The Harness Workbench: Unified and Adaptive Access to Diverse HPC Platforms

Presented by

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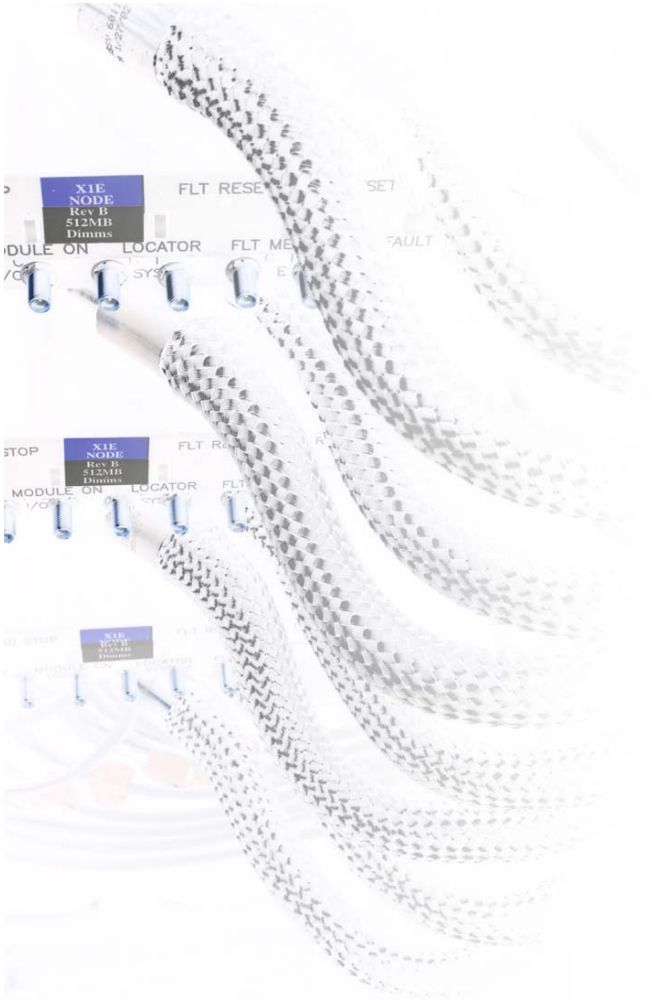
Existing scientific application development and deployment issues

- The diversity of HPC platforms and associated software complexity often pose challenges that lead to slow or hampered scientific discovery.
- Application scientists expend considerable time and effort dealing with development, deployment, and runtime interfacing activities.
- Additionally, the short HPC system deployment and upgrade interval requires frequent redeployment of scientific application to different system software stacks.



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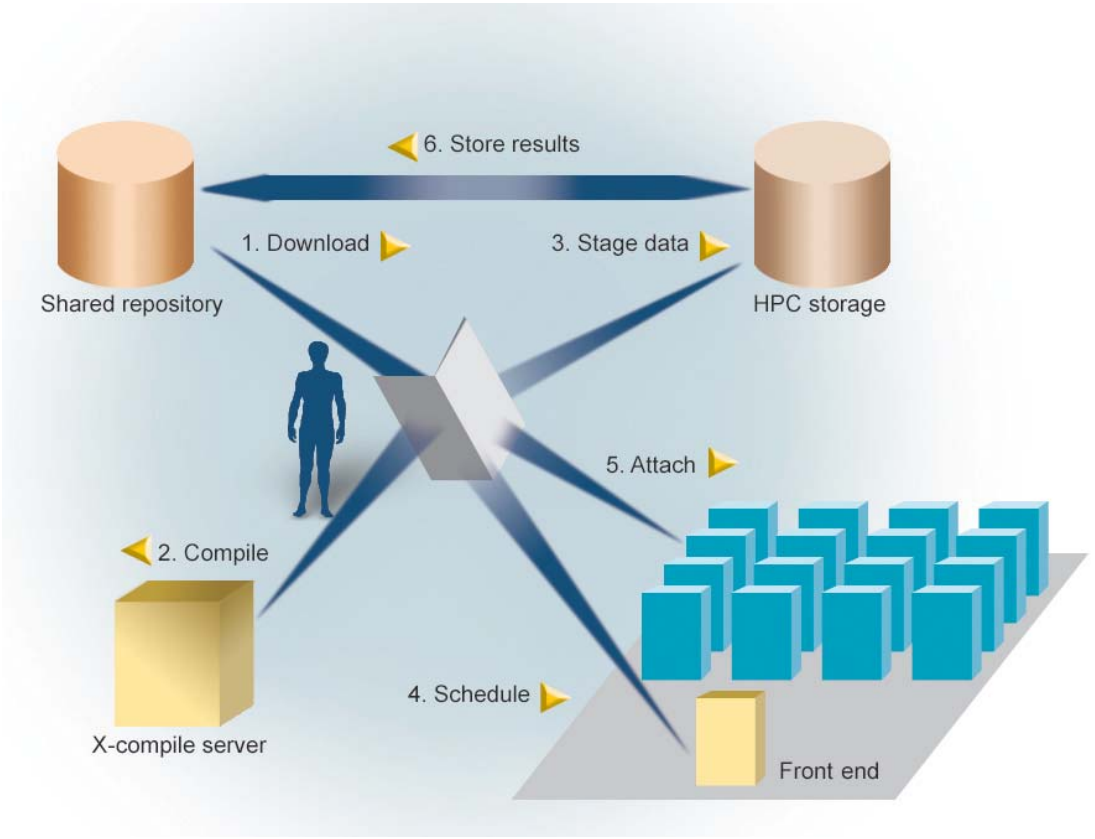
Research and development goals

