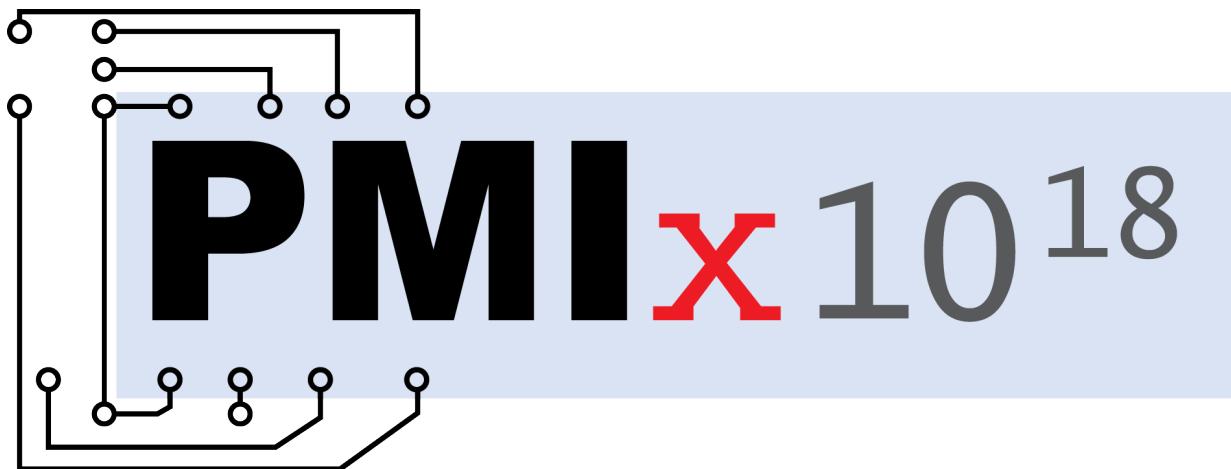
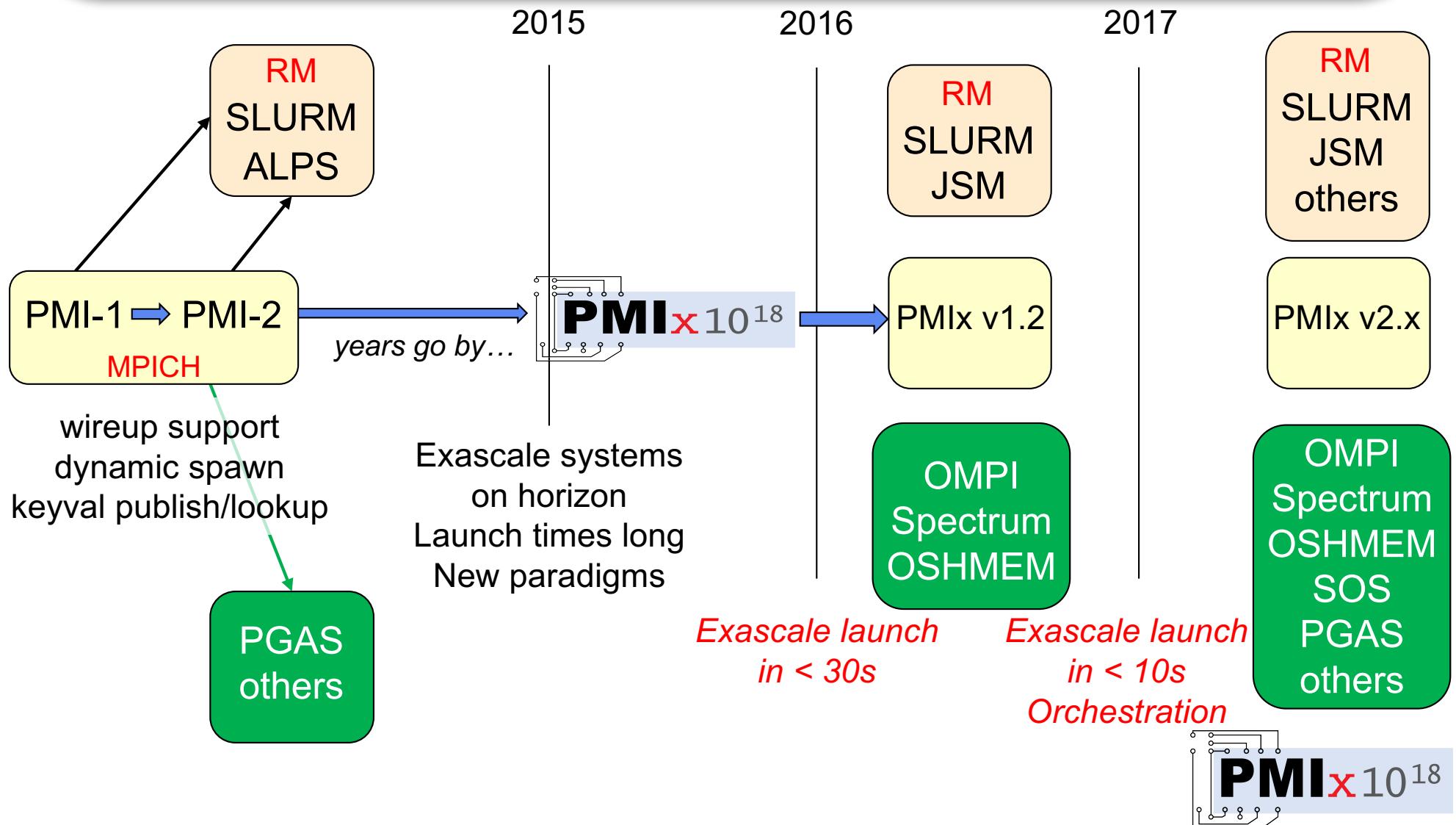


