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HEAnet – 20 years leveraging

Ireland's National Education and Research Network provides internet connectivity and IT services to third-level education and research organisations. It secures the best possible deals for colleges, staff and students when it comes to shared services

Twenty years is a long time – a long time in politics, a long time in business and a very long time in technology.

When HEAnet was set up in 1997, the people charged with running it had no way of knowing just how important it would become or, how diverse the range of services it would come to offer.

HEAnet is Ireland's National Education and Research Network. Providing internet connectivity and associated IT services to third-level education and research organisations (HEIs) throughout Ireland, today the company delivers ultra-high bandwidth connectivity and services to one million users across the country.

Another of HEAnet's key objectives is to secure the best deals possible for colleges and their students and staff when it comes to shared services – ultimately delivering real value for money across the entire HEI sector.

Before HEAnet was set up, the Department of Education had limited resources available to connect Irish universities to the internet. John Boland, chief executive of HEAnet, explains: "If you go back around 30 years, there was a voluntary collaboration project between the seven universities, who came together to try to share expensive computing resources. It was around this time that what we think of today as the modern internet started to happen."

John Boland was appointed chief executive of HEAnet when the company was established in 1997. "At that stage, the Higher Education Authority (HEA) provided funding for the university collaboration project and HEAnet was set up. We were connecting using Telecom Éireann's X25 network, but as the universities started to use TCP/IP and email, the number of connections rapidly outgrew the available network capacity," according to Boland. TCP/IP (Transmission Control Protocol/Internet Protocol) was adopted as the basic communication language or protocol of the internet.

Before taking on the chief executive role, Boland worked in Dublin City University as Systems and Network Manager for seven years.

"Back then, most internet users in Ireland were connecting with dial-up connections and leased lines were as far as connectivity had advanced," he says.

Boland has witnessed the impact that the internet and its associated technology advances has had on the higher education system in Ireland.

He recalls: "Twenty years ago, things were a lot simpler. We seemed to spend most of our time trying to provide the universities with basic internet connectivity – and the universities that had it also had an unending queue of students out the door each morning looking to get access in the computer labs"

John Boland, chief executive, HEAnet
Picture: Maura Hickey

Shared services

HEAnet has achieved success by growing and developing its services through a vision of collaboration and sharing. This model began by investing in leased lines that would connect the seven universities together. This was significant because for the first time, academic institutions could take advantage of always-on Internet connectivity, rather than paying for it on a pay-as-you-go basis.

While there had been some prior pooling of resources, Boland describes this sharing model as a breakthrough.

"This was a big departure. It offered a way to control our costs and it was the beginning of the idea of shared services. To connect from Cork to Dublin was very expensive but for the universities to do it via the new HEAnet network, it was really cheap by comparison," Boland says.

"There had been some funding for an expensive mainframe, but the government at the time had said 'We can only afford to buy one of these, so you're going to have to find some way to share it.' That was the actual beginning, but it was when the internet came along that true cooperation really took hold."

Global connectivity

The funding for the establishment of HEAnet was part of the then government's strategic decision to invest in internet infrastructure. HEAnet was set up in October 1997 with an annual budget of £2 million.

