JS7 JobScheduler Architecture

Security Architecture:

Connections, Access, Operation

Information for Interested Parties

- Secure Connections
  - Network Connections
  - Certificate Preparation
  - Certificate Deployment

- Secure Access
  - Identity and Access Management
  - User Account and Role Management
  - Use of Identity Services
  - Certificate based Authentication
  - FIDO2 Authentication

- Secure Operation
  - Secure Deployment: Security Level Low
  - Secure Deployment: Security Level Medium
  - Secure Deployment: Security Level High
  - Secure Roll-out

Network Connections

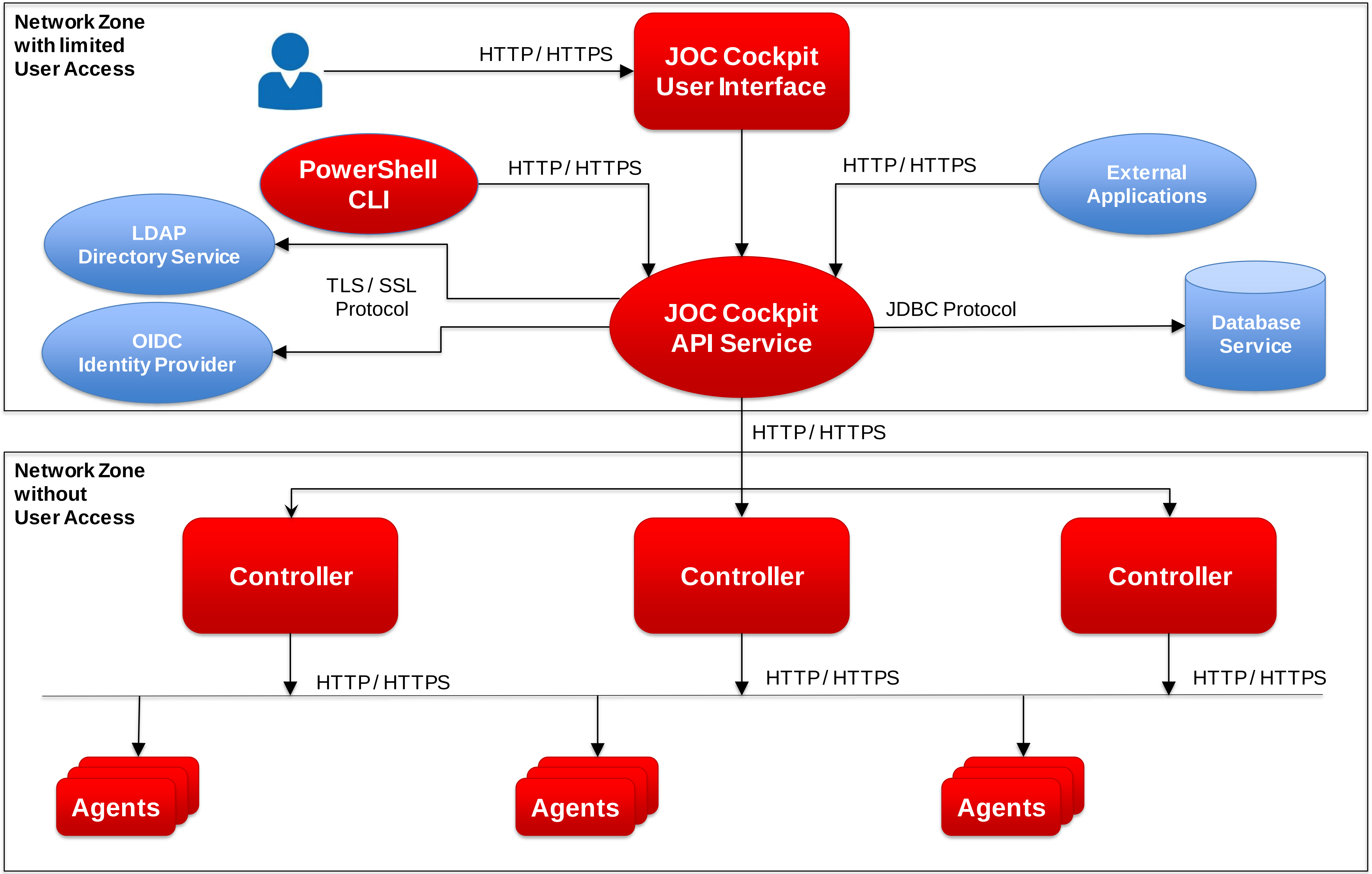
Secure Network Connections

Network Zone with restricted User Access

- Use of HTTPS for any connection to JOC Cockpit
- Access to JOC Cockpit requires authentication
- Access to JOC Cockpit is authenticated by the API Service using TLS/SSL

Network Zone without User Access

- Controller and Agent instances can be operated in a network zone without user access
- Controller instances are accessed exclusively by the JOC Cockpit API Service
- Agent instances are accessed exclusively by Controller instances
- Use of HTTPS for connections with client and server authentication certificates (mutual TLS authentication)



