PROLONGING THE LIFETIME OF WIRELESS SENSOR NETWORKS THROUGH HYBRID CLUSTERING AND ROUTING

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Abstract

These days Wireless Sensor Networks (WSN) have been used in various Internet of Things (IoT) applications viz., healthcare monitoring, disaster management, smart buildings, smart farming etc. it is one of the substitutes for solving distinct problems of IoT in various areas. Power efficiency is one of the major issues with sensor networks. In the earlier days, WSN was working on Client Server (CS) model, but for the improvement of energy efficiency, researchers proposed Mobile Agent (MA) based WSN. These sensor nodes are generally arranged in a diverse space like in war space where human are hard to reach. WSN generate large amount of data in form of bits or stream. These nodes contact over a precise range of nodes which are frame in an Ad-hoc structure and get the data to the sink. WSN have many limited resources like limited energy, memory, computation power, communication capacity etc. So the dissertation consists of a hybrid Cluster Routing algorithm for improving the network lifetime.

This dissertation presents a hybrid clustering and routing algorithm. We develop a simulation area for node movement and communication. A hybrid clustering and routing protocol present for reliable and efficient data collection in large-scale wireless sensor network. Theoretical analysis and simulation results will prove the connectivity and efficiency of the network topology generated.

Simulation results show that the present hybrid clustering and routing algorithm gives better result in terms of node life time, node dead time, throughput, energy, mobile agent than previous results.

I. INTRODUCTION

The Advancement in small scale hardware framework is the significant reason for the advancement of WSN in the period of twenty first century. WSN has gotten fundamental for day by day client, without WSN our work would have been very weight or hard. WSN are skilled of detecting, changing and course of the data. These sensor nodes are commonly organized in a various space like in war space where human are difficult to reach. WSN create enormous measure of data in type of bits or stream. These nodes contact over an exact scope of nodes which are outline in a specially appointed structure and get the data to the sink. WSN have many constrained assets like restricted energy, memory, calculation power, correspondence limit and so on.

These sensors are disseminated in a region which is being watched and data is gathered continuously and identified with the physical condition [2]. Sensors take a shot at batteries. It is impracticable to change the battery for the network. For expanding the network lifetime, it is awesome advance for structuring the calculation so the transmission amount can be diminished. Various undertakings are taken to reduce the quantity of unfortunate transmissions in sensor network. The data collection strategies increment energy utilization in WSN.

"The data amassing is a framework to join data from various sensor nodes to abstain from dreary data and give a rich and multi-dimensional point of view on the watching condition. The data gathering figuring can decrease the amount of transmission by allowing the aggregator node to transmit only the essential data, not the overabundance data".

The rest of the paper is organized as follows. Section 2 discusses related work of localization. Section 3 describes proposed approach in brief. Section 4 provides an overview simulation and results analysis. Section 5 concludes the paper.

II. RELATED WORK

Recently, many localization techniques have been proposed for WSNs, and simultaneously many studies have been done to analyze existing localization techniques and algorithms. **H. El Alami et al., [1]** So as to accumulate data all the more efficiently, a clustering hierarchy calculation is utilized for data correspondence in wireless sensor networks (WSNs). This calculation is one of the significant strategies to improve the energy productivity in WSNs and it gives a powerful way to augment the lifetime of WSNs. Hierarchical conventions based on clustering hierarchy are proposed to spare energy of WSNs in which the nodes with higher residual energy could be utilized to gather data and transmit it to a base station. In any case, the vast majority of the past methodologies based on clustering hierarchy have not considered the excess data gathered by the nearby nodes or nodes cover one another. In this paper, an improved clustering hierarchy (ECH) approach has been proposed to accomplish energy proficiency in WSNs by utilizing dozing waking system for covering and neighboring nodes. Hence, the data excess is limited and then network lifetime is expanded.

