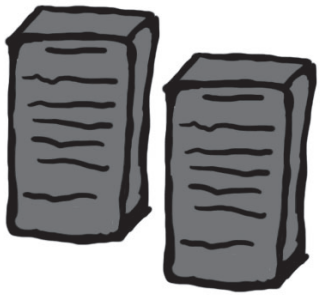
Activity 11

Tablets of Stone—*Network Communication Protocols*



Summary

Computers talk to each other over the internet via messages. However, the internet is not reliable and sometimes these messages get lost. There are certain bits of information we can add to messages to make sure they are sent. This information makes up a protocol.

Curriculum Links

- ✓ Mathematics: Developing logic and reasoning
- ✓ English: Communication, interpersonal listening

Skills

- ✓ Co-operative problem solving
- ✓ Logical reasoning

Ages

- ✓ 9 years and up

Materials

Each student will need:

- ✓ Many blank "Tablets"

Each messenger will need:

- ✓ A set of message action cards

The teacher will need:

- ✓ A timer

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Tablets of Stone

Introduction

In this activity students consider how different methods of communication operate successfully. By looking at rules and procedures in place, students are introduced to communication protocols. By working through a role-play scenario, pupils test their own protocol operating in an unreliable environment similar to that found in packet switching on the Internet, specifically, TCP/ IP.

Preparation (30 minutes)

1. First gather the cards. You'll need to print out the action cards (below) and cut them up. These form the basis of the game.
2. Next, decide on some messages for student to send. It's important that they're *not* English sentences or anything that can be put back together by their structure. Something like "1LHC255HD(RLLS" would be a suitable message, or a phone number.
3. Print out copies of the "tablets'. Each tablet has places for six characters or numbers, so you cannot fit the whole message on one tablet. You will be need roughly 30 tablets per student, depending on how long you wish to run the game.

Note: The action cards are three types; delay, don't deliver, deliver. Adjusting the ratio between these will represent the quality of your messengers. More "deliver" cards means a more reliable messenger. More "delay" and "don't delivers means a less reliable network. These cards are analogous to a computer network/communication channel.

Playing the game

1. Split your class into pairs. It is crucial for the pairs to sit apart from one another where they cannot see or communicate with each other. Two rooms are ideal but sitting students on opposing sides of a classroom should suffice.
2. Give one of each pair a message to deliver to their partner.
3. Shuffle the Action Cards and choose a messenger. You could be the messenger or if you use a student if you have an odd number. You might need more than one messenger if you have a large class.
4. A student is now to write on their tablet and give it to the messenger. The tablet should at least say the name of the other person on it.

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5. The messenger now picks the top action card, turns it over, reads it and uses it to decide what to do with the tablet.
6. Repeat steps 4 and 5 with each tablet

After 5 or so minutes of chaos and frustration, your students should realise that names alone are not good enough for a protocol. Stop the class and discuss this… what is the first issue they're having? Is it order? Perhaps it would be be best to use one of those 6 slots to put a tablet number in? This means there is less room for the actual data – what does this mean in terms of the number of tablets we have to use now?

After some more time, they might notice other problems, and these should also be discussed. Possible problems could be missing tablet, not knowing if the tablet was delivered, not knowing whether to resend a tablet. Solutions you could suggest would be a sending back acknowledgements and waiting to hear back for these before re-sending another – this means that the receiving student(s) also need blank tablets to send messages, and they will have to agree on what their 6-character responses mean before they play the game again.

You'll need at least two students for this game, but we recommend having as many as possible. If you have a large class, consider a few messengers. Once again, discuss this with your class… what happens if you have many messengers? What happens if you had one?

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Deliver this tablet now	Deliver this message after the next one
Deliver this tablet now	Deliver this message after the next one
Deliver this tablet now	Deliver this message after the next one
Deliver this tablet now	Don’t deliver this message
Deliver this tablet now	Don’t deliver this message

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To:

From:

To:

From:

To:

From:

To:

From:

To:

From:

To:

From:

To:

From:

To:

From:

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Tablets of Stone

In an ancient city there are a number of very important Governors. These Governors decide how the city is run and make very important decisions. They each live in different houses all over the city.

The Governors often want to communicate, they need to send and receive messages all over the city. Governors are identified by their house number and they all have access to a group of messengers whose job it is to deliver the messages.

The only way to send messages is by writing them on large rectangular stone tablets, which the messengers carry to their destination. The stone tablets are of a fixed size and can only fit 6 pieces of information on them. One piece of information can be one letter or one number. Messages are often split over a number of tablets, and as these tablets are very heavy they can only be carried one at a time.

The messengers cannot be trusted to always deliver the message correctly as they are forgetful and lazy. They often stop for long breaks during working hours and even try to escape from the city.

The Governors want to find a way of making their communication reliable, they want to develop a set of rules that they will all follow. By doing this they can tell whether or not their message has been delivered and if the message was correct. The Governors have already decided that the destination should be written on the tablet.

In your groups your task is develop the rules that the Governors will use to communicate...

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What's it all about?

On the internet, data is broken into packets for transportation. However, the channels in which these packets travel is not always reliable. Individual packets sometimes are damaged, lost or lose their ordering.

In Tablets of Stone, tablets are packets and their contents is data. Packets contain both data and *header* information. The size of the header information affects how much data can be transferred – so a balance has to be reached, as packets are of finite size.

Students will find that they will need to swap some of their data boxed for information such as packet number and total packets, or whether or not the packet is an acklnowledgement packet. Due to this information taking up data boxes, overall more packets will be needed.

Internet protocols such as TCP and UDP balance these factors to create reliable and efficient data transfer.

This activity is adapted from one available through the "Computing Science Inside" project (csi.dcs.gla.ac.uk).

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