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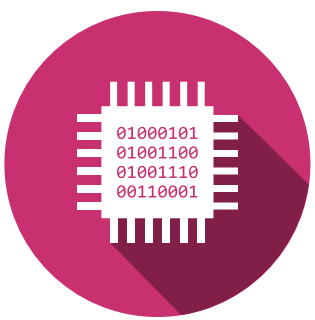
Digitales Design (DiD)

Festwertspeicher

ROM

Studiengang Systemtechnik
Studiengang Energie und Umwelttechnik
Studiengang Informatik und Kommunikationssysteme



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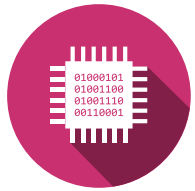
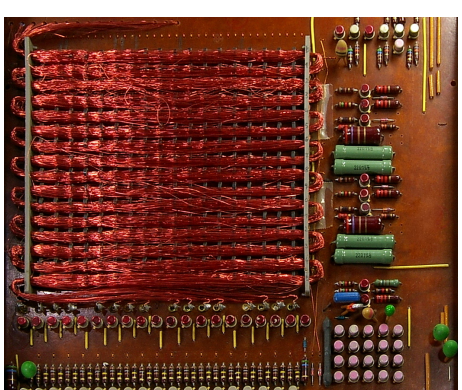
ROM – Read only memory



Festwertspeicher (ROM) ist ein Datenspeicher auf den nur lesend zugegriffen werden kann und der nicht flüchtig ist. Das heisst er hält die Daten auch im stromlosen Zustand.

Wird heutzutage meist durch Flash ersetzt.

Hauptanwendungsbereich sind die Bios Speicher

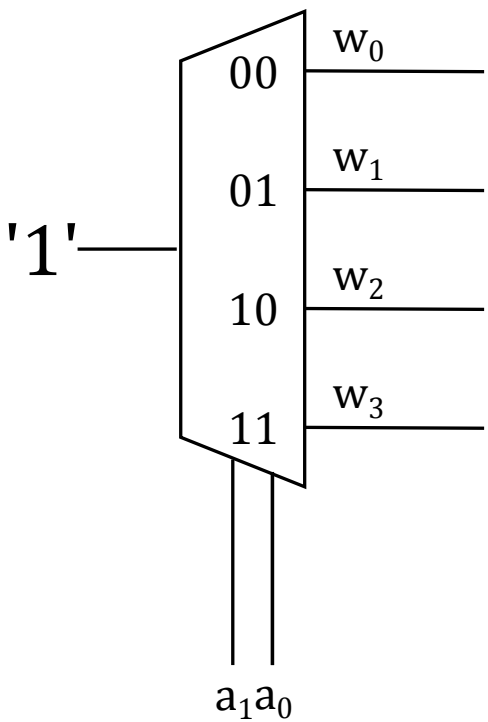


Quelle: Wikipedia

ROM – Read only memory

Mux Aufbau

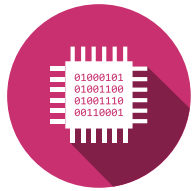
a_1	a_0	w_0	w_1	w_2	w_3
0	0	**1**	0	0	0
0	1	0	**1**	0	0
1	0	0	0	**1**	0
1	1	0	0	0	**1**



