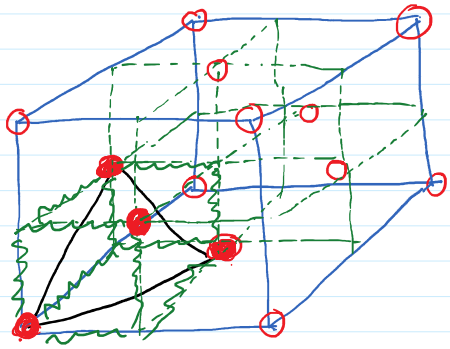
Locating tetrahedral and octahedral voids

a) Tetrahedral voids.

i) Consider a ccp or fcc lattice unit cell, and divide the unit cell into 8 small cubes



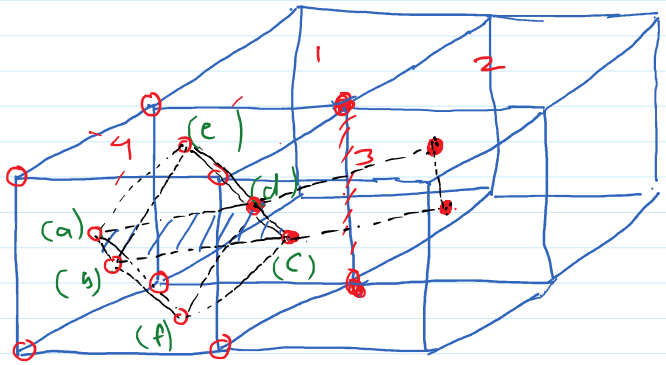
ii) Each small cube has 4 atoms. When joined to each other, they make a regular tetrahedron.

iii) Thus, there is one tetrahedral void in each small cube and eight tetrahedral voids in one unit cell.

b) ccp or fcc lattice has 4 atoms per unit cell. Thus, the number of tetrahedral voids is twice the number of atoms.

b) Octahedral voids.

i) Consider a ccp or fcc lattice unit cell. The body centre of the cube is surrounded by six atoms on face centres.



ii) On joining these faces, an octahedron is generated. Thus this unit cell has one octahedral void at the body centre of the cube.

iii) Besides the body centre, there is one octahedral void at the centre of each of the 12 edges. It is surrounded by six atoms, four belonging to the same unit cell (2 on the corners and 2 on face centre) and two

belonging to two adjacent unit cells.

IV) Each edge of the cube is shared between four adjacent unit cells, hence $\frac{1}{4}^{th}$ of the octahedral void located on it, belongs to the unit cell.

V) Total number of octahedral voids = (Octahedral void at the body centre) + (Octahedral voids at edge centre x contribution of void at edge centre towards unit cell)

$= 1 + \left(12 \times \frac{1}{4}\right) = 4$

VI) In ccp structure, each unit cell has 4 atoms. Thus the number of octahedral voids is equal to number of atoms.