RUTGERS
WINLAB | Wireless Information Network Laboratory

Multihoming in MF Future Internet Architecture

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Introduction

Multihoming: Host can connect to the network using multiple network interfaces with multiple network addresses.

Motivation:

➢Devices coming with multiple radios.

➢ Ability to connect to multiple access technologies e.g. Wifi, Cellular, bluetooth etc.

➢ Ability to Connect to multiple networks.

➢ Link quality varies significantly with mobility.

Objective:

➢To implement the multihoming feature on Mobility First Internet Architecture.

➢To improve the reliability, performance and stability of data communication.

Design Goals

1) Receiver driven multihoming : receiver chooses the network interface(s).
2) Source driven multihoming: source chooses interface(s) before address binding.
3) Network driven multihoming: Network makes a decision dynamically to select the network interface(s).
4) Transport protocol to support multipath with multihoming for improved performance.

Ideas and Challenges

Ideas:

➢ Receiver interface manager scans link qualities and selects the network interface(s) as per certain policies.

➢ The receiver publishes all the available network interface(s) and sender chooses among those before address binding.

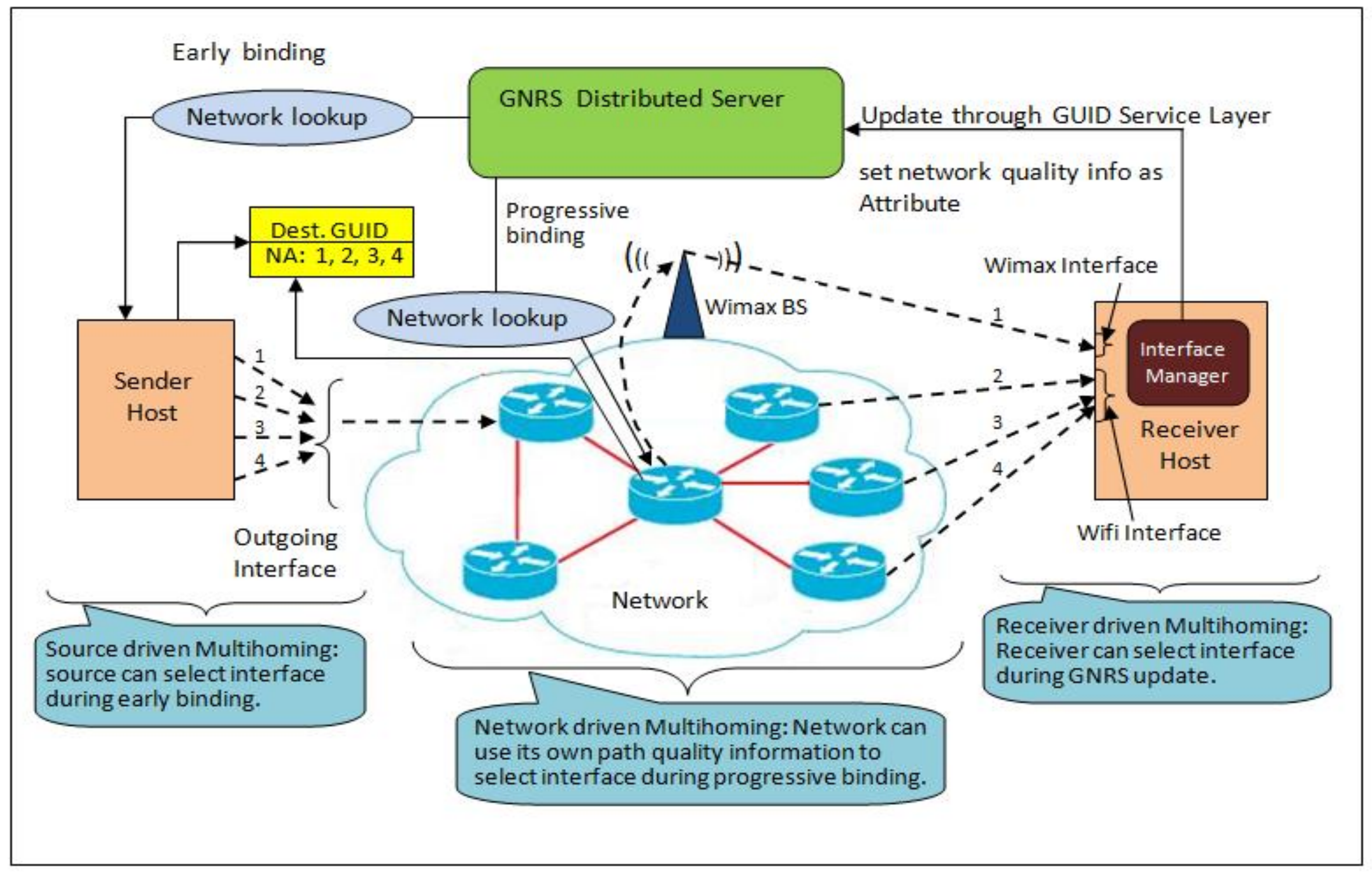
➢ The router has more information about the path quality, it can choose the interface(s) dynamically.

