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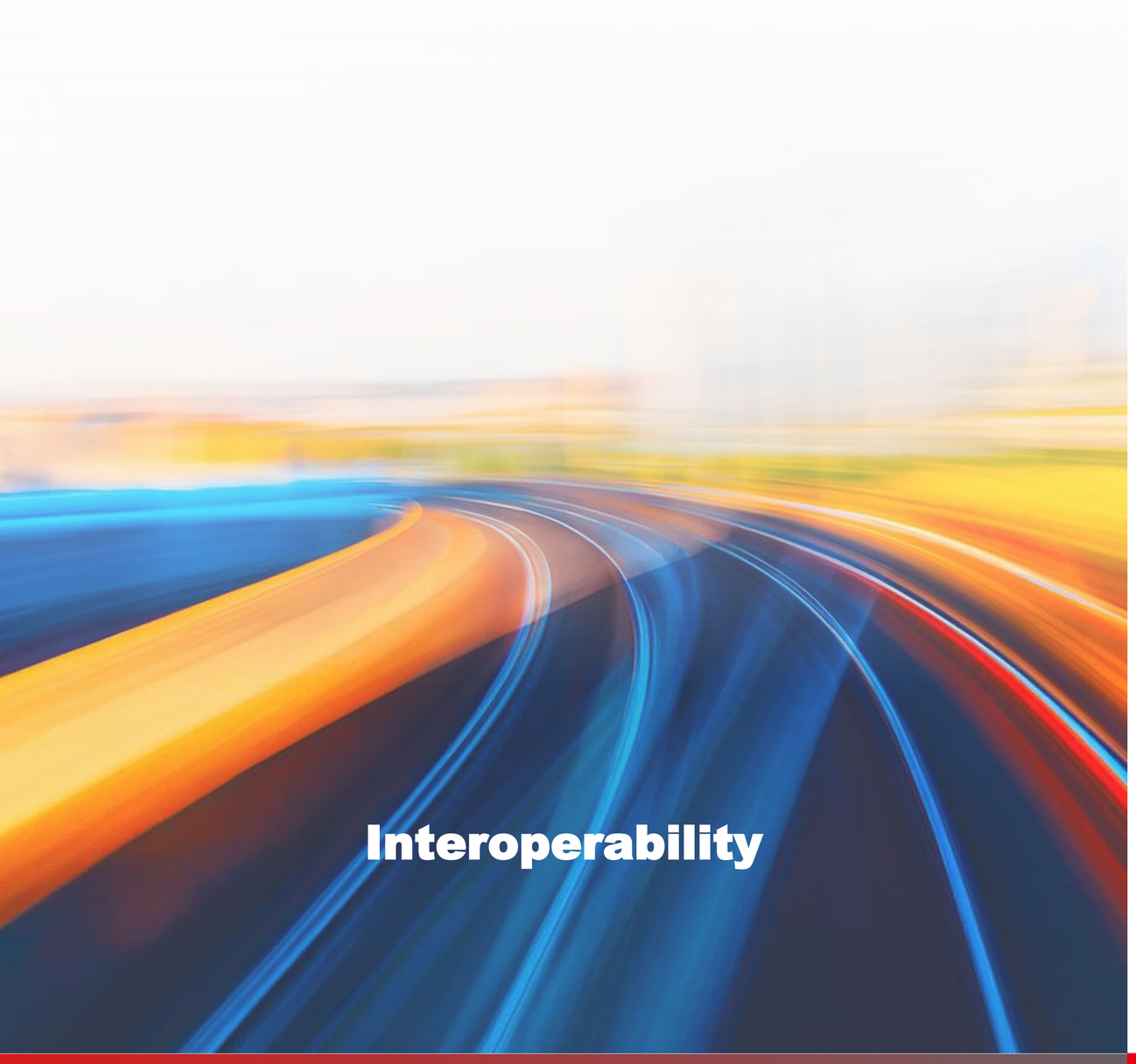
深化亚太铁路运输数字化高级别会议



中国周边国家铁路标准互联互通研究课题介绍

Research on the Railway Standards Interoperability of China&Neighboring Countries

