CHAPTER **M**

Management and Control

On Saturday evening, Henri finally thinks that now he deserves refreshments, not so much, because he had written several pages of the business plan for his innovative application, but because of the great success of the flowers.

As usual, Henri's steps are directed towards a local bar, full of engineering students many of whom he knows at least superficially: one supports Manchester United, while another one at the same table hates sports. Then Henri notices an older student—well over 30 years old, Henri judges—in a side table. The Umpire, as the student was often called, seems to know very well all kinds of interesting facts, the taste of beers among them. A couple of weeks ago Umpire had recommended a rare beer that happened to be available at the bar. Henri recalls the name of the beer, Samaura Special—what a strange name for a beer. Anyway, as he liked its soft flavor he decides to take one. Disappointingly, the bartender tells that due to an unexpected boom, Samaura is not available now, but he has ordered more. The delivery will arrive next week, the bartender promises, but there might be a shortage for a month or so, because the wholesaler could not deliver immediately as many cases of beer as the bartender has wished.

Henri asked, "How many did you order?" Quite a lot, the bartender answers and continues that according to his experience, it is better to react faster than others in order to satisfy the demand peaks as efficiently as possible. So, Henri takes a local beer, Otaolut they used to call it, while wondering what would happen if all bar owners thought and behaved in the same manner. Maybe he could discuss about this with Umpire, as he usually is keen to argue about any topic or occurrence that is somehow paradoxical.

Once again, Umpire has some thoughts worth listening to. He starts to tell about the intricate problems of imperfect information, feedback loops, and chaotic processes. He even tries to illustrate a chaotic process by using beer mats. If there are too many delays in the feedback channels, the system tends to behave in a chaotic manner, and if the feedback channels are blocked the system cannot anymore adapt at all. Point in case, the problem does not lie in the skills of the actors but in the platform that supports the process, Umpire continues his explanation.

Anyway, the discussion soon wanders to other questions. Particularly, Umpire has lately considered the fundamental question about what it means to say that something is better than something else. He had recently read a fascinating book; Beer was the name of the author, most appropriately. Furthermore,

Beer also collaborated with Salvador Allende in the early seventies. One of Beer's arguments was that in current societies money is the primary metrics used define what is better and what is worse. If something is economic, it is good and should be considered advantageous independent of any other consequences it may have. In Beer's opinion, that is a blatantly mistaken mind-set. Besides, there are plenty of psychological studies showing that if a person strives for wealth and money, he will most likely get at least some amount of them, but without ever becoming happier. In contrast, Umpire continues, those people that strive for more intrinsic goals, particularly the well-being of other people instead of money, earn less but are happier in the long run.

So what should we aim at if not wealth? Henri asks not really disagreeing at all with Umpire and Beer, but keenly waiting for an expert's answer. The answer comes swiftly: Love.

Henri had expected something like that but he wants to use the opportunity to request a more detailed answer. What is so special in love? Isn't love just one emotion among many others? Umpire has the habit, especially during the later phases of a beer session, to drop names. The next one was Niklas Luhmann who had said that love is the only social system that cannot be described by a binary code.

At this stage of evening, Henri easily agrees. Whatsoever the Umpire has meant by the binary code, it definitely sounds true. Love is neither binary nor a code, which in fact reminds Henri that he shall send a couple of text messages to Irene. He had promised to himself that whatever he will do and wherever he will be, he will remember Irene.

He even asks advice from the Umpire. What shall he write to improve the spirit of a female living physically far away but so close mentally? Umpire promised to help, on the condition that his advice will remain secret. Henri swears that he will never tell anything. Thus, we cannot show here the content of the messages. For an outsider observer they are ordinary messages with a length of 157 and 42 characters, sent at 11:22 pm and 11:39 pm, respectively. Two messages are also received. All of them are invaluable.

After all the conversations with the Umpire and Irene, Henri is pretty excited and satisfied with everything in his life. They continue their discussion although now the bar begins to be a quite noisy and restless place for any serious conversation. Henri is not sure whether that is good or bad. Have you ever communicated with beer, Umpire asked? If you taste the aroma of a beer, is that an act of communication with the beer, or maybe with the brewer of the beer? Perhaps the brewer wanted to utter something, but at least, any taste is a piece of information.

Is it good to drink beer, if the beer creates pleasure now? It might sometimes be better to communicate with a bottle of beer than with a person. Beer is more consistent than money in its expressive nature. No, perhaps not, whatsoever the benefits offered by beers and other refreshments are, Irene always is

much more important for him. The Umpire seems to carry on a discussion with a group of younger students, but Henri does not anymore participate in that discussion and decides to leave the bar earlier than usual on a Saturday evening.

Henri had struggled through James Joyce's Ulysses during the winter holiday. What a weird book. He had memorized a couple of sentences, just for the sake of it. He tries to remember. What was the name of the guy who wandered through Dublin? Bloom. One advice in Flourishator could be to read certain pages in Ulysses, and that advice could be behind a secret code, a special combination of emotions—fear, love, s…

Henri continues his walk through the quiet student campus and forgets the code but oddly remembers a list of strangers, Sinbad the Sailor, Tinbad the Tailor, … Heigho! Although the path appears to be like a strange loop twisting in a space with multiple dimensions he finally gets to his bed without any conscious control, just relying on the automaticity provided by the deep realms of his mind. Best effort rules, he thinks when falling asleep.

Controlling ecosystems

One of the major dilemmas addressed in this book is the impossibility to *control* the aggregate behavior of an *ecosystem*. Every agent in the ecosystem is also an element of the ecosystem. No external actor would be able to control all inputs of the ecosystem in a way that makes it possible to achieve any desired outcome. Thus, the possibilities for true control are limited except perhaps on the lowest level of technologies. What agents can do inside the ecosystem is to make interventions that affect the course of the ecosystem—but without the possibility to predict how. Those interventions are often more an art than science, and thus depend on the personal expertise of people involved, including consultants.

Some actors can consider that an ecosystem is a system that can be controlled, at least in principle. In that mental model illustrated in Figure M.1, if Agent A puts something into the ecosystem, the agent expects to get something specific out of the ecosystem. If Agent A is a service provider, it may offer a service with certain properties and price in the ecosystem in order to get money from customers. In reality, each agent interacts with a large number of other agents, such as customers, competitors, partners, and regulators. Therefore, the management of an ecosystem is, almost by definition, an impossible task.

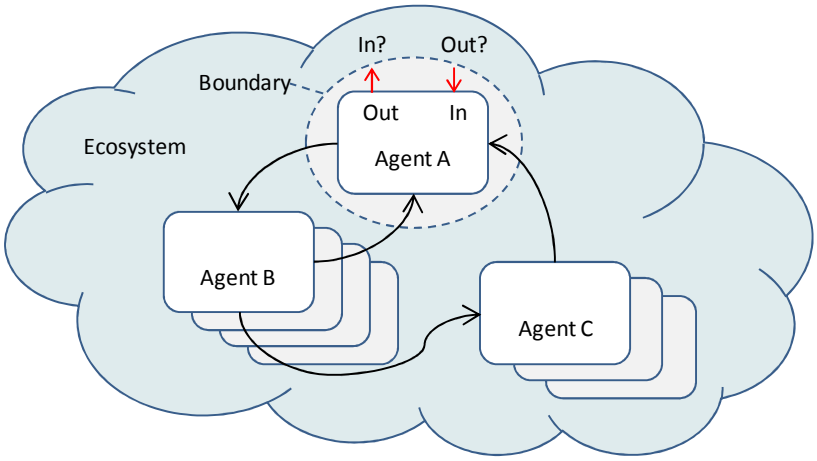

Figure M.1: The challenge of controlling an ecosystem.

Management is still an important matter within organizations. If an organization has explicit boundaries towards its environment, it typically has a clear, and often hierarchical, internal structure. Both the internal operations and external interactions might then be based on tight control. An army is a natural example. On the other hand, modern communications ecosystems seldom allow the development of clear boundaries and stable organizations. All kinds of partnerships are created and ended new entrants change the established rules, and new technologies enable novel business models, and at the same time, ruin old businesses. The management of an organization must adapt to the incessantly changing environment. This chapter offers some tools to cope with this challenge.

Most notably, the interactions within a system seem to follow patterns that are called *system archetypes* by Peter Senge. Three of the archetypes are discussed in this chapter to demonstrate the usefulness of these mental models. In addition, this chapter discusses control in general by using traffic control as an example. The justification for the discussion is that the principles of control are largely independent of the context. We have, as human beings, a wish to control our environment. Sometimes the controlling actions lead to the desired outcomes, but more often than not, many undesired outcomes emerge—this is the main theme of this chapter.

