

# eLAN™ Technology White Paper

Improving DNP Polling performance  
in a networked environment





## Introduction

Although RTU response latency is rarely a significant issue in the serial world, it is a substantial factor in a networked environment. It has been found to be a key factor in determining how many devices could go on a LAN or WAN based on the desired update rates. The issue is not the volume of data but device latencies. This paper identifies the issue, and shows how Bow Network's eLAN technology may be used to eliminate the problem.

## RTU poll performance

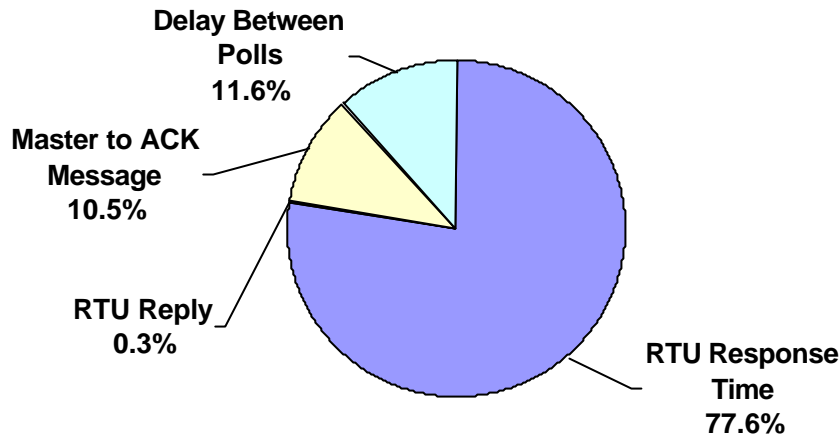
Lab testing of one widely deployed RTU brand with direct ethernet connection, has found that an unloaded RTU had a 50 to 100 millisecond delay before it responded to a request for data. Testing of a loaded RTU demonstrated delays ranging from 100 to 500 milliseconds depending on how busy the RTU was (in rare cases even 1 sec if the RTU was very busy and a large amount of data had to be reported). Averages are presented in the table below:

	ethernet		% of transaction		Serial
	Test mSec	Field mSec	test	Field	in mSec
RTU Rx delay	133	54	77.6	62.6	349
Rx Length	1	1	0.3	1.2	140
Rx to ACK delay	18	11	10.5	12.9	19
Total transaction time	172	86	11.6	23.4	507
- 20 mSec delay assumed from ACK to complete next Tx					

With a sequential poll scheme, the EMS could only poll 6 - 10 RTUs per second. Rather disappointing performance for a 10 MHz network!

In this test, the LAN loading was measured to be only 0.3%. The following graph indicates the allocation of time during the poll cycle.

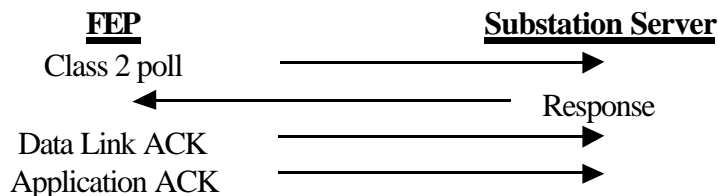
## Ethernet Bandwidth Utilization Breakdown Test Data



### eLAN poll performance

Poll latency can be dramatically improved by deployment of an eLAN Substation Server or FEP. The processing power of eLAN results in sub millisecond poll-response times.

During a recent Factory Acceptance Test, an eLAN FEP was connected to an eLAN Substation Server. Both CPUs were 600MHz Pentium IIIs. The FEP was polling the Substation Server, with both data link and application acknowledgements enabled. A DNP poll transaction therefore was:



The poll transaction rate was measured to be between 1200 and 1500 transactions per second, depending on system loading. This equates to a poll transaction time of 667  $\mu$ S to 833  $\mu$ S.

### Poll Acceleration with eLAN

An eLAN Substation Server or FEP may be used to alleviate the RTU latency problem at the EMS. The eLAN system is configured to poll the RTU(s) for data. eLAN maintains a virtual image of each RTU's database. Using the earlier measured values as a guide, the RTU image in the eLAN database should be current, within the RTU latency time (say 150 mS typ.). Furthermore, a separate scan task may be created for each RTU (except in a multi-drop serial configuration), resulting in all RTUs being polled in parallel. Therefore, the entire set of RTU data is accurate at eLAN, within a single RTU poll-response time.

The *e*LAN device directly responds to polls from its master, based on the data in this virtual RTU image. As previously shown, this response will occur in less than one millisecond. If the data map is unchanged (ie each "real" RTU is exactly mirrored by the virtual RTU polled by the master), the master should be able to round-robin poll all RTUs in under 1 mS each.

A side benefit of this increased poll performance is that there is no longer a need to concentrate multiple real RTUs into a single virtual RTU for more efficient polling by the master. Point maps are kept consistent from the RTU up to the EMS, without transposition or mapping.