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Whitepaper

How Composable Technology Is Revolutionizing Supply Chain Management

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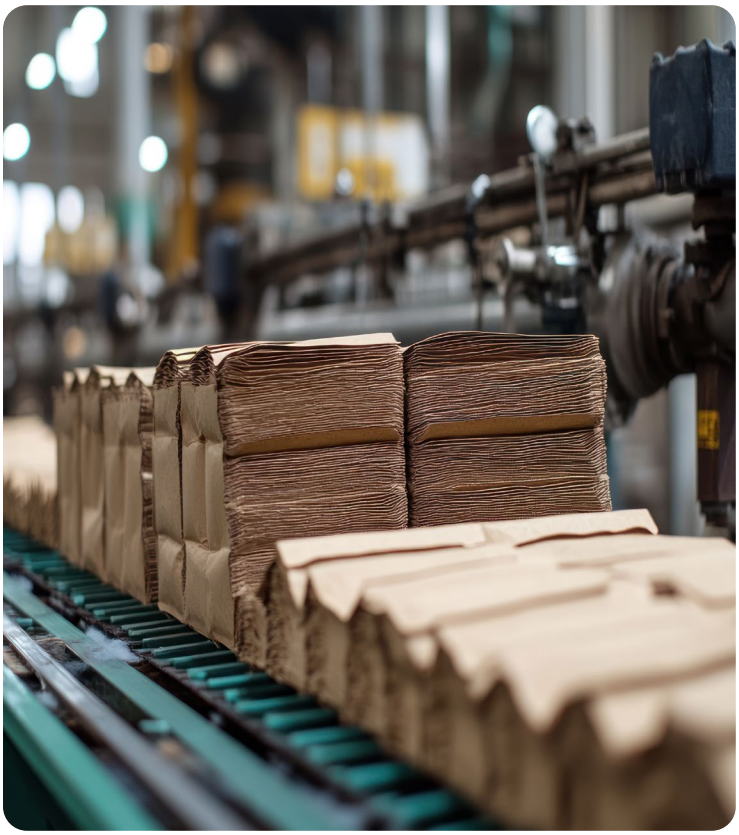
Executive Summary

The future is uncertain. With their inherent rigidity and complexity, traditional monolithic systems lack the agility to keep pace with change. This white paper explores the need to shift from monolithic architectures and old ways of thinking toward a modular, flexible approach that allows organizations to innovate, respond, and ultimately thrive in a volatile landscape.

Composable solutions prioritize agility, leveraging reusable, interoperable, and autonomous modular services. (Think modular Danish building blocks.) This network is underpinned by microservices, API-first design, and cloud-native development, transforming operations into evolving adaptive ecosystems. Composability offers seamless integration and improved data accuracy, enables cross-functional collaboration, driving efficiency and responsiveness in a way that monolithic systems are not designed for.

Driving the transition from a monolithic to a composable solution approach is the ability to effectively harness data, using real-time analytics for better decision-making and improved service levels. This requires thoughtful planning, strong data management practices, and a commitment to collaboration. Yet, the rewards far outweigh the risks. By embracing composable technology, organizations position themselves not only to navigate disruption but to use it as an opportunity to innovate and gain a competitive edge.

This white paper envisions a future where supply chains are no longer reactive but proactive—resilient, innovative, and driven by real-time insights. Composable technology isn't just a choice; it's the foundation of sustainable success in the future of supply chain operations.



Unlocking Supply Chain Potential in a Rapidly Changing Business World

Supply chains operate in an environment where adaptability is no longer optional—but a necessity to stay competitive. Traditional approaches centered around large-scale functional transformations require years of planning and execution and often fail, leaving businesses unable to respond quickly to challenges. Composability offers a new paradigm, enabling organizations to:

Tackle Specific Problems Effectively: Composable solutions focus on addressing high-impact problems such as lead time prediction or inventory reallocation without disrupting entire systems.

