Upper Key Stage 2 – *Data Matters* – Theme Guide

Children investigate the concept of "big data" and its use in the world. They review file types and protection. They explore binary form and develop understanding of computer networks. They search more efficiently and investigate their digital footprints (or 'digital tattoos'), building safe and responsible use of online spaces. They create and search flat-file databases, developing accuracy and efficiency.

Learning objectives for the term
To investigate how "big data" is used in our world.
To understand file extensions can identify software used to create a file, but files may be accessed/edited using other software.
To understand computers store/process data as 0s and 1s, known as binary form. *Add two binary numbers.*
To have a broad understanding of the school's computer network and the role of the server/master computer.
To understand network devices can be identified by IP address.
To understand that we can use tools to improve the accuracy and efficiency of our digital searching.
To understand that internet activity can leave a permanent trail.
To understand that databases provide a way to store, organise, retrieve and analyse sets of data.
To understand database structure determines the queries it can answer.
To understand the stages in database development.
On-going Learning Objectives
To organise their work confidently in agreed locations, using appropriate file-naming conventions and folder structures.
To save drafts of their work and use these to support critical review through which they evaluate and improve their work.
To understand some of the methods they can use to report concerns about content and contact.

Vocabulary – see Glossary in main scheme document for definitions (for terms in blue)	
Big data, *common file types,* *encryption,* *server and client,* *web crawler,*	*digital footprint/tattoo,* *database,* *(database) fields,* *records,* *common file types*

Possible resources for this theme (further resources are suggested with the explanatory notes below. Note that these are examples and not formal recommendations.)	
Flat-File Database Software • 2Simple® 2Investigate • Information Magic / Workshop • Textease Database • J2Data (as part of J2E)	**Advanced Search Tools** • Google Advanced Image Search: https://www.google.co.uk/advanced_image_search?hl=en-GB&fg=1

Please note that with any online platform it is essential that you review the privacy policy and terms and conditions of the service. The school is responsible for the protection of data it holds and compliance with current data protection legislation. Always assess both the data protection and safety of the service you are considering using, and ensure any necessary permissions are in place before using with pupils.

Free *Barefoot Computing* activities to support this theme.

• **Modelling the Internet Activity.** Link Pupils learn about difference between Internet and WWW, and how web pages are viewed. • **Network Hunt Activity**. Link Pupils hunt around school to find and map locations for network connected devices.	*Barefoot Computing* provides freely available resources to support teachers in delivering the computer science aspects of the 2014 Primary National Curriculum for Computing. Free registration with the *Barefoot Computing* website is required to view and download these resources. To register, visit: http://barefootcas.org.uk References to these resources and the accompanying links are provided with permission from *Barefoot Computing*.

Primary Computing Scheme online materials that are referenced in this guide can be accessed from: http://www.hertsforlearning.co.uk/user/login

You will need to be logged into your school account and have a current subscription to the Primary Computing Scheme to gain access. The materials can be accessed from the *My Resources* link at the top/right of the screen, once you are logged in.

Key learning objectives (some objectives might be used for more than one lesson)
To investigate how "big data" is used in our world.
• The term 'big data' refers to the collection of massive amounts of data in order to identify trends and patterns, particularly in human behaviour / habits. Consider that many organisations collect and analyse data for different reasons including predicting future trends, for public information, for commercial gain etc. • Frequently, in the news and suchlike, we will read or see stories about how people are spending more, or less, are buying particular types of product more, are consuming more or less of something etc. This knowledge comes from the collection and analysis of 'big data.' • There are plenty of websites with lots of fascinating and fun statistics, some of which will have been derived from the collection and analysis of 'big data.' Do check these carefully first as some of these have the occasional 'rude' or inappropriate statistic. It may be safer to use some of the statistics shown to present to the class from your screen/board rather than allowing children to use the sites independently. • Discuss different examples of big data with the pupils (as examples above.) Who uses the data that is collected? Why? • Discuss how 'big data' might be collected. What do we do that might lead to data being collected from us? Consider that when we go online, buy goods, sign-up for online or offline services, watch a TV program, download a game or podcast or visit a museum, data may be collected which forms part of this 'big data.' • Discuss supermarket loyalty cards, cashless spending, online accounts etc. and how they might be used to collect data. • Consider how the 'Internet of Things' can be used to collect data. For example, when we control household devices over the internet, this may be sending out data about our usage of those devices. • Consider how much data we may be giving away when using social media tools. By interacting with various accounts, playing certain games, taking part in social quizzes and polls etc. we may be giving away our data. • How do we know that data about certain behaviours has been collected about us? For example, if you search an online shop for a particular item, it is likely that the item or similar items will appear in online adverts when we are on different websites or playing games etc. • What are the positive and negative aspects of this data? • The website Gapminder has an interesting animated bubble chart about life expectancy over the years, as well as other tools, which you might use to show how 'big data' can inform us. http://www.gapminder.org • The website http://www.internetlivestats.com/ shows statistics about internet use, with 'live' counters for

