Embedded Distributed Systems:

A Case of Study

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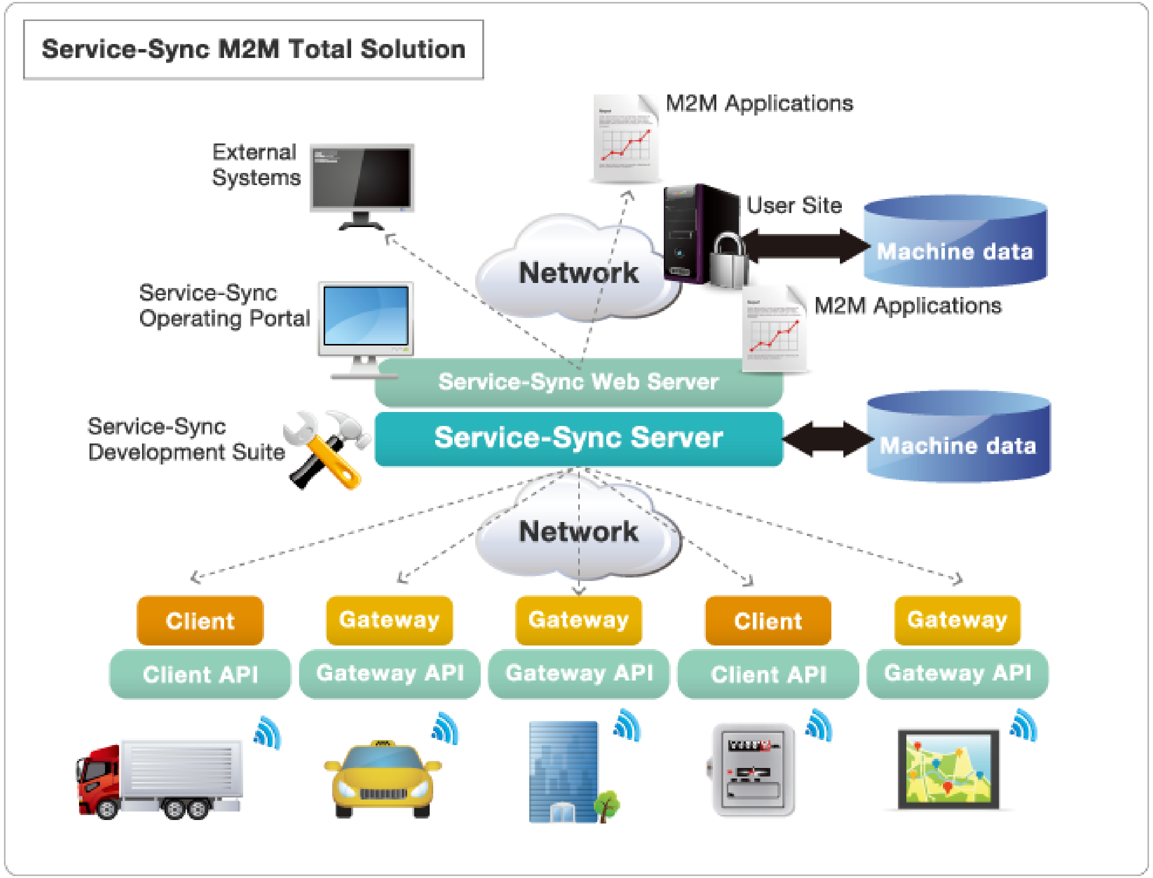
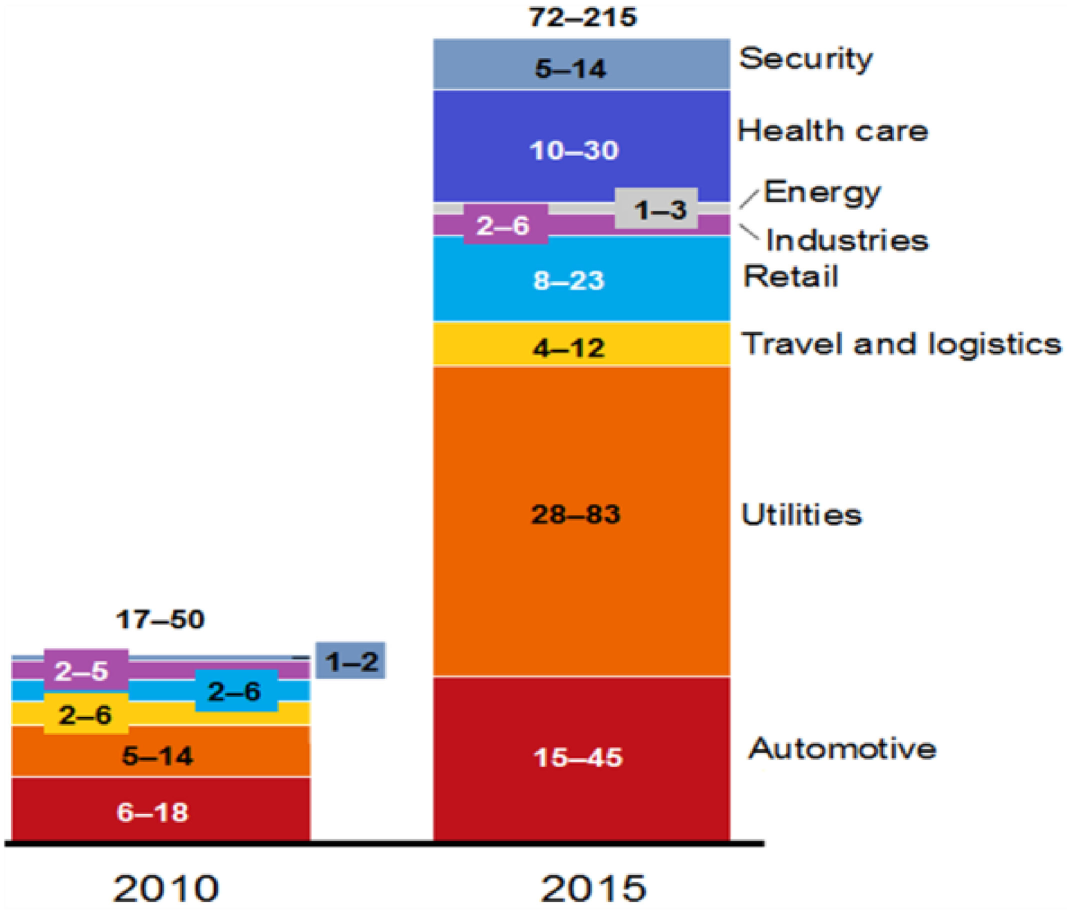
The rise of embedded & IoT ....



