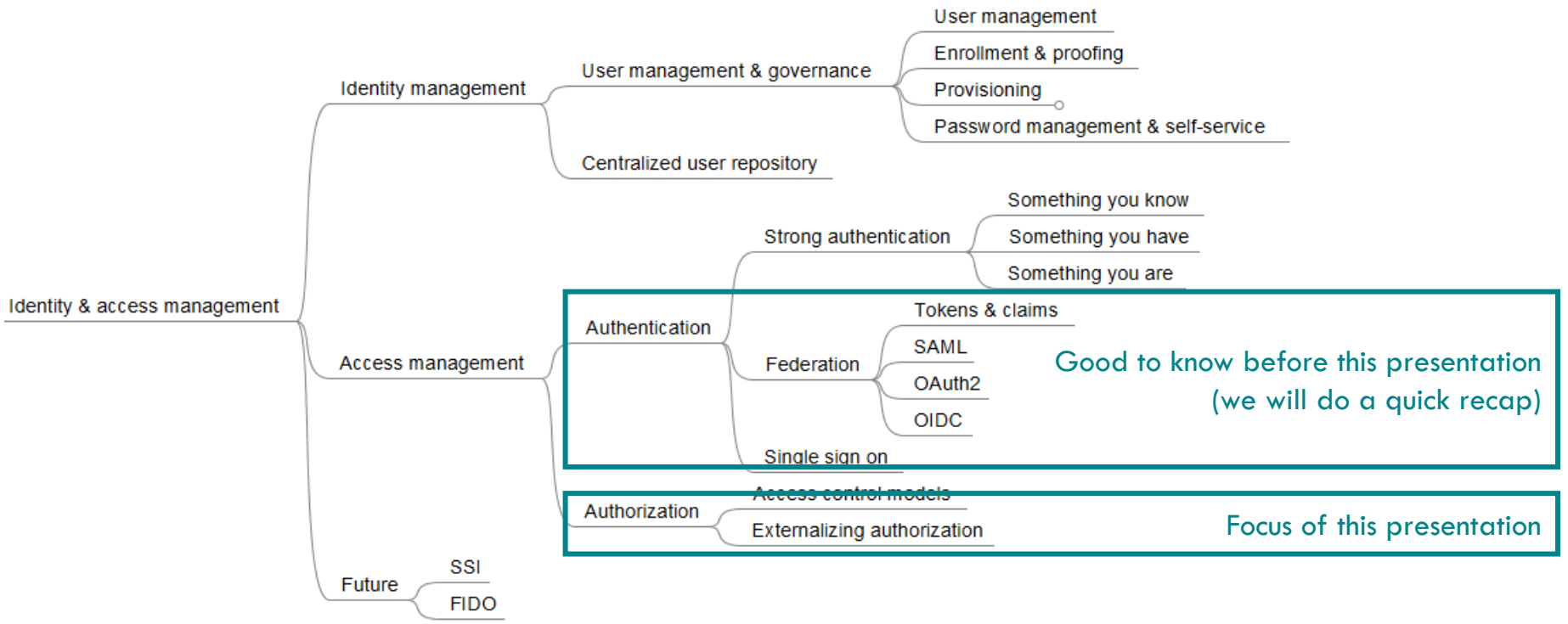
EXTERNALIZING AUTHORIZATION
USING OPEN POLICY AGENT


Identity & access management
Identity management
User management & governance
User management
Enrollment & proofing
Provisioning
Password management & self-service
Centralized user repository
Access management
Authentication
Strong authentication
Something you know
Something you have
Something you are
Federation
Tokens & claims
SAML
OAuth2
OIDC
Single sign on
Authorization
Access control models
Externalizing authorization
Future
SSI
FIDO
Good to know before this presentation
(we will do a quick recap)
Focus of this presentation

IMPORTANT CONCEPTS

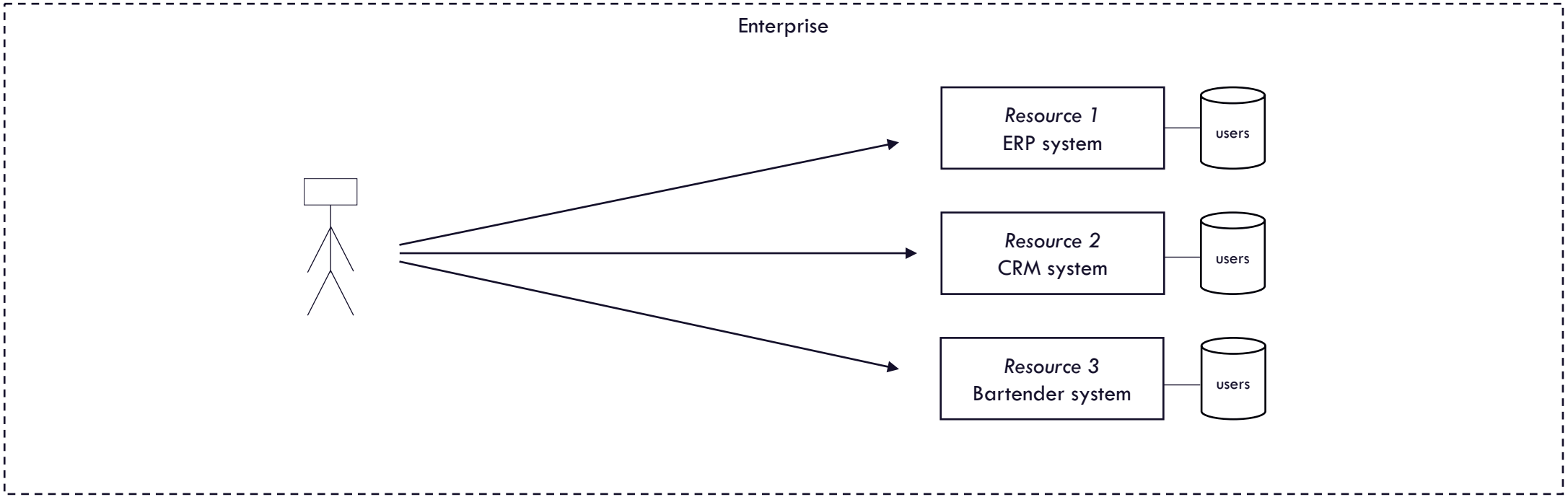
- **Identification**: The process of discovering the identity (i.e., origin or initial history) of a person or item from the entire collection of similar persons or items.
- **Authentication**: Verifying the identity of an entity (user, process, or device), often as a prerequisite to allowing access to resources in an information system.
- **Authorization**: The process of verifying that a requested action or service is approved for a specific entity.
- **Externalization**: In the context of this presentation, 'externalization' means separating out specific (security) functionalities from an application into a component dedicated for such specific functionality. Often this naturally leads to '**centralization**', as more and more applications externalize to the same dedicated component.

