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INTRODUCTION

Project Overview

The significance of capacity analysis and traffic operations helps in identifying the traffic condition and structure in urban areas in India. The intent of this study is to comprehend the performance structure of vehicles regarding traffic operations in urban areas in India. This study discusses the capacity of vehicles and traffic operations in the context of mixed traffic conditions in India. Research background In India, the status of socio-economic structure and urbanisation have improved through which the capacity of vehicles increased at a rapid pace. The urbanisation level has enhanced from 17.29% in 1951 to 31.6% in 2011 and continued. India is one of the fastest-growing countries all over the world through which the urban population has also increased at a rapid pace. Due to the growth of this population, the mixed traffic behaviour has also increased thus; the traffic management operators can face positive and negative impact due to this traffic situation. Most of the time, these operators have failed to manage the traffic situation that can lead to uncertain accidents. It can negatively impact on the population and violate the structure of mixed traffic operations.Traffic simulation models describe the flow of cars according to the lane through which the capacity of vehicles and structure of lanes can be understood properly. Thus, the traffic management team in the urban areas in India can take crucial measures to handle this traffic situation and manage the issues within the heavy traffic condition. On the other hand, lanes also play a key role in managing the capacity of vehicles using LC choice models.

Purpose

Traffic Handling Capacity of Major Ports. The Infrastructural development and capacity augmentation of Major Ports is a continual process. The process inter-alia includes mechanization of the Ports by way of use of latest version of crane and other equipments/techniques for quicker turnaround of cargo.Port performance indicators are simply measures of various aspects of the port's operation. To fulfil their purpose, such indicators should be easy to calculate and simple to understand. They should provide insight to port management into the operation of key areas.

The Infrastructural development and capacity augmentation of Major Ports is a continual process. The process inter-alia includes mechanization of the Ports by way of use of latest version of crane and other equipments/techniques for quicker turnaround of cargo. Implementation of some of the new initiatives suggested by benchmarking consultants had a positive impact in this regard. Keeping in view the recent initiatives taken like new Berthing Policy, 2016, Stevedoring Policy, Project Unnati, an exercise was taken to re-rate the capacities of Major Ports. This has resulted in the installed capacity of the Major Ports going up from 1065.83MTPA during 2016-17 to 1359MTPA.

LITERATURE SURVEY

Existing problem

In the existing system,it proposes a method to determine PNTC from the results of a computer simulation.Due to technological improvements and resultant increases in operational efficiency, the vessel traffic inside a port has increased to levels that might become problematic.

There is a need to be able to quantify the maximum traffic flow that a specific waterway network can sustain, given a specified level of service, adequate safety provisions and acceptable waiting times.

Terminal operations normally have the lowest capacity rate and determine the productivity of the system, but no method currently exists to estimate the vessel traffic capacity in a port, in order to quantify its traffic efficiency.

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Problem Statement Definition

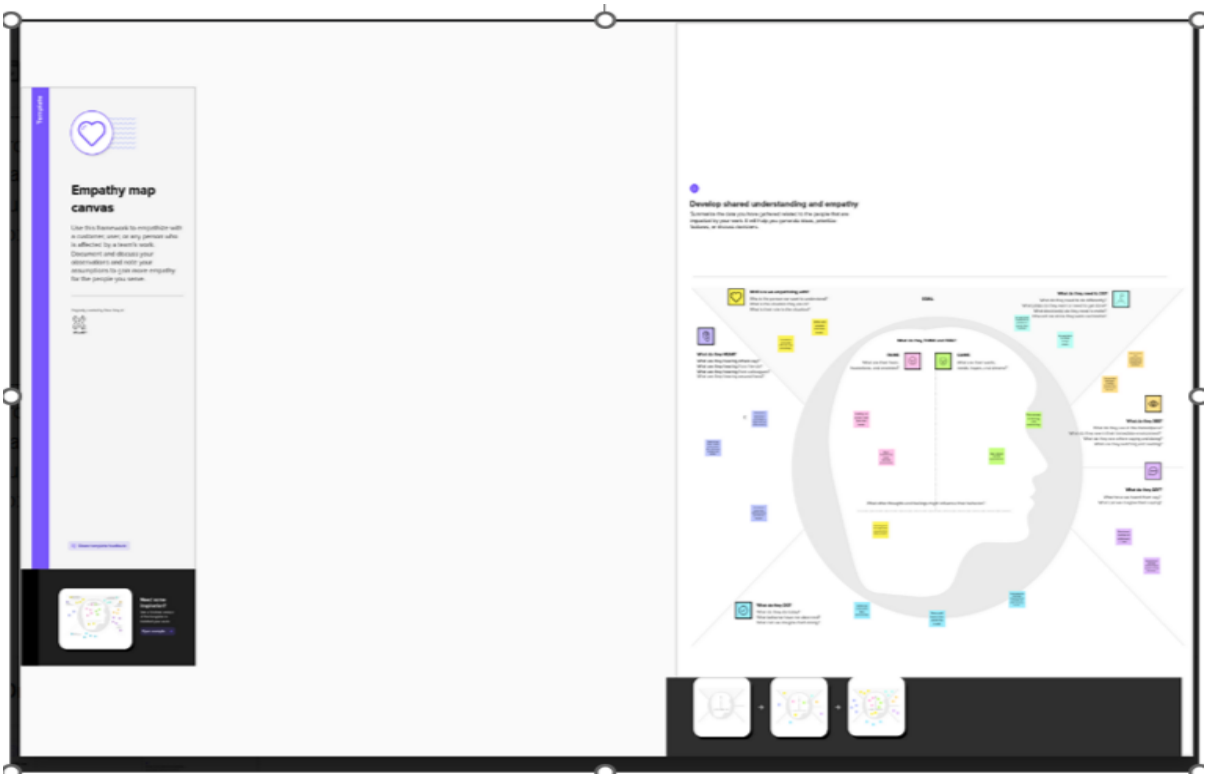
A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

A problem statement is important to a process improvement project because it helps clearly identify the goals of the project and outline the scope of a project. It also helps guide the activities and decisions of the people who are working on the project. The problem statement can help a business or organization gain support and buy-in for a process improvement project.

