Approaches to the “NEC Automotive Cloud Computing”

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Abstract

With the worldwide expansion of the production and sale of automobiles, the telematics and related markets are expected to grow at a similar pace and the creation of various services and added values for automobiles is expected on the networking platform. In this market, NEC is promoting the “NEC Automotive Cloud Computing” project, which will be a platform for providing automobile users, automobile manufacturers and related businesses with various services by utilizing NEC’s proprietary technologies in cloud computing, networking and open platforms. This paper introduces the activities underway for this purpose.

Keywords

automotive, cloud, telematics

1. Introduction

NEC has long been providing diverse solutions and services for automobile manufacturers. In particular, we are tackling automotive telematics services and the associated technological domains in the framework of the “NEC Automotive Cloud Computing” project.

While automobile sales and production in Japan are in a decreasing trend, worldwide automobile production and sales are expected to expand thanks to the expansion of demand from emerging countries. A similar expansion is expected in the telematics market. With respect to these technological domains, we are planning to provide automobile users, automobile manufacturers and related businesses with various service platforms and added values by utilizing our proprietary technologies in cloud computing, networking and open platforms.

With regard to this approach, sections 2 and 3 of this paper describe the surrounding market environments and the expected effects to customers and section 4 describes the assumed service platforms and utilized technologies.

2. Circumstances Surrounding Telematics

Automotive telematics has a history of more than a decade, with some services starting to be provided by some automobile manufacturers in the latter half of the ’90s. The number of vehicles benefiting from these services is still small compared to the total number of vehicles in the country, but data announced by survey companies has shown that the number will expand greatly in the coming decade. For example, the estimate for FY2020 is that, globally, about 100 million vehicles will have the potential to use telematics (as networked vehicles).

For car-mounted terminals providing services, the market has been changing from the currently popular navigation-dedicated machines to PNDs (Portable Navigation Devices/Personal Navigation Devices) at lower prices. Additionally, in the past year or two, smartphone-based navigation services have started and have been expanding their numbers of users. As seen above, navigation services are shifting from expensive dedicated machines to products and services featuring low prices and open technologies. With car-mounted systems, too, the previous world that was centered around dedicated machines and dedicated applications has shifted to the world to meet a need for platforms that are more open. This is because the lifecycle of vehicles is different from the lifecycles of infotainment products and the services users need are different, which makes it possible to provide information products and services to users in quicker cycles. As a result, the current situation requires us to respond to users’ expectations by making use of open platforms and various applications and content running on these open platforms.

Next, when we focus on the world of service providers, we see that previous services were provided independently by automobile manufacturers. More recently, however, carrier network enterprises have begun to provide services and individual service providers (map service-dedicated providers, for example) have begun to provide services in their strongest

