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Centrum voor Wiskunde en Informatica
Centre for Mathematics and Computer Science

Turning Knowledge into Business
A Practical Approach to Transferring Technology



CONNECTING EUROPE TO THE INTERNET

The Internet is all pervasive. It reaches into the offices, homes and lives of millions of people across Europe.

For these people fast, electronic communications are

an everyday part of normal life. Not everyone is

aware of the pioneering role that CWI has

played in creating the Internet links that we all

depend on. During the 1980s, some of CWI's

most dedicated researchers were at the forefront

of developing exciting new links between the

scientific and academic community that, today, have

broadened into basic human activity. Research at CWI

has not stood still since. In a range of spectacular,

ground-breaking ways our researchers continue to plot the

course of changes that promise to shape and improve our lives

far into the future.

- CWI INCUBATOR BV
- A PRACTICAL APPROACH TO DEVELOPING NEW BUSINESS
- NLNET AND UUNET
- GENERAL DESIGN/SATAMA AMSTERDAM
- DATA DISTILLERIES
- CANDIENSTEN
- UNIPAY TECHNOLOGIES
- DIGICASH
- FINANCIËLE WISKUNDE AMSTERDAM
- EIDETICA
- ORATRIX DEVELOPMENT BV
- SOFTWARE IMPROVEMENT GROUP
- CWI – STILL FURTHER INTO THE FUTURE

CHANGE IS A POWERFUL OPPORTUNITY



CWI (Centre for Mathematics and Computer Science) has followed a dual mission since its foundation in 1946. Our pioneering mathematics and computer science research, of the highest international calibre, continues today, for instance in the promising areas of hypermedia, software engineering, bio-mathematics and visualisation. However, at the same time we aim to put our discoveries at the disposal of society.

Today, giant leaps forward in high technology are proving to be the main key to prosperity. We ensure that the innovative technology we develop in this competitive area is transferred straight to the heart of our country's economy.

The institute publishes more than 500 professional papers annually and enjoys productive contacts with many existing enterprising companies. However, one of our most effective 'windows to the market' is a growing panel of successful spin-off businesses. Our aim is to create an environment where our 210 employees have every opportunity to become successful entrepreneurs.

In the following pages, we show how many of our key research projects have developed into powerful independent trading companies, some of which have achieved a worldwide impact.

We wholeheartedly welcome their success as part of a two-way process. Operating at the forefront of change, our spin-offs are well placed to feed back to us further pacesetting research projects, supporting the innovations of tomorrow. At the same time, we are happy to see a steady flow of our researchers joining young, expanding companies and putting their ideas into practice. This may seem surprising, until one realises that some people now join CWI precisely because they have every opportunity to become entrepreneurs!

Our relationships with these visionary enterprises take several forms. Whilst we often hold a financial shareholding at the beginning, some companies move on to become major partners in high-profile mergers and buy outs. Others deliberately foster continuing research links with us as one of their prime strengths. A number operate independently, happy to cooperate with us in a variety of ways as they grow.

Now we are changing gear. In 2000, we are launching CWI Incubator BV, a totally independent highway to the high-tech market – designed to create at least one new company every year.

Dr Gerard van Oortmerssen, Director CWI
Amsterdam



CWI INCUBATOR BV

We are establishing a dedicated company with the aim of providing an ideal environment for researchers to measure their abilities in the business world with minimum early risk, and for successful ventures to accelerate on a firm footing into the mainstream of world commerce.

The role of CWI Incubator BV is to be the fertile seedbed where sound new ideas can be prepared to succeed in rapidly advancing, but fiercely competitive, high-tech marketplaces.



One of the main objectives of the new parent company is to provide complete financial transparency. This will demonstrate that start-up companies are genuinely economically sustainable – enjoying plenty of professional support, but no direct subsidy.

Such independence will also assist the young companies themselves in proving to their clients, merger partners, banks, financial backers and markets that they are viable in their own right.

