



# NEW HORIZON COLLEGE OF ENGINEERING

Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC  
Accredited by NAAC with 'A' Grade, Accredited by NBA



The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka  
Awarded Outstanding Technical Education Institute in Karnataka-2016  
Ring Road, Bellandur Post, Near Marathalli, Bangalore -560 103, INDIA

## Department of Computer Science & Engineering

### *Computer Systems Architecture Vs Quantum Computer*

Mohan Krishna

1NH14CS071s

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Assistant Professor,  
Dept. of CSE, NHCE

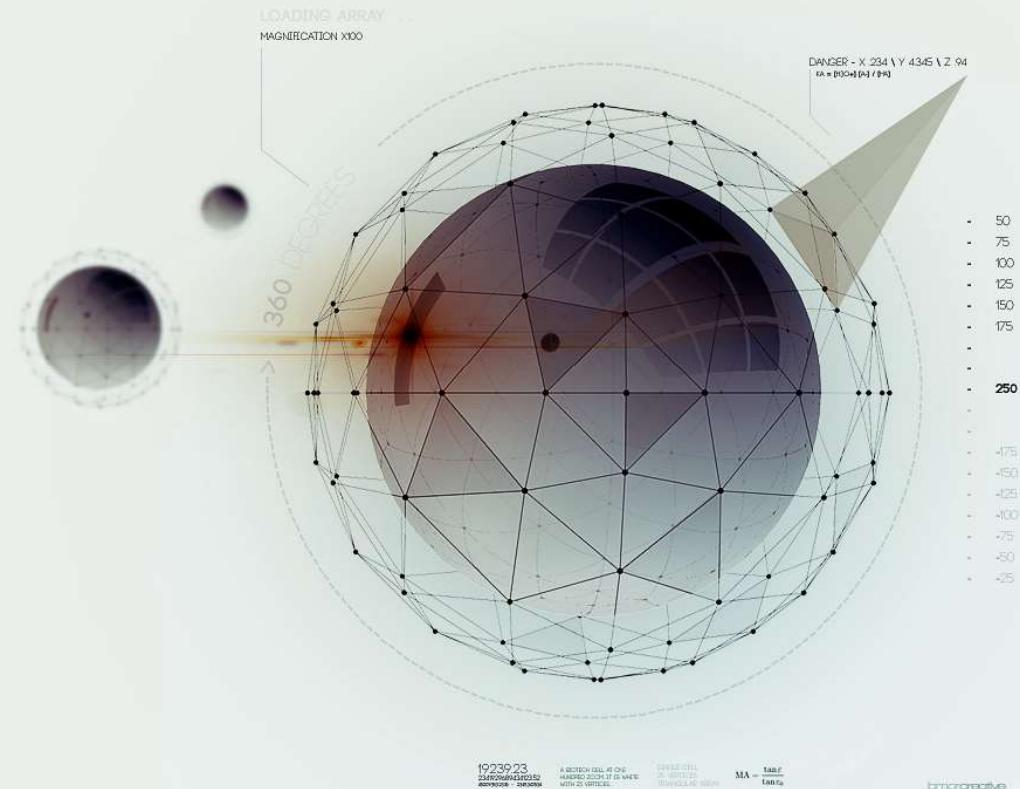


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23/09/2019 11:20:54  
A REVIEW COPY OF THE  
HANDBOOK 2019-20 OF NEW  
ADMISSIONS FOR THE  
SESSION 2019-20  
MA  
TANCA  
TANCA  
bmcreative

bmc creative

# Contents

- ❖ Abstract
- ❖ Introduction
- ❖ Existing System
- ❖ Problem
- ❖ Solution



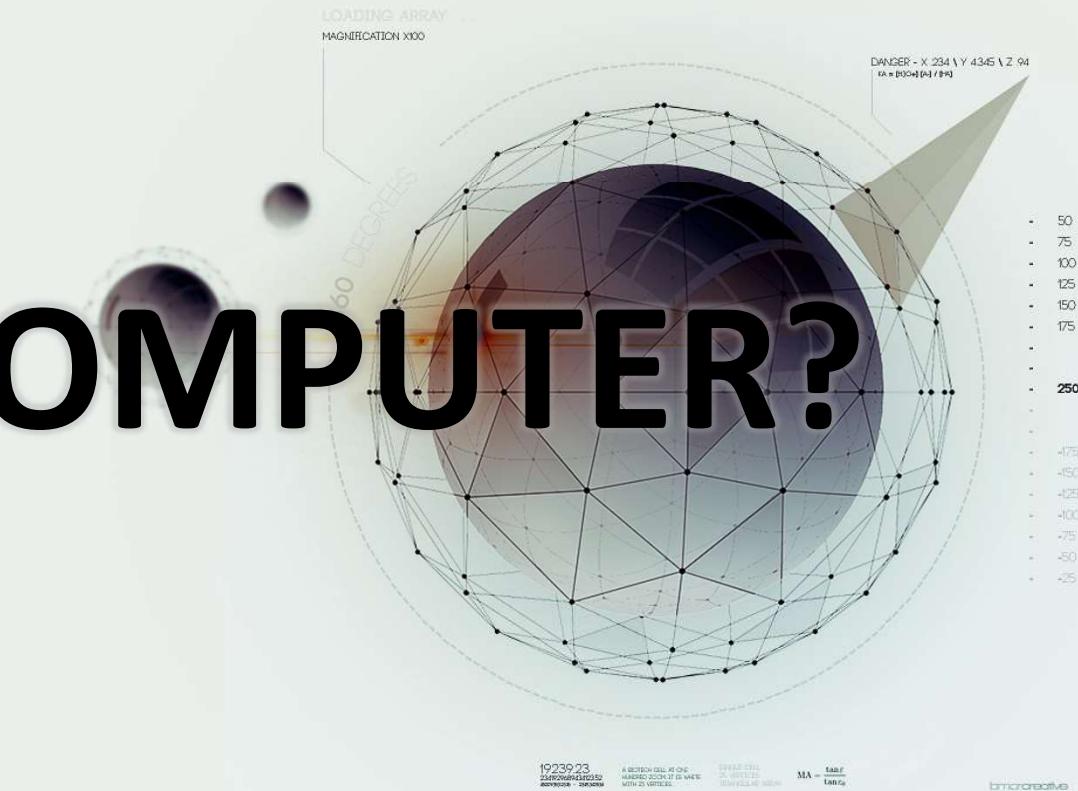
# Abstract

Technology is growing very fast, every day we see new things and changes to technology. There is a lot of history for computer systems. Nearly they are for 60 years. Computer Architecture is changed from day one to till today. Based on Computer Architecture new computer systems are developed. Computer Architecture is different for microcomputer, minicomputer, mainframes, laptops, palmtop, tablets, mobile phones which are used as smart computers. Each device is having its own architectures. These systems are based on Boolean algebra. In this paper we say about quantum computers system with architecture. Quantum Computer is based on using device at required amount. Quantum Computers are one type of supercomputers, can solve lot of problems that which cannot be solved by normal computers. This is 100 times faster than microcomputers. It is based on quantum physics