Certificate Management

Certificate Preparation

Server Certificates

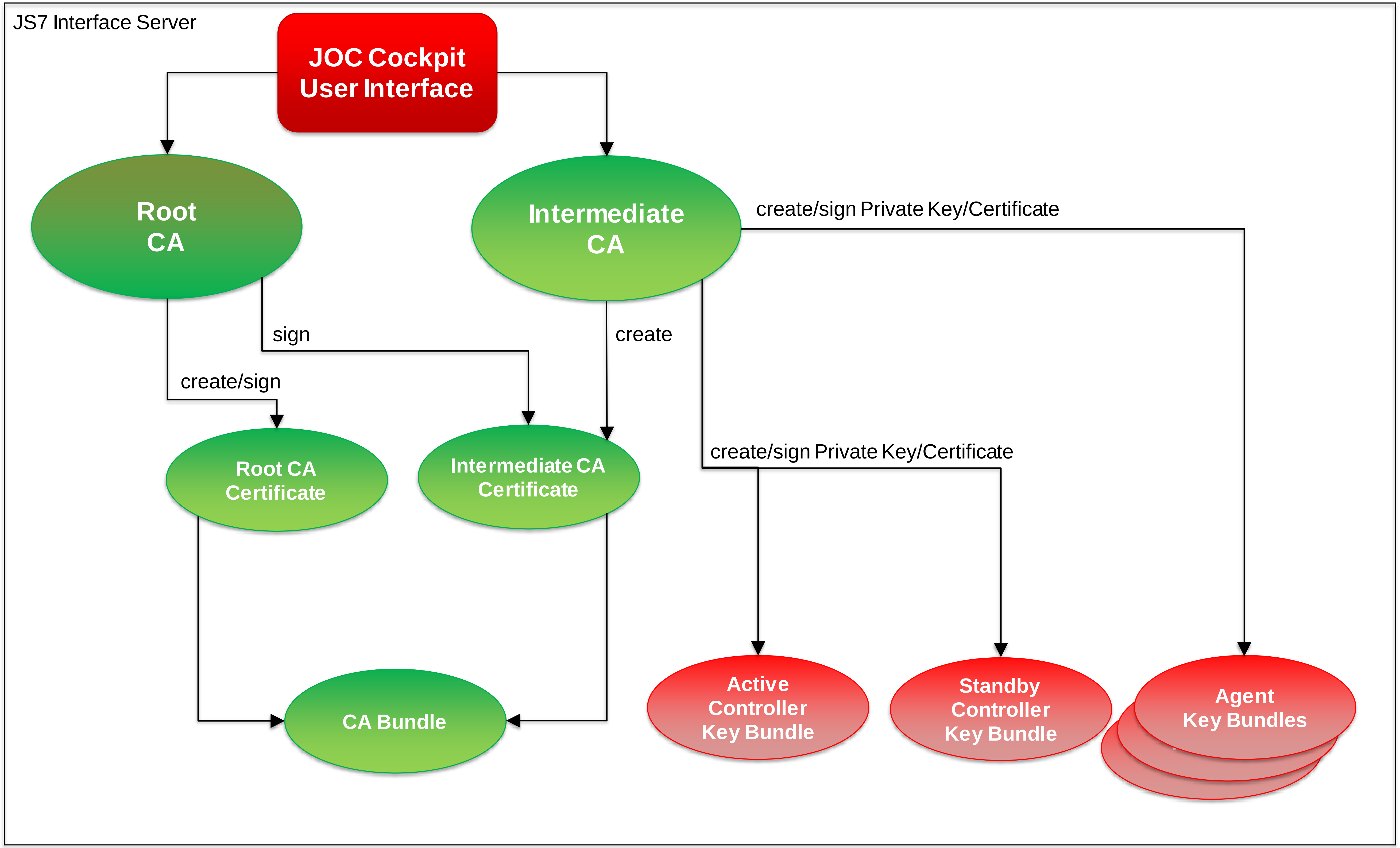
- Server Certificates are required to secure network connection by HTTPS
- Certificates are managed by the user‘s CA or by the CA provided with JOC Cockpit

Root CA / Intermediate CA

- The Certificate Authority (CA) is used to create the Root CA Certificate and Intermediate CA Certificate
- Both certificates are bundled and made available to Controller and Agent instances

Controller/Agent Certificate

- The Intermediate CA creates and signs the certificates for each Controller and Agent
- The CA Bundle and the instance‘s Key Bundle are deployed to the respective Controller and Agent


JS7 Interface Server
JOC Cockpit User Interface
Root CA
Intermediate CA
create/sign Private Key/Certificate
sign
create
create/sign
Root CA Certificate
Intermediate CA Certificate
create/sign Private Key/Certificate
CA Bundle
Active Controller Key Bundle
Standby Controller Key Bundle
Agent Key Bundles

Certificate Management

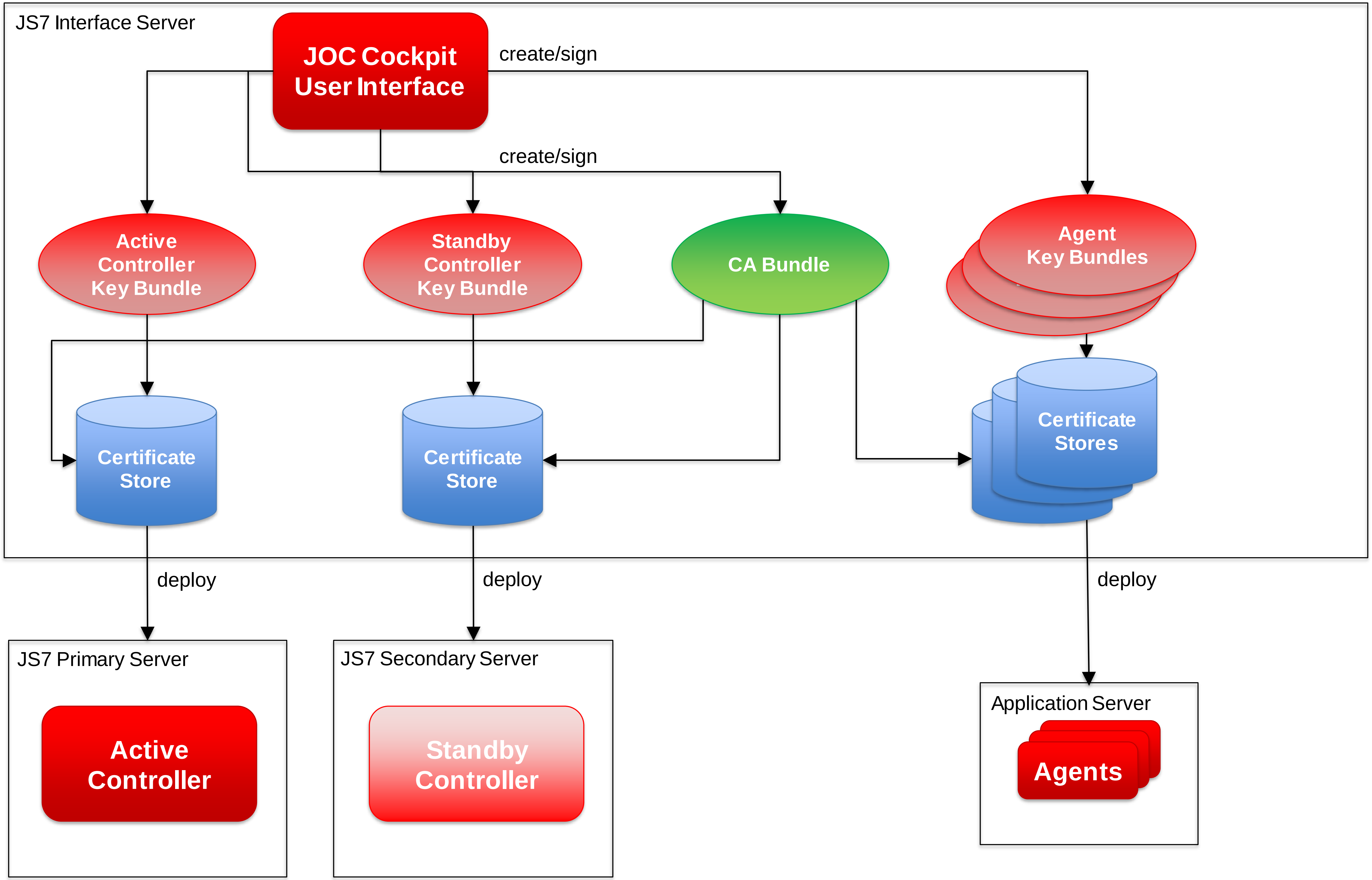
Certificate Deployment

Private Keys / CA Bundle

- The Certificate Authority (CA) adds the Root CA Certificate and Intermediate CA Certificate to a Bundle
- The CA Bundle together with the Private Key is added to a Certificate Store that is managed for each Controller/Agent instance

Deployment

- The Certificate Store is deployed to each Controller/ Agent instance
- The transfer of Certificate Stores to Controller/Agent instances is integrated with the user's deployment solution



