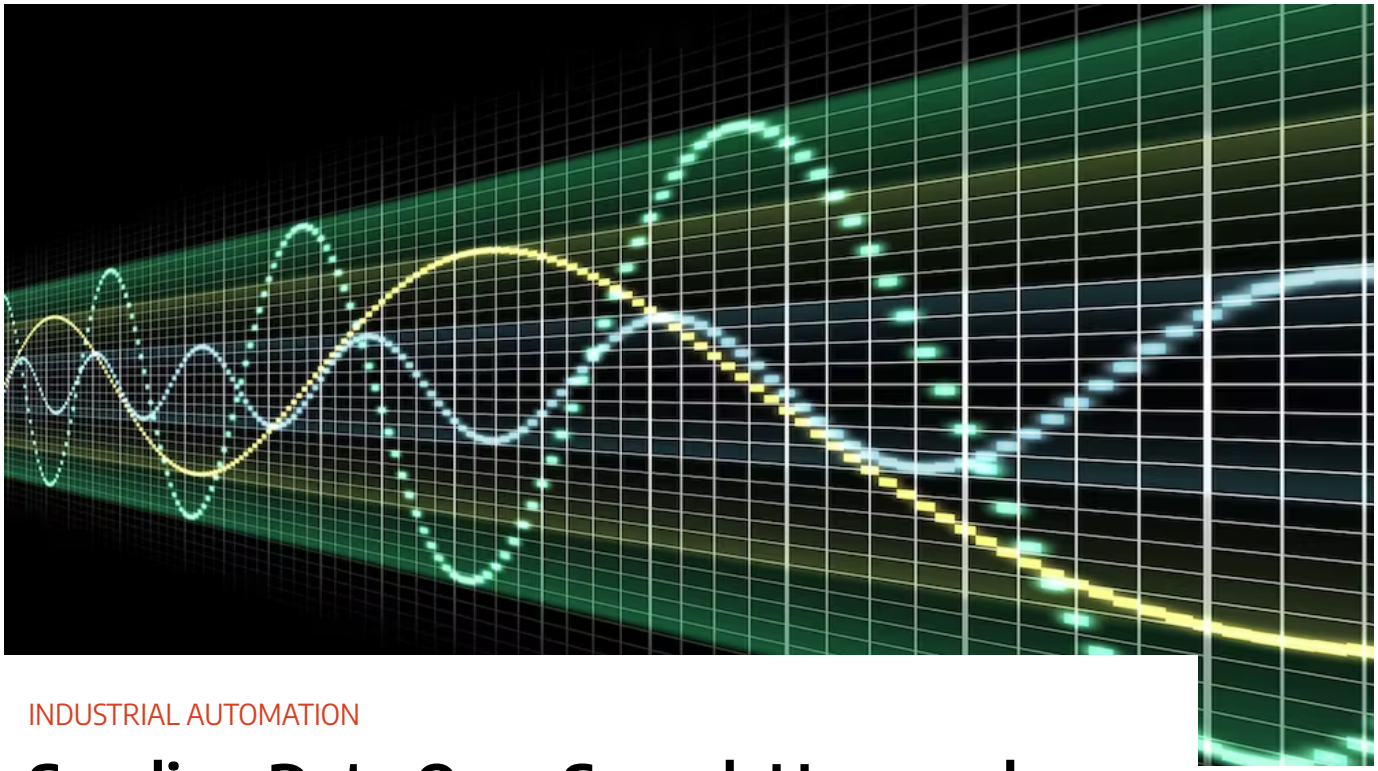

INDUSTRIAL AUTOMATION

Sending Data Over Sound: How and Why?

June 24, 2019

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Demand grows for better IoT connectivity, with the need for the most basic of smart devices to be able to process real-time audio and perform intelligent DSP. One emerging solution is sending data-over-sound.

James Nesfield

From smartphones and tablets, to industrial equipment and smart-home appliances, hundreds of thousands of smart devices now require different forms of connectivity. The inevitable demand for better connectivity in the IoT era has increased the expectations for even the most basic smart devices to have the capability to process real-time audio and perform intelligent digital signal processing (DSP) on the network's entry point device.

This has ultimately paved the way for a host of innovative market entrants, looking to both challenge and work in tandem with traditional solutions to provide quality data-transmission capabilities.

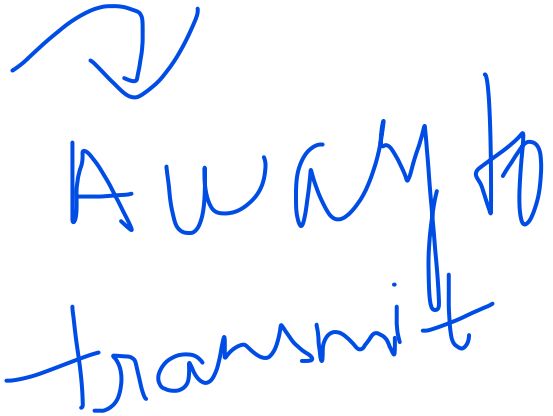
Data-over-sound is one technology that's now rapidly emerging as an exciting connectivity option for engineers and developers looking to achieve frictionless interactions between an ever-growing number of connected devices. But how exactly does data-over-sound work? And where does its true value lie in an

increasingly connected world?

