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Venice: eschewing the cloud by leveraging local communication channels

(or why you don't need the cloud)

R. Raes, A. Luxey-Bitri, R. Rouvoy, D. Frey & F. Taïani

Project members



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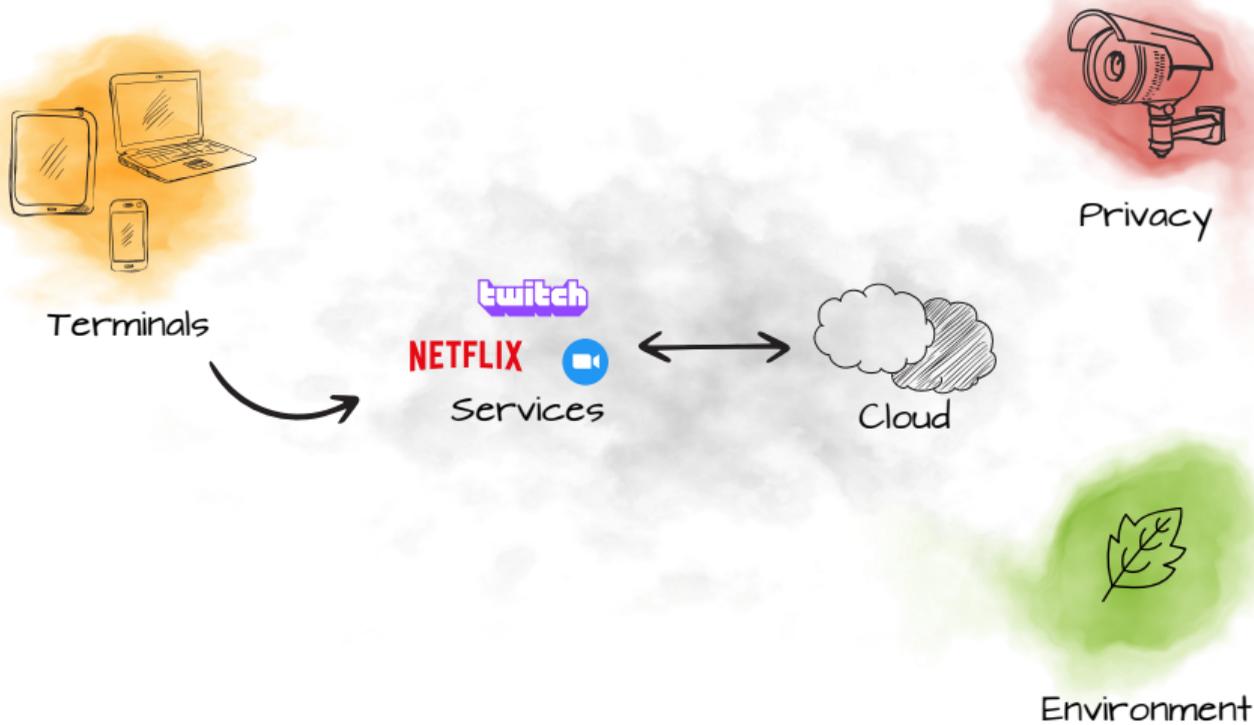


François TAÏANI
Univ. Rennes
Inria / IRISA

01

Context

Cloud is used everywhere



- **Vicinity** (physical proximity)
- **Applications**
 - > Photos exchange
 - > Video streaming
- **Device-to-device (D2D) communications**
 - > Security guarantees
 - > Privacy protection
 - > Environmental friendliness

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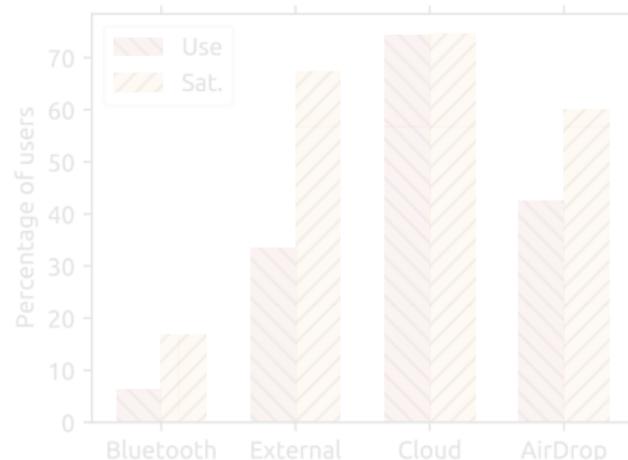
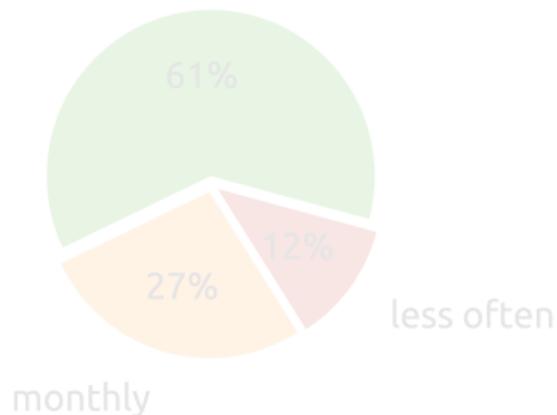
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02

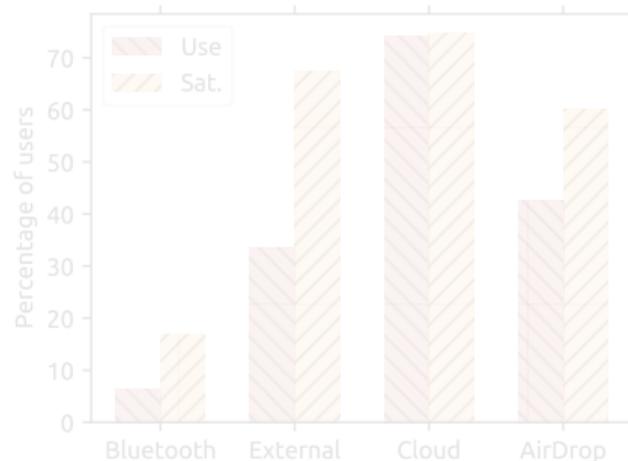
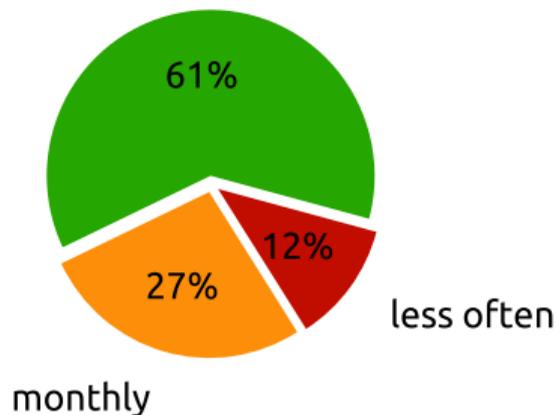
Current state

