# CHAPTER I

# STRATEGIC INFLECTION POINTS

## Strategic Inflection Points in Information Technology

A *strategic inflection point* (SIP) is a time in the life of a society, an economy, a company, or a person when the fundamentals of its existence, and therefore of its future fortunes, are about to change. The SIP can be a threat, but it also provides the opportunity to break out of the current status and thrust into a higher level of achievement. Precisely because it represents exogenous change, a SIP involves risks when it is not attended to:

- in time and
- in an able manner.

Information technology has gone through eight strategic inflection points in fifty-five years: in 1954, 1959, 1964, 1973, 1982, 1989, 1994, and 2010. These are indicative milestones, and therefore approximate, because a big change in business does not happen overnight; a SIP wave in IT can come from hardware, software, or a system change, and it takes time to build up. Table summarizes some basic changes in hardware and software characteristics, as IT moved to a new epoch.

Over more than a half century, from 1954 to 2010, there have been many more basic IT developments worth noting, but each on its own did not create a strategic inflection point. At the end of the 1950s, however, the use of transistors altered the dynamics of computer design, while the first high-level languages, Fortran and

**Strategic Inflection Points in Information Technology**

| Approximate Year | Time Gap | Hardware | Software |
|---|---|---|---|
| 1954 | | First industrial applications[3]Univac vs. EAM[b] | Symbolic programming language (by Grace Hopper) |
| 1959 | 5 years | TransistorsIBM-7090 | Fortran (1957/8) Cobol (1959) |
| 1964 | 5 years | Integrated design of a computer line[0]IBM 360 | OS 360 Algol (1963) |
| 1973 | 9 years | MicroprocessorsMinicomputers[01]Distributed information systems | Virtual Memory C language |
| 1982 | 9 years | PCs, LANs | Expert |
| 1989 | 7 years | Client-servers | systemsSpreadsheetsC+Ethernet ShellsPaint on video |
| 1994 | 5 years | Wide adoption of Internet | Horizontal system integrationSeamless access |
| 2010 | 15 years | Cloud computing | Virtualization Metalevels Virtual integration |

Cobol, had a lasting impact on applications software (the term *software* was coined in 1958). Developments in those early years were unrelenting. In 1963 IBM released IMS, the first ever DBMS, originally developed in 1958 for NORAD. That same year Ramac 350 was marketed, the first disk storage ever. In late 1968 came SNA, the first system architecture released by a vendor (also by IBM). Both IMS and SNA were hierarchical, the technology of the 1960s, which is still in *use.*

Among other important developments of the early to mid-1960s was the Multics operating system, developed at MIT (on whose notion Unix was based). Applications-wise, a breakthrough has been time sharing while on the hardware side of computing hard disks started to compete with magnetic tapes as the storage medium. All these references added up to the 1964 IT inflection point, particularly characterized by:

- upward compatibility in the 360 product line and
- Operating System 360, which integrated I/Os, housekeeping, and other rou-tines—and whose design proved to be more complex than that of the new product line s hardware.

The eye-catcher of 1973-74 was the microprocessor by Intel and Texas Instruments. DEC's minicomputers, too, were a breakthrough leading to distrib-uted information systems (DISs) over the following years. The early 1970s also saw a popularization of real-time applications, though the laggards remained faithful to mainframes and batch. (Chronologically real time saw the light in the late 1950s, when AT&T attached a nonintelligent terminal to a central resource, but it took more than a dozen years until applications started to become popular among the leading firms.)

A lesson to be learned from that time is that the companies at the leading edge of information technology in the 1960s and early 1970s were those who seriously studied the aftermath of developments connected to IT's strategic inflection point. They capitalized on them by projecting over the medium to longer term the most likely impact these SIPs would have on:

- their market,
- their customers, and
- their own organization.

A breakthrough in data communications came in the late 1970s with X.25, the layered public packed switching protocol (based on the Arpanet concept). For data-base management purposes developed Ingres—the first relational DBMS. Its advent brought system designers, developers, and end users into a new era of flexibility in computer applications (It was followed in the mid-1980s by object-oriented data management structures.)

