



Dell's Strategic Convergence:

How Innovation in Sustainable
Product Design Delivers Quantifiable
ROI and Reduced TCO



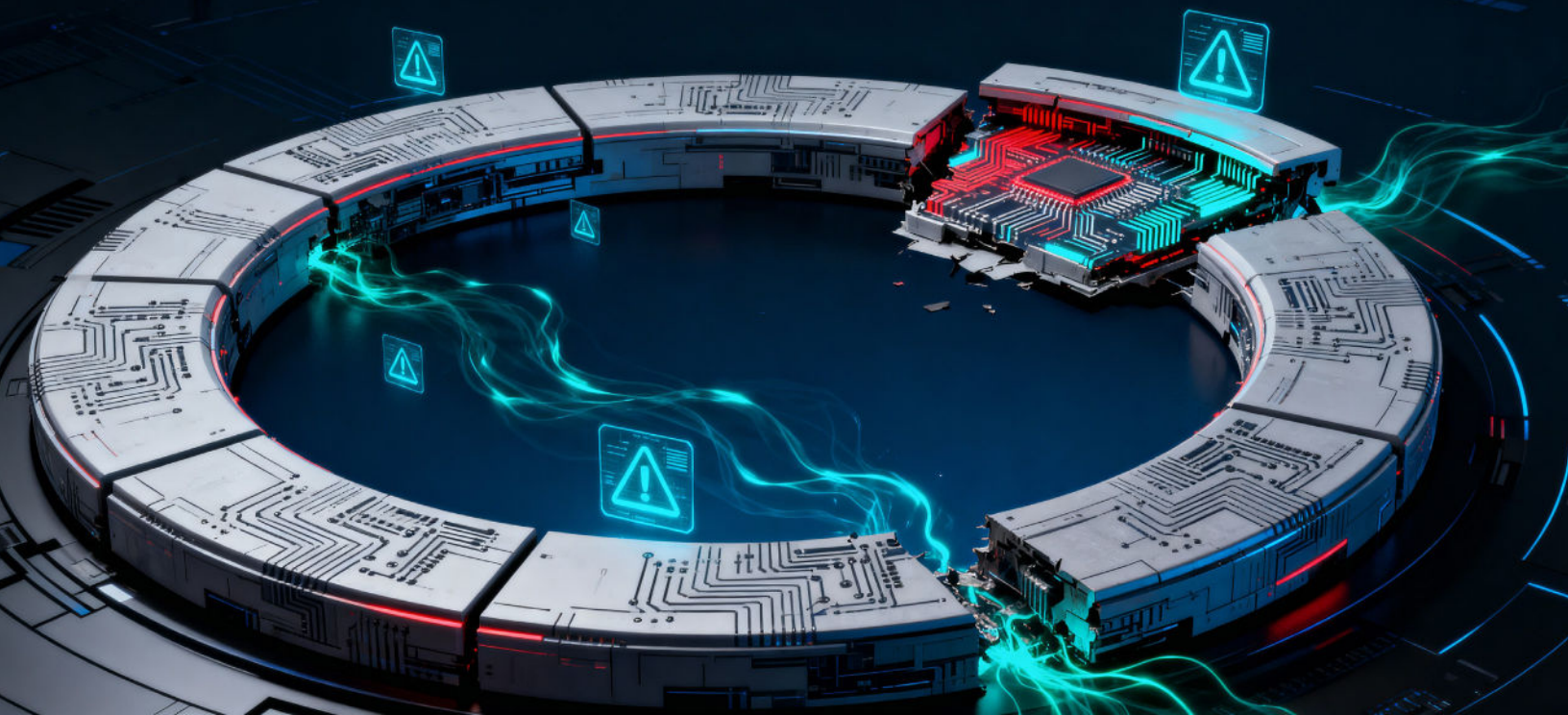
I. Executive Summary: The Strategic Imperative

The global electronics industry operates on a fundamentally linear economic model (extract, manufacture, use, dispose) that is neither economically nor environmentally viable for enterprises. Dell Technologies has been steadily moving beyond this model, using both product innovation and ambitious sustainability goals to demonstrate a direct link between circularity and ROI (return on investment), while improving customer value in the process.

Dell Technologies' ongoing transformation of the product lifecycle to a circular IT model lowers TCO (total cost of ownership), and maximizes ROI for enterprise customers. Two of the innovations driving this effort are Design for Serviceability (DfS) and integrated service offerings.

