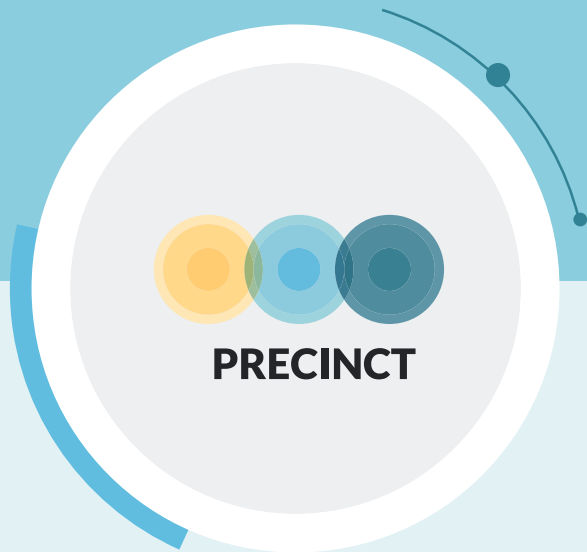# NEWSLETTER

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Issue #04

PRECINCT

Preparedness and Resilience Enforcement for
Critical INfrastructure Cascading Cyberphysical
Threats and effects with focus on district or
regional protection

PRECINCT

WELCOME TO PRECINCT

Welcome to our quarterly Newsletter.

It is our fourth newsletter and we are excited to tell you all about the work that has been going on from July to October 2022. The next issue planned for early 2023 will present further PRECINCT developments, we will reveal the deliverables completed and the progress. We will also give the floor to consortium partners and will keep you informed on upcoming events.

Anticipating the cascading effects of a flood in Antwerp

By Sophie Vanhove, Project Officer, Vias institute, Shirley Delannoy, Researcher, Vias institute, Isabel Verwee, Knowledge Group Manager, Vias institute

As the backbone of our European cities, economies and security, critical infrastructures are increasingly facing a variety of threats, be they cyber, physical, natural or hybrid, intentional or unintentional. Far from operating in a vacuum, these critical infrastructures are increasingly interdependent, with the operations of one potentially impacting the operations of another. It is therefore essential to understand the dynamics of these interdependencies in order to implement operational measures to ensure the security and resilience of the infrastructure, its operationalization and sustainability.

The four Living Labs

"Living Labs (LLs) are defined as user-centred, open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real life communities and settings." (ENoLL, 2015, cited in Yosuoka, Akasaka, Kimura & Ihara, 2018) .

The approach for the deployment of the PRECINCT platform is based on the Living Labs (LLs) methodology. This methodology, unlike a traditional laboratory, is rooted in a real context with a research approach centered on users and other stakeholders and applying various research, data collection and testing methods. In the Living Labs methodology, users and stakeholders from the public and private domains are involved and play a key role in development and innovation research, based on the principle of co-creation. These interdisciplinary experts are brought together to develop, deploy and test the technologies, services or products that will be implemented.

This user-centered research methodology is used for the development, implementation, monitoring and evaluation of the PRECINCT platform by integrating throughout the process both public stakeholders, such as emergency services or public authorities, and private stakeholders from the transport, energy or telecommunication sectors, as well as technical and scientific representatives.

Four Living Labs, corresponding to four European cities, are designed within the project and will assess the resilience of Critical Infrastructures to cyber and physical attacks through the implementation of the platform and its attack management tools. These events are simulated scenarios and have no actual physical consequences. Vias institute from Belgium is responsible for the overall coordination of the four Living Labs.

• The Living Lab in Ljubljana focuses on a physical threat and a cyber-attack with simultaneous DDoS attacks on critical parts of industrial control systems, electricity and communication operators, which provide important services for the continuity of the transport mobility platform.

- The Antwerp Living Lab deals with a natural physical threat, a flood, and its cascading effects on the city's water and traffic infrastructure.

- The Athens Living Lab will face a series of cyber-physical attacks affecting airport, metro and road communication services.

- Living Lab Bologna will focus on a cyber-attack on rail or air transport, combined with a "fake news" attack and a cyber-attack on the city's IT system.

In addition, in parallel to these four LLs, transferability demonstrators will follow the deployments of these various technologies within the LLs in order to be able to transfer the knowledge gained into their own demonstrators and tus achieve maximum impact. These demonstrators are Ireland (with a focus on transport and energy related CI) and Luxembourg (with a focus on energy and telecommunication related CI).

On the way to greater resilience of the critical infrastructure of the City of Ljubljana

By Tinkara Bulovec, M. A., coordinator, Municipal Constabulary Department, City of Ljubljana

In the time of the rise of smart cities, data and systems integration, it is necessary to be aware of the extreme importance of critical infrastructure (CI) for day-to-day operations. Due to the integration of CI, they represent a target for threats, attacks, and (both natural and man-made) accidents, which can have a cascading impact. Managing the cascading effects of increasingly frequent cyber-physical threats and enabling rapid recovery of CI and city are crucial and very challenging. The tasks and processes of the city administration and relevant public services are necessary for vertical and horizontal interaction with private organisations that manage CI and with state stakeholders, such as national security authorities. Understanding the city response and interdependencies between the city and private CI is essential to understanding threats, city functioning and its exposed areas, CI themselves and preparedness to efficient response if anything happens.

