Industry-wide Logistics Visibility, The Time Has Come

CONVERGE

An Executive White Paper

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by Petere Miner, Converge Inc.
and Mark Withington, PLM Research

Executive Overview

Over the past 30 years, corporations have evolved from vertically integrated manufacturing behemoths to distributed, horizontally integrated value chains. Nowhere can this transformation be better observed than in the high technology sector. Dominant high technology players such as Digital Equipment Corporation (DEC) — characteristic of vertically integrated "sand-to-systems" supply chains — are now extinct, fallen prey to leaner, more agile competitors who delivered new products to market faster and at lower costs. These competitors focused upon their core competencies, outsourcing processes and products of marginal value-add to others in the supply chain. In doing so, they transformed the high tech supply chain into today's loose confederation of independent global enterprises that manufacture, distribute, and assemble electronic components, subsystems, assemblies, and end-user systems for the business and consumer electronics markets.

During that transition, participants within the high tech supply chain came to realize that they really served two masters in their quest for survival — profitability of the individual enterprise and efficiency of the supply chain as a whole. Unfortunately, Information Technology (IT) investments over the last decade lacked the inter-enterprise capabilities necessary to provide the end-to-end view required for true Supply Chain Management (SCM).

Fundamentally, SCM optimizes a set of four, macro-level decisions:

- What capabilities and capacity to offer
- Where to establish production facilities, stocking points, and sourcing points
- How to distribute inventory transition points across the supply chain — raw materials, work-in-process (WIP) to finished goods
- When and how to move inventory through the chain

Logistics plays an integral role within the SCM effort by providing the connections and transportation that link the independent nodes of the supply chain from point-of-origin to point-of-consumption. Its role within the high tech supply chain becomes particularly critical in light of several unique characteristics within this sector:

- Global dispersion of supply chain nodes arranged to take advantage of favorable local economic conditions
- A boom-to-bust business cycle coupled with an increasingly abridged product life cycle
- Multiple, independent participants within the chain offering different levels of technical sophistication and operating according to different business cultures

The need to control the flow and storage of goods, however, is only part of the logistics mandate. Visibility — near real-time information regarding the status of in-transit and static materials — is essential for efficient and effective SCM. This has emerged as the Achilles' heel of today's high tech supply chains and becomes increasingly problematic for International Trade Logistics (ITL) where the potential for delays increases exponentially. The significance of ITL within the high tech supply chain cannot be overestimated. Financial, political, and regulatory conditions, uncommon to domestic freight, inject logistic delays that impact the industry as a whole.

While some of these issues are systemic in nature, and therefore beyond the shippers control, others are simply a result of poor decisions caused by global complexity and poor visibility within the supply chain. In order to meet Service Level Agreements (SLA) and avoid costly production line stoppage, participants are forced to carry buffer stock — inventory held in lieu of accurate information — which consumes working capital and ultimately weakens the chain's ability to compete as a whole.

This paper explores the root causes of supply-chain problems and proposes that supply chain visibility is paramount to the continued success of the high tech industry as a whole. It argues that the Internet provides a better conduit for visibility due to its ubiquity and low cost, which EDI lacked, promoting industry-wide adoption. It endorses evolving high tech e-markets that offer a fractional cost of ownership value proposition, as well as intra-high tech data aggregation points that private exchanges cannot. It further proposes that visibility and aggregation together can provide an operating environment that enables shippers and carriers to work more efficiently — lowering cost, leveraging volume, and securing lift capacity within the chain — so the high tech sector as a whole can operate more effectively.

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The Horizontal Evolution

The move from vertically integrated manufacturing in the 1960s to today's horizontally "connected" supply chains has no doubt increased efficiency throughout the industrialized world. Characteristically, horizontal supply chains do this by placing planning and process optimization within the individual participants of the chain, rather than the vertically integrated, centralized authorities of the past. Participants in these new value chains must serve two masters to ensure their ultimate success:

- Profit motivations of the individual enterprise — Individual organizations must continually hone their core competencies and drive non-strategic processes to others in the supply chain.

- Competitiveness of the chain in its entirety — Individual enterprise optimization will not yield the most profitable end product in a horizontally integrated supply chain. The success of the participating enterprises ultimately relies upon the success of the chain as a whole.