IDEATION & PROPOSED SOLUTION

Empathy Map Canvas

An empathy map is a template that organizes a user's behaviors and feelings to create a sense of empathy between the user and your team. The empathy map represents a principal user and helps teams better understand their motivations, concerns, and user experience.



Ideation & Brainstorming

Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas. A principal difference between ideation and brainstorming is that ideation is commonly more thought of as being an individual pursuit, while brainstorming is almost always a group activity. Brainstorming is usually conducted by getting a group of people together to come up with either general new ideas or ideas for solving a specific problem or dealing with a specific situation. The lines between ideation and brainstorming have become a bit more blurred with the development of several brainstorming software programs, such as Bright idea and Idea wake.

Proposed solution

Problem Statement (Problem to be solved)

The Current ProblemRising traffic congestion is an inescapable condition in large and growingmetropolitan areas. Peak-hour traffic congestion is an inherentresult of the way modern societies operate. It stems from the widespread desires of people to pursue certaingoals that inevitably overload existing roads and transitsystems every day. But everyonehates traffic congestion, and it keeps getting worse,in spite of attempted remedies.

Idea / Solutiondescription

The current traffic control system in the metro citiesof India are inefficient due to randomness in the traffic density pattern throughout the day. The traffic signal timershave a fixed time period to switch traffic between differentdirections.

Novelty / Uniqueness

This includes port operational efficiency improvement,

capacityexpansion of existingports and new port development. A 10-year tax holiday is extended to enterprises engaged in the business of developing, maintaining, and operating ports, inland waterways, and inland ports.This bill aims to decentralise decision making and reinforce excellence in major port governance.

Social Impact / Customer Satisfaction

The impact of service quality on customer satisfactionin the portsector lacks research.The results from this studyreveal that PSQ is a construct of five factors, and that enhanced PSQ positively influences customer satisfaction. In terms of contributing to knowledge and practical applications, the current study helps enhance the understanding of service quality as a relational marketing tool, particularly in the context of the port sector.

Problem Solution Fit

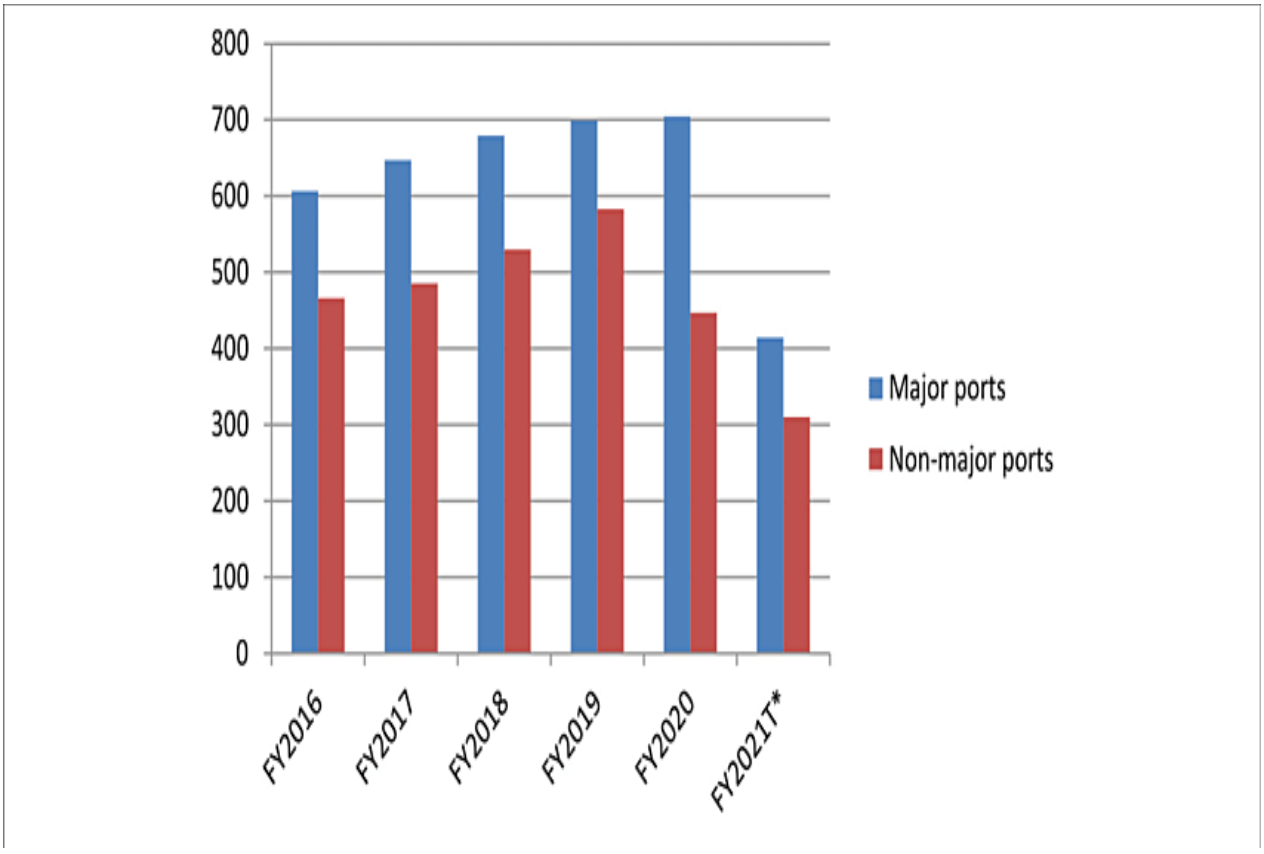
REQUIREMENT ANALYSIS

Functional requirement

Functionality is measured as a set of inputs to the system under test to the output from the system. It implementation in a system is planned in the System Design phase whereas, in case of Non-functional requirements, it is planned in the System Architecture document. It defines a function of a software system or its module. Functional requirements talk about a particular system outcome when a task is performed on them by the user.

