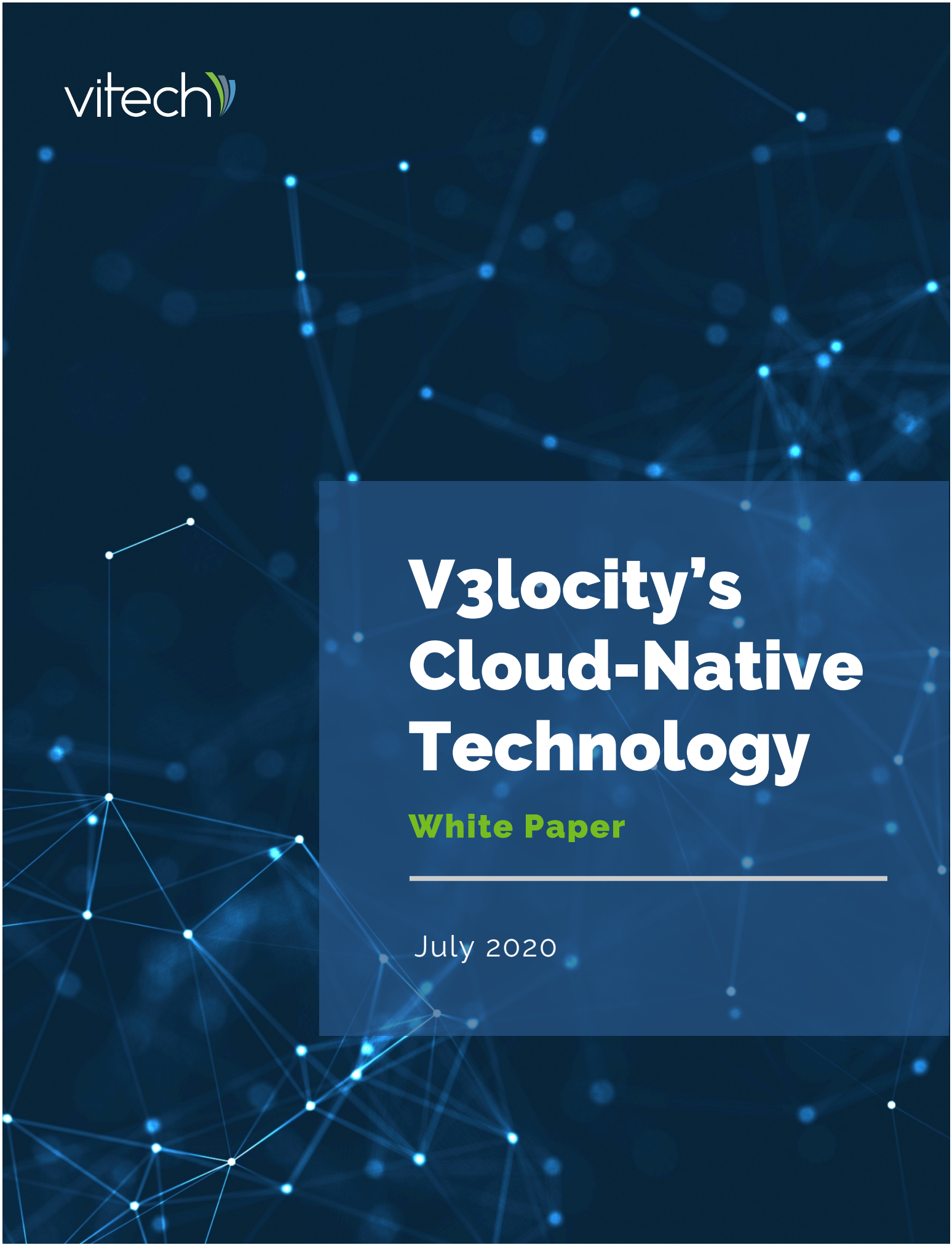


V3locity's Cloud-Native Technology

White Paper

July 2020

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Introduction

In today's rapidly changing business environment, adapting to change is paramount for future success. Sustainable competitive advantage is derived from continuous adoption of new ideas, new strategies, and new business models.

