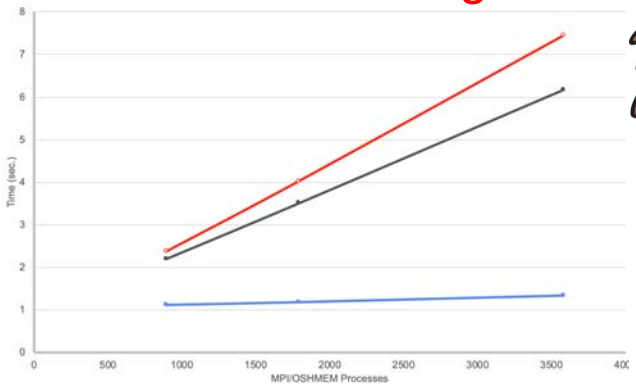
PMIx: Storage Integration

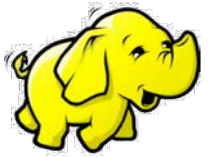
Origin: Changing Landscape

Launch time limiting scale



Programming model & runtime proliferation

Legion

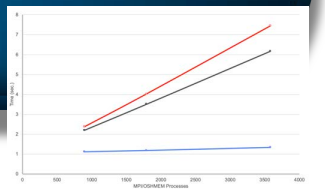


Hybrid applications

Model-specific tools

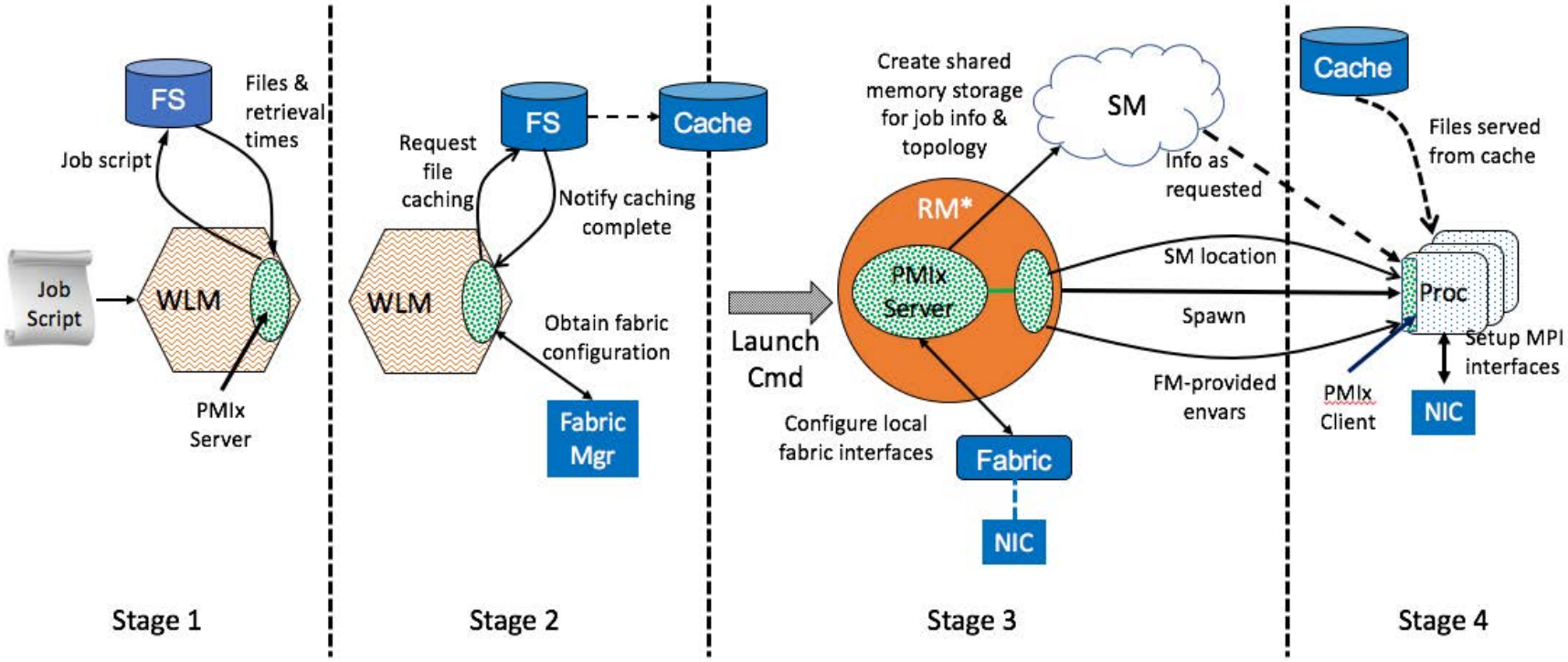
Container technologies

Start Someplace!