Non-Functional Requirements

Non-functional requirements explain the quality aspects of the system to be constructed viz. performance, portability, usability, etc. Non-functional requirements, unlike functional requirements, are implemented incrementally in any system. They are mostly derived from functional requirements based on input from the customer and other stakeholders. Non-functional requirement implementation details are documented in the System Architecture document.



Project Design

Data flow design

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

It maps out the flow of information for any process or system. It uses defined symbols like rectangles, circles and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination. It became more popular in business circles, as it was applied to business analysis, than in academic circles. Data flowcharts can range from simple, even hand-drawn process overviews, to in-depth, multi-level DFDs that dig progressively deeper into how the data is handled. They can be used to analyze an existing system or model a new one. They can be used to analyze an existing system or model a new one.

Solution & Technical Architecture

This differs from enterprise architecture that may include long term road maps that take many years to implement. It is the process of developing solutions based on predefined processes, guidelines and best practices with the objective that the developed solution fits within the enterprise architecture in terms of information architecture, system portfolios, integration requirements and many more. Solution architecture is a structural design that addresses a set of functional and non-functional requirements. It is immediately implements as a program, project or change.

It can then be viewed as a combination of roles, processes and documentation that are intended to address specific business needs, requirements or problems through the design and development of applications and information systems. It is described in a document that specifies a certain level of vision for all current and future solutions, applications and processes that the organization has. Design and development of solutions and applications then follow the guidelines specified in the solution architecture document to ensure that they conform

to set standards that make integration and communication easier, and make the tracking of problems and inconsistencies between solutions easier as well.

User stories

Project planning and scheduling

Sprint planning and Estimation

There are two ways of Sprint Planning.

- Velocity-based Sprint Planning
- Capacity-based Sprint Planning

Velocity-based planning of the Sprint determines how much work the team can accomplish in the Sprint. In any Sprint, the velocity is calculated as the number of Story points completed per sprint. This is a basic introduction to Velocity-based Sprint planning. We will learn more about this type of sprint planning in the next section .

What is Capacity or Commitment-based Sprint Planning?
Capacity-based sprint planning, also called Commitment-based Sprint planning, is based on the team's available capacity (in hours) for the sprint and tries to fill that capacity effectively without overburdening and under committing the team members. Capacity-based planning is considered the best way of sprint planning due to the following 3 main reasons.

The capacity of the teams may vary from one sprint to another, depending on holidays, leaves, or other commitments. So, every sprint is not an average sprint.

The story points and the velocity are the two important measures over multiple sprints for estimating the release dates. But story points are found to be coarse-grained for planning the details of a two-week sprint. If you

consider the hours, they are fine-grained enough and much useful for estimating concrete tasks.

Lastly, in the Sprint Planning, the user stories allow the development team and the Product Owner to consider each story in detail to develop a shared understanding of the end product.

In capacity-based sprint planning, a team commits to one product backlog item at a time by roughly estimating the involved tasks and finishing the task when they feel that the Sprint is full.

Capacity-Based Sprint Planning QuoteWhile planning a capacity-based sprint, it is crucial that the team's commitment is not looked at as a guarantee. Here, commitment can be viewed as a team's commitment to do its best. In fact, teams can perform at their highest level 80% of the time. The commitment should be something that can be taken seriously and should utilize most of the time. In this way, businesses gain the confidence of in what time they can deliver the products.

Who all participate in the Capacity sprint planning?
A capacity or commitment-driven sprint planning meeting involves the Scrum Master, Product Owner, and all the development team members. The Product Owner presents the highest-priority product backlog items in the meeting and introduces those top-priority items to the team.

How to do Capacity-based sprint planning?
Scrum teams often face the challenges of sprint commitments during a sprint planning. The challenges include-

How many user stories can the team commit in a sprint?
How to know the team's capacity?
The second challenge is a crucial one because for committing to the sprint

goal, you need to know the capacity of the current team and the capacity can be calculated as per team members' availability in the sprint.

Let's understand it with an example:

Consider a team consisting of 6 people working for 8 hours per day for 3 weeks sprint (15 days). Then the total capacity of the team can be calculated as-

Team's Capacity = number of team members * time in hours * days
= 6*8*15
= 720 hours
But planning a total capacity in this pattern may-

Burn out the team with loads of tasks
Make them rush to reach the end goal
Hamper the quality and lead to low team morale.

Sprint Delivery Schedule

The deliverables of a sprint aren't as predictable as they are for other projects. Sprint participants have produced sketches and drawings, writing, photographs, comic strips, videos and fully coded working prototypes. The answer is whatever's right to answer the problem.

Sprints also produce different deliverables for different audiences – the team, your organisation at large, the public – it really depends what you want to show people to help them understand your solution.

Here's a table outlining what usually comes out of a sprint project:
Things sprint team makes and uses

Sketches and notes – shorthand ideas Using post-its, A3/A4 drawings, business/campaign canvasses To quickly communicate ideas to one another

Things for our customers

A prototype or test Making clickable presentations, paper prototypes, quick coded tools, role plays To get a response – does it work the way they want it to?

Things for the people delivering the idea

Plans and briefs Creating a written vision and an outline of what needs to be done, with what, by whom, by when. To work out how the idea will be delivered.

Things for the rest of our organisation

Documentation – the story behind our work Make a presentation, a blog post, a staff newsletter, a photo gallery, an exhibition To earn agreement and buy in for our planned solution

Things for the rest of the world

Things we want to share – our successes and failures Explaining our work through blog post, a talk, a Q&A or a video telling the story So people can learn from and be inspired by our work

Reports from JIRA

To access reports in JIRA, the user should go to Project → choose Specific project. The following screenshot shows how to navigate to a specific project.

Reports

Click on the Reports icon on the left side of the page. It will display all the reports supported by JIRA. The following screenshot shows how to access

the Report section.

Report Section

When the user clicks on Switch report, it will display the list of reports. The following screenshot shows list of reports available for quick switch.

