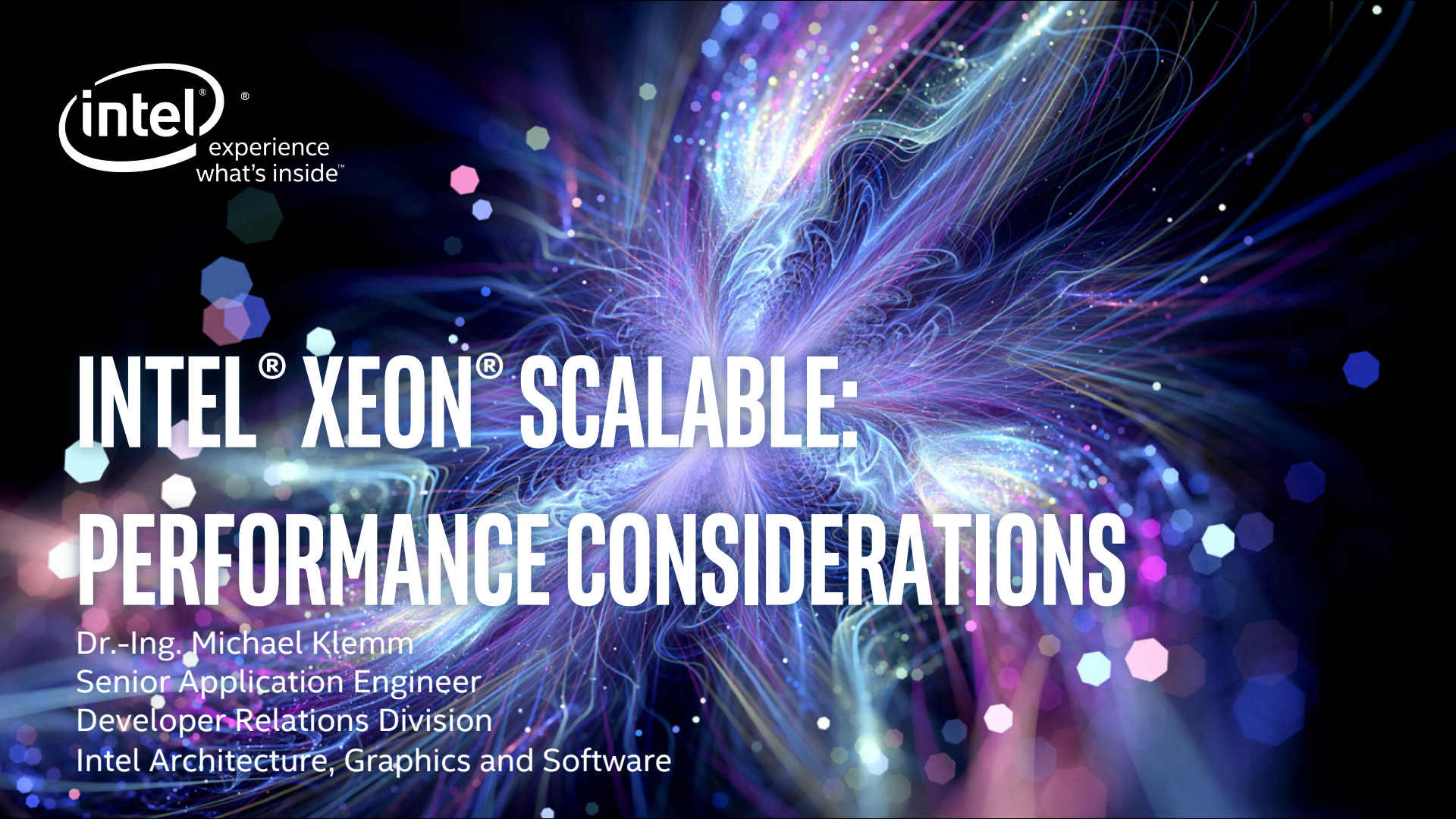

INTEL® XEON® SCALABLE: PERFORMANCE CONSIDERATIONS

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Developer Relations Division
Intel Architecture, Graphics and Software

Contents

- Application Performance Snapshot
- SIMD Programming
- Skylake Performance Considerations
- MPI Tuning

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APPLICATION PERFORMANCE SNAPSHOT

Intel® Performance Snapshots

Three Fast Ways to Discover Untapped Performance

Is your application making good use of modern computer hardware?

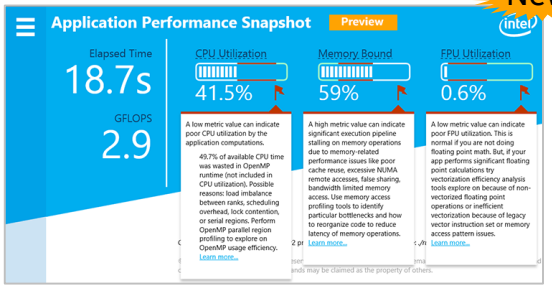
- Run a test case during your coffee break.
- High level summary shows which apps can benefit most from code modernization and faster storage.

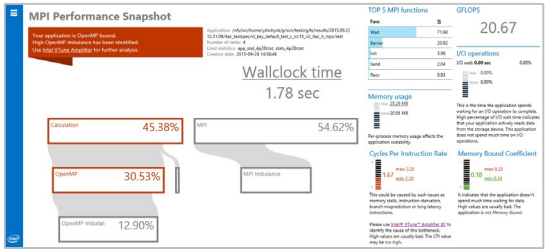
Pick a Performance Snapshot:

- **Application** – for non-MPI apps
- **MPI** – for MPI apps
- **Storage** – for systems. Servers and workstations with directly attached storage.

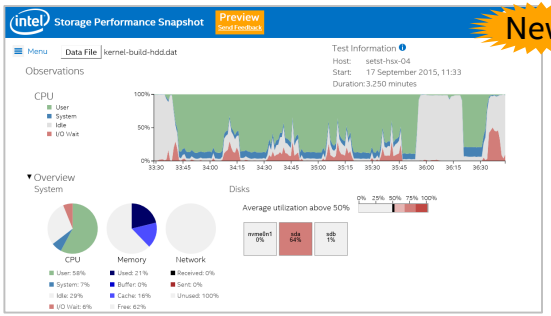
Free download: http://www.intel.com/performance-snapshot
Also included with Intel® Parallel Studio and Intel® VTune™ Amplifier products.

New!





New!



Preview!

Application Performance Snapshot

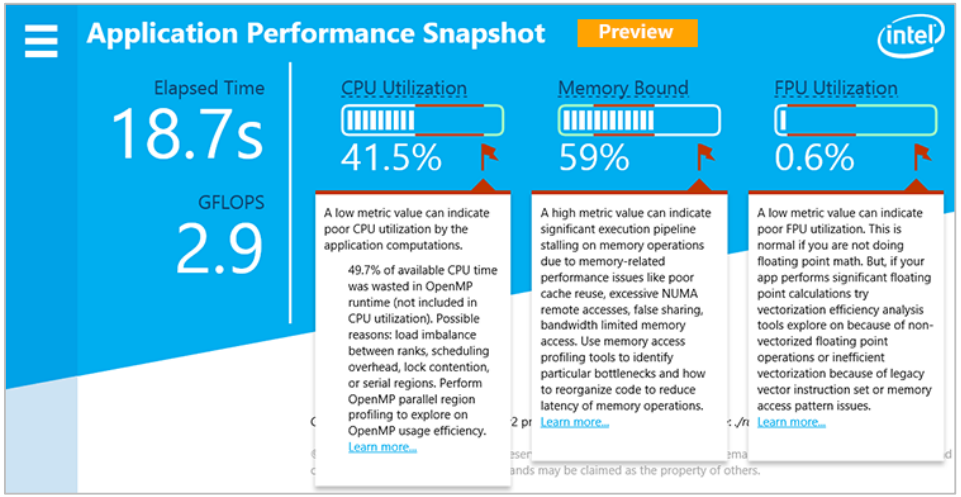
Discover opportunities for better performance with vectorization & threading

Objectives

- Simple enough to run during a coffee break
- Highlight where code modernization can help

Users

- Performance teams – fast prioritization of which apps will benefit most
- All Developers – size the potential performance gain from code modernization



Non-Objectives

- Actionable tuning data – that is another tool. Snapshot is just a fast “health” check.

