Purity

Powering Next-Gen Shared Accelerated Storage

SUMMARY

If data is now an organization’s most valuable asset, then the means to store and analyze that data effectively, and derive full value from it, are among an organization’s most important tools. FlashArray//X is such a tool, and at its core, driving all of its speed, agility, and intelligence, is Purity Operating Environment.

SOFTWARE-DEFINED, NEXT-GENERATION

Purity is the software-defined engine of FlashArray//X – it’s the driver that enables //X to deliver comprehensive data services to power all of your traditional and modern data center applications. Purity’s core technologies provide the speed, agility, and intelligence needed to simplify everything in your production environment.

Purity’s features set the pace for next-generation shared accelerated storage – from enterprise data services for all workloads, to industry-leading FlashArray 99.9999% availability, to 10:1 total efficiency. In the pages that follow, we’ll explore many of Purity’s critical components, from DirectFlash global flash management via 100% NVMe, to business continuity via ActiveCluster, and on to completely non-disruptive operations and integrated data security.

All new array features, by the way, are included: there’s nothing extra to license or install. And thanks to Pure’s Evergreen™ Storage ownership model, new array features and improvements to Purity are just a non-disruptive upgrade away – included with your Evergreen subscription.
PURITY CORE SERVICES
Across all Pure Storage arrays, Purity implements communication protocols and delivers rich data services that are founded upon four core services. These are the technologies that drive the next generation performance and industry-leading resiliency of Pure Data Centric Architecture.

<table>
<thead>
<tr>
<th>PROTOCOLS</th>
<th>&gt; BLOCK</th>
<th>&gt; VM</th>
<th>&gt; FILE</th>
<th>&gt; OBJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA SERVICES</td>
<td><img src="reduce.png" alt="Reduce" /></td>
<td><img src="assure.png" alt="Assure" /></td>
<td><img src="protect.png" alt="Protect" /></td>
<td><img src="secure.png" alt="Secure" /></td>
</tr>
<tr>
<td>CORE SERVICES</td>
<td><img src="store.png" alt="Store" /></td>
<td><img src="metadata.png" alt="Metadata" /></td>
<td><img src="fabric.png" alt="Fabric" /></td>
<td><img src="directflash.png" alt="DirectFlash" /></td>
</tr>
</tbody>
</table>

**STORE**
The future is multi-protocol, and Purity is designed to translate between multiple languages. Purity implements a Common Object Core, and builds all protocols on top as peers. This means you can read and write simultaneously in any protocol, and share data easily. It also makes it simple to add future protocols.

**METADATA**
Purity leverages on a variable block metadata engine across all layers of every array – powering built-in, always-on compression, thin provisioning, encryption, and rapid data locking, as well as HA and NDU. The metadata engine provides faster mixed workload performance while ensuring that data services have no performance impact.

**FABRIC**
Purity provides all our arrays a next-generation, software-defined fabric to extend the benefits of ultra-low latency, high bandwidth DirectFlash. For FlashArray, NVMe over Fabrics (NVMe-oF) delivers high-performance capacity expansion via DirectFlash Shelf. (In a follow-on release planned for 2H 2018, Purity will enable NVMe/oF on the front end – to servers – as well.)

**DIRECTFLASH**
Purity implements global flash management (allocation, I/O optimization, garbage collection, and error correction) at the system level, driving 100% NVMe-connected raw flash within DirectFlash™ Modules, and eliminating the performance density limitations and unpredictable latency of large SSDs. DirectFlash exploits the full potential of flash – delivering predictable, consistent, microsecond latency alongside higher throughput and reliability, better efficiency, and ultra-high density.
PURITY//FA – THE SOFTWARE-DEFINED HEART OF FLASHARRAY

Purity for FlashArray is the core of FlashArray//X, delivering enterprise data services, DirectFlash™ global flash management, and Evergreen improvements with every release. Purity//FA 5.0 delivered ActiveCluster, QoS, File, and VVols – while the latest Purity//FA 5.1 brings Snap to NFS and up to 20% better overall data reduction efficiency. All Purity data services and APIs are built-in and included with every array as part of the Evergreen subscription.

<table>
<thead>
<tr>
<th>PROTOCOLS</th>
<th>DATA SERVICES</th>
<th>CORE SERVICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
<td>REDUCE</td>
<td>RUN</td>
</tr>
<tr>
<td>&gt; FC</td>
<td>REDUCE</td>
<td></td>
</tr>
<tr>
<td>&gt; FC</td>
<td>REDUCE</td>
<td></td>
</tr>
<tr>
<td>&gt; SDM</td>
<td>ASSURE</td>
<td></td>
</tr>
<tr>
<td>&gt; VVOL</td>
<td>PROVISIONING</td>
<td></td>
</tr>
<tr>
<td>&gt; NFS</td>
<td>REDUCE</td>
<td></td>
</tr>
<tr>
<td>&gt; SMB</td>
<td>ASSURE</td>
<td></td>
</tr>
</tbody>
</table>

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 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 (to heterogenous NFS targets). 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.

