From IT strategy to operations.
Using the IT driver model to align service levels to business.

Christoph F. Strnadl
ATOS ORIGIN Information Technology GmbH, Wien, Austria
27th Annual International Conference of The Computer Measurement Group, Inc.
December 2–7, 2001, Anaheim, California USA

Business strategies can be clustered in three different and mutually exclusive categories: customer intimacy, operational excellence, and product leadership and innovation. This paper links these strategies to three key forces in the “IT driver model”: availability, total cost of ownership, and adaptability. Application of the model reveals four areas in need of management attention: (1) incompatible static prioritization; (2) demand inhomogeneity; (3) dynamic changes in prioritization; (4) requirements for e-business; and shows how to craft service level agreements coping with these.

1 Introduction

Businesses are increasingly relying on their information technology (IT) and information systems (IS) to conduct core business processes. Moreover, proper application of IT also influences the competitive ability in continuously changing market situations. With regard to the planning phase of IT deployment information systems executives and Chief Information Officers (CIOs) continue to struggle with the question of strategic alignment of IT, determining ex ante the “fit” between business objectives and requirements and IT strategy, management, and operations (Boar 1994, Henderson et al. 1996, van der Zee and de Jong 1999).

It is obvious that all attempts to bridge the often perceived gap between business and IS/IT executives need a mutually understood conceptual framework within which each stakeholder is able to formulate, communicate, and interpret contributions to the alignment issue. In addition, any such framework should lend itself easily to translation of strategic IT objectives into the concepts of IT service management. However, despite its importance in the research community, no commonly accepted definition for this domain has evolved yet (Boumann et al. 1999, Lewis and Ray 1999, Garschhammer et al. 2001).

Based on the generic core strategies of the competitive analysis by Treacy and Wiersema (1995) this paper introduces the “IT Driver Model” of three potential, but mutually exclusive key IT drivers: availability, adaptability, and total cost of ownership.

Application of the IT driver model to real-world cases of alignment will demonstrate how the model is able to transgress the communications chasm between business and IT management. A summary of high-level “lessons learned” shall provide a checklist of issues easy to overlook albeit critical to ensure that IT really does add value to the enterprise.

2 Alignment of business and IT strategy

2.1 Generic business strategies

In his seminal work, Michael Porter (1985) has identified essentially three generic business strategies enterprises can and should pursue to obtain sustainable competitive advantage: cost leadership, differentiation, and focus. He noted that it is hard to nearly impossible for a single company to simultaneously implement more than one single strategic objective. Studying 80 market-leading companies, Treacy and Wiersema (1995) have found another set of three mutually exclusive “value disciplines” describing firms which lead in their respective markets

- operational excellence
- product innovation and leadership
- customer intimacy

Their findings have been recently corroborated by Kaplan and Norton (2001) and included in the Balanced Scorecard framework. Because each discipline requires a company to emphasize different processes and to create different business structures, companies have to choose one value discipline if they want to dominate and win their respective markets. Not choosing means ending up “stuck in the middle” (Porter 1985) at a mediocre level of competence and service.
differentiation.

<table>
<thead>
<tr>
<th>Product</th>
<th>Cost</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Total Cost</td>
<td>Achieve low-cost position on product and service support</td>
<td>Build a better product, for which customers will pay a premium</td>
</tr>
<tr>
<td>Value Discipline</td>
<td></td>
<td>Product innovation and leadership</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational excellence</td>
<td></td>
<td>Solve the client’s broader problem and share in the benefit</td>
</tr>
<tr>
<td>Value discipline</td>
<td></td>
<td>Customer intimacy</td>
</tr>
</tbody>
</table>

Table 1. Dimensions of customer value and strategic response (after Treacy and Wiersema 1995).

Treacy and Wiersema note two rules that shall govern market leaders actions:

**Rule 1:** Provide the best offering in the marketplace by excelling in a specific dimension of value.

**Rule 2:** Maintain threshold standards on the other dimensions of value.

2.2 IT strategies – IT driver model

Based on the analysis above we describe for each of the three generic business strategies typical articulations of internal organizational demand of IT services. These properties are then aggregated into a single strategic IT theme—the IT driver—best describing the overall response of the IT/IS function to the corporate strategy. This yields three generic IT drivers:

- availability
- adaptability
- total cost of ownership

The resulting relationship between business and IT strategy is depicted in Table 2 below.

