

The Cloud and the Changing Structure of Production and Accumulation

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**AI
Disclosures
Project**

Why care: the cloud is reshaping costs, profits and control

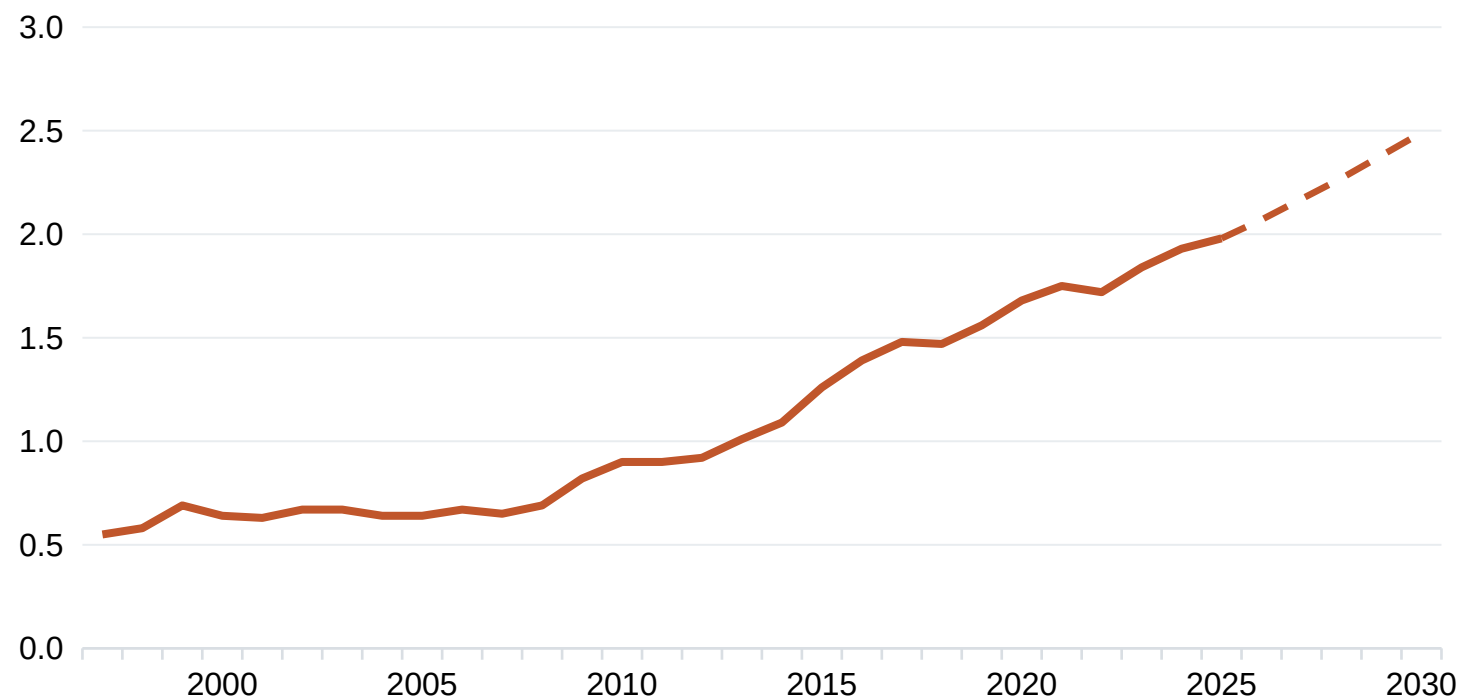
- **Costs, profits:** a growing share of costs and profits flows to a handful of firms, which accumulate the capital.
- **Control:** the internet's protocols are open; its cables, data centers and platforms are controlled by a few companies.
- **Sovereignty:** who governs the infrastructure a country depends on, and under whose law?
- **South Africa:** can the cloud advance inclusive local growth, domestic input sourcing and domestic business?

Not explored in depth in this talk: open protocols, open formats, open source, open hardware.

Cloud and related: 0.55% of US input costs in 1997, 2% in 2025

What US industries spend on data processing and related information services, as a share of everything they buy as inputs

Data processing, internet publishing and other information services (*BEA commodity 514*) used as intermediate inputs, as a share of total US intermediate inputs (%)



This shows: of every \$100 US industries spend on inputs, about \$2 now goes to data processing and information services, up from 55 cents in 1997.

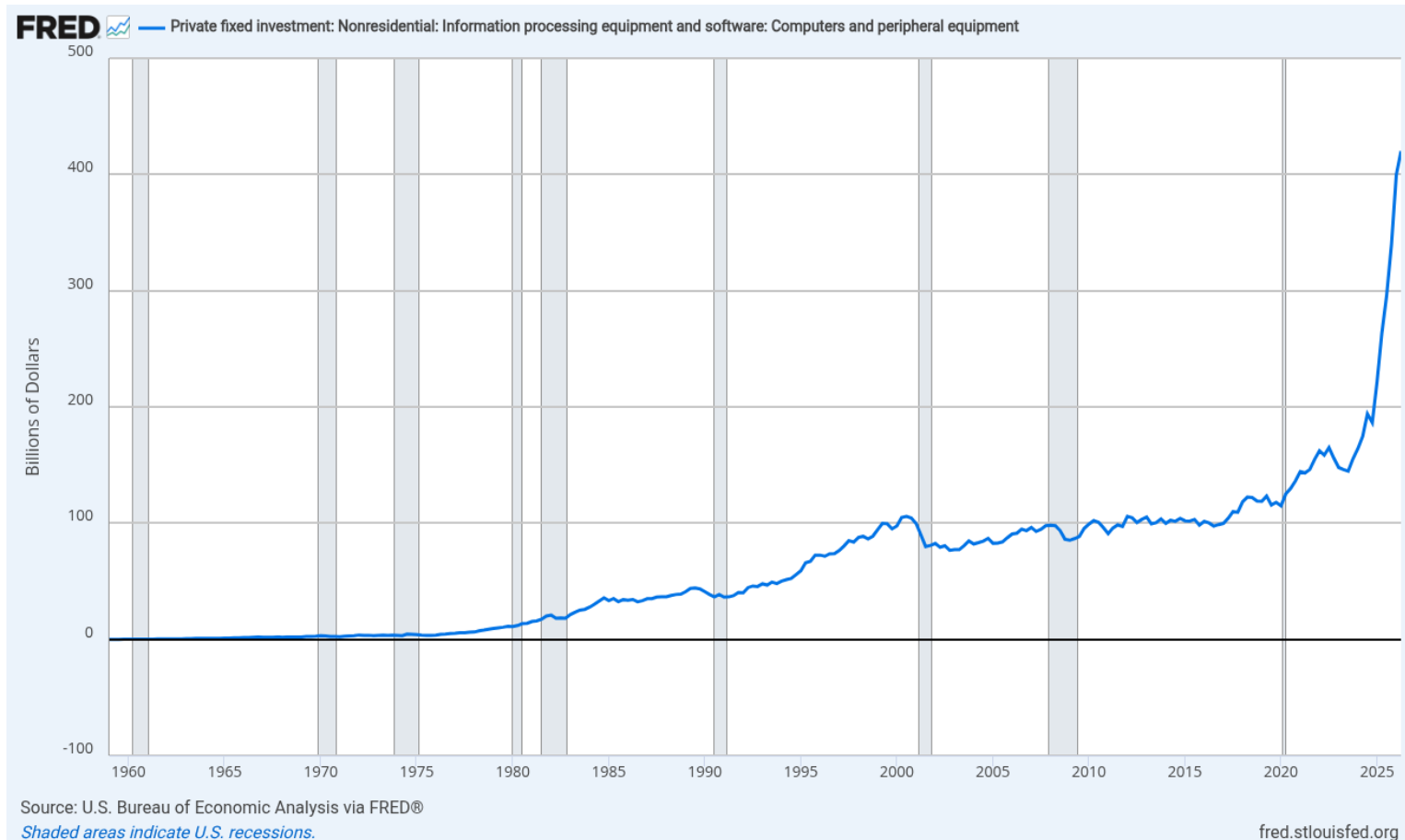
≈**2.5%** by 2030 if the 2015–25 trend continues (*dashed line; illustrative*)

Note: the annual category charted here is broader: it adds internet publishing and web search to data processing and hosting.

Sources: [BEA Use tables](#) (before redefinitions, producers' prices; released 30 Sep 2026). Trend: own calculation (appendix).

Economy-wide: US investment in computers has quadrupled since 2017

Private fixed investment in computers and peripheral equipment, current dollars: 1.3% of GDP in Q2 2026, above the dot-com peak



\$420bn at a seasonally adjusted annual rate in Q2 2026: 1.3% of GDP, against about 1.0% at the dot-com peak (2000). In real terms (*chained 2017 dollars*) investment is 3.4 times its 2017 level.

Owning vs buying computing: the capital changes hands

The cloud provider holds the capital; the user firm pays per use for a metered service

On-premises

- The firm buys servers, storage and software licenses
- It hires IT staff to run them
- It sizes capacity for its own peak, so much of it sits idle
- Recorded as the firm's own investment

Cloud

- **Metered:** the firm pays per second of server time, per gigabyte stored per month, per request, per AI token (*a chunk of text, priced per million tokens*)
- The cloud provider owns the data centers, chips, networks and software
- Capacity is pooled across many customers
- The user firm usually records a purchased service; the cloud provider records the investment

Question: *is this only a change in how firms buy IT, or does it enable a broader change in investment, production, and distribution?*

Three questions

- I. What economic transformation did the cloud produce?
- II. What structure of accumulation and market power has emerged around the cloud?
- III. Is this a new regime of accumulation, and what does it mean for inequality and development?

Part I: What changed

What economic transformation did the cloud produce?

Definitions: the cloud sells computing, not information

Internet, web, cloud and applications are different layers

- **Internet:** separately owned networks of cables, routers and switches (*Telkom, Vodacom and MTN here; Google and Meta worldwide*) joined by open protocols (*TCP/IP*); it moves data
- **The web:** one application on it: linked pages
- **The cloud:** computing capacity in data centers (*servers, storage and their own cables, routers and switches*), reached over the internet and sold on demand as a metered service
- **Applications:** Netflix, Snowflake, Claude, a bank's app, built on the layers below

Essential characteristics (NIST)

1. On-demand self-service
2. Broad network access
3. Resource pooling
4. Rapid elasticity
5. Measured service

Cloud services (NIST's three service models): **infrastructure as a service**, such as Amazon's EC2 (*virtual servers that run software, billed by the second*) and S3 (*storage for data, billed by the gigabyte per month*); **platform as a service** (*managed databases*); **software as a service** (*Microsoft 365*)

Owning vs pooling: shared servers need far less capital

Customers' peaks do not coincide, so pooled capacity can be far smaller than the sum of their peaks

- **Owning:** unlike the cloud model, each firm buys for its own peak, so its servers sit idle most of the time
- **Pooling:** with identical, uncorrelated demands, spare capacity grows with the square root of the number of customers: four times as many customers need only twice the buffer

Pooling, illustrated: (*assumed numbers*) 100 firms each need 10 servers at peak but 3 on average. Owning: 1,000 servers, 30% busy. Pooled, if peaks rarely coincide: about 400 servers, 75% busy. Same output, 60% less capital

Examples of cloud usage

Most of what you do online is executed somewhere else: your phone or laptop sends a request to a computer in a data center, which retrieves stored data, performs the computation and sends the result back.

