Cloud Computing for Agent-based Traffic Management Systems

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ABSTRACT
Increased traffic congestion and the associated pollution are forcing everyone in transportation to think about rapid changes in traffic processes and procedures [2]. This paper titled "Cloud Computing for Agent-Based Traffic Management Systems" illustrates the use of autonomy, mobility, and adaptability of mobile agents to deal with dynamic vehicular traffic over the cloud environment [1]. Cloud computing can help such systems cope with the large amounts of storage and computing resources required to use traffic strategy agents and mass transport data effectively. This paper also reviews the history of the development of traffic control and management systems within the evolving computing paradigm and shows the state of traffic control and management systems based on mobile multi agent technology [3]. Intelligent transportation clouds could provide services such as decision support and a standard development environment for traffic management strategies. With mobile agent technology, an urban-traffic management system based on Agent-Based Distributed and Adaptive Platforms for Transportation Systems (ADAPTS) [3] is both feasible and effective. However, the large-scale use of mobile agents will lead to the emergence of a complex, powerful organization layer that requires enormous computing and power resources. To deal with this problem, the proposed system also illustrates an urban-traffic management system using intelligent traffic clouds.

Keywords
Mobile Agents, Cloud Computing, Distributed.

1. INTRODUCTION
URBAN transportation plays a critical role in the continuous development of modern cities. From 2003 to 2008, automobile ownership in Bangalore has increased from 2.5 million to 3.55 million, marking a 12.2% increase annually. The amount of traffic congestion and pollution produced by such a rapid increase in a metropolitan area makes the development of an advanced public transit system necessary for its sustainable growth [6]. Agent technology was used in traffic management systems early 1992 but multi agent traffic management systems were proposed later [10]. However, all these systems focus on negotiation and collaboration between static agents for coordination and optimization. In 2004, mobile agent technology began to attract the attention of the transportation field. Characteristics of mobile agents-autonomous, mobile, and adaptive make them suitable to handling the uncertainties and inconstant states in a dynamic environment [13]. In this paper mobile agent moves through the network to reach control devices and implements appropriate strategies in either autonomous or passive modes. In this way, traffic devices only need to provide an operating platform for mobile traffic agents working in dynamic environments, without having to contain every traffic strategies. This approach saves storage and computing capacity in physical control devices, which helps reduce their update and replacement rates. Local area networks (LANs) appeared to enable resource sharing and handle the increasingly complex requirements. One such LAN, the Ethernet, was invented in 1973 and has been widely used since. During the same period, urban-traffic management systems took advantage of LAN technology to develop into a hierarchical model. Network communication enabled the layers to handle their own duties while cooperating with one another. In the following Internet era, users have been able to retrieve data from remote sites and process them locally, but this wasted a lot of precious network bandwidth. This proposed agent-based computing and mobile agents were to handle this vexing problem. Only requiring a runtime environment, mobile agents can run computations near data to improve the performance by reducing communication time and cost [12].

1.2 Agent-Based Traffic Management System
Urban Traffic Control system (UTC) based on agent technology that is able to adapt and respond to traffic conditions in real-time and still maintain its integrity and stability within the overall transportation system and in the meantime get a system that makes better use of the capacity of intersections.

UTMS using intelligent traffic clouds have overcome the issues we've described. With the support of cloud computing technologies, it will go far beyond than any other multi agent traffic management systems, addressing issues such as infinite system scalability, an appropriate agent management scheme, reducing the upfront investment and risk for users, and minimizing the total cost of ownership. Cloud computing provides on demand computing capacity to individuals and businesses in the form of heterogeneous and autonomous services [8-9]. With cloud computing, users do not need to understand the details of the infrastructure in the "clouds;" they need only know what resources they need and how to obtain appropriate services, which shields the computational complexity of providing the required services. The propose a system that autonomously can adapt to changing environments.

