SARDAR PATEL INSTITUTE OF TECHNOLOGY

B. Tech.

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Experiment No. 02-B

To Implement Channel Assignment Methods - Dynamic

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Aim: To implement Dynamic Channel Allocation method.

Theory:
Types of Channel Allocation:

1. Fixed Channel Allocation,
2. Dynamic Channel Allocation and
3. Hybrid Channel Allocation which is a combination of the first two methods.

Channel allocation deals with the allocation of channels to cells in a cellular network. Once the channels are allocated, cells may then allow users within the cell to communicate via the available channels. Channels in a wireless communication system typically consist of time slots, frequency bands and/or CDMA pseudo noise sequences, but in an abstract sense, they can represent any generic transmission resource. There are three major categories for assigning these channels to cells (or base-stations).

Dynamic Channel Allocation
Dynamic Channel Allocation (DCA) attempts to alleviate the problem for FCA systems when offered traffic is non-uniform. In DCA systems, no set relationship exists between channels and cells. Instead, channels are part of a pool of resources. Whenever a channel is needed by a cell, the channel is allocated under the constraint that frequency reuse requirements cannot be violated. In DCA, frequency channels are not fixed for any node or user. Channels are assigned to the user depending upon knowledge of the environment. The distribution of the frequency carriers in a cell depends upon distribution of the users/nodes in the cell and also on offered traffic load. DCA is currently supported by the GSM. In the Dynamic Channel Allocation Scheme all the channels which are available for a system, are kept in a queue or a spool. These channels are allocated to any cell temporarily. The interference can be minimized by fulfilling the distance criteria.

The dynamic channel allocation schemes can be divided into three categories:
1) IA-DCA (*Interference Adaptive Dynamic Channel Allocation*)
2) LA-DCA (*Location Adaptive Dynamic Channel Allocation*)
3) TA-DCA (*Traffic Adaptive Dynamic Channel Allocation*)

These schemes are based on the type of network dynamics they consider while making decision. All DCA schemes basically evaluate the cost of using each available channel and opts the channel which introduces lowest cost.
The algorithm should have accurate knowledge of the environment for taking better decisions for channel allocation with most accurate results.

The main algorithms which are considered under the study of Dynamic Channel Allocation are: Centralized and Distributed Dynamic Channel Allocation. In DDCA, a channel is selected based on co-channel distance, signal strength and signal-to-noise interference ratio. It is important to note that the performance of channel allocation methods depends on the type of traffic and its allocation priorities. The distributed

dynamic channel allocation methods are proved to be best in utilizing bandwidth effectively. But the performance greatly depends on the channel reservation factor for different types of traffic.

Channel Allocation Strategy:

1) As new calls arrive in the system, all the channels are assigned dynamically which are kept in a central pool.
2) The channel is returned to the central pool after the call is completed. It is fairly straightforward to select the most appropriate channel for any call based simply on current allocation and current traffic, with the aim of minimizing the interference.
3) The Base Station requests a channel from the MSC, if all channels are occupied. MSC then allocates the channel to the Base Station.
4) DCA schemes can be centralized or distributed. The centralized DCA scheme involves a single controller selecting a channel for each cell.
5) The distributed DCA scheme involves a number of controllers scattered across the network (MSCs).
6) For a new call, a free channel from the central pool is selected that would maximize the number of members in its co-channel set.

PROBLEM STATEMENT:

1. Assume Total Number of Channels (50-100).
2. Assume 15-20% of total Channels are reserved for Control channels.
3. Remaining are Voice/Data channels.
4. Distribute Control and Voice Channels in 7,9,13 size of Cluster.
5. Display results of Control and Voice channels separately in matrix format

ALGORITHM:

Step1: Take user input for total channels, and cluster size 7,9 or 13.
Step2: Take user input for number of channels required in each cell.
Step3: Using random function allocate half channels to high priority and half channels to low priority.
Step4: Each cell to be assigned 50 percent high priority channels and 50 percent low priority channels.
Step5: Use sample function to choose these high and low priority channels.
Step6: Display traffic channel assignment.

Code:

```
clc
channel_num=input("Enter the total number of channels: ");
cluster_num=input("Enter the cluster size: ");

%checking if cluster size is valid
flag=0;
for i=0:10
    for j=0:10
        if(cluster_num == i*i+j*j+i*j)
            flag=1;
            break
        end
    end
end
if(flag==1)
    fprintf("Enter %d channel demands\n",cluster_num);
    demand=zeros(1,cluster_num);
    total_demand=0;

    for i=1:cluster_num
        demand(i)=input("Enter:");
        total_demand=total_demand+demand(i);
    end

    percentage=zeros(1,cluster_num);
    for p=1:cluster_num
        per = (channel_num*demand(p))/total_demand;
        percentage(p) = round(per);
    end
    high_low=mod( reshape(randperm(1*channel_num), 1, channel_num), 2 ); %randperm random permutation of 1 and 0

    arr = zeros(1,channel_num);
    h=zeros(1,channel_num);
    l=zeros(1,channel_num);
    y=zeros(cluster_num,max(demand));
    mlow=1;
    nlow=1;
    n=channel_num;

    for i=1:channel_num
        if (high_low(i)==1) %if 1 assign to high
            arr(mlow) = i;
            h(mlow)=i;
            mlow=mlow+1;
        else %if 0 assign to low
            arr(n) = i;
            l(nlow)=i;
            nlow=nlow+1;
            n = n -1;
        end
    end

    %Counting non zero entries
    non=nnz(high_low);
    high=zeros(1,non);
    for i=1:non
        high(i)=h(i);
    end