- Resolve launch scaling
  - Pre-load information known to RM/scheduler
  - Pre-assign communication endpoints
  - Eliminate data exchange during init
  - Orchestrate launch procedure

PMIx Launch Sequence



*RM daemon, mpirun-daemon, etc.

Build Upon It

- Async event notification
- Cross-model notification
  - Announce model type, characteristics
  - Coordinate resource utilization, programming blocks
- Generalized tool support
  - Co-launch daemons with job
  - Forward stdio channels
  - Query job, system info, network traffic, process counters, etc.
  - Standardized attachment, launch methods

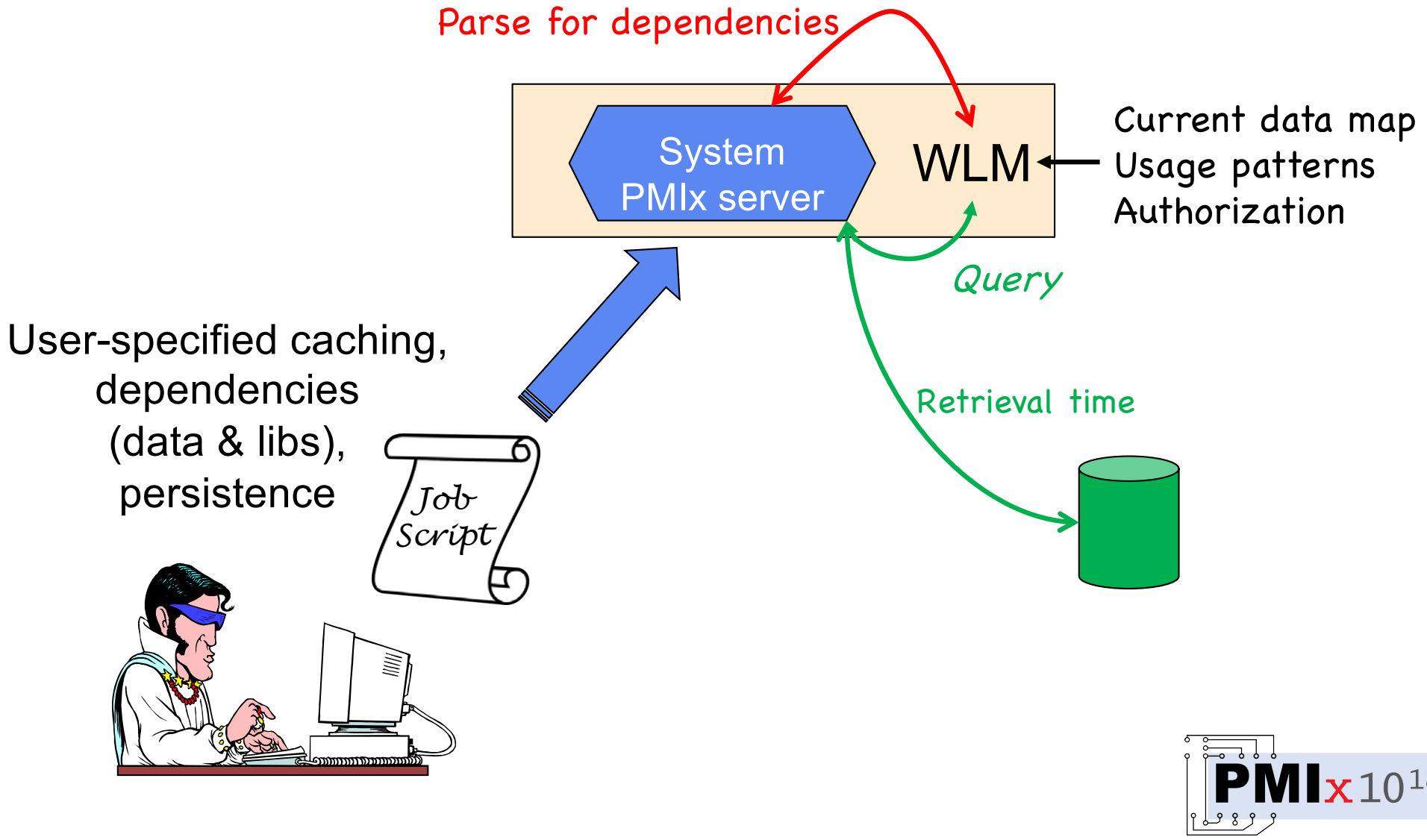
Sprinkle Some Magic Dust

- Allocation support
  - Dynamically add/remove/loan nodes
  - Register pre-emption acceptance, handshake
- Dynamic process groups
  - Async group construct/destruct
  - Notification of process departure/failure
- File system integration
  - Pre-cache files, specify storage strategies

