



SAND2015-5030C

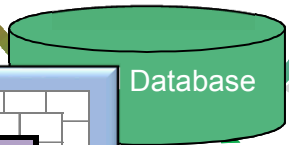
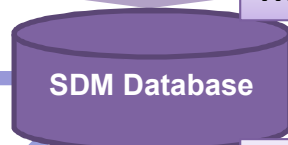
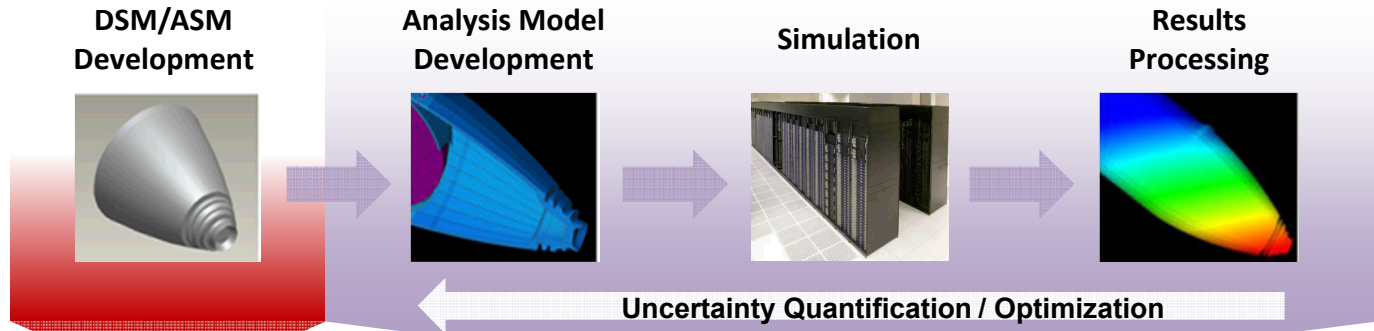
INTERNATIONAL CONFERENCE
Simulation Process & Data Management

INCORPORATING WORKFLOW FOR V&V/UQ IN THE SANDIA ANALYSIS WORKBENCH

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SAIC

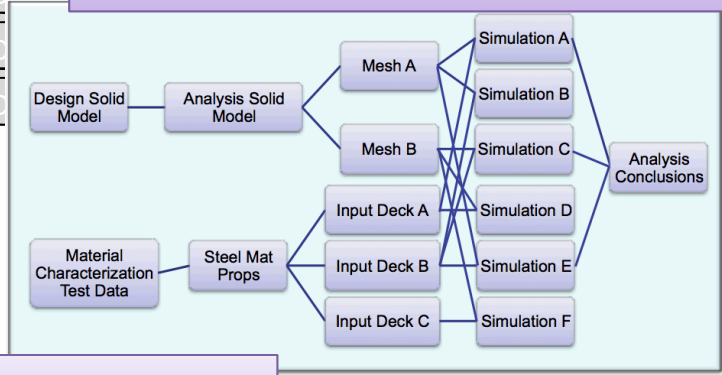
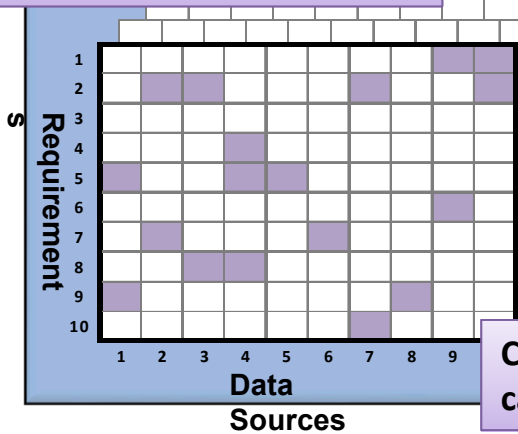
Support the Design-To-Analysis process, capturing data in context



How credible are my simulations?

Do I understand the pedigree of my analysis data?

Can I support my engineering assertion?



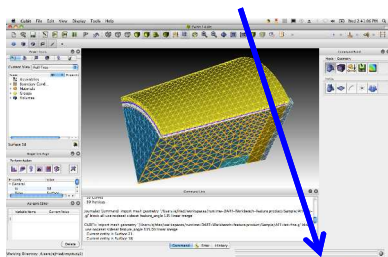
Can I re-execute models as computational capabilities continue to evolve?

