TIBER-NL IMPLEMENTATION GUIDE

How to conduct a TIBER-NL test

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TIBER NL AFM

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01 Introduction

1.1 Background

Entities that comprise the Dutch financial sector must continuously work on their resilience against cyberattacks causing systemic impact. To help achieve this goal, the Dutch Financial Stability Committee has commissioned De Nederlandsche Bank (the Dutch Central Bank/DNB) to lead the development and implementation of a framework for Threat Intelligence-based Ethical Red teaming: the TIBER-NL framework. The development and implementation of the framework is a joint effort of the most critical Dutch entities and officially started on 30 June 2016. TIBER-EU has been commissioned in 2018 by the ECB. This framework is leading and TIBER-NL is a derivative thereof. The Dutch Authority for the Financial Markets (AFM) has adopted TIBER-NL in 2021. The aim of TIBER-EU is to make cross border testing of multinational entities possible and make sure tests can be recognised by all the competent authorities of the Euro-system countries who have adopted TIBER (and also under some conditions by countries with similar testing frameworks). The TIBER method has proven to be applicable in other critical infrastructure sectors.

Within the TIBER-NL guide, Entities hire cyber security providers to deliver intelligence and controlled simulated attacks on their live critical production systems. Procedures and safeguards will be put in place to minimise the risk to the integrity, confidentiality and availability of the operational processes.

TIBER-tests mimic potential attacks from real threat actors. The test emulates high level threat groups only (organised crime groups / state proxy/ nation state threat actors) and thereby tests whether defensive measures taken are effective (capability assessment), supplementing the present work done by supervisors and overseers (compliance assessments). The tests also supplement current penetration tests, red teaming exercises and vulnerability scans executed within entities. Test scenarios will draw on current commercially obtained threat intelligence that will where possible be enriched and reviewed with Governmental Intelligence Agencies (GIA). This testing method aims to determine, and importantly serves to improve the cyber resilience capabilities of targeted entities. The TIBER-NL framework is intended to improve their cyber operational resilience and ultimately, the cyber operational resilience of the entities as a whole. TIBER-NL testing will be a recurrent exercise.

A TIBER-test can therefore be defined as: the highest possible level of intelligence-based red teaming exercise using the same Tactics, Techniques and Procedures (TTPs) as real adversaries, against live critical production infrastructure, without the foreknowledge of the organisation's defending Blue Team (BT). As such, the BT is unaware of the TIBER-NL test. The actual test consists of time boxed phases (in, through, out). As a consequence, existing controls, prevention measures, and security detection and response capabilities against advanced attacks can be tested throughout all phases of the attack. It also helps identify weaknesses, errors or other security issues in a controlled manner.

The test phase is followed by full disclosure to the BT and a replay (which has to include purple teaming) between the Threat Intel Provider (TIP), Red Team Provider (RTP) and the entity's BT to identify gaps, address findings and improve the response capability. During the test a White Team (WT) consisting of only the smallest necessary number of people from the entity security and business units will monitor the test and intervene when needed, e.g., when the test seems to lead to critical impact. During a test business impact is allowed to a level agreed on beforehand, critical impact is not. The WT will be in close contact with the TIBER-NL Test Managers (TTM) from AFM's TIBER-NL Cyber Team (TCT), who convoys the TIBER-NL test process.

Collaboration, evidence and improvement lie at the heart of TIBER. What differentiates TIBER-NL from other security tests is its intelligence-led holistic

approach and financial sector's focus in which collaboration and learning are central elements. This means that entities can improve their resilience based on proven relevant weaknesses rather than on perceived / possible weaknesses. Hence TIBER-NL delivers a higher return on security investments than solely working from a compliance-driven risk framework and defending against perceived risks. In addition, the TCT enables comparison and the distillation of best practices in the FCI,the pension, insurance sector and AFM participants.

This guide is updated knowing the regulatory technical standards of Digital Operational Resilience Act (DORA) on Thread Led Penetration Tests (TLPT) and the TIBER EU framework will be written/revised. With this taking up to two years from now, we did not want to wait to update this NL Guide.

1.2 Purpose of this guide

This guide has been developed by the TCT from the Dutch Central Bank in close cooperation with all participants of TIBER-NL and is a derivative of the leading TIBER-EU framework. The AFM has applied necessary adjustments in this guide to serve its TIBER-NL participants and their cyber security service providers. It explains the key phases, activities, deliverables and interactions involved in a TIBER-NL test.

This document is a guide rather than a detailed prescriptive method. It should therefore be consulted alongside other relevant TIBER-NL, TIBER-XX and TIBER-EU materials which will be provided by the TCT to TIBER-NL participants. This guide only details the TIBER-NL test process. The TCT is available to answer any questions that entity or cyber security service providers might have on the TIBER-NL test process or the TIBER-NL program.

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02 TIBER-NL overview

2.1 Summary

The main goal of this chapter is to give a broad overview of the most important elements of TIBER-NL. It describes a general process overview where all phases and the goal of TIBER-NL is explained, it gives a brief explanation of the most important stakeholders during a test, it describes the role of the TIBER-NL Cyber Team and finally it gives guidance on how to manage tests which take place in multiple jurisdictions and the might entail involving multiple TCT's.

2.2 Process overview

The main goal of TIBER-NL is to give the tested entity a learning experience as to how resilient they are against attacks from high end adversaries such as nation states and organised crime groups. This is achieved by performing a scenario based red team test based on recent intelligence as to which adversaries would be most likely to target the entity. The Red Team is then tasked to follow the tactics, techniques and procedures of the relevant actor.

