

Epic on AWS Architecture Guide

November 20, 2020



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Abstract

This guide discusses the benefits of building or migrating an Epic environment on AWS including end-to-end and hybrid architectures that provide cost optimization, business continuity, high availability, and simplified hardware refresh cycles.

Introduction

Cloud is becoming the new normal for healthcare systems and hospitals around the world. While the shift from paper-based health records to electronic health records drove the deployment of many clinical systems into on-premises data centers of healthcare organizations, these same organizations are realizing the constraints of on-premises deployments related to securing and converting data to meaningful clinical insights in a scalable and reliable IT infrastructure. As a result, healthcare organizations are deploying cloud technologies to allow them to shift their focus back towards their core mission: to better serve their patients and communities.

AWS has been working closely with Epic Systems to address the growing interest across organizations wanting to host clinical systems in the cloud, and AWS is excited to announce that healthcare organizations can now host their Epic Electronic Health Record (EHR) system in the AWS cloud. Healthcare organizations looking to host their Epic system in the cloud generally are looking to:

- Reduce capital expenses due to a hardware refresh cycle by minimizing on-premises data center needs and shifting to a more elastic, operational model.
- Integrate new technology into existing environments with minimal operational impact in a cost-effective way.
- Improve disaster recovery (DR) capabilities in a cost-effective manner with large-scale, geographically dispersed data centers and availability zones.

As a trusted partner for many healthcare organizations, AWS continues to explore new ways to support customers in their cloud journey including standing up an Epic environment, deploying machine learning capabilities, and addressing clinician burnout. As part of this guide, we will dive deeper into how your organization can benefit from hosting your Epic EHR system on AWS and provide an overview of the key considerations in an implementation of Epic on AWS.

Epic has two deployment models for their customers: 1) Epic hosted and managed solutions and 2) customer hosted and managed implementations. This guide explores the second offering and how those customers now have the option of running their implementation in the AWS cloud.

The Environment

The Epic electronic health record is built upon four key foundations. These foundations include production or primary instances and corresponding members that act as the disaster recovery or secondary instances. For healthcare organizations, Epic DR is sized and able to handle complete production workloads without noticeable differences to providers and patients.

Foundations

- Operational Database – Built upon Chronicles, this is the Epic specific database that uses the framework of Intersystem Cache or IRIS DB. The patient record resides here and is the point of truth for the rest of the Epic environment.
- Cogito & Clarity Databases – Built on Microsoft SQL Server or Oracle DBMS, this is the reporting and business intelligence layer.
- Hyperspace –The customer presentation layer that runs as a fat client, a pushed application, or virtual desktop with client install. This runs on Citrix’s Virtual Apps and Desktop or VMware Horizon Desktop and Application Virtualization.
- Web, Servers, and Support – This is the layer responsible for web presentation, printing, Hyperspace Web, and BLOB. This runs atop Windows servers.

Besides the key Epic components, an Epic on AWS deployment also leverages other third party applications and services, including Citrix ADC (formerly NetScaler), F5 Global Load Balancers, and Microsoft Active Directory.

Cloud Adoption

Healthcare organizations have been exploring Epic workloads on AWS as part of one of two journeys: 1) a complete greenfield all-in solution for those just implementing Epic, or 2) an incremental approach for existing customers that provides a roadmap to migrate any or all of the above components as a hybrid design where parts reside in either on-prem or co-located facilities and the rest is in the AWS Cloud. The architecture can be designed as single region, multi-availability zone workloads, or as multi-region, multi-availability zone designs to best meet the needs of your organization’s practice. This approach provides a predictable and operationally supported method of moving this critical resource to the cloud with minimal impact and risk.

Here, we present three scenarios available to existing Epic customers to migrate their EHR to the cloud:

- Test/dev/training environments on AWS that quickly scale up and down as needed to support organizational needs without duplication of hardware investments.
- Fully-supported and economical DR environments that quickly scale up during a disaster to meet demand and scale down to keep costs low.
- An all-in Epic design that provides single or multi-region protection.

All of these designs build upon each other to achieve high availability and business continuity. Your AWS account team, working with your Epic Technical Coordinator (TC), can help you decide the best options and scenarios that right-size deployments to your needs and requirements.

Securing & Connecting Your Healthcare Data

Clinicians rely heavily on the information in the EHR to be readily available to make patient care decisions. Patients trust that their personal information is secure within their healthcare provider's EHR. Protecting this valuable data as well as providing seamless access to your resources requires planning and pre-work before the first Epic workloads can be introduced into the AWS cloud.

