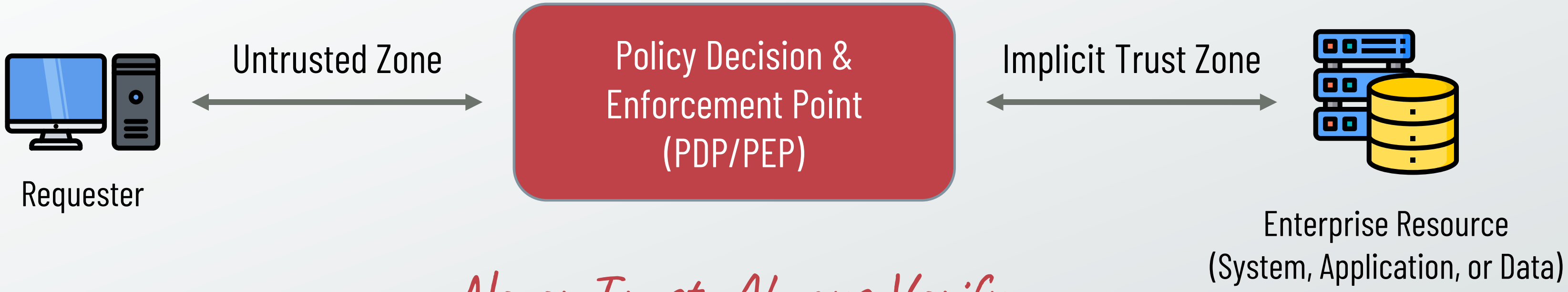
Zero Trust Architecture (ZTA) Fundamentals

NIST Zero Trust Architectural Model

Simplified View of ZTA



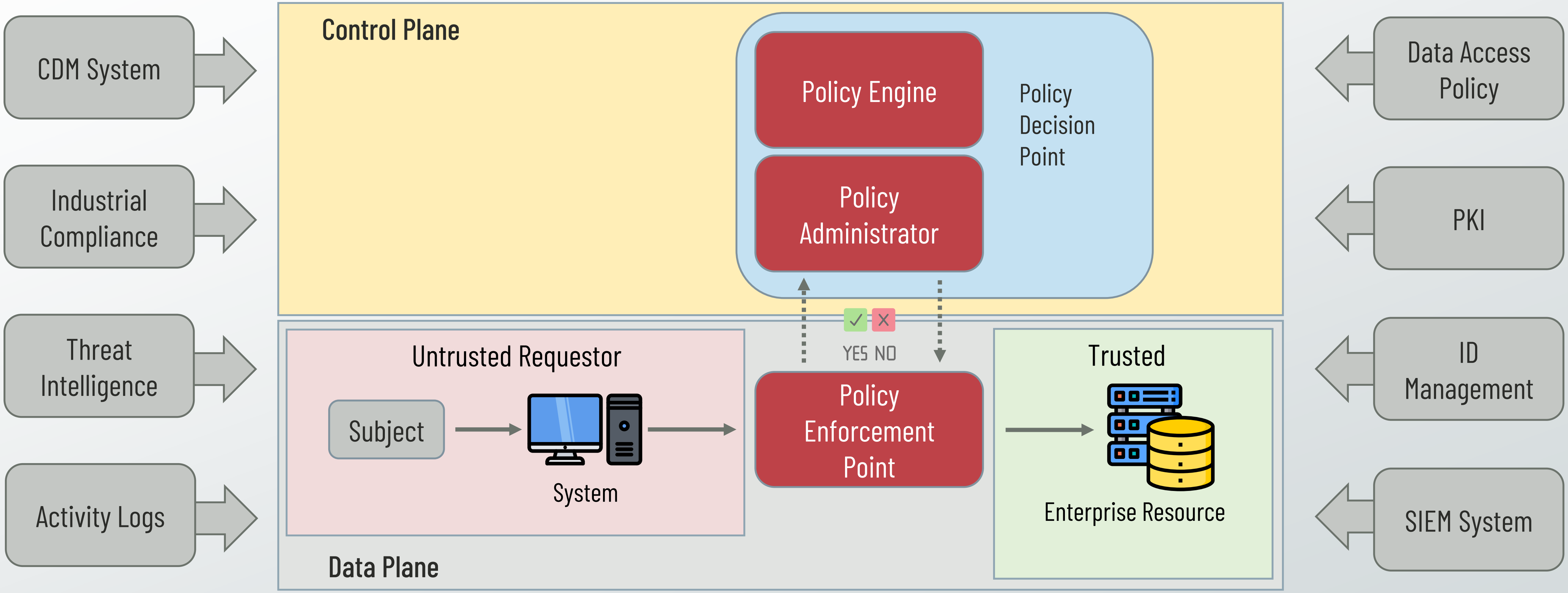
Requester
Untrusted Zone
Policy Decision & Enforcement Point (PDP/PEP)
Implicit Trust Zone
Enterprise Resource (System, Application, or Data)

Never Trust, Always Verify.

NIST SP 800-207: Zero Trust Architecture

NIST Zero Trust Architectural Model

Widely Accepted Vendor Neutral Conceptual Model



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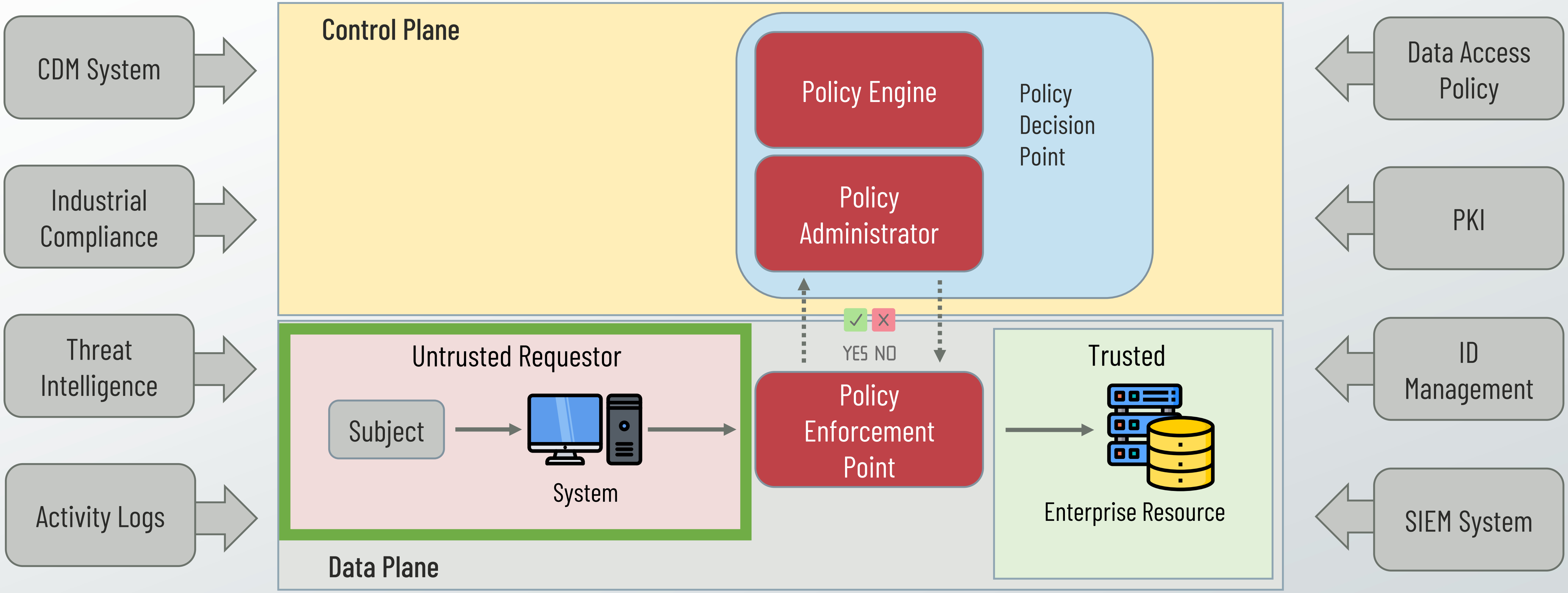
ZTA Logical Components



Untrusted Requestor: Per the basic tenets of Zero Trust, the requester is untrusted by default and is only allowed access to trusted resources via the Policy Enforcement Point (PEP).

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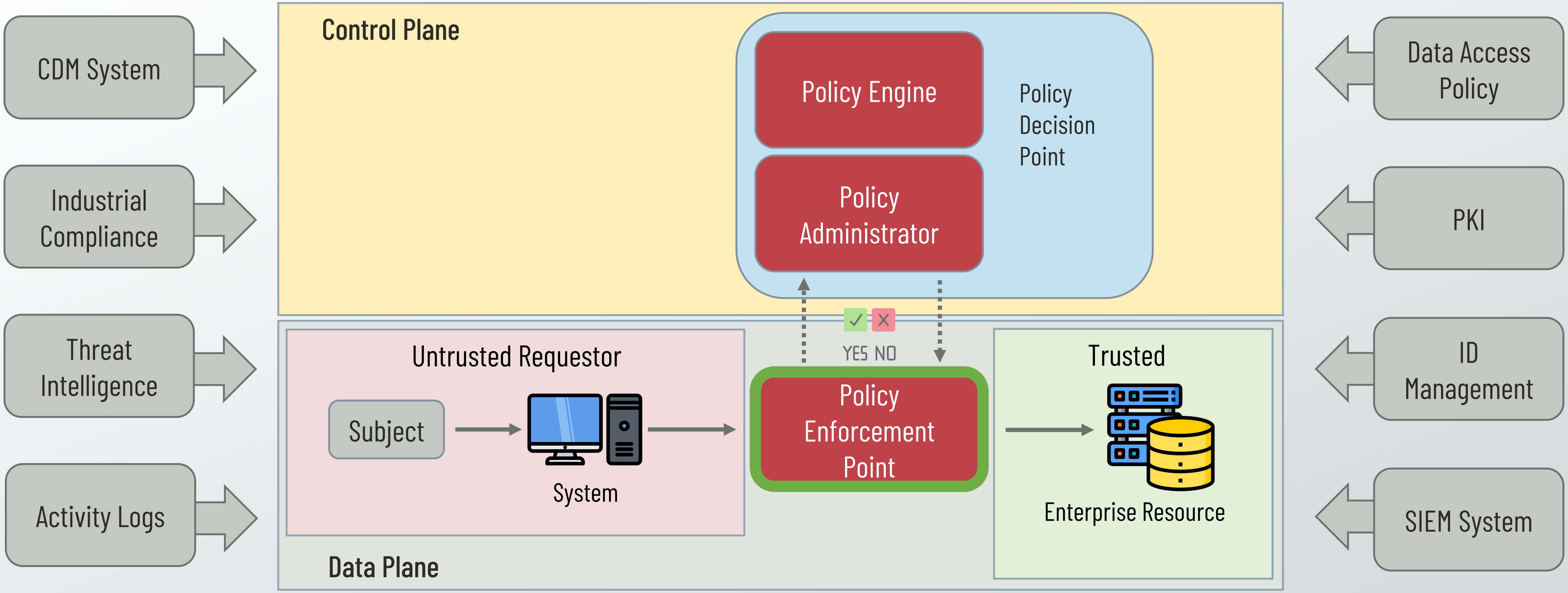
ZTA Logical Components



Policy Enforcement Point (PEP): The PEP enables, monitors, and terminates connections between a subject and enterprise resource via communicating with the Policy Administrator (PA).

