



cilium

# 2022 Annual Report Year of the CNI

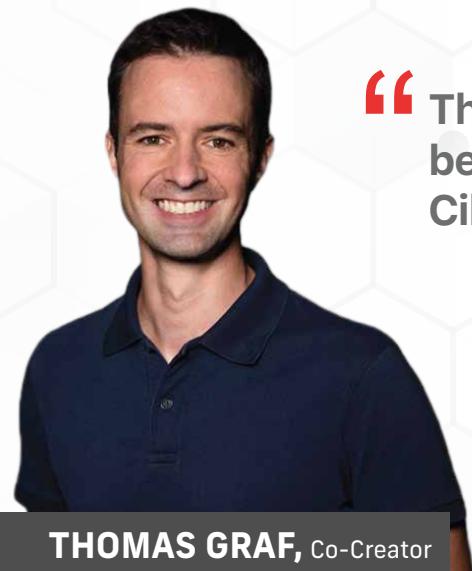


## About this Report

2022 has been a wild ride for the Cilium project! The project itself is now 7 years old, but I feel like we are just at the start of the most exciting part. With Kubernetes finally reaching large scale and widespread adoption, the strengths of Cilium are truly beginning to show. 2022 was the year where Cilium became the de-facto standard CNI. All major cloud providers and many of the most popular Kubernetes distributions are using Cilium. This standardization on Cilium is bringing the benefits of eBPF everywhere, giving companies a consistent connectivity experience wherever they need to deploy Kubernetes, in or across clouds, on-prem, or even on a ship.

Based on the feedback from our user survey, this consistent connectivity is crucial because most people are running multiple clusters with different tenants across disparate infrastructure. Having Cilium as the CNI everywhere creates a seamless user experience anywhere you need to connect an application - and in distributed computing everything goes over the network. **End users across diverse industries like finance, retail, software, and telecommunications are all realizing the benefits of Cilium and eBPF and have shown that it is production ready at scale.**

2022 is the year of the CNI for Cilium, but this is just the beginning of the Cilium ecosystem. The purpose of this report is to share highlights of events, milestones, and feedback in the Cilium Project's community. The data included in this report is taken from the [Cilium User Survey](#), [project's public dashboard](#), [GitHub organization](#), [Slack](#), [blog](#), and [social media](#). If you have any comments or feedback about this report, please reach out to the project at [contribute@cilium.io](mailto:contribute@cilium.io).



**THOMAS GRAF**, Co-Creator

**“ This is just the beginning of the Cilium ecosystem ”**

**Thomas Graf**  
Co-Creator Cilium Project



## Project snapshot

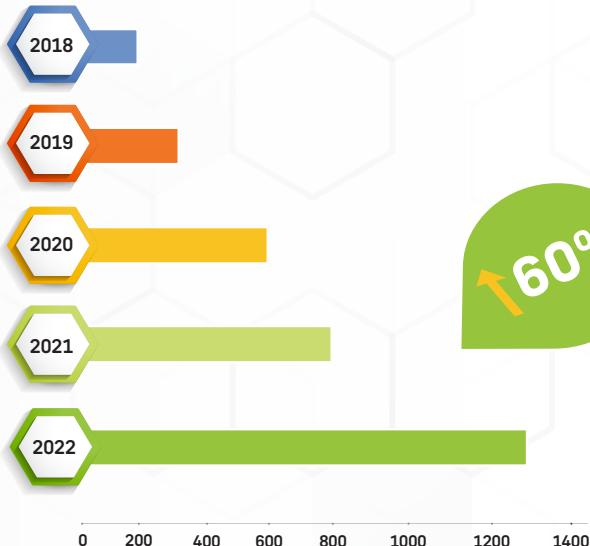
Cilium has seen tremendous growth in the project and community over the past year. These stats provide a quick snapshot of some of that work!

### Contributors

The top 10 contributors by number of PRs were **Tobias Klauser, Paul Chaignon, Joe Stringer, André Martins, Michi Mutsuzaki, Tam Mach, Martynas Pumputis, Bill Mulligan, William Findlay, and Jarno Rajahalme**. Thank you for all the work you have done for the project!