- n-Bit Steuerungseingang
- $2^n n$-Bit mögliche Ausgänge

Aufgabe

Realisierung einer programmierbaren OR-Funktion

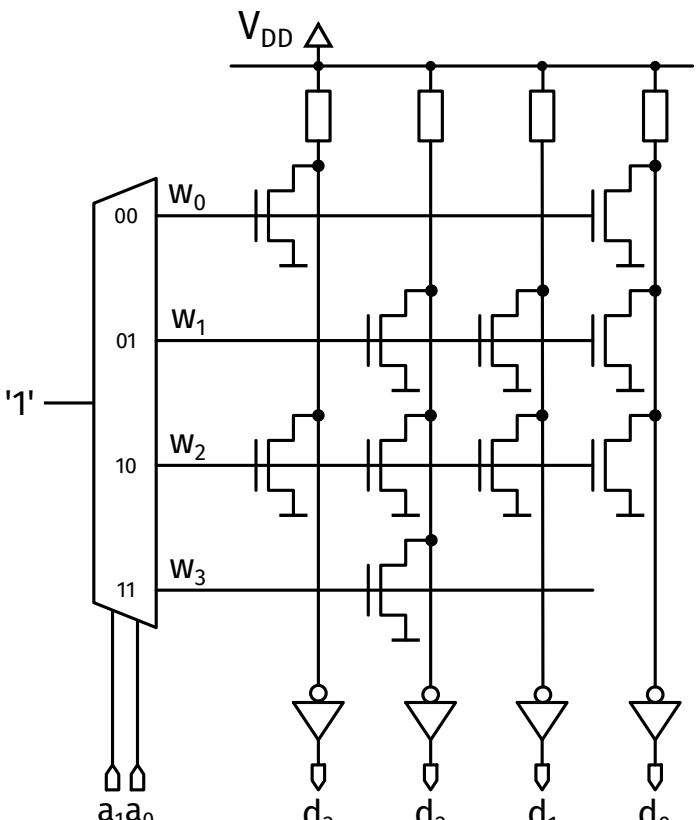


a_1	a_0	w_0	w_1	w_2	w_3	d_3	d_2	d_1	d_0
0	0	**1**	0	0	0	1	0	0	1
0	1	0	**1**	0	0	0	1	1	1
1	0	0	0	**1**	0	1	1	1	1
1	1	0	0	0	**1**	0	1	0	0

$$\begin{cases} d_3 = \overline{a_0} \\ d_2 = a_0 + a_1 \\ d_1 = a_0 \oplus a_1 \\ d_0 = \overline{a_0 * a_1} \end{cases}$$

ROM – Read only memory

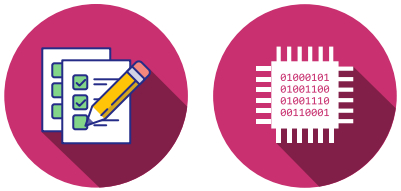
Mux-OR Aufbau & Kapazität



$$C = n_w * n_d = 2^{n_w} * n_d$$

Aufgabe 1.1 *(rom/logic-function-01)*

Speichergrössen

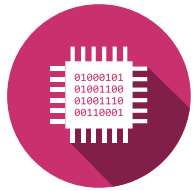


a) Was für eine Kapazität hat der Speicher im vorherigen Slide?

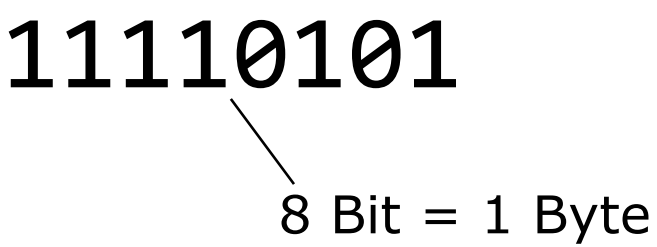
b) Was für eine Kapazität besitzt ein Speicher mit 10 Eingangs- und 8 Ausgangsleitungen?

c) Was für ein Kapazität besitzt ein Speicher mit 18 Eingangs- und 8 Ausgangsleitungen?

