

Towards Virtualized 100+ Gbps Data Acquisition Software Systems

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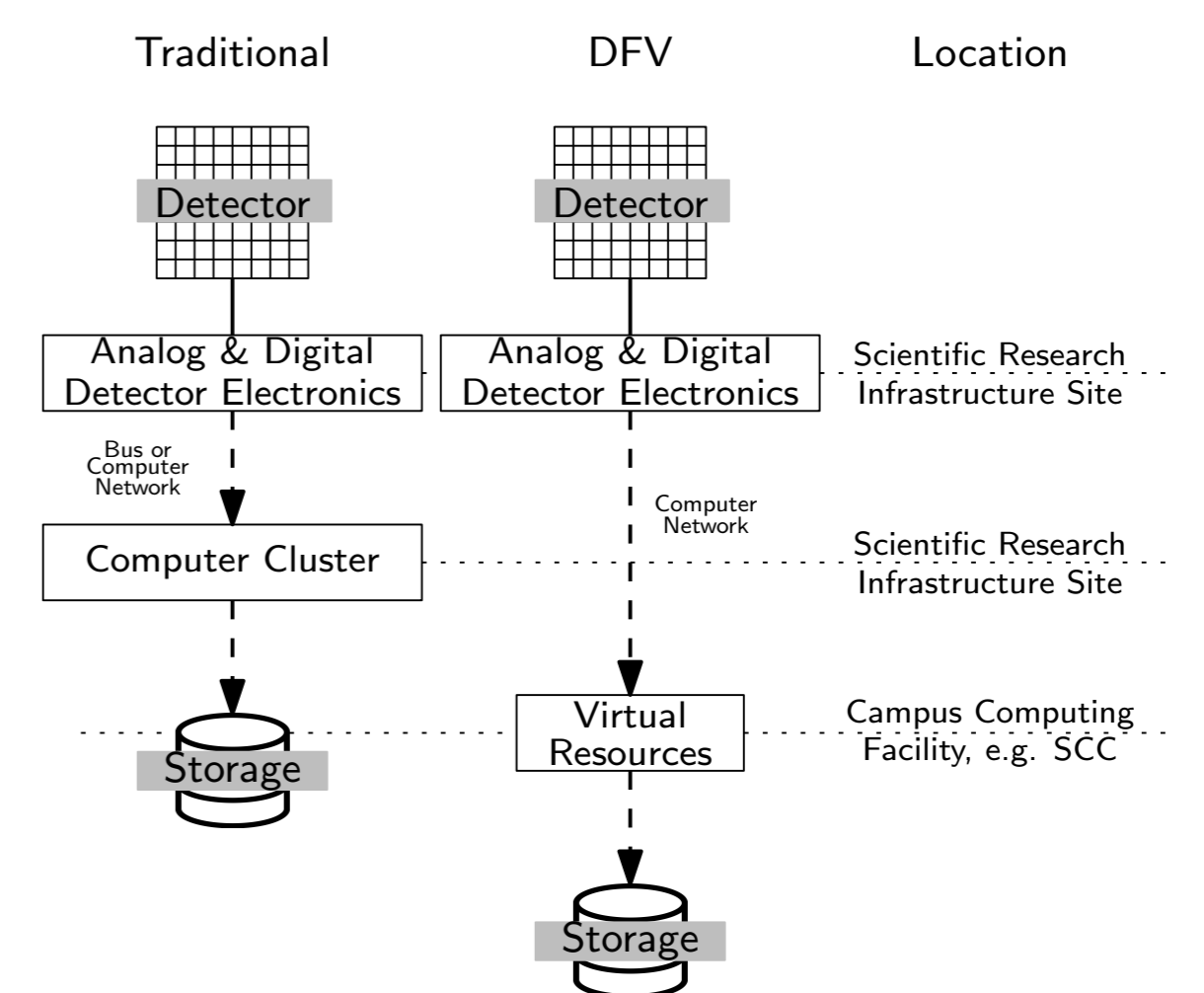
Operational Challenges of Hybrid Hardware-Software DAQ Systems

Increased Efforts to Operate Computing Infrastructure

Modern Hybrid Hardware-Software DAQ Systems Use **Dedicated** Computer Clusters due to the Increasing Throughput of Modern Detectors, e.g. KATRIN/TRISTAN: ~25 GBps.

