



Timestamps and Clocks

Energy Efficient HPC: Procurement Considerations

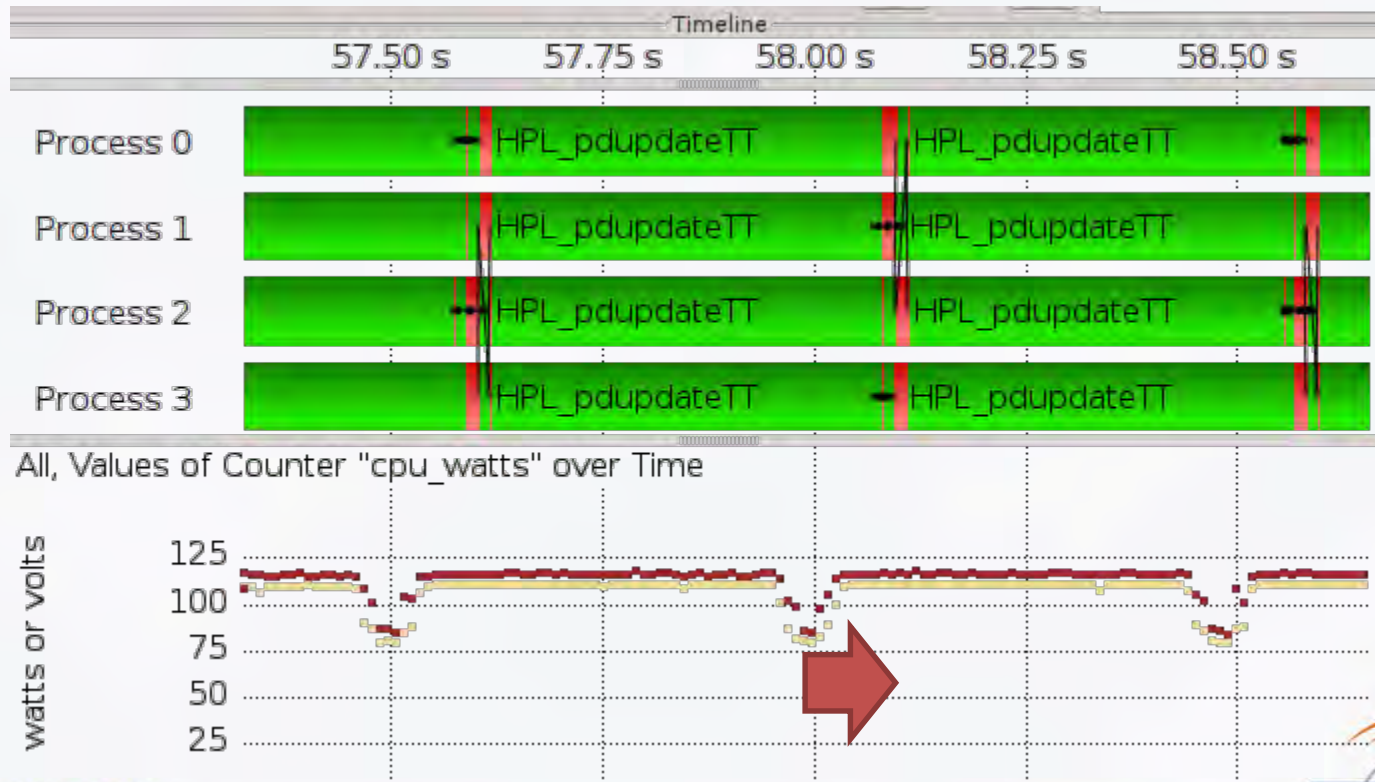
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Why are timestamps/clocks important? (1)

- Correlation of Application events and power consumption records
- How much power / energy does a function in my application consume?
- Correctly compare different nodes or hierarchy levels in a distributed system

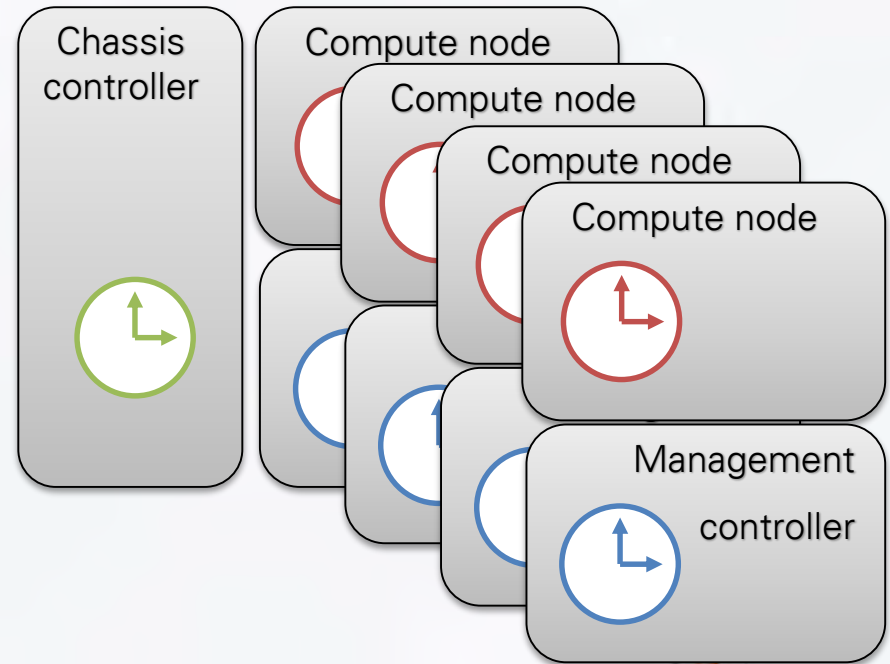


Why are timestamps/clocks important? (2)

