THE TELEMATICS CONTENTS GATEWAY BASED ON INTEROPERABILITY

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ABSTRACT In this paper, we analyze the problem with existing telematics contents service systems that have been provided telematics information on a special contents provider. Then, we suggest methods to solve the problems and propose the architecture of TELIC(Telematics Information Center) to implement our methods. We also verify the stability and the accuracy of the suggested architecture through a comparison with an existing service system. With our system, it is possible to develop telematics content application without additional developing the integration method of various contents.

KEY WORDS: Telematics Contents Gateway, Interoperability

1. INTRODUCTION

According as drivers request more telematics information (traffic information, POI, location information, geography information, weather data, travel information etc.) and services, it is necessary to easily integrate these information and services (Korea Telematics Business Association, 2005; T. Groot , 2000; U. Visser, 2000; Val Noronha, 2000). But, TCPs(Telematics Contents Provider) offer these dependant on their database schema and network infrastructure. So, each TSPs(Telematics Service Privider) must make an more effort and develop contents-conversion system to service integrated information independent on TCPs. Because of the increase of information-searching and development cost, ultimately it is difficult to provide telematics information and service by inexpensive price to consumers.

To solve these problems, we suggest the interoperability methods to provide telematics information and services with the standard database schema and independent service architecture. And we describe the architecture and functions of Telematics Contents Gateway that implement these methods. In section 2 of this paper, we analyze the problem with existing telematics contents service systems that have been provided telematics information on TCPs. In section 3, we suggest the interoperability methods to provide TCPs's different telematics information and services and propose an architecture of Telematics Content Gateway to implement the methods. We verify the stability and the accuracy of suggested system in section 4 and conclude in section 5.

2. THE EXISTING TELEMATICS SERVICE SYSTEM

Current telematics information service systems are in confusion with a database schema and a specific network infrastructure of each TCP. Figure 1 shows the chain of using the information of TCPs. TSP D is willing to search the information serviced to user. Because there is no system registered the metadata of TCPs and their information, TSP D must contact to TCPs individually whether each TCP provides the specific information. After TSP D discover the information, it receive these from the TCP. TSP D match these information to own formation to service user. To match, TSP D develop the converting modules to each TCP's information. If the number of TCP is N and TSP is M, the sum of the converting module is N * M.

Figure 1 shows the TSP D collects the different-formed information from TCPs and converts these information to own format.