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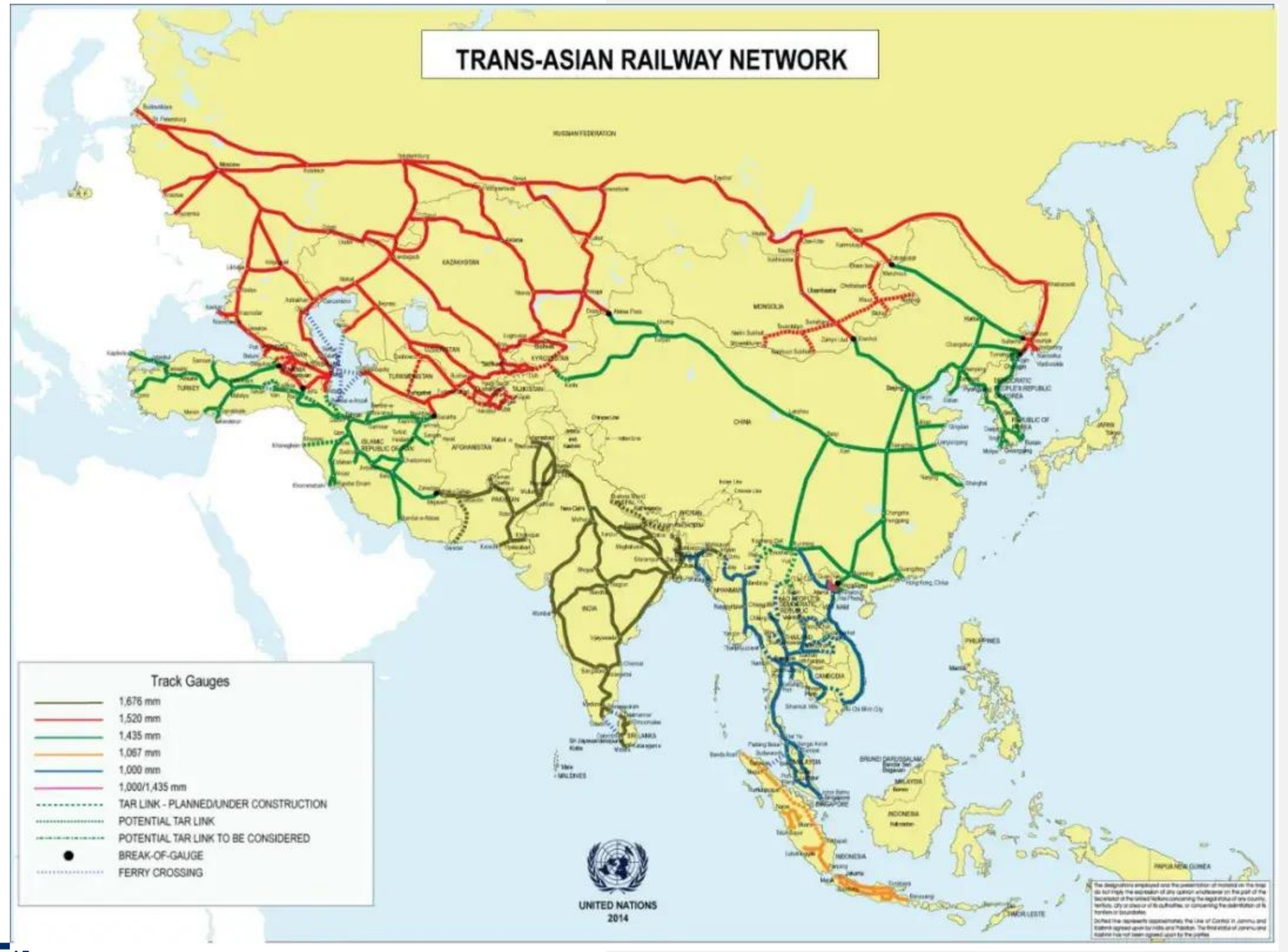
背景和意义
Background and Significance



背景和意义
Background and Significance

中国与周边国家铁路国境站和轨距表
Railway border stations and gauge between China and neighboring countries

