaboration</li></ul>

We are the only organization of our kind: with turnkey project, training, event, marketing, research, and IT support



# The LF Brings Partners Together to Create Ecosystems

Identify Value Equation

## Support and Resources

Projects often benefit from neutral leadership, marketing, engineering and legal resources available to the community

## Community Metrics

If you can measure the health of your project community, you can identify ways to improve it

## Channels

Reaching your project's target technical and commercial audience requires knowing which channels to reach them

## Marketing Programs

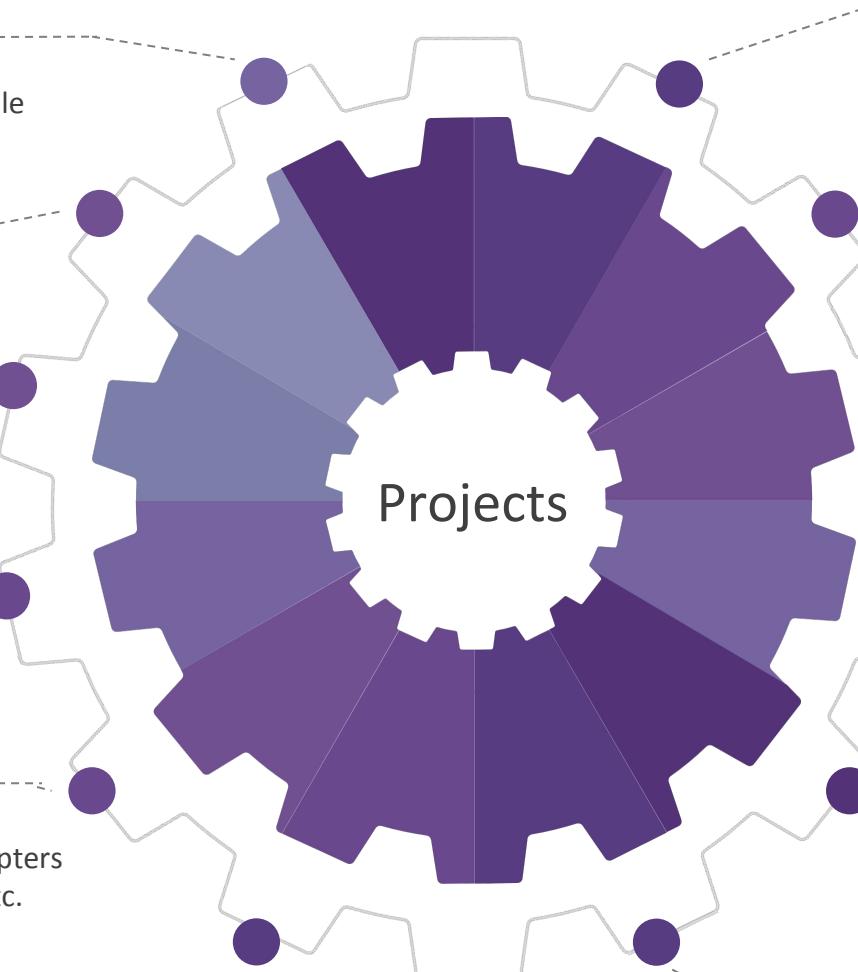
Drive awareness and visibility for your project through PR/AR, community advocacy, rewards and recognition, startup/incubator engagement

## Content

Engage users and contributors with code samples, getting started guides, FAQs. Attract potential adopters with case studies, whitepapers, blogs, webinars, etc.

## Programs

Projects with goals to achieve interoperability for commercial solutions often require programs to test conformance with expected behavior.



Projects

Projects generate ecosystems of talent through developer and administrator online and onsite training, including professional certification and skills based testing

Projects that define what problem they are solving enables clear positioning in the technology landscape, helps align existing efforts and enables others to join Neutral Home

Neutral, open collaboration needs a home for project assets, governance separating business and technical decisions and curates a sense of community identity

## Legal Framework

The contribution, IP and governance frameworks need to align with the community's goals and concerns and implementation needs to conform

