

Een plus Vier

**Ambities voor investeren in ICT voor onze toekomst
als de diensten-ondernemers van Europa**

Dr. Ir. Egbert-Jan Sol (ejsol@dse.nl)



Amsterdam, 23 januari 2003

Conceptversie



Voorwoord

Systeem architecten en produkt ontwikkeling ingenieurs zijn eigenlijk een strategie officieren of soldaten in de economische oorlog van de 21 eeuw. Toch voel ik mij liever een 21ste-eeuw ridder van de kennis maatschappij, dan wel conform deze cartoon.



Als lid van allerlei 21ste-eeuw ridder kringen, brengt zo'n adelstand ook verplichten met zich mee. Voorbeelden toen waren het verdedigen van het land en haar opbrengsten, maar ook het beschermen van de zwakken. Het geven van lezingen en of het schrijven van artikelen, maar ook verbeteren van open software als Linux of opzetten van een digitale stad zijn dan de middelen van een kennis-ridder van de moderne tijd. Gelukkig vallen er tegenwoordig geen doden of gewonden in de strijd voor welvaart.

Dit verhaal gaat over de economische strijd die ons de komende 10 jaar te wachten staat en hoe wij die zouden kunnen winnen. Ik ben daarin een werk-ridder die een paar kruistochten in de ontwikkelingen van de technologie heeft mogen mee maken. Daarbij kan ik op dit moment, buiten het land van de Prins van Oranje, mee helpen de architectuur van breedbandige vaste en mobiele netwerken van 2007 te definiëren en vorm te geven.



Een plus Vier **ambities voor investeren in ICT voor onze toekomst** **als de diensten-ondernemers van Europa**

Nederland is een rijk land. Om ons welvaarts niveau te behouden kunnen wij niet potverteren, maar moet nog altijd geknokt worden voor een toekomst, dit maal in het opbouwen van een concurrentie positie in diensten. Diensten (engelse termen: services, applications and content) omvat alles op het gebied van zorg, veiligheid, comfort-gevoelens, ervaringen, maar ook geld, verzekeringen, handel, software, muziek, etc. Hierin speelt informatie (data) en communicatie technologie een essentiële rol. Daarbij zijn kennis en ICT cruciale productie factoren van deze tijd. Daar moet je continue in investeren.

Maar wel anders dan wij zijn gewend. Niet meer in klassieke generieke computers en PC's met grote software pakketten. Diensten omvatten software en inhoud, zullen functioneren op allerlei toepassingsgerichte kleine apparaatjes die (bijna) verscholen rondom de mens hun taak verzorgen. De mobiele telefoon, de MP3 spelen, de pinpas, de afstandbediening van het autoslot, de pacemaker, etc zijn al bekende voorbeelden. Maar er gaan nog tientallen meer volgen! Simpele apparaatjes die als vanzelf allerlei taken voor hun rekening nemen van zorg, communicatie, regelen en comfort (care, communicatie, control, comfort). Let op het begrip simpele apparaatjes, geen moeilijk te bedienen computers. Als je er tientallen hebt, dan moet als er een kapot gaat of niet werkt, de taak vanzelf door een andere worden overgenomen.

Dankzij grondstoffen als aardgas, een goede ligging, een gezonde handelsmentaliteit groeide ons welvaart de laatste eeuwen. Van een historie met 20.000 tot 100.000 jagers en vissers in de lage landen groeide onze bevolking tot 1990 als gevolg van productiviteitsstijging in de landbouw tot meer dan een miljoen. Marx voorspelde dat het mis zou gaan en deze mensen arm zouden blijven. Door een productiviteitsstijging in de industrie met een factor 50 in het maken en transporteren van goederen gebeurde dat niet. In een Europees omgeving waar anderen waarde creerden door de productie van goederen, creerden wij vooral waarde, en verhoogde onze welvaart, door de productie en verwerking van voedsel, bulk chemie en in het transporteren van industriële goederen en voedsel.

Je zult altijd een fabriek nodig hebben om een aantal losse componenten bij elkaar te voegen tot bijvoorbeeld een televisie waar mensen meer voor willen betalen dan de losse componenten. Met die fabriek of het verbouwen van gewassen genereren wij waarde. Je zult ook met transport waarde kunnen generen door het juiste product op het juiste moment op de juiste plaats bij een klant te brengen die daarvoor wil betalen. Ook met diensten kun je waarde creëren. Nieuwe nuttige kennis of een efficiëntere patiënten administratie zijn daarvan voorbeelden. In een concurrentie situatie impliceert het genereren van waarde dat je steeds iets nieuws moet doen of dat je iets op een goedkopere of betere manier doet.

Door concurrentie vanuit Azië en Oost-Europa met lagere loonkosten is en wordt dat steeds moeilijker om in Nederland te doen. Tel daarbij op dat bij ons, in de rest van Europa, maar ook in de USA en Japan de vergrijzing de komende decennia als een molensteen om de nek van de economie kan komen te hangen. Van een bevolkings populatie van 20% 65+ en 40% 20-64 jarigen gaan wij naar een bevolking met 15% in de werkzame leeftijd van 20-64 en



40% 65+ maar daar in een veel grote aantal veel zorg behoeftige 85+ jarigen. De Marx van 2000 zou denken dat het weer helemaal mis gaat. Maar de ondernemer (en ondernemende landen) zien hier in juist een uitdaging om door slimmere diensten waarde te creëren, ondermeer door allerhande apparaatjes, maar ook diensten die indirect gebruik maken van onze ICT infrastructuur. Denk daarbij een gezondheidszorg op afstand, maar ook verkeersbegeleidingssystemen die de mensen die werken niet in files vast zetten.

