Section 3: Week 8: Corporate Risk Management Plan

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# Corporate Risk Management Plans

NCU Financial (NCU-F) operates on a finite budget and must prioritize investments into features and services. On the one hand, the business would like to spend all available resources delivering its core mission, enabling personalized investing. Allocating time and money into other projects might even appear to detract from this mission and feel like a waste. However, along the journey are risks from a litany of sources that can derail progress, cause financial hardship, and harm the organization’s reputation (Erickson & Neilson, 2018). Using a security framework, such as COBIT or NIST Cybersecurity, formalize processes for identifying and approaching threats from these risks (Devos & Van de Ginste, 2015). It would be economically prohibitive to remove every threat against the organization. Instead, a prioritization discussion must delineate between threats and vulnerabilities.

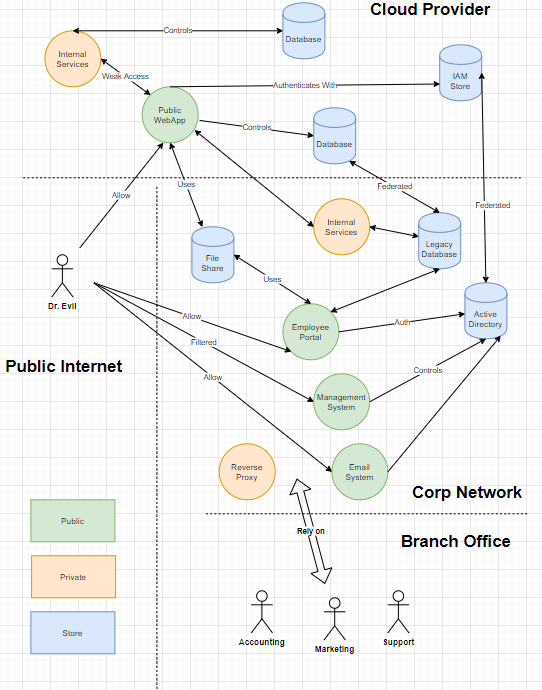
Assessing and addressing vulnerabilities requires a mixture of proactive and reactive controls that constrains the blast radius of malicious and negligent people, processes, and products. Meeting that expectation requires a corporate strategy that minimizes risks using mitigation, avoidance, and transference strategies (Baskerville, Rowe, & Wolff, 2018). Deciding the appropriate solution is contextually sensitive and can also require tooling and redundancies. For example, data loss can occur from ransomware, hardware failure, or accidental deletion. While the reasons vary, the resolution is to perform a disaster recovery process. Suppose the business accounts for that resolution ahead of time. In that case, systems will already exist, and the impact on service continuity is curtailed. Lastly, the most brilliant risk management plans are ineffective without processes to verify accuracy and disseminate across the team members. Over time business priorities and technologies change, necessitating the need to confirm these procedures continue being complete.

# State of the Organization

## Corporate management of systems and applications

NCU-F has significant investments in its private data center resources, which hosts several legacy and business-critical systems (see Figure 1). There are fifty branch offices across the country that transact with the corporate network using Virtual Private Networking (VPN). Around four years ago, the firm began transitioning to a hybrid cloud model with plans to decommission the private data center eventually. The global pandemic has recently forced most employees to work remotely utilizing combinations of personal equipment, mobile devices, and employer-purchased hardware.

Figure 1: NCU-F Network Topology



The network administration team must define policies and procedures for ensuring the consistency of these different environments. This requirement is challenging because resource ownership extends over multiple parties, and technology stacks range drastically. For instance, the cloud solution uses a mixture of Infrastructure, Platform, and Software as a Service (IaaS, PaaS, and SaaS) platforms. Meanwhile, client technicians must support Microsoft Windows, Apple iOS, and Google Android. Further complicating matters, the applications that run on these systems execute with varying levels of isolation and trust. While the business can mandate anti-virus products and patch management, there is still a chance that some of these machines will become infected with malicious software.

