

Creating Power Acquisition Network (PAQ Net) with LabVIEW

by Petr Bilik, Senior Lecturer,
Jan Zidek, Associate Professor,
Daniel Kaminsky, Associate Professor,
Jiri Hula, Software Developer,
Marek Malohlava, Software Developer,
Jan Sima, Senior Lecturer,
VSB TU Ostrava, Department of Electrical
Measurements/ELCOM, a.s. Division of
Virtual Instrumentation, PC-based
instruments group

The Challenge: Developing an independent network of power quality analyzers and a network server configuration tool that can provide data to other interfaces and store to a PQDIF database.

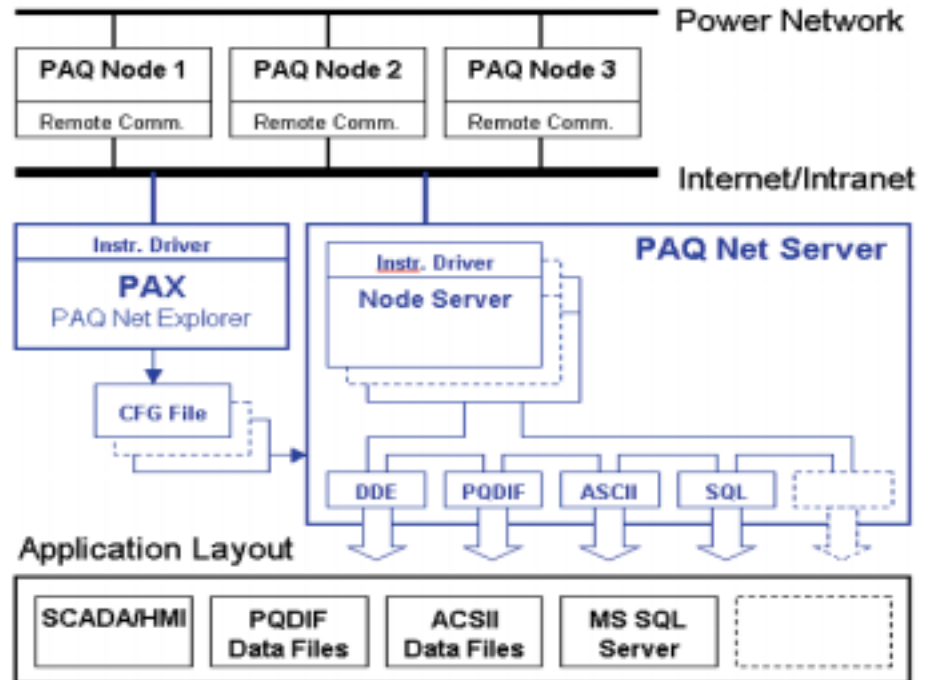
The Solution: Creating the PAQ Net Explorer (PAX) software application using NI LabVIEW for configuration of measurement nodes (PAQ Nodes) via instrument driver of selected analyzer.

Introduction

Power distribution companies receive many requests to monitor power quality in many different distribution points. They use varied instruments from different vendors. To keep all measured parameters in one place independent of the instrument type or topology of communication network, we developed the Power Acquisition Network (PAQ Net).

PAQ Net

We based the PAQ Net on independent power quality analyzers that we call PAQ Nodes. Users can connect to these nodes from anywhere in the world through connection to the Internet or an intranet. To add power analyzers from any vendor to PAQ Net, the instrument must have an instrument driver and an Ethernet or modem connection to the Internet. Users can add any power analyzer that meets these conditions to the PAQ Net with the PAQ Net Explorer (PAX). Each node's PAQ Net server provides measured parameters in many ways: DDE for SCADA/HMI, PQDIF for saving data to PQDIF data files or database, ASCII for



PAQ Net

saving data to ASCII files, and SQL for saving data to MS SQL Server.

PAQ Net Server provides data in many formats and is open to other data interfaces, such as OPC. For every PAQ Node in the system, the Node Server runs in parallel, even when other connected nodes take measurements. PAQ Net Server retrieves information about aliases, IP addresses, and other properties of properly configured PAQ Nodes from configuration files, which the

Using National Instruments RT Series DAQ and PXI devices compatible with the LabVIEW graphical development environment enables us to run the PAQ Node ELCOM on independent hardware using a real-time operating system.

