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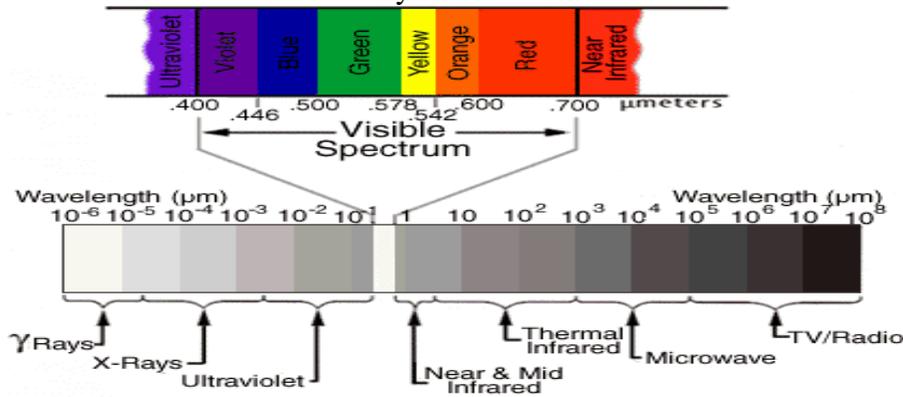
Infrared Thermographic Report
For
SAMPLE FOR AIR EFFECTIVENESS FOR SERVERS



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What is Infrared?

- IR is part of the electromagnetic spectrum discovered in the 1800's
 - By William Hershel



IR 101

- The IR imager sees emitted energy in the IR spectrum range from (shortwave) 3-5 microns (longwave) 7-13 microns.
- The amount of energy is seen through the imager. The reason everything is colored is to give the eye something to interpret.
- Interpretation is key with Thermography.

How Infrared can help Commissioning

Commissioning is the process where by the system is put through its sequence of operation at its design. There are many tools and techniques to start up and check out systems. Buildings all have their own special issues not in the design, that's why we commission.

- Infrared Thermography can help as a great tool to help locate and even show why certain things don't work properly.