## Fundraising Model

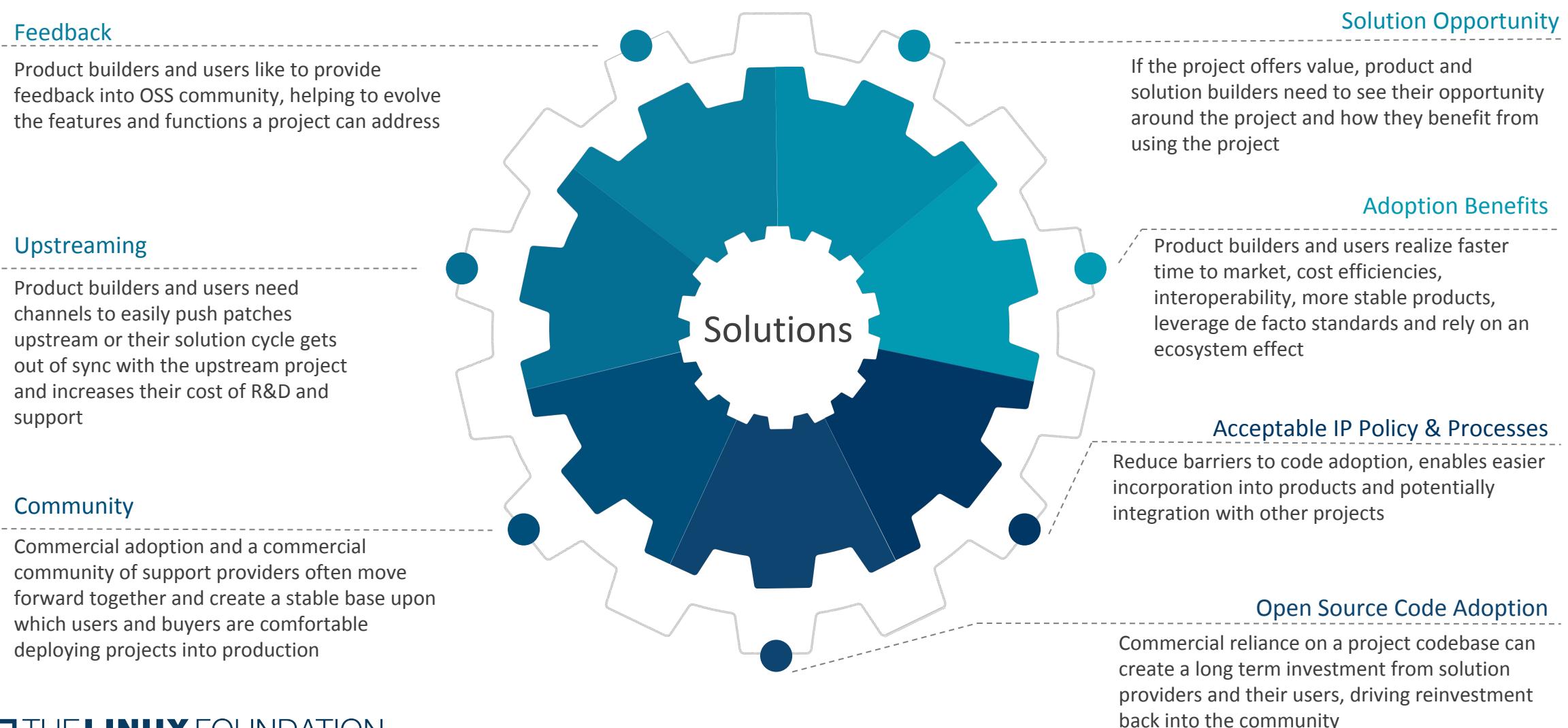
Communities that want open, shared resources often use leveraged fundraising to provide contributors neutral infrastructure and resources

## Developer Engagement

Projects leverage both online (e.g. IRC, mailing lists) and face-to-face (events, meetups) options to engage and collaborate. Knowing where the developers are and how to engage can help broaden your community of contributors and users

