DELIVERING ACTIONABLE INSIGHTS THROUGH DIGITAL SOLUTIONS USING AZURE

Customer Introduction

Rolls -Royce Systems (MTU), a division of Rolls Royce PLC, develops and manufactures high-speed engines and propulsion systems for ships, heavy land, rail and defense vehicles.

Challenges

Challenges as follows: -

- RRPS were unable to track and monitor remotely individual assets or the entire fleets across the globe due to,
    - Non availability of **Centralized platform** / application that could show unable to view Alarms, Alarms history, Fleet history & **Engine IoT Sensor** data the health of these engines.
    - Poor visibility on the upcoming maintenance schedules for efficient servicing and maintenance of engines
- Detecting engine anomalies & notifying in early stage to avoid failure of engine
- Onboarding of multiple customers and ensure their data privacy, security, and access control.

Solutions

The solution proposed by BGSW had multiple components to address the various needs of RRPS :

- **HIVE** – An Azure cloud centric centralized platform was built on Micrsoervices' architecture to integrate, track, monitor and analyze the engine data. This platform served as single source of truth about the Engine for operating hours, Alarms, History of events, upcoming Maintenance Schedules etc.

  Each service was conceptualized as a cloud native application, developed and pushed as an image into **Azure Container Registry** and deployed into Azure Service Fabric Managed Clusters as stateless containers.
    - Leveraged **Service Bus** for the Event driven functionalities to communicate within the microservice.
    - Real Time Alarm Processing, we have developed the system using Azure Event Hubs along with Azure Stream Analytics which helps to process and analyze millions of alarms data and persist in Azure SQL.

- The **HIVE** platform boasts of strong RBAC (Role Based Access Control) for enabling multiple customers to use this platform with string authentication & authorization access control following Azure components

- o Microsoft **Azure B2C** was used as the Identity Management System for all the Web/Mobile facing Applications to enable SSO and integrate with Social IDP. Azure B2C give an advantage on customization, branding and ability to address complex user flows with the support of B2C custom policies
  - o All the **REST API** calls are authorized via Azure API management using JWT token inbound policies.
  - o For ensuring high level network security all the Azure services were Part of the different subnets under a VNET and secured via NSG rules.
  - o All the services can be accessed only via **Application Gateway**.
- Proactively alerting the end users using real time notification to avoid the engine operational failure
  - o We have developed AI algorithm using Azure ML which analyze the engine telemetry data on a continuous basis. If any anomaly detected, then triggers the notification.
  - o Twilio SendGrid SAAS service for email and SMS notification. Azure Notification Hub for push notification.
  - o **Azure Apple-APNS** used to send notifications for timely maintenance updates to service technicians
- **Front End Applications** – Easy to use responsive Progressive Web Application providing dashboard view of all assets and engine health. Provides features to display the Alarms, strong multigraph features helping the CCC's to efficiently troubleshoot customer problems powered with data.

