Testbed Overview in China

Xiaohong Huang

Beijing University of Posts and Telecommunications

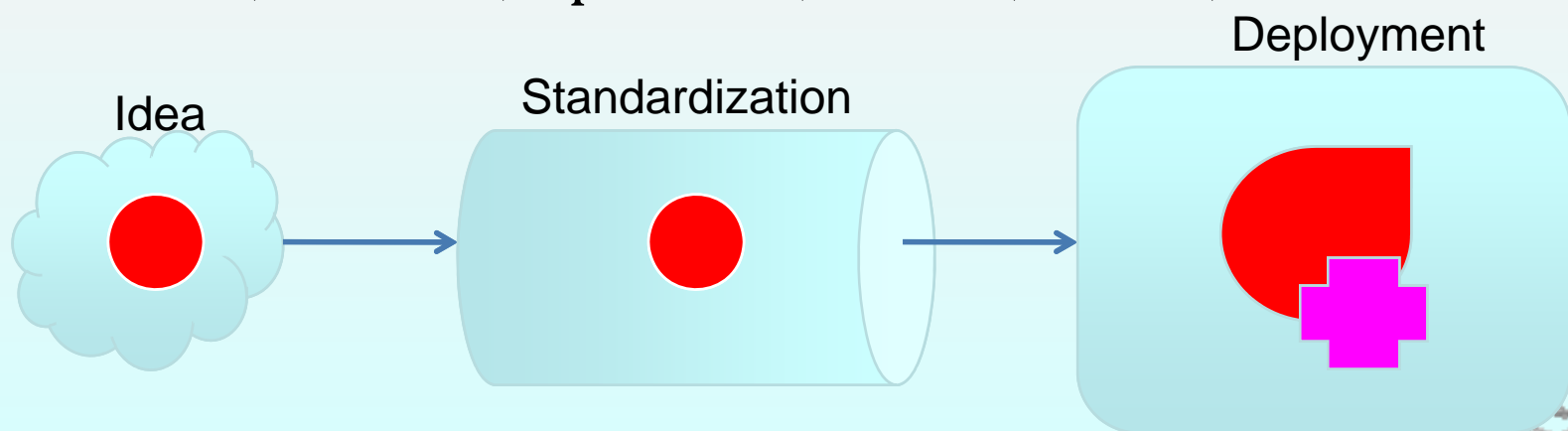# Agenda
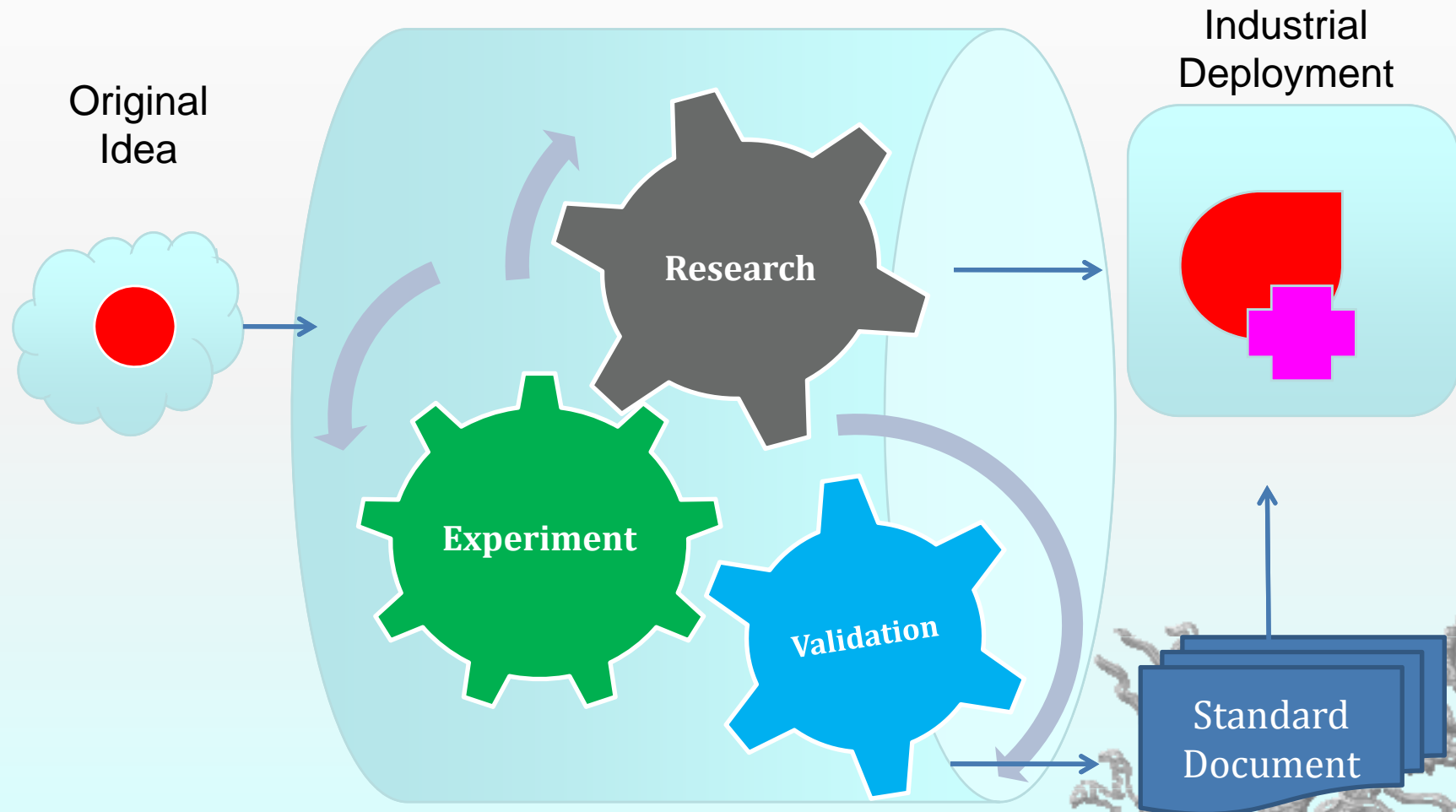
◈ Projects in China