Quick Switch

Type of Reports

JIRA has categorized reports in four levels, which are −

Agile

Issue Analysis

Forecast & Management

Others

Let us now discuss the features of the above-mentioned report categories in detail.

Agile

Following are the list of features of Agile Reports.

Burn down Chart − Track the total work remaining, also whether sprint is achieving the project goal or not.

Sprint Chart − Track the work completed or pushed back to the backlog in each sprint.

Velocity Chart − Track the amount of work completed from sprint to sprint.

Cumulative Flow Diagram − Shows the statuses of issues over time. It helps to identify high-risk issues or unresolved important issues.

Version Report − Track the projected release date for a version.

Epic Report − Shows the progress towards completing an epic over a given time.

Control Chart − Shows the cycle time for the product, its version or the sprint. It helps to identify whether data from the current process can be used to determine future performance.

Epic Burn Down − Track the projected number of sprints required to complete the epic.

Release Burn Down − Track the projected release date for a version. It helps to monitor whether the version will release on time, so mandatory action can be taken if work is falling behind.

Issue Analysis

Following are the list of features of Issue Analysis.

Average Age Report − Displays the average age in days of unresolved issues.

Created Vs Resolved Issue Report − Display the number of issues created vs the number of issues resolved in given period.

Pie chart Report − Shows a pie chart of issues for a project grouped by a specified field.

Recently Created Issue Report − Shows the number of issues created over a time-period for a project and how many of those were resolved.

Resolution Time Report − Displays the average time taken to resolve issues.

Single Level Group by Report − .It helps to group the search results by a field and see the overall status of each group.

Time since Issues Report − It helps to track how many issues were created, updated, resolved, etc., over a time-period.

Forecast & Management

Following are the list of features of Forecast and Management type of reports.

Time Tracking Report − Shows the original and current time estimates for issues in the current project. It can help to determine whether work is on track for those issues.

User Workload Report − Shows the time estimates for all unresolved issues assigned to a user across projects. It helps to understand how much a user is occupied, whether overburdened or has less work.

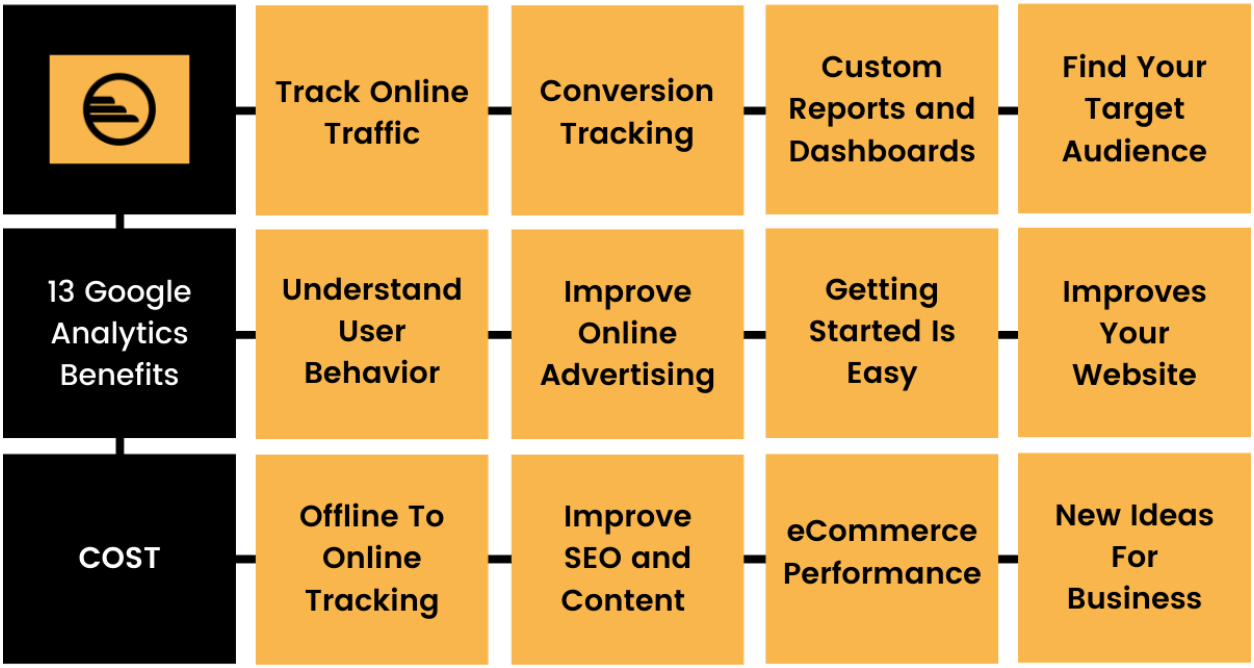
Version Workload Report − Displays how much outstanding work is remaining per user and per issue. It helps to understand the remaining work of a version.

CODING & SOLUTIONING (Explain the features added in the project along with code)

Feature 1

Traffic Capacity is expressed as the maximum number of vehicles in a lane or a road that can pass a given point in unit time, usually an hour, i.e., vehicles per hour per lane or roadway.

A quantitative technique for measuring the effectiveness of existing transport. facilities in moving traffic and people. Fundamental to the planning, design and operation of roads and transport. services.



Feature 2

Urban transport systems under infrastructural constraints cannot cope with a continuous increase in road traffic. Uncontrolled growth in the number of road vehicles leads to negative consequences, such as an increase in accidents, harmful emissions, congestion, speed violations, etc. One of the popular tools in the control andmonitring of traffic flows is video surveillance

HCM has developed the capacities standard and LOS measure for various facilities. Each traffic facility has its own unit for the capacity and measure of effectiveness for each item will also vary. The traffic facilities can be divided into three, namely: the uninterrupted facilities, interrupted facilities, and others. Interrupted facilities include freeway (basic freeway, weaving sections, and ramps), multi-lane highways (unidirectional), two-lane highways(bidirectional). Freeways normally have density as the measure of effectiveness, while multi-lane and two-lane highways have delay/speed as the MoE.

