Symbiosis theory & Security for digital twin in smart city

Mengxiang Han, China Unicom

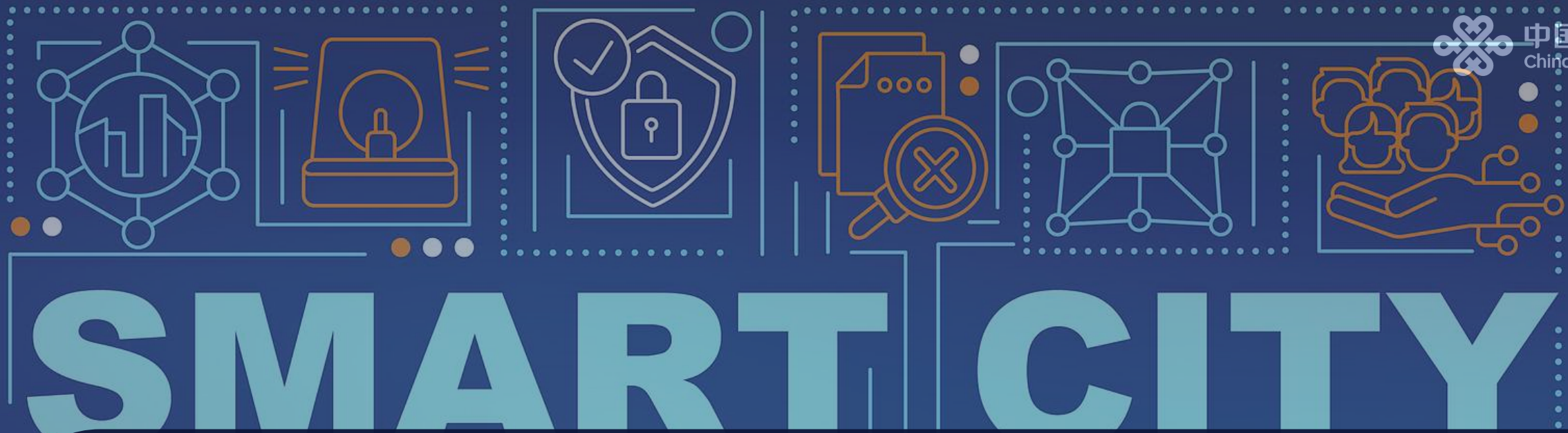
中国联通 China unicom

Contents

中国联通
China unicom

01

Symbiosis theory & Security for smart city



中国联通
China unicom

Biological Insights into the security Challenges of smart Cities

01 Symbiosis Theory

The word "**symbiosis**" comes from Greek,which was coined in 1879 by De Berg,a Germanmy cologist.
Symbiosis is a universal biological phenomenon,which has been researched as a biological research for more than100 years, its theory has been extended to sociology,economics,management and other subjects.

02 Interdisciplinary Transfer

In the field of smart city safety, by drawing on the interdependent and interactive relationships among organisms in the symbiosis theory, the safety elements in a city are regarded as symbiotic units, and a digital urban safety system is constructed to achieve the coordinated development of safety capabilities.

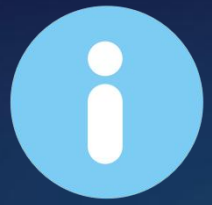
03 Symbiotic City Security

The symbiosis theory emphasizes real-time interaction, just like the information transfer and material exchange among organisms. In urban safety, various safety elements share information in real time and jointly evolve their safety capabilities to deal with the constantly changing security challenges.

Composition of security-symbiosis system

中国联通 China unicom

Based on the symbiosis theory, we constructed the security symbiosis system.



Symbiosis unit: security symbiosis unit

【Basic security capacity production and interaction unit constituting digital twin city symbiont】
Security capabilities forms "**Inner Circulation**" in security symbiosis system
Security capabilities and digital twin city symbiont form "**Outer Cycle**"

Symbiotic environment: security symbiotic environment

【The basic conditions for the symbiosis of digital twin city symbiont and for the generation and development of safe symbiosis unit】
"**Internal environment**" : security standards and management system, security evaluation and certification system
"**Outer environment**" : digital twin city security industry system

Symbiosis mode: integrated symbiosis

【Through digital twinning of global security capability, security capability and digital twin city can be symbiosed all the time and all the way】
"**Security→City**" : It provides security awareness, situation exchange, security cooperation and other "energy" for digital twin cities to improve the security of digital twin cities
"**City→Security**" : Urban infrastructure and systems interact with security symbiotic systems to enhance security decision-making and support capabilities

City-level security symbiotic system enables smart city security

中国联通 China unicom

It break through the traditional layered and decentralized security architecture.

