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# Blueprint for supply chain visibility

Service-oriented architecture  
can help drive agility, supplier  
collaboration and demand-  
driven replenishment

Supply Chain  
Management



## **IBM Institute for Business Value**

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# Blueprint for supply chain visibility

## Service-oriented architecture can help drive agility, supplier collaboration and demand-driven replenishment

By Karen Butner

*Effective supply chains are agile, with the capability to quickly respond to shifts in supply, production and demand. As well, they can enable companies to move rapidly into emerging markets, while simultaneously allowing them to take advantage of global sources of supply, production, distribution and talent. This flexibility and responsiveness, in turn, can fuel sustainable growth. Companies can facilitate the creation of agile supply chains by establishing a blueprint that enables visibility of all aspects of their globally integrated supply chains. We believe service-oriented architecture can provide the foundation for that blueprint.*

### Introduction

Global sourcing and aggressive global competition, combined with increasing customer demand, are significantly affecting the supply chain. When compounded by complex logistics networks, capacity constraints, distributed and fragmented information, as well as increasing security requirements, these global market challenges and complexities can lead to excess inventory, longer cycle times and deteriorated customer service.

To combat these new globalization challenges, many companies are shifting from a “push” supply chain model to a demand-driven, customer-centric model. The desire to become demand-driven requires sophisticated, flex-

ible responsiveness at every point along the supply chain – from sourcing and procurement to consumption. A customer-driven supply chain has several objectives:

- Speeding new, high-margin products to customers while obtaining realtime visibility to supply chain and customer events
- Enabling realtime collaboration and data exchange
- Synchronizing supply and demand while balancing inventory exposure across the supply chain
- Streamlining and increasing effectiveness of global sourcing and supplier management, including developing deeper supplier relationships with more sophisticated integration

- Adopting an enterprise asset management discipline to better realize value from critical assets
- Understanding and optimizing product lifecycle to make developing, launching, selling and servicing products more competitive and more profitable.

Figure 1 shows a model of a supply chain with products and information moving from supply sources, through production and throughout the pipeline to customer delivery and post-sale service. Simultaneously, across each functional area (e.g., plan, source, produce) there is need for increased visibility.

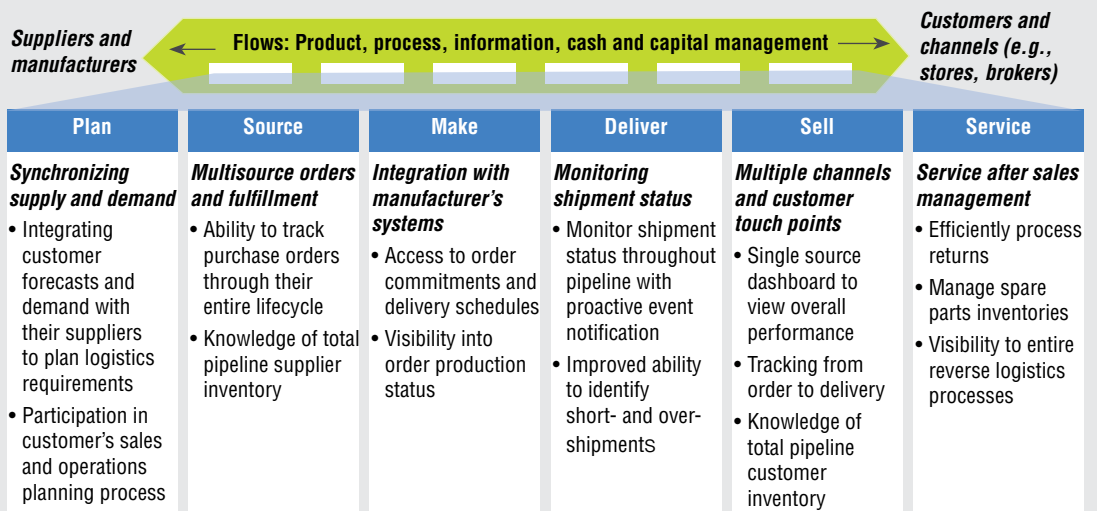
Technical obstacles, however, can limit increased visibility in demand-driven supply chains. Many application architectures are “hardwired,” made up of hundreds – even thousands – of custom-coded connections, each of which must be recoded every time a connection or something it connects is

altered in any way. For an organization with hundreds of trading partners, implementing rapid change on top of this foundation can be a formidable, time-consuming task.

