CIVIL INFRASTRUCTURE PLATFORM
INDUSTRIAL GRADE LINUX

THE LINUX FOUNDATION | Research

Civil Infrastructure Platform: Industrial Grade Linux at 10

A decade of securing and sustaining the world's industrial systems

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CIVIL INFRASTRUCTURE PLATFORM: INDUSTRIAL GRADE LINUX AT 10

Massive Infrastructure Investment

Global infrastructure investments reach $106 trillion today and are forecast to reach $150 trillion globally by 2050.

Operational Structural Disconnect

Physical civil infrastructure operates across 20- to 40-year lifecycles, contrasting sharply with short-term software support windows.

Severe Vulnerability Overhead

Independently tracking identical security bugs in isolation creates a massive, duplicated corporate engineering liability.

Super Long-Term Support (SLTS)

CIP converts standard Linux kernels into 10-year SLTS baselines to match long-living industrial deployments.

Mainline Upstream First Strategy

Requires all code modifications to merge into mainline Linux first prevents proprietary forks and lowers total cost of ownership.

Mutualized Regulatory Compliance

Member organizations pool technical bandwidth to navigate strict mandates like the EU Cyber Resilience Act (CRA).

Severe CRA Non-Compliance Fines

CRA penalties reach up to €15 million or 2.5% of global turnover, making shared compliance frameworks essential.

Automated Continuous Testing

CIP integrates with KernelCI to continuously validate SLTS patches against physical industrial reference hardware.

Supply Chain Security Rigor

Achieving OpenSSF Gold status and enforcing cryptographically signed releases guarantees end-to-end software supply chain integrity.

Unified Corporate Baselines

Industrial enterprises leverage CIP to construct single internal Linux distributions across diverse, multi-divisional product lines.

Ecosystem Hardware Alignment

Collaborative governance bridges the operational gap between physical silicon development lifecycles and fixed SLTS software releases.

UN SDG Alignment & Impact

CIP directly advances UN SDG Goal 9 by standardizing non-differentiated open source code to secure societal infrastructure globally.

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Foreword

The industrial sector stands at a critical technological crossroads. As an engineer by training, I view systemic challenges through the lens of structural integrity and efficiency. In the physical world, we know that civil infrastructure, which spans energy grid distribution, transportation networks, and industrial manufacturing plants, is built to operate securely for twenty, thirty, or forty years. Yet, as software has become embedded into industrial systems, enterprises have traditionally relied on short-term, consumer-grade lifecycle support windows. This structural disconnect places severe operational strain on firms attempting to maintain safety, reliability, and security over decades.

The historic model of industrial software maintenance is fundamentally flawed because it relies on a massive duplication of effort. For years, companies worked in isolation, independently spending valuable resources to track identical security vulnerabilities and fix the same baseline bugs. Today, as tightening regulatory frameworks like the EU Cyber Resilience Act (CRA) introduce strict compliance deadlines and heavy non-compliance penalties, navigating this landscape alone has evolved from a structural inefficiency into an untenable corporate liability.

This qualitative research report shares insights from industry-leading organizations, revealing how a unified, community-led framework completely changes the economic and technical equation of software longevity. By establishing the 10-year Super Long Term Support (SLTS) kernel and related core libraries as the de facto industry standard, the Civil Infrastructure Platform (CIP) project enables competitive organizations to pool their technical know-how and optimize their innovation costs.

This report is essential reading for stakeholders across global industrial systems. It describes the economic value experienced by organizations when they shift their strategy from passive software consumption to active ecosystem stewardship. Leading enterprise technologists share perspectives on the benefits of mass collaboration through open source, including driving down the total cost of ownership, eliminating downstream code fragmentation, and mutualizing regulatory risk.

The durability and ultimate sustainability of our shared civil infrastructure depend entirely on the size and vibrancy of the community backing it. To expand technical capacity, accelerate hardware enablement, and secure the end-to-end supply chain for the next decade, organizations must actively join, fund, and co-govern this common foundational asset. The framework is proven, and the community's doors are open.

Mike Woster, CRO / COO, *The Linux Foundation*

Executive summary

Civil infrastructure systems represent fundamental lifelines of modern economies. As cumulative global infrastructure spending is forecast to climb well into the trillions by 2050, the software driving long-living industrial systems faces an absolute operational requirement: it must endure reliably, securely, and cost-effectively for decades. Reaching its 10th anniversary as a Linux Foundation-hosted project, the Civil Infrastructure Platform (CIP) project has proven the collaborative model of open source innovation, establishing a secure, "industrial grade" software base layer that eliminates duplication of effort, code fragmentation, and interoperability friction across critical infrastructure.

This report explores the people, organizations, and technical frameworks behind CIP, detailing how open source collaboration addresses common structural challenges among industry peers. Founding and active members have built a shared, pre-competitive baseline that optimizes innovation costs while giving asset-heavy industries the operational flexibility required to manage long-living deployments. Project leaders from current contributing organizations highlighted how the infrastructure innovation landscape is defined by the necessity of multi-decade software longevity, strict upstream code alignment, and the mutualization of regulatory compliance in the face of shifting global mandates.