Free download: http://www.intel.com/performance-snapshot

Also included with Intel® Parallel Studio and Intel® VTune™ Amplifier products.

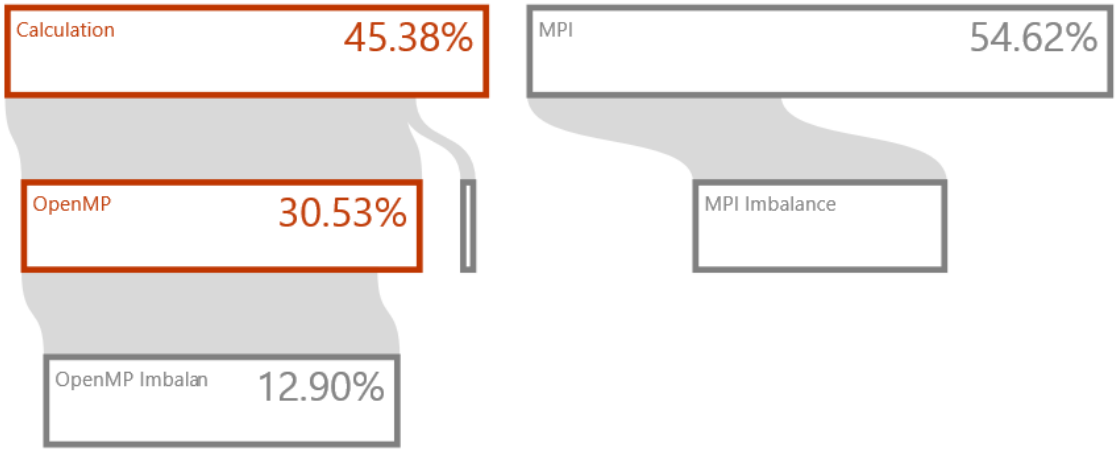
MPI Performance Snapshot

Your application is OpenMP bound.
High OpenMP imbalance has been identified.
Use Intel VTune Amplifier for further analysis.

Application: /nfs/inn/home/yshchyok/p/svn/testing/ts/results/2015.09.23
12.31.09/itac_testspec/vt_key_default_test_c_icc15_n2_itac_it_mps/test
Number of ranks: 4
Used statistics: app_stat_4p28t.txt, stats_4p28t.txt
Creation date: 2015-09-28 14:58:48

Wallclock time

1.78 sec



TOP 5 MPI functions

Func	%
Wait	71.98
Barrier	20.92
Init	3.98
Send	2.04
Recv	0.93

GFLOPS

20.67

I/O operations

I/O wait: **0.00 sec** 0.00%

PEAK 0.00%
MEAN 0.00%

This is the time the application spends waiting for an I/O operation to complete. High percentage of I/O wait time indicates that your application actively reads data from the storage device. This application does not spend much time on I/O operations.

Memory usage

PEAK 25.29 MB
MEAN 20.95 MB

Per-process memory usage affects the application scalability.

Cycles Per Instruction Rate

4
1.67
0
max: 2.23
min: 1.10

This could be caused by such issues as memory stalls, instruction starvation, branch misprediction or long latency instructions.

Please use Intel® VTune™ Amplifier XE to identify the cause of this bottleneck. High values are usually bad. The CPI value may be *too high*.

Memory Bound Coefficient

1
0.18
0
max: 0.23
min: 0.14

It indicates that the application doesn't spend much time waiting for data. High values are usually bad. The application is *not Memory Bound*.

Free download: http://www.intel.com/performance-snapshot. Also included with Intel® Parallel Studio Cluster Edition.

Storage Performance Snapshot

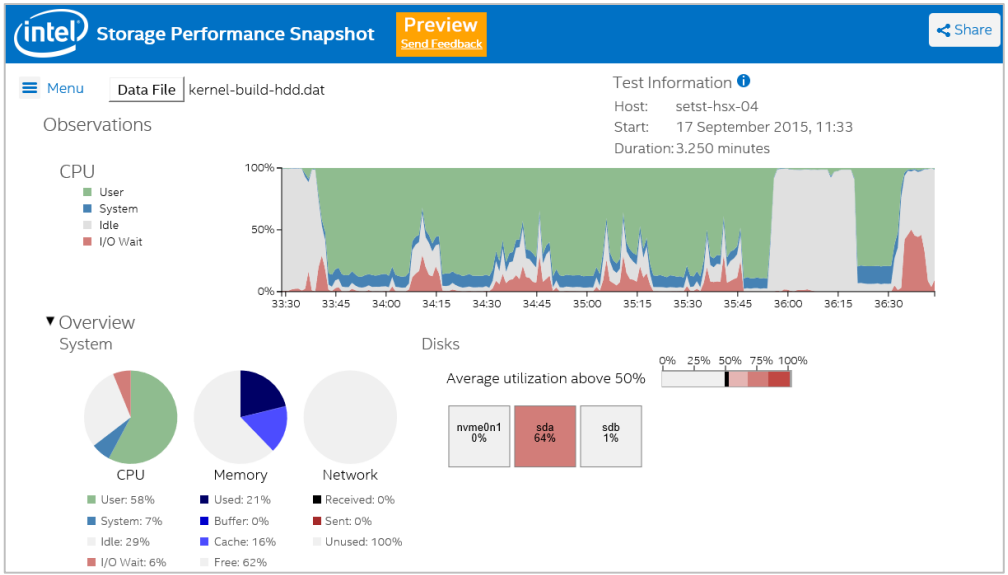
Discover if faster storage can improve server/workstation performance

Learn It On One Coffee Break

- Easy setup
- Quickly see meaningful data
- System view of workload
- Any architecture

Targeted Systems

- Servers & workstations with directly attached storage
- Not scale out storage clusters
- Linux kernel 2.6 or newer dstat 0.7 or newer
- Windows Server 2012, Windows 8 or newer Windows OS



Free download: http://www.intel.com/performance-snapshot

Also included with Intel® Parallel Studio and Intel® VTune™ Amplifier products.

