MASTERY

BY **INSTRUCTURE**

MASTERY CONNECT
ARCHITECTURE OVERVIEW

Engineering, Security, and Operations

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Mastery Connect Architecture

The true meaning of mastery is to possess and display great skill or technique. And nowhere is this more critical than in the classroom at the beginning of the educational journey that we all take in life. Even the most skilled panda knows mastery doesn't always come easily—a little targeted remediation can go a long way. With Mastery Connect by Instructure, we provide teachers and administrators with a comprehensive data-driven K-12 platform so they can get a fast handle on what their students know and don't know through standards-based formative and benchmark assessments. This data can then be used to target interventions and adjust instruction. Or in the eyes of students, simply give them insights into knowing where they are and how they're progressing in said journey. And since it's Instructure, Mastery Connect is BFFs with Canvas LMS, meaning single sign-on and automatic data passback let you launch Mastery Connect assessments directly from the LMS you know and love.

The following supplemental document describes the Mastery Connect platform architecture for those curious technical types who love getting into the detail of just how we enable you to have meaningful conversations around assessment data and the best ways to promote student growth.

Hosting

Instructure's product family, including Mastery Connect, is hosted in the cloud by Instructure and delivered over the internet through the world's most trusted public cloud provider, Amazon Web Services (AWS). The basic building blocks of AWS include services such as Elastic Compute Cloud (EC2), Elastic Load Balancing (ELB), Auto Scaling Groups (ASG), Simple Storage Service (S3), Elastic Block Store (EBS), Virtual Private Cloud (VPC), Simple Email Service (SES), and Identity and Access Management (IAM). We also use advanced AWS platform capabilities including Amazon Kinesis, AWS Lambda, AWS Fargate, AWS Elastic Kubernetes Service ("EKS"), and Amazon Relational Database Services ("RDS"). Instructure's products are designed to make full use of the real-time redundancy and capacity capabilities offered by AWS, running across multiple availability zones in regions throughout the world. Primary storage is provided by Amazon S3, which is designed for durability exceeding 99.99999999%.

Hosting Regions

Mastery Connect is primarily hosted in the AWS US-East-1 region located in Virginia. Within this region, Mastery Connect takes advantage of 3 different availability zones.

Security Program

Mastery Connect is included as part of Instructure's robust information security program that runs on a continuous, PDCA-cycle. It was created based on guidance provided by ISO/IEC 27000:2018 and controls described in ISO/IEC 27001:2013 and is managed by Instructure's Chief Information Security and Privacy Officer. The security program is attested to by a number of current security certifications including ISO 27001, SOC 2, SOC 3, and UK Cyber Essentials Plus.

Mastery Connect has a software development lifecycle (SDLC) that incorporates secure coding practices and controls. All code goes through a developer peer-review process before it is merged into the code base repository. The code review includes security auditing based on the Open Web Application Security Project (OWASP) secure coding and code review documents (including the OWASP Top Ten) and other community sources on best security practices.

Instructure's Security Team regularly performs vulnerability scans on Mastery Connect using a number of internal and external tools and techniques and we make available the results of our annual third-party penetration tests because we believe that being open about all things - security included - enables us to build the best possible product for our customers.

In addition to these measures, the Amazon Web Services infrastructure on which Mastery Connect is hosted has a variety of formal accreditations. Some of the many certifications include:

DoD SRG • FedRAMP • FIPS • IRAP • ISO 9001 • ISO 27001 • ISO 27017 • ISO 27018 • MLPS Level 3 • MTCS • PCI DSS Level 1 • SEC Rule 17-a-4(f) • SOC 1 • SOC 2 • SOC 3 • UK Cyber Essentials Plus

For additional information about AWS security certifications and standards compliance, please refer to http://aws.amazon.com/security and http://aws.amazon.com/compliance/.

Product Security

The following is an overview of Mastery Connect's product security measures:

- All data is encrypted in transit with TLS v1.2 or higher.

- All data is encrypted in storage (at rest) using the AES-256-GCM algorithm.

- The Mastery Connect API is secured by OAuth.

- The Mastery Connect VPC (Virtual Private Cloud) securely resides within the AWS network, which is separate from the public internet. Within our VPC we also have separate public, private and protected subnets.

- A level 7 Web Application Firewall monitors for malicious requests and further protects the application from potential exploits by filtering traffic before it even reaches the platform.

