



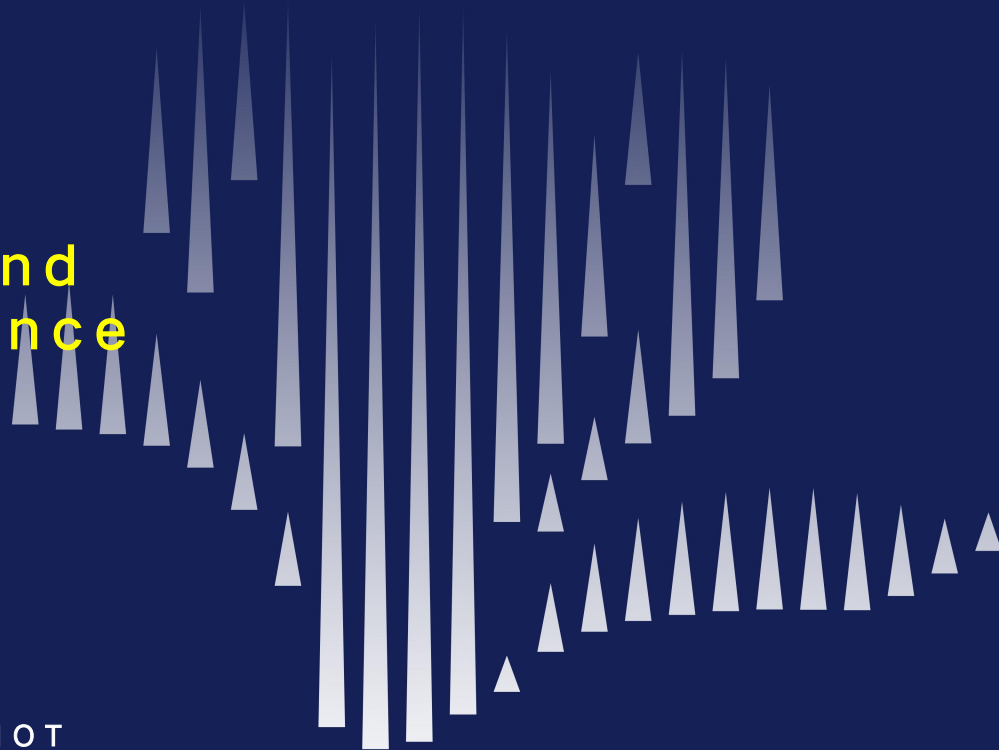
# Understanding and Practice of Perception System and Urban Digital Governance

感知体系与城市数字治理  
的认识和实践

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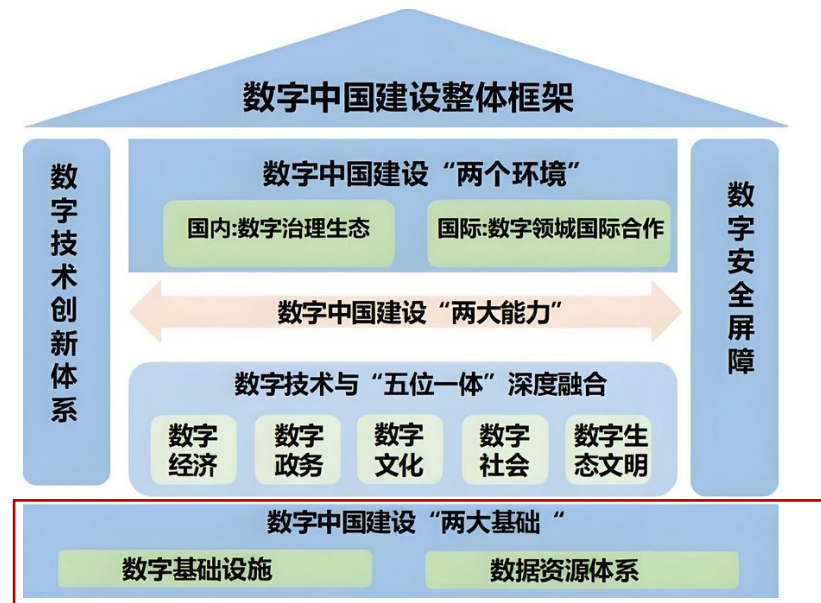


In March 2023, the Central Committee of the Communist Party of China and the State Council issued the "Overall Layout Plan for the Construction of Digital China", which clarified the **overall framework of "2522"** for Digital China and made comprehensive deployment from the strategic perspective of the overall development of the Party and the country's cause.

Building the digital China is an important engine to promote **Chinese path to modernization** in the digital era and a powerful support to build a new competitive advantage of the country. 建设数字中国是数字时代推进**中国式现代化**的重要引擎，是构筑国家竞争新优势的有力支撑。

The "Two Foundations" of Digital China Construction:

- **Connect the main arteries of digital infrastructure**, optimize the layout of computing power infrastructure, and strengthen the digital and intelligent transformation of traditional infrastructure.
- **Smooth the circulation of data resources**, clarify the important foundational role of data elements in promoting the construction of digital China.



Overall framework of the Digital China

In December 2020, the Municipal Committee of the CPC and Municipal Government of Shanghai jointly issued the “Opinions on Comprehensively Promoting the Urban Digital Transformation of Shanghai” (the “Opinions” ) --- “**Shanghai Model**”

### 2020.12, 上海市委市政府发布《关于全面推进上海城市数字化转型的意见》 - “上海模式”

The Opinions point out that **overall transformation, comprehensive empowerment and revolutionary re-shaping** shall be adhered to promote the general urban digital transformation in aspects of “**economy, life and governance**” .

- The Opinions also propose to develop **digit-foundation based** support to comprehensively empower the complex giant system of a city. According to the principle of “co-building and co-sharing under integrated planning” , we will **create a digit base for cities connected by things, data and intelligence**. The Opinions stress the need for **systematic planning of the “urban neuronal system”** , and scientific deployment of sensing terminals relating to video images, monitoring sensing, control and execution, to achieve a comprehensive AIoT covering all major urban elements. The Opinions also emphasize the need to build an **urban intelligence hub** highlighting “lightweight, centralization, and sharing” .
- The Opinions state the necessity of facilitating **governance of digital transformation** and improving **effectiveness and efficiency of modern governance**. The Opinions also underline further development of “an integrated network for urban operations” with focus on public security, emergency management, planning and construction, urban grid management, traffic management, market supervision, ecological environment and other key areas, to achieve **general identification of all material issues, risk monitoring and warning, intelligent study and judgement of the trends, integrated scheduling of resources, human-machine collaboration**.

