

## DAGSI Research Topic

1. **Research Title:** Development of Publish-Subscribe Architecture for High Throughput Fiber Networks

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**

Electrical Engineering, Computer Engineering, Computer Science, or related field  
 BA/BS, MS or PhD level acceptable; MS or PhD level preferred depending on level of experimentation proposed.

4. **Objectives:** Develop a publish/subscribe architecture and middleware implementation that supports high throughput of fiber networks (100GB/s and higher). The goals include:

- a. **Cybersecurity focused** – authentication built in, possible encryption support, corrupt data elimination, etc.
- b. **Maximizes Throughput** – architecture must maximize throughput of high speed links
- c. **Low latency and Real-time** – little overhead from processing is desired and reduction in jitter with deterministic worst case timing known
- d. **Standardized/Open Implementation** – the architecture and implementation should be based on standards or should be able to be standardized with a focus on open and usable to the community without royalties or restrictions.
- e. **Flexible Network Layout** – the architecture supports centralized and federated layouts
- f. **Separation of Transport from Encoding** – the middleware supports the separation of transport API from encoding while still allowing advanced techniques such as filtering

5. **Description:** Current publish/subscribe technologies (such as DDS) focus on standard network technology (such as 1 GB Ethernet). This allows diverse transport capabilities, but does not always translate easily to high speed networks (>100GB/s) where packet size can limit throughput. This can be examined in Figure 1, where small packets limit the throughput of the network until 8192 bytes, where the throughput reaches about the maximum for a 100 GB/s link. This also must be balanced against the rate at which messages can be sent to achieve low latency. As shown in Figure 2, the message rate decreases as the message size increases.

It is desirable to have a publish/subscribe architecture, like DDS, but that is designed to take advantage of these qualities (or limit the disadvantages). In addition the architecture/middleware should have the following: 1) cybersecurity focused; 2) maximizes throughput; 3) low latency and real-time (deterministic); 4) standardized implementation and open architecture; 7) flexible network layout; 8) separation of transport from encoding. While

all of these qualities are desirable, it is recognized that there will be trade-offs between each one. With this in mind they are ordered from high priority to low priority. The overall goal is to define and implement the next-generation publish/subscribe architecture for high speed networks.

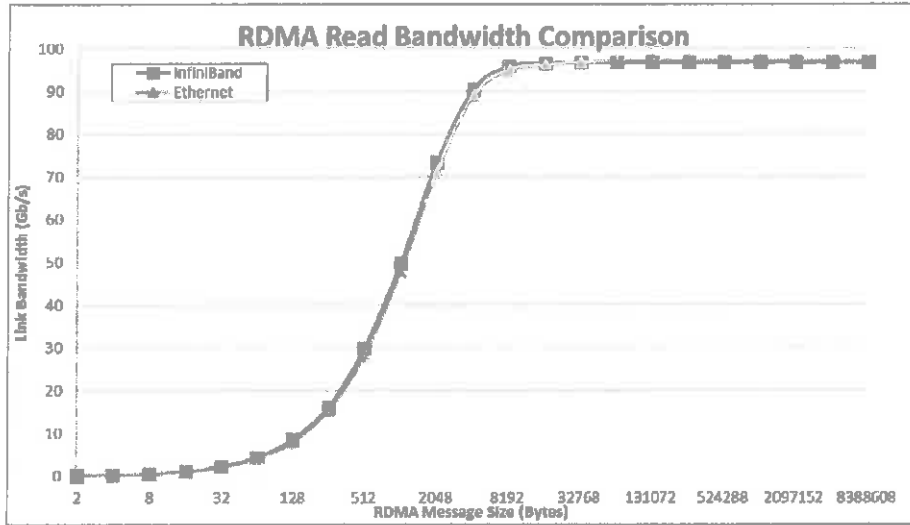


Figure 1: Message Size vs. Throughput

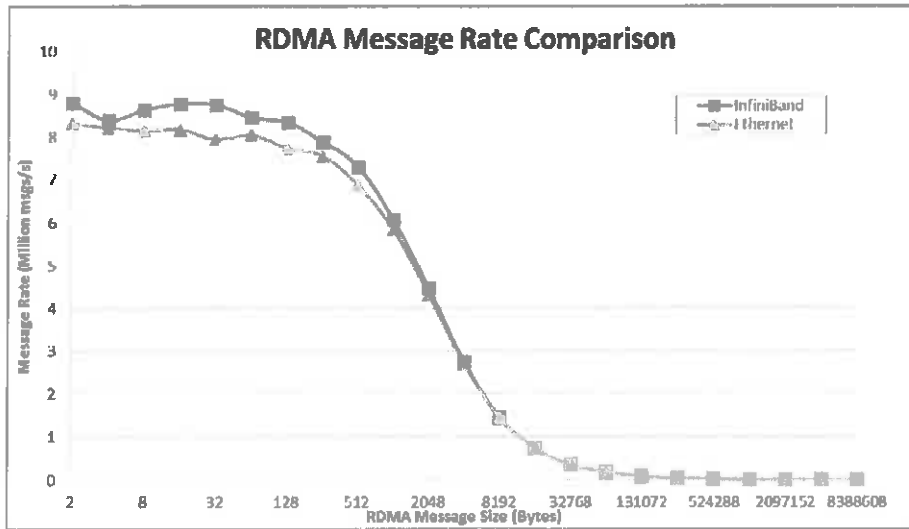


Figure 2: Message Size vs. Message Rate

6. **Research Classification/Restrictions:** Basic Fundamental research, no restrictions expected.
7. **Eligible Research Institutions:** Any organization with a suitable research background.