An Efficient Dynamic Parallel and Distributed Network with Hybrid Hyper Cube

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ABSTRACT

The interconnection network topology is the very significant contemplations in plan of equal frameworks as it is spine network over that the various parts of PC speak with one another. The topology properties, for example, network, reliability, cost, adaptation to internal failure, measurement and cut width decide the perfect less information transmission among source &sink hubs. In this manuscript, we suggest another hybrid interconnection network topology named "Hybrid Hyper Cube (HHC)"that will be a result of two old style mainstream interconnection geographies to be specific hypercube and torus. Moreover, we display the development and qualities of suggested interconnection topology. We additionally introduced few essential significant properties and defined 2 routing procedures for HHC.

Key words: Hypercube (HC), Network Reliability, Hybrid Hyper Cube (HHC).

I. INTRODUCTION

The interconnection network accept a urgent activity in arrangement of passed on structures as it describes the strategies for data exchange among various autonomous taking care of units. The interconnection network furthermore signifies shrouded building for instance topology used for these structures. In this manner, the introduction of these frameworks generally depends upon their interconnection network. As such, to design a significantly strong dispersed framework, it should be ensured that utilized interconnection network must be especially reliable for instance it must work adequately for a particular time period even occasion of specific frustrations like association just as preparing units. Moreover, the utilization of interconnection network in these structures must be judicious. One path to deal with measure the price of interconnection network will be consequence of its degree to width. Toward the day's end, it might be said that outstandingly strong similarly as commonsense interconnection network should be sent to plan such frameworks. A couple of instances of Interconnection network join Hypercube and its varieties, Torus, Mesh, etc. The HC is utilized in [1-2, 20, 28-31] because of its properties such as little separation over, strong accessibility consistency,

symmetricity, recursive turn of events, partionability, and adjustment to non-basic disappointment, and unwavering quality. Various varieties of HC are suggested in previous either to improve its dependability or to reduce its price. The variety consolidates cube related cycles [23], wound HC [3], crumbled HC [5], crossed cube [6, 8], exchanged HC [4, 41], lacking crossed cube [5], banyan HC [15], and so on. The HC is in like manner a not too bad determination of experts to propose various different levelled interconnection networks viz. different levelled HCs, dynamic crossed cubes, dynamic cube networks, extended HC, and so on [30]. In any case, the major issue related with HC and its varieties is their proposed restriction to scale.The obvious topographies to give a genuine degree of flexibility are Mesh and torus [24-27]. These networks have viewed as utilized by and large in domain of legitimate estimations, stream components, essential assessment, etc. In any case, the huge estimation of work network forbids its use in the arrangement of a colossally equivalent PC system [9-10]. Moreover, noteworthy cost and inconvenience in set-up and backing of this network further make it difficult to complete, in reality, equivalent machines. Interestingly with work, Torus has high network and continuously strong. Thusly, it is utilized in structure of various equivalent machines, for instance, Cray X1-E vector PC [14], Cray XT3 [11], Alpha 21364-based HPGS 1280 [4], X1E [13], and XT4 [12]. Furthermore, IBM Blue Gene gathering of immensely equivalent PCs are few striking samples of mixed Radix 3D Tori [30-32]. To reduce gigantic separation across of torus, another class of recursively sorted out torus affiliations networks named "recursive inclining torus (RDT)"is suggested in [22].The discussion did as such far reveals that torus has a fixed degree yet has a for the most part huge broadness (2n). While, the width of the hypercube is pretty much nothing, yet its center point accessibility increments logarithmically with network size. In such situations taking after effect of 2 typical topographies is a normal strategy of building another interconnection network [16-19]. The cross consequence of interconnection networks apparently beats traditional topographies with different fundamental properties [11]. Subsequently, the issue of arranging a versatile, down to earth, and significantly reliable, issue indulgent network with less separation across and strong accessibility with less gear multifaceted nature is yet a test.

This influences us to suggest another "hybrid interconnection network" called (HHC) that obtains the properties of 2 notable interconnection geologies: torus & HC. The suggested topology (HHC) mishandles a huge bit of the critical properties of torus& HC. The current work communities and dismembers the various arrangement segments of HHC and differentiations its topological properties and that of other noteworthy interconnection geologies.

