Having identified four key areas of strong market growth potential, Cisco Systems is focusing its substantial R&D efforts to maintain and strengthen its leadership position in these fields, Mario Mazzola, the company’s chief development officer, explains to Anthony Harrington.
Short product life cycles in the technology sector mean that billion-dollar technology companies have to budget for a large R&D spend – whatever the economic climate. “Our customers are not making a one-time-only decision at a particular moment in time. They generally have an operating network with a lifetime of a decade or more,” says Mario Mazzola, chief development officer at Cisco Systems (NASDAQ: CSCO). “So their major question is: ‘What vendor will be in a position to innovate continuously and consistently over that period of time?’”

Cisco has the deep pockets and the commitment to R&D to be that vendor. In fiscal 2002, it spent $3.3 billion on R&D, or 17.5 percent of its $19.9 billion revenues. Cisco’s R&D spend compares well with other top players in the IT sector. Mazzola points out that, taking R&D spend as a percentage of revenues, Cisco comes out ahead of companies such as IBM and Hewlett-Packard, both famed for their sustained R&D spend.

This investment has paid off. Cisco maintains a strong leadership position in total router sales, with an 85 percent share of the $7 billion global routing market for the year, and currently holds 69 percent of the $12 billion switching market, says market analyst Dell Oro. It also puts Cisco as the number one in voice-over-IP (Internet protocol), cable head-end, DSL CPE routers, enterprise wireless LANs (local area networks), and the VPN (virtual private network) and firewall markets.

By outspending rivals in strategically chosen markets, Cisco intends to ensure it strengthens its leadership position. “Weak R&D investment leads to a loss of market share,” says Mazzola. One of Cisco’s chief differentiators is its ability to make targeted investments - through R&D, and with acquisitions and partnerships - to address customer needs. It has also increased engineering efficiencies through programs such as value-engineering, which allows developers to use a common set of tools, such as ASICs and software, across platforms, he adds.

“Cisco takes a customer-driven, pragmatic approach to R&D,” he notes. For the company to invest heavily in product development in a new market, there must be revenue potential of at least a billion dollars, or the area is seen as key by Cisco customers. It has identified four new markets with such potential: IP telephony, wireless and mobile, security and the emerging storage networking market, in addition to its core markets of routing, switching and network system software. As a result, it is applying 40 percent of its R&D spending to new growth markets – such as storage area networking, security, IP telephony and wireless/mobility - which represent 15 percent of business today, says Mazzola.

**Customers want security**

Security, says Mazzola, is now at or close to the top of the list of priorities for all its customers. “Eighteen months ago, we and the industry had a product-centric view of security, all about protecting ingress and egress points to a network.” Now, as companies try to gain competitive advantage by using their networks to build team-working, security is all about protecting business applications and services. “This has caused a major shift in our strategic thinking and in our development program,” he says.

This gave the company two challenges for product development. Many customers see special-purpose appliances as a way of adding additional layers of security to a network. But others want security to be at the heart of the network, with security features embedded in routing and switching technology. Routers are natural points to control which sets of users have access to what resources because they set up and control communications pathways.

Cisco is responding to these demands, says Mazzola. Its product development strategy focuses on creating common software and hardware architectures for secure appliances and routers.

The company is also concentrating on two other areas of security highlighted by customers: deployment and manageability. The former involves implementing security across a large-branch office infrastructure, as just one example. Manageability, however, refers to setting, implementing and maintaining policies and managing security-related devices.

IP telephony has become a “no brainer” for Cisco to prioritize, says Deb Mielke, managing director of the market analyst, Treillage Network Strategies. Customer investment in IP telephony...
was initially driven by a desire to lower clients’ operating expenditure by using it for ‘toll by-pass’- user organizations install an IP PBX exchange allowing inter-office voice call traffic to piggy-back and ride free on established inter-office data networks.

Mazzola points out that the company launched its first products in this area in 1995. IP telephony is now on its way to mass adoption, and Cisco is leading the way with a more than 52 percent market share, says Synergy Research. Cisco has shipped 1.5 million IP phones, and has 6,000 Cisco IP telephony customers worldwide. Its current R&D is about enabling new intelligent services, such as IP-based video conferencing.

**Strengthening voice**
Cisco is also developing and strengthening its voice product range aimed at service providers (SP). These providers are eager to use IP telephony to create new revenue-generating opportunities, such as managing IP-based call centers and multi-service centers for clients. The company’s IP platforms enable SPs to offer a complete managed telephony service for customers. In all, in voice technology Cisco now has more than 500 patents either issued or pending.

The rise of storage area networks (SANs) made storage an obvious area of interest for Cisco. Its research showed that SAN deployment by corporate customers tended to be very application-specific – each application would get its own SAN. By using its data networking skills to create a storage ‘network of networks’ spanning these isolated SANs, Cisco was able to add value for customers. “Our first efforts here were aimed at bringing our collective experience in building global IP networks to bear on the storage arena,” says Mazzola. “So we focused on developing multi-protocol platforms that could fit in with whatever equipment the customer already had, and that would enable them to connect existing isolated SANs in different geographic areas.”

Cisco has developed, and is continuing to develop, platforms that can support other transport layers such as fiber channel-over-IP, or SCSI-over-IP. The company’s goal is to produce SAN platforms that interoperate with existing technologies. “We want our equipment to have at least a ten-year life span, irrespective of technology developments,” points out Mazzola.

