

Embedding the Web in an Industrial Environment

Internet technology is bringing almost every kind of data and, increasingly, every kind of service directly to users through their web browsers. The rapidly increasing deployment of Ethernet in the industrial environment enables the use of this technology to monitor and control production processes and machinery from almost anywhere. Now, with the availability of low cost, embedded web servers, web-based management systems can be realised quickly and cost effectively.

Graphical user interfaces for monitoring and controlling factory production lines, industrial processes and other equipment, traditionally rely on vendor specific, dedicated systems. Today there is an increasing trend toward the use of “open systems” and particularly TCP/IP, web browser based systems for many monitoring and control applications. There are numerous advantages to using a web browser for such purposes including:

Ubiquity - any monitoring system which uses standard Internet protocols (IP/TCP/HTTP etc.) and therefore a standard browser user interface can be accessible not just on the factory floor or production office but anywhere on the corporate LAN and beyond, for instance local management and quality staff or engineering and maintenance staff on-call at home via the Internet and a VPN.

Platform Independence – web browser applications are available for just about any computing platform with a display from mobile phones and PDA’s to PCs, Macs and others. The implication here is that any control and monitoring system based on HTML can be implemented with almost no regard to the eventual user interface.

Minimal User Training – end users will already be familiar with the operation of their particular computing platform and web browser application, so if the web pages providing the interface to the plant or process are intuitively designed, in many cases no user training will be required at all.

Inherent Multi-User Capability – web servers are designed to serve web pages to any number of client (web browser) applications and therefore the same process information can be made available to multiple users simultaneously.

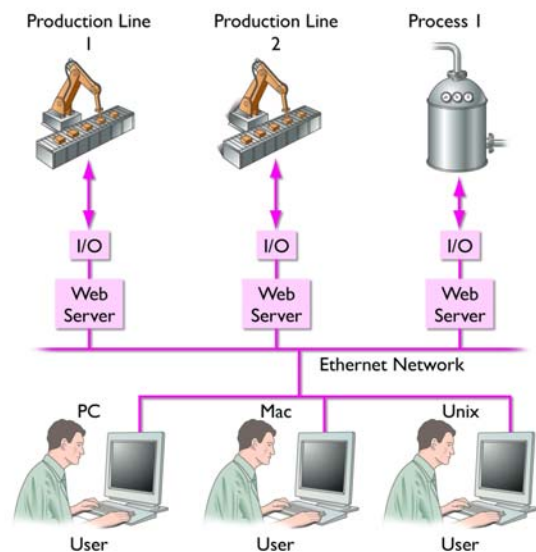
Leverages Existing Network Infrastructure – many organisations already have an extensive Ethernet based LAN infrastructure encompassing both administration and production areas. The benefits of using this existing infrastructure to implement a process monitoring and control system are obvious.

Simple Programming – a browser based monitoring system uses an HTML page to display or change process variables. A text based HTML page to display and change the data of interest can be very simply created in minutes by almost anyone who can use a word processor. At the other end of the scale, and depending on the expertise available, the same data can be displayed using sophisticated graphics and additional languages such as Java or JavaScript.

Distributed Web Servers.

Web based monitoring and control starts with a web server. For many, a web server brings to mind a rack-mounted computer sitting in an air-conditioned room. A new generation of web servers such as the 'PicoServ' from Compulogic will fit in the hand, draw a few milliamps and operate up to 70°C.

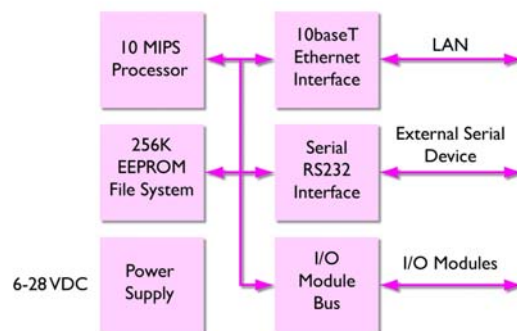
Such servers can therefore be placed virtually anywhere where they can be interfaced to the systems or equipment to be remotely accessed. The PicoServ technology is low cost allowing servers to be deployed at each point where remote access is required. This multi-server distributed architecture allows the building of simple and reliable remote access systems.



Distributed Web Server Architecture

Web Server Module.

The PicoServ web server module is a completely self-contained web server measuring 50mm x 70mm. It has an integral 10baseT Ethernet network interface and a 256K EEPROM based file system for storing almost any type of file including HTML, GIF, JPEG, JAVA etc. Two I/O interfaces are provided. An RS232 serial port for exchange of measurement and control data between the server module and external systems with serial data capability, and a PicoServ I/O module bus provides connectivity for PicoServ I/O modules. The web server module takes care of all the network interfacing and Internet protocols such as Ethernet, IP, TCP and HTTP.



