EUROPEAN DEFENCE AGENCY

Fact sheet

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SPEEDUS – Formulation of Standard Procedure to Estimate the Dependency of Large and Complex Civilian & Military Assets with Respect to Public Services

Background Description

Military and civilian functional infrastructures (i.e. hospitals, airports, operational and command & control centres and so on) do depend, to a certain extent, on public critical infrastructure (CI) which deliver critical services (CS) such as electricity, telecommunication, water and gas, transported via routes and railways, etc.

Although military installations (MI) have their own buffer systems enabling them to cope with outages of external services, MI always display a certain level of dependency which must be known to ensure the handling of crisis situation management, by avoiding the reduction of functioning levels below certain given thresholds and by the appropriate dimensioning of back-up systems (BUS). BUS shaping requires a knowledge of the level of MI dependencies with respect to CS outages as it should result from the identification of the worst-case scenario which could hit the area in which it is located and affect the local public infrastructures.

To this end, a global resilience assessment of the MI could be carried out; the project **SPEEDUS** aims at reaching the objective of design and realise a **complete protocol** for assessing MI dependency and allowing its continuous monitoring of the **state of risk** with respect to CS outages.

Project Analysis

MI generally get the resources required to perform their functions, from external suppliers through contracts granting under standard agreed conditions, and through the furnishing of needed support services. Also, they have back-up systems sized for the needs of the compound within a certain time, as required by standard directives.

An efficient consideration of the dependency problem, with the aim of improving MI resilience, will produce a threefold impact:

- the mitigation of the impacts induced by perturbations from the external supplies;

- the reduction of the time needed by the MS to return to its ordinary and effective functions and, finally;
- the accurate shaping of alternative, internal back-ups.

Objectives

The resilience protocol of an MI should leverage on different tools, technologies and activities, as follows:

(1) It is important to design an appropriate protocol for identifying external dependencies (i.e. the specific vulnerability of a MI with respect to the reduction -or complete loss- of one or more CS -which might be at the same time). On the one hand, such assessment should be done per se and, on the other hand, it cannot avoid to realistically make an all-hazard recognition, also considering the possibility of specific black swans (i.e. in area with endemic propensity to earthquake, simulation of worst case cannot neglect to consider severe scenarios with large disruption estimated on the bases of possible large earthquakes in the area, although with their recurrence times);

(2) The project will make use of a system enabling to link to a specific event (expected in a given area):

   - the anticipated degree of disruption of critical infrastructure in that area; and,
   - the consequent reduction of the CS that they transport.

   This tool will allow an educated guess of what a specific natural scenario could cause in terms of outages which an MI could experience. Thus, a major outcome of the SPEEDUS project is the customisation of a state-of-the-art stress test emulators (STE)1 for predicting events and their impacts on assets. The STE could also use the input of a synthetic scenario to provide assessment of even maximal outage levels to be expected (i.e. black swan or particularly severe events), which could be used in (1) for shaping the effective specific dependency of the MI with respect to single (and/or correlated, i.e. multi-service) outages;

(3) By using the STE as a prediction tool, and by knowing the level of specific vulnerabilities to outages, after having appropriately shaped the BUS, MI is ready to face predicted events. The STE system (used as a prediction tool) can be shared with the civilian emergency governance in a way to ensure a coherent set of data and information used during an emergency scenario. This could allow the development of a Resilient Response Capability at a regional level. In fact, BUS could be jointly used (in collaboration with the civilian operators) to produce a maximally efficient response in case of emergency. This will trigger the onset of internal/external joint strategies (IEJS) which could enhance the systemic resilience of the whole given area;

(4) The project SPEEDUS will perform two test cases of the whole predicted cycle of actions (1)-(3) above. Specific MI will be chosen (in collaboration with military partners) in a way to focus on high impact assets (particularly those having a dual-use relevance). The proposed SPEEDUS results will be thus customized, prototyped, and deployed for a true technology readiness Level (TRL) 7 validation.

[1] The system CIPCast could be used, developed by ENEA within an EU-FP7 funded project.

Impact – Expected Outcomes

The **expected outcomes of the project SPEEDUS** will be the following:

- a norm (i.e. a set of a prescription and a recipe) for assessing Member States' (MS) dependency on external services and its susceptibility with respect to their outage (or supply reduction);

- a decision support system (DSS) for risk analysis and forecast in the whole area [(civilian embedding environment (CEE) and that of MS site)] enabling to predict natural events which might endanger the system of CI/CS. The DSS, whose outcomes would be shared between military and civilian emergency management control rooms;

- a 'deep analysis' of a number of synthetic scenarios using historical data and the functionalities provided by the DSS (which can also be used to analyse synthetic scenario other than real-time data). This would produce the identification of capabilities and strategies enabling a joint (MS and CEE together) crises management.

Opportunities

Beneficial results can provide military capabilities with the efficiency of MI and better management of a crisis. Crisis management starts (and must encompass) a number of actions in peace times (prediction and prevention) which, if appropriately dealt with, could largely reduce the impact of perturbations and greatly improve systemic resilience. This will be a major outcome of the project which puts in evidence its dual valence, as it can be easily transferred to strategic civilian assets (hospitals, plants, airports, etc.).

The project is eligible for potential funding at European level, for instance, through the European Regional Development Fund (ERDF), the Structural Reform Support Programme (SRSP) and the LIFE Programme.

Challenges

The main possible issues could arise from different sources:

- difficulties in sharing data and information between military and civilian environments;

- protocol 'inflexibility' (particularly for emergency management);

- scarce compliance of public (or private) CI operators, with a subsequent lack of data needed for risk analysis and forecast, other than for providing clues for optimal emergency management strategies.