- **A website:** you type in an address → a server in a data center runs the website's software → it sends the page back to your browser. The website's owner typically rents the computing power, storage and network traffic from a cloud provider such as Amazon, Microsoft or Google; Amazon operates an AWS cloud region (*a cluster of data centers*) in Cape Town.
- **Netflix:** almost everything before you press Play (*logging you in, your account data, recommendations, search*) runs on Amazon Web Services. Copies of the films sit on Netflix's own servers, separate from AWS, many inside or very close to internet service providers such as Telkom or Vodacom. When you press Play, Netflix's systems on AWS pick a nearby Netflix server, which streams the video to your device.
- **AI assistants:** your prompt travels to a remote data center → clusters of specialized AI chips (*GPUs and other AI accelerators*) run the model → the answer is sent back to your device. A business need not buy those machines: it can rent access through Amazon Bedrock or Microsoft Foundry, paying according to its use.

Netflix Example: What are its cloud costs?

At AWS's published prices, storing a film costs cents and sending it to viewers costs the most

1. **Encode:** done once, on AWS (*Amazon's cloud*): turning a two-hour film into one HD video file (*high definition, compressed for streaming*) costs \$1.80 to \$2.88; Netflix makes many versions of each title (*for different screens and internet speeds*)
2. **Store:** one 6 GB copy (*6 gigabytes: two hours in HD*) costs 14 cents a month in AWS's Virginia data centers, 16 cents in Cape Town
3. **Stream:** sending those 6 GB to one viewer costs about 30 cents from Virginia and 67 cents from Cape Town, every time it is watched (*AWS's published price for big users, above 150 terabytes a month*)
4. **Per viewer:** watching two hours a day for a month uses 180 GB: about \$9 from Virginia, 45% of Netflix's \$19.99 US Standard plan; about \$20 from Cape Town (*South Africa's Standard plan: R179 a month*)

Instead: Netflix delivers its video mainly from its own servers (*Open Connect; Netflix provides them free of charge to internet providers*); almost everything before you press Play (*sign-in, recommendations, search*) runs on AWS.

Paying per use: investment becomes a reversible expense

Owning servers

- **Capital:** bought in large lumps, up front
- **Timing:** capacity comes before demand
- **Risk:** servers become stranded assets
- **Lead time:** months of procurement

Cloud services

- **Capital:** rented as a service, paid by the hour or second
- **Timing:** capacity follows demand
- **Risk:** if demand falls, the user firm switches off the meter
- **Lead time:** minutes

Two layers: entry gets cheaper downstream, dearer upstream

The capital needed to enter declines for users (*cloud customers*) and increases for cloud providers

The cloud (AWS) heralded a revolution in competition and market entry as now a smaller start-up, such as Netflix, could compete with established media giants' infrastructure, paying only for the needed compute and gain access to the highest quality of service (see *The Everything Store* by Brad Stone).

- **Users** (*downstream cloud customers*): Capital needed to start was lower across sectors → software firms, retailers, banks, AI applications.
- **Cloud providers** (*upstream infrastructure*): Capital needed to compete became even higher. Need to construct data centers and procure chips, power, and networks; and then offer a greater diversity of software services.

Evidence: the cloud has benefited younger, smaller firms

Incumbents benefit less

- **US start-ups:** AWS cut the cost of starting a business. First venture rounds in the sectors most exposed to the cloud were about 20% smaller (*Ewens, Nanda and Rhodes-Kropf 2018*).
- **US factories:** Young manufacturing plants that bought more computer services (2006–14) were more productive and less likely to close; building up their own IT capital raised their risk of closing (*Jin and McElheran 2025*).
- **UK firms:** The cloud raised young firms' employment by 14% and sales by 16% a year; while incumbents did not grow larger and gained less in productivity (*DeStefano, Kneller and Timmis 2025*).

The accounts: national and company

National accounts: investment moves to the server owner

User firms usually record a purchased service; cloud providers record the investment

- **User firm:** its cloud bill is a payment for a service and almost always *intermediate consumption*
- **Cloud provider:** its purchases of servers, and of buildings it owns, are *gross fixed capital formation*

The cloud does not abolish fixed capital. It concentrates and relocates it, across firms, industries and borders.

Company accounts: capital turns into a recurring bill

The user firm becomes asset-light

- **Balance sheet:** property, plant and equipment (i.e. capital stock) falls
- **Income statement:** Leads to depreciation falling; hosting fees are expensed as incurred (*counted as costs right away*) and these rise
- **Cash-flow statement:** capital expenditure (*an investing outflow*) falls; operating outflows rise

Capital vs expense is a company-accounts distinction, separate from the national accounts.

Part II: Accumulation and market power

What structure of accumulation and market power has emerged around the cloud?

A Brief History of AWS

Build out of Cape Town!

- **2006:** S3 sells storage, space to keep data such as files and backups, at 15¢ a gigabyte a month; EC2 sells computing power, virtual servers that run software, at 10¢ an hour; no minimum fee. Amazon set up a Cape Town development center in 2004 “to build ... the technology behind Amazon EC2” (*Amazon, 2020*)
- **2009–14:** discounts for reserved capacity, managed databases, a separate cloud region for government; in 2013 AWS won a CIA contract over IBM despite bidding \$54m more
- **2012–18:** proprietary services (*DynamoDB, Redshift, Lambda*) and its own chips (*Graviton*); AWS's results first reported in Q1 2015: \$195m operating income on \$1.57bn of sales (*restated*)
- **2023–26:** distributor of AI labs' models, their landlord and an investor in them; \$45.6bn of operating profit in 2025; Amazon's backlog, mostly AWS, reached \$496bn by mid-2026

Concentration

Concentration: two or three firms supply 60–80%

Competition authorities' findings on cloud services

- **United Kingdom:** 70–80% by AWS + Microsoft in 2022 (*Ofcom*)
- **UK, EEA:** 60–80% by Microsoft + AWS (*IaaS: renting servers and storage*) in 2024 (*CMA, Competition and Markets Authority; EEA = European Economic Area*)
- **Netherlands:** 70–80% by Microsoft Azure + AWS, all cloud services except productivity software in 2020 (*ACM, Authority for Consumers and Markets*)
- **Japan:** 60–70% by AWS, Microsoft, Google in FY2020 (*JFTC, Japan Fair Trade Commission*)

Why the infrastructure layer concentrates

Sunk costs, scale and scope favor a few giants

When firms buy computing as a service instead of buying servers, the cloud providers must make the investment (*capital expenditure, or CapEx*) for them.

“As the CapEx is in specific assets, with limited resale value, the cloud providers’ CapEx therefore represent unavoidable ‘sunk’ costs.” (Autorité de la concurrence, France’s competition authority, 2023, para 213)
UK Competition and Markets Authority (2025), final decision, para 5.9

- **Sunk:** specific assets with little resale value
- **Scale:** cheaper hardware in bulk; servers kept busier
- **Scope:** one cloud provider for computing, data and AI

Concentration: three cost advantages favor the biggest

Pooling, upfront fixed costs and buying power

- **Pooling:** Raises utilization (*how busy the servers are*). A firm that owns its servers must buy for its own peak, so they sit idle most of the time. A cloud provider serving firms whose peaks fall at different times needs far less spare capacity: with identical, uncorrelated demands, four times as many customers need only twice the buffer. Larger cloud providers generally keep their machines busier (UK competition authority).
- **Fixed costs:** large and paid upfront. Buildings, grid connections and chips are paid for before the first customer arrives: \$493bn of capital spending by four cloud providers (*company-wide, not only cloud*) in twelve months. Average cost falls as output grows, and an entrant that fails cannot fully recover the money.
- **Buying power:** size buys scarce inputs on better terms: hardware up to 30% cheaper in bulk (*a 2010 Microsoft study, cited by Ofcom*); long-term power contracts; and own AI chips (*Amazon's Trainium, Google's TPU*) instead of paying Nvidia's 75% gross profit margin. Amazon's chip business passed a \$25bn annual run rate (*recent sales, scaled to a full year*) in 2026.

Pooling (*assumed numbers*): 100 firms each need 10 servers at peak but 3 on average. Owning: 1,000 servers, 30% busy. Pooled, if peaks rarely coincide: about 400 servers, 75% busy. Same output, 60% less capital.

Lock-in (often leads to exploitation of customers)

Lock-in, part 1: data in is free, data out is charged

Fees on data sent out (*egress fees*), by the gigabyte, make using a second cloud provider costly

- **Data in:** \$0.00 per gigabyte at AWS
- **Data out:** \$0.09 per gigabyte from AWS's US regions; \$0.154 from Cape Town
- **Ofcom:** the UK regulator found the biggest cloud providers' egress fees were 5–10 times some rival platforms and likely above the cost of providing the service
- **Full exits:** Since 2024, AWS and Google open to waiving the exit fees worldwide. In the UK, AWS and Microsoft now waive the degree fees for at least first 180 days. The EU banned switching charges from January 2027.
- **Switching:** fewer than 1% of UK cloud customers switch cloud provider in a year

Lock-in, part 2: contracts, licenses and code

Beyond the price list, five mechanisms bind the customer

- **Committed-spend discounts:** bigger discounts for committing to spend more with a single cloud provider
- **Marketplace drawdown:** third-party software bought in the cloud provider's online store counts toward the above commitment
- **Software licensing:** Microsoft software costs more on rival cloud providers, pushing customers to Microsoft's cloud, *Azure*.
- **Proprietary services and data formats:** leaving can mean rewriting parts of applications
- **Start-up credits:** up to \$150–350k of free cloud use to win start-ups' first choice of provider

Profits

Surplus and Distribution

Cloud is now a core source of profit for Amazon, Microsoft, and increasingly also Google