Achieve Quick Wins: Unlike monolithic transformations, composable architectures enable companies to deploy and refine solutions in weeks, not months, generating immediate value.

Reduce Risk: By complementing existing systems rather than replacing them, composable solutions lower adoption barriers and minimize operational disruption.

Optimize IT Costs: The deployment and scaling of services as needed, reducing the financial burden of comprehensive system overhauls.

Reducing Complexity: Simplify technology integration and eliminate bottlenecks that impede progress, freeing resources to focus on strategic goals.

Through a composable approach, supply chains can pivot faster, optimize resources more effectively, and unlock opportunities for innovation—positioning themselves to thrive in an unpredictable global marketplace.

The Evolution of Supply Chain Technology

In the ever-changing supply chain landscape, traditional monolithic architectures have presented no shortage of challenges. These systems, characterized by unified codebases, can hinder rapid updates and adaptations. Shifting towards composable solutions offers flexibility and the rapid adaptability needed to turn your supply network into a competitive advantage.

The Transition from Monolithic to Composable Architecture

Traditional monolithic architecture presents significant challenges when tasked with keeping up with the speed of change in supply chain. Monolithic systems are characterized by a single, unified codebase that handles multiple functions. Offering an appealing promise of an all-in-one solution. However, it also means that any updates or additions to the system may require comprehensive code changes across the entire structure. This interdependency makes implementing new features or updates complicated without enlisting help. If a company wishes to integrate a new forecasting module, for instance, they are in danger of getting caught in a "web of interdependencies," slowing down response times and making updates cumbersome and time-consuming. This rigidity impedes a company's ability to adapt swiftly to rapidly changing conditions.

Composable architecture, in contrast, offers a modern, flexible approach that mitigates many of the limitations associated with monoliths. Composable platforms are comprised of modular, independent services that can be "composed" together to form a resilient technological ecosystem system. Each service performs a specific function and can be deployed or updated independently of other functions, continually making improvements without disrupting the entire system. For example, a supply chain can deploy a lead time prediction service that functions independently while seamlessly integrating with other planning functions like demand forecasting and inventory optimization.

This shift in thinking for planning and design means that supply chains should no longer rely on a single monolithic platform to support their operations. Instead, supply chain professionals should leverage services that can plug into any platform and be managed independently. Modularity allows companies to adapt quickly to changes, innovate faster, and maintain a competitive advantage in an uncertain marketplace. By adopting composability, businesses will achieve greater agility, ensuring that their supply chain technology remains responsive and effective in meeting ever-evolving demands.

Understanding Composable Technology

Composable technology is a shift in software architecture toward modular, loosely coupled systems where individual services are crafted to perform distinct, specific tasks and can be reused across various applications. The idea behind composability is that each service performs a particular function and can be reused or orchestrated with other services to meet various business or technical needs.

Key characteristics of composable services include:

Modularity: Each service is self-contained and performs a distinct function.

Reusability: Services can be reused across different applications or contexts.

Interoperability: Services are designed to interact with other services seamlessly, often using APIs or message-driven communication.

Loose Coupling: Services are not tightly dependent on each other, meaning changes to one service should not heavily impact others.

Scalability: Composable services can scale independently based on the application's specific needs.

Autonomy: Each service can be developed, deployed, and managed independently.

The components of a composable architecture are based on four principles:

Microservices: Self-sufficient units, each diligently handling specific functions or services. This paradigm ensures a modular and efficient system, with each component operating independently yet harmoniously.

API-First: Application Programming Interfaces (API) provide seamless communication between microservices. These APIs enable data exchange, paving the way for agile, responsive operations.

Cloud-native: Ensures unprecedented scalability, rapid development cycles, and flexibility that traditional server-centric systems cannot match.

Headless: Decouple the front end (the user interface) from the backend to liberate the user experience and empower creative expression without compromising functionality.

