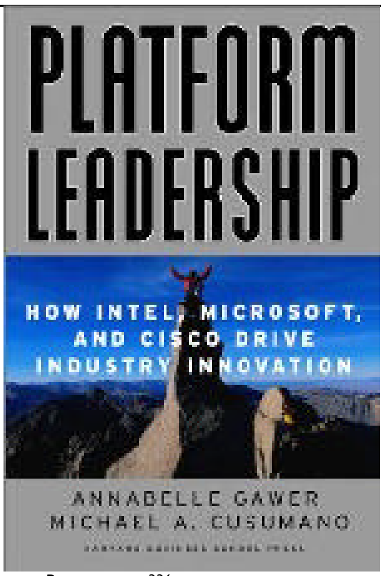
Platform leadership



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Many industries are characterized by the interdependence of various products and the ability of many players to innovate. Companies in such industries must make fundamental decisions while taking into account what other companies, active in the network of interlocking parts, are doing. The network as a whole contributes to innovations. Competition in such industries is guided by how the platform evolves rather than the evolution of a single product. Companies like Intel, Microsoft and Cisco are platform leaders. *Platform Leadership* describes in detail what goes into the making of a platform leader.

In the initial phase of many industries, a few firms develop most of the components necessary to make the products. But as industries evolve, specialized firms typically emerge to develop different components. Industries like computers, telecom, and automobiles are all moving toward a more modular architecture with different players specializing in different modules.

Platform leaders are companies who drive innovation in their industry. Ensuring the integrity of the platform and driving its evolution are the strategic imperatives for platform leaders. They realize that no single company can replicate all the innovative capabilities of a market. As a result, they work closely with other firms to create initial applications and then new generations of complementary products. Platform leaders and complementary innovators have great incentives to cooperate, because their combined efforts can increase the size of the pie for everyone.

We can think of products as goods or services that companies can put a price on and sell in markets where multiple firms compete with one another. When a firm invests in developing an innovation, usually it hopes not only to create value but also to capture value. Firms usually capture value by making it difficult for others to imitate the product innovation (through secrecy or patents), by controlling key suppliers in the market, or by having a strong brand that builds customer loyalty. These barriers to entry help innovators profit from their investments.

Things are different when a firm invests in developing a new platform interface. Interfaces are enabling technologies. They contain valuable content or information that probably could have value (a price) in the marketplace. But protecting that content, by hiding the detailed specifications of the hardware or software interfaces, would defeat their entire *raison d'etre*. Interfaces exist to entice other firms to use them to build products that conform to the defined standards and therefore work efficiently with the platform. Enabling technologies channel and facilitate complementary innovation, thereby reinforcing the architectural leadership of the firm that sponsored them.

In industries that center around platform products, the value of a platform increases when there are more complements. It is in the interest of a platform leader to stimulate and channel innovation on complementary products. The more people use these complements, the more incentives are there for complementary producers to introduce more complementary products. This in turn stimulates more people to buy or use the core product, stimulating more innovation, and so on.

Since platforms are made of components whose interaction is built around standard interfaces, wars on standard are an integral part of platform strategies. For example, Netscape Navigator's market share declined sharply in popularity as a result of Netscape's inability to keep it as the industry standard.

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Intel's rise to platform leadership

Intel has long been the world's leading microprocessor manufacturer. Its business model has been built around developing newer and powerful versions of microprocessors at regular intervals. Intel executives were disturbed that no computer manufacturer was attempting to advance the PC Platform. As a result, innovation at the system level, was proceeding at a slow pace. Intel was unwilling to tolerate a 'bad' PC architecture that limited the performance of its microprocessor.

Intel realized that a PC's overall performance depended not only on the performance of each individual component but also on the performance of the links between those components. A computer bus transmitted data in branches in the form of electrical signals or bits between components. The faster the bus, the faster the transmission of data.

Intel decided to change the PC's interfaces. Until then, Intel engineers had only designed the microprocessor. Intel decided to change the architecture of the system to affect the construction of a computer that had a PCI bus. The PCI bus was an internal interface whose definition affected several companies that designed and manufactured parts attached to the bus. Therefore, altering the bus was a major architectural change involving significant risk. Not only did Intel have to design a bus that worked faster, but it also had to convince other firms to adopt this new standard and invest in new products that used it. Winning over other firms to the new standard was the biggest challenge Intel faced.

Eventually, Intel convinced other firms including IBM to adopt the PCI design. But to do so, Intel realized that it had to demonstrate its commitment to the new standard. Intel did this by starting mass production of PCI chip sets at its Folsom, California division.

In addition to chip sets, Intel soon expanded its motherboard business, a major component of PC that combined the microprocessor with essential chip sets for peripherals as well as memory chips. Intel made this move because suppliers were slow to move. Intel wanted its customers to take advantage of its latest microprocessor technology.