APS Usage

Setup Environment

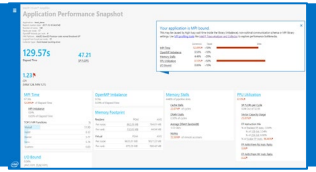
- source <APS_Install_dir>/apsvars.sh

Run Application

- mpirun <mpi options> aps <application and args>

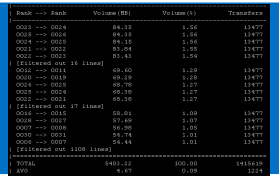
Generate Report on Results

- aps -report <result folder>



Generate advanced CL reports on Results

- aps-report -<option> <result folder>



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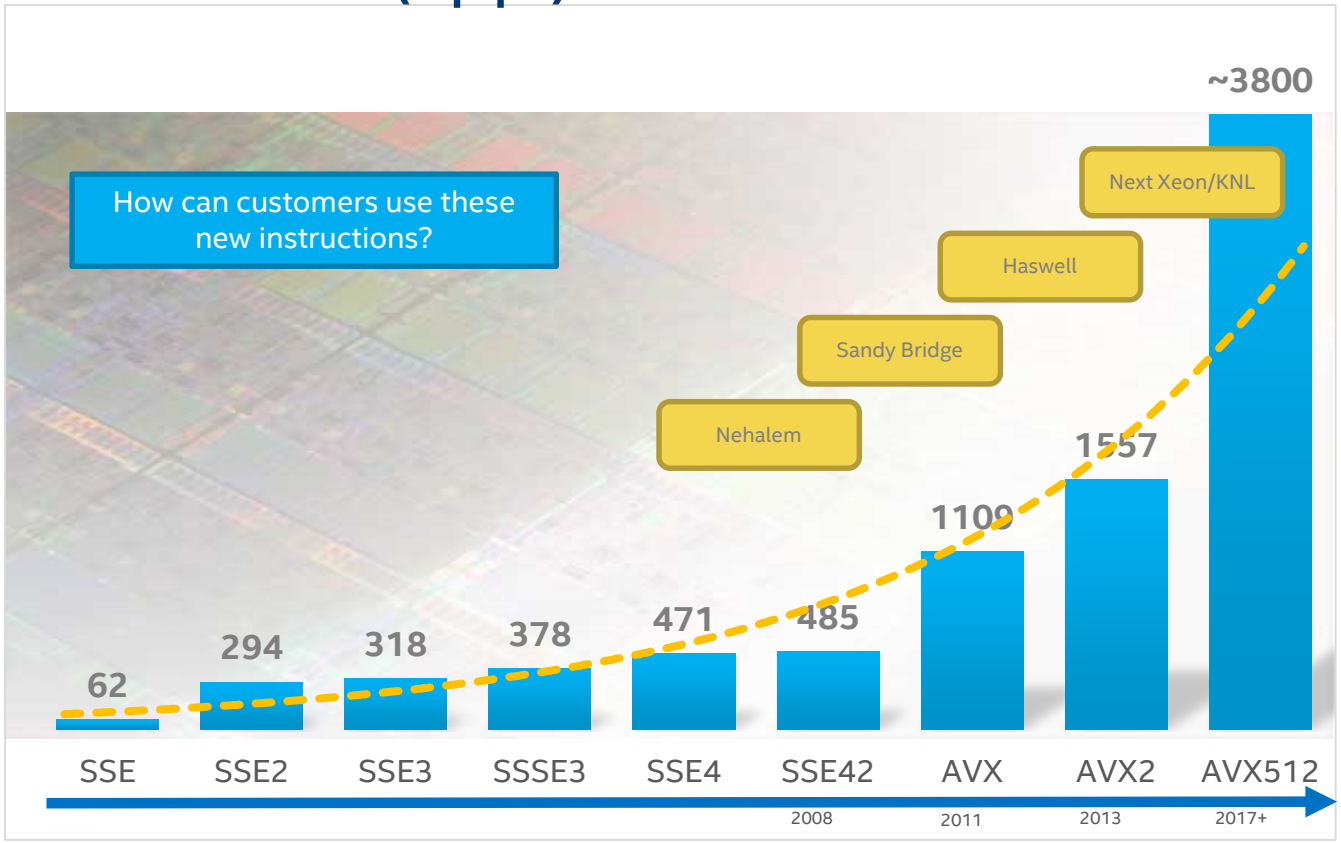
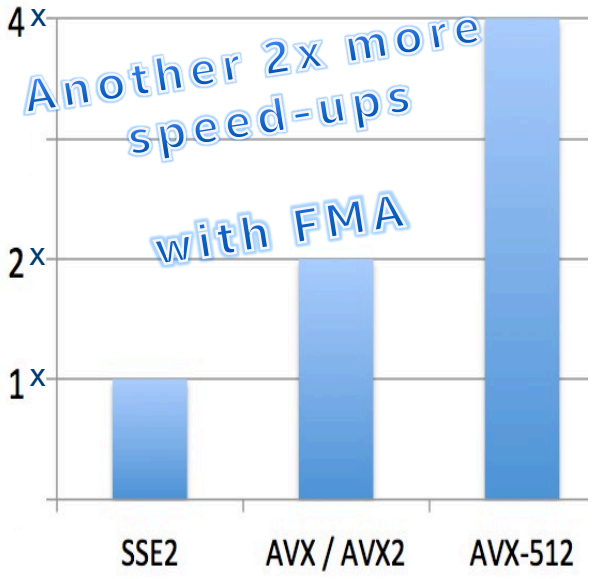
VECTOR PARALLELISM: WHY DO WE CARE?

Vector
Processing

Cumulative (app.) # of Vector Instructions



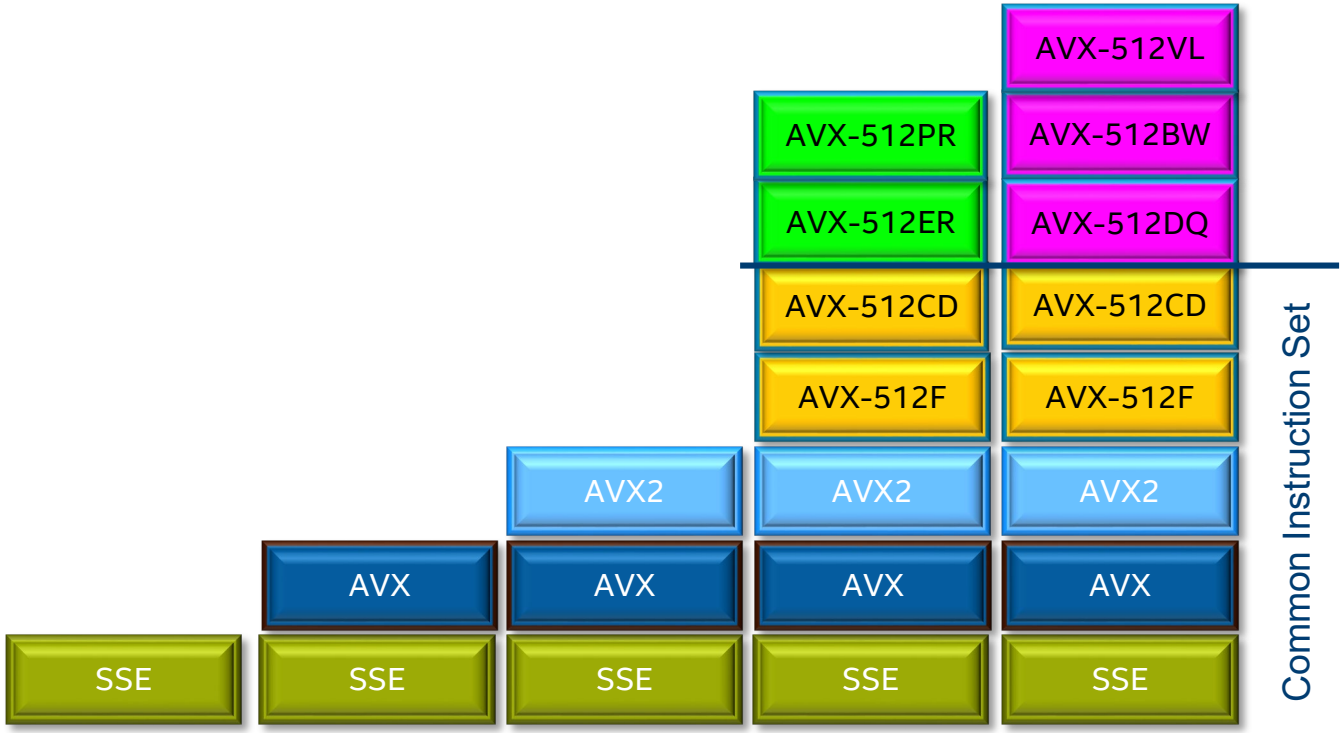
16x DP speed-up over scalar.
8x DP speed-up over SSE
with Advanced Vector Extensions 512 (AVX-512)



