

## Topic 3

### EU Directive 2022/2225 Network Information System v2 (NIS2)



### EU Regulation 2024/2847 Cyber Resilience Act



Dr Diarmuid Ó Briain

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**Dr Diarmuid Ó Briain**



## Table of Contents

<b>1</b>	<b>Introduction.....</b>	<b>5</b>
1.1	Objectives.....	5
<b>2</b>	<b>Network Information Security (NIS).....</b>	<b>6</b>
<b>3</b>	<b>The three main pillars of NIS2.....</b>	<b>7</b>
3.1	National Competent Authorities.....	8
3.2	Sectoral NCAs.....	9
<b>4</b>	<b>Entities.....</b>	<b>11</b>
<b>5</b>	<b>Essential and important entities.....</b>	<b>11</b>
5.1	Sectors of high criticality.....	12
5.2	Other critical sectors.....	14
5.3	Supervision of Entities by NCAs.....	15
<b>6</b>	<b>Incident Notification.....</b>	<b>16</b>
6.1	Incident reporting obligations.....	16
<b>7</b>	<b>Cyber Security Risk Management Measures.....</b>	<b>17</b>
<b>8</b>	<b>Infringement Penalties.....</b>	<b>18</b>
<b>9</b>	<b>Management Responsibilities.....</b>	<b>19</b>
<b>10</b>	<b>Operationalising Compliance: Frameworks for OT Security.....</b>	<b>20</b>
10.1	MITRE ATT&CK and D3FEND.....	20
10.2	NIST Special Publication 800-82.....	22
10.3	ISA/IEC 62443 Series of Standards.....	23
10.4	Comparison between NIST SP 800-82r3 and ISA/IEC 62443.....	24
10.5	ISO/IEC 27001 and Domain-Specific OT Frameworks.....	24
10.6	Cyber Fundamentals Framework.....	25
<b>11</b>	<b>Meeting the NIS2 Requirements.....</b>	<b>26</b>
<b>12</b>	<b>What is Next: Cyber Resilience Act (CRA).....</b>	<b>27</b>
12.1	Scope: Who is Affected and Excluded.....	27
12.2	Product Categories and Assessment Requirements.....	28
12.3	Mandatory Product Security Requirements.....	28
12.4	Penalties.....	29
12.5	Preparing for CRA Compliance.....	30
<b>13</b>	<b>Bibliography.....</b>	<b>31</b>

## Illustration Index

Figure 1: The three main pillars of NIS2.....	7
Figure 2: Competent Authorities and Reporting Relationships.....	8
Figure 3: Entities defined in NIS2.....	11
Figure 4: Sectors of High Criticality.....	12
Figure 5: Digital Infrastructure and Public Administration.....	13
Figure 6: Other critical sectors.....	14
Figure 7: CRA Conformance by Category.....	27

## Index of Tables

Table 1: Supervision of Entities by NCAs.....	15
Table 2: NIS2 Incident reporting deadlines.....	16
Table 3: NIS2 Mapping: ATT&CK for ICS vs. MITRE D3FEND.....	21
Table 4: Comparison of Frameworks in the context of NIS2.....	26

## 1 Introduction

The Network Information Systems 2 (NIS2) Directive [1] seeks to further enhance the work started in the NIS Directive [2] to build a high common level of cybersecurity across the European Union (EU). It places obligations on Member States and individual companies in critical sectors. NIS2 adds more sectors, more entities, New methods of selection and registration, New incident notification deadlines and extra requirements based on the learnings from the implementation of the initial directive.

### 1.1 Objectives

By the end of this topic, you will be able to:

- Understand the key objectives of the NIS2 directive
- Identify the key pillars of the NIS2 directive
- Understand the categorisation of essential and important entities under the NIS2 directive
- Recognise the incident notification obligations under the NIS2 directive
- Evaluate the requirements of organisation to comply with the NIS2 directive
- Identify potential solutions for organisations to be compliant
- Understand the CRA's objectives, product categories, compliance, and penalties.

## 2 Network Information Security (NIS)



The open market nature of the EU facilitates organisations to operate across EU Member States within a single market. In terms of Cybersecurity organisations operated differing requirements and standards from member state to member state. As the cybersecurity requirement increased and lack of a standard approach by Member States, particularly in the case of Critical National Infrastructure (CNI), the European Union (EU) responded with the Network and Information Systems (NIS) Directive 2016/1148 [2] which was published in the Official Journal of the EU in July 2016. This was transposed into Member States law, in Ireland's case on 18/9/2018 via Statutory Instrument No. 360 of 2018. The directive is a framework that brings all entities to a common level of security no matter which state, or states, within the EU they operate in, therefore protecting CNI, the consumer, companies, states and the market alike. The directive focused on two specific groups; Operators of Essential Services (OES) and Digital Service Providers (DSP). However, this first NIS Directive had certain limitations. The digital transformation of society, intensified by the COVID-19 crisis, has expanded the threat landscape. New challenges appeared, which required adapted and innovative responses.

The introduction of the NIS2 2022/2225 [1] directive broadened the scope of the original directive. It identifies 10 sectors of high criticality and 7 other critical services. Entities in both categories must meet the same requirements. However, the distinction is in the supervisory measures and penalties.

