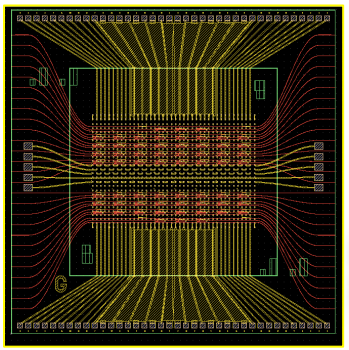
SAND2014-18936C

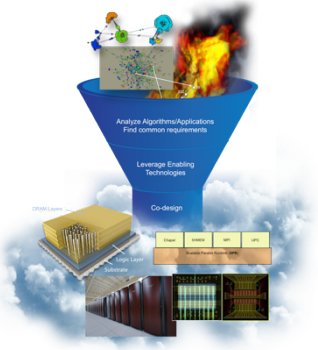
Exceptional service in the national interest

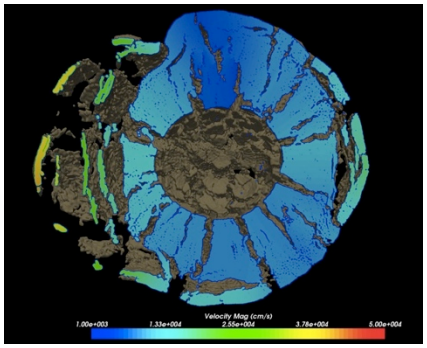
Sandia National Laboratories

XGC

EXTREME-SCALE COMPUTING GRAND CHALLENGE







(Two) Informatics Proxy Apps

Brian Rigdon, Jon Berry, Dylan Stark & XGC Team
Sandia National Laboratories

CLSAC 2014 Random Access
October 15, 2014

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND NO. 2011-XXXXP

Miniapps project : Mantevo

Cleverleaf 1.0	Eulerian on structured grid with AMR
CloverLeaf 1.0.1	Compressible Euler eqns, explicit 2nd order accurate
CoMD 1.1	Molecular dynamics (SPaSM)
HPCCG 1.0	Unstructured implicit finite element
miniFE 2.0	Implicit finite element solver
miniGhost 1.0.1	FDM/FVM explicit (halo exchange focus)
miniMD 1.2	Molecular dynamics (Lennard-Jones)
miniXyce 1.0	SPICE-style circuit simulator
miniAMR	Adaptive mesh refinement of an Eulerian mesh
miniSMAC	FD 2D incompressible N/S on a structured grid.
PathFinder	Signature graph search
miniAero	3D unstructured FV R-K 4th order time marching, inviscid Roe Flux
miniContact	Solid mechanics
miniExDyn-FE	Explicit Dynamics (Kokkos-based)
miniITC-FE	Implicit Thermal Conduction (Kokkos-based)
miniSAT*	Boolean Satisfiability
miniTri*	Graph triangle enumeration
phdMesh	Explicit FEM: contact detection

Modified for XGC

Developed for XGC

Pathfinder

miniTri

Pathfinder: for code analysis

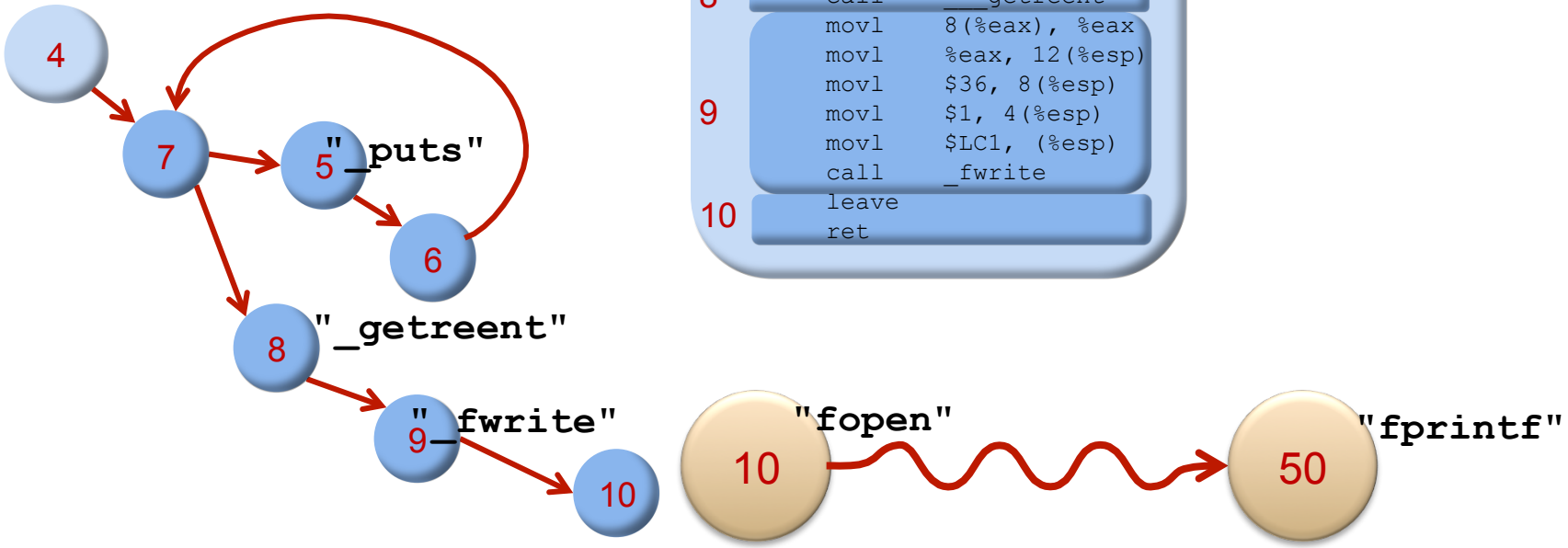
Sandia National Laboratories

```
void answer(int arg)
{
    int i = 0;

    while ( i < arg ) {
        printf("Not the right answer\n");
        ++i;
    }

    fprintf(stdout, "\n\tLife, the universe"
            " and everything\n");
}
```

