Acid Clouds

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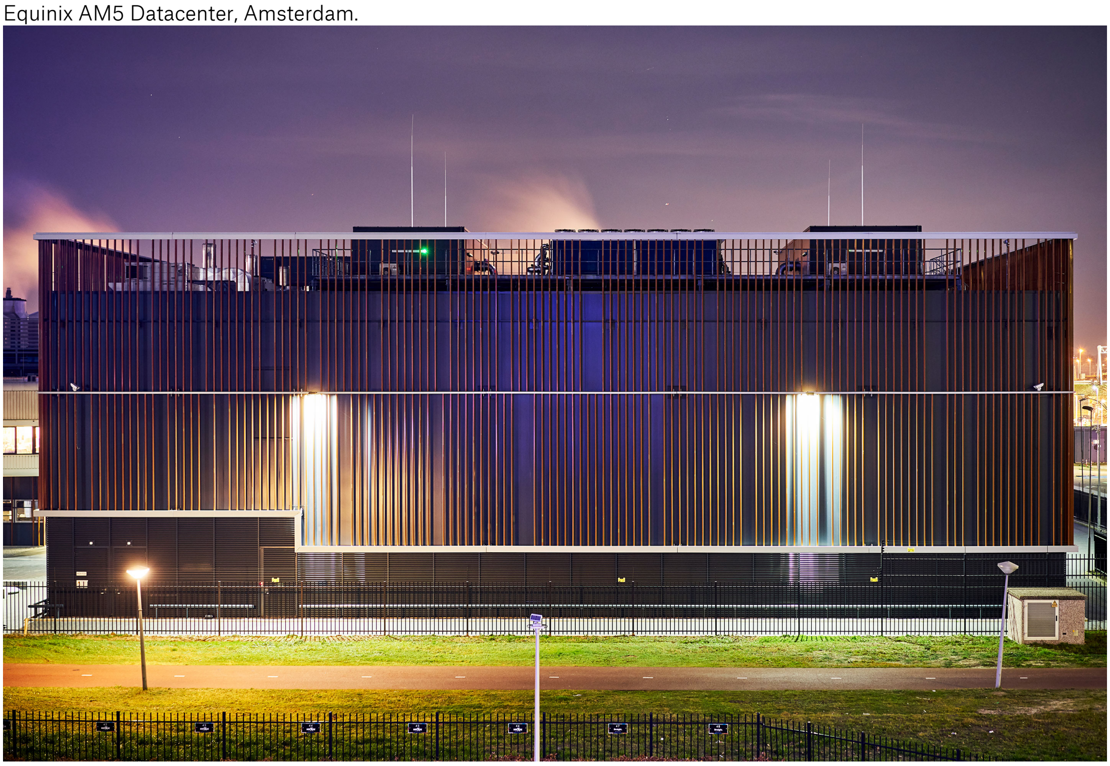
To date, critiques of technology have been focused on the environmental harm caused by sourcing the raw materials for, and the manufacturing, shipping and disposing of, our hardware. There is an urgent need, however, to scrutinize the environmental and psychological impacts of our ever-accumulating software and data waste. Undertaken as part of the Koninklijke Academie van Beeldende Kunsten (KABK) Research Group 2018, Niels Schrader uses online tools and published online media in combination with site immersion and visual analysis to understand more fully what happens when the resources needed to create, share and store our daily output of 2,5 quintillion bytes of so-called 'virtual' data encroach on the physical environment.

Interxion AM8 Datacenter, Rozenburg. – Photos by Niels Schrader and Roel Backaert

Data Tower, Amsterdam.

Equinix AM4 Datacenter, Amsterdam.

Equinix AM5 Datacenter, Amsterdam.



Equinix AM1 Datacenter, Amsterdam.

Alticom Datacenter, Hilversum.

Equinix AM6 Datacenter, Amsterdam.

Equinix AM8 Datacenter, Amsterdam

Storage as a Concept

The number of computer data storage facilities has grown exponentially in the last few years. This is no surprise given the global increase in consumption of digital content, propelled by seemingly unlimited bandwidth and ubiquitous WiFi coverage. However, little attention is being paid to the ecological effects of these endlessly humming, heat-producing and energy-draining architectural structures now often among the biggest CO polluters of the environment[1].

