Benchmarking and Evaluation, a vendor's perspective

March 15th, 2016

NEC Deutschland GmbH

Intention

I want to explain certain difficulties on the vendors' side, no offense intended.

- Examples are not meant to be complaints or accusations.
- I do not have any specific project in mind.
- Rather a few years of experience reading and analyzing RFPs.

On my side I hope to get a better understanding of customers' problems generating an RFP.

- I have been working „on the other side", too, but quite some years ago.

In the ideal case we might create a better mutual understanding.

Benchmarking, why?

Customer:
- Identify the „best" offer from a set of competing proposals, fair!
- This is prescribed by law, at least in the public sector.
- In industry it is prescribed by the necessity to proof the business case to the finance- or purchase-department.

Vendor:
- Understand the customer's requirements
- Optimize the proposal accordingly
- This is necessary to have a chance

Common interest: some kind of optimization

Necessary:
- Well defined **rules**
- **Mandatory requirements**
- **Evaluation scheme** should clearly reflect the requirements
- All need to be **disclosed – this is not always the case!**

Remark: Vendors rely on the evaluation scheme to determine the configuration. (*1)

\Orchestrating a brighter world **NEC**

Rules and Mandatory Requirements

▎Definition: violation will result in an invalid offer

▎No doubt these are necessary, but … they should not exclude valuable solutions.

- Example (*2): a certain expectation for some technical feature of the system is provided, two potential realizations prescribed as the only possibility, but there is a better solution to the problem …

▎**Describe the intention rather than the implementation!**

▎Example (*3): Memory per core

- Suggestion: memory per socket, this leaves number of sockets per node open, or per node
- Case:
  - 2 sockets, 4 DIMMs per socket on the board (cheap, but why buy useless slots?)
  - 8 Gbyte DIMMs → 64 Gbyte per node
  - Requirement: 4 Gbyte per node → 8 cores per socket max.
  - Broadwell era: 10, 12 and 14 cores often provide best price / performance
  - → 16 Gbyte DIMMs? Expensive!
- Application needs?

\Orchestrating a brighter world   **NEC**

Discrepancies

Discrepancy between mandatory requirements, benchmarking and evaluation scheme, and perhaps … statements in the RFP.

- Example (*4): Evaluation scheme in favor of peak performance, while the RFP states application performance and importance of memory bandwidth
  - more general: text emphasizes a certain direction, the evaluation scheme does not reward it
- Example (*5): probably unintended, the way to win was to offer less kit way under budget
  - It did not work out in the end … and I still don't know why

\Orchestrating a brighter world **NEC**

Not disclosing the evaluation scheme

Honestly: I would love to understand the intention
- There are cases … agreed
- Particularly if the customers knows **extremly well** what he needs

Not disclosing evaluation scheme → gambling?

Please understand the problem:
- 5-8 different CPU SKUs (perhaps more)
- Perhaps 4 different options for the interconnect
- Say 2-3 options for the storage system
- Total: at least 40 different configurations to evaluate
- How big is the chance to accidentally select the right one?

\Orchestrating a brighter world **NEC**

„Optionitis“

Can the customer choose a SKU, an interconnect technology, a parallel filesystem …?

- Not sure … but if, please tell us!
- „optionitis“ … a problem for everybody
- We often spend quite some time on this, time that could be used to optimize the proposal.

I am not sure how to cooperatively solve this

- For sure it would help to talk before you start your project

Seting up a benchmark

▌ If you want to help: Small, medium and big case, with SAME functionality!

▌ Please provide reference outputs and clear rules to validate results!

- Validation: we might not know that a certain number in the output is the final accuracy of an iterative method

▌ Flexible Setup

- E.g. code can only deal with power of two … perhaps QCD
- But well, if it is your most important code … what could you do?

▌ Standard benchmarks???

- Do they really help you?
- SPEC: license cost! People mostly cite numbers from the internet!

▌ ISV benchmarks, or e.g. VASP

- Again, there are license costs involved
- often it takes quite some time to get a response, please help!

\Orchestrating a brighter world   NEC

Seting up a benchmark (cont.)

