WHITE PAPER

IP and Data Management

Challenges, Solutions, and Best-in-Class Approaches

KEYSIGHT

Overview

The electronic design industry is characterized by its reliance on rapid innovation, collaborative workflows, and precise execution. Yet, as projects become increasingly multifaceted, traditional approaches to IP and design data management often fall short, creating bottlenecks in productivity and collaboration.

Between September 2024, and October 2024, Keysight conducted an industry-wide survey that gathered insights from 912 professionals to evaluate the state of IP and design data management. This whitepaper synthesizes these insights, providing actionable recommendations to address identified challenges and prepare for future technological shifts.

What You Will Learn in this White Paper

This white paper provides a comprehensive overview of the current challenges and emerging trends in IP and design data management within the electronic design industry.

By reading this paper, you'll learn:

- Key challenges in IP and design data management, including version control and documentation issues
- How trends like AI, chiplets and simulation-driven design are reshaping workflows
- Core features of effective data management solutions
- How Keysight's SOS platform addresses these needs
- Industry examples showing real-world impact on innovation and efficiency management on innovation, compliance and time-to-market

Challenges, Solutions and Best-in-Class Approaches

Key Challenges in IP & Data Management

Modern electronic design teams face numerous challenges in managing intellectual property (IP) and design data throughout complex chip development cycles. The Keysight survey sheds light on the scale and impact of these challenges and highlights several critical pain points:

Version Control Complexities in Hardware Design

Companies invest heavily in developing reusable IP blocks, but poor management of these assets leads to under-utilization and duplicated work. In many organizations, design teams struggle to locate existing IP across siloed repositories, and tracking the relationships or versions of IP used in different projects is manual and error-prone. The survey found that when teams lack a centralized IP catalog, the result is to reinvent the wheel — designing components from scratch that already exist — due to difficulty finding or trusting older IP. This inefficiency not only wastes engineering

time but also introduces inconsistency and potential integration issues when IP dependencies (sub-IP versions, third-party cores, etc.) are not tracked rigorously.

These persistent issues highlight systemic gaps in training, enforcement of best practices, and insufficient integration between Version Control Systems (VCS) and design workflows. The result is inefficiency, increased error rates, and delayed project timelines.

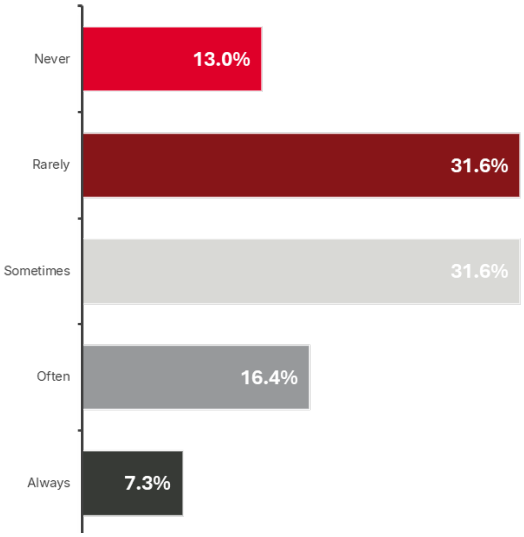


Figure 1. How often do you encounter issues with version control or tracking of your design files? Source: Keysight survey 2024

Documentation and Knowledge Bottlenecks

Documentation is a persistent bottleneck in design workflows. Critical information about IP (specifications, integration guidelines, test results) is often scattered in disparate documents or email threads. A lack of standardized documentation and cataloging forces engineers to hunt for details or rely on tribal knowledge, slowing down projects. Our survey showed that 55% of engineers reported that keeping documentation in sync with design data is a major pain point – outdated or missing documentation can stall design reviews and cause miscommunication. Without an integrated way to capture design intent, requirements, and change histories alongside the data, teams face avoidable delays and quality issues.

Conventional version control tools, while effective for software, struggle in hardware design environments. IC designs produce large binary files (schematics, layouts, etc.) that traditional text-based version control systems cannot handle efficiently. Engineers often encounter poor user experiences and workflow inefficiencies when using software-centric tools for hardware data. The inability to diff or merge binary design files and the lack of hardware-specific version tracking lead to frequent errors and lost productivity.

Respondents rated knowledge accessibility as “Moderate to Easy,” yet poor documentation remains a recurring issue. Inconsistent practices limit knowledge transfer and impede cross-team collaboration.

