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## Communicating Machines Are Triggering an Embedded Revolution

Embedded devices are getting the ability to autonomously exchange information via low-cost communication links. Machine-to-machine communication lets developers combine them in large, even vast, systems whose functionality is greater than the sum of its parts.

By Bob Burckle and Steve Pazol, WinSystems and nPhase

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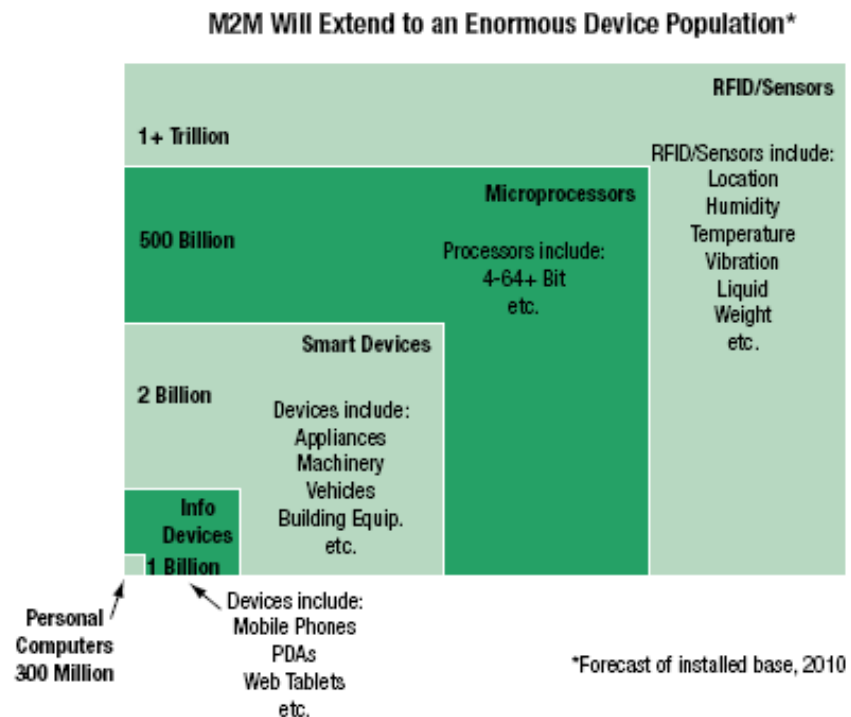
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**THALES**

The introduction of the Internet has changed the way we communicate and run our businesses, with the count of people using it totaling over one billion strong. Yet a similar, but significantly larger, revolution is poised to take place in embedded computing with the advent of machine-to-machine (M2M) communications. This linkage of machines has enormous market potential and holds the promise of dramatically altering and expanding the landscape of embedded computing.

At its heart, M2M simply involves devices that can communicate over a network. These wired or wireless communications can be quite simple, offering only the ability to send and receive data and simple command-and-control parameters over the network. The specific network protocol or means of connecting to the network are not what's important. The key ingredient is the ability of a device to become part of something larger, resulting in enhanced information flow in numerous environments and markets. Market research estimates put the potential for such applications at well over a trillion devices by 2010 (Figure 1).



**Figure 1** By 2010, machine-to-machine (M2M) communications could extend to a device population well over a trillion, according to estimates from The Focal Point Group ([www.fpgroup.com](http://www.fpgroup.com)).

In some ways, M2M resembles traditional industrial control. Both involve communications among machines. But traditional industrial control networks, such as supervisory control and data acquisition (SCADA), have more restrictive requirements than M2M. Industrial control networks require reliable, real-time communications in order to fulfill their purposes. Individual SCADA devices depend on signals from the network in order to perform their functions properly, and they must receive information in a timely fashion. In many cases, these networks also require a human operator to process data, make control decisions and issue commands.

M2M networks have no such restrictions. The primary purpose of M2M networks is not necessarily to control a process, but rather to simply gather and pass along data to a central server. As a result, M2M devices tend to be relatively autonomous, performing their functions with little or no input from outside sources. This allows the networks used to be tolerant of delays and even failures in communications. In turn, easing the restrictions gives M2M networks wider range. Devices can be scattered across a large area—even worldwide—because they do not depend on time-critical information from the network. Although commands and parameter updates may come across the network, either from a human or a central server, the function of an M2M device does not depend on such communications.

### Low Cost Driving M2M

The rising interest in M2M systems has several drivers. One is the declining cost and increasing performance of processors. Many devices that might have once used hard-wired logic to provide a low-cost implementation can now be run as software on an embedded processor for the same cost, with the benefit of increased design flexibility.

Another factor driving interest in M2M is the success of standards for robust and versatile communications channels. Networks such as Ethernet and protocols such as TCP/IP have permeated the industry, leading to high-volume production and thus lowering the implementation cost of hardware and software. The success has also ensured widespread design expertise, easing system development.

The growth in wireless systems has also spurred the development of M2M applications. While an M2M system does not have to involve wireless communications, freedom from wires provides design flexibility that greatly increases the scope of potential applications. As with the networks and protocols, the success of wireless systems has lowered the cost of hardware implementation through high-volume production. Wireless transceiver modules are available for numerous standards, including Bluetooth, WiFi, cell phone and satellite communications (Figure 2).



**Figure 2** A representative M2M module for mobile, industrial applications, such as this WinSystems PCM-GPS, includes either a CDMA or GSM cell modem for communications and a GPS receiver for determining location.

The common thread in all of this is lowered cost. Many potential M2M applications provide value in proportion to the number of devices on the network. Automated wireless gas meter reading, for example, benefits the gas company by increasing the efficiency of meter readers and thereby reducing operating costs. The more meters the gas company automates, the greater the savings. A low per-unit implementation cost helps quickly amortize the investment needed to first establish the network.

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