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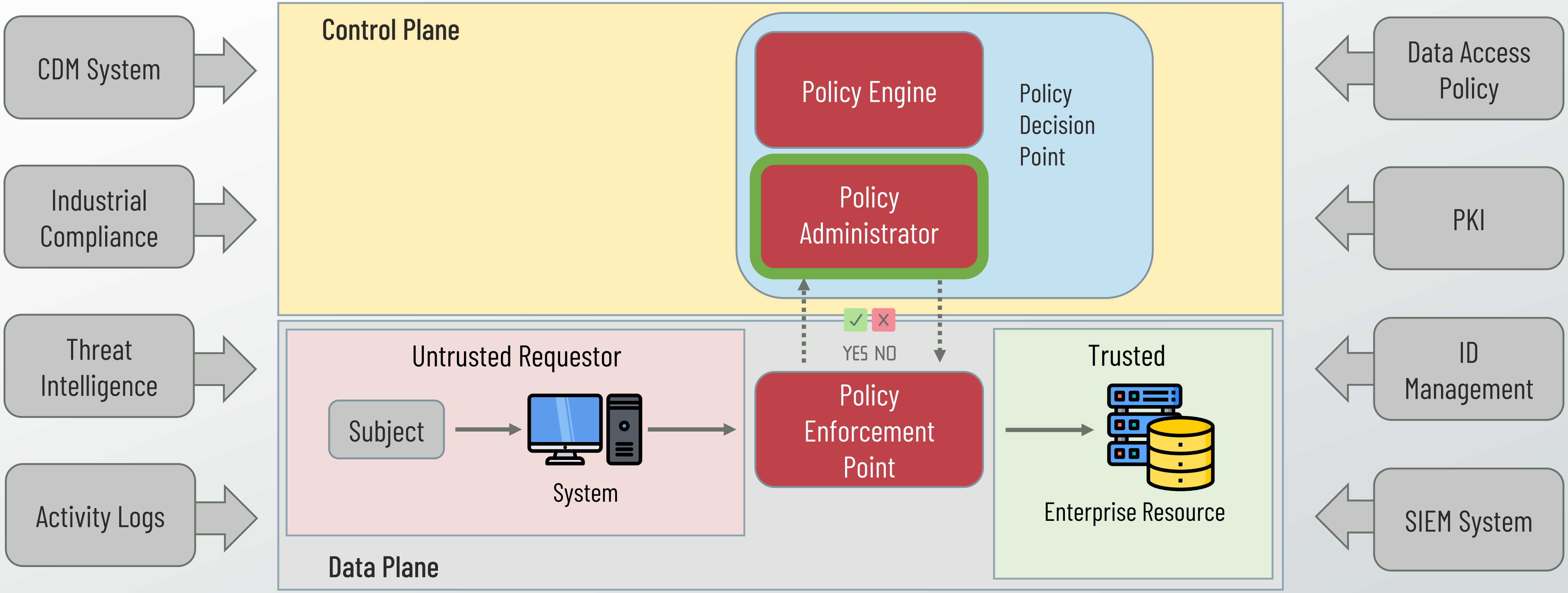
ZTA Logical Components



Policy Administrator (PA): The PA executes the Policy Engine’s decision to either approve or deny access by signaling the PEP to create or block a connection.

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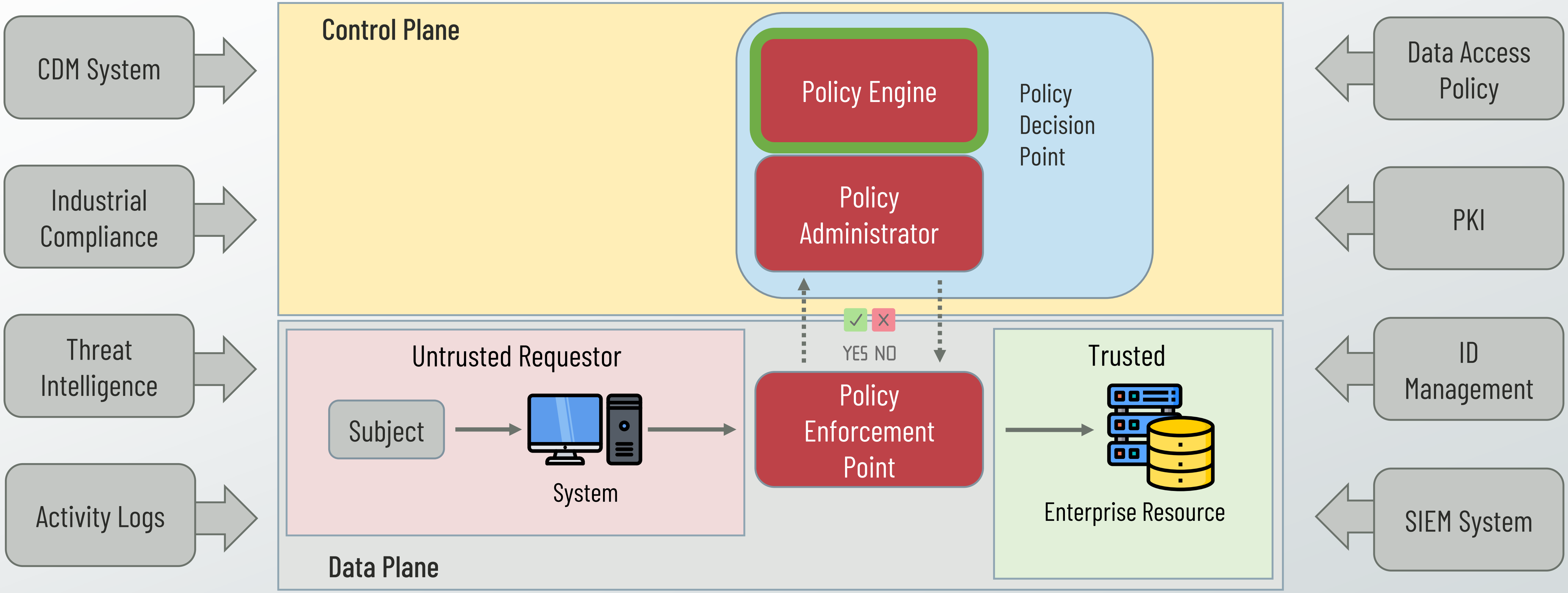
ZTA Logical Components



Policy Engine (PE): The PE evaluates input signals and compares them with access policies to determine whether access should be granted to the trusted enterprise resource.

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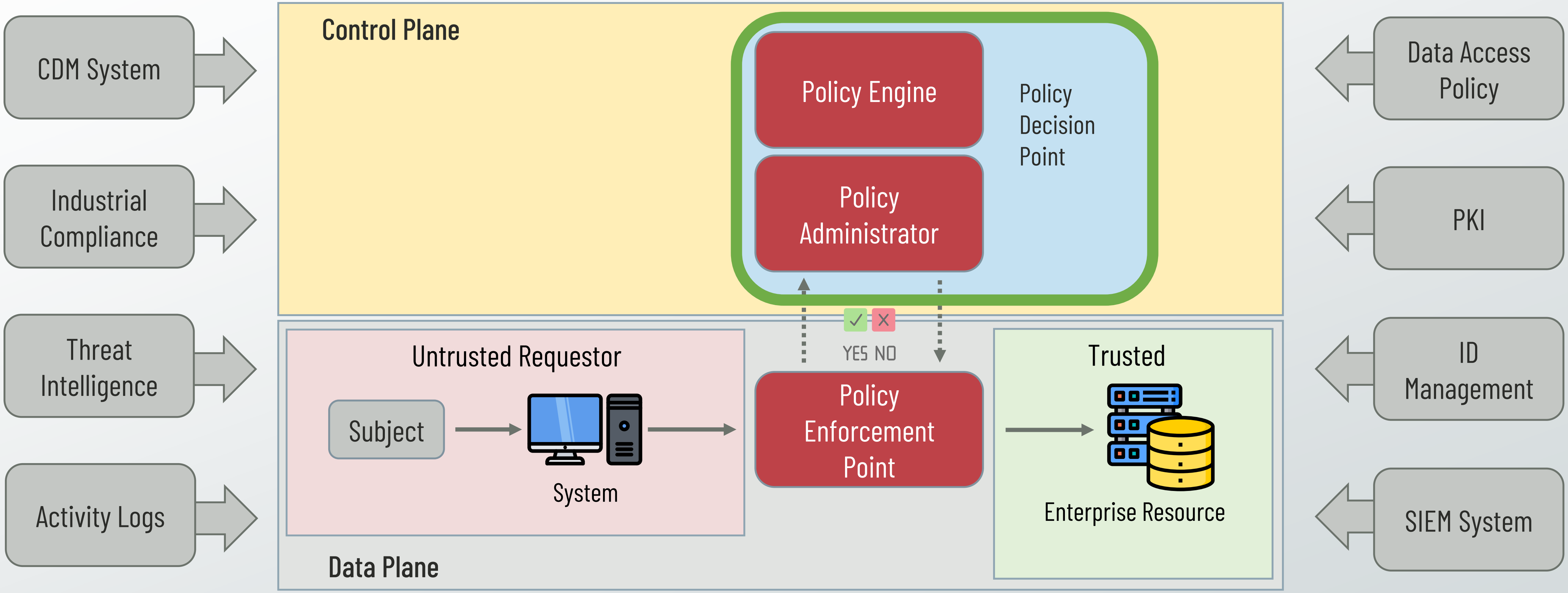
ZTA Logical Components



Policy Decision Point (PDP): The PE and PA working in conjunction with one another within the Control Plane.

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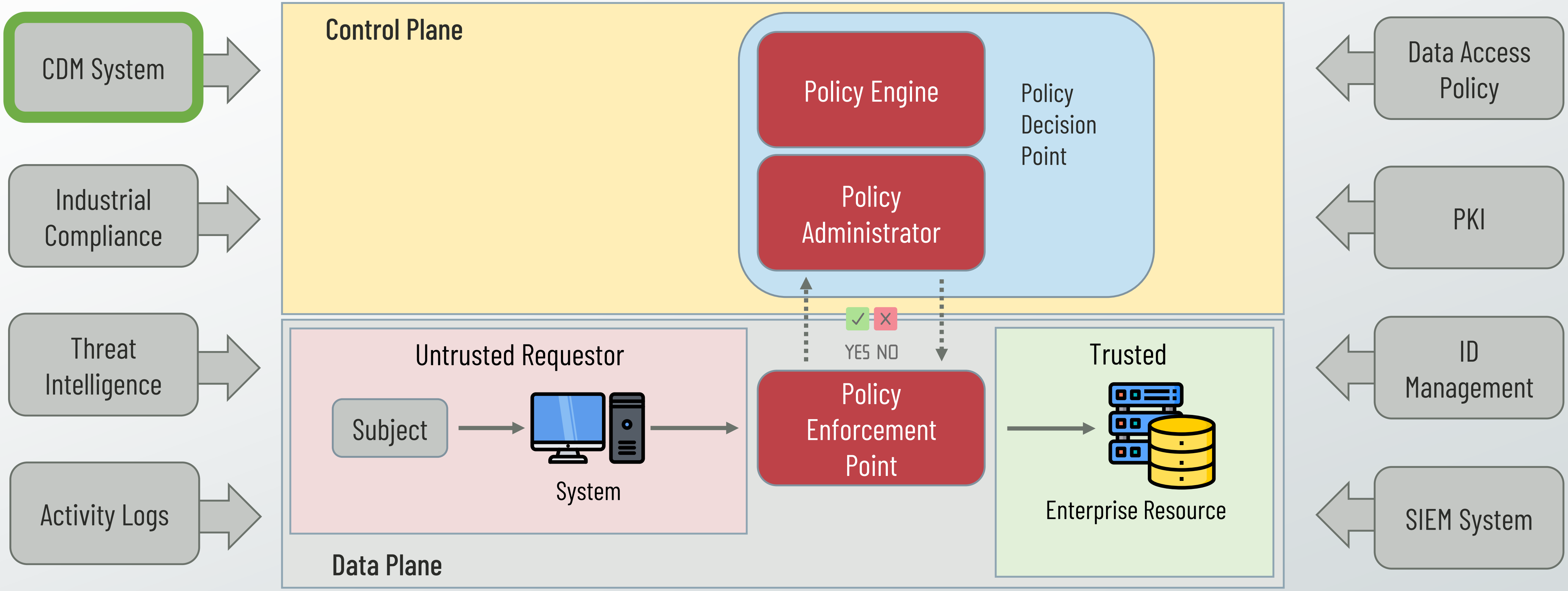
ZTA Data Sources



Continuous Diagnostics and Mitigation (CDM) System: CDM systems collect information regarding enterprise-owned systems to determine their current state and apply configuration and software updates, as needed.