http://www.yourinventit.com/en/product/ServiceSync/summary/ServiceSync-platform.html

The rise of data ....



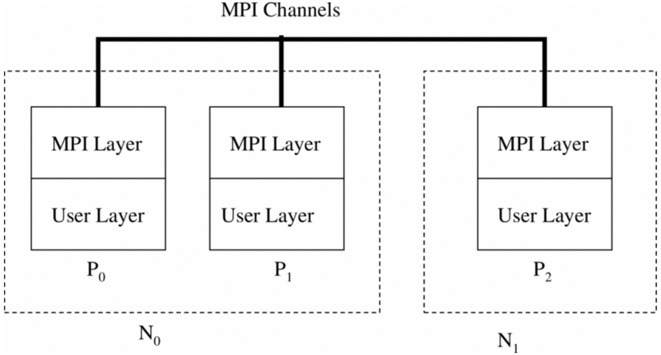
http://www.nojitter.com/post/240152248/big-data-internet-of-things-the-network-impact

The rise of real problems …

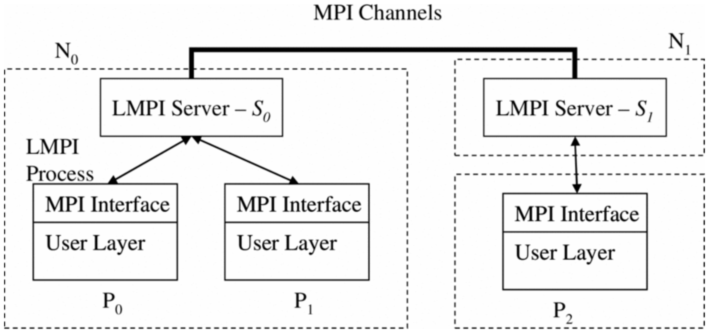
“The total amount of user data (data payload) to be stored or processed doubles every two years”

