Mobile Computing
Mr. Saurabh Singh

Adaptive Clustering For Mobile Wireless Networks:

Clustering- It are often considered the foremost important unsupervised learning problem. It involves finding structure during a set of unlabelled data.

Definition of cluster-"The process of organizing objects into groups whose members are somewhat similar.**"**
Therefore, a cluster could also be a set of objects that are "similar" to them/not almost like objects belonging to other clusters.

Clustering: Two methods for clustering are-

Distance: according to a given distance, if two or more objects are close, they belong to the same cluster. This is often called distance-based clustering.

Conceptual: If two or more objects belong to the same class, it's considered that this is often a "common" concept for of those objects, namely the conceptual class.

Goal: Determine the inherent grouping during a group of unlabelled data.

Requirements: clustering algorithm. Should be satisfied

- Scalability
- The ability to affect noise and outliers
- High-dimensional
- Interpretability and usefulness
- Handle differing kinds of attributes
- Discover star clusters of any shape

Application: clustering algorithm. Can be used in many fields some of are-

- Marketing-customer groups with similar behaviours
- Biology-classification of animals and plants
- Library-Book Order
- Insurance – Determine the group of auto insurance policy holders
- Earthquake research-a collection of observed earthquake epicentres
- www-file classification
- Urban planning-determine the house group according to the house sign. To their house type

Clustering Algorithm: It may be classified as –

- k-means (exclusive)
- Fuzzy C mean (overlap)
- Hierarchical clustering (hierarchical)
- Gaussian mixture (probability)

Architecture:
In the cellular (single hop) networks, all stations understand each other's requirements directly or through the control station (such as BS), which makes resource allocation easier. By creating radio clusters, it can be extended to multi-hop networks so that access can be controlled and bandwidth can be allocated in each cluster. Most cluster architectures of

mobile radio networks are based on the concept of cluster head. The cluster head acts as a local coordinator for transmission within the cluster.

Multihopping: This means that the radio can forward packets from one relay to another without a base station.

In the proposed specification, nodes are organized into non-overlapping clusters. The cluster is independently controlled and dynamically reconfigured as the nodes move. This network architecture has three main advantages.

- First of all, it provides spatial reuse of bandwidth due to node clustering.
- Second, bandwidth can be shared or reserved in a controlled manner in each cluster.
- Finally, in the face of topological changes caused by node movement, node failure, and node insertion/removal, the clustering algorithm is robust.

Adaptive clustering in mobile wireless networks:

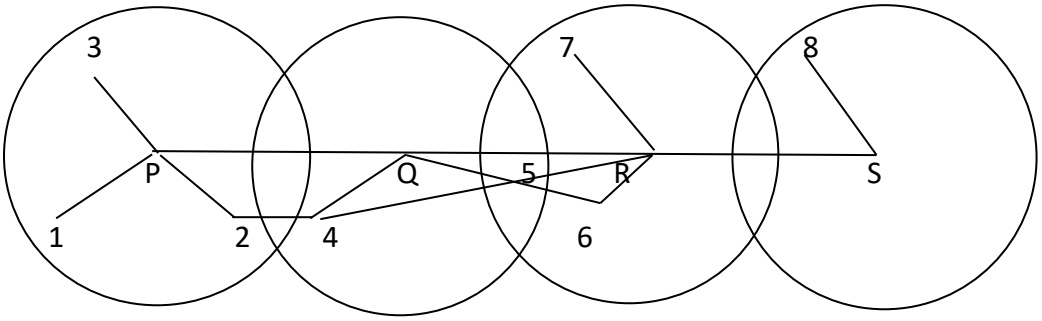
The cluster is independently controlled and dynamically reconfigured as the nodes move. This network architecture has 3 main advantages −

- Due to the node cluster bandwidth, it can share or reserve bandwidth in a controlled manner in each cluster, thereby providing spatial reuse of bandwidth.
- Finally, the cluster algorithm. It is very powerful in the face of topology changes caused by node movement, node failure and pattern insertion/removal.