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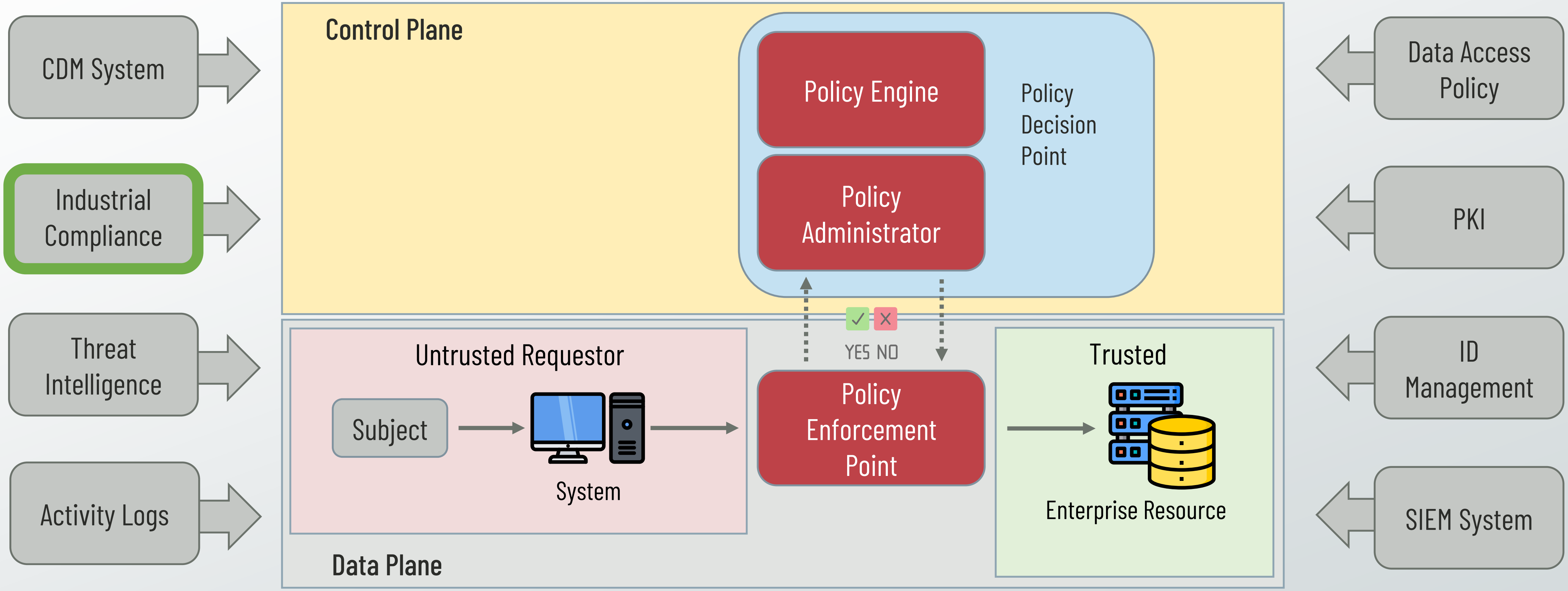
ZTA Data Sources



Industrial Compliance System: This system ensures the enterprise remains compliant with regulatory requirements, such as FISMA, HIPAA, PCI DSS, etc.

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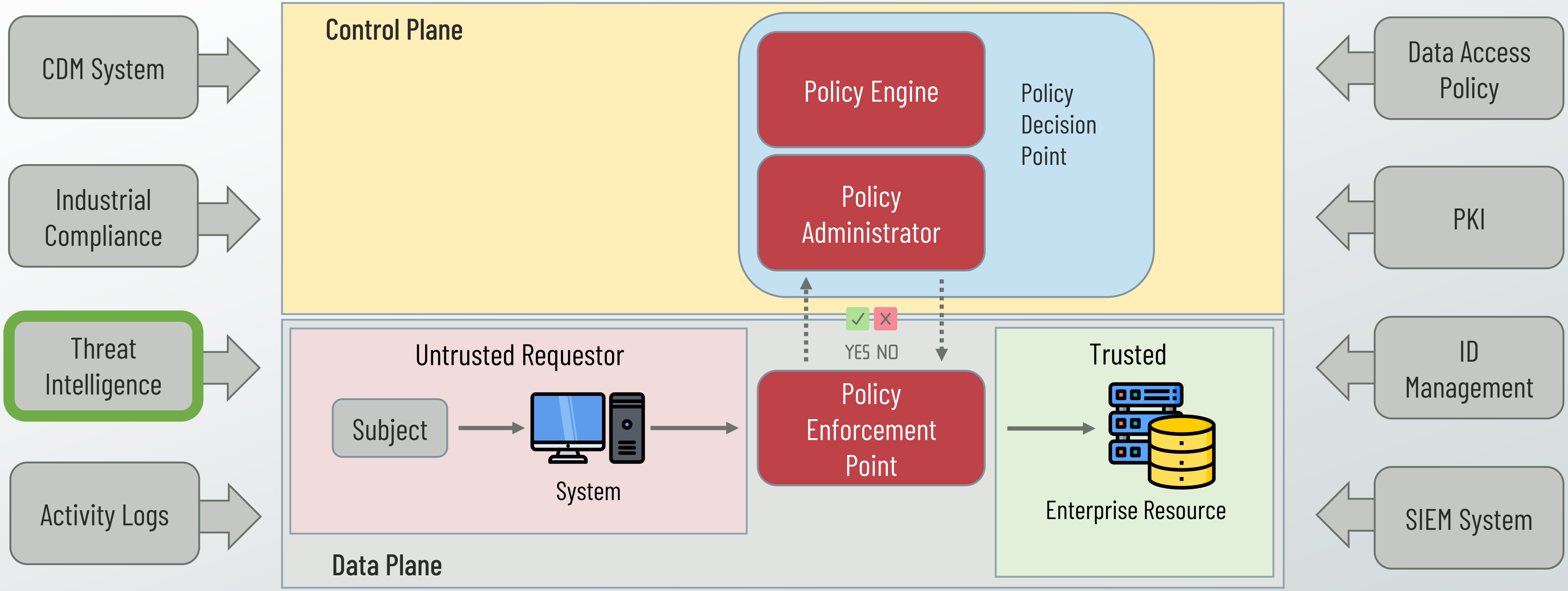
ZTA Data Sources



Threat Intelligence Feeds: These are database feeds that provide information regarding newly discovered attacks and vulnerabilities, which are used to help the enterprise understand emerging cyber threats.

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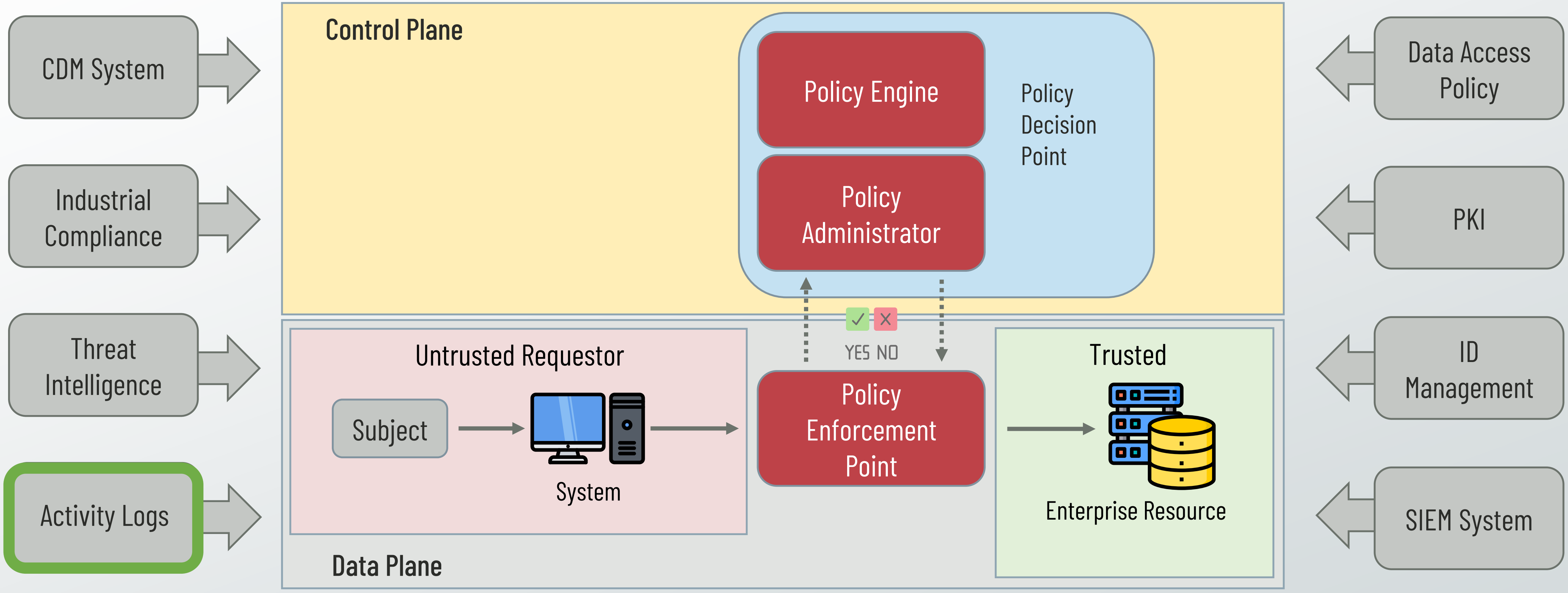
NIST Zero Trust Architectural Model

ZTA Data Sources



Network and System Activity Logs: These are aggregated to provide real-time or near real-time feedback on the security posture of enterprise IT systems.

