

DICOM currently defines Image IODs by storing the rows and columns as unsigned short integer. This means that an image can only be at most of size $2^{16} * 2^{16}$ pixels. This is a limitation for eg. Microscopy Images as, for example, typical Whole Slide Images can be 80,000 * 60,000 pixels. Since images are generally stored with 24-bit color pixels, this means WSI can go up to 15 Gb and for multiple Z planes it will go more than this. In addition to these “hard” restrictions, another consideration is that entire WSI objects are not accessed all at once. Typically for viewing applications a client requests image data incrementally from a server, at random, supporting rapid panning and zooming without first transmitting and storing the entire WSI object to the client.

To solve the above problems, we need some solutions which are listed below:

1. Provide a way to store large size images (WSI).
2. Support rapid panning and zooming.

These tasks can be divided in three parts.

- 1) **WSI Storage:** We can come over the limitation of rapid panning by Storing images with a tiled organization and for rapid zooming the WSI consists of multiple images at different resolutions as shown in Figure1.

To come over the 32 bit limitation we can **store the individual “tiles” of a WSI pyramid as individual frames in a DICOM multi-frame image object**. Multiple resolution images are needed or desired for the WSI, each “level” is stored separately in the series. As shown in figure1:

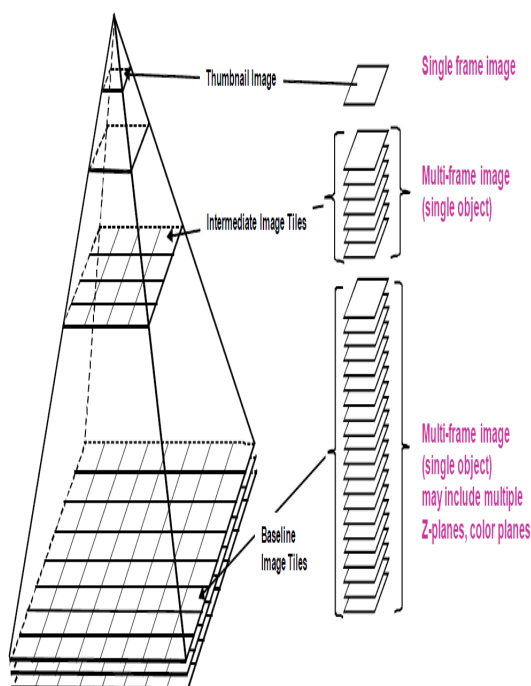


Figure : 1

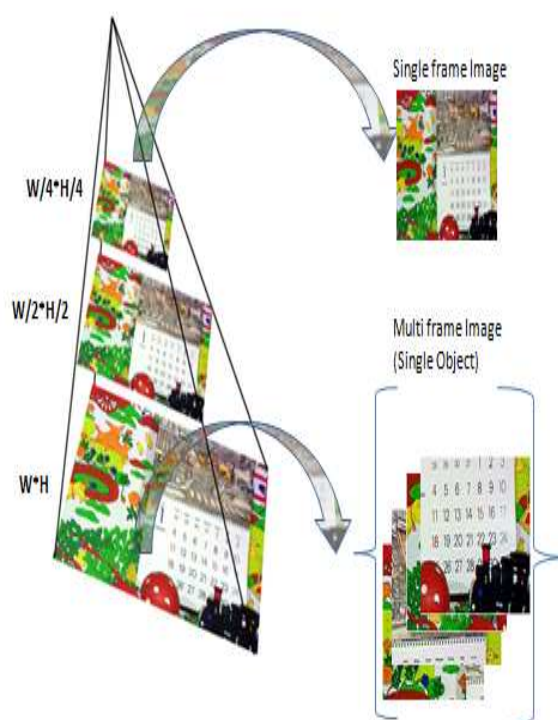


Figure -2 (Example of figure 1 with 4 tiles at higher resolution)

Each image in the pyramid may be stored as a series of tiles, to facilitate rapid retrieval or arbitrary subregions of the image. WSI consists of multiple images at different resolutions (the “altitude” of the pyramid corresponds to the “zoom level”).

2) The WSI Information object Definition(IOD):

It is necessary to provide a description of the “mapping” from images in the DICOM series to the tiles in the conceptual WSI pyramid. There are also metadata(optical path, frame of reference) useful for pathology applications which should be stored for the overall image object, each pyramid level, and [possibly] each tile. The role of the WSI IOD is to provide a repository for these data, consisting primarily of the tile map and image or tile metadata.

To implement the above we need to extend GDCM library and **new DICOM IOD will be created** to describe the sequence of images within the series, indicating which images and tiles are present. This IOD will be known as the WSI IOD, and will contain a “data map” describing which data are present and how they are stored within the DICOM series.

3) WSI image data access:

For accessing WSI image data client connects to a server encapsulating the WSI image, retrieves the WSI IOD (“data map”), and then accesses individual images from within the WSI series as needed. To facilitate navigation across the WSI data set (series) WSI IOD proposes a LOCALIZER “image flavor” as a visual guide to the various resolution levels and tiles/frames within those levels, Although DICOM does not specify display application behavior, the Multi-Resolution Navigation Module in the localizer image provides sufficient information for an application to navigate through all frames of images in the series. It identifies the corresponding location in the localizer image of all frames, and provides their salient characteristics (resolution, color, Z-plane).