

Red Team Professional Certification in the UAE: How Credentials Translate to Real Adversary Simulation and What Your Security Team Learns From It

There is a test that most UAE enterprise security programs have never actually taken.

Patch compliance reports confirm that updates are deployed. Vulnerability assessment reports confirm that known weaknesses are being tracked. Firewall rule reviews confirm that policy has been followed. What none of these activities confirm is the answer to the question that actually matters when a sophisticated threat actor targets the organization: *would our security team detect them, and stop them, before they reached the assets that matter most?*

CERTIFIED RED TEAMING EXPERT

THINK LIKE AN ADVERSARY. SECURE LIKE A PRO.

ADVERSARY EMULATION | ATTACK SIMULATION | THREAT DISCOVERY | POST EXPLOITATION ANALYSIS | DETECTION & RESPONSE TESTING

VALIDATE. TEST. STRENGTHEN.

- ✓ Simulate Real-World Attacks
- ✓ Identify Critical Security Gaps
- ✓ Evaluate People, Process & Technology
- ✓ Improve Detection, Response & Resilience

CERTIFIED EXPERTS
REAL-WORLD IMPACT

ATTACK SIMULATION

TARGET ENVIRONMENT: NETWORK, ENDPOINTS, CLOUD, APPLICATIONS, PEOPLE

ENGAGEMENT OBJECTIVES:

- Identify Attack Paths
- Bypass Security Controls
- Test Detection & Response
- Provide Actionable Insights

ATTACK COVERAGE

KILL CHAIN

- RECONNAISSANCE
- WEAPONIZATION
- DELIVERY
- EXPLOITATION
- INSTALLATION
- COMMAND & CONTROL
- ACTIONS ON OBJECTIVES

THREAT INTELLIGENCE

HIGH RISK ACTIVITY

SECURITY POSTURE

78% RISK LEVEL HIGH

RED TEAM EXPERT

EXPLOITATION RESULT: ACCESS OBTAINED

OFFENSE BUILDS DEFENSE

EXPERT-LED RED TEAMING | BUSINESS-FOCUSED APPROACH | ACTIONABLE RECOMMENDATIONS | STRONGER DEFENSE. LOWER RISK.

A red team exercise conducted by [certified red teaming expert](#) practitioners answers that question with evidence. Not with an audit finding, not with a policy review — but with a documented record of what a skilled adversarial team was able to accomplish inside the

environment, what the security operations team caught, what it missed, and specifically what needs to change before the next real adversary attempts the same approach.

This guide examines what [red team professional certification](#) programs assess and why the credential hierarchy matters when UAE enterprises are choosing who conducts those exercises — from what CRTP and CRTE examinations actually require of candidates, to how certified practitioners approach APT simulation differently from standard penetration testers, to what security operations teams should expect to learn from a properly scoped engagement delivered by Femto Security's certified red team.

Why Red Team Certification Exists as a Distinct Credential Category

Cybersecurity credentials span a wide spectrum. Some test knowledge. Others test the ability to identify vulnerabilities in controlled lab settings. **Red team professional certification** programs test something the others do not: the ability to sustain a covert adversarial campaign inside a defended environment — evading detection while achieving defined objectives — under real examination pressure.

Direct Answer:

A red team professional certification validates a cybersecurity practitioner's demonstrated ability to plan and execute sustained, multi-stage adversarial simulations against live, defended environments — covering the full attack lifecycle from initial reconnaissance through privilege escalation, lateral movement, defense evasion, and controlled impact demonstration. Unlike knowledge-based credentials, leading programs require candidates to operate against actual defended systems rather than pass written examinations.

The practical examination format is the defining characteristic. CRTP candidates are given access to a live Active Directory environment and must achieve defined compromise objectives within a time-limited window. CRTE candidates face harder environments with modern endpoint detection in place. Red Team Operator candidates must operate custom tooling against mature defenses. In each case, the examination setting has no multiple-choice fallback — the candidate either executes the attack chain successfully or does not pass.

