

## AIRLINES AND AIRFIELD DATA MANAGEMENT USING HADOOP

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*Abstract- Collaborative higher cognitive process (CDM) has been utilized as a vital worldview to expand the potency of traffic flow management (ATFM), together with departure or landing operations at airplane terminals. Movement administration (ATC) administrations and airlines are included inside the current CDM, however, airfield management service benefit, an essential impartial, has not been concerned be that as it may, for the most part. This paper proposes a fresh out of the box new CDM display that is called satisfying CDM, that is upheld the delightful hypothesis of recreations. This model incorporates 3 primary substances (ATC, airlines, and airfield management) in ATFM. The entire arrangement of capacities is built up for everything about elements. Since the defer inferable from the ground or air holding surely modifies the departure or the arrival request of a flight, the grouping of departure and landing is set through the wonderful arrangement technique. Through CDM, the data amongst airlines and ATC added to the upgrade of the ground delay program (GDP). Proposed idea manages giving database by utilizing HADOOP device can break down no restriction of information and basic add number of machines to the group and get comes about with less time, high throughput and maintenance cost is less and utilizing joins, partitions and bucketing procedures as a part of HADOOP.*

**Keywords:** Airlines, Artfield, Collaborative Decision Making, Ground Delay Program, Matching Theory, HADOOP.

### I INTRODUCTION

The expanding worldwide interest for air transportation throughout the most recent decade has altogether affected the intricacy of Air Traffic Management (ATM). To profitably sort out the improvement of explorers, gathering, and plane, either on the ground or recognizable all around, is secured by numerous methods where security is a key point for all districts included. This raises new troubles for a couple accomplices, for instance, Air Traffic Control (ATC) units, bearing masters, transporters, and Airport Management associations, among others. The noteworthy bottleneck made by this new circumstance relates to airspace blockage, an issue by and large tended to through the ground postpone program (GDP), i.e., execution of deferrals for plane still on the ground. At whatever point completed and running, GDP incorporates the reallocation of landing

openings noticeable all around terminal. This results in another flight-arrival get ready for all the related plane terminals. This condition is known as opening circulation issue. The organization of these delays relies on upon Collaborative Decision Making (CDM), a perspective where the genuine target is the consolidation and data exchange between ATM specialists. Notwithstanding being utilized for more than 10 years, awesome CDM execution of GDP just allows the aircrafts to join the decision method for fighting these open resources. The issue is that, in bona fide, more accomplices impact and are affected in Air Traffic Management (ATM) get ready. A more present approach, called Airport CDM (A-CDM), starting at now realized in the most air terminals in both Europe and moreover the United States, in like manner just considers the slants of ATC operators and those of the aircrafts. This basically prompts to simply satisfying the slants of a set number of

accomplices may realize nonappearance of motivation and inspirations for share bona fide information. In this paper, broaden current best in class approaches for CDM by outlining another model for ground defer program (GDP). This model, in view of Matching Markets Mechanisms of the Game Theory, permits to incorporate the inclinations of the Airport Management, beside those of the ATC agents and the airlines. The theory of CDM turned into an ATFM worldview since the 1990's. Around then, information exchange and correspondence between airplane terminal control (ATC) organizations and bearer organizations were essential concerns [2], [3]. Through CDM, the information among the aircrafts and ATC added to the move up to the ground postpone program (GDP). By reallocating the openings of control of a runway, air action controllers can compose a flight with ground delay as opposed to airborne holding. Basic leadership in ATFM frequently uses confining measures, for instance, ground delay, airborne holding, miles-in-trail, reroute, and space swapping, to control carrier stream, as showed by the examination by Odoni [1], Hoffman [2], Butler [4], and Vossen and Ball [5]. The CDM structure, together with the related information development, has been completed in numerous critical air terminals on the planet. In Europe, CDM relies on upon the exchanging of data among the accomplices of the air transportation structure to improve shared situational care. It gives a structure focused on Airport CDM to manage flight operations and air terminal organizations [6]. In the United States, the ground postpone program improvement (GDPE) reach out under CDM conveys landing openings to flying machine at plane terminals in the midst of periods when demand outperforms capacity. ATC organizations and bearers use GDPE balanced information structures, for instance, Surface CDM, to breaking point blockage at a section air terminal to an attractive level by issuing ground deferrals to aircraft before their departure [2], [5]–[7]. It is watched that the plane terminal organization, as a pioneer, is obviously included either in Airport CDM or in Surface CDM. In Brazil, the CDM thought has been exhibited by the Air Navigation Management