M. A. Hossen et al., [2] Psychological radio (CR) is an adaptive radio innovation that can naturally identify accessible diverts in a wireless range and change transmission boundaries to improve radio working conduct. Because of the dynamic idea of range accessibility and wireless channel condition, it is exceptionally difficult to keep up solid network availability. Cluster-based CR specially appointed networks (CRAHN) mastermind CR nodes into gatherings to successfully keep up solid self-governing networks. Clustering in CRAHN underpins agreeable assignments, for example, range detecting and channel administrations and accomplishes network versatility and dependability. In this paper, we proposed a Q-learning based cluster development approach in CRAHN, in which Q-esteem is utilized to assess every node's channel quality. To shape a disseminated cluster network, channel quality, lingering energy and neighbor node/network conditions are thought of. By trading every node's status data as far as channels and neighbors, every node knows neighboring geography and which node is the best candidate for cluster head (CH). Dispersed CH determination, the ideal normal dynamic data channel choice, and door node choice methodology are introduced in this paper.

X. He et al., [3] In wireless sensor networks (WSNs), gathering data with mobile sinks is a compelling method to settle the "energy gap issue". In any case, a large portion of existing calculations of mobile sinks disregard the heap equalization of meeting nodes, which will altogether abbreviate the network lifetime. Additionally, most mobile sinks are generally required to visit areas of sensor nodes without exploiting their correspondence ranges. Along these lines, this paper proposes an energy-efficient direction arranging calculation (EETP) based on multi-target molecule swarm streamlining (MOPSO) to abbreviate the direction length of the mobile sink and equalization the heap of meeting nodes. EETP plans to diminish the deferral in data conveyance and draw out the network lifetime. To abbreviate the direction length of the mobile sink, we plan a component to choose potential visiting focuses inside correspondence covering scopes of sensor nodes, as opposed to areas of sensor nodes. Furthermore, as indicated by direction attributes of the mobile sink, we structure a compelling direction encoding strategy that can create a direction containing an unfixed number of visiting focuses.

W. He et al., [4] An efficient and energy-sparing calculation, K-means and FAH (KAF), has been proposed to take care of the issues of node energy limitations, short network cycle and low throughput in current wireless sensor networks. Network clustering is gotten by upgrading K-implies clustering. Based on FAHP (Fluffy Logical Hierarchy Procedure) technique, the cluster head determination is upgraded thinking about the components of node energy, good ways from base station and energy proficiency of nodes. Based on the variables of transmission separation, energy and bounce number, multi-jump routing is built to successfully lessen the energy utilization of nodes in data transmission. The reenactment results show that contrasted and different conventions, KAF calculation has evident preferences in lessening node energy utilization, drawing out network life cycle and expanding network throughput. And under various routing convention, the exhibitions of the calculation are checked. By changing the size of the candidate node set determination territory, the dependability of data transmission of the significant distance node is expanded, and the energy utilization heap of the close separation node is diminished.

W. Osamy et al., [5] Wireless sensor networks (WSNs) have dazzled significant consideration from both modern

and scholarly examination since most recent couple of years. The main consideration behind the exploration endeavors in the field of WSNs is their tremendous scope of uses, for example, observation frameworks, military tasks, medicinal services, condition occasion checking, and human security. In any case, sensor nodes are low potential and energy requirement gadgets; along these lines, energy efficient routing convention is the premier concern. In this paper, another Cluster-Tree routing plan for social occasion data (CTRS-DG) is suggested that made out of two layers: routing and total and remaking. In collection and reproduction layer, a dynamic and a self-sorting out entropy based clustering calculation for cluster head (CH) choice and cluster arrangement is proposed.

S. Phoemphon et al., [6] Shrewd multifunctional sensors incorporated with wireless availability (otherwise called wireless sensor networks or WSNs) assume a significant job in the Web of Things (IoT). A few difficulties related with WSNs have been explored and energy utilization speaks to the principle impediment. Another significant test is restriction on the grounds that a sensor or node ought to act naturally contained and sorted out and have a low expense of incorporation. The without range approach is promising because of its straightforwardness. Strikingly, it doesn't require extra rationales and needs just key boundaries.

S. Si et al., [7] Wireless sensor networks (WSNs) conveyed in brutal situations, i.e., front line and cataclysmic events regions, regularly experience the ill effects of the issues of the intentional assault, equipment disappointment, and energy consumption. It is urgent to propose the shortcoming open minded and energy-efficient advancement models to achieve undertakings of uses in these situations. Past investigations have detailed that sans scale (SF) geographies can improve the adaptation to non-critical failure of WSNs. Nonetheless, energy-productivity is less worried in the vast majority of these SF WSNs models. Furthermore, past models considered just node degree in figuring association probabilities between two nodes, topological attributes, which can improve solid correspondence, are once in a while thought of. To address these deficiencies, we present three new SF-development instruments (ECN, ELP, and ELCP) of huge scope WSNs from the novel part of connection forecast. In particular, three notable connection

IV PRESENT METHOD

The present algorithm is implemented in two phases

1.2.1 Set-up Phase:

There are three types of nodes: normal, intermediate and advanced having different energy levels.

