RANGE INSTRUMENTATION AND CONTROL SYSTEM (RICS)

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ABSTRACT

The Range Instrumentation and Control System (RICS) is a PC-based multi-platform data acquisition and display system utilizing CORBA and Multicast UDP in a client/server architecture. Its main purpose is to collect time-space position information (TSPI) from one or more remote radar sites and distribute it in real-time across a wide area network (WAN). This paper describes the collection of MS Windows-based software applications that are designed to control and monitor data acquisition in real-time from a remote console.

KEYWORDS

C++, CORBA, Multicast-UDP, VxWorks, MS Windows

INTRODUCTION

RICS is collaborative effort between the 46th Test Wing and the 96th Communications Group to replace the aging radar data acquisition systems on Eglin's Test Range with a twenty-first century solution. A number of the systems have been in place for over 30 years and the antiquated technology poses limits on expandability, data rates, throughput, and repairs (many components are no longer commercially available). The goal of the project is to provide a scalable distributed data acquisition and collection system that builds upon commercially available components, follows industry standards, and utilizes the latest software and hardware technologies.

SYSTEM DESCRIPTION

RICS is composed of three main parts: a data acquisition computer to collect radar data, a console computer for remote control and display, and a network for communication and data distribution. Communication between any two computers on the network is platform independent, using CORBA

(ref [1]) and multicast-UDP (ref [2]), thereby avoiding dependence on any specific hardware, operating system, or computer language. The initial phase of the project includes development of three new test sites with three or more console computers each and a mobile data acquisition PC for each site.

Data acquisition is accomplished from the Data Interface Adaptor (DIA). The DIA is a PC-based computer that interfaces directly to the radar. The main functions of the DIA are data acquisition, distribution, recording, playback, slew tests, and radar slaving. The implementation of the DIA at the three initial RICS sites is a rack mount system with a PCI-backplane (ref [3]), single-board computer, and a collection of interface cards for input and output, all housed in a mobile climate-controlled trailer. The DIA's software is written in standard C++ and runs on a real-time operating system, VxWorks by WindRiver Systems (ref [4]).

The RICS Console Computer is the command and control component of the system providing a remote graphical interface to one or more radar systems. The console provides a windows-based operating system to launch several GUI-based utilities for DIA control and data monitoring. The initial implementation of the RICS Console is with the Microsoft Windows operating system. The RICS system design allows console computers to be developed under other operating systems (i.e. LINUX, Mac, etc.) and participate in the RICS system by communicating with other computers via platform-independent protocols. The remainder of this paper will focus on the software applications developed by the Test and Analysis Division of the 96th Communications Group for the RICS Console Computer for the first phase of the RICS project.

DIA ADMINISTRATOR

The DiaAdministrator application (Figure 1) provides the user with the capability to detect, configure, monitor, and control one or more remote DIAs. The application listens for DIA heartbeats on a multicast-UDP channel and displays a list of available DIAs on the network. If the user chooses to monitor a DIA, the DiaAdministrator will open a two-way CORBA connection with the selected DIA. Status information will be updated on the application display showing the state of the DIA. To control a DIA, the user must lock the DIA to prevent others from manipulating it.