Cloud segment as a share of the parent

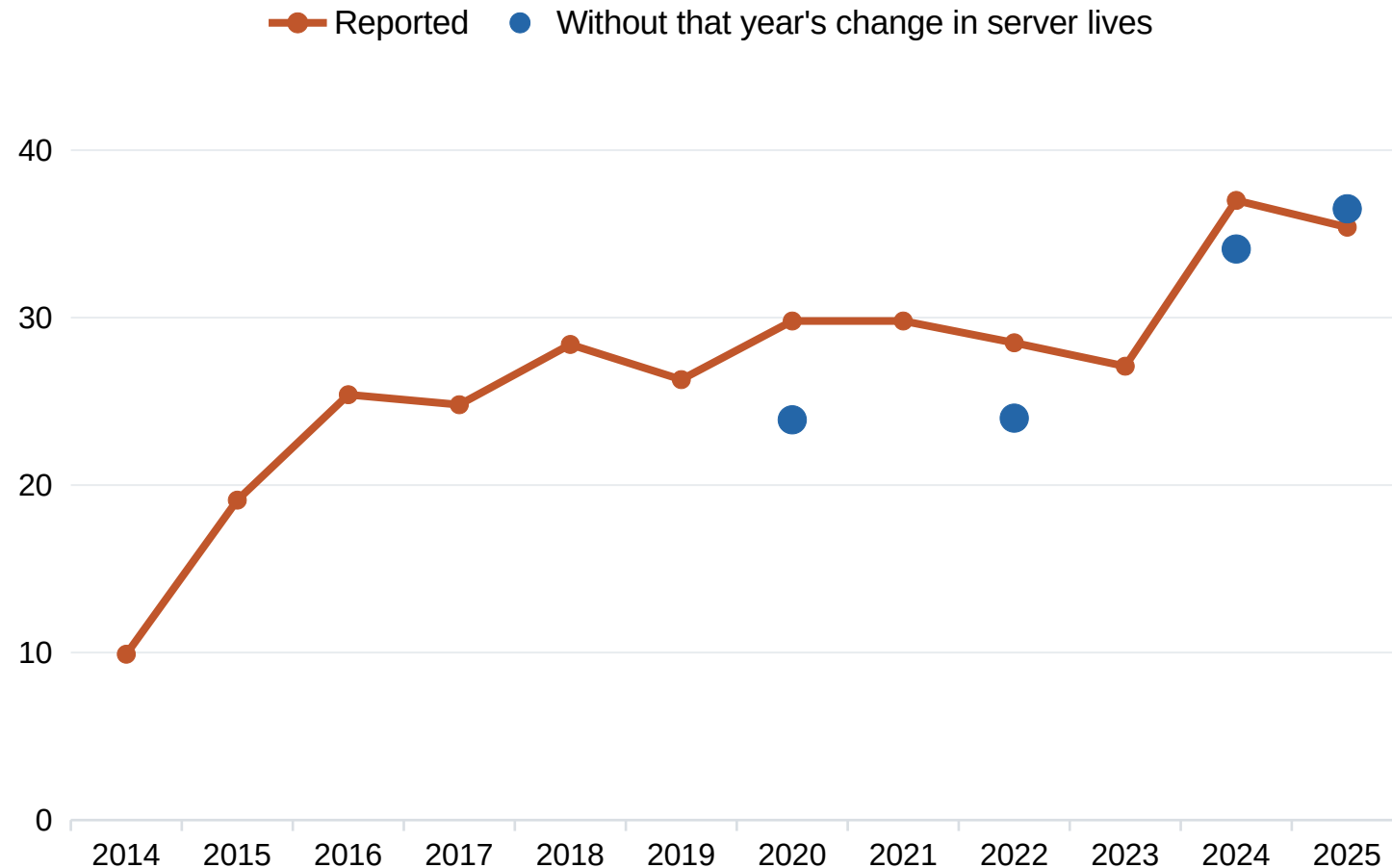
<u>Firm and segment</u>	<u>Quarter</u>	<u>Revenue (%)</u>	<u>Operating income (%)</u>
Amazon: AWS	Apr–Jun 2026	21%	61%
Microsoft: Intelligent Cloud	Apr–Jun 2026	44%	39%
Alphabet: Google Cloud	Apr–Jun 2026	21%	22%
Oracle: all cloud	Jun–Aug 2026	60%	Not disclosed

Own calculations from segment data. Microsoft's segment includes on-premises server software.

Cloud revenue: AWS \$129bn (2025), Azure \$102bn (year to June 2026), Google Cloud \$59bn (2025, incl. Workspace office apps).

Cloud profit margins appear to be rising: AWS from 10% (2014) to 35% (2025)

AWS operating income as a share of AWS net sales, worldwide (%)



This shows: AWS keeps about 35 cents of each dollar of sales as operating profit, up from about 25 cents in 2017.

34.1% = AWS's 2024 operating margin without the change in server lives (from five to six years; Amazon's depreciation \$3.2bn lower, mainly at AWS)

Google Cloud operating margin was **35.6%** in April–June 2026, up from 23.7% in July–September 2025

Snap: the cloud bill is a quarter of its costs

Snapchat runs on Google Cloud and AWS; hosting was 25% of Snap's total operating costs in 2025

- **Snap:** the company behind Snapchat relies on Google Cloud and AWS “for the vast majority of our computing, storage, bandwidth, and other services” (*Snap 10-K, 2025*)
- **\$1.58bn** of infrastructure costs in 2025, mainly payments to “third-party infrastructure partners for hosting our products” (*Snap 10-K*), for storage, computing and bandwidth
- **25%** of Snap's total operating costs in 2025 (*23% in 2024*)
- **Coinbase:** website hosting and infrastructure (*cloud services and data centers*) was 5.6% of its total operating costs in 2025
- **Snowflake:** third-party cloud infrastructure was at least 18% of its total operating costs (*May–Jul 2026*)

Economy-wide: cloud earns about 3% of US corporate profits

- **3%** of all US corporate profits, which also include profits earned abroad, was the worldwide operating income of three cloud businesses: AWS, Microsoft's Intelligent Cloud and Google Cloud (*four quarters to mid-2026*)
- **1.1%** was due to AWS alone in 2025, up from 0.07% in 2015

AI and the cloud

Selling AI: cloud providers sit between AI labs and customers

Three ways to sell AI through the cloud, and what each gives the AI lab and the cloud provider

1. **Middleman** (*Claude in Amazon Bedrock*): AWS runs the AI lab's model and bills the customer. The lab reaches 100,000+ AWS customers but gives up a share of revenue.
2. **Vertical integration** (*Amazon Nova, Google Gemini, Microsoft MAI*): the cloud provider keeps all the revenue but pays to build the models, and competes with the AI labs it sells.
3. **Hybrid** (*Claude in Microsoft Foundry; Claude Platform on AWS*): the AI lab sells and runs its own product inside the customer's cloud account; the cloud provider keeps the billing.

Why the cloud: logins, audit logs, data rules and spending commitments already sit with the cloud provider, so firms buy AI there too.

AI stakes: cloud providers paid in compute and took equity

Why cloud providers own stakes in OpenAI and Anthropic

Scarce compute was converted into equity in the most valuable AI firms: Microsoft owns about 25% of OpenAI; Amazon has put \$18bn into Anthropic (*convertible notes and non-voting preferred stock*), now valued on Amazon's books at \$190bn; Google owns 10% or more of Anthropic (*court filing, 2025*).

1. **Scarce compute:** frontier AI needs gigawatts of data centers that take years to build, and the cloud providers had them; the AI labs could not pay from revenue alone. Anthropic has committed to spend over \$100bn on AWS (*April 2026*) and \$30bn on Azure (*November 2025*); OpenAI an extra \$250bn on Azure (*October 2025*)
2. **Payment:** the cloud providers paid in compute: the money comes with commitments to spend much of it on the investor's cloud, so it returns as cloud revenue (*US Federal Trade Commission staff: 'circular spending'*). At a 35–40% operating profit margin, \$10bn spent back costs the cloud provider about \$6–6.5bn to supply (*illustrative*)

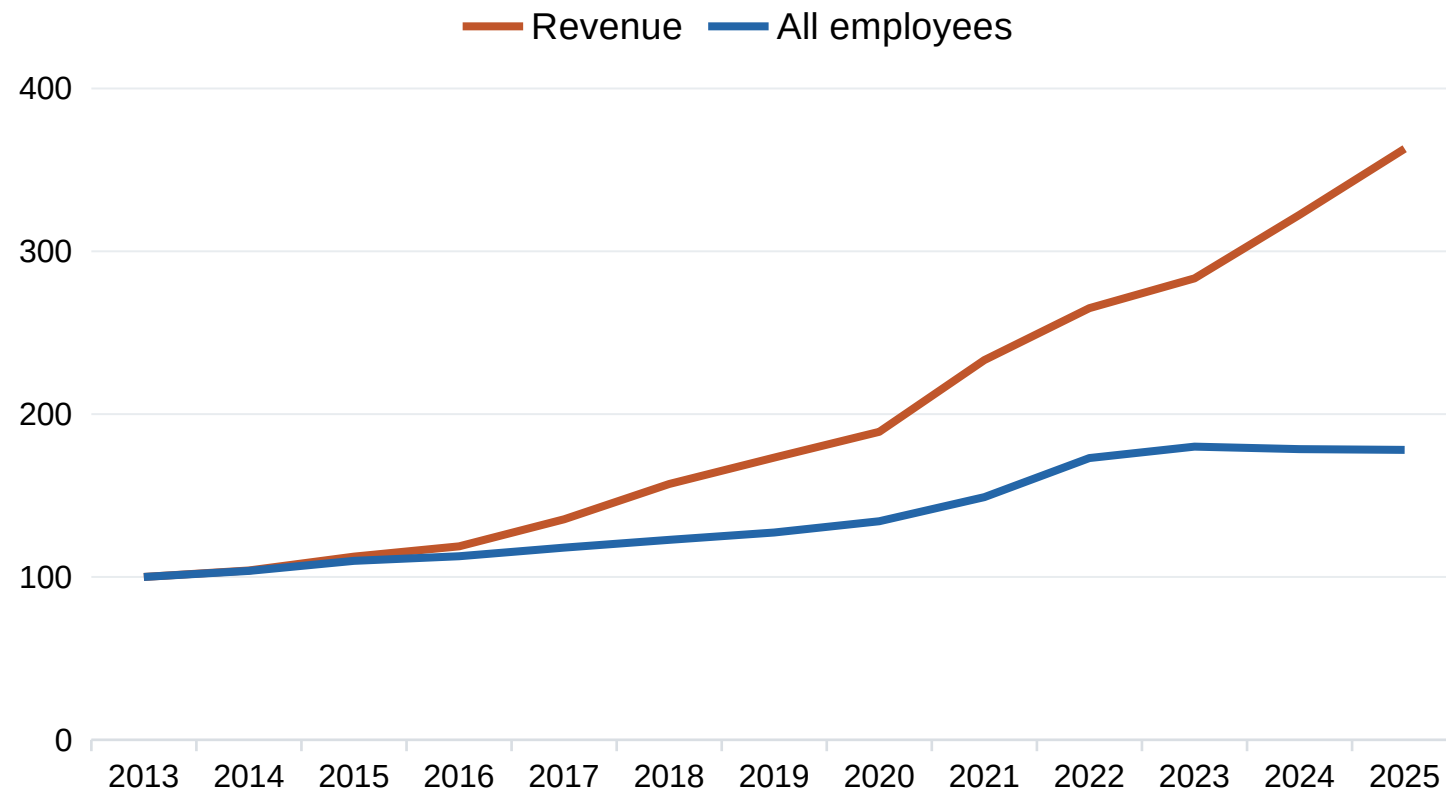
Part III: How does the cloud impact inequality and development?

More research is required

Cloud production is machine – and therefore profit – intensive

US data processing, hosting, and related services (*industry code NAICS 518*), 2013–2025

Data processing, hosting and related services (*NAICS 518*), index 2013 = 100



- **55%** of value added goes to gross operating surplus (*profits plus depreciation*) in data processing, internet publishing, and other information services (*NAICS 518–519, 2025*)
- **vs. 45%** across all US private industries

Where is the cloud? Not where most people live

60% of the world's people live in countries that hold 9% of its data-center capacity.

Distance: physics and law decide what must be local

How far can computing in one country serve another?

From most to least sensitive to distance:

- **Local:** gaming, trading, real-time AI agents. Johannesburg–London: at least 89 milliseconds round trip at the speed of light in fiber in a straight line; real cables run longer.
- **Partly local:** video, web pages and search: caches (*stored copies of popular content*) sit inside local internet providers; the computing stays abroad.
- **Anywhere:** storage, backup, model training. The capital-heavy core of the cloud goes where power, land and capital are cheapest.

Law: privacy rules limit sending personal data abroad. The laws of South Africa (*POPIA, section 72*) and the EU (*GDPR, Chapter V*) allow it only under conditions such as adequate protection in the receiving country, binding safeguards or the person's consent. The US CLOUD Act cuts the other way: US authorities can demand data held by US cloud providers wherever it is stored, including in Cape Town.

