# Open edX Architecture

# Open edX 架构

Open edX is a web-based platform for creating, delivering, and analyzing online courses. It is the software that powers edx.org and many other online education sites.

Open edX 是一个可以生成、发布、分析在线课程的基于 web 的平台。

该平台为 edx.org 等其他在线教育网站提供软件框架。

This page explains the current architecture of the platform at a high level, without getting into too many details. We also describe where we are actively working on making changes.

本文主要概括性的描述了 Open edX 现有技术架构，不包含更为细致的技术内容。

同时，我们也描述了我们目前主要工作集中在何处。

## Technologies

### 技术

Almost all of the server-side code in Open edX is in Python, with Django as the web application framework, using Mako templates.

平台服务端源代码主要基于 Python 编写，同时在 Web 应用层框架基于 Django 框架下的 Mako 模版系统开发。

The browser-side code is written primarily in JavaScript. Some of the code is written in CoffeeScript, and edX is working to replace that code with JavaScript. Parts of the client-side code use the Backbone.js framework, and edX is moving more of the codebase to use that framework.

系统前端主要基于 JAVAScript 编写。一些前端代码基于 CoffeeScript 编写，我们目前也正在致力于将 CoffeScript 部分用 Backbone.js 框架进行重写，同时计划将更多的代码库用 Backbone.js 进行替换。

Open EdX uses Sass and the Bourbon framework for CSS code.

Open edX 使用 Sass 和 Bourbon 框架编写 CSS 代码。

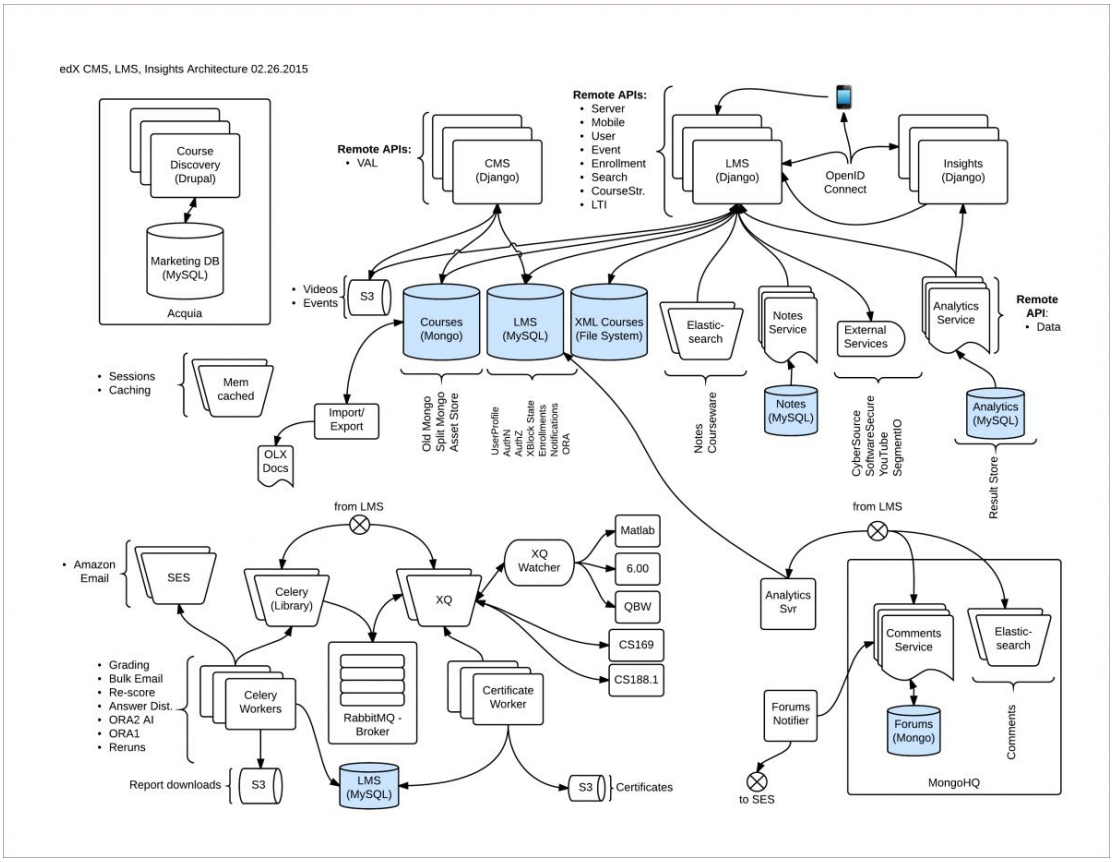


图 1.1 Open edX -CMS-LMS 系统技术架构图

# Components

## 组件

There are a handful of major components in the Open edX platform. Where possible, these communicate using stable, documented APIs.

