Abstract of the introductory talk by Octave Curmi. This talk aims at providing an introduction to some concepts from singularity theory, and in particular singularities of complex surfaces, and their relation to low-dimensional topology.

A point of a complex surface is called *singular* if the surface is not locally *smooth* at that point, as is the case for example at the intersection of two lines. Given a singularity of complex surface, one can compute a so-called *resolution* of the singularity, which consists somehow in a desingularization of the surface. Such an objet can be encoded by a graph. It is a classical result in topology of singularities that this graph also encodes a 3-dimensional manifold associated to the singularity, namely its *link*, which encodes the topological type of the singularity.

The graph, in turn, provides a *lattice*, that is, a free group of rank equal to the number of vertices. I will expose the concepts defined above and explain how one can build so-called *weight functions* on the underlying vector space, leading to specific cubical complexes.

This will be an introduction for Némethi András's talk, who will explain some of the geometrical and topological meaning of the cohomology of those cubical complexes.

Abstract of the main lecture by András Némethi. By this talk we wish to focus an a beautiful amalgam of combinatoric, topology and algebraic geometry via a new invariant. The lattice cohomology is a bridge which connects the 3-dimensional topology with the theory of algebraic varieties. The first version (the 3-dimensional topological version) is an invariant of those 3-manifolds which are links of complex surface singularities. This can be compared with Heegaard Floer cohomology of such 3-manifolds. Later the analytic version also was constructed, which is able to code several analytic invariants of the analytic germ as well. This can be related e.g. with certain Hodge theoretical invariants. The definition is based on the mutual position of weighted lattice points in a higher rank lattice.