BT Group

The IoT: a world of connectivity

Lesson 1

Resources

- PowerPoint presentation

Intro (10 mins)
Slides 2-9

Introduction

First ask students if they know what “IoT” stands for, or what this term means, then show slide 2 to compare answers. Explain that the IoT stands for the Internet of Things, and that this term refers to a network of devices that are connected to the internet.

Ask students where they might have seen the Internet of Things in action, before showing slide 3 which gives a few common examples. Explain that you will look at more innovative uses of the IoT and how they work later on in this lesson.

Make sure to highlight the ‘Big Thinking’ question on slide 4 which will be revisited throughout the module - using their creative and analytical skills to challenge ideas and develop opinions, key capabilities for the tech and digital future. They don’t have to have all the answers by the end but should be able to share an opinion on the key questions.

Use slides 6-9 to introduce the module overview and learning objectives of this lesson.

Resources

- PowerPoint presentation

Activity 2 (15 mins)
Slides 10-15

Exploring the Internet of Things

Play the video on slide 11 which introduces how the IoT works and how it is used to improve and transform lives. Tell students to listen actively or make notes. Run through any terminology they did not understand.

Share these key terms with students:

- **Interconnected (IT) ecosystem:** the network of services, users and providers that can create, share and deliver information within an organisation's connected internet system
- **Automation:** the process of using software to programme preset actions, which therefore replaces the need for humans to make these actions happen manually
- **Smart-bots and smart systems:** AI-powered devices which use data to carry out different tasks
- **Internet-enabled devices:** devices (e.g. mobile phones) which can connect to the internet
- **Analytics:** information gathered and processed by machines which we can use to make decisions or solve problems

You may want to play the video again if there are some elements that it would be helpful for them to hear again

On their own, smart devices have limited benefits. But, when linked together, they form an interconnected ecosystem by combining data with automated systems. This means that the IoT system can gather and analyse information to help humans complete a task. This allows humans to use the smart features on phones or other internet-connected devices to control other devices that are far away – for example, using the voice command to turn off an air conditioner in an office when working from home.

Ask students if they can think of any other examples of devices that use the IoT, then talk through the selection of examples shown on slides 12 and 13. Did any of these examples surprise them? Were there any they were familiar with, or that they use themselves?

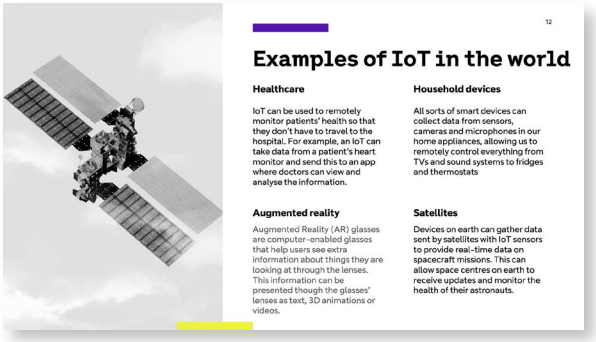
Play students this video on slide 14 from BT showing how the IoT is used at a port.

Finish this activity by showing slide 15 and asking students to name some of the benefits of having these types of IoT devices in the world. How can they improve our lives?

It allows us to collect data and enable automation, which means we can make the most of internet-enabled devices by using them to make our lives easier and reduce time spent on simple tasks. For example, using the IoT to set an automatic timer for an office's lights or thermostat saves the office manager's time and reduces energy use, adding items to your shopping list via a voice command can make shopping more efficient.

Optional extension activity: The IoT and human skills

Machines can learn in a similar way to humans by processing, analysing and using data



to make decisions – this is the basis of Artificial Intelligence (AI). Explain that the IoT networks use connected devices to share data, communicate with each other and manage complex tasks as a result.