Companies want high availability of data from storage, Mazzola adds. Until now, they just thought about the features in the storage box. Now, Cisco is encouraging its user base to move to the high availability focus to the storage network, which provides a consolidation of boxes. High availability is now a function of network intelligence, it argues. Much of Cisco’s effort in this area is devoted to adding intelligence in both software and hardware, the latter through the design of application-specific integrated circuits (ASICs). Security is also vital in a networked storage environment, so Cisco’s security R&D overlaps this area.

**Network in motion**
Mobile and wireless space presents a range of challenges to network specialist, and constitutes one of the most promising new growth areas. As Mazzola notes: “What we are now seeing is the evolution of the network in motion.”

Instead of a fixed access point on a fixed network, the model now is of a body in motion – in a plane, train or car – crossing one network after another. The problem for Cisco is to maintain the connection, as most applications fail if they see a dropped connection.

Cisco’s new Mobile Access Router, launched in October 2002, maintains the connection as users move between networks. The same technology is good for the SP market, as it enables SPs to provide seamless connectivity, no matter which network the user is moving across.

**The size advantage**
The combination of size and sustained investment in R&D allows Cisco to enter new markets and continually innovate.
in existing markets. The steady increase in the complexity of technology in general, and networking technology in particular, means it is harder and harder for new entrants to compete with established players. With the largest market share in its key markets of switching and routing, Cisco benefits more from this trend than its rivals, as it has more clients to support more R&D spend.

“A new entrant can operate in stealth mode while it is developing its first product. Then when it launches, it gains a brief advantage. What it cannot do, however, in the short window of opportunity that its new product brings it, is to gain a sufficiently large client base to be able to get anywhere near our continuing R&D spend for future generations of products,” Mazzola argues.

TNS analyst Mielke agrees: “Cisco has a tremendous ability to outspend its competitors when it comes to R&D, and to use that spending muscle to leapfrog the competition. If you jump Cisco, it has enough cash from its large customer base to jump right back and then you get into a position where you can’t keep competing with their spend.”

The key point about the networking market is that it is not about a single, new, innovative product, concludes Mazzola. Instead, it is about continuous innovation over time, together with a policy of ensuring backward compatibility so that the investment customers have made in a particular supplier’s equipment is protected.

Critically, he says, few customers can afford to jettison previous networking investment to pursue the latest equipment. Instead, they favor an ‘evolutionary’ model, where new innovative products are compatible with prior generations and will work alongside them. “This need for backward compatibility in innovation,” says Mazzola, “is a key driver in Cisco’s R&D thinking.”

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**MARKET LEADERSHIP | REAPING THE BENEFITS OF R&D**

Cisco can point to a string of successful products emerging from its R&D operation. The latest demand, for example, is in the area of converged voice and data networks.

Cisco aims to meet the need by offering a converged networks migration path, together with products that will provide the user with the ability to integrate new services, such as voice-over-IP and video-on-demand, onto a converged network.

“We are very skilled at bringing different forms of networks into a single IP-based packet infrastructure and we have protocol leadership with MPLS (multi-protocol label switching), a technology that brings quality of service management to IP [Internet protocol] networks,” says Mario Mazzola, Cisco’s chief development officer.

Invented by Cisco, MPLS is a protocol to prioritize voice and data traffic on the Internet. The technology allows businesses to use the Internet more effectively for all their communications needs, delivering a more streamlined service and offering the potential for significant savings on running costs.

Cisco began its MPLS project as an R&D venture in 1996, feeling that it was on to something ‘relevant’.

Now, more than six years later, the “bet” Cisco took is coming to fruition. Operators around the world are investing with increasing speed to convert their networks to MPLS, with Cisco standing to benefit hugely from the conversion process.

The company is predicting that MPLS will develop into a $2 billion market within the next two years.

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**TECHNOLOGY | FIRST AND FOREMOST: FROM THE OUTSET, CISCO HAS LED ROUTER DEVELOPMENT**

**1986 - THE WORLD’S FIRST MULTI-PROTOCOL ROUTER**
The Cisco AGS enabled users in business, government and education to connect different computer systems and share information.

**1993 - THE FIRST HIGH-END ROUTER**
The first high-performing router, the Cisco 7000 Series, also introduced dual-power supplies and hot-swappable line cards, allowing uninterrupted network services during network maintenance.

**1994 - THE FIRST FULL-FEATURED ROUTER FOR SMALL OFFICES**
With the release of the Cisco 2500 Series, customers could utilize routing software unbundled from the router hardware, allowing them to buy just the feature set they required.

**1995 - THE FIRST MULTI-GIGABIT BACKPLANE ROUTER**
The Cisco 7500 Series was the first router to have a packet-over-SONET interface – a revolution in the way Internet and IP traffic is carried over long distances.

**1996 - THE FIRST PURPOSE-BUILT ROUTER FOR IP AND OPTICAL NETWORKING**
The Cisco 12000 Series router was the first specifically built to meet the demands of scaling the backbone of the Internet and IP networks. It could be scaled seamlessly without the need to take it out of the network or replace it.

**1998 - DPT: A REVOLUTIONARY SYSTEM FOR CONTROLLING INTERNET TRAFFIC**
With DPT (dynamic packet transport), Cisco combined the best attributes of IP routing and fiber-ring architecture. DPT uses the intelligence of IP routing to determine the most efficient way for data to travel from A to B. Traffic loads are fairly distributed, so no area is under or over-utilized, and flow is protected from interruption by offering alternate routes for data.

**2001 - THE FIRST MOBILE NETWORKS**
Cisco extended mobile IP, a breakthrough technology that allows entire networks to roam. For example, passengers aboard an airplane can now stay connected to the Internet.