South Africa

South Africa: hosting the capital, not owning it

The cloud providers with regions (*clusters of data centers*) here are owned abroad

- **2004:** Amazon opens a development center in Cape Town “to build ... the technology behind Amazon EC2” (*Amazon, 2020*), the service that rents out virtual servers
- **2019:** Microsoft Azure, Johannesburg and Cape Town: Africa's first large cloud regions
- **2020:** Amazon Web Services, Cape Town
- **2022:** Oracle, Johannesburg
- **2024:** Google Cloud, Johannesburg: no machines with GPUs (*AI chips*) listed

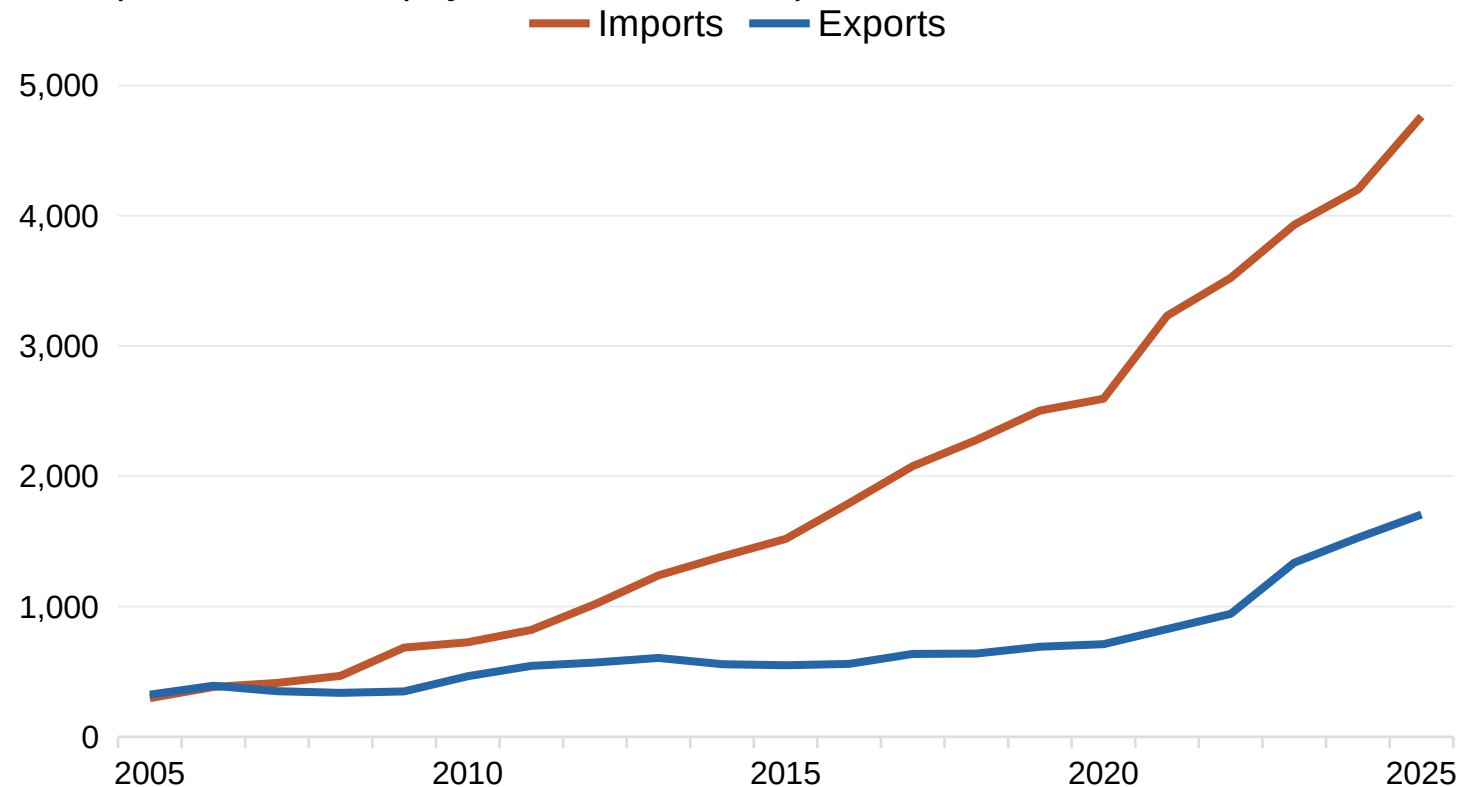
Teraco, South Africa's largest data-center operator (*a landlord for other firms' servers*): controlled by US firm Digital Realty since 2022 (*61% indirect interest, rising to 77%*).

AWS's planned ZAR 46bn 'investment' (2018–2029) includes operating costs and imported equipment and software.

South Africa: cloud use shows up as service imports

The ICT (*telecom, computer and information*) services deficit reached \$3.1bn in 2025, about four-fifths of the whole services deficit

South Africa: trade in telecommunications, computer, and information services, US\$ million (*IMF balance-of-payments data, BPM6*)

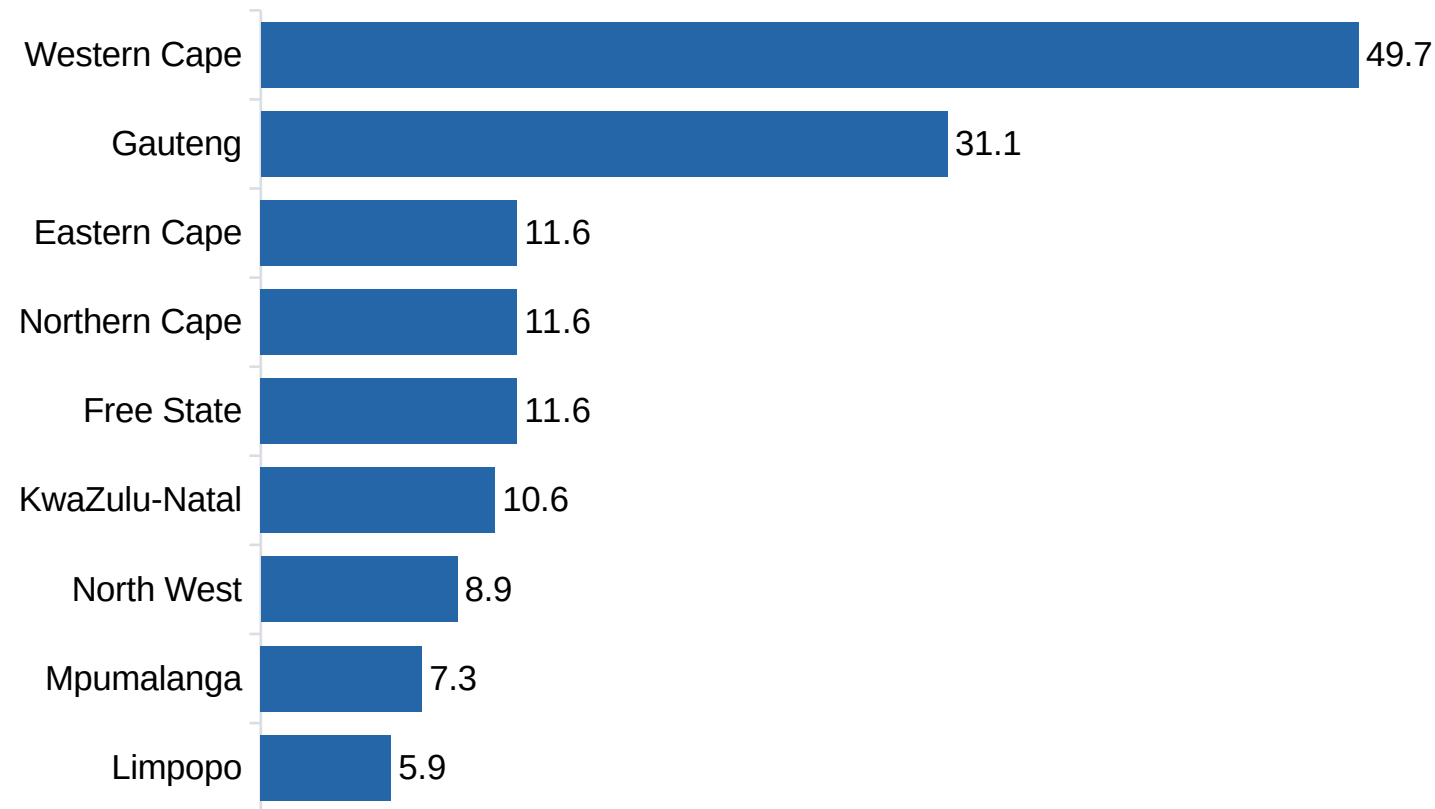


- **22%** of South Africa's services imports were ICT services in 2025, up from 2% in 2005
- **R85bn** of ICT services imports in 2025: about half the value of net gold exports (*R172bn*) and 4.5% of merchandise exports
- **Imports understated:** cloud sold through foreign providers' local subsidiaries is not counted as an import

South Africa: two digital economies

Firms buy frontier computing as a service while four in five households lack fixed Internet at home

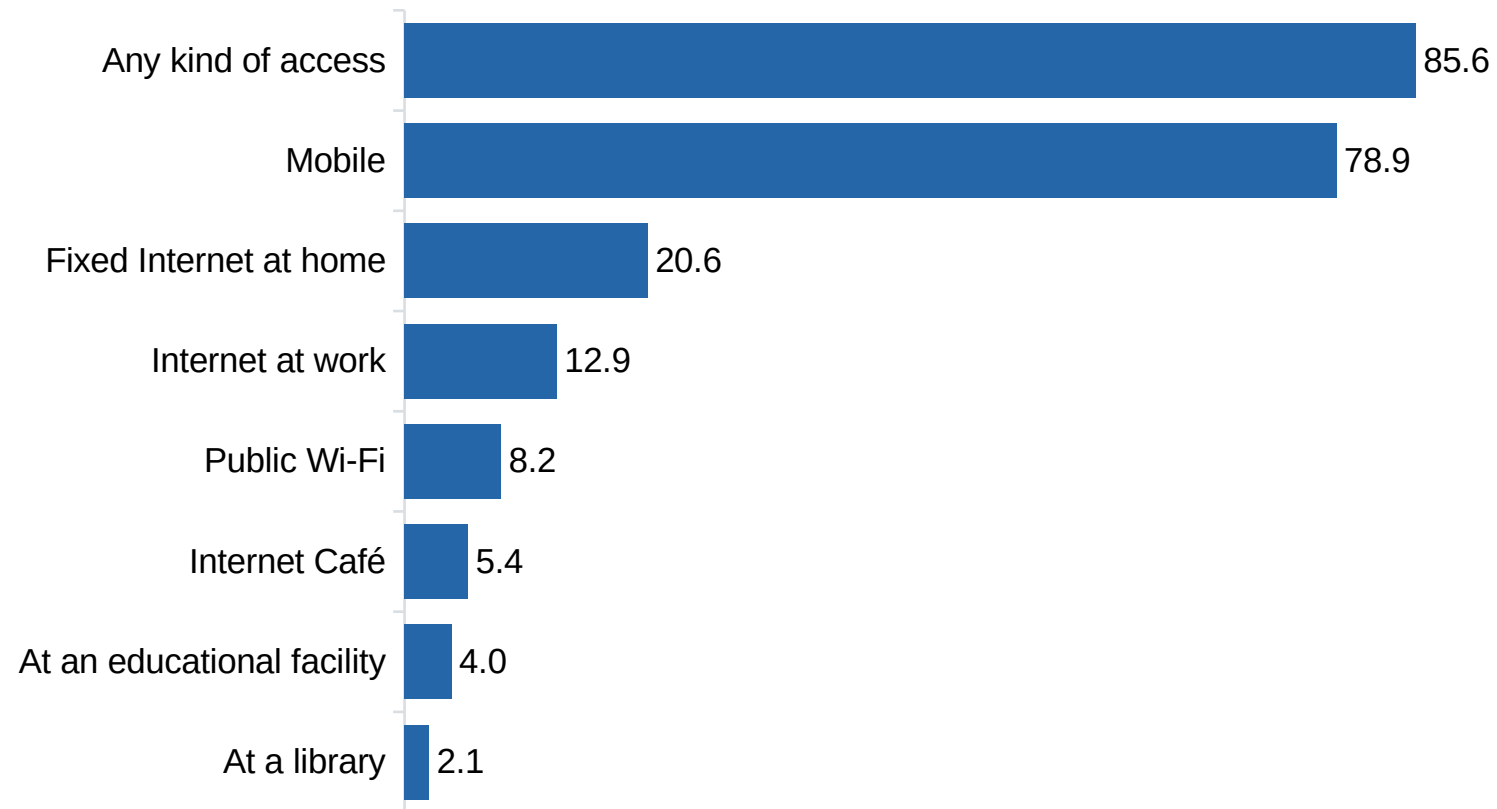
Households with fixed Internet at home, by province, 2025 (%)