## Threats Every Organization Faces

Traditional threat discovery processes focus on technical management using filter and barrier products, such as firewalls and Intrusion Detection and Prevention Systems (IDS/IPS). Modern and mature processes include information governance, compliance, continuity planning, ethical norms, and regulatory requirements within the model (Bobbert & Mulder, 2015) (see Figure 2).

Cybersecurity controls are a collection of mechanisms and processes that constrain risk to business systems by ensuring they meet performance and consistency expectations, even under erroneous conditions (Mickens, 2018). These erroneous conditions arise due to malicious and negligent scenarios, degrading our service offerings' confidentiality, integrity, and availability. When categorizing these risks, a taxonomy needs to consider the incentives and origin of the risk (Li & Liao, 2018). Incentives of malicious and negligent behavior are drastically different and require unique approaches. Kosub (2015) proposes the terms cyber-risk (negligence) and cyber-crime (maliciousness) to distinguish between these scenarios. For instance, technical support staff wants to follow the cultural norms set by their employer and minimize any friction in completing their assignments (Weston, Conklin, & Drobnis, 2018). Meanwhile, malicious actors seek to exploit espionage, sabotage, and subversion attacks (Matsubara, 2014). While policies and training can reduce the impact of erroneous technicians, those solutions do not apply to external criminals.

Figure 2: Corporate Data Landscape

## Organizational Chart

Implementing enterprise software solutions requires teams of professionals from across multiple disciplines, each with a unique perspective. Alignment and inclusion of these different perspectives are critical, resulting in distortion, leading to political confrontation and critical misses. These diverse ideas originate from industry norms that seek to improve consistency, accuracy, and efficiencies for different aspects of the business (see Table 1). While there are advantages for teams to operate in vertical silos, such as the speed of decisions, an integrated framework draws on the expertise across the company (Nicho, Khan, & Rahman, 2017). When all stakeholders can participate in the process, it culminates in releasing the right product at the right time.

Table 1: Stakeholders

|  |  |
| --- | --- |
| Team/Role | Primary Concerns |
| Customers and other end-user | Privacy, reliability, usability, and available |
| Security Engineers | Confidentiality, integrity, and availability |
| Software Engineers | Reliability, observability, and performance |
| Program Managers | Functionality, predictability, and extensibility |
| Support Engineers | Observability and supportability |
| User Experience (UX) | Convenience and performance |
| Legal and Compliance | Privacy and confidentiality |
| Marketing and Sales | Functionality and consistency |
| Accounting and Finance | Economical and profitable |
| Senior Leadership | Connects with the broader company strategy |
| Technical Writers | Consistency and explain-ability |
| Network Security Engineers | Authentication, authorization, and auditing |
| Operations | Observability, reportability, and discoverability |

# Objectives of Risk Management Plan

The fundamental purpose of a risk management framework is to identify and prioritize threats, plan and correct those issues, and finally verify and monitor those changes (Gillies, 2011). While it is possible to mitigate specific scenarios pre-emptively, other challenges require reactive compensation. For instance, anti-virus software can reduce the chances of ransomware corrupting a mission-critical database. However, an extensive catalog of reasons could conclude at the same point (e.g., application defect or drive failure) (see Figure 3). NCU-F has finite resources and cannot address every vector that results in a loss of confidentiality, integrity, and availability. Instead, the risk management plan must address a subset of circumstances and default to general recovery procedures for other cases. These decision trees need to consider the influence of both asset classification and failure reasons. For example, if an employee’s workstation becomes unresponsive, the support office might follow a ‘retry-reboot-reinstall-replace’ workflow. Meanwhile, a legacy mainframe might be too costly to touch and need a concise remediation process.

