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Digital Product Development

Demo

TU Delft

Module 3 Networking Technologies

By Elvis Borges and Jacky Bourgeois

The Internet-Connected Wheelchair

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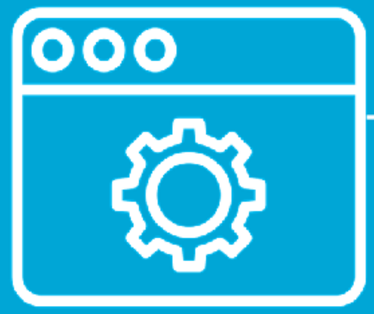

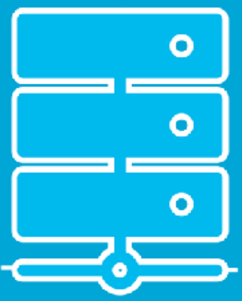

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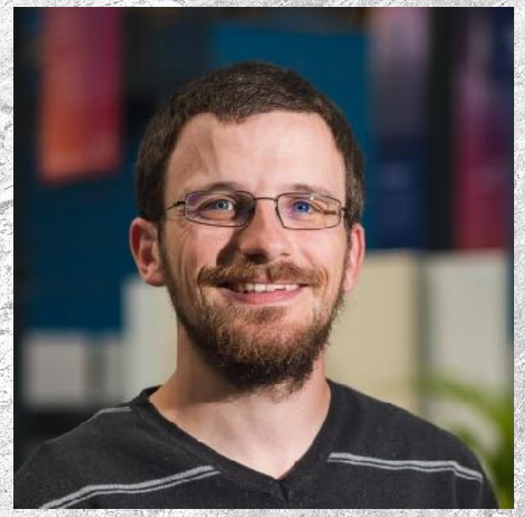

By Jacky Bourgeois

- What is the Internet Things?
- What are network requirements?

Internet of Things (IoT)

- Identified

QR Code

RFID Tags

- Uniquely connected
- Extending the Internet

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That 'Internet of Things' Thing

In the real world, things matter more than ideas.

By Kevin Ashton

Tags: IT/Infrastructure, Operations

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Jun 22, 2009—I could be wrong, but I'm fairly sure the phrase "Internet of Things" started life as the title of a presentation I made at Procter & Gamble (P&G) in 1999. Linking the new idea of RFID in P&G's supply chain to the then-red-hot topic of the Internet was more than just a good way to get executive attention. It summed up an important insight—one that 10 years later, after the Internet of Things has become the title of everything from an article in Scientific American to the name of a European Union conference, is still often misunderstood.

