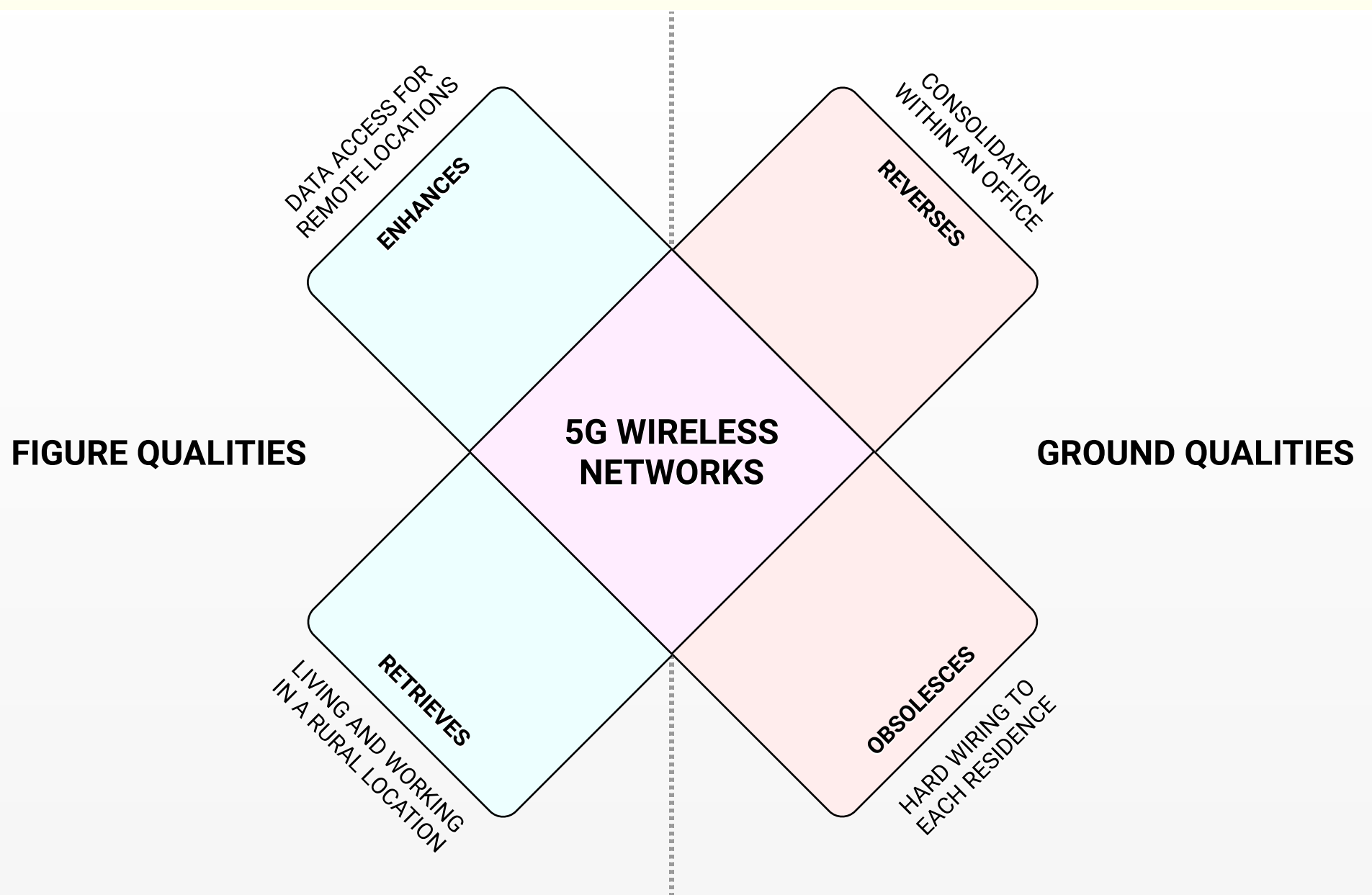


Exploring enabling technologies: 5G networks

Nathan Smith – ADES 5430 – Spring 2021



What is 5G?

