Backhaul-Aware Cell Selection Policies in 5G IAB Networks

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***Abstract*—IAB is a feasible and economical solution to deploy ultra-dense cells in the 5G networks, where access and wireless backhaul links share the same spectrum. IAB eliminates the need to connect ultra-dense cells to the core network through the wired backhaul. However, mmWave backhauling and multihop topology imposes new constraints on the 5G IAB network that become a hindrance to its effective performance. In this paper, we elaborate on cell selection and present a few cell selection policies designed explicitly for IAB networks. Unlike the popular RSRP based policy that may lead to load unbalance in the IAB network, the proposed policies are devised after considering the backhaul constraints and end-to-end performance requirements. The performance of these policies is investigated using system-level simulations. These policies have shown tremendous improvement in achieving cell-edge throughput while maintaining comparable average UE throughput. The policies provide better load balancing and topology in the IAB network than the RSRP based policy.**

***Index Terms*—IAB, integrated access and backhaul, wireless backhaul, cell selection, association, ultra-dense network**

I. Introduction

The upcoming Fifth Generation (5G) cellular network is expected to operate in the millimeter-wave (mmWave) band [1]. Due to the high-frequency band, bandwidth can be higher; the 5G network would provide increased capacity and capability to offer diverse services. However, operating in the mmWave spectrum would introduce severe path and penetration losses, making coverage significantly small and requiring several cells to cover a given geographical region [2]. When this type of ultra-dense deployment happens, it is a primary concern to backhaul enormous access traffic to the core network via a wired fiber connection. It would involve high capital and operational expenditures for network operators [3].

Integrated Access and Backhaul (IAB) is a promising solution that allows the densification of cellular networks without incurring additional costs of wired backhaul deployment [4]. In an IAB network, a Base Station (BS) can use the same spectrum to serve User Equipments (UEs) in the access link and communicate with other BSs over the wireless backhaul link. By wireless backhauling the access traffic to the Core Network (CN) and utilizing mmWave for communications, it is possible to densify 5G cells without densifying the transport network proportionately. IAB enables the network to form a multihop topology where UE and CN can communicate over any number of wireless backhaul links. Thus, by utilizing IAB in 5G networks, diverse deployments scenarios can be envisioned, such as outdoor-to-indoor, outdoor small cell and group mobility (e.g., on buses or trains) scenarios.

In traditional 5G networks, UEs measure the Reference Signal Received Power (RSRP) from neighboring BSs and associate with the one that offers the maximum RSRP. However, in the IAB network, such a policy may lead to low resource utilization and unbalanced network topology [5]. Also, BSs may need to make radio connection to their appropriate upstream BSs over wireless backhaul links to reach the CN. Due to multihop relaying, the cell selection becomes challenging as access traffic passes through each backhaul link, impacting both network and UE performance. But, backhaul links in the IAB network typically have better propagation conditions than the access links and thus can provide more line-of-sight links to other BSs or UEs. This characteristic provides an opportunity to design intelligent cell selection policies that are aware of the IAB topology, capable of minimizing network congestion and are easier to implement.

Related Works

The 3rd Generation Partnership Project (3GPP) has recently standardized IAB architecture and its radio protocols in Release 16 [6]. The standards, however, have no guidelines for cell selection, and it is up to the network operators to devise cell selection policies depending on their requirements.

Since IAB is a relatively new topic, only a handful of work has been done specifically on the problem of cell selection. Most of the literature works focus on radio resource management [7], [8]. Nonetheless, the paper [5] studied different distributed cell selection policies for the IAB network, and shown that it is possible to reduce the number of backhaul links without much degradation in the link quality. The authors extended the work in [9] and demonstrated that the policies increase the capacity of the IAB network and benefit cell-edge users. There is also literature on joint cell selection and resource allocation problems [10]–[13]. Still, considering that cell selection is performed at UEs and resource allocation at BS, we need a centralized controller.

In this paper, we present a few backhaul-aware cell selection policies tailored explicitly for IAB networks and evaluates their performance on various metrics. We intend to design these policies with minimal modification in control signaling and almost no change in existing IAB architecture so that we can integrate these policies into a real IAB network. Further, these policies aim to have suitable topology, acceptable load balancing and increased capacity for the IAB network.