E.g. Show cellular model for wireless network

- P, Q.R&S are fixed BSs connected through wired backbone nodes, and nodes 1 to 8 are mobile nodes.
- The mobile node is only one hop away from the BS.
- The communication between two mobile nodes must be carried out through a fixed BS and a wired backbone network.
- If the BS fails, the mobile node may not be able to access wired n/w in a single hop.
- Therefore, multi-hop requirements may appear in cellular networks. If the BS fails, the mobile node may not be able to access wired n/w in a single hop.
- If BS Q fails, node 4 must access BS P or R through node 2 or node 5, which largely acts as a wireless multi-hop repeater.

Conventional Cellular Network (Single Hop)



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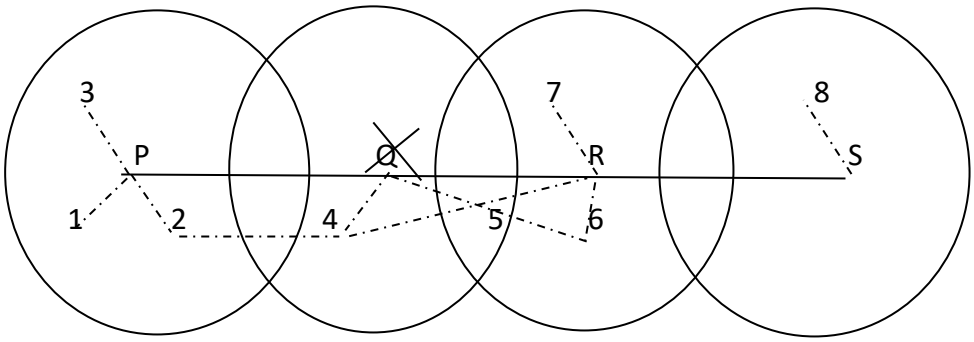
Multihop Situation When BS Q Fails



The Multicluster Architecture:

Multi-cluster architecture: The main challenge in multi-hop is to consider the ability of resources so that bandwidth reservation can be made on it.

By creating radius clusters, the solution can be extended to multi-hop networks so that access rights can be controlled and bandwidth can be allocated in each cluster. Most hierarchical cluster architectures are based on the concept of cluster head.

The cluster head acts as a local coordinator for transmission within the cluster.

It is different from the base station concept in the current cellular system because it does not have a special h/w and is actually dynamically selected among a group of stations. However, doing so will increase the extra workload. Ordinary radio, so it may become the bottleneck of the cluster. The purpose of the proposed clustering algorithm is to find a set of interconnected clusters covering the entire node population.

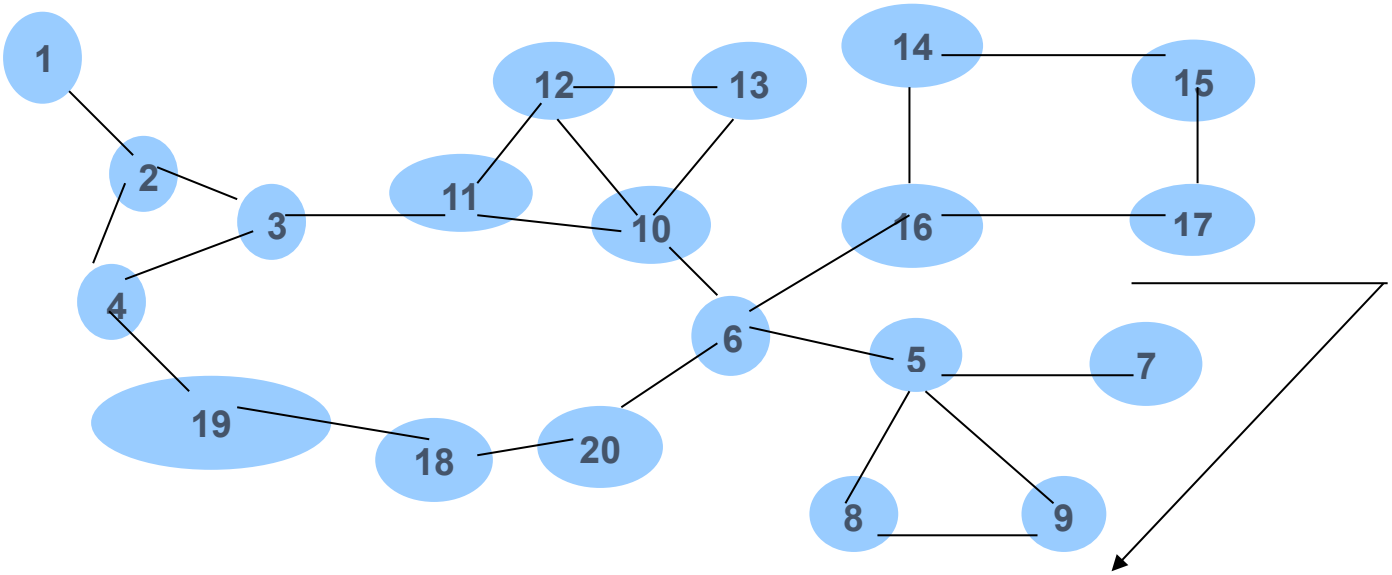
Clustering algorithm: In order to support multimedia traffic, the wireless n/w layer must guarantee QoS (bandwidth and delay) for real-time traffic components.