## Training and Certification

# We enable a rich downstream by teaching industry, government, and academia how to consume and contribute



# We show industry how to create value in order to achieve continual upstream reinvestment

## Reinvestment

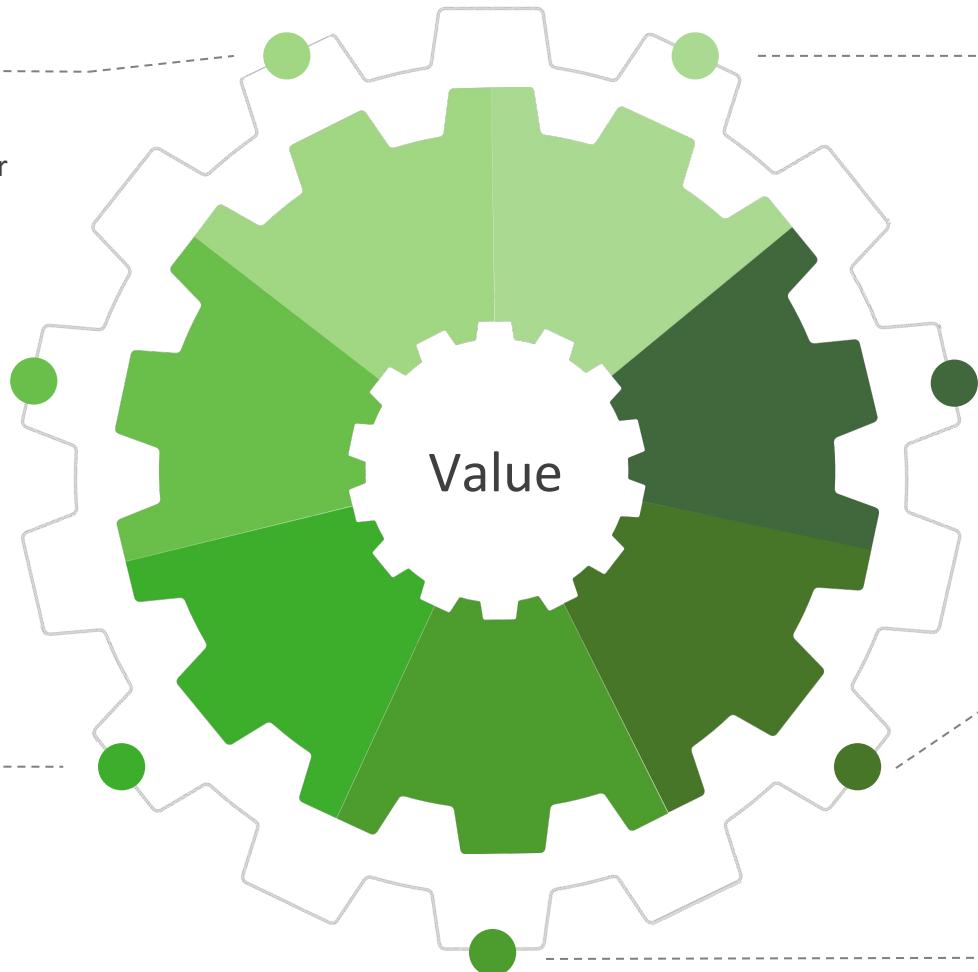
Profitable vendors and users are more likely to reinvest patches, features and resources back into the project community, increasing hiring for developers with expertise in the project

## Ecosystem

Profitable communities enable new innovation and markets in ecosystems well beyond the codebase

## Open Standards & Specifications

Open source projects can add value by delivering de facto open standards and specifications that industries leverage for interoperable solutions



## Commercial Opportunity

There are segments for innovation and value capture around the project, enabled by adopting the project or in entirely new markets created by the project

## Profit Capture

Adopters of projects and users realize value (efficiency, speed of innovation, reliability, interoperability) which increases their opportunity to deliver profit

## Users

Users buy support, solutions, adjacent solutions and products enabled by the project

## Startup Innovation

Open source projects have a low barrier to creation and often lead to frictionless access to technology new, leading edge companies create

# Key Linux Foundation Outcomes: Industry Wide Collaboration

# Avoid duplicate effort and increasing innovation: Academy Software Foundation



## Major Problem

- Film industry profitability is driven by CGI, animation, VR/AR, etc.
- Software tools and infrastructure are complex and duplicated by each studio on each film or production



## How LF Innovated

- Spent two years with the Academy of Motion Pictures Arts and Science to create an open source co-development initiative led by major studios
- Educated business decision makers, legal staff, and engineers on how to participate in open source community



## Results - 2018

- First time in history the Academy has lent its brand to any organization
- Launched project with Walt Disney, DNEG, DreamWorks, Epic Games, Foundry, Google, Intel, Cisco, SideFX, Studios and Weta
- Development underway to consolidate production pipeline software

# Telecom, End User driven Innovation & Billions in Savings



## Major Problem

- How to create a standard management and orchestration platform for global operators
- How to automate network management preparing for 5G
- How to create NFV and SDN reference architecture

## How LF Innovated

- 2016 the Linux Foundation brokered a merger of AT&T's eComp platform and China Mobile's Open-O efforts to create the Open Network Automation Platform

## Results - 2018

- AT&T will save \$1.6B through dis-aggregation
- Within one year ONAP was joined by telecommunications providers representing 70% of the world's telecom subscribers – roughly 3.5 billion people.
- \$576M of shared development by a community of over 2,500 developers.
- Operators using this code in production have reduced service deployment from 6 months to 15 minutes.