II. A Short Description of IAB

An IAB network mainly consists of two types of BSs, namely IAB-donors and IAB-nodes. The IAB-donors are connected to the CN directly using wired backhaul, whereas the IAB-nodes use wireless backhaul to connect to their upstream IAB-nodes or IAB-donors. We refer to access link as the link between an UE and an IAB-node or IAB-donor, and backhaul link as a link between an IAB-node and its child IAB-node or parent node (IAB-node or IAB-donor). Note that for a given backhaul link for an IAB-node, it may be a parent node or child node, depending on the topology. Also, any data path always has a single access link and any number of wireless backhaul links. It means a particular IAB-node communicates to the CN via an IAB-donor over one or more wireless backhaul links. Any downlink access traffic is first forwarded to an IAB-donor and then it hops through one or more radio links (including backhaul and access links) to reach the intended UE.

In the IAB network, the IAB-node plays a dual role, as a UE from the perspective of upstream IAB-nodes or IAB-donors, and as a BS from the perspective of downstream IAB-nodes and UEs. The UE part of the IAB-node that is visible to the IAB network is termed as Mobile Termination (MT). Like a UE, an MT registers itself to the network, receives broadcasts from neighboring BSs, and maintains wireless connection and sends periodic measurements to its parent node.

III. Cell Selection in IAB Network

It is a broad consensus that IAB would help in the faster and easy rollout of the 5G network by significantly reducing deployment cost. During network deployment within a geographical region, if a few BSs (IAB-donors) are already connected or can connect to the CN via wired backhaul, then the rest of the BSs (IAB-nodes) can become part of the network using wireless backhaul and multihop relaying. It is then possible for IAB-nodes to communicate with the CN using IAB-donors as access gateways.

Before an IAB-node starts relaying operation over its wireless backhaul, its MT must perform cell selection procedure and associate to the 'best' parent node. The definition of 'best' parent node for MT depends on the cell selection criteria and desirable end-to-end performance metrics such as increased UE throughput or cell-edge throughput. By utilizing multihop relaying, the IAB network can support several different topologies like tree, mesh and directed acyclic graph topology. In this work, however, we only focus on the tree topology, where each MT has only one parent node. The tree topology is simple, as there is only one path between an MT and the CN, and hence routing is also simple. Further, backhaul establishment and maintenance may be simpler in the tree topology.

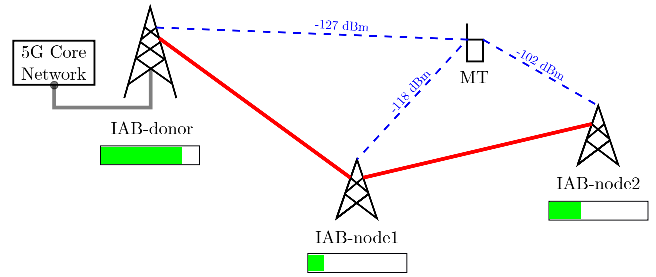

Fig. 1: An example of cell selection in an IAB network. The RSRP value and load level corresponding to each BS are also indicated. Although the example is for MT association, similar behaviour is expected from UE association.

The most straightforward approach to form an IAB network topology is to start from all IAB-donors and then associate each MT one by one, to an IAB-donor or other associated IAB-nodes. In the traditional 5G network, UEs' cell selection only considers the link quality of the access link. However, in the IAB network, cell selection considering only access link quality may lead to unbalanced network topology and inferior performance. An example of a cell selection problem in an IAB network is shown in Figure 1. The IAB-node2 is served by IAB-node1, which in turn, is served by IAB-donor. The MT is not connected to the network and can select IAB-donor, IAB-node1 or IAB-node2 as its parent node. If MT only considers the RSRP value of the access link, then IAB-node2 is the best choice. However, IAB-node2 may increase latency as it is the farthest from the CN, which may result in low MT throughput. On the other hand, the IAB-donor is the closest to the CN, but it is heavily loaded compared to other candidate parent nodes and may again degrade MT's throughput. The IAB-node1 might be a better choice in this scenario as it is lightly loaded and is not far from the CN. Therefore, both the access link between MT and candidate parent node and backhaul links related to the intermediate IAB-nodes in the path should be considered when the MT performs cell selection. After the MT association stage, the IAB-nodes can act as candidate parent nodes for the UEs. The UEs can then perform the cell selection procedure and associate with either IAB-nodes or IAB-donors to achieve the desired end-to-end performance metrics, similar to the MT association stage.

