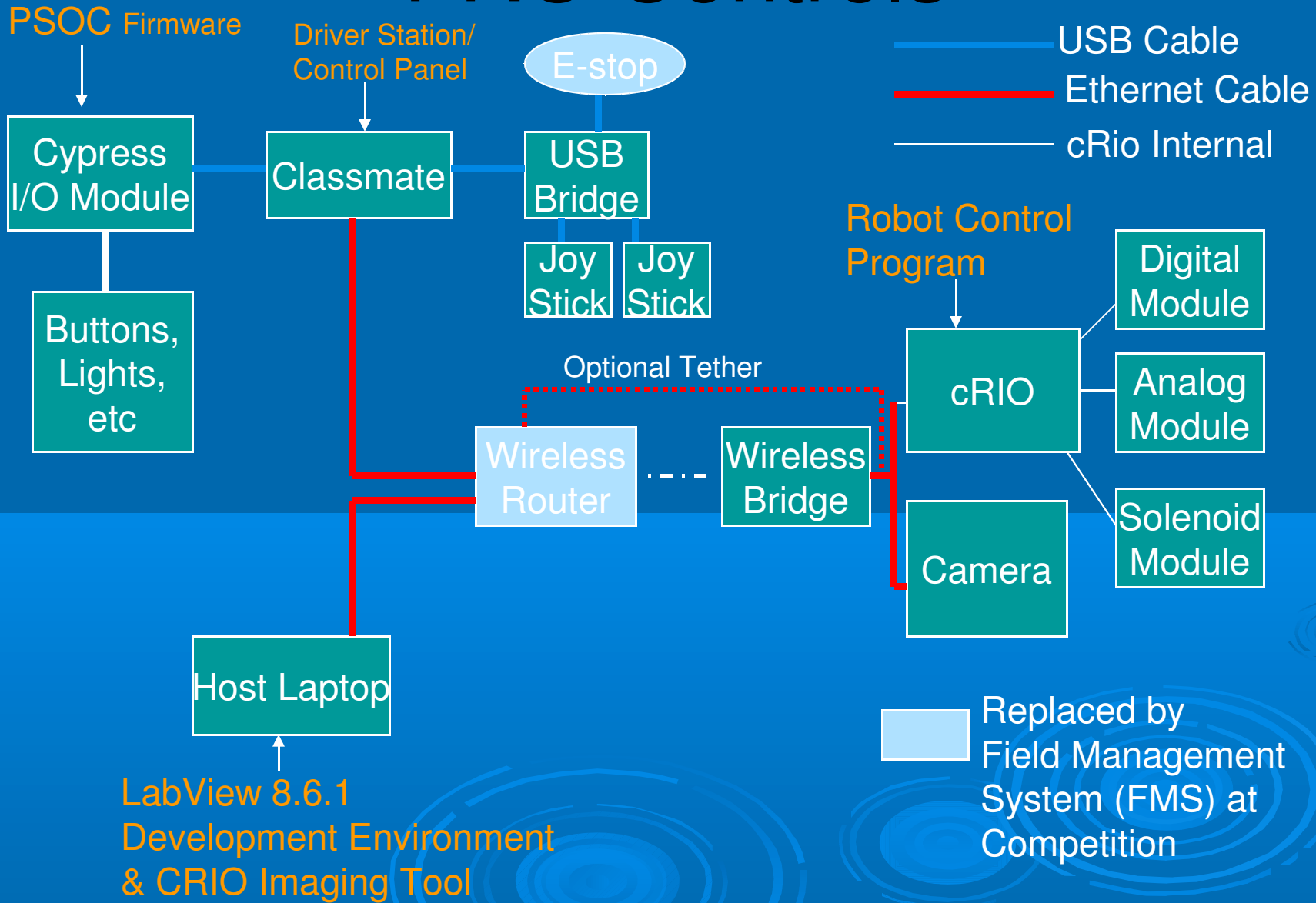# Intro to LabView for FRC

Team 1912

Outline

- The FRC Control System Overview
  - Components
  - Data flow
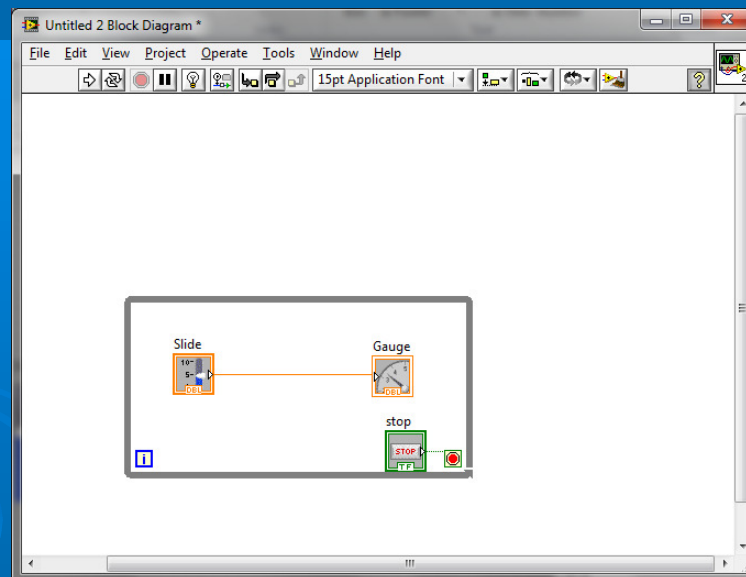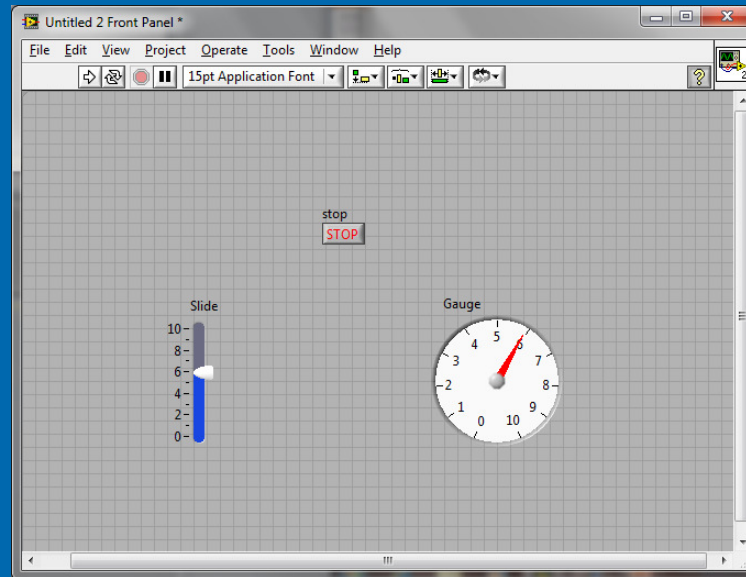 - Software/Firmware
  - Software Framework
- LabView Programming Model
  - Virtual Instruments
  - Front Panel
  - Block Diagram
  - Sub-vi's
  - Wiring sub-vi's
  - Development Environment - Project organization

FRC Controls

PSOC Firmware

Driver Station/
Control Panel

