Cisco Systems Architecture:
ERP and Web-enabled IT

Cisco CEO John Chamber’s vision of a “New World Network”—where voice calls over the Internet would be free—was as far-reaching in 1999 as Microsoft Chairman Bill Gates’ vision of “information at your finger tips, with a computer in every desk and in every home” a decade earlier.

CIO Peter Solvik explained:

The vision is core to our perception of the marketplace. We all carry these cards in our wallets with our goal printed on them: “Internet experts: the Global Internet Company.”

Founded by two Stanford computer scientists in 1984 and brought public in 1990, Cisco Systems, Inc., proceeded to dominate the exploding “Internetworking” market. In 1997, its first year on the Fortune 500, Cisco had ranked in the top five companies in Return on Revenues and Return on Assets. (See Exhibit 1 for Cisco’s financial performance.) Only two other companies, Intel and Microsoft, had matched this feat. On July 17, 1998, just 14 years after being founded, Cisco’s market capitalization passed the significant $100 billion mark. Less than two years later, on March 27, 2000, Cisco overtook Microsoft as the most valuable business in the world with a market cap of $531 billion.

Cisco’s core technology began with routers. Routers were what made the Internet work. They acted as multilingual translators connecting disparate computer networks around the world to the Internet, in much the same way that telephone networks in different countries passed calls to one another.

Cisco was at the forefront of challenging a world of three independent proprietary networks: the phone networks for voice, the local-area and wide-area networks for data, and the broadcast networks for video. Digitization enabled the convergence of the three networks; the Internet, as a global network of networks, made it possible to transmit voice, data, and video over one network in a more efficient and economical way than transmitting signals over the three independent and proprietary networks. The Internet and its open standards were creating a new competitive battleground for the entrenched telecommunications (telecom) players, including AT&T, Verizon (GTE & Bell Atlantic), British Telecom, and Deutsche Telecom.
Challengers to the incumbents spearheaded their attacks through the Internet by offering services such as Internet access, hosting, extranets, e-mail, and search capabilities. Many—including UUNet, PSINET, GTE/BBN, and over 5,000 other ISPs (Internet Service Providers)—were competing on price to provide fax, messaging, and EDI (electronic data interchange) capability.

All of this activity signaled the acceleration of the trend to IP (Internet Protocol)-based networks, a market that did not exist three to five years earlier. By 1999 in the United States, it was estimated that data network traffic exceeded voice network traffic. More than 75% of all Internet traffic traveled over Cisco products. In 2000, more than 275 million people were on the Internet, projected to be more than a billion by 2005.

In 2001, Lucent Technologies (with revenues of $33 billion and a market cap of $60.1 billion) was the leader for telecom gear and had not stood still since its 1996 spin-off from AT&T. As phone companies shifted their traffic from overstretched networks—which were designed to carry voice versus the zeros and ones of computers—Lucent was remaking itself to transition with its customers.

IP-based networks had cost advantages over traditional phone networks. In addition, the new IP-based technology providers such as Cisco were better equipped to address performance and security issues due to their constant influx of venture capital and talent. Many of the IP-based technology companies benefited from being located in Silicon Valley where there was a strong spirit of innovation in both technology and management. Juniper Networks competed with Cisco directly by providing next-generation Internet backbone routers specifically designed for service providers. Juniper Networks floated their IPO on June 25, 1999, and with revenues of about $100 million had a market value of $2.1 billion. In 2001, Juniper had revenues of $673.5 million and a market cap of $31,974 billion.

But neither Cisco nor Lucent had the products they needed to ensure a big win, nor did any of the other network companies, including Northern Telecom (Nortel), Bay Networks (now a part of Nortel), or 3Com. All of the network companies were racing to develop a new hybrid product with the speed and efficiency of a router and the precision of a telephone switch.

The Top Management Team at Cisco

The two founders of Cisco were long on innovation acumen. Don Valentine, partner of Sequoia Capital and vice chairman of the board of Cisco, was the initial venture capitalist who invested in Cisco; believing that Cisco would be a success, he took a chance when other venture capitalists were more cautious. One way that Valentine protected his initial $2.5 million investment was by reserving the right to bring in professional management when he deemed it appropriate.

In 1988, Valentine hired John Morgridge as CEO. Morgridge, an experienced executive in the computer industry who had worked at Grid Systems, Stratus Computers, and Honeywell, immediately began to build a professional management team. This team soon clashed with the
founders, and after Cisco’s initial public offering in 1990, both founders sold all of their stock and left the company. Some observers felt that this early exit of the founders provided a receptive environment and laid the groundwork for disciplined management which, in turn, let the company capitalize on market opportunities and grow at a phenomenal rate without derailing its focus or losing control.

Morgridge believed that many Silicon Valley firms decentralized too quickly and did not appreciate the proven ability of the functional organizational structure to scale without sacrificing control during high levels of growth. Accordingly, Morgridge maintained a centralized functional organization that was still in place in 2005. While product marketing and R&D were now decentralized into three “lines of business” (Enterprise, Small/Medium Business, and Service Provider), the manufacturing, customer support, finance, human resources, information technology (IT), and sales organizations remained centralized. The only responsibility of country sales managers was to sell the three market segment products. They were not responsible for non-sales activities (e.g., accounting, IT, manufacturing, etc.) within a country or geography. There was a belief within Cisco that consistency of strategy, goals, organization, and management provided a strong stabilizing benefit to a fast-growing and fast-moving company.

