# Having seen the light
Broadband Twente Foundation
Province Overijssel
Province Gelderland

# Contents

# Having seen the light

We are on the eve of an exponential increase in data offering and data use. The broadband infrastructure has meanwhile become a vital facility, also in corporate disciplines. But what is broadband, what can you do with it, which interests play a role, what technologies are available? Some knowledge of this crucial subject matter is vital to policymakers and businesses alike. As the decisions we take now, will have far-reaching consequences. A number of years ago, a group of people in Twente (Easthern region province Overijssel) from various disciplines and organisation put their heads together. This vanguard developed the Twente Model. Together they formulated the ten Twente Broadband Commands. Their experiences and insights have been incorporated in this book, so that each and everyone can capitalise on it. This information is shareware. This book further contains a substantiated plea for an open infrastructure with open standards. Fibreglass can literally transport data through light (at the speed thereof). The Twente vanguard hopes to achieve that with this book, everyone will see the light.

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**The 10 Twente Broadband Commands**

**Once and for all we build a dark fibre network infrastructure.**
Fiber optic is proven technology to ensure future proof and scalable communication networks

**We will deliver open and truly transparent connections between end users and the digital market place.**
Meaning a point to point Ethernet-connection based on dark fiber thus scalable

**In our contracts we make a clear distinction between data services and data transport.**
Free choice of services, no forced contracts

**The principle of open network will be accomplished with no exceptions**
In order to ensure openness the owners of infrastructure will have no final say in who will deliver the network services on its network

**Municipalities will adopt a smart strategy for integrating ICT in public work**
Meaning demand bundling, no cherry picking and integrating ICT infrastructure into their daily planning for public works

**Every service provider will be connected under equal conditions**
It is essential that every service provider connects to the nearest digital market place
**We will provide fiber to the home**
Homes will be passed and connected in the most effective way
**We will guarantee every customer a fair choice between several services**
Meaning Ethernet services including VLAN's
**We operate within a broader public scope**
Efficiency, cost prices, transparency, broadband infrastructure as a public good
**Internet access is threated as a service and not as a part of the network**
Internet is not an integrated part of the network infrastructure and will not be supplied as such. Level playing field for all internet service providers

Stichting Breedband Twente (Broadband Twente Foundation)
Province Overijssel
Province Gelderland

## Preface on behalf of Broadband Twente

When the first cars trotted along the (unpaved) roads, no-one could foresee the current congestion problems, let alone the effects cars were to have on our lifestyle. Yet, no-one will deny that the government has made a substantial contribution to prosperity by constructing roads. A proper road network is of major economic importance. Roads, markets and other connections attract people and economic activity. Many cities and villages were created as a result of it and it forms the very basis of our current prosperity. The new generation of entrepreneurs too will want to be close to a connecting road, a digital one this time, made of fibreglass. So they can use it to send all their new products, services and visions to their clients with a minimum of obstacles, at the speed of light and at any time and to any place in the world. In brief, together we are at the eve of enormous social changes. Businesses and organisations are developing rapidly. New products, services, markets and insights are following each other in rapid succession. Old models lose their validity and new models are often too fragile to survive on their own. A vision is important, particularly in these times. A vision of the modern digital infrastructure, which has proven its strength in Twente, is expressed in this book. A new market has been created. It is a digital market. Surely each market needs regulation to some extent, new markets in particular. Access to digital marketplaces must be secured for both small and large businesses. After all, we cannot expect 'the market' itself to offer that guarantee, whereas this access is of a general interest. If, at the time, the government had allowed the railway companies to muddle on, the nationwide railway network would never have materialised. All smaller railway companies had good individual business cases, but it did not serve the general interest. Many companies were formed partly thanks to their favourable location along the railways, waterways or motorways. And a motorway is of course open to all users. The same applies to the digital highway. Hence there must be an open fibreglass network. I am thoroughly convinced that we can no longer do without such an open network. Likewise, I am absolutely sure that we are unable to forecast the effects of such a network. However, the fact that the Twente Model holds the future is without any doubt. The successes speak for themselves. We cannot stop the future, the best we can do is slow development down by making the wrong technological choices or, as a government, remaining sidelined for too long. A fibreglass network stimulates, enhances and renews local and regional economies. That is in the interest of businesses and

residents alike. The Twente Region recognises the importance of an open fibreglass network and is acting accordingly. It would be a positive thing if more municipalities and parties would start to see the light and join the source, thanks to this book for instance. I raise my glass to that!

Eric Helder
*Alderman responsible for Economic Affairs in Enschede*
*Chairman of the Broadband Twente Foundation*

## Preface on behalf of the province of Overijssel

Whoever looks back on the year 2000 and realises to what extent the application and use of ICT has increased in society in such a short time, will understand the importance of a solid basis for digital information and communication. That basis consists of various elements, the first one being an open broadband infrastructure on the basis of fibreglass. This booklet shows how much and how quickly entrepreneurs, governments, education and research institutes located in Overijssel - with Twente and Deventer as its pioneers - have invested in linking up with that infrastructure. In doing so, a deliberate choice has been made for an open model which separates infrastructure and services. The advantages thereof, for businesses, institutions and authorities, will be discussed in detail in this booklet. The practical matters and obstacles that can be faced and for which solutions have been found are also discussed. Technical and organisational aspects of installing broadband connections will come up. However, installing access roads to the digital highway alone will not suffice. Just as important is accumulating knowledge on new applications offered by broadband in everyday life and the actual deliverance of new services. Not only does this include classic services such as Internet access, telephony or remote workplace management, but also CCTV security in corporate grounds and all sorts of visual communication in the healthcare and education sectors. The developers of these new services for businesses, authorities and consumers have a great interest in a reliable, open and low-threshold fibreglass infrastructure, one that ultimately reaches into the capillaries of society. It must be possible for new applications to be available via this infrastructure through fast and low-cost connections. This way, new economic activities are stimulated, subsequently contributing to prosperity and wellbeing. Innovation is absolutely vital in order to continue to be able to compete as a business and a region, also in a digital world. That innovation does not come from large businesses alone. Smaller, regionally active players too develop new services and want access to digital marketplaces. A host of talented young entrepreneurs is eager to conquer the market. Twente University and Colleges are preferred suppliers for new companies. And this new talent wants to enter the worldwide web to market their innovations. We must retain and increase the lead that the Netherlands have gained in making available broadband connections. Lots has been realised already and more initiatives are being developed, certainly so in Overijssel. In order to be successful in this, close

and positive cooperation appears to be important. A cooperation which is more and more put into effect digitally and, as a result, has every interest in a proper broadband infrastructure. During the 2005-2007 period, thanks to the support of the Broadband Action Programme of the province of Overijssel, many innovative trial projects have been carried out. Now the time has come to share the knowledge that has been gained and to apply the services that have been developed in a wider scope. This booklet invites you to do this.

Carry Abbenhues
*Deputy for Economics, Tourism and Employment*
*Province of Overijssel*
*April 2007*

## Summary for politicians

The digital world is global. The co-production of goods and services by businesses, often in regional ventures, is also a global trend. The digital sale of goods and services has assumed enormous proportions. It effortlessly crosses regional and national borders. Regions in which mutual broadband connections are common property can respond to these trends quicker. This means that fast, affordable and reliable data connections are becoming increasingly important. In more and more regions, authorities and business sectors work together to realise such connections. Not only in a country such as France, but also in Asia, for instance.

Lots of data traffic is taking place between businesses within the same region. That data traffic is growing and new services generate even more data traffic. Furthermore, the trend shows that an increasing number of products and services feature digital components that need refreshed data on a regular basis.

Decisions on the installation and management of an important infrastructure are made today. These decisions will affect economic life and more for some time to come. We are at the eve of an entirely new era. An era of digital networks, locally, regionally, nationally and globally.

Today, major businesses and organisations capitalise on the advantages of a fibreglass infrastructure through their own networks. By using ICT, they gain competitive advantages. It is time to allow smaller businesses and organisations to capitalise on these advantages as well, enabling new services. This will contribute to local and regional economies.

When constructing or revitalising business parks and commercial premises, it is both crucial and relatively cheap to include broadband access facilities at the same time. It is, however, important how that is done, who is responsible and how we secure the future management of that infrastructure. After all, many companies have meanwhile become dependent on their digital infrastructure. Who will own the digital infrastructure? Who determines what can be sent across it and how much is it all going to cost? We cannot leave that to the market alone. The market is not a properly functioning market as yet and it is under threat of becoming a monopoly or oligopoly

of some major commercial players. However, a proper and low-cost digital infrastructure is important to practically every social playing field (business community, education, healthcare sector and the government). Parties who deem continuity and social return more important than maximising profits must occupy the bare network and the marketplace. The remainder, the active part of the infrastructure and the services, must be accessible to all. To many regional economies in the global economy, the fast realisation of broadband in a region is more important than the higher profits offered by a more limited rollout of infrastructure providers.

The municipality can dig cheaper than no other party can. The costs of creating broadband access only form a fraction of the costs that are involved with the construction or revitalisation of business parks or the construction or alteration of commercial premises. In addition, digging must take place anyhow, further reducing any costs for creating broadband access. These are the natural moment to realise that access and to include the costs in the exploitation.

As is the case with the road, gas and electricity networks, the construction, ownership, maintenance and management of the digital highway creates natural monopolies which require to be actively directed by the government. Otherwise, only the (commercially) most attractive locations will be provided with access. Furthermore, there is the risk that commercial network owners abuse control of access to their networks by keeping the costs of access for external service providers artificially high. This in its turn will slow down the development of new services.

Through an open network, ownership of the network is detached from the service delivery. The service provider may be an entirely different party than the actual owner of the network. Basic principle of an open network is accessibility for all service providers, on equal conditions. Within that context, the service provider is neutral, they have no interest in terms of which providers are or are not given access to the network. The advantage of an open network is that the client (consumer or business) has maximum freedom of choice in the type of services that he/she/they want(s) to purchase and in the service provider which offers this/these service(s). Since there are multiple service providers, competition takes place at service level, which can lower the overall price and increase quality.

The role of the government more and more changes from service and product provider, to facilitator and framework provider. Frameworks within which market parties need to operate. Here, the government monitors access, quality, price level of the infrastructure, services and products. Hence it plays a crucial role in regulating marketplaces and stimulating the formation of new markets, processes, services and products. Today, broadband, in addition to energy, water and sewerage is the fourth of the utilities. Therefore, the challenge for those politically responsible is to secure the future economic backbone. It is partly the responsibility of the political decision-makers to timely organise things on the demand side and to provide a piece of the infrastructure puzzle; for instance, by installing empty pipes, where necessary, with a mandatory connection to a neutral marketplace.