1. Initially Cluster-heads are selected from the set of intermediate nodes.
2. After cluster formation each CH will broadcast a short message containing its ID to find its neighbors.
3. Each non-cluster-head node from the set of normal nodes determines to which cluster it belongs by choosing the cluster-head that requires the minimum communication energy, based on the received signal strength of the advertisement from each cluster-head.
4. The selected CH will create a TDMA schedule defining the time slot for each member in its cluster to forward data to it.

1.2.2 Steady-state Phase:

1. all the cluster members (normal nodes) will send data to their corresponding cluster-heads (intermediate node).
2. after aggregation cluster-heads will send the aggregated data to an advanced node which is closer to the BS than the CH. To find such a node CH will compare the distance between advanced node and BS with that between itself and the BS. Whichever is smaller will be used to transmit data to the BS. If no such advanced node is found then it will send the data directly to the base station.
3. The advance nodes will again aggregate the sensed data and the data received from the CHs.

After that it will forward the result to the base station.

Algorithm is implemented with various steps as given and discusses below.

Step 1:

- Threshold value setup for queue size, packet delivery ratio, Routing protocol setup, Node setup, Scenario setup, Source and destination setup.

- Each individual node read its congestion statues value by using average queue length,Compute average queue length.

Step 2: Every node directs the location of itself in the system network to its Neighbors.
Step 3: Every node estimates its parameter by applying GA method based on three descriptors – density, energy and centrality;
Step 4: Every node that has additional chance than its Neighbors, announce itself as cluster Head nominee to the Base Station (BS);

Step 5: now BS applying Genetic algorithm method, main cluster heads are determined;

Step 6: key cluster heads are announced to all nodes in system network;

Step 7: Every sensor node will connect to the adjacent CH

Step 8: Every sensor node applies time distributed to it to communicate data to the CH through a multiple- hop transmission;

Step 9: After all data has been received, the CH performs data fusion function by removing redundant data and compresses the data into a single packet. At that time transmit it to the base station by means of single hops transmission.

V SIMULATION RESULT

The present algorithm is implemented using MATLAB software. The following parameters considering for the simulation-

Sr No.	Parameters	Values
1	Software	MATLAB 8.3
2	Tool	Communication tool box
3	Simulation area	750 m X 750 m
4	Total rounds	1200
5	Total nodes	100 to 1200
6	Initial energy of node	0.5J
7	Transmitter/Receiver electronics E_{elec}	50 nj/bit

8	Data aggregation (E_{DA})	5 nj/bit/report
9	Reference distance (d_0)	87 m
10	Transmit amplifier ϵ_{fs}	10 pJ/bit/m^2
11	Transmit amplifier ϵ_{mp}	0.0013 pJ/bit/m^4
12	Message size (l)	4000 bits

Table is showing the input simulation parameter values. The total simulation area considers 750m X 750m. Total rounds during simulation are 1200 round. Total nodes are 100 to 1200 number and implementation using joint Cluster methodology.

