Emerging Trends in Mobile Communications

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1 Acoustic data transmission

> I tried to discover, in the rumor of forests and waves, words that other men could not hear, and I pricked up my ears to listen to the revelation of their harmony.
>
> Flaubert, (*November*)

1.1 Introduction

The rise of IoT devices in the home and workplace has created a world where data and connectivity are becoming increasingly complex. Lucero, (*IoT platforms: enabling the Internet of Things*) predicts a staggering 75 billion connected devices by 2025, up from 26 billion in 2019, as shown in Figure 1. As IoT technology advances and the demand for efficient ways of communicating data between these devices grows, the world has witnessed a rise in emerging new data transmission technologies which are looking to provide secure and effective solutions for sharing information. One solution rising to meet these new demands is data-over-sound.

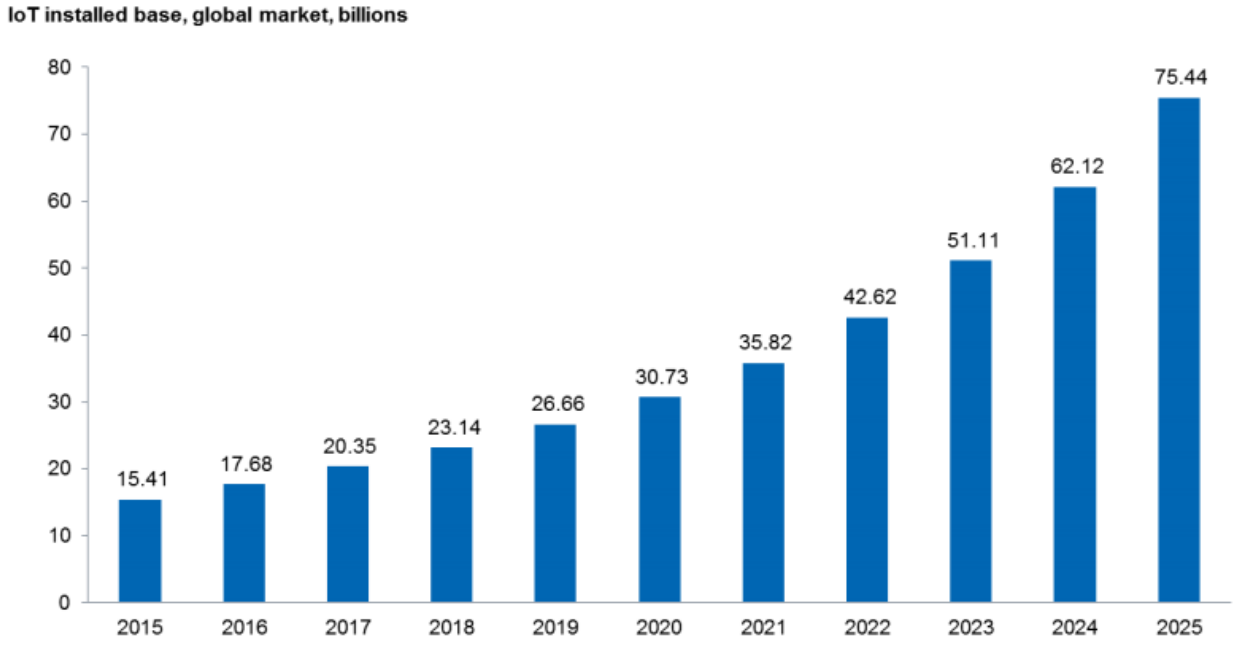

Figure 1: Number of IOT devices that will be installed worldwide from 2019 to 2025 (in billions).

Data-over-sound (DoS) presents a compelling solution for many device-to-device connectivity applications, particularly for use cases that require frictionless, low cost connectivity with nearby devices. DoS harnesses devices existing speakers and microphones to send and receive data over an acoustic channel. Because it doesnt require any additional networking hardware, DoS has captured the interest of companies interested in adding wireless connectivity functionality to existing devices. Some big names such as Google and Cisco already have point-product DoS integrations

There are a number of connectivity technologies available in the market today, including extremely short range (NFC and QR); short range, high bandwidth (Bluetooth and Wi-Fi). Each technology has its advantages which makes it more or less suitable for certain applications. An overview of these considerations are given in Table 1.

	DoS	QR	NFC	Bluetooth	Wi-Fi	Li-Fi
Two-way communication	1	0	0	1	1	1
One-to-many broadcast	1	0	0	0	0	1
Non line-of-sight communication	1	0	0	1	1	0
Zero pairing/set-up procedure	1	1	1	0	0	0
Low power operation	1	1	1	1	0	0
max data rate	1 kb/s	3 kb	424 kb/s	25 mb/s	70 mb/s	1 gb/s
max range	100m	10:1	20/cm	100/cm	50m	10m

Table 1: Feature comparison for DoS vs alternative technologies

1.2 Advantages of Data-over-Sound

According to Table 1 following advantages can be listed.

Device interoperability The simple hardware requirement of a speaker and/ or microphone make data-over-sound arguably the most wide-reaching wireless communication technology in terms of device compatibility. Mobile phones, voice controlled devices, and any device with an alarm speaker are able to communicate using data-over-sound. This includes many legacy devices. Data can also be transmitted over media channels such as radio and TV, and over existing telephone lines.

Frictionless UX Data-over-sound requires no pairing or configuration, making data transfer as simple as pressing a button.

Physically Bounded Because sound waves respect room boundaries, particularly in the near-ultrasonic range commonly used in data-over-sound, transmissions do not pass between neighbouring rooms. This means that it can be used for detecting the presence of a device with room-level granularity.

Zero power The advent of wake-on-sound MEMs microphones such as the Vesper VM1010 enables devices to communicate using data-over-sound, whilst draining virtually no battery power in between communications (< 10 A).

References

Flaubert, Gustave. *November*. Gustave Flaubert, 2005.

Lucero, Sam. *IoT platforms: enabling the Internet of Things*. Tech. rep. ihs, Mar. 2016. URL: `https://cdn.ihs.com/www/pdf/enabling-IOT.pdf`.

2 test

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