NTT Press Releases

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Fujitsu Limited
Nippon Telegraph and Telephone Corporation
NEC Corporation

Fujitsu, NTT and NEC Launch Joint R&D for World's Top-Level, 400Gbps-class Optical Transmissions Technology

- To deliver optical networks that are both energy efficient and flexible -

Tokyo, December 11, 2012 — Fujitsu Limited (Fujitsu), Nippon Telegraph and Telephone Corporation (NTT) and NEC Corporation (NEC) today announced the commencement of joint research and development toward making the world's top-level,400Gbps/channel-class digital coherent optical transmissions technology (*1). Bringing together the technological capabilities that have enabled the commercialization of 100Gbps-class optical transmissions methods, which are becoming more prevalent among the world's optical networks, the companies will work to further enhance the performance and functionality of the digital coherent optical transmissions method, a key technology in optical transmissions. This enables the possibility of realizing the world's top-level optical networks that combine ultra-high speeds, low energy consumption and flexibility, while also contributing to improvements in optical transmissions technology and the global spread of the research results. This R&D initiative was commissioned and is sponsored by Japan's Ministry of Internal Affairs and Communications (MIC) as part of the "Research and Development Project for the Ultra-high Speed and Green Photonic Networks" program.

"In 2012 the supply and demand of 100G products began to converge, leading to significant growth in deployments. The demand for network connectivity will only increase. Therefore, the need for 400G solutions that provide even greater bandwidth with the lowest possible power consumption and flexible, adaptive modulation will be critical," noted industry analyst Dana Cooperson, VP Network Infrastructure, Ovum, Inc. "Fujitsu, NTT and NEC's collaborative efforts to meet this growing demand illustrate what's possible when key industry players work together. Carriers, enterprises, governments, and others would be wise to look closely at this solution as they evolve their networks."

1. Background

To accommodate the explosive growth in data communications traffic stemming from the spread of the Internet and smartphones in recent years, 100Gbps-class optical transmission methods are starting to become more practical. At the same time, with the arrival of the big data era, along with a surge in the diversity of data due to the spread of machine-to-machine communications, customer expectations with regard to speed and service continue to grow. Not only will data traffic in the near future grow at a rapid pace, but networks will also experience extremely large fluctuations in communications traffic, thereby resulting in a need to build flexible network infrastructure that can withstand such demand.

To address these impending challenges, core optical networks will require even greater speeds. With existing optical transmission technology, however, it is difficult to ensure the optical transmission performance needed to meet this demand for higher speeds. Moreover, existing communications equipment consumes a substantially higher amount of power in proportion to the amount of data transmitted. To enable high-capacity optical transmissions using relatively low power, a new optical transmissions solution is needed.

Building a flexible network architecture requires the ability to adapt, in real-time, to changes in data volumes and transmission distances. Therefore, great demand exists for the construction of highly flexible networks that can support regional differences in network architectures with a single core technology.

To meet these challenges, the three companies are aiming to build flexible, low-power networks in an effort to bring about a comfortable, eco-friendly society. As such, they are commencing research and development directed at implementing the core technologies required for these networks.

2. Joint Research and Development Program

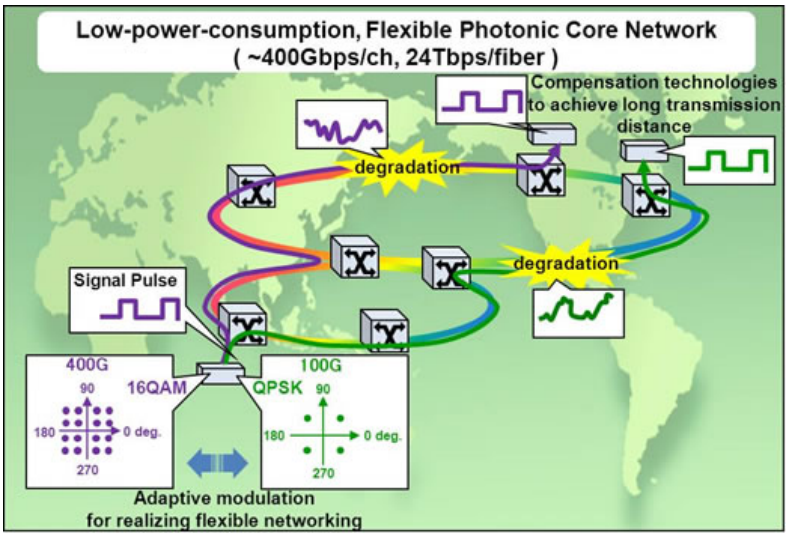
Fujitsu, NTT and NEC have pursued R&D on 100Gbps-class digital coherent optical communications technology as part of the MIC's "Research and Development on High Speed Optical Transport System Technologies" program (2009) and "Research and Development

on Ultra-high Speed Optical Edge Node Technologies" program (2010-2011). The digital coherent DSP-LSI (*2) that was commercialized in 2012 as a result of these programs currently holds the world's top market share. Moreover, the achievements of these development initiatives are currently being deployed by each company as part of a global roll-out to optical networks throughout the world.