This IBM Institute for Business Value executive brief will explore the following topics:

- The business imperatives that require greater supply chain flexibility and responsiveness through enhanced visibility
- New business strategies, capabilities and competencies that can improve a company’s supply chain operations but may seem unreachable in existing technology environments
- A service-oriented architecture (SOA) technology strategy that can help provide better and faster business change and responsiveness
- The first steps and considerations that companies should consider to begin migration to an SOA environment.

FIGURE 1.  
End-to-end supply chain visibility model.



Source: IBM Institute for Business Value.

# Blueprint for supply chain visibility

*Service-oriented architecture can help drive agility, supplier collaboration and demand-driven replenishment*

## Adapting to the changing landscape

Today's business environment changes quickly. The supply chain leader must deal with changing market boundaries and new channels. Companies are quickly realizing a global market means more than duties and currency conversion. Contract manufacturing – and other sourcing and manufacturing strategies with multiple tiers and partners – have increased the complexity of the modern sourcing chain. The distribution side has also grown more complex, as logistics networks have evolved to multitiered strategies. Throughout the entire supply chain, information continues to grow more important, but also more distributed and harder to rein.

Economic flows are increasingly multidirectional, placing fundamental pressures on supply chain performance. From the demand perspective, globalization is changing market boundaries and opening up new channels for sales and distribution – as well as encouraging new market entrants and aggressive competition. Customers continue to have aggressive demands for differentiated products and services, while product lifecycles are shortening. Meanwhile, organizations feel “supply shocks” as sourcing strategies continue to evolve toward lower-cost jurisdictions. Accordingly, logistics networks have also become more complex. We believe the combination of these factors is causing increasing reliance on specialization within the supply chain for differentiated capabilities, better integration and more collaboration among the expanding network of partners (e.g., suppliers, service providers and contract

manufacturers). This calls for new business models that encompass more flexibility, agility and innovation.

## SOA: A foundation for agility and visibility

SOA has emerged as a means for supply chain managers to transform the business model, enabling demand-driven synchronization of supply chain planning and execution activities in collaboration with suppliers, service providers and partners. SOA integrates repeatable “component business services,” allowing companies the opportunity to balance demand and supply, as well as optimize customer service and inventory levels by managing supply chain events in realtime across organizational boundaries.

### Key concept: Service-oriented architecture

SOA is a technology strategy and architecture model in which discrete bundles of software functionality are componentized and delivered to other functions and systems as “services,” enabling different applications to use common parts. In turn, new applications can be built by assembling these reusable components. This enables companies to build new technological capabilities more quickly, change their operations more rapidly and better preserve the existing value of current systems.

SOA is a business-driven IT architectural approach that takes everyday business applications and information and breaks them down into individual functions and processes called services. Each of these services can be mixed, matched and reused to create new,

**SOA integrates people processes and information and is designed to speed up new application development.**

flexible business processes to address new corporate priorities. The services then can be made available to others in the extended network – such as other departments, trading partners and customers. And when processes are altered, companies can use existing, assembled, composite services and just “snap-in” the additional new process, shortening the response time.

SOA is designed to speed up new application development and often grants legacy systems a new lease on life. By putting new interfaces onto older systems, they can continue to coexist and interoperate with the latest generation of information technologies.

