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The 20-Ton Packet

Ocean shipping is the biggest real-time datastreaming network in the world.

By Stewart Taggart

Staggering in from the sea, a cargo container ship heaves into the Port of Singapore every few hours. At the mouth of the harbor, tugboats take charge, guiding the ship into port like paramedics escorting a stretcher. Within minutes of each ship's docking, multiton containers are shifted from the decks. Sweaty crane operators, dangling in glass booths from the hoisting arms, hump cargo with amazing speed. They'd better hustle. The ships sail again with the tides.

Away from the water's edge, trucks roar in and out of the port's gates. As each arrives, digitized data about its load is transmitted to a central port computer. Within seconds, the driver's beeper is paged by the computer, sending instructions for where to drop the truck's load among acres of five-deep container stacks. The cargo will land in a spot that minimizes the number of times it'll be moved before sailing.

Lest it seem that transporting physical goods by sea is hopelessly offline in a world of next-day delivery, consider that 95 percent of world cargo volume still moves by ship. FedEx and Airborne Freight, which handle but a tiny fraction of earth's cargo, generally carry small, high-value, time-sensitive goods, things like blood supplies or *Wired* magazines. The real heavy lifting happens down here, amid the grunting trucks and heaving cranes of cut-rate economy class. This is the domain of the lower-value, higher-volume majority of the world's cargo. Stuff like clothing, stereos, construction goods, household items. FedEx may be the planet's Formula 1, but ocean shipping is its 18-wheeler.

And with the exception of bulk commodities like grain and oil, most sea cargo travels the world locked into standard-size containers commonly 8 feet wide, 8.6 feet tall, 20 or 40 feet long, and weighing up to 20 tons. In 1998, the steamy equatorial port of Singapore moved more than 15 million 20-foot equivalent units (TEUs) of such containers. That's the same as shifting around one of New York's World Trade Center towers each day. A close second to Singapore, Hong Kong moved 14.6 million TEUs. Today, enough shipping containers exist on the planet to build an 8-foot-high wall around the equator - twice.

At its heart, ocean shipping is a network business, just like airlines and telecommunications. Passengers, bulk goods, data - all three represent uniform-size cargo, shooting through global transport and sorting systems 24/7/365. Viewed this way, airline seats, data packets, and 40-foot shipping containers are much the same - commoditized units for carrying content.

So it's not surprising that container shipping has enjoyed its own network effects since its early years in the '50s. As more ports and ships carried containers, the benefits of being a container shipper or port grew. As more ports came online, carriers were able to expand their containerized fleets. And containers brought untold economies to shipping from the start, causing costs to drop steadily - and with them margins, which have fallen to around 5 percent, roughly one-third that of the average company in the benchmark Standard & Poor's 500.

The effects of the network continue to drive the business today. An otherwise sluggish industry, subject to a tangle of international regulations and charged politics, is nevertheless seeing innovation in the engineering of ships and ports. More marked, though, is the drive to advance using new information technologies. Forty-plus years after the introduction of the container, ubiquitous communications - new means for circulating and managing data - are hitting the industry like a 30-foot wave. Experts contend that the future of shipping lies in services that ride atop the shrinking margins of low-cost container transport - services like shipment tracking, flexible routing, stopwatch scheduling, and logistics management - each extended throughout the supply chain.

As this revolution unfolds, a once all-brawn industry, seen as the domain of musclebound stevedores and union toughs, is morphing into a brawn-and-brains business, peopled with computer geeks and systems whizzes.

The Packets

Just as the Net and deregulated telephony spelled the death of distance for telecommunications, containers spelled the death of distance for manufacturing. By breaking down cargo into standard units, greater amounts could be more efficiently pushed through a network.

Today this seems almost common sense. But look back to the 1954 film *On the Waterfront* and you'll get a good idea of how things used to be. New York dockworker Terry Malloy (played by Marlon Brando) climbed into the rusting hulls of cargo ships and used brute muscle to move freight using nets and grappling hooks. Loading and unloading was so slow, ships might remain in port for days, even weeks. Only four decades ago, contemporary photos of Singapore's port showed shirtless workers stumbling down wooden gangplanks carrying enormous bundles of bananas on their backs. It was called break-bulk shipping.