This is why **certified red team professional exam** credentials carry weight with security-literate enterprise buyers that knowledge certifications alone do not. The credential confirms that the holder has operated under adversarial conditions against defended systems — not simply that they studied how to do so.

The Credential Ladder: From CRTP to Advanced Operator

The **red team professional certification program** landscape has developed a recognizable progression from entry-level Active Directory focus through advanced EDR evasion and custom tooling capability. Understanding where each credential sits in this progression is essential for matching practitioner qualification to engagement complexity.

CRTP — Certified Red Team Professional (Altered Security)

The CRTP credential, issued by Altered Security (which evolved from Pentester Academy), built its reputation by focusing precisely where enterprise intrusions most commonly succeed: Active Directory. The majority of enterprise Windows environments rely on Active Directory for authentication, authorization, and resource access — making it the central target in sophisticated enterprise attacks and the primary pathway from initial foothold to domain-level control.

Technical scope examined in the CRTP:

- AD enumeration using BloodHound graph analysis and PowerView querying to map attack paths from any starting position
- Kerberoasting and AS-REP roasting to extract service account credentials from the domain without authentication privilege
- Pass-the-Ticket, Pass-the-Hash, and Over-Pass-the-Hash for credential reuse across systems
- Unconstrained, constrained, and resource-based constrained delegation abuse for privilege escalation
- Golden Ticket and Silver Ticket attacks for persistent domain-level access
- Cross-domain trust exploitation to extend compromise beyond the initial domain
- Common defense evasion techniques against Windows Defender and enterprise AV products

The examination presents candidates with a target AD environment and requires them to achieve a series of defined compromise milestones within the allotted lab time. The certificate is awarded only when the candidate submits a report demonstrating successful completion of the required objectives with documented methodology.

Significance for GCC enterprise buyers: Virtually every enterprise Windows environment in Dubai and across the GCC runs Active Directory. A red team engagement team without CRTP-level Active Directory attack capability is not equipped to test the attack paths that represent the highest-consequence intrusion scenarios in these environments. CRTP is the baseline qualification — the **red teaming expert certification** ladder begins here — and any provider whose practitioners cannot demonstrate this level of Active Directory tradecraft is not ready to deliver meaningful red team engagements against UAE enterprise environments.

CRTE — Certified Red Teaming Expert (Altered Security)

Where CRTP validates Active Directory attack capability in standard environments, the **Certified Red Teaming Expert** credential advances the practitioner into harder territory on two axes simultaneously: the defensive maturity of the target environment, and the technical sophistication the examination demands to operate successfully within it. Earning the status of **certified red team expert** at this level requires demonstrating evasion capability against modern endpoint detection — not just Active Directory attack chain execution.

Technical scope extending beyond CRTP:

- Multi-domain and multi-forest AD environments requiring cross-forest trust abuse and SID filtering bypass
- Microsoft Defender for Endpoint evasion — the EDR platform deployed across the majority of GCC enterprises using Microsoft infrastructure
- AMSI bypass techniques to defeat PowerShell and .NET script scanning at the runtime layer
- Diamond Ticket and Sapphire Ticket attacks as alternatives to classic Golden Tickets against monitored environments
- Azure Active Directory (Entra ID) attack paths including Primary Refresh Token abuse and Seamless SSO exploitation
- Custom C2 infrastructure deployment with operational security discipline to avoid detection by network monitoring
- ETW (Event Tracing for Windows) manipulation to suppress telemetry collection

The **certified red teaming expert** examination environment deploys modern endpoint detection — candidates cannot use standard tool configurations that any mature EDR would block. This is what distinguishes CRTE holders as practitioners capable of conducting engagements against organizations with genuine defensive investment, not just against environments where detection is nominal.

Significance for GCC enterprise buyers: UAE enterprises deploying Microsoft Defender for Endpoint, CrowdStrike Falcon, or SentinelOne as their endpoint security layer are not adequately tested by a red team that uses standard Metasploit stagers or default Cobalt Strike beacon configurations. Every major EDR product blocks these by signature. An engagement using off-the-shelf tool defaults against an EDR-equipped environment tests whether the tools get caught — which they do — rather than whether the defensive program would detect a practitioner operating around detection controls. CRTE validates the latter capability.

