kontron

»Kontron Application Note«



Complete guide to use the AM42XX in Target mode (boot from PCI Express)

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Customer Service

Contact Information:	Kontron Canada, Inc.	Kontron Modular Computer GMBH
	4555 Rue Ambroise-Lafortune	Sudetenstrasse 7
	Boisbriand, Québec, Canada	87600 Kaufbeuren
	J7H 0A4	Germany
	Tel:(450) 979-5320	+49 (0) 8341 803 333
	(800) 354-4223	
	Fax: (450) 437-8053	+49 (0) 8341 803 339
	E-mail: support@ca.kontron.com	support-kom@kontron.com

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Introduction

This document provides instructions on how to enable the PCI Express interface of an AM42XX board. In the process, the PCI-NIC package is installed as an example. It will allow the AM42XX SFP ports to be seen by the host card as if it was its own network interfaces.

To learn more about possible application offered by Cavium Networks and to download complementary packages, visit:

Cavium Network support website: https://support.caviumnetworks.com/websilo
Cnuser website: http://www.cnusers.org/

Before you begin, make sure you dispose of the following files and hardware.

Files required

Provided by Cavium Network at www.cnusers.org:

- cnusers_sdk_1.8.1.tgz
- cnusers_pci_0.9.8.tgz

Provided by Cavium Network at https://support.caviumnetworks.com/websilo and also available on Kontron product ftp site ftp://ftp.kontron.ca/Support/Products/Product_List.html. The following files are contained in the am42xx-patches-OCTEON-SDK-1.8.1-GA-2.02 ZIP folder.

- am42xx-patches-OCTEON-SDK-1.8.1-GA-2.02.tar.gz
- patchme

Hardware required

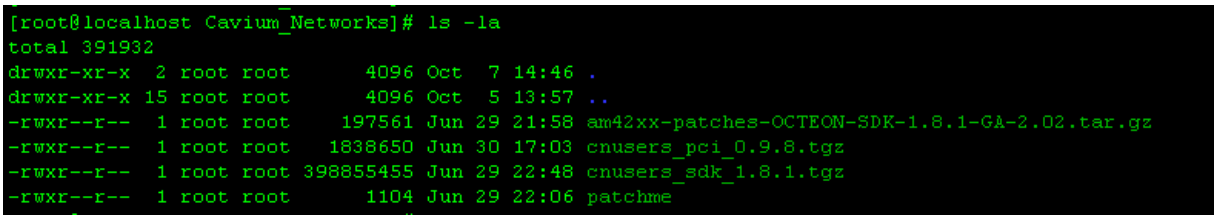
- AM42XX board
- A carrier AMC with PCIe capable interface (AMC.1, for this application note, an AT8050 has been used)

1. Before you get started

If you already have SDK_1.8.1 installed on your Host AMC carrier, **you must uninstall it.** It is very important to apply the GA2.02 patch on a newly installed SDK.

2. Set-up your environment

1. In your build environment, copy the needed files to the /usr/local/Cavium_Networks folder as shown here:



*Output may vary depending on your OS, AMC carrier card and settings.

2. Untar cnusers_sdk_1.8.1.tgz and cnusers_pci_0.9.8.tgz :
   # tar -xzf cnusers_sdk_1.8.1.tgz
   # tar -xzf cnusers_pci_0.9.8.tgz

3. Set-up the environment in the OCTEON-SDK folder. This is essential for updating your paths. Use the following command :
   # cd OCTEON-SDK/
   # . env-setup OCTEON_CN56XX --runtime-model --checks

