

Datascape

Speculative City for Data to Inhabit

Datascape

Speculative City for Data to Inhabit

Erik López

Master's Degree in Advanced Studies in
Design-Barcelona (MBDesign)

Specialization:
Contemporary Design (CD)

Escola Tècnica Superior d'Arquitectura de
Barcelona
(ETSAB)

Universitat Politècnica de Catalunya (UPC)
Universitat de Barcelona (UB)

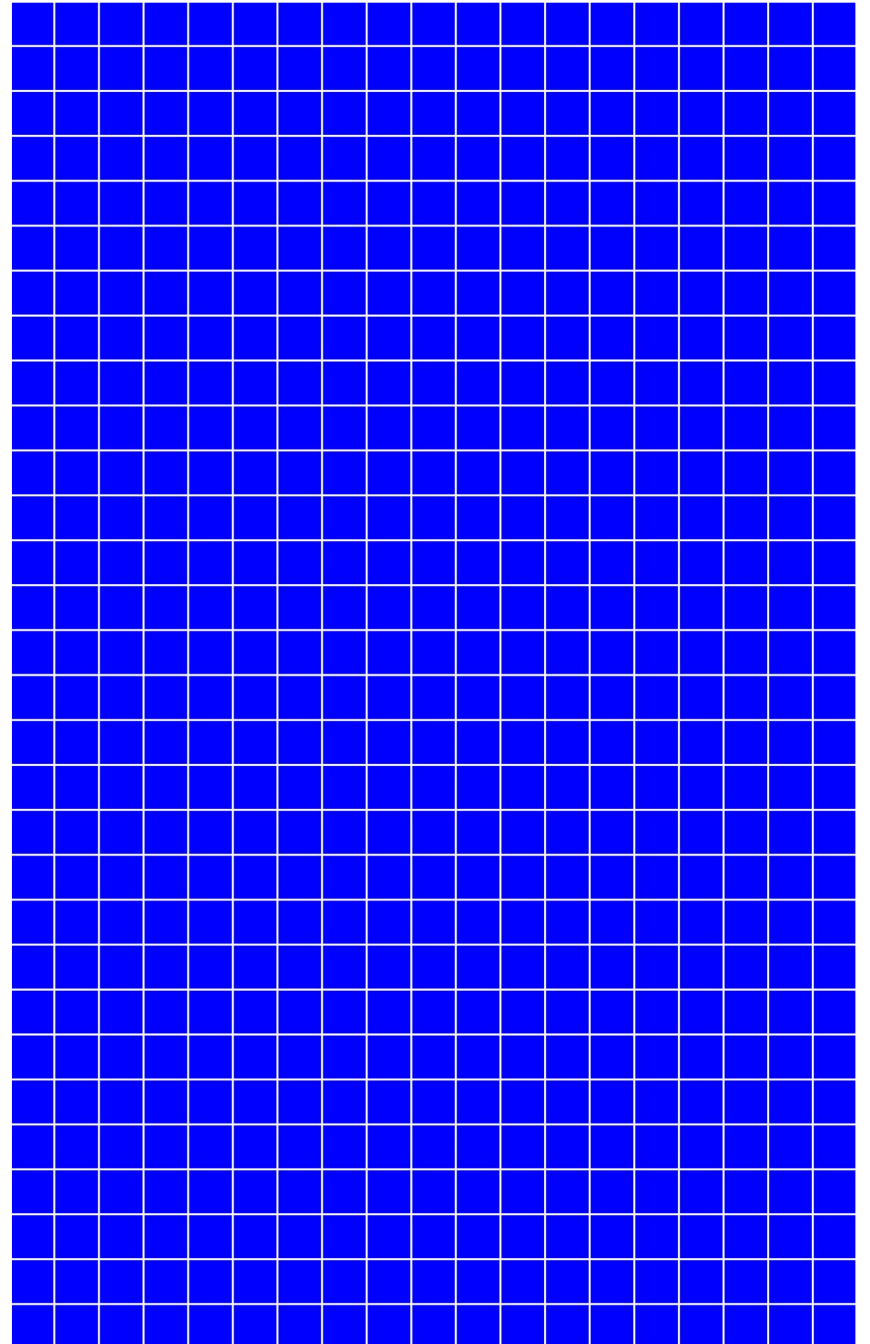
Title:
Datascape.
Speculative City for Data to Inhabit

Author:
López Rodríguez, Erik Eduardo

Supervisor:
Navarro, Isidro

Academic year 2022/2023
Barcelona 2023

Fig. 0 / Abstract representation of data network.



**What is the
impact of data
in the physical
world?**

Abstract

ESP

La creciente exponencial de datos está afectando profundamente el entorno físico, y su proliferación descontrolada continuará reconfigurando y alterando el paisaje. Sin embargo, estas afectaciones pueden no ser inmediatamente aparentes.

Este proyecto tiene como objetivo explorar y representar visualmente el impacto de la producción masiva de datos en el paisaje físico, diseñando una ciudad especulativa para que los datos la habiten para ilustrar las posibles implicaciones de esta posibilidad en el futuro. El objetivo es estudiar el estado actual de la producción de datos, comprender sus efectos en el medio ambiente y crear una representación visual que resalte las posibles consecuencias del crecimiento de los datos.

A través de la investigación, el análisis y el diseño, este proyecto pretende contribuir al discurso sobre las implicaciones ambientales de la producción de datos y ofrecer ideas sobre los posibles escenarios futuros que esperan a nuestro entorno construido. Se invita a realizar un examen crítico de nuestras prácticas digitales y se fomenta un enfoque responsable y sostenible en la producción y consumo de datos.

ENG

The exponential rise in data is profoundly affecting the physical environment, and its uncontrolled proliferation will continue to reshape and alter the landscape. However, these impacts may not be immediately apparent.

This project aims to explore and visually represent the impact of massive data production on the physical landscape by designing a speculative city for data to inhabit, illustrating the potential implications of this impact in the future. The objective is to study the current state of data production, understand its effects on the environment, and create a compelling visual representation that highlights the potential consequences of data growth.

Through research, analysis, and design, this project aims to contribute to the discourse on the environmental implications of data production and offer insights into potential future scenarios that await our built environment. It calls for a critical examination of our digital practices and encourages responsible and sustainable approaches to data production and consumption.

KEYWORDS

Data, Data Center, Landscape, City, Speculative Design, Internet

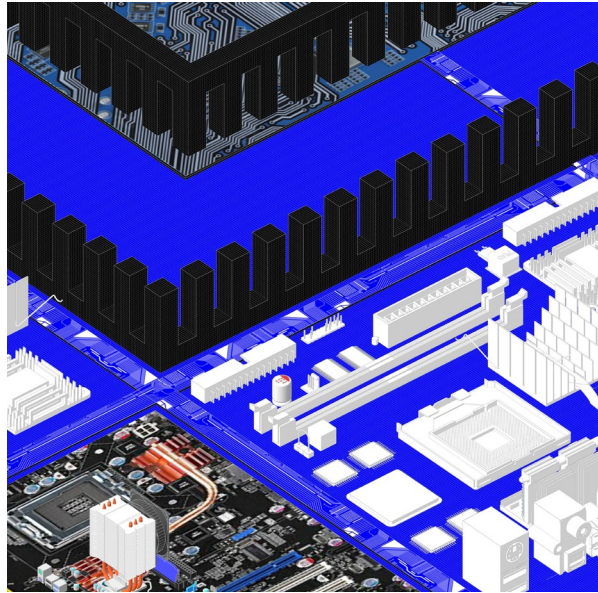


Fig. 1 / Image that illustrates the Datascape project.

What?

This project is a speculation of the future of data growth and how this will modify the physical landscape.

Why?

To study the current state of data production and its effects on the environment, and to show how data (apparently invisible) is shaping and will shape the physical landscape.

How?

Creating a speculative data landscape through an audiovisual and graphics; adopting, reinterpreting and reusing data from the internet (3D, video and image).

Objective

The objective of this project is to explore and visually represent the impact of massive data production on the physical landscape, as well as to design a speculative city to illustrate the potential implications of this impact in the future.

Specifically, the project aims to study the current state of data production and its effects on the environment, and to use this understanding to create a compelling audiovisual representation of a speculative city that highlights the potential consequences of unchecked data growth.

The project also seeks to demonstrate the potential of adopting, reinterpreting, and recycling data to create a proposal, and to bring attention to the environmental impact of digital practices. In what way can the impact of data be visualized when it is an intangible concept? What physical elements can we identify that represent the presence and effects of data in the world?.

Hypothesis

The exponential rise in data is having profound consequences for our physical environment, and its uncontrolled proliferation will continue to reshape and alter the landscape.

However, this impact may not be immediately apparent to the naked eye. Exploring the physical manifestations of information in the built world, allows for a deeper comprehension of data's impact and how the potential consequences of unchecked growth in the digital realm can be imagined. As a speculation, one can visualize a future where cities are designed only to accommodate data or where the physical landscape is transformed into a habitat for digital information.

What if data centers become cities just for data to inhabit?

This project hypothesis is that visualizing the physical effects of data waste can facilitate a more informed and conscientious relationship with digital information.

Methodology

The methodology for this project entails an initial examination of the concept of data growth and its physical consequences. Subsequently, the research will focus on three specific environmental and physical implications of data production: land and sea use, electronic waste (e-waste), and energy consumption.

Through an analysis of these physical consequences, the investigation will explore hypothetical scenarios, including the speculative future possibility of transforming the physical landscape into an environment exclusively dedicated to digital information. More specifically, the study will investigate the potential outcomes of constructing cities solely to accommodate data and the resulting impact on the physical environment.

In order to accomplish this, the project will draw upon relevant references in speculative design to provide valuable insights. Additionally, references related to urban expansion and infrastructure will be consulted to aid in the design of this hypothetical city.

The project will work with the concept of “using the existing” to visually demonstrate the potential for data recycling to create, incorporating diverse data resources from the internet, such as 3D models, videos, and images. Ultimately, through the creation of an audiovisual representation (video) of a speculative data landscape, the project will visualize this subject that is usually imperceptible.

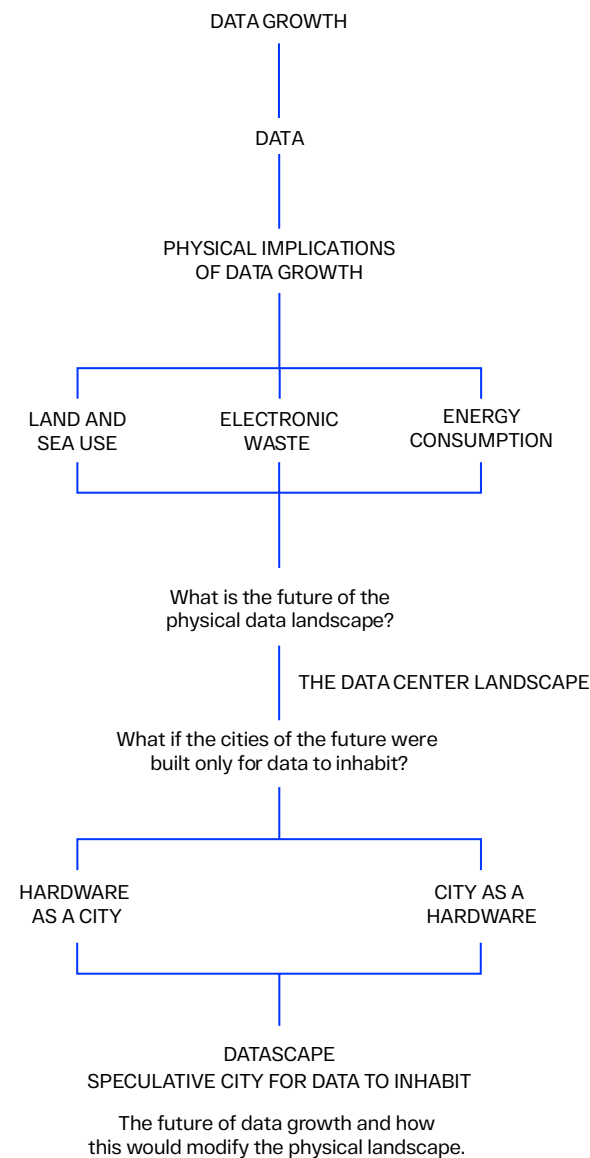


Fig. 2 / Diagram synthesizing the methodology used in this project.

Content

Abstract		
Objective		
Hypothesis		
Methodology		
0___ Introduction	18	
Glossary	23	
1.0___ Data Growth	24	
1.1 Data	30	
1.2 Implications of the increasing amount of data	34	
2.0___ Physical Consequences of Data Growth	36	
2.1 Land and sea use	40	
2.2 Electronic waste / e-waste	46	
2.3 Energy consumption	50	
2.4 The impact of data in the landscape	54	
3.0___ The Data Center Landscape	58	
3.1 Architecture as a monument.	70	
From prehistoric structures to data centers		
4.0___ The Past Future. Speculative Scenarios	76	
4.1 Monumento Continuo (1969) by Superstudio	80	
4.2 MetaCity DataTown (1999) by MVRDV	82	
4.3 Planet City (2021) by Liam Young	84	
5.0___ Hardware as a City, City as a Hardware	86	
5.1 Data center as suburbs	94	
5.2 Hardware as a design tool	100	
5.3 Artificial Intelligence as a design tool	106	
6.0___ Working with the Existing	114	
6.1 Working with the existing data	120	
7.0___ Datascape	126	
7.1 Speculative City for Data to Inhabit	140	
7.2 Video	158	
8.0___ Epilogue	160	
9.0___ Sources	164	

‘...we have to leave the dust where it is. What does that mean? It means, for instance, that every town on Earth should have a well-monitored, protected, yet visible, amount of plutonium right in the middle of the town square. Visible, not hidden. It’s a matter of pragmatic urgency. Because if you hide it, if you put it underground, it’s going to leach into the groundwater. And no matter how many warning signs you erect, they will eventually decay and no one will understand them or remember what they are.

“Dark Ecology”

Interview with Tim Morton by Lucas van der Velden & Arie Altena
(2014)

The rapid growth of data in the digital age² has produced a new realm of possibilities and challenges. As the volume and significance of data continue to expand, it becomes crucial to explore its implications on physical environments and urban landscapes. However, understanding data can be challenging to comprehend since it is intangible and cannot be seen or perceived.

Therefore, from the question *What if data centers become cities just for data to inhabit?* this document delves into the visualization of the consequences resulting from data growth, focusing on the exploration of the *Datascape*—a speculative city specifically designed to accommodate the ever-increasing presence of data. It examines the far-reaching implications of the increase of data and its tangible manifestations; explores the landscape of data centers; and envisions exaggerated future scenarios that integrate architecture, technology, and data.

Chapter 1 introduces the fundamental concepts of data and highlights the implications arising from the exponential increase in data volumes. It delves into the profound social, cultural, and technological transformations brought about by the abundance of data. However, its primary focus is highlighting the significant environmental considerations arising from the escalating data growth.

Chapter 2 focuses on the physical implications of data growth. It delves into the land and sea use, considering how the expansion of data infrastructure affects the environment. The chapter also explores the issue of electronic waste (e-waste) generated by the disposal of outdated data-related hardware and investigates the energy consumption associated with data centers. Furthermore, it investigates the impact of data on the landscape, both in terms of physical transformation and its influence on the perception and experience of space.

Chapter 3 delves into the landscape of data centers. It considers the historical trajectory of architecture as a monument, from prehistoric

structures to contemporary data centers. By examining the architectural aspects and symbolism associated with data centers, the chapter sheds light on the emergence of data centers as monumental structures in the contemporary landscape.

Chapter 4 explores speculative scenarios that envision the future of cities in different contexts and temporalities. It examines notable projects like “Monumento Continuo” by Superstudio, “MetaCity DataTown” by MVRDV, and “New City” by Liam Young, which offer creative and provocative visions of how cities might shape our urban environments.

Chapter 5 investigates the relationship between hardware and the city. It explores the notion of data centers as suburban entities and examines the potential of hardware as a design tool. Additionally, it explores the role of Artificial Intelligence (AI) as a design tool in shaping the physical manifestations of the Datascape.

Chapter 6 examines the possibilities of working with existing data and repurposing it within the Datascape. It explores strategies for utilizing the wealth of existing data to visualize the functioning of the city.

Chapter 7 delves into the core concept of the Datascape, presenting a speculative city designed specifically for data to inhabit. It explores the unique characteristics and considerations of designing a city that caters to the needs and dynamics of data. The chapter also includes a video conveying the vision and experience of the Datascape.

This project aims to explore the intricate relationship between data growth and the physical environment. By envisioning a *Speculative City for Data to Inhabit*, it opens up new avenues for understanding and reimagining our future landscapes in the era of data proliferation.

² Digital age: the present time, in which many things are done by computer and large amounts of information are available because of computer technology. Source: Cambridge Dictionary. (n.d.)

This research will delve into multiple meanings, and to provide a concise introduction to certain concepts, the following words will be consistently employed throughout the project:

Physical:

→ Relating to real things that can be seen and touched.

Digital:

→ Recording or storing information as a series of the numbers 1 and 0, to show that a signal is present or absent.

→ Using or relating to computers and the internet.

Data:

→ Information, especially facts or numbers, collected to be examined and considered and used to help decision-making, or information in an electronic form that can be stored and used by a computer.

Landscape:

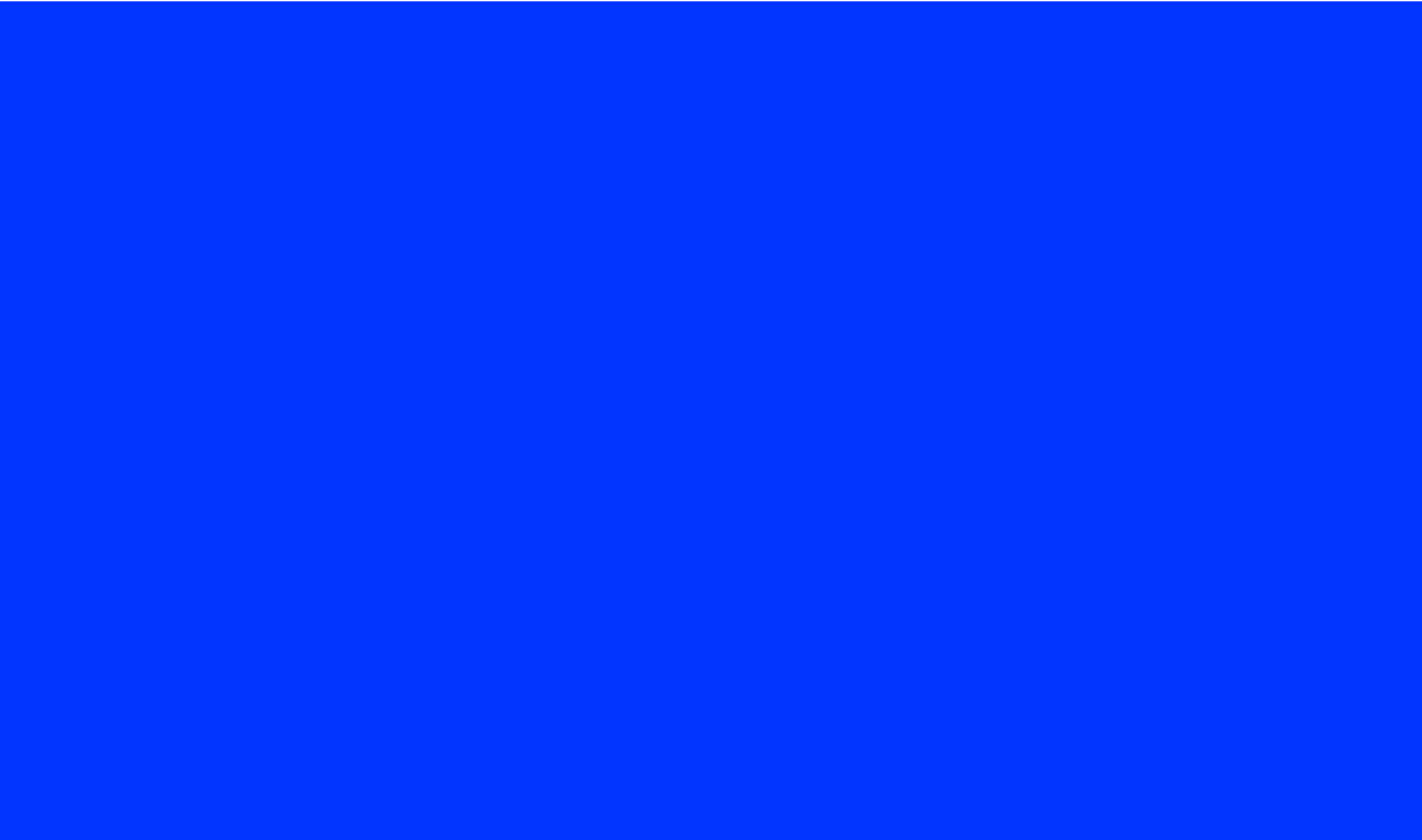
→ A large area of countryside, especially in relation to its appearance.

→ The scenery in a particular place.

Data center:

→ A building containing many powerful computers and the systems needed to keep them running, so that large amounts of data (computer information) can be dealt with effectively and without interruption.

³ Cambridge Dictionary. (n.d.). In Cambridge Dictionary Online. Retrieved June 01, 2023, from <https://dictionary.cambridge.org/>



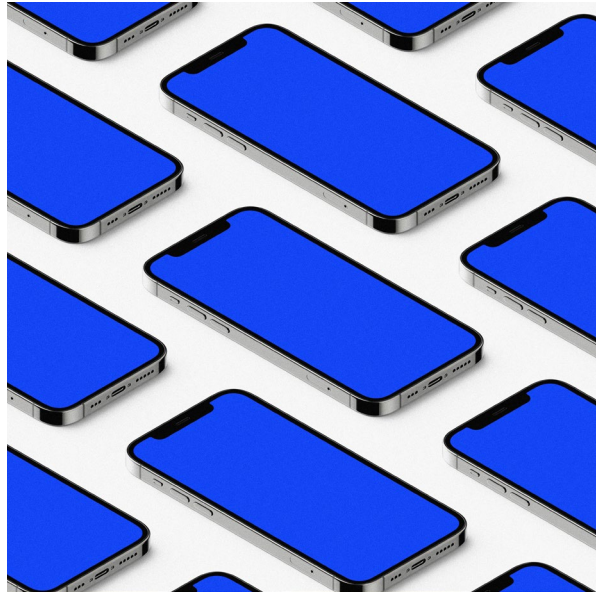
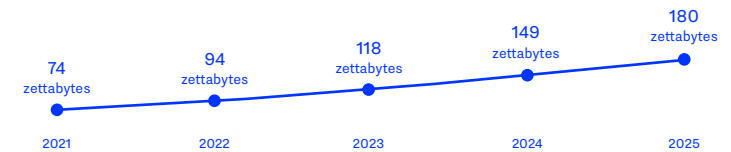


Fig. 3 / Image that illustrates the proliferation of data use.

Data growth refers to the increase in the amount of data that is being generated, collected, and stored worldwide. This growth is being driven by the increasing use of technology, the proliferation of the internet, and the rise of digital platforms and devices.

The amount of data being produced and stored is growing exponentially every year and according to the research portal [Statista \(2021\)](#), the estimation of data generated worldwide is projected to increase more than 180 zettabytes by 2025.

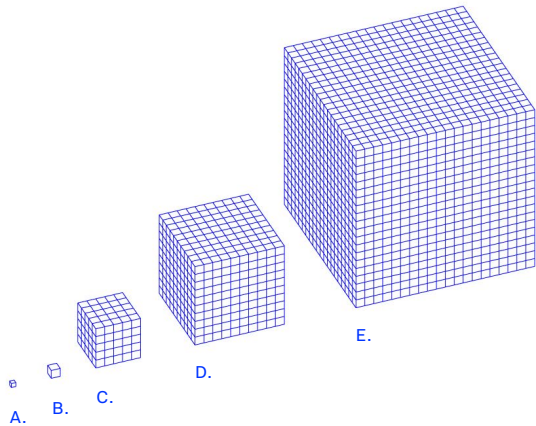


⁴Estimated data consumption from 2021 to 2025 (Statista, 2021)

On one hand, the increasing availability of data provides unprecedented opportunities to gain insights into customer behavior, improve business operations, and support decision-making. On the other hand, managing this vast amount of data can be overwhelming and costly, requiring significant investments in storage, processing, and energy.