South Africa: households get online mainly by mobile

Most households have some kind of access; one in five has fixed Internet at home

Households with access to the Internet, by type of Internet access, South Africa, 2025 (%)



South Africa's 2024 data and cloud policy: buy cloud, don't build it

The state will buy cloud services from industry

2021 draft

- **Localization:** critical-information-infrastructure data processed and stored in South Africa
- **State capacity:** a state computing center
- **Competition:** review the law on dominance

2024 policy

- **Localization:** only security-sensitive state data
- **State capacity:** 'cloud-first' buying from industry
- **Competition:** the Competition Commission to study the market; review the law only if evidence warrants

“it may not be feasible for the government to own and manage data centres with its limited resource base” (National Policy on Data and Cloud, 2024, p.141)

Policy

Utility? Natural-monopoly features, no utility duties

Is the cloud a utility like water or electricity?

Utility-like

- Networked and metered
- High fixed costs, mostly sunk
- Scale and pooling economies
- An essential input for other firms

Not utility-like

- No universal-service duty
- No rate regulation (*the EU caps only switching and egress charges*)
- **Less fungible:** proprietary services, so customers sink costs in one cloud provider and switching is costly
- Sold across borders
- Servers written off in six years or less

Utility and platform: profit margins likely sit in the platform

Compute is sold like a utility; switching costs, and probably profit margins, sit in the platform around it

- **Utility-like layer:** compute, storage, networking; metered and pooled; price competition may push it toward utility economics. High fixed cost market.
- **Platform layer:** proprietary databases, identity (*logins and permissions*), developer tools, marketplaces, AI models, license bundling, spending commitments and egress fees; differentiation and switching costs concentrate here, and probably profit margins
- **Not neutral:** the cloud provider decides whose models appear, on what terms, and sells its own
- **Two rulebooks?** (1) As a utility: common carriage (*a duty to serve all comers*), non-discrimination and price oversight; (2) As a platform: interoperability, data portability and unbundling

Policy: What to own, what to regulate, what to open?

- **Private Platform:** Vertically integrated, proprietary → current state (*AWS, Microsoft Azure, Google Cloud*)
- **Regulated Utility:** Easy switching, non-discrimination, fair prices (*EU Data Act: switching charges banned from January 2027*)
- **Open Protocols:** Competition between cloud providers and in the services built on them (*TCP/IP, which joined the internet's separately owned networks; Anthropic's Model Context Protocol for AI agents*)
- **Federated Capacity:** Independent cloud providers that interconnect (*Gaia-X, a European federation framework founded in 2021*)
- **Public Capacity:** Compute as a metered public utility (*the EU's EuroHPC AI Factories: public supercomputers offering AI computing to start-ups free of charge*)

Middle powers: which layers must be owned, which governed, and which only need to interoperate?

Could African and European data centers train AI together?

Joint production could expand what both regions produce (*more demand, more supply, more financing*); not as one tightly linked cluster, but in a looser form, it is possible.

Synchronous (lockstep): no

- Light in fiber adds at least 85–90 milliseconds to every round trip between South Africa and Europe
- The 2Africa cable's whole West trunk (*England–South Africa*) carries what the network cards of about 200–450 GPUs (*AI chips*) move inside one cluster

Looser: yes

- Low-communication training (*sites sync only occasionally*) cuts traffic 400–500 times
- A 10-billion-parameter model has been trained across three continents this way (*Prime Intellect's INTELLECT-1, 2024*)
- Fine-tuning and serving (*running the model for users*) can be split across sites

Ownership: Google and Microsoft already train across their own distant data centers. Pooling African and European capacity held by different owners would also need open interfaces and shared rules. For looser training, the cable is not the bottleneck; the scarcer inputs in Africa are likely chips, power and capital.

Questions for further investigation

More research is required on how the cloud is impacting the distribution of profits, investment, and innovation in South Africa and globally.

1. How does the cloud shape the regime or mode of accumulation (*how investment, profits and demand fit together*)?
2. Should cloud providers be neutral between their own services and their rivals'?
3. Which governance for which layer (*utility-like or platform*): utility rules, platform rules, a public option, a federation of independent cloud providers?
4. Can middle powers combine infrastructures they do not own? For example, as a buyers' bloc that uses sovereignty over sites and market access:
 - pooled procurement across countries
 - common portability and interoperability rules (*the EU Data Act is the model*)
 - conditions attached to data-center approvals and grid connections, such as local access, open interfaces or public stakes

Appendix

Method: the cost share

- **Cost share:** what all US industries spend on data processing, internet publishing and other information services (*BEA commodity 514*) as intermediate inputs ÷ their total intermediate inputs, from BEA's Use tables (*before redefinitions, producers' prices*): 1997, \$37.4bn ÷ \$6,816bn = 0.55%; 2025, \$434.8bn ÷ \$21,936bn = 1.98%
- **Industry purchases:** in 2025 only 59% of the category's output (\$736bn) was bought by industries; consumers took 24.5%, investment in intellectual property 15.6% and exports 1.1%, so total output divided by inputs would overstate the cost share by about 1.7 times
- **Hosting alone:** BEA publishes data processing and hosting on its own only in its detailed tables: 0.50% in 2007, 0.61% in 2012 and 1.15% in 2017, two-thirds to four-fifths of the broader category
- **Trend:** the share grew 4.7% a year from 2015 (1.26%) to 2025 (1.98%); carried forward five years, about 2.5% in 2030. At the 2020–25 rate (3.4% a year), 2.3%. An extrapolation, not a forecast
- **Size:** BEA's last digital-economy accounts (December 2023) put cloud services at 7.1% of US digital-economy gross output in 2022; the digital economy's value added was 10.0% of GDP
- **Caveats:** the category also includes internet publishing and web search, and excludes in-house IT and cloud bought inside software or IT-services contracts; producers' prices, current dollars; 2021–2025 can be revised

Method: the profit shares

- **Profit shares:** both sides include profits earned abroad: AWS's worldwide operating income ÷ BEA's national corporate profits with inventory valuation and capital consumption adjustments (*IVA, CCAdj; FRED series CPROFIT; domestic profits plus US firms' profits from abroad, less profits paid to foreign owners; annual average*): 2015, \$1.5bn ÷ \$2,173bn = 0.07%; 2025, \$45.6bn ÷ \$4,025bn = 1.13%. Three cloud segments (*AWS, Microsoft's Intelligent Cloud, Google Cloud*), four quarters to mid-2026: \$136bn ÷ \$4,337bn = 3.1%
- **Definitions:** what still differs is definition, not scope. Company operating income uses accounting depreciation and comes before interest. BEA uses economic depreciation, deducts net interest and excludes capital gains. That affects the size at the margin, not the order of magnitude
- **Caveats:** segment operating income is defined by each company; Microsoft's Intelligent Cloud includes on-premises server licenses (*about a quarter of its revenue is not Azure*); Alphabet does not charge Google Cloud for shared AI research; Oracle does not report cloud profits

Open formats: lock-in moved from compute to data

Open standards made computing portable; lock-in moved to data, proprietary services and contracts

- **Containers** (*Docker, 2013*): package an application with everything it needs, so it runs unchanged on any machine with a compatible operating system; an application can then move between cloud providers without being rewritten, unless it relies on a cloud provider's own services
- **Kubernetes** (*open-sourced by Google, 2014*): runs containers on any cloud provider; AWS, Azure and Google all offer it as a managed service
- **Open formats** (*Apache Parquet; Apache Iceberg, created at Netflix*): let different software read the same stored data
- **Lock-in survives** where software relies on proprietary services and where data sits in proprietary formats

Measurement: Need for official data

Official sources to use for a research program

- **Cost shares:** cloud's cost share in every industry, from BEA input-output Use tables (*commodity 518200 in benchmark years; the annual tables merge it into 514*)
- **Profits:** BEA gross operating surplus for data processing and internet services (*industry 514*), which is domestic; company segment profits are worldwide, so the two need a common scope
- **Firm panels:** annual-report (*10-K*) disclosures of cloud hosting costs, like those of Snap, owner of Snapchat
- **Who adopts:** US Census Bureau's Annual Business Survey; Eurostat survey of ICT use in enterprises
- **South Africa:** Reserve Bank balance of payments: payments for telecommunications, computer and information services, and income paid abroad

Value added moves upstream, even when the cloud is priced at cost

Example with made-up numbers: a firm moves its IT to the cloud

1. **Before:** the firm runs its own servers. Its IT wages (\$10m), server depreciation (\$20m) and a normal profit on its servers (\$4m) add \$34m to its value added. It also buys \$4m of electricity
2. **After:** the firm pays a cloud provider \$38m a year instead: the same \$34m plus the \$4m of electricity, with no mark-up
3. **User firm:** the \$38m bill is a purchased input, so the firm's value added falls by \$34m
4. **Cloud provider:** the wages, depreciation and profit now sit with the cloud provider, so its value added rises by \$34m

Result: total value added is unchanged, but \$34m of it, and the capital behind it, has moved to the cloud provider.

Cables: Google and Meta build Africa's new routes

Who owns the cables?

- **Peering, transit:** networks swap traffic directly, often with no money exchanged, or pay a carrier for transit to the rest of the internet; large networks peer wherever they can
- **Google:** about 10 million km of land and subsea fiber, including its own Equiano cable from Portugal to South Africa (*landed 2022*)
- **2Africa:** a cable built by a Meta-led consortium with MTN, Orange, Vodafone and others; core system completed in November 2025, connecting 33 countries
- **So:** Google keeps traffic between its cloud regions, including between Europe and its Johannesburg region, on its own network rather than the public internet

Governance: every option has a precedent

Examples for each design choice

- **Private platform:** vertically integrated, proprietary (*the status quo*)
- **Regulated utility:** switching and interoperability rules (*EU Data Act*); voluntary cuts by AWS and Microsoft to fees for moving data out (*UK Competition and Markets Authority, 2026*)
- **Open protocols:** competition between cloud providers and among the services built on them; TCP/IP (*the protocols that joined the internet's separately owned networks*) as the precedent; open protocols for AI agents, such as Anthropic's Model Context Protocol (*MCP*), donated to the Linux Foundation's Agentic AI Foundation in 2025
- **Federated capacity:** Gaia-X, an international non-profit association under Belgian law, founded in 2021 to link independent cloud providers
- **Public capacity:** South Africa's 2021 draft data and cloud policy proposed a state computing center, linked by a state network company; the 2024 policy dropped both

Theory

A new mode of production? A new regime of accumulation?