In May 2024, the National Data Bureau, together with other three national authorities, jointly issued the “Guiding Opinions on Deepening Development of Smart Cities and Promoting Urban Digital Transformation across All Sectors “ (the “Opinions” ) --- “**National Model**”

### 2024.5, 四部委发布《关于深化智慧城市发展 推进城市全域数字化转型的指导意见》 - “全国模式”

The Opinions state that **Integration, development and application of data** shall be adopted throughout the construction of **urban digital transformation covering all sectors**, so as to better secure **high-quality development, high-efficiency governance and high-quality life** of cities.

- The Opinions indicate that efforts should be made to accelerate the **digital transformation and intelligent operation of public facilities** such as urban buildings, roads and bridges, gardens and green spaces, underground pipeline corridors, water conservancy and water services, gas and heat, environmental and sanitation, and to **coordinate the deployment of resilient intelligent sensory terminals covering ubiquitous network**. The opinions also point out that it is essential to establish a **commonness foundation for urban digitization**, build an **intelligent hub for urban operation and governance with unified planning, architecture, standards, and operation and maintenance**.
- The Opinions explicitly propose to promote **targeted and refined urban governance**, deepen the development of “an integrated network for urban operations” , facilitate the integration of data throughout the entire process of urban planning, construction, management, operation and maintenance, capitalize on the intelligent hub of urban operation and governance to integrate multiple functions such as state perception, modelling analysis, urban operation and emergency command to **achieve general identification of situation, intelligent study and judgement of trends, coordinated and efficient handling, prompt response in scheduling, and rapid switch in case of emergency**.

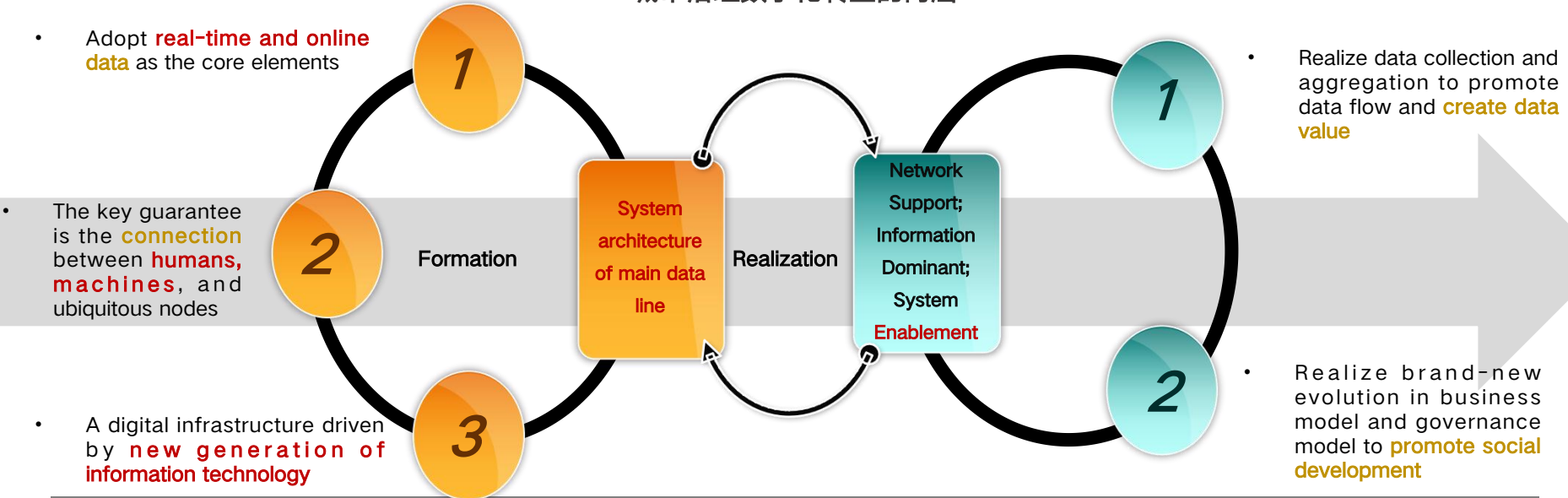
## II. Understandings on Digital Transformation of Urban Governance

### 城市治理数字化转型的认识理解

Digital transformation of urban governance: relying on the **urban perception system**, with **real-time online, cross domain multimodal data** as the core element, following the system architecture of the data mainline and the basic principles of the network information system, through **the close integration of data and scenarios**, realizing the value of data, and promoting the modernization of the urban governance system and governance capacity.

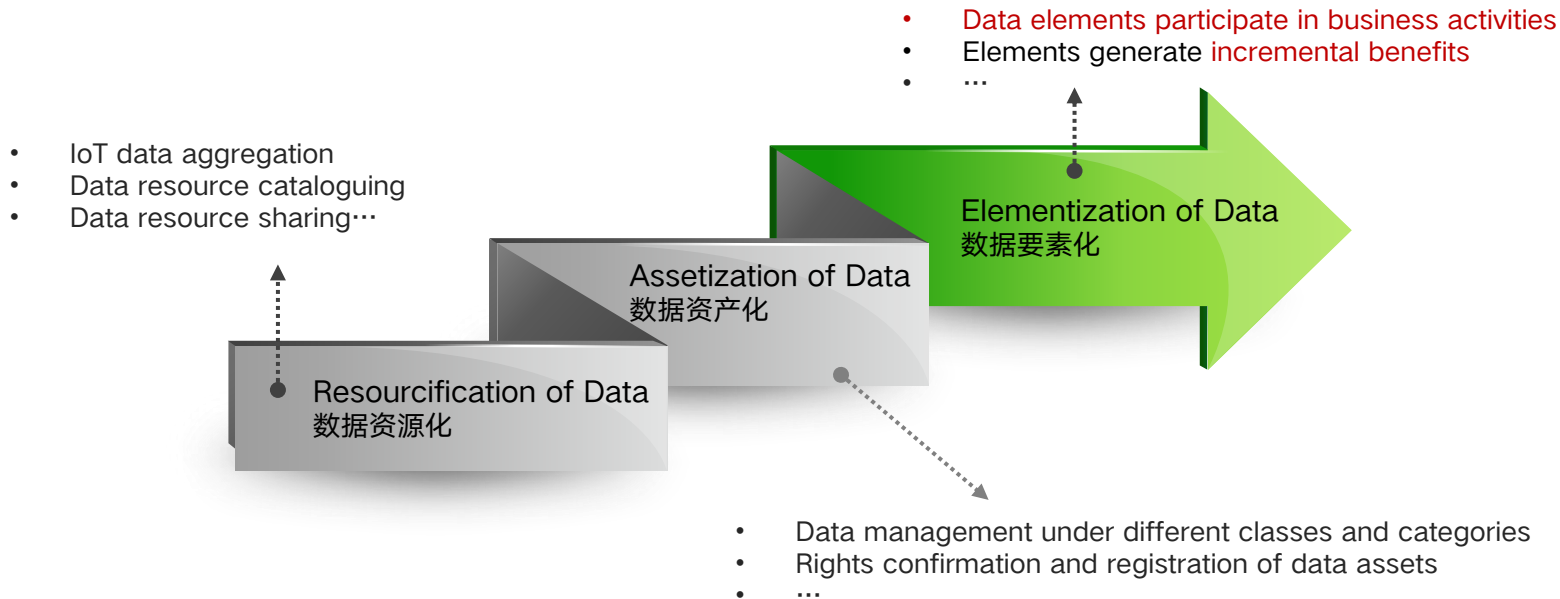
### The connotation under Digital Transformation of Urban Governance

