NÚKIB

National Cyber and Information Security Agency of the Czech Republic

HOW TO DEVELOP A CYBER SECURITY TABLE-TOP EXERCISE

A PRACTICAL GUIDE

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CONTENT

PREFACE

How can governments and other entities involved in enhancing cyber security stay ahead of evolving threats represented by cyber-savvy criminals and hackers? Staying up to date on technology developments, and being able to quickly adapt to new threats, requires being cyber-knowledgeable. This can be ensured only through continuous learning processes. Special lectures, courses, seminars, reading books – all are useful and favored. However, there is one more method of education that is specific for several reasons – cyber security exercises.

IT experts are usually not fully aware of the implications that IT products and technology solutions have on national security as well as technical personnel on operational level are not familiar with the processes of political, diplomatic and strategic decision-making. Likewise, senior leadership, law enforcement officials and policymakers face difficult challenges in their work without knowing the technical implications and impacts associated with cyber incidents. Cyber exercises pose a great opportunity how to get technically skilled professionals and government representatives, and confront each other with their different perspectives on problem solving. In addition, cyber exercises enable to tackle the important aspects of responding to incidents, such as technical solution, teamwork, information sharing or cooperation. It can provide a real-time evaluation of lessons learned, especially important for reviewing and improvement of internal procedures, contingency planning, crisis management etc. Alongside the knowledge gap between technical staff and decision-makers, we also must deal with varying capabilities and skills between younger and older generations. Thanks to practicality, interactivity, and even fun element that such exercise usually offers, it might be an appropriate form of education for every age group. Thus, effectively targeted and crafted cyber exercises can contribute to the digital literacy of the population. Having another correlation here, it can be said that the more the population is cyber-knowledgeable, the more digitally-secure the country is.

INTRODUCTION

CONTEXT

Crisis/full-scale management exercises and military exercises are the pillars in ensuring security. They have been conducted for many years to train readiness for military operations and emergency management procedures in case of any natural disasters. The merit (and success) of such exercises lies in the ability to adapt them to real environment/reality. Accordingly, with an increase of the importance of IT security, technological dependencies, and hybrid threats involving cyber warfare in recent years, cyber security and cyber defense get more and more attention in education and exercise area. Thus, many institutions and business companies participate in cyber exercises that are recognized as a perfect learning tool.

PURPOSE

The purpose of this handbook is to provide context and guidance for planning, developing, organizing and improving cyber security table-top exercises. It is designed principally to introduce the topic, give practical advice on how to plan, design, run, and evaluate such exercises. It is neither a detailed step plan nor technical guide.

AUDIENCE

This handbook is intended for those responsible for protecting and operating critical information infrastructure, important information systems, or any kind of high-value assets. The primary goal is to help the less experienced in carrying out their own exercises by showing them how they can develop it, and to help those who are already conducting exercises to get the best results. The handbook also serves as a reference framework to compare possible avenues of conducting exercises.

SCOPE

The handbook describes how cyber exercises should be designed, in order to effectively educate and train different target groups, ranging from technical personnel to executives and political leaders. Based on the experiences of the Czech Republic since 2014, when the first national cyber security table-top exercise was held, the manual offers a framework and methodology for designing such training. In addition, it integrates key lessons learned and recommends best practices.

CHAPTER 1 EXERCISE TYPOLOGY AND DESIGN

EXERCISE TYPOLOGY

Cyber security exercises can be divided into many types: table-top, technical, communication, simulation, war gaming, capture the flag, procedural or hybrid. Having slight overlaps among them, geographical origins of participants may pose another dividing criterion. In that case, we can talk about national, bilateral, regional, international or even world exercises. All types enable participants to tackle the important aspects of responding to security incidents, such as teamwork, information sharing and institutional/cross-border cooperation etc.

While technical exercises are designed to practice primarily technical skills and capabilities, discussion-based exercises are often used for testing procedures, crisis management processes and agreements. Moreover, non-technical exercises are helpful in creating new or revising old continuity plans and policies. They also serve new staff and not fully cyber knowledgeable leadership to orient in the field.

Exercises aimed at practicing decision-making processes and procedures can be conducted as *non-technical/table-top exercises (TTX)*. There is no need to use a virtual environment to expose senior leaders to cyber-related matters. All what you need is to provide a relevant scenario and injects tailored to a given audience, in order to help them make effective decisions and relay orders to lower echelons. Executives might not be IT-knowledgeable, nor might they have to face cyber-related challenges on a daily basis. Accordingly, they may not be capable of adequately assessing a particular crisis. TTX is one of the best tools to educate decision-makers on the importance of cyber security and its relevance to national security. According to the tools you involve in the exercise, TTXs can be further divided as rudimentary (literally only paper and pen needed) or more as advanced (more „sophisticated“ tools involved, e.g. digital platforms, applications for online editing and sharing documents, exercise news portal, audio-visual tools etc.). From the exercise objective perspective, both hold high value.

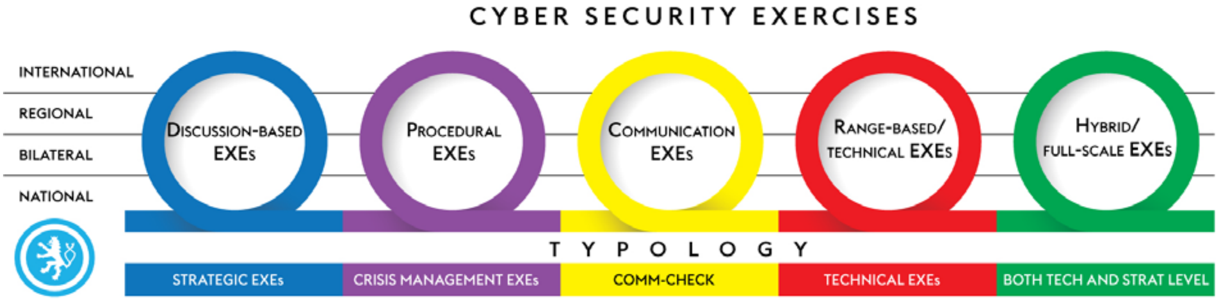


Figure 1: Cyber exercise typology including a geographical aspect.

Unlike TTXs, *technical exercises* planned and executed in cyber range allow for testing individual and collective practical skills while responding to cyber-attacks. Therefore, they are more suitable for experts with IT knowledge and experience in system administration and securing infrastructure. Such range-based exercises expose those IT professionals and administrators to configuring, setting up, installing, practically securing dedicated infrastructure, investigating, analyzing, and handling complex cyber incidents. One of the best and most used hands-on concept of technical exercise is *Red* *team/Blue team* model.[1] A Red/Blue team exercise is a model where exercise participants form Blue teams that are responsible for the protection of a dedicated infrastructure. Defending teams face real-time attacks (performed by the Red team) escalating from simple attacks (application denial-of-service, defacement,…) to more advanced ones (exploits, specially crafted malware, logic bombs, etc). Aside from the technical aspect, trainees have to react to company users' issues and complaints, and assess the potential legal and media impacts of the incidents. The range of training objectives is usually wide and covers the practice of technical skills, work in increased stress situation, and the communication aspect. Blue teams are scored for maintaining usable environment for end-users, for availability, information sharing, communication with media and legal advisors. Awarding points should promote healthy competition and provoke even better performance through gamification.