Terms

You likely are familiar with the key terminology used in this section. Many key terms, such as feedback and control, can be used in various contexts. They are defined, thus, in a generic way referring to any kind of system with inputs, outputs, and separate elements. We shall remember, however, the difference between controllable systems and ecosystems (in which no agent has the capability to control the whole ecosystem). In this sense, the Internet is an ecosystem while the traditional telephone network is a system. Figure M.2 illustrates the relationship

between the mission and strategy of an organization: strategy is considered here the way through which the organization approaches its mission. In this sense mission is defined as something that is worth pursuing. Note also that this structure of policy-actions-strategy-mission roughly corresponds to the structure of capability-performance-efficiency-worth.

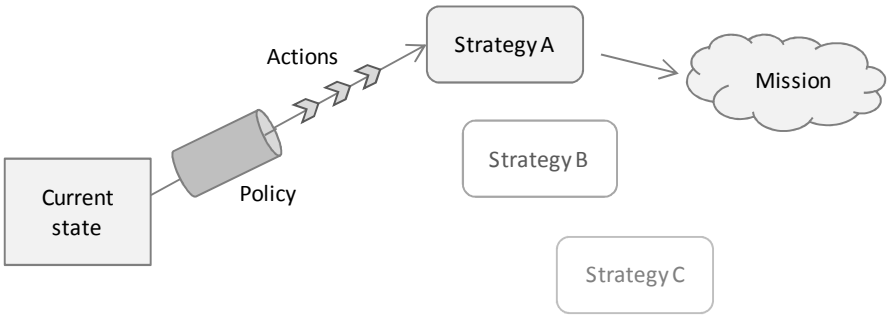

Figure M.2: Relationship between mission, actions, strategy, and policy.

Other essential terms in this domain include:

control: capability of choosing the inputs to a system so as to make the state or outputs change in a desired way,

copyright: the exclusive legal right granted for a period to print, publish, perform, film, or record literary, artistic, or musical material,

feedback: a causal process whereby some proportion of a system's output is returned to the input,

leadership: the art of motivating a group of people to act towards achieving a common goal,

management: control and coordination of the activities of an organization in accordance with certain policies to achieve clearly defined objectives,

mission: the core purpose of a person, group, or organization,

organization: a purposefully arranged system consisting of knowledge, data, people, things, or other elements,

policy: a set of principles and associated guidelines, formulated and enforced by the governing body of an organization, to direct and limit its actions in pursuit of long-term goals,

protocol: a formal description of messages and rules to be used by two or more systems to exchange information,

regulation: controlling human or societal behavior by rules or restrictions,

resource: a reserve supply of something such as money, personnel, or equipment,

rule: a statement specifying what is permissible under given circumstances,

standard: a universally or widely accepted or agreed upon set of requirements, and

strategy: art and science of planning and marshalling resources for their most efficient and effective use.

Glossary explains also the following terms:

bureaucracy	intellectual property	provider
change agent	interface	regulator
congestion	Internet protocol (IP)	shifting the burden
congestion control	intervention	signaling
connection	IPR	SLA
consultant	ISP	solution
contract	ITU	stakeholder
development	logistics	symptom
DPI	measurement	system archetype
end-to-end principle	mission-critical system	TCP
escalation	MPLS	walled garden
government	network neutrality	wisdom of crowds
hierarchy	patent	
IETF	project	

Management

Management is one of those topics that I have limited personal experience with. Perhaps it would have been better to recommend some well-known management books without any of my own text. Nevertheless, that would not be in line with the philosophy of this book. I could surely read 10 management books and make an overview of their main messages. However, enough of those overviews are already available. Another approach could be to take the perspective of a person that has been the object of management. I have spent my professional career in large organizations with established processes and management. I have had the privilege of working under some excellent managers in organizations that are mostly functioning well enough. Of course, I have experienced some less pleasant management actions and dealt with odd bureaucracy. However, I have seldom had any need to analyze the performance of management more than what is normally discussed during coffee breaks. Consequently, I have no theory of good (or bad) management of my own.

Still, as a CEE, you will encounter management both in the organization you are working and in the communications ecosystem you are analyzing. Management is an inevitable and integral part of any human ecosystem. Thus, my principal approach is to give some guidance about how you can *observe* management, instead of giving advice about how you can *become* a good manager. Note that in some cases the most difficult obstacle for changing the functioning of an ecosystem can be resistance in the domain of management. In those cases, all good advices to develop technology, customer interaction, or business processes will be futile if the management remains unchanged.

My consideration is directly based on the seven rules for CEE presented in the Introduction. I will interpret the rules first from the viewpoint of a good manager, and later discuss about situations in which you are the observer of better or worse management activities.

1. Rule of human benefit: Human benefit is the driving force for all human ecosystems.

   Although the route can sometimes be long and obscured, without the driving force provided by human benefit any organization will eventually die. If you are a manager in a smaller or bigger organization, identify the original place where benefits emerge and your organization is able be get compensation in one form or another. Correspondingly, identify the places where the actions of your organization have negative effects on human benefit. Even though the short-term success of an organization might depend more on the direct benefits (e.g., an increase of sales during a quarter) than the indirect sacrifices (e.g., environmental damages), the total balance has to be positive in order to guarantee the long-term success of the organization.

2. Rule of metrics: Define carefully your own metrics and understand the metrics used by others.

   In a professional context, the primary metric of a manager is typically determined by his or her task and position in the organization. This observation is valid for you, too. The metric defined by your position might be in conflict with your inner motives and with the metric that you apply in other parts of your life. This conflict of metrics may become a source of unbearable stress. My advice is to be always honest with yourself, particularly when you are tempted to compromise the mission of your life because of short-term gains or social pressure in the professional domain. If you want to remain honest, you have to compensate for your harmful actions to those that have suffered from them. When you are honest, you can follow your heart, that is, your innermost metric. Otherwise, you need to play an infinite amount of games with diverse metrics at the same time.

3. Rule of all-inclusive evaluation: Analyze behavior by simulating emotions, but do not limit the analysis to the most obvious individual.

   Assess individual behavior and emotions by means of your innate capability of assessing the emotions of others by assessing our own emotions while observing them or even when visualizing imaginary situations. However, you shall not limit this effort to the most obvious individual, because almost any action affects many people. Thus as a manager when you solve a problem for one person, be careful, because the solution might cause a small amount of harm to numerous people. Those small amounts when cumulated may create large-scale damages. Thus, every solution shall also be considered from the viewpoint of all relevant people in the organization.

4. Rule of systems thinking: Take always also a holistic system viewpoint because in reality everything happens as a part of a bigger system.

   In addition to emotions, take a holistic, system viewpoint, also when the issue seems to be minor and separate. Systems tend to obey similar behavioral patterns. Thus it is worth learning a set of simple patterns, which may be called system archetypes, in a way that you can almost automatically check whether a situation seem to comply with some of them. If that is the case, then do a more detailed analysis and if possible sketch a numerical model. As a manager, remember that the group of people under you is just a part of the organization or ecosystem. In order to make useful decisions within your group you need feasible understanding (or a conceptual model) about the bigger system and about the position of your group within the system.

5. Rule of ecosystem evolution: When you want to change something in an ecosystem, remember that an ecosystem can hardly ever be developed in a systematic and predictable way.

   As a manager, identify whether the system you want to manage or analyze is evolving or whether it can be intentionally developed. There always is a level in any ecosystem on which no one can intentionally direct the development. As a manager, you might be able control what is done on a given day, but you are hardly ever able to control the other consequences of your actions. All control methods aimed at human beings tend to affect their motivation and the interrelationships with other people. In the long term, those effects are typically more important than what is achieved on a given day in a measurable way. In practice, if you want to have a certain kind of effect you need, first, to select the level of intervention and, secondly, to observe how the system in general reacts. Whatsoever the reaction will be, try to avoid accusing other people of destroying your good intentions. Instead, try to invent a better way of intervening.

6. Rule of positivity: Remember to give at least three times more positive feedback as negative feedback.

   In addition to positive feedback, be honestly interested in what others are thinking and saying and do not only promote your own arguments. This sort of behavior is highly beneficial for the performance of any organization in the long run.

7. Rule of multiple intelligences: Use your multiple strengths.

   Do not rely only on reasoning, even if you are highly intelligent and capable of applying complex and subtle models. In addition, a manager needs strong interpersonal skills either as a natural characteristic or through training. Furthermore, you certainly have many other capabilities, perhaps in the areas of story-telling or artistic creation that are useful in management tasks. As to the challenge of solving problems creatively, see Gause and Weinberg (1990).