Wij moeten in Nederland economische waarde en welvaart/welzijn creëren in het ontwikkelen en aanbieden van diensten. Omdat je alleen kunt winnen in een concurrentie strijd op basis van je sterkten moet je goed weten wat je wilt en keuze maken. Onze zwakte zijn hoge lonen, rond 2010 nog versterkt door de vergrijzing. Sterkten zijn het bezitten van een voorsprong in kennis (om bijvoorbeeld software of software in hardware chips gegoten) en informatie (wat welke klant waar precies wil). Hoe kunnen wij dan in Nederland de diensten ondernemers van Europa worden? En welke diensten dan, entertainment diensten, financiële diensten, logistieke diensten, publishing diensten, zorg diensten? In elk geval diensten waar je waarde toevoegt bijvoorbeeld door middel van intellectuele eigendom (chips) of waarvan de executie bijna niets kost omdat het efficiënt en effectief van een vooruitstrevende (ICT) infrastructuur gebruik maakt die anderen (nog) niet hebben. Zo maar diensten als het serveren van een hamburger of het verlenen van een vergunning dankzij iets minder bureaucratie leveren weinig toegevoegde waarde. Zonder veel investeren of met goede wil kan ieder ander land dat ook en zullen anderen zonder dat je je kunt verdedigen je winsten laten verdampen. De enige bescherming is dat het locatie gebonden zijn.

Om straks een concurrentie voordeel te hebben moeten wij nu het lef hebben om niet meer in asfalt, staal en beton te investeren, maar met de juiste visie, in ICT. Dit verhaal is een poging die visie te geven. Combineer dat met het type ondernemersschap van de grondleggers van Philips, AKZO, etc, uit het einde van de 19-de eeuw, maar nu in financiële diensten, commerciële zorg van inbraakbewaking tot gezondheid of verkeerbegeleiding of entertainment zoals van den Ende. Dan ontwikkel je een gezonde economische bedrijvigheid. De economie ontwikkelt zich altijd lang golven. Ondernemen kun je in “hypes and craches”. De kracht is het zien van de nieuwe mogelijkheden en wetmatigheden. In bestaande markten zijn de grootste spelers vaak het sterkst en wordt de concurrentie strijd uiteindelijk gevoerd om wie het goedkoopste is. In nieuwe markten is wendbaarheid en het nemen van de juiste beslissingen belangrijker.

Het bijzondere in deze tijd is dat als gevolg van de snelle ontwikkelingen van de microelectronica en laser en radio communicatie technologieën ervaringskennis binnen een generatie verouderd zijn. Het onderkennen van de mogelijkheden van een nieuwe paradigma en snel kunnen voorbereiden en aanpassen daarop vereist kennis en de juist culturele instelling. Een voorbeeld van een nieuw paradigma of wetmatigeheid is ICT geen middel meer is voor het verhogen van productiviteit in de industrie, maar de productie factor om in een diensten maatschappij de waarde creatie van Nederland, juist in een internationaal perspectief te realiseren. Zo’n verandering (“ICT is de productie factor voor Nederland Diensten land”) is misschien schokkend, juist omdat het zo snel gaat. Nog schokkender is het paradigma dat je straks tientallen simpele draadloze ge-internet-te apparaatje om je heen hebt.

Was de eerste generatie van het internet tot 1990 nog een academisch vrij netwerk hoofdzakelijk tussen relatief grote computers, de tweede generatie werd mogelijk door goedkope PC en goedkopere telefonie kosten: het WWW en inbel Internet liep van 1990-2000. Nu ontstaat met breedband en mobiele toegang een derde generatie Internet dat altijd en



overal beschikbaar is en waar mee allerlei diensten van online spoorweg boekje tot thuiswerken mogelijk wordt. Wat wordt het paradigma waarmee wij in 2010 diensten zullen kunnen creëren en leveren? Ah, U zat de opmerking ICT is de productie factor voor Nederland Diensten Land nog te verteren. Het zou anders gaan worden, dus we stormen verder.

Voor 2010 zal de vierde Generatie Internet haar vorm krijgen. Dan zullen niet meer 100 mensen een grote (mainframe) computer delen zoals voor 1990 of per individu 1 PC en 1 mobiele telefoon beschikbaar zijn, maar zal rondom een individu zo'n 10 tot 100 apparaatjes allerlei taken naadloos en bijna onzichtbaar overnemen. De intelligentie van die apparaatjes, veelal draadloos verbonden met andere apparaatjes en de rest van de wereld, leidt door onderling samenwerken tot diensten en het uitvoeren daarvan op een wijze die wij ons nu nog maar nauwelijks kunnen voorstellen. Net als in 1990 toen nog niemand dacht dat je in 2000 een auto telefoon in de broekzak zou stoppen en per dag tientallen emails zou versturen in plaatst van allerlei briefjes, memos en officiële brieven. Hoe schokkend dit paradigma is spreekt misschien uit het gegeven dat er in 2003 1 Miljard GSM gebruikers zijn, maar bij dit paradigma zijn er straks richting 100 Miljard kleine apparaatjes waar in de Nederlandse context Philips de chips en ontwerpen voor kan maken en waar honderden diensten op kunnen draaien. Alleen al het maken van de chip machines door drie Nederlandse ondernemingen ASML, ASMI en BESI voor zo'n productie is niet voor te stellen.

In de vorige eeuw was telefonie gebruik nog een maat voor welvaart en werd kennis en innovatie belangrijk gevonden. In deze eeuw wordt ICT en onze kennis infrastructuur een belangrijker productie factor dan een goede wegen infrastructuur. Als kleine Europese provincie liggen hier volop mogelijkheden. Zo kunnen wij snel en goedkoop een nationale hogesnelheid communicatie infrastructuur inclusief op nationale schaal breedband toegang mogelijk maken. Dit leidt tot een basis (nr 0) ambitie - **breedband en hogesnelheidsnetten waarmee naar consumenten voor 1 Euro/Etmaal voor 2010 1000 x meer bandbreedte (10/10+Mbps) naar ¾ van alle woningen en kantoren krijgt**. De echte ambities voor de BV Nederland zijn het ontwikkelen en leveren van diensten over die infrastructuur, diensten die enerzijds ook exporteerbaar zijn naar anderen en anderzijds een vergrijzende bevolking van dienst zijn.