AGENDA

The problem we are trying to solve (≈ 5 slides)	Stage 0: The start Stage 1: Externalize the user directory Stage 2: Externalize authentication (**current state**) Stage 3: Externalize authorization (**focus of this presentation**)
How it's done in practice (≈ 4 slides)	From RBAC to ABAC in a .NET application
Demo time (≈ 2 slides)	A demo bartender system where authorization is externalized
Common questions (≈ 4 slides)	Relation to SSO Relation to Conditional Access Relation to ABAC Relation to XACML
Conclusion and questions (≈ 2 slides)	Conclusion and questions

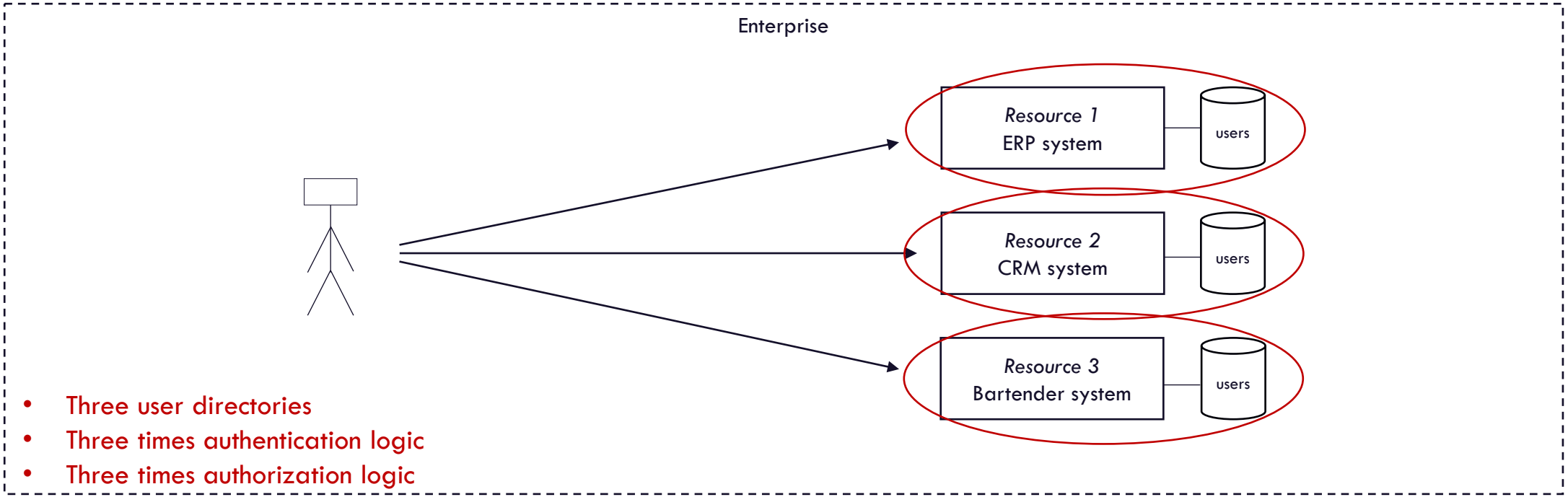
WHICH PROBLEM ARE WE TRYING TO SOLVE?

STAGE 0: THE STARTING PROBLEM



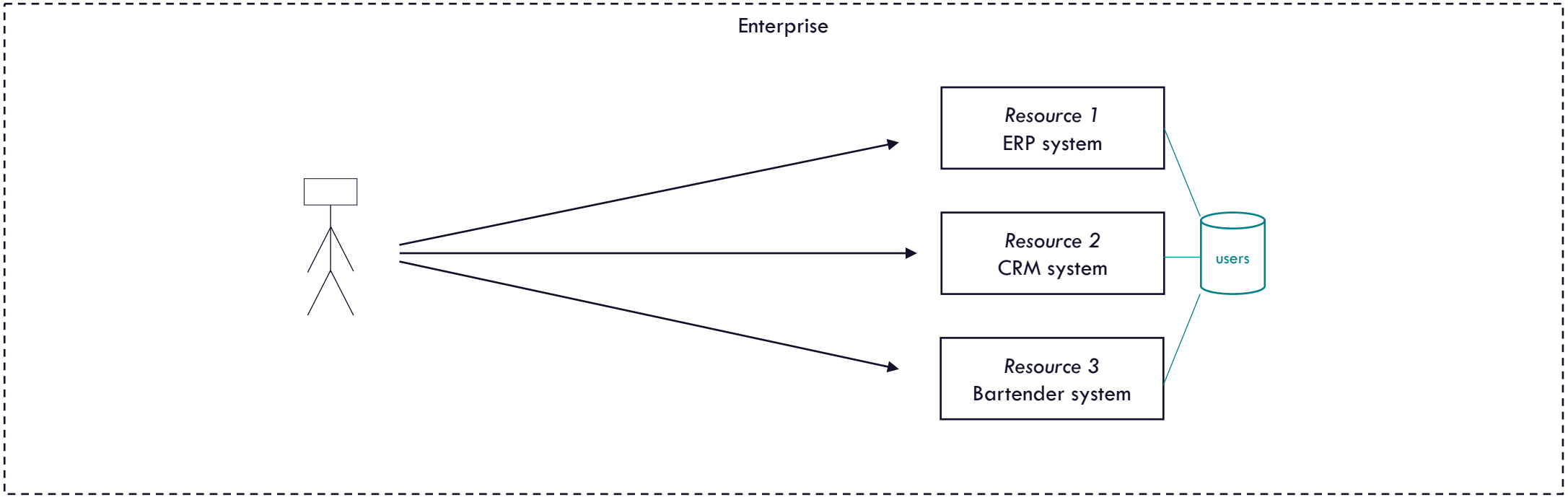
People need access to systems.