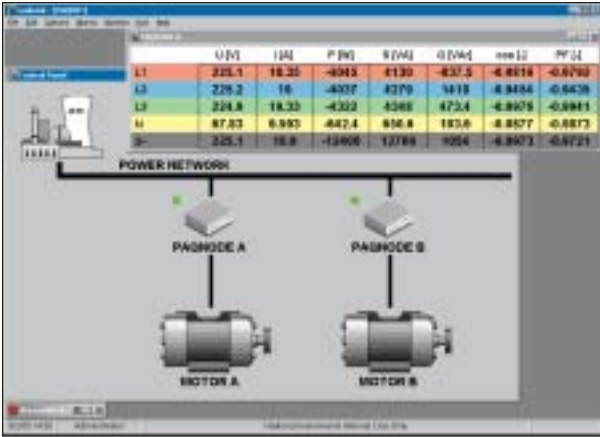
PAX generates. This network can integrate with other types of instruments and measurement units to measure physical quantities and display them at one central point.

PAX – PAQ Net Explorer

Users can configure the PAQ Nodes with PAX, which helps them select proper alias of the node, IP address, averaging interval, connection scheme, and ranges. PAX uses an instrument driver to communicate with a specific node. Users can insert new nodes or change the configuration of existing nodes with a simple step-by-step wizard.

As a first step to add a new node, the user specifies the type of the node (to use the proper driver) and alias of the node (to identify node on the server side). For the next step, the user defines the IP address of the node and averaging interval. Next, the user must configure instrument connection and ranges.

After inserting or changing of any nodes, the PAQ Net Server restarts with new configurations. A green checkmark or a red cross in the PAX list of nodes indicates the connection status of the node. The PAQ Net



Lookout application using PAQ Net

Server delivers this information to PAX. The right side of the panel lists the preset parameters of the selected node.

Using PAQ Net DDE Server in Lookout

PAQ Net Server can interface data using Dynamic Data Exchange (DDE). Since DDE is a common data exchange standard, the PAQ Net can provide data to many environments, applications, and programming languages supporting DDE.

The Lookout application is a testing application from the electrical drives laboratory. The application visualized the measured values in Lookout and stored them as ASCII data files, all driven by PAQ Net. We used two Elcom PQA01 analyzers as the PAQ Nodes.

PAQ Node Elcom PQA01

PAQ Node Elcom PQA01 is a scalable, remotely controlled display-less PC-based power analyzer. PAQ node ELCOM PQA01 is an instrument for stand-alone use, but its concept designates it as a base software

element for user-defined power analyzer or distributed system. Remote commands make all set-ups and data readouts possible. The VISA PnP drivers written in LabWindows/CVI and LabVIEW correspond with the PQA01. The PC platform inherently provides important interfaces for remote control of the instrument by Ethernet or modem connection. Five instruments – an FFT analyzer, a power flow monitor, an EN50160 voltage monitor, a transient recorder, and

a symmetrical components analyzer of a three-phase system – can capture data and perform processing in parallel. Instead of storing data as files on local hard disk, the system uses the concept of circular data acquisition (DAQ) process. The system presets an averaging interval for all analyzed values before the start of the measurement. At the end of each averaging interval, measured values write to the circular buffer. The user can select the buffer length. Through the remote commands, users can read required scans from buffer and scan backlog value. With data buffering, the system can handle interruptions in connection with the supervising system.

Hardware Platforms for the PAQ Node ELCOM PQA01

We implemented the analyzer on the PXI hardware platform. The PXI chassis includes an NI PXI-8175 controller and an NI PXI-6052E 16-bit DAQ module. The NI SCXI-1120D module, equipped with anti-aliasing filters, provides signal conditioning.

To extend input range of the SCXI module, we used the TBX-1316 high-voltage terminal block. This configuration delivers connection of up to a 1000 VDC/680V_{rms} maximum working voltage. The DAQ process of instrument software uses sampling frequency 9,6 kS/s per channel. Generally, users can implement the developed application on other platforms, based on a PC, DAQ board, and a signal conditioning board.

Future Vision

In the future, we hope to further extend the set of available instruments for use with the PAQ Net system. We also plan to focus our R&D effort on innovation of the distributed system for monitoring of electrical quality and power parameters based on the described PQA01 analyzer. Our R&D team is developing tools for using Microsoft Internet Explorer as the only tool for full remote setup of distributed PQA01 analyzers.

Using National Instruments RT Series DAQ and PXI devices compatible with the LabVIEW graphical development environment enables us to run the PAQ Node ELCOM on independent hardware using a real-time operating system. Only the supervising system would run on a standard PC, fully utilizing of the graphical Windows OS features. ■

*For more information, contact
Petr Bilk, VSB TU Ostrava/ELCOM, a.s.,
Division of Virtual Instrumentation,
Technologická 371/1, 708 00
Ostrava-Pustkovec, Czech Republic,
Tel: +420 69 699 6930,
E-Mail: petr.bilk@elcom.cz*



ni.com/success

(512) 683-0100 • Fax (512) 683-9300 • info@ni.com

For worldwide contact information, please visit ni.com/niglobal