◈ Testbeds in China

◈ Testbeds in BUPT

Why we need testbeds

- Long process from idea to final deployment

- Hard to test new ideas

- Technology needs innovation

- Testbeds in other countries
  PlanetLab, Emulab, OpenFlow, Seattle, ORBIT, …

Deployment

Standardization

Idea

Testbed with Standardization process

Original
Idea

Research

Experiment

Validation

Industrial
Deployment

Standard
Document

Current open testbeds used in China

- Planetlab
  - Universities currently join Planetlab
    - 北京邮电大学 Beijing University of Posts and Telecommunications
    - 中科院声学所国家网络新媒体工程技术研究中心 National NetWork New Media Engineering Research Center
    - 国防科学技术大学 National University of Defense Technology
    - 北京大学 Peking University
    - 解放军理工大学 PLA University of Science and Technology
   - 上海交通大学 Shanghai Jiaotong University
    - 清华大学 Tsinghua University
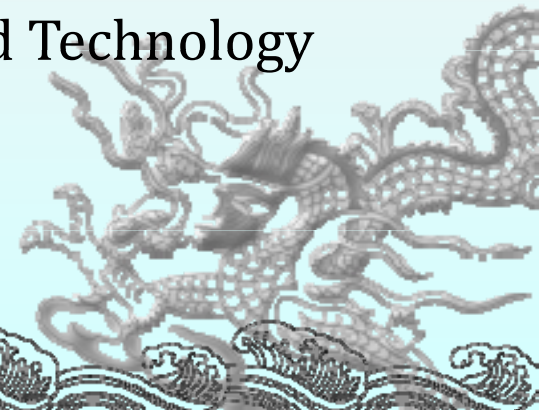
Why we need testbeds in China

