

Data communicatie

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**Data Communicatie**

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# Introductie :

Communication over wires

What is the wireless physical medium that makes radio communication possible?

*Het geluid omzetten in een elektrisch signaal*

# Communication over Wires :

Problems

What is a bit?

*De kleinste eenheid van informatie. 1 bit = 8 byte*

How many bits are there in a kilobyte?

*8000 bits*

Explain the use of Ground (GND) and 3V pins in your micro:bit.

*3 v zorgt dat de 2e micro:bit stroom heeft (3v = 3 volt)*

*GND verbind met de grond zodat het circuit compleet is*

How many bits did you send to the receiver in your “Simple Heart Transfer” program?

*4 bits*

How are the bits in your program sent over the wire in your program?

*Via Voltage*

# Broadcast communication :

Problems

Which frequency range does your micro:bit’s radio work in?

*In de range van 2402 MHz tot 2480 MHz.*

What is the speed of light?

*300.000 m/s (precies = 299.792.458 m/s.)*

Using the wavelength equation, calculate the wavelength of your micro:bit’s radio.

*wavelength (meter) = Speed of light (meter/second)/Frequency (hertz)*

*wavelength(meter) = 299.792.458 / 2402 = 124.809 λ*

Is it easier to broadcast using wired or wireless communication? Why?

*Draadloos. Je hoeft niet alles op elkaar aan te sluiten met kabels.*

# Group communication :

Problems

Fill in the blank in this sentence: “A one-to-may communication between one sender and a group of receivers is --- communication.”

*Multicast*

Let’s assume the group ID is 3 bits. For example, 010 is a group ID. What is the maximum number of groups can you have in a network?

*8 mogelijke groepen*

*000, 001, 011, 111, 100, 110, 101, 010*

If the group ID were 6 bits, what is the largest group ID you could choose for your micro:bit?

*111111*

“Compared to broadcast, the receivers in group communication receive more messages.” True or False?

*Dat is waar (True)*

# Game 1: Shakey Donkey

Problems

At the beginning, what is the value of the "caught" variable for both players? Does anybody need to change the "me" variable?

*Caught = 0 in het begin. Me moet wel veranderd worden*

Who gets to send their "me" variable first?

*Wie als eerste schud*

When you receive a number, you set the "caught" variable. What does the "caught" variable mean?

*Hoeveel ezels je hebt gevangen*

You also change the "you" variable by the "receivedNumber". What does the "you" variable track?

*De score van de andere persoon*

Imagine you already started playing the program. You saw some donkeys appear on your display, and you shook them away. How did your "me" variable change? What is it equal to?

*Het is gelijk aan hoeveel ezels je hebt gevangen. Als je er 1 vangt verandert de “me” variabele met 1*

How do you know you won? Does the other player know the result? How? Explain how the "me" and "you" variables are used to decide the winner.

*Als 1 van de variabelen een bepaalde score hebben bereikt.*

*Als er 1 heeft gewonnen laat hij een ‘happy face’ zien en op de andere een ‘sad face’.*

How would you make sure you win this game?

*Door als eerste de ezel weg te “shaken”.*

# Unicast communication

Problems

In what ways is unicast like broadcast and group communication? In what ways is it different?

*Ze verzenden allebei berichten naar ‘receivers’*

*Unicast verzend alleen maar berichten naar 1 ‘receiver’*

*Broadcast verzend berichten naar meerdere ‘receivers’*

Which ones are not IP addresses?

-1.0.0.1 -- 278.0.10.0 -- 104.20.14.61 -- 127.0.0.1 -- 161.23.84;18

161.73.246.13 -- 104.20.14.61.15

*Geen IP adressen zijn:*

*-1.0.0.1*

*161.23.84;18*

*104.20.14.61.15*

In this chapter, you used two-letter strings for your addresses. How many different people can you unicast using this address size?

*1*

When selecting an address size for your message header, can you pick any size you like? In your program, what happens if you increase your address size to 10 letters? Do you see any benefits? Or are there any limitations?

*Het bestand wordt groter en dan duurt het langer voordat hij het kan verzenden*

How does the size of a data packet header affect the actual packet size? If your data packet size were 100 Bytes, and your header size were 10 Bytes, how big could your messages be? What happens if the header size increases to 50 Bytes?

