KEYFACTOR

EBOOK

Certificate Lifecycle Management Maturity Model

A Practical Guide to Scale and Automate
Certificate Management

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The Growing Need for Certificate Lifecycle Management

The role that digital certificates and keys play in securing your business has reached critical importance. The exponential growth in certificate usage has reached unprecedented levels; industry standards for certificate lifespans continue to shrink, and quantum-safe certificates are gaining traction.

On average, a typical organization uses 255,000 keys and certificates today to secure data and authenticate systems, and that number continues to grow yearly. However, over 77% of companies admit that digital certificates have and continue to cause unplanned downtime and outages. What's more concerning is that over half of these same companies say that these outages, which take hours to resolve, have impacted customers negatively. These are just some recent examples and challenges that plague the minds of IT and security leadership.

Bottom line: security teams need to get certificate management under control.

And that's why we've built this model to help. The broad scope of certificate management makes it hard to know how mature your current practices are today and where they need to be for the future. Each level in this model describes the most common scenarios we hear from the companies we work with every day. This model outlines practical next steps to move you to the next level and provides quick insights into your expected achievements.

Ways to use this guide:

Self-Assess:

Start by understanding each maturity level and pinpoint where you stand.

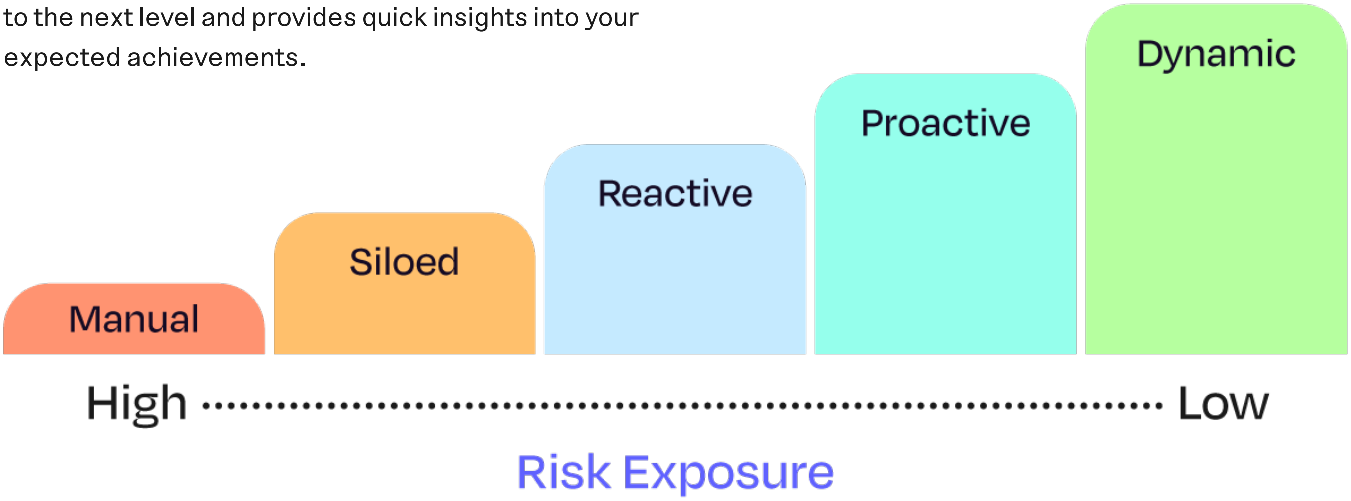
Identify Gaps:

Define your success criteria and plan practical next steps to address existing gaps.

Make a Plan:

Share findings with your team and involve leadership.

Now, let's take a closer look at the five levels of certificate management maturity. By doing so, you'll understand how to scale and automate the management of certificates across your organization (and keep your sanity in the process).



LEVEL 1:

Managing at High Risk with Manual Processes

(Manual)

Spreadsheets & Manual Process • Time-consuming and error-prone • High risk of outages

At Level 1, you're likely aware of the increasing volume and sprawl of certificates across your organization, yet you're still tackling the problem with highly manual processes. This typically involves using spreadsheet-based tracking to keep tabs on your inventory and using some form of calendar reminders or scripts to notify certificate owners about pending expirations.

