

Top 10 ways that IBM Spectrum Computing can save you money

Do more with less and reduce a range of expenses with grid and cluster scheduling and management software

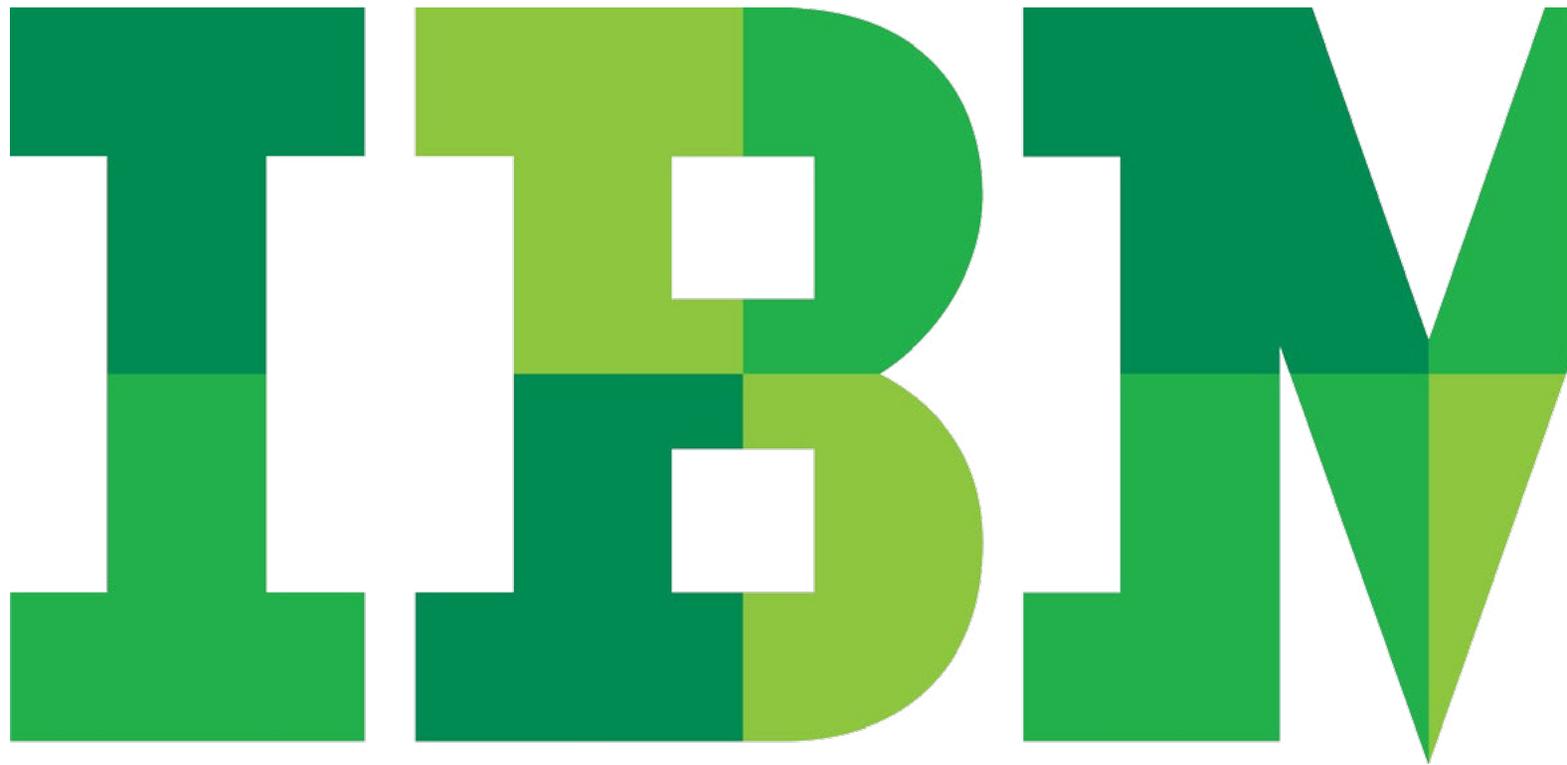


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Introduction

As a research or design organization, you face competition and time-to-results pressure.

Whether in education or life sciences, aerospace or oil and gas, your organization needs to innovate faster than ever—at less cost. Yet there is little room for getting it wrong.