### 3 The three main pillars of NIS2

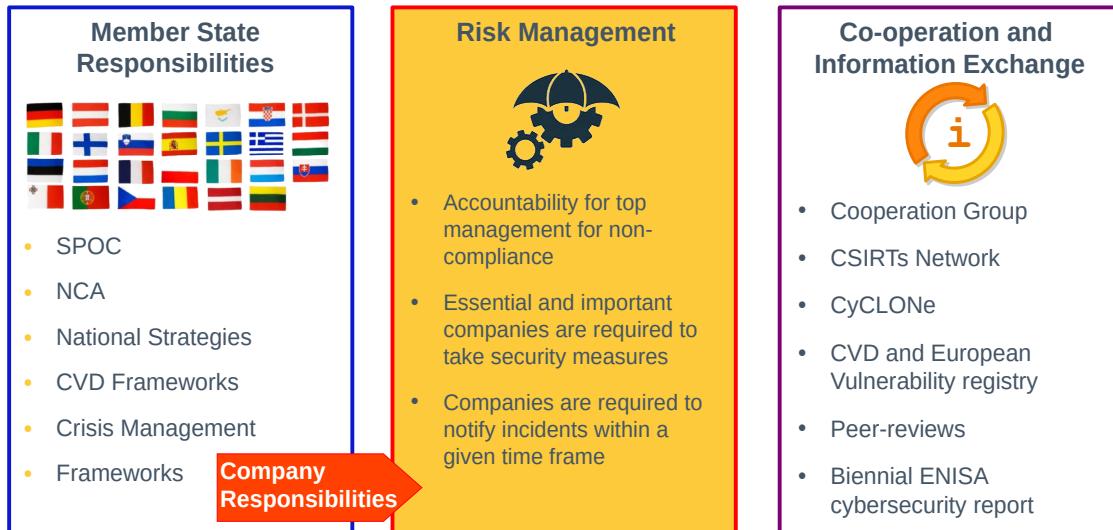


Figure 1: The three main pillars of NIS2

The three pillars of NIS2, as illustrated in Figure 1, support the EU collaborative approach to Cybersecurity. The figure depicts the shared responsibilities of Member States, National Competent Authorities (NCA), Essential Entities and Important Entities. It highlights the collaborative approach that is essential for achieving the directive's goal of enhancing cybersecurity in the EU.

Member States play a crucial role by implementing the NIS2 directive through designating and establishing a Single Point of Contact (SPOC), such as the National Cyber Security Centre (NCSC), in Ireland, individual NCA, and identifying and categorising both Essential and Important Digital Service Providers, as well as developing national cybersecurity strategies. They also monitor the cybersecurity performance of Essential and Important Entities and enforce the directive's requirements.

NCAs are the frontline enforcers of the NIS2 directive within their respective jurisdictions. They work closely with Member States to identify and categorise Essential and Important Entities, monitor their cybersecurity practices, and investigate any reported incidents.

Essential and Important Entities are the private sector entities that are subject to the NIS2 directive's requirements. They must conduct cybersecurity risk assessments, implement appropriate security measures, establish incident response plans, and notify NCAs of significant cybersecurity incidents.

The figure also emphasises that effective cybersecurity requires a collective effort from all stakeholders. Member States, NCAs, and Essential and Important Entities must work together to identify, assess, and mitigate cybersecurity risks, and to respond promptly and effectively to any incidents that occur.

By promoting collaboration and accountability in this way the NIS2 Directive aims to create a more resilient cybersecurity landscape that can protect critical infrastructure and safeguard the digital economy.

- Coordinated Vulnerability Disclosure (CVD)
- European Cyber Crisis Liaison Organisation Network (EU-CyCLONe)

- European Network Information Security Agency (ENISA)

### 3.1 National Competent Authorities

Every Member State has a central point of contact for compliance with the Directive and a coordinating Computer Security Incident Response Team (CSIRT) for incident reporting. In Ireland, this is the role of the CSIRT Ireland (CSIRT-IE) within the NCSC. As the NCSC is Ireland's Lead NCA for the purpose of NIS2.

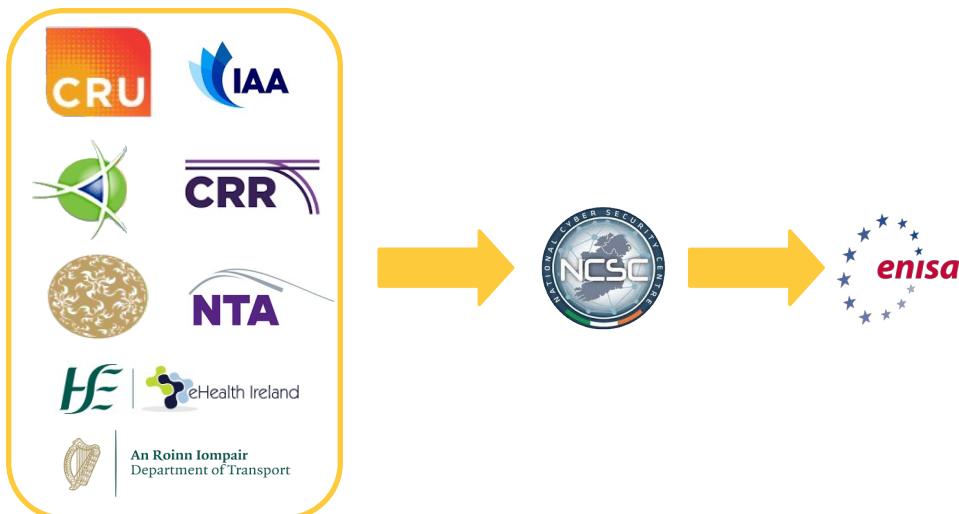


Figure 2: Competent Authorities and Reporting Relationships

As illustrated in Figure 2 a number of specialist NCAs have been appointed to handle specific NIS areas. The NCSC serves as the central pillar of the nation's cybersecurity framework and is the body that reports to ENISA, the EU agency tasked with achieving a high common level of cybersecurity across the Union. While the NCSC is specifically designated as the NCA for *all other sectors* not covered by the sectoral regulators, its overall responsibility extends far beyond this direct oversight. The NCSC is tasked with developing national cybersecurity strategies, providing overarching guidance, and acting as the national CSIRT-IE for incident detection and response. In this pivotal role, the NCSC actively supports the other designated sectoral NCAs (such as the Commission for the Regulation of Utilities (CRU), the Communications Regulator (ComReg), Central Bank of Ireland (CBI), Irish Aviation Authority (IAA), Commission for Railway Regulation (CRR), National Transport Authority (NTA), eHealth Ireland and the Minister for Transport) by sharing threat intelligence, offering operational advice, coordinating responses to significant cyber incidents, and ensuring a consistent national approach to cybersecurity resilience across all critical sectors covered by NIS2. This ensures a cohesive and robust national cybersecurity posture, leveraging the NCSC's expertise to uplift the capabilities of all NCAs and the entities under their supervision.