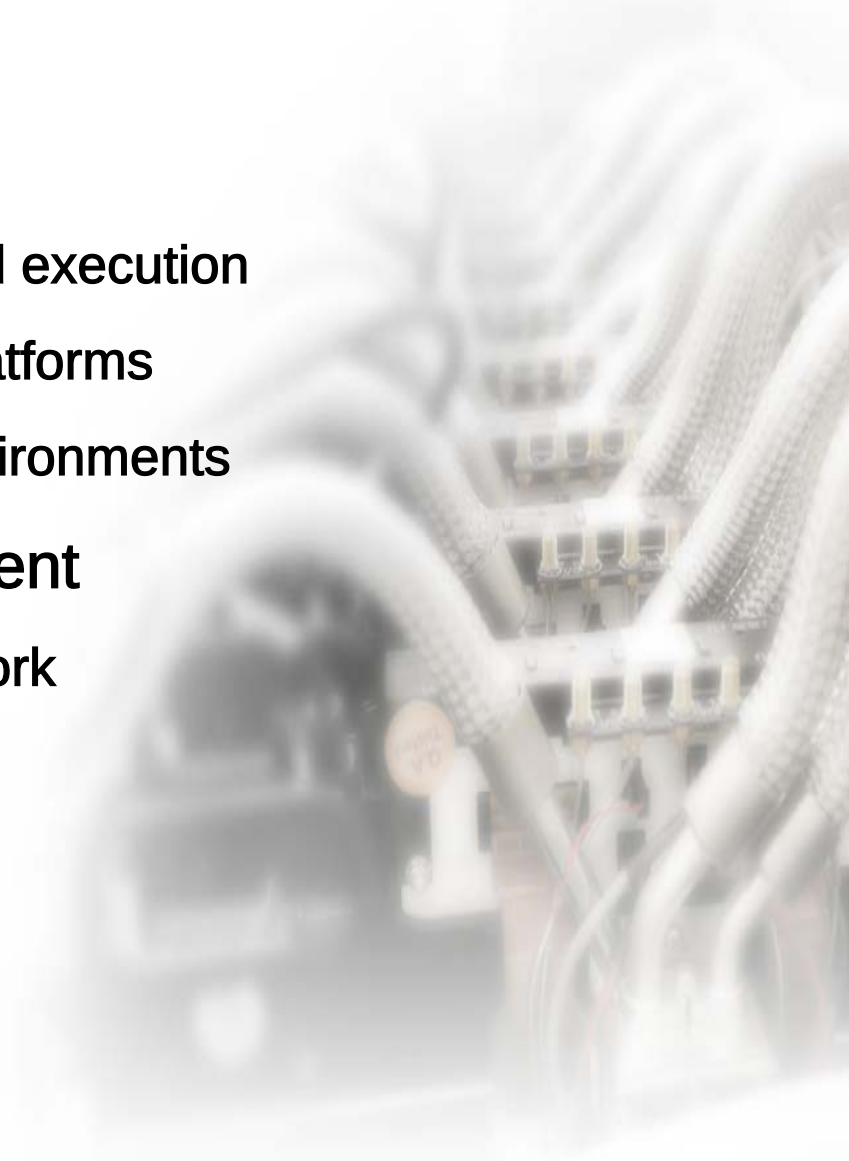
- Increasing the overall productivity of developing and executing computational codes
- Optimizing the development and deployment processes of scientific applications
- Simplifying the activities of application scientists, using uniform and adaptive solutions
- “Automagically” supporting the diversity of existing and emerging HPC architectures