- Secure Connections
  - Network Connections
  - Certificate Preparation
  - Certificate Deployment

- Secure Access
  - Identity and Access Management
  - User Account and Role Management
  - Use of Identity Services
  - Certificate based Authentication
  - FIDO2 Authentication

- Secure Operation
  - Secure Deployment: Security Level Low
  - Secure Deployment: Security Level Medium
  - Secure Deployment: Security Level High
  - Secure Roll-out

Identity and Access Management

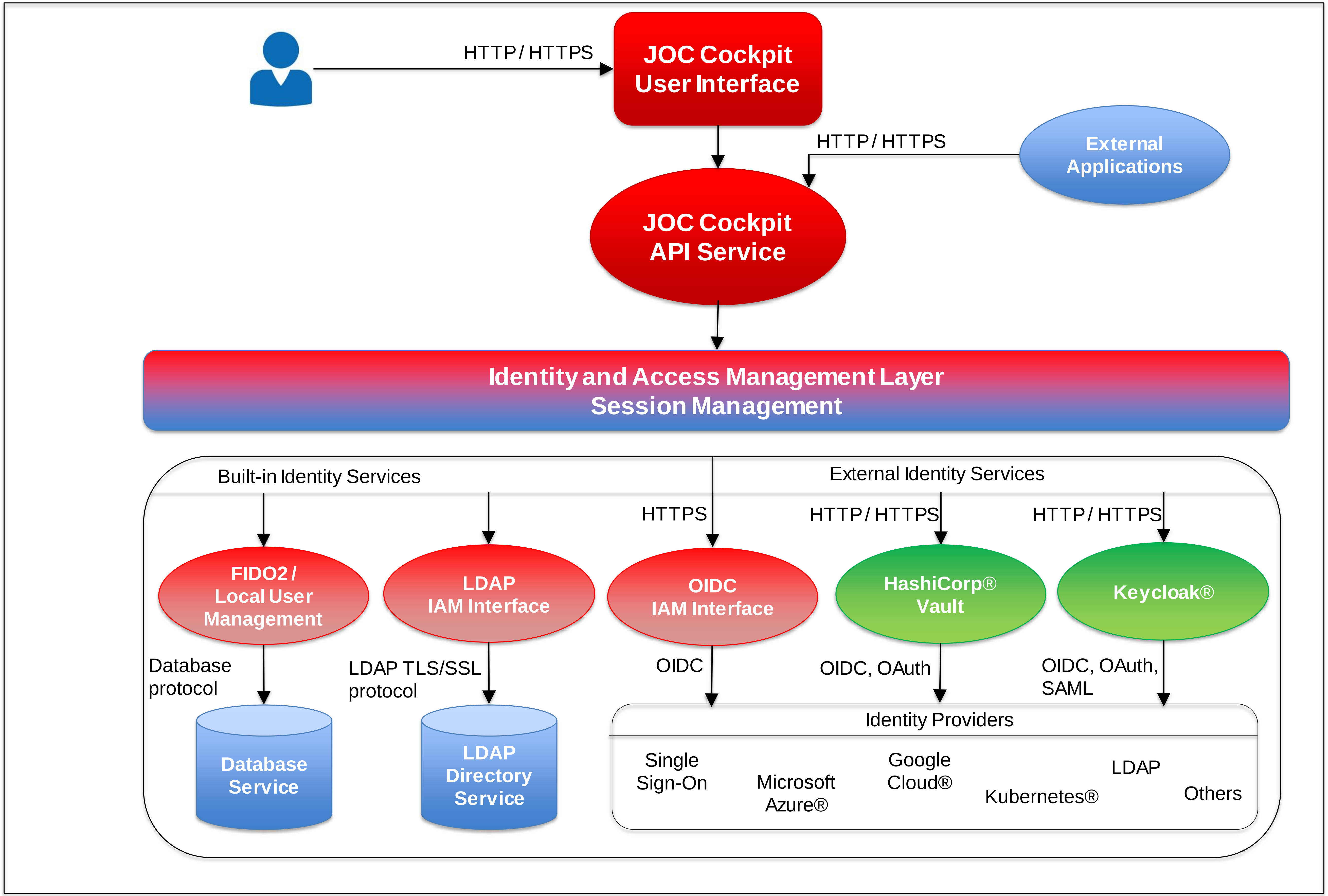
Secure Access

Built-in Identity Services

- JOC Cockpit offers built-in user management with its Database Service
- JOC Cockpit integrates with LDAP Directory Services such as Microsoft Active Directory® and OpenLDAP.®
- LDAP connections can be configured for TLS and SSL
- JOC Cockpit allows authentication with OIDC based Identity Providers, e.g. Azure
- JOC Cockpit offers Single Sign-On based on OIDC

External Identity Services

- HashiCorp® Vault and Keycloak® are integrated by their respective REST API
- JOC Cockpit can manage users and roles locally and by use of an Identity Service
- JOC Cockpit requests and renews access tokens with the Identity Service
- Identity Services manage access to the respective Identity Providers