Interrupted facilities include un-signalized intersection, signalized intersection, and arterials or corridors. They have respectively control delay, total delay and average travel speed as the measure of effectiveness. Other facilities may include pedestrian pathways, bicycle tracks, bus-transit system, rail-transit system and air-transportation system. Each of them have facility specific measure of effectiveness.

Database Schema (if Applicable)

Use the Capacity Planning/Database menu item to access a summary of database CPU, Storage, Memory, and I/O utilization across the selected compartment.

From the Database Capacity Planning Summary page, you can view current database resource utilization by CPU, storage, memory, and I/O . You can also compare and contrast resource usage between databases, and identify which databases use the most resources, and are expanding rapidly.

Image shows the Capacity Planning Summary page.

This page directly supports the goals of providing a birds-eye view of database resource usage and trends, and providing proactive insights into specific utilization issues either current or forecast for the near-term.

From this page you can perform the following tasks in support of the Capacity Planning use case goals:

View total allocation and utilization of CPU, Storage, Memory, and I/O resources for all (enabled) databases in the compartment
Identify top-5 databases of CPU, Storage, and Memory by absolute usage or utilization percentage
Identify top-5 databases by CPU, Storage, and Memory growth over the time period
See aggregated historical usage trends for CPU, Storage, and Memory over the time period

Capacity Planning color scheme associates green with CPU resources and

blue with Storage resources.

The Inventory section displays the total number of databases enabled for Operations Insights along with the database types. In addition, the CPU, Storage, Memory, and I/O usage charts display overall resource consumption (Top Consumers and Usage Trend) by these database targets.

The section shows the current utilization of databases and the databases that are reaching the server capacity headroom.

TESTING

Test Cases

Top 5 Capacity Testing Best Practices

As explained earlier, a fraction of a second of delay or poor performance can lead to extensive losses that add up to millions of dollars in today's uber-competitive market, where customers are demanding optimal quality (e.g., – page load times, duration of transactions) with fast time-to-market. Numerous factors could affect the software's performance and it's response time.

An organization planning to deploy an application needs to have a realistic grasp of the load limitations of a given infrastructure under different use cases, business processes, and conditions. It needs to make sure to test against the right SLAs and performance metrics, against the right use cases and business processes and against varying, diverse and realistic user conditions simulating the experience of real users in the production environment.

This helps detect and mitigate the factors that may impact the performance and user experience. Capacity Testing helps identify the right infrastructure for different user scenarios and business needs, ensuring that the customers get an optimal and consistent user experience regardless of the circumstances (e.g., – holiday season, product launch, the beginning of the school year).

Here are some Capacity Testing best practices you should consider.

Best Practice 1: Define Processes and Stick to the 80/20 Rule
Before even getting started with Capacity Testing, you should be creating Pareto charts, not before identifying the stakeholders that are most relevant to the testing and determining the processes that will actually be tested. The most common people involved in Capacity Testing processes are Database Administrators (DBAs), developers, SMEs, product owners, and business executives.

Furthermore, it's highly recommended to stick to the 80/20 Rule, which can be applied to all aspects of Capacity Testing – performance, load, volume, and more. By applying the 80/20 rule to your Capacity Testing, you can focus on the more problematic and volatile processes that are likely to affect the organization's profits and create the biggest bottlenecks.

Best Practice 2: Set Proper Criteria and SLAs
Sometimes the automated test tool used before the deployment to the production environment may not understand the business processes associated with the application or the most generated traffic business processes. To avoid these loopholes, the automation engineer should consult with the Product Owner, SMEs, and business analysts for the real-life use case.

You need to make sure that the SLAs you are testing against are realistic,

accurate, and relevant to the most important use-cases.

Best Practice 3: Detailed Performed Test Specification
Before conducting any test or capacity test, it is recommended to document the detailed test specification, which can include various parameters like the hardware specification, the version of the Software and Client type, if any (thick, thin), the number of processes running in the background, volume test, type of network, data volumes, and other relevant database details.

You should also factor in the environment type into your Capacity Testing process. Knowing and defining whether it is QA, Sandbox or Pre-Production environment will let you duplicate the production environment in the best possible manner. The more detailed information you can create while testing, the closest you will get to remediating potential issues.

Best Practice 4: Automate for Consistency
It's recommended to repeat the Capacity Testing and run it continuously with different data sets to fine-tune the app and infrastructure. Some unidentified issues get reported with a different set of data or are plagued with memory-related issues, which can happen after a few test runs. By reducing manual intervention, some intermittent problems also will get identified after a few test runs. Automate the process for better results.

With more and more organizations scaling up exponentially, there are limited available resources. Automated Capacity Testing, integrated to your CI/CD pipeline, is the best way out.

Some capacity test automation tools have the limitation of providing only black-box results, making it very difficult to isolate the issue and pinpoint the root cause of a particular problem. This is a crucial part of capacity planning. If possible, go for the advanced tool, which will help monitor the

white box result as well. When your business is time-sensitive, it can’t wait for a different report from the black-box test.

Best Practice 5: Reporting and Comparing Results
Cross-department friction is to be found in all organizations today, at one level or another. This is especially common when there are bottlenecks or during unexpected downtimes. These unpleasant instances can be reduced or eliminated with proper Capacity Testing. By creating comprehensive reports that can be shared with the key stakeholders, you can improve transparency and boost collaboration between departments.

Capacity Testing reporting should always include response time numbers, transaction metrics, error percentage, throughput, and server utilization.

User Acceptance Testing

User acceptance testing into all stages of the software development process. The methodology invites business stakeholders, such as the product owners, into the fold as a member of the Agile team, where they can make sure their needs are met. User acceptance testing (UAT), a critical part of the testing process, is where business stakeholders determine whether an application or feature fulfills its purpose. In Waterfall deployments, UAT is typically the final phase in the software development lifecycle. However, it's difficult and expensive to find out that a product fails to deliver on its promises, or includes big defects, right before it goes live.

