



Brook+
SC07 BOF Session

November 13, 2007

What is Brook+?

Brook is an extension to the C-language for stream programming originally developed by Stanford University

Brook+ is an implementation by AMD of the Brook GPU spec on AMD's compute abstraction layer with some enhancements

Example

```
kernel void sum(float a<>, float b<>, out float c<>)
{
    c = a + b;
}
```

```
int main(int argc, char** argv)
{
```

```
    int i, j;
    float a<10, 10>;
    float b<10, 10>;
    float c<10, 10>;
```

```
    float input_a[10][10];
    float input_b[10][10];
    float input_c[10][10];

    for(i=0; i<10; i++) {
        for(j=0; j<10; j++) {
            input_a[i][j] = (float) i;
            input_b[i][j] = (float) j;
        }
    }
}
```

```
    streamRead(a, input_a);
    streamRead(b, input_b);

    sum(a, b, c);

    streamWrite(c, input_c);
    ...
```

```
}
```

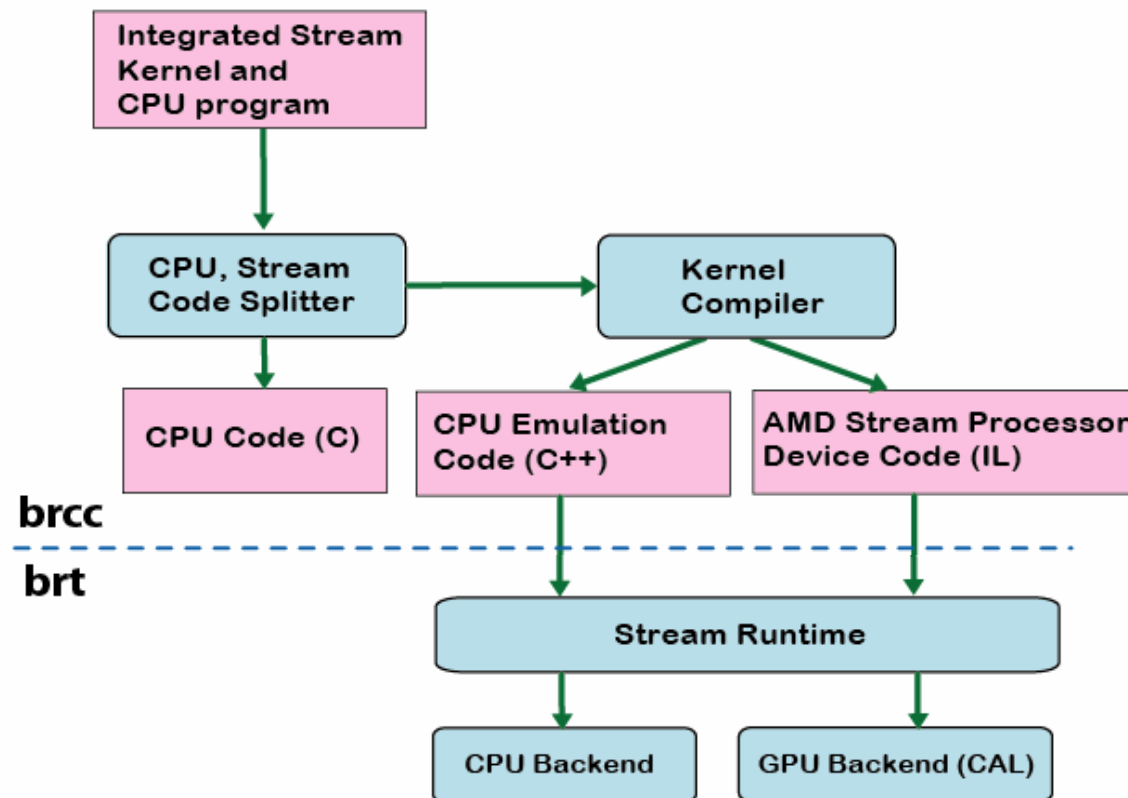
Kernels – Program functions that operate on stream elements

Streams – collection of data elements of the same type which can be operated on in parallel.

