

Convergence of 5G Technology by Using Distributed System

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Abstract: We are existing in an innovative world of science where technologies are matured enough to fulfil human desires. But requirements of human being augment day by day. But nothing is sufficient for the person who finds sufficiency too little, however further modernization will be on convergence of existing technology in to a single platform. This research paper highlights on some of the existing algorithms in Distributed Systems in to a single core network, called Master core network architecture and proposes VALEA which could be a better solution for 5G Wireless network.

Keywords: 5G, Distributed System, Master Core Network Architecture, AIPN and VALEA

I. INTRODUCTION

5G technologies will change the way most high bandwidth users access their phones. With 5G pushed over a VOIP-enabled device, people will experience a level of call volume and data transmission never experienced before. 5G technology is offering the services in Product Engineering, Documentation, supporting electronic transactions (e-Payments, e-transactions) etc. As the customer becomes more and more aware of the mobile phone technology, he or she will look for a decent package all together, including all the advanced features a cellular phone can have. Hence the search for new technology is always the main motive of the leading cell phone giants to out innovate their competitors. The ultimate goal of 5G is to design a real wireless world that is free from obstacles of the earlier generations. This requires an integration of networks. The 5G technologies include all type of advanced features which makes 5G technology most powerful and in huge demand in near future. Amazing isn't it such a huge collection of technology being integrated into a small device. The 5G technology provides the mobile phone users more features and efficiency than the 1000 lunar module. A user of mobile phone can easily hook their 5G technology gadget with laptops or tablets to acquire broadband internet connectivity. The 5G technology's billing interface is highly advanced making it efficient and appealing.- It offers huge quantity of broadcasting data, which is in Giga Bytes, sustaining more than 60,000 connections.- This technology also provides remote diagnostic feature.- Provides up to 25 megabytes per second connectivity. Also it supports the private virtual networks [1] [2].

II. DISTRIBUTED SYSTEM

A distributed system consists of a collection of autonomous computers connected through a network and distribution middleware, which enables computers to coordinate their activities and to share the resources of the system, so that users perceive the system as a single, integrated computing facility. A distributed system is built on top of a network and tries to hide the existence of multiple autonomous computers. It appears as a single entity providing the user with whatever services are required. A network is a medium for interconnecting entities (such as computers and devices) enabling the exchange of messages based on well-known protocols between these entities, which are explicitly addressable [3].

III. 5G MASTER CORE NETWORK ARCHITECTURE

The Master Core is the 5G potential, which will require the design of a single wireless user terminal able to self-explanatory operate in different heterogeneous access networks. A fully upgradable terminal changes its communication functions depending on network and/or user demands. In addition, the main challenge for an upgradable Master Core is to deal with increasing number of different radio access technologies based on solid interoperability criteria and mechanisms. A core could be a convergence of the aforementioned nanotechnology, Parallel Multimode (PMM) technology, cloud computing and cognitive radio, upgradeable and based on All IP Platform and 5G-IU is called the Master Core. The 5G Master Core is an upgradeable and multi-technologies core. The Master Core upgradability could be a self-adaptation and made adaptation to a dynamically-changing environment or mission oriented adaptation to meet a given set of mission requirements with the aim of improving service delivery and spectrum utilization. The Master Core changes its communication functions depending on network status and/or user demands. Upgradability could be in both software and hardware. Hardware upgradability is mainly performed by operators, adding additional equipment's to increase network capacity at a specific time. However, in software upgradability and with the power of SDR, network is dynamically upgradable, which means that the programs (running on the upgradable processing elements) as well as the communication links between the processing elements are upgraded at run-time. Different processing elements are used for different purposes. The general purpose processors are fully programmable to perform different computational tasks [4].