Prior to any data going into the AWS cloud environment, we encourage our customers to review best practices on architecting for HIPAA and HITRUST. Security controls will be required to leverage HIPAA-eligible services and must be PCI-compliant. It is also recommended that your organization evaluates other security programs (e.g. NIST and HITRUST) to be implemented. AWS has a comprehensive portfolio of security-related tools and services that healthcare organizations can use to assess and further secure their environments. Please refer to the [AWS HIPAA Compliance](#)¹ page for more information.

AWS Direct Connect is recommended for initial rollouts and required for low-latency production grade workloads to support multiple and geographically diverse connections from your site to an AWS region. AWS Professional Services has Epic programs as well as general healthcare migration strategies to create, secure, use, and maintain your infrastructure.

Epic Core Virtual Private Cloud (VPC)

The first step in configuring the Epic environment is the core VPC. This VPC is the first step in any deployment to a new region. It consists of:

- Bastion/RDP/relay servers
- AD/DNS/NTP replication servers
- Certificate servers
- Epic Kuiper and System Pulse servers
- The multipurpose Microsoft SQL Server used by Epic for management and logging
- Citrix or VMWare management systems in a separate subnet for the application and or VDI infrastructure
- Subnet for F5 or Citrix load balancers management tools.

As you expand your infrastructure into different regions, this VPC is the first component to be deployed.

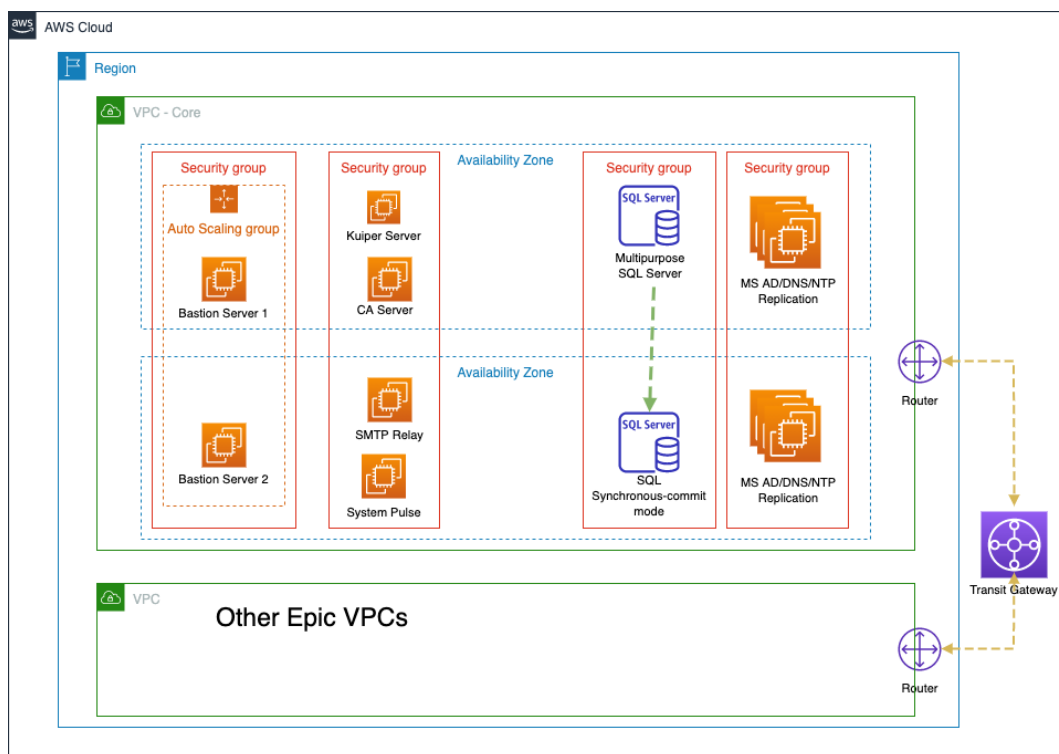


Figure 1 - The Epic Core VPC containing critical components

Test/Dev/Train Deployments VPC

Customers introduce new technology and workflows early into training, test, and development environments where cloud economics and technology provide powerful benefits. AWS gives you the ability to immediately deploy test and development environments, with correctly sized resources, that can easily mirror production. These resources can later be paused or terminated when not needed in order to save costs. This can be done in an automated fashion using only the resources that the trainers need for their classes. The diagram below illustrates the segregated control and access gained from the different subnets for test, dev, and train.

