

A Detailed Analysis and Summary of the Information Technology Infrastructure of United Parcel Services

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United Parcel Services, Inc. began in 1907 as a small company run by teenagers to provide private messenger and delivery services to Seattle, Washington. The company's core values are "customer courtesy, reliability, round-the-clock services, and low rates". Founder Jim E. Casey's slogan for his company eventually came to embody the entire company's mission: "Best Service and Lowest Rates". The company quickly expanded down the Western seaboard through Los Angeles and pioneered the concept of consolidated delivery, that is, grouping packages by similar localities in the same shipment. From the beginning, logistics has been the strategic focus of the company and has allowed UPS to compete with other established competitors to provide low-cost delivery services.

One major point of growth and logistical support need for the company was 1975, when UPS was granted authorization to deliver in all 48 contiguous states: before this time, many delivery services were restricted from intrastate delivery. UPS employed a wide variety of emerging technologies including air delivery. In 1988, the FAA granted UPS permission to operate its own airline, and quickly expanded their services to include next-day delivery to all fifty states and Puerto Rico. Today, UPS is one of the largest airlines in the world and requires a sophisticated, adaptable infrastructure to route over 13 million packages per day for 8 million customers through thousands of ground delivery and over 1,500 air delivery segments per day. Not only does UPS manage their own business transit needs, but also they outsource their resources to other companies to provide complete supply-chain solutions for others.

To accomplish this incredible logistical feat, UPS invests more than \$1 billion every year on information technology and spends over \$11 billion in the last fifteen years

in technology upgrades alone. UPS spends over \$300 million a year in employee training programs alone to ensure their workforce can take full advantage of the company's technology infrastructure. The company focuses on several major areas, included: supply chain management, strategic alliances, web-based services, wireless services, systems integration, and electronic financial services.

Supply chain management is the heart of both UPS' parcel delivery service and its outsourcing service leased to other companies. UPS is aggressively extending their service offerings and their strategic marketing positioning at the same time by offering solutions that ease customer returns. All of the solutions UPS offers require an extraordinary array of technological resources, both human and equipment. Over 5,000 IT professionals man two crucial data centers that coordinate the vast package tracking network, obtaining over 6.6 million request for information per day. The data centers themselves contain 15 mainframes, operating at over 20 billion instructions per second and service 210,000 PC's, 4,500 servers, and provide data to up to 100,000 DIADs (personal tracking units used by ground delivery personnel). Vast amounts of research and development resources have gone into the automation of the tracking and pickup aspects of the delivery unit of UPS, and the sheer volume of data that must be processed in a distributed fashion creates major IT challenges for the organization. The role UPS has come to fulfill with its services require such an IT system that can handle massive usage spikes as well as a consistently high level of information processing. The business principles governing the package delivery industry also experience daily environmental changes that can have major repercussions throughout the entire scheduling and tracking systems. Therefore, all elements of the business logic as carried out by automated agents

must be able to dynamically adjust to changes in outside forces, making for a very complex and interdependent supply chain that requires multiple tiers of IT infrastructure support to effectively manage.

Integral to the continual survival and growth of UPS is its strategic alliances, most notably with Oracle, SAP, PeopleSoft, and eBay. Oracle is an industry leader of database software and SAP is a solutions leader in enterprise resource planning software. UPS' partnership with Oracle and SAP have given them a competitive advantage with one of the most technologically sophisticated address validation systems along with improved package tracking services both for internal use and as accessed through the UPS website. PeopleSoft focuses also on ERP and CRM software, and UPS is actively tightly integrating their operations with the scheduling and delivery capabilities of these packages to ensure maximization of their large, distributed workforce. Through their partnership with eBay, UPS is expanding the ease-of-use of their services by integrating their shipping and delivery services with eBay's auctioning services, providing a tight interaction between the companies that will both accelerate UPS' business and enhance eBay's electronic service offerings.

