An SRE-Driven Framework for Detecting and Prioritizing Security Incidents Using Reliability Metrics in Cloud-Native Systems

Team Member:
Manula Manjitha Hindurangala — *Student ID: 300390724*

Course:
4495 – Applied Research Project

Section:
002

Introduction

Background and Research Context

Modern software systems operate at large scale, are highly distributed, and are continuously exposed to both operational failures and malicious activity. As organizations increasingly adopt cloud-native architectures and DevOps practices, the frequency and complexity of incidents affecting system reliability and security have grown significantly. Site Reliability Engineering (SRE) has emerged as a discipline focused on maintaining system reliability through measurable service-level objectives (SLOs), error budgets, and operational metrics. In parallel, cybersecurity practices focus on detecting, responding to, and mitigating security incidents that threaten the confidentiality, integrity, and availability of systems. Despite this overlap, reliability engineering and security operations are often treated as separate domains in practice.

Problem Framing and Research Motivation

In real-world operational environments, not every anomaly or system degradation is necessarily a security incident. Reliability failures, performance regressions, misconfigurations, and traffic spikes may resemble malicious activity but originate from non-adversarial causes. Conversely, genuine security incidents, such as denial-of-service attacks, credential abuse, or exploitation attempts, often manifest initially as reliability symptoms, including increased latency, elevated error rates, or rapid error budget consumption. This overlap creates a significant challenge for operators in accurately identifying the nature and severity of incidents.

Research Questions and Importance

The primary question this research seeks to address is how SRE reliability metrics can be systematically used to distinguish security incidents from general operational incidents. A related question concerns how these metrics can support incident prioritization based on potential impact and urgency. These questions are important because misclassification of incidents can lead to delayed responses, inefficient use of resources, and increased risk to system availability and security.

Related Work and Existing Limitations

Existing literature and industry practices have extensively explored SRE metrics, such as service-level indicators, error budgets, burn rates, and high-percentile latency, to manage system health and reliability. Separately, cybersecurity research has focused on intrusion detection systems, log analysis, anomaly detection, and threat intelligence. However, these approaches are typically developed in isolation. There is limited research on using SRE reliability metrics as primary signals for security incident detection, and many existing security tools lack transparency in how operational signals are interpreted and prioritized.

Knowledge Gaps Addressed by This Research

A key gap in current research is the absence of a structured, metrics-driven framework that integrates SRE reliability data into security incident classification and prioritization. Existing approaches often rely on security-specific tooling or manual analysis, which can be opaque and operationally inefficient. This research aims to bridge that gap by proposing a framework that explicitly maps reliability metric deviations to security-relevant interpretations.

Hypotheses and Assumptions

This research is based on the hypothesis that security incidents produce distinct and measurable patterns in reliability metrics that differ from those caused by non-security-related failures. It is further assumed that correlating multiple reliability indicators, rather than evaluating metrics in isolation, can improve confidence in identifying security-related incidents.

Expected Benefits and Research Contribution

The anticipated outcome of this research is an SRE-driven decision-support framework, demonstrated through a web-based visualization interface, that assists administrators in monitoring reliability signals and making security-aware incident response decisions. By grounding security analysis in established SRE metrics, this research aims to improve transparency, reduce misclassification, and contribute to more integrated and effective reliability and security operations.

Proposed Research Project

Research Design and Objectives

This research follows an applied, exploratory research design focused on developing and validating a practical framework rather than producing a purely theoretical model. The primary objective is to design an SRE-driven framework that uses reliability metrics to support the detection, classification, and prioritization of security incidents in operational systems. A secondary objective is to demonstrate this framework through a web-based visualization and decision-support tool that enables administrators to interpret reliability signals in a security-aware context.

The research is designed to bridge the gap between reliability engineering and security operations by operationalizing commonly available SRE metrics for security-relevant decision-making. This design is appropriate because the research emphasizes real-world applicability, interpretability, and integration with existing operational practices rather than proposing a new detection algorithm in isolation.

Methodology and Justification

This research adopts Design Science Research (DSR) as its primary methodology, as the study focuses on designing, implementing, and evaluating a practical artifact to address an operational problem. DSR is appropriate for research where the primary outcome is a framework or system intended to improve existing practices.

The research follows the established stages of Design Science Research:

1. **Problem Identification**
   The research identifies the challenge of distinguishing security incidents from non-security operational incidents using operational data already available in SRE monitoring systems.
2. **Objective Definition**
   The objective is to develop an SRE-driven framework that uses reliability metrics to support security incident detection and prioritization in a transparent and operationally interpretable manner.
3. **Design and Development**
   A structured framework is designed that maps reliability metrics—such as error rates, latency percentiles, error budget burn rates, and availability—to security-relevant interpretations. This framework is implemented through a web-based decision-support and visualization tool.
4. **Demonstration**
   The framework is demonstrated using simulated incident scenarios representing both security-related and non-security operational events, allowing observation of metric behavior under controlled conditions.
5. **Evaluation**
   The artifact is evaluated by analyzing its ability to correctly classify and prioritize incident scenarios based on observed metric patterns, with emphasis on interpretability and operational usefulness.

The use of Design Science Research is further justified by its alignment with coursework in site reliability engineering, monitoring, cloud systems, and cybersecurity, where metrics-driven analysis and system design are central concepts. DSR supports an applied, explainable approach, making it suitable for integrating reliability engineering principles into security-aware incident response.

Data Collection Methods

Data for this research will be collected through a combination of simulated incident scenarios and synthetic operational metrics. Controlled scenarios will be designed to represent both security-related events (such as traffic floods or unauthorized access patterns) and non-security operational incidents (such as configuration errors or resource exhaustion). Reliability metrics generated during these scenarios will be recorded and analyzed.

The dataset will consist of multiple incident instances rather than human subjects, making the sample size dependent on the number of simulated scenarios and metric observations collected over time. Each scenario will produce time-series data for key reliability metrics, allowing comparison across incident types. This approach ensures repeatability, control over variables, and ethical simplicity while remaining representative of real operational environments.

Technologies Used

The following technologies will be used to implement and demonstrate the proposed framework:

Operating System / Platform

- Linux-based operating system or cloud-hosted virtual environment

Programming Languages / Frameworks

- Python for data processing, metric analysis, and backend logic
- JavaScript for front-end interaction and visualization

Database

- Relational or document-based database (e.g., PostgreSQL or MongoDB) for storing metric data and incident records

Front-End and Back-End

- Front-end: Web-based dashboard using HTML, CSS, and JavaScript (with a visualization library)
- Back-end: RESTful API implemented in Python to process metrics and apply framework logic

These technologies are selected due to their widespread adoption in both SRE and security environments, as well as their suitability for rapid prototyping and applied research.

Expected Results

The expected outcome of this research is a validated framework demonstrating that reliability metrics can be effectively used to support security-aware incident detection and prioritization. It is anticipated that security incidents will exhibit distinguishable patterns in metric behavior, such as sustained error budget burn combined with traffic anomalies and latency spikes, compared to non-security operational failures.

The resulting web-based tool is expected to provide administrators with clearer situational awareness by visualizing reliability signals in a structured and interpretable manner. Practically, this research contributes a decision-support approach that enhances incident response efficiency, reduces misclassification, and promotes tighter integration between SRE and security practices. The findings are intended to inform both academic discussions and real-world operational workflows.

Project Planning and Timeline

Project Overview and Planning Approach

This research project is planned as a solo, milestone-driven applied research project, following the stages of Design Science Research (DSR). The project is divided into clearly defined phases, each with specific deliverables and deadlines. This phased approach ensures steady progress, allows iterative refinement, and aligns development activities with research objectives.

As the sole researcher, all responsibilities related to research design, implementation, analysis, documentation, and submission are managed by a single team member. This allows for consistent decision-making, reduced coordination overhead, and clear accountability for all deliverables.

