Since the first devices with tomographic capabilities where developed in the early 70's, medical imaging has become a cornerstone of modern medicine in many disciplines: oncology; traumatology, muskoskeletal disorders, etc. Currently imaging is critical for diagnosis and a better evaluation of the treatment effects.

Since their conception, the temporal and spatial resolutions of many image modalities have increase to the point where we may state that information is no longer 3D but 4D. This fact has a significant impact on the data size that has to be processed, i.e. a 512x512x512 3D hearth image takes 512 MB of memory while 10.7 GB would be needed to store a full cycle with 20 frames. A 11 x 11 x 11 filter convolution requires ~179 billion multiply add operations in the 3D volume while a 11 x 11 x 11 x 11 filter would requires ~39 trillion multiply add operations in the 4D volume.

The generation of such datasets has become possible thanks to the development of advanced data acquisition front-ends, incorporating advanced real time signal processing algorithms to transform the raw signal into an image, as well as to the development of new processing programmable architectures, optimized for image processing, which allow the implementation of sophisticated algorithms to reconstruct the image. As 3D and 4D processing is becoming common, the implementation of tasks such as image segmentation, registration, denoising or filtering, with an increasing demand of computational power, is progressively evolving towards the cloud.

In this session we will evolve from the micro to the macro, starting with the architecture of modern field programmable electronics that have made possible the incorporation of complex real time digital signal processing as part of the acquisition front end, and ending with the architecture of modern computers and the increasing need for parallel programming to maximize the use of existing resources.