# Task 4

## Migrating Indian Railways System to AWS

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# Migrating Indian Railways System to AWS

The Indian Railway System (IRS) is the world's fourth largest railway network, with a total route length of 67,956 kilometres. Functioning over a million trains in a humongous railway network like the IRS can be extremely complicated and computationally demanding; any hiccup can result in train crashes or trains running late, affecting public morale and expenses. Monitoring a state's railway system alone on an on-premise datacentre can be a huge challenge, as any blackouts or disruptions in communication can cause a slew of problems, imagine doing so for a large-scale network like our Indian Railway System.

## How AWS can improve IRS

The above issue can be solved using AWS cloud services. AWS provides numerous services that can be used to optimise railway routes for passengers and cargo trains so neither the passenger train nor the cargo train is delayed. By deploying it in different AWS Availability Zones, the Railway System will have extremely low latency from either zone and will continue to function even if a disaster occurs in one of the availability zones**. Amazon EC2 instances** provide a variety of optimization types that can be used to perform country, state, and area level optimization with minimal computation time.

It can take several months to migrate the entire Indian Railway Management System to AWS. The cloud providing partner would need to go through several case studies related to this and research into the client's requirements to get a clear picture of what needs to be done and how it can be accomplished. There would then need to be several weeks of

meetings with the Cloud partner and the clients discussing features to include in order to cover all of the client's requirements with high security and within the cost limit. During this meeting, the provider will ask the client questions about the application, such as whether it has any *legacy applications, data security, additional features* they want to add, and compliances at a cost they can afford.

Whether any of the features exceed the client's budget, the provider will recommend a less expensive alternative solution that includes a different set of features. The cloud migration can begin once the client is satisfied with the plan. Based on the client's security, cost, and feature requirements, the provider will select a strategy from the **6 R's**, which are **Re-host, Re-platform, Repurchase, Refactor, Retire, and Retain**. Following the selection and migration of the strategy, a performance quality is measured on the cloud-based system and presented to the client. Once the railway management system is deployed on AWS, any authority from anywhere in India with the appropriate authentication can access the Railway Management System to make changes or monitor for any anomalies or issues and completely managed by the Amazon employees.

# Services that can be used by IRS while migrating to AWS

## 1. EC2

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers. We have the most powerful GPU instances for machine learning (ML) training and graphics workloads, as well as the lowest cost per inference instances in the cloud. More SAP, high performance computing (HPC), ML, and Windows workloads run on AWS than any other cloud.

## 2. S3

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers
industry-leading scalability, data availability, security, and performance.

## 3. Elastic Load Balancing

Elastic Load Balancing (ELB) automatically distributes incoming application traffic
across multiple targets and virtual appliances in one or more Availability Zones (AZs).

## 4. S3 Glacier

Amazon S3 Glacier is a secure, durable, and extremely low-cost Amazon S3 storage class for data archiving and long-term backup. With S3 Glacier, customers can store their data cost effectively for months, years, or even decades.

### 5. CloudSearch

Amazon CloudSearch is a managed service in the AWS Cloud that makes it simple
and cost-effective to set up, manage, and scale a search solution for your website or
application. Amazon CloudSearch supports 34 languages and popular search features
such as highlighting, autocomplete, and geospatial search.

### 6. SES

Amazon Simple Email Service (SES) is a cost-effective email service built on the reliable and scalable infrastructure that Amazon.com developed to serve its own customer base. With Amazon SES, you can send transactional email, marketing messages, or any other type of high-quality content to your customers. This service helps people to get their train tickets mailed in a fast manner.

### 7. SNS

Amazon Simple Notification Service (Amazon SNS) is a fully managed messaging service for both application-to-application (A2A) and application-to-person (A2P) communication.

### 8. Worklink

Amazon WorkLink is a fully managed service that lets you provide your employees with secure, easy access to your internal corporate websites and web apps using their mobile phones. Traditional solutions such as Virtual Private Networks (VPNs) and device management software are inconvenient to use on the go, and often require the use of

custom browsers that have a poor user experience. As a result, employees often forgo using them altogether.