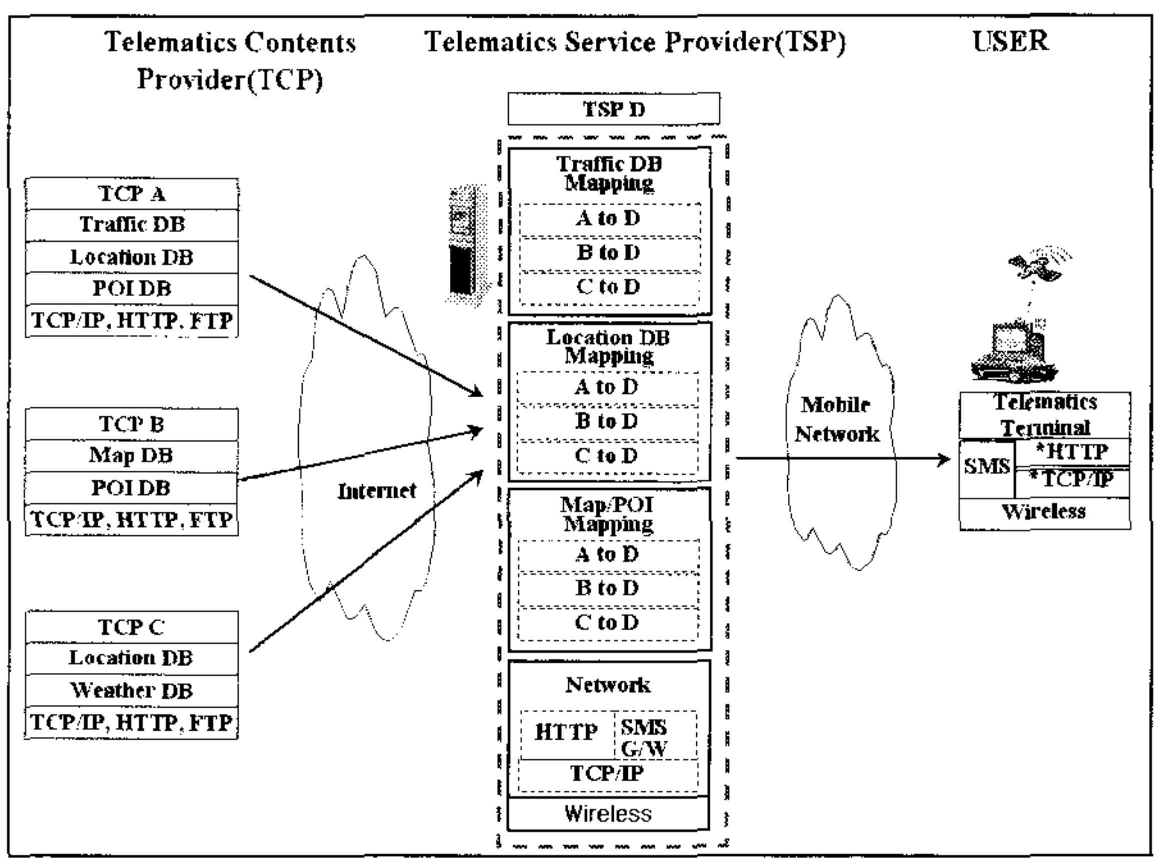

Figure 1. The Existing Telematics Contents Server Systems.

3. RELATED WORK

Our research is to bind telematics contents consumers and its providers, and to integrate existing heterogeneous telematics contents. So our work is reached on the two research fields, "interoperability of telematics contents" and "web-technologies" for binding the consumers with the providers. We summarize briefly previous works in the two fields here.

3.1 Interoperability of Telematics Contents

In previous section, we emphasize the importance of the interoperability between various telematics contents based on a road network topology provided by TCPs. Interoperability implies the sharing of data semantic as well as data syntactic(Y. Bishr, 1997; U. Visser, 2000). And it is classified into two groups; data interoperability and service interoperability. The former can be guaranteed by a common data model to integrate different road network models into the common model(C. Goodwin, 1997; D. J. Abel, 2005; A. R. Stockus, 1999; V. Noronha, 2000). The latter is to provide the service interfaces with standard API(T. Groot, 2000; L. Bernard, 2003; W. Y. Han, 2005). Our study is focused on the view of data interoperability.

In the data interoperability, representing of a phenomenon shared in the same time, and space and the accuracy of converted data are important. For this, (C. Goodwin, 1996) proposed to use a standard data format and minimum data profile independent of specific systems. This method has the advantage of exchange contents without data conversion between systems, so we will respect the idea when we develop telematics contents model of our TCG system.

When we design a telematics data model in terms of data interoperability, we need to consider a location referencing, because telematics contents such as location information or traffic information are regarded as events on roads. In this work, we will use a linear referencing approach using link IDs, because current telematics contents providers are using the approach.

3.2 Web Technologies for Data Publish

The OpenGIS Consortium(OGC) has developed open standard for data service through the web - GML(Geography Markup Language), WRS(Web Registry Services), WMS(Web Map Services), WFS(Web Feature Services), WCS(Web Coverage Services), CPS(Coverage Portrayal Services). It provides standard interface and interoperability. In particular, a WRS are a software component that supports the runtime discovery and evaluation of resources such as services, datasets, and application schemas[11]. Based on these technologies, we will propose a way to publish telematics contents, and to bind the contents and telematics service providers.

4. THE ARCHITECTURE OF TELIC

Telematics provides new opportunities for auto manufacturers, auto suppliers and a variety of content and service suppliers. We considers that telematics is one of the driving force of Korean economy. To expand telematics market, government-initiated project, was proposed by TSP(Telematics Service Provider)s. *Activation of telematics industry is realized by providing* low price telematics contents(traffic, geometric information) that the telematics service providers require commonly, through the building of telematics information center. The gateways should provide the traffic information that is the core service in the telematics industry.

Telematics Information Center (TELIC) is the gateway to provide one-stop service to TSPs. TELIC is providing information about standardized traffic, navigation map, POI, weather and etc. The view point of TSPs, it is very difficult to access the telematics information that is owned public organization. However, through the TELIC, if is possible for the providers to acquire, process the information with lower cost. Consequently it is derived that the service cost is decreased. To establish "Telematics One-stop Service System", which provides the core infrastructure, telematics DB (information about geography, POI, accident and weather) and traffic information, in order to provide telematics service.