Cisco’s Business Strategy

Morgridge hired John Chambers in 1991 from Wang Laboratories and turned over the duties of CEO to Chambers in 1995. Morgridge reflected: “When Chambers took over, Cisco never lost a beat.” Chambers continued to execute a plan that he jointly created with Ed Kozel (chief technical officer) and Morgridge in 1993. The plan consisted of four elements:

1. Assemble a broad product line so Cisco can serve as one-stop shopping for business networks. (Exhibit 2 shows how information is routed through the Internet; it also shows Cisco’s revenues and market shares for various products.)

2. Systematize acquisitions as an efficient business process. Cisco made more than 70 acquisitions and key strategic alliances since 1993 to fill out its product line.


4. Pick the right strategic partners. Cisco worked with Microsoft to create an industry standard for security over the network; with MCI to deliver premium Internet services; and with HP to develop and sell Internet-based corporate computing systems built with HP and Cisco products.

Chambers believed that if he could successfully execute on this four-point plan, Cisco would be the lead architect and provider of technologies for the new Internet-based infrastructure in which voice, data, and video would be delivered through one network. Chambers further believed that

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5 Chambers had also worked for IBM for six years.
... by providing the end-to-end network plumbing, we can change the way entire companies and industries operate. Only now are businesses beginning to realize how much the network will touch their people and customers and suppliers, and how much productivity and profitability can improve when they become truly global networked companies.8

In the end, Chamber’s ultimate focus was on the customer, emphasized by his directive to have the words “Dedication to Customer Success” on every Cisco worker’s badge.

Building Cisco’s IT Infrastructure

When Peter Solvik joined Cisco in January 1993 as its new CIO, Cisco was a $500 million company and was running traditional financial, manufacturing, and order-entry systems. Solvik, fresh from Apple, concluded that he had two key challenges: First, Cisco’s Information Technology (IT) department was too traditional in being viewed as a cost center reporting through the finance department. In addition, it was too internally oriented. As a result, the potential contribution of IT to the business was much smaller than it could be, and Solvik believed this had to change. Solvik’s second challenge was that the current systems could not scale to support Cisco’s growth, nor were they flexible nor robust enough to meet management requirements.

To address the first challenge, three changes were made: First, the IT-reporting relationship was changed from accounting to the Senior Vice President of Customer Advocacy. (See Exhibit 3 for a Cisco organization chart.) Second, the IT budget pertaining to the functions were returned to the functions, leaving just a small portion in the G&A (General and Administrative) account. This created a structure in which all IT application projects were client-funded. Third, the central IT steering committee was disbanded and replaced with a structure whereby IT investment decisions on application projects were pushed out to the line organization but still executed by central IT.

A Defining Moment

Finally, in January of 1994, Cisco’s legacy environment failed so dramatically that the shortcomings of the existing systems could no longer be ignored. An unauthorized method for accessing the core application database—a workaround that was itself motivated by the inability of the system to perform—malfunctioned, corrupting Cisco’s central database. As a result, the company was virtually shut down for two days.

Cisco’s struggle to recover from this major shutdown underscored the fact that the company’s systems were on the brink of total failure. Solvik, Randy Pond9 (a director of manufacturing), and several other Cisco managers concluded that the autonomous approach to systems replacement that they had adopted was not going to be sufficient. An alternative approach was needed. Solvik described what they did:

We said, “we can’t wait casually by while order entry, finance and manufacturing go out and make three separate decisions. It would take too long to get those applications in place.” We needed to take faster action. At that point we got sponsorship from the SVP of manufacturing, Carl Redfield. He was with Digital before Cisco, in PC manufacturing. He

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9 Randy Pond became codirector with Pete Solvik of the ERP project.
took the lead and said, “OK, let’s get on with this . . . let’s start from the manufacturing perspective, and see if we can get the order entry and financial groups interested in doing a single integrated replacement of all the applications instead of taking a longer time to do separate projects.” And so in February, about a month after the company shut down, we put together a team to do an investigation to replace the application.

Redfield understood from previous large-scale implementation experiences at Digital how “monolithic” IT projects could take on lives of their own. He echoed Solvik’s concerns about project size and had strong views about how Cisco should approach a large implementation project:

I knew we wanted to do this quickly. We were not going to do a phased implementation—we would do it all at once. We were not going to allow a lot of customization, either. There is a tendency in MRP systems[10] for people to want the system to mirror their method of operation instead of retraining people to do things the way the system intended them. This takes a lot longer. Also, we wanted to create a schedule that was doable, and [we wanted to] make it a priority in the company as opposed to a second-tier kind of effort.

Selecting an ERP Product

Cisco’s management team realized that implementing to meet business needs would require heavy involvement from the business community. This could not be an IT-only initiative. It was critically important to get the very best people they could find. Solvik elaborated: “It was our orientation that in pulling people out of their jobs [to work on the project], if it was easy then we were picking the wrong people. We pulled people out that the business absolutely did not want to give up.”

