Interactive Systems Simulation and Analysis Department
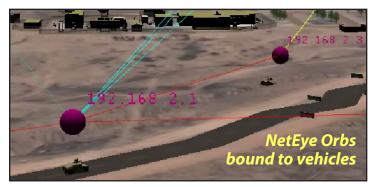
FACT SHEET

Analysis and visualization of dynamic physical-cyber operations has been difficult to achieve. As one solution, Sandia has integrated its flexible *Umbra* environment that allows modeling and simulation of physical, cyber, and human cognitive elements with its *NetEye*, a flexible dynamic interaction event visualizer.
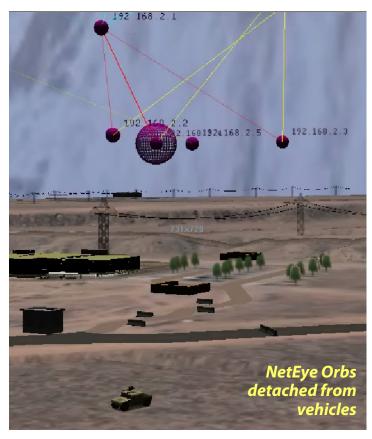
Dynamic visualization allows analysts to understand operational relevance and detect patterns in behavior displayed at rates faster, slower or equal to real time.

In the illustrated examples on this sheet, NetEye was set up to display network TCP/IP traffic occurring between vehicles in a mobile ad-hoc network. Hosts were represented by red orbs. Transmitted network packets were represented by yellow lines and blue lines for reception, each touching a TCP port plane suspended above the physical simulation. Red lines represented network control.

NetEye was detached and suspended above the physical simulation of vehicles, roads, and facilities. Orbs (hosts) sending more moved right. Those receiving more, moved left.

Orbs that had more traffic moved up, and those with less traffic moved down. See illustrations on the next page. Through
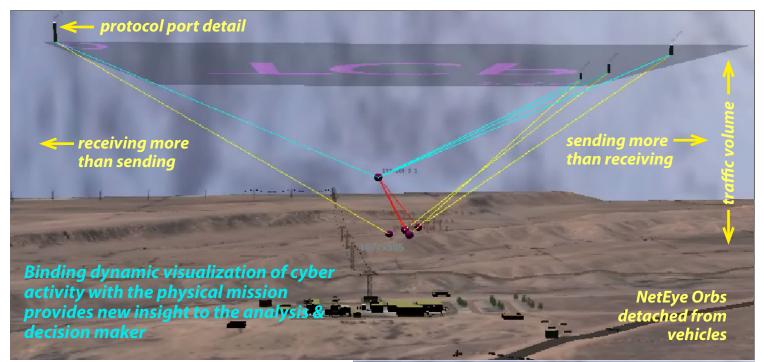

NetEye Orbs detached from vehicles

this visualization it was evident that one host was acting as a uplink to a long-range network because of the pattern of activity and positioning of the orbs denoting hosts. It was not clear which vehicle moving along the ground was serving this function.

A simulation control commanded all orbs to descend to their respective vehicles. This binding showed which vehicle held the uplink function while temporarily losing visualization of traffic volume and send/receive ratio available in the detached co-visualization.

Because of Umbra's modular nature, this capability is available to all Umbra-based tools.

NetEye Orbs bound to vehicles

protocol port detail

receiving more than sending

sending more than receiving

traffic volume

Binding dynamic visualization of cyber activity with the physical mission provides new insight to the analysis & decision maker

NetEye Orbs detached from vehicles

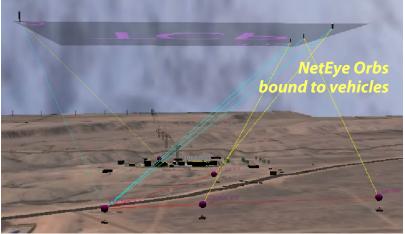

NetEye Orbs bound to vehicles

This particular simulation and visualization is only one example of how a dynamic cyber and physical system can be viewed. NetEye within Umbra allows for creating any visual metaphor for events that could include social interactions, weapon hits on targets, as well as communication protocols such as radio, cell phone, and Internet traffic. Events can be from recorded, simulated, or live sources and can be quickly reconfigured through a graphical interface.
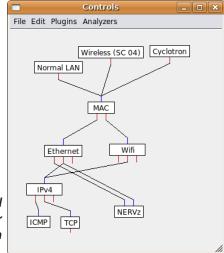
Umbra allows for variable fidelity of simulation including terrain, buildings, vehicles, physics, human behavior models, and cyber activity. Umbra can directly federate with other simulations and is HLA and TENA compliant.

Activity in Umbra simulations can mix live, virtual, and constructive (LVC) activity which allows mixing simulated and live devices, people, or components of a system into one real-time interaction.

NetEye graphical interface allows for rapid reconfiguration of the visual display.

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Built upon

UMBRA

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