TrueNAS® iXsystems™

2023

AGENDA

#1 Open Source Storage OS - Now TrueNAS Core

USER BASE

Over **10M** Downloads

~1M Estimated Deployments

Over **500K** Downloads Annually

Over **200K** Community Members

STRONG COMMUNITY

250K monthly Website Visitors

72K Registered Forum Users

50K+ YouTube Videos, >100M Views
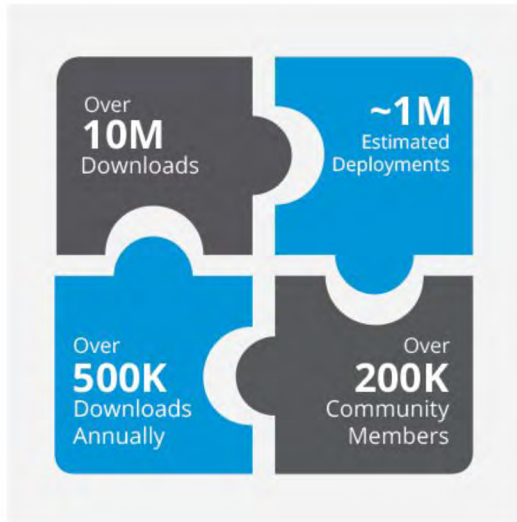
>3,000 Leads Annually

GLOBAL FOOTPRINT

99% of Countries

50+ Languages

Exabytes of entrusted data

SupportCALL | iXsystems | TrueNAS
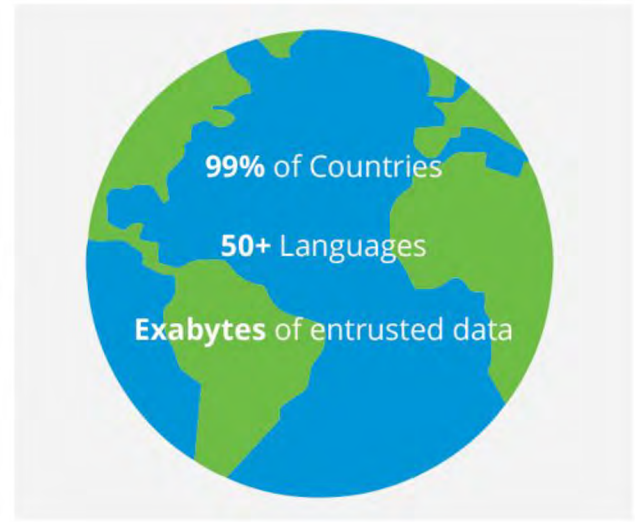
TrueNAS family growing customer base

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TrueNAS 2022

OPEN STORAGE

TrueCommand

Enterprise Storage with Open Source Economics

Enterprise features, security, integrations, & support

Manage data growth with cost-effective scalability

Choose software edition & hardware that fits the workload

Hybrid & All-Flash | Scale Up & Scale Out

Unified File, Block, Object, and App Storage

Industry-leading data management & CoW data integrity

Data Center, Clouds, Edge systems

The Industry's #1 Open Storage

>1 Million Deployments and 4-10 Exabytes

>250K User Community and #1 ZFS Distribution

EDITIONS

TrueNAS
CORE
Free Single Node edition

TrueNAS
ENTERPRISE
High Availability edition with Support

TrueNAS
SCALE
Hyper-converged edition

PLATFORMS

aws

Clouds

VMs

Minis

R-Series

M-Series

X-Series

TrueNAS® - 3 Editions, ONE SOFTWARE

TrueNAS CORE

Best "free" NAS

Open Source SDS
DIY - Community Supported

Non-critical Apps

TrueNAS ENTERPRISE

Scale-up HA Appliances

Dual Controller Platforms
Up to 20 PB, Five 9's

Mission Critical Apps

TrueNAS SCALE

Scale-out Clusters

SDS and Appliances
Hyperconverged: Kubernetes, VMs

Scale-out Storage

TrueNAS OPEN STORAGE

- File
- Block
- Object
- Applications
- Admin/APIs
- Platform Mgmt
- Security/VPNs
- Networking
- Data Management
- Data Replication
- Data Reduction
- Data Acceleration

TrueCommand your NAS Fleet

TRUENAS HA Systems

TrueNAS ENTERPRISE

TrueNAS SCALE

TrueNAS CORE

TrueCommand
Single Pane of Glass Management

HTTPS

REST API

Automation of ZFS Storage Operations

✓ Powerful and Customizable Alerting system

✓ High level Dashboard and Detailed Reporting

✓ Monitoring of Datasets, Snapshots & Replication

✓ Role Based Access Control, Audits, AD/LDAP

✓ Predictive Analytics & Rapid Fault Diagnosis

✓ Cloud Service with integrated VPN

Hosted On:

vmware   docker   CLOUD

TrueNAS Remote Systems

FreeNAS

SupportCALL | iXsystems™ | TrueNAS

TrueNAS Family: The Open Storage Technology Stack

ENTERPRISE STORAGE APPLIANCES

· Hybrid / All-Flash systems   · Unified NAS/SAN storage

· Scalable to 100Gb/s & 10 PB   · 24x7 service and support

· High-Availability (HA)   · Certified with VMware and other enterprise software

TrueNAS Enterprise

#1 OPEN SOURCE STORAGE OS   · Community support

· >1M deployments   · VM and plugin support

· File, block, object sharing   · Hybrid cloud enabling

TrueNAS CORE

OPEN SOURCE FOUNDATION

· ZFS   · FreeBSD   · Bhyve   · Iocage   · MinIO

iXsystems™ | SupportCALL

TrueNAS delivers flexible Open Storage

OPEN STORAGE

TrueCommand
Single Pane Management

docker CLOUD

SCALE UNLIMITED CAPACITY

1000PB

ENTERPRISE 24/7 ENTERPRISE SUPPORT

TrueNAS M-Series

CORE BEST FREE NAS

TrueNAS X-Series

TrueNAS R-Series

10TB

aws

TrueNAS
Cloud Instances

TrueNAS MINI

S3 RI SAS NVME

Storage Media Choices

TrueNAS Expansion Shelves

TrueNAS Product Family - Detailed Hardware Overview

TrueNAS Mini
No HA Support

Mini E:
- 4 bays
- 8 to 16GB DDR4
- Dual-core Intel Atom

Mini X:
- 5+2 bays
- 16 to 32GB DDR4
- Quad-core Intel Atom

Mini X+:
- 5+2 bays
- 32 to 64GB DDR4
- 8-core Intel Atom

Mini XL+:
- 8+1 bays
- 32 to 64GB DDR4
- 8-core Intel Atom

TrueNAS R-Series
No HA Support

R10:
- 1U 16x 2.5" 7mm bays
- 32 to 96GB DDR4
- 6 to 10 core Xeon SP

R20:
- 2U 12x 3.5" bays + 2x Exp. Shelf
- 32 to 192GB DDR4
- 6 to 16 core Xeon SP

R40:
- 2U 48x 2.5" 7mm bays + 2x Exp. Shelf
- 32 to 192GB DDR4
- 6 to 16 core Xeon SP

R50:
- 4U 48x 3.5", 3x NVMe bays + 2x Exp.
- 32 to 192GB DDR4
- 6 to 16 core Xeon SP

TrueNAS X-Series
HA Options Available

(All 2U 12x 3.5" bay)

X10:
- 2U 12x bays + 1x ES24
- 32 DDR4
- 6 core Xeon D

X20:
- 2U 12x bays + 1x ES60
- 64GB DDR4
- 6 core Xeon D

TrueNAS M-Series
HA Options Available

(All 4U 24x 3.5" bay)

M30:
- 64GB DDR4
- 8 core/8 thread Xeon SP

M40:
- 2x NVMe bays + 2x Exp. Shelf
- 128 to 192GB DDR4
- 10 core Xeon SP
- 1x 16GB NVDIMM

M50:
- 4x NVMe bays + 4x to 8x Exp. Shelf
- 256 to 384GB DDR4
- 2x 10 core Xeon SP
- 1x 16GB NVDIMM

M60:
- 4x NVMe bays + 8x to 12x Exp. Shelf
- 768GB DDR4
- 2x 16 core Xeon SP
- 2x 32GB NVDIMM

Expansion Shelves:
- 2U 12x 3.5" bay (ES12)
- 2U 24x 2.5" bay (ES24F)
- 4U 24x 3.5" bay (ES24)
- 4U 60x 3.5" bay (ES60)
- 4U 102x 3.5" bay (ES102)

(ES102 on R50 and M60 only, requires 1.2M deep rack)

Network Options:
- 1GbE RJ45
- 10GbE RJ45
- 10GbE SFP+
- 40GbE QSFP+
- 25GbE SFP28
- 100GbE QSFP28
- 8 Gb/s FC
- 16 Gb/s FC
- 32 Gb/s FC

(Not all network options available on all platforms)

Encryption Support:
- Native OpenZFS Encryption
- Self-encrypting drives (SEDs)
- FIPS 140-2 SEDs

TrueNAS R30

Extreme Performance Density

Enterprise-Grade Appliances

ECC RAM, IPMI and TN Enclosure Mgmt

3 Year HW Warranty with Bronze/Silver/Gold Options

Extreme Performance

Single AMD Processor: 16-64 Cores, 64GB - 1TB RAM

Performance Networking: 4 × 10Gbe/25/40/100Gbe

NVMe SSD Expansion options - 3.8TB- 15TB: 240TB Max

Built for SCALE

KVM or Kubernetes

Scale-out Storage - File (SMB, Gluster), Object (S3)

December 2022 with Bluefin
-    32Core 256GB

R30
AMD EPYC Single Socket
16 DIMM slots
16 × 2.5" NVMe Bays in 1U
M.2 SSD Boot
2 PCIe Slots
Redundant 800W Platinum PS

TrueNAS Mini R

Builds on the success of Minis - ideal for small office deployments.