“Boeing 787s to create half a terabyte of data per flight, says Virgin Atlantic”

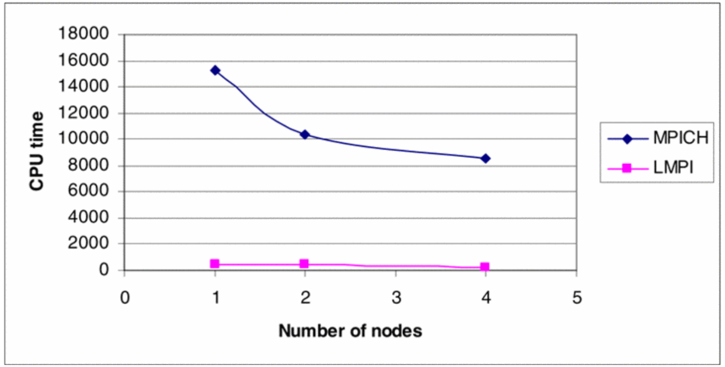
We are not the first one…. LMPI



An example of a traditional MPI.



An example of the LMPI system.

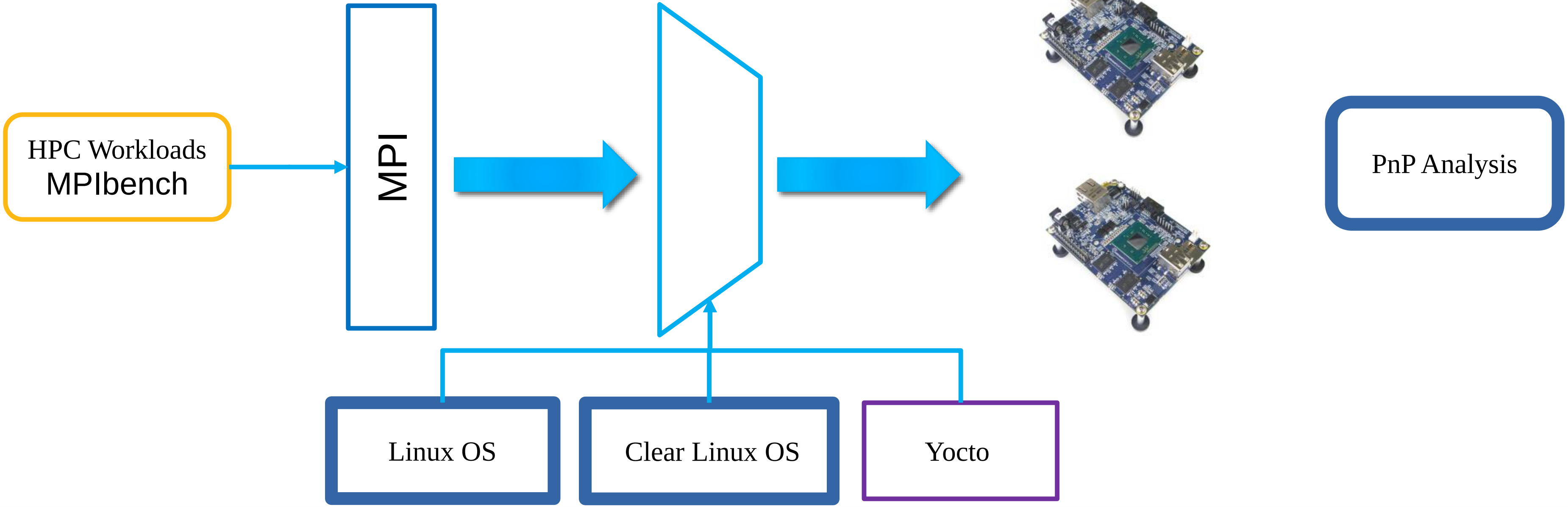


The CPU time with different number of nodes in Jacobi with 4 processes

We *might* not need a server

The main objective of this work will be to prove that some distributed embedded system can coordinate itself to process its own data with out the need of an external HPC system.

