

The collection of Charmed Operators

A win-win for users and developers

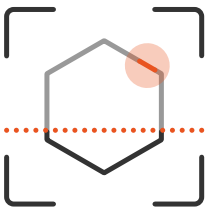
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Introduction

In an [interview from 2017](#) [1], the CEO of the IT unit of the Deutsche Bahn railway company pointed out that the number of servers for productive applications before the great migration to the cloud reached a peak of 12,000 – serving 300,000 employees and their customers. And this number did not include test or staging servers or further non-productive experiments. Of course, not every organisation is this large. And we need to consider that not every service or application will be migrated to a public cloud. In the 2021 [Cloud Usage Report](#), 77,8% of the 1200 respondents said that they maintain at least a hybrid or multi-cloud setup in their organisations [2].

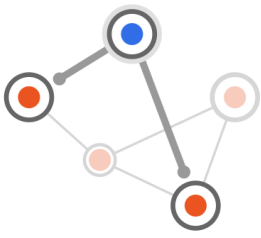
Overall, these numbers suggest high management and operation efforts, and it is predicted to even grow. According to a Statista forecast [3], the market for container management will double from 2020 until 2024. And depending on the web page or report that can be cited, an average company has between 50 to 150 different applications in place. That said, the amount of work to be done when operating applications appears huge. Thus, management solutions for applications in multi-cloud environments face a rising demand that seems will keep on increasing in the future.

Today's challenges



The basic challenge for IT operations and IT admins is to compensate for the rising demand for hosting applications with automation and management solutions. Otherwise, organisations will add more and more people to the teams to manage the workload, which also does not scale very well. In addition to the growth of application and service usage, modern IT environments face two additional challenges:

- In the past 5 years, we have witnessed a series of high-rated vulnerabilities affecting IT systems all over the world. Even non-IT experts already know [Shellshock](#) [4] or [Heartbleed](#) [5] also because these vulnerabilities were covered in the daily TV news. Recently, the [Log4Shell](#) [6] vulnerability reached similar popularity. In all these cases, millions of extra hours were spent updating existing IT systems and keeping the running applications secure.
- Applications do not stand alone. A Web server or a proxy server runs together with other applications. Some services implement workflows orchestrating while integrating other applications, making the possibilities of integrating scenarios infinite. This leads to dependencies between applications and added complexity for management and operations.



In summary, IT management today does not only face a rising number of applications, but also an increased number of security vulnerabilities, which increases the management effort per application. In addition, today's application landscape consists of more sophisticated integration cases, increasing dependencies and complexity. Now more than ever, organisations need a management infrastructure to operate applications and maintain manageability and even reduce efforts.

A Software Operator Framework

Several tasks are involved to operate applications. Installing and uninstalling the application are among the most fundamental tasks. Updating and scaling up or down will also be part of an application's lifecycle. Other relevant IT admin tasks are scanning for malware, checking for vulnerabilities, migration to other clouds or upgrading to a high availability setup. IT admin carry out these tasks for their applications as their daily routine, in many cases manually and repeatedly. Different approaches for automating these tasks exist, they have led to a commonly accepted general solution approach, which is recognized as a technical pattern when operating applications.



The design pattern of software operators

The approach to use software for automating such tasks is described as a [design pattern for cloud applications](#) [7]: the software operator pattern. The operator pattern defines a software element implementing all the expert IT admin tasks that would normally be executed manually or with unstructured scripting. One advantage of the operator patterns lies in the reusability of source code to operate applications. If all the functionality to operate an application is covered by a self contained software element, such elements can be published and shared between organisations. Operators for applications are even suitable as open source projects allowing software vendors to jointly develop the source code together with users. Once operator software is available for an application, its publication at a central location such as a repository makes even more sense to reach more users and to advertise its availability.

Canonical has introduced an extended implementation of the operator pattern as [Charmed Operators](#) [8]. The Charmed Operator Framework is a toolkit and libraries written in developer-friendly Python to allow for a structured implementation of operators for applications and services. Canonical calls the operators Charmed Operators, because they not only cover the operational tasks of the application in isolation, but they also cover the integration between applications with the [concept of relations](#) [9].

Conveying software

In the early days of computing, software was either provided by the vendor, or in addition, compilers allowed the end user to create their own apps. Soon small markets emerged with third parties either selling licences for software or individuals distributing software as public domain, shareware or open source software or combinations of them. Distribution channels were fragmented for many years and included brick and mortar stores for commercial software. The early Internet provided then places for downloading (mostly freely available) software. Software vendors needed to cover many different channels when trying to reach all users of the ecosystem. Large vendors of computer systems have initiated developers programs to support third parties providing software in a uniform manner. However, distribution of software stayed for a long time fragmented.