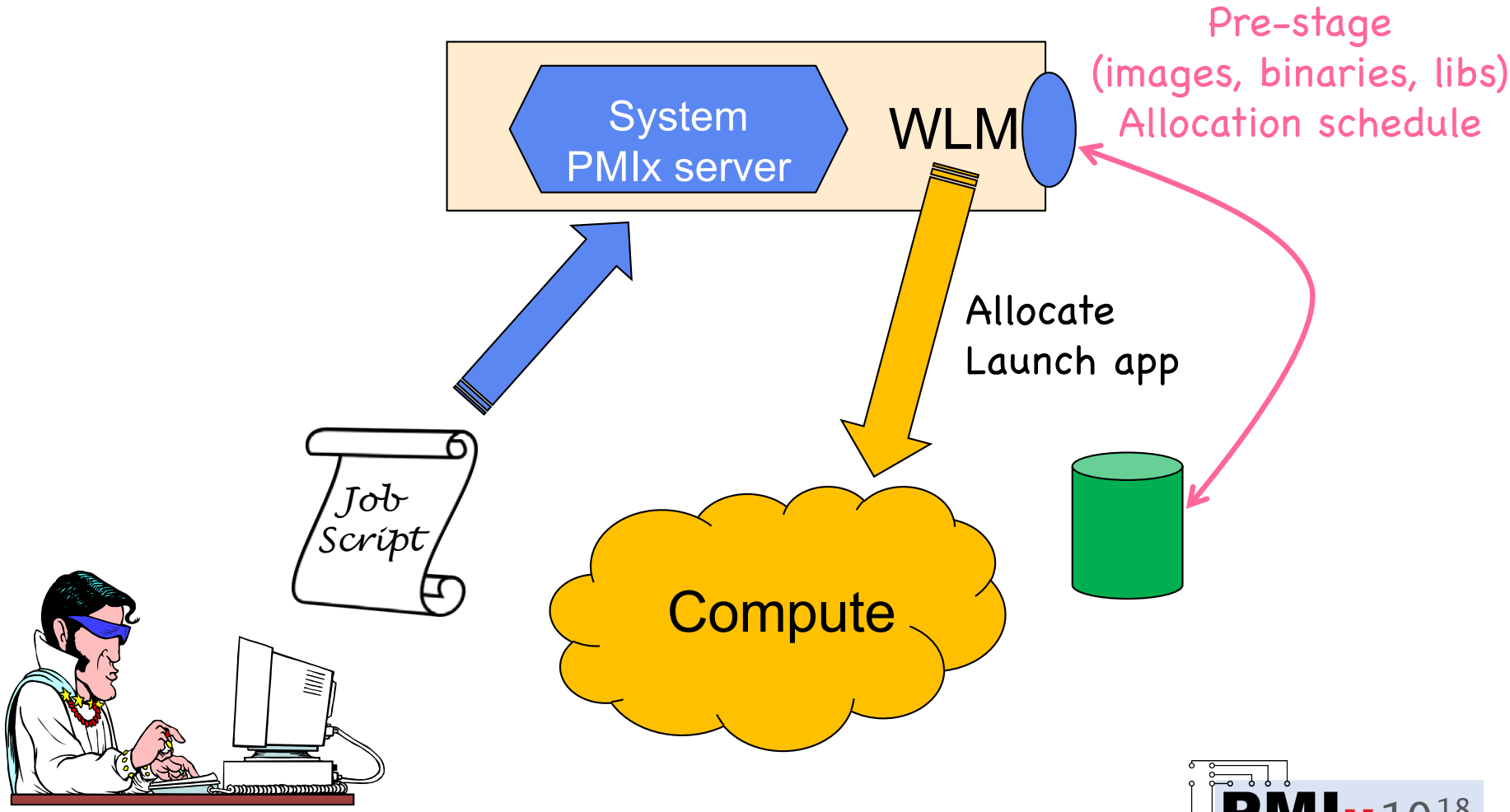
Baseline Vision

- Tiered storage
  - Parallel file system
  - Caches at IO server, switches, cabinets, …
  - Caches hold images, files, executables, libraries, checkpoints
- Bits flow in all directions
  - Stage locations prior to launch
  - Movement in response to faults, dynamic workflow, computational stages

