



**PROGRAM EXECUTIVE OFFICE FOR
SIMULATION, TRAINING & INSTRUMENTATION**

Operational HPC for Interactive Training Applications

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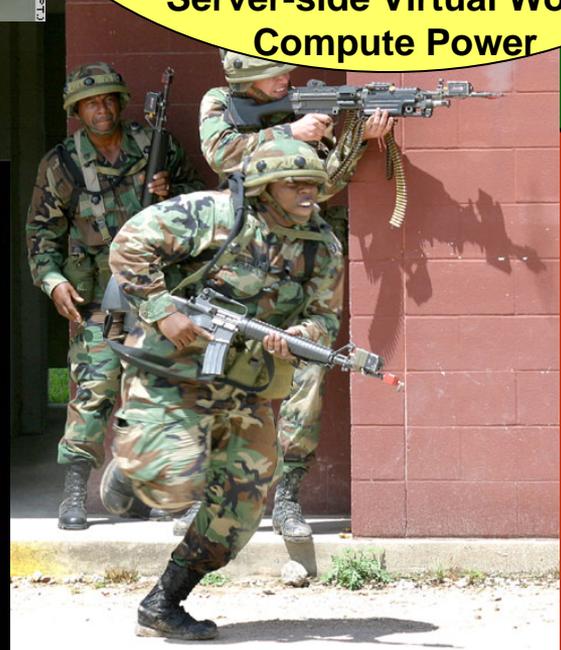
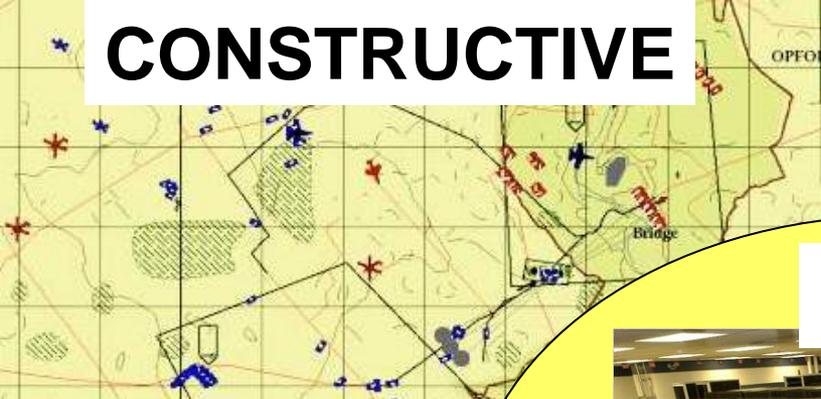
CONSTRUCTIVE

VIRTUAL

HPC



**Server-side Virtual World
Compute Power**



LIVE



HPC Benefits to Warfighter Training

- HPC as the server farm for interactive training simulation
 - ❖ **Constructive:** Primary host for training
 - ❖ **Live & Virtual:** Wrap-around play box
 - ❖ **Games:** Rich server-side models

- Break the “one facility, one exercise” paradigm
 - ❖ Multiple simultaneous exercises supported from a single simulation center
 - ❖ Put the Sim Center in the cloud

- Physics-based objects, weather, and terrain
 - ❖ Put the “reality” in virtual reality

