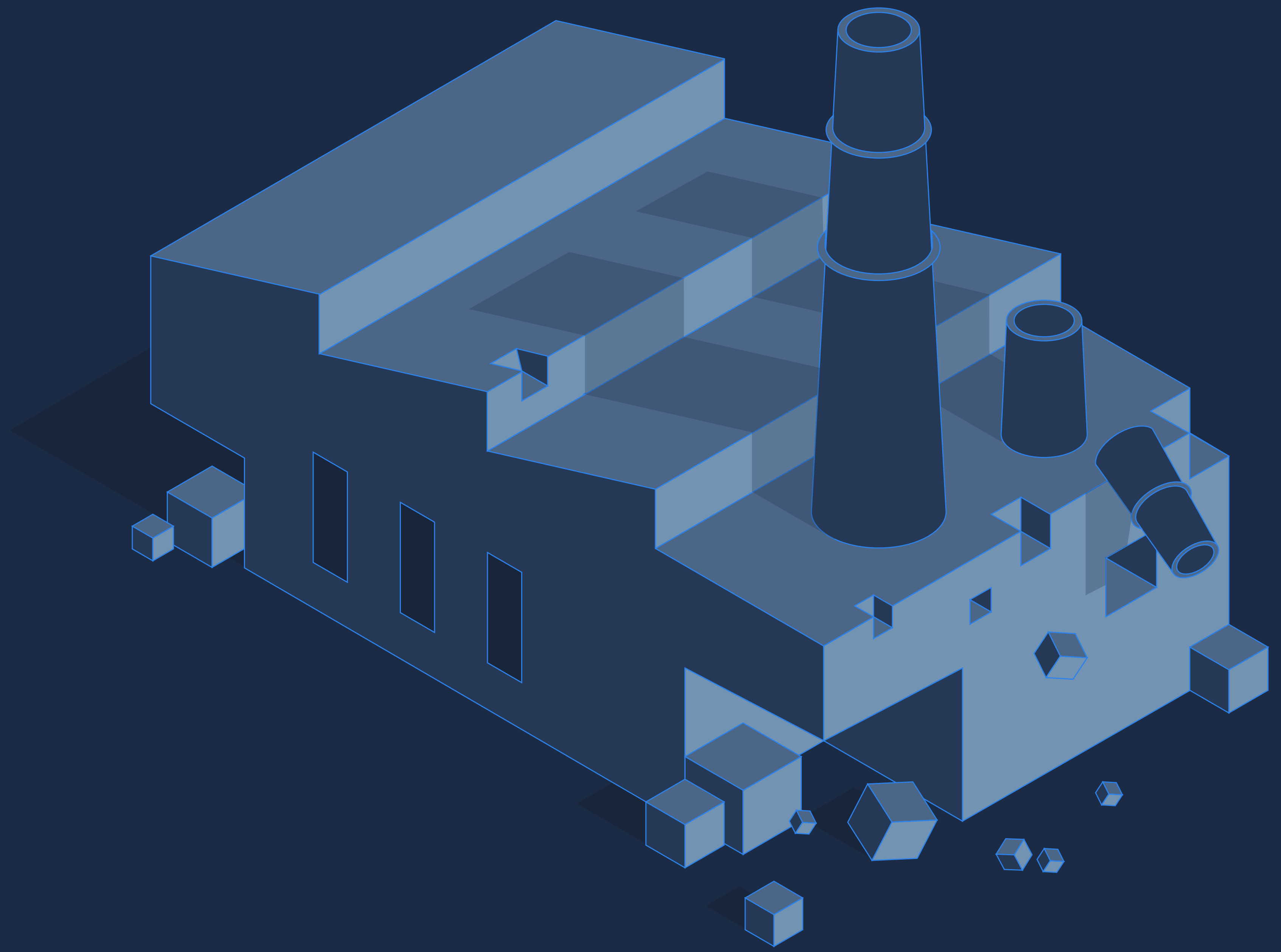


ALSID ACADEMY

Episode 2

A GLOBAL THREAT TO ENTERPRISES: THE IMPACT OF ACTIVE DIRECTORY ATTACKS

If you are a CEO, CFO, CMO, or basically any non-IT member of a management team, you probably haven't ever heard of Active Directory (AD). Nonetheless, you are using it every day, every hour, every minute when you log in to your device, open your emails, access an application, or share a file. It is the very foundation on which your IT infrastructure is built.