Through effective leverage of native cloud advantages and continuous innovation and reinvention, Vitech is helping organizations achieve winning business results. The turnkey operating efficiency enabled by our cloud-native administration platform helps simplify operations, lower risks, and maximize investments. It also enables agility and speed to market, offers personalized and effortless customer experiences, and helps unleash innovation and growth.

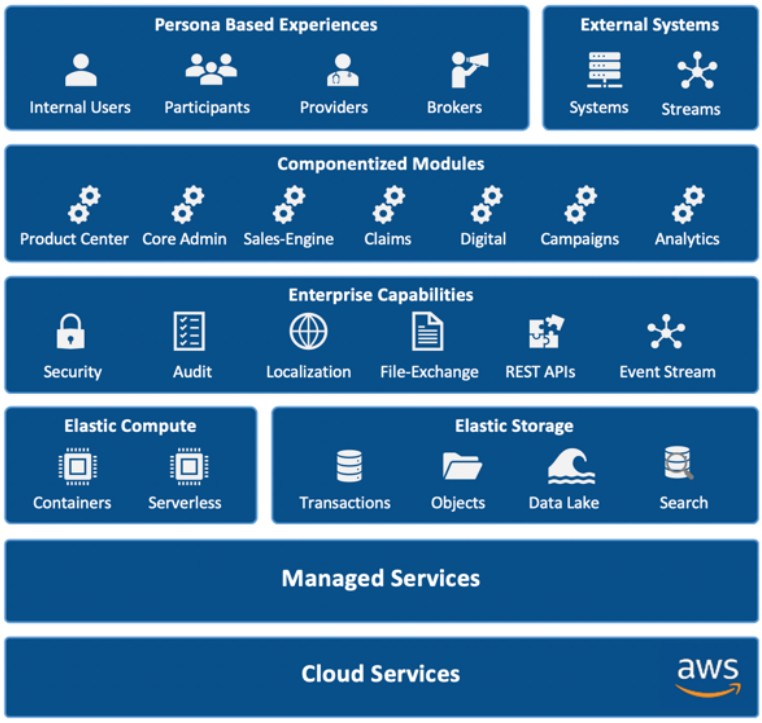


In this paper, we will examine the key tenets of the V3locity® platform, including:

1. A Microservices-Oriented Architecture
2. A Modern Technology Stack
3. An Effortless Digital Customer Experience
4. Next Generation Analytics
5. Cloud-Native Technology for Scalability, Resiliency and Security

1. A Microservices-Oriented Architecture

V3locity embodies a robust architecture that focuses on cloud-native elasticity, resiliency, security and scale. It is built from the ground up on microservices-oriented architecture, representing a high degree of modularity and componentization which spans domain-specific and enterprise-wide capabilities.



V3locity Architecture

Leveraging V3locity's modular building blocks and native configurability, Vitech has composed a series of fit-to-purpose experiences serving a wide range of personas, including employers, participants, providers, brokers, and investors. Digital experiences are data-driven, leveraging industry standard REACT user experience framework, fully responsive and adaptive, and analytics-augmented to ensure that each experience is personalized using configurable business rules as well as individuals' preferences.

Experiences and components are designed to take advantage of cloud-native elasticity. This includes elastic computing with infrastructure automation, container-based and serverless deployments, as well as elastic storage for real-time and cost-effective management of relational and object-oriented data, real-time data streams, and full elastic indexing and search capabilities.

An extensive library of APIs come pre-packaged with V3locity, which streamlines interoperability by using RESTful interfaces and GraphQL queries, Kafka-based queue for message-based integrations, and Data Lake for real-time streaming, large data processing, and analytics.