Classical Economics: shared infrastructure, sold as an annuity, earning interest

Three ideas behind Harvey and Marx's 'fixed capital of an independent kind'

1. **Infrastructure:** roads, canals and railways are 'general conditions of production', used by many firms in common; capital takes them over from the state only with 'the highest development of production founded on capital' (*Grundrisse*, pp.530–31)
2. **Annuity** (*a stream of regular payments*): sold by installments rather than all at once, infrastructure earns like interest: its value returns 'in the form of an annuity, where interest represents the surplus value and the annuity the successive return of the value advanced' (*Grundrisse*, p.723)
3. **Profit rate:** such undertakings 'are still possible if they yield bare interest, and this is one of the causes, stemming the fall of the general rate of profit' (*Grundrisse*, *Notebook V*); firms using shared infrastructure advance less capital, so their profit rates can rise (*Harvey*)

The cloud fits all three, but its owners appear to earn more than 'bare interest'.

Regime of accumulation? A basis for one, not yet a regime

1. **Definition:** regularities in production, investment, distribution and demand that keep accumulation on a coherent path for decades.
2. **Already present:** a new norm of production (*computing is bought as a service, not owned*) and a long horizon for investment.

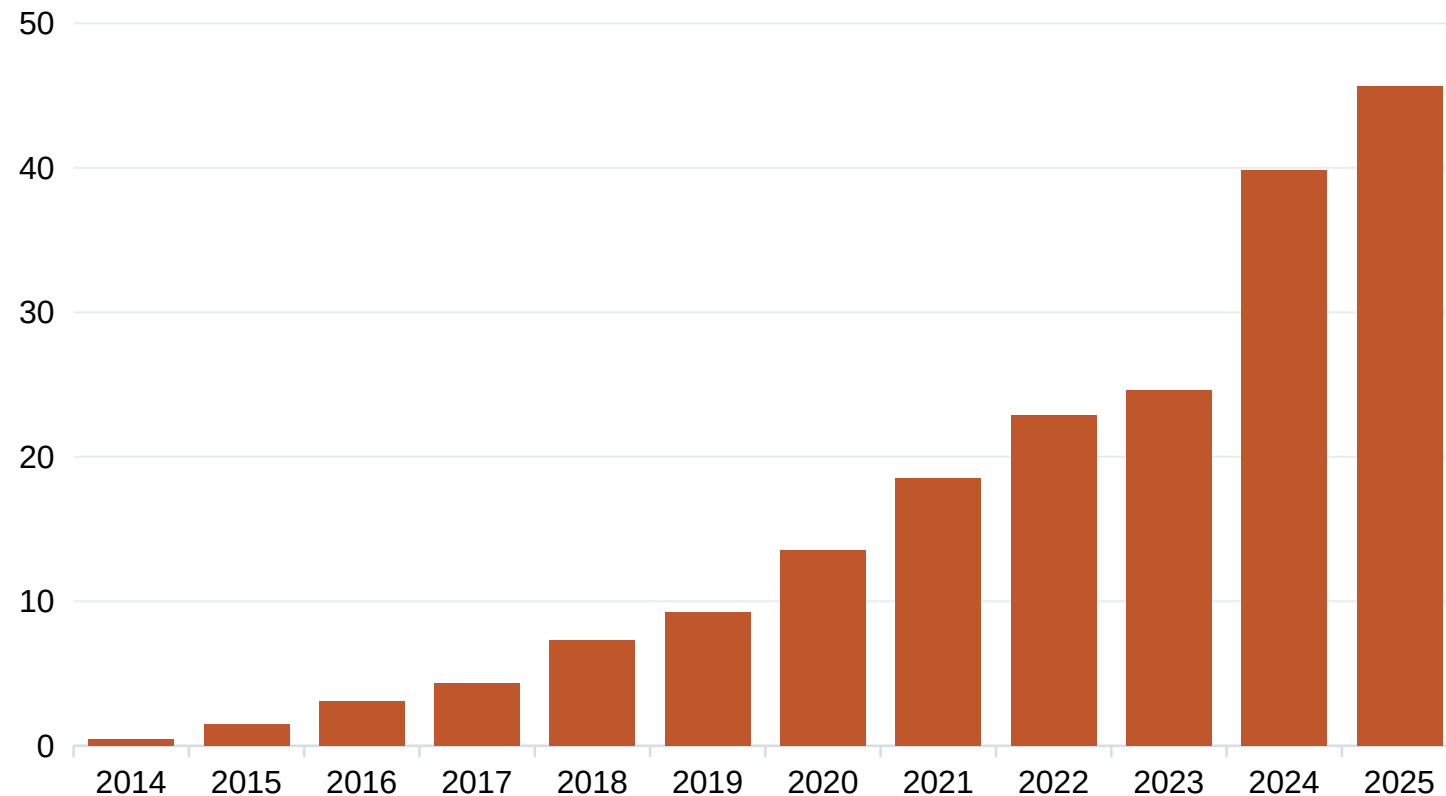
For now, demand comes from investment and finance (*see the leftover slides on demand and circular spending*).

Leftover slides

AWS: a small share of sales, most of Amazon's profit

18% of Amazon's sales and 57% of its operating income in 2025

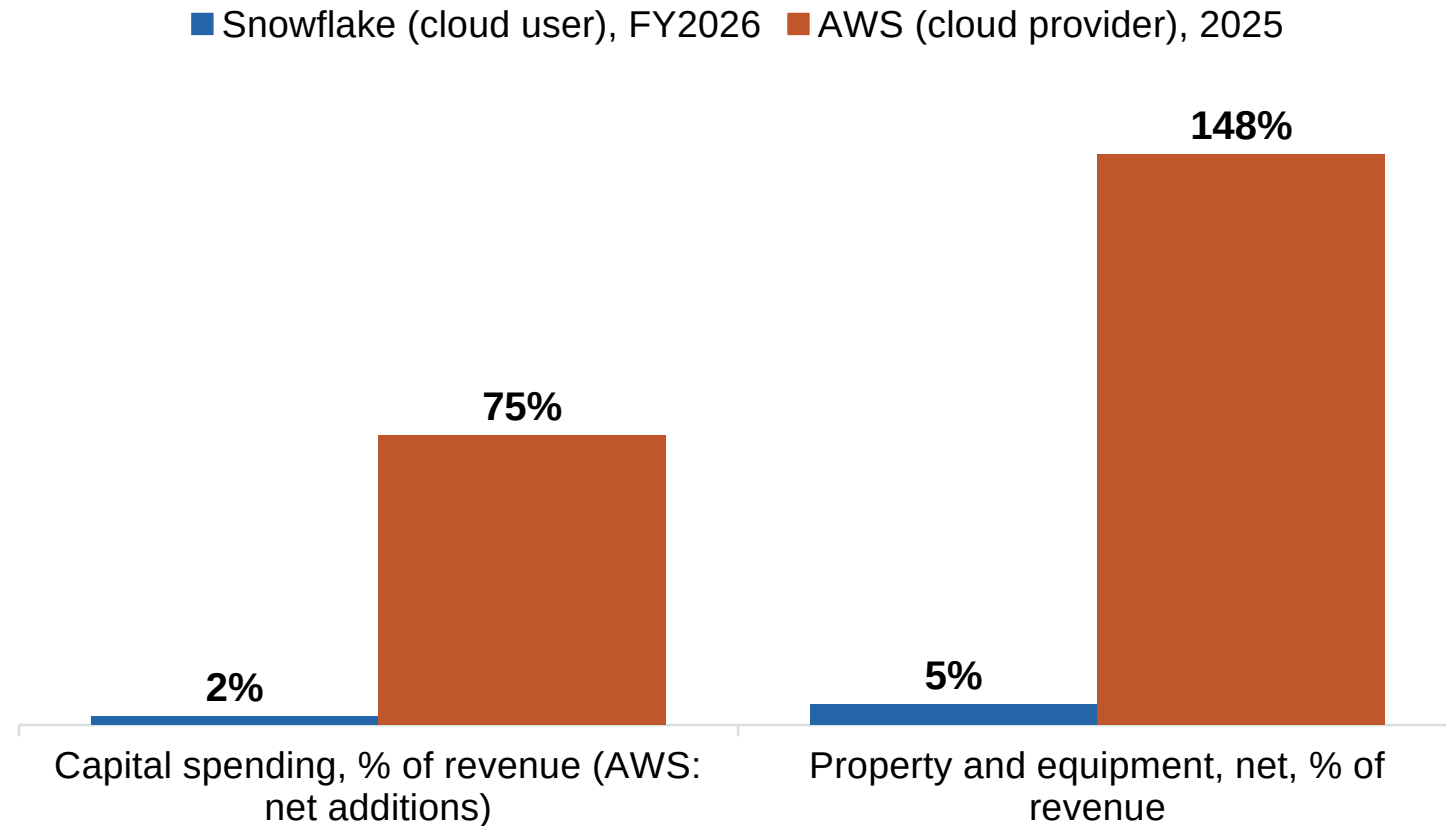
AWS segment operating income, \$ billion



- **57%** of Amazon's operating income came from AWS in 2025, on 18% of its sales
- **Profit margins:** AWS 39%, Google Cloud 36%
(segment operating margins, Q2 2026)

Filings: asset-light user firms, asset-heavy cloud providers

Company filings show the two layers side by side

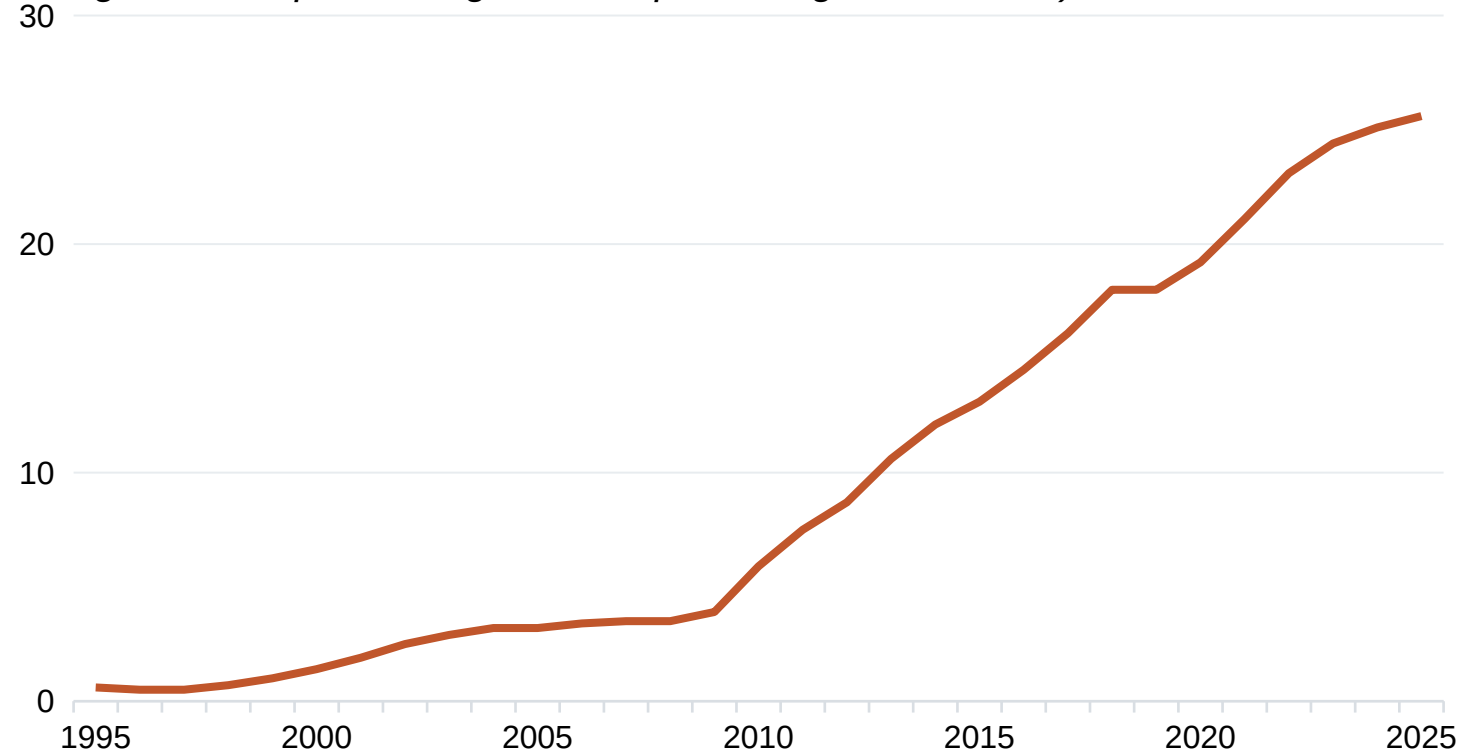


- **Leaving AWS:** Dropbox moved most user data off AWS onto its own infrastructure in 2015–16
- Its gross margin rose from 33% (2015) to 67% (2017)