weekly or more



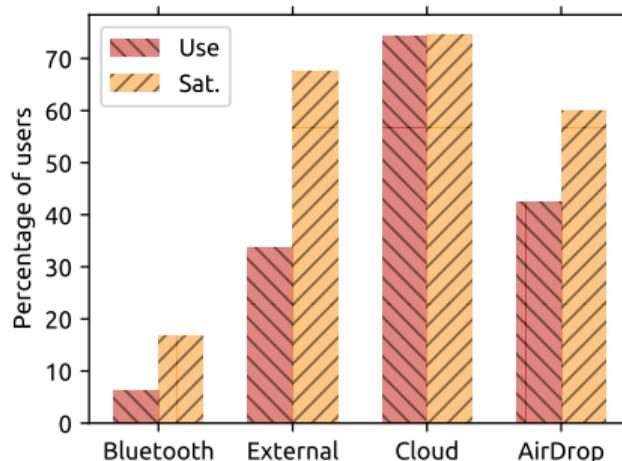
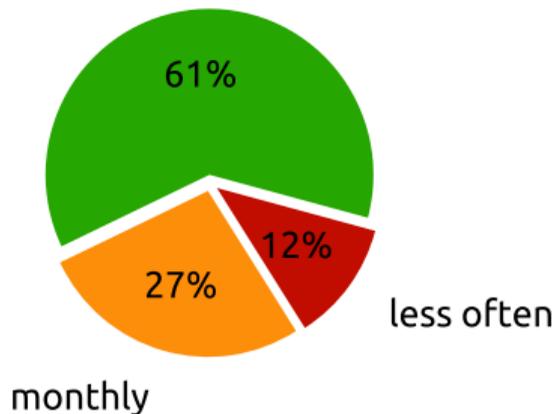
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Name	Specification date	Device discovery *	Maximum distance **	Maximum data rate	Frequency
Optical					
Infrared (IrDA)	1994 [1]	Manual	Several meters	16 Mb/s	0.3-430 THz
QRCode-flashing	—	Manual	Around a meter	23.6 kb/picture	440-790 THz
Wi-Fi					
802.11 (legacy)	1997 [2]	Automatic	100 m	1-2 Mb/s	2.4 GHz
802.11ax (Wi-Fi 6E)	2021 [3]	Automatic	100 m	1.2 Gb/s	1-7.125 GHz
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Bluetooth					
Bluetooth Core v1	1999 [5]	Automatic	100 m	1 Mb/s	2.4 GHz
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RFID					
NFC	2004 [8]	Manual	20 cm	106-424 kb/s	13.56 MHz
Ultra-WideBand					
UWB	2007 [9, 10]	Automatic	200 m	27 Mb/s	3.1-10.6 GHz

* Some channels require *manual* human supervision to be used, whereas some others *automatically* discover peers in the vicinity.

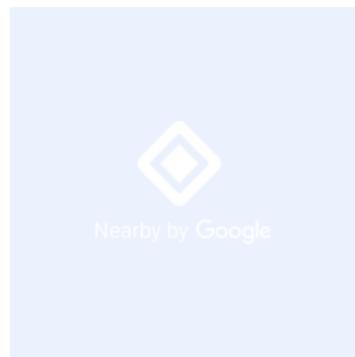
** The range of a radio signal depends on its frequency (which drives signal attenuation) and on the antenna's power and type (directional or omni-directional), not on its underlying standard [11]. The maximum distances presented here refer to typical user equipment.

- **AirDrop**

- > Hidden implementation details
- > Not compatible with devices outside of the Apple ecosystem
- > Vulnerable to MiTM, DoS & privacy attacks [12]

- **Google Nearby Connections**

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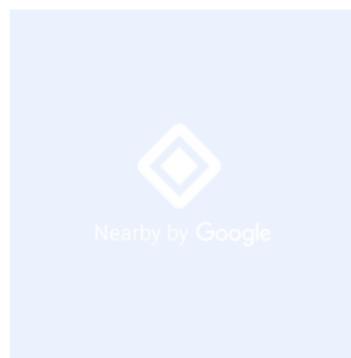


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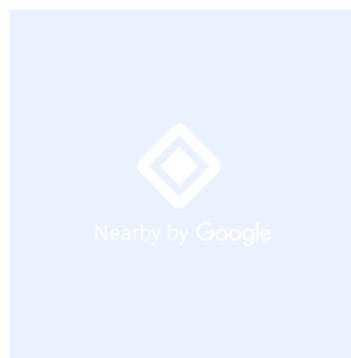


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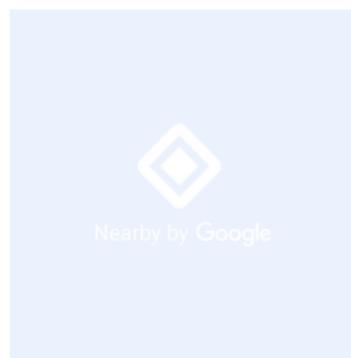


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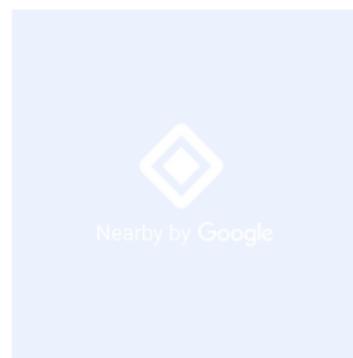


