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FAST AND REACTIVE HANDOFF OVER HETROGENOUS NETWORK

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Abstract

In the last decade several wired and wireless network have made immense contribution for giving global information access to diverse users. The next generation communication aims at integration of different networks. The communicating devices needs frequent mobility and communicate to each other in the different architectural and topological networks. However, there is a serious problem of call drop or interrupted communication due to improper handoff if a mobile devices moves among different types of network during communication. It also affects it's QoS. Therefore, in this paper, we propose a reactive handoff management mechanism in heterogeneous network for mobile nodes with respect to IP network and MANET.

Keywords: *Heterogeneous Network, IP Network, MANET, handoff, Admission Control, QoS.*

1. Introduction:

A Heterogeneous network is an interconnection of multiple networks irrespective of topology, network architecture etc. The networks may be multiple IP networks, Cellular networks, ad hoc networks, and satellite networks with prescribed bandwidth capacity, link speeds and other parameters. Each network has respective performance metrics for describing their characteristics.

In the era of communication revolution, mobile and wireless technology is exponentially becoming ubiquitous. Proliferation of different networks in recent years suggests the emergence of a heterogeneous network for smooth and seamless communication.

The problem with reference to QoS in MANET is a call drop [2-3] or seamless communication due to numerous reasons behind it. Thus, improper handoff in heterogeneous network is an emerging research area. While mobile node moves from one network to another network with different parametric values, a seamless handoff operation is not performed due to numerous reasons. Often call drops and QoS affects.

To support mobility [3] in different networks there are two approaches available named as reactive and proactive handoff? When a mobile node communicates with the host in other network and the intended destination location may be provided by location server, whenever location is not provided by location server then location discovery process get executed. This approach is called Reactive handoff [16].

Reactive handoff improves the services to users by reducing the time of handoff during the ongoing user's session. It also makes the existence of heterogeneous networks transparent because of which mobile node may perceive the entire system as an integrated connectivity rather than a collection of different networks.

This paper is organised in sections. Section - 1 discusses Introduction. Section - 2 deals with Backgrounds that includes related work in reference to present problem. Moreover, the proposed architecture and mechanism is discussed in Section - 3 under heads of proposed architecture and mechanism for Fast and Reactive Handoff over Heterogeneous Network. The conclusion of this paper is mentioned in Section - 4 under heads of Conclusion. Section – 5 discussed about the future aspects of this paper. Finally Section – 6 mention all references that's used in this paper.

2. Backgrounds:

Communication and sharing of information is an important aspect in our everyday life. Very often it is found it is found that when a mobile node moves from one network to another there is loss in connectivity or a mobile node gets an interruption in the call. Thus service continuity or temporary loss in connectivity is a serious research issue.

Service continuity [4-5] in ad hoc network has been studied. Services can migrate from node to node, following a mobile user, in order to maintain seamless interaction with the client application. A

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migratory service based reliability approach [5] has been proposed in order to address the shortcoming of continuity in services.

To suit the conditions of continuous service execution abundant work on service migration [2-3] in mobile and pervasive computing environment has been performed, which involves the issues and challenges of migrating an ongoing service from one device to another. More recently a centralized model for context-aware service migration has been proposed [2]. [3] Considers a transport layer overlay to assist users to seamlessly migrate through heterogeneous networking environments.

A challenging problem for mobility of mobile nodes still existed for which various proposals of mobility management [20] are stated in different layers of Internet Protocol Suite. Media Independent Handover (MIH) [28] offers mobility information for the execution of a vertical handoff process and requires major modifications at both the network and user side. At the Internet Layer, IETF has specified Mobile IPv6 (MIPv6) [29] protocol requires the maintenance of a Home Agent (HA) node as a third party router/server.

By extending the MIPv6 protocol, IETF has also proposed Network Mobility (NEMO) protocol [30] in order to manage the mobility of mobile networks. At the Transport Layer, Stream Control Transmission Protocol (SCTP) [31] is proposed, which is based on maintaining an end-to-end connectivity. Unlike MIPv6, SCTP does not require any intermediate network elements for maintaining status information. To support MU and enable vertical handover, SCTP is extended with a mobile SCTP (SCTP) [32] solution, where a MU can manage different valid IP addresses by using the Dynamic Address Reconfiguration (DAR) feature [33]. The drawback however is that all the TCP based applications have to be modified in order to make use of SCTP solution.

