FlashArray //X

Shared Accelerated Storage for Every Workload

SUMMARY

Pure Storage FlashArray//X is the world's first enterprise-class, all-NVMe & NVMe-oF flash storage array. It's a new class of storage – shared accelerated storage, which is a term coined by Gartner – that delivers major breakthroughs in performance, simplicity, and consolidation.

100% NVME PERFORMANCE

- As low as 250 μs latency
- Up to 2x faster than previous gen AFAs
- NVMe & NVMe-oF DirectFlash architecture

EFFICIENT & AFFORDABLE

- Industry-leading 5:1 data reduction, 10:1 total efficiency
- All array software included

ULTRA-DENSE CONSOLIDATION

- 3PBs effective in 6U
- Proven 99.9999% availability plus always-on QoS

ULTIMATE SIMPLICITY

- AI-driven management and predictive support
- REST API for cloud orchestration

INDUSTRY RECOGNITION

- A Gartner Magic Quadrant Leader for solid-state arrays 5 years in a row[i]
- 86.6 2018 Satmetrix Net Promoter Score, certified by Owen CX, in the top 1% of B2B Companies

A NEW CATEGORY: SHARED ACCELERATED STORAGE

In a world of fast, pervasive networking, ubiquitous flash memory, and an evolving scale-out application architecture, next-gen shared accelerated storage has the power to unite both networked and direct-attached storage in a single, shared architecture. A shared design consolidates data silos, accelerates production, DevOps, and data analytics, and helps enterprises pivot to a data-centric architecture – one that will drive intelligence and advantage from an organization's most valuable asset: data.

ACCELERATE MISSION-CRITICAL APPLICATIONS

With latency as low as 250 μs, the all-NVME architecture of FlashArray™//X brings new levels of performance to mission-critical business applications – think faster transactions and more immersive customer experiences. And with built-in Purity ActiveCluster™, more applications can now benefit from the always-on reliability of Active/Active metro clustering.

HYPER-CONSOLIDATE YOUR CLOUD

NVMe also enables unprecedented performance density – the kind of density required for mixed-workload consolidation in your cloud. //X currently supports ultra-dense 18.3TB DirectFlash™ modules, which can be adopted non-disruptively, with full performance. In addition, Purity's always-on QoS feature means you can consolidate radically diverse applications without fear of I/O contention.

UNIFY TODAY'S AND TOMORROW'S APPLICATIONS

Organizations have evolved to run a mix of classic business apps and new, modern web scale apps. Previously these two worlds necessitated radically different architectures, but with FlashArray//X and end-to-end NVMe, everything can run on a single shared accelerated storage architecture.

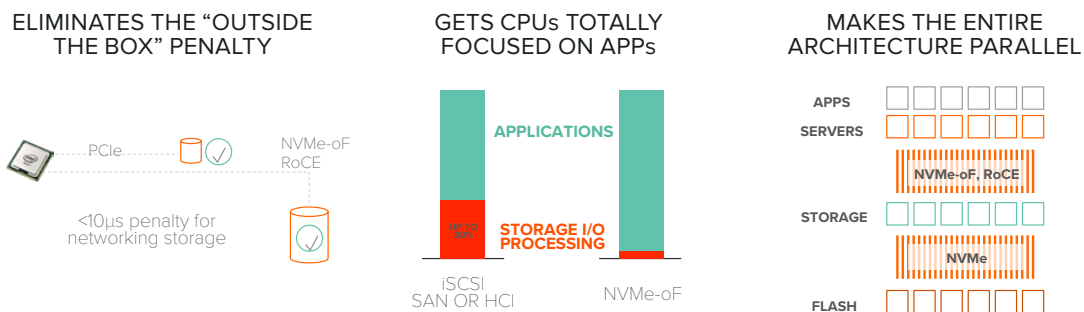## SHARED ACCELERATED STORAGE

With the arrival of pervasive flash memory, fast networks, and parallel protocols like NVMe and NVMe-oF, it's now possible to define a new category of storage that has the potential to unite SAN and DAS into a single storage architecture. Shared accelerated storage, a term coined by Gartner, can deliver the simplicity and performance of DAS, while enabling the efficiency and reliability of shared storage. This allows classic scale-up applications like databases and VMs to share the same data-centric architecture as modern scale-out applications like analytics, NoSQL databases, and container farms.