Binärsystem - Auffrischung



- 8 BIT bilden ein Byte (octet)
  - Rein historisch

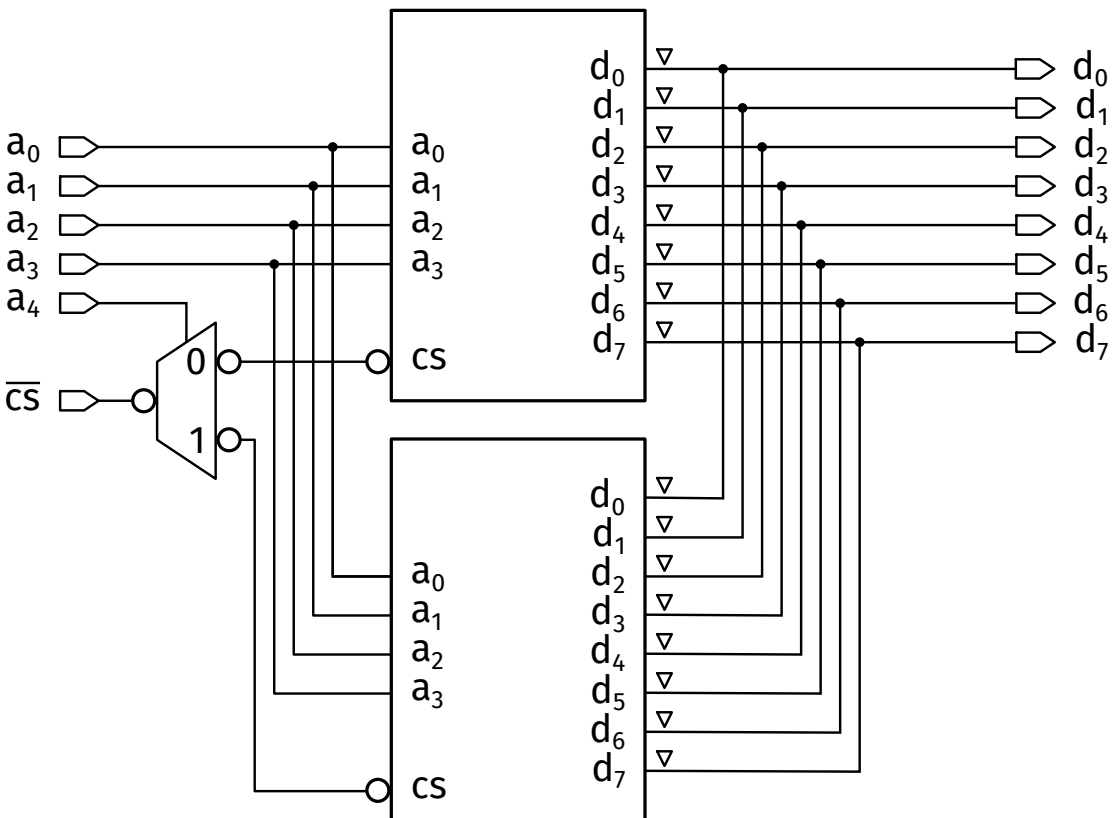


- Using IEC standard:
  - 1 KiB = 1’024 bytes (Note: big K)
  - 1 MiB = 1’024 KiB = 1’048’576 bytes
  - 1 GiB = 1’024 MiB = 1’048’576 KiB = 1’073’741’824 bytes

- Using SI standard:
  - 1 kB = 1’000 bytes (Note: small k)
  - 1 MB = 1’000 kB = 1,000,000 bytes
  - 1 GB = 1’000 MB = 1’000’000 KB = 1’000’000’000 bytes