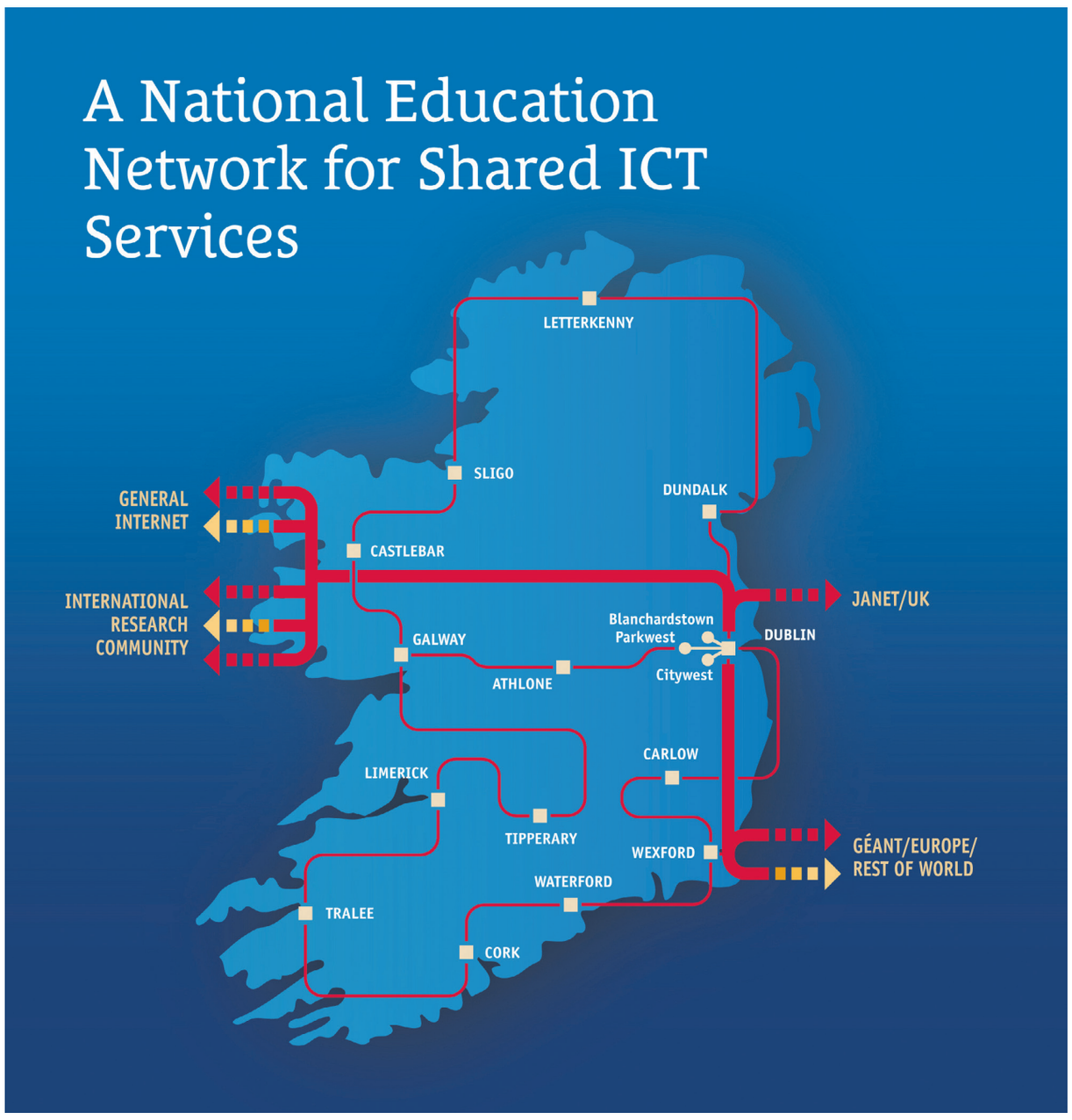
The first order of business was to secure a connection to the internet and begin sharing that connection.

"My first challenge was to increase internet bandwidth," explains Boland.

"We already had a one megabit per second circuit to New York, which gave us our worldwide internet connectivity, and I negotiated a deal with MCI WorldCom to double this capacity and establish a HEAnet point-of-presence in New York. The deal swallowed up half of our annual £2 million budget that year."

Around this time, the Department of Communications, under the leadership of then secretary general Brendan Tuohy, was developing a tender for massive external fibre connectivity for Ireland. This visionary initiative ultimately led to a long-term multimillion deal with Global Crossing, which made fibre pairs available at wholesale costs in Ireland. HEAnet fully supported this and was one of the first adopters of that international connectivity.

"It operated at around two megabits per second. To put this into context, today the average student has a smartphone in their pocket with upwards of 60 megabits per second, but back then that two-megabit connection had to serve the entire academic community encompassing seven universities, with each one connected at around 64 kilobits per second – one megabit is 1000 kilobits," says Boland.



The internet has exploded in the 20 years since 1997 but, according to Boland, it is vital not to underestimate the importance of the then government's decision to invest in international connectivity. This multimillion-euro deal gave Ireland unprecedented access to Global Crossing's worldwide fibre optic network, and laid the foundations for Ireland's enormous success in attracting global ICT companies like Google and Microsoft.

Real value

HEAnet's client list includes seven universities; 14 Institutes of Technology, eight third-level colleges, 30 other educational and research organisations; government agencies and 4,000 primary and post-primary schools across Ireland.