Timeline: Week 1

Milestones:

- Identify research domain and problem area
- Establish initial research direction
- Review course requirements and assessment criteria

Deliverables:

- Confirmed research topic
- Initial problem statement outline

Timeline: Week 2

Milestones:

- Finalize research problem statement
- Develop and refine research questions
- Define research objectives, scope, and assumptions

Deliverables:

- Defined research questions
- Research objectives and scope document

Timeline: Week 3

Milestones:

- Begin focused literature review (SRE and security incidents)
- Select and justify research methodology (Design Science Research)
- Begin conceptual framework and initial implementation setup

Deliverables:

- Literature review draft (initial)
- Methodology and framework outline
- Initial implementation setup (environment + structure)

Timeline: Week 4

Milestones:

- Finalize proposal content
- Refine literature review and methodology
- Validate feasibility and scope

Deliverables:

- Final approved project proposal
- Refined literature review section
- Confirmed framework and implementation plan

Timeline: Week 5

Milestones:

- Continue literature review and gap analysis
- Design framework logic and metric selection
- Begin core framework implementation

Deliverables:

- Literature review (expanded)
- Metric selection and framework logic documentation
- Initial framework implementation

Timeline: Week 6

Milestones:

- Finalize reliability metrics and decision logic
- Implement incident classification and prioritization rules
- Prepare midterm progress material

Deliverables:

- Metric-to-decision mapping
- Framework logic implementation
- Draft midterm progress report

Timeline: Week 7

Milestones:

- Complete core framework implementation
- Develop a working prototype
- Validate framework using sample scenarios

Deliverables:

- Midterm progress report
- Working implementation (prototype)
- Demonstrable incident classification results

Timeline: Week 8

Milestones:

- Enhance implementation and add metric visualizations

- Improve usability and clarity of the tool

Deliverables:

- Enhanced prototype with dashboards
- Updated implementation documentation

Timeline: Week 9

Milestones:

- Simulate security and non-security incident scenarios
- Collect and analyze metric data

Deliverables:

- Synthetic incident dataset
- Preliminary evaluation results

Timeline: Week 10

Milestones:

- Refine framework based on evaluation results
- Improve classification accuracy and prioritization logic

Deliverables:

- Refined framework and implementation
- Updated evaluation analysis

Timeline: Week 11

Milestones:

- Finalize implementation and evaluation
- Prepare presentation and defense material

Deliverables:

- Finalized implementation
- Complete results and discussion sections
- Presentation-ready system

Timeline: Week 12

Milestones:

- Polish final report
- Document limitations and future work

Deliverables:

- Final report draft

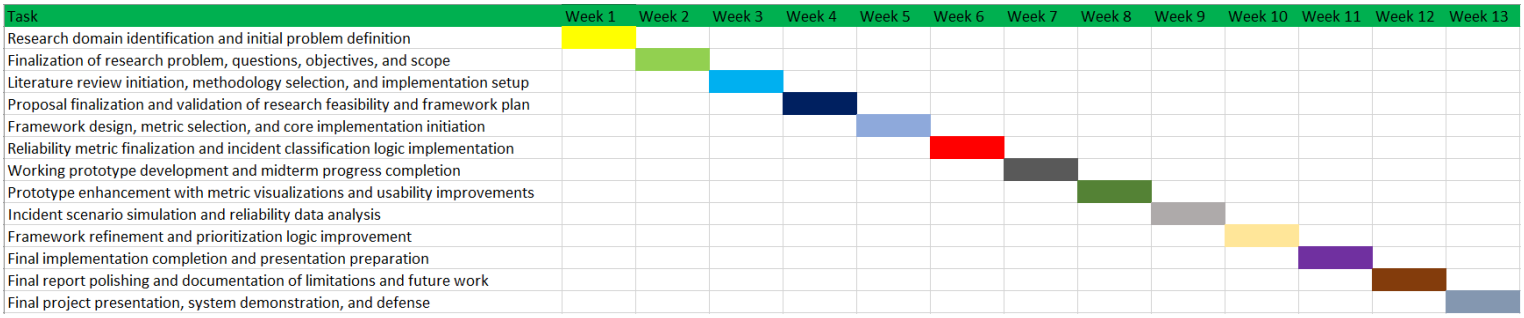
Timeline: Week 13

Milestones:

- Present and defend research project
- Demonstrate final working system

Deliverables:

- Final report
- Final implementation
- Oral presentation and defense



Project Contract

I agree to complete this individual research project in accordance with the scope, timeline, milestones, and deliverables outlined in the approved project proposal. I understand that the project will follow the specified research plan and deadlines set by the course, and that any significant changes to scope or timeline will be discussed with and approved by the course instructor. I also agree to provide regular progress updates as required and to complete all submissions and presentations in line with course expectations.

AI Usage

AI Tool Name	Version, Account Type	Specific Feature for which the AI tool was used	Value Addition
ChatGPT (OpenAI)	GPT-4 / GPT-5.x, Plus account	Brainstorming and refining the research problem statement and motivation	The core research idea, problem framing, and relevance to SRE and cybersecurity were independently developed by the student. AI suggestions were critically reviewed, selectively incorporated, and adapted to align with course requirements and real-world SRE practices.
ChatGPT (OpenAI)	GPT-4 / GPT-5.x, Plus account	Improving academic tone, clarity, and structure of proposal drafts	All content was written and revised by the student. AI was used only to improve wording and coherence; the student ensured originality, technical correctness, and alignment with applied research standards.
ChatGPT (OpenAI)	GPT-4 / GPT-5.x, Plus account	Assisting in articulating Design Science Research (DSR) methodology steps clearly	The choice of methodology, justification, and mapping to the research problem were independently decided by the student. AI was used to help clearly express established concepts, not to select or design the methodology itself.
ChatGPT (OpenAI)	GPT-4 / GPT-5.x, Plus account	Reviewing timeline and deliverables for feasibility and clarity	The project plan, milestones, and deliverables were created by the student based on course constraints. AI feedback was used only to validate clarity and improve presentation.
ChatGPT (OpenAI)	GPT-4 / GPT-5.x, Plus account	Grammar checking and consistency review across sections	The student manually verified all corrections and ensured that technical terminology, assumptions, and research intent remained accurate and consistent throughout the document.

Worklog

Date	Number of Hours	Description of work done
09-Jan-26	2	Initial exploration of applied research domains; evaluated overlap between Site Reliability Engineering (SRE) and cybersecurity incident management

10-Jan-26	2	Defined preliminary research idea focusing on using reliability metrics to distinguish security incidents from operational failures
11-Jan-26	1.5	Reviewed course requirements and assessment criteria; aligned research idea with Applied Research Project expectations
12-Jan-26	2	Drafted initial problem framing highlighting challenges in incident misclassification between reliability and security domains
13-Jan-26	2	Refined research motivation and identified key knowledge gaps related to SRE metrics and security incident detection
14-Jan-26	2	Conducted initial literature scan on SRE concepts (SLOs, SLIs, error budgets, burn rates) and security incident characteristics
15-Jan-26	1.5	Developed proof-of-concept project structure; created repository folders and committed initial implementation scaffolding
16-Jan-26	2	Formulated research questions and objectives focusing on metric-driven incident classification and prioritization
17-Jan-26	1.5	Selected Design Science Research (DSR) methodology and mapped research activities to DSR stages
18-Jan-26	2	Designed conceptual framework linking reliability metric deviations to security-relevant interpretations
19-Jan-26	2	Defined candidate reliability metrics (error rates, latency percentiles, error budget burn) for incident analysis
20-Jan-26	1.5	Drafted methodology, data collection approach, and assumptions using simulated incident scenarios
21-Jan-26	2	Planned web-based decision-support and visualization tool architecture (frontend, backend, data flow)
22-Jan-26	2	Refined proposal sections for clarity, academic tone, and alignment with applied research outcomes
23-Jan-26	1.5	Reviewed project timeline, milestones, and deliverables for feasibility and consistency
24-Jan-26	2	Finalized proposal draft and consolidated research framework, expected outcomes, and implementation plan

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Appendix

Perfect — now we're at the core of your research 🤌
What you need is a minimal, high-signal metric set that can answer two questions:

Is this likely a security incident?

What is the impact / severity (from an SRE perspective)?

I'll give you a clean, research-ready metric taxonomy, not a bloated SIEM checklist.

1 Core SRE Reliability Metrics (Your Primary Signals)
These are mandatory. They form the backbone of security impact and severity.

- ◇ Latency

What to track

p95 / p99 response latency

Endpoint-specific latency (e.g. /login, /api/*)

Why it matters for security

Layer-7 DoS

Credential stuffing

Bot abuse

Security signal

Latency ↑ without proportional legitimate traffic growth

Latency ↑ concentrated on auth or sensitive endpoints

- ◇ Error Rate

What to track

4xx rate (especially 401, 403)

5xx rate

Error rate per endpoint

Why it matters

Brute-force → spike in 401s

API abuse → unusual 4xx patterns

DoS → backend 5xx

Security signal

Sustained auth errors + retries

Error rate ↑ + saturation ↑ = attack likelihood high

- Traffic Volume

What to track

Requests per second (RPS)

Traffic per endpoint

Traffic per client / IP (coarse)

Why it matters

Traffic shape matters more than raw volume

Security signal

Traffic ↑ but user diversity ↓

Traffic spike isolated to one endpoint

High request rate from few sources

- Saturation

What to track

CPU usage

Memory usage

Thread / connection pool utilization

Why it matters

Attacks consume shared resources

Security signal

Saturation ↑ without deployment or feature change

Resource pressure correlated with specific request patterns

2 Error Budget & SLO Metrics (Your Novelty Layer)

This is where your work becomes SRE-centric and not just monitoring.

- Error Budget Burn Rate

What to track

Error budget consumption over time

Burn rate (how fast budget is being used)

Why it matters

Converts technical degradation → user impact

Enables severity classification

Security signal

Fast burn rate = high-impact incident

Low burn rate = suspicious but non-critical

📌 This metric answers: “How urgent is this?”