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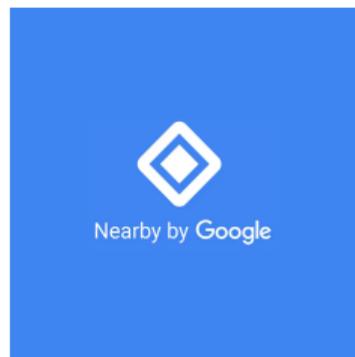
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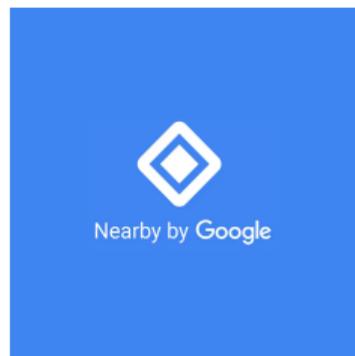
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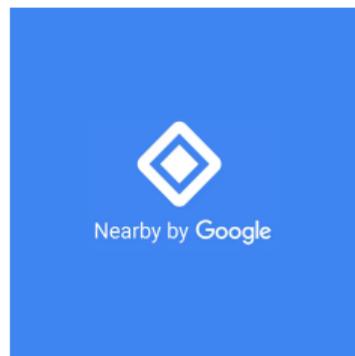
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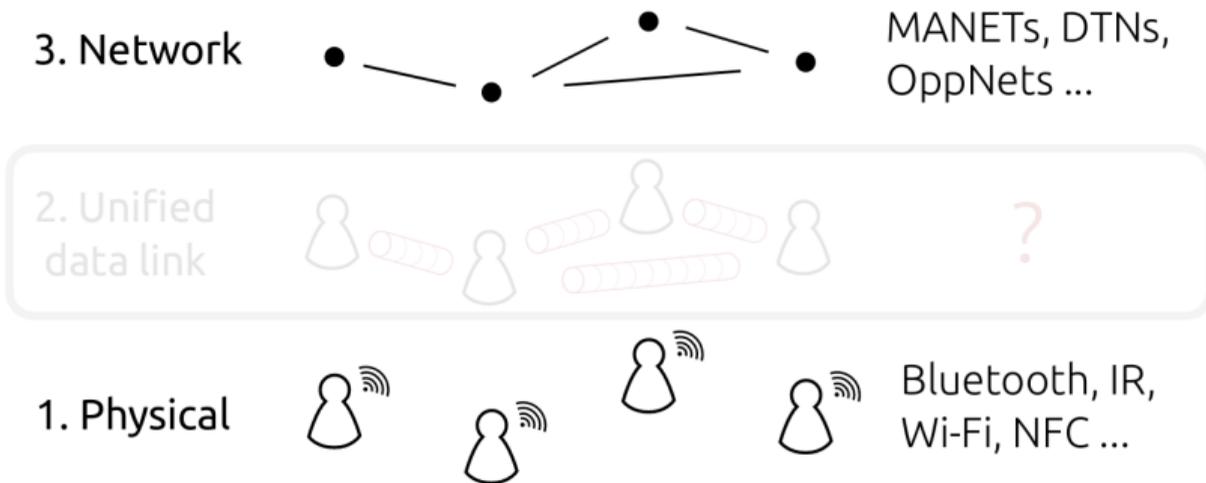




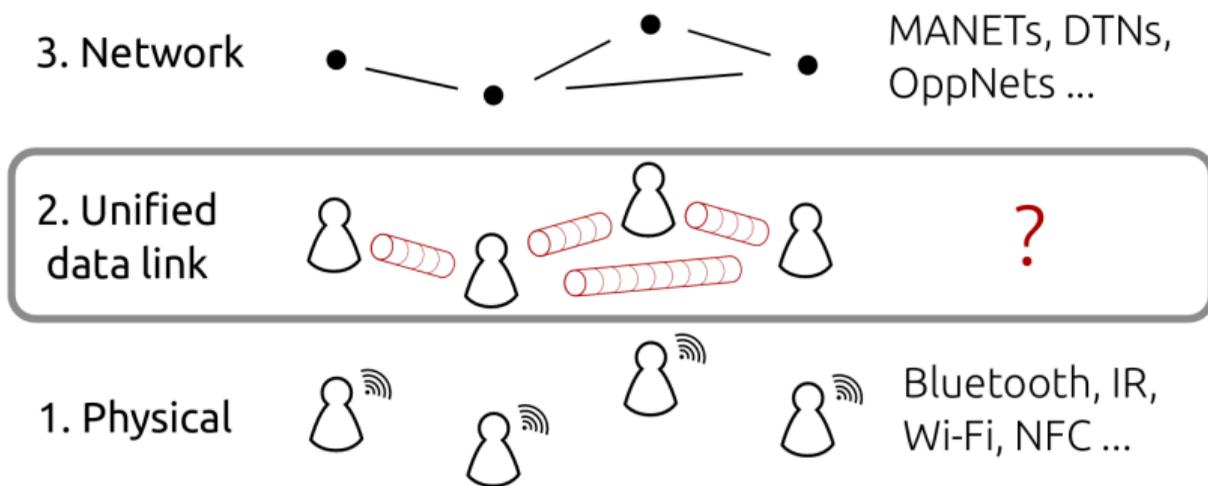
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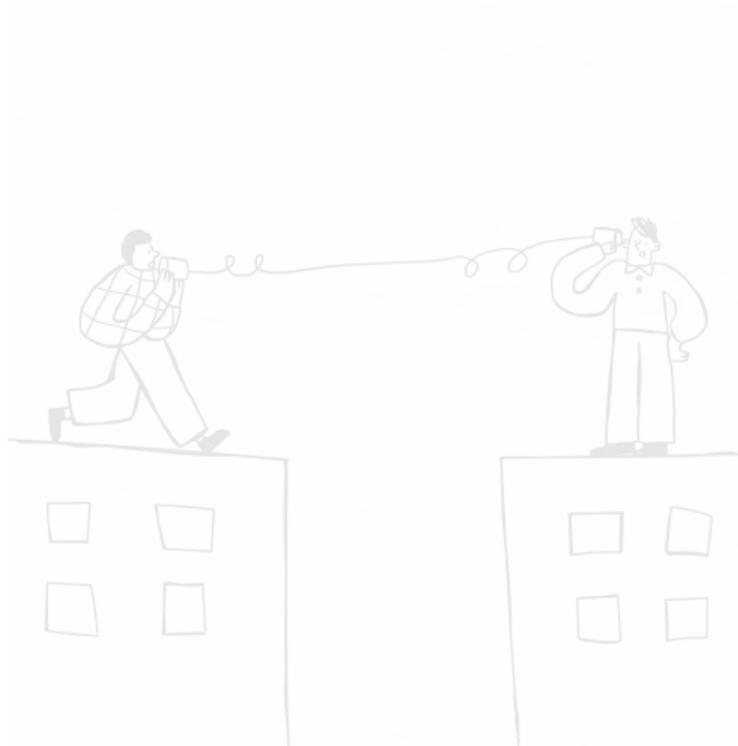
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03