2. PROPOSED NETWORK

Interconnection networks assume a significant job in the general execution of the framework. Choosing the fitting network is a significant issue in the plan of equal and dispersed frameworks. When all is said in done, deciding the ideal network to execute any equal application doesn't have a known hypothetical solution. There are various approaches to decide proficient geographies that exchange off elevated level execution issues against different implementation constraints. A Topology is assessed as far as various execution boundaries, for example, degree, distance across, bisection width and cost. A few analysts have created different structures which are considered better as far as specific boundaries.

A couple of varieties base on the decrease of the separation across , some of them concentrated on the structure of direct controlling and correspondence calculation . Adaptability is in like way a significant issue to assess the showcase of interconnection frameworks. Regardless, it can't be unmistakably referenced what interconnection sort out is working better by deduction pretty much all the cutoff points. To the degree irregularity interconnection frameworks might be arranged into two basic portrayals. The first is cube based plans which controls a rich interconnection topography. The Binary hypercube or n-cube has been regularly utilized interconnection orchestrate in the structure of identical frameworks. Two or three assortments of hypercube building are spoken to in the pieces two or three models are folded hyper-cube (FHC), meta-cube (MC), folded meta-cube (FMC) and folded dual-cube (FDC), and so forth. The immense shortcoming in such frameworks is the advancement in the measure of correspondence joins for each inside and the expansion in the full scale number of focus focuses in the structure which at long last upgrades the whimsy of such interconnection frameworks. Along these lines, there is a need to complete the presentation evaluation of different interconnection arranges by considering their topological properties.

The underneath normal of the framework is clearly extensible frameworks, for example, straight show, ring, authentically extensible tree and truly extensible cube, and so on . The

multifaceted thought of these frameworks is lesser as they don't have exponential augmentation. Other than the adaptability, different cutoff points to assess the presentation of such frameworks are degree, number of focus focuses, estimation, slice width and change in accordance with inside disillusionment. The standard clarification behind this paper is to consider and isolate the unmistakable multiprocessor organizes close by their properties to help in the structure of another interconnection planning. Decision of a pervasive interconnection framework may have two or three uses with lesser complexities and improved force suitability. One such present day application is compose on chip point of view where distinctive centers are installed with fitting accessibility. Several models may join work, torus, star, and so forth.

3. PERFORMANCE PARAMETERS

The need for compositional execution appraisal exists from configuration stage to its foundation. As far as possible pick the structure choices and gives a proportion of decision known as cost execution exchange off. If all else fails, the presentation of different models is assessed by the going with limits.

A. Degree (d): It is accessibility among various focus focuses in a framework. The accessibility of the inside focuses picks the multifaceted plan of the framework. The more noteworthy number of relationship in the framework proposes dynamically basic is the multifaceted nature.

B. Separation across (D): It is portrayed as the best most constrained route between the source and goal center point. The manner in which length is assessed by the amount of associations explored. This goal is huge in choosing the partition drew in with correspondence and along these lines the introduction of equivalent structures.

C. Cut width (B): The cut width of framework is base number of edges whose expulsion will accomplish two explicit sub frameworks. Dynamically indisputable partition width is better for a framework to be defect kind.

D. Cost (C): It is depicted as the result of the partition across and the level of the middle point for the unbalanced framework (for example Cost = D*d). This factor is generally utilized in execution appraisal. E. Extensibility This is the uprightness which stimulates titanic surveyed structure out of negligible ones with least changes in the plan of the middle focuses. It is the most minor development by which the structure can be connected in an obliging manner.
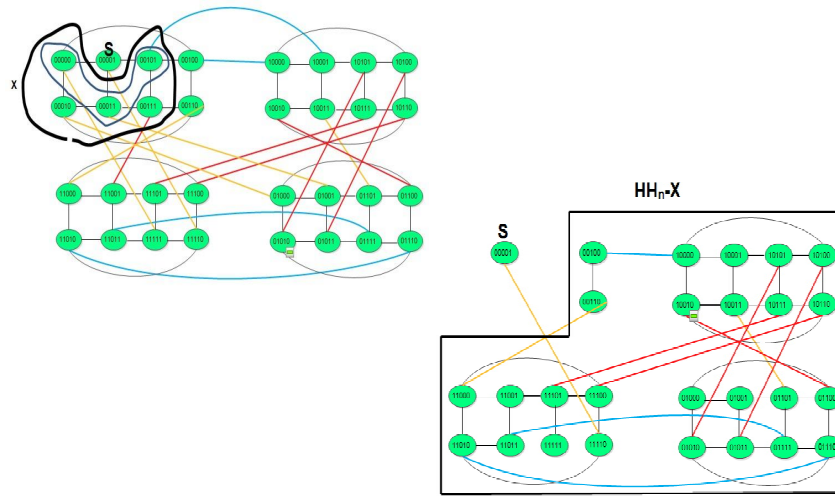
3.1 Cube based Architectures