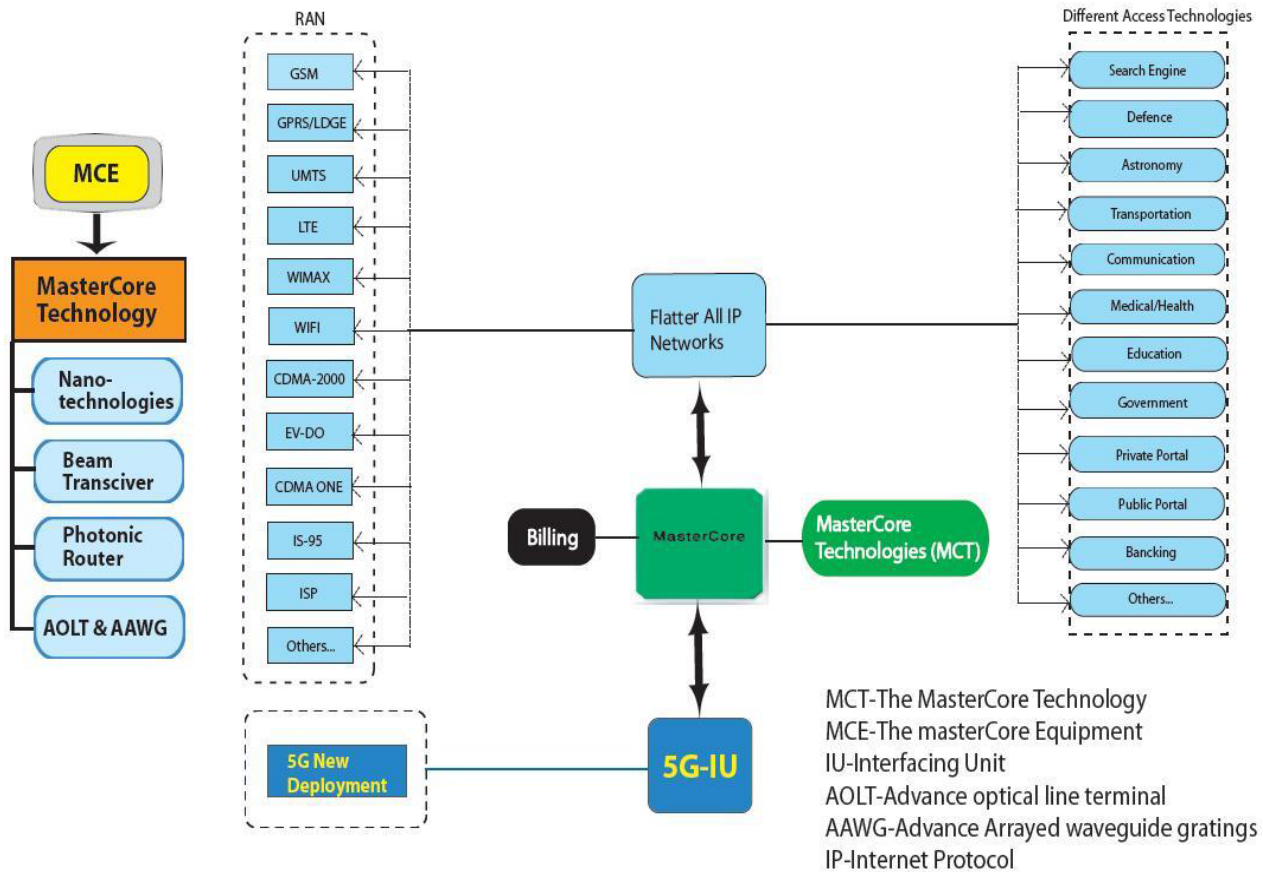


Figure1: The Master Core Architecture

IV. AIPN (ALL IP NETWORK)

The All-IP Network (AIPN) is an evolution of the 3GPP system to meet the increasing demands of the mobile telecommunications market. To meet customer demand for real-time data applications delivered over mobile broadband networks, wireless operators are turning to flat IP network architectures. Primarily focused upon enhancements of packet switched technology, AIPN provides a continued evolution and optimization of the system concept in order to provide a competitive edge in terms of both performance and cost [4].

Characteristics of the AIPN

1. Support for a variety of different access systems
2. Common capabilities provided independent to the type of service provided with convergence to IP technology considered from the perspective of the system as a whole
3. High performance mobility management that provides end-user, terminal and session mobility
4. Ability to adapt and move sessions from one terminal to another
5. Ability to select the appropriate access system based on a range of criteria
6. Provision of advanced application services as well as seamless and ubiquitous services
7. Ability to efficiently handle and optimally route a variety of different types of IP traffic including user-to-user, user-to-group and ubiquitous service traffic models

8. High level of security and support for user privacy e.g. location privacy, identity privacy
9. Methods for ensuring Qos within and across AIPNs
10. Appropriate identification of terminals, subscriptions and users Federation of identities across different service providers.