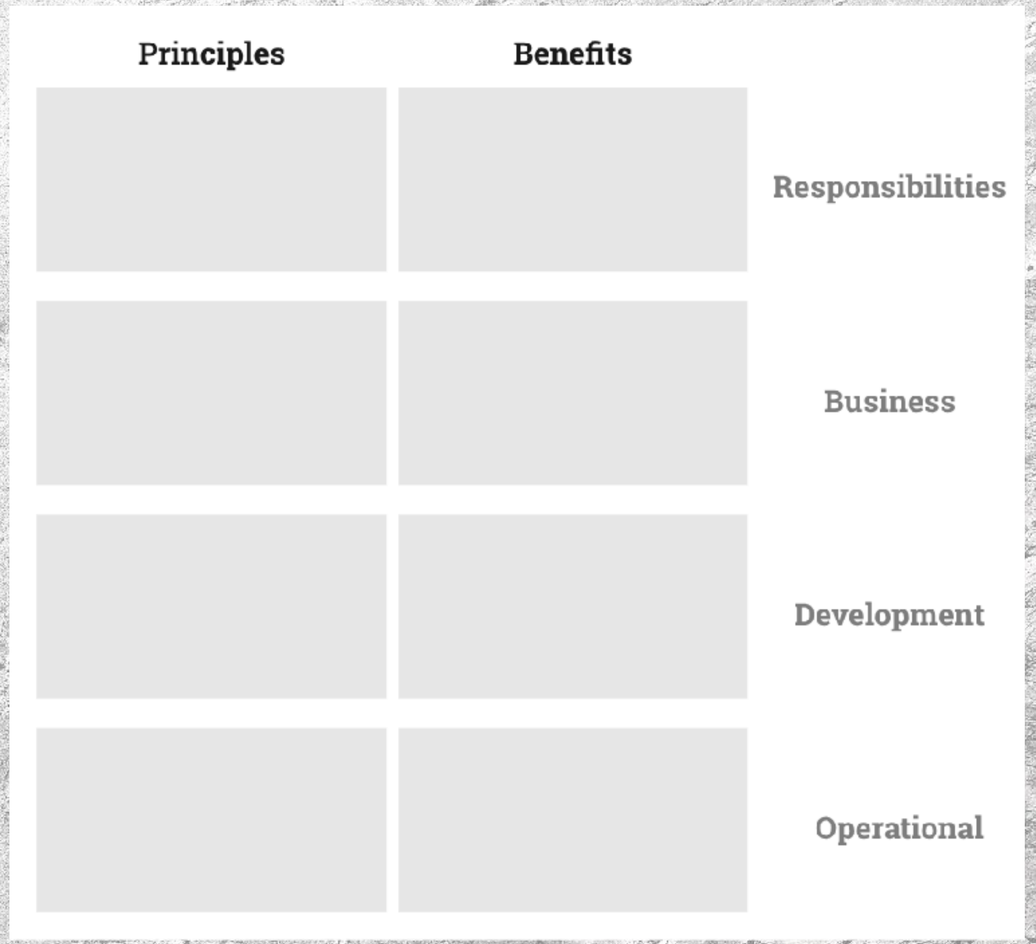
The fact that I was probably the first person to say "Internet of Things" doesn't give me any right to control how others use the phrase. But what I meant, and still mean, is this: Today computers—and, therefore, the Internet—are almost wholly dependent on human beings for information. Nearly all of the roughly 50 petabytes (a petabyte is 1,024 terabytes) of data available on the Internet were first captured and created by human beings—by typing, pressing a record button, taking a digital picture or scanning a bar code. Conventional diagrams of the Internet include servers and routers and so on, but they leave out the most numerous and important routers of all: people. The problem is, people have limited time, attention and accuracy—all of which means they are not very good at capturing data about things in the real world.

Network Requirements

Dimension	Specification	Justification	Importance
User	The device must be battery powered.	Users should be able to use it while moving around.	High
Interface	The user should be able to interact with the device directly from his phone.	Users have their phone when travelling, this will be the main interface.	High
…	…	…	…

Users

- **Purpose** - What will users do with the product?
- **Promise** - What is critical for the success of the product?
- **Form factor** - How big can the device be?
- **Cost** - Distribution of cost for the user (cost per message): Can we request users for a subscription plan?