- New technologies requires new types of testbeds
  - Network technologies in future Internet
  - Internet of things
  - Optical technology
  - Cloud computing
  - Etc
- The testbeds should support following tests
  - Network architecture
  - Key functions and algorithms
  - New services and applications
 - Performances
  - Etc
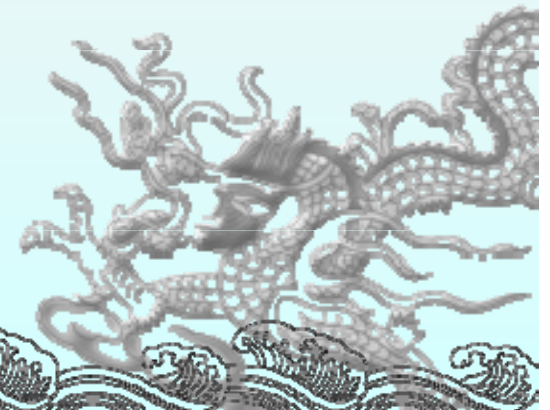
Testbed supported in different projects

- National Science and Technology Major Programs of 2011
  - Integrated Testing and Validation Evaluation Environment of Information-Convergence Sensor Network
  - Focus on sensor network system verification, performance measurement and analyze, and fault diagnose
- National 973 projects: Research on New Generation Internet Architecture
  - Integrated testing and validation platform for new generation Internet Architecture
  - Focusing on testing tools and network behaviour generator, which is able to generate different network process and import real network behavior
- National 973 projects: Research on Testable, controllable, manageable IP networks
  - Structure, modelling and testing for testable, controllable, manageable IP networks
  - Focus on the testing and validation of testable, controllable, manageable functions and algorithms
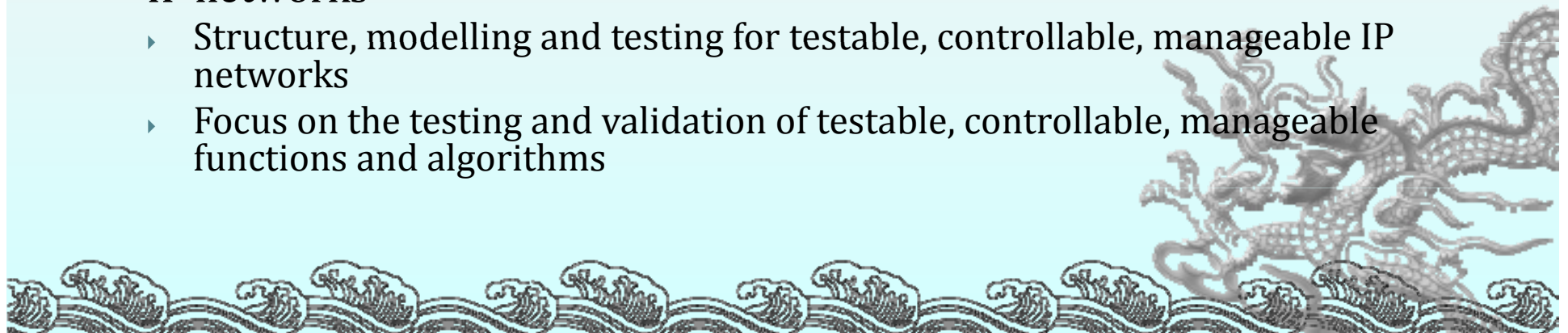
Testbed supported in different projects