Capital stock: computers concentrate in internet and data firms

Firms in data processing, hosting, internet publishing and web search (NAICS 518–519) own a quarter of US private-sector computers (*by value*), up from 1.4% in 2000

Share of the US current-cost net stock of private computers and peripheral equipment owned by BEA's information and data processing services industry (NAICS 518–519: *hosting and data processing, internet publishing, web search*), %



- **25.6%** of that stock in 2025, up from 1.4% in 2000
- **\$1.21tn** net property and equipment of Amazon, Microsoft, Alphabet and Oracle (*whole companies*) in 2026, up from \$157bn in 2018

Sunk costs: cloud providers could not get their money back by exiting

That deters entry and rewards lock-in

- **Short-lived:** about two-thirds of Microsoft's capital spending in April–June 2026 went on short-lived assets, mainly CPUs and GPUs (*general-purpose processors and AI chips*); Amazon cut the depreciation period of some servers from six years to five because AI is changing hardware so fast
- **Specific:** custom servers, cooling, substations, grid connections and fiber are fixed to one site and one firm's architecture
- **Few buyers:** the natural buyers (*other cloud providers*) would face the same fall in demand, so specialized assets sell at fire-sale prices
- **Commitments:** Microsoft has \$329bn of leases, primarily for data centers, signed but not yet commenced

So entrants risk their outlay, incumbents whose costs are already sunk will cut prices rather than leave, and cloud providers need long contracts and locked-in customers to recover the outlay.

Demand: who buys what the new capital can produce?

The missing piece is demand

$$\Pi = I + (X - M) + (G - T) - S_w + C_k$$

gross profits (*net of taxes*) = gross investment + export surplus + budget deficit – workers' saving + capitalists' consumption

30% of US real GDP growth in 2025 came from investment in information-processing equipment and software

What sustains demand when the investment boom slows?

Circular spending: it validates itself, for a while

Amazon and Anthropic, step by step

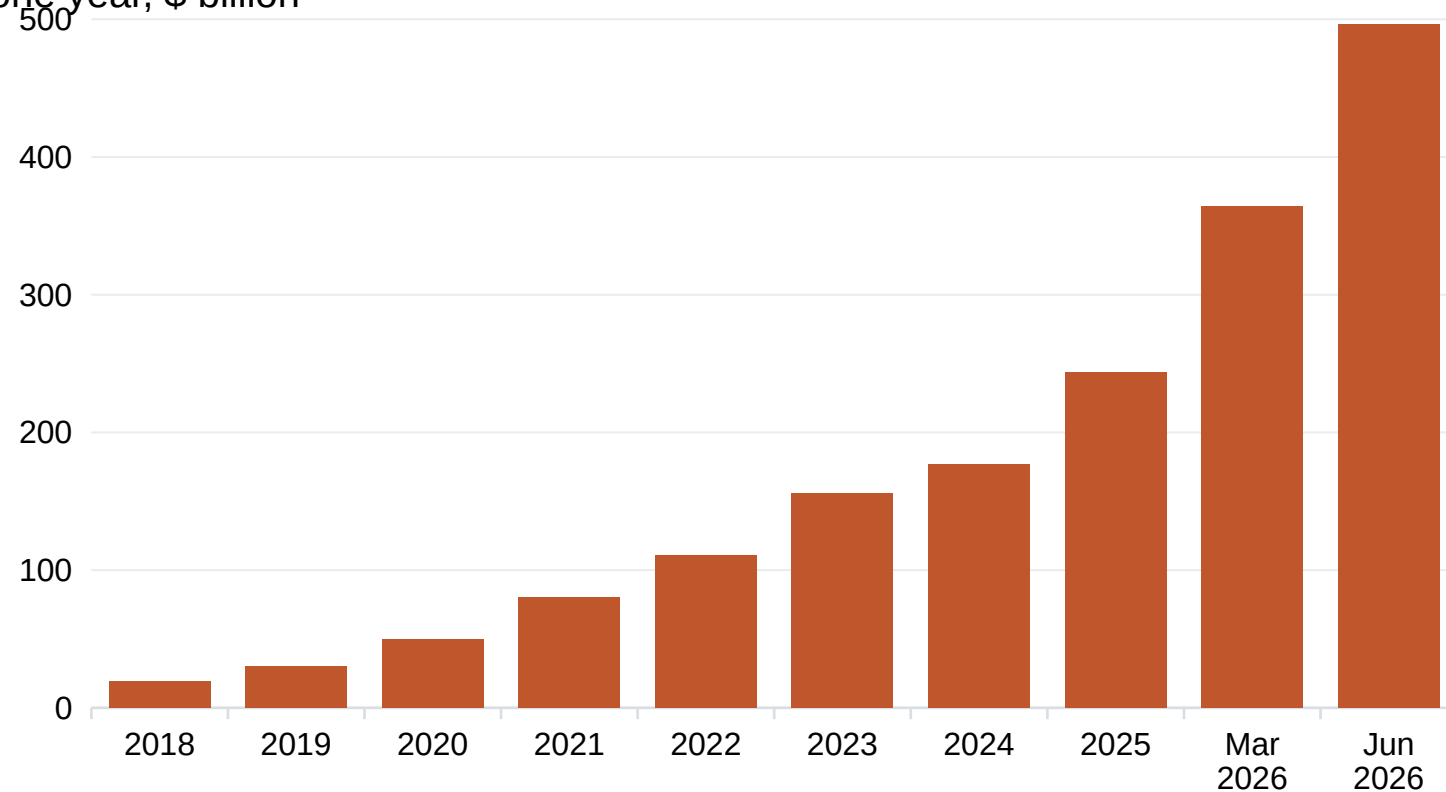
- 1. Invest:** Amazon invests ~\$18bn in Anthropic (2023–26)
- 2. Commit:** Anthropic expands its AWS commitment by more than \$100bn over ten years
- 3. Build:** Amazon's total backlog (*contracted revenue not yet recognized*), \$496bn (*all customers*), underwrites record capital spending
- 4. Revalue:** Q2 2026: \$53.4bn gain, mainly on the Anthropic stake

FTC staff call this “circular spending”. The gain was two-thirds of Amazon's pre-tax income that quarter.

Backlogs: AI compute is booked years in advance

Amazon's commitments not yet recognized: \$496bn, weighted-average remaining life 6.4 years

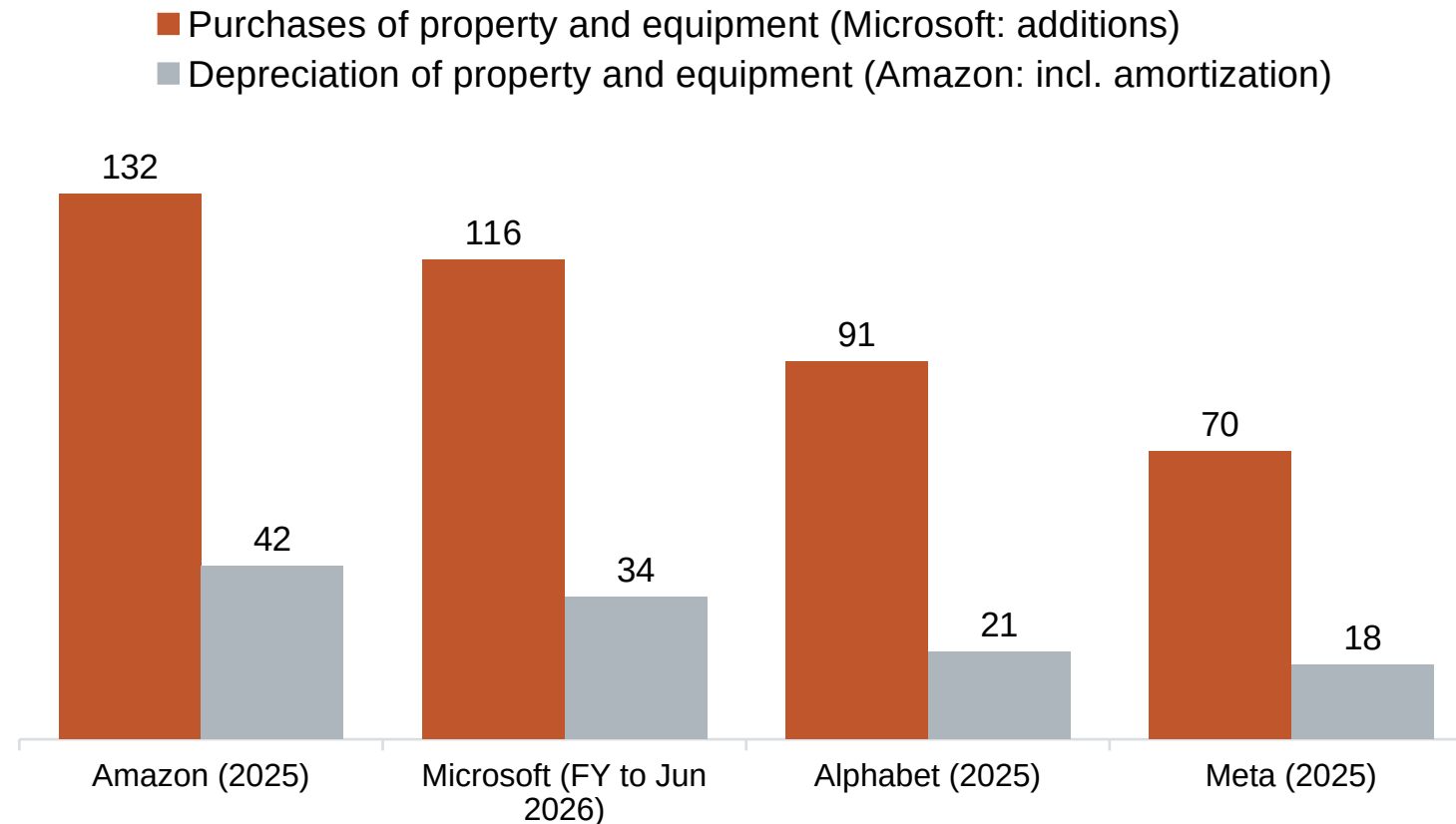
Amazon: commitments not yet recognized as revenue, contracts with original terms over one year, \$ billion



- **6.4 years:** weighted-average remaining life of these contracts in June 2026, up from 4.1 in December 2025
- **Other backlogs:** remaining performance obligations (*contracted revenue not yet recognized*), defined differently: Microsoft (*commercial*) \$678bn and Google Cloud \$514bn (*June 2026*); Oracle \$664bn (*August 2026*)