Intel engineers designed PCI so that future versions of the microprocessor would not require a redesign of anything else in the PC architecture. This move left enough room for Intel's chips to evolve without requiring further approval or extra coordination between other industry players. The PCI and chip set designs introduced a local modular architecture into the part of the PC that decoupled Intel's zone of innovation from the rest of the computer. If Intel were to develop new microprocessors, other industry players would not have to redesign their products in order to be compatible with the new Intel chip.

The PCI bus initiative was only the first in a series of architectural changes that Intel championed. PCI conveyed data to and from PC subsystems surrounding the processor, whereas the AGP transferred data between the microprocessor and graphics cards. AGP was geared especially toward boosting the performance of computers running graphics software applications. Intel also got involved from the early stages of design in FireWire, a serial bus interface standard offering high-speed communications from PC to peripherals.

Intel's USB initiative began in the mid-1990s when it became apparent that there were other platform bottlenecks to overcome. Limited bandwidth between PC and peripheral devices— such as printers, scanners, joysticks, and digital cameras—were slowing down the overall PC performance. The USB, a new interface aimed at linking PC to external devices such as the mouse, keyboard, scanner, and printer. It served as a 'universal' plug into PC. A user could connect several peripherals into one USB plug, which was not possible with legacy serial connectors. The problem again was the architecture. PC manufacturers had designed PC so that each peripheral device needed its own individual plug in the back of PC. The USB would remove this limitation. Intel expected the USB to accommodate many peripherals and stimulate further innovation on existing products such as joysticks or other hardware products yet to be invented. USB allowed greater flexibility, augmented the versatility of the PC and advanced the PC platform.

Intel managers believed that many more innovations could emerge from a computer industry organized in layers of specialized firms that created products able to interact through 'open' interfaces. Modular architectures and open interfaces would enable many firms to participate in the innovation process.

Getting outside firms to support new standards such as PCI or USB required time, patience and planning. Intel had learned this with PCI. The company proceeded gradually rather than with a burst of publicity and investment. During the early phases, Intel generally initiated relationship with a small group of outside firms and brought them together in Strategic Interest Groups (SIGs). Then, in collaboration with SIG members, Intel engineers designed the first features of the new standard. Intel had the backing of even influential firms like Microsoft and Compaq because they had a chance to participate early on in the design process and to influence the evolution of the standard.

In 1990, around the time of PCI, Intel managers also decided to build Intel's brand name. They launched the ambitious 'Intel Inside' marketing campaign in November 1991. This conveyed to the world that Intel microprocessor lay inside the Compaq, Dell, and IBM boxes, and encouraged consumers to go with Intel brand rather than buy PCs with microprocessors from other companies. The campaign was a great success in creating brand awareness among consumers. The campaign enabled Intel to gain bargaining power vis-à-vis suppliers, and charge a premium for its products. It also strengthened the company's credibility as a platform leader.

Intel has from time to time demonstrated the ability to cultivate internally a 'system mindset.' Such a mindset requires managerial attention, technical expertise, and resources at the level of the overall system or platform rather than on the inner details of the core product or the part that is the firm's speciality.

Intel has created external momentum by communicating its vision of the PC platform evolution; building consensus, starting with small groups of influential firms; providing tools for development of complements that fit into Intel's overall vision; highlighting business opportunities for potential complementors and facilitating external innovation.

In PC industry, Intel has acquired a reputation as a trustworthy and relatively impartial broker of information. Companies have come to believe Intel looks out for the good of the industry overall. Intel can build consensus among industry players while having a strong say in how specific PC technologies and standards evolve. Intel maintains significant influence over the design of interfaces that other companies use to interconnect their components to Intel's chips. Thanks to its reputation for impartiality and its ability to influence industry standards, Intel is virtually guaranteed a supply of innovative complements for its new microprocessors.

Intel has also encouraged outside complementors to compete by picking one firm (called a 'rabbit') to be a leading proponent of a new technology or standard. Intel has invested in marketing and public relations support to focus industry attention on the 'rabbit' as well as on the market in which this firm is trying to establish itself as a leader.

Intel managers have established trust in the minds of complementors. Firms get to participate in the definition of the standard or technology in question and make it as technically sound as possible. They get an opportunity to shape it in a direction that is in harmony with their vision for product evolution. This approach increases the likelihood of getting 'political' support from these external players. Intel also assures partners that critical technical information would remain open and it would treat intellectual property fairly.

One of the key roles of a platform leader is to 'lead on' complementors. The platform leader must declare support for a new technology and not favor any one group to encourage external companies to innovate. When these firms base their R&D and marketing plans on this commitment, the platform leader cannot change its mind midway without severely undermining its reputation. Intel has done well in this regard.