Mini (R)ackmount: 2U with 12x 3.5 Bays
Lockable Mini 3.5" Drive trays
WD Red Plus Drives (4-18TB): 200+TB
2.5" SSDs (1.9-7.6TB) with adaptor: 90TB

Mini X+ Motherboard
8 Cores + 32/64GB DRAM, USB3.0 at rear
Dual 1/10GbE-BaseT
NIC Slot - Optional 10GbE SFP+
Can run TrueNAS CORE or SCALE

Very Quiet 3x 80mm speed-controlled fans
350W PSU (non-redundant like Minis)

Standard 2U rail kit (19" to 26.6")
Can sit on shelf/desktop without rail kit
Optional rail kit available (26.5" to 36.4")

Mini R
2U Rackmount - 12 Bays
WxLxH = 17.2" x 21" (short) x 3.5"
437mm x 533.4mm x 88.9mm

**Diskless: 63W,
With drives & 10G Add-on-card: 167W**

Network Application Services

📁 File
- ✓ NFS v3/4, SMBv1/2/3
- ✓ AFP, FTP, WebDAV, rsync

🗄 Block
- ✓ iSCSI, iSNS, FC, VAAI, Cinder, vCenter
- ✓ Certs: vSphere, Citrix, Veeam

💾 Object
- ✓ S3 Host, Scale-out
- ✓ Cloud sync/backup, Credentials

⚙ Applications
- ✓ Plugins: Asigra, NextCloud, Iconik, Gitlab, Zoneminder, and more
- ✓ HA FreeBSD Jails/Plugins

🔒 Security
- ✓ Self-Encrypted Drives (SEDs)
- ✓ FIPS 140-2 Level 2 option
- ✓ Software disk encryption
- ✓ Encrypted replication, SSH
- ✓ Active Directory, LDAP
- ✓ Local users and groups
- ✓ Kerberos, ACLs, NIS

OpenZFS Services

🕐 Data Management
- ✓ Unlimited Snapshots & Restores
- ✓ Zero cost Clones
- ✓ Auto-restart ZFS Replication

🗄 Data Protection
- ✓ Copy-on-Write, 2-Copy Metadata
- ✓ RAID-Z1/Z2/Z3, Mirrors
- ✓ Fast Resilvering & Replication
- ✓ Data Integrity CRC, Scrubbing

📥 Data Reduction
- ✓ Thin Provisioning
- ✓ In-line Compression
- ✓ Snapshot Clones

📈 Data Acceleration
- ✓ All-Flash, Multiple Pools
- ✓ ARC, L2ARC Read Cache
- ✓ Write Cache - SAS or NVDIMM

TrueCommand
- ✓ Single pane of glass
- ✓ 24x7 Team operation
- ✓ RBAC, Audit, Single Sign-On (SSO)
- ✓ Alerting, Reporting, Analytics

Platform Services

🖧 Networking
- ✓ IPv4: 1- 100GbE, DHCP
- ✓ LAGG, VLANs, Firewall
- ✓ Fibre Channel (8-32Gb)

▦ Administration
- ✓ Web UI, Wizards, SNMP, Syslog
- ✓ REST API, WebSockets API
- ✓ Alerting, Email, Support
- ✓ Tasks, Cron Jobs, Scripts, Reports
- ✓ In-Service Updates, Autotune

🐡 Operating System
- ✓ FreeBSD, Boot mgmt, SSH
- ✓ Iocage jails
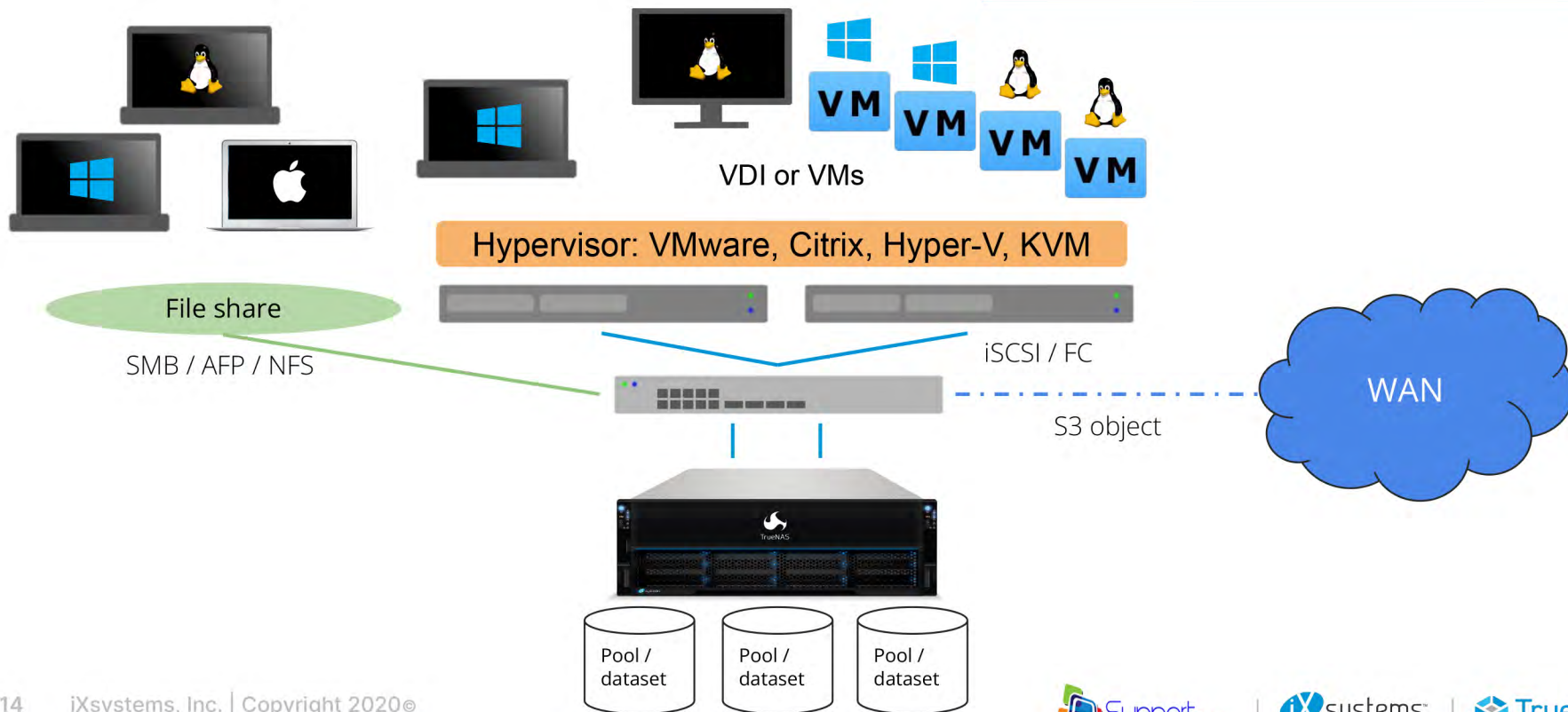- ✓ System logging, NTP

