International Journal of Aquatic Science
ISSN: 2008-8019
Vol 12, Issue 03, 2021

Improving The Collaborative Learners Experience By Adapting Efficient Data Replication Strategy In Distributed Cloud Environment

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Abstract: Smart Learning Services Have Recently Attracted Various Instructors Because It Adopts Subject Conscious Techniques In Addition With Greater Competence, Because Of The Fact It Is Prominently Relying On Learners' Attitude Towards The Process Of Learning. If The Content Of Learning Becomes Popular Then That Content Will Be Accessed By Learners Repeatedly. For Enhancing The Performance In Rate Of Accessing Of Data, Data Should Be Replicated At Various Locations Devoid Of Interference From Other Users Who Are Trying To Access The Same Data. Therefore, The Need Of The Hour Will Be The Proper Selection Of Replication Strategy For Optimizing The Accessing Time Of The Data And Storage Space. Here In This Work A New Dynamic Replication Strategy Termed As Cbtbest Is Adopted For Replication Of Data. This Replication Strategy Has The Advantage Of Reduced Storage Space Required For The Replication Along With The Minimizing The Access Duration Of The Data. It Reduces The Quantity Of Overhead For Determining The Location Of Data Storage While Replicating The Data. Experimental Results Demonstrated That The Proposed Cbtbest Technique Performs Superior On Comparison With Traditional Dynamic Replication Strategy And No Replication Strategy Under Two Conditions That Will Be Under Constant Data Rate And Fluctuating Data Rate.

Keywords---Smart Learning, Cloud Computing, Dynamic Data Replication And The Centralized Binary Tree Test Based Estimation (Cbtbest)

1. INTRODUCTION

An Innovative And A New World Of Data-Driven Education Has Revolutionized The Art Of Learning. Automation In Pedagogical Decision-Making Is Mostly Adopted By Teachers.

Because Of The Approved Fact, That The Education Method Principally Comprises The Active Knowledge Sharing, Three Substantial Organizational Modifications Are Stressed. Initially Frameworks Containing Continuous Information Gathering, Incessant Technical Appraisal, And Numerous Document Preservation Is Created With The Help Of Generating The Simulated Education Settings With The Assistance From Information Technology This Strategy Preserves The Conservative Privacy Of Academic Data In Addition With The Provision Of Secured Learning Environment. Subsequently, These Systems Will Be Utilized In Limiting The Instructors' Intellectual Independence, Ambiguous Pupil's Assessment, Along With The Minimizing Students' Involvement In Academic Decision-Making Process. Lastly, Big Data-Enforced Methods Explain The Need For Metrics In Assessing Academic Environment With The Help Of Matching The Ideas, Generating The Composition, Identifying The Measures, And Framing The Anticipated Consequences Of Knowledge For Teaching.[1]

Within Last Two Decades, The Technology Of Computing Emerged As The Leading Technology And Replaces The Most Of The Conservative Techniques. The Biggest Motivation Of The Computing Technology Will Exist In Exchanging Of The Knowledge In A Secured Manner. Research In Education Has Been Revolutionized To A Greater Extent Because Of The Existence Of Big Data. Traditional Academic Frameworks Will Be Utilized In Aiding Instructors In The Investigation Of Pupil's Knowledge And The Techniques Should Suit For Analyzing Of Every Student [2]. Instructors Are Trained With Innovative Methodologies And Having The Capacity To Perform In A Competent Manner In The Academic Functioning. A Quick Response Is Provided By The Pupils And Instructors On Their Method Of Learning And Teaching Functions In The Academic Background With The Help Of Data Mining And Data Analytics Platforms. In Depth Investigation Of Certain Academic Patterns Might Be Offered By These Techniques [3].

A Smart Learning Provides A Prompt And Flexibility For The Students With The Help Of Instantaneous Investigation Of Requirements For Specific Students With Diverse Perceptions. (E.G., Training Functionality, Training Manners, Individual Parameters). The Expansion Of Knowledge That Is Conscious Over The Pervasive Educational Background Which Contains The Capacity Of Identifying The Actual Training Position Of Pupils That Will Be Empowered With The Advent And Development Of Mobile And Wireless Techniques. Consequently, Suitable Knowledge Might Be Delivered To All Distinct Pupils In The Correct Venue And Within The Stipulated Duration. Greater Number Of Parameters Should Be Taken Into Consideration For The Formulation And Construction Of Academic Framework To Learn In The Real Time Background. [4].