Een eerste ambitie bouwt voort op onze handelsmogelijkheden en moet Nederlandse financiële bedrijven een concurrentie voorsprong geven. Ambitie 1: **Veilig, contactloos elektronische betalen**. Voor 2010 contactloos betalen, huis/kantoor deur open en ook auto starten met Uw identiteit sleutel die U veilig en gesplitst bij U draagt en waarmee U uw rechten beheert. Het beheersen van verkeerstromen blijft belangrijk. Zonder een autoindustrie zouden wij ICT moeten inzetten om een **ambitie 2: intelligent verkeersnet** te maken, niet alleen voor elektronisch rekenrijden, maar juist voor veilig en efficiënter verkeer met voorspelbare verkeerstromen. Als ambitie 3 zou, dankzij ICT en voortbouwden op de media industrie (uitgevers, omroep bedrijven) **nieuwe interactieve, multi-media vermaak, communicatie en nieuws** mogelijk moeten worden gemaakt. Een groter deel van de bevolking krijgt hier meer tijd voor. ICT onderzoek dient zich reeds nu op deze gebieden de juiste kennis en concepten toe te eigenen. GigaPort, Kenniswijk, Towards (congestion and location) Freeband, Ambient Intelligence, Beyond 3G, 4G ambient internet zijn hiervan reeds voorbeelden waaraan gewerkt wordt opdat Nederland binnen 2 x 4 jaar dankzij ICT haar welvaart en waarde met een diensten industrie kan creëren.



- **Ambitie 0 - breedband en hogesnelheid:**
Voor 1 Euro/Etmaal voor 2010 1000 x meer bandbreedte (10/10+Mbps) naar $\frac{3}{4}$ van alle woningen en kantoren, inclusief altijd, overal naadloze toegang
- **Ambitie 1 – elektronische betalen, veilig en draadloos:**
Voor 2010 contactloos betalen, huis/kantoor deur open en auto starten met je identiteit sleutel die je veilig en gesplitst bij je draagt en waarmee jij je rechten beheert.
- **Ambitie 2 – intelligent verkeer:**
Voor 2010 moeten ieder voertuig over elektronische identificatie beschikken, niet alleen voor rekening rijden, maar ook voor onderlinge afstand en route planning opdat veilig en efficiënte verkeerstromen op de snelweg, maar later ook in de stad en wijk mogelijk worden.
- **Ambitie 3 - multi-media ontspanning:**
Voor 2010 moeten mensen, middels ICT, omroep radio en TV bekijken op het voor hun meest geschikte moment alsmede interactief mee kunnen doen aan multi-media massa evenementen.
- **Ambitie 4 elektronische zorg:**
Nog te definiëren, maar misschien is ouderen zorg wel thuis zorg en zijn ambitie 1-3 veel effectiever dan nog meer medische kosten goedkoper proberen maken.

De ingesloten Engelse tekst gaat dieper in op de economische sterkten van Nederland, in het bijzonder het feit dat veel wireless LAN producten een Nederlandse oorsprong hebben. Dat is nauwelijks bekend, maar juist met 100 apparaatjes rondom je, zullen 90+ draadloos zijn. Philips Semiconductor Nijmegen is een van de grootste productie plant op dit gebied. Onze uitdaging is om juist de diensten software voor op die apparaatjes en de inhoud (content) te ontwikkelen. Daarbij spelen zowel kennis van protocollen en beveiliging en versleuteling een kritische rol.

In het IOP Generieke communicatie en het “Freeband” onderzoeksprogramma draaien om dit thema. Het IOP programma van het ministerie van EZ concentreert zich zelf geheel om de communicatie, control, care and comfort behoeften van de prive gebruiker (de passieve, maar ook actieve consument) van 2010.

De uitdaging voor het Internet en het ISOC in Nederland is niet om de Verenigde Staten van Amerika na te doen. Wij moeten wel voorkomen dat het achteraf veilig maken van de open IP protocollen met IP-sec, secure BGP en DNSsec IP te ingewikkeld wordt zodat wij genoodzaakt zijn alleen maar made-in-USA producten van een drietal leverancier te kopen. Daartoe is middels Ethernet, maar ook mobiele, draadloze technologieën nog een heleboel mogelijk. Op zich zal dat leiden tot een forse strijd tussen de grote Europese broadband en mobiele communicatie leveranciers en de Amerikaanse datacom leveranciers. Maar voor de BV Nederland moeten wij ons niet op die strijd richten. Dat zal ons geen economische voordelen opleveren. Terwijl anderen nog altijd om de huidige 2G en 3G Internet strijden, starten wij met een voorsprong om 4G op te bouwen. Tenminste als wij enerzijds niet in slaap vallen of niet terzake doende activiteiten oppakken, en anderzijds lef hebben om nieuwe zaken te gaan ondernemen waarmee waarde wordt gecreëerd om echt geld te verdienen.

Geld verdienen je niet met geld schuiven, maar met investeren in productie middelen, nu kennis en ICT, om effectievere goederen en diensten efficiënter te creëren. Internet is niet de stoom trein van toen, maar de rails. Diensten rijden al als grote stoom treinen rijden daar op rond



naar diverse grote lokaties. Maar binnen tien jaar is er sprake van tientallen “ambient intelligence” per individu die als autootjes overal naar toe zullen gaan. En net als de vierde Kondratieff toen het gebruik van olie auto en vliegtuigen na de tweede wereld oorlog betaalbaar maakte, zal de ontwikkeling naar het 4 Generatie Internet leiden tot een maatschappij waarin ook waarde, geld verdiend kan worden met betere en nieuwe diensten. Voor ons eigen pensioen en onze kinderen wordt nu de bal al opgepakt in het wetenschappelijk technisch onderzoek. Misschien wel wat economisch gedreven onderzoek, maar het doel is niet wetenschap ontwikkeling, maar waarde creatie. Net als Internet geen academisch speeltje is, maar een essentiële productie factor om als Nederland de diensten ondernemer van Europe te worden.

Slotwoord

Een paradigmatische verandering, enerzijds de onderkenning dat kennis en ICT geen middel maar de productie factoren voor diensten zijn en ander zijds dat wij straks omgeven worden met simpele apparaatjes die allerlei taken over nemen, creer op zich een nieuwe wereld. Vanuit een oude wereld lijkt het soms op die nieuwe wereld opgedrongen wordt. Als je er deels in mag zitten en vorm mag geven zoals de schrijver dan ervaar je alle nieuwe mogelijkheden als uiterste boeiend.

Wat zijn diensten (engels: services) of zijn het eigenlijk toepassingen (applications). Het zijn eigenlijk toepassingen van kennis en ICT waarbij de toepassing waarde genereert zonder dat daarbij nog een fysiek product van maker naar gebruiker getransporteerd wordt. Telefonie is de dienst van het verbinden van de ene gebruiker met de andere. Internet is de dienst om informatie overal beschikbaar te krijgen, ongeacht de afstand, in een steeds complexere wereld.

