

LUMEN®


BLACK LOTUS LABS®
by Lumen

Executive summary

The 2026 Lumen Defender Threatscape Report

Why visibility at breach misses the plot



Executive summary

Think of modern cybercriminals and nation-state actors as their own version of an elite heist crew. Instead of cracking safes, they're assembling malicious proxy networks and accelerating operations with generative AI. For business leaders, especially CISOs and cybersecurity leaders, it's now critical to gain upstream visibility into cyber operations before attackers reach the perimeter.

Modern cyber operations look less like isolated break-ins and more like carefully staged heists. Long before a breach makes headlines, threat actors invest significant time assembling the infrastructure that will power their campaigns—using generative AI to continuously scan for exposed edge devices, validate stolen credentials, stand up proxy networks, and test command-and-control (C2) paths. Most organizations only see these operations once the attack reaches their perimeter or endpoint. By then, the preparation is already complete.

Lumen sees these campaigns much earlier.

Backed by our threat research and operations arm, Black Lotus Labs®, Lumen operates from its own vantage point—inside a global internet backbone. Rather than relying on post-infection signals from endpoints or perimeter devices, we analyze backbone-level telemetry to identify coordinated infrastructure behavior as it emerges.

What are edge devices?

Edge devices, such as routers, switches, firewalls, VPN gateways, refer to internet-facing infrastructure and services that sit at the boundary between an organization's internal environment and the public internet, providing access, routing, or control, but typically operating outside traditional endpoint security visibility.

Who is Black Lotus Labs?

Black Lotus Labs is the threat research and operations arm of Lumen, combining unmatched network visibility with expert research, machine learning, and automation to conduct original threat discovery and uncover threat actor infrastructure.

From this comprehensive viewpoint, Lumen has identified a major shift for 2026: **modern cyberattacks are increasingly driven by exposure, with threat actors optimizing their targeting for vulnerable edge devices and services.**

Savvy threat actors recognize that it's harder to breach systems that are protected by well-developed endpoint detection and response (EDR) products. Instead, they're maximizing their chances by targeting any internet-exposed edge device or service. Endpoint detection is still a crucial source of intelligence. However, organizations must also consider exposure at the edge—going beyond firewalls into complex end-to-end network visibility.

Informed by insights from Black Lotus Labs, this executive summary breaks down the key trends we observed in 2025, outlines our top predictions for 2026, and provides defenders with a list of actionable steps they can take to better block adversarial activity upstream.

[Download the complete 2026 Lumen Defender Threatscape Report for additional insight](#) →

1. The Center for Applied Internet Data Analytics (CAIDA), AS Rank, January 2025.

Inside Lumen's internet backbone

Lumen manages and operates one of the largest, most connected, and most deeply peered networks in the world.¹ Black Lotus Labs provides

- Visibility into 99% of public IPv4 addresses
- Daily monitoring of 200B+ NetFlow sessions and DNS queries and 46,000 C2s
- Daily tracking of 2.3M unique threats
- 5000+ C2s disrupted in 2025



2025: Year in review

Cyber threats in 2025 were shaped less by individual malware families and more by the infrastructure attackers built, borrowed, and hid within. Obfuscation networks and botnets became foundational tools, with multi-layered chains of compromised routers, SOHO devices, Internet of Things (IoT) hardware, and virtual servers blending malicious activity into everyday traffic. Their constant churn complicated attribution and overwhelmed traditional detection models.

From inside the global internet backbone, Black Lotus Labs observed a clear escalation in both scale and intent. Criminal and nation-state actors alike relied on millions of vulnerable, often EoL devices to create moving targets. SOHO and IoT devices allowed attackers to “live off the land” while disguising operations behind residential IP space. Shared use of compromised infrastructure further blurred the lines between criminal and state activity, increasing the risk of missed detections and delayed response while allowing hackers to evade prosecution.

The following six insights capture how these operations took shape throughout 2025.