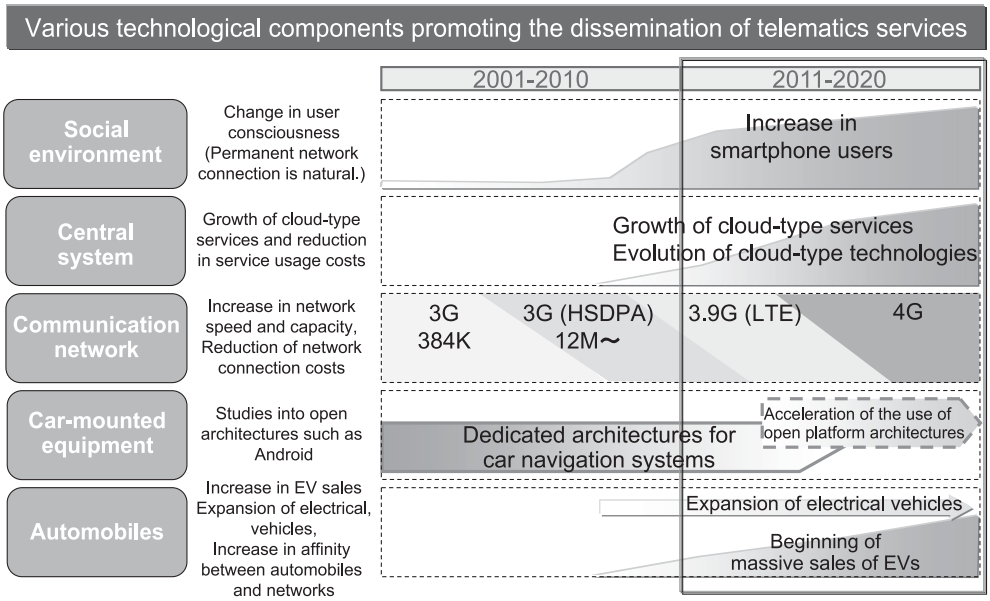

Fig. 1 Social/technological trends.

domains. In other words, the world has moved from a situation in which a single enterprise provides everything to a situation in which several enterprises collaborate mutually to respond to user needs with a variety of services.

Social and technological trends are also promoting the dissemination of telematics in the coming decade from the following five viewpoints (**Fig. 1**):

First, from the viewpoint of social environments (changes in user consciousness), the dramatic increase in smartphones has made it possible for users to use various services under a permanent network connection. This change in consciousness, in which a permanent connection is regarded as natural, is expected to expand among general users. Secondly, regarding solutions for the server domain, cloud-type service platforms and technologies that support telematics are evolving and growing. Thirdly, from the viewpoint of networking, the development of a foundation for faster services is making it possible to provide services with higher degrees of freedom. Fourthly, from the viewpoint of car-mounted equipment, studies into open architectures such as Android are becoming active to replace dedicated architectures. Fifthly, as shown in the beginnings of massive sales of EVs in the past year or two, the expansion in electric vehicles is expected to increase the affinity between automobiles and networks, which leads to a situation in which networking is positioned as a function or added value indispensable for automobiles.

Lifestyle changes, the advent of an “EV society” and the progress of the various technologies above are changing automobiles from individual tools of transportation to “moving information and communication terminals” offering enhanced passenger safety, comfort and environmental friendliness based on maximum utilization of networking.

3. Expected Effects

By connecting automobiles to a network and providing various products and services through it, we aim to create joy among automobile users, automobile manufacturers and related businesses from the viewpoints of “comfort & convenience,” “safety & security” and “environment & energy.”

Examples of services from these three viewpoints include the following. For “comfort and convenience,” there will be a service for obtaining necessary information anytime from the network. For “safety & security,” there will be a service that, in case of an accident, automatically notifies emergency service operators of the location and details of the accident as well

as the driver information. And the service for “environment & energy” will be one in which the data center collects information from the automobile, provides a visualization of the driving situation in the current environment and feeds back the information for later use. Providing services for networked vehicles from the three viewpoints described above not only allows us to respond to user needs but also to position such services as the brand power or attractive features of the vehicle.

From the standpoint of supporting user lifecycles, implementing services as cloud-based services can lead to supporting the entire life of each user, while driving the vehicle as well as while not using it, for example while the user is at home or out on foot.

Apart from user “joy” and services that are directly visible for general users, another important target is to let automobile manufacturers and related businesses utilize the data collected through the network. Networking a vehicle means that the user is permanently connected to the automobile manufacturer, so that customer contact can be strengthened in various scenes of later car life. Information that can be obtained only with a permanent network connection, such as vehicle travel information and automobile sensor information, can serve the operations of automobile manufacturers in various phases of the internal process, from product development to quality control, sales and after-sales servicing (**Fig. 2**).

The use of information obtained from networked vehicles in cloud-based services, as described above, is capable of strengthening contacts between users, automobile manufacturers and related businesses and is expected to promote the “joy” of each party synergistically.