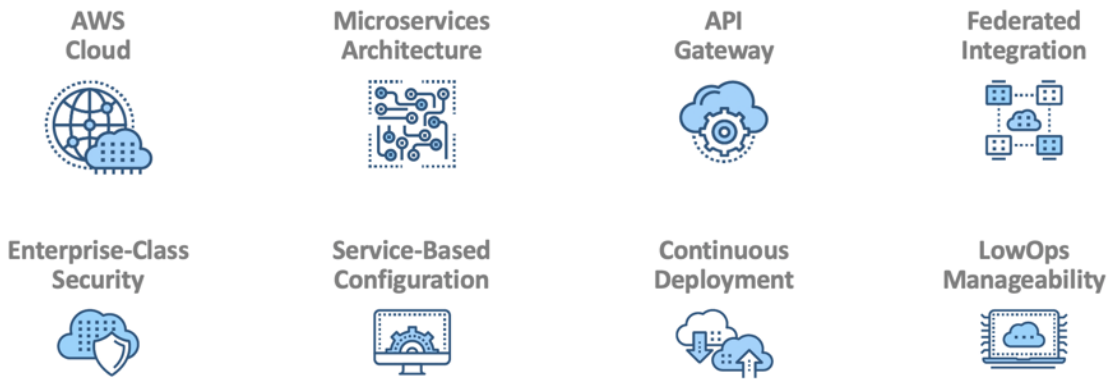
V3locity's out-of-the-box medium-grained RESTful APIs are stateless, support adaptable JSON payloads, operate under Oath2 token-based authentication, and support versioning and API gateways. Interfaces, like all configurations, are externalized which provide platform upgrade resiliency, agility and flexibility.

The zero footprint, turnkey, 24x7, fully managed infrastructure eliminates the overhead that a client would have with managing an on-premise or cloud infrastructure. Our managed services cover a wide range of infrastructure and platform services, including provisioning and management of all pertinent cloud services, vulnerability management and remediation, and disaster recovery.

V3locity is built natively on Amazon Web Services (AWS). By utilizing AWS, we provide our customers with a solution that offers unparalleled scalability, resiliency, redundancy, and security.

Cloud-Native Development Principles

Vitech follows a core set of cloud-native principles to guide the continuous development of V3locity.



V3locity Development Principles

We take full advantage of AWS Cloud and services to optimize our cloud delivery and operations. On top of the AWS Cloud, we layer domain-specific and enterprise-wide

modular microservices that provide the building blocks for our cloud-native application composition.

These microservices leverage a rich set of granular, domain-specific APIs and a robust orchestration gateway that facilitates access to all capabilities of the V3locity platform. With microservices and domain-specific APIs, we enable a Federated Integration model where Vitech's cloud-based services, as well as 3rd Party Services, can be orchestrated in the context of a business activity.

We build on Enterprise-Class security where all data is encrypted, both at rest and in flight, with encryption keys managed using AWS Key Management system for maximum privacy and protection.

We externalize configurations as cloud-based services and provide visual configuration tools to enable business configurability and lower total cost of ownership.

Using continuous integration and continuous deployment pipelines, we enable continuous upgrades to deliver applications that are always up to date. And finally, LowOps Manageability is designed into each cloud service during development. This provides resiliency, redundancy, 24x7 operations and self-healing capabilities.

2. A Modern Technology Stack

V3locity employs a multi-layered technology stack, spanning user interfaces, business applications, on-demand elasticity, integration and interoperability, and managed services, all of which are deployed natively on the AWS Cloud while consuming a myriad of scalable and reliable AWS Cloud services.



V3locity Technology Stack

User interfaces run in standard browsers and represent single-page applications that communicate with the underlying components through REST and GraphQL. Persona-based digital experiences are built on the REACT user experience framework and are data-driven, fully responsive and optimized for browsers, tablets, and mobile devices, and compliant with WCAG 2.1 accessibility standards.

The business application layer is comprised of domain-specific and enterprise-wide microservices as well as a growing number of AWS Cloud services to further enrich the capabilities of Vitech applications and experiences. For example, AWS SageMaker and AWS Kendra are used to power natural language capabilities with V3locity's Digital Self-Service experience.