PMIx: Process Management for Exascale Environments

Ralph H. Castain, David Solt, Joshua Hursey, Aurelien Bouteiller
EuroMPI/USA 2017, Chicago, IL

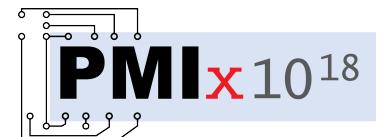


What is PMIx?

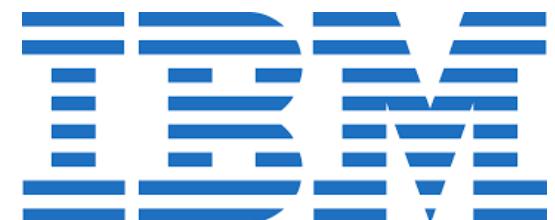


Three Distinct Entities

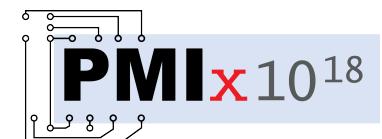
- PMIx Standard
 - Defined set of APIs, attribute strings
 - Nothing about implementation
- PMIx Reference Library
 - A full-featured implementation of the Standard
 - Intended to ease adoption
- PMIx Reference Server
 - Full-featured “shim” to a non-PMIx RM



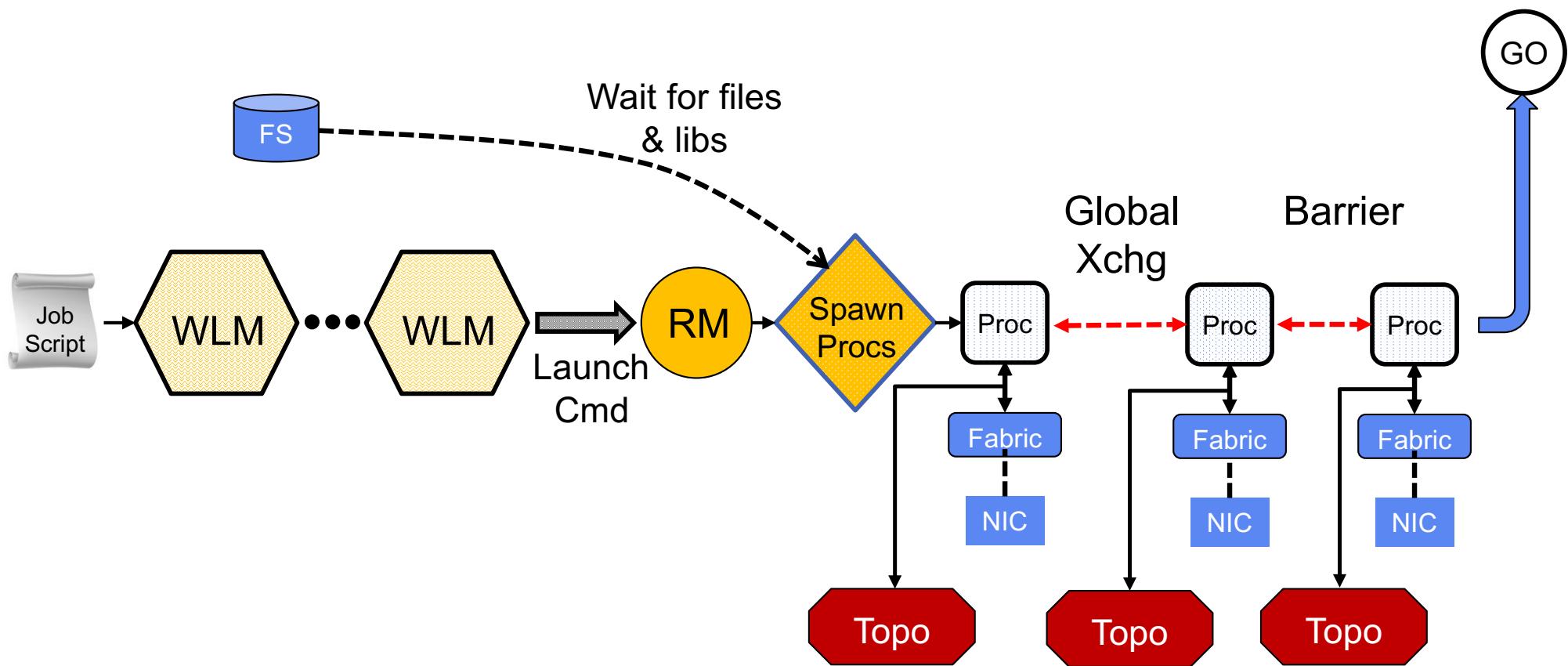
The Community



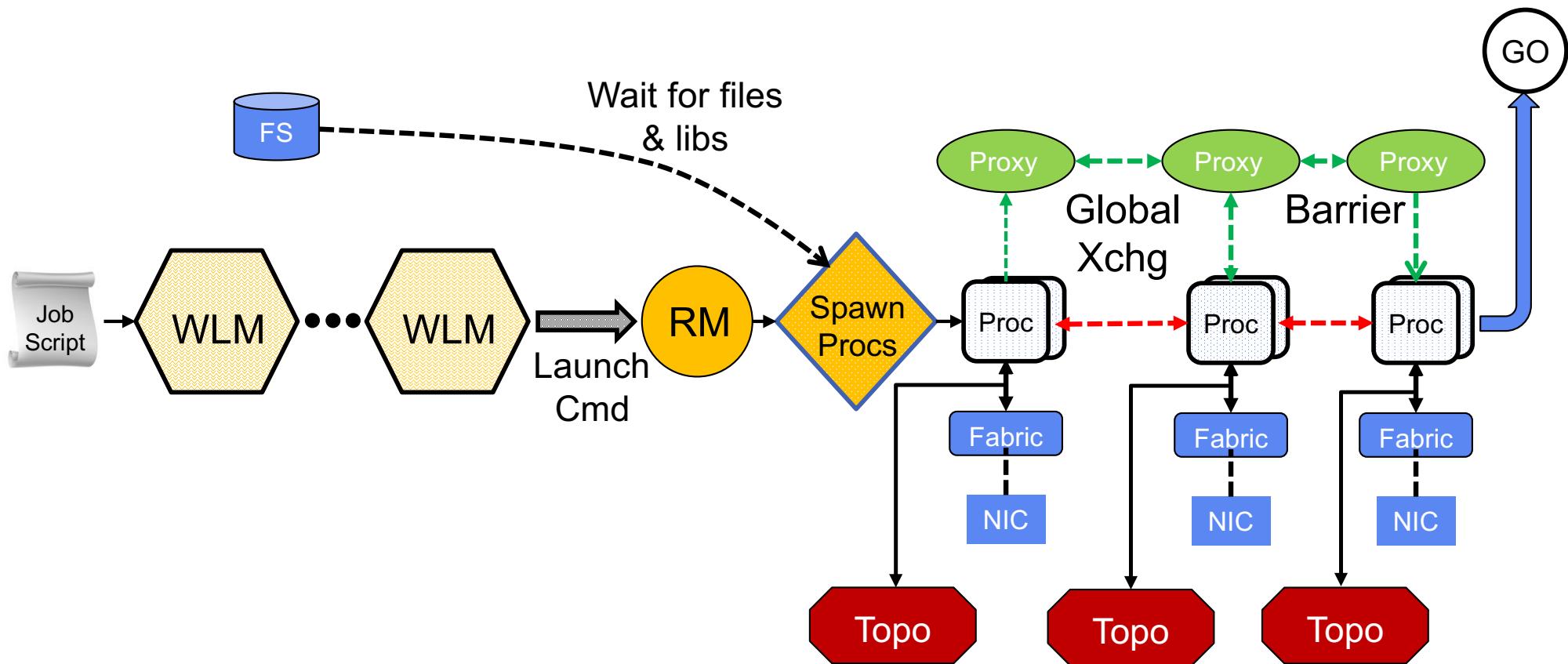
<https://pmix.github.io/pmix>
<https://github.com/pmix>