Beside SCTP, the handover realization can be done via TCP by adding a cross-layered Radio Resource Control [34].At the Application Layer, Session Initiation Protocol (SIP) [35] is proposed for managing the mobility of mobile units. However, like MIPv6 and middleware approaches [36], SIP requires major enhancements to existing network infrastructure and hence is an expensive proposition.

Autonomous network connect to the IP network through gateway. Thus gateway acts as a bridge for transferring data between different networks. Two methods for Internet gateway discovery are described in draft "Global Connectivity for IPV6 Mobile Ad Hoc Networks": Proactive gateway discovery and reactive gateway discovery. Proactive gateway discovery periodically disseminates advertisements to all nodes in the network. Reactive gateway discovery utilizes solicitation and advertisement signaling between network and Internet gateway

Several standard bodies and research groups have proposed handoff management solutions tailored for specific wireless technologies. To the best of our knowledge HLS[6],VDPS[7],GHLS[8] is hierarchical hashing-based location service protocol. The main idea of HLS is partition the network coverage area into cells, which are hierarchically grouped into regions of different both location management and handover management.

Finally in [16] approaches to reactive handoff management for mobile devices for high quality requirements have been proposed. It gives efficient and streamlined continuity in case of handoff. In view of the above work we have proposed a fast [13] and reactive [32] handoff [19] management mechanism for MANET in heterogeneous network.

3. Proposed architecture and mechanism for Fast and Reactive Handoff over Heterogeneous Network:

The proposed work mentioned under heads of architecture and mechanism for Fast and Reactive Handoff over Heterogeneous Network**.** Its operation is mentioned under heads of proposed mechanisms.

3.1 Heterogeneous Network:

The proposed architecture considers a heterogeneous network with interconnectivity between IP network and MANET connected through gateway. A Heterogeneous network illustrated in figure 3.1 is an interconnection of multiple networks irrespective of topology, network architecture etc. The networks may be multiple IP networks, Cellular Networks, ad hoc networks, and satellite networks with prescribed bandwidth capacity, link speeds and other parameters. Each network has their respective performance metrics for describing their characteristics. Mobile adhoc network contains various mobile nodes available in different geographical locations. A mobile node is an Internet-connected device whose location and point of attachment to the Internet may frequently be changed. This node is often a cellular telephone or handheld or laptop computer. Global connectivity is often required for mobile nodes of heterogeneous network desiring communication with the fixed nodes in the Internet. Clouds denote IP networks. Internet gateway can provide Internet connectivity for nodes in the MANET. A mobile node can learn an address of the Internet gateway that provided the node with this access to the Internet.