4. Go back to the "Cavium_Networks" folder, untar the patch then apply it:
   # cd ..
   # tar -xzf am42xx-patches-OCTEON-SDK-1.8.1-GA-2.02.tar.gz
   # ./patchme

```
[root@localhost OCTEON-SDK]# cd ..
[root@localhost Cavium_Networks]# ls -la
total 391940
drwxr-xr-x  3 root root      4096 Oct  7 14:48 .
drwxr-xr-x 15 root root      4096 Oct  5 13:57 ..
-rwxr--r--  1 root root    197561 Jun 29 21:58 am42xx-patches-OCTEON-SDK-1.8.1-GA-2.02.tar.gz
-rwxr--r--  1 root root   1838650 Jun 30 17:03 cnusers_pci_0.9.8.tgz
-rwxr--r--  1 root root 398855455 Jun 29 22:48 cnusers_sdk_1.8.1.tgz
drwxr-xr-x 16 root root      4096 Jan 23  2009 OCTEON-SDK
-rwxr--r--  1 root root      1104 Jun 29 22:06 patchme
[root@localhost Cavium_Networks]# tar -xzf am42xx-patches-OCTEON-SDK-1.8.1-GA-2.02.tar.gz
[root@localhost Cavium_Networks]# ls -la
total 391948
drwxr-xr-x  4 root root      4096 Oct  7 14:59 .
drwxr-xr-x 15 root root      4096 Oct  5 13:57 ..
-rwxr--r--  1 root root    197561 Jun 29 21:58 am42xx-patches-OCTEON-SDK-1.8.1-GA-2.02.tar.gz
drwxr-xr-x  2 root root      4096 Oct  7 14:59 cavium-sdk-patches
-rwxr--r--  1 root root   1838650 Jun 30 17:03 cnusers_pci_0.9.8.tgz
-rwxr--r--  1 root root 398855455 Jun 29 22:48 cnusers_sdk_1.8.1.tgz
drwxr-xr-x 16 root root      4096 Jan 23  2009 OCTEON-SDK
-rwxr--r--  1 root root      1104 Jun 29 22:06 patchme
[root@localhost Cavium_Networks]# ./patchme


About to patch using ./cavium-sdk-patches/cnlinux-build.patch
Press Return to continue...
```

*Output may vary depending on your OS, AMC carrier card and settings.

You will be asked to apply many patches, keep the enter key pressed until finished. Only one patch should have been skipped, this is normal:

```
About to patch using ./cavium-sdk-patches/examples-passthrough.patch
Press Return to continue...***** patch -p0 with ./cavium-sdk-patches/examples-passthrough.patch *****
can't find file to patch at input line 5
Perhaps you used the wrong -p or --strip option?
The text leading up to this was:
--------------------------
|Index: OCTEON-SDK/examples/passthrough/passthrough.c
|===================================================================
|--- OCTEON-SDK.orig/examples/passthrough/passthrough.c
|+++ OCTEON-SDK/examples/passthrough/passthrough.c
--------------------------
File to patch: Skip this patch? [y] Skipping patch.
14 out of 14 hunks ignored
patching file OCTEON-SDK/executive/cvmx-helper.c
```

*Output may vary depending on your OS, AMC carrier card and settings.

3. Compile the drivers

1. Go to the OCTEON-SDK folder
   # cd OCTEON-SDK/

2. Build RAM resident bootloader:
   # make -C bootloader/u-boot/ kontron_t5516_pciboot_config
   # make -C bootloader/u-boot/

3. Build host drivers:
   # make -C components/driver/

4. Build host NIC driver:
   # make -C components/driver/host/driver/linux/octnic/

5. Build host utilities:
   # make -C host/pci clean
   # make -C host/pci

6. Build PICNIC sample application:
   # make -C applications/pci-core-app/nic/

7. Before loading the drivers, you should make sure that all the necessary files are in a same folder:
   # cd ..
   # mkdir NeededFiles/
   # cp OCTEON-SDK/bootloader/u-boot/u-boot-kontron_t5516_pciboot.bin NeededFiles/
   # cp OCTEON-SDK/components/driver/host/driver/linux/octeon_drv.ko NeededFiles/
   # cp OCTEON-SDK/components/driver/host/driver/linux/octnic/octnic.ko NeededFiles/
   # cp OCTEON-SDK/host/pci/kontron-oct-pci-boot NeededFiles/
   # cp OCTEON-SDK/host/pci/oct-pci-bootcmd NeededFiles/
   # cp OCTEON-SDK/host/pci/oct-pci-console NeededFiles/
   # cp OCTEON-SDK/host/pci/oct-pci-load NeededFiles/
   # cp OCTEON-SDK/applications/pci-core-app/nic/cvmcs-nic NeededFiles/

