Small Programs With Big Speedups

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Inria

February 15th, 2024

Objectif

Trouver des petits programmes illustrants des speedups que l'on peut optenir avec des transformations de code

Swap

```
for(int i=0; i<n; i++){
  for(int j=0; j<n; j++){
    T[j][i]++;
  }
}
```

```
for(int j=0; j<n; j++){
  for(int i=0; i<n; i++){
    T[j][i]++;
  }
}
```

Speedup : 6x

Transposition With Tile 2d

```
for(int i=0; i<n; i++){
  for(int j=0; j<n; j++){
    ADDR(V, n, j, i) =
    ADDR(T, n, i, j);
  }
}
```

```
const int L3Space = 4194304;
int blockSize = L3Space/(n<<5);

//we want that blockSize divide n
while(n%blockSize)blockSize--;//blokSize divide n
for(int iBlock=0; iBlock<n; iBlock += blockSize){
  for(int jBlock=0; jBlock<n; jBlock += blockSize){
    for(int i=0; i<blockSize; i++){
      for(int j=0; j<blockSize; j++){
        ADDR(V, n, iBlock+i, jBlock+j) =
        ADDR(T, n, jBlock+j, iBlock+i);
      }
    }
  }
}
```

Speedup : 10.8x

Matrix Multiplication With Tile 2d

```
for(int i=0; i<n; i++){
  for(int j=0; j<n; j++){
    ADDR(V, n, i, j) = 0;
    for(int k=0; k<n; k++){
      ADDR(V, n, i, j) +=
        ADDR(T, n, i, k)*
        ADDR(Ut, n, j, k);
    }
  }
}
```

```
const int L3Space = 4194304;
//traverse the list block by block
int blockSize = L3Space/(n<<5);

//we want that blockSize divide n
while(n%blockSize)blockSize--;//blokSize divide n
for(int iBlock=0; iBlock<n; iBlock += blockSize){
  for(int jBlock=0; jBlock<n; jBlock += blockSize){
    for(int i=0; i<blockSize; i++){
      for(int j=0; j<blockSize; j++){
        ADDR(V, n, iBlock+i, iBlock+j) = 0;
        for(int k=0; k<n; k++){
          ADDR(V, n, iBlock+i, iBlock+j) +=
            ADDR(T, n, iBlock+i, k)*
            ADDR(Ut, n, iBlock+j, k);
        }
      }
    }
  }
}
```

Speedup : 2.1x

Aos2Soa

```
typedef struct{
  int data[32];
}point;

for(int i=0; i<n; i++){
  ps[i].data[0]++;
}
```

```
for(int i=0; i<n; i++){
  pss[0][i]++;
}
```

Speedup : 20.2x

Conditionnal Loop Spliting

```
for(int j=0; j<100; j++){
  for(int i=0; i<n; i++){
    if(j<50)
      T[i] += 1;
    else
      U[i] += 2;
  }
}
```

```
for(int j=0; j<100; j++){
  if(j<50){
    for(int i=0; i<n; i++){
      T[i] += 1;
    }
  }else{
    for(int i=0; i<n; i++){
      U[i] += 2;
    }
  }
}
```

Speedup : 1.12x

Loop fusionning

```
int s=0;
for(int i=0; i<n; i++){
  T[i] = i;
}
for(int i=0; i<n; i++){
  s += T[i];
}
```

```
int s=0;
for(int i=0; i<n; i++){
  T[i] = i;
  s += T[i];
}
```

Speedup : 1.15x

Inline

```
void
__attribute__ ((noinline))
f(int i, int* x){
  (*x) += i;
}
```

```
int x=0;
for(int i=0; i<n; i++){
  f(i, &x);
}
```

```
int s=0;
for(int i=0; i<n; i++){
  T[i] = i;
  s += T[i];
}
```

Speedup : 13x