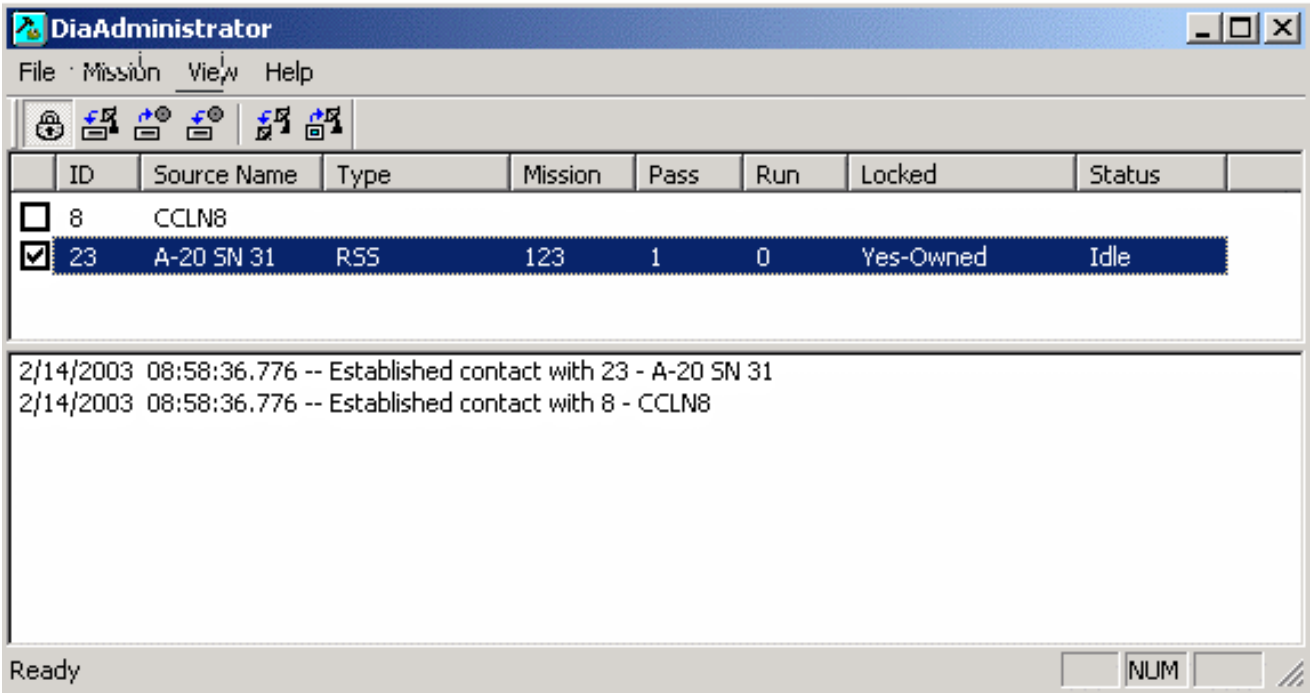

Figure 1. DiaAdministrator Main Window

During a mission, the DiaAdministrator application can control a DIA's data acquisition, recording, playback, slew tests, and radar slaving. The application can be used to configure a DIA by setting bit-weights, scale factors, and mapping. After a mission, the application can download radar data recorded at the DIA for post-mission processing.

DIA VIEWER

The DiaViewer application is used to monitor radar data collect by a DIA in real-time. The main screen (Figure 2) allows the user to select between available radar data being transmitted via multicast-UDP by one or more DIAs. Once the data stream is selected, the application displays the radar source ID, mission information, pad location, timestamp, packet number, and target tracking information.