<table>
<thead>
<tr>
<th>Business strategy</th>
<th>IT driver</th>
<th>process view</th>
<th>Organizational demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>customer intimacy</td>
<td>availability</td>
<td>output</td>
<td>keep systems and infrastructure up and running</td>
</tr>
<tr>
<td></td>
<td></td>
<td>continuous</td>
<td>provide suitable applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>add value for the customer and don’t turn him down</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>keep solution stable – customer is relying on it</td>
</tr>
<tr>
<td>operational excellence</td>
<td>total cost of ownership</td>
<td>input</td>
<td>better cheaper than perfect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>continuous</td>
<td>no “bells and whistles” – good product at the best price</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>keep everything simple</td>
</tr>
<tr>
<td>product innovation</td>
<td>adaptability</td>
<td>time and change</td>
<td>accommodate change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>discrete</td>
<td>provide means to reconfigure processes regularly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>quickly assemble new teams</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>better to be first than 100% perfect — and second</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>speed kills – more flexibility in the future</td>
</tr>
</tbody>
</table>

Table 2. Heuristic mapping of the three IT drivers to the generic business strategies.

The mapping as suggested by Table 2 is to be taken as a heuristic way to derive key IT strategic themes—the key IT drivers—from business strategies. Due to the complexity of the alignment question (van der Zee and de Jong 1999) it is not (and cannot be) a mathematically rigorous one-to-one mapping between business and IT strategies.

It is clear that these three IT drivers are mutually exclusive:

- more availability means less flexibility at higher costs
- an increase in adaptability needs more interfaces with more changes negatively affecting availability at a higher level of IT investments and operations
- at minimum costs availability and adaptability have to be pruned to an absolute low sustainable by the whole organization
How to use the IT driver model
The three IT drivers are conveniently displayed in an arrangement denoting their mutual exclusiveness.

![Figure 1. IT driver model: Availability, adaptability, and total cost of ownership (TCO).](image)

An IT Driver Model diagram conveys both qualitative and quantitative information about the relative strengths of each of the three IT drivers. It shall achieve two distinct goals:

- **show single most important key IT driver**
  with the help of which the enterprise differentiates itself from the competition — the key IT driver

- **show relative ranking of IT drivers**
  with respect to each other

As has been noted also for business strategies (Shapiro 1996) it is counterproductive to fall back into a Procrustean interpretation of key IT drivers. It is never just an all-or-nothing proposition whether to excel at availability or total cost of ownership or adaptability at the expense of the other two, but always a *differentiated* question like

- how much availability at what costs?
- how much adaptability at what availability?
- how much less can I budget for IT without sacrificing minimum levels of availability?

Costs always play a role but only relative to customer benefits — this also holds true for IT services. There exists no *absolutely* “right” cost level or a “correct” level of service availability. In a market-based economy of matching supply with demand (Williamson 1985) it is ultimately the customer who decides about the sustainability of strategies.

Enterprises need to strategically focus on one single *key IT driver* where they wish to excel, with which they can add most value to their business processes and (in the end) the financial performance of their firm. Simultaneously, they need to maintain threshold levels for the other two IT drivers. Key questions would be

- (as IT cost leader): What level of availability do I have to provide to my internal users in order not to jeopardize business processes?
- (focus on availability): How much flexibility and change must the infrastructure provide in the future so as not to impede business development?
- (focus on adaptability): How much will I be able to invest in my information architecture to obtain the high level of flexibility?

The example in Figure 1 shows a situation with availability being *the* key IT driver (priority #1), with adaptability coming 2nd and costs (TCO to be exact) of least concern. Note that the absolute scale of the diagrams is entirely irrelevant as long as the diagram is able to answer the two key questions of the IT driver model:

- Which is my top (number 1) IT priority?
- How do the other two IT drivers relate to this top priority?

Actually we adopt a contingency perspective of IT strategy indicating that the appropriateness of different IT strategies depends on the organizational and competitive setting of business. It would only be of limited sense to “compare” IT driver diagrams across organizations, as no universal set of strategic choices exists that is optimal for all businesses irrespective of their context (Grover et al. 1998).

**Strategic IT principles**

A strategy is always concerned about how to allocate scarce resources (Shapiro 1996, Gadgesh 2001). Effectiveness of any strategy is, thus, limited to the extent to which the strategy enables decision makers to answer such demand for resources. In the case of business strategies and the increased need for decentralized decision making within complex environments this has led to the development of “strategic principles” which shall guide the individual towards cohesive behavior in the absence of central control. “Always low prices” (Walmart) or “Be direct” (Dell) are well known examples.