The number of people commenting on issues and PRs has increased by over 60% in the past year alone, and over 6x in the past 5 years.

#### All unique comments (Year)



#### The top contributing companies to Cilium by number of PRs

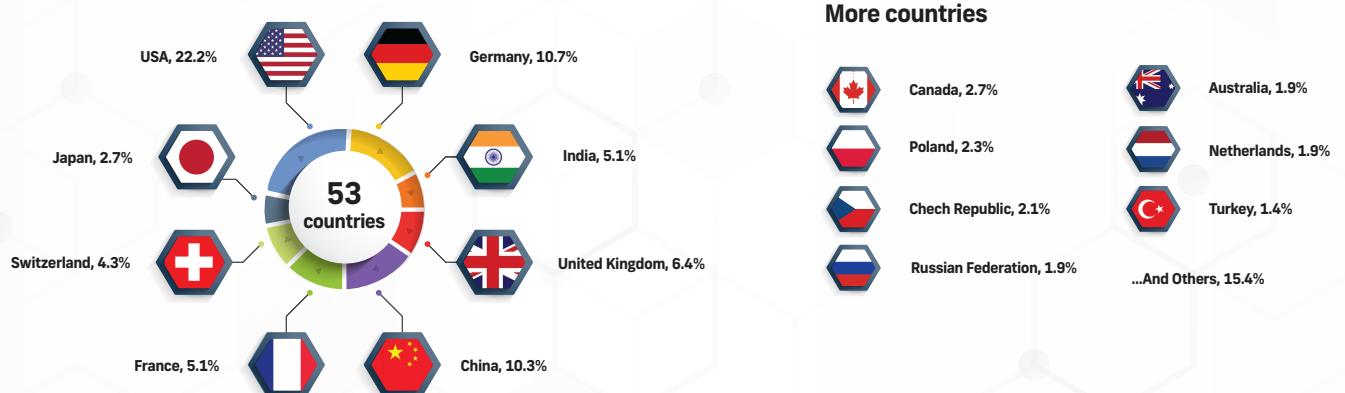


### Users

The number of public users has more than tripled from 30 to 91! Alongside that, Cilium now also has 28 public case studies.

## Geographic location of our contributors

We had contributors from 53 countries with the most contributions coming from US, Germany, China, UK, and India.



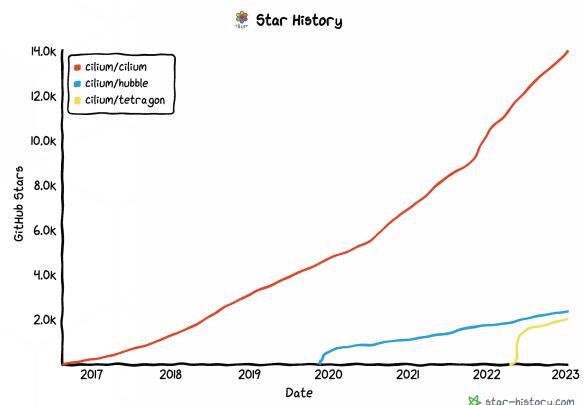
## Blog posts

The number of blogs produced by the community at [cilium.io/blog](https://cilium.io/blog) has more than quadrupled. It is great to see the excitement in the community for Cilium!



## Growth ....20k here we come!

- ★ **Cilium**  
from 9990 stars to 14055
- ★ **Hubble**  
from 1680 to 2405
- ★ **Tetragon**  
from 0 to 2013



## Committers

Finally, we would like to thank the committers of Cilium for all the work and effort they put into the project. Cilium has welcomed six new committers in 2022, and we look forward to adding more in 2023. Cilium committers come from AMD, Datadog, Docker, Google, Independent, Isovalent, Palantir, Red Hat, and SUSE.