Providing Q.s for multimedia includes the following two steps:

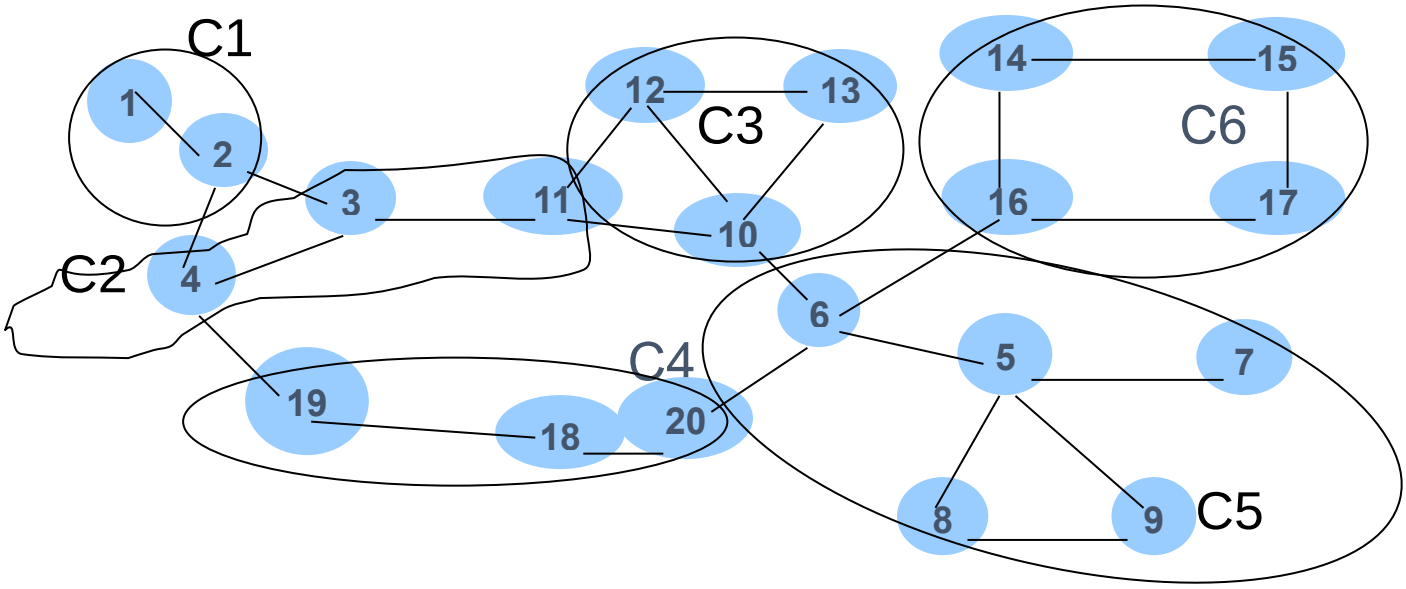
- Partition the multi-hop n/w into clusters so that controlled and responsible bandwidth sharing can be done in each cluster.
- **Establishment:** Virtual circuit guarantee with Q.S.
- **Goal:-**Another purpose of clustering is to divide n/w into several clusters.
- In each cluster, nodes can communicate with each other between up to two hops.
- Can build cluster based on node ID
- Basic assumptions for algorithm construction in wireless broadcasting
- **A1:** Each node has a unique ID and knows the ID of its 1-hop neighbour
- **A2:** The message sent by the node is correctly received by all its 1-hop neighbours within a certain period of time.

