Patterns of expertise are a set of proven leading practices and knowledge that are accumulated by IBM® through client and partner engagements, and are captured, lab tested, and optimized in to a repeatable and deployable form. This knowledge includes, but is not limited to, different IT areas, such as installation, configuration, optimization, and management of a system. Patterns are defined and deployed in three different ways (Figure 1):

- **Virtual appliances:** A single installation package of operating system, middleware, and application configuration that can be deployed together.
- **Virtual systems:** An infrastructure model that defines one or more virtual images that must be installed, configured, and integrated together to implement a system topology.
- **Virtual applications:** An application-centric model that is a representation of the required application system components, dependencies, and management policies that require minimal underlying infrastructure knowledge.

![Figure 1. Pattern types](image-url)
Did you know?

IBM has multiple cloud technologies that can be leveraged internally in your data center or externally in a public cloud that all support patterns of expertise. Patterns of expertise can be created from scratch, used as is, or personalized to fit your business requirements.

Business value

IT environments are becoming more complex, which increases the requirements for the skills and time to design, test, configure, and maintain a system. Most IT managers concentrate their efforts on maintaining existing applications and the underlying infrastructure environment that supports those applications. This situation allows little time for quickly responding to new business needs or supporting emerging technology advances, which leads to technical risk and an increased cost of the currently deployed systems. As a result, businesses might lack the agility to be successful in a fast-paced and competitive environment.

Patterns of expertise within a cloud environment are a way for IT managers to simplify, and decrease their time to maintain, their current assets, while also providing the business with an increased focus on delivering additional capabilities or new business opportunities. When applications and systems are deployed through patterns, information is retained within the pattern as institutional memory that is the intellectual property of the business, not the individual. Despite any change that can occur in the IT unit or resource, the knowledge is retained and the skill transfer period is shortened.

Patterns are designed to deliver the following benefits:

- **Simplicity**: Easily consolidate different servers, storage, and applications into an easy-to-manage abstracted view that can be controlled from a single management console.

- **Agility**: By abstracting and then automating key processes such as installation, configuration, and deployment, patterns can reduce the cost and time that is required to manage systems.

- **Scalability**: Patterns offer policies that administrators or developers can use to scale the systems up and down automatically according to workload.

- **Reliability**: Because patterns are an abstraction of the underlying infrastructure, when they are deployed, the same system or application can be deployed over and over again, which results in a more consistent environment.

- **Efficiency**: With patterns, users can optimize IT processes, such as installation and configuration, which results in the conservation of valuable resources and the time to deploy systems.
Understanding these capabilities and your options allow you to make an informed decision that is based on your use case and experiences, as they differ for each pattern type. A summary of additional value statements for patterns is shown in Figure 2.

Figure 2. Value of patterns

**Solution overview**

Patterns of expertise let you design, deploy, manage, and port patterns from one cloud technology to another, which gives you the freedom of using IBM internal private cloud technologies or externally hosted solutions.

Cloud environments depend on patterns to run correctly. All cloud environments, including IBM cloud environments, are implemented to support the design, deployment, and management of patterns or service templates. One reason for this situation is to support fast business response and simplify changing workload demands. Patterns enable IT resources to quickly respond to these needs.
Using patterns, users can make different choices based on what type of IT problem they are trying to solve or the environment they are trying to create. A high-level view of what goes into the virtual appliance, virtual system, and virtual application pattern software packages is shown in Figure 3.

Figure 3. Pattern solutions

For more information, see *Cloud Computing Patterns of Expertise*, REDP-5040.
The design of a pattern, that is, what an administrator or developer creates, can look different from what is being deployed. An example of a pattern, with an abstract view of the underlying infrastructure it is deployed on, is shown in Figure 4, with a virtual application pattern.

![Figure 4. Defined versus deployed patterns](image)

**Solution architecture**

IBM cloud technologies are all based on patterns and can be deployed across heterogeneous technologies with little to no change. Customers are given more options that are based on their requirements for choosing a particular cloud solution. They can choose to use their own infrastructure with SmartCloud Foundation and products such as IBM Workload Deployer (IWD), buy an integrated system with IBM PureApplication™ Systems, or deploy to an external cloud with consumer services such as SmartCloud Application Services (SCAS).

Patterns can be designed from scratch, personalized from existing default patterns, purchased, or downloaded from independent software vendors (ISVs). All IBM cloud technologies come with default patterns, but more patterns can be downloaded from IBM Passport Advantage® or IBM PureSystems™ Centre. Here is a link to IBM PureSystems Centre, where you can find IBM and independent software vendors (ISVs) patterns:


Here are the different IBM SmartCloud® technologies, each of which supports pattern-based deployments:

- Workload Deployer (IWD)
- SmartCloud Provisioning (SCP)
- SmartCloud Orchestrator (SCO)
Patterns for Cloud Computing

- PureApplication Systems
- SmartCloud Application Services Workload (SCAWS)

All of these technologies support the following tools:

- Pattern Builder
- Plug-in Development Kit (PDK)
- Image Construction and Composition Tool (ICCT)
- Virtual Pattern Kit for Developers (VPKD)
- Command-line interface (CLI)

Figure 5 shows how patterns can be deployed on any of the IBM SmartCloud solutions.