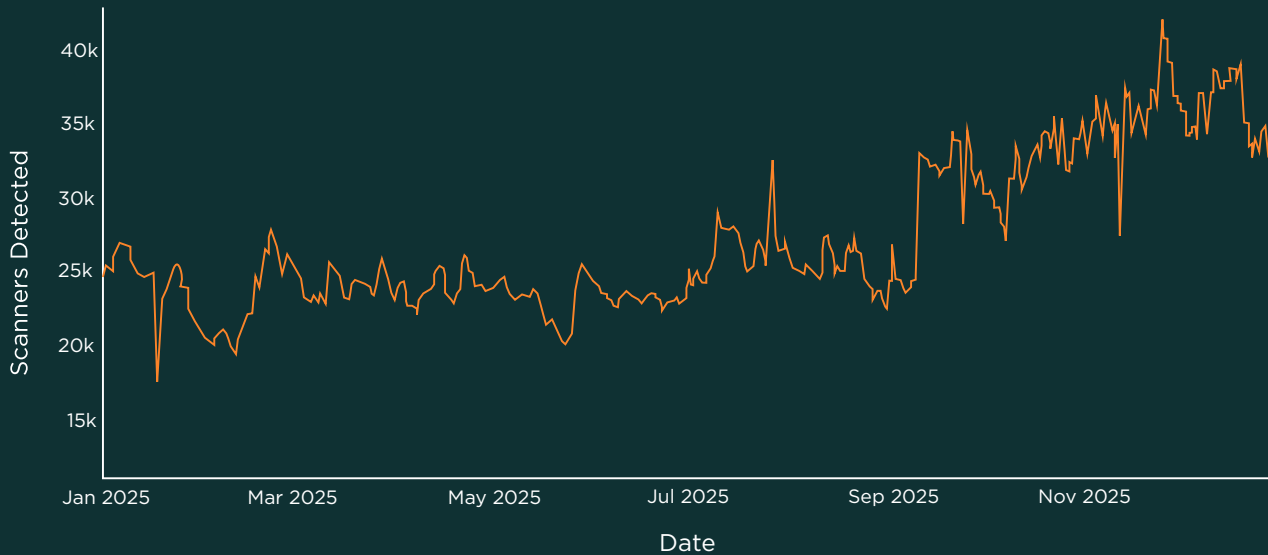
1 **Generative AI changed the tempo, unleashing attacks at machine speed.**

Threat actors embraced automated tasking, scanning, infrastructure rotation, and C2 management in 2025, in addition to adopting new generative AI-enabled attack vectors. This automation sustains malicious campaigns indefinitely with minimal oversight. Human operators step in only to update exploits, payloads, or targets, letting machines handle daily maintenance. Even these human-operated tasks are increasingly assisted by generative AI tooling.

Attackers also got more creative in how they leveraged different types of devices. This scalability and adaptability pushed organizations to rethink how they detect and disrupt attacks, examining new types of signals to anticipate threat actors' movements before they breach the network perimeter and pre-positioning IP address blocks to stop threat actors in their tracks.



Total malicious scanners detected per day (2025)



The massive volume of malicious scanning indicates attackers' commitment to taking a systematic, continuous inventory of internet-facing devices and services. Botnet operators, initial access brokers, and advanced actors use this scanning to assess the opportunity space for their exploits on edge devices before they ever launch an attack.

Top enterprise edge devices brute forcing events tracked by Black Lotus Labs (October-December 2025)



Using Black Lotus Labs' brute force detections, we blocked significant traffic from attack attempts in Lumen Defender Essentials and Plus against enterprise edge devices. This chart represents the five most-targeted devices based on connections blocked by Lumen Defender Essentials & Plus between October-December 2025.

2 **Attackers moved deeper into the network itself—hiding in the infrastructure.**

In 2025, we saw sophisticated adversaries shift more of their attention away from endpoints to vulnerable, less-secured devices at the edge, like routers, VPN gateways, and firewalls. Here, they can “live in the middle,” stealing credentials to access the protected information beyond, hiding their activity inside the connective tissue of the internet.

Sophisticated attackers know that completing the heist in a single sitting may alert defenses. By lurking in devices outside the reach of standard security controls and reaching back out days, weeks, or even months after the initial access, attackers can better evade detection and prevent defenders from connecting the dots.