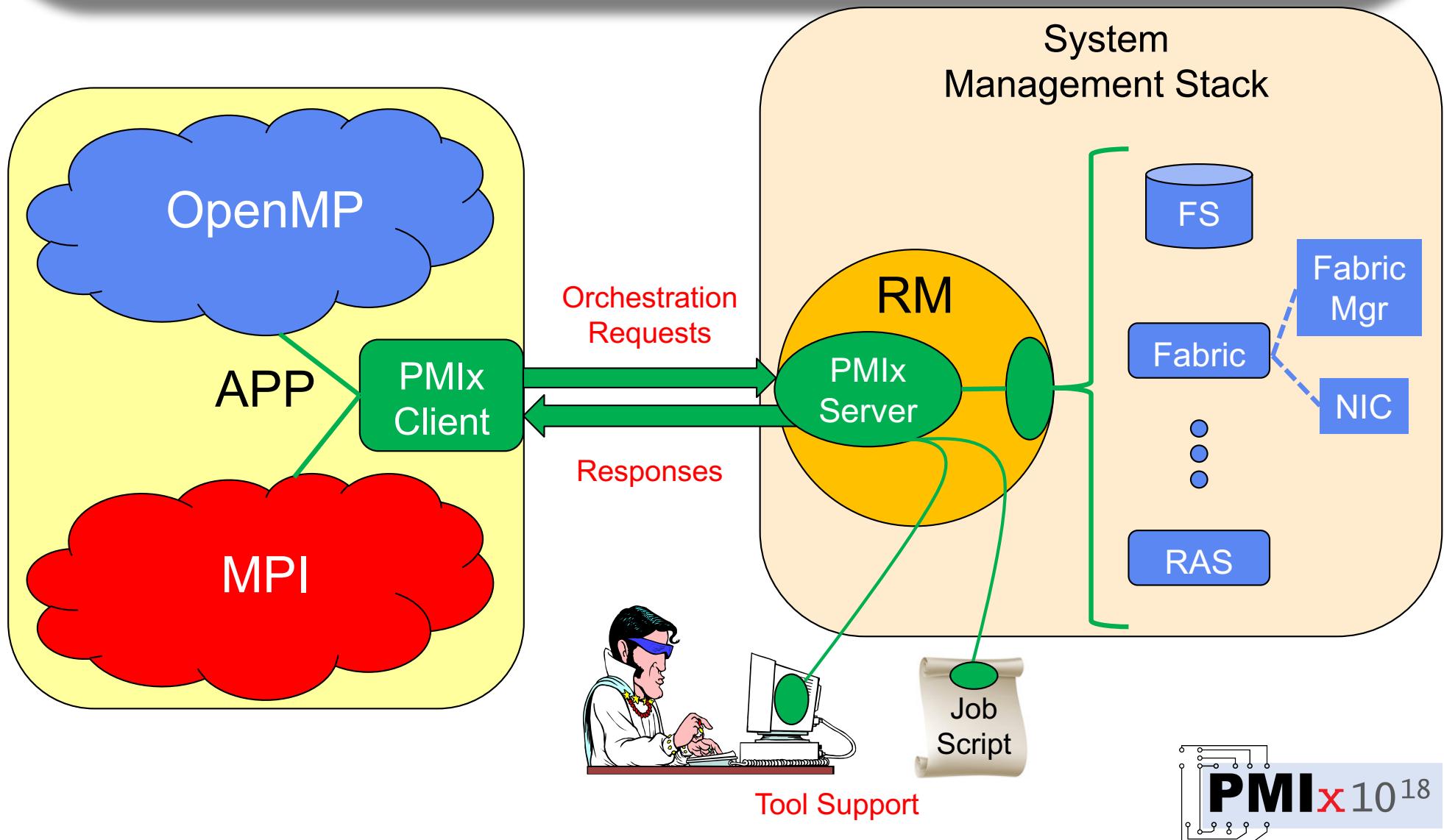
Traditional Launch Sequence



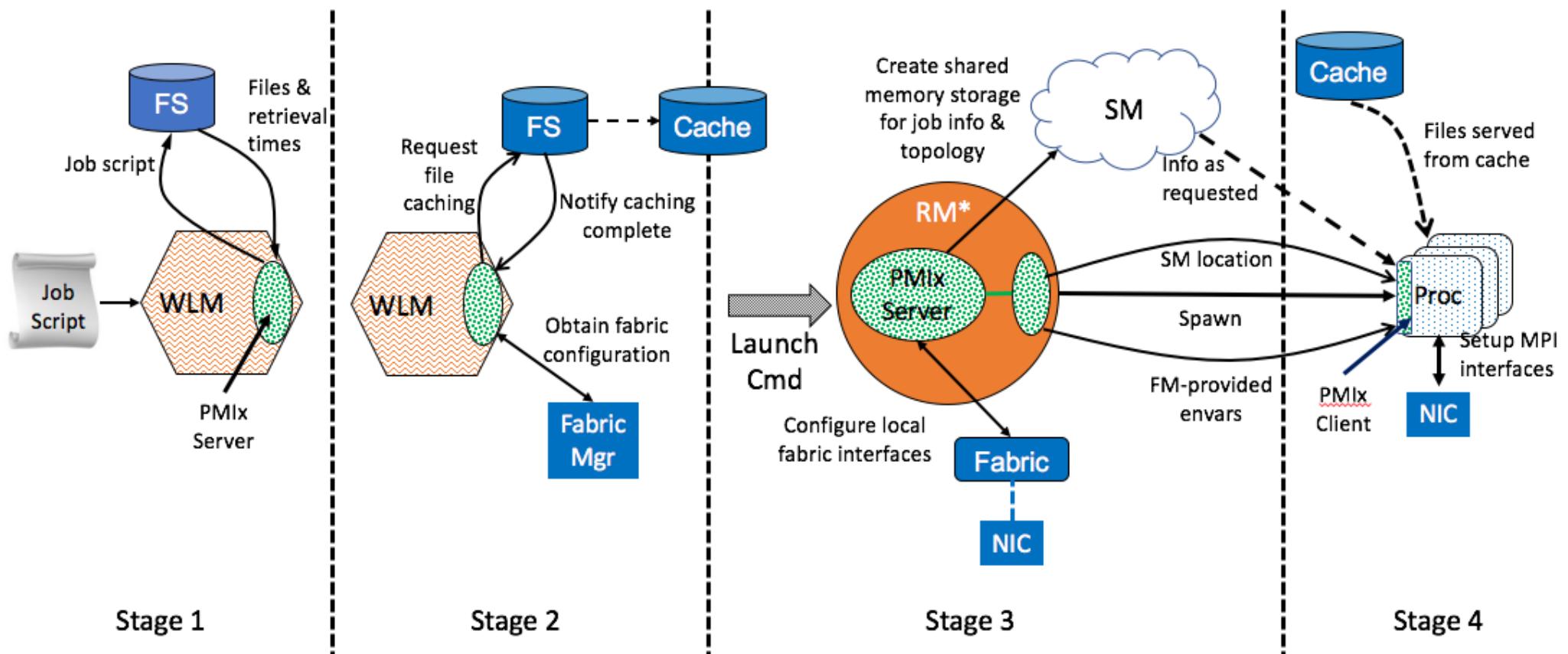
Newer Launch Sequence



PMIx-SMS Interactions



PMIx Launch Sequence

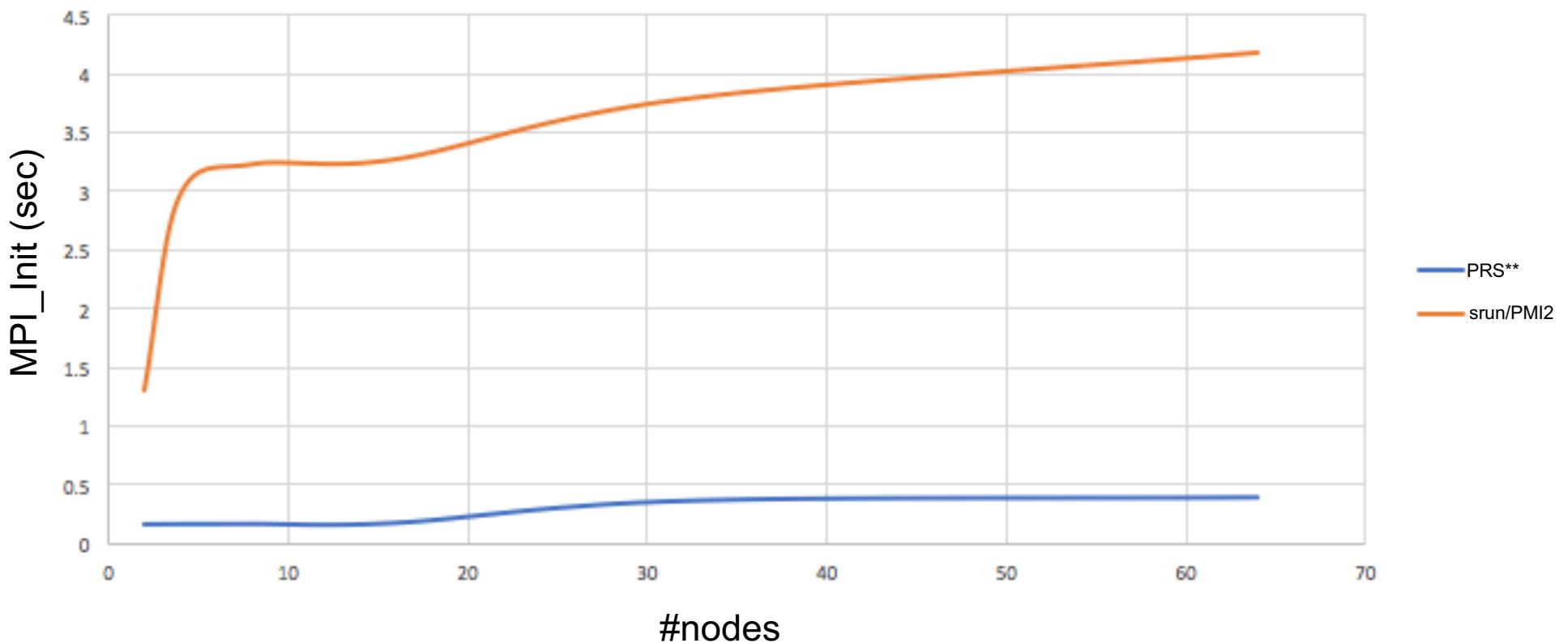