It is obvious that many managers and management departments do not deem human benefit as their driving force, but rather limit their judgment to the flow of money and power. The challenge is that in the short term this limitation might work sufficiently well and thus diminish the motivation to extend the perspective. Still, you may ask, as a CEE, additional questions about the flow of money or power: what is behind that source of money or that source of authority? You can repeat that question until the answer clearly refers to human benefit. Then you shall evaluate whether that benefit is large enough to justify the total cost of maintaining the organization or part of the organization. Surely, this is a demanding undertaking.

My tentative feeling is that it is difficult for an organization to rely on several types of human benefit at the same time. An illustrative example is the challenge of Telecom service providers to extend their business to the domain of entertainment. The bundling of communications and TV services is somehow an attractive idea, because the same customers consume both services and they can be offered through the same infrastructure. I am somehow uncomfortable with this kind of bundling because the nature of benefit is different when I interact with other people than when I stare at a TV. However, the popularity of bundling in many markets indicates that consumers are comfortable with bundling. One may still wonder whether, because of the bundling of communications and entertainment services, communication with other people will be considered as just a way to entertain oneself.

Some problems might also emerge at the other end of the chain, that is, in the service provider's organization. It might be hard to manage conflicts between departments responsible for different areas relying on different types of human benefit. In addition, the personnel responsible for customer interaction might have problems to understand their true mission if they need to serve customers with too diverse needs.

The point from a CEE perspective is that in order to make a realistic study these aspects of human benefit have to be taken into account, although the analysis is often tricky. Furthermore, even if you were able to make a convincing analysis, you may still encounter the problem

that different people, including managers, have different metrics to assess the merits of the predicted outcome. It will be practically impossible to change that metric by any reasoning or persuasion.

Remember also that the genuine metric is revealed by real decisions rather than by any explanations or promises. Thus, do not be deceived by what a person claims to be his true metric when he is acting against his declared principles. A customer may fully accept the results of your analysis and still act against your advice. You should not judge him as stupid or immoral, but rather you shall try to understand the reasoning behind the action through the metric the manager uses when making essential decisions. In any organization doing business, there is a strong social pressure to use a metric that satisfies relatively short-term business objectives. Additionally, if the customer is a manager he is most probably interested in his career development. The manager can always find good reasons to ignore anything that does not serve either of these metrics (profit or career).

Finally, as practical advice when you are not in the position to make changes in managerial principles in your organization, but still believe that something has to be done, I would like to cite Daniel Pink (2009, p. 176):

1. Instead of trying to change the organization as a whole, start small. There are always possibilities to make small changes to make things a little better.
2. When needed, be rebellious and bend the established rules because innovative changes rarely come from the top.
3. Emphasize results, instead of means.

Note also that if you stress the need to change the current management practices, managers probably consider that as a pure criticism. Then the "bad is stronger than good" principle starts to dominate the interaction with a predictable outcome. That kind of progress can be avoided only by focusing on the good results.

System archetypes

Peter Senge's Fifth Discipline (1990) is one of those books that every ecosystem expert should read. It provides numerous illustrative examples and offers a systematic framework to understand complex systems in the form of system archetypes. In this section, I present three of them: Shifting the Burden, Escalation, and Growth and Underinvestment. Others system archetypes described by Peter Senge include limits to growth, eroding goals, fixes that fail, success to the successful, and tragedy of the commons. All these provide a useful framework to consider complex phenomena both in the personal and business domains. Braun (2002) offers a shorter introduction to the systems archetype framework. After the system archetypes, I present my version of the famous *Beer game* (see Chapter 3 in Senge 1990).

Shifting the burden

This is perhaps the most fundamental system archetype. The essence of the archetype is that instead of the factual problem a person concentrates on alleviating a symptom of the problem as shown in the upper circle in Figure M.3. While the symptomatic method may alleviate the symptom in the short term, it has a negative network effect on the fundamental problem. Thus in the long term even the symptoms are increased because of the symptomatic method. A lucid example is an attempt to lessen excessive stress by means of alcohol. Surely, alcohol may reduce the experienced stress in the short term. However, alcohol hardly ever solves the fundamental problem that is behind the stress. In contrast, it tends to amplify the problem itself, for instance, by deteriorating health.

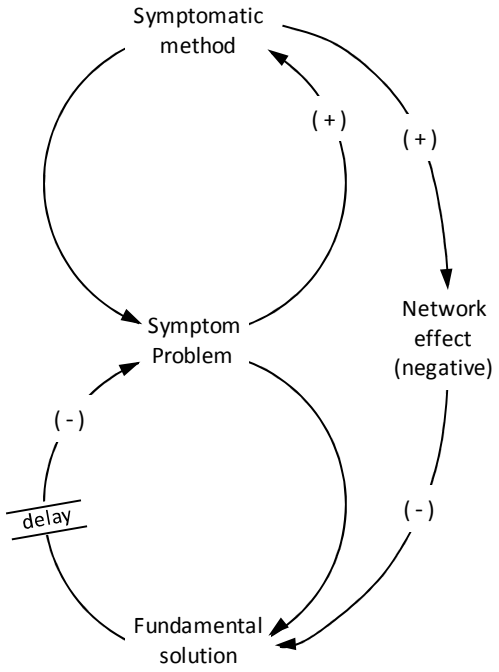

Figure M.3: Shifting the burden, based on Senge (1990, p. 392).

Note also a couple of terminological issues. Firstly, a *method* that does not solve the problem is not a *solution* but an inefficient or harmful method. A harmful method typically induces negative network effects that often are called *side effects*. However, the attribute *side* may underrate the importance of the network effect. If a person selects the symptomatic method, he may think that he himself is not responsible for any negative effects the method may also produce. For instance, a manager may have problems with his subordinates that do not seem to work as hard as they should work. The most obvious symptomatic method would be to put

more pressure on the subordinates. In the short term, this might alleviate the observable symptoms. Unfortunately, the pressure does not solve the fundamental problem of working motivation, in reverse, it likely increases it.

If the manager uses in his mind the term "side effect" he may consider his symptomatic method appropriate even if we is aware of this system archetype. Side effects are, in his opinion, always caused by the others, in this case by the subordinates and by other parts of the organization that have not taken care of the motivation of employees. Thus, a manager unable to take into account all relevant network effects has a lack of leadership skills. As to this question, in general I would recommend the book published by The Arbinger Institute (2010): *Leadership and Self-Deception*.

As to the communications ecosystems, there are numerous possible examples that might be classified to this archetype. For instance,

> **walled garden**: an attractive environment designed to keep a captive reasonably satisfied, and requiring some cost in escaping from it

applied by some large service providers to lock in customers can be interpreted as a shifting the burden archetype. Although in some markets a walled garden might be a reasonable approach to make business, it does not solve the fundamental objective of customers to maximize the total benefit obtained by means of communications services. This also is the message of the first rule for CEE: Remember that human benefit is the driving force of all human ecosystems.

If the method concentrates on something other than the true human benefits, the method may lead to the shifting the burden archetype. In this respect, shifting the burden is also related to the selection of metrics: if a manager concentrates on improving performance of a limited part of the system, he may endanger the overall worth of the system as a whole.

Escalation

Another simple but powerful system archetype is *Escalation* depicted in Figure M.4. In this case, two people or organizations compete with each other in a way that both consider the other one as threat to their own success. When side A gets ahead, side B tries to react in a way that improves B's position relative to the other one. Typically, both sides believe that the other side is the reason for the escalation. This belief can be partly explained by the bad is stronger than good –phenomena discussed in Chapter H. In those cases, the situation resembles the chain of events depicted in Figure H.6. In business domain, escalation may mean a price war that at least in the short term would be beneficial for the customers. However, the chain of actions may threaten the survival of both sides in the long term.

An example from the technical domain could be the development of

> **deep packet inspection (DPI):** a process in which the data part of a packet is analyzed in order to prioritize traffic or filter out unwanted data.

If the users and application developers believe that DPI is used to control their behavior and legitimate right to use their network access to any imaginable way, they most probably would design counteractions to make DPI more difficult to realize. This may lead to a situation in which network operators have an even stronger believe that they have a right to control the traffic in *their* network. A true solution to the fundamental problem can be based only on cooperation between both sides. All sides involved, including service and content providers, application developers and users must believe that the methods used in the network will serve their needs in the long term.

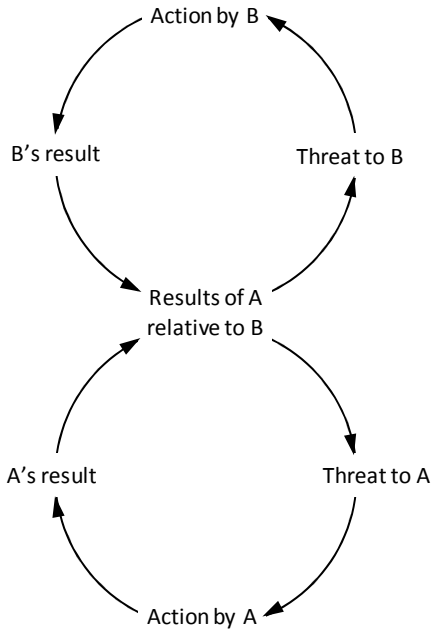

Figure M.4: Escalation as a system archetype based on Senge (1990, p. 395).

