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WHEN COMPUTERS GET HOT
THE COOLING PROBLEM IN DATA CENTERS

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ABSTRACT

Data centers, where thousands of very powerful computers are placed, have become an essential part of any modern business. These computers generate a significant amount of heat and must be properly cooled for their uninterrupted operation. With a variety of complex layouts of data centers and ever-increasing heat loads, it is a major challenge to ensure that all computers are adequately cooled. Also, there is a renewed emphasis on using minimum amount of energy to provide the required cooling.

Rather than performing costly and time-consuming trial-and-error, we can use computational simulation to address this problem. We can build a computer model of the data center and calculate the complete distribution of airflow and temperature in it. Such a simulation allows us to assess the effectiveness of cooling, examine proposed changes in the layout, perform "what-if" studies, evaluate new cooling strategies, and optimize the cooling. The simulation results also enhance our understanding of the flow and temperature patterns and guide us towards improved designs.

The lecture will describe the concept of a data center, outline its cooling design, and show the effect of important design parameters. A number of interesting case studies will be shown via pictorial representations of airflow and cooling. Finally, the results of the computational simulation will be compared with measurements performed in real-life data centers.