FAST NETWORKS AND PROTOCOLS CHANGE EVERYTHING

Fast networks, coupled with NVMe and NVMe-oF, enable shared storage to have the same performance as local storage – and fully offloads storage processing from host CPUs, which was particularly problematic in iSCSI SANs.

ELIMINATES THE "OUTSIDE THE BOX" PENALTY

GETS CPUs TOTALLY FOCUSED ON APPs

MAKES THE ENTIRE ARCHITECTURE PARALLEL

THE OPPORTUNITY: MASSIVE CONSOLIDATION AND AGILITY

Shared accelerated storage delivers the ultimate in consolidation: broadly-shared storage services connect easily to diskless commodity compute, driven by open, full-stack orchestration tools. What if your infrastructure could evolve – from a siloed collection of appliances to an automated, integrated architecture?
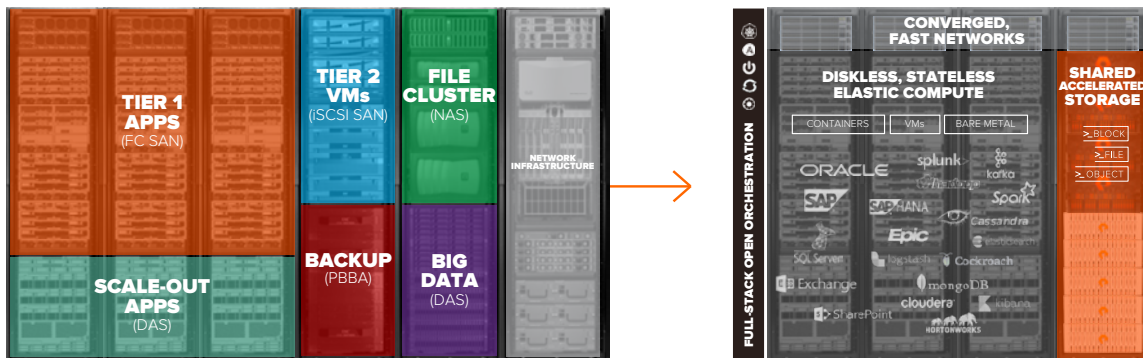
A WHOLE LOT MORE THAN JUST NVME

While NVMe provides the performance potential of a truly parallel architecture, at the end of the day it's just a protocol – what matters is what you do with it. With FlashArray//X, Pure moves beyond the legacy SSD architecture that makes flash pretend to be a hard disk, and enables our Purity software both to speak directly to raw NAND and to leverage NVMe-oF – we call this architecture DirectFlash™. DirectFlash is implemented in four components – DirectFlash Software which runs inside Purity, a DirectFlash Module, a DirectFlash Shelf, and the new DirectFlash Fabric available in Purity 5.2.
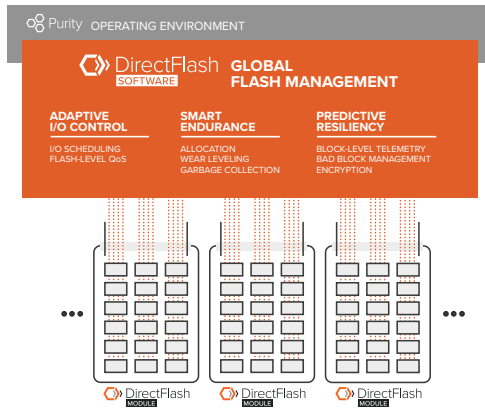
DIRECTFLASH SOFTWARE

All the flash management that in legacy architectures is carried out independently in each SSD is now done globally in DirectFlash Software (DFS). DFS handles flash wear leveling and bad block management at a global level, again leading to less over-provisioning. And DFS also provides detailed I/O scheduling and performance management globally, making I/Os deterministic and reducing average latency by slashing the number of slow I/Os that would often occur in SSD architectures. DFS manages everything globally, for a faster and more efficient architecture.
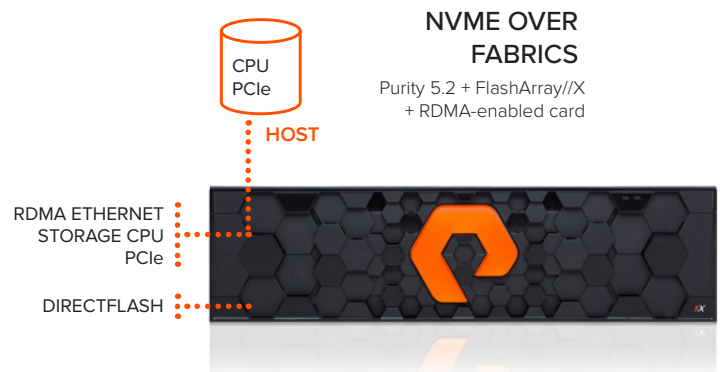
DIRECTFLASH MODULE