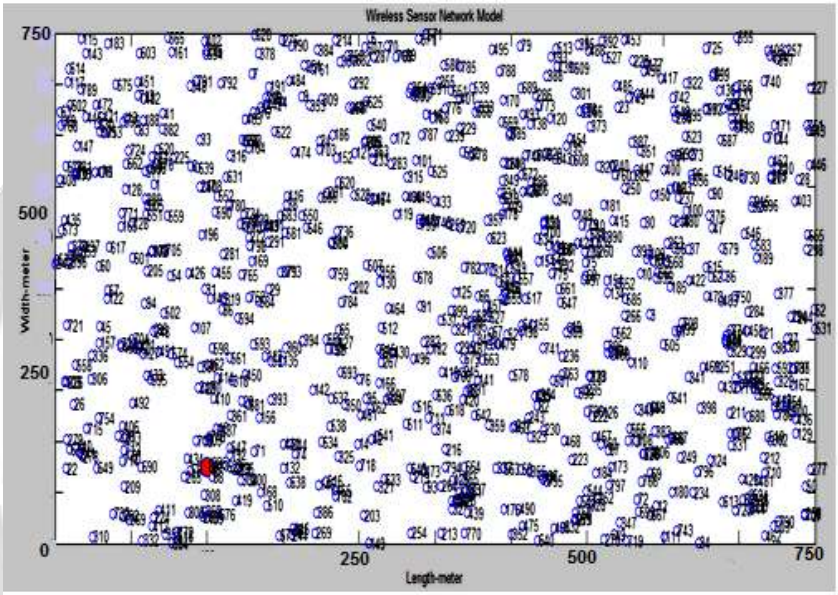

Figure 1: Simulation area 750m X 750m

Figure 1 show the simulation scenario where length and width of wireless sensors network area is 750m X 750m. Total nodes taken are 100 to 1200. In this step all variables, mobile agent and configuration are initialize the simulation.

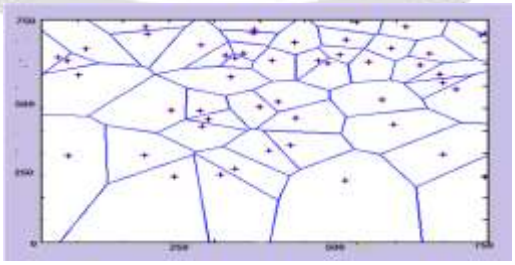

Figure 2: Clusters form initialization

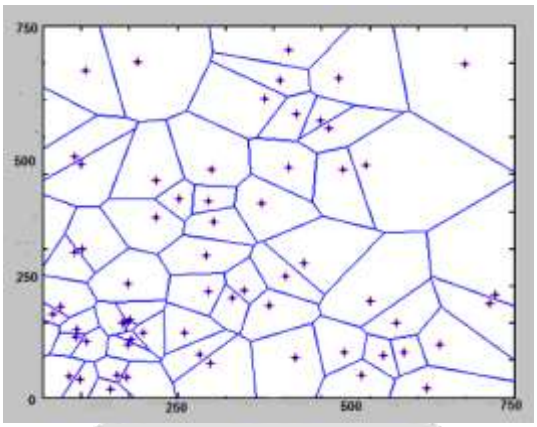

Figure 3: Clusters form

This figure 3 presents cluster formation. Here applied present algorithm. The combination of Energy Efficient Hierarchical Clustering and Modified low energy adaptive clustering hierarchy are using for joint clustering.

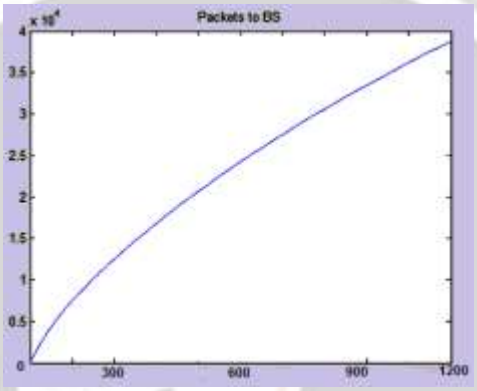

Figure 4: packet sent to base station

This figure 4 presents the output performance of nodes during simulation. The total packets sent to base station is approx 3.9 X104 bits/sec or it is 39 Kbps.

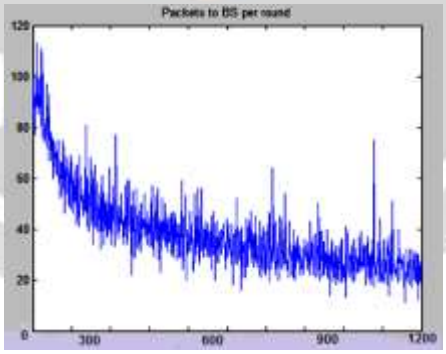

Figure 5 : packet sent to base station per round

This figure 5 presents the transmission of data packets during per round to the base station. It can be say that data packets are transmit in each round.