The City of Ljubljana is Slovenia's political, cultural, scientific and educational centre. Due to its location, Ljubljana also represents an important European trade, business, transport, congress and fair centre. One of the essential advantages of the City of Ljubljana is its safety. To ensure safety, it is necessary to constantly implement appropriate measures and look for new approaches to preserve it in the future. Besides, a collaboration between local, private and state stakeholders is needed, with legal bases in The Capital City of the Republic of Slovenia Act (2009).

Duties and collaboration of state and city authorities are foreseen in areas of public interest, which primarily include environmental protection, planning and use of space, public safety, city traffic and its safety and the provision of economic and non-economic public services. Only legally defined cooperation between the stakeholders mentioned above is not enough. A better mutual understanding is needed between the key stakeholders to ensure the safety of the citizens, continuity of the essential functions of the local government and preparedness in the event of an emergency.

Within the PRECINCT project in Living Lab Ljubljana, we will implement and test different PRECINCT technological tools such as digital twin, the concept of serious games, interdependency graphs with simulation tools, and ecosystem platform. Doing the abovementioned will allow us to study the vulnerabilities and interdependencies of CI. Proposed PRECINCT technological tools can help us by improvement of our response to achieve CI resilience, which »refers to the essential attributes of cities that enable them to deal with disasters and other threats over which they have little control«. In other words, it means the »capacity to respond to a range of risks and uncertainties (Seeliger and Turok 2013) . Due to the diversity of threats, specific circumstances, and different availability of natural and human resources, the city's response to achieving resilience differs and needs to be adaptable to the specific situation. Depending on circumstances, the crucial capability of a resilient city can be rapid recovery and adjustment of existing arrangements and systems to the given situation. Following the abovementioned and according to Seeliger and Turok (2013), we can divide resilience into three categories. 1) Engineering resilience focuses on the city's ability to »recover its population, infrastructure and institutions« after an event. To avoid breakdown is essential to retain vital urban functions. 2) The essence of multi-equilibria resilience is the capability of the city to adapt itself to the situation to achieve better management or threat elimination. 3) Socio-ecological resilience addresses it from the perspective of its dynamic nature and ongoing changes in a city whose structures are being rearranged and its institutions reorganised. In light of constant changes, this type of resilience, besides persistence or restoration, also includes adaptation.

To achieve city robustness, resourcefulness and successful future performance, it must be able »to maintain vital functions while at the same time adapting and developing in the light of changing circumstances« (Seeliger and Turok, 2013). In the case of the City of Ljubljana, we have a private, local and state CI cluster. Local CI, which is essential for the functioning of a city and is managed by city services, is represented by energy pipelines (water, hot water, sewerage), roads and public places. In project PRECINCT, crucial CI, managed by private stakeholders, are electricity networks, telecommunications, railway, and bus transportation. Based on the above, the city's functioning and operation of the city's services would be most affected by an electricity fallout and a telecommunications interruption. Minimising the effects of threats that can cause damage to vital CI, city preparedness is crucial. Following the

concept of resilience, continuous operations and the smart city evolution, PRECINCT allows us to test modern solutions. By implementing technological solutions, we want to ensure the quick detection of threats and improve our responsiveness and intervention methods. To do so, we need to start with the basics. Following the S.A.R.A model (figure 1), we can divide city response into four phases. The first phase includes scanning the field of operation to find and prioritise the problems. Secondly, we must execute a risk analysis showing our vulnerabilities. The third phase includes the city response, which can go in three directions 1) adapt, 2) transform, and 3) recover. After all, the abovementioned is essential to assess the effectiveness of the city response. We can use the proposed PRECINCT technological tools in all phases of the presented model in figure 1 because they offer a good insight into preparedness, interdependencies and response of CI. Based on the obtained insight, a city can shape the response, adapt quickly to the situation, transform the operation, mitigate damage, or recover quickly. In this way, we can achieve the resilience of CI and ensure continuous operation.
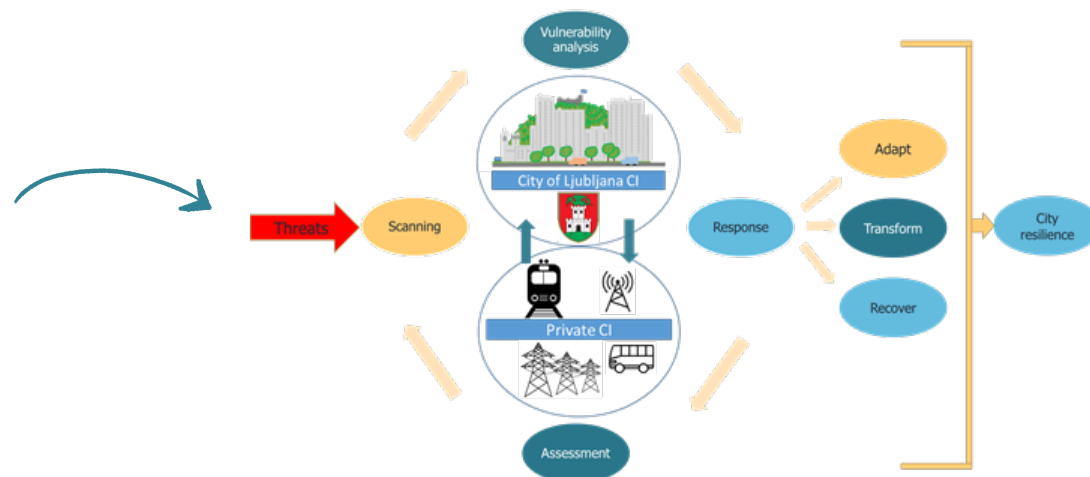

