Whitepaper

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API Access Management

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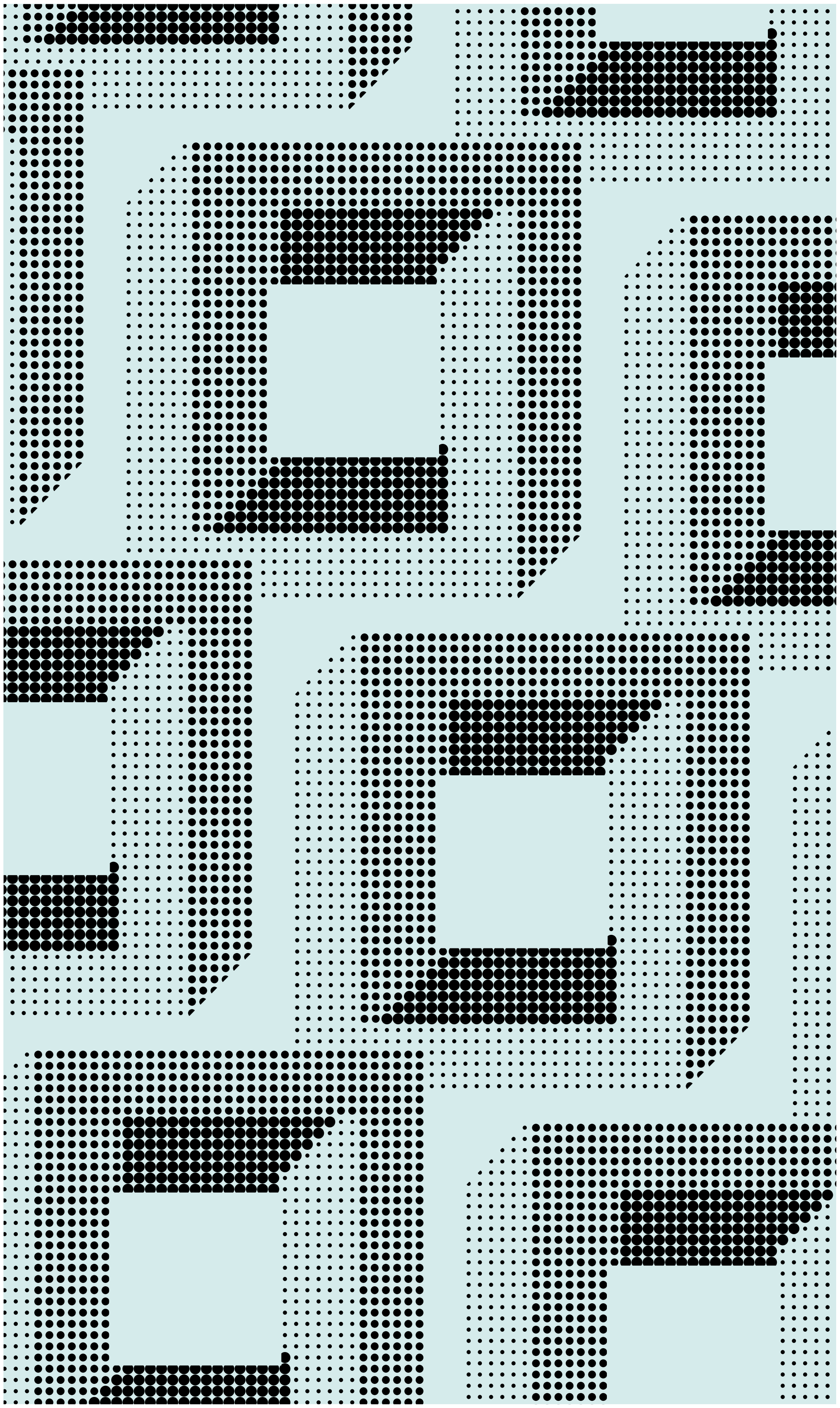

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API Security from Concepts to Components

This whitepaper describes the modern API security landscape and how to effectively leverage OAuth 2.0 and API gateways for authentication and authorization from both an infrastructure and software development mindset. To date, most organizations have had hard boundaries between system administrators and their software development teams, where they occasionally interact, rarely coordinate, and never collaborate. While this concept has worked for decades, the assumptions, constraints, and requirements of software development have quickly changed as employees bring their own devices, partners connect in new and deeper ways, and customers expect smooth, consistent user experiences across every device. As the needs for collaboration between IT administrators and software developers - both internal and external - continue to grow, we need to reconsider the boundaries of our systems, expectations of users, and the security policies that protect both.

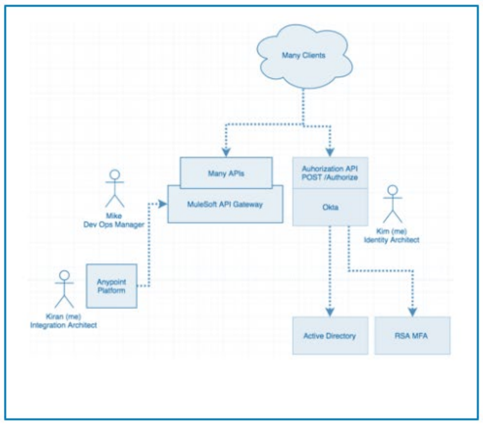
How have IT and Software Development Changed?