Typical scientific application development, deployment, and execution activities

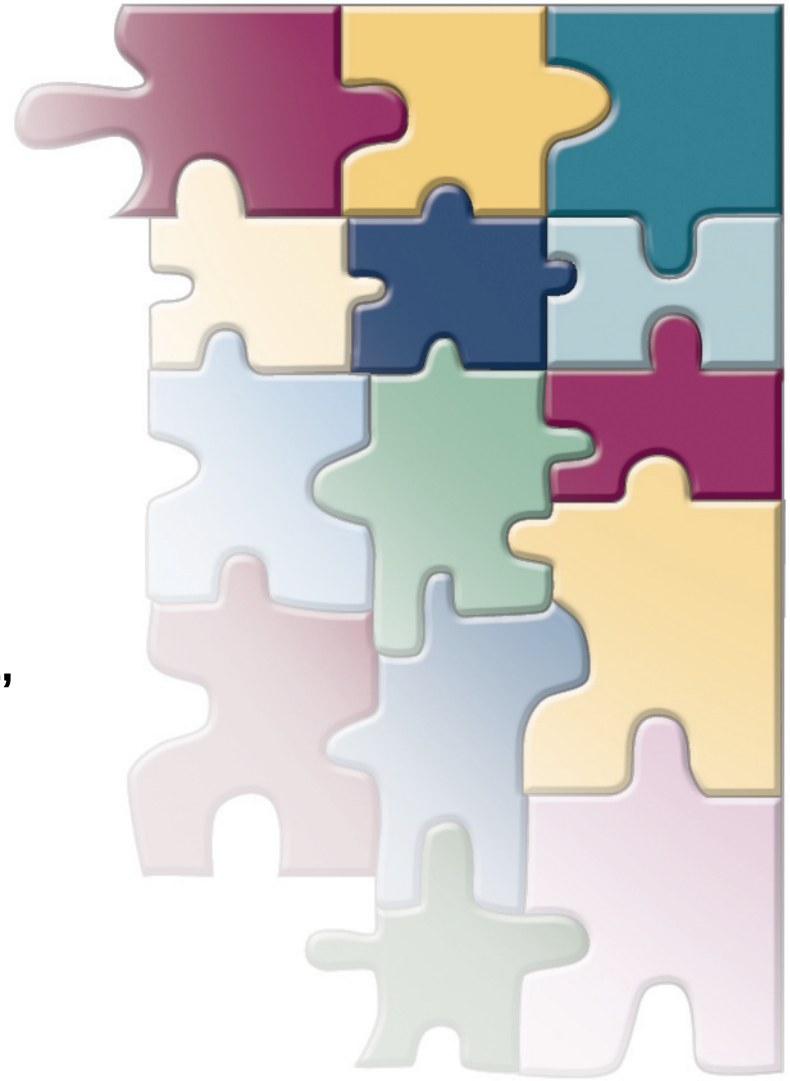
Harness workbench core components

- Harness Workbench Toolkit
  - Unified development, deployment, and execution
  - Common view across diverse HPC platforms
  - User-space installation and virtual environments
- Next-generation runtime environment
  - Flexible, adaptive, lightweight framework
  - Management of runtime tasks
  - Support for diverse HPC platforms