Hypercube: The Binary hypercube or n-cube has been one of the most standard interconnection frameworks having logarithm division across. Each middle in this framework is related through bidirectional nonconcurrent highlight point correspondence interface with different focus focuses. The basic disadvantage of the hypercube is the improvement in the measure of correspondence joins for each inside point with the expansion in the all-out number of focuses in the framework. The hypercube has a high division width b=2n-1 and has phenomenal limit of imperfection deterrent.

Folded Hypercube: The folded hypercube (FHC) is a standard hypercube with some additional affiliations set up between its middle focuses. A folded hypercube of estimation n will be named FHC (n). The FHC (n) is created from a standard hypercube by interfacing each middle to the remarkable focus that is farthest from it. The FHC (n) is an ordinary arrangement of focus point accessibility (n+1) &HC of degree 3 is changed over to FHC organize as show in Figure 1. The extensiveness of a FHC (n) can't abstain from being (n/2) and cut width is 2n/4
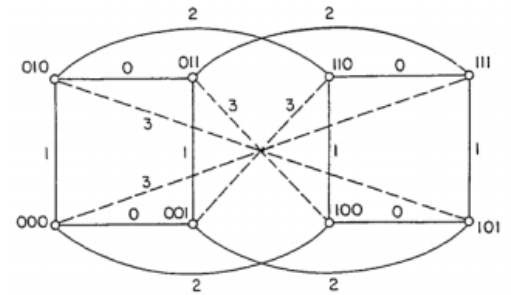

Figure 1: Meta cube

As shown the figure 1 Meta-cube The meta-cube (MC) will be an interconnection composes for an incredibly huge equal PC. In this framework, the measure of focus focuses is essentially more noteworthy than hypercube with hardly any relationship for each inside [4] [14]. The meta-cube organize shares many required excellencies of the hypercube, for example, little width. The meta-cube (MC) arranges joins the twofold cube as an exceptional case. The MC mastermind has two level cube structure a raised level cube (classes) tended to by the k-estimation and low-level cube (gathering) tended to by m-estimation. A MC (k, m) framework might connect 2k+m2k focuses with (k+m) joins per focus point. The degree is m+k= (n-k)/2k +k and the division width of a MC (k, m) is 2m2k/2.

Folded Meta-cube: The folded meta-cube is an interconnection topography which secures a touch of the obliging properties of the meta-cube and folded hypercube (FHC). The folded meta-cube is layout G
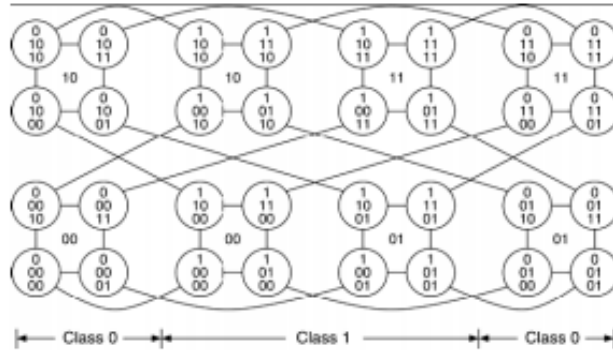
Figure 3: The hubs connectivity of folded dual-cube is (n+3)/2, the measurement is n-1 and having bisection width is 2n/2.

(V, E) as show in Figure. Where V tends to a huge amount of vertices and E tends to a lot of affiliations. The outline is a reasonable of meta-cube. The broadness of folded meta-cube is 2(m+k)- 1 and the Bisection width of G is 2m2k/2 + 2m2k+k-2 .
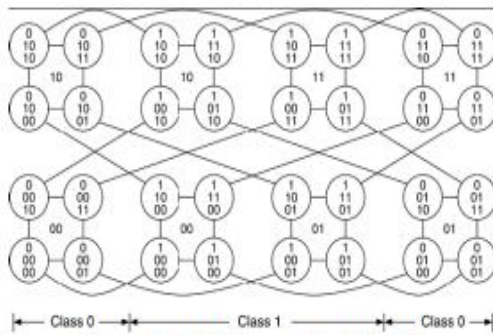

Figure 2:. Folded Dual cube

Folded Dual-cube: The Folded dual-cube (FDC) is a cube based geography which secures a segment of the supportive properties of the dual-cube [8] and the folded hypercube (FHC). The folded dual-cube, which is developed by interfacing each center point farthest from it and is show in Figure.

