IMPACT
BY INSTRUCTURE

ARCHITECTURE OVERVIEW

Engineering, Security, and Operations

November 2022

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Introduction

Overview

One of the key aspects to increasing technology adoption is to start by making faculty aware of the tools available to them and how these tools can help them to improve learning and teaching. Given our experience in the EdTech space, we know Institutions put a lot of effort into training, communication, instructional design, and support, but are often challenged to quantitatively understand their effect on technology usage. This is where Impact comes into play.

Impact by Instructure, formerly EesySoft, is an innovation solution that allows institutions to improve the usage of the tools in Canvas LMS among all teachers and students. Impact ensures that they are getting the most value out of Canvas by allowing administrators to target those who need support, right when and where they need it. With this level of differentiated support, teachers save time and energy on trying to traverse new technologies and are able to invest it into their courses, students, and themselves. Students can engage more deeply, allowing them to focus on the content and not the tech. Impact's insightful dashboards and dynamic reporting provide a panda's eye view of how well students and faculty are engaging with available EdTech tools.

The following document provides insight into Impact's architecture for those enquiring - and technical - minds among our customers and community.

Architecture

Impact Architecture

Impact by Instructure is a cloud-native SaaS application built on Apache Tomcat and MySQL, and hosted on Amazon Web Services, the leading global cloud services provider. Impact relies upon the following web content technologies: HTML, CSS and JavaScript. Through partnerships with the leading EdTech providers, Impact offers our customers turn-key integrations with their learning management systems. After implementation of our software, Impact offers relevant contextual help and creates a personalized support experience for end users while also providing real-time insight to administrators about how users are interacting with systems.

Hosting Regions

For Impact customers, Instructure uses Amazon Web Services (AWS) regions, ensuring that client data is not stored outside of our customer's region*. The current regions in use for Impact are:

- USA: Oregon / Virginia
- Europe: Frankfurt
- Canada: Central
- UK: London
- Asia: Singapore / Mumbai
- Australia: Sydney
- LATAM: Oregon / Virginia

*LATAM Impact customers hosted in US region.

Product Security

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

- All data in Impact is encrypted in transit
- All data is stored at rest within AES-256-bit-encrypted AWS Elastic Block Store (EBS) volumes excluding S3 buckets for static assets
- Working alongside a customer's LMS as the source of truth, minimal PII is captured in Impact.

In addition to this, the Amazon Web Services infrastructure on which Impact 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

System Requirements

For best performance, Impact should be used on the current or first previous major release of Chrome, Firefox, Edge, or Safari. Because it's built using web standards, Impact runs on Windows, Mac, Linux, iOS, Android, or any other device with a modern web browser.

