Like termites (left), companies, and in particular their warehouse and distribution centers, need tightly linked logistics chains. The October 12 order specified a robot with a navigation system and vacuuming and window-cleaning functions. The computer automatically asked suppliers when the robot’s components would arrive and then calculated the completion time for assembly: “October 15, 10:13 a.m.”

“Why did we need 20 minutes to package the goods and another 20 to reach the loading bay?” Susan asks the Station 4 supervisor as she examines output figures. “Why did it take so long?” The supervisor explains that he decided to load the truck right to the roof, once the software agents had calculated that it would be cheaper to deliver to a number of destinations on one run. And the route planner had worked out an optimal itinerary. “So, more pallets had to be loaded, and everything took just that much longer.” Susan nods, aware that sensors record the times that items enter and leave the warehouse. Thanks to small radio-operated transponder tags fixed to the goods, inventory can be checked at any time.

A click of a mouse is all it takes to call up an order received at 6:45 p.m. on October 12. “One toy robotic dog, one dark-blue designer dress and one household robot,” it says. A second later, the computer displays the availability of the goods. The dog is in stock, but the dress had to be made to order by a supplier and didn’t arrive until two days later. In 2015, customers still like to go shopping in fashion boutiques. What’s changed, though, is that shops now keep only one example of a particular item in each size. If a customer likes a garment, he or she is measured optically and the article is made to order. Again, the aim is to limit delivery time to less than three days.

Mail-order companies in 2015 not only maintain gigantic warehouses, but often also assemble items, such as household robots, themselves. The October 12 order specified a robot with a navigation system and vacuuming and window-cleaning functions. The computer automatically asked suppliers when the robot’s components would arrive and then calculated the completion time for assembly: “October 15, 10:13 a.m.”

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More than 10 years ago, Susan was one of the first in the business to replace bar codes with intelligent transponder tags. Since then, the volume of missing merchandise at the company has dwindled to practically zero. Similarly, satellite technology is used to determine a truck’s precise position and track the exact progress of the goods. Seven years ago, she changed from GPS to the GALILEO European satellite system, which had started to offer the same services at lower cost. A quick glance at Station 7 — Deliveries — tells Susan that no one was at home when the order arrived. So the mailman left the package in the home delivery box, a large mailbox built into the wall of the house. “Good work.” It took barely 66 hours from receipt of the order to delivery of the goods at the customer’s house,” says Susan, who already knew this information. That’s because in this particular case, Susan is the customer, and at 12:35 p.m. her home delivery box sent a message to her cell phone confirming that three packages had arrived. Just in time, thinks Susan, who is planning on wearing the new blue dress to the theater this evening.

Ulrike Zechbauer
A Flawless Flow of Goods

In a global market, companies with international operations face a real challenge in coordinating streams of materials and information. An optimally organized logistics system is increasingly becoming the key to survival.

Smoothly supplying a metropolis of two million inhabitants is no easy feat. In fact, it’s something of a miracle — especially when the community lives in a structure 2,000 times the size of the residents who erected it. In this particular case, the inhabitants are African termites — genus Macrotermes — and they build their seven-meter mounds in the African savanna. The secret of their success is a flawlessly organized flow of goods. Supplies run without interruption from the system’s multi-branch network to its main traffic arteries. Each termite is always in the right place at the right time to pick up a delivery and transport it to its ultimate destination. And all of them are highly motivated to carry out their tasks.

Rolling Jigsaw Puzzles. Logistics specialists can only dream of such working conditions. They are more accustomed to facing congested highways and interruptions in the flow of materials caused by such factors as delays at cargo-handling facilities. Nevertheless, in Germany alone logistics specialists have to ensure that approximately ten million tons of goods are transported on time every day — by truck, train, ship and plane (see insert, p. 10). In their efforts to do so, they have managed some major achievements.