## Summary for policymaking officials

Today, broadband, in addition to energy, water and sewerage is the fourth of the utilities. When constructing or revitalising business parks and commercial premises, it is both crucial and relatively cheap to include broadband access facilities at the same time. It is important how that is done, who is responsible and how we secure the future management of that infrastructure. After all, many companies have meanwhile become dependent on their digital infrastructure. So who will own this digital infrastructure? Who determines what can be sent across it and how much is it all going to cost? The market is not a properly functioning market as yet and it is under threat of becoming a monopoly or oligopoly of some major commercial players. However, a proper and low-cost digital infrastructure is important to practically every social playing field (business community, education, healthcare sector and the government). Thus the bare network and the marketplace must be owned by parties who do not pursue maximisation of profits, but continuity and social return instead. The remainder, the active part of the infrastructure and the services, must be accessible to all.

The municipality can dig cheaper than no other party can. As is the case with the road, gas and electricity networks, the construction, ownership, maintenance and management of the digital highway creates natural monopolies which require to be actively directed by the government. Otherwise, only the (commercially) most attractive locations will be provided with access. Furthermore, there is the risk that commercial network owners abuse control of access to their networks by keeping the costs of access for external service providers artificially high. This in its turn will slow down the development of new services.

Municipalities must make a plan. A geographical pipe design which, like the sewerage network, is approached on a project basis. The municipal project agency must have a pipe master plan. The administration thereof too must be regulated. The documentation of all mutations is best regulated regionally.

From a policy-technical point of view, it is a matter for the economic affairs department to prioritise broadband. Executive departments must be aware of the key elements therein and how to implement them. This means formulating proper preconditions during the planning and tendering process.

Analogue to the EIA, a further possibility is to make a Digital Impact Assessment (DIA) mandatory.

*Points for consideration when formulating an access plan*
- A simple plan is preferred. This is because there are often uncertainties in terms of the use of the infrastructure in the future. Time and again, practice shows that plans change prior to creating the actual connections. Elaborate and detailed designs on the basis of a fully redundant (bilateral access) ring structure are costly and will cause the construction to be expensive. In general, what is important in this phase is that provisions can be realised at low cost by combining previously planned activities. Hence a high level of pragmatism is recommendable.
- Where will the pops be installed and suchlike; does the business park offer space to accommodate equipment with the necessary provisions later? If no facilities are offered in this respect, where does the potential accessibility for the park as a whole lie? These points can be decisive for the structure of the installation.
- What are the distances in the park and between individual businesses?
- Working safely with glass. In the event of tenders, it is advisable to avoid health claims by demanding that specialist staff is protected against glass particles which may be released when working on a cable.
- Is it possible to issue a date on which the infrastructure becomes operational? Installation in the verges of the road is easier when creating subsequent access than installing in the middle of the road.
- Can we make provisions to facilitate an easy passage across roads and water later? For example, arrange for drillings that need to be carried out anyhow with a larger diameter.

The details of the plan must of course be sufficient in order to register and manage the provisions made. With that, the choice of systems can impose additional requirements. Often the most straightforward and effective way for governments is to opt for installing an empty pipe-in-pipe infrastructure (or having this installed), with the added requirement that it connects to a public marketplace.

# Introduction

## Introduction

Clean drinking water and connections to the water and sewerage networks. We all take it for granted in the Netherlands. Yet it was not that long ago that only the rich had access to that. Thanks to this water infrastructure, the wellbeing and life expectancy of the average Dutch national has improved considerably. We can see the same development in broadband. At one time it was only available to the happy few; meanwhile broadband clearly becomes increasingly vital to a great many organisations. It will not be long before we start asking ourselves how we ever coped without it.

Think of broadband today and you think of fibreglass. Enormous reels and people digging becomes a recurrent sight in the city and surroundings. Everywhere we look we can see blue and green cables disappearing into the ground. Those cables consist of flexible glass fibres, packed in flexible tubes. Sometimes these tubes are packed into bigger tubes. Glass fibres are extremely thin threads through which flashes of light are sent. Smart boxes (switches, exchanges etc) translate these flashes of light into little packages of data and vice versa. Everyone understands the very basics of the technology. However, more insight is needed, certainly so among the policymakers. After all, major social interests are at stake. Decisions on the installation and management of an important infrastructure are made today. These decisions will affect economic life and more for some time to come. In order to take the right decisions, we need to be well-informed. Knowing the key factors and examples we can learn from. After all, we are at the eve of an entirely new era. An era of digital networks, locally, regionally, nationally and globally.

### Economic interest

This book discusses the economic interest in particular. Businesses and authorities have a direct interest in this. When constructing or revitalising business parks and commercial premises, it is both crucial and relatively cheap to include broadband access facilities at the same time. It is important how that is done, who is responsible and how we secure the future management of that infrastructure. After all, many companies have meanwhile become dependent on their digital infrastructure. Without affordable connections (telephone, Ethernet, Internet), they are doomed. Having no digital connection for more than one day can be fatal for some companies. Many companies may as well give up when the data stored on their in-house server is destroyed due to fire or calamities. Today, data can be stored safer, in a secured data centre. Hence some urgency with broadband access is required.

Digital services and applications (data storage, communication, security, multimedia, server capacity, teleconsulting and videoconferencing) have entered the scene and are only set to increase. This will change our working methods. Continuous communication with suppliers and clients, co-production and virtual chain formation; we have already grown accustomed to it today. Meanwhile, most machines are already software-controlled. Maintenance, replacements and instructions are carried out more and more remote. Businesses that already use a digital highway internally, often still need to cross a digital sandy path or cycling path such as ADSL externally. Using fibreglass, all traffic will be travelling on a wide digital highway. Companies already working with fast connections internally will be given the same fast connections with the outside world, thanks to fibreglass. If the connections are fast enough, small companies can even form one single large virtual organisation. This brings all associated scale advantages. This way we will create more and more new chains of small companies, instead of new multinationals.

There is a new perspective regarding the employer and entrepreneur. According to the Volkskrant newspaper (2006), young people (born after 1988) live in a digital reality for many hours per day. This is only set to increase dramatically as and when this so-called Einstein generation is growing older. Bulk users of broadband are on their way. They are social, always online and do not think in series, but in parallel. They use the computer as a social machine for chatting, self-publishing, sharing, gaming, purchasing and sales. They are smart zappers and surf the world for knowledge and contact. They share videos, photos, texts and music. They make and live in digital networks. They will only consider it to be natural in their later working environment. The fast online sharing of information will be as common as breathing. 'Mum, how on earth did you do things in the old days, without a mobile and MSN?'

### Crossroads

At all levels, there is a terrible lack of knowledge of the new opportunities. This needs to change, as decisions can have far-reaching consequences. By

designing the future infrastructure with flaws or making it accessible to large and financially strong businesses only, we will miss the boat. The much needed small and promising companies, for instance, are hardly given a chance on growth markets dominated by mega players. Cable companies and telecom operators have major interests to protect and are acting accordingly. It is understandable, yet it may not contradict social interests. After all, the future of a crucial infrastructure is at stake. A proper and low-cost digital infrastructure is important to practically every social playing field (business community, education, healthcare sector and the government). The manner in which we realise that infrastructure is crucial, otherwise we lose the momentum.

Services and goods are becoming cheaper and better by sharing labour. This brings increased prosperity as well as perhaps wellbeing. The best thing is to allow others to do what they are good at and leave the remaining tasks to others. Broadband enables businesses to capitalise on their strengths. Broadband is important to entrepreneurs. Hence in the first chapter we will discuss opportunities for businesses.

Society finds itself at a crossroads. That requires vision from the government on important issues. This will be discussed in the second chapter. Because who will own the digital infrastructure? Who determines what can be sent across it and how much is it all going to cost? We cannot leave that to the market alone. The market is not a properly functioning market as yet and it is under threat of becoming a monopoly or oligopoly of some major commercial players.
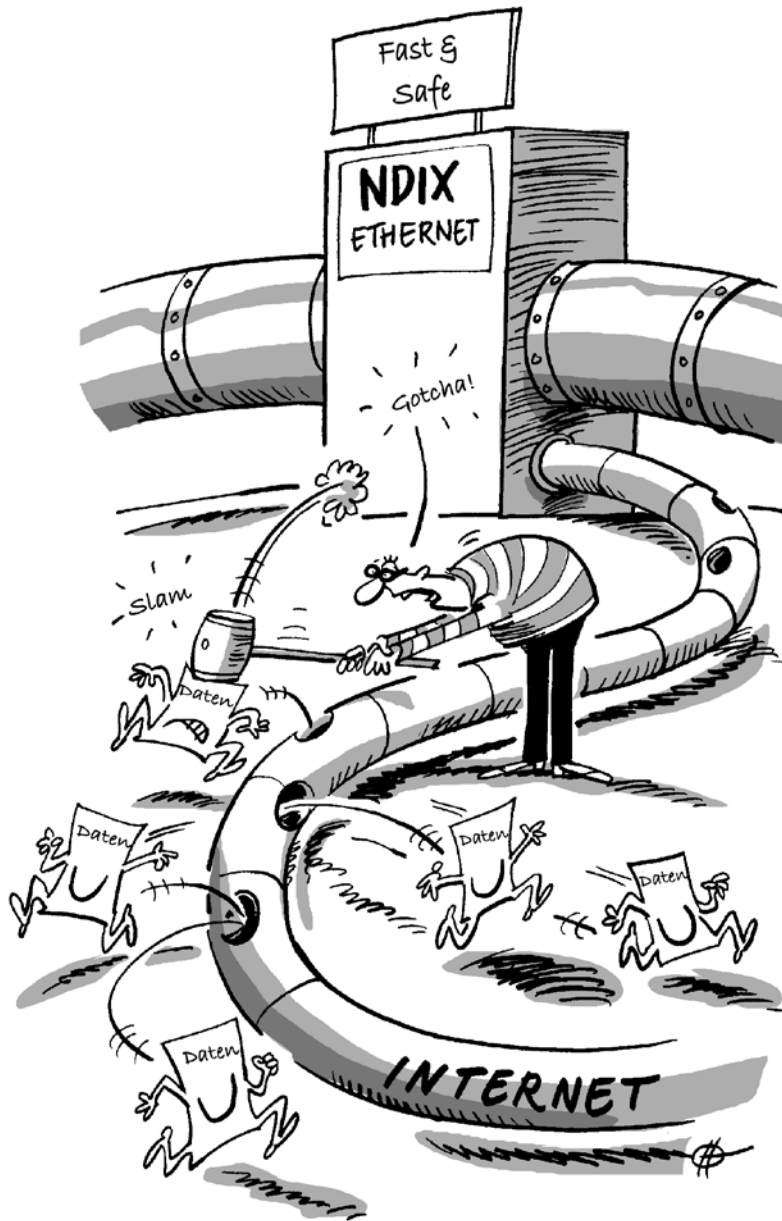
We can learn a lot from the experiments that have been carried out already. Solutions have been thought of and implemented. The Twente Model, for instance. It is tested and proven to be successful. Basic principle: usage for all, on equal conditions. In order to reach this, separating services and transport is a principal requirement. High bandwidths can be scaled up further at realistic additional costs. This will be discussed in the third chapter.