Platform leaders must also have concern for the long-term financial health of complementors. The leaders must define carefully the scope of their own activities and investments, especially when deciding to enter complementary markets directly. Intel implicitly assures complementors that it will not invade their business provided they do what is expected of them to advance the platform.

Intel has made a distinction between 'specification IP' (proprietary information that describes the functional details of a new technology) and 'implementation IP' (proprietary information necessary to apply the technology in an actual product). Intel licenses or gives away specification IP, but is more careful with implementation IP, especially if one of its product groups intends to compete in this area.

When external companies produce a complementary innovation, they can share the returns on this investment if the platform leader buys their innovation (the complementor then becomes a supplier) and pays them a fair price or distributes this innovation with its core product. But, if the platform leader does not pay a fair price for innovation, the outside company has no incentive to innovate. Conversely, if the complementor tries to capture too much of the profit coming from an innovation, the platform leader might have less incentive to invest in activities that facilitate third-party innovation. Intel seems to have understood these problems well. By keeping some complementary expertise and possibility to commercialize complements in-house, Intel has a powerful bargaining chip: the ability to compete with its complementors. While Intel is unlikely to enter certain areas, it reserves the right to make an entry, should the situation demand. This happens when complementors do not live up to Intel's expectation. A good example is chip sets.

The first step in managing tension is to acknowledge rather than ignore them. Intel executives acknowledge, that in the quest for platform leadership, internal conflicts of interest can emerge. For example, managers continually face the choice of whether to distribute new technologies and information as aids to complementors or keep them for developing in-house products. Executives do not expect people to resolve disagreements as soon as they appear. Instead, the company encourages formal debates on the issues underlying these tensions, where people can express dissenting views. These debates often take place under the guidance of senior executives like Andy Grove, and Craig Barrett, who make the final decisions in many cases. Open debates help inform Intel managers about how new technologies can be put to use. Intel has tried to establish a 'Chinese wall' to separate internal product and R&D groups that might have conflicting interests among themselves or with third-party complementors that rely on Intel microprocessors. Intel is well known for having a corporate culture that tolerates ambiguity in goals and objectives and encourages open confrontation. Divergent opinions allow important information to surface and help managers become aware of changes in their environment.

Microsoft

Microsoft, another platform leader, has pursued an approach different from that of Intel. Microsoft, has limited the scope of its business but always made it clear that it might compete with software and even hardware complementors. Its strategy for software applications is to enter any 'horizontal' business of large market potential. Its strategy for Windows is to ward off potential competition by enhancing the operating system with numerous features or technologies that complementors often sell as separate products. Microsoft also makes many of its complements.

Of Microsoft's $23 bn in fiscal 2000 sales, almost half ($10.47 bn) came from applications and developer support tools like programming languages and compilers. In contrast, in 2000, only 20 to 30 % of Intel's revenues came from non-microprocessor products and services. Major Microsoft applications include Office Outlook, and e-mail, scheduler, and information manager embedded in Windows; Exchange, a workgroup server; and enterprise products such as the BackOffice suite of servers and programming tools, and the SQL Server database system.

Microsoft does not have any 'Chinese wall' between its operating systems groups and applications groups. Microsoft has made it loud and clear that 'integration' of different applications, systems, and networking technologies (such as embedding an Internet browser in Windows) is central to its strategy and good for customers.

Microsoft's business model has depended not only on revenues from new sales of Windows and applications but also from 'upgrade' sales as users move to new versions of Windows and applications. Like Intel and PC manufacturers with the hardware platform, Microsoft realizes that software programs have now become so powerful that few users feel a pressing need to upgrade. But it must still find ways to advance the platform.

Due to its ability to create its own complements, Microsoft places a lower priority on gaining and maintaining the trust of its complementors, unlike Intel. Its recent venture into home game machine design with the Xbox (a $20 bn market) indicates that Microsoft has the resources to even create a new hardware platform around its software. The Xbox which has a powerful microprocessor competes not only with Nintendo machines but also with the Sony PlayStation. This move might create tensions with Sony, a partner for its PC business.

Managers and programmers at Microsoft who work on operating systems and related technologies, are primarily interested in making Windows work with different applications and hardware combinations, whether they are Microsoft applications or products from other companies. Microsoft applications groups try to take advantage of their special understanding of Windows. At the same time, Microsoft product groups that make versions of their applications for the Macintosh have preferred to be more neutral. As a result, Microsoft has had to deal with numerous internal as well as external disagreements.

But Microsoft has found its own ways to manage these contradictions. It has developed close relationships with many hardware vendors, who bundle Microsoft applications along with Windows on their PCs. Microsoft also has close relationships with retail software stores, which give prominent space to Windows applications. And, thanks to agreements with hardware vendors, million of customers see the Microsoft name every time they start up their computers. These marketing relationships have developed brand awareness and helped Microsoft popularize its products, including applications such as Works, PowerPoint, Mail, and Access, which were initially slow to catch on with customers.