Replication Of Database Will Be Defined As The Recurrently Plagiarizing Of The Data Content That Has To Be Stored In A System Or Server In Another Database In Such A Way That Entire Clients Can Obtain The Similar Quantity Of Material. As A Consequence, Scattered Database Will Be Created By This Way And Hence All Clients Can Speedily Obtain The Information That Will Be Appropriate With The Events That They Are Handling Deprived Of Interruption Because Of The Activities Of Other Clients.
The Cloud Computing Will Be Described As The Technique That Delivers Resources Required By The Clients With The Help Of Utilizing The Most Powerful Medium "Internet". Clients Will Be Able To Obtain The Resources Such As Application Software Or Storage Space From Cloud Deprived Of The Requirement For Owning The Resources. Payment To Cloud Service Provider In Accordance With The Usage Is Mandatory For Obtaining The

Access Of The Required Resources. The Notion Of Cloud Computing Does Not Belong To The Latest One. It Is Arrived From Integrating Various Existing Computing Technologies Such As Grid Computing, Distributed Computing Etc.,[5]

Cloud Computing Is A Significant Technology In Smart Learning. Cloud Computing Circumstance In Accordance With The Smart Learning Delivers Fresh Notions And Solutions For The Accomplishment Of Inter-Functioning Of The Assorted Resources And Frameworks. Cloud Facilities Might Use Internet As Greater Platform, Resources, And Background. Students Will Be Provided For The Permission To Use The Internet Regardless Of The Place And The Time, Utilizing Extensively Scattered Dynamic Equipment's. On The Other Hand, Prevailing Cloud Computing Techniques Will Not Be Receptive For The Consumer's Requirements. The Mentioned Condition Requires For The Utilization Of Positive Cloud Facilities Relatively Compared With Inactive Facilitates. The Quantity Of Knowledge And Facilities Computed Via The Various Techniques Will Be Progressing Because Students Characteristically Will Consider Mobile Equipment Of Certain Category In The Hands Of Them.

This Paper Aims At Developing A New Replication Strategy In Such A Way That Data Accessibility In Knowledge Sharing System Becomes Easier. The Objective Is To Minimize The Data Access Complexity And Duration And Enhancing Learners' Understanding.

The Contents Of The Paper Includes The Analysis Of The Various Literatures, The Statement Of The Problems, The Proposed Methodology , The Simulation Results , Performance Analysis And Conclusion .

2. LITERATURE SURVEY

[1] Cloud Computing Is Defined As Processing Prototype In Such A Way That Clients Will Be Provided Permission To Obtain ICT Facilities And Resources. There Is No Requirement To Keep The Sources In The Place Of Client. Linkage Resources Repeatedly Develop Blockage In Facility Providing Aimed At Numerous Cloud Applications. Consequently, Data Replication That Carries Data (E.G., Databases) Nearer To Data Consumers Will Be Realized As Significant Solution.

The Data Replication Process Is Demonstrated In Figure 1.