This inefficiency irked Malcom McLean, a crusty North Carolina trucker who defied convention to spark a logistics revolution that continues to reverberate today. Dubbed the Father of Containerization, he laid the foundation in the 1950s for what would arguably become the world's first truly packetized transport network.

McLean reckoned there had to be a better way of loading and unloading ships than the clumsy, slow, and theft-prone process of break-bulk. His first brainstorm: stacking sealed truck trailers on flatcars for long train journeys, trucking them only the few final miles to their destination. But the railroads weren't interested, so in 1955 he bought a small tanker company named Pan Atlantic and modified two of its ships to carry 58 detachable trailers. In order to stack the trailers, he removed the wheels and strengthened the sides. In April 1956, the first of these converted ships sailed from New York Harbor to Houston, and containerization became a sunrise industry.

The enterprise worked so well, he bought more ships and converted them, eventually operating out of Elizabeth, New Jersey, and renaming the company Sea-Land Service. In 1966 he sent the first container ship across the Atlantic to Rotterdam in the Netherlands, and within the next few years the company became a major carrier of matériel for the US military in Vietnam. To fill empty containers on the return leg, Sea-Land sought cargo for export to the US from Hong Kong, Taiwan, and Japan. The region soon found its niche as a low-cost producer of consumer goods for export - all carried away on ships piled high with containers. Without containers, says Bill Flynn, Sea-Land's Hong Kong-based vice president for Asia, "conventional shipping would have had a hard time handling Asia's volume of exports at any kind of affordable cost."

The result of this international shipping-unit standardization has been an economic win just about all around. Coupled with falling global tariffs, collapsing freight-transport costs provided a huge boost to postwar trade and living standards as an unprecedented range of goods came within reach of the world's consumers. Since 1950, world trade has grown more than twice as fast as the overall global economy.

In 1997, the volume of world merchandise exports rose 10.5 percent, more than double the world GDP growth of 4.1 percent. In 1998, export growth stood at 3.5 percent, still nearly double the 2 percent increase in world GDP. Between 1997 and 2005, according to UK-based analyst Drewry Shipping Consultants, container port throughputs worldwide are likely to rise by nearly 60 percent, to 271 million TEUs.

Now, moving nearly seamlessly among ships, trucks, and trains, numbered boxes course through a system optimized to carry them. Each carries its own kind of header, known as a bill of lading, which identifies its contents and owner and directs its progress. On a single ship, thousands of containers are headed to different end destinations. Dangerous cargo, such as chemicals, is segregated; refrigerated containers are placed near the ship's power supply. Some containers are piled high up on the ship and some ride low, but all are strategically stacked to minimize a ship's loading and unloading time in port.

From a small base of about 6.3 million in 1972, the number of containers handled by the world's ports had risen 26-fold, to 163.7 million, by 1997. As scale efficiencies grew, prices dropped. Over the past 20 years, nominal unit-transport costs on the key Asia-US route have fallen by about one-third, or roughly two-thirds in inflation-adjusted terms. Translated into walkmans and toys, this has put downward price pressure on just about any internationally traded good you've bought since the mid-'70s. Today, transport costs account for about 1 percent of the final price of consumer goods, making country of origin largely an afterthought in purchasing decisions.

"Remember the old westerns where the bartender points to the mirror above the bar and says, 'That came all the way from St. Louis!'?" says Bruce Lambert, senior economist at Standard & Poor's DRI trade-forecasting service in Washington, DC. "Today, it's often cheaper to move things from the Far East to the US than it is to move them domestically."