Microsoft developers hold annual development forums for applications developers to demonstrate how the Windows programming interfaces are evolving. The company ships Software Development Kits with programming tools and sample code to help applications developers. Microsoft also works closely with hardware component vendors like Intel as well as PC manufacturers like Compaq, Dell, IBM, and HP. This is to ensure they understand how to design computers that can use the latest versions of Windows.

The Internet has presented a different set of challenges to Microsoft's Windows and applications business. Users can access the Internet through non-Windows PCs and workstations, as well as through non-PC devices, such as cell phones and PDAs. Companies can host applications products on large servers and allow users to utilize these applications through browsers running on PCs or non-PC devices—thus potentially eliminating the need for Windows and Microsoft's desktop applications.

As a result of this broad threat to its businesses, Microsoft in mid-2000 announced a five year plan to evolve the Windows software platform, server products, applications, and MSN in a way that would make Internet browsing and applications hosting capabilities available as Windows 'services'—that is, special programs hosted on remote servers that Windows users can access through .NET features. All applications and devices enabled with the .NET technology would also be able to communicate with each other, for example, an individual user's e-mail or data files accessible from multiple devices and locations.

With .NET, Microsoft potentially faces even more tensions with external partners. Microsoft does not have the reputation of making sure its complementors run successful businesses. In the past, Microsoft has aggressively entered the domains of many applications companies that were once key partners and drivers of demand for the PC – Lotus, WordPerfect, Novell, Netscape, AOL, Oracle, and many others. It is by no means certain that .NET will generate outside cooperation and investment in complementary products and services of the magnitude that Microsoft expects. Nonetheless, Microsoft is well placed because it has the money and technical resources to produce enough complements to .NET, including development tools, applications, and services. Because Microsoft makes many of its own complements, it is safe to assume that at least some users will move to the new platform. These incentives might not be enough, however, to create a new platform standard or replace revenues lost from Microsoft's traditional systems and applications businesses.

Cisco

The trend in Cisco has been to integrate as many product technologies as possible and offer comprehensive 'solutions'. In 1991, Cisco had annual sales of $70 mn. By the fiscal year ending July 2001, revenues had reached $22.2 bn. Much of Cisco's impressive growth is due to the existence of complements such as Internet browsers (introduced by Netscape and Microsoft in 1994-1995) and high-powered server computers (led by Sun Microsystems since the 1980s). Cisco has also benefited from e-commerce applications and communications products that take advantage of the Internet. In addition to external complements, Cisco has added to its product range, networking products that complement the basic router. In fact, 61 % of Cisco's sales in 2001 were from nonrouter products, compared to only 20 % in 1985.

The basic vision of Cisco's founders was to provide networking systems based on the Internet. They started with a specific problem and used their understanding of networks and computer technology to solve it. As opposed to one technology and 'black-box' solution, Cisco's sales, marketing, and engineering people would probe the networking requirements of various types of organizations and figure out how to meet their needs.

By the early 1990s, Cisco had learned a lot about the strengths and limitations of the router product line and the value of connecting routers to other types of communications gear. Cisco concluded it lacked the resources to develop a full slate of networking technologies and keep pace with the innovations going on, in and around the Internet. Hence, the management decided to acquire the complementary technologies needed to provide broad networking solutions to customers and to continue fueling growth. Cisco also decided to acquire companies with competing technologies that potentially could displace routers in some network applications. Cisco also focused on defining and driving industry standards for networking protocols that allowed different networks to communicate more easily and thereby help Internet usage to grow. It also began to form alliances and partnerships with complementors and even competitors, not only to provide complete solutions but also to get access to new markets and new technologies.

After taking over as CEO in 1994, John Chambers moved aggressively to market total solutions to a larger group of companies with a broader set of product lines and technologies. He created a decentralized organization of business units organized around the company's main product lines. Each group had its own marketing and engineering groups, though Cisco kept most sales support centralized to provide better service to customers. Cisco modified this organizational structure as its product lines and customers needs evolved. In 1996, the company reorganized around three lines of business: Enterprises, small/medium businesses, and service providers. To reduce overlaps across different divisions and facilitate development of comprehensive solutions in particular areas, Cisco announced in August 2001 a reorganization into eleven new groups, based on key technologies, led by Internet switching, optical networking, and wireless products.

Cisco has acted as a platform leader by providing much of the hardware and software infrastructure behind the Internet. With a market share of some 80 % for its core router products, Cisco is to Internet-based networking what Intel is to microprocessors and Microsoft is to PC software. But Cisco has championed open standards far more enthusiastically. Industry-standard communications protocols form the basis of Cisco's platform technology. Cisco's primary strategy is to enable interoperable networking between Internet routers and a wide variety of other types of networking and communications technologies.