- Significant leap to 512-bit SIMD support for processors
- Intel® Compilers and Intel® Math Kernel Library include AVX-512 support
- Strong compatibility with AVX
- Added EVEX prefix enables additional functionality
- Appears first in future Intel® Xeon Phi™ coprocessor, code named Knights Landing

Higher performance for the most demanding computational tasks

Intel® AVX-512 - Comparison



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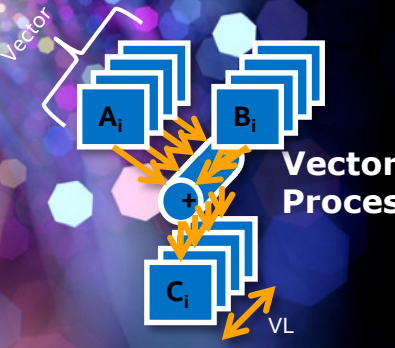
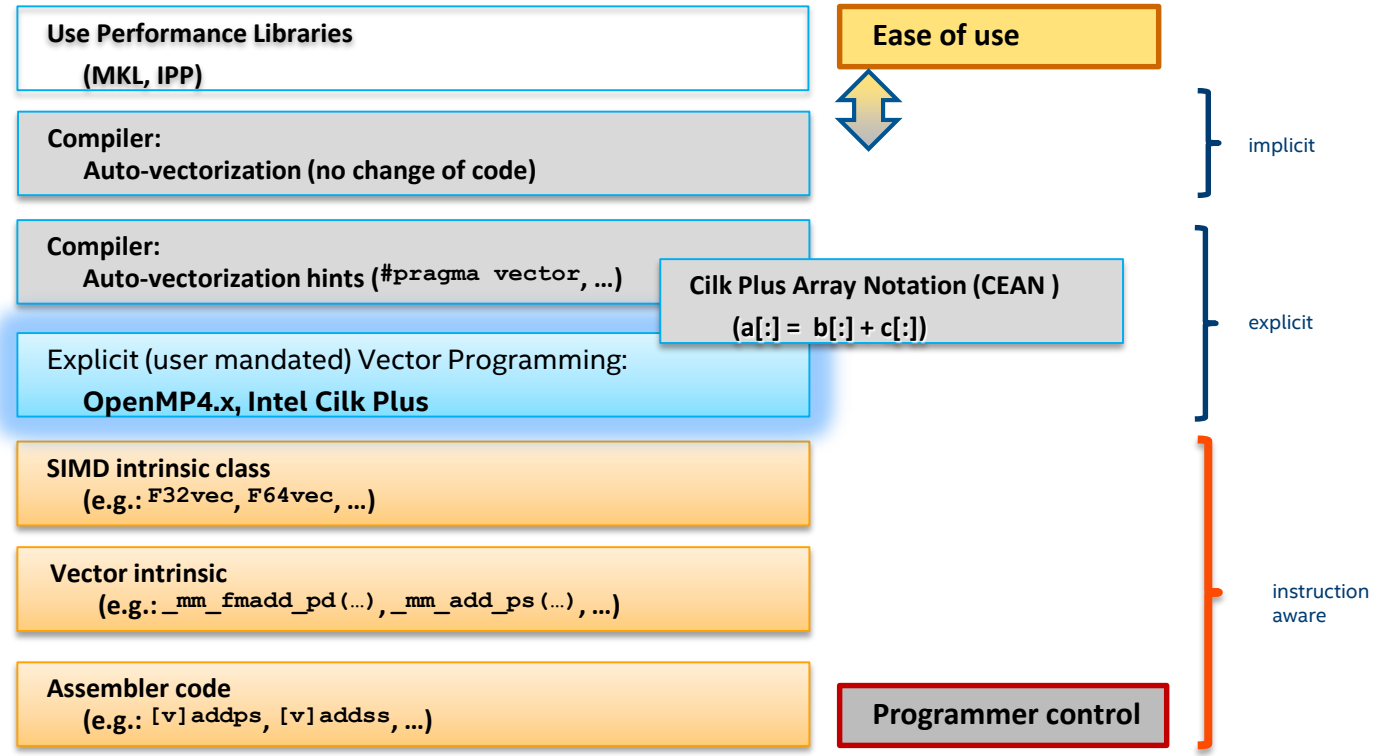
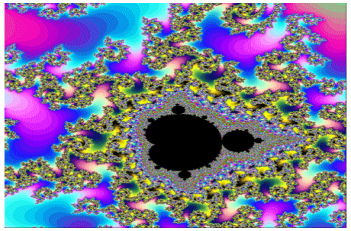
SIMD AND OPENMP* SIMD

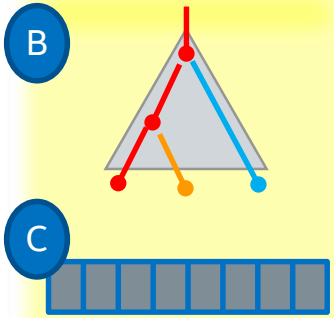


Many Ways to Vectorize



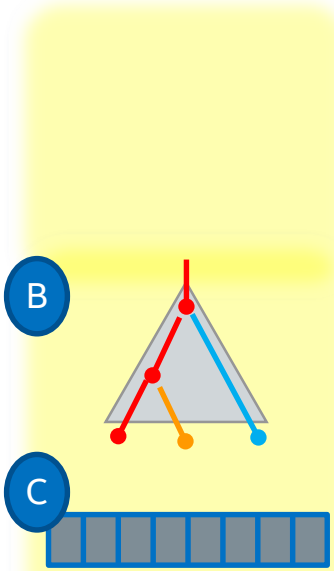
2 level parallelism decomposition with **OpenMP4.x**: image processing example

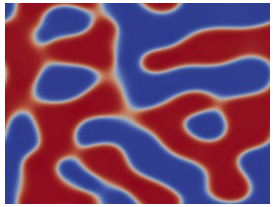





```
#pragma omp parallel for
for (int y = 0; y < ImageHeight; ++y){
#pragma omp simd
   for (int x = 0; x < ImageWidth; ++x){
      count[y][x] = mandel(in_vals[y][x]);
   }
}
```

2L parallelism decomposition with **OpenMP4.x**: fluid dynamics example





```
#pragma omp parallel for
for (int i = 0; i < X_Dim; ++i){
#pragma omp simd
   for (int m = 0; x < n_velocities; ++m){
      next_i = f(i, velocities(m));
      X[i] = next_i;
   }
}
```

Factors that **prevent Vectorizing** your code

1. Loop-carried dependencies

```
DO I = 1, N
   A(I + M) = A(I) + B(I)
ENDDO
```

1.A Pointer aliasing (compiler-specific)

```
void scale(int *a, int *b)
{
   for (int i = 0; i < 1000; i++)
         b[i] = z * a[i];
}
```

2. Function calls (incl. indirect)

```
for (i = 1; i < nx; i++) {
  x = x0 + i * h;
  sumx = sumx + func(x, y, xp);
}
```

3. Loop structure, boundary condition

```
struct _x { int d; int bound; };

void doit(int *a, struct _x *x)
{
  for(int i = 0; i < x->bound; i++)
    a[i] = 0;
}
```