It reconstruct the security product system, create new city-level security products and systems.

Security of smart city and traditational security

- During the development and construction of smart city, the introduction of new technology brings new security problems.
- With a large of city operation data, security problems is more prominent.

Traditional security mode

- **Based on single system, physical unit protection**
- **Security capabilities are scattered and uneven**

◆ **It would have a strong impact on the security of smart city when be attacked.**

City-level security innovation

- **Simultaneous construction of physical city and digital city**
- **Security grows with the construction of smart city**

◆ **It has a city-level security global perspective, and posseesses future evolution.**

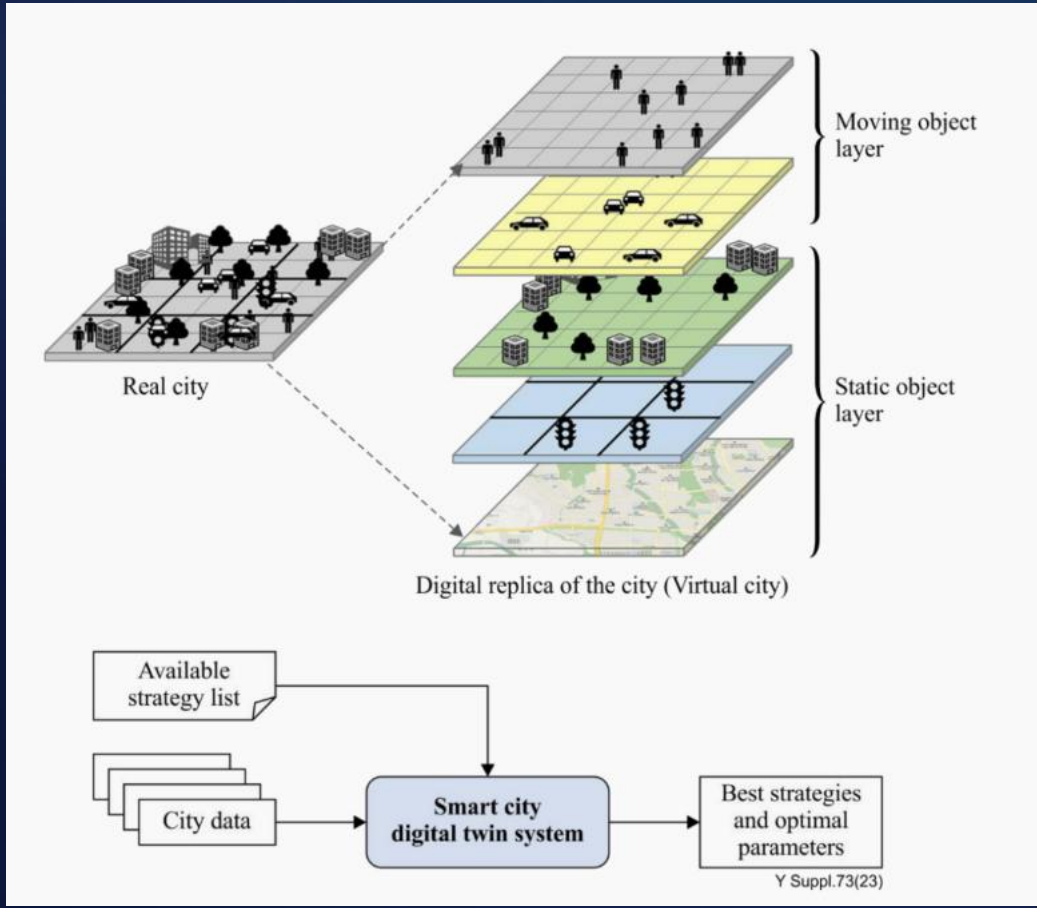
中国联通
China unicom

02

Security for digital twin in smart city

Smart city & Digital twin

Smart city digital twin [ITU-T Y.4600]: A digital twin for a smart city.