The DirectFlash Module (DFM) is a Pure-designed flash module which connects raw flash directly to the FlashArray™ via NVMe. Unlike traditional SSDs, there's no flash controller or flash translation layer (FTL) in the DFM, it's just raw flash. This removes the performance roadblocks that exist in every SSD within legacy retrofit architectures. DFMs make 100% of available raw flash visible to – and usable by – the system-level software.

DIRECTFLASH™ SHELF

We've even extended the DirectFlash architecture outside the FlashArray//X chassis: DirectFlash Shelf connects to the //X base chassis with NVMe-oF over 50 Gb/s RoCE Ethernet, delivering capacity expansion and the ability to mix and match differently-sized DirectFlash Modules, which matters over time as flash density improves and new forms of solid state memory become available (SCM and QLC, for example).
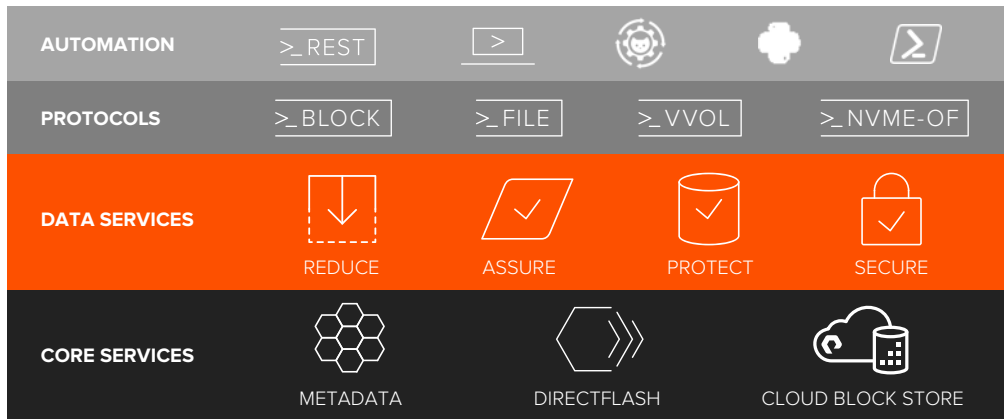
DIRECTFLASH™ FABRIC

DirectFlash Fabric delivers DAS performance with enterprise class reliability and data services. //X is the first enterprise storage array to deliver NVMe-oF RDMA over converged ethernet, enabling massive optimization between the storage controllers and the host over fast networking. DirectFlash Fabric brings both performance and efficiency gains – 50% latency reduction compared to iSCSI and 20% compared to FC, 4X capacity efficiency, and up to 25% host CPU offload.

NVME OVER FABRICS

Purity 5.2 + FlashArray//X + RDMA-enabled card

PURITY – THE SOFTWARE-DEFINED HEART OF FLASHARRAY

Purity for FlashArray is the software-defined heart of FlashArray//X, delivering rich, enterprise data services, DirectFlash™ global flash management, and Evergreen™ improvements with every release. Purity//FA 5 delivered ActiveCluster, QoS, File, and VVols – while the latest Purity//FA 5.2 brings NVMe-oF with DirectFlash Fabric and built-in cloud backups with Purity CloudSnap. All Purity storage services, APIs, and advanced data services are built-in and included with every array.

AUTOMATION	>_REST	>_	(icon)	(icon)	/≥/
PROTOCOLS	>_BLOCK	>_FILE	>_VVOL	>_NVME-OF	
DATA SERVICES	REDUCE	ASSURE	PROTECT	SECURE	
CORE SERVICES	METADATA	DIRECTFLASH	CLOUD BLOCK STORE		

COMPRESSION IMPROVEMENTS

The industry's best data reduction gets even better. Purity delivers additional data reduction savings of up to 20% via new compression enhancements. With a simple, non-disruptive upgrade, Purity further compresses your data in the background!

PURITY REDUCE implements five forms of inline and post-process data reduction, including compression and deduplication, to offer data reduction that's typically 2x better than the competition. With thin provisioning, total efficiency averages an industry-leading 10:1. Data reduction is always-on and operates at a 512-byte variable block size, enabling effective reduction across mixed workloads without tuning.