statistics such as number of websites published, number of blog posts published etc. Whilst not entirely related to 'big data' it may be a useful site to show the size and scale of internet services use, from which big data may be gathered. Note this website is advert supported.

To understand file extensions can identify software used to create a file, but files may be accessed/edited using other software.

- In general, helping children become familiar with file extensions is best embedded across their learning, drawing attention to file extensions whenever children are saving and or accessing different types of files.
- See the glossary for a list of commonly used file extensions.
- Quiz the pupils, matching file extensions to type of file, and / or software the file might be opened with. See the accompanying Microsoft® Powerpoint Quiz: [*File Extensions Quiz*.]
- Why might we want to protect a file to make sure that nobody who isn't authorised can open it, or edit it?
- How can we do this? For example, in Microsoft® Word you can password protect files from the *File* menu, using the 'Protect Document' menu. Pupils could explore the different options offered with a document file specially created for the activity (rather than an important piece of work, in case they forget their password.)
- To help children learn about making good passwords, use the accompanying PowerPoint slides [*Passwords Activity, Making a Strong Password*] which can be downloaded from the online area.
- The online game-based activity, "Interland" from Google® has a game on making strong passwords: https://beinternetawesome.withgoogle.com
- Discuss PDFs (Portable Document Format) and why they have become a popular method of distributing electronic documents. (PDFs can be opened on numerous different types of devices, regardless of operating system etc. and look more or less the same regardless of how they are being viewed. In this way, the author of the document can be sure it will look more or less the way they intended, to all viewers. Also, without specific software, PDFs generally cannot be changed by the viewer/reader.)
- Discuss advantages and disadvantages of using PDFs.
- Practice converting files such as Word documents into PDFs (using the *Save as* command.)

To understand that computers store and process data as 0s and 1s and this is known as binary form. *Add two binary numbers.*

- This is just an introduction to the way computers use binary. There is no requirement to understand it in depth or teach binary/decimal conversion.
- Binary is a numerical system made up of 0s and 1s. A computer processor is effectively made up of thousands of 'switches' which can either be on or off. On is represented by a 1, off is represented by a 0.
- Computer programs are converted to binary so that the computer processor can handle them.
- Documents etc. are also converted to binary. We might see a page with lots of writing, in a language we understand, but the computer sees a massive string of 0s and 1s.
- You could liken it to Morse code. Morse is made up of only two sounds, but by combining them into different patterns we can make a complete communication system. Binary is only made up of 2 digits but when combined into certain patterns it makes a complete number system.
- Numbers are converted into binary for the computer to understand. Letters are first given a decimal number, which is then converted into a binary number, in order for the computer to be able to handle it. You can find lists of letters with their decimal and binary representations online by searching for an 'ASCII table' (ASCII stands for *American Standard Code for Information Interchange.)*
- Explore some binary representations of letters and numbers. E.g. the letter 'c' is represented by the decimal number 99 and the binary number 01100011. This was found by looking at an ASCII table.
- Wikipedia has an ASCII table, here: https://en.wikipedia.org/wiki/ASCII#Printable_characters
- Practise identifying binary numbers.
- Some children may like to try converting numbers to binary or adding binary numbers.

To have a broad understanding of the school's computer network and the role of the server/master computer.