Venice

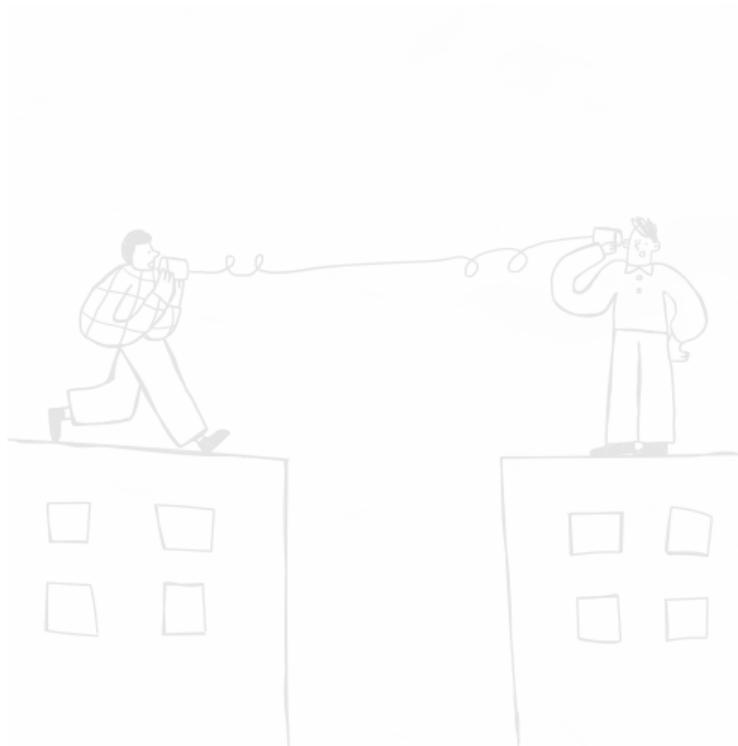
- **Set of abstractions**

- > Channels
 - Bootstrap
 - Data
- > Schedulers



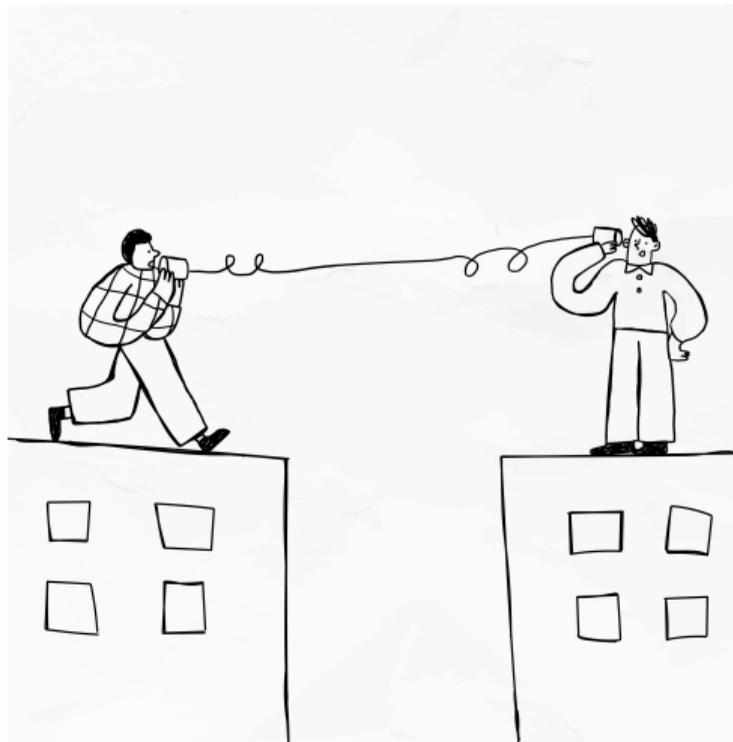
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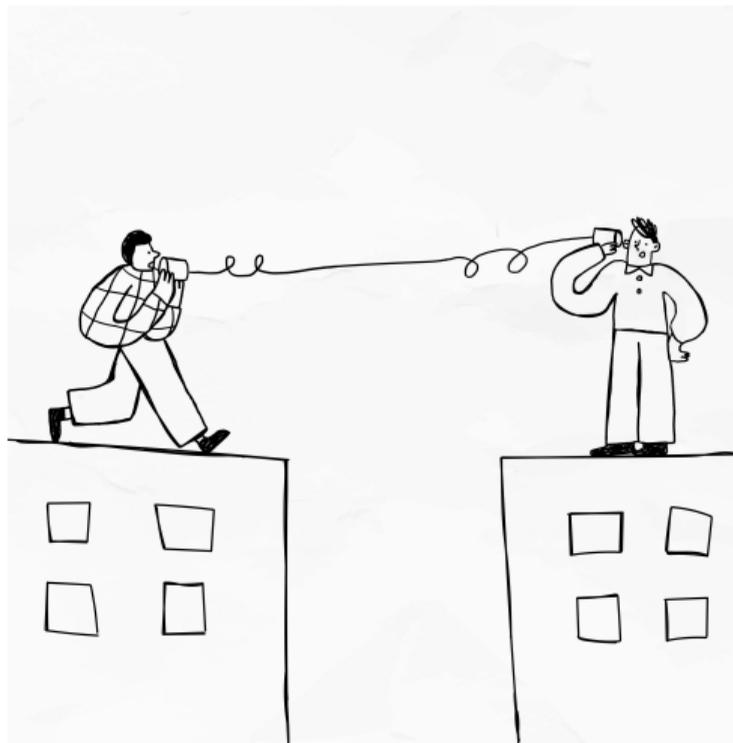
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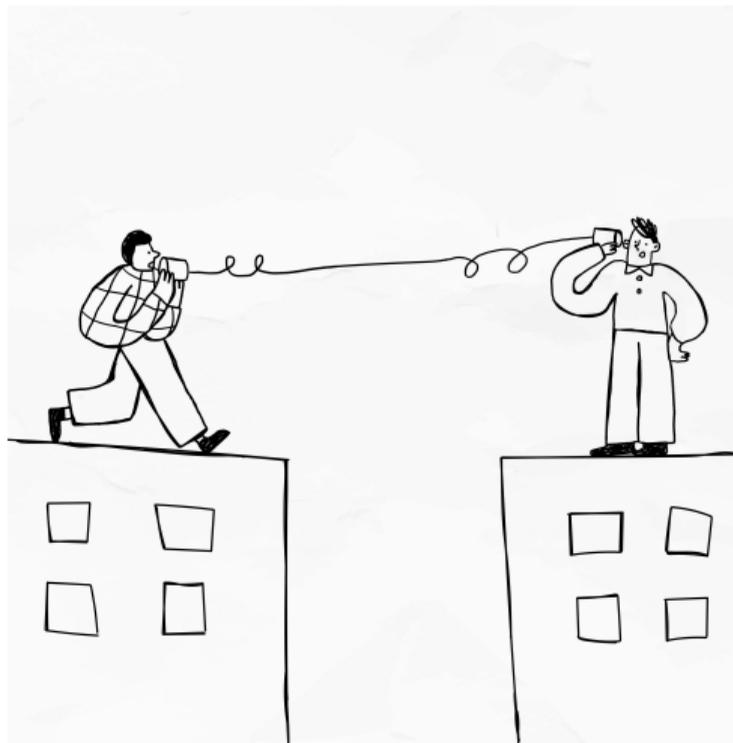
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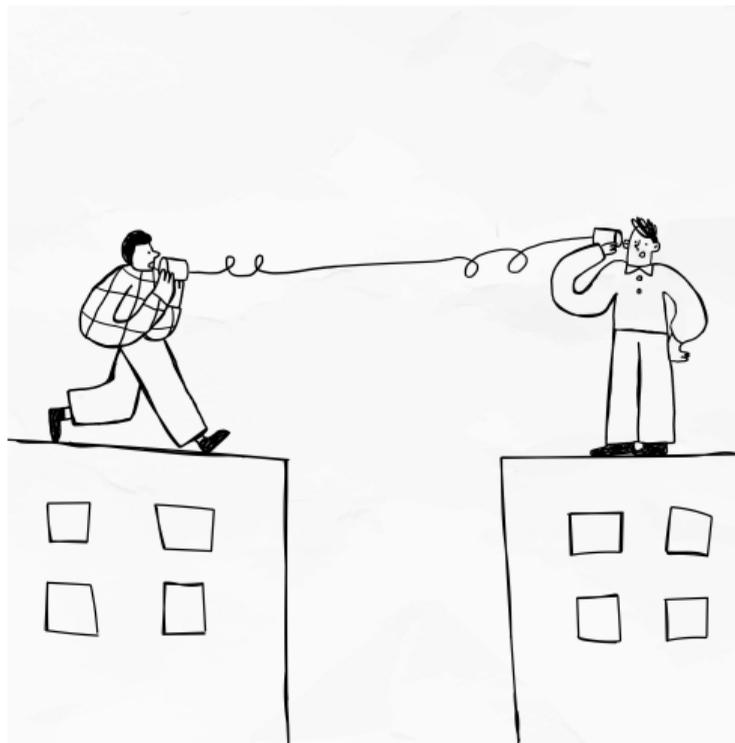


