Real-Time QoS-Aware Vehicle Tracking: An Experimental and Comparative Study

Dr. Basem Almadani, Abdullah Al Mamun, Ahmad Khayyat
Department of Computer Engineering
King Fahd University of Petroleum and Minerals
Dammam, Saudi Arabia.

Introduction

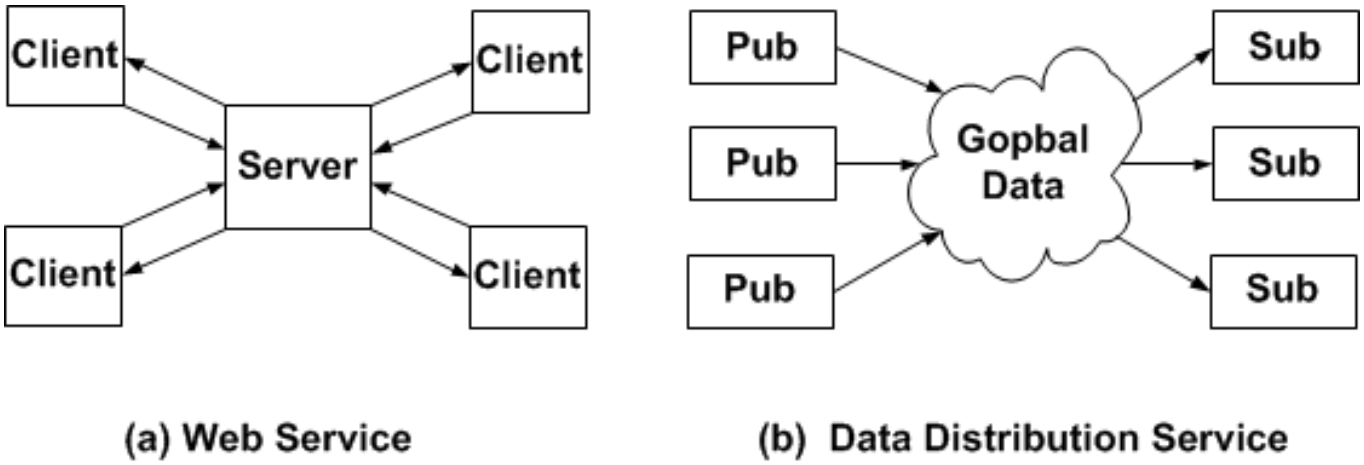
Socket IO

Socket IO is nothing but a javascript library that runs on a node js server, it has two parts: a client-side library that runs in a browser, others library runs on server. Both components have a nearly identical API. Usually node.js is an event-driven server scripting. Socket IO primarily uses the Web Socket protocol and it will automatically select the best suited real-time communication protocol at run-time per client.

Data Distribution Service (DDS)

It is a set of stipulations standardized by the OMG. The DDS middleware is a known standard with fixed data-structures and attributes quantified by meta-information called topics [6].

Architectural View



(a) Web Service

(b) Data Distribution Service

Supporting DDS QoS Polices

- **Deadline**

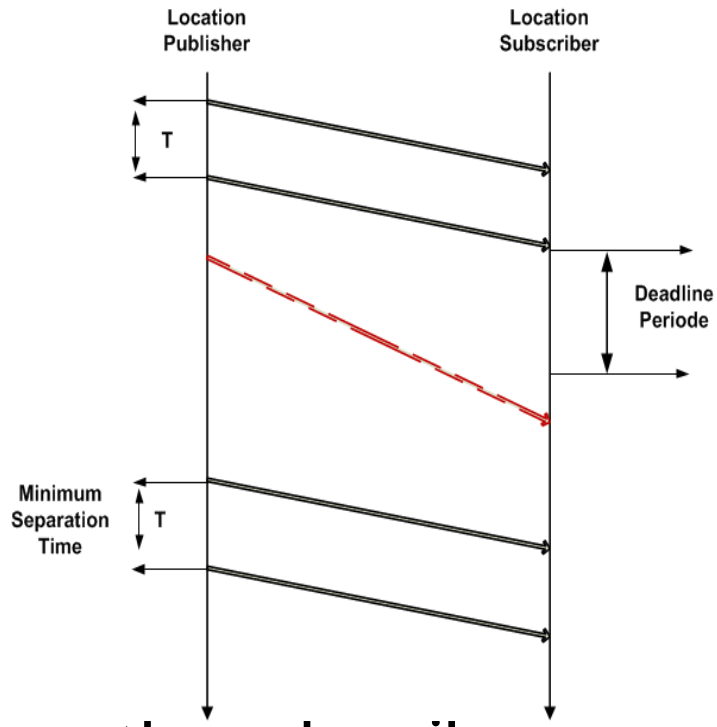
  Network congestion occurs when a link or node is overloaded and as a consequence, it results in packet loss, increased delays and blocking of connections at a time. A lot of research has been done for mitigating network congestion. In the middleware layer, a deadline QoS policy can be used for congestion detection and control, as illustrated in fig1(c) where red arrows shows the amount of time taken by sender to send a packet which is reached at destination after deadline.