> **By breaking down cargo into standard units, containers spelled the death of distance for manufacturing.**

The Hardware

Take out your calculator. Assuming there's a modest $20,000 worth of shoes, shirts, clock radios, and computers in each 20-foot container, a fully loaded 6,000-TEU ship is hauling $120 million worth of cargo. Since each ship costs about $120 million itself, that's about a quarter-billion dollars afloat. At 5 percent interest, that's nearly $33,000 ticking away each day on just the inventory and the ship's value. That's why efficiency matters. And efficiency can be increased in only a limited number of ways.

For years, innovation in shipping centered on the ships. As ports handled more containers, the ships grew, from a petite 600 TEUs in 1966 to today's common 5,000. In 1999, when you talk of massive scale, it's hard to imagine what can surpass the gargantuan silver ships operated by the Maersk Line, a low-key Danish company with an Ozymandias complex. The 6,600-TEU container ship *Sovereign Maersk* and others like it cast among the biggest shadows in the business. Stand it up vertically and it's one-third taller than San Francisco's Transamerica Pyramid.

But bigger ships are on their way. A Maersk competitor, P&O Nedlloyd, has a ship on the sea, *P&O Nedlloyd Rotterdam,* with a capacity of 6,690 TEUs. Maersk is cagey about its plans, but few theorists see any engineering reason ships can't grow to 8,000 or 10,000 TEUs, or even into the 15,000- to 25,000-TEU realm. That kind of growth would require new efforts to expand the width of vessels, allowing room for more containers while providing better vessel balance. As dimensions of the huge craft change, ships become subject to the dangers of torsion, corkscrew effects that can cause vessels in heavy seas to bend at the center as much as 16 feet from bow or stern. According to Thomas Boyd, a spokesperson for Maersk, which is cranking out a new 6,600-TEU ship every three months - for a total of 13 - "We've gone about as long as we can go without going wider."

Far tougher, though, than any structural challenges in increasing the bandwidth of this network are the challenges of improving the routers. Already, the constraints of current ports are showing. In July 1998, Maersk sent another of its largest ships - the 6,000-TEU *Regina Maersk* - to the East Coast of the United States. Arriving to fanfare at Port Newark, New Jersey, the vessel had to enter the harbor less than full, riding the high tide and with its bridge mast down to avoid either being grounded in the harbor mud below or hitting the Bayonne Bridge above.

Just as Manhattan's finger piers eventually became health clubs and condos as the shipping industry gravitated to huge container facilities along the New Jersey coastline, so New Jersey was almost bypassed as the revolution progressed. Earlier this year, Maersk and Sea-Land decided to keep their major East Coast hub in the New York/New Jersey area, but not before seriously considering rival bids from Baltimore and Halifax, Nova Scotia.

To eliminate the need for dredging as bigger ships sit ever deeper in the water, some suggest building huge ports totally offshore, using them as scalable transshipment hubs for even larger ships. But physical space is hardly the only challenge posed by gigantic vessels. As ships grow to 8,000 TEU and above, ports may need to move as many as 330 containers per hour, more than twice what the average modern terminal handles today. Already, the Port of Singapore must hustle to get a ship like the *Sovereign Maersk* in and out within 24 hours, and Singapore is built to move more than double the containerized cargo handled by second-tier ports like Rotterdam and Kao-hsiung, Taiwan. That's almost four times the traffic of North America's biggest container port, Long Beach, California.

"We can easily build a much bigger ship," says Tom Winslow, former chief naval architect for APL, a top-tier US container carrier, and now a private consultant in Oakland, California. "But you need the infrastructure to serve a ship of that size. It could take two to three days just to unload."

At its simplest, port container handling has much in common with how airports handle people. Units are checked in, stored in a departure area, and then put on a plane or ship. Packet throughput is always maximized, and speeding this flow is one of the holy grails of both businesses. That's because it allows planes and boats to do what they do best: earn money by being in transit.

In both industries, the bottlenecks occur in the transfer infrastructure. In aviation, ticketless travel, preissued boarding passes, and curbside check-in all aim at speeding the movement of travelers. In sea freight, storing containers as close as possible to their departing ships and increasingly digitizing the data exchanged among shippers, ports, and ship owners are high priorities. At your average container port, two sets of cranes are at work: loading cranes, which lift the containers on and off ships, and stacking cranes, which move containers around storage areas. Shuttle trucks move boxes between the two. And it's this process of unload, shuttle, and stack that ports now target for efficiency gains.