The architecture of TELIC is separated to three parts according to function and usage: Information Gathering Server(TGS), Information Processing Server(TPS), Information Service Server(TSS). Figure 2 present the flow of data gathering, processing, and servicing.

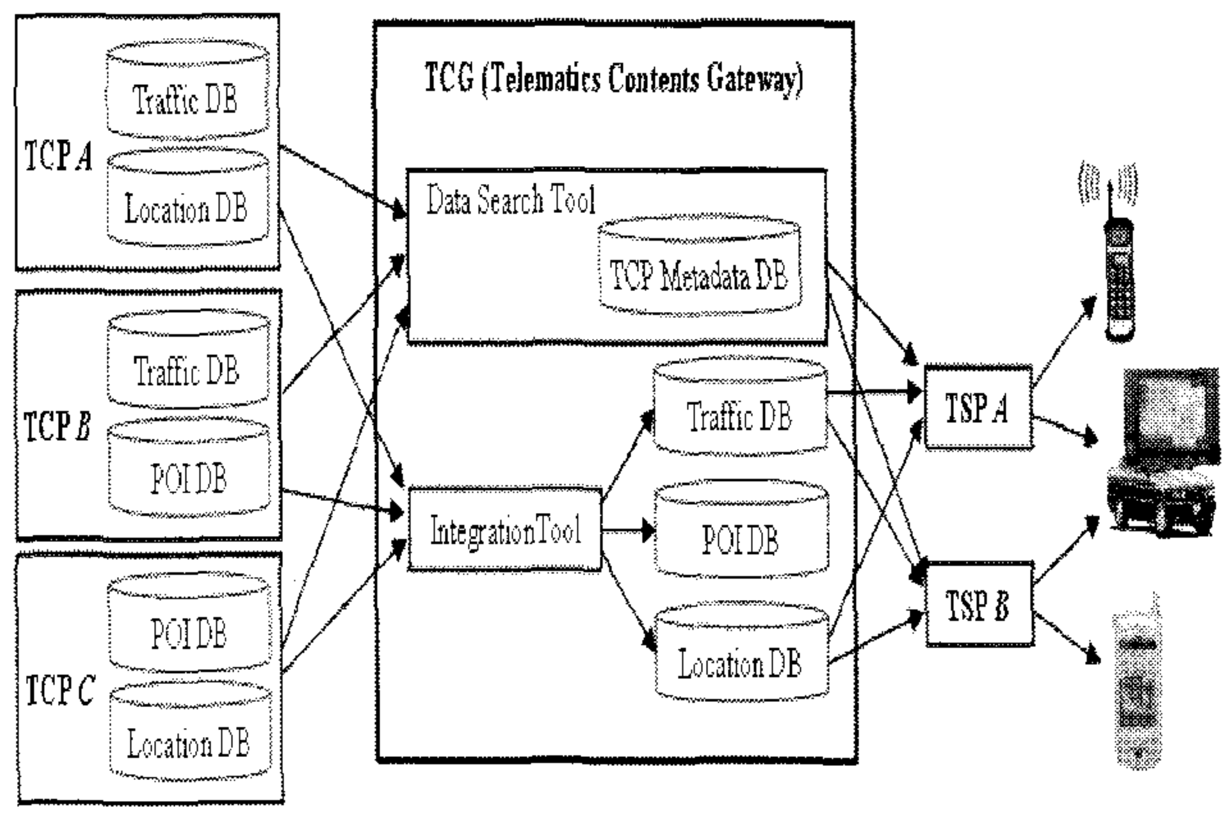

Figure 2. The Flow of Data in TELIC

It is necessary a node-link data structure which includes traffic information and road network topology information to provide the real-time navigation services (Korean Research Institute for Human Settlements, 2003). But, the term and the data structure of every TCP is different from a kind of traffic information, and designs about facilities such as an intersection of a road network, a tunnel, an overpass. So, TELIC defines the schema of the traffic information and objects of road facilities to support the interoperability between TCPs.

The schema of the traffic information standard is defined the data are provides commonly by TCPs and particular additional information dependant on each TCP. That is, our schema supports the scalability of traffic information and the distinction of the quality of the information is provided by TCPs. So, TSPs use the information of TELIC without the additional effort such as the processing and transformation.

A node-link data structure is focused on the design of road network object. The identifier of node and the link are identified by region units. We construct the matching table between TELIC and TCPs case by case to keep up the correctness of information provided by TCPs. In addition, our system maximize the efficiency of data management and reduce the redundancy of information with the unique identification of the node and the link data.