Experiment 1



Justification

- By definition: A distributed system consists of a collection of autonomous computers, connected through a network and distribution middle-ware, which enables computers to coordinate their activities and to share the resources of the system, so that users perceive the system as a single, integrated computing facility

Advantages

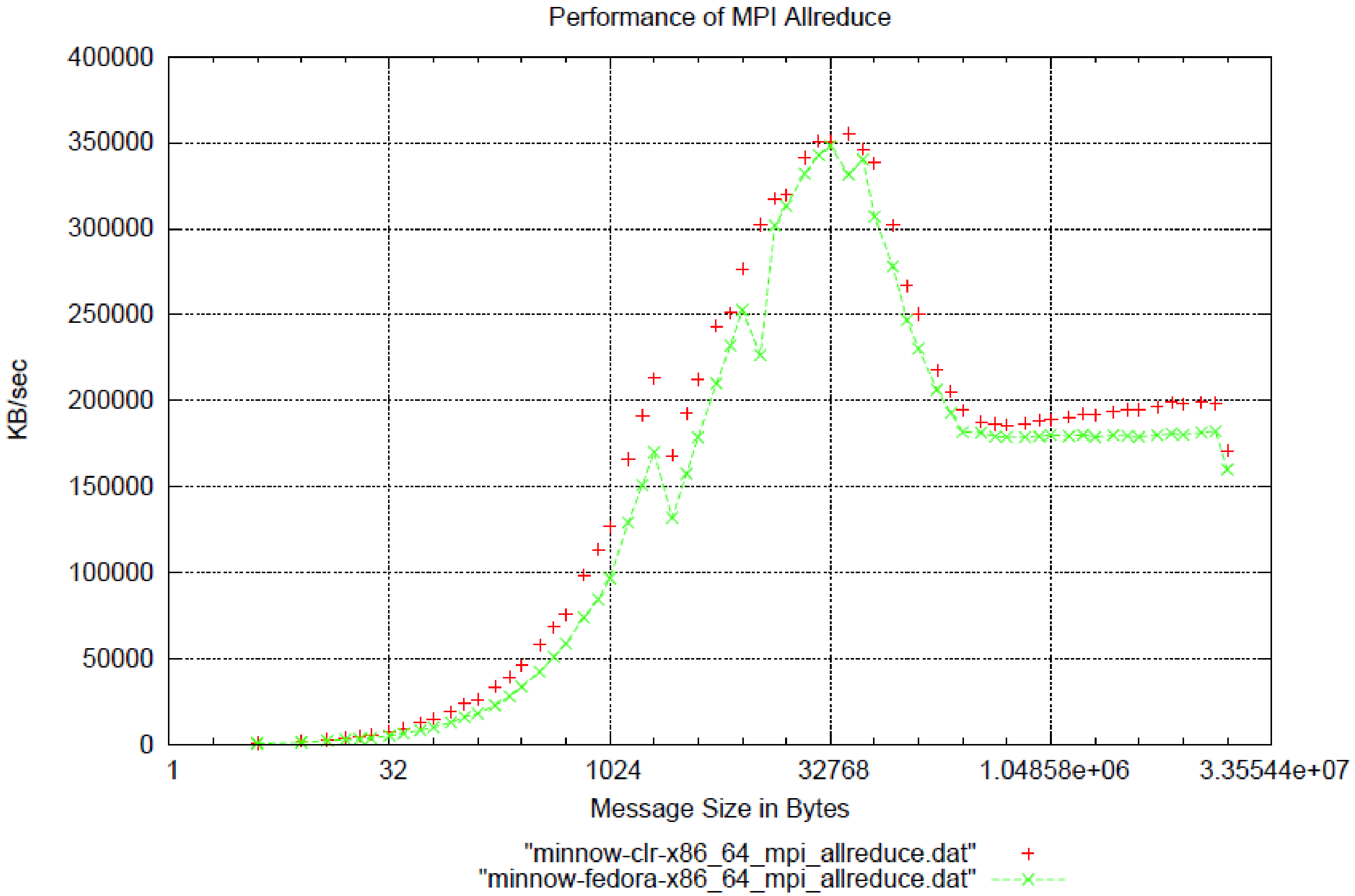
- Partitioned Workload:
- Heterogeneous HW:

Disadvantages

- Network:
- Lack of optimized OS:

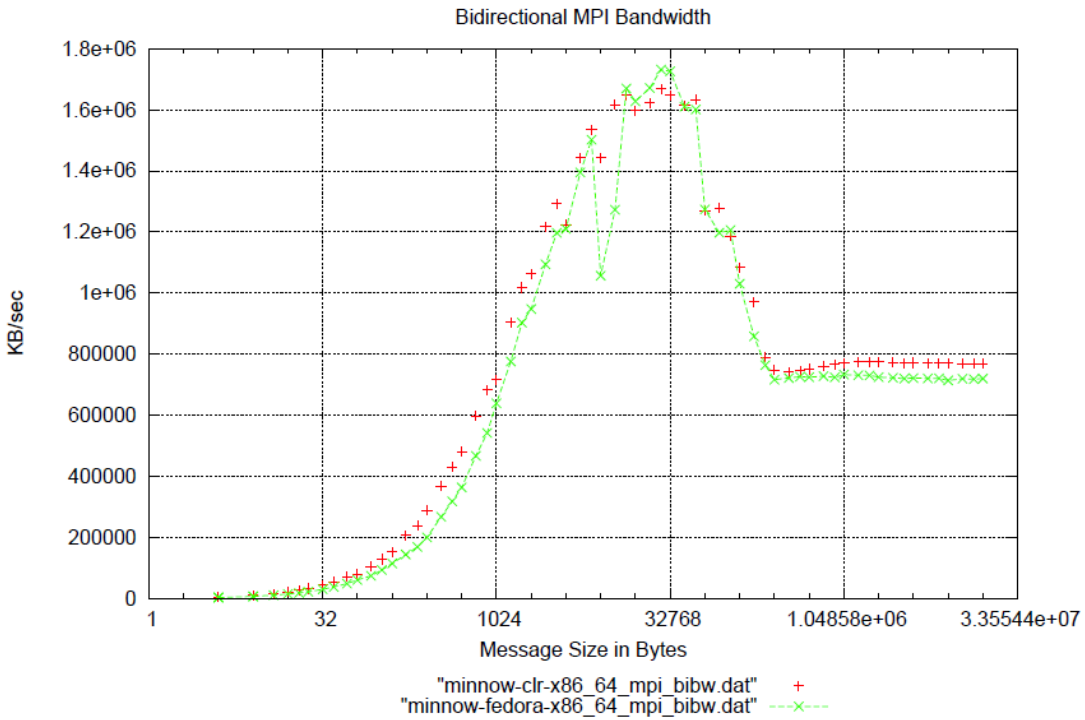
Results

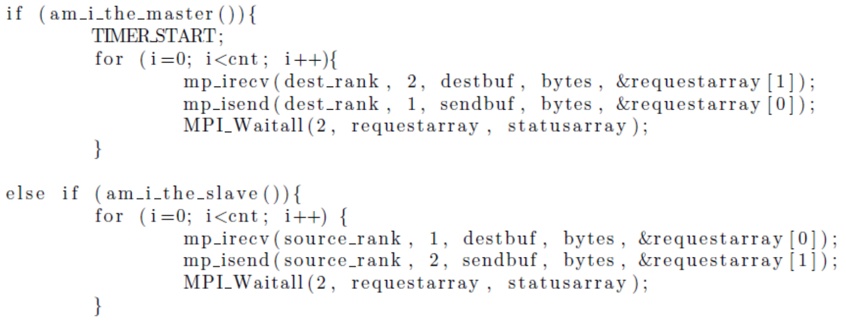
All Reduce



Results

Bidirectional Bandwidth

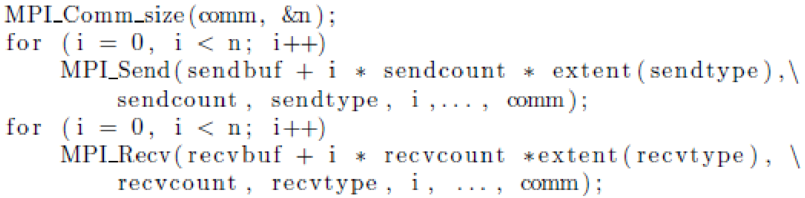




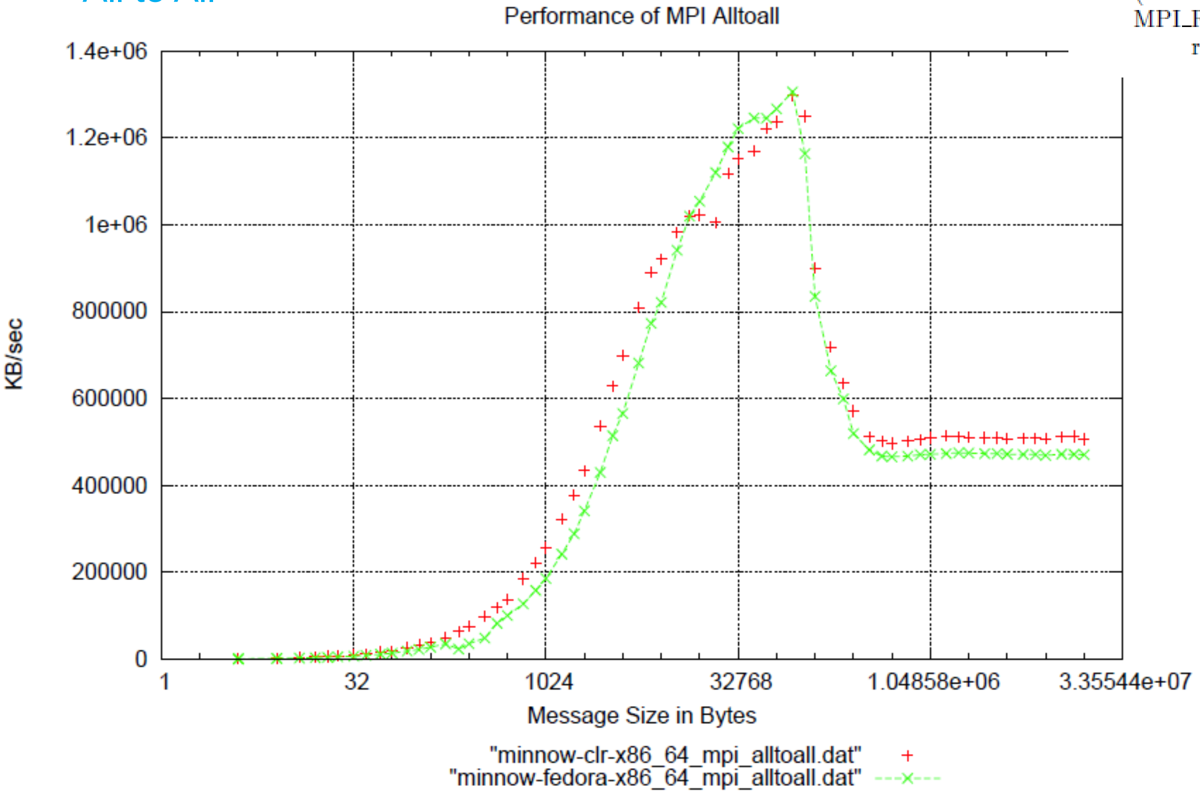
```
if (am_i_the_master()){
        TIMER_START;
        for (i=0; i<cnt; i++){
                mp_irecv(dest_rank, 2, destbuf, bytes, &requestarray[1]);
                mp_isend(dest_rank, 1, sendbuf, bytes, &requestarray[0]);
                MPI_Waitall(2, requestarray, statusarray);
        }

else if (am_i_the_slave()){
        for (i=0; i<cnt; i++) {
                mp_irecv(source_rank, 1, destbuf, bytes, &requestarray[0]);
                mp_isend(source_rank, 2, sendbuf, bytes, &requestarray[1]);
                MPI_Waitall(2, requestarray, statusarray);
        }
```