Fig 1: City response to CI threats using S.A.R.A model and concept of resilience

1. Capital City of the Republic of Slovenia Act [Zakon o glavnem mestu]. (2004). Official gazette, 22/4, 110/09 and 59/17.
2. Seeliger, L., & Turok, I. (2013). Towards Sustainable Cities: Extending Resilience with Insights from Vulnerability and Transition Theory. Sustainability, 5(5), 2108–2128. doi:10.3390/su5052108

Ljubljanski Potniski Promet

By Gregor Cunder, traffic analyst, Ljubljanski Potniski Promet

LPP as public transport operator in Ljubljana is facing challenges related to unobstructed operation. Within the plan to deal with extraordinary events, at present, there is no protocol regarding collaboration among other stakeholders – among critical infrastructure managers.

There is theoretical plan, as to who is responsible for management of certain unusual events, but it is based on communication among individuals and personal knowledge of certain people responsible for its field of operations.

PRECINCT project with Living Lab and Serious games will highlight all possible discrepancies in communications and event management. Different events require different protocol and different event management. With construction of new passenger transport hub in Ljubljana, there is need for event management and taking into account also other critical infrastructures involved or effected by certain event.

A Living Lab with »application« for simulation of different scenarios will prove useful to detect possible shortcomings in organisational and communicational aspect. Within the Living Lab there are going to be performed simulations of different events. Simulation results will provide us data and will show us where corrections are to be made in existing risk management plans or creations of new ones. Expected results of the PRECINCT project are to be able to plan all required steps managing different extraordinary events and correctly include critical infrastructure operators. Defining involved stakeholders and consequently proper communication protocols, the events can be managed in most effective way and in shortest time possible. All stakeholders and critical infrastructure managers will gain from PRECINCT project regardless of their local or national importance.

Improving Resistance of Telekom Slovenije's Network against Cyberphysical Attacks

By Peter Zidar, expert, Telekom Slovenije

Telekom Slovenije is participating with its knowledge of telecommunications network as one of crucial partners in European project PRECINCT (Preparedness and Resilience Enforcement for Critical Infrastructure Cascading Cyberphysical Threats). Evaluating the resilience of Critical Infrastructure to combination of cyber and physical attacks is among most important tasks within this project. In order to secure continuous operation for the company and other stakeholders of critical infrastructure, including its public, private and business users, Telekom Slovenije must maintain stable and resilient network during and after such attacks and prevent any cascading effects. During these critical events, it is of utmost importance to keep the telecommunication network functional and to enable all emergency services personnel to communicate quickly and efficiently. The role of Telekom Slovenije's CSOC (Cyber Security Operations Centre) is essential to ensure highest level of protection against cyber-attacks and keep all critical telecommunication services running.

As partner in this project, Telekom Slovenije participates in activities of Living Lab 1 (Ljubljana). This Living Lab involves several Critical Infrastructure operators in the area of current (and soon to be built) main Ljubljana transportation hub. Together with them and with other international partners we are preparing Digital Twin and Serious Games solutions to simulate possible outcomes of complex cyber-physical attacks targeting our infrastructure. These tools combined with realistic exercises will help us identify potential weaknesses, gaps in protection procedures and improve notifications exchange. Participating at this project will give us many new insights into safety of telecommunication network and will improve its overall performance.

Fig 2: Cyber Security Operations Centre of Telekom Slovenije

Flood hazard forecasting in Antwerp Living Lab

by Daan Buekenhout and Prof. Patrick Willems, KU Leuven, Department of Civil Engineering – Hydraulics and Geotechnics Section

For the Antwerp Living Lab, pluvial flooding as a consequence of very intense rainfall events, are being considered as one of the important and increasing threats. The Digital Twin under development for that Living Lab by PRECINCT partner IMEC will therefore include a pluvial flood hazard assessment and forecasting component. This component is being developed by PRECINCT partner KU Leuven, and will be based on a novel concept of surrogate and hybrid modelling.