Center (Centro de Gerenciamento da Navegação Aérea or CGNA) of the Department of Airspace Control (DECEA) of the Brazilian Federal Government. It has been adequately associated in the ATFM progression structure, especially in the midst of the 2014 Federation International Football Association (FIFA) World Cup in Brazil [8]. Differentiating Brazil CDM and Airport CDM in Europe and Surface CDM in the United States, the qualification lies in whether the plane terminal organization is consolidated into the CDM philosophy at the operational level. It is basic to determine that since 2012, a couple of all inclusive focus point plane terminals in Brazil, for instance, São Paulo—Guarulhos, Campinas—Viracopos, and Brasilia, have been privatized and in this way have their own specific money related premiums. In perspective of this privatization, the adequacy and the way of air terminal organization benefits in Brazil have improved by and large in the piece of ATFM. Be that as it may, the privatization additionally changes the airplane terminals into a vital partner in CDM.

## II RELATED WORK

To guarantee the security and stream of flights, ATM manages the conceivable imbalance between interest for airspace utilize and limit of the current aeronautics and air terminal framework [7]. Then again, ATM is viewed as a to a great degree complex and profoundly specific undertaking, other than being firmly in view of the experience of the movement chief. Its exercises address basic issues, for example, productivity (familiarity and postpones decrease), value (working with various airlines), flexibility (treating climate conditions), trust and security (overseeing air terminals). This area introduces the related looks into concerning the ideas of A-CDM, coordinating markets and calculations of Game Theory, and enhancement models for space designation in air terminal. In spite of the significance of the TFM decision making to the general ATM ability, there are almost no distributed investigations of the TFM decision making handle for convective climate ATM. It shows up from the writing that the most material

model is the recognition-primed-decision (RPD) display created by (Klein, 1999). In any case, operational utilization of the RPD decision making approach may repress the compelling utilization of enhanced climate and coordinated climate ATM data since the propensity of the chief will be to mainly consider arrangements that were utilized as a part of the past.

## 2.1 Collaborative Decision Making

In the 1990s, the theory of Collaborative Decision Making (CDM) was viewed as another worldview for the Air Traffic Flow Management (ATFM). It was planned in view of the start that an advancement in the procedures of correspondence and data trade between Air Traffic Control (ATC) office and carriers would prompt to better choices in overseeing flying machine movement [4]. At the time, the data trade between Federal Aviation Administration (FAA) and carriers, both members in the CDM, permitted the definition of the present procedures of Ground Delay Programs (GDP). Generally, the planned flight operations are beforehand allotted to a departure/arrival line, involving ATC openings. An ATC space can be seen as a base measure of time required for a flying machine to be allowed to play out a takeoff or landing operation on the runway of a controlled plane terminal [14]. The most extraordinary number of flying machine that can touch base at an air terminal in a given period is known as the Airport Arrival Rate (AAR). A comparable relationship can be made in portraying the rate of takeoff in a plane terminal as Airport Departure Rate (ADR). In case it is recognized that a division of airspace will be congested at a particular time, the action controller must apply appropriate measures, endeavoring to diminish the amount of flying machine at the impacted territory. This abatement is relied upon to keep up a protected measure of flights working in the same controlled part, sidestepping blockage. Notwithstanding the way that there are distinctive restrictive measures, for instance, ground holding delay, airborne holding delay, miles-in-trail, reroute, opening swapping, among others. For security reasons, slant is given to exercises that

incorporate courses of action concerning ground holding. It is sound judgment the suspicion that it is more secure to change the states of flight of an air ship that is in the ground than noticeable all around [6, 13, 20]. At the point when a ground defer program is connected, the AAR of a few airplane terminals is decreased.

