Chapter 4.6
Applying Service Oriented Architecture and Cloud Computing for a Greener Traffic Management

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ABSTRACT

Traffic Management System (TMS) is a possible implementation of a Green IT application. It can have direct impact on reducing the greenhouse gases. The focus of this report is to illustrate how event driven SOA design principles can be applied in designing traffic management system. It also discusses how cloud computing concept can be used for TMS application. Traffic during peak hours is a problem in any major city where population growth far exceeds the infrastructure. Frequent stop and start of the cars on the heavy traffic roads and slow moving traffic causes greater fuel consumption, which results in greater emission of carbon gases. If efficient traffic management system can speed up the traffic average speed it will help reduce the carbon emission. As the WiMAX technology reaches maturity and achieves greater reliability and speed for wireless data transmissions new mobile applications are possible. Traffic Management System is one such example. WiMAX can facilitate communication to and from fast moving cars. WiMAX combined with GPS (Global Positioning System) technology can facilitate building an efficient traffic management system. The authors have also discussed various scenarios where Cloud computing technology can be utilised resulting in further optimisation of the computing resources and therefore reducing the carbon emission.

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INTRODUCTION

Traffic chaos in a major city during peak hours or when returning from holidays has become a nightmare. Distance covered in one hour drive can sometimes take much more. Apart from frustration to the driver and passengers, the slow traffic has an impact on the environment. According to a study in UK the fuel consumption on urban roads can be up to 70% more than that in the highway conditions (http://www.environment.gov.au/). In simple terms that would cause upto 70% more pollution. Any reduction in traffic chaos could help reduce the carbon emission. This paper attempts to provide a solution that can help reduce travel time for cars in peak hours, reduce idling time and improve average speed of travel and therefore reduce the greenhouse gases.

This chapter extends and builds on a traffic management system (TMS) we have developed and reported (Bhalla and Chaudhary, 2009). In this paper we have illustrated how Event Driven Service Oriented Architecture (SOA) can be used in designing Traffic Management System. The technologies we have proposed to use to achieve our objective of better managing the traffic are

- WiMAX: technology to provide wireless transmission of data at high speed
- GPS (global positioning system)
- Event Driven Service Oriented Architecture (SOA)
- Cloud Computing

The TMS can use the position of all the vehicles on various major road junctions and compare that to normal traffic volume to determine the traffic congestion. Based on this real time traffic data, the best alternative route to reach the destination can be provided. This is different to the normal GPS system, which provides only the static route without consideration to the real time situation on the road. Traffic condition data can also take into account some planned traffic blockages like road work, accidents and snow or rain. TMS can also compute the total carbon emitted by the vehicles during certain period (typically the peak hours) and help in monitoring and controlling carbon emissions.

The backend servers to run the TMS system can also be organized in a manner as to stagger the use of the servers. For example, a TMS hosted on a single server can handle the peak hours of various regions within a country - like Sydney and Perth in Australia. There is two to three hours time difference between Perth and Sydney. Thus, unused server capacity during off-peak period can be utilised to manage traffic of another city. Similarly unused capacity of servers can be made use of to manage traffic of a city in another country in different time zone. TMS system can be deployed on a cloud of servers residing in various locations running traffic management software. Servers in geographically distributed sites can make use of solar energy available in the location as much as possible. Availability of Sunlight in different locations would differ according to the time zone.

The focus of the report is to present the principle of operations of TMS, description of various technologies and components required for TMS and mainly how event-driven design principles can be applied in developing traffic management system. Relevance of TMS as Green IT application will be discussed and how cloud computing can be applied for TMS will also be elaborated.

CASE STUDY: TRAFFIC MANAGEMENT SYSTEM

Problem Description

A fictitious Traffic Management System (TMS) is used to manage and monitor traffic. It has been used to illustrate a Cloud Containing Event Driven SOA Architecture and the analysis and modelling of a solution.