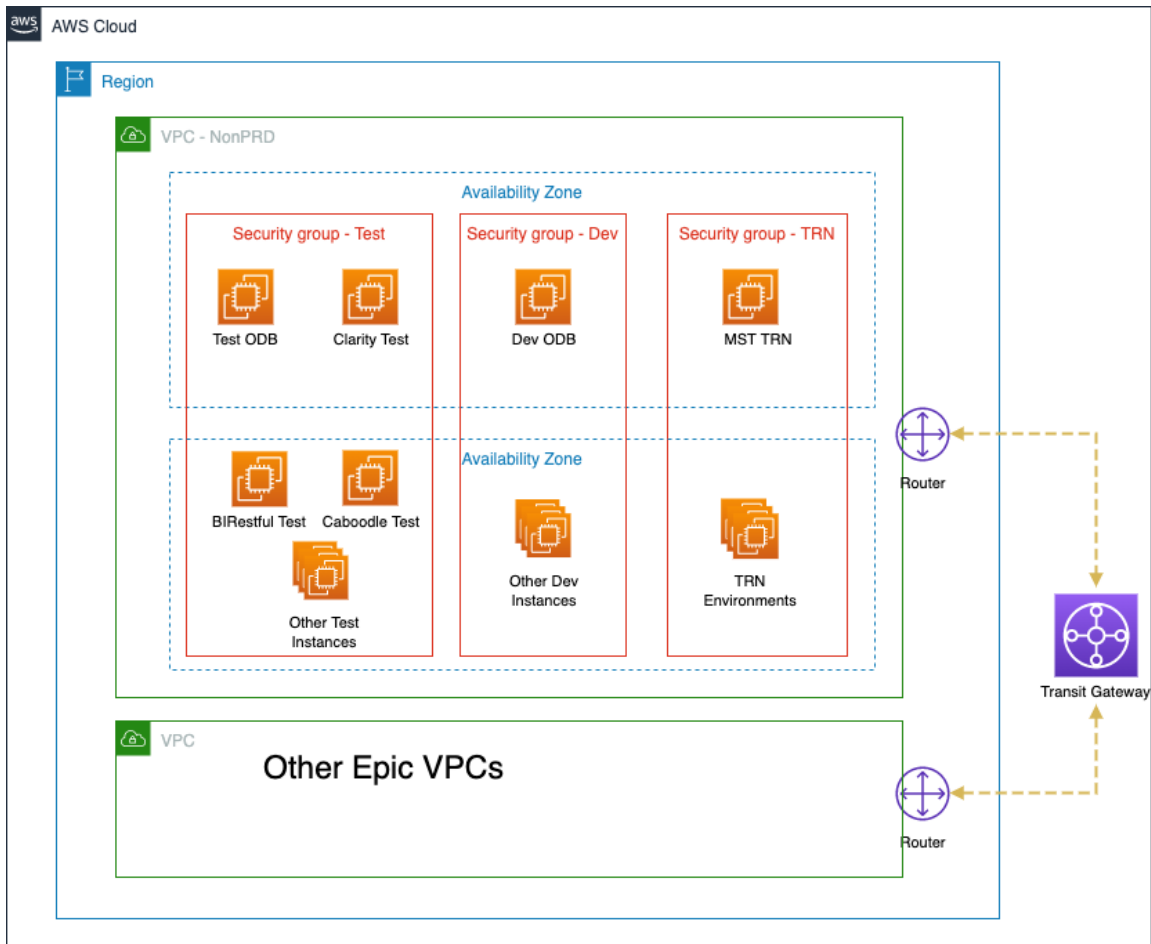


Figure 2 - Development, Test, and Training environments

Disaster Recovery VPC

Downtime costs an average healthcare customer \$8,900 per minute². Implementing a Disaster Recovery (DR) plan using AWS can mitigate that risk. A disaster recovery

deployment to an AWS region can serve as a supplement to an existing DR strategy to provide geographically diverse protection or can stand alone as a complete DR solution. The concepts and architectures will have similarities modular in design to support the required DR components such as full DR, Chronicles only, Hyperspace and WSS only, and/or Cogito/Clarity DR.

Active/active and active/passive Hyperspace designs

Latency between the Chronicles layer and the Hyperspace layer is the only factor that determines which version of Hyperspace you can run. This includes hybrid design, same region design, and multi-regional designs. A significant advantage that AWS offers is leveraging existing tools to create a seed, passive Hyperspace site that allows you to keep a significantly smaller footprint ready to receive patients in case of failover and then spin up to 100% capacity.