For example, you may copy them into a new folder named “NeededFiles” as shown below.

```
[root@localhost OCTEON-SDK]# cd ..
[root@localhost Cavium_Networks]# mkdir NeededFiles
[root@localhost Cavium_Networks]# ls -la
total 391956
drwxr-xr-x  5 root root      4096 Oct  7 15:26 .
drwxr-xr-x 15 root root      4096 Oct  5 13:57 ..
-rwxr--r--  1 root root    197561 Jun 29 21:58 am42xx-patches-OCTEON-SDK-1.8.1-GA-2.02.tar.gz
drwxr-xr-x  2 root root      4096 Oct  7 14:59 cavium-sdk-patches
-rwxr--r--  1 root root   1838650 Jun 30 17:03 cnusers_pci_0.9.8.tgz
-rwxr--r--  1 root root 398855455 Jun 29 22:48 cnusers_sdk_1.8.1.tgz
drwxr-xr-x  2 root root      4096 Oct  7 15:26 NeededFiles
drwxr-xr-x 16 root root      4096 Jan 23  2009 OCTEON-SDK
-rwxr--r--  1 root root      1104 Jun 29 22:06 patchme
[root@localhost Cavium_Networks]# cp OCTEON-SDK/bootloader/u-boot/u-boot-kontron_t5516_pciboot.bin NeededFiles/
[root@localhost Cavium_Networks]# cp OCTEON-SDK/components/driver/host/driver/linux/octeon_drv.ko NeededFiles/
[root@localhost Cavium_Networks]# cp OCTEON-SDK/components/driver/host/driver/linux/octnic/octnic.ko NeededFiles/
[root@localhost Cavium_Networks]# cp OCTEON-SDK/host/pci/kontron-oct-pci-boot NeededFiles/
[root@localhost Cavium_Networks]# cp OCTEON-SDK/host/pci/oct-pci-bootcmd NeededFiles/
[root@localhost Cavium_Networks]# cp OCTEON-SDK/host/pci/oct-pci-console NeededFiles/
[root@localhost Cavium_Networks]# cp OCTEON-SDK/host/pci/oct-pci-load NeededFiles/
[root@localhost Cavium_Networks]# cp OCTEON-SDK/applications/pci-core-app/nic/cvmcs-nic NeededFiles/
[root@localhost Cavium_Networks]# cd NeededFiles/
[root@localhost NeededFiles]# ls -la
total 7828
drwxr-xr-x 2 root root    4096 Oct  7 15:27 .
drwxr-xr-x 5 root root    4096 Oct  7 15:26 ..
-rwxr-xr-x 1 root root 1848375 Oct  7 15:27 cvmcs-nic
-rwsr-sr-x 1 root root  618960 Oct  7 15:27 kontron-oct-pci-boot
-rw-r--r-- 1 root root 2450484 Oct  7 15:26 octeon_drv.ko
-rw-r--r-- 1 root root  522376 Oct  7 15:26 octnic.ko
-rwsr-sr-x 1 root root  579224 Oct  7 15:27 oct-pci-bootcmd
-rwsr-sr-x 1 root root  784352 Oct  7 15:27 oct-pci-console
-rwsr-sr-x 1 root root  583320 Oct  7 15:27 oct-pci-load
-rw-r--r-- 1 root root  524292 Oct  7 15:26 u-boot-kontron_t5516_pciboot.bin
[root@localhost NeededFiles]#
```

*Output may vary depending on your OS, AMC carrier card and settings.