- Children should learn and understand that in this day and age, the majority of computing devices we use in our daily lives – laptops, tablets, phones, games consoles etc. will be networked in some way (i.e. connected to other computers/devices.)
- What are the advantages of this? Why is everything networked? What can we do when we are networked, that we cannot do on stand-alone devices?
- Why do we have to log-on to the network? Where is our work stored? How does a computer know which folders we can access and/or not access?
- A server computer offers services to other computers on the network, which may be referred to as 'clients'. These services may include storing users' files, managing printers and providing internet access.
- See the accompanying Microsoft® Powerpoint® slides showing how a typical school network might work: [*How a*

simple school network works.pptx]

- Compare the way we work at school to the way devices are connected at home (where it is unlikely a server will be present.) Talk about the way we can share files from device to device, discussing the safety implications.
- Investigate approaches to connecting devices such Bluetooth™ or AirDrop™.
- See the free Barefoot Computing activity (link above):
  - Network Hunt Activity

To understand network devices can be identified by IP address.

- All devices on a network have an IP address so that they can identified. Children should understand that computers, printers and other devices on a network can be identified by their IP (Internet Protocol) address, as houses are identified by postcode and number. You cannot have two devices with the same IP address on the same network, just as you cannot have two houses in the same road with the same number. Again, see the accompanying Microsoft® Powerpoint® slides showing how a typical school network might work: [*How a simple school network works.pptx*]
- Unlike house addresses, IP addresses can be 'dynamic' and change from time to time. It is usually the server that provides the IP address to a device (client) on its network, for a certain amount of time. It then changes the address for a new one.
- All websites also have an IP address so they can be identified. We use the URL (Uniform Resource Locator) or website address to identify websites, as they are easier to remember. Computers called DNS servers (Domain Name System) translate these addresses to the actual IP address of the website.
- Some children in your class may be familiar with using IP addresses through various online games, where they can sometimes choose which server they want to connect to in order to play the game and interact with other players.
- In school, a computer's IP address may be shown on the screen, depending on the system you use.
- IP addresses also identify computers on the internet, and some search engines and online services can use IP addresses to track the browsing or collect data about the person carrying out the search (refer back to 'Big Data').
- An IP address can usually give away our approximate location so advertising can be targeted at us. Discuss the advantages and disadvantages of this.
- Discuss the potential risks of sharing IP addresses.

To understand that we can use tools to improve the accuracy and efficiency of our digital searching.

- Explore search operators, such as *equal to or greater than* (=>) and *equal to or less than* (=<), and linked searches using AND, OR, NOT.
- Apply these approaches in digital searching using advanced search engine tools.
- Try carrying out different searches using different operators, to observe the effect the operators may have on the search results. For example, try the following searches:
  - harry potter
  - "harry potter"
  - harry +potter
  - harry –potter
  - harry or potter
- It is important that children learn how to use advanced search, where available in major search engines. This is particularly important to identify images that we able to use without infringing copyright, providing we follow the terms of use that accompany the image.
- See the accompanying video guide, available from the downloads area: [*Using advanced search tools*.]

To understand that our internet activity can leave a permanent trail.

- Remind children that what we do, say, post etc. online could permanently stay online. The phrase '*once online, always online*' is a good one to use.
- The term "digital footprint" has been used to refer to the trail we leave online through our internet activity. Increasingly the term "digital tattoo" is being used instead, as a footprint is not permanent.
- You can look at the search history in a browser to see the sites visited on that computer. In Internet Explorer, for example, this is usually located from the 'star' (favourites) button at the top right of the browser window.
- Children should understand that by deleting the history, they are not deleting any information they have put online or any data that may have been collected whilst they were online.
- Therefore we must always think twice about what we are posting. The '*think before you post*' phrase is useful here.
- In order to help children think about their online activity and the resulting digital tattoo, you could carry out a

project where children record all their online activity in a table (individual to each child) across a specific amount of time. They could record websites visited, number of images liked, images shared, comments made etc. At the end of the activity, children review their online activity, thinking about how it has added to their digital footprint / tattoo.

- Because of the permanent nature of online sharing, and the big part it plays in many children's lives, discuss the importance of building and maintaining a positive digital footprint / tattoo, and ways in which they might generally reduce the 'size' of their footprint / tattoo (by, for example, sharing fewer images, not 'liking' everything they see, making sure their profiles are not public, not commenting on public posts, only making positive online comments, etc.)
- Children could make a presentation, poster or other digital asset with tips and advice for maintaining a positive footprint / tattoo and warnings about the risks of having a negative one.

To understand that databases provide a way to store, organise, retrieve and analyse sets of data.