SAW provides a unified view of distributed enterprise resources on the desktop

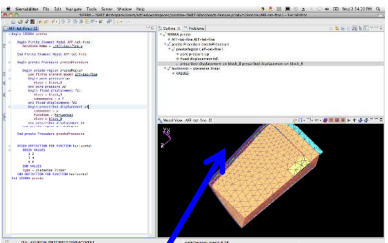
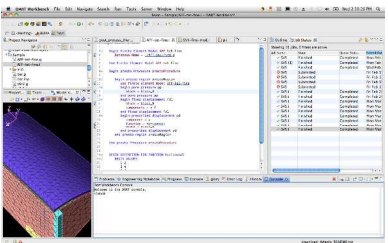
Simulation Data Management

Eclipse Workbench

Job Submission & Job Management



Multiple applications and tools combined into one, streamlining work and reducing complexity



Project Teaming

Model Assembly

```
1 # Generated by:
2 # SDMA version 67 Build number 3201(Ad-hoc).
3 # Built on ejfried-dell at 4/23/2009 12:03:47
4 # Exported on Fri Nov 19 10:23:14 MDT 2010
5 #
6 #begin sierra 3_point_bend_test1
7   {include("gpm_functions.txt")}
8   {include("gpm_functions.txt")}
9
10
11   {include("gpm.txt")}
12
13
14   begin property specification for material Default
15     density = 1000.
16   begin parameters for model ELASTIC
17     poissons_ratio = 0.2333
18     youngs_modulus = 3E7
19   end parameters for model ELASTIC
20   end property specification for material Default
21
22   begin property specification for material mat_1
23     density = 5000
24   begin parameters for model elastic
25     poissons_ratio = 0.245
26     youngs_modulus = 195.0e+09
27   end parameters for model elastic
28   end property specification for material mat_1
29 # Functions for conditions
```

Name	Machine	Stage	Queue Status	Submit Date
joint_model_SALINAS	shasta	Finished	Completed	Tue Nov 24 15:56:2
joint_model_SALINAS	shasta	Finished	Completed	Tue Nov 24 16:01:1
joint_model_SALINAS	shasta	Finished	Completed	Tue Nov 24 16:20:1
dt1b_blivet_060515	thunderbird	Finished	Completed	Tue Nov 24 16:37:1
joint_model_SALINAS	thunderbird	Finished	Completed	Wed Nov 25 12:09:2
Tall_assy	thunderbird	Finished	Completed	Wed Nov 25 12:25:4
Tall_assy	thunderbird	Finished	Completed	Wed Nov 25 12:25:4

Name	Size	Modified
3_point_bend_test1	7.9 KB	Nov 3, 2010 1:00:07 P
3_point_bend_test1.cfg	284 bytes	Nov 3, 2010 1:00:16 P
3_point_bend_test1.g	1 MB	Nov 3, 2010 1:00:09 P
3_point_bend_test1.g.4.0	322 KB	Nov 3, 2010 1:00:16 P
3_point_bend_test1.g.4.1	355.9 KB	Nov 3, 2010 1:00:16 P
3_point_bend_test1.g.4.2	385.2 KB	Nov 3, 2010 1:00:17 P
3_point_bend_test1.g.4.3	345.9 KB	Nov 3, 2010 1:00:17 P
3_point_bend_test1.lib.err	0 bytes	Nov 3, 2010 1:00:16 P
3_point_bend_test1.lib.out	2.1 KB	Nov 3, 2010 1:00:16 P
3_point_bend_test1.nem	204.7 KB	Nov 3, 2010 1:00:16 P
3_point_bend_test1.pex	588 bytes	Nov 3, 2010 1:00:16 P

Distributed File Management & Viz

Parametric Analysis Workflow

- Automated process to execute and post process a single analysis – IT IS THE MODEL
- Driven by UQ/Optimization engine (DAKOTA at SNL)
 - **Efficiently**: leverage DAKOTA to manage concurrency
 - **Reliably**: resilient to random HPC (High Performance Computing) failures; report failure to UQ/Optimization engine for analysis instance retry
 - **Responsibly**: manage HPC utilization, manage disk space on file system; archive selected files after execution completes
 - **Platform independently**: environment fully parameterized
 - **Incrementally**: add post processing to existing design points as needed; evaluate QoIs and quantitative/qualitative credibility evidence
- **Required for UQ**
- **Supports analysis credibility evidence**
 - Documents all computational steps from input parameters to responses
 - Committed in repository