Table 1: Key Findings Snapshot

Metric	Impact	Quantified Value (3-Year NPV)
Pain Point Mitigation	Advanced modular design (e.g. the modular USB-C introduced in select CY25 commercial notebooks) reduces PC disassembly time	Reduces disassembly time both for repairability and for material recovery, which lowers employee productivity and increases IT help desk tickets
Financial Performance	Dell APEX PC-as-a-Service (PCaaS) shifts CapEx to OpEx	Significant ROI and Net Present Value (NPV) for the composite organization
Cost Efficiency	Design for Service principles and integrated support services	Lowers device lifecycle support costs and minimizes user device downtime
Circularity	Asset Recovery Services and Lifecycle Hub offerings	Ensure that PCs are responsibly assessed for repair, refurbish, and redeployment before recycling efforts



II. Critical Challenge: The Cost of Linear IT

The IT industry's reliance on a "traditional" linear economic model has produced twin crises for enterprise customers: the first involves mounting environmental liabilities and the second results in accelerated TCO.

The Mounting E-Waste and Longevity Crisis

Global e-waste is projected to reach over 80 million tons by 2030¹. This problem is primarily caused by a combination of products often being designed for finite, and typically short, lifecycles with a few accessible repair and life-extension options. This is compounded by consumer demand for faster innovation cycles and frequent feature improvements in electronic devices.

For enterprises, this product architecture creates four critical pain points:



High Disposal Costs: Managing, transporting, and legally disposing of obsolete equipment can be complex, costly, and resource-intensive.



Supply Chain Risk: Dependence on critical materials exposes supply chains to resource scarcity and volatile commodity prices.



Reputational Risk: Being seen as a contributing cause of e-waste through poor end-of-life management can create significant public-facing risks for enterprises.



Security Risk: If not managed by a reputable partner, such as Dell Asset Recovery Services, PCs could potentially not have the data securely deleted, or worse, even shipped to hostile parties and regions that could exploit it.

¹ "The global E-waste Monitor 2024", UNITAR, November 2024

The Economic Inefficiency of Aging Fleets

The true cost of hardware extends far beyond the initial purchase price. For instance, maintenance and support costs rise as PCs age, often making both prohibitively expensive beyond the average warranty period. This helps explain why the optimal refresh cycle is roughly three-and-a-half years. Organizations with longer or delayed refresh cycles often incur higher costs in the form of reduced employee productivity and increased IT help desk tickets.

To make matters worse, traditional CapEx models with large, sporadic capital outlays further discourage the consistent, proactive fleet rotation, let alone the kind of circularity necessary for modern TCO efficiency.

Navigating the Regulatory Landscape

Furthermore, these economic pressures are also compounded by a rapidly changing regulatory environment. The global 'Right to Repair' movement (now codified in numerous jurisdictions, most notably by France and being adopted across the EU) mandates that manufacturers provide consumers and independent shops with access to parts, tools, and manuals.

Simultaneously, evolving ESG compliance requirements and regulations are forcing IT leaders to proactively seek verifiable, more sustainable, and more efficient hardware solutions to avoid regulatory and investor risk. As a result, the market now rewards suppliers that can demonstrate a clear, governed path to circularity.





III. Product Innovation to Address IT Pain Points: DfS

Dell's response to both the e-waste crisis and Right to Repair movement is rooted in Design for Serviceability (DfS), a core engineering philosophy that dictates how products are built to extend their usefulness by allowing for multiple repairs and refurbishments before the eventual end-of-life for recycling.

The Modularity Mission (Concept Luna)

Dell's Concept Luna prototype, first introduced in December 2020², served as the lighthouse for the company's sustainable product design strategy, showcasing what a highly modular PC could look like. This strategic convergence of repairability and modularity is demonstrated by:



Disassembly Time Reduction: Dell's evolved design dramatically streamlines disassembly, reducing service time and lowering costs for repairs as well as material harvesting for refurbishing and recycling.



Reduced Friction: Concept Luna reduced the number of screws required to access internal components to as few as four and eliminated complex adhesives in favor of standardized fasteners.



Intelligent Telemetry: Continuous investment in ProDeploy and ProSupport have, for instance, integrated AI-driven telemetry to predict issues before they become a problem. Not only does this reduce downtime and maintenance costs but when a device does require maintenance, the built-in repairability provided by DfS-driven designs translates to faster, more reliable, and more cost-effective service outcomes.