The technical matters are discussed in depth in the original Dutch booklet, but are not part of this translation. The technical part contains a wealth of information on VLANs and the difference between Ethernet and Internet. Incredibly useful knowledge to have at hand pending a meeting with a

supplier or engineers. Technological principles: Ethernet instead of Internet: a reliable and easy to secure infrastructure, suitable for any service. This can be realised with fibreglass through a public piping system, an open network. Transparent and secure; as a memory aid: ego = tv (Ethernet, Glass fibre and Open Network are Transparent and Secure).

# 1

**What does broadband mean
to entrepreneurs?**

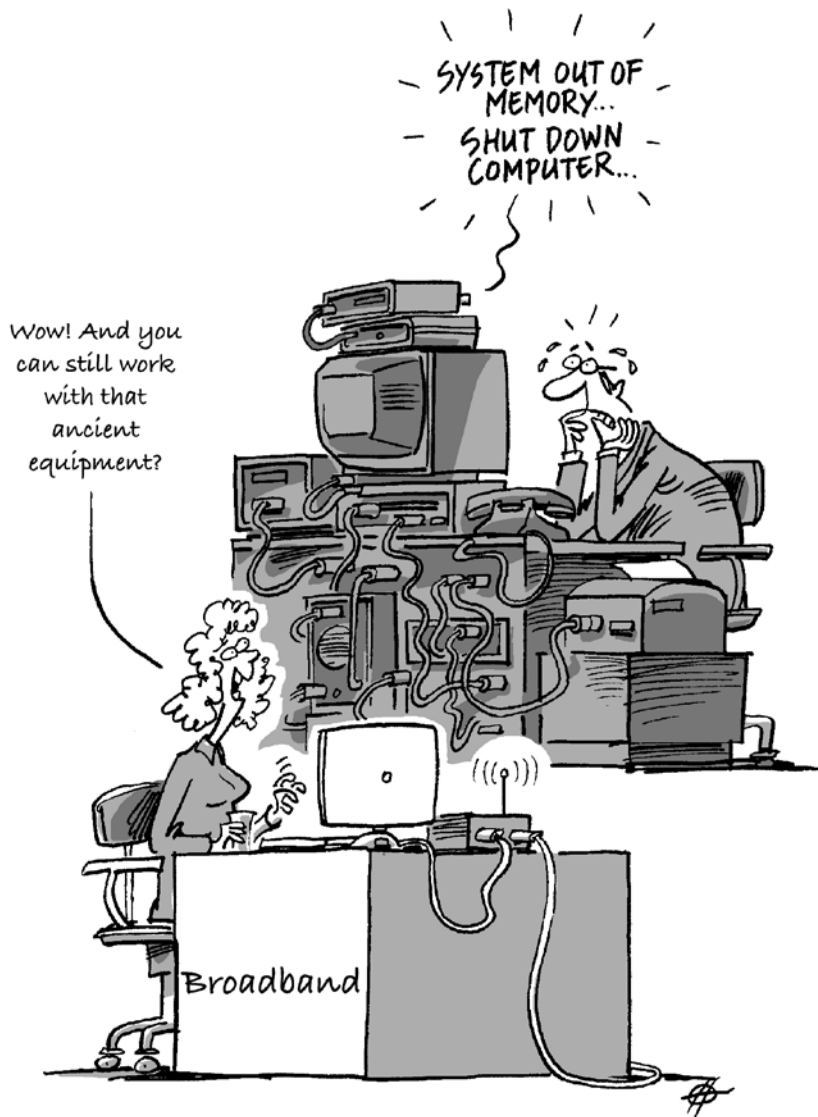# 1 What does broadband mean to entrepreneurs?

Today, entrepreneurs often lack a clear insight into what broadband parties have on offer. A 100Mb offer is meaningless, if we do not know what services we can use at that speed. And provided by whom and at what rates? If we can only use broadband for cheap telephone calls, we miss out on too many opportunities. It is as if we are given access to a fast car, but we only fancy its seating without actually driving it.

Today, major businesses and organisations capitalise on the advantages of a fibreglass infrastructure by means of their own networks. By using ICT, they gain competitive advantages. The time is ripe to allow smaller businesses and organisations to capitalise on these advantages as well, which in its turn enables new services. Why is it that large-scale companies can outsource their entire ICT at low costs, whereas small entrepreneurs still need to spend valuable time on maintaining their computers? Wasting all those hours on updates? Each time, having to download and install new spam filters, virus scanners and other malarkey. Another party can often do this better, quicker and, foremost, cheaper. Provided that the supplier can reach the small entrepreneur with a secure, fast and low-cost broadband connection.

Entrepreneurs are hardly ever aware of the new possibilities and the advantages to be gained. When entrepreneurs are not informed thereof, they are not in a position to know which technologies have meanwhile become available. Let alone how their corporate processes are affected by these developments. Yet there is no escaping it and it will happen fast. Telephony becomes more than calling alone. It will develop into another type of service: speech data integration. Each telephone call can be linked to additional information, e.g. whether the caller is a supplier or a client. This creates a new service with new possibilities.

### The advantages at a glance

First, the new services make it possible for considerable cost-savings to be made. This is because large numbers of users make collective use of the same machine capacity or expertise. Remote availability, regardless of whether it is hardware or software. Why purchase expensive machines yourself, when you may just as well use it on a joint basis? And if we need a speech

recognition programme, not every individual needs to develop or purchase that programme.

A second advantage is that smaller companies too can use professional automation environments and facilities. Otherwise, these would have been prohibitively expensive and thus out of reach. In the future, this new group of services appears to be capable of creating the biggest shifts in organisation and procedures for the business community. Businesses can start to organise their automation in a completely different manner and concentrate on their core activities once more.

A third advantage is that external users can obtain rights to possess the same information. For instance, a staff member has mobile access to client dossiers. This advantage in flexibility also applies to projects in which multiple organisations are active and in which the project administration is kept on a joint basis.

A fourth advantage is virtual chain formation. For instance, this strategic advantage enables smaller entrepreneurs to take on larger jobs together.

Another hard to quantify, yet relevant additional, advantage can be found in the convenience, security and the speed at which many people can communicate.

**Some practical applications**

Practically everyone is confronted with digital plagues: spam, viruses, spyware. Installing and maintaining firewalls, spam filters, virus scanners and other software is costing a lot of time and money to us all. That is not efficient. Furthermore, most users delay these jobs too long, with all the associated risks. By outsourcing automation services, we stop ourselves from doing the same thing our neighbour does. And the necessary maintenance is carried out, promptly and by an expert. Many things can be regulated cheaper and better centrally on a joint basis rather than individually.

Thanks to broadband, existing services and processes can be applied in a new manner. For instance, a logistical service provider can process and share complex data with others quicker. This way he can offer existing and new clients a better service and respond better to e.g. changes in destination, turnaround times, transport volumes, permits and forms for these clients.

New services can develop further in a broadband environment. For instance, there are already services that enable us to pay smaller amounts at a low cost. There are also smart programmes for energy management and methods to compensate for or prevent peak loads. This generates savings for the entrepreneur, the energy supplier and society and could make a whole power plant superfluous. Each day, creative young entrepreneurs think of new ways to (net)work more efficiently by means of broadband.

A large number of services are already available; others will be in the short term. These services will help the entrepreneur to concentrate on his core activity and release him from the side issues. So thanks to the broadband connection, entrepreneurs can make savings and renew processes at the same time. This applies to both hardware and software. Applications can be used for a single building or for an entire business park. A brief overview of the developments:

1. *Automation services*: from straightforward offsite back-up hosting/storage to central locations, server management, workplace management to fully outsourcing automation functions and thin clients. In the event of thin clients, we only have a small box (the broadband outlet) connected to a computer elsewhere. The keyboard and monitor are then connected to that small box. In that case, the computer computation power is received via the network rather than via a personal computer. We no longer need to have a computer in-house, thus investments are lower. Additional and new thin clients are easy to realise, organising workplaces is a mere matter of connecting additional keyboards and monitors to the broadband outlet.

2. *ASP (Application Service Provider)*: in case of these services, the software used by an entrepreneur no longer runs on a PC, but on an external web server. ASP ensures that programmes are up-to-date at all times. The entrepreneur is released from keeping up with updates and always has the latest software version at his disposal, while having sufficient storage space for his data. ASP services (e.g. storage on demand or server management) can be paid for per user or per user unit. This may concern all types of software packages. Accounting packages (Twinfiled already has thousands of users, particularly smaller companies), creditor/debtor control, purchasing, stock control, office packages, selection of transport companies on the basis of a service/costs comparison and automatic instruction via Internet (e.g.

Philips), staff and occupational health & safety services. In that case, the advantages can be found in a reduction of the management costs, increased availability and consolidation. Fixed costs become variable. Pay4use. For most programmes we can make a personal selection of the desired functions, paying for each function separately. For instance, an office package of which we only purchase the mail and relationship management functions. Costs become variable with the number of workplaces. This way, starting entrepreneurs can control their expenses better. They need to invest less and retain financial space for growth. For smaller companies in Twente, e.g. in business complex Drienerlo, an increasingly wider package of broadband services is available. This enables them to restructure a number of functions in their organisation. Organising the corporate process more efficiently is possible, thereby even reducing costs levels.

3. *Building management, domotics*: the various networks (data, telephony, video, sunblind control, smoke detectors, climate control etc.) are all incorporated in a single network. Since each of these disciplines had different infrastructure requirements, this led to a tangle of cables. In the near future, this will all be integrated into a single network, with a single protocol suitable for all disciplines. Connection points become multifunctional in terms of their application (this time it is used for videoconferencing, next time it serves as a building management module). Thanks to its infrared detection mode, a CCTV camera can also serve as a fire detector. This generates huge savings on cabling and offers new possibilities. By means of central software and thanks to standardisation, we are able to apply intelligent image processing. For instance, the decision can be made to assign number recognition to camera three for the next couple of house and facial recognition to camera four. Through remote energy management, we are able to control energy consumption in such a way that peak loads are prevented.

4. *Park management*: broadband infrastructure can be used to link up all sorts of peripheral equipment, e.g. CCTV cameras, different types of sensors or other equipment which need to be controlled or managed. Maintenance of installations is easy to carry out centrally.

## Turning point

The attractiveness of broadband services very much depends on the state of affairs with individual users. Are replacement investments up-to-date; does the corporate process or the service change? In the short term, a company that only recently invested in new services and software, will have less advantage to gain compared to another company which is still to make this investment. When entrepreneurs are faced with new investments or when they have an ICT problem, it forms the natural moment to start using broadband services, e.g. when entrepreneurs want to purchase new computers, storage capacity, software or switchboards, or when new workplaces or new machines are installed.

