# Enhancing What-If Analysis for Infrastructure Monitoring Application

## 1. Introduction

This document outlines the necessary steps to enhance our application's capabilities for What-If analysis. What-If analysis allows us to simulate various scenarios and their impact on infrastructure performance, helping in proactive decision-making and resource optimization.

## 2. Current State

Currently, our application collects and monitors resource utilization data, including CPU, Memory, and Disk usage, across Physical Servers, VMs, TAS, TKGI, Azure, GCP, and OpenShift. The data is stored and visualized using Grafana Mimir and Prometheus.

## 3. Gaps and Required Enhancements

### 3.1 Additional Infrastructure Metrics

To perform meaningful What-If analysis, we need to enhance the metrics collected beyond CPU, Memory, and Disk. Additional required metrics include:

* ✔ Network Metrics: Bandwidth, Latency, Packet Loss
* ✔ Storage IOPS: Disk Read/Write Operations per Second
* ✔ Database Query Performance: Slow queries, Connection Pool, Index Usage
* ✔ Application Performance: API Latency, Response Times, Error Rates
* ✔ Auto-Scaling Triggers: Kubernetes HPA, VM auto-scaling configurations

### 3.2 Business Workload Data

To link resource usage with business performance, we need to capture:

* ✔ Transactions Per Second (TPS) - Banking transactions processed per second
* ✔ API Requests Per Minute - Incoming API calls and their latency
* ✔ Peak Load Patterns - Understanding spikes based on day/week/month
* ✔ Batch Job Schedules - Identifying workload overlap and conflicts

### 3.3 Historical Data & Forecasting

Prometheus and Grafana Mimir store time-series data, which can be leveraged for forecasting. To make What-If analysis accurate, we need:

* ✔ At least 90-day historical data for trend analysis
* ✔ Anomaly detection for spotting outliers and workload spikes
* ✔ Capacity forecasting to predict when infrastructure saturation will occur

### 3.4 Defining What-If Scenarios

Potential What-If scenarios include:

* ✔ Traffic Surge: What happens if API traffic increases 5X?
* ✔ Job Scheduling Conflicts: What if multiple batch jobs run at the same time?
* ✔ Cloud Migration Impact: What if 100 VMs are moved to OpenShift?
* ✔ Failure Simulation: What if an Azure region goes down?

## 4. Implementation Plan

Steps to implement What-If analysis:

* ✔ Integrate additional metrics into Prometheus & Grafana
* ✔ Collect business workload data and link it to infrastructure performance
* ✔ Use historical data for predictive forecasting models
* ✔ Develop an ML-based recommendation system to suggest optimal resource configurations
* ✔ Implement automated simulations to test potential failure conditions

## 5. Expected Outcomes

By enhancing What-If analysis, we can expect:

* ✔ More accurate capacity planning and proactive scaling
* ✔ Cost savings by optimizing infrastructure resources
* ✔ Faster response to infrastructure failures with preemptive solutions
* ✔ Better decision-making for cloud vs on-prem resource allocation

## 6. Next Steps & Recommendations

To move forward, we recommend forming a dedicated team to implement these enhancements. The first step is to conduct a detailed assessment of our current monitoring setup and define the roadmap for integrating What-If analysis capabilities.