#### 城市治理数字化转型的内涵



From the **resourcification** and **assetization** of data to the **elementization** of data, we continuously promote a good atmosphere for data development and utilization that is clear in rights and responsibilities, smooth in circulation, and safe and orderly. Data elements are data assets that deeply participate in social and economic business activities and bring value to the owners and operators of data.

从数据的**资源化**、**资产化**，进一步到数据的**要素化**，不断推进权责清晰、流转顺畅、安全有序的数据开发利用良好氛围，数据要素是数据深度参与社会、经济的经营活动，并为数据的所有者和经营者带来价值的**数据资产**。



## Co-development of digitalization and security

1. Information security is the **major prerequisite** and **essential** in the process of digital transformation

数字化转型过程中信息安全是大前提，必不可少

2. Information security should be **taken into account** when making **planning, design, construction and deployment** for the digitalization project.

信息安全要和数字化项目**同规划、同设计、同建设、同部署**

### Full-dimensional data architecture security

#### 全维数据架构安全

- Data security (blockchain, privacy computing and data encryption...)

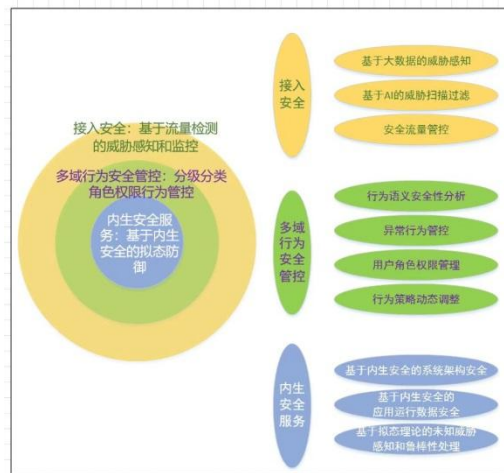
数据安全（区块链、隐私计算、数据加密、....）

- Computility security (independent and controllable, hardware security, trusted computing chips...)

算力安全（自主可控、硬件安全、可信计算芯片、...）

- Algorithm security (trusted AI models, algorithm governance...)

算法安全（可信AI模型、算法治理、...）





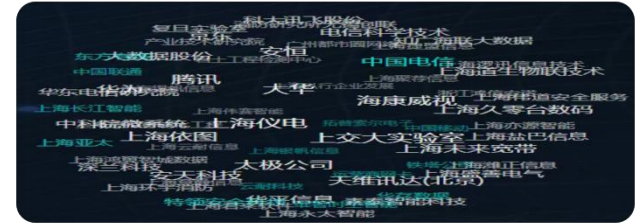
## Scenarios Traction and Diversified Ecology 场景牵引和多元生态

### Intensify scenarios traction 强化场景牵引

- Adhere to the principle advocating “overall planning, people-oriented, scenario traction, and urgent use going first”, and strengthen construction of application scenarios, so as to make us generally recognized by the grass-root units and civilians with effective practical use.

### Build diversified ecology 构建多元生态

- Promote the construction of application scenarios in key areas in an orderly manner through strengthening the core functional scenarios, refining the social and livelihood related scenarios and optimizing the urban governance scenarios, and develop a new type of cooperation with joint participation of diversified parties.



# III. Construction Elements of Perception System in the Digital Transformation of Urban Governance 城市治理数字化转型中感知体系的建设要素

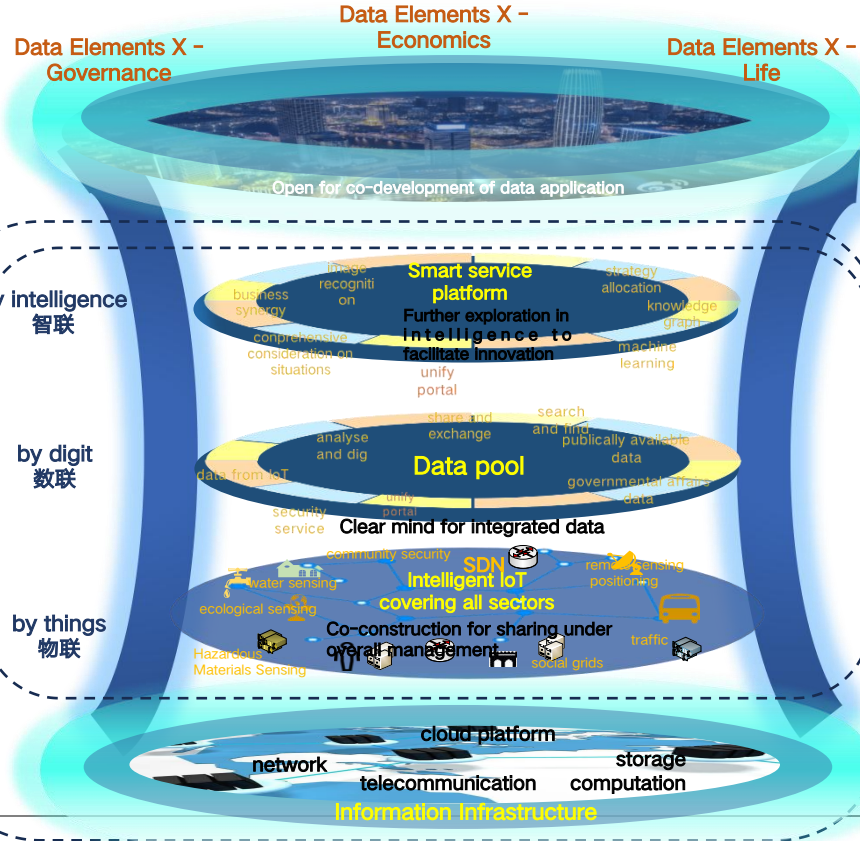
## Conceptual Framework for Digital Transformation of Urban Governance 城市治理数字化转型的理念架构

