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## **Big Tech's Dominance and Transnational Infrastructure<sup>1</sup>**

*Open Access Teaching Case Developed for the Tech for Humanity Pathways Minor*

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### **Background**

Creating a competitive market is viewed as a healthy practice to improve the economic welfare in any society. However, in many industries, the market shapes competition and impacts businesses and societies in unexpected ways. This is especially evident in digital industries, which are known to be more fluid in growth. Think about Amazon, Apple, Facebook (now Meta) and Google, together known as GAFA. These giant companies are currently the four dominant platforms in the digital market and, consequently, have the greatest impact on the community of technology users worldwide.

In recent years, the US government has investigated GAFA several times for anti-competitive behavior that disadvantages smaller competitors and reinforces their dominance. For instance, because Amazon simultaneously works as a sales platform for other vendors and has its own brands, it can determine when a third-party product is popular and can accordingly manage its own brand prices, shipping options, etc. for its own benefit, reinforcing its dominant market position. In the same vein, Google can determine when a third-party app is attracting more interest by users of its Android mobile operating system, and that information may guide acquisition or product development plans. These moves can further increase market concentration.<sup>2</sup>

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<sup>2</sup> You can read more about this in the following report -- U.S. House Judiciary Committee. (2020). Investigation of Competition in Digital Markets: Majority Staff Report and Recommendations. U.S. House Judiciary Committee. Available at: [https://judiciary.house.gov/uploadedfiles/competition\\_in\\_digital\\_markets.pdf](https://judiciary.house.gov/uploadedfiles/competition_in_digital_markets.pdf).

A missing point in this discussion is the consequences that this market concentration has not just for the industry, but for internet users around the world. In this case study, we are going to outline why you should care about GAFA's dominance in the market, and how it is connected to the distribution of their private transnational infrastructures worldwide. The physical and geographical location of GAFA's information infrastructure has an impact on the dynamics of how big and small internet service providers (ISPs) compete in local markets, and consequently, how your and other internet users' data physically moves when accessing GAFA's content.

### Did you know?

GAFA is a term that refers to the four dominant digital platforms: Google, Apple, Facebook, Amazon. This term is more commonly used in Europe and other regions, while in the U.S. it is common to call these companies "Big Tech," including Microsoft.

Most of us are users of GAFA's products, as they are currently the most popular content providers on the internet. The ISPs serving our households or mobile phones need to be *interconnected* to GAFA's networks to bring their content to you every time it is requested. Let's say that you want to update your Android or Apple phone. Your internet provider will make sure that your request reaches Google or Apple, and that the data packets with your requested updates then reach your device. How this interconnection between your ISP and GAFA happens affects the speed, the price, and the quality of the service you receive from your ISP.

*Interconnection* is the key word here, and if it sounds new for you, remember that it is not only an element of internet architecture. Interconnection is also the basis of telecommunication services. Imagine when you need to call a friend and your carrier (e.g., Verizon, or AT&T) is different from theirs. These two companies' networks need to *interconnect* at a certain point for your call to be completed. We do not usually think of that interconnection requirement, because it is invisible to us, and so we take it for granted—but interconnection arrangements negotiated between different actors determine every aspect of our digital connectivity. Internet providers try to interconnect to as many networks as possible, including content providers (e.g. GAFA) and ISPs, because with better connectivity they can decide how to attend to your request in the quickest and cheapest way possible.

In this case study, we will outline key aspects of global internet interconnection and GAFA's

market dominance, and explain how they affect internet users from the global North and global South differently. In the following section, you will learn a new vocabulary about internet infrastructure and discover the implications of market concentration on the equality of global interconnection.

### **Presentation of the Case**

Although the internet is generally imagined as a borderless and virtual medium, it is still affected by the material world, with physical structures and legal environments defined by national borders. Global platforms like GAFA make their content physically available in servers located in data centers worldwide. They are selected based on commercial interests and strategic business plans. These servers are called content delivery networks (CDNs). There are CDNs owned directly by content such as GAFA, and there are also companies who specialize in creating and maintaining CDNs (e.g. Akamai, Cloudflare, etc.) that store content of different content providers together. When internet providers interconnect to GAFA, they interconnect to GAFA's CDNs or specialized CDNs with GAFA's content.

