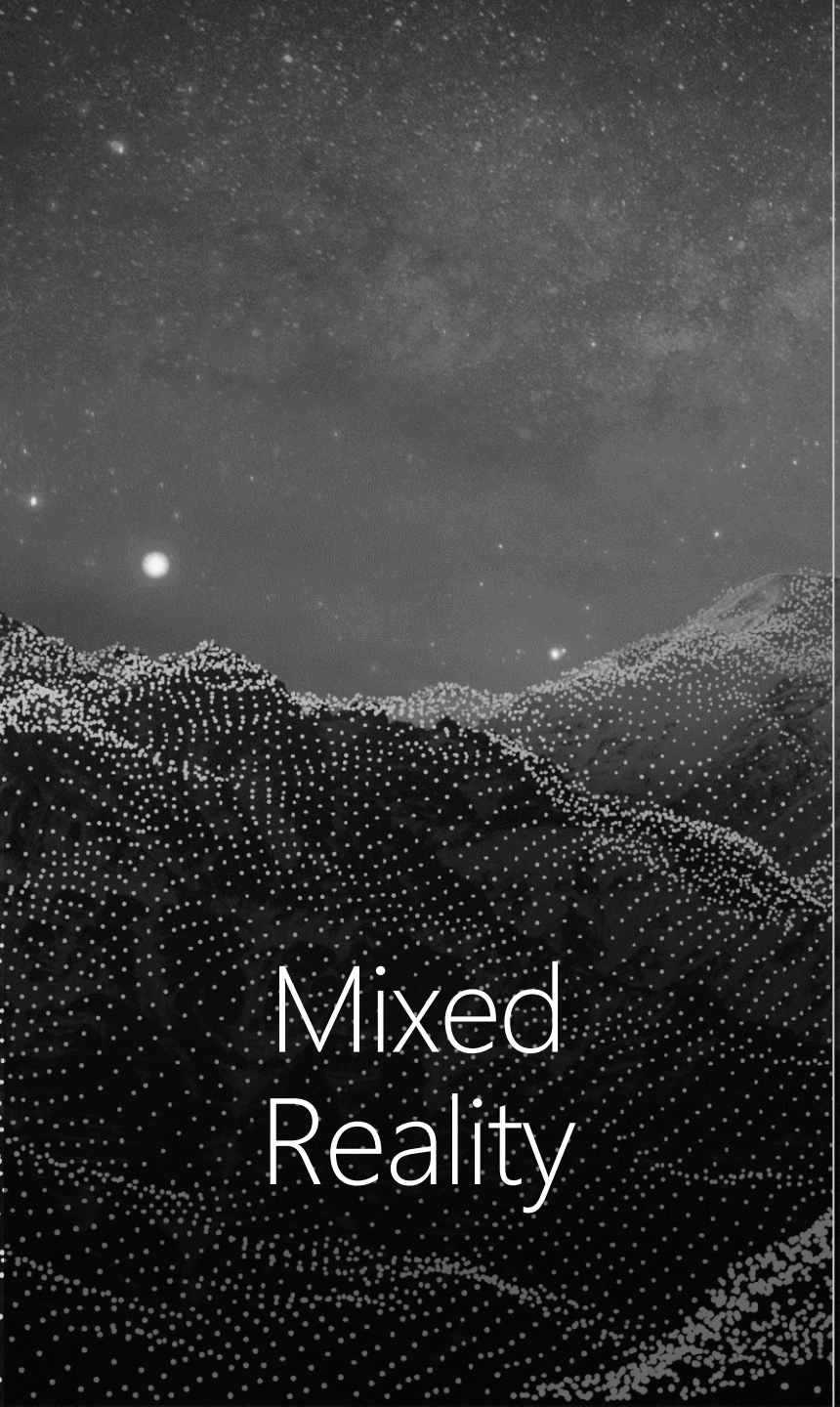
Microsoft

Artificial Intelligence

Driven by Innovation in Compute

Sandeep.Alur@Microsoft.com

@saalur



Mixed Reality

Artificial Intelligence

Quantum Computing

Microsoft

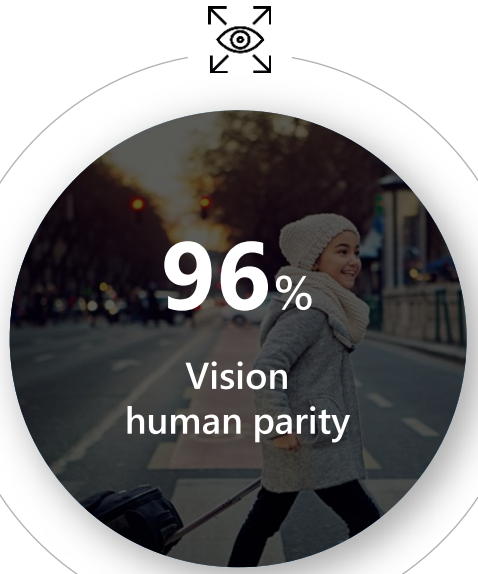