Optimizations?
- Example (*?): one vendor won because of optimizations, but another vendor offered a bit more of the same hardware, was this a benefit for the user?
  - Generally you want as much kit as you could possibly get
  - If the winning vendor made the very dominant production code 20%-30% faster …
  - Or if the winning vendor could provide user trainings which resulted in faster execution of a big part of the workload?

X86-64, a self-fulfilling prophecy?
- Do you need alternatives?
- Sorry, that might appear a bit selfish now …

Extrapolations? Difficult topic!
- Example, non-linear scaling because of cache effects
- Extrapolation requested which is impossible: e.g. HPCC random ring

And then again: evaluation scheme!

→other issue: „magic numbers" (later)

\Orchestrating a brighter world NEC

Evaluation of Benchmark Results

„Scaling"
- Problem: times enter the evaluation function → normalization necessary
- Often: all results are scaled by the fastest result of all vendors
  - Score = t_measured / t_fastest
- Or even using the slowest and the fastest result:
  - Score = (t_measured – t_slowest) / (t_fastest – t_slowest)
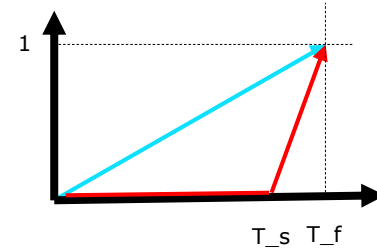
in both cases: how can vendors optimize the proposal?
- In the second case even the worst result can change the scene significantly!
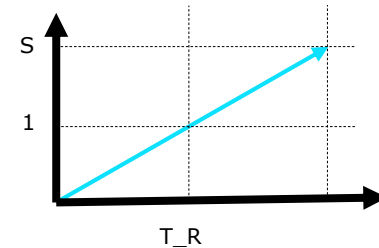
And there is a problem on the customer's side
- kind of „fake competition"

Evaluation of Benchmark Results, Recommendation

„Scaling": relate the score to the reference result
- So you get some kind of „speedup", it has a real meaning
- Fully transparent to the vendor
- no dirty tricks possible

Very often, and I think it is a good idea: „HPC throughput"
- Define a minimum performance requirement, or perhaps minimum speedup
- Beyond that: number of copies that can run simultaneously

- **CAUTION: you need to know what is possible**!
  - Increasingly difficult!

Orchestrating a brighter world   **NEC**

„δ Effect" – intentionally lower case

- Most offers based on the same hardware → similar benchmark results
- Example: 75% score for benchmark, 25% score for technical merits
  - But variation of the benchmark timings minimal, say 10%
  - Score variation between 67.5% and 75% → technical merits become decisive!
- Honestly: no idea, is this good or bad, can one prevent it?
- In particular: what if the evaluation scheme is not disclosed?

Admittedly: this is gone if scaling is performed with slowest and fastest result

\Orchestrating a brighter world   **NEC**
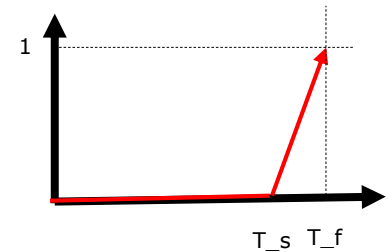
„Magic Numbers", just to make you aware

Definition: a threshhold which causes a severe change of the configuration

- example: IfiniBand-configurations
  - Two level fat tree, blocking 2:1, 36-port-switches

# of Switches	Max. Ports
3	48
4	72
5	---
6	96
7	120
8	144
9	---
10	168
11	192
12	216
13	---
14	240

The smaller the configuration and the coarser the granularity of some piece of the configuration … the worse the effect could be

No idea what could happen, worst case, or how to prevent

\Orchestrating a brighter world

NEC brings together and integrates technology and expertise to create
the ICT-enabled society of tomorrow.
We collaborate closely with partners and customers around the world,
orchestrating each project to ensure all its parts are fine-tuned to local needs.

Every day, our innovative solutions for society contribute to
greater safety, security, efficiency and equality,
and enable people to live brighter lives.