4.IMPLEMENTATION

Under hub disappointment model, a cube may work in an effortlessly degradable way by supporting equal algorithms in littler sans fault cubes. So as to lessen execution lull in cube with a given faults, it is basic to distinguish the greatest sound sub cubes (maximal inadequate sub cube) in the faulty cube. This paper proposes another strategy to recognize all the maximal

deficient sub cubes present in a faulty cube taking greatest fault resistance level for example number of faulty hubs is equivalent to the framework dimension. The strategy is a conveyed one, as each sound hub close to a bombed one plays out a similar technique freely and concurrently. At that point the reliability expression for the cube is determined. This technique is all around bolstered by a productive calculation which runs polynomially. The proposed strategy is seen as basic, general and effective and in this way is pertinent to all the cube based geographies.

A Hybrid hypercube has the equivalent basic complexities of the hypercube. It safeguards the alluring properties of the hypercube and enhances the communication time by decreasing the breadth by a factor of two. This paper presents the fundamental communication and a portion of the essential operations typically required in equal registering on the Exchanged hypercube interconnection network.

We propose a methodology for most limited way routing technologies from source vertex to destination vertex in HHC(s, t) with time multifaceted nature O(n), whereas $n = s + t + 1$ and $1 \leq s \leq t$. We centeraround edge congestion that is a significant marker for cost examinations and execution estimations in interconnection networks. In view of our briefest way routing calculation, we show that edge congestion of HHC(s, t) is $3 \cdot 2s+t+1 - 2s+1 - 2t+1$. In addition, we demonstrate that our briefest way routing calculation is an ideal routing technique concerning the edge congestion of HHC(s, t).

The communicate inactivity alludes to the slipped by time from when a source hub conveys the main duplicate of its communicate message to its neighboring hubs until the last destination in the network gets a duplicate. Many existing examinations have utilized

communicated inactivity as a measurement to evaluate the presentation benefits of various communicate algorithms due to its incredible effect on generally speaking application speedup.

4.1 Reliability

The disappointments of either the connections or the hubs decimate the normality of the cube interconnection topology. This prompts the formation of inadequate sub cubes. In this examination, an exhaustive investigation has been done for hub disappointments autonomously.
The Hybrid Hypercube is a variation of the hypercube and it gives a promising topology of interconnection networks for enormously equal frameworks. The measurement of the n-Hybrid Hypercube is practically equivalent to (n+3)/3, which is littlest among the variations of the hypercube.
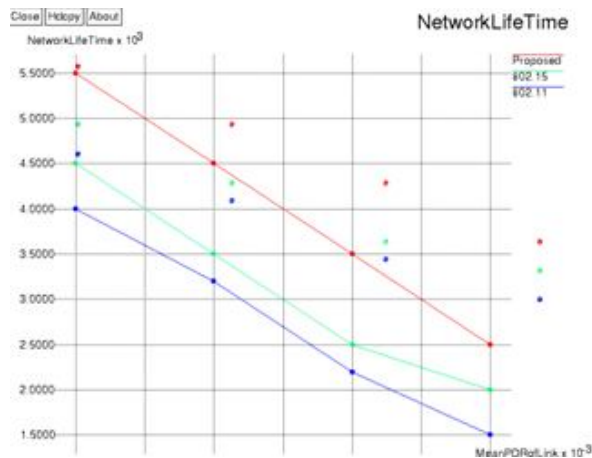
5. RESULTS

Figure.5: Reliability test
As shown the figure 5 graph represents a reliability test.

6. CONCLUSION

Another interconnection topology to be specific HHC will be suggested in this manuscript. The proposed topology will be acquired from two base class geographies: torus& HC. A routing calculation is additionally suggested for trading of information between the handling components. The different topological properties of suggested topology are dissected and assessed. A nitty gritty comparison of HHC against other significant interconnection networks is introduced and talked about. From this comparison, it very well may be seen that the proposed interconnection network is increasingly reasonable for equal PC design due to its high connectivity, lesser breadth, minimal

effort, better bisection width, more fault open minded and low normal separation. The distinctive reliability proportion of the HHC like network reliability, two-terminal reliability and k-terminal reliability are assessed and thought about against that of other interconnection networks of intrigue. From these comparisons, it tends to be concluded that the proposed interconnection network is profoundly solid and financially savvy with a superior level of versatility. The work completed in this paper may additionally be stretched out to propose another various leveled interconnection network utilizing HHC as the base network.