To provide broader networking solutions, Cisco needed to fill many gaps in its product lines. It invested heavily in in-house R&D, which totaled some $3.8 bn or 17 % of sales in fiscal 2001. Like Intel and Microsoft, Cisco also became a major venture player and spent some $200 mn in 1999 alone on start-up investments. Cisco also pursued alliances to drive industry standards and to develop new applications and services that use Cisco's routers and other products.

But, perhaps more than either Intel or Microsoft, Cisco pursued an aggressive acquisition strategy. Between 1993 and 2000, Cisco acquired 71 companies, spending more than $20 bn. It made 23 acquisitions in 2000 alone. Each acquisition made the company less dependent on the original router product line. In 2001, Cisco had revenues from switches, mostly for LANs ($10.6 bn or 47 % of total revenues) that were larger than its router revenues ($8.7 bn or 39 %).

In recent times, Cisco has been losing sales to upstart companies such as Juniper Networks, with more advanced router and switching technologies useful in niche areas such as ultra-high-speed applications. Established competitors Nortel and Lucent dominate fiber-optic networking equipment and large-scale telecommunications switches, used to build high-speed and high-capacity telephone and data line systems. New types of switching technologies that might replace routers pose another threat to Cisco. This and the commoditization of basic router market during the late 1990s has prompted Cisco to diversify into router complements and to vary the kinds of networks it builds for customers.

Most of Cisco's networking products complement the basic router by connecting different types of networking equipment. The Cisco 'platform' by 2001 had evolved from the Internet router, to the broader concept of interoperable networking, which could include Internet routers, ATM and frame-relay switches, LAN and WAN systems, and connections to Internet telephony systems, cable-TV Internet access and DSL equipment, and wireless communications servers.

Cisco manages to link or 'glue' together most of these different networking technologies through its operating system software, IOS. IOS is probably more important for Cisco platform than Internet router because software lies at the foundation of Cisco's solutions. Cisco licenses and sells IOS by packaging different sets of features, depending on the user's requirements. Its two main flavors, Basic and Plus, vary depending on the hardware combinations. Cisco also offers a version of IOS with encryption technologies.

Like Microsoft's Windows platform, IOS is an 'open but not open' platform technology. The specifications that define the interfaces for connecting with IOS are open. IOS itself, however, is not an open system such as Linux or Apache. It has proprietary software code that enable Cisco products to operate alone with each other.

In the late 1990s and early 2000s, IOS became a common software platform for Internet networking because Cisco routers were so widely used. Vendors of other equipment usually had little choice but to license IOS from Cisco and test their code with it to make sure their products worked properly with Cisco's products. Cisco licensed IOS aggressively to powerful companies such as Compaq, HP, Cabletron, DEC, NEC, Microsoft, Alcatel, Ericsson, and GTE. Cisco promoted IOS as the equivalent of Windows in the PC software world. Marketing promotions described the software as the 'glue' that every major networking equipment vendor should rely on to make sure their products operate with each other and, of course, with Cisco's system. There was enough proprietary code within IOS to allow Cisco products to work better when they talk to each other, rather than with machines made by rivals.

Over time, the drawbacks of IOS have become more obvious. The software has evolved somewhat haphazardly from Cisco's early days and, after 12 versions through mid-2001, remains a hodgepodge of code from different products and networking protocols. It has some modular, layer like characteristics but is not an operating system designed in a disciplined way as Windows NT/ 2000 or UNIX. It took until 1997 to make IOS a working system for multiple products, not only routers. From this point on, IOS enabled Cisco to offer broad networking solutions that connected Internet routers with routing hubs, ATM and frame-relay switches, computer-based file servers, and other equipment.

Like the Intel inside campaign, Cisco launched a marketing campaign promoting Cisco-Powered Networks. The effort involves media ads as well as creating forums for communications services providers and equipment resellers. Instead of selling or giving away software development kits like Microsoft and Intel, Cisco has sold advertising kits to customers that have networks where Cisco components make up at least 70 %. The arrangement allows these customers to use the 'Cisco-Powered Network' logo in their own advertising and claim that networks using Cisco equipment are superior to those of competitors.

Cisco also pushed the idea of a "community of Cisco users and partners." The "Cisco Connection Online" website (launched in 1996) provides the latest information on Cisco products and facilitates technical support and Q&A sessions. Through the website and its networking technology conferences, Cisco has created a 'virtual culture' around its products. This culture reinforces Cisco's branding and licensing campaigns and, supported by aggressive price cuts, helps maintain Cisco's platform leadership status. Most competitors cannot compete with Cisco on pricing because of its economies of scale and lean operations.

