PMIx: Process Management for Exascale Environments

What is PMIx?

2015   2016   2017

RM
SLURM
ALPS

PMI-1 → PMI-2
MPICH

years go by…

PMIx 10^{18}

wireup support
dynamic spawn
keyval publish/lookup

PGAS
others

Exascale systems
on horizon
Launch times long
New paradigms

RM
SLURM
JSM

PMIx v1.2

OMPI
Spectrum
OSHMEM

*Exascale launch
in < 30s*

*Exascale launch
in < 10s
Orchestration*

RM
SLURM
JSM
others

PMIx v2.x

OMPI
Spectrum
OSHMEM
SOS
PGAS
others
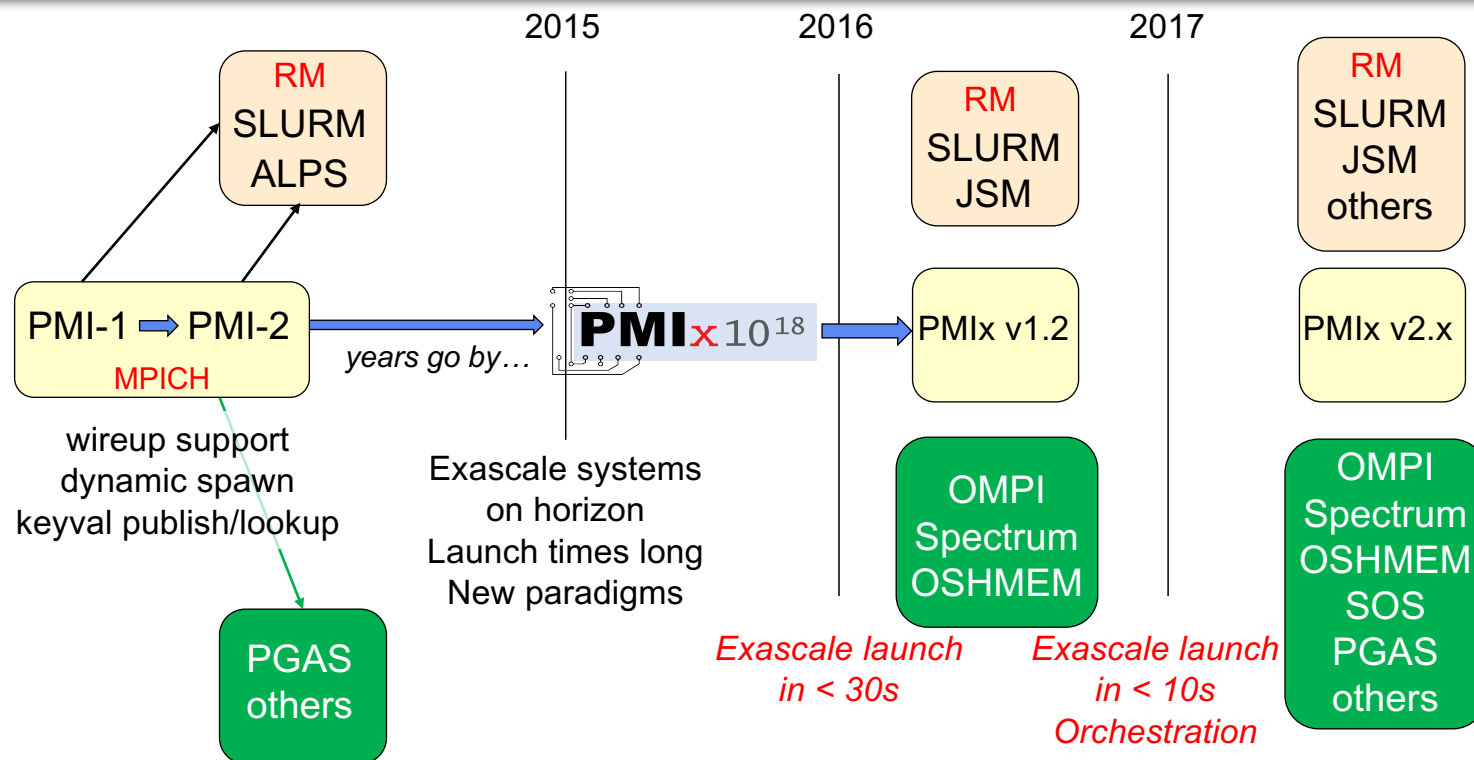
Three Distinct Entities

- PMIx Standard
  - Defined set of APIs, attribute strings
  - Nothing about implementation

Standards Doc under development!

- 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
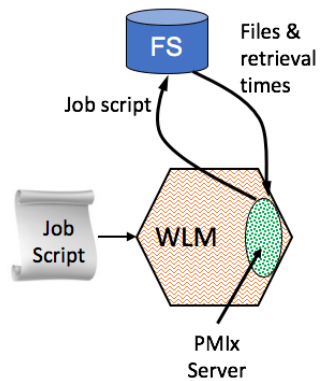 - Provides development environment

Where Are We?

