Present architecture and improvements

Legend:
- Proactive resource acquisition
- Exact resource request and execution
- Resource matching and execution
- Dynamic distributed k8s cluster
- Workflow performance monitoring

JRM: JIRIAF Resource Manager
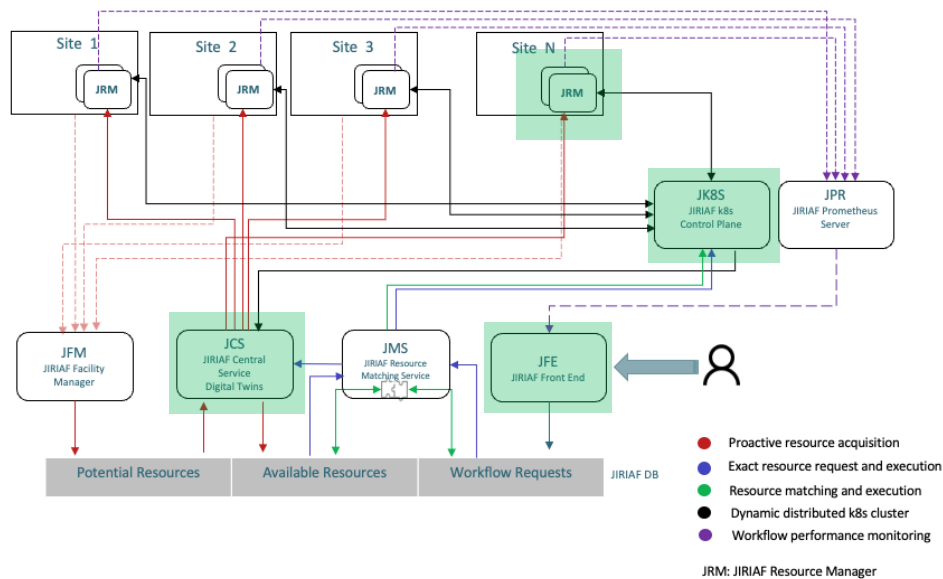
Successful 100 Gbps data-stream processing at NERSC

- Digital agent state transition: $F_t = P(D_t \mid D_{t-1}, U_{t-1})$
- Quantity of interest: $F^{QoI}_t = P(Q_t \mid D_t)$
- Reward function: $F^{Reward}_t = P(R_t \mid D_t, Q_t, U_t, O_t)$
- Assimilation (inverse probability or likelihood): $F^{Assim}_t = P(O_t \mid D_t)$
- Control action: $F^{Control}_t = P(U_t \mid D_t, Q_t)$

$P(D_0 \ldots D_t, Q_0 \ldots Q_t, R_0 \ldots R_t \mid O_0 \ldots O_t, U_0 \ldots U_t)$
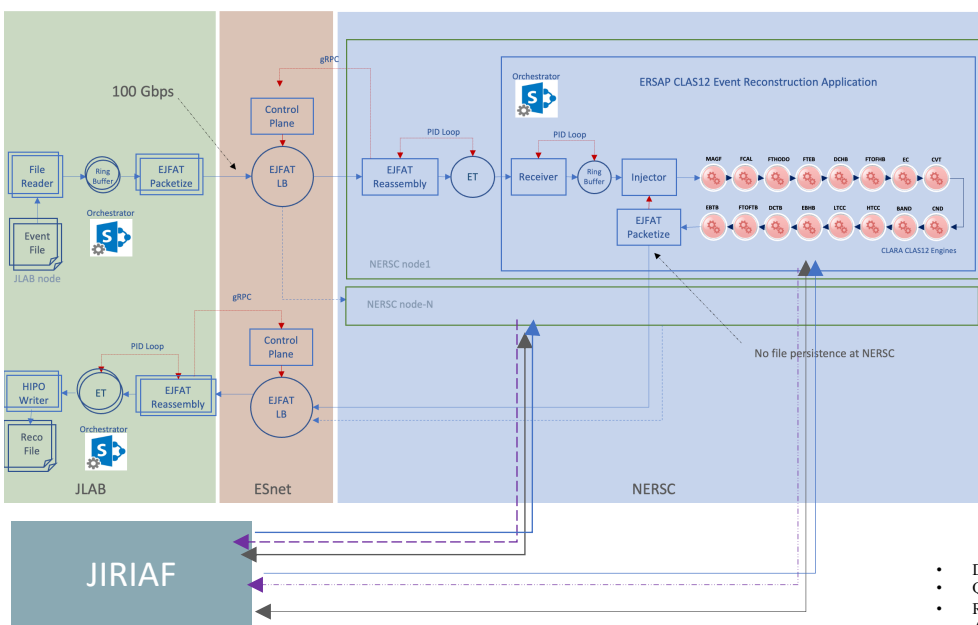
Q2 Achievements

1. The operational elastic and distributed computing cluster, utilizing resources from DOE computing facilities and coordinated by an adapted Kubernetes system, does not require any additional setup requirements from the provider's infrastructure.
2. The initial demonstration of remote data stream processing at a rate of 100 gigabits per second from JLAB to NERSC, marked a significant milestone.
3. Enhanced cooperation involving various Department of Energy (DOE) facilities.

