



Agilio OvS 2.2 Getting Started Guide

Netronome Intelligent Server Adapters

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Agilio OvS 2.2 Getting Started Guide: Netronome Intelligent Server Adapters

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Revision History

Date	Revision	Description
24 February 2016	000	First DRAFT for Agilio OvS 2.2.
6 April 2016	001	Added description of the experimental Conntrack version of Agilio OvS software bundled with the standard version.
18 July 2016	002	Documented package installation and trivial NIC mode.
28 July 2016	003	Updated installation instructions and added information about kernel patch.

Table of Contents

1. Introduction	5
1.1. Scope	5
1.2. Related Documents	5
1.3. Terminology	5
2. Installation and Setup	7
2.1. Supported Platforms	7
2.2. Host Requirements	7
2.2.1. Ubuntu 14.04 LTS, 64-bit x86	8
2.2.2. RHEL/CentOS 7.1, 64-bit x86	8
2.2.3. ERR47 Kernel Patch	9
2.3. Installing Agilio OvS	10
2.3.1. Ubuntu 14.04 Package Installation	10
2.3.2. RHEL/CENTOS 7.x Package Installation	11
2.3.3. Source Installation	12
2.3.4. Experimental Agilio OvS Contrack Version	13
2.4. Starting and Stopping the Software	13
2.4.1. Trivial NIC Mode	14
2.5. Backing Up and Restoring Configuration Files	14
3. Usage Examples	15
3.1. Open vSwitch Forwarding	15
3.1.1. Configuration Example	15
4. Uninstalling Agilio OvS Software	16
5. Technical Support	18
5.1. Related Documents	18

1. Introduction

1.1 Scope

This document serves as a guide to new users of Netronome's Agilio OvS software and describes the documents that need to be consulted in order to use the software.

1.2 Related Documents

Descriptive Name	Description
Netronome Network Flow Processor: Agilio OvS 2.2 Programmer's Reference Manual	A reference for programming and system design using the Netronome Agilio OvS.
Netronome Network Flow Processor: Agilio OvS 2.2 User's Guide	Provides a general overview of the Agilio OvS software.
Netronome Network Flow Processor: Datasheet	Contains summary information on the Netronome Network Flow Processor NFP including a functional description, signal descriptions, electrical specifications, and mechanical specifications.

1.3 Terminology

Acronym	Description
BDF	Bus/Device/Function
CDP	Customer Development Platform
DPDK	Intel© Dataplane Development Kit
GSG	Getting Started Guide
GUI	Graphical User Interface
LTS	Long Term Support
NFD	Netronome Flow Driver
NFP	Netronome Network Flow Processor
NIC	Network Interface Card
OvS	Open vSwitch
OS	Operating System
PCIe	Peripheral Component Interconnect Express
PMD	Poll Mode Driver

Acronym	Description
SDN	Software Defined Networking
SR-IOV	Single Root I/O Virtualization
VF	SR-IOV Virtual Function

2. Installation and Setup

2.1 Supported Platforms

The Agilio OvS software is supported on the Netronome Intelligent Server Adapter, optionally including a card to attach the Intelligent Server Adapter to a second PCIe slot. The following Netronome Intelligent Server Adapters are supported by this release of Agilio OvS:

- 2x10G Lithium - Half height, half length.
- 1x40G Beryllium - Half height, half length.
- 2x40G Beryllium - Half height, half length.
- 1x40G Hydrogen - Half height, half length.
- 2x40G Starfighter - Full height, half length.
- 1x100G Starfighter - Full height, half length.
- PCIe expansion through Star Shuttle for each of the Starfighter adapters.
- 4x10G Breakout cables supported on each of the adapters supporting 40G interfaces.
- 10x10G Breakout cables supported on each of the adapters supporting 100G interfaces.

2.2 Host Requirements

The Agilio OvS software is compatible with a wide variety of 64-bit GNU/Linux distributions and is expected to work on many distributions. It has been tested with the specific distributions listed below. Supported Linux kernel versions are:

- RHEL/CentOS 7.1 with kernels 3.10 to 4.3 — only Red Hat (not vanilla) kernels
- Ubuntu 14.04 with kernels 3.13 to 4.3



Note

Agilio OvS 2.2 is not compatible with Ubuntu 16.04 running kernel version 4.4. This incompatibility has been inherited from the upstream OvS version 2.5.1 on which Agilio OvS 2.2 is based. Similarly, GCC version 5.x is not supported in the Agilio OvS 2.2 release.