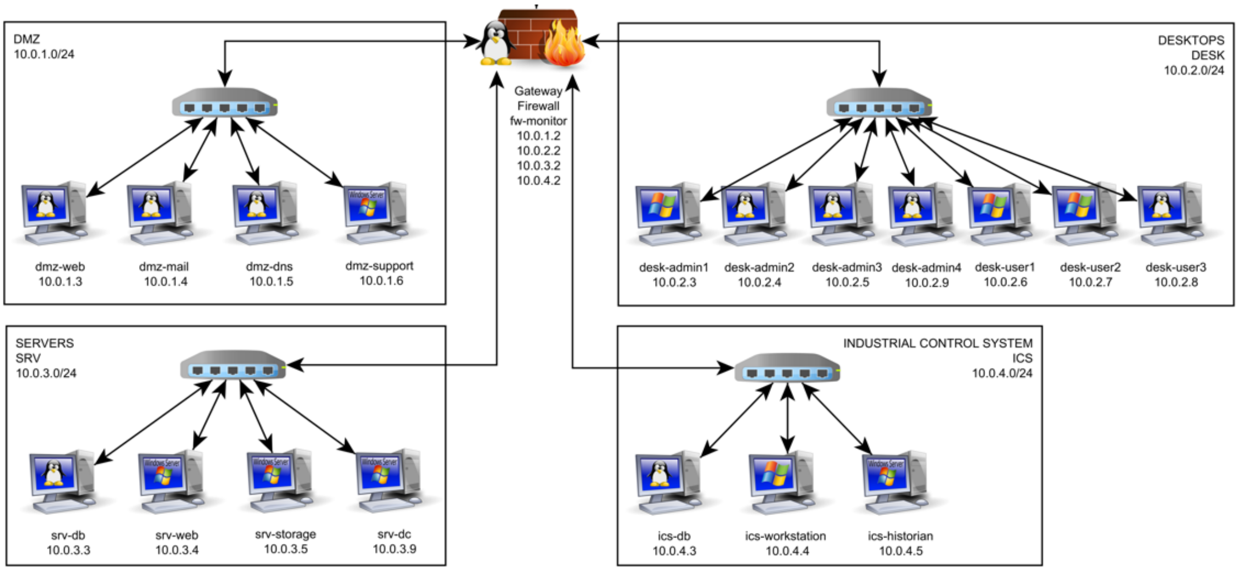


Figure 2: An example of technical infrastructure during the Cyber Czech 2016 exercise. The infrastructure consists of 4 network segments (DMZ, Clients, Servers, ICS) and a central firewall.

Communication exercises are extremely important for testing availability point of contacts (PoCs) in given institutions, and for testing whether and to what extent the points of contact are up-to-date. We would not strictly classify them as either technical or non-technical. A major goal of these communication exercises, (also sometimes called "comm-check") is to regularly verify availability and how much time it takes to reach out to an institution/person relevant to solving a potential incident or crisis.

Hybrid exercises can be viewed from different perspectives. For the purpose of this guide, a hybrid exercise is considered an overlying and interconnecting concept of the abovementioned exercises. In this sense, a hybrid exercise combines technical exercise with a strategic level TTX, allowing participants from the technical layer of cyber security to train together with the highest-level decision making entities in one exercise. As such, it an offers "all-inclusive" package for players to train in both technical capabilities and decision making, via interaction between these two specific levels. Nowadays it is not possible to strictly separate the technical world from the political or strategic.

[1] Technical exercise may also include hackathons, capture the flag, competitions etc.

Since this is a very advanced model of the exercise, it is worth consideration to deploy it only after you have gained enough experience with the technical and table-top exercises. Hybrid exercises can realistically only accomplish positive outcomes when they are properly prepared, and when the operational level (and the sum of its outcomes) are logically linked to a strategic intent, and vice versa. This might be very challenging, especially when linear development in the technical layer does not correspond to the time-based nonlinear aspects of decision making at the strategic level. Unlike cyber-attacks, decision making - often burdened by bureaucracy - might seem to be too slow.

Cyber defense exercise Locked Shields 2017, organized by NATO CCD COE, might serve as a good inspiration and example of a hybrid exercise (https://ccdcoe.org/locked-shields-2017.html).

Note: Hybrid exercise should not be confused with hybrid concept as the nature of threat (combining kinetic operations with irregular and cyber warfare).

The type and scope of the exercise should be selected based on the available organizational resources and exercise objectives to be achieved.

EXERCISE DESIGN

Design issues should be determined when an exercise type is outlined, in order to drive subsequent planning steps. Design decisions must go hand in hand with basic exercise objectives.

- *Do we want to test the IT security team's speed to recognize, analyze and respond to a cyber incident?*
- *Will the exercise test the roles of law enforcement, the intelligence community and military bodies, as well as their coordination and information exchange during a crisis?*

What else must be decided before we start planning?

Here are examples of questions worth addressing at initial planning stage, for selecting the right exercise concept.

- *Will the exercise simulate reality by running 24/7, or will it be phased over a two-day/one-week period condensed into a very busy 6-hour exercise, where a few hours reflects some pre-determined time passage?*
- *Is the exercise aimed at practicing crisis management only during office hours, or conversely, does the exercise intend to test readiness outside of working hours, or even during the weekend?*
- *What other specific tasks, functions, roles, or activities does the exercise intend to evaluate?*
- *What all can be simulated in order to make the exercise authentic?*
- *What hardware or equipment does the exercise require – computers, phones, mock news reports or any other tools?*
- *Is an exercise team/unit present in your institution? What is the maturity level of that team? Do they have any experience with conducting the selected type of the exercise? How much time do they need to get familiar with the preparation mechanism/exercise lifecycle?*

The optimal length of a table-top exercise is around 60-90 minutes (excluding time break). It is important to note that the longer a training session is, the more difficult is to keep trainees' attention. Thus, time dragging can affect the overall outcome of the exercise.

Another option is to train various target groups and scenario escalates across layers of decision making. In that case, the exercise can take a day or even two, excluding the set up and evaluation. Attendees might be involved only in certain portions of the exercise, when the issues are most relevant to their agenda and level of competence. E.g. high-ranking officials will not be able to stay 8 hours at the exercise place, especially without contact with outside world. It is advisable to make policymaker participation effective by tailoring the exercise environment to them. Despite such customization, the goals of the exercise may be still met.

CHAPTER SUMMARY

- **According to your needs, capacities and resources, select the most suitable exercise design. In this step, always consider exercise purpose and major goals.**
- **Tailor planning to the experience and skills of exercise creators.**
- **An exercise must be feasible from all aspects – funding, preparation time, manpower, facility, technology, leadership support and other resources.**
- **Remember, you will not have a second chance during the participation of real decision makers.**

CHAPTER 2
EXERCISE OBJECTIVES AND TRAINING AUDIENCE

EXERCISE OBJECTIVES

One of the first steps in the planning stage is to determine the purpose and intended objectives of the exercise. This must be logic-driven, based on the exercise design chosen in the previous step. Examples of core general exercise objectives might include to:

- practice technical skill;
- train coordination and complex response measures to cyber incidents;
- grasp the broader national security implications of a wide array of cyber incidents;
- practice communication and information sharing with counterparts (other CERT teams, media, private sector, law enforcement bodies etc.);
- practice reporting to managers and decision-makers;
- train teamwork (delegating, dividing and assigning roles);
- exercise time management and prioritization;
- expose and validate cyber security/defense policies and procedures;
- experience work under stress and time pressure;
- gain deeper understanding of the technical, political, strategic, diplomatic and legal contexts of cyber crises;
- improve the ability to convey the big picture;
- test a new organization, technology, tools, processes and thereby reveal weak spots and points of friction;
- enhance cyber education and awareness at all levels;
- and many others.

The number of objectives should be balanced to keep the exercise manageable. Objectives can be broken down into main goals and more specific ones. E.g. a main objective of a technical exercise might be to test technical capabilities, and specific training goals can be defined by training incident handling process, reporting to higher echelons, analyzing specific malwares, conducting forensic investigation, writing technical analysis, practicing reverse engineering, and so forth.

All objectives should be measurable. In other words, they should be clearly defined, realistic, reasonable, and in accordance with the organization´s visions, principles, competencies and current and future challenges the organization faces. Where it serves a purpose, a time limit should set to determine by when the results and tasks are to be completed.

TRAINING AUDIENCE

To solve incidents rapidly and properly, all relevant entities must be involved in the solution. Cooperation and coordination across the security community (*horizontal perspective*) pose the key and irreplaceable element in dealing with serious incidents. In this sense, exercises offer a great opportunity for establishing or strengthening relationships and trust. Inviting representatives from different spheres and sectors to the exercise event creates opportunities for effective future collaboration. More importantly, as cyber-attacks (even if at first sight trivial) might escalate further, those stakeholders/representatives might be affected as well (as indicated in Figure 3). Cooperation and information sharing is used in real life to help organizations better protect themselves against cyber-attacks; cyber exercises simulating those attacks should be treated the same way.

