Design reference

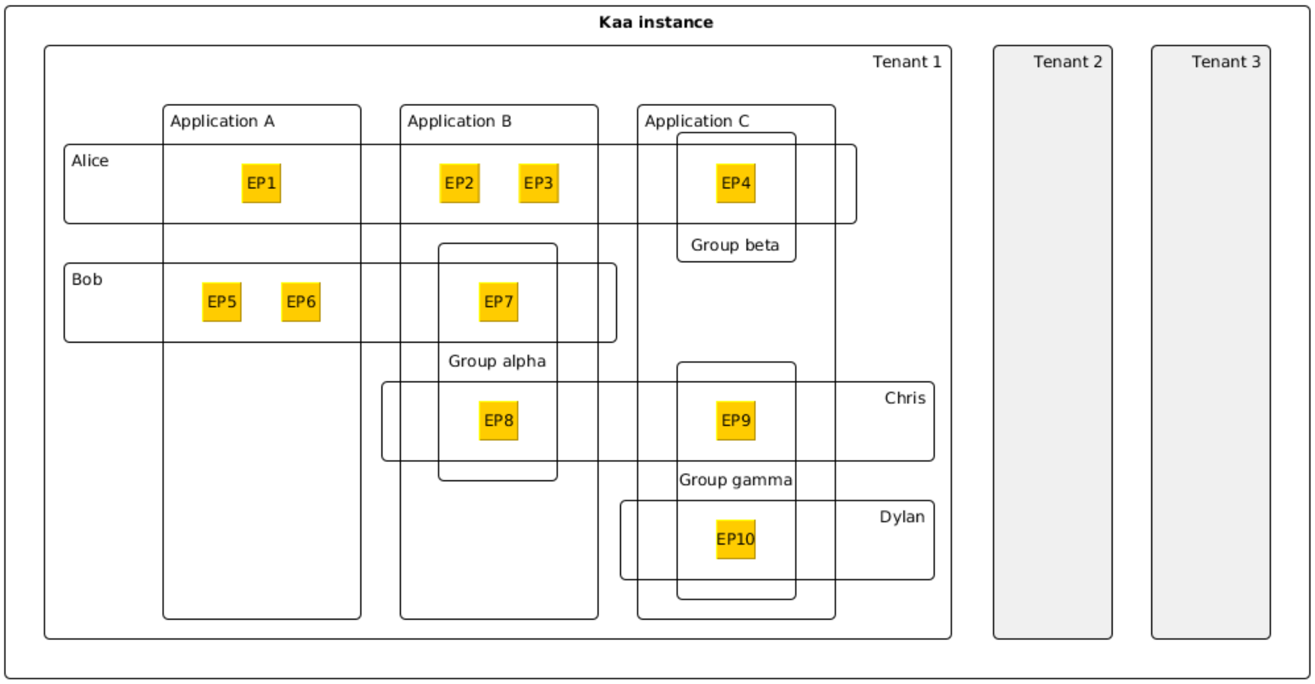
The *Kaa framework* consists of the *Kaa server* and *endpoint SDKs*. The Kaa server implements the back-end part of the framework, exposes integration interfaces, and offers administrative capabilities. An endpoint SDK is a library which provides communication, data marshalling, persistence, and other functions available in Kaa for specific type of an endpoint (e.g. Java-based, C++-based, C-based). This SDK can be used to create *Kaa clients*, which are any pieces of software that utilize Kaa functionality and are installed on some connected devices. It is the responsibility of the Kaa client to process structured data provided by the Kaa server (configuration, notifications, etc.) and to supply data to the return path interfaces (profiles, logs, etc.).

A *Kaa instance* (interchangeable with *Kaa deployment*) is a particular implementation of the Kaa framework and it consists of a *Kaa cluster* and *endpoints*. A Kaa cluster represents a number of interconnected Kaa servers. An *endpoint* is an abstraction which represents a separate managed entity within a Kaa deployment. Practically speaking, an endpoint is a specific Kaa client registered (or waiting to be registered) within a Kaa deployment. For example, a news application installed on your mobile phone, the same news application installed on your tablet, and the same news application on your WiFi-enabled fridge would be considered three different endpoints in Kaa.

An *application* in Kaa represents a family of available implementations of a specific software application used by endpoints. For example, two versions of a sound frequency measuring application which differ by their implementation for, respectively, Arduino and STM32 platforms would be considered the same application in Kaa.