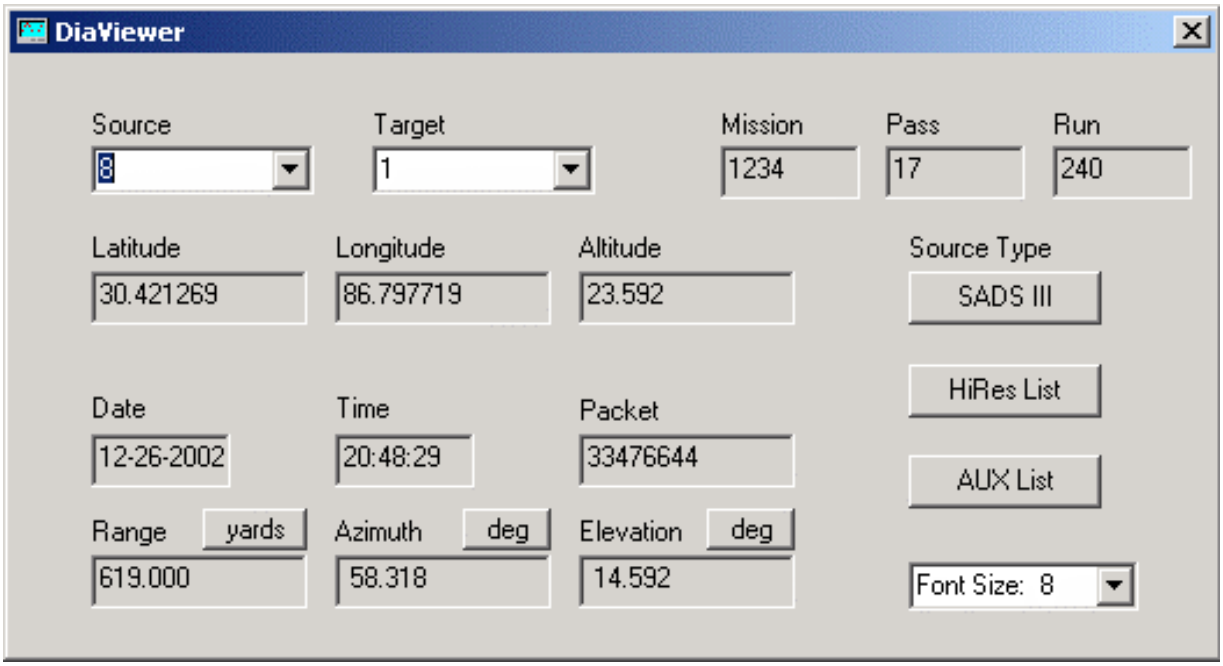

Figure 2. DiaViewer Main Window

The DiaViewer application can also display raw source-specific information collected from the radar (Figure 3). This includes various analog and digital data, time-interval measures, discrete bits, and event times. The application provides the ability to display a list of discrete bits with user-defined names to monitor one or more key events (e.g. bomb tone, on track, etc.)

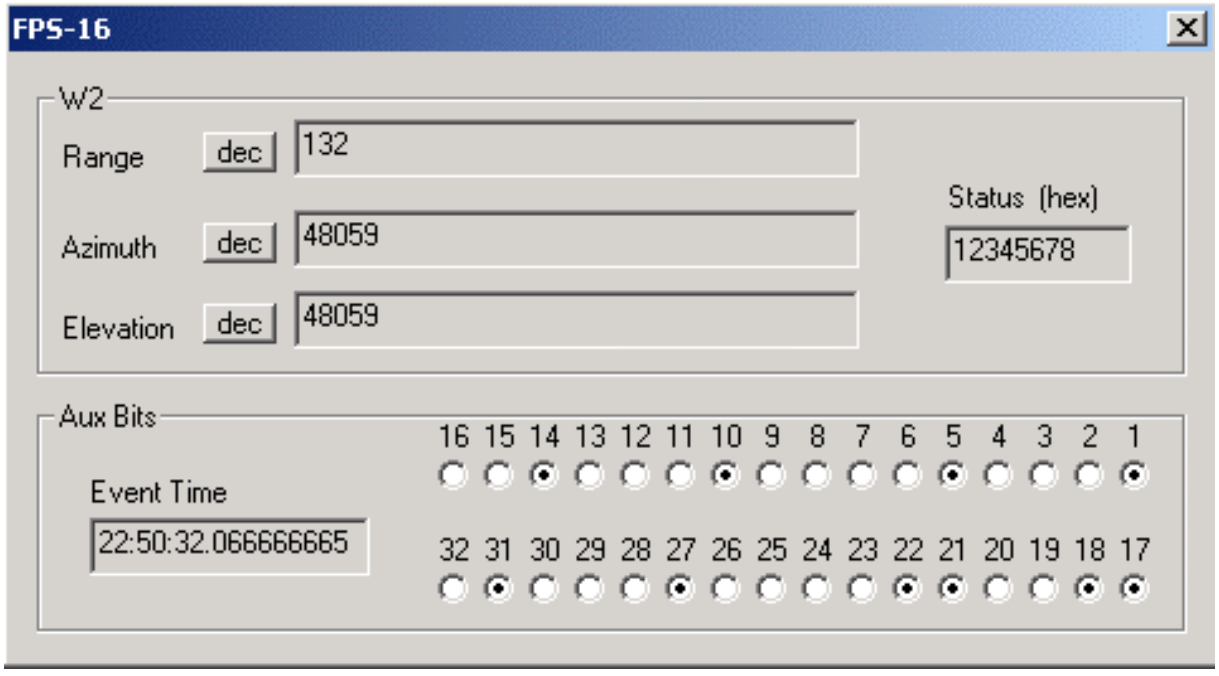

Figure 3. DiaViewer Source Specific Information Window

RANGE MAP

The RangeMap application (Figure 4) displays the target track of one or more DIA-equipped radar systems in real-time. The target track is drawn over a map background that depicts the Eglin Range and South-East United States coastline. The application provides the ability to pan and zoom the display and to automatically center on a target of interest. Target tracks are color coded to allow distinction between multiple targets.