8. Reboot your build environment system. This step is very important.

4. Enable Target Mode (boot from PCIe)

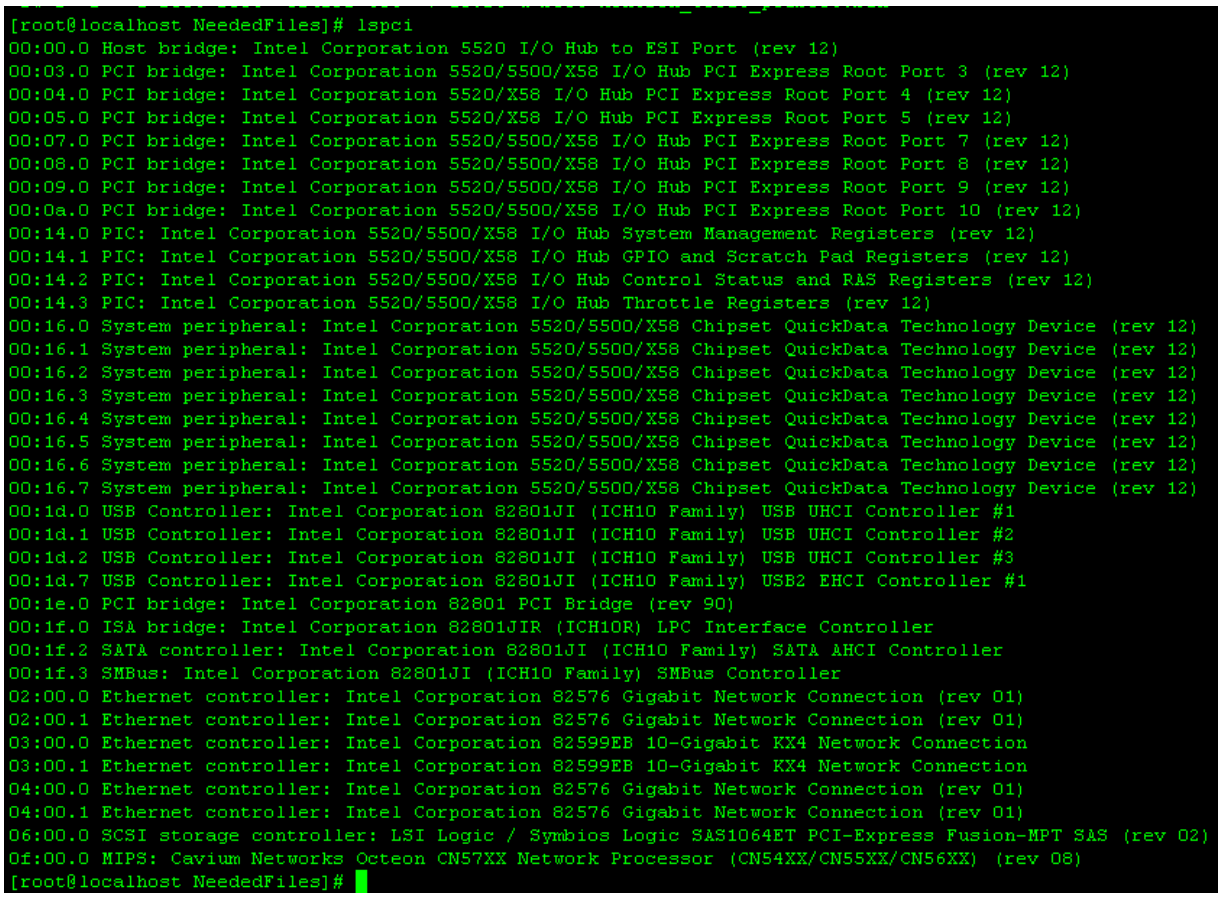
Before loading the drivers, you must enable the boot from PCI Express Target Mode on the AM42XX. To do so, please refer to the application note: AN09002 - How to configure AM42XX Octeon NPU from a remote interface.

To make the setting is applied and that no problem occurs, please extract than re-insert The AM42XX as well as the PCIe Host.

5. Load the drivers

For the screenshot example displayed in this section, the build environment is accessed via the serial port. If you use an ssh connection, you will miss some of the outputs.

1. Verify that the AM42XX is recognized as a PCIe Target:
   # lspci



*Output may vary depending on your OS, AMC carrier card and settings.

If it is not recognized, make sure that you have enabled the boot from PCIe Target Mode on the AM42XX.

2. Go to the "NeededFiles" folder and load OCTEON base host driver:
   # cd /usr/local/Cavium_Networks/NeededFiles/
   # insmod octeon_drv.ko

```
[root@localhost ~]# cd /usr/local/Cavium_Networks/NeededFiles/
[root@localhost NeededFiles]# insmod octeon_drv.ko
octeon_drv: module license 'Cavium Networks' taints kernel.
-- OCTEON: Loading Octeon PCI driver (base module)
OCTEON: Driver Version: PCI BASE 0.9.8 build 63
OCTEON: System is Little endian (1000 ticks/sec)
OCTEON: PCI Driver compile options: NONE


OCTEON: Found device 177d:50..Initializing...
OCTEON: Setting up Octeon device 0
OCTEON: Performing device initialization
OCTEON: CN56XX PASS2
OCTEON: BAR0 start: 0xd7ffc000 len: 16384 remapped 16384 bytes @ ffffc200100b0000
OCTEON: BAR1 start: 0xd0000000 len: 67108864 remapped 16777216 bytes @ ffffc20010a80000
OCTEON: BIST enabled for soft reset
OCTEON: CONFIG_PCIE_DEVCTL: 0x00002810
OCTEON: Device Control (Config 0x78): 0x00002810
OCTEON: Enabling PCI-E error reporting..
PCIE_REQ_NUM: 0x8010101010101010
CN56XX Pass2 Core Clock: 600 Mhz
OCTEON: Octeon device 0 is ready
-- OCTEON: Octeon PCI driver (base module) is ready!

-- OCTEON: Octeon Poll Thread starting execution now!
[root@localhost NeededFiles]#
```

