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1

About Smart Homes

This chapter introduces the concept of the smart home and shows some of the uses for smart home devices.

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Some people consider smart home devices to be an irrelevance that automates tasks that are already easily done manually. However, similar things were said when the television remote control was first introduced. The range of functionality for smart home devices ensures that it is likely that they will become as common in the home as the ubiquitous TV remote.



Smart home devices use a range of methods of wireless communication to link to their related apps or remote controls. The most common is Wi-Fi, but various devices also use Bluetooth, Zigbee and Z-Wave. These are looked at on page 13.

Introducing the Smart Home

The concept of the smart home, i.e. one in which most of the electronic devices are controlled via voice controls, apps, or accessed remotely, is not a science fiction vision of the future; it is very much part of the here and now, and a realistic and affordable option for most households. For a smart home to work to its full potential there are a number of elements that can be in place:

- Smart home devices.
- Digital voice assistants, or hubs.
- Apps on smartphones and tablets, and online access.

Smart homes can operate without all three of these elements; e.g. smart home devices can be operated without digital voice assistants or apps, but to get the complete smart home experience, it is worth having all three in place.

Range of devices

Also known as the Internet of Things (IoT), smart home technology now spans a wide range of devices (and this is increasing regularly) as manufacturers realize the commercial importance of smart homes. Some of the current devices are:

- **Smart lighting systems**, including smart light bulbs and a bridge that connects to your Wi-Fi router. Individual lights can be controlled around the home with an app, a digital voice assistant, or a remote control. Groups of lights can also be used to create artistic effects. Smart lighting apps contain a range of settings that can be used to give you maximum control and flexibility over your lighting system.



...cont'd

- **Smart thermostats.**

Heating systems can be controlled to turn them on and off and set the temperature. They can also be used to determine whether there are people at home, and regulate the temperature accordingly. In this way, they can be used to save money on your heating bills.



- **Smart security systems.** Extensive security systems, using external cameras, can be installed, and controlled and viewed via an app.

- **Smart locks.** In addition to security cameras, smart locks can be used to add additional security to your home. They can be activated by key cards, key fobs, apps, digital voice assistants, time-limited PIN codes, and even remotely.

- **Smart cameras.**

Individual cameras can be used within the home, such as for monitoring a baby's bedroom, or the outside of a property.



- **Smart plugs and sockets.** Individual smart plugs can be used throughout the home, so that devices can be turned on and off without having to physically press a switch.

- **Robotic lawnmowers and cleaners.** Tasks within or outside the home can be automated through the use of robot lawn mowers, vacuum cleaners and mops. These do not all have their own compatible apps, but can work independently.



Smart home devices can also operate in the traditional manual way, in case their wireless communication is not working. For instance, smart light bulbs can be operated using the usual wall switch, and a smart heating system can still be controlled using the manual control panel.



There are also an increasing number of miscellaneous smart home devices, such as smart kettles, smart blinds, smart humidifiers and smart portable air conditioners. The list of smart home devices will undoubtedly expand as the technology becomes more widely available.



It is possible to combine separate digital voice assistants with your smart devices. For instance, you can control them from the Amazon Echo and Alexa, and also with Siri on your iPhone or iPad, using the Home apps on these devices.

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Digital voice assistants

Digital voice assistants are fast becoming the must-have accessory in the digital world. They consist of a stand-alone speaker, with the functionality provided by the digital voice assistant, which provides information from the cloud via your home Wi-Fi.

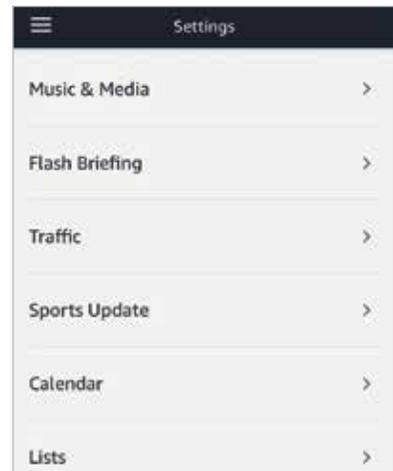
Digital voice assistants can perform a range of tasks such as providing news updates, telling a joke, playing music, and controlling smart home devices.

Different manufacturers have their own digital voice assistants, and the main ones are (the speaker is first, with the digital voice assistant second):

- The Amazon Echo and Alexa.
- The Google Home and Google Assistant.
- The Apple HomePod and Siri.