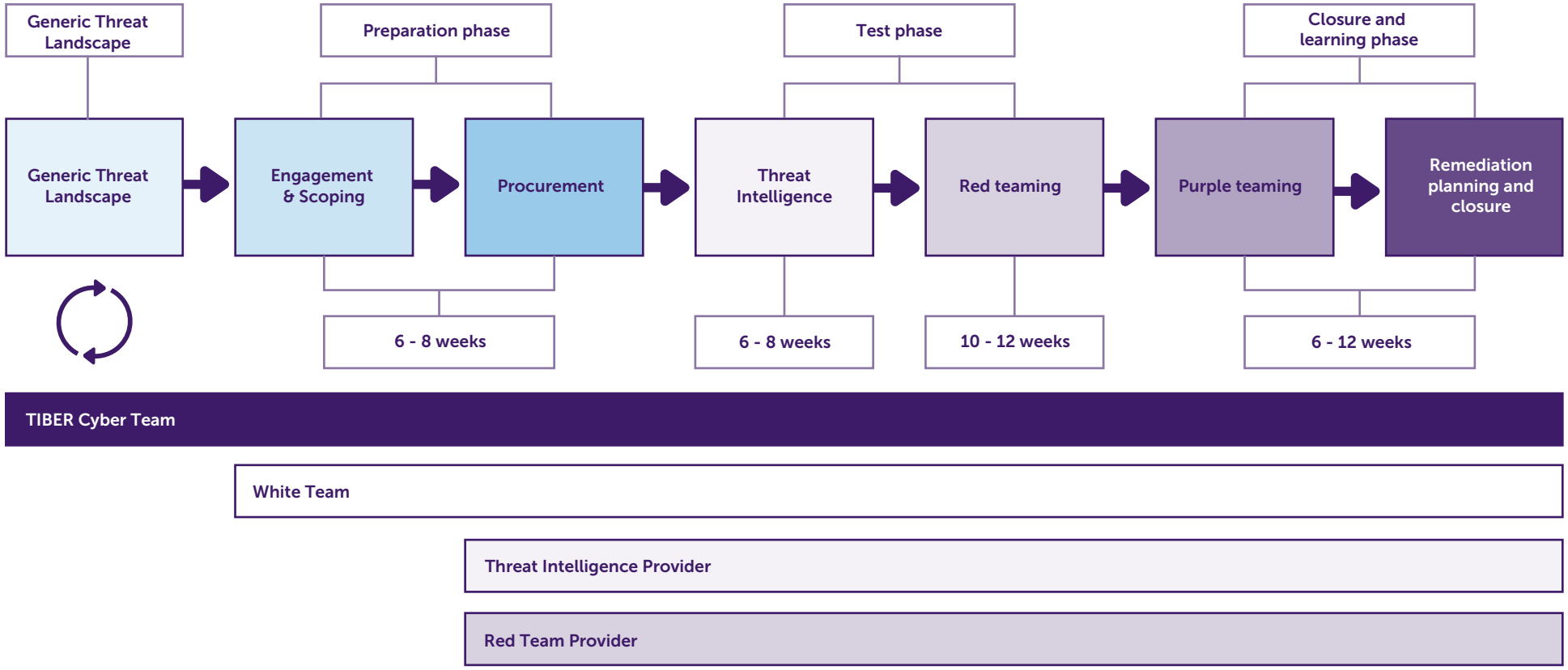
The process is divided into four phases:

- **The Generic Threat Landscape phase** shows which threat actors are relevant for the entities within the TIBER-NL scope and reflects on the motivations of these actors to attack the critical functions of the entity. This document will where possible be enriched and reviewed with Governmental Intelligence Agencies (GIA).
- **The Preparation phase**, during which the TIBER-NL test is formally launched, the WT is established, the test scope is determined, critical information and functions (CF) are defined and approved by the board, and a TIP and an RTP are procured. If the RTP is capable of providing target intelligence and producing intelligence led scenarios to the highest standards, then procuring a separate TIP is not mandatory. The RTP in that case needs to comply with the requirements of 'Chinese walls' in scenario development between threat intelligence and red teaming phases. Note: procurement of a TIP might differ between an organisation's first TIBER-test and consecutive tests. See 5.2.2.
- **The Test phase**, during which target intelligence is gathered and intelligence led scenarios are produced, and the RTP prepares (format test plan) and executes an intelligence-led red teaming test against a specified target (systems and services that underpin one or more critical functions). Note: gathering of TI and development of scenarios might differ between an organisation's first TIBER-test and consecutive tests. See 6.2.1.
- **Learning and Closure phase**, during which a replay of the executed scenarios will take place between the BT, the TIP and the RTP. The TIBER process is reviewed and the entity remediation plan is finalised. Good practices will be shared with peers by the entity if the benefit is greater than the risk. The entity informs their respective supervisor and / or overseer about the TIBER-NL test in their regular meetings based on their remediation plan following the test.

The process model below is a logical depiction of the TIBER-NL process. However, in reality the process is not such a neat linear sequence of steps: some activities may start earlier and run in parallel with others in order to increase efficiency given the limited timescales of the test. The TTM will help by advising the WTL on the timing of the test phases in order to generate synergy.

The first phase, the generic threat intelligence process will be executed by the TCT for all of the tests. The output (Generic Threat Landscape) will be shared with the entities. The next three phases (Preparation, Testing and Closure & Learning) will be dealt with separately per entity.

Figure 2.1: TIBER-NL test process model



2.3 Stakeholders

The most important stakeholders during a test are the following:
- White Team and their Lead (WT and WTL)
- TIBER Cyber Team (TCT)
- Board of directors of the entity
- Blue Team of the entity (BT)
- Threat Intelligence Provider (TIP)
- Red Team Provider (RTP)

2.3.1. White Team and their Lead

The White Team is the team managing the test from the entity's side. They are the only few people fully aware of the test. The White Team consists of a White Team Lead and its backup, a board member, the CISO, subject matter experts, if necessary, and a member from third parties, if necessary. For a full description of the White Team please consult the TIBER-EU White Team Guidance

2.3.2. The TIBER Cyber Team

The role of the TTM is to make sure entities undergo tests in a uniform and controlled manner. During all phases of the TIBER-NL process, the entity's WT closely cooperates with the TTM. The TTM convoys the WT through the TIBER-NL phases but can in no way be held accountable for the WT's actions or any TIBER-NL test consequences. The TTM has a close relationship with the WT but is not formally part of the team. They have a right to escalate (major) deviations from the set test scope or scenario to the TCT program manager, to whom they directly report

The TCT Test Manager (TTM) will:
- Align closely with the WTL to make sure the test follows the agreed procedure and meets the right quality level for a TIBER-NL test.
- Make sure the individual tests fit the function of the entity, the threat intelligence and high-level scenarios provided.
- Involve a Threat Intelligence Advisor (TIA) from the TCT during the TI phase to verify the quality of the target intelligence and the scenarios in the Targeted Threat Intelligence (TTI) Report.
- Assess the level of the cyber security service providers, and the level of the work of the RTP and possibly the TIP during the test.
- Facilitate sharing and learning between the entity participating in TIBER.
- Develop international cooperation with other TIBER-NL(-like) programs regarding testing.
- R&D regarding intelligence, testing and talent development.
- Continuously develop the TIBER-NL framework based on experiences during the tests.

2.3.3. The board of directors of the entity

The board of directors is an important stakeholder throughout the test and in various ways. One of the board members is part of the White Team and has to formally give a go on the start of the test. They will be aware of the test and what is happening and can, if necessary, take decisions with regards to events during the test. It is the responsibility of the WTL to keep the board member involved and up to date during the test.

The other board members are not aware of the test and thus only involved during the closure and learning phase. This can either be during the purple teaming sessions when the tabletop exercises take place, or when the test is finished. After each test it is mandatory for the WT and the board to allocate time for the WT to present the findings and proposed remediations of the test.

2.3.4. Blue Team of the entity

The Blue Team (BT) is the defending team. They should not be aware of the test until the test is finished. However, due to circumstances it might be that they find out earlier about (parts of) the test, which the entity should try to prevent at all costs. After the test phase has ended the BT can be made aware of the test to its full extent. Together with the Red Team they will evaluate the findings of the test and create their learning experience during the purple teaming session.

The BT is not just limited to technical personnel such as a security operations centre or IT administrators. The BT consists of everyone that are not part of the WT and therefore are not informed about the ongoing test. This ranges from the person receiving the phishing e-mails to personnel whose accounts might be compromised during a test.

2.3.5. Threat Intelligence Provider

The Threat Intelligence Provider (TIP) TIP is responsible for providing the Targeted Threat Intelligence during the test phase and provide additional intelligence if necessary, during the Red Team. The TIP should provide a team with a Threat Intel lead and one or more analysts. The main product of the TIP is the TTI-report which contains a company overview, a threat landscape for the entity and scenario's to be played. They are also part of the purple teaming sessions. For more information see the EU services procurement guideline and the targeted threat intelligence report format.