#### **What is a CDN?**

CDN stands for content delivery networks. They are physical servers where content providers such as GAFA store (cache) their content, bringing it closer to users and facilitating access of ISPs via points of interconnection.

CDN locations matter. They influence the routes that ISPs will take online and how your data circulates around the world. Let's go back to our example of updating your smartphone. If Google and Apple's CDNs and your internet provider are in the same country, city, or even the same data center, that requires less time and money to reach the information. This means better speed, less latency or delay in transferring the information, and lower cost to interconnect and receive the needed data.

In this case, your ISP could *peer* with Apple or Google. Peering means that your ISP and the content provider collaborate by establishing a direct interconnection among their networks to exchange data and traffic. With a peering relationship, your internet provider takes less time to reach a server and fulfill your update request. However, if your ISP does not have peering

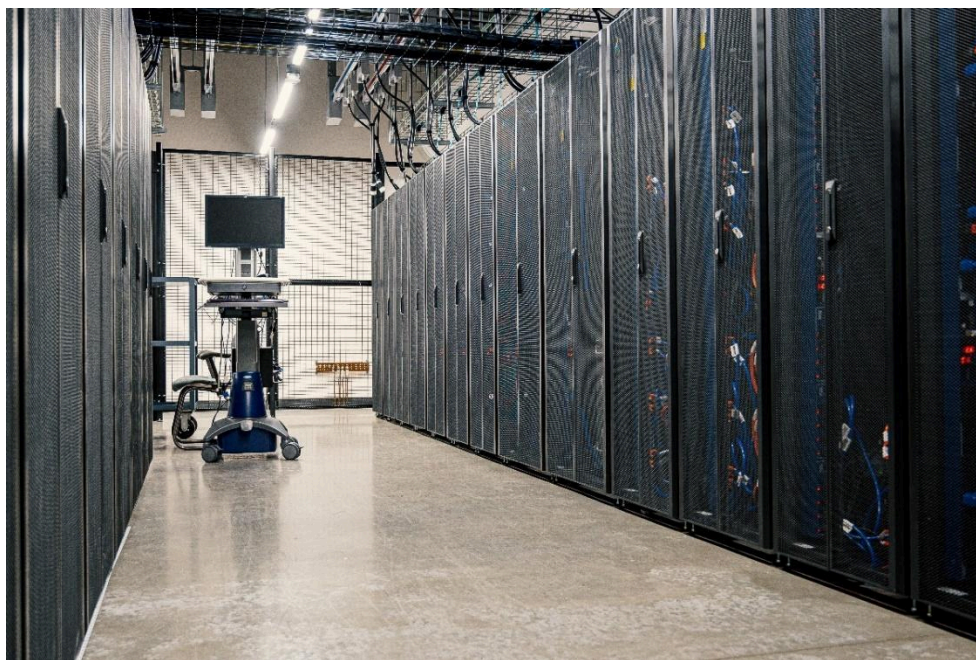
agreements with these content providers, then it will have to transit your request through a larger ISP. This transit costs money, unlike a peering agreement.

As a user, you will generally not know the difference whether your data is sent via peering or via transit. Your request will be fulfilled in both cases and the transactions occur in milliseconds. However, what is important to understand is that your data circulates differently and can go to different parts of the globe depending on where you live and where the content that you are requesting is located.

Here, two things should be clear. First, you should know by now that a huge part of an ISP's business is to find where desired content is located within the physical internet and then decide the most cost-effective way to bring that content to its users. To do this, they need to interconnect to these content providers. Consequently, a huge part of GAFA's business is to make its content available around the world in the most cost-effective way possible. This means that GAFA may decide not to set up their CDNs in certain cities due to commercial reasons. The ISPs of that city would subsequently need to pay for transit to interconnect to GAFA, and this means that sometimes users' data will move internationally. This is especially true for countries from the global South. Given how concentrated the global market around these platforms is, ISPs from all over the globe have their costs and quality of services impacted by GAFA's CDN locations. Moreover, every time that their users access such content, their data will move to and from these locations as well.

