LabVIEW NXG Web Module: Developing Web-Based User Interfaces

Tai Wooi Ling
Application Engineer
Designing Distributed User Interfaces

Remote UIs Require Command of the Following:

- **Standard Web Technologies**
  - HTML | CSS | JavaScript

- **Networking and Communications**
  - HTTP | WebSocket

- **Application Hosting**
  - Web Servers | Security
LabVIEW NXG Web Module
Visualize Your Process Data Anywhere, Anytime

- Quickly create powerful engineering UIs
- Intuitively move data across your application
- Efficiently share UIs with your stakeholders
“Using WebVIs allows us to provide our users an interface to the test management database from anywhere, anytime, and we were able to develop the web interfaces using just our core LabVIEW skills. We saved development time, and the users have instant access to review data or change test criteria.”

–Jeremy Marquis, Engineering Team Lead, G Systems
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**
Orchestrate communications with secure and scalable industry-standard technology

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

Clients: Desktops, Laptops, Tablets, Phones

Server: Any Networked PC

Devices: CompactRIO, PXI, Desktops

Web Server

Data Services

Data Service APIs

LabVIEW, LabVIEW NXG, Third Party

WebVI
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
WebVIs: Create Web-Based User Interfaces
Run VIs on Any Modern Browser, No Plugins or Installers Required

<table>
<thead>
<tr>
<th>STANDARDS BASED</th>
<th>ENGINEERING FOCUSED</th>
<th>OPEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTML</td>
<td>CSS</td>
<td>JavaScript</td>
</tr>
<tr>
<td>Host on Any Web Server</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
High-Performance Engineering Widgets

Commonly Used Engineering Widgets
- Buttons, LEDs
- Tanks, sliders, gauges
- Numerics, strings, enums, rings

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

Import/Export of Web Content
- Maps, videos, streaming media, and so on
Flexible Layout
Commonly Available LabVIEW Functions
- Program flow (loops, cases, timing)
- Data types (Numeric, Boolean, String, Array, Cluster)
- Basic math

Communications APIs
- Tag- and message-based communications
- HTTP client
Automatic Code Generation

HTML/CSS

JavaScript
HTML: Hyper Text Markup Language
Customize Look and Feel

```html
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <style ni-autogenerated-styleid=""/>
    jqx-led[ni-control-id='116'] {
      left: 1827px;
      top: 1078px;
      width: 168px;
      height: 328px;
      font-size: 12px;
      font-family: Segoe UI, Arial, sans-serif;
      font-style: normal;
      font-weight: normal;
      text-decoration: none;
    }
    jqx-led[ni-control-id='116'].jqx-true-content-container {
      background: rgba(238, 28, 37, 1);
    }
  </head>
  <body>
    <div id='map' style='position: absolute; left: 240px; top:300px;'></div>
  </body>
</html>
```
JavaScript
Control Behavior, React to Events

```javascript
function initMap () {
    var myLatLngs = [
        {
            lat: 30.2926,
            lng: -97.7474
        }
    ];
    var map = new google.maps.Map(
document.getElementById('map'),
    {
        zoom: 14,
        center: myLatLngs [1]
    });
}

<script src="https://maps.googleapis.com/maps/api/js?key=AIzaSyCtaCR-h7RWgv4RkkbKLfMZU83hmfhY&callback=initMap"></script>

<div id='map' style='position:absolute; left: 580px; top:320px; width: 1490px;height: 600px'></div>
```
CSS: Cascading Style Sheet
Apply Styles and Templates

```css
.ni-front-panel {
    width: 375px;
    height: 667px;
    background-image: url('https://background.jpg');
}

ni-url-image[ni-control-id='166']{
    opacity: 0.75;
}
```
Data Services
Intuitively Move Data Across Your Application
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
Coexistence With Data Services

Skyline API can be used in:
- LabVIEW NXG
- LabVIEW 2014 and later
- LabVIEW Real-Time 2014 and later

HTTP API can be used with:
- LabVIEW 2014 and later web services
- Third-party web services

Therefore, you do not need to port your LabVIEW application to LabVIEW NXG before using the LabVIEW NXG Web Module!
Skyline Tag and Message APIs

**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)
Skyline Tag and Message APIs

WebVI Block Diagram Code
HTTP Client API
Invoke LabVIEW and Third-Party Web Services
Call any RESTful web services hosted alongside the WebVI or across the web.
HTTP Client API
Invoke LabVIEW and Third-Party Web Services

Call any RESTful web services hosted alongside the WebVI or across the web.
NI Web Server

Securely Share Your User Interfaces
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
NI Web Server

Intuitive Web Hosting
- Industry-standard web server
- Simplified installation and configuration

Securable Design
- 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

Diagram showing:
- Web-Based UI
- I/O
- Edge Node
- Web Server
Central Node Deployment Pattern

- Scalability to multiple edge nodes
- Centralized management and data aggregation
- Separation of IT and OT
- No direct access to measurement hardware
- Additional hardware required
Deploying a WebVI Application
Local Deployment Pattern

LabVIEW NXG Web Module

Create WebVI

Build Web Application

Move Output Files

NI Web Server

Local Server

Remote Request

C:\Program Files\National Instruments\Shared\Web Server\htdocs
Future Investments
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 plugins 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

- Scalability 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
High-Performance Interactivity

Events
- Value change events
- User-defined events

Property Nodes
- Focus is on most used UI properties
- More properties will be available each release

WebSocket
- Better suited for waveforms
- Asynchronous events
Integration With Third-Party IP

JavaScript Library Interface (JSLI) Node
- Enables third-party visualizations and libraries
- Defines interface between G and JavaScript
- Analogous to calling C/C++ from LabVIEW
LabVIEW NXG Web Module: Packaging

- WebVI Editor Experience
- SystemDesigner integration
- Build and Deployment Automation
- WebVIs Hosting
- In-Browser Dashboard Editor
- Data Communication APIs (LabVIEW 2014+ and LabVIEW NXG)

SystemLink Cloud
- NI Web Server
- Data Communication APIs (LabVIEW 2014+ and LabVIEW NXG)

Perpetual or Subscription  SSP Entitlement

TRY IT!

ni.com/labview/webmodule
webvi.io
ni.com/systemlinkcloud
Thank You