See-through networks

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(PhysOrg.com) -- Promising faster, more efficient and cheaper computer networking, transparent networks are the paradigm of the future. But thanks to European researchers, they are on their way already.

Transparent networks are all-optical systems data transport systems. Touted as the solution to future networking needs, they nonetheless present a difficult technical challenge.

To make the network truly transparent, it must be optical throughout the transmission, from end to end. That raises many tricky conversion issues as the network changes speed and wavelength, to mention just two of the variables. This requires new photonic technology, primarily optical switches, capable of tying heterogonous network elements together.

The envisaged future scenario of the TRIUMPH project posits transparent connectivity between core/regional-metro rings supporting data rates up to 160 gigabytes per second (Gbit/s) and metro-access rings supporting up to 40 gigabytes per second. Considered until recently to be a future networking technology, their feasibility has already been shown thanks to the work of the TRIUMPH project.

Just in time, too. Network demands are overtaking the capacity of traditional metro systems to cope. Internet traffic growth is unpredictable; users are deploying new, high-bandwidth applications, and content delivery needs are exploding as the internet begins to take over from television.

Agile and see-through

With all this unpredictability, networks need to handle very large capacities and be able to adapt very quickly. Agility is the key requirement to respond to fluctuating needs, but current metro network technology imposes heavy limitations.

Transparent, all-optical networks offer a solution. Up to now, transparent networks were limited to traffic at the same speed. Now the TRIUMPH project has proven that it is possible to create all-optical networks across widely varying bandwidth, wavelength and communication protocols.

It sounds simple, but it is anything but. It requires a high degree of innovation in network architectures and needs state-of-the-art photonic switches capable of tying together the access, metro access, and core metro networks together. This tie-up is particularly difficult because they all run using different speeds, wavelengths and protocols.

TRIUMPH stands for Transparent Ring Interconnection Using Multi-wavelength Photonic switches and the team worked on all aspects of the

problem, starting with network architecture.

The team specified the requirements and then studied the technology options, applying value analysis and benchmarking to each system. TRIUMPH sought commercially viable solutions at each stage.

Once the architecture was defined, the team worked on optical switching nodes for Coarse Wavelength Division Multiplexing (CWDM) at rates between 10Gbit/s and 130Gbit/s. CWDM is a way of adding capacity to a network by using different 'colours', or frequencies, along a single optical fibre.

Clean signals

The team also developed a 're-amplifying and reshaping' (2R) multi-wavelength regeneration device for cleaning up distorted signals. It is an important device providing signal integrity in the core network.

Signals also had to be mapped from lower bit-rate Wavelength Division Multiplexing networks, typically used on access networks, to high-speed Optical Time Domain Multiplexing networks such as may be used on core networks. For this the team developed non-linear optical modules.

These modules delivered a compact, energy efficient optical switch of enormous technical ingenuity, capable of optical grooming and aggregation as well as signal regeneration.

Grooming is the name given to a family of optical network design and resource allocation algorithms that can enable cost-efficient use of both network bandwidth and electronic switching. Combined, this functionality makes for an incredibly sophisticated switch.

Finally, the team developed a testbed and demo to validate their

technology, as well as a manufacturing plan for the commercialisation of the platform.

Flexible, powerful, economic

This was a key aspect of the project, which featured a European who's who of optical network experts. TRIUMPH's technology responds to real problems that exist now and that call for new solutions.

The upshot is a flexible, powerful and economic system capable of coping with the emerging demands of modern networks.

"The switches developed by TRIUMPH are compact and very low power compared to the non-optical switches currently in use, and this is an added attraction for network operators," explains Juerg Leuthold, coordinator of the TRIUMPH project and a professor at the Karlsruhe Institute of Technology (KIT).

It all means better networks in the future, and world-class expertise for network component manufacturers in Europe.

More information: TRIUMPH project - www.ihq.uni-karlsruhe.de/resea … ch/projects/TRIUMPH/

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