OCCAM'S RAZOR IN CS: CREATING VALUES FOR CLIENTS IN THE SIMPLEST WAY POSSIBLE

TALK DIRTY TO ME: THE RELATIONSHIP BETWEEN NORTHERN VIRGINIA AND DATA CENTER COMPANIES

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On my honor as a University student, I have neither given nor received unauthorized aid

on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General Problem

What are the costs of using artificial intelligence? Artificial intelligence (AI) is all around us nowadays. When I was a first year at UVA, it was only a niche subset of computer science, often relegated to research. Now, private and public companies alike are racing to use it in their proprietary software, and they are trying to convince everyone as to how life changing AI is. In light of this, I would like to examine what the costs of using AI are for a plethora of stakeholders, including developers, the companies making them, the planet, local and federal governments, and the general public. What does each stakeholder do to alleviate the costs? How does each stakeholder view the benefits of AI with respect to the cost?

Naturally, developers are one of the most important stakeholders in the AI discourse, as they are the ones designing the large language models or utilizing the technology in their codebases. Therefore, a careful examination of the developer experience is necessary. An approach similar to a cost benefit analysis will be the most effective way to go about properly analyzing the advantages and disadvantages of using artificial intelligence in development.

How did the infrastructure around AI come about? How did each stakeholder involved argue their case for or against the technology, and what is the impact of that technology on the surrounding population and environment? It is easy to get wrapped up in the excitement of a new technology that is revolutionizing the tech industry, but it is necessary to take a step back and examine how we got to where we are now, and what the effect of that technology is. The hub of AI infrastructure lies in Northern Virginia and its massive concentration of data centers. We must examine how Northern Virginia was able to support this infrastructure, and how different groups of people feel about these energy-guzzling monoliths of modern technology.

Occam's Razor in CS: Creating Value for Clients in the Simplest Way Possible

A major manufacturer with a major market share in its industry found its manufacturers and client-facing account managers working without any communication, causing unfulfilled orders and frustration for the end customer. To solve this problem, my intern team and I created a full-stack inventory management and communication system using the MERN (MongoDB, Express, React, and Node) tech stack. This allowed plant managers and account managers to be more in sync with each other to provide the end customer with maximum transparency. Despite our manager's request to incorporate artificial intelligence (AI), I convinced the team not to use AI because our solution did not need AI and it would only slow us down. Ultimately, ours was one of the only solutions actually deployed by the end of the internship, and our approach allowed us to meet all of our stretch and scrum goals throughout the summer. My conclusion: In an ever-changing computer science world that includes AI, often the best solution is still just the simplest one. I would like to test this theory further by doing more client projects that avoid time-intensive and/or complex technologies during development and compare the two for deliverable hits.

Shojaei, et. al. (2023) discuss how using AI can save precious development time, especially on relatively menial tasks like referring to documentation or debugging. He goes on to say that using AI during development can similarly help eliminate human error. However, he also suggests that merely using AI as a "silver bullet solution" for the sake of satisfying stakeholders can lead to poor results in the end deliverable if developers do not have the necessary knowledge (*AI—The Good, the Bad, and the Scary*, n.d.).

Talk Dirty to Me: The Relationship Between Northern Virginia and Data Center Companies

What can we learn about the relationship between Northern Virginia and data center companies, especially in terms of the rhetoric used on each side of the data center argument?

Big tech companies, such as Amazon, Microsoft, and Google, have been employing a number of tactics over the years in order to expand their data center presence in Northern Virginia. These companies need to gain the approval of statewide, countywide, and citywide lawmakers, councilmen, and residents in order to construct new data centers. There are a variety of boons that come from data centers, but the negative consequences are severe. To this end, I wish to uncover the rhetoric that is exchanged between these companies and the various stakeholders of Northern Virginia as each party tries to accomplish their respective goals. This is an important topic to explore because citizens of a democratic government need to be made aware of the kind of language big companies will use to get their way, even if their end goal is not in the best interest of the average citizen. Furthermore, by examining what lawmakers are doing to either support or oppose the expansion of these data centers, citizens must be made aware of what kinds of lawmakers, based on their negotiation strategies, have their best interests in mind.