- What is a database and why do we use them?
- Refer back to 'big data' and consider how the data collected is stored and analysed.
- Following on from the Lower KS2 theme '*Keeping Informed'* revise the history of databases, using images of older non-digital databases such as library card databases, telephone directories, filing cabinets etc.
- Following on from the Lower KS2 theme '*Keeping Informed'*, use 'Top Trumps®' style games to learn about databases. A pack of cards in this type of game is a kind of database, with lots of records (cards) and each record holding different fields of information. We could sort all the cards in our pack according to different criteria, for example in a pack of football players we could sort the pack by number of goals scored by each player, number of international games they've played and so on.
- See the accompanying sheet: [*blank class database cards*] for an unplugged-database activity. (This may have been used in Lower KS2.)
- Where are databases used in our daily lives? Examples include:
  - Online shopping
  - Search engines
  - Computer based music players and delivery/purchase systems
  - On demand TV / Film services
  - Libraries
  - School databases of pupil records
- How can databases help us?

To understand that the structure of a database determines the queries it can be used to answer.

- You will need access to a database program designed for schools. A number of these are commercially available, for examples RM® Information Workshop, Textease® database, 2Simple® 2Investigate (available through Purple Mash,) J2Data (available through J2E.)
- Revise the vocabulary of flat-file databases, e.g. record / field / field name / field content.
- Use a database program to explore ready-made examples, considering how the database is structured. What fields are used? Why type of fields are used (e.g. text / number)?
- Using the same database software, explore the search capabilities and discuss the sort of questions / queries which we can answer by searching the databases.
- How are the search tools in the database software similar to those offered by advanced search options?

To understand the stages in database development.

- In groups, design a database to answer specific queries.
- The database structure is best designed away from the program, thinking carefully about the fields it will contain and the type each field will be (e.g. number, text) in order to minimise mistakes when searching and sorting, and therefore make results more accurate and usable. For example, if we have a field where the age of a person is asked, and we set this to be a text field (expecting the number to be written as text) we open up the possibility of spelling mistakes or typos in the answer, which will affect search / sort results. By limiting the content of certain fields to a given selection (perhaps through a drop-down menu of options) we ensure accuracy of data input.
- Each group of pupils should:
  - Think about the purpose of the database and what it will be designed to achieve.
  - Design the database, creating the structure (as above.)
  - Collect the data needed to populate the database. Pupils could, for example, create a spreadsheet to record answers to specific questions, or use a questionnaire app. Be careful with using online questionnaire tools, keeping in mind data protection and privacy.

○ Review the database design, sharing the strategies used to improve data accuracy (for example, specifying appropriate field types and lengths and using choices or lists, units of measurement etc.)
On-Going Learning Objectives
To organise their work confidently in agreed locations, using appropriate file-naming conventions and folder structures.
To save drafts of their work and use these to support critical review through which they evaluate and improve their work.
To understand some of the methods they can use to report concerns about content and contact.
To understand the need to keep electronic and other data secure and protect personal information when entering data online and to encourage eSafe practice in others.

Suggested independent task – any open-ended activity (2-3 sessions) enabling the children to demonstrate their computing capability around the knowledge and understanding provided in the term
Independently: ➢ Produce a digital resource, selecting software and combining different digital content in an appropriate format to inform younger pupils about an aspect of the online world and encourage eSafe practice (for example effective searching, reducing digital footprints, using online spaces safely, "big data", databases in the world etc.) ➢ Present their resource, explaining how they ensured their own research practice was safe and appropriate. Evaluate. Other considerations: Does the task provide for children to work at different levels? Is there support available for children to select if they wish? Are there opportunities for the children to review and develop their work? Is there an opportunity for the children to evaluate the finished task?

Pupils have the opportunity to make a media rich resource for a specific purpose, demonstrating their knowledge of eSafe practice. They could combine audio, images (selected from a copyright-friendly source, perhaps using advanced search tools to find these) and even video and/or animation. To do this they could select tools such as:

- Book Creator™ app (iPad® / Android)
- Explain Everything™ app (iPad® / Android)
- Puppet Pals HD app (iPad®)
- Smart® Notebook software, if available to pupils.
- Microsoft® Powerpoint®

They can present their digital resource to the class, articulating how they researched the topic and how they found any content that was obtained online (e.g. images via advanced search or a school-friendly image site.)