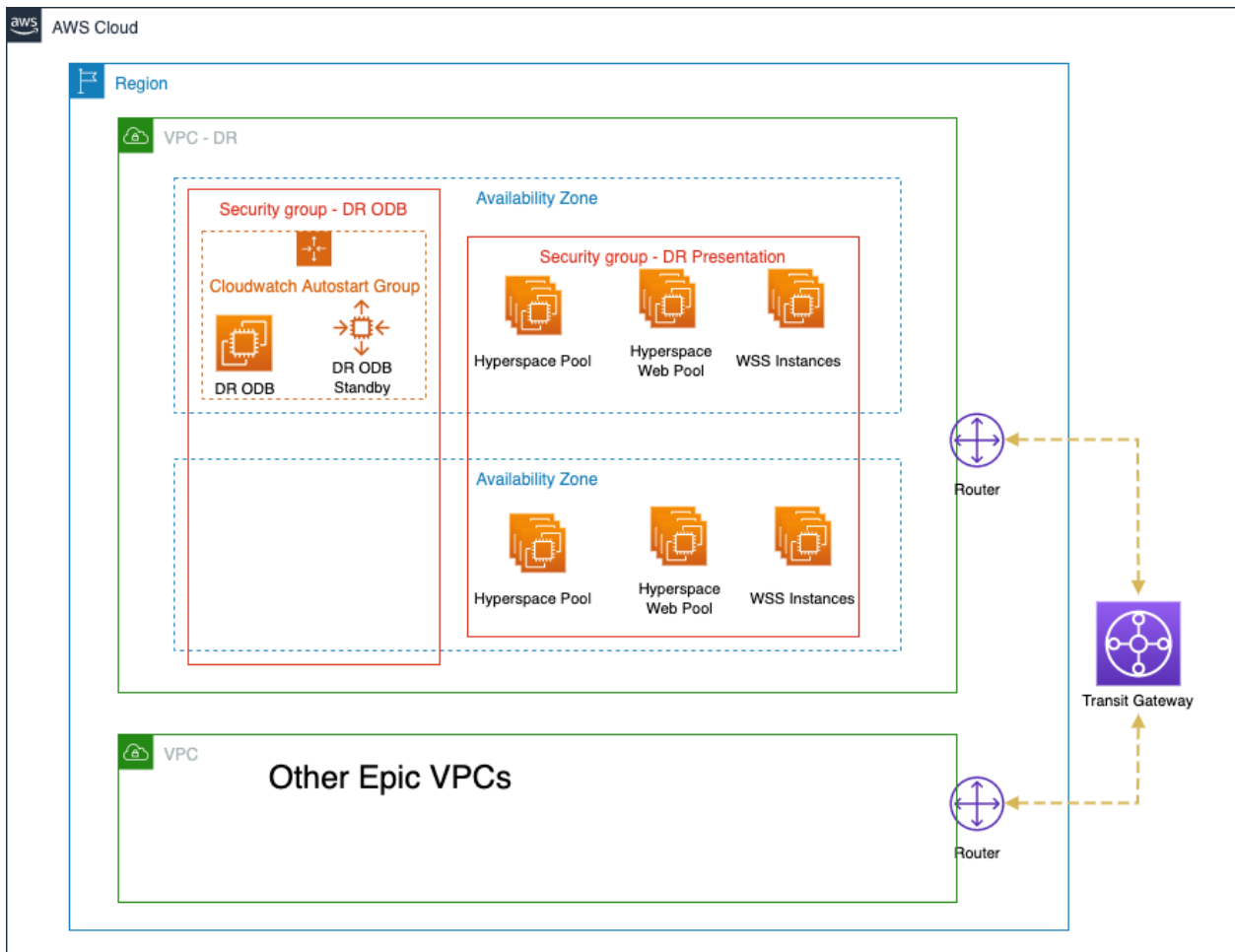


Figure 3 – Hyperspace environment

Full Epic on AWS Cloud

Finally, the last step in your cloud migration journey would be an Epic environment completely on AWS. Below, you will see both a single region design and a multi-region design.