The IT driver model offers a starting point for developing such a strategic principle for IT services. Take our example of Figure 1 where a strategic IT principle can be formulated around the following observations:

- Availability is our number 1 priority. It is never OK to endanger it even if it means cutting back on adaptability or investing more money!
- Any adaptation to existing information architecture is in order as long as availability is not at risk or can be maintained even at higher costs.
- Only after requests for availability and adaptability have been serviced will we look into costs.
Such a framework would not only enable every single professional of the IT department to adjust their daily decisions to the underlying IT strategy but it will also let all involved users better understand, how IT is going to deliver value to the business. Especially users will be able—by virtue of a communicated strategic principle—to come to realistic estimations on future “behavior” of the IT function. This will help reducing disappointments over often inflated user expectations and improve customer satisfaction.

3 Alignment issues

The cases presented in this section highlight application of the IT Driver Model to align business and IT strategies. All situations arose out of actual consulting assignments during the years 1999 – 2001. Some of the client details may have been left out to preserve their anonymity.

3.1 Incompatible priorities

Information technology services are generally (with the exception of services offered on the public Internet) geared towards corporate customers. As IT users accessing and consuming IT services employees represent IT demand with the internal IT department having the role of IT supplier. (Top) management is responsible for aligning this demand versus supply situation.

Without a suitable framework, however, articulation and communication of essential (strategic) priorities often falls between the three stakeholders involved in this mediation process, i.e. users, IT function, and management. In the example below communication between the stakeholders apparently did not take place successfully.

![Figure 2. Case 1: Incompatible priorities between users and management/IT function.](image)

User demand, including middle management, clearly articulates a high availability as first strategic priority of IT. Top management, however, instructed and measured the IT function to maximize adaptability. IT management was acutely aware of this agenda of the top management. While desperately trying to add one new feature after the other they never got around to explaining latent customer dissatisfaction about “unavailable systems”.

It is remarkable that top management and IT management were closely aligned and talking about the same issue, flexibility. Unfortunately, real user demand never entered the equation in the first place.

Causes

The following causes for this situation could be established:

- **No service agreements specified**
  There were utterly no service agreements (not to speak about service levels) specified between demand and supply side.

- **Past (good) performance taken for granted**
  The IT department was able to maintain a fairly high level of service availability (as measured by end users) which was, after a couple of years, unconditionally taken for granted. Users were never aware about the efforts necessary to “just” keep this (high) level.

- **Future expectations neglecting primary business need**
  In light of fairly good past performance concerning system and application uptime users focused on the second priority, adaptability, and made this number one on everyone’s agenda! In the absence of service agreements and missing prioritization of key IT drivers, users easily and implicitly changed priorities to reflect their future needs. They repeatedly brought forward “adaptability” in front of top management which directly and un-critically conveyed the message to the IT function. And IT tried to comply...

Sacrificing availability for flexibility, however, was not intended.

Corrective actions

Based on the causes for this mismatch the following actions successfully corrected the situation:

- **Use the IT Driver Model for differentiated discussion**
  Users, top management, and IT manager used the IT Driver Model to make priorities explicit and to enter a differentiated discussion about which level of availability needed to be maintained and which amount of flexibility would be needed to accommodate new business initiatives.

  The once all-or-nothing proposition of “sacrifice availability for flexibility” could be changed into
“be flexible with regard to this list of projects while maintaining a certain (high) level of availability”. 

- **Establish written service level agreements**

  Expectations were made visible and compatible on basis of a written service agreement between IT users represented by middle management (who eventually pay for IT services) and the IT department. Detailed service levels were included in the service agreement.

### 3.2 Inhomogeneous demand

Case 1 witnessed a misalignment between homogeneous user demand and IT and top management supply of IT services. This section focuses on a case where IT demand in itself happened to be inhomogeneous with regard to the supply function.

#### Users versus users

![Graph showing user vs. users availability, adaptability, and total cost of ownership](image)

Figure 3. Case 2: Inhomogeneous demand.

In this high-tech industry company a fairly large group of software and hardware developers were engaged to create new and innovative consumer electronics products consisting to very large extent of highly specialized circuit boards and accompanying control and communications software. Based on their design, several production lines and traditional corporate functions (marketing, human resources, procurement, logistics, and various others) were situated on the same site to be served by one IT department.

The IT manager was fairly on his own in determining and negotiating service levels vis-à-vis his own (internal) demand and towards a single outsourcing company which was effectively providing a large part (more than 70%) of all IT services.

Despite great efforts by both IT functions (IT manager and external IT service provider) user satisfaction was never convincing although both sides invested a large amount of their time to draft elaborate service level agreements (e.g., local area network service level with guaranteed end-to-end availability better than 99.90%, but also enterprise application outsourcing of the whole production planning system).

