The Villanova Thermodynamic Analysis of Systems (VTAS) is a holistic modeling tool for data center IT equipment and cooling systems.

What is VTAS used for?
• Pinpointing efficiency bottlenecks
• Optimizing equipment layout in a chosen cooling strategy
• Comparing different cooling strategies

How does VTAS work?
• Data center components are linked by fluid loops
• VTAS applies steady-state energy balances to size data center equipment
• 1st and 2nd Law Thermodynamic analysis is done on the chosen cooling solution

Why is this approach useful?
• A 1st Law analysis can predict performance metrics (PUE, WUE, ERE, etc.)
• A 2nd Law analysis can pinpoint efficiency bottlenecks and assess the viability of waste energy recovery
• A flow network approach enables transient predictions of system response to failure scenarios

What components are available?
• Servers
• Junctions
• Fans/pumps
• Data center airspace
• Computer room air handlers (CRAHs)
• Computer room air conditioners (CRACs)
• Chillers
• Cooling towers
• Evaporative coolers & airside economization
• Rear door heat exchangers
• In-row heat exchangers
• Overhead heat exchangers
• Direct liquid heat removal (cold plates)
• Absorption refrigeration systems
• Organic Rankine cycle systems

What features does VTAS contain?
• Graphical User Interface (GUI)
• Import of climate data from database of 1000+ U.S. locations
• Link to airspace detailed CFD data
• User input checker
• Optimization and viability (parameter sweeping)
• System layout and component transient performance plotting

Example legacy air data center:

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