Building HVAC 101

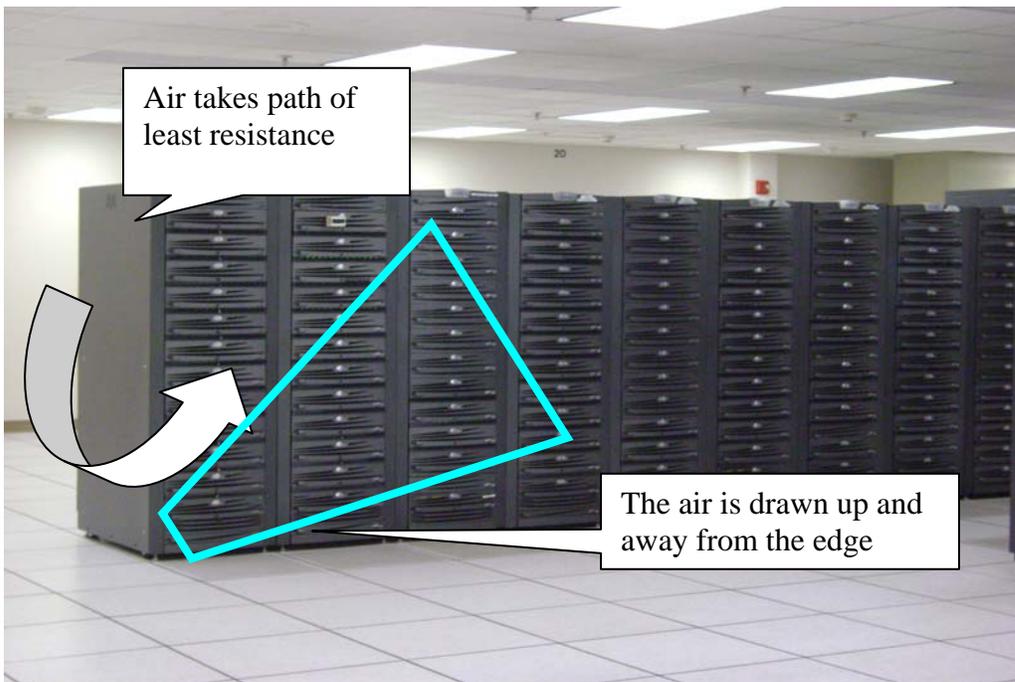
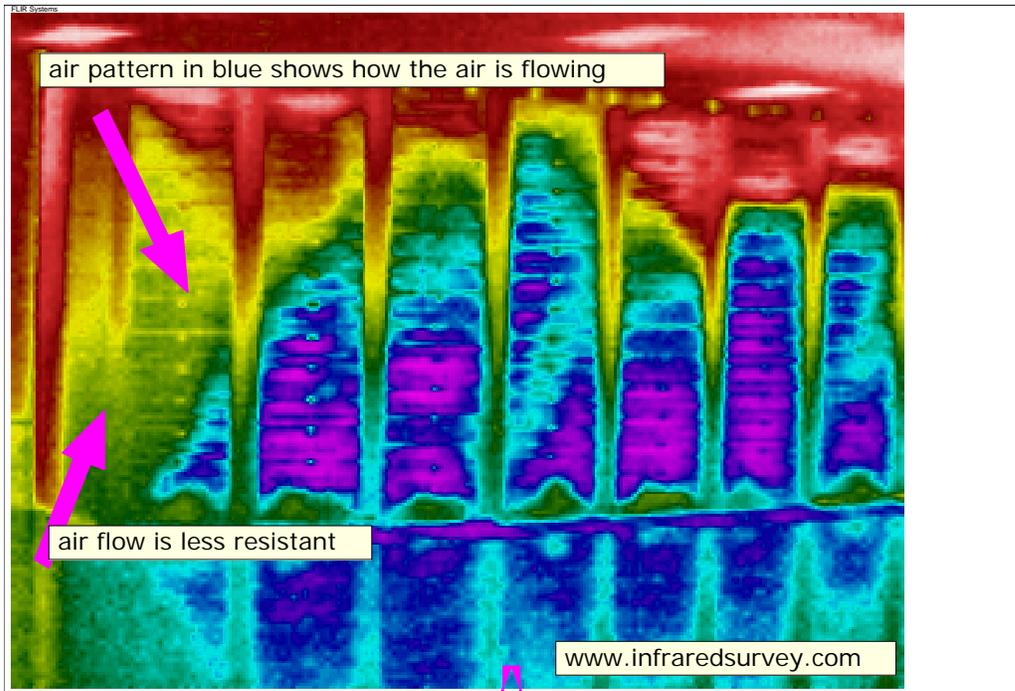
Heating Ventilation & Air Conditioning

Buildings are conditioned by adding or removing heat from a given space through a medium. In this case the medium is air.

