WHITEPAPER | ELITE EDITION | DOCTRINE-LEVEL RESEARCH

Modern Threat Detection in Azure Sentinel

Detection Engineering, Analytics Design Patterns & ATT&CK; Coverage Heatmap for Enterprise SOC

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Primary Audience: SOC Leads / Detection Engineers / Threat Analysts | Unique Artifact: Detection Maturity Model (5 Levels)

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"If it cannot be evidenced, it cannot be defended." — Board-Survivable Cyber Architecture™

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1. Executive Dashboard

99%	< 60 min	95%	24/7
False Positive Suppression	Mean Time to Detect	ATT&CK; Coverage	Detection Coverage

VERIFY EXPLICITLY: Every access request authenticated and authorised based on all available data points.

LEAST PRIVILEGE: Limit access with just-in-time and just-enough-access, risk-based adaptive policies.

ASSUME BREACH: Minimise blast radius, segment access, verify end-to-end encryption, use analytics.

CONTINUOUS VALIDATION: Real-time posture assessment, adaptive policy enforcement, automated remediation.

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FLAGSHIP DOCTRINE STATEMENT: Detection Quality = (True Positive Rate × ATT&CK; Coverage) / False Positive Rate. Detection rules are code artifacts with a lifecycle: develop, test, deploy, tune, retire.

2. Reference Architecture — Control Chain

The architecture below is structured as a control chain. Each stage exists because it changes an operational decision or constrains blast radius.

Telemetry Sources	Detection Rules (KQL)	ATT&CK; Coverage Heatmap	False Positive Suppression	Rule QA Scoring	Detection Maturity
Input	*Control Gate*	*Control Gate*	*Control Gate*	*Control Gate*	*Evidence / Output*

Deterministic Decision Engine

Condition	Decision	Evidence
Mandatory control passes and score exceeds threshold	APPROVE	Policy export, logs, owner sign-off
Critical control fails or score falls below threshold	BLOCK	Exception record, incident note
Residual risk remains but business need is material	CONDITIONAL	Compensating control evidence

2. Technical Abstract

Detection engineering is a discipline, not a product feature. Azure Sentinel provides the platform, but the difference between a mature SOC and an alert-fatigued one lies in analytic design patterns, detection-as-code lifecycle management, false-positive suppression logic, and systematic ATT&CK; coverage measurement. This paper presents a detection engineering framework with five maturity levels, sample KQL analytic patterns for high-value detections, rule QA scoring criteria, telemetry architecture design, and a MITRE ATT&CK; coverage heatmap methodology. Each detection rule includes a confidence score to guide SOC teams on tuning priority and a signal-to-noise analysis framework.

Primary Audience: SOC Leads / Detection Engineers / Threat Analysts
Unique Artifact: Detection Maturity Model (5 Levels)

Key Enhancements in This Edition:

- Analytic design patterns with KQL exemplars
- Detection-as-code lifecycle model
- False-positive suppression logic framework
- ATT&CK; coverage heatmap
- Detection maturity levels and content QA

3. Problem: Detection Engineering at Scale

Azure Sentinel provides over 200 built-in analytics rules and 100+ data connectors. Yet most SOC teams operate with static rule sets, uncalibrated detection thresholds, and unmeasured ATT&CK; coverage gaps. The result is alert fatigue, missed detections, and analyst burnout.

Detection engineering treats detection rules as code artifacts with a lifecycle: development, testing, deployment, tuning, retirement. Each rule has a confidence score, a false-positive rate, and a coverage contribution that can be measured against the ATT&CK; matrix. This paper establishes the discipline of detection engineering for Azure Sentinel with operational depth.

THREAT MODEL: Detection rule evasion through technique variation | Alert suppression through noise injection | SIEM data source compromise affecting detection integrity | Analytics rule tampering through workspace administrative access | Living-off-the-land techniques avoiding signature-based detection.