The problem with manual processes like spreadsheets is that all certificate information must be kept up-to-date and regularly reviewed to ensure that certificates don't unexpectedly expire. All this repetitive work presumes no error or oversight in the process and relies heavily on administrators to ensure all data is accurate and current.

Four critical components are missing from manual tracking:

Visibility:

Spreadsheets only account for known certificates that you're tracking, but it's the unknown and untracked certificates that cause outages.

Resources:

It's time-consuming to maintain an active record of all certificates and ensure the data you have is correct and accurate.

No Automation:

The steps required to request certificates from CAs are slow and manual, not to mention issuance, provisioning, renewal, and revocation.

Error-Prone:

Manual actions lead to higher risks of errors like missing a certificate to a misconfiguration of an endpoint — and these lead to outages or, worse, breaches.

This DIY solution might be good for a small number of certificates (e.g., less than 100); however, this process quickly starts to take up too much time, and attention to detail immediately suffers. Moreover, since different company departments may purchase certificates from various certificate authorities (CA) or stand up their own CAs, there's a high probability that many of these certificates have not been accounted for.

At the end of the day, you might not have experienced a catastrophic event due to an expired certificate, but you've realized you're not prepared to prevent one.

Level one should highlight the need for better oversight, an established process, and the identification of how to remove manual processes.

Questions to Ask

- Do I know how many certificates are in use?
- How many CAs are actively issuing certificates in our environment?
- How much time is spent issuing and updating certificates across all departments?
- Are we confident in our knowledge of potential weaknesses and vulnerabilities? (SHA1 or self-signed certificates)
- Can your current process scale as certificates increase and the lifetimes of certificates decrease?

Next Steps

- **Understand which business units and applications rely on certificates**
- **Audit the number of CAs in use across your environment, how they're used, and where they live**
- **Identify immediate risks and assign clear ownership for certificate management**

LEVEL 2:

Limiting Risk through CA-Provided Tools

(Siloed)

Doing the Bare Minimum • Fragmented, Siloed Visibility & Reporting • Zero to Minimal Automation

At Level 2, your team should look to introduce more oversight into certificate issuance and usage. For example, you may introduce tools your SSL/TLS vendor provides. These tools offer better reporting on certificates issued from their infrastructure.

While tracking the initial issuance of a certificate from the CA is no longer a problem, it's the unknown and untracked that keeps you up at night. Knowing the existing expiration dates helps with visibility, but now you must find where each certificate resides across your network and who to contact to renew correctly. However, this is easier said than done.

The problem is that a certificate can be provisioned to multiple devices. You need network-based discovery and local discovery tools (i.e., agents/orchestrators) to find where those certificates end up on your network, which applications use them, and where the private key is stored.

Although you're progressing from a manual state of being, you're dealing with multiple silos of certificate management spread across disparate toolsets. This siloed management and reporting on upcoming certificate expirations exposes you to critical service interruptions due to expired or misconfigured certificates.

Level 2 also highlights additional challenges in user management and permissions. If one user has access to an issuing CA, they might not have the same access to another CA. This separation of ownership leaves a hole in the overall governance of certificates across your company and creates a single point of failure with no backup for remediation.

You're standing at the crossroads of where you should start to invest in scaling your certificate management. Either you need to invest in more resources to handle increasing workloads, or you need to research complete certificate lifecycle management tools that can scale across multiple use cases.

Questions to Ask

- How many reports does it take to create a holistic view across multiple CAs? Which reports are missing?
- Do I know where the certificate is being used in my organization or just where it was issued from?
- How many CAs do we have, and how do we consolidate inventory across all of them?
- If a certificate is near expiration, how do we ensure the owner will renew it in time?
- How do we notify application owners when certificates are near expiration? How do we escalate the issue if the app owner fails to take action?