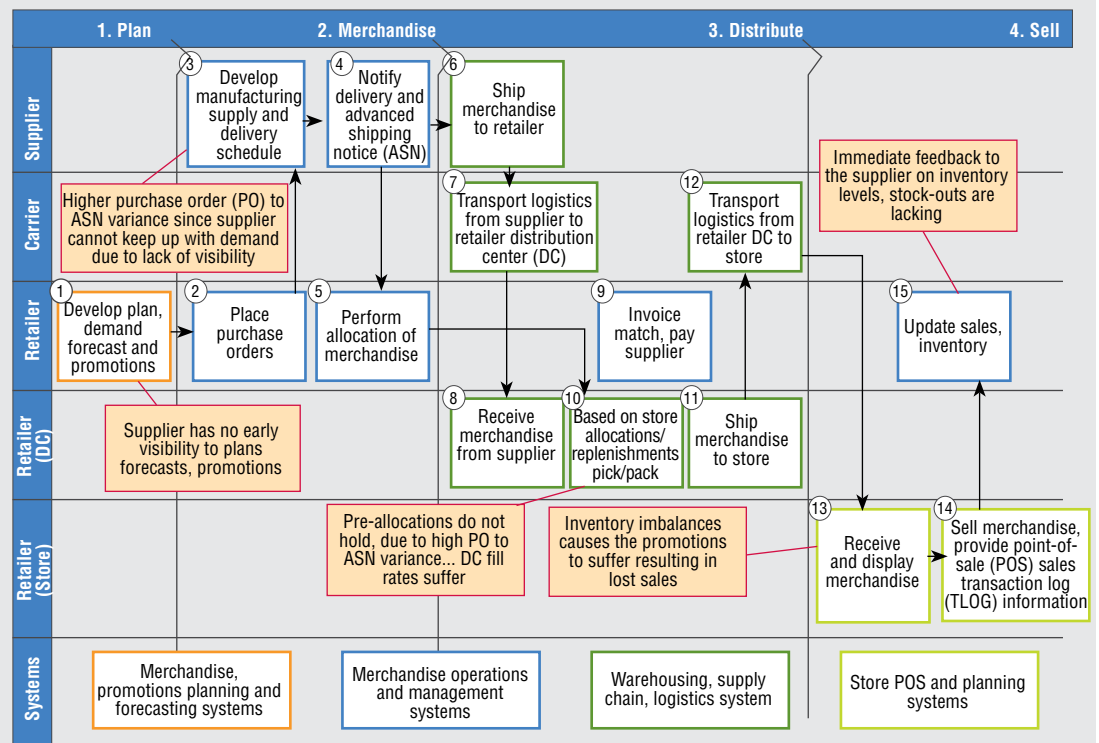
## The SOA blueprint for supply chain visibility

The SOA approach integrates people, processes and information. An SOA strategy helps simplify integration throughout the entire supply chain and can enable companies to respond faster to day-to-day disruptive events and balance trade-offs.

### Demand-driven replenishment

Figure 2 shows an example of the processes employed by a retail company that has planned a major promotion involving a bundled offer: buy the new electronics product at a high price point and get 50 percent off the accessory. Both products are in a Vendor-Managed-Inventory (VMI) program. Before

FIGURE 2. Demand-driven replenishment in retail environment.