UPS' vast intranet tracking system is open sourced in two forms, both through wireless services to their drivers, as detailed in the following section, and through web-based connectivity via the UPS website. UPS provides direct electronic connectivity between their logistical information systems and customers through electronic data interchange direct to merchants to lock customers into virtual shipping contracts by providing such a wide array of easy to use online services. UPS also opens their tracking database to customers through their public Internet website which receives over 40

million hits per day, 4 million of which are package tracking requests. Electronic customer connectivity is an important technology-dependent services as over 90% of packages require activity data access online to customers. UPS' tracking systems are the largest in the world, encompassing both the largest private database and largest private wireless network in the world. The migration of UPS' tracking system to an Internet-based service has eliminated the cost associated with tracking telephone support centers.

UPS' service is global, encompassing an almost unfathomable quantity of transient conditions that require organization-wide synchronization of information and systems integration. The environment affecting UPS' operations is so extensive and difficult to define that the system would require high-level abstract business logic with algorithms that may change daily. Even a ten-minute delay in a flight departure could significantly affect UPS' scheduling network, potentially delaying thousands of packages and require recalculation of downstream variables, rerouting established plans to compensate for lost time. High capacity data transfer mediums must also be employed to allow for the massive amounts of information exchange that occur from data center to data center and filter down and from input processing devices as simple but numerous as the DIADs that the ground delivery personnel use. Not only are the physical requirements of the integrated technology system important for UPS' continued success, but also so is its cache of highly knowledgeable MIS professionals and industrial engineers that must constantly maintain the mission-critical systems and fine-tune its processes.

To guarantee that packages and documents get to their destinations on time, information must be accurate and in real time. A highly complex and integrated information technology infrastructure is required. First, before a package even reaches a

UPS international hub, the logistical information system sends complete information about the package across a wide area network comprised by over 2,000 local area networks, linked to one of 75 AS/400 systems at major international UPS shipping centers. In seconds, the network feeds data to a RISC-based AS/400 server located at each hub. Next, once a package arrives at an air hub, bar cod readers scan shipping data, including destination and content type, from each package in the consolidated cargo shipment. OS/2-based scanning devices feed this cargo data directly to the local AS/400 server. Finally, the AS/400 server verifies the cargo data against the original shipping information and prepares a complete report for immediate review by airport customs officials. In less than an hour, most shipments are speeding towards their destinations.

UPS currently offers the widest range of package delivery services in the world, including air, ground, same-day, next-day, domestic, international, and specialized delivery services. UPS divides their delivery services into three independent components: the movement of physical goods, the movement of information, and the movement of funds. Integrated with all three of these functional areas are additional services that allow UPS to continue to retain a large market share.

UPS' main business is the movement of physical goods in a door-to-door context. The Internet has allowed the delivery business to utilize this technology in order to gain a competitive advantage: for UPS this includes the development of electronic document delivery. UPS Document Exchange is a suite of services that allows customers to immediately ship anything that can be contained in a digital file, including any document, image, or software, over the Internet. UPS' OnLine Carrier is the most popular services since it provides up to 128-bit encryption, maximum file size of 70 megabytes, password

security, and instant delivery notification. UPS Document Exchange has significantly decreased the time and cost associated with physical document delivery. With this delivery solution, UPS has met the needs of mobile users.

UPS' subsidiary UPS Capital Corporation specialized in the movement of funds, providing financial products and services that allow businesses to expand operations, market new accounts, improve inventory, accelerate cash flows, lease new equipment, increase working capital, and reduce risk. This subsidiary of UPS offers COD enhancement services, distribution finance, equipment leasing, electronic invoicing and payment, global trade finance, and insurance solutions. These services combined with UPS' package delivery and information services enable UPS to provide total solutions to their customers.

UPS has developed a strong growth strategy that allows them to continually move forward in this every changing world of new technology. Their growth strategy has several components including expanding their leadership position in their core domestic business, continuing international expansion, providing comprehensive logistics and financial solutions, controlling their leading edge technology and e-commerce advantage, and pursuing strategic acquisitions and global alliances. To accomplish these strategies they must maintain a powerful infrastructure including their services, technology, and continuing effort to stay ahead of the competition.

