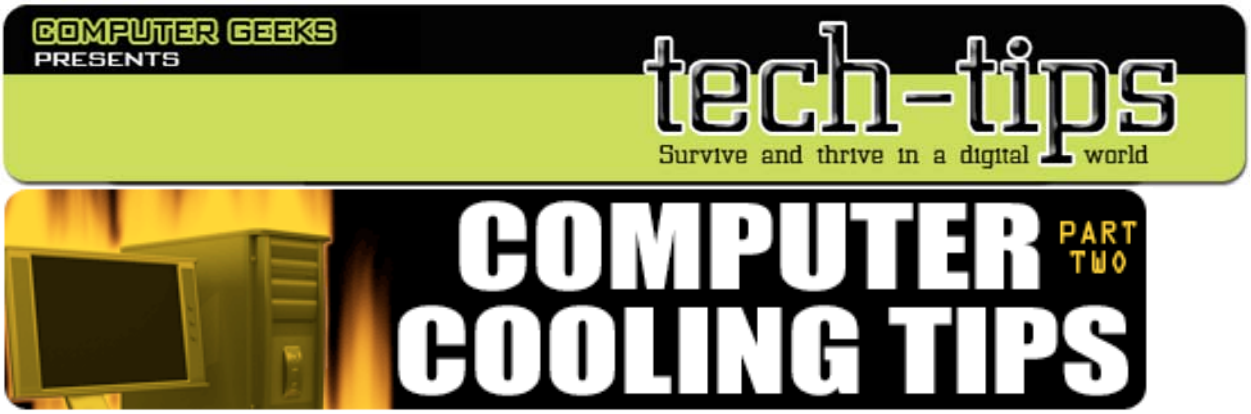

Tech Tip 52 – Computer Cooling Tips, Part 2
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Last week we went over the basics of cooling your computer and covered the essentials of keeping your system running cool. This week, we will go over some key features to look for to keep your components running cool.

1. The Geek Explanation of Where the Heat Comes From

Almost all digital computer circuits are built out of MOS transistors. MOS transistors are tiny electronic switches that pull the logic gate output up for a logical one and down for a logical zero. All the operations of your computer are done with ones and zeros – lots of them. These MOS transistors are very efficient when they are holding a logic state, one or zero. When the circuit changes state from zero to one or from one to zero, it draws a spike of electrical current that is then dissipated as heat.

So think about all the circuits in a modern microprocessor or CPU. Standard 32 Bit microprocessors [http://www.geeks.com/details.asp?invtid=P42800B478-N&cat=CPU] might have 42 million transistors. 64 Bit CPUs [http://www.geeks.com/details.asp?invtid=ADA2800AEP4AX-NB&cat=CPU] can have over a hundred million transistors, while Dual Core microprocessors [http://www.geeks.com/details.asp?invtid=ADA3000DAA4BP-NB&cat=CPU] have twice that.

The first PC hit the market with a clock speed of about 1 Megahertz. That means that the signal that controls the electronic switches allowed them to change state at up to 1 million times per second. Now, we are seeing microprocessors with clock rates at 2,000, 3,000 and even 4,000 times faster. A chip with a 3.2 GHz rating runs at 3.2 billion cycles per second. That generates a lot of heat!

2. Copper Isn't Just for Pennies

One of the keys to high performance heat sinking is the use of copper in the critical areas to ensure the maximum transfer of heat. The measure of heat transfer is W/M-K or Watts per meter-degree. Most heat sinks are made of aluminum with a transfer characteristic of 237 W/M-K. Copper, the base metal in pennies, is considerably better at 401 W/M-K. Only silver is better than copper at 429 W/M-K, but the improvement does not warrant the extra cost of pure silver.

The best traditional style CPU coolers [http://www.geeks.com/details.asp?invtid=CF481B8&cat=FAN] use a copper core heat spreader to move the heat from the lid of the CPU to the base of the aluminum heat sink.

3. Sleeve Bearing Verses Ball Bearing Fans

Many computer fans spin on sleeve bearings. Sleeve bearing fans are the cheapest to manufacture because it is just a steel shaft turning against a block of brass or other soft metal lubricated with oil. Sleeve bearings can work well in many applications, but the slightest wear can allow the fan blades to wobble, making them inefficient for your precious CPU.