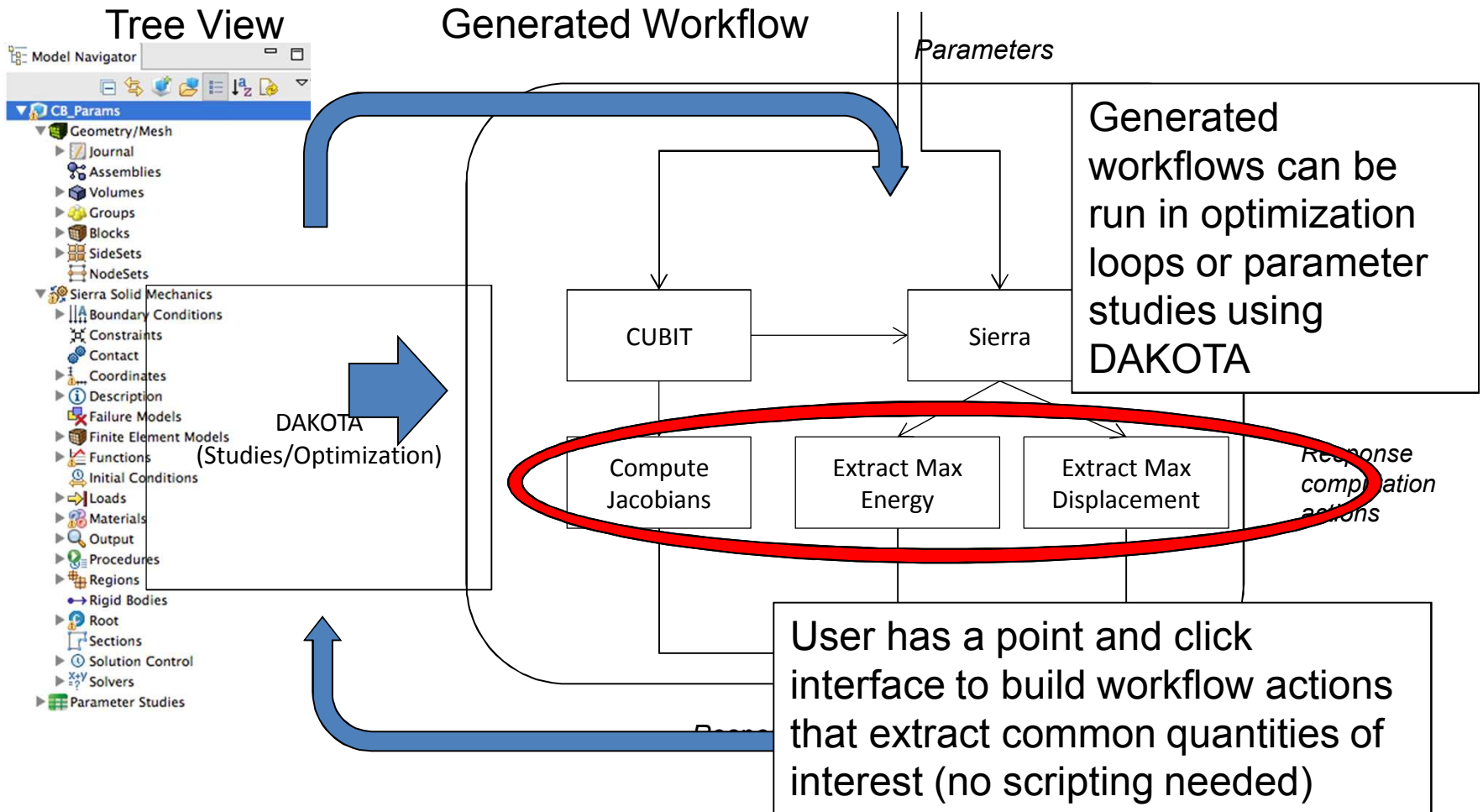
Open Source Workflow Platforms



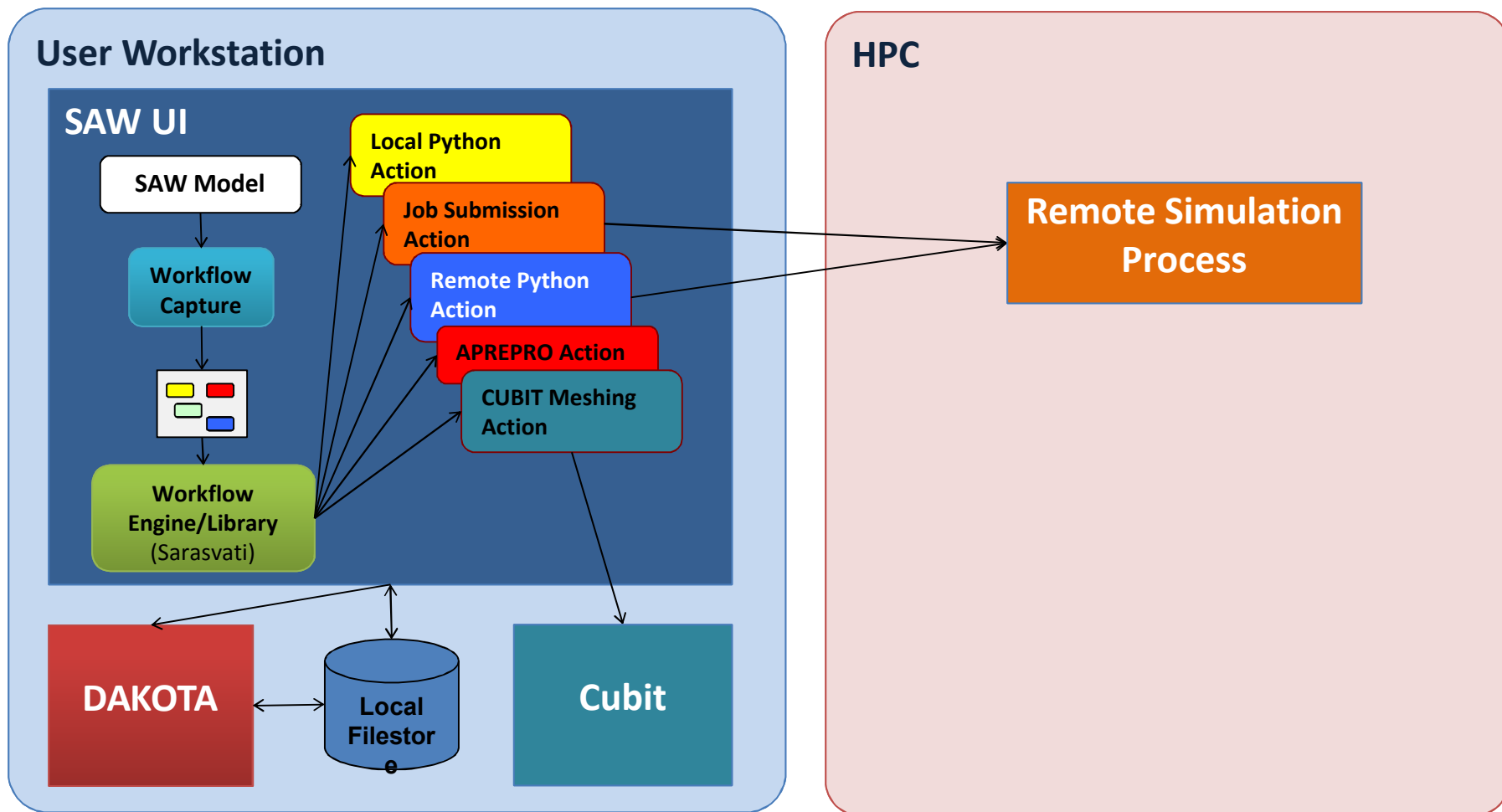
- UC Davis, Santa Barbara, San Diego; graphical model builder, execution engine, Linux, Windows.
- Apache Incubator project; Written in Java, graphical model builder, provenance tracking through OPM, remote web services, cloud/grid capabilities.
- USC; distributed resilient scheduling on heterogeneous computing (desktop, workstation, cloud), Linux, Mac.
