Math from paper [20] –

is a multidimensional adaptation function defined in the space **A** (it is a vector and each represents a different adaptation operation). Essentially this equation states that the correct adaptation function to choose (as in, how to scale the video, which operation to choose, etc.) should maximize the **utility** (), in our case being the perceived user experience **or** the PSNR. The constraint is simply the available resource, in our case the bandwidth of the network, and , the new resource requirement due to the adaptation, should be less than this. This is essentially saying the same thing as . In addition, we assume that , the total bitrate of the video after the adaptation operation. The quality resolution is then calculated as:

In our proposed solution, we select the spatial resolution () and temporal resolution () from a discrete set of values, then calculate the value of as a result of these selections. We can call these sets **C** and **S**, respectively, where is spatial resolution and , and is temporal resolution . We assume that can be determined within a reasonable degree of accuracy. We then heuristically select a value for K, representing the percentage of available bandwidth that is acceptable to fill. This allows us to select values from **C** and **S** that will fulfill the utility based on the user’s preferences.

To satisfy equation (utility equation), we use the user’s class as determined by their profile. With four possible classes, we have four adaptation operations to choose from for each . These four operations should maximize the user experience, being one of the following: high frame rate and size, high frame rate only, high frame size only, or low frame rate and size.

Assume **C** has n values and **S** has m values and we are given the value , the minimum allowable bit allocation:

: Select and , is determined by satisfying (main equation)

: Set and ; Select such that (main equation) is satisfied; Select increasing values for

The adaptation model we employ should reflect this math. The point is to select an operation which will maximize the utility. The way that we select this operation is based on the class the user falls into. It could even be one operation and a set of coefficients (weights) that are determined based on the user’s class.