We propose that the candidate parent nodes should broadcast the following information to assist MTs or UEs to perform the cell selection procedure:

1) Link quality information in terms of either RSRP or Signal-to-Noise Ratio (SNR) of backhaul links in the path from the candidate parent node to the CN. Note that MT/UE already measures the link quality of access link from the candidate parent node.
2) Latency information in terms of the number of hops or backhaul links between the candidate parent node and the CN. In this work, we use the term 'hopcount' to represent latency information. It is desirable to have lower hopcount to ensure acceptable end-to-end latency for the

downstream access UEs.

3) Load information in terms of the number of associated MTs or/and UEs to the candidate parent node. By considering load information, we seek to avoid associating MTs/UEs with a parent node that is too loaded and to distribute traffic load across the network. We may need to also consider load information of the upstream IAB-nodes in the path to minimize traffic congestion at the IAB-nodes.

Since the above information is needed before an IAB-node performs a radio connection setup, it is more practical for the candidate parent nodes to broadcast it. Each of the cell selection policies operates in a distributed fashion. Hence, the cell selection procedures are faster to implement and have significantly lower signaling overhead and control plane latency than the centralized one.

In the next subsection, we describe a few backhaul-aware cell selection policies designed specifically for the IAB network. As explained already, in each policy, we perform a two-stage cell selection approach. The first stage is MT association, where an MT selects the existing node within the IAB topology tree, which has the largest metric, as the parent node. Then the IAB-node corresponding to the MT is appended to the tree and becomes a candidate parent node for the MTs that are not yet associated. The process continues until all MTs are connected to the network. The second stage is the UE association, where a UE selects a parent node with the largest metric.

In cellular networks, cell selection is most commonly performed using the RSRP policy, where a UE associates with the parent node providing the maximum RSRP in the access links. As MTs behave similarly to UEs, the RSRP policy applies to them too. The policy is simple to implement as BSs already provide measurements using synchronization signals. The policy, however, may increase the hopcount as the parent node with the best link quality may lead further away from the CN. Additionally, attaching too many MTs/UEs to one IAB-node may potentially lead to backhaul link congestion. Therefore, other criteria should also be considered for the MT/UE cell selection for better performance. This policy would be used as a benchmark for evaluating the relative performance of other policies discussed hereafter.

A. Backhaul-aware Cell Selection Policies

We assume that N BSs (IAB-donors and IAB-nodes), represented by BS $i,\ i=1,2,\cdots,N$, are deployed within the IAB network. We also assume that h_i and n_i as the hopcount and load information of BS i, respectively. For the MT association stage, n_i is the number of MTs associated with BS i, whereas for the UE association stage, n_i is the number of MTs and UEs associated with BS i. Suppose an MT/UE m wants to associate with the network, then it measures RSRP (in dBm) γ_{im} and SNR Γ_{im} from BS i. With this system model, we now describe each proposed backhaul-aware policy in detail in the following paragraphs. In each policy, if two or more BSs satisfy the association condition, the BS corresponding to the maximum RSRP value is selected as the parent node.

Biased RSRP policies: In these policies, an arbitrary bias B_i is added to the RSRP value γ_{im} from the BS i during cell selection. Then, the MT/UE m associates with the BS i^* that satisfy

$$i^* = \underset{i}{\operatorname{argmax}}\ \gamma_{im} + B_i. \tag{1}$$

This bias can be either broadcast by BSs or calculated by MT/UE with assistance from BSs. The bias allows for load balancing, where depending on the bias value, the BSs can control the number of MTs/UEs associated with them and therefore control traffic intensity at them. The bias can be assigned in various ways, some of which are discussed below.

a) Constant Biased RSRP (CBR) policy: The simplest way is to assign a constant positive bias B_0 (e.g. 7 dB or 10 dB) to the IAB-donors and no bias to the IAB-nodes. In such case, the UE favours the IAB-donors to reduce its hopcount.

b) Dynamic Biased RSRP (DBR) policy: A dynamic bias $B_i = B_0 \cdot \overline{h_i}$ is assigned to the BS i where B_0 is the reference bias and the factor $\overline{h_i}$ is the normalized hopcount of the BS i that is given by

$$\overline{h_i} = \frac{h_{max} - h_i}{h_{max} - h_{min}}. \tag{2}$$

In equation (2), h_{max} and h_{min} are the maximum and minimum hopcount corresponding to all BSs. The bias ensures that the MT/UE associates to an IAB-node only if its link to the IAB-node is sufficiently better than its link to the IAB-donor or other IAB-nodes having lower hopcounts.