Three critical thematic pillars described in this report define CIP's value proposition. The first pillar on Super Long-Term Support (SLTS) details how CIP converts standard Linux Long-Term Support kernels into 10-year SLTS kernels. Validated via KernelCI testing against physical reference hardware, this extended support horizon protects operators from costly, disruptive platform shifts and enables large enterprises to construct unified internal Linux distributions across diverse product lines. The second pillar on the strict "upstream first" methodology outlines how requiring all technical modifications to be merged into mainline Linux prior to backporting prevents proprietary forks, lowers the total cost of ownership, and ensures a predictable software update lifecycle. The third pillar on mutualized regulatory compliance details how member organizations pool technical expertise and resources to navigate stringent security mandates, such as the EU Cyber Resilience Act (CRA) and IEC 62443 certification standards, transforming complex legal liabilities into manageable technical workflows.

To operationalize these insights and sustain global momentum, civil industry stakeholders should prioritize four core strategic actions. First, organizations must transition from open source consumers to active community stewards by embedding engineering teams directly in collective governance to guide technical roadmaps and share validation burdens. Second, institutions should implement security by design to mitigate the super long-term support burden, adopting verified baselines that provide predictable stability updates over multi-decade horizons. Third, industry participants need to mutualize regulatory risk management by leveraging shared consortium frameworks to achieve global certification standards and lower compliance overhead. Finally, manufacturers must drive ecosystem sustainability through hardware alignment, actively bridging physical silicon development lifecycles with stable software releases to build a resilient, end-to-end software supply chain.

Introducing the Civil Infrastructure Platform

Civil infrastructure systems represent fundamental lifelines of modern, functioning economies. They deliver the critical services on which our social and industrial fabric depends: electric power, oil and gas, water, health care, communications, transportation and more. Ten years ago, global infrastructure demand was estimated to reach 4 trillion.[1] Today, it's orders of magnitude higher. A McKinsey report from March, 2026 estimates that the global infrastructure experienced record-setting levels of fundraising and deployment, measuring the world's infrastructure investments at $106 trillion.[2]

Separate from the current physical infrastructure investment, there's another type of investment that often flies under the radar among infrastructure projects. It's a shared investment, and it's one that is driven by open source collaboration, which, by way of a neutral forum, eliminates the duplication of effort, loss of development time, fragmentation, and interoperability issues that exist across today's civil infrastructure systems. That investment is the Civil Infrastructure Platform: Industrial Grade Linux (CIP) project, which recently reached its 10th year as a Linux Foundation-hosted project, a distinguished milestone as open source projects go.

Many open source projects experience a sunset based on market forces. CIP's 10th anniversary achievement has not only proven the collaborative method of supporting technological innovation, it has demonstrated the project's ongoing relevance in modern infrastructure. The milestone comes at a time when the demand for infrastructure is unprecedented on a global scale, and according to PWC's Global Infrastructure Report, cumulative global infrastructure spending is forecast to climb to $150 trillion by 2050.[3]

CIP addresses the need for software components to endure over the lifetime of long-living industrial systems. The project was born out of the need for super long term stable (SLTS) Linux kernels, a support horizon necessary for use in industrial and critical infrastructure, including domains such as transportation (trains and railway infrastructure), power generation and distribution systems, municipal infrastructure, communications systems, industrial control and supervision systems, and healthcare equipment. In each of these examples there is a requirement for high levels of security and reliability, as well as maintenance periods of ten years to accommodate the extended lifecycle of infrastructure projects.

1 PricewaterhouseCoopers, Capital Project and Infrastructure Spending Outlook (PwC, 2016), **https://www.pwc.com/gr/en/publications/specific-to-all-industries-index/capital-project-infrastructure-spending-outlook-2016**

2 Adrian Kwok, Alastair Green, and Connor Mangan, Infrastructure: Investing to Support Global Growth (McKinsey & Company, 2026), **https://www.mckinsey.com/industries/private-capital/our-insights/global-private-markets-report/infrastructure**

3 "Global Infrastructure Spending to Top $150 Trillion Through 2050" (Press release, PwC, April 28, 2026), **https://www.pwc.com/gx/en/news-room/press-releases/2026/pwc-2026-global-infrastructure.html**

In the same fashion that the Linux kernel proliferated with the help of an extraordinarily diverse community of industry contributors, the multi-faceted needs of the manufacturing and civil infrastructure industry could similarly be met by peers working together, each supporting the industrial grade software building blocks their companies relied on. And so, the CIP was officially announced in April of 2016. Then, and still today, large industrial companies serve on the project's Governing Board, which oversees the project's financial matters, while the Technical Steering Committee directs the technical directions of the project.

At formation, the project was both necessary, and aspirational. Founding member Masaaki Iwasaki from Hitachi said in the original project launch press release, "We believe the CIP will become a common, global platform through which we can achieve an even more comfortable and efficient society."[4] Toshiba executive Shigeyoshi Shimotsuji reflected in a similar fashion, saying "Toshiba believes that CIP will become an essential software platform to improve our life."[5] Siemens senior principal Marquart Franz reflected on the opportunities to be gained through collaboration, stating, "Partnering and open source development are necessary to ensure high quality core components."[6]

This report explores the people and the organizations behind CIP today, and the value that they, through the CIP project frameworks, are jointly creating, ten years since the project launched. It will describe how open source collaboration in industrial software addresses many of the common challenges that civil infrastructure projects encounter. It will explore the project's accomplishments in terms of delivering speed, cost savings, reliability, and security, especially in light of changing regulatory requirements. Additionally, it will look into the future and the project's sustainability for its next chapter.