⚙ Hardware Management
- ✓ IPMI Remote Management
- ✓ SAS JBODs, Global hot spares
- ✓ SMART Drive Management

High Availability
- ✓ Dual Controllers, SAS, NVMe
- ✓ NVDIMM, Proactive Support
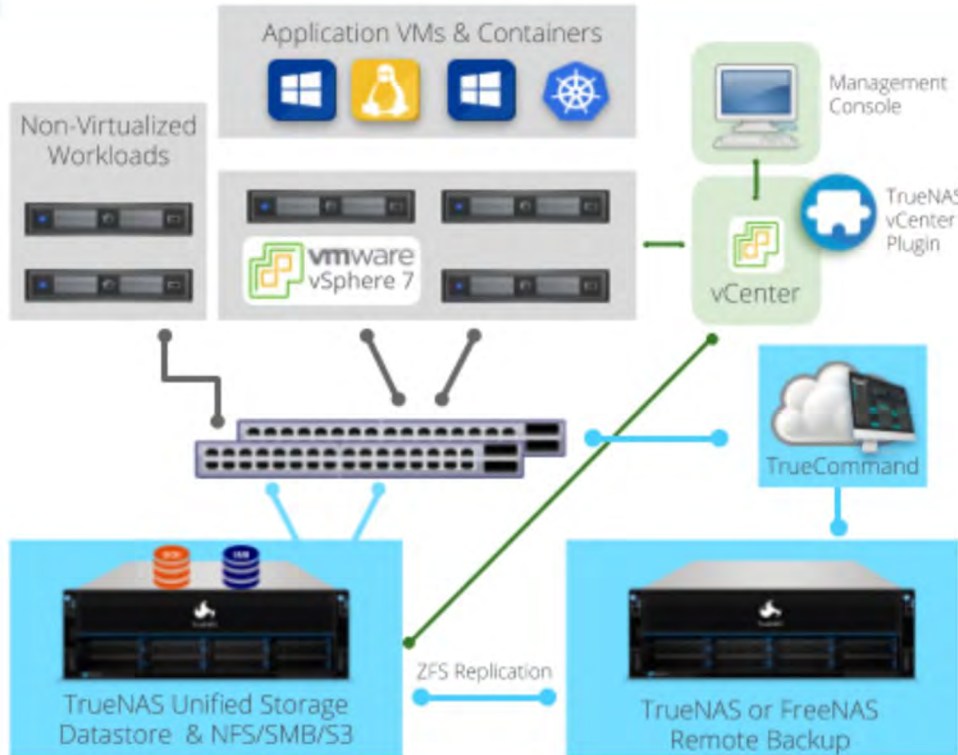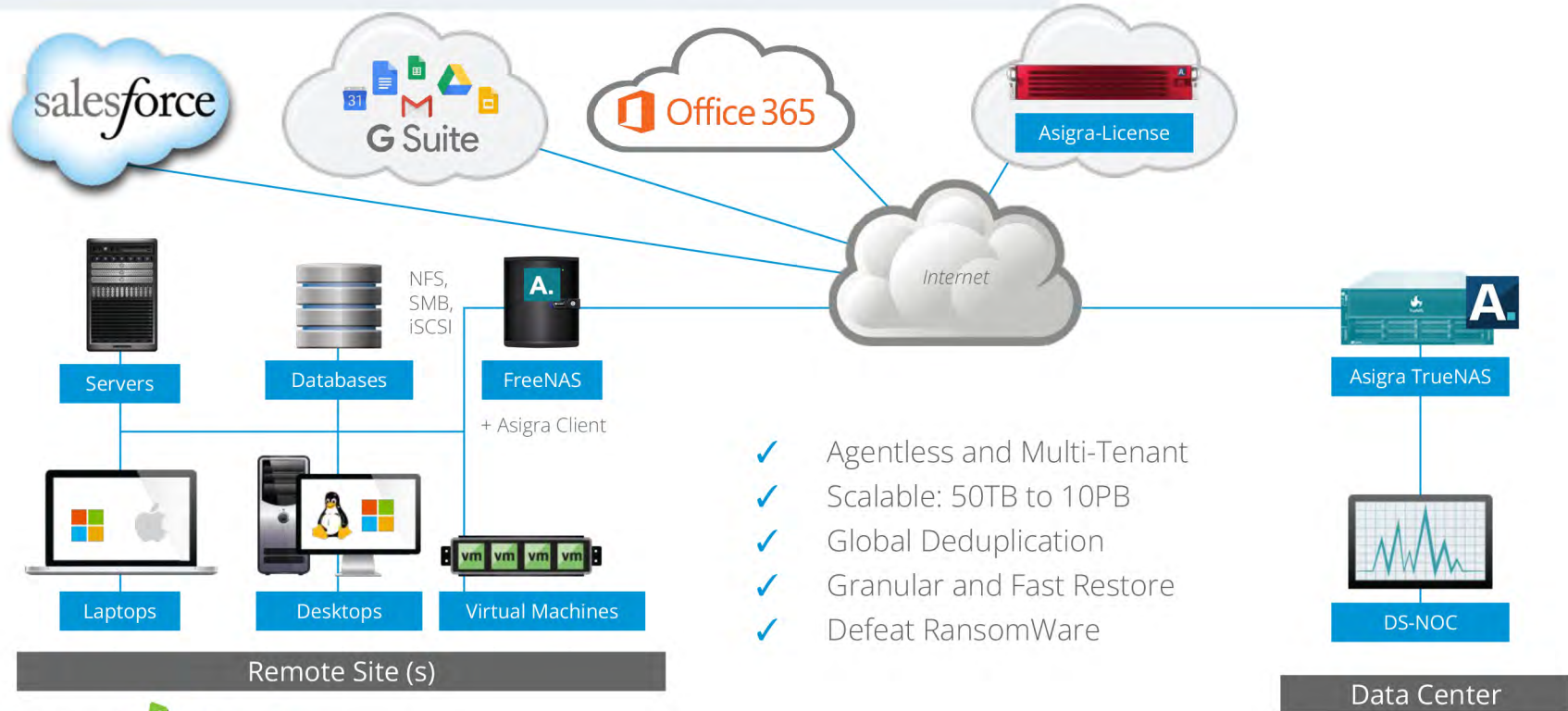- ✓ Enclosure & Failover Management