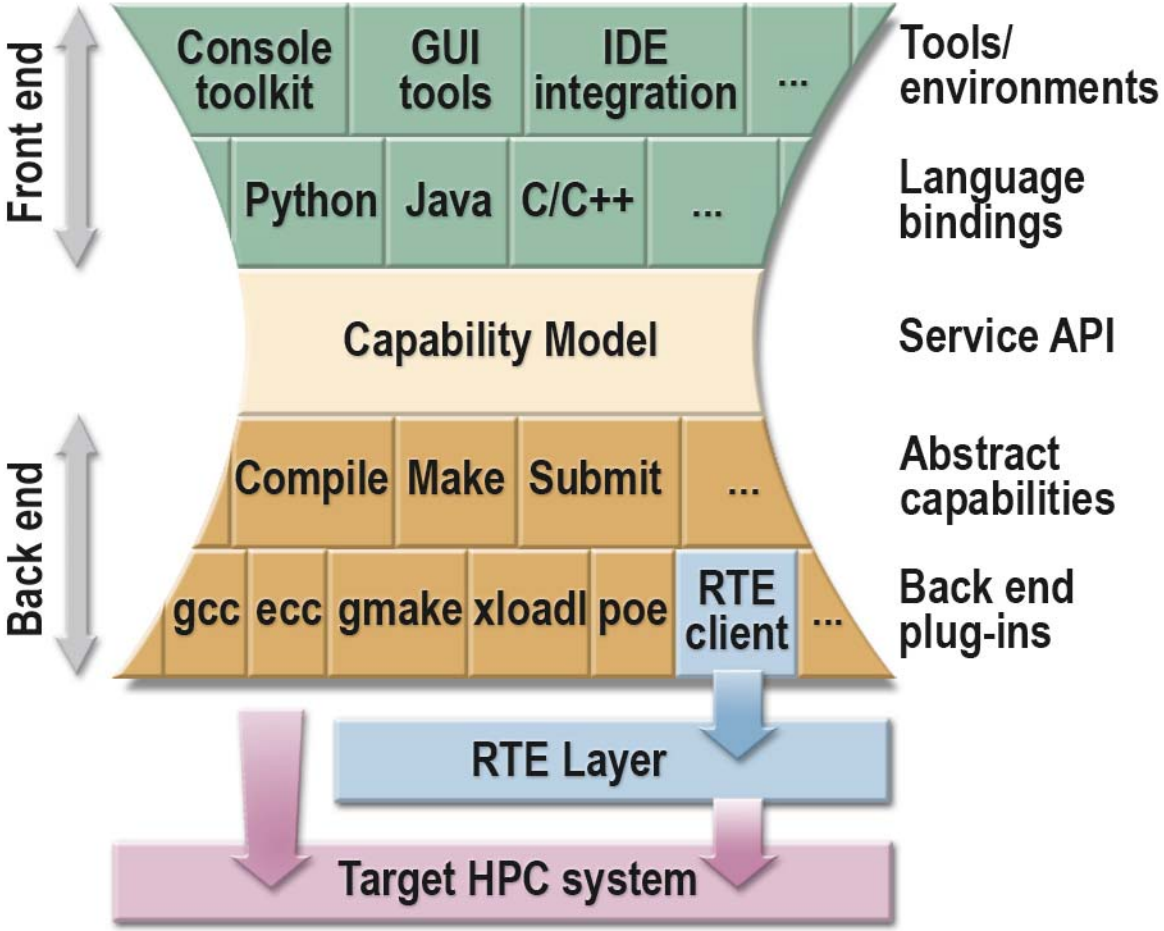
Harness workbench core technologies

- Automatic adaptation using pluggable modules
  - Harness Workbench Toolkit plug-ins
  - Runtime environment plug-ins
- Development environment and toolkit interfaces
  - Easy-to-use interfaces for scientific application development, deployment, and execution