COMPRESSION IMPROVEMENTS

The industry’s best data reduction gets even better. Purity 5.1 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!

WINDOWS FILE SERVICES

Leveraging the Purity Run platform, Purity now 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.

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 (to heterogenous NFS targets). 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.

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 REDUCE

Purity delivers the industry’s most granular, comprehensive data reduction – and the industry’s best total efficiency, at 10:1 – with savings that are typically 2x better than the competition. Unlike other vendors, our data reduction and thin provisioning are built-in, always-on, and require no tuning. Simple, predictable – even predictive. You’ll buy less storage now, and less storage in the future!

HOW PURITY LEADS THE INDUSTRY IN DATA REDUCTION

**Always-On** – Purity Operating Environment is designed to support high-performance, always-on data reduction. All our performance benchmarks are taken with data reduction on.

**Global** – Unlike some data reduction solutions which operate within a volume or a pool, thereby partitioning the data and dramatically reducing dedupe savings, Purity Reduce dedupe is inline and global.

**Five Reduction Technologies** – We’ve got the data reduction that’s necessary for virtually any application, already built-in: pattern removal, deduplication, compression, deep reduction, and copy reduction.

**Variable Addressing** – Purity employs variable addressing, which finds duplicates that fixed-block implementations miss. Purity Reduce scans for duplicates at 512-byte granularity and auto-aligns with application data layouts without any tuning at any layer. In addition, variable (byte-granular) compression avoids diluting your savings with waste that fixed-bucket granular compression implementations propagate.

**Multiple Compression Algorithms** – Different kinds of data compress differently. Purity employs multiple compression algorithms for optimal data reduction.

**Designed for Mixed Workloads** – Purity Reduce delivers optimal data reduction savings for mixed workloads without requiring any tradeoffs and/or tuning. That’s unmatched simplicity for the real world of your data.

DON’T BE FOOLED BY DATA REDUCTION GIMMICKS

Many vendors will include thin provisioning or snap savings in their storage efficiency and data reduction (DR) claims to make up for lackluster core DR. Or they’ll talk about configuring DR per volume, which is really just a way to mask performance impacts. We don’t – we tell you what our inline and always-on DR technologies are delivering, globally across our entire installed base (average of 5:1), and separately what our total efficiency is with thin provisioning included (average of 10:1). When comparing with other vendors’ claims, use Pure’s total efficiency, as that’s more of an apples-to-apples comparison.

View our live data reduction and total efficiency rates.

OUR DATA REDUCTION TECHNOLOGIES

100% THIN PROVISIONED

Thin provisioning dynamically allocates capacity on demand for all volumes and all workloads, optimizing the utilization of the array. While many vendors use thin provisioning as a way to boost data reduction savings, thin provisioning is an over-provisioning, not a data reduction technology. This is why our Purity Reduce Ticker separates the average data reduction savings from deduplication and compression only from Pure’s total efficiency, with thin provisioning included. And granularity? It’s at the 512-byte level just like all Purity services, meaning that Purity thin provisioning delivers even more efficiency than the competition.
PURITY ASSURE
Purity Assure is resiliency that never quits. Purity for FlashArray delivers 99.9999% proven availability, inclusive of maintenance, failures, and generational upgrades. So your data is always available, always performing, and always protected – with no performance loss.

ZERO-IMPACT MAINTENANCE
Add flash capacity online; expand performance, even across generations; replace any failed component, or upgrade software – Purity for FlashArray delivers 100% performance through all of these operations.

HOW PURITY DELIVERS NON-DISRUPTIVE EVERYTHING
Active/Active High Availability – A clustered controller design allows for the complete failure of a controller or any controller component without impacting operations.
Mirrored NV-RAM – Write IOs are persisted to NV-RAM modules, ensuring in-flight writes are protected against power loss and device failure.
Hot-Swappable Components – Flash Modules, NV-RAM Modules, and controllers are hot-swappable for continuous operation, even when recovering from a failure.
Stateless Controller Architecture – Simply unplug a failed controller, cable up a new one, and the FlashArray is back to full-availability, without any performance loss.

DATA THAT’S ALWAYS PROTECTED
Purity for FlashArray incorporates RAID-HA that’s redesigned specifically for flash and its failure modes.

DEVICE FAILURE RAID-HA protects against concurrent dual-drive failure, and re-builds around failures automatically within minutes.
BIT ERRORS RAID-HA uses independent checksums and dedicated parity to detect and heal around bit error issues.
PERFORMANCE VARIABILITY RAID-HA manages performance variability to deliver consistent latency.