TrueNAS for VMware vSphere 7

✓ Unified Storage: NAS or SAN

✓ Proven ZFS Data Protection

✓ All-Flash or Hybrid Performance

✓ Up to Five 9's Availability

✓ Scale Capacity easily

✓ Open Source Economics

✓ VMs and Containers (Kubernetes) support

✓ **vCenter 7.0 Plug-in 3.2**

Enterprise Backup with Asigra

salesforce

G Suite

Office 365

Asigra-License

Servers

Databases

NFS,
SMB,
iSCSI

FreeNAS

+ Asigra Client

Internet

Asigra TrueNAS

Laptops

Desktops

Virtual Machines

✓ Agentless and Multi-Tenant
✓ Scalable: 50TB to 10PB
✓ Global Deduplication
✓ Granular and Fast Restore
✓ Defeat RansomWare

DS-NOC

Remote Site (s)

Data Center

iXsystems™ | SupportCALL

TrueNAS for Multimedia & Entertainment

- Edit high-end video (4K, 8K RAW) and audio files across dozens of clients
  - Up to 10 GB/s bandwidth per NAS
  - Any client, MAM, or access protocol

- Cross-site collaboration and protection
  - Remote or cloud replication, sync
  - ZFS self-healing data Integrity

- Archive projects on multi-PB file shares
  - Unlimited snapshots & recoveries
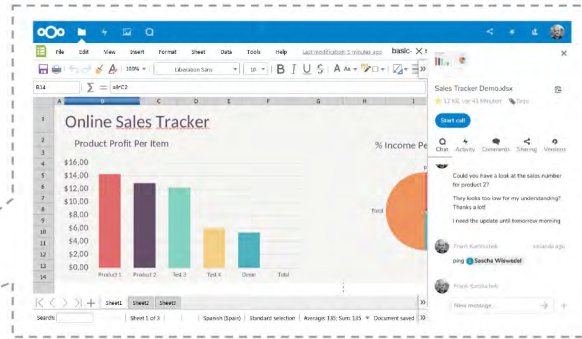 - Never delete content again