The surrogate modelling approach makes use of a machine learning method to obtain pluvial flooded zones based on meteorological data. The model training will be based on a large number of simulations with a detailed full hydrodynamic model for the urban water system of the city, considering a large variety of meteorological boundary conditions including extreme rain storms for different occurrence frequencies. This detailed model is based on the hybrid concept where the one-dimensional underground pipe system is bidirectionally coupled with a two-dimensional surface inundation model for the above-ground system. It is validated based on crowdsourcing data and crisis interventions by the fire brigade during recent pluvial flood events.

The pluvial flood hazard assessment and forecasting component of the PRECINCT Digital Twin for the Antwerp Living Lab will be applied to support the water manager Water-link to investigate and control the flood risk, the city's police to adapt their crisis intervention planning to the changing threats because of climate change. On top of this, a traffic model developed by PRECINCT partner IMEC will be coupled to the flood model to assess implications for the city's traffic conditions.

Fig 3: Flood at the train station of Antwerp-Berchem

Managing real flood risks in a virtual world

By Nico Dries, Hoofd Teamleader Maintenance – Leidingnet, Water-Link

Too often, when our towns and cities are suddenly hit by 'unexpected' events, such as flooding from excessive rainfall or storm surges, we react only to solve the present issue. What if we could predict them so we could plan and be prepared.

WL are partnering with University of Louvain, the Anwerp Police Department, Imec and the Vias Institute to develop a digital twin that will predict pluvial floods.

The project known as PRECINCT (Preparedness and Resilience Enforcement for Critical INfrastructure Cascading Cyberphysical Threats and effects with focus on district or regional protection) will fill in existing gaps in information needed. Understanding the manifold effects of an incident such as a flood not only requires knowledge about the threat, but also about the area and infrastructures that will be affected. The main objective is to interconnect the water and transportation CIs to support decision making by the police and emergency services of Antwerp.

How will WL participate? Knowledge sharing based on maps & experience:

- Sewer network in and around the city of Antwerp and drain direction
- Diameter of the sewer pipes
- 12 known problem areas in the city of Antwerp
- waterlevel in the sewers
- location & pressure of the waterpipes (optional)

Digital twins hold tremendous opportunity for the water sector.

They offer exciting new ways of testing "what if" scenarios and predicting performance. Data from PRECINCT can simulate heavy downpour to see whether sewage systems will be able to cope, how drinking water safety might be threatened, and which areas of the cities might flood. It would also be able to show how interventions by one actor might impact others. This allows us to act pre-emptively, leading to reduced operational costs and greater efficiency.

Living Lab Athens

Edited by John Limaxis, Technical Project Manager, INLECOM

With contributions of
- *Nikos Papagiannopoulos, senior project manager, AIA, and Elma Kalogeraki, AIA External Consultant*
- *Natalia Kalfa, Head of Management Information, and Konstantina Argyropoulou, Strategic & Organizational Transport Analyst, ATTD*
- *Emy Apostolopoulou, Deputy Research and Technology Manager, AMETRO*

Introduction PRECINCT LL3

In the modern era of cyber-physical interdependent infrastructures, deliberate attacks, potential natech accidents or even extreme weather conditions could lead to disruption or the unavailability of services and produce a devastating impact with serious financial and societal losses, resulting even into people injuries and loss of human lives.

In this vein, transport Critical Infrastructures, as those of comprising PRECINCT Living Lab 3, must continuously update their security policies and practices to ensure their safety, sustainability and resilience as well as provide enhanced positive passenger's experience. In more detail PRECINCT third Living Lab consists of five partners in total, of which three are critical infrastructures providing transport services to thousands of citizens daily in the same broader geographical area of Athens. More specifically, those are :

The Athens International Airport (AIA), so-called "Eleftherios Venizelos" is the largest and busiest international airport in Greece which serves its capital, the city of Athens, and Attica

region, located 30 km (19 miles) east of Athens. Athens International Airport is a member of Group 1 of the Airports Council International supporting over 25 million passengers annually and in fact, it hosts more than 370 companies with more than 16.000 employees servicing approximately 100.000 passengers and 800 flights per day during peak periods. Furthermore, Athens International Airport consists of two passenger terminals, the "Main Terminal" and the "Satellite" Terminal which are connected through an underground link as well as Athen's airport is connected with road and rail transport to support passengers' traffic and cargo movement. Finally, apart from life-critical systems, airports are business-critical as they must operate efficiently 24/7 in order to process and support all these passengers and cargo transport services and respective supporting operations.

"Airports are vital infrastructures for passengers' movement and cargo transportation. They are considered Critical Infrastructures (CIs) for the EU economy as they operate essential services for the maintenance of critical societal and/or economic activities."