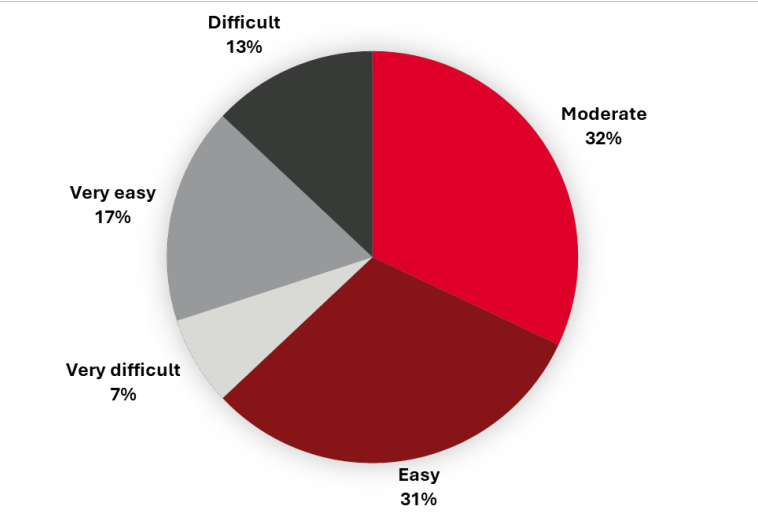


Figure 2. Knowledge Accessibility. Source: Keysight survey 2024

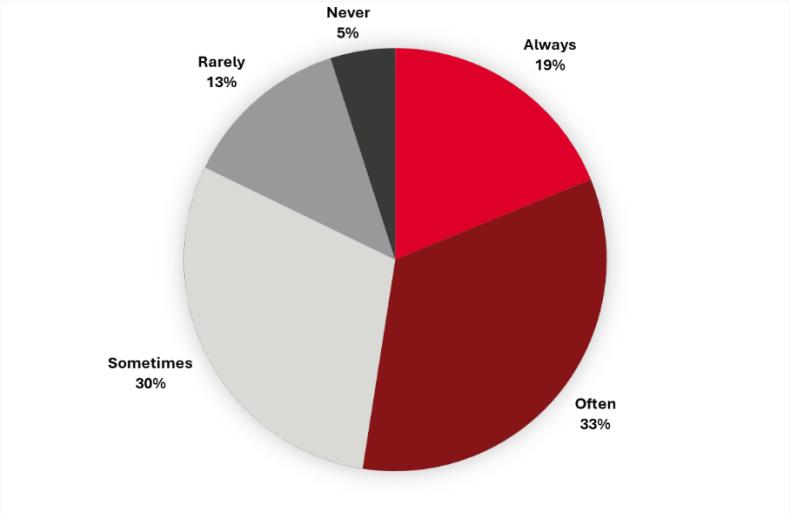


Figure 3. Documentation of IP Components. Source: Keysight survey 2024

Documentation is often deprioritized in favor of immediate project deadlines, resulting in the loss of valuable design rationale and knowledge. This not only hampers future reuse but also leads to repetitive mistakes and missed opportunities for innovation

Dependency Tracking Inefficiencies

On average, dependency tracking consumes nearly 29% of total project time, with teams managing IP, licenses, and third-party components manually or through fragmented systems.

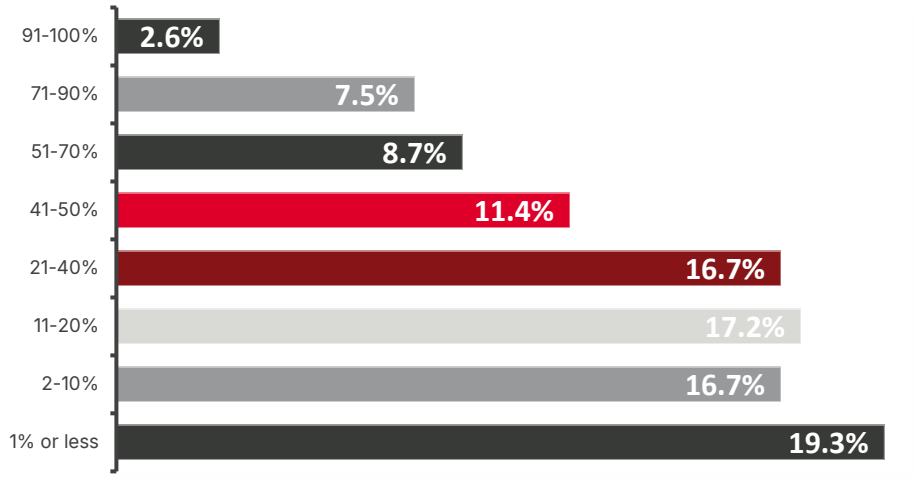


Figure 4. What percentage of your project time do you spend tracking IP, dependencies, and/or 3rd party licenses? Source: Keysight survey 2024

This represents a significant drain on resources. The lack of automation or centralized tracking systems creates redundancies, delays, and risks of compliance lapses.