- National 973 projects for Service-oriented Future Internet Architecture
  - Programmable, Virtualization-based, support new protocol and algorithm
  - Open, adaptable, extensible API for future internet services
  - New performance evaluation system and method
- National 973 projects for Reconfigurable Network
  - Reconfigurable network architecture
  - Adaptable to diversified service
 - Secure, administrable, and controllable
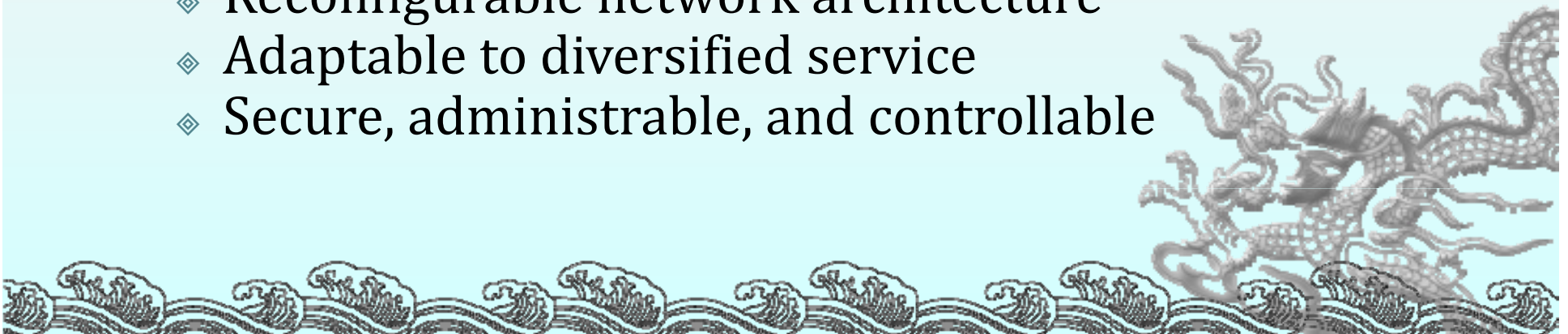
Testbed supported in different projects

- National 973 projects for Internet of Things
  - Basic theory and design methods of Internet of Things
  - Research on architecture of Internet of Things
  - Basic theory and practice of Internet of Things
  - Focus on testing and validation of key technologies of Internet of Things, for example architecture,
- The "Eleventh Five-year Plan" for National Key Project of Scientific and Technical Supporting Programs Funded by Ministry of Science & Technology of China
  - New generation trustable Internet testbed
  - Focus on the testing and validation of key technologies in trustable Internet, providing platform for new security services and network services

Testbed supported in different projects

- National 863 project
  - OTN based flexible and reconfigurable optical testbed
  - Focus on the testing of flexible scheduling of resources, convergence of IP and optical
- National 863 project
  - Research on Gbps wireless transportation key technologies and testbeds
  - Focus on FPGA based 1Gbps wireless transportation testbed
- National 863 project
  - New generation trustable network
  - Focus on a flexible and reconfigurable network, which is able to support the testing of tri-networks integration
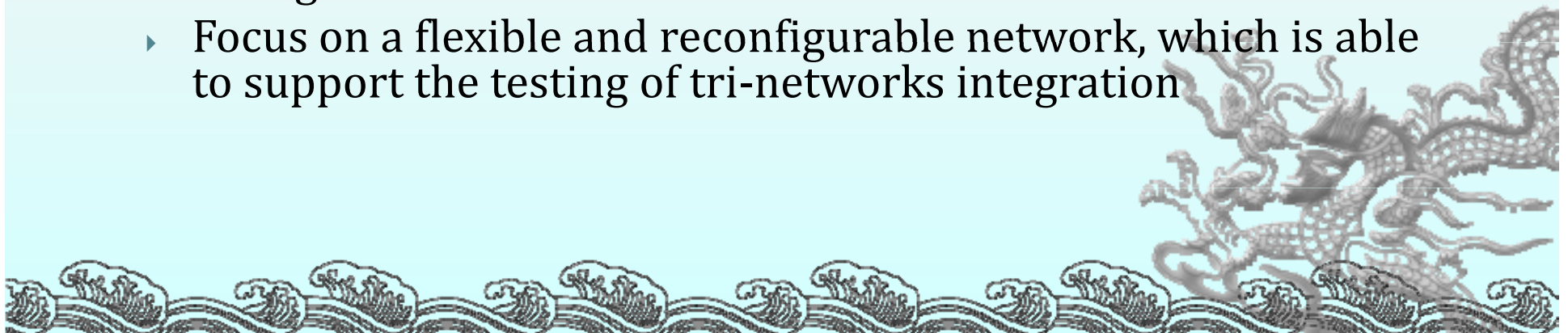
# Agenda

