**Why cloud technology is revolutionizing business.**

**Introduction.**

Hello and welcome to the first module.

In this module, I'll talk about how Cloud technology is changing just about everything.

I'll cover innovations throughout history that led to paradigm shifts in business and human life.

Then how Cloud technology is enabling a new wave of digital transformation.

Next, I'll break down the trends in compute power and data processing capabilities, and finally, I'll show you how cloud computing uses industrial scale compute power and vast amounts of data to create exponential value for businesses.

Let's begin.

Innovation doesn't come in a linear way, it comes in waves, and each of these waves is powered by a breakthrough technology (*tecnología de punta/innovadora*).

There was the age of the printing press, the steam engine, electricity, the transportation age, the first computers, and today, data science, also known as **the age of cloud technology**.

Each of these inventions triggered thousands of innovations in what are called **Kondratiev Waves** or innovation waves.

Consider the invention of the printing press.

It was revolutionary because it gave everyone access to books, encyclopedias, and even playing cards in their day to day lives.

It also led to a broader recognition of intellectual property through widely distributed patents, which in turn paved the way for the first industrial revolution. (*También condujo a un reconocimiento más amplio de la propiedad intelectual a través de patentes ampliamente distribuidas, lo que a su vez allanó el camino para la primera revolución industrial*.)

There was no turning back.

Steam powered (*vapor accionado*) engines brought us cars and trains, which then radically transformed the transportation industry, allowing businesses to produce and transport goods at scale.

The entire industrial revolution resulted from new technologies that came together, enabling new ways of working.

In the same way, electricity brought us the light bulb, household appliances (*electrodomésticos*), and eventually the computer.

These waves all have one thing in common, **they transform both the supply and the demand at the same time**.

Let me explain.

On the supply side (*Del lado de la oferta*), the new technology can dramatically improve productivity.

At the same time, the new technology can increase consumption, which generates more demand.

Let me give you a specific example.

With electricity, factory managers were able to operate during the day and at night.

They could also share information instantly via telegrams, organization suddenly became much more productive.

At the same time, electricity created new value that didn't exist before.

It gave birth to consumer goods that were then advertised on the radio and on television, which in turn significantly increased the demand for those consumer goods.

What the printing press, the steam engine and electricity all have in common, is that they're all examples of a paradigm shift.

A fundamental and irreversible change in the way that humans work and engage with the world.

Now, how does this relate to current technology?

You guessed it, we're right in the middle of another paradigm shift.

Cloud technology is transforming how businesses create value, how people work, and ultimately how people live.

As with any other innovation, wave Cloud technology is generating thousands of new innovations such as chat bots and predictive medicine.

This is a branch of medicine that aims to identify patients at risk of developing a disease, thereby enabling either prevention or early treatment of that disease.

What is the Cloud or Cloud technology exactly?

How has it created a paradigm shift?

I'll cover that next.

**What is cloud?.**

The Cloud is a metaphor for the network of data centers that store and compute information available through the Internet.

Essentially, instead of describing a complex web of software, computers, network, and security systems, all of that has been combined into one word, Cloud.

When we talk about Cloud computing, we're talking about the technology and processes needed to store, manage, and access data that is transferred over the Cloud rather than the data that remains on your computers hard drive.

For most large organizations, such as enterprise companies, government, or education providers, secure and easy data collection and processing are critical factors for operating and delivering products and services.

Historically though, these organizations have had to spend substantial amount of money upfront to set up the necessary infrastructure that would store and process their data.

However, as they grow in size, the cost of maintaining and setting up new infrastructures substantially increases too.

Companies such as Google Cloud have invested heavily in their own IT infrastructure, creating vast digital spaces to store and process data.

Now they're helping other organizations around the world by offering them the use of their digital platform to run their applications at scale.

This has generated massive cost reductions for companies that operated data warehouses without economies of scale and allowed software developers around the world to access well-established IT infrastructures.

How is Cloud technology different from the traditional methods that we've used for decades?

One of the most common misconceptions about radically new technology is that it is only meant to ease or solve for something we used to need.

For instance, we could all agree that the laptop is much better for typing a message than a typewriter.

The laptop also replaced the need for a typewriter, but laptops or computers in general are not only meant to make it easier to type a message, we use them for sending and receiving messages, reading news articles, for video conferencing, designing graphics, and so much more.

The same is true for the Cloud.

It's not meant to only be a place to store your data, it's capable of doing so much more.

Cloud is revolutionary because it enables every professional to fundamentally rethink and re-imagine how they do business, from collecting data to gaining insights from it, to working with their peers globally, to serving their customers.