PURITY ASSURE provides high availability, dual-parity RAID-HA, non-disruptive Always-On QoS with limits, and encryption – all of which are designed to deliver consistent performance to FlashArray during component failures and maintenance.

PURITY REST APIs leverage Purity's open platform, cloud connections, and integrations to drive automation with VMware, Microsoft, and open-source tools such as OpenStack.

PURITY PROTECT combines Purity ActiveCluster with space-saving snapshots, replication, and protection policies into an end-to-end data protection and recovery solution that protects data against loss locally and globally. All Purity Protect services are fully-integrated in FlashArray and leverage native data reduction capabilities.

PURITY SECURE means FlashArray meets the highest security standards (with FIPS 140-2 validated always-on encryption, NIAP/Common Criteria Certification, and Rapid Data Locking) and is well-equipped to assist with compliance on new data regulations such as GDPR.

PURITY RUN is a platform for running applications on FlashArray ideally suited to lightweight, data services-oriented processes. Purity Run apps include: Windows File Services, Snap to NFS, VM Analytics, and CAT for SAP.

WINDOWS FILE SERVICES

Leveraging the Purity Run platform, Purity offers native CIFS/SMB and NFS file services via the fully-integrated Windows File Server. Purity's WFS capability enables you to fully consolidate your data center, replacing legacy file servers with modern, efficient WFS file shares running right on FlashArray. Meanwhile, Purity's QoS features ensure that file access doesn't impact application performance!

ACTIVECLUSTER – MAKE BUSINESS CONTINUITY EFFORTLESS

Make "recovery" a thing of the past with Purity ActiveCluster, Pure's ultra-simple solution for running applications Active/Active between two data centers. ActiveCluster's innovative design, including our cloud-based Pure1® Cloud Mediator and full integration with snapshot replication, enable all data center applications to take advantage of metro-area clustering. Best of all, ActiveCluster takes just minutes to set up, requires no third site, and is included in your Evergreen™ subscription at no additional cost.
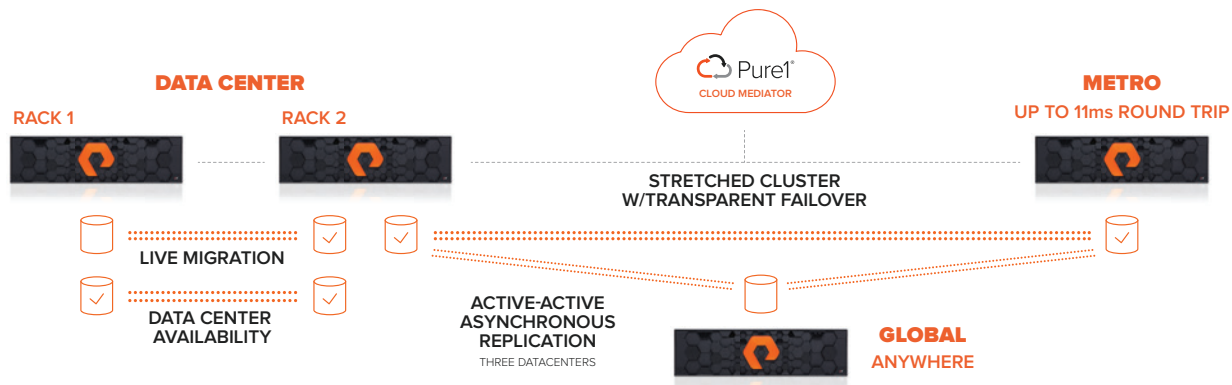
ActiveCluster has use cases within and between data centers. It enables live migration between any two FlashArrays, or rack-level HA clustering of four controllers for maximum resiliency. ActiveCluster really shines in the metro use case: simply take a running volume and "stretch" it between two sites separated by as much as 11ms of latency, with zero additional configuration required.

ASYNC TO THIRD SITE GOES ACTIVE/ACTIVE

ActiveCluster has offered asynchronous replication to a remote third site from the beginning, but with Purity 5.2 this feature comes into its own. Purity now enables Active-Active async replication to a third site globally, meaning that a target array makes intelligent and resilient use of async replication links from both source arrays. The loss of either source array or a replication link is transparent to async replication and requires no re-baseline: automatic failover, load balancing, and recovery are built-in. This feature provides effective protection from regional disaster, and, as a part of ActiveCluster, is included with every FlashArray.

