



**FOR INFORMATION**  
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## **Launch of MIRAI-net, a Test of the Network of the Future**

Nippon Telegraph and Telephone Corporation will launch a research and development effort on an information sharing network, "adaptive network", based on a completely different concept from traditional networks. An adaptive network is one that responds flexibly to changes in the demand by users for a wide variety of services, and to the rapidly changing demand for communications. It is a network whose functions and configuration dynamically evolve. Beginning in October 1999, an experiment, called the MIRAI-net, will commence. Its purpose will be to test the effectiveness and feasibility of an adaptive network, and it will tie together three research and development facilities - in Yokosuka, Atsugi, and Musashino - with a state-of-the-art photonic network.

NTT will gradually introduce in the market the results of the research done on MIRAI-net. NTT will seek to achieve a natural and easy-to-use communications environment that will expand the ability of the user to gather and understand information, and it will enhance their capabilities of self-expression and their capabilities to communicate.

### **(1) Background**

As symbolized by the quick penetration of the Internet into our lives, we are embarking on what is being called the age of the "information sharing society," in which a variety of information is distributed across the network. This phenomenon is grounded in recent advances in computer and data communication technologies, and it is the product of rapid advancements in the computerization of social and economic activities.

The services being provided over the network are growing in complexity and diversity, while the level of knowledge and procedures required of users to make use of the network and to access its information is also rising and becoming increasingly complex. There is an information gap that has arisen between individuals with network and computer knowledge and those without, and that gap is becoming a real problem. Unlike in the prior telephone-centered era, the ways in which the network is utilized and the diversity of services have rendered accurate forecasts of communications traffic impossible. Network operators must take steps to speedily accommodate the many new services, which are making their appearance in rapid succession. At the same time, they must make effective use of network resources, and reliably provide services that meet the rapid changes in the traffic.

## **(2) NTT's Next Generation Network Solution, the Adaptive Network**

It is NTT's belief that in the coming information sharing society, anyone should be able to exchange multimedia-based information freely and easily, without any sense of place, time, or distance, or even being aware of the existence of the network itself. In other words, the user should not have to adjust himself or herself to the needs of the network. Rather, the network should respond immediately to the user's own environment, which is diverse and speedily mutating, and to changes in the user's demand for services. It should provide a natural and pleasant environment in which communication can take place, and it should aid in extending the user's ability to gather and understand information, and enhance their capabilities of self-expression and their ability to communicate. It will also be necessary that the configuration of the network, and the functions of the network equipment itself, change dynamically to be able to incorporate new services, and absorb changes in traffic at the macro level.

NTT seeks to respond instantaneously to changing conditions. We see the adaptive network, which can freely alter its functions and configuration, as the network infrastructure that will support the coming information distribution-based society. To realize that vision, we are engaged in research and development of a variety of fundamental, leading-edge technologies.

## **(3) Characteristics of the Adaptive Network**

At NTT, we use three key concepts to describe the adaptive network: Intelligence, evolution, and simplicity and seamlessness.

Intelligence - The Ability to Adapt to the User ([Figure 1](#))

The network has intelligence, and supports the user in all aspects of his or her social activities. For example, it understands not only the user's demands, but also his interests and his environment. It then provides appropriate value-added information and services on a timely basis. Furthermore, the network supports the settings for connecting the user's terminal to the network, as well as automatic updating of its functions. Several types of technologies make that sort of network possible: Technologies for comprehending the user's environment, technologies for locating network resources and providing an appropriate mix of those resources, and technologies for automatic updating of the functionality of the user's terminal equipment.

Evolution - The Ability to Adapt to Changes in the Demand for Communication ([Figure 2](#))

Through the use of programmable hardware, the network causes its configuration and functions to autonomously evolve. That will render it unnecessary to install additional communication equipment and new interfaces when implementing new services. Our goal is to provide timely new services with only about twenty or thirty percent of the investment in equipment and time that used to be required. We also seek to build an economical broadband network that makes effective use of network resources. The network will accomplish that by absorbing extreme, unpredictable changes in traffic through dynamic network reconfiguration, and implementing load distribution by modifying in real time the functions of the communications equipment to cope with concentrated bursts of service requests to the server. The enabling technologies for that include network operation technologies employing autonomous distribution control,

and techniques for autonomous modification of network functions using programmable hardware.

A Fusion of High-Capacity Optical and Wireless Infrastructure Grounded in Simplicity and Seamlessness ([Figure 3](#))

We will be able to provide network services that cross the boundaries of fixed, mobile and satellite media through the use of a very high-capacity core transport network in the terabit (one trillion bits) per second range, and a combination optical-wireless user access network. Through a combination of the technologies of real-time network function and configuration modification mentioned above, we seek to achieve a network capable of providing bidirectional access in the 100Mb/s class under a variety of usage conditions, for approximately 10,000 yen per month. The technologies necessary to attain that level of service include adaptive photonic networking, very high-capacity optical transmission, self-replicating wireless networking, and high-speed wireless transmission technology.

#### **(4) Launching MIRAI-net, an Experimental Adaptive Network**

To verify the effectiveness and feasibility of an adaptive network, a test of MIRAI-net will begin in October of this year. It will link three research and development facilities in Yokosuka, Atsugi, and Musashino using a leading-edge photonic network now in development at NTT research laboratories. The photonic network is capable of carrying optical signals with tens of differing wavelengths in a single fiber, and it can route the signals in optical form at the nodes in accordance with the information provided by their wavelengths. MIRAI-net is now testing various advanced fundamental technologies with the aim of bringing about adaptive network services based on this very high-capacity and flexible photonic network.

#### **Explanation of Terms**

##### **Photonic Network**

A network that utilizes optical processing technologies. Those include wavelength multiplexed transmission technology, which enables transmission of massive amounts of information in a single optical fiber by passing over it multiple signals of differing wavelengths. Another of the technologies is wavelength routing, which allocates different paths for signals in optical form by wavelength without electrical processing.

##### **Programmable Hardware**

Hardware that possesses both the high performance of hardware and the great flexibility of software, and alters its functions and configuration in real time in response to changing conditions and applications.

#### **Attachment**

- [Fig.1 Ability to adapt to the user](#)
- [Fig.2 Ability to adapt changes in the demand for communication](#)
- [Fig.3 A fusion of high-capacity optical and wireless infrastructure](#)
- [Fig.4 MIRAI-net's overall configuration](#)

For further information,

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