Consolidation of distribution channels

Today, for the distribution of applications, most of us know app stores for their smartphones. The original reason for the app stores for smartphones was to ensure the safe operation of the device in a cellular network. Vendors established a central distribution channel for software in order to ensure stability and security when operating a smartphone in the cellular network. Before that, the applications were pre-configured on the device by the vendor and updated only by the suppliers. Initial smartphones were not providing users with a facility to install their own applications from their computers.

App stores went further and were extended to many areas beyond smartphones. Today very successful app stores exist for game consoles, edge devices, smart watches, even for entertainment systems in cars. The industry has adopted the concept for many non-consumer devices, such as industrial embedded systems, IoT or Edge devices or special purpose solutions.

But what is the advantage of app stores? Different stakeholders can take advantage of app stores: the vendor, the end-user and the third party software vendors. App stores bring the stakeholders together into a joint ecosystem.

App stores have changed software distribution massively. For some products and devices, app stores are the only option for third parties to provide end-users with their software. The distribution of the software is not fragmented anymore and thus more efficient. Moreover, app stores add transparency for third parties providing software, because the purchase and / or installation of software by users can be precisely tracked.

The end user perspective

Initially, end users wrote the software for their computer systems on their own. Then, listings of computers were exchanged, later computer programs were transferred with floppy discs or in the early Internet. At some point it was popular for many end users to buy software in classic brick and mortar stores. Also for end users the fragmentation of software distribution channels was a problem. For example, software being available in stores in one country while not being available in other areas of the world.

It took a long time until it was possible to buy software on the Internet. With app stores, end users have a central place to find software. And for some ecosystems,

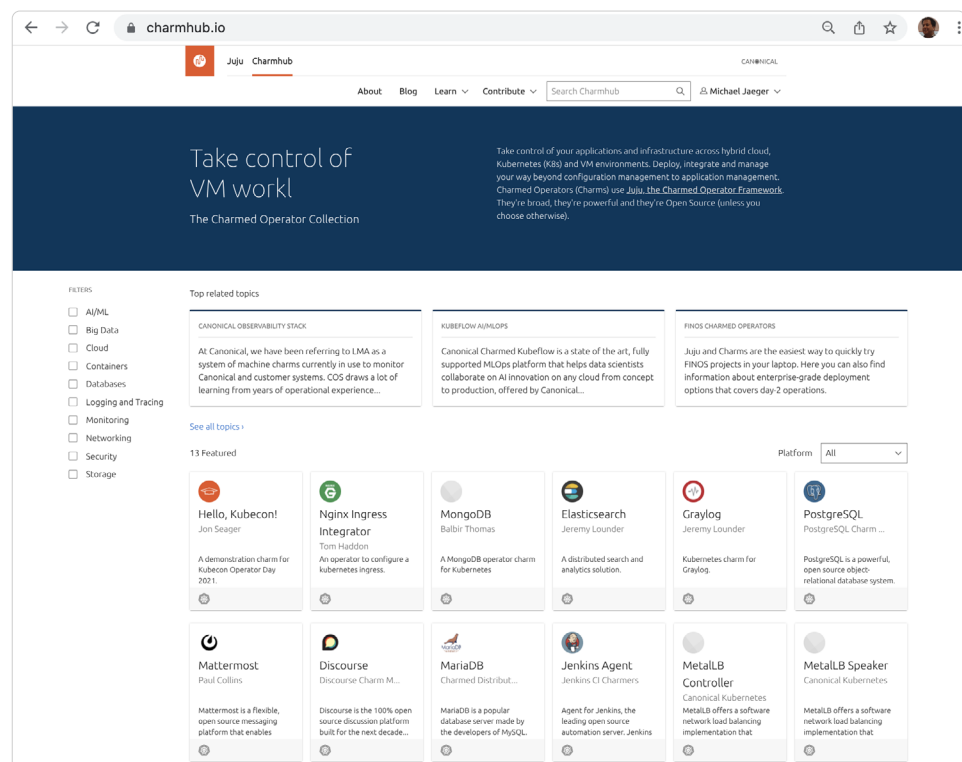
it is the only option to install software. Apps stores help users to evaluate and select the available software for their devices. For personal computers or general purpose computing, users must and will retain the option of running their own software, even self written software without the prior publication in an app store. But for specialised cases, such as apps for smart phones or smart watches, the app store helps users to select the right apps for their own goals.

Best for Software Operators

Also, the app store plays a more important role enabling the intended technical operation of a technology platform. In fact, app stores for some devices are the crucial element to bringing software to the devices. At the same time, an app store allows for the promotion of individual software published. Some app stores go even further with the ability to push updates to the user (which can be often configured by the user if not wanted), or exercise revocations for technical reasons. App stores can implement configuration elements for end devices. And, app stores provide publishers with useful information about downloads and usage.