Unavailable services caused immediate negative feedback from the production lines which were operating in a 7×24 environment with no room to catch up lost hours. Due to a fairly volatile demand of the market, reaggregation into new workgroups or relocation of development capacity was virtually never ending. And as soon as availability was restored the development department got through with its requests for immediate movement of personnel and equipment (“We will relocate today… Make sure we can use our equipment as in our old location…”). Efforts to standardize desktop equipment were simply neglected or subtly sabotaged—even contrary to existing global corporate standards. Totally relying on his external service provider, the IT manager just echoed the demand of site middle management towards the IT supplier, who was in no position to resolve the contradicting orders.

#### Causes

Even superficial analysis of the situation within the IT Driver Model yields the (ex post) obvious finding that internal demand for IT services was inhomogeneous in this case and that, apparently, no means had been institutionalized to sort out this discrepancy.

The developers clearly had adaptability as number 1 IT driver with availability as number 2. Costs were, essentially, of no concern. The production function instead was fairly complacent with its IT services as long as everything worked for their 7×24 hours shifts. Costs were always important in consumer electronics business (hence #2 driver) and adaptability cycles were measured in months (rollout of the next generation product) with some marginal flexibility needed, mainly in fine-tuning software components.

Not only were these facts buried in day-to-day trench wars with the external service provider regarding failed expectations but IT management also did not contribute anything of its own accord to manage or somehow ameliorate this apparently contradictory demand versus the IT outsourcing company. Moreover, IT management even shielded off internal IT demand from the external supplier: Middle management (who were actually paying for IT services by way of a general and undifferentiated overhead compensation) was only superficially involved in drafting any of the several service agreements.

Top management was mostly concerned with high level strategic issues (deterioration of margins, decreasing consumer demand, fierce competition on price and features) and showed no interest in IT issues. From their perspective IT was only one of several overhead cost positions and certainly made no critical contribution to their business. It was a classic lose-lose situation confined within a negative feed-back loop.
Corrective actions
Two trivial actions would have been able to correct most of the mess in this case:

- **draft separate service agreements** for the two main groups of IT demand (production/availability focus and development/adaptability focus)
- **institutionalize charge back** for performance beyond a certain baseline standard (e.g., relocation within 12 hours would cost extra)

Certainly it would be no problem to measure the external service provider against two different service level agreements for different parts of the user population. But neglecting this difference and non-communication inevitably led to mutual frustration.

The second recommendation, implement a way to directly charge for IT services, relies on the coordinating forces of a market to sort out the level of demand as opposed to the (in this case not working) internal hierarchy (Williamson 1985).

#### 3.3 Dynamic changes in prioritization
Cases 1 and 2 focused on diverging priorities between users, IT function, and management. These could be traced to an unsuccessful because partial and un-guided communication between stakeholders. Once the IT Driver Model had been introduced as a suitable framework of discussion, effective communication set in and discussions converged.

Case 3 is of a different kind with stakeholders being well aligned in the internal perspective. Over time, however, competition grew stronger, systems (and availability) got better and the enterprise was no longer able to differentiate its service offering as a provider of a “best total solution”. As a result of “commoditization” of services, price became the key variable of competition.

This process usually shows as a creeping and slow erosion of user satisfaction. Dissatisfaction never directly occurs between internal demand and supply (written service levels did exist) but only indirectly between internal demand and external customers. In this case of price erosion it was fairly easy to track down the critical dimension of TCO by immediate feedback from the marketplace (“Your services are too expensive”). This subsequently caused sufficient internal pressure on costs and led to an evaluation of all corporate functions, including IT.

Given all facts, especially the initially good alignment of demand and supply, all people involved knew they should not complain based on the written service agreements. Nevertheless users’ uneasiness with the total situation grew – “something clearly needs to change”—without anyone being able to pin-point “what to change”. The surprise in the IT department about this “misalignment” was great and not really “motivating” during later discussion how to remedy the situation.

### Causes
Primary cause for this “slip of focus” could be traced back to a missing high-level steering mechanism ensuring on-going and cyclical alignment of business and IT strategy.