Forming alliances with complementors has been an integral part of Cisco's strategy. In its early days, Cisco did not have the same influence over the industry as Microsoft or Intel and thus needed partnerships. Cisco could not acquire all complementors and potential substitutes. Even if Cisco had the financial resources, managers were reluctant to make acquisitions that strayed too far from Cisco's core technical capabilities. In the early and mid-1990s, Cisco also did not have the ability to sell and service its routers and other equipment in all global markets, where demand was rising rapidly. Early marketing service partners included most major Japanese electronics, Internet, and telecommunications firms (NEC, Hitachi, Fujitsu, and Softbank, among others), as well as HP and IBM.

Although Cisco is still the market leader in Internet-based networking equipment, competition is intensifying. Juniper has emerged as a strong player in technology for high-end routers, used mainly by telephone companies as the backbone of the Internet infrastructure. Juniper had about 35 % of the $2 bn market in late 2000, compared to about 65 % in case of Cisco, a drop of some 15 % within a year or so. But Cisco had a mere 3 % of the $25 bn market for optical switching equipment – a key networking technology of the future.

Cisco also faces some fundamental challenges with respect to IOS. The software contains the standard interfaces that outside companies need to link into networks and make their products work together. It is a convenient way to link diverse products. But IOS is not a product in itself, like the Intel microprocessor or Microsoft Windows. IOS does not have a proprietary or internal set of APIs that make it easy for Cisco's business units to create special links among their products. Consequently, Cisco has less control over its own platform technology. By the early 2000s, IOS had become extremely large and cumbersome because of all the products and interfaces that Cisco had tied into the system. Making changes or additions to the software was complex and slow. Sometimes, it took hours to change even one line of code.

Cisco redefined the concept of 'platform' for Internet-based networking from the router to a set of software-based communications standards that work with routers and other types of networking equipment. It broadened the set of networking technologies that fit into the category of platform. And it provided the glue—the IOS software, imperfect though it is—to make disparate networking technologies work together. In early 2003, Cisco remains the market leader in Internet-based networking, though its position is not invulnerable.

Palm

With approximately 12 million handheld devices sold till early 2001, (a number expected to grow to nearly 34 million by 2004), the market for PDAs has been growing rapidly. The PDA device and its operating system (Palm OS) make up the Palm platform. The platform needs complements such as software applications and wireless services. Thousands of firms are beginning to create software applications, offer services, and create attachments that complement the basic functions of the PDA device. In 2001, three main contenders led the PDA market, although Palm had more than a 70 % global share for its hardware devices with cumulative sales exceeding 11 million PDA units. Palm's revenues rose from $1 mn in 1995 to $923 mn in 2002. Palm is clearly the market leader in both PDA hardware and software, especially with Handspring, the second leading vendor of PDA devices in 2000 (with about 14 % of the market,) also using Palm OS.

What Palm executives focused on during their critical formative years, in between 1995 and 1996, was to create a device that would sell and demonstrate the viability of the PDA market. This was a segment of computing business that Apple, AT&T, Microsoft, and a host of other wealthy firms had failed to develop before Palm came along.

Palm executives started to talk openly about a platform strategy only in 1998 after they had sold a million or so units. Confident of their early lead, Palm executives reformulated their strategy and decided to promote Palm OS as the industry software platform for hand held computing. For Palm, that meant both growing the market for handheld devices in general and trying to license Palm OS as broadly as possible. To achieve these objectives, Palm executives began to facilitate complementary innovations at outside firms by providing interface information, technical assistance, and some financial assistance. They tried to grow the market by licensing the operating system to competitors as well as partners.

In 1992, Palm introduced a product called the Zoomer, which it built in collaboration with Casio (for the hardware), Geo Works (for the operating system), and Tandy (for the distribution). Palm engineers wrote the applications. The Zoomer, offered at $700, and with inadequate writing recognition software, sold a mere 15,000 units, but Palm learned much from the experience. The company started over from scratch, and focused on a few key goals that would soon define the essentials of the PDA platform: Simpler features, a lower price, better handwriting recognition software, and easy connectivity with the PC.

Palm made its brilliant 'second debut' in 1996 with the launch of Palm Pilot 1000 and Palm Pilot 5000. These devices integrated the hardware and software with a proprietary architecture, and were hugely successful with consumers. By the end of 1996, Palm had sold thousands of units and owned 51 % of the nascent PDA market – surpassing Sharp, Casio, and Apple as well as IBM and Microsoft, which had their own offerings.

When it was launched, the Palm Pilot, was positioned as an accessory to PCs, to be a complement to the well-established PC architecture, dominated by Intel and Microsoft. Thus Palm avoided attracting too much of Microsoft's attention in the handheld segment, unlike Netscape, which had boldly positioned Navigator as an alternative platform to Windows. (Palm's approach has been referred to as judo strategy by David Yoffie of Harvard Business School.)

