Genetic analysis of light assists faster internet

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Australian scientists have used genome analysis tools to create a patented technology to investigate the fate of the laser beams zapping through the optical fibres that connect our cities.

Their ideas have broken the back of a communications industry problem – how to identify the causes of noise in these optical cables that form a key part of the backbone of the internet.

The device that they and their fellow engineers at NICTA, Australia's Information and Communications Technology (ICT) Research Centre of Excellence, have invented, will, for a few thousand dollars, do a job that today would cost $100,000 plus and would require multiple types of test equipment.

And it will allow phone companies to confidently increase the speed ratings on long haul optical fibres – from 10 gigabits per second to 40 gigabits per second or more without losing data in the noise in line.

"We developed a way of presenting an optical signal as a two dimensional image," says NICTA Principal Researcher , Trevor Anderson, who is based at NICTA's Victoria Research Laboratory and directs the Managing and Monitoring the Internet (MAMI) Project.

"We thought that it would allow us to recognise the 'fingerprint' of the various kinds of optical noise that can interfere with the signal," he says.

"But we didn't know how to analyse the image," he says. "Fortunately in the next door laboratory NICTA has a team of geneticists analysing vast lengths of genetic code to find patterns of gene sequences that would indicate a tumour.

"Dr Adam Kowalczyk looked at our problem and laughed – 'This is easy – biology is so much more complex,' he said to me.

"We have to identify cancer subtypes using a handful of noisy examples to learn from rather than the thousands that are available to you, so Dr Kowalczyk said lets try our algorithms on your data," Mr Anderson said.

The result is a new device known as a multi-impairment monitor. And it can identify the distinct visual patterns created by the common forms of noise and distortion in optical fibres.

The six most common sources of impairments are:

- Optical amplifier noise
- Too much dispersion as the laser beam travels down the fibre
- A fibre that's not quite symmetric – leading to more dispersion of the signal
- Power levels that are too high
- Interference from adjacent channels
- Unwanted reflections.

"The current tools available in the marketplace only count the errors in the data, telling the operator a problem exists but not what that problem is, where the problem is or what caused it," Mr Anderson said. "Our device can already identify the top four sources of noise and we expect to be able to do all six."

He anticipates the device will be ready for market in 12 months.

"In the long-term we hope it will be small enough and cheap enough to be embedded throughout long haul networks."

Patents have been lodged for the technology in the new device and telecommunications companies are lining up to discuss the potential.

It's a second major win for the NICTA team. Another device – an optical signal-to-noise ratio (OSNR) monitor – has already been licensed to an industry partner, Optium. It can distinguish and measure the impairment caused by optical amplifier noise, improving the ability to manage the network.

"We expect the information provided by the monitor could save telecommunications carriers the time and expense that is currently required to deploy a truck and technicians to fix a problem on a network and to provision new services."

Why does the technology matter?

We're all placing more and more demands on optical fibres: YouTube, video on demand, Facebook, industry – everyone wants to send more and larger files and data streams through the web.

But laying new fibres is expensive. So the phone companies are using new technologies to push more information through the fibre.

Fibres which were originally carrying 10 gigabits per second are now carrying 40 gigabits per second or more. And they're being automatically reconfigured to automatically switch channels between fibres.

NICTA's tools will allow phone companies to carry out advanced tests in the field which otherwise could only be conducted in the laboratory.

The result: companies are lining up to participate in the field trials – which will be focused on long-haul landlines like the Sydney-Melbourne cable.

The cost will be dramatically cheaper than the $100,000 plus suite of equipment that would be needed to emulate NICTA's system using existing hardware.

In the future NICTA anticipates that the devices will be small enough to be embedded throughout the optical network

Notes

About NICTA

National ICT Australia Limited (NICTA) is a national research institute with a charter to build Australia's pre-eminent Centre of Excellence for information and communications technology (ICT). NICTA is building capabilities in ICT research, research training and commercialisation in the ICT sector for the generation of national benefit.

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