

# R&D AND INTELLECTUAL ASSETS STRATEGY

Based on its three long-term research visions, NEC is promoting R&D activities that contribute to realizing an “information society friendly to humans and the earth,” while closely tying these activities to its intellectual assets and standardization strategies.

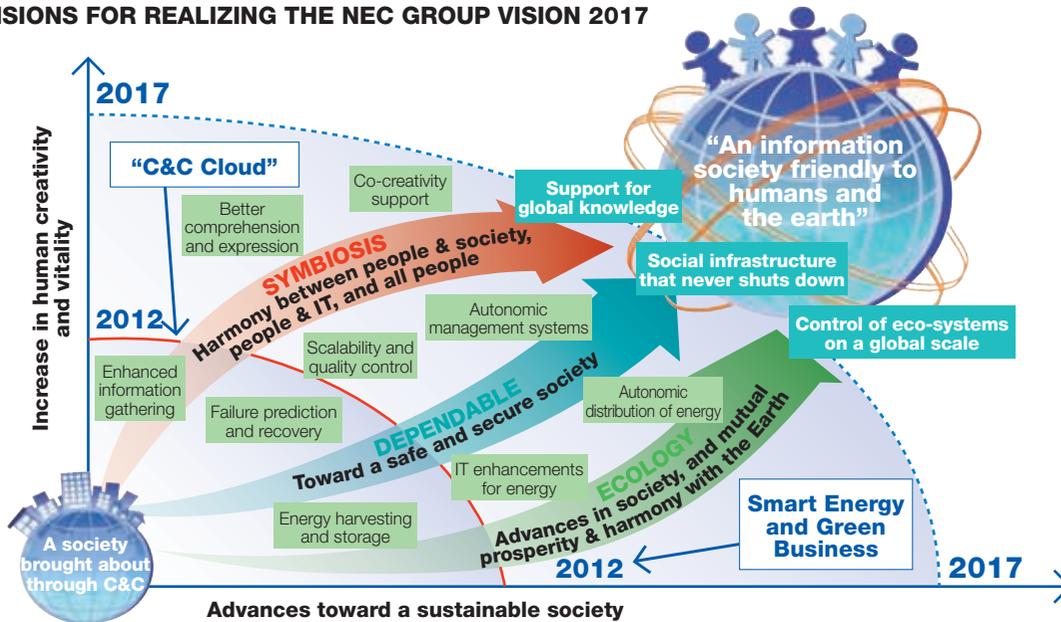
## R&D STRATEGY

In order to create “an information society friendly to humans and the earth,” which is asserted in the NEC Group Vision 2017, it is important to increase both human creativity and vitality, while developing a sustainable society. To this end, NEC has established three long-term research visions as the foundation of its long-term R&D efforts, with the aim of realizing this vision. These are: 1) “Symbiosis,” defined as harmony between people and society, people and IT, and all people; 2) “Ecology,” which is mutual prosperity and harmony with the earth; and 3)

“Dependable,” which refers to creating a safe and secure society. These three visions define the directions in which we will deepen our technologies through R&D activities over the long term.

Over the medium term, NEC will closely follow this long-term R&D policy, as it establishes key research areas to expand and enhance “C&C Cloud Strategy” related businesses, the Smart Energy and Green business, and other operations. At the same time, we will focus on producing research achievements that support the realization of the goals laid out in “V2012”.

## ENHANCE R&D ACTIVITIES BASED ON THREE LONG-TERM RESEARCH VISIONS FOR REALIZING THE NEC GROUP VISION 2017



### SYMBIOSIS

—Realizing a harmonious coexistence between people and the information society, supporting the use of global knowledge—

This refers to technology that will help people to gather the necessary information from the overwhelming amount of information in the world and assist them in understanding that information. In other words, we will develop technology that will serve as a bridge between people and the information society, and help both to develop and grow. In the future, we aim to develop technology that will support mutual understanding among people, and support co-creation utilizing knowledge from around the world.