In reality, however, the Palm Pilot was not simply a device. The architecture of Palm OS allowed add-ons and extensions—a critical element for a platform. A look at the design of Palm OS architecture, indicates that Palm engineers must have viewed their operating system as a potential platform from the beginning. But Palm managers did not advertise the platform capabilities of their product before a PDA mass market emerged.

The Palm Pilot sold in millions in 1996 and 1997, demonstrating the viability of the PDA market. Competition entered the PDA arena during this time. Microsoft decided to push a cut-down version of Windows as the software platform for this market and to develop relationships with various hardware makers. Palm executives decided to pursue a software platform strategy rather than just try to sell devices.

Palm understood that attractive software applications would augment the value of the Palm Pilot. Quickly it realized the need to woo developers. But Palm could not pursue external software developers too aggressively without attracting attention from Microsoft. So, without much fanfare, Palm began to provide developers with software tools useful in creating complementary software applications that ran on Palm OS.

Like Intel, Microsoft, and Cisco, Palm sought out agreements with potential complementors. Palm also provided a full set of software development tools to outside companies to help them build applications. Palm created both formal and informal mechanisms to stabilize its interface standards and facilitate technical exchanges and business dealings among the growing community of complementors.

The Palm case suggests that a potential platform-leader must be patient. It is not a good idea to try to be a platform leader before a platform has gained mass-market acceptance. It takes a lot of effort and public relations to attract, license, support, and possibly subsidize partners and complementors. It makes sense to maintain a low profile in the early days of market development and focus on designing a product that people want to buy. It also takes time to earn the trust of applications developers. Only then is platform leadership possible.

Conclusion

How does a potential platform leader drive the industry? A large market share, even of an emerging market, is a good start. A successful product makes it easier for the market leader to become the platform leader in terms of architecture, features, and technology. An open architecture allows external, complementary innovation and relationships with external developers to stimulate these innovations. Another requirement of a platform leadership is a user-centered vision for the future of the complete product as well as for the evolution of the whole industry and its particular platform. This vision, should lead both customers and complementors along a path that, in the end, benefits the platform leader more than its competitors.

Both Intel and Microsoft have invested extensively in evolving their platform as well as in creating consensus among external players to support innovations. Intel took the lead in shaping interfaces that partitioned complementary innovations and in promoting interfirm cooperation. It tried to be a neutral broker, exploring new interface standards and applications on behalf of the whole PC industry – albeit with the understanding that what was good for the computing industry was especially good for Intel. Microsoft also pushed a grand vision of the future—a PC on every desktop, running a variety of software that did everything from entertaining to enhancing office productivity. Over the years, the Microsoft vision has evolved from DOS to Windows.NET.

A platform strategy is not a substitute for a product strategy. For a platform strategy to work, the market has to adopt the platform product in large numbers. This depends, at least in part, on having features and prices suitable for the mass market. The platform leader need not be superior to the competition in all product features. It is difficult to claim, for example, that Windows, (particularly the early versions), was technically superior to the Macintosh operating system, or, in of home video recorders, VHS was superior to Sony's Betamax. But the network as a whole delivered more in the case of successful platform leaders.

A platform leader should also maintain architectural control over its platform. When the future of a platform battle is very uncertain, managers need to prepare for multiple scenarios and develop an aggressive strategy to promote the outcome they favor.

Not all industries are suitable for platform leadership strategies. The dynamics that make it possible occur only under certain conditions. A fundamental condition is that the firm's product has limited value when used alone but gains in value when used along with complements.

There are a number of crucial decisions to be made, when it comes to complements. Making vs outsourcing is probably the most important decision that platform leaders have to make. This is neither a one-time decision nor an either-or decision. Companies that want to become platform leaders need to assess whether they really need innovation to happen on complements. They also need to determine what will most increase the demand for their product as well as the platform overall: Do they need an ever-increasing variety of complements, or just a few stable complementary applications?

Platform leaders need to make an ongoing assessment of their existing capabilities and the direction in which the industry or technology is evolving. They need to focus on developing a platform where they will have an advantage over competitors and where the core technologies will be difficult to imitate. Then, they need to determine whether outside firms can contribute to the success of the platform by developing complements. If so, the platform leader needs to consider whether these external developers have enough incentives to work on complements for a platform they do not own or control.

Architecture can determine who does what type of innovation as well as how much investment in complements occurs outside the platform leader. Whether a firm chooses a modular architecture is particularly important because modularity facilitates the development of complements. Modular designs can reduce the cost of innovation for outside firms and encourage the emergence of specialized companies that may invest heavily and creatively in complements. For a modular architecture to encourage third-party innovation, the interfaces should be open. In other words, the platform leader should specify publicly how complements will be linked to its platform.