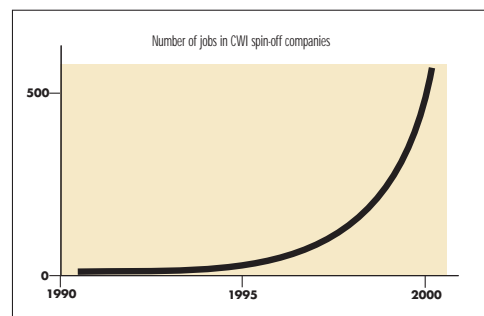
CWI will remain closely involved with its fledgling start-ups. We will continue to take a minority shareholding in many spin-offs and will usually hold an active seat on the board of directors. CWI Incubator BV will act as a holding company through which this financial investment can be kept distinct, and will show a clear audit process.

It will also enable us to strengthen the support we can extend to entrepreneurs as they venture away from familiar research systems. At the same time, it will provide a channel for unimpeded feedback from their commercial contacts that will lead to further original research work.

This is the central premise of our spin-off philosophy. In order to generate a growing number of enterprises, we need to increase still further the research base of CWI. The income generated by our shareholdings in spin-offs will be used to invest in innovative, high-risk, fundamental research.

Fostering a spin-off culture is a central tenet of CWI's policy at every level. We routinely review the scope of our current – and proposed – research strategy. An aspect that receives structural attention is possible spin-off generation, particularly with an eye to the needs of the national economy tomorrow – and far beyond.

Researchers are encouraged to think in terms of realistic spin-off potential as an intrinsic part of their research approach – and so feel confident to discuss concerns and opportunities.



A PRACTICAL APPROACH TO DEVELOPING NEW BUSINESS

Wherever possible, we help to offset worries when researchers decide to change career paths. By going 'into business' they are obliged to resign their posts within CWI. To reduce their uncertainty, we offer flexible employment clauses, e.g. research positions are kept available for some years of corporate life when young companies may face failure.

One of CWI's most significant contributions to eager young companies is the sheer breadth of our professional network. This can put them in contact with potential customers and other research organisations.

We can also provide contacts for different forms of professional support, such as legal advice, employment law and all areas of general administration. Being part of a network is also very valuable when raising venture capital. And, of course, our computer facilities are a major resource that could otherwise become a major financial liability on hard-pressed, young cash flows.



The net advantage for our spin-offs is a significant reduction in initial investment costs and risk at a time of greatest vulnerability. At the same time, we take care not to shield them from the unavoidable rigours of market competition.

Our Amsterdam location is ideal: at the science park WTCW (Science and Technology Center Amsterdam), in the direct vicinity of many research institutes, the Twinning Center and one of the most important Internet hubs in Europe. We are in the nation's heart of ICT and multimedia activities, and close to Schiphol International Airport.

We believe that the launching of CWI Incubator BV is a statement of CWI's faith in the pioneering role The Netherlands is now poised to play.



NLNET AND UUNET

Creating global communications

CWI staff have played a key role in bringing the Internet to Europe. Their unique contribution to EUnet in the early 1980s – based on solid technological expertise, inspired by vision and supported by goal-orientated organisational skills, and above all, sheer enthusiasm – paved the way to advanced electronic communications throughout The Netherlands and Western Europe.

“We were doing the right thing, at the right time, at the right place, and most importantly with the right people. And we had the right international connections,” says one of the founder players, Piet Beertema.

But, what started as a technology-driven initiative in an academic environment, soon had to face a breathtaking public hunger for efficient, fast and reliable, electronic solutions and services.

A number of unique organisations came, and still come, into being to respond to this accelerated change in the working and community environment of countless business and individual information users.

Today, these include Stichting NLnet – a dedicated organisation that aims to stimulate and support electronic communication over a wide area; Stichting Internet Domeinregistratie Nederland (SIDN); and UUNET – a commercially successful Internet service provider.