Product owners can solve this problem in Agile development. Product owners provide input on user story prioritization, how to define acceptance criteria, end-user-related questions and feature approval for release. And when business stakeholders test earlier in the process, they'll find fewer big defects right before deployment.

Here's how to integrate UAT into Agile workflows before, during and after a

sprint. We also examine some user acceptance testing best practices.

RESULTS

Performance Metrics

At a glance

Top rule

IBM Z® Performance and Capacity Analytics (formerly IBM Z Decision Support for Capacity Planning) V3.1delivers end-to-end near real-time collection, curation, and reporting for simplified performance, financial, and capacity management. Leveraging SMF and other structured data sources on z/OS® and other platforms, it quickly and efficiently transforms enterprise-wide IT utilization information into actionable Key Performance Metrics and Capacity Planning reports. Forecasting and modeling functions help ensure resources are in place to run the business and meet expected service levels, for both today and the future.

With IBM Z Performance and Capacity Analytics V3.1, you can:

Curate system performance and management data for easy access to historical enterprise-wide IT utilization information for use in performance reporting, service-level management, operational and capacity planning, and IT cost accounting. Curated metrics are stored in IBM® Db2® but can also be streamed off platform to other analytics platforms, such as Splunk and Elastic Stack.
Visualize curated metrics with built-in dashboards across various analytics platforms, such as Splunk, Elastic Stack, IBM Cognos® Analytics, and IBM QMF.
Automatically gather and transport System Management Facility (SMF)

records for near real-time curation to IBM Z Performance and Capacity Analytics.
Enable root-cause analysis of performance, system health, and capacity problems with point-and-click drill-down analytics reporting.
Perform business-critical capacity planning using performance data that is curated in near real-time.
Predict future resource usage and requirements through forecasting analysis that is based on existing historical data and insight that uses IBM Large System Performance Reference (LSPR) information.
Understand consumption across CEC, LPAR, workload, business application, and service and report class levels to identify cost-optimization opportunities, whether measuring on 4-Hour Rolling Average (4HRA) or Tailored Fit Pricing enterprise consumption models.
IBM Z Operations Insight Suite V1.2 offers a single point of control for essential processing and analysis of IBM Z operation data. With the capability for near real-time transport of SMF record types and a broad set of log types, it is the single point of data collection, enabling your organization to gain deep insights into the operations of its IBM z/OS-based data center.

IBM Z Operations Insight Suite V1.2 includes:

IBM Z Performance and Capacity Analytics V3.1 (replacing IBM Z Decision Support for Capacity Planning V2.1)
IBM Z Operations Analytics V4.1 (including IBM Z Common Data Provider V2.1)

ADVANTAGES & DISADVANTAGES

Advantage

Ports serve as important transportation hubs that facilitate goods

movement goods movement The distribution of freight (including raw materials, parts and finished consumer products) by all modes of transportation including marine, air, rail and truck. to businesses in local communities and worldwide markets.

Advantages and direct costs of living in a port city. The benefits of a port are well-established: lower logistics costs for companies and consumers, better local and regional infrastructure and, of course, more direct and indirect jobs.

Deep sheltered waters. Track record in oil and gas. On and offshore renewable support. Premier Cruise destinations.

Disadvantage

- Cost of living. While salaries tend to be higher in major cities, this doesn't always help with the high cost of living. ...
- Noise. Many major cities share one thing: noise levels. ...
- Lack of space. ...

- Meeting new types of people. ...
- Activities. ...
- Public Transportation. ...
- Big Events. ...
- Salary.
- Disadvantages of Water Transportation. Sluggish and Time-Consuming. Reliability. Port Accessibility.
- Severe congestion also may lead to drivers being involved in “road rage” incidents that can have minor impacts like increased stress, or major impacts like damage to vehicles, injuries to drivers and passengers, or death.
- Increasing traffic congestion, air pollution, and fuel consumption. Increase in use of less-adequate roads to avoid traffic signs. Excessive delay due to time allocated by the traffic signals.

CONCLUSION

This paper consists of a literature review of missing traffic state estimation based on multi-source data fusion on urban road networks. Previous research on this topic, which is classified based on different missing scenarios, different application data categories, and different fusion modes has been reviewed and summarized. In summary, among the actual engineering applications of missing state estimation on urban networks, we can choose the appropriate methods published in previous papers to carry out practical application with accuracy requirements of projects and data resources. This research has a certain reference value in improving the accuracy of estimation results and optimizing the deployment of fixed detectors.

Furthermore, this paper also discussed the challenges and opportunities of

urban road network volume estimation from the perspective of different missing scenarios, different data structures, and different fusion methods. By summarizing and classifying existing problems, and investigating existing advanced methods and limitations, this paper discussed feasible, future research directions. With the advent of the digital twin era and the continuous development of detector technology

FUTURE SCOPE

India is the 16th largest maritime country in the world. Out of the 200 non-major ports, 44 are already functional and strategically located. However, the others are steadily gaining share with massive cargo traffic shifting from significant ports like Jawaharlal Nehru Port Trust and Mudra to smaller ones. The traffic at non-major ports accounted for 45% of the total cargo for FY2020. The numbers will see a further jump as the government's initiatives to develop such ports to decongest rail and road networks continue.

Meanwhile, the traffic handled at major ports also witnessed a YoY growth of 0.8% during the same financial year and stood at 704.6 million tonnes. With several government initiatives, the port capacity is expected to grow at a 5-6% CAGR until 2022, thus adding at least 275 MT of capacity. The demand in India is for end-to-end integrated logistics solutions. The government aims to operationalize 23 waterways by 2030 as they are cost-effective and environmentally sustainable.

Besides the gamut of initiatives, pursuing 'Make in India' will further increase tremendous opportunities, especially in the ship repair industry. The shipbuilding policy will further encourage Indian shipyards to get more foreign orders. In tandem with the increasing awareness about being environmentally conscious, the maritime industry is pushing towards using alternate cleaner fuels to reduce carbon emissions as much as possible.