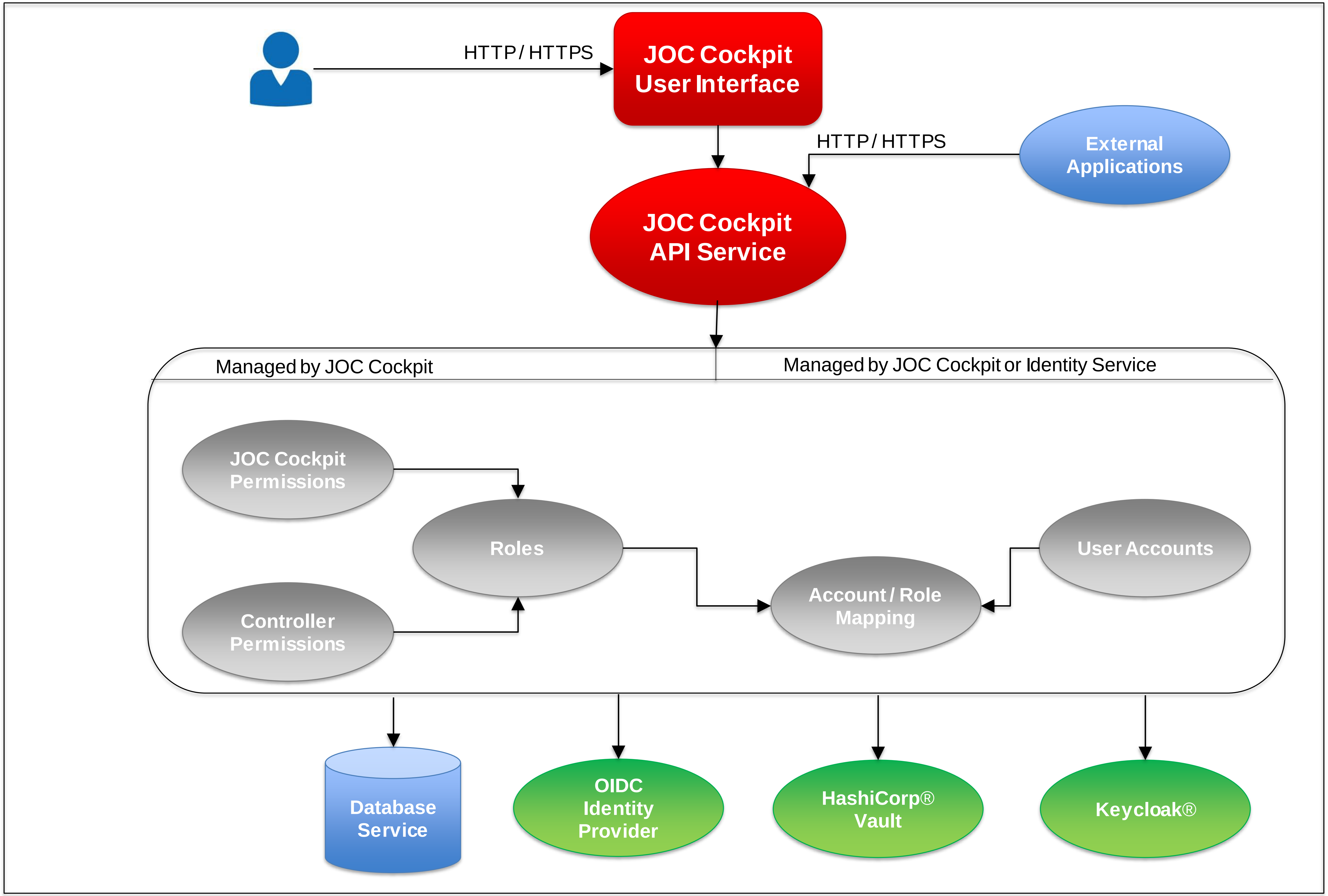
User Account and Role Management

Permissions and Roles

- Permissions for JOC Cockpit and for individual Controllers are managed by the JOC Cockpit API Service
- JOC Cockpit stores permissions and roles with its Database Service

Account and Role Mappings

- User accounts can be managed and stored with the JOC Cockpit database
- Alternatively user accounts can be managed and stored with an Identity Service or OIDC Identity Provider
- JOC Cockpit can be used to populate Identity Services with user accounts and role mappings and it can be used to retrieve role mappings from an Identity Service when a user logs in
- HashiCorp® Vault and Keycloak® are integrated by their respective REST API



Use of Identity Services

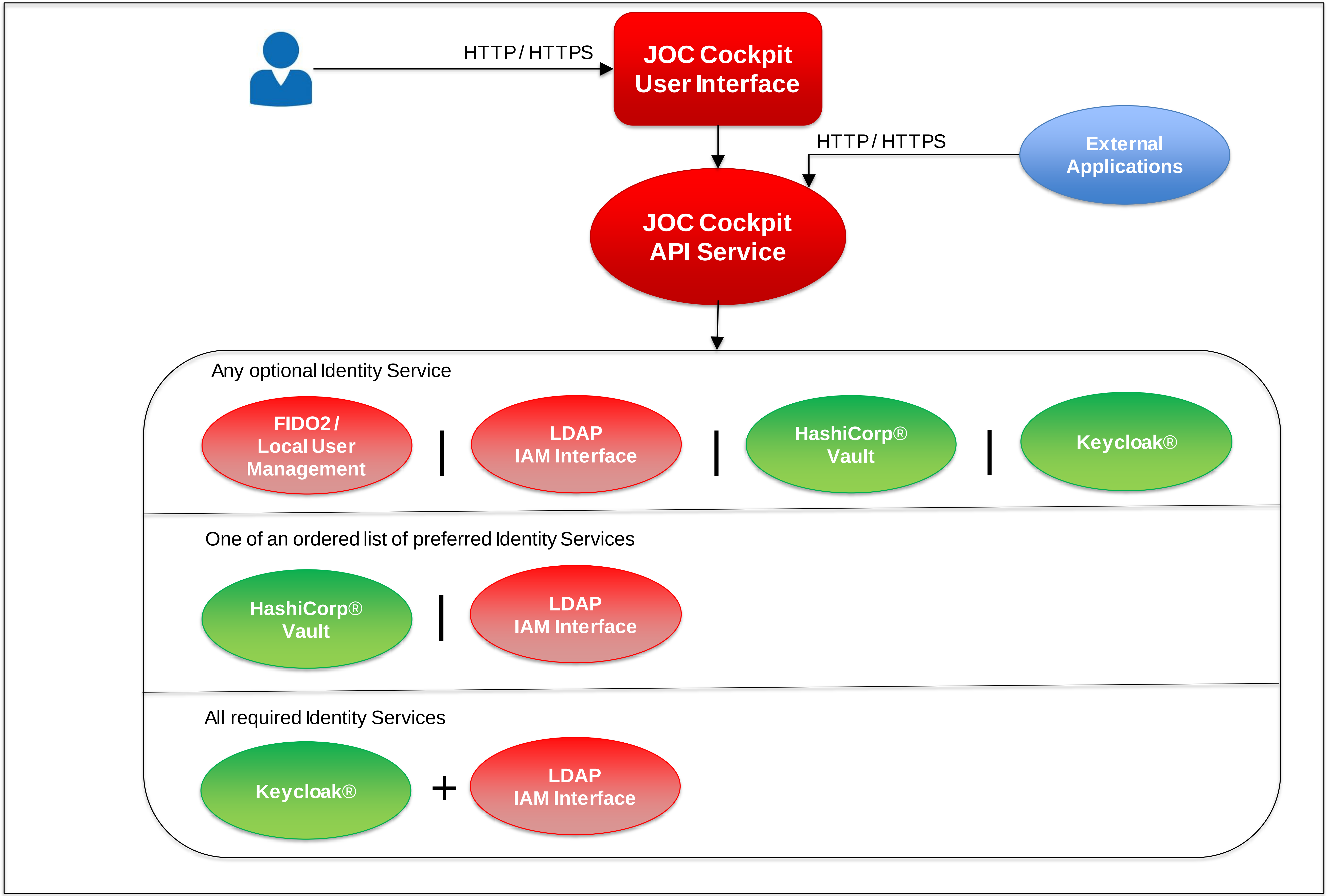
Secure Access

Required Identity Services

- JOC Cockpit offers to specify one or more Identity Services to be required
- This includes to login with all required Identity Services
- A failed login with any required Identity Service results in denial of access to JOC Cockpit
- Role mappings are merged from all required Identity Services

Optional Identity Services

- JOC Cockpit offers to specify any number of optional Identity Services
- With the first successful login to an optional Identity Service the user is logged in and no further Identity Services are consulted
- Identity Services are consulted in the sequence in which they are ordered



