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**A Report on**  
**Heroku Platform**

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# Abstract

Heroku is a cloud application platform used by organizations of all sizes to deploy and operate applications throughout the world. This report paper digs deeper into the core architecture, use cases, security and privacy of Heroku platform and how one share ideas via fully developed and deployed application and scale it through time as it grows bigger through this platform. This report also suggests why Heroku is best for deploying modern applications. Different use cases and deeper analysis of Heroku platform is also included in this paper.

**Keywords:** Heroku, Cloud Computing, Platform as a Service (PaaS), continuous deployment.

# Introduction

Developed in July 2007, Heroku is a cloud service that provides, Platform-as-a-Service (PaaS). It supports several programming languages such as Ruby, Java, Node.js, Scala, Clojure, Python, PHP, and Go. Heroku is primarily being used as a Web Application Deployment model by many developers. Heroku was founded by James Lindenbaum et al., in July 2007 and was acquired by Salesforce.com in 2010.[1] When Heroku was in initial phase, it supported only the Ruby programming language, but now supports Java, Node.js, Scala, Clojure, Python, PHP, and Go.[2]

Heroku is said to be a polyglot platform (a computer program that performs same operations or output independent of programming language). Hence, it allows the developer to build, run and scale applications in a similar manner across all the languages. The Procfile exposes an architectural aspect of the application and this architecture aims to help the developer scale each part independently. [1]

Heroku also has support for its databases. At present Heroku supports MongoDB and Redis databases in addition to its standard PostgreSQL.

Some of the key products developed by Heroku are: [3]

- Heroku Platform (a powerful ecosystem, for deploying and running modern applications)
- Heroku Postgres (a Cloud database (DBaaS) service form Heroku based on PostgreSQL)
- Heroku Redis (a customized Redis from Heroku to provide a better developer experience)
- Heroku Enterprise (provides services to large companies which help them to improve collaboration among different teams)
- Heroku Teams (a team management tool which provides collaboration and controls to bring customer's developers, processes and tools together in order to build better software)
- Heroku Connect (a service that lets users to easily integrate with Salesforce deployments at scale)
- Heroku Elements (a service that provides users with Add-ons -Tools and services for developing, extending, and operating the applications)

# Literature Review

Tse-Chuan Hsu, Dong-Meau Chang and Hsin-Jan Lee conducted research on the study of application and evaluation with NoSQL databases in Cloud Computing using Heroku[4]. The purpose of this research study was to investigate the cloud computing environment, the credibility of information use in the different database structures such as MongoDB and PostgreSQL. In this case, they use Heroku architecture through new types of conduct practical cases verify. After the establishment of a commercial website modular shelf space cloud environment, using heroku mongo database architecture platform support, and support for station management interface design. To set up the MongoDB database in Heroku, cms-mongolab application is created from heroku dashboard. Through this, Mongo databases project is instantiated to setup a mongodb database. In this study, to compare the database performance, databases are setup via the Heroku platform test, including the back-end database, and are used PostgreSQL MongoDB system, the following description separately.

A whitepaper published by the Salesforce in June 2016 called, “Salesforce Heroku Enterprise: June 2016 A Cloud Security Overview”.[5] This paper includes, Security responsibilities, customer data protection and awareness and how Salesforce and Heroku communicate with each other. This paper states that The Global Privacy Counsel is responsible for Salesforce’s privacy program, including compliance with applicable privacy and data protection laws. Additionally, all Salesforce personnel are required to follow Salesforce confidentiality, privacy, and information security policies. Data security in Heroku’s Premium and Enterprise Postgres database plans encrypt data at rest by using AES-256, block-level storage encryption. Data encryption is implemented using the AWS EBS disk encryption feature. Encryption keys are fully managed by AWS and are not visible to Heroku or Heroku customers. Postgres access credentials are also encrypted at rest.

Customer data is stored in access-controlled physically-segregated databases. Each database requires a unique username and password that is only valid for that specific database and is unique to a single application. Customers with multiple applications and databases are assigned separate database instances and accounts to mitigate the risk of unauthorized access. Customer connections to Postgres databases require SSL encryption to ensure a high level of security and privacy. When deploying applications, Heroku encourages customers to take advantage of encrypted database connections. Stored data can be encrypted by customer

applications in order to meet data security requirements. Customers can implement data storage, key management, and data retention requirements when developing their application.

# Use Cases

There are more than 50 satisfied clients that uses Heroku and services provided by it. Some of the use cases of Heroku are:

- Dubsmash [6]

Dubsmash is an application that enables users to easily and quickly create videos and share them with their friends. Dubsmash Delivers Video Messaging Service on Heroku. Daniel Taschik, Co-Founder & CTO of Dubsmash says that they chose Heroku primarily because of the platform is easy to use and has GitHub integration for continuous delivery.[] Also, developers and CTO were familiar with the Heroku platform, so they felt easy to deploy the application in Heroku. Also, the backend of Dubsmash is written in Python and later moved Go programming language which are both supported by the Heroku platform. Since, it is a video sharing platform, Dubsmash has huge data storage requirements. For such volume, they prefer to use a NoSQL service like DynamoDB and use Heroku Postgres for their relational database needs. Dubsmash also integrates several Heroku Add-ons, including New Relic APM and Librato for performance monitoring, MemCachier for caching, SSL encryption, and Papertrail for logging. This allows them to focus on development.