Table: Preferred communication type per channel

Chan. type	Physical channel				
	QR	Infrared	RFID	Bluetooth	Wi-Fi
Bootstrap	☑	☑	☑	☑	☒
Data	☐	☒ [1]	☒ [14]	☑	☑

☐: not implemented; ☒: possible; ☑: widely deployed.

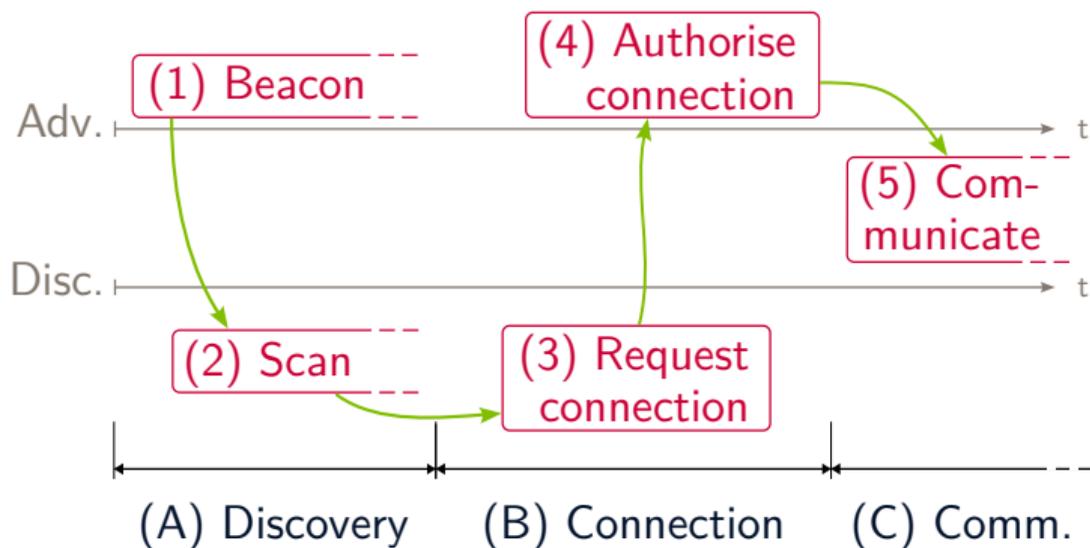
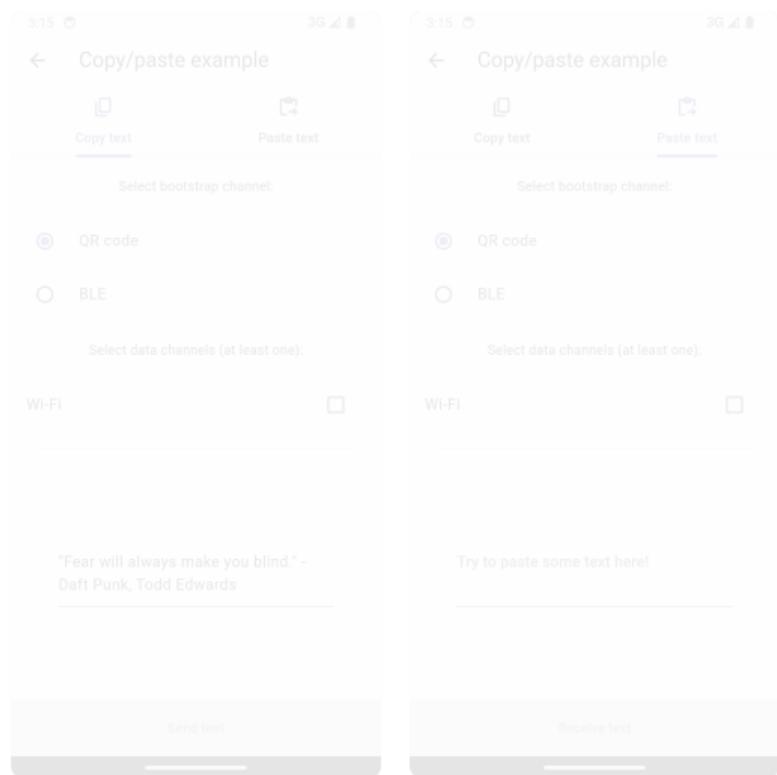
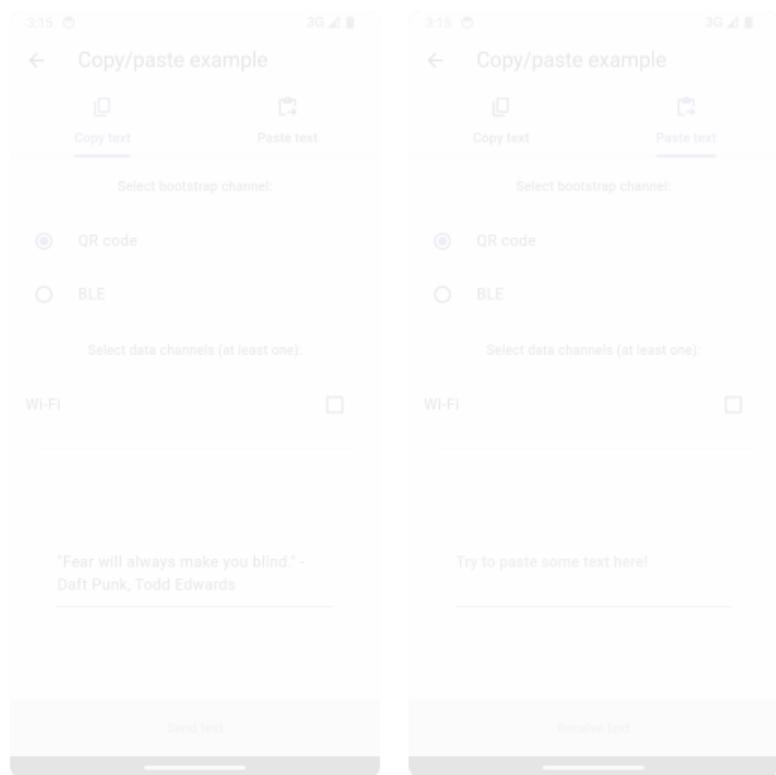


Figure: Typical device-to-device connection process.