NDU EVERYTHING
Upgrade and expand everything non-disruptively, with data in place – and without performance impact. Hello weekends.

AVOID DOWNTIME
Designed for 99.9999% availability, FlashArray has no single point of failure, and all components are hot-swappable and upgradeable online.

PROTECT YOUR DATA
Adaptive dual-parity RAID-HA and always-on encryption mean zero data loss.

PURITY QOS
Get worry-free consolidation of workloads via comprehensive, powerful, effortless storage QoS.

ALWAYS-ON Automatic protection against “noisy neighbors” – no knobs, no configuration.
RATE LIMITS Enforce performance expectations for targeted workloads with throughput limits per volume or workload.
PURITY PROTECT

Purity is designed to ensure your data is safe. From full business continuity with Purity ActiveCluster, to multi-site replication, to space-efficient local and remote snapshots, get the flexibility you need to operate worry-free. Purity supports automation of Purity ActiveCluster deployments, replication, and local snapshots – all within the Pure Storage GUI.

PURITY ACTIVECLUSTER

Purity/FA 5 includes ActiveCluster natively – enabling organizations to achieve new levels of availability effortlessly and affordably, with no additional hardware or licenses. Live migrations, business continuity within a rack, a data center, or across metro regions – even three data center protection with async replication. It’s all there: Active/Active synchronous replication, transparent failover, and a built-in Pure1® Cloud Mediator that acts as a third site. Set up in minutes!

Unlike Active/Passive implementations, ActiveCluster serves I/O on a given volume from both sites simultaneously. You don’t have to worry about the complexity of managing VM or database instance affinity to a site, and application latency is optimized with reads served locally.

INSTANT, LIMITLESS SNAPSHOTS

Purity Protect Snapshots to FlashArray or to an NFS target are instantaneous, space-efficient, and have no effect on performance.

SNAPSHOT ANY VOLUME AT ANY TIME at the click of a mouse. No planning or reservations required, no performance overhead.

SNAPSHOTS HAVE FULL CAPABILITIES because all volumes in the FlashArray are virtual and independent. So mount, read, write, or snapshot your snapshot again — no restrictions, full performance.

ALWAYS FULL YET SPACE SAVING snapshots work like full clones, and are always thin, deduped, and compressed.

RECOVER ANYTHING TO ANYWHERE from any other volume or snapshot in the array, instantly.

ASYNCRONOUS AND SNAPSHOT REPLICATION

The powerful combination behind ActiveCluster. Achieve low RPO with regular delta updates and enable RTO zero via instant recovery from point-in-time snapshots.

DATA REDUCTION-OPTIMIZED means always thin, deduped, and compressed. No more lost performance, ballooning data, and added complexity.

INSTANT RECOVERY ENABLES RTO ZERO with no data copying required. Get back online faster.

MULTI-SITE REPLICATION 1:Many, Many:1 or Many:Many replication delivers flexibility. Use for data sharing, centralized backup, or DR.
PURITY SECURE

Purity Secure incorporates software and hardware measures to meet the highest security standards, ensuring the safety of customer data, while streamlining administrative requirements. Purity Secure has no impact on performance and is completely transparent to both server hosts and users. It can also be a key resource for organizations needing to meet modern compliance regulations like GDPR.

ALWAYS-ON ENCRYPTION

Purity continuously encrypts all data within FlashArray via FIPS 140-2 validated AES-256 encryption, meeting the U.S. government’s highest security standard for data-at-rest encryption. Encryption is built-in, always-on, always inline, and costs nothing: no impact on performance, no administrative overhead, no key management – and no additional fee.

EVERYTHING ENCRYPTED 100% of data at rest is encrypted, protecting against drive theft or loss.

INLINE, WITH NO PENALTY Encryption is always-on, inline, and has no impact on performance.

ZERO KEY MANAGEMENT Internal key management provides security without user intervention.

TOUGH EXTERNAL SECURITY

FlashArray protection has achieved accreditation by the Common Criteria Organization (CCO) to meet its stringent standards for data system security. Rapid Data Locking (RDL) offers smart card-based instant locking of an array, and similarly KMIP support enhances software-generated secrets used to regenerate an array’s flash module access keys.

INSTANTLY DISABLE an array and crypto-lock its data, greatly reducing risk of loss, capture, or compromise.

SIMPLIFY LOGISTICS of shipment and deployment.

SECURE ADMINISTRATION Multiple account types, directory-based authentication, and secure management connectivity enable secure administration.

PURITY CAN ASSIST WITH GDPR

Every organization that collects and/or processes the data of data subjects in the EU is subject to GDPR and must comply. Penalties for non-compliance are significant, but a combination of data policies and technology considerations – such as encryption and data reduction – can help you achieve GDPR compliance cost-effectively.

VISIT PURESTORAGE.COM TO LEARN MORE