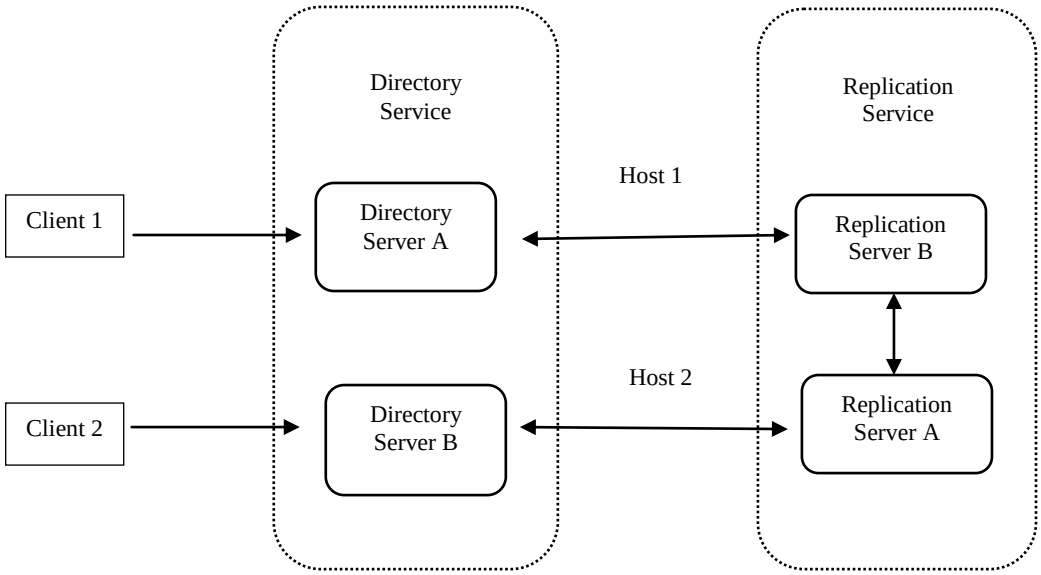

Figure 2.1 Process Of Data Replication

[2] For Enhancing The Resources Obtainability, Replicating The Prevalent Data At Various Appropriate Places Is The Recommended Strategy That Has To Be Adopted So That Clients Might Obtain The Required Resource From The Places That Are Adjacent To Them. The Research Work [7] A Dynamic Data Replication Methodology Is Recommended For Distributed Processing Conditions. The Proposed Methodology Comprises: 1) Investigating And Demonstrating The Association Between System Obtainability In Addition With The Quantity Of Copies; 2) Appraising And Recognizing The Widespread Information In Addition With Generating A Replication Process While Trendy Information Conveys Active Threshold; 3) Computing Appropriate Quantity Of Copies For Satisfying The Considerable Framework In Addition With Deploying The Replicas Out Of The Data Nodes In A Composed Manner 4) Formulating The Active Information Replication Technique.

[3] Replication Of The Prevalent Document And Keeping And Maintaining Of Replica At Places In The Vicinity Of The Clients That Will Be Generating The Requirements Of The Resource, Supposed To Be The Better Option For Minimization Of Processing Duration. Nevertheless, Replication Supports For Enhancing The Obtainability, The Enquiry That In What Way To Arrive At A Best Replication Quantity And Precise Positions For Placing The Replicas Considered The Most Significant Problems. The Research Work Proposed By Jayalakshmi And Srinivasan (2015) [8] Conducts Small Analysis Over Numerous Data Center Choices In Addition With Replication Techniques Utilized Was Pronounced. In Addition, A Framework Containing Two Stages, Data Epicenter Choices And Active Data Replication, Recommended With The Purpose Of Enhancing The Efficient Data Obtainability In Addition With Minimization Of Client Expectation Duration By The Least Quantity Of Replicas Was Established In The Proposed Work.

[4] The Paper Work By Gudadhe And Agrawal (2017) [9] Will Be Taken Into Consideration For The Utilization Of The Various Parameters That Are Listed As 1. Quantity Of Incoming Client's Requirements, 2. Differentiated Framework For Storage Of Cloud, 3. Reachable Bandwidth And 4. Fluctuating Proportion Of Familiarity Of The Subjects In Examining And Delivering Based On The Investigations And Comparisons With Obtainable Replication Methodologies. The Data That Is Being Requested Will Be Replicated With Anticipated Node In The Cloud Setting That Results In Healthier Information Obtainability, Quicker Granting Of Permission To Access The Data In Addition With Optimized Usage Of Bandwidth. The Replica Is Generated While The Subject Familiarity Exceeds The Threshold, For Keeping The Huge Obtainability Of The Information In The Setting. While, The Familiarity Of The Information Minimizes The Diminishing Request, The Inactive Replica Requires To Be Compulsorily Withdrawn From The Data Node. The Research Work Suggests A Technique Of Generation And Removal Of The Replica Based On The Subject Familiarity Threshold In Delivering A Competent Replication Technique In Addition With The Provision Of Enhanced Obtainability Along With Optimal Storage Utilization In The Data Nodes.

