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<td>1.0</td>
<td>Initial release.</td>
<td>March 2020</td>
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1.0 Introduction

This document was designed to help debug issues with Intel® QuickAssist Technology (Intel® QAT).

It contains the following sections:

- How To...
- Intel® QAT Driver Installation Issues
- System Configuration Issues
- Application Issues
- Intel® QAT Virtualization Issues
- Intel® QAT Performance Issues
- NGINX Issues
- OpenSSL/QAT_Engine Issues
- HAProxy Issues
- Miscellaneous Issues

1.1 Terminology

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<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>BIOS</td>
<td>Basic Input/Output System</td>
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<td>DC</td>
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<td>PCI</td>
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<tr>
<td>PF</td>
<td>Physical Function</td>
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<td>QAT</td>
<td>Intel® QuickAssist Technology</td>
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<td>SoC</td>
<td>System-on-a-Chip</td>
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<tr>
<td>SRIOV</td>
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1.2 Reference Documents and Software

Table 2. Reference Documents and Software

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<thead>
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<th>Number/Location</th>
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<tr>
<td>Intel® QuickAssist Technology Software for Linux* – Release Notes</td>
<td>336211, 01.org</td>
</tr>
<tr>
<td>– Hardware Version 1.7</td>
<td></td>
</tr>
<tr>
<td>Intel® QuickAssist Technology Software for Linux* – Getting Started</td>
<td>336212, 01.org</td>
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<tr>
<td>Guide – Hardware Version 1.7</td>
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<td>Intel® QuickAssist Technology Software for Linux* – Programmer’s</td>
<td>336210, 01.org</td>
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<td>562366, 01.org</td>
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<td>Drivers – Hardware Version 1.7</td>
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<tr>
<td>Intel® QuickAssist Technology API Programmer’s Guide</td>
<td>330684, 01.org</td>
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<tr>
<td>Intel® QuickAssist Technology – Performance Optimization Guide</td>
<td>330687, 01.org</td>
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<tr>
<td>Using Intel® Virtualization Technology (Intel® VT) with Intel®</td>
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<tr>
<td>QuickAssist Technology Application Note</td>
<td></td>
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<td>HAProxy* with Intel® QuickAssist Technology Application Note</td>
<td>337430, 01.org</td>
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<tr>
<td>Intel® QuickAssist Technology Software for Linux – Release Notes</td>
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<td>– Hardware Version 1.7</td>
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<td>Videos</td>
<td><a href="https://software.intel.com/en-us/networking/quickassist">https://software.intel.com/en-us/networking/quickassist</a></td>
</tr>
<tr>
<td>Electronic Design Kit</td>
<td>565762</td>
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1.3 Resources

- [https://01.org/intel-quickassist-technology](https://01.org/intel-quickassist-technology)
- [https://github.com/intel/QAT_Engine](https://github.com/intel/QAT_Engine)
- [http://www.intel.com/quickassist](http://www.intel.com/quickassist)
- [https://github.com/intel/QATzip](https://github.com/intel/QATzip)
- [https://github.com/intel/asynch_mode_nginx](https://github.com/intel/asynch_mode_nginx)
- [https://www.haproxy.org/](https://www.haproxy.org/)
- [Intel® Select Solutions for NFVI](https://software.intel.com/en-us/networking/quickassist)
2.0 How To...

This section describes how to perform various status checks on Intel® QAT.

2.1 How to Determine if Intel® QAT is Installed

1. Determine if Intel® QAT is installed by running the following command:

   ```bash
   lsmod | grep qa
   ```

   If Intel® QAT is installed, you should see output like the following:

   ```bash
   # lsmod | grep qa
   qat_c62x               13473  0
   intel_qat             141688 1 qat_c62x
   authenc                17776 1 intel_qat
   dh_generic             13323 1 intel_qat
   rsa_generic            18819 1 intel_qat
   ```

2. If Intel® QAT is not installed, run the following commands, then rerun the command above to verify Intel® QAT is installed:

   ```bash
   mkdir -p -v /opt/APP/driver/QAT
   cd /opt/APP/driver/QAT
   wget https://01.org/sites/default/files/downloads/qat1.7.1.4.4.0-00023.tar.gz --no-check-certificate
   tar -xvf qat1.7.1.4.4.0-00023.tar.gz -C /opt/APP/driver/QAT
   export ICP_ROOT=/opt/APP/driver/QAT
   ./configure
   make -j10
   make -j10 install
   systemctl start qat_service
   ```

   Please note that, in this example, QAT 1.7.1.4.4.0-00023 acceleration software is unpacked in the folder /opt/APP/driver/QAT.