Certificate Based Authentication

Certificate based Authentication

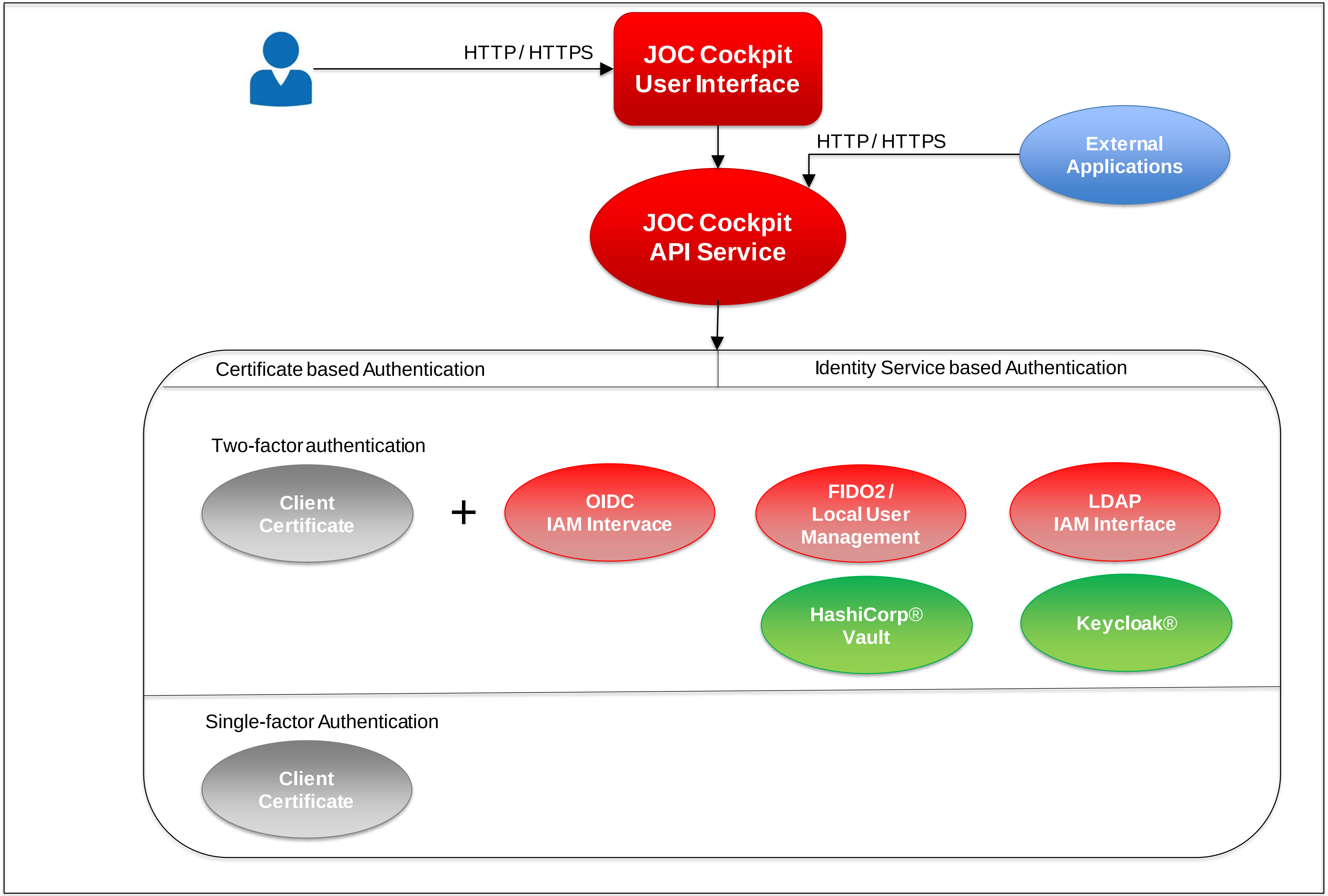
- JOC Cockpit offers use of X.509 Client Authentication Certificates
- Such certificates are used for mutual authentication between JOC Cockpit and Client, e.g. the user browser or external application

Two-factor Authentication

- A certificate is required in addition to credentials that are used with available Identity Services
- If the certificate cannot be validated then the user account is denied access to JOC Cockpit

Single-factor Authentication

- A certificate is accepted as a single factor to authenticate user accounts
- This option is frequently used for automated login by batch processes


HTTP / HTTPS
JOC Cockpit User Interface
HTTP / HTTPS
External Applications
JOC Cockpit API Service
Certificate based Authentication
Identity Service based Authentication
Two-factor authentication
Client Certificate
+
OIDC IAM Intervace
FIDO2 / Local User Management
LDAP IAM Interface
HashiCorp® Vault
Keycloak®
Single-factor Authentication
Client Certificate

FIDO2 Authentication

FIDO2 Authentication

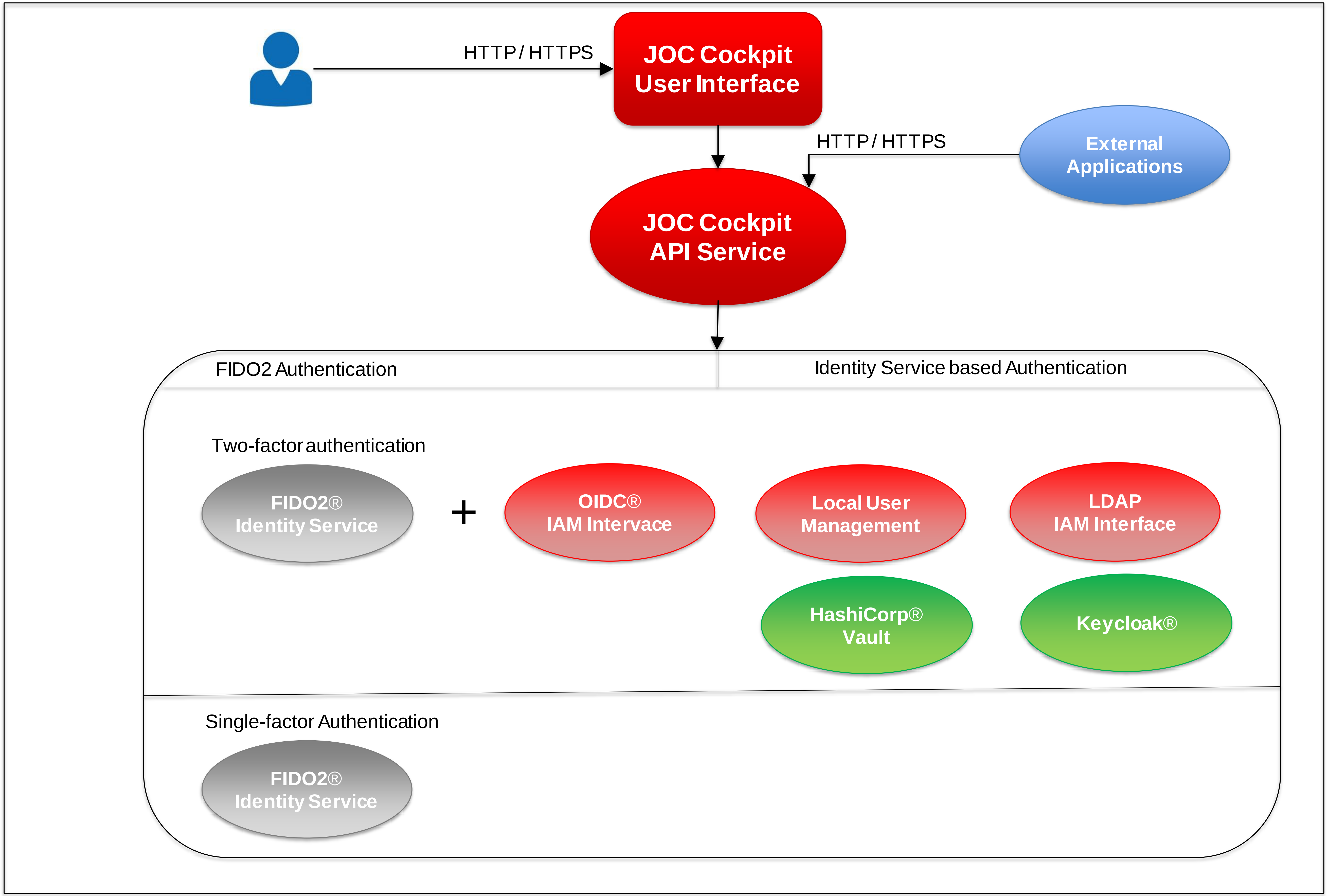
- The JOC Cockpit User Interface implements a FIDO2 Client for browsers
- The JOC Cockpit API Service implements a FIDO2 Server (Relying Party)
- Any FIDO2 compliant Authenticator can be used
- Credentials from a number of FIDO2 compliant devices can be used

