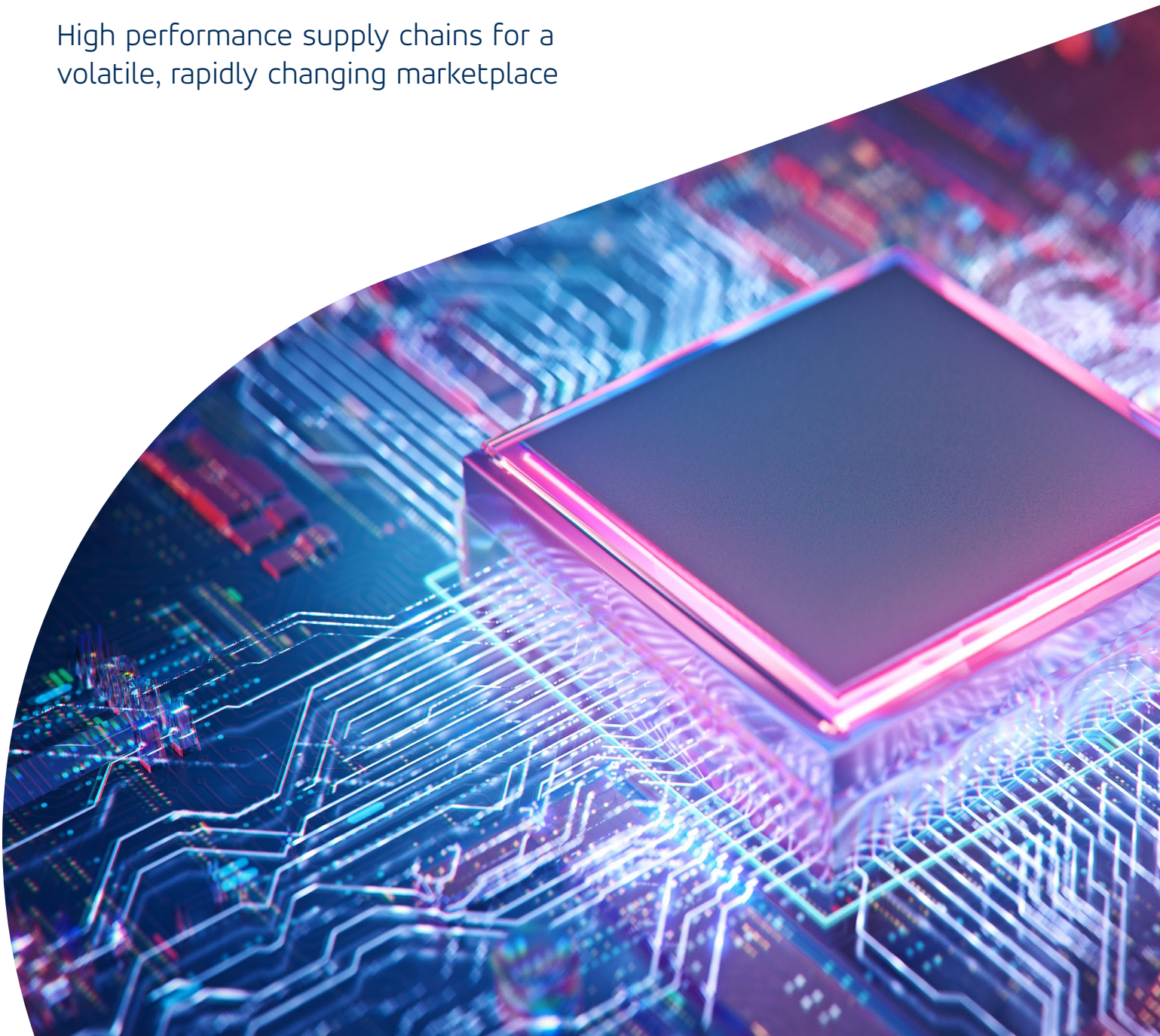
BlueYonder

The Semiconductor Industry Imperative for Supply Chain Resiliency

High performance supply chains for a volatile, rapidly changing marketplace



Integrated device manufacturers (IDMs), fabless companies and foundries can improve asset utilization, minimize supply chain risks and better balance customer service levels with inventory positions using Blue Yonder's solutions for Semiconductor.