## 3.2 Sectoral NCAs

The government have designated specific sectoral regulators to act as NCAs for areas under their remit. For example:

### 3.2.1 Commission for the Regulation of Utilities (CRU)

The CRU is Ireland's independent energy and water regulator. It is the NCA for entities in the energy and water sectors. They take specific responsibility for:

- Energy (electricity, gas, oil)
- Drinking Water
- Waste Water

### 3.2.2 Commission for Communications Regulation (ComReg)

ComReg is the regulatory body for the electronic communications and postal sectors in Ireland. They are the NCA for entities within their regulated domains, such as telecommunications providers and Internet Service Providers (ISP). They take specific responsibility for:

- Digital Infrastructure
- ICT Service Management
- Space
- Digital Providers

### 3.2.3 Central Bank of Ireland (CBI)

The Central Bank is the NCA for the financial services sector, including credit institutions, investment firms, and financial market infrastructures. They oversee NIS2 compliance for:

- Banking
- Financial Market

### 3.2.4 Irish Aviation Authority (IAA)

The IAA is the statutory body responsible for the safety and economic regulation of the civil aviation industry in Ireland. They are the NCA for entities in the aviation transport sector. They take specific responsibility for:

- Transport - Aviation

### 3.2.5 Commission for Rail Regulation (CRR)

The CRR is the independent safety authority for railways in Ireland. They are the NCA for entities in the rail transport sector. They take specific responsibility for:

- Transport – Rail

### 3.2.6 The Department of Transport

The Minister and Department of Transport holds overall responsibility for national transport policy and infrastructure in Ireland. In the context of NIS2, the Minister is the NCA for entities in the maritime transport sector. They take specific responsibility for:

- Transport – Maritime

### 3.2.7 National Transport Authority (NTA)

The NTA is responsible for the planning and development of public transport and sustainable transport in Ireland. They are the NCA for entities in the road transport sector. They take specific responsibility for:

- Transport – Road

### 3.2.8 eHealth Ireland

eHealth Ireland, as part of the Health Service Executive (HSE), drives the digital transformation of healthcare services in Ireland. eHealth Ireland perform the NCA functions for the health sector. They take specific responsibility for:

- Health
- Pharmacy

## 4 Entities



Figure 3: Entities defined in NIS2

Figure 3 illustrates the entities that NIS2 divides organisations. This division is primarily based on their size and this determines the type of supervision each receive, depending on the sector. Large Enterprises (LE) are defined by having 250 or more employees or a revenue exceeding €50 million, while Medium Enterprises (ME) have 50-249 employees or over €10 million in revenue, and Small & Micro Enterprises (SME) have fewer than 50 employees.

## 5 Essential and important entities

*“Entities may be designated as “Essential” or ‘Important’ depending on factors such as size, sector and criticality.”*

For the purpose of compliance with cybersecurity Risk-Management Measures (RMM) and reporting obligations entities are classified into two categories, essential entities and important entities that reflects the extent to which they are critical as regards their sector or the type of service they provide, as well as their size. Essential Entities will be required to meet supervisory requirements, while important entities will be subject to ex-post supervision, meaning that in case authorities receive evidence of non-compliance, action is taken.

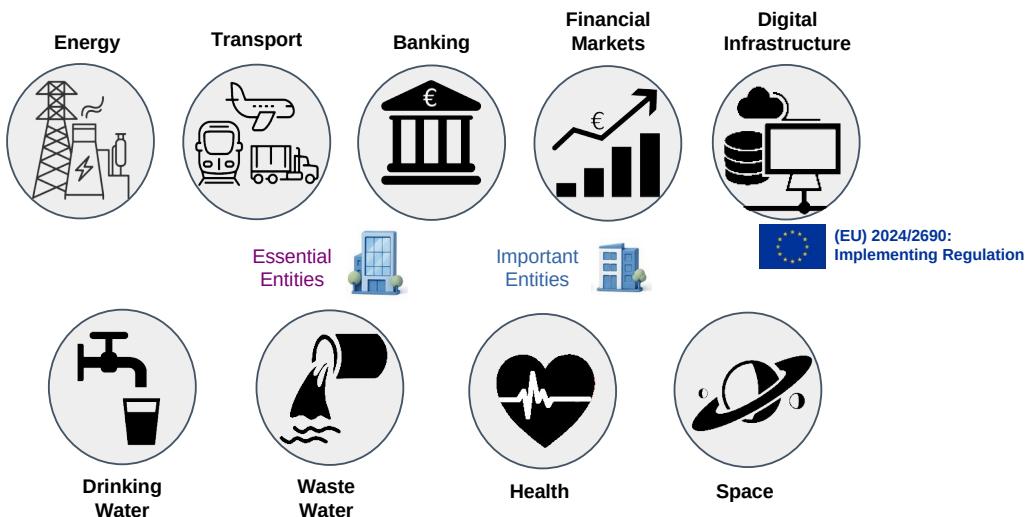


Figure 4: Sectors of High Criticality

## 5.1 Sectors of high criticality

As illustrated in Figure 4, energy, transportation, banking, and financial market infrastructure are among the sectors of high criticality identified by the NIS2 directive. These sectors are considered essential for the smooth functioning of the EU economy and society, and they are therefore subject to more stringent cybersecurity requirements under the NIS2 directive. These are detailed below:

1. **Energy:** Electricity, District heating and cooling, Oil, Gas and hydrogen
2. **Transport:** Air, Rail, Water, Road
3. **Banking**
4. **Financial market infrastructures**
5. **Health:** Manufacturers of pharmaceutical products including vaccines
6. **Drinking water**
7. **Waste water**
8. **Space**
9. **Digital infrastructure**
  - Internet eXchange Points (IXP)
  - Cloud computing Service Providers (CSP)
  - Data centre service providers
  - Content delivery networks (CDN)

In each of these cases LE are considered Essential Entities while ME are considered Important Entities. SMEs are considered out of scope of NIS2.