4 "The Linux Foundation Launches First Linux-Based Civil Infrastructure Project," Linux Foundation, April 4, 2016, https://www.linuxfoundation.org/press/press-release/the-linux-foundation-launches-first-linux-based-civil-infrastructure-project

5 Linux Foundation, "Linux-Based Civil Infrastructure Project."

6 Linux Foundation, "Linux-Based Civil Infrastructure Project."

Solving common challenges among industry peers

Today, the CIP project represents a shared and cost-effective software asset that provides a baseline for high quality solutions in embedded and industrial systems, especially long-living ones, to ensure smooth updates and maintainability. The premise behind industry peer collaboration being that when the pre-competitive baseline is done right, the stage is set for commercial extensions across industrial products. But ten years ago, at the time of the project's formation, such a baseline was merely a vision, a big idea discussed by peers engaging in the Linux kernel ecosystem.

Toshiba Corporation expert Kazuhiro Hayashi reflects on the project's pre-formation origins and discussions. He says, "The roots of this initiative trace back to 2014 within the Consumer Electronics Working Group of the Linux Foundation. Toshiba proposed a Linux based foundation trusted for long term use in civil infrastructure, a vision Siemens simultaneously put forward based on identical product field demands. CIP grew directly from these shared requirements."[7]

The stars aligned in 2016 for CIP's official formation, allowing for big visions to transform into a new reality for materially relevant industrial software solutions. In 2016, the open source community had grown and matured significantly in the nearly ten years following the rebranding of the Open Source Development Labs (OSDL) to the Linux Foundation. Mike Dolan, Linux Foundation senior vice president and head of projects and legal, reflects on the extent to which open governance was becoming a more well developed muscle. He says, "Looking back at the timeframe when the CIP was forming, the open source model of mass collaboration was hitting its stride. The Linux Foundation was standardizing governance templates, getting the legal community aligned, and shifting toward successful umbrella frameworks. This established environment helped make the formation of specialized projects like CIP possible."[8]

Jan Kiszka, principal key expert for open source embedded systems at Siemens, reflects on the ambitious nature of the project during its early days. He says,

> "When we co-founded the project, aiming for a 10-year long-term supported kernel was a massive experiment, as nobody had attempted that timeline for our domain as a community effort before. While five years was too short for our industrial products and twenty years was logistically unfeasible, ten years provided the perfect buffer. Even though we actively encourage product teams to update around year seven or eight rather than exhausting the full lifecycle, having that 10-year

7 Kazuhiro Hayashi, written interview with the author, 9 July 2026
8 Mike Dolan, interview with the author, 3 June 2026

flexibility allows asset-heavy industries to adjust exactly when and how they deploy system updates."[9]

The promise of industry-specific collaboration has, to a significant extent, been realized over the course of the project's history. From its earliest days to present, CIP participants find tremendous value in the consortium model of innovation and knowledge sharing. Toshiba Corporation expert Kazuhiro Hayashi elaborates on this benefit. He says, "CIP operates as an essential bridge between individual industrial corporations and open source communities. The consortium allows members to consolidate their know-how and polish technical proposals through peer feedback. Presenting these refined concepts as a unified, common opinion of CIP gives us the leverage needed to effectively move things forward within larger open source ecosystems."[10]

Yoshitake Kobayashi, CIP Technical Steering Committee Chair, speaking at Open Source Summit Japan, December 2025.

9 Jan Kiszka, interview with the author, 15 May 2026
10 Hayashi, interview.

The Super Long Term Support value proposition

CIP selects specific Long-Term Support (LTS) Linux kernels and converts them into Super Long-Term Support (SLTS) kernels. While standard Linux LTS kernels are supported for a few years, CIP commits to maintaining their SLTS kernels for 10 years. LTS activities are designed to ensure that software components are both functional and secure for industrial usage over time, and it is CIP members who influence the LTS activities themselves.

Let's start with functionality. Because CIP is responsible for maintaining kernels that run critical infrastructure, the software simply cannot fail. To ensure this extreme reliability requirement is fulfilled, the CIP project heavily relies on another Linux Foundation hosted project, KernelCI. CIP uses KernelCI's testing framework to continuously test their SLTS kernels against industrial hardware, ensuring that a patch applied to a 10-year-old kernel doesn't accidentally break something else. It's meticulous, rigorous work. As Jonathan Corbet writes in his blog on **LWN.net**, "Supporting a Linux system for even one year is a challenging task."[11]

For Renesas, the 10-year support period through CIP has proven beneficial for industrial systems broadly, and its products specifically, providing the flexibility to update systems with long-living components. As Takehisa Katayama, senior principal software engineer at Renesas and CIP governing board member says, "For our high-end RZ Family of processors, maintaining continuous software lifecycles is critical, as industrial systems are expected to remain in operation for decades. Through our engagement in CIP, we aim to establish SLTS as a de facto industry-standard kernel, delivering the long-term stability and sustainability required by the industrial sector."[12]

This standardizing effect is not limited to external product offerings, but creates an opportunity to reshape how large industrial conglomerates manage internal technology alignment. Instead of maintaining separate, siloed software teams for every individual division, enterprises are leveraging the SLTS framework to construct a single, unified internal Linux distribution. This corporate-wide digital asset acts as a highly adaptable foundation that can be deployed across wildly diverse product lines—from logistics and building systems to power generation plants. By embedding CIP as the reliable core engine of an internal operating system, massive corporate groups can simultaneously accelerate software deployment times and dramatically simplify group-wide long-term maintainability.