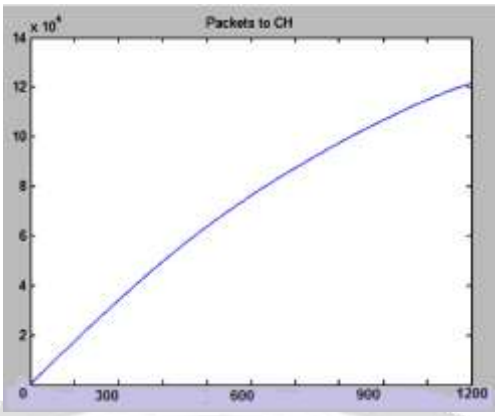

Figure 6: packet to cluster head

This figure 6 presents the transmission of data packets during per round to the base station. It can be say that data packets are transmit in each round.

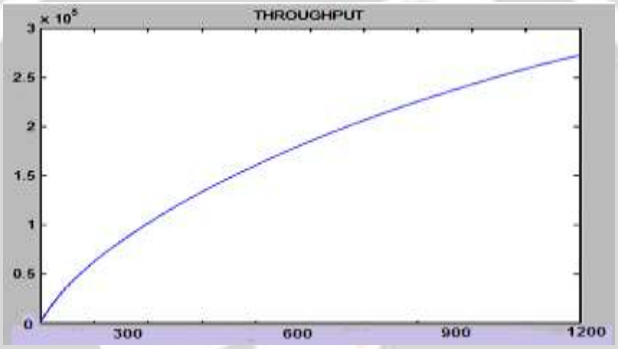

Figure 7: Data transmission rate or throughput

This figure 7 presents the data transmission rate or throughput rate. It is clear that the throughput is 275Kbps.

Figure 8: Count of cluster heads vs rounds

This figure 8 shows that the total count of cluster heads during simulation. Total 1200 rounds simulation performed and cluster head form in each round. No vacant CH during simulation.

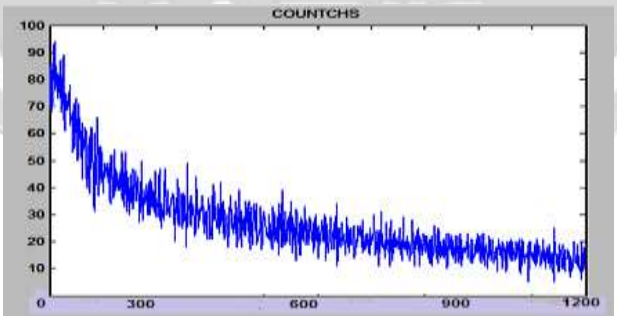

Figure 9: Average residual energy

This figure 9 shows that the average residual energy of nodes. Therefore total 390 J energy takes by nodes.

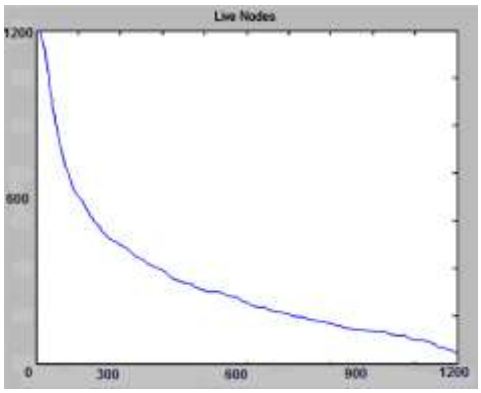

Figure 10: live nodes

This figure 5.10 shows that the total lives nodes during round of simulation. Therefore total 140 nodes live in 1200 rounds.

Sr No.	Parameters	Previous Work	Proposed Work
1	Simulation area	500m X500m	750m X 750m
2	Total nodes	200 to 800	100 to 1200
3	Network transfer rate (Throughput)	250 Kbps	275 Kbps
4	Data size	200 byte	400 byte
5	Node Energy consumed	5 nJ	1 nJ
6	Execution time	1000 Sec	164.9 seconds
7	Overall energy consumption	1000 J	390 J

Table 2: Comparison of proposed work result with previous work.

Table 2 shows that comparison of proposed work with previous work method. Consider total simulation area 750X750 meter and nodes area taken between 100 to 1200 during nodes simulation. Present method based on hybrid cluster while previous approach based on novel method. Network transfer rate or throughput is achieved by proposed method is 275Kbps while previous it is achieved 250Kbps. Simulation time is also reduced upto 835 Sec. The overall energy consumption is 380J while previous it is 1000J. Therefore it is clear that proposed methodology gives significant better results than previous approach.

