Requirements for a 3D mapping framework:

- Probabilistic representation
    - Mobile robots sense the environment by taking 3D range measurements
    - The underlying uncertainty has to be taken into account probabilistically
- Modelling of unmapped areas
    - Robots can plan collision-free paths only for sensor measurements
    - Unmapped areas should be avoided and for this reason should be represented in the map
- Efficiency

Octrees avoid the main shortcomings of fixed grid structures. They don't delay the initialisation of map volumes until measurements need to be integrated. Therefore the extent of the mapped environment does not need to be known beforehand and the map only contains volumes that have been measured.

OctoMap is available as a self-contained C++ library for this.

An OpenGL-based 3D visualisation application is available with the library to view stored octree files and to incrementally build up maps from range data.

PointCloud contains points, a point3d_collection which is a vector of 3-vector's of xyz