Ask students to think about the ways humans share and process information. For example, when they're doing a class project, or a fun activity outside of school, how do communication and connectedness play a part? Can students think of any other examples from their lives? Possible answers could include:

- Completing a class project where each person has to contribute a different ability such as presenting to the class, researching the ideas, or developing the creative materials to showcase their project
- Playing a game (e.g. sport, co-op videogame, escape room) with friends, where teamwork and verbal communication are essential to tackling challenges and winning the game / completing the mission. Someone may also need to lead the team and make sure they listen to what their teammates suggest, using adaptive thinking to solve problems as they come up
- Making a meal with a friend or family member, where each person has to listen to the other to understand who is cooking which part of the meal. They also need to be able understand written instructions to make sure the recipe is followed correctly. They may provide creative ideas for how to improve the recipe, or use adaptive thinking to tweak the recipe if some ingredients aren't available.

How do the ways connected devices and humans share and process information compare? Highlight to students that connected devices can not adapt the way they communicate and make decisions the way humans can.

Highlight the importance of using different human skills in these contexts. Remind students that these are all essential skills which can be transferred and used in a workplace setting as well.

Finish by explaining that the ability to work with and share ideas with others can be really helpful, and often essential, to completing many tasks and even succeeding at work.

Resources

- PowerPoint presentation

Activity 2 (25 mins)
Slides 16-19

The Internet of Things in our lives

Tell students that they are going to hear from a young person called Emma as she talks about a day in her school week. Show slide 17 and tell students that they'll need to think about the questions on the slide as they listen to the story.

- Which IoT devices does she use, and how does she use them throughout the day?
- What benefits does Emma experience from having IoT devices? What benefits are presented for other people in Emma's life?
    - E.g. turning off the lights helps her family save on their household bills and is better for the environment; being able to upload her work to the school's online learning platform helps her teacher to see how students are doing on their projects; monitoring her fitness using her smartwatch gives her coach an idea of how well the team will be do at the athletics tournament; using the voice command on her smartwatch to send a message means she doesn't have to look at her screen again before bed.

Show slide 18 for Emma's story.

A day in the life – Emma's story

I wake up late and panic. I must have missed my alarm! I check the bus timetable on my phone and, to my relief, the live updates tells me that my usual bus is a few minutes late. If I leave quickly, I should still be able to catch it and make it to tutorial on time. Crisis averted.

As I'm heading out the door, I can see dark clouds outside. I ask our smart speaker what


16

Emma and her Internet of Things

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As I'm heading out the door, I can see dark clouds outside. I ask our smart speaker what the weather is looking like for today. It tells me there will be heavy showers, so I grab an umbrella before I leave. No bad hair day for me today.

Halfway to school, I remember that I've left my bedroom light on. Mum is always nagging me to turn it off because it wastes electricity. Luckily, we have an app that lets me control the lights from wherever I am, so I quickly do that. Which means no lectures this evening about being responsible for the planet and keeping the energy bills from going through the roof. Phew!

After school, I head to athletics club. Today, we're practising for the 100-metre sprint for next week's tournament. My coach has been really pushing me to beat my personal best, so I use the app connected to my smartwatch to check out whether I've improved since last time. I complete a circuit and see that I've done it in record time. Not only that, but the data shows me that my running style, fitness and recovery times have improved. Coach gives me a high-five and tells me I should be confident about next week's competition. Result!

Athletics club runs over, but thankfully I've got an app on my phone which shares my location with the rest of my family. Mum can see where I am and sends me a message to let me know that she'll keep dinner in the oven for me.

Once I've got home and eaten, I log on to our school's online learning platform. We have a group project that's due for tomorrow, but because of athletics running over, I haven't had time to go round to my mate's house to finish it. Luckily, the platform has a feature where we can talk to our classmates and submit homework online so that our teacher can track our progress and mark our work. We get the project done in no time, so we kick back and complete a level of the co-op videogame we've been enjoying. Mum's chuffed that I got everything done today and remembered the turn off the lights, so she says I can go to Jamal's house party at the weekend. Before going to bed, I use the voice command on my smartwatch to send Jamal a quick message telling him I'll be there on Saturday. What a day!