IBM® Spectrum Computing cluster, grid and high-performance computing (HPC) cloud management software can help transform your environment to deliver results better, faster and at less expense. The [IBM Spectrum Computing family](#) of products is designed to save money by making an organization's existing infrastructure work better, enabling you to:

- Share infrastructure and run applications more efficiently
- Harvest idle compute cycles within your organization



- Accelerate application development and deployment
- Boost performance by avoiding unnecessary replication of data
- Improve availability and ensure service-level agreements (SLAs) are met

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IBM Spectrum Computing products also save organizations money by reducing a variety of direct costs associated with grid and cluster computing. Your organization can slow the rate of infrastructure growth and reduce the costs of management, support, personnel and training—while also avoiding hidden or unexpected costs.

This e-book gives you a closer look at each of these money-saving capabilities.

Meet the money-savers

Designed for organizations running high-performance analytics and technical computing grids and clusters, IBM Spectrum Computing products include:

- IBM Spectrum Symphony, a family of products designed to provide high-performance grid services for distributed computing and big data analytics
- The IBM Spectrum LSF family, a comprehensive set of tools for intelligent scheduling of workloads and dynamic resource allocation
- IBM Spectrum Scale™ (formerly IBM General Parallel File System [IBM GPFS™]), which provides a high-performance enterprise file system to optimize data management

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1. Running applications more efficiently

The low-latency scheduler in IBM Spectrum Symphony can keep cluster nodes at nearly full utilization, significantly reducing application run times and enabling performance goals to be achieved with less hardware. Whereas competing schedulers struggle to keep systems even 50 percent busy, IBM Spectrum Symphony has been demonstrated to sustain very high levels of utilization for extended periods of time.

IBM Spectrum LSF incorporates multiple scheduling models that can run concurrently on the same cluster. This means the infrastructure is kept as busy as possible while ensuring critical business workloads are given priority. IBM Spectrum LSF also helps improve cluster efficiency through advanced workload management. By taking advantage of superior scheduling capabilities, your organization can

better align cluster resources to business needs and achieve better levels of cluster utilization, allowing you to do more with less.

By ensuring workload reliability, platform schedulers can guarantee that once started, jobs will run to completion, avoiding wasted cycles that can occur when a job needs to be restarted due to a failed task or workflow component. If a job runs for several hours but fails before completion and needs to restart, it represents wasted time and nonproductive work on the cluster. And as the failed job re-runs, other workloads may have to sit in queues—resulting in project delays. However, IBM Spectrum LSF and IBM Spectrum Symphony have the ability to tolerate failures and recover jobs from where they left off. So work gets done faster and the cluster is more fully utilized.

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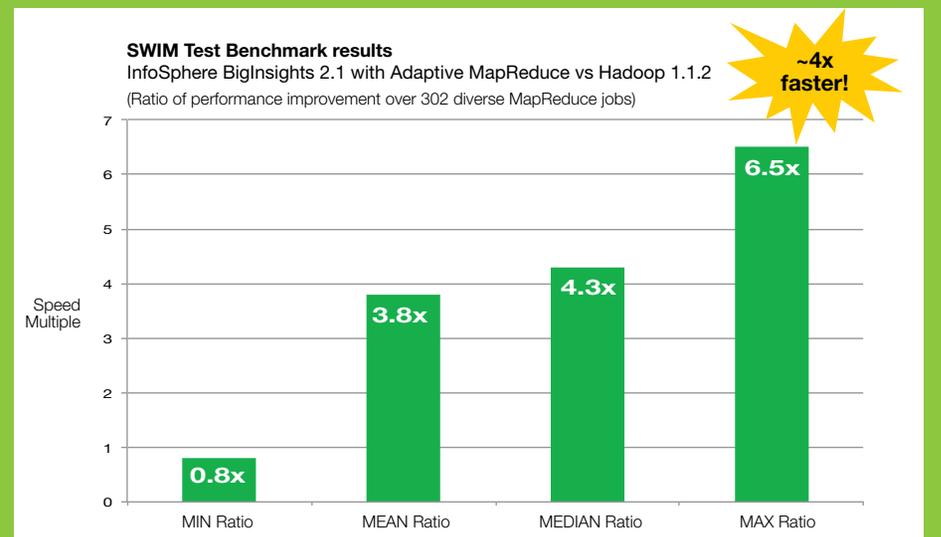
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A source of inefficiency that is sometimes overlooked relates to user errors on job submission. For example, a 16-way message passing interface (MPI) job that runs for two hours, but needs to run again because the user submitted the job incorrectly, can “cost” an estimated 32 hours of CPU time.