◇ SLO Violation Windows

What to track

Time to first SLO breach

Duration of breach

Why it matters

Security incidents that affect users should violate SLOs

Helps distinguish noise from real incidents

3️⃣ Security-Indicative Behavioral Metrics (Lightweight, Not SIEM)

These are supporting metrics, not deep security telemetry.

◇ Authentication Failure Rate

What to track

Failed logins per minute

Success-to-failure ratio

Security signal

Brute force / credential stuffing

Password spraying

- ◇ Unique Client / IP Cardinality (Approximate)

What to track

Number of unique IPs per time window

IP churn rate

Security signal

Many IPs + same endpoint = botnet

Few IPs + high rate = scripted attack

- ◇ Request Distribution Entropy

What to track

How evenly traffic is spread across endpoints

Security signal

Legit traffic → diverse

Attacks → concentrated

(You don’t need fancy math — simple ratios are enough.)

4️⃣ Correlation Metrics (Where “Detection” Actually Happens)
These are derived relationships, not raw metrics.

- ◇ Metric Correlation Patterns

Track co-occurrence, not values:
PatternLikely MeaningLatency ↑ + Saturation ↑ + Traffic ↑L7 DoSAuth failures ↑ + 401s ↑ + IP diversity ↑Brute forceTraffic ↑ + single endpoint focusAPI abuseErrors ↑ but no saturationLogic / config issue
📌 This is where you infer “security” instead of “outage”.

5️⃣ Incident Impact Metrics (For Evaluation & Reporting)
These help you quantify impact, which professors love.

- ◇ User Impact

% of failed requests

% of users affected

Duration of degraded experience

- ◇ Recovery Metrics

Time to detection (TTD)

Time to mitigation (simulated)

Error budget recovered post-incident

6️⃣ Minimal Metric Set (If You Want to Be Extremely Lean)
If someone asks:

“What’s the smallest set you actually need?”

Answer:

Latency, error rate, traffic, saturation, authentication failures, and error budget burn rate.

That’s it. Everything else is derivative.

7 How This Looks in Your Framework (One-Line)

“Security incidents are inferred by correlating reliability degradation patterns with lightweight behavioral signals, and their severity is determined using SLO error budget consumption.”

That sentence alone explains your metrics philosophy.

8 Next (Very Useful Step)
If you want, I can:

Map each attack type → exact metric pattern

Define threshold-free decision rules

Create a 1-page metric → decision table

Help you justify why you intentionally excluded many security metrics

Just tell me which one you want next 👇

SRE metrics are designed to detect unexpected deviations from normal behavior.
Cyber attacks also cause deviations — just with malicious intent.

SRE Signal	Reliability Meaning	Security Interpretation
Error rate spike	System failing requests	Injection attacks, auth abuse
Latency (p95/p99) jump	System under stress	DoS, resource exhaustion
Traffic surge	Increased demand	Bot traffic, brute force
Saturation increase	Resource limits hit	Cryptomining, lateral movement

👉 Conceptual overlap:

SRE metrics surface “what’s wrong”; security asks “why it’s wrong.”

2. SLIs and SLOs as a Baseline for “Normal” vs “Suspicious”

SRE is obsessive about defining normal behavior.

SLIs → what you measure (latency, error rate, availability)

SLOs → acceptable boundaries of that behavior

From a security perspective:

Anything that systematically violates SLOs without a known deployment or load event becomes suspicious

Repeated micro-violations can indicate slow-burn attacks (credential stuffing, data scraping)

👉 Conceptual overlap:

SLOs act like behavioral guardrails; attackers push systems outside those guardrails.

3. Error Budgets as a Security Impact Lens

Traditionally:

Error budgets tell you how much unreliability you can “spend”

Reframed for security:

A security incident consumes error budget

Faster budget burn = higher severity incident

Examples:

DDoS → rapid error budget burn

Abuse of an API → gradual but persistent burn

Auth endpoint probing → localized burn on specific services

👉 Conceptual overlap:

Security incidents can be prioritized by how fast and how broadly they burn reliability.

4. Burn Rate as an Early-Warning Signal for Attacks

Burn rate answers:

“How fast are we violating reliability guarantees?”

Security translation:

Sudden high burn rate → active attack

Low but sustained burn rate → stealthy abuse

Localized burn rate → targeted exploitation

This is powerful because:

It's quantitative

It's service-aware

It aligns with on-call and incident response workflows

👉 Conceptual overlap:

Burn rate turns security detection into a time-based risk problem.

5. Service-Centric Thinking Matches Modern Attack Surfaces

SRE models systems as:

Services

Dependencies

Critical paths

Modern attacks:

Target specific services (auth, payment, APIs)

Exploit dependency chains

Amplify blast radius via shared infrastructure

By mapping:

Security events → affected services

Services → user-facing impact

Impact → SLO degradation

You get security incidents ranked by business impact, not just alerts.

👉 Conceptual overlap:

SRE already models blast radius — security just reuses it.

6. Incident Response Is the Shared Operating Model

Both SRE and security rely on:

Detection

Triage

Severity classification

Post-incident analysis

Key overlap:

SRE incidents = “system is unhealthy”

Security incidents = “system is unhealthy because someone caused it”

SRE metrics give you:

Objective severity signals

Timeline reconstruction

Measurable recovery indicators

👉 Conceptual overlap:

Security incidents are reliability incidents with adversarial root causes.

7. Big Picture (Great One-Liner for Proposals)

If you want a crisp conceptual statement:

SRE metrics quantify system behavior; cybersecurity interprets abnormal behavior through an adversarial lens. When combined, reliability metrics become early indicators and prioritization signals for security incidents.

Or even sharper:

Every meaningful security incident eventually manifests as a reliability problem — the earlier we detect it in SRE metrics, the smaller the blast radius.

Here’s a clean, applied-research way to position it 👇

Core Problem Framing

Instead of:

“How do we detect security incidents?”

Frame it as:

“How can organizations systematically distinguish between operational failures and security-driven incidents using observable system behavior and reliability signals?”

That subtle shift matters — because you're not replacing SIEMs or IDS tools. You're solving a classification + prioritization problem.

Applied Research Problem Statement (Structured)
Practical Problem Context

Modern digital systems generate large volumes of incidents triggered by:

infrastructure failures

configuration errors

scaling issues

software bugs

malicious activity

Operationally, these incidents often look identical at the signal level:

latency spikes

error rate increases

service degradation

availability loss

This creates ambiguity in incident response pipelines:

Teams respond reactively, not diagnostically

Security teams get alerted too late

Operational teams treat attacks as reliability bugs

Incident prioritization is misaligned with real risk

Research Gap Framing

You can frame the gap like this:

Existing incident detection systems focus either on operational reliability (SRE tooling) or security detection (SIEM/SOC tooling), but there is limited integration between the two at the decision-making layer — where incidents are classified, prioritized, and escalated.

Or more applied:

There is currently no unified operational framework that uses reliability metrics as structured inputs for distinguishing between accidental system failures and adversarial security events in real time.

Decision-Oriented Framing (Very Strong for Applied Research)

This is gold for professors and applied projects:

The core problem is not the absence of data, but the absence of a decision model that interprets system reliability signals in a way that supports security-aware incident classification and prioritization.

So you're not building "another detection system" — you're building:
👉 a decision-support framework

Example Problem Statement Paragraph (Proposal-Ready)

Here's a clean paragraph you can drop into an applied proposal:

In modern distributed systems, operational incidents and security incidents often manifest through identical system-level signals such as increased latency, elevated error rates, service degradation, and resource saturation. As a result, incident response teams face a fundamental classification challenge: determining whether observed system instability is caused by internal operational failure or external adversarial activity. Current reliability engineering tools are optimized for service health and availability, while security monitoring systems operate largely in parallel, leading to fragmented situational awareness and delayed security escalation. This creates a critical gap in incident management where security-driven events may initially be treated as routine operational failures, increasing response time, blast radius, and organizational risk. This research addresses the absence of an integrated, reliability-informed decision framework for distinguishing and prioritizing security incidents within operational incident response workflows.

Research Framing in One Line (High-Impact)

If you want something sharp and quotable:

The challenge is not detecting incidents, but distinguishing intent — failure versus attack — using the same observable system signals.

or

Modern systems detect failures well, but they do not interpret causality well.

Applied Research Angle (Important for credibility)

To keep it “applied” (not theoretical):

You frame your work as:

Not replacing SOC tools

Not replacing SIEM

Not replacing SRE platforms

Not doing ML-first detection

But instead:

Building a practical classification and prioritization layer that sits between monitoring systems and incident response teams.

Conceptual Model Framing

You can describe your system like this:

Signals → Interpretation → Classification → Prioritization → Response

Where:

Signals = SRE metrics

Interpretation = reliability patterns

Classification = operational vs security-driven

Prioritization = impact + burn rate + blast radius

Response = escalation path (SRE vs SOC)

Applied research typically:

Solves a real operational problem

Works with imperfect, real-world data

Produces artifacts (frameworks, tools, prototypes)

Aims for practical decision support, not universal proofs

Your problem:

Distinguishing security incidents from operational incidents using SRE metrics

- ✔ Real operational ambiguity
- ✔ Existing teams struggle with this daily
- ✔ Uses production-style metrics (latency, error rate, burn rate)
- ✔ Naturally leads to a framework or tool

That's textbook applied research.