[5] Huge Cloud-Dependent Applications Was Suggested For Requirement Of Larger Storage Availability Of Data Centers. Information In The Cloud Should Be Kept In A Greater Competence And Cost-Efficient Manner Whereas Satisfying The Demand Of Consistency. In Present Cloud Settings, Characteristic 3- Replicas Data Replication Methodologies Were Enforced With The Consistency Of Data In Mind. In The Work By Li Et Al., (2011) It Was

Suggested To Utilize An Innovative Cost-Efficient Active Data Replication Methodology That Provides Cumulative Replication Strategy In Minimizing Cost Of Storage The Storage Cost In Addition With Satisfying The Consistency Of Data Obligation With Concurrence. The Replication Methodology Functions Better Particularly For Data That Will Be Utilized Provisionally And/Or Contains Comparatively With Least Consistent Obligation.

[6] Computer Supported Collaborative Learning Helps Competent Training With The Help Of Sharing Of Concepts And Information With Students, Cooperative Permission Of Important Records, In Addition With Response From Teachers In Terms Of The Academic Training. Innovative Guidelines Will Be Used In Constructing The Collaborative Training Strategies In Cloud Are Projected. Construction Of Training Strategies Necessitates Permission To Use The Considerable Information Maintained In The Cloud. Guaranteeing Effective Permission To Use That Data Was Obstructed By Greater Delays Of Extensive Networks In Fundamental Cloud Framework. For Enhancing Student's Involvement In Learning With The Help Of Speeding Up Of Permission To Use The Information, Significant Records Might Be Replicated In Such A Way That A Set Of Students Will Be Permitted For The Utilization Of The Data From Adjacent Places. Cloud Setting Is Extremely Active Because Of Resource Obtainability, Network Delay, And Students Demands Can Be Altered. The Research Work By Shorfuzzman Et Al., (2015)[10] [11] Established Benefits Of Collaborative Learning And Concentrating Over The Significance Of Data Replication In The Formulation Of Active Cloud-Dependent Setting That A Collaborative Training Space Utilizes. They Established A Greatly Dispersed Replication Strategy Which Identifies Best Places For The Information For Enhancing The Performance Of Permission To Utilize The Information And Reducing The Replication Overhead. The Problem Is Designed By Utilizing The Dynamic Programming Technique.

3. PROBLEM STATEMENT

This Paper Is Aimed At Improving The Data Accessibility In The Smart Learning Circumstance By Adopting The Data Replication Strategy[12]. Here In This Paper The Adoption Of Data Replication Strategy That Is Called As Centralized Binary Tree Test Based Estimation Strategy Is Utilized For Smart Learning Environment. The Proposed Strategy Minimizes The Memory Required For Replication And Computational Overhead. As It Reduces The Computational Overheads To An Extent That Is Considerable The Data Access Time Is Greatly Reduced. As The Suggested Methodology Follows The Binary Based Strategy It Reduces The Storage Space For The Replication.

4. PROPOSED METHODOLOGY

The Proposed Methodology For The Data Replication Strategy Is Centralized Binary Tree Test Based Estimation Strategy For Improving The Data Accessibility In The Application Of Smart Learning In Cloud Environment. The Proposed Methodology. The Centralized Binary Tree Test Based Estimation (Cbtbest) Strategy Falls Under The Category Of Dynamic Time Replication Strategy.

4.1 The Centralized Binary Search Best Strategy:

The Centralized Binary Search Best Strategy Contains 5 Stages: (1) File Batching, (2) Tree Construction (3) Inferring Tree Node Value (4) File Capacity Estimation And (5) Calculation Of File Familiarities And Conclusion With Respect To The Replicas [13]

The Number Of Requests For File *F* In Node *N* During Slot *T* After An Increase / Decrease In Its Demand By A Factor *X* And Y Are Denoted By $NR_t^{f,n}(x)$ And $NR_t^{f,n}(y)$ Respectively.