11 Jonathan Corbet, "Supporting Long-Term Linux Kernels," LWN.net, October 12, 2025, **https://lwn.net/Articles/1049604/**.
12 Takehise Katayama and Chris Paterson, interview with the author, 7 July 2026

TABLE 1

Current released CIP kernels (as of July, 2026)

Version	Maintainer(s)	First Release	Projected EOL	Target Releases/ Month*
SLTS v6.12	Nobuhiro Iwamatsu & Pavel Machek	2025-05-20	2035-06	2
SLTS v6.1	Nobuhiro Iwamatsu & Pavel Machek	2023-07-14	2033-08	1
SLTS v6.1-rt	Pavel Machek	2023-07-16	2033-08	0.5
SLTS v5.10	Nobuhiro Iwamatsu & Pavel Machek	2021-12-05	2031-01	1
SLTS v5.10-rt	Pavel Machek	2021-12-08	2031-01	0.5
SLTS v4.19	Ulrich Hecht	2019-01-11	2029-01	1
SLTS v4.19-rt	Pavel Machek	2019-01-11	2029-01	0.5
SLTS v4.4	Ulrich Hecht	2017-01-17	2027-01	1
SLTS v4.4-rt	Pavel Machek	2017-11-16	2027-01	0.5

Source: https://wiki.linuxfoundation.org/civilinfrastructureplatform/start

Equal to the sustainable functionality of software over long-lifecycles is the security of that software. To achieve this, the project backports critical security fixes and stability patches alike, without changing the core behavior of the system. Security is an unequivocal, priority focus area for the CIP project and member participants, and security standardization a leading benefit. The project is designed to ensure that systems are secure against external and internal attacks and that they meet strict safety requirements. For members of CIP, the value comes in the reduced costs of certification. In other words, members don't have to "go it alone" when it comes to compliance with IEC 62443, a globally recognized series of standards that defines the core requirements and processes for implementing and maintaining secure Industrial Automation and Control Systems (IACS), essential to industrial plant safety. bridging IT networks and the physical operational technology (OT) environments.

The CIP methodology: Upstream first

At the heart of the CIP technical strategy is a strict commitment to a "mainline-first" (or "upstream-first") development workflow. Standard vendor–specific or commercial kernels typically focus on rushing out immediate, flashy features. Unfortunately, this propensity to prioritize features often sacrifices structural stability, introducing disruptive incompatibilities and heavy maintenance headaches when upgrading systems later.

CIP bypasses these roadblocks by requiring all technical modifications and bug corrections to be submitted, evaluated, and merged directly into the primary Linux kernel codebase first. Only after these changes are officially accepted by the broader open source community are they backported into CIP's SLTS releases. This deliberate, community-aligned methodology delivers three distinct advantages:

- **Prevents fragmentation:** By anchoring development to the central Linux mainline, CIP avoids the creation of isolated, proprietary forks. This shared baseline makes it highly feasible to sustain specialized patches for reference hardware or legacy packages over long timelines.
- **Reduces total cost of ownership:** Utilizing global open source peer review channels considerably reduces the overall engineering hours and operational budget needed to patch bugs and secure software across a ten-year lifecycle.
- **A smooth software lifecycle:** By backporting only pre-approved, mainline-vetted patches, this process provides industrial operators with a predictable software foundation, ensuring critical systems receive vital safety updates without risking compatibility failures.

Ultimately, the goal is industry-wide alignment. By encouraging silicon suppliers to fully adopt this upstream-first model, the industry can streamline hardware enablement directly through CIP—eliminating the need to negotiate custom Linux support with individual vendors.

Khasim Syed Mohammed, Director of Engineering, Processors Business Unit at Texas Instruments, describes this benefit specifically as it relates to CVE management through a collaborative forum:

> "Historically, Texas Instruments has committed to supporting our customers with bug fixes and SDK migrations for 15 to 20 years. However, in the past, tracking security vulnerabilities was largely handled on an ad-hoc basis. As cybersecurity mandates tighten, managing a proprietary CVE monitoring portal, validating patches, and merging fixes entirely on our own becomes a massive liability. Moving away from a fragmented, vendor-specific approach to a collaborative consortium under the Linux Foundation allows us to establish a unified, robust standard for how the entire industry handles CVE management."[13]

Managing complex vulnerability compliance across multiple hardware platforms over a multi-decade window demands an immense operational commitment. For individual companies, the standalone financial and engineering cost to independently monitor, validate, and maintain a custom kernel repository for this length of time is prohibitive. By pooling engineering bandwidth and financial resources within the CIP framework, CIP member organizations have lowered their baseline maintenance costs. This collaborative cost-sharing model transforms an otherwise massive corporate liability into a high-ROI asset, allowing industry leaders to solve shared regulatory hurdles collectively while freeing up internal engineering resources to focus on customer-specific features.