When an organization takes advantage of new technologies such as Cloud to redesign and redefine relationships with their customers, employees, and partners, the result is a company wide digital transformation.

Digital transformation is about taking advantage of established global scale IT infrastructures and leveraging vast compute power that makes it possible for developers to build revolutionary new applications.

It's about a foundational change in how an organization operates and optimizes internal resources and how it delivers value to customers.

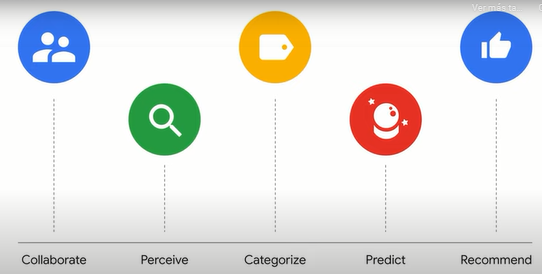
Let me share a few concrete examples of how Cloud technology creates value for businesses.

Cloud technology can map, understand, and predict human behavior, human biology, global industrial systems, and every other complex and dynamic environment.

These examples are things we could only dream of doing digitally in the past.

This means that in the same way electricity powered light bulbs, radios, and computers, Cloud technology is powering a new range of applications that are continuously learning and improving.

Cloud enables and redefines our ability to collaborate, perceive, categorize, predict, and recommend in every industry for every activity.



We will explore these ideas further in coming modules.

For now, let's learn more about, one, why it's critical for businesses to embrace new technology, and two, the implications of staying the same.

We'll look at specific examples of companies that have digitally transformed and thrived (*prosperado*) and other companies that have failed to adapt and no longer exist.

**Danger of maintaining the status quo.**

There's no greater danger for any organization than to keep the technology its always used to refine and perfect what it's always done instead of letting it go and moving on to the next technology platform.

**Abandoning old technology for a new one is commonly referred to as the "Burning Platform Effect."**

It requires organizations to take a leap of faith and to continually adapt as new technologies create new paradigm shifts.

Let me illustrate what happens as a result of a burning platform effect with two concrete examples.

The first company takes advantage of new technology and makes a paradigm shift, and the second doesn't.

Our first example is Nintendo.

Nintendo has been creating games since 1889.

They started with traditional Japanese playing cards called Hanafuda, which were made possible by the printing press.

From there, Nintendo has consistently used new technology to transform their business and become a leader in the gaming industry.

They were even among the first to introduce gaming consoles and mobile gaming devices.

Still, they didn't dwell on these successes.

Instead, they revolutionized mobile gaming when they launched Pokmon Go in 2016.

Then the first cloud gaming console, Nintendo Switch, one year later, in 2017.

At a time when most of their competitors were going out of business, Nintendo jumped from one burning platform to the next, consistently maintaining and even expanding its market share and its customer base along the way.

What makes Nintendo so successful at this?

The answer is that they consistently focus on why they exist, not how they operate.

They exist because they want people to play.

Naturally, they'll use any technology as a resource to achieve this mission.

If they focused on liquid crystal displays as the best tool for gaming, then each new technology would have posed a threat to them.

Instead, they utilized liquid crystal displays for a while and then quickly shifted as the next technology became available to continue motivating people to play.

This is an example of a company that thrives with new technology.

By contrast, companies that sold encyclopedias all focused on how they operate, how to print and sell a very specific set of books.

This is what they were proud of, a beautiful set of leather-covered books, lined up on the shelves of the finest libraries.

Because of the high costs of these sets, only a few scholars or the elite could afford them.

For businesses that made and sold encyclopedias, they needed printing machines, well-kept warehouses, bookshelf makers, a way to ship and receive heavy containers, and a good door-to-door selling mechanism.

These companies became obsessed with the books and lost sight of their initial mission, to capture and share human knowledge by any means.

Naturally, as new technology became available, instead of serving as an opportunity, it served as a threat to their business.

The first of these threats was the CD-ROMs.

Quite amazingly, all the CD-ROM-based encyclopedia providers made the exact same mistake and were later driven out of business by cloud-native applications such as Wikipedia.

Nintendo and encyclopedia companies were both born from the printing era.

Nintendo beginning with traditional playing cards, and encyclopedias stemmed from traditional books.

Yet the two companies didn't react to their burning platform the same way, and their business has led to very different outcomes.

One drives and the other no longer exists.

Many other traditional industries have been disrupted in similar ways.

The movie rental industry, for example, has been disrupted with On-demand streaming services.