3 **Criminal ecosystems professionalized, adopting the polish of legitimate SaaS.**

Gone are the days of crude panels and chaotic infrastructure. In 2025, cybercriminal operations became indistinguishable from professional software businesses. We saw adversaries assemble polished platforms—complete with customer support and subscription tiers—as a way to scale access, automate abuse, and lower the barrier to entry for cybercrime.

To block these professionalized operations, defenders must leverage network-level intelligence to identify when a criminal platform is scaling its infrastructure and intervene before the next wave of customers can ever press “deploy.”

4 **Malware-backed proxy networks became full-fledged economies of disguise.**

Adversaries can spend months, sometimes even years, laying the groundwork for their next operation. That’s why we saw threat actors industrialize their entry and escape routes in 2025.

Compromised home routers, IoT devices, and high-volume VPS hosts became rentable identities—on-demand personas that can be purchased for a few dollars’ worth of cryptocurrency. This tactic allowed attackers to disguise themselves as trusted remote employees, bypassing geofencing, ASN-based blocking, IP reputation checks, and many Zero Trust location signals.

5 Nation-state & criminal crews blurred together on shared infrastructure.

In classic heist films, every crew has its signature—the safe expert, the hacker, the criminal mastermind. But in 2025, those signatures overlapped. Nation-states piggybacked on criminal infrastructure; cybercriminals reused tooling forged by intelligence services.

Attribution became less about ownership and more about intent. Everyone was using the same or similar digital playgrounds to achieve their distinct goals while making it difficult for defenders to know exactly who they're protecting against.

6 The global backbone transformed from a conduit into an early-warning system.

2025 underscored how threat actors are constantly exploring new attack vectors and using AI to accelerate the speed and sophistication of their operations. This transforms the global internet backbone from an invisible highway for threat actor transport into a critical detection and disruption layer.

As adversaries weaponize routers, appliances, and management planes, the infrastructure layer itself becomes the first theater of operation. Backbone telemetry exposes patterns that endpoint logs alone can't catch, from the quiet appearance of a new proxy node to botnet recruitment,

automated scanning, or the sudden regeneration of C2 servers as operators prune and replace infrastructure at machine speed.

Together, these insights surface a critical shift for defenders in 2026: the decisive battleground is no longer just the endpoint—it's the infrastructure beneath, which is now powered by generative AI.



2025's most wanted

Black Lotus Labs detected over 2 million IPs associated with very large botnet families in 2025 such as Aisuru and Vo1d. On any given day, the largest Black Lotus threat families detected by Black Lotus Labs in Lumen's global telemetry were Aisuru-based proxies and bullet proof anonymization platforms.

Top 10 threat families based on indicators detected (2025)

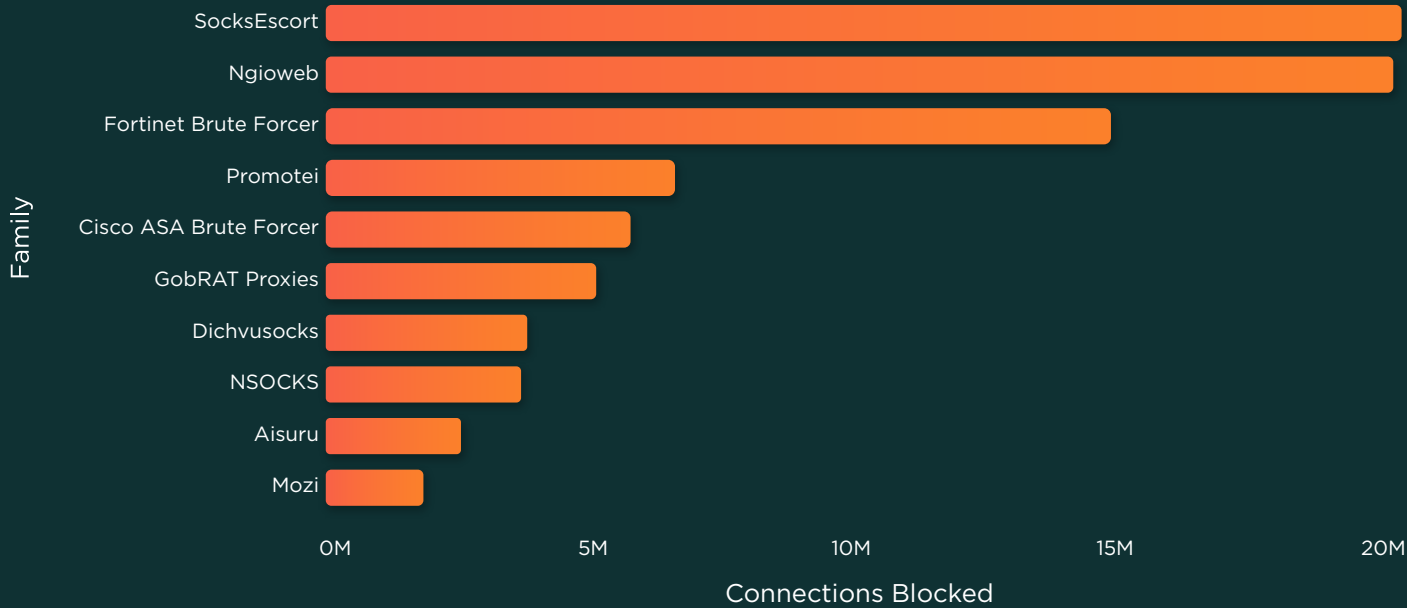
	Family	IPs Detected
1	Aisuru	2,948,616
2	Vo1d	2,519,125
3	AWM	2,356,202
4	Aisuru Proxies	2,246,215
5	NexusNet	2,231,627
6	NSOCKS	1,482,113
7	StarVPN Proxies	1,428,920
8	Mylobot	1,377,437
9	SOCKS5 Systemz	1,184,444
10	Tofsee	1,132,114