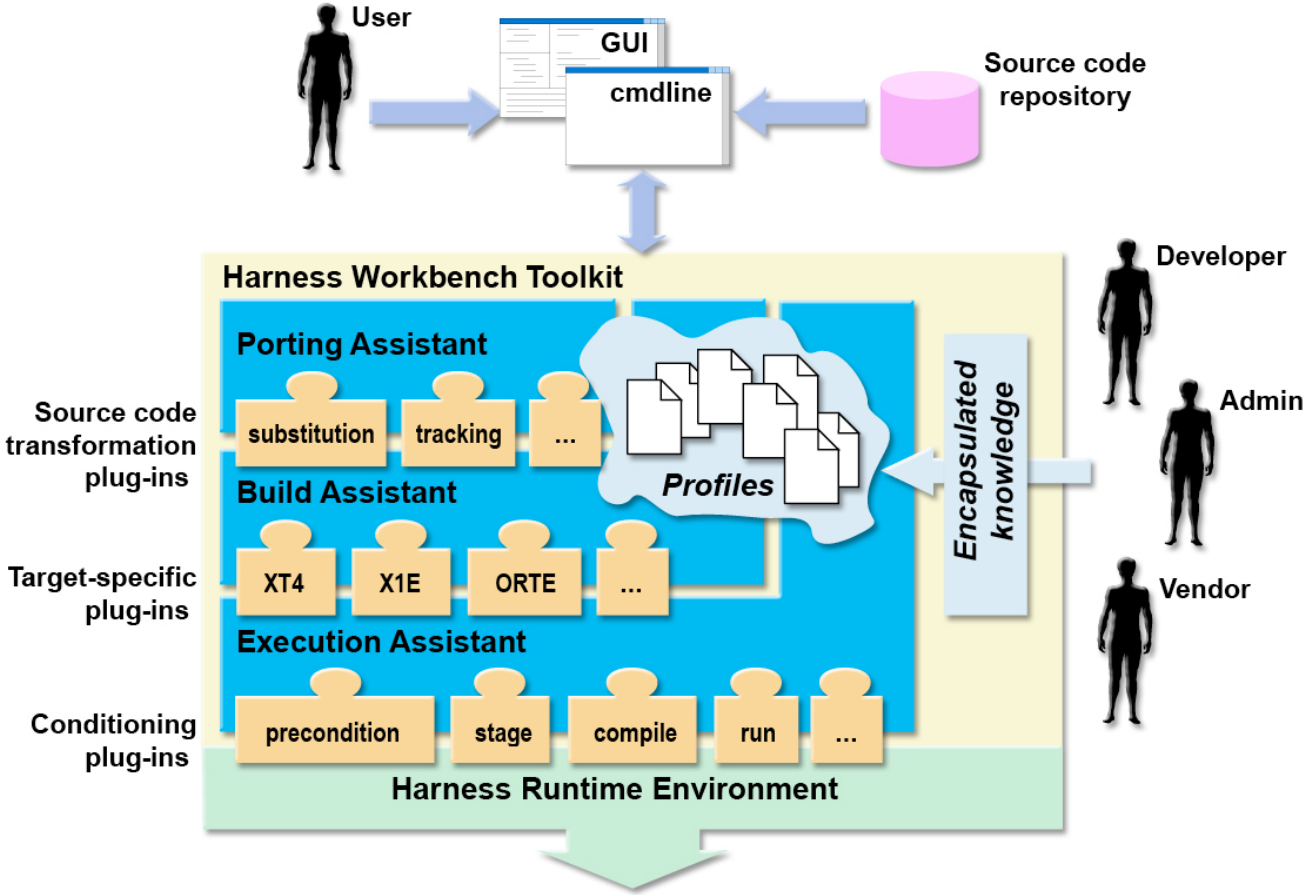
Common view across diverse platforms

- Various interfaces and bindings to external development and deployment tools and environments
- Generalized model for unified access to common development and deployment activities
- Mapping of generalized activities onto platform-specific toolkits and runtime environments (RTEs) via pluggable modules