2.3.6. Red Team Provider

The Red Team Provider (RTP) is responsible for executing the Red Team test based on the earlier made scenarios. For this the RTP should provide a team of a Red Team Lead and one or more red teamers who specialise in various fields of red teaming. The main products delivered by the RTP are the Red Team attack plan and the Red Team report. They are the main drivers behind the purple teaming sessions. For more information see the EU services procurement guideline, the Red Team attack plan format and the Red Team report format.

2.4 Multi-jurisdiction tests

In the case where an entity is participating in a TIBER program of multiple jurisdictions with TIBER and an active TIBER Cyber Team, the lead TTM is provided by the central bank who is the main supervisor or overseer for the tested entity. It is the joint responsibility of the WTL and the TTM to make sure to involve all relevant TIBER schemes in the test. In collaboration it can be decided to inform overseers or supervisors who don't yet have a TIBER scheme of the results of a test. For more detail on multi-jurisdictional tests: TIBER-EU Framework.

03 Managing a TIBER-NL test

3.1 Project management

The WTL is responsible for managing the project of the TIBER-NL test. This means that he is responsible for planning the mandatory meetings, agreeing on ways of communication, password policies and draft a high-level overall planning for the entire test. Part of the project management is also making sure internal stakeholders such as the board are onboarded to the test in a timely manner and make sure that the external parties deliver according to the planning or make sure the planning is adapted in case of changes.

While a formal project plan is not a necessity, it is advised to create one to keep things clear. A planning is mandatory to create and communicate with all parties involved.

3.2 Risk management

There are risks associated with a TIBER-NL test for all entities due to the criticality of the target systems, the people and the processes involved in the tests.

Before an entity engages in a TIBER-NL test they should conduct thorough due diligence of (possible) in scope systems to ensure that at least backup and restoration capabilities are in place. Furthermore, it is advised that the entity conducts a risk assessment with regards to the risks a TIBER-NL test poses and that these risks are taken into consideration and handled.

The entity makes sure when hiring cyber security service providers (whether a RTP and / or a TIP) that there is mutual agreement on at least the following aspects: the scope of the test, boundaries, timing and availability of the providers, contracts, actions to be taken and liability (including insurance where applicable). A peer-check with the TIBER-NL Steering Group on previous experiences with the cyber security service provider(s) involved in a TIBER-NL test, is another measure designed to further mitigate the risk of damage to critical live systems. In addition, close involvement of the TTM in each TIBER-NL test makes sure that the test proceeds according to the agreed test scope, scenario, planning and process as described in the cooperatively developed framework documents. Minimum requirements for cyber security service providers, both TIP and RTP, are described in the TIBER-EU Services Procurement Guidelines.

Risks are also reduced by planning, informing only a select group of people in higher management about the test and the scope of the test, a clear definition of the scope and predefined escalation procedures. It is important to note that the entity remains in control of and responsible for the test. At any time, the WT can order a temporary halt if concerns are raised over damage (or potential damage) to a system or business processes. Trusted contacts within the WT positioned at the top of the (security) incident escalation chain help prevent miscommunication and knowledge about the TIBER-NL test leaking out.

To prevent TIBER-NL tests from leaking out, code names are used. These code names should be used throughout all documentation related to the TIBER-NL test as best as possible but at least in document titles and throughout the documents. Elements where codenames can't be used (such as, but not limited to URL's, screenshots etc) are exempt and the full name of the entity can be used. Codenames will be assigned by the TCT, however providers and/or the entity are free to use their own codenames. It is important to make sure one codename is used throughout all documentation.

The testing should be flexible enough to mimic the (seen, current and potential future) actions of a real threat actor and is to be performed in a planned and controlled manner in order to (amongst other things) ensure uniform testing, protect those involved (e.g.: indemnifications) and prevent damage. These elements are essential in order to make sure the entity and its peers can learn and evolve, not only using their own but all relevant results and findings.

As a result of the test, it is possible that during a test the BT has reached a level of escalation where it starts to inform relevant authorities such as, but not limited to, police, intelligence agencies or data-protection agencies. The WT should at all times try to prevent this from happening. Authorities should not be burdened by a TIBER-test. In case the WT is informed of an active escalation to third authorities, the test should immediately be paused and measures should be taken to prevent the authorities to act on the incident escalation.

The following is prohibited in TIBER-NL (not an exhaustive list):

- Unauthorised destruction of equipment
- Uncontrolled modification of data / programs
- Unauthorized jeopardizing continuity of critical services
- Extortion
- Threatening or bribing employees
- Kidnapping
- The use of names, logos or otherwise identifiable information of real people or companies

04 Generic Threat Landscape

4.1 Summary

The Generic Threat Landscape (GTL) is a document describing the threat landscape of the entities within the TIBER-NL scope. It is created by the TCT of the DNB in collaboration with the AFM and distributed to the WT as soon as the test starts. It shows which threat actors are relevant for the entities within the TIBER-NL scope and reflects on the motivations of these actors to attack the critical functions of the entity.

Figure 4.1: Generic threat landscape overview

4.2 Process

The TCT creates the GTL two times a year using various internal and external sources. Those sources are combined into a threat landscape which shows the main threat actors targeting the critical functions of the Dutch financial sector.

The document is where possible enriched and reviewed with the Governmental Intelligence Agencies: The General Intelligence Agency (AIVD), the Military Intelligence Agency (MIVD), Team High Tech Crime of the Dutch National Police and the National Cyber Security Centre. For individual entities there is the possibility to perform a check on specific target information.

4.3 Meetings

During the GTL-phase there are no mandatory meetings.

4.4 Deliverables

The main deliverable is the Generic Threat Landscape. The document is delivered twice a year and distributed on demand each time a test starts and the TIP and RTP have been procured.

05 Preparation phase

5.1 Summary

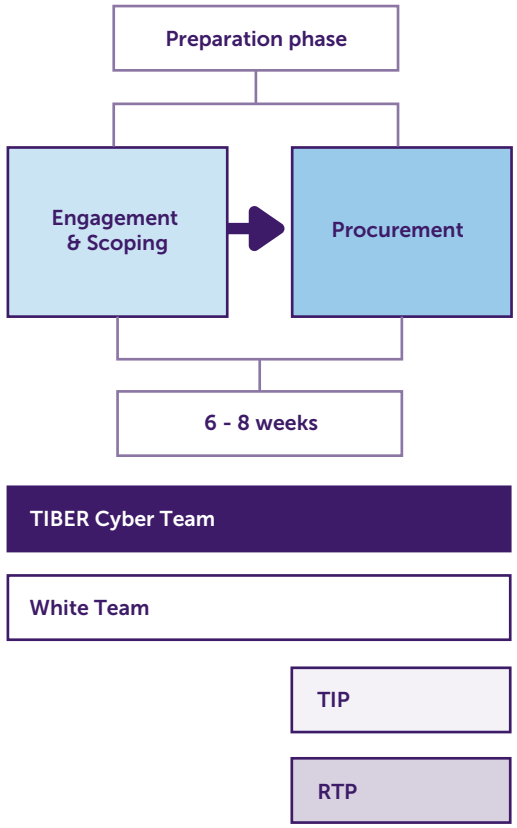
During the TIBER-NL Preparation Phase the TTM starts engaging with the entity and the project is formally launched. The scope is established, and the entity procures the cyber security service provider(s). The duration of this phase of work is approximately 4–6 weeks, not including the duration of the entity procurement process. The goal of the preparation phase is to deliver the scoping document, procure the providers and formally launch the TIBER-NL test.