### Corrective actions
Once the external situation had been analyzed with regard to the competitive setting it was (theoretically) easy to adjust to the new top key IT driver, total cost of ownership. Practically speaking, the IT department pursued several classical options to reduce its costs:

- consolidate operations (e.g., data centers) and services to reap economies of scale
- prune services (with regard to market demand)
- reduce own headcount
- outsource certain parts of its services
- institute charge back to cover for “premium” service options

Besides this immediate action an “IT Governance Panel” had been instituted comprising members of the board, the CIO, and various high level business unit managers. This panel would oversee general IT strategies and investments and regularly review service level agreements as to their effectiveness versus market situation.
3.4 Requirements for eBusiness

3.4.1 Some considerations on the network economy

It is undisputed that Internet technologies have brought about a paradigm shift in how business transactions can be conducted with digital means. Theoretically speaking (Evans and Wurster 1997, 1999, 2000; Shapiro and Varian 1999) digitization (potentially) leads to a separation of the economies of things and the economies of information. This, in turn, opens up possibilities to deconstruct and disintermediate whole value chains and to reconfigure and to rebuild them anew. Old players will vanish and new actors will rise at certain intermediate positions in this “new economy” ecosystem of “click-stream hypermediation” (Carr 2000), the so-called “infomediaries” (Hagel and Singer 1999, Tapscott et al. 2000) or “navigators” (Evans and Wurster 2000).

As a matter of fact, the recent drastic downturn in the development of “Internet economy” has scattered some of the commonly held beliefs about the pervasiveness and completeness of this vision which has been touted to overturn virtually all incumbent businesses by more agile dot-com startups.

Without (additional) venture capital flowing in Internet start-ups are currently discovering that amidst this turmoil of technology change economic laws have not changed (Shapiro and Varian 1999). And the most basic and effective law—the profit law—is no longer lurking in the dark: In the long run, average revenues from operations have to exceed average total costs. No business can sustain violating this principle for a prolonged period of time; the bankruptcy of eBusiness consultancy marchFIRST being a case in point.

Despite this somewhat bleak analysis, all of the fundamental principles of network economy (Tapscott et al. 2000) are still at work. Businesses do employ Internet technologies for good and for profit—it is just time for more business acumen to set in as opposed to unrealistic hype. And even within this more realistic setting genuine challenges of IT are still rising.

3.4.2 Maximize both, availability and adaptability.

When offering services via the Internet we basically observe two strategic imperatives for IT:

- revenues directly depend on IS availability
- constant need for differentiation directly affects services and, hence, information systems

Information systems, applications, and information and communications technologies are the exclusive means by which any Internet transaction is conducted. While there has been some information technology dependence for conducting business transactions already in the past, linkage has been looser and more indirect than to-date. Internet services now directly depend on information systems and their availability.

Revenues depend on availability

In identifying that business revenues directly depend on the availability of information systems we are not talking about only displaying marketing information on a web site but about conducting economic transactions over the net. The (monetary) value attached to these transactions directly contributes to an enterprise’s top line (i.e., revenues). Unavailability of any element in the delivery chain (browser – PC – Internet – Web server – transaction server – corporate network – back-end systems) immediately destroys the ability to conduct this business.

Cisco System’s web site has already generated $200 million in (on-line) sales per month back at the end of 1997 (Clark 1997). Since then, the figure for on-line orders has risen to 76% of all orders, which is equivalent to $28.1 million per day ($ 850 million per month) as of April 1999 (Cho 1999). This makes calculation of lost revenue per single hour unavailability trivial. Repeated outages of eBay in June 1999 ultimately cost the company between $3 million and $5 million in lost revenues (Williams 2001).

While such a dependency on systems has been true also for some legacy systems (e.g. order entry tools) the situation is exacerbated by the principles of the network economy.

- **reach**
  Via the Internet you now potentially reach “all” your customers which as of to-date amounts to several millions.

- **speed**
  Internet users are accustomed to instant notification, not to mention gratification. Any service outage will be immediately recognized by the customer and velocity has increased dramatically—at least from the customer’s point of view.2

- **easy switching**
  Out of stock conditions have always directly affected sales of non-differentiated commodities due to the easiness of locating substitutes. To-date, switching to another Internet supplier is literally only some clicks away. Marginal switching costs are thus nil.

- **time**
  The Internet is “open” 7x24 hours spread over all time-zones of the world. This makes sure that for some customer any hour would be her prime time irrespective of the local time of your web server.

- **richness**
  Order entry typically has already depended on in-

2 We certainly acknowledge that there usually exists something like a “velocity disconnect” between the speed of the front-end process and back-end activities.
formation systems in the past. However, the amount of information had to be limited due to the non-digitized (i.e., analogue) form of information exchange. Internet technologies, by directly using digital representation of all data, are now able to convey much more information. Without systems available, any attempt of manual reconstruction of data at this level of detail proves to be futile.

As an aside, repeated downtimes might not only affect top line but also shareholder equity as e*trade and eBay experienced in 1999, when several outages—combined with extensive reporting about this “bad news” caused some 20–25% stock hit (Williams 2001).