Alteration, relocation, the construction of new buildings or searching for a location for a new branch, they are situations in which broadband services and their availability and attractiveness become topical. When a business complex or commercial premises has proper and low-cost broadband facilities or will do so in the future, it may well affect the choice of place of business.

Large companies more and more often demand integration with the ICT systems of their suppliers and clients. An entrepreneur being forced to participate in virtual chains again creates a natural moment to start taking the new technology onboard.

The costs of creating broadband access only form a fraction of the costs that are involved with the construction or revitalisation of business parks or the construction or alteration of commercial premises. In addition, digging must take place anyway, further reducing any costs for creating broadband access. These are the natural moments at which to realise that access and to include the costs in the exploitation.

## Who can benefit from broadband now?

The use of broadband connections becomes increasingly attractive for larger organisations with multiple branches. Particularly companies with multiple locations can save costs with broadband connections between them. Broadband offers a digital basis in order to organise the organisation more efficiently. Thanks to broadband, opportunities are created to automate functions and centralise telephony. In principle, telephonic traffic on the basis of IP (Internet Protocols) can be conducted within this network free

of charge. Smaller companies forming their own network by means of broadband generate savings as well as opportunities.

Various sectors have already made the transition to broadband, whereas others will want to do so in the short term. Detailed below is a division into categories of companies and their interest in broadband access.

Business community, ICT service providers, Internet sector
This group includes all businesses that offer services on and in relation to the Internet and ICT networks. The main ones being: Internet Service Providers, Hosting and co-location providers, providers and developers of web applications. These businesses and their corporate models fully rely on the Internet. They often already have broadband connections. They have an interest in a reduction in the price for broadband connections, both for themselves and for others. When the number of connections increases, they can increase their market.

Business community, multimedia, advertising, technical research
For these companies, the Internet forms an important secondary condition. They often make ample use of Internet services. They send and receive large files via the Internet. The costs and the quality of the connection are important factors for this group when deciding on the type of connection.

Currently, these companies often use ADSL or rental connections. We expect demand for broadband connections from this group to become topical soon (or perhaps it already is).

Business community, corporate service provision
These businesses (layers, administration offices, travel organisations) use e-mail and the worldwide web for their communication with clients and for providing services. They search the Internet for information and share it via e-mail. Their Internet use is related to the size of the organisation, the extent of the automation, the nature of the business and the number of branches. In addition to the connection prices, security of both data traffic and transactions are important arguments for them to transfer to secure and private fibreglass connections.

**Advantages of extending corporate network**

A basic thought when implementing broadband is expanding the corporate network, in which equipment, software and/or expertise is available at central points at all times and which can be easily used locally, thanks to the speed and capacity of broadband. As a result, not everybody needs a personal server, which needs to be maintained and cooled, anymore.

Cost advantages are created by e.g. organising computation or storage capacity centrally, in large volumes and by sharing it with multiple companies. Only then can you make the best possible use of the opportunities offered by consolidation. Other advantages can be gained by bundling license management or making available specialised central software and expertise. Digital marketplaces, exchanges such as the NDIX (see chapter 3) are of strategic importance in this process as here, in the very heart of the network, supply and demand meet.

**Corporate security**

Securing business parks or premises by means of broadband will become interesting in the short term. Relatively speaking, businesses spend a lot of money on security. The traditional porter is a striking example thereof. Savings can be made in terms of security, particularly with regard to insurance costs. Insurers often charge 20% less premium when specific security requirements have been met.

The installation of a CCTV system and storing images is relatively simple. Furthermore, fully automated systems for Number Plate Recognition, registration of data etc. are available. When using broadband, images no longer need to be compressed and thanks to the higher resolution, more details can be retrieved and interpreted from the images. However, the real-time monitoring of CCTV images and actively managing the follow-up is still very new. A number of companies are preparing new security concepts which are based on new technologies to a much greater extent. An important aspect here is that the follow-up within a security concept requires fewer people. A security official driving around, for instance, becomes much more efficient. In brief, the follow-up costs are less compared to the old situation. The application of new technology in security is far from standard as yet. In many cases, security firms apply a traditional approach mainly aimed at the delivery of man hours. Thus new technology reduces their turnover. Hence

they do not want to renew as yet. Some of them are even poorly informed of the new technological possibilities. This means that implementing new security methods and the use of new technology must be thoroughly prepared.

**Learn to live in abundance**

The cost for storage of data is rapidly coming down. In the beginning of the digital revolution, we all used one large computer together, thanks to terminals. The storage of data took place on expensive large disks and endless stacks of tapes. In the period thereafter, PCs enabled the storage of data on the local hard disk and the use of a wide range of applications. Many new applications were created. With the development of the Internet, we started to copy more and more files to our own PCs. The availability of increased bandwidth keeps in step with the availability of improved storage media. At the time of 24K modems, we still used a floppy and later on a CD. Subsequently, we en mass changed to using DVD and USB sticks, wearing our personal data on a string around our neck.

Thanks to broadband, access to data has become fast to the extent that we can once more change from a distributed environment (each having his own PC and data storage) to a consolidated environment (each connected to a central data storage unit). In brief, it has meanwhile become unnecessary to make copies of e.g. presentations; we can retrieve it from the central computer just as quickly. We need to get used to the fact that we are living in abundance, at least in terms of storage. All sorts of temporary solutions become superfluous, such as the compression of data. Widescreen advertising films in the shop? We can adjust them at any desired moment, in all branches simultaneously. The graphic designer can communicate with the printer and his machines directly; the courier will need to focus on other packages. The architect can send his inspiring drawing to the constructor directly. And the constructor can share his complex data with all parties involved. Thanks to broadband, we will be able to centrally store our data at high speeds. After all, it is much safer to store our data in a centralised data centre than at home next to the coffeepot. And our files continue to be available for instant use.

2

**What role does the
government have?**

## 2 What role does the government have?

Modern society is unfeasible without computers and connections for telephony and data traffic. The requirements we set to connections are increasingly higher. The importance of connections for numerous economic and social functions continuously increases. A fibreglass network is generally regarded as the best solution to guarantee the required transport capacity of data in the long term.

Commercial parties are developing this infrastructure in the current situation. With a view to the major importance of a communication infrastructure at its best, the government has a duty in monitoring equal access and quality for all, to set frameworks within which market parties can operate, and to take the lead, where necessary, to ensure that the network is available to everybody.

In this modern international society we see local, regional and national governments looking for a new role and identity. Due to the limited financial space, the large capital flows that are difficult to control, levy problems, increasing emancipation and public involvement, the limited possibilities of control instruments and the influence of global players do not leave room for any other decision. Governments more and more outsource tasks. They shift responsibility to the market, the public and the independent organisations that operate on a non-profit basis. With that, the role of the government increasingly changes from service and product provider to that of facilitator and framework provider, just as it fulfils that role for the railway or energy networks. The government monitors access, quality, price levels of the infrastructure, services and products. Hence it plays a crucial role in the regulation of markets. It also plays an important role in stimulating the formation of new markets, processes, services and products. Today, broadband, in addition to energy, water and sewerage, is the fourth of the utilities.

### Practice: Chicken and Egg

In the hectic life of everyday politics, politicians and officials often lack the time and space to bring their knowledge of the quickly changing broadband world to the required standard. Yet that insight is required. In 2005-2006, the world of cable and telephone companies is buzzing. Mergers and takeovers

are the new trend. The transport of data (such as text, image, sound, and numbers) has meanwhile grown to be just as important as the transport of goods. That transport of data is a basic condition for new services. For instance, the security sector will ultimately start to use CCTV monitoring and smart software more and more often. This service swallows up bandwidth and sets stringent requirements to the security of data traffic.

The development of broadband services is of course the story of the chicken and the egg. After all, the threshold to start using new developments is raised significantly when the connection costs are high. As a result, businesses that need broadband infrastructure in order to offer new services will encounter greater difficulty to access the market. Here a regulatory role from the government is vital. In locations with only a single commercial infrastructure supplier, the prices are much higher compared to a situation with an open network or with multiple suppliers. For instance, early 2006, € 2,000 per month for a 2 Mbps connection was still very common, if there was only a single commercial provider. While at the same time, in an open network model in a different location, the costs for a 100 Mbps connection were less than € 300 per month. This represents a difference of € 25,000 per connection per year. And this is without taking the difference in capacity into consideration. In terms of Mkb, broadband in the latter situation is feasible, in the first one it is not. It is therefore clearly a government task to ensure that an affordable broadband connection is feasible for every player. By clustering client demand, by making access subject to requirements and sometimes by being a co-contributor of risk-bearing capital, the government can ensure that this task is fulfilled. After all, an affordable broadband connection forms a basic condition for a fast and successful development of electronic services.

### Spaghetti or structure

Fibreglass is not the only option for data traffic, although it is the best choice in the long term. This is because its capacity is practically unlimited. For instance, wireless networks are complementary and support mobility. Yet they are inherent to limitations. Wireless networks are more susceptible to interference than fibreglass networks and are harder to secure, including all associated risks. Furthermore, the number of frequencies that can be sent through the air is naturally limited. The transmitters of wireless networks require an underlying fixed fibreglass network. Even the air cannot do without light!
Meanwhile, fibreglass networks run through parts of the Netherlands which

connect the large data exchanges. Some networks are controlled by a (semi) government institution, others by commercial parties. Furthermore, during the Internet hype (in the last decade of the previous century) different parties installed fibreglass cables at the most attractive locations. Sometimes there are so many cables running along and on top of each other, that you can find a spaghetti structure of cables underneath the road surface that no-one can make any sense of. In Utrecht, for instance, the streets are sometimes literally bulging due to the underlying infrastructure. The mantra of the free market did its round, while no-one asked at this stage whether it was the right thing to do. As ultimately, it is the consumer of course who pays for this capital destruction and inefficiency.

The municipality can dig cheaper than no other party can. This is because a municipality can combine digging for fibreglass with e.g. other activities. Thus the municipality can opt for smart excavations. As is the case with the road, gas and electricity networks, the construction, ownership, maintenance and management of the digital highway creates natural monopolies which require to be actively directed by the government. Otherwise, only the (commercially) most attractive locations will be provided with access. Furthermore, there is the risk that commercial network owners abuse control of access to their networks by keeping the costs of access for external service providers artificially high. This in its turn will slow down the development of new services. It is crucial that we understand that we cannot allow everyone to do their own thing. Otherwise, the situation will soon become irreparable, with all the associated consequences.