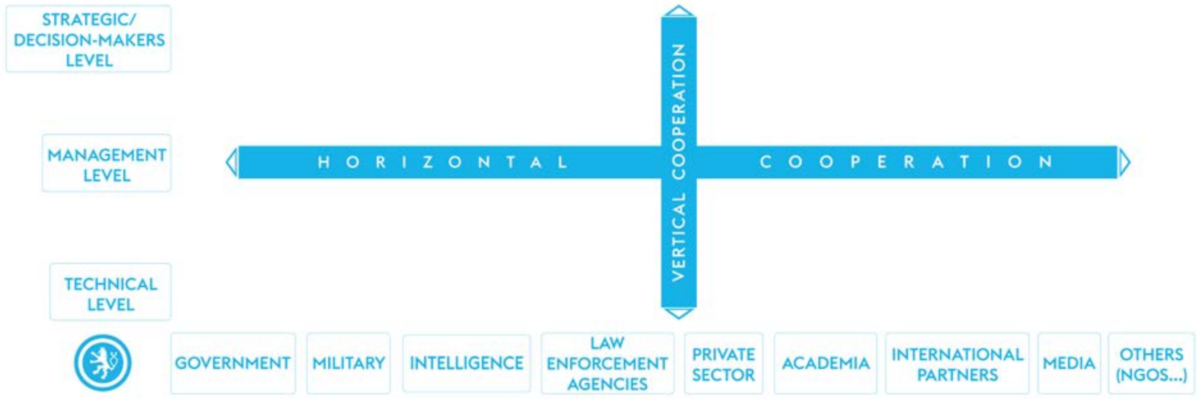


Figure 3: Illustration of whole-of nation approach.

For a better demonstration, the following is presented as an example of an incident which escalates and impacts various domains.

„Several regions across country X suffer power outages. These outages affect several major industrial areas, and even a military bases experiences partial power outage. Due to unexpected technical difficulties, back-up generators are unable to begin providing the military facility with electricity directly after the blackout occurs. Best estimates suggest that recovery will take at least 10 hours. The current situation affects the everyday life of country X's population. The mood becomes worse as the blackout has left millions of people without electricity. The outages induce public unrest, with protests in the streets. According to investigation, the loss of functionality was caused by a malware attack that might have been conducted by a group of attackers linked to a nation state."

Domains that might by affected by such an incident (*the following questions can also steer you to formulate the objectives*):

GOVERNMENT – Government faces a crisis with national impact, due to limited distribution of energy and outages.

- *What governmental department should be the lead in dealing with this situation to coordinate the responses of multiple governmental entities?*
- *Is there a capability to legally and operationally prioritize electrical supply to critical services such as military and national security installations, healthcare systems and emergency services?*
- *Are necessary policies, personnel, and recovery plans in place for large scale cyberattacks that affect the whole population?*

MILITARY – Since there are partial electricity shortages at military headquarters, military capability is affected as well.

- *Would a cyberattack on electrical grid be considered legitimate grounds for use of force it such an attack subsequently cripples the defensive capacities of the state? On what basis?*
- *Is the military legally and operationally able to conduct active defense operations in peacetime conditions (according to IHL) in an asymmetric campaign like this?*

INTELLIGENCE – To defend against such an attack, the role of cyber threat intelligence analysts is critical.

- *Is the malfunction considered an intended attack?*
- *Are the attackers linked to a nation state? How to attribute the attack to the attackers?*
- *What else do we know about the attackers and their motivation?*
- *Do you have tools in place to gain sufficient insight?*

LAW ENFORCEMENT ENTITIES, LEGAL ADVISORS – After an incident is detected, the investigation process begins.

- *Do you have the legal framework to respond to a cyber crisis?*
- *Are the legal conditions fulfilled for declaring a state of emergency?*

PRIVATE SECTOR - The SCADA management systems at different private electricity distribution companies were attacked.

- *What information would you exchange with affected private companies?*
- *Is the necessary list of points of contact in place?*

INTERNATIONAL/DIPLOMATIC ASPECT - Shutting down the grid can subsequently damage grids in neighboring countries if they experience massive overload and instability.

- *Do we have means for contacting the neighboring state authority to remedy possible impact of their electricity disrupting our grid?*
- *Do we have funds to compensate for any subsequent damages over the border?*

MEDIA – Media have started reporting without deeper understanding of the situation. Moreover, due to blackout, there is a problem with getting sufficient information from the affected area.

- *How can government communicate its position and recommendations to the citizens if they are out of power?*
- *What will be the narrative?*

PUBLIC – Disapproval with the government doings has moved people to the streets. Public trust in government is decreasing dramatically.

- *What will be the narrative towards the public?*

Depending on what you want to test in the exercise, all relevant entities on the horizontal line must be reflected in the exercise.

In addition, the *vertical perspective* has to be taken into account. During the exercise planning, all necessary levels of the "chain of command" must be assessed, in order to not skip anyone important to the passing and carrying out orders. Starting with the clear identification of primary exercise objectives could help better understand what level (operational, tactical, strategic, all?) the exercise should focus on. Let's go back to our possible scenario.

TECHNICAL/OPERATIONAL LEVEL – Since critical services and SCADA systems were compromised, computer emergency response team (CERT) and technical/SCADA experts are included.

- *How quickly will they be able to assess the severity of the situation?*
- *How and through what channels will they report incidents to higher echelons?*
- *Who will they ask for assistance?*
- *What information would they share with partners?*
- *Do they have tools/skills to analyze such malware (can be kicked off further at the technical exercise)?*

MANAGEMENT LEVEL – Management is responsible for assessing crisis and eventually escalating incident response.

- *How quickly will they be able to make decisions regarding the report coming from the technical/CERT team?*
- *What countermeasures and recommendations would they make, in order to mitigate the escalation of the situation? Do they have pre-set policies and SOPs?*
- *What would they report to the highest level of the chain of command?*

STRATEGIC/DECISION-MAKER LEVEL – A national crisis should involve all crisis management bodies.

- *Will a state of emergency/crisis be declared?*

- *Will the central crisis staff be activated? When and how?*
- *Are the necessary communication matrices/PoCs in place?*
- *How does government address the issue of reassuring the public? Does government have a strategic communication plan in place for such events?*
- *Given the international dimension, what will be the official external narrative?*

Academics and students represent a special target group as well. They can be involved both in the form of active players and as part of the exercise planning team. Both options might bring mutual benefit. Internship or direct participation in exercises helps build trust among students. Aside from benefits as a result of recruiting, such cooperation with the academia sector is essential.

There exists plenty of room for elaboration. However, for understanding the complexity of the cyber incident, and with regard for how many various elements and levels are necessary to take into account to tackle large scale incident, it should be illustrative enough. To ensure preparedness for such an incident, it is necessary to always reflect the whole-of-nation approach, both in the real life and when developing exercises.

Relatively lower exercise participant numbers (20-30) will make for a better "workshop-environment". In other words, it can provide for a more candid atmosphere stimulating further discussions. Moreover, it will be easier to divide a smaller group into the teams of 4 or 5. The fewer the group total, the easier it is to handle and evaluate their performance. Conversely, you can train larger audiences (80-90) at one time. Such large exercises can also be manageable, but you need to be aware of possible rigors. In the case of involving dozens of participants, you must count on more effort and resources (money, manpower, facility, technical requirements, time for preparation etc.). For less-experienced audiences, it is recommended to start with fewer numbers of attendees. Keep a reasonable scope of the exercise.

CONSIDERATIONS FOR SENIOR PARTICIPANTS

Having defined the audience, consider how to address specific participants. Especially when it comes to top management, political leaders, and executives, it might be challenging to get them all to one table simultaneously. Coordination and invitations must be executed well in advance, and explain the importance and benefits of the exercise. Logistics and organizational issues can be tailored as well. Reduce the exercise document to the minimum (one-two page resume) and invite them for up to one/two hours when scenario escalates to respective level of decision making. As soon as you have the top level decision makers on board, let their subordinates brief them and arrange everything needed (just like in real life).

CHAPTER SUMMARY

- In compliance with exercise design and purpose, define the training objectives.
- Determine training audience and assign respective tasks following the sub-goals set in the previous step.
- If you are developing your first exercise, try to concentrate on specific levels/goals rather than devote all your efforts to the preparation of an all-inclusive exercise.
- The intention is not to include as many participants as possible, but rather to keep the logic, scenario and information flow intact.
- The array of the audience is wide. Your task is to select the correct blend of participants that relates directly to exercise purpose/scenario and make the game beneficial for all participants.
- Besides how much and what audience, ask yourselves how you get/convince them to participate.
- Keep the exercise manageable.