Access Local Rate (ALR) policy: Selecting parent nodes that provide the best achievable rate to MTs/UEs would increase the overall network capacity while facilitating load balancing. In ALR policy, the MT/UE m evaluates achievable local rate (using Shannon's formula) from each BS and selects BS i^* as its parent node where

$$i^* = \underset{i}{\operatorname{argmax}}\ \frac{1}{n_i(1+h_i)} \log_2(1+\Gamma_{im}). \tag{3}$$

On average, $1+h_i$ slots would be needed between when data is introduced in the network and received by MT/UE m when served by BS i. Hence, the factor $1/(1+h_i)$ is included in the equation. The factor $1/n_i$ is the channel access probability i.e. the probability that the MT/UE m obtains a channel for transmission from the BS i. Using this policy, the MT/UE may not select a congested parent node despite its high link quality and low hopcount. For a large number of incoming MTs/UEs, this policy balances the traffic load among different BSs.

Achievable Rate of Path (ARP) policies: Each radio link in the path from MT/UE to the CN influences the performance of the IAB network. Hence, considering each link's capacity along the path while devising cell selection is expected to provide better results. Suppose MT/UE m considers BS i as its parent node, then it would encounter set P_i of radio links along its path to the CN. Given a radio link between a child node j (including the MT/UE m) and its (prospective) parent node k, the normalized capacity of the link is given by $C_j =$

$\log_2(1+\Gamma_{kj})$. After calculating normalized capacity rate of each radio link along the path, the MT/UE m can find the achievable rate of the path as R_i and thus associate with BS i^* satisfying

$$i^* = \underset{i}{\operatorname{argmax}}\ R_i. \tag{4}$$

We consider four different measures of a path from MT/UE to the CN, as described below.

a) ARP using Minimum rate (AM) policy: The worst link in the path act as a bottleneck for the performance. Thus, the rate R_i is written as

$$R_i = \frac{1}{1+h_i} \min_{j\in P_i} \Big\{ C_j \Big\}.$$

b) ARP using Harmonic mean of rates (AH) policy: If we use the inverse of the capacity of a link as the time to transmit 1 bit through that link, we can calculate R_i as

$$R_i = \frac{1}{\sum\limits_{j\in P_i} \frac{1}{C_j}} = \frac{1}{1+h_i} \underset{j\in P_i}{HM} \Big\{ C_j \Big\}.$$

c) ARP using Scaled Minimum rate (ASM) policy: It is an extension of the AM policy that also combines the channel access probability of child node j from its (prospective) parent node k in the path. Hence, we obtain R_i as

$$R_i = \frac{1}{1+h_i} \min_{j\in P_i} \left\{ \frac{C_j}{n_k} \right\}.$$

d) ARP using Scaled Harmonic mean of rates (ASH) policy: It is an extension of the AH policy that is calculated similar to the ASM policy. Here, the rate R_i is given by

$$R_i = \frac{1}{1+h_i} \underset{j\in P_i}{HM} \left\{ \frac{C_j}{n_k} \right\}.$$

Hybrid policy: It is possible to combine two different policies for the different stages, i.e., the MT association stage uses one policy and the UE association stage uses another policy. Such a hybrid policy can compensate limitations of one policy with the other policy and vice versa. For investigation purpose, we use the AH policy for the MT association and ALR policy for the UE association. The AH policy considers the backhaul information to form IAB network topology. As the ratio of the number of IAB-nodes to the number of IAB-donors is typically small, unnecessary load balance may increase hopcount and thus degrade the achievable rate of their child nodes. On the other hand, the ALR policy for the UE association takes load information of the candidate parent node into account. It makes sure access traffic load is distributed evenly across BSs.

