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DYNAMIC PHYSICAL RESOURCE BLOCK (PRB) ADAPTATION TECHNIQUES FOR MULTI-PROTOCOL ACCESS POINTS

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ABSTRACT

Presented herein are techniques that provide for the ability to modify Physical Resource Block (PRB) allocation for a multi-protocol access point (AP) when encountering a limited fronthaul environment and/or when encountering thermal and/or power constraints.

DETAILED DESCRIPTION

Some equipment manufacturers may desire to develop a combination Wi-Fi/5G product platform, which is a complex product that includes two radios that are independent in operation, yet interdependent in the utilization of AP platform resources. In constructing high-capability, multi-function, multi-protocol APs, oversubscription issues can sometimes occur that may impact instantaneous fronthaul bandwidth and/or platform thermal/power limitations. Rather than reducing Radio Frequency (RF) power or shutting features or capabilities off (the conventional adaptation means), a more graceful adaption is desired that doesn't affect cell range or mobility.

This proposal involves techniques in which the 5G personality of a platform, whether it is a Radio Unit (RU) or a complete gNode B (gNB), may derate its fronthaul requirements and impact on the thermal budget by throttling PRB allocation in the downlink, and, in some instances, uplink (UL) grants to user equipment (UE). The throttling may achieve a desired affect without impacting transmit (TX) power (and therefore range) or Multiple Input Multiple Output (MIMO) order (and therefore Modulation and Coding Scheme (MCS)). In essence, a Layer 2 (L2) scheduler, whether local or in a remote Distributed Unit (DU), can throttle user plane throughput in response to one or more of:

- Fronthaul bandwidth (BW) re-allocation (e.g., due to changing UE/client demands between Wi-Fi and 5G, if the network connection is oversubscribed);
- A need for thermal deration (e.g., if the unit is getting too hot);
- A need for power deration (e.g., if the unit isn't getting full power from a Power over Ethernet (PoE) switch);
- In an RU application, the RU can communicate its condition to the DU and L2 scheduling can be performed to accommodate lower downlink (DL) and UL utilization;
- In a gNB application, the gNB can adapt its own L2 scheduler locally;
- The Wi-Fi section may do likewise, may throttle, or may disable sections in conventional fashion.

Techniques of this proposal may be implemented by a machine learning algorithm with inputs from the Network Subsystem (NSS) layer (e.g., a hardware accelerator section for the wired side, which may provide data rate statistics on the fronthaul/network connection) and thermal sensors that may be configured for an AP. For example, Figure 1, below, illustrates example details of a system that may be utilized to facilitate techniques of this proposal. As illustrated in Figure 1, the system may include a Multi-Access Resource Manager (MARM), a Wi-Fi sub-system to facilitate Wi-Fi access for one or more users, and a 5G subsystem to facilitate 5G access for one or more users.

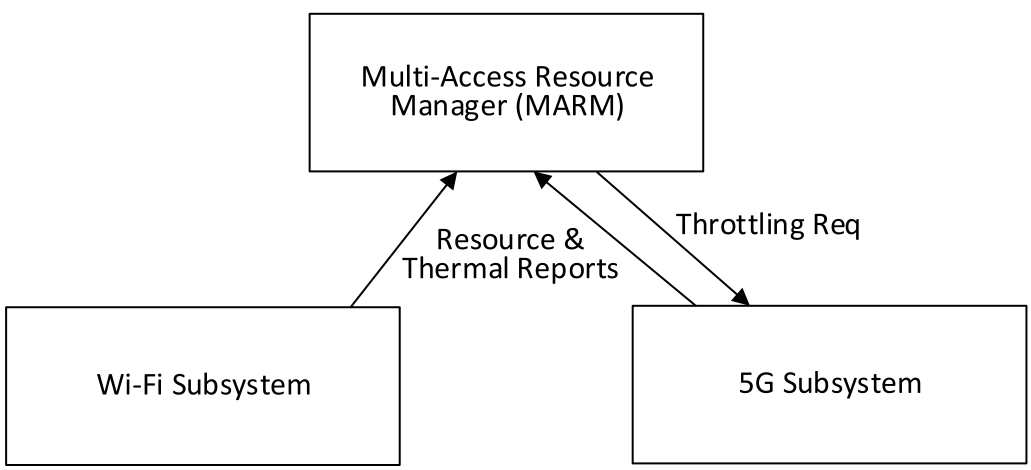

Figure 1

During operation of the system illustrated in Figure 1, both the Wi-Fi sub-system and the 5G subsystem may report resource utilization metrics, fronthaul load, and/or thermal loading of the system to the MARM. In some instances, a resource utilization report can also include a load share metric indicating an allocation between higher priority users versus lower priority users. Based on the reports, the MARM will determine if there is a need to throttle down or release a throttle for PRB allocation for the 5G subsystem.

For example, if the MARM detects that demand on the Wi-Fi access has increased and/or that the temperature of the system is increasing, the MARM can determine to rate down the bandwidth/PRB allocation on the 5G subsystem. The MARM will process resource reports from the 5G subsystem and, based on the amount of bandwidth that is being utilized by higher priority users on 5G, can determine the amount of bandwidth that can be throttled to increase the fronthaul needs of Wi-Fi.

For example, the MARM can determine whether bandwidth that is being used by non-priority users on the 5G access can offset the demand on the Wi-Fi access. Based on a determination that bandwidth being used by non-priority users on the 5G access can offset the demand on Wi-Fi access, the MARM can proceed further to increase the Wi-Fi fronthaul bandwidth. However, based on a determination that bandwidth being used by non-priority users alone will not offset the demand, the MARM may also take away additional bandwidth from high priority users (e.g., based on a policy, etc.). Upon determining an amount of bandwidth that is to be throttled, the MARM can inform the amount of bandwidth to the 5G L2 scheduler for the 5G subsystem and the 5G L2 scheduler will schedule users within the PRB/bandwidth constraints imposed by the MARM.

Similar operations/logic may be performed for thermal considerations. In various implementations, MARM behavior can be controlled and/or managed via policy parameters that may include thresholds, priorities between access technologies, combinations thereof, and/or the like.

In summary, techniques proposed herein may provide for the ability to modify PRB allocation when encountering a limited fronthaul and/or when encountering thermal and/or power constraints for combination Wi-Fi/5G an access point.