The Operability Challenge:

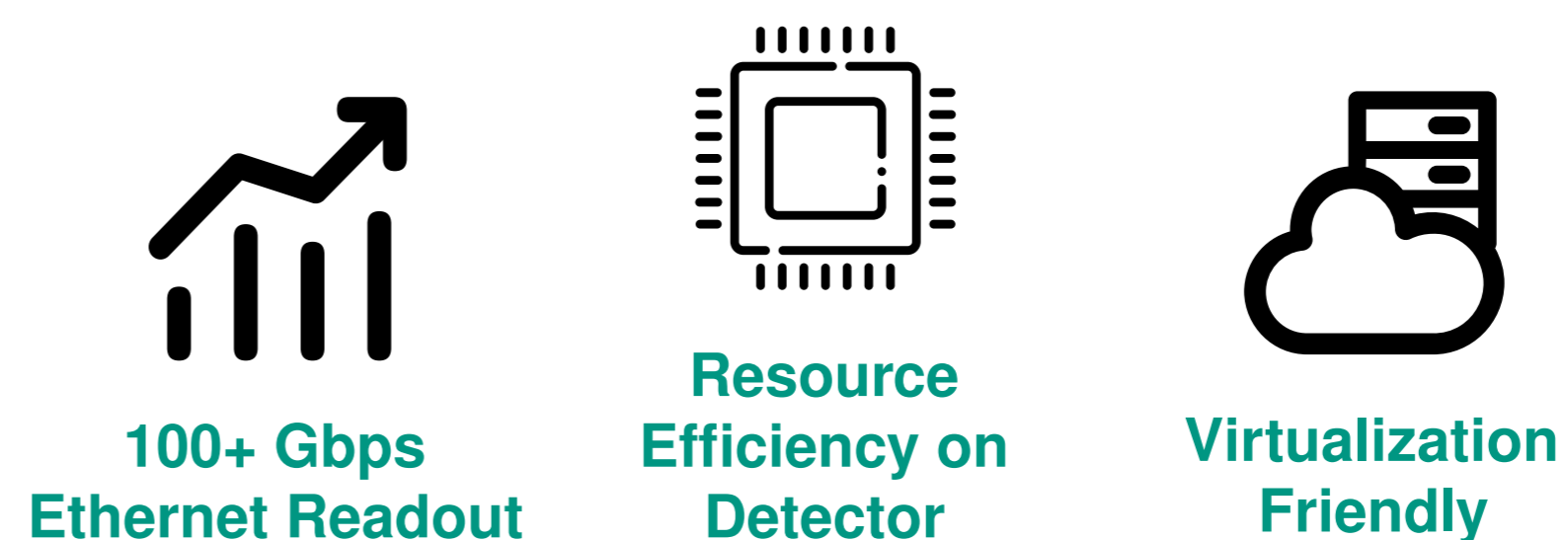
- Active System Maintenance
- Low Scalability
- Lack of Expertise
- Every Experiment Buys its Own Infrastructure
- Single-Purpose Under-utilized Clusters



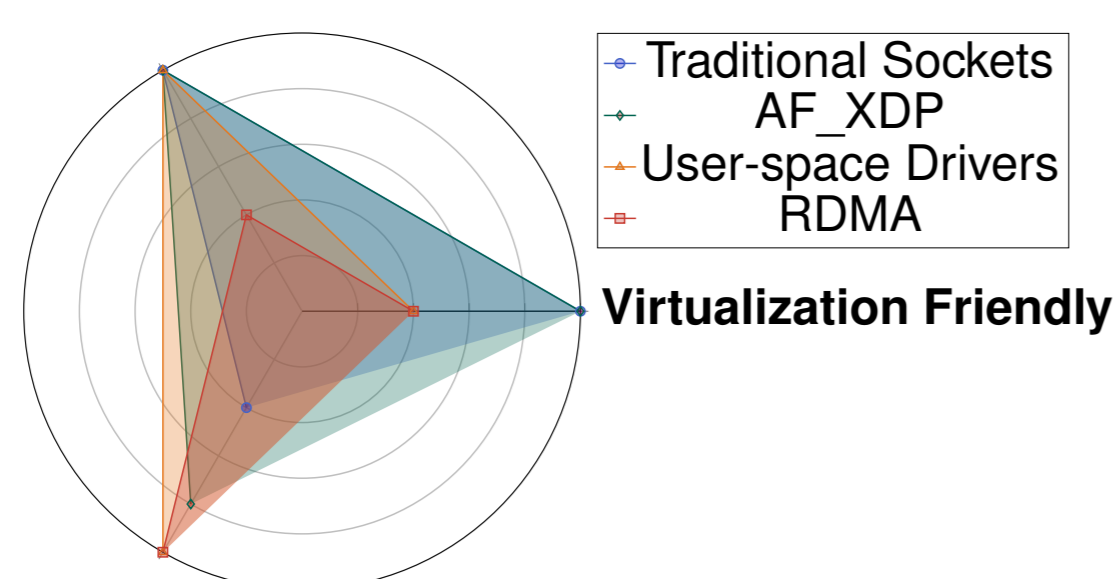
Data Acquisition Functions Virtualization (DFV)