Stichting NLnet, according to co-founder Ted Lindgreen, now takes as its mission to contribute to the public domain; the financial support of a lecturing chair at the Vrije Universiteit, the work of NLnet Labs to promote greater Internet security and imminent release of globally significant, open-source-style software for the Internet.

UUNET managing director Ries Bode adds, “In recent years, UUNET has grown into a medium-sized company that generates an annual turnover of more than 50 million dollars. We offer professional IP services to the business market and now serve some 15,000 organisations in The Netherlands. This makes UUNET an undisputed market leader in this segment.”



Whilst NLnet, EUnet (now taken over by KNPQwest) and UUNET have expanded far beyond their original ties with CWI, a substantial portion of the companies' roots go back to CWI.

GENERAL DESIGN/SATAMA AMSTERDAM

Interfacing mobility

The public flotation in February 2000 of the former General Design BV as part of a major merger with Helsinki-based Satama to form the internationally focused Satama Interactive perhaps marks the ultimate success of a young spin-off company.

General Design was founded in 1994 at CWI to close, what was then, a global gap in user-friendly computer applications. “We wanted to make computer access user-not technology-driven,” says General Design founder, and now Satama Interactive country manager, Eddy Boeve. It soon gravitated to the Internet, intranets and extranets. Now the company specialises in website solutions for the rapidly emerging mobile communications industry – WAP technology, mobile phones, laptops, public data services and broadband digital television.

Principal clients include Nokia and Sonera. However, most design work remains at the very high-quality end of the ‘conventional’ website market serving The Netherlands' leading 500 companies, including Schiphol, ABN AMRO, Lucent Technologies and Honig.

“One of our key strengths is in combining consultancy with strategy, design and technology,” says Boeve. This has led to the company opening offices in major cities of every country where its mobile technology clients operate, including Dallas, London, Düsseldorf, Amsterdam, Stockholm and Helsinki.

Boeve also sees the mobile communications interface design market continuing to grow strongly. With the pressure on technology companies to develop the hardware, Satama Interactive is ideally placed as a software provider of choice.

The mobile phone challenge, for example, requires mastering a small screen where finite data can be displayed at once, but where a great depth of information has to be easily available on demand.



WAP-LOOK is the company's own internal business information service for websites and includes the ability to trade on-line. Meanwhile, major effort continues to go into related projects such as an Internet publicity system to give companies the ability to post their own financial data on-line.

“Because we hold the source codes, our products work perfectly for all our customers,” asserts Boeve.



Eddy Boeve still has to complete the interface technology PhD with CWI he set aside to become an entrepreneur. “Being part of the CWI network was vital for us and we still retain links with other spin-off companies,” he says. “It was while researching interface systems that I saw the commercial potential. It was a natural process at CWI to develop this, and that strong relationship has continued.” Until the merger and the stockmarket flotation of Satama Interactive CWI held a seat on the board of directors.

DATA DISTILLERIES

Insight into customer behaviour

The high-tech, data-mining software company, Data Distilleries, is a world leader in its booming financial sector niche market.

Preparing for a potentially multi-billion-dollar stockmarket flotation, helping major companies achieve up to hundred-fold sales increases and opening offices on both sides of the Atlantic – the company has done well since starting life as a fledgling spin-off at CWI in 1995.

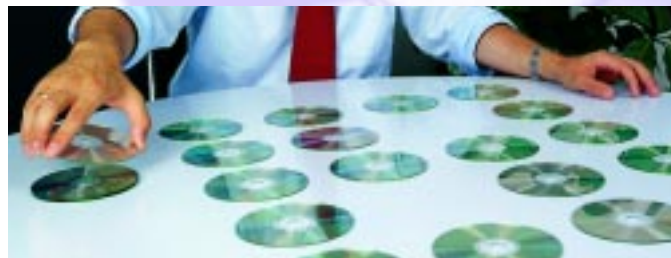
The key to success was the discovery made by founder, Marcel Holsheimer, during PhD work at CWI. He has taken data mining from being a science-orientated research tool and applied it with incredible success to the financial world where it is used to predict and respond to the needs of millions of public customers worldwide.

