Technical Report

Configuring NVIDIA Jetson Nano with NetApp E-Series Storage Systems

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Abstract

This document describes how to deploy NVIDIA Jetson Nano devices with NetApp® E-Series storage systems.

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Solution Overview

This document describes how to deploy NVIDIA Jetson Nano devices with NetApp® E-Series storage systems. This solution allows you to offload data collected from devices that are attached to the Jetson Nano system, such as cameras and sensors.

Deployment steps include configuring the Jetson Nano operating system to access enterprise storage, using iSCSI and Device Mapper multipathing.

Target Audience

This solution is intended for NetApp customers who want to implement NetApp E-Series storage with Jetson Nano devices, including:

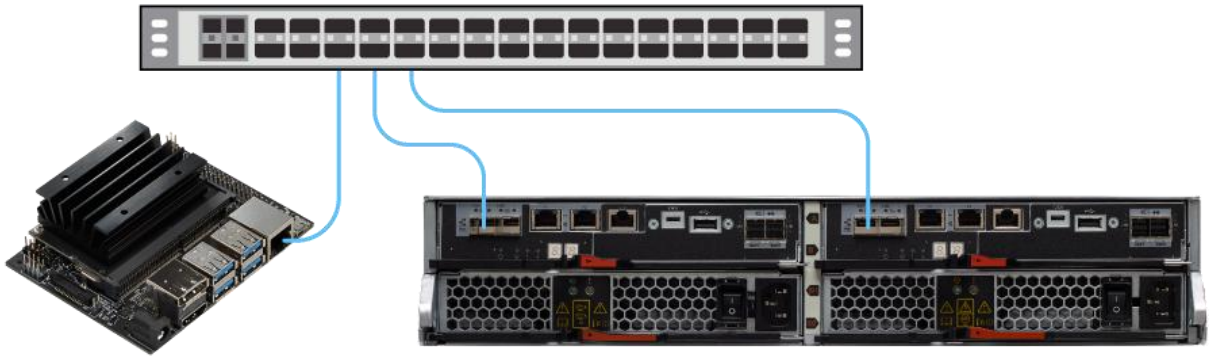
- IT professionals implementing video monitoring solutions
- Data scientists implementing artificial intelligence or machine learning solutions

Solution Technology

One or more Jetson Nano devices can be connected in a network with access to NetApp E-Series storage systems. Transceivers might be needed to convert from an optical SFP to RJ45 connections.

The Jetson Nano architecture is arm64; physically it has one network interface port.

Figure 1) Network connections from Jetson Nano to E-Series storage.



Technology Requirements

Hardware

Table 1) Hardware requirements.

Hardware	Quantity
NVIDIA Jetson Nano Developer Kit	One
NetApp storage array	One or more
Networking switch	One

Software

Table 2) Software requirements.

Software	Quantity
Kernel modules	Modules are listed in Deployment Steps, next
Open-iscsi	One package from OS repository
Multipath-tools	One package from OS repository

Deployment Steps

To set up a Jetson Nano device with an E-Series storage array, follow these steps.

1. Configure the Jetson Nano device using the developer kit. For instructions, go to Getting Started with Jetson Nano Developer Kit.
2. Because the operating system requires additional modules for E-Series storage, you must recompile the kernel.
   a. Go to NVIDIA - Kernel Customization.
   b. In the third section, “Building the NVIDIA Kernel,” modify the config file to include these modules:

```
CONFIG_EXPERT
CONFIG_BLOCK
CONFIG_SCSI_MOD
CONFIG_SCSI
CONFIG_PROC_FS
CONFIG_SCSI_PROC_FS
CONFIG_DM_SWITCH
CONFIG_DM_LOG_WRITES
CONFIG_DM_ZONED
CONFIG_SCSI_CONSTANTS
CONFIG_SCSI_LOGGING
CONFIG_SCSI_SCAN_ASYNC
CONFIG_SCSI_ISCSI_ATTRS
CONFIG_SCSI_LOWLEVEL
CONFIG_ISCSI_TCP
CONFIG_SCSI_DH
CONFIG_SCSI_DH_ALUA
CONFIG_BLK_DEV_DM_BUILTIN
CONFIG_DM_DEBUG
CONFIG_DM_BUFIO
CONFIG_DM_BIO_PRISON
CONFIG_DM_PERSISTENT_DATA
CONFIG_DM_SNAPSHOT
CONFIG_DM_THIN_PROVISIONING
CONFIG_DM_CACHE
CONFIG_DM_CACHE_SMQ
CONFIG_DM_ERA
CONFIG_DM_MIRROR
CONFIG_DM_LOG_USERSPACE
CONFIG_DM_RAID
CONFIG_DM_ZERO
CONFIG_DM_MULTIPATH
CONFIG_DM_MULTIPATH_QL
CONFIG_DM_MULTIPATH_ST
CONFIG_DM_DELAY
```

3. When the operating system is installed and you can reach the internet, access packages for `open-iscsi` and `multipath`, which are available from the default `sources.list`. You can use the following commands to install `open-iscsi` and `multipath`:

```
apt-get install open-iscsi
```

```
apt-get install multipath-tools
```

4. After the operating system is configured and running on the Jetson Nano, you must adjust the network interface card (NIC) to support external storage. During this step, the Jetson Nano connects to E-Series storage via iSCSI and then creates three virtual interfaces on the host. Two of the virtual interfaces connect to E-Series storage, one for each controller. One virtual interface is used for your public network connection.

To adjust the NIC, see the following example (`eth0:0` is the public network connection; `eth0:1` and `eth0:2` reside on the subnets of their associated storage controller):

```
cat /etc/network/interfaces
# interfaces(5) file used by ifup(8) and ifdown(8)
# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto eth0:0
iface eth0:0 inet dhcp

auto eth0:1
iface eth0:1 inet static
address 192.168.1.250
gateway 192.168.1.1
netmask 255.255.255.0

auto eth0:2
iface eth0:2 inet static
address 192.168.2.250
gateway 192.168.2.1
netmask 255.255.255.0
```

5. Configure the iSCSI connection between the Jetson Nano device and the E-Series storage array. For instructions, see the following section in the NetApp Linux Express Configuration guide:

   iSCSI Express Setup.

6. Verify that the iSCSI sessions and mapped volumes from Express Setup are present with the following commands:

```
iscsiadm -m session
tcp: [1] 192.168.1.166:3260,1 iqn.1992-08.com.netapp:5700.600a098000d858c8000000005c66e243 (non-
flash)
tcp: [2] 192.168.2.167:3260,2 iqn.1992-08.com.netapp:5700.600a098000d858c8000000005c66e243 (non-
flash)

multipath -ll
3600a098000d858c80000063f5edff8e9 dm-0 NETAPP,INF-01-00
size=500G features='3 queue_if_no_path pg_init_retries 50' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
| `- 1:0:0:0 sdb 8:16 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  `- 0:0:0:0 sda 8:0  active ready running
3600a098000d85966000006505edffa06 dm-1 NETAPP,INF-01-00
size=500G features='3 queue_if_no_path pg_init_retries 50' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
| `- 0:0:0:1 sdd 8:48 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  `- 1:0:0:1 sdc 8:32 active ready running
```

7. After you confirm that the setup is complete, with iSCSI sessions existing and multipath being preset, you can create additional volumes, add file systems to the existing devices, and prepare storage for production use.

Where to Find Additional Information

You can find additional information about NetApp storage arrays on the NetApp Product Documentation site.

Version History

Version	Date	Document Version History
Version 1.0	December 2020	Initial release.

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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