13 Khasim Syed Mohammed, interview with the author, 19 May 2026.

Mutualizing regulatory compliance

In the previously referenced LWN blog, Jonathan Corbet additionally noted that while maintaining long term support for a system is challenging, it is even more complicated within continually shifting regulatory environments.[14] It is in this context that CIP standards and practices are especially noteworthy. In 2025, CIP, along with the Yocto Project and the Zephyr Project, was recognized as a standout project for its security practices not only being compliant with the minimum requirements of the EU Cyber Resilience Act (CRA), but going beyond them.[15]

This compliance cliff edge represents a profound shift in operational risk, making siloed vulnerability tracking an increasingly unsustainable corporate burden. By contrast, a unified consortium approach allows member organizations to share the compliance workload, transforming regulatory obstacles into manageable technical processes. Toshiba Corporation expert Kazuhiro Hayashi highlights how collaborative security frameworks materially accelerate market readiness under these mounting legal pressures:

> "With regulatory pressures like the Cyber Resilience Act intensifying, vulnerability handling is becoming more complicated and higher load by the day. Leveraging the resources of CIP's security working group, which achieved IEC 62443-4 verification

14 Corbet, "Supporting Long-Term Linux Kernels."

15 Mirko Boehm, Hilary Carter, and Cailean Osborne, "Pathways to Cybersecurity Best Practices in Open Source: How the Civil Infrastructure Platform, Yocto Project, and Zephyr Project are Closing the Gap to Meeting the Requirements of the Cyber Resilience Act," foreword by Miriam Seyffarth, The Linux Foundation, March 2025.

Under the CRA: Penalties for non-compliance

"The penalties provided for shall be effective, proportionate and dissuasive." (CRA, Article 64(1))

When determining the fine amount, authorities must consider the nature, gravity and duration of the infringement, whether previous fines have been applied, and the size of the offending organisation. Fines are tiered by the nature of the infringement:

- **Non-compliance with essential cybersecurity requirements:** Up to €15,000,000 or 2.5% of global annual turnover (whichever is higher)
- **Non-compliance with other obligations:** Up to €10,000,000 or 2% of global annual turnover for non-compliance with other obligations
- Other obligations are laid out in Articles 13 & 14
- **Supplying incorrect or misleading information to authorities:** Up to €5,000,000 or 1% of global annual turnover

Exemptions (CRA Article 64(10)):

- Microenterprises and small enterprises are exempt from fines for missing the 24-hour early warning notification deadline
- Open source software stewards are exempt from fines for any infringement of the Regulation

of conformity in 2026, significantly reduces the time and costs required to make Toshiba products compliant with global certification demands."[16]

Siemens principal key expert for open source embedded systems Jan Kiszka describes the regulatory readiness benefits in detail. He says,

"While CIP has driven immense internal value over the past ten years, its role as a consolidating force has become exceptionally critical in the face of upcoming European cyber regulations like the Cyber Resilience Act (CRA). Instead of attempting to manage, secure, and patch literally hundreds of disparate software variants across our embedded product lines, the majority of our systems have consolidated around a unified, Debian-based framework embedded with CIP. This baseline gives us an active mitigation strategy against software vulnerabilities without duplicating maintenance costs."[17]

Conversations with active CIP members made clear that engaging in the CIP has allowed them to enhance their regulatory defence posture, and receive value not just in terms of code and collaboration, but in terms of improved risk management. Further details on how the CIP project aligns with the essential requirements of the CRA can be found in the section How CIP collectively navigates security and regulation.

In February, the CIP project's security posture reached a new threshold: achieving Gold level in the OpenSSF's Best Practices Badge program (formerly the CII Best Practices Badge). The program helps open source projects demonstrate adherence to rigorous software development, governance, and security standards, and for CIP, it holds this distinction alongside fewer than 100 open source projects.[18] The badge's prerequisites are comprehensive, including having previously attained Silver level, having a "bus factor" of two or more, at least two unassociated contributors, and follow rigorous change control, quality, security, and code analysis practices.[19] It reflects a long-standing commitment by the project to ensure that OEMs can rely on a powerful combination of secure software, license continuity, and long term support.

16 Hayashi, interview.

17 Kiszka, interview.

18 Civil Infrastructure Platform. "Blog." Accessed September 15, 2026. **https://cip-project.org/category/blog**.

19 Open Source Security Foundation, "FLOSS Best Practices Criteria (All Levels)," OpenSSF Best Practices Badge, accessed September 15, 2026, **https://www.bestpractices.dev/en/criteria**.

How CIP collectively navigates security and regulation

The **Cyber Resilience Act (CRA)** is a landmark European Union regulation designed to establish mandatory cybersecurity requirements for products with digital elements (PDEs). By imposing strict oversight on software and hardware commercialized within the EU, the law aims to reduce vulnerabilities, ensure security throughout a product's lifecycle, and provide users with transparent information to make informed decisions. For organizations like the **CIP**, the CRA necessitates a shift toward standardized security documentation and robust vulnerability management to support the global digital supply chain. The project has successfully navigated the CRA regulation through a community culture that prioritizes security best practices.