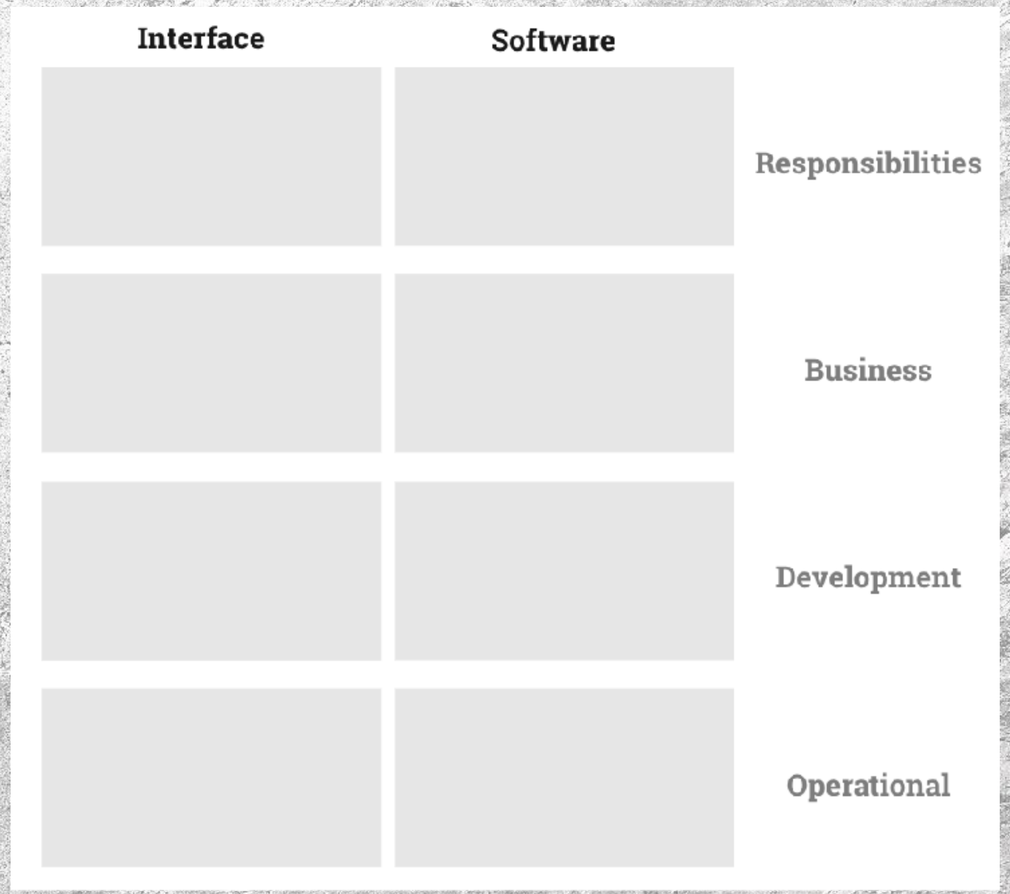
Product Behaviour - User Prespective

- **Learning curve** - What feels natural for the targeted user?
- **Access** - How to pair with the network?
- **Interoperability** - Should the product interact with other devices of the Interaction with other devices?
- **Density** - how many devices per user? How many users? When do they interact? Is this distributed over time? Is there a peak time?
- **Direction** - Should the communication be unidirectional or bidirectional?

	Functionalities	Interaction
Responsibilities		
Business		
Development		
Operational		

Product Behaviour - Technical Perspective

- **Rate** - How much data do we need to transfer in 1 second?
- **Cost** - Cost of development of device
- **Business** - Do you want to enforce a way through the cloud?
- **Interoperability** - Should the product be able to talk to other devices around?



Infrastructure

- **Environment** - Is there already a network infrastructure in place? Do users have control over the network environment?
- **Energy** - Are there any energy resource constraints?
- **Cost** - What is the cost of deploying or leveraging a network infrastructure?
- **Standards** - Is there regulations, restrictions, security requirements?

Network Requirements

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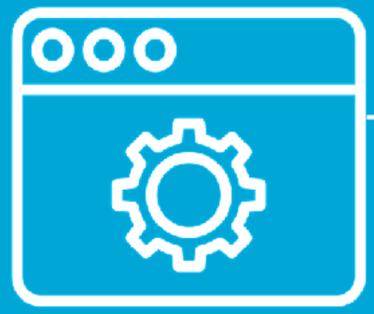

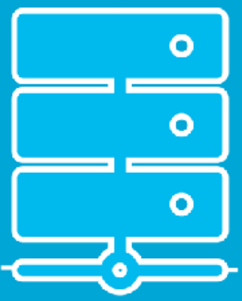

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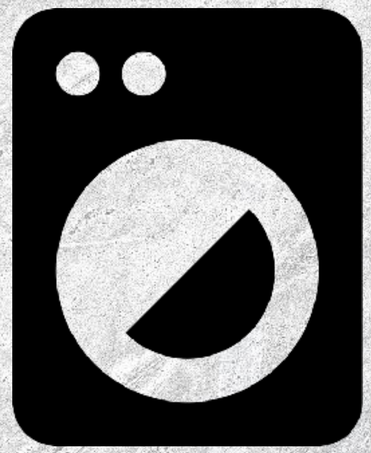
Module 3 Networking Technologies

By Jacky Bourgeois

- What are Network Industry Standards?
- What are Interoperability Challenges?