"Our clients are customers, certainly – they pay fees for our services and, in turn, we must give good value for the services we provide. An independent study commissioned in 2015 by the chairman of our board to establish the value-for-money proposition bore that out from two perspectives," he said. "Firstly, do we represent value for money for our clients when compared to what they could do themselves? And secondly, in terms of the Irish taxpayer, are we value for money? In both cases, the findings of the 2015 study were overwhelmingly positive."

This independent study found that for clients using HEAnet services, the cost of replicating the agreements and services offered to them would be substantially higher than the existing arrangement with HEAnet. It also found that HEAnet could generate annual net savings for the Irish taxpayer, calculated at €19.98 million.

The study also found that without HEAnet, it is very unlikely that an alternative provider or providers would have been able to deliver the current broadband services for "The Schools Network" at the same level of capacity, reliability, security and cost as was and continues to be provided by HEAnet, leveraging its existing network infrastructure and resources, according to Boland.

The problem with academia and organisations like HEAnet from a government point of view is that they can seem like bottomless pits.

"This is absolutely true, but investment leads to development and growth as well as creating jobs and opportunities that otherwise wouldn't exist. For example, to facilitate research activity within higher education we built a very high bandwidth network. It is this network which connects Irish researchers to the internet, online educational resources, and to other national educational and research networks in Europe, the US and the rest of the world," Boland says.

The Schools Network

The commitment by HEAnet to provide connectivity to every school in the country was another government-funded initiative, which led to significant savings for the taxpayer and an improved experience for teachers and pupils alike.

"In discussions with the Department of Education and the Department of Communications back in 2005, we persuaded them that they could connect every primary and post-primary school in the country to the internet. The resulting Schools Network, which leverages HEAnet's existing infrastructure, provides connectivity to some 4,000 schools across the country," Boland says.

"It wasn't easy and it wasn't cheap – you've got to buy equipment and a connection for all 4,000 of those schools. And the person who I think it's fair to say had the greatest personal drive and determination to see this happen was Eamon Ryan, when he was Minister for Communications."

According to Boland, Ryan "absolutely got it" and drove the project forward during difficult financial times, when the Department of Education and Skills (DES) did not have the money to invest in it. He made a deal, under which the then Department of Communications Energy and Natural Resources (DCENR) would foot the initial set-up bill, with DES looking after the recurrent spend once the network was up and running.

> **We are very much leading the pack in Europe in terms of schools connectivity**

The schools project has continued to be supported by subsequent communication ministers, including the current minister, Denis Naughten, and his predecessors Alex White and Pat Rabbitte, as well as Jan O'Sullivan and her successor as Minister for Education Richard Bruton.

"The project wouldn't have happened if it had been judged on a purely commercial basis. Paying for high-speed connections for 4,000 schools would cost an absolute fortune and there are not many countries in Europe even now who can claim to have connected every school to the internet," said Boland.

"But Ireland can say that, and it happened because of HEAnet's links with government and by our responsiveness and expertise. We are now very much leading the pack in Europe in terms of schools connectivity.

"Today, every post-primary school in Ireland has a 100 megabit per second high-speed broadband connection, when just a few years ago an institute of technology had the same 100 megabits connection shared between all its students and staff.

However, Boland says, this level of high-quality access to advanced technology for schools is justified.

"For example, there's a school on Tory Island that only has five pupils but absolutely hammers its 100 megabits connection, because it can do so much with video and connecting to other schools for honours maths classes, for example. It's an invaluable educational aid for them."

Brokerage services

A major next step for HEAnet was to start brokering deals on behalf of the third-level sector as a whole, using this scaled buying power to secure the most competitive deals.

"Brokerage at this scale is something that didn't exist a few years ago. Back then it was all about the network and trying to build our network infrastructure. Although we must keep the network growing and reliability and resilience is critical, our clients also want us to broker services for them as well – that's the challenge," said Boland.

One of the most significant

the power of the internet

HEAnet chief executive John Boland and Agile Networks managing director Darragh Richardson announce a seven year deal worth €5 million to deliver an ultra-high bandwidth network for one million students and staff across Ireland's education and research sector.

brokered deals was with Microsoft, which continues to make software available to students at a hugely significant discount.

"These are the sort of deals for education that we are at the forefront of negotiating," explains Boland.

"In today's world of cloud technology, brokerage is becoming more and more relevant. There's a growing demand to move services off campus and into the cloud and in many cases, we are that neutral, central provider," he says.