**Excavation rights and coordinated installation**

Municipalities are obliged to grant permission to telecom parties to install fibreglass cables. These excavation rights are laid down by law. The digging party needs the permission from the municipality. The municipality can merely set conditions, but not refuse permission. The municipality is obliged to take a decision on the matter within three months. Strangely enough, in the case of water and sewerage, this situation is completely different and municipalities have much more control. However, municipalities can decide to install empty pipes themselves in places where commercial parties decide not to. Subsequently, conditions are set under which commercial parties are allowed to run fibreglass cables through it.
In order to reduce the costs and inconvenience for the public, the municipality

or regional government can take advantage of existing developments:

1. *Installing the fibreglass network simultaneously with the development of new residential and industrial estates*
Since preparing a site for construction involves opening up the ground for the installation of sewerage, electricity, cable television and telephone, we can save in terms of the excavation costs when the rollout of the fibreglass infrastructure is planned simultaneously.

2. *Installing the fibreglass network simultaneously with the replacement of road surface, sewerage, urban renovations, revitalising of industrial estates etc.*
The argumentation is the same as in point 1. Since the surfacing (stones, asphalt) is by far the largest cost item, a coordinated planning can save a lot of costs in terms of excavation and surfacing.

Coordinated installation planned to coincide with other activities can significantly reduce the costs of the installation. A coordinated installation without generating additional excavation costs, the costs for cables and pipes do not exceed € 2 per metre in a standard situation. This does of course depend on the requirements (depth) and whether the cables need to be installed underneath or on top of existing cables and pipes etc.

When a trench is shared, it is common to also distribute the costs of the activities (gas, sewerage, electricity etc.) on a pro rata basis. Hence the costs of a coordinated installation often depend on the situation. In the event of the coordinated installation of fibreglass, we do not need to take into account problems such as inference phenomena with e.g. electricity.

If the municipalities want to regain control of the installation of, to them, high-priority infrastructure, another legislative change is required. This is because the disastrous change in telecommunications law of 2006 limits that control. The requirement for clearer control has meanwhile been sufficiently demonstrated. The continuous opening up of the street, the random installation of abundant and superfluous cabling which is left unused, is an unnecessary economic loss item.
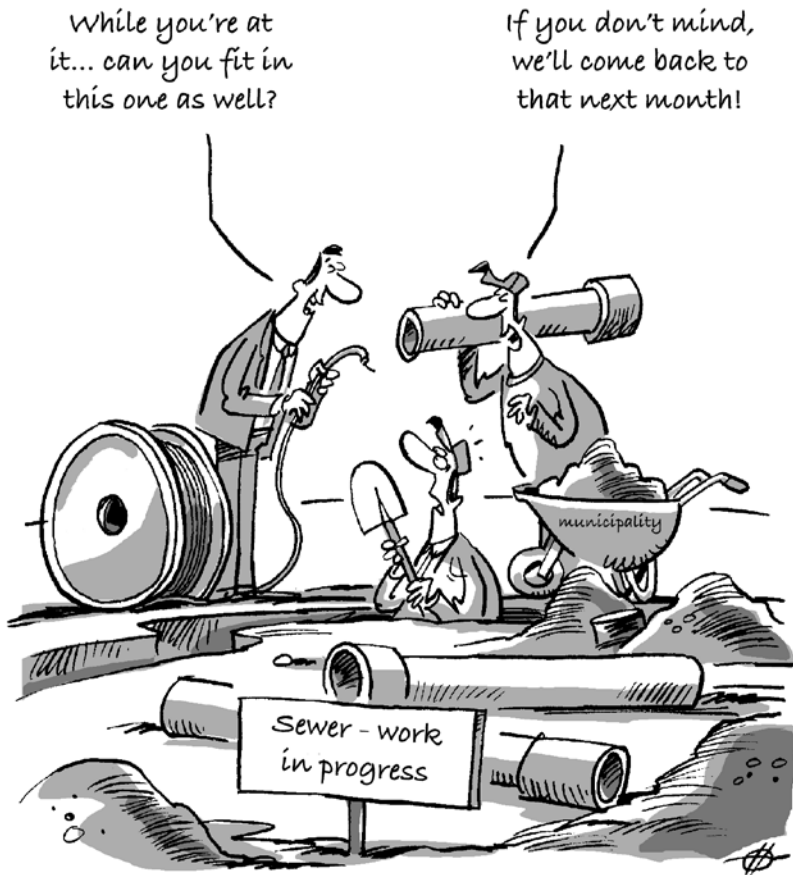
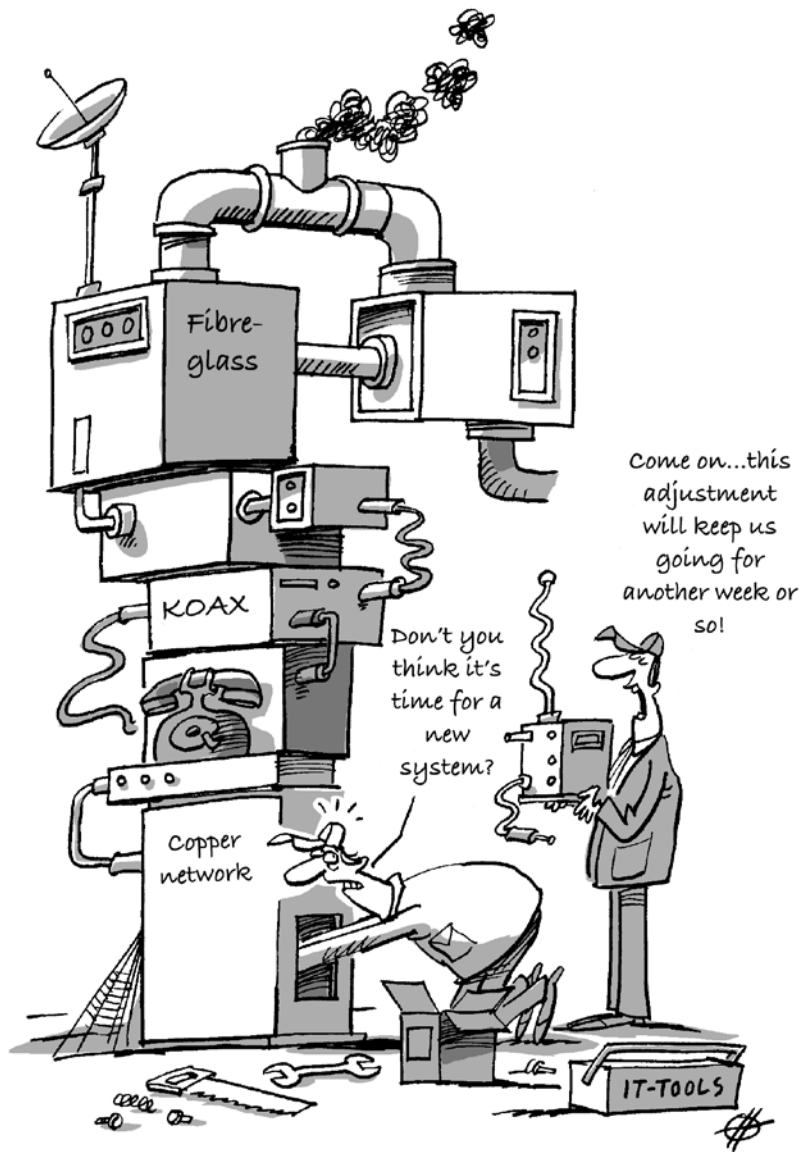Key questions always remain: who does the pipe belong to, who runs the

While you're at it... can you fit in this one as well?

If you don't mind, we'll come back to that next month!

municipality

Sewer - work in progress

cables through it, who determines what can be sent across it and who determines the price thereof?

### The heavy load from the past

Telephone! Do you have any idea how the telephone works? If we still use an old device, the telephone exchange connects us with the caller. If we use VOIP, telephone via the Internet or Ethernet, the bundled data packages seek the correct exit to our telephone each time, via all sorts of digital highways. Companies that provided us with our old telephone connection still need to ensure that this old telephone remains operational. A technology that is completely different from the one used by modern telephones. And a business that still has copper telephone wires would prefer to use this for some time to come. Every additional month is a bonus. However, this does mean that these telecom companies must keep two different technologies operational. This is referred to as a legacy problem and does of course cost money. Obsolete (legacy) and/or expensive technologies remain in use, whereas cheaper alternatives would be more logical. The copper network was once intended for telephony, the coax network for television signals. Meanwhile we use copper and coax for data transport as well and telephone and television signals have turned into data more and more often. However, there is a new technology for data transport: glass fibre, offering a practically limitless capacity at low costs.

Old telecom and cable companies have past baggage that weighs them down. This legacy problem limits their flexibility and the possibility to apply new techniques. A large telecom operator still needs to keep an infrastructure operational for dated services, software and equipment and is therefore forced to apply expensive technologies. The existing business models too prevent new possibilities. Small service providers cannot be injected in e.g. the KPN network individually. It would be too difficult for the configuration management of KPN and the financial threshold for small companies is too high. However, KPN does need success factors, services that they cannot all offer themselves. However, they do not want the overheads. They, at the most, want to take over the small ones when they are scaling up; a well-known practice of large companies, also in the digital world.

New providers of fibreglass connections do not have those legacy problems. They can immediately apply the latest and cheapest equipment and technologies, use new business models and simply scale up the connection by changing the exchange. As a result, they can operate (much) cheaper for the consumer (e.g. businesses in a business park)

A new technology is ready to replace the old one. The Twente NDIX marketplace is already a collection point for the small ones and as such a volume broker. The established, powerful and rich players can try and delay the development, buy out the new players and monopolise the market. Alternatively, they can do the right thing (encouraged by gentle force from the government, if needed) and opt for open standards and an open network. As a result, they will be able to grow along in a new economic reality.

**Marketing managers and social momentum**

The increasing popularity of the market trend also affects the broadband world, also in a less favourable manner. This is because a marketing manager, a salesman, often has a short horizon. The fact is, this discipline is trained to maximise short-term advantage for the own organisation, using any legitimate means. Therefore, he will be inclined to use and include all sorts of tricks in contracts and negotiations to enhance that advantage. Which is fine, but from a social interest point of view it needs to be compensated by other social players such as politicians and administrators. It may be advisable for a marketing man to build a dominant market position when installing infrastructure and maximise return in investments. However, it may be contradictory with the desired social return. As to many regional economies in the global economy, the speed at which broadband is created in a region is more important than the higher profits offered by a more limited rollout of infrastructure providers.

**The hoop net**

If something is used by in increasingly large number of people, it acts like a hoop net, it becomes the standard. That standard is not necessarily the best technology, it is merely the most popular. Translated freely: the winner takes all. We know about the classic examples and consequences of the hoop net. VHS (Sony & co.) versus Video2000 (Philips), Word versus WordPerfect and Open Office. Google and Ebay dominate their global markets; there are very few niches left for others.

An important term, also in terms of broadband country, is lock-in, a form of conditional sale.

In a lock-in situation we can only use the broadband services of our connection provider or its partners.

Our telecommunications provider, Internet access or back-up service has already been chosen by the supplier of our connection.