Two-factor Authentication

- FIDO2 authentication is required in addition to use of any other Identity Service
- If FIDO2 authentication is not successful then the user account is denied access to JOC Cockpit

Single-factor Authentication

- FIDO2 is accepted as a single factor to authenticate user accounts



- Secure Connections
  - Network Connections
  - Certificate Preparation
  - Certificate Deployment

- Secure Access
  - Identity and Access Management
  - User Account and Role Management
  - Use of Identity Services
  - Certificate based Authentication
  - FIDO2 Authentication

- Secure Operation
  - Secure Deployment: Security Level Low
  - Secure Deployment: Security Level Medium
  - Secure Deployment: Security Level High
  - Secure Roll-out

Secure Operation

Secure Deployment: Security Level Low

JOC Cockpit Signing

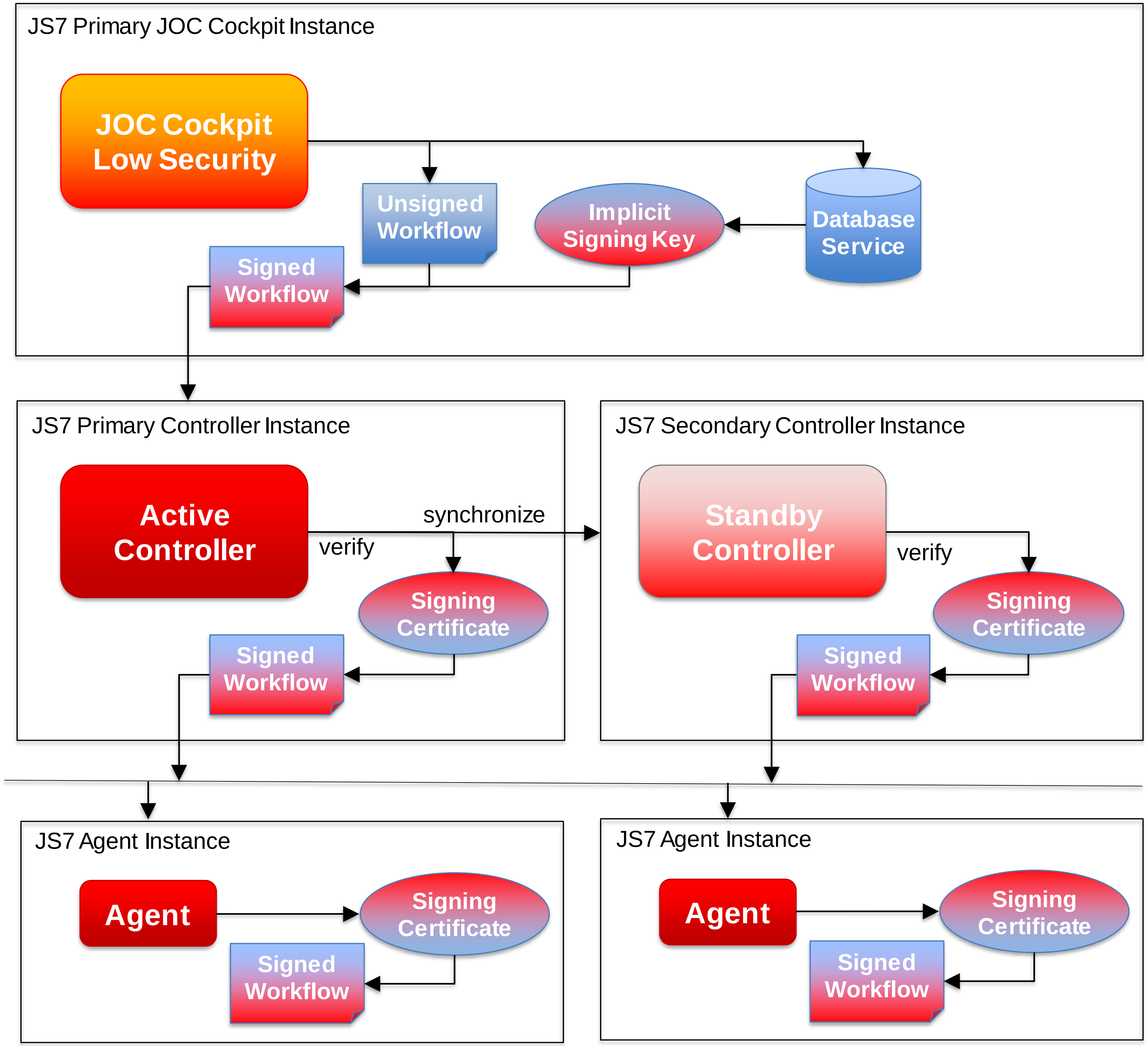
- Workflows are signed for deployment using a Signing Key from the database.
- The signature is deployed with the workflow.

Controller Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Controller and otherwise are denied.
- Similar check is performed by the Standby Controller that requires availability of the same certificates.

Agent Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Agent.
- Workflows are not accepted in case of failed signature checks.