STAGE 0: THE STARTING PROBLEM



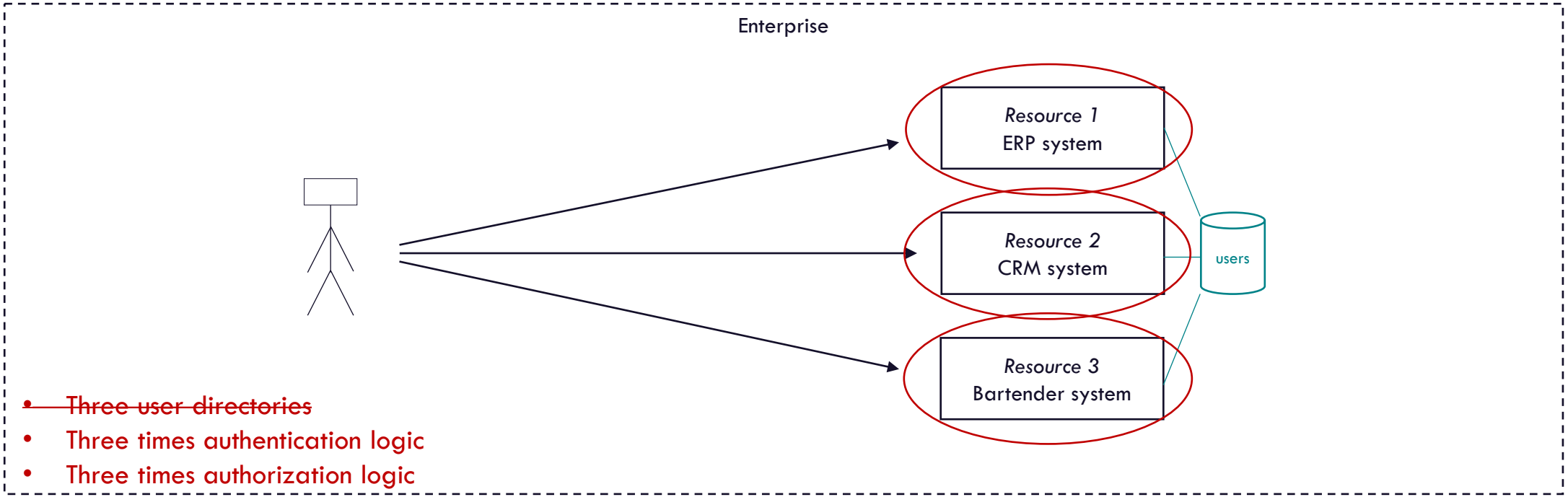
Every application reinvented the wheel.

STAGE 1: EXTERNALIZE THE USER DIRECTORY



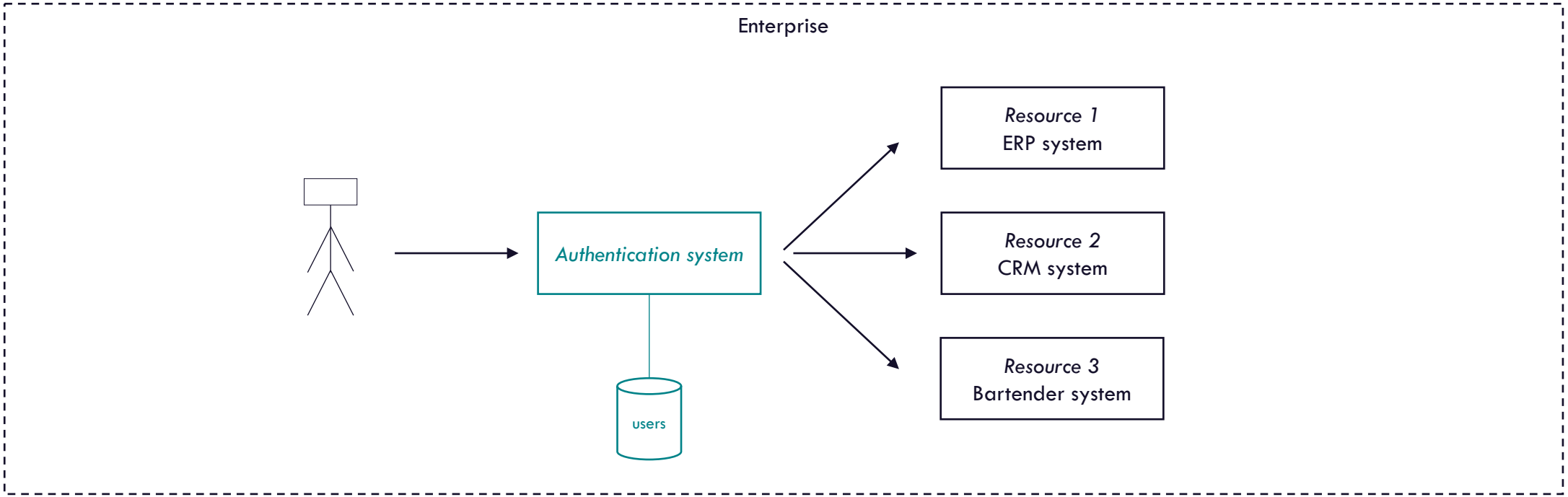
This was a lot better! Think Kerberos and Active Directory.

STAGE 1: EXTERNALIZE THE USER DIRECTORY



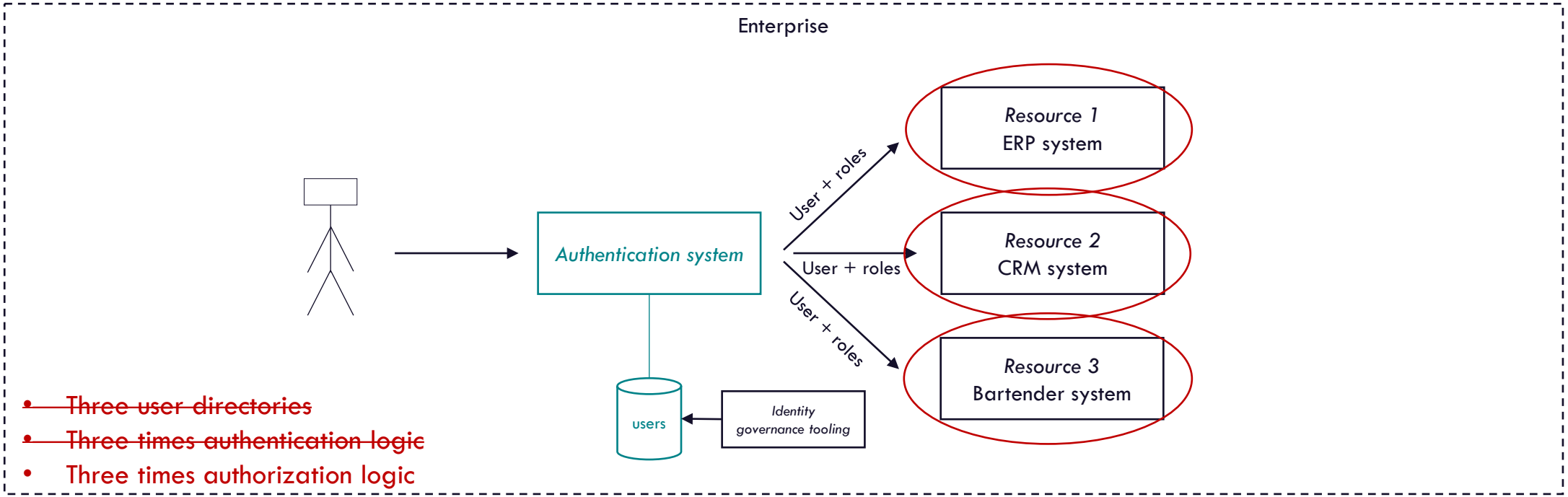
Still, the authentication logic was not shared