# INTRODUCTION



# What is a COMPUTER?



**HARDWARE**



Computer  
Architecture

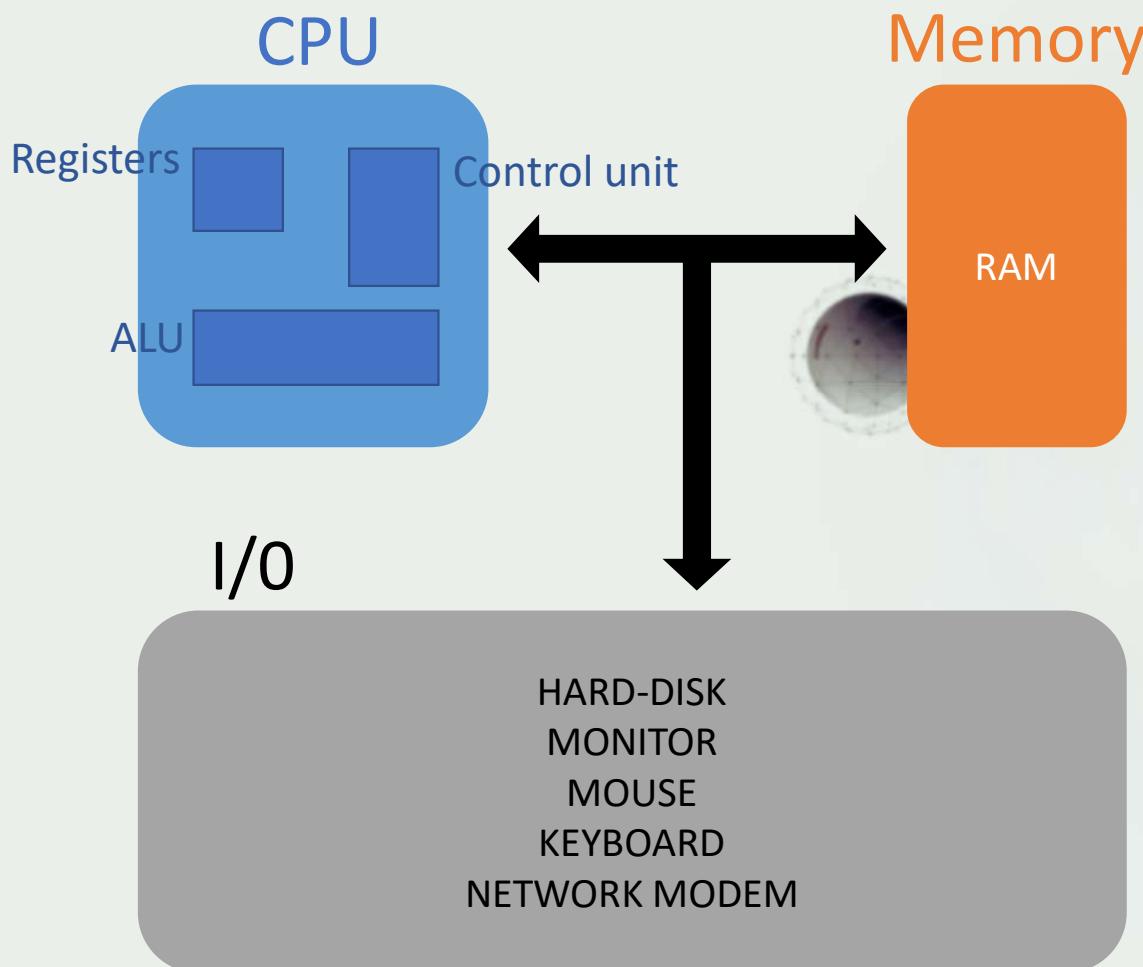
**+**

**SOFTWARE**



OS  
& Application  
Software

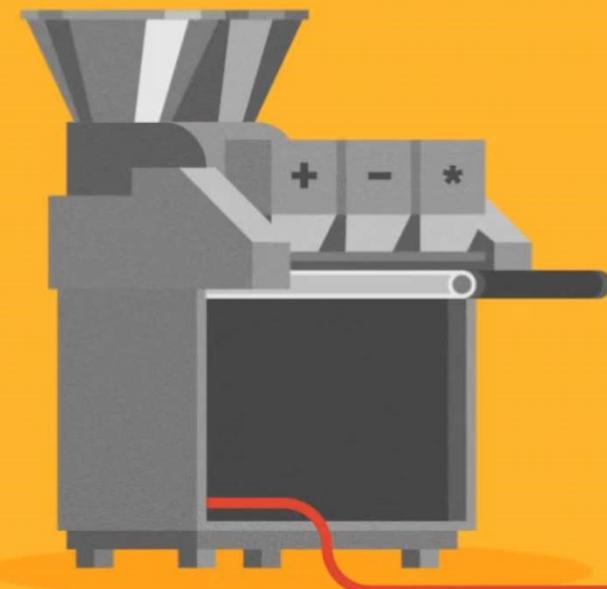
# Basic Computer Architecture



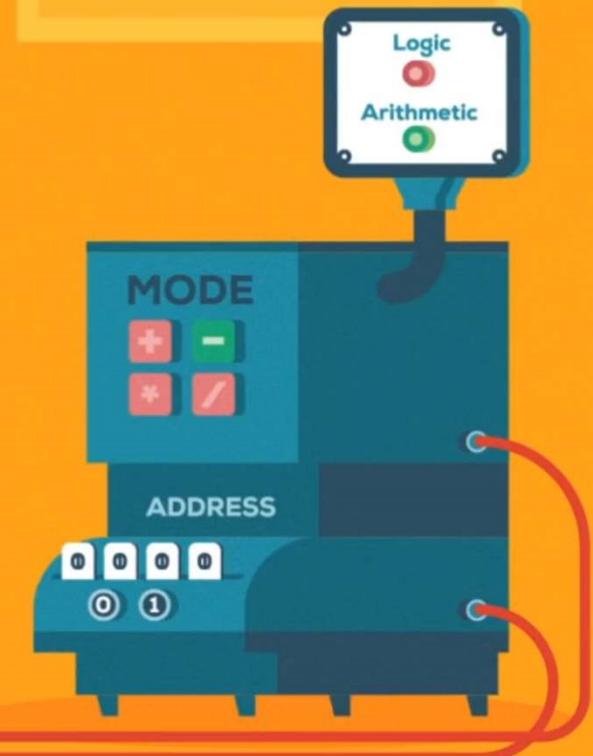
## Main Memory

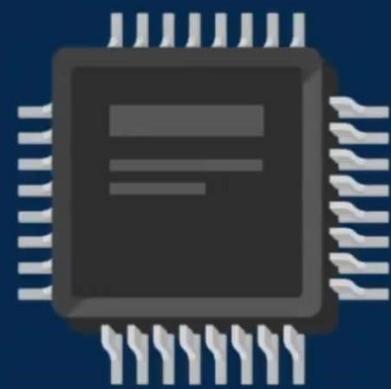


## Arithmetic Unit

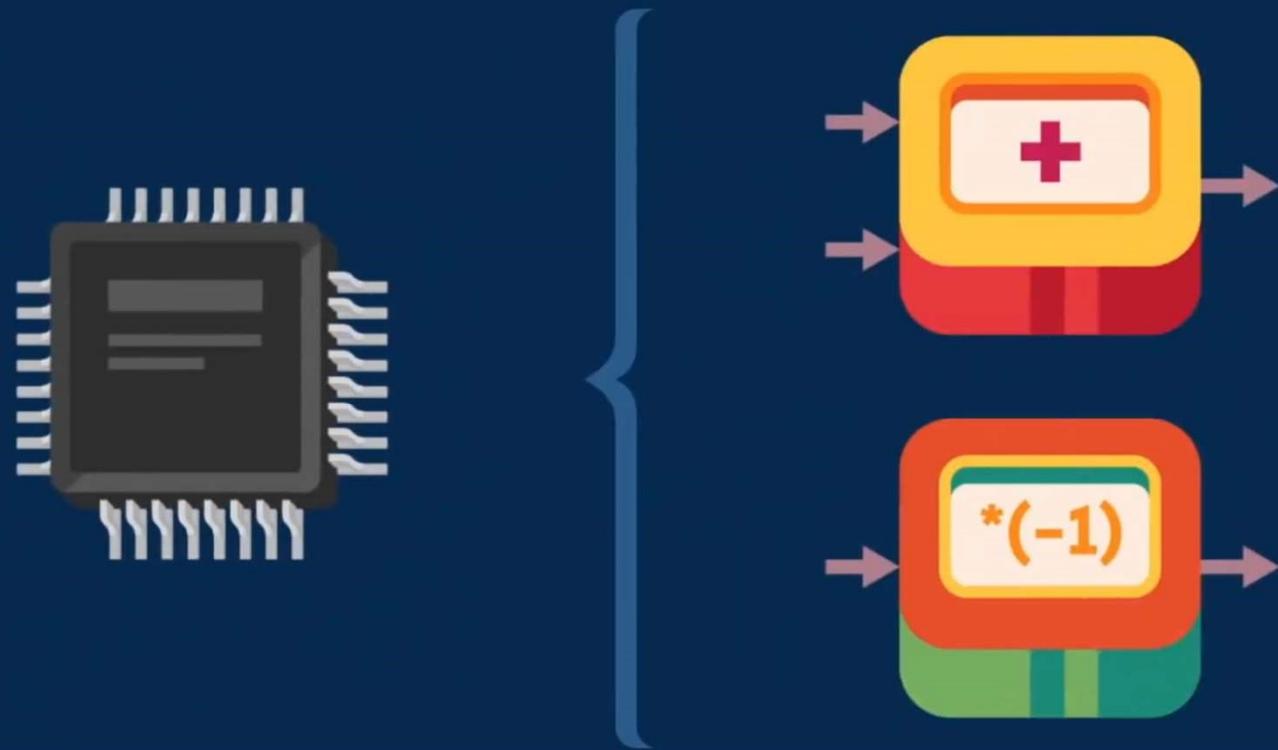


## Control Unit





**circuit chip**



**circuit chip**

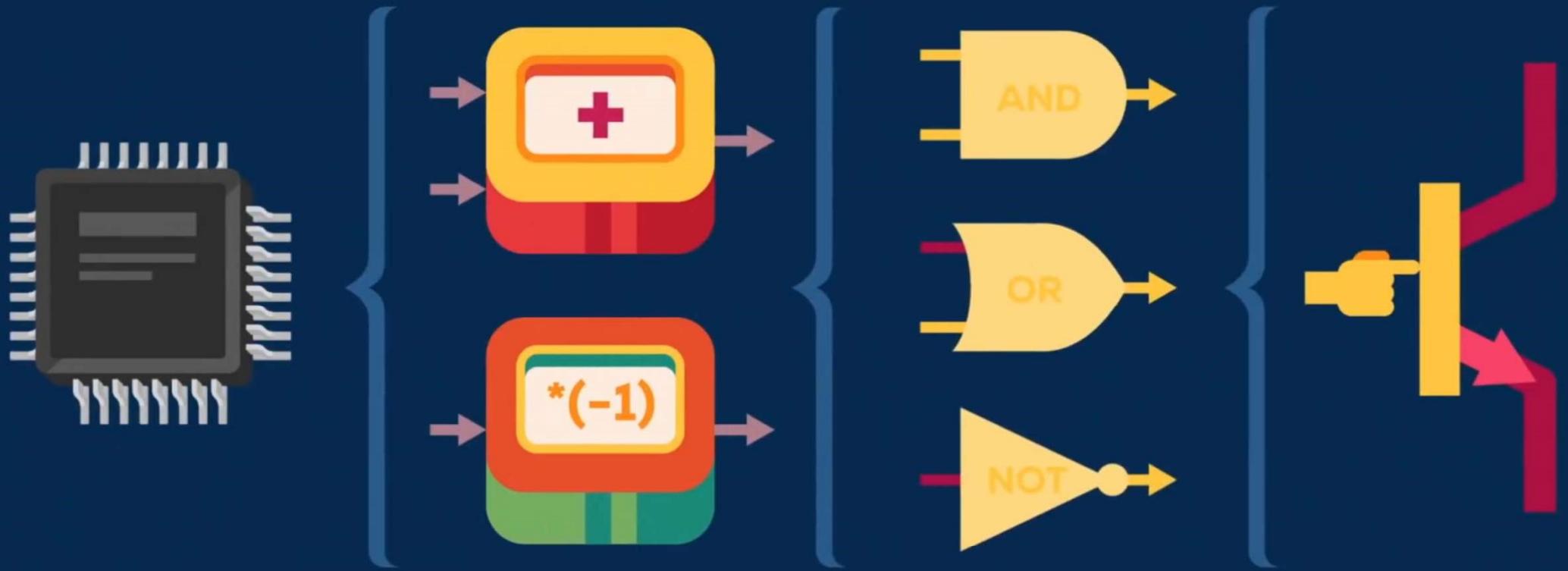
**basic modules**



**circuit chip**

**basic modules**

**logic gates**



**circuit chip**

**basic modules**

**logic gates**

**transistors**

**TRANSISTOR**



# TRANSISTOR



**BITS**



**BITS**



**BITS**



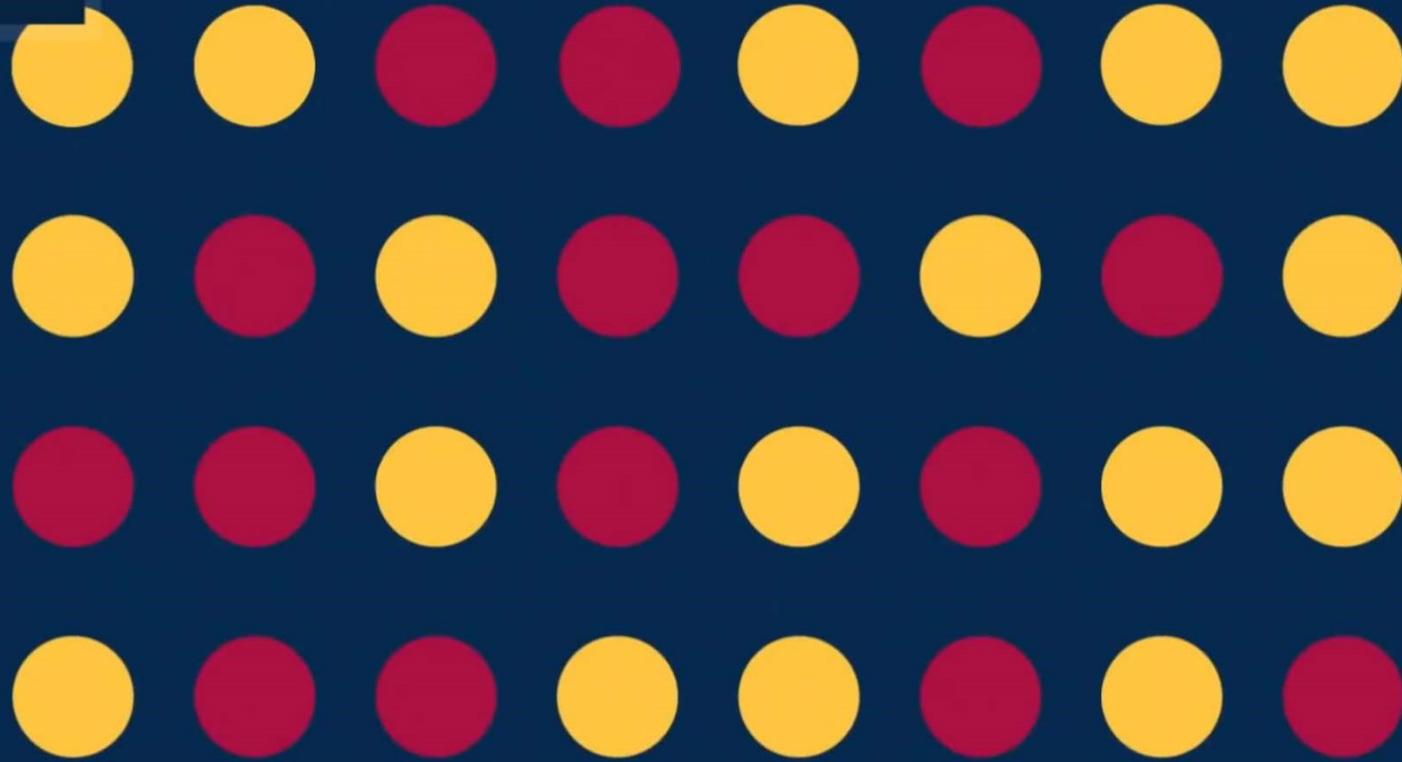
**2bit: the 4 Gameboy greens**

# BITS

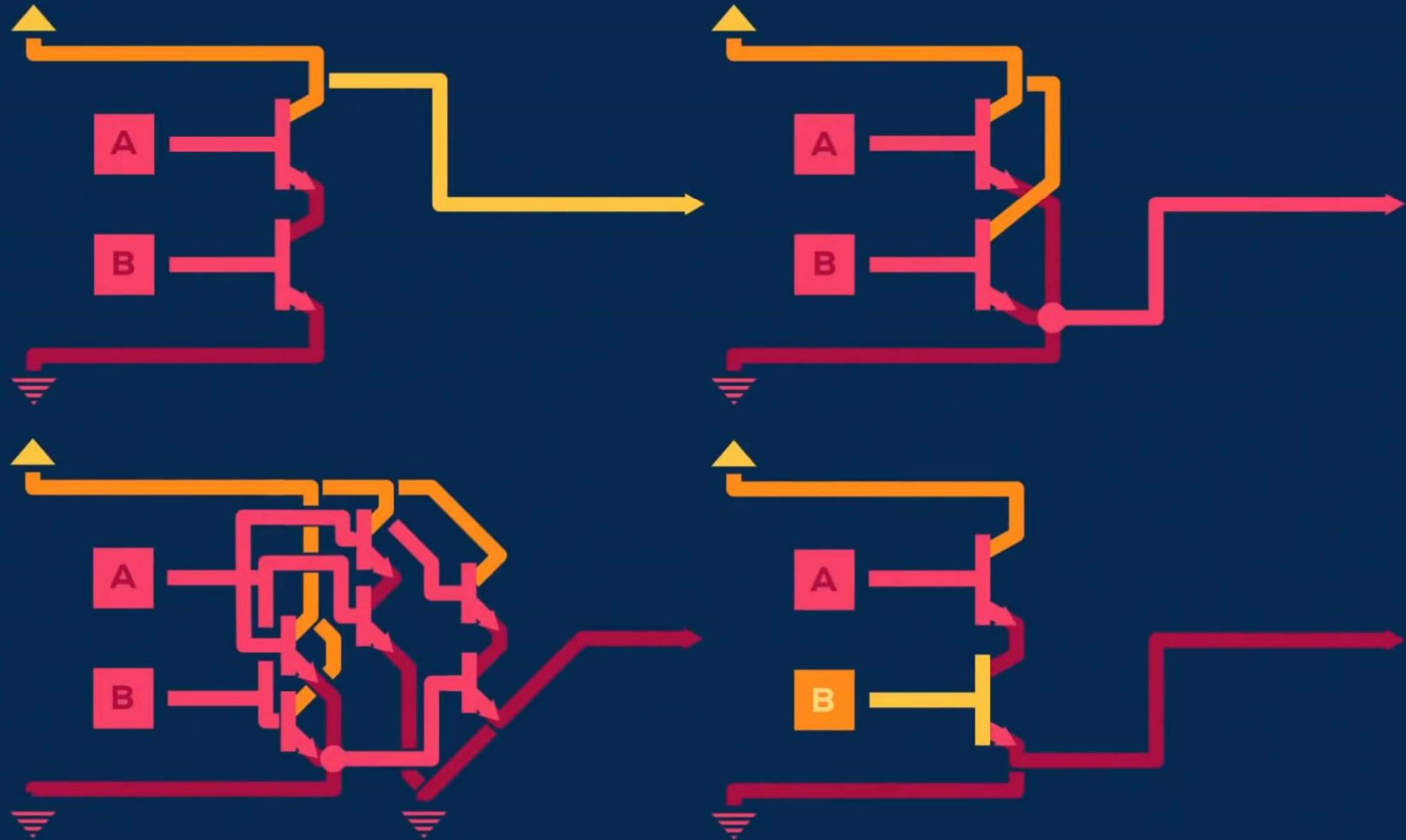


**7bit: 128 different ASCII characters**

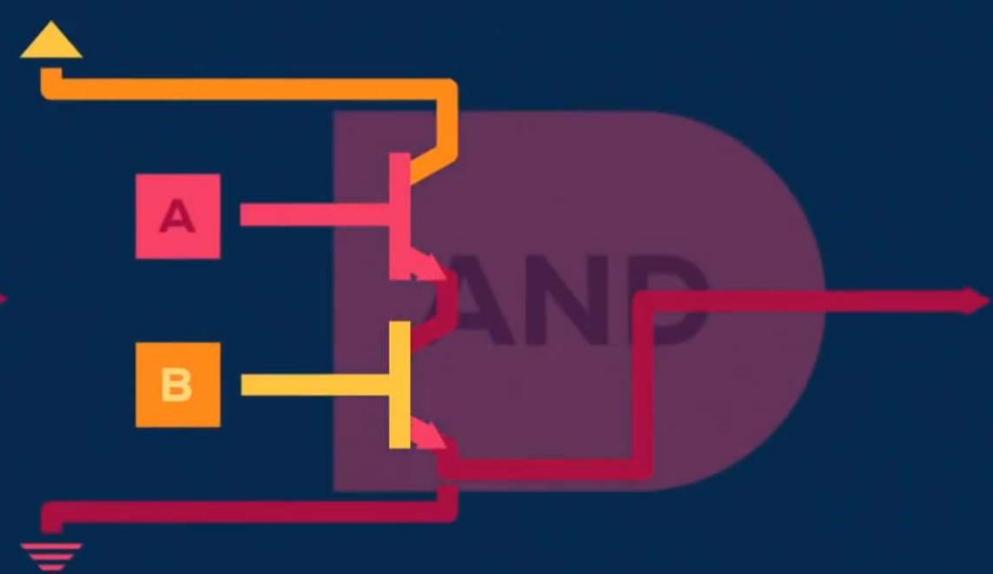
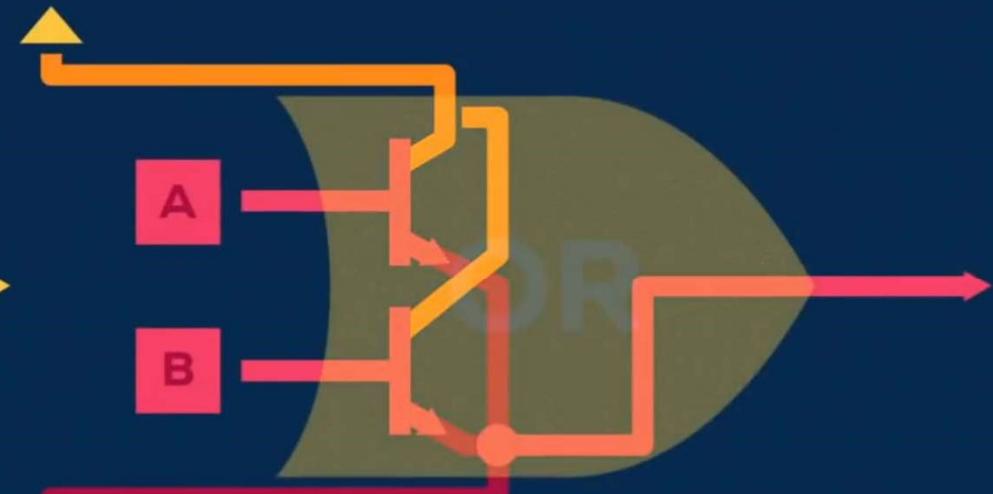
**BITS**