Advances that make AI real

Vast amounts of data

Huge computational power

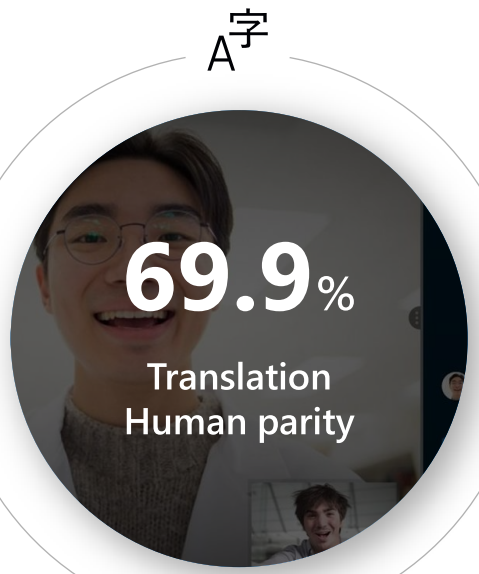
Microsoft

Reaching human parity

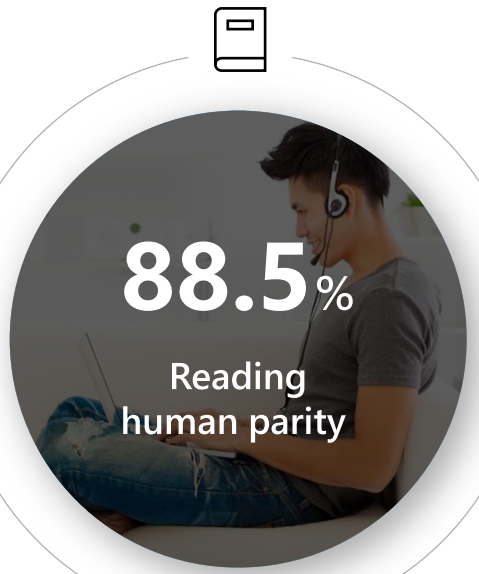


2016

2017



2018



2018

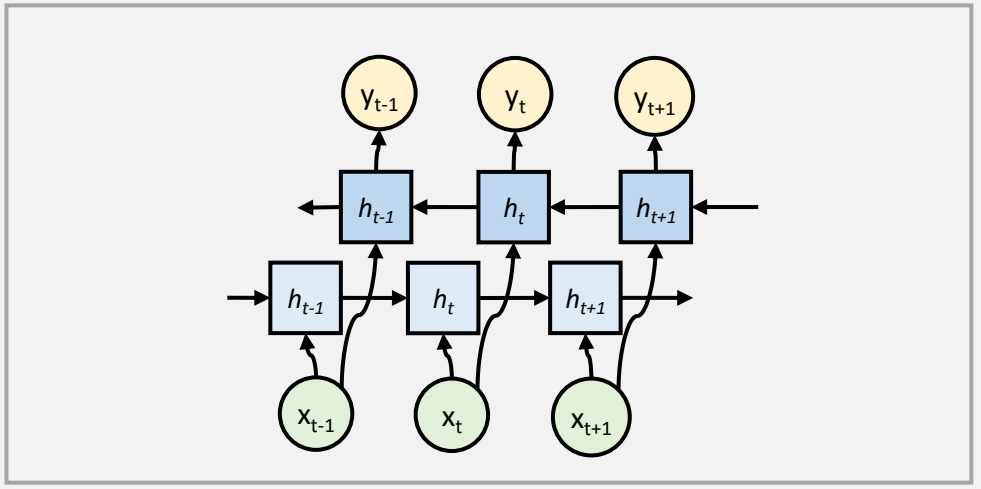
Microsoft AI advancements