- DAWN/Passerelle; modular/dynamic platform for process automation. Wraps Ptolemy II (UC Berkeley) open-source platform for actor-based modeling.

Challenge: Correct make/buy decisions based on long-term ubiquitous adoption and commitment for support; some assembly required!

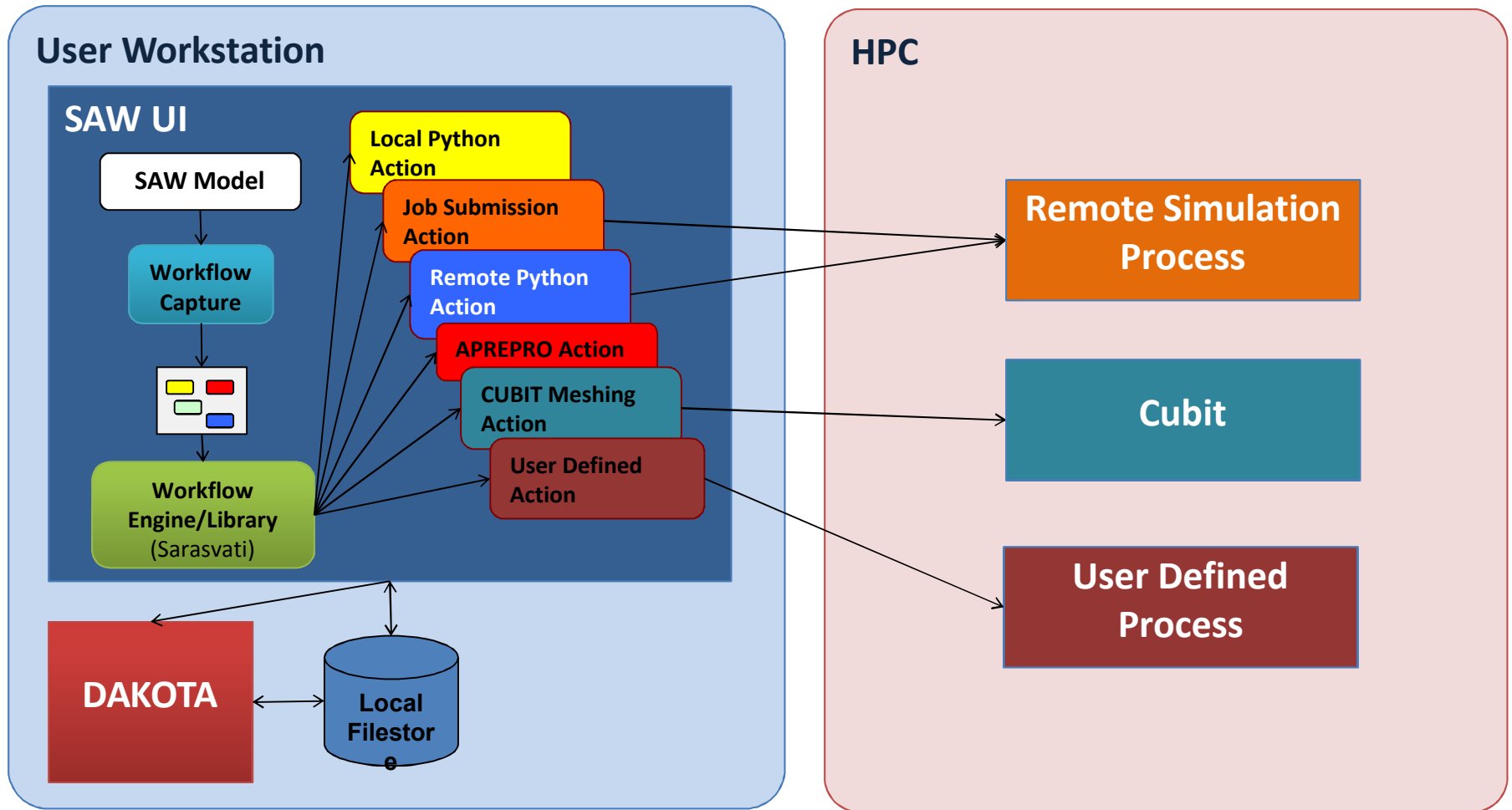
Current Status: Automatic Workflow Capture