These developments were soon joined by PCs and local area networks (LANs), culminating to the 1982 strategic inflection point, which was also characterized by a golden horde of artificial intelligence (AI) constructs. The era of expert systems divided IT users into two asymmetric populations:

- e-system users who were ahead of the curve and
- the laggards (the majority), who still kept with obsolete, ineffectual, inflex-ible, and highly costly Cobol programming

The next strategic inflection point in IT came in the early 1990s with the Internet, but the client-server model continued strong, eating up the market from mainframes. Contrary to the preceding SIPs, in 1994 the Internet promoted client- server solutions rather than replacing them, giving client-servers a life cycle of two decades—the longest ever in IT's brief history.

In fact, as things presently stand, cloud computing—the SIP of 2010—inte-grates client-servers as megascale repudiates it, as some people like to think. Also, it *may* be that in this integration it is upgrading servers at the expense of clients. Time will tell whether this is a profitable switch and therefore whether it becomes effective.

In principle, the more advanced and complex the technology we are planning to use is, the greater is the degree of necessary foresight, insight, know-how, and homework.

## Cloud Computing and Its Slogans

Strategic inflection points are huge business challenges propelled by cultural forces, political currents, social movements, or technological strides. The latter change either the systems concept, as it has happened with client-servers, or some of the most fundamental components of the prevailing solution.

*Competitiveness* is a much better criterion when we are making investments, and the way to bet is that greater competitiveness will rather come from onDemand software and the cloud's platforms than from infrastructural services.

## User-Centered Solutions and Cloud Computing

In today s global markets, enterprises succeed or fail based on the speed with which they can respond to changing conditions. Properly chosen and correctly used infor-mation is a vital ingredient of rapid response to market drives. Therefore, business solutions must be developed and deployed faster than ever before, reaching online the ultimate end user for input, output, and interactive communications purposes. Speed and quality of delivery see to it that:

- in many cases it is no longer practical to build new business applications from the ground up, and
- neither is it viable to deploy the classical off-the-shelf onPremises software, keeping the responsibility for upgrades and maintenance in-house because the package has been massaged.

Where business competitiveness is at stake, the answer is rapid prototyping and fast track or, alternatively, software onDemand, which is a user-centered approach.

Innovation, not just in IT but in any human enterprise, does not consist of looking to the future through the rearview mirror but of capitalizing on the fact that with broadband Internet, optical networking, and advances in storage, com-puting power, and networking:

- it has become less relevant where the servers are located,
- but it is highly important where the end users are and what they need in IT support today—not in three years.

As every good manager and professional knows, the key to winning in busi-ness is to operate at a faster tempo than your adversaries. Thats part of being in charge of the time cycle loop. Cloud computing may provide the raw stuff for it but surely not the detailed solution.

Cultural changes always accompany strategic inflection points because the before and after realities are so different. A basic prerequisite of cultural change is that our attitudes, policies, and procedures must change. This will not be provided in a miraculous way by the cloud but through reengineering, which is the user organizations responsibility. User-centered approaches are by no means an empty label, but expectations will not be fulfilled just by altering the crust of the cake.

## Risk and Opportunity

Personal computers in the 1980s, and global network of computers and com-munications in the 1990s, have been instrumental in increasing the information-carrying capacity of systems. There has been plenty of opportunity for doing so as research and develop-ment at both the very big and the very small end of technology's spectrum became the mover and shaker of innovative products and processes. "Nanotechnology is in our watches, cars, hospitals and it shuffles information around. But it's also about therapies and new ideas—the next big thing that's going to change the world.

Table provides with projections that explain why so many software and hardware companies have put their cloud at the core of their strategic plans.