Standardized industrial development practices

The CIP aligns with the CRA's essential requirements by implementing development practices that prioritize transparency and public auditability. It was a pioneer in adopting IEC 62443-4-1 requirements, which specify process standards for the secure development of products used in industrial automation and control systems. Furthermore, the project maintains a clear delineation between development and release versions through a rigorous tag and branch system.

Comprehensive cybersecurity policy and handling

At the core of CIP's compliance is a cybersecurity policy maintained on GitLab that adheres to international industrial standards. The project facilitates effective vulnerability handling through established communication channels, including mailing lists for release notifications and a private email address for responsible disclosure. These mechanisms are integrated with the broader Linux kernel and Debian community processes to ensure rapid response times.

Super Long-Term Maintenance and support

To meet the CRA's mandate for maintaining cybersecurity throughout a product's lifecycle, CIP provides Super Long-Term Support (SLTS). While the CRA typically requires a five-year support window, CIP commits to a minimum maintenance period of 10 years. This extended support is critical for industrial sectors, such as railway and energy systems, where the expected operational life of a product can span several decades.

Cryptographic integrity and supply chain due diligence

CIP exceeds the baseline requirements of the CRA by implementing advanced cryptographic measures to ensure software integrity. All release tags and tarballs must be cryptographically signed, providing unambiguous identification of committers and ensuring the source code has not been tampered with. Additionally, because CIP acts as an integrator, it performs extensive due diligence on upstream projects to manage risks within its software dependencies.

A culture of contribution with clear ROI

CIP is supported by numerous employees inside a relatively small set of active individual member companies. The project's core contributors are active, and they know each other well. This dynamic has enabled both ease of execution, and expeditious decision-making. The peer to peer learning, problem solving, and standard-setting opportunities that come from engagement in the project are key benefits noted by many of the project participants. Khasim Syed Mohammed, Director of Engineering, Processors Business Unit, Texas Instruments, describes the collaboration benefits as follows:

"One of the greatest advantages of the consortium model is that it brings domain experts from peer organizations together to address common structural roadblocks. Because many of us share the same commercial customers, designing a standardized software baseline ensures that the end users can seamlessly deploy security updates into their equipment without fragmentation. Learning from the best practices of our peers ensures that our technical teams can confidently address complex customer inquiries regarding safety manuals, compliance protocols, and certification processes."[20]

This collaborative learning model naturally triggers a deeper organizational shift. Rather than acting as passive consumers of upstream code, participating companies transition into active custodians of the platform. Shifting this corporate mindset allows members to proactively mitigate risk by co-steering the project's long-term technical trajectory. Takehisa Katayama, Director and CIP Governing Board Member at Renesas, explains how this active governance model redefines traditional engineering economics:

"Traditionally, semiconductor and industrial companies handled long term software validation entirely on their own, investing massive individual engineering effort to fix and validate identical base layer bugs. By shifting our corporate mindset from merely consuming an ecosystem to driving collective project governance, we can actively shape the Industrial Grade Linux standard from the inside out rather than working in isolation."[21]

Siemens, one of CIP's founding member companies, has more than ten employees from different lines of business contributing to the project today, with anywhere between five and eight employees contributing frequently. Team members support each other to not only use the project, but to become contributors outright.

Open source contribution typically comes in one of three forms: code, community, and financial, and often companies engage across multiple contribution types. Measuring the return on investment (ROI) that comes from contributing to open source projects has been a priority for open source practitioners, especially in recent years. In discussions with CIP member organizations, contributing

20 Khasim Syed Mohammed, interview.

21 Takehise Katayama and Chris Paterson, interview.

time, financial resources, and code combined is a highly worthwhile endeavor. CIP member Texas Instruments comments that the ROI from their contributions has been material. According to Khasim Syed Mohammed,

> "While our gold membership requires an active investment—both financially and in the dedicated bandwidth of our engineers who participate in technical steering committees and working groups—the return on investment is massive. The entry-level cost to independently monitor, maintain, and validate a kernel repository for complex vulnerability compliance across all our hardware platforms would be staggering. By pooling our resources within CIP, we drastically lower these maintenance costs while directly collaborating with fellow industry leaders to solve common regulatory hurdles."[22]

A similar value sentiment was shared by CIP member and contributor Hirotaka Motai, expert software engineer and Open Source Program Office (OSPO) staff at Cybertrust Japan Co. He says, "The real value of the project lies in the open community discussions. Member companies gain direct access to active product engineers who bring real-world development insights and field experience to the table from the exact same perspective."[23]

And it's not just CIP projects and workstreams themselves that are the beneficiaries of CIP community contributions. CIP stakeholders actively engage in the review and testing of upstream stable kernels, making the Linux kernel project better for everyone. Testing takes place through a dedicated Working Group, whose objective it is to design and implement testing infrastructure that can be used to test CIP software on a suite of reference hardware.[24] Additionally, CIP project leaders have made significant upstream contributions to projects like the Debian Linux distribution, and to KernelCI, a Linux testing framework.