Naturally, you probably haven't heard of what would happen if this vital pillar of your IT were compromised. You might even think this is an unrealistic scenario. Perhaps it's nothing more than a thought experiment for security geeks who dream up zombie-apocalypse scenarios?

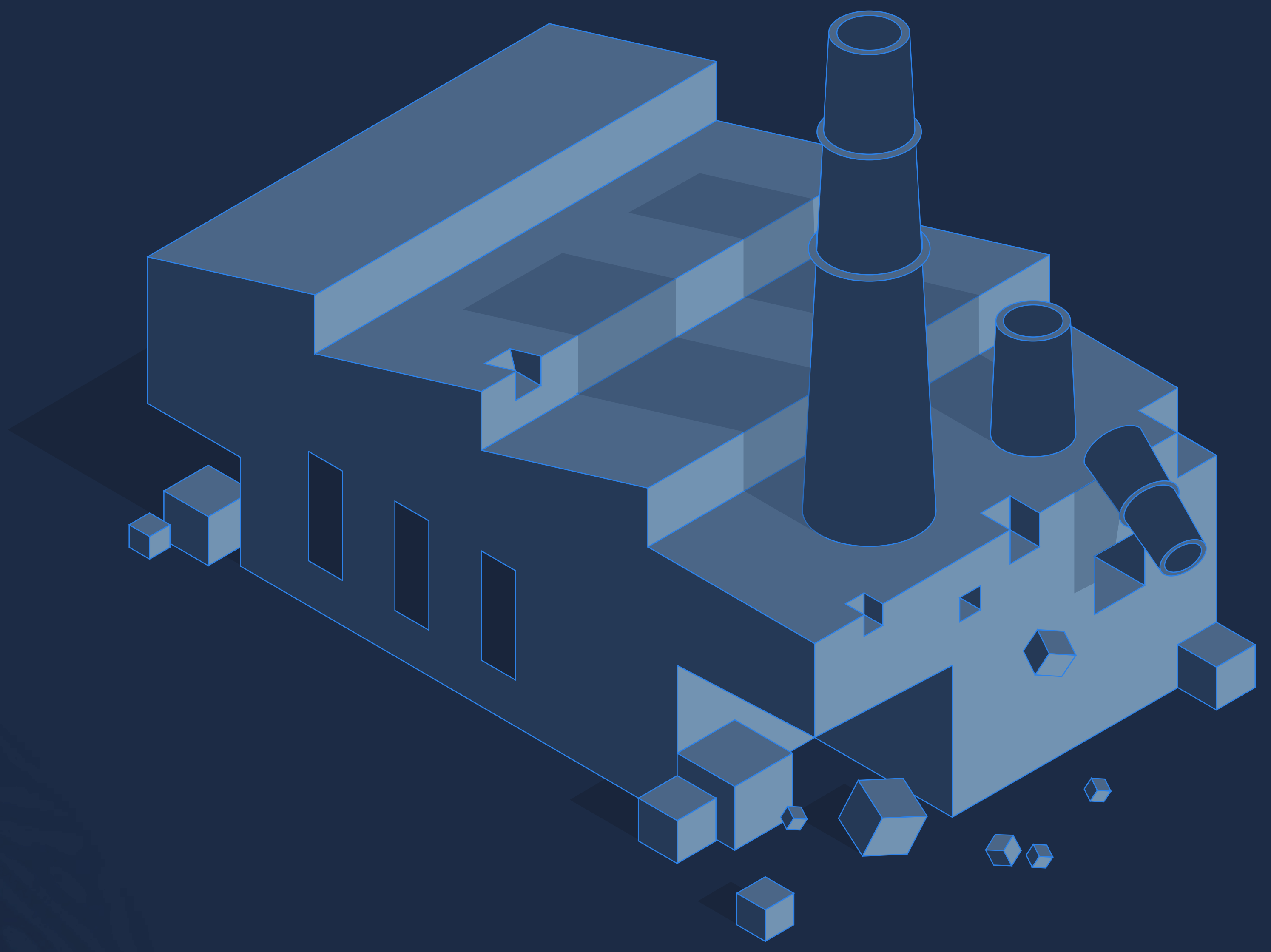
We are so glad you are reading this paper.