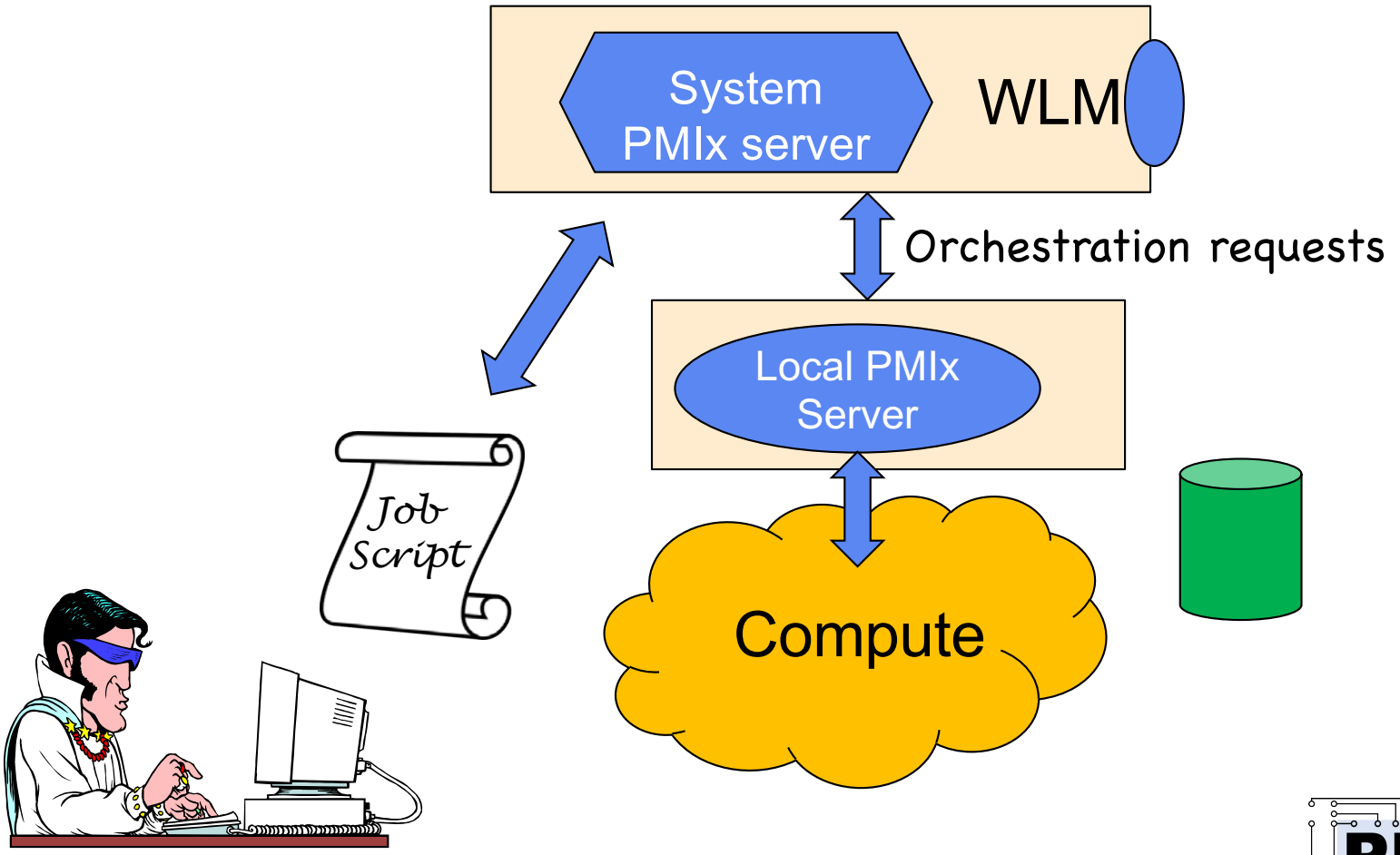
Planned Support



Planned Support



Planned Support



Push Forward?

https://pmix.org https://github.com/pmix

PMIx 10^18

Overview Paper

PMIx: Process Management for Exascale Environments

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Abstract

High-Performance Computing (HPC) applications have historically executed in static resource allocations, using programming models that ran independently from the resident system management stack (SMS). Achieving exascale performance that is both cost-effective and fits within site-level environmental constraints will, however, require that the application and SMS collaboratively orchestrate the flow of work to optimize resource utilization and compensate for on-the-fly faults. The Process Management Interface - Exascale (PMIx) community is committed to establishing scalable workflow orchestration by defining an abstract set of interfaces by which not only applications and tools can interact with the resident SMS, but also the various SMS components can interact with each other. This paper presents a high-level overview of the goals and current state of the PMIx standard, and lays out a roadmap for future directions.

Ralph H. Castain, Aurelien Bouteiller, Joshua Hursey, David Solt, “PMIx: Process management for exascale environments”, Parallel Computing, 2018.

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