Applications of vertically coherence and horizontally connection

Multi-connection 众联

The "real-time digital foundation" integrating connection in things, data and intelligence, is an important component of digital infrastructure and also a core carrier of the "Data Elements X" initiative.

Traditional safety + endogenous safety 内生安全



Data is alive, and only real-time, fresh and online data and data foundations can generate value and benefits of the Data Element X initiative.

Take all-life cycle of data as the main line to build a system architecture integrating sensing, transmission, processing and empowerment.

All-life cycle data operation 数据全生命周期运营

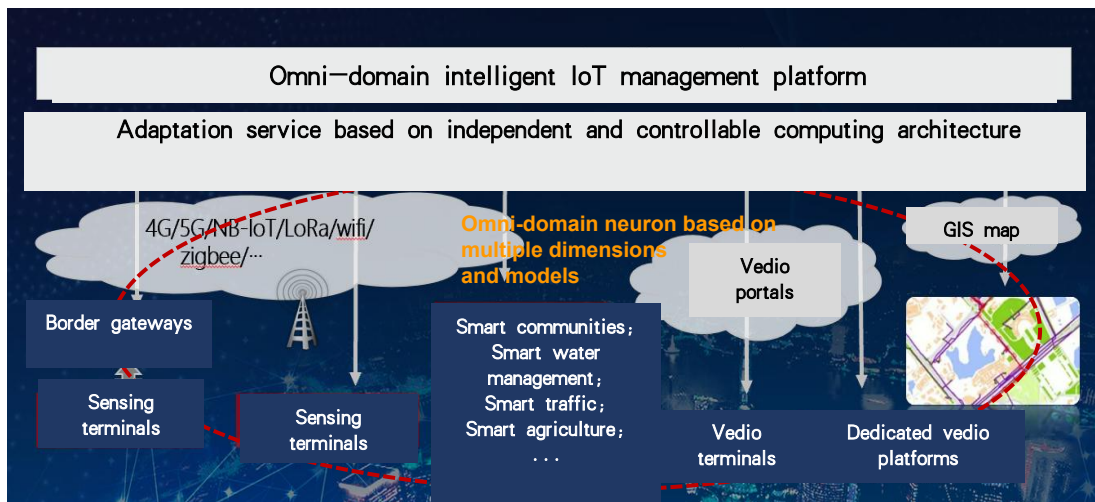
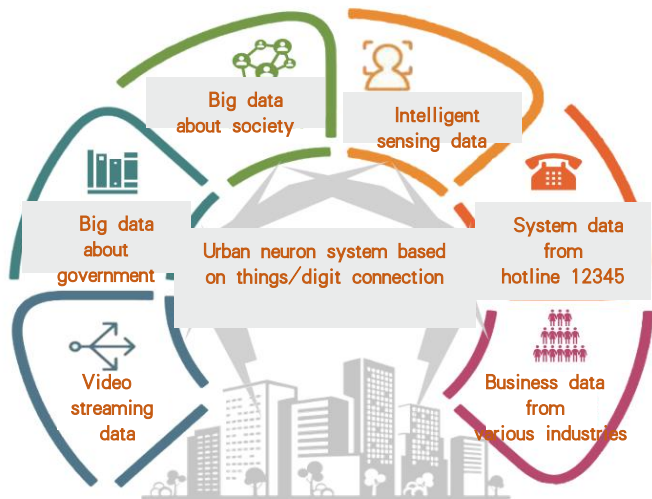
Digital Infrastructure 数字基础设施

Real-time Digital Foundations 实时数据底座



Core Elements One of the Perception Systems  
感知体系的核心要素一

Omni-domain neuron system based on multiple dimensions and models (full transparency)  
多维多模态全域神经元体系（全透明）



Core Elements Two of the Perception Systems 感知体系的核心要素二

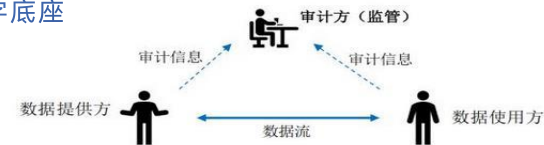
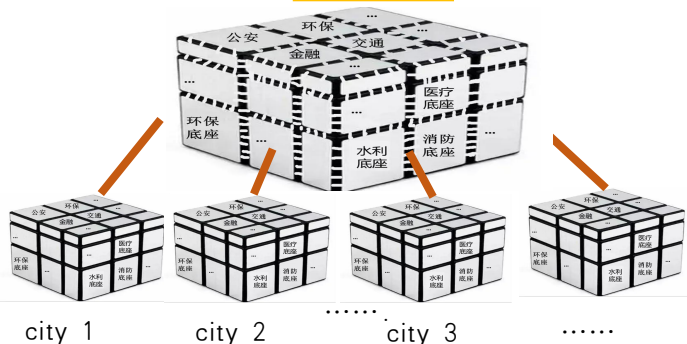
Distributed unified safety digital foundation 分布式统一的安全数字底座

Distributed Unified Digital Foundation 分布式统一数字底座 (分布式)

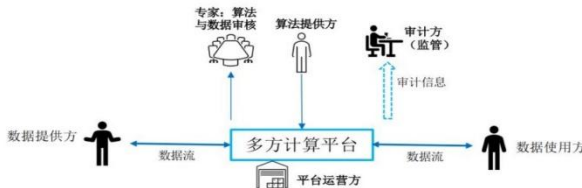
Integrated applications across various regions, networks, cities and sectors

跨域、跨网、跨城、跨行的一体化应用

Flow of data



Visible data available for use (applicable for data exchange models, data auditing...)  
数据可用又可见 (数据交换模型、数据审计...)