But how can we measure these figures? Looking at the numbers it seems alarming, but it is complicated to visualise concepts or data that are not common. That is why this chapter will be dedicated to the study and understanding of these data from a tangible perspective.

A. bit	1/8 of a byte
B. bytes	1 byte
C. Kilobyte	1,000
D. Megabyte	1,000,000
E. Gigabyte	1,000,000,000
F. Terabyte	1,000,000,000,000
G. Petabyte	1,000,000,000,000,000
H. Zettabyte	1,000,000,000,000,000,000



⁵ American Energy Society (2016)

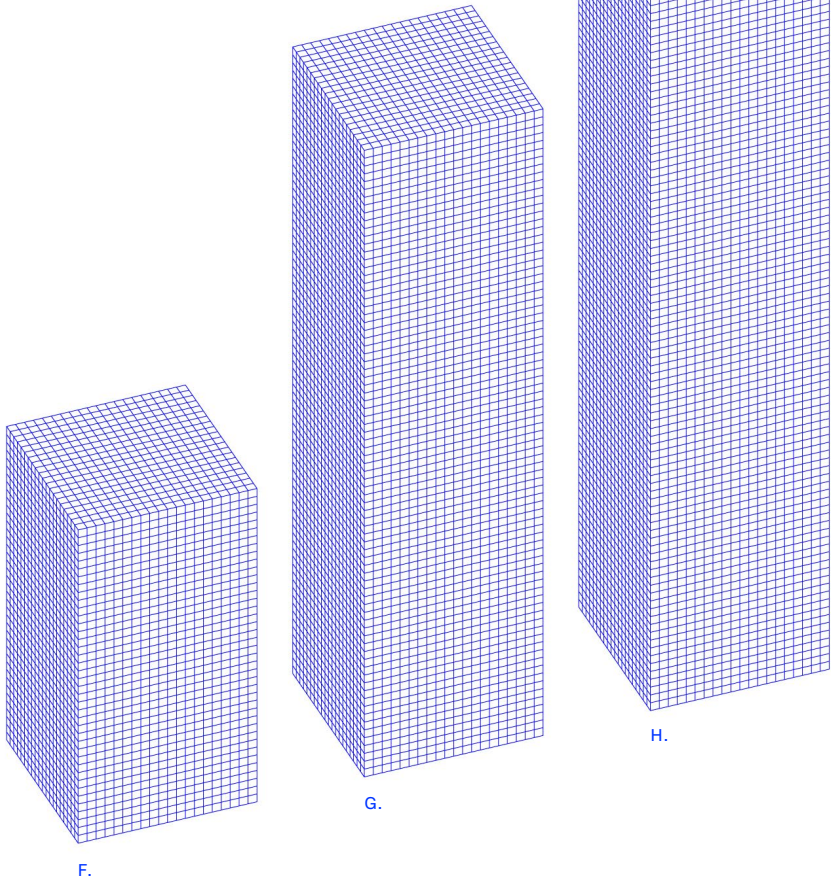


Fig. 4 / Visual representation of data units.

According to [Madeline Jacobson's](#) article on the [Bloomfire platform \(2023\)](#), data refers to any collection of information, facts, or statistics that can be stored, processed, or transmitted by a computer or other electronic device. There are different types of data based on how they are collected, represented, and used. Here are some of the most common types of data:

1. Numeric data are numerical values that can be measured or counted, such as height, weight, temperature, or age.
2. Categorical data are non-numeric data that can be grouped into categories, such as gender, race, or color.
3. Time-series data are data points that are collected at regular intervals over time, such as stock prices, weather data, or sales data.
4. Spatial data are data that refer to geographic or spatial locations, such as maps or GPS coordinates.
5. Text data are unstructured data that represent text, such as emails, social media posts, or news articles.
6. Image data are data that represent visual information, such as photos or videos.
7. Audio data are data that represent sound or speech, such as music or speech recordings.
8. Big data refers to data sets that are too large and complex to be processed using traditional data processing methods.

While these categories provided highlight the variety of data, the fundamental question for this project is [Where is this information located?. Is it stored in the sky in what we commonly refer to as "The Cloud"⁵](#)? The concept of data can be challenging to comprehend since it is intangible and cannot be seen or perceived. However, it is essential to understand that data occupies physical space in the world, even though it may not be visible.

⁵The Cloud refers to servers that are accessed over the Internet, and the software and databases that run on those servers. Cloud servers are located in data centers all over the world. By using cloud computing, users and companies do not have to manage physical servers themselves or run software applications on their own machines. Cloudflare, Inc. (2023)

**Everything
produced digitally
has physical
consequences
as well. But
what are these
implications?**

1.2 Implications of the increasing amount of data



Fig. 5 / Google data center in Eemshaven (2019).

The increasing amount of data presents both opportunities and challenges; while the growth of data presents positive possibilities for improved decision-making, opportunities for innovation, increased efficiency and personalized experiences, it also poses negative consequences such as environmental, social, security and economic implications:

- **Environmental implications:** The growth of data waste contributes to the global electronic waste problem, the energy consumption and the land and sea use.
- **Social implications:** The growth of data waste can have social implications, including health and safety risks, inequitable access to technology, and employment opportunities.
- **Security implications:** Improper disposal of data waste can result in the exposure of sensitive and confidential information, which can have implications for personal privacy, corporate espionage, and national security.
- **Economic implications:** Data waste can have significant economic implications, including the costs of disposing of electronic waste, the loss of valuable resources and materials, and the potential impact on industries that rely on the availability of these resources.

The main concerns of this project are the physical and visible consequences of the massive production of data. Therefore, for practical purposes of this research, we will focus on studying the environmental implications that emerge in the physical landscape.

2.0___Physical Implications of Data Growth

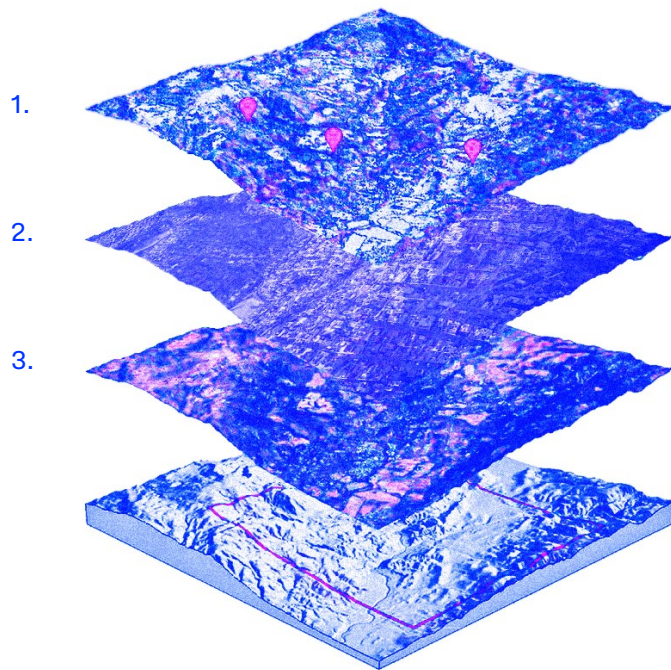


Fig. 6 / Visual representation of environmental implications.

One of the fundamental aspects of the project is the research into the impact that digital waste has on the planet and its influence on the transformation and redefinition of the physical landscape. That's why this chapter refers to the case studies that are determined by the continuous and growing wave of data that is generated and stored, but are almost imperceptible due to their geographical location or their physical conditions.

This project will focus on the study of three different examples of the physical consequences of data growth mentioned in the previous chapter. The intention is to dig deeper into the impact this causes on the global landscape and create an overview of the situation:

1. **Land and sea use:** Data centers and other storage facilities require large amounts of land to build infrastructure, leading to the displacement of ecosystems and habitats and resource exploitation. Also, data infrastructure require large amounts of water for cooling purposes, which can put pressure on local water resources in areas with limited water availability.
2. **Electronic waste (e-waste):** The growing number of electronic devices that produce data, generates a large amount of waste due to programmed obsolescence, in addition to containing dangerous materials, such as lead, mercury and cadmium, which can damage the environment if not disposed of properly.
3. **Energy consumption:** The storage and processing of data require significant amounts of energy, leading to an increase in carbon emissions and contributing to climate change.

2.1 Land and sea use

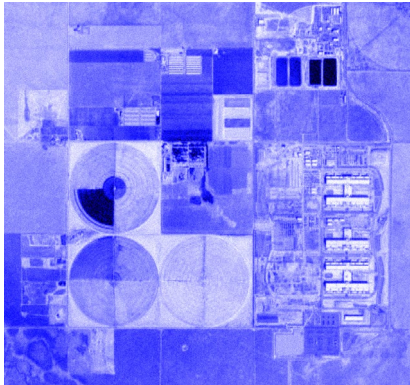
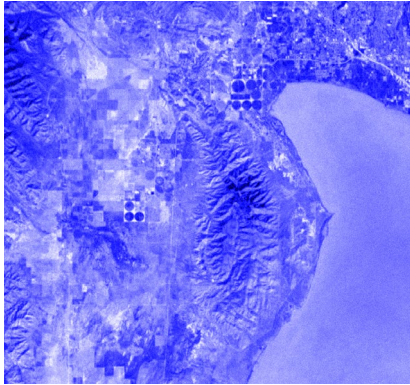


Fig. 7 / The Apple Data Center in Mesa, Arizona (2017).
Photo by Jim Todd / Reuters file

The increase in the intensive use of cloud services, such as video conferencing tools, video streaming sites like Netflix or YouTube, online gaming and social media, particularly due to people being in quarantine during the COVID-19 pandemic; has increased the demand for the computing power offered by data centers world-wide. As a result, some of the largest technology companies like Amazon, Microsoft, Apple and Google, are currently building more data centers to meet the growing demand, with millions of customers utilizing their services. (NBCnews, 2021)

Data centers are large facilities that house computer systems such as storage systems, telecommunications, and backup power supplies. These facilities are critical for the operation of cloud services, as they provide the necessary infrastructure to process and store massive amounts of data that are transmitted over the internet.

The COVID-19 pandemic has highlighted the importance of cloud services and data centers as remote work and online activities have become the norm for many people. The need for reliable and secure access to these services has increased, and data centers play a critical role in ensuring that these services are available and accessible to users. As the demand for cloud services continues to grow, companies are investing heavily in building new data centers and expanding their existing infrastructure to meet the needs of their customers. This trend is expected to continue in the coming years, as more businesses and individuals move their operations to The Cloud.



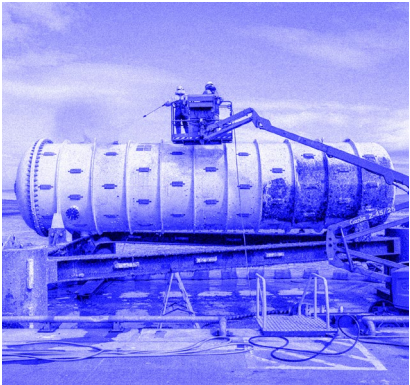
→ Fig. 8 y 9 / Meta Eagle Mountain Data Center. Google maps view (2023)
→ Fig. 10 / Meta Eagle Mountain Data Center (2022).

Typically, the locations of data centers are based on proximity to customers and infrastructure, the cost of land, the tax incentives offered by local governments and access to low-cost electricity (NBCnews, 2021).

Synergy Research Group (2021) shows that the total number of large data centers operated by hyperscale providers increased to 597 at the end of 2020, having more than doubled since the end of 2015. In terms of location, the US continues to account for almost 40% of the major cloud and internet data center sites. The next most popular locations are China, Japan, Germany, the UK and Australia, which collectively account for another 29% of the total. Among the hyperscale operators, Amazon, Microsoft and Google collectively account for over half of all major data centers.

Recently, Meta (formerly known as Facebook) announced the expansion of Eagle Mountain Data Center located in Utah, USA. This Data Center is designed to support Meta's growing infrastructure needs, including its various apps, websites, and services. It is one of Meta's newest and largest data centers, with a total floor area of over 2 million square feet (185,806 m²), making it one of the largest in the world (Data Center Dynamics, 2022).

Additionally, in 2022 Meta said that it would continue to spend heavily on data center infrastructure announcing the expansion of its data center campuses in Tennessee, Illinois, Alabama, and Nebraska, and announced new data centers in Idaho, Texas, and Kansas City, along with a new campus in Toledo, Spain, joining Facebook's existing European data centers in Sweden, Denmark, and Ireland.



- Fig. 11 and 12 / Members of the Project Natick team power wash the Northern Isles underwater datacenter (2020). Photo by Jonathan Banks.
- Fig. 13 / Microsoft's Project Natick team used a gantry barge to retrieve the Northern Isles datacenter from seafloor of Scotland's Orkney Islands (2020). Photo by Simon Douglas.

Indeed, the impact of data is not limited to land-based infrastructure and systems: the increasing amount of data generated and transmitted globally has led to a significant impact on the marine environment as well. Nowadays, Microsoft has been working on better energy performance for data centers, which has led to the development of the Project Natick initiative that aims to explore the feasibility and benefits of deploying data centers underwater.

In 2018, this project successfully completed a 105-day experiment where a self-contained data center pod, about the size of a shipping container was deployed, off the coast of Scotland. The data center was submerged underwater at a depth of around 35 meters. The experiment demonstrated the potential advantages of underwater data centers, such as improved energy efficiency, reduced cooling costs, and faster deployment in coastal areas. The cold ocean water helps to naturally cool the data center, reducing the need for traditional cooling mechanisms. (Microsoft, 2020)

While this project and surely others continue to advance towards still unknown possibilities, the truth is that the growth of data and therefore of data centers seems to have no territorial extension limits.

2.2 Electronic Waste (e-waste)

Electronic Waste is generated when electronic devices are discarded and is defined as anything with a plug, electric cord or battery (including electrical and electronic equipment) from toasters to toothbrushes, smartphones, fridges, laptops and LED televisions that has reached the end of its life, as well as the components that make up these end-of-life products. E-waste may also contain precious metals such as gold, copper and nickel as well as rare materials of strategic value such as indium and palladium (A New Circular Vision for Electronics, 2019).

According to [The Global E-waste Monitor 2020](#), in 2019 an astonishing 53.6 million metric tonnes of e-waste were generated, the equivalent to just over 7 kg for every person on the planet. Europe and the US alone contribute to almost half of the total e-waste generated annually:

Continent	e-waste generated metric tonnes (mt)	e-waste documented to be collected and properly recycled
America	13.1 mt	1.2 mt / 9.4%
Europe	12.0 mt	5.1 mt / 42.5%
Africa	02.9 mt	0.03 mt / 0.9%
Asia	24.9 mt	2.9 mt / 11.7%
Oceania	00.7 mt	0.06 mt / 8.8%

⁷World production of e-waste during 2019 (The Global E-waste Monitor 2020)

Of this total amount, 40 million tonnes of e-waste are discarded in landfill, burned or illegally traded and treated in a sub-standard way every year.



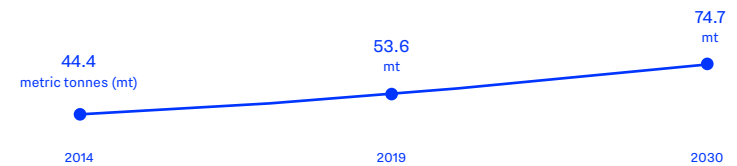
Fig. 14 / Women take devices apart in a warehouse in Guiyu, China (2018). Photo by Kai Löffelbein.



→ Fig. 15, 16 and 17 / The E-Waste Mega Dump of Agbogbloshie (2019).

For example, Agbogbloshie is a commercial district located in Accra, the capital city of Ghana in West Africa. This place is known for its informal e-waste recycling industry, where electronic waste is dismantled, burned, and processed for valuable materials like copper, aluminum, gold, etc. Many of the electronic devices that are brought to Agbogbloshie come from developed countries in Europe and North America, where they are discarded and exported to developing countries for recycling. (Wired, 2020)

The informal e-waste recycling industry in Agbogbloshie is considered to be dangerous to human health and the environment, as the burning and processing of electronic waste releases toxic chemicals and heavy metals into the air, soil, and water. The workers who process the electronic waste are often exposed to these materials and work in unsafe conditions.



⁸ Global E-Waste generated from 2014 to 2019 and an estimation to 2030. (Source: The Global E-waste Monitor 2020)

The perpetual cycle of electronic waste persists as digital devices, which are the very sources of this data, are continuously discarded at the end of their useful life. Consequently, the production of electronic waste will continue to grow.

2.3 Energy Consumption

The exponential growth of data has significant consequences in terms of energy consumption, as data volume expands, the demand for data centers and their infrastructure increases, leading to a higher overall energy demand.

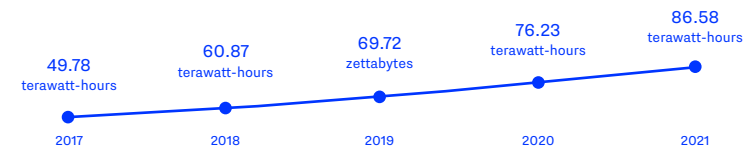
This energy consumption contributes to greenhouse gas emissions and environmental impact, as conventional energy sources, such as coal or natural gas, are often used releasing carbon dioxide and other pollutants into the atmosphere.

Moreover, the necessary computing power and storage capacity required to support global demand accessing cloud services; however, this level of processing requires significant energy consumption that generates heat, which data centers must remove using cooling equipment that consumes energy. Operational costs for data centers are also affected, with higher electricity bills impacting their financial bottom line.

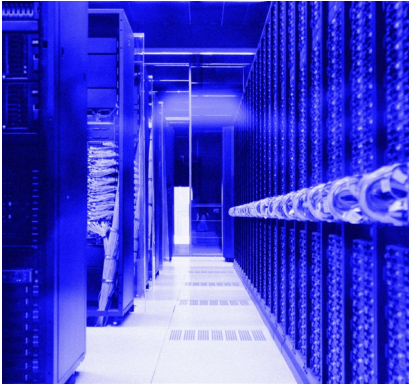
While efforts are made to improve energy efficiency, the rapid growth of data often outpaces these improvements, leading to a continuous rise in energy consumption in data centers.



Fig. 18 / The system used to cool servers inside the Apple Data Center in Mesa, Ariz. (2021). Photo by Tom Tingle / The Republic / USA Today Network.



⁹ Global energy demand Hyperscale Data Centers worldwide (Statista, 2021)



→ Fig. 19, 20 and 21 / Data servers at the Barcelona Supercomputing Center (2023). Photos by Erik López.

The Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC-CNS) is a research institution in Spain, dedicated to advanced research and innovation in four fields: Computer Sciences, Life Sciences, Earth Sciences, and Computer Applications in Science and Engineering. As a high-performance computing center with several powerful supercomputers that works 24 hours non-stop, the BSC-CNS consumes a significant amount of energy to power and cool its IT equipment.

During a visit to the BSC-CNS, the site manager Oriol Riu mentioned that keeping this data center running requires 1.5 Mw, which is equivalent to approximately €2M per year.

2.4 The impact of data in the landscape

→ **Landscape:** a large area of countryside, especially in relation to its appearance. / the scenery in a particular place.

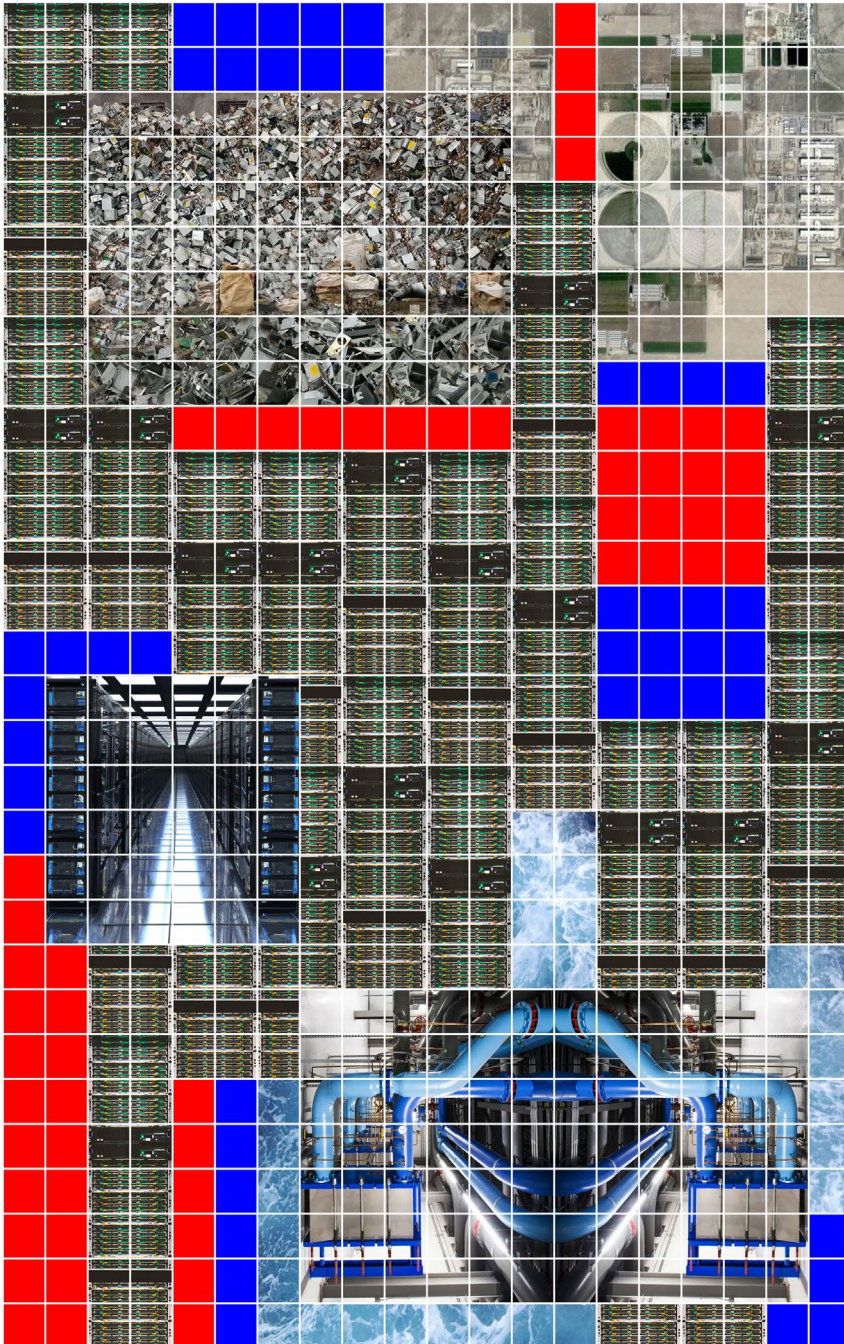
[Cambridge Dictionary Online \(n.d.\)](#)

After the study in this chapter, it becomes clear that the impact of data in the landscape is primarily driven by the rapid expansion of data and the consequent need for robust computing resources. The continuous growth of data, fueled by technological advancements and digitalization, necessitates the scaling and adaptation of data centers and other information technology infrastructure to meet the ever-increasing demands.

The infrastructure and technologies that facilitate data storage, processing, and transmission play a significant role in shaping the visual and functional aspects of the landscape. The construction and operation of data centers, with their distinctive architectural designs and energy requirements, can leave a tangible imprint on the physical environment, and these facilities, characterized by large-scale structures, can become prominent features in urban or rural areas.

Furthermore, the establishment of telecommunication networks, including fiber-optic cables and cell towers, not only supports the transmission of data but also adds to the infrastructure that shapes the landscape. These network components, although often hidden underground or camouflaged within existing structures, contribute to the overall connectivity and functionality of the data-driven landscape.

Fig. 22 / Collage about the impact of data in the landscape.



**If data keeps growing
more and more...**

**What is the future
of the physical data
landscape?**

3.0___The Data Center Landscape

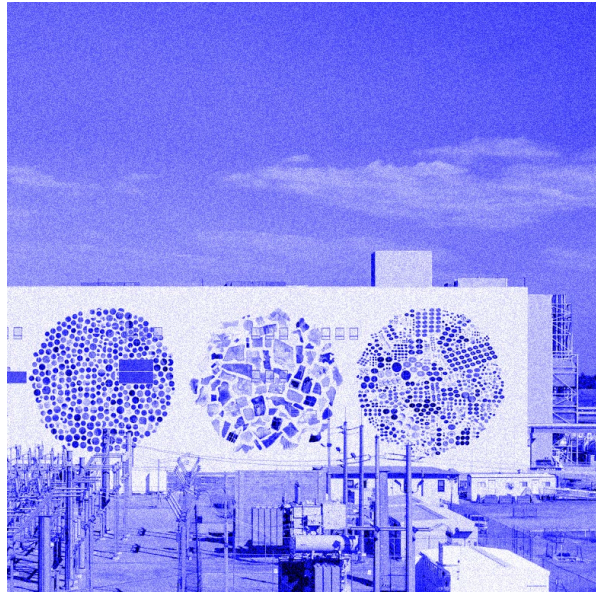


Fig. 23 / Google data center, Oklahoma (2007).