The conclusion from the mentioned points above is clear: an app store is the natural place for a collection of Charmed Operators. The public Charmhub.io implements this concept.

Software vendors upload their Charmed Operators for their application. A community driven approach allows for publicly highlighting such a solution. And Canonical evaluates the Charmed Operators for adhering to quality criteria. Since the middleware environment connects directly with the Charmhub.io via its API, it facilitates the technical integration for easily start operations of the applications.



Our solution, a central place for Charmed Operators, technically integrated:
<https://charmhub.io>

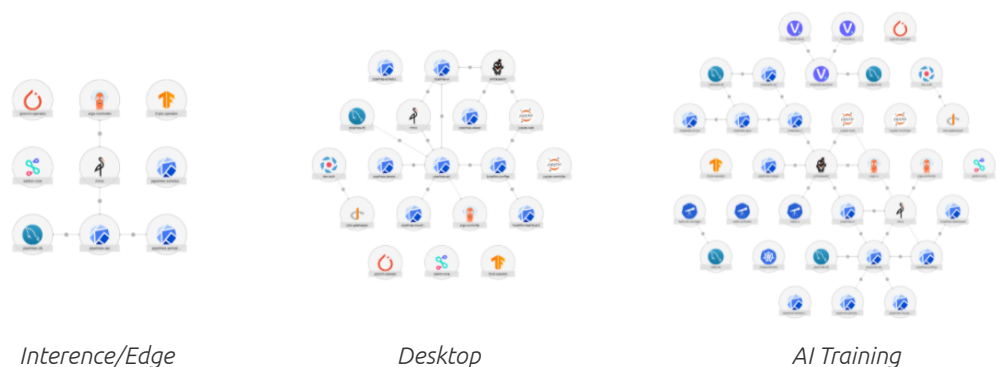
A Collection for Compositions

A collection of Charmed Operators provided at the central place Charmhub.io offers also another advantage for IT management: IT applications are composed of different elementary applications: Web servers, databases, storage to name a few elements.

With a collection of Charmed Operators for applications, admins can compose these applications by [declaring relations](#). Relations are a very powerful concept covering the reality of application deployments today. It is obvious that a central place for these application elements is crucial: Otherwise an IT admin would search the Internet for available Charmed Operators which would be inefficient and frustrating.

Increased reuse

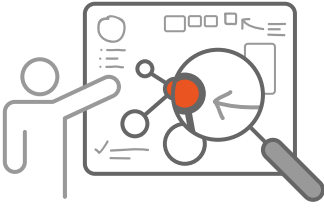
We already see a number of composed applications in the Charmhub.io, For example, the [Kubeflow](#) and [MLFlow](#), both different application compositions in the area of machine learning, integrate the same [Charmed Operator for MariaDB](#), a popular relational database. In this case, the operator implementation for operating MariaDB in production is reused in two application compositions. This increases reuse, saves efforts and most importantly, means a larger community for this operator. An IT admin who uses this Charmed Operator also will also stay familiar with one way of operating this database, not different ways in different projects.



Kubeflow topologies for different scenarios reusing Charmed Operators in multiple compositions.

Using Operators for running applications is just at its beginning. As a consequence, not many meaningful statistics are available. Considering the download numbers of MariaDB on the [container image repository hub.docker.com](#) shows this database server being one of the most popular applications. Thus, the potential for a Charmed Operator which helps IT admins not only downloading and installing MariaDB, but also operating the software professionally is enormous.

Win for Software Vendors



Besides IT admin finding charms and downloading via the technical integration of Charmhub.io, third parties also take advantage from a centralised place. Third Party software vendors naturally provide their software via different channels. Those channels include download opportunities via the homepage, download opportunities on app stores. There is a technical component as well, because different downloads are usually required to support different target platforms.

For example software vendors package their application for the ecosystem of RPM packages, and at the same time or likewise package for the Debian ecosystem. Not in scope of Charmed Operators but very important to know is that [using Snaps](#) means to [package an application once](#) and distribute it to more than 20 different Linux distributions regardless of the underlying package manager ecosystem. Therefore Snaps are a very effective solution for software vendors to reach their users, because [any larger Linux platform can run snap packages](#).

Charmed Operators — added value delivered by software vendors

Charmed Operators are not snaps, maybe they would use snap packages to actually install and update the covered application. However, Charmed Operators are not directly about distributing the application software itself. How do Charmed Operators help them to reach more users? For complex applications, the challenge does not lie in having the software available, but in how to use it. IT admins quickly find out, of course, where software can be downloaded and installed. But today's applications are becoming more and more complex to set up, operate, and most importantly, to integrate. And Charmed Operators are supposed to cover these points; in other words, Charmed Operators cover the next step, after the IT admin has downloaded or installed the software.

