# Python Software Foundation 2017 Google Summer of Code Application

Project: Font Reshaping and Font Fallback Support

## Sub-organization information

- **Kivy**

## Mentors

- **Akshay Arora**
- **Jacob Kovac**
- **Matthew Einhorn**

## Student Information


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## University Information

- University: The LNM Institute of Information Technology, Jaipur
- Major: Computer Science and Engineering
- Current Year: 2nd Year
- Expected Graduation date: In June 2019
- Degree: B-Tech

## Code contributions

I am  active contributor to Kivy and has been contributing to her from december 2016.Beside supporting the codebase i helped Kivy users on stackoverflow,added tutorials of Kivy on stackoverflow and spread word about Kivy on quora.

- **To kivy/kivy**
    - [WIP] Harfbuzz based Text Layout Engine integration.
    - [WIP]Pango text provider integration
    - added support for opencv 2 and 3 (camera)
    - Focus fix #4816
    - Removed textinput cursor bug #3237
    - addition of colour example.
    - Pep8 fixes for example directory.
    - corrected some leftout errors .
    - Removed intersection bug and added more functionality
    - Return statement added
- **To kivy/plyer**
    - Error catch addition
    - Linux camera feature
    - orientation feature for linux
    - adding audio feature for linux
    - barcode feature for linux
    - Maps feature for plyer
    - Audio features
    - External App browsing

## Project Abstract

- **Title:** Font Reshaping and Font fallback
- **Description:** Currently Kivy does not support **reshaping,unicode bidirectional algorithm implementation and font fallback** .The project focus on solving these problems using harfbuzz shaper,fribidi for shaping,bidi and fontconfig for font fallback.Kivy programs to illustrate the problems faced can be found here.
- This project will focus on providing a new text provider to Kivy utilizing harfbuzz

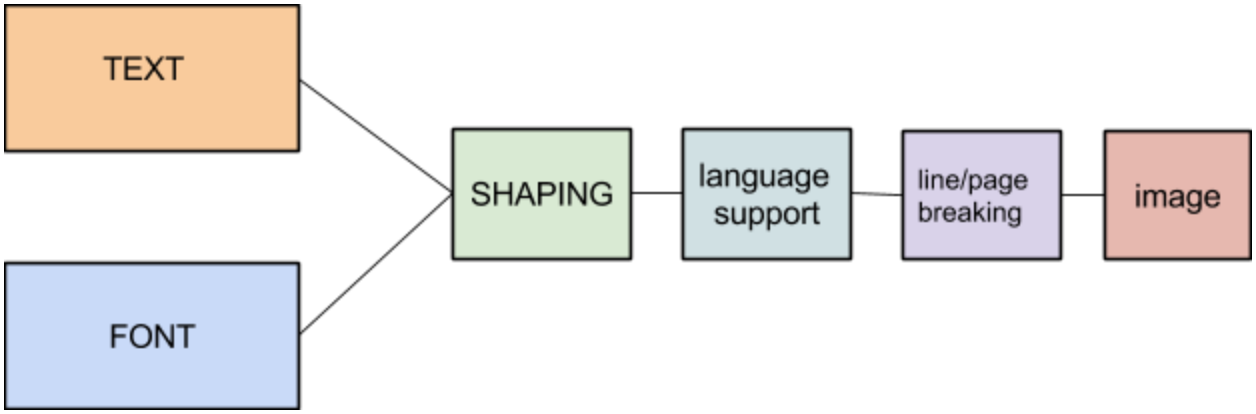
shaper.
- I have worked out  harfbuzz based programs here and  pango programs here.I have also written about text layout engines here and setting up harfbuzz with python here.

