WHITE PAPER

Accelerating Virtualization with Pure Storage and Canonical

Pure Storage FlashArray and Canonical LXD modernize virtual infrastructure with open source technology.

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Introduction

Organizations are rapidly adopting open source virtualization and containerization platforms to increase cost-efficiency and agility and streamline infrastructure operations. Canonical LXD—a scalable open source virtualization platform—offers a lightweight, secure alternative to traditional hypervisors. As LXD adoption grows in enterprise environments, infrastructure teams require a storage back end that can match its efficiency, resilience, and simplicity. This is where Pure Storage® FlashArray™ comes in.

This white paper presents a jointly validated solution that combines the power of Canonical LXD with the performance and operational excellence of Pure Storage FlashArray. Through native integration, the solution enables high-performance virtualization with reduced complexity, seamless scaling, and enterprise-grade data services such as snapshots, deduplication, and always-on encryption.

Together, Canonical and Pure Storage provide a highly available virtualization platform that delivers exceptional performance for modern workloads.

Solution Overview

The combination of Canonical LXD and Pure Storage FlashArray offers a compelling solution for organizations seeking to modernize their virtualization infrastructure with open source technologies and enterprise-class storage.

Canonical LXD: Lightweight, Secure Virtualization Platform

Canonical LXD is a lightweight, open source virtualization platform designed for efficient deployment and management of system containers and virtual machines (VMs). It is suitable for a large range of environments, from a developer workstation to a 50-node cluster running production workloads. With LXD, you can reduce infrastructure overhead while maintaining workload agility. Security is built in by default, reducing risk without adding complexity, while resource efficiency means LXD can power environments that need to do more with less. When combined with efficient and performant storage, LXD provides a seamless experience for your production workloads.

All of these benefits are included when using LXD as a part of the MicroCloud deployment.

Pure Storage FlashArray: High-performance, Always-on Storage

Pure Storage FlashArray, a unified block and file storage solution driven by software-defined technology, provides a seamless and reliable user experience. It incorporates data reduction capabilities without compromising performance. All Pure Storage products feature an available Evergreen® subscription model, allowing for capacity and performance upgrades without requiring new storage purchases. Additionally, FlashArray empowers businesses and organizations to significantly reduce direct carbon emissions in their data storage systems, achieving up to an 80% decrease compared to competing all-flash systems and even more when compared to magnetic disks.

Integrated Solution

By natively integrating FlashArray block storage with Canonical LXD, enterprises gain a unified virtualization and storage platform that:

- Eliminates unnecessary abstractions between compute and storage, improving performance and reducing latency for container and VM workloads.
- Simplifies management by providing storage interactions directly from the virtualization layer through the user interface, command-line interface (CLI), or application programming interface (API).
- Supports scaling without downtime, leveraging the nondisruptive operations of Pure Storage and seamless scaling capabilities of LXD.
- Provides enterprise-grade data protection.

This white paper details how to deploy, configure, and operate this integrated solution for production use.

Use Cases

This integrated solution serves a wide range of use cases across industries and IT environments. Following are some of the most common scenarios where Canonical LXD and Pure Storage FlashArray deliver outsized value.

Lightweight Virtualization for Enterprise Application

LXD offers a lightweight, open source alternative to traditional hypervisors, making it ideal for running enterprise applications in isolated environments. FlashArray ensures that these workloads benefit from consistent, high-performance storage.

Edge Computing and Remote Deployments

LXD’s compact footprint and remote management capabilities make it a strong fit for edge locations and distributed environments. The reliability, compression, and low power requirements of the Pure Storage FlashArray support resilient infrastructure at the edge with minimal maintenance.

Hybrid and Private Cloud Infrastructure

When building a private cloud or hybrid infrastructure, LXD provides lightweight, API-driven virtualization while FlashArray delivers the consistent performance and elasticity to scale with demand.

Secure Multi-tenant Hosting

Organizations hosting multiple environments or departments can benefit from LXD’s project-based isolation, coupled with built-in fine-grained access control and the ability of the FlashArray to deliver storage-level quality of service (QoS), encryption, and monitoring per tenant.