这里介绍 Open edX 平台几大主要组件，和一些必要的已经稳定的功能 API 接口。

**Select the diagram to the right** to view a larger image of the components of Open edX.

图 1.1 画出了 Open edX 平台的主要组件构成。

### Learning Management System (LMS)

### 学习管理系统

The LMS is the most visible part of Open edX. Students take courses using the LMS. The LMS also provides instructor dashboards.

学习管理系统是 Open edX 平台面向用户可见的部分。学习者通过 LMS 系统进行学习。同时，LMS 系统也向授课教师提供操作界面。

The LMS uses a number of data stores. Courses are stored in Mongo, with videos served from YouTube or Amazon S3. Per-student data is stored in MySQL.

LMS 系统使用了一定数量的数据存储。课程存储在 Mongo 数据库中，视频源主要存放在 YouTube 和亚马逊云存储中，每个学习者的信息存在 MySQL 数据库中。

As students move through courses and interact with them, events are published to the analytics pipeline for collection, analysis, and reporting.

学习者直接学习课程的过程主要通过以上数据库进行记录，同时记录了发布事件、数据分析管道收集、分析和报告等功能。

Work is underway to enable the LMS to be an LTI provider so that Open edX courseware can be embedded into other learning environments.

LMS 系统作为学习工具交换提供方底层系统，将 Open edX 平台的课件内容嵌入到学习环境中。

## Studio

## 工作室组件

Studio is the course authoring environment. Course teams use it to create and update courses. Studio writes its courses to the same Mongo database that the LMS uses.

工作室组件式面向作者的应用环境。课程开发团队运用工作室组织机构创建、更新课程内容。

工作室组件和 LMS 系统使用同一个 Mongo 数据库存储课程数据。

## Course Browsing

## 课程浏览组件

Open edX provides a simple front page for browsing courses. The edx.org site has a separate home page and course discovery site that is not open source.

Open edX 平台提供简洁的前端页面用于浏览课程。Edx.org 网站的主页和课程发现网站不是开源的。

## Course Structure

### 课程结构组件

Open edX courses are composed of units called XBlocks. Anyone can write new types of XBlocks, allowing educators and technologists to extend the set of components for their courses.

Open edX 平台利用 XBlocks 作为课程的组织单元。任何人可以编写新的 XBlocks 该框架为教育者和技术专家提供可扩展的组件方式去开发他们的课程。

The edX Platform also still contains several XModules, the precursors to XBlocks. EdX is working to rewrite the existing XModules as XBlocks and remove XModules from our codebase.

Open edX 平台也存在一些 XModules 代码，XModules 是 XBlocks 的前期版本。我们也在组件的重写代码将原有的 XModules 代码改写为 XBlocks。

In addition to XBlocks, there are a few ways to extend courseware behavior:

有以下几个途径去扩展课程：

- The LMS is an LTI tool consumer. Course authors can embed LTI tools to integrate other learning tools into an Open edX course.

  LMS 系统是学习工具交互工具。课程开发者可以使用其他类型的学习交互工具嵌入到 Open edX 平台课程中。

- Problems can use embedded Python code to either present the problem or assess the student's response. Instructor-written Python code is executed in a secure environment called CodeJail.

  问题可以以 Python 脚本嵌入的方式去展现问题或者为学习者提供反馈。指导者写好的 Python 脚本可以在 CodeJail 环境下安全执行。

- JavaScript components can be integrated using JS Input.

  JavaScript 组件可以利用 JS Input 集成。

- Courses can be exported and imported using Open Learning XML (OLX), an XML-based format for courses.

  课程可以通过 OLX xml 格式导入导出。

## Discussions

### 课程讨论组件

Course discussions use a separate server called the Comments Service. Discussions are one of the few non-Python components, written in Ruby using the Sinatra framework. The LMS uses an API provided by the Comments Service to integrate discussions into the students' course experience.

课程讨论组件被安置在名叫 Comments Service 服务器中。讨论组件是平台中极少不使用 Python 语言开发的组件。该组件使用了 Ruby 语言的 Sinatra 框架编写。LMS 系统使用 API 调用，将课程讨论功能嵌入到课程系统。

The forums include a notifier process that sends students notifications about updates in topics of interest.