- Host-based vulnerability scans are performed at least quarterly on all external-facing systems. Critical and high vulnerabilities are tracked to remediation.

- Minimal PII is captured, and Instructure maintains a Data Protection Policy reviewed annually.

- Instructure is compliant with the EU's national data privacy and protection law, the General Data Protection Regulation ("GDPR").

Tech Stack / Languages

Mastery Connect is made up of several components, with some variation of programming language:

- The Mastery Connect backend application is Ruby on Rails.

- The Mastery Connect frontend is the Instructure UI which is built on top of React.

Scalability

Instructure's Learning Ecosystem is hosted on Amazon Web Services, and with Mastery Connect, we take advantage of AWS Fargate along with AWS' Elastic Container Service. With these services, we are no longer required to manually provision, configure or scale servers within the Mastery Connect environment. This is done automatically without human intervention. To assist with automated scalability, Mastery Connect also uses auto-scaling read replica databases running RDS Aurora MySQL instances.

Furthermore, to ensure greater scalability of our student assessments and scores, we leverage AWS Kinesis and DynamoDB.

Architecture and Data Flow Diagram (AWS)
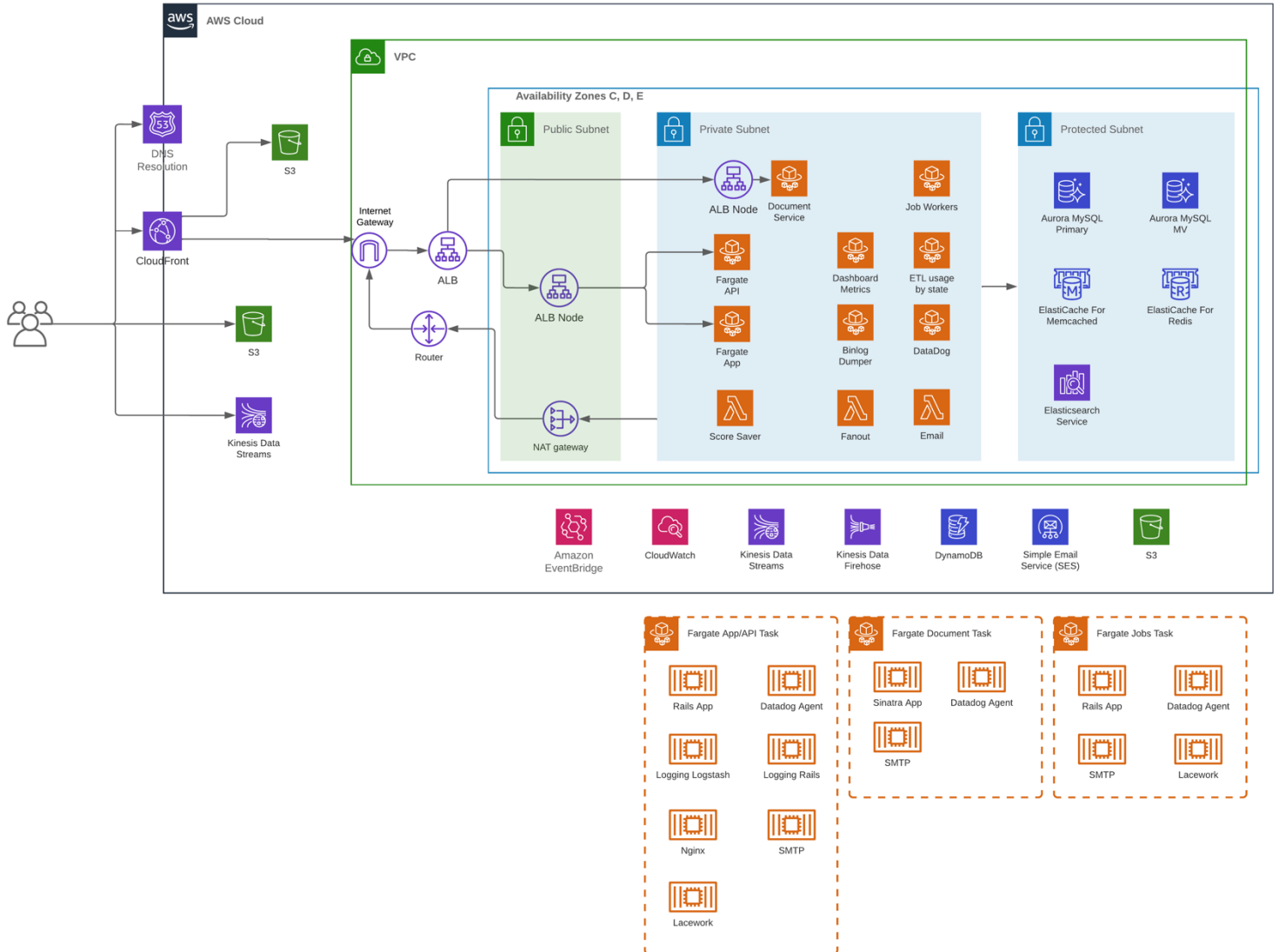
API

