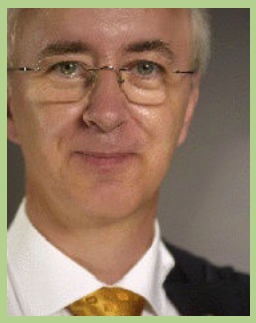
Towards a European CIP Research Facility

Eric Luiijf
Principal Consultant
TNO Defence, Security and Safety
eric.luiijf@tno.nl

Erich Rome
Co-ordinator
Fraunhofer IAIS
diesis@iais.fraunhofer.de



The EU funded project DIESIS has investigated the feasibility of a new European facility for joint research in Critical Infrastructures and their protection. This article summarises the project results.

Our vision is the establishment of a European Infrastructures Simulation and Analysis Centre (EISAC). EISAC will be a distributed European research facility dedicated to foster modelling and simulation-based research in Critical Infrastructures (CI), Critical Information-based Infrastructures (CII), and their protection (CIP). EISAC enables consequence analysis of decisions as part of disaster management activities and planning thereof.

The EU DIESIS project has been a first step in the requirement analysis and design of the EISAC. The next step requires international support by nations, CI operators, and the CIP R&D communities.

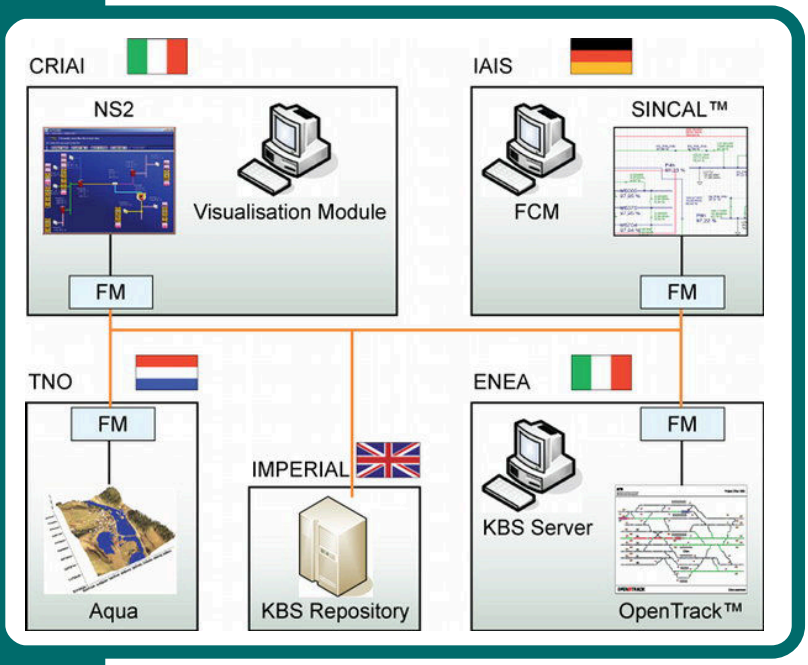
To protect our CI, it is necessary to understand CI and CII dependencies and possible cascading failures better. Such understanding can only be gained either by analysing disruption incidents or by using modelling, simulation and analysis techniques. For obvious reasons, one cannot disrupt the day-to-day operations of e.g., a power grid to perform experiments. In a computer, one can! Nevertheless, researching CI/CIP is a complex task facing many challenges. In particular, the investigation of CI dependencies requires wide domain know-how, and access to specific and often sensitive CI and CII data.

Currently, most infrastructure simulation models are CI-specific (e.g., a power grid simulator) and certainly not interoperable. The EU-sponsored initial design study DIESIS studied the business, operational, and technical requirements for EISAC, the distributed CI modelling, simulation, and analysis centre. This project was undertaken by the consortium Fraunhofer IAIS (Germany), Imperial College (United Kingdom), ENEA and CRIAI (Italy), and TNO (The Netherlands). The consortium identified a number of challenges such as the lack of interoperable CI simulators, the lack of CI data and suitable analysis tools. Moreover, establishing an EISAC requires an effective international cooperation of researchers and stakeholders, not only in the fields of CI and CIP, but also from R&D communities like threat generating models (e.g., a hurricane), and consequence analysis models (e.g., to determine the potential economic and environmental impact). The thorough conceptual DIESIS design study included two proofs-of-concept. Firstly, a technical proof-of-concept, demonstrating primarily the techniques for coupling different CI simulators and running distributed coupled simulations. Secondly, a preliminary business proof-of-concept describing the services of the facility, potential customers, and legal, organisational, and economic aspects of the trans-national EISAC.