Dev/Test and Continuous Integration Pipelines

LXD’s fast provisioning and snapshotting capabilities make it well-suited for development and quality assurance workflows. FlashArray further accelerates these cycles with instant cloning, deduplication, and nondisruptive performance even under load.

Architecture Overview

The integration of Canonical LXD with Pure Storage FlashArray provides a high-performance, scalable, and efficient platform for managing system containers and VMs using enterprise-grade block storage. This section outlines the architecture of a typical deployment, including storage connectivity, LXD storage configuration, and network layout.

Logical Architecture

At a high level, the architecture consists of the following components:

- **Pure Storage FlashArray**: provides high-performance block storage via iSCSI, NVMe over TCP, or Fibre Channel; note that the current integration only supports iSCSI and NVMe over TCP, with Fibre Channel support coming in future releases
- **LXD hosts**: Ubuntu systems with LXD installed, either as standalone nodes or clusters for high availability and scale-out
- **LXD storage pool**: configured to use Pure Storage FlashArray volumes for instance root filesystems or persistent storage
- **Management interfaces**
  - **LXD**: CLI, web user interface, or REST API
  - **FlashArray**: CLI, web user interface, or REST API

Deployment Topology Diagrams

The following diagrams show deployment topologies for integrating Pure Storage FlashArray with Canonical's LXD cluster (Figure 1) and MicroCloud (Figure 2).