Attikes Diadromes SA (ATTD), also known as Attica Tollway Operations Authority, is the Operation and Maintenance Company of the Attiki Odos Motorway (Attica Tollway) in Athens, Greece. The Tollway is a 70 km-long urban Motorway (with sections that are part of Orient/East-Med TEN-T corridor), fully access-controlled through 39 toll stations and with an annual average of entries in the order of 210.413 vehicles (2021 data). The motorway mainly links the airport to the city centre, but also provides access to major urban arteries and main intercity motorways or other public transport modes. Key objective of the company is the constant and incessant operation of the motorway on a 24-hours-a-day, 7-days-a-week, 365-days-a-year basis, ensuring primarily the safety of the road users.

Attiko Metro S.A. (AMETRO) is a 27-year old state-owned company, specializing in planning, engineering, managing and implementing urban rail projects, also certified by TÜV Austria on the quality management system, according to EN ISO 9001:2015. The company's expertise includes all engineering topics, covering from geotechnical and structural engineering, architecture, electromechanical installations, power supply systems, radio communication (TETRA), CCTV, track works, signaling & SCADA, rolling stock, depots to operation control centers (OCC) and intrusion detection systems. Attiko Metro is the owner of Critical Infrastructure assets (tunnels, stations, depots, etc) of the Athens Metro network and has already delivered 67 kms of metro lines and 68 stations in Athens. Furthermore, Metro lines 2 and 3 reliably serve over one million (1,000,000) passengers daily and together with urban rail line 1 Pireaus-Kifissia constitute the core of the public transport system in Athens. Finally, Metro Line 3 including its very recent extension to Pireaus , starting from October 2022 provides a direct connection of the Athens Airport to the country's greatest port in Pireaus, while in its D.Plakentias-Airport section of 20.7km length it cooperates together with the suburban railway, along with Attiki Odos motorway.

"Attiko Metro is primarily concerned about improving the resilience of the metro system. In case of a major incident, (e.g. natural disaster or physical attack), it is imperative to improve system resilience in order to safeguard passenger safety, minimise damage of critical metro infrastructure, while continuing to provide passenger service through alternative transport network options in case of disruption of metro service".

Fig 4: Athens Transport Network

Inlecom Innovation is the research arm of the INLECOM Group based in Athens, with an international team of experts in the area of software engineering and business management focusing on collaborative R&D in Digital Eco-System platforms and technologies. Inlecom Innovation as part of PRECINCT Living Lab 3 aims to drive the effective coordination and communication among the various CIs stakeholders and PRECINCT technical partners ensuring that the project's meet its innovative, business and technological objectives for enhancing Critical Infrastructures security management against cyber-physical threats`.

PRECINCT LL3 Athens Region Transport Resilience: Use Cases and Vision

PRECINCT Athens Living Lab is supported by three prominent air, road and rail transport CIs in Greece representing the principal transport network of Athens used by over 4 million people living in the broader area of Attica and by over 25 million visitors a year highlighting the importance and need of resilience management of interconnected transport Cis. PRECINCT aims to connect private and public CI transport stakeholders in a geographical area to a common cyberphysical security management approach in order to yield a protected territory for citizens and infrastructure. In particular, Athens Airport in collaboration with the other LL3 CIs aim to test and validate the PRECINCT system and accompanying tools under the scope of coordinated cyber and physical attack scenarios impacting airport employees, passengers and other aviation stakeholders.

"The ultimate goal of PRECINCT Athens Living is to investigate how these CIs, which operate under the same geographical area, could increase their resilience against combined cyber-physical attacks."

Concerning the road transport CI, ATTD currently manages Attiki Odos operation based mainly on pre-defined response steps and procedures, executed primarily by the Traffic Management Centre and in collaboration with the Traffic Police and ATTD patrols on site. ATTD is interested in maintaining timely response and management procedures and is always in search of new opportunities to enhance its procedures. The PRECINCT platform can play a fundamental role towards this direction, offering new and more effective ways of ensuring smooth operation following a physical/cyber-attack, either to the motorway or to an interconnected Critical Infrastructure e.g. attack to the airport. Indicatively, Digital Twin capabilities could provide ATTD with better real-time visibility on road conditions, fast/automated interconnection with other CIs, the ability to execute what-if (simulation) scenarios, etc., thus improving response procedures incl. response times, communication and user safety levels. Finally, information sharing through PRECINCT ecosystem platform relating to illegal activities or incidents in adjacent infrastructure will give a broader view to Attikes Diadromes, so as to be able to take action, to be as proactive as possible and to minimize response times, as well as any impacts on safety and traffic operations.

"Damage or destruction of motorway assets by natural disasters, terrorism or criminal activity can have devastating consequences for the safety of the road users. Equally, similar threats to the other Cis in the Attica region can have adverse effects on the operation of Attiki Odos. Therefore, a common cyber-physical security management approach is necessary in order to better coordinate and manage a critical situation."

