FULL FORCE AHEAD

25 YRS OF NIWeek May 20–23, 2019 | Austin, Texas
Learn how to use the LabVIEW NXG Web Module to create engineering user interfaces that run on any modern browser without plug-ins or installers. Quickly visualize your data from distributed systems through drag-and-drop engineering widgets, intuitive communication mechanisms, and secure hosting all based on industry-standard technologies.
Rita Prather
NI Software Product Manager
Remote UIs Require Command of:

Standard Web Technologies
- HTML
- CSS
- JavaScript

Networking and Communications
- HTTPS
- WebSocket

Application Hosting
- Web Servers
- Security
LabVIEW NXG Web Module
Visualize your Process Data Everywhere, Any Time

- Quickly Create Powerful Engineering UIs
- Intuitively Move Data Across your Application
- Efficiently Share UIs with your Stakeholders
<table>
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<tr>
<th>Remote Monitoring</th>
<th>Remote Control</th>
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<tbody>
<tr>
<td>Data Entry</td>
<td>Data Exploration</td>
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</table>
Remote Monitoring

Data Entry

Distributed Temperature Monitoring

Temperature History

Temperature (°F)

Sites

Water Feed Pump
Gas Line
Aerator
Overflow Tank
Remote Control

Data Exploration

Yellow plots are the limits. The red plot is the results of the Filter Characterization test.
Remote Monitoring

Data Entry

https://www.gsystems.com/blog/labview-web-based-ui
Remote Monitoring
Remote Control
Data Entry
Data Exploration
“The LabVIEW NXG Web Module is a disruptive technology that’s given more powers to LabVIEW developers. The Web Module took me no time to develop and deploy; it broke the HTML, CSS, JS barrier and now I can build apps for the web. The Web Module is simple, powerful and gets better with every release!”

Navin Subramani, Project Lead, Soliton Technologies
LabVIEW NXG Web Module Components

**WebVIs**
Design UIs with standard web technologies (HTML, CSS, JavaScript) through drag-and-drop high-performance engineering widgets

**Data Services**
Secure and scalable industry standard technology to orchestrate communications

**Web Server**
Efficiently host your UIs in the cloud or on-premises using the included NI Web Server or any third-party mechanism
WebVIs

Quickly Create Web-Based Engineering UIs
Using the LabVIEW NXG Web Module

Clients
- Desktops, Laptops, Tablets, Phones

Server
- Any Networked PC

Devices
- CompactRIO, PXI, Desktops

WebVI
- LabVIEW NXG

Web Server
- Data Services

LabVIEW
- LabVIEW NXG
- Third Party

Data Service APIs
High-Performance Engineering Widgets

Commonly Used Engineering Widgets
• Buttons, LEDs
• Tanks, Sliders, Gauges
• Numerics, Strings, Enums, Rings
• New in 3.1: Tree Control, Dialog Box

High-Performance Charts and Graphs
• 500,000 @ 60fps
• Wide variety of data types

Import/Export Web Content
• Maps, videos, streaming media, etc
Flexible Layout
Commonly Available LabVIEW Functions
• Program Flow (loops, cases, timing)
• Data Types (Numeric, Boolean, String, Array, Cluster)
• Basic Math
• New in 3.0: Events and Properties

Communications APIs
• Tag and Message-based communications
• HTTP Client
• New in 3.1: WebSocket Client
Automatic Code Generation

HTML/CSS

VIA

JavaScript
Integration with 3\textsuperscript{rd} Party IP

\textbf{JavaScript Library Interface (JSLI)}
- Enables 3\textsuperscript{rd} party visualizations and libraries
- Defines interface between G and JavaScript
- Analogous to calling C/C++ from LabVIEW
Data Services
Intuitively Move Data Across Your Application
Using the LabVIEW NXG Web Module