In 1989, UPS was trying to keep up with the competition of FedEx by tracking next-day and two-day air shipments. They first needed to upgrade their customer support centers: They employed approximately 7,000 customer service representatives and wanted the delivery information available to all of them. They began upgrading the

customer service telephone centers with AS/400s and designing scanning hardware and software that allowed data collection centers to capture delivery records and transmit this information to the UPS central data center. When a customer called to inquire about a package, a customer service representative could locate information about the package online, merge it with a delivery confirmation letter, and fax it back to the customer. This system was on a two-year project plan but became profitable in less than 10 months.

Another efficiency problem then faced UPS: They could not justify scanning a piece of paper for each package delivered. UPS then began to capture the customer's signature electronically when their couriers delivered packages. This was successful and by 1989, UPS had sent out over 600,000 wireless devices to their delivery personnel. They became the first package tracking company to digitize signatures and to make them available electronically for verification.

Their next step was to capture data at the point of the shipment and simplify their operations to encourage more direct business customer demand. This had two benefits: by making it easier for corporate customers to do business with UPS, they could increase customer loyalty. Second, by allowing customers to automate their own shipping processes, UPS would gain accurate information at the point of shipment. UPS later developed shipping and tracking software that corporate customers could integrate with their own systems that would enable direct links into the UPS mainframe through electronic data interchange.

UPS knew that to stay ahead, they needed the ability to track the packages en route. UPS started with scanning and bar coding its premium air service packages and later bar-coding all packages. This allowed them to scan the package at least three times

through shipment. Scanners continuously update information about each package into UPS mainframe, requiring the largest DB2 application ever developed. To increase efficiency UPS not only bar-coded packages but also every truck, pallet, and shipping container. As shippers move packages within loading areas, overhead scanners scan them and check consistency. This constant tracking allows them to quickly and efficiently catch and reroute packages on the fly if necessary. UPS even developed wearable scanners that allowed shipping personnel to scan packages they loaded without wasting the motion required with physical wand scanners.

As UPS continued to build a strong infrastructure, they built the most comprehensive mobile radio network in existence today. UPS equipped every truck with a cellular antenna, a cellular telephone modem, and a hand held Delivery Information Acquisition Device (DIAD), the device with which customers digitally sign for packages. These DIADs communicate with UPS via data radio and link into UPS' worldwide network. DIADs were the first devices to contain a two-way radio. As a result, drivers can instantly receive new instructions, messages, and requests for additional pickups.

The services available through the UPS website include UPS Capital, UPS Consulting, UPS Community, UPS Document Exchange, UPS e-Logistics, UPS E-Commerce, UPS Logistics Group, UPS Professional Services, UPS Strategic Enterprise Fund, and UPS Wireless. UPS Capital delivers a portfolio of financial products and services that "get you where you want to go." UPS Consulting is comprised of professionals that specialize in supply chain solutions that take advantage of a changing world. UPS Community is a philanthropic organization that strives to provide services to UPS employees, their families, and the community. UPS Document Exchange allows

customers to move data including image and software files more efficiently. UPS e-Logistics provides clients with the power to manage information, move inventory, and expand their capabilities. UPS E-Commerce provides solutions that can improve a company's business processes. UPS Logistics Group offers a portfolio of logistic services that include logistics design, re-engineering and management expertise, leading edge information systems, and benchmarking processes to measure productivity. UPS Professional Services is a global management solutions firm that is dedicated to providing strategic business results via innovative technologies, expert financial analysis, and distribution policy practices. UPS Strategic Enterprise Fund is a venture capital group that focuses on developing critical partnerships and acquiring knowledge returns from its investments. Lastly, UPS Wireless provides information about deliveries via a wireless phone, a web enabled pager, or PDA.

No information system is without deficiencies however, and UPS faces situations in which they must either invest large sums of money in their technological infrastructure or lose customers. The United Parcel Service is a major company that can compete with other delivery companies, but they have major problems with their infrastructure. In order for UPS to stay ahead of their competitors, they must find new ways to improve their business operating procedures and meet changing consumer demand.