Relevant Collateral

2.2 How to Determine if Intel® QAT is Running by Looking at Firmware Counters

Intel® QAT firmware counters can be monitored to determine if Intel® QAT is running as in the following example:

```bash
watch cat /sys/kernel/debug/qat_c6xx_0000\:3d\:00.0/fw_counters
```

These firmware counters are the

/`sys/kernel/debug/qat_<devicetype>_<bus_device_function>/fw_counters`

Intel® QAT firmware counters increase when Intel® QAT is running. If Intel® QAT is not running, the firmware counters will remain at their current value.

Relevant Collateral


2.3 How to Determine if Intel® QAT is Active

1. Run one of the following commands:

```bash
systemctl status qat_service
```

or

```bash
service qat_service status
```

You should see resulting output similar to the following:

```bash
$ systemctl status qat_service
qat_service.service - LSB: modprobe the QAT modules, which loads dependent modules, before calling the user space utility to pass configuration parameters
Loaded: loaded (/etc/init.d/qat_service; generated)
Active: active (exited) since Fri 2019-12-20 18:32:32 UTC; 28min ago
Docs: man:systemd-sysv-generator(8)
Process: 48577 ExecStop=/etc/init.d/qat_service stop (code=exited, status=0/SUCCESS)
Process: 48635 ExecStart=/etc/init.d/qat_service start (code=exited, status=0/SUCCESS)
Dec 20 18:32:30 dbubuntu qat_service[48635]: Restarting all devices.
Dec 20 18:32:30 dbubuntu qat_service[48635]: Processing /etc/c6xx_dev0.conf
Dec 20 18:32:30 dbubuntu qat_service[48635]: Processing /etc/c6xx_dev1.conf
Dec 20 18:32:30 dbubuntu qat_service[48635]: Processing /etc/c6xx_dev2.conf
Dec 20 18:32:30 dbubuntu qat_service[48635]: Checking status of all devices.
Dec 20 18:32:32 dbubuntu qat_service[48635]: There is 3 QAT acceleration device(s) in the system:
```
Dec 20 18:32:32 dbubuntu qat_service[48635]: qat_dev0 - type: c6xx, inst_id: 0, node_id: 0, bsf: 0000:3d:00.0, #accel: 5 #engines: 10 state: up
Dec 20 18:32:32 dbubuntu qat_service[48635]: qat_dev1 - type: c6xx, inst_id: 1, node_id: 0, bsf: 0000:3f:00.0, #accel: 5 #engines: 10 state: up
Dec 20 18:32:32 dbubuntu qat_service[48635]: qat_dev2 - type: c6xx, inst_id: 2, node_id: 1, bsf: 0000:da:00.0, #accel: 5 #engines: 10 state: up
Dec 20 18:32:32 dbubuntu systemd[1]: Started LSB: modprobe the QAT modules, which loads dependant modules, before calling the user space utility to pass configuration parameters.
# service qat_service status
Checking status of all devices.
There is 3 QAT acceleration device(s) in the system:
qat_dev0 - type: c6xx, inst_id: 0, node_id: 0, bsf: 0000:3d:00.0, #accel: 5 #engines: 10 state: up
qat_dev1 - type: c6xx, inst_id: 1, node_id: 0, bsf: 0000:3f:00.0, #accel: 5 #engines: 10 state: up
qat_dev2 - type: c6xx, inst_id: 2, node_id: 1, bsf: 0000:da:00.0, #accel: 5 #engines: 10 state: up

Note: You can also run the systemctl <start, restart or stop> qat_service command, or qat_service <start, restart or stop> to perform the specific request.

Relevant Collateral

2.4 How to Determine if the Intel® QAT Device Has Failed or Hung with Heartbeat Monitoring

You can use Heartbeat monitoring to determine if the Intel® QAT device is in a functional state.

To simulate the Heartbeat management process, run the following commands:

**cat /sys/kernel/debug/<device>/heartbeat**

If 0 is returned, it indicates the device is responding. If –1 is returned, it indicates the device is not responding.

**cat /sys/kernel/debug/<device>/heartbeat_sent**

This number will increase each time the cat heartbeat is sent, because it tracks the number of times the control process checks to see if the device is responsive.

**cat /sys/kernel/debug/<device>/heartbeat_fail**

This number will increase each time the return value of the cat heartbeat is –1 because it keeps track of the number of times the control process finds the device unresponsive.