→ **Data center:** A data center is a network of computing and storage resources that enable the delivery of shared software applications and data. These centers can house large volumes of critical data and therefore are vital to the daily functions of companies and consumers alike, with the security and reliability of data centers as key factors. Published by Petroc Taylor (Statista, 2022).

The digital age has brought about significant changes in various aspects of our lives, including communication, business, education, entertainment, etc.; one of the key components being the storage, processing, and management of vast amounts of data, which has led to the emergence and importance of data centers. Data centers are specialized facilities that house computer systems, servers, networking equipment, and storage devices. They are designed to store, manage, process, and distribute large amounts of data for various purposes. Nowadays, data centers play a crucial role in supporting the operation of numerous online services and applications we rely on daily, such as cloud computing, social media, e-commerce, streaming services, and more.

According to the portals [Data Center Hawk](#) and [AFL Hyperscale \(2020\)](#), data centers can be explained and broadly classified into these categories, basically differentiated by their size and storage capacity:

1. Hyperscale data centers
2. Colocation data centers
3. Enterprise data centers
4. Edge data centers

1. A **Hyperscale data center** is a facility owned and operated by the company it supports. This includes companies such as Microsoft, Google, and Apple. Hyperscale computing is necessary for cloud and big data storage, due to their offer of robust, scalable applications and storage portfolio of services to individuals or businesses. They have anywhere around 500 or more cabinets, measuring at least 10,000 square ft., and usually with a minimum of 5,000 servers.

2. A **Colocation data center** consists of one data center owner selling space, power and cooling to multiple enterprise customers. Depending on the size of your network requirement, you can rent 1 Cabinet to 100 Cabinets, in some cases $\frac{1}{4}$ or $\frac{1}{2}$ a cabinet is available. A colocation data center can facilitate 100s if not 1000s of individual customers.

3. An **Enterprise data center** is a facility owned and operated by the company it supports. It is often built on-site but in certain cases can also be found off-site. Some choose this path because they want the privacy and security of their own facility. May have certain sections of the data center caged off to separate different sections of the business. Has anywhere from 10 Cabinets upwards.

4. **Edge data centers** emerged recently in the data center industry and provide data center services where the end users are. Instead of a single large data center servicing a large region, edge data centers are smaller facilities spread out to serve smaller areas of a region. This provides lower latency connections from the end user to the data center infrastructure and reduces traffic on major fiber lines. For example, people want quick access to Netflix content, so it doesn't make sense to route them to a data center in a major market 200 miles away.

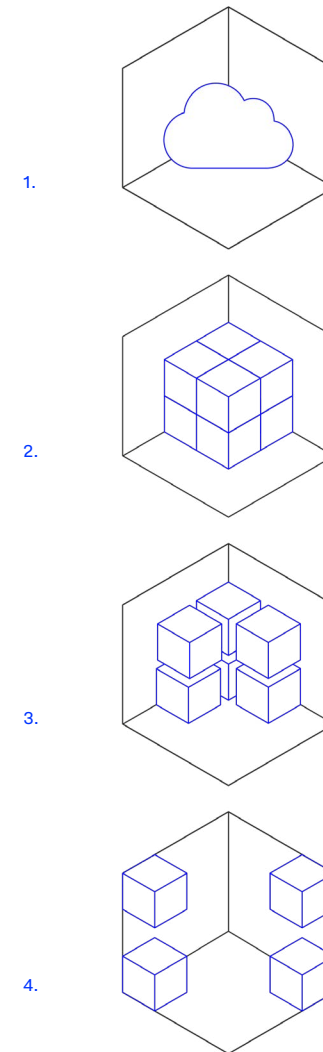


Fig. 24 / Visual representation of data center types.



Fig. 25 / Image created by AI DALL-E 2 asking: "an infinite landscape of data centers viewed from the sky".

Forecasting the exact behavior of physical data growth landscape is challenging due to the complex and rapidly evolving nature of technology (CB Insights, 2019). However, several key trends mentioned below can provide insights into the future of data growth infrastructure, clearly led by Data Centers:

- **Expansion of Data Centers:** The demand for data centers will continue to grow as people increasingly rely on digital services and cloud computing.
- **Modular and scalable infrastructure:** Data centers will increasingly adopt modular and pre-fabricated designs that allow for rapid deployment and scalability. Modular infrastructure enables faster expansion or downsizing of data centers based on demand, providing flexibility to meet evolving needs.
- **Energy-efficient designs:** Data centers will prioritize energy efficiency to reduce costs and environmental impact. Advancements in cooling technologies, power management, and server efficiency will help optimize energy consumption. The use of renewable energy sources, such as solar or wind power, will become more prevalent for sustainable data center operations.
- **Data center optimization:** Organizations will focus on optimizing resources and reducing operational costs. Data center operators will continue to explore innovative approaches to maximize resource utilization and minimize downtime.
- **Security and compliance considerations:** As data continues to grow, ensuring data security and regulatory compliance will remain crucial. Data centers will invest in robust security measures, including physical access controls, encryption, and comprehensive monitoring systems. Compliance with data protection regulations, industry standards, and privacy laws will shape data center design and operations.

**What if the future is
shaped by the image
of the data center?**

**Is it the data center
a new icon of
architecture?**

“Every era has had its own iconic architectural typology. The dream commission was once the church, Modernism had the factory and then the house; in the past decade we celebrated the decadent museum and the gallery. Now we have the data centre.”

¹⁰ Liam Young, 2019
From the book “Machine Landscapes.
Architectures of the post-anthropocene”

3.1 Architecture as a monument. From prehistoric structures to data centers

→ **Monument:** a structure or building that is built to honour a special person or event. [Cambridge Dictionary Online \(n.d.\)](#)

Now that our lives are governed by the digital and this digitality requires a storage system called a data center, can we say that the data center is the monument of our era?

It would be a stretch to classify data centers as “architecture monuments” in the traditional sense. Architectural monuments typically refer to structures that have historical, cultural, or artistic significance and are recognized for their architectural design and craftsmanship. Examples include iconic and historical landmarks like Stonehenge, the Parthenon, the Mesoamerican pyramids, or modern museums such as the Louvre and iconic skyscrapers. These architectural monuments often have symbolic value and represent the identity of a place or a civilization.

However, the graphic “I am a Monument” featured in the book “[Learning From Las Vegas](#)” by [Denise Scott Brown](#), [Robert Venturi](#), and [Steven Izenour](#), challenges the prevailing notion that the commercial and kitsch architecture of Las Vegas is merely superficial and devoid of architectural value. Instead, the graphic asserts that these structures should be recognized as a distinctive form of monumental architecture. The authors argued that these decorated facades and signs, with their bold forms and flashy aesthetics, were symbolic of the consumerist culture and represented a significant aspect of contemporary architectural expression.

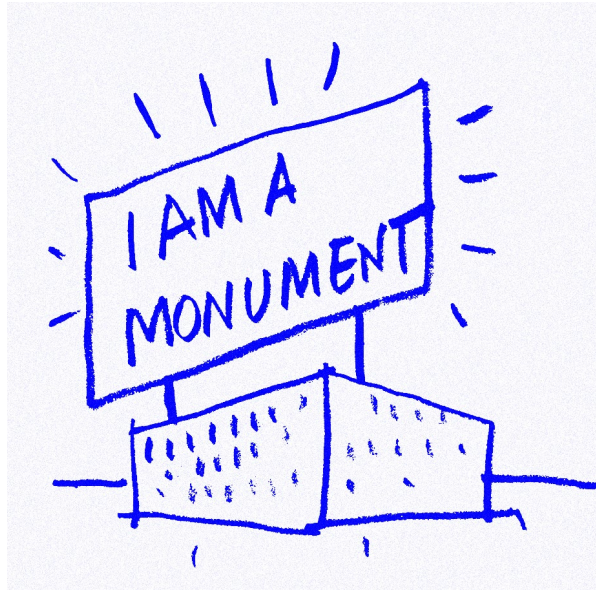


Fig. 26 / Graphic “I am a Monument” from the book “[Learning from Las Vegas](#)” (1972).



Fig. 27 / Stonehenge,
Wiltshire



Fig. 28 / Parthenon,
Athens



Fig. 29 / Teotihuacan,
The State of Mexico

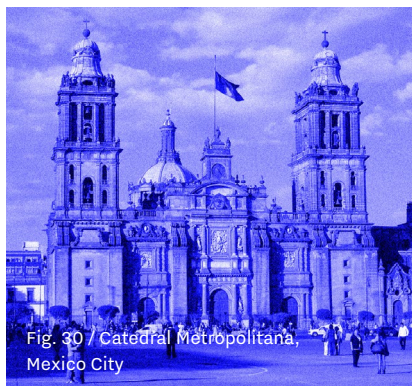


Fig. 30 / Catedral Metropolitana,
Mexico City



Fig. 31 / Battersea Power Station,
London



Fig. 32 / Empire State,
New York City

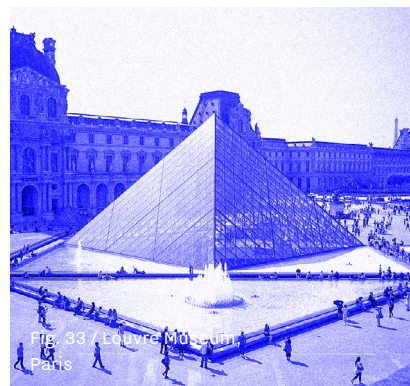


Fig. 33 / Louvre Museum,
Paris



Fig. 34 / Camp Nou,
Barcelona



Fig. 35 / Meta data center,
Singapore

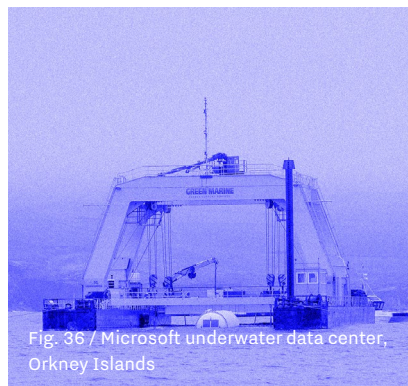


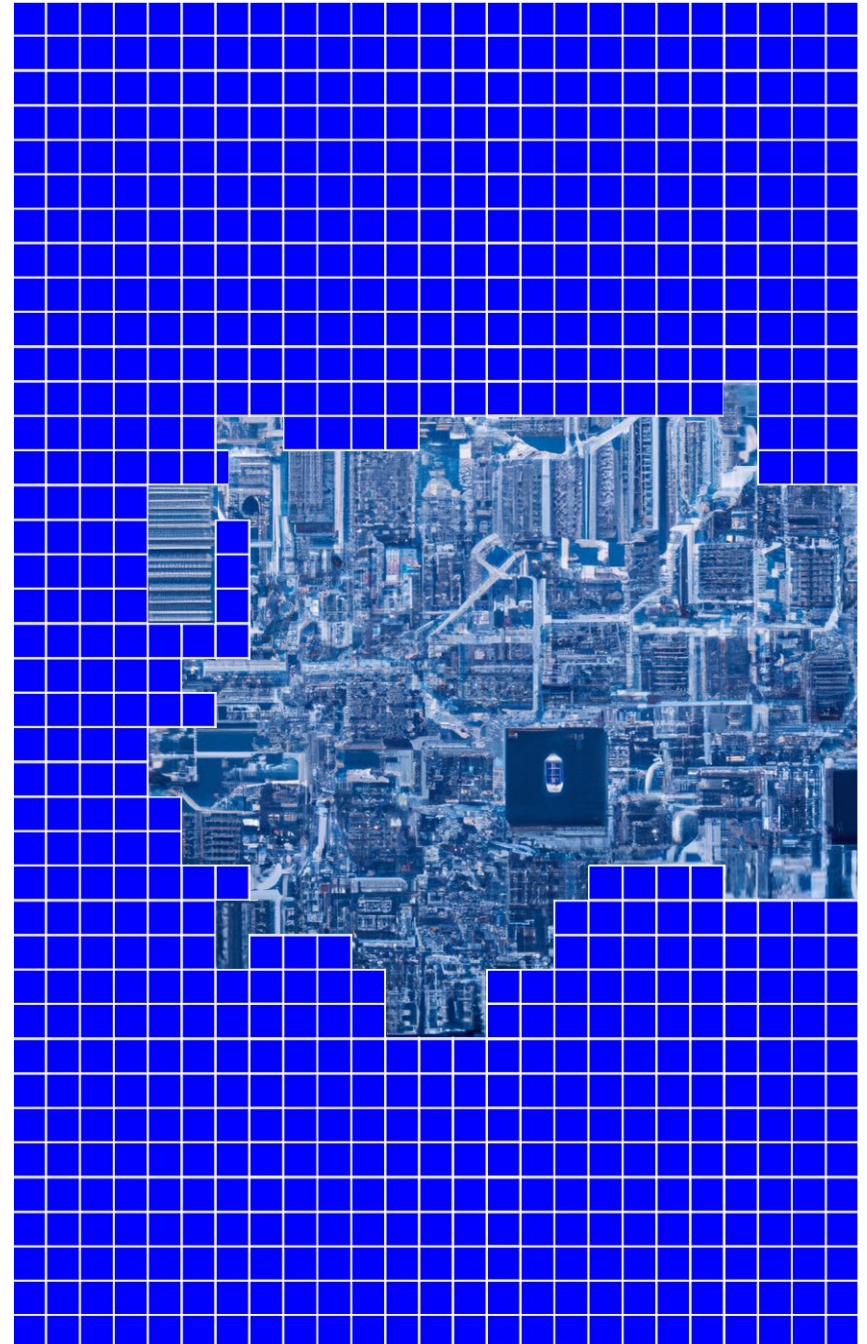
Fig. 36 / Microsoft underwater data center,
Orkney Islands



In this sense, we could say that data centers are the monuments of our era because they are significant in terms of their impact on the contemporary world. They underpin our increasingly digital infrastructure, enabling the functioning of various industries and services and they are vital for the data growth, representing a contemporary architectural and technological achievement, shaping the landscape of our digital era.

At this point, we could affirm that the future landscape will be shaped by data center infrastructure and based on this forecast, [what if we speculate with a future built from this point of view, a future created only for data to inhabit?](#)

Fig. 37 / Abstract representation of data infrastructure.



4.0___The Past Future. Speculative Scenarios

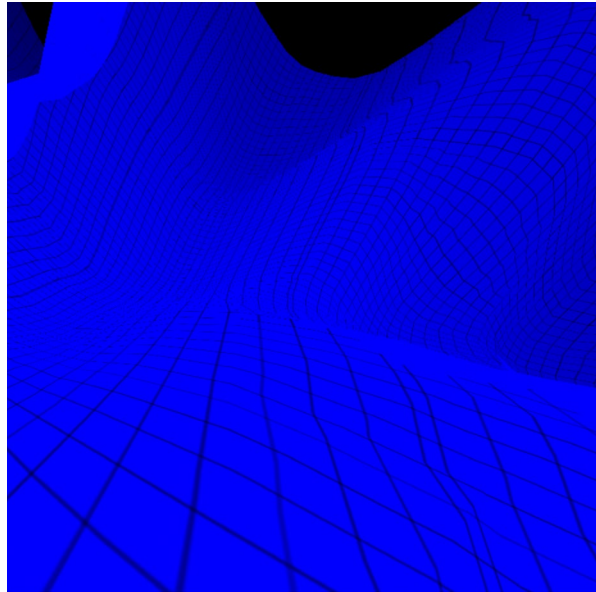


Fig. 38 / Speculative representation of data network.

Speculative design uses design principles and techniques to create fictional scenarios, objects, or systems that depict possible future scenarios. According to [Anthony Dunne and Fiona Raby](#) in their book [Speculative Everything](#), the goal of speculative design is not necessarily to propose practical solutions or predict the future accurately. Instead, it aims to encourage dialogue, explore possibilities, and generate new perspectives by presenting alternative visions of the future. Speculative design invites people to question current norms, assumptions, and values, and to think critically about the direction society is heading.

Additionally, speculative design often blurs the boundaries between art, technology, design and science ([Matt Malpass, 2017](#)). It can involve the creation of physical prototypes, digital simulations, interactive experiences, or thought-provoking narratives. It may also involve points of view from various fields, such as from scientists, sociologists, or philosophers, to ensure that the designs are grounded in research and informed speculation.

From this point of view, what if we create a speculative and exaggerated vision of the future to visualize the future of data growth? How can we translate all of this into a design project? Therefore, the following case studies are presented as a reference and starting point for potential future explorations related to technology, urban expansion, the environment, and computational data across various periods of the last 60 years, a hypothetical representation of the future that is now in the past.

- [Monumento Continuo \(1969\)](#) by Superstudio
- [MetaCity DataTown \(1999\)](#) by MVRDV
- [The New City \(2019\)](#) by Liam Young

4.1 Monumento Continuo (1969) by Superstudio

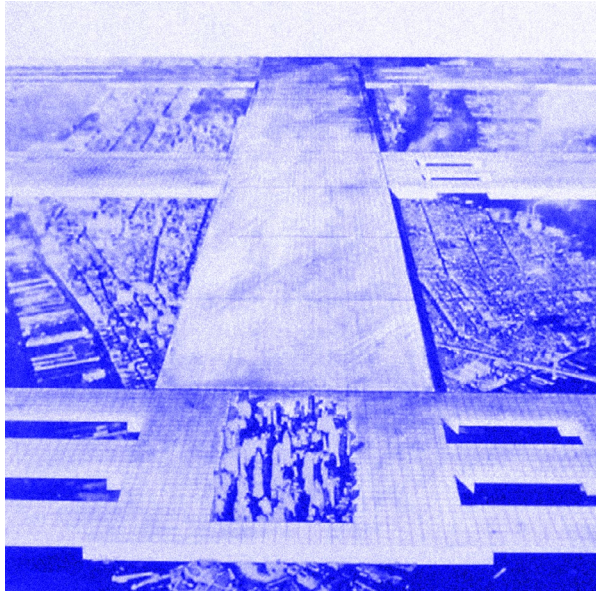


Fig. 39 / “Monumento Continuo” serie New New York: las tres etapas, by Superstudio. Collection: Musée National d’Art Morden, Centre George Pompidou, Paris.

Superstudio was an Italian architectural firm founded in 1966 by Adolfo Natalini and Cristiano Toraldo di Francia. One of their most notable works is the “Monumento Continuo”, a conceptual project proposed in 1969 as a critique of modern architecture. The project consisted of a hypothetical continuous structure that would cover the entire planet, creating a single, homogeneous environment. In the book [Beyond Speculative Design](#) the authors mention:

- ¹¹“This was an architectural structure that covered and shaped the entire world. The structure was intended to serve as a refuge for humanity, its volume acting as the optimal living space that would offer a place for every human being, leaving the rest of the Earth uninhabited allowing for natural development, free from human intervention.”

The article [Cincuenta años de Superstudio](#), Barbara Pierpaoli also mentions:

- ¹²“El Monumento Continuo revela la desmonumentalización del monumento, mina sus bases ontológicas y afirma la volatilidad– de su significado y de su figura– que ha experimentado este concepto en su historia y propone una revisión, otra mirada al monumento como paradigma de la arquitectura y de su significado.”

In their designs, Superstudio blended social criticism with irony, operating within a space where ideas took precedence over the need for final realization. Their creations consistently featured an element of irony, regardless of the scale or importance of the subject matter. The objective of their work was to explore concepts, reflecting a mindset that went beyond that a single execution.

4.2 MetaCity DataTown (1999) by MVRDV

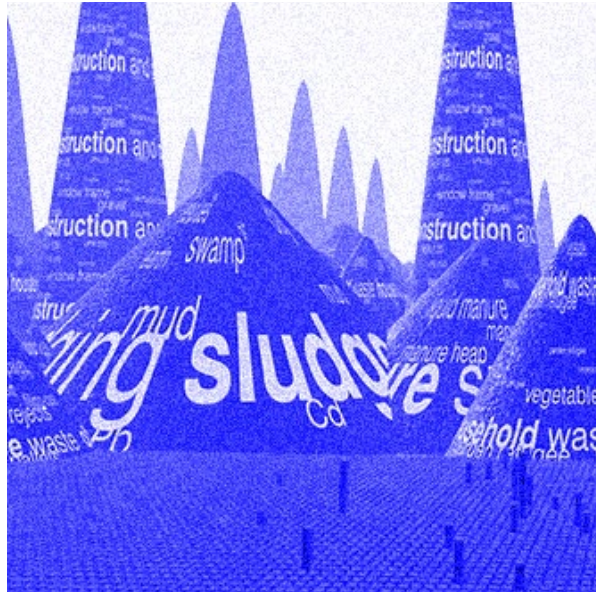


Fig. 40 / "MetaCity DataTown" by MVRDV.

MetaCity DataTown is a project by architecture and urban design firm MVRDV that reimagines the future of urban planning through the integration of big data and smart technology. In the words of the authors:

→ ¹³“Datatown is based only upon data. It is a city that wants to be described by information; a city that knows no given topography, no prescribed ideology, no representation, no context. Only huge, pure data.”

The project envisions a future city where data is utilized to inform decision-making processes, optimize urban functions, and enhance the quality of life for its inhabitants. It explores the possibilities of using data to create more efficient transportation networks, sustainable energy systems, improved public spaces, and personalized urban experiences.

One of the key features of MetaCity DataTown is its emphasis on flexibility and adaptability. The city is designed to be easily reconfigured and updated in response to changing conditions, allowing it to remain responsive and relevant over time. The project is presented through a series of visualizations, diagrams, and conceptual designs that showcase the potential impact of data-driven urbanism. They also mention:

→ ¹⁴“Datatown, therefore, is not a design; it is not about mix or not-mix, about compositions or relations. It can be seen as a prelude to further explorations into the future of the Metacity, explorations that could induce a necessary round of self-criticism in architecture and urbanism, and even a redefinition of practice.”

4.3 Planet City (2021) by Liam Young



Fig. 41 / “Planet City” by Liam Young.

Planet City is a project by Liam Young, exploring the concept of a single, highly dense and interconnected city that could house the entire global population. The project envisions a speculative urban design that could accommodate the projected 10 billion people on Earth by the year 2050. Liam Young mentions:

→ ¹⁵ “As a consequence of hundreds of years of colonisation, globalisation and never-ending economic extraction we have remade the world from the scale of the cell to the tectonic plate. But what if we radically reversed this planetary sprawl? What if we reached a global consensus to retreat from our vast network of cities and entangled supply chains into one hyper-dense metropolis housing the entire population of the earth?”

The project raises questions about the future of urbanization, sustainability, and the consequences of continued population growth. It examines the potential benefits and challenges of consolidating the global population into a single city, imagining the social, cultural, and environmental implications of such a massive urban experiment.

The design incorporates existing urban forms, such as towers and skyscrapers, but at an unprecedented scale. It envisions a megastructure that integrates infrastructure, housing, transportation systems, and even natural landscapes that already exist around the world on a huge scale.

