THINK. CHANGE. DO

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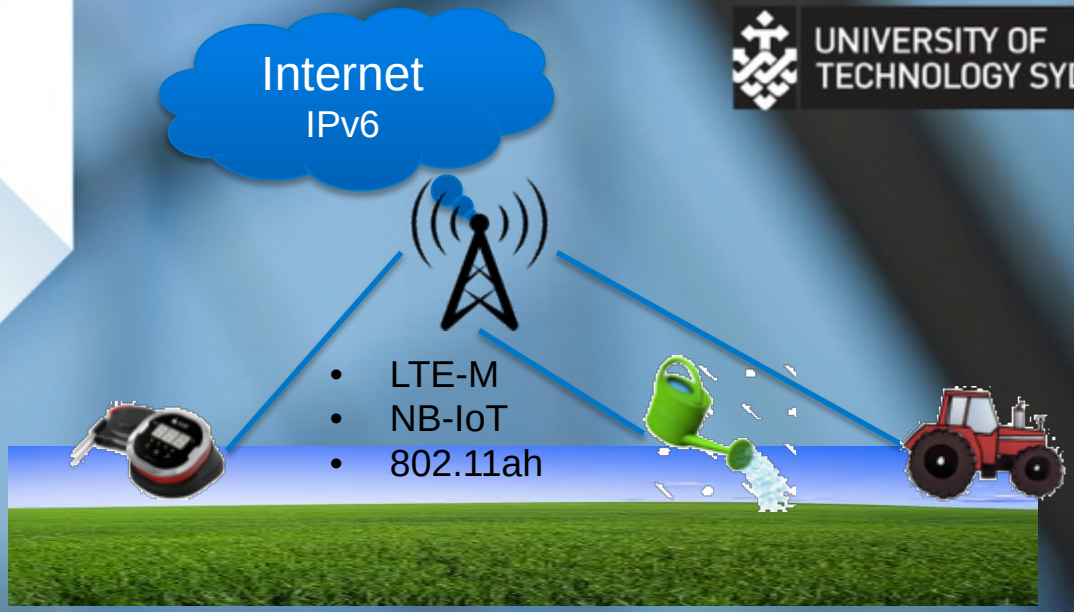

IoT and Security

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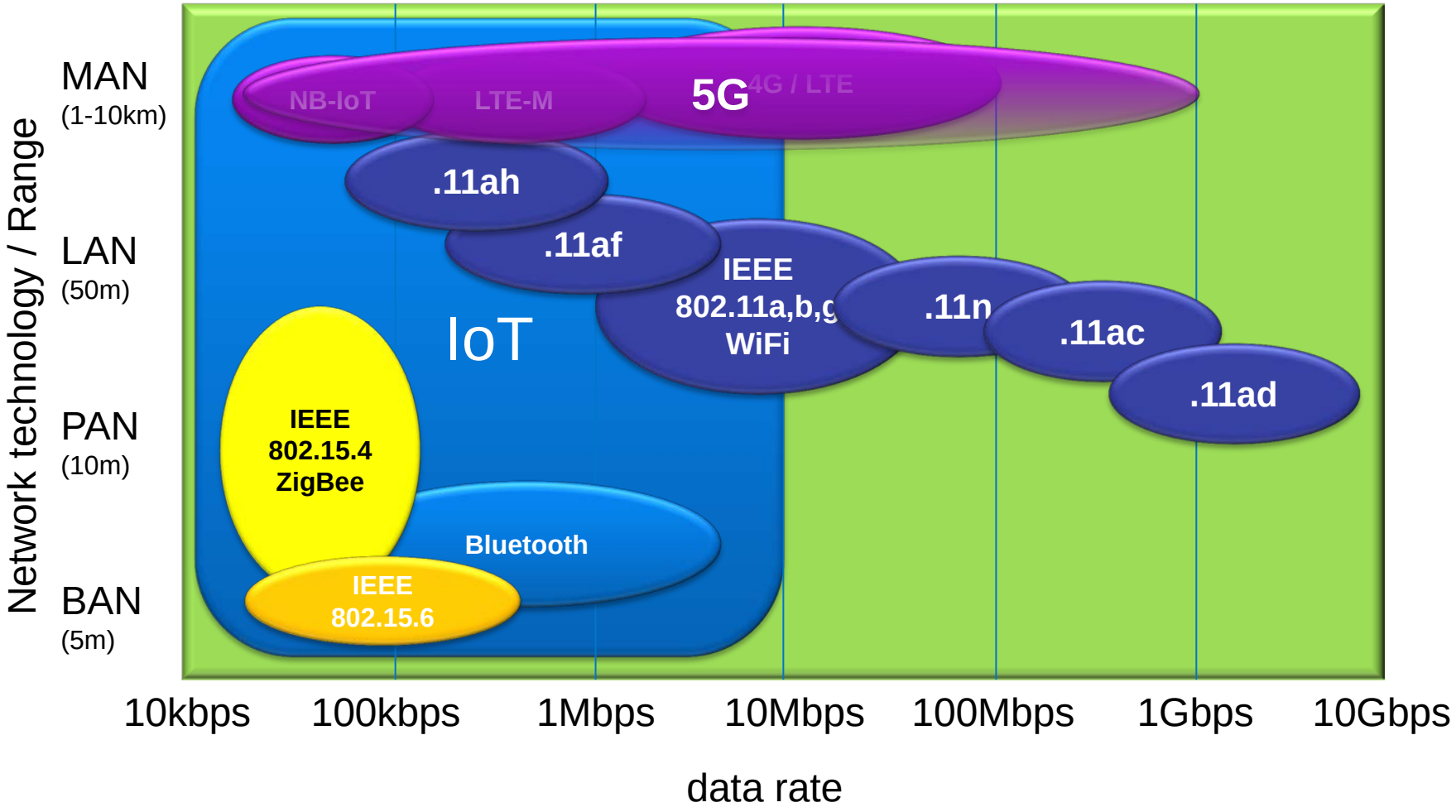
IoT: Past, Now, and Future