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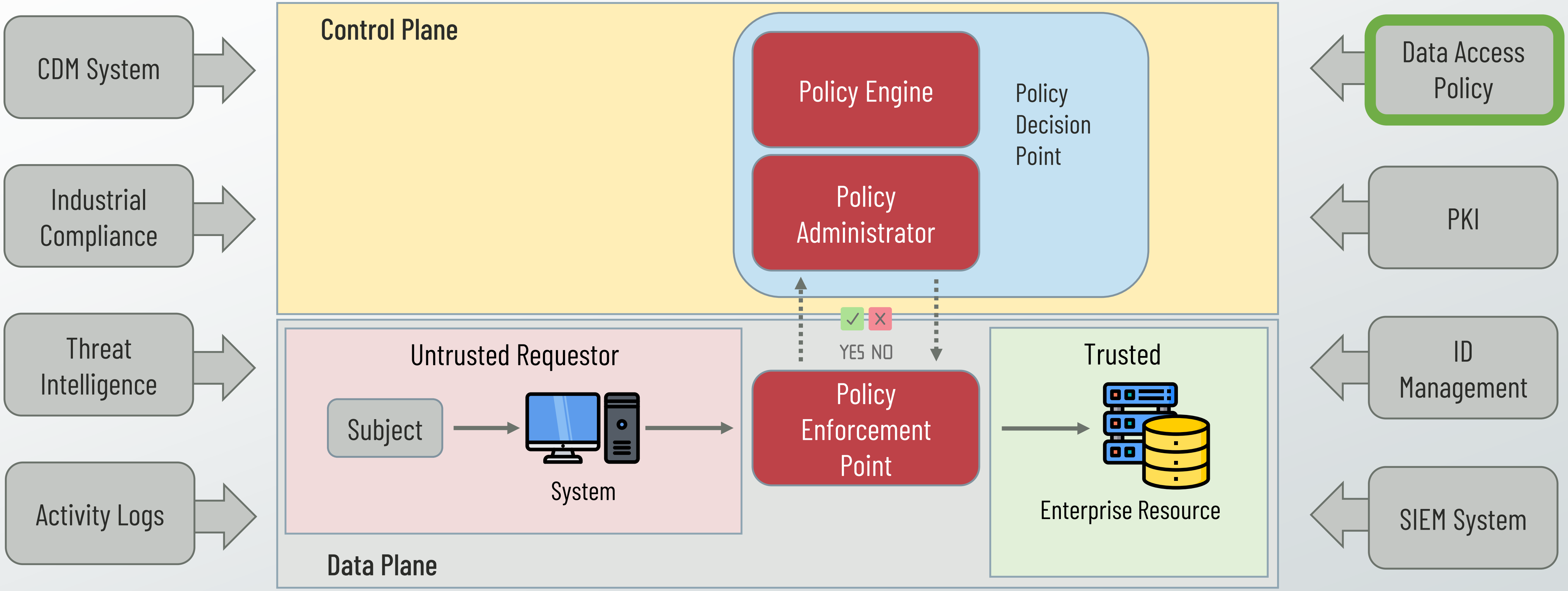
ZTA Data Sources



Data Access Policies: These are attributes, rules, and policies that help determine how access is granted to trusted enterprise resources.

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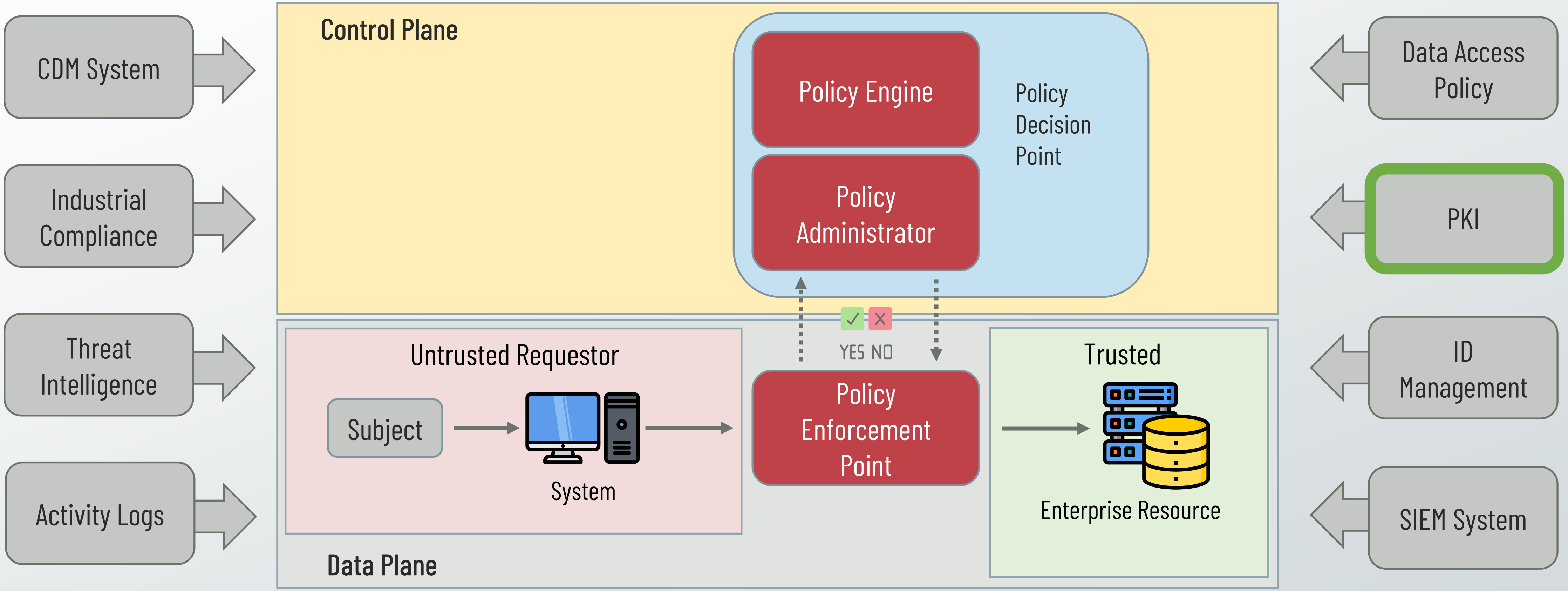
NIST Zero Trust Architectural Model

ZTA Data Sources



Enterprise Public Key Infrastructure (PKI): PKI is responsible for generating and logging certificates issued by the enterprise to subjects, resources, and applications.

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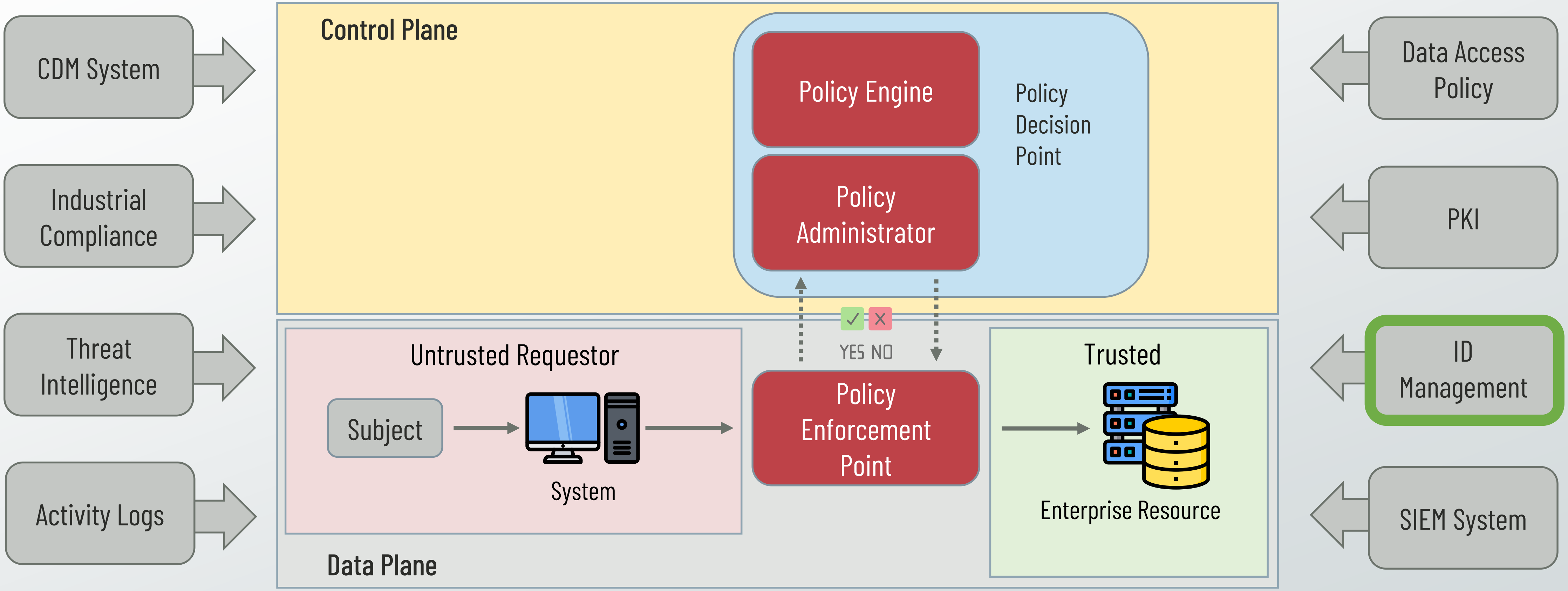
ZTA Data Sources



ID Management System: This system is responsible for creating, storing, and managing enterprise user accounts and identity records.

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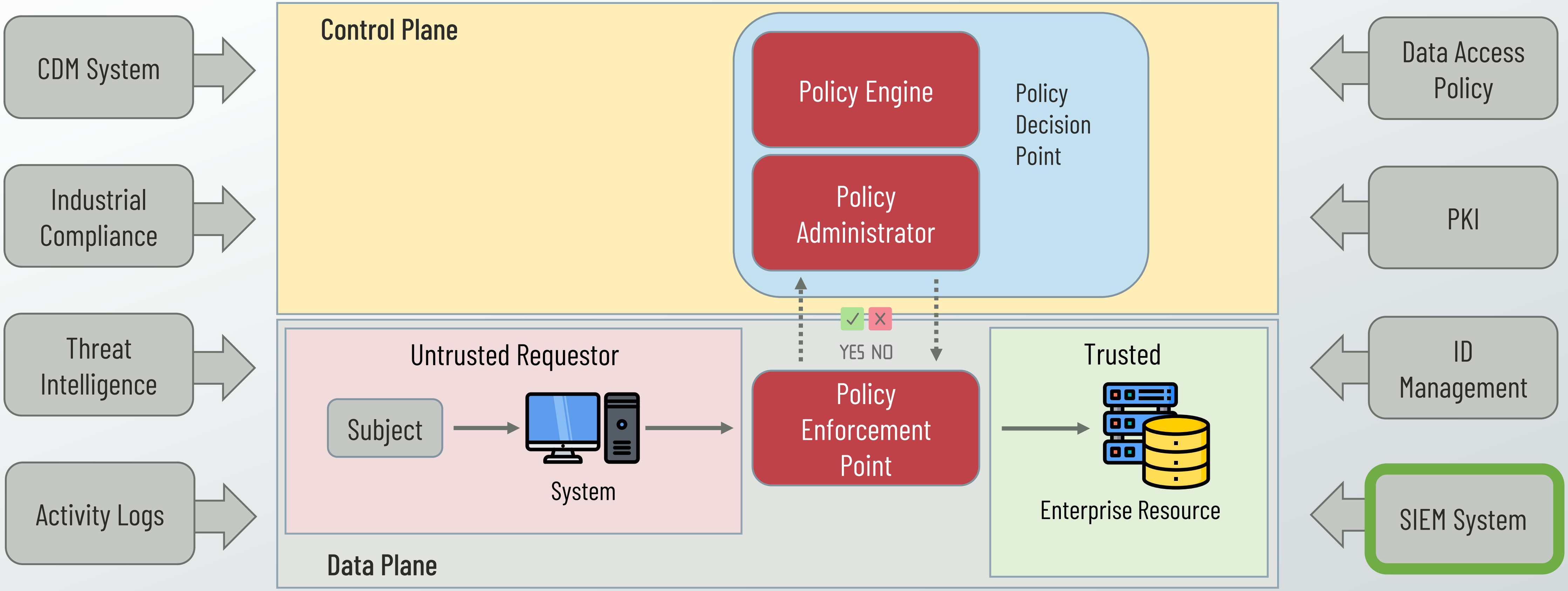
ZTA Data Sources



Security Information and Event Management (SIEM) System: The SIEM system collects, aggregates, and analyzes security-centric information, which helps the enterprise recognize potential cyber threats, as well as refine policies.