The service is two-fold. Firstly, Data Distilleries software identifies complex behavioural trends in customer databases based on lifestyle information. Secondly, whenever individual customers contact their financial service providers, they are provided with a suite of purchase proposals, such as investment instruments and insurance products, which appear to be totally personalised for their specific circumstances.

Providing message consistency to customers across a full range of media – or ‘touchpoints’ – is the core of the offer, according to Dirk Jan Hoekstra, marketing vice-president. Feedback is so sophisticated and immediate that, if the customer accesses a website moments after declining an offer by another touchpoint, he or she will not be antagonised by a repetition of the same purchase offer.

The big shift into modelling customer behaviour came in 1998 with the development of customer behaviour modelling (CBM) software, followed by customer relationship management (CRM), and finally multi-touchpoint personalisation (MTP).

“The revolutionary thing is that our software is independent and can drive all communication channels towards the customer,” says Hoekstra. “This means that our clients sell more at lower cost. They enjoy a much more successful relationship with their customers, with revenue increases often worth tens of millions of dollars.”



 **Data Distilleries**
driving e-business personalization

Data Distilleries is a classic case of technology transfer from the CWI stable, where an original research concept flourished in the pro-enterprise culture to become a formative force in the modern, electronically connected world market, according to Dirk Jan Hoekstra. CWI's renowned research facilities continue to lie behind the company's accelerating success. Strong support in establishing a corporate structure, and extensive access to the institute's influential network were also vital.

CANDIENSTEN

Software you can count on

CANdiensten grew out of a government initiative in the late 1980s to stimulate the use of computer algebra. Today it makes contemporary mathematical and statistical modelling packages available to tens of thousands of people throughout the Benelux countries.

Having started life at CWI, as an expertise centre under the auspices of the Foundation for Computer Algebra Netherlands, CANdiensten became an independent commercial company under managing director Dick Verkerk in 1995. Now it supplies powerful research tools to universities, government agencies and major industrial laboratories.

“Through training courses and software solutions tailored to specific analytical problems, we have fulfilled our brief of a decade ago to bring effective high-end computer algebra to both academia and commercial research communities,” says Verkerk.

CANdiensten's software packages support fundamental research in international, industrial companies based in The Netherlands – including Philips, Shell and chemical giant, AKZO.

In the important Dutch financial sector, its packages are increasingly being used in cutting-edge projects such as derivatives modelling, option pricing and risk analysis. Current clients include ABN AMRO, ING and the Netherlands' banking group, Rabobank.

A major pharmaceutical company recently needed to satisfy US Food and Drug Administration (FDA) legal requirements for its products. CANdiensten's response was an advanced statistical solution based on an intranet.

In a completely different area, the company worked on a special statistical software solution to monitor the welfare and distribution of sea birds in the North Sea. This project was carried out for the government agency, Rijkswaterstaat.

“Our vision has been to make high-quality analytical software tools affordable for routine research. Today they are widely known in the Benelux. More than 90% of our higher education institutions are now using advanced Mathematica, Maple and S-PLUS programs supplied by us,” says Verkerk.





CANdiensten began life at CWI in the next room to Data Distilleries. “CWI is an important shop window to the world that can introduce a small company to contacts it could not reach alone,” says Dick Verkerk. The young company also benefited from support in administrative areas, such as accounting services. Today, the two organisations cooperate in providing a powerful Netherlands' software showcase to visiting professionals, with CANdiensten participating in many seminars and exhibitions.

UNIPAY TECHNOLOGIES

Encryption for the billions

In a high-tech world where ensuring the absolutely secure transfer of electronic information – including e-money – is a prerequisite to sustainable commerce, Unipay is actively helping to build confidence.

Founder Ray Hirschfeld focuses his work on consumer transactions where billions of future payments will depend upon electronic authentication that is as reliable as tried-and-tested paper signatures are today. For ordinary citizens, defence against fraud and assurance of privacy will be paramount.

