

Computers' *Lingua Franca*

Bluetooth is emerging as the universal language of computer peripherals, says S.Ananthanarayanan.

As devices like wireless mice, headphones, cell phones or even other computers, that need to talk with one another, multiply, not having a common communications standard is coming in the way of connecting together the devices, or even of being able to use some of them at all.

Tower of Babel

In the Biblical story, people were building a tower that would link the earth to Heaven. The Gods were frightened at how well the work was going on despite every obstacle that the Gods sent down! Finally, they sent down different languages – and that was the end of the project. Are computer peripherals being similarly affected by different communications specifications?

Computer devices are notoriously finicky about data and signals that they use having to be *just so*. The slightest change in the order of the electrical pulses that they use, or even their duration, and the device concerned is rendered lifeless – isolated and incommunicado. Pairs of devices that need to talk first need to agree on how they connect – by wires or wireless. If by wires, then how many wires – 2, 8 or 25? What signal will pass on each wire and how will it be read? What will be the frequency and how will a device tell apart the signals from different devices?

Each device, then, comes with a 'driver' which helps match the way it uses signals with other devices. And sometimes a pair of devices does not find a common interface.

Bluetooth

This is a form of radio signaling that engineers in Europe decided to agree upon for all computer devices. In whatever way the internals of a device may work, it would hear and speak with others through radio signals at a particular frequency (2.45 billion cycles a second, or 2.45 gigahertz). Bluetooth also specified how the 'bits' in the signals would be spaced and how errors in communication would be detected and corrected.

Bluetooth then eliminates the need to agree on wiring conventions and in fact eliminates the use of wires. Unlike Infra-red, which did the same thing, Bluetooth does not need 'line of sight' communication and can pass through walls, within its range of 10 metres.

Bluetooth devices contain tiny (inexpensive) radio modules and they are ready to talk with other Bluetooth devices as soon as they are switched on. Bluetooth devices in range

find and introduce themselves as soon as they come on and follow rules so that their signals can be told apart.

No cross-talk

Bluetooth devices divide the range of frequencies set apart for them into 79 separate frequencies. Each pair of devices then randomly changes from one frequency to another, in a random order that they agree upon. In Bluetooth, this change of frequency happens 1600 times a second! The result is that cases of signals for one set of devices being confused with those for another are rare and short-lived.

As soon as devices are switched on or come within range, they talk to all other devices to check whether they have data to share. Once devices make contact, they form a *personal-area-network(PAN)* in which the members randomly 'hop frequencies' in unison.

A device leaves the PAN as soon as it goes out of range, but gains entry again as soon as it re-enters. The low power (milli watt) and frequency hopping also eliminate interference with devices like automatic garage door openers and some cordless phones, which use the same range of frequencies.

Why Bluetooth?

Communications companies in the Baltic region, Denmark, Norway, Sweden and Finland are important players in the industry and the development of the new standard for computer peripherals. The name 'Bluetooth' is after *Harald Bluetooth*, who ruled Denmark in the 10th century AD and was one of the earliest to think of unification, when he united Norway and Denmark into a single kingdom.