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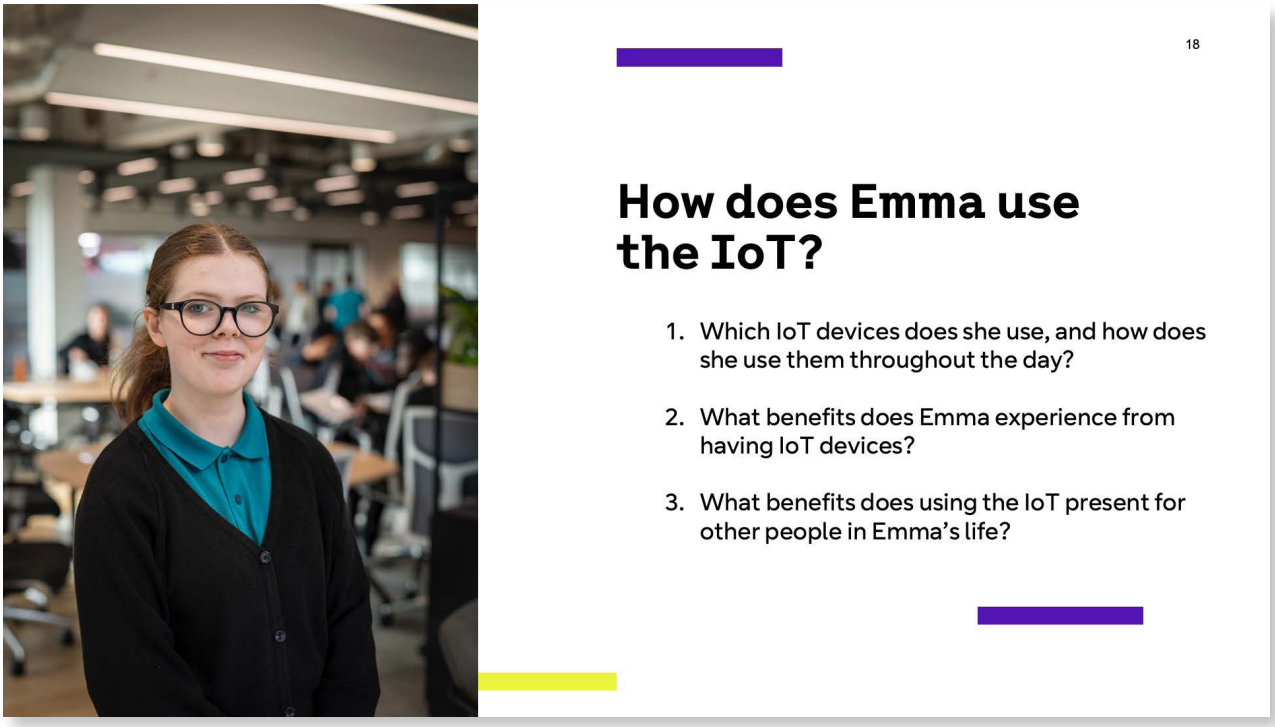
Show slide 17 again and give students a few minutes to answer the questions.