During this period, other jobs may be pending in the workload management system, waiting for available resources. IBM Spectrum Computing provides interfaces tailored to applications, helping reduce the occurrence of human error during job submission. If there is an error, users can easily manage their jobs in real time to quickly spot and rectify issues.

IBM Spectrum Computing delivers improved throughput

IBM InfoSphere® BigInsights® including IBM Spectrum Symphony delivers a 4x performance advantage¹ on average over open source Hadoop across a range of workloads. These gains were made possible by a measured 11x throughput gain in the workload scheduler.



SWIM Test Benchmark results.

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2. Sharing infrastructure more efficiently

Resource sharing has to be done right to ensure different departments or applications get their allocated share of resources. IBM Spectrum Computing scheduling software is highly flexible, enabling you to share resources according to policy among multiple users, applications and departments. For example, IBM Spectrum LSF can offer deadline-oriented scheduling, or provide throughput or workload velocity guarantees.

IBM Spectrum Symphony is unique in its ability to enable multiple tenants on a shared grid. You can allot each tenant a guaranteed minimum resource level, and then let the scheduler constantly rebalance work to keep clusters 100 percent busy. Driving



up aggregate resource utilization while guaranteeing service levels means that less infrastructure is needed to meet your business objectives—helping your organization reduce or defer infrastructure spending.



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This resource sharing extends globally across data centers as well. Multicenter capabilities in the IBM Spectrum Symphony Advanced Edition offering enable an organization to link across global data centers and manage the resources as one shared computing pool. As a result, quiet times in remote time zones can be leveraged and resources pressed into service to avoid the need for new capital spending. You can even add new applications without additional spending on infrastructure by finding additional capacity on existing resources.

Major Wall Street firm leverages IBM Spectrum Symphony resource sharing

The firm deployed IBM Spectrum Symphony globally between multiple data centers, creating a shared, flexible infrastructure for both compute- and data-intensive analytics applications, including portfolio risk analysis.

Benefits:

- The firm can analyze 700 times more portfolios, in minutes rather than hours, sharpening the firm's agility to respond quickly to changing market conditions and client demands.
- The performance and scalability of the solution help the firm keep pace with the dynamic nature of its global business.

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3. Harvesting idle compute cycles

In most organizations, not all computer systems are used around the clock. Even when grid environments are deployed, other data center assets such as off-grid servers are often idle. Add-on schedulers available for both IBM Spectrum LSF and IBM Spectrum Symphony enable clusters to automatically harvest unused resources from various non-grid resources, depending on what is appropriate for the applications in question (Figure 1). Harvestable resources include idle desktop computers, off-grid servers with excess capacity and virtualization platforms such as VMware, Citrix or KVM.



Figure 2. NVIDIA Tesla GPU.

IBM Spectrum Symphony can also intelligently schedule and share hardware assets such as NVIDIA GPUs (Figure 2) or Intel Xeon Phi co-processors for applications that can run on these kinds of specialized resources. By harvesting resources off the core grid, organizations can deliver better service levels and accommodate additional workload without expanding the size of the shared grid computing environment.

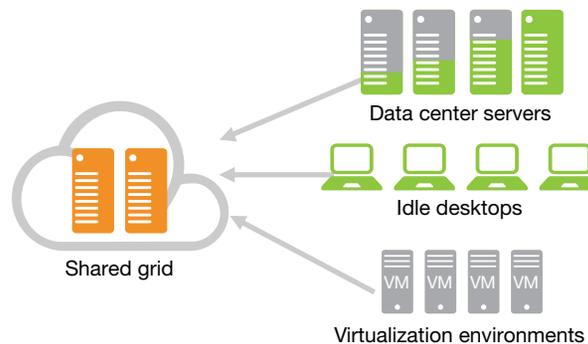


Figure 1. IBM Spectrum Symphony harvests resources from otherwise idle assets.