Consistent with the need for a strong Cisco team, the company would also need strong partners. Solvik and Redfield felt it was particularly important to work with an integration partner that could assist in both the selection and implementation of whichever solution the company chose. Great technical skills and business knowledge were a prerequisite. Solvik explained the choice of KPMG as the integration partner:

KPMG came in and saw an opportunity to really build a business around putting in these applications. They also saw this as kind of a defining opportunity to work with us on this project. As opposed to some other firms that wanted to bring in a lot of “greenies,” KPMG was building a practice of people who were very experienced in the industry. For instance, the program manager who they put on the job, Mark Lee, had been director of IT for a company in Texas that had put in various parts of an ERP system.

With KPMG on board, the team of about 20 people turned to the software market with a multi-pronged approach for identifying the best software packages. The team’s strategy was to build as much knowledge as possible by leveraging the experiences of others. They asked large corporations and the “Big Six”[11] accounting firms what they knew. They also tapped research sources such as

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[10] MRP represents a class of systems, often thought of as predecessors of ERP, that focus on planning the material requirements for production. Forecast or actual demand is fed to MRP either manually or from other types of systems. MRP functionality is embedded in the offerings of all leading ERP vendors.

By orienting the selection process to what people were actually using and continuing to emphasize decision speed, Cisco narrowed the field to five packages within two days. After a week of evaluating the packages at a high level, the team decided on two prime candidates: Oracle and another major player in the ERP market. Pond recalled that size was an issue in the selection. “We decided that we should not put Cisco’s future in the hands of a company that was significantly smaller than we were.”

The team spent 10 days writing a Request For Proposals (RFP) to send to the vendors. Vendors were given two weeks to respond. While vendors prepared their responses, the Cisco team continued its “due diligence” by visiting a series of reference clients offered by each vendor. Following Cisco’s analysis of the RFP responses, each vendor was invited in for a three-day software demonstration and asked to show how their package could meet Cisco’s information processing requirements. Cisco provided sample data, and vendors illustrated how key requirements were met (or not met) by the software.

Selection of Oracle was based on a variety of factors. Redfield described three of the major decision points:

First, this project was being driven pretty strongly by manufacturing and Oracle had a better manufacturing capability than the other vendor. Second, [Oracle] made a number of promises regarding the long-term development of functionality in the package. Third, we liked the flexibility offered by Oracle’s being close by.

Cisco also had reason to believe that Oracle was particularly motivated to make the project a success. Randy Pond provided his impression of Oracle’s situation: “Oracle wanted this win badly. We ended up getting a super deal. There are, however, a lot of strings attached. We do references, allow site visits and in general talk to many companies that are involved in making this decision.” The Cisco project would be the first major implementation of a new release of the Oracle ERP product. Oracle was touting the new version as having major improvements in support of manufacturing. A successful implementation at Cisco would launch the new release on a very favorable trajectory.

From inception to final selection, the Cisco team had spent 75 days. The final choice was team-based. Solvik described how the decision was made and presented to the vendors:

The team internally made the choice and informed the vendors. There was no major process we had to go through with management to “approve” the selection. We just said “Oracle, you won; [other vendor], you lost.” Then we went on to contract negotiations with Oracle and putting a proposal together for our board of directors. The focus immediately turned to issues of how long the project would take, and how much it would cost. The team decided “yes, we will do this and we ought to go forward with the project.” So now at the very end of April we were putting the whole plan together.

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12 The Gartner Group is a leading industry resource for information on ERP and other information systems and manufacturing-related research.

13 Redfield later noted that not all of these promises were met in the time frame agreed on during contract negotiations.

14 Oracle and Cisco world headquarters were both located in the Silicon Valley approximately 20 miles from each other.
Going to the Board

Before going to the board for approval, the team needed to answer two very important questions: How much would it cost and how long would it take? They knew their executives were worried that a big project might spin out of control and deliver substandard results. Despite the risks, the team took a pragmatic approach to estimating project requirements. Solvik described the process:

Our quarters go August to October, November to January, February to April, and May to July. So right here on May 1, [at the] beginning of the fourth quarter, we are asking “how long should it take to do a project to replace all of our core systems?” This is truly how it went. We said “you know we can’t implement in the fourth quarter. The auditors will have a complete cow.” If it takes a year we will be implementing fourth quarter, and that won’t work. We thought it really should take 15 months, July or August a year later. Tom Herbert, the program manager, said, “there’s no way we are going to take 15 months to get this done. That’s ridiculous.” So we started going in the opposite direction and said, “well, can we do it in five months?” That just didn’t seem right. Understand, we did not have a scope yet. In the end we basically settled that we wanted to go live at the beginning of Q3, so we would be completely stable for Q4. [See Exhibit 4 for a summary of milestone ERP implementation dates.]