Robotic Automation for Repair and Reassembly: Modular design and lack of screws allow a specialized robot to easily remove components, scan component barcodes for tracking, and reinstall the new component so that the device can be returned to the end user faster than it would have been with a more traditional model.

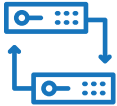
² "How Dell is Designing All of its Products for Circularity", Fast Company, December 2020

Engineering for Repairability and Serviceability

DfS principles based on insights gleaned from Concept Luna are already being integrated into Dell's commercial line, directly lowering the cost and complexity of repair and service:



Mainboard Size Reduction: Dell learned from Concept Luna that using a high-density interface (HDI) board could help significantly reduce the size of the main board (a significant contributor to product manufacturing emissions). Doing so creates additional space for more robust thermal designs, which in turn helps eliminate heat and thus improve battery life. The mainboard and I/O board design on the new Dell Pro and select Dell Pro Max PCs is reduced by up to 29% compared to the previous generation³.



Simplified Access for Commonly Used Components: Another innovative design inspired by Concept Luna is the development of more intentional I/O boards that allow PC ports to be repaired by replacing only the smaller I/O board, rather than the larger mainboard with its carbon-intensive components. For instance, when a commonly used power or display port begins to fail from normal wear, it can be swapped out more easily and with significantly lower e-waste and carbon impact. Dell's new battery designs (available on Dell Pro and select Dell Pro Max PCs) use fewer critical materials, contain more recycled content, and are end-user replaceable.



Smarter Design: Dell's modular USB-C port was uncovered as a key area of customer feedback following sessions related to the Concept Luna design. Many customers expressed a desire to improve access and repairability of the power port, as this port is used most often and can be damaged when the cord is unexpectedly pulled out by inattentive children, adults, and pets. This spurred a new innovation area related to improving the serviceability of the port, which resulted in durability improvements: The design delivers up to 4x better twist resistance and 33x better impact resistance compared to previous generations, improving durability and enabling easier repairs⁴. As an added bonus, this design aligns well with French Repair Index criteria, which include a dedicated score for the power port and spare parts associated with it.



Tool-Less Access Back Cover (Dell Pro Max Plus): Designed without screws (although an optional screw can be added for additional security), customers can easily slide the back cover off of the notebook to access components such as the battery, memory, and storage. This access is critical to users who are often upgrading these key components and allows for an extended lifecycle, while also simplifying repairs.



Tool-Less Chassis Design (Dell Pro Desktops): With a simple thumbscrew, customers can easily slide off the side cover to access internal components, making upgrades and repairs quick and hassle-free.



Digital Entry QR Codes and AR App Tutorials: 2025 products feature QR codes on the internal and external components of the device that link to support pages featuring intuitive repair guides. The Dell AR Assistant app (free and available in the app store) also offers step-by-step augmented reality guides for replacing parts on select Dell computers.

³ Based on internal analysis; April 2025. Compares Dell Pro 14 Premium vs. Latitude 7x50 mainboard and I/O board size.

⁴ Applies to Dell Pro, Dell Pro Plus, and Dell Pro Premium laptops launching in 2025. Based on internal comparison of the solder connection on Latitude 7450 vs screwed connection testing data of the Dell Pro Premium laptop, subject to a standard repeated axial load and a standard wrenching torque in multiple directions. New USB-C port design is screwed on connection for easier repairs and improved durability. Read warranty information for USB-C port replacement instructions.

Material Circularity

These modular PC designs are complemented by Dell's commitment to material innovation with a strong focus on increasing the use of recycled and/or renewable materials such as closed-loop plastics, recycled steel, recycled aluminum, recycled copper, and recycled/reduced cobalt in batteries. By focusing on increasing recycled content in key areas, Dell is able to improve supply chain resilience and material sourcing.

IV. Competitive Differentiation Through End-to-End Service and Scale

Dell transforms its DfS commitment into a clear competitive advantage by marrying it with a mature, high-scale service ecosystem that competitors struggle to replicate.

Established Service Superiority

The foundation of Dell's consumption model is its proven service maturity. While competitors such as HP and Lenovo offer similar DaaS (Device-as-a-Service) and XaaS (Everything-as-a-Service) platforms (such as TruScale), Dell's strength lies in the depth of its integrated services.

