GSoC 2017 Ideas

Projects that we maintain:
- libva : https://github.com/01org/libva
- libva-utils: https://github.com/01org/libva-utils
- vaapi-intel-driver : https://github.com/01org/intel-vaapi-driver
- gstreamer-vaapi : https://cgit.freedesktop.org/gstreamer/gstreamer-vaapi/
- libyami: https://github.com/01org/libyami
- libyami-utils: https://github.com/01org/libyami-utils
- libxcam: https://github.com/01org/libxcam

List of Project Ideas:
libva/libva-utils
- Implement a simple HEVC(h265) encoder
  We have similar h264 encoder as a part of libva, add similar encoder program for HEVC codec too. H264/AVC encoder application code is here: https://github.com/01org/libva-utils/blob/master/encode/avcenc.c
    Difficulty: Medium
    Skill Required: C
    Optional Skills: Understanding of H265/HEVC codec
    Hardware requirement: Intel Skylake, Broxton or Kabylake microarchitecture based PC
    Possible Mentor: Sreerenj Balachandran <bsreerenj@gmail.com>
    IRC: sree_ on freenode/gstreamer
    Slack: sree on https://intel-media.slack.com/

- Implement a minimal VP8 encoder
  Implement a simple vp8 encoder similar to the avcenc implementation. H264/AVC encoder application code is here: https://github.com/01org/libva-utils/blob/master/encode/avcenc.c
    Difficulty: Medium
    Skill Required: C
    Optional Skills: Understanding of VP8 codec
    Hardware Requrement: Intel CherryView, Skylake, Broxton or Kabylake Microarchitecture based
  PC
    Possible Mentor: Sreerenj Balachandran <bsreerenj@gmail.com>
    IRC: sree_ on freenode/gstreamer
    Slack: sree on https://intel-media.slack.com/

- Implement a minimal VP9 encoder
  Implement a simple vp9 encoder similar to the avcenc implementation. H264/AVC encoder application code is here: https://github.com/01org/libva-utils/blob/master/encode/avcenc.c
    Difficulty: Medium
    Skill Required: C
    Optional Skills: Understanding of VP9 codec
    Hardware Requrement: Intel Kabylake Microarchitecture based PC
    Possible Mentor: Sreerenj Balachandran <bsreerenj@gmail.com>
    IRC: sree_ on freenode/gstreamer
    Slack: sree on https://intel-media.slack.com/

- Optimize/speed-up the test filter routine for the `test_va_api` test suite. This test suite uses the googletest framework (https://github.com/google/googletest) and its test filter routine is slow. The `test_va_api` suite has over 15k test cases and executing each test in its own process (via --

gtest_filter option) can be much slower than executing the entire suite as a whole... this appears to be caused by the test filtering operation. Any solution to speed it up should be contributed back to the googletest project.

    Difficulty: Medium
    Skill Required: C, C++
    Optional Skills: GTest framework
    Possible Mentor: Eoff, Ullysses A <ullysses.a.eoff@intel.com>
    Slack: uartie on https://intel-media.slack.com/

- Develop more test cases for the `test_va_api` test suite
    Difficulty: Medium
    Skill Required: C, C++
    Optional Skills: GTest framework
    Possible Mentor: Eoff, Ullysses A <ullysses.a.eoff@intel.com>
    Slack: uartie on https://intel-media.slack.com/

  intel-vaapi-driver:
- Implement Packed header support for slices in MPEG2 encoder.
  Some drivers require packed headers for slices, but we currently only support packed headers for sequence and picture parameters in intel driver.
- Develop more test cases for the `test_i965_drv_video` unit test suite.

  libxcam:
- Improve Defog/Dehaze quality and performance. Design and tune algorithm based on Dark Channel Prior to improve image quality, especially on Halo removal and color balance. Also need to consider performance improvement based on OpenCL in IA platform.
    Difficulty: Medium
    Skill Required: C/C++, OpenCL
    Optional Skills: Familiar with image processing
    Hardware required: IvyBridge+ PC
    Possible Mentor: Wind Yuan <feng.yuan@intel.com>
    Slack: fengyuan on https://intel-media.slack.com/

- Porting gstxcamfilter and gstxcamsrc from libxcam into gst-plugins-bad Fix Gstreamer related issues in gstxcamfilter/src and submit patches to gst-plugins-bad, Also need follow up and even refine each patch in Gstreamer review. Currenlty both of these plugins are implemented as part of libxcam. The idea is to port the plugin to upstream gstreamer
  project : https://cgit.freedesktop.org/gstreamer/gst-plugins-bad/
    Difficulty: Easy-Medium
    Skill Required: C/C++
    Optional Skills: Familiar with gstreamer
    Hardware required: IvyBridge+ PC
    Possible Mentor: Wind Yuan <feng.yuan@intel.com>
    Slack: fengyuan on https://intel-media.slack.com/

- Enable a deblocking feature with OpenCL accelerated Design and implement algorithm to remove block boundary issues for Wavelet noise reduction. It can work as a single class CLDeblokHandler or enable algorithm in a cl kernel in CLNewWaveletDenoiseImageHandler class. Also need add test-case.
    Difficulty: Difficult
    Skill Required: C/C++, OpenCL
    Optional Skills: Familiar with image processing
    Hardware required: IvyBridge+ PC
    Possible Mentor: Wind Yuan <feng.yuan@intel.com>
    Slack: fengyuan on https://intel-media.slack.com/