The investigation of large scenarios with cascading CI failures affecting critical services in multiple CI requires the use of federated simulations consisting of one or more simulators for each of the involved CI. Additionally, studies may require the linking of CI models with models that generate external threats to the CI, such as a snow storm, wild fire, or flooding of the area. For analysis and decision-support purposes, effects/consequence models in terms of economic loss, casualty, and affected area need to interoperate. And, last but not least, visualisation and other real-time analysis tools may need to be part of the federation of simulators.

Technically, this requires suitable middleware that allows the synchronisation of events and simulation times, the exchange of data between the various distributed simulators, and the exertion of control functions like starting, pausing, resuming and stopping simulations. The analysis and development part of the DIESIS project addressed these issues by designing and developing an ICT architecture, a middleware layer for federating simulators and tools, performance-enhanced IPv4/IPv6 communication middleware for connecting the distributed simulators, and an ontology-based approach for achieving semantic interoperability of the models.

The DIESIS technical proof-of-concept showed the interaction of a simulator representing the electrical power grid (SINCAL™), a simulator representing the telecommunication grid (NS2), a simulator representing railway operations (OpenTrack™). The specific scenario involved a flooding of a specific district of Rome, Italy. The three simulated CI located there were affected by the flood either directly (disruption of service) or indirectly through their critical dependencies. Google Earth was used to visualise the status of the different CI. The proof-of-concept demonstration showed the effectiveness of the DIESIS interoperability middleware and communication tools connecting the distributed simulators located in the UK, the Netherlands, Germany, and Italy (cf. Figure 1).



The EISAC organisational, legal, and economic aspects

An initial activity of DIESIS consisted in clarifying the demand and requirements for a facility like EISAC and in particular the needs of its potential users. A set of business-driven and technical requirements were derived. The trans-national nature of EISAC required the clarification of the legal and organisational aspects including the new European legal organisation form particularly created for trans-national research infrastructures: the European Research Infrastructures Consortium (ERIC). In principle, an ERIC would be the suitable legal form for an EISAC. However, due to its novelty and the required involvement of at least three Member States, the establishment of an EISAC ERIC is perceived to take a long time and be more complicated as compared to other, well-established legal organisation forms.

The DIESIS project has elaborated on the EISAC's business model. It consists of a structured description of possible EISAC products and services, groups of target users and customers, sales channels and marketing activities, such as possible partners for providing products and services and for further developing technology. Typical EISAC products would include interoperability middleware, repositories of models, tools and simulators, scenario management tools, and a workflow tool for setting up federations of CI simulators. EISAC services would include support for sanitising and anonymising CI data, and providing a platform for collaborative CIP research.

Conclusion and Outlook

The realisation of EISAC would foster CI and CIP research in Europe in an unprecedented way. EISAC would have the potential to prevent or reduce CI disruption consequences for nations reducing damages and loss of life. Therefore, the establishment of an EISAC will be beneficial for the European economy as a whole and for the well-being of European citizens. DIESIS has made a first step towards establishing a basis for EISAC. The technical proof-of-concept was a success making it is a strong showcase for EISAC showing that the developed technological concepts are valid and suitable. Possible next steps after the end of DIESIS include further preparation of the construction and deployment of EISAC, provided that support for our view at national and European levels is granted. The consortium looks forward to receive your support for our vision that may be your vision too. Please let us know your reaction.

Acknowledgments

The research leading to these results was partly funded by the European Community's Seventh Framework Programme FP7/2007-2013 under grant agreement n° 212830.