Implicit Signing

- Workflows are implicitly signed for deployment
- Deployments by any user make use of the same Signing Key
- Deployment is a single click operation in the user interface

Security Level Low

- JOC Cockpit offers built-in signing operations for workflows
- Signed workflows are not associated with individual users
- The Signing Key might be copied or compromised as it is accessible from the database

Secure Operation

Secure Deployment: Security Level Medium

JOC Cockpit Signing

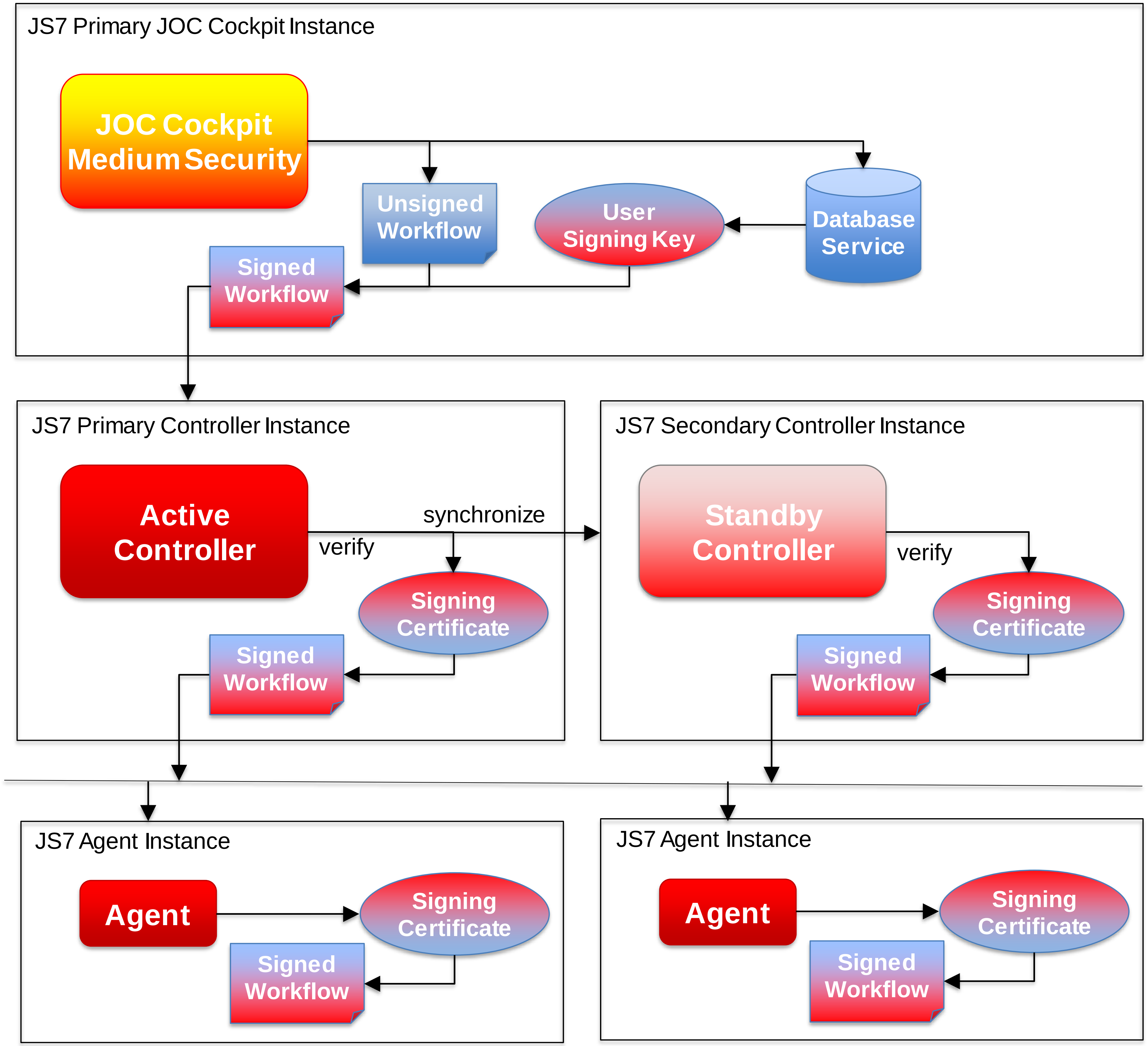
- Workflows are signed for deployment using a Signing Key from the database
- The signature is deployed with the workflow

Controller Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Controller and otherwise are denied
- Similar check is performed by the Standby Controller that requires availability of the same certificates

Agent Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Agent
- Workflows are not accepted in case of failed signature checks



User based Signing

- Workflows are signed individually per user for deployment with an individual Signing Key
- Deployment is a single click operation in the user interface

Security Level Medium

- JOC Cockpit offers built-in signing operations for workflows
- Each signed workflow is associated with a user
- The Signing Key might be copied or compromised as it is accessible from the database

Secure Operation

Secure Deployment: Security Level High

External Signing

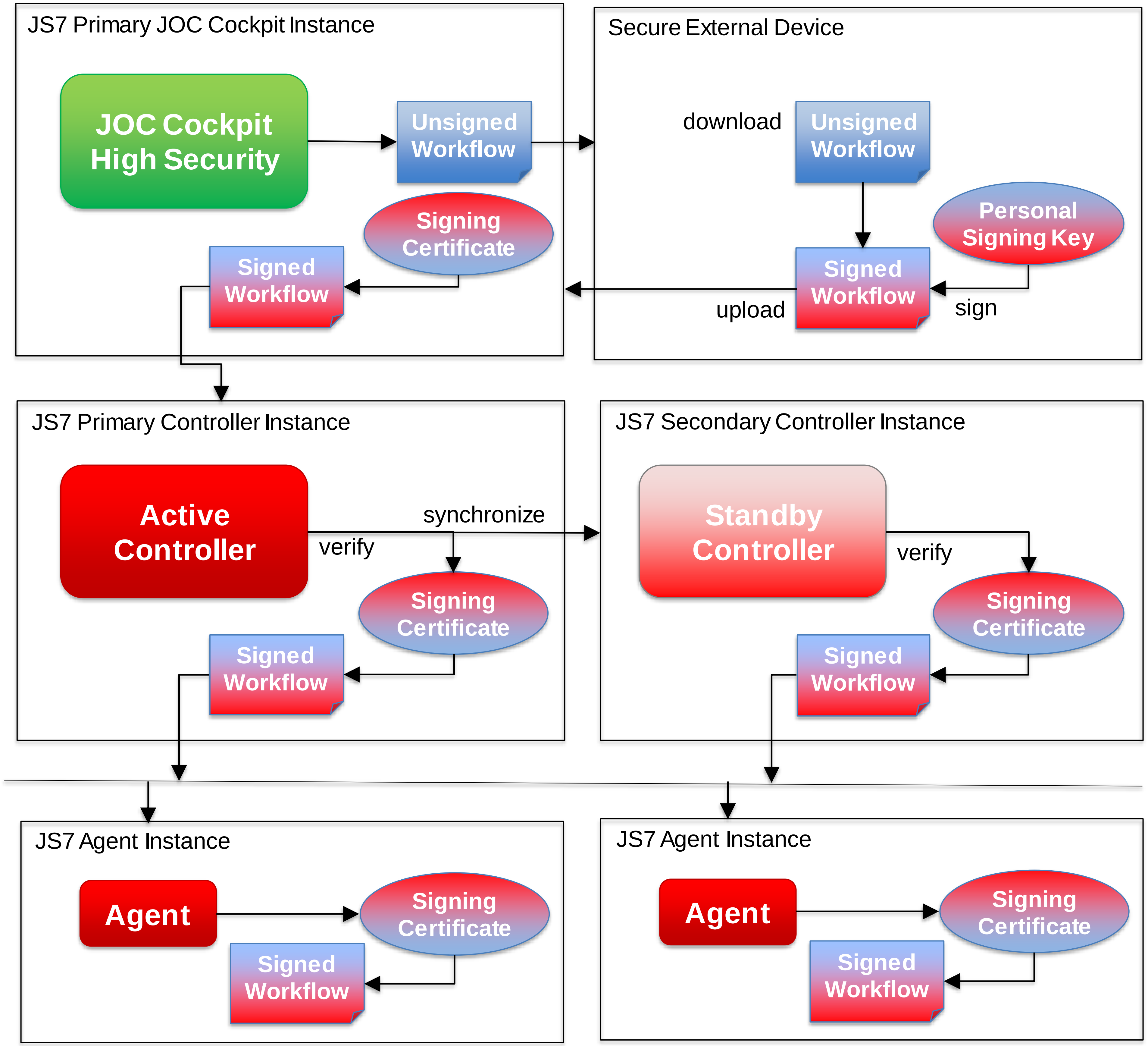
- Workflows are signed for deployment performing the signing from a secure external device.
- The signature is deployed with the workflow