2. RELATED WORK
ADAPTS [3] during its runtime need to send the agent-distribution map and the relevant agents to artificial transportation systems (ATS) for experimental evaluation, which increases the cost of this operation. The load and communication volumes increase with the number of intersections [11]. If the time to complete the experimental evaluation exceeds a certain threshold, the experimental results

become meaningless and useless. As a result, the carry capacity for experimental evaluation of one PC is limited. The traffic-control agents communicate with ATS to get traffic detection data and send back lamp-control data. ACP-based framework for the control and management of complex systems AI techniques can play a critical role in this process, especially in the construction of agent-based artificial systems and in issues related to social computing, behavioral modeling and prediction, and intelligent decision-support systems [3].

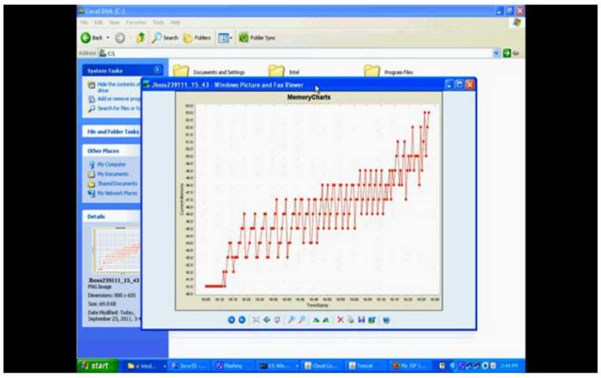

Figure 1. The time required to run ATS and Adapts experiments on one PC.

In our test, we used a 1.66-GHz PC with a 2-Gbyte memory to run both ATS and Adapts. The experiment took 3,200 seconds in real time. The number of intersections we tested increased from two to 40, and Figure 1 shows the time cost of each experiment. When the number of traffic-control agents is 40, the experiment takes 2,260 seconds. If we set the time threshold to 1200 seconds, the maximum number of intersections in one experiment is only 24. This is insufficient to handle model major urban areas such as Mumbai, where the central area within the Second Ring Road intersection contains up to 238 intersections. We would need several PCs or a high performance server to handle the experimental scale of several hundreds of intersections. To handle the different states in a traffic environment, the proposed urban-traffic management system must provide appropriate traffic strategy agents [10-13]. The proposed systems improve performance to generate, store, manage, test, optimize, and effectively use a large number of mobile agents.

Vast amounts of traffic data such as the configuration of traffic scenes, regulations, and information of different types of agents in ATS need vast amounts of storage. Similarly, numerous traffic strategy agents and relative information such as control performances about agents under different traffic scenes also consume a lot of storage resources. Finally, the decision-support system requires vast amounts of data about the state of urban transportation.

Two solutions can help fulfill these requirements:

• Equip all centers of urban-traffic management systems with a supercomputer.

• Use cloud computing technologies— such as Google's Map-Reduce, IBM's Blue Cloud, and Amazon's EC2—to construct intelligent traffic clouds to serve urban transportation.

The former both wastes social resources and risks insufficient capacity in the future. The latter takes advantage of the infinite scalability of cloud computing to dynamically satisfy the needs of several urban-traffic systems at the time. This way we can make full use of existing cheap servers and minimize the upfront investment of an entire system.

Urban-traffic management systems using intelligent traffic clouds have overcome the issues we've described. With the support of cloud computing technologies, it will go far beyond than any other multi agent traffic management systems, addressing issues such as infinite system scalability, an appropriate agent management scheme, reducing the upfront investment and risk for users, and minimizing the total cost.

Urban-traffic management systems based on cloud computing has two roles: service provider and customer. All the service providers such as the test bed of typical traffic scenes, ATS, traffic strategy database, and traffic strategy agent database are all veiled in the systems core: intelligent traffic clouds. The clouds customers such as the urban-traffic management systems and traffic participants exist outside the cloud.

Different kinds of traffic loads, costs and demand

- Intersection manager control the excess load allocation process
- Excess numbers of requests can be handled with updated cost.
- We are updating the route and provide the new route identification.
- Apply the assumption function and increases the driver agent's creation process, create the new agents prototype.
- Apply the transportation from one driver agent to another driver agent.

Urban Traffic Management System (UTMS) consist of four modules listed below.