Interconnections usually happen in data centers (see Figure 1). To encourage peering there are facilities known as internet exchange points (IXPs) distributed in data centers all over the world. Here, ISPs and content providers come together to directly interconnect to each other. Although it is cheaper to use peering and interconnect to other providers at IXPs, it is ultimately up to individual businesses to decide if they want to interconnect or not, and if they want to be physically present in IXPs or not. Internet service providers' and GAFA's decisions not only impact their operation costs and consequently the price of internet access that consumers around the world need to pay, but also how internet users' data will circulate within the global internet infrastructure.

**Figure 1. Inside a Data Center<sup>3</sup>**



Considering how key interconnection is for competition and business among internet providers and content providers, these companies voluntarily keep a popular database of data centers and IXPs online, called PeeringDB. Here, they can find each other and figure out which datacenters and IXPs contain potential peers open to interconnection. This allows them to find the most convenient locations to establish peering relations. Using this database, we can see where GAFA has public points of interconnection that give access to their CDNs distributed around the world. The geography of where these interconnection points are located affects the connectivity and service of ISP's in both the global North and the global South. Let's take a look at these location distributions in Figure 2.

In Figure 2, we can see the preponderance of GAFA's public points of interconnection in data centers in the global North. On the left you see their distribution in IXP facilities, and on the right in both IXPs and private interconnection facilities.<sup>4</sup> Apple is the most Northern company, with 93% of all public points of interconnection in the global North. Amazon has 84%, Facebook 75% and Google has 74%. The lower their presence in the global South, the greater the need for

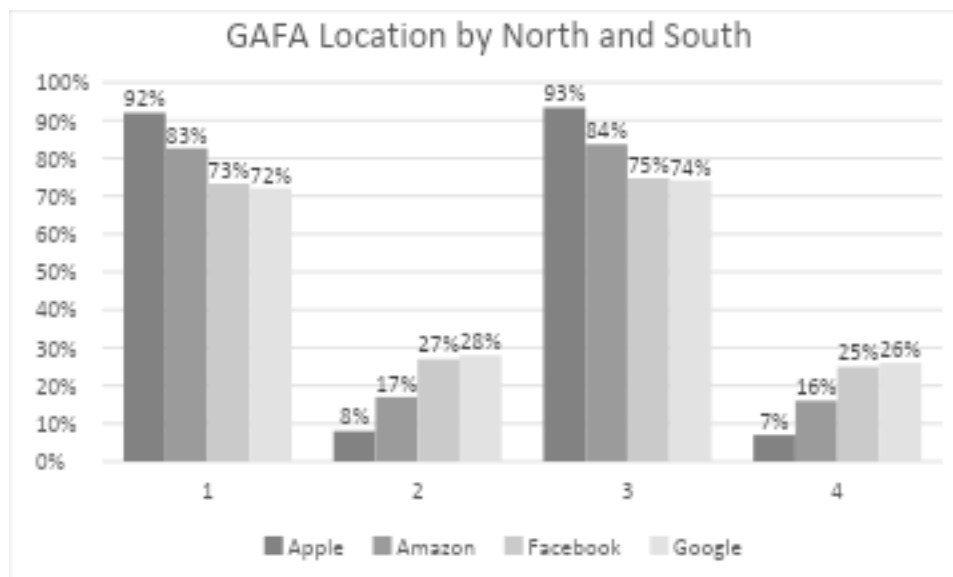
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<sup>3</sup> Credits: Bretty Sayles/Pexels.

<sup>4</sup> The difference between IXPs and private facilities will not be explored here, but you should just know that inside data centers interconnection can happen in different ways.

internet providers from that region to pay for transit to connect their users to the IXPs and data centers which host their data, usually located in the global North.<sup>5</sup>

