

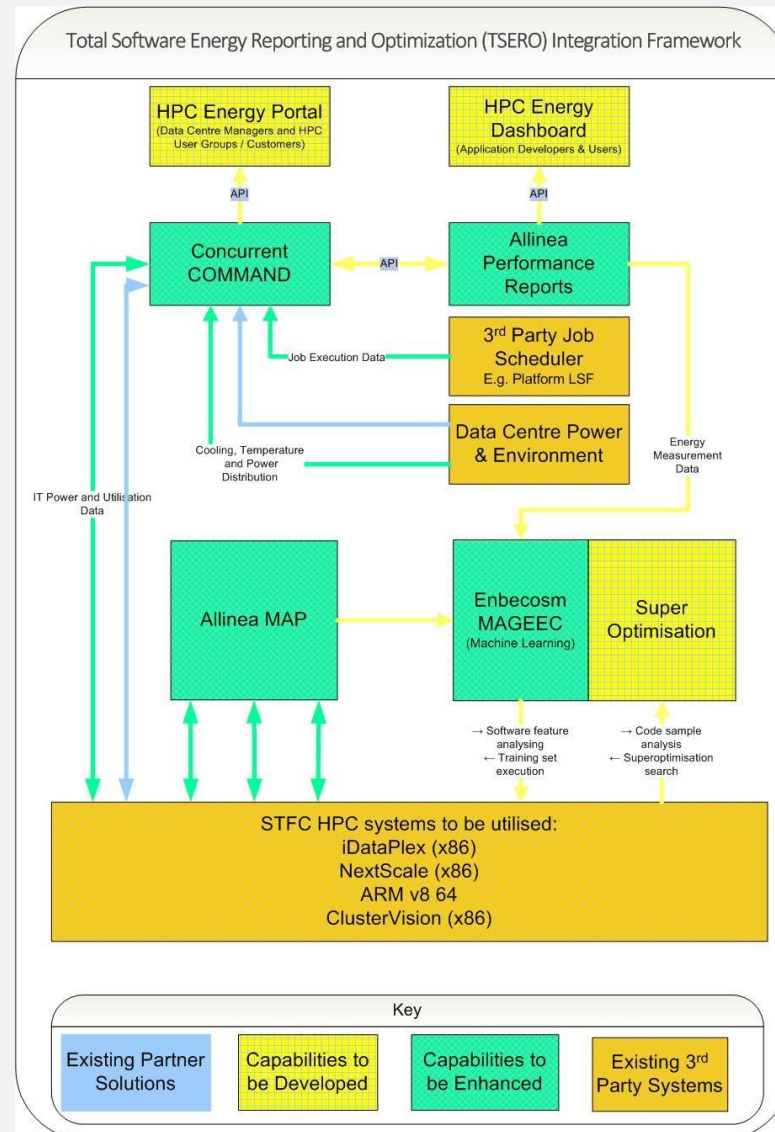
TSERO

Total Software Energy Reporting and Optimization

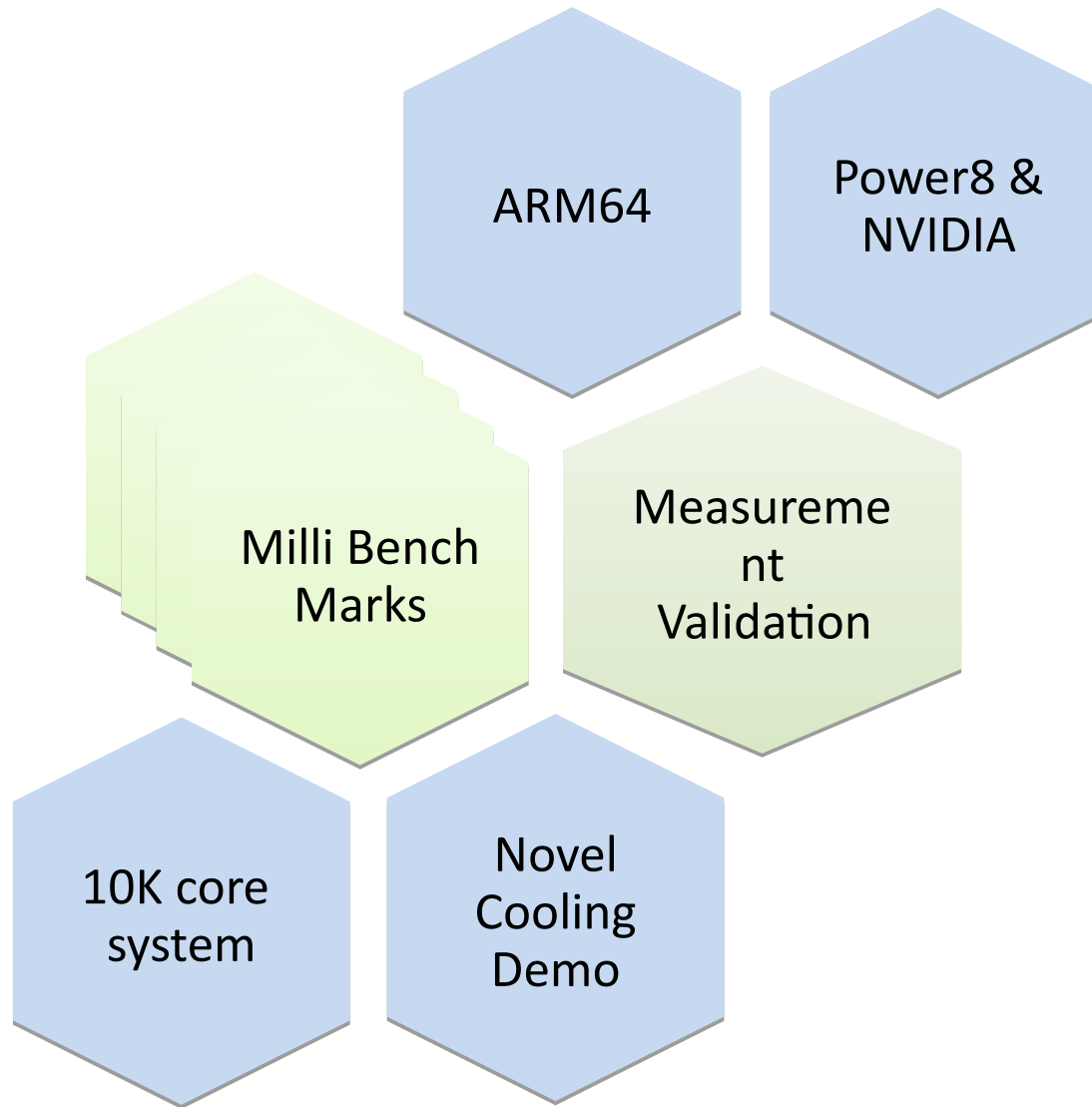
Adam Bowen, Alinea
Michael Rudgyard, Concertim
Jeremy Bennett, Embecosm
Michael Bane, STFC Daresbury