5.0___Hardware as a City, City as a Hardware

¹⁶ *The message is clear. Nowhere escapes the net. A map of all the webs passing through any particular space would be impossibly dense. Invisible networks seemingly threaten visible means of defining space, dissolving the walls of buildings. The architecture of borders, walls, doors, and locks gives way to that of passwords, fire walls, public key encryption, and security certificates. Indeed, the idea of a space occupied by networks or superimposed by them has been replaced by that of overlapping networks within which physical space only appears as a fragile artifact or effect.*

“Network Fever” by Mark Wigley
Grey Room 04, MIT Press
(2001)

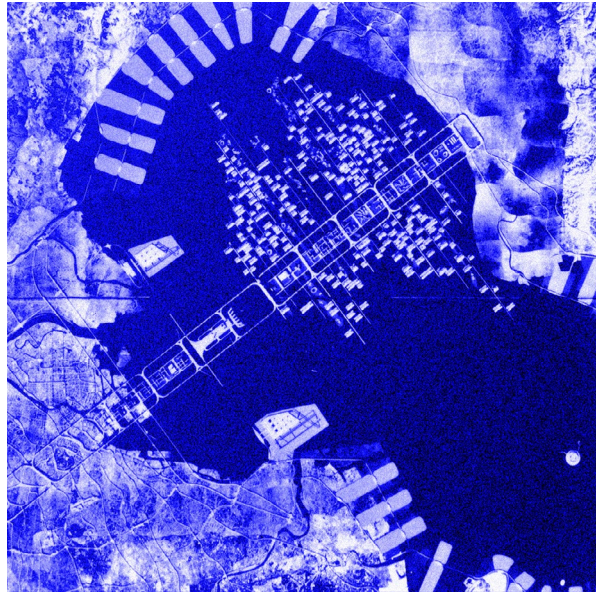


Fig. 42 / Plan for Tokyo top view by Kenzo Tange (1960)

Throughout history, the concepts of cities and housing have been the subject of numerous discussions and theories. The uncontrolled growth of cities, the emergence of megalopolises, and the interest in the future of our existence have given rise to speculation from various disciplines such as architecture and urbanism.

For example, in the 1960s, the Metabolism movement in Japan emerged from the idea of cities as living organisms in constant change. In the article [“Starting from Scratch: The Japanese Metabolists,”](#) (2016) Mónica Arzoz mentions that after World War II:

→ ¹⁷ “Japan, like many other countries, faced deserted or completely destroyed cities that needed to be rebuilt from scratch.... Metabolism proposed that cities and the architectural forms composing them should be conceived as living beings and, therefore, should grow organically in response to the new needs of their inhabitants.”

By considering the elements that enable the operation of a data center, parallels can be drawn to the functioning of a city envisioned through the principles of Metabolism as a network. Kenzo Tange, a member of the Metabolism movement, stated that:

→ ¹⁸ “Society is evolving into a more advanced state, as plants evolved into animals, and animals into men. We have begun to create a new nervous system in society using the advanced communication technology that will enable the social brain to function more effectively. In large contemporary urban complexes, communications networks twist and interlink into a complex which must be something like the nervous system of the brain.... whirling around in these brains are the people and the information. The citizens are like electrons flowing in an electronic brain.”

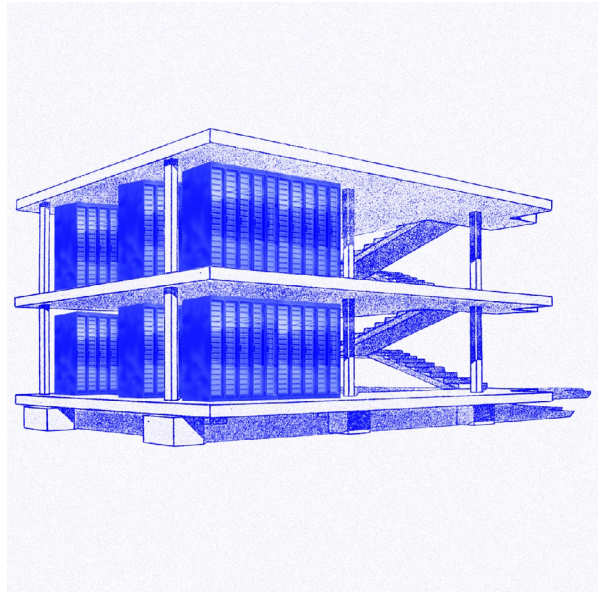


Fig. 43 / Drawing of the “Maison Dom-Ino” by Le Corbusier (1914–1915), digitally intervened with data centers inside.

What if the data center is the current data’s “machine for living in” ?

**If the data centers
are the homes where
data lives...**

**What would the city
formed by these
houses look like?**

5.1 Data center as suburbs

→ **Suburb:** an area of houses on the edge of a city.

[Cambridge Dictionary Online \(n.d.\)](#)

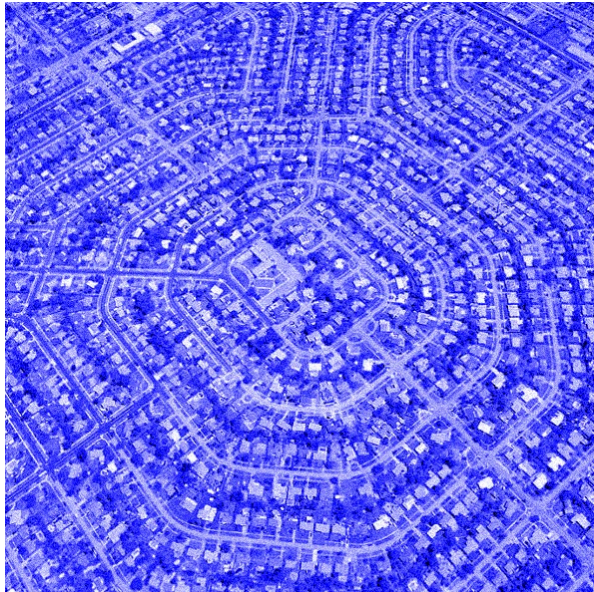


Fig. 44 / Suburb aerial view. Photo by Christoph Gielen.

A suburb is a residential area primarily designed to provide housing for workers who commute daily to other cities or nearby metropolitan areas for work. Considering that data centers are often located on the outskirts of larger cities due to the availability of larger land parcels and room for expansion, one could draw a comparison between their growth and the concept of extensive urbanism observed in suburbs.

For example, in his book “[Ciphers](#),” [Christoph Gielen](#) explores the aerial views of American sprawl, showcasing the development patterns of suburbs. He mentions:

→ ¹⁹ “Countless neighborhoods can be identified as sprawl. Such communities do not live up to the promise of an idyllic suburban alternative to the stress and hardship of dense city life - but have failed economically, socially, and ecologically. Yet planning practice in the United States largely continues to promote and subsidize this type of settlement pattern through codes and policies that would make building traditional cities and towns illegal today. These trends are perpetuated despite what we now know about more efficient use of land, energy, and water.”

When contemplating the creation of a city specifically designed to house data centers, one can draw a parallel by examining the characteristics of suburbs. This is because there are certain shared elements that serve similar functions or can be used as analogies in this context:



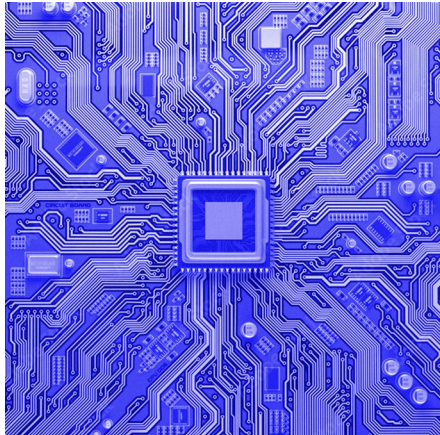
- Fig. 45 / Server racks inside of a Google's data center at Council Bluffs, Iowa.
- Fig. 46 / "Ciudad de la noche IV" Queretaro, México. Photo by Livia Corona Benjamin.

- **Function:** A suburb is a residential area designed to house people who work in a nearby town. Data centers, on the other hand, are facilities that house servers and computer equipment to store, process, and distribute data.
- **Location:** Suburbs are generally located on the outskirts of larger urban areas, while data centers may be located in different locations in both urban and rural areas, however the largest data centers are located in areas far from big cities.
- **Size and scale:** Suburbs are typically relatively large residential areas with a variety of housing and services for their residents. Data centers, on the other hand, are facilities that occupy large tracts of land, and are constantly growing.
- **Infrastructure:** Suburbs have the necessary residential infrastructure for their operation, such as homes, schools, and parks, while equipped data centers have the necessary infrastructure to maintain and operate servers, such as cooling systems, power supplies and security systems.
- **Human interaction:** Suburbs focus on providing housing for commuting workforces, while data centers are primarily technical facilities that are not intended for human residence but focus on the operation of equipment and servers to host data.

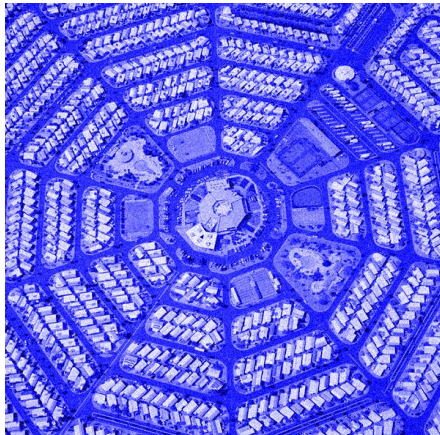
**What if data centers
become cities just for
data to inhabit?**

**What if the city
infrastructure
worked only for data?**

5.2 Hardware as a design tool



→ Fig. 47 / Circuit board system chip with core processor. Image by Maksym Yemelyanov.
→ Fig. 48 / Suburb aerial view. Photo by Christoph Gielen.



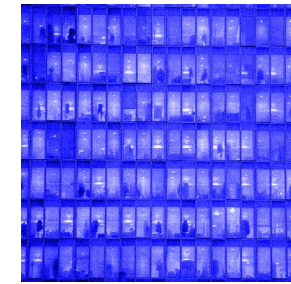
→ **Hardware:** the physical and electronic parts of a computer.
[Cambridge Dictionary Online \(n.d.\)](#)

Exploring the interior of a data center would be an interesting analogy between its hardware and the infrastructure of a city, where each component serves a specific function.

Just like a city needs a solid infrastructure to support its various activities, a data center requires a robust infrastructure to ensure its proper functioning. Similar to a city where streets, buildings, transportation systems, and public services work together for the overall functioning of the system; in a data center servers, storage systems, communication networks, and other devices collaborate to process, store, and transmit data efficiently and securely.

Additionally, the aesthetics of small components, such as microchips, within a data center can serve as a reference for a city on a different scale. Mentioned below are some similarities between the hardware of a data center and the infrastructure of a city:

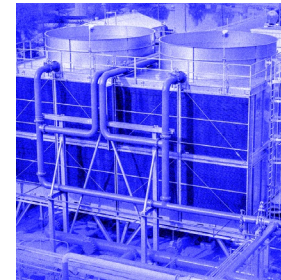
- **Processors and servers as office buildings:** Just like a city has office buildings that house different public and private companies, a data center has processors and servers that execute and store data from various applications and services.
- **Data storage as warehouses and storage facilities:** In a city, warehouses and storage facilities are places where products and supplies are kept and organized. Similarly, in a data center, data storage is performed on hard drives, solid-state drives, or other storage media, where data is categorized and stored.
- **Cooling systems as air conditioning systems:** To maintain an appropriate temperature in a data center and prevent equipment overheating, cooling systems like air conditioning units are used. This is similar to the use of cooling systems in buildings and homes in a city to ensure the comfort of its inhabitants.
- **Communication networks as transportation networks:** Just like a city has a transportation network that enables communication and the flow of people and goods, a data center has communication networks like fiber optic cables and routers that allow data transmission between different components of the data center and connect data centers with the rest of the world.



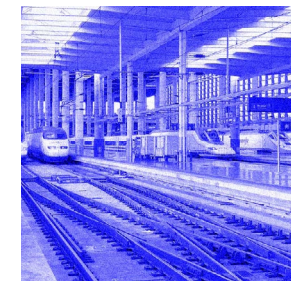
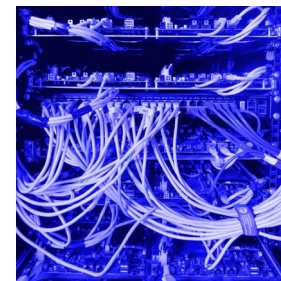
- Fig. 49 / Google Data Server racks in Council Bluffs, Iowa.
- Fig. 50 / View of a window with people working in the interior of an office building at night.



- Fig. 51 / Data storage at the Barcelona Supercomputing Center
- Fig. 52 / Storage facility

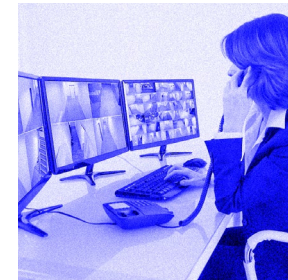
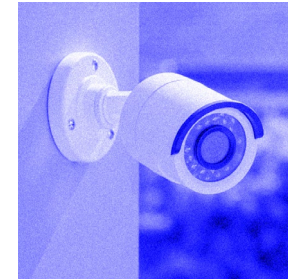
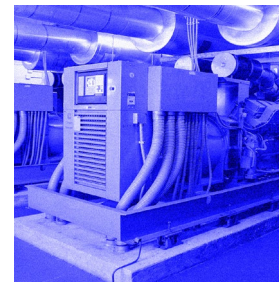
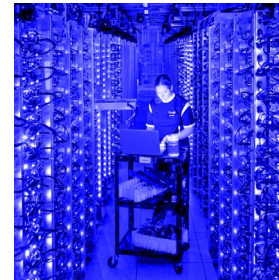
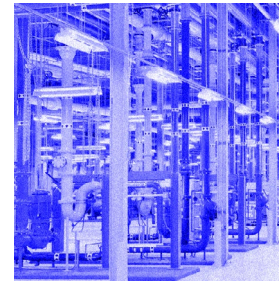


- Fig. 53 / Data center cooling system
- Fig. 54 / Housing air conditioning system



- Fig. 55 / Data Server cables
- Fig. 56 / Train track, Atocha Station, Madrid

- **Cable distribution systems as utility networks:** Similar to a city having an underground utility network made up of electricity cables and water pipes, a data center has a cable management system to organize and manage network cables and power cables that connect different equipment and components.
- **Firewalls and security systems as law enforcement and public/private security systems:** Just like a city implements security measures to protect its citizens and properties, a data center uses firewalls and security systems to protect data and equipment from external threats such as cyber-attacks and unauthorized access.
- **Monitoring and control as surveillance systems:** Similar to a city having surveillance systems monitoring day-to-day life, a data center uses monitoring and control tools to supervise the performance of equipment, temperature, power consumption, and other key parameters. This allows for the identification of potential issues and optimization of the the data center operation.
- **Backup power systems as emergency generators:** In a city, emergency generators are used as backups in case of power outages. Similarly, a data center has backup power systems like generators to ensure continuous power supply and avoid interruptions in the operation of the data center.



→ Fig. 57 / Distribution systems at Google's Douglas County data centre in Georgia
→ Fig. 58 / Transmission tower

→ Fig. 59 / An example of a type of biometric-based physical security measure
→ Fig. 60 / House security camera

→ Fig. 61 / Monitoring and control of data servers
→ Fig. 62 / Surveillance systems

→ Fig. 63 / Backup power system in a data center
→ Fig. 64 / Emergency generator

5.3 Artificial Intelligence (AI) as a design tool

→ ²⁰ “Artificial intelligence (AI) is a wide-ranging tool that enables people to re-think how we integrate information, analyze data, and use the resulting insights to improve decision making—and already it is transforming every walk of life.” Darrell M. West and John R. Allen (Brookings, 2018)

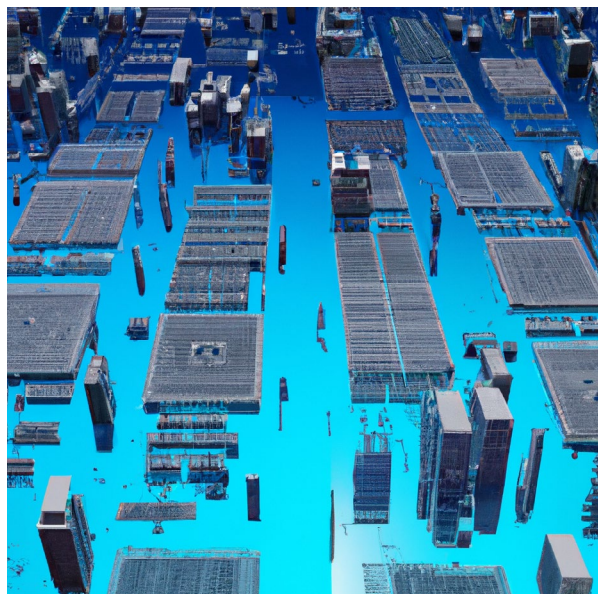


Fig. 65 / Image created by AI DALL·E 2 asking: “city built by data centers”.

In this subchapter, AI was employed as a design tool to explore the possibilities of this project. ChatGPT and DALL·E 2 were consulted as sources, and the following is a presentation of the outcomes achieved. The following text was written by ChatGPT asking: If data centers are the homes where data lives, What would the city formed by these houses look like? (write the idea without thinking that humans will live there):

If data centers are the homes where data lives, the city formed by these houses, devoid of human presence, would exist as a mechanical metropolis thriving with the pulse of computational activity. Picture a sprawling landscape of towering structures, gleaming with metallic surfaces and adorned with intricate circuitry.

In this city of machines, the buildings themselves are sentient beings, interconnected and communicating through intricate networks of fiber optic cables and high-speed data highways. They pulsate with the hum of electricity, their walls housing vast arrays of servers and supercomputers, tirelessly processing and storing data in a symphony of digital harmony.

The streets are pathways of meticulously organized cables, carrying torrents of information flowing between the buildings. Autonomous robotic entities traverse the thoroughfares, diligently maintaining the infrastructure and ensuring uninterrupted data transmission. Massive data pipelines stretch across the city, resembling arteries that channel the lifeblood of information.

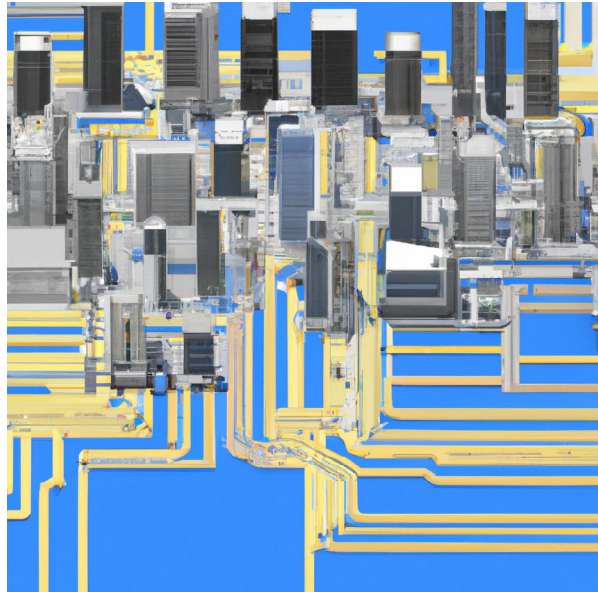


Fig. 66 / Image created by AI DALL-E 2 asking: "city built by data centers".

As you delve deeper into this city, you witness mesmerizing displays of computational power. Streams of data, represented by cascading streams of binary code or shimmering streams of light, flow through the air like ethereal rivers. Enormous screens display mesmerizing visualizations, depicting complex algorithms in constant motion, transcending human comprehension.

The city's skyline is an array of mesmerizing patterns, with data centers forming striking geometric shapes that shift and transform in real-time. Brilliant lights flicker within the buildings, a visual manifestation of the ceaseless data processing occurring within their digital walls.

Within this city, artificial intelligence thrives, each data center housing its own unique intelligence and purpose. Advanced machine learning algorithms continuously analyze and refine their own operations, enhancing efficiency and adapting to evolving data needs. They collaborate and exchange information seamlessly, forging new discoveries and optimizing their collective performance.

This city is a testament to the raw power and potential of machines and the data they harness. It operates at a scale and complexity unimaginable to human minds, driven solely by the pursuit of data-driven objectives and optimizing computational prowess.

In this extraordinary city of machines, the pursuit of knowledge and data reign supreme. It is a realm where the boundaries of human perception are transcended, as machines relentlessly delve into the depths of data, unlocking insights and discoveries that propel technological progress to unprecedented heights.

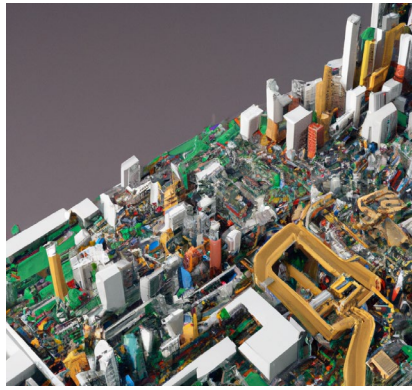
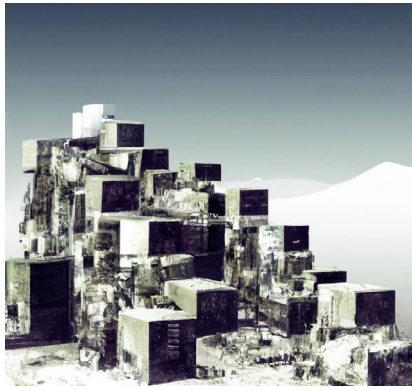
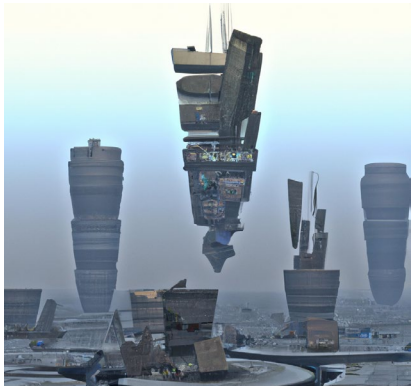


Fig. 67 / Images created by AI DALL-E 2 asking:
“speculative architecture landscape built of
digital waste”.

Fig. 68 / Images created by AI DALL-E 2 asking:
“an infinite landscape of data centers viewed
from the sky”.

Fig. 69 / Images created by AI DALL-E 2 asking: "city of circuit board system with core processor in the middle".

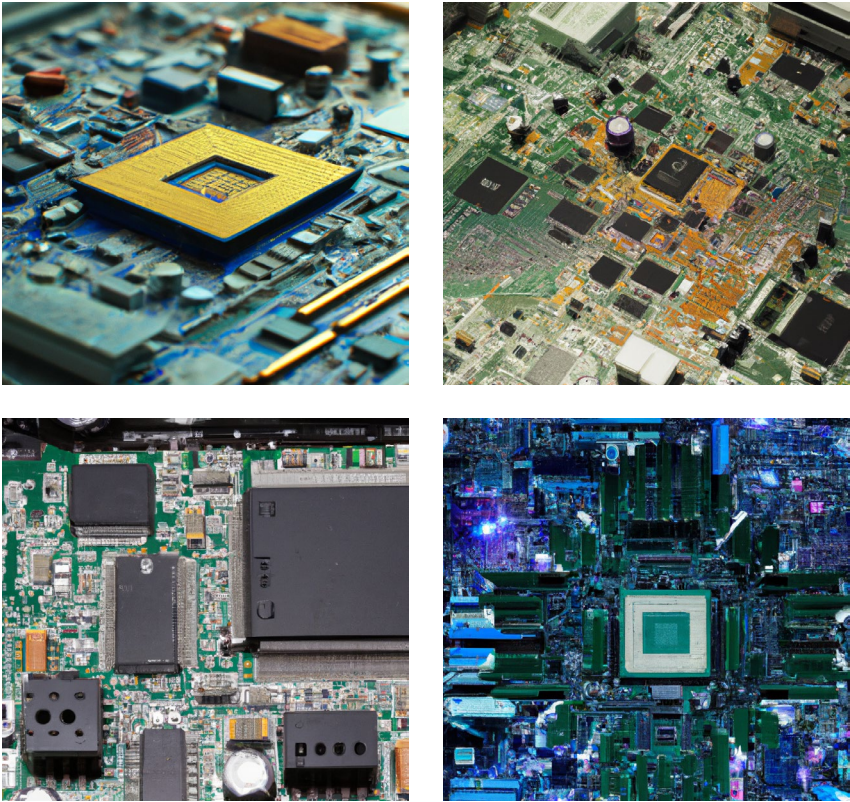
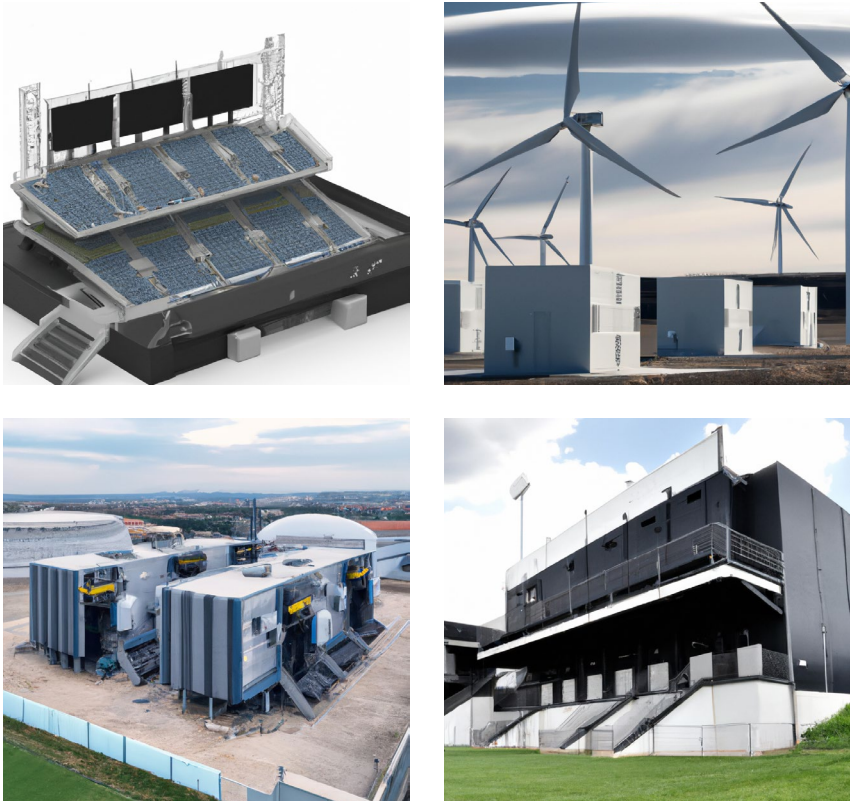


Fig. 70 / Images created by AI DALL-E 2 asking: "city infrastructure as data center".



