BUSINESS WHITE PAPER

Automotive Industry Point of View

Pure Storage examines the IT needs for an industry in transition

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An Industry in Transition

The automotive industry has always embraced change and new technology. But the current changes happening in the automotive industry are more dramatic and happening faster than ever before, and these changes are being driven more by software than mechanical engineering. This is putting pressure on legacy automakers who are struggling to shift to new ways of managing data and software development—containers, open source data services, etc.—while simultaneously maintaining significant legacy IT systems.

This white paper presents the Pure Storage® view of the automotive industry from an information technology standpoint, based on the close relationships we've established with numerous automotive OEMs and part suppliers.

We begin with a brief history of automotive transformation and then discuss key challenges around software development, artificial intelligence, and other areas impacting automakers. We conclude by examining real-world use cases where Pure Storage has helped our automaker customers.

The Journey of Automotive Transformation

The history of the automotive industry has been one of continuous technological change. We've divided that history into four parts, as explained below.

The Analog Vehicle

The first modern automobile was produced by the Daimler Motoren Gesellschaft in 1901. Of course, this entirely mechanical vehicle had no digital features of any kind, and this form dominated for the next 80 or so years. This was the age of the internal combustion engine (ICE) vehicle, sometimes facetiously referred to as "the ICE Age".

Electronic components began appearing in 1922 with the electric starter. Many advances followed: the car radio (1930), power steering (1951), air conditioning (1953), anti-lock brakes (1971), and much more. With so much new technology and innovation by automakers, the digital shift was inevitable.
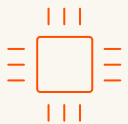
The Intelligent Vehicle

The shift to the intelligent, computerized vehicle began in 1968 when Volkswagen introduced the first truly computerized fuel injection system (designed by Bosch), which had an appropriately futuristic name of "Jetronic." But it wasn't until the 1970s that computerization started to become standard equipment. Chrysler introduced its Electronic Lean-Burn System in 1976 to manage spark timing. The first touch screen appeared in the 1986 Buick Riviera. By the 1990s, computers and sensors were everywhere and cars had truly become intelligent and digitized.

The Connected and Electric Vehicles

The next development was to connect the automobile to the world beyond the car. General Motors led the way in 1996 when the first OnStar system appeared in the Cadillac DeVille. By 2015, OnStar had processed over a billion customer interactions. OnStar was critical in proving out the subscription model for automakers.

What we normally think of as the "connected" vehicle came along in 2014 when BMW offered in-vehicle 4G services and included a built-in SIM card. Connectivity is now standard, and automakers are looking for services to offer beyond entertainment systems, such as remote diagnostics and predictive maintenance.

At the same time, electric vehicles (EVs) had a rebirth. EVs were actually quite common in the early 1900s before they faded out due to ICE competition from the Model T. There were several failed attempts at sellings EVs until Toyota released the commercially successful Prius in 1997. Since then, all the major OEMs have produced EVs while multiple startups, including Tesla (2006), have entered the market.

The Mobility Ecosystem

Most industry analysts predict a broadened mobility ecosystem that will go beyond automobiles to trucking, micro-mobility (e.g. electric scooters), robo-taxis, and even air mobility. At the same time, the rollout of 5G services is enabling "smart cities" to become a reality.

In the future, everything will connect with everything. Vehicle-to-infrastructure communication will provide direct communication between vehicles and the road infrastructure, which will allow for features such as automated traffic control.

The future of mobility is software-based. McKinsey notes that automakers and their suppliers are investing heavily in software. By 2030, the global automotive software and electronics market is expected to reach $462 billion.

Why Software is Vital to Automotive Transformation

The key to automotive transformation is software. Software will define winners and losers over the next decade, and billions in revenue are at stake. The market for autonomous driving (AD) and advanced driver assistance services (ADAS) alone may achieve $300 billion to $400 billion in revenue by 2035, according to McKinsey. Winning in this market will require flexible and highly responsive software-driven development processes that make use of fleet data as well as delivering consumer-focused services.

Firms will need to attract top-level coding talent, but they will also need a modern IT infrastructure for software development, testing, simulation (such as digital twins), analytics, and more.

Software will be critical for multiple revenue opportunities, including in-car payments, location-based services, security features and info-tainment such as music streaming. Car body and energy software are growing along with EVs, as are premium comfort features such as massaging seats and heated steering wheels.

Barriers to Effective Software Development

With software and electronics at the forefront of automotive transformation, it is vital for automakers to evaluate their readiness to shift forward. While the critical issue of successful developer hiring is beyond the scope of this paper, we will look at challenges in both software development and supporting IT infrastructure.

These challenges are especially relevant to legacy automakers who have IT departments that can stretch back to the 1950s with mainframe computers and the 1980s with IBM AS/400 systems which were prominent on the manufacturing floor. There is also a history of monolithic data architectures, with huge database silos running Oracle, SQL Server, or IBM DB2. The newer, all-electric manufacturers are not hindered by these older IT design choices. The legacy OEMs are faced with the need to move to new ways of doing things, while simultaneously maintaining legacy systems during a transition period that may take decades.