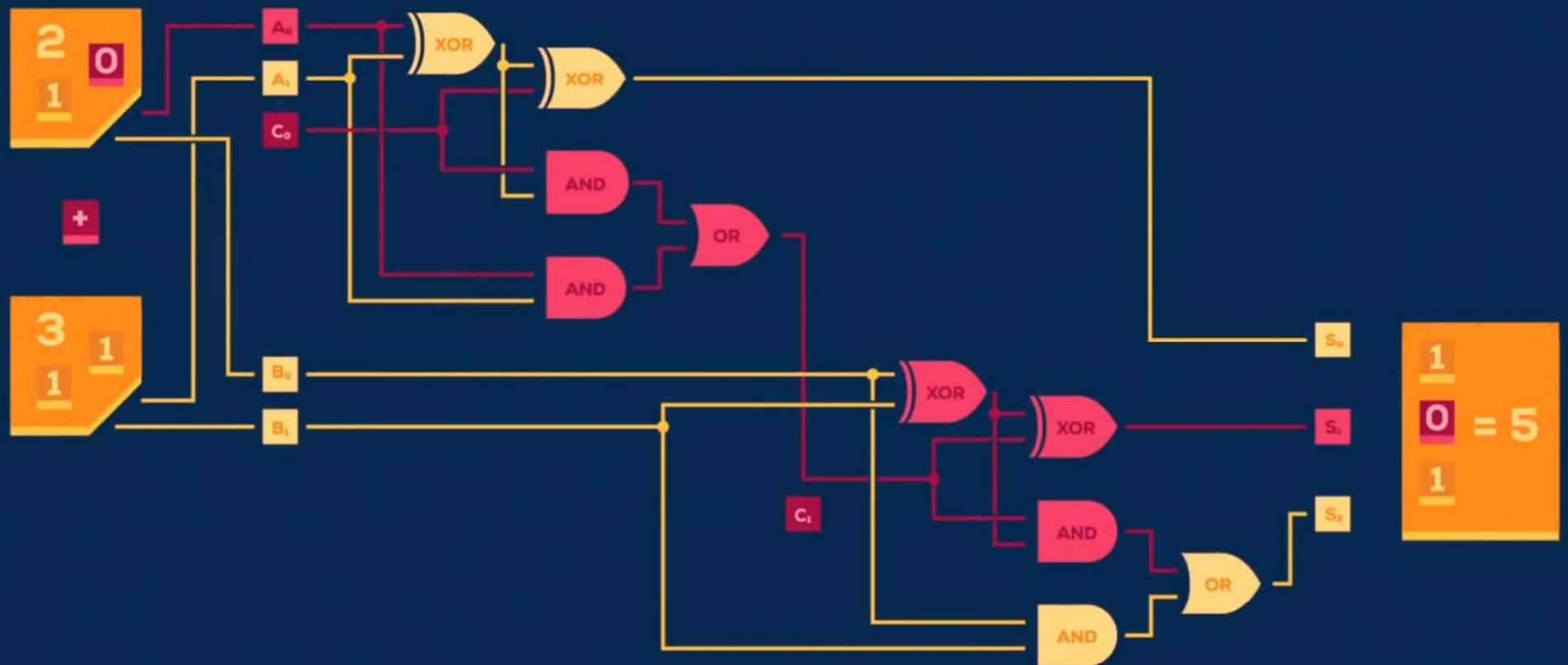
**32bit: 4 billion RAM addresses**

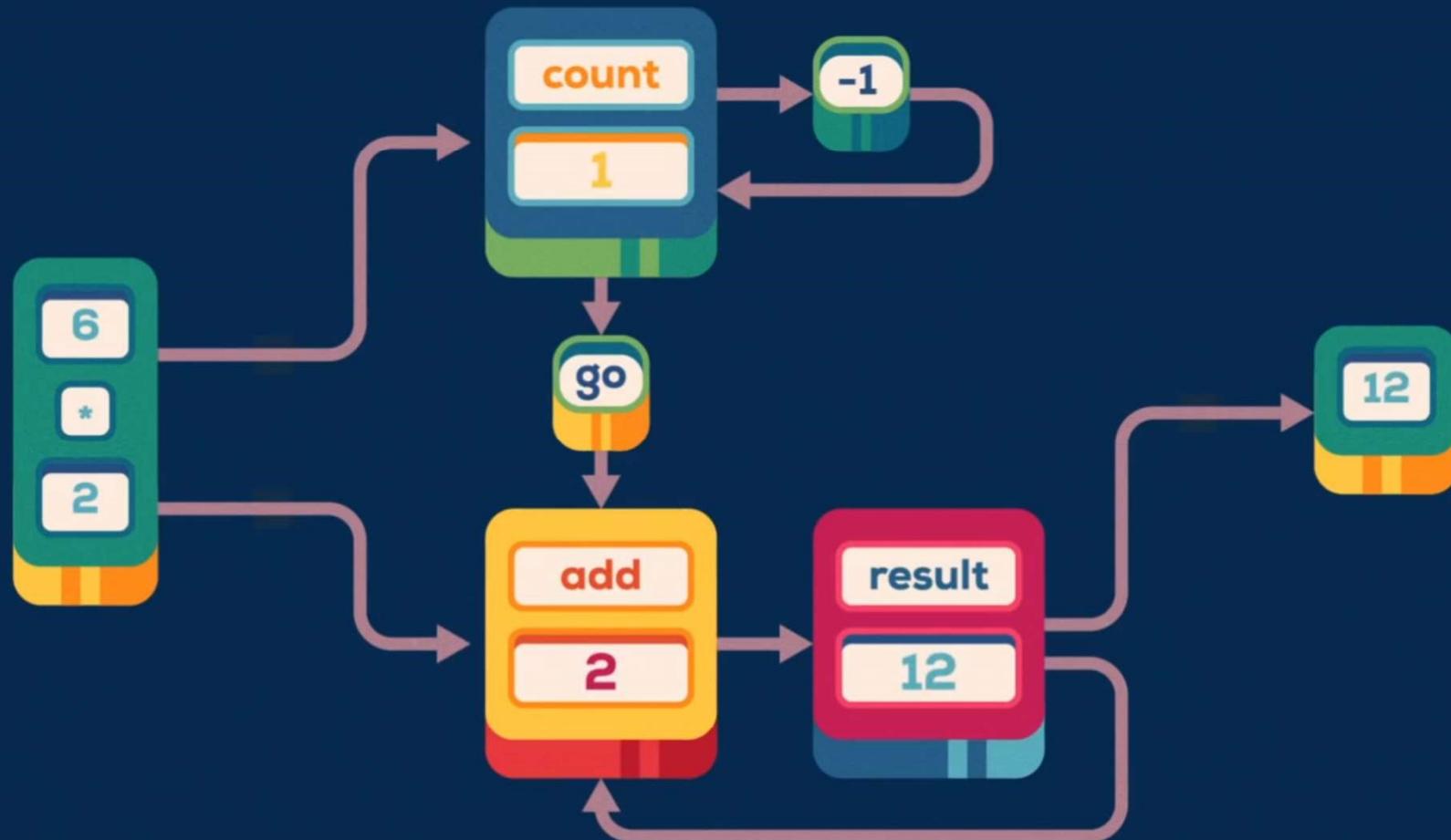


**TRANSISTORS CAN BE USED TO FORM SMALL CIRCUITS WHICH FORM LOGIC GATES WHICH ARE USED TO PERFORM SMALL OPERATIONS SUCH AS NAND, AND, OR, XOR ETC..**



THESE LOGIC GATES CAN BE USED TO FORM CIRCUITS WHICH CAN BE USED TO PERFORM LITTLE LARGER OPERATIONS SUCH AS ADDITION, SHIFT, INCREMENT ETC..



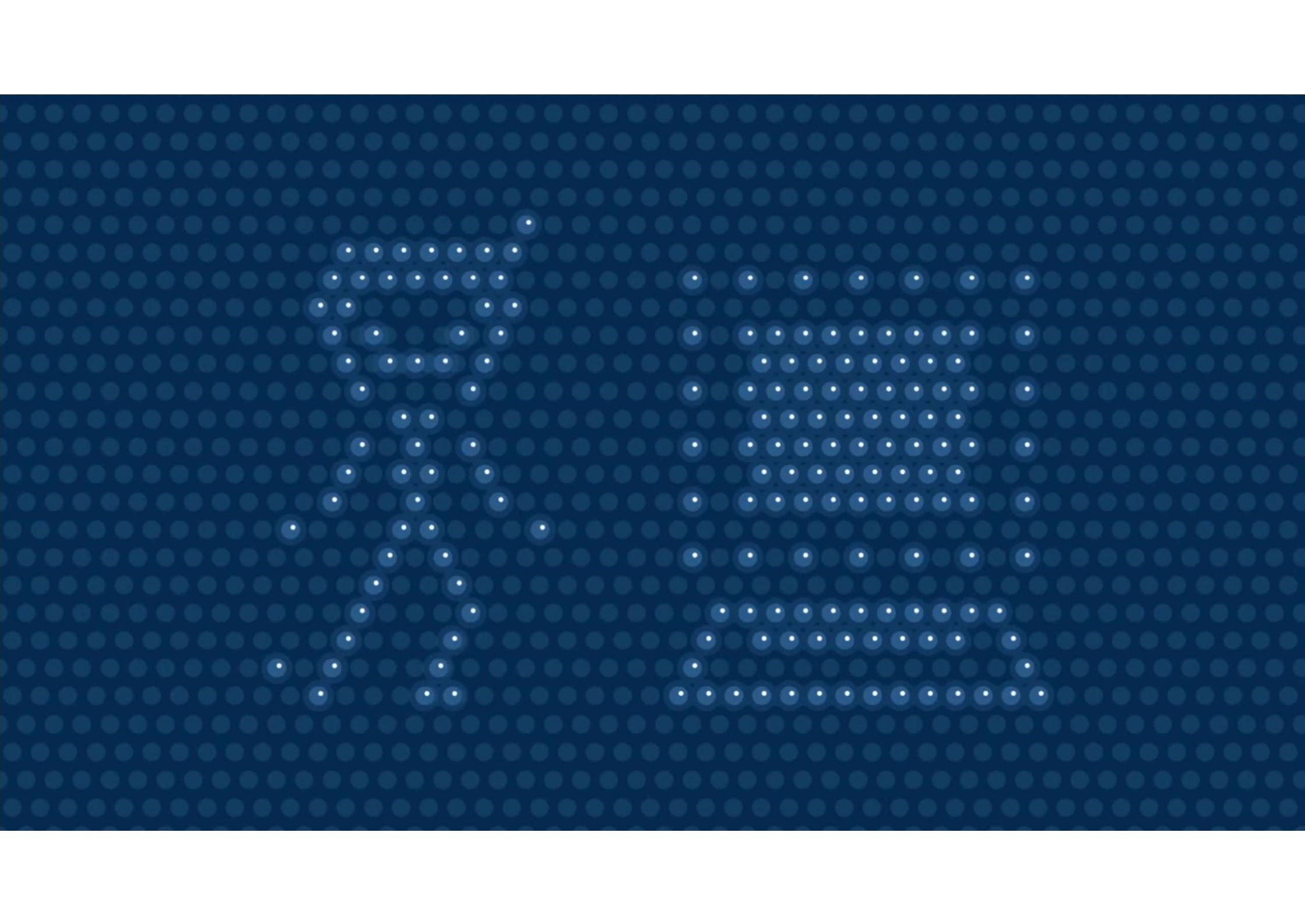


# POWER OVERWHELMING

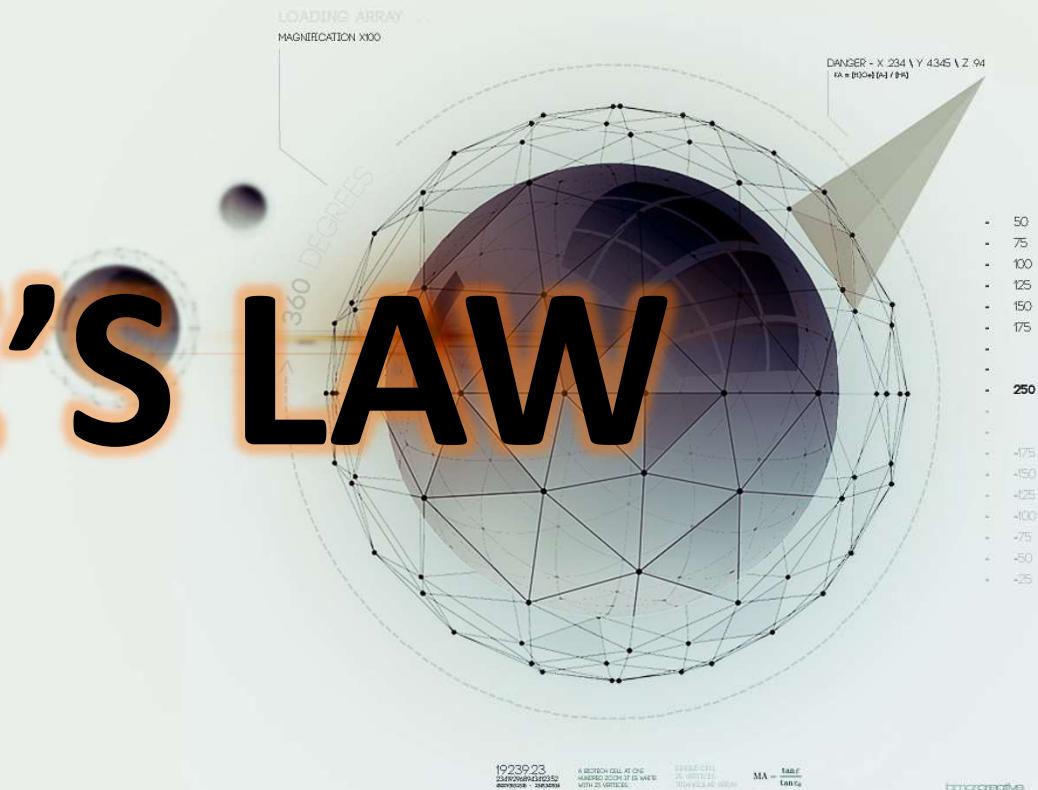




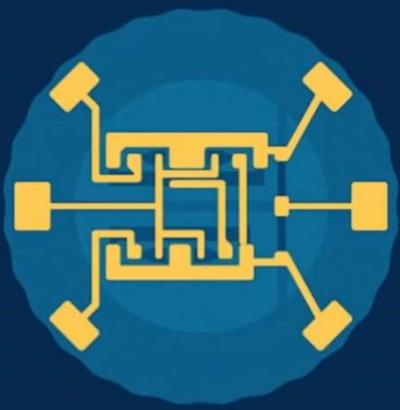
ONCE WE CAN ADD WE CAN DO ADDITION  
WE CAN PERFORM MULTIPLICATION AND ONCE  
WE CAN PERFORM MULTIPLICATION WE CAN DO  
ANYTHING FROM DOCUMENT TO GAMES.



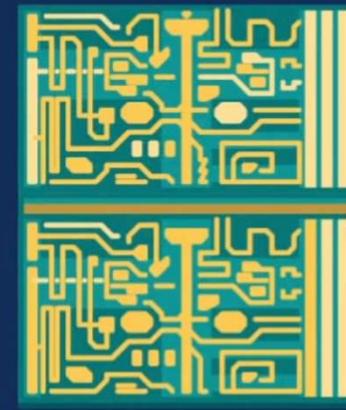
# MOORE'S LAW



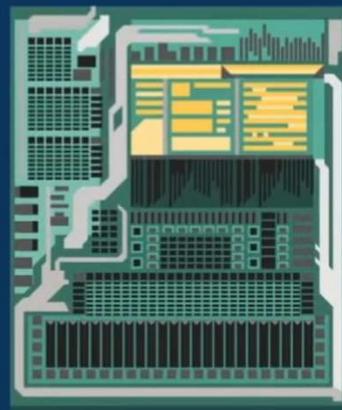
The number of transistors doubles  
every two years while the cost halves