- **Time-based Filter**

  The minimum separation time is the time gap between two successive packets that are going to be receive by the subscriber. This QoS policy used in tracking applications is to reduce application load (receiving rate) at the subscriber.

Time-based Filter

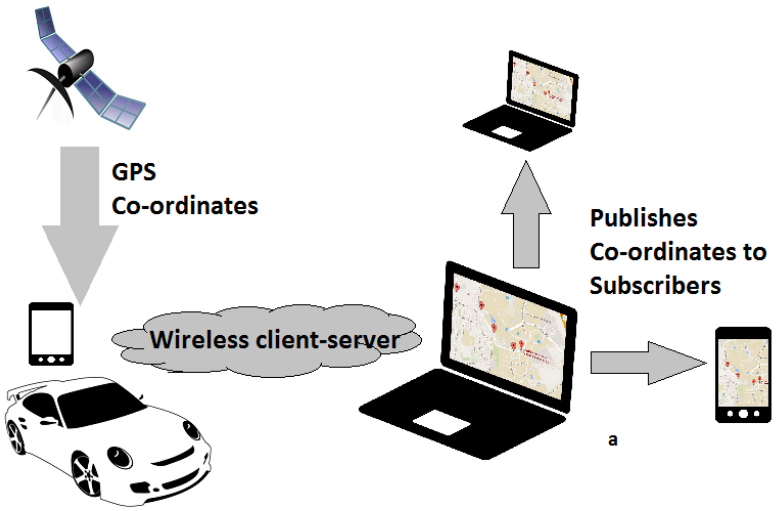
T is indicating the minimum separation time. Note that the time-based filter value must be less than the value of deadline because the deadline is the maximum wait time for data update on the subscriber.

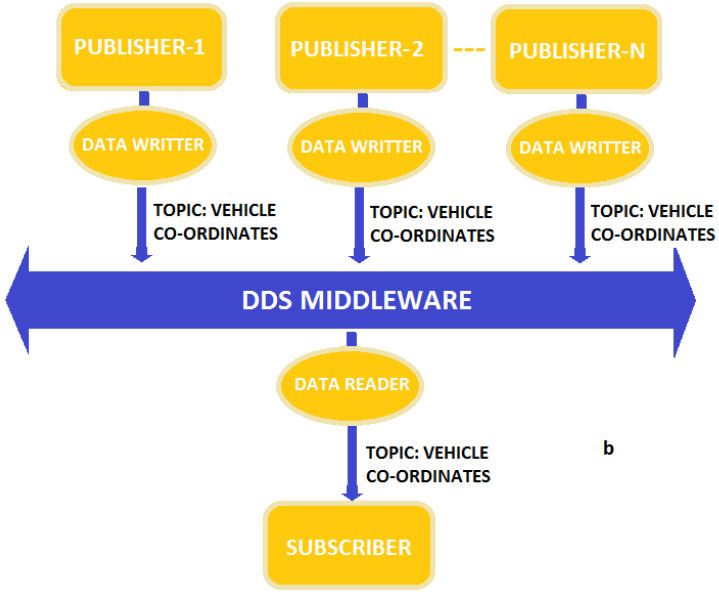


Experimental Work - Tools

- Soket IO (MIT licensed)
- Nodejs server
- Google Map
- Android SDK
- Smart Phone
- RTI connext
- Wire Shark