To put this into perspective for supply chain planning and design, composable architecture breaks down features into sub-components. It creates cloud-native micro or mini services, which, when combined, provide the functionality offered in a traditional monolithic architecture. For example, an inventory optimization service breaks down into independent services for ABC analysis, service level optimization, safety stock setting, and multi-echelon optimization. Each individual service is maintained independently and can plug into any technology platform – another composable platform or a monolith – and present itself through the other technology platform's user interface, or it can have its own front-end UI.

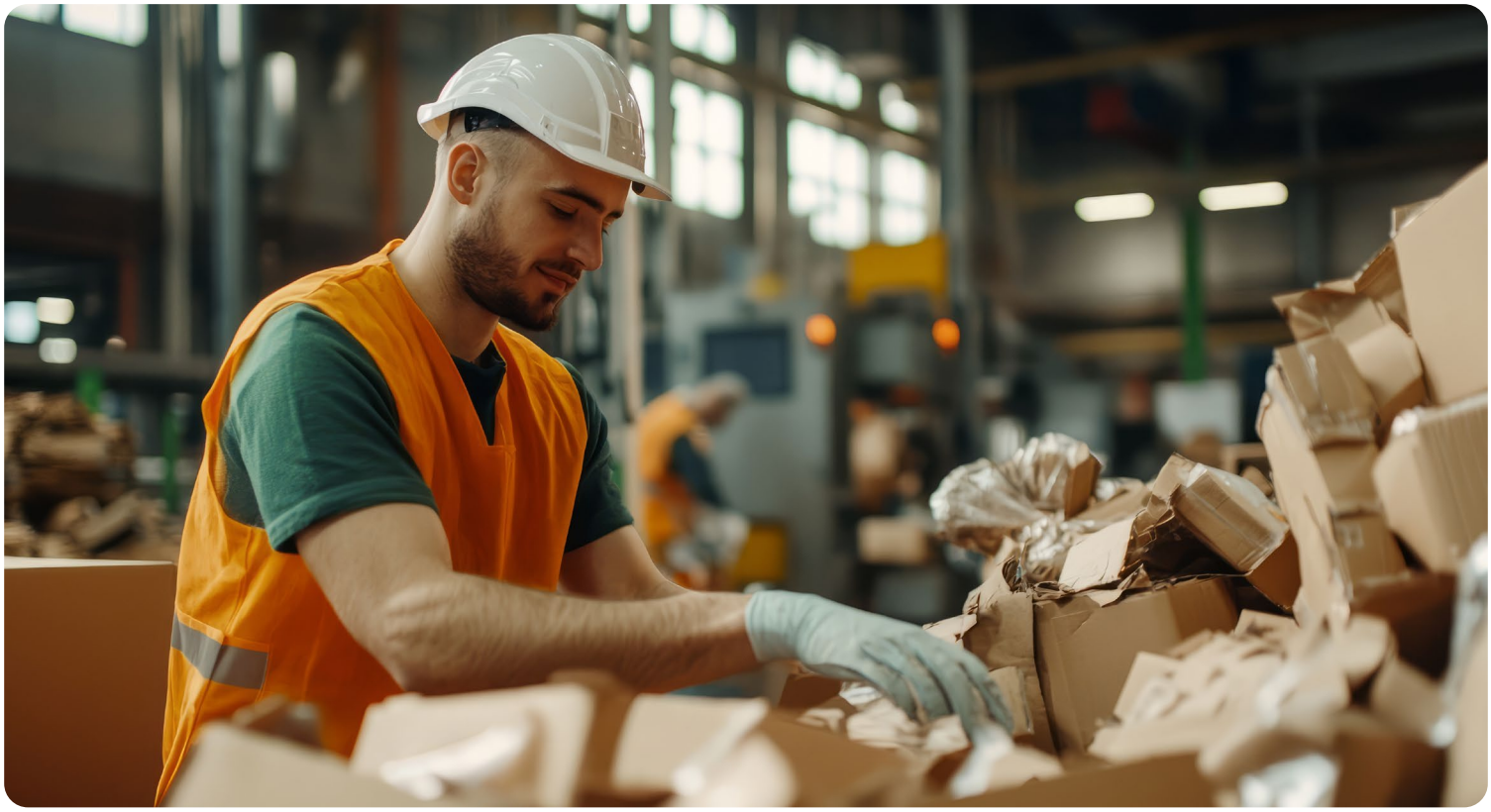
One of the common misconceptions about composable technology is the oversimplification of its definition as merely an API strategy. While APIs are critical for communication between microservices, they do not inherently make a system composable. Some vendors market modular APIs as composable solutions, but these often remain tightly coupled, limiting their flexibility and adaptability. An authentic composable architecture, in contrast, ensures that each microservice can operate independently, allowing for more seamless integration and reconfiguration of services as business needs evolve.