The Republic of Singapore's penchant for order and efficiency is suited to the controlled environment of handling cargo for transshipment. Today the Port of Singapore is spending heavily to build a new container terminal with a technological edge. In the new storage area, stacking cranes will slide along overhead tracks, instead of being moved by independent wheeled vehicles on the ground. In addition, crane operators will work from a central control room away from the stacks, and each operator will be able to control more than one crane.

In the Port of Rotterdam, pilotless automated guided vehicles (or AGVs) in a terminal operated by Sea-Land have been on the job since 1993. Some 50 AGVs circulate in a cordoned-off area of the terminal, ferrying containers from the stacking area to the ship-loading cranes. Using top-mounted infrared eyes, the AGVs travel freely, connecting the container stacks and the loading cranes. The system allows Sea-Land to work in fog that would otherwise have slowed or halted operations, and, what's more, the site is a drawing card for tourists, who journey out to the windy northern extremity of the Rhine to have a look. Jan Gelderland, Sea-Land's general manager for western Europe, says the unmanned vehicles have helped boost productivity at the port by 25 to 30 percent. He thinks they'll be most appropriate for high-volume, high-labor-cost ports.

> **By 2005, container port throughputs worldwide are likely to rise by nearly 60 percent.**

While crane technology has improved, landing a container on a freighter's deck is still like bowling in the dark. Lee Chok Leung is a 20-year veteran of crane operations at one of Hong Kong's busiest terminals, Modern Terminals Limited. Working for hours in a glass-enclosed perch 100 feet above the dock, he often must be directed via radio on the deck for stowage instructions - and as a safety precaution.

"It's hard, for instance, at night when it's raining," he says. "But when I get one in just correctly, it feels a lot like playing a videogame well."

Elsewhere, other new technologies for increasing port efficiency are on the drawing board. One, called Speedport, would consolidate the functions of cranes and shuttle trucks, shifting containers between the ship and storage stacks on interlocking overhead tracks. "We think of the system like ants at a picnic taking one crumb at a time in a continual assembly line," says John Arntzen, president of ACTA Maritime Development, a startup in Staten Island, New York, devoted to developing and marketing the system. "It's kind of nature inspired." Arntzen believes Speedport could move more than 270 containers per hour.

But at press time, it had no takers. "It's an interesting concept," says Maersk's Boyd, "but it's still hypothetical." Other players in the industry tend to agree: The huge investments involved in ports make radical shifts to untried new technologies a menacing bet.

Instructive innovations in port management are taking place in China, however, where brand-new ports - free of the problems of legacy technology - are nipping at the heels of established facilities. Take Shenzhen. This special economic zone bordering Hong Kong took off following China's economic reforms in 1979. Two Shenzhen ports, Yantian to the east and Shekou to the west of crowded Hong Kong, are building up volume rapidly. The three ports are expected to be the international spillway for a torrent of low-cost goods from southern China in the years ahead. With up-to-date equipment, such as new cranes, being installed on greenfield sites, Yantian and Shekou are in the vanguard of Chinese ports.

Located just three miles from the Hong Kong border, Yantian is mainland China's first developed deep-water port to handle a 6,000-TEU ship, the *Knud Maersk.* On the other side of Hong Kong, at the mouth of the silty Pearl River, the muddy port of Shekou likewise is ramping up. This port saw its container-throughput volume double in 1998, to 463,100 TEUs, a figure that could rise by 30 percent or more in 1999 as the region cranks out clothing, toys, and other goods for export.

As southern China continues to grow economically, the entire region may well become a kind of collective transport organism, breaking down into micromarkets such as international direct shipments, transshipments, and feeder traffic between larger ports and smaller ones. Hong Kong itself, one of the most cramped harbors in the world, broke ground this year for a major new container terminal expected to expand the port's current throughput by nearly 20 percent. It's scheduled to begin operations in 2002.