- Reduce sim-to-sim lag
 - ❖ Host multiple sims on the same computer



OneSAF vs. World of Warcraft

World of Warcraft

Visual Detail: 100X

Algorithm Detail: 1X

Heavy Client Demand

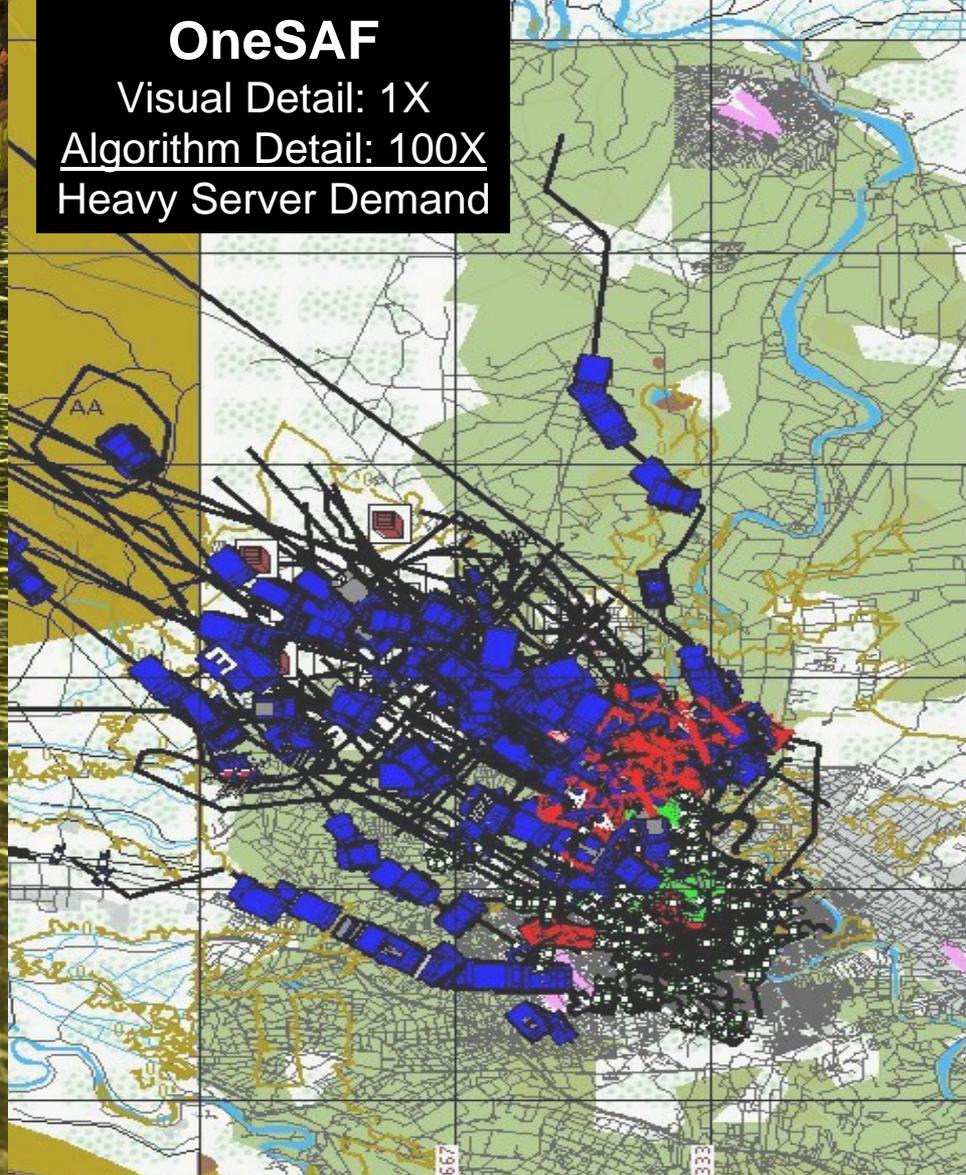


OneSAF

Visual Detail: 1X

Algorithm Detail: 100X

Heavy Server Demand



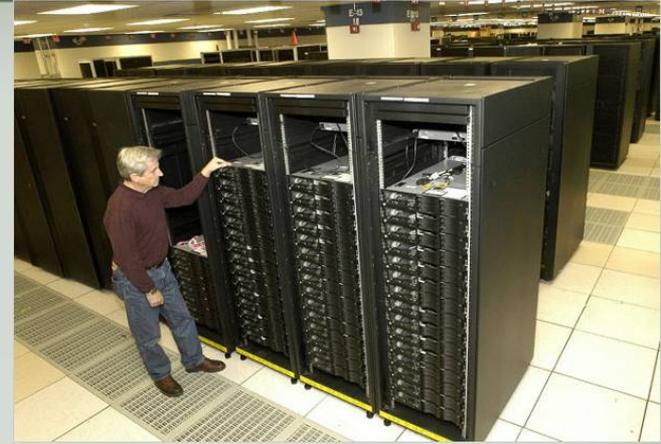


Some Technical Challenges

1. **Interactive HPC** – exploring bandwidth sufficiency from the computational elements to multiple external users.
2. **HPC I/O Structure** – HPC structure that best supports interactive users.
3. **Interactive User Security** – verification of users communicating with jobs on open ports.
4. **Simulation as an IT Service** – creating infrastructure to match customers and sims.
5. **Fault Tolerance** – auto restarting a job when a processor dies, and doing so without losing the partial data that was in the works.
6. **Processing Hierarchy** - introduction of a processing hierarchy in the logic of simulation architecture design.
7. **Parallel Programming** – training the simulation industry in parallel programming techniques, vs. the network programming that has dominated for 20 years.
8. **Cloud Compute Environments** – load-balancing and task assignment in a network of HPCs and traditional workstations.
9. **Organizational Restructure** - technical and organizational challenges of using a shared resource for interactive simulation, rather than distributed commodity hardware.



Evolving the Simulation Center





Predecessor Experiments

- WARSIM Port
 - ❖ HPCMO, ARL, SAIC
- Physics-based Environment for Urban Operations using OneSAF
 - ❖ HPCMO, STRI, SAIC, CERDEC, NRL
- Millennium Challenge Exercise Clutter using JointSAF
 - ❖ JFCOM, Maui SCC, Alion
- PEO-C3T C4ISR On-the-Move using OneSAF
 - ❖ CERDEC, HPTi, SAIC, HPCMO



Conclusion

- Increase soldier/unit access to training systems
 - ❖ Open connection to dot.mil network
- Reduce operational costs for hardware, shipping, set-up time, travel, staffing
 - ❖ Connect from home station, stop traveling
- Increase model fidelity
 - ❖ Power to enrich the virtual world
- Increase model synchronization
 - ❖ Tight connections between processors
- Increase exercise reliability and availability
 - ❖ Multiple redundant resources