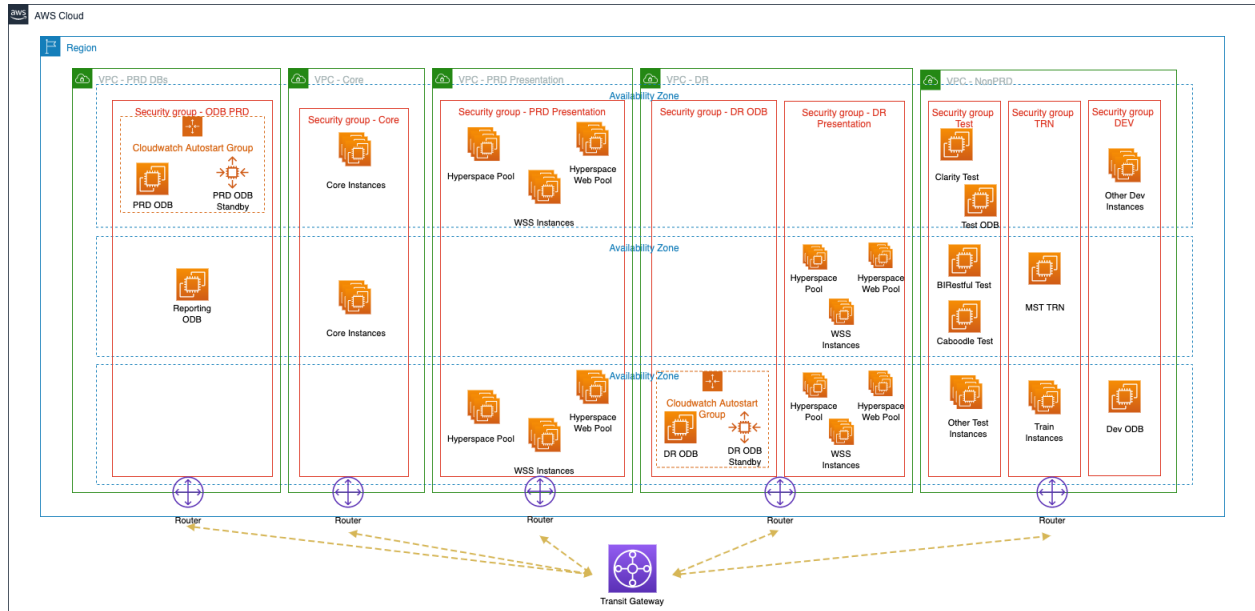


Figure 4 – A single region example architecture

MULTIPLE REGION DESIGN

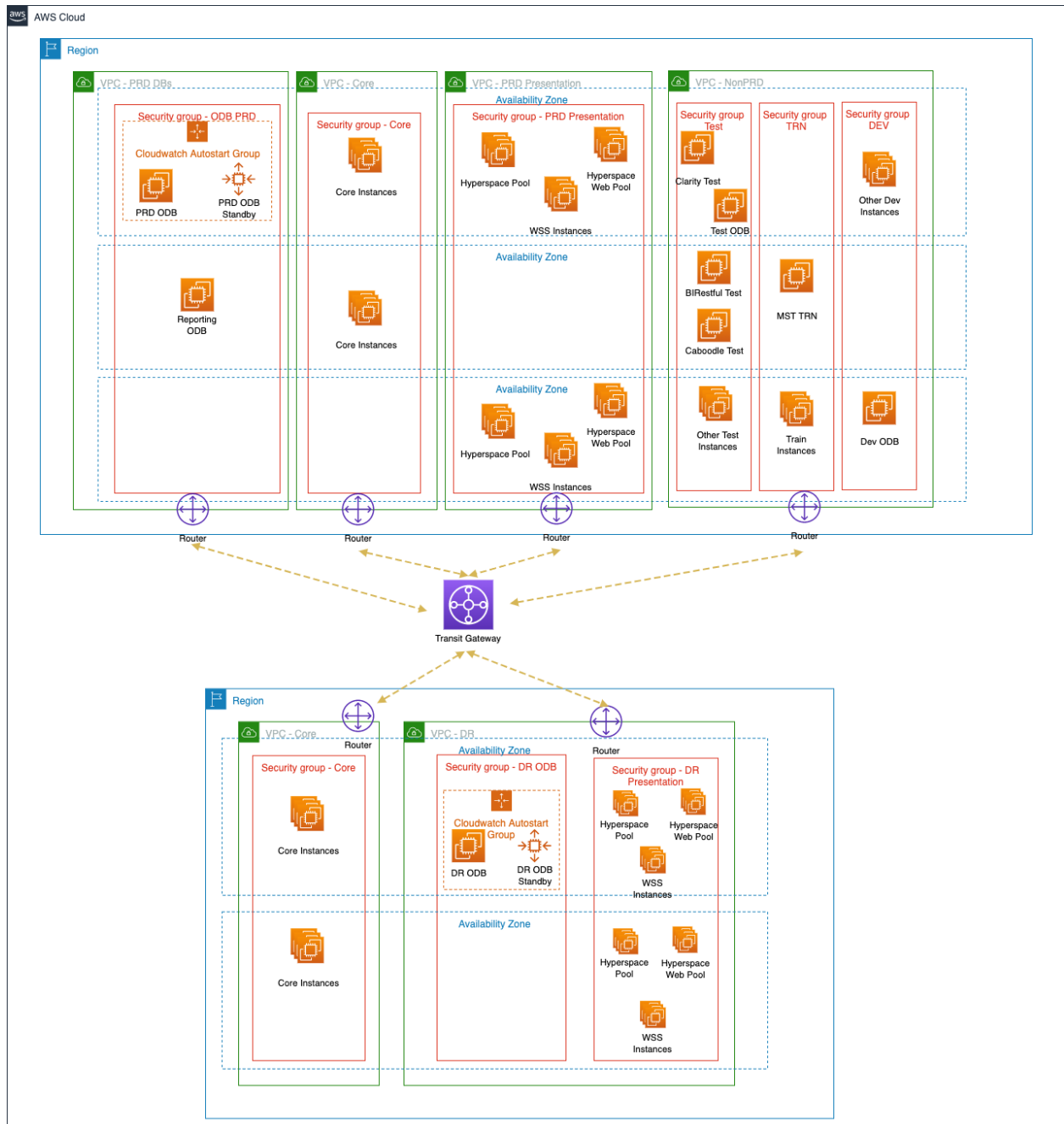


Figure 5 – A multi-region example architecture

Advantages to Running Epic on AWS

Healthcare organizations are finding both financial and technical advantages of running Epic on AWS to address key challenges in their on-premises environments.

Technology refresh ease

One of the hardest challenges for healthcare customers is trying to align hardware purchases with the quickening pace of technical change in their environment. This is especially the case with the Intel processor road map. With AWS, healthcare organizations will now be able to swap out instances and add new technology easily without the burden of repurposing and maintaining older hardware.

Performance that matches on-prem

Epic workloads have demanding requirements around compute and storage. AWS can run on the same approved processors as on-prem as well as provide storage performance that matches on-prem arrays.

Flexibility in environment copies and refresh

Many healthcare organizations receive internal demands to deploy various Epic environments. Those demands often are unfulfilled because the organization does not have the storage or servers on-prem. Conversely, the organization may purchase excess storage and compute to handle sporadic workloads increasing expense and design complexity. With AWS, organizations have access to the resources they need and pay only when they actually use those resources.

Support to help achieve outcomes

AWS offers support plans designed to provide the right mix of tools and access to expertise that work on your behalf to solve your toughest challenges in the cloud including troubleshooting, understanding best practices, and finding the right services to meet your needs. Healthcare organizations can leverage an AWS Enterprise Support plan to gain access to a dedicated Technical Account Manager (TAM) who provides advocacy, guidance, and case management.