- Enable a debluring feature with OpenCL Design and implement CLDeblurHandler class to reduce waves caused by denoise or camera shaking in videos. Also need to add test-case.
  Difficulty: Difficult
  Skill Required: C/C++, OpenCL
  Optional Skills: Familiar with image processing
  Hardware required: IvyBridge+ PC
  Possible Mentor: Wind Yuan <feng.yuan@intel.com>
  Slack: fengyuan on https://intel-media.slack.com/

  gstreamer-vaapi:
- Add Scalable Video Encoding (SVC) support in H264 encoder

  * Difficulty: High
  * Skills Required: C
  * Useful skills: video processing
  * Hardware/Software required: Intel CPU Sandybridge or newer
  * Description: Finish the implementation of SVC support in the gstreamer-vaapi
    H264 encoder. The initial implementation needs to be cleaned up and tested,
    which is only supporting temporal svc. Implement the spatial svc encoding and
    adding bit rate control over different temporal layers are the major tasks involved.
    https://bugzilla.gnome.org/show_bug.cgi?id=725536
    https://cgit.freedesktop.org/~sree/gstreamer-vaapi/log/?h=svc-enc
    Possible mentors: Sreerenj Balachandran (sree on IRC/gnome) and
          Víctor Jáquez (ceyusa on IRC/gnome)

- Add more tuning options for adjusting the encoding quality

  * Difficulty: Medium
  * Skills Required:
  * Useful skills: video processing
  * Hardware/Software required: Intel CPU Sandybridge or newer
  * Description: Expose as many tuning options to the gstreamer-vaapi encoders as current software
  encoders expose
      Possible mentors: Sreerenj Balachandran (sree_ on IRC/gnome) and Víctor Jáquez (ceyusa on
  IRC/gnome)

- Add support for inter-view prediction in h264 MVC encoder

  * Difficulty: High
  * Skills Required: C
  * Useful skills: video processing
  * Hardware/Software required: Intel CPU Skylake or newer
  * Description: Multiview video contains a large amount of inter-view
    statistical dependencies, since all cameras capture the same scene from
    different viewpoints. Therefore, combined temporal and inter-view prediction
    is important for efficient MVC encoding. A frame from a certain camera can
   be predicted not only from temporally related frames from the same camera,
   but also from the frames of neighboring cameras. These interdependencies can
   be used for efficient prediction.
    https://bugzilla.gnome.org/show_bug.cgi?id=745096
    Possible mentors: Sreerenj Balachandran (sree_ on IRC/gnome) and Víctor Jáquez (ceyusa on
  IRC/gnome)

- Add support for decoding MVC base views only in H264 decoder

* Difficulty: Medium
  * Skills Required: C
  * Useful skills: video processing
  * Hardware/Software required: Intel CPU Sandybridge or newer
  * Description: A standard AVC conformant decoder should be able to decode the
   base view of MVC encoded streams. vaapih264dec should be able to negotiate
   MVC profiles and decode the base view if the hardware doesn't support MVC
   decoding.
   https://bugzilla.gnome.org/show_bug.cgi?id=732265
   Possible mentors: Sreerenj Balachandran (sree_ on IRC/gnome) and
           Víctor Jáquez (ceyusa on IRC/gnome)
libyami:

- Add temporal and spatial encoding support in VP9 Encoder
       Currently we have h264 temporal encoder at
  (https://github.com/01org/libyami/commit/ea0b5fd79715d0a154b79319d113cf50...) and vp9
  encoder (https://github.com/01org/libyami/blob/apache/encoder/vaapiencoder_vp9.cpp)
       Difficulty: Medium
       Skill Required: C++
       Optional Skills: Understanding of VP9 codec
       Hardware required: Intel KabyLake+ PC
       Possible Mentor: Xu Guangxin <Guagnxin.Xu@gmail.com>
       Slack: guangxin on https://intel-media.slack.com/

- Add runtime check for all hardware supported features
        We have compile time capability query function
  here(https://github.com/01org/libyami/blob/apache/decoder/vaapidecoder_host.c...). It will report
  supported decoder/encoder. Extent the API and query driver capability using
  vaQueryConfigEntrypoints, and report driver supported decoder/encoder.
        Difficulty: Medium
        Skill Required: C++
        Optional Skills: Understanding of VAAPI
        Hardware required: Intel SandyBridge+ PC
        Possible Mentor: Xu Guangxin <Guagnxin.Xu@gmail.com>
        Slack: guangxin on https://intel-media.slack.com/

- Add C APIs for Video Post Processing
        We have C API for
  decoder(https://github.com/01org/libyami/blob/apache/capi/VideoDecoderCapi.h) and
  encoder   (https://github.com/01org/libyami/blob/apache/capi/VideoEncoderCapi.h) C API P.
  Similarly Add video post process C API.
        Difficulty: Easy to Medium
        Skill Required: C++
        Hardware required: IvyBridge+ PC
        Possible Mentor: Xu Guangxin <Guagnxin.Xu@gmail.com>
        Slack: guangxin on https://intel-media.slack.com/

libyami-utils:

- Add feature to share buffers between camera and encoders
        We can read yuv frames from the camera (https://github.com/01org/libyami-
  utils/blob/master/tests/encodeInputCame...) but it will copy yuv data many times. Add zero copy
  functions to the camera input.
        Difficulty: Medium

Skill Required: C++
Optional Skills: Understanding of V4L2
Possible Mentor: Xu Guangxin <Guagnxin.Xu@gmail.com>
Slack: guangxin on https://intel-media.slack.com/

- Add C API demo application for video postprocessing and encoder
  We have decoder capi test application(https://github.com/01org/libyami-utils/blob/master/tests/vppinputdecodec...). Add vpp and encoder C API test application.
  Difficulty: Easy to Medium
  Skill Required: C++
  Optional Skills:
  Possible Mentor: Xu Guangxin <Guagnxin.Xu@gmail.com>
  Slack: guangxin on https://intel-media.slack.com/