MAM, DAM, Transcoding, Rendering
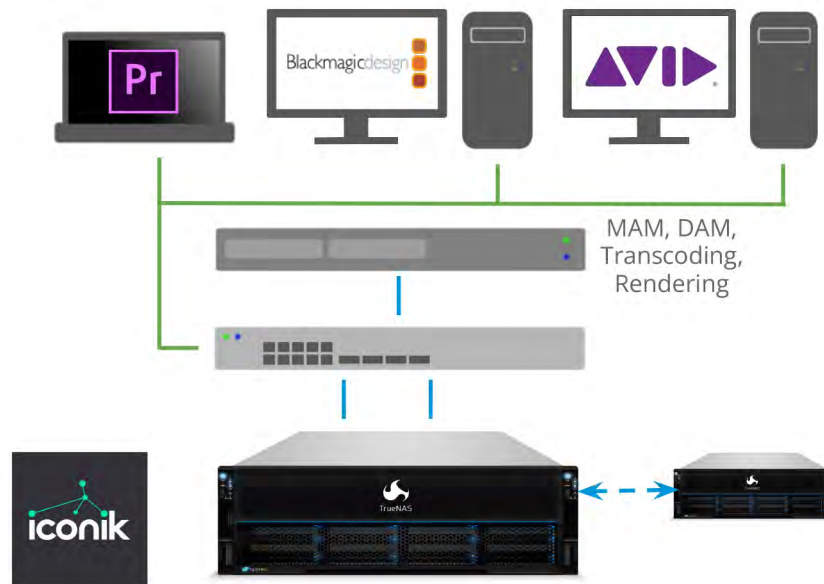
Collaboration Plugin: Iconik
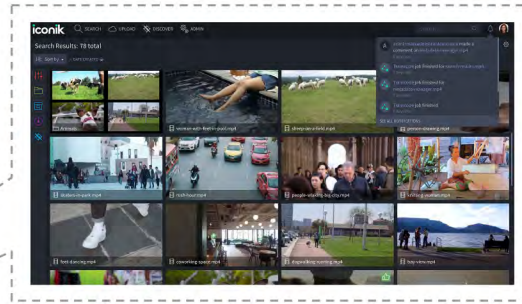
Iconik manages Media across Local & Cloud Storage

- ✓ Media-centric UI masks file location
- ✓ Simplify search based on tags
- ✓ Backup, cross-site collaboration
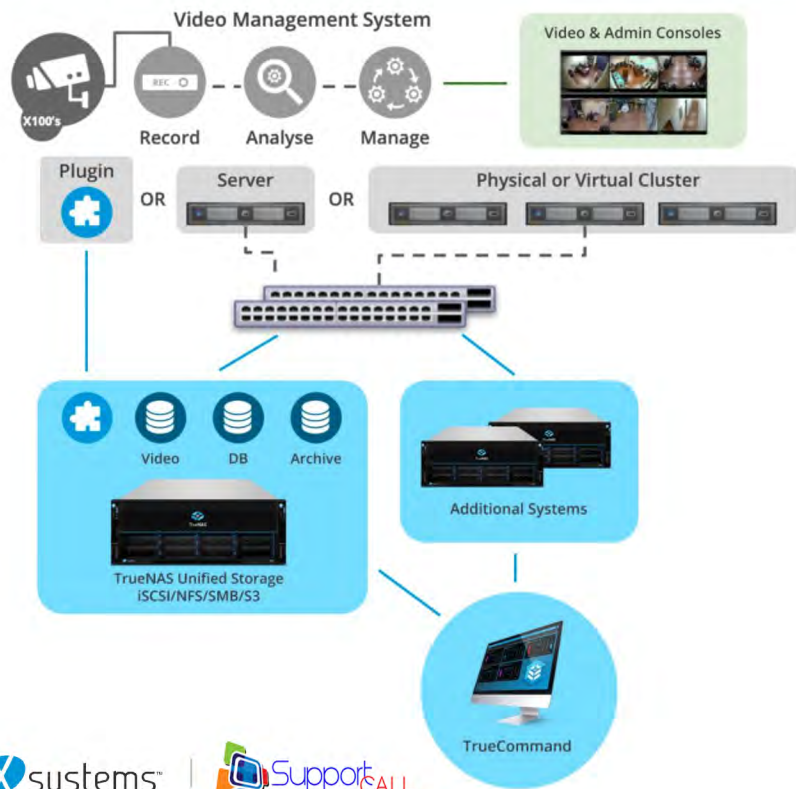- ✓ NAS storage is faster and cheaper
- ✓ Any Cloud storage

Collaboration Plugin: NextCloud

NextCloud is a Private Productivity Platform

- ✓ Chat, Calendar, Messaging and Email
- ✓ Document create, sync, share, collaborate
- ✓ Multimedia conferencing

Scalable Video Surveillance Storage

- Scalable storage up to Petabytes to integrate with Video Management Server (VMS) integrated as NVR
- Unified Storage that provides iSCSI/Fibre Channel, and also NAS protocols. S3 Object storage is getting popular
- Strong HA features with read-only snapshot protection
- High bandwidth support up to tens of GB/sec
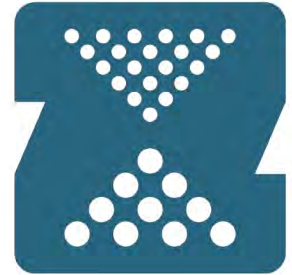
The Z File System and OpenZFS

iXsystems Technical Training

The Z File System & OpenZFS

- The Z File System (ZFS, formerly "Zettabyte File System") was created by **Sun Microsystems** in **2001** as a file system for Sun's OS **Solaris**. Both ZFS and Solaris went **Open Source** in **2005.**

- ZFS maintained by Sun as **Open Source Software (OSS)**, all code and updates were released publically for free use.

- Oracle buys Sun in **2010**, all ZFS updates from then on are kept private (i.e., project goes closed source)

- In **2013**, one of the original ZFS creator (**Matt Ahrens**) forks last open source version to create OpenZFS

- Oracle still maintains ZFS and sells ZFS-based solutions, but all the work they've done on it is **closed source** (Oracle's "real" ZFS is not very popular)

- The **OpenZFS Project** maintains the open source version of ZFS which is far more popular than Oracle's closed-source version

- Because OpenZFS is **far more popular**, when people say "ZFS", they are often referring to the open source version as opposed to Oracle's ZFS

RAID, ZFS Pools, and Virtual Devices

- **RAID — R**edundant **A**rray of **I**ndependent **D**isks, a data storage technology to group hard drives for increased capacity and fault tolerance. Can be done in software or with a hardware controller.