V3locity delivers on-demand compute and storage elasticity using AWS Elastic Beanstalk, Fargate, Lambda Serverless functions, Aurora Postgres, S3 object storage, and ElasticSearch for full text indexing and search across the platform.

As far as interoperability is concerned, V3locity provides an extensive library of APIs, managed through AWS API Gateway, managed Kafka for message-based interoperability, and real-time streaming and large data processing for data-level integrations using AWS Athena, AWS Redshift, and AWS DMS services.

V3locity uses AWS Elastic Beanstalk for server-side Java processing. Beanstalk is a web/app container that provides the ability to auto scale in and out based on established resource thresholds. Beanstalk is front ended by AWS elastic application load balancers, which perform automatic load distribution and death detection of failed Beanstalk instances in and across AWS availability zones.

The V3locity Managed Services layer represents a turn-key offering that leverages the resiliency, scalability, and security features of Amazon Web Services (AWS), and other third-party products to provide clients with a highly available, high-performing, and highly secure operating environment. Multi-zone real-time replication and failover provide a resilient operating platform for V3locity and minimize operational interruptions to clients' applications.

3. An Effortless Digital Customer Experience

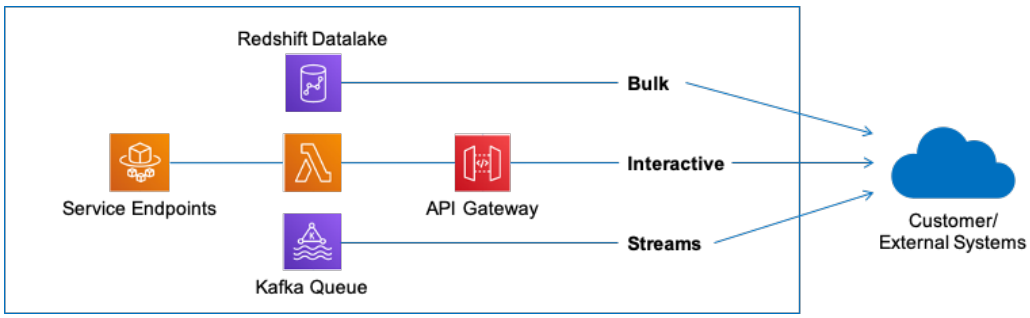
Benefits and investment organizations often struggle to engage with end-participants in an enjoyable way, and companies of all types find it difficult to offer highly personalized service to their customers across a wide range of digital channel and device types.

We have invested significantly in our next generation digital self-service assets that provide highly personalized servicing experiences for group client participants, internal users, brokers, and other service providers. We have achieved this through a combination of responsive/adaptive user design practices, full accessibility (WCAG 2.1), extensive visual configuration capabilities through its cutting-edge visual experience designer, and flexible branding and theming support.

V3locity Digital Self-Service employs cloud-native architecture, modular core admin and digital microservices, and a multi-tenanted configuration store. And because these digital experiences leverage business rules and logic defined in V3locity's core admin services, they offer powerful straight-through processing capabilities.

Open Interoperability

V3locity comes pre-packaged with an extensive library of APIs to streamline interoperability, using RESTful interfaces and GraphQL queries, Kafka-based queue for message-based integrations, file-based exchange, and Data Lake for real-time streaming, large data processing, and analytics. V3locity REST API is a collection of medium-grained JSON-based services that can be accessed over HTTPS by an authorized system or user.