Data available for use while not visible (applicable for multi-party computation, federated learning, zero-knowledge proof...)  
数据可用不可见 (多方计算、联邦学习、零知识证明...)

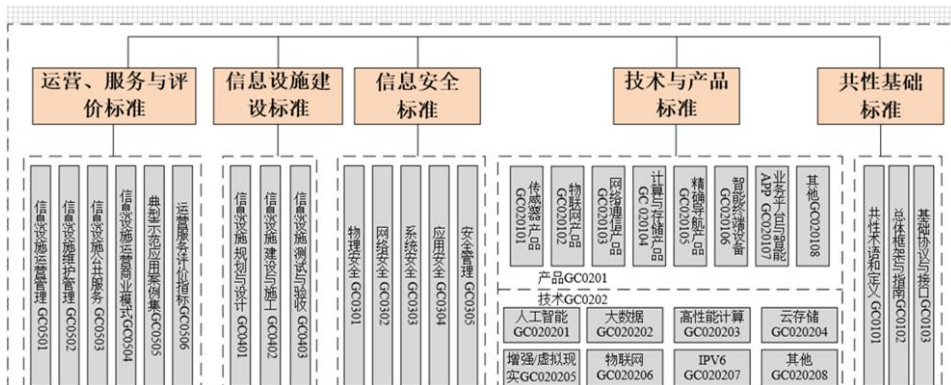
Subject to the compliance regarding data security and privacy, **federal learning, multi-party secured computing, zero-knowledge proof** and other technologies are applied to achieve “data availability and invisibility”, so as to deliver a balance among data security, privacy protection and data regulation.

## Core Elements Three of the Perception Systems 感知体系的核心要素三

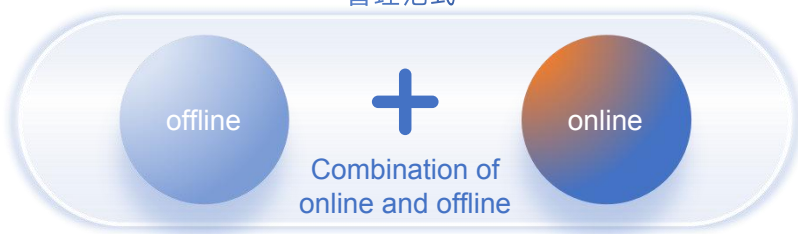
Standardized system and management concept 标准体系与管理范式

### Technical standards 技术标准

#### Technical standards for digital transformation 数字化转型技术标准



### Management concept 管理范式



Core Elements Four of the Perception Systems  
感知体系的核心要素 四

Unified system framework of openness (flexibility and resilience)  
统一开放的体系架构（柔性和韧性）

Unified system framework of openness (flexibility and resilience)  
统一开放的体系架构（柔性和韧性）

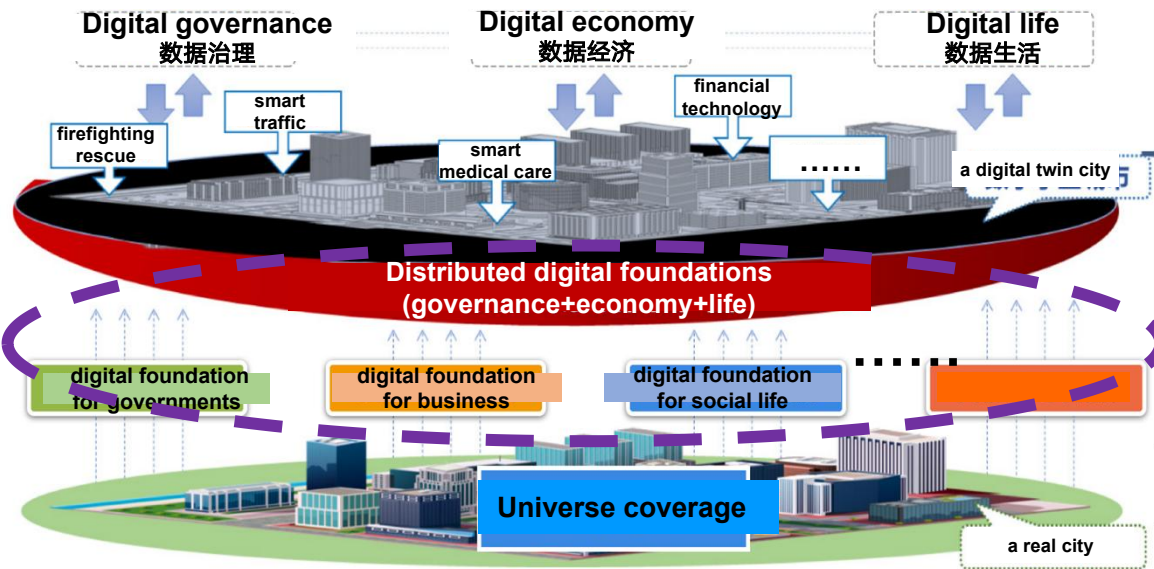
- vertically cohered (covering all-life cycle of data)  
纵向打通（数据全生命周期）

- horizontally connected (Data Elements X)  
横向互联（数据要素X）

- sound coordination (system and mechanism)  
协调有力（体制机制）

- generally applied as modules and plugules  
模块化、插件化

- security of algorithm, data, computility and architecture  
算法、数据、算力和架构安全



Combination of business applications, modularisation of system functions and integration of digital foundations

## Core Elements Five of the Perception Systems 感知体系的核心要素 五

### Market-driven diversified industry ecology 市场驱动下多元行业生态

Strengthen co-building of diversified ecologies and distribution of the value arising from flow of data elements, and promote efficient allocation of digital resources

强化多元生态共建和数据要素流动价值的分配，推动数字资源高效配置

#### Extension of digital foundations 数字底座延伸

Business focus has been expanded to ToB and ToC from ToG, which provides governance support in respect of economic and life data under the Data Elements X and thus promotes growth of digital foundations