### 9. DataSync

AWS DataSync is an online data transfer service that simplifies, automates, and accelerates moving data between on-premises storage systems and AWS storage services, and also between AWS storage services. DataSync can copy data between Network File System (NFS), Server Message Block (SMB) file servers, self-managed object storage, AWS Snowcone, Amazon Simple Storage Service (Amazon S3) buckets, Amazon EFS file systems, and Amazon FSx for Windows File Server file systems.

### 10. IAM

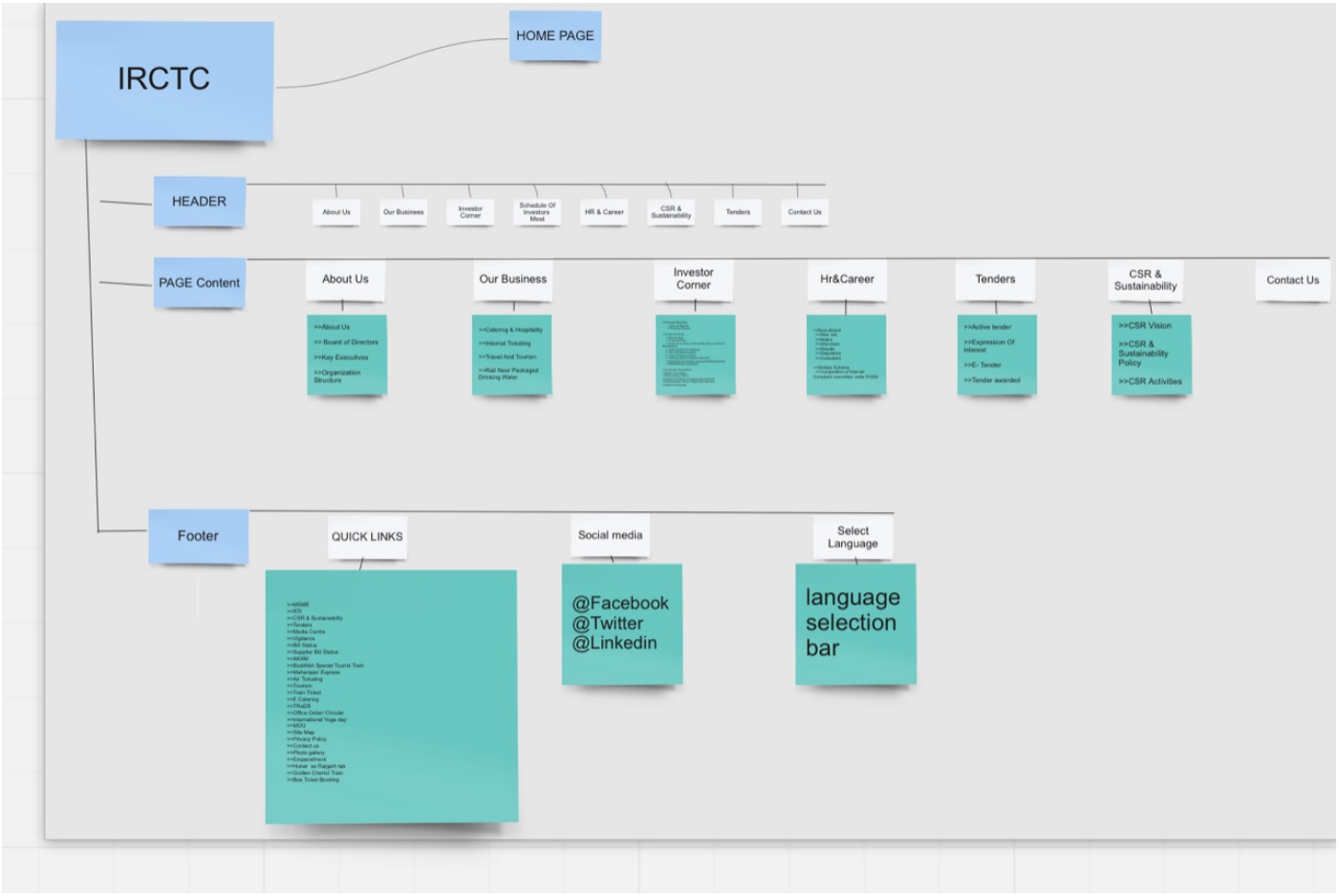
AWS Identity and Access Management (IAM) enables you to manage access to AWS services and resources securely. Using IAM, you can create and manage AWS users and groups, and use permissions to allow and deny their access to AWS resources.