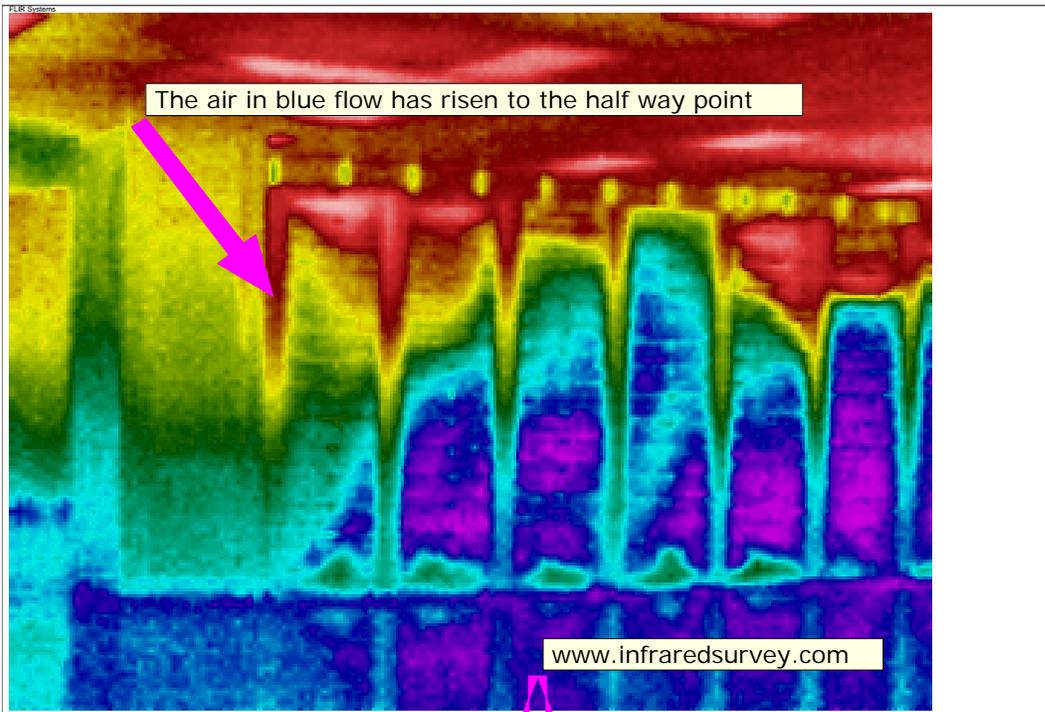
The air is circulated through a refrigerated coil or DX coil or chilled water coil, which removes heat and transfers the heat through the refrigerant/water to the condenser coil/cooling tower, via a fan/pump. Dirty filters or poor air flow causes coils to freeze and Compressor failure.

Why can we see water?

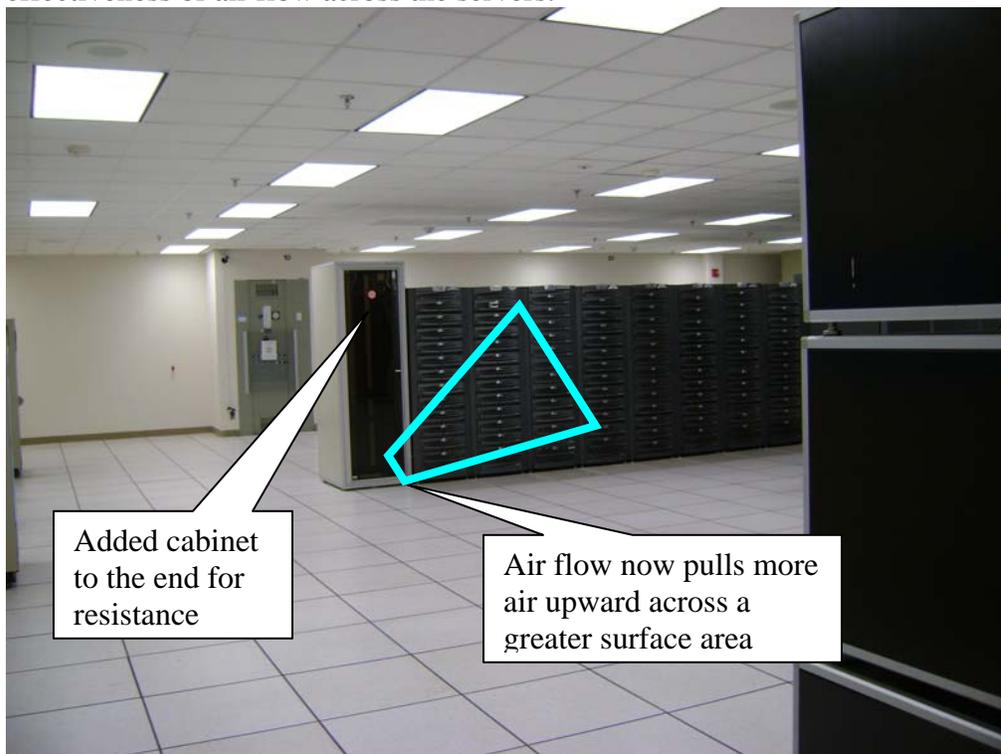
Water is a conductor and transfers heat. Heat or the lack of heat is what thermal imagers see. When water, a conductor, contacts a non-conductor such as wood or sheetrock-we see the heat transfer which can be colder or hotter than the surface of which it contacts. The color of choice for cold is blue and red for hot.