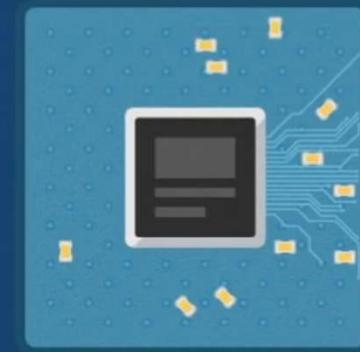
1960s



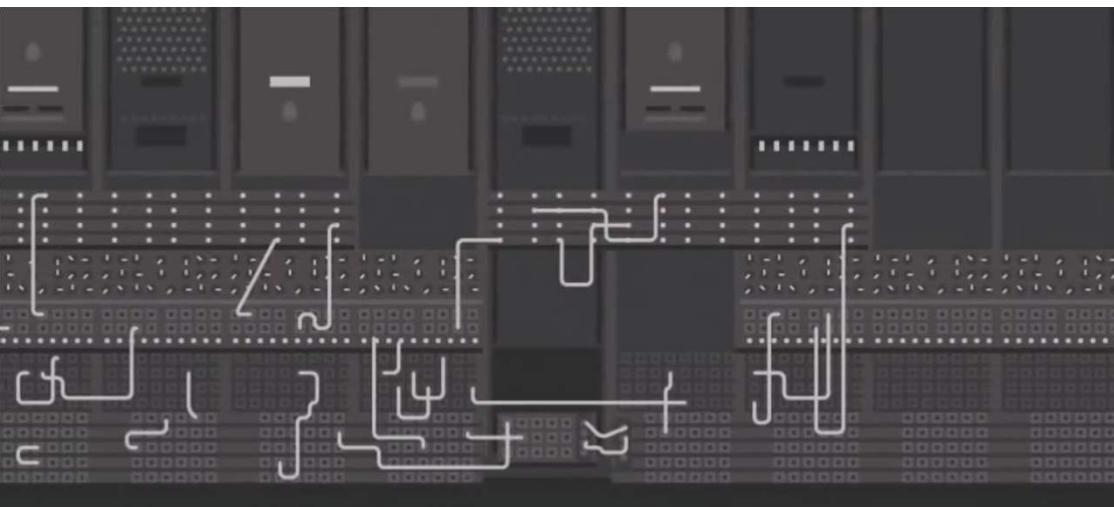
1970s



1980s



Today



1960s



1980s



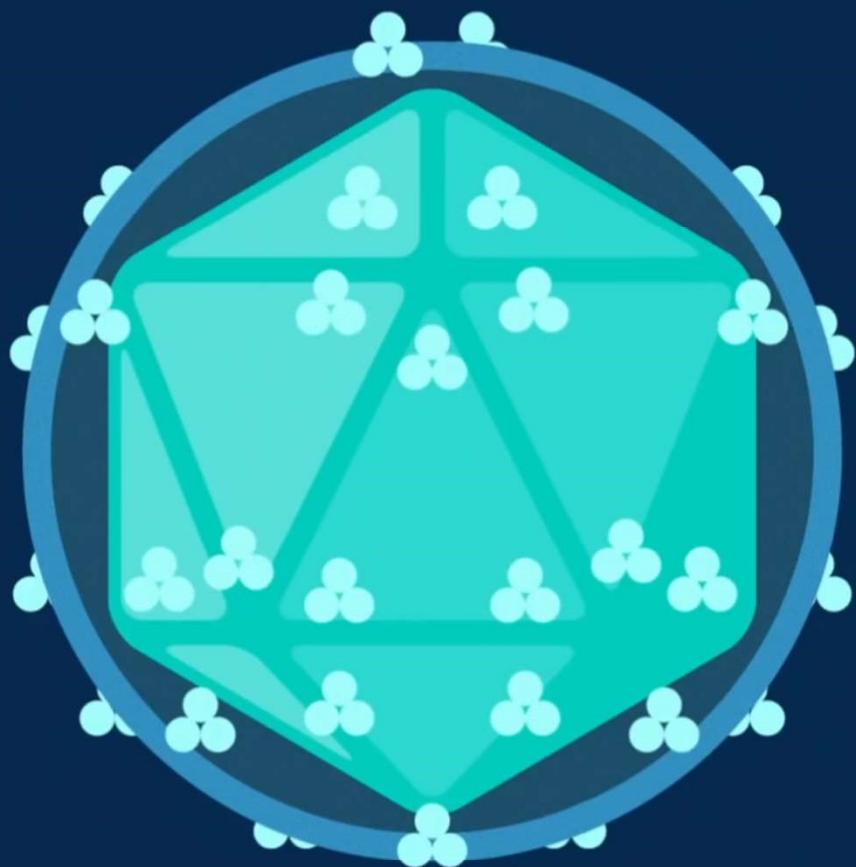
1970s



Today



Transistor: 14nm



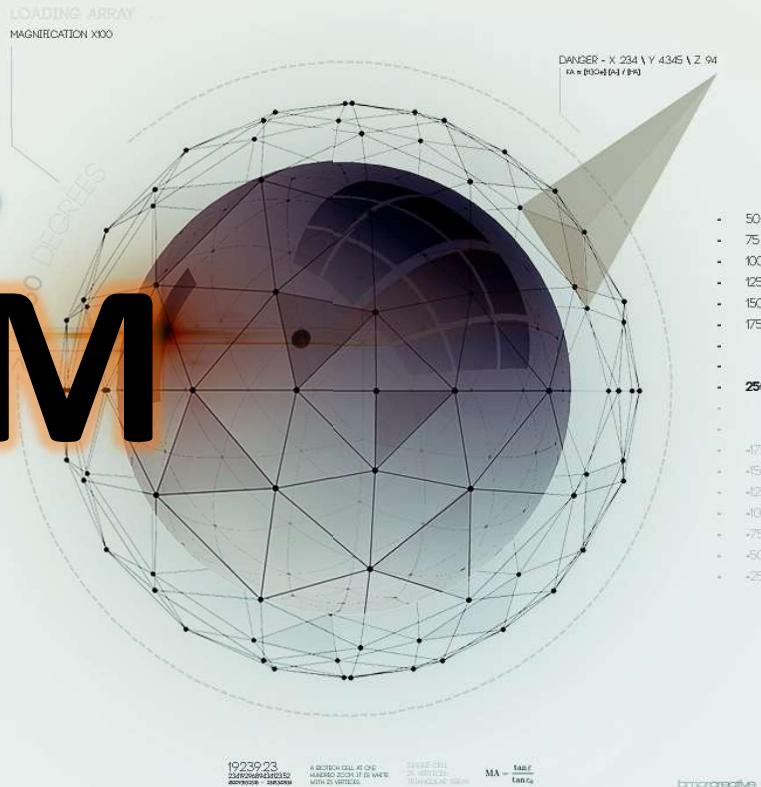
HIV: 120nm



**Red Blood Cell: 7 $\mu$ m**

THE CURRENT DAY TRANSISTOR IS OF THE SIZE  
OF 14nm WHICH IN COMPARISON IS 8 TIMES  
SMALLER THAN THE HIV VIRUS AND 500 TIMES  
SMALLER THAN THE RED BLOOD CELL.