Clients
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WebVI
- LabVIEW NXG

Web Server

Data Services

LabVIEW, LabVIEW NXG

Third Party

Data Service APIs
<table>
<thead>
<tr>
<th>Application Side</th>
<th>LabVIEW NXG WebVI Side</th>
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<tbody>
<tr>
<td>SystemLink APIs in LabVIEW NXG SystemLink APIs in LabVIEW</td>
<td>SystemLink APIs</td>
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<tr>
<td>LabVIEW Web Services 3rd Party RESTful Web Services</td>
<td>HTTP Client API</td>
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<tr>
<td>LabVIEW with WebSocket toolkit(s) 3rd Party WebSockets</td>
<td>WebSocket Client API</td>
</tr>
<tr>
<td>Possible 3rd Party mechanisms</td>
<td>Possible 3rd Party mechanisms via JSLI</td>
</tr>
</tbody>
</table>

Use **LabVIEW** and **LabVIEW NXG** together!
SystemLink Tag & Message APIs
Included in LabVIEW NXG Web Module

Tags
- Single data point with most recent value
- Use cases:
  - Track live status of a channel
  - Write single point control values

Messages
- Synchronous and Asynchronous string messages
- Use cases:
  - Display status and warning messages from remote systems
  - Send a keyword to trigger an event
  - Transmit ordered data (waveform)
SystemLink Tag and Message APIs

PROCESS Data Services

CLIENT

WebVI Block Diagram Code

http://host:port
admin
****
System.Temperature
Double

Temperature
DBL
TF
HTTP Client API
Invoke LabVIEW and 3rd Party Web Services

Call any RESTful Web Services hosted alongside the WebVI or across the Web.
HTTP Client API

Invoke LabVIEW and 3rd Party Web Services

Call any RESTful Web Services hosted alongside the WebVI or across the Web
Special Considerations for LV Web Services
Cross Origin Resource Sharing (CORS) on multiple servers

During WebVI Development
- LabVIEW Web Server
- NXG Web Server

Deployment
- LabVIEW Web Server

GET requests only
WebSocket Client API

- WebSocket = continuous TCP connection between client & server
  - This means more efficient communication, which is good for Streaming use cases
- For WebSocket Servers, use 3rd party LabVIEW toolkits
<table>
<thead>
<tr>
<th>API</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>SystemLink APIs</td>
<td>• User-friendly APIs for WebVI and VI</td>
<td>• Only supports latest value and message data, no stream or file with WebVIs yet</td>
</tr>
<tr>
<td></td>
<td>• Easily integrated with NI Web Server, SystemLink Server, and SystemLink Cloud</td>
<td></td>
</tr>
<tr>
<td>LabVIEW Web Services + HTTP VIs</td>
<td>• You might already have these implemented</td>
<td>• Hard to iterate on during WebVI development (mentioned previously)</td>
</tr>
<tr>
<td></td>
<td>• More flexible than other options</td>
<td></td>
</tr>
<tr>
<td>WebSockets</td>
<td>• You might already have these implemented</td>
<td>• Must use a 3rd party toolkit for Server side</td>
</tr>
<tr>
<td></td>
<td>• User-friendly WebVI API</td>
<td>• Must implement security in the WebSocket server yourself</td>
</tr>
<tr>
<td></td>
<td>• Low-latency communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Supports the streaming use-case better than the other options</td>
<td></td>
</tr>
</tbody>
</table>
Demo Continued…
NI Web Server

Securely Share Your User Interfaces
Using the LabVIEW NXG Web Module

Clients
- Desktops, Laptops, Tablets, Phones

Server
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Devices
- CompactRIO, PXI, Desktops

WebVI
- LabVIEW NXG

Web Server
- Data Services

LabVIEW
- LabVIEW NXG

Third Party
- Data Service APIs
NI Web Server

INTUITIVE WEB HOSTING
- Industry-standard web server
- Simplified installation and configuration

SECURABLE
- Manage ports and certificates
- Data encryption

ACCESS CONTROL
- Granular access to applications
- Roles and permissions management
Edge Node Deployment Pattern