Results

All to All

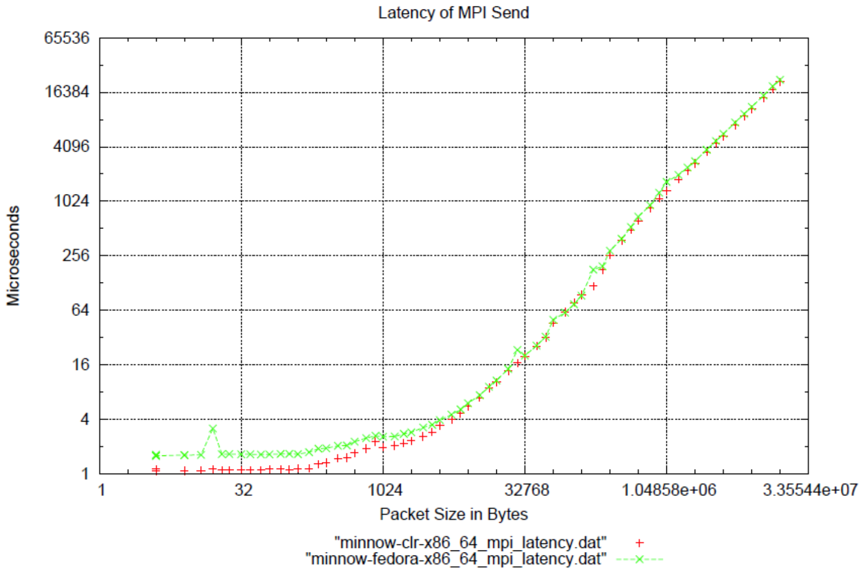


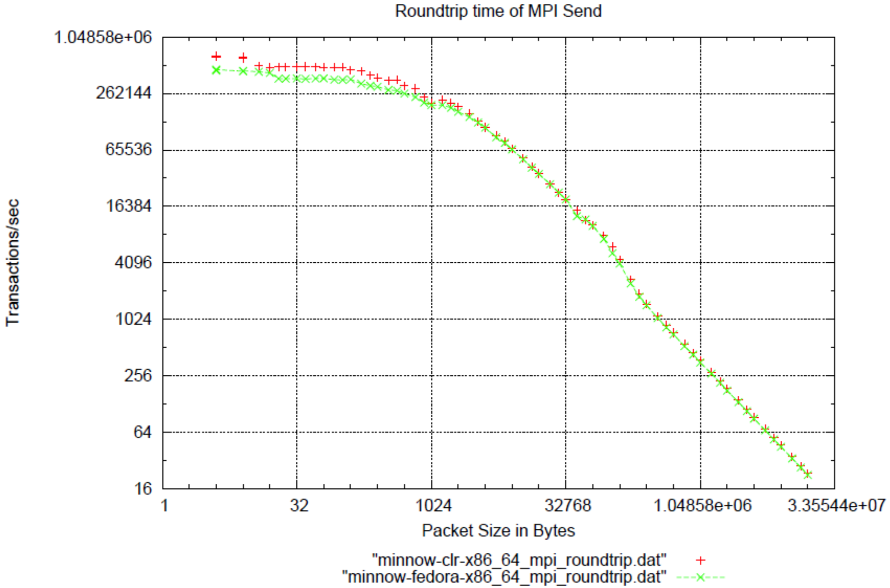
```
MPI_Comm_size(comm, &n);
for (i = 0, i < n; i++)
    MPI_Send(sendbuf + i * sendcount * extent(sendtype),\
        sendcount, sendtype, i,..., comm);
for (i = 0, i < n; i++)
    MPI_Recv(recvbuf + i * recvcount *extent(recvtype), \
        recvcount, recvtype, i, ..., comm);
```