SET UP IN MINUTES

Purity ActiveCluster uses the same simple and easy storage management model as the rest of FlashArray. Enabling ActiveCluster involves just one new command. It takes only four short steps to setup: Connect the arrays, create a stretched pod, create a volume, and connect the hosts. Done.

1. CONNECT THE ARRAYS
```
> purearray connect --type sync-replication
```

2. CREATE A STRETCHED POD
```
> purepod create pod1
> purepod add --array arrayB pod1
```

3. CREATE A VOLUME
```
> purevol create --size 1T pod1::vol1
```

4. CONNECT HOSTS
```
> purehost connect --vol pod1::vol1 host
```

OPEN, SELF-PROTECTING STORAGE, FROM LOCAL TO DR TO CLOUD

Data backup is no longer simply about storing data: it's about flexible protection, fast restores — and above all, making your valuable data available for other uses, such as test/dev and analytics. Legacy, complex **disk-to-disk-to-tape** backup architectures can no longer keep up with the advanced and constant flow of data that businesses are tasked with protecting — and exploiting — today.

FlashArray//X is a key element in **flash-to-flash-to-cloud** — a modern backup strategy designed for the scale and use cases of today's workloads. Flash-to-flash-to-cloud provides more flexible backup and recovery options, faster restores to meet aggressive RTOs, and simpler, more efficient operations while taking advantage of cloud economics. Consolidate workloads on FlashArray and secure them with a robust flash-to-flash-to-cloud backup and recovery strategy.

COMPREHENSIVE ON-PREMISES AND CLOUD BACKUP OPTIONS
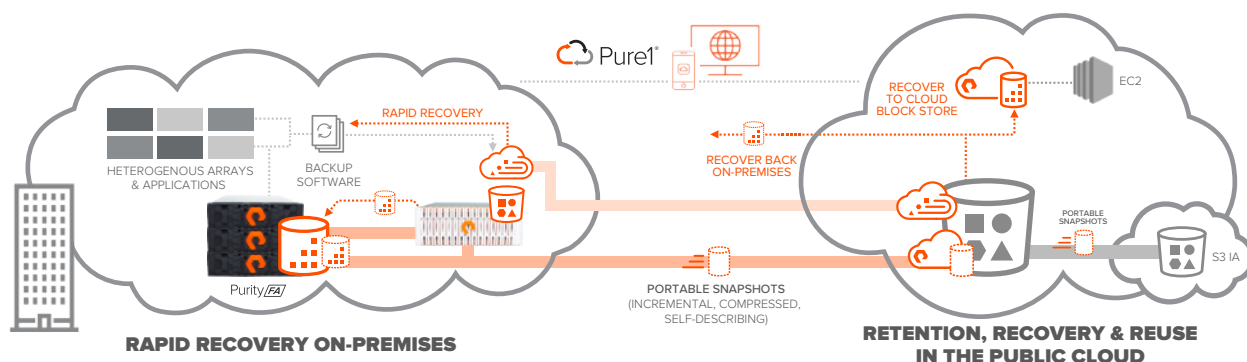
GET FLEXIBLE BACKUP AND RECOVERY

Pure portable snapshots provide simple, built-in, local and cloud protection for Pure FlashArray. Purity Snapshots, Snap-to-FlashBlade, Snap-to-NFS, and CloudSnap™ together enable free movement of space-efficient copies either between FlashArrays, to FlashBlade, to 3rd-party NFS storage, or to the cloud, respectively. Unlike other cloud backup solutions, Pure portable snapshots are also cost-efficient, because they encapsulate metadata — which means they're incremental, space-efficient, and self-describing.

ENJOY COMPLETE VISIBILITY

Pure1® cloud-based management includes a Snapshot Catalog of all of your backups in one place — whether the target is another FlashArray, FlashBlade, another NFS target, or public cloud (like Amazon S3). Monitor for compliance and for storage consumption trends. Manage the repurposing of your data for other use cases, such as test-dev and analytics. Best of all, know exactly what options you have when you need to recover.

SIMPLICITY BY DESIGN, FROM DAY 1

FlashArray//X has the power to simplify everything. The hardware, software, and cloud management experience are co-designed to make everything just work — no manual required! Just a few of the ways we make it effortless:

ONE BOX	30-MINUTE INSTALL	6 CABLES	NO MANUAL REQUIRED	ALL ARRAY SOFTWARE INCLUDED

DATA-AT-REST ENCRYPTION	NO TIERING OR PERFORMANCE TUNING	APIs FOR AUTOMATION	AI-DRIVEN CLOUD SUPPORT, MANAGEMENT & ANALYTICS

BUILT TO ACCELERATE AND INTEGRATE

FlashArray//X builds on the rich integration track record of the FlashArray family — tested and certified to work with all your critical applications and cloud infrastructure.