Next Steps

- **Look for solutions that support network-based discovery of rogue or unknown certificates across your internal and internet-facing infrastructure**
- **Replace manual certificate requests with automated workflows and lifecycle handling**
- **Consolidate inventory and management of certificates across internal and external CAs into a platform**

LEVEL 3:

Full Oversight with a Single Pane of Glass

(Reactive)

Centralized Visibility & Control • Advanced Reporting & Alerting • Expiration Reporting

The risk lies in not knowing where certificates are being used: you can't manage the unknown. Prior to Level 3, there was sporadic oversight of the certificate landscape across fragmented, disparate tools and data sources.

Now that's all changed.

Level 3 begins a massive turning point in your certificate management maturity. Consolidation of all certificates across all issuing CAs (public and private) has been brought under a single pane of glass to manage. Teams can now start categorizing certificates and assigning metadata to understand the breadth of their certificate inventory better.

A continuous inventory scanning and monitoring process has been established to know where each certificate lives, when it needs to be renewed, where it is located, and who issued the certificate. You've expanded your certificate monitoring to detect weak keys, signing algorithms, or validity periods around the certificate so that you can respond to crypto events in real time.

Reporting gets significantly upgraded as you move from static visibility to proactive prevention, detection, and response. Multi-CA support and simplified dashboards provide an overview of your environment. You can pull any report within minutes, rather than days or hours, that instantly gives the health status of your certificates.

Level 3 should provide peace of mind about having a complete inventory, but more work is ahead. Automation must be incorporated to stop the reactive communication around certificate activities across departments.

Questions to Ask

- Does my certificate management extend to give me visibility into cloud and on-premise workloads?
- Which applications are most affected by outages caused by expired certificates?
- How much time do application owners and PKI administrators spend requesting, issuing, and provisioning certificates?
- How quickly can we identify and remediate certificate-caused outages?
- Can I do discovery across all the certificate landscape (Cloud, DevOps, CAs, Shadow IT, etc.)

Next Steps

- **Identify high-priority applications for certificate automation (e.g., web servers, load balancers, etc.)**
- **Define automation and approval workflows for certificate issuance, provisioning, renewal, and revocation**
- **Shift to a self-service model for application owners to request security-approved certificates from a common portal or API**

LEVEL 4:

Enabling Self-service and Automation

(Proactive)

Certificate Lifecyle Automation • Simplified CSRs • Automated Workflows with ITSM

At level 4, automation takes center stage as you move from certificate management into certificate lifecycle automation. This starts with providing users with a self-service portal or API to request certificates quickly. Then you can automate the lifecycle of those certificates — from provisioning them to end devices to renewing them automatically before expiration.

Beyond sending alerts to users about expirations, which require manual actions, you can now push certificate updates without human intervention. This allows you to renew certificates with the same information as the previous certificate and automatically bind that certificate to the necessary application.

Automated workflows, self-service certificate issuances, and integrations with existing ITSM tools, like ServiceNow and BMC Remedy, have become a significant time-saving mechanism for the business.

By allowing network and infrastructure teams to obtain certificates on demand quickly, you've reduced the workload on PKI and security teams that would typically be spent fulfilling certificate requests. Not only does this improve productivity and reduce costs, but it also allows you to expand into new use cases.

Level 4 organizations should be encouraged that automation has begun, and this motivates you to start extending automation across the business. You've laid the groundwork for certificate lifecycle automation and reduced the workload by growing certificate counts. Now it's time to consider aligning your identity strategy with leading-edge initiatives, like your DevOps workflows and cloud infrastructure.

Questions to Ask

- How much time does it take to request and deploy a certificate?
- After a certificate alert is received, where can we add automation to resolve this?
- Can certificate owners bypass manually importing certificates into applications?
- Can we effectively update the Roots of Trust of a device?