The escalation may most likely occur when the results are immediately observable or when they create strong emotions. Thus, it might be advisable to react in a way that creates a different type of consequence. For instance, if the first company lowers price, the other company may improve the quality of the product. Similarly, if another person criticizes you, it is not advisable to invent an even worse criticism against that person to win the debate. Instead, you may try to demonstrate your ability to control your *own* emotional reactions (not by force but by self-reflection). The stress here is on the attribute *own*, because controlling the emotional reactions of another person would be a futile if not harmful approach.

Growth and underinvestment

The experience of controlling own emotional reaction can be more rewarding than the transient feeling of winning a debate. Moreover, controlling your own reactions has obvious long-term benefits. This leads to the system archetype illustrated in Figure M.5 called growth and underinvestment. You may discover many examples of this archetype in the business domain, including the sector of communications services. Here the archetype is described in the context of career development.

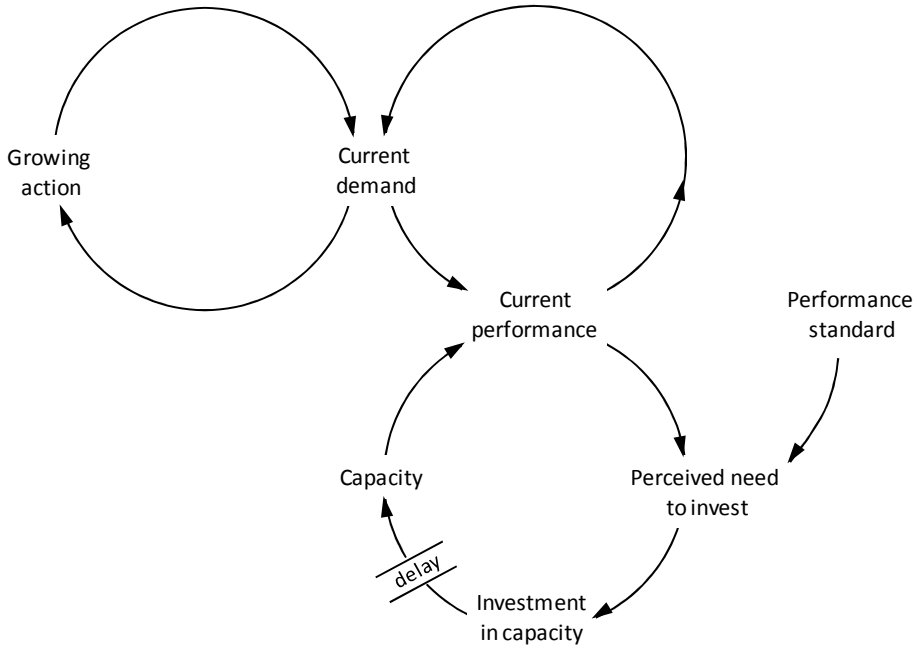

Figure M.5: Growth and underinvestment based on Senge (1990 , p. 400).

Let us consider a student that has performed well in the early phase of studies by investing a lot of time and effort to gain knowledge and skills. However, the student may start to think that her current performance level is high enough and that she shall also enjoy her life. That is a justifiable thought—in the long term; there are many other important things than studying in a university. However, let us assume that as a result of this reasonable consideration, the student decides to work in a hamburger bar 20 hours per week to fund all her novel activities. That amount of additional work surely affects her ability to invest in studying. As a result she may still be able to perform well enough to pass mandatory courses, but without accumulating new knowledge or skills, that is, her expert capacity. In consequence, she would likely lower her standards for studying performance. As Peter Senge describes the early warning symptoms of this archetype (1990, p. 400):

> "Well, we used to be the best, and we'll be the best again, but right now we have to conserve our resources and not over-invest."

The student may consider as an over-investment to read any professional book unless it is a mandatory reading for a course, for instance, Senge's Fifth Discipline.

Beer game as a logistic challenge

Let us study a popular example used to illustrate the behavior of a system with human actors. We may even call it an ecosystem model, as it consists of a large number of consumers, three bars, one wholesale company, and one brewery. This example is based on the case presented by Senge (1990, p. 27 - 42), but it is modified and used within a couple of courses at Aalto University.

In the starting state, the consumption of a specific beer is constant: 10 cases per month (or about 8 bottles per day). Consequently, the bar owner orders 10 cases from the wholesaler at the end of each month. The cases are delivered at the middle of the next month, if the wholesaler happens to have enough beer in his stock. After collecting all orders, the wholesaler sends the beer cases during the second week of each month. Unfortunately, the beer is produced in a distant country with bureaucratic tradition. The brewery takes new orders only on the last week of each month. The wholesaler receives the beer delivery from the brewery during the third week of next month. It is assumed that the brewery is able to deliver any amount of beer. The process is illustrated in Figure M.6.

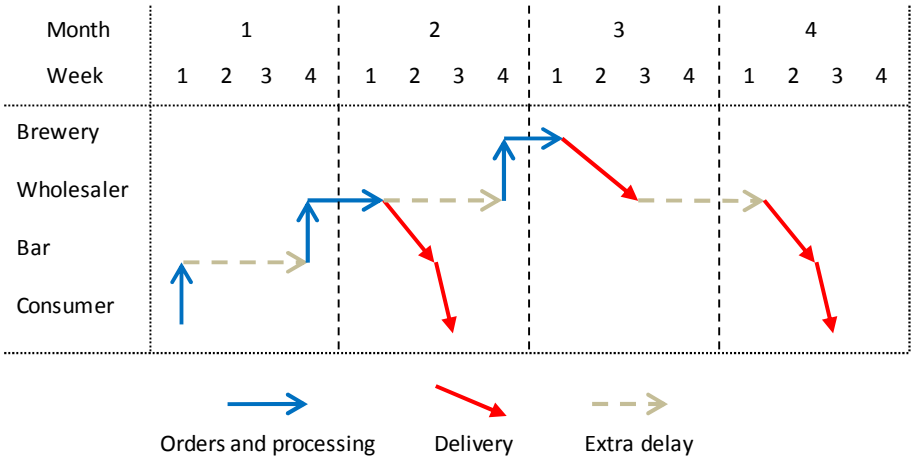

Figure M.6: Ordering and delivery schedule for a special beer.

This schedule generates long delays in the system. If the demand for a specific beer is increased at the beginning of a month so much so that the stocks in the bars and at the wholesaler cannot meet the demand, it will take 6 weeks to get enough beer from the wholesaler to the

consumer, and over 3 months if more beer is needed from the brewery. Clearly, the logistics are not optimized.

This is an informative case for a practical experiment. Students, or any other people including professionals, can act as the agents (bar owners and wholesalers). In a typical setting, the demand is constant over the period under consideration, except that the demand is instantly increased, say, from 10 cases to 30 cases per month. If we assume that each bartender had at the beginning of the month 2 months consumption in his stock, he can serve his customers until the end of the month when the demand is increased. The crucial moment is at the end of month when he has to decide how much to order from the wholesaler. There are three basic strategies (and you can invent more):

1. To order always the same amount as has been sold during the last month.
2. To order the demand plus enough to have extra stock for a month or two.
3. To overreact and order more than what would be really needed. The logic is that an excess order may guarantee a big enough share of delivered beers if the wholesaler has problems to satisfy all requests.

Now if we look at the wholesaler, we notice that he will encounter a similar dilemma. When the demand is increased, the wholesaler receives a much larger number of orders than earlier. If we assume that Bars 1, 2 and 3 adopt strategies 1, 2, and 3, respectively, the wholesaler may receive 30 + 60 + 120 = 210 orders instead of 30. However, the wholesaler has only 60 cases in his stock. We may assume that the wholesaler divides the available cases proportional to the size of the orders, and then informs that the pending orders will be delivered later. As a result, Bars 1, 2 and 3 get 9, 17 and 34 cases of beer, respectively. From this perspective, strategy 3 seems to be best, at least in the short term. The main problem with strategy 3 is that if the bar keeper continues to order excessive amount of beers, he needs to invest in stock capacity.

This is a kind of mild version of prisoner's dilemma, because the overall optimum is something like the following (if we assume that the bar keepers and the wholesaler do not know beforehand that the demand will be increased): The bar keepers do not react before the demand or orders are increased, but after that they behave optimally. In this particular case, this means that:

- Each bar orders at the end of first month 20 cases of beer, at the end of second month 10 cases, and from then on, 30 cases per month.
- Wholesaler orders 90 cases from the brewery each month starting from the second month (during the first month the wholesaler has no indication of the multiplied demand).