At Pure Storage, we have identified several areas of concern:

- **New applications and data services**: The future of software development is containers, open source data services, and object storage. Without mastering these, it is highly unlikely an organization can take a leading role. However, these may not be compliant with current IT practices or part of the IT department's skill sets.

- **Intensive performance demands at scale**: More data than ever is being generated and needs to be saved, stored and processed. Analytics and artificial intelligence (AI) processing adds further performance stress. Legacy compute and particularly storage infrastructures may not be up to the task. Scaling systems to meet data needs is one of the most difficult IT challenges to solve.

- **Increased IT complexity**: Having to maintain legacy systems while simultaneously rolling out new applications and data services can stress even the best IT teams. Standard IT operations—backup and restore, disaster recovery, data migrations, etc.—are fundamentally different for containers.

- **Data center power and space constraints**: At the same time that data is growing, many organizations find themselves constrained by power and space limitations in the data center. How do you store more data than ever, while maintaining or even reducing your power and rack space consumption? Buying more of the same equipment can't solve the problem.

- **Cyber resilience, data protection and rapid recovery**: In close alignment to the software-defined architecture that auto manufacturers are pivoting to, a modern storage architecture also needs to be resilient with robust air gap and safe, protected snapshot methodologies. It should offer several layers of protection and business continuity in the event of contingencies. Rapid recovery of data is also another critical requirement.

For all of these reasons, organizations are struggling to modernize IT practices. AI projects add further challenges, which is why according to a Gartner survey, only about half of AI projects make it from pilot to production. Legacy systems cannot solve these challenges.

How Pure Storage Can Help Automakers Modernize

The Pure Storage portfolio of hardware and software solutions offers immediate benefits in meeting the challenges outlined above.

- **A modern data architecture**: Unlike our major competitors, Pure Storage is not held back by an outdated storage architecture. Other storage vendors were born in the era of disk-based systems and were limited in their design choices when modifying for all-flash. Pure Storage started as an all-flash company with a clean design slate. This gives us a fundamentally different storage architecture that our competitors cannot match, and provides advantages in terms of performance, reliability, data reduction, and more. While this is not the place for a deep dive on our differentiation, we invite you to peruse our Better Science blogs here and here for a detailed discussion on what makes us better than others in the market.

- **Low latency and high bandwidth**: Performance is always a concern, and it comes in two dimensions. Low latency is required for transactional workloads that need fast response time, like legacy databases or containers that run databases. To use an automotive metaphor, latency is like drag racing. You are trying to get one vehicle, or transaction, from point A to point B as quickly as possible. The other aspect of performance is bandwidth. Bandwidth is like a ten lane highway. The goal is to move as many cars as possible from point A to point B without running into a traffic jam. Large amounts of bandwidth are needed for applications such as analytics, artificial intelligence, software code repositories, and so on, along with any workload that needs to move large volumes of data at the same time.

  For storage systems, latency and bandwidth are fundamentally different problems to solve. In some cases, both are needed for the same workload. The Pure Storage FlashArray™ and FlashBlade® product families provide performance in multiple dimensions, and we have solutions that will fit your needs whatever the characteristics of the workloads.

- **Simple to deploy, simple to use**: It takes a tremendous amount of effort to make a solution easy. A laser focus on ease of use is a founding principle of Pure Storage, and we don't release any new features before we've made them as foolproof as possible. Complexity results in human error, and that can have serious consequences to the point of system failure and data loss. Plus, the simpler we make our storage, the more time your IT department has to spend on their many new priorities. Our users constantly tell us how they "don't have to worry about storage anymore."

Since no storage operates by itself, we also focus on making sure we have effective integrations across databases, virtualization platforms, analytics platforms, containers, etc.

- **Continuous innovation**: Just as the automotive industry has a history of innovation, we at Pure Storage never rest on our success, and we're always pushing forward with new features, and better hardware. All software features are included, so you never pay to add a new capability. Hardware and software upgrades are non-disruptive. In addition, our unique Evergreen® technology means that you can update hardware components in-place without having to bring down services. This even applies to controller updates, and Pure Storage has successfully updated over 10,000 controllers with our customers.

And Pure doesn't just innovate technology. We've changed the way automakers can buy software and storage with our Evergreen buying models that range from traditional CapEx to a fully subscription-based offering.

How Pure Storage Delivers on Automotive Use Cases

Pure Storage is helping automakers modernize to drive revenue, increase margins, bring cars to market faster and be more competitive while boosting their sustainability.

World Class Manufacturing

The manufacturing floor is the beating heart of any automaker or parts supplier. Reliability is key as production line downtime can easily cost $1 million per minute or more.

