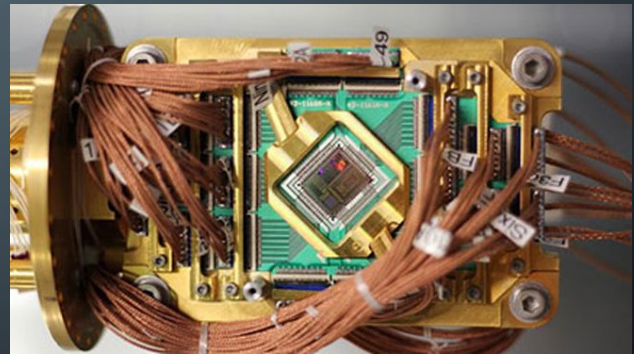


D-WAVE

THANANON PATINYASAKDIKUL



D:wave

The Quantum Computing Company™

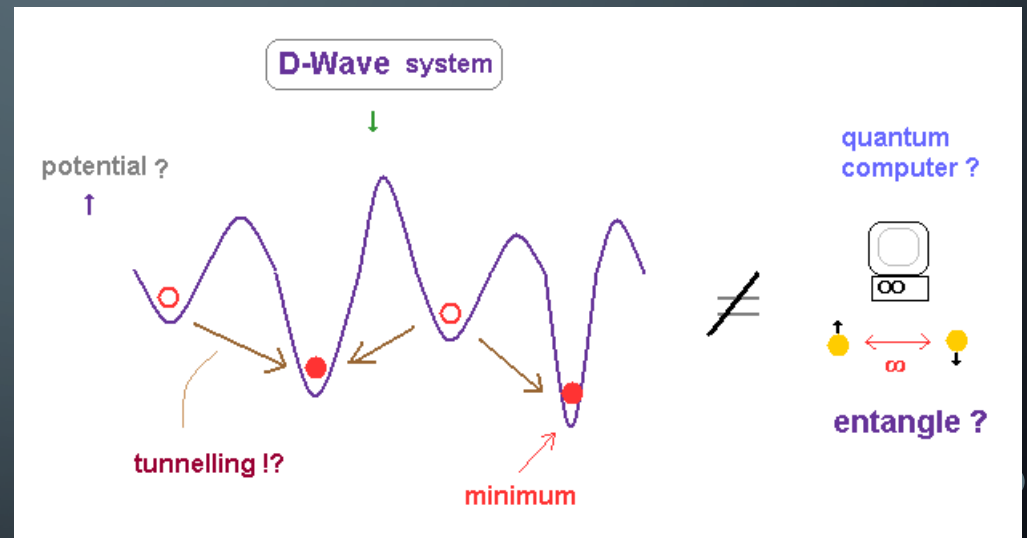
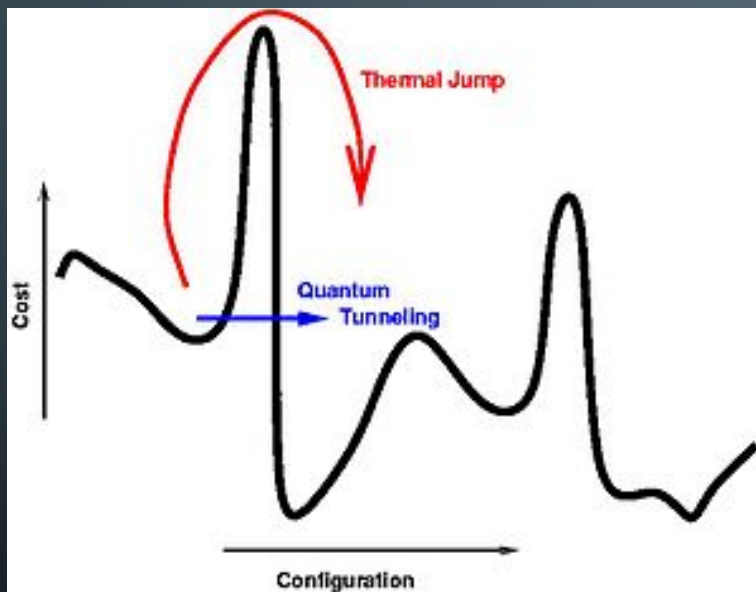
D-WAVE

- First and only commercial quantum computer company.
- Canadian
- Founder was a Ph.D candidate in physics.
- Debuted in 2007 with a prototype computer that solves cool problem.
- First commercially available computer released in 2011 with 128 qubits.
- First client? Lockheed-Martin
- Their latest computer, D-WAVE 2x has 1000+ qubits.