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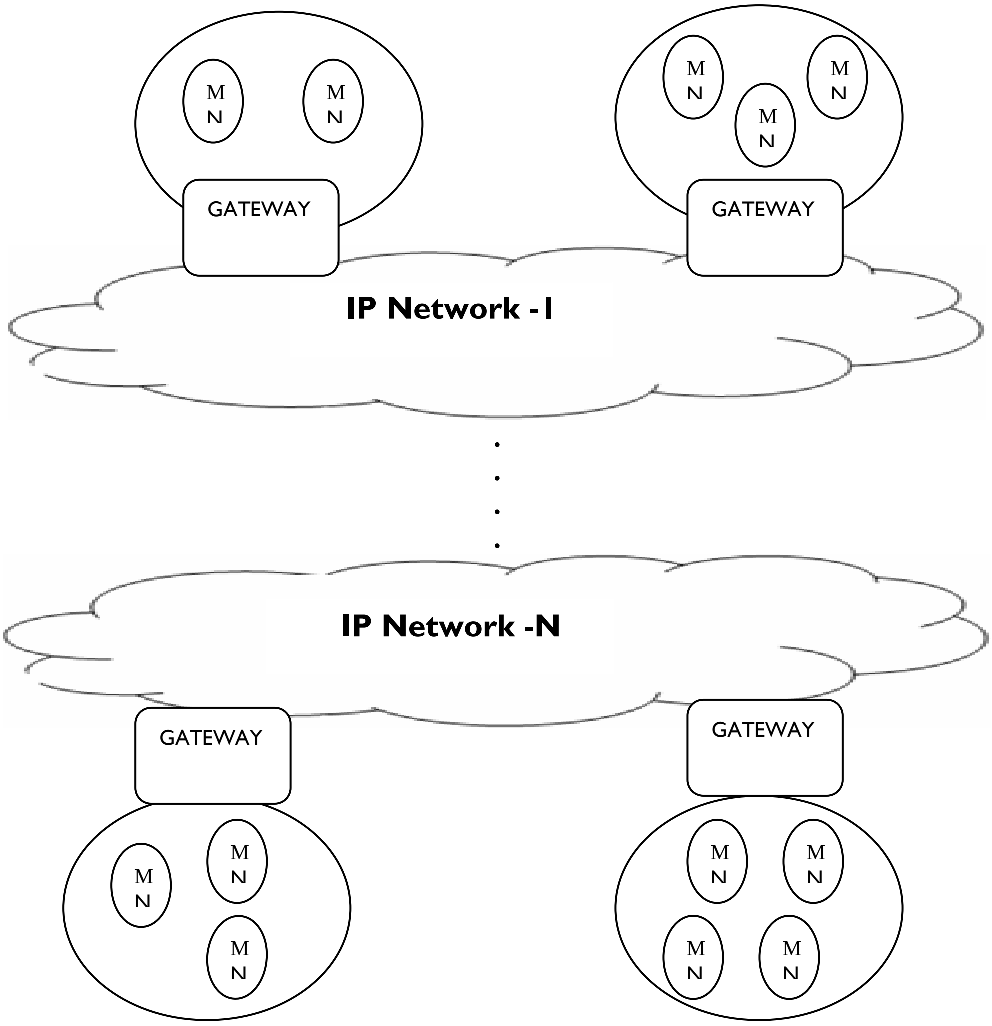
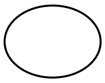
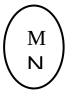


Figure -3.1: Heterogeneous Network

LEGENDS:


: MANET



: MONILE NODE

…………..: WIRELESS

------------: WIRED

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3.2 Architecture of handoff over heterogeneous network:

In figure 3.2 mobile nodes that want to communicate with host gets connected with the gateway for communication. Mobile node (MN) enters the admission control module. This module checks whether MN is authentic and has the privilege to access communication facility with the host. Once the working of admission control is over, registration server registers the MN in the database. Node type checks the type of node and directs this information to location server. Location server updates this information in the database. If a new mobile node joins the network then Address Allocator assigns a unique mobile IP to the node and sends an update to update manager.

Mobility manager detects the mobility of MN and notifies the update manager. Update manager updates the database. Whenever handoff manager detects handoff it informs the mobility manager or if a movement of mobile node is detected by the mobility manager informs the handoff manager for handoff. Both the modules in turn update the update manager which updates the database.