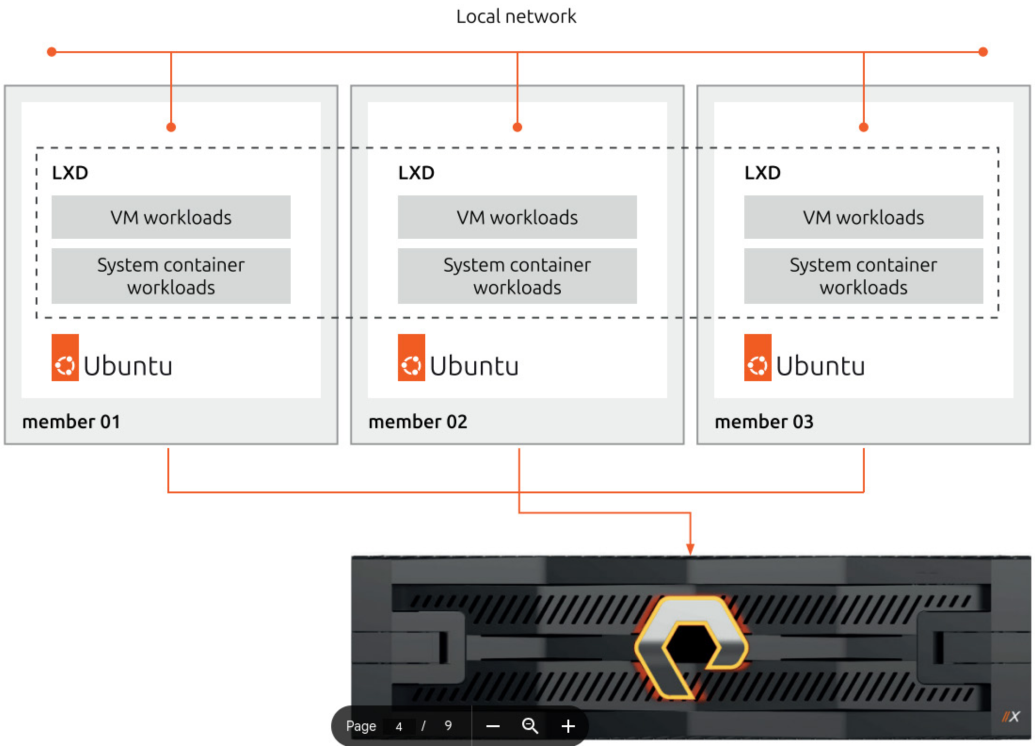


FIGURE 1 LXD cluster and Pure Storage FlashArray

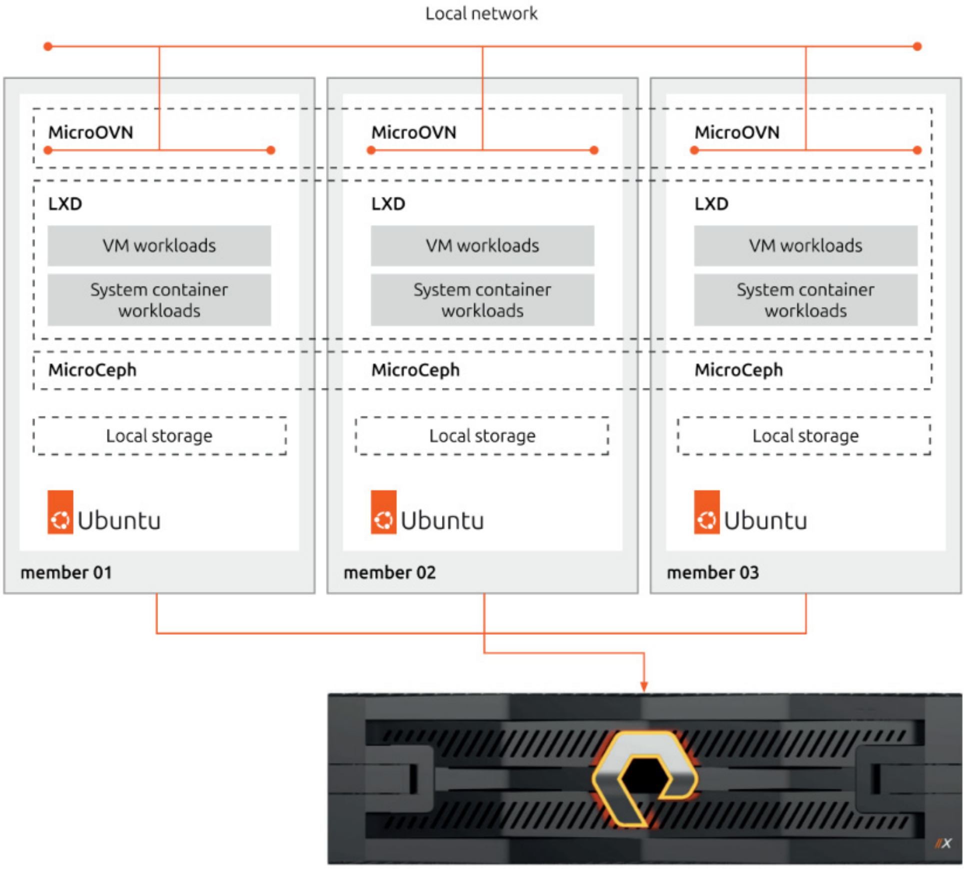


FIGURE 2 MicroCloud and Pure Storage FlashArray

Storage Configuration and Host Mapping with Pure Storage in LXD

Each storage pool created in LXD using a Pure Storage driver represents a Pure Storage pod, which is an abstraction that groups multiple volumes under a specific name. One benefit of using Pure Storage pods is that they can be linked with multiple Pure Storage arrays to provide additional redundancy.

LXD creates volumes within a pod identified by the storage pool name. When the first volume needs to be mapped to a specific LXD host, a corresponding Pure Storage host is created with the name of the LXD host and a suffix of the used protocol. For example, if the LXD host is `host01` and the mode is `nvme`, the resulting Pure Storage host would be `host01-nvme`.

The Pure Storage host is then connected with the required volumes to allow attaching and accessing volumes from the LXD host. The created Pure Storage host is automatically removed once there are no volumes connected to it.

LXD expects Pure Storage to be preconfigured with a specific service (for example, iSCSI) on network interfaces whose addresses are provided during storage pool configuration. Furthermore, LXD assumes that it has full control over the Pure Storage pods it manages.

