Fine-Grain Computing

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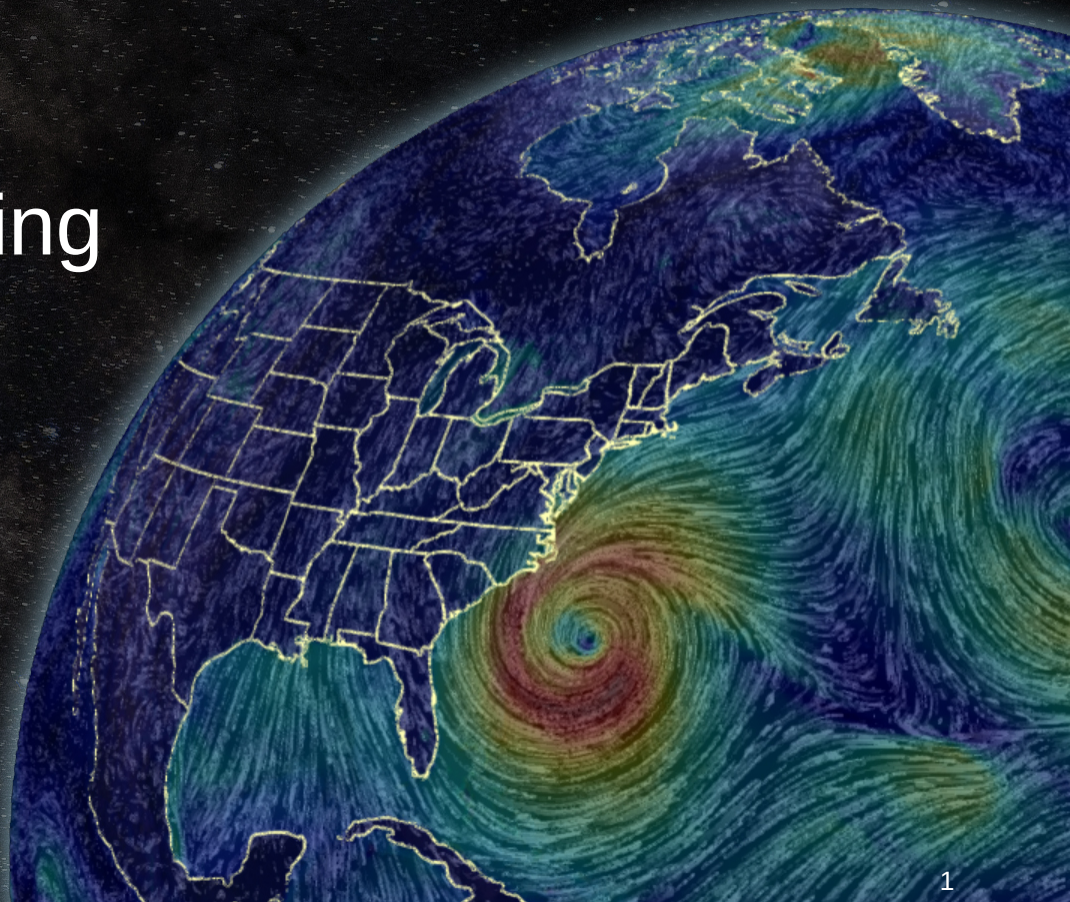
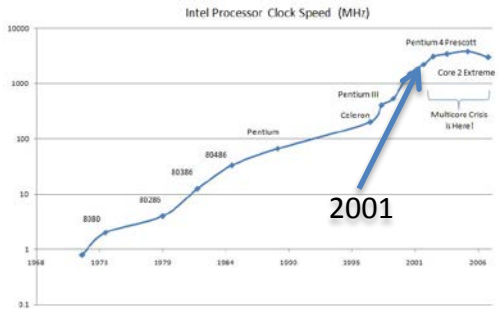
GSD Science Review
3-5 Nov 2015



Evolution of HPC

- Increasing number of cores
- Increasing cost: system, facilities, power

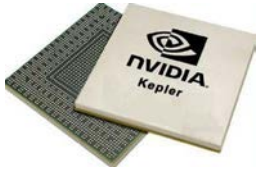


CPU

Intel Haswell
24 cores / chip
270 Watts, $3.5K

Key Chip Technologies in 2015

Fine-Grain: GPU & MIC



NVIDIA Kepler GPU
4992 cores / chip
300 Watts, $5K

Theia CPU: 25K cores, $17M

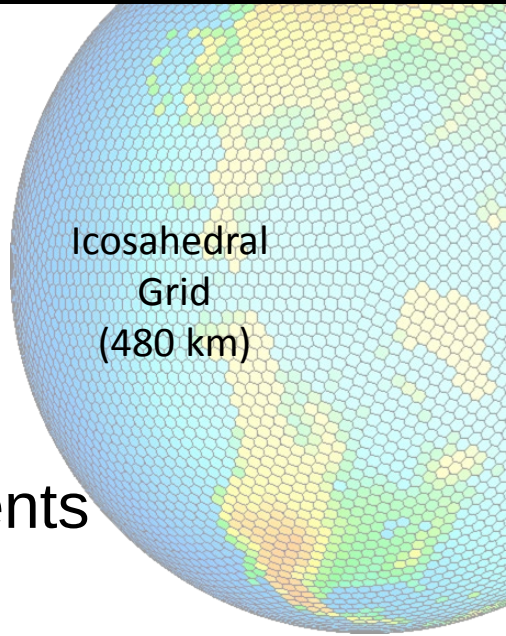
NOAA Research Systems

NOAA FG System
May 2016

??? cores, $8M

Fine Grain Computing Research

- Goal: run 3 km global at NWS by 2020
  - 5 billion grid cells (50M horizontal, 100 vertical)
  - 1000 GPUs = 5 million compute cores
  - Models must exploit parallelism
- NIM used to demonstrate and drive requirements
  - Good design
    - Portability, Performance
    - CPU, GPU, MIC
  - Compilers, directives
    - F2C-ACC drives Industry



2015 Edison CPU
130K cores

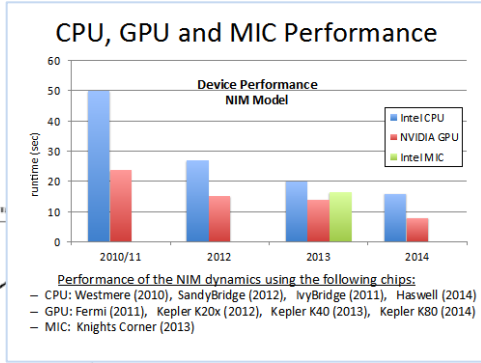
2012 Titan GPU
17K GPUs

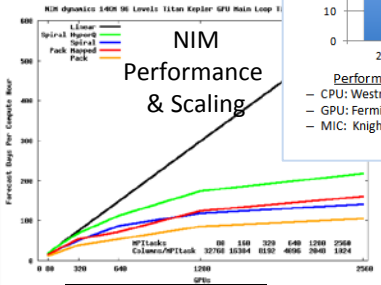
Research and Operations

- Leadership on HPC for NOAA
  - Explore new technologies
  - Collaborations with industry
- Apply NIM lessons to FV-3, MPAS

CRAY

intel



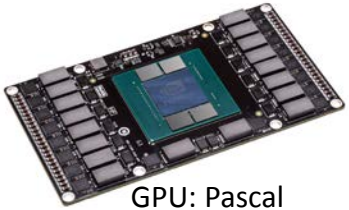


IBM

NVIDIA

PGI

2016 Chips



GPU: Pascal

MIC:
KNC

CPU: ARM-64