The electronics industry is booming with ever-changing markets for computing, tablets, smartphones, GPS-enabled devices and gaming systems, as well as for automotive, residential and industrial applications. Increased mobile functionality, including higher integration at the chip level, smaller form factors, lower power requirements, the acceleration of 5G, and bigger, brighter screens are several factors driving consumption decisions. This is greatly expanding demand for semiconductors, but is also creating new challenges for this asset-intensive industry as increasingly volatile demand and ever- shorter product lifecycles require faster time-to- market. As a result, semiconductor manufacturers are struggling to optimize internal asset utilization while balancing customer service commitments with appropriate inventory levels across complex, global supply networks.

These market dynamics and challenges are also increasing supply chain risk. Only those companies that are agile and efficient will survive in this environment. Leading semiconductor companies recognize that they need machine-learning based digital supply chain management technology to support both customer commitments and corporate goals for profitability and agility in this rapidly changing marketplace.

Specifically, they need an integrated digital supply chain platform that will enable them to:

- Better sense and forecast ever-changing global demand by region and customers
- Achieve Rapid demand/supply matching (RDSM) for rapid "what-if" scenario analysis and quick decisions
- Satisfy customer order commit dates with high levels of reliability
- Synchronize enterprise planning to optimize asset utilization and delivery performance
- Balance customer service commitments with differentiated inventory levels by segment
- Minimize supply chain risk while enhancing financial performance

Customers who have deployed Blue Yonder semiconductor solutions to support these needs have achieved the following benefits*:

- Improved customer-requested delivery date performance by up to 10-15 percent
- Improved due-date stability by up to 15 percent
- Generated supply chain savings in excess of US$20 million
- Reduced planning effort by up to 30 percent
- Cut forecasting lead time from four weeks to two weeks
- Decreased planning errors up to 90 percent
- Reduced forecast adjustments by a factor of 10
- Increased finished goods inventory turns by up to 40 percent
- Successfully instituted global sales and operations planning for cross-functional synchronization
- Improved asset utilization with what-if scenario-based capacity planning

*Based on actual results reported by Blue Yonder customers

The Semiconductor Manufacturing Imperative – Supply Chain Resilience

The complexity of global supply chains has opened the way for unanticipated events causing a cascading array of unintended consequences, among them the rapid breakdown of many supply chains. This lack of agility and resilience poses major risks not just to businesses, but to society at large. To be successful in today's volatile, complex, technology-driven marketplace, all manufacturers, including those in the semiconductor industry, must embrace five core tenets of supply chain excellence.

- **Business Agility** – semiconductor technology and consumer preferences are changing more rapidly than ever. Manufacturers must be able to rapidly pivot their supply networks to respond to volatile shifts in business conditions
- **Customer-centricity** – consumer preferences change rapidly and semiconductor industry leaders must respond with demand-sensing strategies based on intelligent analytics
- **Segmentation** – supply chain strategies must be dynamically segmented by region, market segment and customer profile to offer differentiated service across an expanding array of segments
- **Synchronization** – supply chain operations must be synchronized across increasingly complex networks of multi-tiered suppliers to drive efficiencies, prevent supply gaps and improve velocity
- **Efficiency** – LEAN principles, best practices and more sophisticated technology platforms are necessary to optimize supply networks and manufacturing operations to improve efficiency, cost and throughput.

The Semiconductor Marketplace

New computing and mobile technologies, along with expanding gaming, automotive, residential and industrial applications, are driving an ever-increasing share of semiconductor consumption, pressuring semiconductor supply chains to keep pace with rapid new product introductions and shrinking product lifecycles. This new business normal, characterized by extremely volatile demand, growing lead times and scarce supply, is straining and challenging semiconductor supply chains like never before. Companies across the globe, unable to keep demand and supply in sync, are struggling to maintain customer service levels. Constant fire-fighting and order expediting are eroding hard-earned gross margins while declining customer satisfaction levels are threatening market share. Semiconductor manufacturers must proactively find ways to work smarter, faster and with reduced risk.

For leading global semiconductor manufacturers, this has meant investing in Blue Yonder digital supply chain solutions designed specifically for the semiconductor industry that deliver global supply chain visibility, optimize end-to-end production processes and enable more effective value-chain partnerships.