NIST SP 800-207: Zero Trust Architecture

Real-Life ZTA Solutions

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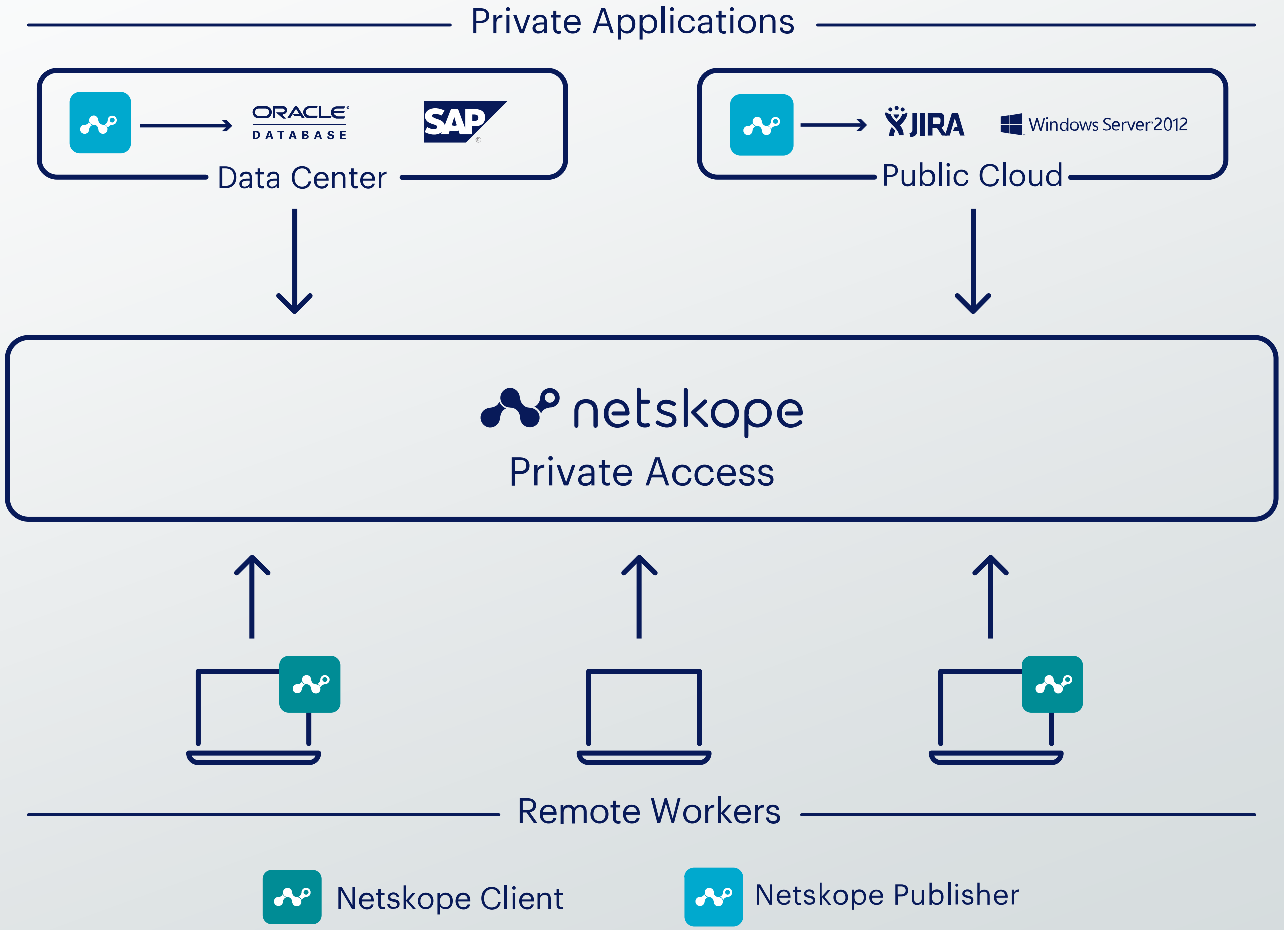
Netskope Private Access



https://www.netskope.com/products/private-access

Real-Life ZTA Solutions

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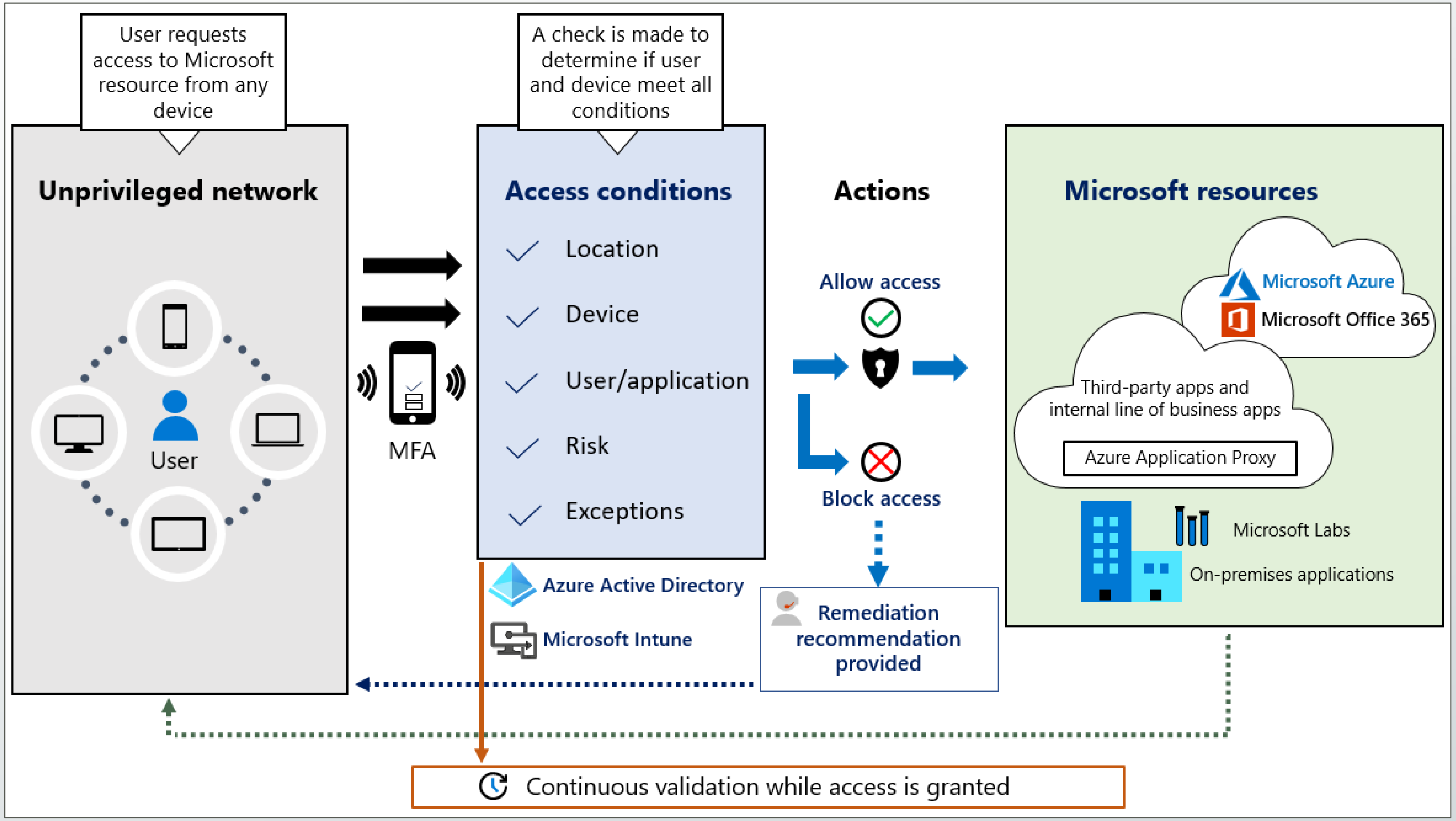
Microsoft's Internal Zero Trust Architecture



https://www.microsoft.com/insidetrack/blog/implementing-a-zero-trust-security-model-at-microsoft/

NIST ZT Architecture Approaches

ZTA Workflow Approaches

Enhanced Identity Governance	• Utilizes identity as the main source of policy creation.
Micro-Segmentation	• Utilizes network segments to protect enterprise resources.
Software Defined Perimeters	• Utilizes software defined network perimeters.

NIST SP 800-207: Zero Trust Architecture

Device Agent/Gateway Deployment Model

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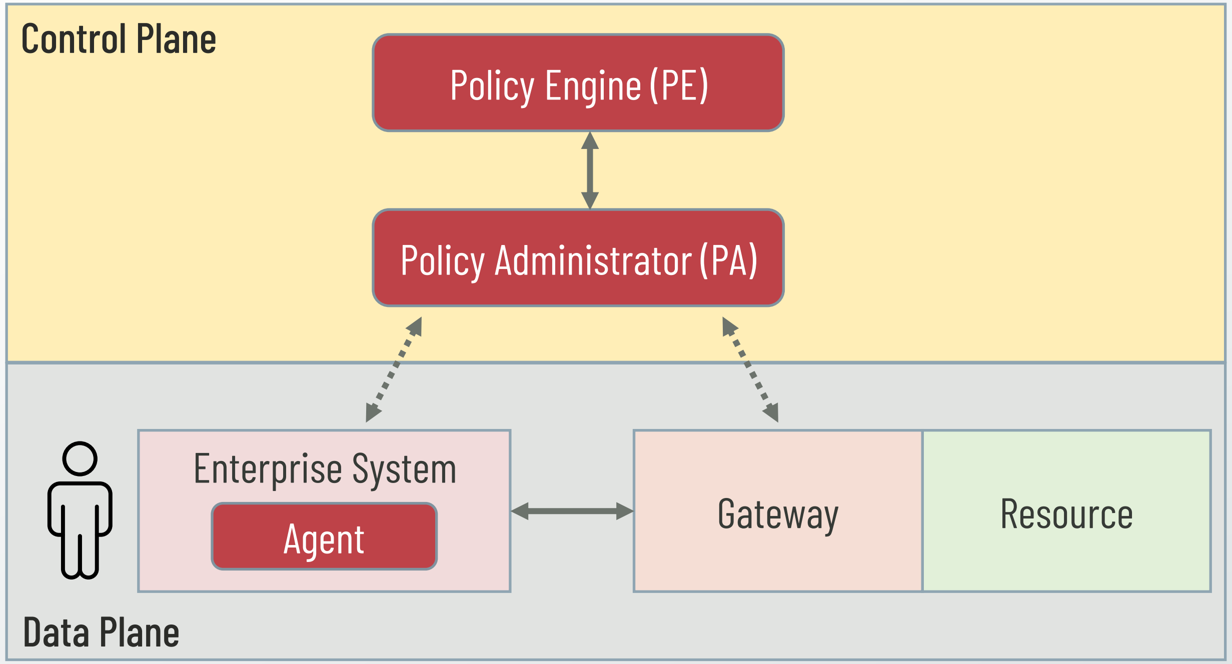

Deployment Model Details

- A user agent PEP is deployed on all enterprise systems.
- The user agent PEP communicates with the PA.
- If approved by the PE, the PA will establish a communication channel between the user agent PEP and resource gateway.