The Value of Composable Architecture for Supply Chains

Composable platforms represent a significant advancement in how businesses can leverage technology to streamline operations and improve efficiency. This modularity enables organizations to directly address specific operational challenges, with the flexibility to integrate new capabilities into their existing technology stack without requiring a comprehensive system upgrade.

Instead of focusing solely on large-scale functional transformations, composable technology encourages a problem-centric mindset. This approach prioritizes identifying high-impact problems and deploying targeted solutions to solve them. For example, businesses can deploy a modular lead time prediction engine that integrates seamlessly into their existing systems rather than overhauling an entire supply chain management system to improve lead time accuracy.

According to Accenture, when interoperability supported by composable architecture is enabled, companies can transform faster, better and cheaper. Further, Accenture has identified that companies with higher interoperability unlocked up to five additional percentage points of revenue growth than low/no interoperability companies stuck in the technology status quo.



Supply chains can experience several benefits by embracing composability, including:

Simplified Integration: Eliminates the need for complex integrations between systems, reducing costs and maintenance efforts.

Improved Accuracy: Ensures more accurate planning and better decision-making by leveraging native logic from various systems.

Enhanced Cross-functional Communication: Enables bidirectional communication between systems, facilitating better information sharing and alignment across functions within the supply chain, across the enterprise, and across the external ecosystem.

Flexibility: Provides the ability to swap out services as needed, allowing for faster decision-making and adaptability.

Faster Responsiveness to Changing Business Conditions: Reduces waiting times for IT projects, enabling quicker responses to supply chain needs.

Technology Heterogeneity: Allows using the best components from different systems rather than being tied to a single platform.

Version Control: Supports multiple versions of services, enabling the use of preferred features from different versions.

Ease of Use: Simplifies the user experience by allowing seamless integration and use of various services.

By embracing the principles of composability, supply chains have the tools to optimize their operations incrementally, focusing on specific areas of improvement without the need for a full-scale software implementation. The result is a supply chain that is more efficient and more resilient to the uncertainties and fluctuations of today's global marketplace.

Strategic Advantages for Supply Chain Leaders to Better Manage Uncertainty and Variability

Adopting a composability mindset can yield opportunities to generate value for the business through supply chain efficiencies and reduce value leakage across the business ecosystem.

Flexibility and Adaptability to Quickly Adopt to Changing Business Conditions

In the current rapid business environment, supply chain executives face the challenge of quickly generating value. The old way of waiting for comprehensive software upgrades is ineffective. Instead, composable technology provides a way to implement specific services fast and effectively, ensuring immediate benefits without a massive system overhaul. A standout example is the lead time prediction service, which offers precise delivery predictions through machine learning and analytics, enabling better inventory and demand forecasts. Composable technology's modular approach means updates can be made to individual components, facilitating faster adaptation and operational optimization.

A multi-version service model enables companies to run different versions of software services simultaneously. For example, a business might operate an older version of an inventory optimization service alongside a newer version of another service, such as demand forecasting. This approach allows for seamless integration and optimization, ensuring that each part of the supply chain can adapt independently and efficiently. Additional benefits include:

1. **Tailored Solutions:** Businesses can choose services that best fit their operational objectives and match their KPIs, ensuring rapid adaptability to market changes and consumer expectations.

