

HMI in the Cloud: The Secret SAAS

Ramal Murali, President, Software Horizons Inc.

Cloud Computing

Traditional business computing involves hardware, Operating System, Application Software, and infrastructure. All this complexity may require facilities and expert staff to install, configure and maintain. The modern business computing concept involves outsourcing the headache of ownership to someone else; the focus is on what needs to be done but not on the infrastructure and other non-essential details of how to get it done. With this focus, there are two important aspects of the customer task: selection of applications of interest, and selection of companies who provide such application functionality to be accessed over the Internet.

Since a cloud is used to represent the Internet in the network diagrams representing modern computing, the term 'Cloud Computing' is used when an Internet connection is utilized to access the application functionality of interest from 'Cloud Vendors'.

The SPI framework is the most accepted classification in Cloud Computing [1, 2]: the 'S' stands for Software as a service (SAAS); the 'P' stands for Platform as a service (PAAS); and the 'I' stands for Infrastructure as a service (IAAS).

We present here some ideas on how SAAS is an essential ingredient to make HMI in the cloud a reality. In Software Horizons' implementation of GoToMyHMI, some elements of Infrastructure and specialized platform are inter-woven with SAAS to meet the goal of providing an HMI in the Cloud. HMI in the Cloud is a simple idea, but it can have a huge impact on the way you think about HMI for your business. It is truly thinking that is 'out of the box' and in the cloud!

HMI Architecture

The important elements in the design and implementation of a traditional Human Machine Interface (HMI) are as follows: A Designer is used to create your HMI Project (Tag Database, Screen Objects, etc.). The project is then deployed on the target platform to be rendered by the Runtime software, installed on that platform, for the benefit of users (Operators and Managers).

Moving to the Cloud

HMI Server Connection for Internet Access

Most traditional HMI Runtime Servers can also support remote Runtime Clients (installed on a Windows Platform) over the Internet; but, the focus of this article is browser based Cloud Nodes as opposed to Runtime Clients.

Connection to the Internet requires two things:

- DNS server to resolve the domain name you are trying to access into the equivalent IP address, and
- Gateway where your network connects to the Internet.

A Gateway or a Router facilitates communication among hosts that are not on the same logical network (e.g. IP-subnet). The Router receives packets of data on an interface and uses a routing table (logical network locations) to route them to their destination.

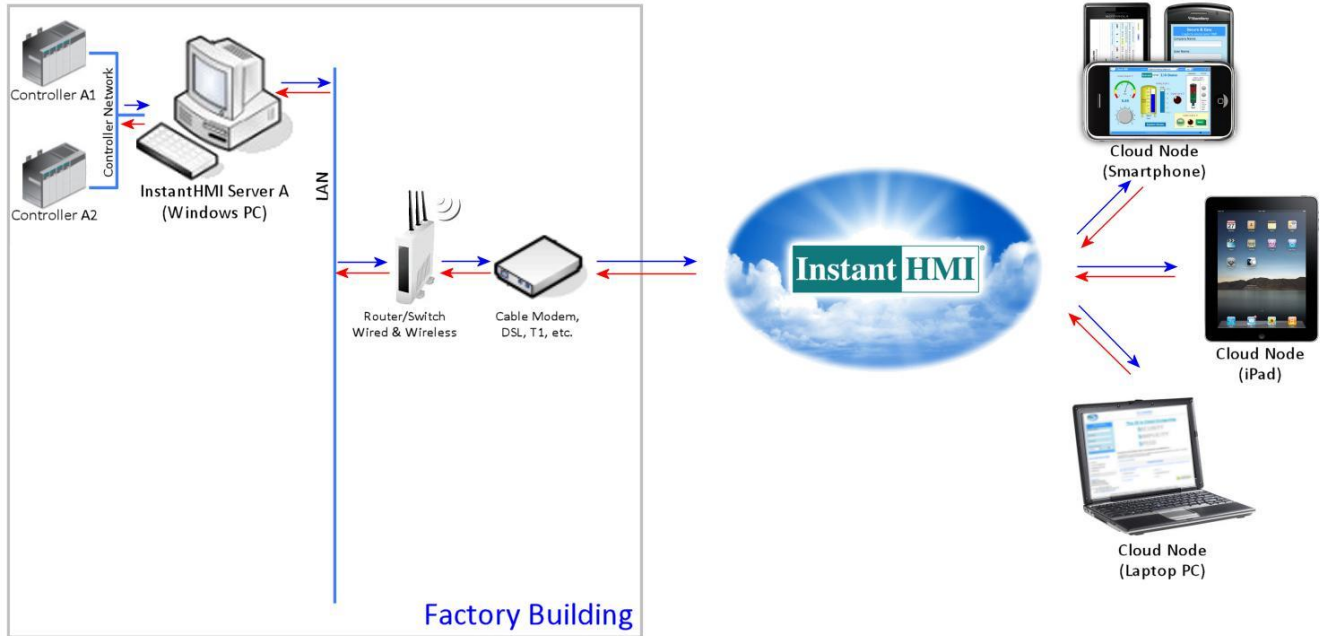


Figure: HMI Server Setup for Internet Access via HMI-Gateway from Cloud Nodes

Figure shows HMI Server A setup to be accessible from the Internet via the Cable Modem and Router path from the LAN. The function of a gateway can be performed by hardware, as in the case of Routers, or software.