NIST SP 800-207: Zero Trust Architecture

Enclave-Based Deployment Model

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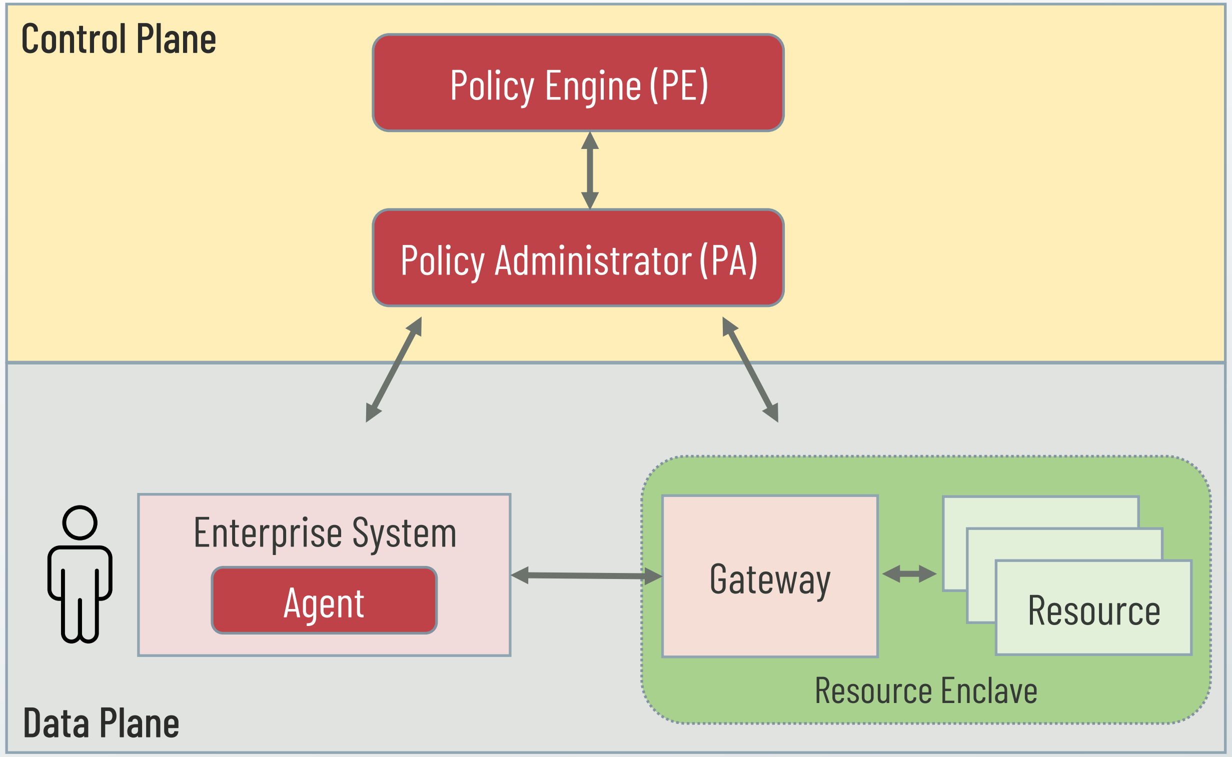

Deployment Model Details

- Variation of the Agent/Gateway Model
- The Gateway protects several resources, instead of one, called a Resource Enclave.

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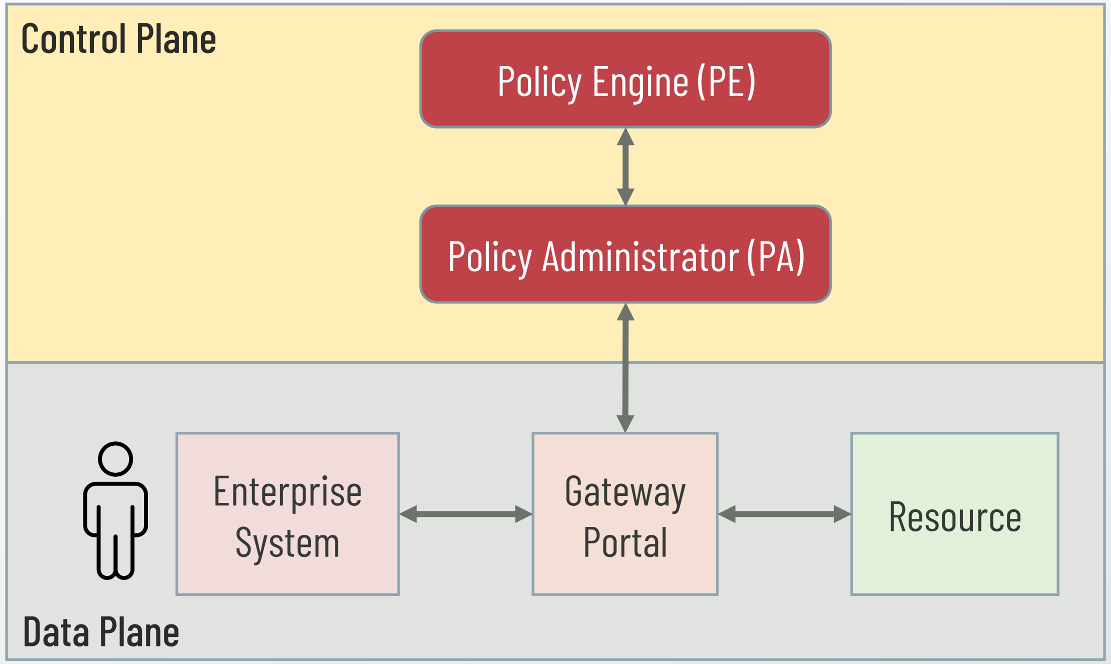
Resource Portal Deployment Model



Deployment Model Details

- Agentless Deployment Model
- The user utilizes a Gateway Web Portal to access protected resources.
- May provide access to a single resource or resource enclave.

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Trust Algorithms & Policies Fundamentals

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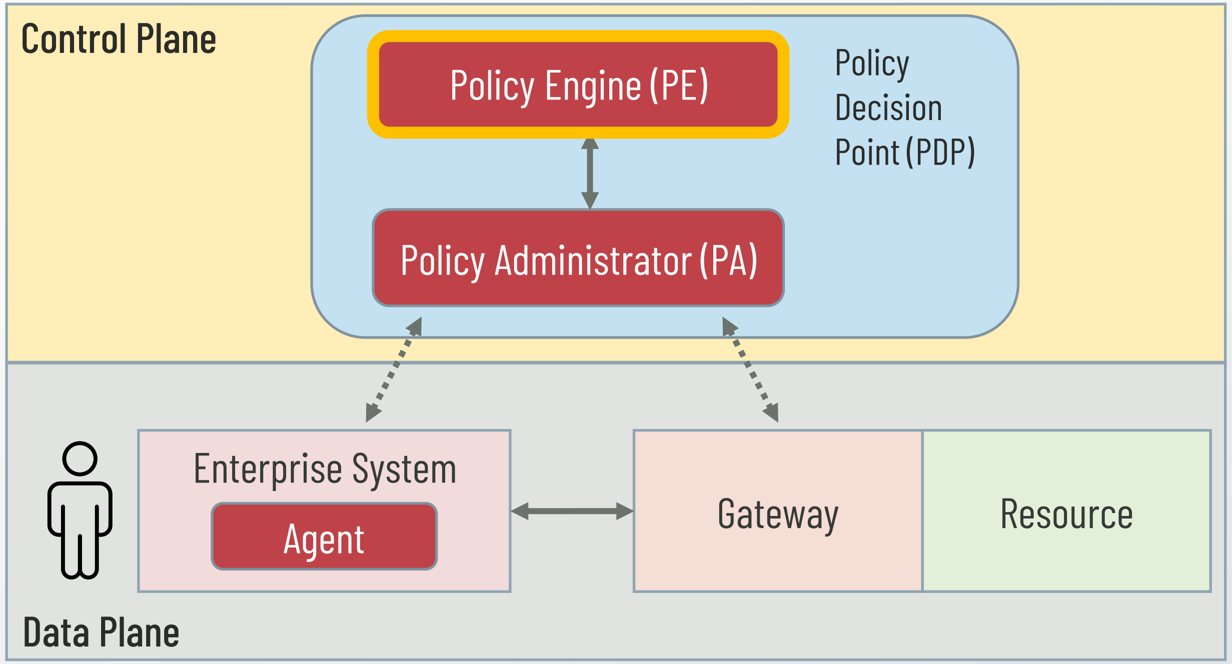