CERTPRO / CPENT — Multi-Vector Campaign Scope

Certified Ethical Red Team Professional programs including EC-Council's CPENT address a different dimension of red team competency: campaign breadth across multiple attack vectors rather than depth within a single domain. These credentials cover integrated attack planning that incorporates web application exploitation, wireless attack vectors, physical security bypass, and social engineering alongside network and AD techniques.

Additional technical scope these programs address:

- Multi-stage campaign planning that chains web application initial access into internal network compromise
- Wireless attack techniques including WPA2 cracking, evil twin access points, and PMKID attacks
- Physical security bypass including lock picking, badge cloning, and tailgating in physical assessment contexts
- Integrated social engineering: pretexting call scripts, spear-phishing campaign construction, and vishing methodology
- IoT and industrial control system enumeration within enterprise scope

These broader credentials reflect the reality that sophisticated adversaries do not restrict their approach to a single vector. An engagement team with multi-vector capability tests the full attack surface that real threat actors exploit.

Red Team Operator (RTO) — Zero-Point Security and Maldev Academy

At the practitioner-facing end of the credential spectrum, Zero-Point Security's Red Team Operator course and Maldev Academy's tooling development programs address the capability that separates mature red team operations from standard penetration testing relabeled for marketing purposes: the ability to develop and deploy custom offensive tooling that operates below the detection threshold of mature endpoint security platforms.

Technical scope at operator level:

- Custom C2 framework architecture — designing command and control infrastructure with operational security properties that distinguish it from known tool signatures
- Process injection techniques: reflective DLL injection, process hollowing, and APC queue injection for in-memory execution
- Direct syscall implementation to bypass EDR user-mode hooks monitoring Windows API calls
- ETW patching and hardware breakpoint-based API monitoring evasion
- Cobalt Strike malleable C2 profile customization to make beacon traffic appear as legitimate application communication
- Payload staging and in-memory execution chains that avoid writing known malicious artifacts to disk

Practitioners at this level are equipped to conduct engagements against organizations where the security operations team is actively threat hunting looking for unusual behavior rather than waiting for signature alerts to fire. This is the practitioner profile appropriate for exercises designed to challenge mature defensive programs rather than verify that basic controls are in place.

Matching Credential Level to Engagement Objective

The credential hierarchy maps directly to the appropriate engagement type — and selecting the wrong level in either direction wastes the engagement investment.

Practitioner Certification	Target Environment Profile	Exercise Objective
C RTP	Standard enterprise AD, basic AV	Validate AD attack path exposure and domain compromise risk
C RTE	Modern EDR deployed, SOC monitoring	Test detection capability against evasive AD attack chains
CERTPRO / CPENT	Multi-vector environment, physical premises	Full-scope exercise across technical and human vectors
RTO / Maldev	Mature SOC, threat hunting, EDR telemetry	APT simulation against high-maturity defenders

An organization running its first red team exercise almost certainly benefits most from a C RTP/C RTE level engagement — the Active Directory attack chains validated at this level represent the highest-consequence intrusion paths in the majority of UAE enterprise environments. An organization with an established security operations center, a dedicated threat hunting function, and modern EDR deployment gains more meaningful intelligence from an RTO-level engagement that genuinely challenges detection capability rather than confirming that standard tool signatures are caught.

What Separates Red Team Certification From Penetration Testing Credentials

The procurement process for red team services regularly conflates **red team security professional** credentials with penetration testing certifications. Both involve offensive security skills. The examination scope, operational objectives, and evidence value are materially different.

Penetration testing certifications — OSCP, CEH, eJPT, CompTIA PenTest+ — assess the ability to discover and exploit vulnerabilities within a defined target scope. The examination objective is typically to achieve root or administrator access on a set of target machines. The model assumes a defined scope, a reporting obligation, and a goal of identifying exploitable weaknesses.