That took care of setting a target date. Next came the task of estimating a project budget. Once again, Cisco was aggressive: Solvik explained: “After we set a date, we estimated budgets. We put this whole thing together without really being that far into this program. We just looked at how much [the ERP system] touched.” Instead of developing a formal business case (i.e., a financial analysis) to demonstrate the impact that the project would have on the company, the team chose to focus on the issues that had sparked the analysis in the first place. In Solvik’s view, Cisco had little choice but to move. He explained his approach to the situation:

We said that we had this big outage in January—that we were the biggest customer of our current software vendor and that the vendor was being bought by another company. It was unclear who was going to support our existing systems and we needed to do something. The reliability, the scalability and the modifiability of our current applications would not support our anticipated future growth. We needed either upgrades to the new version of the current application or we needed to replace it. If we replaced it, we could either do it in parts or do it as a whole. We evaluated those three alternatives, talked about the pros and cons of each one, and recommended that we replace our systems “big-bang,” with one ERP solution. We committed to do it in nine months for $15 million for the whole thing. [See Exhibit 5 for a breakdown of project costs.]

Although Cisco was, to some extent, compelled to implement ERP, proceeding without a formal economic justification was also a matter of management philosophy. As Redfield put it: “You don’t approach this kind of thing from a justification perspective. Cost avoidance is not an appropriate way to look at it. You really need to look at it like, ‘Hey, we are going to do business this way.’ You are institutionalizing a business model for your organization.”

At $15 million, the project would constitute the single largest capital project ever approved by the company. Members of the team prepared to take this number to senior management with some trepidation. The first meeting with CEO Morgridge did nothing to alleviate their concerns. Pond described the meeting with Morgridge:

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15 Cisco’s financial year-end was July 31.
Pete Solvik, Tom Herbert, and I took the proposal to Morgridge and the reaction was pretty interesting. He made the comment, “you know, careers are lost over much less money than this.” Pete and I were as white as a sheet of paper. We knew that if we failed that we were going to get shot. Failure is not something the business took to well, especially with this kind of money.

But Morgridge approved taking the project proposal to the board. Unfortunately for Pond and Solvik, the reception was not much warmer there. Pond described what happened:

Before we even get the first slide up, I hear the chairman speaking from the back of the room. He says, “How much?” I said I was getting to it and he responded: “I hate surprises. Just put the slide up right now.” After I put it up he said, “Oh my God, there better be a lot of good slides.”

There were, and the board ended up approving the project.16 In the weeks and months following the meeting, Morgridge did his part by making it clear to the rest of Cisco that the ERP project was a priority. The project emerged as one of the company’s top seven goals for the year. “Everybody in the company knew this was happening and that it was a priority for the business,” Pond explained.

The project was completed successfully and on time and formed the centerpiece of the two-year, $100 million series of initiatives to replace all IT applications and platforms worldwide. Solvik described the results: “In a two-year period, we literally replaced every piece of technology in the company. We have a very low-cost/high-value technology architecture. We have no mainframes, no mini computers, and no legacy technology. Everything is current.”

The IT platform architecture was standardized throughout Cisco: 100% UNIX at the server level, 100% Windows NT at the LAN level, 100% Windows Toshiba and HP PCs at the client level, 100% Oracle at the database level, and 100% TCP/IP (Transmission Control Protocol/Internet Protocol) for the worldwide network. Voicemail, e-mail, meeting schedule software, desktop and server operating systems, and office productivity suites were all standardized. Virtually all business functions used single applications packages worldwide. (Cisco’s architecture is detailed in Exhibit 6.)

Being standardized to this degree gave the company a high level of flexibility. For example, when Cisco reorganized R&D and marketing from multiple business units to three lines of business, they completed all of the changes required across all applications in fewer than 60 days for a cost less than $1 million. Solvik believed that “without the IP and open-systems-based IT architecture and standardization, we would never have been able to accomplish such a feat in the short time that we did, and at an incredibly low cost.”

Although standardization meant flexibility, from a scalability perspective, distributing the company’s systems and yet keeping a single system image remained a daunting task. Solvik explained:

The biggest and most challenging projects we have going on are distributing our centralized core systems. We have very big UNIX servers with huge, huge databases that just don’t have the inherent reliability and scalability that the same size DB2 database would have on a mainframe. A tremendous amount of our effort goes into designing our systems to be reliable and scaleable. The whole UNIX platform has a much lower cost than mainframes, so we’re able to spend that money to have plenty of server capability.

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16 Pond added that getting approval for the project was made easier by the fact that the legacy systems crashed on the day of the board meeting. “The day of the meeting, [the legacy system] went down. We were able to walk into the board meeting and say, ‘It's down again.’ It was really a compelling story.”
Completion of the IP-based open-standards architecture initiative provided the centerpiece of the Cisco IT architecture. It also provided the foundation for the next phase of Solvik’s strategy—incorporating the Internet.

**Internet and Intranet Applications and Benefits**

Cisco began web development in the early 1990s when it discovered Mosaic, a public domain primitive web browser developed at the University of Illinois. Within six months of the discovery, Cisco had production and transaction web applications for itself and its customers, and a year after that they shifted from the Mosaic browser to the Netscape browser. Solvik recalled that early on, “when we purchased our applications, none were web-enabled. We had to web-enable them all. So we did that with a standard set of tools and a smart group of people.”

The initial three-year investment cost was about $115 million, $15 million for ERP and $100 million for web-enablement. The following table details the key components of the intranet and Internet applications.