Breakthroughs in deep learning demand real-time AI

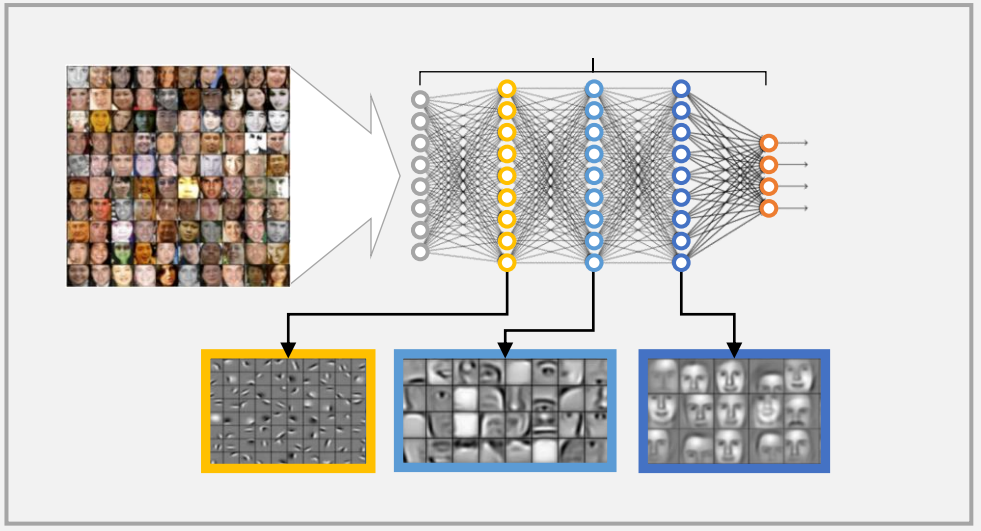
- Deep neural networks have enabled major advances in machine learning and AI

- Problem
  DNNs are challenging to serve and deploy in large-scale online services