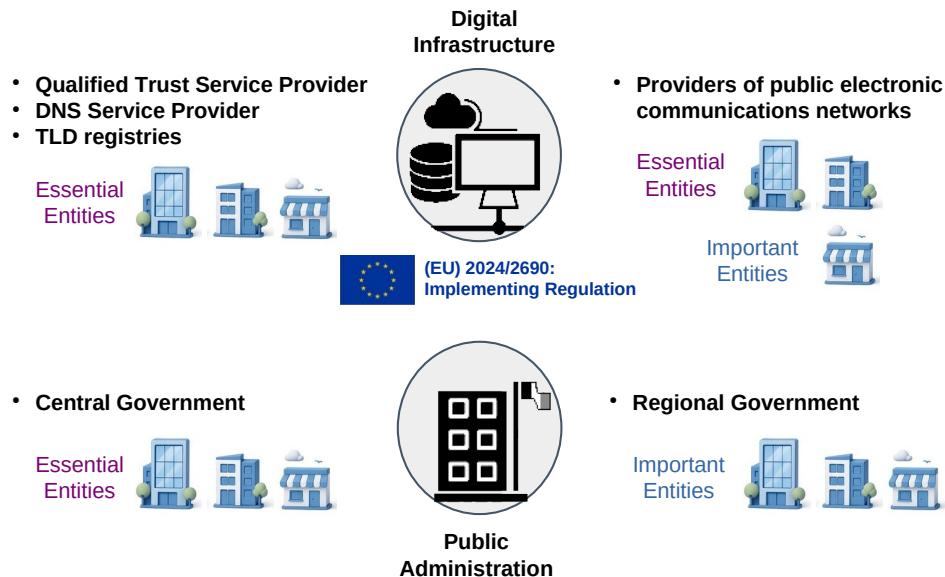


Figure 5: Digital Infrastructure and Public Administration

Some digital infrastructure and public administration are considered differently with NIS2 impacting on SMEs also.

As illustrated in Figure 5, **Digital infrastructure** providers such as Qualified Trust service providers (organisations that provide Electronic Signatures (QES), Electronic Seals (QESeal), Electronic Time Stamps (QTS), Electronic Registered Delivery Services (QERDS), Certificates for Website Authentication (QWAC), Preservation of Electronic Signatures, Seals, or Certificates), Domain Name Systems (DNS) service providers and Top Level Domain (TLD) name registries are considered Essential Entities no matter their size and LE and ME that provide public electronic communications networks and publicly available electronic communications services are considered Essential Entities while SMEs in this category are Important Entities.

**Public administration** is also different with central government functions considered Essential Entities while regional government are Important Entities.

Taking account of the cross-border nature of the activities of Digital Providers specifically and in order to ensure a coherent framework for them, the EU added Regulation (EU) 2024/2690 Implementing Regulation[3] to lay down the technical and the methodological requirements of the measures referred to in Article 21(2) of Directive (EU) 2022/2555 and to further specify the cases in which an incident should be considered to be significant as referred to in Article 23(3) of Directive (EU) 2022/2555.



Figure 6: Other critical sectors

## 5.2 Other critical sectors

As illustrated in Figure 6, postal and courier services, waste management, manufacturing, production, and distribution of chemicals are among the Other critical sectors identified by the NIS2 directive. These sectors are considered to have a significant impact on the EU's security, public health, or economic and social well-being, and they are therefore subject to cybersecurity requirements under the NIS2 directive.

1. **Postal and courier services**
2. **Waste management**
3. **Chemicals**
4. **Food**
5. **Manufacturing**
  - o Medical devices
  - o Computers and electronics
  - o Machinery and equipment
  - o Motor vehicles
  - o Trailers and semi-trailers
  - o Other transport equipment
6. **Digital providers**
  - o Online market places
  - o Online search engines
  - o Social networking service platforms
7. **Research organisations.**

### 5.3 Supervision of Entities by NCAs

*Table 1: Supervision of Entities by NCAs*

Essential Entities	Important Entities
Ex Ante & Ex Post	Ex Post
On-site inspections and off-site supervision	On-site inspections and off-site, ex post, supervision
Regular & Targeted Security Audits	Targeted Security Audits
Security Scans	Security Scans
Information Requests	Information Requests
Requests for information necessary to assess the cybersecurity RMMs adopted by the entity concerned	Requests for information necessary to assess, ex post, the cybersecurity RMMs adopted by the entity concerned

Table 1 outlines two distinct approaches to oversight and risk management by NCAs, categorised by Essential Entities and Important Entities. The key differentiator lies in the timing and scope of their supervision methods. While Essential Entities are subject to a more comprehensive and proactive regime, encompassing both ex ante (before the event) and ex post (after the event) assessments, Important Entities primarily undergo ex post supervision. This distinction impacts aspects such as security audits, information requests, and the overall approach to assessing cybersecurity risk.

## 6 Incident Notification

NIS2 imposes notification obligations in phases, for incidents which have a 'significant impact' on the provision of their services. These notifications must be made to the relevant NCA CSIRT.

### 6.1 Incident reporting obligations

Every incident with significant impact should be notified by the Essential and Important Entities without undue delay. Organisations report to the appropriate NCA for their sector (such as CRU, ComReg, CBI, IAA, CRR, NTA, eHealth Ireland and the Department for Transport). These NCAs provide summary reports to the NCSC CSIRT-IE as lead NCA.

The NCSC acts as a single entry point for incidents to ENISA. This is to reduce the administrative burden, including for cross-Member State incidents. The NCSC reports to the ENISA on incidents in their jurisdiction every three months, using anonymised information. ENISA will consolidate the information in the form of a report to be published every six months on the EU incidents [4]. This reporting helps organisations and Member States to learn from other incidents and is a crucial change in the new NIS2 Directive.

Table 2 lists the various NIS2 incident reporting deadlines, by whom, and to whom.

*Table 2: NIS2 Incident reporting deadlines*

Time	Incident reporting
Within 24 hours	<b>Early Warning</b> should be communicated, as well as some first presumptions regarding the kind of incident
After 72 hours	<b>Official Incident Notification</b> A full notification report must be communicated, containing the assessment of the incident, severity and impact and indicators of compromise.
Upon Request	<b>Intermediate Status Report</b> At the request of CSIRT or relevant competent authority.
After 1 month	<b>Final report</b> must be communicated.
Every 3 months	Member states CSIRT reports incidents to ENISA.
Every 6 months	ENISA reports on all incidents EU wide.



## 7 Cyber Security Risk Management Measures

*“Essential and Important Entities must take appropriate and proportional technical, operational and organisational measures to manage the risks posed to the systems.”*

Essential and Important Entities must take appropriate and proportional technical, operational and organisational measures to manage the risks posed to the systems which underpin their services, and prevent or minimise the impact of incidents on their and other services.

Such measures shall be based on an all-hazards approach that aims to protect the network and information systems and the physical environment of those systems from incidents, and must include at least the following:

1. **Risk Assessment & Security:** Analyse risks and secure information systems.
2. **Incident & Crisis Management:** Handle security incidents and ensure business continuity.
3. **Supply Chain Security:** Secure external vendor relationships.
4. **System Lifecycle Security:** Integrate security into system acquisition, development, and maintenance.
5. **Policy & Compliance:** Implement policies to assess and improve cybersecurity.
6. **Basic Cyber Hygiene & Training:** Educate users on fundamental security practices.
7. **Cryptography & Encryption:** Use secure cryptographic methods.
8. **Access Control & Asset Management:** Secure human resources and manage access to assets.
9. **Secure Communications:** Utilise multi-factor authentication and secure communication channels.