Brook+ access functions

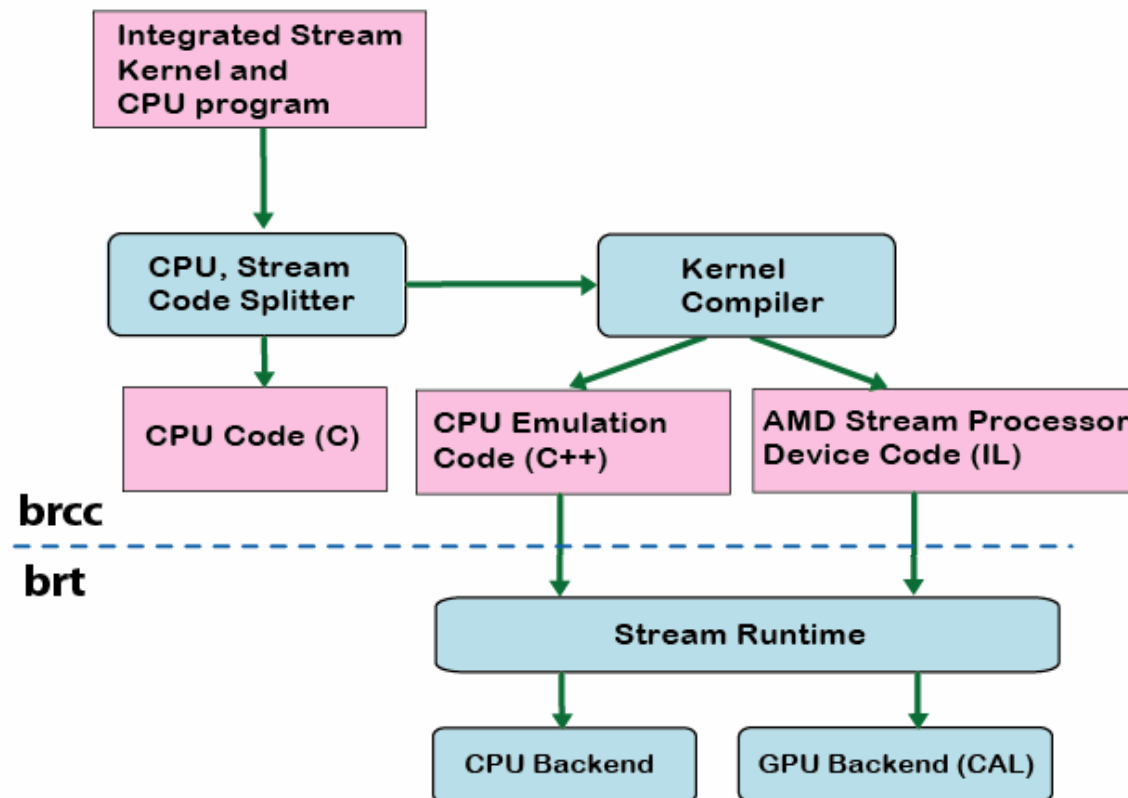
Brook+ Compiler

Converts Brook+ files into C++ code. Kernels, written in C, are compiled to AMD's IL code for the GPU or C code for the CPU.



Brook+ Runtime

IL code is executed on the GPU. The backend is written in CAL.



Brook+ Features

Brook+ is an extension to the Brook for GPUs source code.

Features of Brook for GPUs relevant to modern graphics hardware are maintained.

Kernels are compiled to AMD's IL.

Runtime uses CAL for the GPU backend.

Original CPU backend also included.