Differentiation necessitates adaptability
It is a well known strategic threat (Evans and Wurster, 1999) that (pure) infomediaries themselves are constantly prone to imitation by competitors. One strategy to avoid copying by others—besides pursuing cost leadership—is to constantly differentiate the service offering (Shapiro and Varian 1999). Amazon.com, for instance, is adding new features to its virtual store approximately every 30 days; AOL has an even more aggressive strategy to deliver new add-ons every fortnight.

As all “products” or “services” are essentially delivered as or embedded into IT applications, any differentiation immediately translates into adaptation of the underlying information systems. All parameters how this differentiation may be achieved directly depend on the extent to which the total information architecture is flexible enough to accommodate for these changes.

IT strategic imperatives
With regard to the IT Driver Model the analysis above clearly translates into the following two strategic IT imperatives:

- **short term priority: increase availability**
  As it is affecting top line, availability must be increased beyond traditional limits immediately. This has short term priority!

- **strategic priority: increase adaptability**
  Adaptability of information architecture is critical for attaining a favorable competitive position. Information architecture designed for adaptability may even constitute a sustainable competitive advantage for enterprises.

The change in these imperatives is depicted below.

![All versus eBusiness](image)

**Figure 5.** Case 4: Requirements for eBusiness: Maximize both, availability and adaptability.

In this eBusiness context we would specifically like to point out the radically diminishing importance of the cost dimension. Actually, businesses have to increase their investment into information systems and technology to achieve the primary strategic objectives of the IT Driver Model.

Per mid of 1999 Cisco Systems’ investment into its 18 Internet commerce applications totaled $20.5 million (Cho 1999), and eBay has invested $30 million alone in the second half of 1999 on system and software upgrades (Lear 2000).

### 3.4.3 Implications for availability

We note the following critical issues:

- availability of 99.99% and more
- end-to-end connectivity
- security

**Availability of 99.99% and beyond**
Given any 7x24 hours operation and sufficiently high revenue availability needs to go far beyond traditional 99.0% or 99.5% for back-end systems.

<table>
<thead>
<tr>
<th>availability level</th>
<th>maximum down-time</th>
<th>expectation level</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.9%</td>
<td>8:45:00 hrs</td>
<td>expect few events per year</td>
</tr>
<tr>
<td>99.99%</td>
<td>0:52:34 min</td>
<td>expect (plan for) only one event per year</td>
</tr>
<tr>
<td>99.999%</td>
<td>0:05:15 min</td>
<td>expect (plan for) only no event per year</td>
</tr>
</tbody>
</table>

**Table 3.** Availability figures on an annualized basis.

While it is realistic to expect that knowledgeable administrators are able to fix problems within a day (or night!) in the case of 99.9% availability, this is no longer true for 99.99% availability. Looking and searching for potential faults would take much too long to
guarantee a maximum time to repair (nobody is interested in response times) of less than one hour. Such a level of uptime may be achieved by built-in resilience of the infrastructure (e.g., cold stand-by systems) or spare parts available on-site. In case of any failure the technician’s “only” task is to locate a faulty subsystem and to replace it with a (functioning) spare part.

Availability beyond 99.99% can only be achieved by full redundancy already designed and built into the whole information architecture. Automatic failover of applications and systems is a necessity, warm-stand-by the only (costly) alternative to achieve this objective.

This implies a drastic shift from operations and service level agreements to planning, design, and implementation strategy, which is summarized below.

<table>
<thead>
<tr>
<th>Availability</th>
<th>Design issues</th>
<th>Modus Operandi within SLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.9%</td>
<td>■ provide diagnostic equipment</td>
<td>■ look, search, and fix</td>
</tr>
<tr>
<td></td>
<td>■ plan for resilience</td>
<td>■ provide technicians on stand-by (on-site within 30–90 minutes)</td>
</tr>
<tr>
<td></td>
<td>■ provide cold stand-by systems</td>
<td>■ in case of fault: try to find and correct it</td>
</tr>
<tr>
<td></td>
<td>■ provide spare parts on-site for every unique part</td>
<td>■ isolate and change</td>
</tr>
<tr>
<td></td>
<td>■ implement redundant links</td>
<td>■ provide technicians on-site 7×24 hours</td>
</tr>
<tr>
<td></td>
<td>■ implement re-active fault notification systems</td>
<td>■ in case of fault: isolate subsystem and replace with spare part from on-site store</td>
</tr>
<tr>
<td>99.99%</td>
<td>■ design full redundancy including applications</td>
<td>■ monitor and improve</td>
</tr>
<tr>
<td></td>
<td>■ provide hot stand-by systems</td>
<td>■ constantly monitor thresholds</td>
</tr>
<tr>
<td></td>
<td>■ implement pro-active monitoring</td>
<td>■ check fail-over mechanisms regularly, whether in place and operational</td>
</tr>
</tbody>
</table>

Table 4. Implications on service management.