Factors like safe shipping, increased seaborne trade, and the use of greener fuels will further drive India’s maritime logistics industry growth. The maritime logistics industry has a bright future with technological advancements and the government’s multiple projects already in place.

APPENDIX

Source Code

In [1]:
```
import numpy as np
import pandas as pd
```

In [5]:
```
data = pd.read_csv('/datafile_02.csv');
```

In [6]:
```
print(data.columns)
data.head()
```

```
Index(['Port', 'Traffic in Eleventh Plan (MT) (2011-12)Proj.',
       'Traffic in Eleventh Plan (MT) (2011-12) Ach.',
       'Traffic in Eleventh Plan (MT) (2011-12) %',
       'Total Capacity  in Eleventh Plan (MT) (2011-12) Proj.',
       'Total Capacity  in Eleventh Plan (MT) (2011-12) Ach.',
       'Total Capacity  in Eleventh Plan (MT) (2011-12) %'],
      dtype='object')
```

Out[6]:

	Port	Traffic in Eleventh Plan (MT) (2011-12)Proj.	Traffic in Eleventh Plan (MT) (2011-12) Ach.	Traffic in Eleventh Plan (MT) (2011-12) %	Total Capacity in Eleventh Plan (MT) (2011-12) Proj.	Total Capacity in Eleventh Plan (MT) (2011-12) Ach.	Total Capacity in Eleventh Plan (MT) (2011-12) %
0	Kolkata	1343	1223	9100	3145	1635	5100
1	Haldia	4450	3101	7000	6340	5070	7900
2	Paradeep	7640	5425	7100	10640	7650	7100
3	Visakhapatnam	8220	6742	8200	10810	7293	6700
4	Ennore	4700	1496	3200	6420	3100	4800

In [7]:
```
data.rename(columns = {'Traffic in Eleventh Plan (MT) (2011-12)Proj.':'Traffic_Projected','Traffic in Eleventh Plan (MT) (2011-12)Ach.':'Traffic_Achie
data.rename(columns = {'Traffic in Eleventh Plan (MT) (2011-12) Ach.': 'Traffic_Achieved'},inplace = True)
data.rename(columns = {'Total Capacity  in Eleventh Plan (MT) (2011-12) Ach.': 'Total_Capacity_Achieved'},inplace = True)
data.rename(columns = {'Total Capacity  in Eleventh Plan (MT) (2011-12) Proj.':'Total_Capacity_Projected'},inplace = True)
```

In [8]:
```
Traffic_Percent =round((data.Traffic_Achieved/data.Traffic_Projected)*100,2)
Traffic_Percent
```

Out[8]:
```
0     91.06
1     69.69
3     82.02
4     31.83
5     96.89
6     88.59
7     52.66
8     67.49
9     87.54
10    79.07
11    99.56
12    95.13
dtype: float64
```

In [9]:
```
Total_Percent =round( (data.Total_Capacity_Achieved/data.Total_Capacity_Projected)*100,2)
Total_Percent
```

Out[9]:
```
0      51.99
1      79.97
2      71.90
3      67.47
4      48.29
5     110.26
6      52.11
7      74.85
8      84.25
9      62.63
10     48.45
11     66.95
12     71.12
dtype: float64
```

In [10]:
```
data.rename(columns = {'Traffic in Eleventh Plan (MT) (2011-12)%':'Traffic_Percent%','Total Capacity in Eleventh Plan (MT) (2011-12)%':'Total_Percent%
data.iloc[:,3:4] = Traffic_Percent
data.iloc[:,6:] = Total_Percent
data
```

Out[10]:

	Port	Traffic_Projected	Traffic_Achieved	Traffic in Eleventh Plan (MT) (2011-12) %	Total_Capacity_Projected	Total_Capacity_Achieved	Total Capacity in Eleventh Plan (MT) (2011-12) %
0	Kolkata	1343	1223	91.06	3145	1635	51.99
1	Haldia	4450	3101	69.69	6340	5070	79.97
2	Paradeep	7640	5425	71.01	10640	7650	71.90

0	Kolkata	1343	1223	91.06	3145	1635	51.99
1	Haldia	4450	3101	69.69	6340	5070	79.97
2	Paradeep	7640	5425	71.01	10640	7650	71.90
3	Visakhapatnam	8220	6742	82.02	10810	7293	67.47
4	Ennore	4700	1496	31.83	6420	3100	48.29
5	Chennai	5750	5571	96.89	7230	7972	110.26
6	Tuticorin	3172	2810	88.59	6398	3334	52.11
7	Cochin	3817	2010	52.66	5475	4098	74.85
8	NMPT	4881	3294	67.49	6050	5097	84.25
9	Mormugao	4455	3900	87.54	6690	4190	62.63
10	Mumbai	7105	5618	79.07	9191	4453	48.45
11	JNPT	6604	6575	99.56	9560	6400	66.95
12	Kandla	8672	8250	95.13	12220	8691	71.12

In [11]:
```
data.shape
```

Out[11]:
```
(13, 7)
```

In [12]:
```
data.isnull().sum()
```

Out[12]:
```
Port                                              0
Traffic_Projected                                 0
Traffic_Achieved                                  0
Traffic in Eleventh Plan (MT) (2011-12) %         0
Total_Capacity_Projected                          0
Total_Capacity_Achieved                           0
Total Capacity  in Eleventh Plan (MT) (2011-12) %    0
dtype: int64
```

In [13]:
```
data.info()
```

```
RangeIndex: 13 entries, 0 to 12
Data columns (total 7 columns):
 #   Column                                        Non-Null Count  Dtype
---  ------                                        --------------  -----
```