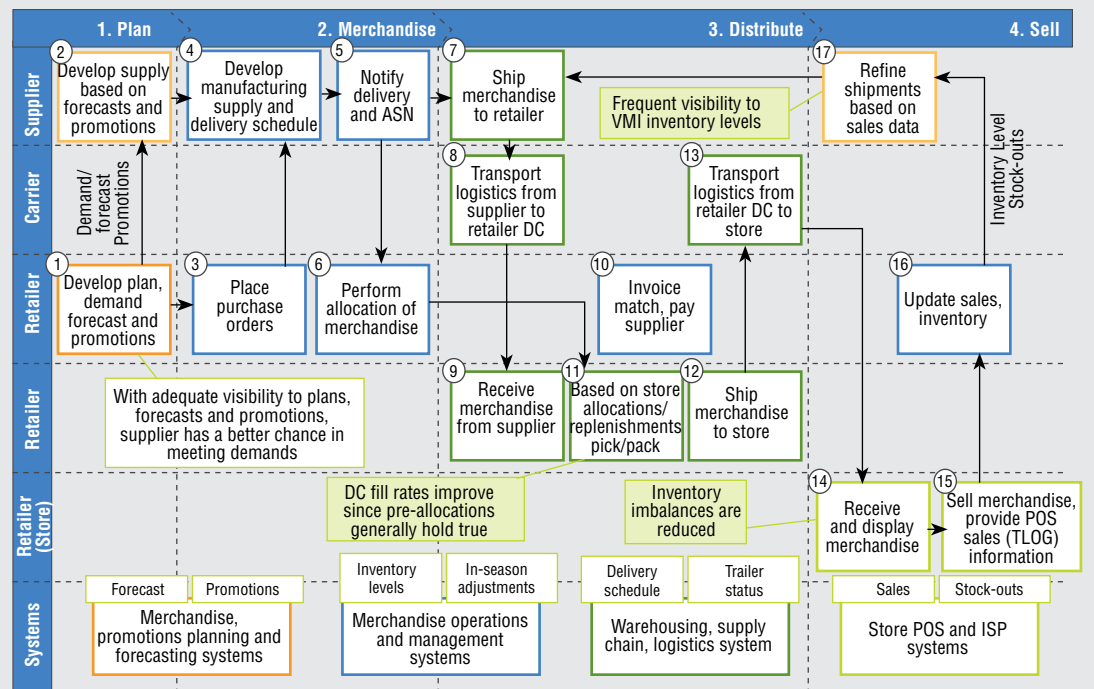


Source: IBM Institute for Business Value.

the promotion, the accessory was managed to a 90-percent service level. The accessory vendor was not made aware of the promotion. The new product was replenished using a “new arrival push strategy,” and an effective service level was maintained of 99 percent. But the retailer quickly ran out of inventory of the accessory item in some stores. Combined with the inability to locate and transfer inventory among stores, the promotion resulted in disgruntled customers and lost sales. Had the point-of-sale data (POS) been communicated to the planners and suppliers in a timely manner, potential out-of-stock situations could have been proactively monitored to allow redirection of existing inventory.

With an underlying SOA enabling new and sophisticated triggering capabilities, these interactions can be managed more effectively. Disruptions in any one of these would create an event notification, alert or performance failure message to a business dashboard. In this example, the POS data of actual customer purchases would immediately trigger a replenishment order. The supply/ demand synchronization “service” initiates the process to receive POS and promotions data. Analytical models evaluate the accuracy of the original promotion forecast and compare it to current inventory and supplier commitments. Shipment and distribution events are monitored for any disruptions, and inventory in the pipeline is constantly monitored (see Figure 3).

FIGURE 3.  
Using demand signals to synchronize supply.



Source: IBM Institute for Business Value.

**With access to supply chain information from different partners, SOA can help provide a flexible and responsive supply chain environment.**

SOA can help create a more flexible and responsive environment, enabling access to supply chain information from many different partners, such as POS transactions, revised forecasts based upon actual demand, new production plans from suppliers and capacity constraints of logistics providers. Acting upon and sharing this information allows the supply chain to become much more responsive to shifts in market demand.

### ***Supplier collaboration in a manufacturing environment***

Let's examine another scenario in the consumer electronics area. In this example, an OEM works with various suppliers to source components for a product and then engages with a contract manufacturer to build the product, which ultimately ships to various customer segments.

Although the company has the ability to connect with supply chain partners, it lacks a fully integrated, scalable and flexible environment. The underlying technology has been cobbled together over time and impedes the ability to meet the ever-increasing demands of a rapidly changing marketplace – not to mention realtime reaction to the demand and supply shocks. Efforts to share information and smooth the flow of goods between the multitiered component supply base have often failed or fallen short of expectations, causing production schedule disruptions and customer shipment delays. The inability to provide sustainable visibility of supplier commits and inventory status has resulted in lost sales and increased operating expense (carrying costs, transportation costs and idle lines as a result of poor forecasts to suppliers).