E-stop

──────── USB Cable

──────── Ethernet Cable

──────── cRio Internal

Cypress
I/O Module

Classmate

USB
Bridge

Robot Control
Program

Digital
Module

Buttons,
Lights,
etc

Joy
Stick

Joy
Stick

cRIO

Analog
Module

Optional Tether

Solenoid
Module

Wireless
Router

Wireless
Bridge

Camera

Host Laptop

LabView 8.6.1
Development Environment
& CRIO Imaging Tool

Replaced by
Field Management
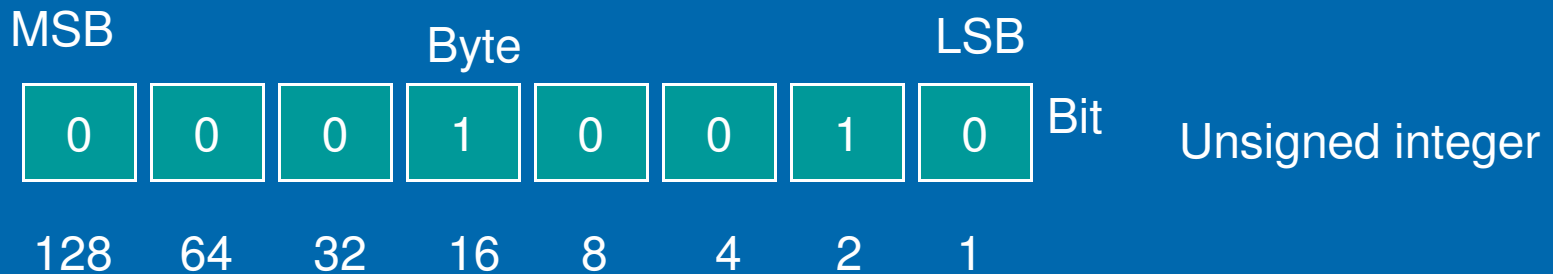System (FMS) at
Competition

LabView Model

Outline (Continued)