And, we designed the facility objects as the particular properties of the road network. First, we designed the facilities such as a tunnel, an overpass of a road network. Second, we constructed the topologies of an intersection in detail. There is the general intersection, the large-size intersection, the radial shape intersection, and the cubic intersection. Figure 3 shows the road network topologies of TELIC and TCPs.

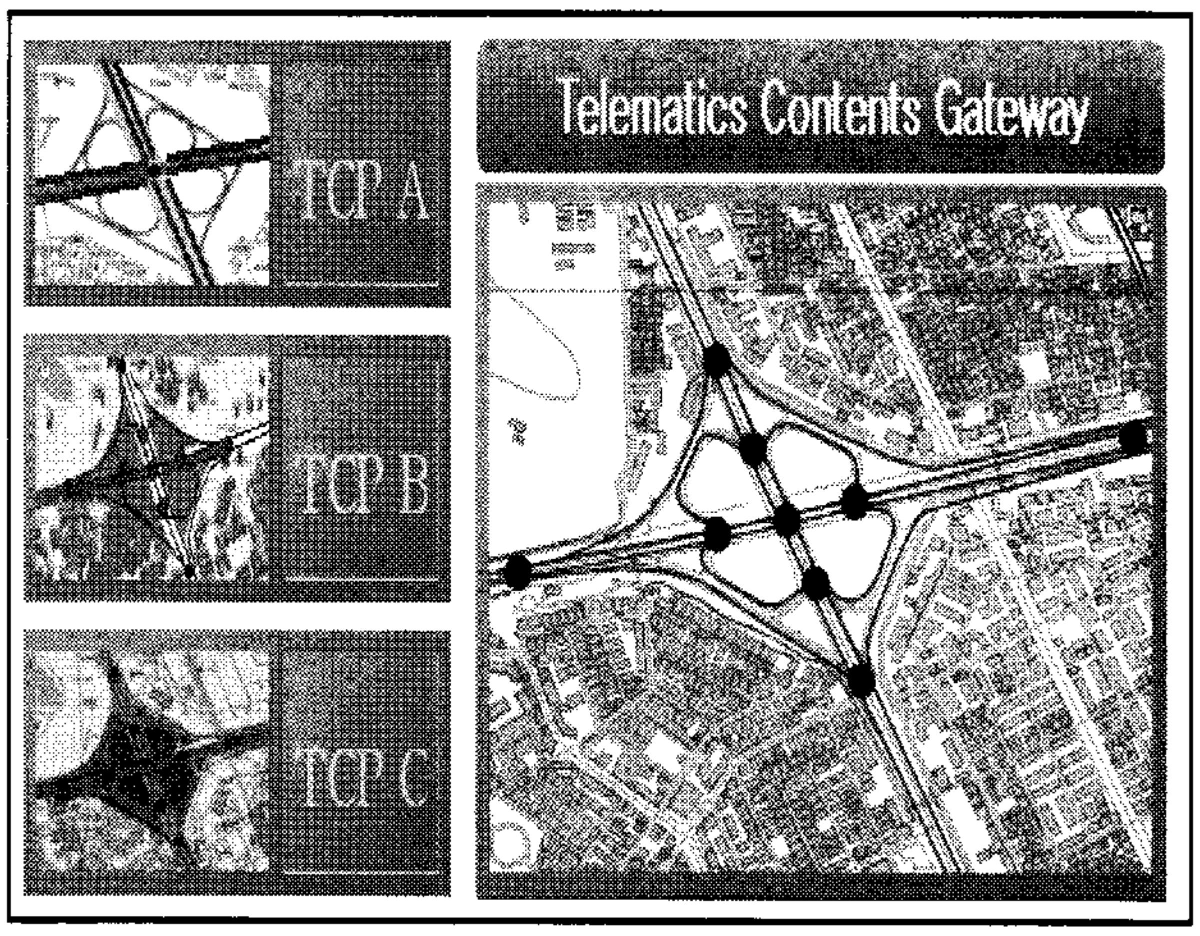

Figure 3. The Example of the large-size intersection

5. VERIFICATION AND IMPLEMENTATION

Now, we are providing the exhibition service using TELIC as figure 4. The purpose of this service is the testing of the stability of TELIC and the accuracy of conversed information of TCPs. TCPs provide the real-time traffic information and location information to TELIC at five-minute intervals. Then, TELIC convert these information based on the road network topologies of TCPs to the common data model defined in previous section. Finally, TSPs provide the common information from TELIC to telematics terminals and cellular phone via wireless network.