5.2 Process

5.2.1. Engagement

The Pre-Launch meeting marks the start of the planned and agreed on TIBER-NL process for the entity. The TTM asks the entity to establish a WT. This comprises a select number of senior individuals who are experts and/or are positioned within the security incident escalation chain. The WTL will make sure they are aware of the TIBER-NL test, the need for secrecy and the process the team should go through in case the BT detects and escalates a TIBER-NL related incident. The TCT and the WTL jointly decide whether other jurisdictions of the entity will be included in the TIBER-NL test as discussed in 2.4.. This decision is made based upon in which jurisdictions the tested entity is part of the vital infrastructure. General rule is that if an entity is part of the vital infrastructure of a jurisdiction and there is a TCT active in that country, the TCT from that country should be included in the test.

Figure 5.1: Preparation phase overview



The RFP (Request for Proposal) used to procure a TIP and an RTP is shared with the TCT. The TCT will then make sure that the RFP contains all the necessary elements from the TIBER-EU Services Procurement Guidelines.

After the Pre-Launch meeting, the entity starts its procurement process. The entity then selects an RTP and a TIP to perform the test. Importantly, the entity offers a shortlist of potential providers to the TIBER-NL Steering Group and receives feedback regarding the providers from the TTM.

During procurement the entity undertakes the following activities:
- Procures and takes on board an RTP and a TIP, ensuring that it has incorporated the NDA clauses into its cyber security service provider contracts.
- Completes the TIBER-NL Test Project Plan, including the schedule of meetings to be held between the entity, TIP, RTP, and TCT.

Note: the requirements for a TIP might differ between the first test and consecutive tests at the same entity. These requirements need to be agreed upon by both the WT and the TCT. 6.1 and 6.2.1 will go into detail about potential differences.

5.2.2. Scoping

During the launch, the TCT provides the entity with the latest version of the TIBER-EU Scope Specification format. The entity then starts work on a draft version. The TTM is available during the scoping process to clarify the requirements and is available to give feedback. The TIBER-EU Scope Specification defines the scope of the TIBER-NL test, specifically the critical functions involved. Critical information and functions are defined as the people, processes and technologies required to deliver a core service which, if disrupted, could have an impact on the Dutch financial stability, the firm's safety and soundness, the firm's customer base or the firm's market conduct.

Entities across the entire sector support and deliver these functions in different ways via their own internal processes, which are in turn underpinned by critical systems. It is these critical systems, processes, and the people surrounding them, that are the focus of TIBER-NL threat intelligence and Red teaming. Flags are placed on the critical systems in the TIBER-EU Scope Specification document. These flags form the goal for the later test scenarios which are based on relevant threat intelligence.

The entity is allowed to involve the RTP and TIP in the scoping process. The TTM will involve supervision and / or oversight during the scoping phase to verify whether the scope is a realistic representation of the entity.

During the scoping process, the entity must complete the TIBER-EU Scope Specification document. The TIBER-EU Scope Specification sets out the scope of the TIBER-NL test, and lists the key systems and services that underpin each CF. This information helps the WT set the "flags" to be captured, which are essentially the targets and objectives that the RTP must strive to achieve during the test.

The WT should discuss the flags with the TTM, who must approve them. Although the flags are set during the scoping process, on some occasions they can be changed following the threat intelligence gathering and as the test evolves.

5.2.3. Procurement

With regard to contractual considerations, smooth delivery of a TIBER-NL test requires that the process is transparent and appropriate information and documentation flows freely between the relevant parties. To facilitate the free flow of information, Non-Disclosure Agreements (NDA) can be used.

5.2.4. Go/No go

After all steps have been completed there will be a formal go/no go moment where the TCT and WTL will decide whether the Preparation phase has been completed, the quality has been sufficient according to TIBER-NL, all meetings have taken place and all deliverables have been delivered.

5.3 Meetings

During the preparation phase the following meetings are mandatory:
- Pre-launch meeting
- Launch meeting
- Scoping meeting

Apart from the mandatory meetings it is advised that the TCT and the WT have regular meetings to discuss progress. The TCT can, whenever needed, support the WT in the procurement process or participate in workshops to create a scoping document.

It is of the utmost importance that the both the RTP and the TIP understand the scope of the test, not only the technical components but also the business processes. If the WT feels this isn't the case, it is advised to have a meeting where the scoping document is explained by the WT to the RTP and the entity.

5.3.1. Pre-Launch Meeting

The pre-launch meeting finalises the pre-launch phase. A WT is established, and it marks the start of procurement of the TIP and RTP. The framework is explained to the WT and expectations are exchanged between the WT and the TCT. If not agreed before, this is the moment when the decision is made which other jurisdictions, if applicable, will be involved in the test. After the pre-launch meeting the risk register can be created and a planning can be made. It is a preparation for the launch meeting in which also the providers will be present.

The participants of the Pre-Launch meeting are:
- WT
- TCT

5.3.2. Launch meeting

The launch meeting is the formal launch of the TIBER-NL test. During the launch meeting the following topics are discussed:
- the TIBER-NL process and documentation
- other involved TCT members
- stakeholders, roles and responsibilities
- contractual considerations
- project planning
- preparation of leg ups

After the launch meeting the TIBER-NL test is formally started. The launch meeting can be combined with the scoping meeting.

The participants of the Launch meeting are:
- WT
- TCT
- RTP
- TIP

5.3.3. Scoping meeting

During the scoping meeting the scoping document is agreed upon by the TCT and the entity. More importantly this is the meeting where the scoping document is approved by one board member of the entity, usually this is the COO.

The participants of the scoping meeting are:
- WT
- TCT
- RTP
- TIP
- C-level member of the entity

The launch meeting and the scoping meeting can be combined for efficiency.

5.3.4. Business Overview Workshop

To support the TIP and RTP in their understanding of the entity, a workshop is planned to discuss the activities of the entity and how this would impact its threat landscape.

The WT should prepare the following for this meeting:
- explanation about the core business of the entity, what is most critical for them and why is the entity vital for the broader landscape of entities
- a business and technical overview of each CF-supporting system in scope
- the current threat assessment and/or threat register
- examples of recent attacks

The participants of the scoping meeting are:

- WT (including a business expert)
- TCT
- RTP
- TIP

5.4 Deliverables

The main deliverables of the preparation phase are that:

- A WTL is appointed and a WT is formed.
- An RTP and TIP have been procured.
- A scoping document is delivered.
- The scoping document is approved by a C-level executive of the entity.
- Communication protocols are established and relevant communication groups are created.
- File sharing policies are established.