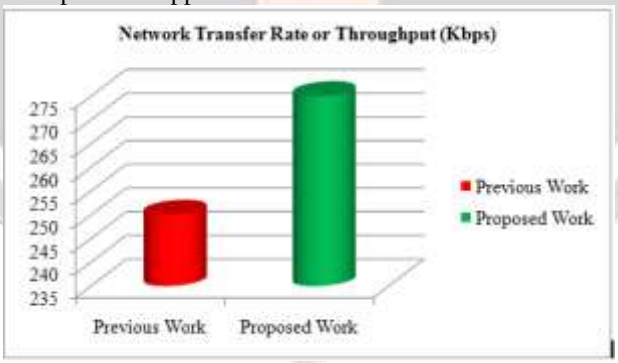

Figure 11 Comparison of Network transfer rate

This comparison graph 5.14 shows that network transfer rate or throughput by previous and proposed methods. Therefore 25Kbps data rate increase by proposed method.

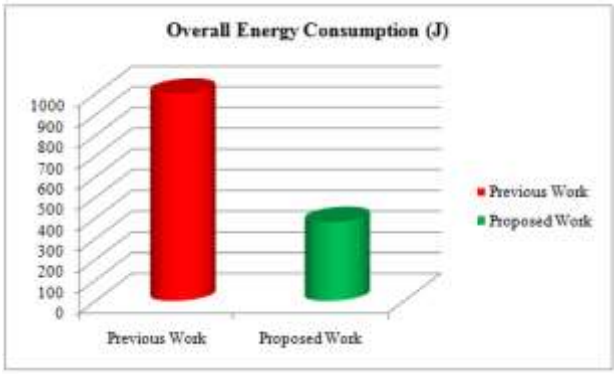

Figure 12 Comparison of overall energy consumption

This comparison graph 5.15 shows that overall energy consumption by previous and proposed methods. Therefore energy consumption is reduced by 610 J.

Figure 13: Comparison of Simulation time

This comparison graph 13 shows that Simulation time by previous and proposed methods. It is very significant parameter, reduced 835 sec by proposed approach. Therefore it is clear that proposed methodology gives significant better results than previous approach.

Conclusion

Applications of the wireless channel are on the rise at a remarkable speed. Progresses in energy-efficient scheme have produced new portable devices that empower exciting uses for the wireless channel. While the wireless channel makes deployment task easier, it adds constraints that are not found in a wired environment. Although, the wireless channel is bandwidth-constrained, and the portable devices that using the wireless channel are battery-operated and therefore energy-constrained. In addition, the wireless channel is error-prone and time-varying. Therefore, it is important to design protocol and algorithms for wireless networks to be bandwidth and energy-efficient as well as robust to channel errors. The work presented in this dissertation represents an energy-efficient routing technique which is mainly suitable for application like environment monitoring where sensor nodes located in nearby region collect similar type of data. The protocols have more traffic overhead and more energy consumption. To make the most of the network lifespan data transmission is augmented by applying energy-efficient and reliable routing protocols. The experiment results represented that it also reduced the traffic of the WSN and increases the overall system performance. This thesis present enhanced energy efficiency in wsn.

This work present hybrid clustering convention approach. It consider all out recreation region 750X750 meter and nodes region taken 100 to 1200 during nodes reproduction. Network move rate or throughput is accomplished by present strategy is 275Kbps while past it is accomplished 250Kbps. Simulation time is additionally diminished up to 835 Sec. The general energy utilization is 390J while past it is 1000J. In this manner it very well may be say that the present technique approach gives noteworthy better execution in wireless sensor network than past methodology.

Future Scope

Wireless Sensor Network (WSN) is a self-sorted out network created by countless smaller scale sensors that are randomly sent in checking local through wireless correspondence. With its wide application in military observation, clinical guide, coordination's the executives, ecological checking, agribusiness and other business territories, WSN

has become the furthermost innovation in the field of correspondence and PC research. Sensor nodes depend on battery power gracefully, their correspondence ability and energy stockpiling limit are constrained, in this way, how to use the energy of nodes efficiently, balance the network energy utilization and expand the network lifetime has become a future improvement for WSN. Perform such simulation with considering more parameters.

- Perform such work in different software.
- Hardware implementation of all the concepts.
- Perform for more nodes and more bandwidth with less time.

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