## 2.2 Matching Markets

Diversion Theory has been utilized as a numerical hypothesis for demonstrating and investigation of the methodologies among different players by financial experts, mathematicians, researcher and PC researchers and others to build up the applications with extensive social commitment [16]. Lately, Game Theory has turned into the concentration of a few examines in transportation studies [3, 4, 19]. One reason for the accomplishment of this hypothesis is because of the differing qualities of hypothetical and genuine situations that it can be connected. For instance, we can specify the investigation of securities exchange, the predominance of qualities in hereditary advancement, territorial war struggle, decision comes about, monetary markets, among others [4, 16]. In financial matters, it is utilized to contemplate the relationship amongst free market activity of assets in social orders. Be that as it may, a few specialists utilize it to break down the conduct of portion calculations, empowering the circulation of these assets among agents in particular settings. Since 1950's, Game Theory has been utilized to take care of an extensive variety of issues, for example, enlisting forms in the work market, understudies' confirmations in the colleges, system and web outline, organ allotment among patients and givers, among others [10,11].

## 2.3 Optimization Models for Slot Allocation

The arrangement of postponing flying machine at the air terminal to manage limit issues is a perplexing issue known as Ground Holding Problem (GHP), in which the air ship will be influenced and the defer time appointed to every air ship. Despite the fact that there are a few techniques proposing various arrangements,

running from operation research to multi-specialist frameworks, the Ball et al. [4] and Wolfe et al. inquire about demonstrate that there is, for some time now, a pattern of utilizing improvement models in light of Game Theory to go to the advancement of the A-CDM. Rassenti et al. [18] built up a combinatorial sale system for airplane terminal spaces; Ball et al. [4] continued the study, investigation of goals and concerns with respect to aeronautics closeout issues. What's more, Balakrishnan [3] created two arrangements in view of market models utilizing Top Trading Cycle (TTC) and Vickrey-Clarke-Groves (VCG) evaluating components. These inventive studies demonstrated a noteworthy differentiation between the proposition and the systems that are presently utilizing as a part of ATFM. A procedure utilizing financial exchanges between airlines, amid space allotment, is viewed as a huge change in the present worldview. With a specific end goal to decide the adequacy of these models, a more nitty gritty investigation of trade strategy is required, and in addition taking movement controllers and different members in the CDM to have another point of view of the procedure. In their late work, Cruciol et al. [8] created compensate capacities to assess the execution identified with flying machine on ground and noticeable all around administration, ground defer control and many-sided quality investigation of air segments. Ribeiro and Weigang [19] displayed an answer in view of Game Theory to administration the departure arrangement of flying machine at air terminals.

### III EXISTING SYSTEM

In the progression of Satisficing CDM, ATC administrations, aircraft administrations, and airplane terminal administration administrations are incorporated clearly amid the time spent CDM. Cooperative basic leadership (CDM) has been used as an essential perspective to extend the productivity of air movement stream administration (ATFM), including flight or landing operations at plane terminals. Aviation authority (ATC) organizations and carriers have been incorporated into the current CDM, however

plane terminal organization advantage, a basic accomplice, has not been incorporated yet, all things considered. Existing idea manages giving backend by utilizing MySQL, which contains lot of drawbacks i.e. information restriction is that handling time is high when the information is tremendous and once information is lost, we cannot recoup so in this manner we proposing idea, by utilizing HADOOP tool.

### 3.1 DRAWBACKS OF EXISTING SYSTEM

- Could prepare restriction of information.
- Get comes about with take additional time
- Maintenance cost is high.

### IV PROPOSED SYSTEM

This paper proposes another CDM show, which is named as satisficing Collaborative Decision Making that relies on upon the satisficing preoccupation theory. This model consolidates three standard substances (ATC, aircraft's, and airplane terminal administration) in ATFM. The whole course of action of limits (slant, rejects capacity, and chooses capacity) is developed for each of the substances. Since the deferral in view of ground or air holding possibly changes the takeoff or the entry demand of a flight, the game plan of takeoff and landing is settled through the satisficing exchange handle. Through CDM, the information among aircraft's and ATC added to the overhaul of the ground concede program (GDP). Proposed idea manages giving database by utilizing HADOOP device we can break down no restriction of information and basic add number of machines to the group and we get comes about with less time, high throughput and maintenance cost is less and we are utilizing joins, partitions and bucketing procedures as a part of HADOOP .