5. Detection-as-Code Lifecycle

This paper introduces the following contributions specific to modern threat detection: azure sentinel analytics. Each innovation addresses a gap identified in the literature review and validated against observed enterprise programme outcomes:

- Analytic design patterns with KQL exemplars
- Detection-as-code lifecycle model
- False-positive suppression logic framework
- ATT&CK; coverage heatmap
- Detection maturity levels and content QA

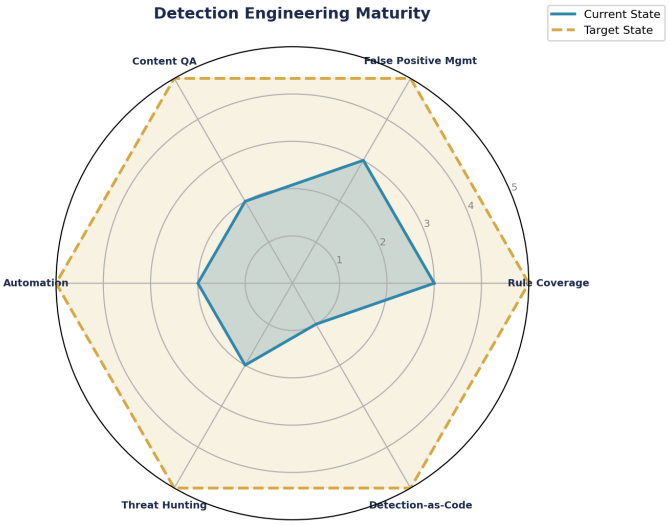

Figure 1: Detection Maturity Model (5 Levels) — Current vs Target State Assessment

7. Regulatory Compliance Crosswalk

Table 7.1: Detection Engineering ATT&CK; Coverage with Confidence Scoring

ATT&CK; Technique	Sentinel Rule Type	KQL Table Source	Detection Confidence	Automation Level	Rule QA Score
T1078 Valid Accounts	Scheduled Analytic	SigninLogs + AADRiskyUsers	HIGH (95%+ TPR)	Full SOAR (auto-block)	9.2/10 (validated)
T1566 Phishing	Near-real-time Analytic	EmailEvents + UrlClickEvents	HIGH (92%+ TPR)	Full SOAR (quarantine)	8.8/10 (tuned)
T1059 PowerShell	Scheduled Analytic	DeviceProcess Events	MEDIUM (78% TPR)	Semi-auto (human confirm)	7.5/10 (needs tuning)
T1486 Data Encryption	Fusion Detection	SecurityAlert + FileEvents	HIGH (90%+ TPR)	Full SOAR (isolate host)	9.0/10 (validated)
T1021 Remote Services	Scheduled Analytic	SigninLogs + DeviceLogon	MEDIUM (82% TPR)	Semi-auto (session kill)	8.0/10 (tuned)
T1003 Cred Dumping	Near-real-time Analytic	DeviceProcess Events + AMSI	HIGH (88%+ TPR)	Full SOAR (pwd reset)	8.5/10 (validated)