At a practical level, IT departments are considered a cost center with the sole responsibility of "keeping the lights on" while application development teams drive new revenue, customer retention, and the resulting growth and the information security teams have responsibilities in both areas. At the same time, the IT department is charged with writing and enforcing the security policies that the development teams must implement.

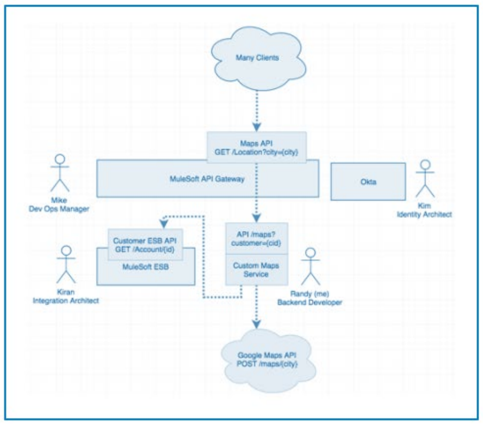
Unfortunately, most software development teams are encouraged to "move fast and break things" while the IT department and the organization's customers suffer the consequences of data breaches for months and years to come. Even worse, as information security teams have tried to assert their rightful role in protecting the organization, they are treated as obstacles to be avoided and worked around.

Two Groups –Always at Odds

IT & Administrators



Developers



In terms of APIs specifically, whether it's a backend system, partner-facing website, or customer-facing mobile application, the development teams are sharing more data, in more ways, to more users than ever before. While most companies attempt to find a "balance" between the two groups, that does not work. Instead, the IT department should make the easy way the right way by choosing technologies, tools, and patterns that enable developers to build secure, reliable systems.

API Security Goals and Approaches

As companies move to secure their APIs, their goals are the same as securing any other system or software. Fundamentally, it comes down to: 1. the right people and systems (authentication) 2. have access to the right things (authorization) 3. to accomplish their task and nothing more (least privilege) for the shortest time necessary. If a company fails to do any of those three, their systems will be frustrating, unreliable, catastrophically insecure, or all three. While the mindset doesn't change with regards to APIs, the tools we have available are different.

Approach #1: No Security

While this isn't a serious approach to security, it is the most common by far. As developers build mobile apps, they believe if the API is hidden within the application then it doesn't require the same care and security that a publicly available API requires. Unfortunately, that's 100% wrong. If an API is online, it is susceptible to abuse. Being "public" or "private" is a false hope because the vast majority of data breaches occur from insiders and today's trusted partner may be tomorrow's compromised system.

Approach #2: API Keys

Most API access starts with API keys. The required logic is implemented by most frameworks out of the box so they're fast and easy to implement but not sufficiently secure. API keys are created by the developer and inherit their permissions. At first glance, this makes sense but it does not take into account the end user's permissions and what they need to accomplish. Therefore, an API key may allow read/write access, even when the use case only needs read access. Further, since the keys are at the account level, generally there is only one per account so all applications share the same over-permissioned key.

Finally, since most APIs only support a single key per account, developers often reuse keys between applications which makes automatic expiration impossible and rotation challenging. If a key is compromised, a developer leaves the team, or a simple copy and paste error in the wrong place, and the owners of all impacted applications have to coordinate a simultaneous update to minimize downtime.

API keys address Authentication but rarely address Authorization or Least Privilege.

Approach #3: OAuth 2.0

OAuth 2.0 serves as a more advanced approach to granting and protecting API access. In the simplest implementation, an OAuth 2.0 token looks and acts quite a bit like an API key but with two distinctions:

1. A token inherently includes the concept of 'scoping' to enable API designers to grant fine-grained permissions to applications. For example, a simple logging application could have a token for read-only access while a different application would have a different token with different access.
2. A token is designed to expire and therefore has a refresh process built into the specification.

As a result of these two aspects, if a token is compromised, we get three benefits over API keys:

1. The token will be scoped to the use case the end user allows, not necessarily to the user's entire permissions or the developer's access. As a result, the token may be useless for attacking other parts of the system.
2. The token automatically expires, so the timeframe for an attacker's to execute an attack is limited.
3. Tokens can be revoked with a simple API call, blocking access immediately.

Regardless, while OAuth 2.0 is a much better solution, it is still not a complete solution for securing APIs because while it addresses the original three points of Authentication, Authorization, and Least Privilege, these are only the policy decisions. We still need to enforce these policies to protect the API. While building this enforcement into the API seems like the best answer, we quickly into a world where we can't audit or even review the enforcement without sharing code. As enforcement and those policies change over time, we may have to redeploy pieces of the API. Alternatively, what if we can enforce those policies before the API?