Experimental Work - Setup

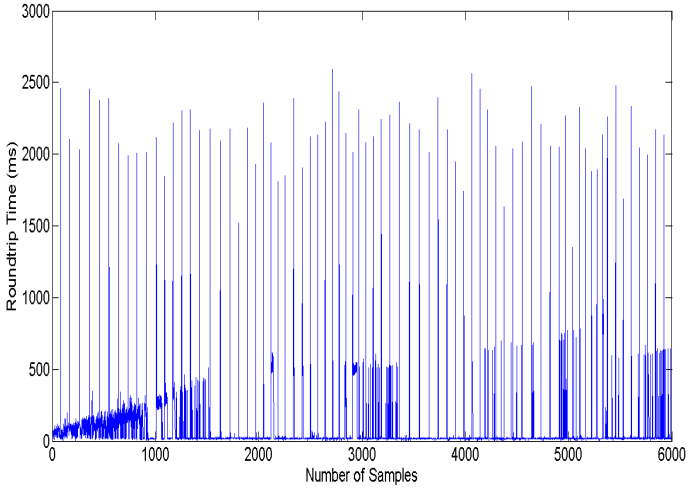


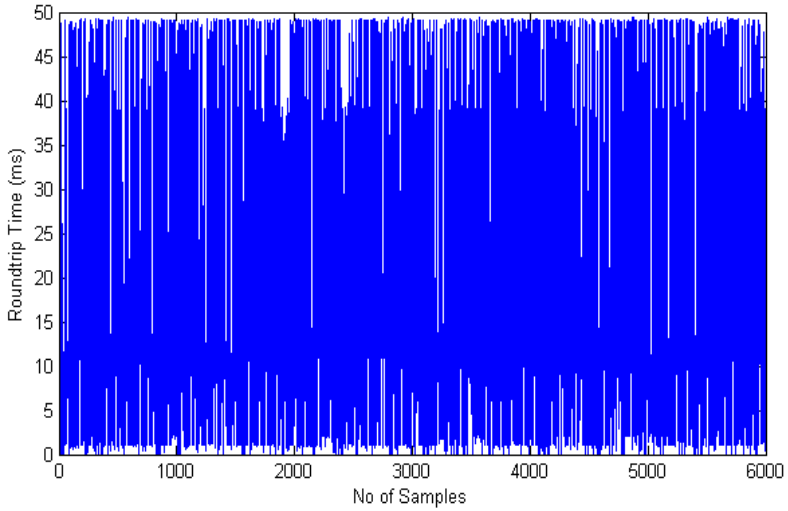


Result - RTT Comparison

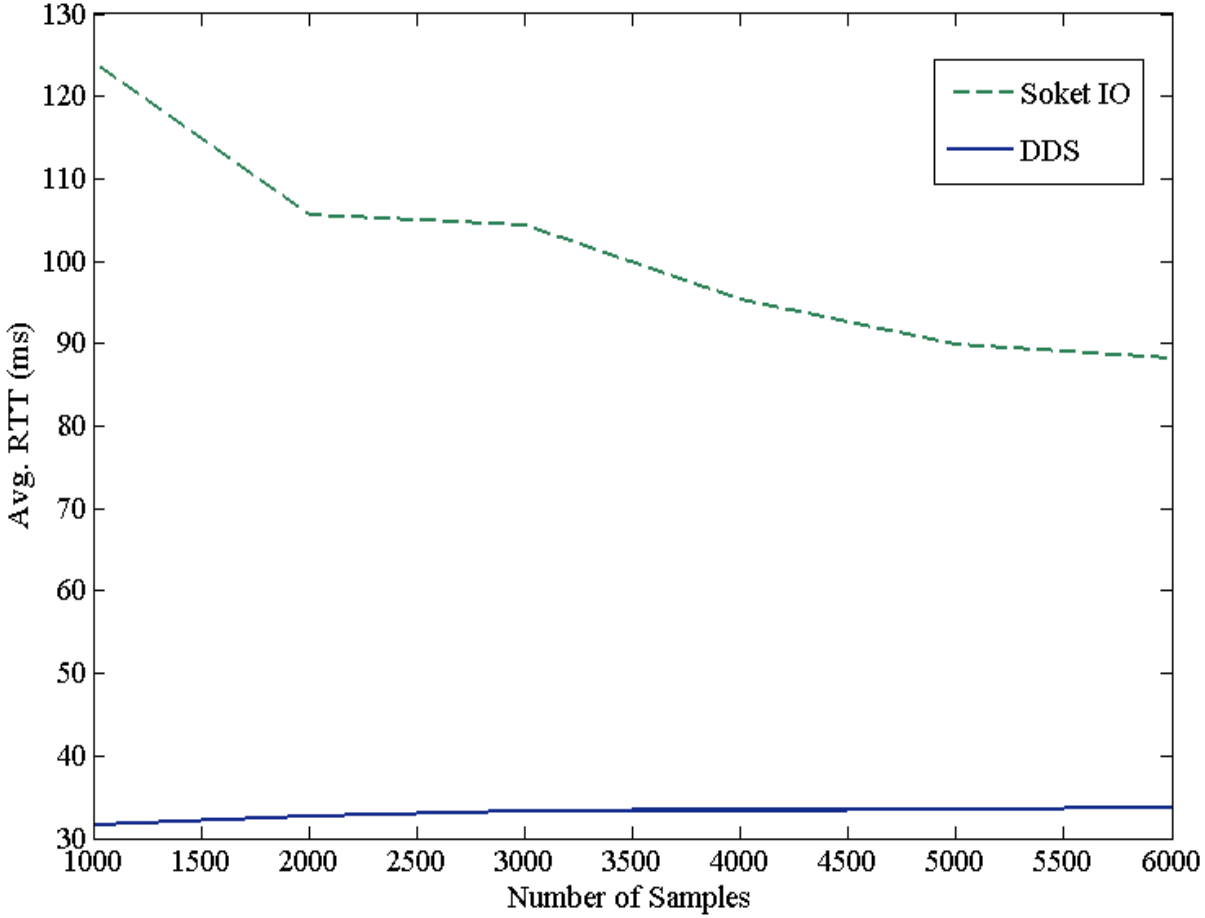
Type	No. of sample	Avg. RTT (ms)	STD. (ms)	Min RTT (ms)	Max. RTT (ms)
	1000	124.12	220.02	6	2458
	2000	105.61	234.91	6	2458
Socket-IO	3000	104.41	255.31	6	2590
	4000	95.36	255.82	5	2590
	5000	89.89	258.25	5	2590
	6000	88.28	262.22	5	2590
	1000	31.61	14.23	0.03	49.35
	2000	32.64	14.40	0.03	49.35
DDS	3000	33.33	14.62	0.03	49.35
	4000	33.40	14.59	0.03	49.35
	5000	33.54	14.62	0.03	49.35
	6000	33.75	14.65	0.03	49.35