For each device the functionality is similar: the speaker connects to your home Wi-Fi and any requests for information are then sent to the cloud service for the relevant device. For instance, if you ask the Google Assistant to tell you the weather for the following day, the details will come from Google, in the same way as for searching with Google on the web. For smart home devices, instructions can be given to the digital voice assistant, and these will be actioned via your home Wi-Fi and the Wi-Fi functionality of the smart home device.

Digital voice assistants also have associated apps, where settings can be applied for the device; e.g. the Alexa app for the Echo and Alexa, the Google Home app for Google Home and the Google Assistant, and the Home app for the Apple HomePod and Siri. Depending on the device, there is a considerable range of settings that can be applied with the associated app.



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Smart home apps

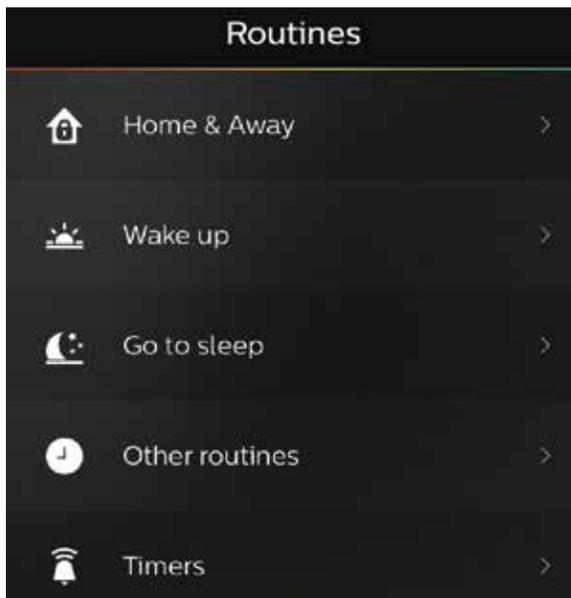
Although it is not essential to use apps with smart home devices, it rather defeats the purpose of them if this valuable option is ignored. Most smart home devices have a companion app that can be used to control the device, either in the home, or remotely. Remote access can require registering with the device's related website; e.g. if you are using the Philips Hue smart lighting system, you can register at the Philips website and then control your lighting system when you are away from home.

Smart home apps offer significant functionality, depending on the type of smart home device, and some of the options include:

- Turning devices on and off.
- Using preset scenes (for devices such as smart lighting) to create a variety of color combinations.
- Setting timers so that devices turn on and off at specific times; e.g. set smart heating to come on in the morning and turn off in the evening, and also a variety of times in between.
- Creating customized routines to give ultimate control over your smart home devices.



Digital voice assistants have to be linked to a compatible service in order for them to communicate with a smart device. This is similar to adding an app on a smartphone or tablet.



Controlling Smart Devices

Most smart home devices perform tasks that we have traditionally done by physically interacting with the devices. However, smart home functionality now means that there are several ways that we can interact with devices around the home and control them.

Manual control

For anyone nervous about the prospect of smart home devices becoming inactive due to a technological breakdown (or worse, being hacked and controlled by a malicious agent), it is important to note that most smart home devices can be controlled manually, without any need for wireless connectivity. For instance, smart lights can be turned on and off by hand, without any concern about the wireless technology that they contain. This means that if, for instance, your Wi-Fi is not available, you can still control the majority of the smart devices in your home. Similarly, if you have security concerns about unwanted access to your devices, you could turn off your Wi-Fi and still be able to use your smart home devices, but without much of their smart functionality.



Like all computing devices, security for smart home devices is an important issue. For more details about this, see pages 16-20.

App control

Smart home devices have their own companion apps that can be used on smartphones and tablets to control the devices. This is usually done via a reasonably straightforward interface where devices can be turned on or off, or have timing schedules applied for them, and a variety of general settings.

Digital voice assistants

Digital voice assistants, such as Amazon's Alexa, Google's Google Assistant and Apple's Siri, can be used for a variety of tasks, including controlling smart home devices. This is done by enabling the digital voice assistant with the equivalent of an app on a smartphone or tablet, and then using this to control smart home devices with voice commands. Not all smart home devices are compatible with digital voice assistants, but it is something that is being included with an increasing range of devices.

Smart home hubs

Digital voice assistants act as hubs to control smart home devices. Similarly, there are hubs that are designed specifically for this task, without the additional functionality of a digital voice assistant. These hubs can be used to connect and control a wide range of smart home devices, using the hub's companion app.