Top 10 threat families based on average daily bot count (2025)

	Family	Average IP Count
1	Aisuru Proxies	129,487
2	Mysterium	45,097
3	Aisuru	31,549
4	Vo1d	28,906
5	AWM	18,310
6	NexusNet	16,399
7	Mylobot	12,035
8	NSOCKS	11,881
9	RemProxy	11,451
10	StarVPN Proxies	11,035

The IPs detected for the top 10 threat families include bots and infrastructure such as C2s, while the second chart shows the families that maintained the largest pool of bots in Lumen visibility in 2025.

Top 10 threats blocked in Lumen Defender based on Black Lotus Labs tracking (2025)



*Note that this chart excludes blocks due to malicious scanners.

In 2025, Lumen Defender blocked the most threats from malware-backed proxies such as SocksEscort and Ngioweb. IPs employed in these networks provide digital cover for criminal actors to launch attacks while evading detection. Also prominent by volume of blocks in Lumen Defender are from threat actors brute forcing popular edge devices.

Top infostealers based on victim count (2025)



Black Lotus Labs analysis over Lumen’s global visibility indicate that Lumma and Rhadamanthys claimed the largest share of victims when compared to other infostealers in 2025.

2026 threat predictions

In 2026, the most dangerous cyber operations won't look radically different at the moment of impact. Breaches will still begin with stolen credentials, exploited edge devices, or trusted infrastructure abused at scale. However, what will change is how fast those operations are assembled through the proliferation of generative AI tooling, how little forensic evidence they leave behind, and how effectively attackers blend into the background noise of the internet itself.

From Black Lotus Labs's vantage point inside a global internet backbone, we believe four shifts are already coming into focus.

Prediction 1: Setup gets faster as adoption of generative AI and agents goes mainstream

Speed is a crucial element of every good heist. In 2026, we expect to see a sharp acceleration in AI-enabled chained exploit paths targeting edge devices and internet-exposed management interfaces, including firewalls, VPN gateways, routers, and orchestration panels. We believe that attackers will increasingly rely on AI-driven agents that evaluate privilege levels, identify adjacent trust relationships, select the next best exploit path, and adapt tactics mid-operation based on network response.

Edge devices are already prized because they sit at the crossroads of authentication, encryption, and routing and often lack deep forensic visibility. When agentic AI accelerates how quickly attackers move through those devices, the window for detection shrinks dramatically. Defenders can counter this shift with more proactive visibility.