Traditionally, it has been a big challenge for third-level computer services departments to provide email for students and manage these systems. Now, student email is provided via services such as Gmail and Office365.Boland says the use of cloud technology is the norm among their clients. "For example, library systems, finance systems and what's increasingly called the virtual learning environment (VLE)," he says.

VLEs have transformed the experience of students and IT managers across the education and research sector. These days, students expect to be able to work online 24/7, and not be tied to being on campus. That means being able to submit assignments, look up lecture notes and stay up-to-date with course work.

These expectations and demands present key challenges for HEAnet. "Traditional nine-to-five networking is just not acceptable anymore. Students do their work and typically submit assignments at two or three o'clock in the morning and the network has to be available for this, otherwise the student may be penalised when the lecturer comes into class the next morning and the assignment isn't uploaded."

Cyber security

Another shared and critical service provided by HEAnet is cyber-security expertise. Boland says: "In recent times, distributed denial of service (DDoS) attacks have become a big thing. With colleges experiencing these types of attacks which bring down the whole campus, we used our network security expertise to procure the best solutions to mitigate these DDoS attacks.

"Today cyber security is a big part of what we do and it is constantly evolving. It takes a lot of time and resources, but it's unavoidable. By providing our shared DDoS Mitigation service, we lighten the load for individual clients having to access security expertise from the marketplace as we have the expertise right here."

The increasing ubiquity of the cloud brings more questions and issues for an organisation like HEAnet.

"Is it secure? Is it reliable, is data being backed up?"

According to Boland, this is particularly true for academic researchers who have concerns about putting sensitive data into the public cloud.

"There's a role for perhaps a private cloud piece here as well, which is what we do in our data centres – they are complete walled gardens of security for our clients. That's the solution for clients doing research that might have commercial value and of course they don't want to find it on a pirate bay."

Maintaining a strong network

Going forward, Boland sees HEAnet's major challenges as continuing to support the high level of resilience and reliability that people have come to expect, as well as facilitating the major drive towards the adoption of cloud services.

"When it comes to the reliability of the network, our clients, third-level education and research institutions and their students and staff cannot tolerate network downtime," he says.

The academic world is increasingly global and 24/7 in nature. "Things have evolved to the point where students and staff relay on being connected seven days a week, 24 hours a day. There is absolutely no question that the network we provide must be available all the time, because the information that students are accessing to do their assignments can be anywhere, from Seattle to Amsterdam to Shanghai – stored on databases and e-journals all around the world.

"Students expect to be able to complete those assignments wherever they are: at home, in the coffee shop or on campus. So it's a different challenge now. In the beginning, it was just a question of connecting seven universities together. Now it's about making sure all third-level students and staff have Internet access anytime, anywhere, anyhow."

The number of people that rely on the HEAnet network and services on a day-to-day basis is just over one million – this means it is operating as a network and connectivity provider for what amounts to a virtual city.

"In the third-level sector, there are over 210,000 people connecting and at primary and post-primary level, it's around 800,000. These are huge numbers of people and you'd be surprised at their usage patterns," says Boland.

The future for HEAnet looks set to be dominated by the evolving nature of the networks it oversees. At the same time as bandwidth speeds are increasing and more schools and educational institutions are being connected to the network, the way in which people are using the technology is also changing.

"Home and business users will see the speeds offered to them jump a lot in the coming years, if our experience is anything to go by. Prices will come down and cloud-driven services will become even more pervasive. By 2020, it is believed that 70 per cent of all IT will be in the cloud and not on your premises," says Boland. It is also important to the academic community that students and staff at all levels are working with technology that mirrors what they can expect to work with when they graduate and join the global workforce.

Facilitating bring your own device services (BYoD) is a challenge for many private companies but within third level, it is the normal way that students and staff interact with college facilities.

"They all have a laptop or tablet, they all have a smartphone and they want to be connected to social media all the time. The 24-hour nature of connectivity is one challenge for us, to resource it and make it resilient and secure is another. On top of this, we have to support the move towards the cloud – it is an ongoing battle but very exciting."

> **Our clients cannot tolerate network downtime**

Boland says: "Traditionally, universities and education networking has been a few years ahead of the market, because it has to be at the leading edge for researchers. The people using our network are researching the next generation of the internet and what will happen on it, so we have to provide services that are ahead of the curve. In many ways it doesn't make commercial sense for a company to provide the levels of bandwidth that we do.