Unipay evolved from Hirschfeld's encryption research at CWI. This work found algorithms that can be used to verify the credentials of electronic message senders and recipients.

Today, he concentrates on two key areas. Off-line, tamper-resistant, smart payment cards that are commonly available – if not yet popular – as an important form of electronic cash, and e-money or digital finance. Hirschfeld works to improve mathematical security in these 'electronic purses'.

The other area where he is frequently asked to assess and advise is Internet payments, where an increasing number of companies are anxious to construct safe systems for client transactions on-line.

"In the absence of tamper-resistant hardware, Internet security requires building assured conduits that are proof against attack," he says. "Unfortunately, it is impossible to guarantee that any system is secure. It is far easier to demonstrate that it is insecure."

As concepts of cash, trade and personal finance mutate rapidly in the booming electronic environment, Hirschfeld's future aim is to research a bridge between the two worlds. "The Internet and electronic purse payments must become inter-operable," he says.

DIGICASH

Another spin-off aimed at creating ground-breaking technology for securing digital financial transactions is DigiCash. Based on encryption technology, this company invented a form of digital money that combines verifiable authenticity with anonymity.

DigiCash was founded in 1990 by David Chaum. In 1997, the company moved from Amsterdam to Silicon Valley to be better placed for the US market. In 1999, DigiCash's technology was acquired by the US-based company eCash. The services offered by eCash are based on this technology.



Impetus created within CWI was a major motivation for turning an academic line of investigation into a viable commercial activity. Having evolved from an institute line of research, Unipay continues to make extensive use of contacts established through the institute's participation in national and international research projects. "Over the years the institute has consolidated a considerable family of close contacts sharing mutual interests that are of exceptional use to young, up-and-coming companies," says founder Ray Hirschfeld.

FINANCIËLE WISKUNDE AMSTERDAM

Balancing risk with opportunity costs

In a world of increasing financial risk in fast, complex, global markets, Financiële Wiskunde Amsterdam (FWA) is a new conduit to attack real business problems with powerful mathematical research tools.

CWI, the University of Amsterdam and the Vrije Universiteit (Amsterdam) are FWA's co-founders. The body liaises with commercial organisations through high-level lectures, training and one-to-one consulting.

"Quantifying risk management within the international financial industry is one such area," says Dr Gerard van Oortmerssen. "Here, the volatility, size, global spread and sheer competitiveness of markets are stimulating new thinking not only in the banking sector, but also in insurance and other related areas."

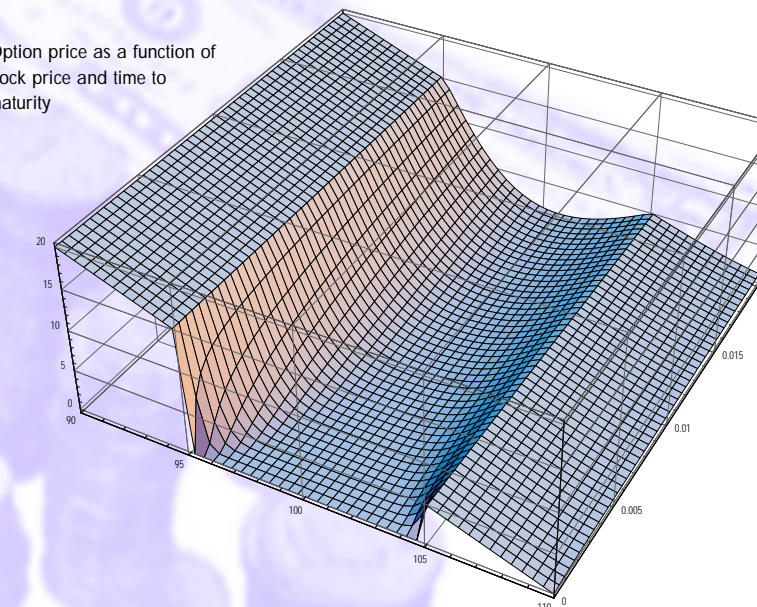
This is reflected in high demand for recent lectures covering advanced financial engineering, such as 'modelling stock market fluctuations', and 'the pricing structure of derivatives'.