Forecasting rapidly-changing customer demand

While semiconductor manufacturing cycle times can be as long as 60 to 90 days, customer order lead times are not. As such, production starts must be based on forecasted demand. But rapidly-changing customer demand, especially from the mobile and consumer electronics segments, makes accurate forecasting more difficult and increases production risks. Reconciling demand signals on thousands of end-items from disparate customer segments, as well as from sales, marketing, distributors, and contract manufacturers, makes it extremely challenging to forecast accurately. Semiconductor manufacturers need planning systems that can sense and evaluate demand from all sources, not just extrapolate historical trends, to form an accurate picture of demand going forward for each customer segment.

ML-powered demand planning

The volatility of consumer demand in the high-tech world puts a premium on accurately sensing demand, planning production and optimizing distribution to respond quickly and profitably to each customer segment. Blue Yonder solutions provide visibility into all critical functional areas for holistic optimization across end-to-end supply chain processes.

Demand planning – Machine-learning based forecasting techniques support bottom-up and middle-out demand forecasting from sales and supply chain partners to better understand true end-point demand. This is coupled with top-down revenue forecasting with automated reconciliation across product and customer hierarchies. Intelligent forecasting algorithms support lifecycle forecasting and new product introductions, and incorporate third party data for causal forecasting. The result is a more accurate picture of demand across all operations and segments.

Blue Yonder demand planning solutions deliver a streamlined, closed-loop forecasting approach proven to enhance accuracy and effectiveness. These solutions:

- Enable collaborative demand planning with bottom-up sales forecasting coupled with top-down revenue forecasting
- Leverage intelligent statistical and ML-based forecasting techniques aligned with observed demand patterns
- Support consensus demand planning while still enabling stakeholders to review the forecast from their perspective—revenue, units, margins and what-if analyses

"Blue Yonder understands our business quite well. They also understand the specifics of the semiconductor industry well, and that gave us a good basis to work from." – **Vice President, IT Supply Chain Management, Infineon Technologies**

Creating a Flexible Supply Chain at Western Digital

Western Digital Corporation is a global leader in flash memory storage solutions which can be found in many of the world's largest data centers, embedded in advanced smartphones, tablets and PCs and at hundreds of thousands of retail stores worldwide. "During our partnership with Blue Yonder, our mix of OEM and retail customers has changed substantially, requiring us to be flexible. We have adapted our business processes using Blue Yonder solutions to support our company's growth." **– Director of IT, Western Digital**

As Western Digital's business grew, they needed to migrate from homegrown, spreadsheet-based planning tools to robust, scalable solutions that would support their expanding original equipment manufacturer (OEM) channels and retail presence. Western Digital sought an integrated advanced planning solution that would help them maintain profitable growth and maximize margins while continuing to meet customer demand and increase customer satisfaction. They chose Blue Yonder's Luminate™ Planning solution to transform their planning processes.

"We felt that Blue Yonder had the best solutions and that those solutions would enable us to grow on a much larger scale." **– VP Supply and Demand Planning, Western Digital**

Western Digital leverages Blue Yonder's advanced planning capabilities to manage demand, compute statistical forecasts and translate sell-through forecast data and actuals to sell. This allows them to effectively identify optimal inventory levels and stages and manage silicon allocation. The solution is also used to manage complex demand prioritizations, optimize supply and demand responses based on material, capacity, cost and service levels and support replanning multiple times per day based on demand signals and what-if analysis.

End-to-end supply chain visibility and collaboration

It is becoming increasingly important for semiconductor companies to be able to see, analyze and act on information across supply chains in real time, and then learn from those experiences to become better at sensing and responding to supply chain risks and opportunities. Blue Yonder's digital control tower provides real-time, end-to-end supply chain transparency and visibility that enables visualization of the flow of goods across suppliers, factories, distribution centers, customers, and distributors, with the ability to correlate any events

or exceptions impacting supply and demand. It provides an intelligent response framework that allows organizations to prioritize responses to current and predicted disruptions based on severity and impact, as well as run what-if scenario analysis using real-time insights to better understand trade-offs. An intelligent response framework enables real-time collaboration with networked partners to resolve exceptions and execute decisions across the supply chain and extended network.

Semiconductor companies must create a supply chain risk center to continuously assess and learn from changing supply chain operations to better sense and respond to risks and opportunities as they occur. Because of Blue Yonder's advancements in artificial intelligence and machine learning, the risk center can be powered by a digital control tower that can analyze data at scale and spot trends and anomalies in real time. This enables semiconductor companies to predict events, analyze variables and understand the ramifications and risks of different response options, and receive cognitive recommendations. This holistic view of supply network operations enables semiconductor manufacturers to collaborate with business partners to execute strategic business plans, proactively identify bottlenecks, develop resolution strategies and track and manage execution throughout the product lifecycle.