- **OpenZFS —** Open source implementation of ZFS used in TrueNAS and FreeNAS

- **Virtual Devices (vdevs) —** Grouping of one or more hard disks. Vdevs are typically configured to group the disks using one of the following methods:

  - **Stripe:** Data is simply striped across all disks; no redundancy (like RAID 0)
  - **Mirror:** All disks in vdev get a copy of the data (like RAID 1)
  - **RAIDZ1:** Any number of data disks plus **one** parity disk (like RAID 5)
  - **RAIDZ2:** Any number of data disks plus **two** parity disks (like RAID 6)
  - **RAIDZ3:** Any number of data disks plus **three** parity disks

- **ZFS Pool —** Sometimes called a "zpool" or simply a "pool", this consists of one or more vdevs are striped together (like RAID 0). For example, multiple mirrored vdevs in a pool behave like RAID 10 (or RAID 1+0). Multiple RAIDZ2 vdevs in a pool behave like RAID 60 (or RAID 6+0).

- Vdev and pool configurations will have a major effect on overall storage **capacity**, **reliability**, and **performance**. Each configuration, its drawbacks, and its advantages will be discussed in the following slides.

If one or more vdevs in a pool fails, the data in the pool will be lost!

OpenZFS

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The Three Primary Storage Performance Metrics

Throughput
The maximum sequential data transfer speed while reading or writing. Also called "bandwidth".
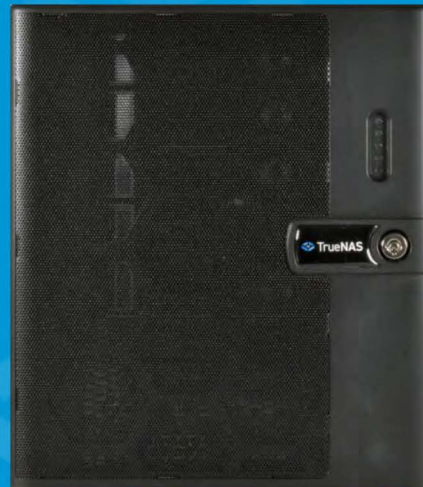
IOPS
The maximum input and output operations per second. Also known as "random performance".

Latency
Measures how quickly the disks respond to a request, usually measured in milliseconds.

TrueNAS Minis

TrueNAS CORE Software

Unified storage with SMB, NFS, iSCSI, Apple, S3 services

OpenZFS-based with powerful Data Management tools

VMs and Plugins like Plex, Nextcloud, and many more
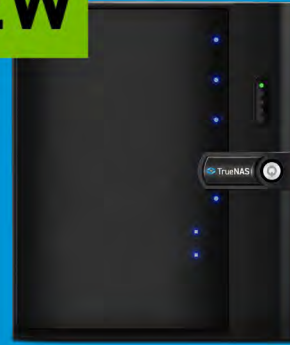
Professional Grade Platform

ECC RAM, IPMI Remote Mgmt and OpenZFS

Compact, Whisper Quiet, Low Power

HW & SW Warranty (1-3 Years), Enclosure Management

Hybrid, Fusion, or All-Flash Performance

Up to 2 × 10GbE, USB 3.1, 8 Core, 64GB RAM

Over 100TB hybrid or 50TB Flash Capacity

NEW

TrueNAS Mini X+

Dual 10GbE-BaseT
5 × 3.5" Bays
2× 2.5" SSD Bays

TrueNAS Mini X

Quad 1GbE-BaseT
5 × 3.5" Bays
2× 2.5" SSD Bays

Mini E
Quad 1GbE
4 × 3.5" Bays

Mini XL+
Dual 10GbE
8 × 3.5" Bays
1 × 2.5" Bay

SupportCALL | iXsystems™ | TrueNAS

TrueNAS R-Series

High Rack Density: Capacity & Performance

Enterprise-Grade Appliances

ECC RAM, IPMI and Enclosure Mgmt

3 Year HW Warranty with Bronze/Silver Options

Fusion or All-Flash Performance

Single Controller: 6-16 Cores, 32-192GB RAM

>600K IOPS and 10GB/s per Node, Dual 100Gbe

HDD and All-Flash Expansion options

Built for All TrueNAS Options

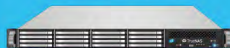Scale-up or Scale-out

Plugins or Kubernetes

ENTERPRISE

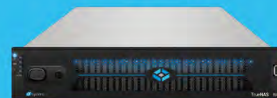SCALE

R10
16 × 2.5" Bays in 1U
10GB/s, 120TB

R20
12×3.5" Bays in 2U
2 × 2.5" SSDs + Expansion
10GB/s, 200TB - 2PB

R40
48 × 2.5" Bays in 2U
10GB/s, 360TB

R50
48 × 3.5" Bays in 4U
3 x NVMe Bays
10GB/s, 860TB
+ Expansion to 3PB

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TrueNAS R-Series Support Pricing

Pricing is based on the value of the platforms

WARRANTY	BRONZE	SILVER	GOLD
Included	**Enterprise**	**Enterprise**	**Not Available**
3 Year Term	Provided as 3 or 5 Yr Plans at time of purchase		
Standard Features	Enterprise Features	Enterprise Features	Enterprise Features
+ Enclosure Management	Advanced replacement	NBD On-site support/repair	HA Appliance Only
Advanced replacement	Software Support	9×5 Support - local hours	24×7 Support
Community Support	9×5 Phone Support - PST	Pro-active support	4Hr On-site response
Minimum Cost	**Next Day**	**Business Hours**	**24×365**

Higher support levels are additive and include all capabilities of lower support levels.