Concept of a digital twin in a smart city

Smart firefighting

Air quality management

Response to infectious diseases

Standards related to digital twin security in smart cities

中国联通 China unicom

ITU-T X.2012

Security measures for digital twin system of smart cities

ITU-T Y.4600

Requirements and capabilities of a digital twin system for smart cities

ITU-T Y.4489

Reference architecture of digital twin federation in smart cities and communities

ITU-T X.smdtf

Security measures for digital twin federation in smart cities and communities

ISO/IEC 30173:2023

Digital twin — Concepts and terminology

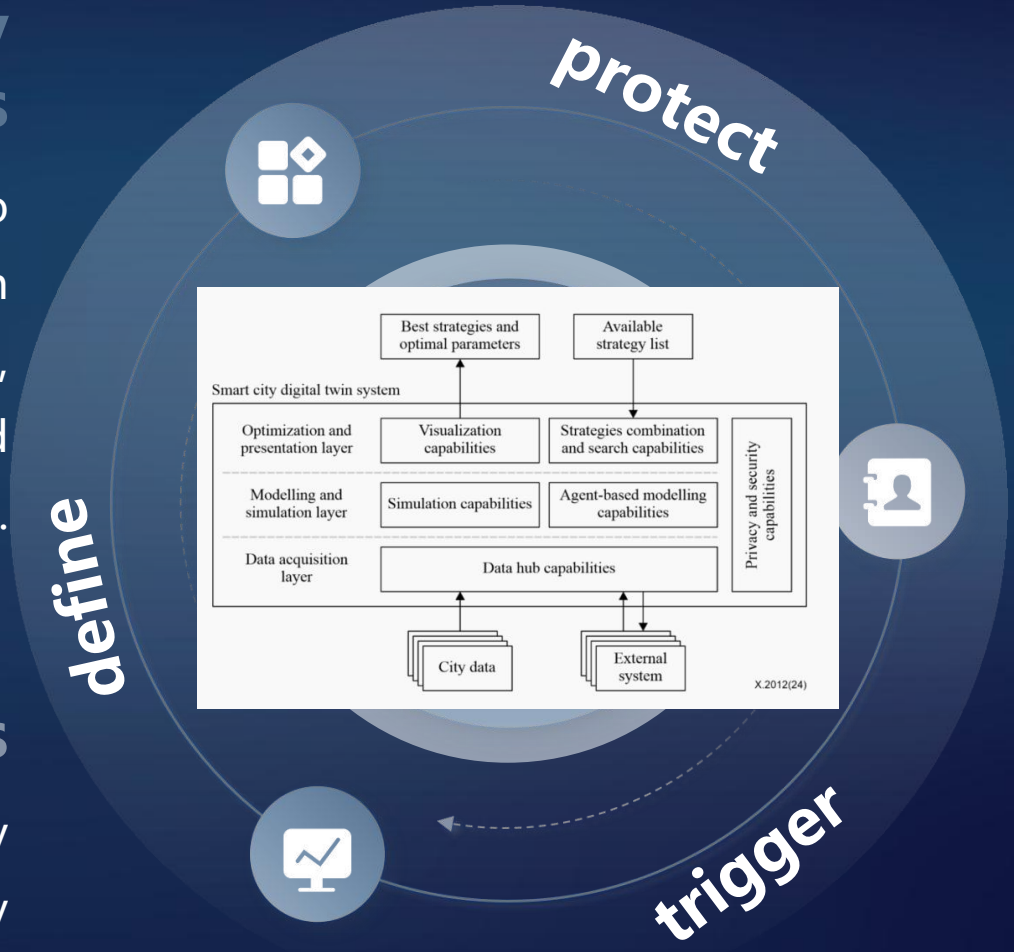
Security measures for digital twin system of smart cities

Security measures

Requirements correspond to layered protection measures such as access control (RBAC/ACL), AES/HMAC encryption, and dynamic algorithm verification.

Security requirements

Threats drive layered security requirements including entity authentication, data confidentiality, and algorithmic integrity checks.



Security threats

Smart city digital twins face layered security threats such as SQL injection at the interface layer, data tampering at the data layer, and model extraction at the modeling layer.