Connectivity for Devices

Smart home devices communicate wirelessly with the app, hub or digital voice assistant that is instructing them with commands. However, different devices use various methods of wireless communication to achieve this. These include:

- **Wi-Fi.** This is a well-known method of wireless communication, due mainly to its role in connecting computing devices wirelessly to the internet. However, it is increasingly being used to connect smart home devices. This is usually done with a bridge that connects to your home Wi-Fi router. The smart home device's app, hub or digital voice assistant can then communicate with the device, via the bridge that is connected to the Wi-Fi router.
- **Z-Wave.** This is a method of wireless communication that was developed in 2001, specifically for use with smart home devices. It enables Z-Wave devices to communicate directly with an app, hub or digital voice assistant, without the need for a bridge connected to a Wi-Fi router.
- **Zigbee.** This is another method of wireless communication designed to operate over relatively short distances, and is therefore well suited to smart home devices. It is similar to Bluetooth communication in its operation but intended to have simpler technological requirements. It operates by allowing apps, hubs and digital voice assistants to connect wirelessly to Zigbee-enabled devices, creating a personal area network between the smart home device and the method of connecting to it (app, hub or digital voice assistant).
- **Bluetooth.** A well-established method of wireless communication over short distances, Bluetooth can be used to connect a range of peripherals to computing devices. It can also be used to connect smart home devices, although many manufacturers of these devices lean towards Wi-Fi or one of the wireless communication methods that are designed specifically for smart home devices.



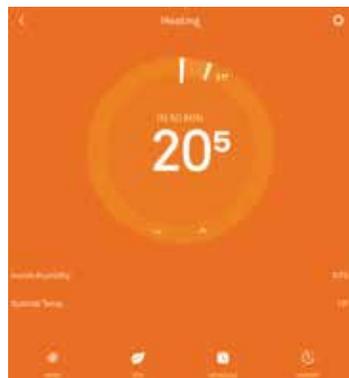
If devices connect directly to an app on a smartphone or a tablet, without the need for a Wi-Fi bridge, you may not be aware of the type of connectivity used by the device. However, this should be listed in any documentation that comes with the device.

Day in the Life of a Smart Home

Everyone will use smart home devices in different ways, and this will probably evolve over time as more devices are added. Here are some examples of what you could do in your smart home:

Morning

- Wake up to the smart lighting coming on automatically.
- Ask for a news and weather update from your digital voice assistant.
- Turn on the heating from your smartphone or tablet, using the smart heating app.
- Open the curtains/drapes with an app on your smartphone or tablet.
- Ask your digital voice assistant to boil your smart kettle for a breakfast cup of coffee.



Before buying any smart home device, ask yourself if it will really make a difference to your home, and the way that you interact with it, rather than just being a gimmick that is rarely used after the initial novelty of it.

Afternoon

- Use the smart vacuum cleaner to clean your home.
- Answer the front door to someone, using a smart video doorbell, so that you can see the caller at the door.
- Turn on a smart plug that is connected to a robotic lawnmower to cut the grass automatically.
- Get a traffic update from your digital voice assistant before you go out.



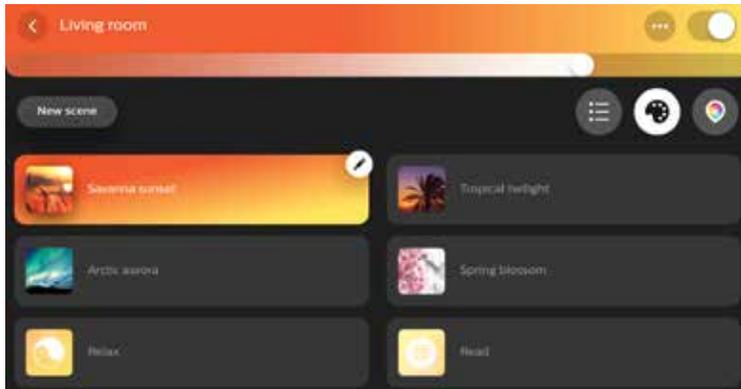
Smart heating systems can be set up so that they can recognize when there is no one at home and apply the Eco setting accordingly.

- Set the smart heating system to Eco setting when you go out.

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Evening

- Turn on all the lights in your home with a single tap on an app or a voice command for your digital voice assistant.
- Set a lighting scene for a room that has colored smart light bulbs, to create colored combinations.



Smart home devices such as smart heating and smart lighting can have schedules applied to them so that they are turned on and off at specific times.

- Check that all smart locks are shut, using the smart lock app, or digital voice assistant.
- Check that all electrical devices are off, using the smart plug app, or digital voice assistant.
- Turn off the heating with the smart heating app, or digital voice assistant.
- Check the smart security camera system before you go to bed.
- Turn off all the lights with the smart lighting app, or digital voice assistant.



Security Issues

How secure is the smart home?