Prediction 2: Targeting will focus on opportunity at the edge

Malicious scanning for edge devices and exposed services is continuous and indiscriminate, with continuous malicious scanning representing 33% of all malicious traffic blocked by Lumen Defender Essentials & Plus. Firewalls, VPN gateways, remote management interfaces, identity services, and load balancers are probed relentlessly across all sectors. When a reachable device is found—especially one with weak authentication, missing patches, or limited logging—attackers move quickly, using whatever technique is most effective at the moment.

Organizations that prioritize asset visibility, patch discipline, privilege management, and retiring unsupported devices will be better positioned to anticipate attacks.

Prediction 3: The real signals lie in the network

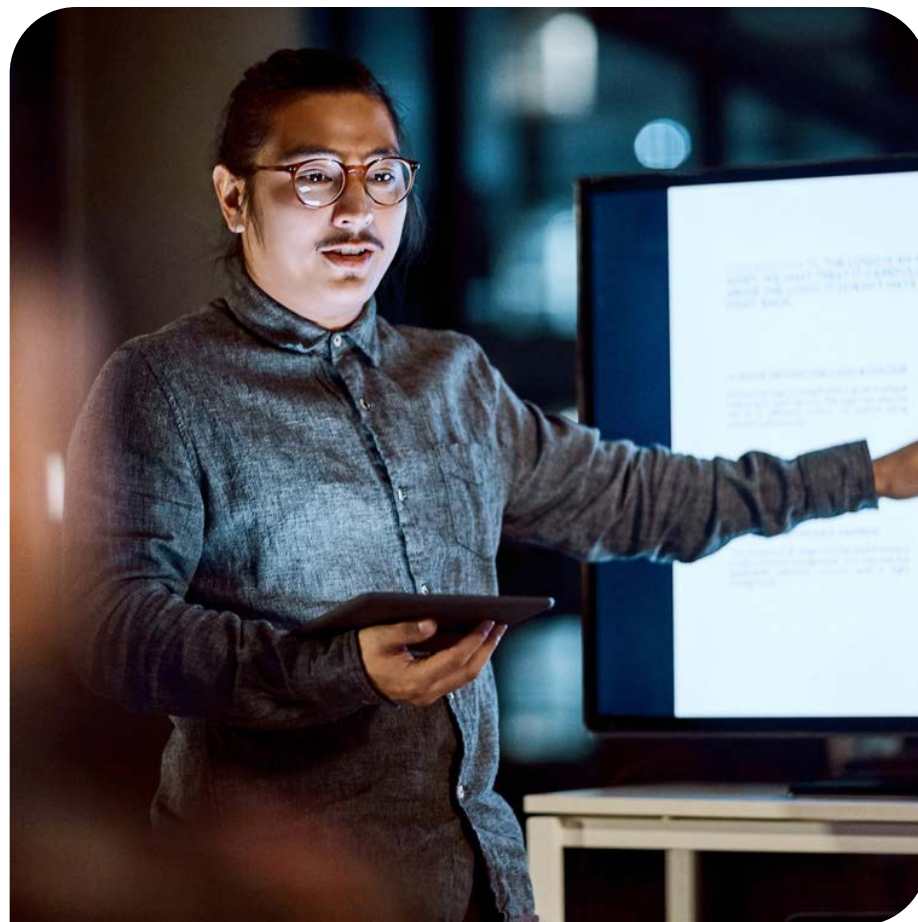
By the time defenders investigate a compromised firewall or router, the most important evidence will already be gone. That's why we believe detecting adversary networks in addition to individual tools will be essential in 2026.

The earliest signals won't come from device telemetry. They'll emerge from how infrastructure behaves collectively, such as rapid C2 rotation, sudden proxy layer emergence, orchestration traffic patterns, and coordination across geographies. Organizations can counter this trend by augmenting EDR and perimeter defense with network infrastructure intelligence to proactively spot attacks in the planning and preparation stage.

Prediction 4: The best disguises will be legitimate infrastructure

In 2026, we predict that adversaries will rely even more heavily on malware-backed proxy networks, small office/home office (SOHO)-based botnets, hijacked VPS infrastructure, and "clean-looking" residential IP spaces to hide their operations in plain sight. These tactics obscure attribution; blur the boundaries between criminal and nation-state activity; enable shared infrastructure across multiple campaigns; and allow attackers to rent, trade, or reuse capabilities at scale.