This is why the proven system reliability of 99.9999% across the Pure Storage user fleet of FlashArray systems resonates with automakers. Our users are able to upgrade array software and hardware non-disruptively and without downtime, so manufacturing lines can run continuously. This is why a large automotive OEM is deploying FlashArray globally to all of its manufacturing facilities. They also subjected the array to multiple stress tests which it passed with flying colors.

The performance of Pure Storage solutions is also vital to run the database workloads and SAP systems that often underlie the manufacturing process. Exchange of computer aided designs, simulation data and any other applications required to align with workflows between design engineering and manufacturing will require a modern, high-performing storage and data management architecture to ensure no loss in productivity with rapid time–to-market.

Improved Customer Experience

Software development will define the customer experience, and a positive experience will strengthen brand loyalty. Portworx® Kubernetes data platform greatly simplifies storage management for containers, helping out your IT team who may not have the depth of experience needed. Even better, Portworx makes your developers more productive, because it allows them to directly access storage resources via code.

One large automaker is using Portworx to deliver on cloud-native development efforts, reducing time to market. Portworx can work with any physical storage, but Pure Storage users gain additional integration benefits. Portworx also works with most major public cloud Kubernetes offerings, giving you an easy hybrid-cloud strategy that makes container mobility push-button easy.

Autonomous Vehicles and Mobility

AD and ADAS are dependent on massive amounts of training data that needs to be ingested, processed and then loaded elsewhere in the pipeline. These are all high-bandwidth tasks. When costly GPUs are being used to process the data, the underlying storage often cannot "feed" the GPU fast enough, meaning cycles and capacity are wasted.

Pure Storage FlashBlade is a massively parallel file and object storage platform that can feed the hungriest GPUs and let you maximize investment value while reducing project timelines.

NavInfo, a company that develops advanced mapping and simulation models for car manufacturers, uses FlashBlade to power their NVIDIA GPU servers.

Vehicle Electrification

The electric vehicle is sometimes referred to as "the smartphone on wheels," and EVs are far more software-dependent than ICE vehicles. Whether for components such as thermal management systems or battery development, or for user experience features, software is at the forefront.

Pure Storage FlashBlade arrays deliver the processing bandwidth needed to speed up software development, reducing project timelines. FlashBlade can enhance performance of software repositories such as Perforce or ClearCase. And it's massively scalable. This solves an adjacent problem of data being distributed across disparate silos which can't easily serve as a single source of truth. It's also ideal for centralizing battery analytics to enhance design.

Flexible purchasing options from Pure Storage also allow automakers to scale up or down easily as project needs change, without either over- or under-spending.

5G Edge Services

Data collection at the edge will be greatly enhanced as 5G services become more widely available. A high-bandwidth infrastructure is critical for receiving the data generated by vehicle sensors, video, RADAR, LIDAR, GPS, and other processes and funneling it through data pipelines, AI/ML modeling, and other processing. One major OEM uses both FlashBlade and FlashArray to provide a high-performance, ultra-reliable storage infrastructure that ensures projects keep running and developers stay productive.

At the same time, Kubernetes is emerging as the preferred model for application delivery due to agility, resilience, speed of updates, easy expansion to public cloud compute, etc. Containers are even being deployed onboard vehicles to create a seamless service mesh. Portworx provides the ideal management platform for edge service delivery.

Net Zero and Sustainability

Sustainability concerns are certainly wider than the IT department, but the data center remains a critical opportunity for power reduction. Data growth and new, power hungry initiatives like AI and machine learning are also stressing power capacity and rack space.

The storage products from Pure Storage use unique technology that allows them to be far more power efficient, using up to 80% less power and generating fewer carbon emissions than competitive all-flash systems. They also have extreme levels of data density to reduce rack space. Pure Storage has also delivered all-flash storage that competes directly with disk systems, offering superior performance, density, and power consumption at a similar price point. In addition, Pure Storage products create far less e-waste over the lifetime of the storage.

As the data footprint in the automotive ecosystem grows at over 40% CAGR, the Pure Storage technology roadmap projects roadmap projects continued lowering of unit energy consumption ($/GWHr) and unit carbon emissions ($/metric ton of CO_2), while also achieving new levels of system density with larger flash modules.

Conclusion

The automotive industry has come a long way from analog-only vehicles and monolithic IT data structures. With auto technology moving faster than ever before, automakers need fast and resilient data storage that can support the agile, containerized data services they need to support critical use cases.

As a partner to multiple automakers and parts suppliers, Pure Storage has the storage and software solutions you need to drive success and lead in a fiercely competitive marketplace. With the highest level of technology investments compared to our industry competitors backed by industry's best CSAT rating, we aim to continually innovate and provide the highest economic value for the software defined automotive ecosystem.

Additional Resources

- Explore Pure Storage automotive blogs and our industry page.

- Watch the video version of Pure Storage's Automotive Point of View.