STAGE 2: EXTERNALIZE AUTHENTICATION



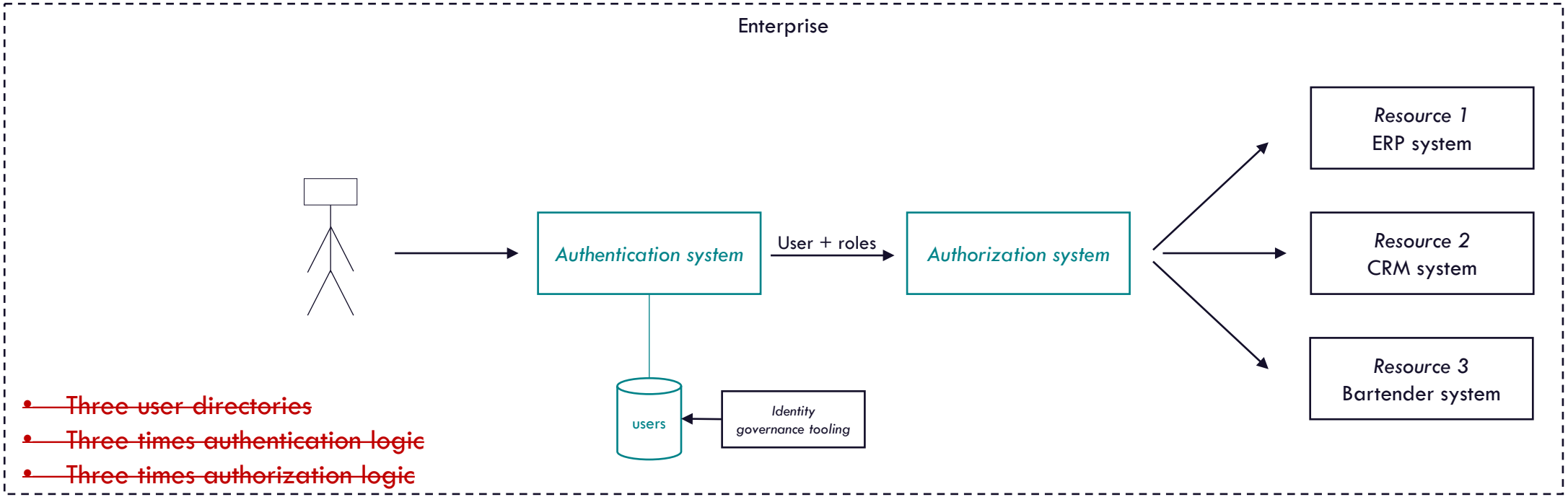
This currently is the state of the industry. Think SAML, OAuth2 and OIDC.

STAGE 2: EXTERNALIZE AUTHENTICATION



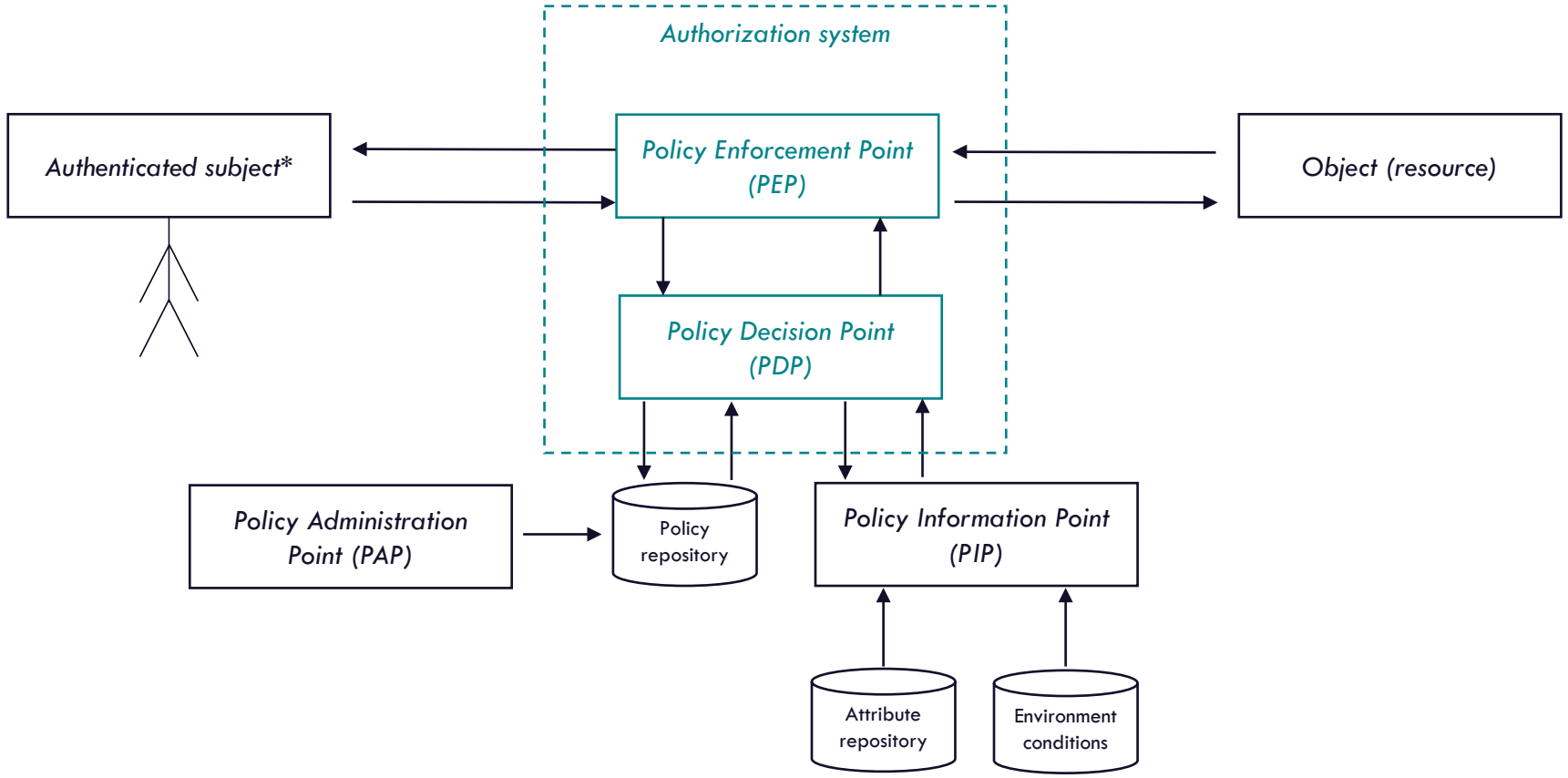
*But, what about authorization? Sure, roles are at best governed centrally. But **deciding what permissions are linked to these roles is still managed inside each system separately**.*