06 Test phase

6.1 Summary

During the Test phase target intelligence is gathered on the entity. This results in intelligence-led test scenarios. These scenarios will be expanded by the RTP into a Test Plan. If urgent findings are found to be relevant to other entities, these will be shared. How extensive the 'intelligence gathering' needs to be depends on a number of factors. Is this the entity's first TIBER-test or a successive test? How much time has there been between tests? How much has the entity changed between tests? And how much has the threat landscape changed between tests?

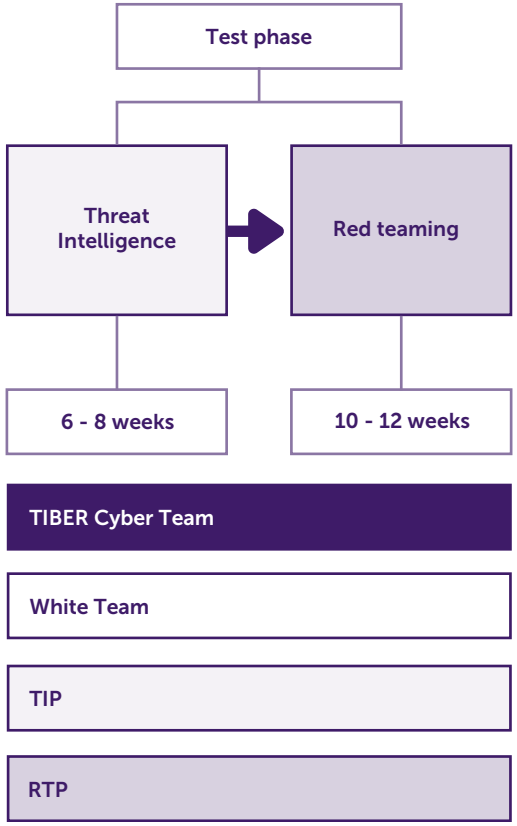
6.2 Process

6.2.1. Threat Intelligence phase

In this phase, during the first TIBER-engagement of the entity, the TIP executes an initial furtive, broad, intelligence-based targeting exercise of the kind typically undertaken by threat actors as they prepare for their attack. The objective is to draw a picture of the entity as a target from the threat actor's perspective. The use of various methods (including OSINT, TECHINT, and intelligence-based initial targeting) is encouraged. It cannot be stressed enough that this phase is a passive phase. *No active reconnaissance should be undertaken*. All reconnaissance should be performed in close cooperation with the RTP.

The targeted threat intelligence process results in the production of a TTI-Report, which is a bespoke, focused threat intelligence report for the entity being tested. It consists of three parts:

Figure 6.1: Test phase overview



1. A business overview from an intelligence perspective.
   This section is meant to provide a strategic understanding of the business of the entity and its current and planned activities. It also gives a more detailed insight into the business and systemic consequences of compromise of the critical functions. This is primarily based on the information gathered in the business overview workshop as discussed in 5.3.4.

2. Actors and high-level scenarios.
   For relevant threat actors it will be determined how likely and capable they are to attack the CFs of the entity. This will lead to a list of most likely and capable threat actors. The TIP can use the GTL as a starting point, but it is possible to motivate which additional threat actors would be relevant from the TIP perspective. These actors will form the basis for the scenarios. The TIP will write a high-level scenario of how an attack by the specific threat actor would take place including with which motivation and intent the threat actor would attack specific CFs. Based on this the enrichment of the TTI-Report contains the following items:
   - Most likely threat actors to target the CF of the entity.
   - A motivation as to why exactly these threat actors.
   - Most likely targets for each threat actor based on the scoping document.
   - High level scenarios for the most likely threat actors.

3. Intelligence on entity's (digital) presence to support the scenarios.
   In this part the TIP provides the RTP with (passive) intelligence that relates to the scenarios that are drafted. For example: a scenario of an OCG attacking via RDP vulnerabilities is only relevant if the entity is vulnerable to these kinds of attack. This part of the TI-report serves mainly to provide more detail on how the proposed threat actor would potentially attack the entity, given the real-life opportunities found in the entity's (digital) footprint. The entity can provide information to help focus the search of TIP. It is not the intention of this section of the TI-report to provide a broad data dump on everything that there is to find about the entity. This is done by the RTP. The intelligence should, as mentioned, relate to the proposed scenarios.

The TTI-report will be verified by the TIA of the TCT. The target intelligence delivered by the TIP will contribute to the further development of the test scenarios.

Some key considerations for the TIP:

- TI providers must engage with the entity to obtain useful context for conducting the threat analysis. To facilitate this the business overview workshop (5.3.4) is planned. Although the entity may not always be able to share the details of sensitive incidents with the TIP, it should still be possible to learn about the entity both through engagement gathering and evidence of previous breaches from public sources. The TIBER-EU Scope Specification can be a basis for this.
- Cyber security service providers should have adequate language support. Languages play an important role in providing cyber threat intelligence. Cyber threats are a global phenomenon, and a TIP that offers little linguistic coverage of online threats will potentially miss a significant proportion of relevant information.
- TI providers should be able to use a variety of methods in intelligence gathering, for example OSINT (which is derived overtly from publicly available sources).
- TI providers must always demonstrate strong ethical behaviour.
- TIP and RTP must work together in a collaborative, transparent and flexible manner. A TIP must demonstrate willingness and the ability to work in this way, sharing its deliverables with its RTP counterpart for review and comment. The TIP should also demonstrate a willingness to work with the RTP during the remainder of the test. This includes the creation of testing scenarios, as well as any new intelligence requirements that occur as the test progresses. The TIP is expected to provide input into the final report issued to the entity.
- Should the TIP and the RTP be separate parties, it is essential that the RTP is involved during the TI phase.

Differences between TI reports for first and successive TIBER-tests

The standard requirement for every TIBER-test is a full TTI-report, created according to the TIBER-EU TTI-framework and the guidance of the TCT.

In some instances, the standard TTI-requirement may not be in the best interest of the participating entity. For the consecutive TIBER-test, the organisation or its threat landscape may have stayed largely the same since the foregoing test. In these cases, creating a full TTI-report may lead to a significant overlap in TTI-reports.
In case the standard TTI-requirement offers too little added value for a participating entity , the TCT may decide to allow, in consultation with the WTL, an update of the last TTI-report.

The following non-exhaustive list of factors is relevant for this decision:

a. The degree in which the threat landscape has changed since the start of the TI-phase of the foregoing TIBER-test (geo-political changes, new threat actors, modus operandi, etc.).
b. The degree in which the profile of the entity has changed (reorganisations, mergers, change in customers & services offered, system changes, etc.).
c. The report that is updated cannot be older than 24 months. The TCT may deviate from this term in case of special circumstances.
d. Updating a TTI-report is only allowed once. The standard TTI-requirement applies for the consecutive TIBER-test. After that an update to the standard TTI-report could be made again.

Additional information delivered by the entity

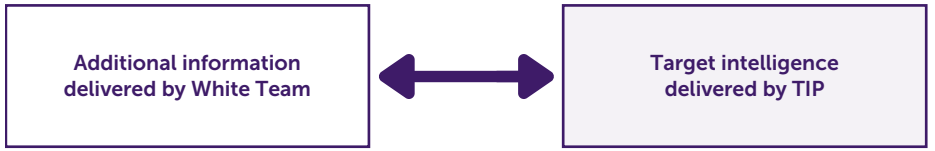
The entity delivers additional information for the TIP on the scenarios chosen including on people, (business)processes and systems targeted in the scenario. The level of detail of this information is up to the entity to decide.

