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My topic is relevant and of broad interest to the Training, Simulation, & Education community:

I affirm

My abstract includes significant new information beyond that of my previously published works:

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My topic principally does not describe a product or service for sale (i.e., is not a sales pitch):

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Subcommittee Category:

Simulation

Title:

A Structure for Representing Critical Infrastructures

How would you label your submission?:

Industry

Abstract:

As per directive PPD-21, and as the war in Ukraine has exposed, models and simulations need to incorporate Critical Infrastructures (CIs) to ensure using them results in effective training. Historically, CI has been minimally included in legacy training systems because modeling them correctly is tremendously complicated. CIs challenge the conventional representation of the terrain in that they require more than a description of physical attributes of structural elements (e.g., location, shapes, materials, and visual attributes). CI models must describe how a given structure is linked to other structures and how they are interdependent in terms of function and use. Many aspects of representing and handling CI is difficult, such as reasoning about non-local, far-reaching, first-order ripple effects caused by damage to the intended function of a structure. Even more difficult is taking account of second- and third-order impacts due to unintended functions and uses. Thus, it is not enough that CI structures and their linkages appear in the terrain; the runtime system must also preserve the coherence of the terrain by accounting for the cascading results of local damage to these structures.

In this paper, we describe a flexible data model that can be used to assemble complicated CI networks. This novel solution invites the cooperation between static terrain data generators, runtime, and modeling subsystems to architect the CI. We also present a solution that maintains coherence of the CI network via a runtime engine, while leaving the modeling to the simulations, by adapting Leontief's Input/Output classical model. This prize-winning approach has historically been employed by economists to determine the state of an infrastructure network given changes in demand for the goods and services the infrastructure provides. As a use case, the paper demonstrates this methodology using a realistic specification of a megacity's infrastructures.

Keywords:

M&S, TERRAIN

Additional Keywords not in the list above:

Critical/Civilian Infrastructure, OWT, Megacities,

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No

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