**cat /sys/kernel/debug/<device>/heartbeat_sim_fail**
This command simulates a failure on the Intel® QAT device. The return value will be zero. In addition, you can use the `icp_sal_heartbeat_simulate_failure()` API to simulate a heartbeat failure as well. For examples of other types of applications, refer to the following subdirectory of the QAT directory where the acceleration software is unpacked:

```
quickassist/lookaside/access_layer/src/sample_code/functional/common
```

**Note:** To simulate the heartbeat failure, Intel® QAT has to be configured as follows:

```
./configure --enable-icp-hb-fail-sim
```

### Relevant Collateral


### 2.5 How to Reset or Restart the Intel® QAT device When it has Failed or Hung, Using adf_ctl

When the Heartbeat monitoring detects that the Intel® QAT device has failed or hung, the device can be reset or restarted with the `adf_ctl` utility. In addition, the Intel® QAT device can be configured for auto reset via the configuration file. For more information, please refer to Document Number 336210, Intel® QuickAssist Technology Software for Linux* – Programmer’s Guide, Sections 3.3 and 5.2.6 contain information on the `adf_ctl` utility. “Resetting a Failed Device,” under Section 3.17.1, contains information on Intel® QAT device auto-resetting via the configuration file.

The `adf_ctl` tool is in the subdirectory `quickassist/utilities/adf_ctl` of the QAT directory where the acceleration software is unpacked. In the following steps, `/opt/APP/driver/QAT` is the directory where the acceleration software is unpacked.

```
/opt/APP/driver/QAT/quickassist/utilities/adf_ctl]
```

```
# ./adf_ctl qat_dev0
```

```
# ./adf_ctl qat_dev0
```

The first example above resets the `QAT_dev0` device, while the second example restarts the `QAT_dev0` device. Note that if `AutoResetOnError` is set to 1 in the `[GENERAL]` section of the Intel® QAT Config file (i.e., `c6xx_dev0.conf`), the reset is done automatically, and there is no need to perform the first example.

### Relevant Collateral

How to Gather Necessary Information for Debugging

The icp_dump.sh tool is in the quickassist/utilities/debug_tool subdirectory of the QAT directory where the acceleration software is unpacked. In the following steps, the QAT directory is /opt/APP/driver/QAT and the tar file (created from icp_dump.sh) will be stored in the /root/iss_nfvi/icp_dump directory.

**Note:** Run the command mkdir /root/iss_nfvi/icp_dump (or the directory of your choice) before running these steps.

1. Define ICP_ROOT as the directory you have installed QuickAssist.

   ```bash
   export ICP_ROOT=/opt/APP/driver/QAT
   ```

2. Run icp_dump.sh with one parameter: the directory where you would like the tar file to be stored.

   ```bash
   # ./icp_dump.sh /root/iss_nfvi/icp_dump
   ```

   **Note:** You will need to accept and run the debug tool, so type yes when prompted.

3. Unzip the file and verify Intel® QAT acceleration devices in the system are up.

   ```bash
   iss_nfvi]$ tar -xzvf ICP_debug_18h_52m_07s_17d_10m_19y.tar.gz
   iss_nfvi]$ cd ICP_debug
   ICP_debug]$ cat adf_ctl_status.txt
   Checking status of all devices.
   
   There are three Intel® QAT acceleration devices in the system:
   
   - qat_dev0 - type: c6xx, inst_id: 0, node_id: 0, bsf: 0000:3d:00.0, #accel: 5 #engines: 10 state: up
   - qat_dev1 - type: c6xx, inst_id: 1, node_id: 0, bsf: 0000:3f:00.0, #accel: 5 #engines: 10 state: up
   - qat_dev2 - type: c6xx, inst_id: 2, node_id: 1, bsf: 0000:da:00.0, #accel: 5 #engines: 10 state: up
   ```

4. Verify that all Intel® QAT configuration files are the same.

   **Note:** The SHIM section needs to be in place when QAT SHIMs are used. This includes QAT Engine and QATqzip. The CPA sample code uses the default QAT configuration files that are installed along with the Intel® QAT driver. This would be [SSL].

   The following is an example of the configuration that contains the [SHIM] section:

   ```bash
   ICP_debug]$ cd config_files/
   config_files]$ cat c6xx_dev0.conf
   …
   ##############################################
   # User Process Instance Section
   ##############################################
   [SHIM]
   NumberCyInstances = 1
   NumberDcInstances = 0
   ```
NumProcesses = 10

# Crypto - User space
Cy0Name = "UserCY0"
Cy0IsPolled = 1
Cy0CoreAffinity = 0

Relevant Collateral

3.0 Intel® QAT Driver Installation Issues

The following sections describe steps for resolving Intel® QAT Driver installation issues.