IV. PERFORMANCE EVALUATION

In this section, we first provide necessary details on the system model used for the performance evaluation, and then discuss the simulation results and compare the different policies described in the previous sections.

A. System Model

We consider the homogeneous scenario or urban micro deployment [4] of IAB network with 19 hexagonal cell sites, out of which 7 BSs are IAB-donors and the rest BSs are IAB-nodes. There are 10 UEs dropped uniformly and randomly within each cell. The BSs and UEs are equipped with 16×16 and 4×4 uniform planar antenna arrays, respectively, at both transmitter and receiver sides. For physical layer aspects of mmWave frequencies, we use the NYU channel model as described in [14].

The performance evaluation is done through Monte Carlo simulations with 10000 independent runs for each policy. We assume that control signalings are instantaneous and don't occupy any radio resources. The system level parameters are derived from [4], [15] and the important ones are summarized in Table I.

Parameters	Urban macro scenario
Inter-site distance	200 m
Carrier frequency	28 GHz
System bandwidth	400 MHz
Subcarrier spacing	120 KHz
Thermal noise density	-174 dBm/Hz
Pathloss model	UMi Street Canyon
Antenna height	BS: 10 m, UE: 1.5 m
Transmit power	BS: 33 dBm, UE: 23 dBm
Noise margin	BS: 5 dB, UE: 13 dB
MCS index table	derived from [15]
Reference bias, B_0	10 dB

TABLE I: System and simulation parameters for IAB evaluations.

B. Downlink Resource Allocation

As access and backhaul links share the same spectrum, an IAB-node typically cannot receive and transmit at the same time slot. We assume that each time slot is 0.125 ms wide (corresponding to subcarrier spacing of 120 KHz). For throughput analysis, we consider static Time Division Multiplexing (TDM) resource allocation between backhaul and access links, as illustrated in Figure 2. With a static TDM scheme, a predefined TDM slot allocation for the backhaul links and access links is used, and the access link (backhaul link) is not scheduled in the backhaul (access) slot even if the slot is not fully occupied. Further, in each time slot, either odd-hop BSs (including IAB-donors) transmit and even-hop BSs receive or vice versa. Finally, each BS performs round robin scheduling to serve downlink traffic to its child nodes (MTs or UES).

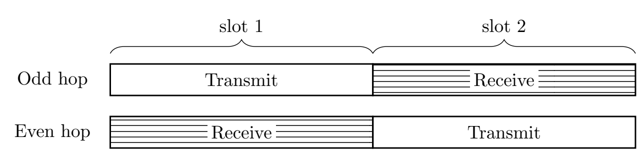

Fig. 2: Example of static TDM scheme during a slot.

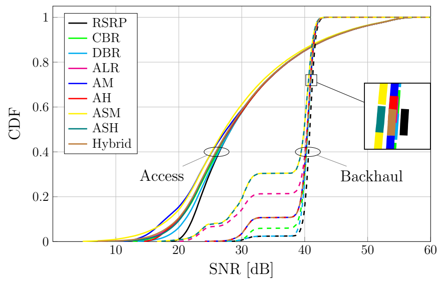

Fig. 3: Empirical CDF of SNR values for access and backhaul links.

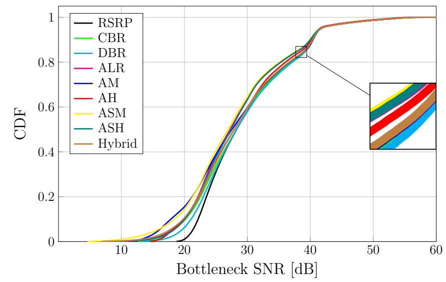

Fig. 4: Empirical CDF of bottleneck SNR values for access links.

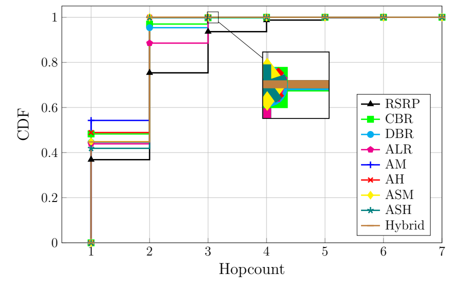

Fig. 5: Empirical CDF of hopcount for UEs.