Examples of service functions that can be provided on such a platform include the following:

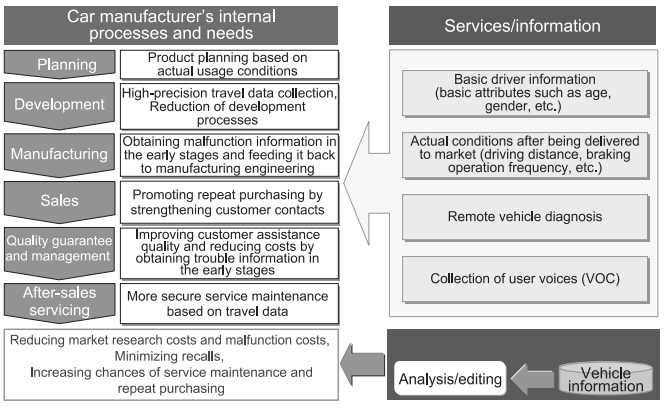

Fig. 2 Examples of applications for an automobile manufacturer.

(1) User-oriented services

- Traffic information-related services (latest traffic news, etc.)
- Drive support services (Eco-drive support, etc.)
- Remote services (remote maintenance, emergency alarm, etc.)
- Vehicle information services (vehicle information monitoring, etc.)
- EV-oriented services (battery information management, etc.)
- Infotainment functions (music, video, etc.)
- Common platforms (communication control, authentication/billing, security, etc.)

(2) Automobile manufacturer-oriented services

- Storage, processing and distribution of a large volume of automobile information
- Data analysis functions (data mining, troubleshooting, etc.)

(3) Related business-oriented services

- Inter-business linkage based on stored data (advertising, insurance, etc.)

4. NEC’s Approach

We are promoting the development of cloud-type services as the platform for meeting the needs and aims described above.

One of the existing environments using telematics is the dedicated service provided individually by some automobile manufacturers. As many service providers will provide specialized services in the future, it is expected that they will have difficulties providing everything individually on their own. Consequently, we believe that the modes of service provision in the future will advance toward shared use-type and inter-business linkage-type services (**Fig. 3**).

We promote the NEC Automotive Cloud Center as the foundation for shared use-type and inter-business linkage-type

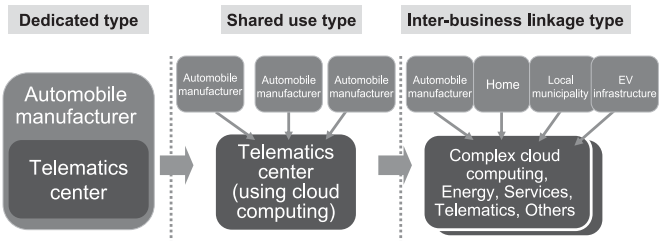

Fig. 3 Change in modes of service usage.