Meeting increasingly diverse market expectations

Meeting the increasingly diverse expectations of different market segments across global operations is a constant struggle. With shrinking product lifecycles and frequent revision changes increasing the risk of inventory obsolescence, the one-size fits-all approach to inventory management is no longer appropriate for semiconductor companies serving multiple high-tech market segment, and can negatively impact corporate balance sheets. Semiconductor companies must segment their customer base to balance customer commitments and inventory investments based on the value of each segment in achieving corporate goals.

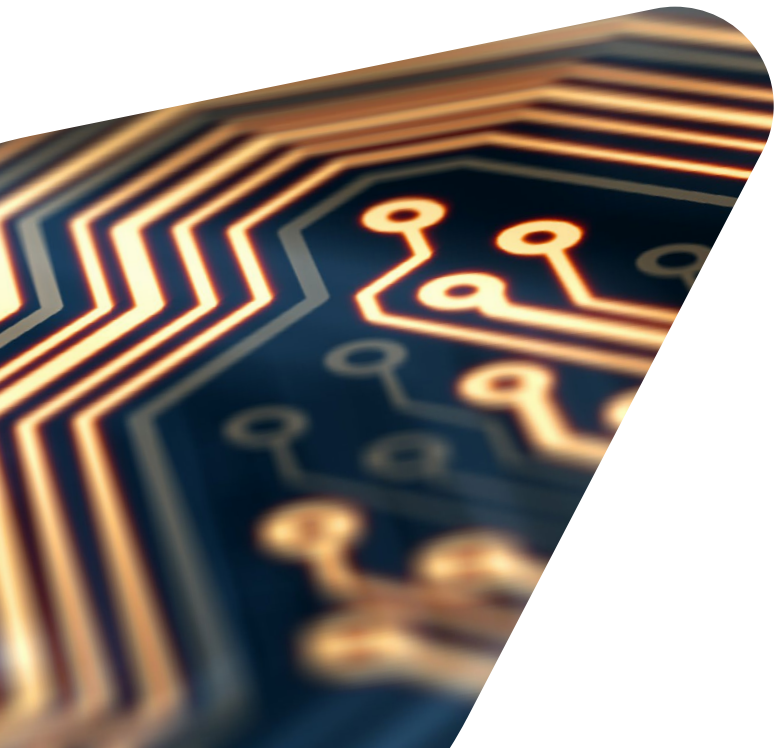
Intelligent business segmentation and inventory optimization

The secret to meeting market expectations profitably is not to attempt to be all things to all people. Not all customer segments are the same, nor do they expect the same service levels. A one-size-fits- all approach from a semiconductor manufacturer requires too much inventory, raising carrying costs and unduly risking obsolescence. Instead, semiconductor companies must segment each market's needs based on long-term value and align supply chain policies to serve those needs cost-effectively. Through such an exercise, a company may determine that it chooses to serve its strategic segments with a different inventory policy, for instance.

Blue Yonder solutions provide an integrated suite of capabilities enabling supply chain segmentation to dynamically balance market expectations with inventory investments.

Segmentation - Each market can have unique service, time-to-market and product lifecycle requirements. To serve these diverse needs with differentiated products and services, semiconductor companies must segment their markets and supply chain operations accordingly. Blue Yonder's dynamic segmentation and inventory optimization capabilities enable semiconductor manufacturers to profitably tailor operations to deliver the right products at the right time to each market segment. This reduces supply chain costs while improving service levels for the most valuable customers.

Inventory optimization - Advanced algorithms determine optimal inventory levels at each node of the multi- echelon supply chain using artificial intelligence to mine customer order history to discern order lead-time patterns. The system supports what- if analyses to plan inventory for new product introductions and customer-specific variations to demand and supply patterns. By right-sizing inventory levels, safety stock can be reduced, resulting in lower capital requirements and improved cash flow from operations.