- Toyota Motor Europe [7]

Toyota Motor Europe runs over 40+ web applications on the Heroku platform that deals with the customers. Heroku provided the trusted platform that Toyota Motor Europe needed to build and scale their continent-wide portfolio of customer-facing applications, at the speed and complexity of their businesses. Instead of having to deal with hundreds of cloud infrastructure deployment scripts or racking servers to scale.

- Scoot Networks [8]

Scoot Networks provides mobility for the city: shared, smart phone-enabled, electric, Vespa-style scooters. Scoot Network's application lets riders to reserve, turn on electric scooters, map their trip, track their battery charge, and pay for the ride, all from their smart phone, and it's all powered by Heroku.[] Scoot Networks engineering team focus on building new features without setting up servers for their customers all through Heroku.



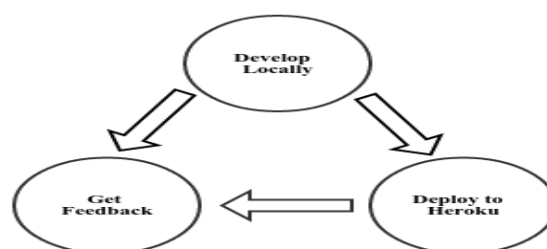
# Analysis

Application require infrastructure. It we want to run a modern day application we need a lot of moving parts like file storage, a server, a database server, a DNS, a domain name. Hence, Heroku is platform that provides all those moving parts. It the developers choice because it lets developer to focus on their application and deliver more value to customer. Applications large and small use Heroku such as Macys, Toyota, Apartment list, Marsh, Lutron, Applauze, etc.

## Architecture

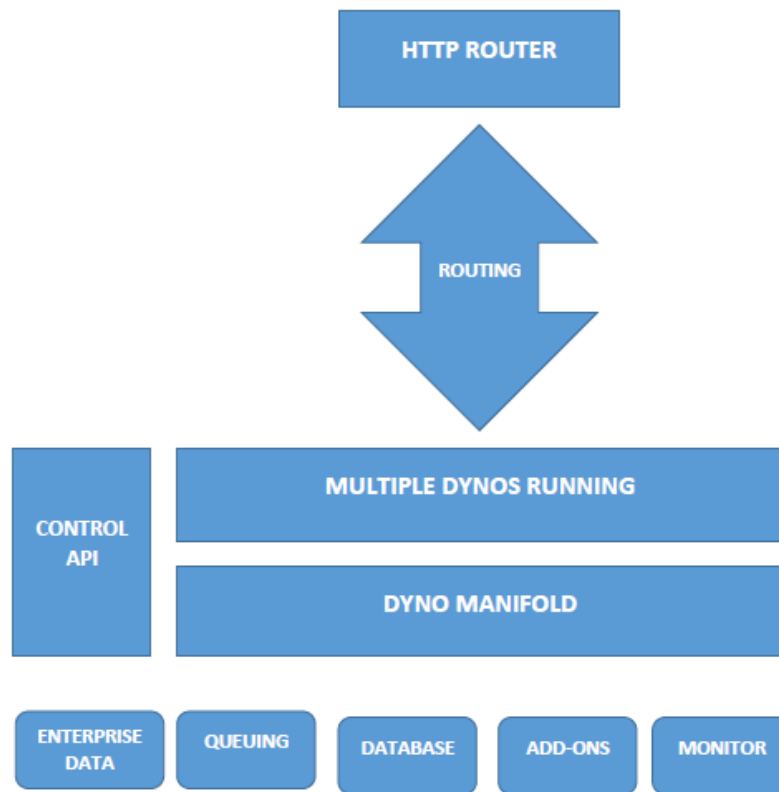
Heroku as a proven scale with a largest platform with 8 billion requests per day, more than 5 million Apps created, and more than 150 Add-on services.[9] It provides everything that we need to build customer facing application. Core of any Heroku application is called Dyno. It can be thought as a really small virtual machine that just runs our application and they can be scaled horizontally. Heroku provides PostgreSQL database that is ran and maintained internally. And the most powerful feature of Heroku platform is Add-ons which provides a marketplace for data stores and app services like Redis, MongoDB, Email services which can be configured and added in the application within a matter of seconds. Applications that are run from the Heroku server use the Heroku DNS Server to direct to the application domain (typically “applicationname.herokuapp.com”). Heroku’s Git server handles application repository pushes from permitted users. Heroku core supporting languages that are supported internally includes Ruby, Python, Java, PHP, Go, JavaScript. Other than these programming languages are supported virtually through community build packs. [1]

Heroku is developer oriented. The main way to develop and deploy through Heroku is get through the version control. Because of this, a developer can deploy their code instantly which supports continuous deployment.