我国与邻国 China and Neighboring countries	中国国境站 Border station(in China)	邻国国境站 Border station(in Neighboring countries)	中国铁路轨距（mm） Gauge in China	邻国铁路 轨距 Gauge in neighboring countries (mm)
中朝 China-DPRK	丹东	新义州	1435	1435
	集安	满浦	1435	1435
	图们	南阳	1435	1435
中越 China-Vietnam	凭祥	同登	1435	1435/1000
	山腰	老街	1000	1000
中俄 China-Russia	满洲里	后贝加尔	1435	1520
	绥芬河	格罗迭科沃	1435	1520
	珲春南	卡梅绍瓦亚	1435	1520
中哈 China-Kazakhstan	阿拉山口	多斯特克	1435	1520
	霍尔果斯	阿腾科里	1435	1520
中蒙China-Mongolia	二连浩特	扎门乌德	1435	1520
中老China-Laos	磨憨	磨丁	1435	1435

背景和意义
Background and Significance

- China has 14 neighboring countries in total, but currently, only six countries including Russia, DPRK, Mongolia, Kazakhstan, Laos and Vietnam have achieved railway connections with.
- The development level of railways between China and neighboring countries varies greatly. There are 4 types of gauges, different axle loads and structure gauges, multiple types of signal systems and different operational regulations. The lack of railway standards interoperability has restricted the development of railway infrastructure, and the corrider capacity is far behind the transportation demands.

- 中国陆地接壤的邻国多达14个，目前仅与俄、朝、蒙、哈、老、越6国实现了铁路联通。
- 中国与周边国家铁路的发展水平参差不齐，存在4种轨距、不同轴重和限界、多种信号系统以及不同的运营规定，铁路技术标准不统一制约了中国与周边国家间铁路基础设施发展，通道运输通而不畅。
- 本次研究对象包括基础设施子系统、能源子系统、命令与控制子系统、机车车辆子系统等。

背景和意义
Background and Significance

Basic Needs

- Enhancing Railway Transport Service Quality;
- Promoting Regional Economic Integration;
- Advancing Sustainable Railway Development;
- Upgrading National Technical Standard Systems;

基本要求

- 提升铁路运输服务质量;
- 促进区域经济一体化;
- 推动铁路可持续发展;
- 升级国家技术标准体系;

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背景和意义
Background and Significance

Basic principles

- Safety and Health;
- Technical compatibility;
- Enhence the reliability and availability of the service;
- Environment sustainability;
- Promote accessibility for people with disabilities and those with limited mobility.

基本原则

- **确保安全和健康**：确保铁路网络的安全性，保护乘客和工作人员的健康。
- **确保技术兼容性**：确保铁路基础设施和车辆的兼容性。
- **实现服务的可靠性和可用性**：确保铁路服务的可靠性和可用性。
- **促进环境的可持续性**：通过减少对环境的影响来推动铁路系统的环保。
- **促进残疾人和行动不便人士的无障碍性**：确保铁路系统对所有人的可达性。

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研究过程
Research process

- Site Investigation of the current situation of railways in Thailand, Vietnam, Laos and Kyrgyzstan;
- Site Investigation of the cross-border railway transfer stations, etc.
- Site Investigation of the latest technology of variable-gauge bogies and multiple-gauges turnouts;
- Technical seminars and workshops;
- Preliminary technical report, and to determine the core technical elements related to the interoperability.

- **调研泰国、越南、老挝、吉尔吉斯斯坦等国家铁路现状；**
- **调研铁路换装站等现状；**
- **调研变轨距转向架、套轨道岔技术；**
- **召开多次技术研讨会；**
- **编写课题中间成果报告，确定互联互通的核心要素。**

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研究初步成果Preliminary research results

Infrastructure subsystem

- **Structure gauge and axle load** are core elements in the structures.
- **Design speed, fleet length (for freight), and platform length (for passenger)** are of great significance for line classification and determining the main technical standards.
- **The Distance of centers of lines** and **maximum slope** are core elements for the alignment.
- **The distance from the edge of the platform to the center of the adjacent track** are the core elements in the station .
- For track system, **gauge, cross section of rail and equivalent conicity** are core elements for interoperability.