Storage and Network Strain from Design Data

The volume of data in semiconductor design has exploded, straining existing infrastructure. Traditional distributed version control approaches (e.g., cloning full repositories for each user) become impractical when each repository contains gigabytes of binary data and years of history. It is not uncommon for every engineer on a project to maintain a full copy of all design files, consuming costly high-performance storage and network bandwidth. In our survey, 60% of the respondents noted inefficient use of storage as a growing concern – large design teams may maintain dozens of duplicate data sets, and syncing these over global networks wastes time. Inefficient data storage not only incurs high IT costs but also slows down check-in/check-out operations, directly impacting development speed. There is a clear need for more storage optimized approaches to design data management.

Future Technology Trends Impacting Design Workflows

Emerging technology and workflow trends are further complicating IP and data management. For example, simulation-driven design is on the rise – over 70% of design teams expect to perform significantly more simulations in the next two years. This shift-left approach means even more

data (waveforms, results, models) that must be stored, versioned, and correlated with design revisions. Likewise, the promise of future AI/ML tools in EDA to automate design tasks must be tempered by the reality that the technology will generate substantial additional data (multiple design variants, exploration results) that can overwhelm traditional data systems.

Another trend is the move toward chiplet-based architectures and heterogeneous integration, where systems are built from many interdependent IP components. This approach improves flexibility and performance, but it demands rigorous data and IP tracking across a complex hierarchy of components and vendors. Finally, heightened security and compliance requirements (such as export controls and functional safety standards) mean design data must be tightly controlled and traceable. In summary, future-facing design workflows will produce more data, more interdependencies, and stricter process requirements than ever before – exacerbating the challenges above if not addressed with the right tools.

Requirements for an Effective Solution

To overcome these challenges, organizations need an IP and data management approach with several key capabilities. Based on industry best practices and the survey findings, an effective solution should provide:

- **Robust version control for large files:** Ability to handle very large binary design files without requiring full duplication for every user. This implies a centralized repository architecture that stores files once and lets users pull only what they need, avoiding costly clone operations. Techniques like intelligent caching or delta storage are crucial for efficiency.
- **Concurrent design collaboration:** A system to coordinate multi-user access to data, including features like file check-in/check-out or merge locking for binary files, so that designers can work in parallel without corrupting each other's work. Unlike text, binary EDA data often cannot be auto-merged, so the solution must manage edit conflicts (for example, by using exclusive edit locks on schematic or layout files). Real-time synchronization and update notifications are needed to keep distributed teams in sync.
- **Comprehensive IP catalog & dependency tracking:** A centralized IP repository where all IP blocks (internal or third-party) are cataloged with metadata and version history. The solution should automatically track where each IP is used and its dependencies within larger designs (e.g., which SoC uses a given core, and which version). This enables quick impact analysis (knowing what projects will be affected by an IP change) and prevents teams from losing track of IP lineage.
- **Integrated documentation management:** The ability to attach or link documentation and meta-information directly with design data and IP. All relevant artifacts – spec sheets, datasheets, verification reports, licensing info, etc. – should be stored or referenced in one platform. This ensures that engineers can easily find up-to-date documentation in context, without resorting to email or shared drives. Such integration reduces the "documentation chase" bottleneck and preserves institutional knowledge with the design assets.
- **Storage optimization and network efficiency:** Mechanisms to minimize data duplication and optimize storage use. For example, a central file cache with reference links for workspaces can prevent each user from storing redundant copies. The system should also clean up unused file versions automatically to save space. Efficient WAN transfer protocols or site proxies (caching servers) are needed to accelerate data access for geographically dispersed teams, ensuring that large files can be quickly synced across sites without overwhelming the network.