Being the owner of Critical Metro Infrastructure in Athens, Attiko Metro is primarily concerned about improving the resilience of the metro system. Currently, the Metro operator (STA.SY.) has Standard Operating Procedures for metro operation, which also include procedures in case of various incidents/events. It is evident that in case of a major event, (e.g. natural disaster or physical attack), it is imperative to improve system resilience in order to safeguard passenger safety, minimise damage of critical metro infrastructure, while continuing to provide passenger service through alternative transport network options in case of disruption of metro service. AMETRO will participate in the Athens Living Lab (LL3), together with Athens Airport and Attikes Diadromes to test and evaluate the performance of the PRECINCT platform in terms of minimizing the cascading effects of unserved travel demand to/from Airport and shift to Attiki Odos road traffic and/or unserved travel demand from Syntagma to Airport and vice versa due to a cyber-physical attack on power or metro/urban rail infrastructure.

The ultimate purpose of LL3 operations is to utilize the PRECINCT ecosystem in order to leverage CIs security, improve response procedures at individual CI operator level, enhance communication and coordination among the interconnected CIs and first responders in view of an incident and thereby raise CIs preparedness and increase their resilience.

"Attiko Metro is primarily concerned about improving the resilience of the metro system. In case of a major incident, (e.g. natural disaster or physical attack), it is imperative to improve system resilience in order to safeguard passenger safety, minimise damage of critical metro infrastructure, while continuing to provide passenger service through alternative transport network options in case of disruption of metro service."

Increasing the resilience of Bologna airport as a CI and multimodal hub

By Dora Ramazzotti, Responsible Corporate Secretariat, Bologna Airport

Aeroporto G. Marconi di Bologna S.p.A. is the company that manages Bologna airport, Italy's eighth-largest by number of passengers in 2021. Bologna Airport is classified as a "strategic airport" in Italy's National Airport Plan and is located in the heart of Emilia-Romagna's "Food Valley" and automotive and packaging districts. It has a catchment area of approximately 11 million residents and approximately 47,000 companies with a strong focus on exports and internationalisation and commercial expansion policies targeting Eastern Europe and Asia. The airport's infrastructure can support the operation of short-, medium- and long-haul flights, 24 hours a day, thanks to a 2,800-metre runway, 31 aircraft stands, a 46,140 m2 passenger terminal, 64 check-in desks, 20 boarding gates, and over 5,300 parking spaces.

Fig 5: Bologna Airport

The company's core business is developing, designing, building, adapting, managing, maintaining and operating installations and infrastructure for airport operations, together with associated and related activities. The company's commitment is to modernise its infrastructure, constantly improve quality of service, develop its route network and traffic volumes, enhance the area's tourism potential to draw travellers and stimulating the growth of the airport business and the local economy.

Inspired by customer centrality, the value of individuals, and farsightedness, Bologna Airport aims to be included among the most modern and efficient in Italy, capable of offering passengers an accommodating, well-connected facility that improves their travelling experience while also creating value for Italy's economy.

The Airport is committed to a significant infrastructure development plan, as a fundamental part of its strategy, together with the growth of its network and passenger traffic.

In its role of a **Functional Hub**, airport activities have a strong impact on the surrounding area: a deep analysis was therefore conducted to identify material topics, i.e. those that have a significant impact on the airport economic, social and environmental performance and that therefore are capable of significantly influencing the expectations, evaluations and decisions of stakeholders. In 2021, a Stakeholder Engagement Plan was defined and the Intercompany Sustainability Committee prioritised the stakeholders to be involved. In 2021, the following stakeholder categories were involved: employees, carriers and sub-concessionaires, authorities, transport and logistics operators, and passengers. The matrix below has been constructed based on the findings of the analysis conducted.

The topic of "Airport safety and emergency management" and "Accessibility of infrastructure" are both in the top right area, it means they are both relevant for the company and its stakeholders (source Non-financial Declaration 2021 Bologna Airport - www.bologna-airport.it/System/files/IR/AdB-Sustainability-Report2021.pdf).

In this perspective, the participation to the PRECINCT project aims at increasing the resilience of the airport as CI and multimodal hub, relying on emerging and innovative technological/operational solutions to protect the individual CI and the interrelation among different Cis, composing the multimodal transport system.
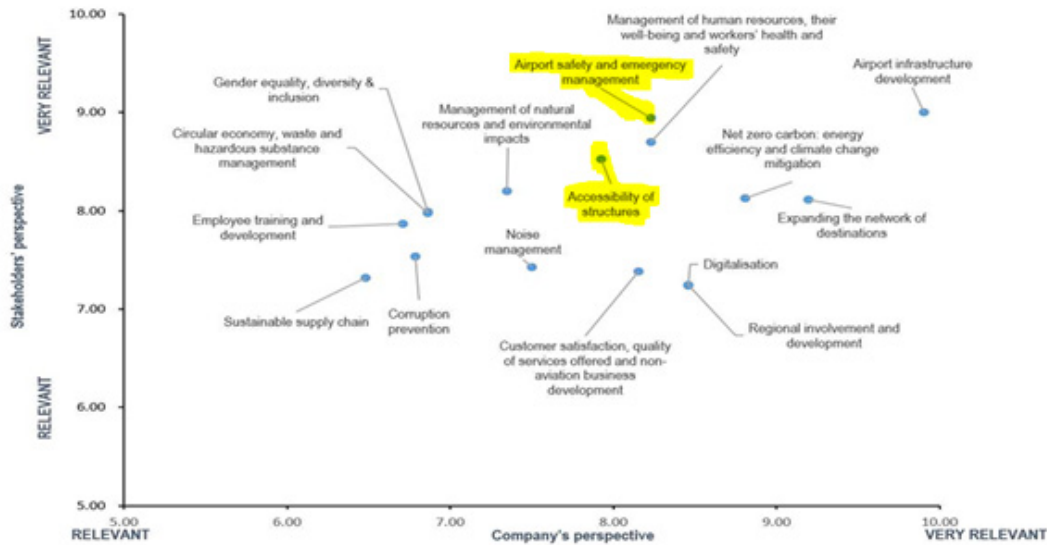
Fig 6: Matrix about the topics relevant for the different stakeholders