3. MODULES OF PROPOSED SYSTEM

1. Agent-Based Traffic Management Systems
2. Intelligent traffic Module
3. Traffic-strategy agent Module
4. Intelligent Traffic Clouds Storage

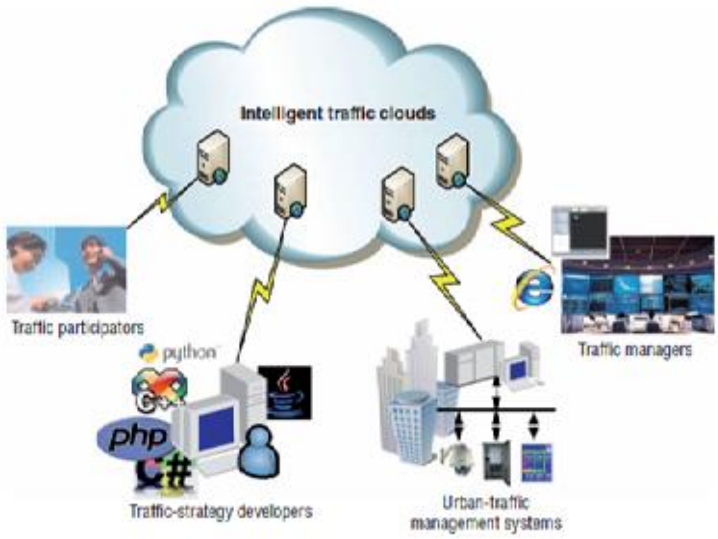

Figure 2. Overview of urban-traffic management systems based on cloud computing.

1. Agent-Based Traffic Management Systems

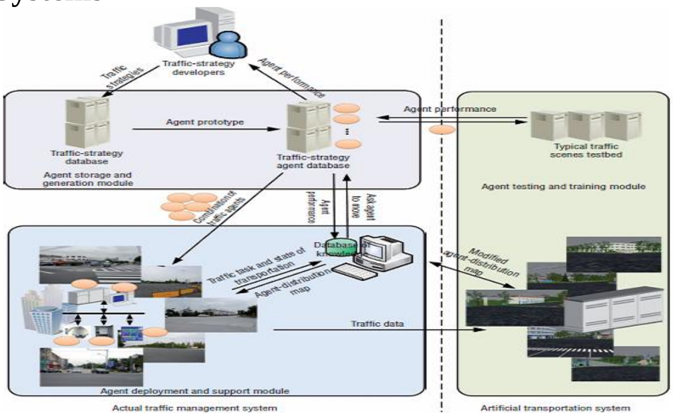

Figure 3. Shows the management agent architecture

According to the basic structure of cloud computing, [9] an intelligent traffic clouds have four architecture layers: application, platform, unified source, and fabric. The application layer contains all applications that run in the clouds. It supports applications such as agent generation, agent management, agent testing, agent optimization, agent oriented task decomposition, and traffic decision support. The clouds provide all the services to customers through a standard interface. The platform layer is made of ATS, provided platform as a service. [1],[12] This layer contains a population synthesizer, weather simulator, path planner, 3D game engine, and so on to provide services to upper traffic applications and agent development. The organization layer consists of a management agent (MA), three databases (control strategy, typical traffic scenes, and traffic strategy agent), and an artificial transportation system. As one traffic strategy has been proposed, the strategy code is saved in the traffic strategy database [1]. Then, according to the agent's prototype, the traffic strategy will be encapsulated into a traffic strategy agent that is saved in the traffic strategy agent database. Also, the traffic strategy agent will be tested by the typical traffic scenes to review its performance [2]. Typical traffic scenes, which are stored in a typical intersections database, can determine the performance of various agents. With the support of the three databases, the MA embodies the organization layer's intelligence.

2. Intelligent traffic Module

With the development of intelligent traffic clouds [12], numerous traffic management systems could connect and share the clouds' infinite capability, thus saving resources. Moreover, new traffic strategies can be transformed into mobile agents so such systems can continuously improve with the development of transportation science.