PROBLEMS

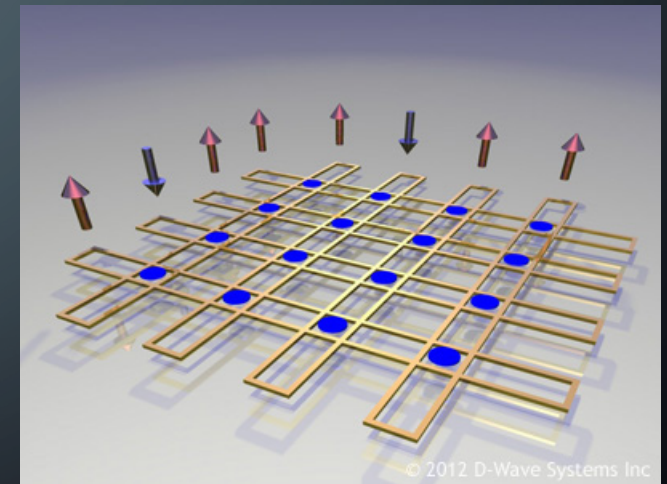
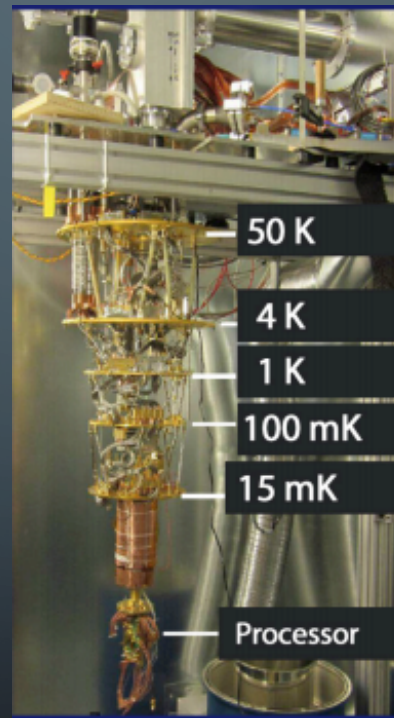
- Quantum computer is very sensitive.
- Need error correction mechanism.
- More qubit, more correction.
- Might spend a lot more in the error correction than the computation itself.