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<td>EIS (Executive Information Systems) and DSS</td>
<td>Extranet supply chain (information transparency)</td>
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<td>(Decision Support Systems)</td>
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<td>Employee self-service</td>
<td>Customer self-service through website</td>
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<td>Communication and distance learning</td>
<td>Net commerce through the web</td>
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<td>Collaboration and workflow management</td>
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<td>Web-enabled legacy systems</td>
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Most of Cisco’s interactions with customers, partners, and suppliers were network-based and began at Cisco’s home page (see Exhibit 7). From the Cisco Connection Online (CCO), the user navigated to the information needed for the interaction work, or “published and subscribed”—that is, the user directly contributed information required to do business with Cisco, or enriched Cisco’s intellectual asset base. This allowed others (both internally and externally) to do business more efficiently and effectively with Cisco.

Cisco built its business processes on its own global intranet, and Cisco people deployed around the world interacted on this intranet to address business issues and customer needs. Links to strategic vendors and customers allowed Cisco to collaborate more efficiently with those outside the company. The intranet also provided a proving ground for new Cisco technologies and products, ensuring that they were ready for mission-critical applications before they were offered to customers.

**Employee Self-Service: Internal Applications**

The majority of Cisco’s internal applications had been web-enabled. For example, almost all functions that salespeople performed on the computer were done using a web browser. EIS and DSS systems, training (including distance learning), and self-service HR were all web-based.

Cisco Systems’ corporate intranet, Cisco Employee Connection (CEC), addressed the unique needs of its 40,000+ employees by providing centralized access to the information, tools, and resources needed to streamline processes, facilitate knowledge exchange, and maximize employee productivity. (See Exhibit 8 for the “Cisco Employee Connection” home page.)
Cisco leveraged the web to truly revolutionize existing process and create new, end-to-end capabilities. Because the web integrated data and tools from a variety of sources under a unified user interface, Cisco’s intranet was a key enabler of workforce optimization.

In addition to replacing its own custom-designed applications, Cisco worked with its vendors to help them convert the applications that Cisco had purchased for use within the company. By 2001, virtually every application in the company used a web browser as its only user interface.

**Communication and Distance Learning**

The network continued to enhance the ability to communicate with employees and added an important dimension to training. Distance-learning modules available to Cisco employees could be activated at the employee’s desktop. The use of these distance-learning modules, as well as information about their effectiveness, could be easily tracked to determine the extent of use of the various education modules. By tracking information, the quality of the modules could be assessed to ensure high levels of effectiveness as the needs of the organization changed.

Cisco worked with Yahoo! to make a Cisco-tailored version of “My Yahoo!” for Cisco employees. It was an early example of personalized home pages and used “push” technology, which retrieved information from the Internet based on user preferences and “pushed” it onto the user’s desktop, tracking everything from news reports to up-to-the-minute information about worldwide financial markets. (See Exhibit 9.)

Now Chambers’s addresses at Cisco’s quarterly meetings could be viewed from employee’s desktops in real time. Thousands of employees tuned in to view the addresses live or watch them in a delayed broadcast over the intranet, using their PC to bring up a video window. This streaming of live video provided another capability that strengthened the Cisco culture by making the company seem closer to each employee.

**Customer Self-Service: Electronic Connection with Customers**

Cisco management never missed a chance to reinforce that the customer was the focal point of its business. The centerpiece of this strategy was Cisco.com, a comprehensive, web-based, online resource for information and networked applications. With about 590,425 active registered users from around the world, Cisco.com was accessed approximately 3.8 million times each month by registered users (as of January, 2001), making it the primary vehicle for delivering responsive, around-the-clock customer support. Customers relied on Cisco.com to answer questions, diagnose network problems, and provide solutions and expert assistance worldwide. In fact, over 80% of Cisco’s technical support for customers and resellers was delivered electronically, saving Cisco nearly $506 million annually and improving customer satisfaction. For its international customers, portions of Cisco.com were translated into 17 languages with nearly 68 different country pages.

Solvik reflected on the importance of the customer at Cisco:

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17 In June 2000 there were 15 million hits per month on the Cisco website, and this number was increasing by 3.6% per month. Seventy percent of these hits were not from registered users but individuals visiting the Cisco website for general company information. Registered users had a special login that gave them access to specific Cisco information.

I have 600,000 registered Customers hooked up—those are Customers with a big “C”—compared to 42,617 Cisco employees. In contrast to most internally focused IT organizations in many other companies, my mission does not primarily focus on providing services and systems to meet the needs of the employees of the business. In fact, I refer to my employee users as clients, and not as Customers.

Customers who are using our systems directly express higher satisfaction with us and enjoy a lower cost of doing business with us than those who do not use our systems. And, of course, we also lower our cost of doing business.

Seventy percent of the employees in Cisco have a very significant bonus multiplier tied to our annual customer satisfaction survey. The first thing we review at every senior staff meeting is the status of critical accounts. Every night Chambers gets a personal update on the status of every critical account. Any employee can put a Customer on the critical account list as an advocate of the Customer. So if I get a call from someone who knows me or has met me or has my business card, and they say “I’m having a problem with your company,” I will find the relevant salesperson and call the account team to get the issue resolved, or I can place the account on the critical account list. If you have an unhappy Customer, they stay on the critical account list until the problem is fixed.