Red team certification programs assess a different operational discipline: sustaining a covert adversarial campaign over an extended period while actively working to avoid triggering

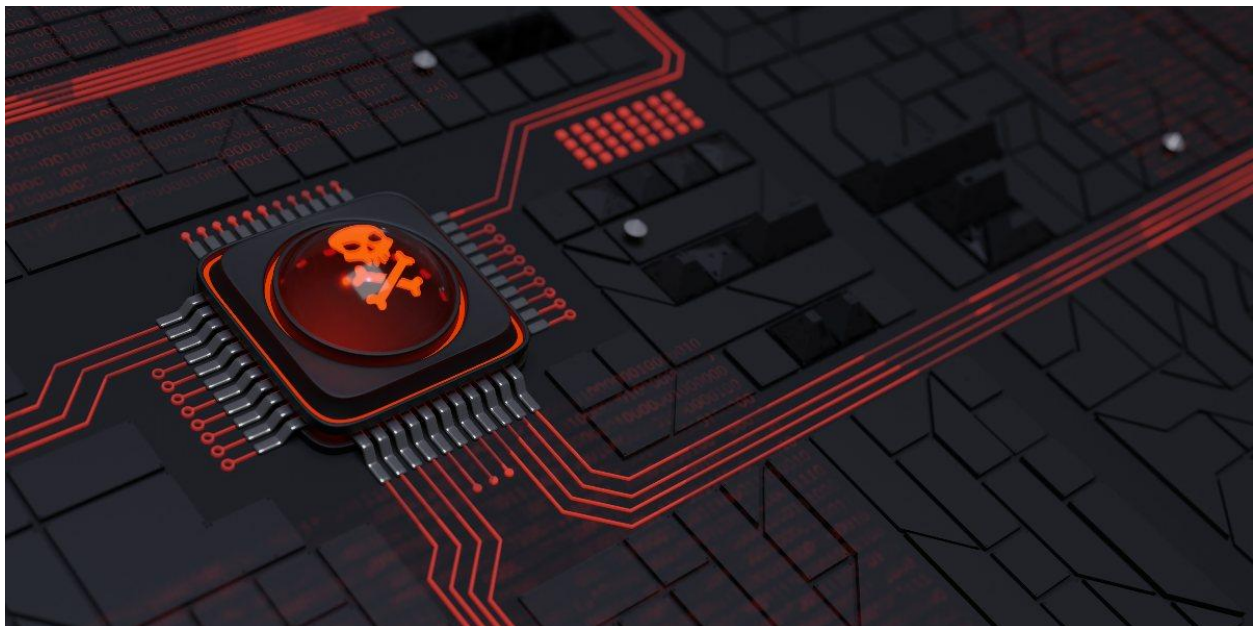
detection — and demonstrating controlled impact against defined high-value objectives even when a blue team is monitoring for exactly the activity underway. The evasion objective is central, not incidental.

Femto Security's [red teaming](#) operations are delivered by practitioners credentialed in both disciplines — because effective adversary simulation requires the deep exploitation tradecraft that penetration testing certifications develop alongside the persistence, evasion, and objective-oriented campaign planning that [certified red team professional](#) credentials specifically assess.

For UAE organizations presenting red team exercise evidence to VARA inspectors, ISO 27001 certification auditors, or central bank cybersecurity reviewers, documentation that articulates the credential level of the engagement team and the MITRE ATT&CK framework mapping of techniques used carries substantially more regulatory weight than a penetration test report issued under a red team label.

Certified Red Team Professional UAE: The Regional Threat Context That Shapes Engagement Design

Certified red team professional UAE engagement design cannot be separated from the specific threat actor landscape operating against UAE industry sectors. Generic adversary simulation — red team operations that simulate a hypothetical attacker with no defined profile — produce generic findings. Sector-specific threat actor emulation produces intelligence about the actual groups targeting the organization.



Mapping UAE Sector Targets to Known Adversary Groups

UAE financial institutions face documented targeting from several distinct adversary categories: FIN7 (Carbanak), the Lazarus Group, and regional cybercriminal syndicates with established SWIFT infrastructure attack playbooks. Emulating these actors in a financial services red team engagement requires familiarity with their documented initial access preferences — spear-phishing targeting treasury operations staff, watering hole attacks on financial information platforms, and supply chain compromise through financial software vendors.