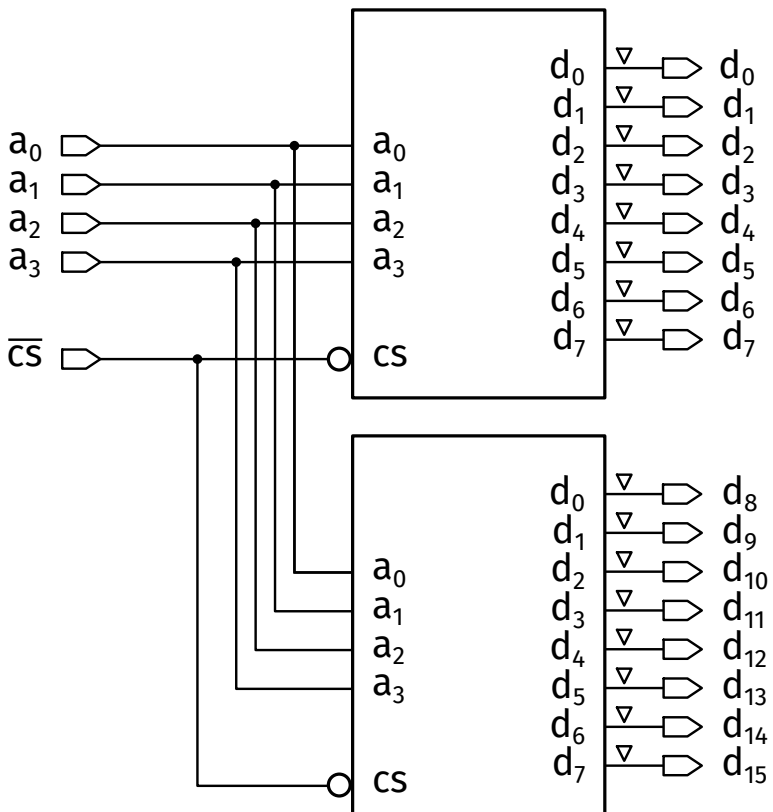
Speicher Zusammenschaltung

Serienschaltung

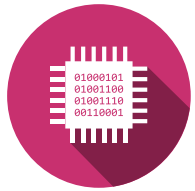


Speicher Zusammenschaltung

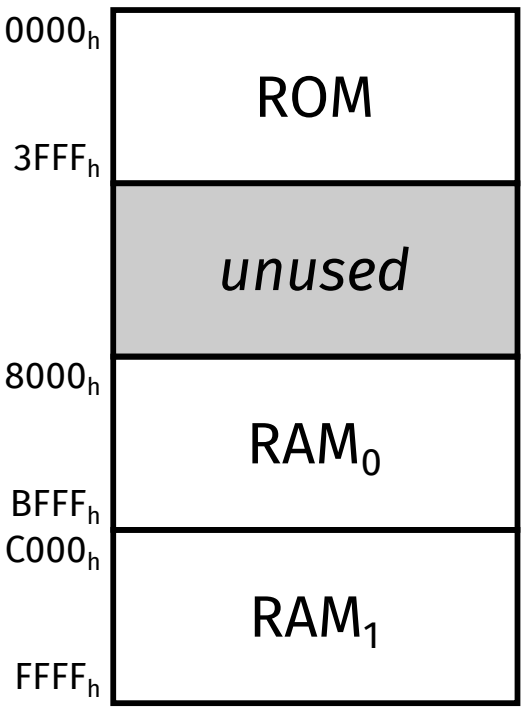
Parallelschaltung



Speicherbelegungsplan

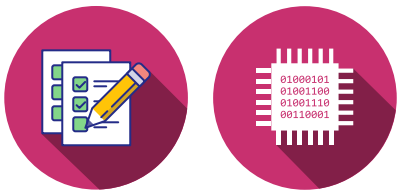


- Speicherbelegungsplan eines µP mit 16 Addressleitungen

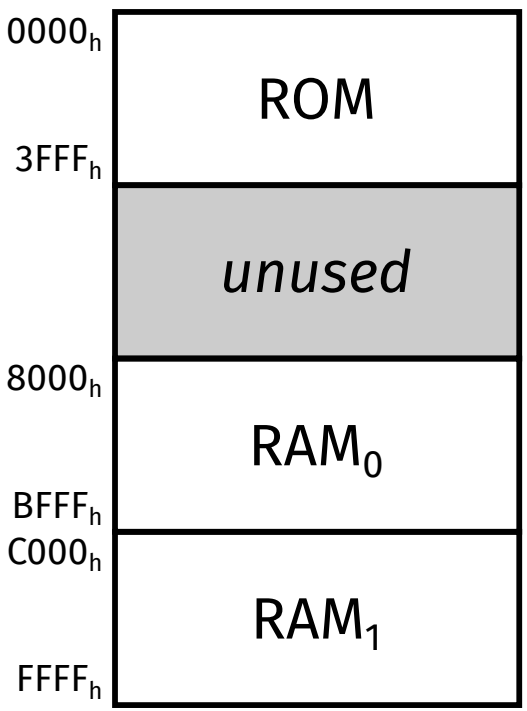


Aufgabe 2.1 *(rom/rom-circuits-01)*

ROM Dekodierung

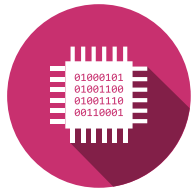


Zeichnen Sie Dekodierung des ROM der folgenden Speicherbelegung.



Object file format

Intel HEX

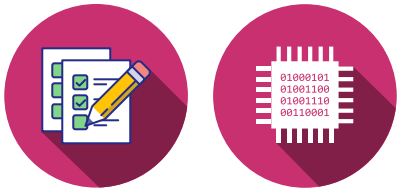


- `:` - Start delimiter
- Byte Count
- Address
- Record Type
  - 00 - Data
  - 01 – End of File
  - 02 – Extended Segment Address
  - 03 – Start Segment Address
  - 04 – Extended Linear Address
  - 05 – Start Linear Address
- Data
- Checksum
  - Das Prüfsummenbyte eines Datensatzes ist das Zweierkomplement des niedrigstwertigen Bytes (LSB) der Summe aller dekodierten Bytewerte im Datensatz vor der Prüfsumme

```
:02000002000FC
:10000000000D1925313C47515B636A71767A7E7F1A
:100010007F7F7E7A76716A635B51473C3125190D8B
:1000200000F3E7DBCFC4B9AFA59D968F8A868281A6
:10003000808182868A8F969DA5AFB9C4CFDBE7F316
:00000001FF
```

