



The Rise of Cloud Services

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Research background

- “AI and the Financial Markets” 2021–2024 (3 seniors, 2 postdocs, 1 PhD)
- ”AI-based RegTech” 2021–2026 (2 seniors, 2 PhDs)
- ”AI Design Futures” 2023–2028 (3 seniors, 1 postdoc, 2 PhDs)
 - includes professor Mark Coeckelbergh (Vienna), professor of philosophy of technology

Agenda

- What is cloud services?
- The rise of cloud services
- How are CSPs regulated under EU law?
- What are the main concerns going forward?





What is cloud services?

- NIS 1 Directive Art 4(19), cited in the Digital Markets Act
‘cloud computing service’ means a digital service that enables access to a scalable and elastic pool of shareable computing resources
- NIS 2 Directive Art 6(30)
‘cloud computing service’ means a digital service that enables on-demand administration and broad remote access to a scalable and elastic pool of shareable computing resources, including where such resources are distributed across several locations

Directive (EU) 2022/2555 on measures for a high common level of cybersecurity across the Union



What is cloud services?

- 1996: Compaq Computers identify online file storage as a profitable service
- 2006: Amazon Web Services launches Infrastructure-as-a-Service (IaaS), allowing customers to use AWS servers and computational power rather than invest
- Platform-as-a-Service (PaaS) includes hardware, OS, and software needed for developing and deploying applications
- Software-as-a-service (SaaS) is for customers who want ready-to-use applications
- Serverless computing / FaaS is customized cloud usage, no need to manage anything





What is cloud services?

- Cloud is essential to the deployment of artificial intelligence
- The data sets held by CSPs (cloud services providers) are the best available for training AI algorithms
- CSPs also provide the computational power needed
- ...and will not hesitate to buy a nuclear plant to provide it!



The rise of cloud services

- Cloud is now crucial to our economy, in particular the financial economy
- Estimates are that 94% of businesses worldwide use some form of cloud computing
- Cloud Security Alliance estimates 98% of financial organisations worldwide do
- CloudZero (consultancy) estimate the net value of cloud services globally:
 - 2010 \$24.6 billion
 - 2020 \$156.4 billion
 - 2030 over \$1,000 billion



The rise of cloud services

- The cloud services market is highly concentrated worldwide

- Q1 2024 statistics (statista.com):

AWS	31%	
Microsoft Azure	25%	
Google	10%	(total oligopoly share: 66%)
Others	34%	(slowly declining share, from 45-50% in 2018)

- "Others" notably include Alibaba Cloud, Tencent Cloud, Oracle, IBM, Deutsche Telekom



How are CSPs regulated under EU law?

- Competition law and GDPR: The baseline
- Data Act, Art 35:
Interoperability of data processing services, allowing customers to switch CSPs
- Digital Markets Act, Art 2(2)(i):
CSPs can be designated as gatekeepers
- Data Governance Act, Artificial Intelligence Act, Digital Services Act:
Cloud only mentioned in recitals





How are CSPs regulated under EU law?

- Digital Operational Resilience Act (DORA)
- ...concerns cyber security and risk management in financial business
- ...but through financial business, it seeks to govern CSPs
- DORA includes mechanisms for
 1. direct oversight of the largest CSPs, and
 2. far-reaching governance of B2B relations (finance <-> cloud services)



What are the main concerns going forward?

- Although 92% use more than one CSP, the oligopoly seems robust
- With great power comes great responsibility – can we trust the CSPs?
- The EU approach: Antitrust, interoperability, cyber security
- Environmental concerns



What are the main concerns going forward?

- A lock-in effect – CSPs are too big to fail?
- Semi-public governance structure for large CSPs under DORA?
- Market entry barriers (lock-out effect) for smaller CSPs under DORA?
- Will entrepreneur CSPs therefore leave the EU market to be able to scale up?
- Will large CSPs compartmentalise operations, contradicting the 'Brussels effect'?



What are the main concerns going forward?

- Lehdonvirta: We are building a new 'Soviet era 2.0' cloud economy
- Are we willing to make the investments necessary to have options to the oligopoly?
- Are we capable to?
- The choices are politically charged, and there are significant security issues
- Let's make high-stakes choices *consciously!*



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