Government entities and critical infrastructure face state-sponsored APT groups including APT29 (Cozy Bear) and regionally active groups whose documented TTPs emphasize long-dwell persistence, credential harvesting at scale, and staged data exfiltration designed to avoid bulk data movement detection. Emulating these actors requires different campaign design from commodity threat emulation.

VARA-licensed virtual asset businesses face threat actors whose primary objectives are hot wallet access, private key extraction, and stablecoin reserve manipulation — requiring engagement design focused on custodial infrastructure, API key management systems, and the specific platforms that crypto operations use for treasury management.

Femto Security's [red teaming](#) engagements simulate documented campaigns from APT29, APT41, FIN7, and Lazarus Group — with technique selection and campaign phasing calibrated to the adversary profile most relevant to each client's sector and asset profile.

MITRE ATT&CK as the Regulatory Standard for Engagement Documentation

UAE regulatory frameworks have increasingly adopted the MITRE ATT&CK framework vocabulary as the reference standard for evaluating red team exercise scope and depth. VARA, ISO 27001 implementations, and UAE national cybersecurity framework compliance assessments all benefit from red team documentation structured around ATT&CK tactic and technique identifiers — providing auditors and inspectors with a standardized basis for evaluating what the exercise tested and whether it was comprehensive.

Femto Security's engagements document an average of 47 distinct MITRE ATT&CK techniques per exercise across the full tactic spectrum — from TA0043 (Reconnaissance) through TA0040 (Impact) — producing documentation granular enough to satisfy regulatory review without requiring post-engagement translation into compliance vocabulary.

What a Professionally Certified Red Team Engagement Produces

Understanding what **certified red teaming expert** credentials validate helps clarify what the engagement deliverables should look like — and how to distinguish a rigorous exercise from a penetration test issued under a red team brand.

Narrative Attack Chain With ATT&CK Technique Mapping

Not a finding list — a complete narrative of how the engagement unfolded, from initial reconnaissance through every stage of the attack chain to final objective achievement. Each action in the narrative is mapped to the specific ATT&CK technique identifier it corresponds to: T1595 for active scanning during reconnaissance, T1566 for phishing-based initial access, T1055 for process injection during lateral movement, T1078 for valid account abuse, T1003 for credential dumping.

This technique-level documentation is what security operations teams need to build specific detection rules, tune EDR behavioral alerts, and construct threat hunting queries — not just a summary of what was achieved.

Blue Team Assessment and Detection Gap Report

The central intelligence product of a red team exercise: a structured analysis of every detection opportunity the blue team had during the engagement, which ones were taken, and which were missed. For each missed detection opportunity, a specific improvement is specified — the SIEM rule that should have fired, the EDR behavioral policy that should have flagged the activity, the network monitoring alert that should have triggered.

Femto Security's engagements produce an average of 23 actionable blue team improvement recommendations per exercise — each tied to a specific technique used during the engagement and a specific detection control that would have caught it.

Objective Achievement Evidence

Documentation proving that defined crown jewel objectives were reached — not merely that initial access was achieved. Financial record access, source code repository download, private key extraction, administrative credential harvesting, or whatever high-value targets the engagement was scoped around. This evidence is what demonstrates that the attack chain was complete end-to-end, not interrupted at some intermediate stage.

Board and Regulator Presentation Package

An executive narrative covering engagement scope, adversary profile simulated, objectives achieved, what was detected versus what was not, and the prioritized security program improvements the engagement identified — framed for a board or regulatory audience without requiring technical background to interpret.

Continuous Visibility Between Exercises: Why ASM Complements Red Team Programs

A red team exercise conducted by **certified red team professional** practitioners provides a verified assessment of defensive posture at a defined point in time. The value of that assessment begins to decay the moment the engagement closes — because the environment continues to change while the findings remain static.

New internet-facing assets appear. Cloud resources are provisioned. Development environments become externally accessible. Each change potentially modifies the initial access opportunities available to the next adversary, and none of these changes are visible in a prior red team report.