Blue Yonder's solutions for dynamic segmentation and multi-echelon inventory optimization are driven by machine-learning and artificial intelligence-based algorithms to determine optimal inventory levels for each market segment. Blue Yonder solutions:

- Deliver the most comprehensive and easy-to-use framework for product and market segmentation based on flexible criteria such as revenues, volumes, margins, etc.
- Support differentiated customer service levels for each segment using what-if scenarios based on configurable input parameters
- Position inventory across multiple stages of the supply chain with intelligence from customer order lead-time patterns and automated mining of order history

Complex, asset-intensive global supply networks

Operating in an environment with asset-intensive processes, it is critical for both fabless and integrated device manufacturing semiconductor companies to optimize the utilization of manufacturing assets. Yet it is a constant challenge—too little capacity threatens customer service levels, while too much can erode profit margins. And making this determination is just the start as companies then must tackle what to make, where, when and how much across its complex, global network of in-house and outsourced manufacturing facilities. Semiconductor companies need supply chain planning solutions that optimize production and distribution plans, and immediately alert management to exceptions.

Supply Planning

Blue Yonder's supply planning solutions provide industry-leading master planning, capacity planning, distribution planning and production scheduling capabilities to address the challenges of complex, global asset-intensive production. Its Internet of Things (IoT)-enabled processing supports the smart factories that will lead the competition in efficiency and agility.

A semiconductor supply chain's ability to quickly respond to demand fluctuations and match supply is a powerful competitive advantage. Blue Yonder's SaaS offerings address this need in three ways:

1. End-to-end visibility and collaboration across the extended supply chain through our digital control tower
2. Machine learning-powered base planning capability leveraging hundreds of external demand factors
3. Fast response planning (Rapid Demand-Supply Matching)

All delivered through a single, flexible cloud-based platform. It adds up to empowered planners, improved forecast accuracy, higher product availability, higher productivity, and better customer service.

Master planning – Aiming to deliver the highest customer service through on-time deliveries to customer-request dates, this capability optimizes multiple business constraints and metrics while synchronizing material flows and utilization of resources across multi-stage, multi-site production. This comprehensive production planning solution leverages advanced algorithms to construct a reliable, feasible master plan that can drive manufacturing efficiencies while improving inventory management. This master planning capability features flexible and rapid scenario analysis capabilities that enable plan review with multiple what-if scenarios. A user-friendly exception navigator provides a guided analysis path to understand root causes of problems and resolve planning exceptions. Plan analysis and advanced agile workbench features provide decision support tools and resolution levers that allow surgical human intervention to refine overall master plans.

Distribution planning – Delivering high customer service levels through vendor-managed inventory (VMI) programs requires careful distribution planning across the supply chain network. Blue Yonder's distribution planning capability helps semiconductor companies optimize multi-tier constrained supply allocations, while balancing replenishment plans with transportation constraints and order optimization rules. The solution allows you to plan and control the entire supply picture from determining optimal product quantities, planning and scheduling transportation, to replenishing and optimizing inventory throughout the distribution network. The distribution planning capability also enables item lifecycle transitions and product substitutions for optimum replenishment planning.

Factory planning – Provides artificial intelligence and IoT-based decision support for production planning and scheduling across a single facility, or multiple plants, departments, work cells or production lines. Blue Yonder's factory planning capability helps avoid making costly trade-offs between customer commitments and key financial objectives. It streamlines and aligns the activities of production control, manufacturing and procurement teams by automating mundane tasks and shifting the focus to critical issues that may impact key service, operational and financial targets. Profitable, productive schedules are implemented based on constraints and order requirements, including customer priority, delivery commitments and product features.

"By using Blue Yonder's inventory optimization capabilities to evaluate several different sensitivity analyses – essentially what-if scenarios – TI was able to choose the best set of circumstances and move into production almost immediately." – **Director of Business Support Systems, Texas Instruments**

Blue Yonder's supply planning solutions enable optimized, integrated and executable plans across supply networks with total demand visibility. This enables smart manufacturing that:

- Represents physical reality with rich supply chain models for complex production networks, time-phased yields, alternate routes, components and resources
- Supports intelligent planning capabilities such as attribute-based planning, optimized binning and down-binning logic
- Leverages advanced order-by-order planning and linear optimization-based planning solvers
- Delivers highest customer service levels with the right material, inventory sources and quantities
- Maintains high asset utilization levels and the right production capacity

Rising competition on customer lead times

Satisfying customer expectations for short and reliable delivery lead times has become more challenging and competitive for semiconductor companies. The ever-increasing variability and complexity in supply chain operations coupled with lower forecast accuracy sometimes creates infeasible commitments. Semiconductor companies must rely on available material and capacity to accurately generate real-time promises that are achievable. They need visibility to orders and inventory across extended supply networks to accurately promise deliveries, and subsequently, high performance supply chain execution to fulfill customer commitments.