Net Commerce—Shipping Product over the Internet

Cisco was an early pioneer in using the Internet for full electronic commerce. Cisco began with simple transactions in 1996 and by 2001 had completed configuration and order placement for the company’s entire product line. Solvik recounted the experience:

We’ve learned an incredible amount in the 48 months of live e-commerce. We have racked up Internet shipments of product from 0% in July of 1996, to 2% of our revenue in August of 1996, to $800 million in calendar 1997, and to $1.5 billion each quarter in 1998. As of January, 2001, Internet-commerce-based revenue represents 92% of our total revenue base, a run rate of over $25 billion annually. Cisco operates one of the biggest electronic commerce sites in the world.

Orders could be placed via the Internet from anywhere in the world. After placing an order, customers could use other applications to instantly check the status of pending orders. In addition, over 90% of Cisco’s software upgrades were now delivered via the Internet at a much lower cost and in a shorter time period than when traditional distribution methods were used. Fortune magazine explained the savings:

At Sprint it used to take 60 days from the signing of a contract to complete a networking project. Now, thanks partly to the efficiency of ordering Cisco equipment online, it takes 35 to 45 days. Sprint has also been able to cut its order-processing staff from 21 to six, allowing the other 15 employees to work instead on installing networks.19

Productivity gains of 60% for Cisco and 20% for customers and resellers were being realized through online commerce.20

Cisco’s Supply-Chain Management Initiative

Beginning in 1992, Cisco outsourced much of its manufacturing to contract manufacturers while still performing final assembly and test. The supply-chain functions were jointly performed by Cisco and its contract manufacturers, requiring them to exchange information and interact through labor-intensive processes. As the company began implementing applications to extend to its suppliers and customers, Cisco decided that its core competencies were in design and fulfillment processes rather than physical transformation of product. As a result, Cisco chose to form partnerships with suppliers that performed physical transformation as their core competency.

Cisco was committed to maintaining an efficient supply chain between itself and its suppliers; a central part of Cisco’s philosophy was the removal of barriers that would impede the flow of information within the company and its business partners. To achieve this goal, Cisco implemented five initiatives that would automate the supply chain and increase integration with Cisco’s constituents. These initiatives were as follows:

1. **Single Enterprise**: Cisco used networked applications to integrate suppliers into its production systems, creating in effect, a “single enterprise.” This enabled key suppliers to manage and operate major portions of its supply chain. The electronic links across the single enterprise allowed Cisco and its suppliers to respond to customer demand in real time. Any change in one node of the supply chain was propagated throughout the supply chain almost instantaneously. Other improvements included the elimination of purchase orders and invoice processing.

2. **New Product Introduction (NPI)**: A 1998 Cisco study revealed that as many as four to five iterations of prototype-building were required, with each iteration taking, on average, one to two weeks. Two of the biggest drivers of costs and time delays in the prototype phase were the labor-intensive process of gathering and disseminating information and the delays caused by manufacturability issues. In response to these problems, Cisco automated the process for gathering product data information, thereby reducing the amount of time required from as much as one day to fewer than 15 minutes. By simulating the manufacturability of the product design before release to the factory, Cisco caught roughly 98% of all manufacturability issues up front, reducing the number of interactions to 2.5. In 1999, the use of networked applications in NPI reduced time-to-volume by three months and reduced total cost of NPI by $49 million.

3. **Autotest**: In 1992 Cisco began to build test cells that performed tests automatically with minimal labor and standardized product tests. Testing processes were made routine and were embodied in software test programs that ran the test cells. Once testing had been automated and standardized, it was outsourced entirely to the suppliers, allowing quality issues to be detected at the source. However, although testing was outsourced, the intelligence behind the testing was still supplied by Cisco.

4. **Direct Fulfillment**: Originally, orders were shipped to the customer exclusively from Cisco. Therefore, products configured by partners would have to go through two shipping legs—first, from the partner to Cisco, and then, from Cisco to its customer. Each of these legs took approximately three days. In 1997, the first step in moving toward global direct fulfillment was launched in the United States. The manufacturing partners who transitioned completely represented about 60% of Cisco’s unit volume.

5. **Dynamic Replenishment**: Before supply-chain automation, Cisco manufacturers and suppliers lacked real-time demand and supply information, resulting in delays and errors. To
compensate, inventory levels and overhead were higher than acceptable. The dynamic replenishment model allowed the market demand signal to flow directly to the contract manufacturers without any distortion or delays. It also allowed contract manufacturers to track Cisco’s inventory levels in real time.

As a result of these five initiatives, Cisco had one of the most efficient supply-chain models possible. In 1997 it improved responsiveness while improving profitability by $275 million. Network-enabled applications were key to value maximization in Cisco’s supply chain. This powerful new model of managing the supply chain was referred to as “the Global Networked Business Model.”

EIS (Executive Information Systems) and DSS (Decision Support Systems)

Cisco employees used the web browser as a front end for access to all executive and decision support information in the company. The company’s web-based Executive Information Systems (EIS) was used by all sales managers and executives worldwide—a total of over 2,000 users including the CEO—and provided summary and drill-down Bookings, Backlog, Revenue, Not Booked, Forecast and Plan for all products, customers, channels, geographies, and markets.