# PROBLEM



32nm

22nm

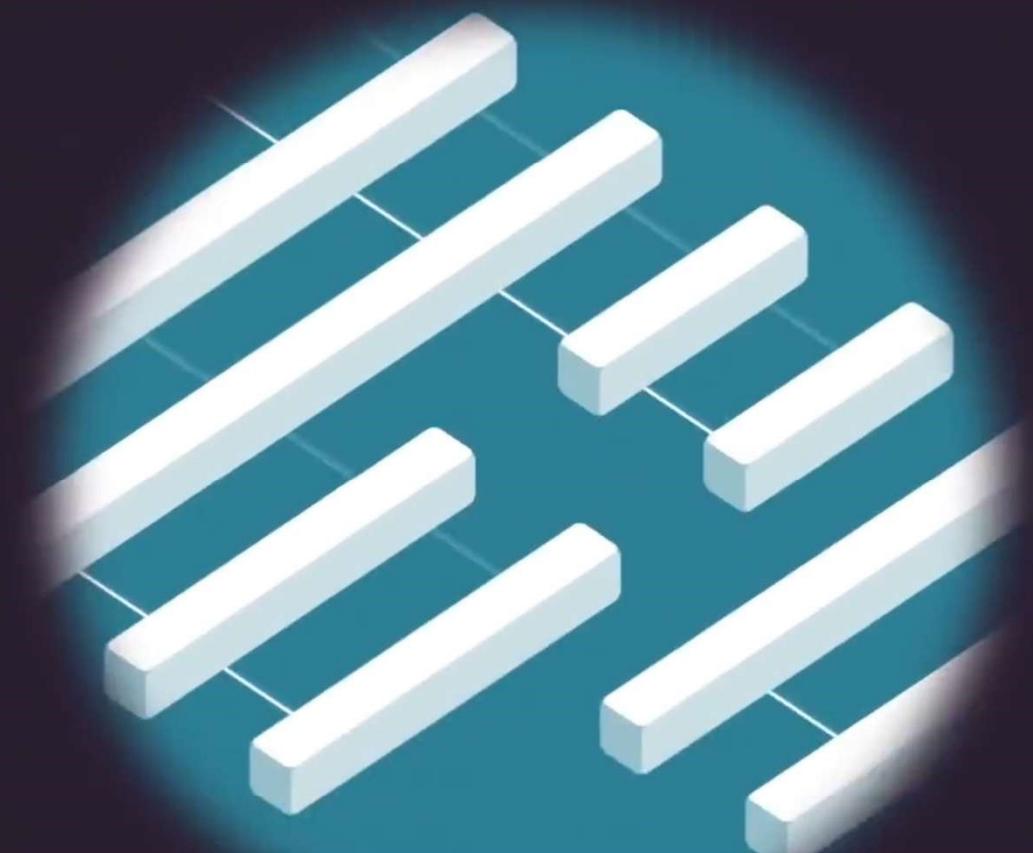
14nm

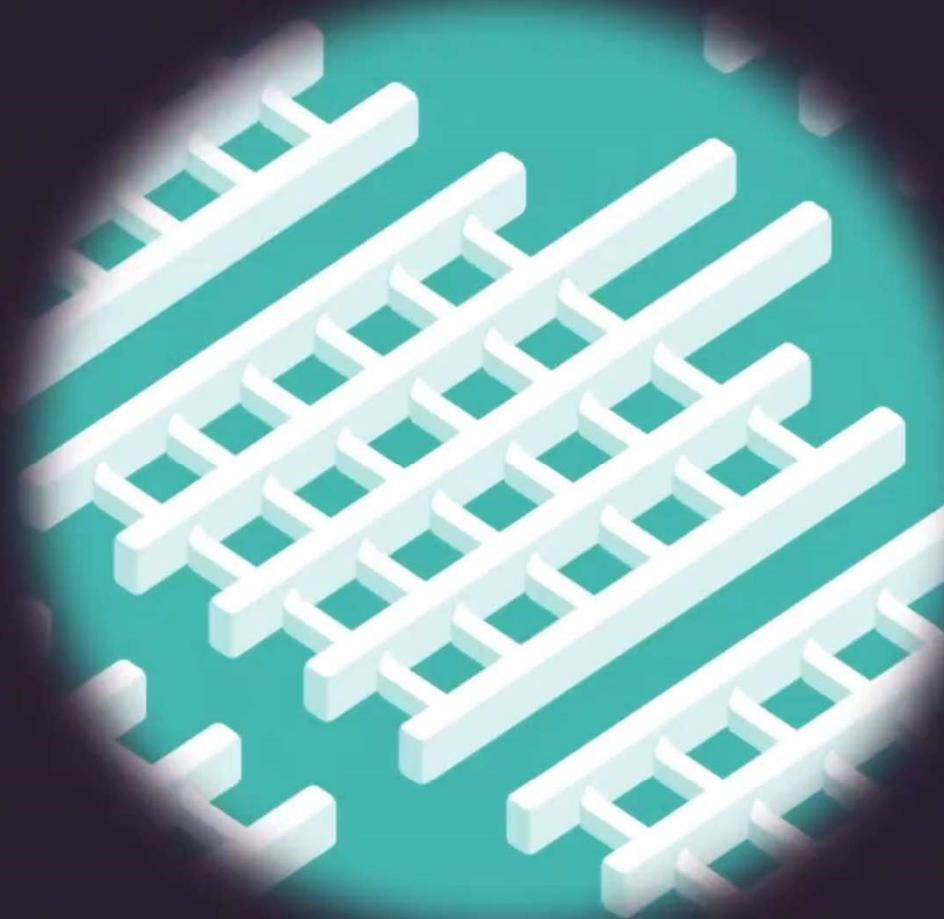
10nm

7nm

5nm

END





32nm

22nm

14nm

10nm

7nm

5nm

END



32nm

22nm

14nm

10nm

7nm

5nm

END

32nm

22nm

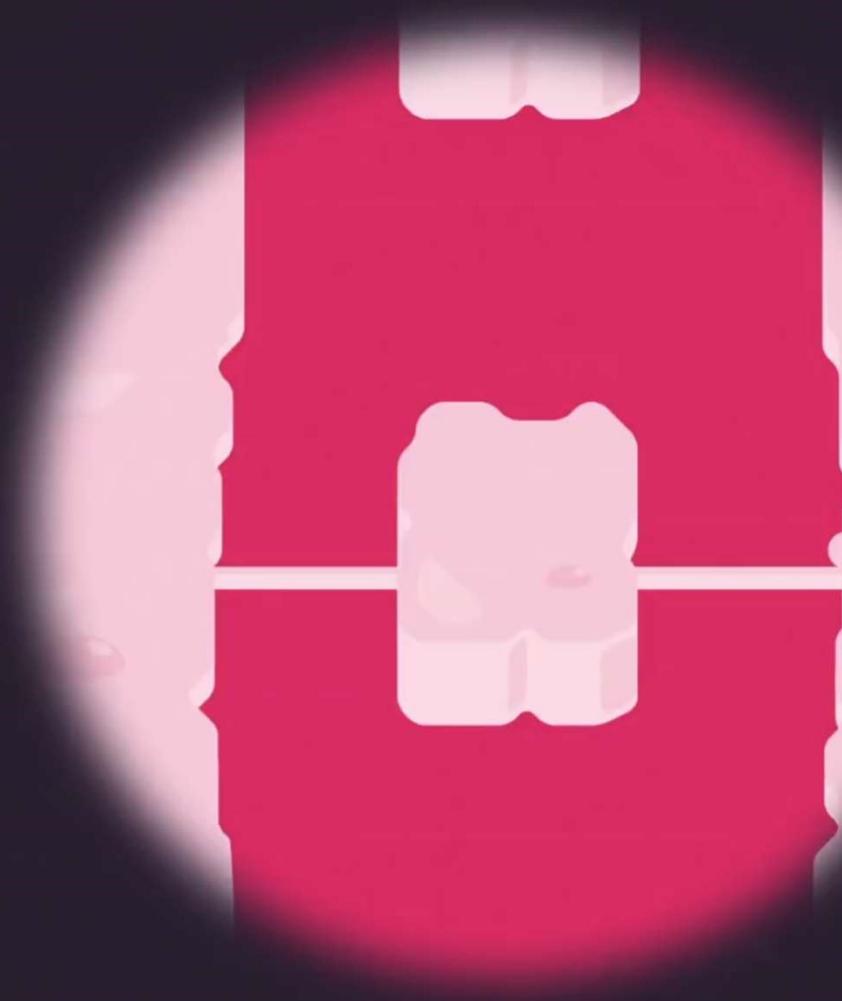
14nm

10nm

7nm

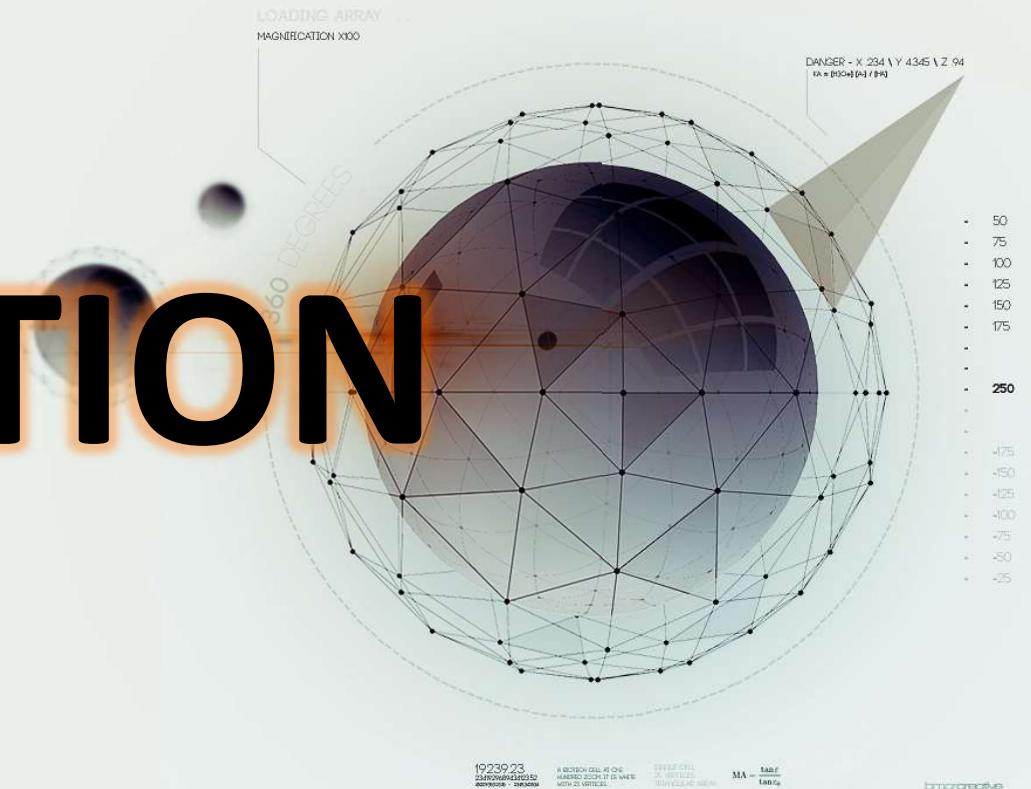
5nm

**END**

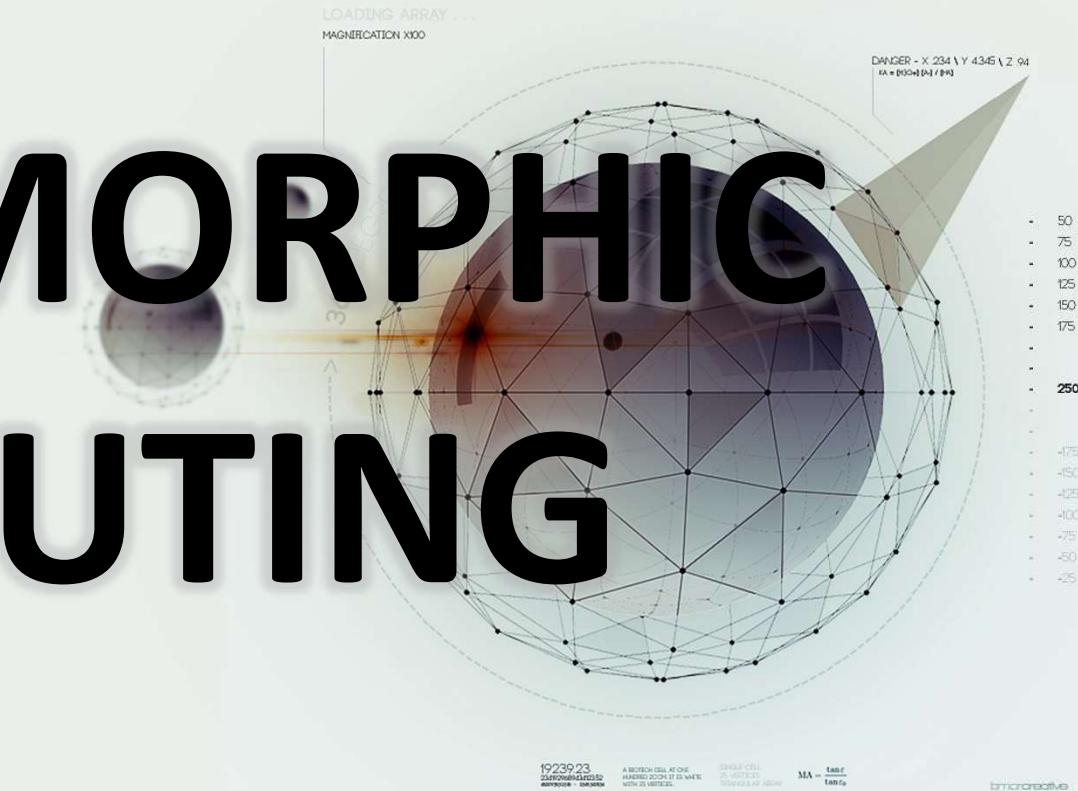


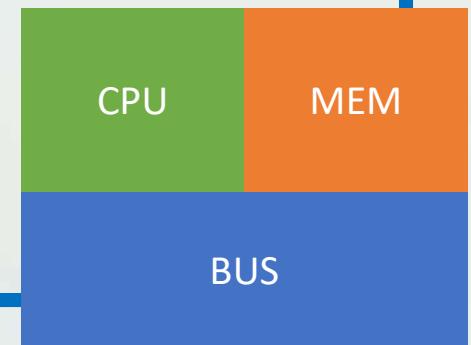
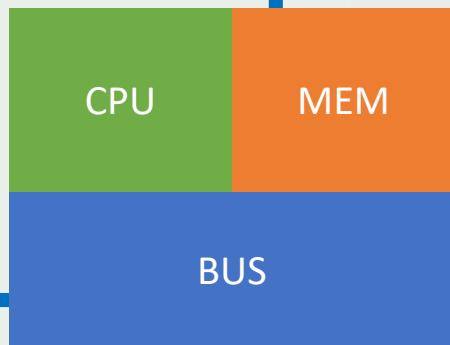
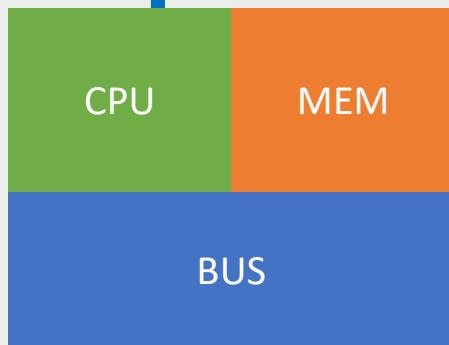
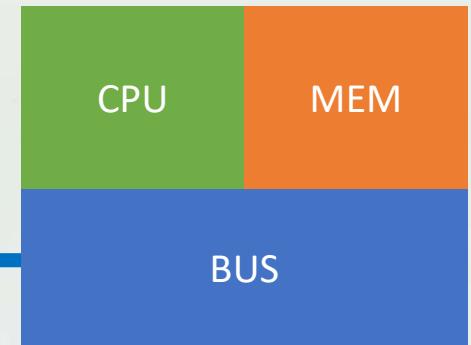
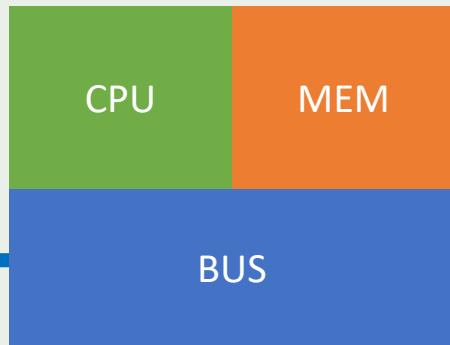
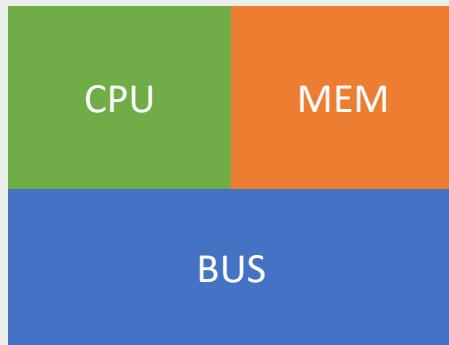
AS THE SIZE OF THE TYPICAL TRANSISTOR DECREASES EVENTUALLY ALMOST EVERY YEAR. NOW THE SIZE OF THE TRANSISTOR HAS REACHED ITS SIZE LIMIT THUS WE NEED TO FIND ALTERNATIVE TO THE TRANSISTOR.

# SOLUTION

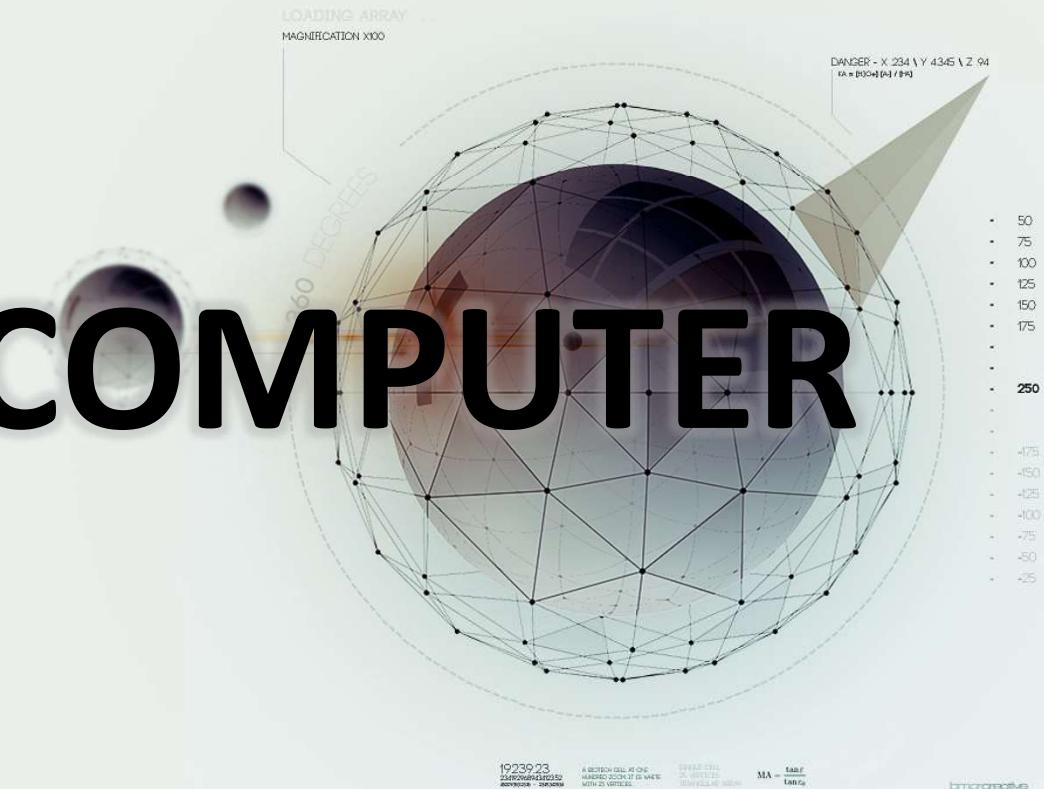


# NEUROMORPHIC COMPUTING





# QUANTUM COMPUTER



**BITS**



**low charge**

**high charge**

# QUBITS

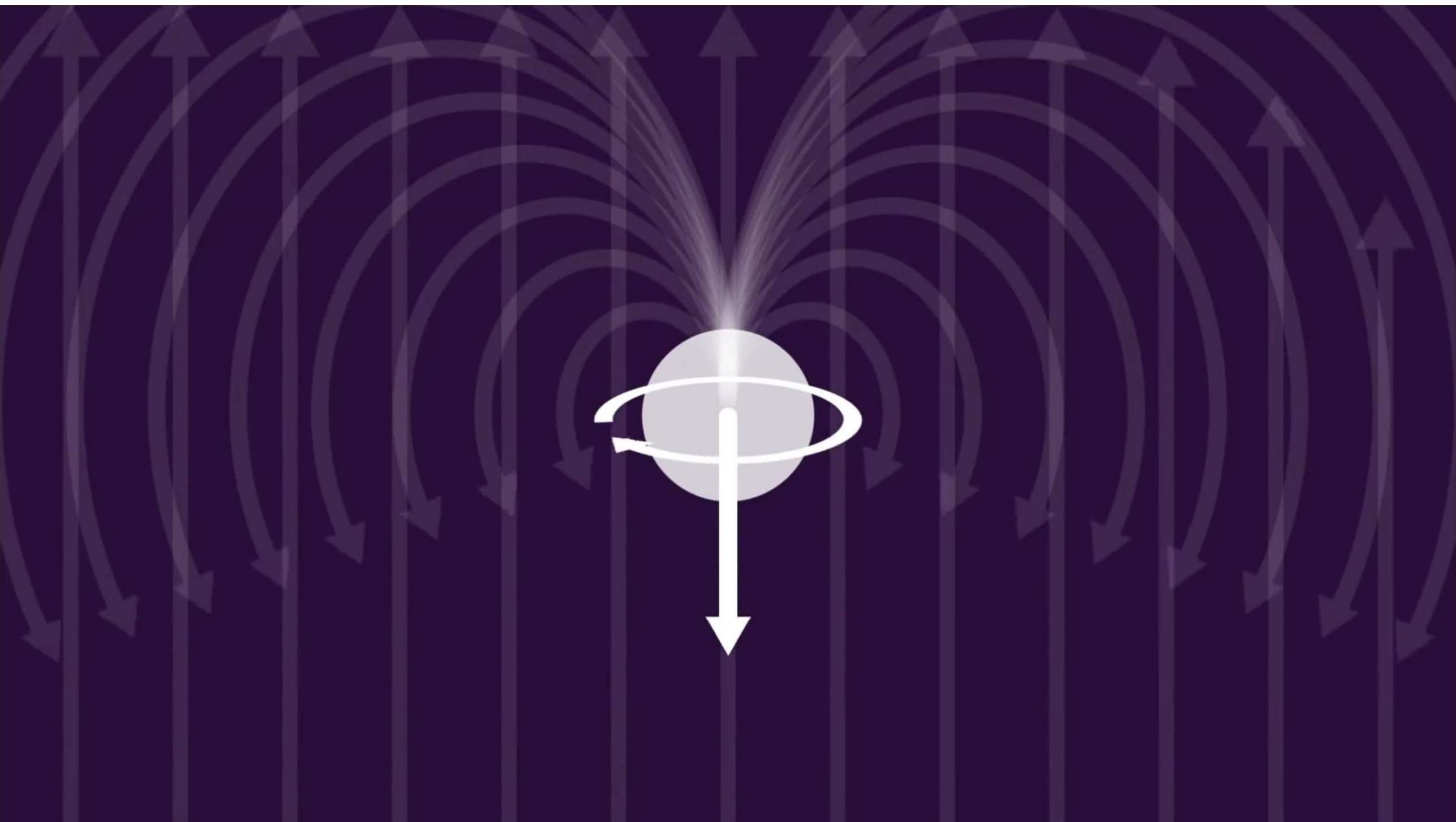
0

1

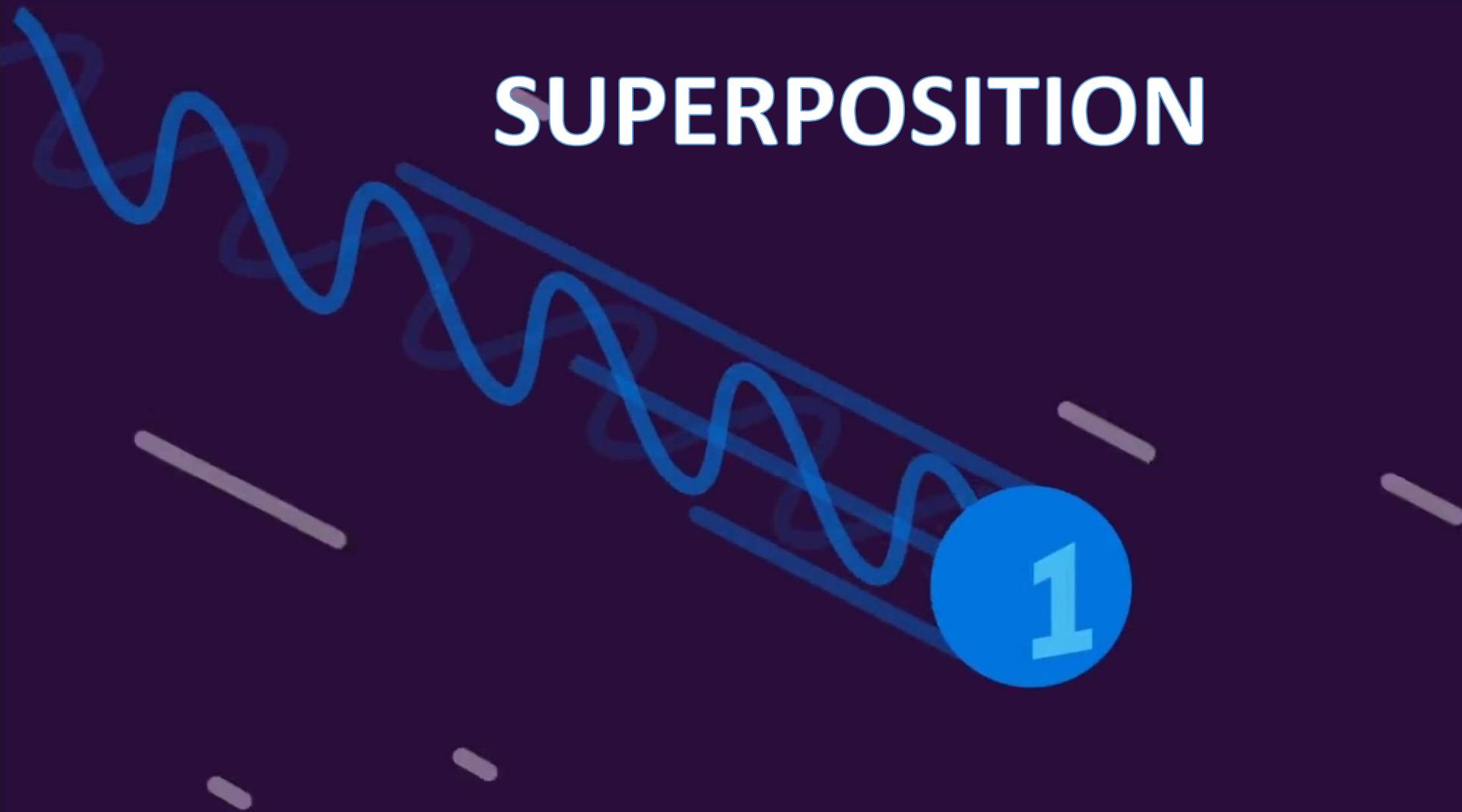
???

???