Recurrent Neural Networks



Convolutional Neural Networks



AI demands a faster and more intelligent cloud

Flexible scale

Data explosion: 2013 4.4 ZB - 2020 44 ZB

Machine Learning & AI proliferating

Low latency

Real-time insights

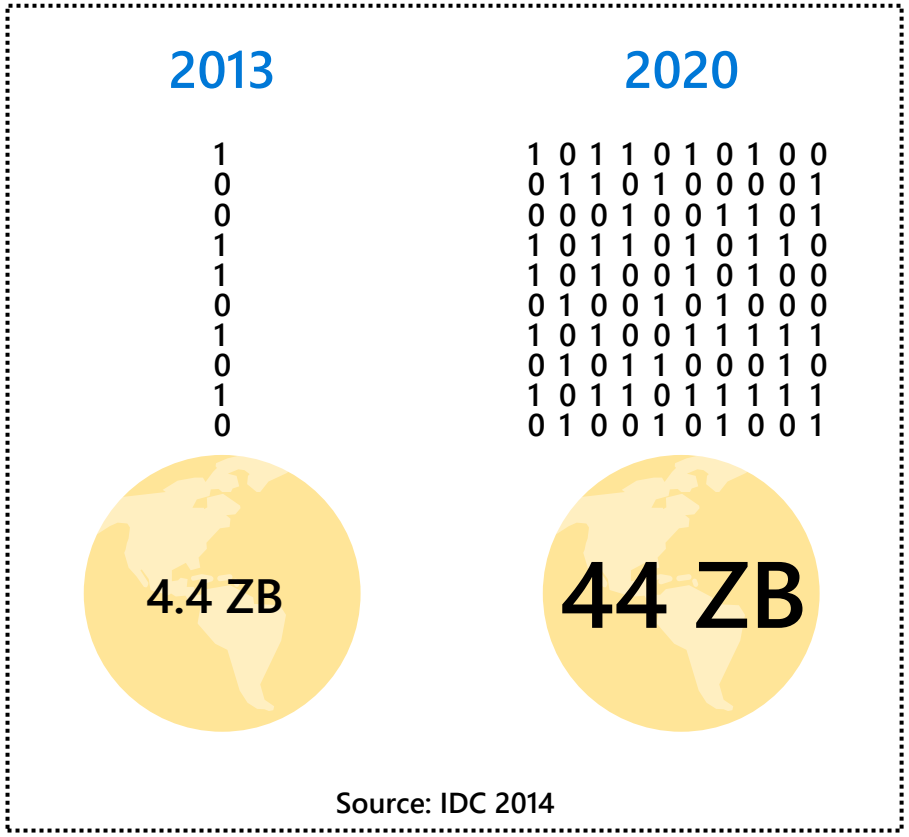
Interactive user experiences

Autonomous decision making

High throughput

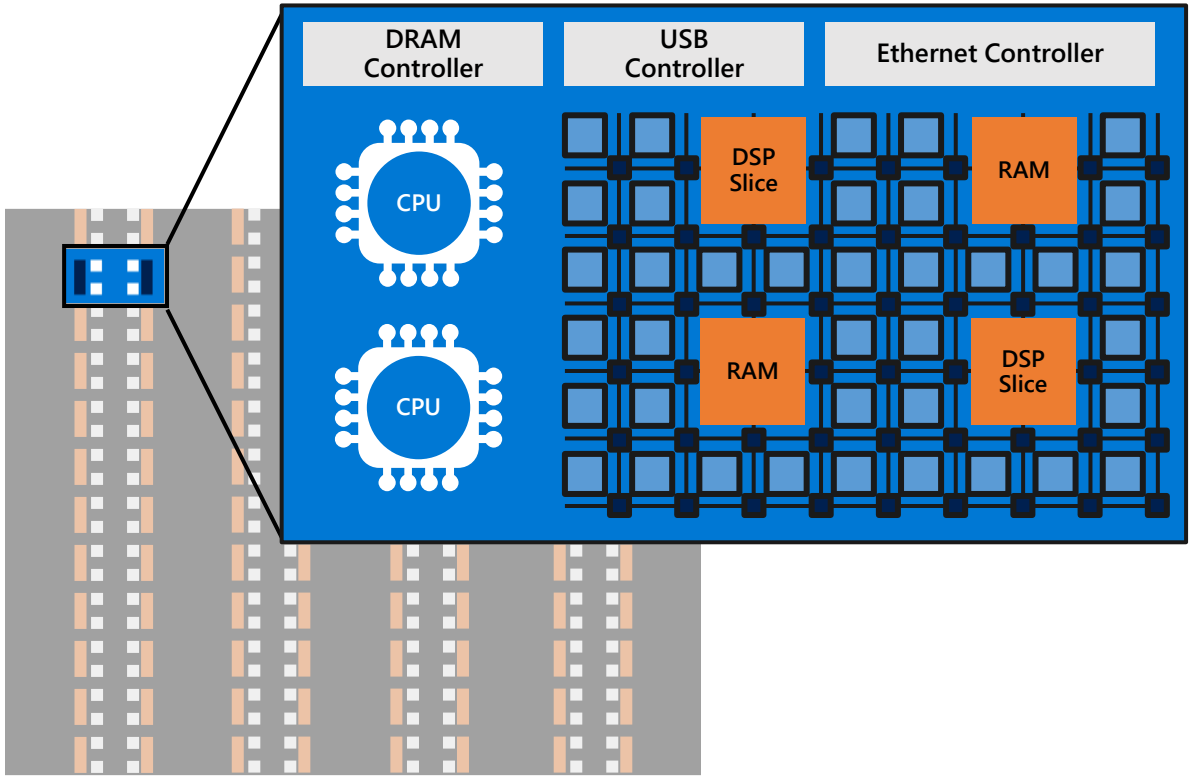
Cloud-scale services

Converting data to intelligence



What is FPGA technology?