中国联通
China unicom

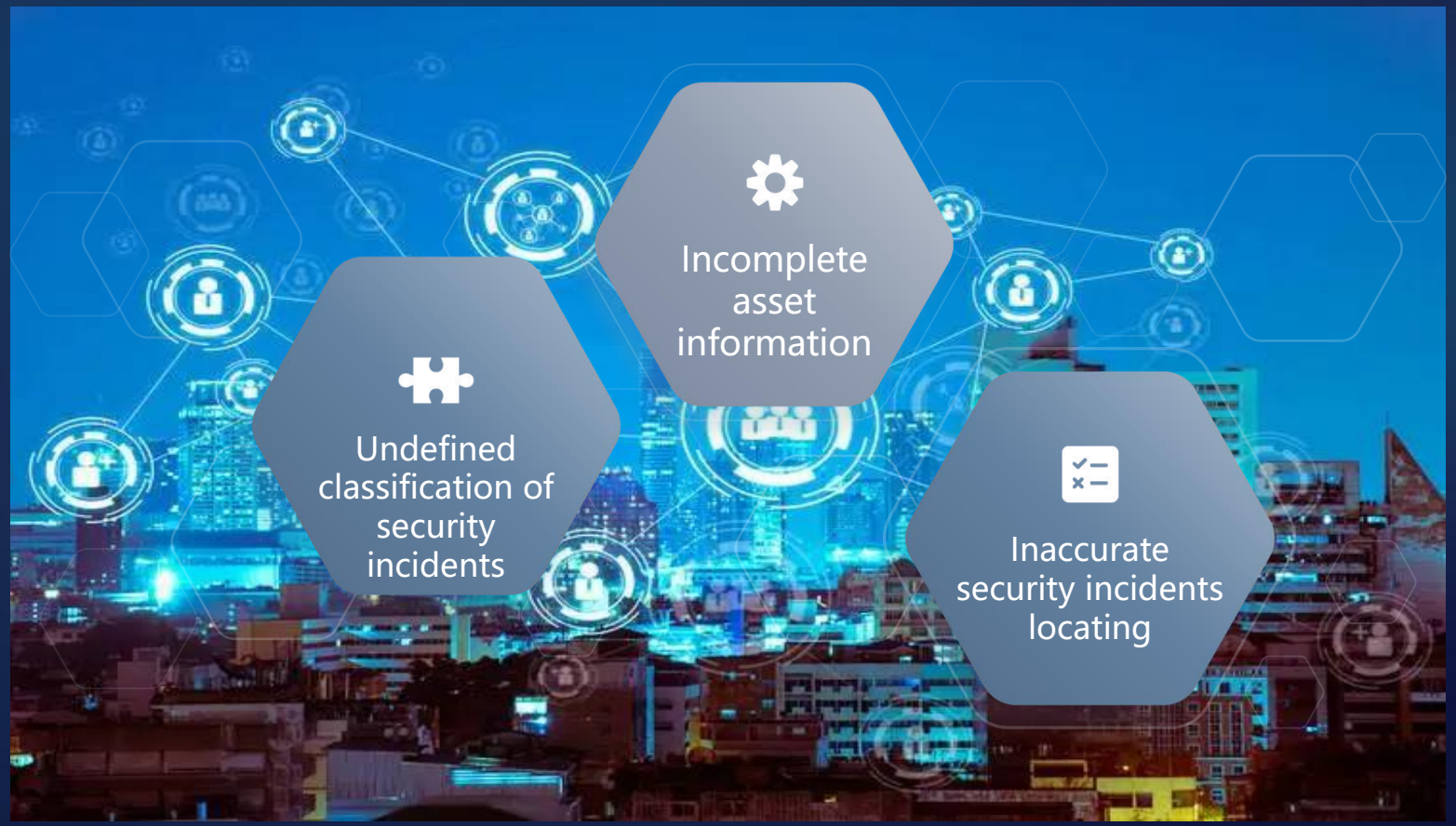
03

Three-dimensional Visualization Architecture Practice & X.fr-vsasi

Background

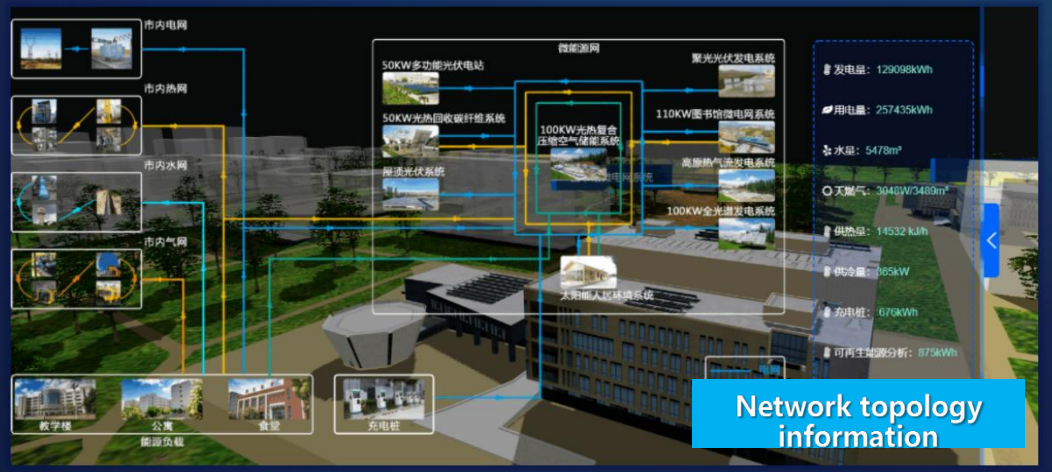
Efficiency & Accuracy of security management

