Computer Architecture Group

Our general research targets …

- **Scalable reconfigurable research platform**
- **Employ and enhance RTR technologies**
- **(Standardized) OS interface/programming model for accelerator usage**
- **Investigate applications that benefit from accelerator technologies**

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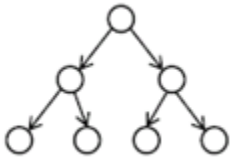
Project idea

Offloading Non-Blocking Collectives (NBCs) on EXTOLL

[GOAL /EXTOLL]:

-Most scientific applications use collective communication calls to optimize data exchange



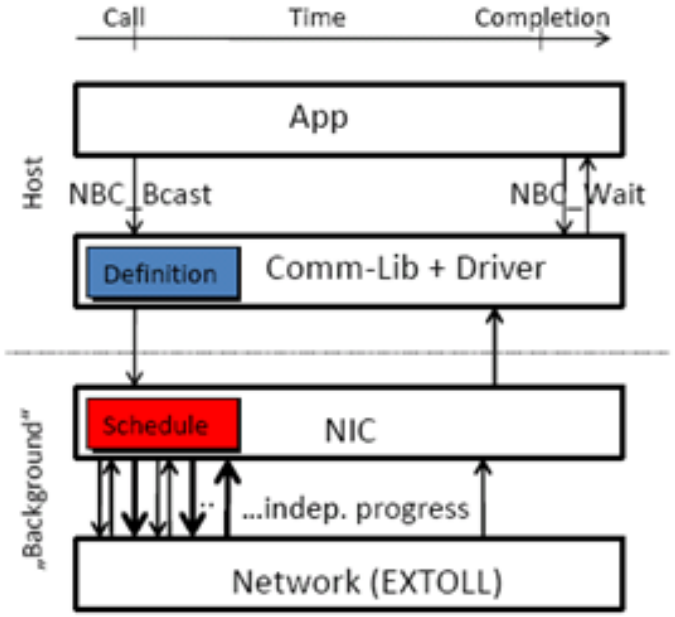
Broadcast

-Their performance is critical to application scaling on large processor partitions

-There are blocking and **non-blocking** collectives (MPI-3 draft)

Proposal: Separation of definition and execution

-NBCs can make progress in the background
when being **offloaded** to the NIC



Definition: Choose the best algorithm + assemble set of schedules
Schedule : Execute schedules indepedently and dynamically

A two-step approach

-For reasons of optimization and flexibility
a two-step approach is taken

-In the **definition** step the host (Comm-Lib)
selects an appropriate algorithm and

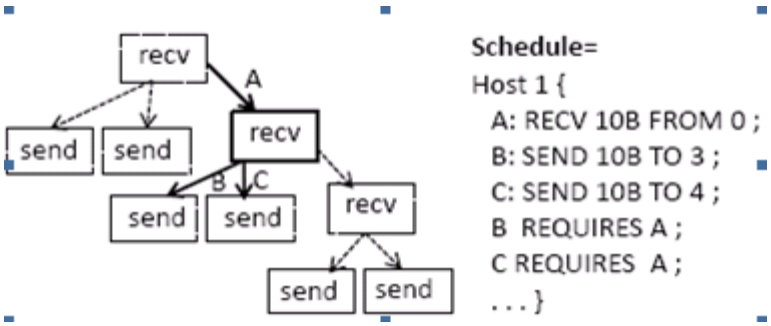
-Generates sets of ordered communication
primitives (**schedules)**

-Which are offloaded to the NIC

NIC dynamically executes schedules

-Communication operations and dependencies are expressed as a graph

-That is stored in binary format [GOAL]



-NIC runs an interpreter for these schedules

Optimized processing by dynamic scheduling

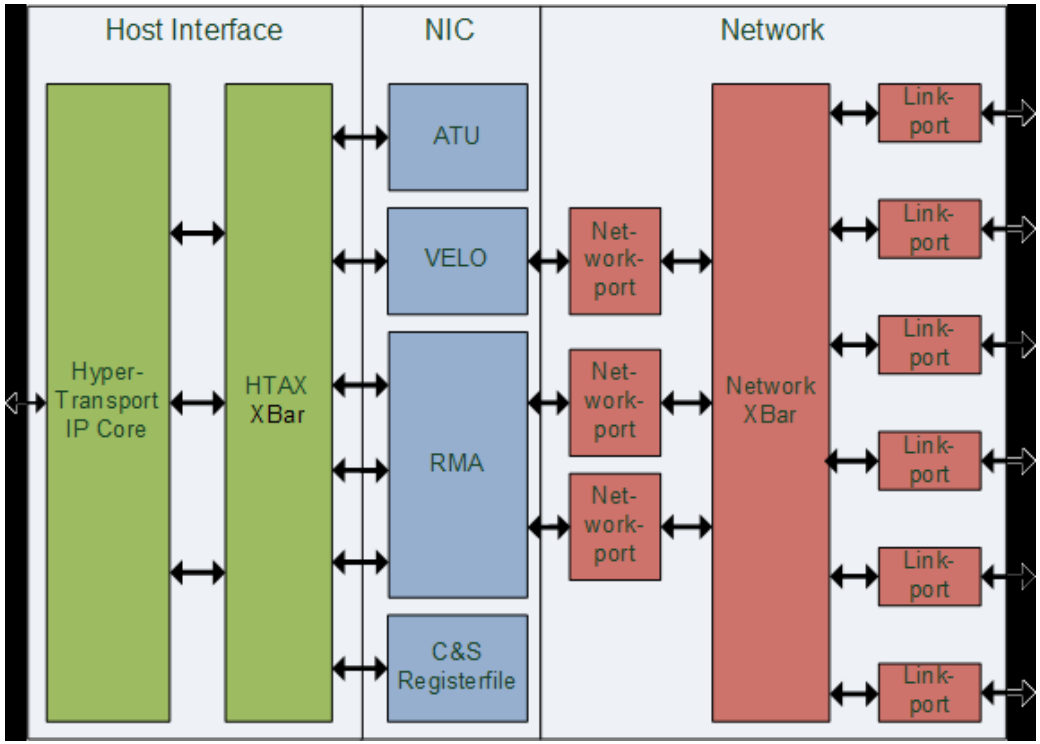
-Schedules can be executed in any topological order (optimization) on the NIC

-Taking into account e.g. current network load and process arrival patterns for optimized processing

-Less switches between App, Lib, and NIC causes less communication overhead

-Side-Band Interface of the EXTOLL-NIC allows for modification of the interpreter(hardware)

EXTOLL Hardware Architecture Overview [EXTOLL]



Ref.
[GOAL]: T.Hoefler et al: .: **Group Operation Assembly Language – A Flexible Way to Express Collective Communication.** ICPP-2009, Sep.2009

[EXTOLL]: U.Brüning: EXTOLL. Computer Architecuture Group, University of Heidelberg, Germany, 2009
http://ra.ziti.uni-heidelberg.de/index.php?page=projects&id=extoll

[GOAL /EXTOLL]: T. Schneider: **Offloading Nonblocking Collectives on ExToll via GOAL**. Research proposal, Computer Architecture Group, University of Technology Chemnitz, Germany, 24 Sept 2009.