V3locity Interoperability Framework

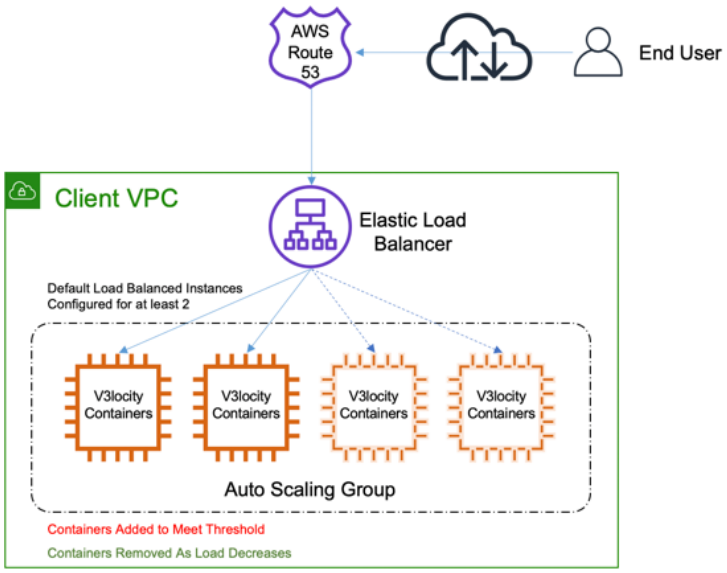
For more specific interface requirements, V3locity supports configured interface facades that reuse various V3locity services. These interfaces support adaptable payloads, security profiles and graining. The interfaces can be ad-hoc or scheduled. They can be activated via a user-initiated application event or via a back-end process.

4. A Highly Scalable and Resilient Platform

V3locity provides a highly scalable and resilient platform, where components scale dynamically in and out based on demand. V3locity has limited points of failure and if failure does occur, it automatically restarts failed components reducing service interruption to a minimum.

The Virtual Private Cloud (VPC) containing V3locity application components resides in a geographic region within AWS. The region consists of multiple Availability Zones (AZs). AZs consist of one or more data centers. V3locity leverages these aspects of AWS to provide a service that by default exists and operates across multiple availability zones simultaneously without degrading performance. Further, automatic death detection capabilities restart a failed web/app in a different availability zone.

Route 53 is an AWS global and highly available DNS service used by V3locity to provide DNS services for application access. It is also used to handle automatic failover in concert with the application load balancers.



Application Resiliency and Load Distribution

Similarly, at the database layer, production databases are configured to be multi-AZ. This means that a primary database instance synchronously replicates the data to a standby instance in a different availability zone. Each AZ runs on its own physically distinct, independent infrastructure, and is engineered to be highly reliable. In the event of an infrastructure failure, the database performs an automatic failover to the standby.

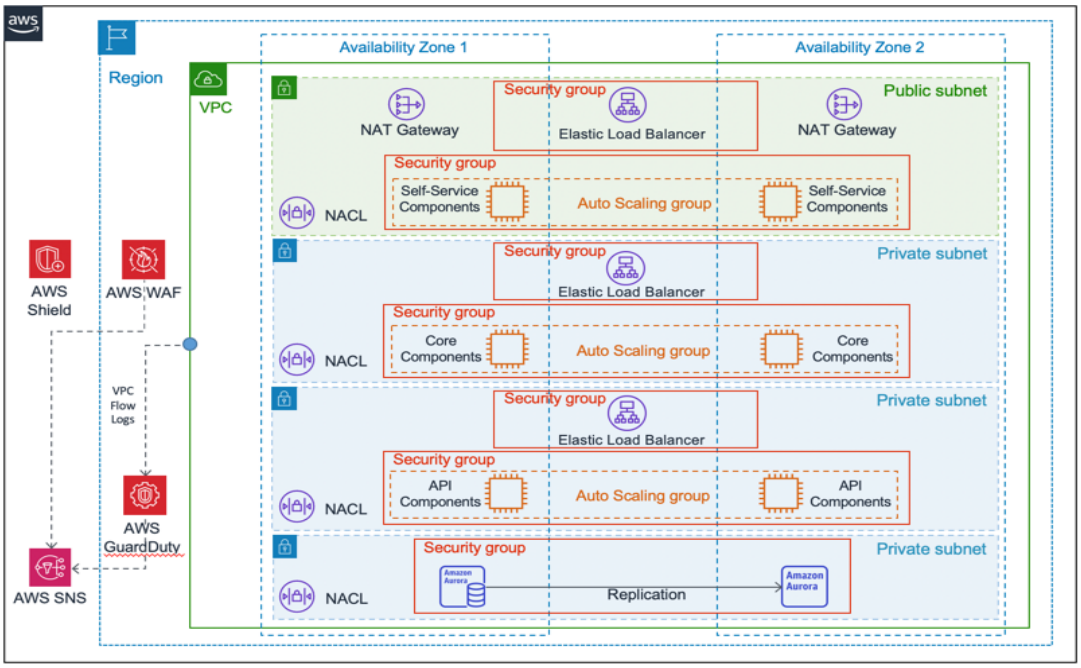
Database snapshots are continuous and incremental so that the database can be quickly restored to any point within the snapshot retention period. Full database snapshots also occur nightly and are retained for 30 days. Daily backups are replicated to an alternate region on a daily basis given data privacy constraints and the availability of alternate regions. Backups can be used to restore the database to any day within the backup retention period. No performance impact or interruption of database service occurs as backup data or snapshot data is being written.