BUSINESS APPLICATIONS

ORACLE® · Microsoft SQL Server · SAP® · Epic · splunk> · EExchange

CLOUD NATIVE

cassandra · mongoDB · MariaDB

VIRTUALIZATION, CONTAINERS, AND CLOUD INFRASTRUCTURE

openstack. · docker · RED HAT OPENSHIFT · MESOSPHERE · Microsoft Hyper-V · kubernetes · redhat · vmware vSphere

DEVOPS & AUTOMATION

ANSIBLE · servicenow · SALTSTACK · puppet

DESKTOP VIRTUALIZATION

vmware Horizon 7 · NVIDIA. · CITRIX XenDesktop

DATA CENTER INFRASTRUCTURE

CISCO · COMMVAULT · ARISTA · BROCADE · veeam · COHESITY · VMTURBO · rubrik

PURESTORAGE®

OUT-OF-THE-BOX CLOUD AUTOMATION

To drive efficiency in your multi-cloud environment, automation is everything. FlashArray//X doesn't just work with containers and virtualization, it's been pre-integrated into all the popular full-stack orchestration tools so you can deliver storage-on-demand for your production team, developers, and data scientists.

ACCELERATING YOUR VMWARE SDDC

There are two key ingredients to running a cloud-model, VM-based environment: VVols and vRealize. FlashArray//X supports VVols natively, and enables instant conversion from VMFS ➜ VVols. VVols not only delivers per-VM storage operations like snapshots and replication, it also provides full VMware storage policy-based management (SPBM) for automation and policy enforcement in your cloud. With vRealize, you can achieve fully-automated provisioning via a service catalog for your end-users: VMs as a service, delivered!

Pure's vCenter Web Client and our new Pure1 VM Analytics mean you can have full management from vCenter and easy VM-to-storage performance correlation.
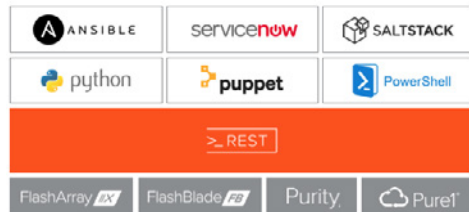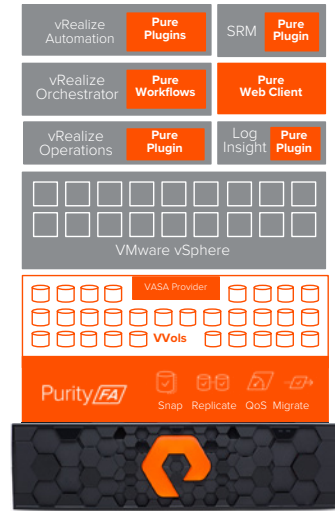
OPEN, FULL-STACK AUTOMATION

A wide range of tools have emerged to streamline orchestration of the full-stack IT environment. Pure's management philosophy is API-first: everything Pure can be controlled via our REST API. We've made automation even easier by delivering integration plugins and toolkits for most major orchestration frameworks.

CONTAINER STORAGE-AS-A-SERVICE: PURE SERVICE ORCHESTRATOR

Container adoption is exploding, but a lack of persistent storage support for stateful containers threatens to slow the trend. Pure has delivered plugins for Docker, Kubernetes, and Mesosphere to enable persistent container support. But the highly-fluid nature of container environments (where containers often "live" for only seconds) necessitates smarter provisioning. Enter the new Pure Service Orchestrator, which enables automated, policy-based container provisioning on the fly, across multiple FlashArray and FlashBlade™ systems.
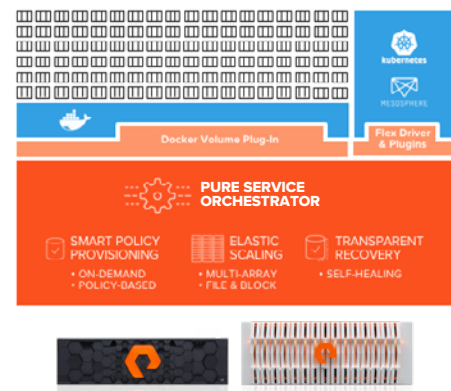
Pure1®