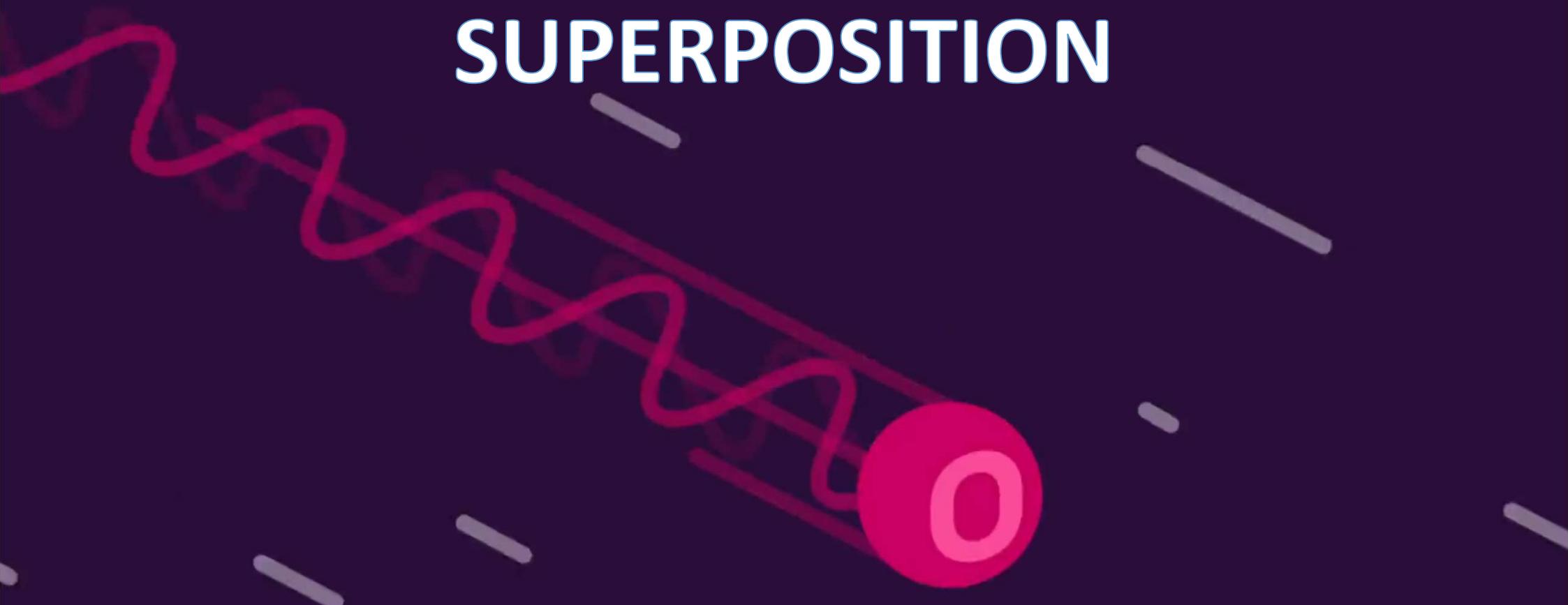
**COMPUTER SYSTEM USE BITS WHICH  
REPRESENT EITHER 1 OR 0. WHERAS  
QUANTUM COMPUTER USE QBITS  
WHICH REPRESENT BOTH PROBALITIES  
OF 1 AND 0 AT THE SAME TIME.**



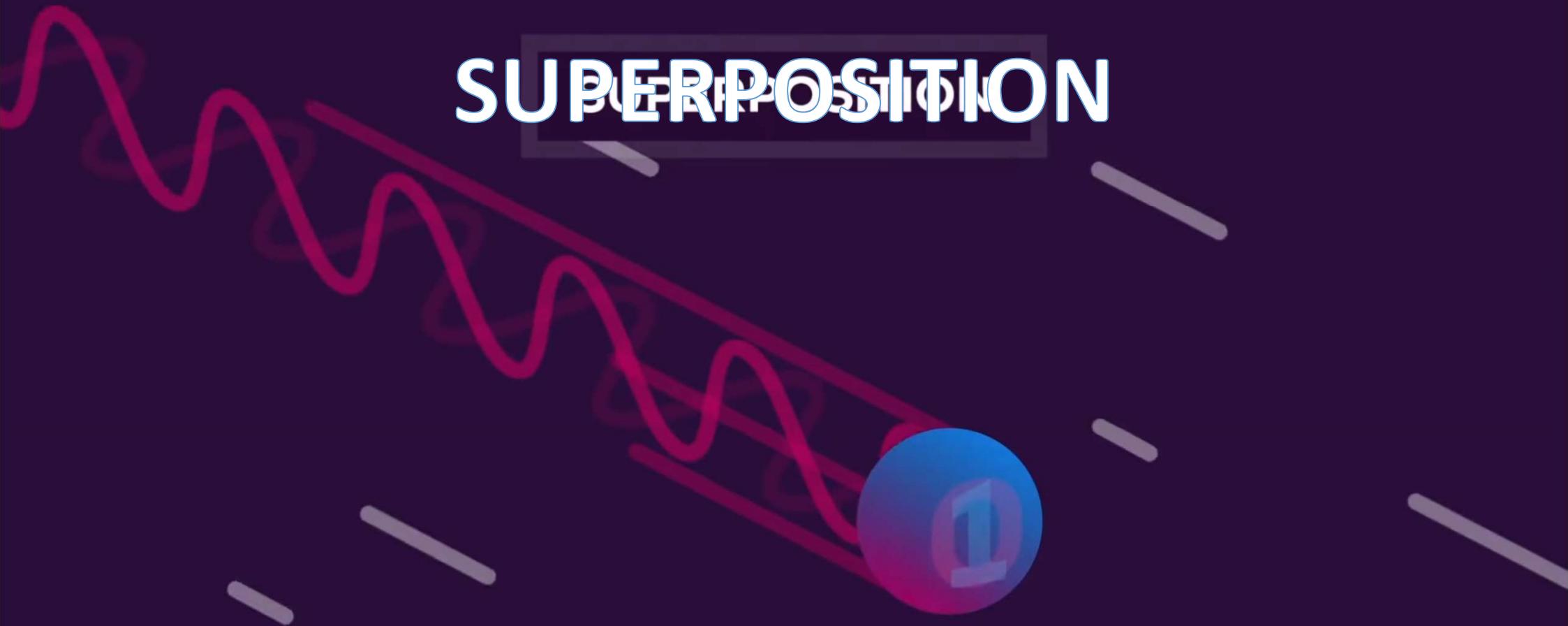
# SUPERPOSITION



# SUPERPOSITION



# SUPERPOSITION



# SUPERPOSITION



0

1

2n

**0000**

**0001**

**0010**

**0011**

**0100**

**0101**

**0110**

**0111**

**1000**

**1001**

**1010**

**1011**

**1100**

**1101**

**1110**

**1111**

CAN BE OF BOTH 0 AND 1 AT THE SAME TIME.



1



1

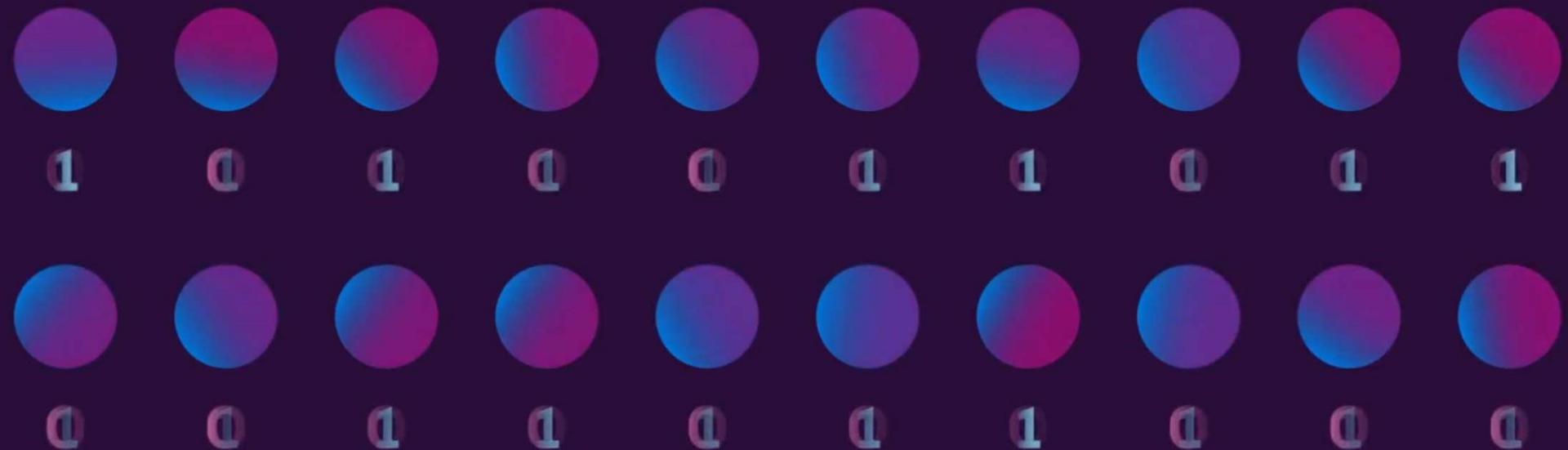


1



0

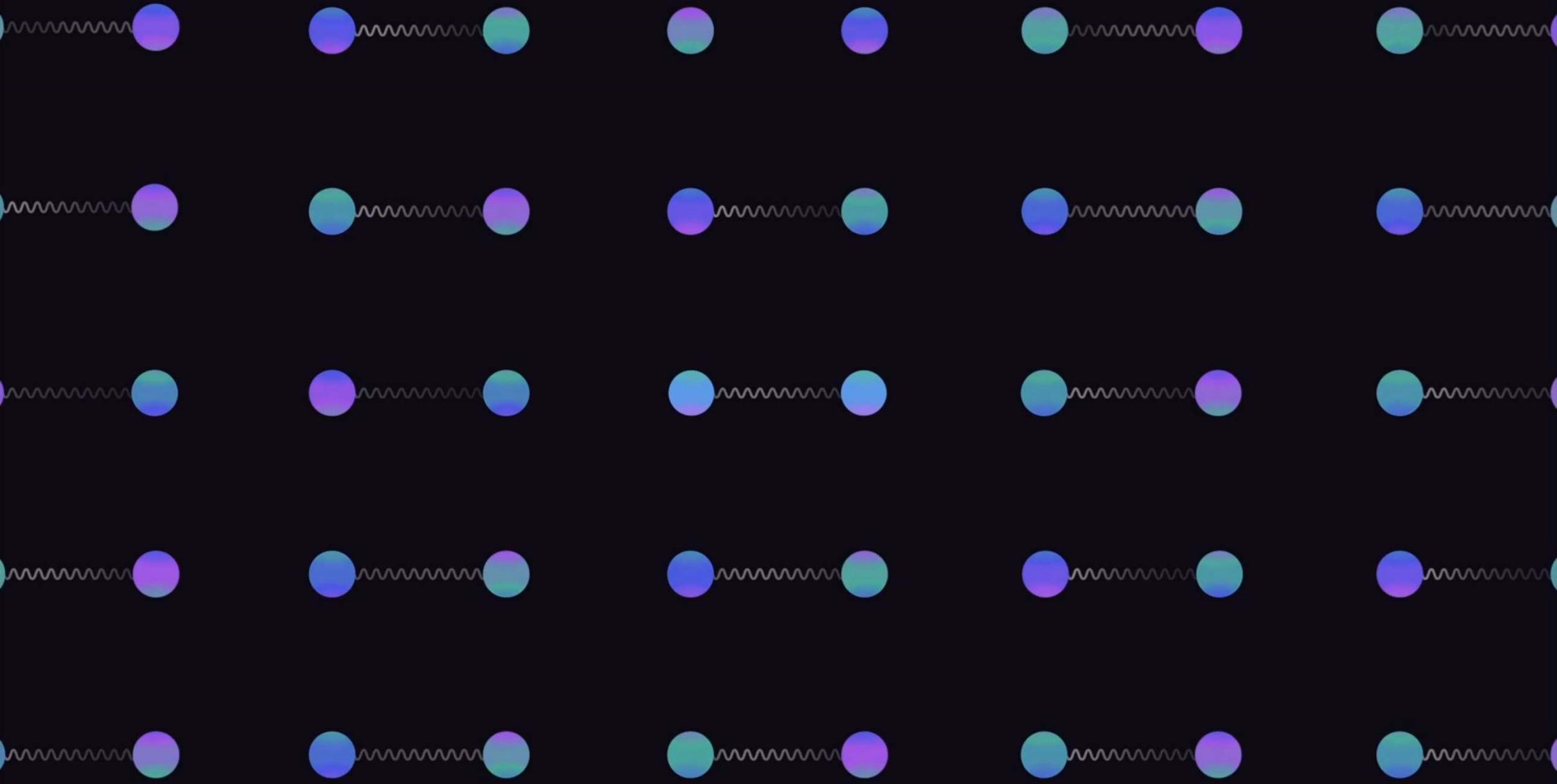
**2<sup>n</sup>**



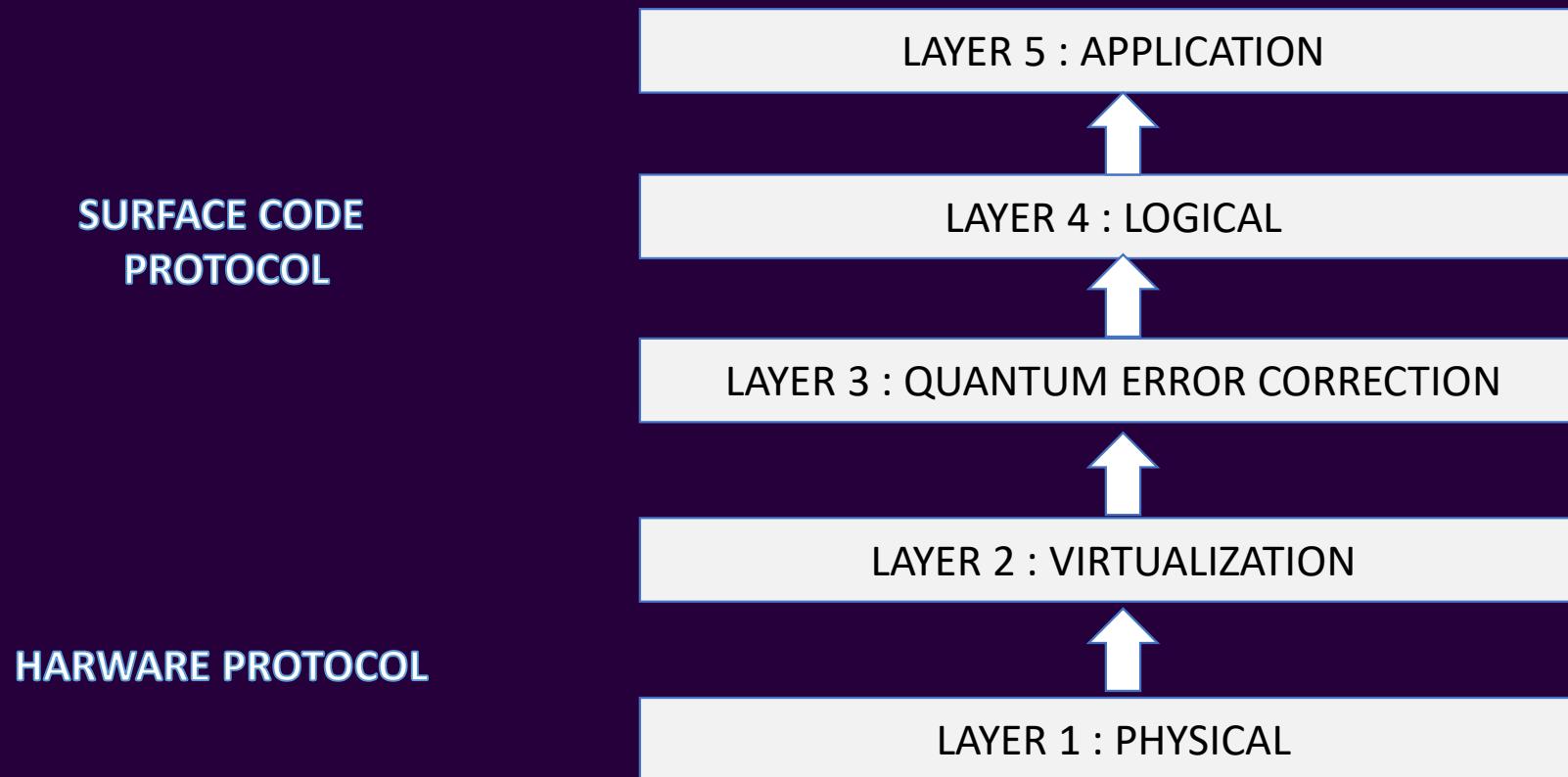
**$2^{20} = 1,048,576$**   
**configurations at once**