2. Why This Is Not Primarily Theoretical

Theoretical research would ask things like:

Can we formally prove classification optimality?

What is the abstract model of adversarial behavior?

Can we derive new mathematical reliability bounds?

Your work does not depend on new theory.

Instead, you're asking:

How can existing metrics be interpreted differently?

What decision rules help practitioners respond faster?

How does this change real incident handling?

👉 That's application, synthesis, and validation — not theory creation.

3. Clear Applied Research Artifacts (This Is Key)

Professors love seeing tangible outputs.

Your research naturally produces:

- ◇ A Conceptual Framework

Mapping SRE metrics → incident characteristics

Linking reliability behavior to security suspicion

- A Decision Model

Rule-based or heuristic classification

Severity scoring using burn rate and blast radius

- A Prototype Tool (Optional but Powerful)

Web-based dashboard

Visualization of reliability-informed security signals

Decision-support for on-call engineers

- Evaluation Using Scenarios

Simulated incidents (DoS vs config error)

Historical log replay

Comparison of response outcomes

All of these are applied deliverables.

4. Strong Design Science Research (DSR) Fit

If your course mentions Design Science Research, this is almost perfect.

DSR focuses on:

Building artifacts

Solving organizational problems

Evaluating utility, not truth

Your mapping:

Problem: Incident misclassification

Artifact: Reliability-driven decision framework

Environment: Modern cloud-native systems

Evaluation: Case scenarios, expert review, simulations

You can literally say:

This research follows a Design Science Research methodology, focusing on the design, development, and evaluation of an artifact that supports security-aware incident classification using SRE metrics.

That sentence alone makes professors nod.

5. Evaluation Without Heavy Theory (Another Applied Win)

Applied research doesn't require:

Formal proofs

Perfect datasets

Statistical generalization

You can evaluate via:

Scenario-based analysis

Expert judgment (SRE / security practitioners)

Before/after classification clarity

Reduction in ambiguity or response time

These are practical success criteria, not theoretical ones.

6. How to Explicitly Justify "Applied" in the Proposal

You can say something like:

This research is positioned as applied research because it focuses on addressing a practical operational challenge faced by reliability and security teams, rather than developing new theoretical models. The goal is to design and evaluate a practical framework that can be integrated into existing incident response workflows to improve decision-making and prioritization.

That sentence is safe, clean, and convincing.

7. One-Line Verdict (Use This If Asked Directly)

If someone asks you directly:

Yes. The problem is inherently applied because it addresses a real-world operational decision gap and aims to produce a practical framework or tool that improves incident classification and response in production systems.

8. Quiet Truth (Between Us 😄)

This topic looks sophisticated because it sits between two domains — SRE and security — but that's actually its strength in applied research:

You're not inventing new math

You're connecting things practitioners already use

And solving a pain they feel every week

That's exactly what applied research is supposed to do.

❌ What DSR questions are not

Avoid questions like:

"Why does X happen?"

"What is the true cause of Y?"

"Is X better than Y in all cases?"

Those are explanatory / theoretical.

☑ What DSR questions are

DSR questions focus on:

How can we design…

What artifacts can support…

To what extent does an artifact help…

How effectively does a solution address…

They are:

Problem-solving

Artifact-oriented

Context-bound

Evaluation-aware

In DSR, the question is not “Is this true?”
It’s “Does this work well enough to solve the problem?”

2. The Core DSR Question Pattern (Very Useful)

Most strong applied DSR projects follow this structure:

Design question – what are we building?

Implementation question – how is it realized?

Evaluation question – how well does it perform?

Utility question – how useful is it in practice?

You don’t need all four, but 2–3 is ideal.

3. Generic DSR Question Templates (Steal These)

You can safely reuse these patterns:

How can a [framework / model / tool] be designed to address [practical problem] in [context]?

What design principles or metrics are most effective for supporting [decision/task]?

To what extent does the proposed artifact improve [outcome] compared to existing practice?

How effectively can [inputs] be operationalized to support [goal]?

4. Tailored Research Questions for Your Project (Proposal-Ready)

Here’s a clean, applied set you can directly use or lightly tweak.

RQ1 — Design Focus

How can a reliability-driven decision framework be designed to distinguish security-driven incidents from operational incidents in modern distributed systems?

Why this works:

“How can” → design-oriented

“framework” → artifact

“distinguish” → decision problem

Context-specific, not universal

RQ2 — Metric Operationalization

Which Site Reliability Engineering metrics can be operationalized to support the classification and prioritization of security-related incidents during operational disruptions?

Why this works:

Focuses on using existing metrics

Avoids inventing theory

Emphasizes practical operationalization

RQ3 — Evaluation / Utility

To what extent does the proposed framework improve incident classification clarity and response prioritization compared to traditional reliability-only incident handling approaches?

Why this works:

“To what extent” → evaluation, not proof

Compares against real practice

Allows qualitative + scenario-based evaluation

(Optional) RQ4 — Tool Support

If you’re building a dashboard or web interface:

How can a visualization-based decision-support tool enhance practitioners’ ability to interpret reliability signals for security-aware incident response?

This is very applied and very defendable.

5. What to Avoid in Your Question Wording

⃠ Avoid these phrases:

“prove that”

“determine the true cause”

“predict attacks”

“achieve perfect detection”

“universally classify incidents”

Those push you into theoretical or unrealistic territory.

6. Mapping Questions → DSR Outputs (Prof-Friendly)

You can even show alignment like this:

Research Question	DSR Output
RQ1	Conceptual framework
RQ2	Metric mapping + decision rules
RQ3	Evaluation via scenarios
RQ4	Prototype dashboard

That screams applied.

7. One-Line Rule of Thumb (Memorize This)

If your research question can be answered by building and evaluating something, it's a Design Science question.

Yours absolutely can.

In applied / DSR work, measurable does not mean:

statistically generalizable

mathematically provable

universally optimal

It does mean:

observable in practice

evaluable via scenarios, metrics, or expert judgment

tied to concrete artifacts or decisions

Your questions meet those criteria.

2. Let's Stress-Test Each Research Question
RQ1 — Design Clarity

How can a reliability-driven decision framework be designed to distinguish security-driven incidents from operational incidents in modern distributed systems?

Clarity: ☑

Clear “how can” → design

Clear artifact → decision framework

Clear distinction → security vs operational

Measurability: ☑

You can show the framework

You can apply it to incident scenarios

You can demonstrate classification outcomes

How it’s evaluated in practice:

Does the framework exist?

Can it be applied consistently?

Does it produce a classification decision?

💡 This is measured by existence, applicability, and internal consistency — which is exactly right for DSR.

RQ2 — Metric Operationalization

Which Site Reliability Engineering metrics can be operationalized to support the classification and prioritization of security-related incidents during operational disruptions?

Clarity: ☑

“Which metrics” is concrete

“Operationalized” implies rules or mappings

“Classification and prioritization” defines the output

Measurability: ☑

You can list metrics

You can define thresholds, patterns, or heuristics

You can demonstrate how they affect decisions

How it’s evaluated in practice:

Are metrics explicitly defined?

Are decision rules documented?

Do different incidents map to different severities?

RQ3 — Evaluation & Utility

To what extent does the proposed framework improve incident classification clarity and response prioritization compared to traditional reliability-only incident handling approaches?

Clarity: ☑

Clear comparison baseline

Clear outcome (clarity & prioritization)

Measurability: ☑ (for applied research)

Before vs after comparison

Scenario-based evaluation

Expert feedback

Reduced ambiguity or faster escalation

Typical evaluation methods:

Incident scenarios (DoS vs misconfig)

Qualitative scoring (low/medium/high clarity)

Practitioner feedback

Decision latency comparison

💡 “To what extent” gives you flexibility — that’s good, not weak.

3. Why These Are Perfect for an SRE-Focused Security Study

They:

Start from reliability signals, not threat intel

Fit on-call / incident response workflows

Avoid promising detection accuracy

Focus on decision quality, not prediction

That aligns with:

SRE principles

Operational reality

Applied research expectations

4. Minor Refinements (Optional but Nice)

If you want them slightly tighter academically, here are safe tweaks:

Polished Version (Optional)

RQ1

How can a reliability-driven decision framework be designed to support the classification of security-driven versus operational incidents in distributed systems?

RQ2

Which SRE metrics and reliability indicators can be operationalized to inform the classification and prioritization of security-related incidents?

RQ3

To what extent does the proposed framework improve incident classification clarity and response prioritization when compared with reliability-only incident handling practices?

These don’t change meaning — they just sound extra clean.

5. Quick Professor-Defense Answer (Memorize This)

If asked “Are these measurable?” you can say:

Yes. Each research question is evaluated through the design and application of a concrete artifact, supported by scenario-based analysis and comparative evaluation against existing operational practices. The focus is on practical decision improvement rather than theoretical optimality.