Supply Chain Management Fundamentals

This latter initiative, and the extent to which it occurs, falls under the heading of Supply Chain Management (SCM). SCM addresses four fundamental decisions in its quest to optimize supply chain efficiency:

- *What capabilities and capacity to offer*

  Identify what to produce, which plants to produce them in, and the determination and allocation of suppliers (make-or-buy decisions) and distribution centers necessary to meet service level agreements and cost structure.

- *Where to establish production facilities, stocking points, and sourcing points*

  Determine the supply chain configuration including the size, number and location of warehouses and sourcing points necessary to minimize total landed costs and meet service levels.

- *How to distribute inventory transition points across the supply chain*

  Balance levels of raw materials, work-in-process (WIP) and finished goods necessary to meet supply chain goals.

- *When and how to move inventory through the chain*

  Assess the tradeoff between pooling inventory near production (financing costs, taxes, and warehousing) versus transporting inventory frequently (logistics expense).

Logistics: The Backbone Of Distributed Supply Chains

Logistics — defined as the planning and execution of inventory flow, storage, control and data management — plays an integral role within the horizontally integrated supply chain. Nearly every aspect of SCM relies upon the connectivity and transport of materials and information that logistics provides. As supply chains strive to balance inventory turns, via just-in-time management, with service level agreements and possible production line stoppage, logistics will become the driving force behind operational efficiency.

The High Tech Supply Chain

Nowhere has the concept of horizontally integrated supply chains been better demonstrated than within the high tech industry. Functionally, this sector originates at the component foundries where continual advances in manufacturing techniques create a proliferation of new "building blocks" from which better products can be designed and brought to market.

During the late 70's and early 80's, traditional, vertically integrated high tech companies came under intense profitability pressures as product life cycles collapsed in response to Moore's Law*. Shortened product life cycles minimized revenue (and profit) streams, and therefore suppressed return on assets. Companies could no longer rely upon the highly profitable latter stages in a product's life to recoup development investment. Rather, they had to introduce new products — often cannibalizing existing lines — out of fear that they would lose their customer base to a new competitor. In such an environment, time to market — the speed at which new products are introduced— became the strategic competitive advantage of a manufacturer. First mover advantage became paramount to a manufacturer's long-range success.

* In 1965, Gordon Moore (Intel cofounder) made a memorable observation when he started to graph data about the growth in memory chip performance. Each new chip contained roughly twice as much capacity as its predecessor, and each chip was released within 18-24 months of the previous chip.

During this time, it became apparent that traditional, vertically integrated product development and manufacturing processes could not meet this "promise" since they lacked the agility and speed necessary to consistently secure first mover advantage. The manufacturers were forced to adapt or perish.

Ultimately, successful companies identified and focused on core competencies like product development and marketing, and gave up non-core assets, products and processes like manufacturing and after-market support. These efforts transformed the high tech supply chain into today's outsourced model of independent enterprises — component manufacturers, subsystems manufacturers, electronics distributors and brokers, contract electronics manufacturers (CEMs) and original equipment manufacturers (OEMs) themselves (Figure 1).

Recently, some alarming symptoms have developed within this outsourced model as the companies attempt to balance profitability of the enterprise and optimization of the supply chain as a whole. The following symptoms have emerged:

- Demand and supply schedules frequently become mismatched resulting in oversupply or underproduction within the supply chain.

- Tactical information flows between links in the supply chain become erratic and inaccurate, forcing participants to tie up working capital in buffer stock to absorb inconsistencies.