The TIBER process is designed to create realistic threat scenarios mimicking possible (future) attacks against the entity. Real-world threat actors may have months to prepare an attack. They are also able to operate free from some of the constraints that cyber security service providers must observe, such as the time and resources available – not to mention the moral, ethical and legal boundaries.[1] This difference can cause challenges when attempting to create realistic scenarios as knowledge about the internal network is often the hardest to gain using morally, ethically or legally justified techniques.

A similar constraint relates to the systems underpinning the CF's which typically do not have a large footprint on the public internet. Whether they are internal bespoke systems or external systems that span multiple organisations with common connecting infrastructure, the knowledge of the functioning of these systems with an RTP may be limited in comparison to those threat actors with the capacity and time to study these extensively.

Therefore, it depends on the entity how much information it is willing to give to make sure the RTP is on the right level of knowledge to mimic advanced attacks. This way, TIBER reflects a 'grey box' testing approach in contrast with the 'black box' approach. The RTP receives support from the entity itself in order to balance out the smaller number of possibilities it has compared to high end attack groups. Experience shows that the more relevant information an entity gives to the RTP the more the entity will gain from the test. Of course, there will be a balance to observe. The claim may never be made in hindsight that the test was manipulated and a real threat actor could not have gotten that information. Therefore, it should be evident that the information given to the RTP could have been obtained by an advanced threat actor, given more time, different known techniques etc. Whether this information is provided by the entity or delivered by a TIP, is up to the entity.

Figure 6.2 Balancing information entity and TIP



1 It is up to the entity to set up contractual agreements with the RTP regarding e.g., the inviolability of their employees' privacy. It is, however, important to note that privacy related information is left out from test reports under all circumstances.

The above figure shows the balance between target information delivered by the entity or TIP. More of one means less is needed from the other, and time can be spent elsewhere (for the RTP this will mean relatively more actual test time).

The WT and the TCT should agree upon the scope and scale of the TTI-report in a second or successive test, before acquisition of a TIP. The WT should give the TIP access to the previous TI-report to prevent overlap and to ensure the new report is drafted as efficiently as possible. The updated TTI-report should be created in accordance with the TIBER-EU TTI-format. It is the responsibility of the WT to ensure that both the previous and the current TIP agree with this approach. The TTM decides, on the basis of the entities request, if an extra GIA check is necessary.

After the TTI-Report is finished there is a formal handover from the TIP to the RTP.

6.2.1.1. Go/No go

After the TTI-report has been delivered there will be a formal go/no go moment where the WTL together with the TCT will determine whether the TTI has been completed, quality standards are met, meetings have taken place and deliverables have been delivered.

6.2.2. Red Team test plan

In the Test Plan, the RTP will put together scenarios for the TIBER-NL test which:

- Uses the TTI-Report (entity + RTP/TIP) and aligns these into credible attack scenarios.
- Provides background to the tradecraft of the type of threat actor that is mimicked in the test.
- Gather OSINT information that would help the threat actor achieve its goal.
- Provides creative elements of what TTPs that have not yet been seen in the wild but that are according to the professional knowledge of the RTP to be expected for the future (scenario X, see below).
- Would, if occurring in real life, have impact on the Dutch financial stability.
- Also provide some elements which test the response of the entity, including evidence on whether the compromise action would be immediately detected or could have a fair chance of succeeding.

Attack scenarios

The scenarios are written from the threat actors' point of view and are intelligence-led. The RTP indicates various creative options in each of the test phases based on various TTPs used by advanced threat actors, to anticipate changing circumstances or if the first option does not work. The RTP should also indicate where a leg up might be needed if the attack is not successful and what this leg up will entail. The scenario writing is a creative process. The TTPs do not only mimic those seen in the past, but can combine techniques of various relevant threat actors thus saving resources. The RTP should motivate why threat actors' techniques could be combined in the scenario.

In addition to these scenarios, a scenario X is prepared. This scenario enables a forward-looking perspective to the attacks. The goal of scenario X is to look forward towards what advanced attacks can be expected in the (near) future. This scenario can be focused on a certain innovative technique, on tactics the RTP and TIP sees developing possibly combined with societal developments or developments in the threat landscape that will impact entity in the future. The end goal of Scenario X is still a CF, but the way towards the CF allows for a large level of creativity. Scenario X will be decided upon by the WT and TTM, supported by the RTP and TIP, after week six of testing.

Rules of engagement

Part of the test plan should be the rules of engagement. This is a part of the test plan where the RTP lays down the rules they will abide to during the engagement. The rules of engagement should contain at least the following:

- High level description of the techniques being used during the attack.
- List of excluded techniques.
- Detailed description of scenario's used for social engineering.
- How privacy of both voluntarily and involuntarily participants is being safeguarded in compliance with rules & regulations.

Detailed out phase plan

Before the start of the out phase a plan has to be delivered by the RTP on how they will approach the out phase. This plan should contain at least the following elements:

- Detailed description of the objective on the out phase and the scope of the out phase.
- Detailed description of the TTP's being used during the out phase.
- An overview of business knowledge needed to perform the out phase.
- A list of possible specialists needed to perform the out phase.
- Risks to be managed during the execution of the out phase.
- Possible leg-ups for the out phase.

It's up to the WT to supply the asked business knowledge and the specialists. The TIP has to judge whether the required knowledge by the RTP is realistic in comparison to the simulated threat actor. If it's not deemed realistic it is advisable that the WT makes a judgment call on whether to supply the information or not. This depends on the risk for the continuity of the business of the proposed actions.

Approval of the attack plan

At three points during the test there will be a formal approval of the attack plan:

- Before the test phase starts the attack plan is approved by the WT, TTM, TIP and RTP.
- After six weeks when scenario X is finalized the attack plan will be approved by the WT, TTM, TIP and RTP.
- After eight weeks the attack plan is finalized and approved again when the detailed plan for the out phase is added.

6.2.2.1. Go/No go

After the Red Team attack plan has been delivered there will be a formal go/no go moment where the WT will determine whether the quality of the Red Team attack plan is sufficient.

6.2.3. The Red Team test

The RTP now moves into execution of the TIBER-test during which it performs an intelligence-led red teaming exercise on the target systems. The scenarios are not a prescriptive runbook which must be followed precisely during the test. If obstacles occur the RTP should show its creativity (as advanced threat actors would) to develop alternative ways to reach the test objective. This is always done in close contact with the WT and the TTM. All actions of the RTP are logged for replay with the BT, evidence for the RTP report and future reference.

The test objectives (compromise actions) are the 'flags' that the RTP must attempt to capture during the test as it progresses through the scenarios. Of course, all captures are in close cooperation with the WT and the overall aim is to improve the BT capabilities. The scenario is to be played out from beginning to end. The RTP may need some help to overcome barriers, it may be discovered etc. but the scenario must continue to make full use of the TIBER-NL exercise within the given timeframe and test all phases of the test (in, through, out).

