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ABSTRACT

Intelligent transportation relies on the Internet of Things (IoT), real-time cloud technologies, and machine learning algorithms to manage traffic flow. Intelligent transportation systems (ITS) require latency guarantees and data analytics solutions capable of ingesting and analyzing data in real-time to produce timely signals that are suitable for the prevailing traffic conditions. As data analytics engines migrate to virtualized environments, there is a need to preserve real-time performance on these virtualized platforms. In this research, we introduce a model of an ITS that predicts future traffic conditions from streaming data. This ITS is used as real-time workload in a virtualized environment to empirically compare latency guarantees using the Xen hypervisor. Experimental results show that the RTDS scheduler minimizes the latency of the streaming application while maintaining real-time performance.

KEYWORDS

RT-Xen, realtime systems, machine learning, LSTM

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1 INTRODUCTION

ITSs are perhaps the most anticipated smarty city services and have already seen widespread adoption. The Sydney Coordinated Adaptive Traffic System (SCATS) is a fully adaptive urban traffic control system that optimizes traffic flow and currently operates in more than 37,000 intersections worldwide (Citation). Optimizing traffic flow conditions not only shortens travel times, but also can also reduce the carbon emissions generated from road vehicle activity (Chong-White C., Millar M., Johnson F. and Shaw S. (2011). The evolution of the SCATS and the environment study, Papers of the 34th Australasian transport research forum, Adelaide, Australia.). Although there has been much research into the development of ITSs, most approaches relied on mathematical equations and simulations. However, such approaches do not encapsulate real world conditions such as weather, traffic accidents, and external events like sports games (2-5 from here https://arxiv.org/ftp/arxiv/papers/1803/1803.02099.pdf). With the advent of IoT, wireless sensor networks (WANs) and wireless sensor actuator networks (WSANs) are being deployed to collect large-scale data of the physical world (Citation). Sensors can collect data from cameras, inductor loops, GPS coordinates, etc. all in real-time. These sensor networks record huge amounts data and then transmit this data to the cloud. Large-scale analytics tools can then turn sensor data into decisions to optimize the operations of a city.

2 BACKGROUND

2.1 Traffic Flow Prediction

2.2 Xen

2.3 RT-Xen

3 DEEP LEARNING FOR TRAFFIC FLOW PREDICTION

3.1 Dataset

3.2 LSTM

3.2.1 Training.

4 EXPERIMENTAL SETUP

5 EVALUATION

6 FUTURE WORK

7 CONCLUSION

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