"We believe that there is a wealth of scientific knowledge and research with the potential to benefit the financial industry but a synergy does not occur by itself. You have to make it happen and that is what we have to do," says Johan Vos, Director of Technology Transfer, the University of Amsterdam.

However, the link between research and practical application is unlikely to stop there.

"We live in an increasingly mathematically orientated world and the financial industry is no exception," says Van Oortmerssen. "We expect to be very much involved with this sector in the future."

Option price as a function of stock price and time to maturity



Financiële Wiskunde Amsterdam

FWA has been set up as a direct response to a series of enquiries received by CWI and the co-founders, particularly from the financial sector. Through its extensive network of contacts, it is actively creating an access to a solution-orientated forum for business to tap into an existing wealth of research data and the academic resources capable of pioneering work in new areas of uncertainty.

EIDETICA

Hosting knowledge

Eidetica highlights a fundamental principle for the entrepreneur determined to create a successful high-tech company based on a concept drawn from advanced research. Annius Groenink, managing director of the text data mining and text hosting company that he founded in 1998, explains, "We realised we could achieve our business aims by adopting fairly simple technology and not following research to an advanced state for its own sake. We switched from being research-driven to picking out problems from market segments that fit our specialty."



Through its repository software, Eidetica provides a unique, computerised auto-classification route for sorting and codifying text-based passages, titles and authoring information as an alternative to the human hand and eye. The software breakthrough came from research at CWI. It treats conventional database information and raw text as equals so that companies can provide their information as a numerical code rather than as open and confidential text.

In extensive live projects, the software's ability to assess huge text volumes and suggest cataloguing solutions has been 70% accurate – directly on a par with human ability.

Eidetica products have established business-to-business uses associated with libraries and publications. A major project has been for PCM Interactive Media which is responsible for Internet activities of five of The Netherlands' leading newspapers. The task of categorising archives and magazines covering 15 years was completed in two months in early 2000. Part of the high-tech magic here, includes the ability to suggest additional key search words from trends the software identifies as it processes.

Future options for the technology could include the computerised selection of e-mail messages to be forwarded to the new generation of WAP mobile phones.

"In a few years' time, auto-classification will be perfect. Development will then focus on presentation to the user," says Groenink. "But we always remind our clients as an article of faith that computers will never supersede human beings as decision makers!"



"Simply quoting CWI's name and being associated with the organisation has, in itself, been a major benefit in business development," says Annius Groenink. "That's the real strength of a brand!" CWI's network and practical support in personnel management issues was also crucial as he and his colleagues turned their attention from academic to commercial horizons. "It is very important to be near the scientific institution where you were 'born'," he adds. The institute's philosophy of allowing research members to transfer gradually away from their research projects was also greatly appreciated. "We now have four PhD people who previously carried out research at CWI."

ORATRIX DEVELOPMENT BV

It's multi, multi media

Few four-person, start-up companies can claim to have radically affected the world in just two years. Oratrix, founded in early 1999, is one of the exceptions. It specialises in multimedia authoring software. "We don't help you make a video but we do help you integrate it into a streaming media presentation," says founder and managing director, Dick Bulterman.

The initial breakthrough came when the web monitoring body – the World Wide Web Consortium (W3C) – introduced SMIL (Synchronised Multimedia Integration Language) as the Internet standard in 1998; SMIL is based largely on CWI's CMIF (CWI's Multimedia Interchange Format). The language is now the world's accepted descriptive base across a host of electronic communications outlets.

"The language you give away free of charge," says Bulterman. "However, it does enable us to sell our accompanying toolbox, GRINS."