Of course, aside from the challenges of dredging and loading, increased volume raises other problems. The bigger a hub port becomes, the more vulnerable it becomes to niche players. Think Southwest Airlines in the US: By offering low-cost direct service between secondary cities, the airline developed a profitable new service and stole business from hub-oriented lines. As bigger ships concentrate on fewer ports, the flexibility they can offer on routes and times will be crimped.

In ocean shipping, the Southwest Air equivalent may be small, superfast container ships able to deliver heavy goods much more promptly than monsters like the Maersk ships, but at lower cost than air freight. One company, called FastShip, plans to offer high-speed container service using jet-powered vessels traveling from Philadelphia to Cherbourg, France, at speeds up to 40 knots, compared with the *Sovereign Maersk's* 25. The idea is to offer a seven-day North Atlantic door-to-door service comparable in speed to air freight, but with a cost closer to that of liner shipping. "Air freight can take on average five days," says FastShip spokesperson Thomas C. Beck, "while many shipping companies use a thumbnail figure of 17 days for ship crossings." Time-sensitive industrial parts, expensive but heavy medical equipment, and even computers would be suitable cargo. FastShip plans to build four vessels for about $220 million per ship, with service expected to begin in 2002. Each ship would make 78 crossings a year, with the capacity to carry 1,432 TEUs per voyage.

The Network

Larger ships, faster ports - these steady advances may guarantee the lumbering giants of ocean shipping the fiscal stability they've enjoyed for decades. Many in the industry, however, don't think so.

Standard & Poor's Bruce Lambert breaks down the evolution of postwar shipping into three stages: The first was Malcom McLean's introduction of containers in 1956. The second was intermodalism, which allowed containers to be shifted more easily between trucks and trains, further integrating the land and sea shipping networks. Now, electronic data interchange and its Web-based offspring are ushering in a third era, marked by ubiquitous data about all goods in the supply chain, from factory to cargo ship to warehouse to retail store.

US carrier APL is a major believer in this third wave. In 10 years, the company thinks, half its business will come from moving information about goods, rather than moving the goods themselves. "Ships are getting bigger and bigger, and transit times are becoming only marginally different between carriers," says Hans Hickler, APL's vice president of consumer-support processes. "The difference between companies will come from services outside basic transport."

For APL, that means taking its cues from Web companies like Yahoo! and Excite. APL goes so far as to dub its own Web site a "portal," where clients get personalized HomePort pages that give them customized shipping and arrival information - and let them track individual goods and shipments. Software made by firms like Oakland, California-based Navis allows the shippers themselves to plan out stacking arrangements for everything from weight to types of cargo to final destination.

> **As bigger ships sit ever deeper in the water, some suggest building huge ports totally offshore.**

To Bruce Lambert, innovations like this begin putting every asset in transit under a spotlight as intense as any in a Hollywood movie. "I'm reminded of the last scene in the film *Raiders of the Lost Ark,* in which some guy pushes the Ark of the Covenant into a huge warehouse, never to be seen again," Lambert says. "Today, it would be barcoded and simply wouldn't get lost."

With this kind of visibility, goods in transit are not so different from goods stored, and some envision the transport network supplanting the function of traditional warehouses. As data exchange between shipping companies and customers becomes more integrated, ships like the *Sovereign Maersk* could replace those crusty warehouses at the edge of town. Why pay for a hotel if you can sleep in your Winnebago?

Many of these changes are being pushed by cost-cutting discount retailers as they move toward just-in-time inventory-delivery systems. A store doesn't care if its offsite stocks are in a warehouse or on a ship as long as it can get delivery when it needs it. In this environment, a shipping company that can deliver within a specified time frame - and change that delivery time if need be - gains a competitive advantage, says Sea-Land's Flynn. Eventually, shipping companies might receive planning data from customers before goods are even produced. "The further upstream you get information about an order or a shipment, the more you can do with the delivery process," Flynn says.