6.0___Working with the existing

²¹ *“La implementación de Internet ha supuesto la multiplicación, masificación y democratización de las imágenes. Estamos rodeados y hemos llegado a tal saturación, que las imágenes ya no representan hechos, sino ideas y estrategias de comunicación. Como reacción ética, estética y por tanto política a esta proliferación descontrolada, proponemos una nueva ecología de las imágenes...”*

Joan Fontcuberta

Interview “Y tú, ¿quieres extinguirte como un fósil?”

by Roberta Bosco and Stefano Caldana.

(2013)



Fig. 71 / German Pavilion at the Venice Biennale of Architecture 2023.

Nowadays, a recurring theme within the creative disciplines has been to question contemporary design practices and how they impact society and the environment, as well as the approach they should have towards the future. For example, in the [Venice Biennale of Architecture 2023: The Laboratory of the Future](#), curated by Lesley Lokko, one of the most interesting interventions was the German Pavilion, [Open for Maintenance](#), curated by [ARCH+](#), [SUMMACUMFEMMER](#), and [Büro Juliane Greb](#), under the statement:

→ ²² “Open for Maintenance is not an exhibition. It is an action framework for a building culture beyond the prevailing model hinging on the exploration of resources and humans. The spotlight is put on previously used materials gathered from over 40 national pavilions and exhibitions at the 2022 Art Biennale, as well as on a broad network of Venetian and German activist groups. By carefully working with the existing -in material, social, and urban terms- the German Pavilion renders visible processes of spatial and social care work which are usually kept hidden.”

This project not only shapes the ever-changing exhibition space, but criticizes the way in which architects can transform spaces instead of building more, demolishing or abandoning, and emphasizes the discursive, material, and economic aspects of sustainability.

Therefore, due to the statement “working with existing resources”, it’s one of the main topics in the present and future of design. [What if we apply this physical idea in the digital world to talk about the data center landscape?](#)

"...¿Qué sentido tiene producir más de lo mismo cuando podemos recuperar y reciclar críticamente material existente, otorgándole nuevos sentido y significado?"

²³ Joan Fontcuberta, 2013

From the interview "Y tú, ¿quieres extinguirte como un fósil?"

6.1 Working with the existing data

All types of information are important for the functioning of the internet but with the increasing of digital world, there is also a significant amount of data waste that is entirely irrelevant and provides no value or purpose to a particular task or objective. This kind of information is useless data and is often outdated or inaccurate, resulting in a waste of resources, time, and storage space.

In this sense, data waste refers to any unnecessary or redundant data that is stored on electronic devices, such as old emails, duplicated files, obsolete documents, or data that is no longer relevant or useful. This can take up valuable storage space, slow down the performance of electronic devices, and make it difficult to find the information that is truly important.

One of the main causes of data waste is the lack of effective data management policies and practices. Many people store data without a clear understanding of its value or purpose, leading to the accumulation of unnecessary or redundant information. Additionally, the proliferation of digital devices and platforms has made it easier than ever to create and store data, further contributing to data waste.

For instance, in the world of design, there are several examples of wasteful practices. Consider the number of photos and videos that are taken but ultimately never used, or the numerous projects that remain as digital concepts, never seeing the light of day. Furthermore, how many completed projects are stored indefinitely and serve no purpose? Lastly, it's worth pondering the number of 3D models available online of the same subject, awaiting download, and likely to go unused.

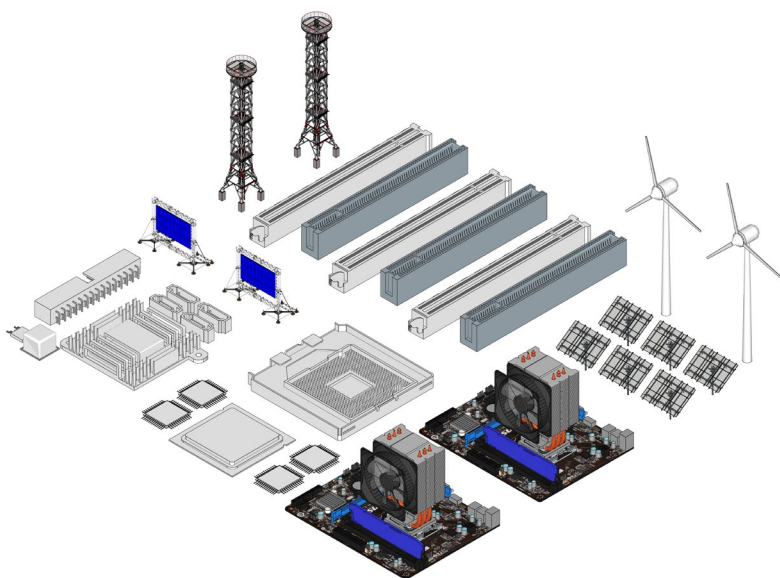
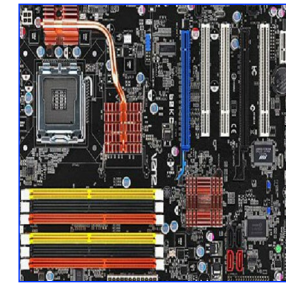
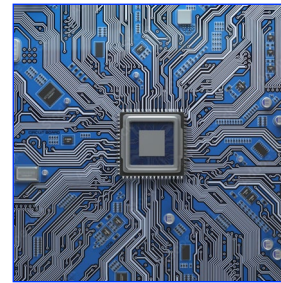
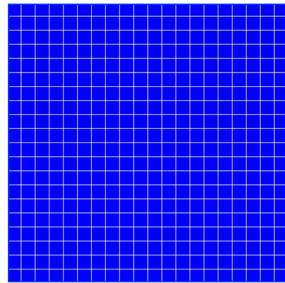


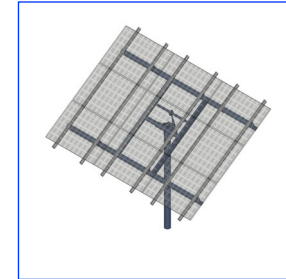
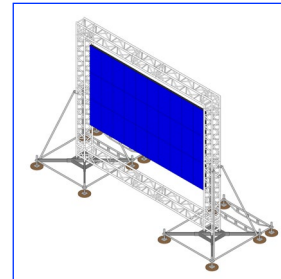
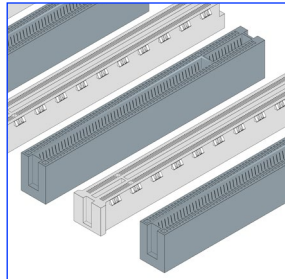
Fig. 72 / Models collected from the 3D Warehouse Sketchup.

**If we speculate about
a city shaped by data
centers, how can we
represent this with
existing resources?**



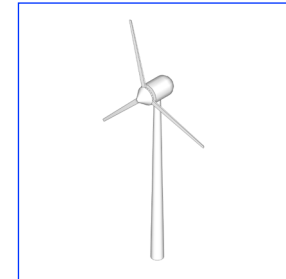
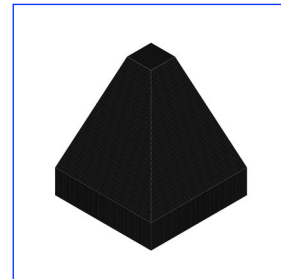
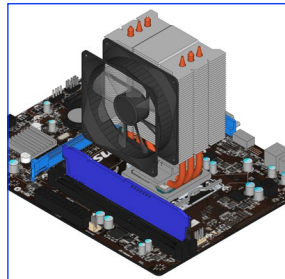
→ Fig. 73 /
Data server racks

→ Fig. 74 /
Distribution system
→ Fig. 75 /
Utility network



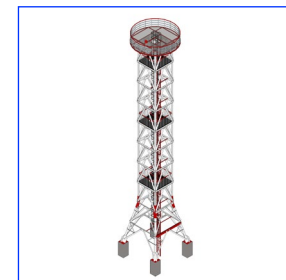
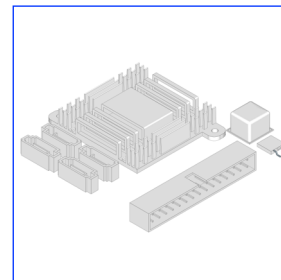
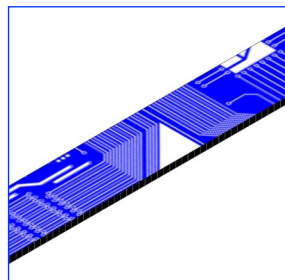
→ Fig. 76 /
Data storage

→ Fig. 77 /
Security screen
→ Fig. 78 /
Solar panels



→ Fig. 79 /
Cooling System

→ Fig. 80 /
Monitoring and control
→ Fig. 81 /
Wind turbine



→ Fig. 82 /
Communication system

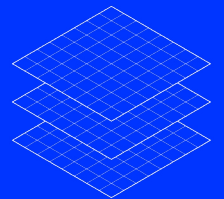
→ Fig. 83 /
Back up power system
→ Fig. 84 /
Communication tower

→ Models collected from the online 3D Sketchup Warehouse that were used to create this project.

²⁴ *“Rather than presenting utopic or dystopian visions, speculative designs pose challenging statements that attempt to explore ethical and societal implications of new science and the role product and industrial design plays in delivering this new science.”*

Matt Malpass

“Critical Design in Context. History, Theory, and Practices.”
(2017)



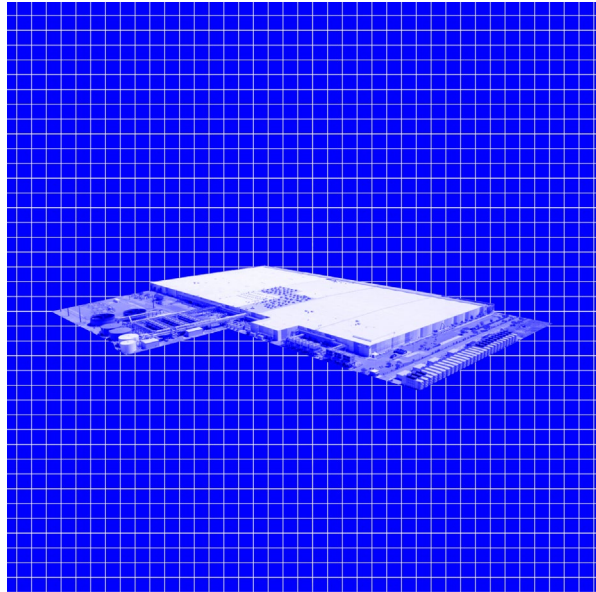


Fig. 85 / Abstract representation of the Datascape.

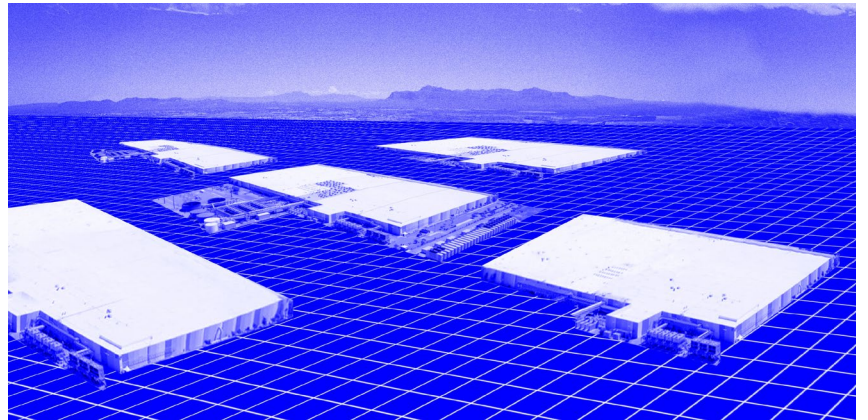
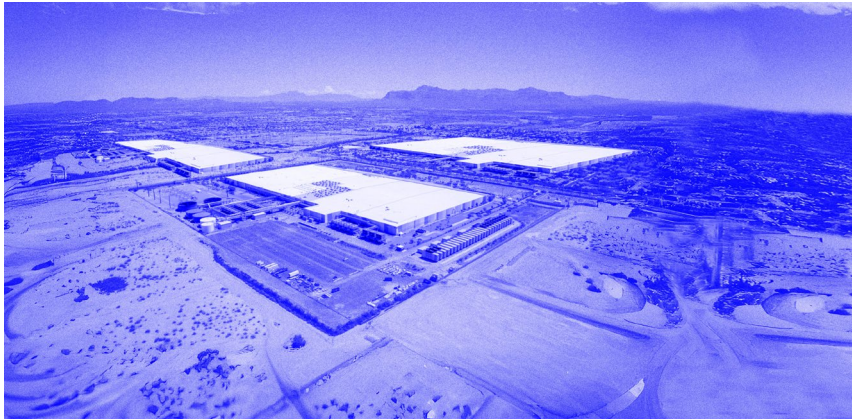
The Datascape represents the evolution of data growth.

As data continues to proliferate at an unprecedented rate, the Datascape emerges as a result of this growth and symbolizes the interconnected web of information that spans across various devices, systems, and platforms.

Within the Datascape, the growth of the network parallels the exponential growth of data itself. It encompasses the expansion of infrastructure, connectivity, and resources needed to support the ever-increasing volume and complexity of data.

The Datascape adapts and scales in response to the expanding network requirements. It involves the deployment of new technologies, such as improved networking infrastructure, advanced data storage solutions, and robust communication protocols, to accommodate the growing demands of data transmission and processing.

In this speculation, data transcends its virtual existence, taking on a tangible presence in a designed environment. It represents a new paradigm where the infrastructure itself adapts to the needs of data, fostering a symbiotic relationship between technology and the physical world. As the Datascape evolves, it becomes a thriving ecosystem where data flows seamlessly through an expansive network.



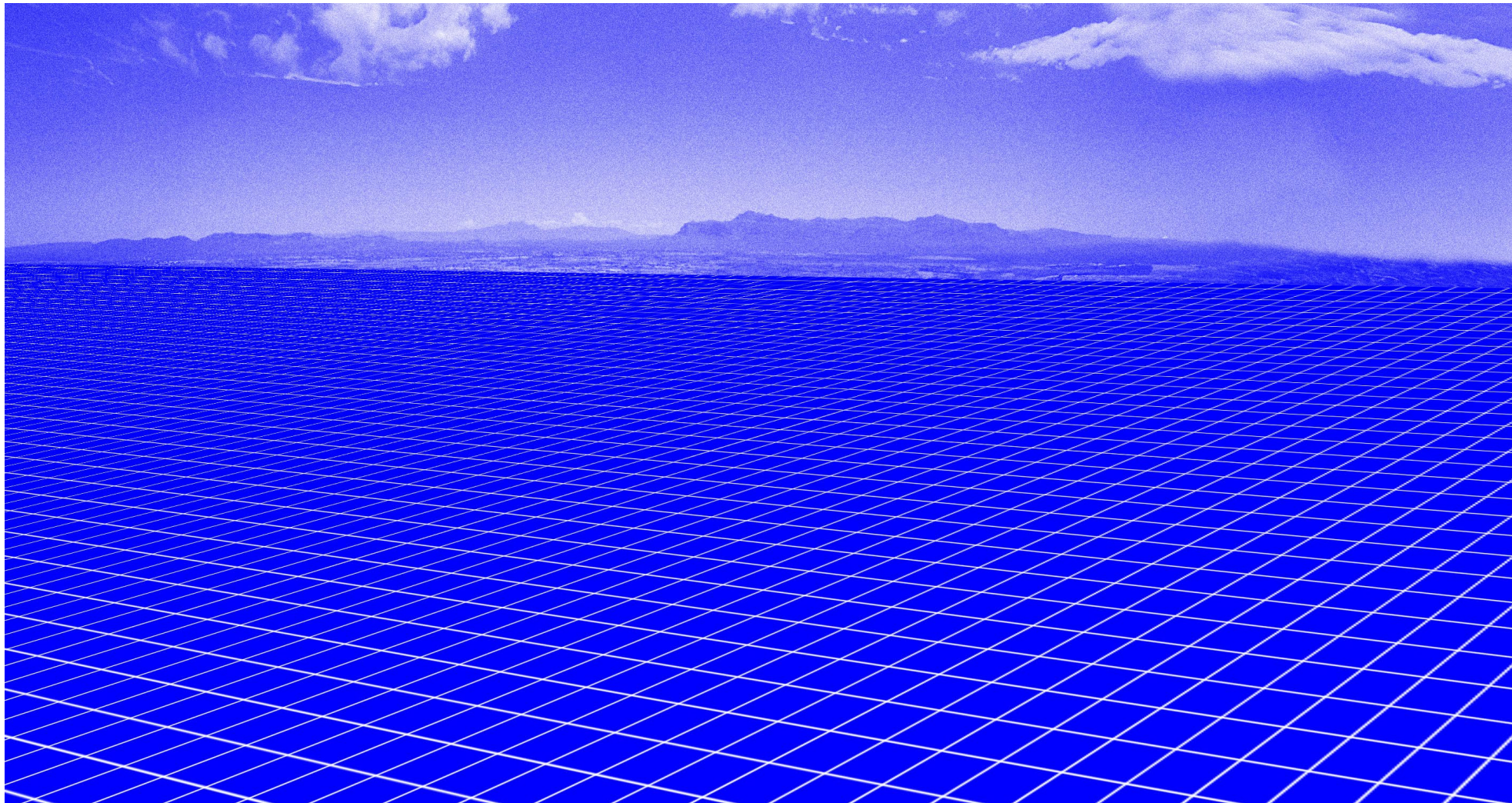


Fig. 86 / Evolution of Data Center growth (7 images).

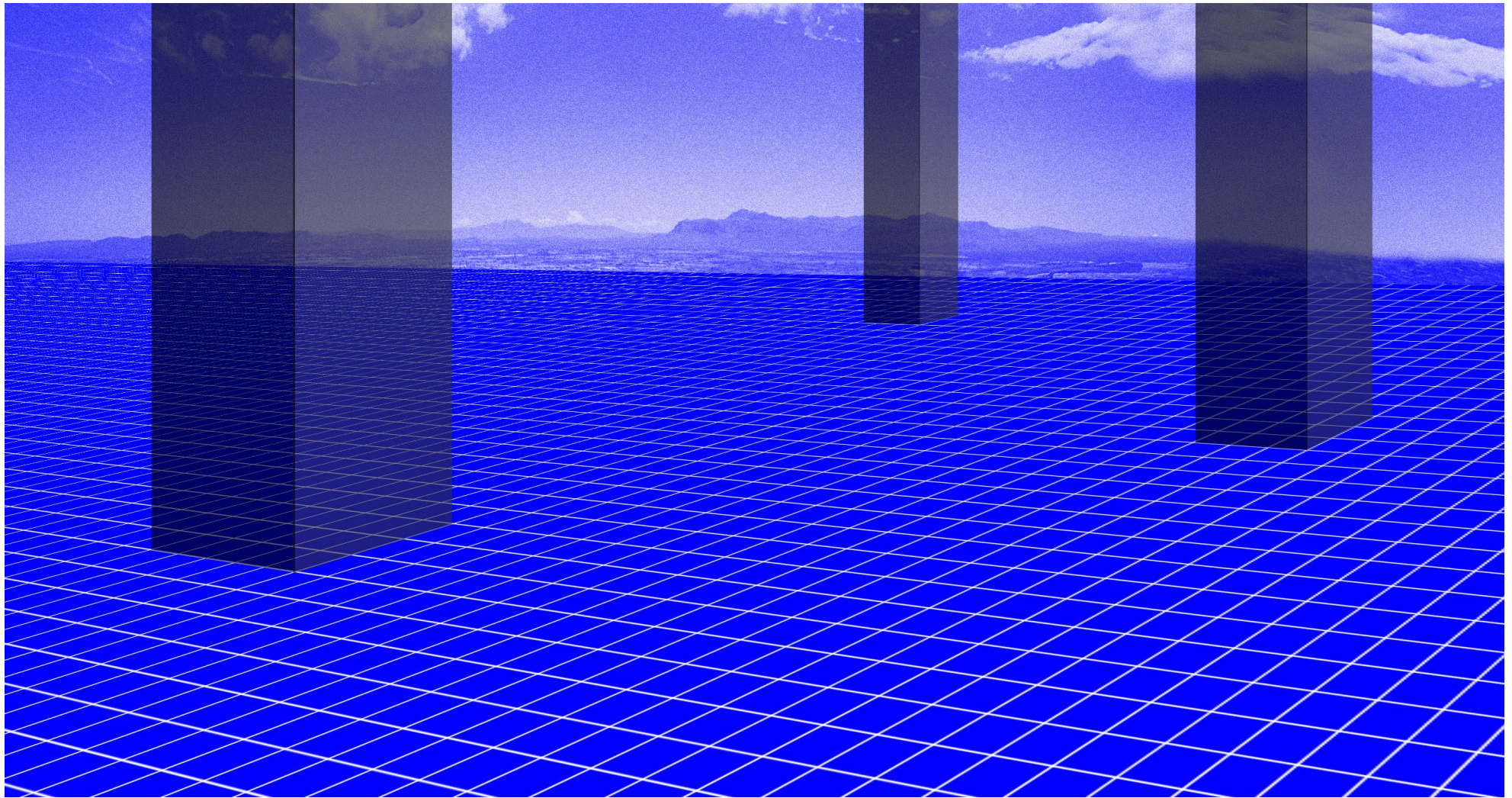


Fig. 87 / Data Center as a monument.