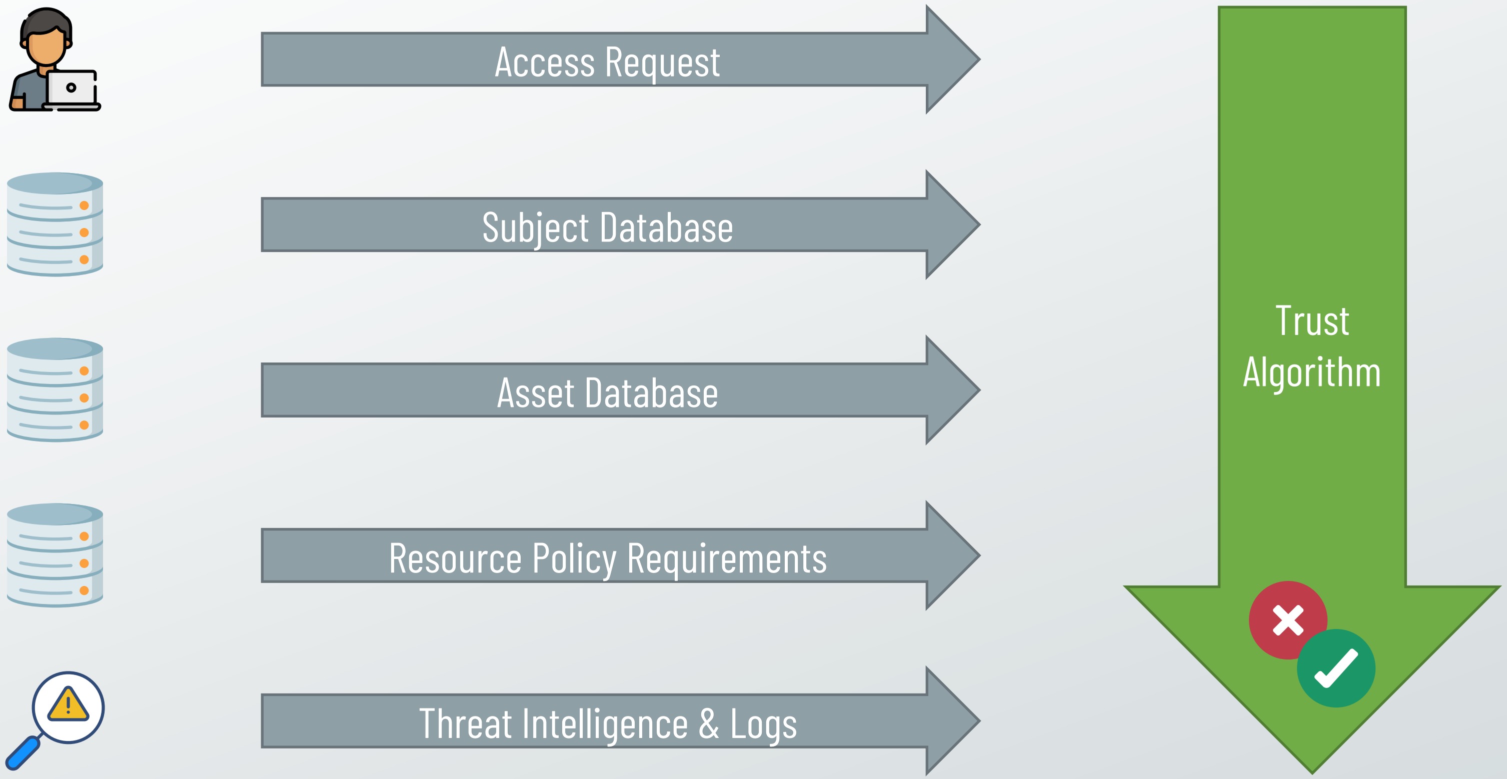
Device Agent/Gateway Deployment Model

Overview

- The PE is the brains of the PDP.
- The PE uses trust algorithms to determine whether to grant or deny access to an enterprise resource.
- The PE utilizes inputs from multiple data sources, as well as a policy database.
- The policy database contains:
  - ✓ Observable Information About Subjects
  - ✓ Subject Attributes and Roles
  - ✓ Historical Subject Behavior Patterns
  - ✓ Threat Intelligence Sources
  - ✓ Other Metadata Sources

NIST SP 800-207: Zero Trust Architecture

Trust Algorithm Inputs



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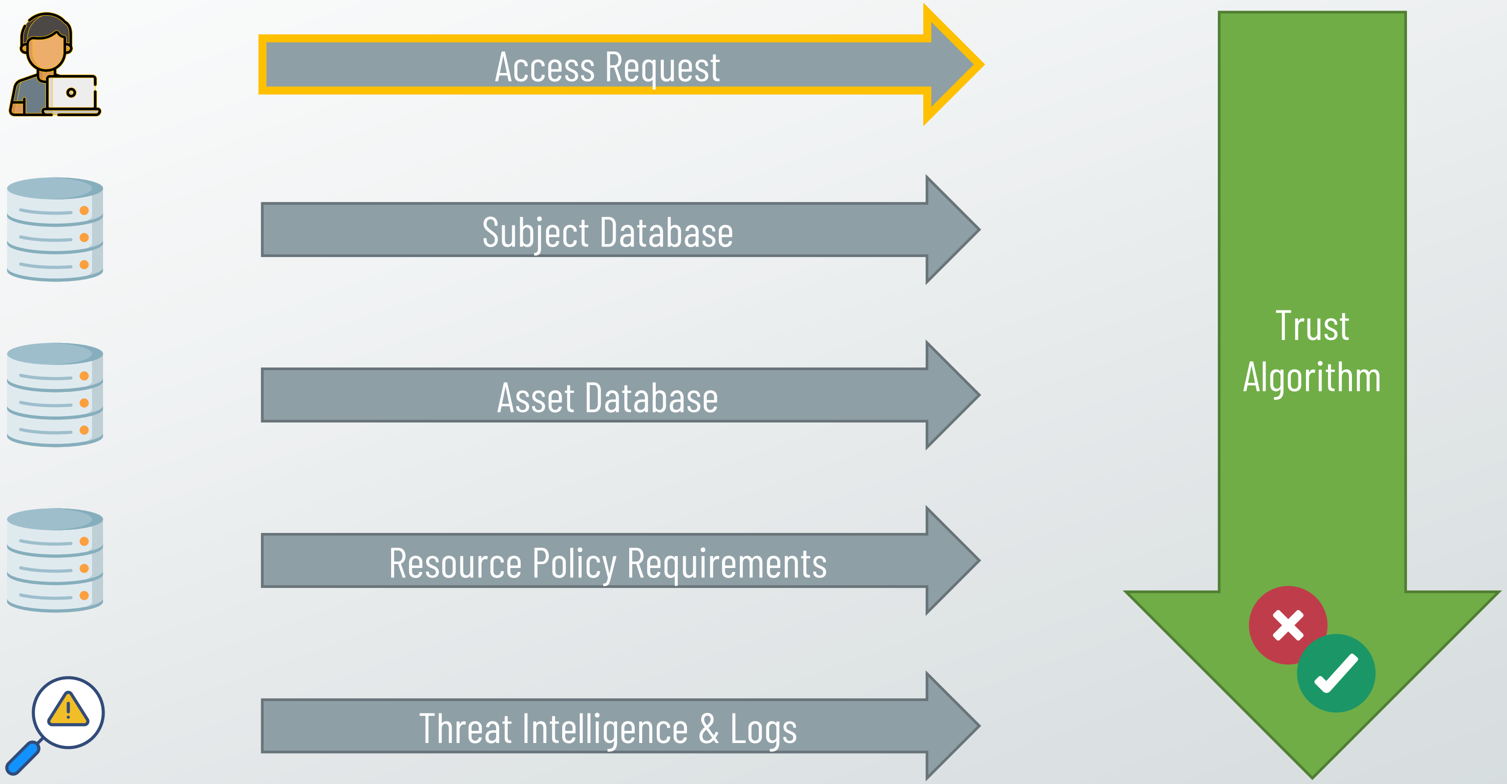
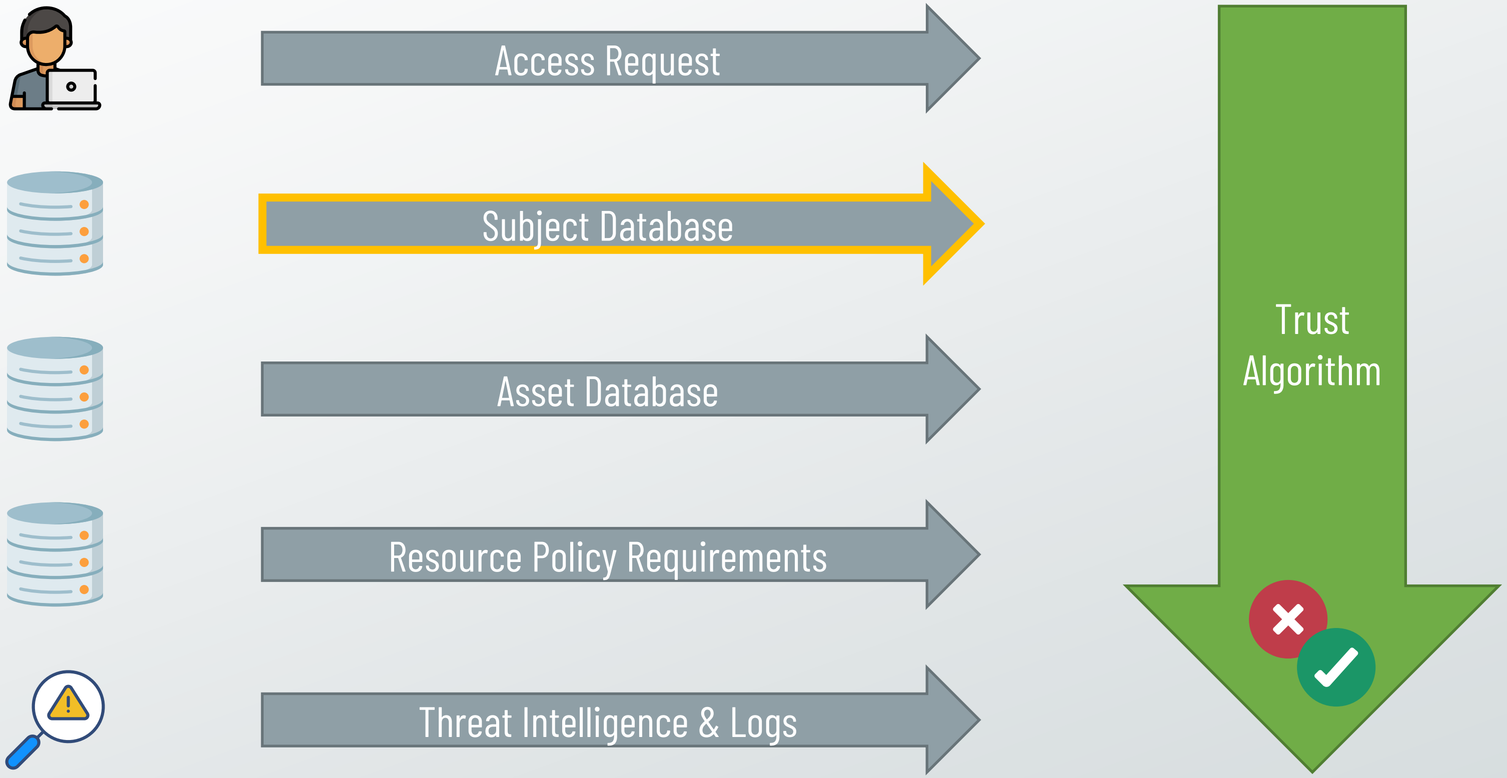
Trust Algorithm Inputs