Welke nieuwe kennis, nieuwe ideeën, nieuwe producten, nieuwe toepassingen, nieuwe diensten, nieuwe bedrijvigheid en nieuwe oplossingen voor maatschappelijke problemen zijn er wel niet mogelijk.

Het “Towards Freeband” initiatief van de Nederlandse technische universiteiten, TNO, TI en enkele bedrijven poogt voor de kennis keten het paradigma rond om “ambient intelligence” te ontwikkelen en zullen zeker bijdrage aan het realiseren van de vier ambities. Maar de eerste ambitie gaat ver voorbij de mogelijkheden van een onderzoeksprogramma. Die ambitie vereist politiek moed en het vermogen voor uit te zien en daar met ons allen na te handelen.

Zie ook:

- **ISOC presentation slides:**
<http://isoc.nl/activ/nieuwjaar-2003.htm>
<http://www.dse.nl/~ejsol>
- **IOP:** <http://www.senter.nl/iop>
- **Freeband:** <http://www.freeband.nl/>
- **Telecommagazine**, november 2002 en sept 2000



Engelstalige versie

One plus Four Ambition for investing in ICT as wealth generator

- *Introduction*
- *Generation of wealth and its relation to ICT*
- *Service society*
- *The ambient intelligence serving you*
- *The Dutch economy leading in the 4G ambient Internet*
- *One plus the Four Ambitions*
- *Measurable goals*
- *What's next*

The “Freeband” vision (written in 2001) comprises location and congestion free bandwidth where the user was not concerned with the “technology “ (and the cost of using it) and required for the realization of this vision 7 areas as new architectures, platform, means of access, etc. For the “Freeband” proposal for funding by the ICES-KIS BSIK AMvB a clear ambition with measurable goals and roadmap for the Dutch society are formulated in this document.

The original “Freeband” vision document was focused on the impact and possibilities of “broadband” and resulted in the Towards Freeband Kennis Impulse in advanced (academic and industrial) scientific research, the ambitions and goals formulated below are far more economical oriented towards the creation of new businesses and (exportable) competitive advantages. Only the first ambition is directly related to the original “Freeband” vision. If you want to offer an explosion of new services, you need at least the bandwidth at an affordable price level and penetration to offer those services.

- **Ambition 0: Broadband:**
“1 Euro/Etmaal” (A Dollar/A Day) implies practically unlimited bandwidth (10/10+Mbps) to 75% of all home/offices before 2010. With such bandwidth comes also seamless always-on, anywhere access.
- **Ambition 1: Wireless secure e-payment:**
Before 2010 your ID card, money, keys become electronics and wireless and are used as such by more then 10% of the population (10% does not sound ambitious, but penetration beyond 10% implies that a mass market success will follow in due time)
- **Ambition 2: Intelligent traffic:**
Before 2010 each car should have electronics vehicle identification, not only for tax purposes, but also to support actual and expecting traffic conditions, both for short range and route control purposes. It implies that the Netherlands has the most intelligent national wide traffic systems using by intelligent vehicle systems that support car drivers in efficient and safe transportation.
- **Ambition 3: Multi-media entertainment:**
Mass market multi-media content creation and delivery for personal use (mass customization) such that before 2010 people can watch broadcasted-type television at the most convenient time for them as well as participate in interactive mass (TV) events.
- **Ambition 4 e-Health”:** tbd



Introduction

The purpose of this contribution is to explain the importance of investing in research and development (or innovation and knowledge) in the “Freeband” arena. It explains the motivation for the ambition of “Freeband” and why certain goals are formulated. It is mainly economically oriented. Judging the economic importance of the “Freeband” proposal is not easy. There is a major assumption that gradually the economy of our society is changing and that certain criteria will lose their importance, while others are not yet completely understood.

Technological academic research, mainly driven by physical sciences, was performed to improve physical products and production means. As the needs of society are changing to services and information and communication means, also the character of needed academic research will change. As other paradigms gain importance as e.g. information (data) becoming valuable on its own or as systems become more complex, research in how users deal with information or e.g. secure protocols between systems become important. Solid academic research needed in the “Freeband” context will gradually differ from the classic technological academic research. Only in hindsight judging the academic quality was easy, but now it is as difficult as shooting a moving target. Past top performance in a traditional area might be less useful in a new or still under developed area. Here ICT research is handicapped when comparing ICT related research with traditional disciplines academic research that change less rapidly. Without the basis of a proven and accepted scientific view on where and how to invest in unknown territories, let’s take an economic point of view.

Generation of wealth and its relation to ICT

The Netherlands could sustain in the old ages a population of 20.000 to 100.000 inhabitants with hunting and fishing. In the last century the Netherlands evolved into an industrialized country with 15M inhabitants. Currently the Dutch society is gradually changing its generation of wealth from industrial production to services.

The transition from an agricultural to an industrial society shifted productivity improvement from the production and transport of foods to goods. Today our society evolves from an industrial to a services society where the production and transport of non-physical goods create value too. “Services” are non-physical goods as care, safety, feelings, experiences, but also money, insurances, trading, software, music, etc. In general for the creation and delivery of services information or data are essential. Computers and communication networks play a key role here. Productivity improvements and investments in this area are needed to continue to improve welfare and wealth in our society.

The remarkable aspect in these “paradigm” shifts is the rate of improvement during the last decades. Marx misunderstood the consequences of a factor 50x improvements in the production and transport of goods by one industrial labor force. It took 100 years, but now 50 times less workers are needed to produce and transport the same amount of goods as in the time of Marx. Instead of poor labor class, a rich middle class emerged. From 2020-2040 we face a heavily elderly population that requires much care while the working force between 20-65 years will be much smaller. This time we do not need investments in factories and roads to improve productivity, but we need investments in information and communication



technologies to improve the productivity of handling and transporting information to lower the costs of creating and delivering services

Today the production and transport of information, due to the price/performance improvement of microelectronics and optical-electronics improves at a rate of 1000 x in 15 and 10 years. Rapid adoption of new academic knowledge as well as rapid changes in local societies due to the introduction of foreign technologies occurs, but never ever such a massive, world-wide rapid change occurred. As people can not change their behavior fast, social inertia will slow down the effects initially. It is a threat to a comfortable life, but it provides new opportunities to create wealth.