TSERO

Overview

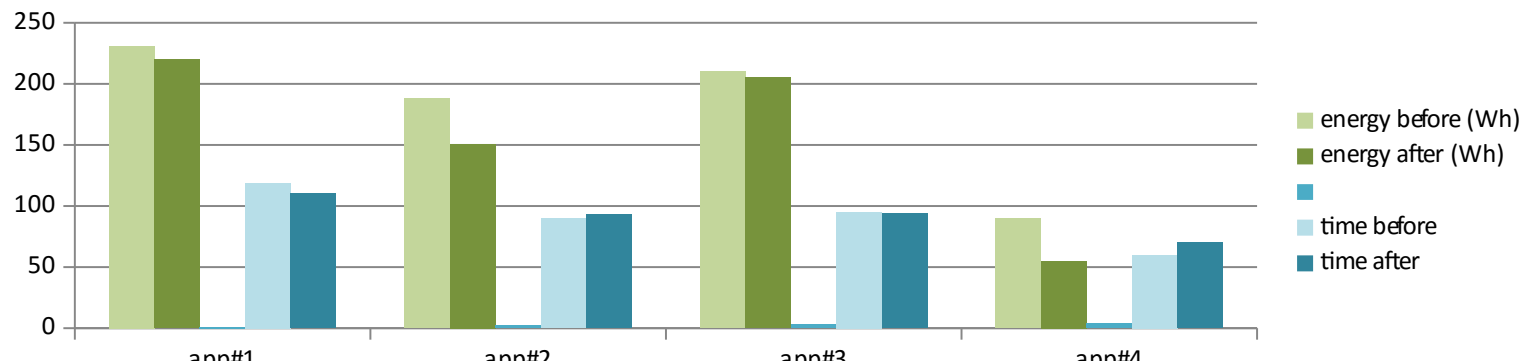
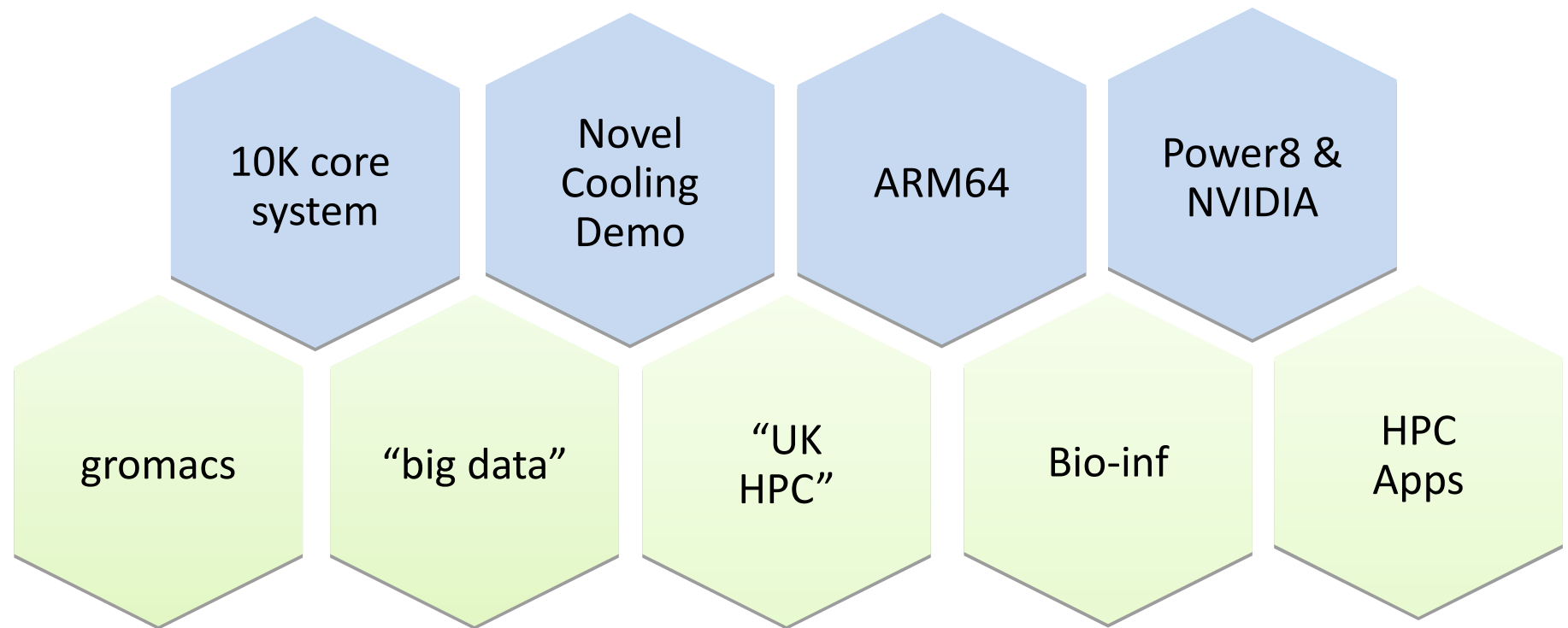