Engaging a TAM early in the Epic on AWS migration process helps ensure a seamless experience with one-on-one assistance and deep AWS expertise to navigate your organization through your cloud journey. A TAM will help you onboard, coordinate access to AWS subject matter experts, present insights and recommendations on your AWS spend, manage events, escalate support tickets, and keep your AWS environment healthy.

Conclusion

Customer obsession drives what we do across AWS. This has been a multi-year journey to marry the technology, security, and operational excellence into a solution that better supports and grows as you need to support your clinicians and patients. This becomes a critical piece in being able to move your datacenters to the cloud.

To find out more about how AWS can help your organization reduce capital expenses, achieve cost-optimized Epic deployment, and integrate advanced technologies, reach out to the AWS Epic team at aws-epic-team@amazon.com. You can also reach out to your Epic Technical Coordinator who can assist you with sizing your Epic environment for AWS and connect you with the AWS Epic team.

Contributors

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Further Reading

For additional information, see:

- [AWS HIPAA Compliance Page](#)¹
- [“Accelerating Innovation in Healthcare” Whitepaper](#)³
- [“Implementing Epic in the Cloud” Webinar](#)⁴

Document Revisions

Date	Description
November 2020	First publication

Notes

¹ <https://aws.amazon.com/compliance/hipaa-compliance/>

² <https://www.fortherecordmag.com/archives/1117p24.shtml>

³ <https://bit.ly/35PXjdm>

⁴ <https://bit.ly/3kV0yox>