Section 2: Week 6: Design a Vulnerability Assessment Procedure

Nate Bachmeier

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North Central University

# Design a Vulnerability Assessment Procedure

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.

## Role of Vulnerabilities

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 a specific threat. The costs to address these predicates range substantially and are highly scenario specific. For instance, the legacy main-frame 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 configuration, such as a public web application, might experience the opposite problem where patching the software defect is a more natural path forward.

## Role of Auditing

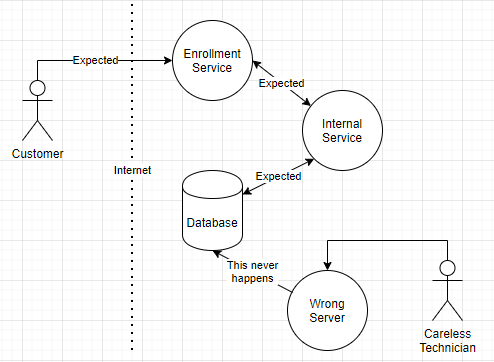
Modern business topologies are dynamic and interconnected, containing components that originate from internal teams, external contractors, and third-party providers. Overtime priorities shift and follow economic incentives to churn out new products and features, causing bitrot to neglected services and new features that lack sufficient security controls (Li & Liao, 2018). 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. Generally speaking, half of these moments come from employee negligence, a quarter from system errors, and the remainder from malicious sources (Valiente, 2017). According to this breakdown, there is significant value is auditing all change across every business process. However, a trade-off exists between performance, storage, and observability, which might limit the companies 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.

## Security Information and Event Management (SIEM)

Audit events are paint dots that make up a larger picture. Process mining forms this picture by clustering related messages into traces, operations, and transactions. Despite extensive research, completely automating this process is challenging in real-world settings (Claes & Poels, 2014). Consider the variability in technology stacks and how this impacts design decisions of event schemas, data formats, and encodings. A data curation process needs to exist for resolving these discrepancies and transforming the raw data into information. Undergoing such a transformation requires event collection, transformation, aggregation, and correlation capabilities to present a holistic semantic model of the business. Next, administrators need functionality to author compliance and remediation policies that monitor changes to the ecosystem. Many enterprises choose to purchase holistic solutions like System Information and Event Management (SIEM) platforms, instead of building custom code or gluing third-party components together.

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.

Figure 1: Enrollment App



Ideally, these events describe relational, functional, and temporal metadata about the change (Adedayo & Oliver, 2015). The

The golden rule of security states each request into the system needs authentication, authorization, and auditing. Without understanding the caller’s context, it is not possible to make informed decisions that sufficiently protect business assets. Recording the result of this approval process enables administrators to reconstruct a chain of events that led to an incident. An incident can occur due to