For many years, customers requested online tracking of package delivery, even when they are away from their computers. "These customers, as well as research firms, told us that they wanted to be able to access UPS shipment information while traveling, as conveniently as they can from their office desktops, without having to call our phone centers or find a place to plug in a laptop" (Air2Web, Inc, 1996). This technology did not

yet exist within the infrastructure of UPS; however, the company has devised a wireless plan to resolve the issues with customers who travel and are mainly away from computers and laptops. UPS now focuses on the idea that the future of the entire parcel delivery industry is going wireless: “Wireless technology is core to our business, says Jerry Skaggs, VP of information services and manager of the Ramapo Ridge facility in Mahwah, N.J., one of two UPS data centers” (Nelson, 2001). One plan to give UPS a competitive technological advantage is the Air2Web mobile Internet platform. This plan lets customers track shipping information through one-way and two-way SMS phones. UPS considers SMS phones to be the biggest piece of the mobile market, but this platform works poorly with equipment like the Palm VII and RIM pagers and does not satisfy customers who lack specific SMS phones.

The next major step that UPS took in the wireless technology area was implement a wide-scale wireless infrastructure, investing nearly \$100 million dollars in two wireless transmission protocols, Bluetooth and 802.11b, that have not even earned solid reputations yet. By using these two wireless transmission protocols, UPS believed they could cut costs and provide a return on investments. UPS was developing an organizational information system was more developed than Fed-Ex’s, their largest competitor, and could process more data faster. “The network feeds the New Jersey and Georgia data centers, which house a total of 15 mainframes with 16,942 millions-of-instructions-per-second capacity and 140 terabytes of company and customer data. It makes what UPS says is the world’s largest installed IBM DB2 database system” (Nelson, 2001). Even though UPS considered their infrastructure system to be very efficient, they now are trying to downsize the hardware systems for short-range

transmissions in warehouses by adopting Microsoft's Windows CE-based systems to consolidate hardware and emphasize the wireless infrastructure system.

United Parcel Service is a well-respected company that feels that their business will grow by using a wireless infrastructure; however, UPS is taking potentially expensive risks investing in immature transmission protocols. "Many industry experts, including Gartner's Egan, say Bluetooth, still in development, isn't ready for full-scale adoption" (Nelson, 2001).

In looking at UPS' long-term future, it is important to note the major focus of the company: that heavy investments in information technology that started in the 1980's is the core foundation for all the corporations' business processes. This focus has given UPS the ability to gain and maintain a distinctive competitive advantage. The future of UPS depends on its continued use of information technology to expand its business and accommodate to the change of a global economy. UPS is enacting its continued metamorphosis by implementing International Shipment Processing Systems (ISPS). ISPS track all overseas shipments, speed customs clearance by pre-notifying customers when packages are en route, and guarantee prompt delivery worldwide. UPS' major priorities are to: grow internationally, deploy technology that allow UPS to introduce new services, electronically connect customers to UPS, add value along the supply chain, and dominate all three converging areas of commerce – the flow of goods, information, and funds.

UPS' must attain its goals in a global climate, but they have a superior IT infrastructure to overcome obstacles associated with multinational corporations. UPS is a

new entrant to the European market, and is poised to dominate efficient parcel delivery through its use of International Shipment Processing Systems.

UPS offers end-to-end connectivity to all its business processes and provides integrated solutions that solidify their market share and leverage additional clients through the conveniences their package solutions offer. UPS does face obstacles to market entry in their quest to be a truly global corporation, including lack of technology infrastructures in underdeveloped third-world countries. UPS must innovate methods to integrate their technology-dependent business with countries that lack sophisticated communications infrastructures.

UPS is in a decidedly advantageous market position: it capitalizes on information technology and maintains a superior market share because of this. UPS anticipates its customers' demands and systematically expands its operations infrastructure to offer new, innovate services that in many cases lock customers into long-term relationships with the corporation. The barriers to market entry in parcel delivery are so great, only a few serious contenders such as FedEx, USPS, and RPS present genuine challenges. As long as UPS continues to maintain technological superiority and seamless integration of IT with its business, it stands to meet great success in expansion and profitability in decades to come.