Note

Unless otherwise noted, newer versions of the systems below are expected to work. Please report any issues with newer versions to support@netronome.com.

The host system must support SR-IOV for Agilio OvS to be runtime operational. Refer to the host system BIOS documentation to determine if this feature is supported and what the required configuration options are to enable SR-IOV.



Note

There are Linux distributions and particular BIOS combinations that may require additional kernel command line options to enable SR-IOV, e.g. the `pci=realoc` kernel parameter. Refer to the kernel and/or distribution documentation for such requirements.

2.2.1 Ubuntu 14.04 LTS, 64-bit x86

The following command will install all the required packages for the Agilio OvS software:

```
sudo apt-get install make autoconf automake libtool \
gcc g++ bison flex hwloc-nox libreadline-dev libpcap-dev dkms libftdi1 libjansson4 \
libjansson-dev guile pkg-config libevent-dev ethtool libssl-dev \
libnl-3-200 libnl-3-dev libnl-genl-3-200 libnl-genl-3-dev psmisc gawk
```

Error messages should be displayed if the packages cannot be installed. Should you nevertheless prefer to manually verify that the packages have been installed, enter

```
dpkg --get-selections
```

and verify that the package names are listed.

2.2.2 RHEL/CentOS 7.1, 64-bit x86

Note: Make sure you install kernel-devel FOR YOUR MATCHING KERNEL. If you have to install both the kernel and kernel-devel packages, then a restart might be required. Commands similar to:

```
rpm -qa | grep kernel
rpm -qa --last | head
```

should help you determine whether kernel and kernel-devel packages match and what you installed last.

Consult your OS guide on how to manage your kernels and whether a restart is required. The rest of the build process assumes kernel and kernel-devel match.

The epel repo must be enabled to install all the required dependencies. This can be disabled again after installation. The following command can be used to enable this repo:

```
yum install epel-release
```

On RHEL systems, the epel repo can be obtained from the Fedora Project resources, e.g.

```
wget https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
```

The following packages must be installed:


```
yum install make autoconf automake libtool gcc gcc-c++ libpcap-devel \
readline-devel jansson-devel libevent libevent-devel libtool openssl-devel \
bison flex gawk hwloc gettext texinfo kernel-devel kernel-headers rpm-build \
redhat-rpm-config graphviz python-devel python python-devel tcl-devel \
tk-devel texinfo dkms zip unzip pkgconfig wget patch minicom libusb \
libusb-devel psmisc libnl3-devel libftdi pciutils
```

Error messages should be displayed if the packages cannot be installed. Should you nevertheless prefer to manually verify that the packages have been installed, enter

```
rpm --query --all
```

and verify that the package names are listed.



Note

On RHEL systems some of the required development packages may need to be installed manually. For example, libnl3-devel, libusb-devel, libevent-devel, jansson-devel and libpcap-devel.

2.2.3 ERR47 Kernel Patch

Linux kernels exhibit undesired behavior in PCIe configuration code. Netronome submitted a fix to the kernel maintainers for this issue which has been accepted into kernel version 4.5. As you may be using an older kernel version, at this stage a patch needs to be applied to the kernel source code, or an already patched kernel needs to be installed. For your convenience, packages containing patched versions of the default kernels for various Ubuntu 14.04 LTS and RHEL/CentOS 7 variants are available on Netronome's support site (<http://support.netronome.com>).

Sample .deb and .rpm packages, on Netronome support site, are as follows:

- Ubuntu 14.04.3 (kernel 3.19.0-33)
- Ubuntu 14.04.2 (kernel 3.16.0-53)
- RHEL/CentOS 7.1 (kernel 3.10.0-229.14.1.el7.x86_64)

Please refer to the Netronome support site as these sample packages will be updated from time to time for more recent kernel versions.