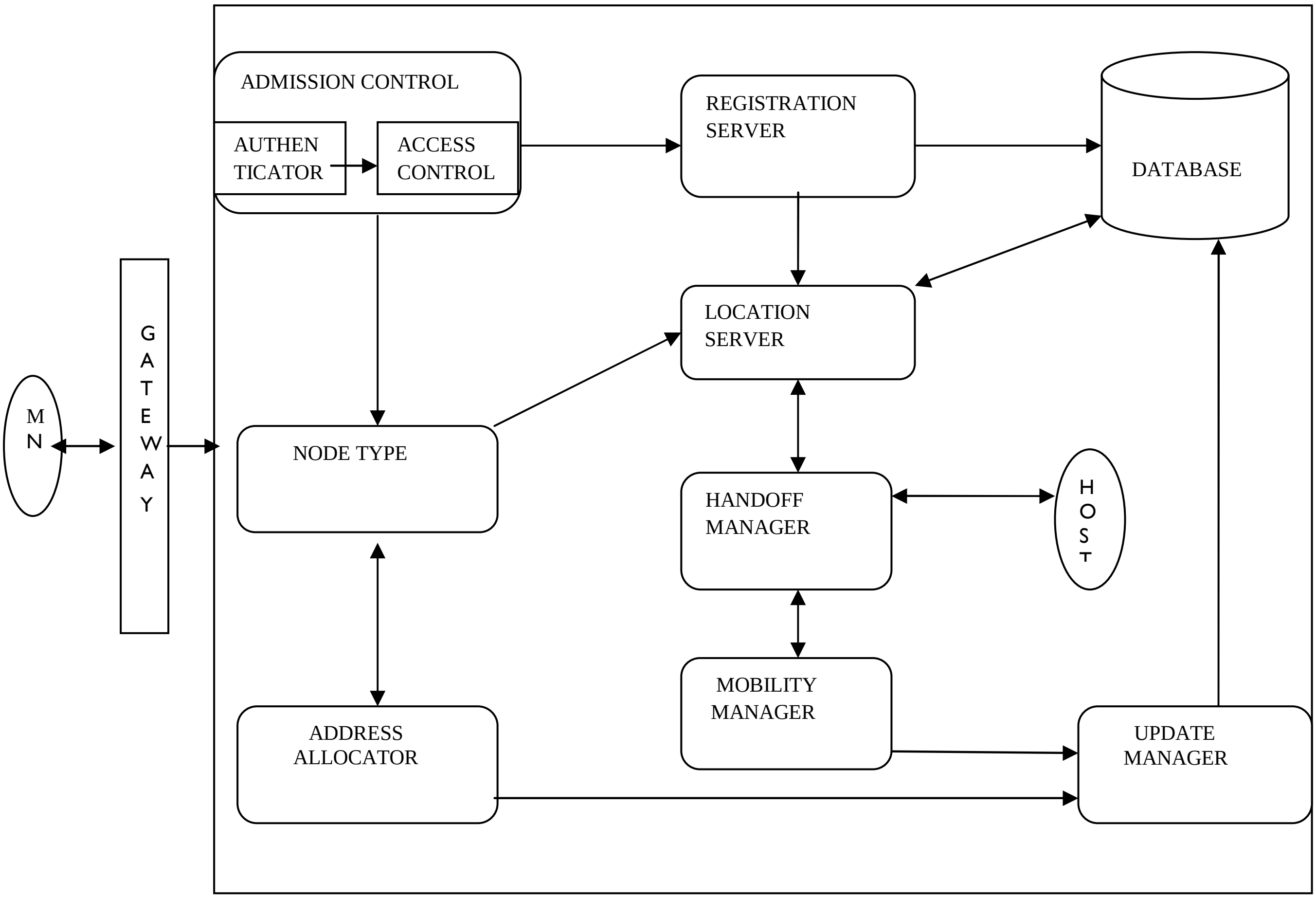

Figure - 3.2: Handoff processing of a call transferred by MN in MANET to host on IP Network.

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3.3 Mechanism for Fast and Reactive Handoff over Heterogeneous Network:

STEP – 1: AdmissionControl( )

```
{
Input MN
Authenticator( );
Access Control( );
Registration( );
}
```

STEP – 2: Authenticator( )

```
{
If(node type==wireless)
{
Starting from the right, double a digit every two digits(e.g., 7 → 14)//digit is IMEI number
Sum the digits(e.g., 14 → 1 + 4)
If the sum is divisible by 10
        Then authentic MN
 Else
         Unauthentic MN
         Exit()
}
If (node type == wired)
{
Extract IP address from configuration file
 If (IP address is present in Table [ISP])// Routing tables containing a list of IP addresses
     Then valid IP
Else
       Invalid IP
       Exit()
}
}
```

STEP – 3: AccessControl()

```
{
 If(CNstate==idle)
      Then valid access
Else
       Invalid access
       Exit()
 }
```

STEP – 4: RegistrationServer()

```
{
If(admission control==Y)
{
Registration server ←Register MN
Database←Registration update
 }
}
```

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STEP – 5: NodeType( )

```
{
If (node type==wired)
   {
    If (Bandwidth<=BW_Th||data rate<=DR_Th||delay==fast) //threshold value may be
                                                  100Mbps, 2 Gbps in wired
                                                  network
    Then CN is fixed node
    Else if (bandwidth<=BW_Th||data rate<= DR_Th ||delay==slow||frequency<=F_Th) //threshold
                                         value may be 11 Mbps, 750 Mbps, 1GHz in
                                         wireless.
    Then CN is mobile node
    }
}
```