Aufgabe 3.1.a *(rom/crc-01)*

CRC Checksum



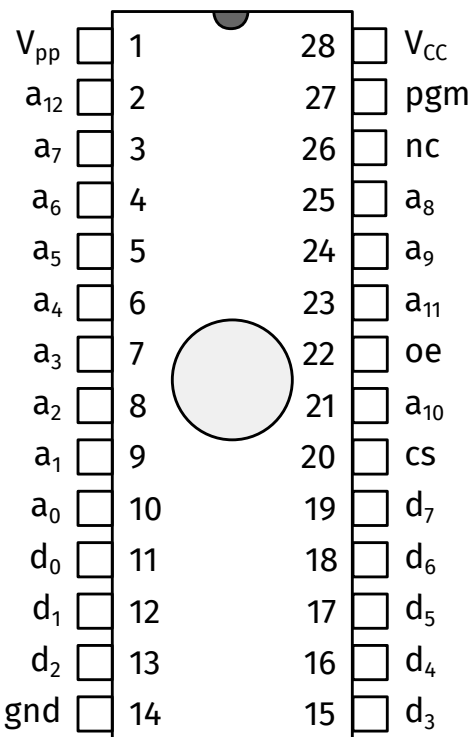
Berechne die CRC Checksumme des Intel Hex File Eintrages

```
:0300300002337AXX
```

Speicher

Typen

- PROM
- EPROM
- OTP-ROM
- EEPROM
- Flash

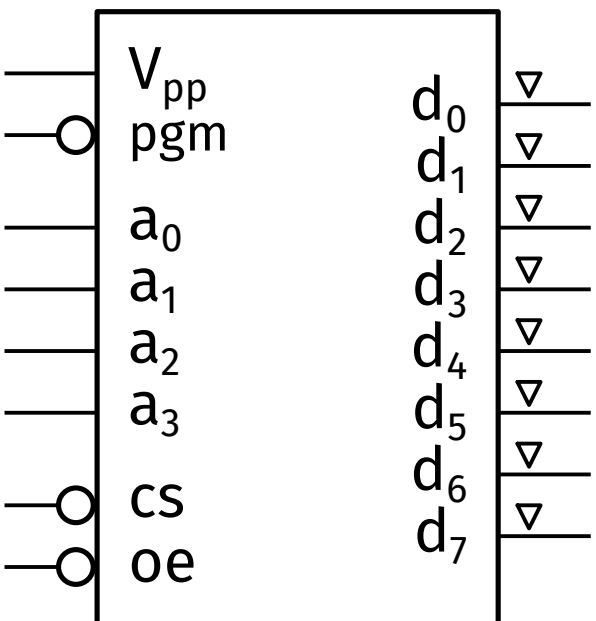


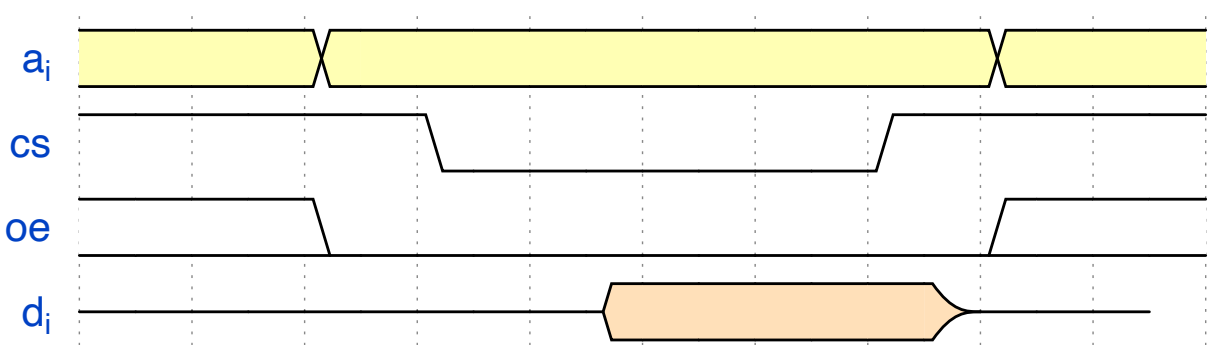
Speicherzugriff

Parallele Schnittstelle

- Mehr Signale
- Höhere Bandbreite

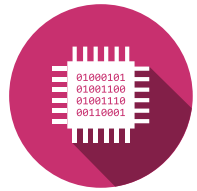
(bei gleichbleibender Taktrate)