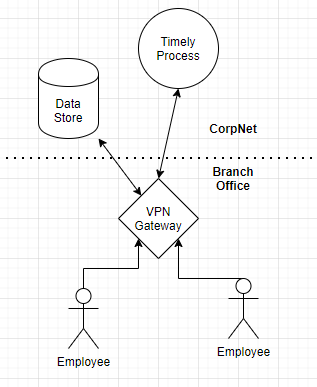
Figure 3: Incident and Response

# Business Impact Analysis

No one likes to think about negative situations, which causes organizations to underestimate the likelihood and cost of a security incident (Eling & Wirfs, 2019). In reality, most data breaches cost millions of dollars, with high-profile instances reach substantially more (Brown, 2015). The economic impact comes from many sources, such as class action lawsuits, regulatory fines, digital forensics, productivity loss, and additional public relations campaign expenses (Erickson & Neilson, 2018). Business impact analysis models these scenarios by building an asset dependency graph and then weighting the edges equal to the value at risk. For instance, a service interruption of the branch office VPN link cascades to workstations at that venue (see Figure 4). Since employees cannot promptly access central information, they will miss out on sales opportunities. NCU-F can then measure the order flow across this channel to quantify the loss from an hour disconnection.

Having this information provides two critical pieces of information. First, it identifies dependencies for the response plan. Second, it enables the business to assess if the risk is acceptable. For example, this channel has a mean failure rate of 0.1% and annually operates 2032 hours (8 hours x 254 days). The business will experience 2.0 hours of service interruption per year. If the order flow across this media is sufficiently high, it highlights the need to purchase a redundant connection.

Figure 4: Example of Business Impact Analysis Scenario



# Plan of Action and Milestones

When an incident happens, the organization needs to follow a methodical remediation strategy that adheres to standard software development processes. This process identifies the stakeholders, understands context, and agrees to timelines and scope (Rafeq, 2019). Inadequate planning, scope creep, and poor communication are three common reasons that projects fail (Jain, 2018). Partial mitigation comes from an iterative design that articulates the barebones solution and lays out a path through multi-release strategies. For instance, an internal content management system is serving malware. The immediate goal is to stop the growing infestation by quarantining the system. Next, administrators need to update patches and run malware removal tools. Longer-term, additional controls must limit the attack surface for unauthorized software to even execute on the server.

Figure 5: Plan of Action

Implementing the holistic remediation plan can take weeks to years, and this requires communication and accreditation checkpoints. A separate incident exposes user privacy, and regulators are seeking damages for non-compliance. During this recovery period, senior leadership must provide timely progress reports, and auditors must confirm the mitigations fully meet expectations. Validation of these product changes must confirm the system remains usable and free from performance or reliability regressions.

# Risk Reduction for Mobile Device Management

Administrators must reduce the risks from mobile platforms while also cognizant that their efforts met governance, compliance, and privacy norms (see Figure 6).

Figure 6: Mobile Risks

## Evolution of Mobility

Legacy network environments heavily rely on centralizing information into a single mainframe or data warehouse. Network security teams could protect these resources through border security solutions, such as firewalls and other network access controls. However, this model lacks the convenience and data portability that users expect (Astani & Ready, 2016), leading to the adoption of Master Data Management systems (MaDaMgmt). The objective of MaDaMgmt is to enable the sharing of business entities and related feeds across the organization (Rivas, Caballero, Serrano, & Pattini, 2017). Now that employees could locally cache information on their corporate laptops and workstations, productivity increased, but ensuring data confidentiality and integrity became more complex.

## Traditional Designs

Deploying client management tooling (CMT) allows the administrators to enforce security policy across these edge devices (Tarzey, 2018). However, these CMT products tend to specialize in specific platforms and scenarios, limiting the device supportability matrix for corporate Information Technology (IT) departments. Due to these restrictions, rigid consistent topologies became the norm instead of allowing the best tool for the job. Modern networks believe that IT enables the business, not stifles innovation. The Bring-Your-Own-Device (BYOD) emersion makes this perspective front and center (Lamolle, Menet, & Le Duc, 2015). When employees are free to use the best tool for their role, it results in highly diverse environments that span multiple technology stacks, like Windows, iOS, and Android. At the cost of sensitive business information, that freedom improves productivity, residing on devices not controlled by the organization and partially trusted at best.