STEP – 6: AddressAllocator( )

```
{
Available bandwidth=Tidle/T*W   // Calculate bandwidth of a new MN
If(bandwidth>BW_Th)
    {
    MN←IP
    Update manager←update
    Database←update manager
}
New MN joins the network
}
```

STEP – 7: LocationIdentification( )

```
{
     for(MN communicate)
     {
       Search (location server, location)
        If location==(Y) && (battery power>BP_Th)&&(security==Y)
             Communication established.
             Else
             Out of coverage area
       }
}
```

STEP – 8: Updatemanager( )

```
{
   If(MN moves from one domain to another)&&(velocity==low)
   Mobility manager→updates(Update manager)
   Update manager →updates(Database)
}
```

STEP – 9: Handoff( )

```
     IF MN moves from one network to another
         {
```

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```
        Calculate network throughput
        If (network throughput>NT_Th)&&(handoff latency==min)&&(admission
         control==Y)&&(access==authentic)&&(heterogeneity==ok)
        Handoff permitted
        FastReactiveHandoff()
        }
    Else
      {
       Handoff denied
      }
```

STEP – 10: MobilityManager( )

```
{
Cluster←Divide (all nodes in the network)
for(each cluster)
{
 Activate a cluster head
 Activate cluster member
 Head location table← store address of its cluster head
 Member location table← record IP address of Neighbour table & neighbour cluster head
Cluster head ←Assign the member location table
Cluster member← Assign Head location table
}
The cluster head separately sends HELLO message along with its address to the other
members
Cluster member send a REPLY message along with its address into its message.
IF a cluster member does not receive 3 HELLO packets continuously from its cluster head
         {
          It shows former cluster head had moved away and the wireless link between them is
         broken.
         Cluster member chooses the latest refresh cluster head in its routing table as its new
         cluster head, which is one hop from it||becomes itself a cluster head if it cannot hear
         any existing cluster head.
        Cluster head broadcasts a HELLO message
         The cluster member will send a REPLY message
         }
}
```

STEP-11: FastReactiveHandoff( )

```
{
Interface1()
   Repository←Signal strength of signals received from multi path
   Compute max(signal strength)
   Remove noise
   Calculate signal intensity
   If MN max(Signal intensity)&&(signal intensity>SI_Th)
   Interface3( );
   Else
   Interface2( );
}
```

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Interface2( )

```
{
If (signal strength<SS_Th)
Then signal rectification()
Register to new domain
}
```

SignalRectification( )

```
{
If the signal quality satisfactory
  {
  Then no change in operational mode interface
  }
Else
  {
  Switch to the alternate operational mode
  }
}
```

Interface3( )

```
{
 If Locator received location from location server
     {
     Establish a session
     MH communicates with the host
     }
 Else
     {
     Initiate location discovery ()
     }
}
```

LocationDiscovery( )