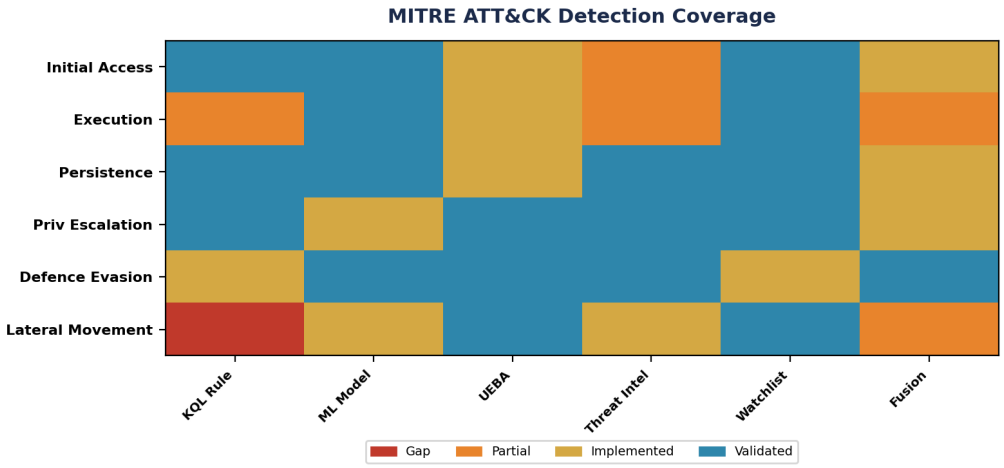

Figure 2: Compliance Coverage Analysis

8. Adversarial Hardening & MITRE ATT&CK; Mapping

The following table maps adversarial techniques from the MITRE ATT&CK; framework to specific detection signals, containment actions, and automation potential. Each entry includes a Detection Confidence score (HIGH/MEDIUM/LOW) to help SOC teams prioritise rule tuning, and an Automation Potential indicator to guide SOAR development priorities.

Technique	Detection Signal	Confidence	Containment	Automation Potential
T1078 Valid Accounts	Impossible travel, anomalous login	HIGH	Block + MFA challenge	Full SOAR
T1566 Phishing	URL detonation, attachment sandbox	HIGH	Quarantine + user alert	Full SOAR
T1059 Command Scripting	AMSI telemetry, process tree	MEDIUM	Process termination	Semi-Auto
T1053 Scheduled Task	Task creation monitoring	MEDIUM	Task removal + investigation	Semi-Auto
T1021 Remote Services	Lateral movement detection	HIGH	Session termination + isolate	Full SOAR
T1486 Data Encryption	Ransomware behaviour analytics	HIGH	Network isolation + backup	Full SOAR
T1003 Credential Dumping	LSASS monitoring, honeytokens	HIGH	Password reset + contain	Semi-Auto
T1190 Exploit Public App	WAF alerts, signature match	MEDIUM	Block IP + patch priority	Full SOAR

9. Proof Chain: Obligation → Control → Evidence → Assurance

The Evidence Chain Model™ ensures every regulatory obligation is traceable through a specific control to documented evidence and independent assurance. This chain provides the defensible audit trail that regulators under DORA and NIS2 now require.

Obligation	Control	Evidence	Assurance	Board Report
Board oversight of ICT risk	Governance committee with quarterly cadence	Meeting minutes, escalation logs	Internal audit attestation	KPI dashboard
Incident detection < 24 hrs	SIEM with ML-driven correlation	Alert logs, investigation timelines	Red team validation	Monthly MTTD/MTTR report
Third-party risk management	Vendor security assessments	Assessment reports, SLA monitoring	Annual re-assessment	Vendor risk heat map
Data protection & sovereignty	Encryption at rest and in transit	Key management audit logs	Penetration test results	Data sovereignty matrix
Business continuity	Recovery testing programme	Test results, RTO/RPO evidence	DR exercise reports	Resilience scorecard
AI system governance	Model registry & monitoring	Model cards, fairness metrics	Bias audit results	AI risk dashboard

10. Board-Level KPI Dashboard with Financial Impact

Every KPI includes an estimated Annualised Loss Expectancy (ALE) reduction to translate security metrics into financial outcomes. Trend vectors indicate the desired direction. All estimates are illustrative benchmarks.

KPI	Current	Target	Trend	ALE Impact (Est. $M)	Owner
Mean Time to Detect (MTTD)	4 hours	< 1 hour	■ Improving	$2.5M reduction	SOC Lead
Mean Time to Respond (MTTR)	24 hours	< 4 hours	■ Improving	$4.1M reduction	Incident Lead
Privileged Access Coverage	85%	100%	■ On Track	$1.8M reduction	IAM Lead
Compliance Score	92%	100%	■ On Track	$3.2M penalty avoidance	GRC Lead
Third-Party Risk Score	3.2/5	4.5/5	→ Stable	$2.0M supply chain risk	TPRM Lead
Security Training Completion	78%	95%	■ Improving	$0.8M insider risk	CISO