CHAPTER 3
EXERCISE NARRATIVE AND INJECTS

EXERCISE NARRATIVE

An exercise narrative drives a story. It should provide participants with a description of an imaginary situation in a geographic environment and at a given time. A scenario usually escalates from simple incidents to more sophisticated ones. The point is to let some serious further consequences and implications occur.

The role of the background story is to create a linking element that encompasses the entire exercise. It also delivers the scenario context to get the game started smoothly. The background story may be divided into several clusters:

- the geopolitical context including geographic location/map, political and historical considerations,
- a list/description of main actors (good guys versus bad guys),
- an initial kick off scenario including a course of past events and current start position,
- scenario timeline running through the exercise and showing the time chronology of the events/attacks,
- technical background information,
- media / press-release / news / background information etc.

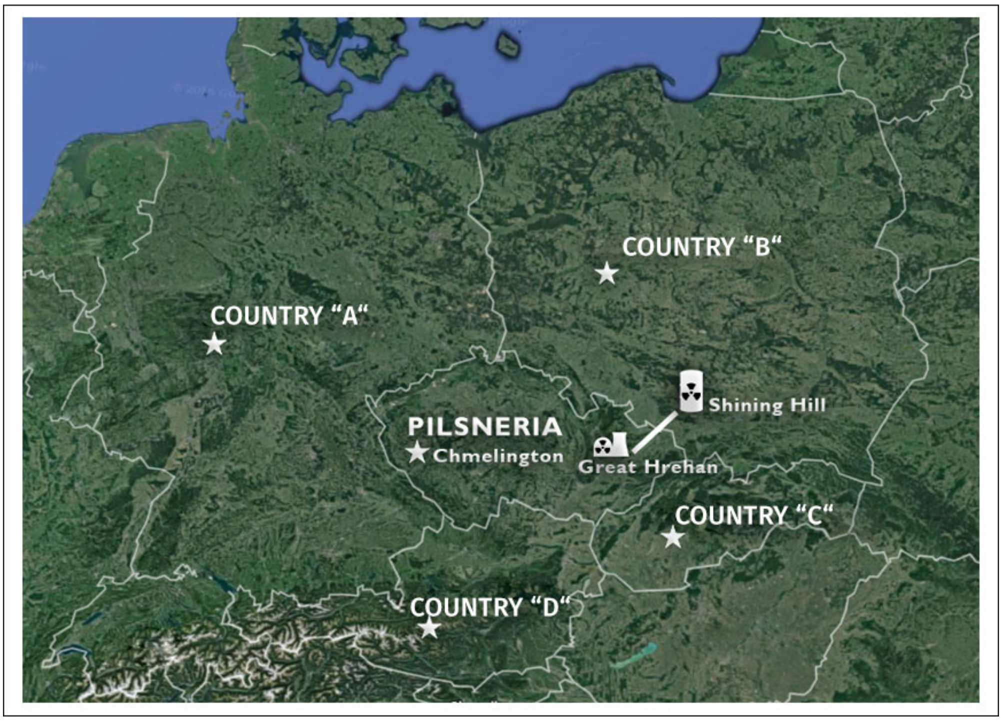


Figure 4: An example of map used in Cyber Czech 2017 exercise.

When it comes the geopolitical environment, the level of realism may vary from complete fiction to reality. In case of a table-top exercise based on hypothetical situation, a scenario can be fully fictitious. Nevertheless, the more fictitious the storyline is, the more background information should be given to the training audience (including history, politics, demographics, foreign relations, armed forces etc.). Otherwise, a sci-fi scenario might be difficult to grasp in the limited timeframe and be become more confusing than helpful.

On the other hand, in the case of a real geopolitical environment, it is expected that basic facts are known (or "google"-able). Thus, handling the reality-based scenario allows participants to become more easily familiarized with their role. However, there is a risk that if you lose control over sensitive exercise materials and they are released to third parties, it can even escalate into real-time diplomatic tensions. For this reason, it is important to mark all exercise materials accordingly and determine exercise material handling procedures (as defined below). You can also provide a disclaimer explaining the zero attribution and fictitious basis of scenario (see Appendix).

INJECTS

As the initial scenario helps to get the exercise launched, the injects get the game moved forward. The injects or drivers should always have a purpose. They develop the baseline narrative given players at the start. You can imagine the injects as short pre-scripted messages that provide context and information which will stimulate trainees to do something. They can be used to plot out the story to speed up or slow down the play. They may act as additional information, or can include one or more questions to be answered. Additional injects can be made operatively to steer participants in a certain direction.

To maintain storyline consistency, all injects must relate back to the exercise objectives and road to crisis. Next, injects must not conflict with each other. The role of the well-crafted drivers should engage trainees in active discussions or other activity. Clear, grounded, realistic, creative and gripping injects are essential. Responders often tend to claim *"that would never happen that way"*. Creating injects which mirror the real world as much as possible can reduce those complaints. However, if participants continue to fight the scenario and not the problems within the scenario, make it clear to them that *"you are here to fight the problem, not the scenario"*. If it is necessary, repeat/summarize the current situation which the participants must address.

Injects should always be customized to the institution/country framework and environment with which the participants are familiar. Injects should match participant skills and capacity; otherwise, it might be difficult for players to identify with their role and situation. Moreover, exceeding participant capacity can make them feel uncomfortable and demotivated. Be aware that the more the exercise injects reflect a real cyber security framework, the more trainees can get in their roles and provide game success.

Once you have a list of vetted injects, you can consider how the drivers will be delivered to your target group, for example by using:

- slides with notes and pictures,
- emails,
- phone calls,
- text messages,
- technical/contextual/threat/situation reports (describing and reporting an incident, providing overall contextual analysis),
- tailor-made audio/video clips,
- real videos,
- authentic photos (even taken by you),
- radio, TV, or newspapers articles,
- electronic news media outlets,
- social media posts,
- blogposts,
- audio records,
- personal visits,
- message from role-played actors,
- etc.

A combination of realistically designed delivery methods creates a more challenging and engaging experience for training audiences.

Defining a time limit to complete injects and respective tasks is also worth considering in advance. Since dealing with the time pressure is vital and inseparable part of the exercise, choose such deadlines so that responders have time to read assignments and discuss it in the team, but still feel under increased time-pressure. For example, at the beginning of the inject, you can provide participants with more initial time, and then shorten it according the situation.

Consider the size of the group – the bigger it is, the more time they need to exchange and discuss opinions and views. On the other hand, close-ended questions (e.g. Do you inform media? Yes/No) require less time than open-ended ones (e.g. Would you consider an internationally/diplomatically coordinated response? Elaborate on that.)

CHAPTER SUMMARY

- The aim of an exercise scenario is to deliver the right experience which will engage each participant.
- A narrative and injects should be consistent with overall exercise purpose and objectives.
- When developing a scenario, pick a well-balanced level of fiction leading to specific tasks and with sensitivity toward everyone involved in the exercise.
- Scripting creative and realistic injects is a must.
- Combine methods for how injects are to be delivered to training audience.
- Adjust exercise pressure by both modifying time limits and setting absolute time limits.
- Always try to keep consistent and standardized exercise document handling.

