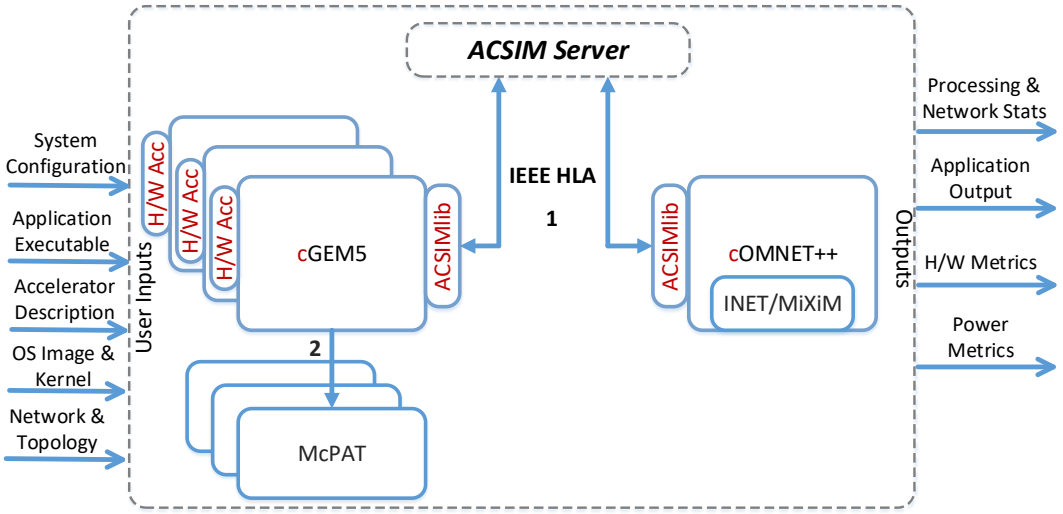
A Novel, Simulator for Heterogeneous Cloud Systems that incorporate Custom Hardware Accelerators

The growing use of **hardware accelerators** in both embedded (e.g. automotive) and high-end systems (e.g. Clouds) **triggers an urgent demand for simulation frameworks that can simulate in an integrated manner all the components** (i.e. CPUs, Memories, Networks, Hardware Accelerators) of a system-under-design (SuD). By utilizing such a simulator, software design can proceed in parallel with hardware development which results in the reduction of the so important time-to-market. The main problem, however, is that currently there is a shortage of such simulation frameworks; most simulators used for modelling the user applications (i.e. full-system CPU/Mem/Peripherals) lack any type of support for tailor-made hardware accelerators. **ACSIM framework is the first known open-source, high-performance simulator that can handle holistically system-of-systems including processors, peripherals, accelerators and networks.**

The ACSIM Framework



ACSIM is built on top of several well-established simulators:

- **GEM5**, a state of the art full-system simulator, to simulate the digital components of each processing node in the simulated system
- **OMNET++**, which is an established network simulator, to simulate the real networking infrastructure
- **McPAT/ MiXIM** to provide energy and power consumption estimations
- **Accellera** simulation framework, which is an established SystemC simulator approved by the IEEE Standards Association, to simulate the H/W Accelerator components

To bind the whole framework together, ACSIM employs the *HLA architecture* through the **open-source CERTI package**. Specifically, ACSIMlib has been developed to enable the interoperability between cGEM5/cOMNET++ and CERTI/HLA.

Framework features

Integrated Simulation Framework: An innovative flow to enable the designer to simulate complete Systems (i.e. CPU, Network, Hardware Accelerators) within one simulation framework**.**

Global Synchronization: A novel global synchronization scheme which takes into account the trade-off between the simulation speed and the simulation accuracy.

Performance: *Parallel execution* support taking advantage of *multi-core/processor systems as well as distributed systems*.

Usability: A unified sophisticated *Eclipse-based GUI* has been developed to provide easy simulation set-up, execution and visualization of results.