2. **Cost Efficiency:** By upgrading only what is needed, businesses can avoid the cost and disruption associated with system overhauls. This modularity eliminates the "all-or-nothing" updates related to traditional systems.

3. **Risk Mitigation:** Multiple service versions reduce the risk of transitioning to new technologies. Companies can test and implement new services at their own pace, ensuring a smoother transition and minimizing the impact on operations.

4. **Agility:** Quick adaptation and service reconfiguration help businesses effectively respond to unexpected market shifts, keeping them competitive.

5. **Future-Proofing:** As new technologies and methodologies emerge, the multi-version service model ensures that businesses can integrate these advancements without overhauling their entire system. This approach positions companies to remain at the forefront of innovation and efficiency.

In summary, the multi-version service model provides supply chain leaders the flexibility and adaptability needed to navigate the complexities of modern business environments. This approach empowers organizations to maintain operational efficiency, reduce costs, and support growth by responding effectively to market dynamics by enabling selective upgrades and integrations.

Improved Decision-making with Better Data Visibility and Data Management

Strong data management is a pivotal advantage for leaders aiming to enhance efficiency and agility. According to Accenture, only 54 percent of companies rank their ability to combine and analyze their data within their supply chain ecosystem as high. Composable technology, combined with a data lake and an ELT (Extract, Load, Transform) model, streamlines data integration and enhances decision-making processes by incorporating a diverse range of data sources, including exogenous factors like economic and seasonal data.

Supply chains can achieve better data visibility by:

Facilitating Integration with Existing ERP Systems

A key advantage of composability is its ability to work harmoniously with existing ERP systems. Companies can ensure that data flows seamlessly between new composable services and legacy systems by employing APIs. This bi-directional flow improves data fidelity, and the decisions supply chain leaders make.

Leveraging a Data Lake for Comprehensive Data Integration

The data lake is a central repository where data in its various forms, structured and unstructured, can be stored. This allows companies to aggregate information from multiple sources, including internal systems and external datasets like economic indicators or weather patterns, creating a comprehensive view of your supply chain.

Streamlining Data Processing with an ELT model

This model loads raw data into the data lake and then transforms as needed for specific analyses. This is more efficient than traditional ETL processes as it reduces the time and resources required to prepare for analysis.

Integrating Real-Time Analytics and Insights

Processing and analyzing data in real-time is crucial for supply chain leaders who need to respond swiftly. The data lake /ELT framework supports real-time analytics, giving leaders timely insights to inform immediate decisions. This approach enhances operational efficiency and positions companies to be more agile and responsive, driving sustained growth and success.

Improved Decision Alignment Across Time Horizons

As supply chain complexity increases, composability is one of the most promising approaches to achieving seamless integration and alignment across an enterprise and with ecosystem partners. Using a composable framework, companies can assemble services that support different types of decisions across various time horizons into one workspace. This helps companies understand the second-order effects of decisions made across the strategic, tactical, and operational time horizons.

For example, suppose network design and supply chain planning can share a common set of services, rather than the design solve estimating the impact of a proposed network design on inventory, service level, etc. In that case, it can instead call the inventory optimization services and ask, "If this design is selected, what will my service levels be? What are my ordering points going to look like?" Instead of using historical data or pulling data from a monolith to answer this question, it can use the services that run inventory optimization daily. This leads to better decisions that support growth and reduce operational costs.

Enterprise and Multi-enterprise Collaboration

Further, with composability and robust data infrastructure, different departments within a company can collaborate more effectively, sharing insights and driving innovation. This interconnected approach encourages the development of new strategies and solutions grounded in a shared understanding of the data. The collaboration extends into the multi-enterprise ecosystem. Companies can more easily share information with their trading partners, logistics partners, and others where the set of services can be shared with all partners, regardless of their level of technical maturity. For example, trading partners can share real-time data via bidirectional APIs.