3. Traffic-strategy agent Module

The more typical traffic scenes used to test a traffic-strategy agent, the more detailed the learning about the advantages and disadvantages of different traffic strategy agents will be. In this case, the initial agent-distribution map will be more accurate [5]. To achieve this superior performance, however, testing a large amount of typical traffic scenes requires enormous computing resources. Researchers have developed many traffic strategies based on AI [6]. Some of them such as neural networks consume a lot of computing resources for training in order to achieve satisfactory performance [7]. However, if a traffic strategy trains on actuator, the actuator's limited computing power and inconstant traffic scene will damage the performance of the traffic AI agent. As a result, the whole system's performance will deteriorate. If the traffic AI agent is trained before moving it to the actuator, however, it can better serve the traffic management system.

4. Intelligent Traffic Clouds Storage

Urban-traffic management systems using intelligent traffic clouds to overcome the issues we've described so far. With the support of cloud computing technologies, it will go far beyond other multi agent traffic management systems, addressing issues such as infinite system scalability, appropriate agent management scheme, reducing the upfront investment and risk for users, and minimizing the total cost of ownership.

SNAPSHOTS

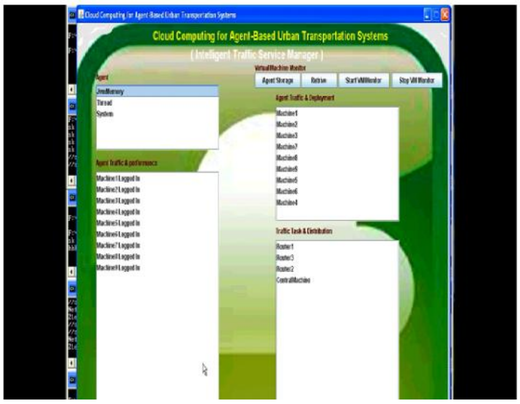

Figure 4. The Agents and virtual machine monitor.

Figure 5. Detailed Information of agents.

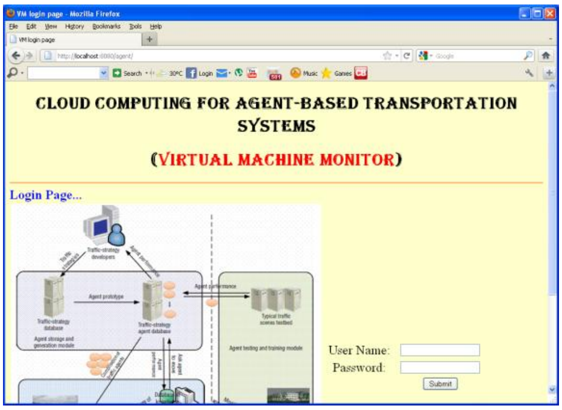

Figure 6. Administrator login.

Figure 7. Shows the agent performance testing and training

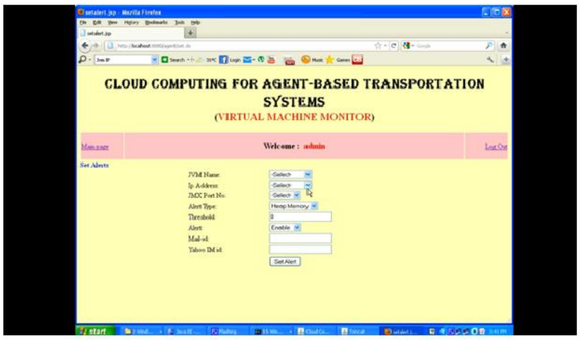

Figure 8. The Admin page.

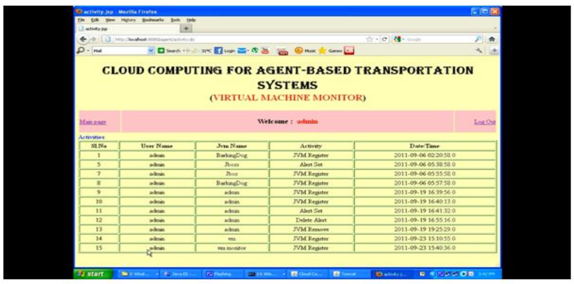

Figure 9. Traffic status.