3.1 Intel® QAT Driver Does Not Compile

If you experience compile errors, try one or more of the following steps:

- Update to the latest Intel® QAT Driver version
- Study the errors and warnings
- Update driver to use the kernel functions that correspond with your kernel and structures
- Install dependencies as described in the Intel® QAT Getting Started Guide

**Note:** Compile errors related to the kernel version are usually observed with newer kernels. Please update to the latest version of the Intel® QAT driver available on 01.org. If you still experience issues, consult with your Intel representative.

**Relevant Collateral**


3.2 Linux* Crypto API Doesn’t Use Intel® QAT

Users may be attempting to use intel® QAT integrated into the Linux* Crypto API and looking for confirmation that QAT is being used. Users can look to the QAT FW counters and verify that they increase as crypto operations are performed. If QAT counters are not increasing, it may be due to one of the following:

- Depending on the user’s version of Intel® QAT, the Linux Crypto API may not be enabled by default. In QAT HW Version 1.7 L4.7 and earlier, the Linux Crypto API was enabled by default. With QAT HW Version 1.7 L4.8 and later, the option must be enabled when installing Intel® QAT, with the following command:

  ```
  ./configure --enable-qat-lkcf
  ```

- The required algorithm may not be installed. The user may add the algorithm, or ask their Intel representative to add the algorithm. The following is an example of how to determine the algorithms supported in the current installation:

  ```
  # cat /proc/crypto | grep qat
  
  driver : qat-dh
  module  : intel_qat
  driver : qat-rsa
  module  : intel_qat
  driver : qat_aes_cbc_hmac_sha512
  module  : intel_qat
  ```
3.3 Issues with the Intel® QAT Make or with Starting Intel® QAT

For the issues listed below, the root cause may be a mismatch of the install kernel and/or headers.

- **Kernel Header Files Missing**

  ```
  make[1]: Entering directory `/opt/APP/driver/QAT'
  make[2]: Entering directory `/opt/APP/driver/QAT/quickassist/qat'
  Makefile:66: *** ERROR: Kernel header files not found. Install the appropriate kernel development package necessary for building external kernel modules or run 'make oldconfig && make modules_prepare' on kernel src to fix it. Stop.
  make[2]: Leaving directory `/opt/APP/driver/QAT/quickassist/qat'
  make[1]: *** [qat-driver-all] Error 2
  make[1]: Leaving directory `/opt/APP/driver/QAT'
  make: *** [all] Error 2
  ```

- **Errors in Intel® QAT Make**

  ```
  include/asm-generic/pgtable.h:632:19: note: previous definition of 'pud_trans_huge' was here
  static inline int pud_trans_huge(pud_t pud)
  ^
  In file included from ./arch/x86/include/asm/pgtable.h:1235:0,
  from include/linux/mm.h:63,
  from ./arch/x86/include/asm/pci.h:4,
  from include/linux/pci.h:1641,
  from /opt/APP/driver/QAT/quickassist/qat/compat/
  qat_compat.h:87,
  from <command-line>:0:
  include/asm-generic/pgtable.h: At top level:
  include/asm-generic/pgtable.h:632:19: error: redefinition of 'pud_trans_huge'
  static inline int pud_trans_huge(pud_t pud)
  ```

Relevant Collateral

Driver code and OS registered functions
Unable to Start/Restart Intel® QAT

Failed to restart qat_service.service: Unit not found.

Resolution

Follow these steps:

1. Determine what kernels are installed on your system as in the following example:

   ```
   # yum list installed kernel
   Loaded plugins: langpacks, product-id, search-disabled-repos, subscription-manager
   Installed Packages
   kernel.x86_64          3.10.0-957.e17          @anaconda/7.6
   kernel.x86_64          3.10.0-957.12.2.e17     @rhel-7-server-rpms
   kernel.x86_64          3.10.0-1062.12.1.e17     @rhel-7-server-rpms
   ```

2. If there is no kernel list as shown in the previous step, then install it as follows:

   ```
   yum install kernel-devel-$(uname -r)
   ```

3. If multiple kernels are installed, remove the kernels that you do not need as in the following example:

   ```
   yum remove kernel-devel-3.10.0-1062.12.1.e17.x86_64
   ```

4. If the only kernel installed is the one you want, then reinstall it by performing Step 3 followed by Step 2.

   This will verify that the correct headers are being used (i.e., there may be a chance that Intel® QAT was previously built with a different Linux kernel, with different headers.)

Relevant Collateral

4.0 System Configuration Issues

This section describes resolution steps for system configuration issues.

