

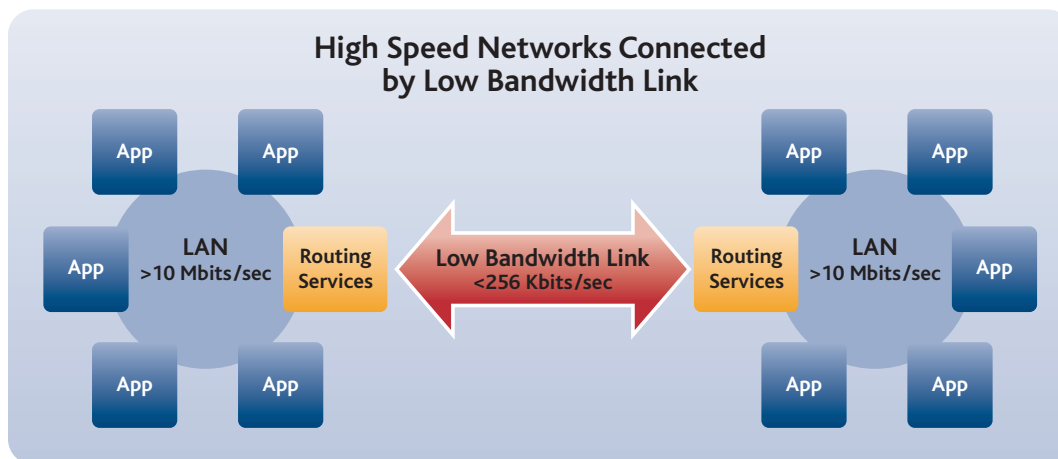
# Design Pattern: Low Bandwidth Links

## TYPICAL APPLICATIONS

Mobile Radio Links  
Line-Of-Sight Radio Links  
Satellite Links

### Overview

Distributed applications often combine fast local communication with remote communication over low-bandwidth, high-latency, or intermittent network links. This application note addresses design considerations for Disconnected, Intermittent, Limited (DIL) links.



A typical architecture for connecting distributed applications through a low bandwidth link uses a specialized bridging component across the link. RTI offers a solution called RTI Routing Service with these capabilities.

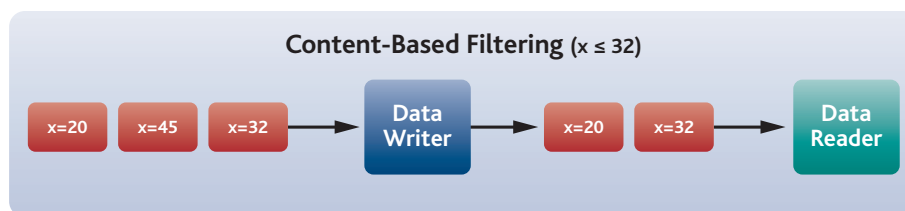
### Design Considerations

#### Minimize Data Volume

When building a system that must use low bandwidth links, the primary requirement is to minimize the amount of data. The use of data compression algorithms can reduce the size of data during transport, but compression and decompression will add latency.

Filtering of data by content can be an effective way to reduce data flow, because DDS only carries data that pass the filter over the low bandwidth link.

DDS provides a per-sample data filtering capability using SQL-like syntax while maintaining real-time performance. These filters are specified by each receiving application, but typically the filtering is performed on the sending side.



### Minimize Frequency

A publisher may be producing samples at a greater rate than a subscriber on the far side of the DIL link requires them. However, this distinction between “local” and “remote” subscribers need not be managed by the application: filtering in DDS and RTI Routing Service may be specified not just by content, but also in time. As with content filtering, the data are typically filtered before traversing the link.

### Minimize Overhead and Redundancy

When each datum is very small in size (up to several hundred bytes), it is not very efficient to send each one individually. Each datum incurs the overhead of a full set of network headers (typically Ethernet, IP, UDP, and RTPS). Combining data with one set of headers enables higher throughput by reducing overhead. DDS enables you to use this batching technique as easily as flipping a switch.

DDS covers the spectrum of reliability from best-effort communications to strictly reliable communications. For low bandwidth links, this

implies fine-grain control of the acknowledgment overhead for reliable data transfers for each type of exchange (per-Topic).

Scaling of data can be achieved by transforming the data model from a large data type to only include the fields of interest, thereby reducing the amount of data. An undifferentiated, message-centric approach does permit the use of data compression, but a datacentric approach affords unique opportunities to avoid redundant data transmission in the first place.

If a publication exhibits spikes of activity, it may temporarily “crowd out” other competing uses for the DIL link. It can be helpful to smooth these peaks by stretching out the actual data transmission over a longer period of time. With DDS, this is a matter of configuration. A highly configurable flow controller model will help you to ensure that the DIL link is not completely saturated during spikes without any additional burden for the publishing application.

Also, with configurable watchdog-like functionality (“Liveliness”), you may publish data on change with confidence, saving bandwidth that might be consumed by redundant periodic samples. Even intermittency in the link is handled automatically (“Reliability” and “Durability”), so that updates missed while the DIL link is down are automatically propagated when the connection is reestablished.