Figure 5. Patterns on IBM SmartCloud solutions

Usage scenario

Organizations can use patterns to rapidly deliver cloud solutions that achieve a quick time to value and reduce costs. Patterns are the basis for Platform as a Service (PaaS) and Software as a Service (SaaS) cloud offerings and dramatically reduce the efforts for deploying and maintaining cloud solutions.

For example, organizations can quickly get started using the IBM Mobile Application pattern to deploy mobile applications to the external cloud using SmartCloud Application Services (SCAS) in minutes. Created for the deployment of mobile applications, the pattern reduces the time, effort, and cost of building and deploying an IBM Worklight solution. If necessary, organizations can then bring this same pattern into their internal private cloud using IBM PureApplication System with minimum changes.
Patterns benefit organizations by removing manual steps and helping automate the delivery of systems for fast time to value and increased agility to responding business needs. With predefined pattern templates available in all IBM cloud technologies, patterns allow organizations to reduce the amount of in-house knowledge to get their environments up and running. This situation results in applications and infrastructure being implemented in a repeatable way, which can lower the risk of human error.

Patterns of expertise can be used with a number of current and upcoming technologies. IBM provides patterns for most of its middleware and database solutions. You can obtain the most current list of available patterns of expertise for the IBM PureApplication System at the PureSystem Centre found at https://www-304.ibm.com/software/brandcatalog/puresystems/centre/browse. New patterns are added monthly.

Integration

Patterns of expertise provide great integration of hardware, software, and applications for installation, configuration, and lifecycle management. Cloud Computing Patterns of Expertise, REDP-5040 demonstrates that patterns can be exported and imported between the different IBM cloud solutions. These solutions can be integrated together to drive additional business value by delivering an overall cloud experience to your organization.

An example of a pattern that has deep integration between differing technologies is the use of IBM Worklight, IBM WebSphere® Application Server, and IBM DB2®. In this pattern, these three components, along with your mobile application, are deeply integrated and tuned so your IT staff no longer needs to understand the in-depth interdependencies and connections between these subsystems. Organizations can take advantage of this integration by using this provided pattern. Some examples of deep integration include the following items:

- Ability to establish a trusted connection between WebSphere Application Server and DB2 to leverage connection pooling and minimize the performance penalty of closing and reopening connections with a different identity.

- Usage of a single sign-on token between WebSphere Application Server and DB2 to ensure that access is being enforced at both the application and database level.

- Targeted, integrated testing and verification of WebSphere Application Server, Worklight, and DB2 versions to provide easy, fast, and less error-prone installation and maintenance.
A view of this pattern and its integration and configuration is shown in Figure 6.

![Figure 6. WebSphere Application Server, Worklight, and DB2 integration pattern](image)

**Supported platforms**

Patterns, as specified earlier in this solution guide, are supported on all IBM cloud solutions. Each pattern can be configured and tuned to fit your specific requirements. All patterns can be maintained and updated through similar tools. For more information, see *Cloud Computing Patterns of Expertise*, REDP-5040, found at the following website:


**Ordering information**

IBM cloud technology solutions are available through Passport Advantage and your local sales team. Contact your IBM sales representative or organizational Passport Advantage representative.
For ordering information for the PureApplication Systems, IBM Workload Deployer, IBM SmartCloud Orchestrator, and IBM SmartCloud Provisioning and IBM SmartCloud Application Servers, see Table 1.

Table 1. Ordering information

<table>
<thead>
<tr>
<th>Program name</th>
<th>PID number</th>
<th>Charge unit description</th>
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</thead>
<tbody>
<tr>
<td>IBM PureApplication System W1500</td>
<td>5725-G32</td>
<td>Per appliance install</td>
</tr>
<tr>
<td>IBM PureApplication System W1700</td>
<td>5725-846</td>
<td>Per appliance install</td>
</tr>
<tr>
<td>IBM Workload Deployer</td>
<td>7199-72x</td>
<td>Per appliance install</td>
</tr>
<tr>
<td>IBM SmartCloud Orchestrator</td>
<td>5725-H28</td>
<td>Per Resource Value Unit</td>
</tr>
<tr>
<td>IBM SmartCloud Provisioning</td>
<td>5725-C88</td>
<td>Per Activated Process Core</td>
</tr>
<tr>
<td>IBM SmartCloud Application Servers</td>
<td>Varies</td>
<td>Contact IBM representative</td>
</tr>
</tbody>
</table>

Related information

For more information, see the following documents:

- **Cloud Computing Patterns of Expertise, REDP5040:**

- IBM Announcement Letter *IBM PureApplication System W1500 and W1700 V1.1 can enable simplified business continuity.*

- IBM Announcement Letter *IBM SmartCloud Application Services Version 1.1:*
  http://www-01.ibm.com/common/ssi/rep_ca/7/897/ENUS613-017/ENUS613-017.PDF

- IBM Announcement Letter *IBM SmartCloud Orchestrator 2.2.*

- IBM Announcement Letter *IBM Workload Deployer 3.1.*

- IBM Offering Information page (to search on announcement letters, sales manuals, or both):

  On this page, enter **Patterns of Expertise**, select the information type, and then click **Search**. On the next page, narrow your search results by geography and language.
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