- 1970s
  - Remote monitoring via telephone line
- 1990s Wireless technology
  - Machine to Machine (M2M) Comms for industrial monitoring / operations
  - Wireless Sensor Networks (WSN) for environmental monitoring
- 2010s IoT Development
  - ✓ Wide adoption of Internet: IPv4 ➔ IPv6
  - ✓ Ubiquitous Wireless Connectivity
  - ✓ Miniature low power embedded devices
- 2025:
  - ➢ 100 billion connected IoT devices
  - ➢ $11 trillion economic impact
- 2040:
  - ❖ ???

IoT Applications

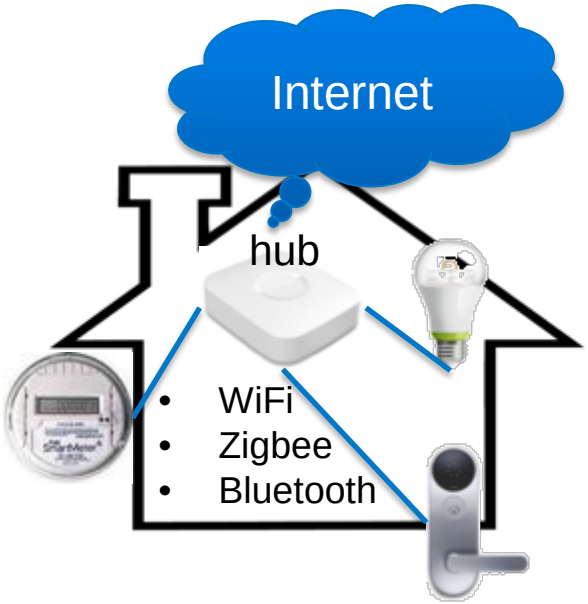
A. Al-Fuqaha, et al, "Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications," *IEEE Comms Surveys & Tutorials*, vol.7, no.4, 2015