### 4.1 ADVANTAGE OF THE PROPOSED SYSTEM

- No information misfortune issue.
- Efficient information handling.
- To exchange the information with the ATM telling voices in Brazil to endeavor

to complete Satisficing CDM in bona fide ATM circumstances.

- To improve the way of introduction of the components of select capacity and reject capacity for every component in Satisficing CDM.

## V OVERVIEW OF SYSTEM ARCHITECTURE

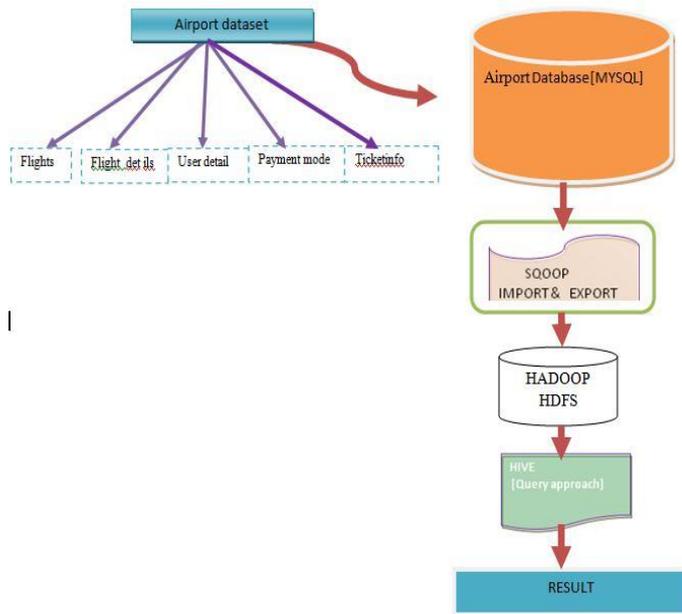


Figure :1. Overview of system architecture

Executing the proposed work initially need to make Data set for Airport Dataset it contain set of table to such an extent that Flight detail,user detail,payment mode,ticketinfo for certain period. Fig 1 demonstrates that information set will be first give into MySQL database help of this Dataset investigation of proposed work. After made the Dataset. At that point move the Dataset into HADOOP (HDFS), that will be happen in this module. SQOOP is a summon line interface application for exchanging information between social databases and HADOOP .after that get the Dataset into HADOOP (HDFS) utilizing SQOOP Tool. Utilizing SQOOP need to perform parcel of the capacity, to such an extent that if need to bring the specific segment or if need to get the Dataset with particular condition that will be support by

SQOOP Tool and information will be put away in HADOOP (HDFS). HIVE is an information product house framework for HADOOP. It runs SQL like inquiries called HQL (HIVE query language) which get inside changed over to outline occupations. Facebook created HIVE. HIVE bolsters Data definition Language (DDL), Data Manipulation Language (DML) and client characterized capacities. In this module we need to examination the Dataset utilizing HIVE device which will be put away in HADOOP (HDFS).For investigation Dataset HIVE utilizing HQL Language. Utilizing HIVE, we perform Tables manifestations, joins, Partition, Bucketing idea. HIVE examination the main Structure Language.

## VI SYSTEM IMPLEMENTATION

Flight dataset from existing MySQL database imported to HDFS through SQOOP. Pre-processing done in Hadoop with imported dataset using HIVE. Dataset taken of Delta airlines from 2008.

Flights dataset containing large entries shown in form of Data Visualization using ggplot2 package in R.

A	B	C	D	E	F	G	H	I	J
	Year	Month	DayofMor	DayOfWei	DepTime	CRSDepTi	ArrTime	CRSArrTim	UniqueCa
0	2008	1	3	4	2003	1955	2211	2225	WN
1	2008	1	3	4	754	735	1002	1000	WN
2	2008	1	3	4	628	620	804	750	WN
4	2008	1	3	4	1829	1755	1959	1925	WN
5	2008	1	3	4	1940	1915	2121	2110	WN
6	2008	1	3	4	1937	1830	2037	1940	WN
10	2008	1	3	4	706	700	916	915	WN
11	2008	1	3	4	1644	1510	1845	1725	WN
15	2008	1	3	4	1029	1020	1021	1010	WN
16	2008	1	3	4	1452	1425	1640	1625	WN
17	2008	1	3	4	754	745	940	955	WN
18	2008	1	3	4	1323	1255	1526	1510	WN
19	2008	1	3	4	1416	1325	1512	1435	WN
21	2008	1	3	4	1657	1625	1754	1735	WN

