Industrial Internet of Things in Graphical System Design

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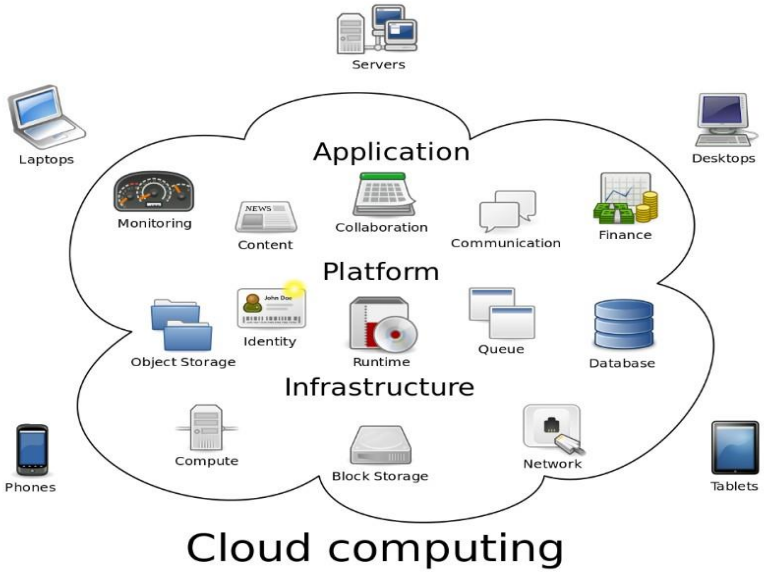
Industrial Internet of Things:

Equipping your "things" with connected and synchronized measurement and control technologies unlocks insights that can increase uptime, boost performance, and drive innovation all while reducing operational costs. Those insights, however, hinge on the availability of accurate and reliable real-world data. With NI's technology providing unmatched capabilities in measurement, control, ruggedness, and connectivity, along with our expert ecosystem, you can realize the benefits of the Industrial Internet of Things (IIoT) today. The world economy will greatly change in the next decade as new Internet-enabled applications are rolled out. Some of these applications are likely to be disruptive and innovative as well as have a large economic impact. This will affect many industries and sectors, as already seen in consumer sectors like hotels (Airbnb) and taxis (Uber). This trend is also noticeable in the industry, for example, Germany's Industry 4.0 initiative. Within Industry 4.0 or the Industrial IoT (IIoT), the focus is on integration and better use of existing technologies. In this sense, industry, machines, products, and people are all digitally connected. Manufacturers are mass producing bespoke products in quantities of one. Intelligent software in the cloud connects enterprise IT systems with the operational world, machines, devices, and sensors to control and optimize production flow.