### 11. Shield

AWS Shield is a managed Distributed Denial of Service (DDoS) protection service that safeguards applications running on AWS. AWS Shield provides always-on detection and automatic inline mitigations that minimize application downtime and latency, so there is no need to engage AWS Support to benefit from DDoS protection. There are two tiers

of AWS Shield - Standard and Advanced.All AWS customers benefit from the automatic protections of AWS Shield Standard, at no additional charge. AWS Shield Standard defends against most common, frequently occurring network and transport layer DDoS attacks that target your web site or applications.

# Sitemap Of IRS



# Architecture Model Of IRS on AWS

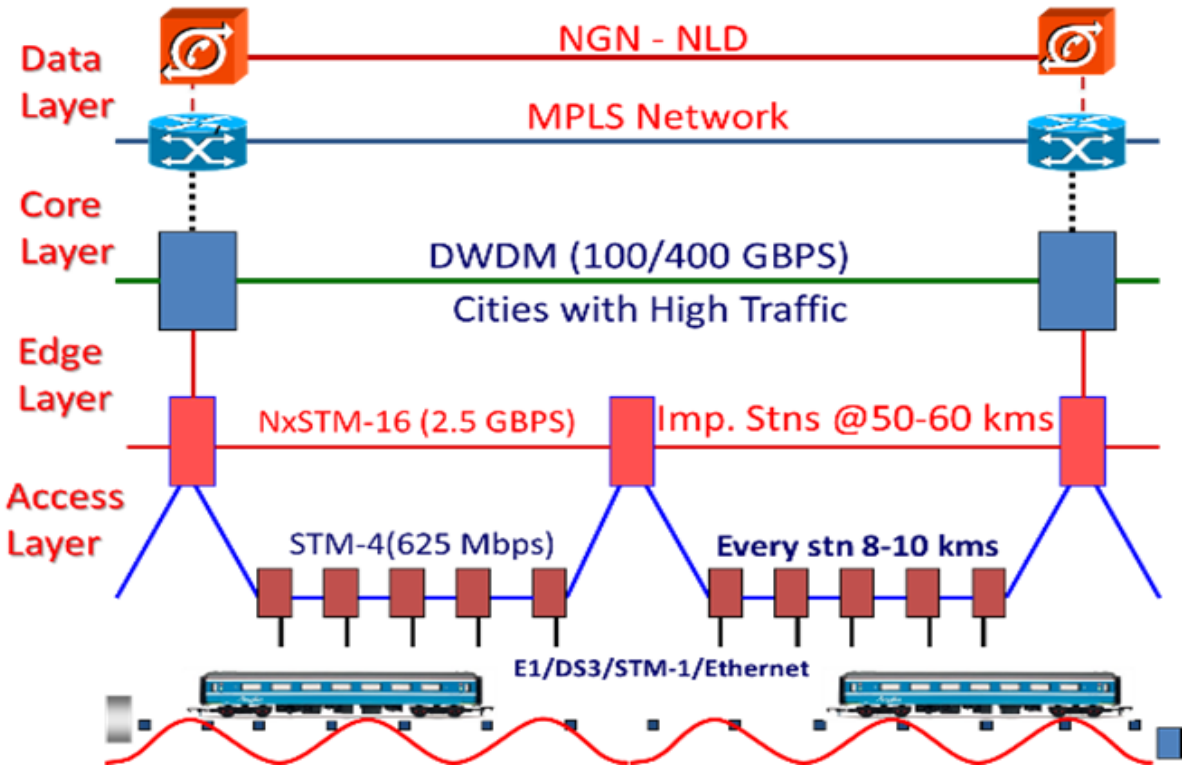
## Layered Network Architecture :

RailTel has followed a layered approach in designing its network for efficient resource utilization and ease of management. Accordingly, RailTel has created three layers viz. Access Layer, Edge Layer & Backbone/Core layer.