Such a rapid improvement results for example in rapid changing economical rules. One lesson we have learned is that it is not the costs or flexibility, key items in the production of goods, but that innovation and knowledge are far more important. For almost a century, and still programmed in the minds of many is that investments in machinery made the production of goods more cost effective. Within a decade one has to change this paradigm into investment in innovation and knowledge to create new and better services. It took decades, or better generations, to change from Marx concepts. With the current rate of improvements in high-tech, the mind of many people has to change within a life time. This implies giving up the lessons learned and accepting new models, at a time that even current economic theories are still struggling to find the right models to value the importance of information and the creation of wealth expressed in services.

One changed rule is that to generate value and wealth for the Dutch society, not the construction of new roads or railways, but building and rolling-out cheaper and faster communication infrastructures is an important enabler. Even if the Dutch or European government can not do it themselves, they need to ensure that commercial players do. As in any upswing of a 50-year Kondratieff wave, people get scared and uncertain as old rules do not work any more and new rules are not fully understood. This certainly applies today with the very rapid improvement changes. Can you invest 5B Euro in broadband to every home or a public wireless or mobile network or should you invest 5B in a “Betuwe” railroad? How much do you afford to invest in research and development in ICT and how to measure the effect of it or even justify it?

Another lesson learned in high-tech economies is “the winner takes all” mechanism. Compared to the classic economic model of reduced extra returns, in high-technology the standard setting parties become the most profitable. Whether is it a company as e.g. Microsoft or a countries like Scandinavian countries with an initial head start in mobile telephony, you have to start early with a new technology and try to fit and obtain a number one position. Later we explain why not investment in broadband and wireless technologies as such, but the ambition to create a leading position in “ambient intelligence” (described in more detail below) will be a goal.

Service society

The investment in innovation and knowledge or new enablers is not the goal, but the means. The goal is to improve the ability to creation of new and improved services that benefit the



Dutch society (inhabitants, industrial players, service providers) and/or are exportable or tradable for the exchange of food or goods (by means of money).

Examples of such services are home care for elderly people, more efficient and effectively, or cheaper and more secure small payment transactions. Given our small, but heavy populated country we have been able to supply almost all houses with a good connection to a road, water, gas, electricity. This implies that it is possible to supply 50% or more of all houses before the end of the decade with a 10Mbps broadband connection. That makes e.g. working from home several days a week possible and thereby lowering road congestion during rush hours. That requires a lot of fiber (not till the home, but at least very close to it) and has to be very low-cost optics. But we are good in and have a low of knowledge on low-costs optics (as e.g. in CD-players).

Or given the trading tradition and the importance of the financial sector for the Dutch economy, why not introduce an electronic payment system for very and small values very early in the Dutch society to enable (money) services providers as banks to export small payment transaction services to all over the world. Such a system needs wireless terminals and we are good in wireless radio technologies as e.g. Bluetooth and Wireless LAN (Wi-Fi). Compared to houses, offices and factories which can be attached by a (glass or copper) wire, people walking, but also money and cars can not be attached by a string or wire. You need wireless (that is radio) technology. Therefore investment in wireless networks, be it personal Bluetooth or similar networks, be it local area network (LAN) in house, buildings, campuses or hotspots (railway stations, shopping center or around highways) or wide area networks as GSM and 3G are all needed to enable the delivery of new and improved services.

Another example you will see soon are smart transport systems to enable a better and more efficient usage of congested roads using real-time traffic information displayed on screens in the car. But beyond that short distance “radar” or “radio” technologies will enable more automatic control of cars from identifying cars for road-pricing to automatic distance & speed control for safety as well as smoother traffic behavior.

The message is that any economical sound investment should be in the creation and delivery of new and improved services. The “Towards Freeband” Program is not to create congestion and location almost free bandwidth, but to enable those new and improved services.

The “ambient intelligence” serving you

The crucial assumption is that new and improved services will be made possible by all kinds of smart, intelligent, embedded, ubiquitous and ambient (computer) devices. The notion “ambient intelligence” describes a concept of many intelligence, inter-working devices around you that take care of all kind of tasks for you. Other names were ubiquitous computing, embedded systems, hidden computer, but the wording “ambient intelligence” shift the focus away from the enabling technology to the service to be delivered.

With ambient intelligence you will not have a general purpose personal computer, but like the mobile phone, you will have several dedicated devices all around you (hidden, but ambient) taking care of all kinds of monitoring, entertaining, controlling, communication, informing you or on behalf of you. This requires of course “always-on” network connections,



wireless around you to gateways, but over broadband from gateways into the network. But it also requires the right kind of physical (consumer electronic) devices, but also the right device software (operating systems distributed over multiple redundant devices as well as automatic loadable applications) and service networks ranging from secure transactions to multi-media streaming and peer-to-peer file sharing.

The birth of the PC was a simple extrapolation that if DEC (Digital Equipment Corporation) could make a minicomputer out of a mainframe, then Apple could make a personal computer out of a minicomputer. The results was not a market of 5, as Watson thought, but really hundreds to thousands mainframe computer to a market of hundred-thousands minicomputers and finally a market of 100 million PCs. Ten years ago there where hundred of thousands car-phones, five years ago mobile telephony penetration could reach in certain countries 30%, now we have a market of 400 million mobile phones a year. The extrapolation of this trend towards smaller and more powerful micro-electronics is that we evolved from the 100 workers sharing a mainframe, via the 1 PC and 1 mobile per person to a 100 devices per individual consumer in a market of 2 Billion. That is interconnecting 200 Billion devices in a network. This is an incredible challenge. A few examples can illustrate this. The current version of IP, version 4, is limited to 4B individual IP numbers. Work is on going to introduce IPv6. Or ..

Dare to image a market of 10 (hidden) devices per individual by the end of this decade and a Dutch company as Nokia owning 40% market share, a Microsoft running 90% of all software in those devices or a Dutch version of Cisco owning 70% of the network market or a Dutch company supplying 40% of all chip manufacturing equipment. This is less weird than it appears. The ambient intelligence market will really peak by 2020 with the huge elderly populations in the whole Western, North American and Japanese worlds. And twenty years ago Microsoft had a few programs for IBM PCs, Cisco was a small Stanford university company with a few products in fifteenth years ago and Nokia was more trading tires and plastic boots then phones ten years ago. They were in the right business at the right time and then made the right decision when that business grows. As long as a new business is still emerging, size of company is not critical, getting the right support from other players in the same area (competitors, subcontractors, and government), feedback from consumers, having access to the newly needed knowledge and proper marketing.