It does not necessarily have to be the cheapest or best provider for us. Good offers often have a lock-in. The connection is cheap, but the other services are quite expensive and we can only go for a different package after the contract term has expired. Or only a couple of services are cheap, but the rest is not and neither is the connection. By committing themselves to a certain model, authorities sometimes - consciously or subconsciously - create a loop net for a number of models and applications.

After all, almost everyone does business with the authorities one way or the other. As a result we also adapt ourselves to the choices made by those authorities, if only to be able to read and update the digital documents they produce.

Commercial parties have a major interest in the quick rollout of their own solutions. It increases the chances of that solutions becoming the standard. It means they can set the price, determine who is in and who is out, who will be given licences, how quickly or slowly updates are applied, etc. By creating a lock-in, they reinforce that process. It may also create a situation where the choice for e.g. an Internet provider automatically leads to who will be the telephony provider. If the infrastructure provider is also the determining factor as to who will provide the services, a lock-in is created.

**The digital marketplace**

A powerful tool in avoiding a lock-in is a digital marketplace: a place where connections come together and where those supplying and demanding electronic services meet.

The government could play an important role here in more than one respect. It can facilitate the initiative to set up a digital marketplace. In practice, it is even more important for the (semi) authorities not to be afraid of acting as launching customer in the general interest.

The (semi) authorities are major parties in the broadband market, as they send enormous amounts of data, both internally and externally. Their volume gives the authorities power. As soon as they enter a market, they become an

important player. A player that attracts other players. Authorities can use that power in order to increase the viability of neutral marketplaces, an important tool in enforcing open networks. This way they can prevent a lock-in for the weaker parties.

Knowledge institutions are a good example of a user group as vanguards. Broadband is a normal phenomenon in university education. In Twente, most secondary education schools now have access to broadband after a campaign by TReNT (a provider of broadband access with open conditions) resulted in lower costs and improved availability.
All these schools are connected to the digital marketplace simultaneously, enabling them to communicate with each other, and at the same time creating a large demand volume.

Major cable and telecom companies prefer their own department stores - referred to as marketplaces for the sake of formality - selected by themselves or partners of their choice. But a department store is not the same as a public marketplace.

There is room for both of them. From a social point of view, it is better to have department stores alongside open marketplaces. Marketplaces with simple and cheap access for every provider and customer. After all, we do not want to get all our shopping from a single department store, do we? Sometimes we prefer fresh, special and/or cheap products from a small market stall.

Even more reason for (semi) authorities to demand open standards, open networks and public marketplaces. If the government will not do so, no-one will. The government should not be tempted into doing business with only one department store; they should be connected to a public market. That way, the government can continue to do business with any party they like. And it offers new parties a chance to do business with those (semi) authorities. So the government has both a social and economic interest in open marketplaces.

**International developments in the region**

As soon as the mobile phone became a bulk item, new applications were developed. Today's generation are tied to a digital leash by their mobile phone. Parents call their children to ask where they are and vice versa. Instead of being kept in the dark about their children's whereabouts, parents send them a text message to tell them dinner is ready. In brief: the mobile phone has led to a cultural shift. MSN, text messaging and its successors, the digital video clips: they have changed the lives of youngsters tremendously. A growing number of young people (and a group of parents) are in constant digital contact with each other. They send each other live clips of the festival they are attending, instant up-to-date photographs of their activities. Youngsters watch less television: they determine what they want to watch or listen to and when. Television and radio channels are losing ground to their Internet dependants. DVDs, downloaded television broadcasts and an enormous selection of audio streams to be downloaded from the Internet are more in line with the media consumption of youngsters than analogue radio and fixed TV schedules. Sites with home videos and self-composed music are now visited by more people per day than could fit in a football stadium.
After a broadband network started operating in a Japanese region, the growth of data traffic between the different users in that region simply exploded. Users started to share an increasing number of movies, music and other files as soon as it became cheap to do so. They came up with new social applications and used new digital services.

The Dutch Ministry of Economic Affairs has a new project: connecting the dots. It connects broadband initiatives from different locations. And that connection is necessary in order to achieve a single platform. That does not apply only on a national level, but also on a regional one. A municipality that accepts the fact that broadband facilities are linked only on a local level completely misses the essence. Because why would we create an archipelago of broadband islands? It would be madness to connect businesses from one town with each other, but not with those from the neighbouring town. It would be much smarter to connect all broadband rings, creating a large, communal market for all parties, with enough capacity to play on an international level too. Improving and facilitating the connection of all neutral marketplaces is a task that demands management from the government. Schools, healthcare,

security and authorities often form (data) clouds that travel far beyond an individual town. Regional agreements about a regional network are vital and can save a lot of money.

The digital world effortlessly crosses regional and national borders. Regions in which mutual broadband connections are common property can respond to these trends quicker. This means that fast, affordable and reliable data connections are becoming increasingly important. In more and more regions, authorities and business sectors work together to realise such connections. Not only in a European country such as France, but also in up and coming economic forces from Asia.

Co-production of goods and services by businesses, often in regional ventures, is also a global trend. The digital sales of goods and services have assumed enormous proportions. The new digital infrastructure is of course vital in that respect.

**Bold administrators wanted**

So the realisation of a regional broadband network poses a challenge for administrators. Such a wide-range network does not build itself, and the management thereof must be organised properly.
Still, it is often less difficult than it seems at first. There are some good examples around. And in the same way that we can demand a company to comply with environmental standards, we can demand that the parties undertake to make their networks accessible. Demand that the connection is always made to a public exchange. Attach standards to the technologies and protocols used. Prevent networks and services from being offered only in conditional sales or only (commercially) attractive locations from being made accessible.
The execution of management can be delegated, as long as the ultimate responsibility lies with a neutral (semi) authority. After all, the motorways are also maintained by the government (with the help of commercial parties).

In addition to (but in line with) the regional initiatives, municipalities themselves can of course ensure that their business parks are made accessible promptly and correctly, provided they apply the following basic principle: ego = tv (Ethernet, Fibreglass and an Open Network are Transparent and Secure). If a municipality decides to lay its own fibreglass infrastructure, it has to

cluster client demand. After all, client demand clustering determines the cost price and coverage, for commercial providers too. Essent made schools in Deventer accessible for EUR 165 per location, using a 100 Mb connection. An excellent low price, made possible by clustering. Whatever applies to those schools, also applies to other organisations. By clustering client demand, we can make business parks and business complexes accessible at an affordable price.

### Requirements and market partners

In order to realise a good infrastructure, the government could cooperate with market partners. Commercial parties have networks all over the place. The government will have to set requirements for those parties. Requirements as to network accessibility, the speed at which the network is built, maintenance and technologies used.
This is necessary in order to prevent market parties from incorporating the costs of their old infrastructure in the prices, applying their own standards or creating monopoly positions for themselves.

It is about time for the government to have the technical standards and network conditions laid down by an independent organisation.

In other words: the government says whether we will drive on the right or left-hand side of the digital highway. And the same rules apply to all of us. Then that independent organisation can update the standards on a continuous basis.

The importance of that and any problems that may arise in the cooperation with market parties will be discussed in chapter 3 on the Twente solution. The division of network and services, as proposed in the Twente solution, remains a crucial requirement for market parties.

# 3

The Twente solution

# 3 The Twente solution

Neighbourliness: neighbours who help each other out. This neighbourliness expands into the digital world and the organisation in Twente. Around the year 2000, knowledge institutions and knowledge-intensive institutions in Twente developed a taste for good mutual broadband connections. Since the market parties did not think it was viable, something else had to be done. It was, and it was done the Twente way.

Early 2000, a preliminary initiative was in development in Enschede. They already had the basis. Twente University had installed an advanced fibreglass network at its campus, managed by the university itself and its students. Surfnet, the provider for academic institutions, made the campus network accessible to the outside world and the Internet. The campus network was used for educational and research purposes, but it also provided each student room with a 100 Mb connection. Thanks to the high connection speeds, the university at that time represented approximately 20% of all Dutch Internet traffic!
However, few operators were active in the Twente region. As a result, broadband was quite expensive outside the campus. The differences in price between the campus and the immediate surroundings were extreme. Students who wanted to set up their own business were confronted with that problem. The business model that saw the light of day in their student room did not apply to the outside world. Their costs went through the roof as soon as they crossed the road to the nearest business complex.
Due to those high costs and the lack of broadband, it was difficult to start anything commercial in the field of computers. Small companies were heading for trouble or disappeared to Amsterdam where the costs were lower thanks to the rivalry between operators.

A number of university people and starters came up with a concept to change all of that. This concept assumed the structure of a cross-border Internet exchange. International traffic was expensive. We in Twente came up with the solution. It could be done cheaper, it had to be. By creating an exchange with two interrelated locations. One on the German side of the border, and one on this side of the border.
It would result in a unique benefit. The objective was to get more operators interested in providing connections in Enschede.

We're thinking of setting up a fiberglass network ourselves...

Don't even think about it...it's very, very complicated stuff...

...and guess what? We've got the perfect solution!