*Output may vary depending on your OS, AMC carrier card and settings.

If you have not rebooted your AMC carrier at step 8 from section 3, proceeding further is not recommended.

3. Load RAM resident bootloader:

   # ./kontron-oct-pci-boot u-boot-kontron_t5516_pciboot.bin

```
t.bin@localhost NeededFiles]# ./kontron-oct-pci-boot u-boot-kontron_t5516_pciboo
Found Octeon on bus 15 in slot 0. BAR0=0xd7ffc000[0x4000], BAR1=0xd0000000[0x4000000]
All cores in reset, skipping soft reset.
Using bootloader image: u-boot-kontron_t5516_pciboot.bin
Initialized 2048 MBytes of DRAM
[root@localhost NeededFiles]#
```

*Output may vary depending on your OS, AMC carrier card and settings.

4. Load PCI NIC sample application:

   # ./oct-pci-load 0x20000000 ./cvmcs-nic

```
[root@localhost NeededFiles]# ./oct-pci-load  0x20000000 ./cvmcs-nic
Found Octeon on bus 15 in slot 0. BAR0=0xd7ffc000[0x4000], BAR1=0xd0000000[0x4000000]
[root@localhost NeededFiles]#
```

*Output may vary depending on your OS, AMC carrier card and settings.

5. Start PCI NIC sample application

   # ./oct-pci-bootcmd "bootoct 0x20000000 coremask=fff"

```
"root@localhost NeededFiles]# ./oct-pci-bootcmd "bootoct 0x20000000 coremask=fff
Found Octeon on bus 15 in slot 0. BAR0=0xd7ffc000[0x4000], BAR1=0xd0000000[0x4000000]
[root@localhost NeededFiles]#
```

*Output may vary depending on your OS, AMC carrier card and settings.

6. Start Octeon PCI console (preferably in another terminal).
   # ./oct-pci-console -noraw 0

```
[root@localhost NeededFiles]# ./oct-pci-console -noraw 0
Found Octeon on bus 15 in slot 0. BAR0=0xd7ffc000[0x4000], BAR1=0xd0000000[0x4000000]
Connecting to PCI console 0
Using raw terminal mode, escape character is ^A, use ^A D  to exit, ^A A to send ^A
Pool stats: [0: 10142 ] [1: 1012 ] [2: 10169 ] [3: 1008 ]
Port 32: db: 0 pkts: 59
--- RGMII driver stats ---
Port16:  From Wire : 58 From Host : 0
Port17:  From Wire : 0 From Host : 0
Port18:  From Wire : 0 From Host : 0
Port19:  From Wire : 0 From Host : 0
Pool stats: [0: 10142 ] [1: 1012 ] [2: 10169 ] [3: 1008 ]
Port 32: db: 0 pkts: 59
--- RGMII driver stats ---
Port16:  From Wire : 58 From Host : 0
Port17:  From Wire : 0 From Host : 0
Port18:  From Wire : 0 From Host : 0
Port19:  From Wire : 0 From Host : 0
Pool stats: [0: 10142 ] [1: 1012 ] [2: 10169 ] [3: 1008 ]
Port 32: db: 0 pkts: 59
--- RGMII driver stats ---
Port16:  From Wire : 58 From Host : 0
Port17:  From Wire : 0 From Host : 0
Port18:  From Wire : 0 From Host : 0
Port19:  From Wire : 0 From Host : 0
```

*Output may vary depending on your OS, AMC carrier card and settings.