Defining the architecture of a system product can also be a powerful way to raise entry barriers for potential competitors. A potential competitor to Intel would not only have to invent a microprocessor with a better price-performance ratio but also rally complementors and OEMs to adapt their designs to this component. This would involve huge switching costs.

Most of the platform leaders discussed by the authors have been reluctant to reveal too much architectural information about the inner workings of their product. However, they have willingly disclosed information regarding the more visible interfaces. Disclosing information about interfaces is a powerful way to encourage external innovation. But care should be exercised as disclosing too much may also facilitate imitation.

Platform leaders need to pursue at least two objectives simultaneously. First, they must try to obtain consensus among key complementors with regard to the technical specifications and standards that make their platforms work with other products. Second, they must control critical design decisions at other firms that affect how well the platform and complements continue to work together through new product generations. But pursuing consensus and control at the same time can be quite a challenge.

The authors argue that consensus among industry players is probably impossible to achieve without at least one firm driving the process that leads to consensus. One firm must also exert some degree of control though it should do so by defining the parameters of choice than by forcing a choice itself. Platform leaders do not care which exact complements can be made, as long as they are compatible with the platform. The flip side, of course, also seems true. Control is probably impossible to achieve without some degree of consensus. In other words, industries that have platform products seem to require at least one firm to act as the technical leader to promote compatible standards.

Platform leaders do not move into markets of their partners very often, but they do it frequently enough to make outside firms wary of them and anxious to keep innovating in ways that benefit the platform. A platform leader may be less likely to intrude on the turf of a complementor if that firm can innovate in ways that the platform leader cannot.

A platform leader must also play the role of industry enabler by helping the industry to innovate in ever-better ways around a platform. The platform leader sometimes has to make decisions that might hurt some external firms, even if they have been complementors in the past (and still might be in the future).

Platform leaders have to find ways to manage these kinds of external tensions. Intel uses a gradual, low-key approach when pushing a particular agenda. This allows input from collaborating firms and permits both sides to 'test the waters.'

Platform leaders need to gain the trust of third parties. They have to act and be seen to act fairly. They need to establish credibility in technical areas where they want to influence future designs or standards. The must make potential complementors feel comfortable that the platform leader is acting on behalf of the whole industry or ecosystem, and not just for itself.

The problem is usually how to compete and collaborate simultaneously. These goals are difficult to balance because some groups within a platform leader might be competing with complementors, while other groups might be trying to get their cooperation. One way is to maintain a clear separation between units charged with achieving different goals, such as stimulating innovation by complementors versus investing directly in complementary markets. This organizational separation may increase trust with external partners.

Organizational mechanisms are necessary to set goals, build consensus, and make the structure work. Intel has an elaborate process for holding meetings at various levels to set strategies and goals, and assess and resolve internal conflicts. Intel also relies on formal planning and off-site meetings and involvement of senior executives to fill an arbiter role to resolve these conflicts. The example of Intel clearly demonstrates that platform leaders must foster an organizational culture that encourages debate and tolerates ambiguity, such as permitting different groups to pursue sometimes-conflicting goals.

Even successful platform leaders can become complacent and fall by the wayside. Platform leaders can become so tied to certain technologies that they may find it difficult to evolve their platform. Evolution is often important to long-term survival. Platform leaders may also become entrenched in one vision of an industry. Microsoft for example has a very 'Windows-centric' view of the Internet. It may never take full advantage of the benefits of open standards or the open source movement. Cisco depends heavily on its ability to weave multiple technologies together through its IOS software. But IOS is a patchwork of code and standards that may well outlive its usefulness one day.

Successful platform leadership requires the ability to evolve the platform while rallying other firms around these changes. Evolving the platform has the effect of reinforcing the system architecture. By contrast, one could suggest that weak technical leadership could easily lead to obsolescence of the system architecture and the overall platform, and can eventually create a risk for all the firms that depend on that platform for their livelihoods.

Platform leaders in competitive markets usually emerge through the mechanisms of the marketplace, rather than through some magical process that recognizes technology leaders. Trying to become the de facto market leader should put a firm in a good position from which it can evolve into the technical leader for its platform. But a high market share and a high degree of innovative capabilities alone do not suffice. A company must have the vision and the organizational capabilities to engage complementors and place itself in the center of the network of innovation around its platform.

Platform leadership begins with a vision that extends well beyond the business operations of one firm or the technical specifications of one product or one component. It is a vision that believes the whole of the ecosystem can be greater than the sum of its parts, if firms work together and follow a leader. The vision and strategic decisions of platform leaders can affect the pace of innovations and the evolution of an entire technology. Their decisions may or may not facilitate investment in research and new product development in the broader industry. Platform leadership and complementary innovation are not things that happen spontaneously in an industry. Managers must attempt to make them happen.

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