These symptoms are problematic due to a number of unique characteristics within the high tech supply chain:

- *Multiple, independent participants within the supply chain offer different levels of technical sophistication and operate according to different business cultures.*

The enterprises that have emerged to offer outsourced contract manufacturing — CEMs and Electronics Manufacturing Services (EMS) —

* The Bullwhip effect refers to the exaggerated production schedules within a supply chain resulting from cumulative communication inconsistencies (e.g. data silos) between partners. Small changes to demand schedules at the head-end of a supply chain are serially conveyed and misinterpreted at each node in the chain. These embellishments cascade down the chain, resulting in massive swings in the supply chain's point-of-origin

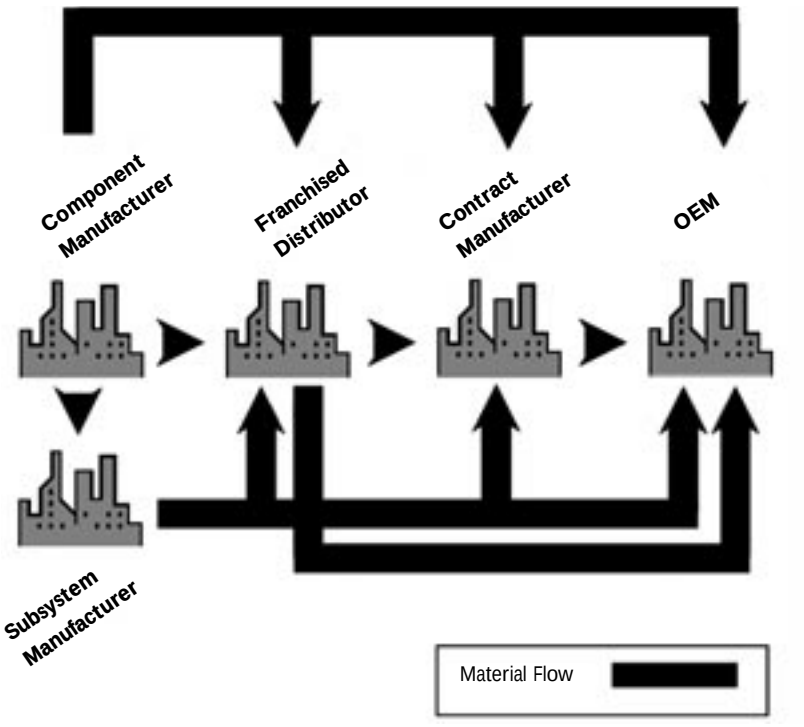
often did so through the acquisition of divested OEM manufacturing facilities rather than organic growth. Often the facilities and their human resources simply transferred ownership "instantaneously", creating a network of plants operating under different IT systems, manufacturing cultures and business processes.

- *A boom-to-bust business cycle coupled with an increasingly abridged product life cycle*

High technology products (particularly consumer electronics) have traditionally demonstrated a strong correlation with the macroeconomic business cycle. Since consumers consider these devices "luxury" goods, this is one of the first sectors to experience a slowdown when consumers postpone purchases in anticipation of a tougher economic climate.

Additionally, the "perishable" characteristic of the electronics product life cycle, coupled with its extreme sensitivity to demand schedule changes (Bullwhip effect*), forces manufacturers to frantically adjust production levels at the slightest hint of a business recession.

Figure 1: The Horizontally Distributed High Tech Supply Chain



Source: PLMresearch April 2001

- *Strategic global dispersion of supply chain nodes - arranged to take advantage of favorable local economic conditions*

