



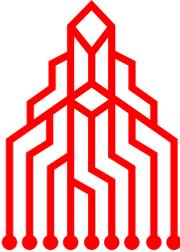
**Continental Automated Buildings Association**

# Information Series



**IS 2004-37**

**Connecting Devices with  
Web Services**



**CABA**  
[www.caba.org](http://www.caba.org)

# Connecting Devices with Web Services

Reprint Date: September 2004

This report was developed by Microsoft, and is published by CABA with permission from Microsoft. CABA expresses its appreciation Microsoft for making this report available to be included as part of CABA's INFORMATION SERIES.

Neither Microsoft, nor CABA, nor any other person acting on their behalf assumes any liability with respect to: the use of, or for damages resulting from the use of, any information, equipment, product, method or process disclosed in this report.

This full report and other INFORMATION SERIES reports appear on CABA's Web site "Members' Lounge": (<http://www.caba.org>), and are available to CABA Members. This information is also keyword searchable. Contact the CABA office if you do not have the passwords to access this material by email [caba@caba.org](mailto:caba@caba.org) or phone 1-888-798-CABA [2222]. CABA requests that its express written consent be obtained prior to the reproduction, in whole or in part, of any of its INFORMATION SERIES publications.

# Connecting Devices with Web Services

Published: May 3, 2004

## **The Integration Opportunity**

Digital devices are moving from the domain of the tech-savvy to the hands, purses and pockets, homes, and cars of mainstream consumers and knowledge workers. From cellular phones and personal digital assistants (PDAs) to gaming devices and wireless digital jukeboxes, these digital devices represent a key opportunity for hardware and software vendors. Although each device may provide access to information, the lack of high-fidelity connections among these devices limits the scenarios that the device and software manufacturers can bring to life.

To address the overall challenge of integrating systems and applications, the computing industry has converged on a set of standards-based protocols. Known as Web services, this collected set of protocols and standards provides a common method for programmatic interactions among applications, services and devices. Web services are revolutionizing how software interacts, without regard to how the applications were built or the platform on which they run. Bringing the benefits of Web service-based connectivity to the device space is a logical extension of the progress and promise that has been realized by the rest of the software industry.

Unlike many other approaches to integration, Web services connect devices simply by agreeing on message format, rather than forcing disparate devices to run identical software. Additional functionality for building secure, reliable, transacted Web services—are possible through a set of recently published specifications (SOAP messaging formats) known as the Advanced Web Services architecture.

## **Integrated Device Scenarios Using Web Services**

With both consumer- and business-focused scenarios, Web services promise to transform the way we interact with devices and the way devices interact with each other.

## **Network Device Install**

According to a survey conducted by Forrester Research in February 2004, consumers most frequently use home networks to:

- Share an Internet connection
- Send files to a network-accessible printer
- Share files between PCs

To date, home networking has used many of the same technologies and management tools that would be found in an enterprise. Home networks, however, are typically installed and maintained by non-professionals. In addition, home networks are subject to more transient or ad-hoc connections as devices come and go or are rearranged within the home. As such, providing a simple and consistent user experience is critical. Yet today, inconsistency often acts as a barrier. Consider the task of sharing a printer between two PCs on a home network. While plugging a printer directly into a single PC yields an expected result (automatic printer recognition by the PC), plugging in a network printer generally requires the user to manually discover the printer and subsequently install the required printer drivers.

Web services help bring an end to this unnecessary inconsistency. When a network device is connected (via wired or wireless network), the user will see no difference between installing the networked device and installing a device directly connected to the PC.

Consider a "connected consumer" who buys a new network-enabled printer and connects it to his home network. Upon connection, the printer, using a Web services message format known as WS-Discovery, can "announce" itself to other devices on the network, including nearby personal computers. A PC running on the Microsoft Windows® operating system may "hear" that message and could present the consumer with the familiar "Found new hardware" wizard and walk him through the installation of the printer.

Later, imagine that the consumer brings home a laptop from work and wants to connect it to his networked printer. WS-Discovery defines a mechanism for the laptop to simply send a message over the home network to look for other network-enabled devices meeting certain criteria. The laptop then connects to the devices without requiring the consumer to engage in a complex configuration. Finally, using Web services, the consumer's printer could communicate back to the laptop in a rich and meaningful way using a proposed specification known as WS-Eventing. Today, users are only alerted to the fact that a job has been sent to the printer. Using Web services, printers can send true end-of-job and other useful messages back to the PC.

Printing is a basic yet vitally important user experience. It is one of the few computing scenarios that nearly every individual and business participates in on a regular basis. Web services add a new dimension to printing, delivering greater ease of use and improved dependability to the end user.

### **Networked Picture Frame**

With more than 25 billion digital photos taken in 2003, digital cameras represent one of the fastest growing segments of the device market. While the number of digital photographs taken annually is expected to double by 2005, many of these are simply stored away on hard drives and are rarely seen again. To help people get more use out of their digital photos, hardware vendors recently introduced digital picture frames to the market. These high resolution photorealistic screens with built-in wireless capabilities provide consumers with a quick and easy way to view and display digital photos.