Server farms are large-scale repositories of data that require a massive maintenance framework. The agricultural reference in the name is no coincidence. With the rise of capitalism, farmers began to produce for the purpose of profit accumulation instead of personal or local consumption, and crops became a commodity to be traded. In the supply chain, storage has always played a key role. It made speculation possible, allowing the sale of agricultural products in times of scarcity and their purchase during a market surplus. Simply put, it became possible to create an artificial shortage that leveraged the demand. Data centres are the new control rooms of the automated landscape, which are not only storing the growing virtual knowledge of the world, but also facilitating its distribution and capital flow. Behind high, windowless walls, the seemingly ephemeral, clean image of data solidifies into a much heavier and hardly degradable, resource-intensive condition, with growing implications for us all.

Growth Narrative

In the technology sector, the capitalistic promise of infinite economic growth is locked tight to Gordon Moore's observation that the number of transistors on a chip doubles every year while its costs are halved [2]. It describes the rapid growth in computational power over decades. Similar dynamics emerge in the global demand for data storage and it seems that both are interlinked. The faster you can process data, the bigger your appetite for it. Conversely, the more data becomes available, the more computational power is required for storage and processing. The industry creates incentives for users not only to produce content, but also to share and back it up, meaning in fact to endlessly duplicate and never delete. Continuous storage is labelled by the tech industry as the solution to our storage problem, but it is in fact creating it instead. The more kilo, mega, giga, tera, peta or exa, the more we unlearn to control our digital clutter. Clutter that manifests itself as overly full inboxes with unanswered e-mails, deserted social media accounts we never actually visit anymore, long-forgotten download files clogging disk space and abandoned Dropbox folders storing identical data on multiple devices.

'Data is the pollution problem of the information age' says Bruce Schneier, cryptographer and computer security specialist, and fellow at the Berkman Klein Center for Internet & Society at Harvard Law School, Cambridge, Massachusetts [3]. Digitalization creates an ever-increasing amount of data that society will eventually need to learn to dispose of. So even though IT efficiency is improving and data centres are becoming greener and consuming less power, these energy savings are offset by growing electricity consumption.

Physical Data

The IT sector labels its products using metaphors that suggest their association with the natural world and the qualities of cleanliness and transparency, thus covering up or deflecting attention from the damaging effects of technology on our living environment. Probably the most familiar of these deceptions is the projected image of a fluffy, vaporous 'cloud' used to misrepresent the power-consuming and earthbound qualities of digital data storage. Similarly, tech companies use visual and verbal rhetoric to present their large-scale storage facilities as clean, sterile and environmentally friendly domains. Google, for example, publishes on the web over-styled press images of its data centres in order to shape public perception.

There is a similar dissonance between the image of how tech companies market their services and the reality of what happens to consumer data. The sharing economy, constant online access and subscription-based models are presented as virtues, having obvious benefits for users. But in reality such qualities provide a frontend distracting from the real activity of data harvesting and offloading both storage and ownership to software companies. Having data is key and keeping it is even more so. To ensure that, server farms are highly protected spaces with concrete demarcations and tangible security measures. The buildings rarely have windows and are commonly surrounded by electric fences, security cameras and water moats. On the inside they are packed with the latest security gadgets like motion detectors, iris scans, facial recognition systems or personalized access codes. It seems the physical access to the data is as regulated, monitored and restricted as the virtual one.

Today's digital landscape is characterized by vast stores of loose, unrefined data, heavily harvested by national intelligence services and large private corporations to track people's movements and behaviour. The typical business approach taken by these corporations is to capitalize on the fact that storage is cheap and to keep on accumulating data even if they haven't yet determined a specific use for it.

Information Ecology

The environmental impact of data centres occurs in three main ways: electronic waste, energy consumption and carbon emissions. It is surprising how tangible these effects are.

The term e-waste covers the physical hardware inside the building and its recycling or disposal. According to *The Global E-waste Monitor* published by the United Nations University, the global amount of e-waste is expected to grow to 52.2 billion kilograms in 2021, with an annual growth rate of 3 to 4 per cent [4]. Propelled by short, market-driven replacement cycles, the amount of obsolete equipment is steadily increasing.

The energy consumption on the other hand concerns the power that is required to run the digital framework of the facility. That includes powering the actual computers, but also the cooling infrastructure. The *Independent* reported that in 2015 the world's data centres consumed about 3 per cent of the global electricity supply. A costly problem, which in 2008 translated roughly to an annual cumulative of $4.5 billion for data centre-related energy bills for the United States only [5].

The third environmental impact of the data centres are the CO emissions. Clearly, they are not directly produced by the data centre itself, but by its energy supplier. If a data centre runs on fossil fuels, the equivalent of a new small city is added to the power grid every time somebody opens one of these facilities. Data centres accounted in 2015 for 2 per cent of worldwide greenhouse gas emissions. This is about the same carbon footprint as the airline industry [6].

