LECTURER: Nghia Duong-Trung

ARTIFICIAL INTELLIGENCE

TOPIC OUTLINE

UNIT 4.1-2

MODERN ARTIFICIAL INTELLIGENCE SYSTEMS

On completion of this unit, you will have …

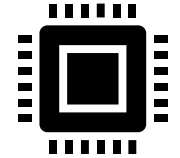
- … awareness of recent advancements in computing technologies.
- … basic understanding of Cloud Computing and Quantum Computing.
- … knowledge of Narrow and General Artificial Intelligence.

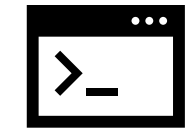
EXPLAIN SIMPLY

1. Explain the concept of Quantum Computing using your own words.
2. Define the term of Narrow Artificial Intelligence. How does it differ from General Artificial Intelligence?
3. Describe Moore‘s Law. Is it still applicable today?

RECENT DEVELOPMENTS IN HARDWARE AND SOFTWARE

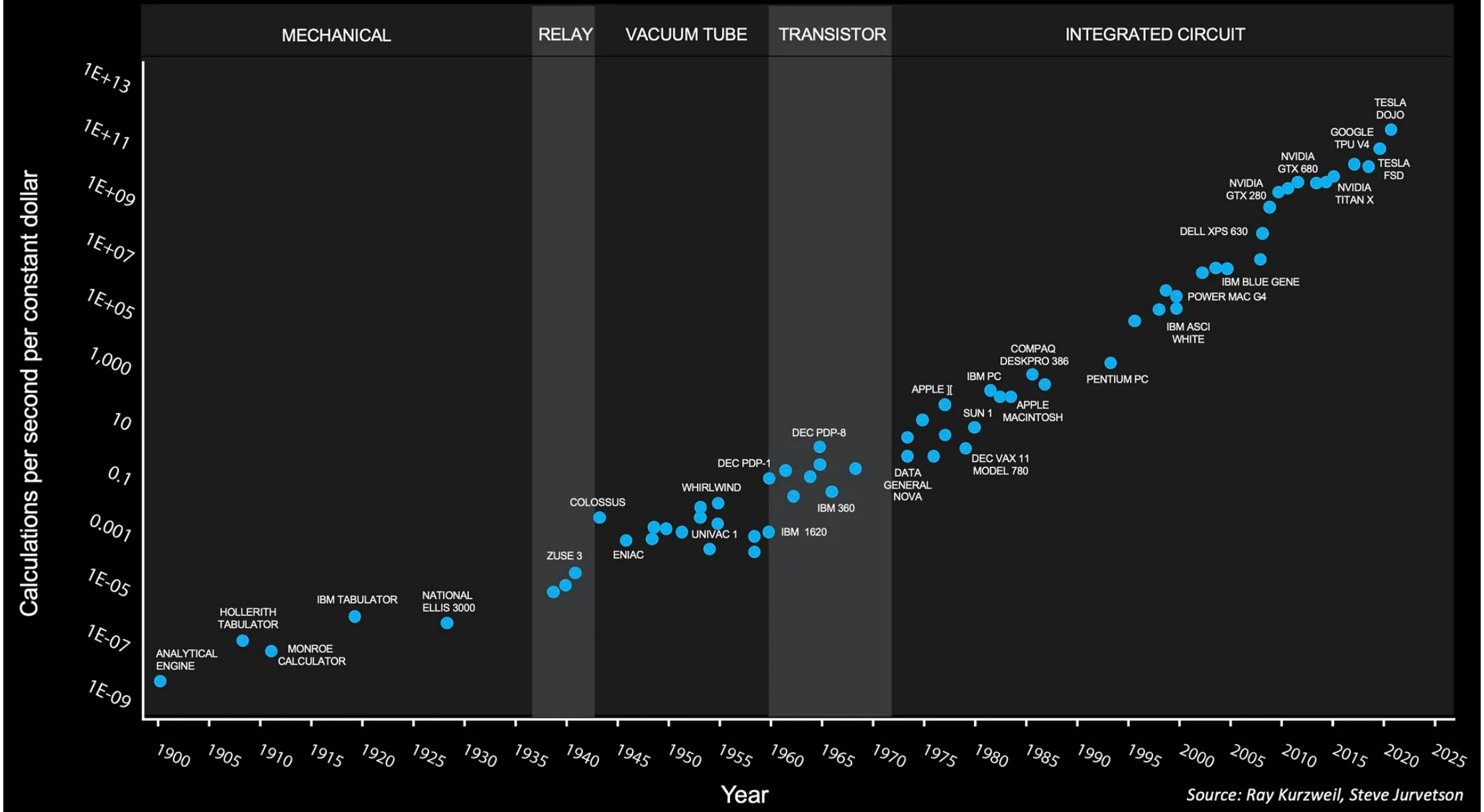
- 1960’s: Moore’s Law = complexity, as measured by the number of transistors on a chip, doubles every two years.
- 1970’s: Microsoft and Apple founded
- 1980’s: CERN research developed protocol of HTTP & concept of “WWW”
- 1990’s: rise of Windows operating system