Sales tracking and reporting were also done via the intranet. If a Cisco salesperson wanted to track certain product sales in a region on a weekly basis, that salesperson merely called up the browser template and requested the information. After a few clicks of the mouse, assuming that the salesperson had authority to access the information, the report was automatically delivered to his/her desktop at the level of detail and for the time period requested.

Integrating Acquisitions into the IP-based IT Architecture

Acquisitions were, and continued to be, an important part of Cisco’s strategy. Approximately two-thirds of Cisco technology was from internally developed efforts, and one-third was from partnerships/acquisitions. In addition, approximately 70% of CEOs from acquired companies remained at Cisco.

Cisco seemed to have mastered the acquisition process. There were no hostile takeovers, and only companies with “market congruent” visions were considered. Because Cisco wanted to be assured of success, only one out of 10 acquisitions that Cisco considered was actually executed.

Once an acquisition was consummated, Cisco used a documented and repeatable process for integration. Generally, the acquired company was acquired for its R&D and developed products that contributed to providing the network customer with an end-to-end solution. The R&D and product organizations of each acquired company were grafted onto the product side of the organization, which included Cisco branding and product-family integration. The manufacturing, sales, and distribution parts of the organization were integrated into Cisco’s functional organization. Within Cisco’s IT organization, a specific group handled acquisition integration and immediately eliminated non-standard technology, integrating the acquired company into all of Cisco’s infrastructures and core applications. Because of Cisco’s IP- and standards-based IT architecture, the company was able to quickly and efficiently add the capacity needed to handle the administrative processes of acquired businesses. Most acquisitions could be fully integrated within 60 to 100 days.

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21 Noel Lindsay, network analyst, Deutsche Morgan Grenfell.
Following cooperative initiatives in a six-year relationship, in August 1999, Cisco announced that it would purchase 19.9% of KPMG’s global consulting arm for the sum of $1.05 billion. KPMG spun off the unit in February 2000 with the intention of taking it through an IPO (Initial Public Offering). KPMG would own the remaining 80% of the equity.

KPMG global consulting planned to use the capital from the deal to build six technology centers that would be staffed with 4,000 of its consultants to deliver Internet-based data, voice, and video consulting services to Cisco’s clients. If a corporate customer wanted to transfer business functions such as accounting or financial reporting to the web, Cisco would provide the hardware and software systems, and KPMG would provide the software required to set up the specific application and maintain it. For Cisco, the alliance with KPMG filled a gap to help customers install and maintain its systems. This was particularly important as Cisco sold an increasing share of its systems to telecommunications providers, who were accustomed to more assistance by their equipment suppliers.

Cisco gained a competitive advantage and increased shareholder value by implementing Internet business solutions across all functional areas (including marketing, employee, manufacturing, customer support, and commerce applications). The bottom-line impact in FY2000, including increased revenue, gross margin, and reduced expenses, was conservatively calculated at $1.3 billion. Solvik observed that the benefits of moving to the new architecture could be thought of as either providing the company free IT services or allowing it to invest $1.3 billion more in R&D than its competitors.

Beyond Cisco

It was clear that Cisco was successful in what it did, and Chambers and Solvik believed that the principles of using the Internet at Cisco applied in general business. In October 2001, Solvik stated:

The opportunity for Cisco to continue growing as a company is highly linked with the adoption of Internet-based infrastructures by other companies. We believe that we can continue to pioneer in the development and use of the Internet, and provide leadership to most traditional companies. These companies can find the same benefits that Cisco has enjoyed.

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22 Of the $1.05 billion, $420 million would be invested in the new unit, and the remainder would be paid to the KPMG audit and tax business.

23 The Wall Street Journal, August 8, 1999, p. A3. To satisfy the SEC, KPMG agreed to give up control of the new entity minimizing its equity holding to around 30%. Two Cisco executives would sit on the board of directors of the entity.

Exhibit 1  Financials and Other Cisco Statistics

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Net sales</td>
<td>$18,928,000,000(^a)</td>
<td>$12,154,000,000</td>
<td>$8,458,780,000</td>
<td>$6,440,171,000</td>
<td>$4,096,007,000</td>
<td>$1,978,920,000</td>
</tr>
<tr>
<td>Income before provisions for income taxes</td>
<td>$4,343,000,000(^a)</td>
<td>$3,316,000,000</td>
<td>$2,302,470,000</td>
<td>$1,888,872,000</td>
<td>$1,464,830,000</td>
<td>$679,046,000</td>
</tr>
<tr>
<td>Net income (loss)</td>
<td>$2,668,000,000(^a)</td>
<td>$2,096,000,000</td>
<td>$1,350,072,000</td>
<td>$1,048,680,000</td>
<td>$913,324,000</td>
<td>$421,008,000</td>
</tr>
<tr>
<td>Common equity—Total</td>
<td>$26,497,000,000 (^a)</td>
<td>$11,678,000,000</td>
<td>$7,106,620,000</td>
<td>$4,289,620,000</td>
<td>$2,819,620,000</td>
<td>$1,378,730,000</td>
</tr>
<tr>
<td>Total assets</td>
<td>$32,870,000,000(^a)</td>
<td>$14,725,000,000</td>
<td>$8,916,710,000</td>
<td>$5,451,984,000</td>
<td>$3,630,232,000</td>
<td>$1,757,280,000</td>
</tr>
<tr>
<td>Price—Close fiscal year</td>
<td>$61.75(^b)</td>
<td>$30.81</td>
<td>$15.958</td>
<td>$8.84</td>
<td>$5.75</td>
<td>$3.097</td>
</tr>
<tr>
<td>Number of employees</td>
<td>31,140</td>
<td>21,000</td>
<td>15,000</td>
<td>11,000</td>
<td>8,782</td>
<td>4,086</td>
</tr>
<tr>
<td>Net sales per employee</td>
<td>$607,835</td>
<td>$578,762</td>
<td>$563,918</td>
<td>$585,470</td>
<td>$466,490</td>
<td>$546,415</td>
</tr>
<tr>
<td>Net income per employee</td>
<td>$85,678</td>
<td>$99,809</td>
<td>$90,005</td>
<td>$95,334</td>
<td>$103,999</td>
<td>$111,720</td>
</tr>
</tbody>
</table>