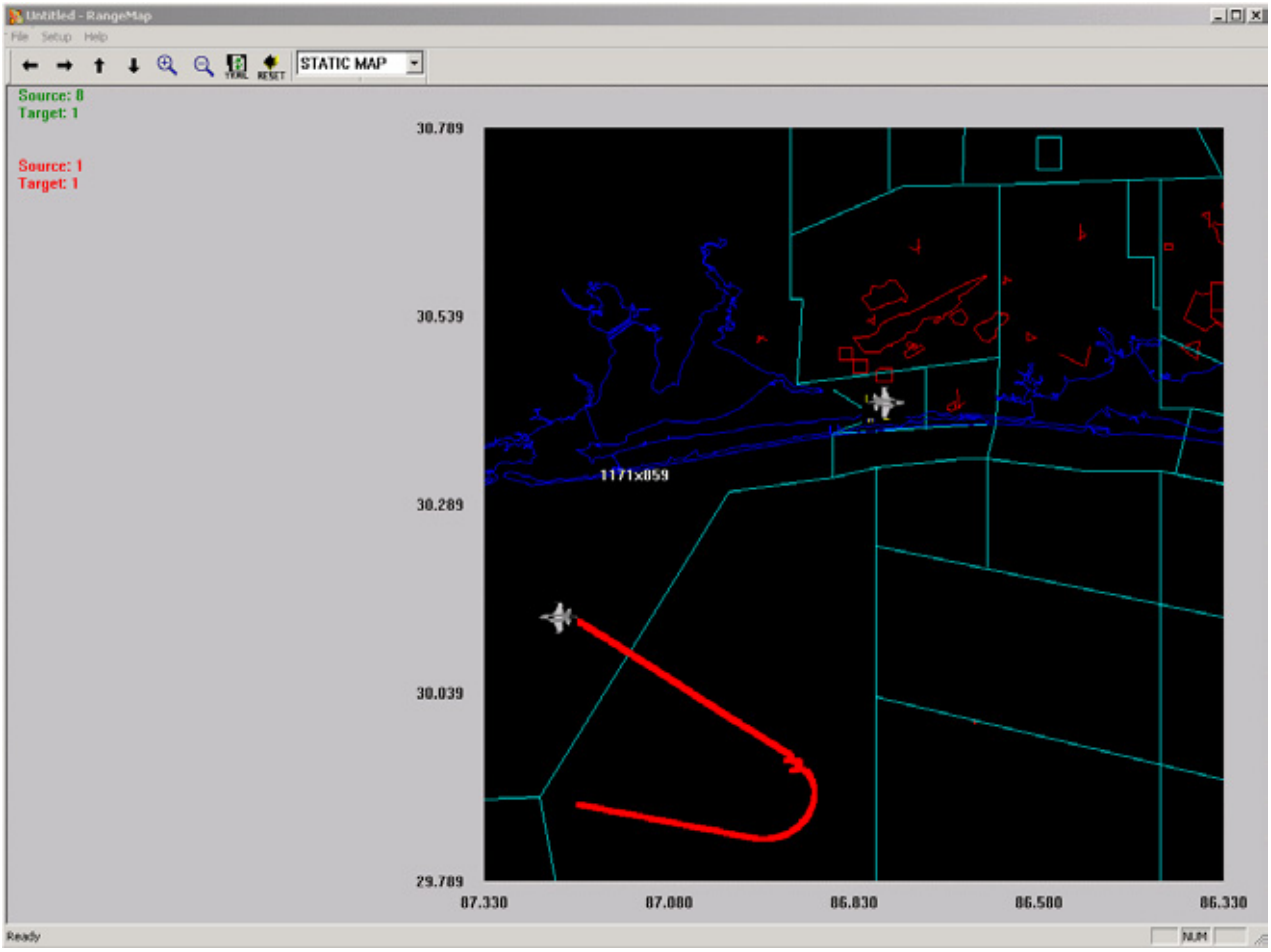

Figure 4. RangeMap Display

CONCLUSIONS

The RICS system design has met our original goal of providing a 21st century solution for distributed data acquisition and collection. Commercially available components were used to build the system to minimize production and replacement costs. In fact, the console computers are standard Dell desktop PCs. Industry standards were followed to accomplish data distribution and communication by utilizing multicast-UDP and CORBA, thereby allowing flexibility in the implementation choices of the computer components.

The RICS Console Software applications provide the user with a set of easy to use tools to quickly and accurately perform test missions to validate a system under test. To monitor a mission, a user needs only a standard desktop (or laptop) PC and access to the RICS network. Due to the passive-listener nature of multicast-UDP, there is no software-imposed limits on the number of PCs receiving and monitoring data. Additional users will not affect the performance of the DIA.

As of this writing, RICS has undergone extensive system testing covering multiple test sites, multiple DIAs, and multiple radar types. The system has proven operational, and is ready for production. The next phase will further proliferate RICS on the Eglin Test Range by replacing the data acquisition systems at several existing radar sites.

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