Now an alert reader may ask, what is the criterion for optimality? The *metric* adopted here is a simple version of economic efficiency: Each sold case of beer is worth of +1 while each case kept in stock (either in a bar or at the wholesaler) creates a cost of 0.1 per month. Thus, the outcome for the whole system for one month is the total number of sold beer cases minus the total number of cases in stock divided by ten.

This metric does not take into account how the total revenue is allocated between the bars and the wholesaler. This type of optimal strategy is hard to achieve in reality, because available information is limited, and because we cannot assume that independent agents would seek total optimality. Something like this might be accomplished if all bars and the wholesaler were part of a bigger company and similar situations had been common in the past. In a competitive situation with irregular customer behavior, the (theoretical) optimum shown in Figure M.7 serves primarily as a yardstick to assess the efficiency of other strategies.

Now let us assume that the bar keepers and the wholesalers always follow the same strategy for 10 months, and only then consider whether they shall change their strategy. If we consider a period of 10 months, then the optimal strategy, or reference case, generates a total outcome of 652.5.

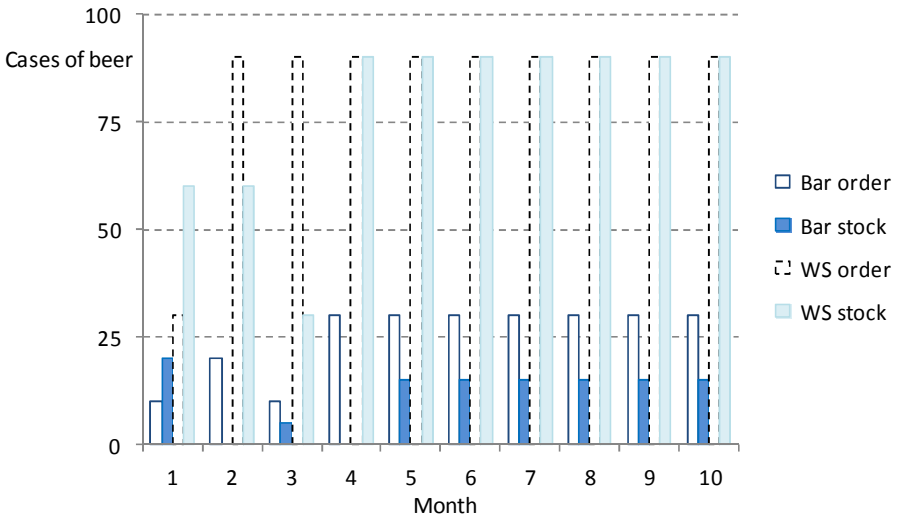

Figure M.7: Bar keepers' and wholesaler's (WS) orders and stock with reference strategy (state 0 in Table M.1).

Moreover, we need to consider the situation from the bar keepers' and the wholesaler's perspective. The outcomes for each bar and the wholesaler during a month are defined as follows:

- Outcome(bar) = sold beer cases – 0.1·(maximum number of cases in stock).
- Outcome(wholesaler) = delivered beer cases – 0.1· (cases in stock + pending orders).

The reasoning behind the pending orders term in the wholesaler outcome is that pending orders may deteriorate a wholesaler's reputation and thus affect the number of orders in a competitive situation (although in this example there is no competition among wholesalers). In

the reference case, the outcome for each bar is 243.5 while the outcome for the wholesaler is 672.

Now we can ask several questions, like:

1. Is the optimal state stable (or Nash equilibrium)?
2. What will happen if each agent seeks individual optimum instead of the common optimum?
3. What is the information each agent has in reality to make reasonable choices?
4. Is the optimized strategy reasonable in diverse situations?

The answer to the first question is, no, it is not stable. If a bar keeper decides to optimize its own business, it can do it at the cost of other agents, if the other agents do not change their strategy.

Let us consider more realistic strategies in which each agent has only limited knowledge and is not willing to execute any complex analysis or optimization algorithm. We may assume that each bar keeper makes the orders based only on:

- the number of sold cases of beer during the last month (S),
- bar's own stock of beer at the end of the month (Q), and
- pending orders at the wholesaler (P).

Furthermore, the bar keeper wants to be prepared for changes in demand by storing an extra amount of beer in stock. Let us assume that bar keepers try to keep either 1, 2 or 3 months sales in his stock. As a result, his order will be:

$$O(bar) = max(0; (n+1)S - Q - mP)$$

where n = 1, 2, or 3, and m = 0 or 1. Note that it is also plausible that some bar keepers ignore pending orders (m = 0).

Now let us start with the (theoretical) starting point with the "optimal strategy," and then assume that only bar keeper 1 changes his strategy from the reference strategy to a (n = 1, m = 0) strategy. This move is reasonable because the outcome of the strategy is better than the outcome of the reference strategy and also better than the outcome of the other bar keepers. This is State 1 shown in Table M.1.

When other bar keepers notice that Bar 1 is performing better than they are, they will follow. As a result all bar keepers adopt strategy (n = 1, m = 0) shown in column 2 of Table M.1. Note particularly that after 10 months we assume that the process is started from scratch with another brand of beer; we only assume that bar keepers have learned something during the previous 10 months.

At this State 2, the situation is special in the sense that the outcome is the same for bar keepers as in the reference case. The reason for this is that the amount of beer delivered to the bars is limited by the stock of the wholesaler not by the orders made by the bar keepers. In contrast, the situation is much worse for the wholesaler due to the larger variations in orders

from the bars. Larger variations bring about much larger amount of pending orders. Consequently, it is both reasonable and likely that the wholesaler changes his strategy. In this case (n = 1) –strategy is essentially better for the wholesaler than the reference strategy. The outcome (State 3 illustrated in Figure M.8) is also better for the given system as a whole (3 bars and the wholesaler) than the result in State 2 even though the outcome is worse for the bars.

Table M.1: States of a logistic system with three bars, a wholesaler, and brewery.

	Outcome with different strategies						
	State 0	*State 1*	*State 2*	*State 3*	*State 4*	*State 5*	*State 6*
Bar 1	Ref.	n = 1 m = 0	n = 1 m = 0	n = 1 m = 0	n = 2 m = 1	n = 2 m = 1	n = 2 m = 1
Bar 2	Ref.	Ref.	n = 1 m = 0	n = 1 m = 0	n = 1 m = 0	n = 2 m = 1	n = 2 m = 1
Bar 3	Ref.	Ref.	n = 1 m = 0	n = 1 m = 0	n = 1 m = 0	n = 1 m = 0	n = 2 m = 1
Wholesaler	Ref.	Ref.	Ref.	n = 1	n = 1	n = 1	n = 1
Bar 1	243.5	257.1	243.5	226.0	232.1	226.9	222.5
Bar 2	243.5	224.8	243.5	226.0	226.9	226.9	222.5
Bar 3	243.5	224.8	243.5	226.0	226.9	223.0	222.5
Wholesaler	672.0	575.3	303.0	532.5	634.5	608.8	583.5
Total	652.5	580.4	468.0	523.5	514.5	468.0	405.0

Then what will happen after State 3 is not so obvious anymore. Each bar has a small incentive to switch from (n = 1, m = 0) strategy to (n = 2, m = 1) strategy. After one bar has changed its strategy, the other bars have an even smaller incentive to change their strategy. If they change, the most likely reason is the tendency to copy the strategy of other agents. Consequently, the likelihood to observe the system in any of the states from 3 to 6 presented in Table M.1 is almost equal. In contrast, there is no incentive for the bar keepers to adopt any other simple strategy than (n = 1, m = 0) or (n = 2, m = 1). What is interesting is that for the wholesaler the outcome depends primarily on the decisions of bar keepers and much less on the wholesaler's decisions. The wholesaler cannot do much to improve his position when there are great variations in the size of orders, as demonstrated in Figure M.9.

In practice, it would be difficult to make precise observations because reality is much more random. The demand does not stay fixed but includes natural variations that easily hide small differences in the outcome. However, even if we add some variations in the demand, the overall behavior does not change, only the comparison between bars becomes more difficult.