All measures must be:

- Proportionate to risk, size, cost, and impact & severity of incidents
- Take into account the state-of-the-art, and where applicable relevant European and international standards.

To ensure appropriate RMMs are in place the EU can:

- Carry out risk assessments of critical ICT services, systems or supply chains
- Impose certification obligations (delegated acts)
- Adopt implementing acts laying down technical requirements.

## 8 Infringement Penalties

NIS2 introduces stricter penalties for non-compliance by entities. NCAs are granted a **minimum** list of enforcement powers for non-compliance through the directive, including:

- Issue warnings for non-compliance
- Issue binding instructions
- Order to cease conduct that is non-compliant
- Order to bring RMMs or reporting obligations in compliance to a specific manner and within a specified period
- Order to inform the natural or legal person(s) to whom they provide services or activities which are potentially affected by a significant cyber threat
- Order to implement the recommendations provided as a result of a security audit within a reasonable deadline
- Designate a monitoring officer with well-defined tasks over a determined period of time to oversee the compliance
- Order to make public aspects of non-compliance
- Impose administrative fines
- An essential entities certification or authorisation concerning the service can be suspended, if deadline for taking action is not met
- Those responsible for discharging managerial responsibilities at chief executive officer or legal representative level can be temporarily prohibited from exercising managerial functions (applicable to essential entities only, not important entities).

There are particularly high penalties for infringements of:

- Article 21 Cybersecurity RMMs
- Article 23 Reporting obligations

In these cases essential entities can be fined up to €10,000,000 or at least 2% of the total annual worldwide turnover in the previous fiscal year, whichever amount is higher while important entities can be penalised by fines of up to €7,000,000 or at least 1.4% of the total annual worldwide turnover, whichever amount is higher.

## 9 Management Responsibilities

*“Senior management have ultimate responsibility for cybersecurity risk management in essential and important entities”*

Senior management have ultimate responsibility for cybersecurity risk management in essential and important entities. Failure by management to comply with NIS2 requirements could result in serious consequences, including liability, temporary bans and administrative fines as provided for in the implementing national legislation.

Management bodies of essential and important entities must:

- Approve the adequacy of the cybersecurity RMMs taken by the entity.
- Supervise the implementation of the RMMs.
- Follow training in order to gain sufficient knowledge and skills to identify risks and assess cybersecurity risk management practices and their impact on the services provided by the entity.
- Offer similar training to their employees on a regular basis.
- Be accountable for the non-compliance.

## 10 Operationalising Compliance: Frameworks for OT Security

The NIS2 Directive mandates that Essential and Important Entities implement appropriate and proportionate technical and organisational measures to manage the risks posed to the security of network and information systems. Key areas include:

- **Risk Management:** Policies on risk analysis and information system security.
- **Incident Handling:** Procedures for detection, management, and reporting of security incidents.
- **Business Continuity & Crisis Management:** Measures such as backup management and disaster recovery.
- **Supply Chain Security:** Cybersecurity in the procurement of network and information systems.
- **Security in System Acquisition, Development, and Maintenance:** Policies and procedures for vulnerability handling and disclosure.
- **Awareness Training & Hygiene:** Cybersecurity training and basic cyber hygiene.
- **Access Control:** Policies and procedures regarding access to network and information systems.
- **Multi-Factor Authentication (MFA) & Encryption:** Use of MFA and cryptographic solutions where appropriate.
- **Assessment of Effectiveness:** Policies and procedures for evaluating the effectiveness of cybersecurity RMMs.

### 10.1 MITRE ATT&CK and D3FEND



MITRE Adversarial Tactics, Techniques, and Common Knowledge (ATT&CK) and Detection, Denial, and Disruption Framework Empowering Network Defence (D3FEND) offer threat-informed frameworks for manufacturing and critical infrastructure organisations to meet their NIS2 obligations. By integrating **ATT&CK for Industrial Control Systems (ICS)** and **D3FEND**, organisations gain a comprehensive, threat-informed framework to meet their **NIS2 obligations**. While ATT&CK for ICS details the specific adversary tactics and techniques used in OT environments, D3FEND provides a standardised catalogue of defensive countermeasures to neutralise those threats. Together, they enable organisations to move beyond generic security by facilitating precise risk analysis, advanced threat modeling, and the deployment of tailored technical controls.

Integrating MITRE D3FEND alongside ATT&CK for ICS provides a complete strategic loop for NIS2 compliance. While ATT&CK focuses on the "Offensive" (the *how* of the attacker), D3FEND focuses on the "Defensive" (the *how* of the countermeasure).

Table 3 maps how both frameworks work in tandem to satisfy NIS2 requirements.