**Table Revenue from Internet Clpuds and Other IT Services: Current Base and Projected Growth to 2013**

| | *Share of Current Base* | *Projected Growth* |
|---|---|---|
| Communications and current type content | 29% | 15-20% |
| Customer relationship management (CRM) | 25% | 20-25% |
| Enterprise resource planning (ERP) | 19% | 14-18% |
| Supply chain management | 13%% | 8-10% |
| Office sites and digital content | 9% | 90-100% |
| Other | 5% | |

Solutions to be given to system challenges associated with cloud computing will provide both opportunities and risks to vendors and to users. The dragons will come as problems associated with cloud computing con-tinue to increase until the new implementation perspective and associated business architecture finally settle.

## Cost Is One of the Dragons

Positioning a company against the forces of strategic inflection points does not come cheap. It takes skill, money, and undivided management attention to steer the firm through the high seas of innovation, toward a believable objective at destination.

Sometimes people are taken by the bandwagon syndrome, or by the projected size of a given market, without counting the costs involved in being a player. User companies switching into cloud computing have poorly estimated (if at all) the cost they will incur in:

- capital expenditures (capex),
- operational expenditures (opex), and
- the resulting profit and loss figures.

*Risk is a cost* and it has to be aggregated with capex and opex in a break-even analysis^ chapter by chapter, 6f the budget in a cloud computing setting.

- Averages and summaries, let alone hopes, are of no help to management decision.
- If anything, average figures are a disservice because they may lead to wrong paths and blind alleys in terms of commitment.

Product cannibalization due to cloud computing:

- is a challenge for all established companies becoming players in that market, and
- this challenge may carry with it significant vulnerabilities in strategic products.

Whether they are active primarily in software or hardware, incumbents will be faced with pressure to develop cloud services that need a lot of consideration for how they integrate with their existing product line. Among the challenges is the cost of building bridges and interfaces to legacy products, at a level of elegance appealing to the client base.

Another important query whose solution a cloud provider should regard as a >alient problem is the internal unbundling of expenses associated with cloud prod-ucts and services. This is important for cost control even if the clients are presented with a bill for bundled services. Theoretical opinions and pronouncements on how to go about it abound, but in practical terms they have little value to r>oth providers and users.

Even if the algorithm were right, the pricing of IT services is in no way a linear proposition. While it is true that costs and billing should be proportional to user nours, data processing applications have many other cost factors—from I/Os to distributed data storage and disk accesses—and algorithms that do not account for them are going to give poor and misleading results. Cloud computing “lends itself well” to markets that are horizontal and large, infrastructure costs will eventually rake care of themselves because they can be shared easily. Infrastructural costs can oe king-size. Yahoo! is reportedly spending some $800 million per year in infra- >tructure. That’s not petty cash to leave its far-reaching implications out of the pric- ng equation. In addition, with cloud computing, demand is unknown in advance when capex decisions are made.

Big companies like Google, Microsoft, IBM, Hewlett-Packard, and some oth-ers have the capital to do huge investments, though whether they get their money back and make a profit is a different matter. Small companies will disappear under the weight of infrastructural capex. Economies of scale, the usual argument, will benefit the larger infrastructure provider, not the smaller one.

Indeed, it is not just a sufficiently large company but also one with a signifi-cant market share that could leverage its capex and opex because of economies of scale. Good governance, too, makes a difference because such a cloud provider must also be able to offer a pricing schedule well below the costs that might have been incurred in a medium-size user organization. Even so, its hope to come out of this experience wholesome is only a hope. There will be plenty of shakedowns in the sector of cloud infrastructure, including the ranks of the bigger cloud providers.

The structuring of the product line evidently plays a critical role in pricing decisions. For a software company entering the cloud computing market the cost of designing, programming, and upgrading interfaces may be a totally new experi-ence. With onPremises software this issue was rather subdued and “specials” were charged to the customer (usually by system integrators).

For the typical off-the-shelf applications software vendor, once a product was developed and put on the racks, most other costs were traditionally variable, relat-ing to sales and commissions (some of them occult). Cloud computing does not work that way. *If a.* software company wants to invade its competitors' territory, *then* bridges and interfaces are unavoidable, and as special engineering items they may capsize the whole profit and loss (P&L) picture.