End-to-end connectivity
Internet service delivery involves several subsystems, networks, and applications extending from the customer’s browser via the (public) Internet, Internet service provider (ISP), firewall(s), front-end web system, web application, corporate Intranet to any back-end applications. Failure of any element in this chain at least impedes conducting business electronically. More realistically, the customer will not be able to access and consume services at all.

Unfortunately, a large part of this infrastructure—the public Internet—cannot be controlled or guaranteed by any enterprise. Despite this lack of accountability and responsibility the following actions may be taken to ensure customer satisfaction:

■ establish redundant access to the Internet
  As minimum measure for providing resilience, redundant connections to the Internet need to be established, preferably also by different ISPs.

■ forge service levels with ISPs
  While in general the Internet is constructed around a best effort (packet) delivery level on top of a meshed physical network topology, some ISPs have differentiated themselves by providing stringent service levels of throughput and latency (e.g., Abovenet). ISPs achieve this by investing into a proprietary high-speed backbone linked to all major Internet traffic exchanges.

■ identify a suitable means of help facilities for web customers
  This may be a dedicated helpdesk for customers, but whatever help is provided should take into account the whole delivery chain including even external parts outside the control of the enterprise.

Security & intrusion detection
Maintaining a proper security perimeter with regard to the public Internet is a critical success factor to ensure service availability. The recent surge in sophisticated distributed denial of service attacks and their devastating impact on services clearly demonstrates this point.

Service agreements have to reflect this need appropriately. However, due to the unpredictability of threats it is hard to establish strict and meaningful service levels (“no more than 2 successful break-ins within 3 months”?). IT organisations, thus, are driven to accept largely input driven service levels specifying how much effort they should “spend” for security activities. Major areas of concern are:
provide continuous investment in security applications
This ranges from standard firewall and application proxy software to state-of-the-art intrusion detection systems.

identify people
Security is, above all, a people business. Identify the number of people concerned with corporate security and provide for their full-time commitment to this job.

identify procedures
Establish procedures how, and especially when to monitor the extensive set of security logging usually produced by security software. Specify exactly which reports shall be generated and when those figures will be discussed.

3.4.4 Implications for adaptability
Traditional means of having a "Change Control Board" approve or reject each and every issue concerning information architecture every fortnight or so are insufficient to accommodate the urgent need of service differentiation. We can identify three key strategies to overcome this limitation.

split responsibilities
according to different time constants of processes

up-front investment in spare capacity

provide plug-ins for scalability

Split responsibilities
Even though new services and applications features could be introduced every few weeks this does not necessarily imply that all elements of the delivery chain have to be changed in line. Separating control of these different entities according to their different characteristic time constants of associated change processes is an effective means of speeding up adaptability.

<table>
<thead>
<tr>
<th>Element</th>
<th>Time constant</th>
<th>Change drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>local area network</td>
<td>6–12 m</td>
<td>technology lifecycle</td>
</tr>
<tr>
<td>wide area network</td>
<td>6–12 m</td>
<td>traffic increase</td>
</tr>
<tr>
<td>Internet bandwidth</td>
<td>6 m</td>
<td>traffic increase</td>
</tr>
<tr>
<td>enterprise storage</td>
<td>3–6 m</td>
<td>storage space increase</td>
</tr>
<tr>
<td>storage area network</td>
<td>12 m</td>
<td>technology lifecycle</td>
</tr>
<tr>
<td>server hardware</td>
<td>3–9 m</td>
<td>CPU resources, technology lifecycle</td>
</tr>
<tr>
<td>firewalls &amp; security</td>
<td>3–6 m</td>
<td>security and application updates</td>
</tr>
</tbody>
</table>

Table 5. Different element classes. Time given in months.

Consequently, service level agreements should address "change processes" per each element class as specified in Table 5.

Upfront investment
Lead times for hardware purchases often prove to be one of the major limiting factors for timely upgrades. This situation may be remedied by a suitable upfront investment in spare (i.e., currently not needed) capacity. From a classical supply chain management point of view this is tantamount to creating a local inventory (Simchi-Levi D. et. al. 2000) with associated “stock keeping costs”. For instance, eBay is overprovisioning initial hardware to maintain at least 40% “headroom” to stay ahead of capacity (Lear 2000).