NDIX

Broadband Twente
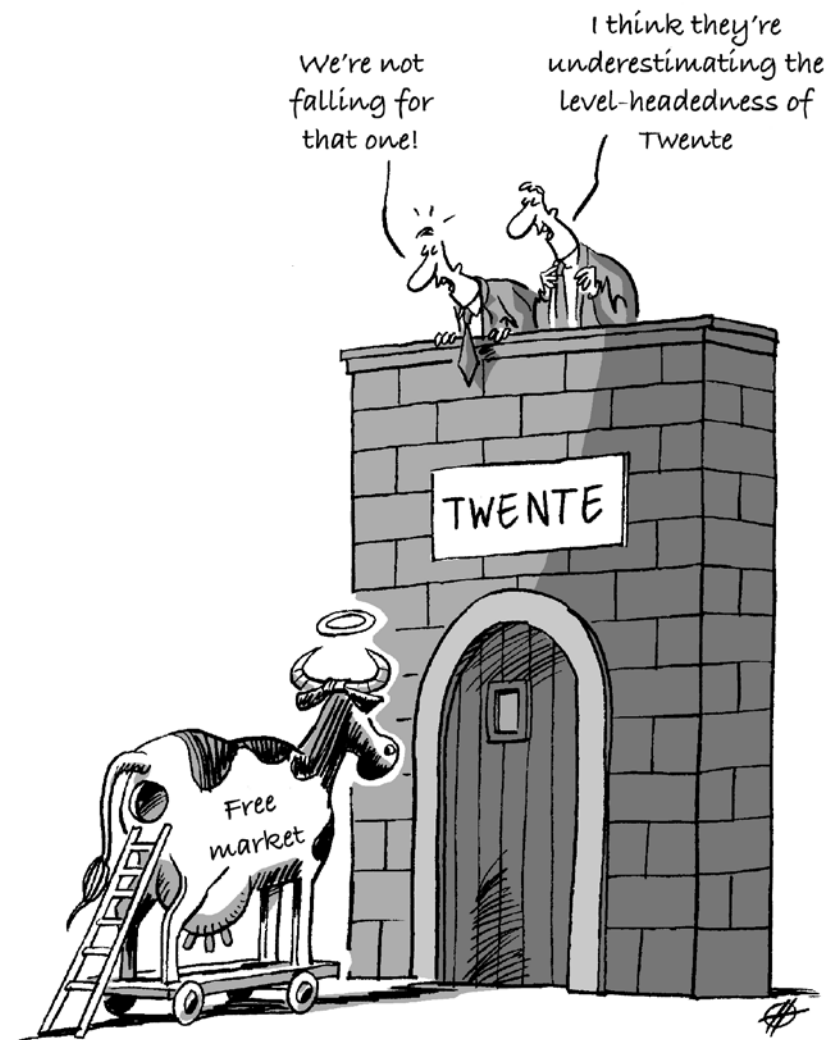
CON-$ULTANTS

CON-$ULTANTS

Not long after, the Dutch-German Internet Exchange (NDIX) was born. Apart from Twente University, the partners of this project included the OOM (Overijsselse Ontwikkelings Maatschappij), the municipality of Enschede and the province of Overijssel. Later, representatives of various organisations met up, pondering over the question how to improve their connections.
It led to a second initiative in 2002. If the parties were to undertake joint projects and research, they needed larger bandwidths. All those involved had locations in Enschede not far from each other, and they knew each other from other, different activities. After several fruitless attempts to obtain fibreglass from commercial parties (so-called dark fibre), they came up with the plan of installing their own fibreglass network. A small fibreglass network - connecting businesses such as Ericsson, Lucent and CMG to knowledge institutions such as CTIT and the Telematica Institute - was already operative in the direct vicinity of the university. In order to manage this network, they had set up a foundation comprising the business sector and knowledge institutions: TReNT.

Six organisations decided to jointly finance the installation of a fibreglass ring.
They approached TReNT to organise it. There was enough knowledge available in the neighbourhood. In principle we in Twente decided that the networks would be accessible to all parties, both profit and non-profit. New parties were more than welcome to join us. The agreement was that if it generated any additional revenue, TReNT would use this to lay a new network. After all: the more, the merrier.

Since it is fun to connect not only our own locations, but also to be able to communicate with everyone, all contracts stipulated that the connections were to be linked to the NDIX. This became the hardcore of the Twente Model: a community with an unlimited scalable infrastructure, with everyone being connected to the same exchange. An efficient network model which expanded rapidly in the following years.

And now, thanks to the Twente Model, you can find a modern fibreglass network in a growing number of locations in Twente. It also provides access to all sorts of business parks and residential areas. Even the business parks that have been ignored by commercial parties.

One of the consequences is that the prices for faster broadband connections in Twente are among the lowest in the Netherlands, correction, the world. That is good for businesses, healthcare institutions, authorities, schools, ICT staff, students and other creative talents in Twente. They use these connections to contact each other, to share information. To make money, and to provide services by public demand. Thanks to the capacity to develop new services and markets. Services that can be provided at competitive prices thanks to the lower connection costs.

**So what is it that the Twente region does differently from the others?**

Not only do we install a network together, at low costs and through some clever digging, and manage it. In Twente we also have low-threshold access to a neutral marketplace, the NDIX, where everyone can offer his services. Both large and small entrepreneurs, profit and non-profit sector.

Regional authorities encourage the rollout of broadband and attach a number of requirements. Persons from Twente, originating from such diverse parties such as authorities and the business sector, help each other out. Knowledge institutions provide the knowledge.
Twente already has the expertise. After all, the university was already used to installing its own network. Contractors in Twente have the practical knowledge and apply it.

Basic infrastructure and services have been clearly separated. The basic infrastructure comprises a system of pipes. This holds an individual pipe for each building (and thus for a number of potential users).
As soon as the customer wants one or more (additional) sets of fibre, we can run the fibreglass through it. Without having to carry out (expensive) digging and welding afterwards. This way, every major party has its own fibreglass set and can use it to communicate with everyone else.  Every small user can - thanks to a so-called Ethernet cloud - have an exclusive connection with others.

The bare network and the marketplace are owned by parties who do not pursue maximisation of profits, but continuity and social return instead. The remainder, the active part of the infrastructure and the services, are accessible to all. A completely different model from the mantra of the free market, where only rival market parties are allowed to organise the infrastructure.

A bit illogical. After all, we do not sell our sewer system to an American waste disposal company and let the French lay a new sewer system next to it? Competition is a means, not an objective.

**Basic principles of an open network**

Most existing networks are closed. It means that the owner of the network also provides the services. Originally, the networks of KPN and cable companies for instance were closed networks: We made our phone calls via KPN and watched television via the cable company.

In the case of an open network, provision of the network is detached from the service delivery. The service provider may be an entirely different party than the actual owner of the network. So the party providing a connection may be completely different from the party who provides us with telephone services. Basic principle of an open network is accessibility for all service providers, on equal conditions. Within that context, the ideal service provider is neutral, they have no interest in terms of which providers are or are not given access to the network.

The advantage of an open network is that the client (consumer or business) has maximum freedom of choice in the type of services that he/she/they want(s) to purchase and in the service provider which offers the service(s). Since there are multiple service providers, competition takes place at service level, which can lower the overall price and increase quality. It is not as if there will be a host of providers for every service. Even if there is a single provider for a certain service, it is still worth opting for an open network. It is where future providers can build up a healthy business case, on the same conditions as the existing providers.

The speed at which this broadening and widening of provision takes place is partly determined by demand. Large potential clients, such as the authorities, can play an important role in terms of demand. As a launching customer they will for instance influence this economic growth and the standardisation to be selected.

The choices that are currently being made will have major long-term consequences for the economy and society. If the choice for open systems is delayed or thwarted, the growth forecasts will have to be considerably

adjusted downwards.
Because in that case, there is no room for innovation for new parties and services.

Table 1 Network and services in the ISO Reference Model for Open Systems Interconnection

| Host layers | Application (7) | Provides services directly to user applications. Because of the potentially wide variety of applications, this layer must provide a wealth of services. Among these services are establishing privacy mechanism, authenticating the intended communication partners and determinant if adequate resources are present. |
| --- | --- | --- |
| | Presentation (6) | Performs data transformations to provide a common interface for user applications, including services such as reformatting, data compression and encryption. Establishes, manages and ends user connections and manages the interaction between end systems. Services include such things as establishing communications as full or half duplex and grouping data. |
| | Session (5) | Establishes, manages and ends user connections and manages the interaction between end systems. Services include such things as establishing communications as full or half duplex and grouping data. |
| | Transport (4) | Insulates the three upper layers 5 through 7, from having to deal with the complex ties of layers 1 through 3 by providing the functions necessary to guarantee a reliable network link. |

| Network Layers | Network (3) | Establishes, maintains and determinates network connections. Among other functions, standards define how data routing and relaying are handled. |
| --- | --- | --- |
| | Data-Link (2) | Ensures the reliability of the physical link established at Layer-1. Standards define how data frames are recognized and provide necessary flow control and error handling at the frame level. |
| | Physical (1) | Controls transmission of the raw bit stream over the transmission medium. Standards for this layer define such parameters as the amount of signal voltage swing, the duration of the voltages (bits) and so on. |

**Market prospects**

People are interested in people, in communicating with people. Especially with the people around them. We prefer to do our shopping in our own neighbourhood. We go to regional shops and markets. And if we need something big, we are willing to search the entire country. It is not very different for businesses. A lot of interaction is local or regional. An increasing amount of interaction depends on digital technology. We want people to be able to reach us virtually anytime, and we often think it is a problem if having digital contact is not possible. 'Can I borrow your mobile for a minute?' If we use a dated navigation system, we run the risk of getting lost. When did we last ask our neighbours for a screwdriver or a cup of sugar? These days, we often end up on their doorstep, panicking: 'Help, I've got no Internet connection!'

Lots of data traffic is taking place between businesses within the same region. That data traffic is growing and new services generate even more data traffic. Furthermore, the trend shows that an increasing number of products and services feature digital components that need refreshed data on a regular basis. This includes the security updates of our computers. Digital input determines a growing segment of (the quality of) our experiences. This input will on an increasing basis be supplied through a broadband network. Businesses and other organisations must be able to transport that data in an inexpensive manner. A good and cheap regional broadband network is of

major regional importance and it strengthens the regional economy. Also, there is not much time: the global market is not going to hang around for us to make our business parks digitally accessible.

Through a clever system of linked ring-shaped fibreglass connections we process a lot of data traffic in Twente among each other safely and inexpensively. Everyone has a unique and private connection with each other. Without introducing all the risks related to the Internet to our homes, but by processing a lot of traffic via a safe and secure Ethernet connection. Furthermore, the Internet connection required is super fast when using this infrastructure, because we in Twente know full well that the world is changing fast and that it is bigger than our own backyard. Today's farmer spends more time behind his computer than on a milking stool, and he needs digital services as much as he needs his hay carts. He wants his critical data to be as safe as his money (data = money). He keeps an eye on the costs of his ICT as much as on those of fodder. He fights to chase the fox out of the chicken run as much as he fights the hacker from his company network, and he likes to communicate with his digital and business relations as much as he likes chatting to his physical neighbours.

Whatever applies to the farmer, also applies to other businesses. In only a couple of decades, ICT has developed into a vital lifeline for almost any business or organisation. If the network, communication and digital data falter or are lost it could - within a couple of days - lead to a disaster that heralds the end of the business or organisation.

Until recently, fibreglass equipment was expensive. As business networks around the world use fibreglass on an increasing basis, the prices of the corresponding equipment also drop in quick tempo. New equipment is introduced to the market in large volumes almost immediately, and thus holds down the prices of those routers, switches etc. The Twente vanguard is happy to use these developments and as such stays in the lead in the digital world. We innovatively apply the globally available bulk products from business networks on a scale for which those products were never intended. And it works. It is how we also avoid expensive tailor-made solutions, which for that matter are often barely scalable.

*Problem? No problem!* The Twente Model also offers benefits if the connection of an entrepreneur fails. Or if there is a fire at the office. The digital work of the entrepreneur is quickly saved with the Twente Model. After all, all services can run via the network, including the possibility to save data externally. This means he can always continue his work from a different location, even from home. All he has to do is connect to the network. And then: back in business. Even if the calamity goes on for weeks.

**The Twente vanguard**

Twente regards an open network as the ideal solution, but only if the party managing the network has no other interests.

So the administrator has to be a so-called trusted party. Also, if we connect everyone to an exchange, a marketplace, we want to be sure that no-one can access the data without permission. Or use the traffic data for his own perusal.

