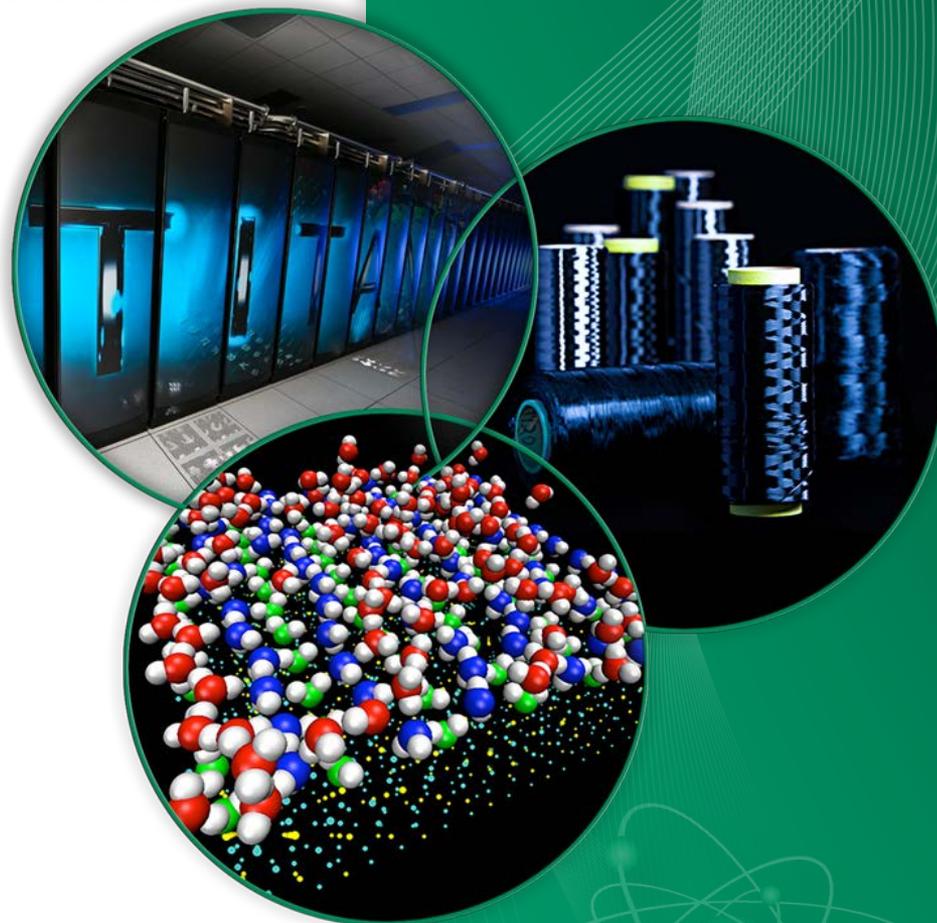


Oak Ridge National Laboratory

Computing and Computational Sciences

Temperature Measurements

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Background

- Why is this capability needed?
 - Temperature affects energy efficiency and operation safety.
- What are the challenges?
 - Safe (and secure).
 - Accurate.
 - Up to date.
 - Affordable.
- What does this mean for procurement?
 - Using existing standards if available.
 - General and specific requirements

Safety

- **(mandatory) The system must operate safely under all conditions.** This includes when thermal emergencies are detected and when thermal sensors are faulty.
 - The system must operate safely even with faulty sensors.
 - System management must be notified in a timely fashion with a detailed account of the incident.

Accuracy

- **(mandatory)** The data on temperature must be
 - physically accurate
 - The accuracy must be $\pm 0.5^{\circ}\text{C}$ or better.
 - reported in real-time
 - Measurements must be sampled no slower than the quickest thermal response time expected, with 1 Hz as the baseline.
 - provide sufficient details
 - Accurately time-stamped, along with a description of how data samples are time-stamped.
 - Also detailed explanation of where in the system the temperature is being measured.

Cabinet Level Temperature

- **(important)** The temperature measurements must characterize the range of operating temperatures
 - within the system by type of device (node, cabinet, etc.).
 - supply and return temperatures for each coolant.
- **(important)** Dew point temperature of the air supplied to cabinets must be measured and reported to the cooling control system in charge of prevention of condensation.
- **(info)** Temperature data are more valuable at the platform and cabinet levels than at the system level. Node and component level temperature measurement may not be as important as cabinet level temperature measurement.

Node/Component Level Temperature

- **(mandatory)** The node level temperature measurements must be real physical measurements of representative temperatures within the node, which must be physically described and justified ...
- **(info)** The information about the correlation between temperature and power is more critical in an air-cooled environment.
- **(enhancing)** The ability to measure the temperature of each individual component should be provided.
- **(info)** Five envisioned use cases.

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