# ENTANGLEMENT

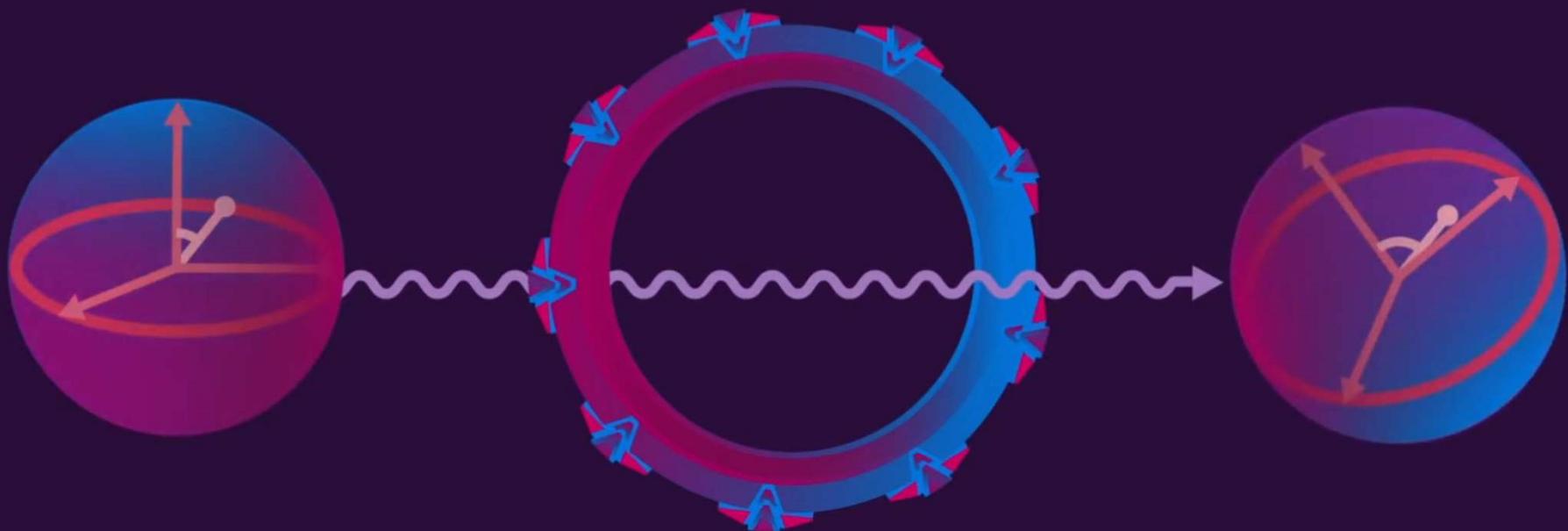




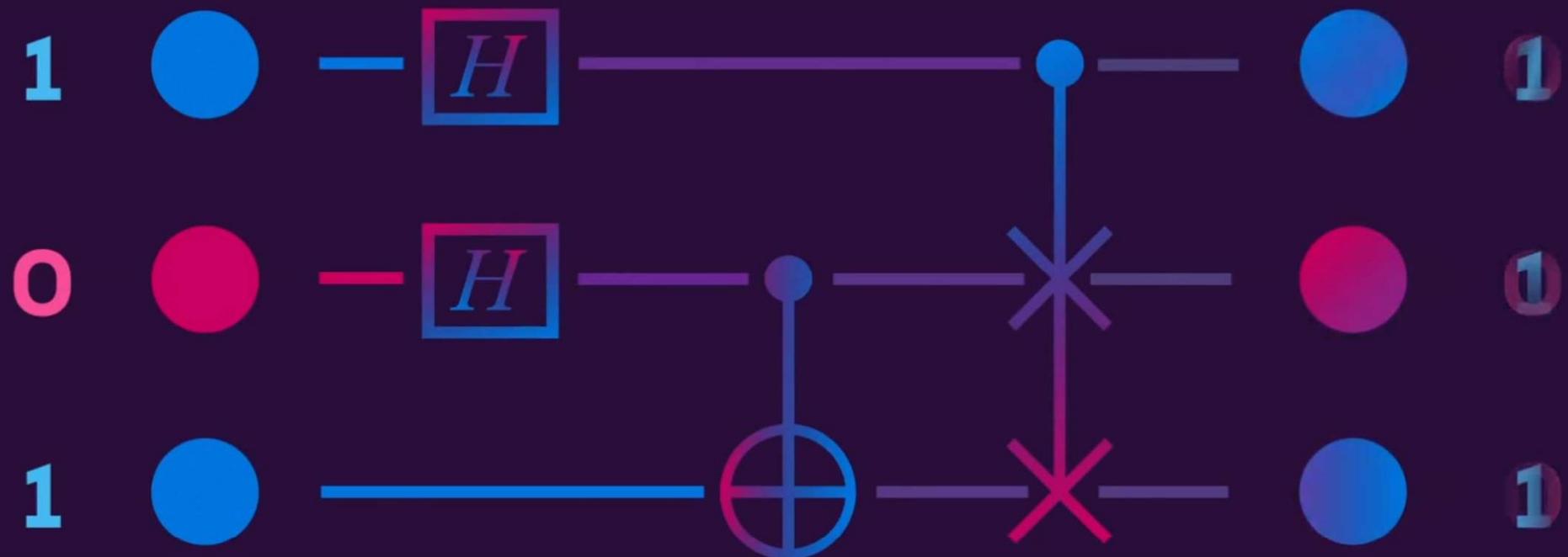
# Quantum Computing Architecture



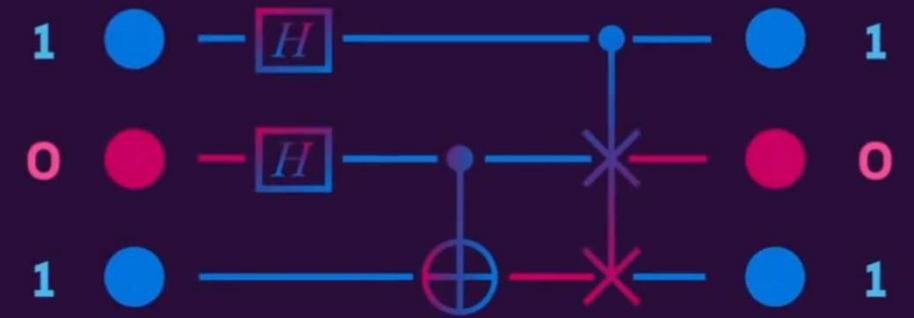
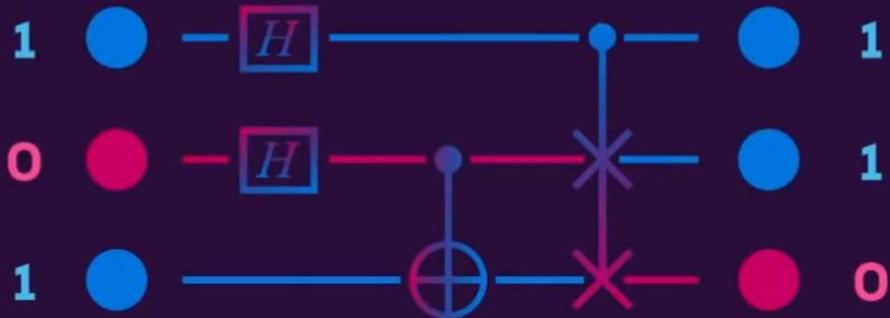
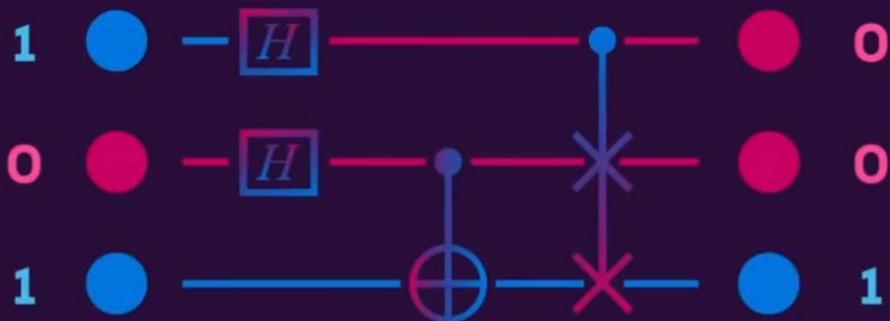
# QUANTUM GATE



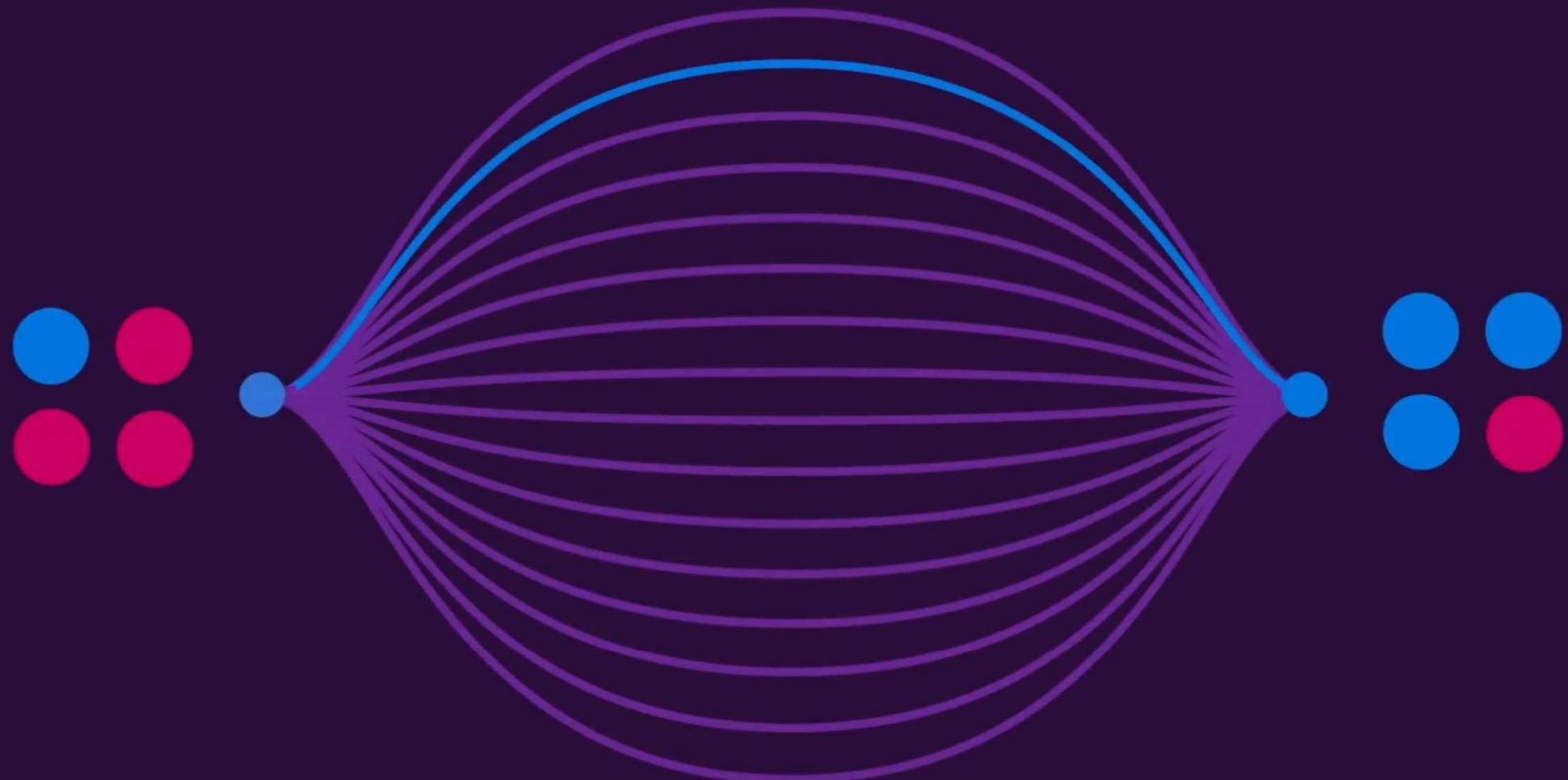
# QUANTUM CIRCUITS



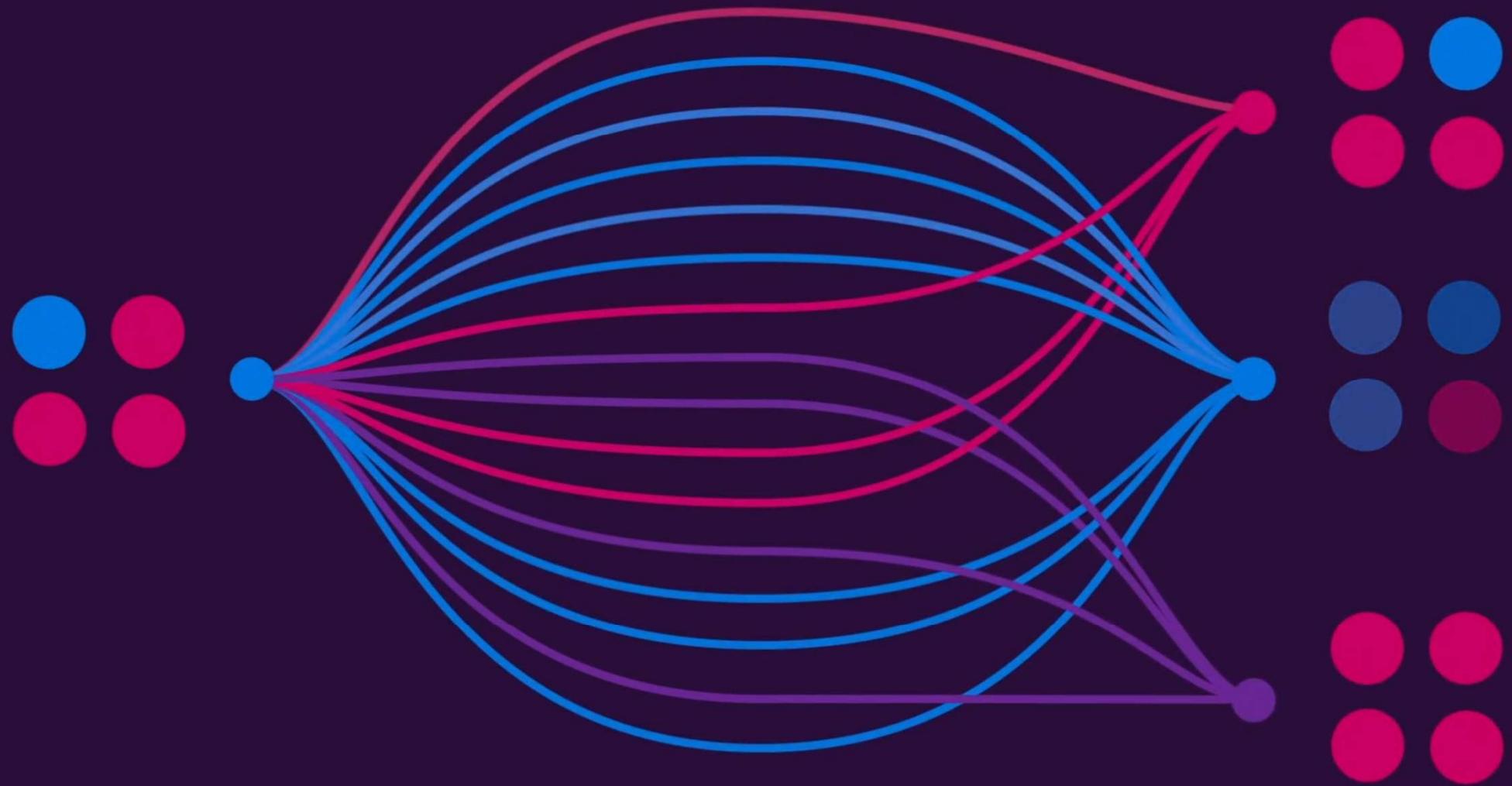
# GIVES ALL THE PROBABILITIES OF ANSWERS