How Does it Work?

In short, data-over-sound enables the exchange of data between any devices with a pre-existing loudspeaker or microphone through sound waves. Delivered through machine-to-machine communications software, the technology works like an audio QR code, sending data over an acoustic channel to enhance end-user experiences and add value to existing hardware.

In practice, data is encoded into an acoustic signal—a series of audible or inaudible pitches and tones to form a kind of “sonic barcode.” This is then played into a space (usually air, but could be VoIP stream or wired telephone lines) and received and demodulated by a "listening" device. Data is subsequently decoded by the receiving device, or group of devices, and returns the original data.



By using a range of audio frequencies, programmers can fit more information into less audio. To filter out noise, developers carefully select frequencies and tune their software so that their applications can speak to each other to detect and decode data signals in noisy environments, like a busy train platform or concert venue.

Its potential as a form of frictionless, low-power connectivity, when applied to

various areas within the IoT, audio, and voice landscapes, is coming to the forefront in a growing number of use cases. So much so that it's increasingly

establishing itself as an integral tool for seamless ultrasonic data transfer in both an industrial and hobbyist developer setting.

Why Sound?

There are very clear and practical affordances of data over sound. From its seamless integration into existing hardware and frictionless connections, to its ability to work offline in even the most extreme environments, there's myriad potential use cases for data-over-sound.

Data-over-sound has a multitude of complementary capabilities when compared to other connectivity technologies. The technology's position as a pairing-free, one-to-many medium means it mitigates some of the setup and provisioning pain points often associated with traditional alternatives such as Bluetooth and Wi-Fi, presenting an appealing and versatile solution for frictionless data transmission. In general, compared to other technologies, data-over-sound is also able to be used in very wide application areas, taking advantage of existing hardware and without prior setup or configuration

without increasing hardware costs. This ability to enhance existing

infrastructure has inevitably captured the interest of companies interested in adding wireless connectivity functionality without adding to their bill of materials.

The future for seamlessly connected devices lies in utilizing a broad range of connectivity solutions, including data-over-sound, where each technology complements the others in the suite. Working in conjunction with other solutions, data-over-sound exists as an essential component of fulfilling the promise of ubiquitous, frictionless connectivity.

The Benefits of Sending Data over Sound

Embedding and extracting meaning from sound provides a quick, secure, and cost-effective solution that works completely offline. Inevitably, there's no "one-size-fits-all" data-transfer solution that will be optimal in all environments and purposes. Yet, in many situations, data-over-sound is now emerging as an ideal medium for simple implementation and reliable connectivity. Some of the most clear affordances of sound include:

Works offline: Sound works peer-to-peer, or one-to-many, meaning no

Works offline: Sound works peer-to-peer, or one-to-many, meaning no additional connections are needed to "the cloud" or other network services.

Thus, data-over-sound software works well in a situation where there's no network access, like rural or RF-restricted areas.

Utilize existing hardware:The rise of microphones in IoT devices means that the hardware requirements are already met for billions of existing devices of all form factors. Combined with the arrival of zero-power microphones, data-over-sound provides an extremely low power, "always connected," device-to-device data-transfer solution. Eliminating the need for additional hardware saves users both money and resources that can be invested back into the business.

Secure, private data transfer: Because acoustic connection doesn't require an internet connection and supports industry-standard cryptography, you'll have peace of mind that any data transferred will not be compromised. No audio, not even audio metadata, is ever stored or sent from a receiving device for processing.

Supports range of platforms: Data-over-sound is compatible with machines and devices of different platforms, form factors, and architectures that

can process audio. From smartphones and tablets to toys and games, and even legacy and analog equipment, any device with a microphone and speaker can receive and decode data with the technology.

Seamless integration: Often implementing new software can be resource- and time-intensive. However, data-over-sound can be delivered through software-development kits (SDKs), which provides a fast and easy integration to a host of platform types, making the solution ideal for hobbyist developers and IoT projects.

Scalable: With data-over-sound, there's no need to reengineer as your application grows. Whether the aim is to enable seamless P2P exchanges or send data from one-to-many, this method of data transfer is completely scalable. Use cases for data-over-sound are therefore wide ranging. They can include IoT devices sending and receiving commands, secure transactions, and un-spoofable receipts to merchants or buyers, as well as sending/receiving credentials (to provision Wi-Fi, for example).

Works in extreme environments: Through a range of frequencies, data-over-sound software is robust to background noise and has been proven to work seamlessly in the most extreme environments. From the streets of Delhi to nuclear power stations, acoustic network connectivity remains universally strong in the toughest environments.

Like every other industry, the world of data and connectivity is becoming increasingly intricate, as new devices emerge and businesses look for new ways to communicate effectively. Data-over-sound is now putting a spotlight on the huge potential of audio as a true medium for fast and secure data transfer. And it can work in collaboration with other technologies to deliver ubiquitous interactions between devices for all purposes and environments.

James Nesfield is CEO of Chirp.

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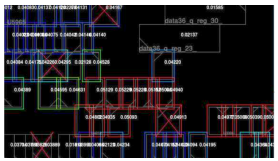

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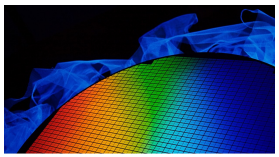

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