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4. Accelerating application development and deployment

Getting new applications deployed quickly is another key to cost savings. After all, running demanding applications is the reason organizations purchase a high-performance infrastructure. But if an application takes six months to deploy into production, the costs associated with carrying and managing nonproductive infrastructure for that time can be considerable.

To accelerate application development, IBM Spectrum Computing offers an IBM Spectrum Symphony Developer Edition. This edition enables organizations to quickly develop and prove the functionality of new applications without taking the time to build a production-scale test grid. Applications that work in the free developer edition are guaranteed to work at scale once they are published to a production cluster.

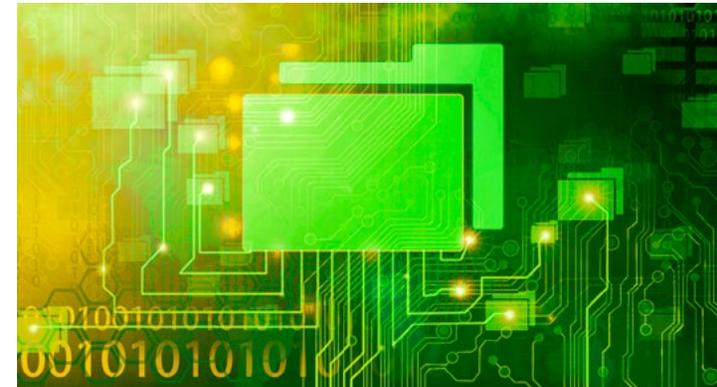
IBM Spectrum Computing also helps accelerate new application deployments and reduce costs by making clusters exceptionally easy to deploy without the need for skilled system administrators. IBM Spectrum Computing and the IBM Spectrum LSF Application Center provide ready-to-run, web-based templates for a variety of HPC applications common in computer-aided engineering, life sciences and research. Generic application interfaces enable you to readily and securely deploy your commercial or in-house-developed applications to users through a portal so workers and assets can become productive more quickly.

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5. Avoiding unnecessary replication of data

Many multinational organizations, where globally distributed design teams and remote collaboration are the norm, face challenges related to the location of data. Achieving good performance often demands making local copies of data, but this copying means dealing with replicas of files that are costly to store, manage, back up and maintain. Version control challenges alone can cause major headaches. IBM technologies can help in several ways.

For example, IBM Spectrum Scale helps avoid unnecessary data replication by using automated file migration (AFM) to construct local data caches that speed data access from remote locations. As a result, a single logical view of data is maintained, eliminating redundant data copies, reducing associated storage costs and simplifying data management.



Similarly, in big data Hadoop environments, organizations must frequently move data into and out of the Hadoop Distributed File System (HDFS) so that Hadoop-resident data can be accessed and manipulated by common operating system applications and tools. IBM Spectrum Scale with the file placement optimizer provides a POSIX-compliant, HDFS-compatible file system that can be shared by both Hadoop and non-Hadoop jobs, avoiding unnecessary data replication.

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In many process workflows, organizations must decide whether to move data to compute hosts, or move compute hosts to where the data resides. These decisions are often complex and depend on multiple factors such as network bandwidth, cost of data migration, scratch space, availability of software licenses and the relative load on systems at different data centers. IBM Spectrum LSF Process Manager can help automate processes that make these determinations dynamically, based on the lowest-cost and most time-efficient option.

IBM Spectrum Computing helps boost performance in additional ways, particularly compared to home-built clusters. With a do-it-yourself approach to building clusters from open source components, your organization risks deploying un-optimized libraries and toolsets—the components may work, but at reduced performance levels, undermining the purpose of deploying a high-performance cluster. However, because the supplied tools and libraries in IBM Spectrum Computing are tuned and optimized for selected vendor hardware configurations, you are assured of getting the highest-possible level of cluster performance.

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6. Improving availability and ensuring SLAs are met

For many businesses, downtime can cost serious money. For example, if a cluster is down or running at a reduced capacity at a semiconductor design firm, engineers are idle and productivity is lost—which can threaten product schedules and ultimately time-to-market. In regulated industries such as financial services, failure to meet tight reporting deadlines can result in financial penalties or sanctions that impact the bottom line.

