New Software Changes Wireless Technology Functions on Demand

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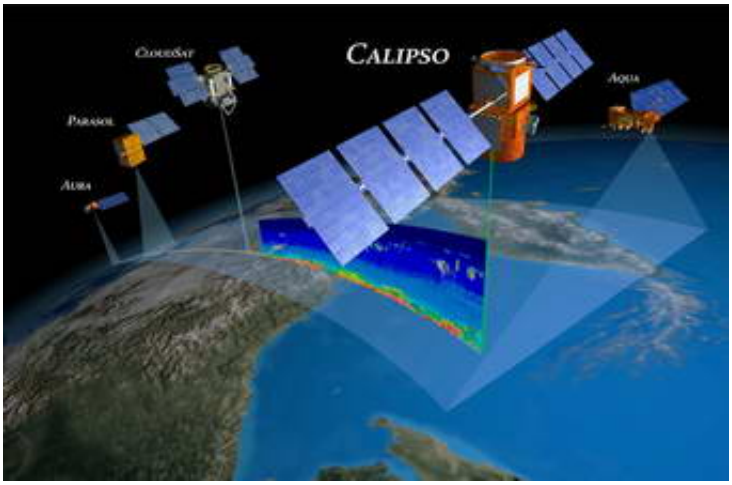

Taking wireless technology to the next level, NASA is leading the way in the field of Software Defined Radio, or SDR, a wireless technology that gives an electronic device the ability to quickly and easily perform new functions on demand.

Image: A group of satellites could efficiently communicate directly with SDR, rather than using ground stations and uplinks. The A-train, shown here, is a constellation of 5 satellites that will collect complimentary data, and is an example of a network that would benefit from SDR technology. CALIPSO and CloudSat, the constellation's two newest members, will launch later this summer. Click on image to enlarge. Image credit: NASA

Imagine an electronic gadget, like your cell phone, evolving into the next generation of communication devices through the use of radio technology. From the prospect of downloading software to adapt a cell phone into a video camera or MP3 player, to the idea that satellites could interact and share data directly by configuring themselves, the possibilities for SDR are without bound.

Researchers at NASA's Goddard Space Flight Center in Greenbelt, Md., are so enthusiastic about SDR that they have recently built an SDR test-bed — providing the necessary foundation for investigating SDR technologies and techniques. This test-bed allows for the rapid, low-cost development of communication and navigation algorithms that will be used in upcoming technology experiments, and eventually, in missions.

Software Defined Radio is a relatively new wireless technology based on the familiar radio technology that has been used for many years. Traditional Earth-based radio technology involves the transmission of a signal, typically “analog” speech or music, as electromagnetic waves using a single purpose radio transmitter. The electromagnetic waves travel through the air until they encounter a radio receiver that has been tuned to receive the right frequency. This receiver processes the signal and sends the result to a speaker. You then hear whatever was broadcast from the radio station. In SDR, the transmitter modulation is produced by a digital signal processor (a form of computer) to produce digital signals, the signals are then converted to “analog” and sent to the transmitter’s antenna. The receiver uses a computer to recover the signal intelligence.

"For NASA, SDR applies to the transmission of data, rather than sound," said Jason Soloff, an SDR technologist. However, Soloff adds that you may be most familiar with the sound-related commercial applications of SDR. "When you are in your car, and you use your MP3 player to receive an FM signal digitally, you are using SDR-like technology. Or,

when you travel from an area with an analog cell phone signal to a digital signal, and your phone switches automatically, your phone is acting as a software defined or reconfigurable radio."

With SDR, manufacturers could install a generic radio chip into electronic devices and later “educate” them to perform functions quite different than their original job through a simple software download.

Similarly, engineers could reconfigure future SDR-enabled NASA missions at will, allowing formerly independent satellites to be linked and give a more complete picture of a unique scientific event. In other applications, two satellites could interact and share information, or an older satellite could be updated with a new function and mission, extending its life and usefulness.

"Many of our current satellites were developed with a fixed set of data rates and modulations, so they can only talk to the ground or the space network," said Soloff. "SDR would allow us to switch between a ground network and a space network with simple uploads, making the satellite or instrument much more flexible."

One of the main goals of Goddard’s SDR testbed is to allow NASA to work with industry to seed new SDR technologies. Another is to create partnerships with others working on SDR.

"The first true SDR components should make spaceflights within the next 3 to 5 years," said Soloff — around the same time experts believe that everyday devices could start becoming SDR-enabled.

Source: NASA's Langley Research Center (by Katie Lorentz)