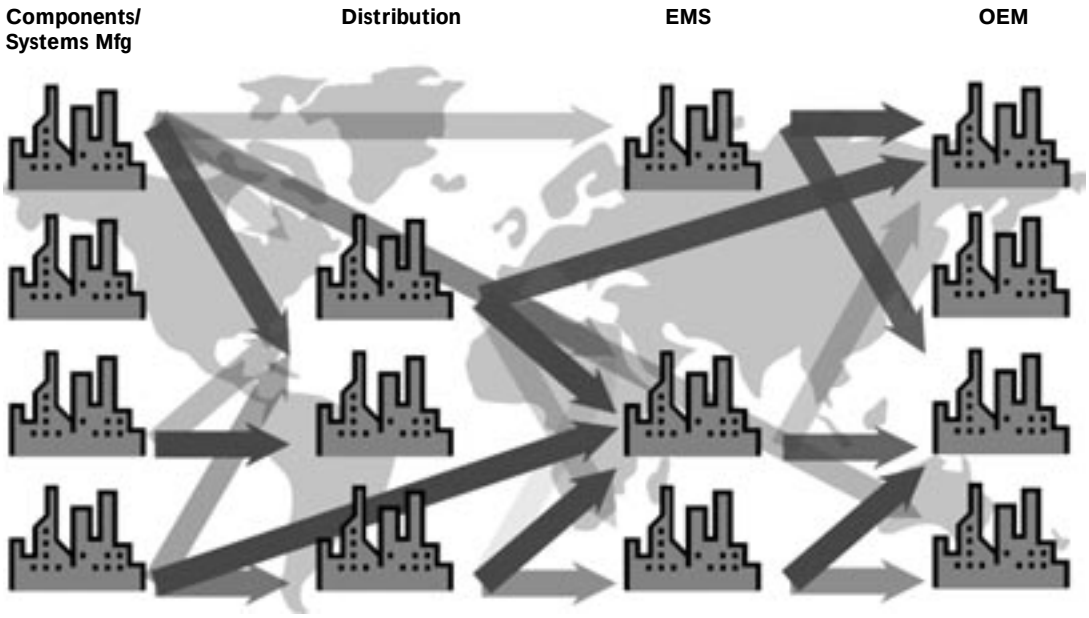
In the quest to minimize cost and raise profit margins, participants have leveraged favorable economic conditions across the global market. They have established manufacturing presence in areas of low labor cost and distribution centers in areas of high-wealth and consumption. As the number of enterprises within the supply chain has expanded (a result of divestures), this network has become increasingly complex (Figure 2).

Think Global, Act Global

The significance of geographic dispersion cannot be overestimated. International Trade Logistics (ITL) — the process by which information and materials flow across national boundaries — creates delays and uncertainties that domestic shipments never undergo. Financial letter-of-credit terms, export licensing requirements, and denial/embargo listings involve multiple private/public agencies and several queuing points within the shipment process (Figure 3).

Many participants have made significant investment in enterprise level tools such as Trade Management Systems (TMS) and Warehouse Management Systems (WMS) over the past decade. However, these systems typically lack the global, inter-supply chain reach and coordination necessary to improve ITL. Therefore, international shippers are forced to rely upon expensive local agents and brokers to ensure reliable, consistent shipments.

Figure 2: Value Chain Complexity



Source: PLMresearch April 2001

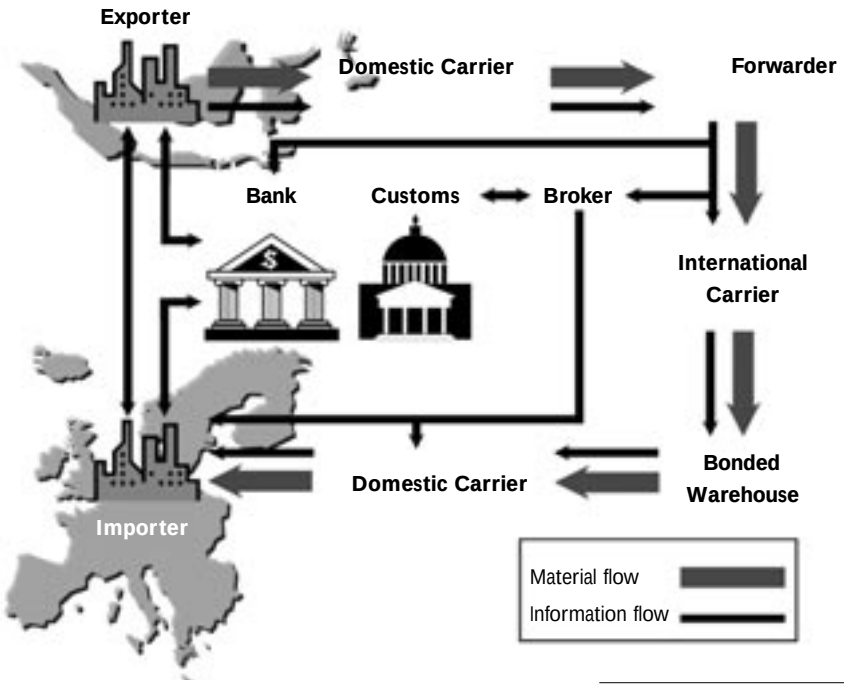
In Search Of Nirvana

Today, nearly every participant recognizes that the supply chain is operating under stress. Buffer stocks are held in lieu of accurate information. Demand/supply schedules are mismatched, with true demand signals from the consumer buried deep within the retail channel. Many high tech companies feel that in order to honor service level agreements and avoid costly production stoppages, they're forced to play a high stakes game of supply chain roulette in which the loser owns the inventory when the economy "stops".