### ECOLOGY

—Controlling ecosystems on a global scale—

In addition to energy-saving technologies, we will develop technologies to create new energy, store energy, reuse and redistribute energy to ensure its effective use. By applying information technology to energy, we make it possible to ascertain, manage and control its use. We will aim to establish autonomous and diversified technologies for energy that can be applied to the global ecosystem.

### DEPENDABLE

—Creating social infrastructure systems that do not shut down—

We are developing technologies that will predict and prevent the failure of social infrastructure systems that require a high degree of reliability, such as energy networks, traffic networks, and distribution networks, as well as make these systems more efficient through coordination among systems. Ultimately, we aim to develop autonomous systems that recover on their own without stopping even if a malfunction occurs.

### MAIN R&D ACHIEVEMENTS IN FISCAL 2011

In fiscal 2011, NEC developed a new video content identification technology that instantly detects illegal video copies. This technology was accepted as part of the MPEG-7 international standard for video identification. In addition, NEC developed a cloud-based charging system that enables charging infrastructure for electric vehicles to be deployed over a wide area, and is taking steps to commercialize this system.

In other areas, NEC developed cloud computing infrastructure technologies that enable systems to easily scale while maintaining high dependability for mission critical systems for enterprises, government bodies, telecom carriers and others. These technologies address the rapid increase in the amount of data processed by these systems. NEC also developed a technology that makes LTE base station installation work more efficient by automatically optimizing the parameters of each base station. LTE is a next-generation mobile communications standard. Another achievement was the development of a

thin and flexible Organic Radical Battery (ORB) with significantly enhanced reliability and output. This ORB is expected to be used in IC cards and wearable devices in the future.

Turning to the contribution of R&D achievements to business operations, NEC developed the world's first next-generation network products equipped with OpenFlow technologies, namely a "ProgrammableFlow Controller" and "ProgrammableFlow Switch". Another achievement was the application of NEC's face recognition technologies to its "NeoFace Ver. 3.0" facial detection/comparison engine. NEC's face recognition technologies received the world's top ranking in the Biometric Grand Challenge's "Still-Face" Challenge Problem carried out by the U.S. National Institute of Standards and Technology (NIST).

Going forward, NEC will continue to promote market-oriented R&D activities and work to continuously drive innovation to support the NEC Group with an emphasis on enhancing R&D efficiency and accelerating the commercialization of new technologies.

## VIDEO CONTENT IDENTIFICATION TECHNOLOGY THAT DETECTS ILLEGAL VIDEO COPIES INSTANTLY

Today, the Internet hosts a multitude of video content, but included among this content are numerous illegally copied or altered videos. Therefore, copyright infringement of the original video content has become a major issue for content holders and service providers.

In response, NEC has developed video content identification technology that

automatically detects such illegally copied or altered video instantly. This technology generates a unique fingerprint (video signature) to identify video content. Video signatures are extracted from frames based on differences in the luminance between sets of sub-regions on a frame. The technology then compares these video signatures to the signatures of the

original content for identification.

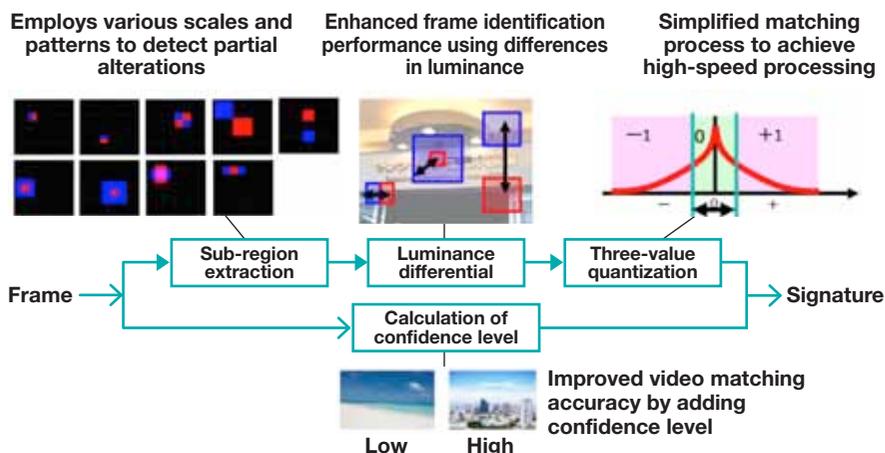
Because the video signature requires very little storage memory, the technology can match approximately 1,000 hours of video in 1 second using the processing speed of a typical home PC. Furthermore, the technology can accurately detect not only simple video copies, but also video that has been traditionally difficult to detect. This includes video content that has been altered through caption and ticker overlays and other means, as well as video camera-captured copies.