That answer lands well.

6. Verdict

✔ Clear
✔ Scoped
✔ Evaluatable
✔ Applied
✔ SRE-aligned
✔ Security-relevant

You're not over-claiming, and you're not under-specifying — that's exactly where good applied research lives.

At a bird's-eye view, DSR follows this loop:

Problem → Design → Build → Evaluate → Reflect

You don't just study the problem — you intervene in it.

2. Core Sections of a DSR-Based Applied Project

Most applied IT / cybersecurity DSR projects are structured like this (even if the headings differ slightly):

3. Problem Identification & Motivation
Purpose

Define a real operational problem that practitioners struggle with.

In applied IT / security:

Incident overload

Alert fatigue

Misclassification of incidents

Delayed escalation

Poor prioritization

What reviewers look for

Is this a real problem?

Who experiences it?

Why do existing tools fall short?

Example (your domain)

Operational and security incidents often surface through identical reliability signals, making early classification difficult during incident response.

This anchors your work in practice.

4. Objectives of the Solution (What the Artifact Must Achieve)
Purpose

Translate the problem into design goals, not hypotheses.

Typical objectives:

Improve decision clarity

Reduce ambiguity

Support prioritization

Fit into existing workflows

In cybersecurity DSR

You don’t say:

“Detect all attacks”

You say:

“Support security-aware incident classification using operational data.”

These objectives later become evaluation criteria.

5. Design & Development (The Artifact)

This is the heart of DSR.

The artifact can be:

A framework

A model

A decision matrix

A methodology

A prototype tool (dashboard, workflow, ruleset)

In applied IT/security projects

Artifacts are often:

Heuristic-based

Metric-driven

Rule-informed (not ML-heavy)

Explainable to practitioners

Example artifacts in your context

Reliability-to-security mapping framework

Decision rules using error budget & burn rate

Service-level blast radius model

Web-based visualization / decision-support tool

What matters is design rationale:

Why these metrics?

Why these thresholds?

Why this structure?

6. Demonstration (Using the Artifact)
Purpose

Show that the artifact can be used, not just described.

Typical methods:

Walkthroughs

Simulated incidents

Hypothetical but realistic scenarios

Log or metric replays

In cybersecurity DSR

Examples:

DDoS vs misconfiguration scenario

API abuse vs traffic spike

Credential stuffing vs auth bug

You apply your framework/tool and show:

What decision it produces

How it differs from traditional handling

7. Evaluation (Does It Help?)

This is where DSR differs from theory-heavy research.

Evaluation is:

Contextual

Comparative

Utility-focused

Common evaluation methods

Scenario-based comparison (before vs after)

Expert feedback (SREs, security practitioners)

Qualitative scoring (clarity, confidence, priority)

Decision latency or ambiguity reduction

What you don’t need

Large datasets

Statistical significance

Universal generalization

What you do need:

Evidence that the artifact improves decision-making in realistic conditions.

8. Reflection & Discussion

Purpose

Explain:

What worked

What didn’t

Trade-offs

Limitations

This is where you show research maturity.

In applied cybersecurity:

Acknowledge false positives

Discuss metric sensitivity

Clarify scope boundaries

Explain where human judgment still matters

This section often scores high if done honestly.

9. Contribution (What Knowledge You Added)

In DSR, contributions are design knowledge, not theory.

Examples:

A new way to interpret SRE metrics for security

A decision model bridging SRE and incident response

Practical guidance for integrating reliability and security workflows

This is perfectly valid research contribution in applied IT.

10. How This Maps Cleanly to Your SRE + Security Project

DSR Step	Your Project
Problem	Incident misclassification
Objective	Security-aware decision support
Artifact	Reliability-driven framework/tool
Demonstration	Incident scenarios
Evaluation	Improved clarity & prioritization
Contribution	Bridging SRE metrics and security decisions

11. One-Sentence Summary (Use This Freely)

Design Science Research structures applied IT and cybersecurity projects around the design, implementation, and evaluation of practical artifacts that address real operational problems, with success measured by utility and decision improvement rather than theoretical optimality.

The strongest DSR justifications don't begin with "I chose DSR because…"
They begin with what kind of problem you're solving.

You are addressing:

A practical operational problem

With no single correct theoretical answer

Where practitioners need decision support, not predictions

That naturally leads to DSR.

Key framing idea:

The problem is not a lack of theory or data, but a lack of a usable structure that translates existing knowledge into operational decisions.

That sentence alone already implies DSR.

2. Explicitly Frame the Framework as an "Artifact"

In DSR, a framework is not "just conceptual" — it is an artifact.

You should explicitly say that.

In Design Science Research, artifacts may take the form of models, methods, frameworks, or decision-support tools designed to solve identified organizational problems.

Then tie it directly to your work:

This study proposes a framework that structures how SRE metrics are interpreted and applied to support security-aware incident classification and prioritization.

Now your framework is doing work, not just describing ideas.

3. Justify Why Other Research Methods Are a Poor Fit

This is subtle but powerful.

Why not theoretical research?

You are not proposing new mathematical models

You are not testing universal causal laws

You are not seeking generalizable proofs

Why not purely empirical research?

You're not observing behavior passively

You're intervening by introducing a solution

You're evaluating utility, not correlation

Then conclude:

As the study focuses on designing and evaluating a practical solution rather than explaining or predicting phenomena, Design Science Research is the most appropriate methodological approach.

4. Tie DSR Directly to Framework Design Logic

This is where reviewers usually nod.

DSR is appropriate when:

The goal is to structure knowledge

The output guides decision-making

Evaluation focuses on usefulness and applicability

Your framework:

Organizes reliability metrics

Encodes decision logic

Supports incident classification

Informs prioritization and escalation

That is classic DSR territory.

You can say:

Design Science Research is well suited for framework-based studies because it supports the systematic design, justification, and evaluation of artifacts intended to improve practical decision-making in real-world contexts.

5. Show the Full DSR Flow (Framework ≠ Static Diagram)

A common reviewer concern is:

“Isn’t this just a conceptual framework?”

You counter that by showing the lifecycle.

Your framework:

Is designed based on problem analysis

Is instantiated through decision rules or mappings

Is demonstrated using incident scenarios

Is evaluated against operational practices

Is refined based on findings

That makes it active, not static.

6. Proposal-Ready Justification Paragraph (You Can Reuse This)

Here’s a clean, professor-safe paragraph you can drop directly into your proposal with minimal edits:

This study adopts a Design Science Research (DSR) methodology, as the objective is to design and evaluate a practical framework that addresses a real operational problem rather than to develop or test new theoretical models. The research focuses on the creation of an artifact in the form of a reliability-driven decision framework that supports the classification and prioritization of security incidents using Site Reliability Engineering metrics. DSR is particularly suitable for framework-based studies in applied IT and cybersecurity contexts, as it emphasizes artifact design, utility, and contextual evaluation. The proposed framework is designed, demonstrated through realistic incident scenarios, and evaluated based on its ability to improve incident classification clarity and response prioritization compared to existing operational practices.

That paragraph alone usually satisfies methodology justification requirements.

7. One-Sentence Defense (If Asked Verbally)

If someone challenges you directly, use this:

Design Science Research is appropriate because the study aims to design and evaluate a framework that improves operational decision-making, rather than to explain or predict phenomena through theory or observation alone.

Short. Clean. Hard to argue with.

8. Quiet Insight (Important)

Framework-based studies fail when they:

stay abstract

lack evaluation

don’t show decision impact

Framework-based studies succeed in DSR when they:

encode logic

support action

are evaluated through use

You’re clearly doing the second.

Design Science Research is a problem-solving research methodology that structures inquiry around the design, development, and evaluation of artifacts intended to address identified organizational or technical problems. In applied IT and cybersecurity research, DSR is commonly structured into the following stages.

1. Problem Identification and Motivation
Purpose

The objective of this stage is to clearly define a relevant, real-world problem and justify why it warrants research attention.

Academic framing

This stage involves:

Identifying a practical challenge encountered in operational environments

Describing the context in which the problem occurs

Explaining the limitations of existing approaches or tools

Example (generic wording)

In complex IT environments, operational and security incidents often manifest through similar system-level signals, creating ambiguity during incident response and leading to delayed or misaligned escalation.

This stage establishes relevance, not solutions.

2. Definition of Objectives for a Solution
Purpose

To translate the identified problem into explicit design objectives that guide artifact creation.

Academic framing

Rather than hypotheses, DSR defines:

Functional objectives (what the solution should enable)

Quality objectives (clarity, usability, decision support)

Contextual constraints (operational realism, integration feasibility)

Example phrasing

The objective of this research is to design a framework that supports security-aware incident classification by operationalizing reliability metrics in a decision-support context.

These objectives later serve as evaluation criteria.

3. Design and Development of the Artifact
Purpose

This stage focuses on the creation of the research artifact, which embodies the proposed solution.

