This talk focuses on presenting the current capabilities in high-order mesh generation and new developments in adaptive methods within the high-order hp/spectral framework Nektar++ and its mesh generator NekMesh.

The theoretical foundations of the variational framework used to generate high-order meshes and drive adaptation will be presented first. We then propose a CAD curve-driven a priori h-refinement implemented in this framework and describe its application to Tokamak geometries.

The advantages and disadvantages of a posteriori p, r and h-refinement approaches will be discussed within the context of compressible flow simulations. We will discuss how to best utilize these methods to improve the resolution of such simulations that exhibit regions of smooth flows separated by discontinuities. An application of error-driven r, p and rp-adaptation for compressible flow will be used as an illustration of these issues. Finally, we will present our current work on a posteriori adaptation.