Those same companies recognize that the solution will require information sharing and collaboration across the supply chain. However, legacy IT investments— primarily materials resource planning (MRP), enterprise resource planning (ERP) and distribution resource planning (DRP) — lack the inter-enterprise capabilities necessary to provide this visibility. The promise of electronic data interchange (EDI) has proven too expensive and too inflexible for penetration beyond first tier suppliers, and the challenges of ITL make a bad situation worse.

In order to maximize the responsiveness and inventory turn of the supply chain, demand/supply changes must be "seen" and adjusted to, rather than "felt" and reacted to. Buffer stock requirements must be managed to reasonable levels, and information must flow freely to all participants. In short, each node must have simultaneous visibility across the entire global supply chain for both in-transit and static materials.

Figure 3: ITL In Practice



Source: PLMresearch April 2001

See Things You've Never Seen

Although total visibility is the identified savior to the stressed supply chain, locating the proper provider of visibility information remains a challenge. The logistics data management role, by virtue of its function within SCM, is ideally positioned to provide this information. However, total visibility has not been available in the past for two fundamental reasons:

- Serial network topologies — Value chains typically convey goods and status information in a series of sequential steps from point-of-origin to point-of-consumption. During these steps, shipment status information often remains with the carrier and shipment themselves, forcing recipients to rely upon missed delivery dates as the only indication that a problem occurred in transit. The delivery slippage propagates slowly down the chain in an "after-the-fact" fashion, compounding its impact at each stop (Figure 4).

- Infrastructure investment — Horizontal supply chains lack dedicated management teams and financial reporting structures that are necessary to create the business infrastructure needed to evaluate, deploy, and manage investment. Therefore, the participants understand the need for visibility, but no individual company has the time, capital, or profit motive to implement it.

Enter The Internet

Internet technology, through its ubiquity, low cost, and flexibility, provides the conduit through which visibility can occur. Inserting low cost enterprise application integration (EAI) middleware "connectors" (Figure 5) at each information interface (e.g. between supply chain partners and ITL participants) provides the "data feeds" that can be aggregated and shared simultaneously throughout the supply chain. Additionally, the interoperability of the Internet supports multiple adoption models within all levels of participation. While tier one suppliers may choose a model based on ease of integration with their legacy systems, others may choose a model based on traditional "rip-and-read" fax, spreadsheet, or browser interfaces.

Centralized, Internet-based information topologies effectively address the technical aspect of supply chain visibility. However, they do not address the second and equally puzzling problem: who's going to do it?

