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Extreme-Scale Parallel Discrete Event Simulation

S&T Campaign: Computational Sciences
Predictive Simulation Sciences

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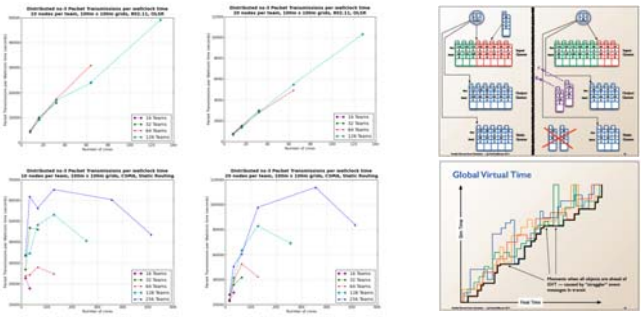
Research Objective

- Develop algorithms for extreme-scale parallel discrete event simulation focusing on new architectures and optimistic approaches
- Integration of algorithms into next generations of network simulation codes

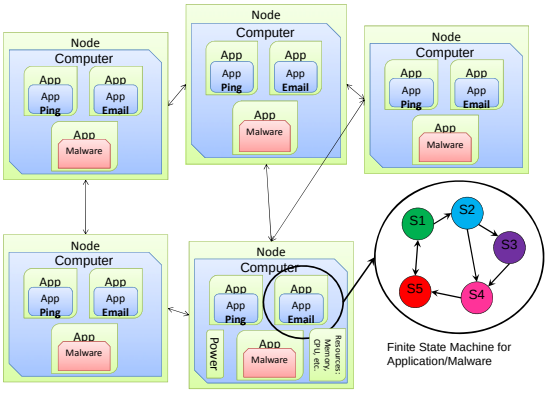


ARL Facilities and Capabilities Available to Support Collaborative Research

- HPCMP/ARL-DSRC supercomputer resources (Pershing, Excalibur)
- Extensive experience with parallel discrete event simulation with NS-3 on HPC platforms
- Demonstrated large-scale simulation on HPC platforms (360M network nodes)

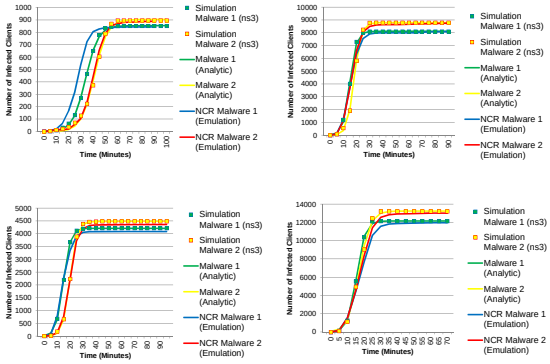
Challenges

- Overcoming inter-process communication latencies among processing elements of a simulation
- Algorithms for optimistic parallel discrete event simulation involving roll-backs and automatic reverse computation code generation
- Internet-scale network simulations
- Packet routing in large-scale network simulations
- Validate hypothesis that finite state machine representations of systems of interest provides sufficient detail to provide statistically accurate results



Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Extreme-scale Parallel Discrete Event Simulation expertise
- Optimistic Parallel Discrete Event Simulation systems and tools for building modeling and simulation codes
- Network simulation tools that can perform at large scales



Run # , Malware #	10% Infected Time (Sim, Emu)	50% Infected Time (Sim, Emu)	90% Infected Time (Sim, Emu)
Trial B Malware 1	1362, 1130	2066, 1770	2754, 2340
Trial B Malware 2	1892, 1856	2558, 2604	3210, 3177
Trial C Malware 1	520, 499	884, 862	1246, 1414
Trial C Malware 2	830, 786	1196, 1206	1562, 1640
Trial D Malware 1	526, 499	867, 897	1206, 1391
Trial D Malware 2	835, 626	1187, 999	1537, 1499
Trial E Malware 1	595, 659	925, 1126	1253, 1613
Trial E Malware 2	593, 713	1021, 1176	1445, 1673

Comparison of Finite State Machine Model and Emulation Testbed Results

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