4.1 Intel® QAT Endpoint is Trained to Less than the PCIe* Max Capability

This issue includes one or more of the following symptoms:

- `lspci` returns a trained value below the maximum PCIe* capability
- Intel® QAT performance is low
- Platform issues: BIOS, jumpers, or analog issues
- Intel® QAT endpoint is trained correctly, but the internal switches report lower speeds

Resolution

Verify that the `cpa_sample_code` gives the expected performance.

Contact your Intel representative for the expected performance numbers, if necessary.

Relevant Collateral

- 330687, Intel® QuickAssist Technology – Performance Optimization Guide, at 01.org
4.2 “adf_ctl status” Shows Fewer than Expected Devices

If `adf_ctl status` shows fewer than expected devices, try the resolution steps below.

Resolution

Check for one or more of the following conditions:

- Intel® QAT modules were not successfully installed with `insmod`
- Intel® QAT modules were not installed with `insmod` in the correct order

Relevant Collateral

5.0 Application Issues

This section describes resolution steps for application issues.

5.1 Intel® QAT app fails to run

Error messages result when starting the Intel® QAT app, usually during the `userStart` function.

**Resolution**

Try one or more of the following:

- Install Intel® QAT.
- Update Intel® QAT configuration files to include the correct section name.

**Note:** Run the CPA Sample App first, to verify that you get good results.

Please refer to Section 4.1 of the Intel® QAT Getting Started Guide.

**Relevant Collateral**

- 336212, Intel® QuickAssist Technology Software for Linux* – Getting Started Guide – Hardware Version 1.7, at 01.org

For example: Section 3, “Building and Installing Software,” and Section 4, “Sample Applications,” in the Getting Started Guide, will show all the necessary steps.

Also, please refer to the following entries in Section 2.0 of this document:

- How to Determine if Intel® QAT is Installed
- How to Determine if Intel® QAT is Active

5.2 Application is Not Using Intel® QAT

Intel® QAT counters are not increasing. For example,

```
watch cat /sys/kernel/debug/qat_c6xx_0000:3d:00.0/fw_counters
```

**Note:** Check `/sys/kernel/debug` for your applicable `qat_c6xx*` directory.

**Resolution**

Applications may not to be patched or configured to use Intel® QAT. Consult the relevant documentation.
5.3 Intel® QAT Endpoint Hangs

The Intel® QAT device is not responsive.

Resolution

Try one or more of the following:

- Step through the application to identify the operation that led to the hang; i.e., focus on replication.
- Run `adf_ctl reset` to recover.
- Verify that all Intel® QAT API operations and addresses are valid.

Relevant Collateral


5.4 Error Reading the /dev/qat_dev_processes File

When testing the driver (e.g., with functional sample code), you receive the error `Error reading /dev/qat_dev_processes file`:

```
# ./ipsec_sample
main(): Starting IPSec Sample Code App ...
ADF_UIO_PROXY err: icp_adf_userProcessToStart: Error reading /dev/qat_dev_processes file
main(): Failed to start user process SSL
```

Resolution Steps

1. Ensure that the configuration files match the application code, i.e., that `icp_sal_userStart` references "SSL" and that the configuration files in `/etc/` also mention "SSL" sections with a declared number of instances.

2. Restart `qat_service`. 

Relevant Collateral

Relevant Collateral

336212, Intel® QuickAssist Technology Software for Linux® – Getting Started Guide – Hardware Version 1.7, at 01.org
6.0 Intel® QAT Virtualization Issues

This section describes resolution steps for Intel® QAT virtualization issues.

6.1 Too Many Intel® QAT VFs are Created

When trying to create fewer virtual functions than the maximum, the maximum number always gets created.

Resolution

None; this is a hardware limitation, currently.

Relevant Collateral

- 330689, Using Intel® Virtualization Technology (Intel® VT) with Intel® QuickAssist Technology Application Note, at 01.org

6.2 Intel® QAT VFs are Not Created

Virtual functions are not created.