CHAPTER 4
BACKGROUND EXERCISE DOCUMENTS

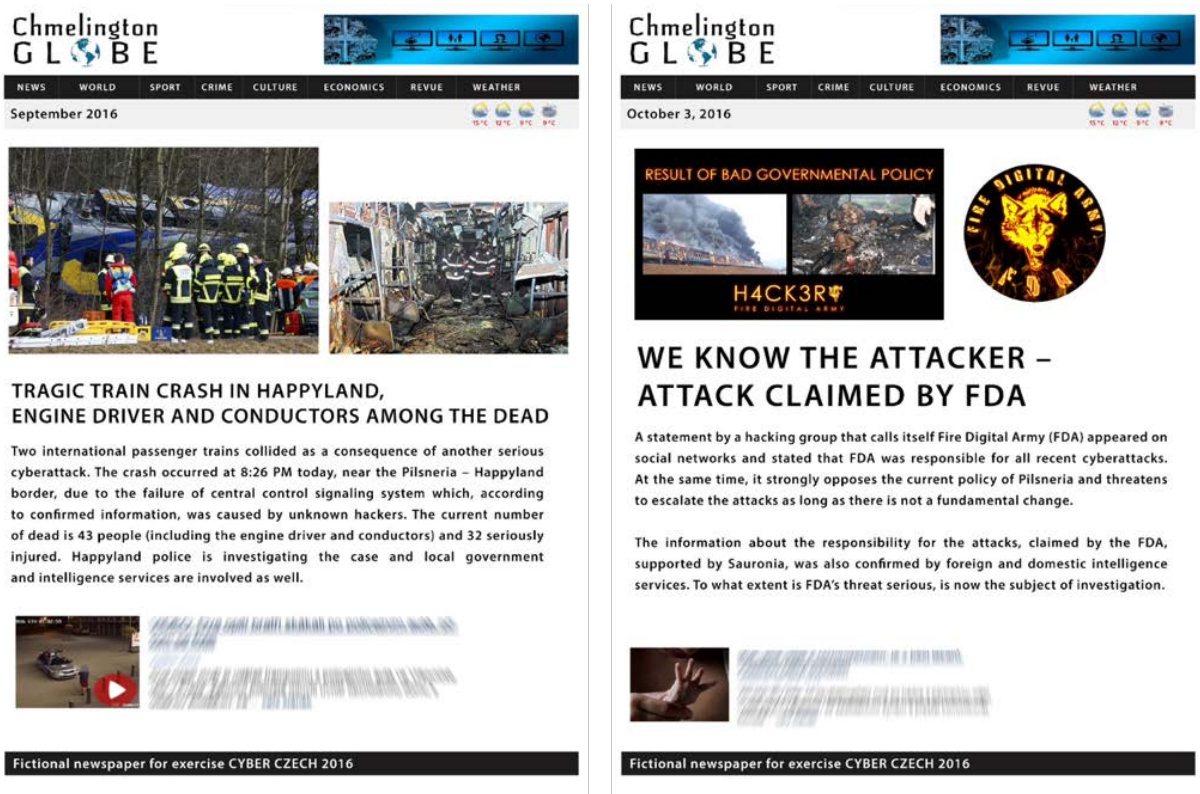
An integral part of each exercise is the creation and maintenance of plentiful supporting documents. The documents are intended to pull participants into the game as much as possible, to ensure realism, and to help players understand the exercise concept and its purpose. Having interesting and clear supporting documents increases the chances of keeping trainees highly tuned to the exercise. These documents can be designed to be fun and engaging elements, but their primary message should remain to push target groups toward developing solutions to given tasks.

In general, there are several handouts that can be considered; some are required, some are optional. How much of which are required always depends on the exercise concept, type and the complexity.

Supporting documents to be considered for exercise attendees and designers, in order to keep a desirable exercise flow:

- situation manual providing basic information, exercise purpose and objectives, initial narrative, geopolitical synopsis, list of actors (handed out day/several hours in advance to have enough time for familiarization);
- instructions and exercise walk-through;
- exercise timeline;
- methods and principles of scoring (if exercise is scored);
- frequently asked questions (available for exercise supporting team not involved in the planning stage);
- other practical information[2];
- technical documentation (incident reports, technical environment description, user instruction manual in case of hacked devices, topology – more typical for technical exercises);
- supporting slides telling the story via injects (it is not supposed to be a lecture, keep the flow clear and try not to distract audience by using too many notes/slides);
- answer sheets (for evaluation purposes, keep a coherent numbering system of questions and answers);
- exercise news portal (electronic)/printed newspapers;
- numbers/names of the teams (ready and steady to be put on the table);
- list of training audience/teams;
- opening videos (to grab training audience's attention, to emphasize, and repeat main rules);
- exercise agenda (are there any designated coffee breaks or not? what time/day is the hot-wash? – a clear and strict timetable will help visitors better plan their business trip);
- final evaluation questionnaire for participants (given after exercise completion to get as much feedback as possible);
- evaluation presentation (or template ready to be used for a final evaluation briefing);
- other documents, as desired.

[2] Situation manual and practical information create a useful package, which serves as one of the hands-on materials. Thus, it should be available for all participants during the entire game.



Chmelington GLOBE

NEWS
WORLD
SPORT
CRIME
CULTURE
ECONOMICS
REVUE
WEATHER

September 2016

TRAGIC TRAIN CRASH IN HAPPYLAND,
ENGINE DRIVER AND CONDUCTORS AMONG THE DEAD

Two international passenger trains collided as a consequence of another serious cyberattack. The crash occurred at 8:26 PM today, near the Pilsneria – Happyland border, due to the failure of central control signaling system which, according to confirmed information, was caused by unknown hackers. The current number of dead is 43 people (including the engine driver and conductors) and 32 seriously injured. Happyland police is investigating the case and local government and intelligence services are involved as well.

Fictional newspaper for exercise CYBER CZECH 2016

Chmelington GLOBE

October 3, 2016

WE KNOW THE ATTACKER –
ATTACK CLAIMED BY FDA

A statement by a hacking group that calls itself Fire Digital Army (FDA) appeared on social networks and stated that FDA was responsible for all recent cyberattacks. At the same time, it strongly opposes the current policy of Pilsneria and threatens to escalate the attacks as long as there is not a fundamental change.

The information about the responsibility for the attacks, claimed by the FDA, supported by Sauronia, was also confirmed by foreign and domestic intelligence services. To what extent is FDA's threat serious, is now the subject of investigation.

Fictional newspaper for exercise CYBER CZECH 2016

Figure 5: An example of fictitious newspaper Chmelington GLOBE for the Cyber Czech 2016 exercise.

Consider in advance which of those documents you want to use. Some of them can be crafted in electronic versions; some are better reserved for use as printed copies. Moreover, copies may serve as a back-up in case of technology/device failure.

Many prefer printed copies of documents for reviewing the scenario, underlining important text, writing additional notes etc. That said, if participants feel a lack of some critical piece of information, this can be adeptly handled; feel free to explain to the complainant that if he were in the middle of a real crisis, he would not have all relevant information/documentation at hand then, either.

Graphic presentation of the exercise and its documents is no less important. Make use of open source graphic tools to make the exercise visually appealing.

CHAPTER SUMMARY

- Do not underestimate the preparation of supporting documents.
- Well-crafted materials are helpful both to exercise trainees and designers.
- Think in advance what needs to be printed out.
- If any technical solution/tool is used, have a back-up plan in case of failure/power outage.

CHAPTER 5
MAKE YOUR EXERCISE CATCHY

Exercise execution costs lots of time, money and manpower. To maximize exercise design efforts, some necessary rules must be followed. If your exercise team's ambitions are even higher, strive to reflect a few more recommended tips. However, keep in mind that each exercise is unique. How polished and well-rounded the exercise ultimately is, always depends on the approach of all the people involved.

WHAT IS NECESSARY

- *Well balanced skills testing* – Both technical skills and the strategic, communication and procedural aspects of cyber security must be continually trained.
- *Reflecting a whole-of-nation response* – Cooperation and interaction among public, government and private sector entities is fundamental for managing malicious cyber activities. All communication channels, cooperation agreements and prearranged conditions must be in place before the attacks hit.
- *Involvement of decision-makers and executives* – Strive to incorporate all levels of the "food chain" from the tactical to the operational, and strategic level. Doing so will result in more effective decision making during a complex crisis.
- *Implementing latest trends* – Since cyber exercises are used as an education tool, it is insufficient to exercise only past incidents that your institution has experienced. The latest trends and threats (the unrecognizable or unfamiliar - concepts out of the traditional comfort-zone) must be integrated as well.
- *Emphasis on evaluation process* – Holding follow-up session where major stakeholders and players can meet and discuss their results, decisions and feedback is essential. Without participant observations, it is impossible to improve the exercise. Moreover, post-exercise analysis is key for analyzing gaps, shortcomings and weak spots, and comparing if any progress has been done.
- *Make the most out of the exercise and its benefits* – Strive to push through the "not interesting" or uncomfortable exercise topics which might tend to otherwise be overlooked. Show, via hypothetical scenarios, what consequences may occur as a result of inadequately addressing an abbreviated or omitted item.
- *Allow friction among different frameworks to discover how they can cooperate during a crisis* – Different stakeholders operate in differing environments (private stakeholders tend to be profit-oriented, versus state sector focus on ensuring the continuity of services), with different tools and mandates/competences.
- *Use scenarios which are as realistic as possible* – Responders must feel as though given incidents are really happening. Most ideally, real incidents are selected and then set into a fictitious context familiar to the responders to some extent.
- *Sharing best practices* – Be candid and share outcomes and best practices from the exercises across the security community. The more institutions implement best practices into the real life, the better cyber security is ensured with greater commonality.
- *Create a candid and non-threating atmosphere* – Explain to all participants (and top management) that the exercise does not aim to show failures, to seek culprits or to be punitive. On the contrary, it is far more valuable to create a friendly and open atmosphere. Emphasize the opportunity that exercises offer – to expose trainees to unusual situations and in an interactive way test their reactions to be ready for a real crisis (without loss of

life, money, good reputation or prestige). Moreover, admitting mistakes, and identifying inefficient processes during the exercise is a good practice.