*Figure 1: Continuous development through version control*

The core architecture of Heroku can be viewed as shown in the block diagram below:



*Figure 2: Core architecture of Heroku*

All the infrastructures lie at the bottom level. This includes databases services, monitor, add-ons, etc. Just above it, it has a Dyno grid or Dyno manifold, which runs multiple Dynos at the same time. These dyno grid is controlled through an API called Control Api. Through control API we can create, add a new dyno, deploy an app, version control it, scale it, etc. And above all HTTP Router is placed through which other users can interact with the application.

Some of the infrastructure's used inside Heroku are:[10]

- DNS

Heroku runs approximately 6 Nginx reverse proxies (plus the customers who pay \$100/month for a dedicated IP/proxy so they can use SSL on a custom domain name).

- SQL Database

A PostgreSQL database is automatically provisioned for each application. Databases are run on either shared or dedicated EC2 instances with EBS persistence. Other databases can be maintained by customer through Add-ons.

- Memcached

Heroku uses Membase provided by Couchbase (formerly Membase formerly NorthScale) as an add-on. Memcached makes application faster via caching the requests and data.

- Workers

Workers (formerly Delayed Job) are also run on the app server dynos. Almost half of the dynos on Heroku's dyno grid are workers.

- Logging

Logs from apps servers' and workers' and even some of Heroku's internal infrastructure components (nginx, router, api, slugc) and add-ons are sent to a syslog router called Logplex. Users can access logs via the command line tool, and even setup their own syslog endpoint.

- Add-ons

Third-party add-ons (and some of Heroku's own services) implement a REST API to automate provisioning. When a customer adds an add-on Heroku makes requests to the add-on's API.

## Security

Trust is a core principle of salesforce.com and Heroku. It's this commitment to customer privacy and inspiring trust that directs the decisions we make on a daily basis. Trust is the responsibility of each and every employee and Heroku takes it seriously. [11]

- Vulnerability Reporting

As part of Heroku's commitment to working with security researchers to make platform safer, Heroku operates a bug bounty program to reward those who find and report bugs in the platform. The bug bounty program is managed through Bugcrowd.

- Security Assessments and Compliance in Data Centers

Heroku's physical infrastructure is hosted and managed within Amazon's secure data centers and utilize the Amazon Web Service (AWS) technology.

- PCI (Payment Card Industry)

Heroku uses PCI compliant payment processor Braintree for encrypting and processing credit card payments.

- Penetration Testing and Vulnerability Assessments

Third party security testing of the Heroku application is performed by independent and reputable security consulting firms.

- Physical Security

Heroku utilizes ISO 27001 and FISMA certified data centers managed by Amazon. Physical access is strictly controlled both at the perimeter and at building ingress points by professional security staff utilizing video surveillance, state of the art intrusion detection systems, and other electronic means.

- Data Security

Each application on the Heroku platform runs within its own isolated environment and cannot interact with other applications or areas of the system. This restrictive operating environment is designed to prevent security and stability issues.

- System Security

System configuration and consistency is maintained through standard, up-to-date images, configuration management software, and by replacing systems with updated deployments.

## Backups

- Customer Applications

Applications deployed to the Heroku platform are automatically backed up as part of the deployment process on secure, access controlled, and redundant storage. It uses these backups to deploy customer's application across our platform and to automatically bring application back online in the event of an outage.

- Customer Postgres Databases

Continuous protection keeps data safe on Heroku Postgres. Every change to the data is written to write-ahead logs, which are shipped to multi-datacenter, high-durability storage.

## Privacy

Some of the protections inherent to Heroku's products include authentication, access controls, data transport encryption, HTTPS support for customer applications, and the ability for customers to encrypt stored data.

## Access to Customer Data

Heroku staff does not access or interact with customer data or applications as part of normal operations. Customer data is access controlled and all access by Heroku staff is accompanied by customer approval or government mandate, reason for access, actions taken by staff, and support start and end time.

# Conclusion

Heroku is a cloud platform that lets companies build, deliver, monitor and scale apps. Heroku is the fastest way to go from idea to URL, bypassing all those infrastructure headaches. Heroku focuses relentlessly on apps and the developer experience around apps. Heroku lets companies of all sizes embrace the value of apps, not the distraction of hardware, nor the distraction of servers - virtual or otherwise. It provides the best security feature that there is in the cloud deployment model. Heroku is best for any startups for continuous deployments, better security, sharing ideas to many peoples through a fully functional application within few hours without any concerns of infrastructures that are needed for an application.

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