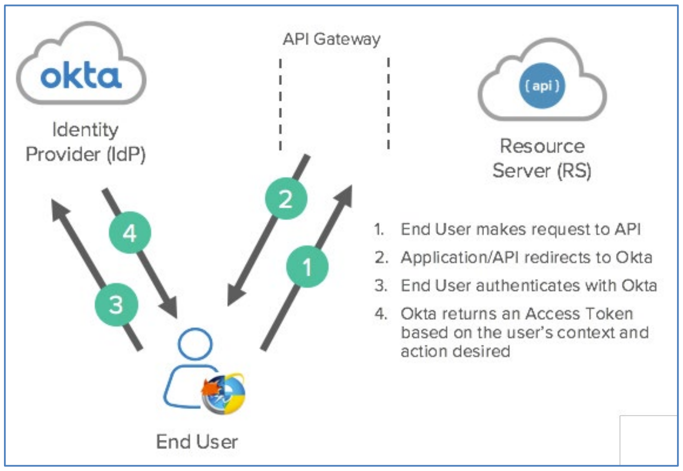
Approach #4: API Gateways

No matter what, malicious users and compromised applications will attempt to misuse and abuse your API. To protect an API's infrastructure and to provide a single policy enforcement point, one of the greatest tools available is an API gateway. From an enterprise architect's perspective, a gateway can serve as an organization-wide design and orchestration tool to connect any API to all other APIs. From a developer's perspective, a gateway can serve microservice-specific systems and be included directly in a continuous integration system for seamless deployment. From both perspectives, a gateway serves as a single point of control and enforcement for policies, logging, and auditing. Regardless of the vendor or project, all gateways serve as an API "firewall" to protect APIs from malicious data, incorrect requests, and denial of service attacks.

In general, API gateways include simple API key creation and management. A select few go further and offer embedded OAuth 2.0 Authorization Servers using simple user profiles. This creates a powerful combination where developers can both protect their APIs with API gateways and implement fine-grained access control for their users. Where this falls short is that it creates yet another place to store, maintain, and authenticate users. You can synchronize user profile fields but as the user's information, behavior, and potentially subscription changes, building authorization policies based on those aspects becomes important.

As we get deeper into scaling our APIs from internal developers to partners to customers, a gateway by itself remains an important piece but not complete solution. If we consider industry-specific specifications and practices such as Open Banking in finance, SMART on FHIR for healthcare, insurance, energy, and other highly regulated industries, we need to include OAuth and its related specifications again.

Approach #5: API Gateway & API Access Management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Identity Provider (IdP)
API Gateway
{ api }
Resource Server (RS)
1. End User makes request to API
2. Application/API redirects to Okta
3. End User authenticates with Okta
4. Okta returns an Access Token based on the user's context and action desired
1
2
3
4
End User

Authentication Flow with an API Gateway

The complete and flexible yet specification compliant solution is not OAuth alone or an API gateway alone but combining the two together. At a practical level, we have to realize that our users are not simply “trusted” or “suspicious” but we must consider what they are trying to accomplish. For example, when you use an HR system’s API to download your vacation history, the risk and consequences are minor. Using that same API to change your direct deposit information is risky if not potentially catastrophic and therefore should require tighter restrictions with elevated permissions. This is where an API gateway combined with API Access Management create a powerful solution.

Okta’s API Access Management is built on Okta’s Universal Directory which allows Sign On and Authorization Policies that limit particular OAuth 2.0 scopes to specific devices, a specific network, and even group membership. Further, specific scopes can require user consent to ensure the user explicitly authorized access for the application. Most importantly, a security team can manage those policies outside the API gateway while centrally logging access requests, grants, and policy changes. For additional compliance needs, access information can also be viewed via the Okta UI or exported to a 3rd party system (such as SIEM/ticketing systems). By shifting the IT department from blockers to enabling developers with simple integrations using well-established standards and tools, it shifts APIs out of the realm of “shadow IT” and back to trusted, known systems.

Summary

An API gateway combined with API Access Management ensures that the right people have access to the right resources to accomplish their task for the shortest time necessary.

According to Gartner, APIs will be the most common attack vector by 2022. Unfortunately, we're already seeing the leading edge of that as the sheer volume of business critical capabilities are provided by underprotected APIs. Therefore, without a deliberate, focused effort on protecting your systems now, that timeline may be optimistic.

API keys are only a starting point. An API Gateway and OAuth 2.0 provide a better, more powerful solution but a centralized point of control with closely monitored policies and context-aware access management is the best solution of all. Today's trusted partner may be tomorrow's compromised system letting attackers mimic legitimate users. We need the flexibility to adjust, respond, and protect our systems based on the full context of the user and their goals.

For Further Reading

Okta's guide to Building Secure APIs [**book**] [**website**]
OAuth 2.0 Simplified from Aaron Parecki
Okta Integration Network: API Gateways
Recommended Practices for API Access Management

About Okta

Okta is the leading independent provider of identity for the enterprise. The Okta Identity Cloud enables organizations to securely connect the right people to the right technologies at the right time. With over 6,500 application integrations, Okta customers can easily and securely use the best technologies for their business. To learn more, visit **okta.com**.