- **Scalability and performance:** The solution must scale to handle the ever-growing volume of design data and number of assets. As simulation data and design complexity increase, the data management platform should accommodate many terabytes of data and thousands of IPs without degradation. High-performance indexing and search capabilities are required so engineers can quickly query the repository (for instance, to find if an IP with certain characteristics already exists).
- **Seamless tool integration:** To encourage adoption, the IP/data management system should integrate natively with the EDA tools and workflows designers already use. This means plug-ins or interfaces for popular design environments (e.g. Keysight ADS, Cadence Virtuoso, Synopsys Custom Compiler, MATLAB, etc.) so that version control and IP access are available within the designer's GUI. A non-intrusive, intuitive interface is key – engineers should be able to version-control a schematic or pull an IP block from the catalog without leaving their primary design tool.
- **Security and access control:** Granular permissions to protect sensitive IP and design data are essential. The system should support role-based access control, encryption, and audit trails to ensure that only authorized personnel can view or modify critical data. This is especially important given today's concern over IP theft and the need to comply with standards (like ISO 26262 in automotive or export regulations). In short, the platform must safeguard IP while still enabling efficient sharing among those who need it.

By meeting these requirements, an IP and data management solution can significantly streamline engineering workflows. It would reduce errors caused by version confusion, save time by enabling reuse, and ultimately shorten design cycles – delivering a strong business advantage in faster time to market and lower development costs.

Choosing the Best Solution

Keysight's **SOS platform** delivers a unified, EDA-native solution for design data and IP management — built to meet the performance, security, and scalability needs of modern engineering organizations. Comprised of two complementary editions, **SOS Core** and **SOS Enterprise Collaboration**, the platform empowers teams of all sizes to manage design data intelligently, collaborate seamlessly, and transform engineering information into a strategic asset.

Born from Keysight's semiconductor heritage (the trusted Cliosoft™ technology, now part of Keysight), the SOS platform is purpose-built for hardware and electronic design, not a retrofitted software tool. It's ISO 26262 certified for functional safety and trusted across industries where reliability and traceability are paramount, such as automotive, aerospace, and semiconductor design.

Keysight SOS Core

High-Performance Design Data Management for Small to Mid-Sized Teams

Keysight **SOS Core** is the ideal solution for design teams that need enterprise-grade version control and collaboration in a simple, high-performance package. It provides fast, reliable access to large design datasets through an intelligent client-server architecture that eliminates the need to clone gigabyte repositories locally. Workspaces pull only the required data and reference a shared cache, dramatically reducing storage consumption and network load.

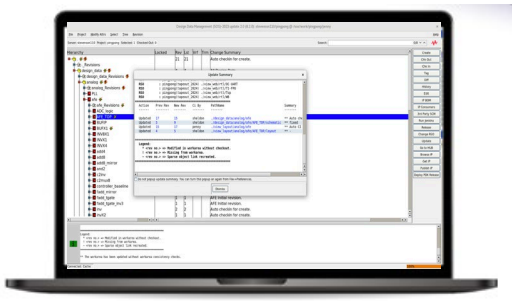


Figure 5. Keysight SOS Core

SOS Core integrates deeply with all major EDA tools, enabling engineers to check in/out designs, track changes, and visualize differences, all without leaving their familiar environment. Its **Visual Design Diff** capabilities allow schematic and layout comparisons that expose changes graphically, helping teams identify errors early and avoid rework.

Beyond version control, SOS Core captures metadata and lineage automatically, enabling IP reuse by design. Proven IP blocks can be quickly discovered and redeployed, accelerating time-to-market while maintaining consistency across projects. With built-in collaboration workflows, change isolation, and exclusive checkouts for binary data, SOS Core ensures data integrity and enables efficient concurrent engineering.

Scalable by design, SOS Core grows as your projects, teams, and data volumes expand — providing a clear upgrade path to **SOS Enterprise Collaboration** when your organization is ready to operate globally.

Keysight SOS Enterprise Collaboration

Global-Scale Governance, Security, and AI-Ready Data Infrastructure

For large, distributed design organizations, SOS Enterprise Collaboration extends the capabilities of SOS Core into a global, secure environment that unifies engineering data across sites and domains. It provides a single, traceable system of record for all design assets, connecting version control, IP management, and lifecycle tracking under one infrastructure.