Next Steps

- **Achieve end-to-end automation**
- **Partnering with engineering and development**
- **Evaluating the current state of PKI**

LEVEL 5:

Zero-Touch Automation, Achieving Crypto-Agility

(Dynamic)

DevOps Integrated • Cloud-First PKI Strategy • CA & Technology-Agnostic

If you have reached Level 5, you've moved into a premier status for certificate lifecycle automation. It may be unrealistic to expect that every certificate lifecycle is automated; however, you know about every certificate, have a process to manage them, and have automated the things that save the most time and reduce the most risk.

You have a complete and continuous inventory for all certificates in the environment, irrespective of source or destination — primarily when related to DevOps workflows.

Development and engineering will always prioritize speed over security. At Level 5, you're merging automated DevOps workflows and security-approved PKI without slowing them down. This means automating the deployment of certificates through infrastructure and container orchestration tools like Kubernetes, Docker, and Istio service mesh backed by a secure root of trust. InfoSec teams are now a part of the DevSecOps fabric that helps engineers succeed rather than block their speed to innovate.

PKI operations, and not just cert management, now achieves critical importance. PKI goes beyond the management of keys and certificates. It's about the people, infrastructure, and policy behind your PKI that allow you to respond and make changes in cryptography, such as signing algorithms, key lengths, and validity.

Monitoring issuance from your CAs now becomes critically important. For example, a spike in one-year certificate issuance from an issuing CA might not be a problem. However, if the intermediate CA is about to expire, all of those recently issued certificates will expire without notice.

Signs You're In Level 5

- Deployed a Cloud-First PKI Strategy
- Support a multitude of CAs, applications, and protocols
- Aligned with DevOps priorities and certificate usage practice
- You've mastered the automation of PKI and certificate-related processes
- You know that any future changes in standards will be easy for the organization to handle

Next Steps

- **Make a plan to change your certificate management process**
- **Expand practices into SSH key management**
- **Investigate PKI use cases for IoT device identity provisioning**
- **Sync with developers on how to deploy secure code signing**

Get Started

Now that we've covered the steps to certificate management maturity, it's time to implement plans.

Here are some practical steps to kick off the roadmap to certificate lifecycle management success.

Bring in the A-TEAM

Chances are that multiple teams across your organization manage digital certificates. Bringing in a stakeholder from each of these teams will ensure that you understand all current and planned use cases. For instance, a team could have stood up its own CA infrastructure for a specific use case without the necessary knowledge or support of the enterprise PKI or security team. Building a cross-departmental team helps you align priorities to enhance certificate management for the future.

Share Best Practices

Learn more about cross-team challenges by joining department meetings. Join their stand-up calls and digital strategy meetings to understand better how certificate management is done. Are there best practices that need to be shared across different business units? Or do you see a more significant problem coming to a head?

Map Out Your PKI

Take your learnings and start mapping them out. Nothing is more potent for conveying a message than a picture. Take time to map out your entire CA infrastructure and certificate management processes on a whiteboard, connecting workflow diagrams or simply writing it down on a napkin. Once you get the process out of your head and into a visual, this helps you quickly identify gaps and inefficient processes.

Propose a Business Plan

In the end, you might realize that you have certificate management under control or have major work to do in the days ahead. If additional work is involved, you'll need to build a business plan to either do the work in-house, evaluate tools to help or keep the status quo. To justify the budget necessary for your project plan, you must convey the business reasons for improving your certificate management maturity. Tie your strategy back to quantifiable metrics such as improved productivity (hours), reduced risk (outages), and cost savings (uptime).

Learn more

See how achieving a dynamic state with certificate lifecycle automation can help keep your certificates and keys more secure with less effort:

Request a demo of Keyfactor Command now.

Request a demo ↗

KEYFACTOR

Keyfactor brings digital trust to the hyper-connected world with identity-first security for every machine and human. By simplifying PKI, automating certificate lifecycle management, and securing every device, workload, and thing, Keyfactor helps organizations move fast to establish digital trust at scale — and then maintain it. In a zero-trust world, every machine needs an identity and every identity must be managed. For more, visit keyfactor.com or follow @keyfactor.

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