- Field Programmable Gate Array
- Reprogrammable silicon
- Specialized compute engines
- Flashed via software in <2 seconds
- Updatable as often as needed



A complete, scalable, quantum system

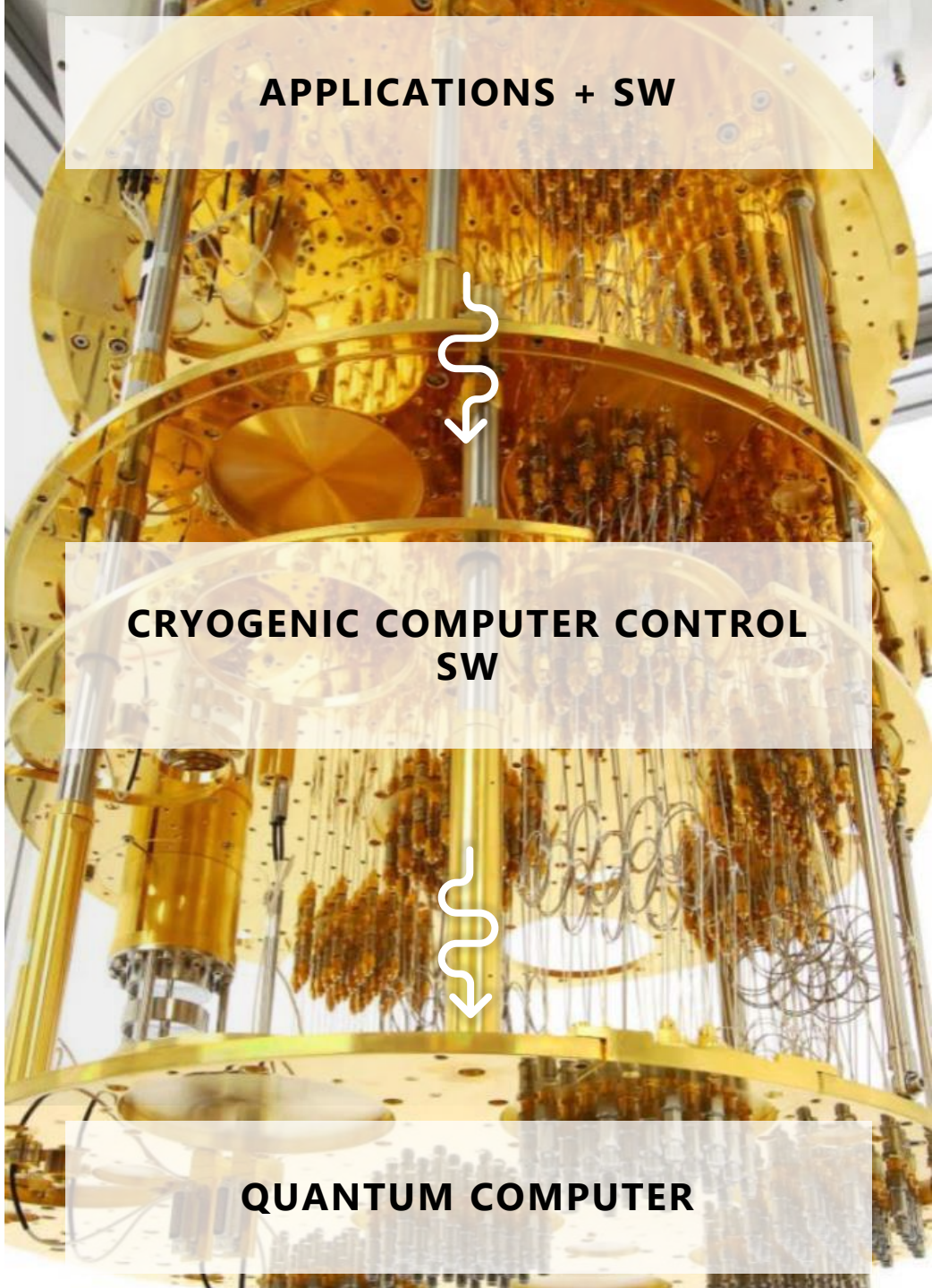
Room temp →

Nitrogen →

Helium →

Deep Space →

Quantum World →



Case study: Domain Expertise

Case Western Reserve University advances MRI research with quantum

Objective: Optimize MRI pulse sequences for…

Better quality imaging

Faster diagnosis

Iterative approach:

Optimization via diffusion Monte Carlo

Weekly in vivo tests

The Microsoft Quantum Development Kit

Q#

A new language for quantum *algorithms*.