Despite the rapid change, uncertainty and struggle to find the right paradigm, we can describe this "Freeband" future in less visionary terms, more in the form of a roadmap with a next step ahead. If you call the plain old telephony system (POTS) and SNA mainframe computer networks generation zero, the academic Internet till the end of 1980 and the car phone mobile networks first generation (1G), then you can call the dial-in and web internet as well as the GSM network second generation (2G). Today the current new mobile and broadband access "always-on" Internet are called third generation or 3G. This "always-on" ability of 3G networks will lead to new services ranging from peer-to-peer file sharing network to remote sensing for safety and security. The mobile capabilities will lead to all kind of location dependent or aware services. The ambition of "Freeband" is to prepare the Dutch society for this coming fourth generation (4G) Internet of billions of interconnected, single purpose wireless and "always-on" devices the fourth generation internet. Of course this 4G ambient Internet goes beyond, but includes the current broadband and mobile Internet.

Always-Best-Connected (the current concepts for the 4G mobile communications) devices implies wireless radio technologies for the at least the first meters (personal network) and



outdoors several kilometers to gateways or chaotic or adhoc networks between peering devices. It also implies very low-energy consuming and highly integrated microelectronic designs. But it also requires agent software technologies that take away the burden of simple tasks from humans as finding the next train departure time, the most optimal route during traffic congestion, to closest by reachable and available doctor. Or the ability to listen to or watch the music and movies anyway, anytime, anywhere you want.

The Dutch economy leading in the 4G ambient Internet

The above information is not unique for the Dutch society. Other nations within the European community, but also the US of America and Asian countries as Japan, but also South Korean are well aware of the (rapid) changing opportunities in this area. There exists even a severe threat that given the very huge funded USA military research in remote battlefield operations will ultimately turn into commercial products used to improve life. Hidden behind military security a little is known already about smart bombs with hundreds of intelligent sensors to detect and interpretate jointly in an ad-hoc network any activity in a battle field. Similar technologies can also be usefully deployed in detecting whether an elderly person suddenly needs help at home or accidentally dropped a cup of tea.

The Netherlands can not bet in all area of ICT research on this future. Without a huge military industry and a focus on low-tech bulk agricultural and chemical goods (e.g. AKZO, DSM, Shell) the Dutch society however did developed a competitive skill in trading, logistic and media services. Also Philips Electronics and in particular its Research Labs (Eindhoven) and Philips Semiconductors (Nijmegen) as well as some loosely related high-tech industries as chip equipment manufacturers as ASML (Veldhoven), ASMI (Bilthoven) and BESI (Waalwijk) deserve a special reference. But also radio (chip) technologies owned by Ericsson (Bluetooth, Emmen), Proxim (old Lucent/Agere, Nieuwegein), Intersil (old No-Wires-Needed, Bilthoven) and National Semiconductors (Den Bosch) is far more concentrated in the Netherlands than any one ever knew and of potential huge importance in realizing the vision of 4G Internet.

With Lucent (fiber optics, Hilversum) and Alcatel (Antwerpen) also a lot of knowledge in broadband networks is available in this geographic area. Alcatel, which owns a 40% market share in the ADSL world market, has not in France, but just across the border in Antwerp all their ADSL development located. And with three universities of technology very close to each others and good co-operating in the area of telecommunications as well as a telematics and a telecom institute, but also related institutes in the area of embedded systems and chip design (including the IMEC in Leuven), there exists also an excellent knowledge infrastructure to build upon.

Already today the “Towards Freeband Impulse” research, application and test-bed projects started working into that direction. Examples are research on UltraWideBand personal or in-home new radio technologies, the plastic (polymer is cheaper to install than glass) fiber, or the wireless LAN with roaming testbed, but also the Beyond 3G/4G application and XML services research. The “IOP Generic Communication”, that is interlinked with the “Towards Freeband Impuls”, decided to concentrate ultimately on the communication, information, entertainment and control needs of the private user.



Good knowledge in consumer electronics, the capability to design and develop the required chip technologies, an excellent knowledge infrastructure, a wealthy home market capable of formulating new demands early all positions the Netherlands to head for a leading position in what will be the next economic battlefield. But we are not good in the back bone communication networks, computer server platforms or software, the more industrial side of this 4G future. We are good in content creation and delivery. But we need more knowledge on security to make electronics payments and digital rights workable. With our sanding soil and tiled sidewalks we can roll out a hybrid copper/fiber access network cheaper and faster to a large majority then any other society. But one needs a government that realizes this unique capability and creates a competitive scene to realize this.

One plus Four Ambitions

Is it realistic to assume in this ubiquitous computer (1991), the hidden computer (1997), the ambient intelligence (2000) “embedded, everywhere” (2001) or 100+ Billion devices 4G Internet (2001) scenario in the time frame of Freeband. In South Korea the government pushed for large scale broadband and, while they faced a severe economic crisis in 1997-8 they achieved a 60-70% broad band penetration in 2002 at a mass market price level of 20-30Euro/month. The rest of the world has still a 10-30% penetration at 35-50 Euro/month. It should be possible to have a 60% penetration of 10/10 Mbps (that is symmetric) Ethernet over DSL (existing copper over 1 km and fiber for the rest) before the end of this decade. This is the Public Ethernet ambition. It eliminates the current bottle neck between the fast home and office networks and the fast backbone networks. Not only in the fixed copper and coming fiber networks, but also the broadband mobile networks with 3.5G and Wireless LAN which their higher frequencies, smaller size and need for a fixed fiber network. But more important it enables a simplification of network technologies and creates the possibility to deploy a multitude of services at the most cost effective level of switching IP/Ethernet data packets all the way without adding costs of conversions to and from other media types.