EEC Group: provision of mini apps for training & PoC

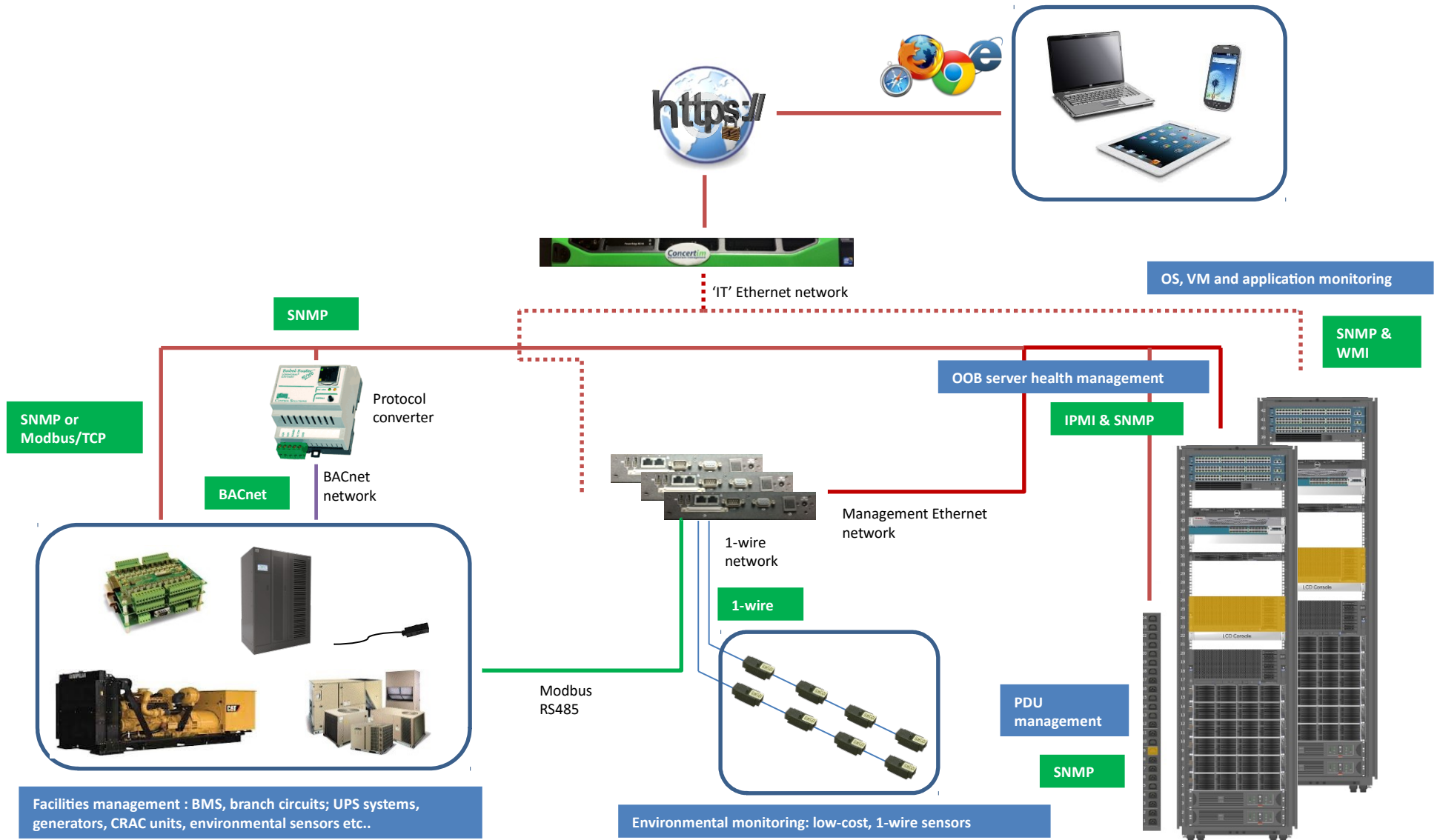


+ *Access to
HPC &
novel archs*

EEC Group: apply trained compiler optimisations to HPC apps & quantify savings



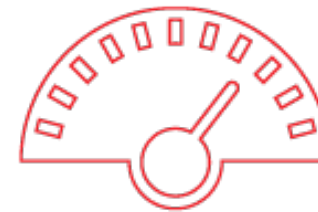
Concertim – What we do



TSERO Objectives

- Measure end-to-end energy usage
 - IT systems and auxiliary Facilities equipment
- Understand and optimise energy usage
 - Report on key efficiency metrics (eg. PUE, normalise cpu utilisation / watt)
- Investigate mechanisms for providing total energy costs on a per user / per group / per job basis
 - Charge-back
 - Include compute costs, network costs, and facilities overheads
 - Integration with Allinea MAP / Performance Reports
- Provide an STFC HPC portal

What Allinea Do



allinea
PERFORMANCE
REPORTS

Debug

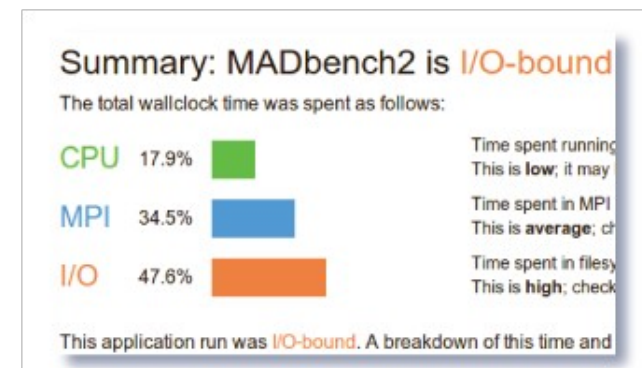
Profile

Develop

Tune

allinea
DDT

allinea
MAP



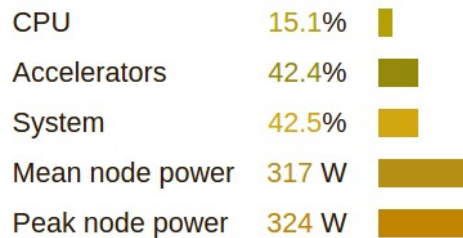
allinea

What Alinea are Doing for TSERO

Connect Performance Reports to DCIM systems for job level energy profiling

Energy

A breakdown of how the 1.32 Wh was used:

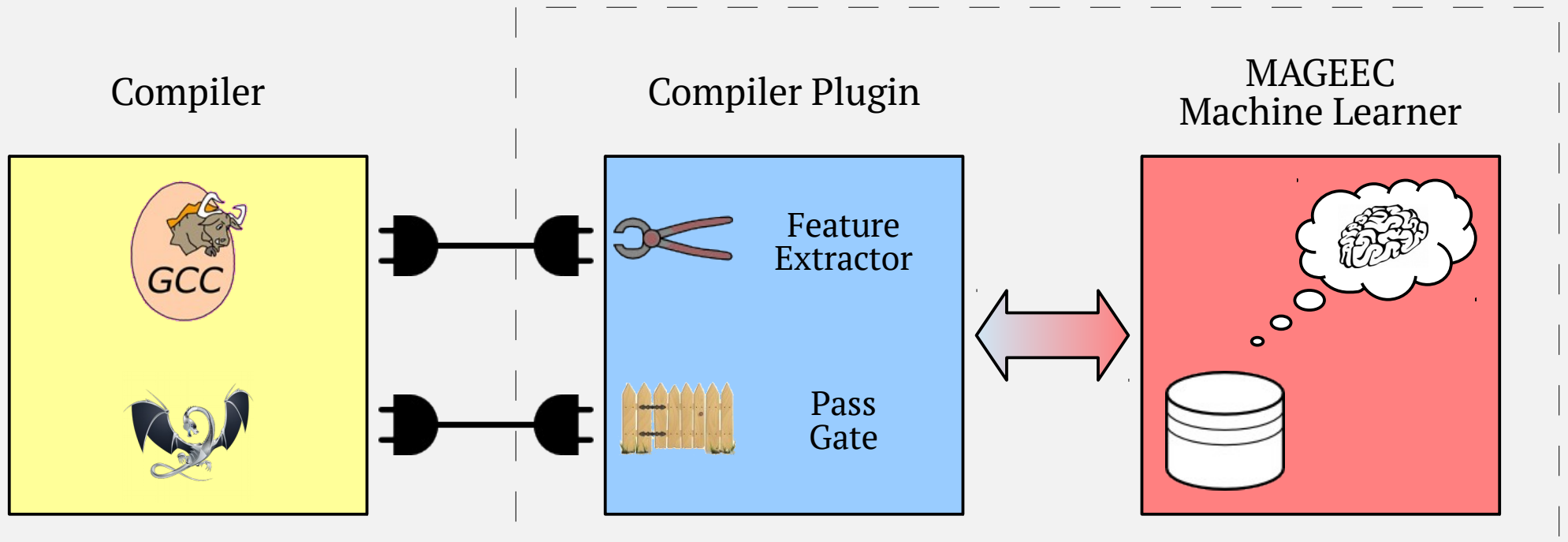


Energy usage appears to be optimal.

First results from experimental function level energy profiling

Self	Total	MPI	Child	Overhead	Function	Self CPU energy	Child CPU energy	Self CPU power	Child CPU power
60.6%	99.4%	8.2%	38.8%		update	47.6 J	32.1 J	7.8 W	8.2 W
30.6%	30.6%				do_math	24.8 J		8.0 W	
7.6%	7.6%	7.6%			MPI_Recv	6.8 J		8.9 W	
0.6%	0.6%	0.6%			MPI_Send	0.5 J		8.9 W	
0.4%	0.4%				init_line	0.3 J		7.4 W	
0.2%	0.2%	0.2%			MPI_Finalize	<0.1 J		3.4 W	
<0.1%	100.0%	8.4%	100.0%		main		80.0 J		7.9 W

MAGEEC



```

int sign (int n)
{
    if (n > 0)
        return 1;
    else if (n < 0)
        return -1;
    else
        return 0;
}

    cmp.l   d0, 0
    ble     L1
    move.l  d1, 1
    bra     L3

L1:
    bge     L2
    move.l  d1, -1
    bra     L3

L2:
    move.l  d1, 0

L3:
    add.l   d0, d0
    subx.l  d1, d1
    negx.l  d0
    addx.l  d1, d1

```

- STFC
 - new reference benchmarks in development
 - Embecosm team trained
- Concertim
 - initial work completed (as Concurrent)
 - now rejoined project as Concertim
- Allinea
 - Allinea MAP provides energy data for Embecosm
 - Allinea performance reports provide energy data for Concertim
- Embecosm
 - GNU Superoptimizer 2.0 toolkit designed and implemented
 - MAGEEC for HPC implemented, next step Allinea MAP integration

TZERO

Thank You

www.tzero.org