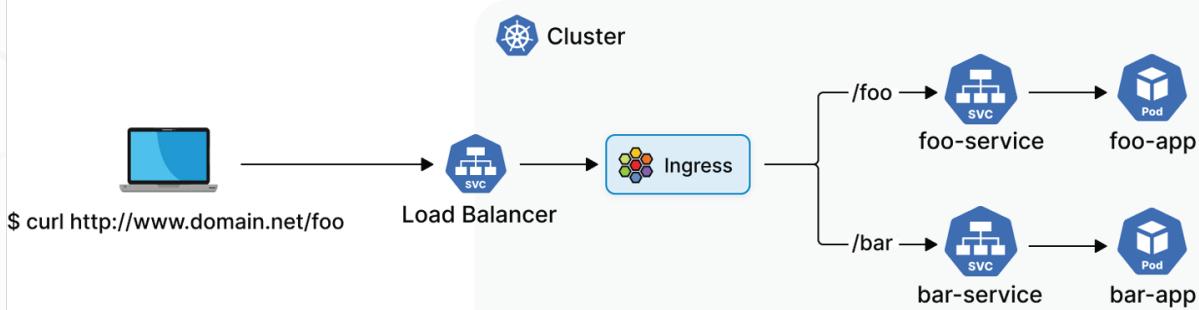
## Release Highlights

Cilium 1.12 was released in July and made [many improvements across networking, security, and service mesh](#). The 1.13 release is imminent, with release [candidate 4](#) already in preview.

## Networking

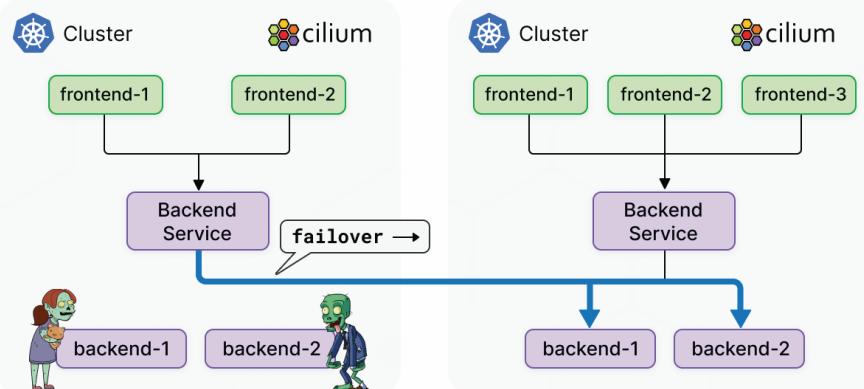
### Kubernetes Ingress

Cilium now provides a fully conformant implementation of Kubernetes Ingress to provide features such as path-based routing, TLS termination, or sharing a single load-balancer IP for many services.



### Cluster Mesh

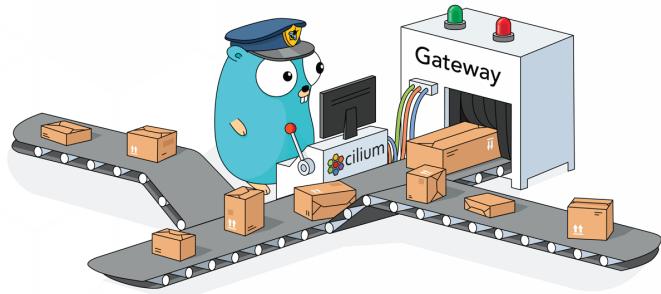
Topology-aware routing and service affinity allows services to be configured to prefer endpoints in the local or remote cluster.



Multi-Cluster for External Workloads allows connecting existing non-Kubernetes workloads into the Kubernetes cluster for a consistent experience. For example, enforcing network policies across Kubernetes, OpenStack, and bare-metal environments all at once.