论坛包括了触发器进程，用于向学习者发送兴趣主题更新通知。

## Mobile Apps

### 移动应用

Open edX includes a mobile application, available for iOS and Android, that allows students to watch course videos.  EdX is actively enhancing the mobile app.

Open edX 平台拥有基于 IOS 和 Android 系统的移动应用，移动应用可以向学习者提供视频课程。我们正在集中火力深化移动应用功能。

## Analytics

### 分析系统

Events describing student behavior are captured by the Open edX analytics pipeline.  The events are stored as JSON in S3, processed using Hadoop, and digested, aggregated results are published to MySQL. Results are made available via a REST API to Insights, a Django application that instructors and administrators use to explore data that lets them know what their students are doing and how their courses are being used.

用户学习行为数据被 OPen edX 平台的分析管道进行捕获。行为数据被存储在 JSON 中，利用 HADOOP 技术进行分类聚合等操作，然后将结果数据发布在

MYSQL 中。结果数据利用 REST API 被解析，最后利用 Django 框架开发的应用区域分析发现学习者正在做些什么、他们的课程如何去被使用。

**Select the diagram to the right** to view a larger image of the Open edX Analytics architecture.

分析系统业务流程参考下图 1.2

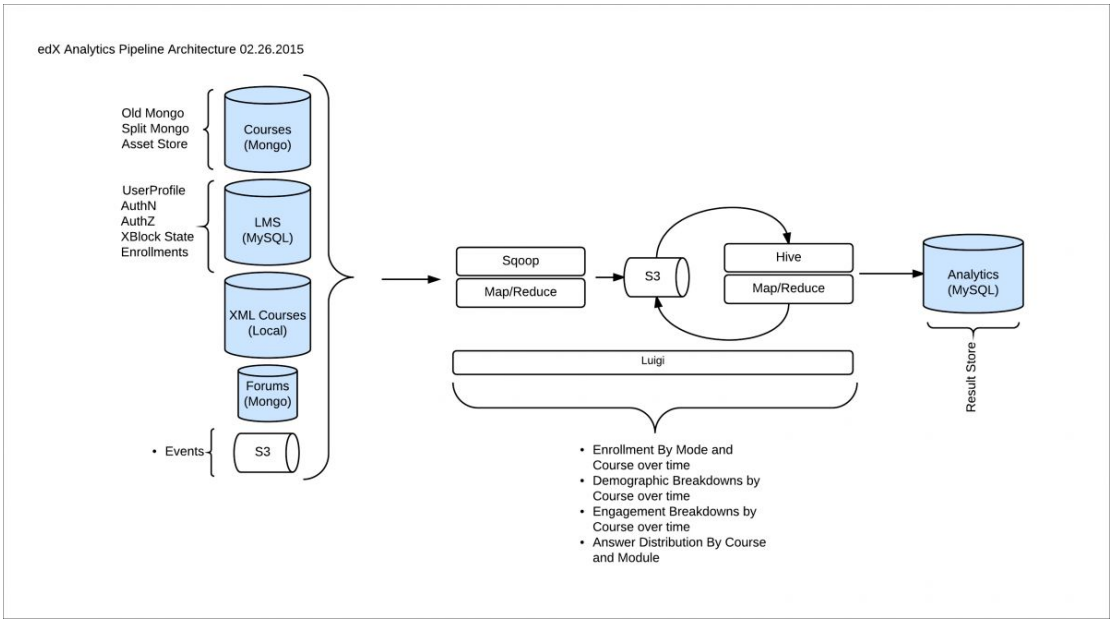


图 1.2 edx 分析组件架构图

## Background work

## 后台工作

A number of tasks are large enough that they are performed by background workers, rather than in the web applications themselves. This work is queued and distributed using Celery and RabbitMQ. Examples of queued work include:

有很多后台工作正在进行，工作量不亚于网页应用。这些后台工作主要通过 Celery 和 RabbitMQ 工具进行队列和分发，具体如下：

- Grading entire courses
- 课程分级
- Sending bulk emails (with Amazon SES)
- 邮件群发
- Generating answer distribution reports

- 生成答案分析报告
- Producing end-of-course certificates
- 生成课程认证

Open edX includes a custom queue called XQueue that can run custom graders. These are separate processes that run compute-intensive assessments of students' work.

平台包括用户队列组件称作 XQueue，该组件可以执行用户分类。这是一个独立的进程去进行学习者学习相关业务。

## Searching

### 搜索功能

Open edX uses Elasticsearch for searching in a few contexts: courseware search, the comments service, and the Student Notes feature.

平台建立了课程搜索、评论搜索、用户笔记搜索等搜索功能。