Fig 7: The People Mover

In 2021, Bologna Airport continued its efforts – in cooperation with local authorities and transport operators – to maintain and improve its levels of airport accessibility, despite the pandemic. The People Mover – a high-speed monorail (5km) that connects the airport to Bologna railway station, with a journey time of about 7.5 minutes – was brought into operation on November 18, 2020, transporting more than 600,000 passengers in 2021, including airport community employees, who can access the service at cut-rate prices thanks to the transport management agreements in place.

The Marconi Express, also known as the People Mover, is an innovative public transport system. The new monorail connects Bologna-Borgo Panigale Airport to Bologna Centrale railway station, stopping along the way at Lazzaretto University campus. The shuttle takes only seven minutes to complete the route, making it an excellent alternative to cars (the journey time for the "old" Aerobus shuttle was 25 to 40 minutes). The frequency of the service depends on the number of users. There is a train every 7 minutes at peak times and every 15 minutes at off-peak times. The infrastructure consists of a highly sustainable elevated monorail. The People Mover is an electric and fully automatic guided vehicle, which will significantly reduce the number of cars travelling to the airport. In addition, the photovoltaic panels installed on the track generate an "energy belt" capable of producing 35% of the project's energy needs. This will reduce CO2 emissions by 300 tonnes when fully operational.

The first year of operation featured the start-up and fine-tuning of a fully electric system that requires the full integration of infrastructures, vehicles, software, and management processes in order to successfully function. An extraordinary maintenance plan was devised to resolve various foreseeable and unforeseeable issues, which resulted in the monorail having to be shut down several times to perform vital maintenance, particularly in November. When the monorail is not in operation, a dedicated bus shuttle service is available but due to sudden activation it is challenging to provide to passengers the right information to allow them to understand what the proposed solution will be.

The bus shuttle service is also called in service to integrate the monorail service in case of unmanageable peaks.

Thanks to these new infrastructures and integrations, AdB will be able to expand its catchment area by allowing an increasing number of passengers to reach the airport. This will have a positive impact on those departing from the Bologna metropolitan area or needing to travel into the city. Having reviewed estimated data on how people reach the airport, it appears that most passengers travel to the airport in their own private vehicle, or in a car accompanied by a friend or relative (over 42%); around 20% of passengers use public transport, and 15% take taxis. Other travel methods include rental cars, car sharing, and shuttles organised by hotels. As for Airport Mobility Management policies, AdB continued to implement and improve the integrated intermodal MaaS (mobility as a service) season ticket pass for Group employees and the airport community, in collaboration with transport operators and local authorities. Developed as part of the Mobility Management Agreement with the Municipality of Bologna and in collaboration with external partners, the comprehensive season ticket allows individuals to combine or alternate the use of transport services on their commute to and from work at a reduced cost. City and suburban buses, metro trains, the People Mover, and electric car sharing services are all included in the season ticket.

It is therefore important to create a common "cyber" environment where the (real-time) information can be shared among the operators (PRECINCT partners and stakeholders) and the telecommunication operator (PRECINCT partner), who can grant the information exchange among them and the data flow to trigger alerts and suggest recovery plans already planned and agreed among them.

As part of its development strategies, the Group works every day with unwavering commitment to provide passengers with a unique travelling experience that prioritises customers through efficient innovative services, and a comfortable, functional infrastructure. The centrality of the customer, which means all-round satisfaction, is the measure of success of the airport and for this reason is one of the central values of the organisation. One of the elements underlying the AdB strategy is the concept of "Experience" which breaks down into development strategies aimed at the ongoing improvement of the services offered to airport users in the business areas in which we operate, both directly and indirectly, while also constantly improving our standards of safety/security, quality and respect for the environment. Providing a passenger experience with comprehensive quality means working every day on the infrastructure and processes in a climate of collaboration and the ever-present stimulus of all those who influence the passenger's journey. Therefore, it means guaranteeing a high-quality experience throughout all phases of the journey, from preparing to depart, reaching the airport, and the travel experience within the terminal all the way up to their return journey home.