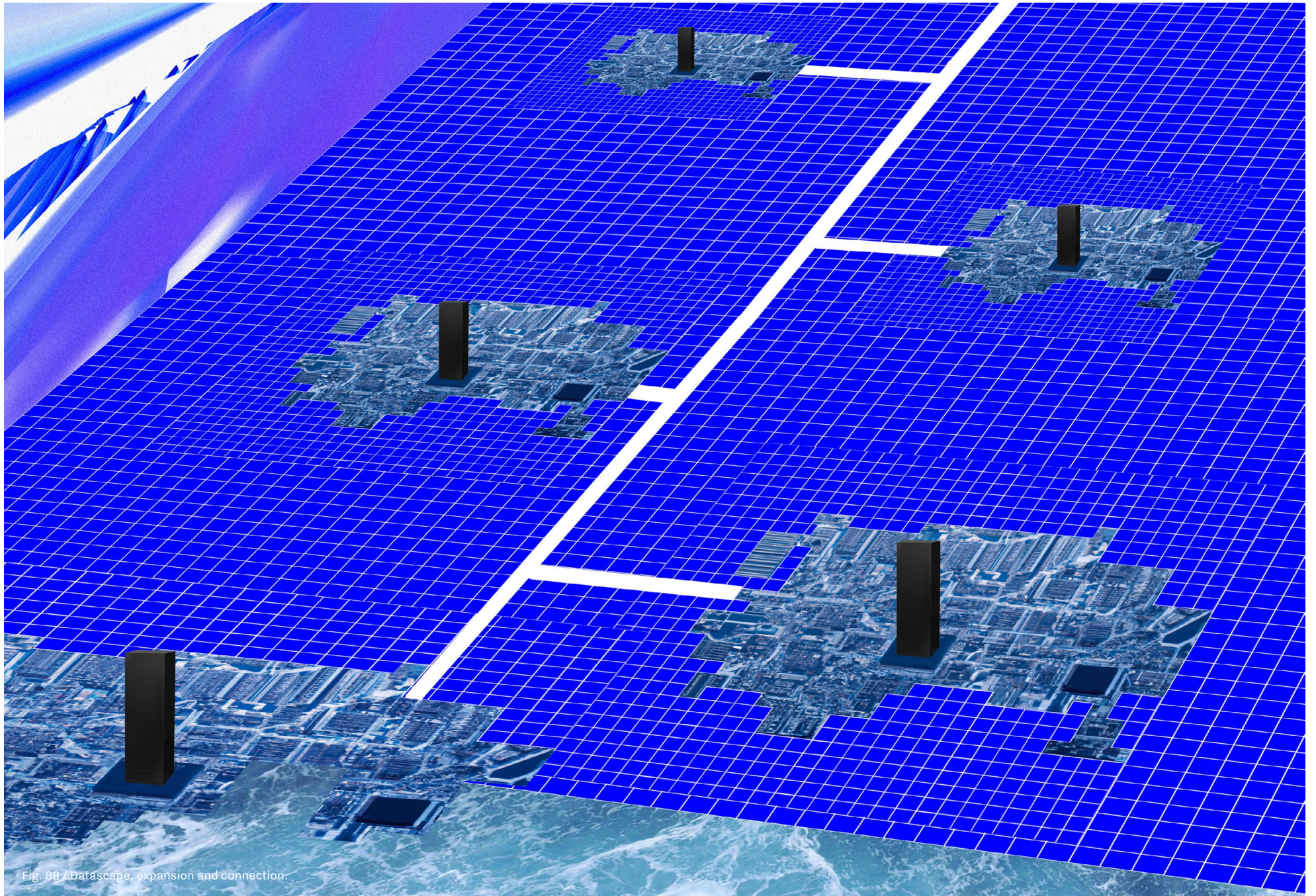


Fig. 88 / Datascape, expansion and connection.

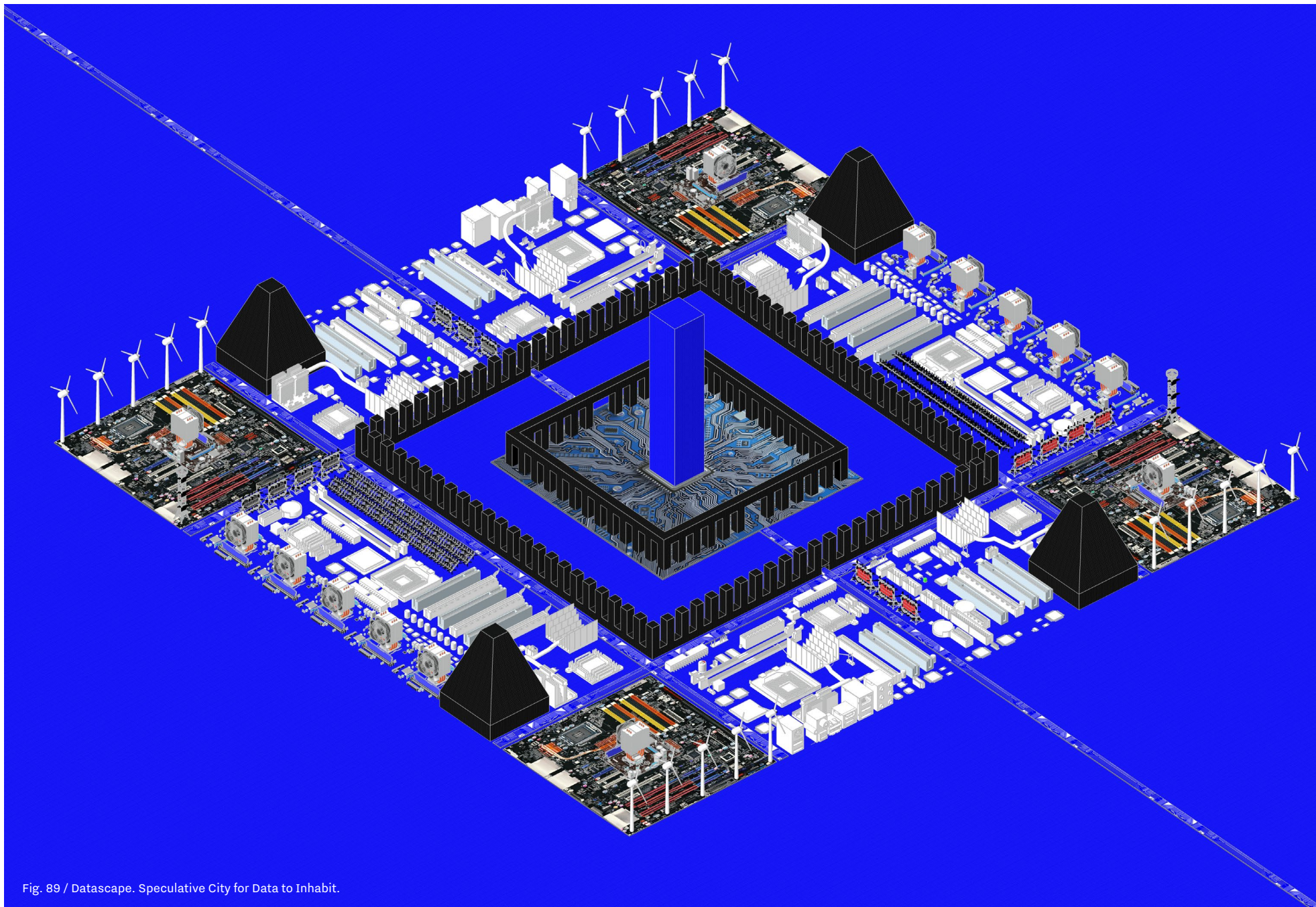


Fig. 89 / Datascape. Speculative City for Data to Inhabit.

7.1 Speculative City for Data to Inhabit

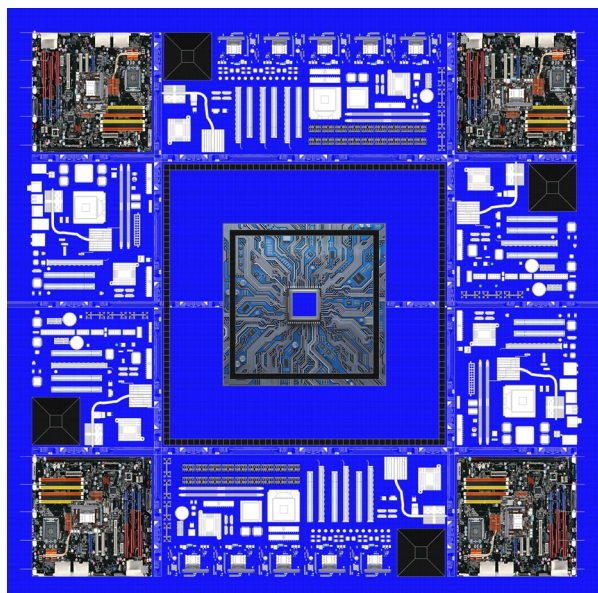


Fig. 90 / Speculative City for Data to Inhabit bird's-eye view.

MANIFESTO

- This city enables data to assume a physical form, existing as an entity with its own infrastructure and architecture.
- This city is purpose-built to accommodate the needs of data and provide a habitat for its existence.
- This city originates from an existing data center or “core” where information is stored and processed.
- The city grows and expands organically from its core, resembling a living organism.
- This city dynamically adapts and extends its physical boundaries to accommodate the expanding needs.
- This city prioritizes scalable infrastructure, ensuring there is always enough space and resources to meet the demands of the ever-growing data.
- This city has a layout and structures that are intricately designed to maximize efficiency and security.
- This city protects the core like a fortress.
- This city utilizes the digital waste it generates to construct its walls.
- This city considers the core as a monument.
- This city has a vast network of data servers running beneath its streets, interconnecting every corner and enabling lightning-fast communication and data exchange.
- This city expands through the network of data servers running underground.
- This city is not an isolated entity but an integral part of a larger ecosystem that is interconnected with other similar data cities, forming a network of hubs.
- This city thrives on the resources available in its location and shares them with cities that require them to continue their work.

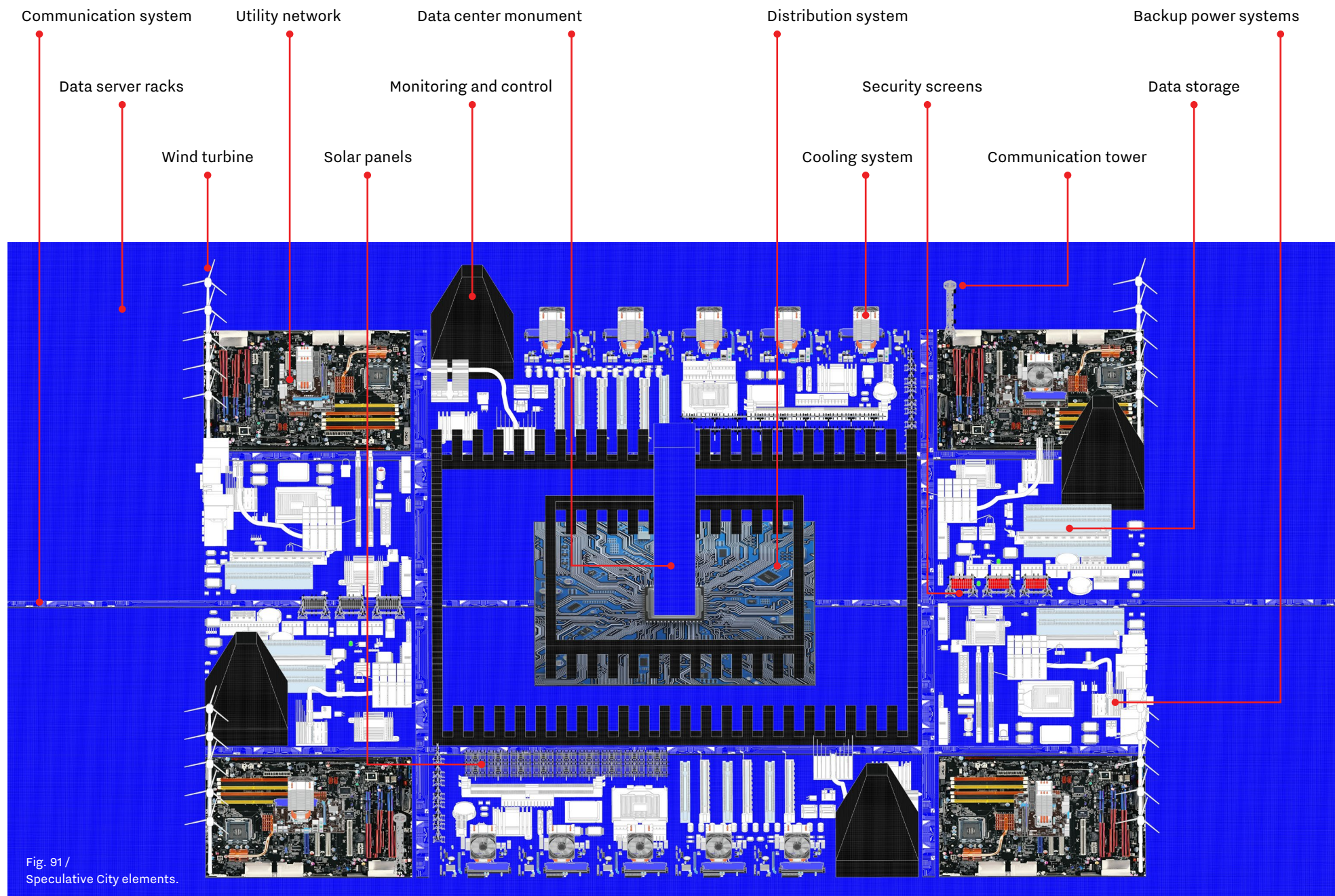
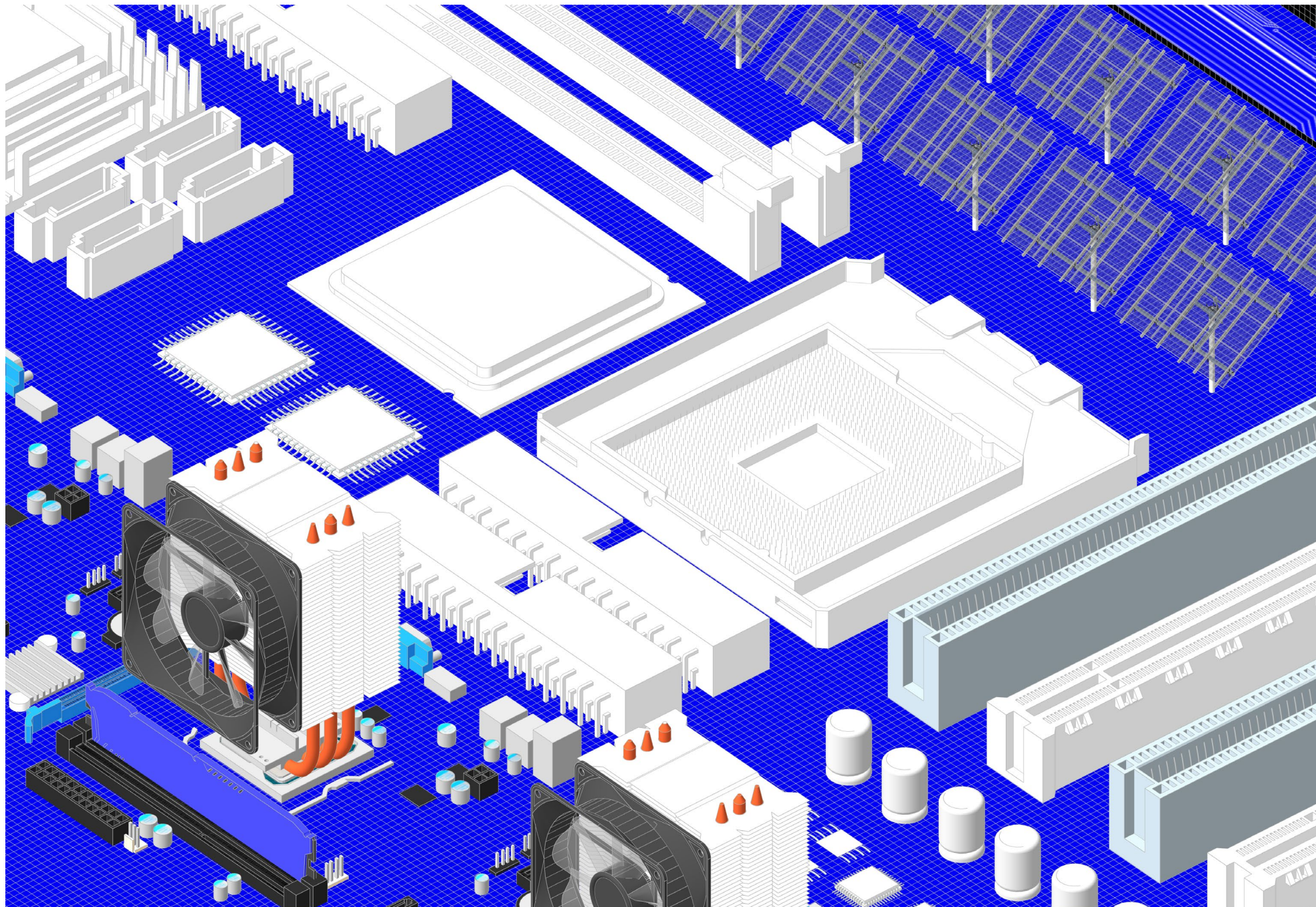
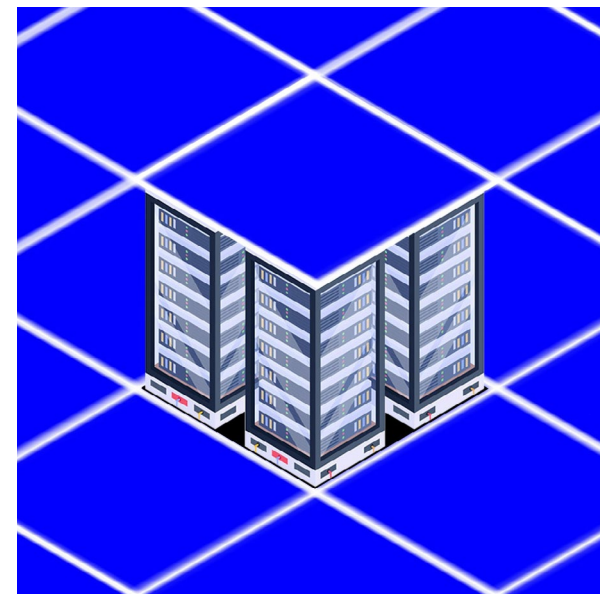
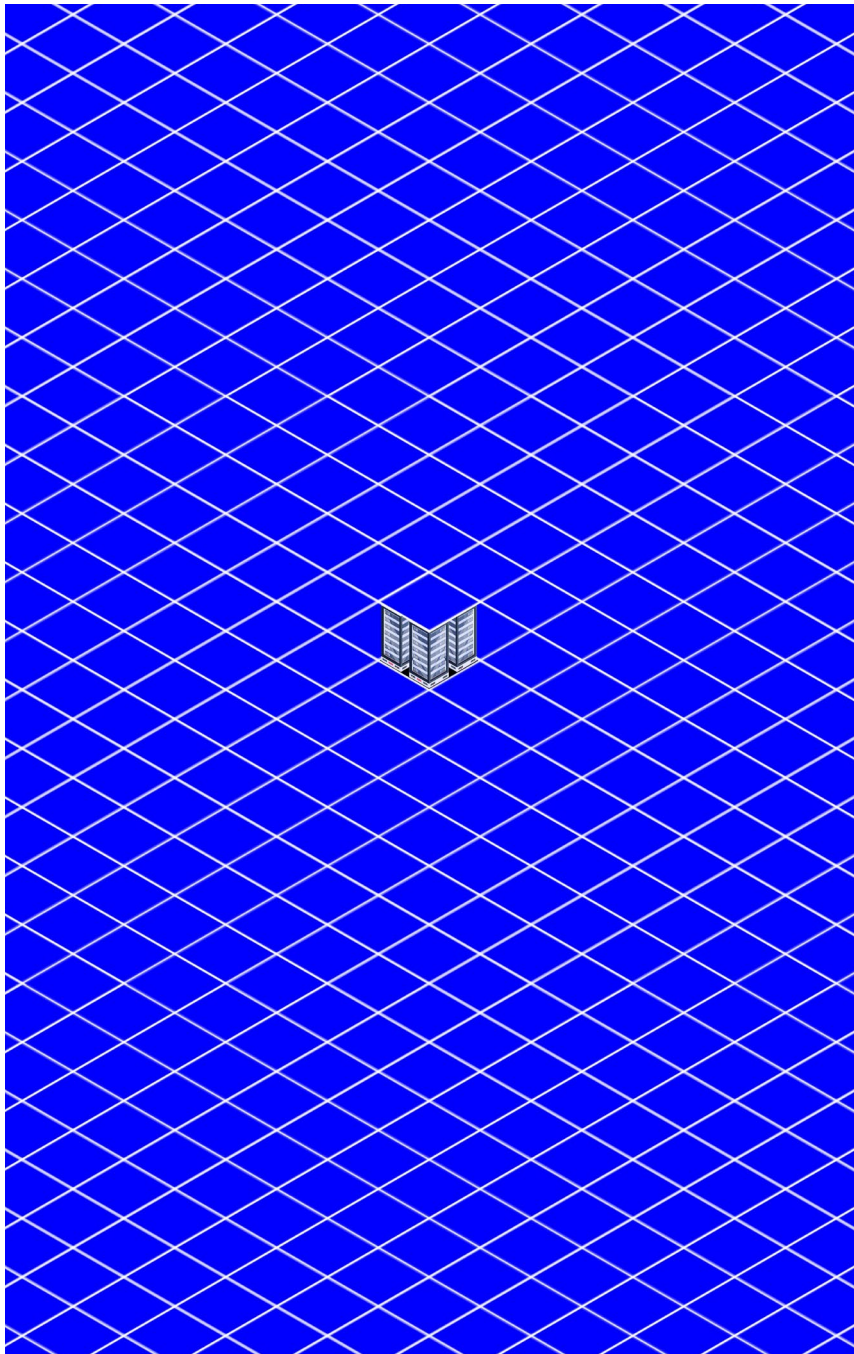
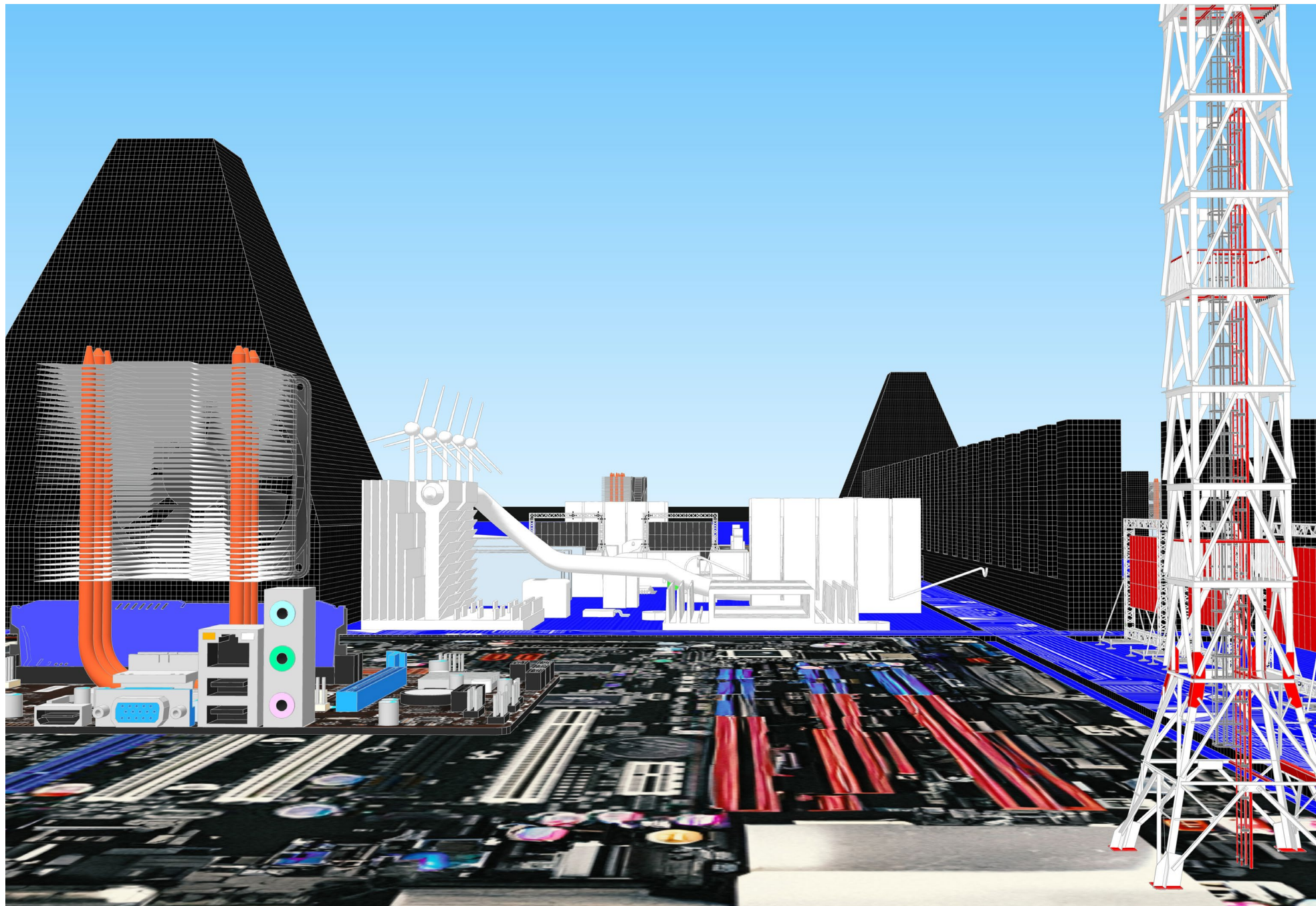


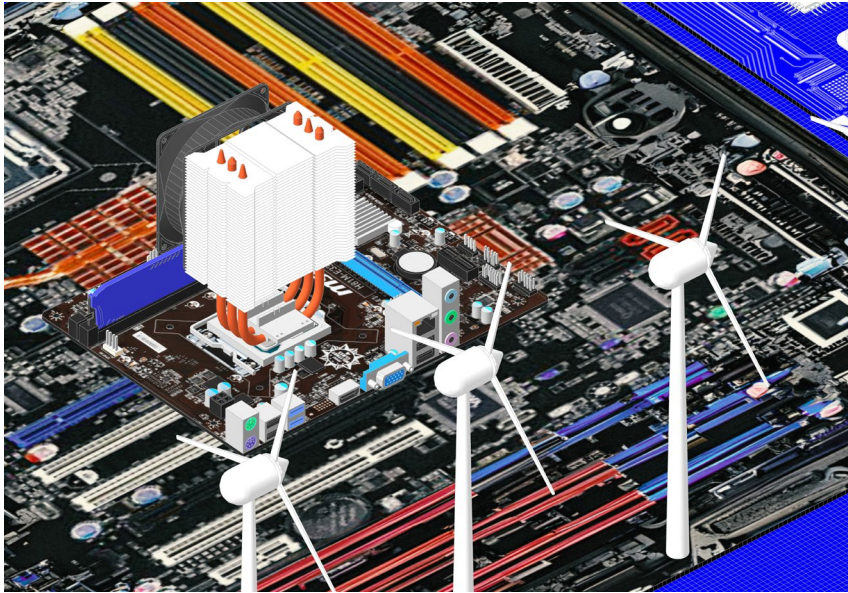
Fig. 91 /
Speculative City elements.