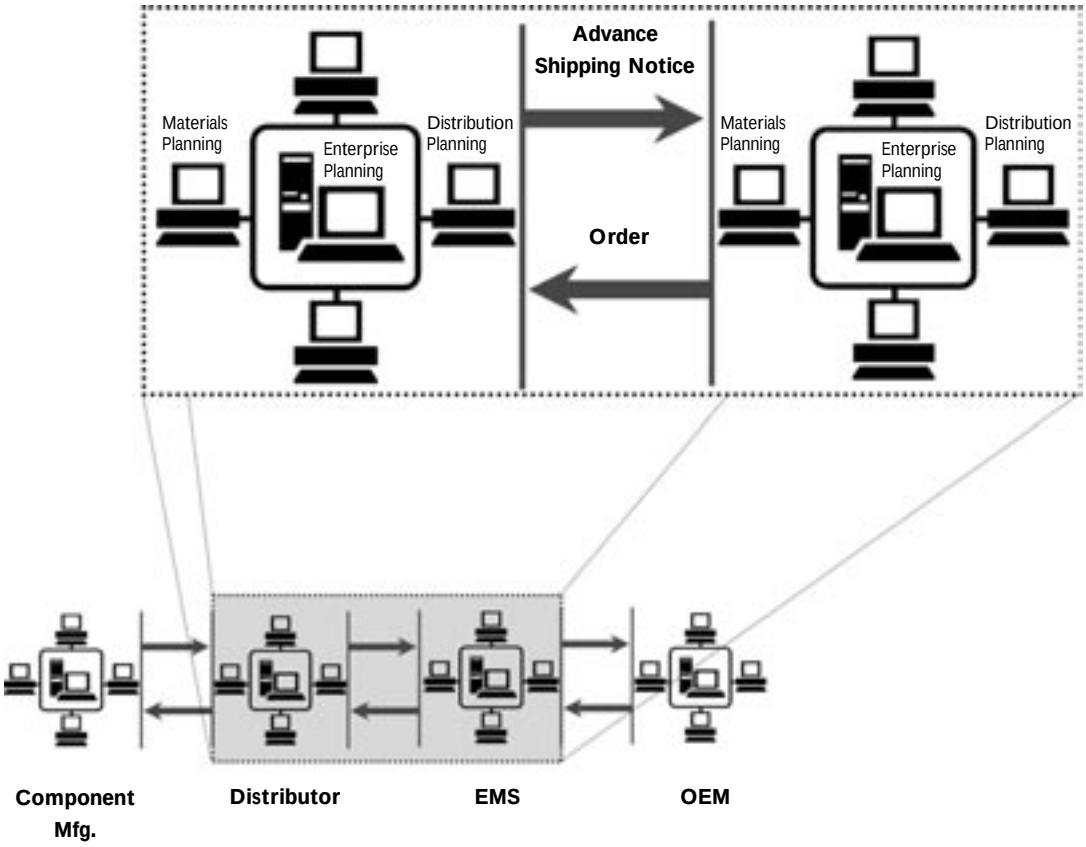
Attributes Of A Centralized Hub

In order to answer this question, and ultimately offer the benefits of centralization, several technical, business process, and economic challenges must be met:

- Security and anonymity – Secure and sometimes anonymous transactions are critical for industry wide adoption. Ultimately, Internet technology must meet or exceed levels of service that participants currently provide.

- Independence – Participants must believe that a "level playing field" exists for all enterprises, and that the network has the best interest of all parties in mind.