#### Role of government functions 政府行业作用

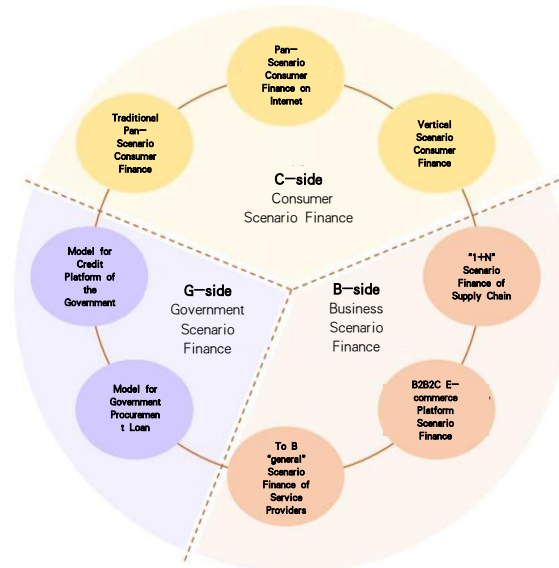
Play the role of governments in market direction, to realize market-oriented allocation of data elements

#### Role of market-oriented system 市场主体作用

Capitalize on the market-oriented system, to realize value allocation resulting from fair and reasonable allocation of economic value of various sources of data

#### Role of functional platforms 功能平台作用

Effect the role of functional platforms, to achieve data supervision sharing mechanism



Taking Financial Industry for Instance 以金融行业为例



Core Elements Six of the Perception Systems 感知体系的核心要素 六

Institutional Empowerment (Program of Head in Charge) 体制赋能 (一把手工程)

Institutional Empowerment 体制赋能

Process Re-engineering, Distribution of Authority and Responsibility 流程再造, 权责分配



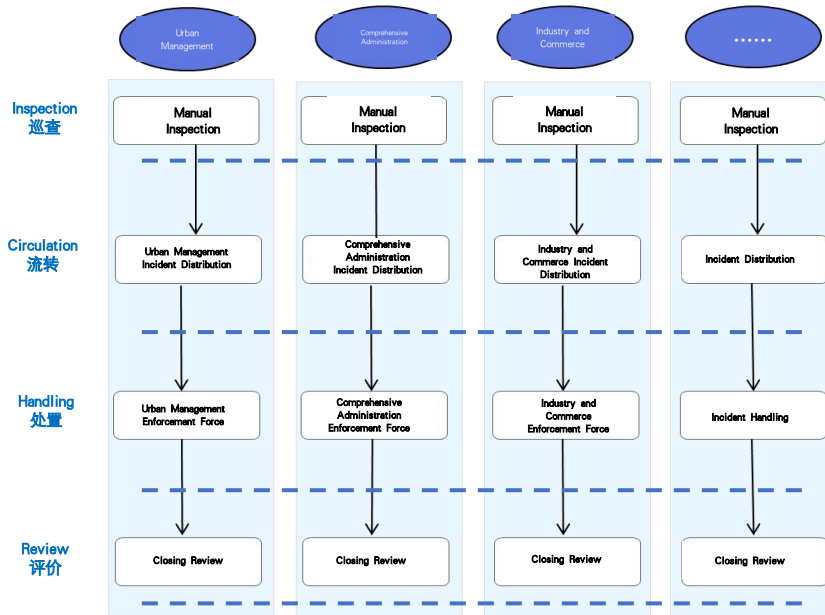
Taking Subdistrict Office for Instance 以街道为例

Re-engineering of processes driven by digitization 通过数字化倒逼流程的再造

Isolated strip management 孤立的条状管理

Transformed into block management 转型为块状管理

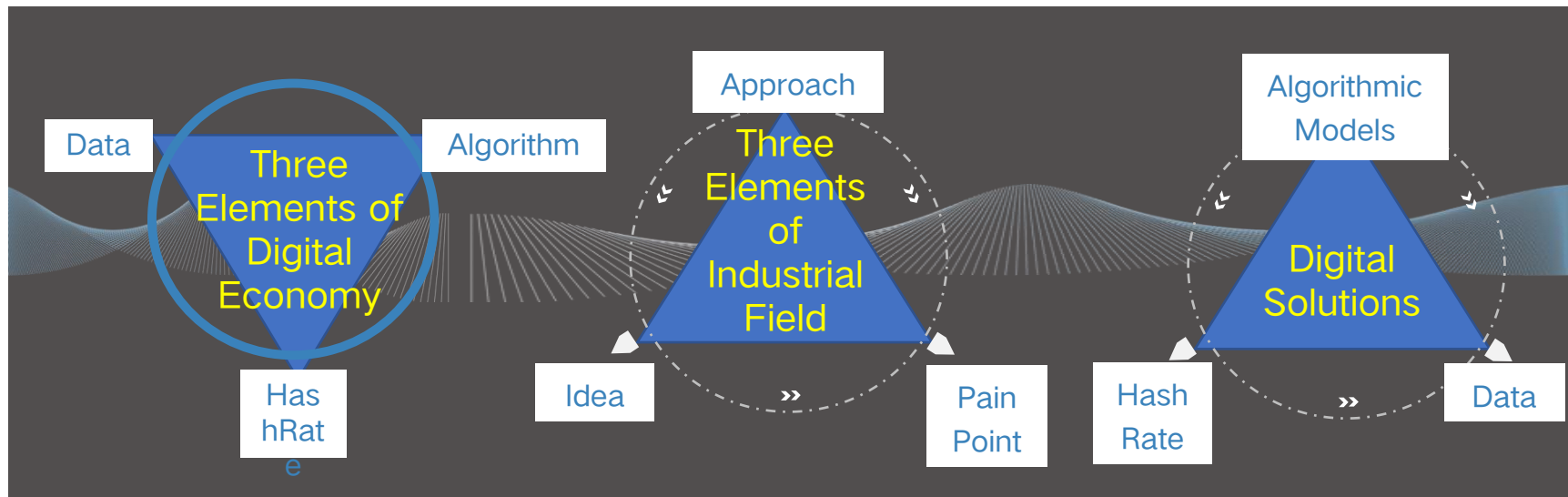
Enhancing network-based aggregation effect and horizontally and vertically integrated synergy and interaction capabilities 提升网络聚能和横向、纵向、一体化协同联动能力





# Technologists + Industry Experts = Digital Solutions

懂行的人+懂技术的人=数字化解决方案



Algorithm models are both technology and system.  
The increasingly deep integration of algorithms and business is a development trend  
算法模型既是技术，又是制度  
算法与业务越来越深度融合是一个发展趋势