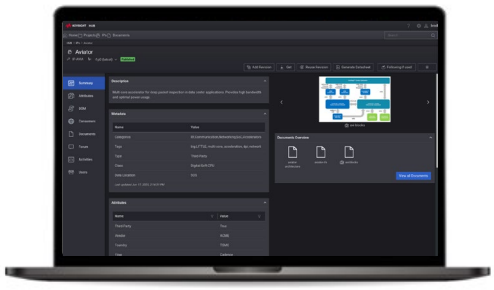


Figure 6. Keysight SOS Enterprise Collaboration

With role-based access control, built-in auditability, and compliance automation, SOS Enterprise Collaboration enables secure, governed data management that meets the demands of regulated industries. It provides full lifecycle traceability, capturing every dependency, IP relationship, and revision from schematic through verification and test. Engineers can instantly see where each IP is used, ensuring that any update, change, or vulnerability is traceable across the enterprise.

The platform also centralizes documentation, verification results, and metadata, ensuring that all design knowledge — from datasheets to simulation outcomes — is captured and accessible. Integration with PLM, ERP, and issue-tracking systems (such as Jira or Bugzilla) connects engineering data to the broader product lifecycle, eliminating silos and improving operational visibility.

Most importantly, SOS Enterprise Collaboration prepares data for the AI era. Its structured metadata and APIs make engineering information machine-accessible, enabling analytics, machine learning, and AI agent workflows. By turning data into an intelligent foundation, organizations can drive automation, improve design quality, and accelerate innovation at scale.

Why Keysight SOS

Keysight's SOS platform provides a complete, field-proven solution for design and IP data management — delivering the reliability of its semiconductor-proven architecture with the intelligence, scalability, and integration modern enterprises require.

- **SOS Core** empowers small to mid-sized teams with high-performance version control, EDA-native workflows, and metadata-driven IP reuse.
- **SOS Enterprise Collaboration** extends those capabilities to global teams, providing governance, traceability, and AI-ready infrastructure.

Together, they enable organizations to manage design data as a connected, intelligent asset — not just a collection of files. With industry certifications, a strong heritage, and proven scalability, Keysight SOS is the best choice for companies looking to move from **control to intelligence** — managing design data, connected and ready for the future.

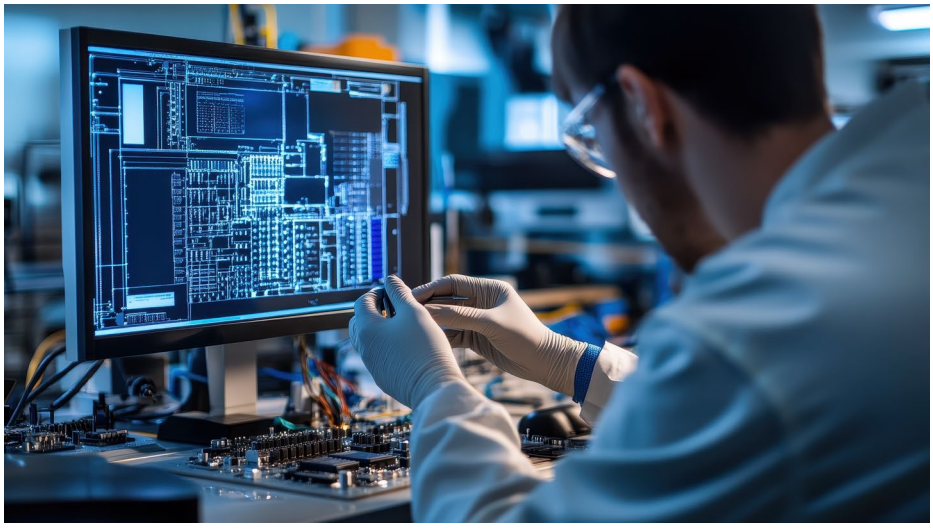
Industry Use Cases

Different technology sectors can reap significant benefits from Keysight's IP and data management solutions. Below we consider a few industry-specific perspectives:

Semiconductors (Integrated Circuit Design)

The semiconductor industry is at the core of IP and data management needs. Modern System-on-Chip (SoC) projects involve dozens of teams and often reuse hundreds of IP blocks across multiple chip designs. Traditional software-oriented data management falls short in this domain–semiconductor design data is simply too large and complex, and the workflows too specialized.

Leading chip companies are turning to Keysight Design Data Management and Keysight IP Management to create a unified engineering platform. This ensures that analog, digital, and RF design groups can collaborate in one environment with consistent version control, rather than using fragmented tools.