IBM Spectrum Computing schedulers can address these challenges by providing no single point of failure and continuing to run even during multiple hardware or software failures. Optional solutions such as IBM Spectrum LSF Process Manager enable repetitive sequences of tasks to be automated with built-in error handling and recovery. By providing software infrastructure that is fault tolerant and avoids the problem of human error—the most frequent contributor to system downtime—you can increase availability and productivity to better meet deadlines and SLAs.

IBM Spectrum Computing addresses availability issues as well, helping to make cluster users more productive by ensuring cluster downtime is kept to a minimum. Features such as the cluster file manager and repository snapshots take the risk out of tasks such as software upgrades and patching. These features enable administrators to easily roll back to a last-known good configuration if anything goes wrong with a software update or patch installation, reducing downtime and providing peace of mind for users who need to make software changes.

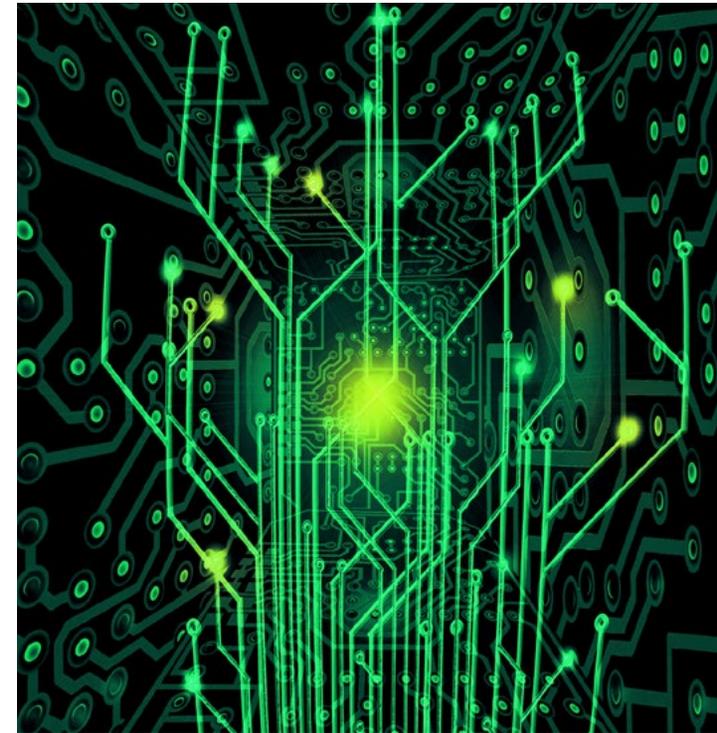
IBM Spectrum LSF can take the relative power-efficiency of systems into account when scheduling work to ensure workloads are deployed to the most cost-efficient systems. As a result, more work can be completed in time to meet business deadlines.

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7. Slowing the rate of infrastructure growth

As business requirements evolve, data center managers must add new infrastructure every year to keep pace with user demands and the need for new applications. However, data center capacity may be limited by floor space, power or cooling capacity. When data centers become inadequate, large capital investments are required to expand or relocate.

By deploying a more efficient environment, and by enabling multi-tenancy, IBM Spectrum Computing schedulers remove barriers that can prevent different applications from sharing the same infrastructure. Multiple versions of an application can share the same cluster, and the progression of the software lifecycle between development, test, quality assurance, production and maintenance can be performed without setting up separate siloed environments.



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This ability to share resources among diverse applications means that it is not automatically necessary to deploy new infrastructure as new applications are deployed. By slowing the rate of data center growth, cost savings mount annually and expensive projects such as data center expansions can be postponed or avoided altogether.

Many sites run both Linux and Windows applications, but provisioning separate clusters for these two environments is inefficient and expensive. Instead, total costs can be reduced by using IBM Spectrum Computing to manage hybrid clusters comprised of both Windows and Linux nodes. IBM Spectrum Computing provides workload-driven OS provisioning as a standard feature, allowing your organization to use a single management tool and avoid unnecessary infrastructure spending.

By running applications more efficiently, and sharing resources according to policy, organizations can generally use less infrastructure while meeting their performance objectives. And by lessening the infrastructure footprint, variable costs related to power, cooling and the data center are reduced automatically. Customers that still need more infrastructure to address peak periods of demand can easily extend local IBM Spectrum LSF or IBM Spectrum Symphony clusters as needed into the global IBM SoftLayer® cloud infrastructure.