22 Khasim Syed Mohammed, interview.

23 Hirotaka Motai, written interview with the author, 26 June, 2026

24 Linux Foundation Wiki, "Centralised Testing," Civil Infrastructure Platform, accessed September 15, 2026, https://wiki.linuxfoundation.org/civilinfrastructureplatform/ciptesting/centalisedtesting.

Challenges to overcome

As much as CIP participants describe the project as critical, and their long-standing, trusted working relationships as being highly collaborative, the CIP community is by no means an exclusive one. Yet new entrants are not frequent, comparatively, to the growth experienced by other open source projects. The leading challenge that surfaced from discussions with project leaders was the need for greater participation by an increasing number of enterprises, which is necessary for the project's long-term sustainability.

In particular, expanding corporate membership would help resolve a persistent structural friction within the community, that being the synchronization of physical hardware development lifecycles with the project's software release cycles. Currently, aligning the commercial launch of new silicon with the fixed, two-year cadence of the SLTS kernel presents an operational hurdle. Because new Systems on a Chip (SoCs) frequently head into production during off-years, hardware manufacturers can experience lag times of up to eighteen months before their new platforms can officially latch onto a fully stable SLTS release.

Resolving this hardware enablement gap requires a delicate balancing act for the project's Techical Steering Committee. The community cannot realistically scale up to support every single annual Linux release for a full ten-year lifecycle, as doing so would create an unsustainable and overwhelming workload for maintainers. This is where bringing more silicon suppliers into CIP is a strategic priority for the project's leadership. Greater involvement would bring fresh perspectives, allow closer alignment with different hardware, and help standardize industrial-grade SoCs.

Chris Paterson, senior staff engineer at Renesas and chair of the CIP Testing Working Group, reflects on the opportunity that new member participants would create. He says, "Looking ahead, CIP will continue to succeed by attracting more member companies and expanding its capacity to maintain multiple kernel generations in parallel over very long periods. Over the next ten years, I believe this ecosystem will grow to a scale where maintaining ten kernels for ten years becomes realistic, fully delivering on CIP's shared industry vision."[25]

A few participants who engaged in interviews called for the need to expand communications and marketing efforts, which would be facilitated by the funding from an expanded member base. In the meantime, CIP leaders are taking matters into their own hands. This year, several CIP members have contributed to a blog series describing the project's value proposition. The project's community days, aligned with various open source summits hosted globally, serve as "open doors" for new contributors and prospective future members to learn more about the opportunities that membership brings.

Indeed, the enthusiastic and engaging nature of current member representatives in the course of conducting this research, is, in this author's estimation, a healthy signal that newcomers will be made to feel welcome.

25 Takehise Katayama and Chris Paterson, interview.

The road ahead: CIP into the future

Building modern infrastructure on systems that are completely updatable is easier said than done. Hardware is not easily updatable, and many systems can't modernize in the near term, let alone overnight. This is the reality facing industrial infrastructure today, and it is what lends itself to the CIP's foreseeable, long-term utility within the industrial-grade manufacturing sector for years to come. As organizations look to optimize their innovation costs and streamlinine their industrial architecture, the CIP project will continue to play a vital role for companies.

This evolution signals that the project's utility is shifting from a reactive maintenance model to a proactive architecture strategy. For long-term sustainability, the consortium must safeguard the broader pipeline of open source components feeding into these multi-decade deployments. Hirotaka Motai, Expert Software Engineer and OSPO staff at Cybertrust Japan Co., Ltd., emphasizes that the long-term roadmap extends far beyond simple risk mitigation. He says, "Looking ahead, CIP is expected to be much more than just a bug or vulnerability fixer. The project's ultimate value lies in building and leading a robust, end to end software supply chain that enhances the entire Linux ecosystem."[26]

Mike Dolan of the Linux Foundation agrees with the positive outlook for the project. He says, "Looking ahead, we can always wish that industries would constantly migrate to the latest software, but if that software requires re-architecting everything, throwing the whole system out is simply not an option. This is where CIP plays a critical role for the future. When you are dealing with multi-decade infrastructure where the hardware cannot be modernized, CIP becomes absolutely essential."[27]

26 Motai, interview.
27 Dolan, interview.

10 years of resilient identity: The CIP logo

As the Civil Infrastructure Platform (CIP) celebrates its 10th anniversary, its visual identity stands as a testament to industrial longevity. Craig Ross, who leads the creative support team at the Linux Foundation, says, "The logo's geometric forms and fluid lines reflect the strength of critical infrastructure, evoking energy, protection, industrial quality, transportation, utilities, and enduring system reliability worldwide."[28] To honor a decade of open source collaboration, Ross's team, in collaboration with the CIP marketing committee members, created a slightly modified version that holds true to the original. He adds, "The 10th Anniversary brand reflects the strength of the project as it embarks on future initiatives."[29]

10th Anniversary
CIVIL INFRASTRUCTURE PLATFORM
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28 Craig Ross, written interview with the author, 27 May 2026
29 Ross, interview.