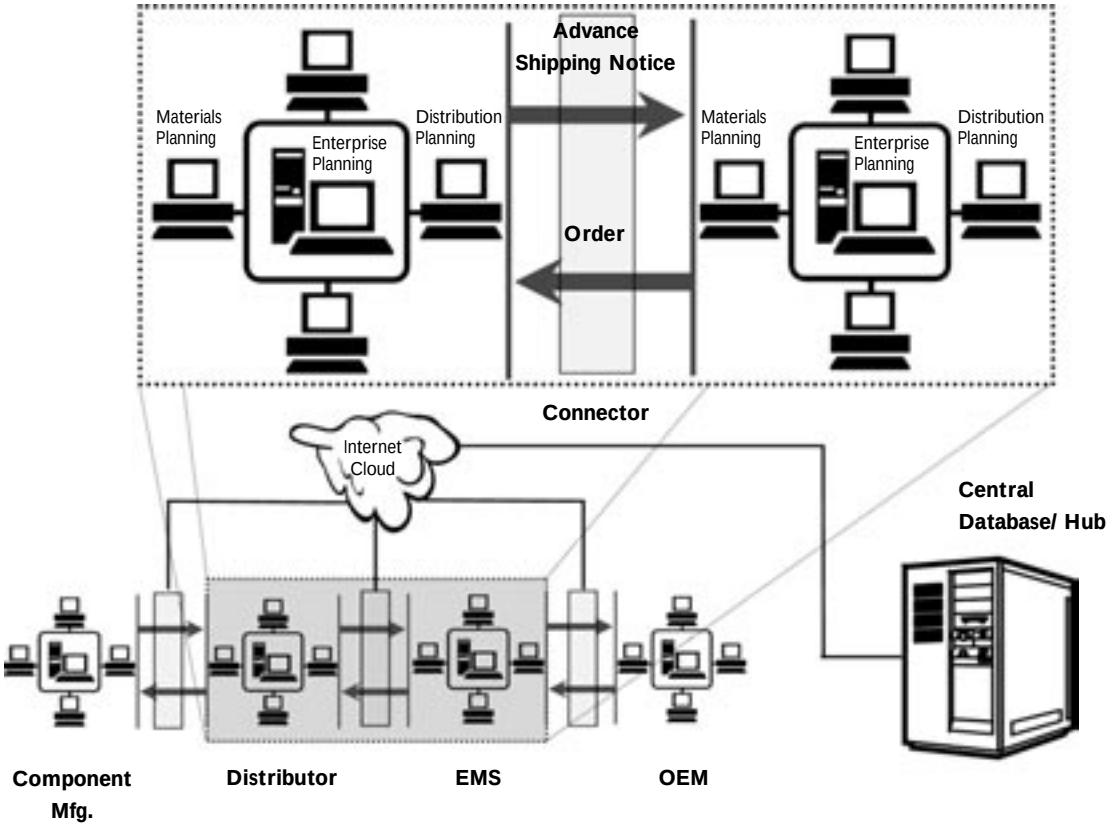
Figure 4: Serial Information Topologies



Source: PLMresearch April 2001

- Domain expertise – The hub (via its personnel) must understand the business processes and environment in which it operates.
- Technical acumen – The hub must align itself with solid technologies and partnerships to ensure rapid and successful deployment. It must staff to and design for high levels of operational excellence.
- Fractional cost model – Due to the capital intensity of creating a centralized hub, the cost of the network should not be borne by a few individual enterprises, but shared equitably across the industry. Participants should be free to join or separate from the network, as well as choose the level of service offering they wish to employ.
- Profit motivated organization – The creation of a centralized hub depends on the "invisible hand" of profit incentive. Volunteer efforts and advisory panels cannot create the devout sense of purpose that for-profit organizations can.

Figure 5: Centralized Information Topologies



Source: PLMresearch April 2001

Industry Exchanges: Independence, Technology, And Domain Expertise

Many exchanges have been formed to fill the need for independence and domain expertise within several industries. These include: Transora, for the consumer products industry; Covisint, for the automotive industry; and CheMatch, for the chemical industry. The leading high tech industry exchange is Converge, Inc — a global marketplace backed by such industry principals as AMD, Agilent, Canon, Compaq, Gateway, Hitachi, HP, NEC, Maxtor, Samsung, SCI Systems, Solectron, Sumitomo, Synnex, Tatung, and Western Digital. Converge has a complete offering portfolio that includes a logistics visibility service provided by ConvergeMove℠. ConvergeMove℠ incorporates a fractional cost of ownership model that provides global data management logistics functionality for the high tech supply chain.

ConvergeMove℠ offers an Internet-based electronic solution for logistics visibility and collaboration throughout the entire shipping route via centralized network topologies (Figure 5). Real-time visibility of product shipment tracking, down to the SKU level, allows a company's logistics team to plan and operate with more certainty. Purchase order signals, Advance Ship Notices (ASN) and transportation provider feeds are aggregated and shared in a confidential and secure way for increased visibility and operating efficiency. Additionally, historical data can be reviewed and analyzed for carrier performance and contractual service level compliance.

ConvergeMove℠ also provides content services (rating and routing) that support shipments booking and monitoring across a full range of carriers, and offers the opportunity to aggregate shipments (lowering transportation costs) and leverage volume directed through the Converge exchange. This latter functionality should be particularly significant in light of recent survey data collected from major high tech supply chain stakeholders (Table 2).

To illustrate how companies can benefit from industry exchanges, the following example describes the systemic problem of lift capacity.

Case Study: The Systemic Problem Of Lift Capacity

Air cargo capacity, particularly along major shipping lanes out of the Pacific Rim, becomes increasingly scarce during critical consumption periods in the United States and Europe.

Lift capacity is a function of four variables:

1. Airport landing rights into and out of key facilities
2. Weather conditions
3. Contractual relationships with the international carriers
4. Profit motivation of the carriers

While many of these issues are systemic in nature, and therefore beyond the shippers' control, contractual relationships (and therefore service levels) with the international carriers rely heavily upon a shipper's ability to forecast (e.g. visibility) and commit well in advance of actual need.

