



# Reliability of Hardware with GRC

A recent study over the course of one year looking at an installation of more than 2000 servers shows that servers running in the CarnotJet are more reliable than servers running in air. The configuration is a standard ATX form factor server, commonly used in server hosting or High Performance Computing.

CPU	Dual E5 v2
Power Supply	One per motherboard, ATX form factor, Supermicro, server grade
Motherboard	Server grad, ATX, Supermicro
Hard Drive	None

FIGURE 1



	Total # Failed	QTY/Server	Total Number	Rate
Power Supplies	7	1	2150	0.33%
Motherboards	30	1	2150	1.40%
Memory DIMM	86	8	17200	0.50%
CPU	0	2	4300	0.00%

FIGURE 2



Shown in Figure 2, the manufacturer confirms failure rates were equal to or lower than a conventional cluster.

As stated by the owner of the cluster, “for a cluster that size, the failure rates are basically zero.” The system is so stable, in fact, the customer is actually shipping all on-site spare parts back to the manufacturer. As they stated, “nothing breaks, so the parts are just taking up space.”

One of the most impressive facts: these were *Minimus style* white box servers and saved the customer hundreds per server, buying hardware with only the features they needed.

Here are some of the ways how the CarnotJet helps to improve server reliability and stability:

**Elimination of hot spots** – The CarnotJet system maintains a very even thermal environment, keeping the temperature difference within  $\pm 1^\circ\text{C}$  across any two points in the rack.

**Superior thermal management** – The CarnotJet system’s closed loop control system constantly monitors the temperature in the rack and ensures peak performance.

**Removal of chassis fans** – Chassis fans are known to be one of the most common points of failure in a cluster, removing them helps reduce the frequency of maintenance events.

**Protection from dust, oxygen, and moisture** – The mineral oil-based ElectroSafe coolant helps protect the servers from dust, moisture, and oxygen, thereby protecting them from corrosion and particulate accumulation.

**Reduced vibrations and reseal errors** – Dielectric fluids such as ElectroSafe coolant are known to improve connector reliability, thereby helping reduce common reseal errors. This effect is complemented by the reduced vibration due to the removal of fans and the dampening effect of the fluid.

As claimed by another customer operating a sizable installation, “*The CarnotJet system has proven to be exceptionally reliable and is helping increase the mean time between failures.*”

– Dr. Stuart Midgley, CTO at DownUnder GeoSolutions

## WIN-WIN

The servers in the study were white box servers that helped reduce upfront costs by more than \$300 per server through the selective mixing and matching of components to meet the customer’s needs. Hence, the end result was lower cost hardware, higher reliability, and significantly higher levels of energy efficiency (cooling overhead of 2%).