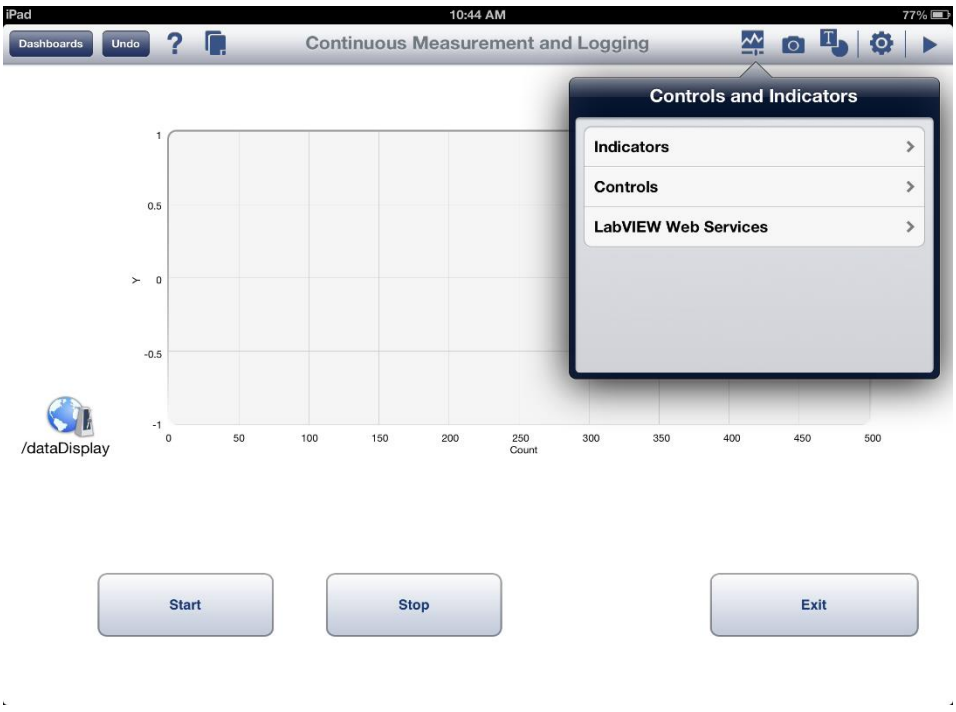


Remote Monitoring & Control – Mobile Device

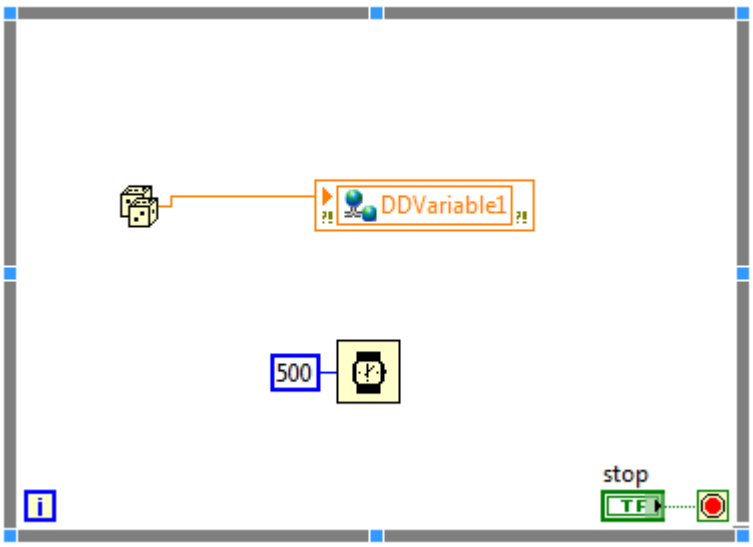
The evolution of the web and mobile devices has changed how we interact with our surroundings. Remote monitoring and control of LabVIEW-based systems from a mobile platform is an increasingly important aspect to a flexible and efficient system. Data Dashboard for LabVIEW is a mobile application that enables the creation of custom user interfaces that can monitor and control LabVIEW applications remotely. This tutorial describes some of the more advanced capabilities of Data Dashboard and assumes some familiarity with the product.

Shared Variables in Applications with Data Dashboard

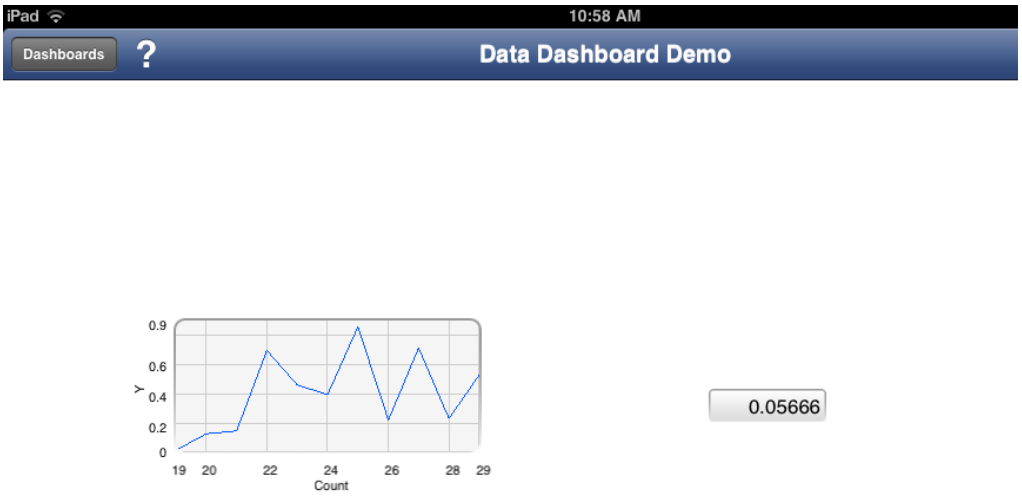
Shared variables interact with the host application through the LabVIEW Shared Variable Engine (SVE) and the updates are handled through the Publish Subscribe Protocol (NI-PSP). For Data Dashboard to have access to these variables, they must be deployed to the SVE through a library project item. Each variable in the library will be deployed and the SVE will reserve a memory space for it. They will remain in the memory space as part of the LabVIEW process whether Data Dashboard is interacting with them or not. With larger data types and data types that can vary in size (strings and arrays) it is important to remember that mobile devices are very different from a full development system.