Hong Kong-based carrier Orient Overseas Container Line (OOCL) is already moving business upstream through smarter information management. At a collection center near Hong Kong, a wholly owned subsidiary consolidates goods from some 200 Asian suppliers into containers destined for Arcadia, a UK clothing chain. Once packed, most containers go direct from Hong Kong to individual stores, bypassing Arcadia's UK distribution warehouses. Arcadia saves both time and money, says Jeffrey Lau, director of OOCL's logistics subsidiary, Cargo System (Asia Pacific), so long as goods are packed into the containers in precisely the right order, right down to colors and clothing sizes needed by individual outlets. The company reduces the need for warehouse space and gains on delivery time in the UK. These savings more than offset the cost of sometimes air-shipping items in short supply.

OOCL also provides packing services for electronics manufacturers. In Singapore, it packages stereo equipment, combining stereo components from Indonesia with speakers from Malaysia into boxes with the manufacturer's brand name. It then ships final goods to the manufacturer's warehouses for distribution to retail stores.

Bill Villalon, APL's head of global marketing, calls all this a reengineering of the supply chain "from the factory floor to the retail store." Villalon works out of the Singapore headquarters of APL's parent, Neptune Orient Lines, and was around during APL's heady "stacktrain" days. In 1984 in the US, APL introduced low-slung railroad cars that carried shipping containers stacked two high instead of just one, boosting railroad freight efficiency roughly as much as compression software sped up Internet file transfers. Today, Villalon thinks the transport system can be tweaked again to APL's advantage by pushing its services further upstream; for instance, to the front doors of low-cost factories far inland in China. "Customers often come to us and say they want low-cost goods from immature infrastructure environments like China, but without sacrificing the information richness they're used to," he says. "We can handle some of that planning and coordination for them. These days, if you concentrate on being just an ocean carrier, you'll miss the boat."

In this new world, the fiber wire and the microchip are set to create the same supply-chain cost savings containers did - possibly greater ones. By lifting days and dollars out of the supply chain, the end-to-end cost of making and selling goods globally should continue to fall toward the vanishing point. As in so many other industries, a main enabler is the digital network.

"What we're seeing here is an exercise in mass synchronicity that's just never happened before," Villalon says. "The Internet allows real-time gathering and dissemination of information on both the supply and demand sides." As such, everyone from ocean carriers to startup companies is getting involved in "third-party logistics" - a fancy name for outsourced management of some segment of the supply chain.

This new business remains highly fragmented. Over time, consolidation should occur as barriers between industries like shipping, trucking, and warehousing break down. For now, in a world growing accustomed to getting best-sellers from Amazon.com the day after tomorrow, the challenges are monumental. Glen Margolis, a onetime naval architect and former head of the supply-chain strategy team at Ernst & Young, is now at BigWords, a San Francisco ecommerce startup dedicated to distributing new and used college textbooks. With 2 million titles to track, and the need to turn orders around quickly, all his logistics needs at BigWords have to be satisfied in-house. The company can't find a vendor that can do a comprehensive job. "Everyone has their specialty; they're all good at certain things," says Margolis. "But no one has really emerged that's able to do everything well."

Ultimately, the logistics business will earn its profits through cutting costs for customers, and that's a finite profit horizon, Margolis says. The real winners, he thinks, will be manufacturers who collaborate with suppliers to reduce inventory costs. As this logistical synchronicity sinks ever deeper roots, it's the systems and information products flowing from interlinked corporate networks that will rise the most in value. Without those, you're flying blind.

Just ask the US military. Under pressure to rapidly mobilize for the Gulf War in 1991, the military had no effective way to keep track of some 37,000 containers it shipped to the Middle East. "We didn't have a good system for telling people what was in the containers," says Gary Adams, chief of the intermodal branch of the US Transportation Command at Scott Air Force Base in Illinois. "Many piled up in open container lots. They had to be opened to see what was in them."