Folding@Home Stats

Folding@Home client using Brook+

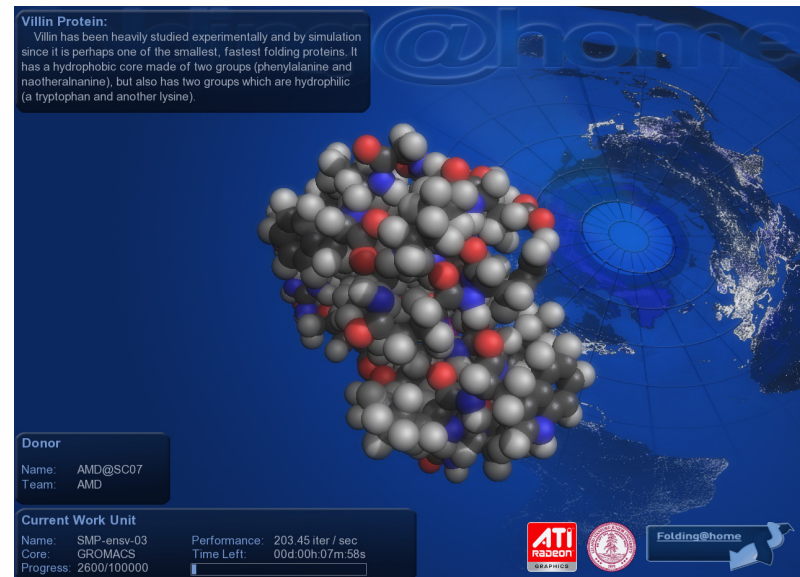
Currently 39 TFLOPS on 664 GPU clients

Avg. **60 GFLOPS** per GPU client

Compared to:

Avg. 25 GFLOPS per PS3 client

Avg. 1 GFLOPS per CPU client



Villin Protein:
Villin has been heavily studied experimentally and by simulation since it is perhaps one of the smallest, fastest folding proteins. It has a hydrophobic core made of two groups (phenylalanine and nautheralanine), but also has two groups which are hydrophilic (a tryptophan and another lysine).

Donor
Name: AMD@SC07
Team: AMD

Current Work Unit
Name: SMP_anav-03 Performance: 203.45 iter / sec
Core: GROMACS Time Left: 00d:00h:07m:58s
Progress: 2600/100000

ATI Radeon Folding@home

Brook+ Release

Brook+ package:

- Compiler and runtime binaries
- Source code and build environments
- Sample applications

Source code released under the BSD License.

Project will also reside on SourceForge.net.

Brook+ Moving Forward

Double precision - FireStream 9170

Mem-export (scatter)

Graphics API interoperability

Multi-GPU support

Other operating systems (Linux, Vista, 64-bit)

DISCLAIMER

The information presented in this document is for informational purposes only and may contain technical inaccuracies, omissions and typographical errors.

The information contained herein is subject to change and may be rendered inaccurate for many reasons, including but not limited to product and roadmap changes. AMD assumes no obligation to update or otherwise correct or revise this information. However, AMD reserves the right to revise this information and to make changes from time to time to the content hereof without obligation of AMD to notify any person of such revisions or changes.

AMD MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE CONTENTS HEREOF AND ASSUMES NO RESPONSIBILITY FOR ANY INACCURACIES, ERRORS OR OMISSIONS THAT MAY APPEAR IN THIS INFORMATION.

AMD SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. IN NO EVENT WILL AMD BE LIABLE TO ANY PERSON FOR ANY DIRECT, INDIRECT, SPECIAL OR OTHER CONSEQUENTIAL DAMAGES ARISING FROM THE USE OF ANY INFORMATION CONTAINED HEREIN, EVEN IF AMD IS EXPRESSLY ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Trademark Attribution

AMD, the AMD Arrow logo and combinations thereof are trademarks of Advanced Micro Devices, Inc. in the United States and/or other jurisdictions. Other names used in this presentation are for identification purposes only and may be trademarks of their respective owners.

©2007 Advanced Micro Devices, Inc. All rights reserved.