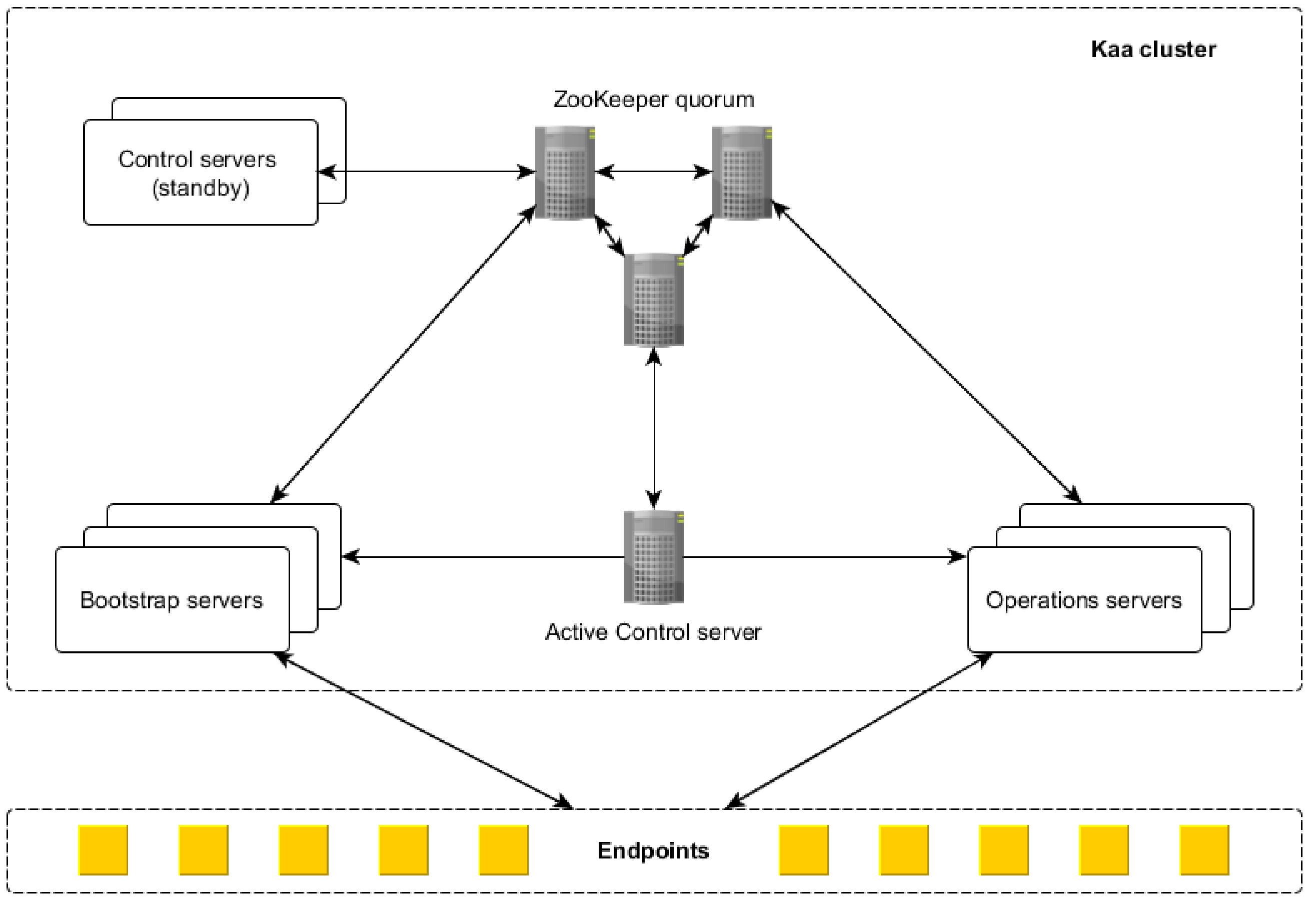
A *tenant* in Kaa is a separate business entity which contains its own endpoints, applications and users.

A single Kaa deployment is able to support multiple tenants, with multiple applications per each tenant. As illustrated in the following diagram, applications belong to tenants, while endpoints register within applications. In addition to tenants, applications and endpoints, there are also users and endpoint groups, which will be described in detail further in this reference.



High-level architecture

The Kaa server is comprised of the Control, Operations, and Bootstrap servers. It also uses third-party database(s) for data persistence and Apache ZooKeeper for servers coordination. In addition, Kaa provides web UI, which is a standalone component that integrates with the Control server and allows users to create applications, register and configure endpoints, create endpoint groups, etc.



Control server

A Kaa Control server is responsible for managing overall system data, processing API calls from the web UI and external integrated systems, and delivering notifications to Operations servers. A Control server manages data stored in a database (independently for each tenant) and notifies every Operations server on most data updates via a Thrift-based protocol. A Control server maintains an up-to-date list of available Operations servers by continuously obtaining this information from ZooKeeper.

To support high availability, a Kaa cluster must include at least two Control servers, with one of them being active and the other(s) being in a standby mode. In case of the active Control server failure, ZooKeeper notifies one of the standby Control servers and promotes it to the active Control server.

Operations server

A Kaa Operations server is a "worker" server that is responsible for concurrently handling multiple requests from multiple clients. Most common Operations server tasks include endpoint registration, endpoint profile updating, configuration updates distribution, and notifications delivery.

Multiple Operations servers may be set up in a Kaa cluster for the purpose of horizontal scaling. In this case, all the Operations servers will function concurrently. In case an Operations server outage happens, the corresponding endpoints switch to the other available Operations server automatically. A Kaa cluster provides instruments for the workload re-balancing at run time, thus effectively routing endpoints to the less loaded Operations servers in the cluster.

Bootstrap server

A Kaa Bootstrap server is responsible for directing endpoints to Operations servers. On their part, Kaa endpoints have a built-in list of Bootstrap servers set up in the given Kaa deployment. The endpoints use this list to query the Bootstrap servers and retrieve from them a list of currently available Operations servers, as well as security credentials. Bootstrap servers maintain their lists of available Operations servers by coordinating with the ZooKeeper service.

Client

A Kaa client is a particular application which uses the Kaa client SDK and resides on a particular connected device. The Kaa client SDK provides functionality for communicating with the Kaa server, managing data locally in the client application, as well as provides integration APIs. The client SDK abstracts the communication protocol, data persistence, and other implementation details that may be specific for any concrete solution based on Kaa.

Further reading

After you familiarize yourself with all the sections in Design reference, use the following guides and references to advance further into Kaa. We also assume that you're already through with Kaa installation as described in either Sandbox or Installation guide. Make sure you did not skip the Getting started page as it allows you to quickly create your first Kaa application.

Guide	What it is for
Administration UI guide	Use this guide to start working with the Kaa web UI.
Programming guide	Use this guide to create your own Kaa applications.
Contribute to Kaa	Use this guide to learn how to contribute to Kaa project and which code/documentation style conventions we use.