Mnemosyne: Program Analysis Tools for HPC Code Optimization

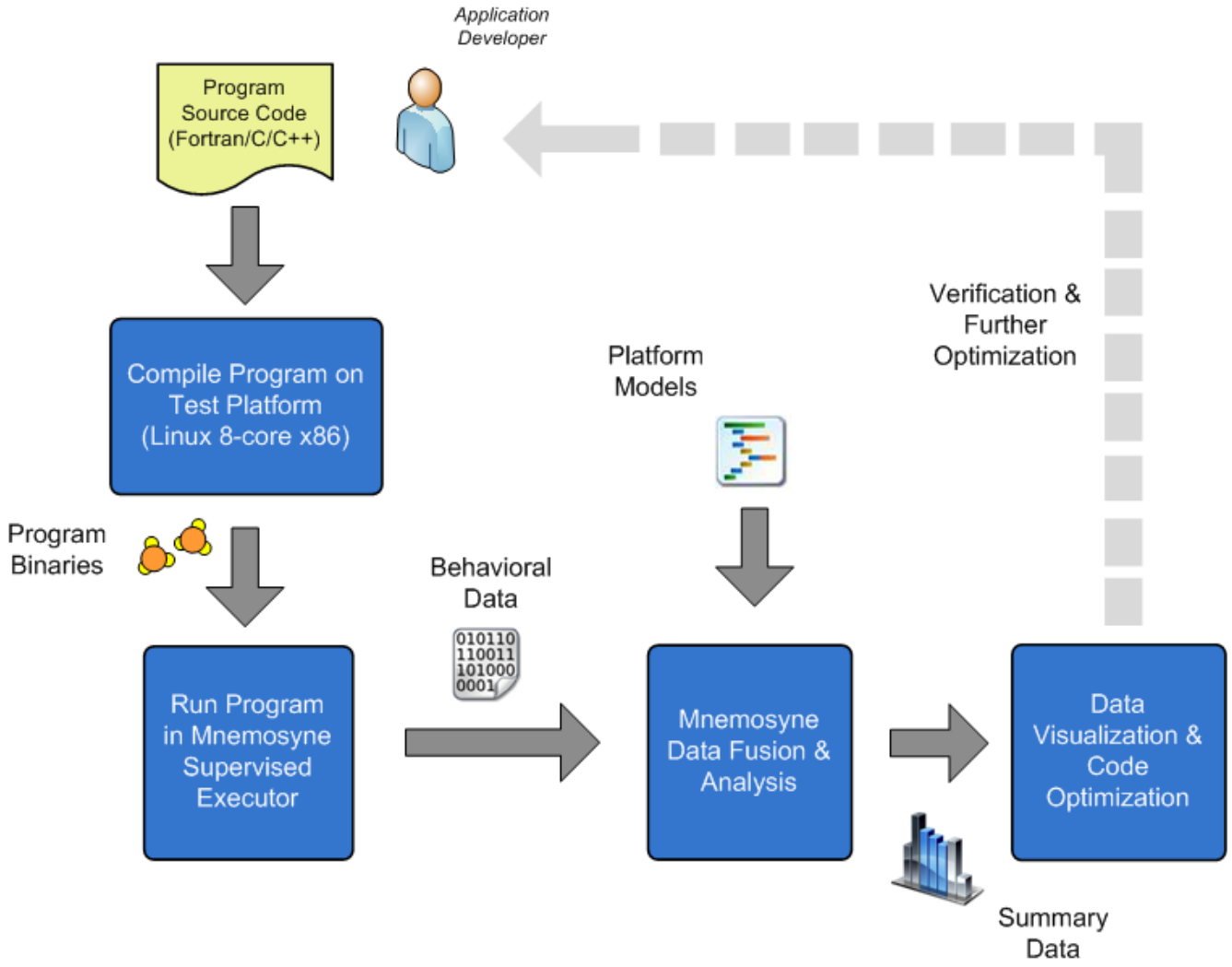
Lockheed Martin
Advanced Technology Laboratories (ATL)
Cherry Hill, NJ

Shahrukh R. Tarapore
Research Scientist

Application Behavior Problem

- **HPC codes are written by domain experts - not computer systems engineers**
- **Naïve implementations lead to bottlenecks which are typically platform specific**
- **HPC hardware architectures will continue to change rapidly**
  - **a new platform often means repeating the optimization process**

Solution: Mnemosyne



Experimental Results

Application	Language	Description	SLOC	Speedup	Behaviors
CIT Airshed	Fortran	Models formation and dispersal of atmospheric pollutants	0.4K	2x	Memory striding Function Invariants
LIBQuantum	C	Quantum mechanics simulation	37K	1.75x	Memory striding
GNU Go	C	Artificial intelligence playing the game ‘Go’	571K	1.05x	Memory striding Branch invariants
OpenLB Poiseuille2D	C++	Computational Fluid Dynamics Simulation	55K	1.02x	Memory striding Branch invariants
ICEPIC	C	High power microwave physics modeling	78K	1x	Memory striding Branch invariants Misaligned Accesses

- **All applications are compiled with dwarf-2 debugging symbols and level 0 optimization.**