AI-DRIVEN, SAAS-BASED MANAGEMENT, FULL STACK ANALYTICS, AND PREDICTIVE SUPPORT

With Pure1, you can manage and analyze your storage from anywhere, and with any device, just by logging in. Like SaaS, Pure1 makes new releases and improvements instantly available to all our customers. We even have a mobile app that will deliver notifications to your smartphone if your attention is needed.
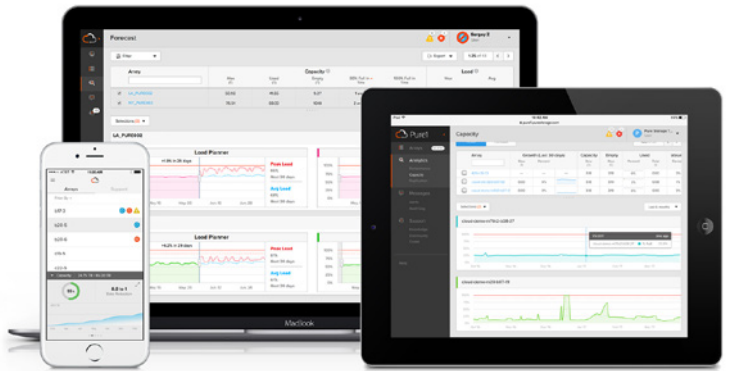

GLOBAL PREDICTIVE INTELLIGENCE ENABLES PERFORMANCE FORECASTING AND ULTRA-PROACTIVE SUPPORT

 Meta

Pure1 Meta™ is the AI engine within Pure1, providing intelligence to help better manage, automate, and support storage. With a global sensor network of 1000s of connected arrays and more than 1 trillion telemetry data points collected per day – over 7 petabytes of accumulated performance data – Pure1 Meta can model and characterize the behavior and interactions of a particular workload – a concept we call Workload DNA. Meta analyzes and simulates how workloads on your FlashArray will interact with each other, how they will grow over time in terms of capacity and performance, and whether a new workload will fit on the array. In addition, Meta continuously scans connected arrays against "issue fingerprints" to detect and alert Pure1 Support to proactively resolve issues before they occur. Meta is driving higher reliability (with more than 500 Sev1 issues avoided to date), increasing simplicity, and lowering the cost of over-provisioning.

Evergreen™ Storage

FlashArray operates like SaaS and the cloud. Deploy it once and enjoy a subscription to continuous innovation as you expand and improve performance, capacity, density, and/or features for 10 years or more – all without downtime, performance impact, or data migrations. We've engineered compatibility for future technologies right into the product via the modular, stateless architecture of FlashArray. Our "Right Size" capacity guarantee ensures you get started knowing you'll have the effective capacity you need, and our Capacity Consolidation program keeps your storage modern and dense as you expand. With Evergreen Storage, you don't have to re-buy TBs you already own. Keep your storage evergreen, modern and dense – and always meet your business needs.

//X10 55 TB   **//X20** 275 TB   **//X50** 650 TB   **//X70** 1.3 PB   **//X90** 3 PB

 PURESTORAGE®
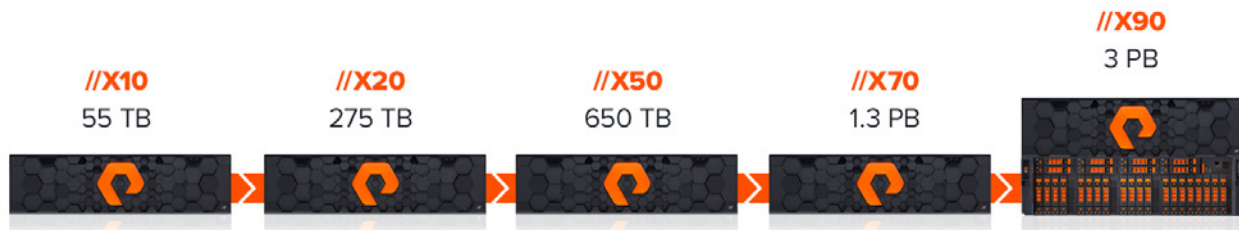
CAPACITY CONFIGURATION OPTIONS

FlashArray//X controllers are designed to support both all-NVMe DirectFlash™ modules and classic SATA/SAS Flash Modules simultaneously — making upgrades and expansion easy. Both the DirectFlash NVMe Shelf and the classic SAS Expansion Shelf can be used with //X.