# Automotive, Externalize Commodity R&D and Build Software Ecosystems



## Major Problem

- How can auto makers compete in software?
- Infotainment #1 buying criteria
- No software experience

## How LF Innovated

- 2012 AGL Created
- 5 of Top 10 Automakers aligned
- Supply chain brought in

## Results - 2018

- AGL in millions of production vehicles
- 130+ Members
- In production in Mercedes, Toyota, slated for more OEM roll outs
- 9 Major OEMs and their entire supply chains participating
- AGL members now account for 50% of the worldwide vehicle shipments.

# Leveling the cloud computing playing field



## Major Problem

- How to create a portability layer for cloud
- How to accelerate “cloud native” computing: devops, containers, microservices

## How LF Innovated

- 2015 Google create Cloud Native Computing Foundation with LF
- Project seeded with Kubernetes
- Cloud Native Computing Foundation founded with 28 members

## Results - 2018

- 258 Members
- Kubernetes defacto standard for container management
- CNCF home to 14 additional projects beyond Kubernetes
- 53 Kubernetes certified providers including 10/10 top public clouds

# Improving the security of the global internet



## Major Problem

- Application security is becoming increasingly important for our collective cyber risk
- Open source is a fundamental part of software supply chain
- Application security in critical open source projects is not well understood

## How LF Innovated

- 2018 partnering with Harvard University and set of research partners to define:
  - World's most important shared software.
  - Who wrote it
  - Why they wrote it
  - Whether it secure
- The idea is to focus on leveraged security investments based on research

## Results - 2018

- Kicked off September 2018
- Major software composition analysis firms contributing anonymous usage data to identify key packages
- Tools to analyze application security and development practices in those projects under way

# The LF AI Foundation

Web site: <https://lfdl.io>

Landscape: <http://l.lfdl.io>

GitHub: <https://github.com/LFDLFoundation>

Wiki: <https://wiki.deeplearningfoundation.org>



We are creating a sustainable open source AI ecosystem that makes it easier to create AI products and services using open source technologies.

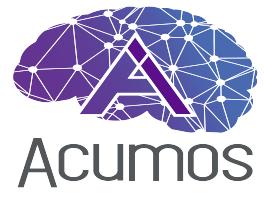
# What is the LF AI Foundation?

- LF AI is a Linux Foundation project founded in March 2018 to support collaboration and open source innovation in the AI, ML, and DL domains.
- LF AI members are collaborating to create a neutral environment with an open governance for harmonization and acceleration of separate technical projects focused on AI, ML, and DL technologies.

# Mission

Build and support an open AI community, and drive open source innovation in the AI, ML and DL domains by enabling collaboration and the creation of new opportunities for all the members of the community

# Current Projects



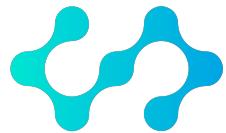
Machine learning platform and marketplace for ML models.

Contributed by AT&T



A high-performance distributed ML platform based on Parameter Server, running on YARN and Apache Spark.

Contributed by Tencent



A framework designed to help DL cloud service providers to build cluster cloud services using different DL frameworks.

Contributed by Baidu



Distributed training framework for TensorFlow, Keras, and PyTorch.

Contributed by Uber



Pyro is a universal probabilistic programming language written in Python and supported by PyTorch on the backend.

Contributed by Uber

# Universities Contributing to LF AI Projects

- Georgia Tech
- University of British Columbia
- Stanford University
- MIT
- Harvard University
- Oxford University
- Penn University
- NYU
- Florida State University
- University of Copenhagen

# Governance

- › LF AI is a single funding effort to support technical projects hosted under the Foundation.
- › Technical projects have their own technical governance following our principle of separation of technical governance from funding governance.
- › The Foundation's Charter is available from <https://lfdl.io>.