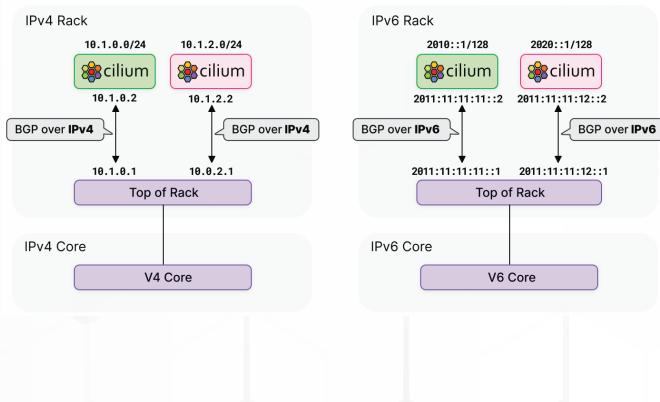
## Egress Gateway

Cilium enables users to route selected cluster-external connections through specific Gateway nodes, masquerading them with predictable IP addresses to allow integration with traditional firewalls that require static IP addresses.



## BGP and IPv6

IPv6 support has been added to the BGP control plane. By leveraging a new feature-rich BGP engine, Cilium can now set up IPv6 peering sessions and advertise BGP IPv6 Pod CIDRs.



## Load-Balancing

Cilium Layer 4 load-balancer (L4LB) now supports NAT46 and NAT64 for services. This allows exposing an IPv6-only Pod via an IPv4 service IP or vice versa. This is particularly useful to load-balance IPv4 client traffic at the edge to IPv6-only clusters.

## Performance

Cilium is the first CNI to support TCP BBR (Bottleneck Bandwidth and Round-trip Propagation Time) congestion control for Pods in order to achieve significantly better throughput and lower latency for Pods exposed to lossy networks such as the Internet. The bandwidth manager used to rate-limit Pod traffic and optimize network utilization has been promoted to stable.

# Security

## Tetragon

Tetragon is the latest open-source project in the Cilium family. Currently considered beta-level maturity, it provides eBPF-based transparent security observability combined with real-time runtime enforcement. The deep visibility is achieved without requiring application changes and is provided at low overhead thanks to smart in-kernel filtering and aggregation logic built directly into the eBPF-based kernel-level collector. The embedded runtime enforcement layer is capable of performing access control on the system call and other enforcement levels.



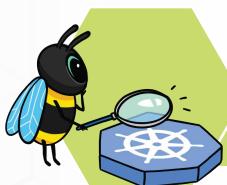
## Security Posture

You can now run Cilium as an unprivileged container/Pod to reduce the attack surface of a Cilium installation and the required Kubernetes privileges have been greatly reduced to the least needed for Cilium to operate.

# Service Mesh

Cilium 1.12 included the GA release of Cilium Service Mesh, enabling a service mesh that doesn't need sidecars in every pod. This release supports Kubernetes Ingress and the Envoy CRD as control plane options, as well as a simple option to enable L7 visibility with Prometheus and OpenTelemetry as outputs. This is an alternative to Cilium's previously existing ability to act as the dataplane for an Istio deployment. The SPIFFE and Gateway API integrations are currently in the works.





## User Surveys

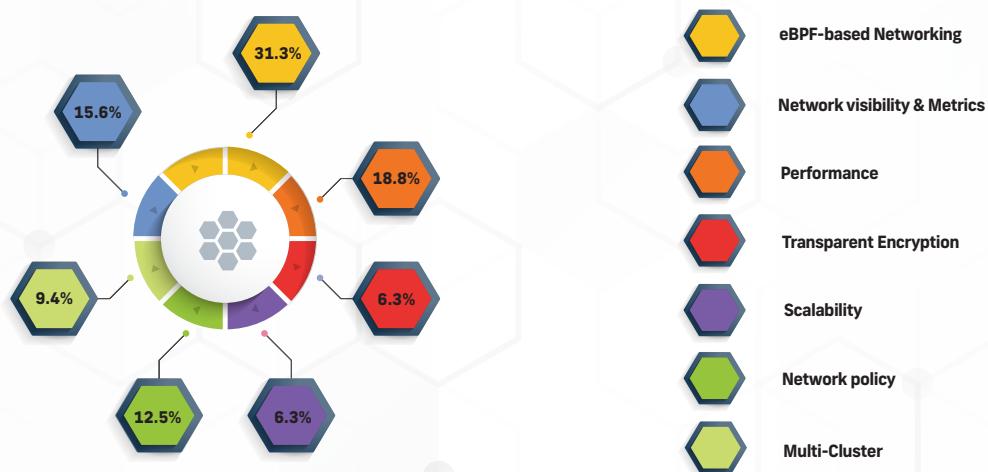
We took the chance to survey our users to see what they said about the project. When we asked what feature of Cilium was most important, there was a mix of responses alluding to Cilium being used in many different ways with different requirements and priorities. However, when asked what the biggest challenge with Kubernetes networking is, our respondents resoundingly answered "observability", and expressed thanks for Hubble's help in this area.