## Modern Solutions

Client management tools give the system administrators the ability to define policy centrally and then target workstations. Effective device management needs a similar mechanism that accounts for platform-specific variations. Unified Endpoint Management (UEM) addresses these issues by creating an abstraction layer that can translate corporate governance and policies into device-specific configurations (Tarzey, 2018). For instance, the administrator can mandate the installation of all critical operating system patches. The implementation of this action varies between Windows desktops, Apple iPhones, and Android Chromebooks—though the intent remains consistent. In addition to desired configuration and patch management, UEM platforms can perform operations like remotely wiping the device or requesting inventory reports. These actions enable the administrators to address specific challenges like the lost and stolen device scenarios. Advanced solutions like Microsoft Intune and MobileIron, support sandbox technologies that prevent mixing personal and corporate data (Soseman, 2019; MobileIron 2020). The data context tagging also opens the door for more imaginative remote wipe scenarios that do not touch personal data like family pictures.

# Tooling Recommendations

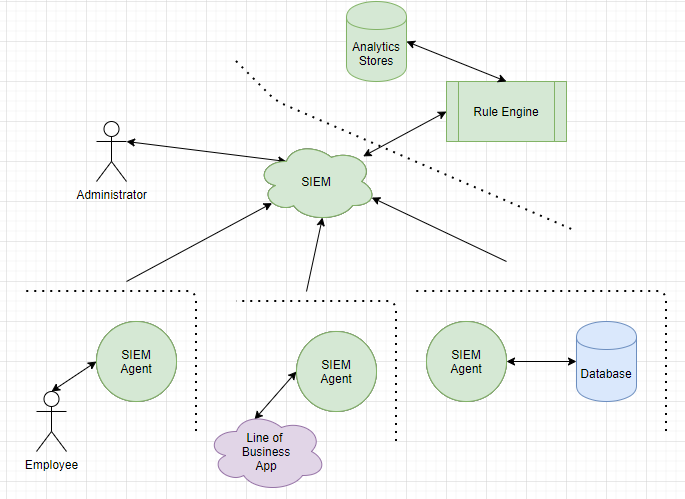
## Standard Protections

NCU-F needs to provide standard protections, such as anti-virus, patch management, and Intrusion Detection and Preventions systems (IDS/IPS). IDS systems use cryptographical proofs and signatures to confirm that tampering has not occurred (Mehresh & Upadhyaya, 2015). For instance, the operating system can store file hashes in a Trusted Platform Module (TPM) and later verify the integrity of the boot loader and other critical components. Many businesses also deploy Honeypots and Honeynets (Westcon-Comstor, 2018). However, these tools can report false positives and be challenging to configure correctly.

## Security Information and Event Management

Modern business topologies are dynamic and interconnected, containing components originating from internal teams, external contractors, and third-party providers. Eventually, service failures occur within this complex environment leading to the natural question, “so what happened?” The cost associated with solving this mystery is dependent on the quality of the auditing information. There is value in collecting and maintaining every change, but that can be impractical. A trade-off exists between performance, storage, and observability, limiting NCU-F’s ability to collect and persist such an enormous volume of data (Adedayo & Oliver, 2015). When choosing what information to keep, a one-size-fits-all solution does not exist. Instead, the administrators need to categorize the potential value of these various events in terms of needs for experimental and retrospective reconstruction. Regulatory compliance can also influence these decisions and establish minimum bars (Keel, 2015).