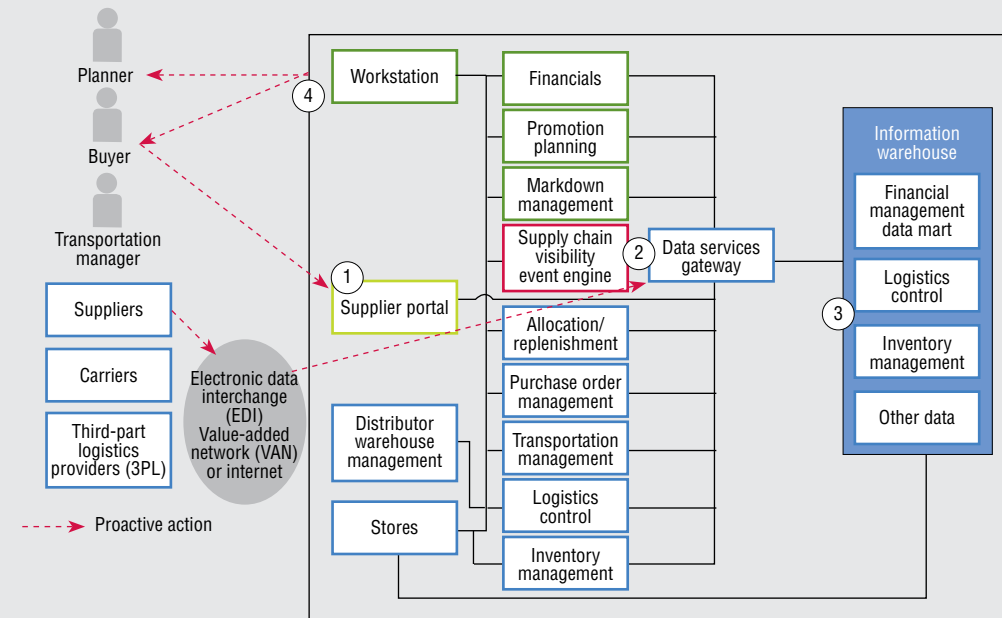
The electronics OEM decided to implement a supplier collaboration hub to provide visibility to key supplier information such as supply (components), commit dates and lead times. Supplier position is compared to demand forecasts, actual demand and current pipeline inventory levels (work in progress, stock and in-transit). Using advanced analytics and statistical analysis, a recommended outlook is then developed. A dashboard reports inventory performance information along with alerts if targets will not be met because of suppliers, logistics or other constraints. SOA enables this capability by using repeatable “services” to define inventory position and to integrate key (and required) information from a multitude of suppliers across the globe (see Figure 4).

With a service-oriented architecture, the company can create a more flexible and responsive environment for its supply chain partners. It can now have access to supply chain information from many different partners, such as a revised forecast based upon actual demand, a supplier's new production plan and a logistics provider's delivery constraint. By sharing and acting upon information, the OEM can become much more responsive to shifts in supply and meeting market demand.

### ***Virtual Command Center***

We believe the lack of visibility to transportation and distribution events may be the largest of supply chain visibility problems. Today's supply chains span geographies, involve multiple logistics service providers, multiple modes, advanced security-regulated import and export requirements and complex value-added distribution strategies. Fragmented

FIGURE 4.  
**Visibility into supplier capacity plans.**



Source: IBM Institute for Business Value.

information only exacerbates the problem. Together, these factors can lead to:

- Lack of visibility to transportation status – frequent unexpected delivery failures can erode customer satisfaction
- Delayed reaction time – problems can be discovered after the fact or after “damage” has already been done
- Integration of shipping and other enterprise applications (order management systems, enterprise resource planning, warehouse management systems, etc.) – application silos may not readily share information, necessitating repetitive manual data entry
- Inconsistent carrier/mode/lane usage policies – multiple transportation planners can make independent mode and carrier selection decisions

- Limited control of assets – limited knowledge of asset utilization because of fragmented reporting capabilities
- Labor intensive track and trace processes – manual processes executed by large clerical/management staffs
- Higher-than-necessary transportation spend in expedited shipments and transfers.