'HMI-Gateway in the Cloud'

An example of a software gateway (Figure) is when you use HMI Services (Monitor, Alarm and Control) in order to share the Internet connection from your HMI Server A with multiple 'Cloud Nodes'. ('Cloud Node' means a suitable hardware platform running a standard web browser session, where the authorized user Logs in to access the HMI Services.) GoToMyHMI gateway not only relays information across networks, but it also performs the 'conversion of protocols' (i.e. HMI project screens and data to browser screen display and data). In addition, it also performs Node Access Translation in order to deliver the HMI packets to its destination (from/to HMI Server to/from Cloud Nodes). Such a Gateway provides multiple Cloud Nodes independent access to the HMI Server simultaneously.

Cloud Node vs. Client Node: Which one to choose?

A Cloud Node mimics your HMI-Server project screens (objects and tag values) in any device that has a standard browser. It allows you to monitor any screen objects, view and acknowledge Alarms, and allow control (entry of Discrete and Analog data values) through appropriate screen objects.

A Client Node is a Windows Platform (usually a PC) with a fully licensed HMI Runtime installed and running the same project as the HMI Server, but using the Server as the Data Source. It has the capability of running a project different from the Server's project (having screens different from the Server if desired) as it can acquire object tag information from controllers using the Server as a proxy to access such controller tags. A Client Node makes a direct connection over the Internet to the HMI Server for information exchange between Client and Server.

The Three S in 'HMI in the Cloud' Computing

Security:

When it comes to Security, it is obvious that the system is only as strong as the weakest link in the chain. Three factors that figure in most security considerations are:

- Authentication,
- Authorization and
- Auditing.

With Authentication one can be confident of both the identity of the sender and the integrity of the message. A certified secure site can be trusted as it is secured with a Web Server Certificate and all browser connections and transactions are protected with SSL (up to 256-bit Secure Sockets Layer encryption). When you access the web site using any standard browser (iPhone, iPad, BlackBerry, Smartphone, Tablets, Laptop PC etc.) your browser establishes a secure link, which is indicated in your browser session with a 'Lock' icon and the protocol https: in the pathname.

Authorization usually involves User name and Password. All remote browser access to your HMI servers (behind your firewall) is controlled by your policy. Your Admin can setup designated ports to access HMI-Server behind the firewall, as well as user access in accordance with company policy.

Auditing useful logged information on user access enables assigning responsibility for user actions. The goal is to have a 'HMI in the Cloud' that is secure enough for everyday use and easy enough for the user, while exhibiting acceptable performance and reliability characteristics.

Simplicity:

Ease of Use and intuitiveness of the user interface are essential for user acceptance. Building a complex fortress chock full of functionality is futile if user acceptance is lacking.

Establishing cloud access to HMI-Server is as easy as 1-2-3:

1. Install and develop HMI-Server in the traditional way.
2. Establish Cloud Service business arrangement with Cloud Vendor.
3. Setup user access security policy.

You are 'Ready to Go'. Use any standard browser on any device; no downloads, no tedious installs. Login and you have the HMI in your hands where you are: factory cafeteria, or parking lot, or on the beach, or even the golf course! Switch screens, view alarms and acknowledge them, even perform remote control data entry as permissible. You may even use a web camera to confirm that your actions took in the factory or the field using web-cam views.

Speed:

Get your HMI screens in the browser updated in seconds, typically 5 seconds. Control actions usually take place much faster (1 second) as can be verified by web-cam views. Of course, the speed depends on Internet connection speeds, latency and network traffic. Mobile Smartphones with expensive data plans or limited bandwidth may require slower update times (30 secs). Faster speeds may be possible with available 'Dedicated Server' option.

Receive Alarm notifications instantly by email wherever you are. Click on the link provided in email for your HMI screen alarm view. Take prompt action from where you are, without tedious side trips to assess the situation before taking action.

Because internet traffic and latency are not predictable, HMI in the Cloud should not be used in life-threatening or critical emergency applications.

Other Factors:

Bandwidth Requirements: High Speed Internet upload Bandwidth in the range of 5 Mbps are available from cable companies at reasonable cost. Download Bandwidths are much higher (22 Mbps). There is a tradeoff between bandwidth and speed. Faster the screen update speeds desired, higher the bandwidth required.

SLA: Service Level Agreements: SLA for availability and performance are available from ISP (Internet Service Providers). These can be as high as 99.9% with the remedy for failure to meet SLA being a refund of portions of the monthly charge.

Cost: HMI in the Cloud computing models are amenable to 'pay as you go' low subscription cost (per user, per month).

Conclusion

The Era of HMI Cloud Computing is here today, exemplified by GoToMyHMI – your 'HMI-Gateway in the Cloud'.

References

[1] Ronald L. Krutz and Russell Dean Vines, **Cloud Security**, A comprehensive Guide to Secure Cloud Computing, Wiley Publishing, Inc., Indianapolis, IN, 2010.

[2] Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, **Cloud Computing**, A Practical Approach, McGraw Hill, New York, NY, 2010.