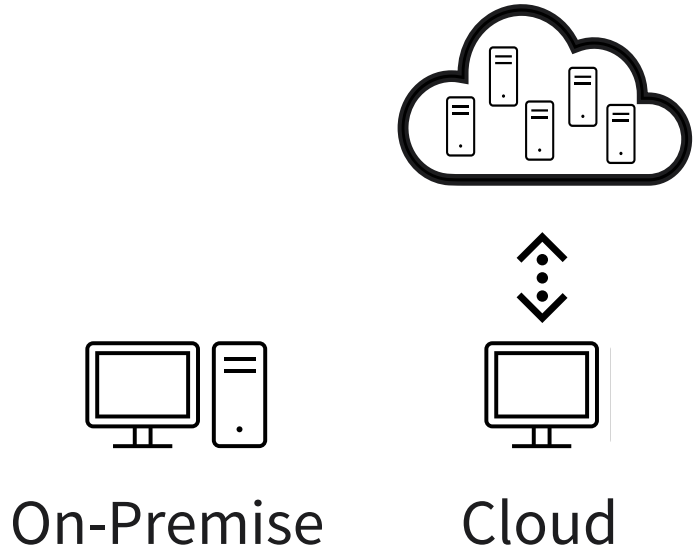
FUTURE VENTURES

122 YEARS OF MOORE'S LAW



Source: Ray Kurzweil, Steve Jurvetson

Cloud Computing = parallel, geographically distributed and virtualized computing



Cloud Computing = parallel, geographically distributed and virtualized computing

Reasons for emergence:

Need for computational and data storage resources due to, e.g., artificial intelligence

Economic opportunity for businesses offering cloud computing capabilities such as Amazon, IBM, and Microsoft

- https://colab.research.google.com/
  - Free, pro versions
- https://www.coursera.org/learn/machine-learning-on-aws
- https://www.coursera.org/learn/aws-machine-learning
- https://www.coursera.org/projects/deploy-ml-model-aws-elastic-beanstalk
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- https://www.coursera.org/specializations/advanced-machine-learning-tensorflow-gcp

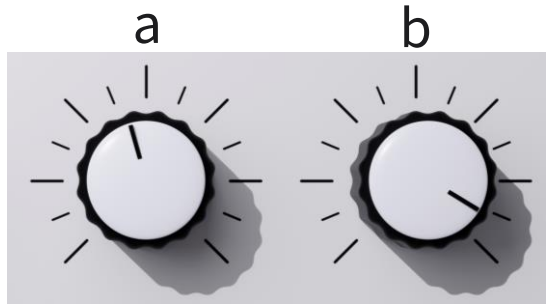
Regular Computing = classic information representation, consists of 0 and 1, e.g., *hi* is 01101000 01101001 (= bits)

Quantum Computing = novel computational paradigms to represent information, classical bit + **superposition** of these states (= quantum bit/qubit)