Result – RTT.

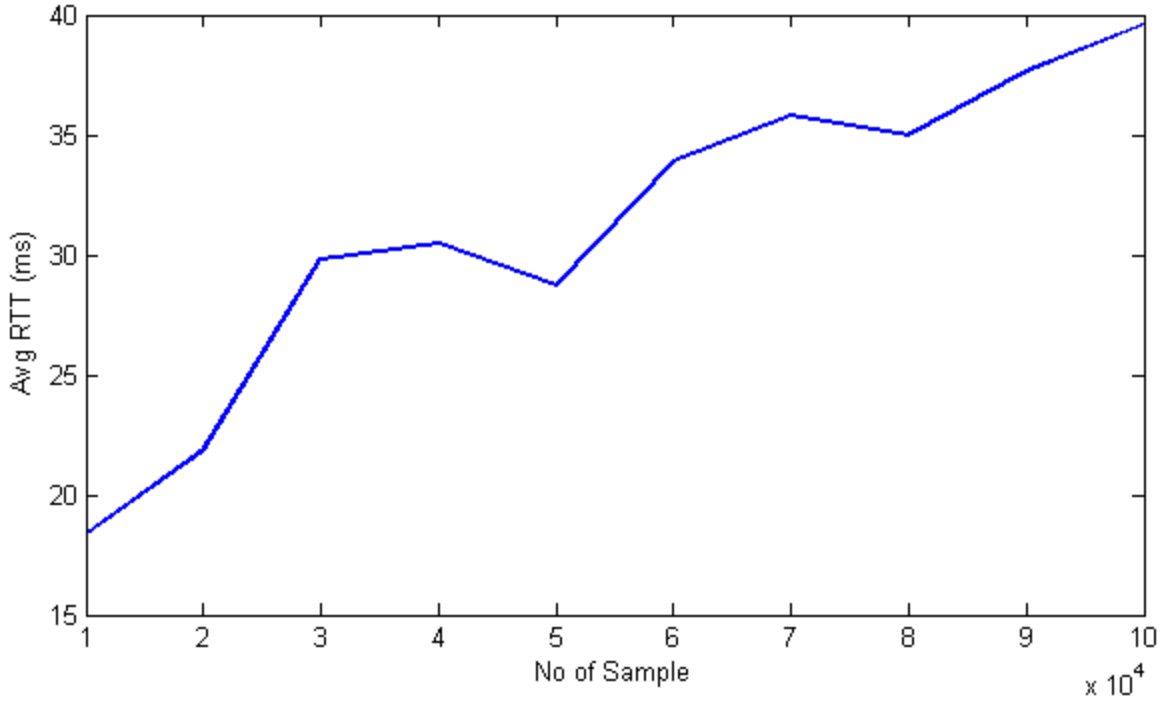

Roundtrip Time (ms)
Number of Samples
0
500
1000
1500
2000
2500
3000
0
1000
2000
3000
4000
5000
6000


Roundtrip Time (ms)
No of Samples
0
5
10
15
20
25
30
35
40
45
50
0
1000
2000
3000
4000
5000
6000

