new vs malloc

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26 may 2016

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new[] isn't always better

During a (serial) code optimization exercise we very slowly discovered that a seemingly innocent C++ 'new double[n]' construct was up to a factor of ten slower than an archaic 'malloc'.

```
01 double norm1_row_wise(double** const A, const int n)
02 {
03     double *rowsums= new double[n];
04 //   double rowsums[30000];
05 //   double *rowsums= (double *)calloc( n, sizeof(double ) );
06     double max_norm=-1.;
07
08     for (int i=0; i<n; ++i)
09         rowsums[i]=0;
10
11     for (int i=0; i<n; ++i)
12         for (int j=0; j<n; ++j)
13             rowsums[i] += abs(A[i][j]);
14
15     for (int i=0; i<n; ++i)
16         if (rowsums[i]>max_norm)
17             max_norm= rowsums[i];
18
19     return max_norm;
20 }
```

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Compilers and CPU architectures

- On older architectures (pre-Sandy Bridge), the problem does not show up
- With Intel ICC v13, the problem does not show up
- When porting to Xeon Phi with ICC v14, the problem REALLY shows up

- Problem reported to Intel
- Had a hard time to convince them it was *their* fault
- They fixed it in ICC v15

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Intel Icc 14 results

- Sandy Bridge-EP
  - stack var: 1063.48 MFlops
  - new[]: 557.99 MFlops
  - malloc(): 1066.75 MFlops
- Haswell:
  - malloc(): 1819.38 new[]: 1017.85
- Broadwell-EP:
  - malloc(): 1229.12 new[]: 654.60
- Xeon Phi:
  - malloc(): 438.73 new[]: 42.73

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> 10 times slower!

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Lesson for today

Writing a short program to reproduce a problem is a real problem

(do I smell recursion ?)

https://software.intel.com/en-us/forums/intel-many-integrated-core/topic/520614

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