From a quiet Amsterdam suburb, the company's products now reside on hard drives around the world.

"We went from being first kids on the block, to delivering the standard used on 120 million desk tops across the world. "Our material is used by the Salvation Army, the Ministry of Defence and the BBC. We plan to be a 100 million dollar company within three years of start-up," says Bulterman.

The Oratrix concept began when he headed CWI's Multimedia and Human-Computer Interaction research project and decided the team must reach far beyond the latest innovation of the time – CD ROMs. "To really reach the audience, the media has to adapt to meet the recipient, and not the other way round," he says.

"We looked at the problem from the perspective of network operating systems and concluded that presentation design and delivery were governed by available bandwidth. In a similar vein, to reach a world audience you need to include multiple languages and levels of customisation. Our systems are uniquely geared to help our users create these adaptive presentations. GRINS removes any excuse for making a bad presentation," he adds emphatically.

Bulterman is fiercely upbeat about Oratrix' Amsterdam role. "We work here to promote high-tech employment in The Netherlands. Undoubtedly our commercial activity will spread to North America but our fundamental research will remain here."



As with other institution spin-off entrepreneurs, Dick Bulterman exchanged a promising research future at CWI for the opportunity to become a formative force in the world's evolving communications infrastructure – with no regrets! "Oratrix is a pure product of CWI's attitude to technology transfer through subsidiary spin-offs," he says. Adamant that Amsterdam is the perfect cradle to meet the unfolding electronic communications revolution he adds, "CWI makes this the ideal place to be."

SOFTWARE IMPROVEMENT GROUP

A powerful legacy

How can you upgrade and continue to operate 30,000 or more outmoded (sometimes unknown) but essential computer programs that still handle hundreds of millions of dollars of financial business?

The Software Improvement Group (SIG) has developed the answer. The CWI spin-off is now working closely with many blue-chip financial companies to keep vital systems – with little formulation and maintenance history – running and compatible with modern programs.

Software development has isolated many effective but ageing systems that are now only connected by a chain of complex middleware.

The products and services offered by SIG have been developed at CWI since 1996 to recognise and analyse the structure of programs. "Documentation is at best out-of-date, and that costs companies money. Our regeneration means operating manuals are always up-to-date," says researcher and SIG co-founder, Arie van Deursen.

To present its solutions directly to the market, SIG will become a full trading company in August 2000. It has already talked to some of Europe's leading corporations. "Our strategy is to open offices abroad in cooperation with companies in our network in the near future," general manager, Marjo Wildvank adds.

However, SIG's philosophy goes far beyond simply offering novel software solutions to IT clients. "Where companies and corporations are willing to allow SIG to understand their business problems, the group sees its core role as applying fundamental research to contemporary problems such as software transformation," says Steven Klusener, a former CWI researcher. At the same time it wants to maintain its original links with CWI.

SIG is a new kind of spin-off. It is developing long-term relationships with major international organisations while reinforcing its ties with CWI as a two-way, symbiotic exchange, joining the commercial world to fundamental research. "CWI played a crucial role in establishing SIG, in facilitating the start of the company", says Tobias Kuipers. "CWI is the powerhouse of some of our most innovative ideas. When clients have specific problems that call for fundamental thinking, an organisation such as CWI is essential. It is a great virtue to be able to call on so powerful a resource," Leon Moonen adds.



CWI – STILL FURTHER INTO THE FUTURE

Mathematics and computer science have been instrumental in developing the information and communication technology that is now changing our society and economy at an ever increasing pace.

CWI has contributed to these changes through high-quality, cutting-edge research. This is increasingly finding economic application through spin-off companies, as described in this brochure.

Our commitment to pathfinding research will continue as we venture into new and exciting fields, such as the life sciences, intelligent agents and wireless networks.

This could lead to future applications that may be almost impossible to envisage now.

However, one only has to remember how inconceivable the Internet seemed to most people just ten years ago to realise the enormous impact high technology will continue to make on our daily lives.



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