In the domain of application provisioning, the terminology speaks of Day-0, Day-1, and Day-2 operations. Day-0 is the phase of understanding requirements, creating a plan, and defining a setup structure. Day-1 covers the installation and configuration of the application. And, Day-2 denotes the productive use of the application, which includes updates, optimisation, maintenance tasks, or migrations. The IT Admin does not have automation for the Day-2 tasks and here manual tasks consume a lot of time. These tasks are prone to mistakes complicating the setup and taking even more effort.

Consequently, for being able to install the software, Charmed Operators do not provide added value. However, the real work starts when operating the application, and thus, software vendors can provide value to IT admins by providing a Charmed Operator for their applications. Software vendors are the natural authors of Charmed Operators, since they know their application best. Once the Charmed Operator has been implemented, the obvious distribution of that operator would be along with the application itself. However, that would miss those users and IT admin who specifically look for applications covered by Charmed Operators as this provides values for their daily tasks. Therefore, publishing Charmed Operators on Charmhub.io is ideal and more beneficial.

Charmed Operators ensure the professional user experience

By implementing the recommended way of operation for their applications software vendors also improve the user experience: a clean, professionally created Charmed Operator will result in less problems on the user side, which

are the IT admins. And, IT admins with less problems, interruptions, outages, blackouts will return less negative feedback and report less issues to the software vendor. Thus, covering operational tasks for the IT admin, does not only mean additional effort on the software vendor side. It also means less work with support on both sides and less negative feedback. With an initial investment, a software vendor can create a sustainable advantage for the operating lifecycle phase of the application.

Charmed Operators enable local SaaS

From a business perspective, the software covered by Charmed Operators competes with the **Software-as-a-service (SaaS)** model. For a vendor, providing the software as a service creates initially more cost since the application hosting for the customers remains on the vendor side at the beginning. With Charmed Operators, the cost for hosting the application is on the customers side. In this setup, the software vendor provides the support in case problems. Support contracting usually represents a source of additional revenue. However, planning and forecasting is required or setting price points. Charmed operators implement the operation of applications and thus improve predictability and the ability to more precisely plan efforts on the customer side. The software vendor can continue to provide a SaaS offering and naturally this SaaS offering is also hosted by using Charmed Operators. And at the same time, Charmed Operators provided to the customer turn deployments into competitive efforts.

Conclusion

Charmed Operators for IT admins

Charmed Operators are essential for IT admins because using Charmed Operators will lead to less effort when running applications. IT admins know how to install applications. However, manual work usually starts when maintaining an application. And Charmed Operators cover these manual tasks with implementations as Charmed Operator software. But Charmed Operators not only provide more automation and reduce efforts, they also reduce mistakes resulting from manually executed tasks.

Charmhub.io implements all necessary elements for the distribution of Charmed Operators, it informs about them and provides means to highlight these. And [Charmhub.io](https://charmhub.io) is fully technically integrated with the [Charmed Operator Framework](#), way beyond just being a B2B directory of contact addresses for software vendors.

With the central place for distributing Charmed Operators, Charmhub.io, IT admins have a convenient one-stop shop for discovering, evaluating, and selecting Charmed Operators for their application. And there is even more: The seamless integration with the Charmed Operator Framework, including its lifecycle manager, truly reduces efforts and improves automation for IT admins. In addition, Charmed Operators anticipate application composition scenarios, because relations between Charmed Applications are a key element of the framework. Thus, IT admins not only browse Charmhub.io for picking individual applications, but also for creating rich application compositions composed of application elements.

Charmed Operators for software vendors



*Photo by Ketut Subiyanto
from Pexels*

At the same time, Charmed Operators pose an opportunity for software vendors. A software vendor would like to reach users on their different target platforms. They can adopt the [Snap package management ecosystem](#). However, the Charmed Operators do not focus on the installation, but on the operational tasks during the use of the application. Providing these tasks implemented in source code, is the anticipated value added to the users of the application — the IT admins. A software vendor provides Charmed Operators to reduce effort on the customer side. The result is a win-win situation, eliminating a negative user experience, reducing support efforts, and thus, improving customer satisfaction.

For application compositions, a central distribution place is essential for providing effective application elements for compositions. And, with each single additionally covered application software vendors add value for their customers, contributing to the catalogue of Charmed applications. The centralised approach of Charmhub.io brings software vendors and IT admins together, but more than that: automating operations by software vendors creates value for IT admins. And Charmhub.io is the platform for this value.

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