Now, Knowing The Values Of $NR_t^{f,n}(x)$And $NR_t^{f,n}(y)$, It Is Possible To Estimate The Value Of $NR_{t-1}^{f,n}$, It Is Possible To Estimate $NR_{t-1}^{f,n}$, The Number Of Requests In The Previous Slot.

$$NR_{t-1}^{f,n} = \frac{xNR_t^{f,n}(y) - yNR_t^{f,n}(x)}{x-y} \quad (1)$$

The Demands For A File During One Round Can Be Observed As An Arbitrary Walk Involving Of A Sequence Of Arbitrary Phases, One Stage Per Slot, Throughout That The Request Is Either Improving Or Diminishing.

4.2 File Batching

In Btbest, Each Node Retains Its Tree Configuration And Computes The Capability And Objective For The Files For That Is Requested[13]. In Cbtbest, There Is Presence Of One Binary Tree Configuration Per Group And It Is Preserved In The Header Node. In Btbest, The Capability And Motivation Are Assessed For Every Demanded File. Clustering Is Employed With Values For D0 And NR0 That Exists In Similar Durations Which Is Pre-Explained By Every Cluster, Depending On The File Requirements It Obtains.

4.3 Tree Construction

The Preliminary Building Of The Tree Structure To Be Added In A File *F*, Necessitates To Form Two Threshold Values T_x And T_y For The Max Value Of *X* And The Min Value Of *Y*, Correspondingly[14]. The Extreme Upsurge In A File's Request For One Slot [Assume That B ≈ 1] Would Be $D_t = D_{t-1}\, T_x$ And The Extreme Reduction Would Be$D_t = D_{t-1}\, T_y$. Thus, If The Request For A File Goes On Swelling Then, Its Greatest Value After *R* Slots Would Be $D_t = D_{t-1}\, T_x^r$. Correspondingly, If The Request Goes On Declining Then, Its Least Value Would Be$D_t = D_{t-1}\, T_y^r$. With These Request Values, It Is Possible To Calculate The Quantity Of Demand Values For The Leaves Of The Tree[15]. The Leaf Values Form Intervals, In The Form $[NR_t^{f,n}(y), NR_t^{f,n}(x)$ These Intervals Are Additionally Split, So As To Generate Subintervals In The Form $[min_t^{f,n}(y) \ldots min_t^{f,n}(x)]$ And$[max_t^{f,n}(y) \ldots max_t^{f,n}(x)]$. These Values Will Be Utilized In Phase 3 Of The Cbtbest.

4.4 Tree Node Values Estimation

Upon Finishing Phase 2, The Header Node Estimates The Outstanding Tree Values Utilizing A Bottom-Up Approach, Under The Supposition That The Request Between Slots T - 1 And T Might Have Been Enlarged By X With A Probability P Or Reduced With The Help Of Y With A Probability (1-P). Every Tree Node Retains Two Values, A Least Value $Minimum_t^{f,n}$ And A $Maximum_t^{f,n}$,Signifying An Interval $[min_t^{f,n} \ldots max_t^{f,n}]$. Eq. (1) Is Utilized Two Times For Finding A Value For The Upper Tree Node Once To Guesstimate The Minimum Value Of The Upper Node Interval, $min_{t-1}^{f,n}$ And One To Approximate The Maximum Value Of The Upper Node Interval, $min_t^{f,n}$

So, (1) Is Rewritten As

$$min_t^{f,n} = \frac{xmin_t^{f,n}(y) - ymin_t^{f,n}(x)}{x-y} \quad (2)$$

$$max_t^{f,n} = \frac{xmax_t^{f,n}(y) - ymax_t^{f,n}(x)}{x-y} \quad (3)$$

4.5 Estimating The File Potential

In The Fourth Phase, The Original Quantity Of Demands For Every File In A Group Is Read At The End Of The Round And Every Feasible Path That Results In This Value Is Inspected. For Every Such Path, The Number *X* Of *X*-Steps And The Number *Y* Of *Y*-Steps Are Calculated. Their Difference Forms The Measurement Are Called As *Potential*$P_{f,n}$ For *F* In Node N After A Round *R*. For Reference, All Nodes Are Indexed With N_i; $I = 1 \ldots 14$. There Are Two Ways To Accomplish An Interval That Includes 80:

1) $N_0 \rightarrow N_2 \rightarrow N_6 \rightarrow$ One Y − Step: In This Circumstance, It Is Possible To Have A xx – Path (The Path Ends At Level K = 2) Resulting In I_{12} Where 80 Prevails. No Demand For *F* Between Slots 2 And 3. By Adding One More Y−Step To Designate No Additional Demands For F After Slot 2.
2) $N_0 \rightarrow N_2 \rightarrow N_5 \rightarrow N_{12}$ (80 Is > Than The Greatest Value Of The Interval [63 … 65] Located In N_{12}. In This Circumstance, It Is Possible To Have A xyx – Path. The Total Sum Of x –Steps Are X = 2 + 2 = 4 And The Total Quantity Of y –Steps Is *Y* = 1 + 1 = 2 And $P_{f,n}$ = X – Y = 4 – 2 = 2.

4.6 File Popularity And Decision About The Replicas

The Complete Familiarity Of A File F In Node N Is Calculated As Trails:

$$FP_{f,n} = NR_{f,n} \times 2^{p_{f,n}} \quad (4)$$

Where $NR_{f,n}$ Is The Quantity Of Demands For File F At The Finish Of A Round In Node N Whereas $P_{f,n}$ Is The Potential Of *F* Throughout The Identical Round In The Identical Node. If $P_{f,n} > 0$ Then The Quantity Of Demands Is Multiplied By A Power Of 2, If $P_{f,n} < 0$ Then Divide The The Number Of Requests With A Power Of Two, And If $P_{f,n}$N = 0 Then There Is No Alteration. Every Node Arranges The Files In Declining Order In Accordance With The *FP* Values .

5. EXPERIMENTAL RESULTS

Data Access Time Is Selected As The Measure To Analyze The Functionality Of The Proposed Technique. For Enhancing Learner's Experience, The Foremost Objective Is The Reduction Of Access Time Of The Data. The Result Is Examined Under Two Circumstances, That Is While Rate At Which Accessing Of Data Is Kept Constant And While Data Access Rate Is Varying. The Proposed Cbtbest Technique Is Analyzed With Dynamic Replication Strategy And The Case Of No Data Replication Is Done.