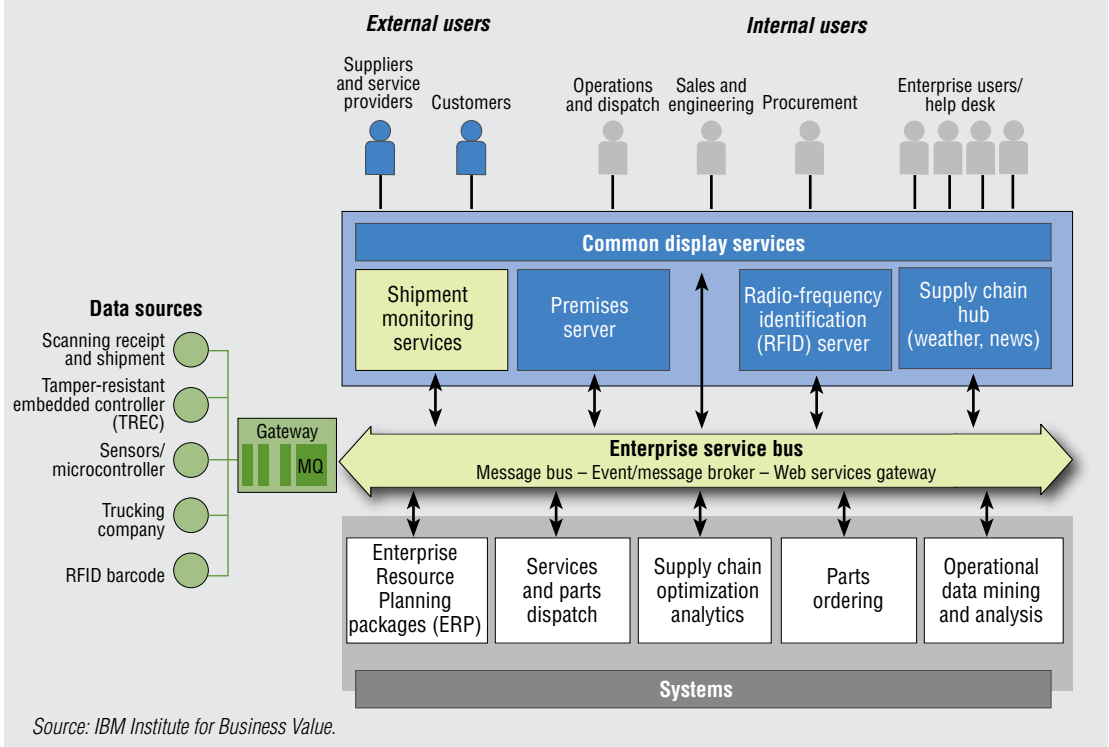
What we believe is needed is a combination of business processes and technology enablers that effectively monitor and evaluate logistics activities across the entire supply chain and provide the ability to integrate the multitude of logistics parties, events and performance criteria into actionable responses. We call this capability a Virtual Command Center.

**The SOA Virtual Command Center delivers operational data and correlates “event” information to determine if any are out of tolerance.**

An SOA Virtual Command Center delivers timely operational data from existing business applications to the designated supply chain constituents, providing visibility as well as proactive monitoring and notification (see Figure 5). Events received from planning and execution systems are correlated to determine if any “out of tolerance” situation has occurred (reactive) or might occur in the near future (proactive). Intelligent agents, based upon business rules, provide detection and alert notification mechanisms. The Virtual Command Center fuses realtime information, event processing and advanced analytic technologies to integrate planning, operations, intelligence and collaboration, by:

- Integrating and synchronizing end-to-end supply chain information among parties
- Bringing together pertinent data on events to monitor activities and performance and to facilitate shared decision making
- Providing visibility to events, alerts and performance indicators displayed on personalized dashboards – a virtual control tower for monitoring activities
- Aggregating or segmenting information for trend analysis, automating business rules and recommending actions based on performance criteria.

**FIGURE 5.**  
**Virtual command center.**



SOA makes this type of enablement possible. The “services” are the events – with repeatable and standardized integration definitions. SOA allows business applications to place discrete events on the Enterprise Services Bus (an entity that connects the services). Event management services collect, cleanse, aggregate and store the discrete events. Process management services allow events to trigger or be used by business processes, which map events to operational metrics and key performance indicators (KPIs). The KPIs are monitored by the process monitoring component. Sense-and-respond adaptive control algorithms will use a combination of business rules and other decision-support methodologies to trigger event and process management instances. Events are analyzed by priority through business analysis services. All of the components are managed by a set of role-based dashboards. Collaboration services manage interactions with other processes and systems within or across enterprises.

In other words, SOA provides the means to increase control through visibility and exception detection across global supply chains.