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TrueNAS X-Series

Compact and Power Efficient HA Storage

Only 2U and under 300W

Over 2GB/s: 4 × 25/40Gbe, 8 × 10Gbe or 4 × 8Gb FC Ports

12 Cores, 128GB RAM, and up to 1600GB Flash Cache

High Availability with Dual Controllers

Dual ported SAS HDD and SSDs

Over Five 9's Availability delivered

Proven Platform

1000+ Successful deployments over 3 Years

1PB Fusion capacity, 540TB All-Flash Capacity

TrueNAS X20

4 ×40GbE, 12 x HDDs or SSDs in 2U
128GB RAM, Upto 72 Drives & 1PB

TrueNAS X10

4 ×10GbE, 12 x HDDs or SSDs in 2U
64GB RAM, Upto 36 Drives & 500TB

Expansion Shelves (1-2)

TrueNAS ES24(F)
24 SSDs per 2U
or 24 HDDs per 4U

TrueNAS ES60

60 HDDs per 4U

TrueNAS M-Series

Industry's Fastest ZFS Storage

Over 20 GB/s & 1 Million IOPS

10,000+ VMs, and thousands of SMB/NFS Clients

Up to 64 Cores, 1.5 TB RAM, 4 NVDIMMs

Double Storage Density with HA

Up to 20 PB capacity, 4 PB All-Flash Capacity in a Rack

Fusion pools (with NVMe) increase performance

Builds on success of M-Series

Proven reliability and TrueNAS 12.0 performance

500+ Successful Deployments of M40 and M50

M-Series

TrueNAS M40
4 × 40/50/100GbE

TrueNAS M50
4 × 100GbE

TrueNAS M60

8 x 100GbE, 24 x HDDs or 28 SSDs in 4U

High Density Expansion Shelves (8-12)

TrueNAS ES24F

24 × 7.6TB SSDs per 2U

TrueNAS ES102

102 × 18TB HDDs per 4U

TrueNAS M-Series Platforms are Upgradeable

Common (M60) Chassis for all M-Series

All platforms have hot-swap NVME option (Fusion, L2ARC)

Increased PCIe interconnect (x16) - M50/M60

Latest generation of Xeon CPUs (faster @ same power)

Single M.2 Boot device (more reliable)

Power supplies (1300W/1600W)

Easier to spare internationally

In-Service Upgrades: M40   →   M50   →   M60

True Enterprise Support at Affordable Prices

➜ Designed and supported for 99.999% availability
➜ Rapid response by US-based support and development teams
➜ Complete responsibility for hardware, storage and OS stack

TrueNAS Support	Gold	Silver	Bronze
Software Help Desk Hours	24×7	12x5	12x5
Hardware Support	4 Hour On-Site Support & Repair	Next Business Day On-Site Support & Repair	Advance Parts Replacement
On-Site Hardware Spares Kit	Included	Optional	Optional
Proactive Support & System Monitoring	Yes	Yes	No
After Hour Maintenance	By appointment	By appointment	No
Online Support & Knowledge Base	Yes	Yes	Yes
Software Updates	Yes	Yes	Yes

Select a model

- Understand the use case
- Understand the networking
- If the TrueNAS is serving multiple clients / server hosts - bandwidth needs to scale
  - **Example:** if there are 4 x servers running VMware looking for 10 GbE and running 500~800 MB/s per host - the M40 with 40 GbE will be much better than the X20 with only 10 GbE
  - **Example 2**: For Media & Entertainment it's hard to size because it depends on user expectation - understanding the number of editors, and their network down is a good place to start.
- Peak throughput depends on model; IOPS depends on drive type

How to choose?

Key questions to ask:

- What is the primary use case - i.e. backup, virtualization data store (just storage), media/video streaming, high-performance computing, database, etc.?
  *This provides an idea of RAID config and performance requirement
- How much capacity will you need in 3 years?
  *This let's us understand the target usable capacity
- What is your network? (i.e. 10 GbE - SFP+(fiber) or BASE-T, 40/100 GbE, FC, etc)
  *Also important for sizing
- How many users and/or VMs will connect to the storage?
  *Key performance question
- What protocol will you use? (i.e. NFS, iSCSI, SMB (CIFS), AFP, FC, etc)
  *Helps understand the total deployment
- Any specific performance, like IOPS or throughput, you are looking for?
  *more for sizing - but be careful of IOPS (system IOPS vs usable IOPS are very different)
- Preferred deployment method: system setup and shared by your staff or assisted deployment with 12×5 or 24×7 support?
- What is the approximate deployment date?
- What other vendors are you considering?