> **Some firms believe that in 10 years half their business will come from moving information about goods, rather than moving the goods themselves.**

With expertise in information management exploding across so many industries, it seems only a matter of time till ocean shipping gets its ammo labeled and makes these sorts of difficulties obsolete. Related businesses, such as suppliers, manufacturers, and distributors - and their banks - will demand it. The three information flows linked with freight cargo - the physical goods themselves, information about the goods (their location, value, route, and delivery time), and the financing of the goods (such as letters of credit) - will have to become more precise and thorough.

Imagine, for example, a US factory making finished goods - shoes and dresses - out of leather and textiles shipped from Mexico and China. If a storm disrupts the supply of leather from Mexico, that leaves the factory with the prospect of shutting down for a short time. Knowing the whereabouts of incoming textile shipments from China, though, a plant manager can decide to pay extra to the shipping line to give its textiles unloading priority at Long Beach - while simultaneously speeding up payment through its bank for the goods. The plant manager might also arrange for part of the textile shipment to be delivered by air to keep the plant busy until the rest of the shipment arrives by rail. Indeed, putting this capability on a plant manager's desk may determine who gets the plant's business.

"Providing the information part of the supply chain may well become the price of admission to the overall shipping business," says Doug Coates, a principal of Manalytics International, a San Francisco-based transport and logistics consultancy. "If you don't have the service, you'll be eliminated before you get to the ballgame."

The Beast

Despite all the big thinking and ideas for the future, some shipping specialists, like Glen Margolis, are pessimistic. Maritime freight shipping, they say, is a business that takes a long time to change. "The shipping industry has been around almost as long as nations have existed," says Margolis, "so thousands of years of tradition have built up around it. This is an industry centered on capital assets that can last up to 50 years."

Peter Koch, the philosophical, free-speaking captain of the giant *Sovereign Maersk,* pilots one of these assets. A 50-year-old Dane who's been at sea for 32 years, Koch thinks more about the weather, pirates, and the need to plan several miles ahead in steering his oceanic beast than he does about moving data up the supply chain. Idle for several hours in the Port of Singapore, he taps an unlit cigarette on the ultrasophisticated instrument panel that drives this swollen floating warehouse and speaks of his lonely days out on the empty sea. "Coming from the Suez Canal," he says, "you can go eight to nine days with nothing happening. Not even a bird."

Most of those days are spent on autopilot. Koch wears away the time pacing, checking the containers and the ship's equipment. His favorite part of the semiglobal voyage between Europe and Asia is the busy waters around Singapore, Japan, and Taiwan. "I like a lot of traffic," he says. "I thrive on the adrenaline." Bearing down at 75,000 horsepower and 25 knots, the *Sovereign Maersk* makes initial radio contact with Singapore just a few miles short of the port. Koch is preparing for docking, the most sensitive part of the journey. Easing the ship into a berth without crashing into the pilings is a task that makes docking the space shuttle on *Mir* look simple. The worst news the captain can hear at that point is that a berth isn't vacant. "They may tell us to slow down," Koch says ominously, "but we can't do that easily. This isn't a car. It takes time to reduce speed."

The irony of comparing the processes of container shipping with those of telecommunications is obvious. How can the mammoth bricks stacked on Koch's freight ship be reduced, through analogy, to nothing but a series of electrical impulses coursing through a thread of glass? Yet the redolence of the concept of "network," pumped full of the corporate giddiness set off by the Internet, makes the comparison irresistible. And worthwhile. Since Malcom McLean, it's safe to argue, no single shift in the big-picture view of the business has been as important as the introduction of systems and insights produced by digital networking.

But the ironies linger. Perhaps they even stand out all the more. Still tapping his unlit cigarette, Koch gazes out from the bridge over stacks of bolted-down containers stretching from the bow to the stern. He doesn't see these boxes as part of the unitized superhighway of the networked economy. He sees only a field of silver metal over which the ocean's waves will crash in the heavy weather of the Indian Ocean, en route to Algeciras, Spain.

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