The Mastery Connect API allows schools and districts to integrate with Mastery Connect using API calls. School and district administrators can use the Mastery Connect API to manage teachers, students, sections, standards, and assessments. The available API calls can "post" data to Mastery Connect from an outside source, or they can "get" data from Mastery Connect to use in other applications for reporting, third-party analytics, etc.

The Mastery Connect API documentation can be found at inst.bid/mastery/connect/api

Learning Tools Interoperability (LTI)

Mastery Connect is connected to your LMS via simple LTI integration.

If using Canvas LMS, your Mastery Connect admins can generate the necessary Key, Secret, and URL from the Admin menu of your Mastery Connect instance and enter this data into the Apps area of your Admin console.

Once configured, Canvas users will have a "Mastery" icon along the Global Navigation bar providing a seamless experience for students who can now take Mastery Connect assessments within Canvas. Additionally, teachers can now create Mastery Trackers from within a Canvas course or link existing trackers to a Canvas course.

Third-Party Integrations

Mastery Connect is designed to integrate with the institution's Student Information System. We have experience working with most SIS platforms in K12 and have a variety of methods to automatically sync rosters and enrollments, including using Clever. We integrate with most learning management systems (LMS) to streamline user experience for both teachers and student using the 1EdTech LTI standard (formerly IMS Global). We also support numerous methods of single-sign-on and have worked with districts all over the country in various SSO implementations.

Backup & Restore

Mastery Connect conducts asynchronous near real-time replications which are stored within a remote site located in the AWS S3 Cloud. Additionally, nightly backups of every database are performed and stored in a third remote site within AWS.

Backups are performed using a combination of Aurora Backups (for PIT and incremental snapshots) and AWS Backup (for monthly and yearly backups).

Backups are retained based on the following schedule:

- Point in Time Snapshots: 35 days

- Daily Snapshots: 35 days

- Monthly Backups: 12 months

- Yearly Backups: 10 years

Compliance

ISO compliance

Instructure has invested in a robust quality management and security program that's founded on the guidance provided by the International organization for Standardization's (ISO) 27000 suite of standards and we hold ISO 27001:2013 certification, of which, Mastery Connect is included in scope.

SOC 2

Mastery Connect has been audited in accordance with SSAE 18, and a SOC 2 Type II report is available for review upon execution of a non-disclosure agreement. A copy of the SOC 3 report is provided in the Mastery Connect Security Package, available at inst.bid/mastery/connect/dl.

FERPA & COPPA

Mastery Connect is compliant with both the Family Educational and Privacy Act (FERPA) and the Children's Online Privacy Protection Rule (COPPA)

Accessibility

Instructure is committed to delivering products that are accessible and inclusive. We target WCAG 2.1 AA standards in our development. The Mastery Connect team is actively making accessibility improvements. We will continue to make and release additional accessibility improvements as part of our Agile development processes and anticipate providing a formal VPAT for Mastery Connect in the future.

Personally Identifiable Information (PII)

Personally Identifiable Information (PII) in Mastery Connect is minimal and only collected to ensure an optimal user experience. We collect Personal Data from Teachers and Parents when a Teacher or Parent accesses and takes actions on our Site, Apps or Services, such as when a Teacher or Parent creates an

Account. We also collect Personal Data from Teachers when a Teacher creates and posts content to his or her Profile and/or Newsfeed and interacts with other users, including with Students.

We also collect Personal Data about Students that is provided to us by Teachers or Schools, such as their names, student assessment responses and other evidence of learning. If a Teacher creates an Account on behalf of the Student, we collect limited Personal Data about the Student from the Teacher to establish the Account.

Users only have access to the dashboards that their permissions allow, thereby prohibiting users from being able to access PII that they do not have permission to view. Furthermore, it is our policy to not create or retain physical records of personally identifiable information (PII) or confidential client data.

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