Figure 7: SIEM Topology



Many organizations deploy SIEM solutions to holistically manage log event collection, aggregation, and rule processing (see Figure 7). While there are many benefits to having a formal SIEM product, it is not a magic box and only provides insights into integrated systems. For instance, NCU-F exposes a public enrollment portal that follows a standard three-tier architecture (see Figure 1). If monitoring exists only for the database, then it can be perplexing to investigate the reason behind specific alerts. Perhaps a careless technician is servicing a request against the wrong server. Alternatively, the inclusion of router and switch logs could detect this traffic anomaly.

# Privacy and Risk from Cloud Environments

## Abstract Boarders

Traditional cybersecurity solutions focus on hardening the network parameter with firewalls and vulnerability scanners. However, this approach is no longer sufficient as attackers center their efforts on the application layer (Astani & Ready, 2016). By design, anonymous users can interact with the organization through public interfaces, such as web services and email. When malicious actors exploit Structured Query Language Injections (SQLi) or embed ransomware into mail attachments—it bypasses these network barriers and allows unauthorized access to information. Further complicating matters, the network boundary is becoming more abstract due to the notion of “everything as a service” (Paller, Mahalik, Skoudis, & Ullrich, 2020). For instance, 40% of enterprises are in the process of uplifting mission-critical services, like identity and authorization, into third-party providers (Galinec & Steingartner, 2017). Shifting ownership to these provides does not mean transferring the responsibility of risk. Users do not care if Amazon owns the physical server—they entrusted the stewardship of their data to NCU-F and will blame them for negligent handling. Modern businesses need to evolve their controls to meet the challenges of these application-specific vulnerabilities using strategies that encompass the governance of people, processes, and products.

## Influence of Geography

The premise of the Internet is an open communication system that connects people from around the world, enabling commerce and ideas to flow freely. However, governments also want to protect their sovereignty and enforce laws around these interactions (Inkster, 2015). These competing requirements cause security policies to make trade-offs between government control, societal freedoms, and the rights of international actors. Specific areas, such as California, Delaware, and the European Union, place a strong emphasis on user privacy and data protection. When organizations violate this trust, it results in severe penalties for non-compliance.

Organizations have legal and ethical obligations to safeguard customer privacy, using controls like Authentication, Authorization, and Auditing (AAA), and encryption of data at rest and in transit. While an industry-standard practice limits access to the fewest individuals, data leaks are inevitable due to malicious theft or judicial subpoena. When these incidents occur, processes need to determine the scope of impact and an appropriate level of disclosure. It can be tempting to ignore any ethical responsibilities and only handle the legal minimum. However, the truth will eventually get out, and this tactic cannot drive the narrative.

# Incident Response Process

After a security incident transpires, the administrative team must devise a response plan to contain the incursion and restore business continuity. While the number of critical issues can be overwhelming, the organization must follow a methodical approach to remediate the situation. The remediation strategy should follow industry best practices, like the guidance from COBIT and NIST Cybersecurity Framework. The mitigation approach must follow a Prepare-Recover-Enhance workflow (see Figure 8) that prioritizes assets and objectives that are the most critical first (Radhakrishnan, 2015). For instance, ransomware has corrupted the mission-critical database and payroll department. Without access to that database, NCU-F cannot continue normal operations, versus the accounting department can temporarily resort to more mechanical processes or offload to third parties.

Figure 8: Incident Response Model

After identifying the most critical systems, planning needs to stop the bleeding before drilling into a longer-term solution. For example, deploying the most recent backup of the database, updating software patches, and installing new malware definitions might be a good first step. Then the business must enhance the alerting and monitoring, revisit network configurations, and consider additional access controls to reduce the time to detect future incidents. If the business lacks the expertise to handle these changes, it can hire external consultants or third-party experts.

