Control System Connectivity

Pat Fairbank & Leigh Pauls ─ November 8th, 2008

Patrick Fairbank

► 9 years of *FIRST* experience

► Mentor for Team 296, 2004 – 2006

 ► 2006 World Champions

► Mentor for Team 1503, 2007 – Present

 ► 2 regional finalists

► University of Waterloo undergrad student

 ► Mechatronics Engineering, Class of 2011

Components

► Communication between control system components is done over TCP/IP

► Connections are made with standard Ethernet cable and RJ-45 connecters

► 802.11n wireless link between driver station and robot

cRIO

► National Instruments Compact Reconfigurable Input/Output

► Communicates via 2 Ethernet ports:
  ► Port 1: Wireless Bridge to the Driver Station
  ► Port 2: Camera

Camera

► Axis 206 network camera

► Connects to Port 2 of cRIO using a crossover cable

Wireless Bridge

▶ Linksys WGA600N Wireless Gaming Adapter

▶ Connects to Port 1 of cRIO using standard network cable

Questions?

Driver Station

► Has 2 Ethernet ports for connecting to:

  ► Wireless router

  ► Programming computer

  ► cRIO (tethering)

  ► Competition radio

Wireless Router

▶ Linksys WRT610N

▶ 4 port switch + Internet

▶ Like the 2007/2008 radios, not used in actual competition

Questions?

Configuration

► Assigning the correct IP address to each piece of the control system

► Imaging the cRIO for C++ or LabVIEW

► Updating the Driver Station firmware and setting the team number

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IP Addresses

Component	Team IP	Example: 1114
cRIO Port 1	10.xx.yy.2	10.11.14.2
cRIO Port 2	192.168.0.3	192.168.0.3
DS Port 1	10.xx.yy.4	10.11.14.4
DS Port 2	10.xx.yy.5	10.11.14.5
Camera	192.168.0.90	192.168.0.90
PC	10.xx.yy.6	10.11.14.6

Where xx and yy are the digits of team number xxyy

Subnet mask for 10.xx.yy.z addresses: 255.0.0.0

Wireless Setup

► Both the WRT and the WGA need to have the same network settings (SSID, security, etc.)

► By default, WRT assigns addresses in the 192.168.1.x range

► If changed to assign addresses in the 10.xx.yy.z range, you can program wirelessly and have Internet access at the same time

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Components
  cRIO
  Camera
  Wireless Bridge
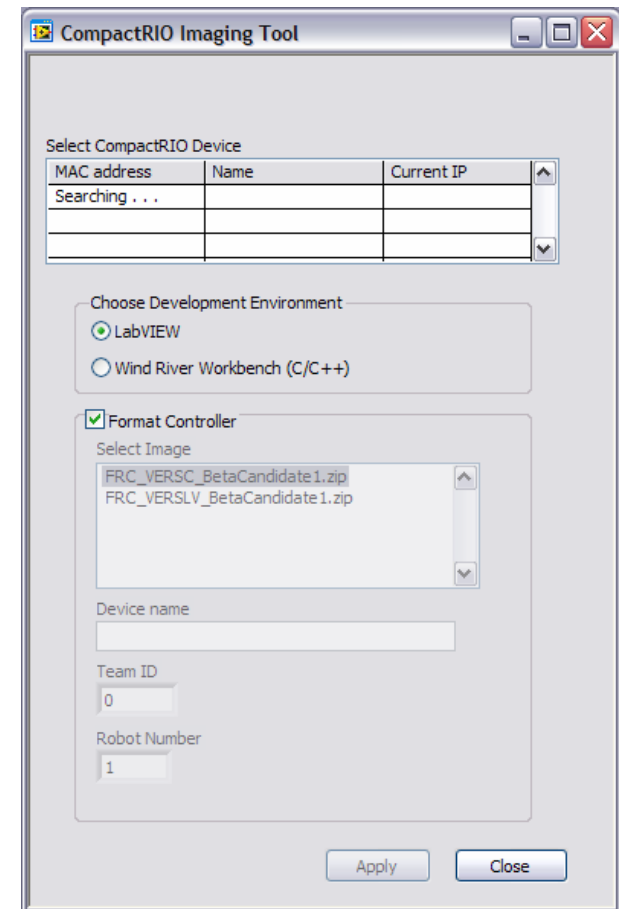 Driver Station
  Wireless Router

Configuration
  IP Addresses
  Wireless Setup
  cRIO Imaging
  Driver Station

Questions?

cRIO Imaging

▶ The cRIO must be "imaged" for firmware upgrades and to switch between C++ and LabVIEW, using a tool from FIRST

▶ Automatically sets the cRIO IP address based on team number

▶ Computer must be set to IP address 10.xx.yy.6, and must have a wired connection to cRIO

CompactRIO Imaging Tool

Select CompactRIO Device

MAC address	Name	Current IP
Searching . . .		

Choose Development Environment
◉ LabVIEW
○ Wind River Workbench (C/C++)

☑ Format Controller
Select Image
FRC_VERSC_BetaCandidate1.zip
FRC_VERSLV_BetaCandidate1.zip

Device name

Team ID
0

Robot Number
1

Apply   Close

Driver Station Setup

▶ IP addresses are set automatically from the team number

▶ The team number is set by holding down the middle button for 4 seconds

▶ Firmware upgrades are accomplished by plugging a USB key containing the new firmware into USB Port 1

Questions?

▶ This presentation and other resources will be posted to the *FIRST* Beta Test Public Forum:

http://forums.usfirst.org/forumdisplay.php?f=743

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