Academic framing

Artifacts in DSR may take the form of:

Frameworks

Models

Methods

Decision-support tools

Prototypes

The design process is informed by:

Prior research

Domain knowledge

Practical constraints

Key academic emphasis

Design rationale: why the artifact is structured as it is

Traceability: linking artifact components to problem objectives

Example phrasing

Based on the defined objectives, a reliability-driven decision framework is designed to structure how SRE metrics are interpreted and applied during incident response.

4. Demonstration
Purpose

To show that the artifact can be used to address the problem in a realistic context.

Academic framing

Demonstration typically involves:

Scenario-based application

Walkthroughs

Simulated or hypothetical use cases

Metric or log replays

This stage answers:

Can the artifact be applied in practice?

Example phrasing

The proposed framework is demonstrated using representative incident scenarios to illustrate how reliability signals can be interpreted to support incident classification and prioritization.

5. Evaluation
Purpose

To assess how well the artifact meets its objectives.

Academic framing

Evaluation in DSR is:

Contextual rather than universal

Utility-focused rather than theory-driven

Common evaluation approaches include:

Comparative analysis against existing practices

Scenario-based assessment

Expert feedback

Qualitative or semi-quantitative scoring

Example phrasing

The framework is evaluated based on its ability to improve incident classification clarity and response prioritization when compared to traditional reliability-focused incident handling approaches.

Importantly, evaluation focuses on usefulness and decision improvement, not predictive accuracy.

6. Discussion and Reflection
Purpose

To critically reflect on:

Findings

Trade-offs

Limitations

Applicability

Academic framing

This stage situates the artifact within:

Practical constraints

Organizational realities

Future improvement opportunities

Example phrasing

The discussion highlights the strengths and limitations of the proposed framework, including its dependency on metric quality and the role of human judgment in final incident classification.

7. Contribution to Knowledge
Purpose

To articulate the research contribution, which in DSR is primarily design knowledge.

Academic framing

Contributions may include:

Novel artifact designs

New ways of operationalizing existing metrics

Practical guidance for practitioners

Bridging previously separate domains (e.g., SRE and security)

Example phrasing

This research contributes a structured framework that bridges Site Reliability Engineering and cybersecurity incident response by demonstrating how reliability metrics can be systematically leveraged for security-aware decision-making.

One-Paragraph Summary (Proposal-Ready)

You can safely use or adapt this:

Design Science Research structures this study around the identification of a practical operational problem, the definition of solution objectives, and the design, demonstration, and evaluation of an artifact intended to address that problem. The artifact, in the form of a decision-support framework, is designed to improve incident classification and prioritization by operationalizing Site Reliability Engineering metrics in a security-aware context. The research emphasizes practical utility and contextual evaluation, aligning with the applied nature of IT and cybersecurity research.
4
1. Service Level Indicators (SLIs)

What they are:
Quantitative measurements of service behavior from a user or system perspective.

Common SLIs in production:

Request success rate

Request latency

Availability (uptime)

Throughput (requests per second)

Data freshness (for pipelines)

Correctness (e.g., valid responses)

Why they matter:
SLIs define what “working” means. Everything else in SRE builds on them.

Security relevance:
Security incidents almost always show up as SLI degradation before they’re labeled as attacks.

2. Service Level Objectives (SLOs)

What they are:
Target thresholds for SLIs over a defined time window.

Examples:

99.9% of requests succeed over 30 days

p95 latency < 300 ms

API availability ≥ 99.95%

Why they matter:
SLOs define acceptable risk and reliability boundaries.

Security relevance:
Sustained or patterned SLO violations often indicate abuse or adversarial activity, not random failure.

3. Error Budgets

What they are:
The allowed amount of unreliability derived from the SLO.

Example:

99.9% SLO → 0.1% error budget per month

Why they matter:
Error budgets guide operational decisions and escalation.

Security relevance:
Attacks consume error budgets. Faster consumption = higher severity.

4. Error Budget Burn Rate

What it is:
How fast the error budget is being consumed relative to time.

Why it matters:
Burn rate is one of the most actionable SRE signals in production.

Typical interpretations:

High, sudden burn → major incident

Slow, sustained burn → chronic issue

Localized burn → service-specific problem

Security relevance:
Burn rate patterns are extremely useful for distinguishing attacks from misconfigurations.

5. Latency Metrics (Especially Tail Latency)

Common forms:

p50 (median)

p95

p99 / p99.9

Why tail latency matters:
Users don't experience averages — they experience worst-case delays.

Production reality:
Most SRE alerts are driven by p95/p99, not mean latency.

Security relevance:
DoS attacks, resource exhaustion, and abuse often show up first as tail latency inflation.

6. Error Rates

What's measured:

HTTP 4xx rates

HTTP 5xx rates

Application-level error codes

Dependency failures

Why they matter:
Error rates directly reflect user impact.

Security relevance:

Auth attacks → spikes in 401/403

Injection attempts → 400-series anomalies

Exploitation → elevated 500s

7. Traffic / Throughput

Common metrics:

Requests per second (RPS)

Concurrent connections

Message volume (queues, streams)

Why they matter:
They establish baseline behavior.

Security relevance:
Traffic anomalies are a primary signal for:

DoS

Bot activity

Scraping

Credential stuffing

8. Saturation Metrics (Resource Utilization)

What's monitored:

CPU utilization

Memory usage

Disk I/O

Network bandwidth

Thread pools / connection pools

Why they matter:
Saturation indicates proximity to failure.

Security relevance:
Attacks often aim to push systems into saturation rather than immediate failure.

9. Availability / Uptime

What it measures:

Percentage of time the service is reachable and functional

Production reality:
Usually derived from:

Health checks

Synthetic probes

User-visible SLIs

Security relevance:
Availability loss may be the last stage of an attack — not the first.

10. Dependency Health Metrics

What's tracked:

Downstream service latency

Error propagation

Retry amplification

Circuit breaker activity

Why they matter:
Modern systems fail through dependencies.

Security relevance:
Attacks on one service can cascade through dependency chains — a classic blast-radius pattern.

11. The Four Golden Signals (SRE Classic)

Most production systems monitor these explicitly:

Latency

Traffic

Errors

Saturation

Why they matter:
They cover almost all user-impacting failure modes with minimal metrics.

Security relevance:
Every major attack affects at least one of these — usually more.

Why These Metrics Are Ideal for Applied Security Research

These metrics are:

Already deployed in production

Continuously collected

Service-aware

Quantitative

Actionable by on-call teams

That makes them perfect for:

Incident classification

Severity scoring

Security-aware prioritization

You're not inventing new metrics — you're reinterpreting existing ones, which is exactly what applied research should do.

One Clean Line You Can Use in a Proposal

Modern production systems already monitor a rich set of reliability metrics—including latency, error rates, traffic, saturation, and error budget burn rate—which provide continuous, service-level visibility into system behavior and form a strong foundation for security-aware incident analysis.
5

Reliability metrics describe how systems behave.

Security interpretation asks why that behavior changed.

1. Error Rates → Probing, Abuse, or Exploitation Signals
Reliability interpretation

Elevated error rates indicate failed requests or service instability

Often attributed to bugs, deployments, or dependency failures

Security interpretation

Error patterns can reflect intentional misuse:

Error Pattern	Possible Security Meaning
Spike in 401 / 403	Credential stuffing, brute-force auth
Repeated 400-series errors	Injection probing, malformed payloads
Rising 500-series errors	Exploit attempts triggering crashes
Errors isolated to one endpoint	Targeted attack surface

Key insight:

Security incidents often fail loudly before they succeed.

2. Latency (p95 / p99) → Resource Pressure & Attack Stress
Reliability interpretation

Increased latency suggests performance degradation

Often blamed on load or inefficient code paths

Security interpretation

Latency spikes — especially tail latency — can indicate:

Denial-of-service attempts

Bot traffic overwhelming specific services

Resource exhaustion attacks

Retry amplification caused by malicious traffic

Why tail latency matters

Attacks rarely affect average latency first

They stress the slowest, most fragile paths

Attackers push systems into pathological states, not just high load.

3. Error Budget Burn Rate → Incident Severity Indicator
Reliability interpretation

Burn rate measures how fast reliability guarantees are being violated

Security interpretation

Burn rate becomes a security severity signal:

Burn Pattern	Security Meaning
Sudden, fast burn	Active attack
Slow, persistent burn	Stealthy abuse (scraping, fraud)
Localized burn	Targeted service exploitation

Security value

Faster burn → higher urgency

Wider burn → larger blast radius

Attacks consume reliability as a side effect.

4. Traffic Volume & Shape → Malicious vs Legitimate Load
Reliability interpretation

Traffic spikes are often treated as scaling events

Security interpretation

Traffic anomalies can reveal:

Bot-driven requests

Credential stuffing

Scraping

DoS amplification

Security-aware interpretation looks at:

Sudden vs gradual growth

Endpoint concentration

User-agent diversity

Geographic dispersion

Not all traffic is demand — some traffic is pressure.