Resources

- PowerPoint presentation

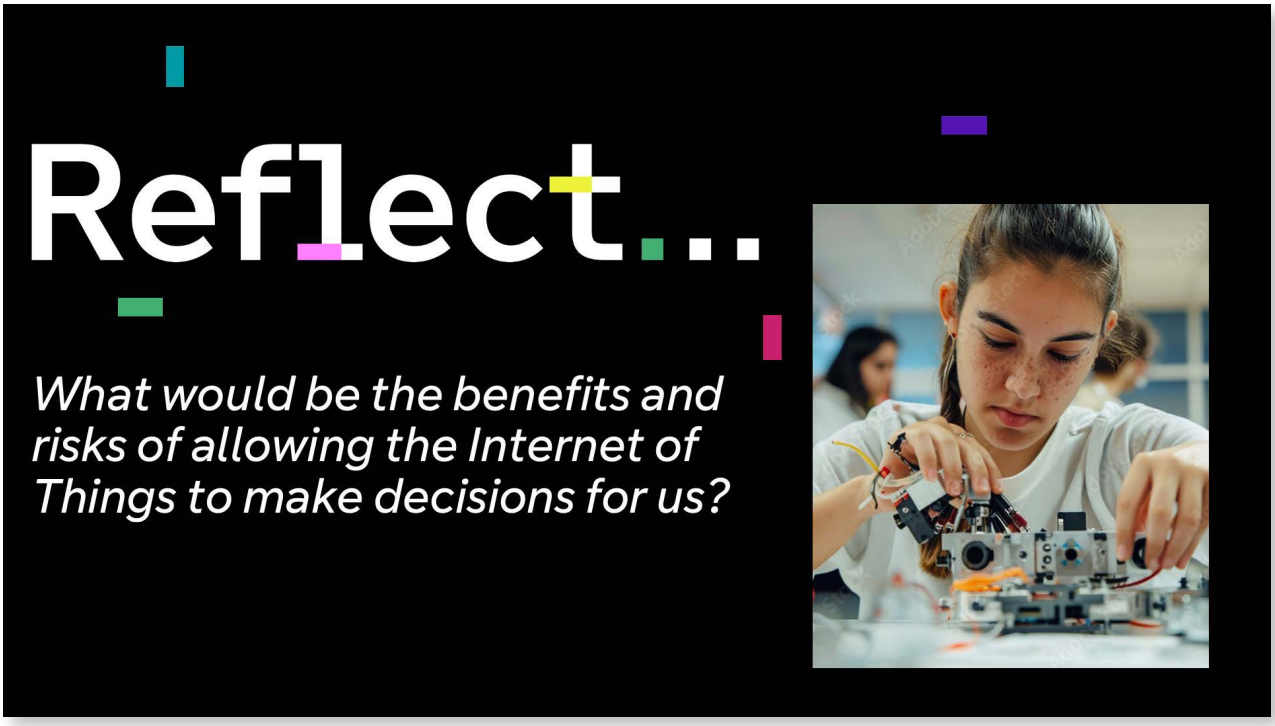
Activity 3 (10 mins)
Slide 19

Reflection

Now they have read Emma's story and have some examples of the ways in which the Internet of Things can transform our lives, ask them to reflect on the question on slide 19 – what would be the benefits and risks of allowing the Internet of Things to make decisions for us?

For example, in the future, the app that controls the lights in the home could learn what time the family usually leave the house, and turn the lights off for them if they forget. Or, if a smart watch knows how old a user is, it can detect a fall and automatically alert the emergency services.

This could be very useful – but it could also get things wrong and cause unwanted issues. As the IoT relies on the sharing of large amounts of data, students may also suggest issues around data security and privacy, which are covered in more detail in Lesson 2 of this module.



Resources

- PowerPoint presentation

Activity 4 (10 mins)
Slides 20-23

Metadata myth-busting

Ask students if they understand what 'metadata' is. Show slide 21 and explain that **'metadata' is essentially data about data**. In other words, it's used to describe or catalogue data in a network so that apps, databases and systems can understand and organise information and use it more efficiently.

It's an essential part of the IoT systems because it allows us to get the most value out of the data being shared, and therefore ensures we can use it in the more helpful way.

The information contained in metadata can include:

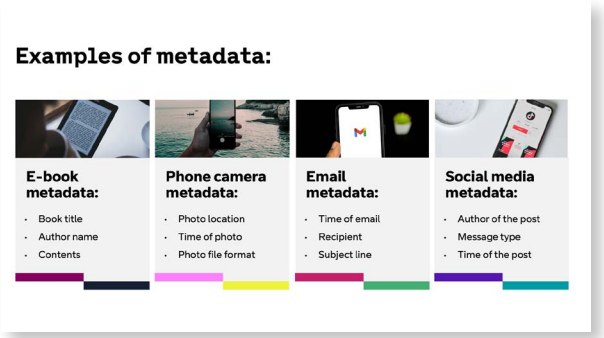
- How the data was generated
- Where and when the data was generated originally
- What format the data is in (e.g. text, videos, images etc.)