Civil infrastructure for the greater good

Beyond giving corporations value, CIP plays a broader role in the context of global societal good. Like all open source software, CIP helps to advance Goal 9 of the United Nations Sustainable Development Goals: Industry, Innovation, and Infrastructure. Goal 9 aims to "build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation."[30] Arpit Joshipura of LF Networking, LF Edge, and now LF India, connects the important dots for how CIP delivers on Goal 9's promise. He states, "If we look at the fundamental premise of OSS, it is [a high percentage] of any stack or any industry. It is that percent that is common, that is shared, and that is nondifferentiated," where companies "create this software layer together, once."[31] This principle of waste minimization, access, and availability, especially at a time when resource costs are high, should provide some welcome relief to industrial innovators.

Importantly, CIP embodies both the inclusive spirit intended by Goal 9 and its ability to accelerate the goal's objective. Its benefits go beyond industry ROI. The maintenance and security of civil infrastructure has a material impact on people, regardless of where in the world they live. When our roads and trains and energy systems function, the conditions for civil harmony are realized. Cybertrust Japan Co.'s expert software engineer and member of the OSPO staff, Hirotaka Motai, connects the higher purpose of the CIP's work, and its significance to his organization. He states, "To achieve our purpose of protecting the peace and safety of our digital society, working with CIP is a truly important core for us. Through this project, we support the safety and sustainability that social infrastructure needs right from the open source software layer."[32]

The CIP project is a place for manufacturing and civil infrastructure organizations from anywhere in the world to come together to jointly safeguard the security of social infrastructure, today, and in the future. The benefits transcend business for the benefit of humanity, as they do across all open source. All are welcome.

30 Goal 9, "Industry, Innovation, and Infrastructure," United Nations, n.d., https://sdgs.un.org/goals/goal9.

31 Kirsten D. Sandberg, "Open Source for Sustainability: How Projects under the Linux Foundation Are Helping to Advance the UN Sustainable Development Goals," foreword by Bilel Jamoussi, The Linux Foundation, September 2023.

32 Motai, interview.

Concluding calls to action for civil infrastructure stakeholders

To sustain global momentum and secure multi-decade deployments, civil infrastructure stakeholders should build capabilities in four strategic areas:

1. **Transition from open source consumers to active community stewards:** Relying passively on open source baselines introduces maintenance liabilities over extended product lifecycles. Organizations must shift their culture to one that is rooted in greater open source collaboration across engagement types (code, community, and financial). Through more active community participation and stewardship, companies can chart technical roadmaps and share the validation burden rather than working in isolation.
2. **Implement security by design to mitigate the super long-term support burden:** Safeguarding multi-decade infrastructure requires moving away from ad-hoc, fragmented patch management. By adopting — and contributing to — verified, industrial-grade baselines that offer predictable stability updates and continuous automated validation over ten- to twenty-year horizons, organizations can ensure that their products are resilient against modern vulnerability threats.
3. **Mutualize regulatory risk management to lower compliance overhead:** With global cybersecurity frameworks like the Cyber Resilience Act approaching enforcement, organizations should leverage the approaches and standardized frameworks developed through consortia like CIP. Pooling market expertise to achieve global certification requirements leaves ample room to focus engineering bandwidth on product differentiation, and speeds time to market.
4. **Drive ecosystem sustainability through hardware alignment and active engagement:** Ensuring long-term project viability requires a diverse, expanding community of enterprises and silicon suppliers working together. Device manufacturers and chip vendors must actively engage in CIP to bridge the operational gap between physical silicon development lifecycles and stable software releases. By committing to an upstream first methodology collectively, the industry can standardize industrial-grade Systems on a Chip (SoCs) and build a robust, end-to-end software supply chain.

Methodology

This qualitative study combines primary interview data gathered in 2026 with a textual analysis of secondary sources. Primary insights reflect firsthand perspectives from in-depth interviews with Civil Infrastructure Platform (CIP) project leaders, Technical Steering Committee members, and Governing Board representatives, who volunteered to participate.

LF Research uses generative AI tooling in varying degrees for research-related tasks including aggregating secondary sources, synthesizing data, supporting report drafting, copyediting, and localization. Authors review the AI-generated output and take full responsibility for the content of the published report.

About the author

HILARY CARTER joined the Linux Foundation in 2021 to launch and lead LF Research, established to deliver empirical insights into open source trends, opportunities, and challenges. Prior to joining the Linux Foundation, Hilary was the managing director of the Toronto-based Blockchain Research Institute, a global, syndicated think tank focused on blockchain technology. She has contributed to nearly 200 research projects focused on open source innovation and its adoption across industries. Hilary holds a Master of Science in Management from the London School of Economics, and is a dual Canadian and Irish citizen.

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Resources

CIP Project Website

CIP Charter

CIP Security Working Group

CIP Documentation

x.com/linuxfoundation

facebook.com/TheLinuxFoundation

linkedin.com/company/the-linux-foundation

youtube.com/user/TheLinuxFoundation

github.com/linuxfoundation

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CIVIL INFRASTRUCTURE PLATFORM
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The Civil Infrastructure Platform ("CIP") is a collaborative, open source project hosted by the Linux Foundation. The CIP project is focused on establishing an open source "base layer" of industrial grade software to enable the use and implementation of software building blocks in civil infrastructure projects. Currently, civil infrastructure systems are built from the ground up, with little re- use of existing software building blocks.

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