Yet the challenge of integration remains. Pictures targeted for the digital frame may not always be located on the same device. They might be located on a camera, spread across multiple PCs, a personal video recorder, or a gaming system. They may even reside somewhere on the Internet. Again, Web services offer a consistent mechanism for accessing photos, regardless of their location. In this scenario, the connected consumer has just hung a new digital picture frame in her home. She has set up a secured wireless connection between the

frame and her wireless network. Now the picture frame can send a WS-Discovery "Hello" message to the network alerting other devices that a picture frame is available. It can also ask the other devices on the network to respond if they are a Web service that serves up digital photos.

With this relatively simple device-based interaction, the consumer's picture frame can display images from any of the digital photo Web services on her network. The picture frame could use a well known Web service called UDDI (Universal Description, Discovery, and Integration), which acts as a directory for Web services, to find photo services on the Internet. In this way, the consumer's digital picture frame could display images from services to which she subscribes, and potentially even services exposed by her friends and family.

Web services can facilitate the sharing of digital image content on a home network and open up opportunities for the picture frame vendor to connect to multiple services using a consistent, standards-based mechanism.

### **Supply Chain Infrastructure**

From the cotton gin to the robotic arm, technology continues to drive the supply chain. Today's successful businesses use technology to make informed decisions faster, connect virtually across the supply chain, and deliver on ever-changing customer requirements. They recognize the need for industrial assets on the factory floor to integrate with one another and across other areas of the supply chain.

Consider a computer parts manufacturer. On the production plant factory floor, constellations of resource-constrained devices work in concert to construct and monitor production. In this environment, efficiency and safety are top priorities. To address these needs, a complex array of checks and balances exist to monitor and regulate the production process. This information should be readily available to plant managers who need frequent updates on production output regardless of where they're located (inside or outside the plant). In addition, the process monitoring and control devices should be intelligent enough to alert each other to problems that exist in the production process.

Using Web services, these devices will have the ability to send alerts to the PCs of managers in the production plant office as well as to those in the field. More importantly, the Web service-enabled plant floor devices will be able to communicate with one another, regardless of the devices' underlying operating systems. For example, if output falls below a specified level or device temperature exceeds a given threshold, WS-Eventing can be used to send an alert to the plant floor manager or temporarily suspend production until the problem is addressed. Managers can access this real time data and stay informed to make better decisions. Information can be stored in a central database where it can be mined for possible process improvements possibilities. Even if the existing infrastructure is heterogeneous or the organization merges with another company with different underlying infrastructure, the standards-based nature of Web services enables seamless interoperability across the enterprise.

Because Web services eliminate the need to design complex proprietary interfaces between disparate enterprise systems, the addition of Web services to supply chain devices has the potential to improve the overall product development processes, reduce implementation time, and keep supply chain management abreast of the production process with real-time data updates.

### **Smart Alarm Clock**

For decades, the alarm clock has served a simple but vitally important purpose: make noise on a set schedule. Like the networked printer, the alarm clock represents a relatively simple device that stands to benefit from the convergence of devices and Web services. For the connected consumer, being able to easily access his calendar, contacts and tasks as well as weather and traffic information on his alarm clock could transform this device into a valuable tool for helping him manage his day-to-day activities.

Imagine that the consumer has just purchased a Web service-enabled "smart" alarm clock. Using WS-Discovery, the alarm clock automatically connects to the

home network in order to interact with other network-connected devices and information sources. Using a PC-based helper application, the consumer configures the alarm clock.

Once configured, the consumer can easily enter the address of his company's calendar Web service. He can indicate the route he takes to work. He can set different default wakeup times for weekdays and weekends. He can also choose to connect to sources of syndicated content, including news feeds, traffic alerts and blogs. That night, before turning in, the consumer can see the times of his morning meetings and decide when he needs to wake up.

Early the following morning, unusually high traffic volume is reported on the highway the consumer takes to work. Because his smart alarm clock subscribes to a local traffic alerting service, WS-Eventing is used to send a message to the alarm clock. As a result, the clock adjusts to wake the consumer up 15 minutes earlier than normal in order to get to work on time.

Upon awakening, the consumer can see the weather and traffic conditions, the time of her first meeting, how many items are in his inbox, and more. He can awaken to his custom play lists, his favorite radio station, or even use text-to-speech technology to hear his favorite RSS feeds. The once simple device now plays an active role in helping the connected consumer manage her life.

### **Opportunities for Developers and Hardware Vendors**

In recent years, Web services have been the cornerstone to overcoming the challenge of software and business integration. With their standards-based foundation and broad industry support, Web services provide a consistent way to exchange information within home networks, corporate intranets and across the Internet, spanning heterogeneous environments. Now, as devices continue to pervade homes and businesses and as customers demand integration among disparate device-based systems, Web services will enable devices to work together in ways never before possible.

Microsoft sees the device space as the next major channel for Web service-based connectivity. We are dedicated to providing device integration through Web services in future versions of our operating system, our device hardware, and in our developer tools.

For more information on Web services for devices, read:

- 1) Devices Profile for Web Services Introduction - <http://msdn.microsoft.com/webservices/default.aspx?pull=/library/en-us/dnwebsrv/html/deviceprofile-techoverview.asp>
- 2) [Device Profile for Web services](#), a proposed specification by Microsoft and leading industry hardware vendors for the UPnP 2.0 architecture.