"But through collective collaboration, we get European funding for our international connectivity and for international research. While we're not competing commercially with the telcos – in the sense that we're not commercial – we do provide services for a closed community of people at the leading edge of what's happening in networking, and we find that the market catches up within a few years."

While the average domestic broadband connection to the internet is still operating in the tens of megabits and businesses are accessing speeds in hundreds of megabits, many of HEAnet's academic clients routinely access data services at speeds of up to ten gigabits per second – a gigabit is one thousand megabits.

Internationally, HEAnet provides students and staff in the higher education and research sector with high-speed resilient internet connectivity via GÉANT, a pan-European network facilitating research collaboration around the world.

According to Boland, a lot of the forward thinking and development that has happened at HEAnet has come about because of the organisation's membership of this 37-nation strong collaboration research network, of which HEAnet is the Irish branch.

"That's driven our ideas on security and identity management. The average student these days has got access or log-in credentials for an email account, a student system, a library account, maybe a database, and assignment submissions system," he says.

The degree of complexity involved in managing this system is enormous and is at the core of HEAnet's services.

"Identity management pulls all these credential requirements together so they only need one single authenticated sign-on that gives them access to everything, including the 3,000 plus e-journals and databases that they're entitled to use. Access to these resources is paid for by government and third-level institutions, so has to be authenticated. This is like our 'secret sauce' – it's a unique service that enables students and staff to interact seamlessly with all their IT services."

Contributing

Boland is keen to point out that in the 20-year history of HEAnet, a number of people have been central to its development and instrumental in its success.

"One of the key founders of the network of people that eventually became HEAnet was Michael Nowlan, ex – Trinity College Dublin, the first person to bring the internet into Ireland. He actually set up a small company to connect to the European EUnet, which makes him technically the first internet provider in Ireland.

"At the same time, Gordon Young, ex-University of Limerick, was also doing sterling work. It was people like him who had a vision of what would be needed.

"Dennis Jennings was the head of computer services in UCD at the time. He was one of the movers and shakers internationally on the internet, being involved in the Defence Advanced Research Projects Agency (DARPA) in the US, which the internet actually grew out of.

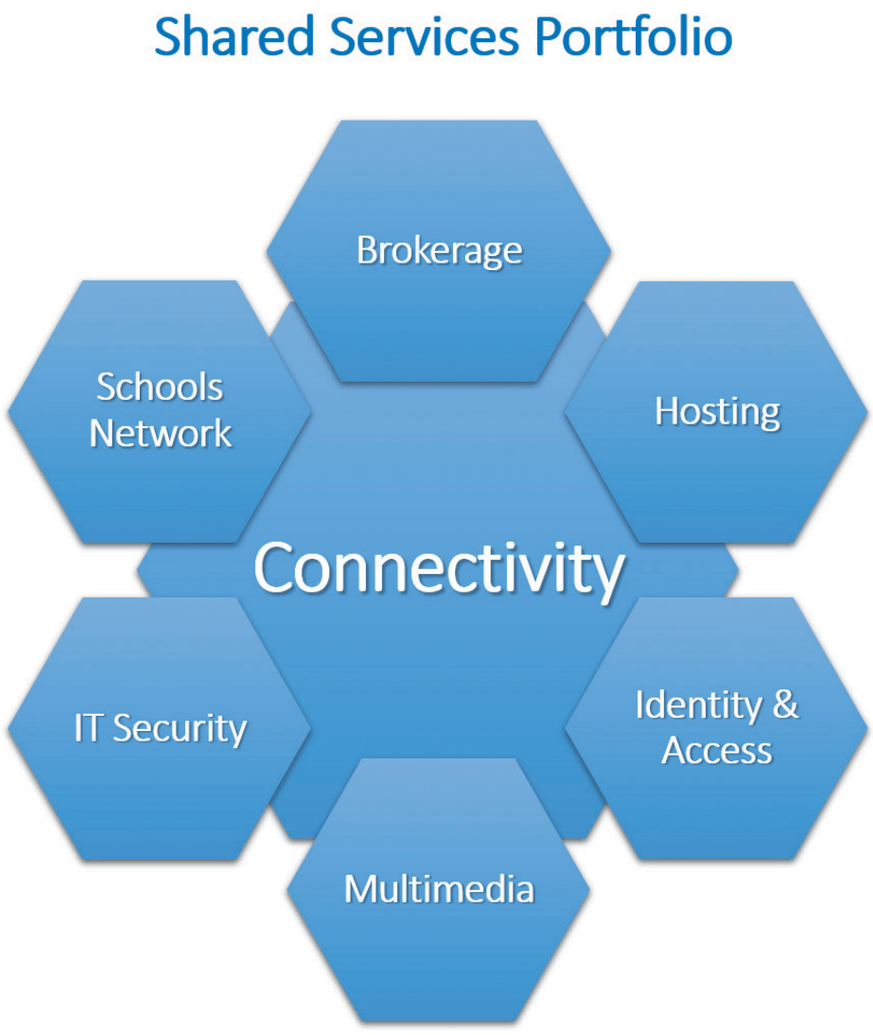
"That triumvirate – Nowlan, Young and Jennings – were around before I came on the scene and they were the people who laid the foundation of how things developed in Ireland.

