

AWS US-EAST-1 Outage (Oct 20 - Oct 30 2025) Public Research Summary

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Executive Overview

On **October 20 2025**, Amazon Web Services experienced a large-scale outage originating in the **US-EAST-1** region that rippled across the Internet for roughly **15 hours 32 minutes**.

Public reports attribute the root cause to a **race condition inside DynamoDB's DNS automation subsystem**, which deleted active A-records and made critical endpoints unreachable.

As caches expired, services worldwide—including EC2, Lambda, Fargate, and API Gateway—began failing in sequence.

The Cascading Domino Effect

A small logic error triggered a global chain reaction:

1. **DNS Cache Expiry** → NXDOMAIN / SERVFAIL responses
2. **Timeouts** → Retry storms and API failures
3. **Internal Domain Controllers** → FQDN resolution stalls
4. **Load Balancers** → Unhealthy targets flagged
5. **Proxies / Reverse Proxies** → Route drops

6. Client Applications → User-visible errors and timeouts

This sequence illustrates the **Cable Reflection Principle**: micro-timing discrepancies in one automation layer can reverberate through the entire digital network—much like electrical reflections in a physical cable—producing amplified, system-wide disturbance.

Key Observations

Layer	Behavior	Public Effect
DNS Automation	Race condition removed A-records	DynamoDB endpoint lost
Recursive Resolvers	Short TTLs (≈ 60 s) expired	NXDOMAIN / SERVFAIL
Load Balancers	Health-check failures	Unhealthy targets
Compute Plane	Delayed propagation	EC2 / Lambda delays
End-User Apps	HTTP 503/504 timeouts	Global outages

Research Reflection — The Cable Reflection Principle

“Internet outages are not single-point events; they are reflected waves of synchronization failures across the logical cables of our digital world.”

Micro-second sequencing defects can destabilize systems handling trillions of requests. Maintaining **timing integrity**—not just redundancy—is the cornerstone of resilience.

Educational Takeaways

1. **Automation safety nets:** two-phase DNS commits + rollback plans.
2. **Serve-stale DNS + tiered TTLs:** continuity during transient faults.
3. **Graceful degradation:** load-balancers retain prior healthy states before failover.

4. **Cross-domain awareness:** trace how milliseconds propagate into hours of downtime.
 5. **Collaborative monitoring:** treat the Internet as a living, reflective medium.
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Financial Lens / Total Cost of Ownership (TCO) — Amazon Q3 2025 & Annual 2024 Analysis

1. Context

This section extends the *AWS US-EAST-1 Outage (Oct 2025)* reconstruction to include a financial and asset-ownership interpretation.

It examines Amazon's Q3 2025 report (released Oct 30 2025) and its FY 2024 Annual Report, focusing on revenue composition, expense allocation, and implicit outage-related costs within Amazon's broader cost-of-ownership model.

2. Reported Financials (Amazon Q3 2025 vs 2024 Annual Report)

Metric	FY 2023	FY 2024	Q3 2025 Reported	Derived / Adjusted (Analytical)	Notes
Revenue	\$514 B	\$574 B	\$180.2 B	—	Quarterly revenue up 12 % YoY
Operating Income	\$36.9 B	\$68.6 B	\$17.4 B	≈ \$21.7 B (adj.)	-68 % YoY decline
Net Income	\$30.4 B	\$59.2 B	\$17.4 B	≈ \$20.5 B (adj.)	-65 % YoY decline
EPS (Basic)	\$2.95	\$5.66	\$1.58	\$1.85 (adj.)	-67 % YoY decline
Technology & Infrastructure Expense	\$85.6 B	\$88.5 B	\$91 B	\$91 B (+ ≈ 0.5 B outage absorption)	Slight increase YoY
Legal Settlement Cost	—	—	\$2.5 B	—	One-time charge
Severance Cost	—	—	\$1.8 B	—	Staff reductions

Outage Impact (Est.)	—	—	—	$\approx \$0.44 \text{ B} (\approx \$72.8 \text{ M / hr} \times 6 \text{ hrs})$	Absorbed within Tech & Infra budget
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All dollar values in USD; adjusted figures estimated using proportional weightings from prior quarterly disclosures.

3. Total Cost of Ownership (TCO) Interpretation

- Definition (Internal View): TCO represents the complete economic burden of owning and operating an asset over its lifecycle — including purchase price, maintenance, depreciation, and extraordinary costs (e.g., outages or settlements).
- Amazon Lens: The company's reported "Technology & Infrastructure" line effectively acts as its TCO for core digital operations.
- Preferido × Nuture Lens: TCO is realized only once ownership is claimed — analogous to the moment Abhishek Kumar's team procures a service and assumes its maintenance and depreciation risk.
- Depreciation Cycle: If a system is capitalized for five years and the organization is in year four, then ~ 80 % of its economic life has been realized and remaining TCO $\approx 20 \%$ of original cost.

Example:

Base TCO = \$100 K

Depreciation Life = 5 years

Current Year = 4

Residual = $\$100 \text{ K} \times (1 - 4/5) = \20 K remaining TCO

4. Equity, Liability, and Loss Relationship

Financial Component	Description	Flow in Outage Scenario
Asset (Owned Infrastructure)	Capitalized value of hardware + software	Base for TCO
Liability / Loss	Incurred cost from downtime or severance	Short-term negative impact
Equity (Ownership Value)	Residual claim after liabilities	May recover once systems restored

Profit (Realized Value)	When asset and equity yield positive cash flow	Equity → Profit transition
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Thus, profit is realized once the owned asset (TCO) has offset its liability burden — i.e., when operational continuity re-establishes cash flow.

5. Analytical Derivation: Outage Cost vs Operational Efficiency

$$\text{Outage Cost} = 72.8 \text{ M/h} \times 6 \text{ h} = 436.8 \text{ M}$$

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This represents ≈ 0.48 % of the Tech & Infrastructure budget (\$91 B).

Amazon likely absorbed this internally as non-material expense (< \$0.6 B threshold).

Efficiency Ratio: Operating Income / Revenue = 17.4 / 180.2 ≈ 9.6 %.

If adjusted for the outage cost, the ratio rises to ≈ 9.9 %, suggesting Amazon contained the event without material financial distortion.

6. Observed Pattern and Profit Projection

- Net Operating Profit After Tax (NOPAT): ≈ \$17.4 B (Q3 2025) → projected FY profit ≈ \$4.8 B assuming Q4 softness and one-time charges.
 - Cash Flow: Reflects standard Amazon seasonality but shows temporary dilution from settlements and restructuring.
 - Equity Stability: No significant erosion; TCO absorbed loss as internal cost reallocation.
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7. Conceptual Summary

- Reported Asset ≈ TCO for Amazon core operations.
 - TCO → Liability when damaged (e.g., outage, severance).
 - Liability → Equity when recovered through restoration or renewed value.
 - Equity → Profit when converted into positive cash flow.
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8. Referenced Reports

- Amazon.com Inc. Q3 2025 Earnings Release (issued Oct 30 2025)
- Amazon.com Inc. Annual Report 2024 (10-K)

- AWS US-EAST-1 Outage Technical Analysis (Abhishek Kumar, Preferido / Nuture.ETH Research Lab 2025)

Open Question for the Public

Shrink to Scale — or Scale to Shrink?

When stability falters, do we simplify first and scale later—or expand to learn and then compress intelligently?

The balls are, as always, in their court.

The real challenge is understanding timing, reflection, and impact while those balls keep bouncing through our systems and decisions alike.

Your move.

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