Challenges:

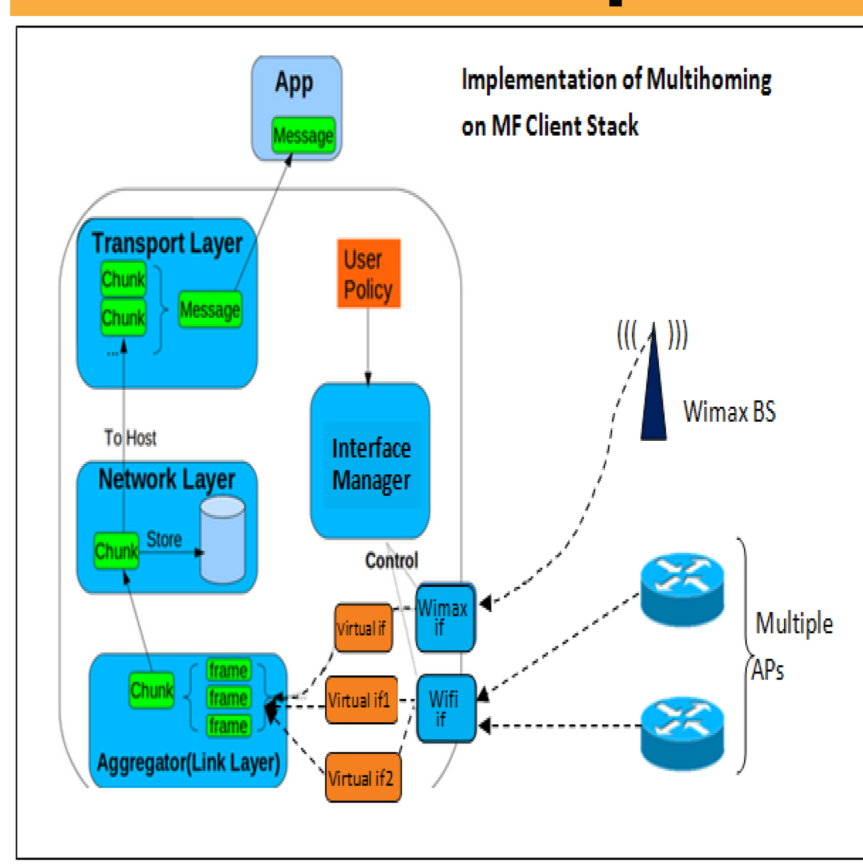
➢ Efficient policies are required to get a performance enhancement.

➢ Additional cost will be incurred at the protocol stack for analyzing the link quality metrics.

Multihoming on MobilityFirst



Implementation



➢Aggregator resembles frames to Chunks, then pass it to Network Layer.

➢Network Layer puts the Chunks in the storage. The Interface Manager selects the network interfaces based on link quality metrics and updates in GRNS server.

➢Transport Layer resembles Chunks into Message and send it to application.

Link quality metrics vs Policies

Policies for multihoming is determined by the following metrics:

➢ Signal strength of wifi access points.

➢ Link capacity/Bandwidth for each link.

➢ Latency of communication for each access point.

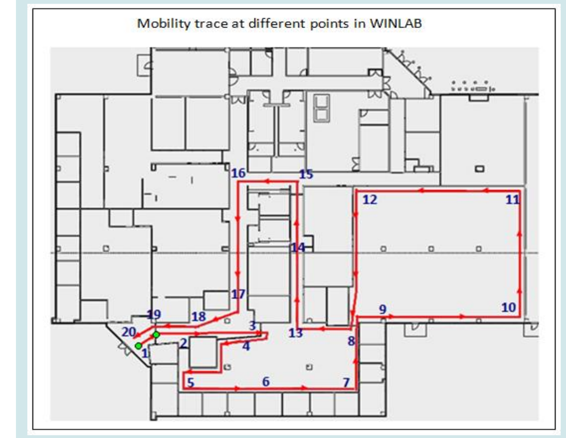
Policies:

Best Performance – *based on best signal strength & link quality.*

Max Throughput – *with multiple APs and multipath support.*

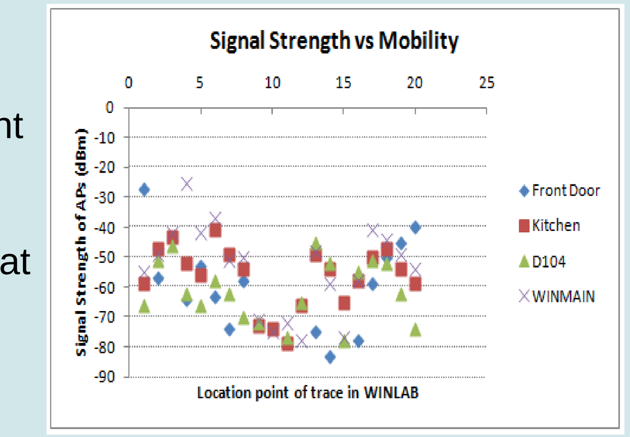
Stable Throughput – *with stable data rate as per application requirement.*