Open-source libraries/samples

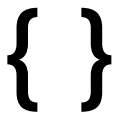
Phase estimation, amplitude amplification, state preparation, and more

Powerful dev tools

Extensions for Visual Studio and VS Code

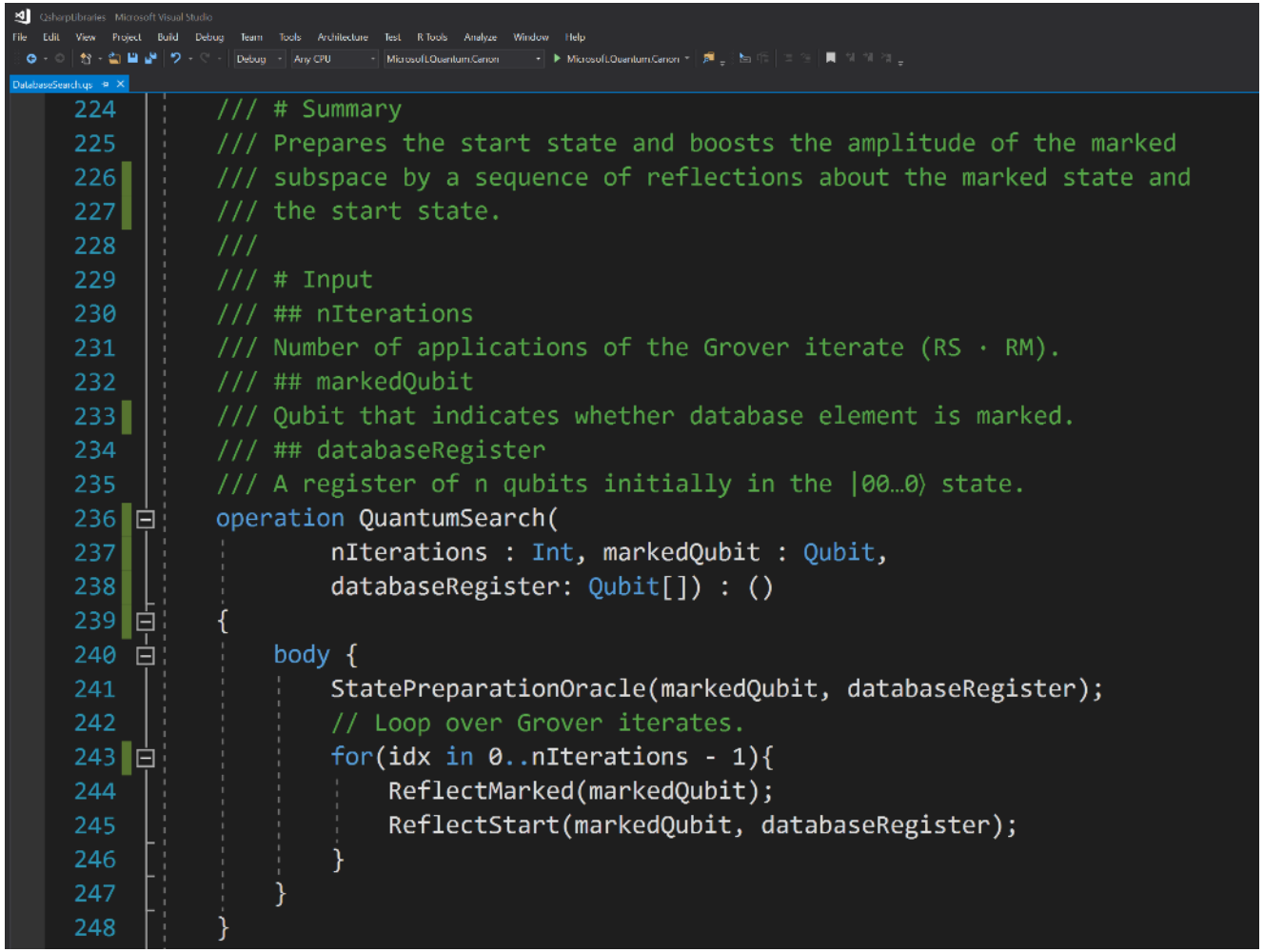
Docs

Comprehensive documentation



.NET Core

Enables cross-platform development on Windows, macOS, and Linux



Q# Goes Open-Source

COMING THIS YEAR

- **Open-source** Q# complier
- **Open-source** quantum simulators
- **Open-source** libraries, samples and katas (self-paced tutorials)

SHARE your ideas!

COLLABORATE with your code!

ENGAGE the Q# community!

DRIVE the quantum revolution!

Microsoft Quantum Development Kit

Microsoft

"Ultimately the question is not only what computers can do. It's what computers should do."