REFERENCES

1. N. R. Adiga, G. Almási, G. S. Almasi, Y. Aridor, R. Barik, D. Beece, R. Bellofatto, G. Bhanot, R. Bickford, M. Blumrich, et al. "An overview of the Bluegene/l Supercomputer", In Supercomputing, ACM/IEEE 2002 Conference, pp. 60-60, 2002.
2. C. -P. Chang, T. -Y. Sung, and L. -H Hsu, "Edge Congestion and Topological Properties of Crossed Cubes", IEEE Transactions on Parallel Distributed System, vol. 11, no. 1, pp. 64-80, 2000.
3. C. -P. Chang, J. -N. Wang and J. -H. Hsu, "Topological Properties of Twisted Cube", Information Science, vol. 1, no. 2, pp. 147-167, 1999.
4. Z. Cvetanovic, "Performance Analysis of the Alpha 21364- Based HP GS1280 Multiprocessor", In Proceedings of 30th Annual International Symposium on Computer Architecture, pp. 218-228, 2003.
    https://doi.org/10.1145/859618.859643
5. R. K. Dash and C. R. Tripathy, "A New Fault-tolerant Interconnection Topology for Parallel Systems", IE(I) Journal-CP, vol. 89, pp. 8-13, 2008.
6. K. Efe, "The Crossed Cube Architecture for Parallel Processing", IEEE Transactions on Computers, vol. 41, no. 5, pp. 513-524, Sept. 1992.
7. M. M. H. Rahman and S. Horiguchi, "HTN: a New Hierarchical Interconnection Network for Massively Parallel Computers", IEICE Transactions of Information System, E86-D, pp. 1479-1486, 2003.
8. H. -C. Hsu, C. -H. Tsai, C. -H. Tsai, G. -J. Wu, S. -H. Liu and P. -L. Lai, "Hierarchical Crossed Cube: A New Interconnection Topology", In Proceedings of 25th Workshop on Combinatorial Mathematics and Computation Theory, Taiwan, pp. 70-79, 2008.

9. IBM, "IBM System Blue Gene Solution", http://www-03.ibm.com / servers / deepcomputing / bluegene.html, 2008.

10. N. Imani and H. Sarbazi-Azad, "Properties of a Hierarchical Network Based on the Star Graph", Information Sciences, vol. 180, no. 14, pp. 2802–2813, 2010.
https://doi.org/10.1016/j.ins.2010.03.029

11. Cray Inc., "Cray XT3 Datasheet", http:// www.cray.com/ downloads/ Cray_XT3_Datasheet.pdf, 2008.

12. Cray Inc., "Cray XT4 Datasheet", http://www.cray.com/ downloads/ Cray_XT4_Datasheet.pdf, 2008.

13. Cray Inc., "Cray X1E Supercomputer", http://www.cray.com/ downloads/ X1E_datasheet.pdf, 2008.

14. P. Lai, H. Hsu, C. Tsai and I. A. Stewart, "A Class of Hierarchical Graphs as Topologies for Interconnection Networks", Theoretical Computer Science, vol. 411, no. 31-33, pp. 2912-2924, 2010.

15. J. Miguel-Alonso, J. Navaridas, and F. J. Ridruejo, "Interconnection Network Simulation Using Traces of MPI Applications", International Journal Parallel Programming, vol. 37, no. 2, pp. 153-174, 2009.

16. P. Rajabzadeh, H. Sarbazi-Azad, H. R. Zarandi , E. Khodaie, H. Hashemi-Najafabadi, and M. Ould-Khaouae, "Performance Modeling of n-dimensional Mesh Networks", Performance Evaluation, vol. 67, no. 12, pp. 1304–1323, 2010.

17. S. Razavi and H. Sarbazi-Azad, "The Triangular Pyramid: Routing and Topological Properties", Information Sciences, vol. 180, no. 11, pp. 2328–2339, 2010.

18. R. Sabbaghi-Nadooshan, M. Modarressi, and H. Sarbazi-Azad, "A Novel High-Performance and Low-Power Mesh-Based NoC", In IEEE International Symposium on Parallel and Distributed Processing IPDPS, pp. 1-7, 2008.
https://doi.org/10.1109/IPDPS.2008.4536501