Plug-ins for scalability
Many elements of base IT infrastructure either provide means to simply “plug in” additional capacity or may be—to a certain extent—duplicated. Common examples are

- empty slots for CPUs/processors
- free slots for disk space (e.g., within the enterprise storage system, RAID etc.)
- unused connections for additional network uplinks
- replication of (dumb) front end web servers
- duplication of application servers (e.g., through clustering)

4 Summary and Conclusions
Despite the ubiquity and urgency of the problem how to best align business and information technology strategies attempts to do so have not been too successful in the past. This may to some extent be due to the so-called semantic disparity problem (Lewis and Ray 1999) where strategic parameters which are easy to measure for the IT (supply) side do not translate well into constructs understood readily by business (demand) side and vice-versa. The lack of a suitable framework for communicating (IT) strategy might subsequently also lead to a loss of focus for IT strategy as a whole resulting in a mediocre performance of the whole IT function as opposed to leveraging technology in the network economy.

This paper introduces the IT Driver Model as a framework to articulate IT strategy. The IT Driver Model rests on the observation that IT strategy may focus on one of three key IT drivers, availability, adaptability, or total

3 These are web caches and load balancers.
cost of ownership. Within this set of mutually exclusive strategic disciplines a leading and winning company has to choose one key driver at which to excel while maintaining threshold performance at the other two drivers. Refraining from explicit choice will entail dilution of strategic thinking, confusion, tension, and loss of energy.

The IT driver model is easy to understand in the connotations of both stakeholders, business management and IT management, and thus is able to bridge the semantic gap between the two functions. This enables effective communication which is a necessary prerequisite for achieving strategic alignment.

Based on applications of the IT driver model to real-world problems, several high level issues for successful alignment of business expectations and IT operations (IT service level management) may be observed.

**Conclusion 1.** It is better to have any written service (level) agreement than just word-of-mouth.

Without anything written down demand priorities will neither be known nor agreed between users, management, and the IT function. Floating expectations and (presumably) best-effort services will inevitably lead to failed expectations, frustrated customers, and also dissatisfied IT service personnel. The IT Driver Model may also be used as a starting point to create a simple “strategic principle” for IT operations guiding not only decentralized decision making within the IT department but also educating user which trade-offs should be expected (e.g., availability before adaptability).

**Conclusion 2.** Recognize inhomogeneous internal demand and make it explicit.

Different priorities of key IT drivers for different groups of corporate IT users may exist which can prove very hard to fulfill synchronously by the IT department unless overtly included in suitably differentiated and tailor-made service agreements. It is advisable to educate internal users about this varying (internal!) demand for IT services and the need for separate service agreements to reflect this complex situation.

**Conclusion 3.** Weak IT governance cannot be substituted by outsourcing or service levels alone.

Weak IT management will not become strong even with the help of outsourcing, be it selective or total outsourcing of IT services. Service levels alone cannot ameliorate a lack of internal governance especially with no concrete key IT driver identified. Demand will change according to the rules of the internal power game and the situation will certainly not reflect a consistent strategic choice of IT drivers but short-term opportunism only. Missing internal governance cannot under any circumstances be covered by market transactions (viz. an outsourcing contract) and will lead to underperformance.

**Conclusion 4.** Regularly adapt the internal perspective of key IT drivers to the external environment.

Even though “perfect” alignment between business and IT strategy may have been achieved at some point in the past, time and changing external conditions may render any chosen key IT driver ineffective as a competitive advantage. IT drivers and service levels need regular reevaluation vis-à-vis the external market setting and competition. This requires some steering or over-sight mechanism comprising business and IT leadership.

**Conclusion 5.** eCommerce and eBusiness demand nearly simultaneous maximization of two competing IT drivers, availability and adaptability.

Conducting business transactions electronically introduces a new element of IT dependence: Availability of IT systems and applications now has immediate impact on enterprise revenues. On the other hand, as marginal costs for duplicating existing information tend towards nil in the digital economy, (pure) information businesses (“navigators” or “infomediaries”) are constantly prone to imitation by competitors. This necessitates a never-ending battle to differentiate one’s (digital) service or product offer requiring an ever increasing level of adaptability of the whole information architecture.

**Conclusion 6.** Divide and conquer—and invest!

Digital economy pushes enterprises to maximize both, availability and adaptability, at the same time (see Conclusion 5 above). As a matter of principle, this cannot be realistically achieved at one instance of time across all levels against reasonable costs. However, by separating information infrastructure according to different time constants of change it may be possible to optimize both IT drivers in order to maintain a competitive edge in the information age. As several key players in eCommerce have demonstrated this, amongst others, means heavy investment in IT infrastructure.

5 References