The Circular Services Ecosystem: A New End-to-End Model

Dell's service offerings also provide a proprietary end-to-end system that equips customers with a simple, compliant path for managing assets:



Asset Recovery Services: This service provides customers with a secure, seamless, end-to-end solution for retiring legacy IT equipment – regardless of brand. It prioritizes reuse to unlock value that can be reinvested to fast-track modernization and drive innovation, keeping businesses competitive in today's AI-powered era. Assets with no value are responsibly recycled, creating a feedstock for the circular economy.



Technology Rotation: This service, when integrated into the consumption model, guarantees cost-effective, sustainable, and timely upgrades for the fleet, with responsible recycling and takeback managed by Dell at no additional cost. This structured rotation is key to minimizing TCO risk and addressing the kinds of device refresh cycle inefficiencies that result from traditional IT economic models.



Case in Point: The Dell Lifecycle Hub is an end-to-end, multi-vendor device lifecycle management solution delivered as a managed service. It essentially acts as a single, secure facility and service team to handle all logistical and technical aspects of a company's PC and end-user device inventory, such as warehousing, configurations, shipping, returns, and refurbishing. A more premium version, called Lifecycle Hub Plus, adds advanced services such as Managed Detection and Response (MDR) for security; Device Refresh Management for ongoing, planning, forecasting, and supply chain management for multi-vendor device rollouts; the APEX PCaaS subscription model to bring flexible financing and predictable monthly costs into the equation, and ProSupport Plus Integration to elevate overall management and employee experience.

With 86% of surveyed ITDMs⁵ in the US, UK, France, Germany, and Japan reporting that collaborating with a 3rd party would simplify their efforts to implement circular IT practices, these are precisely the types of value-added offerings that help move IT practices forward.

V. Quantified Value: Translating Circularity into ROI and TCO

The true measure of Dell's converged strategy is the verifiable financial return delivered to the customer via Dell APEX PCaaS. PCaaS is the strategic culmination of the model, bundling flexible, customized hardware, full lifecycle services (ProDeploy/ProSupport), and asset recovery into a single, predictable OpEx subscription.

Financial Metrics (3-Year Risk-Adjusted Present Value)

Enterprise customers using APEX PCaaS can expect the following benefits:

- Return on Investment (ROI)
- Net Present Value (NPV)
- Short Payback Period

Table 2: Overview of Financial Metrics

Cost Avoidance & Efficiency	Metric	Description
Avoided Support Costs	Measurable reduction in device lifecycle support costs	Direct financial proof of the efficiency gained by integrating DfS/repairability and ProSupport services
Operational Benefits	Significant reduction in user device downtime	Faster refresh cycles, combined with ProSupport's predictive maintenance, drastically enhance employee productivity
Logistics Savings	Additional reduction in shipping and logistics costs	Achieved by using Dell Connected Provisioning to ship pre-configured devices directly to the end user

Future-Proofing TCO with AI

Dell is further demonstrating forward-looking value by using APEX PCaaS to deploy powerful new AI PCs. These devices, equipped with advanced AI-accelerated processors, are capable of running AI workloads locally rather than in the public cloud. While ISVs have been slow to deliver software solutions that fully leverage this capability at scale, market signals from software vendors suggest that change will likely be coming in 2026, with a full ramp-up heading into 2027. Once AI-accelerated workloads begin to shift from the cloud to devices, enterprises will begin to record significant operational savings for key user groups. And while faster processors and more repairable PCs are enough to drive the current PC refresh cycle, futureproofing the enterprise for AI continues to be a factor in the transition from traditional to AI-enabled PCs.

⁵ "Driving the Future: The Imperative Role of CEOs and Governments in Advancing Sustainable IT Practices", Circular Computing, October 2024



VI. Conclusion: A Roadmap for Sustainable IT Leadership

The integration of innovation and sustainability are no longer peripheral corporate social responsibility exercises; they are necessary to convey market leadership and deliver verifiable customer financial results in the modern IT landscape.

Dell's converged strategy and APEX PCaaS's execution, provides enterprises with a compliant, efficient, and profitable roadmap for fleet management. By adopting consumption models such as PCaaS and leveraging integrated services such as ARS, enterprises can transform IT fleet management from a traditional CapEx cost center into a sustainable, high-ROI asset, future-proofing their business against the mounting costs of linear IT.

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