**Figure 2. GAFA Location by North and South, by Percentage<sup>6</sup>**

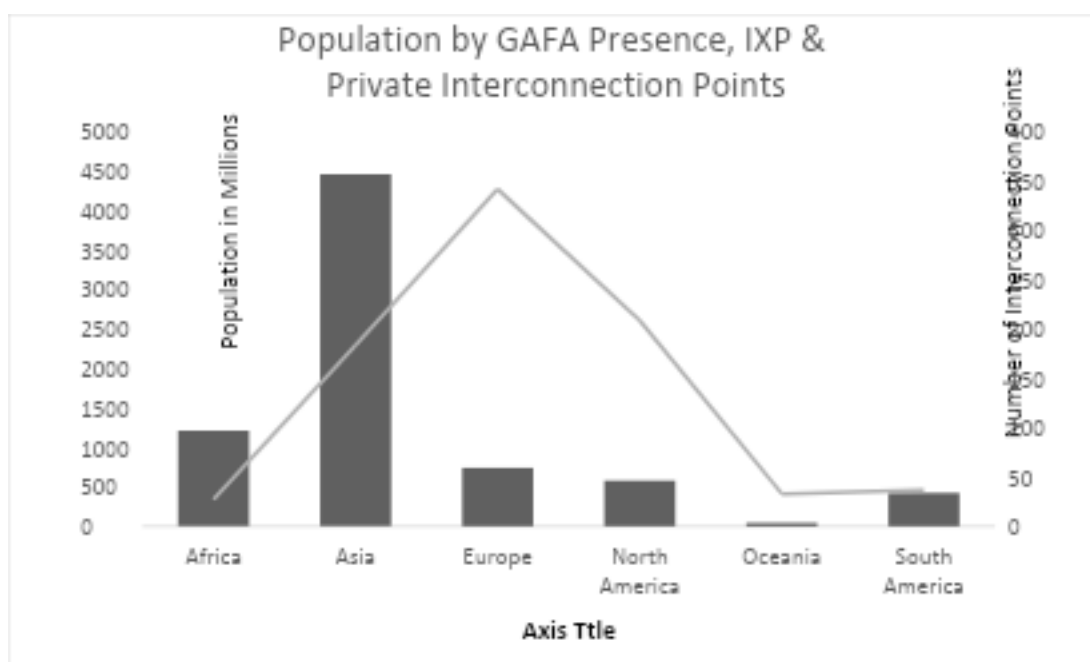


As we have already mentioned, it is up to these businesses, based on their commercial strategies, to be present in a certain locality. For GAFA, it is important that its CDNs are closer to their users, so access to their content is quicker and has better quality. Given that priority, one explanation for the differences in presence between the global North and the global South could be population size: the more people, the more points of connection to GAFA. However, as we can see in Figure 3, population size alone does not explain GAFA's public points of interconnection distribution. For instance, the continent of Africa has more than two times the population of North America (1,216 vs. 579 million people), but the latter has more than seven times the interconnection points (27 vs. 209 respectively).

<sup>5</sup> It is likely that Big Tech has more presence in the global South than this data collected from PeeringDB can capture. PeeringDB's numbers account only for their *public* interconnection points. These companies also have private interconnection agreements in certain markets, to bring their CDNs closer to the end user. Nevertheless, unless a company is the incumbent, or a leading ISP in the market, public interconnection points are the key ways for ISPs to get access to content providers such as GAFA, thus these numbers directly affect their businesses and competing environments.

<sup>6</sup> Source: Rosa, F. R. and Hauge, J. A. GAFA's information infrastructure distribution: Interconnection dynamics in the global North versus global South. *Policy & Internet*, 14(2) 424-449

**Figure 3. Population by GAFAPresence, IXP and Private Interconnection Points**



The predominance of GAFAPresence connection facilities in the global North is better explained by countries' per capita gross national income (GNI): countries with more GNI tend to have more GAFAPresence presence. Europe has more than five times the interconnection points (N=346) than Africa (27) and South America (38) put together. Some countries with no GAFAPresence public presence include: Afghanistan, Angola, Bolivia, Cameroon, Costa Rica, Pakistan, Senegal, and Turkey, among others. The global South has two times more countries with no GAFAPresence interconnection facilities than the global North, but remember: not having GAFAPresence's public interconnection points does *not* mean that these countries do not have access to GAFAPresence. What it means is that internet service providers from these regions face infrastructural, and consequently, economic disadvantages to access GAFAPresence's content, when compared with similar companies in the global North.

*In total, 200 countries or territories were found to not have any GAFAPresence public presence. All of GAFAPresence's points of interconnection indicated in the PeeringDB dataset are located in no more than 49 countries.*

Internet interconnection is a crucial element of digital market competition, and decisions at the level of infrastructure affect how ISPs compete in global and local markets, with important differences between the global North and the global South.