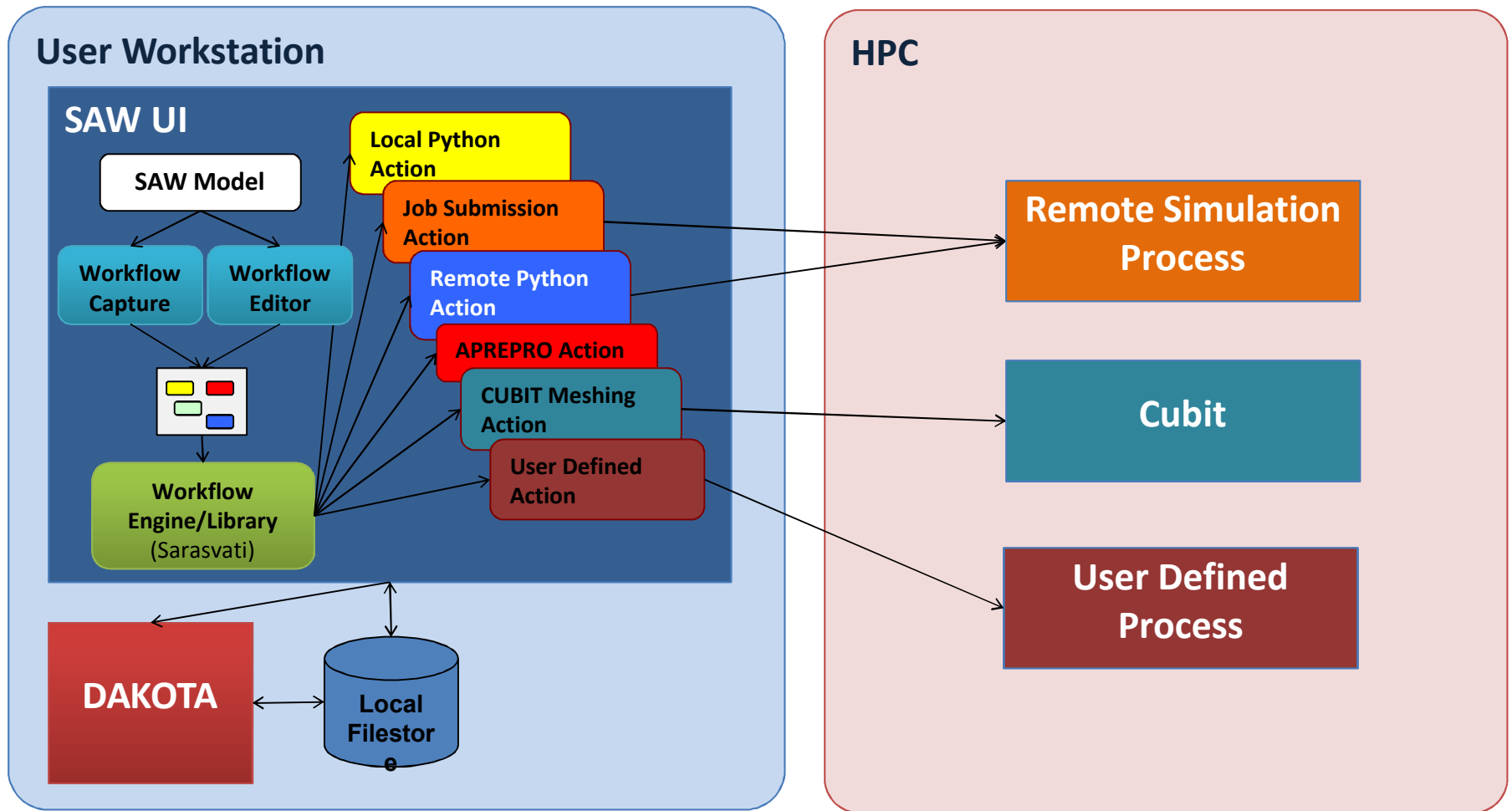
Workflow Architecture – Phase I



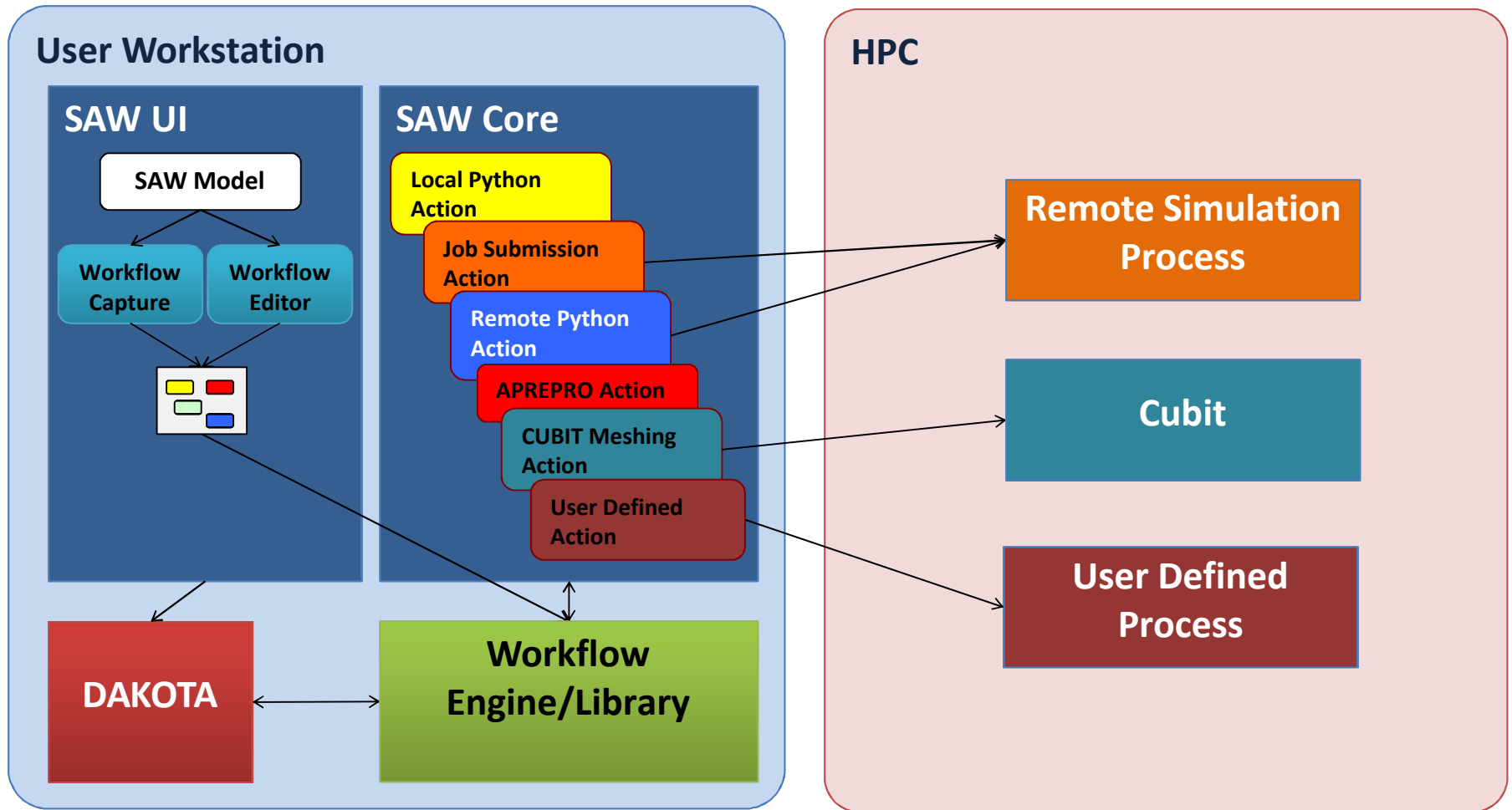
Workflow Architecture – Phase II



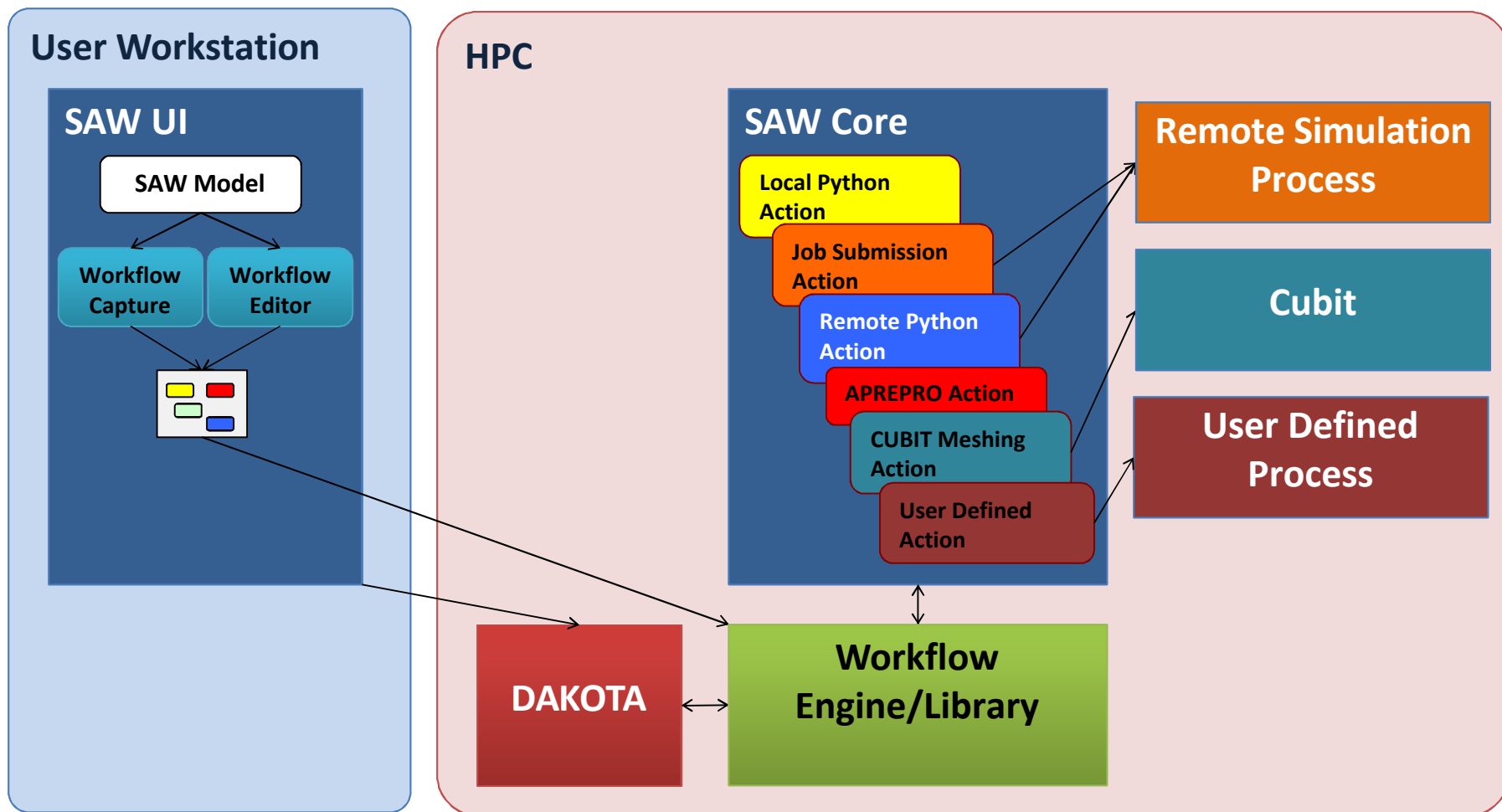