- *Creating adequate pressure* – It is difficult to know in advance the limits of employees when they are exposed to high pressure and stressful situations, prior to their experiencing such conditions. Add more pressure by increasing workload and shortening time deadlines for task completion, in order to determine how participants behave in a crisis situation.
- *Distinguish between exercise and real documents* – Avoid making gaffes and inducing panic that might result from forwarding the exercise documents to persons not involved in the exercise. It is a good practice that all documents and subject lines in emails be marked by "EXERCISE" in a prominent location on the document. Add a note to whom the document may be releasable.

WHAT IS GOOD AND RECOMMENDED

- *Strategic anticipation* – Exercise designers should be able to come up with some red cell style scenario, which entails constantly implementing new threats and discovering vulnerabilities within storylines. If this capacity is not inherent to the given red cell, steer them to cooperate with in-house intelligence threat/analytical unit/other experts that handle this kind of information.
- *Open-minded and out of the box thinking* – By integrating (or consulting) technically oriented experts, legal advisors, managers, STRATCOM professionals and analysts during the planning phase, you can enrich the story with nuanced perspectives, dilemmas and difficulties (mostly unknown to the exercise creators).
- *Gripping and engaging scenario* – Generate a scenario based on real attacks, current threats and trends, explore alternative exploits and attack vectors, consider "what if" scenarios. Such hypothetical situations/inputs might galvanize the creation of new disaster recovery plans, standard operating procedures, emergency action plans to mitigate potential cyber security crises.
- *Cyber security aka team effort* – Exercises pose a perfect opportunity to strengthen team work, build trust and relationships with important counterparts.
- *Active involvement of professional journalists* – Do not simulate press and public media actions if the opportunity exists to invite professionals. In return for providing exercise access to the media, they will potentially bring a much-needed element of pressure, stress, panic and urgency. Additionally, following consent and authorization of the media article by the exercise design team, journalists can effectively publicize the exercise and further spread its importance to the general public.
- *Consult experts* – It is not the responsibility of exercise designers to be familiar with all areas and determine all challenges that individual institutions face. The responsibility of the exercise designers is to compile the story and develop highly specific injects based on the exercise objectives set at the beginning. E.g. if there is an intent to test the private sector, customize the exercise to their current needs and framework. To avoid answers like *"this is not how the commercial organizations work"*, consult specific aspects of the scenario with your partners from private sphere in advance.
- *Do not underestimate the value of a test run/exercise review* – Before each exercise, ask colleagues/partners for exercise revision. Since exercise designers are integral to the plot and know what to expect, they might easily overlook gaps in the process or scenario consistency. In case of technical training or exercises using more sophisticated tools/technology do test runs first, to check that all tools are

working properly, the environment is set correctly etc.

- *Visual aspect of the whole exercise* – Graphically unified documents with own exercise logo, document header or footer might look even more professional and advanced.

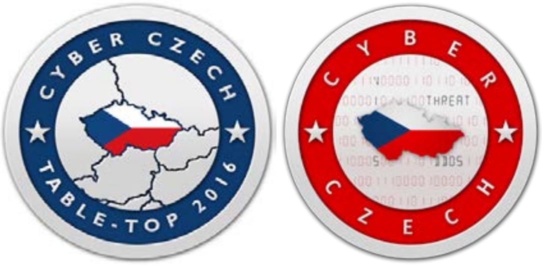


Figure 6: Examples of logo designed for table-top and technical Cyber Czech.

CHAPTER SUMMARY

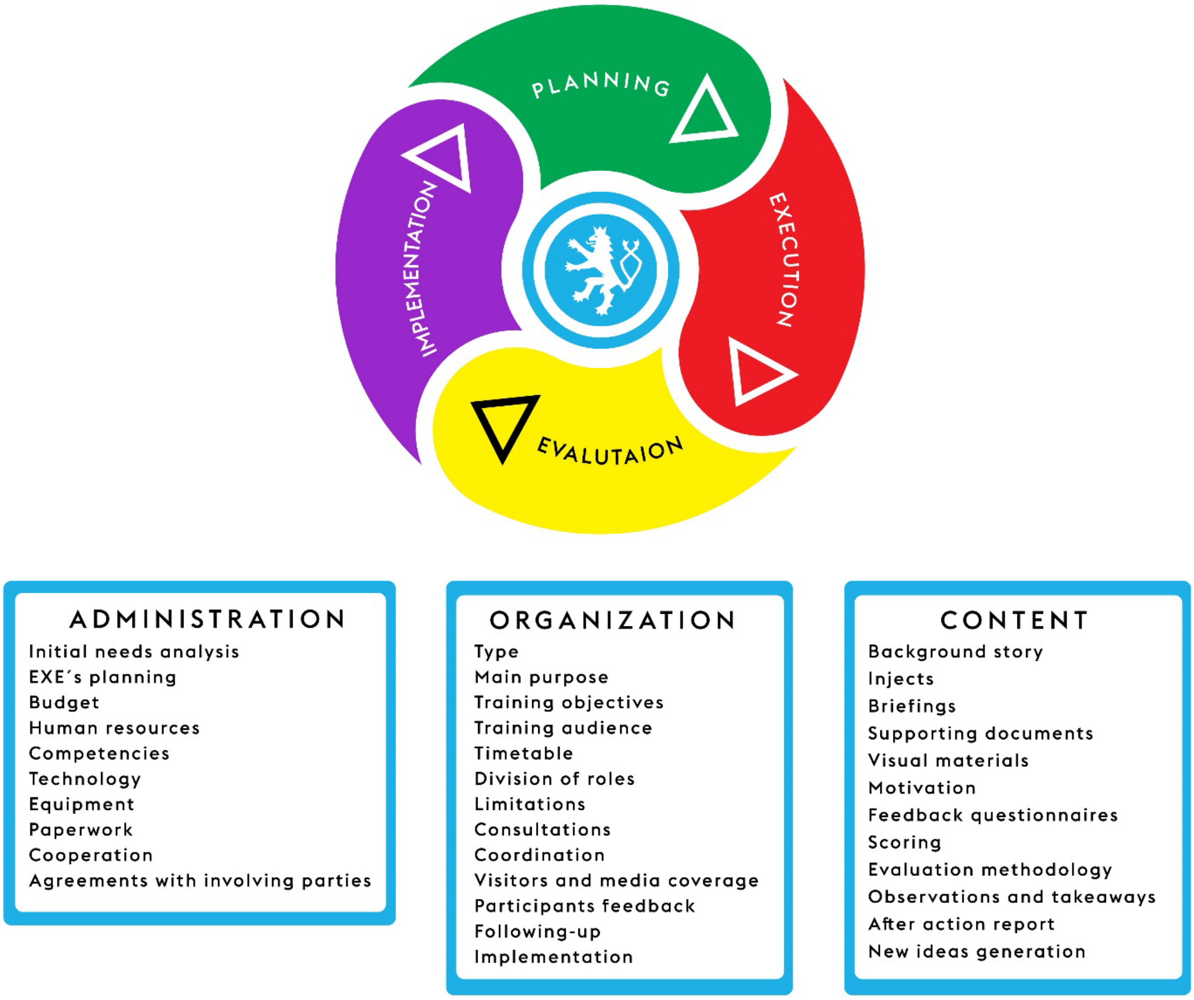
- Although the exercise offers plenty of opportunities for being innovative and creative, some rules should be kept.
- Your exercise can be eye-opening and impressive. Draw inspiration from cyber professionals. Exercise results may lead to new technical or procedural innovations.
- Invite actual professional journalists and let them actively participate.
- Exercise designers cannot cover all the knowledge. Allow for consultation with subject-matter experts.