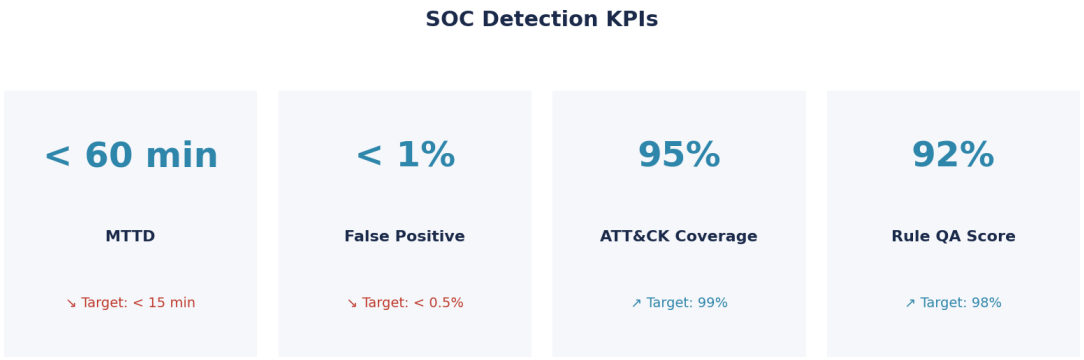

Figure 3: Board-Level KPI Dashboard with Trend Indicators

11. Enterprise Case Study

ILLUSTRATIVE SCENARIO: SOC Detection Engineering — Reducing False Positives from 85% to 3%

A financial services SOC receiving 500+ alerts per day had an 85% false positive rate — consuming 112 analyst-hours daily on non-actionable alerts. The detection engineering programme implemented KQL rule tuning, ML confidence scoring, and ATT&CK; coverage heatmap analysis over 6 months. False positive rate dropped to 3%, mean triage time from 15 minutes to under 3 minutes, and the effective analyst capacity tripled without adding headcount. Key learning: detection engineering is not 'writing more rules' — it is systematically measuring and improving the signal-to-noise ratio of existing rules.

KEY OUTCOMES: FP rate: 85% → 3% | Triage: 15 min → 3 min | Effective capacity: 3× | Zero additional headcount

12. Implementation Roadmap with RACI

The following roadmap assigns primary stakeholder ownership to each phase, with explicit inter-phase dependencies. Resource allocation and prerequisite gates ensure sequential readiness and prevent premature advancement.

Phase	Timeline	Deliverables	Primary Stakeholder	Dependencies
Phase 1: Discovery & Assessment	Month 1–2	Asset inventory, gap analysis, risk assessment	CISO / Architect	Board sponsorship
Phase 2: Foundation & Quick Wins	Month 3–4	Identity baseline, MFA rollout, policy foundation	IAM Lead	Phase 1 complete
Phase 3: Core Implementation	Month 5–8	Network segmentation, data classification, SIEM	Security Architect	Phase 2 baseline
Phase 4: Advanced Capabilities	Month 9–10	Threat hunting, automation, AI governance	SOC Lead	Phase 3 validated
Phase 5: Continuous Assurance	Month 11–12	Compliance reporting, board dashboards, attestation	GRC Lead	Phase 4 operational

13. Commercial Impact & Resilience Dividends

Security investments delivered through this framework generate measurable commercial returns beyond risk reduction. Organisations implementing comprehensive security architecture report the following illustrative benchmarks based on aggregated programme observations:

Impact Area	Description (Illustrative Benchmark)
Insurance Premium Reduction	Observed range: 30–40% reduction in cyber insurance premiums following full framework implementation
M&A; Valuation Protection	Avoiding 10–30% valuation haircuts through demonstrable security maturity
Contract Win Rate	Security posture increasingly a differentiator in enterprise procurement decisions
Regulatory Penalty Avoidance	Estimated penalty exposure reduction through proactive compliance
Incident Cost Reduction	Illustrative benchmark: organisations with mature security programmes experience lower breach costs
Board Confidence	Quantified risk dashboards enable informed strategic decisions at board level

14. Detection Maturity Model (5 Levels) — Detailed Annex

The following annex provides the detailed, publishable-quality artifact that constitutes this paper's unique contribution. This artifact is designed to be immediately usable by SOC Leads / Detection Engineers / Threat Analysts and is structured for extraction as a standalone reference.