4 Outer vs. inner loops

```
for(i = 0; i <= MAX; i++) {
  for(j = 0; j <= MAX; j++) {
    D[j][i] += 1;
  }
}
```

5. Cost-benefit (compiler specific..)

And others……

Factors that **slow-down** your **Vectorized** code

1.A. Indirect memory access

```
for (i=0; i<N; i++)
      A[B[i]] = C[i]*D[i]
```

1.B Memory sub-system Latency / Throughput

```
void scale(int *a, int *b)
{
   for (int i = 0; i < VERY_BIG; i++)
         c[i] = z * a[i][j];
         b[i] = z * a[i];
}
```

2. Serialized or “sub-optimal” function calls

```
for (i = 1; i < nx; i++) {
         sumx = sumx +
         serialized_func_call(x,
y, xp);
}
```

3. Small trip counts not multiple of VL

```
void doit(int *a, int *b, int
unknown_small_value)
{
  for(int i = 0; i <
unknown_small_value; i++)
      a[i] = z*b[i];
}
```

4. Branchy codes, *outer vs. inner loops*

```
for(i = 0; i <= MAX; i++) {
         if ( D[i] < N)
                  do_this(D);
         else if (D[i] > M)
                  do_that();
         //…
 }
```

5. MANY others: spill/fill, fp accuracy trade-offs, FMA, DIV/SQRT, Unrolling, even AVX throttling..

Auto-vectorization

Auto vectorization only helps in some cases

- Increased complexity of instructions makes it hard for the compiler to select proper instructions
- Code pattern needs to be recognized by the compiler
- Precision requirements often inhibit SIMD code gen

Example: Intel® Composer XE

`-vec` (automatically enabled with –O3)

`-qopt-report`

`-qopt-report-file=[filename|stdout|stderr]`

`-qopt-report-annotate[=[text|html]]`

HTML Optimization Report

```
11      void simd_daxpy(double *x, double *y, double a, size_t n) {
```

```
INLINE REPORT: (simd_daxpy(double *, double *, double, size_t)) [2] /nfs/home/mklemm/tmp/frequency.c(11,59)

/nfs/home/mklemm/tmp/frequency.c(11,59):remark #34051: REGISTER ALLOCATION : [simd_daxpy] /nfs/home/mklemm/tmp/frequency.c:11

    Hardware registers
        Reserved     :    2[ rsp rip]
        Available    :   39[ rax rdx rcx rbx rbp rsi rdi r8-r15 mm0-mm7 zmm0-zmm15]
        Callee-save  :    6[ rbx rbp r12-r15]
        Assigned     :    8[ rax rdx rcx rsi rdi zmm0-zmm2]

    Routine temporaries
        Total         :      35
            Global    :      13
            Local     :      22
        Regenerable   :       4
        Spilled       :       0

    Routine stack
        Variables     :       0 bytes*
            Reads     :       0 [0.00e+00 ~ 0.0%]
            Writes    :       0 [0.00e+00 ~ 0.0%]
        Spills        :       0 bytes*
            Reads     :       0 [0.00e+00 ~ 0.0%]
            Writes    :       0 [0.00e+00 ~ 0.0%]

    Notes

        *Non-overlapping variables and spills may share s
         so the total stack size might be less than this.
```

```
28          for (size_t rep = 0; rep < OUTER_REP; ++rep) {
```

```
LOOP BEGIN at /nfs/home/mklemm/tmp/frequency.c(28,5)
   remark #15344: loop was not vectorized: vector dependence prevents vectorization. First dependence is shown below. Use level 5 report for details
   remark #15346: vector dependence: assumed OUTPUT dependence between call:simd_daxpy(double *, double *, double, size_t) (30:12) and call:scalar_d

   LOOP BEGIN at /nfs/home/mklemm/tmp/frequency.c(29,9)
      remark #15344: loop was not vectorized: vector dependence prevents vectorization. First dependence is shown below. Use level 5 report for deta
   LOOP END

   LOOP BEGIN at /nfs/home/mklemm/tmp/frequency.c(32,9)
      remark #15344: loop was not vectorized: vector dependence prevents vectorization. First dependence is shown below. Use level 5 report for deta
   LOOP END
LOOP END
```

```
12      #pragma vector always
13      #pragma ivdep
14          for (size_t i = 0; i < n; ++i) {
```

```
LOOP BEGIN at /nfs/home/mklemm/tmp/frequency.c(14,5)
<Peeled loop for vectorization>
LOOP END

LOOP BEGIN at /nfs/home/mklemm/tmp/frequency.c(14,5)
   remark #15300: LOOP WAS VECTORIZED
LOOP END
```

```
29              for (size_t in = 0; in < INNER_REP; ++in) {
30                 simd_daxpy(x, y, 5.0, ARRAYSZ);
31              }
32              for (size_t in = 0; in < INNER_REP; ++in) {
33                  scalar_daxpy(x, y, 5.0, ARRAYSZ);
34              }
35          }
36
37          return 0;
38      }
```

OpenMP SIMD Loop Construct

Vectorize a loop nest

- Cut loop into chunks that fit a SIMD vector register
- No parallelization of the loop body

Syntax (C/C++)

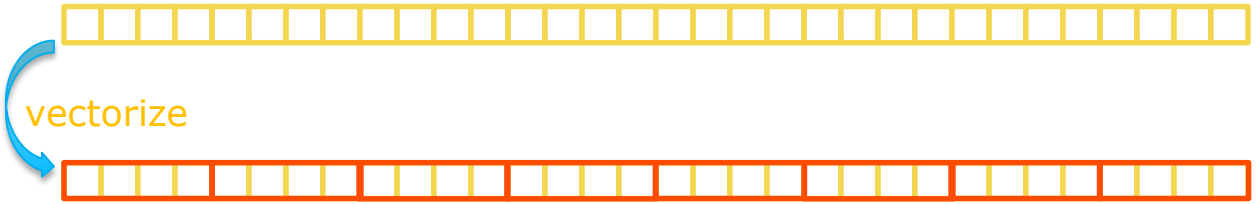
```
#pragma omp simd [clause[[,] clause],…]
for-loops
```

Syntax (Fortran)

```
!$omp simd [clause[[,] clause],…]
do-loops
```

Example

```
void sprod(float *a, float *b, int n) {
    float sum = 0.0f;
#pragma omp simd reduction(+:sum)
    for (int k=0; k<n; k++)
        sum += a[k] * b[k];
    return sum;
}
```



Data Sharing Clauses

`private(var-list):`
Uninitialized vectors for variables in *var-list*

`firstprivate(var-list):`
Initialized vectors for variables in *var-list*

`reduction(op:var-list):`
Create private variables for *var-list* and apply reduction operator *op* at the end of the construct

SIMD Loop Clauses

`safelen (length)`

- Maximum number of iterations that can run concurrently without breaking a dependence
- In practice, maximum vector length

`linear (list[:linear-step])`

- The variable's value is in relationship with the iteration number
  - $x_i = x_{orig} + i * \text{linear-step}$

`aligned (list[:alignment])`

- Specifies that the list items have a given alignment
- Default is alignment for the architecture

`collapse (n)`

SIMD Worksharing Construct

Parallelize and vectorize a loop nest

- Distribute a loop's iteration space across a thread team
- Subdivide loop chunks to fit a SIMD vector register

Syntax (C/C++)