V. VALEA FOR MASTER CORE NETWORK ARCHITECTURE

In proposed (VALEA) Velocity aware leader election algorithm, there is the mobile ad hoc network as a connected graph that consists of a set of nodes, such that each node is assigned a unique identifier, ID and a VALUE, where ID is used to identify nodes during the election process and VALUE is the capacity of nodes which is used to make preferences among nodes during the process of leader election. The VALUE could be velocity (speed) battery, computational capabilities. Velocity is as a major preference-based attribute, such that nodes with lower velocity (thus, more stability) will be preferred to be chosen to participate in the leader election process. There are cases where nodes have the same capacity, i.e. the same VALUE. In these cases node IDs are used to break ties among nodes which have the same VALUE. For example if a node X wants to send an ELECTION message. It firstly creates its Covering Set using its neighbour table, starting from the first entry in the neighbour table (i.e. the neighbour with lower velocity) until reaching full coverage for the 2-hop neighbours. For each neighbour, X checks if this neighbour adds additional coverage (i.e., if it has

path(s) to some of the 2-hop neighbours that are not covered previously by any of the selected nodes). If so, X adds the current neighbour to its Covering Set and checks if there are more nodes that are not covered by any node yet; if so, X repeats the process for the next neighbour until all 2-hop neighbors are covered.

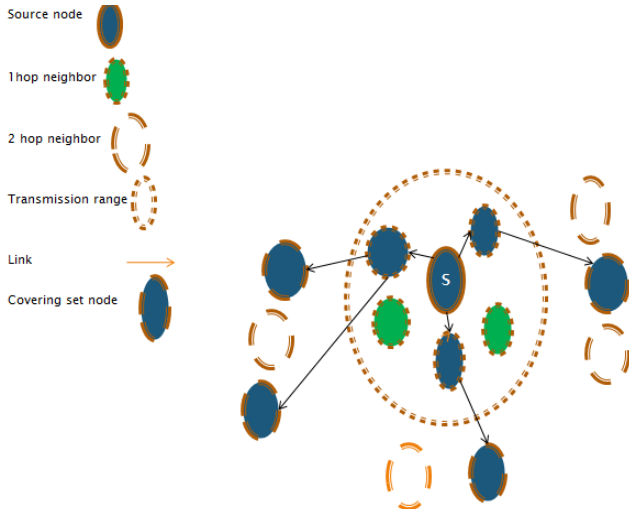


Figure 2: Covering Set-based Leader Election Algorithm in VALEA

Algorithm

1. START
2. Covering Set(x) = NULL
3. for each node m in nbrTable(x)
4. If m gets additional coverage (i.e. it has a path for some 2-hop neighbours that are not covered previously by any other node)
5. Add m to the Covering Set(x)
6. If all the 2-hop neighbours are covered (i.e. reached) by the Covering Set(x)
7. Return Covering Set(x)
8. END

There are two phases in this algorithm.

(a) Reply Back Phase

1. ELECTION messages will be transmitted from one hop to another through the Covering Set nodes until reaching the last hop. At this point, the ELECTION phase terminates and the time to reply back and send OK messages begins. Nodes are responsible to reply their parents informing them about their existence. The OK message includes entries of <ID, VALUE> for each node, to inform them about their capacity, precisely, their velocity.
2. The “VALUE” piece of information is very useful for the parent to decide which one of its children will be considered as a candidate leader, such that the child with the lowest mobility will be passed to the parent, the parent of parent, and so on until reaching the source node that initiates the leader election. At the end, the node with lower mobility will be declared as the leader.

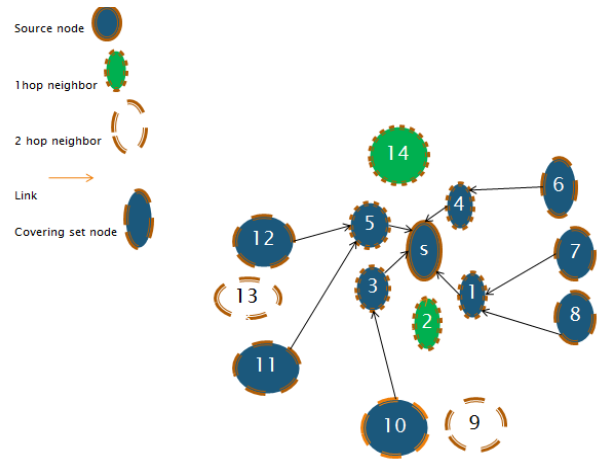


Figure 3: The Reply Back Process

(b) Message Passing Phase

A HELLO-message contains: Unique ID and VALUE.