```
{
Random mobile node←send(MH, location advertisement)
Current internet gateway (CIG)← location advertisement
 If found(adv store, adv ID)
     Then ignore
 Else
      IF (TTL==valid)&&(hop count>service range)
             {
             Current internet gateway (CIG) will increase its service range to N//N is number
                                                                                  of hops
             Location server←location
             }
        Else
             Increment number of hops
             Resend adv to the neighbour node
             Store (Adv store, Adv ID)
```

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}

Interface4()

{

Set a standard to monitor the transmission
Set appropriate operational mode
Activate the inactive mode
Manage the MN

}

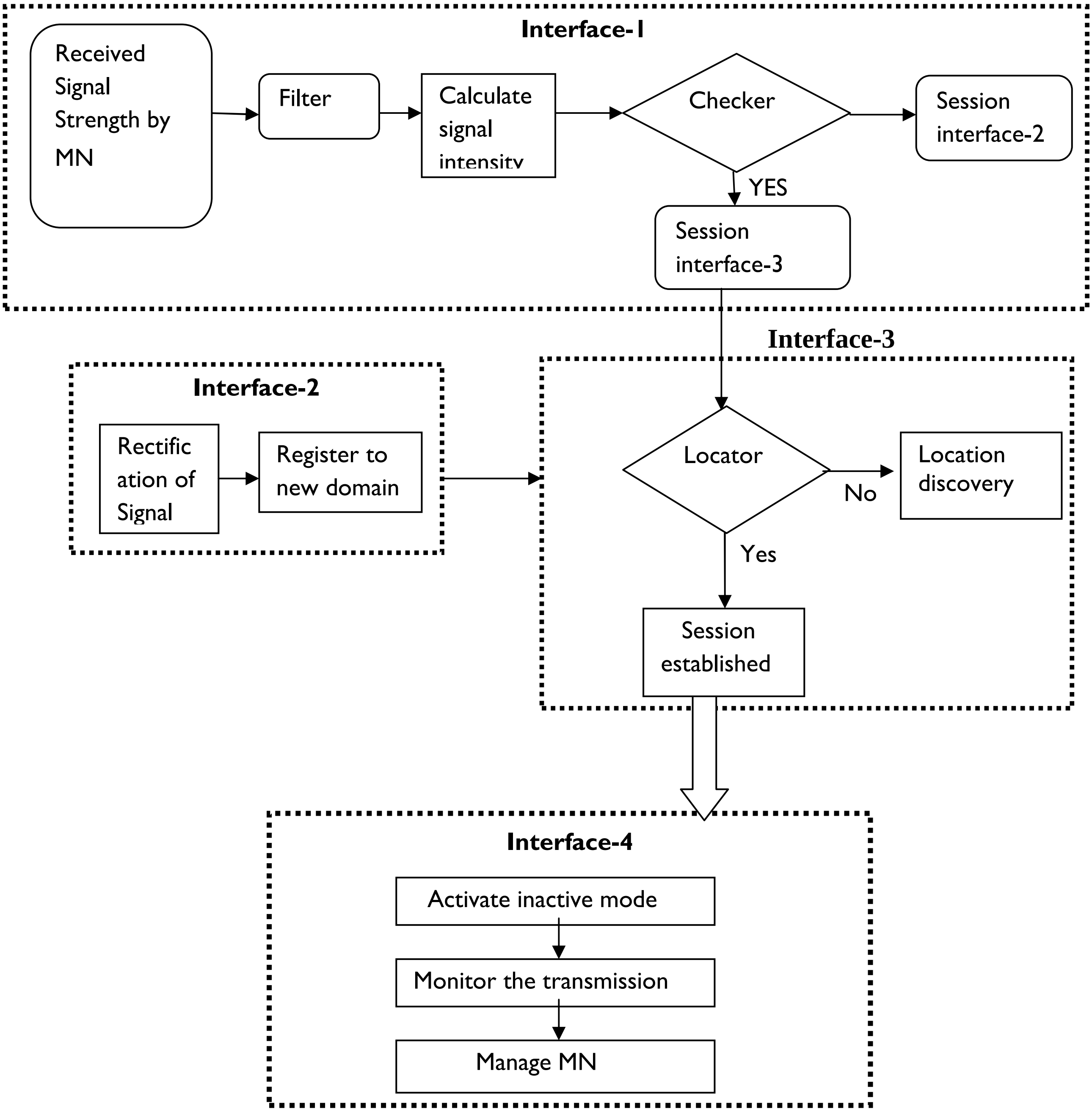

Figure -3.3: Processing of fast handoff operation

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4. Conclusion:

In this paper, the proposed architecture and mechanism is meant for fast and reactive handoff management in heterogeneous network. The primary idea is to exploit a fast handoff mechanism in different networks after accessing their location from location server. These works have been accomplished by the architecture of handoff over heterogeneous network and mechanism for fast and reactive handoff over heterogeneous network. The architecture states various working modules and their flow of work. Mechanisms deal with the logical behaviour of every architectural module.

5. Future Scope:

Techniques adopted for admission control and location discovery may be improved by reliable one so that space and time complexity may be reduced. In some cases when more and more number of nodes increase then quality parameters need to be incorporated to get better quality of service while communication. Sometimes the network is wired and sometimes it is wireless so signaling overhead can be measured to achieve lower handoff latency. Overall throughput can be calculated under heavily loaded network conditions.Security aspect that could be integrated into the system in order to detect adversaries.

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