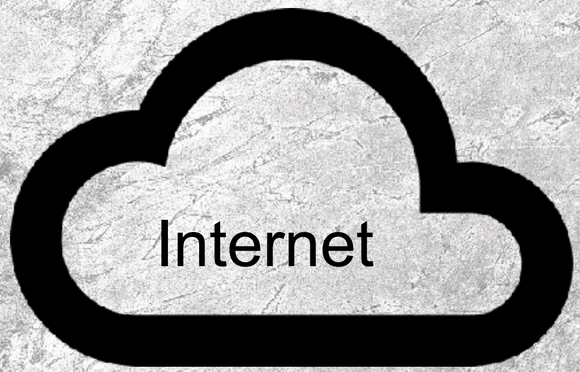
Internet Protocols



Wired (e.g. Ethernet)

Wireless (e.g. WiFi)

Cellular (e.g. 4G)



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Network Areas

How far do we need to send data without device in between?

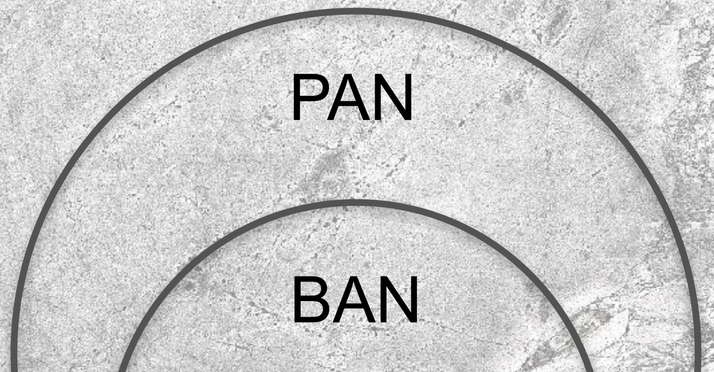
Body

Network Areas

How far do we need to send data without device in between?

Personal

Body



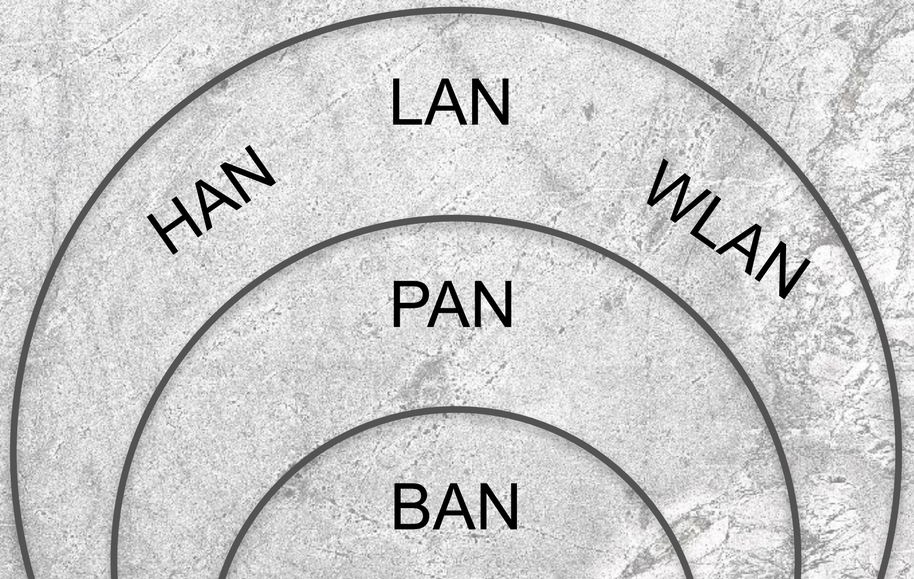
Network Areas

How far do we need to send data without device in between?