Integrated planning and execution

Blue Yonder solutions for Semiconductor offer industry-leading capabilities to create high performance digital supply chain platforms through integrated planning and execution across the supply network. To start with, a customer's order has to be promised in real-time with an aggressive and reliable commit date as close to the customer request date as possible. Thereafter, as this order is planned for delivery, its execution across warehouses and transportation networks must be managed effectively as well.

Blue Yonder solutions provide these integrated planning and execution capabilities:

Real-time order promising – Provides an in-memory, world-class order promising solution that delivers increased order capture, acceptance of the right orders, excellent delivery confidence, full supply utilization and exceptional customer service. When promising an order, the solution fully leverages an accurate picture of available supply, as well as an allocation planning framework, to deliver differentiated service to different market segments. This provides the critical ability to model many supply reservation rules to enforce different contractual service-level agreements. The solution's available-to-promise (ATP) and capable-to-promise (CTP) search logic recognizes and respects detailed constraints which are needed to deliver the ight promise.

"Blue Yonder is the heart of our planning and forecasting process at [our company]. We have gained an increased ability to quickly identify the impact of demand changes to inventories and availability. Required changes can be made daily, if needed, to adjust builds and communicate order fulfillment issues early to our distributors and end customers." **– Director Supply Chain, Leading NA Semiconductor Manufacturer**

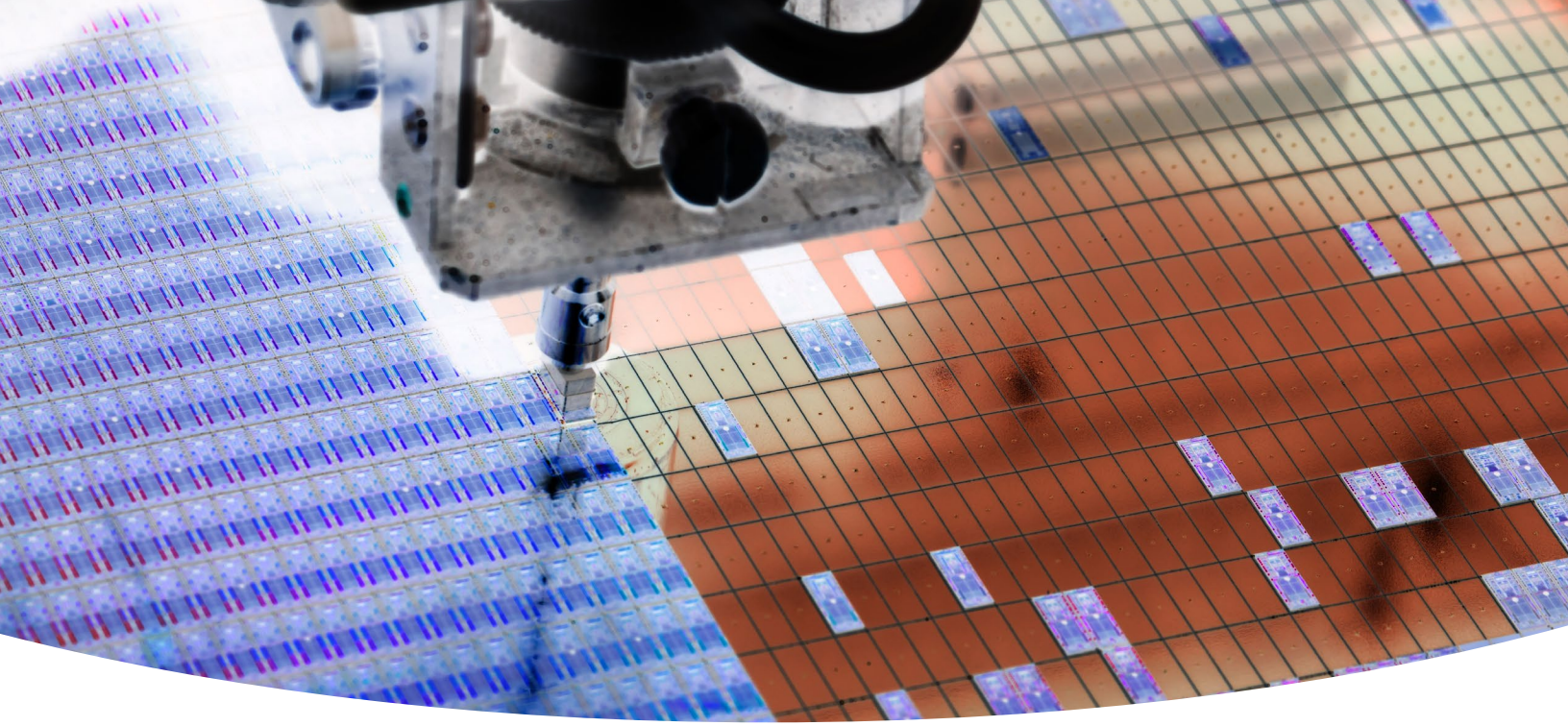
Warehouse management capabilities significantly improve warehouse and distribution center fulfillment efficiency, accuracy and throughput. Task interleaving capabilities automatically assign the next most productive task to each worker based on task priority and the worker's certifications, equipment and current location. The system also helps direct movement of materials, parts and components to and from production lines, through distribution and onto transportation in the most efficient manner. Order fulfillment is accurate and timely to satisfy customer commit dates while reducing operational costs and improving financial performance.