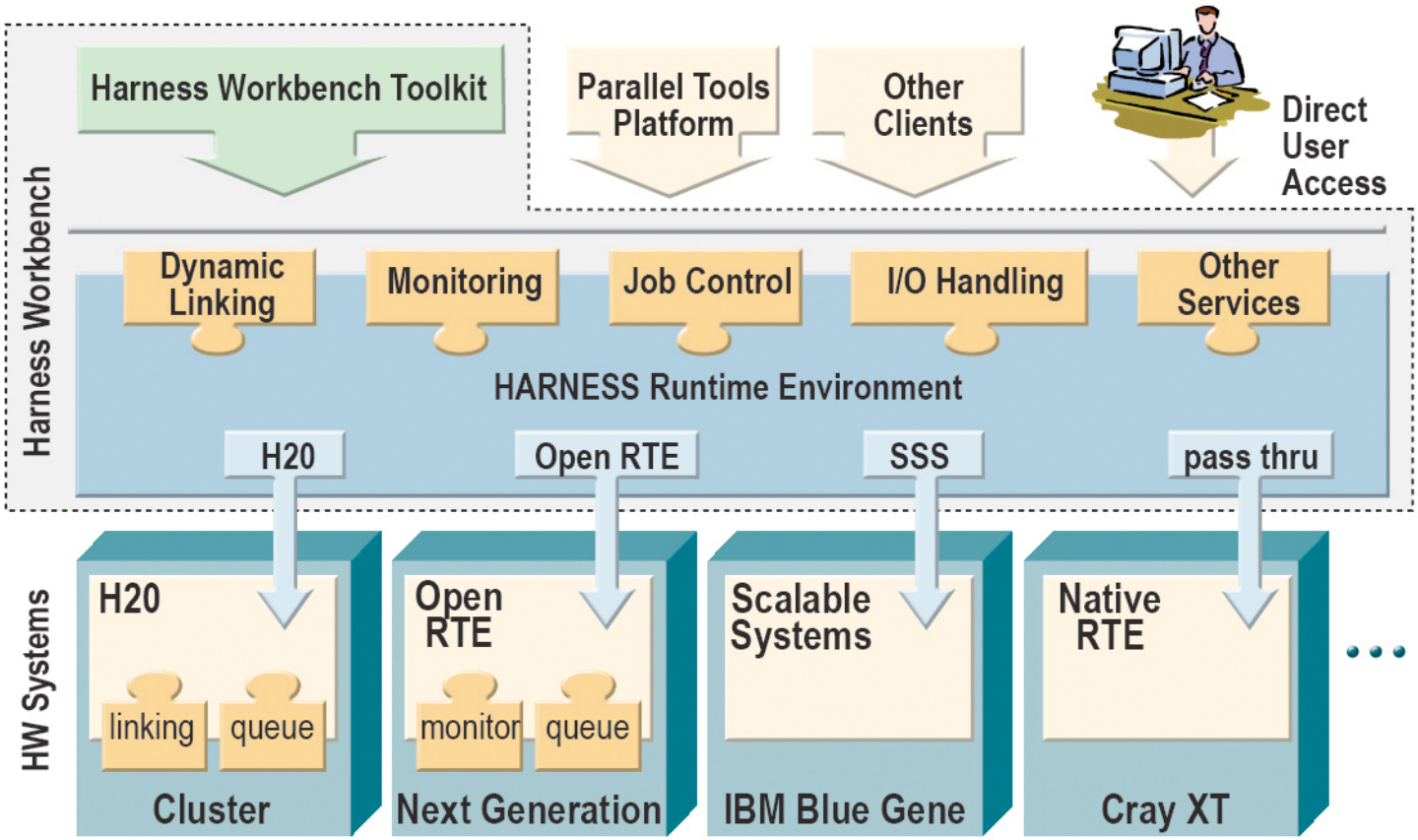
Harness Workbench Toolkit

- Unifying abstraction over heterogeneous HPC resources
- Command line and GUI tools
- Translation into fine-tuned invocations of native toolkits
- Behavior encapsulated in plug-ins
- Configurable through profiles
- Tunable by end users



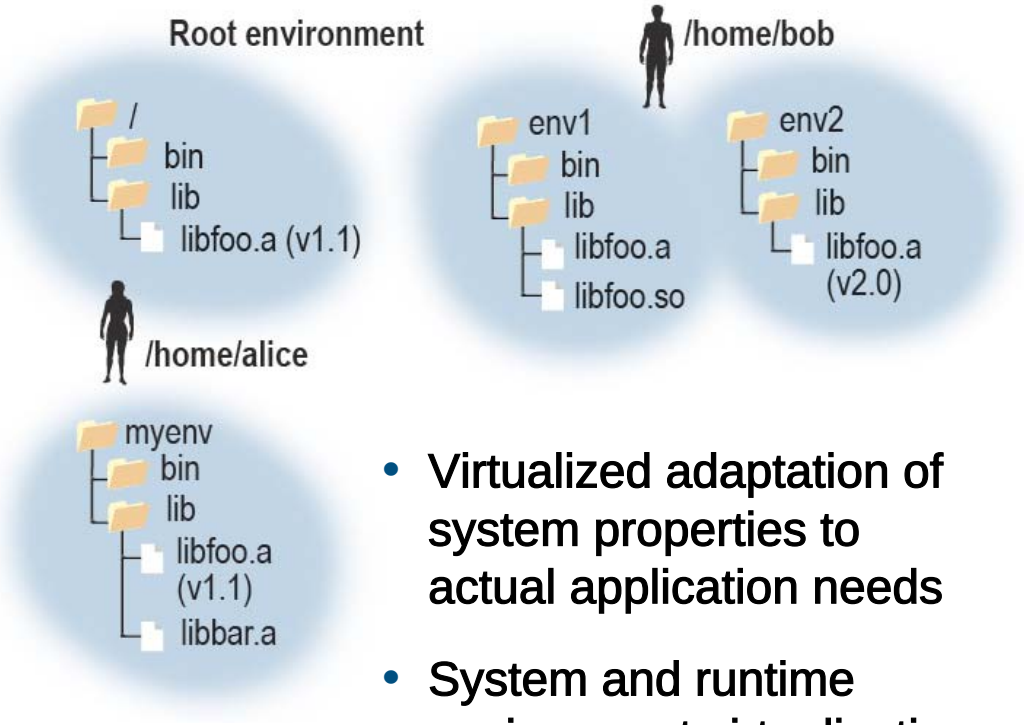
Next-generation runtime environment

- Uniform interface to various front-end systems
- Virtualized baseline platform runtime environment capabilities
- Advanced runtime environment capabilities via high-level plug-ins