Providing resilient communications in a connected Region

By Cristiano Passerini, CTO Emergency Response Division, Lepida

Lepida is a regional in-house society of the Emilia-Romagna regional and local Governments. The Shareholders of Lepida are more than 440 Public Bodies, and Emilia-Romagna Region is the most important one. Lepida provides the IT-infrastructure, communication, and software to its Shareholders. In a pinch, Lepida can be described as an aggregated hub, supporting the regional plans for ICT development in terms of projects, research, development, experimentation, and management of ICT services and products.

The regional communications infrastructure is largely owned by Lepida. It is a high-speed, hybrid fiber-optical and radio network that delivers both private and public services. Security and resilience of network infrastructure, connections, and provided services are the topics of interest for Lepida within the PRECINCT Project.

Private services are of fundamental importance for safety and disaster relief purposes: the most relevant one is the TETRA technology-based network over a full-IP interconnection, known as ERretre. This private service had a major role during the recovery after the 2012 earthquake. Among the users of the private services, the most prominent one is the Regional Civil Protection.

The public services are IP-based. Leveraging on the small-scale nature of the network, al-

though of regional extension, the services are specifically tailored to suit the Public Bodies requirements. These requirements are periodically reviewed, to deliver the optimal set of opportunities to the end-users, that is, the Shareholders. The public network is also comprised of physical and logical infrastructures operating at a different granularity. Specifically, Metropolitan Area Network (MAN) infrastructures are deployed in the largest regional towns. The MAN of the town of Bologna, its performances and security, and the interconnections with local CI's operators are the subject of interest of the Bologna PRECINCT LL4, where Lepida provides its technologies, knowledge, and expertise.

The interest in the PRECINCT project arises from the aim of improving the public network performance. As a matter of fact, the public network core uptime is above 99.999%, the so-called "five-nines" threshold. To attain such a result, benefits have been gained from two self-owned elements: the ownership of the physical infrastructure and the development of processes based on continuous monitoring of:

- equipment status
- links performance
- user feedback

The current aim of Lepida is to extend these performance to its end-users, i.e. Public Authorities, CIs, and citizens, as far as it is possible. PRECINCT project provides a vision, integrated tools, and a group of CIs Stakeholders, with whom to share a plan on how to attain this target. The novel background idea, supported by the PRECINCT vision, is that a change of perspective should be enabled when changing the target from the core network performance to the end-user performance. Specifically, a common, shared background of information is required to move the availability from the "three-nines" to the "five-nines".

From the operational point of view, either monitoring, maintaining and implementing assurance policies of the network are necessary to reach this purpose. These activities require the collection of a vast quantity of data. This is where BigData competencies and assets of Lepida may come in support of the PRECINCT Living Lab and its experimental ecosystem platform. In fact, Lepida is supporting Regione Emilia-Romagna to deploy a regional BigData infrastructure aimed at the awareness of digital citizenship and the support of the governmental decision process.

Similarly, additional sensing of the LL area might be required: also in this field both the IoT regional network, deployed by Lepida in conjunction with the shareholders, and the regional blockchain infrastructure, that can be devoted to increase the security of the sensor data collected, may be investigated in the future as sources to increase the resiliency of regional CIs.
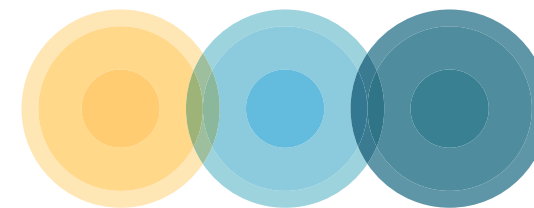
From the early stages of the scenarios ideation, and definition, as well during analysis of requirements, Lepida is envisioning more resilient services. PRECINCT tools greatly facilitated these stages. In coherence with its own mission, Lepida has started experimenting with the involvement of private and public CIs Stakeholders in the geographical area of the Bologna LL. The scope is to raise to a common cyber/physical security management approach, which will yield a protected territory for citizens and infrastructures. The next step is the deploy-

ment and test of the PRECINCT Ecosystem Platform in the Bologna PRECINCT Living Lab. In this specific LL context, Lepida network plays a role of a CI itself and connects the other CIs involved such as Bologna Airport, and Bologna Central Station, and the monorail connection between them (People Mover or Marconi Express MEX), providing services and data transit.

The LL is going to start in September. This testbed, its results, and further Stakeholder engagement will enable Lepida to enlarge and replicate this approach/practice according to its mission of regional provider of connectivity.

Most importantly, the results of the PRECINCT project will offer evidence about the importance of the awareness about the end-user specific requirements about connectivity. This topic can be dealt with by a connectivity provider operator that does understand the missions of its own end-users. The response to this challenging approach to increase the resilience of Smart Territories is the expected result of the PRECINCT contribution by Lepida, in total coherence with its vision and its mission.

PRECINCT

Preparedness and Resilience Enforcement for Critical INfrastructure Cascading Cyberphysical Threats and effects with focus on district or regional protection