- LabView Data Types (Wires)
  - Binary representations of numbers(bits)
  - Integers (8,16,32 bit)
    - Signed or Unsigned
  - Floating Point (single, double)
  - Boolean
  - Character Strings
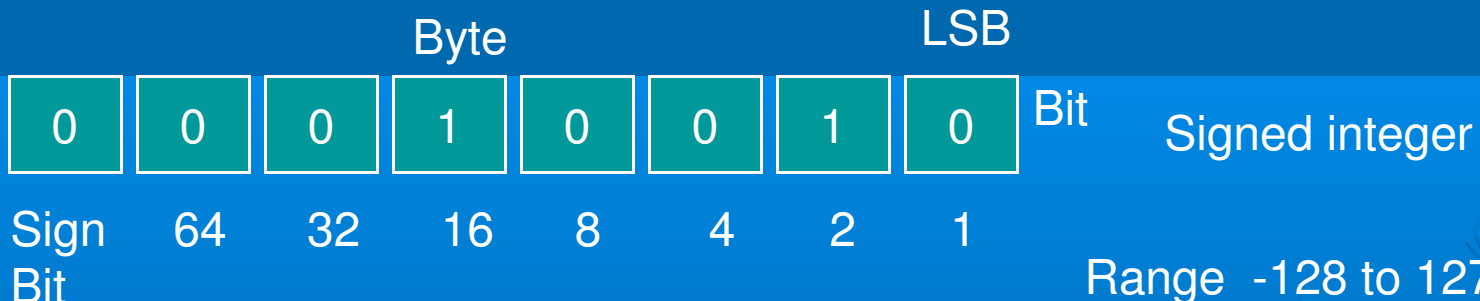 - Arrays
  - Clusters (bundles)

Binary Number

MSB   Byte   LSB

| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | Bit |

128   64   32   16   8   4   2   1

Unsigned integer

Examples

$00001001_{bin} = 9_{dec}$

$00100011_{bin} = 67_{dec}$

Range 0 to 255

Byte   LSB

| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | Bit |

Sign   64   32   16   8   4   2   1
Bit

Signed integer

=1 Negative
=0 Positive

Range -128 to 127

Examples

Two's complement – if neg, complement all bits and add 1

$00001001_{bin} = 9_{dec}$

$11111000_{bin} = -8_{dec}$

Floating Point

Sign

Exponent

Example: -1.234×10^{18}

Significand (mantissa)

Number of Bits	Sign	Significant	Exponent
Single (32 bit)	1	23	8
Double (64 bit)	1	52	11

Boolean

1 = True
0 = False

Character Strings

- A text character is usually assigned an 8 bit code – ASCII
  - Example – A = 65   ,=44   a=97
- Character strings are a string of 8 bit characters followed by the code 0 (null)
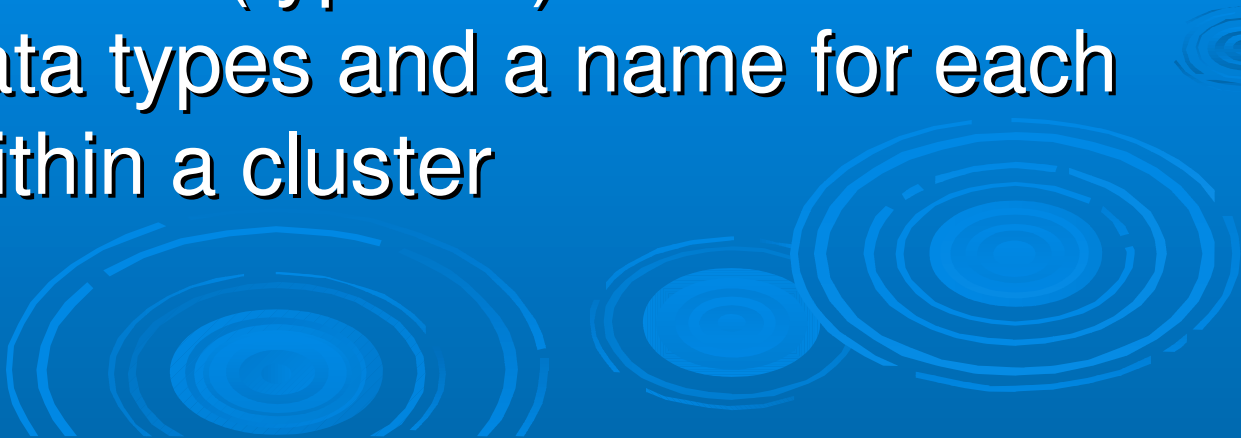 - Called null terminated string

Array

➢ A string of variables of the same type can be given the same name and then referenced by one or more indexes

- Example   a[n]= 1 3 5 2   a[1]=1
- Example   b[n,m]= 8 4 2 3   b[2,1]=7
                                7 3 5 1

Arrays of numbers show up as thicker wires in LabView block diagram

Sub-vi's to extract or insert individual elements or subarrays

Clusters

➢ Variables of different types can be bundled together into a cluster

- Analogous to bundling stereo wires

➢ Then the whole cluster can be moved as a single "wire"

➢ Type definitions (typedef) defines the order of data types and a name for each element within a cluster

Outline (Continued)

➢ Creating data values

- Front Panel Controls

- Block Diagram Constants

- Outputs from Sub-vi's

- Global variables

- Registry variables

➢ Outputting data values

- Front panel indicators

- Input to Sub-vi's (transfer to external hardware)

Outline (continued)

- Creating (or modifying) a vi –programming
- Generating a new vi
- Modifying an example
- Function Palette
  - Numeric Functions
  - Boolean Functions
  - String Functions
  - Comparison Functions
  - Structures Functions
  - Cluster Functions