This will evidently be reflected in the bills cloud user organizations will have to pay. Quality, reliability, and seamless operations don't come cheap. As the vendors'costs for infrastructural services rise, the dollars written in their bills will rise too. There will be no shortage of reasons for higher prices.

Once archived data is in the Cloud, new services become possible that could result in selling more cloud computing cycles, such as creating searchable indices of all archival data or performing image recogni-tion on all (ones) archived photos to group them ... etc. All this not without even a mention of the size of the tab or who pays it.

## The Problems of Opaque Pricing

The pricing of products and services has never been a simple, let alone linear, prob-lem. The leader in a given market has a pricing freedom that his challengers lack. But he does not have an absolutely free hand in pricing, unless there is a monop-oly—as happened from the late 1960s to the late 1970s with mainframes, until DECs Vaxes turned IBM's pricing list on its head.

Existing evidence suggests that pricing and costing associated with cloud com-puting services is still in its infancy, particularly for products other than onDe- mand software. True enough, basic services have their metrics, which, however, tend to vary from one provider to the next. Typically,

- *storage* is charged at $x.x per Gbyte/month,
- *network*, at $y.y per Mbit/second/month,
- *administration*, at $z.z per 100 servers/DB manager, and so on.

There is as well overhead, of which, at least for the time being, cloud providers are not talking about. They probably include it as a flat rate to charged services, but for their own cost control purposes they should handle it separately. A similar statement is valid about local taxes, which are going to be a great diversity given the nature of the cloud's globalized operation.

Pricing and billing based on *usage* should not be confused with *renting,* which involves paying a negotiated price to have access to the resource over a period of time—whether this is a flat fee, hence an average, or is computed on effective time. A billing system truly based on usage involves effectively metering and charging based on actual employment of every resource available on the system. As a matter of principle:

- *pay-as-you-do* service charges must be detailed and well documented, and
- this means that prices and billing cannot be indifferent to incurred costs .

There is no major problem in measuring time of usage as a basis for charges with office suites, CRM, ERP, and popular productivity tools. "Content" is more complex because so many things come under that heading, including communi-cations and collaboration. But computing, and most particularly frequent multi-tenant accesses for accounting, scheduling, deliveries, and other business chores, is a different matter—requiring greater accuracy in monitoring and measuring.

It needs no explaining that plenty of issues must be reflected in a factual and documented service costing and pricing. Past practices of cutting the edges of prices established and demanded by industry leaders, like IBM was in mainframes and GM in autos, no more apply because no single firm will have nearly half the cloud market in the foreseeable future.

Another critical factor that must enter the costing and pricing equation at the infrastructure vendor's side is that of synchronous vs. asynchronous operations. Some services will be real time, and their guaranteed response time on an escalation clause) is vital Others can be asynchronous to benefit from lower costs. "Overnight delivery" is not the only option, though it may appeal to companies on Paleolithic technology characterized by mainframes and batch.

To benefit from lower prices while still accepting an asynchronous mode, more alert users may require that deferred time is limited to one, two, or three hours. This still allows the vendor to optimize the use of his computing facilities, data centers, and network, while time-wise the user organization accepts a compromise. Such an approach, however, poses two prerequisites.

At the user side, workstations cannot be *thin;* i.e., deprived of their disk storage. They have to have embedded disk storage to accept and hold deferred data trans-missions. This does away with the argument of just plugging unintelligent devices in the socket of an information utility, sort of an electric socket allegory promoted by theorists.

In addition, as far as the infrastructural services vendor is concerned, it must get written guarantees with penalties from its suppliers that their computers, switches, and basic software can reliably ship information elements over the globe. A four 9s (99.99 percent) requirement is advisable . The alternative of shipping disks through couriers with redundant or updated data makes fun of the advan-tages the cloud is supposed to have, and therefore it should be discarded.