基础设施子系统

- 在结构中，**建筑限界**和**轴重**是互联互通线路的2个关键要素。
- **设计速度、列车长度（货运）、站台长度（客运）**对于线路分级和确定铁路主要技术标准非常重要，为关键要素。
- 线路平面中的**线间距**、**限制坡度**为关键要素，平曲线半径、竖曲线半径为非关键要素。
- **站台边缘距相邻股道中心距离**为关键要素。
- 轨道设计中**轨距**、**钢轨断面**、**等效锥度**为互联互通关键要素。

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研究初步成果Preliminary research results

Energy subsystem

- The voltage and frequency of the traction power are core element,e.g. AC 25 kV 50 Hz for the national railway mostly. The shift of the locomotive should be matched with the traction power model to meet the safety power collection requirements for cross-line operation.
- For OCS, the height of the contact line, the maximum wind deflection and the pantograph gauge are core element. When the catenary parameters are different, a transition section between needs to be set up to ensure smooth running.

能源子系统

- 供电系统中，牵引网的供电电压和频率为关键要素，宜保持一致。推荐的供电系统标准为交流25 kV 50 Hz。牵引供电制式不一致，供电制式的转换应与车辆受电方式相互匹配，满足跨线运行的安全取流要求。
- 接触网系统中，接触线高度、最大风偏、受电弓限界为关键要素。接触网尺寸不一致时，需要在两者之间设置过渡段，确保列车不同系统间平稳过渡。

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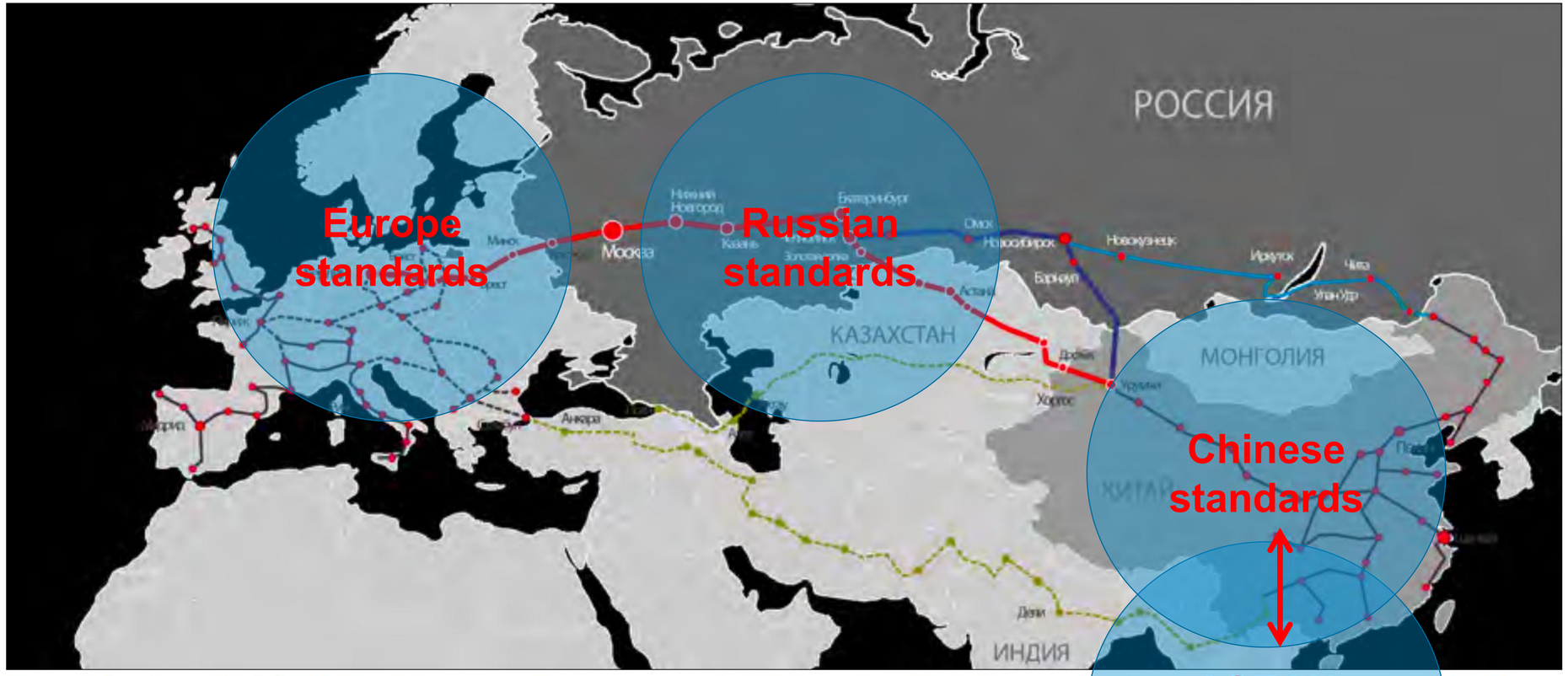
研究初步成果Preliminary research results