STAGE 3: SOLUTION - EXTERNALIZE AUTHORIZATION



Externalizing authorization provides increased control and thereby assurance, easier auditing and compliance reporting, and a centralized management point for all authorization policies.

STAGE 3: SOLUTION - EXTERNALIZE AUTHORIZATION



* *We leave the authentication problem behind us, and assume the subject is already authenticated.*

HOW IT’S DONE IN PRACTICE

LET'S BUILD A BARTENDER SYSTEM

Requirements:

- Every customer can order non-alcoholic beverages
- Only customers >=18 can order alcoholic beverages
- Bartenders can add new drinks to the system

WITHOUT EXTERNALIZATION – PURE RBAC

- The application is responsible to validate what a certain role is permitted to do.
- The developer decides - or forgets (**Broken Access Control is OWASP's number 1 risk**).
- It is ~~difficult~~ impossible to get a view on all permissions linked to a role: Can a customer do something else? And in a different application?

```
[Produces("application/json")]
[Route("api/managebar")]
[Authorize(Roles = "bartender")]
0 references
public class ManageBarController : Controller
{
    [HttpPost]
    0 references
    public IActionResult Post([FromBody] Drink model)
    {
        if (model == null || string.IsNullOrEmpty(model.DrinkName))
        {
            return BadRequest("Invalid data.");
        }

        return Ok($"Success! Drink added: {model.DrinkName}");
```

Bartenders can add new drinks to the system

```
[Produces("application/json")]
[Route("api/bar")]
[Authorize(Roles = "customer")]
0 references
public class BarController : Controller
{
    [HttpPost]
    0 references
    public IActionResult Post([FromBody] Drink drink)
    {
        if (drink == null || string.IsNullOrEmpty(drink.DrinkName))
        {
            return BadRequest("Invalid data.");
        }

        return Ok($"Success! Received order for: {drink.DrinkName}");
```

Every customer can order non-alcoholic beverages

WITHOUT EXTERNALIZATION – ADDING MORE COMPLICATED POLICIES

- The more complex the requirement, the more complex the code.
- **All repeated, for every single method in every single application.** (In a small application, there are easily hundreds of methods.)

```
[Produces("application/json")]
[Route("api/bar")]
[Authorize(Roles = "customer")]
[Authorize(Policy = "Over18Only")]
0 references
public class BarController : Controller
{
    [HttpPost]
    0 references
    public IActionResult Post([FromBody] Drink drink)
    {
        if (drink == null || string.IsNullOrEmpty(drink.DrinkName))
        {
            return BadRequest("Invalid data.");
        }
```

A customer >= 18 can order alcoholic beverages

```
1 reference
public class AgeHandler : AuthorizationHandler<AgeRequirement>
{
    0 references
    protected override Task HandleRequirementAsync(AuthorizationHandlerContext context, AgeRequirement requirement)
    {
        if (!context.User.HasClaim(c => c.Type == "http://schemas.microsoft.com/ws/2008/06/identity/claims/age"))
        {
            return Task.CompletedTask;
        }

        var ageClaim = context.User.FindFirst(c => c.Type == "http://schemas.microsoft.com/ws/2008/06/identity/claims/age").Value;
        if (int.TryParse(ageClaim, out var age))
        {
            if (age >= requirement.MinimumAge)
            {
                context.Succeed(requirement);
            }
        }

        return Task.CompletedTask;
    }
```

Detailed policy to get the age claim from the token

HELLO EXTERNALIZED AUTHORIZATION

- Get rid of authorization logic in the application.
- Only one requirement remains: the application must pass via the authorization system.