# Vulnerability Assessments

## Definitions

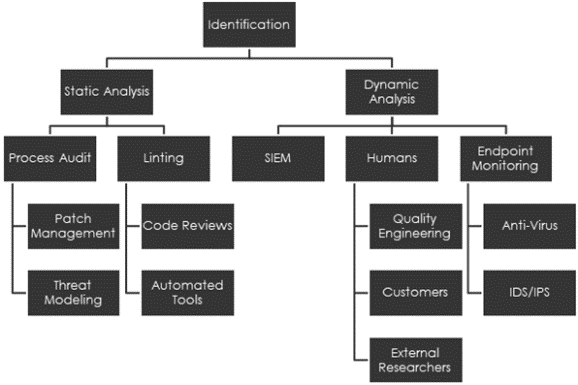
A vulnerability occurs at the intersection of (1) system susceptibility, (2) threat accessibility, and (3) threat capability (Baskerville, Rowe, & Wolff, 2018). Nullifying any of these predicates mitigates an attacker’s ability to compromise the confidentiality, integrity, and availability from that specific threat (see Figure 9). The costs to address these predicates range substantially and are highly scenario-specific. For instance, the legacy mainframe lacks support for modern network encryption and authorization protocols. Upgrading or replacing the system are not feasible solutions, though moving the server to a private network disconnects the threat’s accessibility. Another application, such as a public web portal, might experience the opposite problem where patching the software defect is a more natural path forward. Over a long enough period, all vulnerabilities are discovered and exploited (McLane, 2018). Processes need to combinations of proactive and reactive defenses to defuse these timebombs before they explode.

Figure 9: Mitigating Vulnerabilities

## Identification

Detection of the vulnerability might come from static (offline) or dynamic (online) analysis (see Figure 10). Static Analysis Tools (SAT), such as SonarQube and Check Marx, parse the source code into graph-like structures and then run queries to find defects in the application. While there is the potential to encounter false positives and false negatives, these lint checks effectively catch problems in proprietary systems. Dynamic Analysis Tools (DAT) use telemetry to monitor for security-critical events, making it ideal for black-box situations and discovering unknown unknowns. Outside of tooling, periodic process audits and patch management solutions can surface that a problem exists.

Figure 10: Identification Strategies



## Lifecycle Management

The resolution to a security vulnerability follows a standard software development lifecycle (see Figure 11). During the initial planning, the full impact of a vulnerability might not be immediately visible, as engineering teams often copy-paste existing code and infrastructure into multiple locations. Senior leaders must also reach a consensus for disclosing the issue and a proposal for introducing new changes. Like other software projects, an iterative design must occur that seeks the maximum immediate value (Lam, 2016). These changes present multiple risks to the organization, such as degrading performance (e.g., encryption or verbose logging) or creating new failure points (e.g., surfacing broken code). Verification processes must account for these risks through regression testing. After mitigating the defect, the leadership team needs to communicate the change as prescribed by corporate information governance policies (Fonseca & Ramaswamy, 2014).

Figure 11: Vulnerability Lifecycle

# Disaster Recovery

The operations and security teams at NCU-F seek to reduce risk to the minimum level possible. However, many risks are unavoidable or only partially mitigated due to resource constraints. For instance, an ultra-secure laptop that restricts user access to a finite set of functions could still experience a hardware failure. Lightning could strike the building, and it immediately burns to the ground. A global pandemic could halt international supply chains and force all works to shelter-in-place. There is virtually an unlimited number of scenarios that did not meet the bar for proactive mitigations and require reactive compensations. The compensation strategy will need to follow a procedure that restores service. Suppose the procedure is poorly defined or not implemented. In that case, the Mean Time to Recovery (MTTR) is unacceptably long, creating new risks to the business. These risks need a prioritization discussion that chooses which ones become self-protected, self-insured, transferred, or deferred (Baskerville, Rowe, & Wolff, 2018). Those conversations will need to consider the likelihood and potential costs under a deferment.

## Remote Locations and Fail-Over

An effective strategy for increasing availability is to remove any single point of failure by increasing the replica count. This general pattern of using remote locations and resource fail-over appears across the organizational footprint. For example, an on-premise file server can synchronize into the cloud. While employees prefer the speed and convenience of the local endpoint, having the alternative fail-over system guarantees continuity.