In this document, we present the global business impact of Active Directory attacks. We'll present a threat that proved capable of halting factories, grounding airplanes, breaking brands, disrupting stock markets, and bankrupting corporations. We will help you materialize those risks with previous real-life occurrences where attacks wreaked havoc on some of the largest, most recognizable enterprises.

We hope this will help raise awareness of a threat which, so far, has received too little attention from boards, and far too much attention from hackers.

HIGH-LEVEL RISKS

Being the global orchestrator of your IT infrastructure, Active Directory is, by design, a single point of failure.
On the other hand, Active Directory forests are perpetually evolving, in tandem with the enterprises' organigrams, business architectures, and M&A activities. Thus Active Directory is also, by construction, a heterogeneous system whose security hygiene gets quite ugly quite quickly.
That being said, what are the actual, corporate-level risks that result from this weak link's central position?



Business (Dis)Continuity

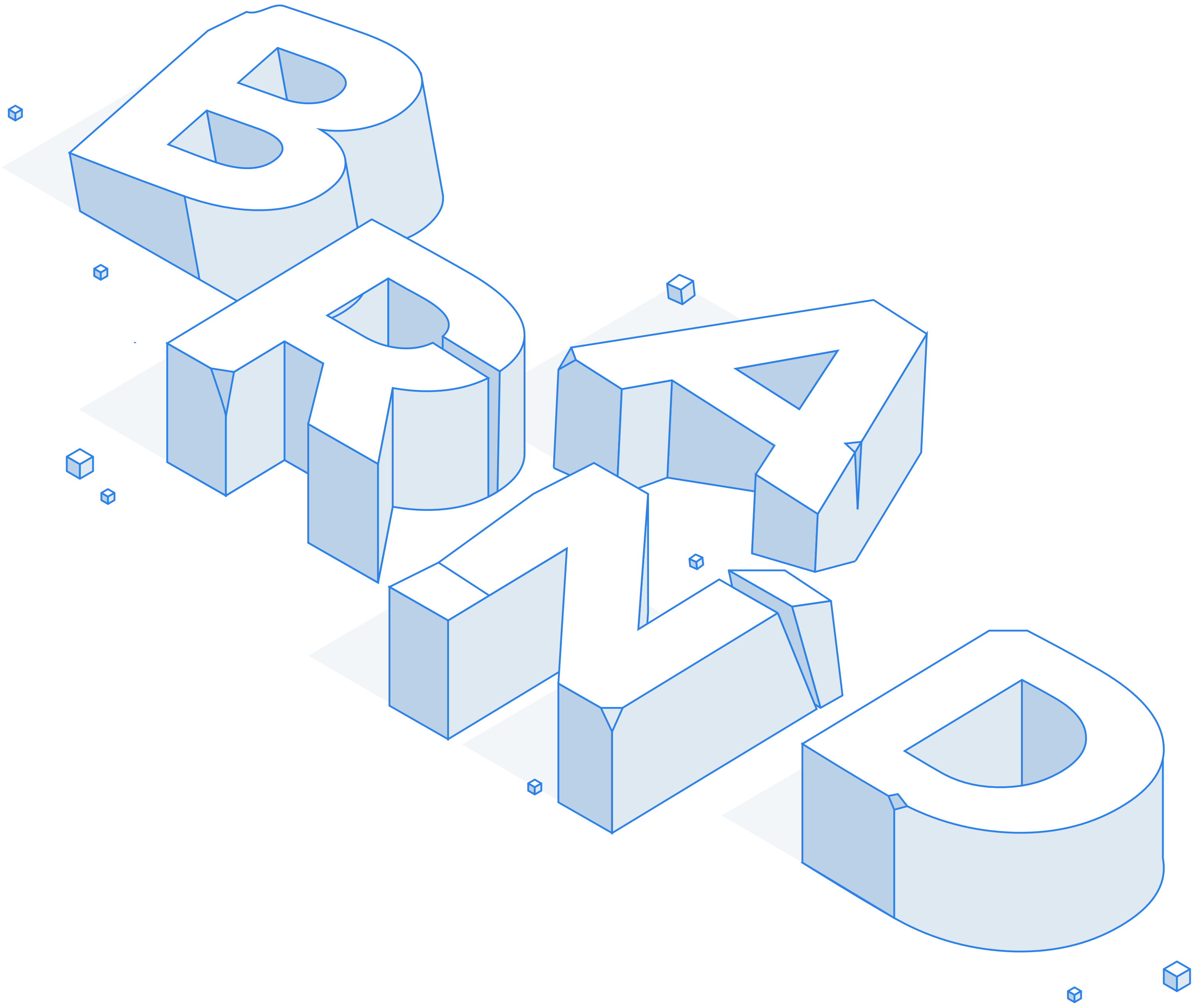
This is the most tangible threat Active Directory's insecurity poses to industries and enterprises. Halting factories, grounding planes, preventing employees from accessing their emails… Nullifying an organization's business capabilities is not a 007 scenario or just a nightmare for overanxious security professionals.
There are two ways hackers exploit Active Directory that lead to dramatic business disruptions:

- **Crippling Active Directory itself.** By undermining the very foundation of an organization's IT, attackers can prevent users and applications from logging in to their systems and accessing their required resources. And while this may seem a hit-and-run tactic, there are some well-documented – albeit poorly addressed – procedures for hackers to persist into their victim's AD even after a greenfield rebuild. Seek, destroy, repeat.

- **Using Active Directory as a transport for destructive malwares.** Destructive malware is not rocket science. Highly-sophisticated payloads such as Stuxnet are the exceptions, while today's consumer-level ransomwares are good enough to do the destruction job effectively. The only challenge in those attacks is distribution: getting these malwares installed on a sufficiently large number of endpoints so that recovery at scale becomes unrealistic. In this regard, exploiting Active Directory weaknesses is the only practical option for hackers to move laterally within the infrastructure. Every large-scale, infrastructure-wide attack that has crippled production capabilities in recent years has had an Active Directory exploit at its core.

Examples:

- **March 2018:** Norsk Hydro is forced to switch to manual operations after LockerGoga encrypts and disconnects systems that manage factory equipment. The incident has been described as disastrous by Hydro officials.
- **June 2017:** A NotPetya ransomware attack shuts down the port terminals of Danish shipping giant Maersk for two days, causing an estimated $300 million in associated costs.
- **December 2017:** French company Schneider Electric is forced to shut down operations of a power plant in the Middle East after malware compromises its industrial control systems. Analysis by security researchers indicates that the attack was sponsored by a nation-state.
- **April 2011:** A coordinated attack on Sony's PlayStation Network shuts the service down for a month, leading to an estimated loss of $171 million.



Brand Damage and Customer Trust

This is by far the most visible damage caused by cybercrime today. With personally identifiable information (PII) leaks making the headlines almost every week, the public reaction tends to become... tense.