C. Simulation Results

Figure 3 plots the CDFs of the RSRP values for both access and backhaul links with different cell selection policies. The figure clearly illustrates the improved link quality of backhaul links compared to the access links due to the height advantage, better propagation condition and larger antenna array size. For example, the 5 percentile and 50 percentile values of the backhaul link distributions experience roughly $12-20$ dB and 12 dB gains, respectively, over the access links. This trend advocates the capability of IAB-nodes in improving spectral efficiency compared to regular access links. In the same figure, we observe that when RSRP is no longer the only criterion for cell selection, the distributions become worse. The deterioration is mainly significant in the backhaul links and not in the access links.

In Figure 4, we show the CDFs of the bottleneck SNR, i.e., the SNR of the worst link in the path from UE to the CN, for different cell selection policies. It can be observed that all the policies have similar bottleneck SNR performance; however, the RSRP policy delivers the best performance among them. This behaviour is also noticeable in figure 3, where the RSRP policy has superior distributions than other policies, especially in the backhaul links. The reason is that considering latency or load information during cell selection sometimes compromises the link quality as MT/UE may not select the 'best' link when selecting the parent node. However, it would be evident later that considering additional criteria for cell selection not only improves hopcount and load balancing in the IAB network but also increase network capacity and is therefore duly reasoned.

Figure 5 shows the distribution of hopcount of access UEs for different cell selection policies. The first thing we see is that the RSRP policy may have hopcount up to 7 as the policy only is based on RSRP value and there is no restriction on hopcount. On the contrary, the backhaul-aware policies are designed to minimize the hopcount and thus have better distributions. In fact, the ARP policies more aggressively reduce the hopcount having a maximum hopcount of 2 for UEs. Typically, an IAB network with more hopcount can have a much higher chance of serving wireless backhaul with line-of-sight links. However, it also worsens latency and throughput and severely impacts the timing-related issues for the MTs/UEs. Hence, there should be a balance between these two aspects in order to derive the benefits of the IAB network.

In Figure 6, we show the load balance index for each cell selection policy. Here, the term 'load' is used for indicating the number of MTs/UEs that are eventually served by a certain IAB-donor. Hence, we define the load balance index, derived from Jain's fairness index [16], to measure the network-wide fair load distribution. Jain's fairness index is often used to measure the fairness of shared resource allocation among contending entities. Similarly, in this case, we aim to measure the quality of the load balance among IAB-donors. If x_i is the number of downstream MTs/UEs within IAB-donor i and N_d is the total number of IAB-donors, then the load balance index is evaluated as $\frac{\left(\sum_{i=1}^{N_d} x_i\right)^2}{N_d \sum_{i=1}^{N} x_i^2}$. The load balance index value ranges from $1/N_d$ (the worst fairness) and 1 (the best value is when all IAB-donors have the same load). In the figure, we can observe that the RSRP policy has the worst load balance index. However, if we consider load information as a criterion, MTs/UEs should be distributed in a more balanced manner among different IAB-donors. This is apparent from the figure as ALR, ASM and ASH policies result in excellent load balance indexes. The other policies have roughly similar load balance index and can do fair load distribution across IAB-donors. It means that latency information also helps in load balancing in the IAB network. We also note that UEs are more evenly distributed among IAB-donors than the MTs.

Finally, we set up simulations to do a throughput analysis of the cell selection policies. In this case, 20 independent runs are performed for each policy. We use light and heavy source traffic models where the network is sending data in the downlink with a constant bit rate of 50 and 500 Mbps, respectively, for each UE. The second simulation setup particularly examines IAB network performance in a saturated state, where the access and backhaul links are continuously used. Figure 7 shows the percentage improvement of average UE throughput and cell-edge throughput of different cell selection policies over the RSRP policy. The first thing we observe that, in heavy traffic setup, cell-edge throughputs have significantly improved (by $70\%-225\%$) by considering latency and/or load information during cell selection. In fact, ARP policies have registered at least 138% improvement on cell-edge throughput. In contrast, under the light traffic setup, the gains are not as significant as those for the heavy traffic setup, but ASM and

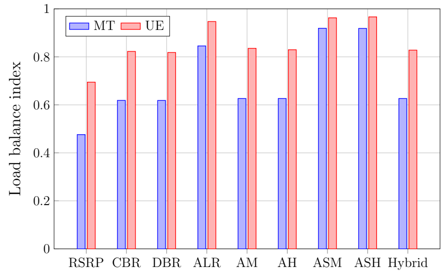

Fig. 6: Load balancing in the IAB network for MTs and UEs.