Practical Applications of Supply Chain Composability

Composable architecture is more than just a modern technology framework—it is a transformative approach to solving real-world supply chain challenges. By enabling modular, flexible, and independent components, composability delivers measurable outcomes across a variety of applications. Below are three impactful examples that showcase its potential.

1. Lead Time Prediction

Accurate lead time prediction is one of supply chain management's most critical—and elusive—goals. Traditional systems often rely on static averages, leading to stockouts or excess inventory when conditions deviate from expectations. Composable solutions tackle this problem with precision:

- **What It Does:** A modular lead time prediction engine combines historical lead time data with exogenous factors, such as regional economic indicators or vendor capacity utilization, to dynamically forecast lead times.
- **How It Helps:** By deploying this service independently, businesses can quickly enhance accuracy without overhauling their existing systems.
- **Outcome:** Faster, more accurate lead time predictions reduce stockouts, optimize inventory levels, and minimize costly safety buffers.

2. Continuous Supply Chain Design

In many organizations, supply chain design is a static, periodic exercise. However, composable technology enables continuous design by integrating real-time data and modular optimization engines.

- **What It Does:** Components such as inventory optimization and dynamic freight modeling work together to evaluate and adjust design strategies as conditions change.
- **How It Helps:** This approach replaces outdated assumptions, like "weeks of supply," with real-time, data-driven decisions. It also prioritizes practical, high-impact adjustments rather than large-scale redesigns.
- **Outcome:** Continuous design improves resource allocation, enhances service levels, and reduces total costs while adapting seamlessly to seasonal or market shifts.

3. Bidirectional Communication Across Systems

One of the most significant challenges in supply chain management is aligning decisions across different systems and processes. Composability enables bidirectional communication, ensuring that changes in one area (e.g., supply chain design) are automatically reflected in others (e.g., inventory optimization).

- **What It Does:** Modular components communicate in real-time, creating a "conversation" between systems rather than the traditional one-way data handoff.
- **How It Helps:** An inventory optimization engine can dynamically adjust reorder points and safety stock levels based on updated distribution flows, providing a seamless integration between design and execution.
- **Outcome:** Improved cross-functional alignment leads to better decision-making, reduced redundancies, and enhanced operational efficiency.

These examples illustrate how composable SCP bridges the gap between innovation and practicality. By addressing specific challenges with targeted solutions, businesses can achieve faster, more sustainable outcomes while setting the stage for long-term scalability and resilience.

Key Challenges and Considerations in Adopting Composable Technology

Organizations must navigate several key challenges during the initial setup phase. These foundations are critical for ensuring a smooth transition and maximizing the benefits of a composable architecture.

API Integration:

A robust API framework is paramount. Companies need to develop a clear strategy for API management. As it will serve as the primary communication channel between microservices, enabling data and system interoperability exchanges. This includes defining a canonical data model to standardize data exchange, allowing various systems to interact smoothly, regardless of their underlying technologies.

Data Standardization:

Standardizing data formats and structures is essential to leverage composable services effectively. Organizations need a unified data model to facilitate integration across disparate systems and services. This involves a thorough examination of existing data structures and the implementation of standardized data handling protocols to ensure consistency and reliability.

Service Management and Monitoring:

Organizations need to determine where the responsibility for managing the composed services lies. Is it with a dedicated center of excellence, like a supply chain center, or should individual planners or buyers self-serve? Maintaining the catalog of composed services requires an entity within the organization to ensure version control, check for redundancy, and maintain data hygiene.

This task becomes more complex with different naming conventions and versions of APIs, which necessitates thorough documentation and version tracking. Companies must improve their documentation practices for effective management and ensure that developers and end-users are disciplined in maintaining and understanding these records. This structured approach is crucial for seamless upgrades, testing, and deprecation of outdated versions, ultimately ensuring a smooth and efficient composable technology environment.