## Approaches to solve the problem:-

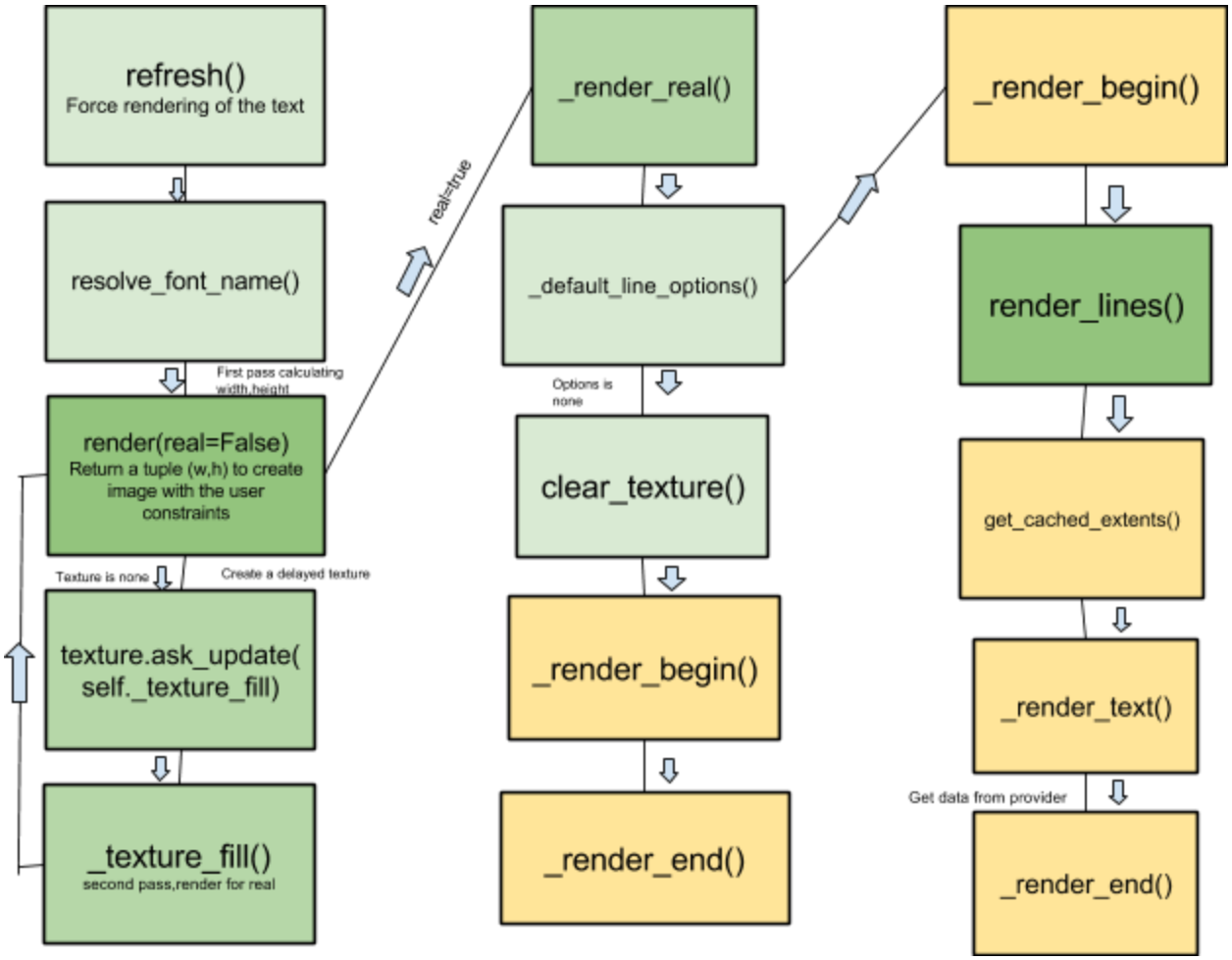
The sub points to each approaches explain why it is not fit for kivy except the last point.I have personally worked with first three approaches and the link justify it.

- **Use pango, freetype, cairo**
    - It is arguable to use pango to solve kivy current text shaping and bidi problems.
    - High list of dependencies.
    - Cairo  will not work if background is transparent which is must for kivy
    - No full control on font selection
- **Use harfpy, qahirah(python bindings for cairo), pybidi and python_freetype by** Lawrence D'Oliveiro
    - It uses ctypes for python bindings.
    - ecosystem of all above softwares is required.
- **Using default python bindings of harfbuzz, pycairo and freetype(make our own python bindings)**
    - Cairo is being used here,the reason against is stated above
- **Using fribidi shaper**
    - FriBidi only does shaping for Arabic/Persian and Hebrew. It is basically because all the glyphs for those languages have a unicode number the shaping can be done without checking any font table.
- **Create python bindings for harfbuzz using cython, create python bindings for freetype using cython and use sdl (most functions required are wrapped already), fribidi for bidi.**
    - This is the best approach till now in case of kivy and harfbuzz is cross platform.
    - https://bugzilla.libsdl.org/show_bug.cgi?id=3046  sdl_ttf + harfbuzz
    - https://bugzilla.libsdl.org/show_bug.cgi?id=3211 using libraqm library