When we asked our users what features they were relying upon the most they answered networking, kube-proxy replacement, and Hubble. Service Mesh, Ingress, Multi-cluster, Encryption, and LB are the most evaluated and planned features and some **people are already running Service Mesh in production today!**

### No one feature is most important to our users

**What do you consider Cilium's most critical feature?**

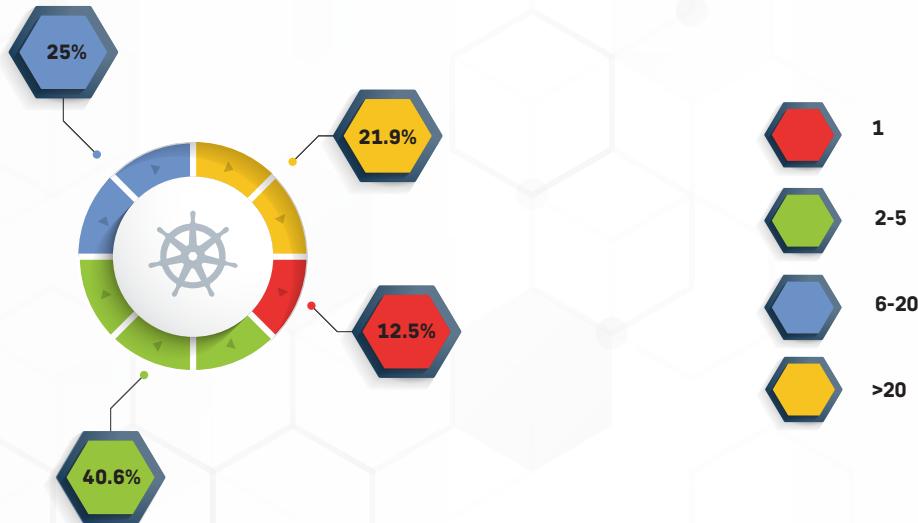
32 responses



People are excited about expanding their use cases for Cilium! This all makes sense when we look at how people are running their Kubernetes environments with almost everyone running more than one cluster and most clusters having multiple tenants. Being able to connect them together and secure the network will be key.

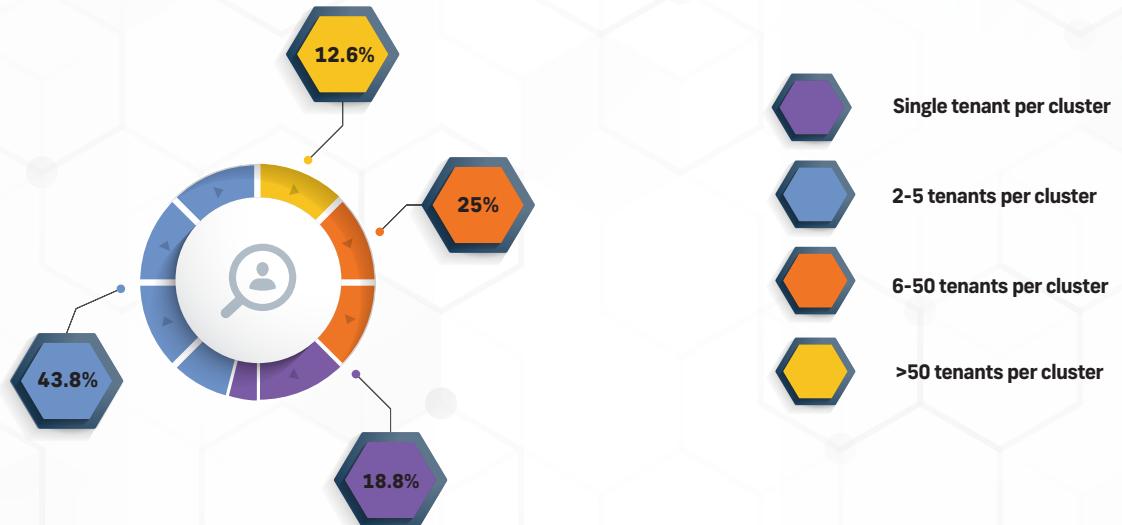
## Basically everyone runs more than one cluster

