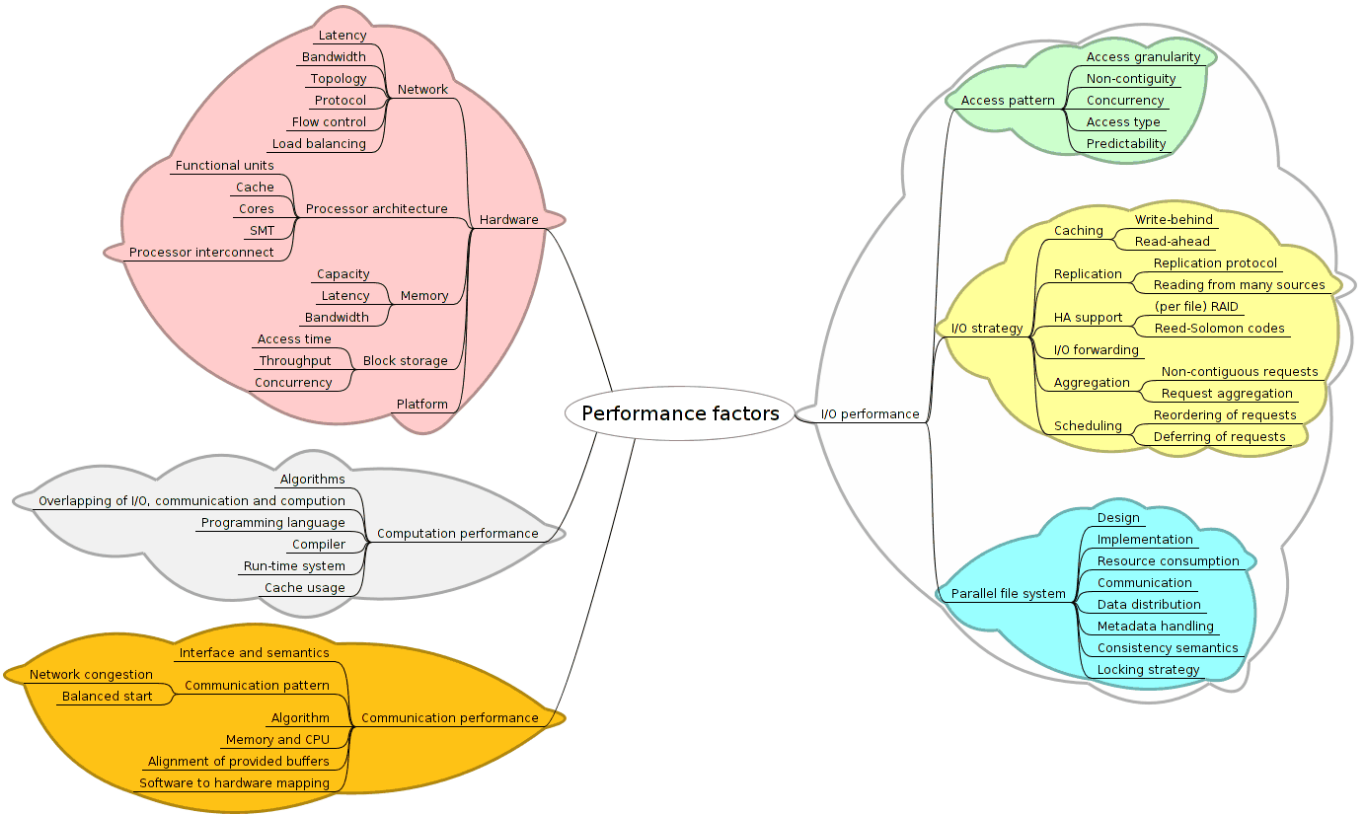

Figure 2.6.: Performance factors. Hardware aspects are orthogonal to computation, communication and I/O performance.

hardware components to contribute to one computation[11]. Intermediate I/O such as for checkpointing are similar to communication in that respect.

Generally, scientific applications are typically composed of *phases* of activity. Consequently, some regularity of computation, communication and I/O phases is expected. Former evaluations showed that most scientific applications tend to regularly access data with similar patterns [MK91, PP94, SACR96, Rot07, CHA+10].

Relevant characteristics and factors are summarized in Figure 2.6. Note that all hardware and software components have diverse character and performance limitations and thus this list does not claim to be complete. Main goal of the discussion is to increase awareness of the diversity of the performance influences and optimization potential.

The optimization strategies introduced are a double-edged sword: On the one hand, they posses the potential to improve performance. On the other hand, they might be counter productive by degrading performance in some cases. To mitigate the risk of performance degradation, exact knowledge of the processing layers below is necessary; then, optimizations could be turned off if they are not appropriate for the situation.

2.2.1. Performance Relevant Hardware Components and Software Layers

In an abstract view all hardware components and software layers which are involved in executing an application contribute to the observable activity and measurable performance – refer to Section 1.1.2 on Page 7 for more detail on software layers in parallel scientific applications.

[11] Reduction operations, as part of many parallel programming models actually perform some wanted calculation, but this could be done without communication as well.