Warehouse labor management capabilities optimize workforce utilization and productivity in manufacturing, distribution and transportation. The solution helps plan and schedule the workforce based on customer order volumes and characteristics to ensure the right number of workers with the right skills are available to match work content and priorities. It continuously monitors work completion by worker or team against pre-defined engineered standards to alert supervisors to performance problems and barriers to success so immediate corrective actions can be taken.

Rapid time to-market and frequent product revisions can wreak havoc on transportation operations, often involving expediting and other costly options. Blue Yonder's transportation management capabilities enable shippers to more efficiently plan shipments to take advantage of least-cost modes, routes and carriers while ensuring that customer delivery window commitments are met. The system optimizes everything from global multi-leg, multi-modal shipments to local multi-stop fleet routing. It tracks all shipment expenses, including surcharges and demurrage, for proper freight audit and payment. And Blue Yonder's transportation, warehouse and labor management solutions are fully integrated to synchronize operations based on priorities and constraints. As a result, all supply chain operations are more coordinated and efficient. reducing costs and the impact of customer demand volatility.

Blue Yonder's integrated planning and execution solutions can help semiconductor companies improve delivery performance and reliably meet customer commitments by:

- Supporting flexible promising policies to accommodate diverse customer needs
- Enabling intelligent allocation management with configurable allocation policies
- Maximizing fulfillment accuracy and warehouse throughput
- Improving labor productivity in manufacturing, distribution and transportation
- Reducing transportation costs and improving on time deliveries
- Supporting real-time packaged integration with SAP and Oracle ERP order management systems



"The ability to perform workforce planning and scheduling in an automated process has driven our biggest savings. We've achieved a 62 percent increase in productivity in just two years. We've also reduced overstaffing and overtime, which helps lower our unit costs." **– Senior Vice President. Operations & Project Management. Avnet Logistics Services**

Disconnected Operations across Global Supply Networks

Profitable operations demand transparency and alignment between internal functional groups and external supply chain partners. Today's semiconductor supply networks are so complex and interconnected, but geographically dispersed, that trying to synchronize and optimize network-wide supply chain operations is an enormous challenge. Major disconnects internally between Engineering, Sales, Marketing, Manufacturing Operations and Finance, coupled with misalignments between supply chain partners, are hampering visibility, agility and decision-making.

The lack of alignment across end-to-end supply chain processes slows down efficient operations, causes errors in execution and makes consensus and accountability difficult to achieve. It also makes it virtually impossible to react to changes or new requirements expeditiously. This can spell trouble for new product launches where quickly responding to market acceptance trends can determine success or financial failure. Semiconductor manufacturers and partners must align supply chain processes and information to drive efficiency and agility across the entire business.

Integrated Business Planning

Sales and operations planning (S&OP) is an established business process by which companies align operations across the enterprise. Semiconductor supply chains must leverage S&OP to go beyond internal cross-functional alignment to facilitate broader network-wide alignment through integrated business planning (IBP). IBP utilizes global supply chain visibility, inline analytics and what-if scenario planning to identify and resolve demand, supply or financial gaps relative to the budgeted business plan. A well-executed IBP process helps you detect and remove supply chain disconnects, make network operations more efficient and agile, and provides rapid analysis of gaps, shortages and disruptions for faster, better-informed decision-making.