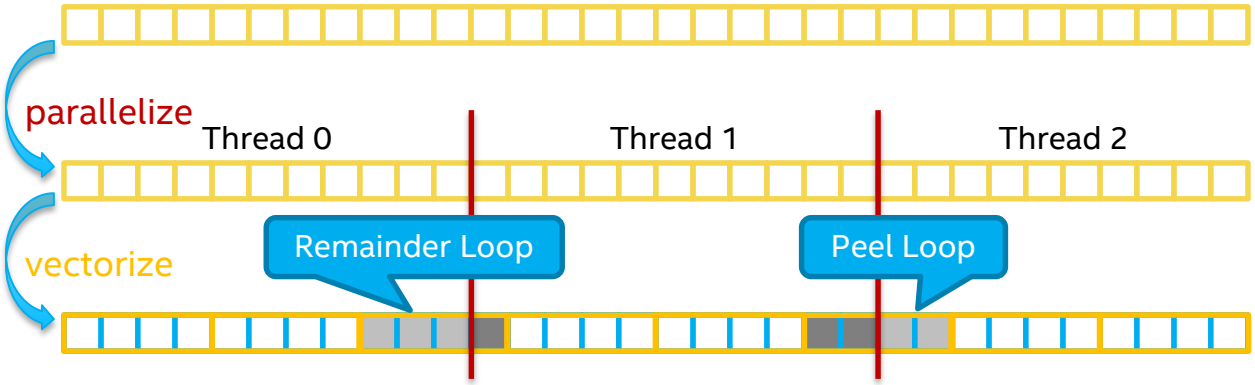
```
#pragma omp for simd [clause[[,] clause],…]
for-loops
```

Syntax (Fortran)

```
!$omp do simd [clause[[,] clause],…]
do-loops
[!$omp end do simd [nowait]]
```

Example

```
void sprod(float *a, float *b, int n) {
    float sum = 0.0f;
#pragma omp for simd reduction(+:sum)
    for (int k=0; k<n; k++)
        sum += a[k] * b[k];
    return sum;
}
```



SIMD Function Vectorization

Declare one or more functions to be compiled for calls from a SIMD-parallel loop

Syntax (C/C++):

```
#pragma omp declare simd [clause[[,] clause],…]
[#pragma omp declare simd [clause[[,] clause],…]]
[…]
function-definition-or-declaration
```

Syntax (Fortran):

```
!$omp declare simd (proc-name-list)
```

SIMD Function Vectorization

```
#pragma omp declare simd
float min(float a, float b) {
    return a < b ? a : b;
}

#pragma omp declare simd
float distsq(float x, float y) {
    return (x - y) * (x - y);
}

void example() {
#pragma omp parallel for simd
    for (i=0; i<N; i++) {
        d[i] = min(distsq(a[i], b[i]), c[i]);
}   }
```

```
_ZGVZN16vv_min(%zmm0, %zmm1):
    vminps %zmm1, %zmm0, %zmm0
    ret
```

```
_ZGVZN16vv_distsq(%zmm0, %zmm1):
    vsubps %zmm0, %zmm1, %zmm2
    vmulps %zmm2, %zmm2, %zmm0
    ret
```

```
vmovups (%r14,%r12,4), %zmm0
vmovups (%r13,%r12,4), %zmm1
call _ZGVZN16vv_distsq
vmovups (%rbx,%r12,4), %zmm1
call _ZGVZN16vv_min
```

AT&T syntax: destination operand is on the right

SIMD Function Vectorization

`simdlen (`*`length`*`)`

- generate function to support a given vector length

`uniform (`*`argument-list`*`)`

- argument has a constant value between the iterations of a given loop

`inbranch`

- optimize for function always called from inside an if statement

`notinbranch`

- function never called from inside an if statement

`linear (`*`argument-list[:linear-step]`*`)`

`aligned (`*`argument-list[:alignment]`*`)`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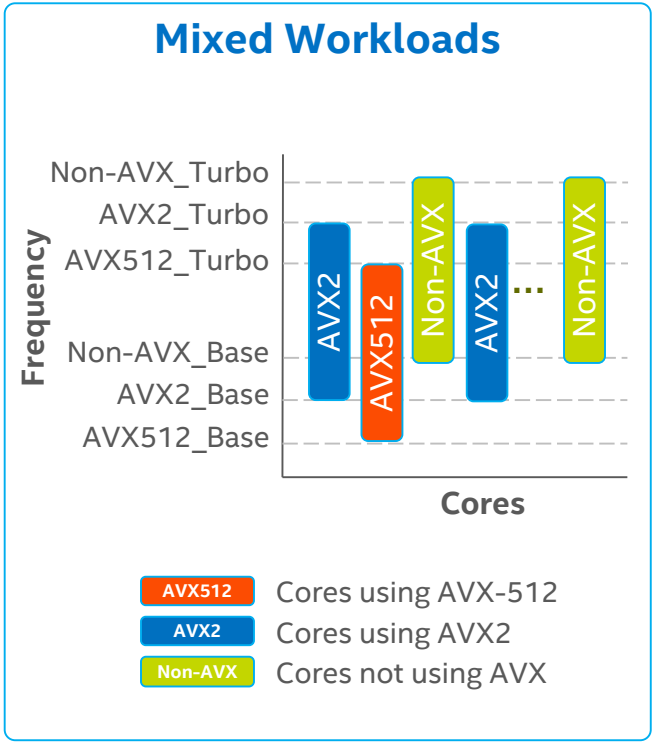
PERFORMANCE CONSIDERATIONS

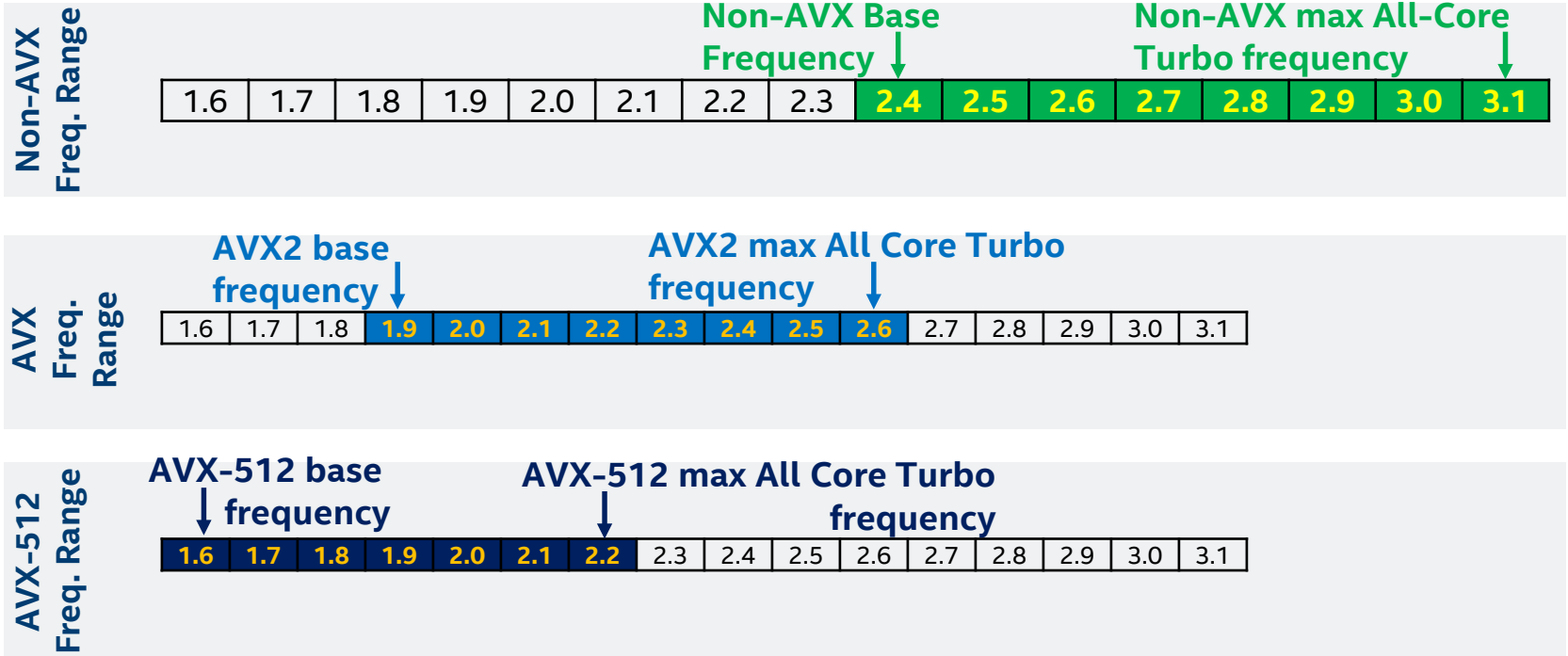
Frequency Behavior While Running Intel® AVX Code