Chemical film manufacturers have been disrupted with LCD sensors and smartphone revolution.

Any business leader who considers cloud technology as not relevant to them or even worse, as a threat to the way they've always done business, risks facing a fate similar to that of encyclopedia companies.

Disruption or ceasing to exist entirely.

Imagine the impact the slow decline of a business has on its workforce.

Many jobs are lost and the remaining workforce is not skilled or able to manage the demands of the new world.

The downstream impacts are significant too.

Vendors and partners could face a sharp decline in revenue due to loss of business.

Now, the good news is, the Cloud is still very new for many businesses.

Wherever business is in the Cloud adoption journey, there's still time to catch up.

The key point is that now is the time for organizations to accelerate their digital transformation and shift the way they think about their business potential.

In the next video, I'll cover what becomes possible when you start to embrace Cloud Technology for your business.

**A paradigm shift.**

The adoption of Cloud technology is not just about survival, it's about thriving (*prosperar*) in a new technological era.

The business benefits of truly embracing a digital transformation using Cloud technology are significant.

Many organizations are already realizing the business benefits of secure and fast application development and deployment.

They're seeing a shift in their costs from capital expenditure to operational expenditure, or from CapEx to OpEx.

In many cases, they're saving costs and generating new value.

They're modernizing their infrastructure, solving business problems at a much faster speed, and gaining insights from their data.

Like Nintendo, these visionary companies are leveraging new technological capabilities to reshape their customers' lives across multiple industries.

When I say new technological capabilities, I'm referring to the ones that brought us innovations like the self-driving car.

It has completely revolutionized the transportation industry once again, and the same is true for smart assistants, which are already changing how we behave and how quickly and easily we get things done.

Think about it, smart assistants let you use your voice and the natural way you speak to get the information you need in milliseconds.

In some cases, you don't even need to prompt the assistant, it proactively makes the suggestions for you.

For example, suppose you're driving and need to slow down or stop because of a traffic jam.

The smart assistant built into your GPS, like Google Maps, automatically suggests an alternate route and in just the right time so you can act accordingly, and there are many more ways Cloud technology is changing our lives.

The Cloud's extraordinary compute capability is combined with large amounts of data to create experiences we've never known before.

For example, the Internet of Things, or IoT, refers to everyday objects or devices that are connected to the Internet and are able to send and receive data.

martphones, connected appliances, mobile sensors, and wearable devices are all IoT examples.

The Internet of Things has become so present in our everyday life that we don't go online anymore, we live online, and while doing so we receive and generate vast quantities of data at every moment.

This was already true with the invention of the radio or the television, but the scale and the speed at which we share data has tremendously increased, and our ability to compute that data has followed an exponential curve known as Moore's Law.

The result is that, today we can build highly accurate statistical models to predict complex behaviors and use that information to anticipate intent.

This is the most profound aspect of the Cloud revolution.

In addition to its predictive capabilities, the Cloud delivers high-performance analytics and enables businesses to reduce equipment downtime, achieve more accurate supply planning and maintain leaner operational organizations that have more efficient systems and less waste.

The power of Cloud also changes the way we work by automating processes and creating open and real-time collaboration opportunities between people globally.

This includes business stakeholders, customers, students, and constituents.

In all of the examples I mentioned so far, there are two common ingredients; **compute power** and **data**.

Not just any compute power or a few files containing data, but extraordinary compute power and very, very large volumes of data.

I'll explain what I mean by compute power and volumes of data in the next two videos.

**Extraordinary compute power.**

Computing at its most basic is any task that requires a calculation.

In the context of Cloud, computing is the ability to process information, to store, retrieve, compare and analyze it, and automate tasks most often done by a computer program.

Compute power, therefore, refers to the speed at which a computer is able to process data.

In the beginning, giant computers owned by institutions filled entire rooms and took a long time to process small amounts of data.

But two recent changes dramatically affected the computing landscape.

The first change brought computers from institutions to individuals and exponential growth trajectory that doubled computing power every other year.

This was only the beginning.

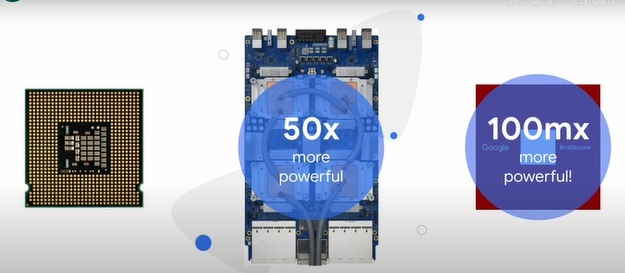
Moore's Law has been disrupted twice by radical new designs in chips.

