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Harnessing the data from edge sensors

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The 2020's are emerging as the decade of the experiment as new instruments come on-line or are being upgraded with significant improvements that will support each of the science domains. The new devices will produce huge volumes of rich data which along with improvements in data processing and simulation methods offer the potential to address grand challenges in science that if resolved could dramatically improve the quality of life.

These include improved time and quality of drug development, improved materials, energy delivery methods to reduce the carbon footprint along with some of the questions that have intrigued mankind for centuries that include understanding the origins of the universe and the standard model of physics. This paper will address three of the key challenges that will be needed to be addressed to realize the potential from these new data sources: Harnessing the data from edge sensors and instruments; Building and orchestrating the composite workflows that will need to be automated and integrated with humans in the loop to better operate the improved instruments and maximize the value of the data obtained, processed, and archived. To complete these workflows the instruments will need to be integrated with the HPC data center and cloud based resources to optimize the diverse requirements for computation and data processing in real-time and near real-time.

The paper will describe the challenges and initial thinking on the solution to maximize the value of the new data sources at the edge. We will use examples from light source experiments, fusion energy devices, Electron microscopy and other instruments used in the high energy particle physics and the drug discovery laboratory. For these devices we will identify the composite workflows that will need to be automated and combined with the new data sources and then presented to humans in the loop as the instruments are operated.

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