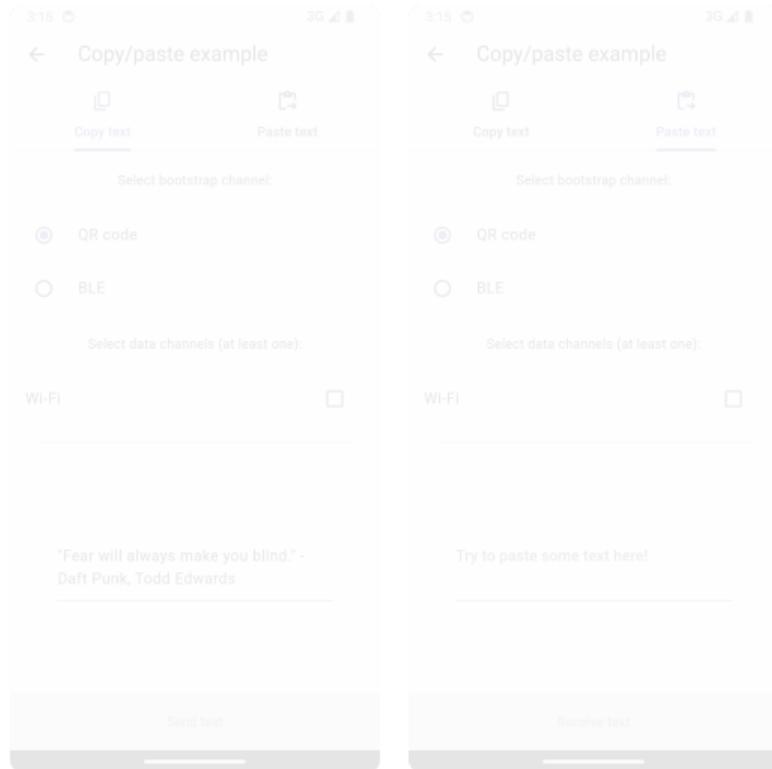
- Demonstrator application (Flutter)
- Several implemented use-cases
 - > Text & File transfer
 - > Sound & Video streaming
- ANDROID: done / LINUX and IOS: on the way
- Source code:
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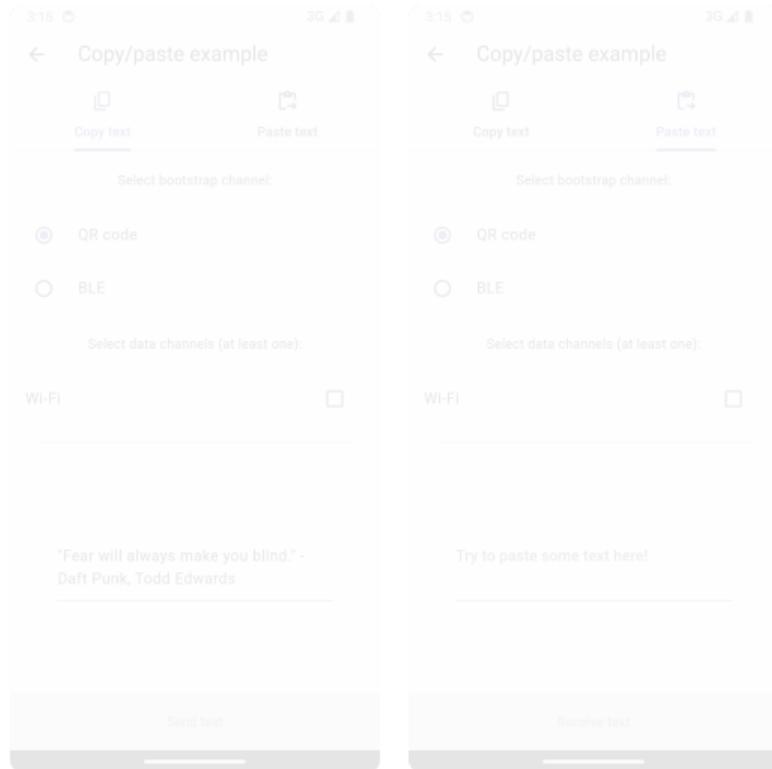
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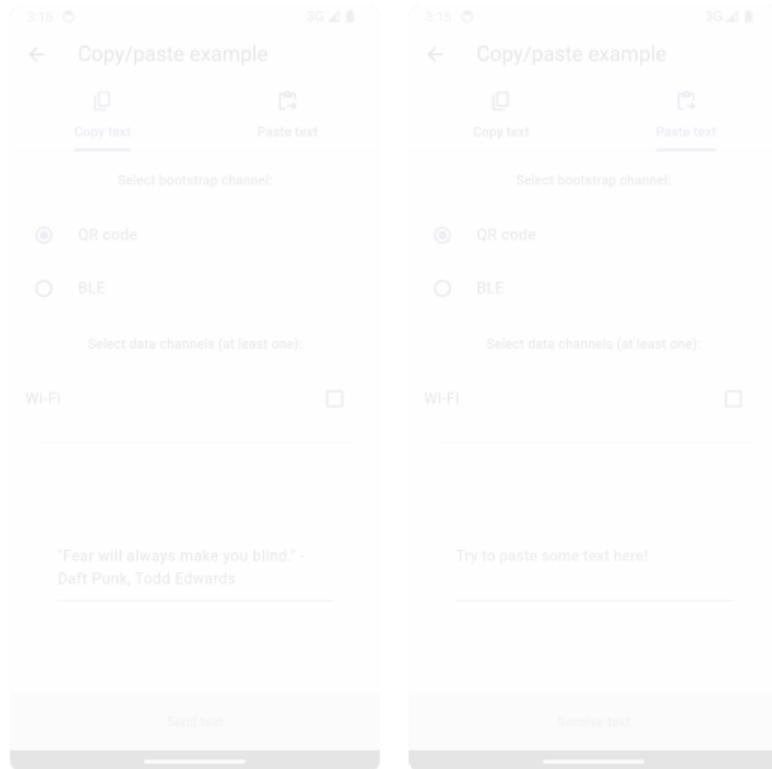