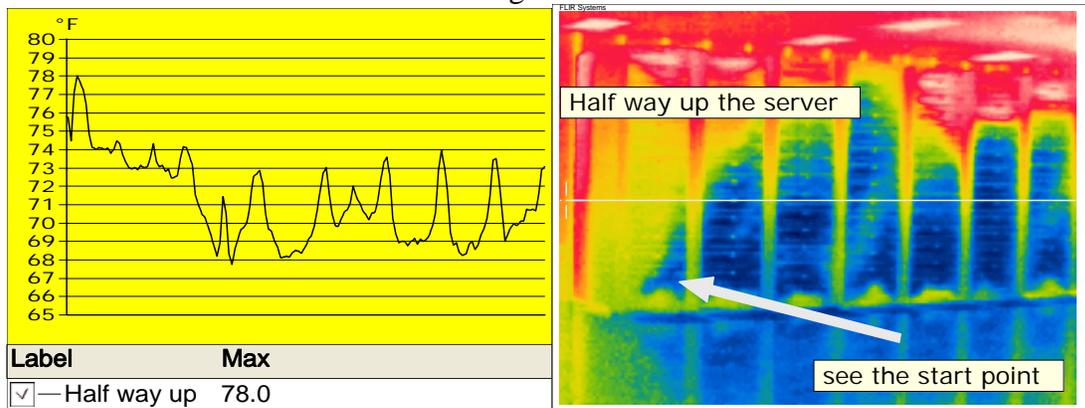
The air pattern above in blue shows the effectiveness of air flow. To the left of the rack there is little resistance to air flow. This allows the air to be less effective. This does not mean the temperature is inadequate just not as efficient. This means energy loss.



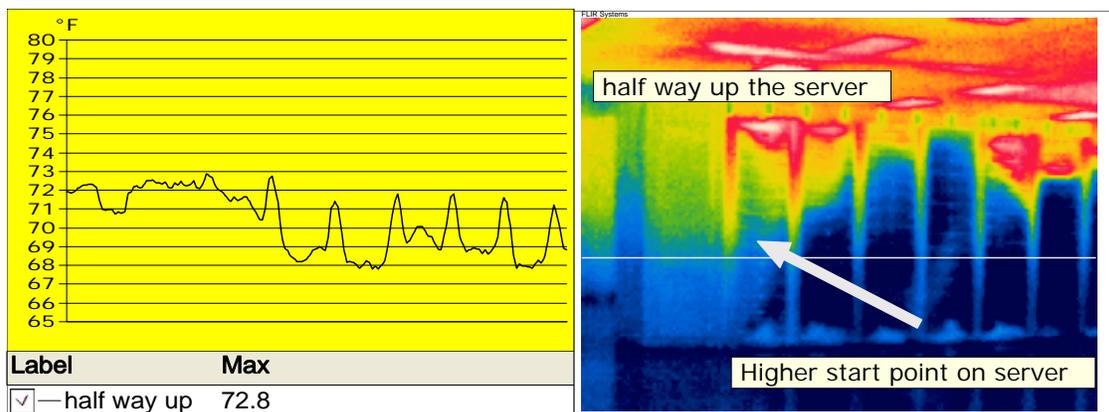
We added a cabinet to the end of the row to add resistance to the air flow. This helps the effectiveness of air flow across the servers.



The left end server cabinet isn't utilizing all the air flow.



Note the max T in the picture above is 78. Below is 72 at the same reference line level.



Over all the servers are in safe operating range and monitored with thermocouples. This survey shows how effective a little adjustment can help maximize energy usage. Adjustments can help energy usage on a multi site scale. The rack will perform more efficiently. Taken this into consideration one can multiply Times the number of racks times the number of facilities. The number can add up to a significant savings. Thermal infrared should be used as part of condition monitoring. Its uses go beyond electrical and mechanical applications. This should be part of any server placement program. Thermography is non-invasive and expedient.