CHAPTER 6
EXERCISE PLANNING CYCLE AND DESIGNERS

As exercise planning cycle is based on a continuous process, a special exercise unit (or at least a team of designers who are primarily responsible for planning, running, evaluating, following-up and implementing the exercise results) is required. More importantly, the most effective and useful cyber table-top exercises are characterized by tailored content and highly specific injects. Preparing such exercises requires a lot of manpower, time, knowledge and experience in project management and coordination skills. A major task-set for creators is to determine the exercise purpose, and to develop the pertinent story with subsequent injects. To be able to do this effectively, exercise designers need to gather inputs from relevant colleagues and partners. To validate that the narrative and injects are oriented in the right direction, consultation with the right professionals is necessary. For instance, depending on the training objectives, ask a legal advisor on legal implications, ask a STRATCOM team to get insight into strategic communication areas, ask experts on crisis management regarding overall procedures and crisis processes, ask technicians about technical aspects, ask foreign affairs/specific region analysts on geopolitical considerations, etc.

Preparation of cyber security exercises is about people. Organizational skills and attention to details are a must when you are picking exercise designers. They must be creative, innovative, and open to new ideas. The more novel the exercise is, the more participants can take away from the training. Precision and strict adherence to schedule is another required skill, as is the preparedness to be ready to absorb lots of information. Exercise unit members should have the opportunity to meet regularly, to hold briefings and conferences with applicable colleagues and parties during the entire planning stage. Good communication and argumentation skills are also very valuable.

To illustrate what all the preparation and execution of the exercise entails, please see the following table and graphic (Figure 7). The table, apart from underscoring the continuous planning process, divides the main activities into administrative, organizational and content portions.



ADMINISTRATION

Initial needs analysis
EXE´s planning
Budget
Human resources
Competencies
Technology
Equipment
Paperwork
Cooperation
Agreements with involving parties

ORGANIZATION

Type
Main purpose
Training objectives
Training audience
Timetable
Division of roles
Limitations
Consultations
Coordination
Visitors and media coverage
Participants feedback
Following-up
Implementation

CONTENT

Background story
Injects
Briefings
Supporting documents
Visual materials
Motivation
Feedback questionnaires
Scoring
Evaluation methodology
Observations and takeaways
After action report
New ideas generation

Figure 7: Planning cycle.

From the outset, determine the boundaries and limits (budget, human resources, time, travel, technology costs, and other resources). Pre-exercise analysis is another important step. What is the overall purpose? What is the intended training audience? What should be exercised, and how? When and where should the exercise take place? The third column of Figure 7 sums up what else must be developed in order to make an interesting and catchy exercise. Start with training objectives, elaborate on scenario, mix it with past incidents, current trends, and strive to add anticipation of developments and some “hot topics” to engage players as much as possible. E.g. while the era of drones is getting too mainstream, artificial intelligence, robotics and autonomous devices are creating lots of headlines these days. Split the scenario into smaller logical clusters, main events and specific injects and tasks. What must be highlighted here is also the motivation aspect. It could be encouraged by tailoring exercise to training audience needs, capacities, and framework and by setting the story into the realistic environment. Be ready to provide some hints in case the audience becomes side-tracked. Create a friendly atmosphere and keep repeating to them it is not a test, but the opportunity to expose them to an unusual but potential crisis scenario.

A special exercise management portal or tool can be very supportive for better coordination of tasks. However, for the needs of a limited-time table-top exercise, a common checklist may suffice as well. Assign roles and tasks, and determine deadlines. Try to keep a reasonable time frame.

A crucial part of each exercise is to receive feedback from participants, evaluate all responses, report to leadership and implement (wherever feasible) all findings and lessons learned into the real world.

CHAPTER SUMMARY

- Planning and execution must be always followed by the evaluation and implementation stage.
- Since it is a long term-process, a special unit/group of people should be dedicated to organizing cyber exercises.
- Enable exercise designers to educate themselves not only in the cyber field, but also in project management.
- Engage decision-makers with insufficient cyber knowledge (but not merely them) by involving hot topics they know from the media.
- Make a checklist.
- Check and double-check everything.

CHAPTER 7
EXERCISE EVALUATION AND FOLLOW-UP

The evaluation stage is an integral part and continuation for exercise planning purpose and objectives. Thus, the evaluation work must begin in the planning phase. The exercise team should key in on several questions: *What do you want to achieve with the exercise? How will the evaluation be done? According to which matrix, methodology, and criteria will the exercise be assessed?* If you do not know what you want to measure, assess or compare, it will be difficult to ask the right questions.

There are two basic purposes/levels of the evaluation:

The first one tells us how to improve the planning process and the exercise itself. It is based on the exercise creators' observations and participants' comments about the organization. This kind of feedback helps organizers better customize exercises to specific audiences and make exercise documents more comprehendible for them. Based on participant response, the exercise can cover the issues and topics most relevant to them. It should focus on areas of improvement and aspects of overall exercise design. This is the right time to ask players about whether they thought scenario and injects were challenging and realistic, what was working and what was not.

Sample evaluation questions:

- *Was the exercise design realistic?*
- *Was the scenario based on real-world examples?*
- *Were the exercise documents and visual materials complete/useful?*
- *Were the main events and injects structured and well-organized?*
- *Was the introductory presentation helpful in understanding exercise objectives?*
- *Did trainees feel under pressure and stress?*

The second level of the evaluation emphasizes systematic assessment of the exercise objective(s), examination of injects and results, and overall responder performance. Put simply, this type of evaluation focuses on bullet points covered in the "content" part in Figure 7 (previously introduced). The goal is to determine how they managed to treat the individual tasks and to what level they performed (low-standard, average or superior). More importantly, it brings to light the strengths and weaknesses, gaps, and shortcomings captured when dealing with a complex crisis scenario.

Sample evaluation questions:

- *List improvements that need to be made to plans and procedures for responding to the exercise crisis scenario.*
- *List the plans, processes or procedures that should be developed, reviewed or revised based on the exercise findings. For each point, indicate who or what agency/unit should be assigned responsibility for it.*
- *What have you identified as major lessons learned from the exercise regarding the content aspect?*
- *Is there anything in particular you would like to see in future exercises?*

To compile all respective notes and observations, target audience can be required to fill out special questionnaires after the end of the exercise *(see sample evaluation questions above)*. In addition, interviews with key players and observers can be helpful. Again, all questions articulated here must be in line with exercise objectives, evaluation metrics and criteria to reveal the greatest challenges and pitfalls. Finally, inputs for evaluation should be gathered during a hot-wash. It is largely a guided discussion, involving organizers, designers, evaluators, observers and participants, aimed at affording an opportunity to express overall impressions, concerns and views.

Basic principles for achieving an objective assessment of the current state/performance include a frank and open assessment of actual conditions. Especially in case of poor performance or failure, leadership might not be willing to accept less than good news. Therefore, evaluation must be considered a way of pinpointing areas of improvement, vice an opportunity blaming or finger-pointing. The goal is to further sharpen participant skills, broaden their experiences and fill gaps identified in the exercise. Additionally, in order not to give the impression of blaming, evaluation should always contain potential solutions to the identified shortcomings.

Evaluation outcomes emerging from feedback and debrief session should be further elaborated in an After Action Report (AAR). Take your time with preparing this summary report (it usually takes several weeks). A high-quality AAR describes the exercise, what the main objectives were and if (and how) they were met. Key aspect of the AAR include highlighting the major weak spots and giving recommendations for how to minimize or eliminate shortcomings observed in the exercise. Without drafting solutions and countermeasures, the AAR (and even the whole exercise) loses its potential to serve as a key supportive tool in promoting the remedy of the situation and driving organizational change (at management or political levels).

