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- The interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data.²

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Internet of Things - Milestones

- 1969 - ARPANET
- 1980’s - Commercial Internet services
- 1993 - Global Positioning System
- 2017 - IPv6 Standard

IPv6 - 128 bit addresses as opposed to 32 bit addresses in IPv4

$$2^{128} = 3.4 \times 10^{38}$$ addresses
The first’s in IoT

- 1982 - World’s first IoT device - Carnegie Mellon University, School of Computer Science, USA
  - Toaster (1990), Webcam/Coffee pot (1993)
- LG Internet Digital DIOS (2000) - First Internet Refrigerator

3, 4, 5

CMU Coke Machine. [https://www.cs.cmu.edu/~coke/](https://www.cs.cmu.edu/~coke/).


Noise in Neural Networks
Comparison of RF technologies

<table>
<thead>
<tr>
<th>Parameters</th>
<th>WiFi</th>
<th>WiMAX</th>
<th>LR-WPAN</th>
<th>Mobile communication</th>
<th>Bluetooth</th>
<th>LoRa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>IEEE 802.11 a/c/b/d/g/n</td>
<td>IEEE 802.16 (ZigBee)</td>
<td>IEEE 802.15.4</td>
<td>2G-GSM, CDMA, 3G-UMTS, CDMA2000, 4G-LTE</td>
<td>IEEE 802.15.1</td>
<td>LoRaWAN R1.0</td>
</tr>
<tr>
<td>Frequency band</td>
<td>5–60 GHz</td>
<td>2–66 GHz</td>
<td>868/915 MHz, 2.4 GHz</td>
<td>865 MHz, 2.4 GHz</td>
<td>2.4 GHz</td>
<td>868/900 MHz</td>
</tr>
<tr>
<td>Data rate</td>
<td>1 Mb/s–6.75 Gb/s (Fixed)</td>
<td>1 Mb/s–1 Gb/s (mobile)</td>
<td>40–250 K b/s</td>
<td>2G: 50–100 kb/s, 3G: 200 kb/s, 4G: 0.1–1 Gb/s</td>
<td>1–24 Mb/s</td>
<td>0.3–50 Kb/s</td>
</tr>
<tr>
<td>Transmission range</td>
<td>20–100 m</td>
<td>&lt; 50 Km</td>
<td>10–20 m</td>
<td>Entire cellular area</td>
<td>8–10 m</td>
<td>&lt; 30 Km</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Bluetooth: Medium</td>
<td>Very Low</td>
</tr>
<tr>
<td>Cost</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>BLE: Very Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

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