When creating a new storage pool using the `pure` driver in either `iscsi` or `nvme` mode, LXD automatically discovers the array's qualified name and target address (portal). Upon successful discovery, LXD attaches all volumes connected to the Pure Storage host associated with a specific LXD server. Pure Storage hosts and volume connections are fully managed by LXD.

For further information, refer to LXD documentation.

Step-by-step Deployment Instructions

This section details how to set up Canonical LXD on Ubuntu.

Installing Ubuntu

Download Ubuntu Server, and follow the interactive installation process (you can also refer to documentation outlining the process).

Option 1: Deploying LXD as a Standalone LXD/LXD Cluster

Install LXD

```
sudo snap install lxd
```

Initialize LXD

```
lxd init
```

Follow the interactive instructions to configure either a single LXD server or an LXD cluster. Detailed steps are available in LXD documentation.

Note: In order to utilize the LXD web user interface, the server needs to be available over the network. You should answer yes to the question about server availability during the init process (the default answer is no), or you can configure it later by setting the core.https_address configuration option. More details are available in LXD documentation.

Access the User Interface

Once the LXD server initialization is completed, you can access the user interface from your browser. Follow the instructions to add a certificate, or follow one of the how-to guides for authenticating via the OpenID Connect (OIDC) provider of your choice.

Option 2: Deploying LXD as a MicroCloud

To make use of automatic deployment, clustering, and networking setup, you can deploy a full MicroCloud with local storage only and then attach additional external storage after the cloud is deployed.

Install MicroCloud

```
sudo snap install lxd --channel=5.21/stable --cohort="+"

sudo snap install microceph --channel=squid/stable --cohort="+"

sudo snap install microovn --channel=24.03/stable --cohort="+"

sudo snap install microcloud --channel=2/stable --cohort="+"
```