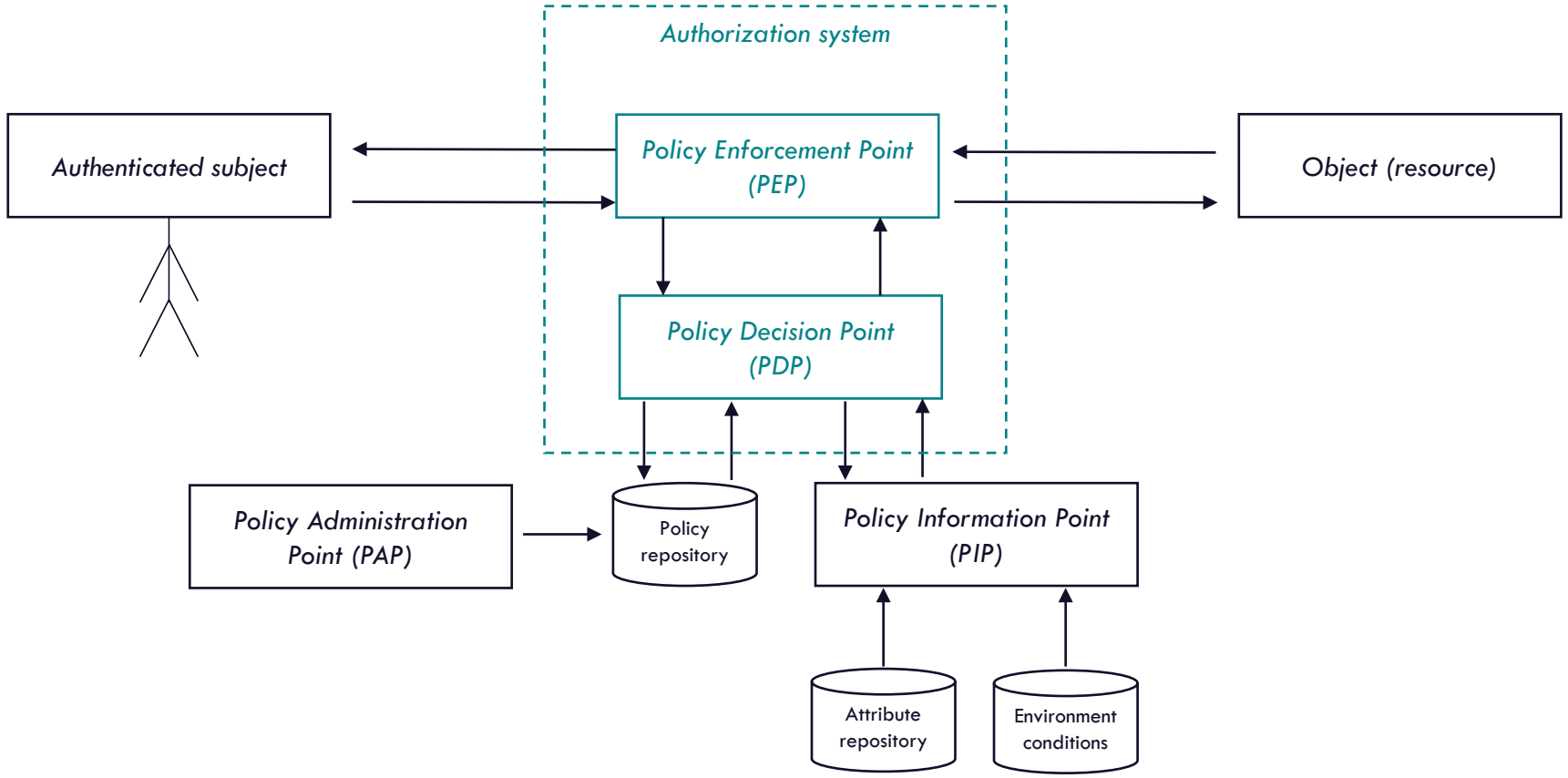
We can get rid of ALL authorization logic in the code.

```
[Produces("application/json")]
[Route("api/bar")]
[Authorize(Roles = "customer")]
[Authorize(Policy = "Over18Only")]
0 references
public class BarController : Controller
{
    [HttpPost]
    0 references
    public IActionResult Post([FromBody] Drink drink)
    {
        if (drink == null || string.IsNullOrEmpty(drink.DrinkName))
        {
            return BadRequest("Invalid data.");
        }

        return Ok($"Success! Received order for: {drink.DrinkName}");
```

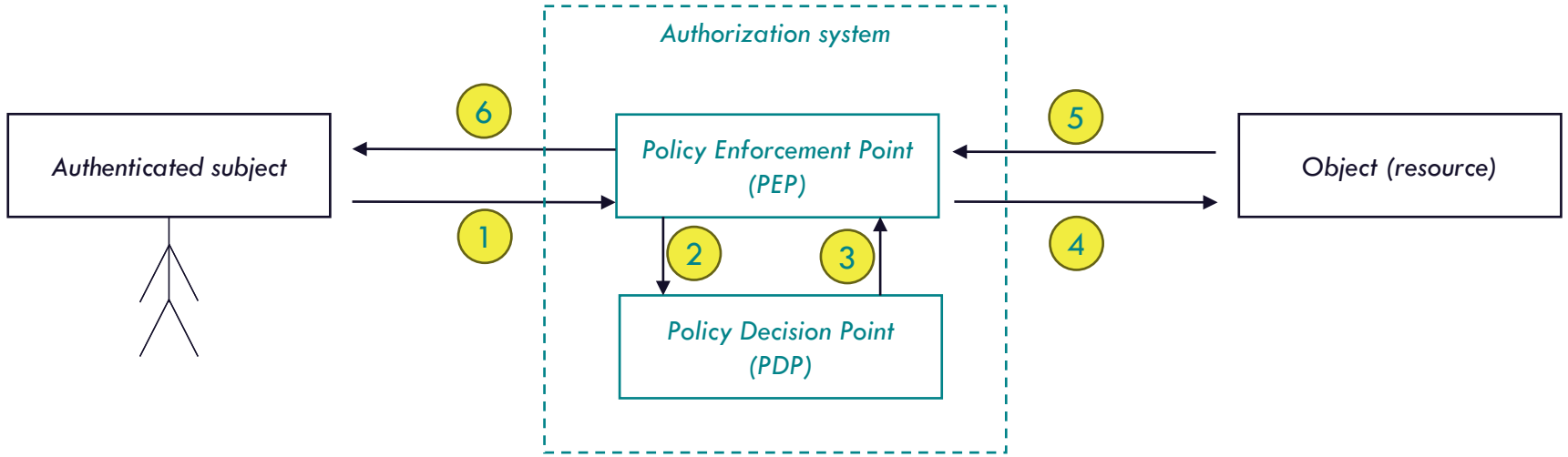
```
[Produces("application/json")]
[Route("api/bar")]
0 references
public class BarController : Controller
{
    [HttpPost]
    0 references
    public IActionResult Post([FromBody] Drink drink)
    {
        if (drink == null || string.IsNullOrEmpty(drink.DrinkName))
        {
            return BadRequest("Invalid data.");
        }

        return Ok($"Success! Received order for: {drink.DrinkName}");
```