Today’s automotive industry is one good example. A car in the BMW 3 series can consist of up to 15,000 parts, making it something akin to a rolling jigsaw puzzle. Every day, up to 850 vehicles, each built according to a customer’s individual order, roll off the
It isn't uncommon for people to spend a couple of minutes placing an order on the Internet and then spend a couple of weeks waiting for the merchandise to arrive. The reason for such slow responses is that limited roads are deluged with traffic. Increasingly, the much-awaited-delivery truck ends up in a traffic jam, especially in metropolitan areas. What's more, the problem is likely to get worse before it gets better. The Institute for Transport Economics at the University of Cologne, Germany, estimates that by 2015 there will be roughly a 23 percent increase in passenger traffic and a 63 percent increase in freight traffic in Germany.

Targeting Traffic with Telematics. In Germany, one out of six newly registered cars is pre-equipped with a navigation system. Of those cars, over half accomplish their dynamic route guidance using TMC (Traffic Message Channel). Congested areas are identified by the navigation system at an early stage and factored into the choice of route.

In addition, Siemens has developed a concept for a comprehensive, integrated system under the SITRAFFIC brand. Traffic data is recorded by induction loops in the road surface or by infrared and video detectors. Then the data is sent via mobile radio to a central office, where the flow of traffic is mapped out and automatically evaluated. Depending on the situation, traffic can then be influenced in such a way that there are as few jams as possible. Telematics systems in Germany, such as those using familiar traffic-control equipment, manage traffic on roughly 3,200 autobahn kilometers and a host of tunnel routes. This helps protect the environment, and, according to the Federal Ministry of Transport, Building and Housing, reduces the number of serious accidents by up to 50 percent. When traffic jams are imminent, these systems issue speed limits for individual lanes or specify no-passing zones and display these instructions on variable message signs — large, programmable illuminated panels on highways. The current flow of traffic can be recorded by measuring stations, such as Siemens' "Traffic Eye." In this case, an infrared detector measures the traffic in each lane, identifying the number of vehicles, how fast they are moving and differences in speeds. Photovoltaic modules provide the required power, and data transmission is handled via radio. Similarly effective are intelligent systems that automatically record and analyze the flow of urban traffic and regulate it through traffic lights. Siemens' MOTION solution, for instance, which has been used effectively in Graz, Austria, since 2001, cuts average driving times by more than ten percent while trimming emissions by 15 percent.

Another telematics solution is offered by so-called "floating car data" systems. Here, the vehicles themselves act as traffic sensors. The current position and speed of a vehicle is determined through its own on-board navigation system and transmitted automatically and anonymously to a collection point via mobile radio. To model current and future traffic flows, between one and five percent of all vehicles must participate in a system of this kind.

Eyes on Fleets. Fleet management systems help fleet operators control and dispatch vehicles in the best way possible. Siemens offers a system consisting of an on-board computer, navigation system and office software that optimizes communication between fleet managers and individual drivers. New jobs or destination addresses can be transmitted directly to the vehicle via text messages. With the push of a button, these jobs can be added to the vehicle's list of destinations by its navigation system's route planner.

The system also allows drivers to confirm job completions by sending messages to the main office through their navigation terminals. Dispatchers can continuously monitor their vehicles, and because they know the time required to reach a destination, can therefore reliably inform customers of the arrival of a delivery. Using this system, a fleet operator can wrap up its consignments more cost-effectively, dispatch its fleet efficiently, and reliably deliver products to its customers.
assembly line at the BMW factory in Regensburg, Germany. Up to 70 percent of the parts are produced outside of Germany, creating a huge wave of materials that BMW logistics specialists have to manage each day. An alternative approach would be longer-term storage, but the company would have to build huge warehouses, which would require employing large numbers of people as well as generating additional costs.

As a result, most parts are delivered to the assembly line shortly before they are used — a system called “just in time” or “just in sequence.” Over the decades, the auto industry has developed a perfectly synchronized, lean and highly flexible supply structure. Indeed, when it comes to logistics, the sector is considered to be a trendsetter. But today its available potential has to a large extent been exhausted.