### **A roadmap to SOA-enabled supply chain visibility**

As managers look to improve their operations to enhance performance, it is likely they often feel the painful reality that changes will never come soon enough. They feel the frustration of either constantly initializing new projects with little effect until it's too late to meet rapid market changes, or having to respond to information they wish they had sooner. This should prompt a question and challenge to supply

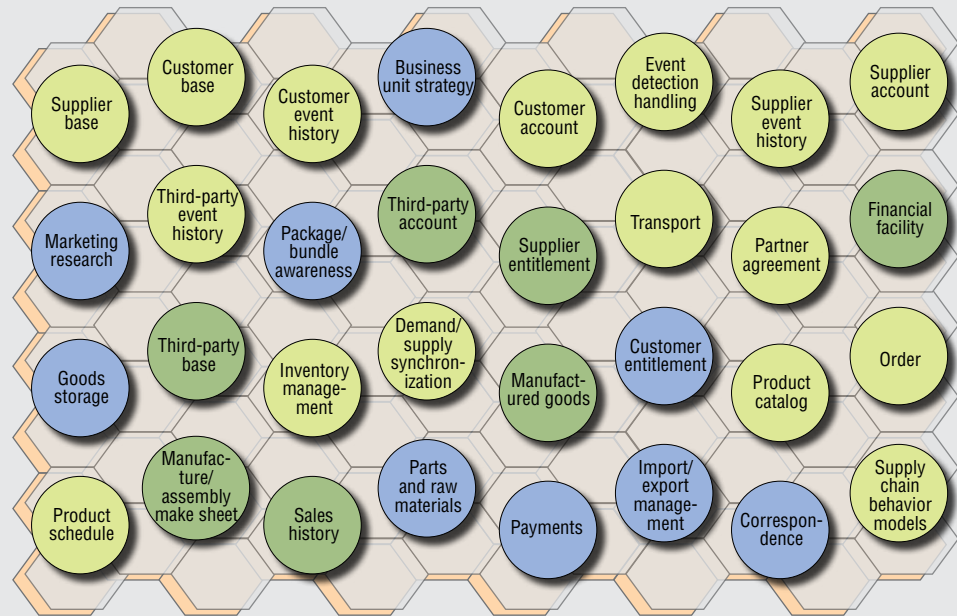
chain management leadership: “How can I update and improve my technology capabilities in a way that is fast enough to meet business needs and in a way that doesn't destroy my existing and ongoing investments?”

We believe the answer lies in “services,” the fundamental building blocks for SOA. Services are pieces of application functionality that represent a repeatable, categorically containable business task. An example may be “update supplier account” or “verify shipment status” (see Figure 6).

The service is only built and maintained in one place. Other applications can access this service and incorporate it into their own functionality. For example, the more complex applications of “order management” or “shipping and delivery fulfillment” must both utilize a function to update a customer's information. In this case, both the order and shipping application would call upon the same “customer information” service to complete the task. The benefit of this is that the common function only needs to be built once, maintenance of the service does not need to be duplicated, and when the service is upgraded, all user applications and systems receive the upgrade. This usage is considered service orientation.

In turn, a *service-oriented architecture* is a technological design discipline that uses service orientation and standards to plan, build, manage and enable information and technology. SOA also allows for greater flexibility moving forward. It is often faster to deploy and upgrading does not require wholesale replacement of existing systems or retirement/replacement of the current generation. This eliminates the need to constantly start from

FIGURE 6.  
Supply chain visibility component services.



Source: IBM Institute for Business Value.

scratch when deploying new systems and enables companies to realize the value and ROI of past investments.

A sound approach to building an SOA transformation plan for supply chain visibility can help provide both technical and organizational success. Our recommended approach to this end includes:

*Develop a comprehensive, top-down strategy for SOA:* Create a vision and strategy for SOA – a governance model and a multiphased implementation roadmap to guide the transformation of the supply chain and supporting systems toward a service-oriented model.

*Conduct a diagnostic:* Assess the current state of service orientation and integration – and the desired or future state – for a line of business or enterprise. Conduct a business process and architecture health check for projects adopting SOA. This should include an SOA maturity assessment, an SOA business process review and an SOA technical review.