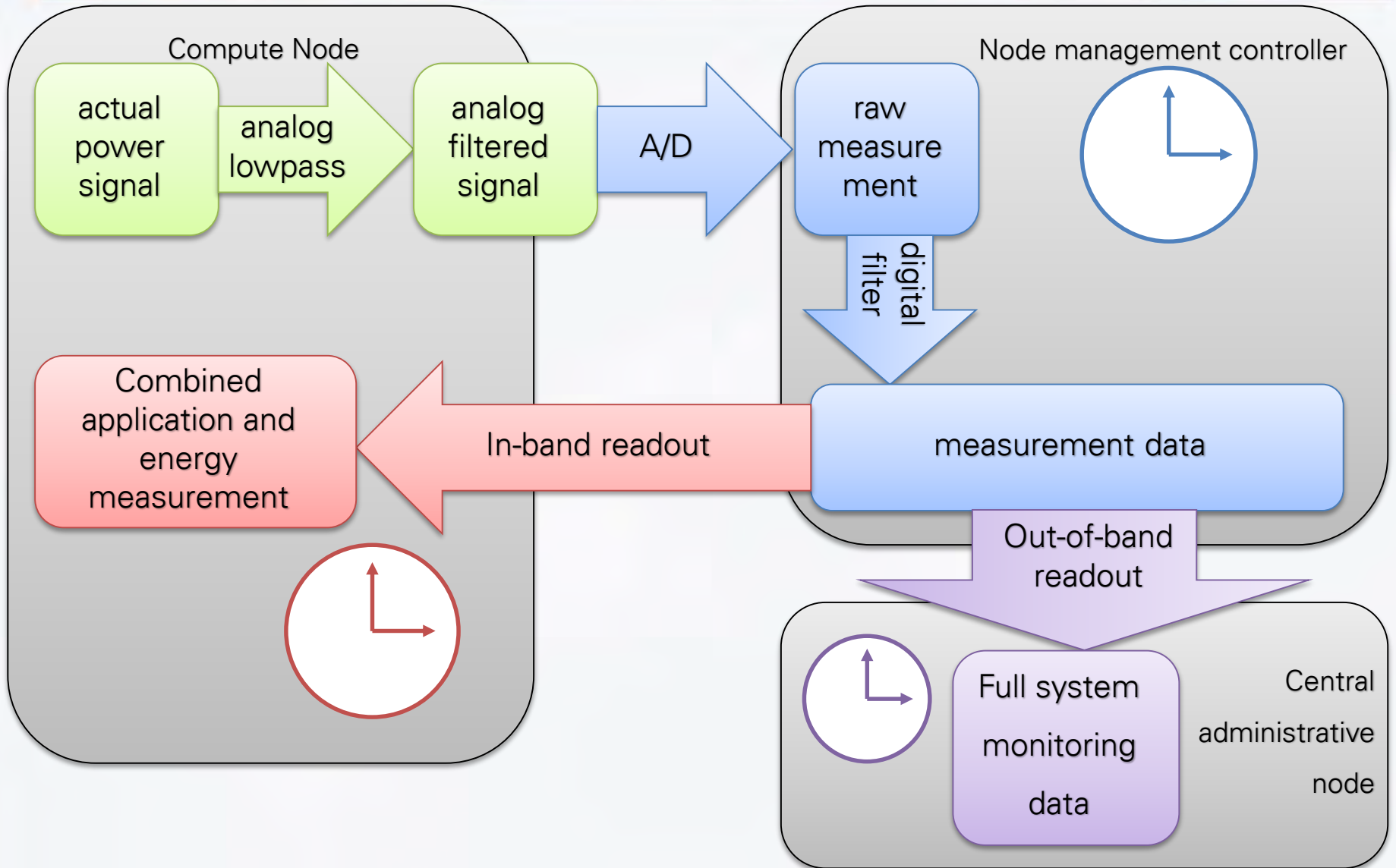
$$E = P \times t$$

Why are timestamps/clocks challenging?

- Application data and energy data is gathered on different entities
 - Compute node
 - Management controller
- Distributed systems → no global clock
- High sampling rates need timer accuracy on the same order of magnitude
 - Reading power samples at 1 kSa/s
 - Time should be accurate $\ll 1$ ms
- Monotonicity of measurement times should be guaranteed



Where & when can we measure time?



What does this mean for procurement?

- Mechanism to associate a timestamp with each measured value
 - Some implications for the API, but that is not in scope of the document
- Good and known accuracy of timestamps
- Documentation to quantify the age of measured value
- Information which clock is used
 - Synchronization
 - Drift
 - In relation to compute node clock
- Requirement are dependent on sampling / readout rate
 - $< 1 \text{ Sa/s}$ → **easy**
 - $> 1 \text{ k Sa/s}$ → **difficult**