In early 2016, a survey by The Economist Intelligence Unit asked 282 C-suite members about their concerns in cybersecurity: "our reputation with our customers" ranked an unequivocal first. This should not be a surprise considering the brand is the overarching umbrella of a company; brand damage has a ripple effect that impacts all its products and services. Moreover, public data breaches tend to be followed by years of customer and shareholder lawsuits.

Those events are widely publicized and recurrently damage a brand and its products.

Contrary to business disruption attacks, data breaches do not always require an Active Directory hack to be effective… only very often, depending on whether the hack requires deep intrusion into the infrastructure or not.

Examples:

- **September 2018:** SingHealth's infrastructure breach involves 1.5 million personal records, plus the prescription details of 160,000 patients, including those of Prime Minister Lee Hsien Loong.
- **November 2014:** Sony Pictures Entertainment is hacked, with the malware deleting data and the hackers posting online employees' personal information and unreleased films. An FBI investigation reveals North Korea was behind the attack.
- **March 2014:** Cybercriminals steal 40 million credit card numbers from Target, with an additional 70 million accounts compromised.

COMPETITIVE LOSS AND IP THEFT

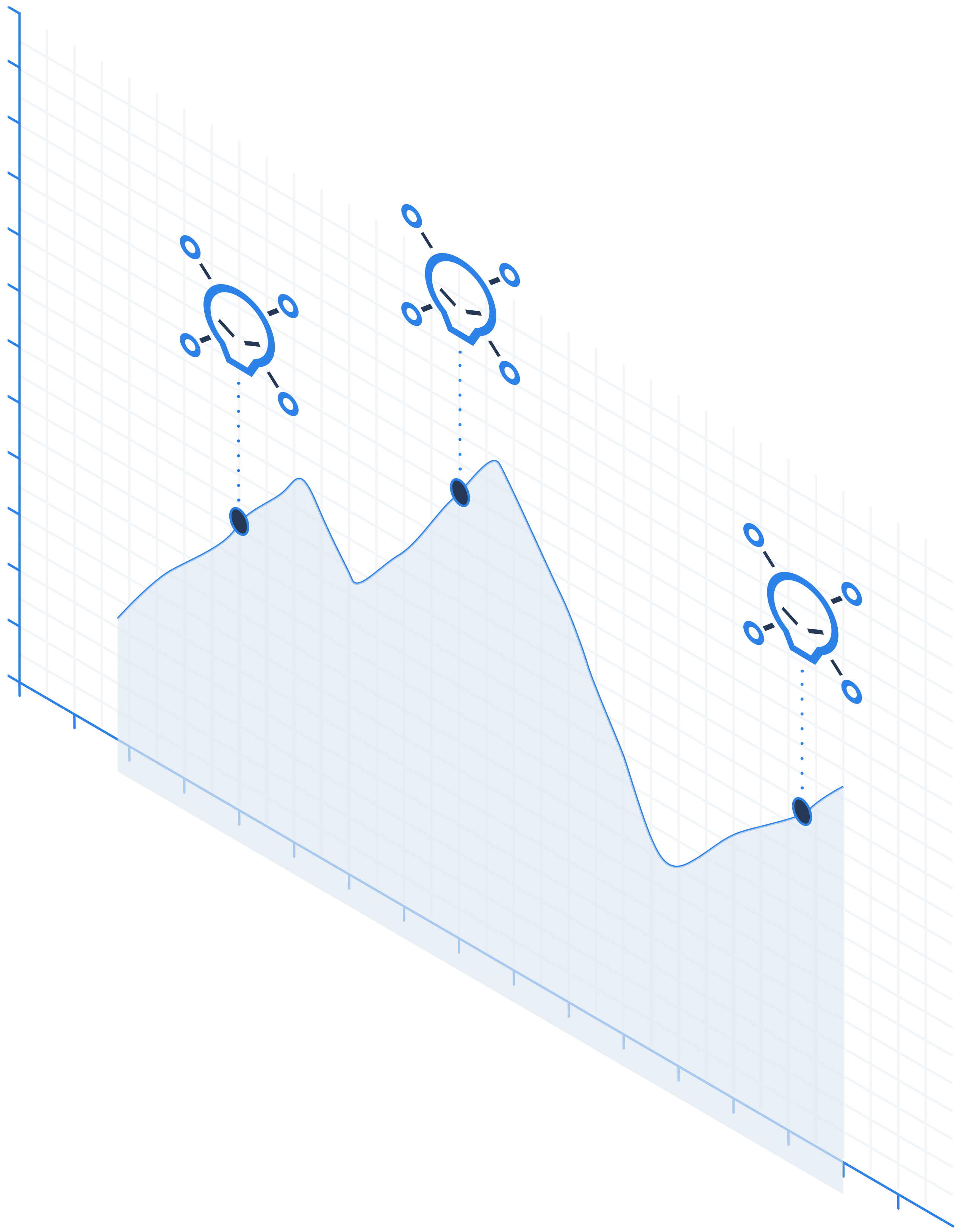
In this digital, fast-paced, innovation-driven century, Intellectual Property is the blood and soul of enterprises. Having IP in the wild is not simply an embarrassment, it's a direct threat to the very existence of the organization.