The Access layer is provided minimum of STM-4 (625 Mbps) bandwidth at every stations normally spaced at every 8-10 Kms. The traffic from access layer is aggregated on to the edge layer each having STM64/STM-16 (10/2.5 Gbps) connectivity which is available in important locations at every 30-40 KMs. While the traffic from edge layer is finally aggregated on to the backbone layer available in big cities/towns located at every 60-70 Kms predominantly having DWDM (n*10 Gbps) capacity.

Backbone network have been configured in multiple 'self-healing' ring architecture which provide for redundancy by automatically redirecting traffic away from failed/ de-graded route for fault-free service. These networks have been designed in such a way that full redundancy is available for bandwidth between any two points, all the time.

The complete network is managed by centralized Network Management System (NMS) located at regional Network Operating Centers (NOCs) at New Delhi, Mumbai, Secunderabad & Kolkata. It enables provisioning of traffic of any granularity with the extensive reach from any part of the country to any other part.



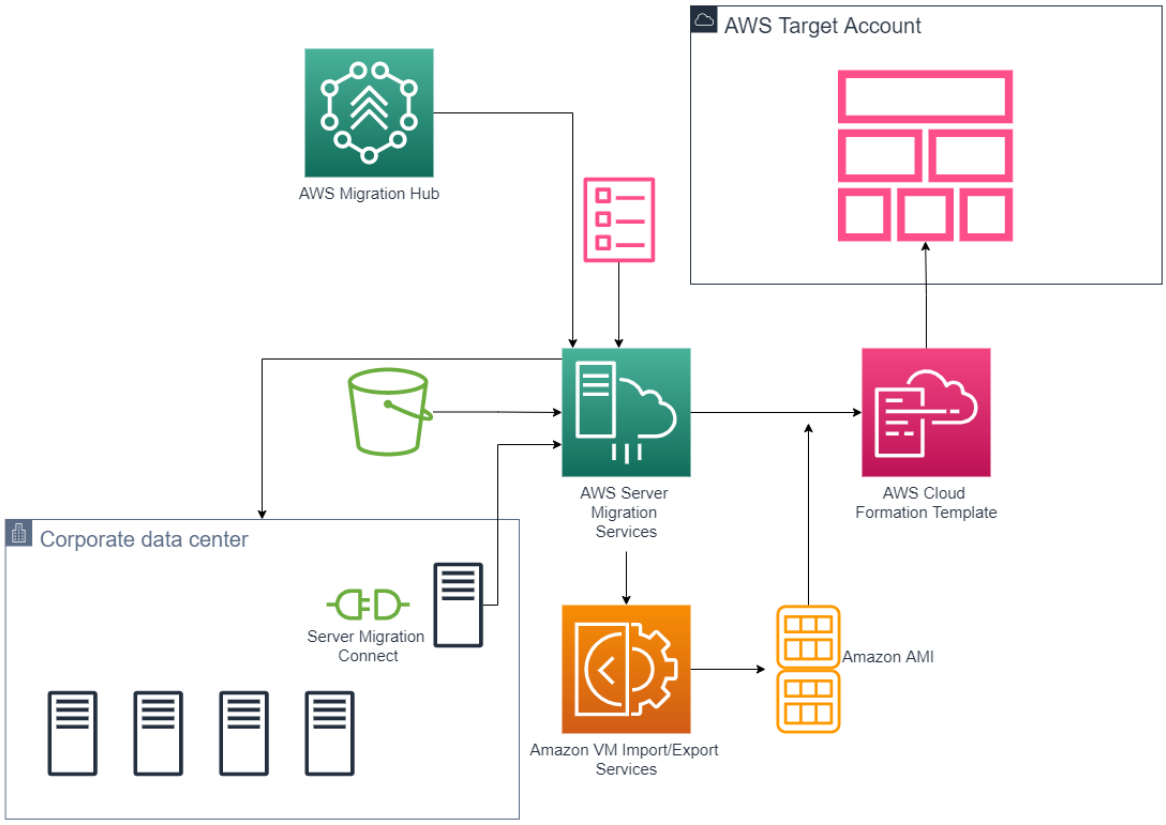

Reference: RailTel.