To install, transfer the package files to a subdirectory on your system, change to that subdirectory, and enter:

- `dpkg -i *.deb` (on Debian systems), or:
- `rpm -Uvh *.rpm` (on RHEL/CentOS systems).

Contact Netronome support if you require additional assistance.

Software for kernel versions can be found at <https://www.kernel.org/>. In the event Software cannot be retrieved, contact Netronome via support site (<http://support.netronome.com>) for additional assistance in obtaining.

This kernel patch code is free software; you can redistribute it and/or modify it under the terms of version 2 of the GNU General Public License as published by the Free Software Foundation.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details, a copy of this license has been provided in the accompanying README file.

2.3 Installing Agilio OvS

The Agilio OvS software is distributed in source and in Debian and RPM packages. The Agilio OvS experimental Conntrack version is only available with the appropriate source package. Please contact Netronome Support for further details if required.

It is highly recommended that only one of the installation procedures below should be used. If one wants to switch between the installation types, please first uninstall the Agilio OvS software with the appropriate uninstallation steps provided in Chapter 4 for each type of installation.

Additional libvirt/OpenStack and MoonGen patches are contained in the Agilio OvS 2.2 Extras package. This package is available on the Netronome Support site. Refer to the package README file for more detail about its contents.



Note

Only DPDK 16.04 is available with the Debian/RPM packaged installation. If other DPDK versions are required, use the source installation.

2.3.1 Ubuntu 14.04 Package Installation

The debian packaging has been tested with Ubuntu 14.04. To automatically install and configure the software, please complete the following steps:

1. All commands should be entered while logged in as root.
2. Collect all the files into the same directory and issue the following command from there:

```
dpkg -i agilio-ovs_2.1.99-0000_amd64.deb \
agilio-ovs-common_2.1.99-0000_amd64.deb \
agilio-ovs-trivial_2.1.99-0000_amd64.deb \
iproute2_*_amd64.deb \
iproute_*_all.deb \
nfp-bsp-release-2015.11_*_amd64.deb \
nfp-bsp-release-2015.11-dkms_*_all.deb \
nfp-cmsg-dkms_0.0.1_amd64.deb nfp-fallback-dkms_0.0.1_amd64.deb \
nfp-offloads-dkms_0.0.1_amd64.deb \
nfp-uio-dkms_0.0.1_amd64.deb \
openvswitch-common_2.5.0-0agilio2.1.99_amd64.deb \
openvswitch-datapath-dkms_2.5.0-0agilio2.1.99_all.deb \
openvswitch-datapath-source_2.5.0-0agilio2.1.99_all.deb \
openvswitch-switch_2.5.0-0agilio2.1.99_amd64.deb \
netronome-dpdk_16.04-0000_amd64.deb \
virtiorelayd_0.0.1-0000_amd64.deb
```

- Once this has been completed, `/opt/netronome/bin/nfp-update-flash.sh` must be executed to check and/or update the NIC flash.



Note

Using the Debian packages for installation, Open vSwitch logs will be available in `/var/log`.

The following `/etc/netronome.conf` settings are recommended for a Debian based installation:

```
SDN_VIRTIORELAY_ENABLE="n"
SDN_BIND_VF_DRIVER="none"
```



Note

DKMS has been provided the module dependency info, but it may fail to resolve the build order. There are two methods to fix this: repeat `dkms autoinstall` until all modules are built, or manually install the modules in the following order:

```
nfp-bsp-release-2015.11
openvswitch
nfp_cmsg
nfp_fallback
nfp_offloads
```

A system with modules installed correctly would appear similar to this:

```
# dkms status
nfp-bsp-release-2015.11, 2016.4.12.212, 3.19.0-33-generic, x86_64: installed
nfp_cmsg, 0.0.1, 3.19.0-33-generic, x86_64: installed
nfp_fallback, 0.0.1, 3.19.0-33-generic, x86_64: installed
nfp_offloads, 0.0.1, 3.19.0-33-generic, x86_64: installed
openvswitch, 2.5.0, 3.19.0-33-generic, x86_64: installed
```

Specific versions may differ for different kernels and releases.