In a technology evaluation conducted by an international standardization organization, the technology achieved an average detection rate of 96% at a very low false alarm rate of 5 ppm (5 in one million) when tested against various video content altered with malicious intent. As a result, the technology was approved as part of ISO/IEC 15938-3/Amd.4: MPEG-7 Video Signature Tools, an international standard for identification technology of video content.

Looking ahead, NEC intends to use this technology to provide a variety of applications, including the provision of services and information linked to promotional videos, surveys to track content usage, and advertising distribution linked to video viewing history.

### VIDEO SIGNATURE GENERATION PROCESS

**Achieves both robustness and identification by analyzing images (frames) using various scales and patterns**



## INTELLECTUAL ASSETS STRATEGY

NEC positions intellectual assets as “the foundation for the NEC Group’s business competitiveness and stability,” and is working to strengthen its intellectual assets from both quality and quantity standpoints. Specifically, NEC is concentrating on establishing a global patent network, to support achieving an overseas sales ratio of 50% as targeted in the NEC Group Vision 2017. One key focus is the core areas set forth in “V2012”, including “C&C Cloud Strategy” related businesses and the Smart Energy and Green business. In these areas, NEC is carrying out Group-wide strategic patent projects on a global basis to obtain strong patents and patents that are being utilized. The NEC Group owns approximately 68,000 patents

worldwide, including approximately 24,000 patents in Japan (as of March 2011).

Furthermore, NEC believes that participating in standards initiatives will help create and expand businesses, and will also contribute to the stable offering of products and services. In addition to pursuing a business model that utilizes standardization, NEC is engaged strategically in standardization activities by actively participating in standardization entities both in Japan and overseas. Also, as part of external engagements with intellectual assets, NEC is actively pursuing licensing activities to reduce business risks and expand business opportunities.

## DEVELOPMENT OF CLOUD-BASED CHARGING SYSTEM ENABLING WIDE-AREA DEPLOYMENT OF NETWORKED ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

The popularization of electric vehicles (EVs) will be a crucial step to realizing a low-carbon society, and is therefore attracting a lot of public interest. Charging infrastructure for EVs will play a pivotal role in support of the full-scale uptake of EVs.

EV charging facilities can be installed in a variety of locations such as service stations

(gas stations) convenience stores, shopping centers, theme parks, train stations and airports, because charging services can be provided wherever a supply of electricity is available. However, when deploying charging facilities over a wide area, EV charging service providers require infrastructure to efficiently operate and maintain charging

facilities. It is also important to ensure that EV users can utilize charging services from any charging facility, without being restricted by differences in EV charging service providers. To this end, there is a need to ensure compatibility with many different authentication and billing methods, and establish links among the charging systems of EV charging service providers.

NEC has developed a cloud-based charging system that enables EV charging service providers to gather and manage information about charging facility usage and technical issues, as well as upgrade charging facility software and perform other related tasks via a network. The system is made possible by linking the maintenance and operating functions of charging facilities with the “cloud.” Because EV charging service providers will be able to maintain and operate charging facilities remotely, they will be able to operate unstaffed charging facilities. This will facilitate the deployment of charging facilities in a variety of locations. In addition, by installing FeliCa multi-service card reader/writer systems in charging facilities, the system can be made to accept a variety of electronic money through links with cloud-based electronic money platforms. In these ways, the system will help to develop user-friendly charging infrastructure for both EV charging service providers and users.

Looking ahead, NEC will trial the new system together with partner companies, with the aim of commencing commercial operation of the system within fiscal 2012.

### SCHEMATIC OF CHARGING INFRASTRUCTURE USING THE “C&C CLOUD”