*RM daemon, mpirun-daemon, etc.

PMIx/SLURM*

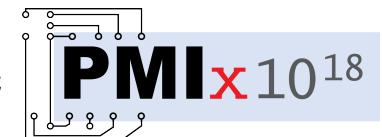
Performance papers coming in 2018!

TOTAL



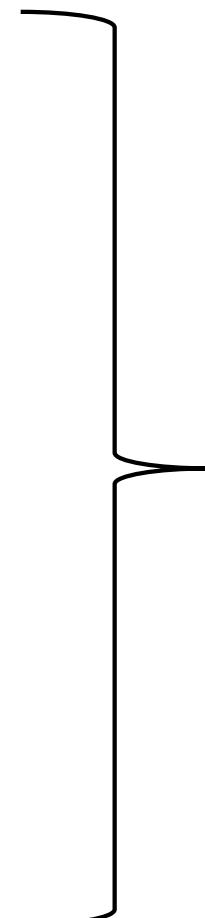
*LANL/Buffy cluster, 1ppn

**PMIx Reference Server v2.0, direct-fetch/async



Similar Requirements

- Notifications/response
 - Errors, resource changes
 - Negotiated response
- Request allocation changes
 - shrink/expand
- Workflow management
 - Steered/conditional execution
- QoS requests
 - Power, file system, fabric