High-quality fans turn on ball bearings. Hardened steel balls allow the shaft to turn freely without wobble and without excessive wear. The free turning gives the fan the ability to move more air from the same electrical input. Because they don't wobble, CPU coolers or case fans equipped with ball bearings tend to be quieter too.

4. Peltier Junction Coolers

What's some French guy with a funny name got to do with cooling off your CPU? A lot of people thought the thermoelectric cooler invented by a watch maker in 1834 would be the most hi-tech way to pull the heat out of a hot microprocessor chip. Over a hundred years ago, they were freezing drops of water with Peltier Junctions merely by passing a current through the device. Sounds like the ideal cooling gadget, right?

Lots of high priced CPU coolers were sold on this premise. The problem is that the Peltier Junction cooler just removes heat from one side of the device to the other. That means you can have a cold face to put on your CPU package (good), but the other face has the heat from the CPU as well as the heat generated by the current to run the Peltier device (very bad). You would need a massive heat sink to cool the cooler!

5. Satellite Technology Under Your Desk?

When satellite designers were faced with the problem of removing heat from the side of the spacecraft facing the sun and moving it to the shadow side where it can be radiated off into space, they were kind of stuck. They couldn't use a massive aluminum or copper heat conductor because the weight of the satellite had to be minimized. The solution they came up with was the heat pipe.

A heat pipe is literally a piece of pipe with the ends sealed off. Inside there is a fluid that evaporates when heated. The evaporation quickly cools the end of the heat pipe where the heat is applied. The vapor then condenses on the cooler end of the heat pipe causing that end to warm up. A wick moves the condensed liquid back to the hot end where it starts the cycle all over. CPU coolers [http://www.geeks.com/details.asp?invtid=CF450B0&cat=FAN] based on heat pipes can move more heat to a wider area than any solid metal CPU cooler. The heat sink can be shaped to better take advantage of the cooling air from the fan.

Overall, a CPU cooler outfitted with heat pipes can be smaller, lighter and more efficient than standard types.

6. A Cooling Tower for Your Computer?

Those round towers outside atomic power plants are a symbol of the nuclear age. They seem sinister with their strange narrow waist and the white plume billowing out the top. But what most people don't realize is that those huge cooling towers are just a way to convert hot water into cool water to remove heat from the reactors. The white cloud over it is really just water vapor from the cooling process.

If liquid cooling is powerful enough for atomic reactors that have to dissipate the waste heat from generating billions of watts of electricity, why not use liquid cooling on your CPU. [http://www.geeks.com/details.asp?invtid=EC-WC-201] The small heat exchanger sits on top of the CPU and pulls the heat into the liquid. The hot liquid flows through a hose to the external heat exchanger where cool air is blown by a fan over the coils containing the hot liquid. The cooled liquid is then pumped back through another hose to start the cycle again, not unlike a car radiator. Liquid cooling provides a super-efficient way to remove dangerous heat out of a tight spot in your computer where blowing adequate cooling air is a problem.

7. Hot-Rodding Your Case Fan

The best scenario for proper system cooling is having a well-designed computer case.

[http://www.geeks.com/details.asp?invtid=XK-TA1&cat=CAS] Newer computer cases are designed with ventilation in mind. Most cases will have at least four spots inside the case to mount fans (if they don't come with fans already). The fans [http://www.geeks.com/products_sc.asp?cat=372] included with most cases should be upgraded for better cooling. Some case fans have LED lights that will give your computer case a makeover.

If noise is a concern, even after using the ball bearing fans, an insulation kit [http://www.geeks.com/details.asp?invtid=NOISEBUSTER&cat=CAS] is an ideal way to eliminate the pesky rattle heard from fans.

Final Words

Our PCs have come a long way from a simple plastic microprocessor plugged into a socket to a sophisticated ceramic or metal clad CPU hiding under of pile of exotic cooling gadgets. The processor on your video card probably has more computing capability and more memory than your last computer. It will need its share of cooling capacity, so don't buy the cheapest CPU cooler on the shelf and hope for the best. A good CPU cooler and an extra case fan can be the ticket to a long and uneventful life for your computer. If you are pushing the limits of computing performance, then you will need the highest performance coolers.