International Journal of Aquatic Science
ISSN: 2008-8019
Vol 12, Issue 03, 2021

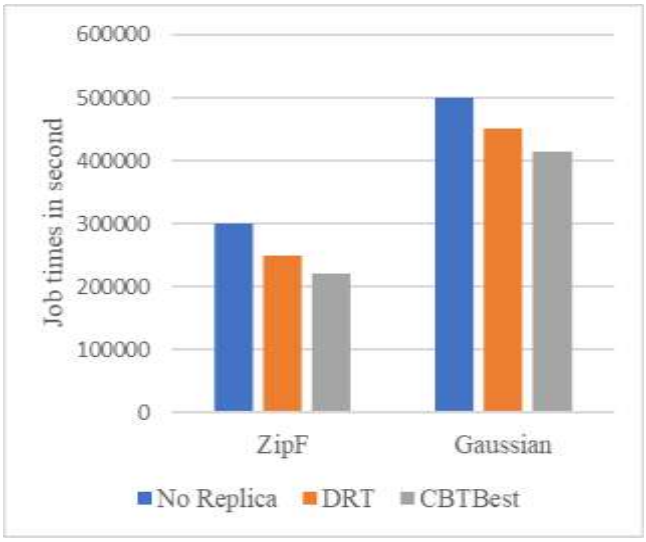

Figure 5.1 Patterns In Accessing Of The Data

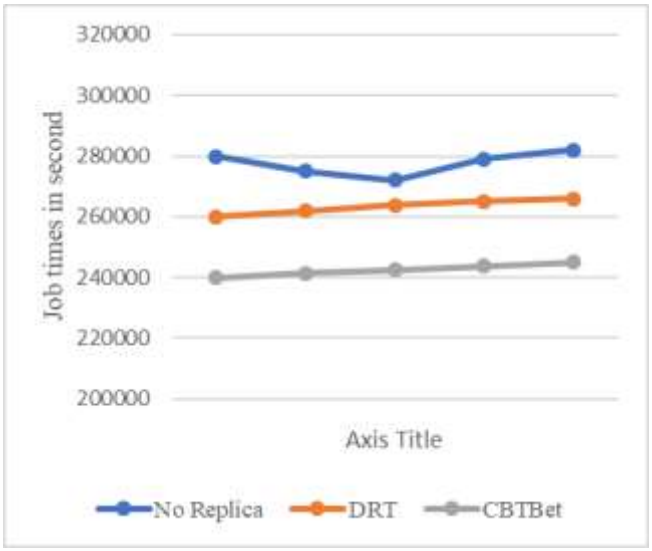

Figure 5.2 Replica Configurations For Server Under Zipf Configuration

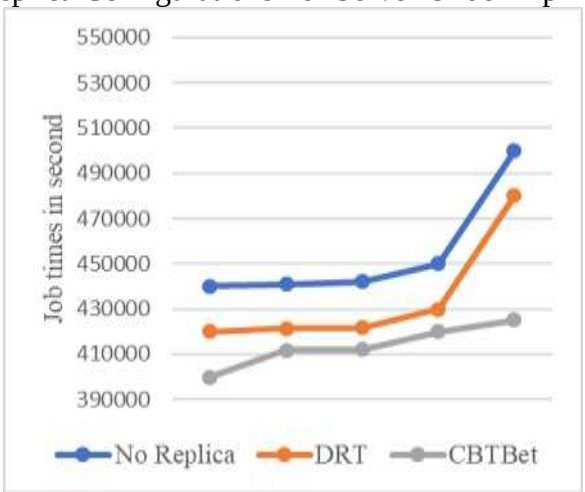

Fig 5.3 Replica Configurations For Server Under Gaussian Distribution

Figure 5.1 And 5.2 Analyzed Access Duration For The Data By Adopting The Proposed Cbtbest With The Access Times For Dynamic Replication Strategy And The Circumstance While Replication Is Avoided As Per Figure 5.3. While The Rate Of Access By Students Is Continue To Be Unaltered., Cbtbest Demonstrates Lesser Processing Duration Than No Replication Case. Superior Position Of Creating The Replica Is Picked With The Help Of Cbtbest By Reducing The Computational Overhead And Reduces The Storage Space And The Delay In The Accessing Of The Data.

The Storage Volume Of The Data Locations Provides Conspicuous Effect Over The Functionality Of Replication Strategy. By Reducing The Capacity, The Access Durations For All The Strategies Are Enhanced By Diverse Quantities. Fig. 5. 4 Shows The Processing Duration For Gaussian And Gaussian Distributions