It becomes clear that even though data is virtual by nature, we will reach the point where digital concerns hit physical constraints. Continuing along this path will leave a giant ecological and economic footprint. Looking forward, the Cisco Global Cloud Index predicts data centre traffic to jump to 15.3 yottabytes in 2020, a figure with 24 zeroes [7]. As a result, the US Energy Information Administration expects global energy consumption is to grow by about 53 per cent by 2035 [8].

A concrete example of how tangible the impact of data centres on our living habitat has become, is Amsterdam's acute capacity problem with the local power infrastructure [9]. The city's ambition to become Europe's biggest data centre hub [10] and its reputation as a start-up hotspot are starting to take their toll. As for Amsterdam claiming to be the number one digital gateway to Europe, its regional power grid is just not growing fast enough to keep up with all the new technological developments. As a result, the reserve capacity is used to stabilize the electricity supply and putting other municipal operations under pressure. It remains to be seen how further growth of this industry will be brought under control.

Solutions for this challenge are highly unlikely to come from either the big businesses that directly profit from our excessive behaviour or from the states and governments that show just as keen interest in our personal data. We should not fall into the trap of believing that increasing the degree of automation and making energy sources greener will solve the problem. Yet, blaming the storage industry solely would mean to deliberately ignore the responsibility that we as consumers have. Even the most eco-friendly technologies and highest recycling rates cannot compete with the simplest but most effective strategy: the avoidance of digital waste. It is about time to replace the growth narrative, acknowledging the fact that we *are* in fact part of the problem and learning how to control and dispose of our digital clutter.

Niels Schrader (1977, Caracas, VE) is a concept-driven information designer with a fascination for numbers and data. He is founder of the Amsterdam-based design studio Mind Design and member of the AGI – Alliance Graphique Internationale. Next to his design practice Schrader has been lecturing at the Delft University of Technology, ArtEZ – Academy of Art & Design in Arnhem and Willem de Kooning Academie in Rotterdam. Since January 2013 he is co-head of the Graphic Design department at the Royal Academy of Art in The Hague. In his work, Schrader plays the role of both a mediator and a designer. He considers communication to be an interactive process that requires participation through questioning. See further: www.minddesign.info.

Roel Backaert (1978, Mortsel, BE) started his study on photography at SISA in Antwerp. He studied in Brussels at the Sint Lucas Academy and graduated in 2004 from the Gerrit Rietveld Academie in Amsterdam, where he still works and lives. Since 2004 he has been traveling the world as an architectural photographer and pursued his career as an autonomous artist. The main focus in his work has been the urban landscape from which he often plucks a peculiar object, building or cityscape out of its context to present it in compelling centralised composition. Backaert works mostly at night with an analogue camera of 4×5 inch, using very long shutter-speeds that pull the subjects out of the darkness of the night into an exceptionally colourful twilight. See further: www.roelbackaert.com.

Footnotes

1. See Ruben Koops and Bart van Zoelen, ‘Dit zijn de tien grootste CO -vervuilers in Amsterdam’, *Het Parool*, 27 May 2019, www.parool.nl.
2. See Gordon E. Moore, ‘Cramming more components onto integrated circuits’, *Electronics* 38, no. 8 (19 April 1965).
3. See Bruce Schneier, panel discussion, *Guardian Activate*, New York, 28 April 2011, www.theguardian.com.
4. See Cornelis Peter Baldé et al., ‘Global E-waste Status and Trends’, *The Global E-waste Monitor 2017* (Bonn / Geneva / Vienna: United Nations University / International Telecommunication Union / International Solid Waste Association, 2017), collections.unu.edu.
5. See Paul W. Taylor, ‘How to Cut Data Center Energy Consumption’, *Government Technology*, 21 May 2008, www.govtech.com.
6. See Tom Bawden, ‘Global warming: Data centres to consume three times as much energy in next decade, experts warn’, *Independent*, 23 January 2016, www.independent.co.uk.
7. Cisco, ‘Cisco Global Cloud Index: Forecast and Methodology, 2016–2021 White Paper’, updated 19 November 2018, www.cisco.com.
8. See Brianna Panzica, ‘Energy Consumption to Jump 53%’, *Energy & Capital*, 20 September 2011, www.energyandcapital.com.
9. See Gerard Reijn, ‘Waarom kan het elektriciteitsnet vraag en aanbod niet meer aan?’, *de Volkskrant*, 29 August 2019, www.volkskrant.nl.
10. See Eline Stuivenwold, ‘The Netherlands is European leader in data centers’, Dutch Data Center Association, 11 June 2019, www.dutchdatacenters.nl.

Tags

Design, Ecology, Open! Academy, Research