In the tech industry at large, blueprints and products are designed months ahead of their public release, giving IP thieves a sufficient lead to preemptively close technical gaps and nullify competitive advantages. In critical national industries, IP thefts have geopolitical consequences no enterprise wants on its track record. Finally, the media and videogame industries are unfortunately now accustomed to seeing their AAA productions leaked into the wild before they reach theaters and shops.

Exfiltrating these data stealthily remains the easiest, albeit not a trivial, part of a hacker's job. Their true challenge lies in accessing the data in the first place: after primo-infection, an attacker rarely has access to his/her targeted assets. Hunting for the valuable data requires the ability to hop from system to system until proper access rights can be inherited or impersonated. And there is only one way to do so: exploiting Active Directory vulnerabilities.

Examples:

- **January 2010:** Operation Aurora is a series of attacks that targets dozens of tech organizations, including Google, Adobe, Juniper, Yahoo, Symantec, Northrop Grumman, Morgan Stanley, and Dow Chemical.
- **November 2014:** Sony Pictures Entertainment is hacked, with the malware deleting data and the hackers posting online employees' personal information and unreleased films. An FBI investigation reveals North Korea was behind the attack.



(Cyber)Insider Trading

These cybercriminal activities are by nature difficult to quantify, but several recent empirical studies found strong correlations between drops in stock prices and breach announcements. Hacker groups involved in Cyber Insider Trading fall under two distinct categories:

- Hacker-traders steal non-public data to inform their trades, thereby gaining an unfair advantage in the free market. Notable cases involve massive theft of soon-to-be-disclosed earning reports (SEC case, see later) or early-stage indications of M&A projects at enterprises or investment banks.
- Traditional cybercriminals anticipate a drop in their victims' stock price after the disclosure of their attack, and thus increase their attack's return-on-investment by adding a trading component to it.

As for any other malware-driven cybercrime, exploiting Active Directory remains the only effective way for hackers to move within an organization's IT until they gain access to the data they are seeking.

Examples:

- **January 2019:** The U.S. Securities and Exchange Commission charges a group of hackers from the U.S., Russia, and Ukraine with the 2016 breach of the SEC's online corporate filing portal, exploited to execute trades based on non-public information.
- **December 2014:** FIN4 cybercriminal group is discovered hacking more than 100 companies, investment advisers, and law firms in search of market-moving information about deals, according to researchers at cybersecurity company FireEye.