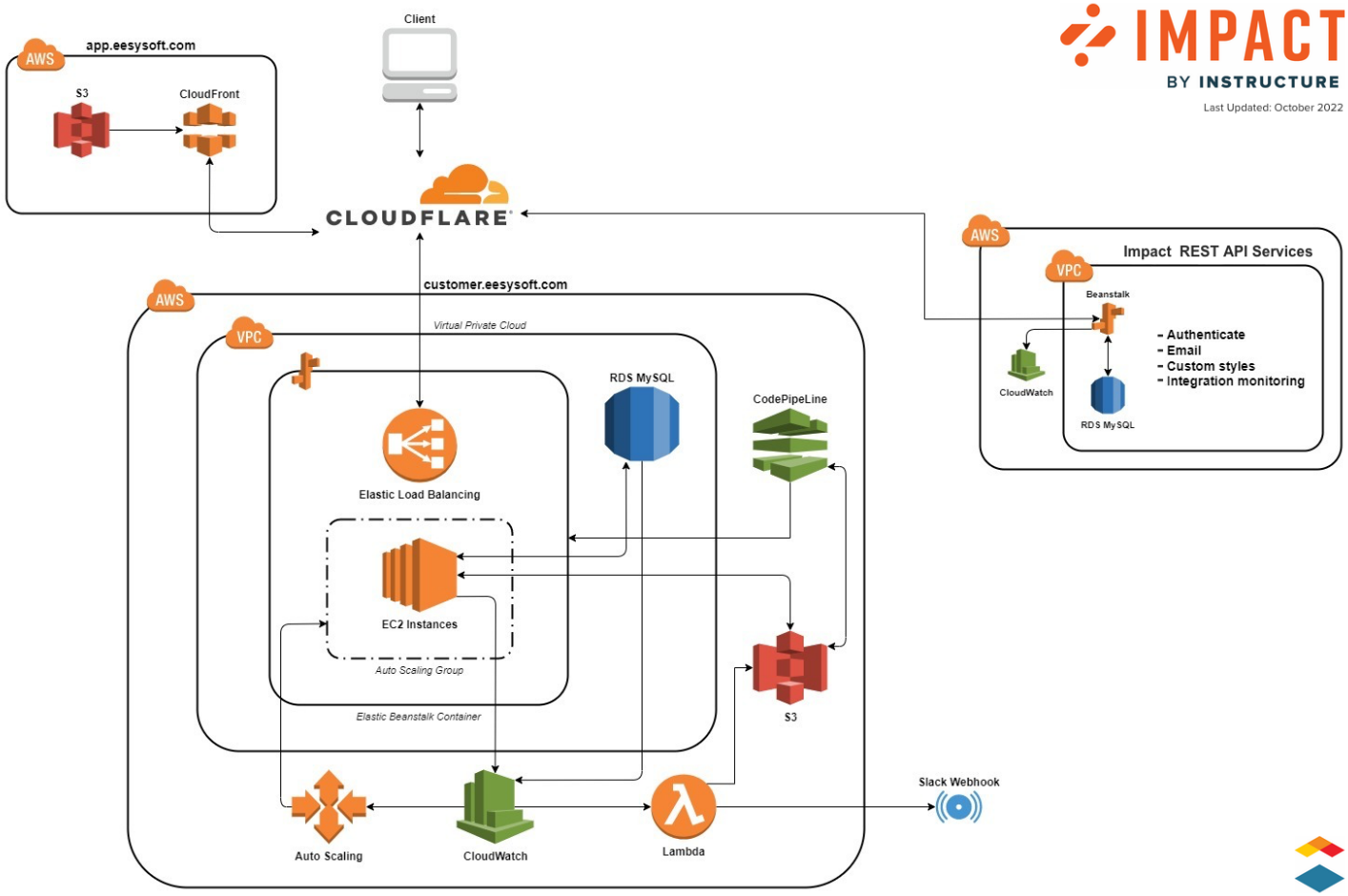
Impact only requires an operating system that can run the latest compatible web browsers. Your computer operating system should be kept up to date with the latest recommended security updates and upgrades.

Supported Browsers

Impact supports the current and first previous major releases of the following browsers:

- **Chrome**
- **Firefox** (Extended Releases are not supported*)
- **Edge**
- **Safari**

System Architecture Diagram



Predictive Scaling

Impact is a Software-as-a-Service (SaaS), hosted by the most established and trusted cloud hosting provider in the world: Amazon Web Services. We leverage AWS' EC2 Auto Scaling technologies to ensure Impact can handle sometimes unforeseen cycles of higher volume. Using Predictive Scaling allows us to predict when a usage peak for any given customer is likely to occur. It also learns from past patterns and launches additional resources in advance of predicted demand, giving them time to warm up and be ready preemptively before a high-demand situation exists rather than in response to one. Additionally, it provides flexible downscaling ensuring that system resources are not removed too quickly when load begins to fall.

Load Balancers

AWS Elastic Load Balancers are deployed in a highly available active/active configuration, which handle incoming requests and dispatch the underlying connections evenly to available Impact application servers. The load balancer maintains a dynamic list of available application servers for dispatch. The load balancer sends regular heartbeats—a simple network message—to verify the application server is healthy, available, and capable of receiving additional work. The load balancer will not dispatch work to unresponsive application servers. Additional capacity is automatically added to the load balancing pool as traffic and demand increases.

Application Servers

Application servers process incoming requests from the load balancers. They are responsible for executing the business logic, rendering HTML, and returning some static assets to the user's web browser.

Application servers are constantly monitored individually for load and capacity information. When all application servers reach a certain load threshold, a new application server is automatically provisioned and deployed. AWS' Predictive Scaling can dynamically and intelligently schedule new application servers in anticipation of high load times, such as during the beginning and end of semesters.

Cache Servers

The Impact caching layer provides performance optimization. A healthy cache means the application servers need to make fewer trips to the database which speeds up response times.

- Amazon CloudFront (a caching CDN) is used for the frontend Impact Dashboard.
- CloudFlare is used for edge caching and CDN for Impact's backend application.

These CDN endpoints are globally distributed, thereby making the network path for these requests as efficient as possible.

Cache servers are constantly monitored. When a cache server fails, a new one is provisioned and deployed to take its place. When a cache server fails, the data that would have been stored on it, is simply retrieved from the database instead.