- Suitable for small systems or direct control
- Simpler topology; no additional machines needed
- Direct access to hardware and data
- Downtime/maintenance/upgrades affect availability
- Incremental compute load on target for every client
- Access to critical hardware is a security concern
Central Node Deployment Pattern

- Scalable to multiple edge nodes
- Centralized management and data aggregation
- Separation of IT and OT
- No direct access to measurement hardware
- Additional hardware required
WebVI Hosting
- Securely host and share WebVIs created with the LabVIEW NXG Web Module
- Display test data and execute client-side logic in the browser
- Based on web standards – no plug-ins required

Cloud Hosted Data Services
- Access data globally, from globally distributed devices
- Leverage data services for tags, messages, and files
- Take advantage of built-in encryption and security

Dashboard Builder
- Browser-based dashboard editor
- Drag-and-drop widgets to create data displays
- Adaptive layouts for mobile devices
- No coding necessary
Central Node Deployment Pattern
SystemLink Cloud

- Scalable to multiple edge nodes
- Centralized management and data aggregation
- Separation of IT and OT
- No direct access to measurement hardware
- Additional hardware required
- Hosting and security managed by SystemLink Cloud
Deploying a WebVI Application
Local Deployment Pattern

- **LabVIEW NXG Web Module**
  - Create WebVI
  - Build Web Application

- **NI Web Server**
  - Local Server
  - Remote Request

- Move Output Files
  - HTML, CSS, JS, JSON, ...

- Location:
  - C:\Program Files\National Instruments\Shared\Web Server\htdocs
Demo Continued…
System Overview

LOCAL NETWORK – BEHIND FIREWALL

TEST STATION
- Testing Application
  - Performs Tests, saves results

SERVER MACHINE
- Database
  - Stores data, searchable, indexed
- Web Services
  - Intermediate layer to Database
- Web Server
  - Hosts web pages

EXPOSED ON THE INTERNET

CLIENT WEB BROWSER

LEGEND
- Developed using NI LabVIEW
- Developed using NI LabVIEW NXG

LabVIEW NXG WebVIs
- Web Application for data visualization
Demo
Creating Powerful Web Apps With the LabVIEW NXG Web Module
Matthias Baudot, STUDIO BODs

Tuesday, 10:30AM – 11:30AM
Room 12B
Future Investments
What’s New Since 2.1?

- LabVIEW NXG 3.0 Web Module
  - Introduced Events & Properties
  - Introduced the JavaScript Library Interface (JSLI)
  - Released SystemLink Cloud as an entitlement to Web Module users

- LabVIEW NXG 3.1 Web Module
  - Further enabling modern web UIs
    - Introduced Flexible Layout
    - WebSockets Client API
    - Added more Events & Properties
    - Customizable WebVI browser icon
  - Additional web controls
    - One and Two Button Dialogs
    - Tree Control
  - Increased usability
    - Automatic dependency injection with JSLI
    - Split-Run Button
    - Better HTML Source Interactions
What’s Coming?

- Better support for Waveforms
- Variant support
- File API for interacting with static data in a WebVI
- Investigating LabVIEW Web Services + WebVIs integration improvements

We love feedback! Let us know your thoughts here, on the forums, over email, or even in NXG…
LabVIEW NXG Web Module – Packaging

Try it out!

ni.com/labview/webmodule
webvi.io
ni.com/systemlinkcloud
## Related Sessions

<table>
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<tr>
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<th>Time</th>
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<tbody>
<tr>
<td>Customizing Your WebVIs</td>
<td>Monday, 4:30pm – 5:30pm</td>
<td>12B</td>
</tr>
<tr>
<td>Creating Powerful Web Apps with the LabVIEW NXG Web Module – presented by Matthias Baudot</td>
<td>Tuesday, 10:30am – 11:30am</td>
<td>12B</td>
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<tr>
<td>Hands-On: Web Module</td>
<td>Thursday, 9:45am – 10:45am</td>
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VIEW WEEKLY SCHEDULE

FIND YOUR SESSION

BUILD YOUR SCHEDULE

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