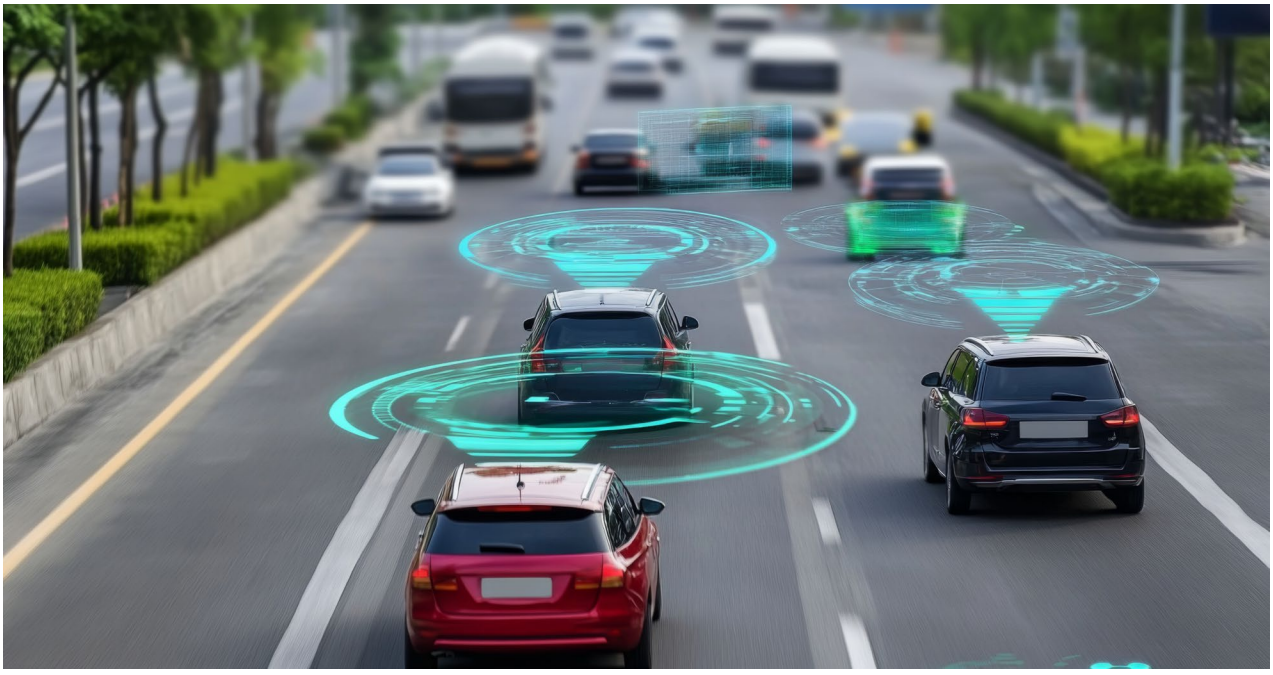


For instance, one group can instantly share a validated IP block through Keysight IP Management so that another group can integrate it, confident they have the correct version and all the documentation needed. By cataloging IP enterprise-wide, companies avoid duplicate design efforts and encourage IP reuse, which accelerates development schedules.

Keysight's solutions also improve design quality: engineers can trace when and how an IP was modified and verify that the latest requirements or spec changes were implemented, which is critical in avoiding silicon re-spins. In an industry where time-to-market and R&D efficiency are paramount, a platform that streamlines data management provides a tangible competitive edge. As one industry survey succinctly noted, purpose-built semiconductor data management tools are now essential to handle the complexity and scale of today's chip designs – exactly what Keysight delivers.

Automotive (ADAS and Safety-Critical Systems)

Automotive electronics developers face intense pressure to meet functional safety standards like ISO 26262. A single vehicle can contain thousands of ICs, many in safety-critical roles, and manufacturers must guarantee that every piece of hardware meets rigorous safety and reliability criteria. This translates to exhaustive traceability requirements – design teams must document every change, review, and test to ensure nothing falls out of compliance. Keysight's IP and data management platform is uniquely positioned to help automotive chip makers manage this complexity. In fact, Keysight's solution itself is ISO 26262-certified, meaning it has been vetted for use in safety focused development processes.



Using Keysight Design Data Management and Keysight IP Management, automotive IC teams can maintain a clear history of each IP and design data revision, linking them to verification results and requirements. If an anomaly is found during vehicle testing, engineers can quickly trace it back to a specific IC revision or IP version using the system's records, fulfilling the traceability imperative.