*Develop an implementation plan:* Establish the high-level solution architecture overview, defining the scope in terms of process, service, security and governance. A robust implementation plan is necessary for successful realization of the SOA solution. It should include a refined a high-level SOA solution architecture, an SOA governance model and a detailed implementation plan.

**Visibility and collaboration capabilities allow monitoring upstream and downstream progress across the supply chain.**

*Define the SOA lifecycle management process:* Define a suite of business process management and SOA services that complement the application implementation lifecycle in every stage of SOA design, development, integration, implementation and management. This should include “as is” business processes, future business processes, a process assessment and analysis (future and as is), and a high-level service model.

Careful assessment, planning and research can go a long way to craft a smart, low-risk path forward.

### **SOA benefits: Responsiveness, flexibility and performance**

Collaboration and visibility (internal and external, local and global), are becoming a top priority. In a recent global value chain study, conducted by IBM, we found that 50 percent of the surveyed companies collaborate with partners’ supply chains, meaning that they have a programmatic and technology-enabled relationship.<sup>1</sup> Having visibility and collaboration capabilities removes many of the latency problems inherent in traditional global supply chain communications. Managers are able to monitor progress across the supply chain both upstream and downstream and make decisions that can affect performance in a meaningful and timely way.

Visibility and collaboration have serious technology, software and data implications. Most companies struggle with sharing information across their own functional groups, divisions and geographies. Adding complex supplier, manufacturing and logistics networks magnifies these problems. It may be easy to imagine

how these problems could be solved with provocative solutions, such as realtime collaboration and information integration or visibility to supply chain and customer events. But the reality is that current systems cannot always be rapidly adapted to fulfill this vision; such changes could require great expense and long timeframes.

Service-oriented architecture (SOA) can enable companies to more rapidly respond to market and operational impetus. It can also help reduce the lag time and the investment needed to make technological improvements while preserving (and, in fact, optimizing) the investments of the past. The benefits, we believe, are significant.

#### ***Responsiveness***

Realtime visibility of supply chain transactional event information allows rapid identification of root causes of issues. Proactively monitoring ongoing supply chain information and events can advise managers of potential “out of tolerance” situations before they occur. SOA can provide standardized integration and helps accelerate the deployment of new functionality. Pre-built service components can be combined and reused for rapid business process composition, application development and deployment in response to market change.

#### ***Flexibility***

The ability to dynamically adapt to supply chain shocks through end-to-end visibility and proactive exception management allows for greater flexibility. SOA can allow the organization to be more flexible in the capabilities it builds, providing for more options with greater integration.

### **Performance**

The ability to detect exceptions and alert affected parties to drive resolution in real-time, along with monitoring KPIs, provides a scorecard to constantly improve end-to-end supply chain activities. SOA can help legacy and enterprise systems to continue to provide value in the functions that they perform, while integrating with reusable services to collaborate in different environments.

Supply chain management leaders may now be able to achieve new responsiveness and flexibility while improving the performance equation. Companies can assemble the capabilities they need in new and different ways. Now, companies don't have to operate their supply chains in a vertically integrated way. A customer-driven, networked and globally integrated supply chain is the future model for many companies. This innovation requires visibility and the ability to make changes flexibly – and SOA can make this possible.

### **About the author**

Karen Butner is the Supply Chain Management Lead for the IBM Institute for Business Value, and an Associate Partner in the IBM Supply Chain Management practice. She focuses on strategy and transformation competencies. Additionally, she is responsible for managing the development and deployment of the Supply Chain Management Global Solutions Portfolio – a collection of integrated business, technology and organizational solutions to support the broad and diversified, multi-industry client base of IBM. She has more than 25 years of experience in supply chain management business practices and strategies. Her concentration over the past several years has been assisting clients in the high-technology, retail and consumer products, electronics, transportation and logistics industries develop strategies and improvement agendas to gain significant value through transforming their global supply chain performance. She can be reached at [kbutner@us.ibm.com](mailto:kbutner@us.ibm.com).

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## References

- <sup>1</sup> IBM Institute for Business Value executive brief. "Scoring High on the Supply Chain Maturity Model." November, 2006.



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