Unrealized savings. Other industries have a lot of catching up to do. “That is particularly true in sectors dominated by small and mid-sized companies, where logistics was looked on as a trivial detail in the past. It was even considered a burdensome necessity,” explains Jörg Scharrenbroich of Siemens’ Logistics Center of Excellence in Duisburg, Germany. Frankfurt-based PRTM, a management consulting company, reports that such sectors could realize a variety of potential benefits by improving their logistics. For example, implementation of appropriate measures could help:

- Reduce a company’s total inventories — its raw materials, goods in process, products stored in company warehouses and branches by 50 to 80 percent;
- Improve the reliability of all deliveries by 10 to 25 percent. The role model here is the automotive-industry supply sector. In this sector, more than 99.5 percent of orders are delivered on time.

Key to Survival. Many companies have begun to tap into this potential. “But their efforts don’t always achieve the desired results, particularly when they rely too heavily on software solutions,” says Wilhelm Dangelmaier, a professor of business-data processing at the Heinz-Nixdorf Institute of the University of Paderborn, Germany (see interview, p. 26). “The first priority should be to identify the company’s goals and develop corresponding organizational concepts for suitable delivery structures,” he suggests.

Today, logistics is not just a pure competitive factor. It is increasingly becoming a key survival factor, particularly for those companies that have to meet a range of different challenges. For example:

- Customers are increasingly demanding tailor-made, high-quality products that must be produced and delivered quickly;
- More and more customers are buying things on the Internet. Items ordered online, like books, are delivered to customers’ homes, raising storage and transport costs;
- Globalization continues to spread, and producers are buying increasing numbers of parts from foreign manufacturers.

Challenges include individually manufactured products, Internet orders and global creation of added value.
**LOGISTICS TRENDS**

“This departure from mass-produced articles has also split up supplier units. They are getting smaller even as the transport volume grows,” says Dr. Carl-Udo Maier of Siemens Corporate Technology in Munich. Maier heads the Pictures of the Future project for Automation and Control.

“Nonetheless, transport and storage costs have to be kept down. At Siemens we’re providing customers with comprehensive solutions in this area.” A glance at the variety of products offered by Siemens Dematic explains why. The range includes automation technology equipment for warehouses, and equipment for mail-distribution centers and airport baggage-transfer systems (see articles, p. 14, 20, 24).

“Increasingly, we are presenting ourselves as much more than ‘just’ a supplier of top-notch technology,” says Dr. Alexander Gediehn of Siemens Dematic in Offenbach. “The customer also wants complete planning and outfitting of facilities. We’re there to offer everything from a single source.”

**End-to-End Tracking.** “Looking toward future developments in logistics, Siemens is focusing on three technological areas: end-to-end tracking systems, highly automated warehouses, and integrated software solutions,” says Maier (see articles, p. 14 and 16). A visit to an automaker’s production facilities shows just what these systems are capable of doing.

Such plants resemble a giant organism. Huge volumes of material are in constant motion, and they must arrive on time at the right spot in the assembly line. “End-to-end tracking systems organize this apparent chaos by tracing the path that the parts take through the labyrinth of conveyer belts to the assembly line and coordinate the resupply stream with software,” Maier says.

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**Relative Costs of Logistics**

Depending on the sector, logistics is a major cost factor. In 2002, logistics services accounted for nearly 28 percent of total costs for German wholesalers and retailers (the graph subdivides these costs in six major categories). Logistics spending totaled nearly 13 percent in the consumer-product industry — that is, for producers of home appliances, mobile phones, toys or writing materials.

The comparatively low total for the automobile industry — about eight percent — is the result of major investments in areas such as research and development, and of the comparatively high costs of production and materials.

These expenses collectively reduce the relative cost of logistics. In addition, the auto industry has been working for years to implement more efficient logistics concepts in an effort to cut these costs. All three sectors predict that their logistics expenditures will fall in the future — a clear indication that they expect to benefit from newly introduced, efficiency-boosting strategies.
RFID makes it possible to follow the entire flow of goods from supplier and producer to consumer — in real time.