DEMO TIME

DEMO: EXTERNALIZE AUTHORIZATION



DEMO: EXTERNALIZE AUTHORIZATION



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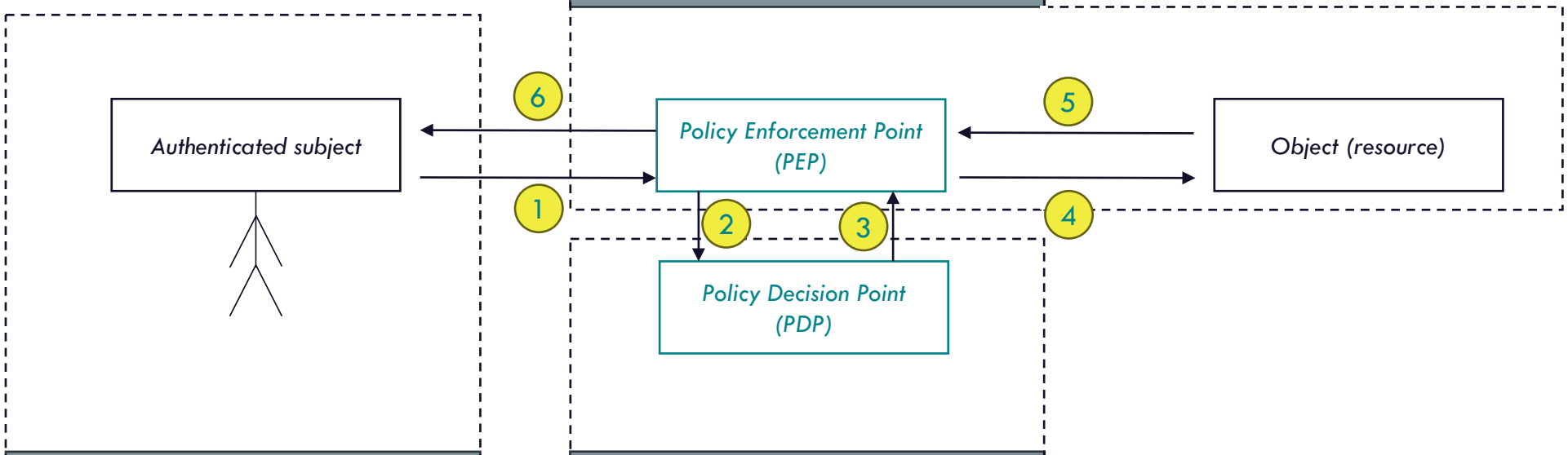
Component 2:
Bar API

Here orders are processed. The API is also the enforcement point as it will enforce a decision for all requests.



Component 1:
Drink order app

Customers use this app to order drinks

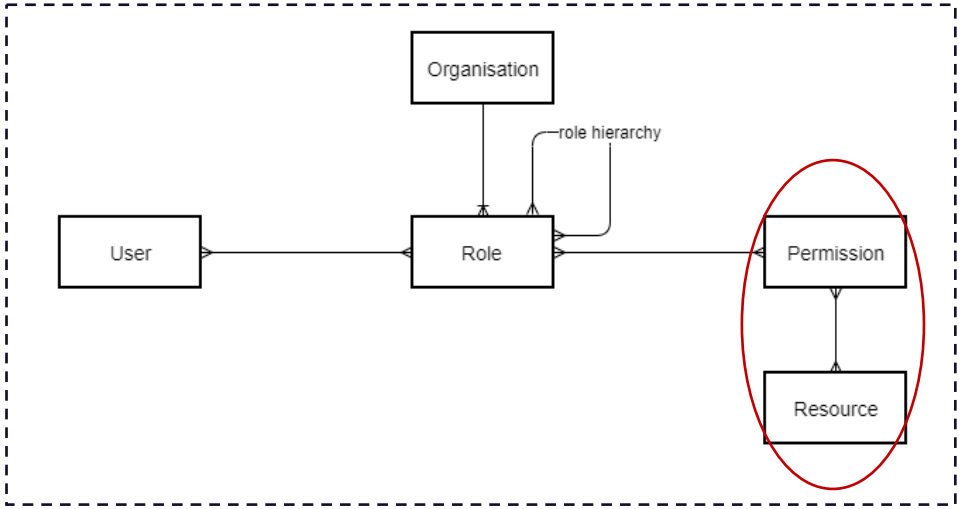
Component 3:
Open policy agent (open-source)

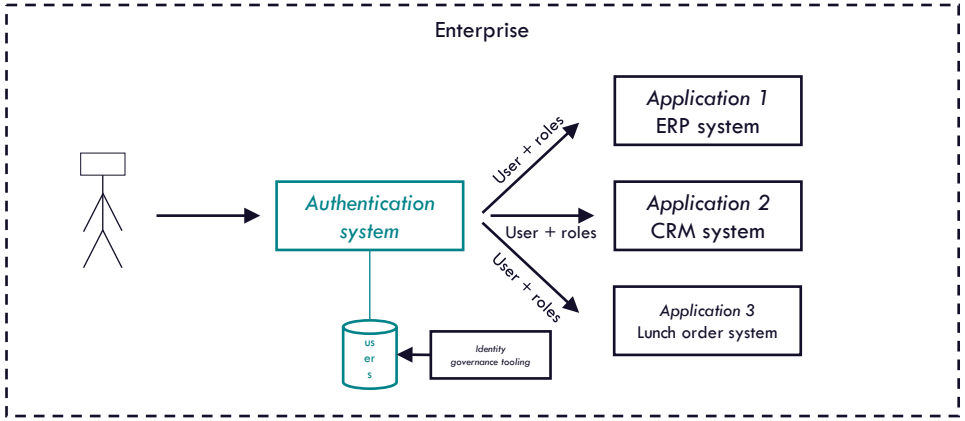
Here it is decided whether or not a request is authorized.

COMMON QUESTIONS

I'M USING SSO, DON'T I ALREADY HAVE CONTROL?

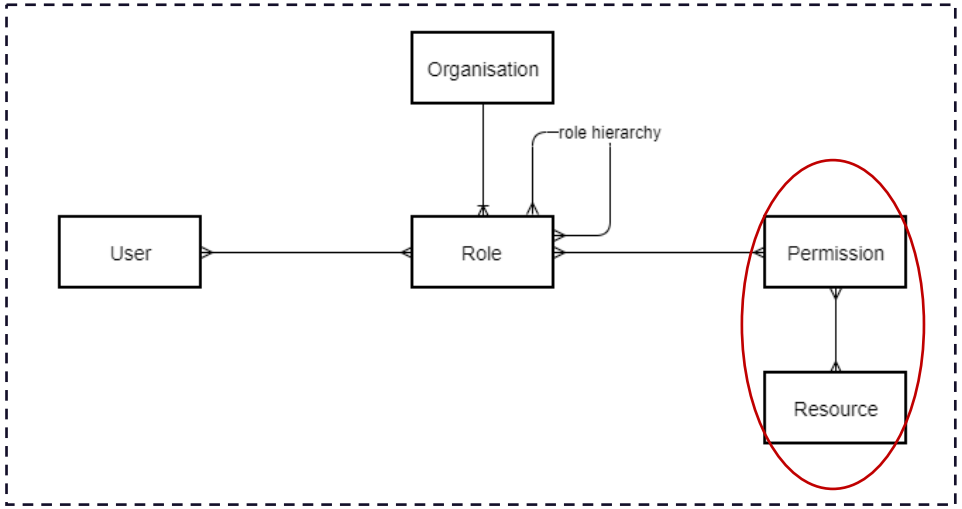
- ☑ You have control over your users.
- ☑ You have control over which users have which role.
- ☒ You have NO control over which users have which permissions in your applications.