Architecture
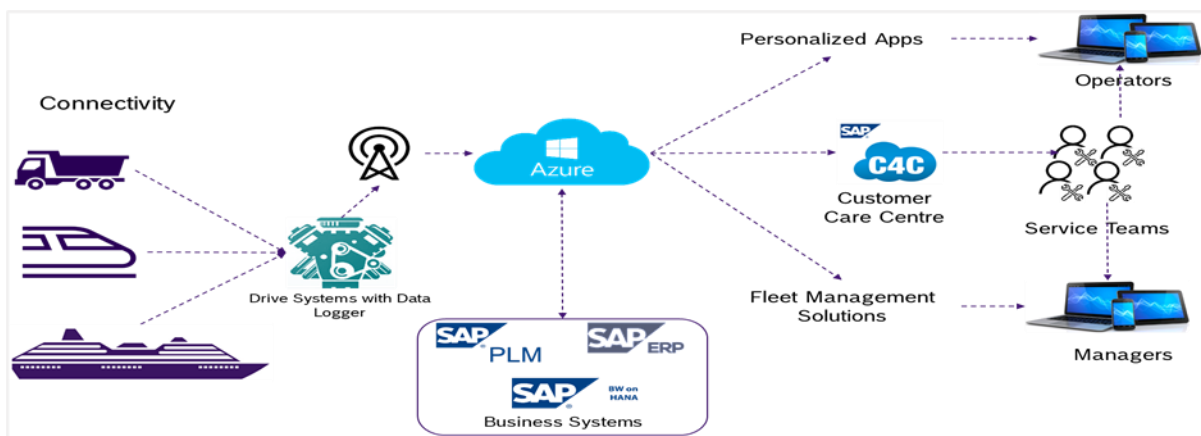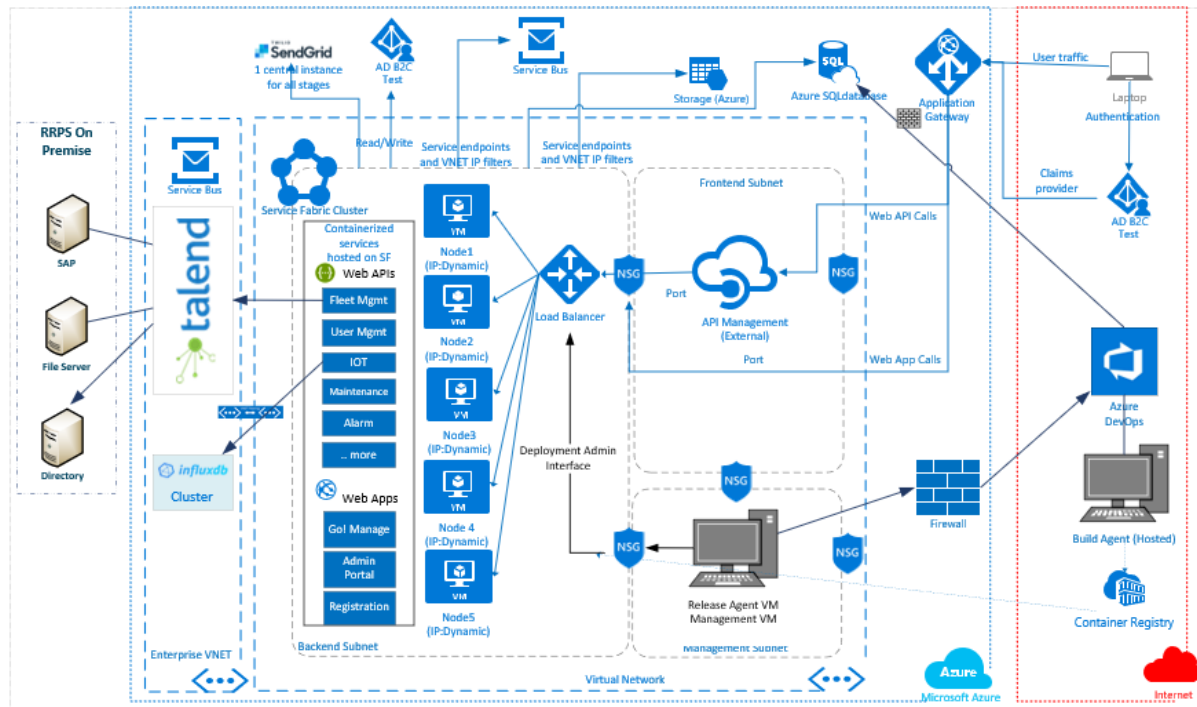
Benefits

RRPS are extremely happy with the implemented solution, which helped them to simplify the process of Monitoring the Connected Engines and overcame manual complexities through end-to-end automation.

1. Centralized & Common platform for Marine, Rail, PowerGen has helped customers to track, monitor & analyze engine IoT data
   - Processing of real time Telemetry data **(~0.1Million)** for every second enabling continuous Engine Health Monitoring.
   - Increase in commissioning of new Assets/IoT devices by **800%**
   - **200+** preventive maintenance activities happening per week
2. Continuous trigger of Events **(~ 5000-7000/min**) are captured, stored & notified. More than **10 million fault alarms** identified which has helped to avoid failure of Engine.
3. Proficiency of platform aided in onboarding **500+** companies adding up Hundreds of IoT Engines and thousands of users.
4. Increased availability and uptime i.e. by monitoring Fleet & System & Engine parameters resulting in less downtime