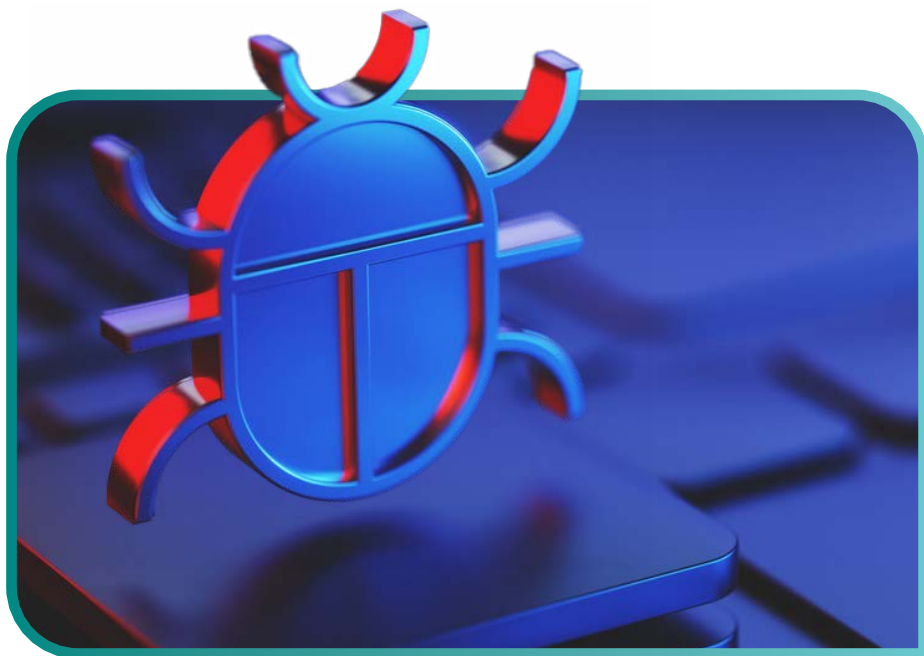
The result is a threat landscape where the attacker infrastructure itself becomes the capability. When cybercriminals blend into legitimate traffic flows, traditional indicators fail, reputation-based blocking lags behind reality, and autonomous system numbers (ASN) and geolocation filters lose relevance. Defenders must have tools in place to spot the subtle signs of a new attack infrastructure taking shape.



Defense guidance: Stopping the heist before it happens

Modern threat operations aren't defined by a single exploit, piece of malware, or intrusion event. They are built as systems that are assembled over long periods of time, tested in pieces, and activated only when conditions are favorable.

The guidance below reflects patterns observed across Black Lotus Labs's telemetry and highlights where defenders can most effectively shift the balance.



1 Defend the edge like it's the vault door

Firewalls, VPN gateways, routers, and management interfaces offer privileged access, long uptime, and limited forensic visibility. Defenders should treat these gateway edge devices as high-value assets and assume that attackers will chain multiple edge weaknesses together—initial access, lateral movement, and persistence—before any endpoint alert fires.

- Thoroughly inventory internet-exposed services and management interfaces, including shadow IT and legacy devices.
- Monitor for anomalous authentication attempts and configuration changes on edge devices, even when traffic originates from residential or “benign” IP space.
- Plan for detection techniques that do not rely on host-based agents, especially for appliances and network gear.

2 Shift from indicators to infrastructure awareness

While indicators of compromise (IoCs) are still important, they often arrive late in the attack lifecycle after threat actors have already reached the perimeter. Infrastructure behavior like C2 relationships, proxy usage, traffic patterns, and routing dependencies reveal malicious activity far earlier than malware signatures. For defenders, this means that detection should focus on relationships rather than just IPs or hashes.

- Look for unusual data flows, including large outbound transfers to nearby geographic regions or unexpected cloud providers.
- Track how traffic enters and exits the environment, not just whether it is “known bad.”
- Correlate authentication activity, proxy usage, and outbound connections to identify emerging campaigns before tooling is fully deployed.