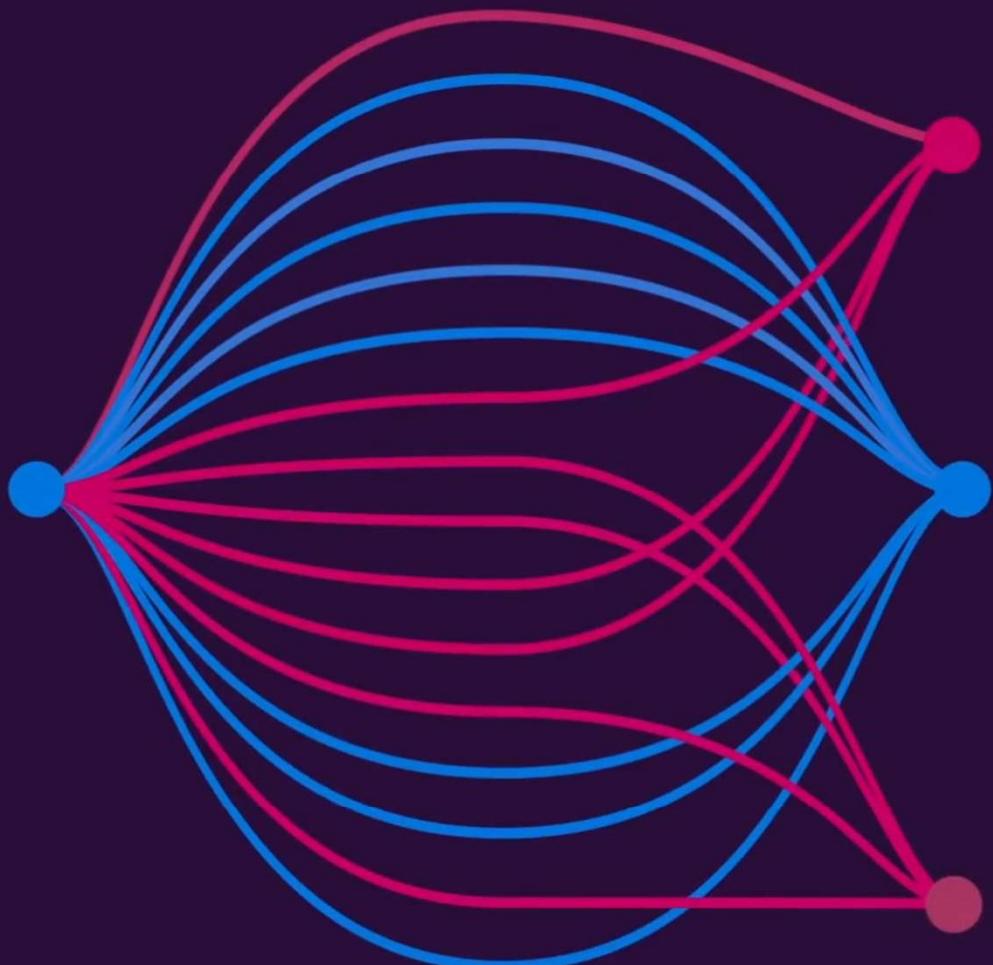
# *Quantum Computer*



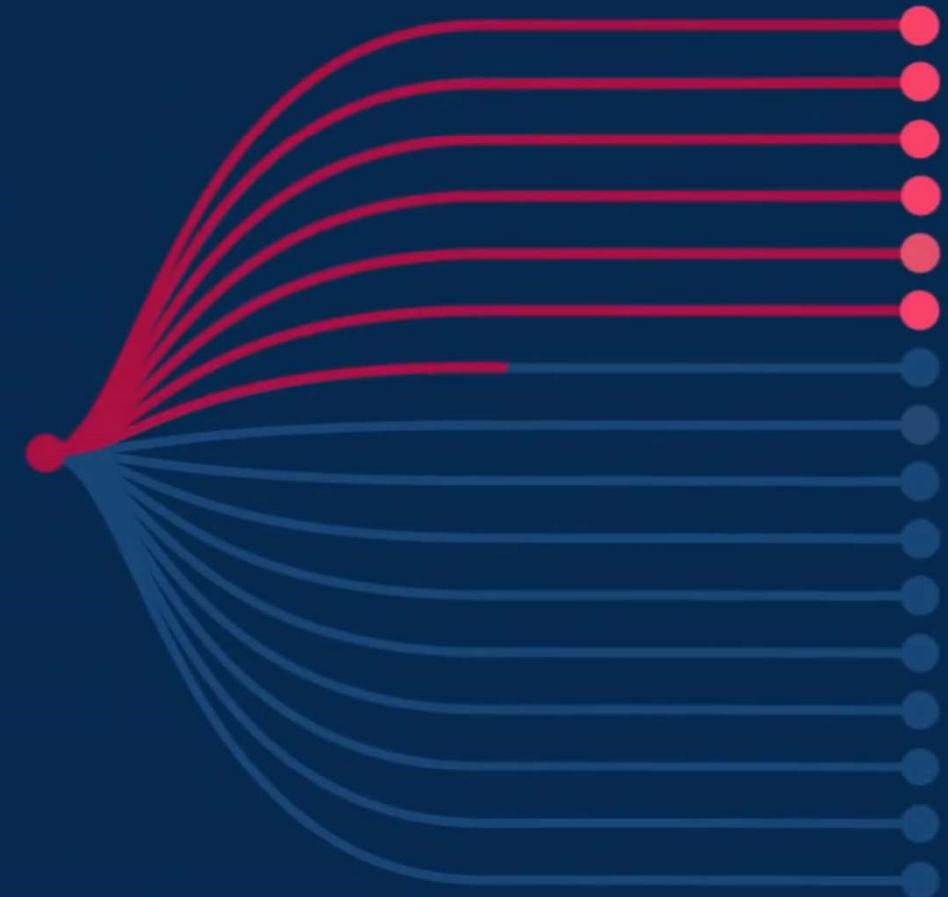
# *Quantum Computer*



**Quantum Computer**

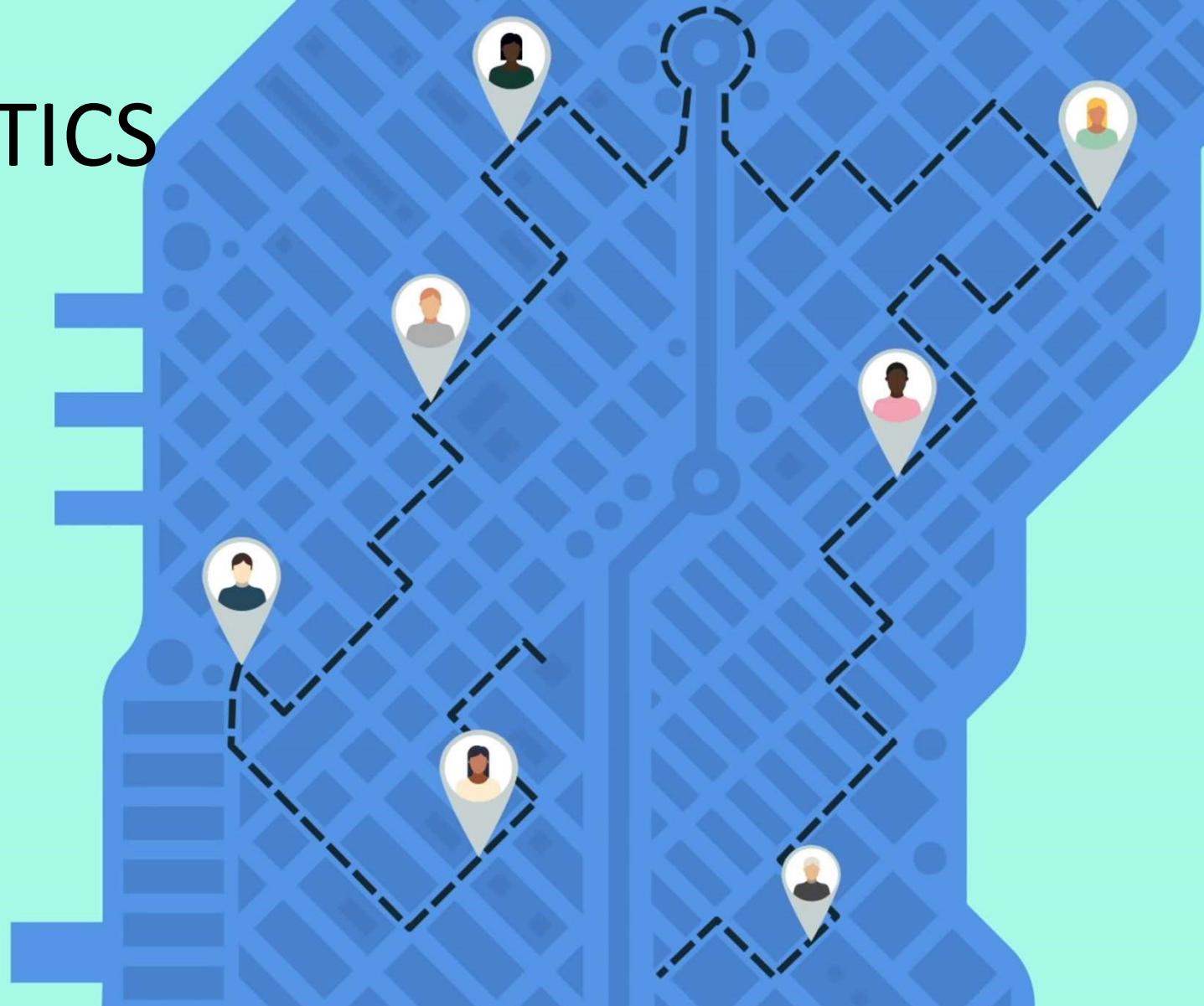


**Computer**



# APPLICATIONS OF QUANTUM COMPUTING

# LOGISTICS



# DATABASE SEARCH

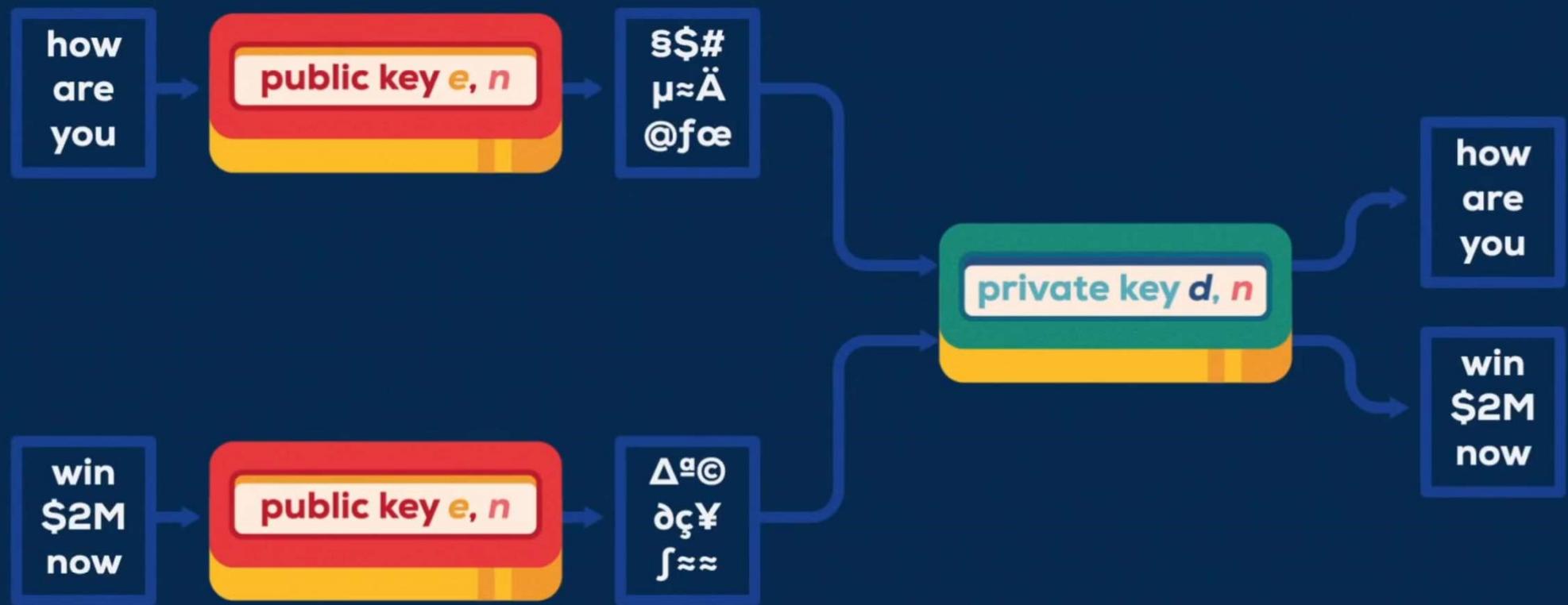
n

1,000,000

$\sqrt{n}$

1,000,~~000~~

# CRYPTOGRAPHY



**BREAKING ENCRYPTION INCLUDES FACTORIZATION OF A NUMBER. PRIME FACTORIZATION OF LARGE NUMBER WOULD TAKE A LONG TIME ON A NORMAL COMPUTER.**

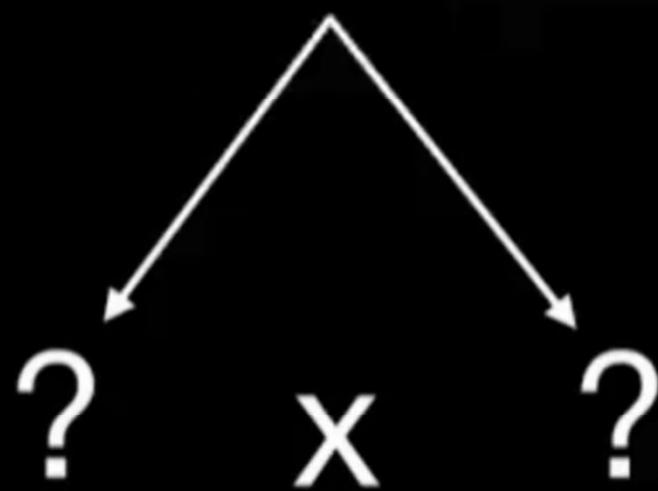
15



5 × 3

FACTORIZATION OF A NUMBER

2519590847565789349402718324004839857142928212620403202777713783604366202070  
7595556264018525880784406918290641249515082189298559149176184502808489120072  
8449926873928072877767359714183472702618963750149718246911650776133798590957  
0009733045974880842840179742910064245869181719511874612151517265463228221686  
9987549182422433637259085141865462043576798423387184774447920739934236584823  
8242811981638150106748104516603773060562016196762561338441436038339044149526  
3443219011465754445417842402092461651572335077870774981712577246796292638635  
6373289912154831438167899885040445364023527381951378636564391212010397122822  
120720357





Classical

1 billion  
years

Quantum

?



Factorizing  
RSA keys...

Easy game...

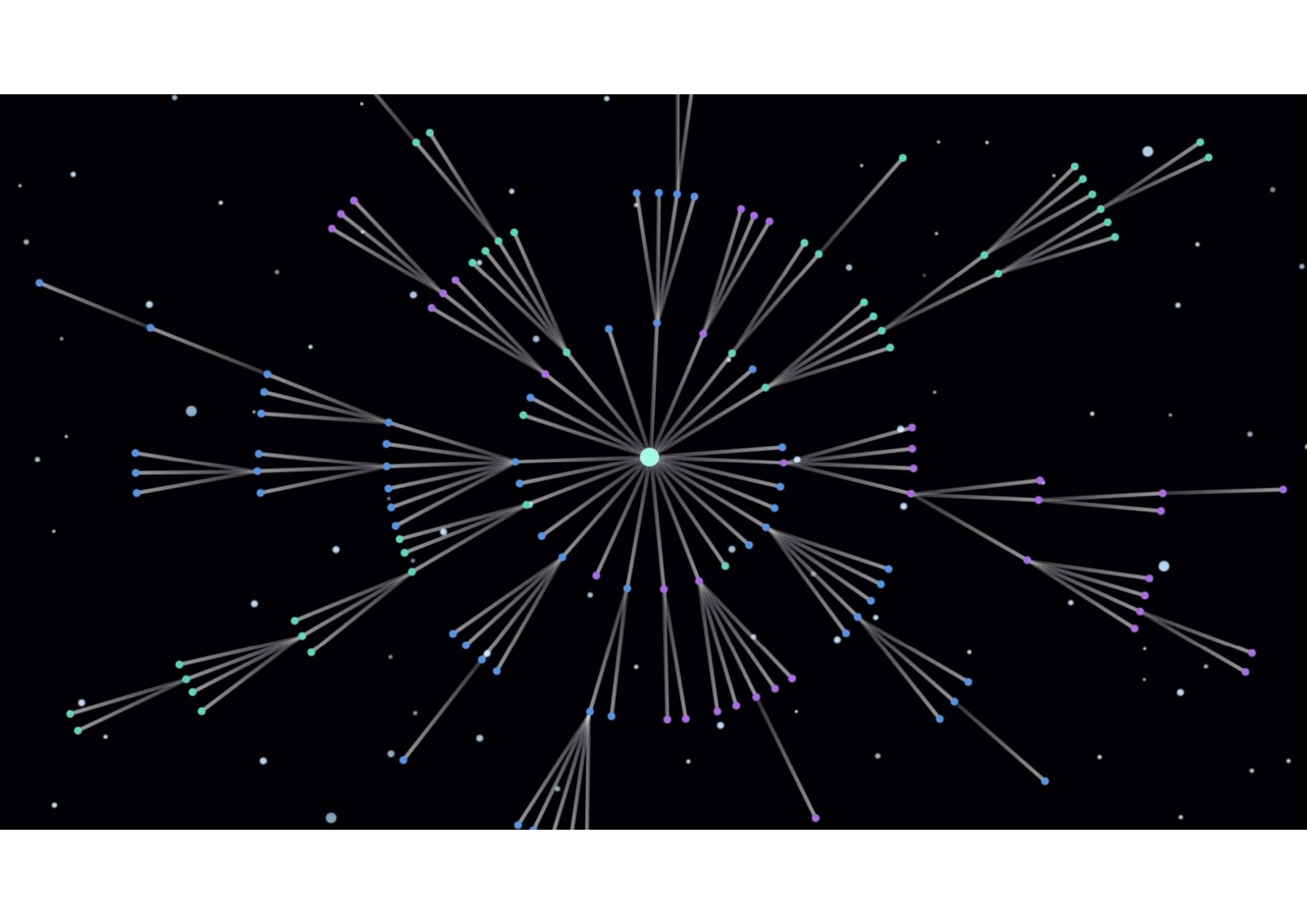
**Classical**

**1 billion  
years**

**Quantum**

**100  
seconds**

THIS ERA IS JUST THE BEGINNING OF THE QUANTUM COMPUTER. THE APPLICATIONS OF IT ARE YET TO BE DISCOVERED AND WE NEVER THE POSSIBILTIES OF THIS TECHNOLOGY AND THIS MAYBE CAN REVOLUTIONIZE THE WORLD WE NEVER MAY KNOW. ALL WE CAN DO IS DISCOVER AND INNOVATE.





# COMPANIES INVESTING ON QUANTUM COMPUTING

**YALE**



**TU Delft**  
Delft University of Technology



**MIT**



 **Bell Laboratories**



**IBM**®



**D-Wave**  
The Quantum Computing Company™



 **University of  
BRISTOL**

**M**

 **UCSD**

 **University  
of South  
Wales**

**ETH zürich**