DIRECTFLASH CAPACITY PACKS	2.2 TB DirectFlash Modules	4.5 TB DirectFlash Modules	9.1 TB DirectFlash Modules	18.3 TB DirectFlash Modules
IN AN //X CHASSIS (10 MODULES)	22 TB	45 TB	91 TB	183 TB
IN A DIRECTFLASH SHELF (14 MODULES)	31TB	63 TB	127 TB	256 TB

CLASSIC SATA/SAS CAPACITY PACKS	512 GB Flash Modules	1 TB / 960 GB Flash Modules	2 / 1.9 TB Flash Modules	3.8 TB Flash Modules	7.6 TB Flash Modules
IN AN //X CHASSIS (10 MODULES)	5 TB	10 TB	20 TB	38 TB	76 TB
IN A SAS SHELF (12 MODULES)		11 TB	22 TB	45 TB	90 TB

TECHNICAL SPECIFICATIONS*

	CAPACITY	PHYSICAL
//X10	Up to 55 TB / 53.5 TiB effective capacity** Up to 20 TB / 18.6 TiB raw capacity	3U 490 – 600 Watts (nominal – peak) 95 lbs (43.1 kg) fully loaded 5.12" x 18.94" x 29.72" chassis
//X20	Up to 275 TB / 251.8 TiB effective capacity** Up to 87 TB / 80.3 TiB raw capacity††	3U 620 – 688 Watts (nominal – peak) 95 lbs (43.1 kg) fully loaded 5.12" x 18.94" x 29.72" chassis
//X50	Up to 650 TB / 602.8 TiB effective capacity** Up to 183 TB / 171 TiB raw capacity†	3U 620 – 760 Watts (nominal – peak) 95 lbs (43.1 kg) fully loaded 5.12" x 18.94" x 29.72" chassis
//X70	Up to 1.3 PB / 1238.5 TiB effective capacity** Up to 366 TB / 320.1 TiB raw capacity†	3U 915 – 1345 Watts (nominal – peak) 97 lbs (44.0 kg) fully loaded 5.12" x 18.94" x 29.72" chassis
//X90	Up to 3 PB / 3003.1 TiB effective capacity** Up to 878 TB / 768.3 TiB raw capacity†	3U – 6U 1100 – 1570 Watts (nominal – peak) 97 lbs (44 kg) fully loaded 5.12" x 18.94" x 29.72" chassis
DIRECT FLASH SHELF	Up to 1.9 PB effective capacity** Up to 512 TB / 448.2 TiB raw capacity	3U 460 - 500 Watts (nominal – peak) 87.7 lbs (39.8kg) fully loaded 5.12" x 18.94" x 29.72" chassis

//X CONNECTIVITY

Onboard Ports (per controller)
- 2 x 1/10/25 Gb Ethernet
- 2 x 1/10/25 Gb Ethernet Replication
- 2 x 1Gb Management Ports

Host I/O Cards (3 slots/controller)
- 2-port 10GBase-T Ethernet
- 2-port 1/10/25 Gb Ethernet
- 2-port 40 Gb Ethernet
- 2 port 25/50 Gb NVMe/RoCE
- 2-port 16/32 Gb Fibre Channel (NVMe-oF Ready)***
- 4-port 16/32 Gb Fibre Channel (NVMe-oF Ready)***

* Stated //X specifications are applicable to //X R2 versions.

** Effective capacity assumes HA, RAID, and metadata overhead, GB-to-GiB conversion, and includes the benefit of data reduction with always-on inline deduplication, compression, and pattern removal. Average data reduction is calculated at 5-to-1 and does not include thin provisioning.

*** Expected Availability 2H 2019.

† Array accepts Pure Storage DirectFlash Shelf and/or Pure Storage SAS-based expansion shelf.

†† Array accepts Pure Storage SAS-based expansion shelf.

[1] Gartner, Magic Quadrant for Solid-State Arrays, 23 July 2018. *Gartner does not endorse any vendor, product or service depicted in its research publications, and does not advise technology users to select only those vendors with the highest ratings or other designation. Gartner research publications consist of the opinions of Gartner's research organization and should not be construed as statements of fact. Gartner disclaims all warranties, expressed or implied, with respect to this research, including any warranties of merchantability or fitness for a particular purpose.*

[2] Gartner, The Future of Hyperconverged and Integrated Systems Will Be Shaped by Shared Accelerated Storage, 25 May 2017

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