In [13]:
```
data.info()
```

```
RangeIndex: 13 entries, 0 to 12
Data columns (total 7 columns):
 #   Column                                        Non-Null Count  Dtype
---  ------                                        --------------  -----
 0   Port                                          13 non-null     object
 1   Traffic_Projected                             13 non-null     int64
 2   Traffic_Achieved                              13 non-null     int64
 3   Traffic in Eleventh Plan (MT) (2011-12) %     13 non-null     float64
 4   Total_Capacity_Projected                      13 non-null     int64
 5   Total_Capacity_Achieved                       13 non-null     int64
 6   Total Capacity  in Eleventh Plan (MT) (2011-12) %  13 non-null     float64
dtypes: float64(2), int64(4), object(1)
memory usage: 856.0+ bytes
```

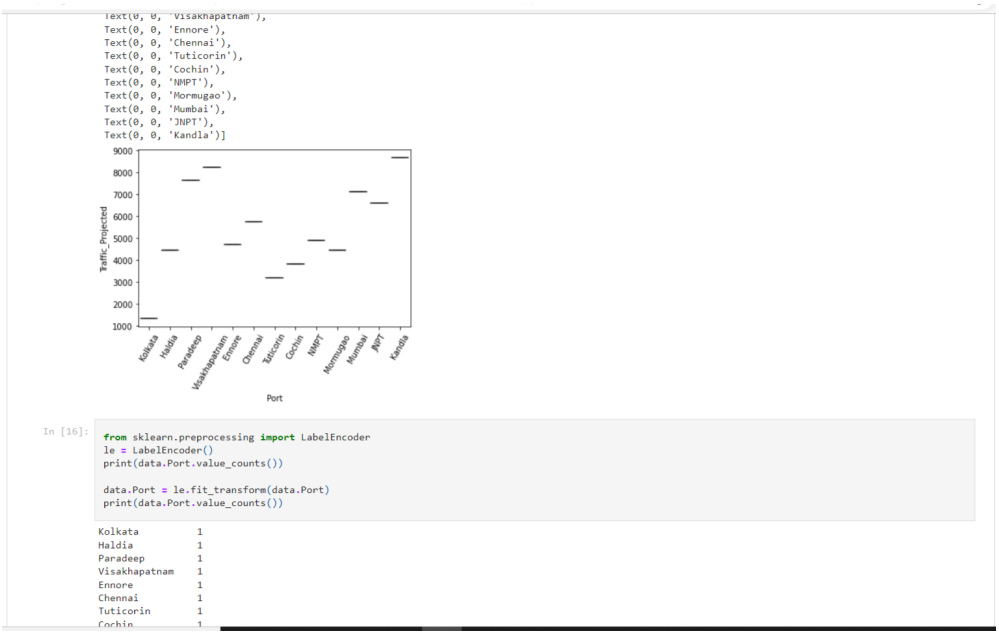
In [14]:
```
data.describe()
```

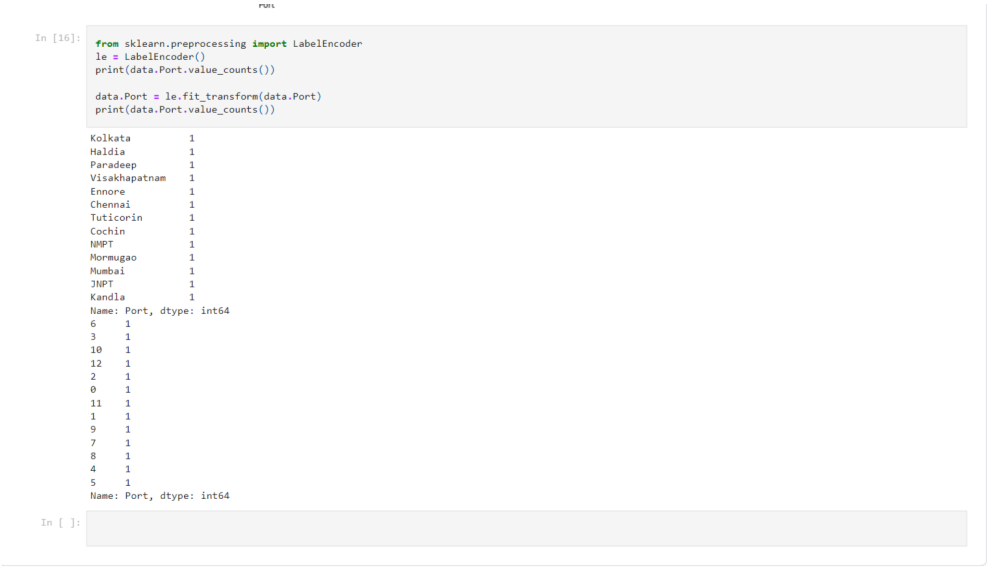
Out[14]:

	Traffic_Projected	Traffic_Achieved	Traffic in Eleventh Plan (MT) (2011-12) %	Total_Capacity_Projected	Total_Capacity_Achieved	Total Capacity in Eleventh Plan (MT) (2011-12) %
count	13.000000	13.000000	13.000000	13.000000	13.000000	13.000000
mean	5446.846154	4308.846154	77.887692	7705.307692	5306.384615	68.480000
std	2133.280019	2212.894855	19.382398	2570.242673	2140.254796	17.252637
min	1343.000000	1223.000000	31.830000	3145.000000	1635.000000	48.290000
25%	4450.000000	2810.000000	69.690000	6340.000000	4098.000000	52.110000
50%	4881.000000	3900.000000	82.020000	6690.000000	5070.000000	67.470000
75%	7105.000000	5618.000000	91.060000	9560.000000	7293.000000	74.850000
max	8672.000000	8250.000000	99.560000	12220.000000	8691.000000	110.260000

In [15]:
```
import seaborn as sns
xx= sns.boxplot(x='Port',y='Traffic_Projected',data=data)
xx.set_xticklabels (labels =data.Port,rotation=60)
```

Out[15]:
```
[Text(0, 0, 'Kolkata'),
 Text(0, 0, 'Haldia'),
 Text(0, 0, 'Paradeep'),
```





GitHub & Project Demo Link

Github: https://github.com/IBM-EPBL/IBM-Project-36133-1660293085

Project Demo Link : https://youtube.be/cVbvXca