Security and Governance:

Implementing a composable architecture necessitates robust security measures and governance protocols. As services become more modular and interconnected, organizations must ensure that data access is tightly controlled and that security practices are uniformly applied across all services. This includes leveraging third-party providers for specific security features, allowing internal teams to focus on core business operations.

Companies can lay a solid foundation for their composable technology strategy by addressing these challenges during the initial setup phase. This groundwork facilitates smoother integration and data standardization and positions organizations to capitalize on the agility and scalability of composable architectures.

The Future of Supply Chain With Composable Architecture

75% of CEOs have an aggressive digital investment strategy intended to secure first-mover or fast-follower status. An MIT Technology Review Insights report states, "Digital Transformation is not just about embracing connected and digital technologies; it is also about revamping processes to adapt to the constant change of technology and using applications to continually improve business processes." Composability will redefine supply chains' operations, support decision-making, fuel growth, reduce costs, and improve customer satisfaction.

Innovation and Continual Improvement

Utilizing an impact matrix, organizations can prioritize high-impact projects for rapid deployment. A method enabling continuous iterations and improvements based on measurable ROI, ensuring that businesses remain agile and responsive to emerging supply chain challenges. Companies can swiftly address issues and capitalize on new opportunities by continuously assessing and refining their systems, ensuring sustained growth and innovation.

Heterogeneous Technology Environment

Composable architecture allows businesses to leverage best-of-breed solutions, providing the flexibility to select the most effective services for each function. For example, companies can integrate a unique inventory optimization module that works seamlessly with various demand forecasting solutions. This mix-and-match approach enables organizations to tailor their supply chain systems to meet specific needs, enhancing efficiency and effectiveness. By choosing best-of-breed components, businesses can utilize the most advanced and suitable technologies available, providing a competitive edge in a rapidly evolving market.

Data-driven Decision Making

Composability supports data-driven decision-making in supply chain planning and design by enabling flexible and modular systems that adapt easily to changing needs. This approach allows organizations to integrate both external and internal data elements, uncovering hidden correlations that enhance decision-making. For example, once exogenous data, such as housing start data by region, is mined, it can be shared across various composable solutions without needing bespoke integrations for each one. This improves efficiency and encourages innovation, as new data elements can be seamlessly added or replaced. Overall, composability provides a robust, flexible, and efficient framework for managing and analyzing data, ultimately supercharging the ability to mine data once and use it everywhere.

In summary, the future of supply chain management with composable architecture is characterized by enhanced flexibility, continuous innovation, and proven success. Businesses can thrive in an ever-changing landscape by adopting best-of-breed solutions, embracing continuous improvement, and learning from successful implementations. This modern approach addresses current supply chain challenges and positions organizations for future success in an increasingly competitive world.

Conclusion

Composable architecture marks a transformative step forward in supply chain technology, delivering the flexibility and efficiency that modern businesses need to thrive. By embracing composable principles, organizations unlock the agility to pivot quickly in response to shifting market dynamics, ensuring they remain competitive in an ever-evolving landscape. The modular nature of composable systems allows companies to make targeted enhancements and seamlessly integrate new capabilities, eliminating the costly and disruptive need for complete system overhauls.

The strategic advantages of composable technology go beyond efficiency—it fosters more intelligent decision-making, strengthens cross-functional collaboration, and provides unparalleled visibility into data. These elements empower supply chains to excel in today's dynamic and uncertain environment.

The journey to composable success requires thoughtful planning, particularly in API integration, data standardization, and service management. Addressing these foundational elements ensures a strong framework for long-term growth.

As supply chains continue to evolve, composable architecture will drive continuous improvement and fuel innovation. Businesses can optimize operations and achieve sustainable growth by leveraging best-of-breed solutions and embedding a data-driven mindset into their culture. The future of supply chains lies in their ability to adapt, innovate, and embrace change—and composable architecture provides the foundation to turn these ambitions into reality.

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