– The Future Computed

Brad Smith ✓
@BradSmi

harryshum ✓
@harryshum

Learn more

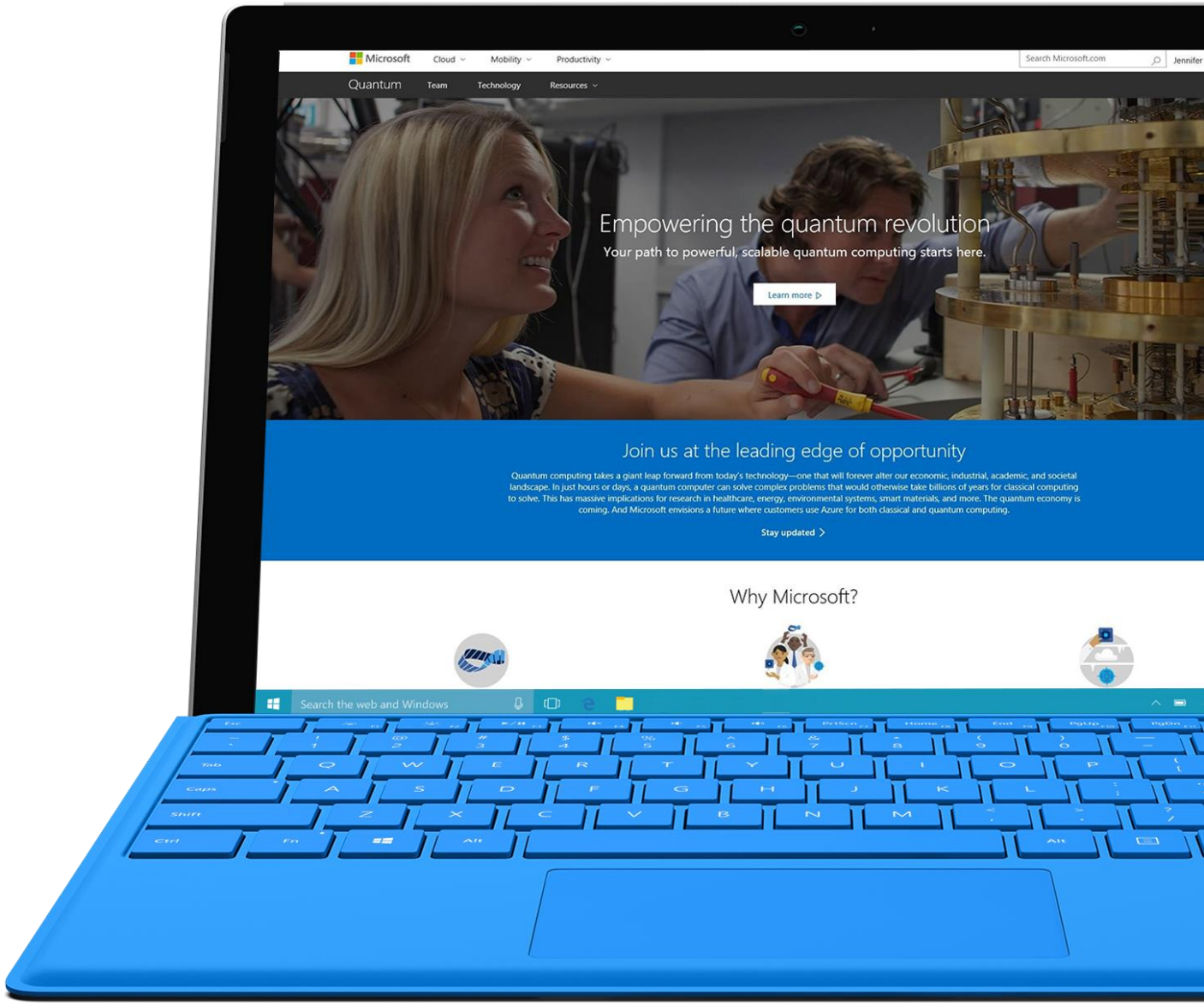
Download the
Microsoft Quantum Development Kit

github.com/microsoft/quantum/

Explore the documentation

docs.microsoft.com/quantum/

microsoft.com/quantum



Microsoft

THANK YOU

Sandeep.Alur @Microsoft.com

@saalur