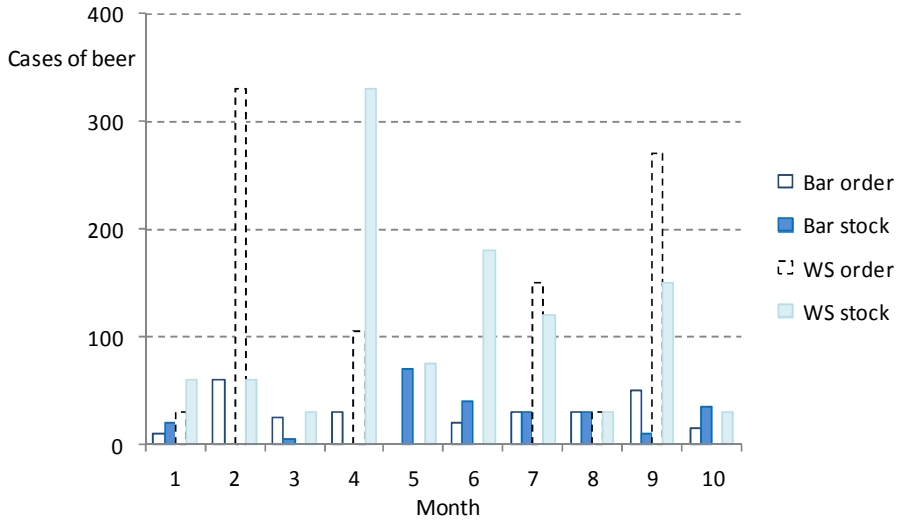

Figure M.8: Orders and stock in State 3 when all bars adopt strategy (n = 1, m = 0) and wholesaler adopts strategy (n = 1).

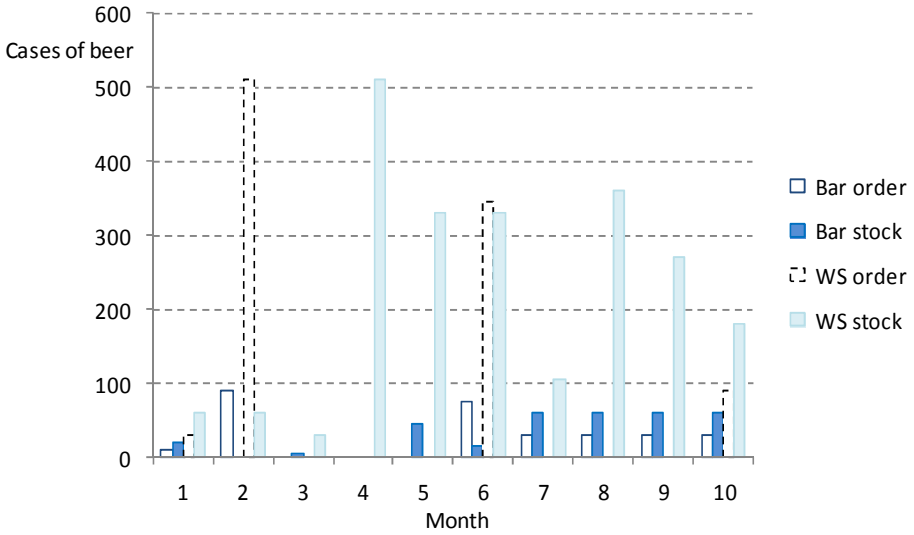

Figure M.9: Orders and stock in State 6 when all bars adopt strategy (n = 2, m = 1) and wholesaler's strategy is (n = 1).

What are the lessons of this fictional experiment for a CEE? First, the observed instabilities are not so much due to the lack of skill among bar keepers and wholesalers, but due to the system structure and delays. Particularly the wholesaler is in a difficult position if the sizes of the

orders from the bars fluctuate in an unpredictable manner. Thus, any considerable improvement to the undesirable system behavior requires a change in the system itself. The most efficient solution includes the removal of all unnecessary delays in the system—which is obvious if you consider Figure M.6.

Bar keepers shall inform the wholesaler about any considerable change in demand immediately without waiting for the regular ordering time. Similarly, the wholesaler shall inform the brewery. Extra deliveries between the regular deliveries should be arranged when the demand is much higher than expected.

As to the idea of control, are there any lessons? It seems, also in the light of this example, that a smooth, best effort principle likely performs better than a strictly controlled fixed system. Think, for instance, of a scenario in which each bar had to reserve fixed capacity for transportation for their cases of beer from the brewery via the wholesaler to their bar, maybe some months in advance. That would create a very predictable outcome, except that consumers act anyway in an unpredictable manner, which destroys the usefulness of this delicate construction of predictability.

Then from the viewpoint of developing control in communications networks, the main lesson is to avoid any excessive delay in the control loop. Then if some delays are totally unavoidable (for instance, due to the limited speed signals), we have to accept the fact that certain amounts of fluctuations will naturally emerge. However, what shall be avoided is to creating consecutive phases of control loops (like between bars and wholesalers, and then between wholesalers and the brewery). If each control loop amplifies the fluctuations in the system, after a couple of loops the whole system may become unstable.

Control principles

The main purpose of this section is to consider different levels of control in parallel. On the lowest technical level, various mechanisms and protocols are used to decide how individual packets are treated. Different control methods take place on the level of session or connections, and on the level of users and customers. On the level of an organization controlling is established by

> **policy:** a set of basic principles and associated guidelines, formulated and enforced by the governing body of an organization, to direct and limit its actions in pursuit of long-term goals.

There is still a higher level of controlling on the level of society, namely:

> **institution**: the laws, informal rules, and conventions that give durable structure to social interactions among the members of a population.

It might be that if a person prefers strict control on one level, he or she is inclined to prefer strict control on all levels. The capability to control either creates positive or negative feelings. That feeling might be, however, totally opposite when the control is directed at you compared

to your own possibility to control something else. In the context of communications ecosystem, network neutrality is an illustrative example of this. You may appreciate the ability of a network operator to control the traffic transmitted in the network and at the same time dislike the idea that someone else defines how you are entitled to use your own Internet access

In many cases, the objective of engineering is to develop means to control different kinds of matters. Thus, the principle of minimum control applied in the Internet might be somewhat strange for an engineer or any person that has a strong desire for order and predictability. Where is the guaranteed quality? Packets are purposely discarded and almost nothing can be guaranteed. Nevertheless, these are the principles that have directed the development of the Internet. Moreover, the current state of Internet corroborates that they are reasonable principles—though some network experts may still disagree. Thus both the best-effort service model and traffic control principles currently used in the Internet (TCP/IP) will likely dominate all networks in which most of traffic consists of data without strict delay and capacity requirements.

I can remember the recurring warnings from the beginning of commercial use of Internet technology fifteen years ago that when video and streaming applications start to dominate Internet traffic, best-effort and TCP will not be able to anymore ensure customer satisfaction. Furthermore, when the Internet becomes the dominant technology it must also support mission-critical systems. The claim was that because of business and technical reasons the Internet needs to evolve towards a more strictly controlled network. Some of the requirements could be fulfilled through operation and management systems, but some of the needs seem to require the capability to control individual connections by means of signaling and traffic control mechanisms.

Streaming video is the most problematic service in this respect. Still, most of the video applications so far have been adjusted to the characteristics of the dominant, best effort service model rather than vice versa. Still, we can identify possible justifications for additional traffic control mechanisms, like limited resources, special requirements of applications, fairness, and willingness to pay. Any of these *may* justify additional control.

Is it more reasonable to design and implement additional control mechanisms when a certain resource is scarce? If resources are abundantly available, why do we need to bother at all? A typical example of a limited resource is radio access capacity in cellular networks. The construction of new base station sites is a major expense for the network operator, and that investment shall be utilized as efficiently as possible. However, that task shall be considered more a business optimization than technical optimization. Thus, a scarce resource can be considered a prerequisite for the need for additional control but not a sufficient reason without other justifications.

As to applications' requirements, an engineer may (and often does) believe that the network must provide special treatment for all applications with special requirements. To put it simply, if an engineer notices a problem, he wants to solve it. If an application does not work properly because the network service is not adequate, that implies a problem. If a special treatment inside the network solves that problem, it has to be implemented. That sounds convincing.

What is the problem with this sort of engineering approach? The problem is the misleading starting point of metric. A more suitable starting point for the analysis is human benefit instead of the requirements of applications. In addition, we shall not limit the analysis to one application and one user. We may argue that applications do not justify any special treatment unless the user somehow demonstrates that the application provides significant benefits for her. Even if the application is beneficial for the user, the network operator has to assess whether the gain for the user of the special application is larger than the loss for all users of other applications. The point is that in order to be relevant the analysis must be done on the level of users instead of the level of applications. If that analysis indicates that the total benefit is positive, then the operator may consider implementing the special control method for the application (but that decision also requires a business analysis).

Human beings are very sensitive to fairness, or actually, a lack of it. However, communications services are typically difficult to observe, which makes it cumbersome to conduct direct comparisons. For instance, two customers that have bought the same mobile data service may get essentially different transmission capacities if they are physically located in different places: one lives near a lightly loaded base station while the other one lives far away from any base station. Is it fair that they pay the same monthly fee? Maybe not, but as far as the customers are not aware of the situation, the service provider has no incentive to improve fairness. Still, it might still be reasonable to put some special effort to improve the fairness of the service, mainly because any clearly observable unfairness reduces overall customer satisfaction.