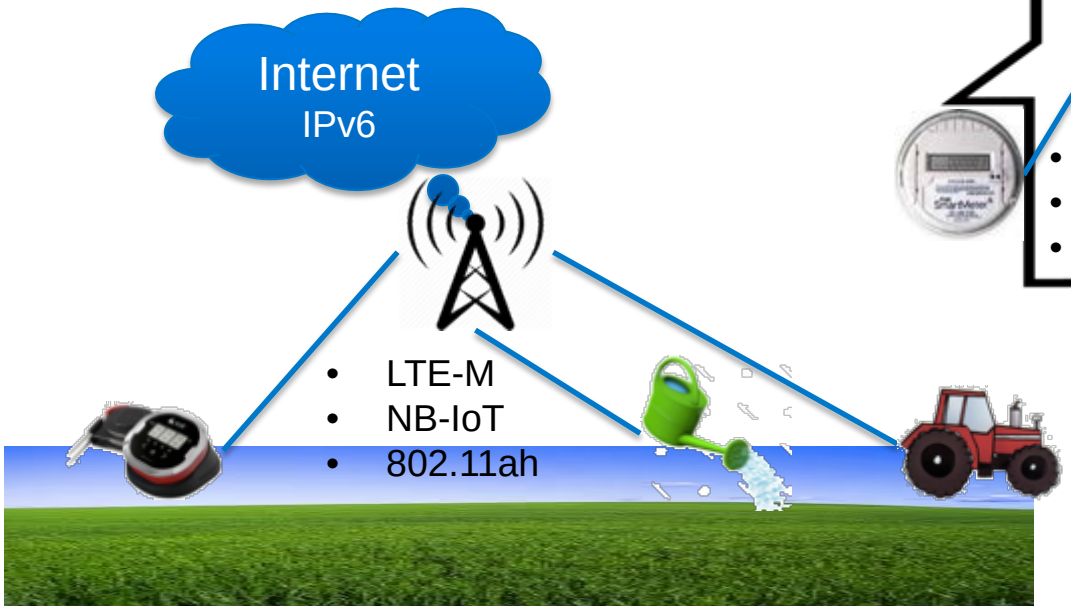
Wireless Technologies for IoT



IoT Architectures

- Device to Device (D2D) Comms
  - Bluetooth, WiFi direct
- Device to Gateway/Hub
  - Zigbee, WiFi, Bluetooth
- Device to Internet
  - 802.11ah, LTE-M, NB-IoT

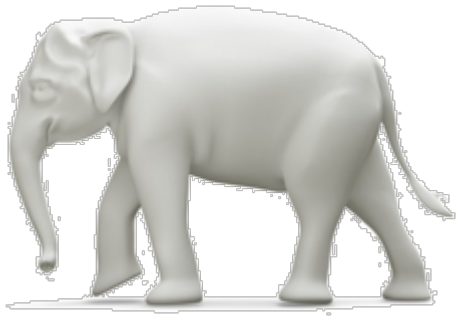




IoT Security

- New Challenges
  - Massive scale: 100,000 devices
  - Identical devices: one vulnerability affect all
  - Unattended:
    - > Operated without human intervention/interaction
    - > Difficult for software patch and upgrade
    - > Physically insecure – accessible to hackers
  - Long-term deployment (10+ years) ➔ outdated security
- Case study: One of the biggest cyber attacks in Internet history – Oct. 2016
  - IoT devices taken over by malware Mirai
  - DDoS attacks from multiple compromised IoT devices
- Security Considerations
  - Cost vs. Security trade-off: light weight security
  - Data confidentiality, integrity, access
  - Field-upgradeability, and Obsolescence

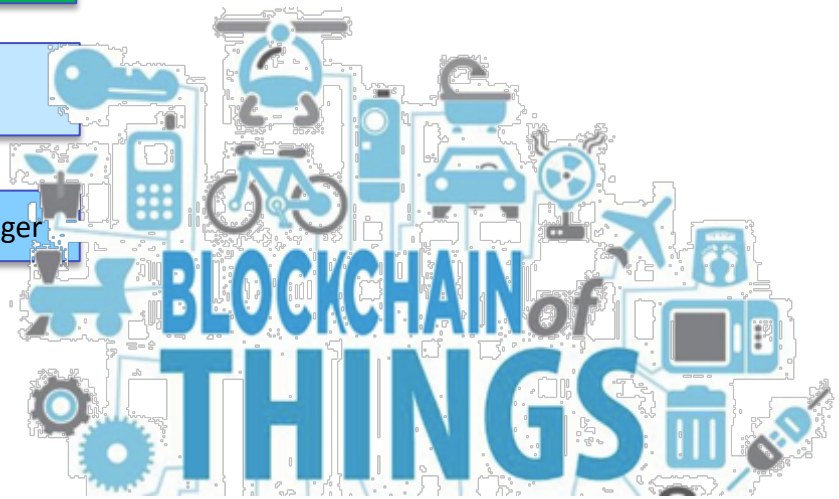
Privacy & Trust



If data cannot be trusted ➔ IoT no use ➔ white elephant

- Solution: Blockchain - tamper-resistant

Privacy & Anonymity	Pub Keys
Authentication	Pvt Keys
Tamper-resistance	Hash chain
Integrity	Distributed validation
Resilience to node compromise	Distributed ledger



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THANK YOU!

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