

# Hitchhiker Guide to Hardware Maintenance

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# Outline

## Why?

- Performance

- Heat

- Damage prevention

## How?

- Questions?

# Performance

# Heat

Integrated circuits (e.g., CPU and GPU) are the main generators of heat in modern computers. Heat generation can be reduced by efficient design and selection of operating parameters such as voltage and frequency, but ultimately, acceptable performance can often only be achieved by managing significant heat generation. The dust buildup on this laptop CPU heat sink after three years of use has made the laptop unusable due to frequent thermal shutdowns. In operation, the temperature of a computer's components will rise until the heat transferred to the surroundings is equal to the heat produced by the component, that is, when thermal equilibrium is reached. For reliable operation, the temperature must never exceed a specified maximum permissible value unique to each component. For semiconductors, instantaneous junction temperature, rather than component case, heatsink, or ambient temperature is critical.

Cooling can be changed by:

Dust acting as a thermal insulator and impeding airflow, thereby reducing heat sink and fan performance. Poor airflow including

## Damage prevention

Because high temperatures can significantly reduce life span or cause permanent damage to components, and the heat output of components can sometimes exceed the computer's cooling capacity, manufacturers often take additional precautions to ensure that temperatures remain within safe limits. A computer with thermal sensors integrated in the CPU, motherboard, chipset, or GPU can shut itself down when high temperatures are detected to prevent permanent damage, although this may not completely guarantee long-term safe operation. Before an overheating component reaches this point, it may be throttled until temperatures fall below a safe point using dynamic frequency scaling technology. Throttling reduces the operating frequency and voltage of an integrated circuit or disables non-essential features of the chip to reduce heat output, often at the cost of slightly or significantly reduced performance. For desktop and notebook computers, throttling is often controlled at the BIOS level. Throttling is also commonly used to manage temperatures in smartphones and tablets, where components are packed tightly

# Questions?

Go ahead, ask me anything (hardware related ^^).