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8. Reducing management and personnel costs

IBM Spectrum Computing products also help reduce costs by simplifying management. For example, by providing more sophisticated management and monitoring tools such as IBM Spectrum LSF RTM and IBM Spectrum LSF Analytics, system administrators become more efficient and can manage larger user communities and infrastructure environments with less personnel.

A key advantage of IBM Spectrum Symphony is its ability to support diverse applications on a single cluster. By reducing the number of individual clusters, administrator work is scaled down accordingly, leading to savings in personnel costs and the ability to deploy scarce technical talent to other important initiatives (Figure 3).

IBM Spectrum Computing can dramatically reduce the time to install and configure a cluster because it is a pre-certified and pretested product that already includes all of the software

features that HPC sites need. With its comprehensive, easy-to-use web interface, IBM Spectrum Computing is simple for nonspecialists to install and manage. Also, by relying on pre-certified configurations fully backed by IBM Spectrum Computing and hardware vendor partners, you are assured that any issues can be addressed quickly and efficiently without the need for on-site consultants or support expertise that result in unbudgeted costs.

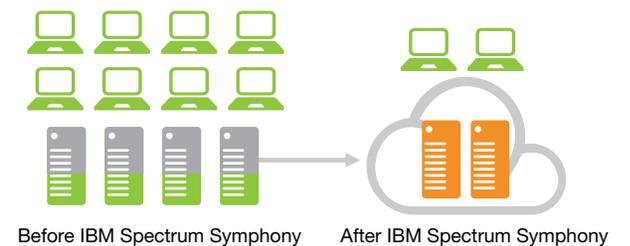


Figure 3. IBM Spectrum Symphony helps reduce management and personnel costs.

9. Decreasing training and support costs

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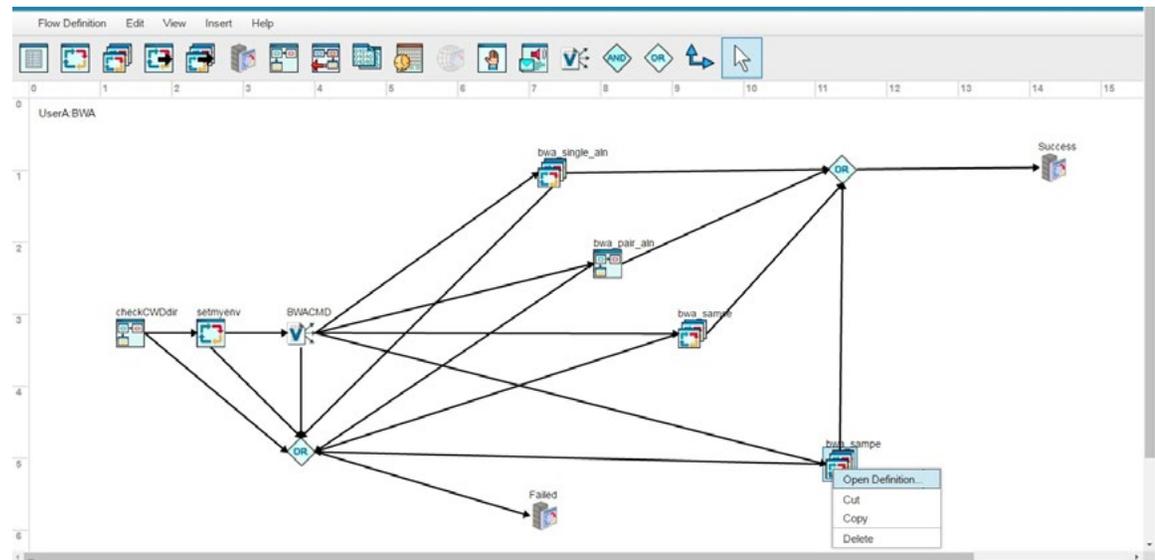


Figure 4. Graphical user interface for IBM Spectrum LSF Application Center showing workflow management.

With intuitive, application-aware interfaces for IBM Spectrum Symphony and IBM Spectrum LSF, users no longer need to master the command-line syntax associated with a specific cluster or workload management system (Figure 4). They can focus on the science—not the computer science.

Applications are encapsulated in easy-to-use web interfaces, allowing training costs to be reduced dramatically. The application interfaces also reduce support requirements, decrease job submission errors and boost productivity.