Workflow Architecture – Phase III



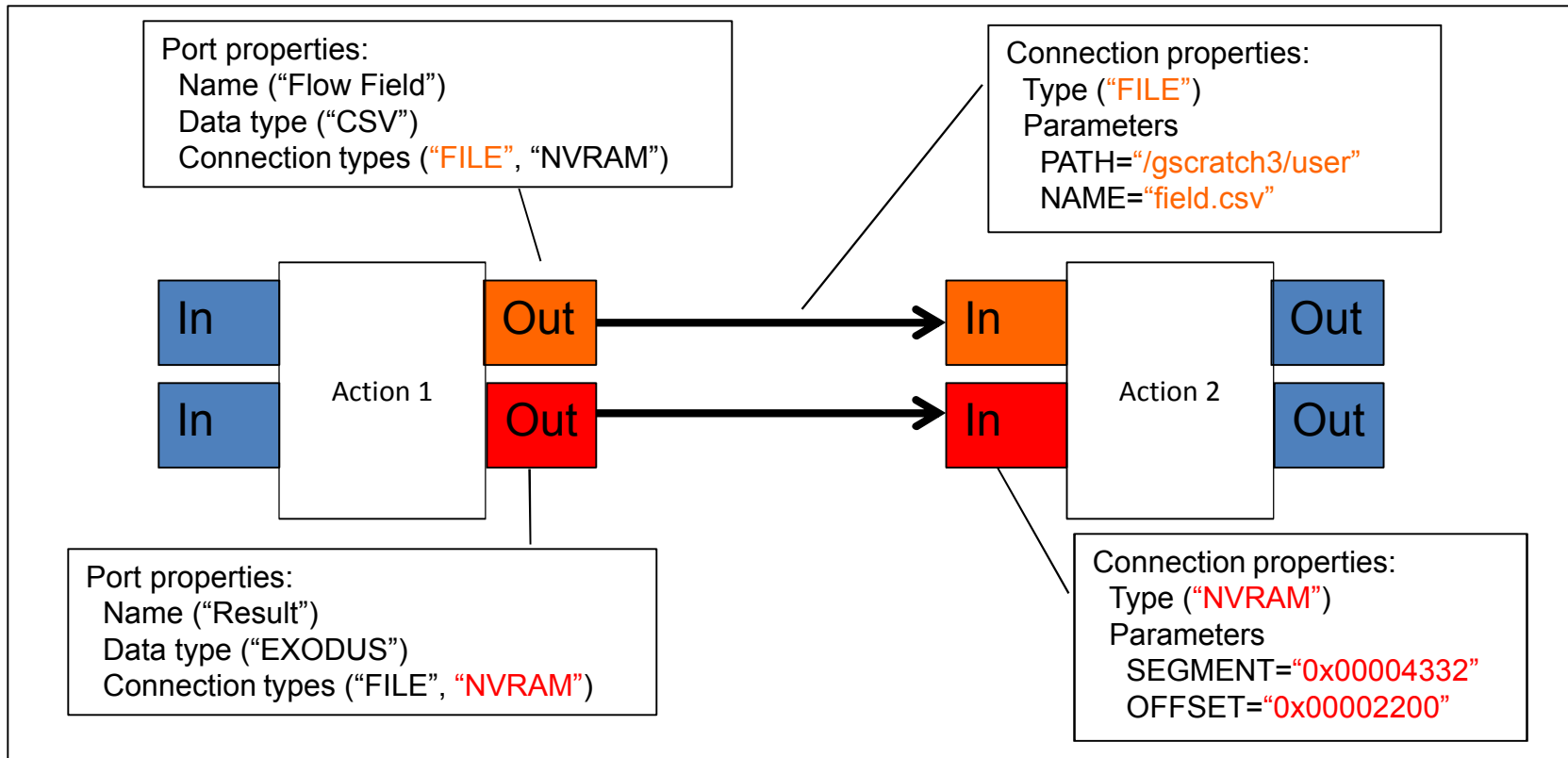
Workflow Architecture – Phase IV



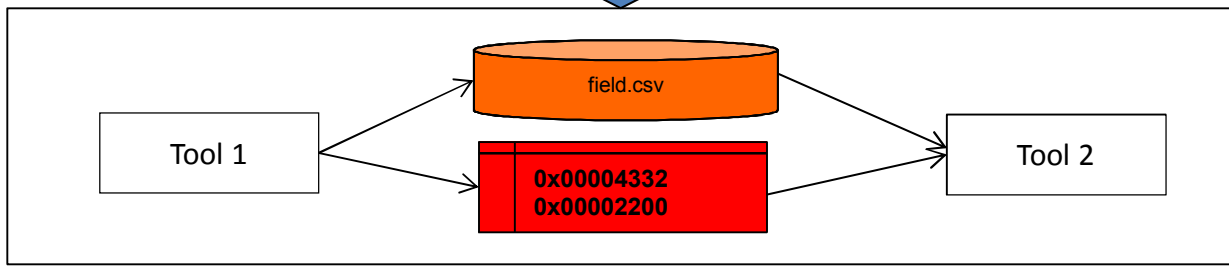
Workflow Architecture – Phase V



Proposed Scalable Workflow Architecture Directly Connects HPC Codes Using Available Comms



Execute using COTS Workflow Engine



Acknowledgements

- Ernest Friedman-Hill (PI)
- Ed Hoffman
- Marcus Gibson
- Kevin Olson
- Mike Glass (Sierra)
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- Brian Adams (Dakota)