- **A3:** During the execution of the algorithm, the n/w topology will not change. In this algorithm, each node only broadcasts a cluster MSG before the algorithm. Stop, the time complexity is O (|V|), where V is the node set.
- The clustering algorithm converges very quickly. In the worst case, the convergence is linear on the total number of nodes.

Consider the System Topology



After Clustering



The Multicluster Architecture:

After clustering , we can find 6 clusters in the system, namely {1,2}, {3,4,11}, {5,6,7,8,9}, {10,12, 13} {14,15 ,16,17} {18,19,20}

In order to prove the correctness of the algorithm, we must prove

- Each node finally determines its cluster.
- In a cluster, any two nodes are at most two hops apart
- Algorithm. Termination

In the multi-cluster architecture, the repeater relays data packets from one cluster to another cluster. Each repeater shares time between a groups of adjacent clusters,

Cluster maintenance:

Cluster maintenance:-Available in dynamic radio network

- Node can change position
- You can delete the node and
- Can add nodes

A topology change occurs when the nodes are connected at a discount, thereby changing the cluster structure. System performance is affected by frequent cluster changes. Therefore, designing a cluster maintenance plan to keep the cluster infrastructure as stable as possible means designing the cluster maintenance plan to minimize the transfer of nodes from one cluster to another frequency. Maintaining the cluster architecture requires two steps

Step 1-Check if any members in the cluster have moved out of the local area.

Step 2-If step 1 is successful, please decide if you should change the cluster or remove my node from the cluster.

Figure (a) shows that there are 5 nodes in the cluster. Due to mobility, the hop distance does not exceed 2. The topology of the node is changed to Figure (b) 4, which is the highest {1,2,3} Change the cluster, but node 5 should join another cluster or from a new cluster

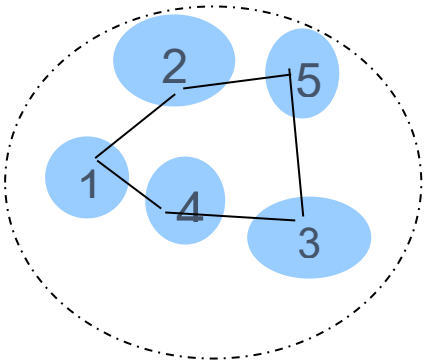


Fig (a)

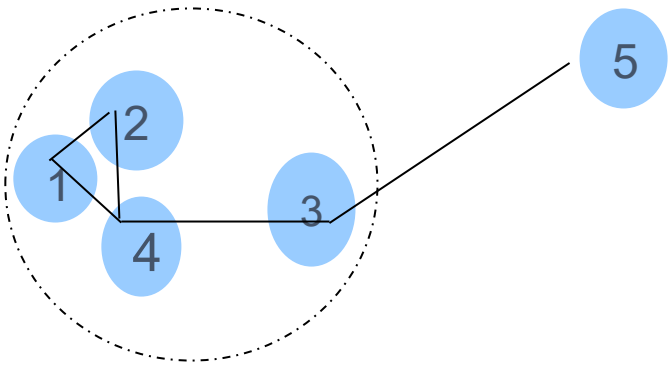


Fig (b)

Re-clustering:-We let the most connected node (its neighbour stay in the original cluster) to remove other nodes.

The cluster head acts as a local coordinator for transmissions within the cluster.