How many Kubernetes clusters are you running?



## Majority of clusters are multi-tenant

Is your Kubernetes environment hosting multiple app teams?





## Cilium in Production

In 2022, Cilium has gone from a few stories to full blown production everywhere. All major cloud providers now use Cilium in their Kubernetes offerings and Cilium is the CNI for many of the most popular Kubernetes distributions.

### Deploy on your preferred cloud



### Use your favorite Kubernetes distribution



KubeLift



## Community Quotes

### Microsoft

**“** Microsoft is thrilled to partner with the Cilium community to bring the power of eBPF and Cilium natively in Azure. Leveraging Cilium's capabilities to provide eBPF-enriched features like efficient load-balancing, extensive network security features, and rich observability integrated well along with industry-leading robust and scalable Azure CNI IP Address Management (IPAM), with VNET and Overlay mode, will give the most performant and best-in-class container networking platform for our customers. As a native offering, customers will find it significantly easier to leverage Cilium directly on Azure and with other integration work in progress to offer the advanced features of Cilium, we are truly excited about the future of Cilium on Azure.”

*Chandan Aggarwal, Principal Software Engineering Manager of Microsoft*

### Grafana

**“** We want to make sure that Grafana observability is easily available wherever our ever-expanding community needs it. eBPF and Cilium are quickly becoming the de facto standard for secure and observable connectivity in Kubernetes, so we partnered with the Cilium team to help our mutual users with a critical need. Our engineering teams are now working together to leverage the open source Grafana LGTM Stack (Loki for logs, Grafana for visualization, Tempo for traces, and Mimir for metrics) to enhance eBPF-based observability for monitoring, troubleshooting, and security workflows.”

*Raj Dutt, CEO and co-founder of Grafana Labs*

### SP Global

**“** It is important to create a Highway in our Kubernetes world in order for the network to seamlessly communicate with all of the ecosystem and still provide the perfect end user experience. Using Cilium CNI, we built that Highway and that Highway today communicates seamlessly with our on-prem, cloud, SaaS, and all our downstream systems in order to make that experience very reliable and very smooth so that every time the app owner or application developer doesn't have to rethink, re-configure, or redo how do I connect to my data and data center, how do I connect to my database, how do I connect to my service in a SaaS. Using Cilium CNI, the Highway is built and through the common fabric of Cilium we provide that very seamless and secure connectivity.”

*Guruprasad Ramamoorthy, VP Global Head of Network Architecture, Engineering & Operations of S&P Global*



## Community Events

### KubeCon

Cilium was well represented at both KubeCon EU and NA. There were 10 talks about Cilium in Valencia and 14 in Detroit. In Detroit, Cilium hosted its first in-person project meeting, and applied for graduation in the CNCF.