- Cores running non-AVX, Intel® AVX2 light/heavy, and Intel® AVX-512 light/heavy code have different turbo frequency limits
- Frequency of each core is determined independently based on workload demand

Code Type	All Core Frequency Limit
SSE AVX2-Light (without FP & int-mul)	Non-AVX All Core Turbo
AVX2-Heavy (FP & int-mul) AVX512-Light (without FP & int-mul)	AVX2 All Core Turbo
AVX512-Heavy (FP & int-mul)	AVX512 All Core Turbo



AVX Frequency – All Core Turbo (SKX 6148)

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MPI TUNING BASICS

Prerequisite –

Make sure your cluster is properly configured

- Install the latest Intel® MPI Library
- Have the documentation at hand
- When benchmarking try to run on the same subset of nodes
- Understand the performance characteristics of your cluster
  - What fabrics are available, how do they perform
    - What is the lowest achievable latency
    - What is the maximum achievable bandwidth
  - Communication speeds differ
    - Intra-socket / Inter-socket
    - Intra-node / Inter-node
  - Use IMB to determine performance

Prerequisite –

Understand the performance characteristics of your Application

- Simple code internal timings
- ITAC traces – use MPI_Pcontrol() to manage overhead
- IMPI statistics
- MPS statistics
- VTune traces

-> know what MPI routines to tune for

Use lightweight statistics

- Set **I_MPI_STATS** to a non-zero integer value to gather MPI communication statistics (max value is 10)
- Set **I_MPI_STATS=ipm** to get statistics in IPM format
- Default names are **stats.txt** or **stats.ipm** and can be changed setting **I_MPI_STATS_FILE** variable
- Change scope with **I_MPI_STATS_SCOPE** to increase effectiveness of the analysis
- Example here: Gromacs rank 0 with

```
I_MPI_STATS=3
I_MPI_STATS_SCOPE=coll
```

```
Communication Activity by actual args
Collectives
Operation       Context  Algo  Comm size    Message size      Calls  Cost(%)
-----------------------------------------------------------------------------
Allreduce
1                    58     1          4              24          1     0.00
2                    58     1          4               4          8     0.00
3                    58     1          4               8         12     0.03
4                    58     1          4            1376        181     0.04
5                    58     1          4            1344         19     0.01
6                    58     1          4            1216          1     0.00
7                    58     1          4             224          1     0.00
8                     0     5        192               8          2     0.00
9                     0     5        192             968          1     0.00
10                    0     5        192             288          2     0.01
11                    0     5        192             768          2     0.00
Barrier
1                    62     5        160               0          1     0.00
2                     0     5        192               0          1     0.00
Bcast
...
Gather
1                    52     3          5              32         25     0.01
2                    54     3          4              36         25     0.00
3                    56     3          8              28         25     0.01
Reduce
1                    60     1         40              24          1     0.00
2                    60     1         40               4          8     0.00
3                    60     1         40               8         12     0.01
4                    60     1         40            1376        181     0.21
5                    60     1         40            1344         19     0.03
6                    60     1         40            1216          1     0.00
7                    60     1         40             224          1     0.00
Scatter
1                    62     1        160               8          1     0.00
Scatterv
1                    62     1        160          315840          2     0.03
2                    62     1        160           52640          1     0.08
=============================================================================
```

Use best available communication fabric

Supported I_MPI_FABRICS	Description
shm	Shared-memory only; intra-node default
tcp	TCP/IP-capable network fabrics, such as Ethernet and InfiniBand* (through IPoIB*)
~~dapl~~	~~DAPL-capable network fabrics, such as InfiniBand*, iWarp*, and XPMEM* (through DAPL*)~~
~~ofa~~	~~OFA-capable network fabric including InfiniBand* (through OFED* verbs)~~
tmi	Tag Matching Interface (TMI) capable network fabrics, such as Intel® True Scale Fabric, Intel® Omni-Path Architecture and Myrinet*
ofi	OFI (OpenFabrics Interfaces*)-capable network fabric including Intel® True Scale Fabric, and TCP (through OFI* API)

- Intel® MPI Library will select the fastest available fabric by default: shared memory within a node and Intel® Omni-Path Architecture (shm:tmi) or Infiniband* (shm:dapl) across nodes
- For the OpenFabrics Enterprise Distribution (OFED*) software stack, select shm:ofa
- Check the fabric being used by setting I_MPI_DEBUG to 2

Disable fallback for benchmarking

- Intel® MPI Library falls back from the 'tmi' or 'shm:tmi' fabric to 'tcp' and/or 'shm:tcp' if the TMI provider initialization failed
- Disable I_MPI_FALLBACK to ensure that the fast default fabric is working. Fallback is also disabled by default if I_MPI_FABRICS is set
- On the command line you can use:

```
$ mpirun -genv I_MPI_FABRICS tmi -genv I_MPI_FALLBACK 0 -n <nprocs> ./app
```

  or, equivalently, use the command line option -PSM2:

```
$ mpirun -PSM2 -n <nprocs> ./app
```

- Using these settings the run will fail if the high performance fabric is not available, rather than run at a degraded performance over a backup fabric.