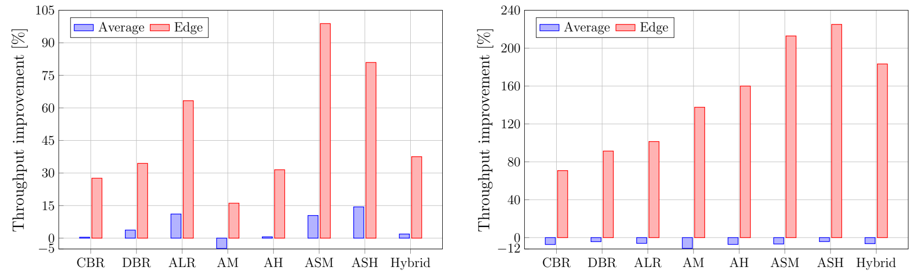

Fig. 7: Average UE and cell-edge throughput comparison for different policies with RSRP policy as the benchmark in the light and heavy traffic setup, respectively.

ASH policies still cross the 75% mark. This trend validates the notion that deciding the parent node should be based on the path from MT/UE to the CN as each backhaul link in the path also contributes to the system performance. Each backhaul-aware policy attempts to ensure that downlink access traffic reaches intended UEs in fewer hops, MTs/UEs maintain high-quality links to their parent nodes and network-wide load is distributed evenly across BSs.

In the same figure, we also observe that the policies have degraded, although marginal, average UE throughput than the RSRP policy when under heavy traffic setup. The maximum degradation of -11.3% on average UE throughput has been observed for the AM policy. The reason for such a behavior is that because the network is saturated, the policy pushes certain UEs with better access links to parent nodes providing inferior links to improve cell-edge throughput. However, in the light traffic setup, except for the AM policy, all policies increase the average UE throughput, with the ASH policy achieving up to 14.4% gain. In the end, we can conclusively say that the ASM and ASH policies can be preferred during IAB cell selection procedures. Both the policies provide remarkable cell-edge throughputs while still managing average UE throughput degradations in heavy traffic setup to an acceptable limit.

V. Concluding Remarks

Ultra-densification is considered one of the key enablers to achieve the capacity objectives set for the upcoming 5G networks. However, connecting ultra-dense cells to the CN through the wired backhaul may not be feasible. IAB is a promising solution that enables economical and faster ultra-dense deployment of 5G cells. IAB is defined when access and wireless backhaul links share the same spectrum. Thus, IAB relay access traffic to the CN wirelessly, thereby removing the need for wired backhaul in all the BSs. However, the use of mmWave backhauling and multihop topology imposes hindrances on the effective performance of the IAB network.

Cell selection is one of the open research problems in IAB networks. Many cell selection policies that are designed for single-hop cellular networks become impractical when applied to the IAB network. Such policies may lead to low resource utilization and load balance in the IAB network. In this paper, we present a few cell selection policies specifically designed for IAB networks. These policies are developed by considering the backhaul constraints and network requirements of multihop relaying topology. In this direction, we have investigated backhaul-aware policies by including latency and load information as cell selection criteria.

The performance of these policies is studied using system-level simulations. The preliminary results show that these policies can achieve up to 99% and 225% gain in cell-edge throughput compared to the RSRP policy under light and heavy traffic setup, respectively. The policies decrease the number of hops if latency information is considered. It was shown that latency information helps in load balancing in the IAB network. The load balancing across the network could be further improved by taking load information into account while devising a policy. Finally, we observed that the average UE throughputs of the policies marginally degrade compared to the RSRP policy under heavy traffic setup. This degradation is, however, eclipsed by improved cell-edge throughput, hopcount and load balance, and therefore well justified.

Our paper has demonstrated that a multihop IAB network is realizable by adopting intelligent cell selection policies that consider backhaul constraints as decision criteria. Using these policies, a faster and flexible rollout of 5G networks can be achieved with significantly reduced deployment cost.

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