The term 5G simply stands for the fifth generation of broadband cellular network connectivity. From a technology standpoint, it is not that much different from previous 4G or LTE (long term evolution) networks. 5G uses similar concepts, albeit operating at higher speeds.

One key difference is that the speed now rivals that of home and office Wi-Fi connections, such that 5G can be a viable alternative to having a hard wired connection in one's residence or place of business.

Within the overarching term 5G, there are actually a number of signal frequencies that are represented. For example, these are the frequencies used by T-Mobile.

- Band n71 (600 MHz)
- Band n41 (2.5 GHz)
- Band n260 (39 GHz)
- Band n261 (28 GHz)

Why is 5G significant?

In 2016, mobile web browsing overtook desktop usage for the first time. Mobile (including tablet) usage rose to 51.3% whereas desktop browsing fell to 48.7%.

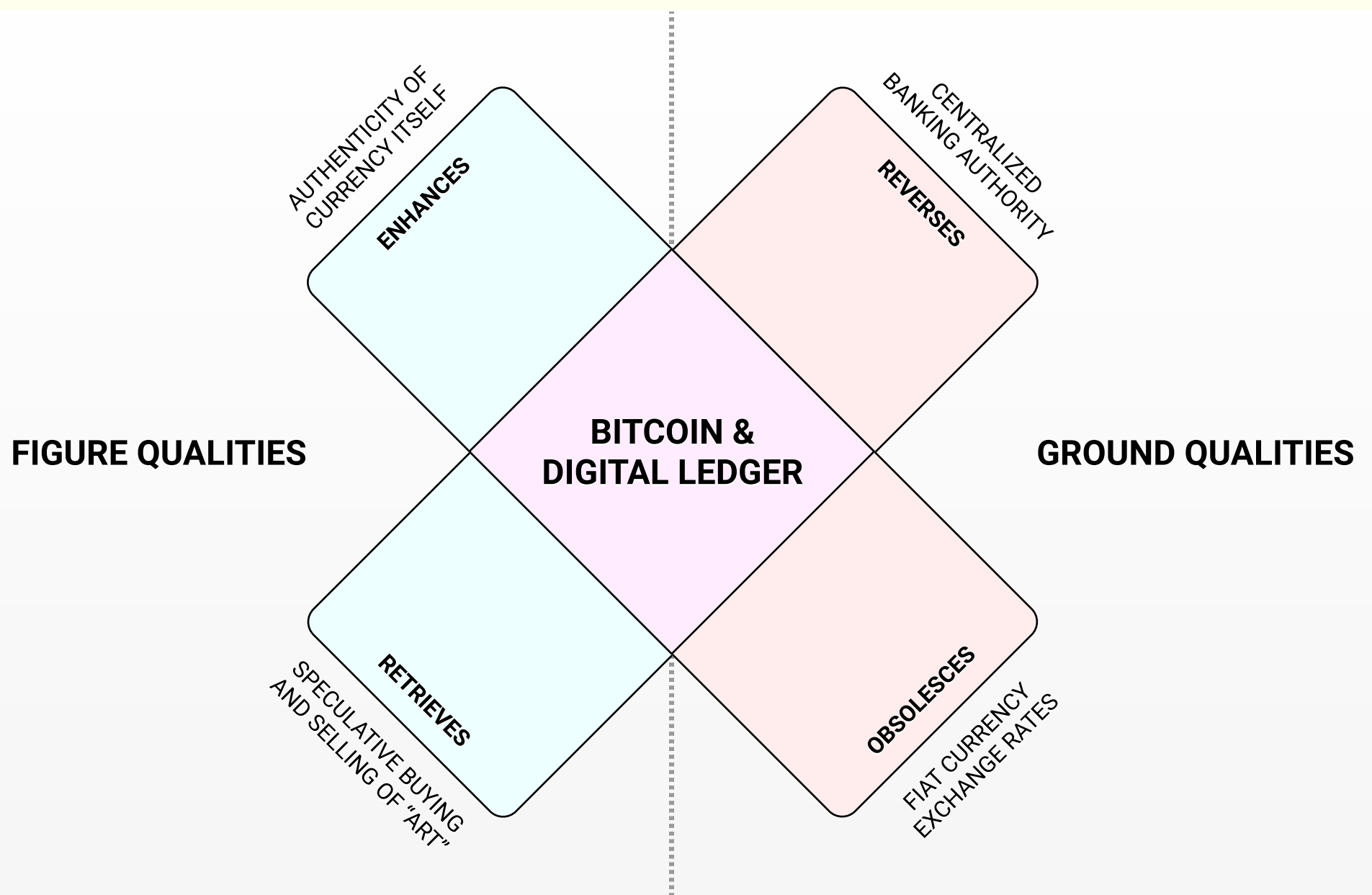
This is significant, because it means that more people are accessing information using devices with cellular connectivity. What it means to get information online has leapfrogged the original vision of Bill Gates: "a computer on every desk." Instead, we are seeing a rise of: "a computer in every pocket," in the form of modern phones.