Femto Security's [Attack Surface Management](#) platform runs continuously between formal red team exercises — mapping internet-facing domains, subdomains, IP addresses, APIs, cloud services, and certificate infrastructure and alerting on newly exposed assets within 15 minutes of detection. Across 2M+ assets monitored and 500+ organizations protected, it provides the persistent external reconnaissance picture that threat actors maintain between their own targeting activities — and surfaces the new exposure points that would otherwise only become visible during the next formal engagement.

The intelligence produced by continuous ASM directly informs subsequent red team engagement scoping: what new assets have appeared, which services have become externally accessible, and where reconnaissance would focus if a threat actor were actively monitoring the organization between formal assessment cycles.

The Social Engineering Layer That Certification Programs Specifically Test

Every serious **red team professional certification program** incorporates social engineering into its technical curriculum — because real adversary campaigns incorporate human manipulation alongside technical exploitation, and exercises that exclude this vector do not test the full attack surface.

Phishing campaign construction, pretexting call development, credential harvesting page deployment, and spear-phishing targeting of specific high-value individuals within the organization are all standard components of comprehensive red team engagements. When practitioners emulate FIN7 or Lazarus Group campaigns for UAE financial services clients, the phishing components of those campaigns reflect the documented lure themes, infrastructure techniques, and targeting patterns those groups actually use.

This is precisely the intersection where red team exercises connect to [Security Awareness](#) training. The phishing simulation component of a red team engagement identifies which employee populations are most susceptible and what lure characteristics are most effective in the specific organizational context. That intelligence directly shapes the adaptive phishing simulation scenarios that Femto Security's security awareness platform deploys — ensuring that

training scenarios are calibrated to actual susceptibility patterns discovered through adversarial testing rather than generic phishing templates.

Across client organizations, this feedback loop between red team social engineering findings and adaptive awareness training has produced a 90% reduction in phishing susceptibility rates — with audit-ready completion certificates generated for ISO 27001, SOC 2, and VARA compliance submissions covering the human security layer that no technical assessment discipline reaches independently.

What Femto Security's Certified Red Team Delivers for UAE Enterprises

Femto Security's [red teaming](#) operations across Dubai and the GCC are built around the operational standards that **certified red teaming expert** credentials represent — with the threat intelligence layer and custom tooling infrastructure that makes those credentials meaningful in real engagement conditions.

150+ red team engagements across GCC enterprises spanning financial services, government agencies, crypto businesses, healthcare networks, and enterprise technology organizations.

98% initial access success rate — confirming that the engagement methodology reaches the environments it targets rather than stopping at perimeter controls. This rate reflects professional tradecraft and targeted reconnaissance, not automated attack tools running against undefended perimeters.

500+ MITRE ATT&CK techniques documented across the engagement portfolio — providing technique-level coverage depth across the complete ATT&CK matrix that maps directly to the regulatory reporting requirements of VARA, ISO 27001, and UAE national cybersecurity frameworks.

48-hour average time to initial access — from engagement start to confirmed foothold — achieved through threat intelligence-driven targeting and social engineering components rather than brute-force scanning and exploitation.

Custom C2 tooling per engagement — with evasion profiles developed specifically for the EDR and SIEM configuration deployed in each client environment, ensuring that exercises test genuine detection capability rather than confirming that known tool signatures are blocked.

23+ blue team improvement recommendations per engagement on average — specific, actionable changes to detection rules, EDR policies, SIEM alert logic, and incident response procedures, tied to the specific techniques used during the engagement.

ISO 27001 certified operations — engagement methodology, documentation standards, and deliverable format aligned to the governance requirements of VARA, ISO 27001, UAE national cybersecurity frameworks, and central bank inspection programs.

Conclusion:

Every security investment an organization makes rests on an assumption: that the controls in place would slow down, detect, or stop a capable adversary pursuing the organization's most valuable assets. A red team exercise conducted by [certified red teaming expert](#) and **certified red team professional** practitioners is the only activity that tests that assumption against something that actually behaves like the adversary.

