Data Flow Diagram One: Digitize Lineaments, Perform QC, and Establish and Extract Drainage Network for Mars

Necessary Modules Needed to Import Data and Setting ArcGIS Environment (Working Directory)

In [ ]:
```
import arcpy # Useful and productive way to perform geographic data analysis, data conv
import os # Provides a portable way of using operating system dependent functionality
import io # Using different input/output systems
import requests # Allows you to send HTTP requests
```

In [ ]:
```
arcpy.env.workspace # Parameterizes the workspace for data to be outputted with ArcPy
```

Out[ ]:
```
'C:\\Users\\Alexander Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\FinalProject\\F
inalProject\\Default.gdb'
```

In [ ]:
```
Working_Directory = r'C:\Users\Alexander Danielson\Desktop\Fall 2022Spring2023\ArcGIS I
```

ETL For CTX/HiRISE Swaths of Interested Geology

Extraction of CTX/HiRISE Images

First CTX Image

In [ ]:
```
CTX_DataPageI = r'http://viewer.mars.asu.edu/planetview/inst/ctx/B19_017188_1768_XN_03S
# Assign variable to data page for first CTX raster in data comparison analysis.
```

In [ ]:
```
CTX_Image_I = r'http://pds-imaging.jpl.nasa.gov/data/mro/mars_reconnaissance_orbiter/ct
# Assign variable to TIFF file for download.
```

In [ ]:
```
CTX_OBJI = requests.post(CTX_Image_I)
CTX_OBJI
# Sending a post request to TIFF file download and getting a valid reponse back.
```

Out[ ]:
```
<Response [200]>
```

In [ ]:
```
PATHCTXIMAGEI = os.path.join(Working_Directory, 'CTXMarsImageI.IMG')
PATHCTXIMAGEI
# Creating output file name for first CTX raster (where the file will be saved) assigne
```

Out[ ]:
```
'C:\\Users\\Alexander Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\FinalProject\\F
inalProject\\CTXMarsImageI.IMG'
```

In [ ]:
```
with open(PATHCTXIMAGEI, 'wb')as f:
    f.write(CTX_OBJI.content)
# Writing (. content of) Response from Post Request to Disk/Directory.
```

Second CTX Image

In [ ]:
```
CTX_DataPageII = r'http://viewer.mars.asu.edu/planetview/inst/ctx/B06_011914_1620_XI_18
# Assign variable to data page for first CTX raster in data comparison analysis.
```

In [ ]:
```
CTX_Image_II = r'http://pds-imaging.jpl.nasa.gov/data/mro/mars_reconnaissance_orbiter/c
# Assign variable to TIFF file for download.
```

In [ ]:
```
CTX_OBJII = requests.post(CTX_Image_II)
CTX_OBJII
# Sending a post request to TIFF file download and getting a valid reponse back.
```

Out[ ]:
```
<Response [200]>
```

In [ ]:
```
PATHCTXIMAGEII = os.path.join(Working_Directory, 'CTXMarsImageII.IMG')
PATHCTXIMAGEII
# Creating output file name for first CTX raster (where the file will be saved) assigne
```

Out[ ]:
```
'C:\\Users\\Alexander Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\FinalProject\\F
inalProject\\CTXMarsImageII.IMG'
```

In [ ]:
```
with open(PATHCTXIMAGEII, 'wb')as f:
    f.write(CTX_OBJII.content)
# Writing (. content of) Response from Post Request to Disk/Directory.
```

Third CTX Image

In [ ]:
```
CTX_DataPageIII = r'http://viewer.mars.asu.edu/planetview/inst/ctx/N08_065597_1949_XN_1
# Assign variable to data page for first CTX raster in data comparison analysis.
```

In [ ]:
```
CTX_Image_III = r'http://pds-imaging.jpl.nasa.gov/data/mro/mars_reconnaissance_orbiter/
# Assign variable to TIFF file for download.
```

In [ ]:
```
CTX_OBJIII = requests.post(CTX_Image_III)
CTX_OBJIII
# Sending a post request to TIFF file download and getting a valid reponse back.
```

Out[ ]:
```
<Response [200]>
```

In [ ]:
```
PATHCTXIMAGEIII = os.path.join(Working_Directory, 'CTXMarsImageIII.IMG')
PATHCTXIMAGEIII
# Creating output file name for first CTX raster (where the file will be saved) assigne
```

Out[ ]:
```
'C:\\Users\\Alexander Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\FinalProject\\F
inalProject\\CTXMarsImageIII.IMG'
```