In order to once again leverage the three companies' technologies and teamwork to bring about even greater capacity optical transmissions with lower energy consumption, the companies will be working under the support of the MIC's "Research and Development Project for the Ultra-high Speed and Green Photonic Networks" to accelerate R&D on element technologies aimed at making practical 400Gbps-class optical transmissions.

The joint research will enable ultra-high-speed 400Gbps-class optical transmissions through the use of dual-polarization quadrature phase shift keying (DP-QPSK) (*3), which is currently in use for 100Gbps transmissions, together with dual-polarization 16 quadrature amplitude modulation (DP-16QAM) (*4), which takes advantage of an even greater number of quadrature carriers. By incorporating these modulation techniques into a high-density 60-channel fiber, the technology will be able to bring about the world's highest capacity optical networks capable of 24Tbps/fiber-class transmissions. In addition, to cut down on power consumption, long-haul transmission technology that can lead to reductions in the number of devices is required.

In light of this, the companies aim to provide the world's first compensation technology for nonlinear optical effects (*5) within an optical fiber—the primary limiting factor standing in the way of long-distance transmission of multiple quadrature modulated signals. When employed together with enhanced-performance versions of existing compensation technologies for chromatic dispersion (*6) and polarization mode dispersion (*7), the new technology will achieve longer transmission distances. Furthermore, the companies will pursue the implementation of adaptive modulation/demodulation (*8) technology that can employ a host of modulation techniques depending on the transmission route using a single hardware device, thereby leading to the construction of flexible network architecture.



Through the new project, the companies will enable the following kinds of next-generation optical network capabilities by 2014:

1. Ultra-high-speed and high-capacity optical transmissions — 400Gbps/channel-class and 24Tbps/fiber
2. Compensation for chromatic dispersion, polarization mode dispersion and nonlinear effects occurring on a fiber-optic line, all of which are factors that lead to performance deterioration. This results in improved optical reach (greater than 2 times that of existing technologies).
3. A substantial reduction in network power consumption (less than half of existing technologies) as a result of the need for fewer devices.
4. The construction of flexible networks through adaptive modulation/demodulation using a single hardware device.

3. Future Development

Going forward, the companies will work until 2014 to address the aforementioned technological challenges throughout the term of the R&D project. As such, they will develop technologies pertaining to 400Gbps-class transmissions and low power consumption, while striving to quickly make available the results of these efforts. In addition, they will collaborate with institutions inside and outside Japan in an aim to deploy their achievements on a global scale.

Glossary and Notes

1. Digital coherent optical transmission technology

A next-generation optical transmission method that combines coherent reception and digital signal processing. In addition to streamlining frequency usage through modulation methods such as polarization wave multiplexing and phase modulation, the technology enables significant improvements in reception sensitivity.

2. DSP-LSI

Digital Signal Processing LSI. A signal processing method for converting analog data to digital data.
http://www.ntt-electronics.com/new/information/2012_02_29.html

3. Dual-polarization quadrature phase shift keying

A technique in which information is conveyed through an optical wave's oscillation timing (phase).

4. Quadrature amplitude modulation

A technique in which information is conveyed through both an optical wave's amplitude and phase.

5. Nonlinear optical effects

A phenomenon in which the optical fiber's refractive index changes in response to the light's intensity.

6. Chromatic dispersion

A phenomenon in which different wavelengths are transmitted at different speeds within an optical fiber.

7. Polarization mode dispersion

A phenomenon that causes differences in transmission delay times within optical fibers due to polarization (direction of vibrations in the electrical field).

8. Adaptive modulation/demodulation

Technology that enables the efficient operation of optical network resources through improved line quality by switching to the optimal modulation/demodulation method depending on the characteristics of the optical network.

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About Fujitsu

Fujitsu is the leading Japanese information and communication technology (ICT) company offering a full range of technology products, solutions and services. Over 170,000 Fujitsu people support customers in more than 100 countries. We use our experience and the power of ICT to shape the future of society with our customers. Fujitsu Limited (TSE:6702) reported consolidated revenues of 4.5 trillion yen (US $ 54 billion) for the fiscal year ended March 31, 2012. For more information, please see http://www.fujitsu.com .

About NTT

NTT Group is the largest provider of wireline and wireless voice, data, leased circuit, telecommunications equipment, and system integration services in Japan, and operates one of the largest telephone networks in the world. Its predominant business is to provide nation-wide telecommunications services.
NTT Group's business domain consists of five primary lines of business:
regional communications business, long distance and international communications business, mobile communications business, data communications business, and other business.
NTT Group reported consolidated revenues of 10.5 trillion yen (US $ 130billion) for the fiscal year ended March 31, 2012. Over 220,000 NTT Group people support customers in more than 100 countries. For more information, please see http://www.ntt.co.jp/index_e.html

About NEC

NEC Corporation is a leader in the integration of IT and network technologies that benefit businesses and people around the world. By providing a combination of products and solutions that cross utilize the company's experience and global resources, NEC's advanced technologies meet the complex and ever-changing needs of its customers. NEC brings more than 100 years of expertise in technological innovation to empower people, businesses and society. For more information, visit NEC at http://www.nec.com .

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