Continuous Security at Scale

V3locity client application environments reside in a VPC. The VPC is a virtual network dedicated to those V3locity application environments and is logically isolated from other virtual networks in AWS. Within the VPC, subnetting and Network Access Controls (NACLs) are utilized to limit traffic in/out of the VPC and between load balancers, web/apps and databases to only those ports and protocols required for processing and administration.

The V3locity Managed Services are provided through a separate and distinct V3locity Management VPC and include infrastructure monitoring and alerting tools, configuration management tools, and security monitoring services, to name a few.

AWS Shield Advanced is used for perimeter monitoring and DDOS threat protection while AWS Web Application Firewall is employed to provide V3locity application-specific traffic filtering and alerting.



V3locity Security Architecture

Traffic is encrypted in transit between each tier of the application. Databases, files and logs are encrypted at rest using AES 256-bit encryption with unique keys for each customer. Access from client offices to V3locity is achieved via a site-to-cloud IPSec VPN tunnel which, in addition to the TLS requirement from Browser to Web server communication, adds an additional level of in-transit encryption. The diagram above depicts these aspects of V3locity's security architecture.

At an instance level, AWS Security Groups are used to provide firewall access controls to each running component. This feature limits port and protocol communication to only those that are needed to run the service. A security group is attached to each component type (Load Balancer, Web/App and Database) and instantiated along with the creation of that particular component. Network Access Control Lists (NACLs) are utilized to limit all traffic in and out of the client VPCs, between load balancers and web/apps, and between web/apps and database instances.

Data is encrypted in transit using TLS 1.2 over port 443 for HTTPS and port 22 for SFTP and SSH access. Data at rest is encrypted using AES-256-bit encryption. This is done for each storage type used by V3locity including the database, the file level, and at a block level.

SSL and SSH certificates are stored and managed using AWS Certificate Manager and use established expiration polices to expire and renew certificates.

Encryption keys are stored and maintained using AWS Key Management Service which uses FIPS 140-2 validated security modules to protect the security of the keys. Keys are unique to each client installation. Keys are automatically rotated by the key management service based on configured policies.

5. One Platform to Maximize Value & Minimize Risk

V3locity® is Vitech's cloud-based administration, engagement, and analytics platform. It is a suite of complementary applications that offer full life cycle business functionality and robust enterprise capabilities. Its modular nature enables flexible, agile deployment strategies. V3locity employs an advanced, cloud-native architecture that leverages the unique capabilities of AWS to deliver a solution with unparalleled manageability, scalability, and resiliency, and which greatly reduces risk.

Vitech has emerged as a market leader and a winning solution for organizations seeking transformation, modernization, agility, and innovation in digital engagements, analytics-based insights, and real-time connectivity to their partner ecosystem.

Vitech is an AWS Advanced Partner and the V3locity platform is recognized as an AWS Well-Architected solution and has achieved AWS Financial Services competency status. V3locity continues to incorporate additional AWS Cloud services, such as Artificial Intelligence, Machine Learning, and Analytics, to deliver differentiated solutions to our customers. V3locity has received three XCelent awards by Celent for Technology, Functionality, and Service setting it far apart from any competing offering.