LabVIEW code:



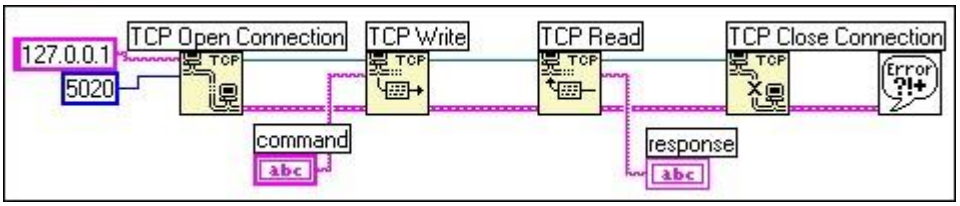
Data Dashboard:



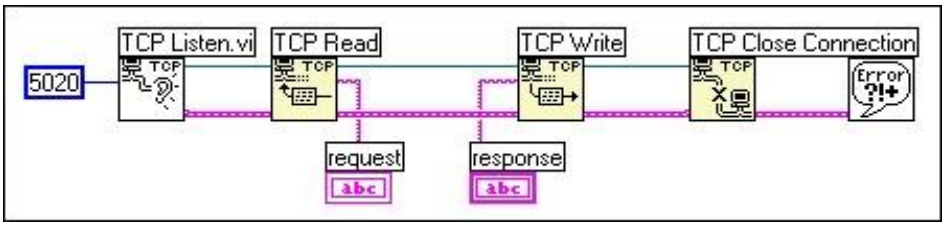
TCP/IP Communication for Local Network:

Internet Protocol (IP), User Datagram Protocol (UDP), and Transmission Control Protocol (TCP) are the basic tools for network communication. The name TCP/IP comes from two of the best-known protocols of the internet protocol suite, the Transmission Control Protocol and the Internet Protocol. With TCP/IP you can communicate over single networks or interconnected networks (Internet).

TCP/IP Server:



TCP/IP Client:



LabVIEW users can develop custom applications for TCP/IP communication. The programmer is responsible for developing both the client and the server.

Because anyone can initiate a connection to a server, you might want server access control. The following block diagram shows how the server uses the remote address output value of the TCP Listen VI to determine whether a remote client has permission to access the server.

Cloud Communication:

All cloud computing platforms securely send and receive data, use strong authentication and authorization methods, and use encryption. The majority also have audit capabilities. Communication protocols are responsible for the network connectivity to the server. Protocols like Wi-Fi, Ethernet, cellular, and LoRaWAN are all communication protocols that provide this level of connectivity. Application protocols sit on top of them to communicate application-specific messages.

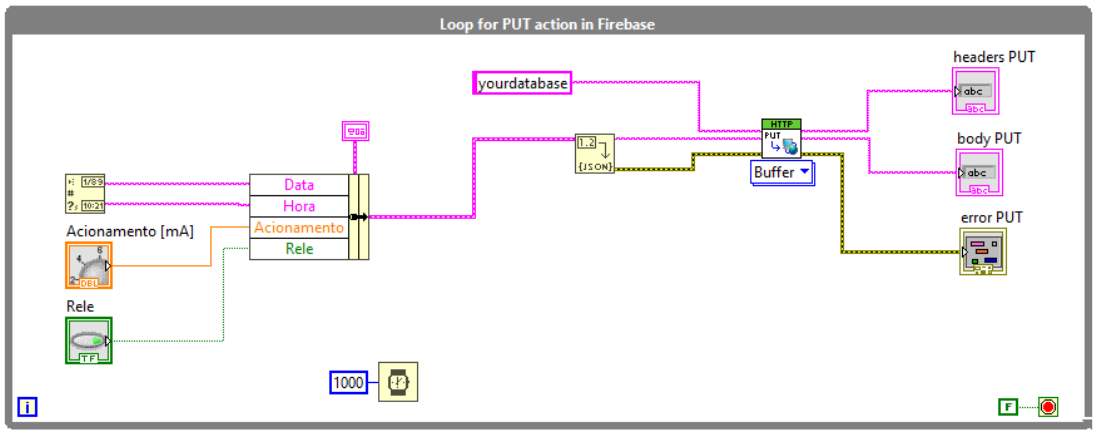
Multiple standards handle the communication between devices and the cloud. As application requirements differ, specific IoT protocols have been developed and therefore the confusion is understandable. Protocols may even have multiple implementations and IoT platforms may have proprietary IoT solutions. To provide a universal solution, devices, applications, and platforms need to be interoperable.

Cloud computing refers to a flexible way of delivering hardware, software, or data resources via the network on a user's request. This is opposite to the use of running a software application on a local computer.