In a business environment, the most obvious way to assess what is beneficial for customers is the willingness to pay. Thus, the most relevant reason to introduce additional traffic control mechanisms is the willingness to pay or something similar in the case of non-commercial services. Then if there is a clear difference in the willingness to pay, the design of the control mechanisms shall also take into account the other aspects: what resources are limited, what kinds of requirements applications have, what is judged fair, and what cost factors the additional control mechanisms generate.

Note particularly that if the best-effort model (or something similar) results in an uneven distribution of resources, the model might be more acceptable if the uneven distribution is random rather than intentional and systematic. For example, the lottery is considered fair even though the result is highly uneven. Similarly, the randomness of best effort models makes it more acceptable.

Finally, the essential point is that when a user is just sitting at her computer and doing something, it very seldom matters for her what mechanisms and principles the network operator is harnessing inside the network. In contrast, if the user has to participate in the functioning of control mechanisms, the nature of the control does matter. Participation can occur in the form of deciding whether the user is willing to pay for a situation in which the network is congested. The other possibility is that the user needs to inform the network about the importance of each application. However, it seems that users are not willing to interact with the network in that way because it may disturb the primary experience of entertainment or communication. For business customers the situation is often different, because enterprise customers *may* require that certain mechanisms, like strict admission control, be used to guarantee service availability and quality. That need of special control might stem from

organizational structure, division of responsibilities, share of cost, and similar matters that do not directly relate to any end-user need. In that kind of case the network operator's decisions shall be based on business analysis.

What is then a proper metric to compare the aptness of different approaches to control traffic? This is an intricate question. First, it is easy to mix up user and operator perspectives. Operators often justify their choices by taking (or by pretending to take) a user perspective. For instance, someone may claim that because users require that their connections through the network are highly reliable, operator must use connection admission control inside the network (as also I claimed in my doctoral thesis). Or even more strangely, some network operators seem to care more for the needs of applications than their own business or the needs of users.

The reason to emphasize applications might also be related to the nature of the engineering department as a social system. Engineers are inclined to overestimate the importance of technical aspects. That inclination can be, to some extent, beneficial for the engineers both as an individual employee and as a part of social system that interacts with other, non-technical social systems. When speaking about applications and their technical requirements they can use their own language and own expertise. Most of the time there is no intentional plan to utilize special knowledge and abilities to obtain personal gains—but sometimes there might be.

Now let us apply the general concepts discussed in the previous section to analyze the feasibility of three traffic control principles: best effort, differentiated services, and connection reservations. A summary is presented in Table M.2. The table gives possible answers to the question: what is the proper metric to compare approaches to control traffic?

The final assessment of control principles depends on many issues. However, the assessment should not be done based only on capability or performance, because they do not take appropriately into account all relevant cost aspects. In a business or technical environment, efficiency might be the right level of evaluation. From a society viewpoint, *worth* is always the issue to be assessed. In the framework of this book worth is analyzed by using the concept of eudemony.

Lessons for CEE

The main lesson of this section for a communications ecosystem expert is that the analysis of a system must be done on the right level and by means of the right metric. A technical capability to control a system can be useful, but it needs to improve the performance of the system in order to be justified. Any additional performance is justified only if the gains exceed the costs; that is, efficiency must be higher with the control method than without it. In the framework of this book, efficiency is typically assessed by means of economic analysis. In many cases, business efficiency is the primary level to be assessed. In the long term, for instance, when a standardization organization defines new control algorithms, an even higher level of analysis is necessary to assess whether something is beneficial for the society as a whole. That type of analysis should also direct the long-term decisions of commercial service providers and network operators, because, once again, human benefit finally defines what will survive and what will not.

Table M.2: Assessment of traffic control schemes with different types of metrics.

Metric *Example*	*Capability* *Traffic control algorithms*	*Performance* *Throughput, packet loss ratio*	*Efficiency* *Throughput divided by total cost (OPEX and CAPEX)*	*Worth* *Usefulness of a service divided by the total sacrifices*
Best effort service	Low (no specific capabilities)	Low (throughput) and high (packet loss ratio*), or low (packet loss ratio*) and high (throughput)	Low for services with strict packet loss requirement, and high for services without strict packet loss requirement	Moderate for voice and very high for data
Differentiated services with drop preferences	Moderate (ability to differentiate packets)	High (throughput) and variable (packet loss ratio)	Moderate or high depending on the relative amount of traffic on different levels	Low (or moderate) when quality requirements do not vary, and high when quality requirements or willingness to pay vary significantly
Connection reservations	High (ability to provide hard guarantees)	Moderate (throughput) and very high (packet loss ratio*)	Moderate	Low for data, and very high for voice

* High and low refer to performance, that is, if packet loss ratio is small, performance is high, and vice versa.

Copyright issues

This section provides a brief discussion about the role of intellectual properties mainly in the context of copyrights and the music business. Intellectual Property Right (IPR) is a broad topic that would deserve a more extensive discussion even in this book. However, I am hardly the right person to write an appropriate general introduction to IPR issues. Yet, I have some relevant experience as the inventor of 25 patents (owned by Nokia) and as the writer of one textbook (Differentiated Services for the Internet).

During the best year (2000), both the royalties from the book and the direct bonuses from the patents represented about 5 percent of my total income. Although the book and the patents likely affected my salary level at Nokia, I have never been primarily an author or inventor. That is the case with a great majority of people doing somehow creative work: even when they get some royalties based on the number of sold units of music or text, their living has to be based on other sources of income. At least for me, the most important reward has not been money but the deep satisfaction during the moment of creation. In my case, this comment particularly concerns the moment of inventing a couple of key patents, but I believe

that the comment is generally valid for many artists as well. In addition to my personal experiences, the main source for this copyright discussion is Lawrence Lessig's Free Culture (2004). My main objective is to link the copyright issues to the more general topic about attractiveness of control.

Once again, the starting point for an analysis that attempts to be relevant must be human benefit. What is the meaning of music, or more specifically, what is the evolutionary reason for music as a human activity? Without going too deeply into this intricate issue, we may notice that during the long history of music, a great majority of music has been performed within a group of people. The primary role of music has not been to obtain amusement by listening to music alone. We may argue that the strong feelings evoked by music date to those ages when a coherent community was a prerequisite of life, and music was an important way to achieve that goal. Thus, sharing is the essence of music of experience, both sharing between the performer and listeners, and between listeners. Note that each listener may also have an active role in enhancing the experience of other listeners, and thus significantly increase the value obtained from the musical experience. As Ian Condry (2004) has expressed:

> "If asked directly by a friend to share music, sharing is the only reasonable thing to do."

That is the fundamental nature of social interaction, also when it is related to music. In brief, the nature of music is to be shared. On the contrary, the music industry seems to treat music as a product sold separately to each person for quick consumption. One may also ask whether music can really be *consumed*. From a business perspective, the ideal situation is when a distinct piece of music is attractive at the moment of purchase but loses its appeal rapidly after the purchase (in order to leave room for new pieces of music to be purchased). Note particularly that this is an automatic consequence of the business logic, not the fault of any individual person or player.

However, the real power of music is not in the product created by an industry but in our common evolution, in the content created by composers and artists, and in the ability of the content to create benefits for people. Moreover, the creation of novel music does not happen in isolation but it is always based on a long common tradition. Thus, a great majority of the value of any music stems from our common history, a smaller but still significant part stems from the creativity of individuals, and an even smaller part is related to the product provided by the music industry. Why then does the music industry have such a strong position in the current system of music consumption? The reason is related to copyrights.

There are at least three main viewpoints to copyrights: legal, utilitarian, and moral. Let us first take an example from another field. Let us assume that someone consumes time, effort, and creativity to develop a new game played with ordinary playing cards. What shall be the "rights" of the game developer? Shall the developer have the right to control whether or not other people are allowed:

- to play the game by using ordinary cards,
- to develop a computer game based on the rules of the game,
- to use the rules of the game in gambling,

- to publish the rules of the game in a book, and/or
- to use some of the rules of the game as a part of a more complicated game?

You may consider these questions yourself from different viewpoints, and then compare the opinions to the situation with music. Someone may still argue that music is essentially different from a card game. Maybe so, but in which sense? A card game also tightens communities, provides enjoyment, and the development of a new game requires creativity.

I do not know whether the law says something specific about the rights of the developer of card games. As a general remark, even in the US with extensive copyright laws, copyright "has never accorded the copyright owner complete control over all possible uses of his work" as stated by the Supreme Court of US (see Lessig 2004, p. 78). In general, what the legal rights are in a particular society, at a particular time and related to a particular issue, is a matter of common agreement. However, the agreement is usually not an arbitrary one, but is justified by some other viewpoint, utilitarian, moral or something else.