Initialize MicroCloud

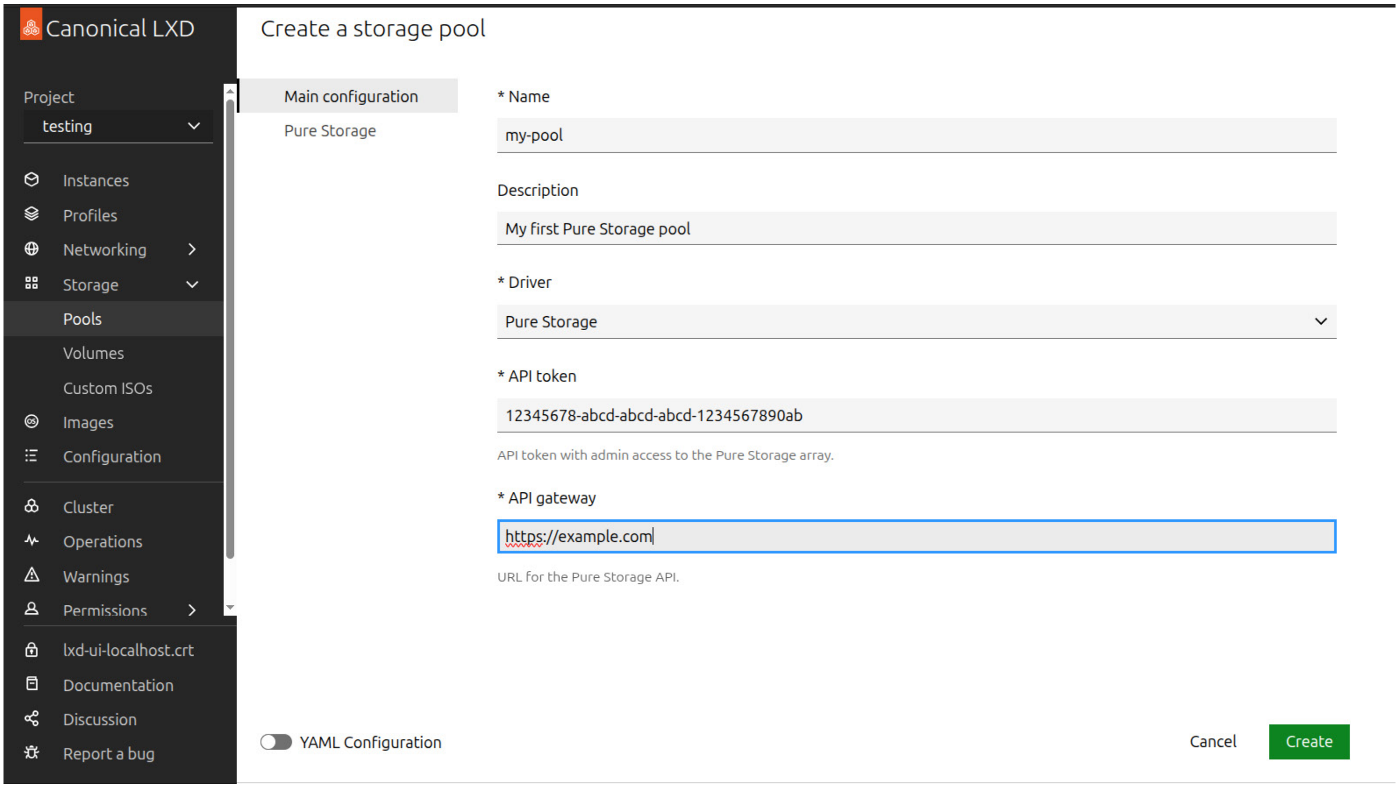
```
sudo microcloud init
```

Follow the interactive initialization process. More information and detailed steps are available in LXD documentation.

Once MicroCloud is deployed, you can use the LXD user interface to interact with the solution. Follow the steps from the previous section to enable it.

How to Connect Pure Storage

Regardless of your deployment method, connecting new storage pools follows the same process. Connecting to a Pure Storage FlashArray appliance requires only the API gateway address and API token. Figure 3 shows how this can be done via the web interface.



Create a storage pool

Main configuration

* Name: my-pool

Description: My first Pure Storage pool

* Driver: Pure Storage

* API token: 12345678-abcd-abcd-abcd-1234567890ab

API token with admin access to the Pure Storage array.

* API gateway: https://example.com

URL for the Pure Storage API.

FIGURE 3 Connecting new storage pools via web interface

The following are examples of connecting storage pools via the CLI.

1. Create a storage pool named `pool1` that uses NVMe/TCP by default.

```
lxc storage create pool1 pure pure.gateway=https://<pure-storage-address> pure.api.
token=<pure-storage-api-token>
```

2. Create a storage pool named `pool2` that uses iSCSI to connect to a Pure Storage array.

```
lxc storage create pool2 pure pure.gateway=https://<pure-storage-address> pure.api.
token=<pure-storage-api-token> pure.mode=iscsi
```

For further information, refer to LXD documentation.

Launch Instances

With your Pure Storage pool now connected, you should set it as the default storage pool when launching instances. You can do so in two different ways:

- On a project level, configure your new Pure Storage pool as the default instance storage pool. Then, whenever a new instance is launched in that project, it will use Pure Storage by default.
- Create a new profile that uses your new Pure Storage pool as the default storage. When creating a new instance, apply that profile so that the instance is launched using Pure Storage.

You are now ready to launch instances. For more information on the basic workflow in LXD, follow the tutorial on getting started with the user interface.

Conclusion

The integration of Canonical LXD with Pure Storage FlashArray provides a modern and efficient virtualization platform that is lightweight, scalable, and enterprise-ready. By combining LXD's flexible virtualization management with FlashArray high-performance, always-on storage services, organizations gain a unified solution that simplifies operations, accelerates workloads, and reduces infrastructure complexity. Whether for full-scale private cloud environments, edge deployments, or development environments, this joint solution delivers the performance, reliability, and automation that modern IT teams demand.

To learn more about LXD and how it provides a comprehensive platform for open source virtualization with a cloud-like experience, visit the LXD webpage.