With the increased speeds of 5G, more people will be able to do work from wherever they have connectivity. This paradigm shift – coupled with the digital transformation brought about by COVID-19 quarantine – may eventually lead to a more distributed workforce.

It could potentially mean classrooms having more access to learning materials in areas of the world where it would be cost prohibitive to build a landline based network.

Exploring enabling technologies: Bitcoin & digital ledger

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What is blockchain (digital ledger)?

In 1982, cryptographer David Chaum proposed a secure protocol in his dissertation “Computer Systems Established, Maintained, and Trusted by Mutually Suspicious Groups.”

In 1991, Stuart Haber and W. Scott Stornetta conceived of a cryptographically secure digital ledger, with a series of tamper-proof timestamps. In 1992, they were joined by Dave Bayer and added Merkle trees – subdivided portions of cryptographical verification – which allowed for what we now think of as “blockchain.”

What is Bitcoin?

In 2008, Satoshi Nakamoto – likely a pseudonym for one or several people – conceptualized using blockchain as a way to prove the veracity of a digital currency: Bitcoin (BTC).

A number of other digital currencies have arisen: Ethereum (ETH), Litecoin (LTC), Ripple (XRP), to name a few.

Why is it significant?

Ultimately, money of any kind only has the value that we collectively ascribe to it. When you think about how many “dollars” are in your bank account, you are thinking in terms of agreed upon wealth. Bitcoin – and other currencies like it – take this to its furthest logical extreme.