Northern Virginia, Data Centers, and You

Northern Virginia harbors one of the biggest data center markets globally (Data Center Legislation: How New Laws Affect Industry Growth, n.d.). In 2019, Northern Virginia had 186 data centers, increasing to 275 by 2023, with countless more in the planning stages. The reason for this concentration of data centers is because Virginia and its Northern Virginia counties and

cities have historically been very favorable to data centers by offering generous tax exemptions. In fact, Virginia governor Glenn Youngkin recently reached a deal with Amazon to invest $35 billion into data center development by 2040, citing that this will create 1,000 jobs (Kshetri & Voas, 2024). These data centers have been powering cloud computing services such as Amazon Web Services, but now their computational load is expanding significantly due to the rise of artificial intelligence. AI has a massive environmental impact due to its energy and fresh water usage. The environmental footprint of data centers is increasing rapidly due to generative AI tools like OpenAI's ChatGPT and Google's Gemini. AI activities in data centers requires massive amounts of fresh water for cooling, known as Scope-1 on-site water consumption (Kshetri, 2024). Putting this in the context that two-thirds of the world may suffer from water scarcity by 2050, it is difficult for some to not be cynical about data centers (Oki et al., 2003). Because of AI, data centers' electricity demand globally may double by 2026. Data centers computational and cooling work from AI and cryptocurrencies used about 460 TWh of global electricity in 2022, about 2% of the total global electricity demand (Electricity 2024 – Analysis, 2024). Many data centers claim that they are working toward sustainability, but it is impossible to hold them accountable due to non-disclosure agreements (Data Centers & Energy Demand – The Piedmont Environmental Council, 2024).

With all of this environmentally damning information, a lot of critics have been calling for a reevaluation on Northern Virginia's friendly stance on data centers. For example, when the Department of Environmental Quality (DEQ) suggested that it would allow data centers to use their diesel generators more, there was significant pushback from several environmental groups, namely the Piedmont Environmental Council, citing concerns over increased air and noise pollution (Foundation, 2023). The DEQ eventually relented because of this pressure. In general,

concerned Virginia residents are urging the public to write to local elected officials to "address data center impacts." The seemingly exponential growth of the data center industry challenges Virginia's goals of reaching a sustainable, clean energy future (Data Centers & Energy Demand – The Piedmont Environmental Council, 2024). When Warrenton was voting on construction of a new data center courtesy of Amazon, Amazon argued that the data center will positively impact the economy, notably by increasing Warrenton and Fauquier County's tax revenue, and that the noise generated from the Warrenton data center will approximately equal the sound of a conversation, per a report commissioned by Amazon (Jarvis, 2022). This data center was eventually approved, despite townspeople pleading that it not be constructed, as Fauquier County citizens had previously been displaced due to noise pollution (Jarvis, 2023).

I plan on analyzing data centers as a sociotechnical system that affects the region in a variety of ways–economically, culturally, and environmentally. Specifically, I will be researching how these data centers have affected the everyday lives of Northern Virginia residents, the political sphere of Northern Virginia, and the economy of the region.

The sources I have used in the background section are merely summaries of the arguments, but I would like to collect more exact quotes from all parties involved. I plan on interviewing Virginia state senators–both for and against data centers–directly how they have been involved in the data center industry. Specifically, I will interview former Virginia state senator Chap Petersen and inquire about his work on Proposed Law HB 1974, legislation which mandated a site evaluation on carbon emissions and water usage for proposed data centers. I am curious to see what kind of pushback there was on this law. Additionally, I will analyze any other relevant Northern Virginia legislation on data centers, especially those that approved new data centers, in an effort to illuminate what arguments worked for successful data center efforts. I

would also like to analyze press releases from Amazon, as that could represent the primary source of pro-data center rhetoric from big tech companies in the region.

Conclusion

So much of the political process is abstracted away from the general population. With my research, I hope to illuminate the tactics tech companies use to persuade Northern Virginia lawmakers and the public to support these massive data centers. Similarly, I aim to understand how the groups opposing these data centers went right and wrong in their anti-data center strategies by analyzing successful and unsuccessful cases respectively. Additionally, a deep analysis of the developer point of view about artificial intelligence is necessary to understanding the full sociotechnical system of AI. Given how much effort and money goes into the data centers that power artificial intelligence, what are the costs and benefits of leveraging the technology in end deliverables? Would it be better for the end customers and clients for AI and other complex technologies to not be incorporated at all? I believe that by answering both of these research questions, I will be able to have a deep understanding of the costs of artificial intelligence. Only by analyzing all parties involved, from developers to lawmakers and citizens, will I be able to identify how this hot new technology is impacting all of us, and what we can do about those impacts.

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