Resolution

Check for one or more of the following causes:

- configure was not run with the right options and needs to be run with the correct option.
- intel_iommu=on is not part of the grub boot settings, and needs to be included in the grub
- Virtualization is not enabled in the BIOS, and needs to be enabled

Example Outputs

1. Run `lscpu` to check if virtualization (vmx) is enabled in the BIOS:

```bash
# lscpu | grep vmx
Flags:                 fpu vme de pse tsc msr pae mce cx8 apic sep
mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht
tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon
pebs bts rep_good nopl xtopology nonstop_tsc aperfmperf eagerfpu pni
pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtrn pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt
tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm
3dnowprefetch cpb cat l3 cdp_l3 invpccd single intel_pipn intel_pt
ssbd mba ibrs ibpb stibp ibrs Enhanced tpr_shadow vmx flexpriority
ept vpid fsgsbase tsc_adjust hmni hle avx2 smep bmi2 erms invpcid rtm
cqm mpx rd_t a avx512f avx512pf rdseed adx smap clflushopt clwb
avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 cqm_llc
```
2. Check `dmesg` to see if Virtualization (DMAR) is enabled for your particular device:

```
# dmesg | grep -i DMAR | grep 0000:d8:00.0
[ 5.361824] DMAR: Hardware identity mapping for device
```

**Relevant Collateral**

- 330689, *Using Intel® Virtualization Technology (Intel® VT) with Intel® QuickAssist Technology Application Note*, at 01.org

7.0 Intel® QAT Performance Issues

This section describes resolution steps for Intel® QAT performance issues.

7.1 CPU Performance Beats Intel® QAT Performance

CPU performance beats Intel® QAT performance.

Resolution

Try one or more of the following steps:

- Optimize the particular application for memory recycling
- Increase application concurrency and Intel® QAT configuration to use full parallelization
- Increase buffer/packet sizes (small packets may not see offloading benefit)
- CPU performance may beat Intel® QAT for certain algorithms, for certain packages, with enough cores

Relevant Collateral

- 330687, Intel® QuickAssist Technology – Performance Optimization Guide, at 01.org

7.2 Intel® QAT Performance is Low

Intel® QAT is not performing as expected.

Resolution

Try one or more of the following steps:

- Optimize the particular application for memory recycling
- Increase application concurrency and Intel® QAT configuration to use full parallelization
- Increase buffer/packet sizes (small packets may not see offloading benefit)
- CPU performance may beat Intel® QAT for certain algorithms, for certain packages, with enough cores
- Remove software stack layers to verify that Intel® QAT performance at the lower-lever layers is as expected
Relevant Collateral

- 330687, Intel® QuickAssist Technology – Performance Optimization Guide, at 01.org
8.0 NGINX* Issues

This section describes resolution steps for NGINX* issues.

8.1 NGINX* + Intel® QAT Performance is Low

If performance is low with NGINX and Intel® QAT, try the resolution steps below.

Resolution

Try one or more of the following steps:

- Use the Intel® Select Solutions for NFVI script to apply the correct settings (i.e., more worker processes, keep-alive settings, high concurrency, etc.)
- Ensure that Intel® QAT is being used with the firmware counters
- Ensure that GRUB does not have `idle=poll`
- Isolating cores in the GRUB has been shown to reduce performance

Relevant Collateral

Intel® Select Solutions for NFVI
9.0 OpenSSL*/QAT_Engine Issues

This section describes resolution steps for OpenSSL*/QAT_Engine issues.

9.1 Error with Version of OpenSSL*

If you see a result like the following:

```
[root@SR1B011 apps]# ./openssl version
./openssl: error while loading shared libraries: libssl.so.1.1: cannot open shared object file: No such file or directory
```

Then most likely, the library path is not set up.

```
[root@SR1B011 apps]# echo $LD_LIBRARY_PATH
```

Resolution

Export the $LD_LIBRARY_PATH and rerun the command again as follows:

```
[root@SR1B011 apps]# export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/ssl/lib
[root@SR1B011 apps]# ./openssl version
OpenSSL 1.1.1 11 Sep 2018
```

Relevant Collateral

https://github.com/intel/QAT_Engine (including the Troubleshooting section)

9.2 Errors with make/make install of the Intel® QAT OpenSSL* Engine

You experience errors with make or make install as in the following:

```
qat_ciphers.c:464:26: note: each undeclared identifier is reported only once for each function it appears in
make[1]: *** [qat_rsa.lo] Error 1
qat_ciphers.c: In function 'qat_chained_ciphers_do_cipher':
qat_ciphers.c:1651:59: error: 'ASYNC_STATUS_OK' undeclared (first use in this function)
if ((job_ret = qat_pause_job(done.opDone.job, ASYNC_STATUS_OK)) == 0)
^>
qat_ciphers.c: In function 'qat_sym_perform_op':
qat_ciphers.c:1778:48: error: 'ASYNC_STATUS_EAGAIN' undeclared (first use in this function)
   if ((qat_wake_job(opDone->job, ASYNC_STATUS_EAGAIN)
```

```
Resolution

The root cause could be that you have cloned the QAT_Engine with the OpenSSL repository. It is not normally advised to clone one git repo within another. In this case, clone the QAT_Engine somewhere other than in the OpenSSL repository.

Relevant Collateral

https://github.com/intel/QAT_Engine (including the Troubleshooting section)
10.0  **HAProxy** Issues

This section describes resolution steps for **HAProxy** issues.

10.1  **HAProxy** + Intel® QAT Error when Starting HAProx

Starting HAProx results in the following message:

```
"ssl-engine qat: failed to get structural reference"
```

**Resolution**

Review the **HAProxy** with Intel® QuickAssist Technology Application Note to verify that all required steps were covered.

**Relevant Collateral**

337430, **HAProxy** with Intel® QuickAssist Technology Application Note, on 01.org

10.2  **HAProxy** + Intel® QAT Performance is Low

You experience low performance of HAProx and Intel® QAT.

**Resolution**

- Use the **Intel® Select Solutions for NFVI** script to reapply the correct settings (i.e., more worker processes, keep-alive settings, high concurrency, etc.)
- Ensure that Intel® QAT is being used, with the firmware counters
- Ensure that GRUB does not have `idle=poll`
- Isolating cores in the GRUB has been shown to reduce performance

**Relevant Collateral**

**Intel® Select Solutions for NFVI**

10.3  **Error with HAProx** Version

If you experience the following error:

```
# ./haproxy -vv
./haproxy: error while loading shared libraries: libssl.so.1.1: cannot open shared object file: No such file or directory
```

It is likely that the **LD_LIBRARY_PATH** variable is not set up.
Resolution

Define the `LD_LIBRARY_PATH` and verify that the “Built with” and “Running on” OpenSSL versions are the same.

```bash
export LD_LIBRARY_PATH=/usr/local/ssl/lib
./haproxy -vv
```

**HA-Proxy version 1.9.4 2019/02/06 – https://haproxy.org/**

**Build options:**

- `TARGET = linux2628`
- `CPU = generic`
- `CC = gcc`
- `OPTIONS = USE_OPENSSL=1`

**Default settings:**

- `maxconn=2000, bufsize=16384, maxrewrite=1024, maxpollevents=200`
- Built with OpenSSL version: OpenSSL 1.1.1 11 Sep 2018
- Running on OpenSSL version: OpenSSL 1.1.1 11 Sep 2018

**Relevant Collateral**

337430, *HAProxy* with Intel® QuickAssist Technology Application Note, at 01.org, especially the following sections:

- Section 3.0, “HAProxy* Setup and Testing for HTTP Connections”
- Section 3.1, “Installing HAPctxy*”
- Section 3.2, “Verifying HAPctxy* Installation”
10.4 HAProxy* Shared Libraries libssl.so.1.1 and libcrypto.so.1.1 are Not Found

HAProxy shared libraries libssl.so.1.1 and libcrypto.so.1.1 are not found.

```
$ ldd haproxy
linux-vdso.so.1 => (0x00007ffe4853e000)
libcrypt.so.1 => /lib64/libcrypt.so.1 (0x00007ff32d26e000)
libdl.so.2 => /lib64/libdl.so.2 (0x00007ff32d06a000)
libpthread.so.0 => /lib64/libpthread.so.0 (0x00007ff32ce4e000)
librt.so.1 => /lib64/librt.so.1 (0x00007ff32cc46000)
libssl.so.1.1 => not found
libcrypto.so.1.1 => not found
libc.so.6 => /lib64/libc.so.6 (0x00007ff32c878000)
libfreebl3.so => /lib64/libfreebl3.so (0x00007ff32c675000)
/lib64/ld-linux-x86-64.so.2 (0x00007ff32d4a5000)
```

Resolution

Define the LD_LIBRARY_PATH variable and verify that the libssl.so.1.1 and libcrypto.so.1.1 files point to the correct libraries.

```
$ export LD_LIBRARY_PATH=/usr/local/ssl/lib
$ ldd haproxy
linux-vdso.so.1 => (0x00007ffd75bbf000)
libcrypt.so.1 => /lib64/libcrypt.so.1 (0x00007feaeb0e4000)
libdl.so.2 => /lib64/libdl.so.2 (0x00007feaeaee000)
libpthread.so.0 => /lib64/libpthread.so.0 (0x00007feaeacc4000)
librt.so.1 => /lib64/librt.so.1 (0x00007feaeaabc000)
libssl.so.1.1 => /usr/local/ssl/lib/libssl.so.1.1 (0x00007feaea82a000)
libcrypto.so.1.1 => /usr/local/ssl/lib/libcrypto.so.1.1 (0x00007feaa345000)
libc.so.6 => /lib64/libc.so.6 (0x00007feae9f77000)
libfreebl3.so => /lib64/libfreebl3.so (0x00007feae9d74000)
/lib64/ld-linux-x86-64.so.2 (0x00007feae31b000)
```

Relevant Collateral

337430, HAProxy* with Intel® QuickAssist Technology Application Note, at 01.org, especially the following sections:

- Section 3.0, "HAProxy* Setup and Testing for HTTP Connections"
- Section 3.1, "Installing HAProxy*"
- Section 3.2, "Verifying HAProxy* Installation"
### 10.5 Fatal Errors with HAProxy* Configuration File

If you experience fatal errors with the HAProxy configuration file, like the following:

```
#] ./haproxy -f /etc/haproxy/allhaproxy.cfg
[ALERT] 178/155753 (38095) : ssl-engine qat: failed to get structural reference
[ALERT] 178/155753 (38095) : parsing [/etc/haproxy/allhaproxy.cfg:3] : (null)
[ALERT] 178/155753 (38095) : Error(s) found in configuration file : /etc/haproxy/allhaproxy.cfg
[ALERT] 178/155753 (38095) : Fatal errors found in configuration.
```

It is likely that the `LD_LIBRARY_PATH` variable is not set up.

**Resolution**

Run the following commands:

```
# export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/ssl/lib
#] ./haproxy -f /etc/haproxy/allhaproxy.cfg
```

**Relevant Collateral**

337430, *HAProxy* with Intel® QuickAssist Technology Application Note*, at 01.org, especially the following sections:
- Section 3.0, “HAProxy* Setup and Testing for HTTP Connections”
- Section 3.1, “Installing HAProxy*”
- Section 3.2, “Verifying HAProxy* Installation”

### 10.6 HAProxy* Test Does not Appear to Produce the Expected Results using ApacheBench as a Load Generator

If you experience this issue, you may need to use the OpenSSL* `s_time` command as a load generator, with a new HAProxy QAT configuration file.

**Resolution**

An example of a recommended HAProxy QAT configuration file is listed below for use when running the OpenSSL `s_time` command. Please note that the **bold** line would be removed if you were running the test without Intel® QAT (i.e., with software).

```
]# cat myhaproxy-qat.cfg
global
user root
group root
nproc 15
maxconn 200000
ulimit-n 700000
daemon
```


**HAProxy** Issues

```plaintext
ssl-engine qat algo ALL
ssl-mode-async
ssl-default-bind-ciphers AES128-SHA
ssl-default-bind-options no-tls-tickets no-sslv3 no-tlsv10 no-tlsv11
tune.bufsize 65536
defaults
backlog 327680
balance source
retries 3

frontend myfrontend
mode http
bind 127.0.0.1:4400 ssl crt /etc/ssl/myhaproxy/myhaproxy.pem
option forceclose
option httpclose
option http-server-close
option nolinger
timeout client 100s
timeout client-fin 0s
timeout http-keep-alive 0s
default_backend mybackend
backend mybackend
balance roundrobin
option httpclose
option http-server-close
timeout connect 100s
timeout server 100s
timeout server-fin 0s
option nolinger
option forceclose
mode http
timeout http-keep-alive 0s
server myvm 127.0.0.1:80 check

Relevant Collateral

337430, **HAProxy** with **Intel® QuickAssist Technology Application Note**, at 01.org, especially the following sections:

- Section 3.0, “HAProxy Setup and Testing for HTTP Connections”
- Section 3.1, “Installing HAProxy”
- Section 3.2, “Verifying HAProxy Installation”

§
11.0 **Miscellaneous Issues**

This section describes resolution steps for otherwise uncategorized issues.

11.1 **Possible Errors Due to BIOS Setting**

Issues like the following may be due to BIOS settings:

- **Running `make install` on the QAT Engine returns an error similar to error -14:**

  ```
  dh895xcc: probe of 0000:bl:00.0 failed with error -14
  ```

  **Note:** The above result may be seen in `dmesg` and/or `/var/log/syslog`.

- **Error "Failed to send admin msg to accelerator":**

  ```
  dh895xcc 0000:bl:00.0: Failed to send init message
  ```

  **Note:** The above result may be seen in `/var/log/messages`.

- **Fewer qat acceleration devices than you expect when starting Intel® QAT:**

  For example, you may see all the c6xx type devices, but not the dh895x device.

**Resolution**

Please refer to Section 4.5 of *QuickAssist Technology Software for Linux - Release Notes - HW version 1.7* (Document ID 336211). The title of the Section is "When trying to start the Intel QuickAssist Technology driver, I see errors similar to one of the following..."

**Relevant Collateral**