The credential matters because the quality of that test depends entirely on the capability of the practitioners conducting it. CRTP validates Active Directory attack tradecraft under examination pressure. CRTE extends that validation to mature defensive environments with modern EDR deployed. Operator-level credentials validate the custom tooling and evasion capability that distinguishes professional adversary simulation from penetration testing in a red team report header.

For UAE enterprises investing in red team exercises to satisfy VARA requirements, ISO 27001 audit evidence, central bank inspection readiness, or genuine security program improvement — the question to ask before any other is who holds the credentials and what those credentials were actually required to prove.

Femto Security delivers [red teaming](#) for UAE and GCC enterprises with 150+ engagement track record, 98% successful breach rate, 500+ MITRE techniques documented, custom C2 tooling per engagement, and blue team improvement recommendations specific enough to implement the week the report lands.

Frequently Asked Questions

What does a Certified Red Team Professional certification prove? CRTP demonstrates that the practitioner has successfully conducted Active Directory-focused attack chains against a live, defended environment under examination conditions — including AD enumeration, Kerberos attacks, delegation abuse, lateral movement, and domain-level compromise. The credential is awarded only on successful completion of a practical examination, not a written test. It confirms operational capability rather than knowledge recall.

Why does the CRTE matter more than CRTP for engagements against hardened UAE enterprises? CRTP validates Active Directory attack capability in environments with standard defensive tooling. CRTE specifically requires operating against environments with modern EDR deployed — Microsoft Defender for Endpoint, Defender XDR — using evasion techniques that bypass runtime monitoring, AMSI inspection, and behavioral detection rules. Most mature UAE enterprises deploy exactly these platforms. An engagement team without CRTE-level evasion

capability will have their activities detected and blocked before the exercise reveals meaningful defensive intelligence.

How should UAE organizations verify red team practitioner credentials? Altered Security credentials (CRTP, CRTE, CARTP) are verifiable through Altered Security's credential verification system. Offensive Security credentials (OSCP, OSEP) are verifiable through Offensive Security's credential portal. Zero-Point Security credentials are issued with verifiable certificate identifiers. Request the specific certification and certificate identifier for each practitioner assigned to the engagement — any credentialed professional should be able to provide both immediately.

What is the difference between a red team exercise and a purple team exercise? A red team exercise operates under stealth conditions — the blue team is not informed of the engagement timeline and must detect and respond as they would to a real intrusion. A purple team exercise is collaborative — red and blue team practitioners work together in real time, with the red team demonstrating techniques and the blue team tuning detection responses immediately. Red team exercises test whether defenses work under real conditions. Purple team exercises accelerate the improvement of detection capabilities through structured knowledge transfer. Both serve different objectives at different security program maturity levels.

How does MITRE ATT&CK mapping in red team reports support VARA compliance? VARA's technology governance standards require virtual asset service providers to demonstrate systematic security testing that covers realistic threat scenarios. MITRE ATT&CK-mapped red team documentation provides VARA inspectors with a standardized reference framework for evaluating what the exercise tested — specific tactics, techniques, and procedures — against the threat actor profiles most relevant to the virtual asset sector. Technique-level mapping is substantially more useful for regulatory review than engagement narratives written in general terms.

What is the typical duration of a professional red team engagement? Femto Security's red team engagement timeline runs approximately five weeks: one week for threat intelligence and reconnaissance, one to two weeks for attack planning and custom tooling preparation, two weeks of active adversary simulation, and one week for analysis and report production. Compressed timelines are possible for organizations with specific regulatory deadlines but typically result in either reduced scope or reduced documentation quality.

How do red team findings translate into security program improvements? The detection gap analysis in the engagement report identifies specific detection failures — each one traceable to a concrete control improvement. SIEM detection rules that would have fired against observed activity are specified in detail. EDR behavioral policy configurations that would have flagged technique execution are documented. Incident response procedure gaps identified during the engagement are described alongside recommended revisions. Security program improvements that flow from a well-documented red team exercise are specific and implementable, not generic recommendations to improve monitoring.