# Structure

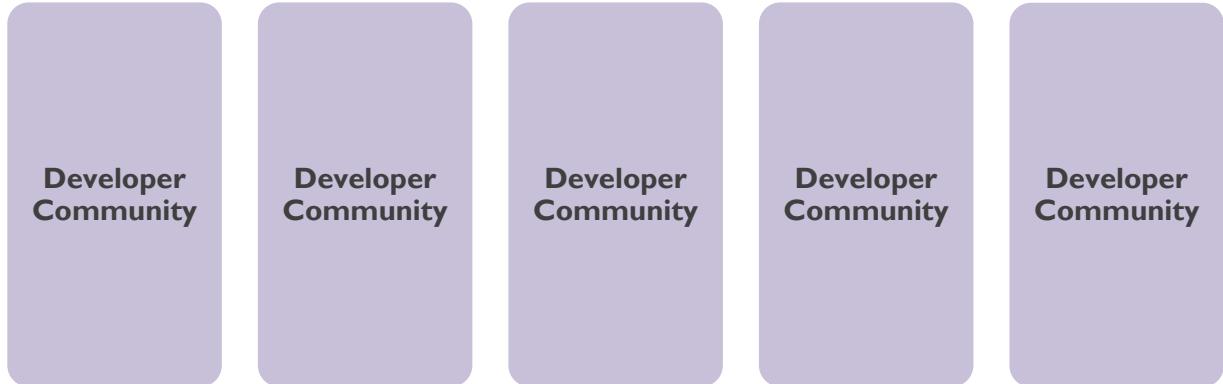
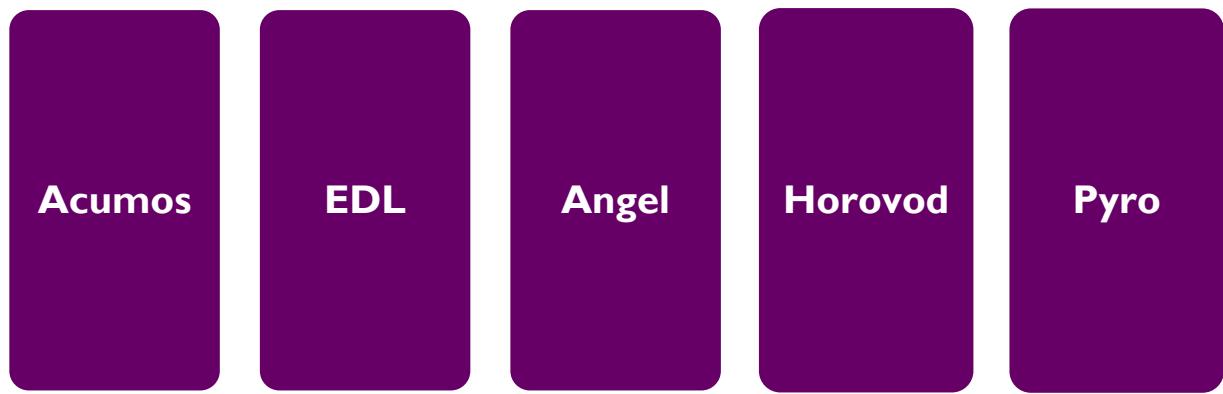
## Funding Governance



## Project Coordination



## Technical Projects



# What a project stands to gain from joining LF AI?

## Larger Community = Larger Pipeline of Potential Customers

Projects that join the LF experience a massive uptick in external contributions to the code. Joining the LFDL could mean that a project could significantly increase its contributor base. That directly translates to increased adoption and more value added to the product without hiring additional engineers.

## Validation From Trusted Source

Being brought into the LF LD umbrella would communicate to the market/community that the project is a long-term pro. Additionally, you would eliminate any concerns about bias/nepotism that inevitably crop up later in a project's lifecycle.

## Scalable Governance

One of the key benefits of joining the LF AI is that the project would have a Technical Steering Committee. The TSC helps provides technical leadership and facilitates bidirectional interaction with application developers, end users, and other open source projects.

## Protection of IP

Joining the LF would significantly extend our capabilities to defend our project should license or trademark abuse ever become an issue.

## Marketing and Awareness

Joining the LF would mean a massive increase in awareness for the project. With events, blog posts, webinars, etc. the project would be able to reach far more people sooner and from a trusted source.

## Getting in at the Ground Floor

In just over 3 years, the CNCF grew to over 40,000 contributors and what started out with just a few projects, now hosts some of the highest velocity projects in the history of open source. The last CNCF/Kubecon event had over 8000 people attend (they started with just 1500 attendees in 2018). The LFDL is on track to replicate that same level of growth but for machine learning and AI.