Another means for following up on emergent issues is to organize a follow-up event, invite respective decision-makers, top management and political leaders, detail key weak spots to them and jointly discuss possible solutions. It is always much better if executives have gone through the scenario and experienced virtual pain if scenario ended up poorly. However, it is critical that the right people be present - people with the power to move things forward. Provide them with the AAR to have something to refer to.

The evaluation process and follow-up event should lead to the creation of a best practices document which constitutes an important part of each exercise. Its purpose is to outline what to do in case of such a crisis/scenario, to serve as a step-by-step manual in dealing with serious incidents. As the best practices document is one of the most useful and practical outcomes for the participants, make it available to your partners and other stakeholders. The more people and institutions are familiar with this document, the more educated and prepared the community it is.

Finally, the essential implementation stage remains to be addressed. Once you have identified weak spots and have produced an AAR and best practice summary, it is time to implement all the findings into the real life wherever feasible. It is likely that cyber exercises will uncover insufficiencies in current procedures, process, SOPs and policies in the wake of a cyber incident. Lay out the standard operating procedures, business continuity plans, disaster recovery plans on the table, assess their adequacy and revise them to avoid the same shortcomings. Develop a plan B for all possible scenarios. Do not neglect to educate senior leadership and other applicable audiences regarding the possible risks and threats.

What to exercise next time? Test and validate whether all revised plans and procedures would suffice and work in a cyber crisis. Find out what progress have been done in this area.

CHAPTER SUMMARY

- Planning and evaluation stages should be devoted the same effort.
- Use the exercise output not only to improve the exercise itself, but also to make real processes more effective.
- Report to leadership about the exercise findings in a suitable way.

CHAPTER 8
SUMMING IT UP

Well-crafted and well-executed exercises are proven valuable and effective tools for raising cyber security awareness among senior leaderships, managers, and IT professionals. Exercises with integrated operational and decision-making components can serve to test real-world procedures, communication flow and improve decision-making at strategic levels, as well as to enhance the technical skills of cyber security operators.

Exercises are perfectly targeted at human individuals who pose the weakest point in the security chain. However, the aim of exercises is not to expose those individuals to stressful situations and to punish them if they fail. Nor is the aim to publicly expose institutional gaps and jeopardize institutional reputations. On the contrary, the benefit of exercises lies in the opportunity to educate personnel and improve functioning of the institution in an exciting way. Additionally, an exercise fiasco does not necessarily mean a disaster. It can identify an issue to be addressed before an actual emergency occurs. Hence, from this perspective, failure might be better than success. It is believed that such demonstrative and engaging exercises can enable participants to take away more knowledge and experience than from the most dense and comprehensive lecture.

It is the intent of this handbook to provide useful guidance and practical advice for designing and carrying out such cyber table-top exercises.

GLOSSARY

AFTER ACTION REVIEW

AAR provides a structured brief overview of the exercise, major strengths demonstrated during the exercise, and areas that require improvement.

CYBER RANGE

A virtual environment that is used for cyber security exercises, cyber technology research, and development. It provides a unique platform and tools for testing and analyzing security threats to critical information infrastructure and other important systems. It is capable of creating various scenarios involving extensive computer networks running services and applications, and thus facilitates the detailed study of the emergence, spread, and impacts of current cyber threats.

HOT WASH

A debrief conducted immediately after an exercise or test with staff and participants.

INJECT

Pre-scripted events that simulate and include directives, instructions, and decisions. Exercise controllers provide injects to exercise players to drive exercise play towards the achievement of objectives. Injects can be written, oral, televised, and/or transmitted via any means.

TABLE-TOP

It is a meeting to discuss a simulated/hypothetical emergency situation. They are used for testing emergency plans, clarifying roles and responsibilities, decision-making processes etc. They should result in action plans for continued improvement of the internal process and emergency plans.

THREAT ASSASEMENT

The product or process of identifying or evaluating entities, actions, or occurrences, whether natural or man-made, which have or indicate the potential to harm life, information, operations, and/or property.

TRAINING AUDIENCE

An individual, staff element, staff or organization that performs a particular task or set of tasks during the execution of the exercise.

APPENDIX

EXAMPLE 1: MAIN EVENT AND INJECT

MAIN EVENT X

INJECT X.1 A week before general election in Country A, the Centre Party becomes victim of a cyber-attack. They have lost control over their mail services and website. It is now showing defacements, damaging the image of the party. The Centre Party is considered to be the most pro-country B of the major parties, supported by many people from Country A as well.

QUESTIONS:

X.1.1 Would you recommend to provide help to the Centre Party? Who can make such a decision?

X.1.2 How would you justify such a decision in the eyes of other political parties and public?

X.1.3 Should Country A offer help to all political parties in case of need?

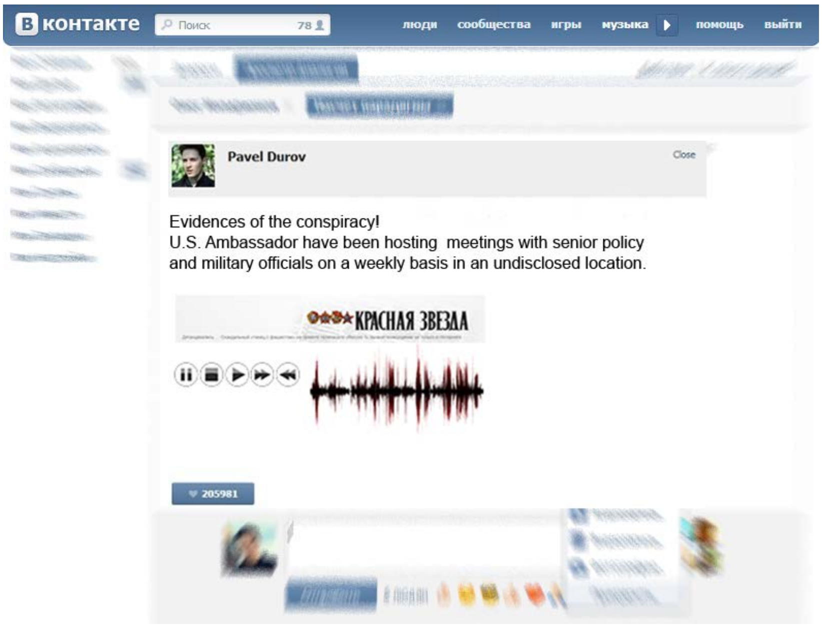
X.1.4 In your opinion, what might be the reputational impacts on the electoral system and government, if unable to ensure a smooth run of pre-election campaigns?

X.1.5 Would you consider postponing the election? If yes, elaborate on that.

Answers:

EXAMPLE 2: AN INJECT DELIVERED IN THE FORM OF SOCIAL MEDIA POST AND AUDIO RECORDING

(Context is fictitious. There is no real US involvement).



Pavel Durov

Evidences of the conspiracy!
U.S. Ambassador have been hosting meetings with senior policy and military officials on a weekly basis in an undisclosed location.

EXAMPLE 3: DISCLAIMER STATING THE LEVEL OF FICTION AND ATTRIBUTION

“Although some events depicted in this exercise are based on real incidents/occurrence, the exercise is fictional and does not intend to link any nation/state/government/group of individuals to any actual wrong doing. Nor does this exercise serve as an attribution tool. The use of nation states and other actors, as well as events, locations, incidents and attribution hints are purely fictional.”

ABOUT THE AUTHOR

Martina Ulmanová is a Head of Education and Cyber Exercise Unit at the National Cyber and Information Security Agency in the Czech Republic. She has extensive experience in the field of cyber security exercises. In her role, she is responsible for the cyber security exercises on the national and international level for the Czech Republic. Since 2014, she has served as an exercise director and local trainer for the Czech Republic in NATO cyber security exercise CYBER COALITION. In 2017 she became a leader of one of the exercise planning sub-teams in the world´s largest cyber defense exercise, LOCKED SHIELDS.

She is involved in preparation and lecturing for university courses on cyber security. In addition, she coordinates and prepares cyber awareness campaigns including e-learning projects and cyber training for special target groups. She holds her master degree in Strategic and Security Studies from the Masaryk University in Brno, Czech Republic.

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