It’s predicted to solve some of the world’s most fundamental problems...

...from inventing new drugs, to making brand new materials...

...and creating more precise climate models

It could solve some problems in seconds...

...that would take current supercomputers thousands of years

The technology is in its early stages...

...but the effort is quickly gaining momentum

So how will quantum computing change the world?

A standard computer might have billions of bits...

...each one can be a one or a zero...

...and they’re all completely separate from each other

Quantum bits, or qubits, work differently for a couple of reasons...

...that come from quantum mechanics

Thanks Jason, but let’s not go down that rabbit hole...

...all you need to know is this

The theory shows that certain kinds of problems...

...not all, just some particularly thorny ones...

...are made much easier when you’ve got quantum computers

One of those problems is in encryption...

...the kinds of codes that protect your credit-card details online...

...or your messages in Whatsapp or Signal

What got people really interested in making quantum computers...

...was the realisation that they could break encryption...

...that was supposed to be too hard to crack...

...because regular computers couldn’t crack them

That’s the kind of thing that gets the attention of national governments...

...the ability to crack other countries’ encrypted networks

As in the case of artificial intelligence...

...China says it intends to lead the world in quantum science...

...and has announced plans to open its own national quantum laboratory...

...to open in 2020

America is getting involved too...

...it intends to create a national quantum initiative

That’s because the prize that quantum computing offers...

...the potential strategic or commercial advantage is huge

Imagine if you could make minute-to-minute, real-time stock predictions...

...based on data from every trade ever made...

...or if you could simply compute the formula for a new fuel...

...or a drug that beats a horrible disease

That’s the kind of promise that quantum computing may offer

There are already quantum computers out there...

...but it’s a bit like the situation with regular computers in the 1950s...

...big basement-sized things that required a pile of PhDs to operate...

...and they still weren’t very powerful

–A typewriter-like keyboard is the master control...

...sending out data and instructions on a punched tape...

...which in turn feeds the electronic computer

...which in turn feeds the electronic computer There’s a huge effort to make more powerful quantum computers

There’s a huge effort to make more powerful quantum computers

This used to be the stuff of university physics departments...

...but you can see the potential when you see who’s in the business now

It’s big names like Google...

...Microsoft...

...IBM

But it’s not just about when one day one company or one lab...

...invents this one computer

It’s going to be a bunch of small advances...

...towards the kind that’s commercially available...

...reliable and can really solve some of these big problems

–Problems that once took the human mind seven years to solve

Here’s the thing...

...when we talk about quantum computing...

...people tend to think of all-singing, all-powerful machines that...

...can run any kind of program...

...what’s called a universal computer

That’s still a distant prospect...

...but in the meantime there will be smaller machines...

...more specific-purpose, less general-purpose

These things are incredibly hard to run...

...they’re held at temperatures lower than that of deep space...

...in very, very controlled laboratory environments

Even if you could just pick one up off the shelf, you wouldn’t...

...yes, they’re incredibly powerful for some kinds of problems...

...but they’re not going to replace the kind of computer on your desk...

...or in your phone

You don’t need quantum powers to edit photos or send emails

In fact what will probably happen is that a few companies...

...have the best computers...

...and you can use them on a kind of time-share basis, in the cloud...

...or you send off your gnarly quantum problem...

...and just get an answer back

But the kinds of problems that we’ll be able to pose...

...the kinds of answers we’ll be able to get...

...are absolutely unthinkable now

That’s what has governments, industry giants...

...and plucky startups in on the race