Cache servers are completely memory based. Memory usage is monitored continuously. When the cache hit rates falls below an acceptable threshold, new cache servers are provisioned and deployed.

Database Servers

The Impact database is a MySQL relational database with one database per institution in a single AWS availability zone (AZ). Server resources are monitored in real time and backup Database servers are created (manually) and made available in case of failure.

Distributed File Storage

Campaign and walkthrough media, including videos, image files, audio recordings, etc. are stored outside the database in a separate and scalable Amazon Simple Storage Service (S3) bucket that is designed for durability exceeding 99.99999999%. All objects within the S3 buckets have version control enabled so previous versions of an object can be restored with minimal effort.

Data Centers

AWS data center electrical and network systems are designed to be fully redundant and maintainable without impact to operations, 24 hours a day, seven days a week. Uninterruptible Power Supply (UPS) units are available in the event of an electrical failure for critical and essential loads in the facility. Data centers use generators to provide backup power for the entire facility.

Instructure creates daily database backups of Impact data and content including media for campaigns and walkthrough. Data is stored redundantly in multiple data centers and multiple geographic locations through Amazon S3. *For further detail on backups, please see Instructure's Business Continuity & Disaster Recovery Paper.*

Through automatic scaling and automated provisioning technology, Impact adjusts cloud resources to handle large usage loads before they cause slowdowns. When concurrent user numbers grow, Impact automatically adds resources so users don't experience outages or slowdown.

Assuring the recovery and redundancy of the Impact platform, we take advantage of multiple geographically separate sites and Availability Zones which provide resilience in the face of most failure modes including natural disasters or system failures. The Impact application is designed to make full use of the real-time redundancy and capacity capabilities offered by AWS and backup server instances can be deployed in alternate Availability Zones if necessary. Primary storage is provided by Amazon S3, which is designed for durability exceeding 99.99999999%.

The Impact architecture is also resilient to failure and capable of rapid recovery from component failure. The Impact application, its media and file storage, and its databases are each independently redundant. If an application hosting node were to fail, all traffic would transfer to living nodes. If load increases, an automated provisioning system ensures that more hosting nodes are made available to handle the traffic—either in response to increased load or in predictive anticipation of future workloads. The database and file stores are also horizontally scalable, adding capacity for both additional storage and load as needed.

Disaster Recovery & Business Continuity

Overview

For detail on Instructure's approach to Disaster Recovery, please see our Business Continuity & Disaster Recovery Paper which covers DR topics such as Incident Management, Recovery Objectives, and Communication. This is available at: https://www.instructure.com/security

While Impact does not store or process customer data, backup procedures have been configured within AWS to run a daily full backup snapshot of Impact system databases and configuration. Impact backups are configured to be retained as follows:

- Daily snapshots for **7 days**

Privacy

Overview

Impact gathers data about a user's interaction with the different tools and functionality in Canvas. This data is sent to the customer-designated server and stored for the purposes of fulfilling the contractual obligations. Upon request, all data about a specific user will be permanently deleted. There will be no subsequent collection of data pertaining to that specific user for any other purposes. If requested, Instructure will provide all data collected about a specific user. Requests about deletion of data and requests about data gathered about a specific user can be sent to privacy@instructure.com. Requests about deleting data will be handled within 48 hours from when the request is made to Instructure. Requests about data collected about a specific user will be handled within 48 hours from the request was made to Impact. The data will only be processed to fulfil a customer contract. No other processing of the data will take place without the written instruction of the controller. No data will, at any time, without the prior written permission of the data controller, be transferred to any third party. The data will only be processed by Instructure employees that have signed a confidentiality agreement, and only for the purposes of fulfilling the contractual obligations.

Sub-processors

Impact uses customer designated servers for storing and processing data. The data in rest and data in transit are encrypted and no personnel at the hosting providers site have access to the data. Impact will not use any other sub-processor without the written consent of the data controller.

Data Protection Officer

Impact has an appointed a Data Protection Officer, in accordance with GDPR Article 39. The Data Protection Officer is responsible for the following tasks:

- Inform and advise the customer and employees of their obligations pursuant to the GDPR regulations
- Monitor the compliance with the GDPR regulations., including assignment of responsibilities, awareness-raising, and training of staff.
- Provide advice when requested.
- Cooperate with the customers with regards to GDPR questions or issues.
- Act as a point of contact for the customer.

Any questions with regards to the GDPR or other privacy matters can be sent to privacy@instructure.com