The first disruption comes from processors that are specifically meant for this type of application and which we call TPUs or tensor flow processing units.

According to Moore's Law, TPUs should be twice as powerful as the preceding processing units, but they're not.

They are 50 times more powerful than traditional chips, and that's not all.

The second disruption comes from quantum computing, which is a hundred million times more powerful.



To illustrate the full impact of the TPU on what organizations can now readily do, I'll use a machine learning example.

First and simply put, machine learning is a way of training a computer to automatically do something using lots of data.

A machine learning model that would require a day of training with traditional processors only requires half an hour of training with TPUs.

Another machine learning model that would require thousands of years of training with traditional processors would now require only a few seconds with quantum computing.

There is a constraint attached to this evolution, though.

Right now, the cooling requirements for these new processors can only be met in large industrial environments.

TPUs need to be cooled with pressurized water within the chip, while quantum computing requires absolute zero temperatures to operate.

Cloud data centers are the only environment where we can create these conditions at scale.

For the foreseeable (*previsible*) future, they'll be the only option to tap into this vast amount of computing power.

Think about electricity, in the first years after its discovery, most users had generators located where they lived or worked.

As the industry became more mature, we created power plants that we access through a grid.

The same principle applies today to computing.

It will mainly be generated in plants, which are the data centers and access to a grid, which is the Internet.

This brings us to the second ingredient common in the examples I covered earlier in this video, data, specifically, lots and lots of it.

Check out the next video to learn more.

**Data as currency.**

Why is data needed to unlock the capabilities of Cloud?

Traditional computing is about taking a piece of information and input through an algorithm in order to get an output.

This can be a very tedious process.

It requires someone to teach a computer what to do one step at a time.

Sure, it can follow those steps faster than any human, but it can only do what humans have programmed it to do and nothing more.

Traditional computing, therefore, follows a static process.

With Cloud computing, things change.

You can provide both the input and output data side by side and generate a trained algorithm.

This means it uses a combination of existing input and output data to learn the correct outcome when faced with information it hasn't encountered before.

It is therefore self-learning.

For instance, in an image-recognition application such as Google Photos, you can provide your photos, the input, and the correct identifier of the friend or family member in the photo, so the output.

Then you can train the image-recognition algorithm embedded in the app to automatically recognize and categorize new photos of your family members or friends even if their appearance goes through significant changes over time.

That's the case, for instance, of a baby that grows to become a child and then eventually an adult.

The app will still be able to identify the person in any new photo at every stage of their development.

Another example of combining compute power and data to create new user experiences can be seen in social media apps.

From personalizing your news feed to better-targeted advertising, social media platforms use machine learning to learn about user preferences and intent.

This can be used to recommend people you may know for example.

The embedded ML algorithm is learning from the profiles that you visit often, your interests, locations you tag in photos, your searches, or a group that you share with someone.

It then compiles a recommended list of people you may want to become friends with or to follow using this information.

The accuracy and performance of the algorithm is also based on the millions of users that the algorithm is constantly learning from.

We'll talk more about the possible applications of machine learning in the Innervating With Data and Google Cloud course and the role that ML plays in digital transformation.

For now, move on to the next module to continue with this course.

**Quiz.**

1. What does ‘compute power’ refer to? Select the correct answer.

The storage capabilities of the computer’s hardware.

The length of time during which a computer is able to store data.

The size of computer hardware.

**The speed at which a computer is able to process data.**

2. What is uniquely common between all inventions that have fueled innovation waves? Select the correct answer.

They have transformed the way we communicate

They have transformed our leisure time activities

They have transformed global travel networks

**They have transformed the supply and demand at the same time**

3. Tensorflow Processing Units (TPUs) are \_\_\_\_\_\_\_\_\_ times more powerful than traditional chips. Select the correct answer to fill in the blank.

100

75

120

**50**

4. When an organization takes advantage of cloud technology to redesign and redefine relationships with its customers, employees, and partners, what is the result? Select the correct answer.

Data storage space becomes available on-demand

Greater collaboration and productivity between users

The “burning platform” effect

**Company-wide digital transformation**

5. Which of these businesses failed to adapt as breakthrough technology became available? Select the two correct answers. (*¿Cuál de estas empresas no se adaptó a medida que se disponía de tecnología innovadora?)*

Video game designers

Music playing devices

**Encyclopedia companies**

Apparel retail stores

**Video rental stores**