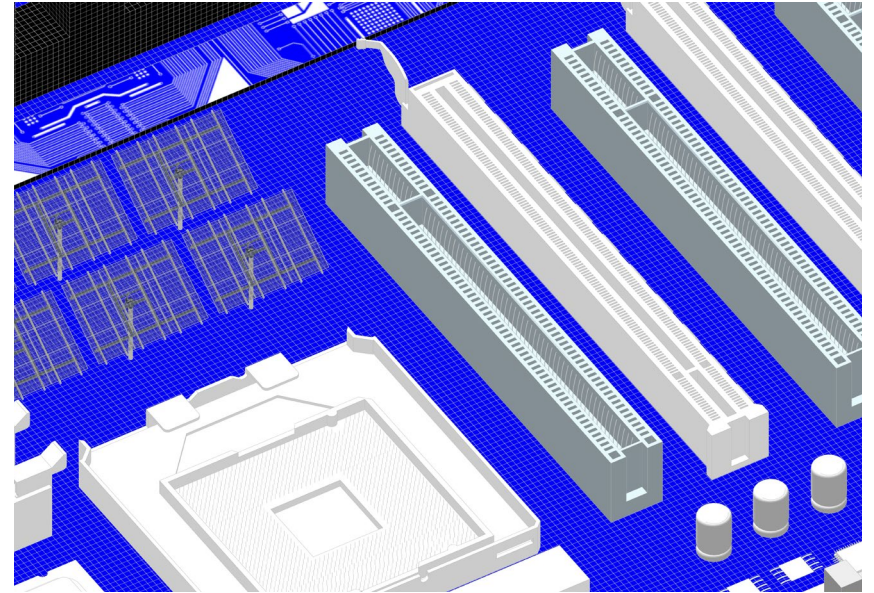


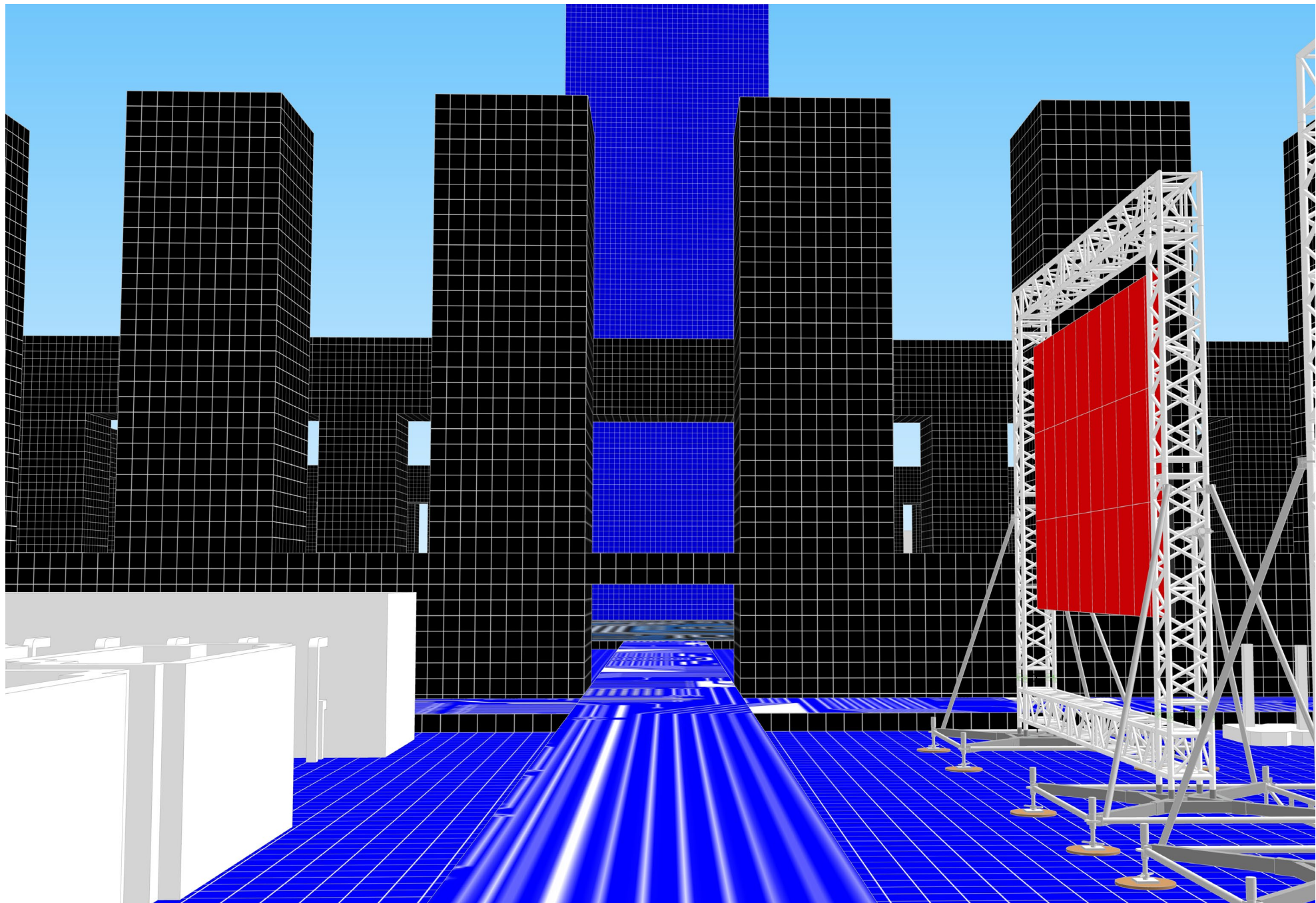
→ Fig. 93 and 94 / Data servers stored on the network.

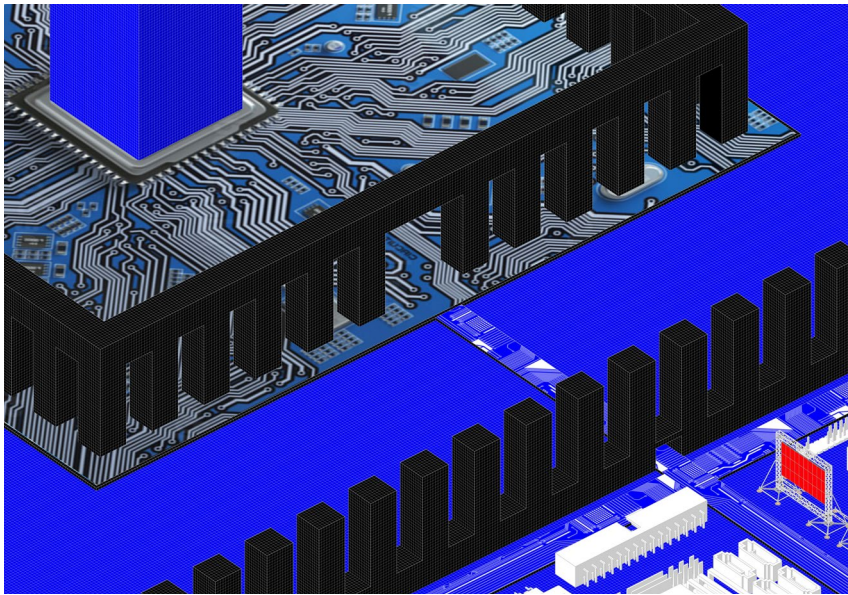




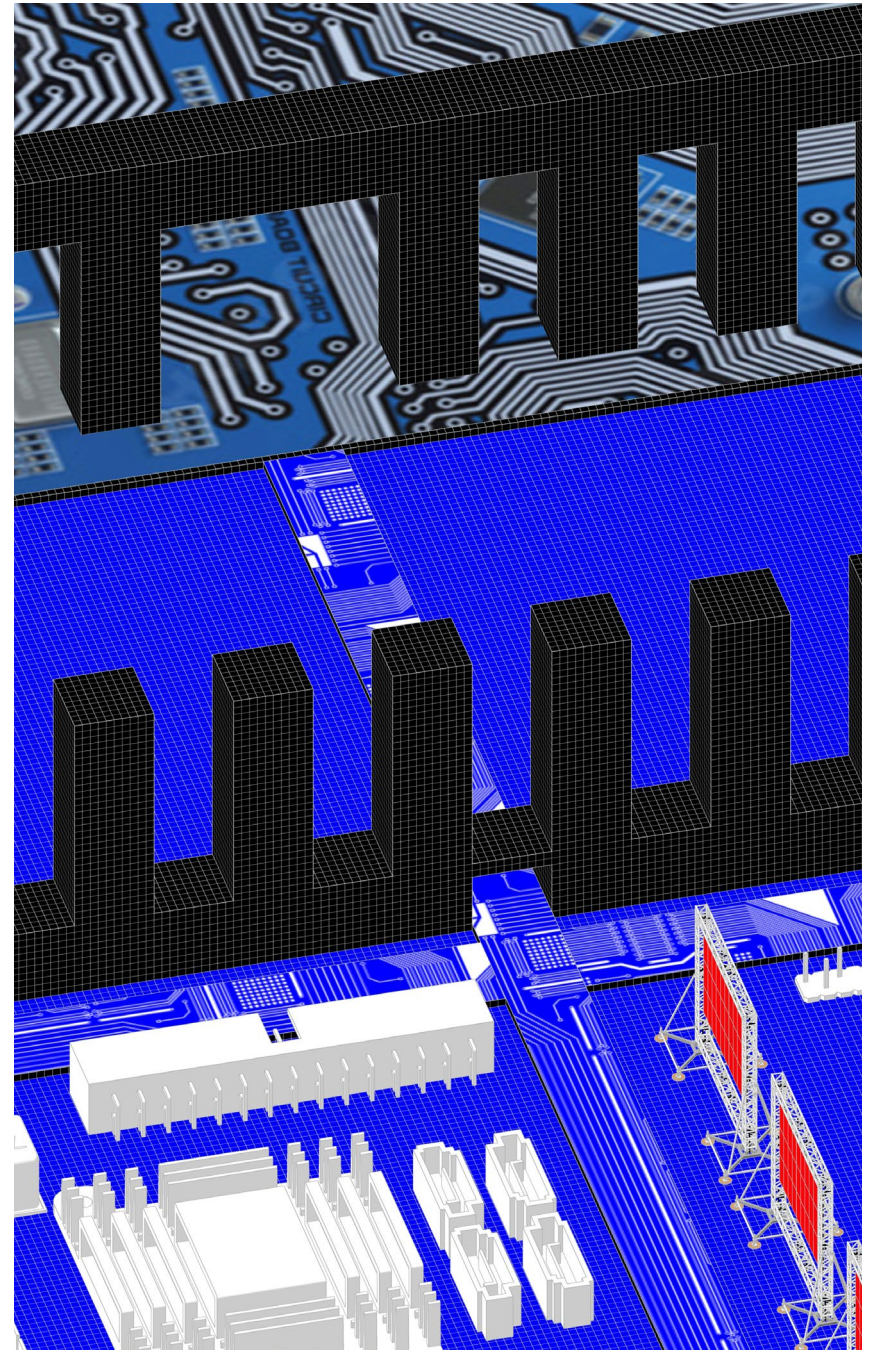
→ Fig. 96 and 97 / Speculative City for Data to Inhabit isometric.

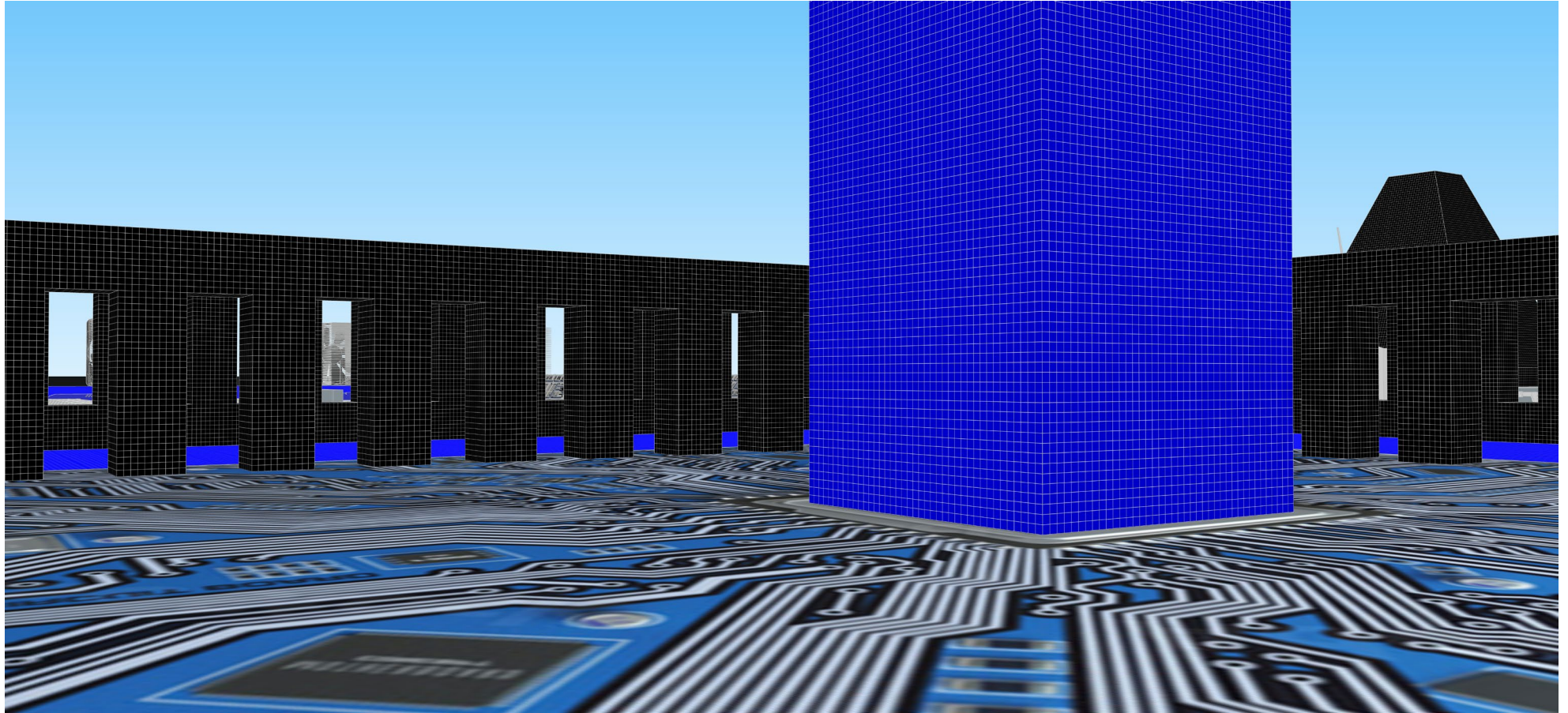






→ Fig. 99 and 100 / Speculative City for Data to Inhabit isometric.





→ Fig. 101 / Speculative City for Data to Inhabit isometric.



Fig. 102 / Video still

This video is an audiovisual summary of the entire research. It aims to present the general idea of the project in a brief and concise manner.

The video was created using footage taken from YouTube, as well as videos from the final proposal of Datascape. Speculative City for Data to Inhabit.

Size: 2560×1440px

Duration: 04:09

Audio: Stereo

Find the video attached to this link: [Datascape \(video\)](#)

²⁵ *“The ideas freed by speculative design increase the odds of achieving desirable futures.”*

Anthony Dunne and Fiona Raby
“Speculative Everything. Design, Fiction and Social Dreaming”
(2013)

Speculative design has become a way to explore and imagine possible futures based on the needs and demands of contemporary society. In contrast to the utopias of the 20th Century, the current approach to the future has acquired a dystopian panorama due to the crises we are facing today in terms of ecology, society, politics, culture, etc.

Under this premise, one of the fundamental aspects of the development of this project was questioning the way design is conceived and executed. Speculative Design provides the excuse to question and contemplate the consequences of the design choices we make today and their potential impact on the future. Consequently, Datascape has taken this valuable opportunity to speculate about the concept of data and explore its imperceptible qualities in a tangible way.

Initially, the project aimed to steer the conversation towards the idea of recycling digital waste and the concept of the ecology of images, as mentioned by *Joan Fontcuberta*²¹. However, during the research, many ways emerged that offered the opportunity to delve into the physical consequences of data growth. This allowed for a tangible visualization of this trend and provided a different approach to the subject.

The unprecedented growth of data centers has led to their consideration as architectural icons of our time, as described in *Liam Young's* book "Machine Landscapes".¹⁰ Finally, the project took a focused direction in the specific study of data centers and their projected future growth. This led to the creation of Datascape, a hypothetical city inhabited by data. While this project may exaggerate reality, it has provided an opportunity to visualize a concept that is often invisible or imperceptible in our daily lives. By giving it a physical dimension, it has enabled the anticipation and understanding of the potential consequences that data growth could entail.

The idea of recycling data was not entirely discarded, as it was utilized but now more as a design tool for this speculative city, taking existing 3D models from the internet to give them a different meaning and interpretation. Another interesting point that was addressed is how Artificial Intelligence can be part of the design process, since it opens up the possibility of an infinite number of unimagined ideas thought up by a non-human brain that could serve as an inspiration during the creative process.

The research has highlighted the importance of embracing and utilizing the resources, systems, and knowledge that already exist rather than constantly trying to build new walls. It acknowledges that resources are finite and it's essential to maximize their potential by repurposing, adapting, and innovating within existing frameworks. Furthermore, this mindset encourages collaboration, cooperation, and the sharing of resources. It emphasizes the importance of collective action and community engagement in finding solutions to complex problems.

Responding to the question generated in the hypothesis, [What if data centers become cities just for data to inhabit?](#) has brought a reflection about a more sustainable and resource-conscious approach. It encourages to reevaluate consumption patterns, rethink design processes, and reconfigure systems to make the most of what we already have.

The findings and insights generated by this project underscore the importance of critically examining digital practices and urgently adopting responsible and sustainable approaches to data production and consumption. As the dependence on digital technologies escalates, it becomes imperative to consider the environmental consequences associated with data generation. In conclusion, Datascape significantly contributes to the ongoing discourse on the impacts of data production while visualizing a potential future scenario that could significantly affect the environment.

Footnotes

- 1_MORTON, TIM. Interview with Tim Morton by Lucas van der Velden & Arie Altena. Dark Ecology [on line]. Sonic Arts, October 12, 2014 [Accessed: April 06, 2023]. Available at: <https://portal.sonicacts.com/darkecology/field-notes/dark-ecology-interview-tim-morton>
- 2 & 3_Cambridge Dictionary [on line]. (n.d.) [Accessed: June 01, 2023]. Available at: <https://dictionary.cambridge.org/>
- 4_TAYLOR, PETROC. Amount of data created, consumed, and stored 2010-2020, with forecasts to 2025 [on line]. Statista, September 8, 2022 [Accessed: April 02, 2023]. Available at: <https://www.statista.com/statistics/871513/worldwide-data-created/>
- 5_MILLS, MARK. Blowing Past the Zettabyte Era [on line]. American Energy Society, 2016 [Accessed: April 02, 2023]. Available at: <https://energytoday.energysociety.org/blowing-past-the-zettabyte-era.html>
- 6_What is cloud computing? [on line]. Cloudflare, 2023 [Accessed: April 19, 2023]. Available at: <https://www.cloudflare.com/learning/cloud/what-is-the-cloud/>
- 7_FORTI, VANESSA, PETER; BALDÉ, CORNELIS; KUEHR, RUEDIGER; BEL, GARAM. The Global E-waste Monitor 2020 [on line] In: World production of e-waste during 2019 [Accessed: April 12, 2023]. Available at: https://ewastemonitor.info/wp-content/uploads/2020/11/GEM_2020_def_july1_low.pdf
- 8_FORTI, VANESSA, PETER; BALDÉ, CORNELIS; KUEHR, RUEDIGER; BEL, GARAM. The Global E-waste Monitor 2020 [on line] In: Global E-Waste generated from 2014 to 2019 and an estimation to 2030. [Accessed: April 12, 2023]. Available at: https://ewastemonitor.info/wp-content/uploads/2020/11/GEM_2020_def_july1_low.pdf
- 9_AIZARANI, JESSICA. Energy demand in data centers worldwide from 2015 to 2021 [on line] In: Global data centers energy demand by type 2015-2021, February 23, 2023 [Accessed: April 12, 2023]. Available at: <https://www.statista.com/statistics/186992/global-derived-electricity-consumption-in-data-centers-and-telecoms/#:~:text=Glo%20data%20centers%20energy%20demand%20by%20type%202015%2D2021&text=Traditional%20data%20centers%20globally%20have,33%20terawatt%20hours%20by%202021>
- 10_YOUNG, LIAM, 2019. Machine landscapes : architectures of the post-anthropocene. Oxford: John Wiley & Sons. ISBN 1119453011. (pp. 9)
- 11_MITROVIĆ, I., AUGER, J., HANNA, J., & HELGASON, I. (Eds.) (2021). Beyond Speculative Design: Past – Present – Future. University of Split. ISBN 978-953-6617-56-2 (pp. 56-57)
- 12_PIERPAOLI, B., 2017. Cincuenta años de superstudio. Una lectura contemporánea del monumento continuo. Revista Indexada de Textos Académicos, no. 7. ISSN 2340-9711. DOI 10.24192/2386-7027(2017)(v7)(08). (pp. 110-119)
- 13 & 14_MVRDV (MAAS, WINY; VAN RIJS, JACOB; DE VRIES, NATHALIE). MetaCity-DataTown [on line]. 1999 [Accessed: March 25, 2023]. Available at: <https://www.mvrdv.com/projects/147/metacity--datatown->
- 15_YOUNG, LIAM. Planet City [on line]. [Accessed: March 20, 2023]. Available at: <https://planetcity.world/Main>
- 16_WIGLEY, MARK, 2001. Network Fever, Grey Room 04. Revised ed. Cambridge, MA ; The MIT Press. ISBN: 0-262-75493-2. (pp. 83)
- 17_Arzo, Mónica. Empezar de cero. Los metabolistas japoneses [on line]. Arquine, September 15, 2016 [Accessed: June 12, 2023]. Available at: <https://arquine.com/empezar-de-cero-los-metabolistas-japoneses/>
- 18_WIGLEY, MARK, 2001. Network Fever, Grey Room 04. Revised ed. Cambridge, MA ; The MIT Press. ISBN: 0-262-75493-2. (pp. 104)
- 19_GIELEN, CHRISTOPH, 2013. Ciphers. Solving Sprawl. Editorial JOVIS. ISBN: 978-3-86859-318-1 (pp. 49)
- 20_M. West, Darrell and R. Allen, John. How artificial intelligence is transforming the world [on line]. Brookings April 24, 2018 [Accessed: June 14, 2023]. Available at: <https://www.brookings.edu/research/how-artificial-intelligence-is-transforming-the-world/>
- 21 & 23_Interview with Joan Fontcuberta by Bosco, Roberta and Caldana, Stefano. Y tú, ¿quieres extinguirte como un fotosauro? [on line]. El País, March 04, 2013 [Accessed: March 10, 2023]. Available at: <https://blogs.elpais.com/arte-en-la-edad-silicio/2013/03/y-tu-quieres-extinguirte-como-un-fotosauro.html>
- 22_ARCH+, Summacumfemmer, Büro Juliane Greb. OPEN FOR MAINTENANCE [on line]. [Accessed: June 10, 2023]. Available at: <https://archplus.net/en/open-for-maintenance/>

- 23_Interview with Joan Fontcuberta by Bosco, Roberta and Caldana, Stefano. Y tú, ¿quieres extinguirte como un fotosauro? [on line]. El País, March 04, 2013 [Accessed: March 10, 2023]. Available at: <https://blogs.elpais.com/arte-en-la-edad-silicio/2013/03/y-tu-quieres-extinguirte-como-un-fotosauro.html>
- 24_Malpass, Matt. Critical Design in Context. History, Theory, and Practices. Speculative design. Bloomsbury, 2017. ISBN 1350125172
- 25_DUNNE, ANTHONY; RABY, FIONA, 2013. Speculative Everything: Design, Fiction, and Social Dreaming. 2013. MIT Press. ISBN 978-0-262-01984-2.