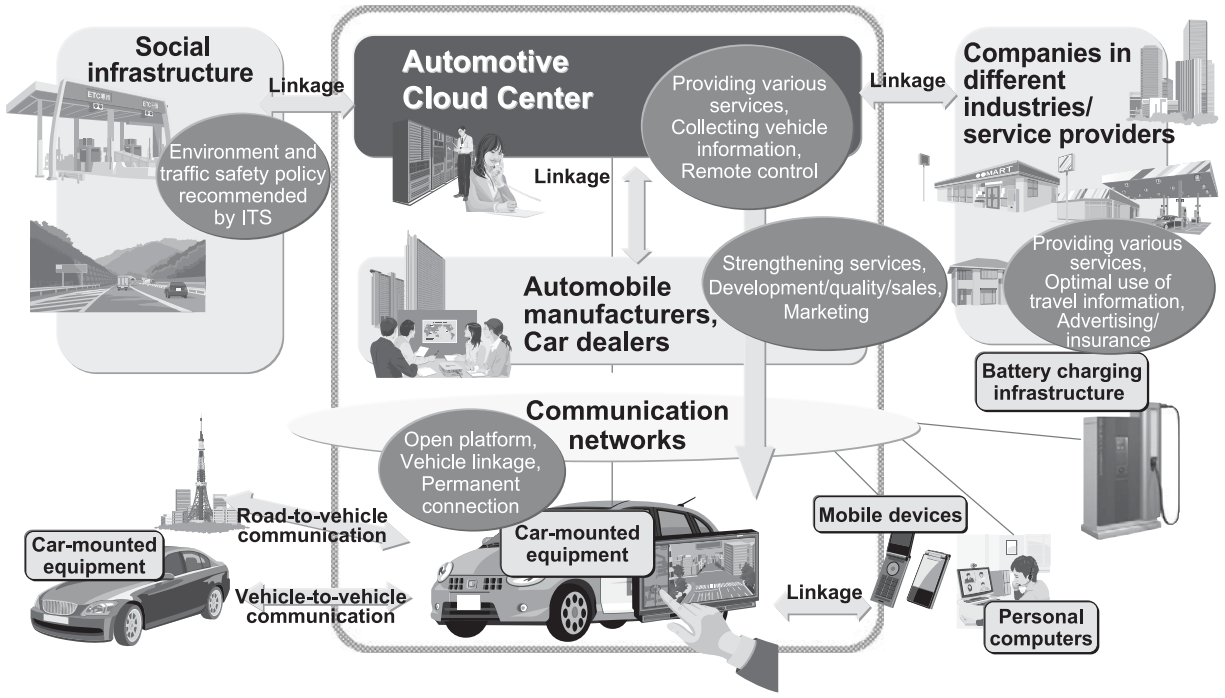

Fig. 4 Overall image of the automotive cloud center.

service provision and aim to implement cloud-type service platforms.

The Automotive Cloud Center has the following three targets:

- **Shared use-type service platform**

Shared systems will be implemented for domains that can be used in common by several automobile manufacturers or carriers. The aim is to reduce the burdens and costs of operations and to collect and use data deserving mutual use. (Sharing traffic jam studies, for example, would lead to mutual advantages for all.) For services in domains under competition between carriers, they may be developed individually or external services may be used.

- **Open, flexible service platform**

We possess a development system of various open-platform products including systems and services (PCs, smartphones, networking, server-related products, etc.), and we are planning to apply our expertise to the world of automobiles. Adopting technologies that are more open than the past car-mounted equipment based on dedicated architectures will make it possible for us to provide an open technology-oriented platform which can provide the services needed by users more quickly, based on linkages with individual service providers, smartphones, etc.

- **Synergistic effects of the one-stop model**

The NEC Group possesses the system and capability to deal with cloud computing, networking, car-mounted equipment and embedded equipment in a total manner and can therefore provide the technological components required for them and their integration in a one-stop system based in a cloud center. Nevertheless, we are not planning to provide all the services on our own. Rather, we are seeking to activate linkages with necessary service providers and car-mounted equipment manufactures in order to provide comprehensive services that can offer maximum benefits to all automobile users, automobile manufacturers and related businesses.

We also wish to make use of our experience in assisting the in-house operations of automobile manufacturers with telematics. Specifically, we are planning to provide job solutions

that are becoming newly available thanks to permanent connection, such as CRM (Customer Relationship Management), PLM (Product Lifecycle Management) and quality management solutions, together with telematics.

At present, we are implementing the Automotive Cloud Center by using our M2M platform (CONNEXIVE) in combination with our proprietary technologies (**Fig. 4**).

Examples of key technological components in the implementation of this foundation in each of the three domains of server, network and terminal are as follows:

(1) Server-domain technologies

The technologies to be used as a foundation for server services include efficient real-time processing of a large number of small data streams generated by the sensors of networked vehicles, analysis of user behavior from the collected information and data mining technology for effective utilization of stored data.

(2) Network-related technologies

We will provide a security function for the global implementation of safe and secure data transmissions, a data compression function and a communication control function using our M2M platform. The technology for device management between servers and terminals will be applied to services such as remote monitoring and remote maintenance.

(3) Car-mounted terminal/device technologies

For car-mounted terminals and devices, we will use open platform technology to use various services (Android, etc.) and UI technologies (voice recognition, image recognition, etc.) for easy and safe use of networks from automobiles. We will also support the smartphone linkage technology that is regarded as one of the critical technologies of the future.

5. Conclusion

Telematics services are presently provided mainly in the USA and Japan, but they will expand on a global scale to include China and emerging countries. As part of this trend, we will promote telematics services by making use of our proprietary M2M platform and other technologies so that we can provide automobile users and manufacturers with services with added values and business effects in the fields of "comfort & convenience," "safety & security" and "environment & energy."

*Android is a trademark and/or a registered trademark of Google Inc.

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