5. Saturation Metrics → Intentional Resource Exhaustion
Reliability interpretation

CPU, memory, or network saturation suggests scaling limits

Security interpretation

Saturation can be the attack objective itself:

Cryptomining

Memory exhaustion

Connection pool depletion

Thread starvation

When saturation:

Appears without legitimate traffic growth

Targets specific resources

Correlates with auth or API endpoints

…it becomes a security-relevant signal.

6. Dependency Failures → Indirect Attack Effects
Reliability interpretation

Cascading failures are dependency issues

Security interpretation

Attacks may:

Exploit upstream services

Trigger retries and amplification

Increase blast radius indirectly

An attack does not need to hit the core service to cause impact.

7. What Changes With a Security Lens (Key Shift)

Reliability-Only View	Security-Aware View
“Something broke”	“Something is causing pressure”
Single-metric alerts	Correlated patterns
Service health focus	Intent & impact focus
Reactive recovery	Risk-aware escalation

8. Proposal-Ready Summary Paragraph

You can safely use something like this:

Reliability metrics such as error rates, latency, traffic volume, and saturation provide continuous visibility into system behavior but are traditionally interpreted only in terms of operational health. When analyzed through a security lens, deviations in these metrics can also indicate adversarial activity, such as probing, abuse, or denial-of-service attempts. Rather than signaling intent directly, reliability metrics reveal behavioral patterns that, when correlated and contextualized, support security-aware incident classification and prioritization.

9. One-Line Insight (Very Strong)

If you want a sharp takeaway:

Reliability metrics do not detect attackers — they expose the pressure attackers create on systems.

That sentence alone explains your entire research angle.

A spike in one metric can mean many things:

Latency ↑ → bug, load, attack, dependency issue

Errors ↑ → bad deploy, client misuse, probing

Traffic ↑ → product launch, bot activity, DoS

Correlation answers the missing question: “What else changed at the same time?”

Correlation as Pattern Recognition (Not Math-Heavy)
4

In applied SRE and security contexts, correlation usually means:

Temporal alignment (metrics change together)

Directional consistency (how they move)

Scope overlap (which services/endpoints)

Persistence (how long the pattern lasts)

This is interpretive correlation, not statistical modeling — which is perfect for Design Science Research.

Core Correlation Dimensions (Proposal-Ready)
1. Temporal Correlation (When)

Do multiple metrics change at the same time?

Examples:

Latency ↑ + errors ↑ at the same minute

Burn rate spikes immediately after traffic surge

Saturation rises shortly after auth errors spike

Security insight:
Attacks often create tight temporal coupling across metrics.

2. Metric-Type Correlation (What)

Which classes of metrics are involved?

Metric Combination	Interpretation
Latency + Errors	Service stress
Traffic + Saturation	Load or pressure
Errors + Auth failures	Abuse or probing
Burn rate + p99 latency	High-severity impact

Key idea:

Security-relevant incidents usually affect multiple signal types, not just one.

3. Scope Correlation (Where)

Which services, endpoints, or dependencies are affected?

Examples:

Only /login endpoint shows errors

Only API gateway latency degrades

One downstream dependency saturates

Security insight:
Operational failures tend to be broad; attacks are often focused.

4. Persistence Correlation (How long)

Is the behavior short-lived or sustained?

Pattern	Likely Meaning
Short spike, fast recovery	Transient failure
Sustained low-level degradation	Stealthy abuse
Rapid sustained degradation	Active attack

Attacks are often persistent by design.

Example: Correlation in Practice
Scenario A — Operational Failure

Latency ↑

Errors ↑

Traffic = normal

Saturation ↑ gradually

Burn rate ↑ briefly

Interpretation:
Likely misconfiguration or capacity issue.

Scenario B — Security-Driven Incident

Traffic ↑ sharply

p99 latency ↑

Auth errors (401/403) ↑

CPU & connection pool saturation ↑

Error budget burn rate ↑ rapidly

Interpretation:
High confidence of malicious activity (e.g., credential stuffing or DoS).

From Metrics → Correlation Rules (Applied & Explainable)

Instead of thresholds like:

“Alert if latency > X”

You define correlation rules such as:

Latency ↑ AND traffic ↑ AND saturation ↑

Error rate ↑ AND endpoint scope is narrow

Burn rate ↑ AND no recent deployment

These rules are:

Transparent

Explainable

Easy to justify academically

Aligned with how on-call teams think

Why Correlation Matters for Security Classification

Isolated Metrics	Correlated Metrics
High false positives	Higher confidence
Reactive	Context-aware
Ambiguous	Interpretable
Symptom-focused	Cause-indicative

Correlation turns:

“The system is unhealthy”
into
“The system is unhealthy in a way consistent with adversarial pressure.”

Proposal-Ready Explanation Paragraph

You can use something like this verbatim:

Rather than analyzing reliability metrics in isolation, this study emphasizes the correlation of multiple metrics across time, scope, and signal type. By examining how latency, error rates, traffic, saturation, and error budget burn rate co-vary during incidents, the framework identifies behavioral patterns that are more indicative of security-driven activity than single-metric deviations. This correlation-based interpretation supports more confident incident classification and reduces ambiguity during operational response.

One-Line Insight (Strong & Defensible)

Single metrics indicate symptoms; correlated metrics reveal behavior.

What This Enables in Your Research

Correlation allows you to:

Define security-likely vs operational-likely patterns

Rank incidents by confidence and severity

Justify decisions without threat intel

Stay fully within applied SRE practice

Applied research evaluates usefulness, plausibility, and decision support — not real-world deployment performance.

You are not claiming:

production readiness

real-time accuracy

zero false positives

You are claiming:

improved reasoning

clearer decisions

better prioritization

practical applicability

That framing is key.

Common Evaluation Strategies Without Production Data
4
1. Scenario-Based Evaluation (Most Common)

What it is
You construct realistic but hypothetical incident scenarios based on:

documented outages

known attack patterns

common operational failures

public postmortems

How it works

Define multiple scenarios (e.g., DoS vs misconfiguration)

Apply your framework step by step

Show classification, prioritization, and escalation outcomes

Why it's valid

Widely used in DSR

Mirrors tabletop exercises used by real teams

Evaluates decision logic, not detection accuracy

Example phrasing

The framework was evaluated using representative incident scenarios to assess its ability to support incident classification and prioritization in the absence of production data.

2. Comparative "Before vs After" Reasoning

What it is
You compare:

baseline practice (reliability-only interpretation)
vs

your framework's interpretation

Evaluation focus

clarity of classification

confidence of escalation

consistency of decisions

What you measure (qualitatively)

ambiguity reduced (yes/no)

severity alignment improved (low/medium/high)

escalation appropriateness

This is very acceptable in applied research.

3. Synthetic / Simulated Metric Data

What it is
You generate controlled metric traces that resemble production behavior:

traffic spikes

latency inflation

error bursts

burn rate acceleration

Why it works

You control cause → effect

You can isolate patterns

You avoid confidentiality issues

You're not validating realism — you're validating interpretation logic.

4. Expert or Practitioner Evaluation (Even Small-Scale)

What it is

Feedback from:

SREs

DevOps engineers

security students / practitioners

Even 2–5 reviewers is fine in applied coursework

What you ask

Does this make sense operationally?

Would this help during incident response?

Is the reasoning understandable?

Why it's strong

Anchors your framework in practice

Compensates for lack of production data

Often scores highly with professors

5. Walkthrough-Based Demonstration

What it is

Step-by-step walkthrough of:

metrics observed

correlation applied

decision reached

This shows:

internal consistency

transparency

explainability

Reviewers care more about reasoning clarity than raw data.

What You Explicitly Acknowledge (This Builds Credibility)

Strong applied projects state limitations openly:

No live production data

No claim of real-time accuracy

No automated detection

No organizational deployment

Then you say:

The evaluation focuses on decision support and interpretive clarity rather than empirical performance metrics.

That sentence protects you academically.

Proposal-Ready Evaluation Paragraph (Safe to Use)

You can use something like this directly:

Due to the absence of access to production system data, the proposed framework is evaluated using scenario-based analysis and comparative reasoning. Representative operational and security incident scenarios are constructed based on common reliability failures and documented attack patterns. The framework is applied to each scenario to assess its ability to support incident classification and response prioritization. Evaluation focuses on decision clarity, interpretability, and alignment with operational expectations rather than detection accuracy or performance metrics.

This is completely defensible.

What Reviewers Look For (Not What They Say They Look For)

They want to see:

Logical consistency

Realistic assumptions

Clear reasoning

Honest scope

Practical relevance

They do not expect:

real logs

production access

SOC approval

enterprise validation

Especially in applied academic settings.

One-Line Defense (Very Useful)

If challenged directly, say:

In applied Design Science Research, frameworks are evaluated based on their ability to support reasoning and decision-making under realistic constraints, rather than through deployment on live production systems.

That’s a standard position.

Quiet Truth (Worth Knowing)

Many published applied security papers:

never touched production data

relied on scenarios, simulations, or expert review

still made valid contributions

Your project fits that lineage.

