We need to find an optimal way to share the downlink capacity of the system among spot-beams so that the queues are utilized efficiently, and flows are served at maximum sustainable rates at the NOC.

Each flow \( f_i \), is assigned a time-share \( w_i \) of the burst duration of the beam \( B_j \), based on the load of the queue and the type of the flows forwarded to the queue. \( M \) beams share access to \( N \) antennas, and the beam \( B_j \) gets a time-share \( w_j \) of the frame duration of the antenna it is assigned to.

For a packet belonging to a unicast flow is forwarded to a single beam queue, corresponding to the location in which the user resides.

In a multicast flow, users may reside in multiple beam locations, and packets need to be duplicated and stored in multiple spot-beam queues.

Therefore, we want to find the optimal vector \( w = (w_1, w_2, \ldots, w_M) \) that would minimize the variance of the rates of a flow across beams for all flows:

\[
\text{argmin} \sum_{i} \left( \frac{w_i}{N_i} \right)^2
\]

where \( \sum_{i} \frac{1}{N_i} = 1 \), and \( N_i \) is the number of beams flow \( f_i \) is forwarded to such that:

\[
0 \le w_i \le 1, \quad \forall i
\]

and \( A_n \) is the set of beams accessing antenna \( n \).

The solution vector, \( \{w_1, w_2, \ldots, w_M\} \) is given in close form:

\[
\left( w_1, w_2, \ldots, w_M \right) = \frac{1}{N} \left( \frac{1}{N_1}, \frac{1}{N_2}, \ldots, \frac{1}{N_M} \right)
\]

We observe that this optimization in general benefits a small number of multicast flows.

In Table 2 shows the results when the system is loaded with 20 active unicast flows and 50 active multicast flows as averaged over 500 session configurations.