An assessment of various automatic block topology generation techniques for creating structured meshes has been performed in the first part of the paper. The objective is to find out optimal blocking methods for generating meshes suitable for flow simulations. The comparison has been carried out using an adjoint-based error analysis of the meshes generated by these block topologies. Different objective functions and numerical schemes have been used for this assessment. It is found that, in general, the medial axis-based approaches provide optimal blocking and yields better accuracy in computing the functional of interest. This is because the medial axis-based methods produce meshes which have better flow alignment specially in case of internal flows. In the second part of the paper, the adjoint-based error indicator has been used to adapt the block topology in the regions of large error.