Figure 2: Data set in CSV Format in R

K	L	M	N	O	P	Q	R	S	T
FlightNum	TailNum	ActualElay	CRSElapse	AirTime	ArrDelay	DepDelay	Origin	Dest	Distance
335	N712SW	128	150	116	-14	8	IAD	TPA	810
3231	N772SW	128	145	113	2	19	IAD	TPA	810
448	N428WN	96	90	76	14	8	IND	BWI	515
3920	N464WN	90	90	77	34	34	IND	BWI	515
378	N726SW	101	115	87	11	25	IND	JAX	688
509	N763SW	240	250	230	57	67	IND	LAS	1591
100	N690SW	130	135	106	1	6	IND	MCO	828
1333	N334SW	121	135	107	80	94	IND	MCO	828
2272	N263WN	52	50	37	11	9	IND	MDW	162
675	N286WN	228	240	213	15	27	IND	PHX	1489
1144	N778SW	226	250	205	-15	9	IND	PHX	1489
4	N674AA	123	135	110	16	28	IND	TPA	838
54	N643SW	56	70	49	37	51	ISP	BWI	220
623	N724SW	57	70	47	19	32	ISP	BWI	220

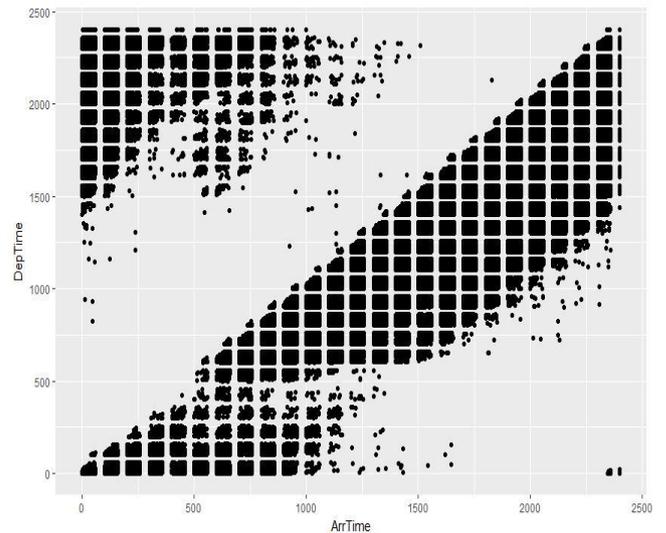


Figure 3: Dataset in CSV Format in R.

Figure 6: Arrival times and departure times shown to see free timings to allot existing or new flights and avoid airport trafficking.

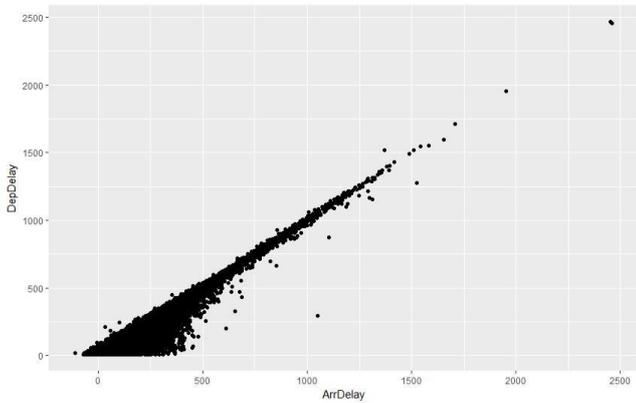


Figure 4: Departure delay and arrival delay shown.