## Processing Questions

- 1) Who is GAFA?
- 2) What is a CDN?
- 3) Why do internet service providers (ISPs) need to interconnect to GAFA's CDNs?
- 4) Why does it matter for ISPs where GAFA's public interconnection points are geographically located?
- 5) What is the difference between peering and transit? Which of them is preferred by ISPs and why?
- 6) What helps explain the different GAFA's public interconnection presence between the global North and the global South? Why do you think this happens?

## Thematic Reflection and Discussion

In this section, you are asked to reflect on this case study and discuss it in light of three themes: inequality, transparency, and competition. Read the paragraph that summarizes each thematic concept and reflect on/ discuss the questions that follow.

### Theme 1: Inequality

There is a historical debate in global communication regarding inequalities embedded in communication infrastructure.<sup>7</sup> For some, the internet is an example of “free flow of information”, where information can and should circulate freely online. For others, there can be no free flow of information if such flow is marked by one-way directionality, from wealthier countries to others. In this case study, you have learned that after some years of internet development, some companies, such as GAFA, have a strong dominance in the digital market and their decisions about where to have public interconnection points have led to an unequal distribution of public access to their content.

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<sup>7</sup> One of the most important sources about this discussion is UNESCO. (1980). *Many voices, one world: Towards a new more just and more efficient world information and communication order* (Reprint). London, New York: Kogan Page. Retrieved from <http://www.un-documents.net/macbride-report.pdf>.

- a) Come back to Figure 3 and compare the number of public interconnection points between Africa and Oceania. Explain the differences that you see among them. What explains the discrepancy?
- b) In pairs, imagine that one of you is an executive at one of GAFAs companies who decides about interconnection matters worldwide, and the other one is the owner of an ISP in Morocco. How would you explain the numbers analyzed in Figure 2 above? Which reasons would you use to support or contest this scenario? How would you position yourselves in regard to the different conditions that ISPs face in these two continents?
- c) GAFAs executive explains that they have physical presence in some of these 200 countries, but their interconnection is done directly with the leading ISPs in that market, and this is why such presence is not registered in PeeringDB database. What are the implications of GAFAs commercial decision for the smaller ISPs in that market? Who has benefited in the local competition between the leading ISP and the smaller ISPs in these countries? Why?

### **Theme 2: Transparency**

As digital platforms become increasingly ingrained in our daily lives, civil society has constantly advocated for more transparency in their operations, especially in content moderation, contention over the spread of disinformation, etc. Now that you have learned about how internet users' data physically flows and how this flow is impacted by the decisions of private companies such as GAFAs and ISPs, and being an internet user yourself:

- a) What kind of information (if any) about your data flows would you like to know? Why?
- b) If your ISP offered you a pay-per-view service to see a map tracking the data centers in the world where your data geographically goes, would you sign up for it or not? Why?
- c) How different do you imagine that a map about how your data circulate online would be from an internet user based in South America?

### **Theme 3: Competition**

The dominance of Big Tech over the digital market has generated effects in other industries in unpredictable ways. At the level of infrastructure, internet providers have been directly affected

by Big Tech's decisions on where they have public points of interconnection to their CDNs. This happens because "ISPs are driven to lower costs, maximize performance, and generate revenue. The choice of where and with whom to peer or transit directly impacts these driving factors"<sup>8</sup> (Metz, 2001, p. 74). At the same time, GAFA, like any content provider, wants their users to have a good user experience. The closer their CDNs are to their users, the better it will be.

Now let's imagine a hypothetical situation in countries that do not have public interconnection facilities to GAFA. A leading ISP, with a big slice of the local internet market and with a large number of existing customers, makes direct arrangements with GAFA to have their CDNs in headquarters. Such arrangements would not require public points of interconnection, and would not be listed in online databases for public consultation. This would be a private negotiation between the businesses considering their mutual commercial interests in the local market.

- a) Who will benefit from these private commercial negotiations? Why?
- b) Who will not benefit? Why?
- c) If you were a customer of the leading ISP, how would these negotiations affect your access to GAFA's services?
- d) How would negotiations like this affect local competition among ISPs?

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<sup>8</sup> Metz, C. (2001). Interconnecting ISP Networks. *IEEE Internet Computing*, 5(2), 74–80. p. 74. Available at: <https://doi.org/10.1109/4236.914650>.