2.3.2 RHEL/CENTOS 7.x Package Installation

The rpm packaging has been tested with CentOS Linux release 7.2.1511 (Core). To automatically install and configure the software, please complete the following steps:

- All commands should be entered while logged in as root.
- Collect all the files into the same directory and issue the following commands from there:

```
yum install epel-release
yum update
yum install \
  nfp-bsp-release-2015.11_*x86_64.rpm \
  agilio-ovs-2.2-*x86_64.rpm \
  agilio-ovs-common-2.2-*x86_64.rpm \
  agilio-ovs-trivial-2.2-*x86_64.rpm \
  openvswitch-2.5.1-*x86_64.rpm \
```

```
openvswitch-dkms-2.5.1-*.x86_64.rpm
```

- Once this has been completed, `/opt/netronome/bin/nfp-update-flash.sh` must be executed to check and/or update the NIC flash.
- After rebooting, the software can be started by using `systemd`:

```
systemctl start openvswitch
systemctl status openvswitch
```



Note

Using the RPM packages for installation, Open vSwitch logs will be available in `/var/log`.

The following `/etc/netronome.conf` settings are recommended for an rpm based installation:

```
SDN_VIRTIORELAY_ENABLE="n"
SDN_BIND_VF_DRIVER="none"
```



Note

DKMS may fail to override the kernel-bundled `openvswitch.ko` module. This is because the bundled module is missing a version tag. In order to ensure the module is updated correctly, the following workaround can be employed after a kernel update:

```
dkms remove openvswitch/2.5.1 --all
dkms install openvswitch/2.5.1 --force
```

A system with modules installed correctly would appear similar to this:

```
# ls /lib/modules/$(uname -r)/extra/openvswitch.ko
/lib/modules/3.10.0-229.20.1.el7.nfp.x86_64/extra/openvswitch.ko
```

Specific versions may differ for different kernels and releases.

2.3.3 Source Installation

To automatically install and configure the software with the source tarball installation package, please complete the following steps:

- All commands should be entered while logged in as root.
- Transfer the latest software release archive file to the host and extract it. File names follow the pattern `agilio-ovs-2.2r*-yyyy-mm-dd-type.tar.gz`.
- Change to the extracted directory and enter `make clean_install`. Installation is complete once the following message is displayed on screen:

```
*** Agilio OvS Software 2.2 Installation Complete!
    Build Number: 'build number'
```

- If the user does not want all the files in the `/opt/netronome` directory to first be removed, the `make install` target should rather be used.

5. After the installation is complete, the user will be requested by means of a message displayed on the console to reboot the host system.

**Note**

Using the source package for installation, Open vSwitch logs will be available in `/usr/local/var/log/`.

**Note**

The `make clean_install` command will remove all the files in the installation directory `/opt/netronome` before commencing with the installation.

2.3.4 Experimental Agilio OvS Conntrack Version

The Agilio OvS source package optionally includes an experimental Agilio OvS Conntrack version. In order to install the Conntrack version of the software, the `make install` or `make clean_install` steps described above, should be replaced with `make install_conntrack` and `make clean_install_conntrack` respectively.

The basic usage for this version of the software is the same as the standard Agilio OvS software version, however not all the features in the standard version is available in the Conntrack version. For usage information about the Conntrack specific features, please refer to the appropriate section in the User Guide or contact Netronome Support.

**Note**

The Conntrack version of the software is in an experimental state which implies that this is not a production version yet. Customers can evaluate this software for deployment planning purposes, however bugs are expected at this stage. Please stay in close synchronization with Netronome support.

2.4 Starting and Stopping the Software

The following commands must be entered as root.

After installation, the software can be started using the following command:

```
/opt/netronome/bin/ovs-ctl start
```

Configuration variables taken into account at startup can be set in the `/etc/netronome.conf` file. Refer to the User's Guide for more information.

The software can be stopped using the following command:

```
/opt/netronome/bin/ovs-ctl stop
```

Refer to the User's Guide and Open vSwitch documentation to configure the system from this point.

2.4.1 Trivial NIC Mode

The Agilio OvS software will be partially started after a host system reboot. In this mode, the representative netdevs will be available for use, such as PXE booting or establishing some other network connection. In this mode, no offloading or VF functionality is supported. This mode is referred to as 'Trivial NIC' mode.