Additionally, Keysight IP Management's access control features allow companies to partition data (for example, firewalling safety-critical IP so only certain teams can modify it), which supports the concept of freedom from interference in safety design. Automotive projects also often involve collaboration with suppliers (external IP vendors or design partners); Keysight's platform enables secure collaboration by sharing only necessary data and IP through controlled hubs, rather than sending files ad-hoc.

The end result is that automotive semiconductor companies can innovate (e.g. in ADAS, electric vehicle power systems, etc.) with confidence that their design data infrastructure will support compliance, security, and efficiency at every step. This reduces the risk of costly recall or redesign situations and speeds up the certification of new automotive electronics.

Telecommunications (5G/6G and Networking Equipment)

In the telecommunications sector, companies designing networking ASICs, RF front-ends, and other communication hardware are dealing with extremely fast product cycles and massive data throughput requirements. For example, the rollout of 5G technology introduced complex chip designs that must be updated frequently as standards evolve. Engineers in this space generate enormous amounts of simulation and test data to validate performance across countless scenarios (different frequencies, loads, etc.).

Managing these datasets alongside the design revisions is a formidable task. According to an industry report, over half of electronics teams said that improved data sharing and integration across the workflow would directly speed up time-to-market for new products. Keysight's integrated solution addresses this need by linking design data management with downstream test data and by enabling geographically distributed hardware and validation teams to work from a single source of truth.

For instance, a telecom chip design team can use Keysight Design Data Management to version-control their FPGA prototypes and simulation models, while the test team uses the same system to pull the latest design configuration and later push back actual lab results. All of this data – design files, simulation outputs, test results – can be correlated through a common platform, eliminating manual data wrangling (which the survey noted can eat up months of engineers' time).

Additionally, telecom hardware often integrates IP from multiple sources (DSP cores, encryption engines, etc.). Using Keysight IP Management, a company can ensure that each of those IP blocks is approved, up-to-date, and licensed properly in every design variant, with full visibility. This prevents mistakes like accidentally using an outdated or unlicensed IP in a new board design, which in a fast-moving telecom project could otherwise be overlooked.

Ultimately, by bringing order to the data and IP chaos, Keysight's solutions help telecommunications engineering teams focus on innovation – optimizing 5G/6G performance – rather than wasting time on version hunts or data transfers. The faster they can iterate and validate designs, the quicker new network equipment can be deployed to the market. (Other industries, such as aerospace & defense or consumer electronics, similarly benefit from these capabilities, but the above examples illustrate the broad applicability of robust IP and data management in accelerating innovation across technology sectors.)

Conclusion

IP and data management may not always get the spotlight in engineering discussions, but as the survey findings make clear, it is a foundational element of successful product development. The challenges of version control, IP reuse, documentation, and data scaling are holding back engineering productivity in many organizations – yet practical, high-impact solutions exist today.

By implementing a dedicated IP and design data management platform like Keysight's, companies can dramatically improve their design workflows: engineers spend less time searching for files or reinventing designs and more time on actual innovation. They can trust that every team member is working on the correct version, that past knowledge is captured, and that scaling up to meet tomorrow's complexities (more data, more IP, more integration) will not result in chaos.

Keysight's IP and Data Management solutions offer a factual, field-proven answer to these challenges. This comprehensive platform balances technical depth (deep integration with EDA tools and support for advanced use cases) with business-oriented benefits (faster time-to-market, lower risk, and increased asset reuse). Companies adopting these solutions stand to gain in efficiency, collaboration, and ultimately competitiveness. Now is the time to take action. Don't let unmanaged IP and design data be the bottleneck in your organization's innovation engine. Keysight invites you to reach out for a closer look at these solutions – whether through a detailed discussion of your specific needs, a live demonstration tailored to your workflow, or even a pilot deployment to prove the value in your environment.

Contact Keysight today to start a conversation about optimizing your IP and data management. We encourage you to request a demo or a free trial of Keysight Design Data Management and Keysight IP Management platforms to see first-hand how they can transform your design workflow. Let us partner with you in eliminating the inefficiencies in your design lifecycle. With the right solution in place, you can focus on what you do best – engineering great products – while Keysight's tools take care of managing the data and IP that drive your success.

We look forward to helping you accelerate your next breakthrough design. (And when you do, you'll wonder how your teams ever managed without it.) To request a demonstration or trial of Keysight Design and IP Data Management.

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