*Table 3: NIS2 Mapping: ATT&CK for ICS vs. MITRE D3FEND*

NIS2 Requirement	MITRE ATT&CK for ICS (The Threat)	MITRE D3FEND (The Defence)
<b>Risk Management</b>	<b>Indirect/Reactive:</b> Informs risk assessments by identifying real-world TTPs relevant to OT environments.	<b>Strategic:</b> Maps technical artifacts to defensive capabilities. D3FEND helps prioritise investments based on the Decouple and Deceive categories.
<b>Incident Handling</b>	<b>Direct &amp; Operational:</b> Provides the taxonomy to categorise and characterise ongoing adversary activity.	<b>Direct &amp; Operational:</b> Provides specific countermeasures (e.g. Message Analysis, Runtime Analysis) to interrupt the attack lifecycle identified in ATT&CK.
<b>Business Continuity &amp; Crisis Management</b>	<b>Indirect:</b> Identifies tactics like Denial of Control or Inhibit Response Function to predict impact.	<b>Functional:</b> Focuses on the Restore and Evict categories, offering techniques such as System Image Restoration and Process Eviction to regain operational stability.
<b>Supply Chain Security</b>	<b>Indirect:</b> Identifies Initial Access techniques such as Supply Chain Compromise.	<b>Structural:</b> Offers defensive techniques like Software Update Validation and Component Authenticity Check to mitigate vendor-related risks.
<b>Security in Acquisition &amp; Development</b>	<b>Indirect:</b> Illustrates how exploits target the Software Development Lifecycle (SDLC) or public-facing applications.	<b>Architectural:</b> Maps to Harden techniques, such as Application Configuration Hardening and Stack Serialisation during the development lifecycle.
<b>Awareness Training &amp; Hygiene</b>	<b>Contextual:</b> Uses examples like Spearphishing to make training relatable to OT staff.	<b>Operational:</b> Provides a technical library that helps security teams understand the "why" behind hygiene controls, moving training from "what" to "how."
<b>Access Control</b>	<b>Informative:</b> Shows how adversaries use Valid Accounts or Default Credentials to move laterally.	<b>Technical Control:</b> Maps directly to the Credential Hardening and User Restrictions categories (e.g. Biometric Authentication, Credential Rotation).
<b>MFA &amp; Encryption</b>	<b>Tactical:</b> Highlights weaknesses like MFA Bypass or Brute Force.	<b>Prescriptive:</b> Offers specific technical countermeasures like Certificate-based Authentication and Inbound Traffic Filtration to protect credentials.
<b>Assessment of Effectiveness</b>	<b>Direct/Red Teaming:</b> Acts as the "Blue-print" for what to simulate during a penetration test.	<b>Direct/Purple Teaming:</b> Provides the scoring and defensive inventory to measure if a control actually works against a specific ATT&CK technique.

## 10.2 NIST Special Publication 800-82



The NIS2 Directive places significant emphasis on enhancing the cybersecurity resilience of critical sectors, including manufacturing and CNI. For such organisations, where Automated Control Systems (ACS) and Operational Technology (OT) play a vital role in their operations, NIST Special Publication (SP) 800-82r3, Guide to OT Security, is a valuable resource [5]. NIS2 mandates comprehensive cybersecurity RMMs, including those related to incident handling, business continuity, supply chain security, and security in system development and maintenance. NIST SP 800-82 provides specific, detailed guidance on how to secure the unique and often sensitive ACS/OT environments, which typically differ from traditional Information Technology (IT) systems in terms of performance, reliability, and safety requirements. By following the principles and recommendations within SP 800-82, manufacturing and CNI organisations can systematically identify, assess, and mitigate risks inherent to their OT systems, directly contributing to their ability to meet NIS2 obligations.

Implementing the recommendations of NIST SP 800-82 allows manufacturing and CNI organisations to address several key NIS2 requirements. For instance, NIS2 demands robust risk analysis and information system security policies; SP 800-82 provides a framework for conducting risk assessments tailored to ICS/OT environments, identifying specific threats and vulnerabilities, and recommending appropriate security countermeasures. Furthermore, the directive stresses the importance of incident handling and business continuity measures, areas where SP 800-82 offers guidance on developing tailored incident response plans for OT systems, ensuring operational resilience and recovery capabilities. By focusing on network segmentation, secure remote access, robust configuration management, and personnel security within their ICS/OT domains, organisations can demonstrate due diligence and build a strong cybersecurity posture that aligns with the *all-hazards approach* promoted by NIS2, ultimately safeguarding their essential services and minimising potential disruptions.

### 10.3 ISA/IEC 62443 Series of Standards



The ISA/IEC 62443 series of standards, specifically designed for Industrial ACS (IACS) and OT cybersecurity [6] [7]. They provide a highly relevant and comprehensive framework for such organisations to meet their NIS2 commitments. Unlike general IT security standards, ISA/IEC 62443 addresses the unique characteristics of OT environments, such as real-time performance, safety implications, and the presence of legacy systems. By adopting a structured approach derived from these standards, organisations can systematically manage their cybersecurity risks, establish robust security programmes, and enhance the resilience of their critical industrial operations, which is a core tenet of NIS2.

The multi-part ISA/IEC 62443 series directly aligns with several key areas of NIS2. For instance, NIS2 mandates comprehensive risk analysis and security policies; ISA/IEC 62443-2-1 provides guidance on establishing an IACS security programme that includes tailored risk assessments for OT environments, while ISA/IEC 62443-3-2 details how to define security levels for zones and conduits within the industrial network. Furthermore, NIS2 emphasises incident handling, business continuity, and supply chain security. ISA/IEC 62443-2-1 and 62443-2-4 offer clear guidance on incident response and recovery planning for both asset owners and service providers, respectively, and the series as a whole promotes secure development lifecycles for products and systems (62443-4-1, 62443-4-2), thereby addressing supply chain security. By leveraging the ISA/IEC 62443 standards, manufacturing and CNI organisations can establish a mature, auditable cybersecurity posture that not only ensures compliance with NIS2 but also significantly enhances their overall operational resilience against cyber threats.

## 10.4 Comparison between NIST SP 800-82r3 and ISA/IEC 62443

In general, NIST SP 800-82r3 offers greater flexibility and potentially lower initial barriers to entry, making it suitable for organisations that prefer to adapt guidance to their unique circumstances. Its cost is more influenced by internal expertise and the chosen level of implementation. ISA/IEC 62443, while potentially more expensive to implement and maintain due to its structured and prescriptive nature (especially if certification is sought), often leads to a more robust, auditable, and systematically secure OT environment. The choice often depends on the organisation's existing security maturity, regulatory drivers (for example, is certification required in the future), and the desired level of assurance. Many organisations find value in using NIST SP 800-82r3 as a practical guide for implementation within an overall programme that may be aligned with the principles of ISA/IEC 62443 or a broader framework such as the NIST Cybersecurity Framework (CSF).

## 10.5 ISO/IEC 27001 and Domain-Specific OT Frameworks



ISO/IEC 27001, provides a high-level, management system approach to information security, establishing requirements for an Information Security Management System (ISMS) across an entire organisation [8]. This makes it ideal for establishing overall cybersecurity governance and risk management to meet broad NIS2 commitments.

In contrast, NIST SP 800-82r3 and the ISA/IEC 62443 series are highly domain-specific frameworks offering detailed technical and operational guidance for securing industrial (OT/ICS) environments. While ISO 27001 focuses on *what* an ISMS should achieve, the OT-specific standards detail *how* to implement robust security within the unique constraints of operational technology. Therefore, for NIS2 compliance, organisations in manufacturing and CNI can effectively layer an ISO 27001-based ISMS for enterprise-wide governance with the specialised, practical security measures from either NIST SP 800-82r3 or ISA/IEC 62443 to protect their critical OT systems.