Use Already Available Virtual Computing Resources in Computing Facilities!

- Shared Reusable Computing Resources
- High Resource Utilization
- Offloading Maintenance to Campus Computing Facilities
- High Scalability
- Automated High Availability



Resource Efficiency

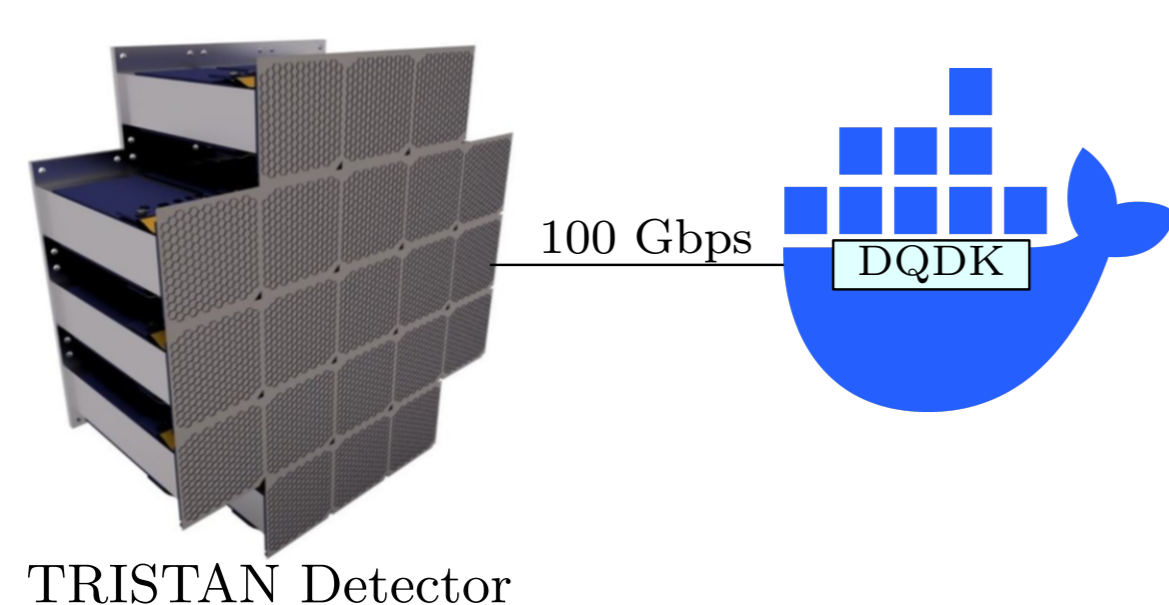


Performance

The Data Acquisition Development Kit (DQDK)

A Novel Framework for DFV and 100+ Gbps Ethernet Readout

- **Virtualization-Friendly:** Preserves Compatibility with Other Apps
- **100+ Gbps Performance:** AF_XDP for High-Performance Network & Software Optimizations
- **Resource Efficiency:** Lightweight Ethernet Protocol (UDP)



TRISTAN Detector

DFV for TRISTAN

- Empirically Prove the Existence of Sterile-Neutrinos as Candidates for Dark Matter
- 9 Modules (1494 px), Up to 200 Gbps
- Flexible Hybrid Hardware-Software DAQ
- DFV Reduces CPU Resources **2.67x!**
- No Impact with Containerization!