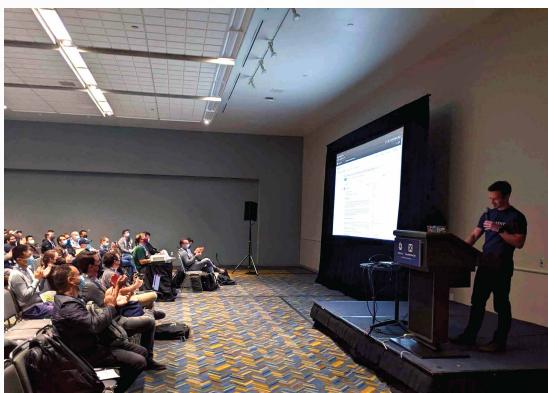


### KubeCon Europe in Valencia

KubeCon + CloudNativeCon EU was the first in person Kubecon since 2019 and there was a lot to catch up on. Cilium was covered in both technical talks from contributors and end user stories from people putting Cilium into production. There were presentations on everything from Cilium Clustermesh to Cilium for telco workloads to a tour of the Cilium service mesh.

### KubeCon NA in Detroit

Cilium was a part of 13 talks at KubeCon + CloudNativeCon North America covering KubeCon, eBPF Day, ServiceMeshCon, Observability Con, Security Con, and Kubernetes on Edge Day. You can read all about them in blog post. Microsoft announced they were choosing Cilium for AKS and Grafana also announced an integration with Cilium.



Thomas Graf submitted the application live on stage at KubeCon and you can show your support for our graduation application on the [PR](#).

## eBPF Summit

eBPF Summit is the yearly conference looking at the innovation around eBPF from many different perspectives, from kernel maintainers working on eBPF implementation, through projects using eBPF technology to create next-generation tools, to end users sharing their experiences of leveraging this awesome new set of capabilities. Cilium was well represented with production use cases and debugging stories.



**Press a hexagon to watch the talk on eBPF**

## Meetups

2022 was the first year back to in person meet ups and it was great to see Cilium popping up in different countries. You can catch all of the videos on [Youtube](#).

## Looking forward to 2023

If 2022 has been the year of Cilium as the CNI, I have three predictions for 2023: service mesh maturity, ecosystem expansion, and increased software supply chain security. Finally, as a milestone, I think Cilium will also [graduate from the CNCF](#).

**Cilium service mesh was launched at the end of 2021 and the first users already have it in production.** Just like using the same CNI everywhere provides a consistent user experience across infrastructures, Cilium Service Mesh provides one solution to control, observe, and secure your network from L3-L7. The main service mesh feature that is missing right now is [mTLS](#), but that will be included in one of the next releases of Cilium. Check out the release candidates to get involved in the testing! Once that is just a flag away, the onboarding to Cilium Service Mesh will massively accelerate. With Cilium Service Mesh, end users finally will have control of their network from L3-L7 in one place rather than trying to debug networking issues across layers and tools.

With Cilium as the standard CNI, an ecosystem can now begin to emerge around it. Standardization makes it massively easier to provide integrations and extensions since everyone is using the same base. We can already see this ecosystem beginning to form with the Grafana [announcement](#). With Cilium everywhere capturing observability data using eBPF, it makes total sense to connect it to Grafana and visualize the data. **With Cilium capturing data in the kernel with eBPF, the ecosystem around Cilium can leverage this data and functionality to build better platforms for end users.** 2023 will be when we start to see these integrations and functionalities explode.

Finally, it wouldn't be 2022 without mentioning the software supply chain security and 2023 will see Cilium at the forefront of it. Cilium as a project has already taken steps forward on this front by generating signed releases and a software bill of materials (SBOM). We have also worked to reduce the privileges needed to run and operate Cilium. More far reaching than this though is how people are [using Tetragon](#) to secure the software supply chain by verifying eBPF traces for Supply Chain Artifacts. There are so many use cases for Tetragon to make systems more secure and the excitement around the project just highlights that. 2023 will see an even more secure Cilium and better protected software supply chain because of Cilium.

If all of this has gotten you excited about Cilium, there are many ways to get involved. The best way to start is to check out the Cilium project on [GitHub](#). There, you can find information about the project, as well as ways to get involved, such as reporting bugs, suggesting new features, or contributing code. Additionally, the Cilium community is active on [Slack](#) and [Twitter](#). If you want to just follow along for now, be sure to sign up for the [newsletter](#). If you have any questions or comments please reach out to [contribute@cilium.io](mailto:contribute@cilium.io).



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eBPF