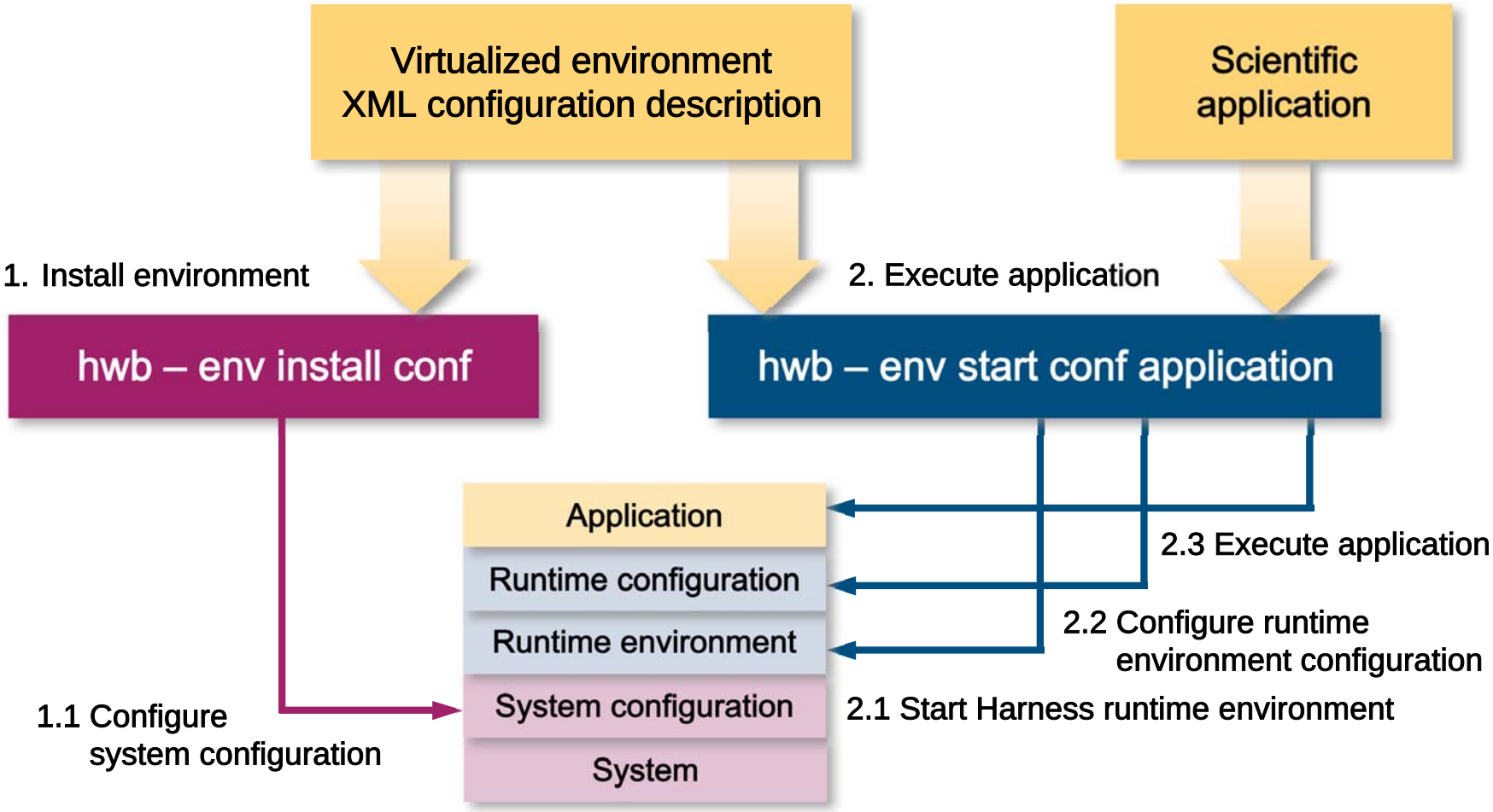
Virtualized environments

- Problem:
  - Application dependencies may cause conflicts with system-wide installed libraries.
- Solution:
  - Use co-existing, alternative user-space installations.
- Approach:
  - Provide isolated installation environments (“sandboxes”).
  - These can inherit from one another to build nested hierarchies.



- Virtualized adaptation of system properties to actual application needs
- System and runtime environment virtualization

Configurable “sandboxes” for scientific applications



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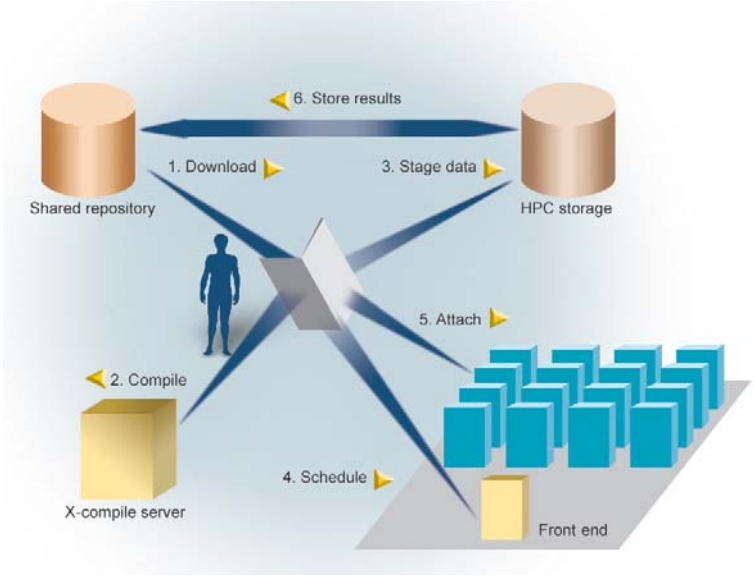