# Direct Benefits of Hosting Projects at the LF AI

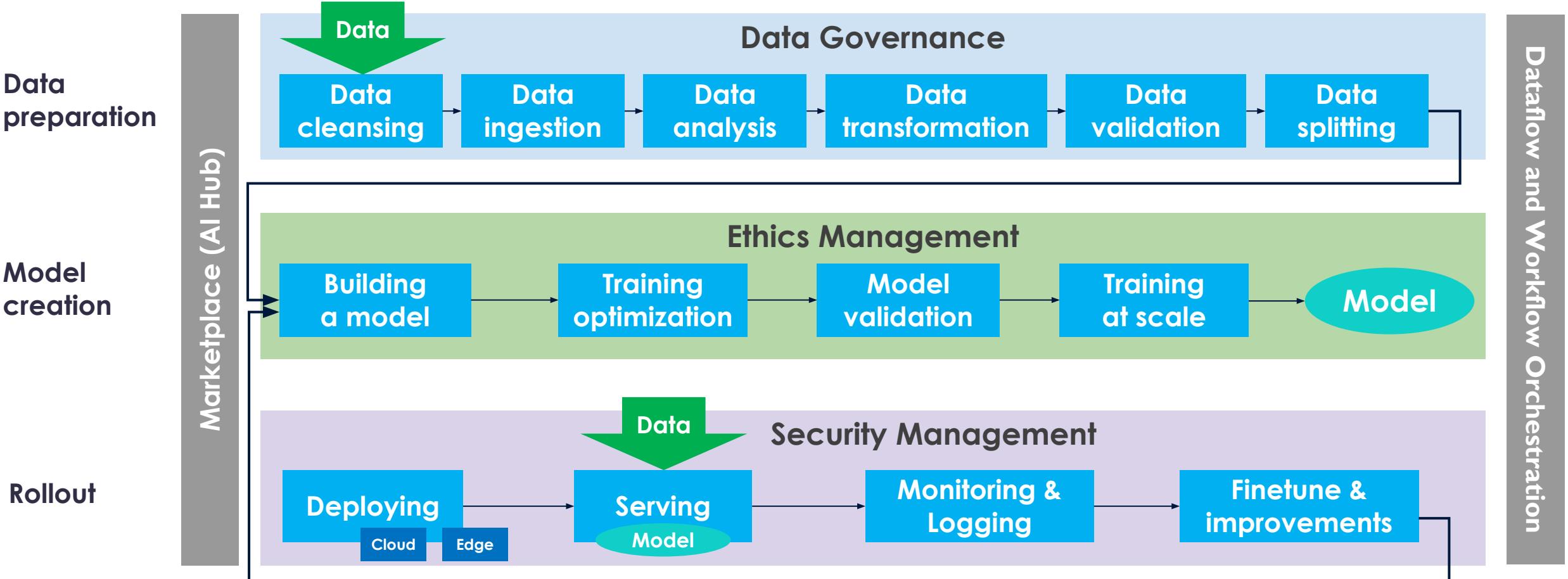
1. Maintain your committers and define your own project governance (as long as its neutral)
2. A not-for-profit, neutral home increases contributions from external organizations
3. LF AI staff eager to assist (Executive Director, Project Manager, IT staff, PR, marketing, events, etc.)
4. LF AI blog announcement or similar announcing the inclusion of the project
5. Infrastructure resources (wiki, build, jira, mailing lists, support staff, etc.)
6. Neutral hosting of the project's trademark
7. An initial license scan of the project's codebase
8. Cross pollination opportunities with other LF AI projects
9. Endorsement by LF AI Technical Advisory Committee (TAC) - Appointment of an existing TAC member as a sponsor of the project and provide recommendations regarding governance best practices
10. Right to refer to the project as a “LF AI Foundation Project,” with the right, subject to applicable trademark usage guidelines, to display the Deep Learning logo on the project’s code repository
11. Graduation stage may receive support as determined by the Governing Board

# Our Value Proposition to Projects

01	Governance Structure	02	Membership Management	03	IP Management	04	Hosting Infrastructure
05	Ecosystem Development	06	Critical Mass at Launch	07	Marketing Platform	08	Awareness and Reach
09	Project Guidance	10	Events Support	11	Trademark Support	12	Independent Neutral Home
13	Funding Model	14	Compliance Scans	15	CLA Management	16	Creative Services
17	Dedicated Staff	18	Validation from a trusted source	19	Collaboration opp with other projects		

# LF AI - ML Workflow

Reference workflow and implementation



# LF AI - Ethics

- › **Focus** - Policies, guidelines and tooling
- › **Documentation** - Content that describes the basic concepts and definitions in relation to AI Ethics in an effort to standardize the vocabulary and terminology
- › **Certification** - A certification or badging program for open source projects that meet the AI Ethics policies and guidelines as defined by LF AI

# Community Data License Agreement

[cdla.io]

**Goal** - Establish the framework for collaborative sharing of data

**CDLA-Sharing** - Designed to embody the principles of copyleft in a data license. In general, if someone shares their data, the CDLA-Sharing agreement puts terms in place to ensure that downstream recipients can use and modify that data, and are also required to share their changes to the data.

**CDLA-Permissive** - Similar to permissive open source licenses in that the publisher of data allows anyone to use, modify and do what they want with the data with no obligations to share any of their changes or modifications



## Data Values & Principles

These values and principles, taken together, describe the most effective, ethical, and modern approach to data teamwork.