PicoServ Server Block Diagram

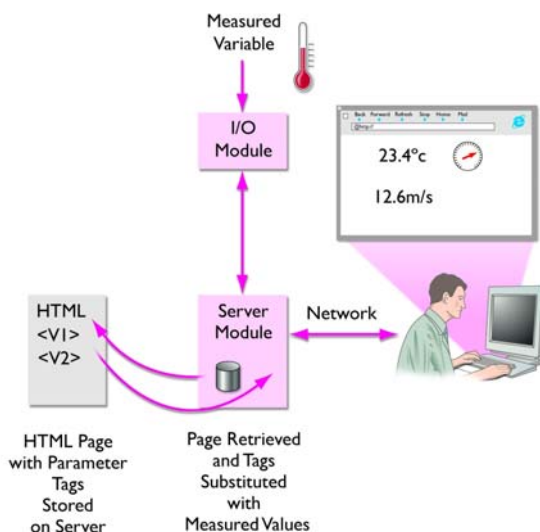
In addition to HTTP, the Simple Network Management Protocol (SNMP) is supported. SNMP is an Internet-standard protocol for managing devices on IP networks. Any PicoServ parameter can be read or updated using the SNMP protocol, including parameters from I/O modules and external systems. In this way the PicoServ system can be used as an “SNMP Proxy Agent” to enable the remote monitoring and control of devices not capable of supporting the SNMP protocol directly using an SNMP based network management system such as HP Open View.

Interfacing the Real World.

Many web servers simply store files which are served up when requested by a browser. Clearly in a remote monitoring and control environment a server must be able to provide real-time data to the user relating to the state of the process or system that is being monitored. Conversely in a control situation, a user must be able to send new data and commands to the system under management. The PicoServ system provides two ways to achieve this.

1. A serial interface running a protocol known as PicoServ Parameter Exchange Protocol (PPEP) can be used to exchange data and commands between the PicoServ server and an external system.
2. PicoServ I/O modules can be connected to the PicoServ I/O module bus. These modules can provide input and output ports for voltage measurements, sensors and transducers, digital I/O etc. The I/O modules have their own processor system and have additional built-in functions such as programmable alarms, time qualification and programmable measurement offsets.

Every input to the PicoServ system has a unique parameter ID. To display the value of variables connected to the PicoServ system all that is required is to create a simple web page (HTML) which contains a special “parameter Tag” at the point on the page where it is required to display the data.



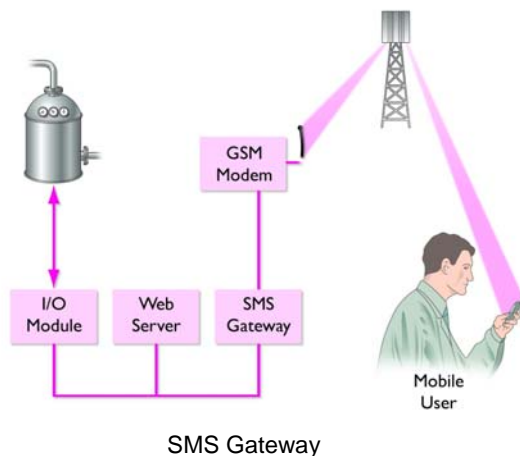
This page is then stored in the PicoServ file system and when requested by the user the page is retrieved and any parameter tags are substituted with the actual values read from their respective I/O module inputs before sending to the browser screen. Many parameter tags can be placed on a single page, allowing the simultaneous display of many parameters if required.

Dynamic Web Pages Display Real-time Data

The sending of commands or variable data to external systems is achieved using a similarly simple process. As for reading variable data, the unique parameter ID is used to send new values to the external system using the HTTP "GET" method. The GET method can send a new value to an external system as a result of typing a value into a form on an HTML page and clicking a submit button or by including the new value in a hyperlink. The link is then simply clicked to set a new fixed value, to turn something on or off, for example.

Beyond The Web

With the addition of an SMS gateway module any state or variable monitored by the PicoServ system can be read or updated from a GSM mobile phone. In addition the gateway can be configured to send an alert message based on some user defined criteria, for instance the closure of an alarm contact or a temperature threshold exceeded.



Alert messages can be sent to one, any, or all of 16 different GSM mobile numbers. Messages can be sent to a pre set group of numbers either all at once, sequentially at fixed time intervals or sequentially after a time interval if no acknowledge is received.

The increasing availability of web enabling technology such as the PicoServ system is allowing straightforward implementation of web based supervision and control systems. By leveraging existing network infrastructure and simple web pages, cost effective remote access to plant and machinery can be made available on almost any computing platform from within the corporate network and across the Internet or mobile networks.