The fail-over system needs to make trade-offs between cost and switch-over durations. At one extreme are cold-sites, an ideal solution for use cases that can tolerate slower startup time. Hot-sites exist at the other end of the spectrum, with the ability to route traffic within seconds to minutes. NCU-F must use a business impact analysis to choose the ideal optimization per resource. Consider the scenario where a branch office catches fire and is no longer usable. The business determines that restoring service to the workstations is more critical than the building because employees can temporarily work from home. In this context, a hot-site transition is most appropriate for the digital assets, versus the cold-site is acceptable for the office. Assuming the inverse was true, then could lease and fully furnished additional office space ahead of time. However, overhead from duplication can be prohibitively expensive to impractical for many conditions.

## Inventory Management

Enterprise Resource Management (ERM) software annually is a 40-billion-dollar problem (Mordor Intelligence, 2020). The reason businesses purchase these programs is that maintaining asset inventories is challenging. Artifacts within this system present varying levels of risk to the continuity of NCU-F, and this requires systematic processes for categorizing and classifying the resource (NIST, 2018)(see Table 2). NCU-F follows a simple classification model of low, medium, highs, and categorizations based on business function. Consider the differences between a server that hosts the public web portal versus an intern’s laptop. These prioritizations decisions are not always so crisp, such as addressing issues between two internal services.

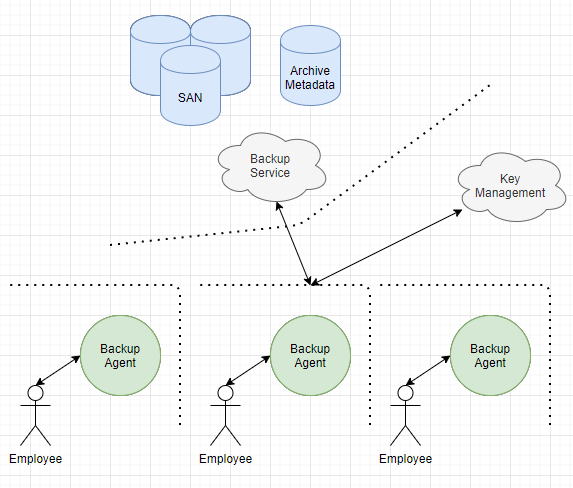
Table 2: Sample Inventory Report

|  |  |  |  |
| --- | --- | --- | --- |
| Example Resource | Location | Priority Classification | Categorization Tags |
| Core Routing Equipment | Corp Net | High | Infrastructure |
| Production Databases | Corp Net | High | Infrastructure |
| Technician Workstations | Branch Office | Medium | Support Systems |
| Employee Workstations | Branch Office | Low | Productivity |
| Web Portals | AWS – Cloud | High | Infrastructure |
| VPN Links | Branch Office | Medium | Infrastructure |
| Printers and Scanners | Branch Office | Low | Productivity |
| Legacy Mainframe | Corp Net | High | Infrastructure |
| File Servers | Corp Net | Medium | Productivity |
| File Servers | AWS – Cloud | High | Infrastructure |
| Mobile Devices | Branch Office | Low | Productivity |
| Video Chat Services | SaaS | High | Infrastructure |
| Email Services | SaaS | High | Infrastructure |
| Email Applications | Branch Office | Low | Productivity |
| Point of Sales Devices | Branch Office | High | Productivity |

## Backup and Recovery

There are dozens of scenarios that result in data becoming corrupt or inaccessible, such as hardware failures, ransomware, accidental deletion, and application corruption. Mitigating these situations requires controls that back up digital information and provide capabilities to restore archives (see Figure 12) promptly. This control needs to extend beyond sensitive documents to include circumstances like reimaging workstations and servers. Associating a file hash with each artifact ensures that the contents are consistent and not vulnerable to hardware failures or malicious tampering. NCU-F has traditionally kept archives in the corporate storage area network (SAN). However, these workloads could transition to the cloud to reduce costs while increases retention periods.