Articles

- PIERPAOLI, B., 2017. Cincuenta años de superstudio. Una lectura contemporánea del monumento continuo. Revista Indexada de Textos Académicos, no. 7, pp. 110-119. ISSN 2340-9711. DOI 10.24192/2386-7027(2017)(v7)(08).

Audiovisuals

- Young, Liam. Liam Young: Planet City - a sci-fi vision of an astonishing regenerative future | TED [video]. Ted Talks, 2021 [online]. [Accessed: March 15 2023]. Available at: <https://www.youtube.com/watch?v=AX4ewS-YIbA>
- MVRDV (Maas, Winy; van Rijs, Jacob; de Vries, Nathalie). MetaCity-DataTown [video]. MVRDV film, 1999 [online]. [Accessed: 11 April 2023]. Available at: <https://www.youtube.com/watch?v=JiMJpfsavME>

Field study

- The Barcelona Supercomputing Center (BSC). <https://www.bsc.es/>
- Venice Biennale of Architecture 2023: The Laboratory of the Future. <https://www.labiennale.org/en/architecture/2023>
- Digital Impact exhibition at the Design Museum in Barcelona. <https://www.digitalimpact.art/?lang=en>

Bibliography

- YOUNG, L., 2019. Machine landscapes : architectures of the post-anthropocene. Oxford: John Wiley & Sons. ISBN 1119453011.
- YELAVICH, S., 2015. Speculative Everything: Design, Fiction, and Social Dreaming. 2015. UK: Oxford University Press. ISBN 0262019841.
- MAAS, W., 1999. Metacity, datatown. Rotterdam: MVRDV, 010. ISBN 9064503710.
- PRICE, C., FALAGÁN, D.H. y FALAGÁN, D.H. (David H., 2022. Una Arquitectura de la aproximación : ensayos y conferencias 1965-1991. Barcelona, España: Puente Editores. ISBN 9788412428766.
- MITROVIĆ, I., AUGER, J., HANNA, J., & HELGASON, I. (Eds.) (2021). Beyond Speculative Design: Past – Present – Future. University of Split. ISBN 978-953-6617-56-2
- VENTURI, R., SCOTT BROWN, D. y IZENOUR, S., 1972. Learning from Las Vegas : the forgotten symbolism of architectural form. Revised ed. Cambridge, MA ; The MIT Press. ISBN 0262220202.
- H. BRATTON, BENJAMIN, 2016. The Stack. On Software and Sovereignty. Revised ed. Cambridge, MA ; The MIT Press. ISBN 978-0-262-02957-5.
- FONTCUBERTA, J., 2016. La Furia de las imágenes : notas sobre la postfotografía. Primera edición. Barcelona: Galaxia Gutenberg. ISBN 9788416495474.
- GIELEN, CHRISTOPH, 2013. Ciphers. Editorial JOVIS. ISBN 978-3-86859-318-1
- WIGLEY, MARK, 2001. Network Fever, Grey Room 04. Revised ed. Cambridge, MA ; The MIT Press. ISBN: 0-262-75493-2
- MALPASS, MATT. Critical Design in Context. History, Theory, and Practices. Bloomsbury, 2017. ISBN 1350125172
- The Laboratory of the Future, Short guide. Venezia : 18th International Architecture Exhibition Venice Biennale. May 2023 [Exhibition catalogue]. ISBN 9788898727827.

Websites

- MVRDV (Maas, Winy; van Rijs, Jacob; de Vries, Nathalie). MetaCity-DataTown [on line]. 1999 [Accessed: March 25, 2023]. Available at: <https://www.mvrdv.com/projects/147/metacity--datatown->
- Solon, Olivia. Drought-stricken communities push back against data centers [on line]. June 19, 2021 [Accessed: March 01, 2023]. Available at: <https://www.nbcnews.com/tech/internet/drought-stricken-communities-push-back-against-data-centers-n1271344>
- Earle Ledger, Florenne. Digital Sobriety: How the Internet is Harming the Environment [on line]. Earth Org, March 02, 2020 [Accessed: March 02, 2023]. Available at: <https://earth.org/digital-sobriety-how-the-internet-is-harming-the-environment/>
- Ritchie, Hannah. Ocean plastics: How much do rich countries contribute by shipping their waste overseas? [on line]. Our World in Data, October 11, 2022 [Accessed: March 02, 2023]. Available at: <https://ourworldindata.org/plastic-waste-trade#:~:text=The%20world%20generates%20around%20350%20million%20tonnes%20of,world%E2%80%99s%20plastic%20waste%20is%20shipped%20overseas%20is%20incorrect.>
- Hardy, Michael. The Hellish E-Waste Graveyards Where Computers Are Mined for Metal [on line]. Wired, January 8, 2018 [Accessed: March 02, 2023]. Available at: <https://www.wired.com/story/international-electronic-waste-photographs/>
- Yeebo, Yepoka. Inside a Massive Electronics Graveyard [on line]. The Atlantic, December 29, 2014. [Accessed: March 02, 2023]. Available at: <https://www.theatlantic.com/technology/archive/2014/12/inside-a-massive-electronics-graveyard/383922/>
- AFL Hyperscale. Understanding Different Types of Data Center [on line] [Accessed: May 29, 2023]. Available at: <https://www.aflhyperscale.com/articles/techsplainers/understanding-different-types-of-data-center/>
- Smith, Luke. What is data center infrastructure? A guide for new industry professionals [on line]. In: Data Center Hawk, February 27, 2020. [Accessed: March 02, 2023]. Available at: <https://www.datacenterhawk.com/blog/fundamentals/what-is-data-center-infrastructure-a-guide-for-new-industry-professionals>

Figures

- Fig. 0 / Abstract representation of data network. Own image.
- Fig. 1 / Image that illustrates the Datascape project. Own image.
- Fig. 2 / Diagram synthesizing the methodology used in this project.
- Fig. 3 / Image that illustrates the proliferation of data use. Own image.
- Fig. 4 / Visual representation of data units. Own diagram.
- Fig. 5 / Seaports, Groningen. Google data center in Eemshaven 2019 [photograph]. In: Google Datacenter Eemshaven [on line] Mineralis. [Accessed: March 02, 2023]. Available at: <https://www.mineralis.nl/en/portfolio/google-datacenter-eemshaven/>
- Fig. 6 / Visual representation of environmental implications. Own image.
- Fig. 7 / Todd, Jim. The Apple Data Center in Mesa, Arizona 2017 [photograph]. In: Drought-stricken communities push back against data centers, 2021 [on line] Reuters file [Accessed: March 28, 2023]. Available at: <https://www.nbcnews.com/tech/internet/drought-stricken-communities-push-back-against-data-centers-n1271344>
- Fig. 8 y 9 / Meta Eagle Mountain Data Center, 2023 [photograph]. In: Google maps [on line] [Accessed: March 28, 2023]. Available at: https://www.google.es/maps/place/Facebook+Eagle+Mountain/@40.2700885,-112.0141867,17z/data=!3m1!4m6!3m5!1s0x874d7bfeeabe9d7f:0x7c1cc3d3333dbe04!8m2!3d40.2700844!4d-112.0116118!16s%2Fg%2F1qn3jy_xs?entry=ttu
- Fig. 10 / Meta Eagle Mountain Data Center, 2022 [photograph]. In: Meta to expand Eagle Mountain campus again, 2022 [on line] Meta [Accessed: March 28, 2023]. Available at: <https://www.datacenterdynamics.com/en/news/meta-to-expand-eagle-mountain-campus-again/>
- Fig. 11 and 12 / Banks, Jonathan. Members of the Project Natick team power wash the Northern Isles underwater datacenter, which was retrieved from the seafloor off the Orkney Islands in Scotland, 2020 [photograph]. In: Microsoft finds underwater datacenters are reliable, practical and use energy sustainably, 2020 [on line] Microsoft [Accessed: April 15, 2023]. Available at: <https://news.microsoft.com/source/features/sustainability/project-natick-underwater-datacenter/>

- Fig. 13 / Douglas, Simon. Microsoft's Project Natick team used a gantry barge to retrieve the Northern Isles datacenter from seafloor of Scotland's Orkney Islands, 2020 [photograph]. In: Under the sea, Microsoft tests a datacenter that's quick to deploy, could provide internet connectivity for years, 2018 [on line]. Microsoft [Accessed: April 15, 2023]. Available at: <https://news.microsoft.com/features/under-the-sea-microsoft-tests-a-datacenter-thats-quick-to-deploy-could-provide-internet-connectivity-for-years/>
- Fig. 14 / Löffelbein, Kai. Women take devices apart in a warehouse in Guiyu, China 2018 [photograph]. In: Ctrl-X, A topography of ewaste [on line] [Accessed: April 12, 2023]. Available at: <https://kailoeffelbein.com/ctrl-x-a-topography-of-e-waste>
- Fig. 15, 16 and 17 / The E-Waste Mega Dump of Agbogbloshie, 2019 [photograph]. In: The E-Waste Mega Dump of Agbogbloshie, 2019 [on line] For 91 Days [Accessed: April 12, 2023]. Available at: <https://ghana.for91days.com/2019/09/25/agbogbloshie/>
- Fig. 18 / Tingle, Tom. The system used to cool servers inside the Apple Data Center in Mesa, Arizona 2021 [photograph]. In: Drought-stricken communities push back against data centers, 2021 [on line] The Republic / USA Today Network [Accessed: March 28, 2023]. Available at: <https://www.nbcnews.com/tech/internet/drought-stricken-communities-push-back-against-data-centers-n1271344>
- Fig. 19, 20 and 21 / Data servers at the Barcelona Supercomputing Center (2023). Own photos.
- Fig. 22 / Collage about the impact of data in the landscape. Own image.
- Fig. 23 / Google data center, Oklahoma 2007 [photograph]. In: Fusión entre arte y tecnología [on line] Google [Accessed: June 04, 2023]. Available at: <https://www.google.com/about/datacenters/locations/mayes-county/>
- Fig. 24 / Visual representation of data center types. Own image.
- Fig. 25 / DALL·E 2. Draw "an infinite landscape of data centers viewed from the sky". [on line]. [Accessed: March 18, 2023]. Available at: <https://labs.openai.com/>
- Fig. 26 / Venturi, R., Scott Brown, D. y Izenour, S., "I am a Monument" [drawing]. Learning from Las Vegas : the forgotten symbolism of architectural form (1972). Revised ed. Cambridge, MA ; The MIT Press. ISBN 0262220202.
- Fig. 27 / Stonehenge, Wiltshire [photograph] In: Get your guide [on line] [Accessed: April 28, 2023]. Available at: <https://www.getyourguide.es/stonehenge-l522/>

- Fig. 28 / Swayne, Steve. Parthenon, Athens Greece in 1978 [photograph]. In: Wikipedia [on line] [Accessed: April 28, 2023]. Available at: <https://es.wikipedia.org/wiki/Parten%C3%B3n>
- Fig. 29 / Burdulis, Šarūnas. Teotihuacan, The State of Mexico [photograph]. In: Una visita a Teotihuacán: la Roma de Mesoamérica [on line] [Accessed: April 28, 2023]. Available at: https://www.eldiario.es/canariasahora/viajarahora/destino_america/que-ver-en-teotihuacan-como-llegar-en-transporte-publico-precio-de-las-entradas_1_9239112.html
- Fig. 30 / Catedral Metropolitana, Mexico City [photograph]. In: Extraordinarias fotos de la hermosa Catedral Metropolitana [on line] [Accessed: April 28, 2023]. Available at: <https://mxcity.mx/2018/10/extraordinarias-fotos-de-la-hermosa-catedral-metropolitana/>
- Fig. 31 / Marshall, Tosh. Battersea Power Station, London 2013 [photograph]. Structurae [on line] [Accessed: April 28, 2023]. Available at: <https://structurae.net/en/media/290299-battersea-power-station>
- Fig. 32 / Empire State, New York City [photograph]. Guías.travel [on line] [Accessed: April 28, 2023]. Available at: <https://www.nuevayork.travel/que-ver-en-nueva-york/empire-state-building/>
- Fig. 33 / Louvre Museum, Paris [photograph]. MuseoLouvre.info [on line] [Accessed: April 28, 2023]. Available at: <https://museoulouvre.info/como-llegar/>
- Fig. 34 / Tordera, Pere. Aerial Camp Nou photography, 2021 [photograph]. In: El Camp Nou, un coliseo en decadencia [on line] ara [Accessed: May 11, 2023]. Available at: https://es.ara.cat/deportes/camp-nou-coliseo-decadencia_1_3885185.html
- Fig. 35 / Meta Data Center, Singapore 2019 [3D image]. In: Rethinking data center design for Singapore [on line] Engineering at Meta [Accessed: May 11, 2023]. Available at: <https://engineering.fb.com/2019/01/14/data-center-engineering/singapore-data-center/>
- Fig. 36 / Eklund, Scott. Project Natick's Northern Isles datacenter is partially submerged and cradled by winches and cranes [photograph]. In: Under the sea, Microsoft tests a datacenter that's quick to deploy, could provide internet connectivity for years [on line] Microsoft [Accessed: May 11, 2023]. Available at: <https://news.microsoft.com/features/under-the-sea-microsoft-tests-a-datacenter-thats-quick-to-deploy-could-provide-internet-connectivity-for-years/>

- Fig. 37 / Abstract representation of data infrastructure. Own image.
- Fig. 38 / Speculative representation of data network. Own image.
- Fig. 39 / Superstudio, “Monumento Continuo” 1969-1970. Collection: Musée National d'Art Morden, Centre George Pompidou, Paris. [photomontage]. PIERPAOLI, B., 2017. Cincuenta años de superstudio. Una lectura contemporánea del monumento continuo. Revista Indexada de Textos Académicos, no. 7, pp. 119. ISSN 2340-9711. DOI 10.24192/2386-7027(2017)(v7)(08).
- Fig. 40 / MVRDV (Maas, Winy; van Rijs, Jacob; de Vries, Nathalie). MetaCity-DataTown [photomontage] In: MetaCity-DataTown [on line]. 1999 [Accessed: March 25, 2023]. Available at: <https://www.mvrdv.com/projects/147/metacity--datatown->
- Fig. 41 / Young, Liam. Planet City [image] In: Planet City [on line] 2021 [Accessed: April 20, 2023]. Available at: <https://planetcity.world/Main>
- Fig. 42 / Tange, Kenzo. Plan for Tokyo top view, 1960 [photomontage]. In: Empezar de cero. Los metabolistas japoneses [on line] Arquine, September 15, 2016 [Accessed: June 12, 2023]. Available at: <https://arquine.com/empezar-de-cero-los-metabolistas-japoneses/>
- Fig. 43 / Drawing of the Maison Dom-Ino by Le Corbusier (1914–1915), digitally intervened with data centers inside. Own image
- Fig. 44 / Gielen, Christoph. Suburb aerial view [photograph]. In: Christoph Gielen's “Ciphers”: Aerial Views of American Sprawl [on line] Archdaily April 14, 2014 [Accessed: June 12, 2023]. Available at: <https://www.archdaily.com/496567/christoph-gielen-s-ciphers-aerial-views-of-american-sprawl>
- Fig. 45 / Server racks inside of a Google's data center at Council Bluffs, Iowa [photograph]. In: Inside the internet: Google allows first ever look at the eight vast data centres that power the online world [on line] October 19, 2012 [Accessed: June 13, 2023]. Available at: <https://www.dailymail.co.uk/sciencetech/article-2219188/Inside-Google-pictures-gives-look-8-vast-data-centres.html>
- Fig. 46 / Corona Benjamin, Livia. “Ciudad de la noche IV” Queretaro, México (2000-present) [photograph]. In: Interview: Artist Livia Corona Benjamin explores architectural traces of rural policy in Mexico [on line] [Accessed: June 14, 2023]. Available at: <https://archive.pinupmagazine.org/articles/interview-livia-corona-benjamin-photography-rural-mexico-silos-natalia-torija-nieto>

- Fig. 47 / Yemelyanov, Maksym. Circuit board system chip with core processor [image]. In: Adobe Stock N° 176615698 [on line] [Accessed: June 14, 2023]. Available at: https://stock.adobe.com/es/images/computer-motherboard-with-cpu-circuit-board-system-chip-with-core-processor-computer-technology-background/176615698?prev_url=detail
- Fig. 48 / Gielen, Christoph. Suburb aerial view [photograph]. In: Christoph Gielen's “Ciphers”: Aerial Views of American Sprawl [on line] Archdaily April 14, 2014 [Accessed: June 12, 2023]. Available at: <https://www.archdaily.com/496567/christoph-gielen-s-ciphers-aerial-views-of-american-sprawl>
- Fig. 49 / Google Data Server racks in Council Bluffs, Iowa [photograph]. In: Inside the internet: Google allows first ever look at the eight vast data centres that power the online world [on line] October 19, 2012 [Accessed: June 13, 2023]. Available at: <https://www.dailymail.co.uk/sciencetech/article-2219188/Inside-Google-pictures-gives-look-8-vast-data-centres.html>
- Fig. 50 / Cruciatti, Piero. View of a window with people working in the interior of an office building at night in Milan, Italy 2018 [photograph]. In: Piero Cruciatti Photographer [on line] [Accessed: June 13, 2023]. Available at: https://www.piero-cruciatti.com/image/10000zSjSp_v2Nog
- Fig. 51 / Data storage at the Barcelona Supercomputing Center (2023). Own photo.
- Fig. 52 / Storage facility [photograph]. In: A Comprehensive Guide On Warehouse Storage [on line] [Accessed: June 5, 2023]. Available at: <https://barbaraiweins.com/a-comprehensive-guide-on-warehouse-storage/>
- Fig. 53 / Data center cooling system [photograph]. In: The pinnacle of cooling [on line] [Accessed: June 5, 2023]. Available at: <https://spxcooling.com/cooling-towers/marley-nc-everest/>
- Fig. 54 / Housing air conditioning system [photograph] [on line] [Accessed: June 5, 2023]. Available at: <https://www.elaireacondicionado.com/noticias/aire-acondicionado-sera-mas-carro-partir-septiembre-23082022>
- Fig. 55 / Data Server cables at the Barcelona Supercomputing Center (2023). Own photo.
- Fig. 56 / Train track, Atocha Station, Madrid. [photograph] [on line] [Accessed: June 5, 2023]. Available at: <https://www.dreamstime.com/high-speed-trains-atocha-station-madrid-spain-january-s-main-cities-connected-image143454201>

- Fig. 57 / Distribution systems at Google's Douglas County data centre in Georgia [photograph] Google [on line] [Accessed: June 5, 2023]. Available at: <https://www.dailymail.co.uk/sciencetech/article-2219188/Inside-Google-pictures-gives-look-8-vast-data-centres.html>
- Fig. 58 / Transmission tower [photograph] [on line] [Accessed: June 5, 2023]. Available at: <https://blog.iqgeo.com/blog-post-esri-utility-network-there-is-an-alternative>
- Fig. 59 / An example of a type of biometric-based physical security measure [photograph]. In: The Importance of Data Center Security Continues to Grow [on line] [Accessed: June 5, 2023]. Available at: <https://www.thesslstore.com/blog/what-is-data-center-security-6-ways-to-ensure-your-interests-are-protected/>
- Fig. 60 / House security camera [photograph] [on line] [Accessed: June 5, 2023]. Available at: https://www.independentespanol.com/?utm_source=redirect
- Fig. 61 / Monitoring and control of data servers [photograph] Google [on line] [Accessed: June 5, 2023]. Available at: <https://www.dailymail.co.uk/sciencetech/article-2219188/Inside-Google-pictures-gives-look-8-vast-data-centres.html>
- Fig. 62 / Surveillance systems [photograph] [on line] [Accessed: June 5, 2023]. Available at: <https://www.marconet.com/blog/8-advantages-digital-video-surveillance-systems-provide-businesses>
- Fig. 63 / Backup power system in a data center [photograph] [on line] [Accessed: June 5, 2023]. Available at: <https://csdieselgenerators.com/why-a-standby-data-center-generator-is-critical/>
- Fig. 64 / Emergency generator [photograph] [on line] [Accessed: June 5, 2023]. Available at: <https://www.rmagreen.com/rma-blog/environmental-permits-emergency-backup-generator>
- Fig. 65 / DALL·E 2. Draw “city built by data centers” [on line]. [Accessed: March 25, 2023]. Available at: <https://labs.openai.com/>
- Fig. 66 / DALL·E 2. Draw “city built by data centers” [on line]. [Accessed: March 25, 2023]. Available at: <https://labs.openai.com/>
- Fig. 67 / DALL·E 2. Draw “speculative architecture landscape built of digital waste” [on line]. [Accessed: April 26, 2023]. Available at: <https://labs.openai.com/>
- Fig. 68 / DALL·E 2. Draw “an infinite landscape of data centers viewed from the sky” [on line]. [Accessed: April 28, 2023]. Available at: <https://labs.openai.com/>

- Fig. 69 / DALL·E 2. Draw “city of circuit board system with core processor in the middle” [on line]. [Accessed: April 28, 2023]. Available at: <https://labs.openai.com/>
- Fig. 70 / DALL·E 2. Draw “city infrastructure as data center ” [on line]. [Accessed: April 28, 2023]. Available at: <https://labs.openai.com/>
- Fig. 71 / The German Pavilion contains recycled materials ready to be repurposed [photograph]. In: German pavilion becomes material bank for Venice repair projects [on line] Dezeen May 26, 2023 [Accessed: June 2, 2023]. Available at: <https://www.dezeen.com/2023/05/26/german-pavilion-material-bank-venice-architecture-biennale/>
- Fig. 72 to 84 / Models collected from the 3D Warehouse Sketchup [on line]. [Accessed: June 15, 2023]. Available at: <https://3dwarehouse.sketchup.com/>
- Fig. 85 / Abstract representation of the Datascape. Own image.
- Fig. 86 / Evolution of Data Center growth (7 images). Own images.
- Fig. 87 / Data Center as a monument. Own image.
- Fig. 88 / Datascape, expansion and connection. Own image.
- Fig. 89 / Datascape. Speculative City for Data to Inhabit. Own image.
- Fig. 90 / Speculative City for Data to Inhabit bird's-eye view. Own image.
- Fig. 91 / Speculative City elements. Own Image.
- Fig. 92 / Speculative City for Data to Inhabit isometric. Own image.
- Fig. 93 and 94 / Data servers stored on the network.
- Fig. 95 to 101 / Speculative City for Data to Inhabit isometrics. Own image.
- Fig. 102 / Video still. Own image.

- This project was produced thanks to the support of Sistema de Apoyos a la Creación y Proyectos Culturales (SACPC). México, 2022.
- This project was produced thanks to the support of Fundación Jumex Arte Contemporáneo. México, 2022.

Master's Degree in Advanced Studies in
Design-Barcelona (MBDesign)

Specialization:
Contemporary Design (CD)

Escola Tècnica Superior d'Arquitectura de
Barcelona
(ETSAB)

Universitat Politècnica de Catalunya (UPC)
Universitat de Barcelona (UB)

Academic year 2022/2023
Barcelona 2023