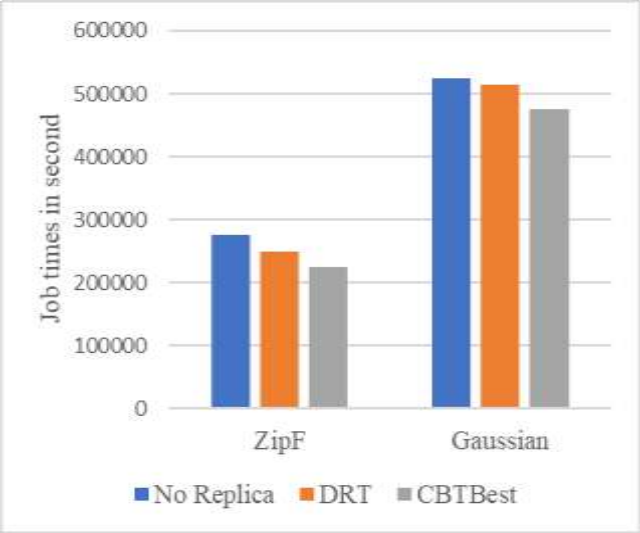

Figure 5.4 Patterns In Accessing Of The Data

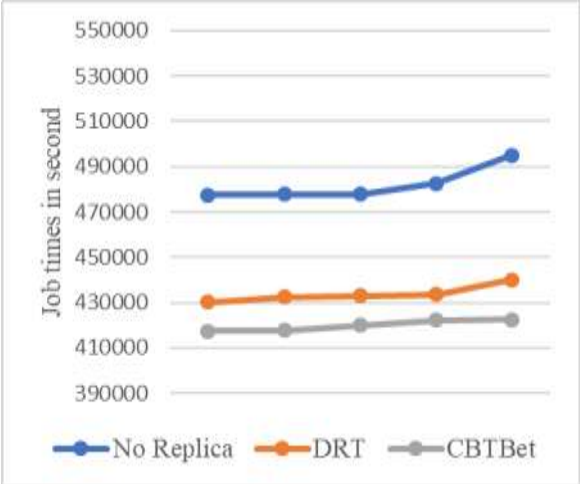

Fig 5.5 Replica Configurations For Server Under Zipf Configuration

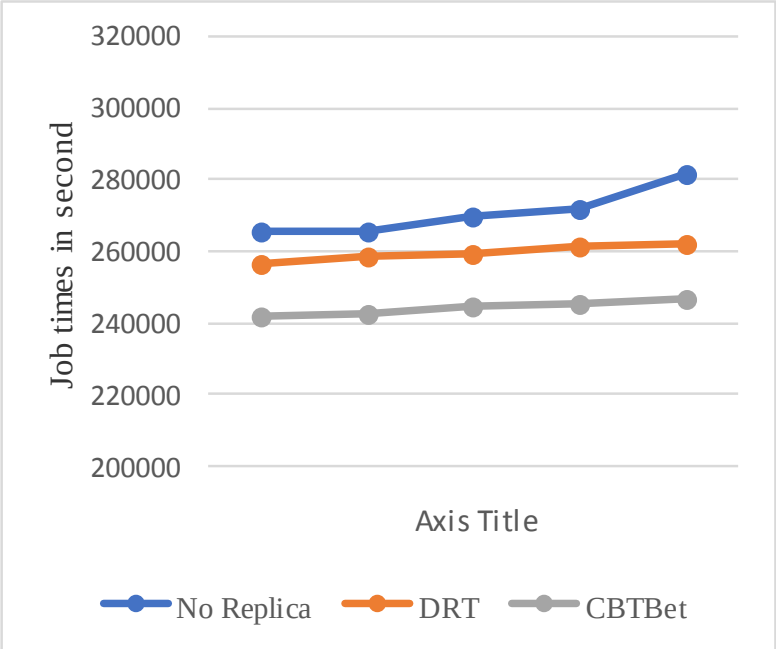

Figure 5.6 Replica Configurations For Server Under Gaussian Distribution

Changeable Access Rate Of Data: Fig. 5.6 Shows The Access Duration Of Data For Cbtbest, DRT And No Replication Circumstance While The Accessing Of Information Of Fluctuating Rate Of Arrival From The Students. Cbtbest Depicts Lesser Durations For Entire Information Patterns For Accessing Because Of Minimized Delay In Accessing. Fig. 5.5 And 5.6 Analyzes The Duration For The Accessing The Data For All Configurations As Rate Of Accessing The Data Gets Fluctuated. With Reduction In Size Of The Storage, The Durations Of Access The Data Are Enhanced In Extreme Circumstances Cbtbest Demonstrates Least Access Durations.

6. CONCLUSION

Smart Learning Requires A Huge Amount Of Data To Be Accessed From The Internet. Some Of The Data Are Very Much Popular So That It Has To Be Accessed Several Times Because Such Data Used More Frequently. Such Data Should Be Made Available For Obtaining The Access At All Time Without Taking Much Time For The Access. For Providing The Availability At All Times And Reducing The Access Time For The Data, Data Has To Be Replicated. In This Paper It Is Proved That By Adopting The Cbtbest Strategy For Data Replication Reduces The Access Times For The More Popularly Used Data. This Is Achieved By The Reducing The Computational Overhead For Selecting The Location Of Data Replication Strategy And Entire Data Replication Process. As The Computational Overhead Is Reduced To A Greater Extent Storage Space Required For Replicating The Data Is Also Reduced And In Addition With Our Primary Motive Of Reducing The Access Time Of Data.

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