## 城市治理数字化的实践成效

### Urban Digital Foundation (Internet of Things, Digital Internet, Intelligent Internet)

#### 城市数字底座（物联、数联、智联）

- Construct a **unified digital foundation** for urban operations with integrated **planning, architecture, standards, and operations & maintenance**. Build an **open, compatible, and universally empowering** digital infrastructure environment that is secure and reliable, and promote the integrated deployment of digital resources such as algorithms and models.
- Comprehensively integrate the **urban IoT perception neuron system**, incorporating perception neuron data sourced from various channels such as government agencies leading, operators maintaining, and ecosystem partners collaborating. A total of **409 types** and **374 million** sensing terminals have been connected, providing real-time, online, and dynamic data on urban operations.
- Integrate multi-dimensional, multi-source, and multi-model data from **IoT perception data, government-shared data, and publicly available social data** to collectively support data-driven elements across thousands of industries.



Establish a unified digital infrastructure for urban operations with standardized planning, architecture, criteria, and maintenance.

构建统一规划、统一架构、统一标准、统一运维的城市运行数字底座

### Digital System for Urban Water Management

#### 城市数字水务系统

- Monitor and sense the **38,400 kilometers** of water supply network in Shanghai, comprehensively enhancing the **regulation and safety assurance of water pressure, flow, and quality** throughout all stages, including water sources, water plants, pipelines, and secondary water supply.
- Achieve **one-stop** monitoring and management, precise **alerting for emergencies, refined management** of water supply operations, and **continuous feedback, tracking, reporting, and remediation** of data quality.



Warning, positioning, and disposal. The emergency response time for water supply pipeline rupture has been reduced from 2–3 hours to 40 minutes.

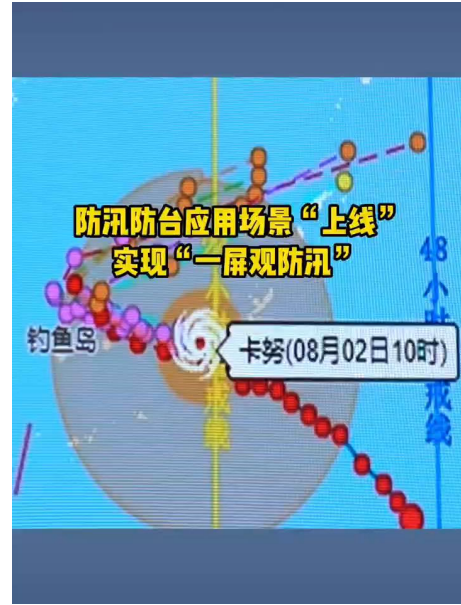
预警定位处置，供水管道爆裂应急处置时间由原来的2-3小时，缩短到40分钟

## 城市治理数字化的实践成效

### Digital Platform for Urban Flood and Typhoon Prevention

#### 城市防汛防台数字平台

- Full regional coverage: Continuous monitoring of all areas, including **underpasses, flood-prone roads, vulnerable communities, overflowing waterways, and construction sites.**
- Full element integration: A unified display of governance elements, including **meteorological information, emergency supplies, response forces, and command systems.**
- Full direction perception: **Integration of IoT sensing, video surveillance, and hotlines for public sentiment.**
- Full cycle tracking: Interface with grid disposal platforms and emergency command systems to achieve **automatic detection, online transfer, on-site responses, and real-time feedback for lifecycle management.**
- Successfully implemented and applied in Shanghai, Chengdu, and other cities



Change from “manual observation” to “intelligent prevention and control”, and there will be no more flood season safety accidents after the system goes online.

变“人工盯防”为“智慧防控”，系统上线后再无出现汛期安全事故

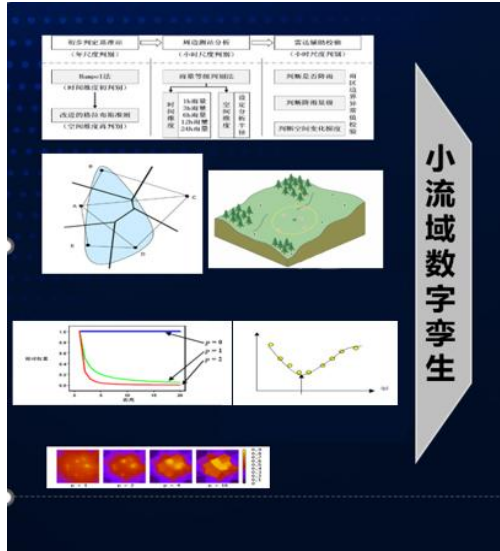


## 城市治理数字化的实践成效

### Smart Water Conservancy: Digital Defense for Mountain Flood

#### 智慧水利：数字山洪防御

- Building on spatiotemporal big data under mountain flood disasters, realizing the “four pre” functions of **predicting, pre-warning, pre-exercising, and pre-planning** for mountain flood disasters, enhancing the defense capabilities against mountain flood disasters in **small watersheds** supported by **data, algorithms, and computing power**.
- Currently implemented in 7 provinces including **Yunnan, Shaanxi, Hubei, and Hunan**.



Through the deduction of risk and hidden danger scenarios, the accuracy of early warning, the extension of foresight period, and the ability to quickly and accurately guide personnel to avoid mountain floods have been improved.

风险隐患情景推演，提高预警精准度、延长预见期、快速准确指导人员避险的山洪防御能力

### Digital Command Platform for Major Events – F1 Chinese Grand Prix Service

#### 重大活动数字化指挥平台-F1中国服务大奖赛

- Serving at the forefront of **safeguarding national major events**, providing technical support for the emergency safeguard platform.
- Focusing on the four key elements of “**people, vehicles, roads, and industries**,” the system consists of five sections: **Situation Overview, Spectator Flow, Smart Transportation, Event Operations, and Race Live**, along with a **3-D digital twin map**. Relying on the integration of three-dimensional real-scene maps and various data aggregations, it presents a panoramic view of the event situation, **further enhancing the capacity for large crowd safety and emergency response efficiency**.



Operating in real-time on a digital foundation, the system conducts analysis, early warnings, and responses based on data elements such as crowd flow, traffic, parking, and public sentiment.

