

**LECTURER: Nghia Duong-Trung**

# **ARTIFICIAL INTELLIGENCE**

TOPIC OUTLINE

History of Artificial Intelligence

1

Early Systems in Artificial Intelligence

2

Neuroscience and Cognitive Science

3

Modern Artificial Intelligence Systems

4

Applications of Artificial Intelligence

5

**UNIT 4.1-2**

# **MODERN ARTIFICIAL INTELLIGENCE SYSTEMS**



On completion of this unit, you will have ...

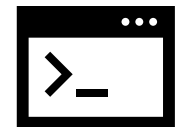
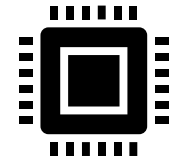
- ... awareness of recent advancements in computing technologies.
- ... basic understanding of Cloud Computing and Quantum Computing.
- ... knowledge of Narrow and General Artificial Intelligence.



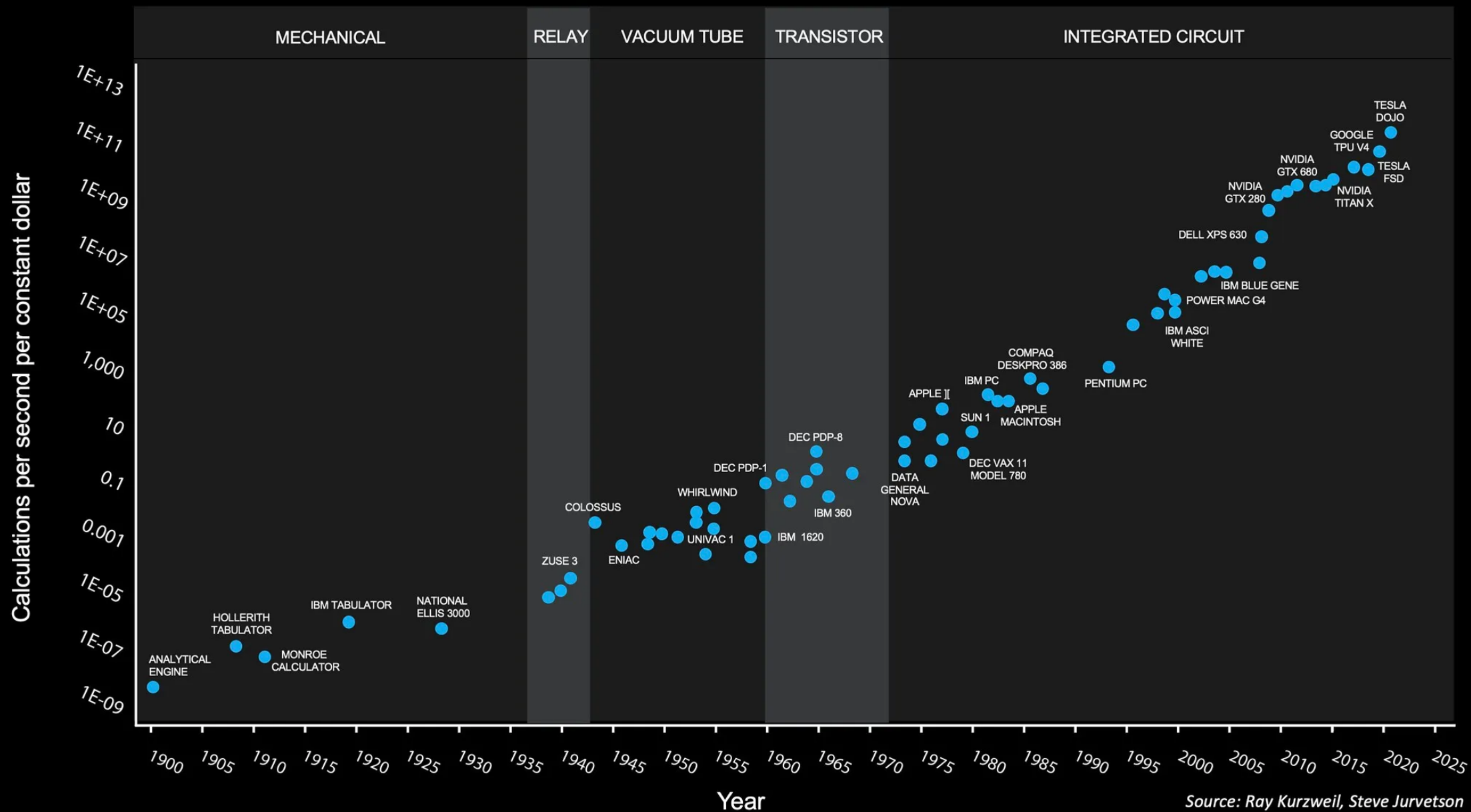
1. Explain the concept of Quantum Computing using your own words.
2. Define the term of Narrow Artificial Intelligence. How does it differ from General Artificial Intelligence?
3. Describe Moore's Law. Is it still applicable today?

## 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

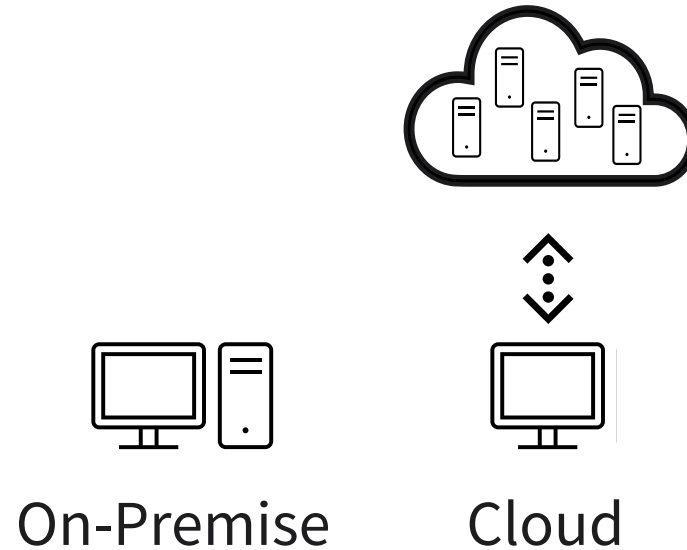


# 122 YEARS OF MOORE'S LAW



## CLOUD COMPUTING

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>
- <https://www.coursera.org/learn/machine-learning-aws-nvidia>
- <https://www.coursera.org/specializations/practical-data-science>
- <https://www.coursera.org/specializations/hands-on-data-science-machine-learning>
- <https://www.coursera.org/learn/google-machine-learning>
- <https://www.coursera.org/specializations/machine-learning-tensorflow-gcp>
- <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)

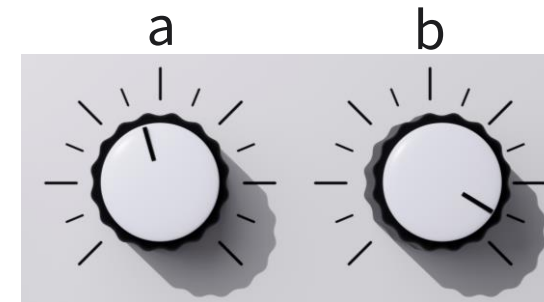
**Quantum Computing** = novel computational paradigms to represent information, classical bit + **superposition** of these states (= quantum bit/qubit)

Classical Bit



Qubit

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



## QUANTUM COMPUTING

- 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

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**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

## 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

## 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.

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