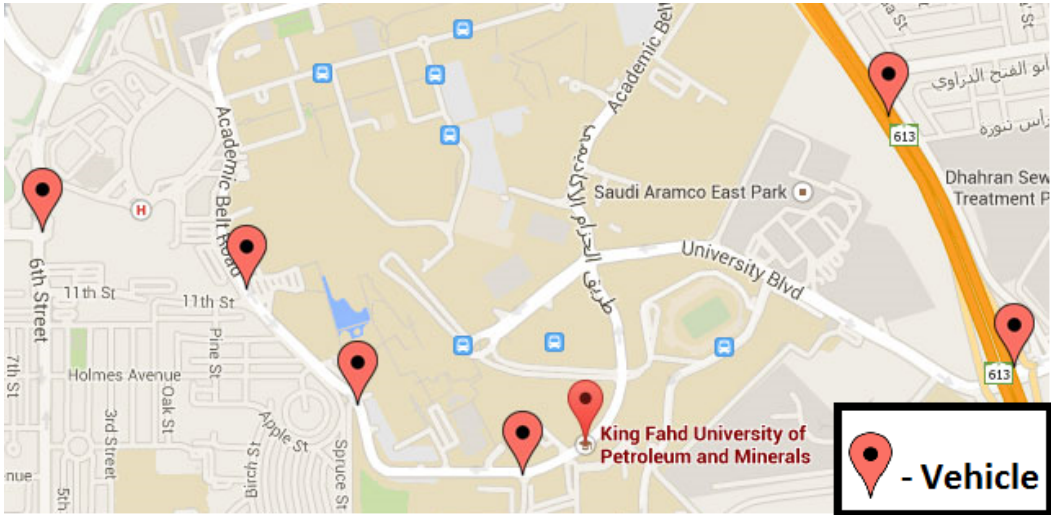
Result - RTT Comparison graph



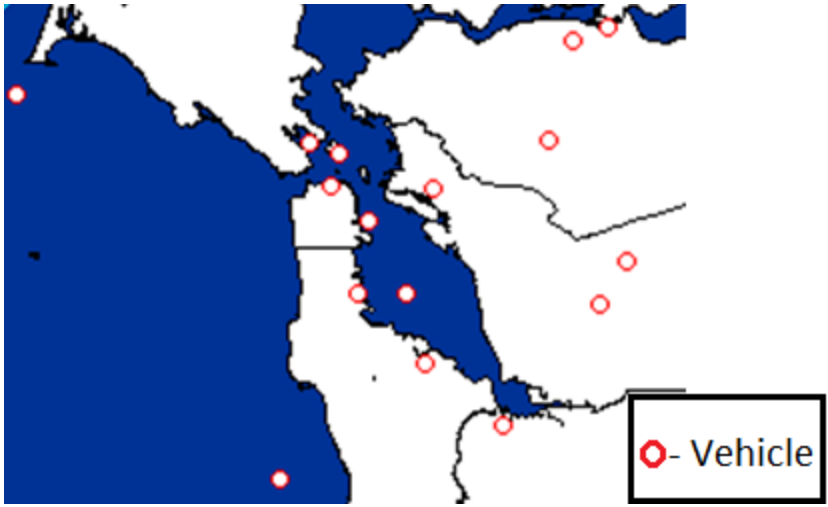
Result – DDS TBF QoS



Visual Output



Socket IO with google map



DDS map

Related Works

- A DDS based middleware called Scalable Data Distribution Layer (SDDL) [19] presents the OMG DDS standard based communication service middleware that supports unicast, groupcast and broadcast and live tracks with more than thousand cellular nodes.
- David, L. et al. [20] presented same things in large scale integration for thousand of nodes. They also used SDDL for developing an application for mobile device to support vehicle inspection by traffic police.
- Traffic surveillance [21] describes the problems related to tracking based on feature which is basically a real time system that is nothing but a prototype, and shown system performance using large data.
- For large-scale mobile system, a middleware called Scalable context-Aware Middleware for mobile environments (SALES) [22] is developed.
- Two main terminologies used are: Quality of Context (QoC) and Context Data Distribution Level Agreement (CDDLA) in this paper. QoC is associated with context information distributive service whereas CDDLA is a quality agreement between consumer and producer imposed by the middleware. The architecture 23 middleware supports mobile nodes and provides reliable data delivery.
- The mobile nodes in this middleware execute light version of the DDS whereas the fixed nodes execute the full version of the DDS. In case of Industrial scenarios [24] proposes a real time Automatic Vehicle Location (AVL).

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Thank You

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