- Projects in China
- Testbeds in China
- Testbeds in BUPT

VegaNet

- Supported by National 863 projects
- Developed by Tsinghua University
- Overlay network on top of real networks
- Provide real network environment for network layer protocol experiments
- Real user traffics
- Support the importation of link failure and link recover

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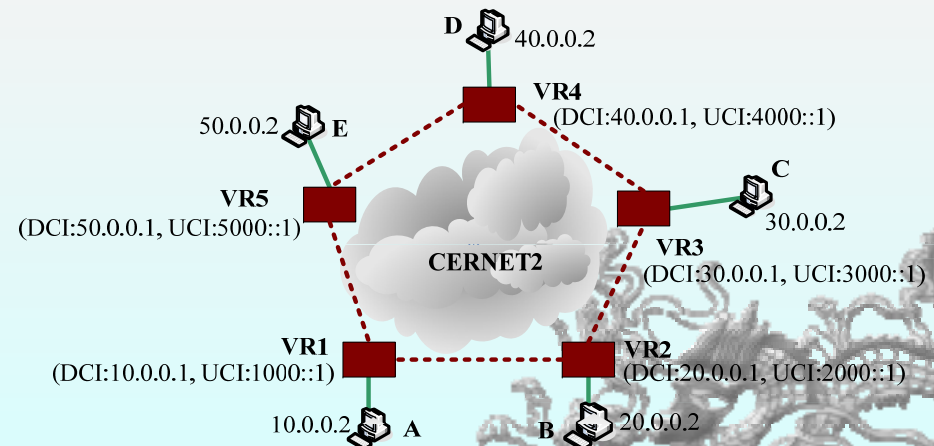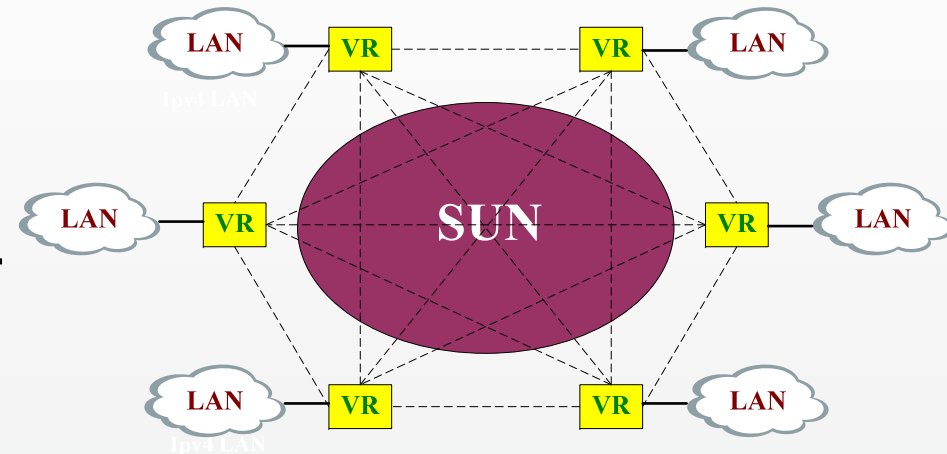
DragonLab

◈ Supported by National 973 and National 863 projects

◈ Developed by Tsinghua University and Ruijie Networks

◈ Support testing and validation of different types of network technologies, network devices, and application systems