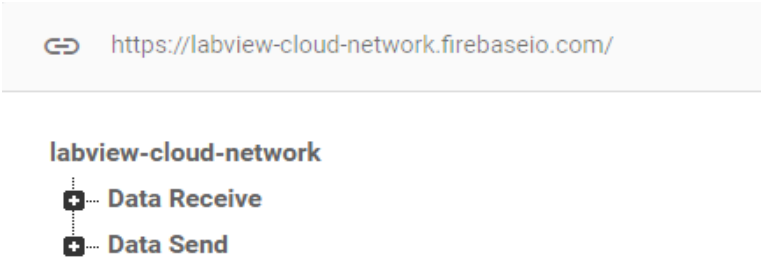
Google Firebase:

The Firebase Realtime Database is a cloud-hosted database. Data is stored as JSON and synchronized in real-time to every connected client. When you build cross-platform apps with our iOS, Android, and JavaScript SDKs, all of your clients share one Realtime Database instance and automatically receive updates with the newest data.

LabVIEW Program:

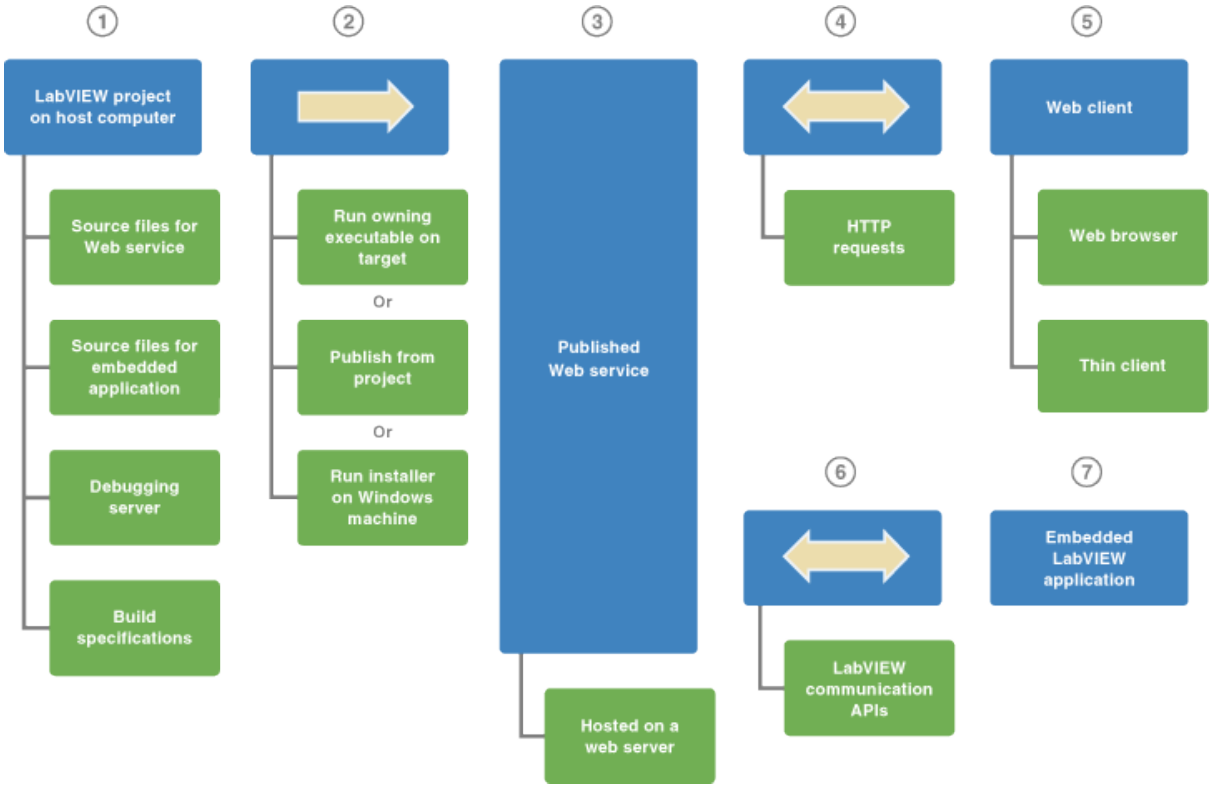


Google Firebase:



Web-based Communication with a LabVIEW Application:

A web client can exchange data with a remote LabVIEW stand-alone application over a network through LabVIEW Web services. A Web service consists of VIs and other files running on a server that respond to HTTP requests from clients.



Web services are useful in the following situations:

Users can invoke the Web service VIs with any HTTP-capable web client, including a standard web browser, to exchange data using a URL and standard HTTP methods such as POST. For example:

- Uploading new parameters to an application
- Retrieving current state or status

Users can remotely monitor and control embedded applications using custom thin clients. For example:

- Updating application state
- Starting or stopping a process

You can conduct application-to-application data exchange between numerous HTTP-capable devices and software from both National Instruments and third parties. For example:

- Connecting to non-LabVIEW clients
- Implementing security and authentication