Local

Personal

Body



Network Areas

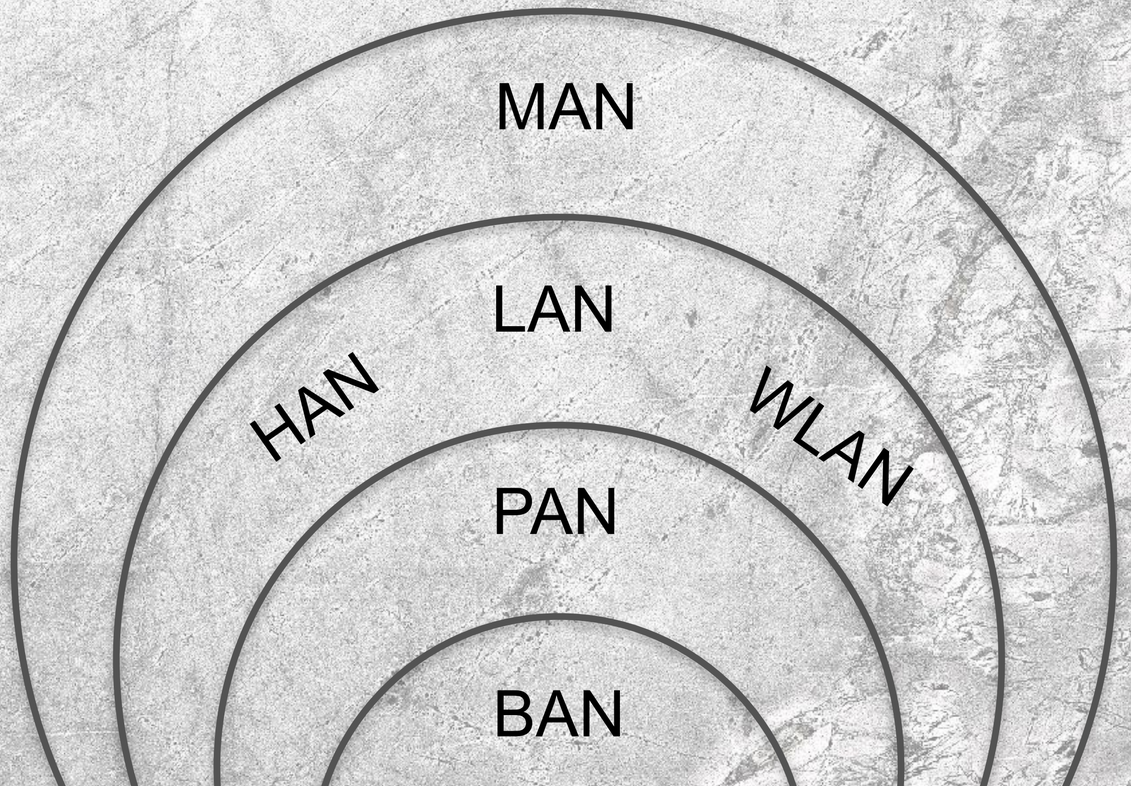
How far do we need to send data without device in between?

Metropolitan

Local

Personal

Body



Network Areas

How far do we need to send data without device in between?