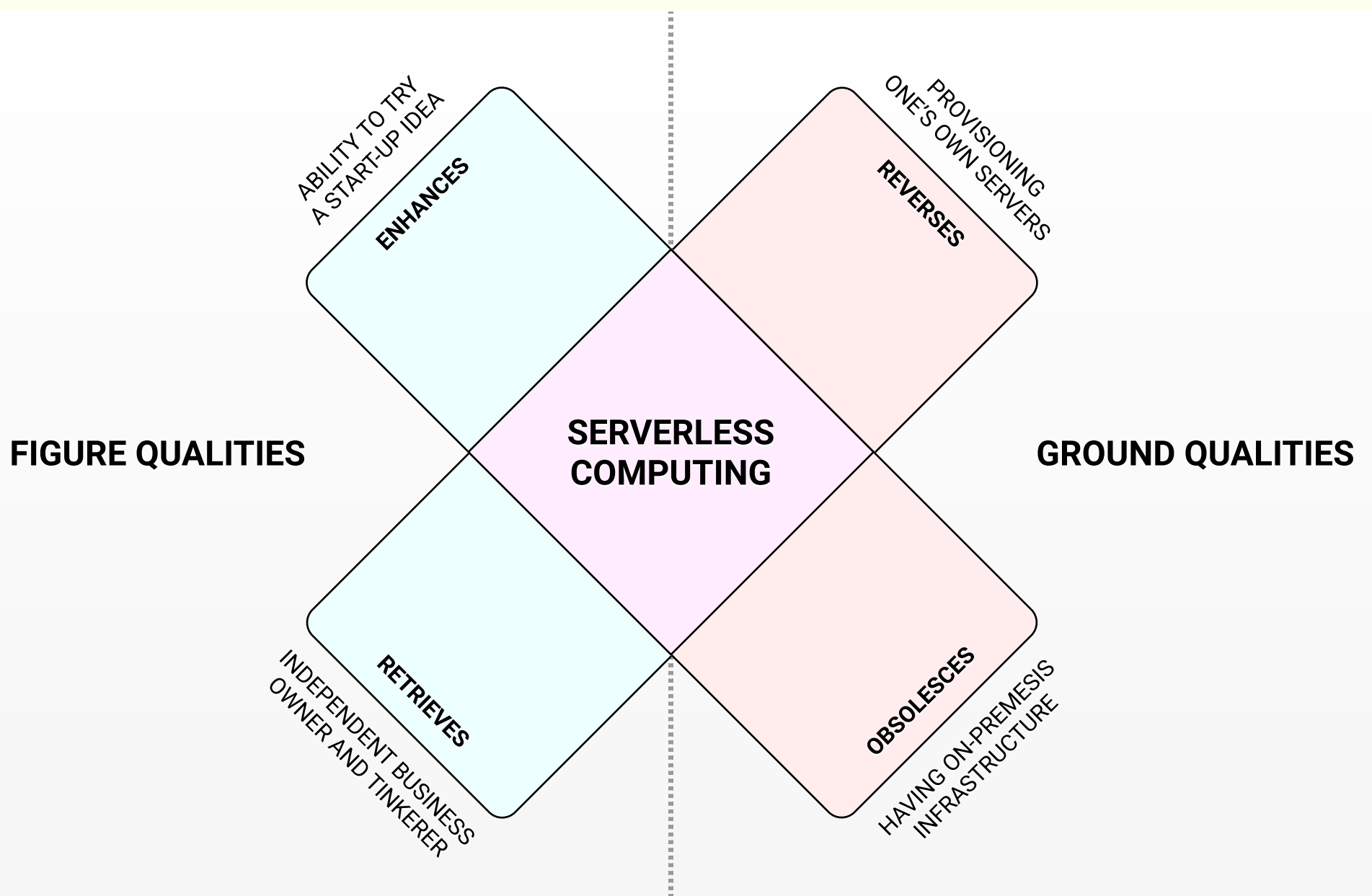
Except that, rather than a few centralized banking systems worldwide, the distributed digital ledger makes everyone (and nobody in particular) the record keepers.

The implication of which is: transactions are potentially beyond the reach of nation state governance, though legislation and regulation are catching up. Exchange rates seem antiquated when compared to 100% digital currency. If it is all digital anyway, why “convert” from CAD to USD?

It has also given rise to the purchase of NFTs (non-fungible tokens), certificates of ownership for digital “art.” The original tweet by Jack Dorsey is currently for sale, with bidding at \$2.5 million dollars.

Exploring enabling technologies: Serverless computing

Nathan Smith – ADES 5430 – Spring 2021



What is cloud computing?

A somewhat cynical way of thinking about it is: "Someone else's computer, for which I pay a rental fee."

Cloud computing is essentially an "on demand server," whereby one can provision what is needed and pay a fractional price of what it would cost to own, maintain, and upgrade one's own server infrastructure.

After years of IBM and Oracle dominating the market for on premises approaches to mainframes, Amazon essentially created the market segment of cloud computing in 2006.

In 2010, Microsoft debuted its Azure cloud offering. IBM and Google followed suit a few years later, with cloud computing offerings of their own.

Household brands like Netflix rely on Amazon's cloud computing infrastructure. Business productivity apps like Slack and design juggernauts such as Figma also make use of AWS (Amazon Web Services).

Why is serverless computing significant?

Whereas cloud computing can be thought of as "infrastructure as a service," serverless — though it is a misnomer — means not having to worry about servers. It is "peace of mind as a service," where software developers only need to be concerned with the code they are writing.

For example, when designing and building a mobile app... That expertise differs from what one would need to setup a "back end" API to send/receive data from a phone. This is where serverless functions can be helpful.

Amazon allows for a *.zip file of code to be uploaded, and then that code can be called when certain criteria are met, or various events are fired.

Though this centralizes more importance with Amazon (or Microsoft Azure), it also democratizes the ability to spin up an app or start-up business idea. Investment to test something now costs pennies on the dollar, compared to the capital of owning one's own server hardware.