RTP are constrained by the time and resources available as well as moral, ethical and legal boundaries. It is therefore possible that the RTP may require occasional steers from the WT to help them progress. Should this happen, then these steers are duly logged. This ensures that maximum benefit is derived by all stakeholders from a time-limited test.

At all times the RTP liaises closely with the entity's WT and with the TTM. The TTM is updated at least once a week by the RTP and WT on the progress. Physical meetings between the WT, TTM and RTP during this phase are strongly encouraged since the discussions add significantly to the quality of the test. Also, entities have had very positive experiences when a member of the WT is onsite with the RTP for some time during the engagement.

During week six of the test there is a cut-off point. If after 6 weeks the Red Team has not been able to complete the "in phase" the RTP will be provided with realistic leg ups so the rest of the scenario can be played or, in case the RTP has gained foothold in another scenario, it can be allowed to use that path for the rest of the scenario where the "in phase" failed.

6.2.4. Removing the TIBER-NL label of a test

As the TCT is not part of the commercial relation between the RTP and the entity, it cannot stop the test. It however has the power to remove the TIBER-NL label. Which means the test is not recognized as a TIBER-NL test. This also means that, in case this was a multi-jurisdiction test, the test will not get the recognition of a TIBER-XX test in other jurisdictions. The TCT is therefore very careful in its decision to remove the TIBER-NL label. The quality and safety of the exercise should always be at the heart of the test.

The TCT can remove the TIBER-NL label in the following situations (this is not an exhaustive list). The decision will always be made in consultation with the WT unless the situation doesn't permit this:

- Either the TIP or the RTP has (repeatedly) shown it cannot live up to the standards laid out in the TIBER-NL framework
- The test has been compromised by the RTP, TIP or the entity either intentional or as a result of (gross) negligence
- When there is foul play by the WT/BT
- All other situations which compromise the quality, safety or the secrecy of the test

Should the TCT decide to remove the TIBER-NL label, the entity can choose to continue the test gaining the learnings from the test but without it being recognized as a TIBER-NL test, or the entity can consult with the TCT what steps have to be undertaken to make the test a TIBER-NL recognised test.

6.3 Meetings

The following meetings are mandatory during the test phase:

- Weekly update meetings
- Approval of the TTI-report
- Approval of the attack plan
- Formal handover workshop from the TIP to the RTP
- Scenario X meeting during week 6

6.3.1. Weekly update meetings

During the complete test phase, both the threat intelligence part and the Red Team test part, there will be weekly update meetings where the TIP and/or the RTP gives an update on the weeks progress and discuss next week's activities. This is to keep all parties involved and up to date with the test and to ensure quality standards are met.

The participants of the weekly update meetings are:

- WT
- TCT
- TIP
- RTP

While not mandatory it is advised that both TIP and RTP are present throughout all the update meetings, whether they are during the intelligence phase or the Red Team phase of the test.

6.3.2. Approval of the TTI-report

After the TIP delivers the TTI-report there is a meeting to give formal approval of this report. This is done to make sure that the TTI-report meets the quality standards of TIBER-NL and contains all the components of the TTI-report.

The participants of the approval of the TTI-report are:

- WT
- TCT
- RTP
- TIP

6.3.3 Formal handover TIP to RTP

After the TIP delivers the targeted threat intelligence report there is a workshop with the TIP and the RTP where the TIP explains the scenarios to the RTP so they can modify the scenarios into an attack plan.

The participants of the handover are:
- WT
- TCT
- RTP
- TIP

This meeting can be combined with the approval of the TTI-report.

6.3.4 Approval of the attack plan

After the Red Team has created the attack plan there is a meeting to give formal approval of the attack plan and start the Red Team phase of the test. This is to ensure that the attack plan meets to quality standards of TIBER-NL and contains all components of the Red Team Test Plan format.

The participants of the approval of the attack plan are:
- WT
- TCT
- RTP

6.3.5 Scenario X meeting

In the 6th week of the Red Team phase there is a meeting with all participants to make a final decision on which scenario X will be played. After this the RTP can commence with activities for scenario X.

Participants of the scenario X meeting are:
- WT
- TCT
- RTP

6.4 Deliverables

The main deliverables of the test phase are that:
- A TTI-report has been approved based on the Targeted Threat Intelligence Report Format.
- An attack plan has been approved based on the Red Team Attack Plan format.
- The Red Team test has been completed.

07 Closure and Learning phase

7.1 Summary

The closure and learning phase starts when the test is finalised. Reports are written, learning experiences are capitalised through P, results are communicated to the board and the test summary is written. The phase consists of different elements each having a different goal. The closure and learning phase takes approximately 6-8 weeks.

7.2 Process

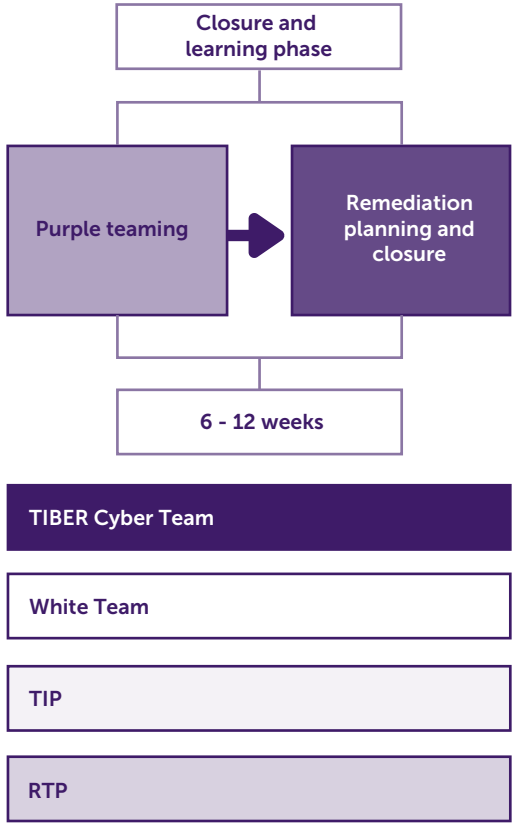
7.2.1. Red Team test report and Blue Team report

The output of this activity is a draft version of the Red Team Test Report produced by the RTP for delivery to the entity. The draft report must be issued within two weeks of test completion. The report must give an overview of the whole TIBER-NL process, including the CFs in scope, the threat intelligence base of the test, the scenarios planned, the scenarios executed, the findings of the test and the advice of the RTP to the entity. For the RT report the RT test report format should be used.

The key members of the entities' BT are informed of the test and will write their own report ahead of the purple teaming session. Should, due to findings or omissions in the monitoring the BT not be able to write a full report, the RT report can be supplied to them to help them in procuring the report.

Both RT and BT reports are input for the purple teaming session.

Figure 7.1: Closure and learning phase overview



7.2.2. Purple teaming

After the RTP delivers its report, the entity arranges a purple teaming workshop. This workshop lasts at least a full day. Often this phase is perceived as the most educational and hence more days are being used. The goal of this workshop is to enhance the learning experience. During the purple teaming workshop, the RTP and entity should replay the attack and collaborate with each other to enhance specifically the defensive capabilities of the entity, as a spin off the attacking capabilities of the RTP will grow. The TTM should be present during parts this meeting. Purple teaming and who should be involved and participate will be described in more detail in the TIBER purple teaming guide. Purple teaming in TIBER-NL is an expansion of the replay where the learning experience for both the BT and the RTP is enhanced.