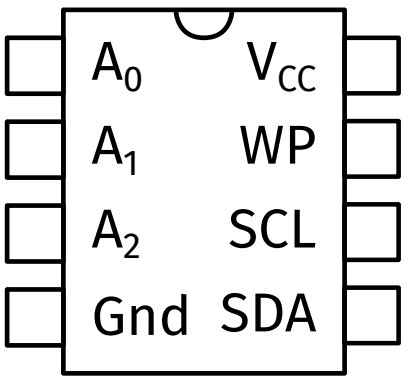
Speicherzugriff

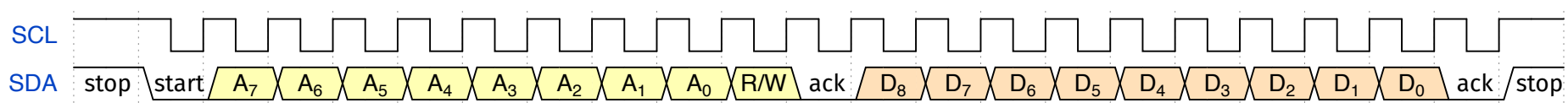
Serieller Schnittstelle (I2C)



- Weniger Signale
- Tiefere Bandbreite

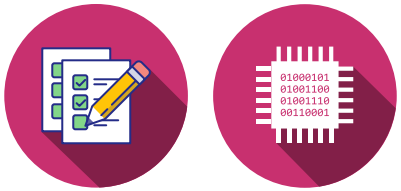
(bei gleichbleibender Taktrate)





Aufgabe 4.1 *(rom/rom-types-01)*

ROM Bandbreite

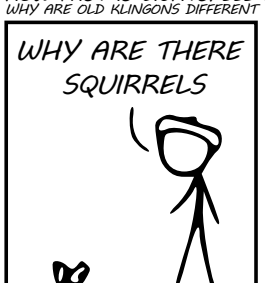


Eine ROM wird mit serieller (I2C) und paralleler Schnittstelle angeboten. Der Speicher umfasst 8 Adress- und 8 Datenbits und wird mit 66MHz getaktet. Berechnen Sie die theoretische maximale Schreibrate. Ausserdem berechnen Sie um wieviel % der schnellere schneller ist.

QUESTIONS

CAN BE ASKED BY ANYONE ANYTIME

WHY ARE THERE MIRRORS ABOVE BEDS
WHY DO I SAY UH
WHY IS SEA SALT BETTER
WHY ARE THERE TREES IN THE MIDDLE OF FIELDS
WHY IS THERE NOT A POKEMON MMO
WHY IS THERE LAUGHING IN TV SHOWS
WHY ARE THERE DOORS ON THE FREEWAY
WHY ARE THERE SO MANY SVCHOST·EXE RUNNING
WHY AREN'T ANY COUNTRIES IN ANTARCTICA
WHY ARE THERE SCARY SOUNDS IN MINECRAFT
WHY IS THERE KICKING IN MY STOMACH
WHY ARE THERE TWO SLASHES AFTER HTTP
WHY ARE THERE CELEBRITIES
WHY DO SNAKES EXIST
WHY DO OYSTERS HAVE PEARLS
WHY ARE DUCKS CALLED DUCKS
WHY DO THEY CALL IT THE CLAP
WHY ARE KYLE AND CARTMAN FRIENDS
WHY IS THERE AN ARROW ON AANG'S HEAD
WHY ARE TEXT MESSAGES BLUE
WHY ARE THERE MUSTACHES ON CLOTHES
WHY WUBA LUBBA DUB DUB MEANING
WHY IS THERE A WHALE AND A POT FALLING
WHY ARE THERE SO MANY BIRDS IN SWISS
WHY IS THERE SO LITTLE RAIN IN WALLIS
WHY IS WALLIS WEATHER FORECAST ALWAYS WRONG
WHY ARE THERE MALE AND FEMALE BIKES
WHY ARE THERE BRIDESMAIDS
WHY DO DYING PEOPLE REACH UP
HOW FAST IS LIGHTSPEED
WHY ARE OLD KLINGONS DIFFERENT