1. Each node maintains a neighbour table that contains <nbr ID, VALUE> entries.
2. These entries are ordered as endingly according to the node’s VALUE.
3. In case a tie (i.e. two or more nodes have the same VALUE) the order will be based on node’s ID.
4. Node’s VALUE guarantees that the nodes with lower mobility will have a higher probability to participate in the leader election process.

VI. IMPLEMENTATION OF VALE ALGORITHM FOR MASTER CORE NETWORK ARCHITECTURE

The result of proposed (VALE) algorithm in terms of message overhead reduction presents an example in which, node S detects that the leader is no longer alive, and initiates a leader election process by sending an ELECTION message to its Covering Set (i.e. the covering, 1-hop neighbors), namely, nodes 1, 2 and 3, therefore, the message reduction is obvious such that node S sends only 3 messages instead of sending 6 messages. Furthermore, each one of the selected covering nodes forwards the message just to their 1-hop neighbors that provide coverage to their next hop nodes. So the message reduction is evident here in that 5 nodes out of 8 will receive the ELECTION message and forward it further.

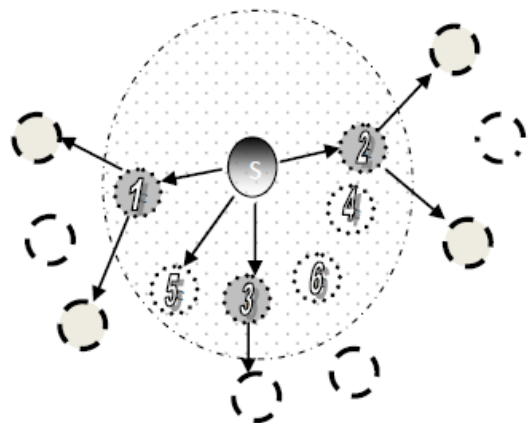


Figure 4: covering set based leader election algorithm

VII. COMPARISON OF VALEA WITH EXISTING ALGORITHMS

The Bully algorithm derives the formula for calculating total number of message, so total no. of messages in bully algorithm is:

$$N(r) = (n-r+1) (n-r) + (n-1)$$

N=Total messages

n = Total no. of processes

r = priority no. of processes who find out the crashed coordinator [3]

In Modified Bully Election algorithm the total no of message passing during communication is calculate by following equation:

$$N(r) = 2 * (n-r) + n$$

N=Total messages

n = Total no. of processes

r = priority no. of processes who find out the crashed coordinator [4][5]

In Improved algorithm the total no of message passing during communication is calculate by following equation:

$$N(r) = m + (n-r+1) (n-r) + n$$

N=Total messages

n = Total no. of processes

r = priority no. of processes who find out the crashed coordinator

$$m=n*k$$

k=no. of times that coordinator sends the biggest found id to processes [6].

In our newly derive approach (VALEA) Algorithm the total no. of message passing is as:

$$N(r) = 2(1b) + ((n-1)-r)$$

N=Total messages

n = Total no. of processes

r = priority no. of processes who find out the crashed coordinator

1b =broadcasting

Table 1: Comparison of leader Election Algorithm with VALEA

No. Of nodes	Total number of messages			
	Bully election algorithm	Modified bully election algorithm	Improved bully election algorithm	Proposed algorithm
5	24	13	30	5
50	2499	248	3450	50
100	9999	298	10500	100
150	22499	498	22499	150
200	39999	598	39999	200
1000	999999	2998	999999	1000
10000	99999999	29998	99999999	10000

VIII. CONCLUSION

There are several election algorithms available in distributed system. There are many disadvantages in mathematical analysis of existing algorithms. To overcome these disadvantages VALEA algorithm is compared with some of existing algorithms, and present that VALEA algorithm is better than previously defined algorithms for reducing the number of messages passing in the 5G Master core network architecture. In future researcher or scientists can also implement this algorithm on different networks and for different technologies.

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