## Basic layout:-



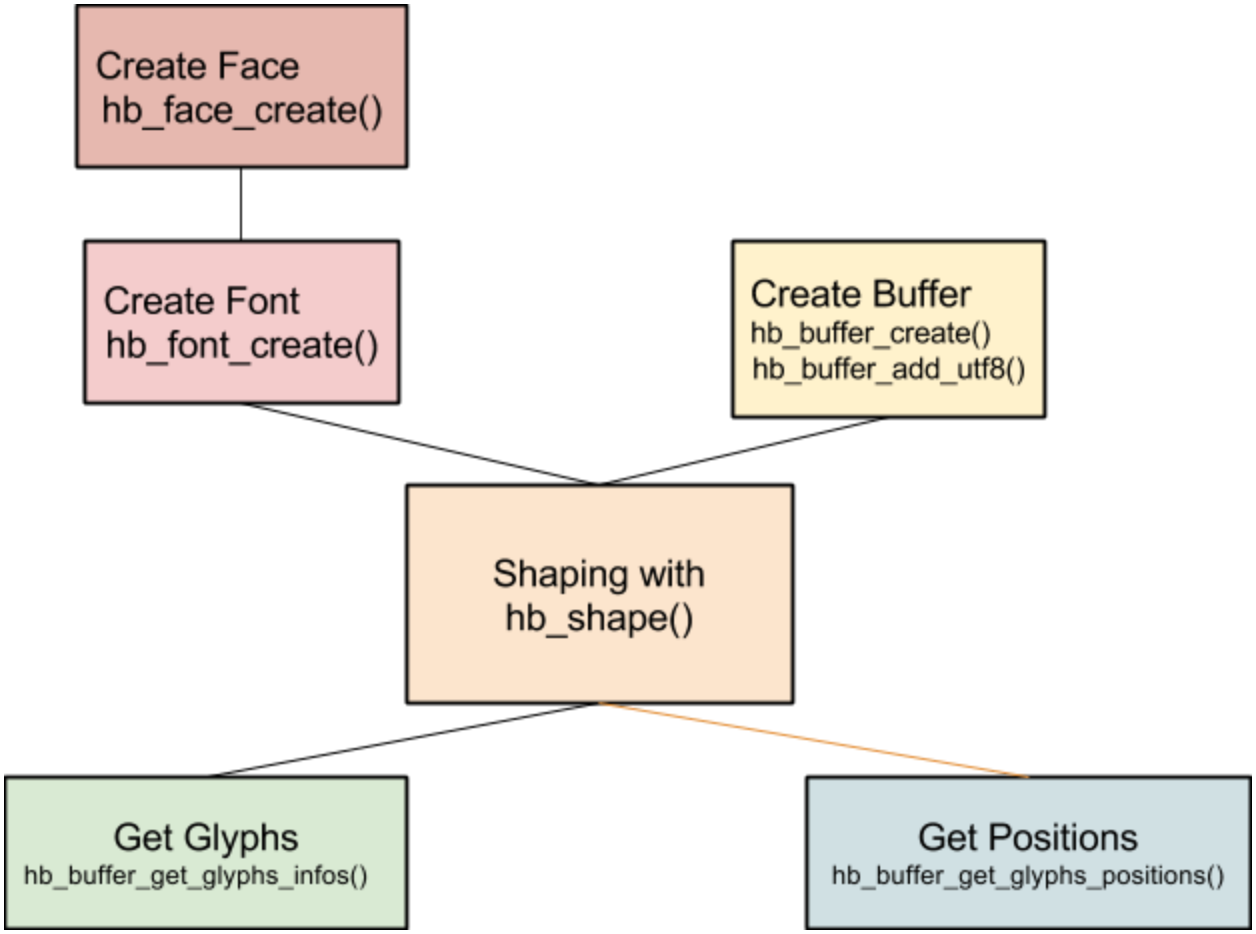

Understanding Kivy text system:-




The following flowcharts **roughly** depicts the functions flow in kivy text.Green color represent my level of understanding those functions.The darker the green color the less understanding i have  for the functions.These all will be replaced by the lightest green

color before the community bonding period.The yellow color box represent the functions those need to be populated while making a new text provider with harfbuzz shaper and bidi logic.Render() and render_line() inside call various functions like get_extents,shorten() and utilizes LayoutWord() and layout_text() internally.

## Basic Harfbuzz shaping:-




## Implementation details:-

It will be designed as new text provider with close resemblance to Kivy's current sdl text provider.Since kivy lacks Complex text layout and bidi capabilities, it need to be solved with harfbuzz shaper and fribidi.I will be writing a new text provider with harfbuzz shaper and fribidi it itself opens new world of possibilities like ( harfbuzz, freetype, fribidi, sdl ) with own python wrapper using cython, (sdl_ttf+harfbuzz+self logic for bidi)

and sdl_ttf + libraqm(contains harfbuzz and fribidi) , help_link.Therefore keeping all these things in mind we need to make new text provider.The new text provider will be designed in such a way that it does not have merging issues with current sdl text layout.I will be taking inspiration from these code1,code2,code3 to populate the logic in get_extents(), _render_begin(), _render_text(), _render() in the text_harfbuzz.py.All the wrapped functions will kept in _text_harfbuzz.pyx which will contain wrapped sdl+sdl_ttf+fribidi( for bidi)+harfbuzz.There can be possibility of using libraqm, if so it will be wrapped and integrated.