"Afterwards, Mike Norris ex-HEAnet came on board as the network coordinator in UCD and he was able to patch together and connect the seven Cisco routers that they had bought – at the time it was that basic."

When Boland was appointed to HEAnet in October 1997, the first person he hired was Norris, who went on to establish a quality ethos and culture of technical excellence which continues to underpin the organisation to this day.

"Again, the Global Crossing deal was hugely important and Brendan Tuohy, secretary general in the Department of Communications at the time, brokered that deal against a lot of opposition. He had real vision and was a forerunner in IT in Ireland, and a lot of the success that the country has seen stemmed from that," he said.

"Likewise there have been people like Tom Boland, who was chief executive of the Higher Education Authority – and isn't a relation! – for nine years. He helped us to establish ourselves with government, secure the annual funding required and was the chair of the HEAnet board of directors during his nine-year tenure."



EduCampus – another level of service

One of the big developments in the last couple of years for HEAnet, according to Boland, has been the creation of a not-for-profit subsidiary company – EduCampus Services, which looks after management information systems (MIS) for the 14 institutes of technology (IoTs).

EduCampus manages finance systems, human resources, library access and student systems, so that all of the IoTs have one single set of services, accessed centrally. This achieves real savings through economies of scale, according to Boland.

Into the future

There is a growing international flavour to Irish academia, which needs to be resourced and supported.

"Transnational education or TNE is transforming the whole student experience towards a global campus. TNE refers to the provision of education qualifications from institutions in one country to students in other countries.

Boland explains the concept. "A number of our universities and institutes of technology are increasingly attracting students from abroad and several have moved to establish campuses, or what they refer to as international hubs, in locations such as Singapore, Bahrain, India and China," he says.

"Their international hubs want to connect to the same shared services that are available here and that's where our global connectivity comes into play."

"Another area that is growing is the development of the internet of things, which will see internet connectivity extended to everyday objects and appliances, enabling them to send and receive data.

"The internet of things is also likely to have a strong impact on the demands faced by HEAnet – and is already happening.

"The developments are driven by research, by people finding new and innovative ways to extend additional functionality to people in different ways. People are talking about it being worth €30 billion by 2020. Some of our people have set up working groups amongst our clients to see what this will mean for our network development and services."

Digital transformation

The final piece of the next generation puzzle for HEAnet is the ongoing digital transformation of the third-level sector, with fewer paper-based forms and permission slips, and the growing integration of student identity management with the day-to-day running of the institutions.

Boland explains: "The move towards putting everything online and making it digital is gaining momentum – making the campus a digital one – that's the vision of our institutions– and facilitating it will require a fresh leap of understanding and investment."

As the world of business and economics increasingly moves towards digital enablement, there is an onus on HEAnet and the third-level sector to be there or even lead, because increasingly that's the world that students are going to graduate into.

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John Boland holds a degree in Electronic Engineering and a postgraduate Diploma in Corporate Governance. He started his career as an electronics engineer for Marconi Communications in Britain. He went on to be a systems administrator for GE-Westinghouse in Australia before joining Dublin City University as the Systems and Network Manager in 1990, where he worked for seven years before his appointment as chief executive of HEAnet.

John represents Ireland on the GÉANT Policy Committee – a collaboration between the European National Research Networks and the European Commission, delivering the advanced pan-European research and education network .

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