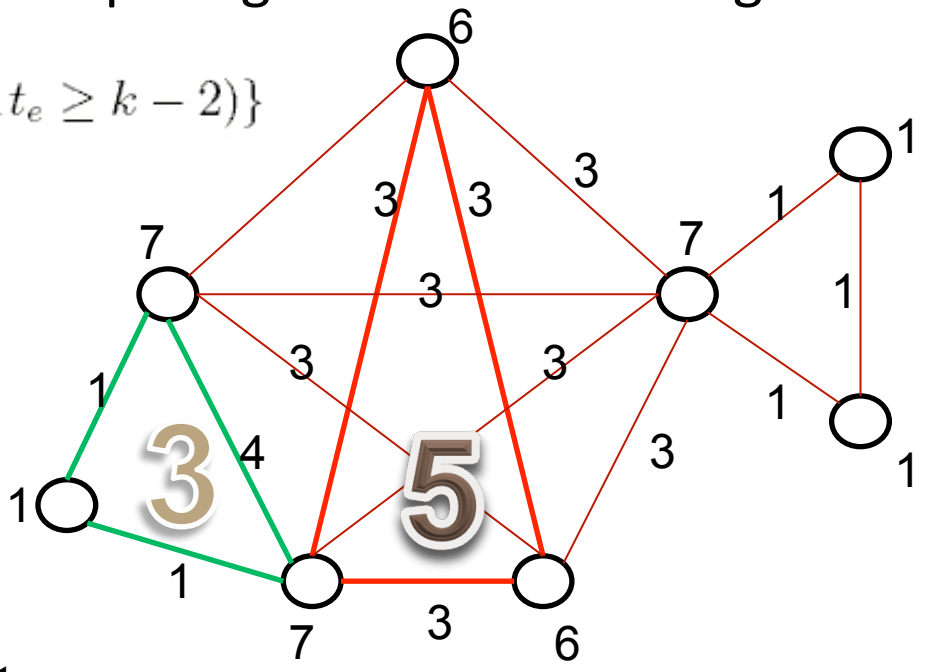
```
_answer:
    pushl   %ebp
    movl    %esp, %ebp
4   subl    $40, %esp
    movl    $0, -12(%ebp)
    jmp     L2
L3:
    movl    $LC0, (%esp)
5   call    _puts
6   addl    $1, -12(%ebp)
L2:
    movl    -12(%ebp), %eax
7   cmpl    8(%ebp), %eax
    jl      L3
8   call    ___getreent
    movl    8(%eax), %eax
    movl    %eax, 12(%esp)
    movl    $36, 8(%esp)
9   movl    $1, 4(%esp)
    movl    $LC1, (%esp)
    call    _fwrite
10  leave
    ret
```



MiniTri: social network analysis

1. Enumerate triangles, computing the triangle degree of each vertex (t_v) and edge (t_e)
2. Enumerate triangles again, computing “k” for each triangle:

$$\arg\max_k \{(\min_{v \in t} t_v \geq \binom{k-1}{2}) \cap (\min_{e \in t} t_e \geq k-2)\}$$



Output: a frequency table of k-counts

K	1	2	3	4	5
#triangles	0	0	2	0	10