We want network neutrality. That means that everyone is accessible on the same conditions and that each user has the same priority on the network, on the same conditions. Otherwise it will distort the relationship between large and small players, substantial and less substantial parties. Network neutrality requires the network administrator not to have any interests other than managing the network and any essential priority (e.g. for VOIP or video conferencing) to be provided in a transparent and cost price-related manner.

At the end of 2002, Twente took a number of initiatives to further broaden the provision of infrastructure. Three parties played a role therein: Casanet bv, Stichting TReNT and NDIX. In principle, these three parties detach infrastructure from services: the only products on offer are infrastructure and data transport. The user determines how he wants to use this facility and which services he purchases in that respect.

*Casanet*
Casanet (taken over by KPN in 2006) provides intricate connections to end users in residential areas. It gets the services its needs for its end users from the NDIX, transmits the relevant signal to the residential areas via the TReNT network and delivers the signal to the end users via the fibreglass network it runs to the houses.

*TReNT and Cogas*
TReNT is responsible for the main access and connects the districts of Casanet and larger businesses and organisations. The TReNT foundation is a non-profit institution. Its objective is to provide access for its users. TReNT provides the infrastructure. The fixed monthly charges for users are based on the necessary investments. This does include a margin for future expansion and the installation of unprofitable connections.
TReNT charges lower access costs on a phased basis thanks to the selected business model. There are no limits to the traffic running across the infrastructure.

TReNT supplies the main connections in the region. Large businesses and organisations are connected to these, and the connections also ensure residential areas and business parks have accessibility. It concerns bare fibreglass, without any equipment. It specifically concerns the linking of educational institutions, municipalities, organisations in the healthcare sector, Internet companies and large business service providers who prefer to arrange their own data traffic and telephony.

TReNT now has its own network in Twente, on the Almelo - Deventer - Apeldoorn line and in parts of the Achterhoek. They also entered into a joint venture with Cogas in September of 2003. Cogas provides connections on a similar basis in a number of other towns and cities.

Virtually the whole of Twente has access to main connections. On the Almelo - Deventer line, nearly all places have access. Cogas and TReNT have installed the infrastructure on the - as yet unprofitable - lines to Denekamp and Losser. Haaksbergen, Neede, Groenlo and Eibergen have been made accessible through the connection to Doetinchem in *the Achterhoek*. And the expansion continues at great speed.

The main TReNT network makes it possible to connect clusters of smaller users in an inexpensive manner. Residential areas and business parks are two specific examples thereof.
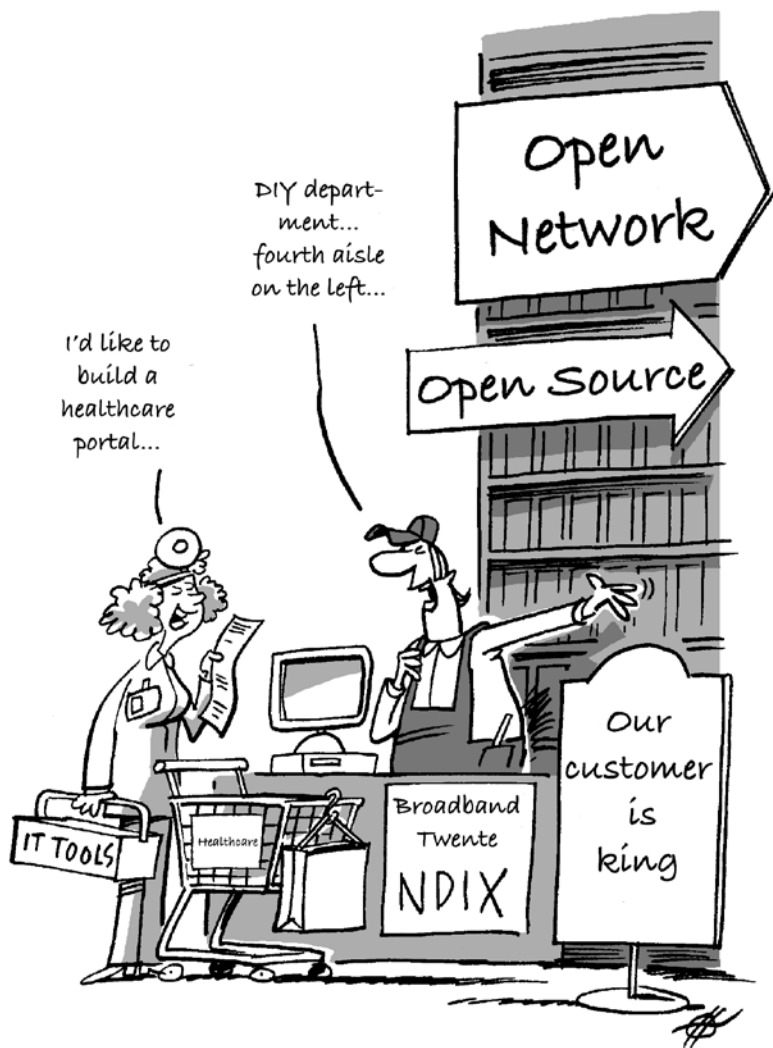
*NDIX*

The NDIX offers all connected users the opportunity to make their own connection with each other. The NDIX, the Dutch-German Internet Exchange, is where the entire network comes together. This is where you find the switches that provide Ethernet traffic between the different network users. The NDIX is the platform where those asking for and providing services meet.

The Internet providers connected to the NDIX have their own connection with the AMSIX, the large international Internet exchange in Amsterdam. The people who need services are service users who are connected to NDIX via the TReNT network. The NDIX links multiple providers who offer services such as data traffic or telephony.

Technically, the NDIX operates as a regional Ethernet Exchange. This in contrast to for instance the FRIX (Friesian Internet Exchange), which mainly focuses on the Internet, and which primarily serves as a conduit between the AMSIX. The NDIX now has locations throughout the east of the Netherlands, which locations are connected by fibreglass sets and which act as a single platform. In Twente, supply and demand are transparently matched on a regional basis from those NDIX locations. It creates options for the users and it can be purchased effectively. Although it is geographically dispersed, the NDIX still acts as one digital market place: all locations are connected by means of a fibreglass set. We can hop on board thanks to the choice for Ethernet-based technology.

**Consequences**

The selected prices and user freedom caused a stir in the market. KPN, but Essent in particular, lost many mainly large customers to TReNT. In Deventer this created openings for municipal campaigns to provide for a broadband network in the city. Deventer itself did not install it, but eventually KPN, Essent and the municipality agreed to offer users some kind of open network (detaching infrastructure and services) at much lower prices. By now, Essent recognised the opportunities of this model and seemed prepared to make similar agreements in a larger geographical area (product City Access of Essent).

Essent is now running a second pilot in Zwolle. Since there is no essential separation between infrastructure and services, there are no fully transparent connections between providers and those that need broadband services.

Since the beginning of 2007, parties such as KPN and UPC have continued to enforce their commercial policies, trying to delay the development of an open network on the basis of price competition. Still, there are signals that they are about to refine this point of view. The objective of independent providers such as TReNT, Cogas and Casanet (owned by KPB for 49% since 2006) is to provide access for users. They do this on an affordable open network. Finally, there are a number of commercial parties who seem to want to move to an open net policy because they believe in it, or because they have to.
The speed at which the developments follow in the footsteps of the Twente Model, becomes evident from the European tender for broadband connections recently completed by the provinces of Drenthe and Overijssel. Both KPN and Essent Kabelcom accepted the principle of separating infrastructure and services as well as connection to the marketplace (NDIX or GNIX) as preconditions for the territory of these two provinces.

**Faster, safer and cheaper**

The Twente solution spreads the costs of new fast fibreglass access, by clustering client demand, across as many participants as possible. Each new participant registering within the set term lowers the costs for the others. After all, according to the Twente Model, no surplus profits need to made on the infrastructure. The monthly costs consist only of the depreciation cost price and maintenance costs. If a new technology can provide higher speeds, it does not

necessarily have to cost an arm and a leg. We only install a different box. A box which will be available on the market as a bulk item.

As the infrastructure has an open character, everyone can use it, including the big operators. There is no longer a need for everyone to have his own infrastructure. We can all have a safe and secure connection with the client. By separating infrastructure and services, we avoid designated suppliers. It creates transparency as to what the customer is offered and what he can do with it.

As a result of the low entry price, the threshold for new service providers is lower. This business model does of course restrict the large telecom and cable operators in their chances for a monopoly or duopoly, but the benefits for the client are enormous. Not the operator, but the client determines which services he can and wants to use. And whether he wants to pay the asking price.

**Scaling up the Twente model to a national level**

With respect to regional bundling of demand the region of Twente has been an example for varouis other regions in the Netherlands. A driving force for demand articulation in broadband is a better value for money. In many cases provincial authorities are initiator and supporter of such bundling of demand. This is also the case in the east of the Netherlands, in the provinces Overijssel end Gelderland . In 2006 both provinces published a Masterplan for accelerating broadband services. Inspired by the medieval Hanza league, connections between cities have been modelled on the principles of open networks intertwined by a number of digital hubs (digital market places). Competion between service providers is stimulated by a free access to open networks and interconnection points.

Starting from the region Twente the TReNT dark fiber network has been expanded into the Gelderland territory. The region development agency Oost NV has played a major rol in the process of bundling local demand for connectivity. In six Gelderland regions, trunk dark fibre lines have been constructed on the basis of open networks. More than 15 industrial estates have been connected to this backbone. In order to connect local network infrastructures, NDIX set up several digital market places in Doetinchem, Zutphen, Arnhem, Nijmegen, Tiel and Harderwijk. Likewise during 2006 en 2007, in the province of Overijssel these digital hubs have been set up in

Zwolle, Hardenberg and Kampen. A growing number of firms and institutes acknowledge the gains of open networks as an alternative to the existing operator owned networks. Direct effects of demand bundling are lower prices for data connection between office locations, telecom, internet access and several remote it-services.

This evolution is not unique for the east of the Netherlands. Also in other areas of the country, regional authorities and cities start up similar initiatives. Yet, Gelderland and Overijssel are the front runners. The ultimate objective is a nation wide open broadband network infrastructure. Such a national foot print greatly contributes to the take up of all kinds of broadband ethernet based services. In order to achieve this, the ministry of Economic Affairs and the Dutch provincies collaborate in a joint broadband policy programme. There is also serious interest from the state of North-Rhine Westphalia to expand cross border fibre networks.

To overcome the initial costs all digital hubs so far have been set up with provincial support. The governance of this fast growing system of digital hubs needs to be strenghtened in the near future. This is a joint responsibility of local and regional government, operators and service providers. Fibre communications is a market in its early stages. Stakeholders' positions are not firmly set yet. However, creating sufficient buying power will always remain important and hence justify the involvement of government.

## Colophon

**Preface**

We invite all supporters of the open network concept to distribute the cartoons
and text from this book by whatever means. We would appreciate it if you could
send us an e-mail to that effect on hans.vanderstappen@oostnv.nl.

**Contact**