Ambition 0: “De Euro/Etmaal” (A Dollar/A Day)

For less then 30 Euro/Month a broadband connection at 10/10 Mbps or more to 2/3 or more of all offices and homes before 2010 suitable for the delivery of voice, internet access, multi-media, safety & security, energy monitoring and other services over this single (Public Ethernet) network. Already since Graham Bell invented the phone and offered it as a service, people do not pay on a monthly basis a certain household-economic level of 20-30 dollars a month, or a dollar a day. Over time and in particular these days, for that 1 Euro or Dollar a day you get more and more bandwidth and start to download more and more MegaBytes of information. The huge impact is that telecom operators, while earning a fortune until 2000 on real and monopolized scarcity of bandwidth, suddenly loose their source of profit. Within a decade they have to become multi-service providers.

Low cost broadband is really an enabler to offer the opportunity to deliver new and improved services at a larger scale and at a lower price level then ever before. In practise, this is 1000 x more bandwidth for the same price as a 9600 kbps dial-in line in 1993 when with Trumpet Winsock and Mosaic browser the world-wide web was created. Research and products in this area are not very high speed optical networks, but on very low-cost highly integrated fiber optical devices. Once available, private users can attach more and more (embedded) “always-



on” devices to the Internet. And service providers finally get a cost effective environment to deliver more and more services too. You want to create and exploit these services and their content as early as possible, and certainly before the rest of the world starts using them too in order to create exportable “service-products”.

Then next four ambition surfs on top of this enabler ambition of having a nation-wide broadband fixed/mobile network. Once you have affordable and practically unlimited bandwidth all over the place, the next step is to attach more and more devices to it. As with the shrinking of devices the space for connections becomes less and less and as radio links are simpler to deploy, we know that the huge majority of the 100+ Billion devices will be based upon technologies as Wireless LAN, Bluetooth and their successors. Low power and low costs are key items, but also understanding their usage by human whether in their houses, cars, and clothes are as important. In 1993 only a few people had car phone, by 1998 we were approaching a 30% penetration, but no one expected a 80+% penetration of mobile phones by 2003. Although one can think about tenths (30-40) of different personal services as mobile telephone, people will probably not use more the 7+/-2 different ones which they will really use. Today you take your wallet, watch, keys and mobile phone when you leave your home. And sadly to admit, Dutch people have to take by that time an ID card with them too.

Ambition 1: Before 2010 your ID card, money, keys (plus the rest of your personal information) become electronics and wireless (in a kind of moving information bubble around you) and are used as such by more then 10% of the population.

At 15 million persons and 1 to 2 to 3 personal devices, that is a market of around 30 million wearable wireless devices, but also a market for electronic transactions and identifications. It requires the co-operation of service and content provide to enable to use of their services on these devices. Only when users perceive a benefit (e.g. no thick bundle of plastic cards or missing the library card, the hospital plastic or loyalty card just when you needed it) and considered it use secure (e.g. automatic blocked if your second secret matching key pairs are not within 2 meters) they will change their behaviour. Technology wise solutions will be come available by 2004-2005, but it will only become usable if they support multiple applications seamlessly and simultaneously. Do not worry about the apparently low penetration of 10%. Any consumer application that got beyond a 10% acceptance by the mass market, ultimately grow far above 50% penetration. It only takes more then a few quarters, actually it can take several years.

Public transport, with the hot spot locations, could be a possible first usage, but other services build on top of 2G-GPRS and 3G mobile networks will also appear. Chip-based, contact-less electronic small payments should be usable 2008 and used on a significant larger scale by 2010. Over years banks have hindered the deployment of this technology as on a national scale no player could gain a competitive advantage and innovation could imply that each could loose its market share. New players as trusted third parties and other approaches as well as a more open European market will change this scene too. Fundamental research does not only include wireless radio technologies, but also different non-hierarchical, autonomous software and other security means and methods to enable other players to enter this market or circumstance existing dominant players eager to defend existing market positions. Application research with first applications and real users are essential too. Especially given the fact that most users ultimately will be elderly people of which several will be handicapped in one way or another. The target is not the eager youngsters. Trading has always been a strength of the



Dutch. New forms of transaction management in service creation and delivery should prepare this trading tradition in the next decades to come.

Advanced transport systems are, due to the importance of logistics in the Netherlands given its trading tradition and its geographic location at cross roads, important too. However in an area of time where smart devices and intelligent control in combination with a smaller workforce can take over monotone tasks, there exist beside the logistic need also another society need. For an important part of the population the efficiency of transport should be increased instead of decreased due to loss of time and money in traffic jams. Automatic vehicle identification should not only be used for tax and road pricing, but for value creating services as traffic jam prediction, automatic car influences system to enforce stable traffic streams, intelligent traffic lights, etc.

Ambition 2:

Before 2010 each car should have electronics vehicle identification, not only for tax purposes, but also to support actual and expecting traffic conditions, both for short range and route control purposes. It implies that the Netherlands has the most intelligent national wide traffic systems using intelligent vehicle systems that support car drivers in efficient and safe transportation. Your car is wirelessly connected to an equally smart road-traffic infrastructure.

There might not be a large automotive industry in the Netherlands for person cars, but for trucks as well as automotive suppliers there is an important (export) industry which can benefit from any significant investment to attain a leading position in new and improved traffic services. But far more important is the possibility to create and develop high-tech based services that will benefit the Dutch society in general. The needs for investment is particular governmental oriented. Not only due to the high costs of the physical environment, but also due to the high taxation by government, the Dutch government plays a double, overruling role as user and vendor. Also in the transition from an industrial to a services society, the mixed responsibility requires the government to create an entrepreneurial role itself. And as a consequences, like in industry, invest a significant amount of financial means into research and development to create new and improved services. The competitiveness to create an atmosphere of continuous improvement and to avoid laziness implies that the government should enforce others to take the role of services providers and only support the infrastructure. The chicken and egg challenge to overcome is the initial platform environment. That should be create by formulating and realizing ambition 3, although ambition 1 (having gateways points) and ambition 2 (enough affordable device) are supportive here too.

The next ambition leverage on the others ambitions and like specific Dutch (geographic) reasons behind ambition 2, ambition 3 is related to a specific Dutch situation. Compared to e.g. the “Maschinenbau” culture in Germany, there exists a relative large publishing and media industry in the Netherlands. But how to handle electronics books, what to do with personal TV as delayed and cached broadcasting television, digital right management etc. But also how will content for new (multi-)media be created and delivered.

Ambition 3: Mass market multi-media content creation and delivery for personal use (mass customization) such that before 2010 people can watch broadcasted-type television at the most convenient time for them as well as participate in interactive mass (TV) events.