WHY ARE THERE DINOSAUR GHOSTS
WHY IS THERE HELL IF

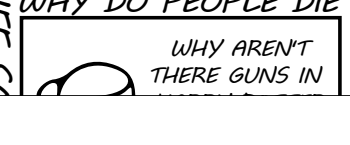
WHY DO IGUANAS DIE
WHY IS THERE CAFFEINE IN MY SHAMPOO
WHY HAVE DINOSAURS NO FUR
WHY DO TWINS HAVE DIFFERENT FINGERPRINTS
WHY ARE SWISS AFRAID OF DRAGONS
WHY AREN'T ECONOMISTS RICH
WHY DO AMERICANS CALL IT SOCCER
WHY ARE MY EARS RINGING
WHY IS 42 THE ANSWER TO EVERYTHING
WHY CAN'T NOBODY ELSE LIFT THORS HAMMER
WHY IS MARVIN ALWAYS SO SAD
WHY ARE THERE ANTS IN MY LAPTOP
WHY IS EARTH TILTED
WHY IS SPACE BLACK
WHY IS OUTER SPACE SO COLD
WHY ARE THERE PYRAMIDS ON THE MOON
WHY IS NASA SHUTTING DOWN
WHY ARE THERE TINY SPIDERS IN MY HOUSE
WHY DO SPIDERS COME INSIDE
WHY ARE THERE HUGE SPIDERS IN MY HOUSE
WHY ARE THERE LOTS OF SPIDERS IN MY HOUSE
WHY ARE THERE SPIDERS IN MY ROOM
WHY ARE THERE SO MANY SPIDERS IN MY ROOM
WHY DO SPYDER BITES ITCH
WHY IS DYING SO SCARY
WHY IS THERE NO GPS IN LAPTOPS
WHY DO KNEES CLICK

WHY ARE THERE FEMALE

WHY IS HTTPS CROSSED OUT IN RED
WHY IS THERE A LINE THROUGH HTTPS
WHY IS THERE A RED LINE THROUGH HTTPS ON TWITTER
WHY IS HTTPS IMPORTANT

WHY IS YKK ON ALL ZIPPERS
WHY ARE THERE WEEKS
WHY DO I FEEL DIZZY
WHY IS THERE A SWARM OF ANTS
WHY IS THERE PILEGRIM
WHY IS THERE LAVA
WHY ARE THERE SO MANY CROWS IN ROCHESTER
WHY IS TO BE OR NOT TO BE FUNNY
WHY DO CHILDREN GET CANCER
WHY IS POSEIDON ANGRY WITH ODYSSEUS
WHY IS THERE ICE IN SPACE
WHY IS THERE AN OWL IN MY BACKYARD
WHY IS THERE AN OWL OUTSIDE MY WINDOW
WHY IS THERE AN OWL ON THE DOLLAR BILL
WHY DO OWLS ATTACK PEOPLE
WHY ARE FPGA's EVERYWHERE
WHY ARE THERE HELICOPTERS CIRCLING MY HOUSE
WHY ARE THERE GODS
WHY ARE THERE TWO SPOCKS
WHAT IS https://xkcd.com/1256/
WHY DO THEY SAY T-MINUS
WHY ARE THERE OBELISKS
WHY ARE WRESTLERS ALWAYS WET

WHY IS LIFE SO
WHY ARE MY BOOBS ITCHY
WHY ARE CIGARETTES LEGAL
WHY ARE THERE DUCKS IN MY POOL
WHY IS JESUS WHITE
WHY IS THERE LIQUID IN MY EAR
WHY DO Q TIPS FEEL GOOD
WHY DO PEOPLE DIE



WHY ARE DOGS AFRAID OF FIR
WHY IS THERE NO KING IN E

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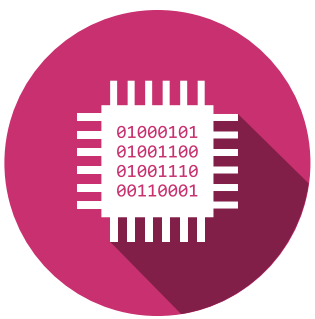

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