## Data Practices Courseware

Consume and collaborate on free and open courses designed to help everyone from the novice to the expert data practitioner.

# Bringing an Open Source Project to the Linux Foundation

# Linux Foundation Projects

- › The LF currently hosts well over 180 open source projects!
  - › <https://www.linuxfoundation.org/projects/>
- › Projects considering the foundation generally seek:
  - › A neutral host foundation for intellectual property (IP)
  - › Governance and community help
  - › Resources (e.g. events, marketing support, community CI/build infrastructure)
  - › Build momentum within the LF community of 1300+ members
  - › Ability to raise and manage funds (optional)
- › Projects often start with individual devs seeking to elevate their project or orgs interested in working together under a neutral home

# Linux Foundation Project Hosting Requirements\*

The project must:

- use an approved OSI open source license;
- be supported by a LF member;
- allow neutral ownership of project assets such as a trademark, domain or GitHub account (the community can define rules and manage them);
- technical do-ocracy and separation of business governance from technical governance (we're flexible on the model) clearly documented in a charter;
- allow anyone to participate in the technical community, whether or not a financial member or supporter of the project

# LF Projects: All Shapes and Sizes

- › There is no “required” or “right” size or shape for a project at the LF
- › Some raise funding and have members, others do not
- › Some have dedicated staff to work on efforts, while others benefit from the community contributing to efforts
- › Some have thousands of developers, others start off with a dozen or so
- › Many are focused on code, while others are building specifications, standards or best practices

# Project Trademarks

- › Our project communities control the name of the project, not any one member or company contributor
- › In order to provide for neutral ownership of project assets, we require that The Linux Foundation entities own the trademarks leveraged by the project.
- › In the event that a trademark is already in use by the sponsoring organization, we recommend that the project create a new name to operate under or the owner assign the interest in the mark to The Linux Foundation.
- › See <http://fossmarks.org> for an education on trademarks in open source

# Project Preparation Checklist

- Prepare draft mission and scope statement
- Identify internal teams within mission and scope
- Identify developers internally
- Analyze code for identification of licenses, license quality and project dependencies
- Assess potential universe of project members
- Identify ecosystem constituents and concerns of each
- Identify any trademarks leveraged by the project (these will be owned by the LF neutrally)
- Outline infrastructure, marketing any other requirements needed for the project
- Name project leads for governance/leadership, marketing, technical and legal teams

# Umbrella Projects

- › An “umbrella” project is a directed fund established to support multiple technical projects (e.g., CNCF, Hyperledger and LFN)
- › This allows a single Governing Board to allocate resources across a variety of projects depending upon (a) the needs and requirements of each individual technical project and (b) evolution and maturation of projects within the umbrella.
- › We include the following additional provisions within a funding charter to accommodate the needs of an “umbrella” project:
  - › “technical projects” versus a single project
  - › “Technical Advisory Body”, or similar, supports communication and coordination (GB + projects); does not prescribe or oversee any technical project’s direction or efforts

# Community Projects

- › A separate legal entity is created for the technical project
- › A “Technical Charter” sets the ground rules for the technical governance of the project and provides for:
  - › Mission and scope of the technical project
  - › Composition of the technical oversight body (generally referred to as a “Technical Steering Committee”)
  - › Details on how decisions are made
  - › IP policy for the project, including the license for code contributions to the project
- › Optionally, a directed fund project has its own governance, separate from that of the technical project (“business governance”)
  - › The “Funding Charter” establishes the fiscal decision-making process
  - › The “Participation Agreement” sets membership fees and binds members to the project’s Funding Charter

# Business Governance (Funding)

- › The funding charter sets forth the business governance for the project:
  - › Membership levels and rights
  - › Governing Board composition and responsibilities
  - › Any committees under the Governing Board (marketing, legal, finance, etc.) or fulfilling an advisory role (such as an end-user advisory committee)
  - › Quorum and voting requirements
  - › Administrative / operational details
- › Membership fees:
  - › Determined at time of formation; some times revised later by the governing board
  - › Involves both '**top-down**' and '**bottom-up**' analyses that assess the projected budget needs against the projection of the number and membership level of potential participants.
  - › **Membership is NEVER REQUIRED TO PARTICIPATE IN TECHNICAL COLLABORATION, contribute code or take a role in the technical community.**