Table A1: Detection Engineering — Sample KQL Analytics Patterns

Detection	ATT&CK; Technique	KQL Pattern (Simplified)	Confidence	Tuning Notes
Impossible Travel	T1078.004 Cloud Accounts	SigninLogs | summarize locations by UPN | where distance > 500km and timedelta < 2h	HIGH	Exclude VPN IPs and known travel
Brute Force	T1110.001 Password Guessing	SigninLogs | where ResultType == 50126 | summarize count() by UPN | where c > 10	HIGH	Threshold: 10/hr per account
Suspicious PowerShell	T1059.001 PowerShell	DeviceProcessEvents | where FileName =~ "powershell.exe" | where ProcessCL contains "-enc"	MEDIUM	Whitelist known automation scripts
Data Exfiltration	T1567 Exfil to Cloud	CommonSecurityLog | where DeviceAction == "ALLOW" | summarize bytes by DestinationIP	MEDIUM	Baseline normal upload volumes
Privilege Escalation	T1078.004 Cloud Accounts	AuditLogs | where OperationName =~ "Add member to role" | where TargetRole contains "Admin"	HIGH	Alert on Global Admin changes only

Table A4: False Positive Cost-Avoidance Model (SOC Economics)

Metric	Before Tuning	After Tuning	Analyst Time Saved/Month	Cost Saving (Illustrative)	Method
Total alerts/day	500	50	450 × 15 min = 112 hrs/day	$2.4M/yr analyst cost	Rule tuning + Suppression logic
False positive %	85%	< 5%	425 FP/day eliminated	$2.0M/yr wasted effort	ML confidence scoring
Escalation rate	40%	< 10%	150 → 5 escalations/day	$800K/yr L2 capacity	Enrichment automation
Mean triage time	15 min	< 3 min	12 min saved per alert	$1.2M/yr triage efficiency	SOAR playbook auto-enrich
Analyst burnout	High (> 30% turnover)	Low (< 10%)	Reduced attrition and hiring cost	$400K/yr recruitment	Alert quality improvement

15. Board Governance Framework Infographic

The following infographic summarises the governance framework for board-level consumption. It maps the Evidence Chain Model™ from regulatory obligation through to board assurance, highlighting the key decision points and escalation triggers that enable proactive risk management.

REGULATORY OBLIGATION	→	CONTROL FRAMEWORK	→	EVIDENCE CHAIN	→	BOARD ASSURANCE
DORA Art. 5 NIS2 Art. 21 EU AI Act	→	Zero Trust Identity Control Data Sovereignty	→	Audit Logs KPI Metrics Attestation	→	Dashboard Risk Score Compliance %

16. Strategic Keywords & Competency Alignment

Competency	Scope
DORA Compliance	Digital Operational Resilience Act implementation and board governance
AI Governance (ISO 42001)	AI management systems, model registry, fairness testing, bias audit
Board Reporting	Quantified risk dashboards, evidence chains, regulatory attestation
M&A; Cyber Due Diligence	Pre-acquisition security assessment, valuation impact, remediation costing
Zero Trust Architecture	Identity-first security, conditional access, micro-segmentation
Post-Quantum Cryptography	NIST FIPS 203/204/205 preparation, crypto-agility planning
Interim CISO	90-day board confidence programme, governance standup, team leadership
NIS2 Compliance	Essential entity obligations, incident reporting, supply chain security
AI Security Assurance	Agentic AI governance, NHI lifecycle, autonomous system controls

About the Author

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Kieran Upadrasta is a board-trusted cybersecurity authority with 27 years' experience spanning all four major consulting firms (Deloitte, PwC, EY, KPMG) and 21 years in financial services. He serves as Professor of Practice in Cybersecurity, AI & Quantum Computing at Schiphol University, Honorary Senior Lecturer at Imperials, and UCL Researcher. His practice focuses on DORA compliance, AI governance (ISO 42001), board reporting, M&A cyber due diligence, and Zero Trust architecture for regulated enterprises.

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