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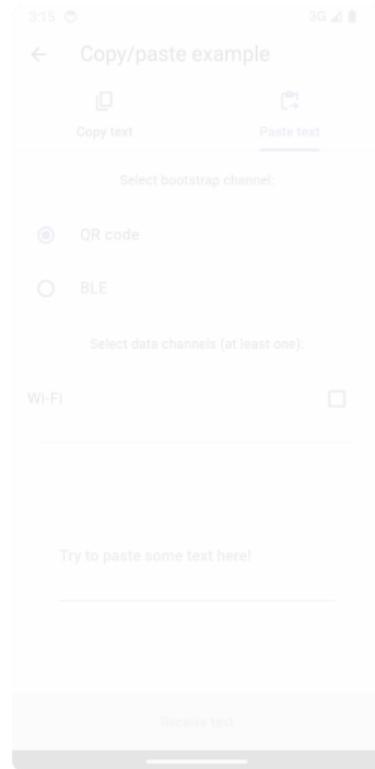
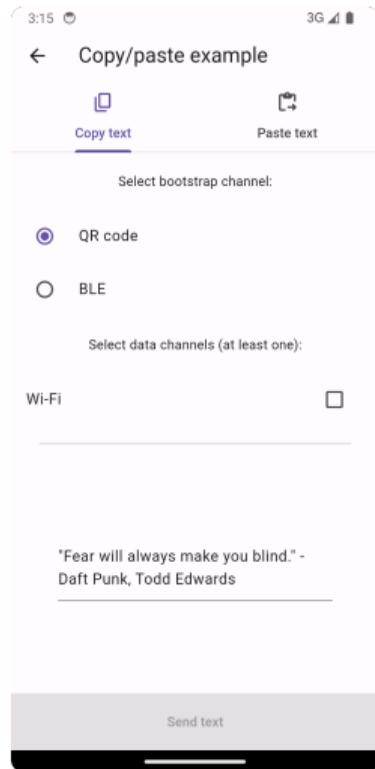
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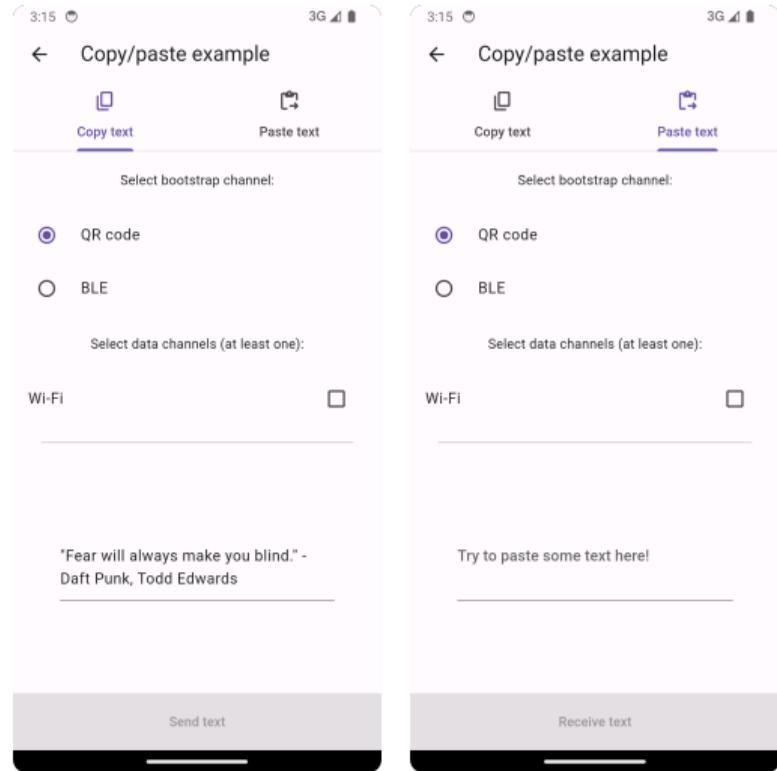
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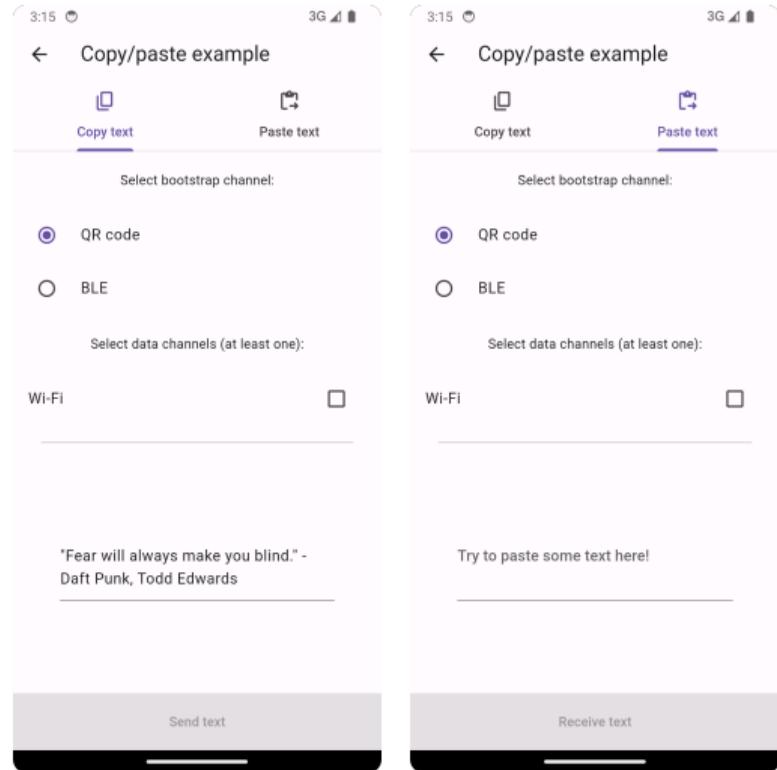


