DIESIS KEY FACTS

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CONSORTIUM

Fraunhofer IAIS	Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS, DE (coordinator)
CRIAI	Consorzio Campano di Ricerca per l'Informatica e l'Automazione Industriale (CRIAI), IT
ENEA – Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile	Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), IT
Imperial College London	Imperial College London (ICL), UK
TNO	The Netherlands Organisation for Applied Scientific Research (TNO), Defence, Security and Safety, NL

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DIESIS

DESIGNING A NEW RESEARCH FACILITY FOR CRITICAL INFRASTRUCTURE PROTECTION

INTRODUCTION

Critical Infrastructures (CI) that are vital for a society and an economy, such as telecommunication systems, energy systems, transport systems, and others, are getting more and more complex. CI dependencies emerge in various ways, due to the increasing use of information and communication technologies, legislation, market liberalisation, and other factors. The understanding of the complex CI systems with all their dependencies and interdependencies is still immature. Yet these CI need to be protected, for instance, against cascading failures that may affect multiple sectors and society at large. Research in the area of CI protection (CIP) therefore has to rely on using models and simulation systems. For simulating complex scenarios with dependencies between different CI, typically heterogeneous federated simulations are used, coupling two or more CI simulators. Researchers applying this method in recent years encountered a number of difficulties, including:

- General modelling interoperability approaches or standards for coupling CI simulators do not exist,
- CI specific data is often corporate sensitive and therefore difficult to retrieve,
- Transforming data into simulation models requires expertise in the involved CI sectors, thus a collaboration with CI sector experts is required but difficult to accomplish,
- Software solutions to CIP problems are difficult or impossible to compare, since standardised benchmarks are lacking.

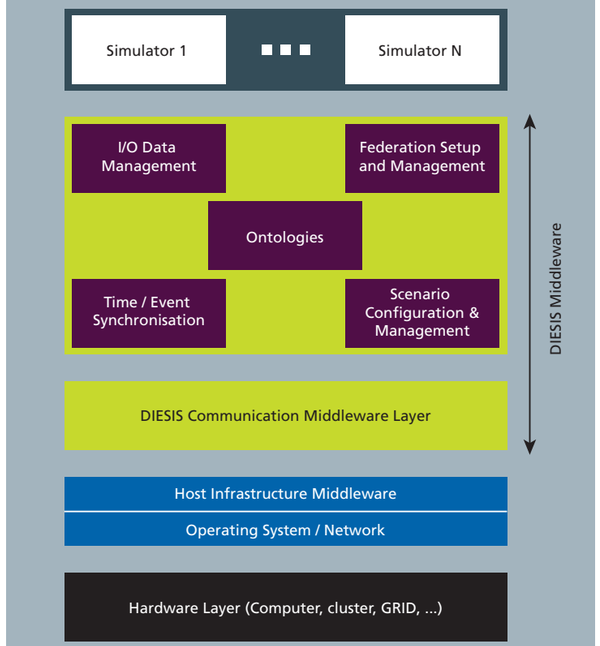
THE EISAC VISION

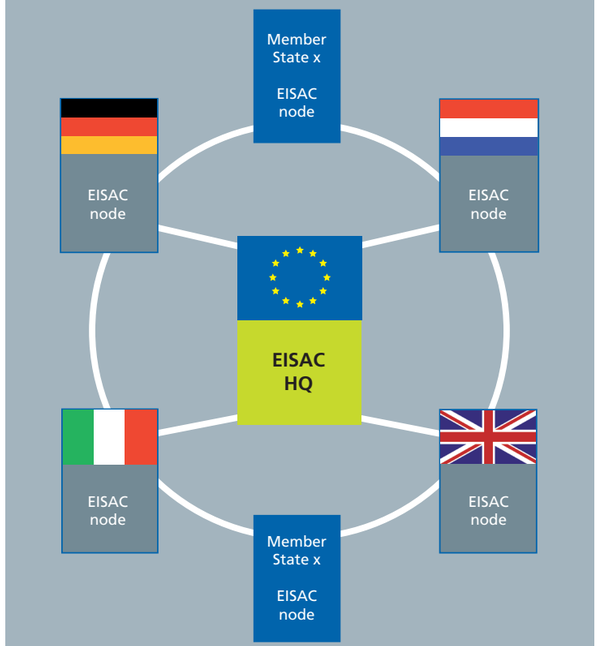
To overcome these difficulties, we envision the establishment of a distributed European research facility dedicated to foster modelling and simulation-based CIP research: the European Infrastructures Simulation and Analysis Centre or EISAC. EISAC will:

- be an operational trans-national European research facility for CIP modelling, simulation, and analysis in the broadest sense, e.g. crisis response and economic effect analysis,
- be a trans-national roof organisation of EISAC fostering standardisation activities, providing infrastructure for technical operations, and ensuring quality and security standards for all EISAC nodes,
- encompass national EISAC nodes which provide special and sensitive national CIP-analysis services,
- be accessible to researchers, CI operators, and governmental organisations involved in CIP for performing collaborative research or private research,
- enable a faster setup of federated CI simulations by providing professional expertise,
- provide collaborative international investigation of cross-border CIP issues,
- provide a comprehensive offer of products and services, including:
  - interoperability technology for distributed, federated CI simulations,
  - repositories of CI and environment data, CI models, threat and effect analysis models,
  - repositories of simulators, analysis tools, and more,
  - repositories of CIP related research results,
  - consultancy in federated CI modelling, simulation and analysis.

THE DIESIS PROJECT

The DIESIS project performed a thorough conceptual design study in order to prepare the establishment of an EISAC. A part of this design study – the technical proof-of-concept – is a scenario-based federated simulation employing three different CI simulators (Siemens Sincal™, NS2, and OpenTrack™), and a common threat simulator (flooding). Underlying are new simulation technologies: CI ontologies at two different levels: the federation and infrastructure domain; a Service Oriented Architecture (SOA)-based CI-model coupling framework; and a quality-of-service-enhanced communication middleware that enables the distributed CI-simulation over the Internet.





The federated simulation employs a scenario of cascading CI disruptions in a large European capital caused by flooding events. This demonstrator has successfully been run over the Internet, with all four simulators running on host computers in four different European nations, exchanging data by means of the performance-enhanced DIESIS communication middleware.

DIESIS TECHNICAL RESULTS

In particular, technical results of DIESIS are:

- An ontology-based information exchange for three CI sectors (electrical power distribution, fixed and mobile telecommunication, and railways), and a common threat simulator (flood simulator). A knowledge-based system (KBS) using the Web Ontology Language OWL is used as middleware to support the ontology-based model connectivity and information exchange.
- An ICT architecture for distributed federations of simulations, including:
  - A scenario-based approach for setting up distributed federations of CI simulators.
  - A lateral coupling approach for federated CI simulations.
  - A methodology for enabling reusable coupling solutions.
- A first version of interoperability middleware for coupling CI simulators, consisting of:
  - A Service Oriented Architecture (SOA)-based framework for linking simulators.
  - A set of standardised links for exchanging data between simulators.
  - A time synchronisation meta-model for three different time and execution models
- A communication middleware for quality-of-service enhanced data exchange over IP-based networks such as the Internet. The middleware is both IPv4 and IPv6 enabled.
- The use of the (draft) Generic Methodology for Verification and Validation (GM-VV) to verify and validate the DIESIS technical proof-of-concept.

DIESIS NON-TECHNICAL RESULTS

The conceptual design study of EISAC includes also non-technical results related to organisational and governance models of EISAC, possible legal forms of the EISAC organisation, economic considerations, and a business model.