3 Treat proxy networks as active threat infrastructure

Malware-backed proxy networks built from SOHO devices, IoT systems, and compromised VPS infrastructure allow attackers to blend into normal traffic and bypass traditional geofencing or reputation-based controls. Today’s defenders must not treat the residential IP space as a trust signal.

- Monitor for suspicious activity originating from residential and VPS IP ranges, especially against authentication services.
- Actively identify and block open proxies and known malicious proxy services where possible.
- Recognize that attackers may deliberately accept higher detection rates during reconnaissance phases, then switch to cleaner proxy infrastructure for exploitation.

4 Assume blurred lines between crime and espionage

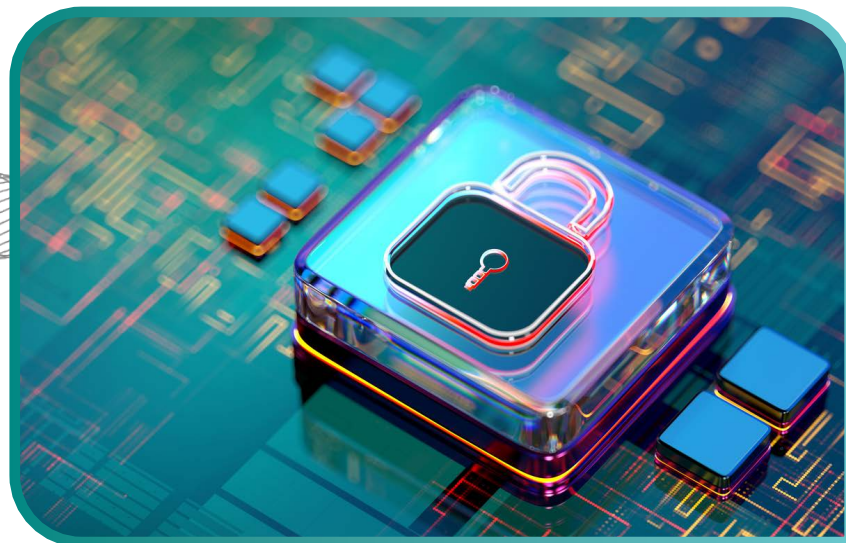
2025 showed us that the same infrastructure can support both cybercrime and nation-state espionage. Threat actors are increasingly co-opting each other's access, tools, and data—making attribution less important than impact. Defenders must treat all unauthorized access incidents as potentially strategic.

- Investigate compromises with the assumption that access may be resold, reused, or repurposed.
- Monitor for secondary activity after initial containment, especially lateral movement and data staging.
- Prioritize visibility into east-west traffic and unusual operator-driven behavior inside the network.

5 Use scale against the attacker

Attackers succeed by operating at scale. Security teams can regain the advantage by doing the same. For defenders, this means that they need to expand the scope of their visibility beyond individual assets to the network paths connecting them.

- Leverage upstream telemetry, intelligence sharing, and automated response where possible.
- Integrate network-level detections with identity, endpoint, and cloud signals.
- Reduce attacker dwell time by blocking malicious infrastructure early, even when confidence is still emerging.



The central lesson of 2025—and the defining risk of 2026—is this: modern cyber threats are built long before they are launched. Adversaries are rapidly assembling infrastructure ecosystems powered by generative AI, resilient proxy networks, compromised edge devices, and shared criminal-state platforms. Organizations that combine strong cybersecurity fundamentals with upstream visibility and infrastructure intelligence will be best positioned to shrink attacker dwell time, block malicious systems early, and stop adversarial operations before they ever reach the vault.

With Lumen's global internet traffic visibility and original research through Black Lotus Labs, we can see malicious infrastructure as it forms—unlocking earlier detection of botnets, C2 systems, and nation-state activity. This same intelligence feeds operational defenses across the Lumen network, so as soon as Black Lotus Labs can detect, our customers can get protection. Black Lotus Labs also helps degrade adversary capability at internet scale, often partnering with law enforcement to disrupt malicious infrastructure, dismantle long-running criminal proxy networks, and significantly impair major botnets.

Our approach does not replace endpoint, identity, or cloud security. It complements them by delivering additional intelligence so defenders can spot and block attacks before they reach the point of intrusion—helping to protect our customers' networks while keeping the internet clean.