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Users can manage their own data and workloads, and some management functions can be delegated to the workgroup level to further reduce reliance on skilled system administrators. Additionally, the application interfaces are self-documenting, helping avoid unnecessary calls to the IT help desk or wasted cluster time resulting from human error.

Still another advantage is that with IBM Spectrum Computing, state-of-the-art Linux clusters can be deployed and managed by nonspecialists, removing a long-standing barrier to Linux adoption—particularly at smaller sites.

Try the TCO Calculator

How much can your organization save by taking advantage of IBM Spectrum Symphony low-latency scheduling and resource sharing capabilities? Find out—take the TCO Challenge with the easy-to-use, online IBM Spectrum Symphony TCO calculation tool located [here](#).

Just spend five minutes entering a little information about your configuration, and see your organization’s results.

IBM Platform Symphony can provide significant savings for organizations deploying distributed applications and big data analytic workloads. Symphony is usually more cost efficient for the following reasons:

- The low latency scheduling and middleware processes tasks faster meaning that less hardware is required to meet performance goals
- Symphony’s sophisticated resource sharing policies enable multiple departments, applications and users to share a common grid reducing the amount of infrastructure investment required
- Because Symphony can drive much high resource utilization than competing grid managers, the rate of cluster growth can be slowed, further reducing infrastructure, power and facilities costs

The results of our high-level analysis are shown below. You can request that a more detailed report be sent to you by e-mail.

Platform Symphony saves \$6,931,876 over three years.

	EOF 1	EOF 2	EOF 3
Other Grid Manager	\$5,999,053	\$6,723,151	\$7,694,427
IBM Platform Symphony	\$3,967,476	\$3,457,648	\$3,596,187
IBM Platform Symphony Savings	\$1,886,104	\$3,237,453	\$3,752,239

IBM Symphony TCO Savings (%)

IBM Spectrum Symphony TCO Calculator interface.

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In high-performance computing, the question can arise whether to deploy a pure open source management environment or to use a supported commercial product built for open source Linux environments. Despite the many benefits of open source software, it is not without pitfalls. This is particularly true for smaller organizations that may lack staff with the requisite expertise to operate and maintain open source software and middleware environments.

For example, unexpected costs can arise when needed functionality cannot be fulfilled by available open source software. Lack of technical road maps for open source software can make planning a challenge. Additionally, some organizations do not include system and network management tools as part of the cost of their open source HPC deployment, and acquiring and integrating these tools can result in real costs.

IBM Spectrum Computing enables organizations to avoid added costs because a full range of capabilities are included as standard features, not treated as extra-cost components. These features include:

- System monitoring and alerting tools
- Workload management systems
- User-centric, application-aware web portals
- Commercial-grade MPIs
- Web-based interfaces for data handling
- Dynamic node provisioning and management tools

These included capabilities and the surprise costs they eliminate are good reasons many organizations prefer to use a commercial product such as IBM Spectrum Computing for open source Linux environments.

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IBM Spectrum Computing solutions are designed to help organizations cut costs in a number of ways—whether maximizing the use of assets to avoid new capital acquisitions, or simplifying the environment to reduce a wide variety of operating costs. Together with IBM Technical Computing hardware, IBM Spectrum Computing software helps simplify the setup, integration and resource management of clusters, grids and HPC clouds.

The software is easy to use, featuring intuitive user and system administrator portals, robust application programming interfaces (APIs) and integration with leading independent software vendor (ISV) applications and tools. At the same time, it delivers higher levels of performance and deeper, more sophisticated analysis for business advantage.



With intelligent resource sharing across multiple clusters or grids, and automated workload, resource and process management, IBM Spectrum Computing software helps companies quickly and efficiently bring products to market. IBM Spectrum Computing software is optimized for compute- and data-intensive workloads, helping to turn research and ideas into reality in fields ranging from education and life sciences to aerospace and petroleum.

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For more information, see your IBM representative or IBM Business Partner, or visit:

ibm.com/systems/spectrum-computing

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¹ 4x is approximate value. See the STAC Report at <http://www.stacresearch.com/node/15370>. Testing involved the SWIM benchmark (<https://github.com/SWIMProjectUCB/SWIM>) and jobs derived from production workload traces. Testing was conducted in controlled laboratory conditions.



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