In [ ]:
```
with open(PATHCTXIMAGEIII, 'wb')as f:
    f.write(CTX_OBJIII.content)
# Writing (. content of) Response from Post Request to Disk/Directory.
```

Fourth CTX Image

In [ ]:
```
CTX_DataPageIV = r'http://viewer.mars.asu.edu/planetview/inst/ctx/N08_065596_2043_XI_24
# Assign variable to data page for first CTX raster in data comparison analysis.
```

In [ ]:
```
CTX_Image_IV = r'http://pds-imaging.jpl.nasa.gov/data/mro/mars_reconnaissance_orbiter/c
# Assign variable to TIFF file for download.
```

In [ ]:
```
CTX_OBJIV = requests.post(CTX_Image_IV)
CTX_OBJIV
# Sending a post request to TIFF file download and getting a valid reponse back.
```

Out[ ]:
```
<Response [200]>
```

In [ ]:
```
PATHCTXIMAGEIV = os.path.join(Working_Directory, 'CTXMarsImageIV.IMG')
PATHCTXIMAGEIV
# Creating output file name for first CTX raster (where the file will be saved) assigne
```

Out[ ]:
```
'C:\\Users\\Alexander Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\FinalProject\\F
inalProject\\CTXMarsImageIV.IMG'
```

In [ ]:
```
with open(PATHCTXIMAGEIV, 'wb')as f:
    f.write(CTX_OBJIV.content)
# Writing (. content of) Response from Post Request to Disk/Directory.
```

Fifth CTX Image

In [ ]:
```
CTX_DataPageV = r'http://viewer.mars.asu.edu/planetview/inst/ctx/B19_017188_1768_XN_03S
# Assign variable to data page for first CTX raster in data comparison analysis.
```

In [ ]:
```
CTX_Image_V = r'http://pds-imaging.jpl.nasa.gov/data/mro/mars_reconnaissance_orbiter/ct
# Assign variable to TIFF file for download.
```

In [ ]:
```
CTX_OBJV = requests.post(CTX_Image_I)
CTX_OBJV
# Sending a post request to TIFF file download and getting a valid reponse back.
```

In [ ]:
```
PATHCTXIMAGEV = os.path.join(Working_Directory, 'CTXMarsImageI.IMG')
PATHCTXIMAGEV
```

```
# Creating output file name for first CTX raster (where the file will be saved) assigne
```

In [ ]:
```
with open(PATHCTXIMAGEV, 'wb')as f:
    f.write(CTX_OBJV.content)
# Writing (. content of) Response from Post Request to Disk/Directory.
```

Suitability Analysis/Geological Implications: Which Digital Product shows more conducive results for Geomorphology on surface Mars For Lineaments? (Slope, Aspect, or Hillshade)

Import Current Shapefile Lineaments to Deafult Geodatabase that have being Digitized for each Digital Product (and the imagery used to make inferences upon)

In [ ]:
```
arcpy.conversion.FeatureClassToGeodatabase("AspectLinear;HillshadeLinear;SlopeLinear;st
#Vector features imported
```

Out[ ]:
Messages

In [ ]:
```
arcpy.conversion.RasterToGeodatabase("slopemars;hillelemars;aspectmars", r"C:\Users\Al
#Raster features imported
```

Out[ ]:
Messages

Develop Fluvial Network for Mars

In [ ]:
```
out_flow_direction_raster = arcpy.sa.FlowDirection("elevofmars", "NORMAL", None, "D8
#Flow Direction of Mars
```

In [ ]:
```
out_accumulation_raster = arcpy.sa.FlowAccumulation("FlowDir_Mars", None, "FLOAT", "
#Flow Accumulation of Mars with Float
```

In [ ]:
```
arcpy.ddd.Times("FlowAcc_Mars", "FlowDir_Mars", r"C:\Users\Alexander Danielson\Deskt
#Times the Flow Direction and Flow Accumulation Raster together to produce part of t
```

Out[ ]:
Messages

In [ ]:
```
out_raster = arcpy.ia.Log10("Times_FlowAcc"); out_raster.save(r"C:\Users\Alexander
# Creates 0 in cell values for calucalting river/stream order in following step for
```

In [ ]:
```
arcpy.ddd.Reclassify("Log10_TimesFlowDirecAcc", "VALUE", "0 1.850321 1;1.850321 6.7
# Relcassify for 4 classes for Stream order based on Strahler Order
```

Out[ ]:

Messages

In [ ]:
```
out_raster = arcpy.sa.StreamOrder("Reclass_Log", "FlowDir_Mars", "STRAHLER"); out_
```