Font fallback support will be designed in such a way that it will be independent of text providers.I will be using fontconfig for unix like system.

## Timeline and List of Deliverables

- **Community Bonding Period**
    - I will try to get in touch with harfbuzz and freetype community and will strengthen the existing bond between with mentors and developers of Kivy
    - More precise i will try to get in touch with Behdad, Kelvin13 and khaledhosny pioneers in harbuzz.(olymyk and kived)
    - I will try to master and research more on text layout engines, complex text layout and terminologies, harfbuzz, pango, cairo, fontconfig, freetype and Kivy's current text layout engine.
- **May 30 - June 30,2017 (solving text shaping problem phase)**
    - Setup freetype and freetype fontface
    - Setup harfbuzz-freetype font
    - Create harfbuzz buffer and populate it.
    - Call harfbuzz shape on buffer.
    - Retrieve glyph information and positions out of buffer and conversions
    - Drawing will be handle via cairo/sdl.
    - Set up cairo surface and cairo fontface with freetype (if using cairo).
    - Integrate in kivy new text providers.
    - inspiration code
    - **Milestone 1: New text provider solves shaping problems.**
- **May 28 - June 30,2017**
    - Write a blog report about my progress.
    - Remove pep8 errors,put proper comments and docs.
    - Get the work done ready for first evaluations.

- **July 1 - June 24,2017 (Solving Bidi problem phase)**
    - Some inspiration will be taken from kived's pr and will respect the comments mentioned in prs thread.(i discovered this pr in irc logs and was surprised how my research work and comments were intersected,which means i am on right track)
    - Do a friBiDi pass
    - Direction of every character will be identified using l2v list.
    - The text will be divided in monodirectional runs.
    - lowest visual position (LVP),logical position (LLP) will be saved for each run.
    - Shape every segment separately.
    - Using the LVP sort the segments
    - Add the LLP to the cluster of every glyph.
    - Inspiration code
    - **Milestone 2:  New text provider solves shaping and bidi problems.**
- **July 24 - July 28,2017**
    - Write a blog report about my progress.
    - Remove pep8 errors,put proper comments and docs.
    - Get the work done ready for second evaluations.
- **July 28 - August 21,2017 (supporting font fallback phase)**

  This is the area where my research falls short and have very basic working knowledge  of font fallback support.This will be compensated before the community bonding period.While reading previous year irc logs i realized  Kived was working with bidi and was about to push font fallback support commits on his pr.Therefore i would need some inputs on this topic from developers and mentors.Mozilla and firefox have good font fallback strategies .Therefore I will be studying their font fallback strategies.HarfBuzz-driven font fallback in chromium is done  similar to what LibreOffice does ie it  shapes with HarfBuzz and the primary font, detect graphemes that need fallback and sort them into contiguous runs, recursively handle them using the rest of the font fallback chain.Even pango utilizes fontconfig for font fallback.

    - Font fallback support for unix like system will be implemented via fontconfig.
    - Confirm the works of https://github.com/kivy/python-for-android/pull/378
    - **Milestone 3: Font fallback support added to kivy**
- **August 21 - August 29,2017**

    - Write a blog report about my progress.
    - Remove pep8 errors,put proper comments and docs.
    - Get the work done ready for final evaluations.

## Motivation:-

I have designed the proposal based on my current skills,knowledge and research.There might be possibility there are some mistakes or the approach may be wrong.Since gsoc is roughly three months period and but i have a headstart of around two months from present day.This brings me period of roughly around five months.During this period i will try to grow my skills,knowledge and research in this direction.Why i guarantee this is because learning new skills and applying them for betterment and productive causes has always been my passion.

## Other Commitments

- Have you applied to any other organization? No.
- Do you have any other commitments during the main GSoC time period? No.
- Do you plan to have any other jobs or internships during this period? No
- Do you have exams or classes that overlap with this period?
    - I will commit more than 7 hours from Monday to Friday and every alternate weekend.
    - I have end sem exams from 27 april to 2nd may.
    - My next semester will start from mid-July, still i will be able to work 5-6 hours a day.