Classical Bit

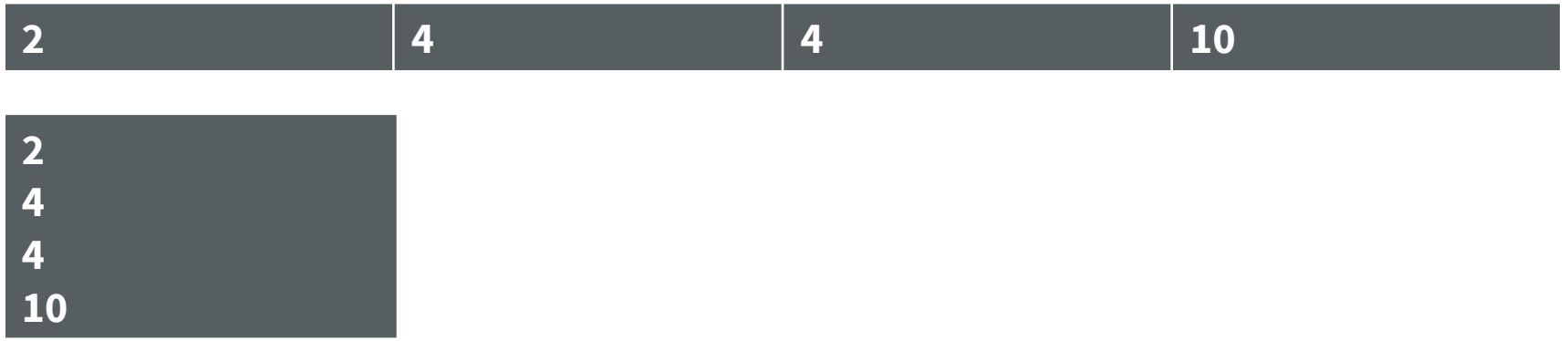
Qubit

$$a|0\rangle + b|1\rangle$$



Source of the images: Pixabay.com/PowerPoint Stock Images.

- A quantum computer has quantum bits or qubits
- Where a bit can store either a zero or a 1, a qubit can store a zero, a one, both zero and one, or an infinite number of values in between—and be in multiple states (store multiple values) **at the same time**
- there are the practical difficulties of making qubits, controlling them very precisely, and having enough of them to do really useful things
- it is still too early to be able to predict the time horizon for a practical quantum computer
- https://www.youtube.com/watch?v=T2DXrs0OpHU&t=386s



Regular Computing = classic information representation, consists of 0 and 1, e.g., *hi* is 01101000 01101001 (= bits)

Quantum Computing = novel computational paradigms to represent information, classical bit + superposition of these states (= quantum bit/qubit)

Potential of Quantum Computing: increase of ability to process information such as cryptography, DNA computing

USE CASES CLOUD VS QUANTUM COMPUTING

Cloud Computing

- Cloud data storage
- Business processes
- Big data analytics via cloud providers
- Communication platforms

Quantum Computing

- Faster research and development of molecular structures and drug design
- Optimization of larger autonomous fleets

COMPARISON NARROW VS GENERAL AI

Narrow AI

- Specialized functions in controlled environments
- One domain/task at a time
- Facial recognition, sales forecasting

General AI

- Open-ended, flexible, domain independent
- Replicates full range of human cognitive abilities simultaneously

You now have …

- … awareness of recent advancements in computing technologies.
- … basic understanding of Cloud Computing and Quantum Computing.
- … knowledge of Narrow and General Artificial Intelligence.

SESSION 4

TRANSFER TASK

TRANSFER TASK

Think about advantages and challenges that Cloud Computing offers for businesses in the field of Artificial Intelligence.

TRANSFER TASK
PRESENTATION OF THE RESULTS

Please present your results.

The results will be discussed in plenary.

1. Characterize the relationship between computer science and artificial intelligence.
   a) The two fields are unrelated and are separate fields of study.
   b) Progress in high performance computing and data storage are major drivers for the current wave of progress in artificial intelligence.
   c) Both fields of study date back several hundred years.
   d) While computer science benefits from artificial intelligence, artificial intelligence does not benefit from computer science.

2. Cloud computing implies
   a) that the unknowns in computing become known or less cloudy.
   b) that the unknowns of data become known or less cloudy.
   c) an on-demand computer and data storage for customers.
   d) that individual servers are not needed any longer.