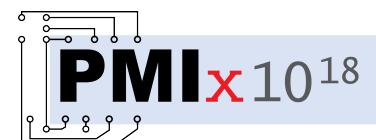
Multiple,
use-
specific
libs?
(difficult for RM
community to
support)

*Single,
multi-
purpose
lib?*

PMIx “Standards” Process

- Modifications/additions
 - Proposed as RFC
 - Include prototype implementation
 - Pull request to reference library
 - Notification sent to mailing list
- Reviews conducted
 - RFC and implementation
 - Continues until consensus emerges
- Approval given
 - Developer telecon (weekly)

*Standards Doc
under
development!*



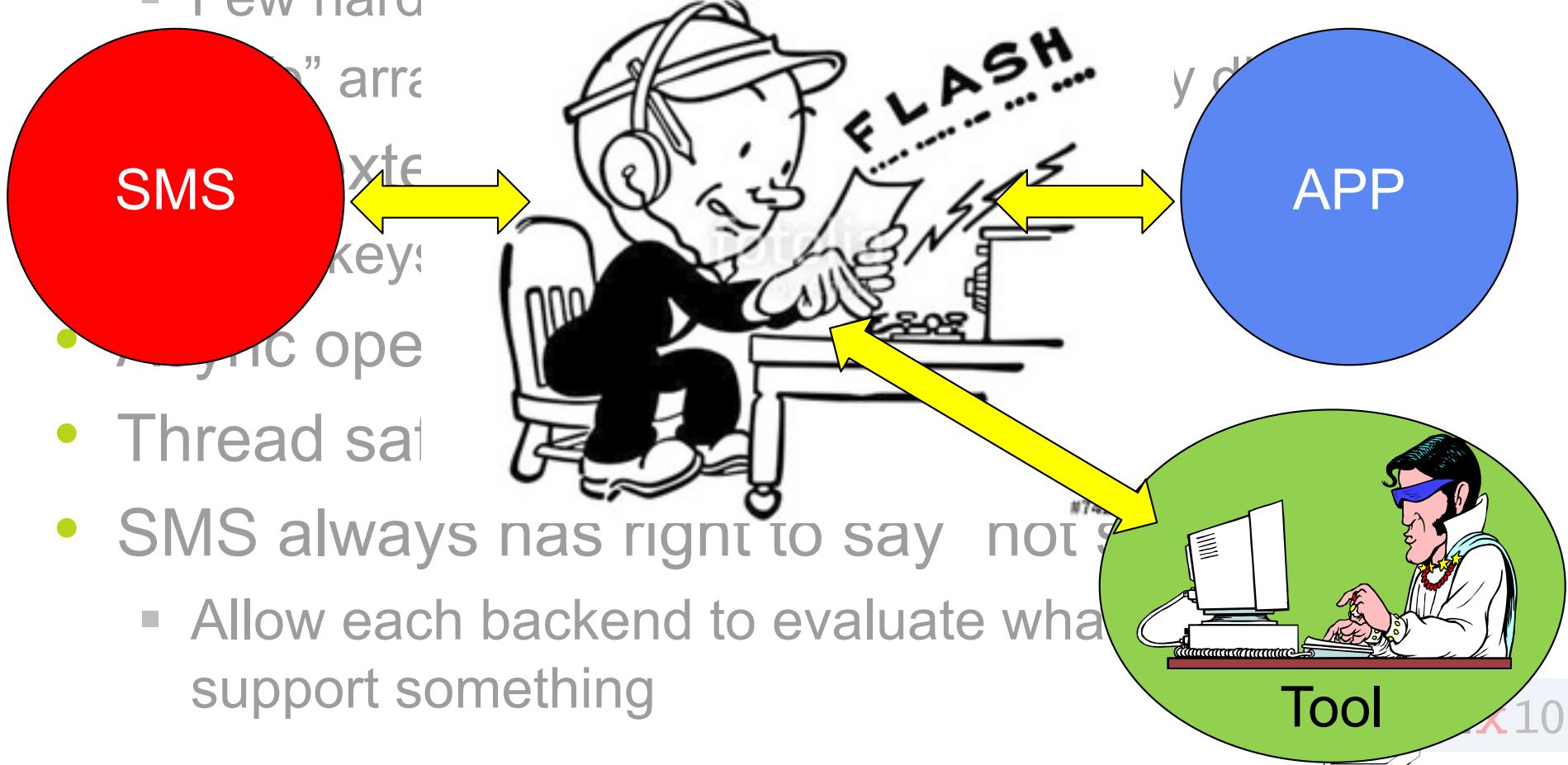
Philosophy

- Generalized APIs
 - Few hard parameters
 - “Info” arrays to pass information, specify directives
- Easily extended
 - Add “keys” instead of modifying API
- Async operations
- Thread safe
- SMS always has right to say “not supported”
 - Allow each backend to evaluate what and when to support something