When Agilio OvS is started with the `ovs-ctl start` command, the Trivial NIC mode is deactivated. Similarly, when Agilio OvS is stopped with the `ovs-ctl stop` command, the Trivial NIC mode is activated again.

The Trivial NIC mode is achieved by loading NFP firmware during the system boot stage. The NFP firmware is added to the initramfs image during installation. This will incur a time penalty during bootup.

If one wants to disable this functionality, add the following text to your kernel boot options:

```
modprobe.blacklist=nfp
```

Refer to the appropriate section in the User Guide for more information about this feature.

2.5 Backing Up and Restoring Configuration Files

To back up the configuration of the software, the following file needs to be preserved if it exists:

- `/etc/netronome.conf`

To restore the configuration from a backup, install the software as described above. Thereafter, replace the `/etc/netronome.conf` file from the backed up version. This file needs to be restored before the software is started.

Currently, there are no considerations to take note of to restore files to different versions of the software. If any particular considerations arise in the future, these will be mentioned in the release notes of the specific software build.

3. Usage Examples

3.1 Open vSwitch Forwarding

This section provides information and an example to fast track the setup of a simple Open vSwitch configuration on the Aiglio OvS software. Refer to the User's Guide for more detailed information.

In order to configure this feature, one must:

1. Start the Aiglio OvS software.
2. Configure OpenFlow based rules via Open vSwitch (OvS).

One configures OvS by adding the "representative netdev" corresponding to each physical port or VF to the OvS bridge. The representative netdevs are created automatically when the Aiglio OvS software starts. The representative netdevs for physical ports are named:

```
sdn_pX
```

where x is a sequential number starting at 0. The representative netdev for VF N on NFP PCIe unit M is named:

```
sdn_vM.N
```

The representative netdevs can be used to obtain statistics and link state of the physical or virtual port it corresponds to. Standard Linux tools such as `ifconfig`, `ip` and `ethtool` can be used for this purpose.

3.1.1 Configuration Example

All commands provided in this example must be entered as root. This example illustrates a simple forwarding configuration where traffic is forwarded from one physical port directly to the other and vice versa. The corresponding representative netdevs are `sdn_p0` and `sdn_p1`. If one wants to use VFs for such an example, the VF must be bound to an appropriate driver. Refer to the User's Guide for more details on using VFs and driver selection.

Start the Aiglio OvS software with the following command:

```
/opt/netronome/bin/ovs-ctl start
```

To configure the bridge and ports in OvS, the following commands can be executed:

```
ovs-vsctl add-br br0 -- set Bridge br0 protocols=OpenFlow13 -- set-fail-mode br0 standalone
ovs-vsctl add-port br0 sdn_p0 -- set Interface sdn_p0 ofport_request=1
ovs-vsctl add-port br0 sdn_p1 -- set Interface sdn_p1 ofport_request=2
ovs-ofctl -O OpenFlow13 add-flow br0 in_port=1,actions=output:2
ovs-ofctl -O OpenFlow13 add-flow br0 in_port=2,actions=output:1
```

This is a very trivial OvS configuration example. Refer to the online OvS documentation for more details on the commands used and the extent of the configuration options available.

4. Uninstalling Agilio OvS Software



Warning

Back up all configuration files, log files, software, or other files you wish to preserve before entering the following commands!

To uninstall the Agilio OvS software originally installed with the Debian based installation, enter:

```
/opt/netronome/bin/ovs-ctl --nfp-reset stop
dpkg --purge agilio-ovs agilio-ovs-common agilio-ovs-trivial \
  nfp-bsp-release-2015.11 nfp-bsp-release-2015.11-dkms \
  nfp-cmsg-dkms nfp-fallback-dkms nfp-offloads-dkms nfp-uio-dkms \
  openvswitch-common openvswitch-datapath-dkms openvswitch-datapath-source \
  openvswitch-switch netronome-dpdk virtiorelayd
rm -rI /etc/netronome.conf /opt/netronome
```