# Bootstrapping the Community/Project

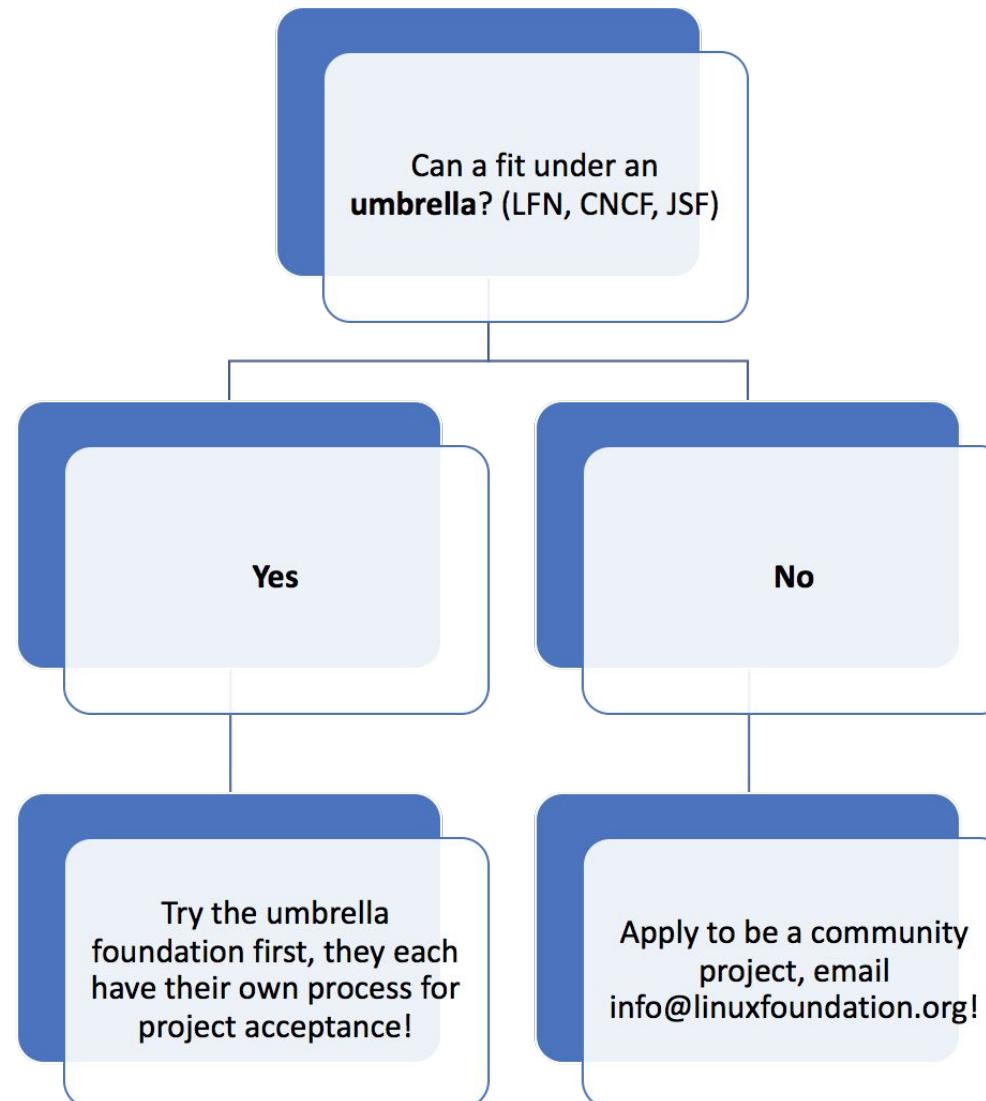
- › Once we have worked out the intended mission and scope of the sponsored project, we work to build out a formation group to draft the governance documents and finalize the project structure as a community.
- › We establish a series of tracks – generally consisting of business governance, legal and technical, and work in parallel to finalize the structure of the project including membership tiers, fee levels, IP policy and other details.
- › Towards the end of the formation process we often convene a marketing team, and LF will prepare the launch press release with input and feedback from the marketing team.
- › The advantage of working via formation teams is that the community is already familiar with working with each other and solving problems collectively before the project even opens publicly.

# Bringing a Project to the LF in a Simple Flowchart



## Umbrella Community + Funding

These projects support several technical projects under the same funding structure and are focused on a technology area. This allows the community to pursue a strategic vision across a spectrum of opportunities while balancing demands on resources. Examples of these projects include: [Automotive Grade Linux](#), [Cloud Native Computing Foundation](#), [Hyperledger](#), [LF Deep Learning Foundation](#), and [LF Networking](#).



# WBG and LF Workshop

July 10, 2019

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