QUANTUM ANNEALING



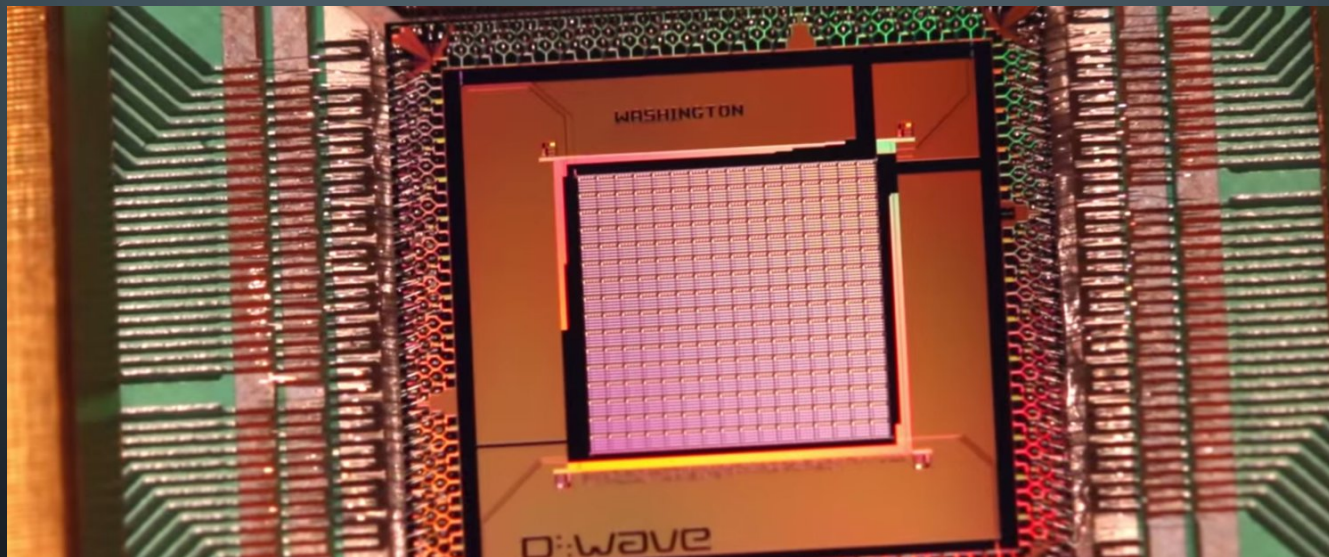
- Great for optimization problem. (Find global minimum)

HOW DOES THIS THING WORK?



HOW DOES THIS THING WORK?

- Using Niobium loops, cool down close to abs zero → superconductor





Niobium?