Figure 12: Backup Service



# Plan Verification

## Implementing Drills

The most well-thought plans are likely to contain gaps in their execution due to unknown side-effects and employee misunderstandings. A practical solution to discover these disparities is by running the procedure. First, in staging environments and as the process matures, promoting these tests into production. It is not sufficient to run the drill once and instead must function on a cadence proportional to the complexity of the procedure (see Table 3).

Table 3: Example Drill Cadences

|  |  |  |
| --- | --- | --- |
| Scenario | Description | Cadence |
| Database fail-over | Perform transition to a cold site | Quarterly |
| Domain services offline | Disrupt authentication services and confirm transition to a hot site | Quarterly |
| Red Team | Execute war games of hacker defender | Biannually |
| Phishing Attack | Launch simulated phishing attacks against employees | Daily |
| Backup and Restore | Confirm that backup processes and intact and usable | Monthly |
| Chaos Engineering | Confirm that production services can handle unreliable dependencies | Daily |
| Fire alarms | Confirm orderly exit from the premises | Biannually |

## Assessing Drills

Transitioning a workload to a remote site takes one week to complete and succeeds 99% of the time-- is that good or bad? Answering this question in a vacuum is impossible. It requires an agreed-upon Service Level Objective (SLO) and simultaneous measurements for Quality of Service (QoS). QoS models measure a scenario in terms of reliability, availability, response time, and throughput (Jammal, 2017). If these measurements are highly variable, it indicates controls are missing from the system (see Table 4).

Table 4: Measurements of QoS

|  |  |  |
| --- | --- | --- |
| Measurement | Description | Example Controls |
| Reliability | The likelihood of a valid transaction succeeds | Event durability and retry policies |
| Availability | An endpoint’s ability to respond to service requests | Load balancers and eventual consistency models |
| Response Time | Time to complete the transaction | Quota Management |
| Throughput | Number of supportable parallel transactions | Elastic and virtual compute solutions |

# Dissemination

## Plan Distribution

The adoption of any process requires sponsorship from executive leadership and proper communication to the troops (Weston, Conklin, & Drobnis, 2018). When either the top or bottom of the organization lack agreement in the solution, it will not become a priority, and team members will sidestep it. Instead, having a cultural alignment ensures that the standard operating procedure makes safe decisions that minimize risk and privacy concerns.

## Awareness Training

Security awareness training reduces the likelihood of an incident but cannot eliminate it (Hunt, 2019). Removing these auxiliary threats requires a fundamental shift in approach centered around zero-trust and an assume breach mindset. Promoting such a shift is only possible under a shared vision of success and collective agreement that change is necessary.

Negligence from employee actions accounts for nearly half of security incidents in enterprise environments (Proctor & Chen, 2015). This group represents both people that want to do the right thing and the most significant slice of the pie. Controls need to exist through compliance training that communicates the expectations and rationale of NCU-F. For instance, flagging email as originating from an untrusted source provides little value when the employee does not understand the meaning of the flag. Training corporate norms can also discourage dangerous behavior, such as installing unauthorized software of company devices or using weak passwords. However, many of these concepts are easier said than done. Users will seek the path of least resistance to accomplish their goals.

## Training Emergency Committee Personnel

Attending an emergency is both stressful and overwhelming. Organizations can reduce these challenges by proactively having committees to plan the response. The goal of these members is to identify likely sources, such as the building catches fire or Advanced Persistent Threats (APT) breaches the network defenses. Next, mitigation strategies need to exist for these sources seeking to maximize employee safety and minimize business loss. Plans must also consider the communication lifecycle, from having an on-call support technician to providing periodic status updates to stakeholders. Drills can provide aspects of the necessary training, but these controlled environments lack the adrenaline of a real crisis. Successful leaders never waste a crisis and instead use them to grow the team’s skills and confidence.

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