Capital spending: 3.5 times depreciation

Firm by firm, latest fiscal year

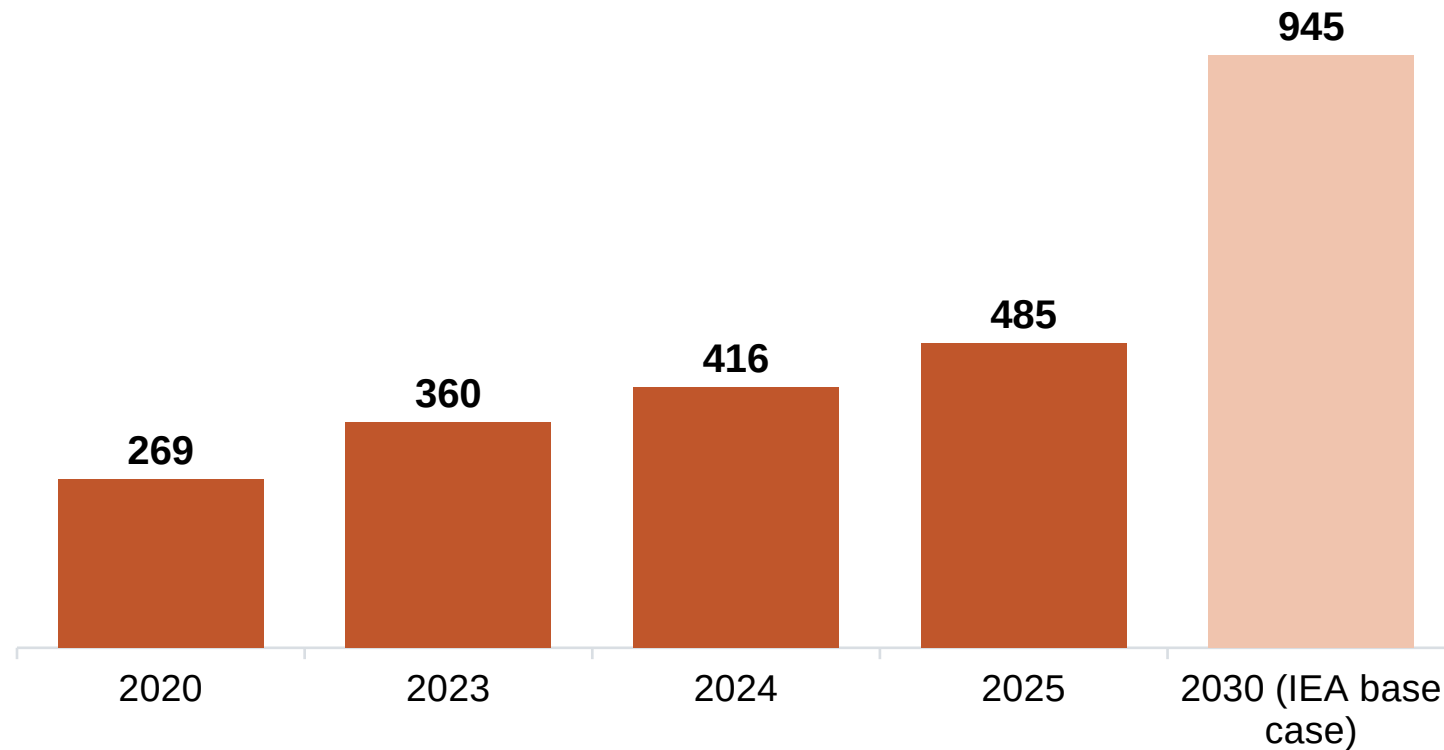


- **\$409bn** of capital spending against \$115bn of depreciation, latest fiscal year, four firms
- **Financing:** Amazon's long-term debt doubled in the first half of 2026; Alphabet raised \$49.6bn in June from new shares and mandatory convertible preferred stock

Electricity: data-center demand set to double by 2030

Virtual to the buyer, physical in production

World electricity used by data centers, terawatt-hours a year

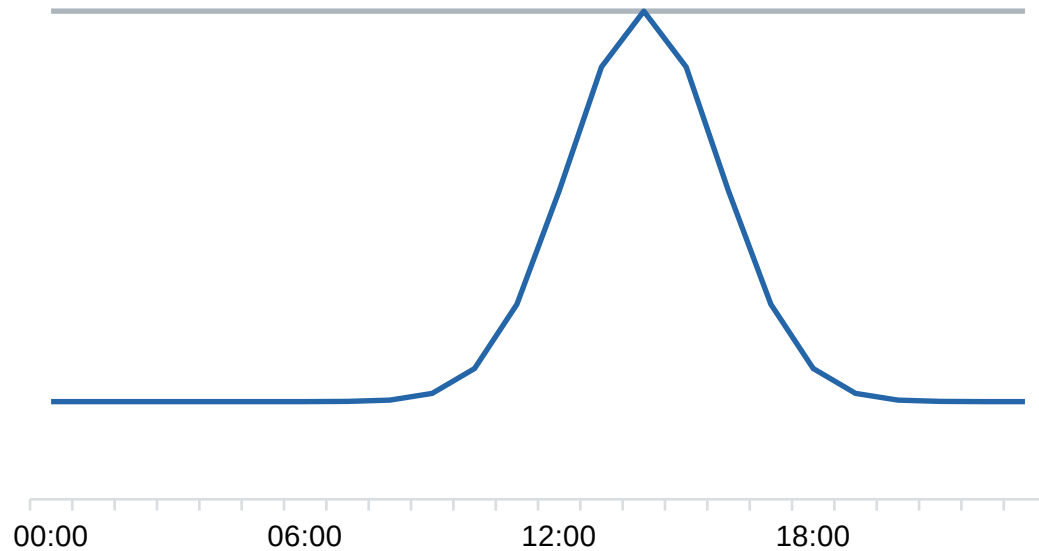


- **\$40–50m** of capital cost per megawatt, including IT equipment, for a cutting-edge AI data center: five to ten times a nuclear plant's
- The cloud does not abolish fixed capital. It concentrates and relocates it.

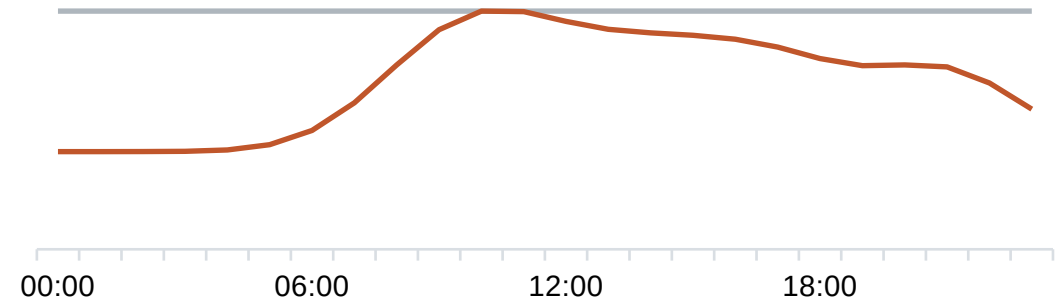
Pooling illustrated: shared capacity needs fewer servers

Owning means buying for your own peak; buying as a service lets a cloud provider pool many peaks

One firm owns its servers



A cloud provider serves five firms (*per firm*)

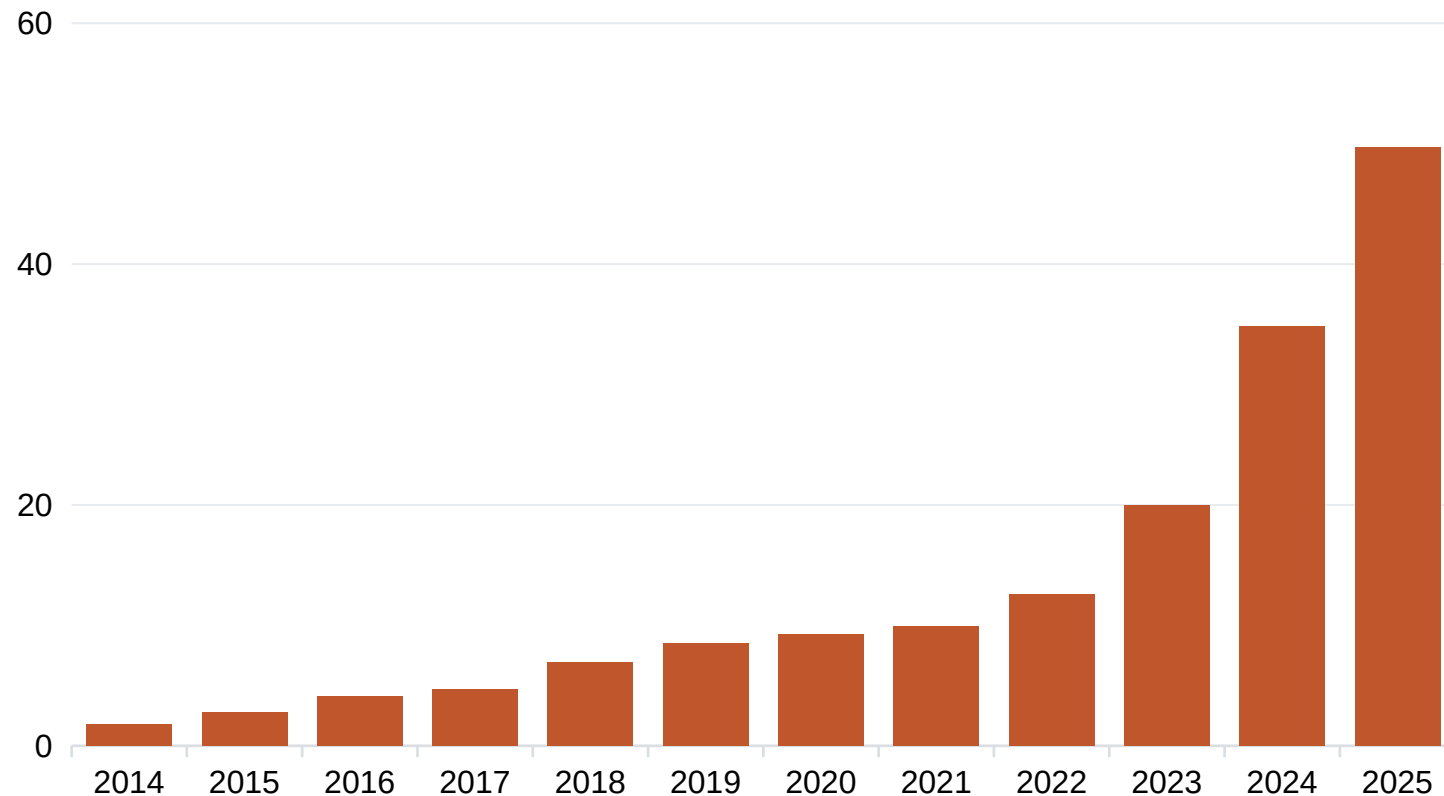


Gray line: capacity that must be owned. Average use of it: 35% alone, 71% pooled (*illustrative*).

Construction: spending on US data centers up 28-fold from 2014 to 2025

Census, value of private construction put in place, data centers

Value of US private construction put in place, data centers, \$ billion a year



- **\$85bn** seasonally adjusted annual rate in August 2026 (*preliminary*), a record and about 11% of all private non-residential construction
- **In 2014** it was \$1.8bn, half of one percent