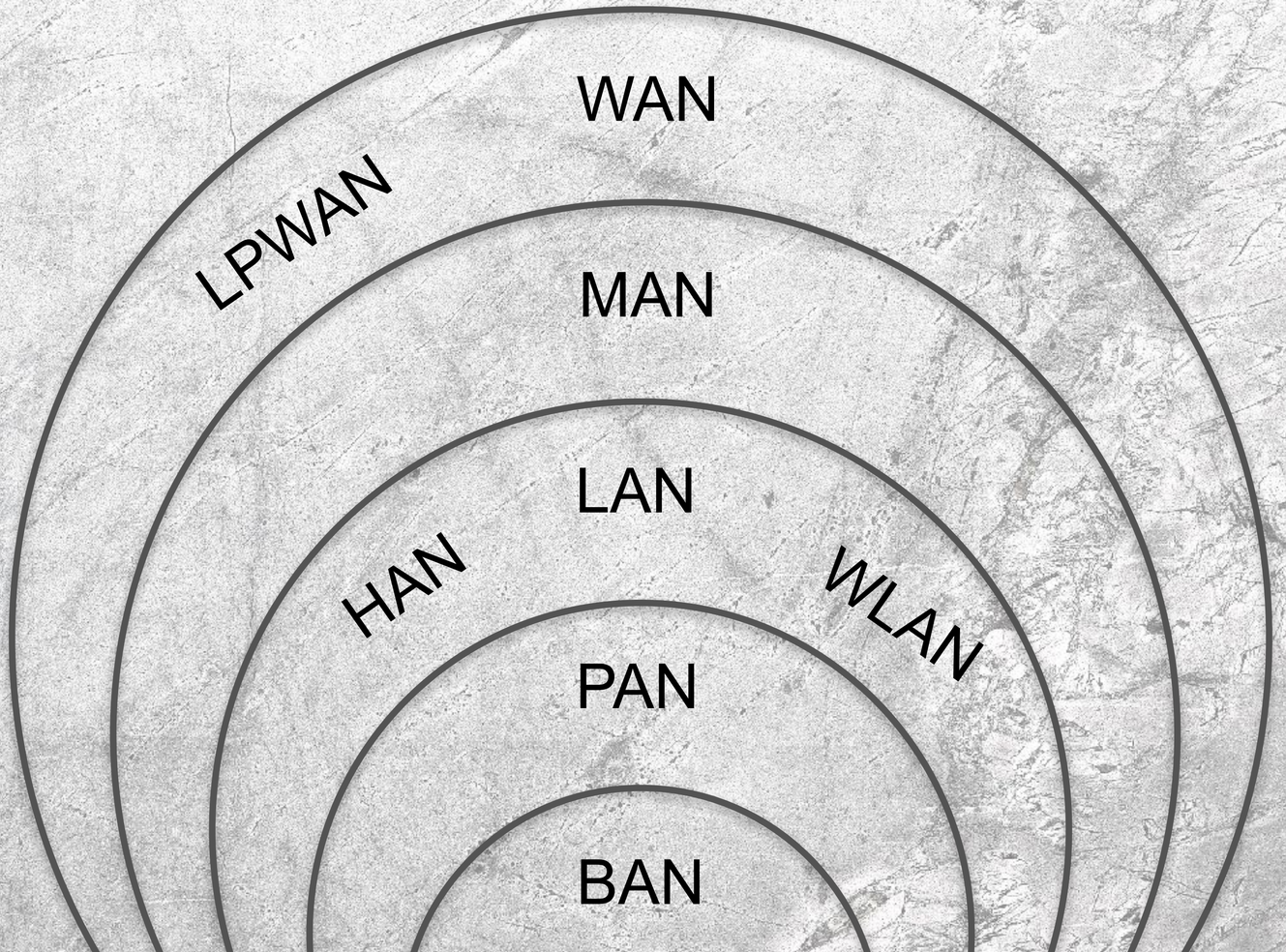
Wide

Metropolitan

Local

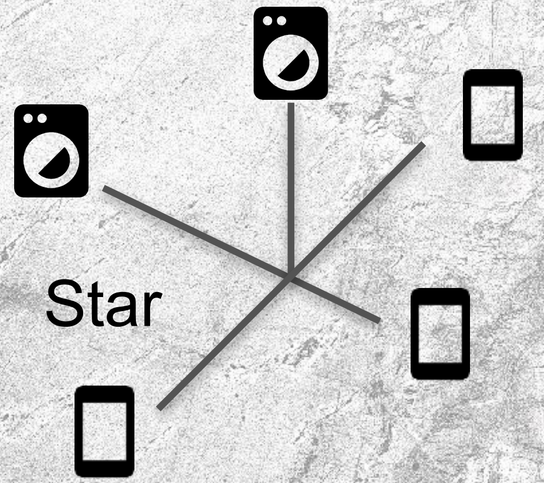
Personal

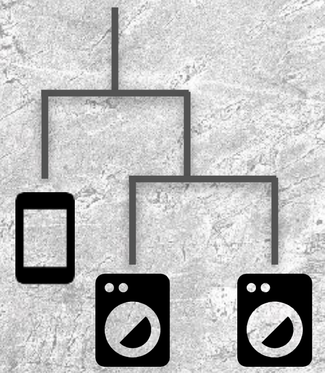
Body

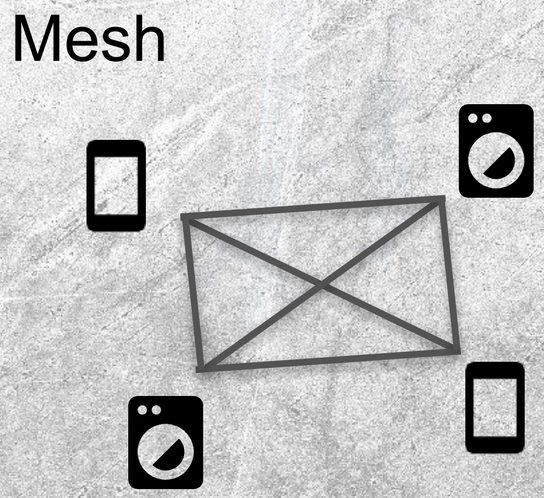


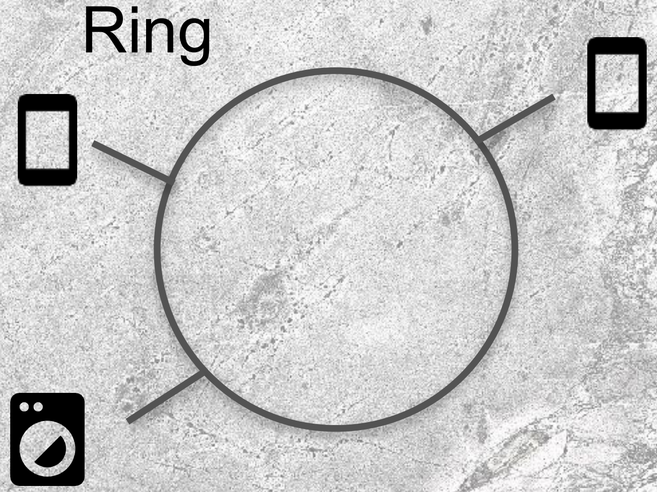
Network Topologies

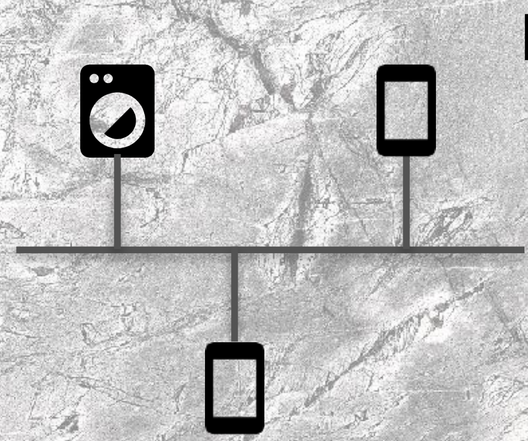
- Star
- Bus
- Mesh











Performance Metrics

- Bandwidth (MBit/s)
- Throughput (MBit/s)
- Latency (s)
- Availability (%)

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Network Industry Standards

- American National Standards Institute (ANSI)
- Telecommunication Industry Association (TIA)
- International Standards Organisation (ISO)
- Institute of Electrical Electronics Engineers (IEEE)

- And many more, including companies

Interoperability

- Via the cloud
- Via the local gateway
- Via the transport layer: Thread, 6LowPAN

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Wrap up

- List of network requirements
- Characteristics of networking technologies
- Interoperability

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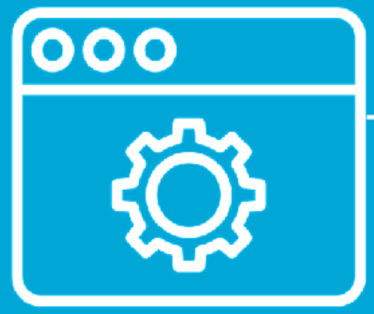

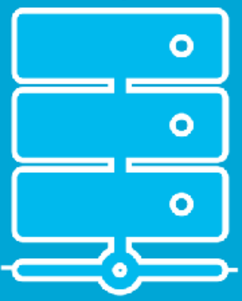

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