Computing devices are inherently insecure to a certain extent and prone to malicious attacks, if the perpetrator is persistent enough. This is an ongoing problem with personal computers and larger commercial computing systems. But what does it mean in terms of security for the smart home? As with any system that relies on computing devices, there is the potential for hackers to gain access to smart home devices and apps that control them. However, smart home technology is still at a relatively early stage of development and security will undoubtedly become more of an imperative as smart homes gain a greater foothold within the mainstream consumer market. Some general areas of smart home security are:



Attacks on smart home devices are not unheard of, but they are relatively rare. It is a personal decision to weigh up the security risks against the range of benefits that smart home devices offer.

- **App security.** Smart home devices are usually linked to companion apps that can be used to control the devices. However, to do this they are granted a range of permissions that influence the functionality of the device, such as being able to open and close a smart lock that is securing your home. If hackers gain access to these apps then it could have considerable security implications, as they will be able to control access to your home. The best way to mitigate against this is to ensure your smart home apps are as up-to-date as possible and that you install any software and security updates that become available for the apps.
- **Wireless security.** Almost all smart devices derive their functionality from some form of wireless communication; e.g. Wi-Fi or Bluetooth. There are also some newer wireless protocols that are designed specifically for use with smart home devices. As with all digital communications, there is potential for hackers to intercept wireless communications (through any security flaws) and use this to gain access to your smart home devices. Wi-Fi is one of the most common ways to connect to smart home devices, so it is important that you protect your home Wi-Fi router as well as you can.
- **Integrated systems.** Some manufacturers offer integrated smart home systems, where one system is used to control all of the smart home devices. The obvious risk here is if hackers gain access to the system then they can control everything in your smart home.

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Secure your Wi-Fi

For the majority of homes with smart devices the main method of communicating with these devices will be through your home Wi-Fi network; i.e. the one that you use to connect to the internet. Therefore it is important that your Wi-Fi network is as secure as possible. This starts with the Wi-Fi router, and there are some areas that should be considered when using a router.

- **Firewall.** A Wi-Fi router that uses a recognized firewall should be used as this will help to prevent malicious software and programs infecting your system.
- **Encryption.** This should be used by your router, to ensure that all communication is encrypted to make it much harder to be hacked or intercepted.
- **Auto-updating.** Routers sometimes have software updates that are designed to improve security or patch any flaws that have been identified. Look for a router that does this automatically whenever an update is available.

One area of security weakness for Wi-Fi routers can be their admin password. This is set when the router is manufactured and is generally very basic, along the lines of “admin” or “password”. It is therefore important to change this password as soon as possible, to make it more secure. To do this:

1 Open a web browser and type the router’s address in the address bar. (This is usually in a form similar to 192.168.1.1 or similar. Check with the documentation that came with the router, or search on the web using your router’s model name)

2 Enter the **Username** and **Password**.

If these have never been changed they should be along the lines of Admin and Password



The screenshot shows a login interface for a Technicolor Gateway. It features a red user icon, the title 'Login', and the instruction 'Enter your username and password to access your Technicolor Gateway.' Below this are two input fields: 'Username:' with the text 'admin' and 'Password:' with a masked password '*****'. At the bottom are 'OK' and 'Cancel' buttons.



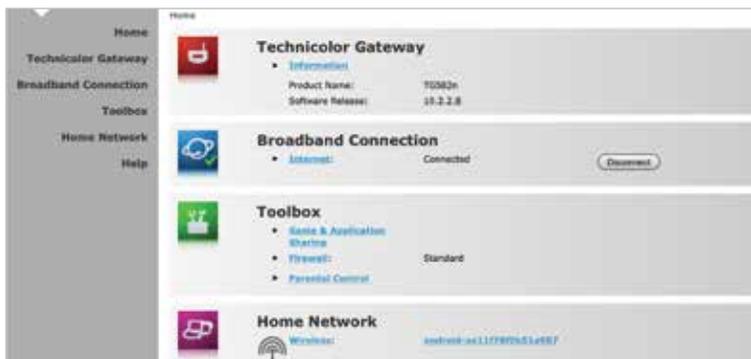
Check the specifications of a router to see what it offers in terms of a firewall, encryption and auto-updating.



Keep a look out for any strange behavior from your smart home devices, such as smart lights turning on or off when they are not instructed to, or flashing unexpectedly, as this could be a sign that your devices have been hacked or are being controlled remotely by someone else.