Direct Financial Losses and Stock Prices

Our industry now has a couple of decades of reference points on cyber extorsions, vandalism, and theft. This sad history has at least one good facet: the direct, immediate financial cost of attacks is now a well-documented field of research.

There are four direct, immediate ways enterprises and shareholders lose money because of a cyber incident:

- **Sudden stock price drops**
- **Legal penalties and charges**
- **Money heists**
- **IT remediation costs**

As explained earlier, no large-scale attack on an IT infrastructure would succeed without exploiting, at some point, a few Active Directory weaknesses. All these costs are therefore linked to the insecurity of this critical infrastructure.

The IT remediation costs themselves can grow exponentially according to the post-incident state of Active Directory itself: if it's entirely compromised – which is often the case – then the remediation truly is a greenfield rebuild. This painful process usually mobilizes dozens, sometimes hundreds, of employees and specialized contractors who refactor the entirety of the architecture during nights and weekends. And that comes at a great cost.

Examples:

- **January 2018:** A Japanese-based cryptocurrency exchange reveals that it lost $530 million worth of the cryptocurrency NEM in a hack, in what amounts to possibly the largest cryptocurrency heist of all time.
- **December 2017:** SoftBank acquires roughly 15% of Uber. The deal valued Uber at about $48 billion, after Uber suffered (and horribly managed) a massive customer data breach. A month before the breach, Uber's valuation peaked at $68 billion. Not all of this 30% drop is attributable to the breach, but analysts see it being a significant factor.
- **June 2017:** Verizon completes the acquisition of Yahoo!'s operating business for $4.48 billion, after the latter suffered two highly publicized breaches that knocked an estimated $350 million off its sale price.
- **September 2014:** An attack on the POS systems of Home Depot exposes the credit/debit card information of 56 million customers. In March 2016, the company agrees to pay $13 million to reimburse shoppers for out-of-pocket losses, and to spend at least $6.5 million to fund 1.5 years of cardholder identity protection services. Overall, the company allocates $161 million of pre-tax expenses to the breach.
- **December 2013:** Target suffers a massive breach of its POS system, leading to the theft of credit/debit card information and/or contact information of up to 110 million people. Target's CIO resigns in March 2014, and its CEO resigns in May of that same year. The company estimates the cost of the breach at $162 million.

Addressing Active Directory Security

The security industry at large hasn't been perfect in addressing this threat early on. But we haven't lost the battle either. Fighting Active Directory-related cybercrime is now an established field of research that has produced practical risk mitigation tactics.

Best Practices

There are several trusted sources which detail the best practices organizations should follow in order to harden and defend their Active Directory. Most notably:

- **Microsoft:** https://docs.microsoft.com/en-us/windows-server/identity/ad-ds/plan/security-best-practices/best-practices-for-securing-active-directory
- **NIST:** https://nvd.nist.gov/ncp/checklist/669
- **ANSSI:** https://www.ssi.gouv.fr/guide/recommandations-de-securite-relatives-a-active-directory

These recommendations will ensure your organization follows a strict hygiene when it comes to AD security, so that you're less exposed to those aforementioned risks. However, they will not help you – or only very marginally – when it comes to detecting ongoing attacks that penetrate your well-hardened infrastructure.

Real-time Monitoring

Using a tool to audit Active Directory can identify configuration issues, but audit data quickly becomes stale, and AD must be monitored continuously to ensure potential threats and breaches are detected swiftly.

Because the threat landscape is constantly changing, events collected from Active Directory should be analyzed against a threat intelligence feed to ensure issues are flagged as they occur and brought to the attention of IT staff. Unfortunately, this is hardly doable without specialized tooling. Taken separately, the security and Active Directory talent pools are already scarce. Hiring a team of professionals who boast both skills is close to impossible. In this context, the use of specialized technologies that can combine AD-focused intelligence feeds and local logs is the only viable solution to monitoring Active Directory at scale.

And we might have a couple of insights about choosing the right **AD-centric security solution**, but this is a story for later...

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