Use connectionless communication

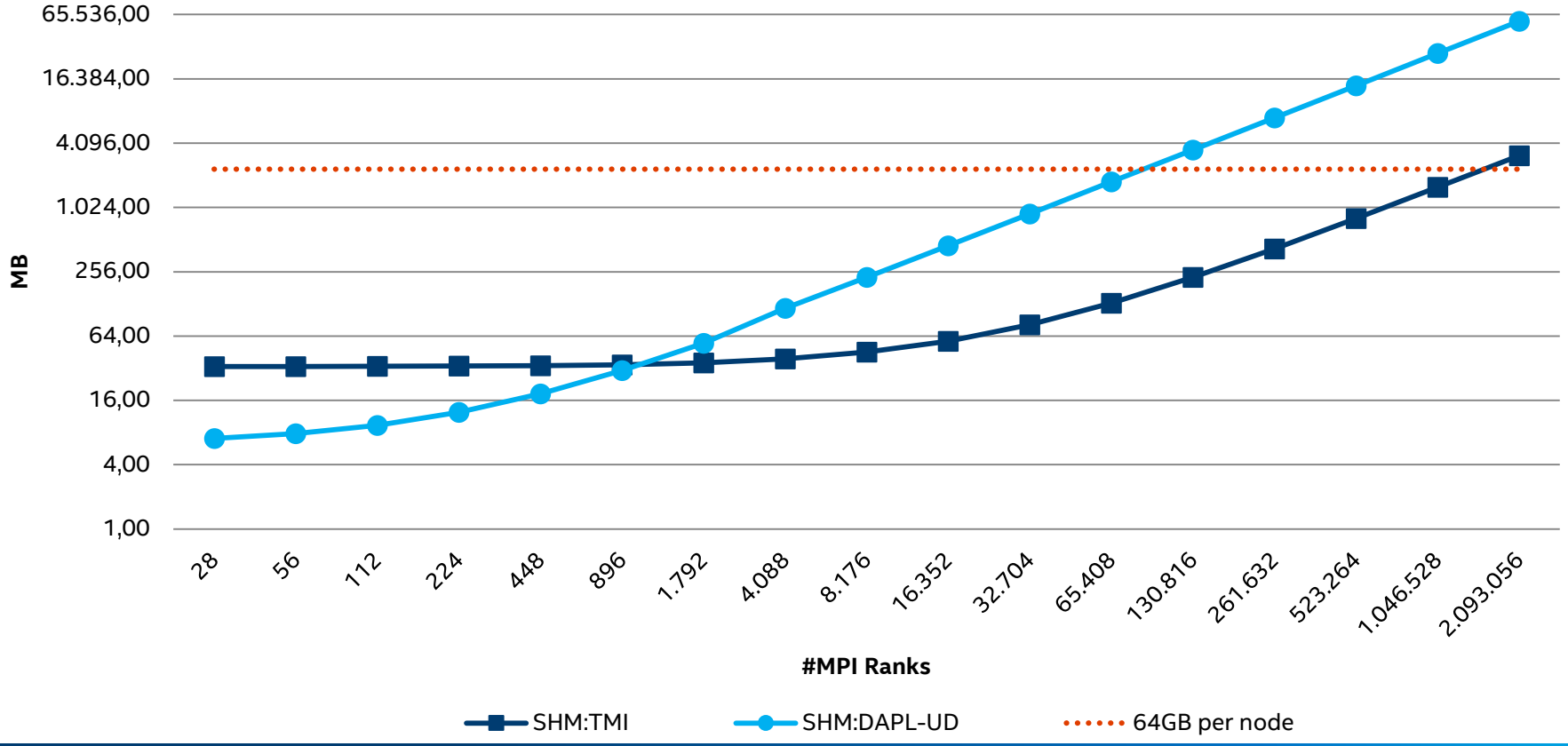
Intel® Omni-Path Architecture fabrics TMI and OFI automatically use the PSM2 provided connectionless communication features

For Infiniband* fabrics using a DAPL provider version higher than 2.0.27 this can be enabled via environmental variables

- Provides better scalability
- Reduces memory footprint by reducing the number of receive queues
- General use for large and memory hungry jobs > 1k MPI ranks recommended
- Automatically triggered for large jobs via I_MPI_LARGE_SCALE_THRESHOLD which is currently 4096 ranks

```
I_MPI_FABRICS=shm:dapl
I_MPI_DAPL_UD=1
I_MPI_DAPL_UD_PROVIDER=<chosen from /etc/dat.conf entries>
```

Intel MPI Library memory consumption model per rank. Alltoall connections. Worst case. Lower is better



Select a proper process pinning 1/3

- The default pinning is suitable for most scenarios
- Set I_MPI_PERHOST or use the –perhost (/-ppn) option to override the default process layout:

```
$ mpirun –ppn <#processes per node> -n <#processes> …
```

- Intel® MPI Library respects the batch scheduler settings - to overwrite use:

```
I_MPI_JOB_RESPECT_PROCESS_PLACEMENT=0
```

- Per-node pinning can also be achieved using a “machinefile”
- Custom processor core pinning can be achieved by two different environment variables

`I_MPI_PIN_PROCESSOR_LIST` - for pure MPI applications

`I_MPI_PIN_DOMAIN` - for Hybrid – MPI + Threading applications

Select a proper process pinning 2/3

- The '**`cpuinfo`**' utility from Intel MPI Library can be used to observe the processor topology
- Threads of Hybrid applications are not pinned by default
- Threads can migrate along the cores of a rank defined by **`I_MPI_PIN_DOMAIN`**
- Therefore, threads should be pinned as well using e.g. **`OMP_PLACES`**
- Further information can be found in the "Process Pinning" section of the Intel MPI Library reference manual

Select a proper process pinning 3/3

Default Intel Library MPI pinning	Impact
I_MPI_PIN=on	Pinning Enabled
I_MPI_PIN_MODE=pm	Use Hydra for Pinning
I_MPI_PIN_RESPECT_CPUSET=on	Respect process affinity mask
I_MPI_PIN_RESPECT_HCA=on	Pin according to HCA socket
I_MPI_PIN_CELL=unit	Pin on all logical cores
I_MPI_PIN_DOMAIN=auto:compact	Pin size #lcores/#ranks : compact
I_MPI_PIN_ORDER=compact	Order domains adjacent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MPI AUTO-TUNING

Cluster Specific Tuning with mpitune

Find optimal values for library tuning knobs on the particular cluster or application environment.

- Run it once after installation and each time after a cluster configuration change
- Best configuration is recorded for each combination of communication device, number of nodes, MPI ranks and the process distribution model
- Configuration is stored in Intel ® MPI folders and available to all users

```
# Collect configuration values:
$ mpitune [options]
```

```
# Reuse recorded values:
$ mpirun –tune ./application
```

Application Specific Tuning with mpitune

Find optimal values for library tuning knobs on the particular cluster or application environment.

- Run it for each application and after application- or cluster configuration change
- Best configuration is recorded for each combination of communication device, number of nodes, MPI ranks and the process distribution model
- Configuration is stored in user's home

```
# Collect configuration values:
$ mpitune [options]   \
--application \"mpirun application\"
```

```
# Reuse recorded values:
$ mpirun –tune ./app.conf \
./application
```

What is the actual search space of mpitune?

I_MPI_DYNAMIC_CONNECTION	I_MPI_ADJUST_GATHERV
I_MPI_RDMA_SCALABLE_PROGRESS	I_MPI_ADJUST_ALLGATHER
I_MPI_RDMA_TRANSLATION_CACHE	I_MPI_ADJUST_ALLGATHERV
I_MPI_WAIT_MODE	I_MPI_ADJUST_SCATTER
I_MPI_ADJUST_BCAST	I_MPI_ADJUST_SCATTERV
I_MPI_ADJUST_BARRIER	I_MPI_ADJUST_REDUCE
I_MPI_EAGER_THRESHOLD	I_MPI_ADJUST_ALLREDUCE
I_MPI_INTRANODE_EAGER_THRESHOLD	I_MPI_ADJUST_REDUCE_SCATTER
I_MPI_RDMA_EAGER_THRESHOLD	I_MPI_ADJUST_ALLTOALL
I_MPI_ADJUST_GATHER	I_MPI_ADJUST_ALLTOALLV

… for different fabrics, iterations, contents, ranks per node and overall rank counts …

Estimating the runtime of mpitune

The overall runtime of mpitune can be estimated by.:

#options x #option parameters x #iterations x application runtime

Can be determined using the scheduler only –so option of mpitune

Can be taken from the options.xml in $I_MPI_ROOT/etc64 but is quite complex – take the average of 5

Default is 3 iterations unless specified differently via the –I parameter

Should be known by the user / alternatively time the execution of the scheduler only mode

mpitune takes time … ! Faster?
-----*fast*-----

Leverage fast tuning to adjust the collective algorithms used by your application.

- mpitune --fast 1 – uses a separate mpitune binary -> different parameters
- Requires certain amount of time spent in collectives (10% default)
- Workflow
  1. Executes target application once
  2. Studies IMPI statistics generated
  3. Runs the Intel® MPI Benchmarks to tune collectives used (#ranks, message size, algorithm)


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