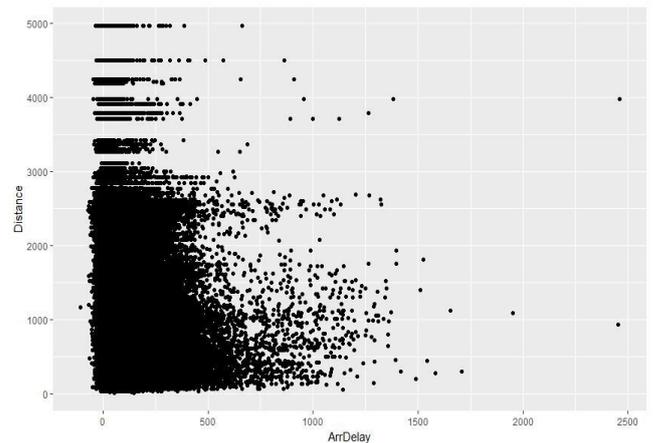


Figure 7: Distance and arrival delay shown to convey that long distances did not affect flight's arrival time. It was observed from the dataset that flights with shorter distance met more delay than long distance flights.

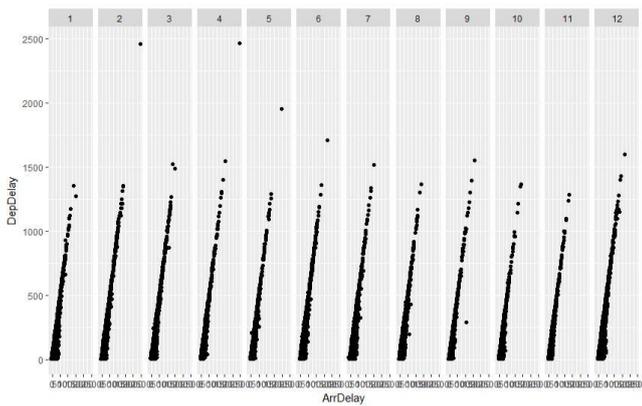


Figure 5: Departure delay and arrival delay shown month wise in facet grids.

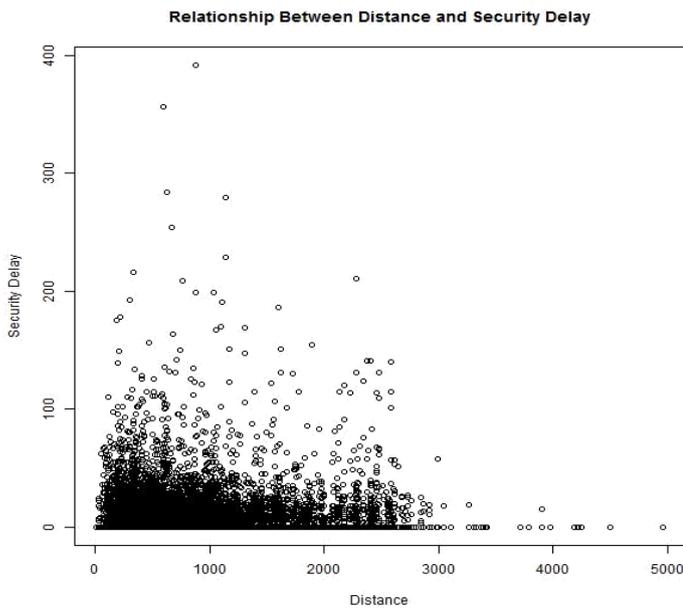


Figure 8: Unique carriers seen for every month in ggplot2 package in R.

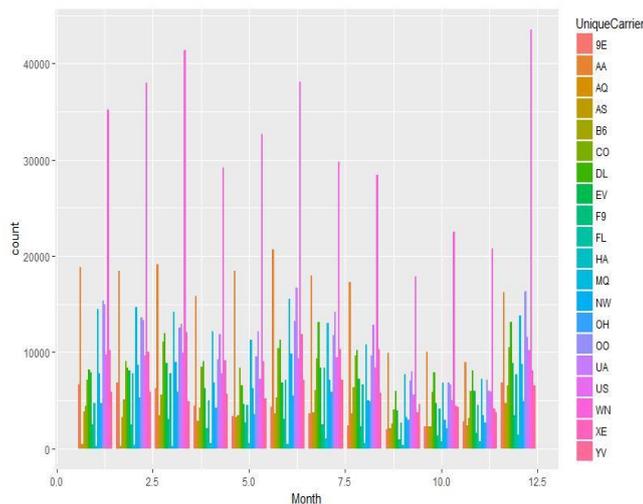


Figure 9: The dataset entries taken as inputs for neural network for training sets. Inputs taken by neurons in feed forward network. Supervised learning. Prediction is done for future outcomes of arrival and departure delay. The values pass sigmoid actuation function so values are normalized at output. The MSE is mean squared error, measure of quality-it is non negative value always and closer to zero.

