The structure of a typical ionic solid - sodium chloride : how the ions are arranged in sodium chloride

Sodium chloride is taken as a typical ionic compound. Compounds like this consist of a giant (endlessly repeating) lattice of ions. So sodium chloride (and any other ionic compound) is described as having a giant ionic structure.

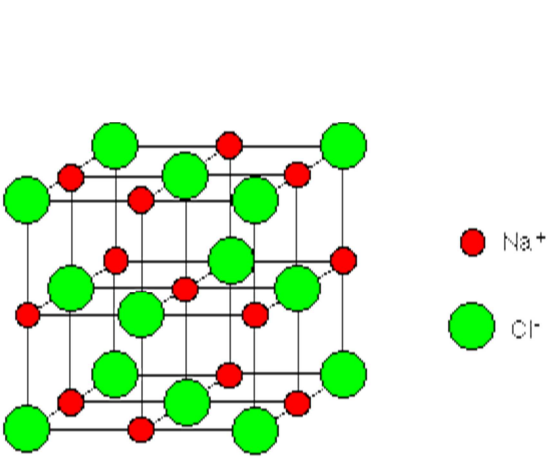
You should be clear that giant in this context doesn't just mean very large. It means that you can't state exactly how many ions there are.

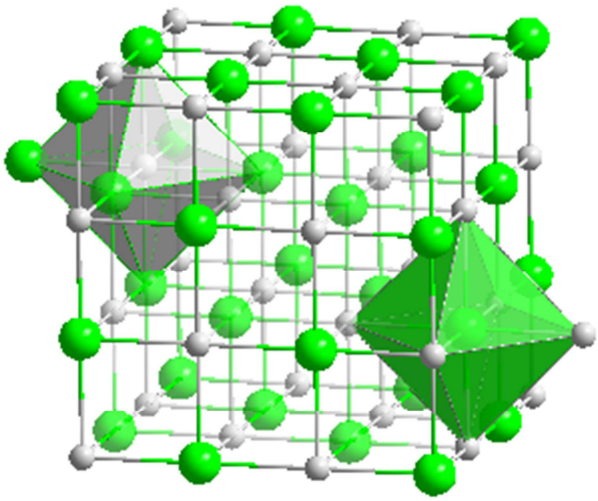
There could be billions of sodium ions and chloride ions packed together, or trillions, or whatever - it simply depends how big the crystal is. That is different from, say, a water molecule which always contains exactly 2 hydrogen atoms and one oxygen atom - never more and never less.

A small representative bit of a sodium chloride lattice looks like this:

If you look at the diagram carefully, you will see that the sodium ions and chloride ions alternate with each other in each of the three dimensions.

This diagram is easy enough to draw with a computer, but extremely difficult to draw convincingly by hand. We normally draw an "exploded" version which looks like this:





Only those ions joined by lines are actually touching each other. The sodium ion in the center is being touched by 6 chloride ions. By chance we might just as well have centered the diagram around a chloride ion - that, of course, would be touched by 6 sodium ions. Sodium chloride is described as being 6:6-co-ordinated.

You must remember that this diagram represents only a tiny part of the whole sodium chloride crystal. The pattern repeats in this way over countless ions.

Why is sodium chloride 6:6-co-ordinated?

The more attraction there is between the positive and negative ions, the more energy is released. The more energy that is released, the more energetically stable the structure becomes.

That means that to gain maximum stability, you need the maximum number of attractions. So why does each ion surround itself with 6 ions of the opposite charge?

That represents the maximum number of chloride ions that you can fit around a central sodium ion before the chloride ions start touching each other. If they start touching, you introduce repulsions into the crystal which makes it less stable.

http://www.chemguide.co.uk/atoms/structures/ionicstruct.html
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