## 10.6 Cyber Fundamentals Framework



The NCSC-IE have responded to the National Cybersecurity Bill, an Irish transposition of the EU Directive 2022/2555 NIS2, by releasing RMM [9] while at the same time supporting the Cyber Fundamentals 2025 (CyFun) Framework [10].

These serve two distinct but complementary functions necessary for compliance with the NIS2 Directive:

- **RMMs:** represent the substance of the legal obligation, a formal guidance on the minimum baseline requirements that Essential and Important entities must meet under Article 21, Cybersecurity RMMs, define what cybersecurity areas must be addressed (e.g., governance, supply chain security, incident reporting).
- 1. **CyFun:** is the recommended tool to demonstrate compliance. It is a voluntary, structured, and risk-based framework that NCSC-IE recommends to entities to use to practically implement, organise, and evidence their compliance with the RMMs. It provides a roadmap for assessing cybersecurity maturity and applying the necessary controls.

The NCSC-IE provides both the mandatory list of requirements (RMMs) [the *what you must do*] and a recommended compliance tool (CyFun) to simplify the process for organisations [the *how to do it and prove it*]. It is promoting both to ensure entities not only know what they must achieve but also have a practical, endorsed method how to achieve and prove it.

## 11 Meeting the NIS2 Requirements

Table 4 presents a visualisation of how these frameworks function as a unified defence for a shipping or industrial operation, mapping each standard against the core mandated requirements of the NIS2 Directive.

*Table 4: Comparison of Frameworks in the context of NIS2*

NIS2 Requirement	NIST CSF 2.0 (Strategy)	ISO/IEC 27001 (Management)	ISA/IEC 62443 (OT/Industrial)	CyFun 2025
<b>Risk Management</b>	GV & ID High-level risk strategy.	CI 6.1.2 Formal ISMS risk process.	62443-3-2 Detailed OT risk & zone/conduit design.	Foundational: Mandatory risk register & impact assessments.
<b>Incident Handling</b>	RS Triage and communication.	A 5.24 Incident policy & logs.	62443-2-1 OT-specific emergency response.	Mandate: Hardwired 24h/72h NCSC-IE reporting workflows.
<b>Business Continuity</b>	RC Restoring services.	A 5.29 ICT readiness.	62443-2-1 IACS continuity & safety recovery.	Essential: Mandatory disaster recovery testing.
<b>Supply Chain Security</b>	GV.SC Third-party risk.	A 5.19 Supplier agreements.	62443-2-4 Requirements for OT service providers.	Important+: Nth-party risk mapping in contracts.
<b>System Acquisition/ Maint.</b>	PR.PS Platform security.	A 8.25 Secure SDLC.	62443-4-1 & 4-2 Secure dev & component hardening.	Technical Pillar: Secure config & patching cycles.
<b>Awareness &amp; Hygiene</b>	PR.AT Staff outcomes.	A 6.3 Awareness programmes.	62443-2-1 Specialised IACS/OT training.	Foundational: Phishing simulations & basic hygiene.
<b>Access Control</b>	PR.AA Identity outcomes.	A 5.15 Logical access.	62443-3-3 OT least privilege & physical keys.	Maturity 3+: Strict Least Privilege audits.
<b>MFA &amp; Encryption</b>	PR.IR Data protection.	A 8.24 Crypto management.	62443-3-3 Secure comms & remote access MFA.	Mandatory: Universal MFA for remote access.
<b>Effectiveness Assessment</b>	GV.OV Oversight.	CI 9.1 Internal audit.	62443-2-1 (4.4.3) Continuous CSMS improvement.	Verification: Maturity scoring & external audits.

**Green:** Excellent alignment; the framework contains the specific language, timelines, or technical depth required by NIS2.

**Amber:** Partial alignment; the framework covers the concept but lacks the specific European legal precision (e.g., missing 24h/72h reporting or board liability).

## 12 What is Next: Cyber Resilience Act (CRA)



The EU's Cyber Resilience Act (CRA) [11], effective December 2024, establishes a baseline cybersecurity standard for digital products sold in the EU, aiming to reduce vulnerabilities and cyber incidents. Products are categorised by risk level, dictating their conformity assessment requirements.

The act came into force on December 10, 2024, and will be fully enforced on December 11, 2027. Manufacturers therefore have a three-year grace period to comply with its requirements. Some obligations, such as mandatory incident reporting, will apply from September 11, 2026.

### 12.1 Scope: Who is Affected and Excluded

The CRA applies to manufacturers, importers, and distributors of products with digital elements sold within the EU. This includes everything from smart home devices, wearables, industrial systems, network equipment, and software applications.

Certain products are explicitly excluded, such as medical devices already regulated under specific EU medical device regulations, motor vehicles, aviation systems, and some Software as a Service (SaaS) products covered by other regulations like the NIS2 Directive.

Category	Default "Unclassified"	Important "Class I"	Important "Class II"	Critical Products
Examples	Smart speakers, games, photo editing software, hard drives, mobile and desktops apps and everything else	IAM/PAM, OS, wearables, smart home, password managers, network management systems, microcontrollers, VPN, SIEM, anti-virus	Hypervisors & container runtimes, firewalls, Intrusion Detection / or Prevention, Tamper-resistant microprocessors & microcontrollers	Smart meter gateways smartcards or similar devices, including secure elements Hardware Security Modules
Conformance	<b>Self Assessment</b>	<b>Harmonised Standards</b>	<b>Third party assessment</b>	<b>EUCC</b>

Figure 7: CRA Conformance by Category

## 12.2 Product Categories and Assessment Requirements

As listed in Figure 7, all products are categorised and each category has particular conformance requirements.

### 12.2.1 Default “unclassified” (Low Risk)

The low risk category handles ~90% of products and self-assessment is generally allowed if the product aligns with a Harmonised Standard, Common Specification, or a European Cybersecurity Certification scheme.

### 12.2.2 Important “Class I” and “Class II” (Higher Risk)

Important products are those with higher cybersecurity risk compared to default products, encompassing essential digital elements such as operating systems, browsers, and network equipment, and requiring more stringent conformity assessments.