Results

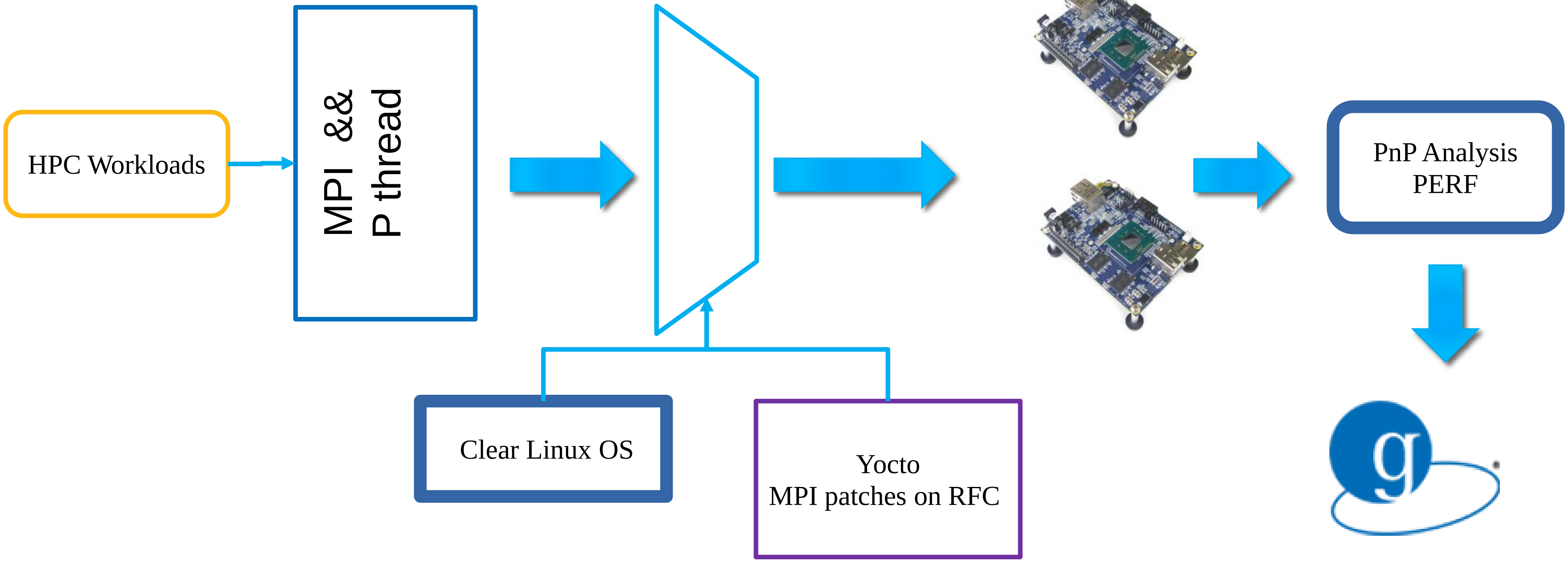
Latency and round trip





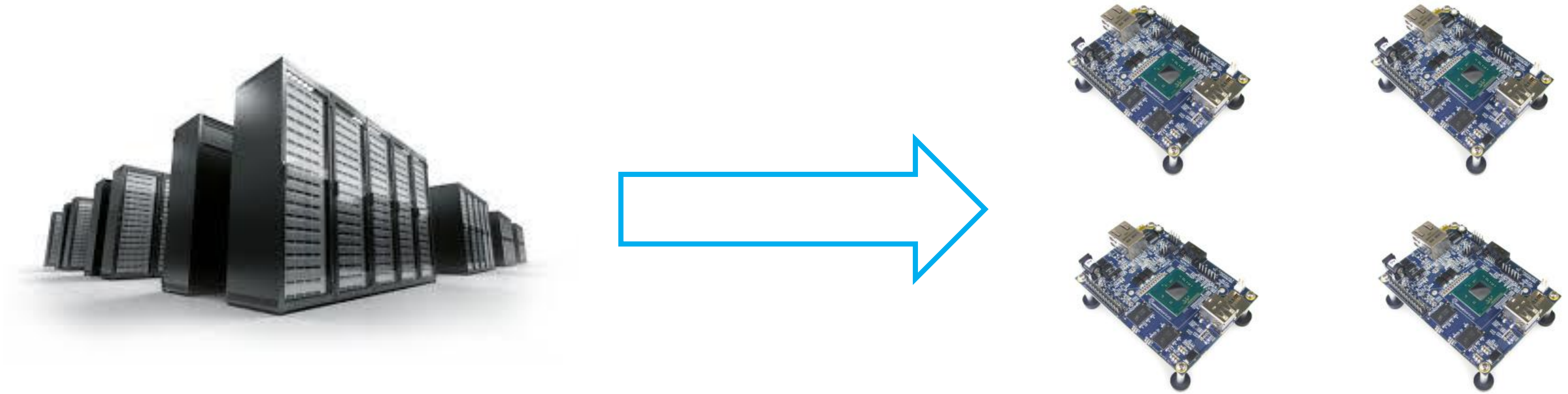
Future Work

Experiment 1



open source software toolkit used for building grids

Everybody wants the control…



Q & A