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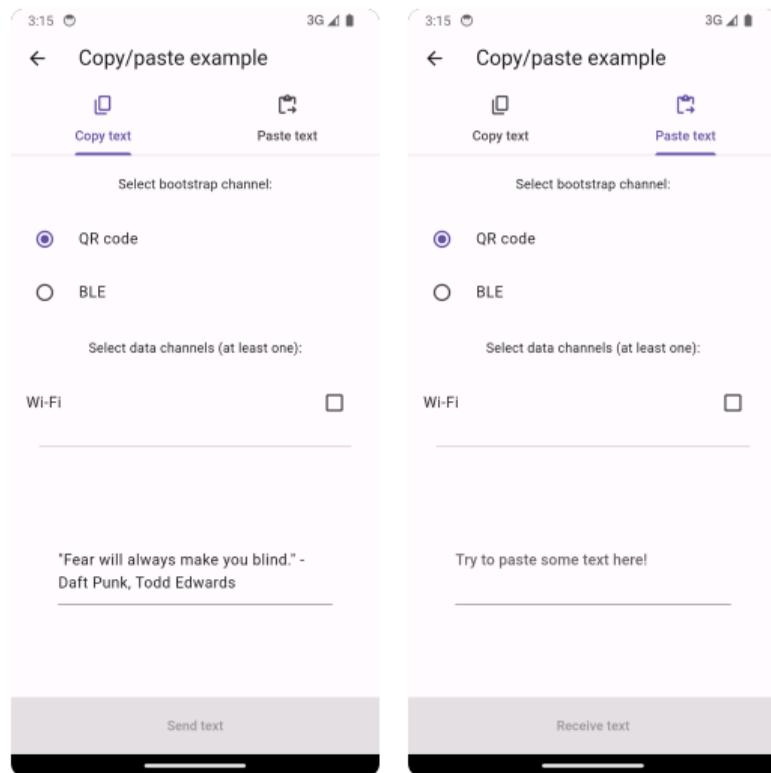


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04

Conclusion

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- Automatic channel selection
- Bandwidth optimization
- High-level abstractions in *kernel*

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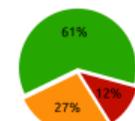
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Take away

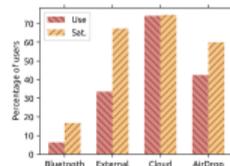
Survey

weekly or more



monthly

less often



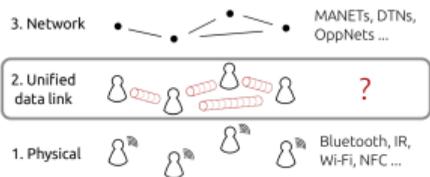
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D2D tech

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Something missing in decentralized network configurations



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Venice framework

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(or why you don't need the cloud)

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- *Mobile Ad hoc Networks* (MANETs) [15]
- *Delay-Tolerant Networks* (DTNs) [16]
- *Opportunistic Networks* (OppNets) [17]

- Adrien Luxey-Bitri, Rémy Raes & Romain Rouvoy
- © SQLite, TimescaleDB & InfluxDB
- © Freepik

-  Infrared Data Association.
Serial Infrared Physical Layer Specification.
Standard v1.4, 2001.
-  IEEE.
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Standard, IEEE Std 802.11-1997, November 1997.
-  IEEE.
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IEEE.

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