通信和信号系统

Figure III–46 EuroAsia corridor route



Source: High Speed Rail (HSR). EuroAsia Project. Presentation at the UIC Intercity & High-Speed Committee, London, 7 September 2017.

研究初步成果Preliminary research results

Communication and Signal System

- The signal systems in SEA countries are diverse in Vietnam, Thailand, Malaysia and other countries, mostly adopt relatively traditional systems such as **mechanical/electrical and relay interlocking**.
- The middle corrider of the Pan-Asia Railway is currently compatible with the China-Laos Railway and Thailand HSR by adopting Chinese standards. Future connections should consider interoperability (such as the EEC HSR, the Bangkok-Malaysia HSR, etc.), and overall principles and common requirements need to be considered in terms of **vehicle-ground communication, trackside devices, testing and certification, etc**. In this regard, the Chongqing Rail Transit Interoperability Standard (**i-CBTC**) provides a good example.
- The signal system between the trunk lines and the secondary lines (such as in China and Vietnam), are currently different, it is considered to adopt **two or more sets of on-board devices** to achieve interoperability.

通信和信号系统：

- 东南亚地区国家铁路信号制式多样，越南、泰国、马来西亚等大都采用**机械/电气、继电联锁等**比较传统的信号系统；
- 泛亚铁路中线主通道，目前中老铁路、中泰高铁均采用中国标准，可以实现兼容。未来连接应尽可能采用可互联互通的信号系统（比如EEC高铁、曼谷至马来西亚高铁等），需要在***车地通信、地面设施协同、联合测试与认证***等方面规定总体的原则和共同要求；在这方面，**重庆市轨道交通互联互通标准（i-CBTC）**提供了很好的范例。
- 在主干道与周边次干道、主干道之间（比如中国和越南）等信号系统制式目前不统一的情况下，考虑采取**2套或多套车载系统**实现兼容；
- 高等级向低等级应尽可能向下兼容设计，低等级系统未来可逐步升级为统一标准。

研究初步成果**Preliminary research results**

RS subsystem

Maximum load; Axle load; Maximum fleet length; RS gauge; Braking characteristics; Noise limit value; EMI; AC; People with limited mobility; Maximum pressure variation in the tunnel; Maximum slope; The geometry of the pantograph; Maintenance (train maintenance of fixed facilities), etc.

机车车辆子系统

互联互通基本要素有：最大载荷；轴重；最大列车长度；车辆限界；制动特性；车辆电气边界特性；车辆机械边界特性；外部噪声限值；电磁干扰边界限值；空调相关限值；行动不便人员运输相关特性；隧道中最大压力变化；最大坡度；受电弓弓头几何；维修（列车维护固定设施）等。

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下一步工作
Next step work

- Set up a technical expert group from multiple countries，to suggest common standard;
- Establish the basic principles and requirements based on the core technical elements of standard interoperability;
- Summarize the current standards related to interoperability in various countries;
- Encourage innovative transitional technical solutions related to cross- border operation.

- 形成多个国家共同参与的技术专家组，建立共同标准；
- 形成基于标准互联互通关键要素的基本原则和要求；
- 在调研基础上总结形成各国互联互通相关技术标准的现状；
- 形成跨国界运行创新的过渡性技术解决方案。

Thank you
for your attention



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