This required new services and equipment for consumers, but also delivery networks and identification means (e.g. for electronic voting). It also involves a complete new type of book or newspaper in which not the written word is the only technology, but also the interaction with the reader, or better, by the user plays a role. Your newspaper is personal assembled based upon your interest and has electronic links in case you want to know more details, links that can lead to more readable, but also viewable media's. Of course one will make use of wireless first meter technologies and broadband first mile technologies, but also the digital ink technologies and digital rights.

Ambition 4: e-Health

Tbd.

Measurable goals

Ambition 0: "De Euro per Etmaal" (A Dollar/A Day)

People pay already a Euro per day; they only get a narrow band and charged per minute. Of the 6-10 million possible connections, 10-15% has broadband, although at a too high price for mass usage. In 2004-2005 bandwidth and price will change and a growth will start from 25% to 50% (2007) to 75+% penetration before end of decade to a standard 10Mbps or more connection.

The measurement will be steady decrease of the cost per download MegaByte, where the amount of MegaBytes approaches a level of one or more GigaBytes for a dollar by the end of the decade. The availability and actual prices levels depend on commercial offerings by operators. With fiber optics being accepted as the only future proof alternative for the next 30 years, the academic roadmap should focus on lower and lower costs of fiber electronics and ultimate simple and low cost installation by 2005-7.

Ambition 1: Before the end of the decade you ID card, money, keys become electronics and wireless and are used as such by more then 10% of the population.

This ambition is already formulated in a measurable way. The roadmap however requires more application research in usability and security, although very low power and very small radio chip devices are essential too. From 2007-2010 is it however more a commercial and application challenge involving economic, legal and user behaviour research activities then a traditional technological research area. To be successful financial service providers should be involved in an early stage too. This is a measurable parameter already in 2003-2004.

Ambition 2:

The most intelligent national wide traffic systems supported by intelligent vehicle systems measured by the number of different services supporting car drivers for efficient and safe transportation. Each car should have electronics vehicle identification, not only for tax purposes, but also to support actual and expecting traffic conditions, but for short range and route control purposes.

Measurable goals and a detailed roadmap (Jan, 1st 2006, all cars have an electronic identification) depended the last few years on political ambitions around the concept of "roadpricing". Political issues can be trend sensitive, but new security and tax collection



models will revitalize or keep interest in this issue. This is mainly due to the rapid improvements in micro electronics and radio technologies as used in small devices. Although dedicated devices are possible (first ideas fuelling the political ambitions), the roadmap should be based upon generic technologies, probably with secure and prove multiple (or exchangeable) security technologies. The tactic is to navigate to an early introduction of 4G ambient internet technologies but without the risks of a proprietary single purpose technology solution too early. There is a relation, possible interdependence, with ambition 1 and its roadmap. In the time period 2003-2007 it will involve technological developments and experiments. Main knowledge development is concentrated on selecting the technologies most suitable for massive reliable use. This knowledge will lead to subsequent developments in other area application fields towards the 4G ambient internet vision.

Ambition 3: Mass market multi-media content creation and delivery for personal use (mass customization) such that before 2010 people can watch broadcasted-type television at the most convenient time for them as well as participate in interactive mass (TV) events.

You can watch more and more archived broadcast TV programs today by downloading them over broadband connections. Their quality and speed of delivery will improve during the next 4 years rapidly. Beside an interest from cultural heritage for a small language area to capture, store and keep it retrievable in a very economical way, there exist no specific Dutch competitive advantage. There could be a competitive advantage if ambition 1 is realized in the Netherlands earlier then other area's in the world. The peak in the roadmap is therefore a little later and should be on creating means to charge the consumption of digital content on multiple devices. As, at least modern, economics learned that any new form of communication is first filled with sex and porno, an early indicator could be the interest by the Dutch adult industry. This statement will upset several readers, but tolerance is an aspect of the Dutch society that might create a competitive advantage. But this is not the issue itself as it is only a roadmap indicator. The ambition is the creation of technical knowledge in the area of new forms of personal multi-media entertainment and by 2010 people should be able to watch the world-cup football at home from the camera position they prefer.

Ambition 4: e-Health

(I had not time to think deep on this subject. Maybe it should be called e-Care. I only have a couple of harsh opinions on a profession that misuses artificial economies. But every one hypes on it, so it has got to be included. Well if a good friend who works as psychiatrist has to write medicin prescriptions three time, some automation is desperately needed. In Sweden with the Swedish ID-system they had everything at least automated so they did not lost on inefficiencies. But this is not the root of the problem). Anyway, any co-author dropping in this some sensible text is welcome.

What's next

The current participants in the "Freeband" arena are large (telecom) technology players. Their business is changing rapidly towards services and will merge and compete with other players not yet involved. It is logical to expect that the "Freeband" ambition will be realized over time in different steps (with separate more detailed calls) such that those other players can step in and even take over the rolls of others.



There are new large leading computer and telecom player based in the Netherlands and therefore this trend is more than logical. Still knowledge and ICT (information and communication technologies) are key production factors for the services industry, but in the Dutch context it will be the service providers themselves, from operators to financial and traffic institutes, that should be leading in innovation and knowledge in this area. But are they? There is a clear strength in consumer application as well as chip design for consumer devices. With the ambitions it is the intention to get them closer together.

Some of these players have their own world and different type of behaviour regarding innovation. The risk is that they continue with classical approaches and are too late to adapt. They do not need new optics or radio technologies, but they need simple protocols, better securities, content creation platforms etc. They will not start such research by them self, neither be able to combine the breadth of expertise that is needed to create these new successful services on their own. Of course there are risks as e.g. new or different academic knowledge that will be needed or still developed, mismatches due to rapid evolving time frames of introducing new services versus fundamental academic research. Especially in the UTwente area with telematics and the TUDelft area with information science around the private user and TU/eindhoven on the embedded system technologies much work has been conducted to make progress in these “not-so-easy” new area. But with the gained importance of services for the Dutch economy the academic study in “service creation and delivery” areas will gain fundamental importance too. Once successful in attaining a leading position in 4G ambient Internet and in particular the creation and delivery of services on all kind of consumer devices, ranging from wearable to home to in-car devices, the Netherlands, also because of this reasonable sized (not too small, not too large) market within the European community would be an extremely attractive place for foreign players to develop and experiment with their new services.