$$MSE = \frac{1}{n} \sum_{i=1}^n (\hat{Y}_i - Y_i)^2$$

$$MSE(\hat{\theta}) = \mathbb{E} [(\hat{\theta} - \theta)^2]$$

$$\begin{aligned} MSE(\hat{\theta}) &= \mathbb{E} [(\hat{\theta} - \theta)^2] \\ &= \mathbb{E} [(\hat{\theta} - \mathbb{E}[\hat{\theta}] + \mathbb{E}[\hat{\theta}] - \theta)^2] \\ &= \mathbb{E} [(\hat{\theta} - \mathbb{E}[\hat{\theta}])^2 + 2(\hat{\theta} - \mathbb{E}[\hat{\theta}])(\mathbb{E}[\hat{\theta}] - \theta) + (\mathbb{E}[\hat{\theta}] - \theta)^2] \\ &= \mathbb{E} [(\hat{\theta} - \mathbb{E}[\hat{\theta}])^2] + \mathbb{E} [2(\hat{\theta} - \mathbb{E}[\hat{\theta}])(\mathbb{E}[\hat{\theta}] - \theta)] + \mathbb{E} [(\mathbb{E}[\hat{\theta}] - \theta)^2] \\ &= \mathbb{E} [(\hat{\theta} - \mathbb{E}[\hat{\theta}])^2] + 2(\mathbb{E}[\hat{\theta}] - \theta) \mathbb{E} [\hat{\theta} - \mathbb{E}[\hat{\theta}]] + (\mathbb{E}[\hat{\theta}] - \theta)^2 \quad \mathbb{E}[\hat{\theta}] - \theta = \text{const.} \\ &= \mathbb{E} [(\hat{\theta} - \mathbb{E}[\hat{\theta}])^2] + 2(\mathbb{E}[\hat{\theta}] - \theta) (\mathbb{E}[\hat{\theta}] - \mathbb{E}[\hat{\theta}]) + (\mathbb{E}[\hat{\theta}] - \theta)^2 \quad \mathbb{E}[\hat{\theta}] = \text{const.} \\ &= \mathbb{E} [(\hat{\theta} - \mathbb{E}[\hat{\theta}])^2] + (\mathbb{E}[\hat{\theta}] - \theta)^2 \\ &= \text{Var}(\hat{\theta}) + \text{Bias}(\hat{\theta}, \theta)^2 \end{aligned}$$

## VII CONCLUSION

Exhibited a Deferred Acceptance CDM show utilizing a coordinating methodology for airport collaborative decision making (A-CDM) with the interest of three specialists: ATC agency, airlines and airport managers. This idea proposed a fresh out of the plastic new CDM demonstrate that is called fulfilling CDM, that supported the satisfying theory of games. Proposed idea manages giving database by utilizing HADOOP tool can investigate no impediment of information and straight forward add number of machines to the group and get comes about with less time, high throughput and support cost is less and utilizing joins, segments and bucketing procedures in HADOOP. The test occurs exhibit the criticalness and amplexness of together with runway organization benefits in CDM. The game plans for takeoff and landing controlled by the expected model by and large meet the slants of the 3 accomplices inside the given honest to goodness action conditions. Future work utilizing flash can get result hundred times speedier than HADOOP. The mystery is that it keeps running in-memory on the bunch, and that it isn't fixing to Hardtop's MapReduce two-organize worldview. This makes

rehashed access to similar information much speedier. Start can keep running as a standalone or on top of HADOOP YARN, where it can read information straightforwardly from HDFS.

### VIII FUTURE ENHANCEMENT

Spark is a cluster-computing framework, which means that it competes more with MapReduce than the entire Hadoop ecosystem. Spark does not have its own Distributed file system, but can use HDFS (Hadoop distributed file system) from Hadoop. Spark is significantly faster than Hadoop's MapReduce jobs. As its performance is well known, BIG DATA can be easily circulated among domains and over Internet. Use of Spark in this project can help reducing Latency times and send/retrieval of data.

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