Use slide 22 to run through some examples of where we can come across metadata:

- When we read an e-book, we can see the title, author name and table of contents
- When we take a photo on our phone, it can sort our gallery by when and where the photo was taken.
- When we send an email, it saves information like the time, date, recipients and subject line
- When we post on social media, it records the author, message type and time of the post.

Use slide 23 to lead a quick fire challenge. Get students to look at the examples on the slide or come up with their own. Call out the different examples of the IoT devices and ask for students to say what would happen if these devices didn't have access to metadata. For example:

- A **smartwatch** user that couldn't pair the watch with their phone would not be able to access their contacts and send messages. It also wouldn't be able to send fitness data to any connected apps
- A **smart speaker** that wasn't able to connect to the internet would be unable to answer questions accurately, if at all because it needs to be able to connect to an online databases to find the information
- An **e-reader** would be difficult to navigate without the metadata to sort the contents. It would also be impossible to search for and download more books as it needs to connect to an online book seller for this



Resources

- PowerPoint presentation
- Pens and paper

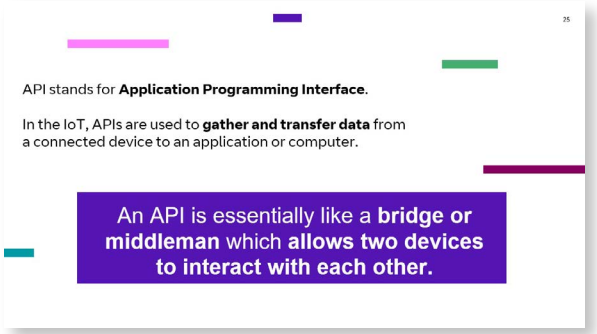
Activity 4 (10 mins)
Slides 24-27

APIs, explained

Ask students if they know what API stands for, and what it means. Show slide 25 and 26 and talk through the explanations and example shown. The IoT needs metadata from sensors along with APIs for devices to successfully communicate. APIs are essential to making sure data can be communicated back to the user. Without them, the IoT ecosystem would fall apart and would not work effectively.

Optional extension activity (15 mins)
Using slide 27, explain that students are going to explore their own 'behind the scenes' example of how an API works. They will do this by carrying out a short roleplay activity:

1. Get students into groups of four and read out the scenario: **you are packing for a festival at the weekend and want to know what the weather is going to be like. You ask your voice assistant to tell you the forecast.**
2. Assign each person a role within the group:
   - One student will be the user (the person who has requested the information)
   - One student will be the voice assistant device
   - One student will be the weather database
   - One student will be the API
3. Give students a few minutes to devise a role play which shows how smart devices, APIs and metadata work together to provide information to the user. They can also include what the user decides to do as a result of the information provided. An example answer would be as follows:
   - User: Alexa, what is the weather forecast for this weekend?
   - Alexa uses an API to instruct a weather database to search for local forecasts
   - The weather database reads the API's instruction and searches its metadata for the weather information requested, then sends this back to the Alexa
   - Alexa provides the user with the information about this weekend's weather: "This weekend, the weather is going to be sunny and hot with a chance of light showers"
   - The user decides to pack a rain poncho along with some summery clothes and plenty of water to stay hydrated in the heat



Resources

- PowerPoint presentation

Plenary (5 mins)

Reflect on learning

Ask students to answer the following questions to recap their learning from the lesson:

- What does the IoT stand for, and what does it mean?
- What are some benefits of being able to use the IoT?
- What are some ethical considerations of using smart devices to make our decisions for us?
- What is metadata and how is it used in the IoT?
- What is an API and how does it work?