- Launch scaling
  - Wireup enhancements complete
  - Fabric "instant on" enablement underway

- Results
  - Tracks spawn propagation time
  - Exascale in < 5 seconds
  - 3rd party confirmation

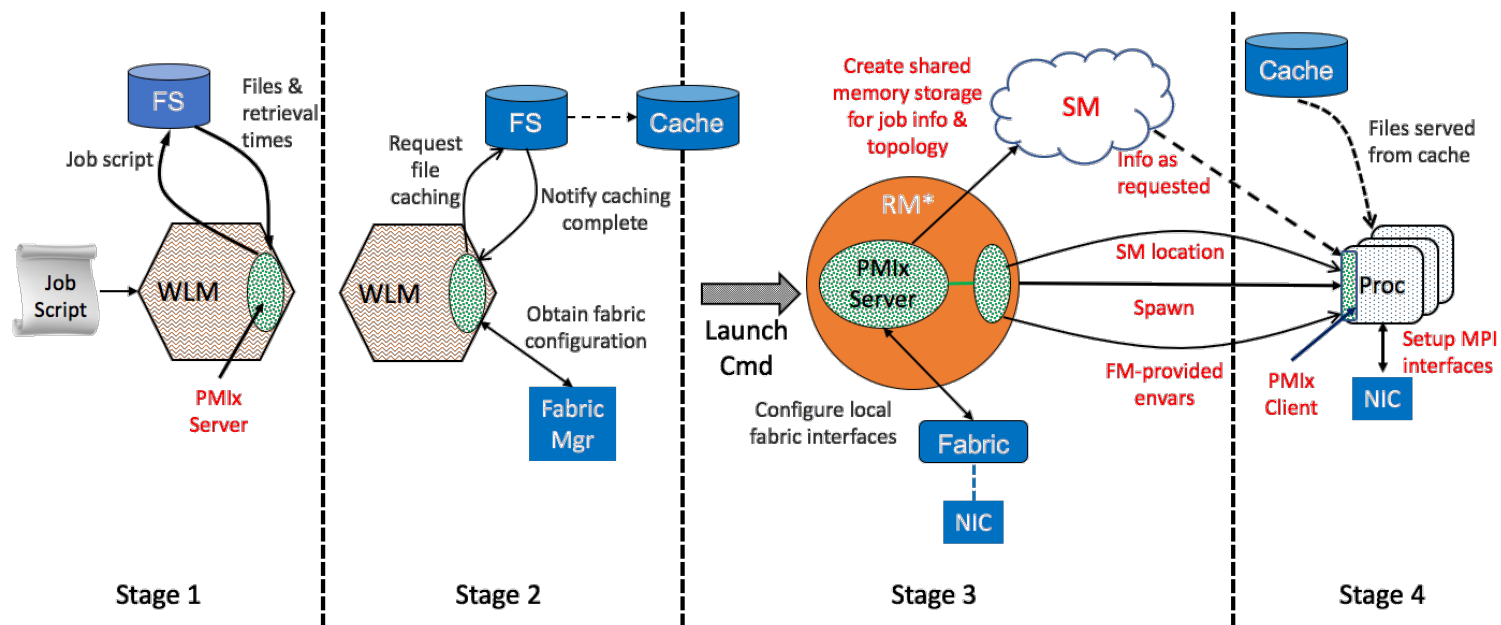EuroMPI 2017 Overview Article*

*extended version to be published

PMIx Launch Sequence

Stage 1

*RM daemon, mpirun-daemon, etc.

PMIx Launch Sequence

*RM daemon, mpirun-daemon, etc.

Current Support (I)

- 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
  - Preemption, failures, timeout warning, …
- Logging
  - Status reports, error output
- Flexible allocations
  - Release resources, request resources

Current Support (II)

- Network support
  - Security keys, pre-spawn local driver setup
- Obsolescence protection
  - Automatic cross-version compatibility
  - Container support

- Job control
  - Pause, kill, signal, heartbeat, resilience support (C/R coordination)
- Async definition of process groups
  - Rolling startup/teardown

In Pipeline

- Network support
  - Fabric topology and status, traffic reports, fabric manager interaction
- MPI Sessions support
  - Rolling startup/teardown
- Generalized data store
  - Distributed key-value storage
- Security
  - Obtain and validate credentials for application/SMS
- Power directives

- 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
  - OpenMP/MPI coordination

■ Nearing completion   ■ Ramping up   ■ Idling

Further Info

- PMIx BOF
  - Wed 12:15, Rms 210-212
- Enhanced SLURM launch scaling
  - Right here, Thurs 2pm
- Community sites
  - https://github.com/pmix