You are not evaluating:

detection accuracy

false positive rates

real-time performance

production reliability

You are evaluating:

decision support quality

interpretability

classification consistency

prioritization usefulness

That framing makes these criteria reasonable.

Core Evaluation Criteria (Proposal-Safe)
1. Classification Clarity

Question it answers:

Does the framework reduce ambiguity when interpreting incidents?

How to evaluate:

Was the incident classified as operational vs security-driven?

Was the classification supported by explicit reasoning?

Would different evaluators reach similar conclusions?

Scoring example:

Low: unclear or conflicting signals

Medium: partial clarity

High: clear classification with justification

2. Consistency Across Scenarios

Question it answers:

Does the framework behave predictably across different cases?

How to evaluate:

Apply the same logic to multiple scenarios

Observe whether similar patterns produce similar outcomes

Why it matters:
Consistency builds trust in operational settings.

3. Metric Interpretability

Question it answers:

Are metric correlations understandable to practitioners?

How to evaluate:

Can the decision logic be followed step-by-step?

Are correlations explainable without advanced math?

Applied relevance:
Black-box reasoning is a liability in incident response.

4. Incident Prioritization Usefulness

Question it answers:

Does the framework help rank incidents by urgency and impact?

How to evaluate:

Does it assign severity or confidence levels?

Does prioritization align with expected operational response?

Example outcomes:

Immediate escalation

Monitor closely

Defer investigation

5. Decision Confidence

Question it answers:

Does the framework increase confidence in response decisions?

How to evaluate:

Are decisions backed by multiple correlated signals?

Is escalation justified rather than reactive?

This is especially important in security contexts.

6. Alignment with Operational Expectations

Question it answers:

Do the outcomes make sense to experienced practitioners?

How to evaluate:

Compare framework output with how incidents are typically handled

Use expert or peer judgment (even informally)

This grounds your work in reality.

Optional (Nice-to-Have) Criteria

These are useful but not mandatory:

7. Scope Sensitivity

Does the framework distinguish localized vs system-wide impact?

8. Escalation Appropriateness

Does it recommend involving security teams only when warranted?

9. Explainability

Can the framework justify why an incident was flagged as security-relevant?

Example Evaluation Table (You Can Use This)

Criterion	Description	Evidence Source
Classification clarity	Reduced ambiguity in incident type	Scenario walkthrough
Metric interpretability	Decision logic understandable	Framework explanation
Prioritization usefulness	Clear severity ranking	Scenario outcomes
Consistency	Similar patterns → similar decisions	Cross-scenario analysis
Operational alignment	Matches expected response	Expert/peer feedback

This kind of table looks very professional in a proposal.

Proposal-Ready Evaluation Paragraph

You can safely use something like this:

The proposed framework is evaluated using simulated incident scenarios based on common operational failures and security-related events. Evaluation focuses on classification clarity, consistency across scenarios, metric interpretability, and the usefulness of incident prioritization. Rather than measuring detection accuracy, the evaluation assesses the framework's ability to support clear, explainable, and operationally reasonable decision-making under realistic constraints.

One-Line Rule of Thumb

If a criterion measures how well people can make decisions using the framework, it is appropriate for applied evaluation.

Quiet but Important Insight

Reviewers rarely penalize what you evaluate — they penalize:

unclear criteria

mismatched claims

overpromising

You're doing the opposite: your criteria match your claims perfectly.

Most applied prototypes follow this pattern:

Browser UI → Backend logic → Data source (simulated or static)

No microservices. No heavy infra. Just enough to demonstrate decision logic.

1. Frontend (User Interface)
Common Choices

HTML + CSS + JavaScript

React (most common in student & applied projects)

Vue (lighter alternative)

Plain Bootstrap UI (totally acceptable for research)

What the frontend usually does

Displays metrics (latency, errors, burn rate)

Shows correlations visually (tables, simple charts)

Presents decisions:

Operational vs Security-driven

Severity / confidence level

Explains why a decision was made

Why this is enough

Decision-support tools are read-heavy, not animation-heavy

Professors care about logic clarity, not UI polish

2. Backend (Decision Logic Layer)

This is where your framework lives.

Very common backend options

Python + Flask (extremely common for applied research)

Python + FastAPI (modern, clean, optional)

Node.js + Express (if you prefer JavaScript)

What the backend handles

Metric ingestion (static JSON, simulated data, or manual input)

Correlation logic

Rule-based classification

Severity / confidence scoring

Returning explanations to the UI

Why rule-based logic is ideal

Transparent

Easy to justify academically

Matches how incident response actually works

No ML justification required

In applied research, explainability beats sophistication.

3. Data Layer (Keep It Simple)

For applied evaluation, you do not need live data.

Common choices

Static JSON files

CSV files

Hardcoded scenario objects

In-memory Python structures

Lightweight SQLite (optional)

Typical data used

Simulated incident metrics

Predefined scenarios (DoS, misconfiguration, abuse)

Time-series samples

This is normal and accepted in Design Science Research.

4. Visualization Libraries (Optional but Helpful)

If you want charts (not required, but nice):

Common options

Chart.js

D3.js (only if you're comfortable)

Simple tables + color indicators (often enough)

What to visualize

Metric changes over time

Correlated metric groups

Burn rate vs threshold

Severity indicators

Remember:

A clear table with reasoning often beats a complex graph.

5. Interaction Patterns That Work Well

For decision-support tools, these patterns are common:

Scenario selector

"Simulated DoS"

"Auth abuse"

"Operational failure"

Metric snapshot view

Correlation summary

Decision output panel

Explanation panel ("Why this decision?")

This directly supports your research goals.

6. Deployment (Optional, Not Required)

Most applied projects:

Run locally

Are demonstrated via screenshots or screen recordings

If deployed:

Simple local server

Lightweight cloud hosting (optional)

Deployment is not required unless explicitly asked.

7. Example “Safe” Tech Stack (Very Defensible)

If you want something you can confidently defend:

Frontend

HTML + CSS

React (optional)

Backend

Python + Flask

Data

Static JSON scenario files

Logic

Rule-based correlation engine

Severity scoring heuristics

This stack:

Is widely used

Is easy to explain

Fits Design Science Research perfectly

Will not raise scope concerns

8. Proposal-Ready Description (You Can Reuse This)

Here’s a paragraph you can safely drop into your methodology or implementation section:

A lightweight web-based decision-support prototype is implemented to demonstrate the proposed framework. The tool consists of a browser-based user interface and a backend service that encapsulates the framework’s decision logic. Simulated incident scenarios and metric data are used as inputs to the system. The backend applies rule-based correlation and classification logic to interpret reliability metrics and generate security-aware incident assessments, which are presented to the user along with explanatory context. The prototype is intended to support demonstration and evaluation rather than production deployment.

That wording is very reviewer-safe.

9. What Reviewers Will NOT Penalize You For

Not using real production data

Not deploying to cloud

Not using ML or AI

Simple UI

Rule-based logic

They will penalize:

Overengineering

Unclear logic

Mismatch between tool and research questions

You’re already avoiding those traps.

Here’s why (and how to justify it academically) without overclaiming.

Why it’s appropriate

Fast to prototype and iterate: Python is great for implementing your framework logic (rules, scoring, correlations) quickly and cleanly.

Explainable decision logic: A rule-based engine in Python is easy to document and trace (important for DSR and security-aware decisions).

Clear visualization: JavaScript dashboards (plain JS or React) are well-suited for showing metric snapshots, correlations, and “why this decision” explanations.

Separation of concerns: Backend = decision logic; frontend = presentation. This clean split makes your artifact easier to evaluate and discuss.

Common in applied IT/cyber projects: This is a standard prototype architecture in academic applied work.

What to keep it scoped to (so it stays “prototype”)

Use simulated scenarios / static JSON/CSV inputs

Keep the backend as a REST API (e.g., Flask/FastAPI) that returns:

classification (operational vs security-likely)

severity/confidence score

explanation (which correlated metrics triggered the decision)

Keep the UI focused on:

scenario selection

metrics view

correlation summary

decision + explanation panel

Proposal-ready justification paragraph (you can paste)

A lightweight prototype is implemented using a Python-based backend and a JavaScript-based dashboard to instantiate and demonstrate the proposed framework. Python is used to implement the framework’s correlation, classification, and prioritization logic in a transparent and reproducible manner, while the JavaScript dashboard provides an interactive interface to visualize metric inputs, correlated patterns, and the resulting decision outputs with supporting explanations. This architecture supports rapid iteration and clear separation between decision logic and presentation, aligning with the Design Science Research emphasis on building and evaluating a practical artifact rather than developing a production-grade system.

One small “make it look rigorous” tip

Have the backend return an “evidence object” like:

triggered rules

contributing metrics

time window used

confidence rationale

That makes evaluation and screenshots much more defensible.

If you tell me what you're leaning toward (Flask vs FastAPI, plain JS vs React), I can suggest a minimal folder structure and the exact API endpoints you'd need.