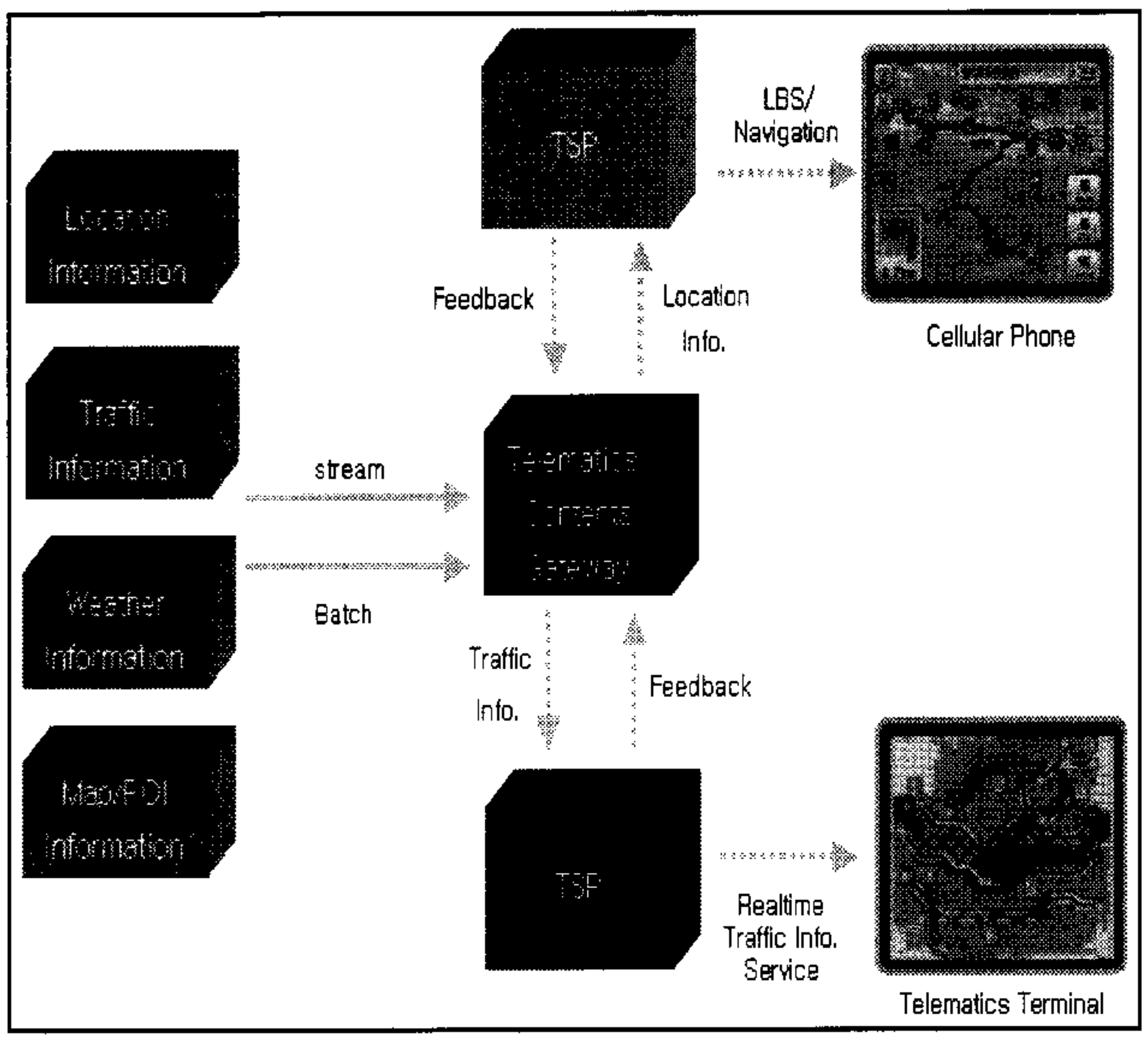

Figure 4. The Exhibition service using TELIC

Our TCG system which was developed on a Windows system with C# has been tested over a year. We introduce the results in this section, specially, in terms of data-loss during an integration process and data transmission time.