Messenger not Doer

- Generalized APIs

- Few hard parameters



- Thread safe

- SMS always has right to say 'not supported'

- Allow each backend to evaluate what they support something

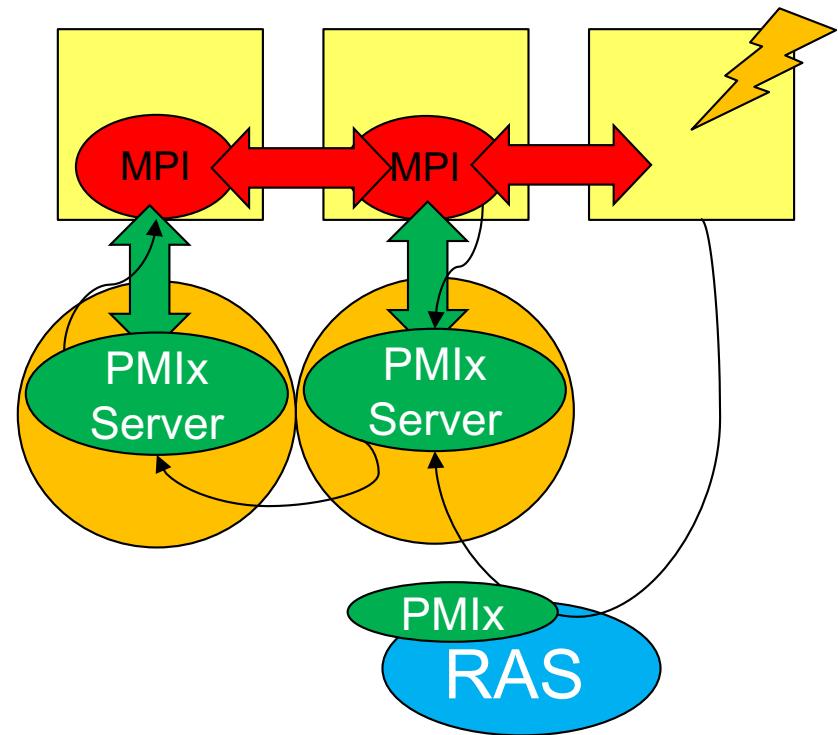
10¹⁸

Current Support

- Typical startup operations
 - Put, get, commit, barrier, spawn, [dis]connect, publish/lookup
- Tool connections
 - Debugger, job submission, query
- Generalized query support
 - Job status, layout, system data, resource availability
- Event notification
 - App, system generated
 - Subscribe, chained
 - Pre-emption, failures, timeout warning, ...
- Logging (job record)
 - Status reports, error output
- Flexible allocations
 - Release resources, request resources

Event Notification Use Case

- Fault detection and reporting w/ULFM MPI
 - ULFM MPI is a fault tolerant flavor of Open MPI
- Failures may be detected from the **SMS**, **RAS**, or directly by **MPI** communications
- Components produce a **PMIx event** when detecting an error
- Fault Tolerant components register for the fault event
- Components propagate fault events which are then delivered to registered clients



In Pipeline

- Network support
 - Security keys, pre-spawn local driver setup, **fabric topology** and status, traffic reports, fabric manager interaction
- Obsolescence protection
 - Automatic cross-version compatibility
 - Container support
- Job control
 - Pause, kill, signal, heartbeat, resilience support
- Generalized data store
- File system support
 - Dependency detection
 - Tiered storage caching strategies
- Debugger/tool support⁺⁺
 - Automatic rendezvous
 - Single interface to all launchers
 - Co-launch daemons
 - Access fabric info, etc.
- Cross-library interoperation

Summary

We now have an interface library RMs will support for application-directed requests

*Need to collaboratively define
what we want to do with it*

Project: <https://pmix.github.io/pmix>

Reference Implementation: <https://github.com/pmix/pmix>

Reference Server: <https://github.com/pmix/pmix-reference-server>