The justification for a law seems often to be based on some kind of utility. We may ask: what type of protection would generate the best variety of new card games to be played in a society? I would say that probably an approach in which playing games with ordinary cards is free. Although the issue is less clear for card games played on computers. Nevertheless, very strict copyright rules are rarely useful from a utilitarian viewpoint.

Finally, there is the moral viewpoint, usually presented from the viewpoint of the initial creator of a novel thing. It also seems that from moral viewpoint different activities are appreciated differently. Note that patents provide much shorter protection than artistic copyrights. Why do the descendants of a composer have rights to a song long after the death of the composer while the developer of a new medicine will lose her rights after 20 years, or so? For instance, Jean Sibelius died in 1957, thus Finlandia (Op. 26) composed in 1899 is still protected by copyright law: you are not allowed to publish the notes without permission. In my mind, the situation is weird. Fortunately, the rule used with art is not valid for inventions like the transistor invented in 1947, because the inventors, Bardeen, Brattain, and Shockley, died as late as in 1991, 1987, and 1989, respectively.

What is the fundamental difference between the creation of music and the invention of technical devices? The difference is not as significant from the human viewpoint as it is from a business perspective. Because regulators define the rules, the strongest business players, naturally, pressure regulators to create rules that are beneficial for them. The copyright owners and distributors seem to be successful in that endeavor, partly because the other two players, artists and consumers, are much more diverse and often have conflicting interests. However, it is not so clear whether the strategy to endlessly increase the scope, depth, and duration of copyrights has been beneficial for the whole sector of music.

As to the patents, the structure of the game is different, because patents are typically used to gain an advantage over other big players rather than to control consumer behavior. Even in the case of patents, the opinions about their true benefits vary significantly. It might be that some level of legal protection increases the motivation of enterprises to develop new technology. Excessive rights might also be harmful because they raise the threshold for new entrants to enter an established market, and therefore, decrease competition. This is obviously the

situation in case of mobile devices in which the established companies have tens of thousands of patents. Note also that the real threat is not so much in the power of individual patents but in the extremely high cost of possible lawsuits.

Then if we return to the example of card games, would it be morally right for the creator to get compensation whenever someone plays the game he has invented? In my opinion, no. Apparently, there is no universal moral rule saying that a creator of an intangible invention, card game, song, novel, cartoon, or whatsoever, is entitled to dictate how others shall use the invention, unless others try to make business out of the invention. Here is the core of the whole issue: only a significant business interest creates the need for copyright regulation. The concept of copyright was invented just as the possibility to create a business copying content emerged.

The complexity of the issue (what is right and in which sense) provides a good opportunity for some stakeholders to offer simple, attractive statements, such as file sharing is robbery and endangers the livelihood of poor artists. Usually the simplest answers are presented in the moral space, whereas the motivation of those who construct the answers is located in the business space. "We want to guarantee a positive cash flow for the next 50 years" does not appear as good a justification as "we want to protect the rights of the poor artists."

If you develop a card game just for fun, the whole question of copyrights and business opportunity will likely not come to your mind. Only when the boundary between fun and business is crossed, the questions of rights emerge. The first time this happened was when book printing became feasible as a relatively small business, that is, in the beginning of 18th century when British Parliament enacted the first copyright act (see chapter 6 in Lessig 2004). Already then, the main dispute was not between the creators of the content and consumers, but between established players and newcomers in a business sector, as illustrated in Figure M.10.

The target of the established players might be to form a permanent situation in which a small number of players dominate the business area, for instance, book publishing or radio broadcasting (see Lessig 2004, p. 194 - 199). Only the largest enterprises can afford and manage expensive and complex systems needed for copyright protection. In that situation, the large companies have a strong bargaining position with both artists and consumers. Only the most successful artists have a well-matched position with large companies, while a great majority of artists have to sell their rights with terms defined by the music industry. The conclusion by M. Geist (2005) was:

> "Given the tens of millions of dollars that the Canadian government spends annually to support the creation of Canadian music, it is apparent that the relative impact of lost royalties due to file–sharing pales by comparison."

So what does this brief discussion about copyrights in the domain of music reveal about control in general? I can identify two reasons for the popularity of control: first, the positive feeling of increased certainty, and secondly, the possibility of powerful players to define rules that are beneficial for them.

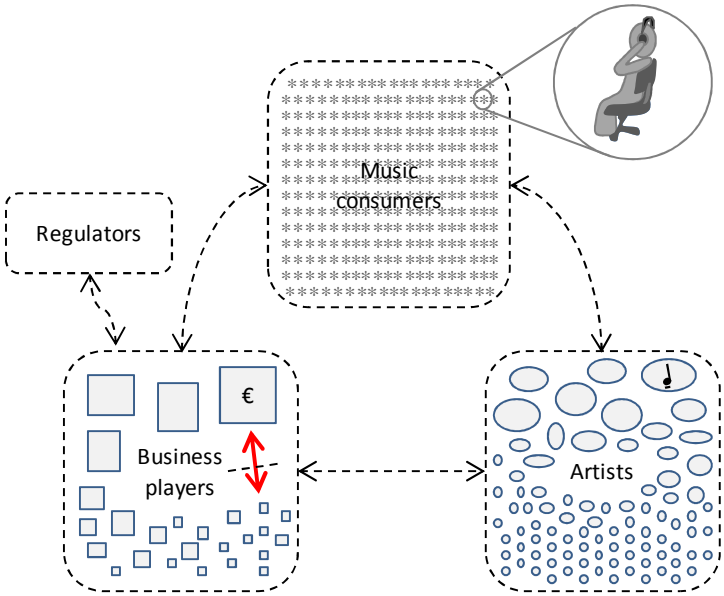

Figure M.10: The main stakeholders and their relationships in music business.

Increased control is attractive typically because it seems to satisfy some inner need for decreasing the uncertainty of future events. If we have this and that control, the outcome will be this, otherwise we do not know. A sure outcome, such as small royalty for a musician, is usually considered better than a less clear situation which may still be much better (even economically) for less popular musicians. However, an increase in control typically increases the certainty about some measurable outcome while it might decrease the certainty in the overall system behavior.

Let us take a rough example: prohibition of alcohol (for instance, in the United States 1919 - 1933 and in Finland 1919 - 1932). It was obvious that prohibiting the selling of alcohol guaranteed that it was more difficult to acquire alcohol, but at the same time, it changed the society as a whole towards an unpredictable path of evolution. In particular, the smuggling of alcohol from neighboring countries considerably increased violent crimes. The stricter the control, the more pressure there is for all players to find clever ways to adapt to the external control. It is always much harder to predict how the system will adapt to additional control methods than to predict the direct effects of control.

As to this book, the point in case is the figures: although all of them are drawn by me, some of the figures (including the sphere of emotions in Figure H.5) are partly based on figures made by other authors. Should I ask permission from the authors to utilize their drawing? Obviously yes, if I had copied the figure exactly in the same format and with the same terms. Am I allowed to put 16 emotions inside a sphere and use the figure in a book without asking explicit permission? I hope so. Of course, I refer to the original source, but the idea to ask permission for utilizing a simple picture format sounds strange (lawyers may

disagree). Besides, how could I ever know who really is the original creator of certain kind of picture? Maybe someone in ancient Greece has already drawn a similar picture with 16 emotions in a circle. Is this uncertainty about rules and procedures one reason why there are so few figures (if any) in many textbooks?

Book recommendations

The Arbinger Institute, 2010, *Leadership and Self-deception, Getting out of the Box*, San Francisco, CA: Berrett-Koehler Publisher.

> There are books that I can recall intentionally, and then there are books that have an automatic and permanent influence on the unconscious part of my mind. This book belongs to the latter category. Leadership and self-deception presents a crucial message that is presented in so lively a way that you cannot forget it. If you want to be a leader in your life, please, read this book.

G. Hamel, 2007, *The Future of Management*, Boston, MA: Harvard Business Review Press.

> Gary Hamel's ambition is to set a new agenda for management. Management ideology was largely based on strict control during the industrial age. In contrast, Hamel wants to utilize the full potential of us to fulfill human needs and even makes questions like: what higher purpose does your company serve? The advice given in the book can be highly beneficial for every manager.

P. Senge, 2006, *The Fifth Discipline, The Art & Practice of the Learning Organization*, New York: Currency Doubleday.

> Fifth discipline is one of the most important books in the area of management. Management is about mental models, some of them are useful while some others are harmful. Thus, it is crucial for you to develop your capabilities to create, maintain, and apply mental models. Systems archetypes are highly valuable in that effort.

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