- **Class I** products must meet Harmonised Standards, meaning European technical specifications that, when applied, allow manufacturers to self-assess their product's compliance with the Act's essential cybersecurity requirements, presuming conformity and simplifying the certification process. For this the CRA leverages the existing CE marking system.
- **Class II** are higher risk and require a mandatory third-party conformity assessment, even if harmonised standards or certifications apply. These are carried out by Conformity Assessment Bodies (CAB), which are independent organisations accredited by Member States to assess product compliance with the CRA.

### 12.2.3 Critical (Highest Risk)

Critical products represent the highest cybersecurity risk, including highly sensitive hardware and security devices, and always require the most rigorous European Cybersecurity Certification Scheme on Common Criteria (EUCC) by a conformity assessment body.

## 12.3 Mandatory Product Security Requirements

The CRA introduces a set of mandatory requirements that manufacturers must meet to enhance cybersecurity resilience:

- **Risk Management:** Manufacturers must perform risk assessments on their digital products and implement appropriate security measures.
- **Secure by Design:** Products should be designed with cybersecurity as a priority, ensuring secure configurations by default and protecting data confidentiality, integrity, and availability.
- **Incident Preparedness:** Organisations must build resilience against cyberattacks, mitigate potential impacts, and ensure efficient security event logging.

- **Security Updates and Maintenance:** Manufacturers are required to provide free and secure updates to fix vulnerabilities promptly and notify users about security patches.
- **Vulnerability Handling Requirements:** Organisations must maintain a Software Bill of Materials (SBOM), conduct regular security testing, and implement CVD policies.
- **Product Information & Guidance:** Clear documentation must be provided to users, including manufacturer contact details, product identification, cybersecurity guidelines, and decommissioning procedures.

## 12.4 Penalties

Like NIS2, the CRA imposes significant penalties for non-compliance, designed to be effective, proportionate, and dissuasive. These administrative fines can be substantial:

- Up to €15,000,000 or 2.5% of the total worldwide annual turnover, whichever is higher, for non-compliance in relation to product security and vulnerability handling.
- Up to €10,000,000 or 2% of the total worldwide annual turnover, whichever is higher, for non-compliance with obligations such as documentation or reporting requirements.
- Up to €5,000,000 or 1% of the total worldwide annual turnover, whichever is higher, for providing incorrect, incomplete, or misleading information to notified bodies and market surveillance authorities.

It's important to note that these fines can be applied in addition to other corrective or restrictive measures, such as market withdrawal, product recalls, and restrictions on market access, along with significant reputational damage that can erode stakeholder trust. Member States are responsible for laying down the specific rules on penalties and ensuring their implementation.

SMEs have largely identical reporting obligations to larger entities, there are some derogations for certain deadlines to ease the administrative burden.

## 12.5 Preparing for CRA Compliance

To prepare for CRA compliance, organisations should:

- **Determine Scope and Applicability:** Identify all products subject to CRA compliance.
- **Perform CRA Conformity Assessment:** Evaluate current security controls against CRA requirements (Gap Analysis) to determine gaps and areas requiring improvement.
- **Build & Execute a Roadmap:** Develop a detailed roadmap outlining specific steps and timelines needed to achieve CRA conformity, including risk management strategies and security policies.
- **Continuously Improve:** Establish a process for ongoing evaluation and enhancement of cybersecurity measures, including regular security audits and updates to security protocols.
- **Audit and Certify:** Achieve certification under recognised certification schemes such as EUCC or other alternatives when available, ensuring long-term compliance and enhanced market credibility.

## 13 Bibliography

- [1] Directive (EU) 2022/2555, *EU Measures to ensure a high common level of cybersecurity in the Union and amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972 and repealing the Directive (EU) 2016/1148 (NIS 2 Directive)*. 2022, p. 73. Accessed: Aug. 08, 2022. [Online]. Available: <https://eur-lex.europa.eu/eli/dir/2022/2555/oj>
- [2] Directive (EU) 2016/1148, *EU Measures for a high common level of security of network and information systems across the Union*. 2016, p. 30. Accessed: Jun. 09, 2023. [Online]. Available: <https://eur-lex.europa.eu/eli/dir/2016/1148/oj>
- [3] Regulation (EU) 2024/2690, *EU rules for the application of EU 2022/2555 as regards technical and methodological requirements of cybersecurity risk-management measures*. 2024. Accessed: Jun. 30, 2025. [Online]. Available: [https://eur-lex.europa.eu/eli/reg\\_impl/2024/2690/oj/eng](https://eur-lex.europa.eu/eli/reg_impl/2024/2690/oj/eng)
- [4] ENISA, 'ENISA Incident Reporting', NIS Incident Reporting. Accessed: Aug. 12, 2023. [Online]. Available: <https://www.enisa.europa.eu/topics/incident-reporting/>
- [5] K. Stouffer et al., *NIST SP 800-82r3 Guide to Operational Technology (OT) Security*, Standard NIST SP 800-82 Rev. 3, Sep. 28, 2023. Accessed: Oct. 30, 2023. [Online]. Available: <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-82r3.pdf>
- [6] ISA/IEC 62443, 'Industrial communication networks - IT security for networks and systems'. International Society of Automation/International Electrotechnical Commission, Jul. 20, 2009.
- [7] P. Kobes, *Guideline Industrial Security: IEC 62443 is Easy*. HEYER, 2017. [Online]. Available: <https://books.google.ie/books?id=uQEjtAEACAAJ>
- [8] ISO/IEC27001, *Information security, cybersecurity and privacy protection — Information security management systems — Requirements*, Standard ISO/IEC 27001:2022, Oct. 25, 2022.
- [9] 'Risk Management Measures (RMM)'. NCSC-IE, Jun. 04, 2025. Accessed: Oct. 10, 2025. [Online]. Available: [https://www.ncsc.gov.ie/pdfs/NIS2\\_Draft\\_Risk\\_Management\\_Measures\\_Guidance.pdf](https://www.ncsc.gov.ie/pdfs/NIS2_Draft_Risk_Management_Measures_Guidance.pdf)
- [10] 'Cyber Fundamentals 2025 (CyFun)', Cyber Fundamentals. Accessed: Oct. 18, 2025. [Online]. Available: <https://cyfun.eu/en/cyfun-2025>
- [11] Regulation (EU) 2024/2847, *EU Cyber Resilience Act (CRA)*. 2024. Accessed: Jun. 13, 2025. [Online]. Available: <https://eur-lex.europa.eu/eli/reg/2024/2847/oj/eng>

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