To uninstall the Agilio OvS software originally installed with the RHEL/CentOS based installation, enter:

```
/opt/netronome/bin/ovs-ctl --nfp-reset stop
yum remove agilio-ovs-2.2 agilio-ovs-common-2.2 agilio-ovs-trivial-2.2 \
  nfp-bsp-release-2015.11 openvswitch-2.5.1 openvswitch-dkms-2.5.1
rm -rI /etc/netronome.conf /opt/netronome
```

To uninstall Agilio OvS software, and other Netronome supplied software, originally installed with the source package enter:

```
/opt/netronome/bin/ovs-ctl --nfp-reset stop
cd /opt/netronome/srcpkg/openvswitch
make uninstall
dpkg --purge nfp-bsp-release-2015.11 nfp-bsp-release-2015.11-dkms
rm -rI /lib/modules/$(uname -r)/extra/nfp* /lib/modules/$(uname -r)/extra/vport-* \
  /lib/modules/$(uname -r)/extra/openvswitch.ko /lib/modules/$(uname -r)/extra/dpdk/*
depmod -a
rm -rI /etc/netronome.conf /opt/netronome
```



Note

If the host system is RHEL/CentOS based, replace the above `dpkg --purge ...` command with a `yum remove ...` command.

Additionally regardless of the original installation method, the following commands must be executed on systems using initramfs (usually Debian based systems):

```
rm -rI /etc/initramfs-tools/scripts/init-premount/aovs-initramfs-poll-wait.sh
update-initramfs -uk $(uname -r)
```

And the following commands must be executed on systems using dracut (usually RHEL/CentOS based systems):

```
rm -rI /etc/dracut.conf.d/netronome.conf
dracut -f
```

Third party software installed during the Agilio OvS installation, e.g. libfluid, will still be present in the /usr directory of the system.

Note that it is not required to uninstall Agilio OvS before upgrading to a more recent version. However, when downgrading, it is recommended to uninstall the current version of the Agilio OvS software first.

5. Technical Support

To obtain additional information, or to provide feedback, please email <support@netronome.com> or contact the nearest **Netronome** technical support representative.

5.1 Related Documents

Descriptive Name	Description
Netronome Network Flow Processor: Agilio OvS 2.2 Getting Started Guide	A guide to new users of Netronome's Agilio OvS software.
Netronome Network Flow Processor: Agilio OvS 2.2 Programmer's Reference Manual	A reference for programming and system design using the Agilio OvS software.
Intelligent Server Adapters: Hardware User Manual	Contains summary information on the Netronome Intelligent Server Adapter (ISA) PCIe card including card physical descriptions.
Netronome Network Flow Processor: Datasheet	Contains summary information on the Netronome Network Flow Processor NFP including a functional description, signal descriptions, electrical specifications, and mechanical specifications.
Netronome Network Flow Processor: Databook	Contains detailed reference information on the Netronome Network Flow Processor NFP.
Netronome Network Flow Processor: Development Tools User's Guide	Describes Programmer Studio and the development tools that can be accessed through Programmer Studio.
Netronome Network Flow Processor: Network Flow Assembler System User's Guide	Describes the syntax of the NFP's assembly language, supplies assembler usage information, and lists assembler warnings and errors.
Netronome Network Flow Processor: Microengine Programmer's Reference Manual	A reference for microcode programming of the Netronome Network Flow Processor NFP.
Netronome Network Flow Processor: Network Flow C Compiler User's Guide	Presents information, language structures and extensions to the language specific to the Netronome Network Flow C Compiler for Netronome NFP.
Netronome Network Flow Compiler LibC: Reference Manual	Specifies the subset and the extensions to the language that support the unique features of the Netronome Network Flow Processor NFP product line.
Open vSwitch Software Documentation	Agilio OvS software offers acceleration of Open vSwitch software. Refer to http://openvswitch.org/ for more details on Open vSwitch.
OpenFlow Specification	Open vSwitch (which is accelerated by Agilio OvS software) is an OpenFlow switch implementation. Refer to https://www.opennetworking.org/sdn-

Descriptive Name	Description
	resources/openflow for more details on this specification.
Data Plane Development Kit Documentation	DPDK related documentation is available at http://dpdk.org .