Air cargo travels either on dedicated container flights or as belly cargo on passenger flights. Historically, an imbalance of outbound over inbound demand exists within developing countries during peak consumption periods in Europe and the United States, as manufacturers move finished goods inventory closer to the point-of-consumption. Carriers choose not to add more imbalanced capacity (inbound versus outbound) for obvious economic reasons and are incapable of adding capacity instantaneously due to airport landing restrictions.

Local agents have long realized that the key to addressing capacity constraints is long-range, stable contracts with the carriers — forecasting, securing air cargo space regardless of identified demand, and selling excess capacity on the spot market if and when necessary.

Strength In Numbers

Agents determine and contract capacity based upon their whole portfolio of clients — aggregating demand at the point-of-origin. The agents recognize that although individual shipper's schedules will fluctuate, the overall portfolio demand will remain stable. The stability of this demand is no different than that in capital markets, where portfolio managers diversify risk and stabilize returns.

Table 2: ITL Pain Points

Capacity from Asia to US & Europe	**41%**
Visibility information	**18%**
Getting into Emerging Markets	**9%**
VMI	**9%**
South America	**6%**
Compliance	**3%**
Europe	**3%**
Distribution Centers	**3%**
Opportunistic Logistics	**3%**
Inbound	**3%**
Other	**6%**

Source: Converge, June 2000

Both agents and carriers benefit from demand aggregation and long-range contracts by improving their ability to plan and allocate capacity – which ultimately increases operational efficiency and profit.

ConvergeMove℠ offers optional demand aggregation and forecasting visibility within the high tech sector. To illustrate this point, Converge conducted a pilot study. The study was designed to answer the following questions:

- Is it possible for independent participants within the high tech supply chain who rely upon different IT infrastructures and business cultures to collaborate on logistics requirements?

- Is it possible to aggregate shipment requirements via traditional communication mechanisms (phone, fax, etc.)?

The results of this study prove that participants are able to collaborate despite competing business models. Demand aggregation is feasible at both a basic (manual) and advanced (Internet-enabled) level. When fully deployed, ConvergeMove℠ offers the high tech sector a demand aggregation tool that optimizes positioning during carrier contract negotiations and provides enhanced lift capacity.

Conclusion

As product life cycles continue to shrink and high tech supply chains fragment further, the focus on logistics will increase. To date, most logistics providers have been unable to offer both transport of goods and shipping status information across the supply chain – opting to provide the former due to the complexities of the latter.

Distributed supply chains can no longer operate under current conditions. Therefore, "data" logistics services will become important to the continued success of the high tech industry. ConvergeMove℠ combines the six attributes necessary for success in the "data" logistics service arena:

- Security and anonymity
- Independence
- Domain expertise
- Technical acumen
- Fractional cost model
- Robust, for-profit solutions

Because industry exchange services are offered in an open format, the industry benefits from data aggregation across all participants. Converge's lift capacity study illustrates one of these many benefits. Although many factors contribute to lift capacity that are outside the control of the shipper, visibility and data aggregation are two variables that may be manipulated to lower the impact of lift capacity on their business.

In closing, visibility within the supply chain has eluded participants over the years - but no longer. ConvergeMove℠ offers the next quantum step in supply chain integration through the use of Internet technology to offer true, global supply chain visibility for all participants.

About Converge

Converge (www.converge.com) is a global marketplace where high technology supply chain professionals connect, collaborate and transact to increase supply-chain efficiencies. Converge's industry leading founders include: Agilent Technologies (NYSE: A), AMD (NYSE: AMD), Canon (NYSE: CAJ), Compaq (NYSE: CPQ), Gateway (NYSE: GTW), Hitachi (NYSE: HIT), Hewlett-Packard (NYSE: HWP), Maxtor (NYSE: MXO), NEC (NASDAQ: NIPNY), Samsung Electronics (OTC: SSNIF), SCI Systems (NYSE: SCI), Solectron (NYSE: SLR), Sumitomo, Synnex/Mitac (privately held), Tatung (TAI: 2371.TW) and Western Digital (NYSE: WDC). For more information about Converge, call (877) 693-5694 or (314) 612-7141 (outside US), or send email to: info@converge.com.