Visualization service of security assets and incidents



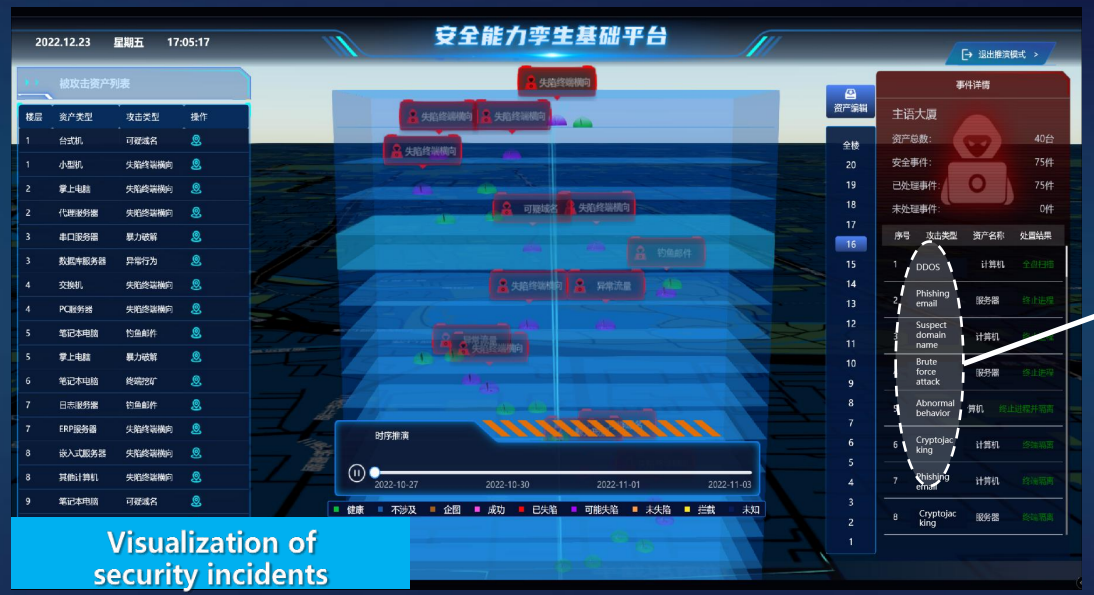
Several aspects need to improve in visualization service

Visualization of security assets based on digital twin



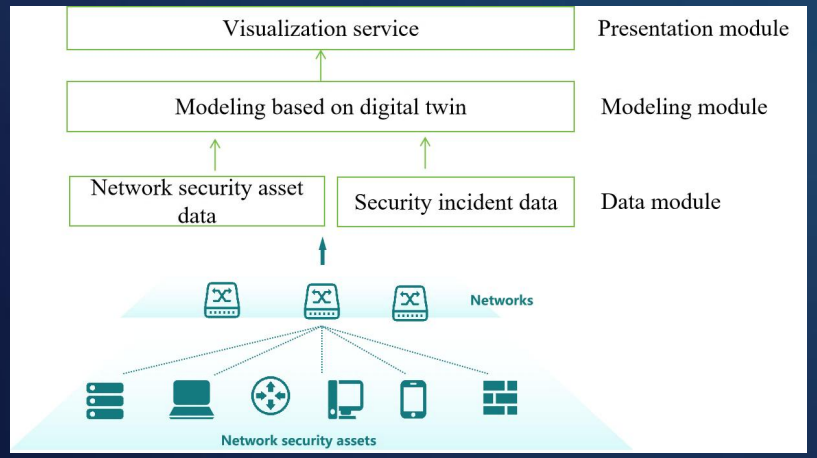
Data of various assets -> Unified spatial service -> Integrated visual management of assets

Visualization of security incidents based on digital twin



Statistically analyze and display the information of security incidents

A Brif induction of X.fr-vsasi



Presentation module

Visualization service functions

- Web browser FE
- App for visualization FE

Modeling module

Modeling based on digital twin functions

- Data querying and visualization FE
- Data analysis and simulation FE
- 2D/3D modeling FE
- GIS engine FE

Data module

- Network Security asset data functions
- Security incident data functions

中国联通
China unicom

Thanks for Listening