7.2.3. 360-Feedback

During the 360-feedback meeting, the entity (WT and BT), TCT, TIP and RTP will come together to review the TIBER-NL exercise. The TTM arranges and facilitates the workshop. In the 360-feedback report all parties deliver feedback on each other. Goal is to further facilitate the learning experience of all those involved in the process for future exercises.

The 360-feedback meeting is a review of the process and performance of all parties involved. It is not meant to discuss findings of the test. The learnings are to be used for all parties involved to make the next TIBER-NL test they are part of an even better learning experience.

For the meeting the 360-feedback format should be used.

7.2.4. Remediation plan and TIBER-NL Test Summary

Based on the test outcomes the entity should work on a remediation plan. The TIBER-NL documentation can be used to support the business case for implementing improvements to mitigate the vulnerabilities identified during the TIBER-NL test. Input for the remediation plan can be the TIP report, the RT report, the BT report, input from the WT and organisational findings.

The TIBER-NL Test Summary summarises the TIBER-NL process and should draw upon the delivered documentation such as the RT and BT reports, the Targeted Threat Intelligence and when available its remediation plan(s). For this the entity should use the Test Summary format

The gathered intelligence and lessons learned from the test will be input for the Generic Threat Intelligence Report used in future tests.

7.2.5. Result sharing

1. Board level executives
   It is of the utmost importance that the board level of entity is informed on threats, test results and the remediation plan (risk mitigation measures). The TCT will be attending the presentation of the results and findings to board level and the TCT will stress the importance of board attention, support and accountability in executing the remediation plan.

2. White Team Leads
   Since the TIBER-NL test focuses on the Dutch financial sector as a group, sharing of information between the entities is in important part of the TIBER-NL framework. As one of the main goals of TIBER is enhancing the sector's operational resilience against advanced threat actors, the entity shares effective remediation solutions and best practices with relevant peers promptly to enhance the cyber resilience of the sector. The entity can share more general lessons learned via the TIBER-NL Test Summary. The TCT and the WT can discuss the forum for sharing the information, and the level of detail. In general, results are shared during the WTL meetings in which the White Team Leads of the different entities.

3. Oversight and/or supervisor
   The TCT will not share TIBER-NL related information or documentation regarding a specific entity with AFM's supervision departments during or after the exercise. After the TIBER-NL process has been completed (the TIBER-NL Test Summary has been delivered), the TCT may notify (cc FI) the supervisor that the test has ended and informs them in general terms about the TIBER process, its goals and way of working. The entity informs its supervisor about the test and any content specific to the test itself (the TCT will not). The RT test report and other sensitive documents belonging related to the TIBER-NL process will remain on premise of the entity. The TCT can be invited to give an explanation regarding the TIBER-NL program and the level of testing during this meeting.

7.2.6. Finalising the test

After the test is finished, results have been shared and after the purple teaming is finished the WTL should make sure that all remains of the test are cleaned up. This means that eg: all traces of malware used during the test should be cleaned up, all data dealing with the test is removed at the participating teams. The RTP should assist the WTL, all communication groups be closed down unless still needed. After all this is done the WTL and the TCT make the formal decision that the TIBER-NL test has ended.

7.3 Meetings

The most important meetings during the closure and learning phase are:
- Kick-off purple teaming
- Board meeting
- 360-feedback session

7.3.1. Kick-off Purple Teaming

The kick-off for the purple teaming session marks the start of the purple teaming. The first component of purple teaming usually is creating a chronological summary. After that the none of the elements are mandatory. It is however recommended to follow all stages of purple teaming and allocate enough time for it to maximise the learning experience. The recommendation is to allocate a minimum of 2 full days. The purple teaming is where most of the learning experiences are gained.

During the purple teaming the kick-off the following are present:
- WT
- TCT
- RTP
- TIP
- BT

7.3.2. Board meeting

After the purple teaming session and finalisation of both BT and RT reports a board meeting is used to communicate the results and the impact of the test. It is important that the board understands the full extent of the results of the test and the impact it had on the organisation.

During the board meeting the following are present:
- WTL
- Board of the entity
- TCT
- The TIP and RTP are optional participants.

7.3.2. 360-Feedback session

During the 360-feedback session all parties actively involved evaluate the test. The evaluation is done on the TIBER-NL process and not on the actual results of the test. The evaluation focuses on how all parties involved performed in light of their role in the process.

During the 360-feedback session the following are present:
- WT
- TCT
- TIP
- RTP

7.4 Deliverables

The main deliverables of the closure and learning phase are that:

- A BT report is delivered.
- An RT report is delivered based on the TIBER-EU Guidance for the Red Team Test Report format.
- The board is informed on the results of the test.
- A 360-feedback report is delivered based on the TIBER-NL 360-Feedback format
- A TIBER-NL Test Summary is delivered based on the TIBER-NL Test Summary format.
- A remediation plan is delivered.

Annex I **Abbreviations used in this document**

Term	Explanation
AFM	Dutch Authority for the Financial Markets (Autoriteit Financiële Markten)
BT	Blue Team
CBEST	The Bank of England cyber resilience program on which TIBER-NL is based
CF	Critical Functions
DNB	Dutch Central Bank (De Nederlandsche Bank)
FCI	Financial Core Infrastructure
ECB	European Central Bank
GIA	Governmental Intelligence Agency
GTL	Generic Threat Landscape
MO	Modus Operandi
NCSC	Nationaal Cyber Security Center
NDA	Non-Disclosure Agreement
IOC	Indicators of Compromise
OSINT	Open-Source Intelligence
RT	Red Team
RTP	Red teaming Provider

Term	Explanation
TCT	TIBER(-NL) Cyber Team
TECHINT	Technical Intelligence
TI	Threat Intelligence
TIA	Threat Intelligence Advisor
TIP	Threat Intelligence Provider
TIBER	Threat Intelligence Based Ethical Red teaming
TTI	Targeted Threat Intelligence
TTP	Tactics, Techniques and Procedures used in a cyber attack
TTM	TIBER(-NL) Test Manager
WT	White Team
WTL	White Team Lead

Annex II **Relevant documentation – an overview**

All documents are 'living' documents. After the first TIBER-NL testing period drafts have been developed for the second testing round that have been aligned with the TIBER-EU documentation. Each future round or development will possibly lead to revision of the TIBER-NL documentation. The TIBER-NL process must always be agile enough to adapt to the evolving threat landscape.

Preparation Phase

- TIBER-EU White Team Guidance
- TIBER-EU Services Procurement Guidelines
- TIBER-EU White Team Guidance
- TIBER-EU Scope Specification template
- TIBER-NL Generic Threat Intelligence Report

Test Phase

- TIBER-EU Guidance for Target Threat Intelligence Report
- TIBER-EU Guidance for the Red Team Test plan
- TIBER-EU Guidance for the Red Team Test report

Closure Phase

- TIBER-EU Format 360-Feedback Report
- Format TIBER-NL Test Summary
- TIBER-EU Purple Teaming best practices

Any questions or comments about this publication?

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