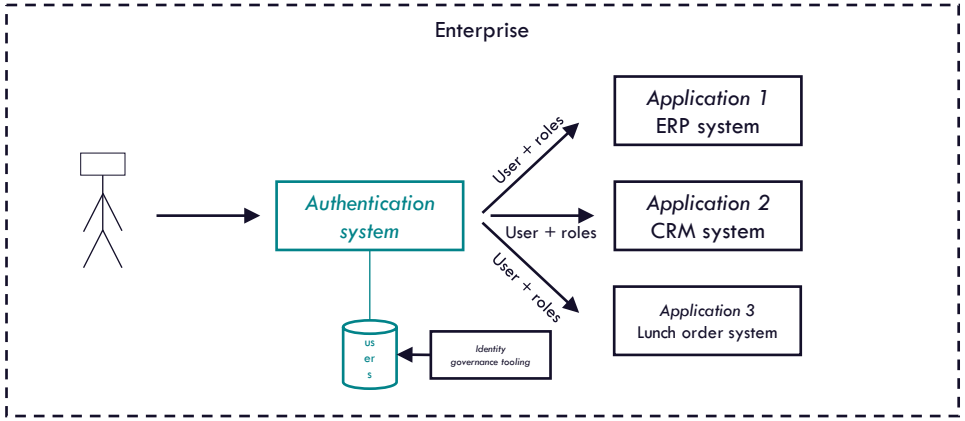




I'M USING CONDITIONAL ACCESS (E.G. MS ENTRA), DON'T I ALREADY HAVE CONTROL?

- ✓ You have control over your users.
- ✓ You have control over which users have which role.
- ✗ You have NO control over which users have which permissions in your applications.
- ✓ You have more control over your authentication: from which location is a user authenticating, at what time, etc.
- ✗ You have NO control over your authorization: has the user moved location after authentication, has the user copy pasted the authentication cookie onto another device, etc.?

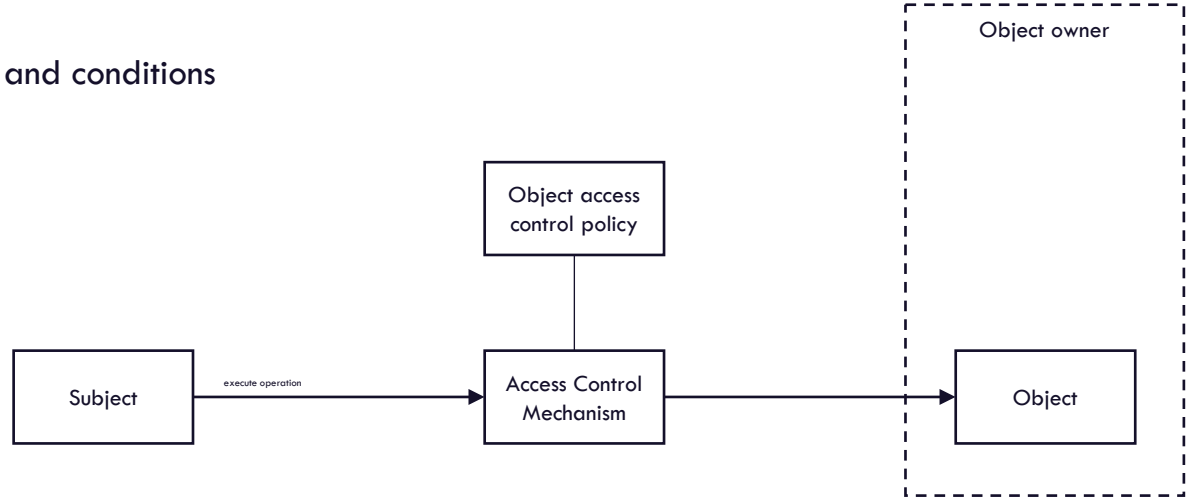




WHERE DOES ABAC FIT IN?

Externalizing authorization works with any model (RBAC, ABAC) but makes ***the transition to ABAC much simpler.***

- RBAC: An access control method where access is granted or denied based on role.
  - Permissions are grouped into roles
  - Users are assigned to a role
  - **Role explosion** is a real problem in many organizations.
- Attribute Based Access Control (ABAC)*: An access control method where access is granted or denied based on
  - assigned attributes of the subject
  - assigned attributes of the object
  - environment conditions
  - and a set of policies that are specified in terms of those attributes and conditions



** "PBAC" is an acceptable synonym.*

WHAT ABOUT XACML?

- XACML has long been the only standard way to implement ABAC;
- However, **XACML is not an implementation,** it is a policy definition language which is implemented by vendors such as Axiomatics or Forgerock
- **OPA is an implementation,** which uses REGO as policy definition language.

	Open Policy Agent (OPA) with REGO	XACML
Language	REGO (declarative, query-based)	XML-based policy language (a JSON profile is available)
Ease of Use	Generally considered more straightforward and flexible	Often seen as more complex due to XML verbosity and reliance on vendor implementations
Integration	Easily integrates with modern cloud-native environments, Kubernetes, microservices	Integrates with enterprise systems; often used in traditional IT environments
Community and Support	Growing community, with increasing support and adoption in cloud-native ecosystems	Established in enterprise environments with robust support but less prevalent in newer tech stacks
Standards Compliance	Not a standard; more of a tool/framework	Standardized by OASIS, ensuring consistent implementation across different platforms
Learning Curve	Moderate, with a need to learn REGO	Steeper, due to the complexity of XACML policies

CONCLUSION

BENEFITS OF EXTERNALIZING AUTHORIZATION

+

- Consistency in access decisions (and therefore less risk of introducing **Broken Access Control** vulnerabilities);
- Reusability of policies across multiple applications and services in different technologies (Kubernetes, Terraform, Kafka, Java, .Net, …);
- Flexibility and scalability since changes in authorization policies do not require a redeploy of applications;
- Modularity since business logic and security logic are decoupled (although the line between the two is sometimes very thin);
- Compliance through centralized policy monitoring and better audit trails;
- Future-readiness given the possibility to transition to ABAC easily (if required);

-

- Requires a high maturity in the access control domain;
- May introduce delays, although these can be limited using smart caching strategies.

*Note that **centralized** policy management does not necessarily mean introducing a single point of failure. OPA allows for having multiple PDPs, **managed** centrally.*

WHO ARE WE

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A cyber security company specialized in vendor-independent and risk-based consultancy, where we combine high-quality enterprise security architecture with in-depth technical cyber security expertise.

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Feel free to contact us for gaining access to the code used in this demo, or for additional information.

QUESTIONS?