◈ Support virtual network experiment

http://dragonlab.org/

GreenOrbs

- Developed by The Hong Kong University of Science and Technology, Xi'an Jiaotong University, Illinois Institute of Technology, Zhejiang A&F University, Hangzhou Dianzi University, Tsinghua University

- Provide environment real-time monitoring

- Include more than 1000 wireless sensor nodes

- Provide real testbed for large-scale wireless sensor networks

http://cn.greenorbs.org/

4G testbed

◈ Developed by Beijing University of Posts and Telecommunications

◈ Peak rate: up to 122Mbps

◈ Based on FPGA and DSP

◈ Support VoIP, steaming, high speed data download, Internet and other services

◈ Supported by MOST 863 "FuTURE" project
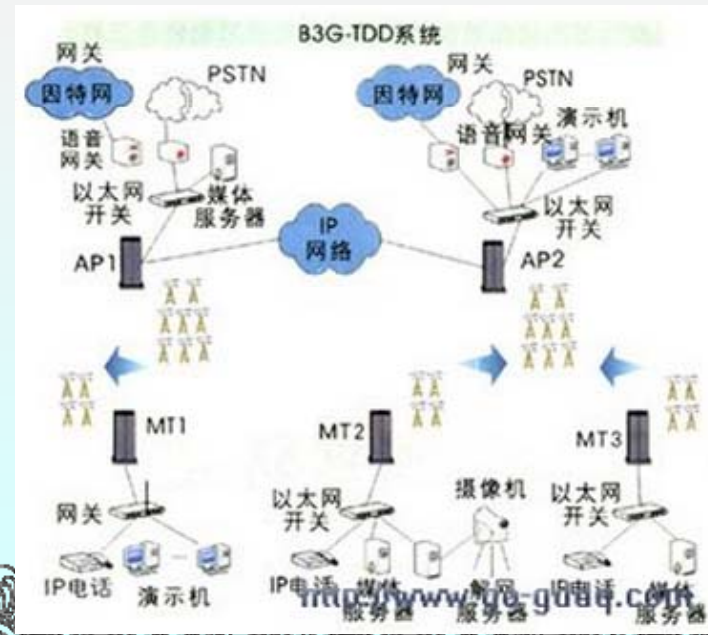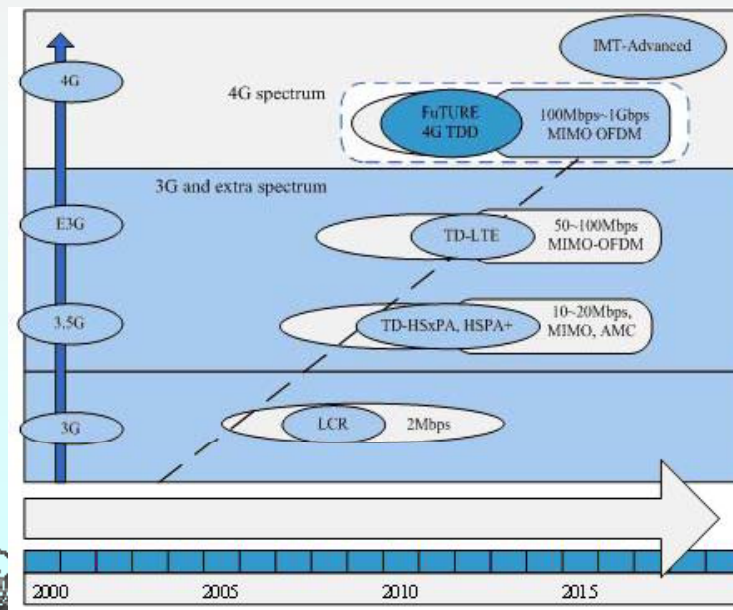
Optical testbed