Sales and operations planning allows device and die-level demand to be aggregated and reviewed at any level of granularity across regions and product hierarchies. An exception-based framework allows users to see supply-demand imbalances across the end-to-end supply chain. An interactive what-if scenario planning framework, which includes rough-cut planning capabilities, enables exploration of different resolution alternatives, examining operational feasibility and financial attractiveness at the same time.

Analytics provide a real-time view and analysis of supply chain operations across the semiconductor network. This continuous monitoring and real-time alerting of supply chain operations enables immediate visibility and reaction to gaps, changes and disruptions with agility and fact-based decisions. It provides a continuous feedback loop for planning and execution to harmonize operations across the end-to-end network.

Infineon Technologies Improves Order Fulfillment and Roi

Infineon Technologies AG offers semiconductor and system solutions addressing three central challenges to modern society: energy efficiency, mobility and security. The company's ability to sense and respond to demand changes, while balancing global production capacity across its more than 20 facilities, can be challenging in today's highly dynamic global markets.

"Our planning process was too complex, too slow and the business-related figures such as turnover [revenues] and the operational topics such as utilization were hard to align. Today's perfect product will be out of the market tomorrow. You have to react fast." – Senior director of supply chain engineering, corporate supply chain

Infineon decided to create a single integrated, multidimensional sales and operations planning process that promotes global collaboration

and enables the company to quickly respond to market changes. After evaluating several vendors for technology support, Infineon

selected Blue Yonder's S&OP capabilities in order to create an integrated solution that could provide both a reliable demand forecast and realistic production plans. Out of all of the solutions Infineon evaluated, Blue Yonder's was the only solution that fulfilled the functional requirements of volume planning and production maturity.

Since completing the worldwide rollout of Blue Yonder's S&OP, Infineon has achieved a broad range of results across every dimension of its business. The company has reduced its planning effort by more than 30 percent, and is able to cut the lead time for its volume rolling forecast from four weeks to two weeks. Planning errors have decreased up to 90 percent. Forecast accuracy has also improved. But the most important result of the implementation is Infineon's new collaborative planning approach, which enables the business to be much more agile and responsive.

"We will always face the combination of a volatile market, long lead times and high capital investments. Blue Yonder's S&OP helps us see how we can best fulfill every customer need, while also making the best use of our investments."

The Blue Yonder advantage

Blue Yonder's solutions for the semiconductor industry provide a unique, integrated suite of supply chain planning and execution capabilities designed specifically with business agility in mind. Built in consultation with the world's leading semiconductor companies, these solutions facilitate network-wide collaboration and alignment of supply chain planning and execution processes to eliminate information gaps, production disconnects, and planning misalignments that stymie rapid response to changes in customer demand. With Blue Yonder, end-to-end supply networks are agile, synchronized and optimized through shared strategic, operational and financial goals, objectives and processes. That's the Blue Yonder advantage.

To learn how you can make your business more agile, synchronize your supply chain network operations, and support profitable business segmentation, visit us at blueyonder.com.

Rapid, low-cost deployment

The Blue Yonder platform and solutions for the semiconductor industry are available on the Microsoft Azure cloud as Software-as-a-Service (SaaS) offerings.

SaaS deployment offers several important advantages, including rapid implementation and faster time-to-value. It also significantly reduces upfront costs and allows companies to charge the solutions as an on-going expense rather than as a capital expenditure.

Flexibility is another key advantage of SaaS deployment. Semiconductor manufacturers can leverage Blue Yonder's SaaS offerings to deploy only the capabilities most needed up front and then selectively add capabilities as time and needs dictate. There is also the ability to scale resources almost infinitely to rapidly expand or shrink processing power as market conditions warrant.

Another important advantage is upgradability. Market conditions and legislative changes occur all the time. Blue Yonder continuously upgrades its solutions to accommodate these changes as well as to provide additional functions and features to improve solution value for customers. With SaaS deployment, customers can take advantage of these upgrades without waiting for internal resources to perform an upgrade.

About Blue Yonder

At Blue Yonder, we're fearless leaders. We're the leading provider of end-to-end, integrated retail and supply chain planning and execution solutions for more than 4,000 customers worldwide. Our unique solutions empower our clients to achieve more by optimizing costs, increasing revenue and reducing time to value so they can always deliver on their customer promises.

Fulfill your potential with Blue Yonder

Learn more at blueyonder.com

Luminate Platform

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