Current TSPs request traffic information per 5 min, and the number of TCPs in South Korea is about 10. Each TCP is able to provide10,000 road links per each period(5 min). Thus, we need to verify if or not our TCG system can finish tasks such as gathering telematics contents from TCPs, integrating them, and providing them to TSPs within 5 min. Figure 5 shows the results that 40 seconds were taken for 10,000 links, and 110 seconds for 100,000 links. Therefore, our TCG satisfies the users' request in terms of the transmission time.

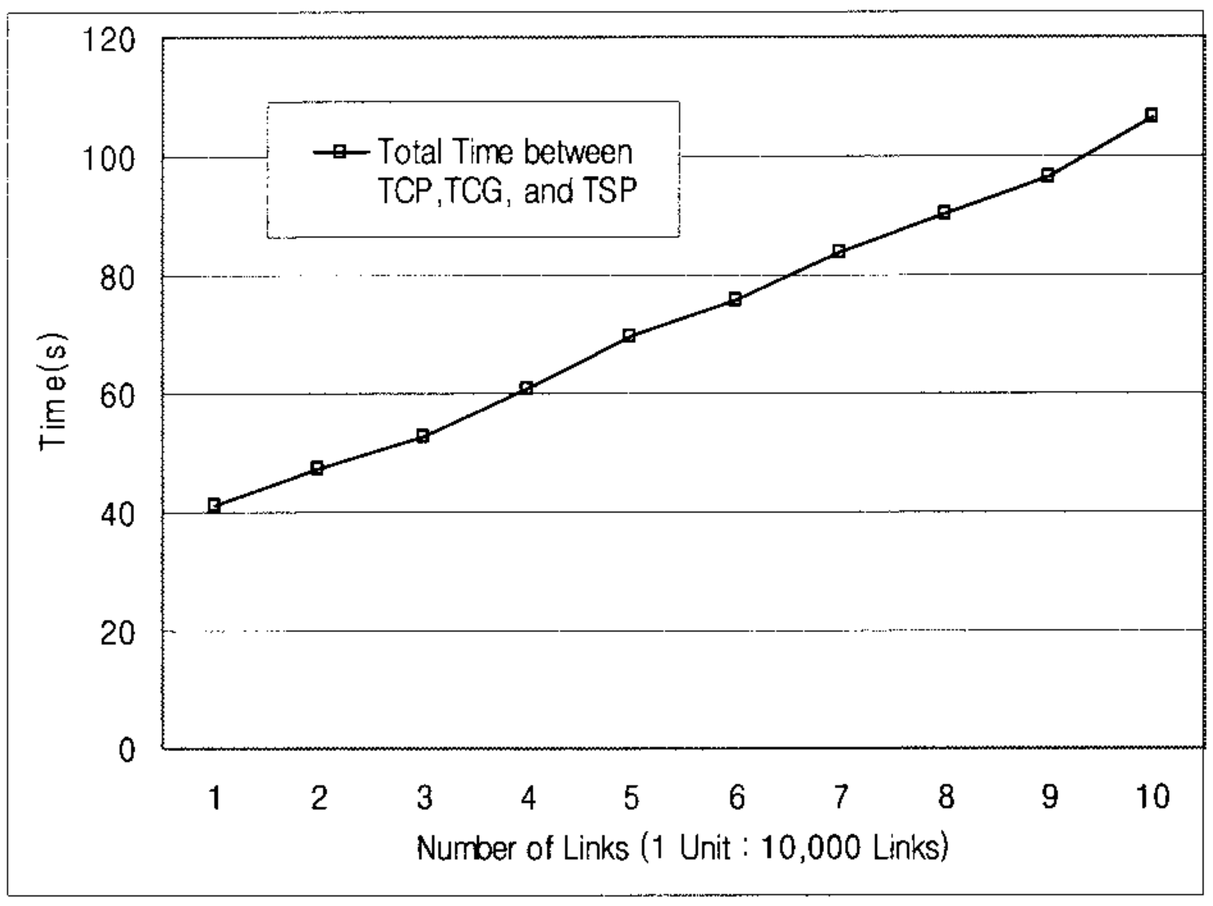

Figure 5. The Transmission Time through TCG

6. CONCLUSION

In this paper, we analyze the problem with existing telematics contents service systems that have been provided telematics information on a special contents provider. Then, we suggest methods to solve the problems and propose an architecture of TELIC to implement our methods. With our system, it is possible to develop telematics content application without additional developing the integration method of various contents.

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