实时运行于数字底座上，基于客流、交通、停车、舆情等数据要素进行研判、预警和处置



**Through the new generation of perception and digital intelligence technology, we will promote the construction of urban digital infrastructure, build a foundation in Shanghai and radiate across the country, and strive to open up the main artery of digital infrastructure and smooth the circulation of data resources, creating an integrated digital infrastructure that is vertically connected, horizontally interconnected, coordinated and powerful. We will comprehensively deepen the construction of smart cities and promote the digital transformation of the entire city. The development of the digital economy cannot be separated from a high-quality ecosystem. We sincerely hope that countries can strengthen connectivity and jointly promote coordinated regional economic development to achieve broader economic prosperity!**

通过新一代感知与数智技术推动城市数字底座的建设，筑基上海、辐射全国，致力于打通数字基础设施大动脉、畅通数据资源大循环，打造纵向贯通、横向互联、协调有力的一体化数字基础设施，全面深化智慧城市建设、推进全域城市数字化转型。

数字经济的发展离不开优质的生态圈，真挚希望各国之间能够加强互联互通，共同推动区域经济协同发展，以实现更广泛的经济繁荣！

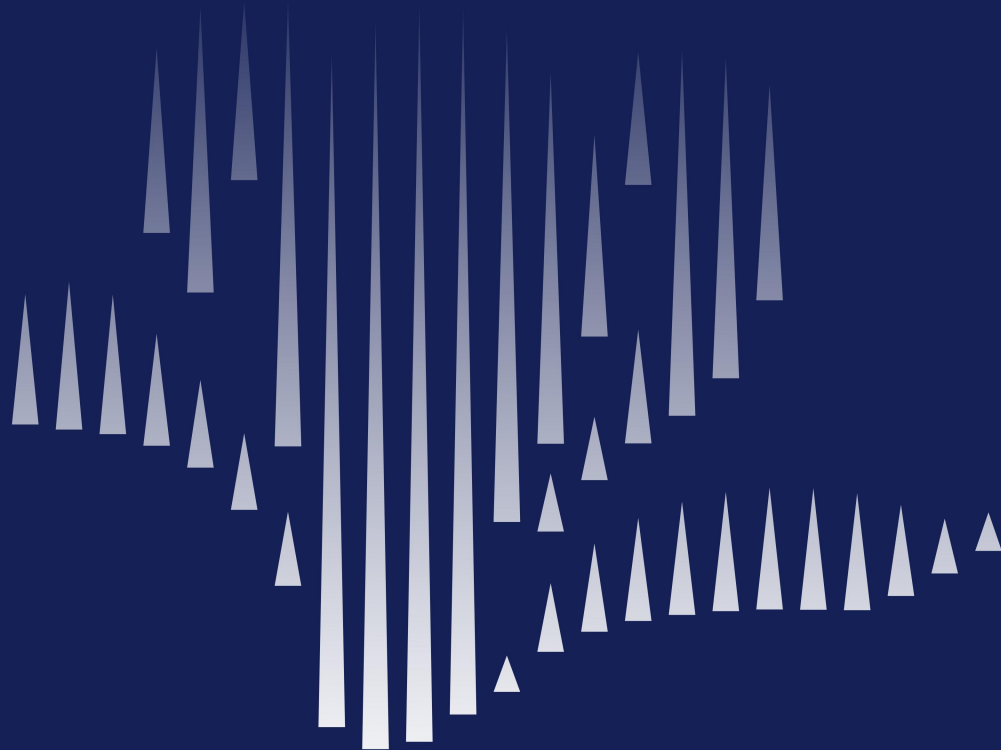
SUSTAINABLE  
DEVELOPMENT  
GOALS



2024数字治理国际会议  
INTERNATIONAL CONFERENCE ON DIGITAL GOVERNANCE

# INTERNATIONAL CONFERENCE ON DIGITAL GOVERNANCE 2024

数字治理国际会议



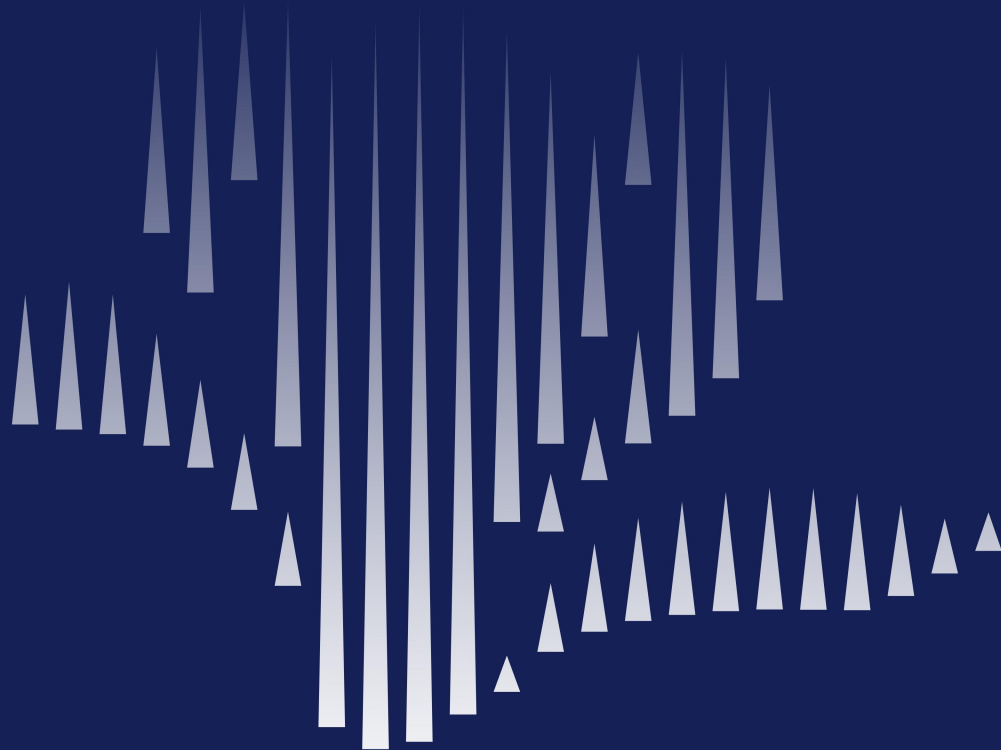
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数字治理国际会议



SUSTAINABLE  
DEVELOPMENT  
GOALS



2024数字治理国际会议  
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数字治理国际会议