*100 bytes*

*Bij 50 bytes = ook 100 bytes*

# Two-way unicast

What is the minimum and maximum round-trip-time (RTT)?

*109 ms (Het was altijd 109 ms)*

What is the average RTT?

*109 ms*

Problems

In the example ping figure from the http://ping.eu/ping site, what is 172.217.23.228?

*Dat is het IP Adres*

What is round-trip-time, and how is it calculated?

*Round-trip-time is de tijd dat het duurt tot een bericht van de zender tot de ontvanger en terug heeft geduurd*

*Berekenen: RTT = Time\_receive\_pong - Time\_send\_ping*

Think about the following scenario: micro:bit 1 sends a Ping to micro:bit 2 at time 5. If the round-trip-time is 10, at what time did the micro:bit 1 receive the Pong message?

*15, 5 + 10(1 ronde)*

In the example ping figure from the http://ping.eu/ping site, what are the minimum and maximum round-trip-times (RTTs)?

*Minimum = 10.149 ms*

*Maximum = 10.206 ms*

In the example ping figure from the http://ping.eu/ping site, the packet loss 0% loss. What is the loss percentage, if 2 Ping messages were lost out of 5?

*40%*

# Game 2: Rock, paper, scissors over the radio

Problems

How do you test a tie in your program?

*Als de getallen hetzelfde zijn*

How does the Table change, if paper=2, rock=0, and scissors=1? Redraw your table.

*Er veranderd niks*

To play with a different player, what do you need to change in your program? Remember you are using unicast to send your hand shape.

*De Group ID moet je veranderen*

What happens if you send your hand shape to the other player before they pick theirs? Will there be a problem? Could they cheat!?

*Er is geen probleem*

# Handling Errors: Retransmissions

Problems

What is interference? Why does it happen?

*Interference is een signaal dat een ander signaal onderbreekt*

*Het kan gebeuren omdat er veel mensen zijn die een signaal versturen en die met elkaar botsen*

If the sender sent 20 messages, and 11 messages were lost on the way to the destination, what is the packet loss?

*0.55*

If the packet error rate is 20% and the sender sent 40 packets, how many packets had errors?

*8 packets*

Assume you do not know how many numbers that will be in the message sequence. But, you know the numbers will start from 1, and will increment by 1. For example, the sent message sequence may be: Start 1 2 3 4 5 6 7 8 9 10 11 12 End. What happens if you lose Start or End messages? Which one is worse: the loss of Start or End message? If the only message you receive is a 4, what can you say about the number of messages you lost?

*Verlies van end message*

*Dat het niet accuraat is*

Assume you do not know how many numbers that will be in the message sequence. And they do not follow any order. For example, the sent message sequence may be: Start 3 5 10 2 End. What happens if you lose Start or End messages in the sequence Which one is worse: the loss of Start or End message? If the only message you receive is a 5, what can you say about the number of messages you lost?

*Verlies van start message*

*Dat het niet accuraat is*

# Handling Errors: Acknowledgements

Problems

What does ARQ mean?

*Automatisch herhalingsverzoek is een methode voor foutcontrole. Het gebruikt bevestigingen en time-outs om pakketten opnieuw te verzenden. Her-verzendingen kunnen doorgaan totdat de afzender een bevestiging ontvangt of een maximum aantal is bereikt.*

In the Stop-and-Wait ARQ protocol, if 10 packets are sent, how many acknowledgements are needed?

*Dan heb je 10 acknowledgements nodig*

# Game 3: Battleship over Radio

Problems

The figure above shows randomly placed ships in a battle area. Which coordinates do you need to send to hit all the ships?

*(3,1) en (0,2) en (4,2) en (1,3) en (1,4)*

The figure above shows randomly placed ships in the battle areas of two micro:bits. Table below lists all the shots that are fired from the micro:bit 1 (left/red micro:bit) and micro:bit 2 (right/yellow micro:bit). Who wins?

*Micro Bit 2 wint het spel*

If you wanted to play this game with another opponent, what do you need to change in your program?

*De Group ID*