Controller Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Controller and otherwise are denied
- Similar check is performed by the Standby Controller that requires availability of the same certificates

Agent Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Agent
- Workflows are not accepted in case of failed signature checks



External Signing

- Workflows are downloaded to a secure external computer, the user's Signing Key might be provided by portable media
- Signing is performed with any tool accepted by company standards, e.g. OpenSSL
- The workflows and resulting signature files are added to an archive file and are uploaded

Security Level High

- JOC Cockpit offers no built-in signing operations for workflows
- Workflows have to be signed externally to be deployable
- The Signing Key is used outside of JOC Cockpit
- A signed workflow is associated with a user (non-repudiability)

Secure Operation

Secure Roll-out

External Signing

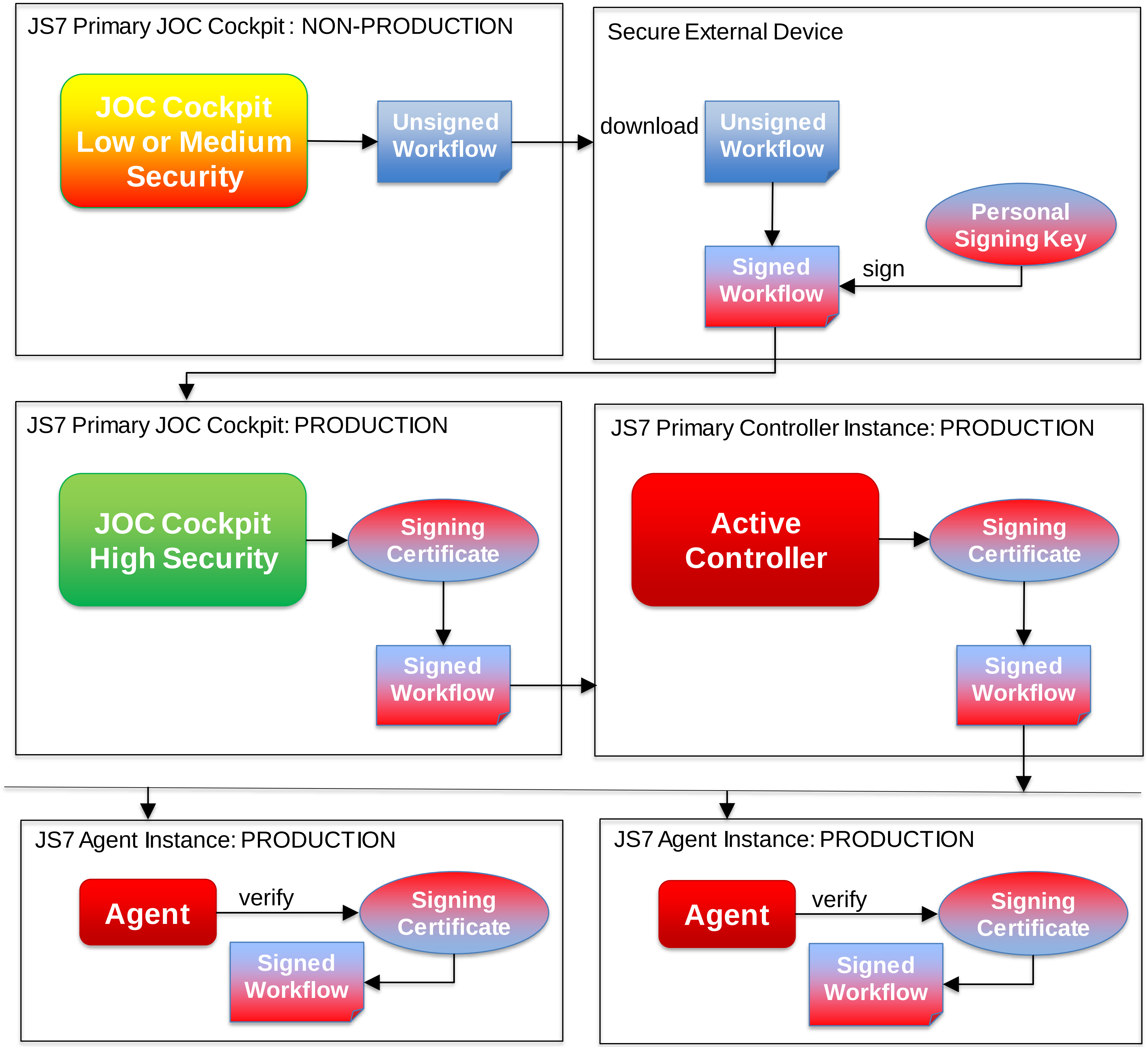
- Workflows are signed for deployment performing the signing from a secure, external device
- The signature is deployed with the workflow

Controller Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Controller and otherwise are denied
- Similar check is performed by the Standby Controller that requires availability of the same certificates

Agent Signature Check

- Workflows are checked if they match the signature provided with certificates available to the Agent
- Workflows are not accepted in case of failed signature checks



External Signing

- Workflows are downloaded to a secure external computer, the user's Signing Key might be provided by portable media
- Signing is performed with any tool accepted by company standards, e.g. OpenSSL
- The workflows and resulting signature files are added to an archive file and are uploaded to a secure JOC Cockpit instance

Secure Roll-out

- A secure JOC Cockpit instance accepts signed workflows only
- There is no possibility to sign a workflow within a secure JOC Cockpit instance
- A secure JOC Cockpit instance will accept workflows only if their signatures match the signing certificate

Questions?

Comments?

Feedback?

Software- und
Organisations-
Service GmbH

Giesebrechtstr. 15
D-10629 Berlin

info@sos-berlin.com
https://www.sos-berlin.com