Dynamic Slice Shutdown

Overview

This document covers Dynamic Slice Shutdown feature (hereinafter referred to as "DSS").

In this document we will refer to processor families by their former codenames for the sake of readability:

- Intel® Xeon® E3-1200/1500 v5 Family and 6th Generation Intel Core™ Processors will be referred to as “Skylake”
- Intel® Xeon® E3-1200 v4 Family and 5th Generation Intel Core™ Processors will be referred to as “Broadwell”

DSS mechanism allows using different slice numbers for particular configuration.

Enabling Configuration

To enable DSS, /etc/igfx_user_feature.txt file should be created:

```
[KEY]
        0x00000001
        UFKEY INTERNAL\
                [VALUE]
                        Slice Count Set Support
                        4 /*key value size, do not change*/
                        1 /*key value, do not change*/
                [VALUE]
                        Dynamic Slice Shutdown /*key name, do not change*/
                        4  /*key value size, do not change*/
                        -1 /*key value, change it according to the table below*/
```

Following key values should be used for /etc/igfx_user_feature.txt:

Key value	Meaning
-1	Use timer-based DSS
0	Use default slices, i.e. 3 for SKL GT4, 2 for SKL/BDW GT3
1	Use 1 slice
2	Use 2 slices
3	Use 3 slices, only for SKL GT4
Other values	Use default slices

Be carefully, slice configuration will only get updated once a new workload is initialized after igfx_user_feature.txt editing.

To check if number of enabled slices is correct, must be used following command in parallel with main workload:

```
watch -n 0.1 cat /sys/kernel/debug/dri/0/i915_sseu_status
```

It will show device info and status. "Enabled Slice Total" line shows currently enabled slices.

```
SSEU Device Info
  Available Slice Mask: 0003
  Available Slice Total: 2
  Available Subslice Total: 6
  Available Subslice Mask: 0007
  Available Subslice Per Slice: 3
  Available EU Total: 48
  Available EU Per Subslice: [8, 8]
  Has Pooled EU: no
  Has Slice Power Gating: yes
  Has Subslice Power Gating: no
  Has EU Power Gating: no
SSEU Device Status
  Enabled Slice Mask: 0003
  Enabled Slice Total: 2
  Enabled Subslice Total: 6
  Enabled Subslice Mask: 0007
  Enabled Subslice Per Slice: 3
  Enabled EU Total: 48
  Enabled EU Per Subslice: [8, 8]
```

DSS policy for N->N, 1->N pipelines with different codecs and resolutions:

- All components (which use RCS) request certain number of slices to configure (this is a cross-process actually). Always max number of slices requested is satisfied, but there is a timeout – if no encoder will request the current max number of slices again within timeout, this maximum will be dropped and new max will be selected among remained requests which did not timed out.

For example, in this 1->N pipeline session #1 request 2 slices, session #2 request 1 slices, in the end 2 slices must be used for this workload:

```
-o::sink  -i::h264 in.264 -n 600 -async 1 -hw
```

```
-w 1920 -h 1080 -o::h264 out.1.h264 -i::source  -b 6000 -u 4 -async 1 -hw
-w 360 -h 240 -o::h264 out.2.h264 -i::source  -b 6000 -u 4 -async 1 -hw
```

Frequent changes of slices number in "Enabled Slice Total" line:

- This can happen if there is any other application which uses RCS, but does not use media-driver slice configuration mechanism. Effectively what will happen is: there is a context which is created by default, i.e. with max number of slices. If that's the case there will be slice reconfigurations on context switches. These are costly and should be avoidable. Those who may use RCS are:
  1. Window Manager: X11, Wayland
  2. OpenCL
  3. OpenGL
  4. Mesa

Performance

There are a lot more computational resources on Render Engine than needed for a range of typical media workloads.

- With the DSS feature, it is possible to switch off spare resources and free power allocation which will lead to lower power consumption or available to be used by other computer units, CPU or GPU.
- Secondly, with the DSS performance may be increased on appropriate workloads. Consider the following table to configure Render Engine slice count depending on your workload:

BDW	2 slices	1 slice
AVC	1. Resolution >=1920x1080 2. Target usage <= 4 3. Not Flexible Encode Infrastructure (hereinafter referred to as "FEI") Or 1. Resolution >= 3840x2160 Or 2. Resolution >= 1280x720 3. FEI PreEnc	Otherwise
MPEG	1. Resolution >=1920x1080 2. Target usage <= 4	Otherwise

SKL	3 slices	2 slices	1 slice
AVC	Not Used	1. Resolution >=1920x1080 2. Target usage <= 4 3. Not FEI Or 1. Resolution >= 3840x2160 Or 1. Resolution >= 1280x720 2. FEI PreEnc	Otherwise
MPEG	Not Used	1. Resolution >=1920x1080 2. Target usage <= 4	Otherwise
HEVC	1. Resolution >=3840x2160 2. Target usage <= 4	Otherwise	Not used

- MFE DSS policy:
  If mfe mode is enabled and number of encoders more than 1, than following policy will be used:

SKL	3 slices	2 slices	1 slice
AVC	1. Resolution >=1920x1080 2. Target usage <= 4	1. Resolution >= 3840x2160 Or 1. Resolution >= 1920x1080 2. Target usage > 4 Or 1. Resolution >= 1280x720 2. Target usage <= 4	Otherwise

In other cases common policy will be used:

SKL	3 slices	2 slices	1 slice
AVC	Not Used	1. Resolution >=1920x1080 2. Target usage <= 4 Or 1. Resolution >= 3840x2160 Or 1. Resolution >= 1280x720 2. Target usage <= 2	Otherwise

Follow these tips to avoid performance regressions:

- Slice powering on/off is time-consuming operation which will temporary stall Render Engine. Thus, avoid frequent reconfiguration.
- Carefully consider how many slices you actually need if you run media and compute workloads parallel. Compute workloads tend to require more computational resources than media, thus, they may need all slices powered on for the optimal performance.

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