Nb

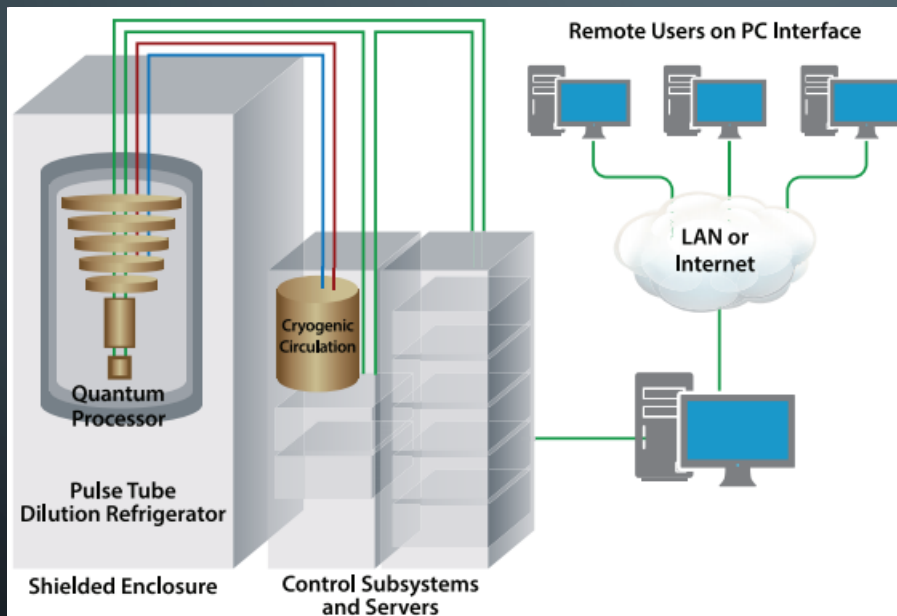
41



Niobium

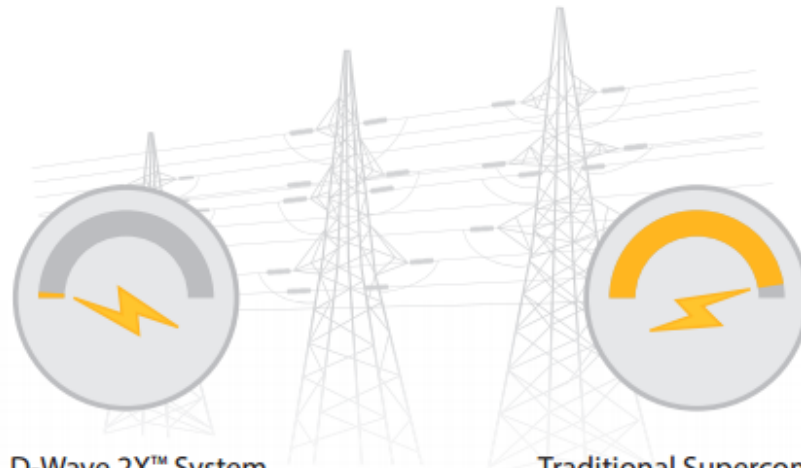
1																	18
H	2											13	14	15	16	17	He
Li	Be											B	C	N	O	F	Ne
Na	Mg	3	4	5	6	7	8	9	10	11	12	Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Ff	Uup	Lv	Uus	Jl
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb		
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

HOW TO PROGRAM?



- C
- C++
- Python
- MATLAB

POWER CONSUMPTION

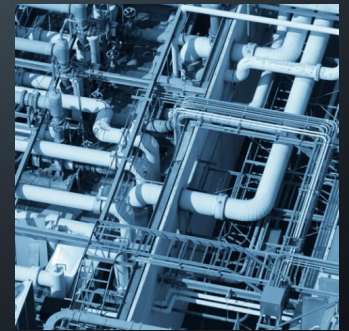
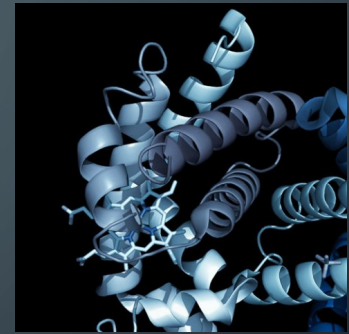
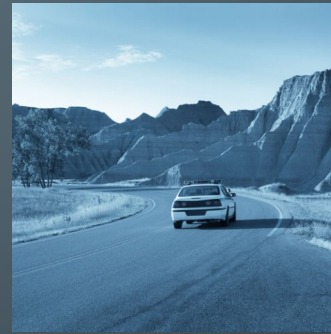