CONCLUSION

The proposed system covers the difficulties in the existing system as discussed by making use of cloud computing and mobile agents. The proposed system seems itself to be evaluated over real time environment with its attractive result.

According to the basic structure of cloud computing, an intelligent traffic clouds have four architecture layers: application, platform, unified source, and fabric. The relationship between the layers and the function of each layer. The application layer contains all applications that run in the clouds. It supports applications such as agent generation, agent management, agent testing, agent optimization, agent oriented task decomposition, and traffic decision support. The clouds provide all the services to customers through a standard interface. The platform layer is made of ATS, provided platform as a service. This layer contains a population synthesizer, weather simulator, path planner, 3D game engine. The unified source layer governs the raw hardware level resource in the fabric layer to provide infrastructure as a service. It uses virtualization technologies such as virtual machines to hide the physical characteristics of resources from users to ensure the safety of data and equipment.

REFERENCES

[1] F.-Y. Wang, "Parallel System Methods for Management and Control of Complex Systems," *Control and Decision*, vol. 19, no. 5, 2004, pp. 485–489.

[2] F.-Y. Wang, "Toward a Revolution in Transportation Operations: AI for Complex Systems," *IEEE Intelligent Systems*, vol. 23, no. 6, 2008, pp. 8–13.

[3] F.-Y. Wang, "Parallel Control and Management for Intelligent Transportation Systems: Concepts, Architectures, and Applications," *IEEE Trans. Intelligent Transportation Systems*, vol. 11, no. 3, 2010, pp. 1–9.

[4] M.C.Choy, D.Srinivasan and R.L.Cheu, "Cooperative, Hybrid Agent Architecture for Real-Time Traffic Signal Control," *IEEE Trans. Systems, Man and Cybernetics, Part A: Systems and Humans*, vol. 33, no. 5, 2003, pp. 597–607.

[5] M.C.Choy, D.Srinivasan, and R.L.Cheu, "Neural Networks for Continuous Online Learning and 9. Neural networks, vol. 7, no. 2006, pp.1511-1531.

[6] N. Suri, K. M. Ford, and A. J. Cafias, —An Architecture for Smart Internet Agents,‖ Proc. 11th Int'l FLAIRS Conf., AAAI Press, 1998, pp. 116–120.

[7] F. Y. Wang, —Agent-Based Control for Networked Traffic Management Systems,‖ IEEE Intelligent Systems, vol. 20, no. 5, 2005, pp. 92–96.

[8] B. P. Gokulan and D. Srinivasan, —Distributed Geometric Fuzzy Multiagent Urban Traffic Signal Control,‖ IEEE Trans. Intelligent Transportation Systems, vol. 11, no. 3, 2010, pp. 714–727.

[9] F.-Y. Wang and S. Tang, —Artificial Societies for Integrated and Sustainable Development of Metropolitan Systems,‖ *IEEE Intelligent Systems*, vol. 19, no. 4, 2004, pp. 82–87. 12. I. Foster et al., —Cloud Computing and Grid Computing 360-Degree Compared,‖ *Proc. Grid Computing Environments Workshop*, IEEE Press, 2008, pp. 1–10.

[10] I. Foster et al., "Cloud Computing and Grid Computing 360-Degree Compared," *Proc. Grid Computing Environments Workshop*, IEEE Press, 2008, pp. 1–10.

[11] B. Chen and H. H. Cheng, "A Review of the Applications of Agent Technology in Traffic and Transportation Systems," *IEEE Trans. Intelligent Transportation Systems*, vol. 11, no. 2, 2010, pp. 485–497.

[12] D.D.D.Suri Babu1, M.Chinna Rao2 and K.Ravi Kumar3 "AGENT-BASED URBAN TRANSPORTATION SYSTEMS USING CLOUDS" *IJART, Vol.3 Issue 1, August 2012, 35- 42.*

[13] ZhenJiang Li and cheng chen, kai wang "cloud computing for agent based urban transport systems" IEEE journals on Intelligent Transportation systems 2011.