Source: Compiled from Standard & Poor's Compustat, except information noted below.


Exhibit 2  How Information Is Routed through the Internet

How Information is routed through the Internet

Manufacturers Revenue and Market Share values from Dell’Oro Group

Source: Cisco.
Exhibit 3  Executive Level and CIO Organization Charts

President & CEO

Sr. VP Customer Advocacy  VP Human Resources

CFO  Sr. VP WW sales

VP global alliances  CTO

VP Internetwork Operating Systems Tech  Sr. VP Mfg & Logistics

Sr. VP/GM Internet BU & RTP Site Exec.  SR VP Sm/Md Bus Line of Business

Sr. VP Svc Prdr & Corp. Mktg Line of Business  Sr. VP Enterprise Line of Business

Sr. VP Customer Advocacy

VP Prof. Serv.  VP WW Tech Support

VP Global Support Engineering  VP CA Sales & Marketing

CIO & VP IS

IS Director, Manufacturing  IS Director, Global Field Ops.

IS Director, Corporate Systems  IS Director, Customer Advocacy

IS Director, Network & Telecom  IS Director, Strategic Services

Sr Manager, Architect Advance Tech.  Sr Manager, Operations

Source: Cisco.
Exhibit 4  Summary of Milestone ERP Implementation Dates

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Kickoff</td>
<td>June 2, 1994</td>
</tr>
<tr>
<td>Prototype Setup Complete</td>
<td>July 22, 1994</td>
</tr>
<tr>
<td>Implementation Team Training</td>
<td>July 31, 1994</td>
</tr>
<tr>
<td>Process, Key Data, Modification Designs Complete</td>
<td>August 31, 1994</td>
</tr>
<tr>
<td>Functional Process Approval</td>
<td>September 30, 1994</td>
</tr>
<tr>
<td>Hardware Benchmark and Capacity Plan Validated</td>
<td>October 15, 1994</td>
</tr>
<tr>
<td>Critical Interfaces, Modifications and Reports Complete</td>
<td>December 1, 1994</td>
</tr>
<tr>
<td>Procedures and End-User Documentation Complete</td>
<td>December 16, 1994</td>
</tr>
<tr>
<td>Conference Room Pilot Complete—Go/No Go Decision</td>
<td>December 22, 1994</td>
</tr>
<tr>
<td>End-User Training Begins</td>
<td>January 3, 1995</td>
</tr>
<tr>
<td>Data Conversion Complete</td>
<td>January 27, 1995</td>
</tr>
<tr>
<td>Go Live!</td>
<td>January 30, 1995</td>
</tr>
</tbody>
</table>

Source: Cisco ERP Steering Committee Report, October 20, 1994.
Exhibit 5  Breakdown of Implementation Costs for Cisco ERP Implementation

![Pie Chart]

- **Software**: 16%
- **System Integration**: 38%
- **Hardware**: 32%
- **Headcount**: 14%

Source: Cisco ERP Steering Committee Report, October 20, 1994.

Note: The project budget estimate did not include estimates of the cost of Cisco personnel time beyond some members of the core team.
### Exhibit 6  Cisco’s IT Architecture

**Technology Standardization**

<table>
<thead>
<tr>
<th>Common PC platform, O/S, Productivity SW, Email, Browser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Applications Packages Worldwide</td>
</tr>
<tr>
<td>Database Mgmt System: Oracle</td>
</tr>
<tr>
<td>Protocol: TCP/IP</td>
</tr>
<tr>
<td>Enterprise Servers: Unix</td>
</tr>
<tr>
<td>Workgroup Servers: NT</td>
</tr>
<tr>
<td>Worldwide Network, Voice PBX/Voicemail, Video Standards</td>
</tr>
</tbody>
</table>

- Reduced time to market
- Reduced costs
- Easier data integration

Source: Cisco.
Exhibit 7  Cisco’s Home Page

Source: Cisco.
Exhibit 8  Cisco Employee Connection Home Page

Source: Cisco.
Exhibit 9  MyYahoo! at Cisco