- Number of events in the system ($Ls = \rho/(1-\rho)$)
- The number of events in the queue ($Lq = \rho^2/(1-\rho)$)
- Waiting time in the system ($Ws = Ls/\lambda$)
- Waiting time in the queue ($Wq = Ws - 1/\mu = Lq/\lambda$)

Arrival rate (λ) — Agent D_t — Service rate (μ)

Q2 Milestones

- Initial testing and refining of the bidirectional data-stream processing between JLAB and NERSC.
- Execution of the initial phase of the migration plan, including setting up and testing the NSLS-II workflow at JLAB.
- Implement the agent model and initial simulations for bottleneck prediction and resource optimization.
- Development of the preliminary mathematical model of an actor, incorporating the identified parameters and dynamics.

Broadening the scope of possible deployments

- Initial testing of workflow containers has been conducted at ORNL. We are currently awaiting the establishment of the L3VPN network connection between ESnet and ORNL.
- Commenced meetings and engaged in discussions with the APS team.
- A recent partnership has been established with ALS to leverage JIRIAF for the deployment and orchestration of ALS beam-line G2 curve reconstruction and analysis at NERSC.
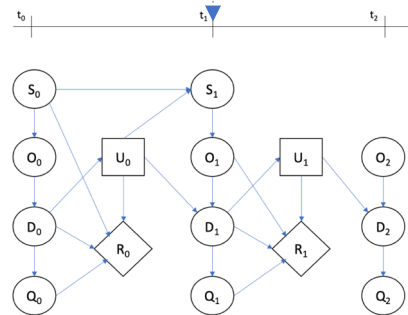
Publications

- 1st paper is accepted for publication in the EPJ
- 2nd technical paper: ACAT conference proceedings (in progress).
- Submitting an abstract to CHEP24

Budget vs. Actuals - LD2405 ($K loaded)
JIRIAF - JLAB Integrating Research Infastructure Across Facilities

FY24 Budget = $211.9K

$K
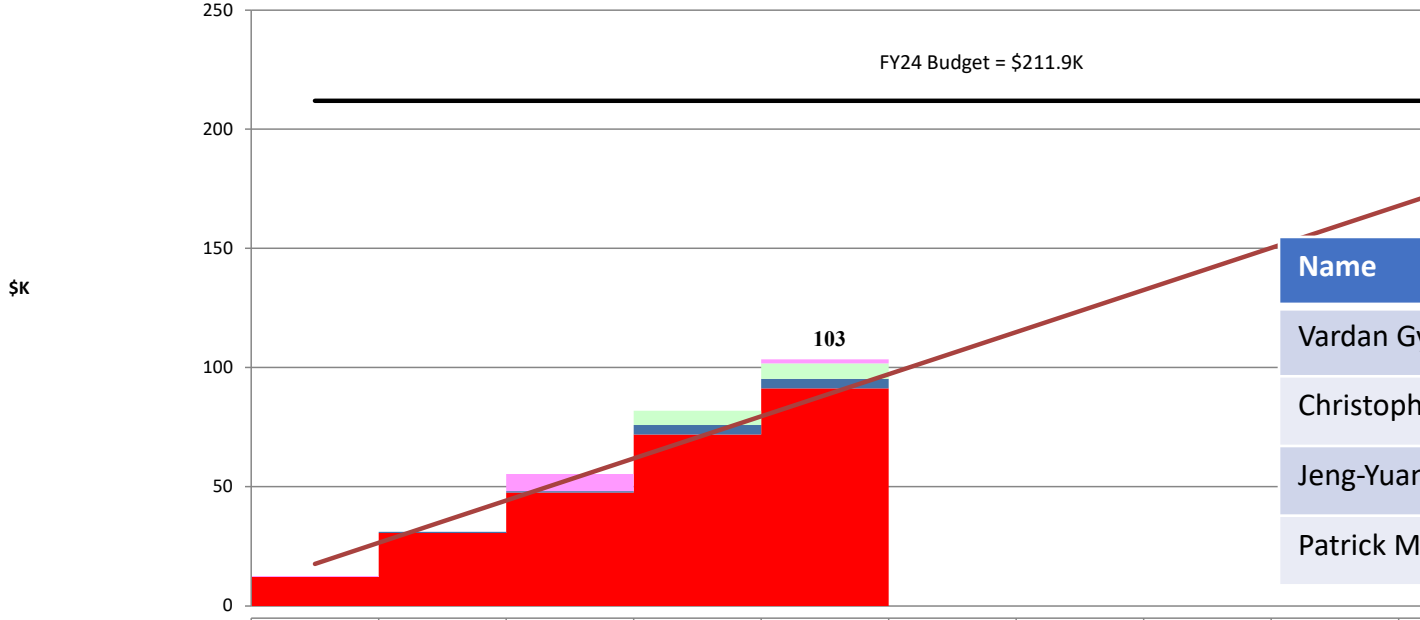
Research Leadership Team

Name	Personnel	Committed time [%]
Vardan Gyurjyan	PI	25
Christopher Larrieu	Co-I	13
Jeng-Yuan Tsai	Postdoc	100
Patrick Meagher	Student	50

	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24
YTD Spending	13	31	55	82	103	0	0	0	0
Pending	0	0	7	0	2	0	0	0	0
Open Obligations	0	0	0	6	7	0	0	0	0
Expenses	0	1	1	4	4	0	0	0	0
Labor	12	31	48	72	91	0	0	0	0
Funding	212	212	212	212	212	212	212	212	212