```

```
        low=zeros(1,channel_num-non);
        j=1;
        num = non + 1;

        for i=1:non
            low(j)=l(i);
            j=j+1;
        end

        disp("High Priority Channels")
        disp(high)
        disp("Low Priority Channels")
        disp(low)
        disp("Number of calls per channel using percentage")
        disp(percentage)

```

```
        curr=1;
        last = max(demand);

        for i=1:last
            for j=1:cluster_num
                if(i>percentage(j))
                    continue
                end
                if(curr<=channel_num)
                    y(j,i)=arr(curr);
                else
                    break;
                end
                curr=curr+1;
            end
        end

        disp("Dynamic Channel Allotment")
        disp(y)
        disp("Total demand")
        disp(total_demand)
        disp("Input")
        disp(channel_num)
        disp("Number of high")
        disp(length(high))
        disp("Number of low")
        disp(length(low))
    else
        fprintf("Cluster Size Error");
    end
```

Results:

1) Channels=45; Cluster=7

```
Enter the total number of channels: 45
Enter the cluster size: 7
Enter 7 channel demands
Enter:13
Enter:16
Enter:2
Enter:0
Enter:9
Enter:5
Enter:7
High Priority Channels
     1     3     4     6     7     8     9    10    13    14    16    19    20    21    23    25    27    30    34    36    39    42    45

Low Priority Channels
     2     5    11    12    15    17    18    22    24    26    28    29    31    32    33    35    37    38    40    41    43    44     0

Number of calls per channel using percentage
    11    14     2     0     8     4     6

Dynamic Channel Allotment
     1     9    20    30    45    40    33    29    24    18    15     0     0     0     0     0
     3    10    21    34    44    38    32    28    22    17    12    11     5     2     0     0
     4    13     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     6    14    23    36    43    37    31    26     0     0     0     0     0     0     0     0
     7    16    25    39     0     0     0     0     0     0     0     0     0     0     0     0
     8    19    27    42    41    35     0     0     0     0     0     0     0     0     0     0

Total demand
    52

Input
    45

Number of high
    23

Number of low
    23
```

2) Channels=45; Cluster=9

```
Enter the total number of channels: 45
Enter the cluster size: 9
Enter 9 channel demands
Enter:13
Enter:16
Enter:12
Enter:0
Enter:5
Enter:7
Enter:9
Enter:8
Enter:6
High Priority Channels
     6     7     9    10    13    14    15    21    22    23    24    26    27    29    32    33    34    35    36    38    39    41    45

Low Priority Channels
     1     2     3     4     5     8    11    12    16    17    18    19    20    25    28    30    31    37    40    42    43    44     0

Number of calls per channel using percentage
     8     9     7     0     3     4     5     5     4

Dynamic Channel Allotment
     6    22    34    43    25    16     8     3     0     0     0     0     0     0     0     0
     7    23    35    42    20    12     5     2     1     0     0     0     0     0     0     0
     9    24    36    40    19    11     4     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    10    26    38     0     0     0     0     0     0     0     0     0     0     0     0     0
    13    27    39    37     0     0     0     0     0     0     0     0     0     0     0     0
    14    29    41    31    18     0     0     0     0     0     0     0     0     0     0     0
    15    32    45    30    17     0     0     0     0     0     0     0     0     0     0     0
    21    33    44    28     0     0     0     0     0     0     0     0     0     0     0     0

Total demand
    76

Input
    45

Number of high
    23
```

3) Channels=45; Cluster=13

```
Enter the total number of channels: 45
Enter the cluster size: 13
Enter 13 channel demands
Enter:12
Enter:11
Enter:1
Enter:0
Enter:9
Enter:6
Enter:3
Enter:4
Enter:0
Enter:6
Enter:10
Enter:14
Enter:15
High Priority Channels
     1     3     4     5     7    11    13    14    16    21    24    25    27    28    31    32    35    36    39    41    42    43    44

Low Priority Channels
     2     6     8     9    10    12    15    17    18    19    20    22    23    26    29    30    33    34    37    38    40    45     0

Number of calls per channel using percentage
     6     5     0     0     4     3     1     2     0     3     5     7     7

Dynamic Channel Allotment
     1    24    41    34    22    15     0     0     0     0     0     0     0     0     0
     3    25    42    33    20     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     4    27    43    30     0     0     0     0     0     0     0     0     0     0     0
     5    28    44     0     0     0     0     0     0     0     0     0     0     0     0
     7     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    11    31     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    13    32    45     0     0     0     0     0     0     0     0     0     0     0     0
    14    35    40    29    19     0     0     0     0     0     0     0     0     0     0
    16    36    38    26    18    12     9     0     0     0     0     0     0     0     0
    21    39    37    23    17    10     8     0     0     0     0     0     0     0     0
fx
```

```
Total demand
    91

Input
    45

Number of high
    23

Number of low
    23

fx >>
```

Conclusion:

1) Voice channels are not allocated permanently in dynamic channel assignment strategy. Each time a call request is made, the serving base station requests a channel from the MSC. The entire pool of frequency channels lies with MSC. The switch then allocates a channel to the requested cell using an algorithm.
2) These schemes adjust bandwidth allotment according to traffic volume, and so are particularly suitable for bursts of traffic.
3) It reduces chances of blocking which increases trunking capacity of the system as all available channels are accessible to all cells.
4) MSC has to collect real time data on channel occupancy, traffic distribution, radio signal strength indication of all channels on a continuous basis, thus increasing the computational load as well as storage load on MSC.

5) In this experiment, we have allocated the channels based on the demand as well as based on the priority.
6) To allocate the channels properly according to the capacity of that particular channel, we have calculated the percentage of how much the capacity it can handle and then allocated it accordingly.