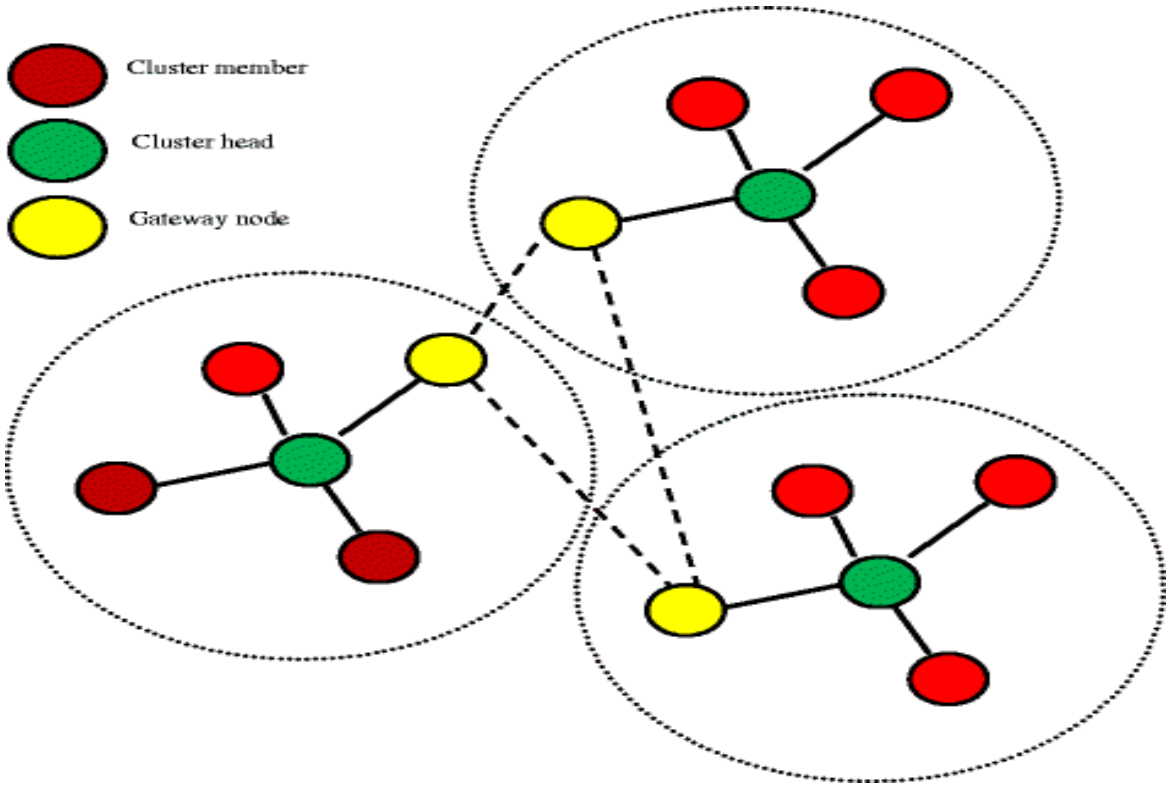
IT is different from the base, there is no special n/w swing frequency device when dynamically selecting the jack in the set workstation, and it will do extra work in the ordinary workstation, so it may become the bottleneck of the cluster

'Divide mobile nodes into clusters, and then use distributed algorithms to select cluster heads.

All nodes in the public area of the cluster head belong to its cluster

A node in the common range of two or more cluster heads, called a gateway node

The cluster head change only occurs when two cluster heads enter a cluster or one node moves out of the range of all cluster heads.



QoS Routing:

Routing:-To make a network delivery QoS, it must make sure that it must retain control resources.

Routing is that the initiative in reservation, and routing products are first reserved along the trail. The key resource supported by multimedia QoS is that the bandwidth, which may be defined because the number of real-time connections which will undergo the node. A node can only send one packet per frame

QoS routing scheme:

The goal of the bandwidth routing algorithm is to seek out the shortest path in order that the free bandwidth is above the minimum requirement within the shortest path calculation. The load of every link is adequate to 1. Additionally to load balancing, our routing scheme also supports alternate paths. During a mobile environment, this is often vital, because during this environment, the link will fail thanks to mobility, therefore the optimal state of the route is secondary. When a topology change destroys an existing route, the routing protocol must be ready to quickly find a replacement route. We recommend maintaining the auxiliary path a, which may be used immediately when the most path fails.

When the primary link on the trail (S, N) fails, each node will use the info packets of its main route to calculate the auxiliary backup path (S, N3). The auxiliary (alternate) route are often easily calculated using the DSDV algorithm (target sequence distance vector). Each neighbour of the node periodically informs the neighbour with the shortest distance d from s to the destination to supply the most route, and therefore the runner-up produces the second route