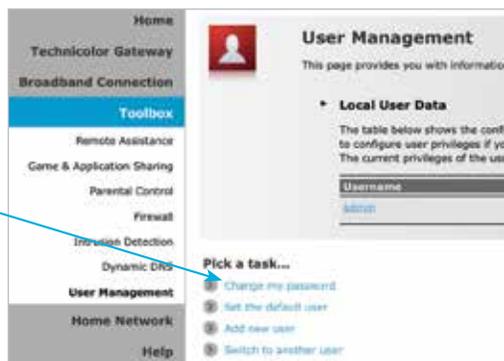
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- 3 The Admin options are displayed. These should include items relating to your internet connection and a toolbox for changing admin settings



The router password is different from the password (key) that is used to connect devices to the router.

- 4 Within the Toolbox, locate the option for changing the password



- 5 Enter the current password (old password), enter the new password, confirm it and tap on the **Change Password** button

The screenshot shows the 'Change Password' form. It contains three input fields: 'Old Password:', 'New Password:', and 'Confirm New Password:'. Below the fields are two buttons: 'Change Password' and 'Cancel'. A blue arrow points from the 'Change Password' button in the previous screenshot to this button.

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Always listening

Smart speakers and digital voice assistants such as Amazon Echo and Alexa, Google Home and Assistant, and Apple HomePod and Siri are increasingly becoming integral elements in our homes, and they contribute to a range of functionality in the smart home.

Digital voice assistants work by listening to your conversations and then acting on specific commands that are preceded by the device's "wake word". The digital voice assistant will also record commands that are preceded by the wake word and store the information on the device's server; i.e. the device manufacturer's computer that is linked to the device. For instance, if you use the Amazon Echo, recorded commands are stored on an Amazon computer. Since the digital voice assistant is always ready to respond to commands, it means that it is always listening, and just waiting until it hears the wake word.

Since digital voice assistants are always listening, it can cause some issues if it thinks it has heard a wake word, when that has not been the case. There have been some instances where a digital voice assistant has misinterpreted a conversation, thinking that it contains the wake word. The device then listened to the conversation and mistakenly sent a recorded message to a contact in its address book, without the person who was engaged in the original conversation being aware of its action. Although this is a rare occurrence, it is important to remember that your digital voice assistant is always listening and to bear this in mind if you are discussing sensitive information such as personal financial details. Some areas of conversation to consider if you are concerned about your digital voice assistant overhearing it are:

- Personal information and details relating to your family members and friends.
- Financial information, such as bank account details.
- Passwords and PIN codes for online websites, and also physical items such as bank credit and debit cards.
- Anything you would not feel comfortable with if it were distributed to a wider audience.

If in doubt, turn off your digital voice assistant before you have a conversation about a particular subject.



Digital voice assistants can also be inadvertently activated if they hear their wake word on the TV or radio.



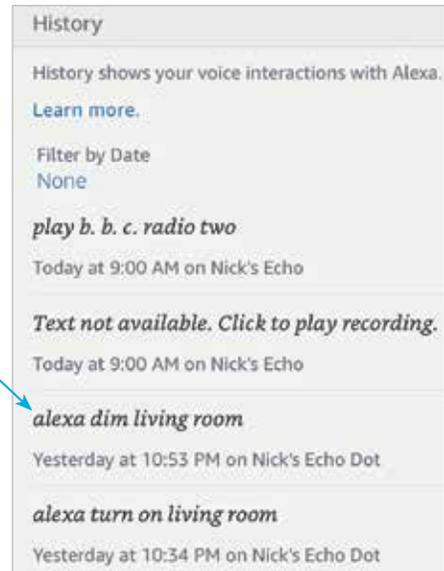
Voice recordings usually start a second or two before the actual voice command. This is because the device is always listening and records just before the command to ensure that the full command is captured.

...cont'd

It is possible to view details of everything that a digital voice assistant has recorded, usually within the device's companion app's settings. To do this (this example is for the Amazon Alexa):

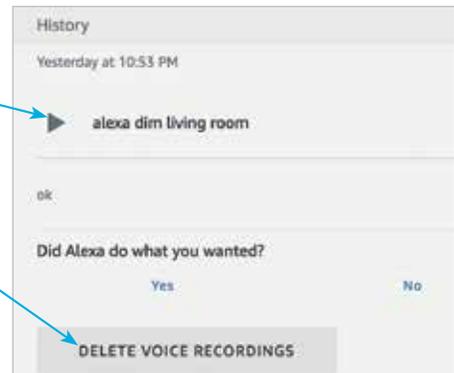
- 1 Open the device's companion app 
- 2 Tap on the **Settings** button 
- 3 Tap on the **History** button 

- 4 Each recorded voice command is listed



- 5 Tap on a command to view its details

- 6 Tap on the **Play** button to listen to the recording



- 7 Tap on the **Delete Voice Recordings** button to remove the recorded data from the device's server