Emulation of link quality variation



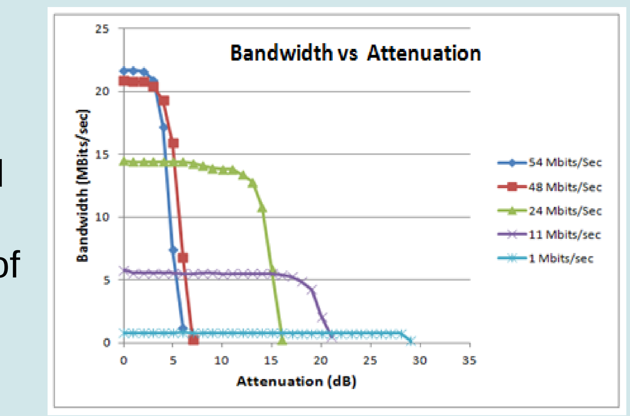
➢Measured signal strength of different APs by moving inside different locations of WINLAB (left).

➢The graph indicates that the best signal strength varies significantly with the mobility (right).



➢We emulate the mobility in terms of attenuation.

➢Reproduced the signal strength of the APs by varying the attenuation of the channel by using orbit sand box 4.

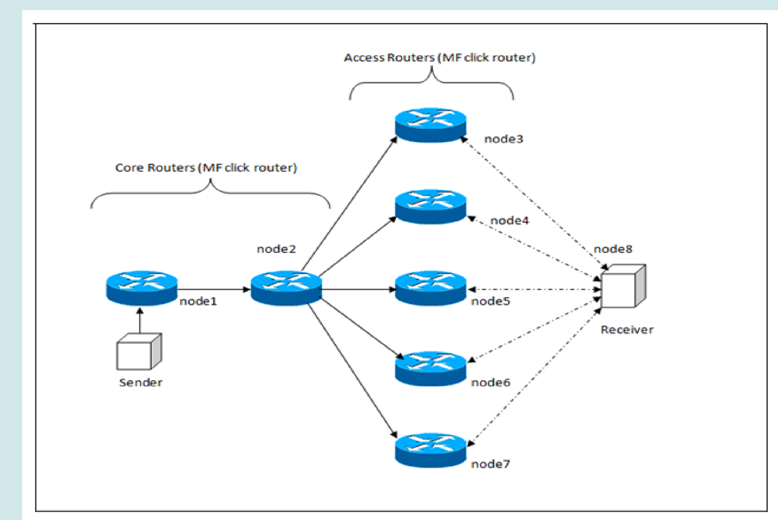


➢Achievable bandwidth decreases with increase in attenuation.

➢Bandwidth depends on the max bit rate of the channel.

➢Policy for choosing k out of n interfaces will be determined using all metrics.

Experiment & Performance Analysis

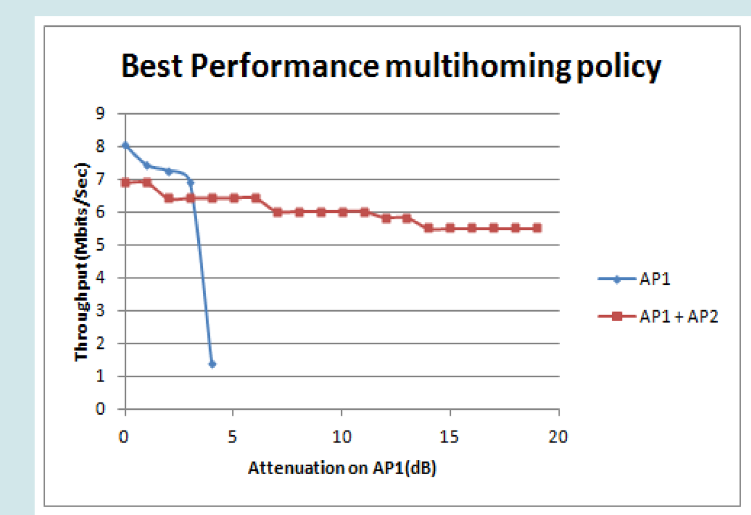


➢Test throughput in terms of bit rate and reliability in terms of data content.

➢Test the topology with different types of apps e.g. data file, Audio file, video file etc.

Throughput Measurement:

Channel bit rate : 54 Mbps
Attenuation is applied to AP1.
file size used ~ 90 MB



Conclusion

➢The best performance policy with higher mobility (attenuation) gives a consistent throughput with multiple APs where as for a single AP it drops to nil.

➢The Max Throughput policy will not give the sum of individual bit rates of the channels, as it will incur additional overhead.

➢The upper limit of the achievable bit rate is the value supported by the device(e.g. wifi card or Wimax modulation scheme).

➢Multihoming is more useful in the scenario where the device can be connected to different networks with non-overlapping multipath transfer.