## Benefits Of Using Network Layered Architecture.

- Each lower layer contributes its services to the top layer, resulting in a complete collection of services for managing communications and running applications.
- It provides modularity and explicit interfaces, allowing subsystems to interact with one another.
- It ensures layer independence by offering services from the lowest to the highest layer without specifying how the services are implemented. As a result, any changes made to one layer have no effect on the other levels.
- The number of levels, functions, and contents of each layer will differ from one network to the next. However, the objective of each layer is to offer the service from a lower to a higher layer while masking the specifics of how the services are performed from the layers.

# Strategy For Shifting IRS to AWS

Lift and Shift Strategy can be used for large scale workloads which will automate and schedule the migration with minimum downtime. This can be adopted for IRS.




CloudEndure Migration supports any source infrastructure as long as it runs on x86 operating systems
supported by Amazon Elastic Cloud Compute (EC2). This includes physical servers, P2V (virtual
servers converted from physical), VMware, Hyper-V, and other cloud providers like Azure, GCP,
IBM, or Oracle (see Supported Operating Systems).

## Consumption of IRS

- The OFC network of RailTel stood at **52025 RKMs** last year. As of now, the OFC networks spans **58000+ RKMs** along the Railway track and 13000 KMs of access networks.
- By March 2020, Wi-Fi services have been provided at **5655 stations.**
- Presently, 5800+ stations are Wi-Fi enabled.
- RailTel is in the process of providing **Content on Demand service** to passengers in trains by preloading multilingual content (Movies, Music Videos, General Entertainment, Lifestyle etc) on media servers installed in trains. This will improve the overall passenger experience but at the same time will increase the non-fare revenue through multiple monetization models.
- Indian Railways have mandated RailTel to provide **IP based Video Surveillance Systems across 6124 railway stations** and 14787 premium train and EMU coaches.
- There are more than **2.6 lakh RailWire broadband customers** in the SMEs/household segment.
- There is a substantial increase in usage of RailTel Services such as TpasS, e office, BW usage & increase in RailWire subscribers due to people working from Home, Schools & colleges starting online classes and digital access to services across every domain.
- RaiTel's **HD Video Conference Service** was extensively used by MR, MoSR, Chairman CEO and other officials of Ministry of Railways, during the lock down to conduct

regular virtual meetings to monitor movement of freight trains and Covid preparedness. The usage during lock down increased by 25 times as compared to pre-Covid times.

- During the pandemic, the usage of the commercial **bandwidth of Railtel increased 1.5 times and retail bandwidth by 2.25 times**.
- Data consumption also saw a four-fold jump over the last year: Compared to April 2018, 60 lakh people in 110 stations consumed **1,600 TB** in March 2017.
- At least 75 lakh users consumed more than **7,100 terabytes (TB) of data in April alone at 370 railway stations** offering WiFi services — the equivalent of almost 23 lakh high definition (HD) movies streamed online or about 5,000 days worth of audio.
- The RailTel network is designed in a three - layered structure for its efficient utilization and management, namely access Layer, edge Layer and backbone layer.
- Access layer provides an **STM-1 (155Mbps)** capacity at stations, spaced at every 8-10 Kms.
- The traffic from access layer is aggregated on to the Edge layer having **STM-16/64 connectivity**, which is available in important locations at every 50-60 Kms.
- Collecting the traffic from edge layer is finally aggregated on to the Backbone layer with **DWDM/STM-64/PTN and IP-MPLS** available in big cities/towns situated at every 60-70 Kms.RailTel has built its optical fiber cable network across cities and towns in India to provide end-to-end bandwidth services through leased circuits, MPLS-VPN ports or Internet bandwidth ports. *Reference: RailTel*