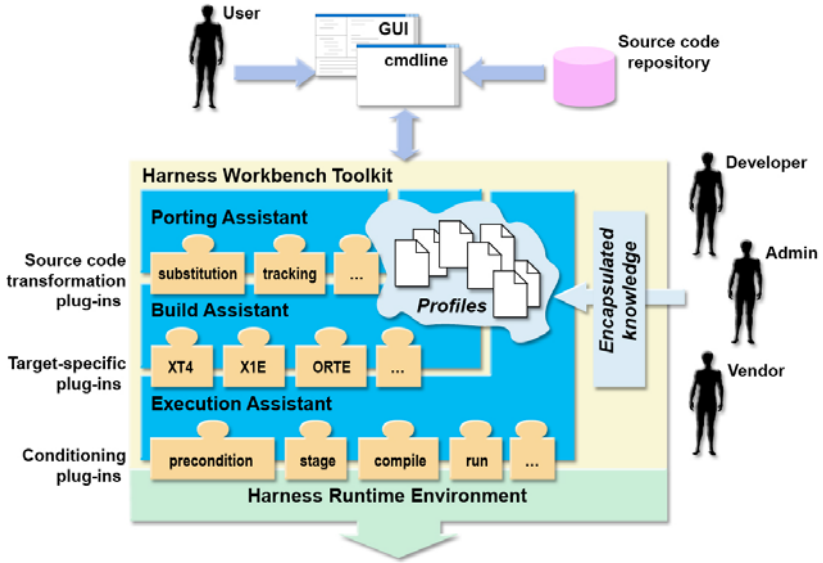

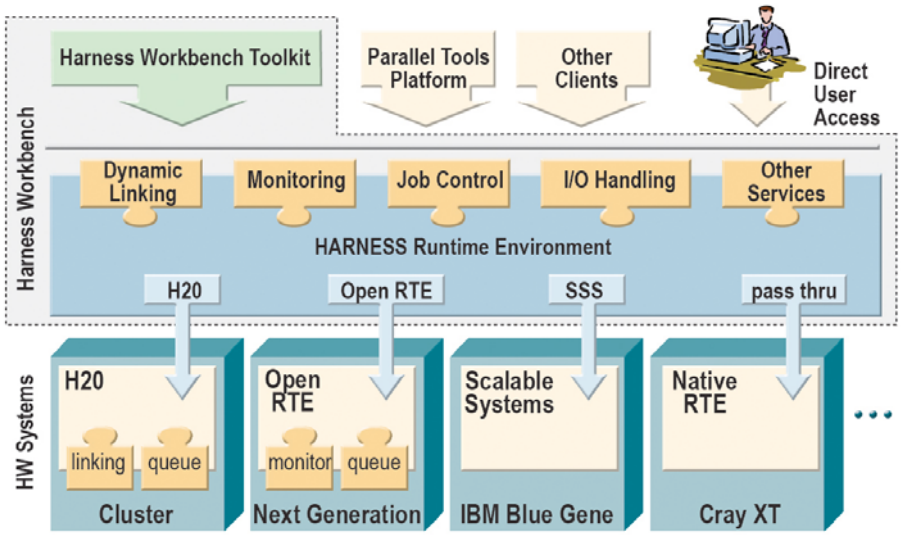

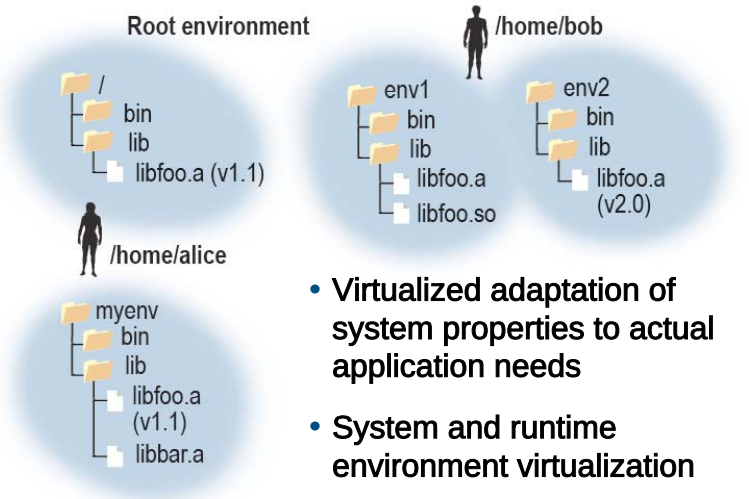

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