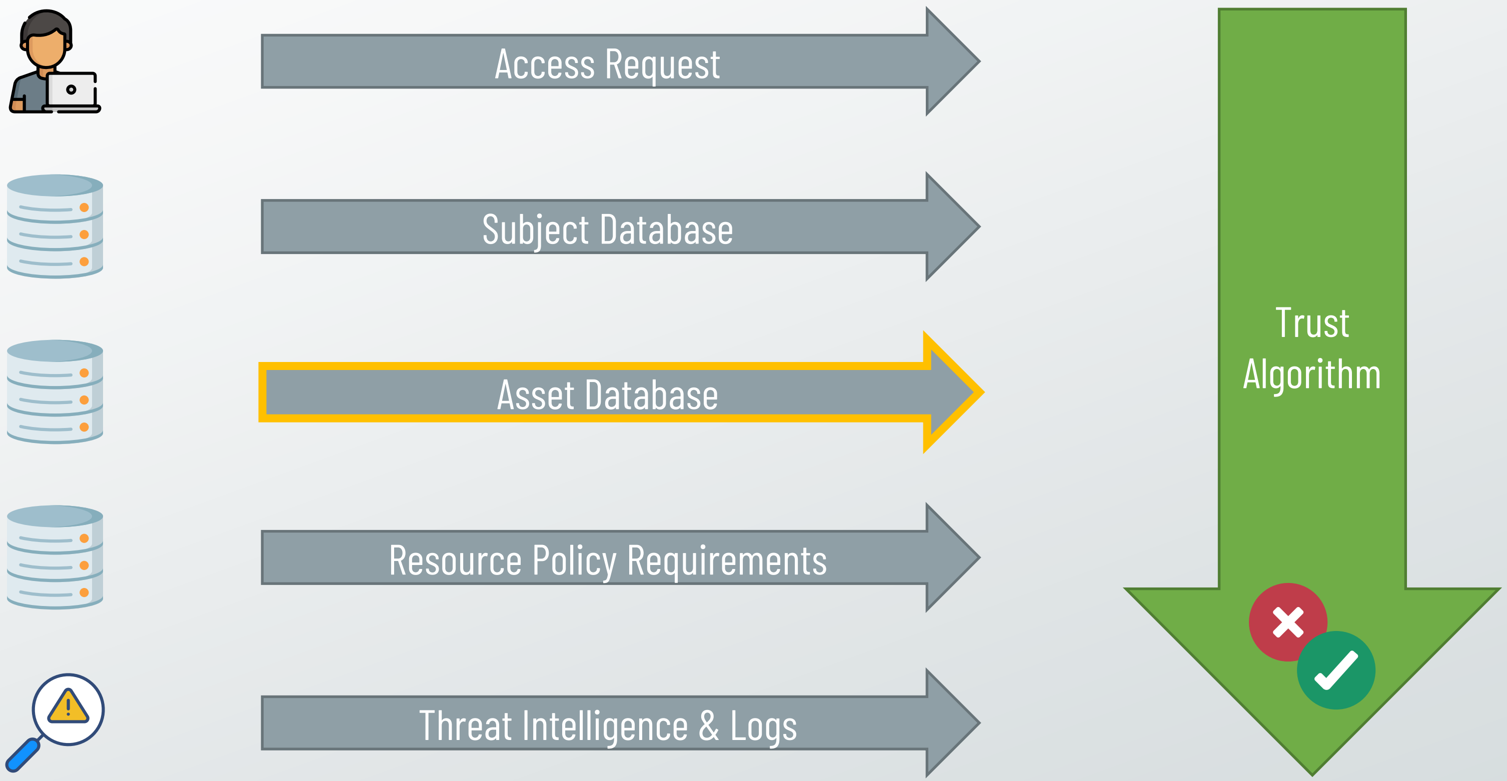
Access Request: The actual request from the subject.

Trust Algorithm Inputs



Subject Database: This database contains known subjects.

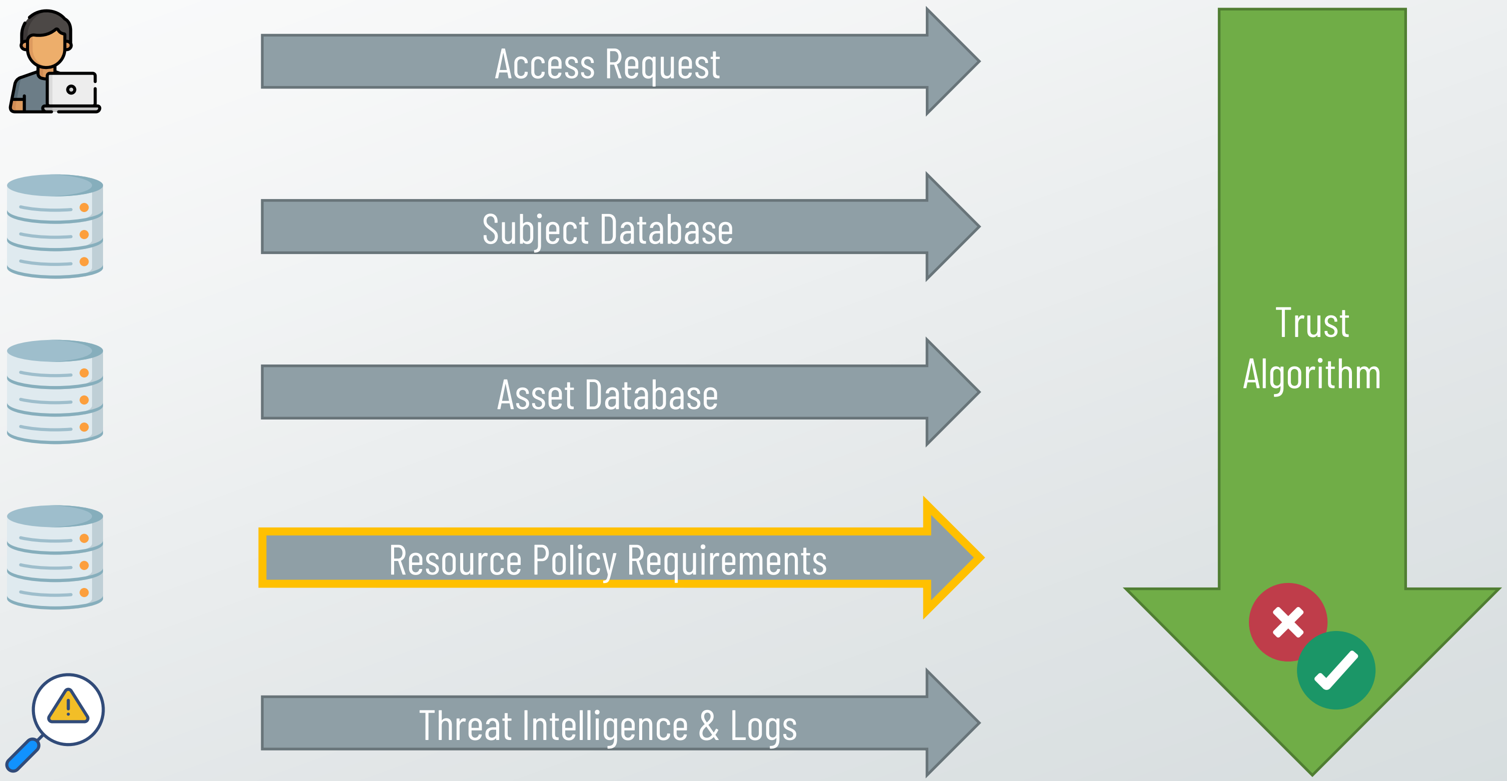
Trust Algorithm Inputs



Asset Database: This database contains known assets, both enterprise-owned and BYOD.

NIST SP 800-207: Zero Trust Architecture

Trust Algorithm Inputs



Resource Policy Requirements: Requirements for allowing access to trusted resources, set forth by the organization.

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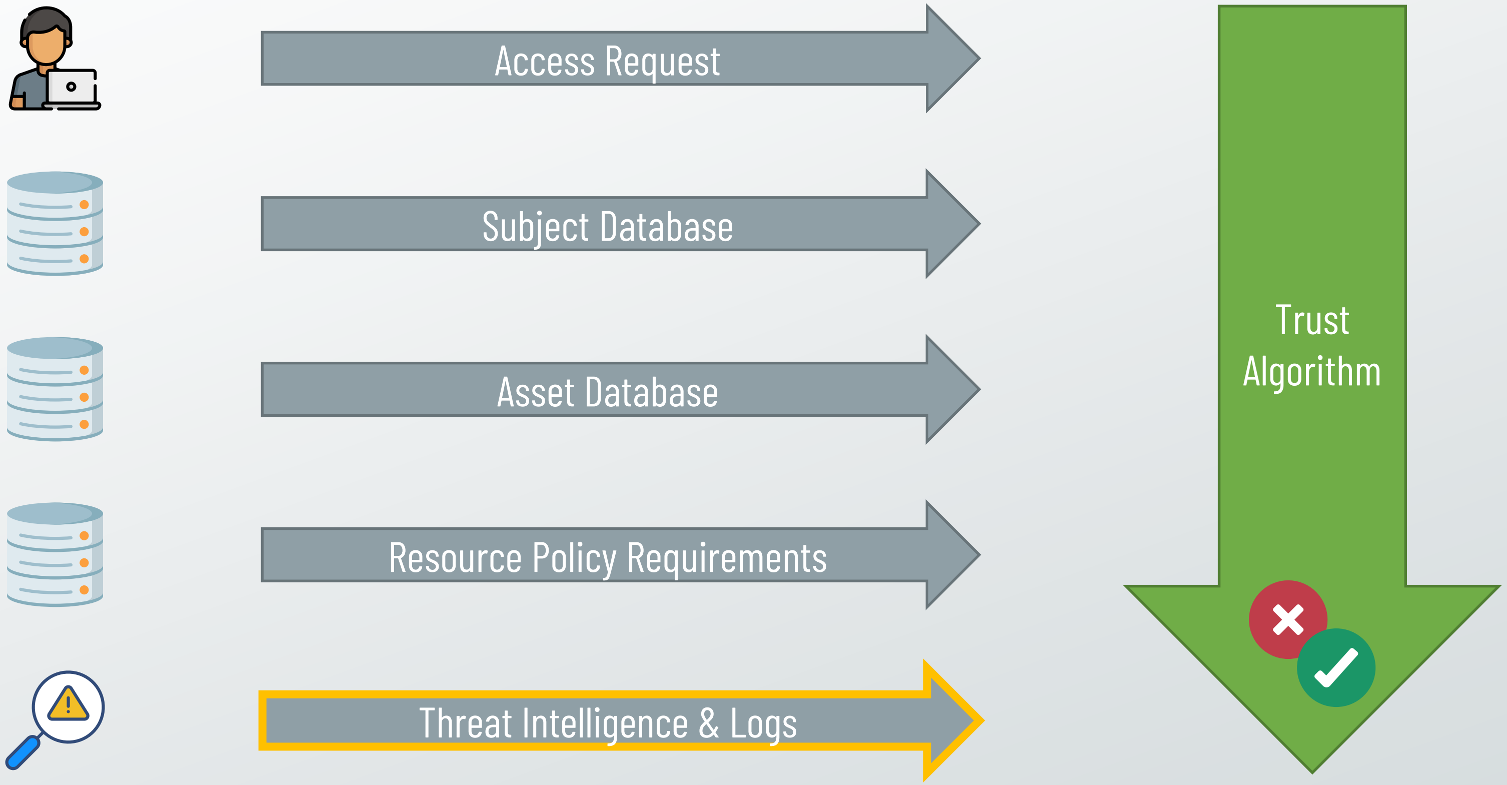
Trust Algorithm Inputs



Access Request: Information feeds about cyber threats, malware, and vulnerabilities.

NIST SP 800-207: Zero Trust Architecture

Attribute-Based Access Controls (ABAC)

Role-Based vs. Attributed-Based Access Control

- **Role-Based**: Uses roles in managing user permissions based on group membership.
- **Attribute Based**: Access is based on several attributes and information from multiple data sources.

Role-Based	Attribute-Based
• Role • Group Membership	• Time • Location • Authentication & Authorization History • Operating System • System Configuration • IP and MAC Address • Malware Signatures • Communication Method • Resource Policies • Additional Data Sources

Key Takeaway: Zero Trust uses a combination of role-based and attribute-based access control, which provides dynamic and contextual information.

Kipling Method for Developing Policies

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Question-Based Methodology for Developing Zero Trust Policies

- **Who** is requesting accessing the trusted resource?
- **What** application is the requestor using to access the trusted resource?
- **When** is the requestor trying to access the trusted resource?
- **Where** is the requestor requesting access from?
- **Why** is the requestor requesting access to the trusted resource?
- **How** should the requestor be allowed to access the trusted resource?

Who	What	When	Where	Why	How
User ID Auth Type	Application ID	Time Restrictions	Device ID Geolocation	Classification Data ID	Content ID Access Methodology Threat Protection