Methodologies

There will be several ways of attempting a dependency assessment of a specific asset (a building, a district, a city, etc.) with respect to the services delivered by public networks:

a) using a natural event as a probe: it produces damages which then cause outages in the different networks. The registration of their spatial and temporal occurrence in real (historical) cases enables a 'phenomenological' understanding of links and dependences, although limited to specific and special occasions;

b) using an analytical or simulation approach, where multiple synthetic events could be used to trigger different systems reactions (in combination with a specific vulnerability assessment of the CI elements), and to produce a reliable dependency map.

A MI dependency assessment on Si could be thus carried out by perturbing the external situation by producing (by synthetic events and/or by recording effects produced by real events) damages on Si elements (Si are the external services needed to MI) which then produce reduction of their services (and of the Sj which will be also perturbed through cascading effects). These actions could be inserted within a well-defined protocol which could be the source of a norm (such as e.g. those of the ISO 28003 class).

This task will deliver two types of results (schematically resumed into the M1 and M2 vectors):

- the prediction of the internal quality of service (QoS_j) when the external services (S_i) would be reduced of a certain amount (M1);

- the prediction of the resulting QoS (called FQoS) when internal resources B_i would be used (M2).

In general, Si(0) is the ordinary amount of PS received from CEE and QoSi(0) the corresponding value of the quality of services that they are able to produce. When some perturbation P hits the external services and reduces (also via cascading effects) the level of service provided to the MS (P[Si(0)]→Si], a resulting reduction in the internal quality of service should be expected (QoSi(0) → QoSi).

The reduction of the service level of the different services could be a function of the type of event, the resilience of the external CI/CS systems and, even more importantly, the specific susceptibility2 of the MS to the reduction of the specific primary services (a MS could be more vulnerable to the lack or reduction of service Si than of the service Sj). If the expected QoSi were below some given threshold (granting MS efficiency requirements), than Bi resources are committed to improve the quality of services; their support should be able to bring the final quality of service FQoSi to an acceptable quality level above the efficiency threshold (see Fig. 1).

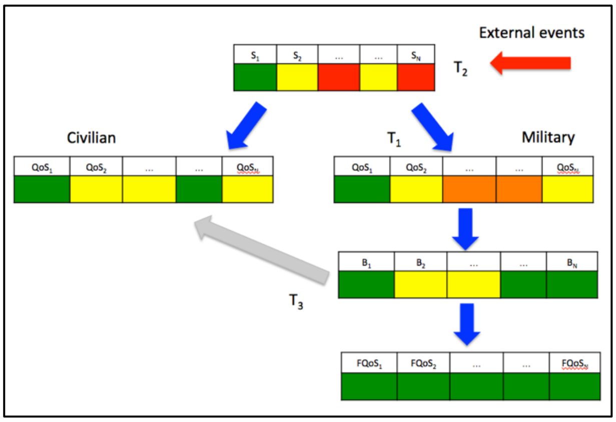

Fig. 1. A schematic representation of the task flow of the project. From the top: External events induce damages (and cascading outages) which reduce the level of public services Si. which are called to supply both military and civilian domains. The resulting QoSi of the services in the civilian and military domains can be different. MS will have available further internal resources Bi which can be committed in order to re-establish an above-threshold state of all services in the MS (all green FQoSi). On the other side, civilian QoSi could be further improved by the coherent and synergic use of internal MS resources through the identification of a common emergency management strategy. Gray arrow indicates the possibility of a "dual use" of Bi services in case of non-local crisis management made in collaboration with civilian administration. T1 indicates the task of understanding the level of MS resilience to the state of external services (i.e. the correlation between Si and QoSi. T2 indicates the task of identifying the expected level of external services from the predicted events. T3 will identify the optimal (if any) collaboration (dual-use) mode of interventions between civilian and military assets.

This will be the overall scheme of the major technological activities of the SPEEDUS project:

- task T1 will identify dependencies from external services, thus enabling the estimate the internal QoSi starting from the prediction of the expected level of external services Si induced by adverse events;
- task T2 will enable the prediction of outages Si generated by expected events, in a way to be able to predict external outages which might have repercussions on MS;
- task T3 will allow to envisage a strategy for the emergency management: this will be alternatively:
    - "local" (i.e. restrained to the MS only) exploited by using internal buffers Bi only for supporting the achievement of over-threshold FQoSi of the MS;
    - "non local" , i.e. coherently agreed with civilian emergency managers, where internal Bi are inserted into a global strategy which, with a coherent strategy established between military and civilian emergency managers, will allow a "dual use" exploitation of all assets, for a better solution of the crisis.

Way Ahead

It should be assumed that, in general terms, there would be a well-defined composition of the partnership which would allow to meet all needs that a project like SPEEDUS will require to gather.

In fact, besides technological partners, there would be the right composition in terms of other types of stakeholders, particularly to satisfy the needs arising from system customisation, data acquisition in the area designated for validation and test (test sites or TS), compliance in the validation and test itself.

Technology providers could also be represented in a larger number (universities, research institutions and private companies could also be engaged) to gather all competencies and expertise. CI operators (in the different TS) should be those related to the most important CI and related services (electricity, telco, water, gas). Municipalities providing the CEE of the MI would also be engaged in the project consortium.

SPEEDUS is expected to develop on a 30 to 36 months period.

This project idea was developed during the second phase of the Consultation Forum for Sustainable Energy in the Defence and Security Sector (CF SEDSS II) and does not entail any future commitment for the EU Ministries of Defence (MoDs) or the EU institutions or agencies. However, it provides the framework for enabling the formation of multi-national collaborations at the European level to help the MoDs to address common defence energy-related considerations and to move towards a defence decarbonised future. The potential of those ideas will be further explored in the context of the forthcoming CF SEDSS Phase III (2019-2023).

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