You must wait until the RGMII driver stats appears.
If you skip this step, the AM42XX interface ports will not be recognized.
To exit, Press : Ctrl-A D (Ctrl+A then D)

7. Insert PCI NIC sample host driver
   # insmod octnic.ko

```
[root@localhost NeededFiles]# insmod octnic.ko
octnic: no version for "octeon_unregister_dispatch_fn" found: kernel tainted.
-- OCTNIC: Starting Network module for Octeon
Version: PCI NIC 0.9.8 build 63
OCTNIC: Driver compile options: NONE
OCTEON: Registered handler for app_type: NIC
OCTEON[0]: Starting modules for app_type: NIC
OCTNIC: Initializing network interfaces for Octeon 0
OCTNIC: oct0 -> 0 Mbps Half Duplex DOWN
OCTNIC: oct1 -> 0 Mbps Half Duplex DOWN
OCTNIC: oct2 -> 0 Mbps Half Duplex DOWN
OCTNIC: oct3 -> 0 Mbps Half Duplex DOWN
OCTNIC: Rx Queue[0] Size: 1024
OCTNIC: Tx Queue Size: 1024
OCTNIC: Network interfaces ready for Octeon 0
-- OCTNIC: Network module loaded for Octeon
```

*Output may vary depending on your OS, AMC carrier card and settings.

The PCI Express interface is now functional. From now on, every step from section 5 must be performed each time the build environment or the AM42XX are rebooted. To load them permanently, please configure your OS to do so appropriately. (IE: /etc/rc.local)

6. Basic Debug and Configuration Commands

In order to use or test the SFP ports of the AM42XX, the following commands may be used.

#ifconfig -a	: Will list all registered interfaces. With an AM4204, you should see oct0(SFP1 port) to oct3 listed.
#ifconfig oct0 ipaddr	: Will set a specified ip address to oct0.
#ifconfig oct0 up	: Will activate oct0 (down will deactivate)
#lsmod	: Will show all active modules on the system

7. Troubleshooting

AM42XX not detected or Carrier Board keeps rebooting

The rebooting issue is a known behavior on the AT8020. It might also occur on other carriers or any PCIe Host.

To avoid this problem and to make sure that the AM42XX is detected on the AT8020, the following BIOS settings must be set:

- Advanced→ Event Log Configuration→ PCI Error Logging: Disable
- Advanced→ Event Log Configuration→ PCI Express Error Logging: Disable
- Advanced→ PCI Express Configuration → Clock Mode Setting NON-SSC

In order for these settings to take effect, the board must be extracted than re-inserted after the new settings have been saved.

Besides these settings, if the AM42XX is not recognized by the PCIe Host, please consider the following:

- Make sure PCIe is enable (BIOS)
- Verify that the AM42XX is in the right mode (see section 4 : Enable Target Mode (boot from PCIe))
- Make sure that when changes have been made to BIOS or to the AM42XX, that the system has been hot-swapped.

OCTEON_CN56XX_ PASS2_1 Error

While compiling Drivers, if an error occur where OCTEON_CN56XX_ PASS2_1 is mentioned, apply the OCTEON-PCI 0.9.8 patch for 56XX 2.1 (PCI_56XX_2.1_patches.tgz) available on the website : www.cnusers.org .

Detailed instruction on how the apply the patch is supplied in the README file.

No such file or directory warining when installing patch am42xx

This warning may occur depending on your PCIe host and its OS. This should not cause any problem during the following steps and should therefore be ignored.

Error during driver compilation or when setting up environment

If you encounter any problems while setting up environment or during compilation, consider the following:

- This is not related to the AM42XX, the AMC does not have to be detected in order to be able to compile the drivers.
- Multiple causes of error are possible (OS not supporting particular functions, Time stamps, BIOS settings, ...)
- When everything seems normal and cause of error is unclear:
    1. Completely remove the OCTEON-SDK/ directory.
    2. Hot-swap the board.
    3. Start again from the beginning and make sure that all steps are performed in the right order.

Error when loading the drivers

If you encounter any problems while loading the drivers, consider the following:

- If the AM42XX is not detected by the PCIe Host:
    - see Troubleshooting : AM42XX not detected or Carrier Board keeps rebooting
- If the AM42XX is detected, then make sure that no errors occurred during compilation.