D-Wave 2X™ System
25 kW

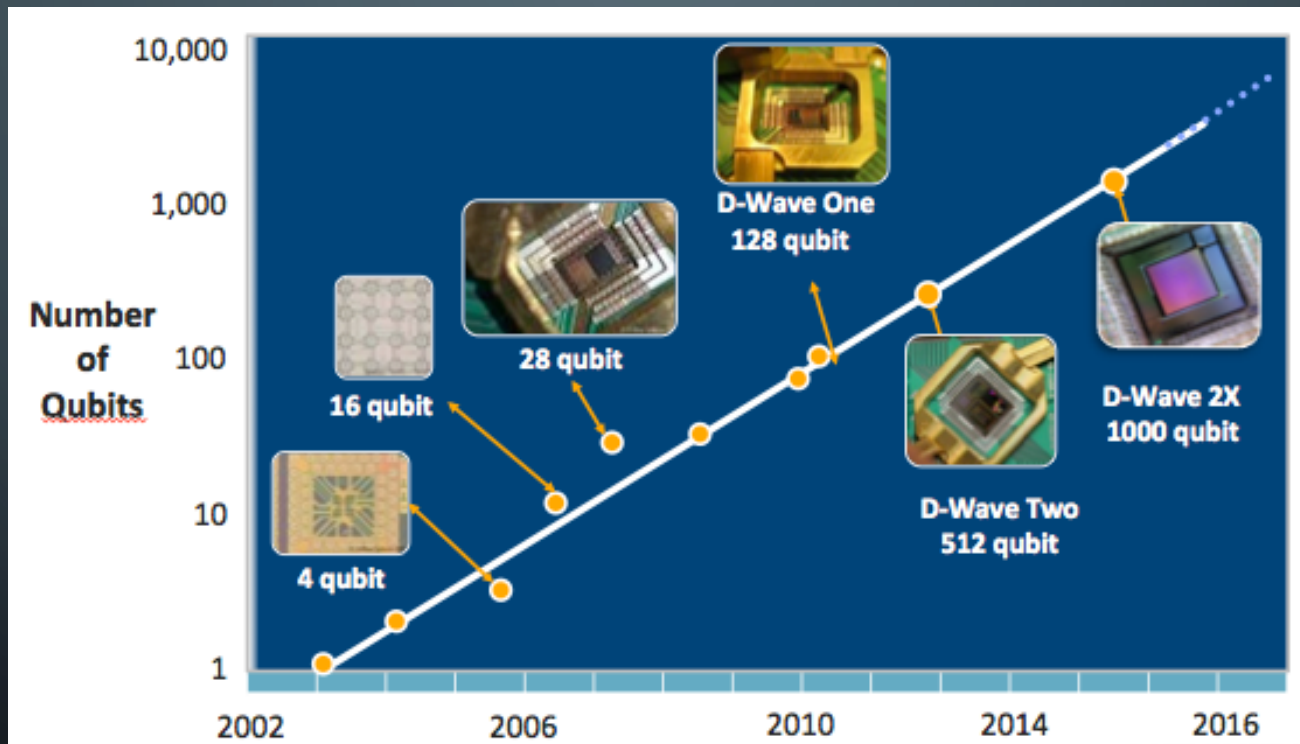
Traditional Supercomputer
2500 kW

APPLICATIONS

- Water network optimization
- Protein Folding
- Binary Classification
- Video Compression



TRENDS





“ DWAVE IS THE BEST QUANTUM COMPUTER EVER! ”
- D-WAVE



OR IS IT?

The image features a dark blue background with white, stylized circuit board traces in the corners. These traces consist of lines and small circles, resembling electronic components or connections. The word "CONTROVERSIES" is centered in the middle of the image in a white, bold, sans-serif font.

CONTROVERSIES



IS IT REALLY QUANTUM?

IS IT REALLY QUANTUM?

- A team of researchers tested D-WAVE for quantum behavior.
- Google/NASA does an acceptance test on the machine.
- Another team of researchers tested for the entanglement.

The image features a dark blue, almost black, rectangular background. In the four corners, there are white, stylized circuit board traces. These traces consist of thin lines that branch out and terminate in small white circles, resembling nodes or components on a circuit. The central area of the background is plain and contains the text.

STILL DOESN'T MEAN IT'S QUANTUM.



DOES IT REALLY GIVE SPEEDUP OVER
CONVENTIONAL COMPUTER?

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- A paper by McGeoch and Wang reports that D-WAVE gain a speedup of x3600 on CPLEX optimization with 439 qubits.

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BUT IT'S RIGGED!

DOES IT REALLY GIVE SPEEDUP OVER CONVENTIONAL COMPUTER?

- A paper by McGeoch and Wang reports that D-WAVE gain a speedup of x3600 on CPLEX optimization with 439 qubits.

BUT IT'S RIGGED!

- They compared the exact method with heuristic method.
- The problem can be solved with classical annealing with similar speed.
- When they compare D-WAVE against tabu search, they still find the advantage but they become much much smaller (no number disclosed).

DOES IT REALLY GIVE SPEEDUP OVER CONVENTIONAL COMPUTER?

- Another researcher has come up with an optimized simulated annealing code that performs 15x faster on a personal computer.
- Another researcher has found that D-WAVE is 10k times slower than his laptop on different problem.

CONCLUSION...



The image features a dark blue, almost black, rectangular background. In the four corners, there are white, stylized circuit board traces. These traces consist of thin lines that branch out and terminate in small circles, resembling electronic components or nodes on a circuit. The central focus of the image is the word "QUESTION?" written in a clean, white, sans-serif font. The text is centered both horizontally and vertically within the dark area.

QUESTION?

REFERENCES

- Dwavesys.com – Resources/press release
- Scott Aaronson, [D-Wave: Truth finally starts to emerge](#)
- Wikipedia
- physicsworld.com, *Is D-Wave's quantum computer actually a quantum computer?*
- Nature.com, *Computing: The quantum company*