- OTN-based flexible and reconfiguration optical testbed
- Developed by Beijing University of Posts and Telecommunications and ZTE
- Support following testing
  - Flexible scheduling of target resources
  - Automatic protection switching
  - Convergence of IP and optical
  - Etc.
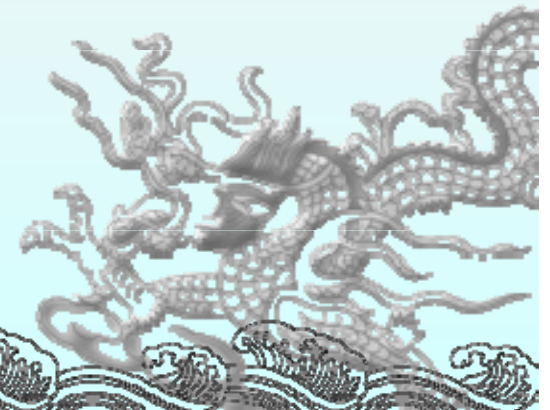
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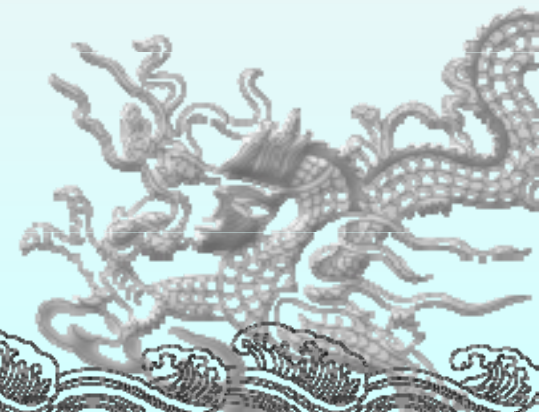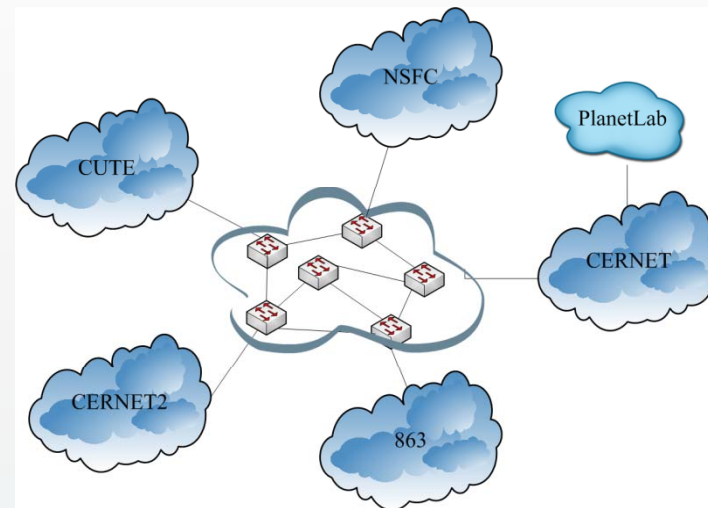
- Projects in China
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Objective

◈ Design a controllable and manageable testbed, supporting various testing and validation in IPv4/IPv6 network environment

◈ Support open, large network experiments, including application layer and network layer

◈ Based on CERENT, CERNET2, NSFC and other networks

◈ Support cross-domain experiments
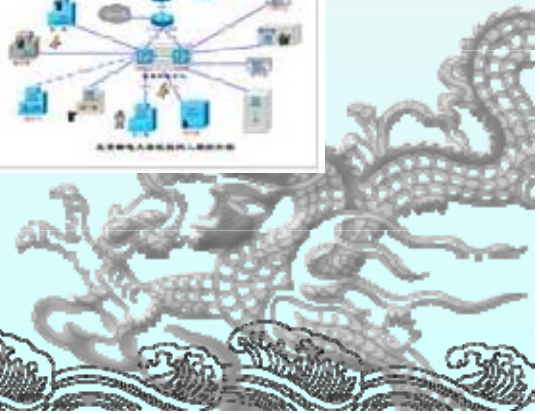
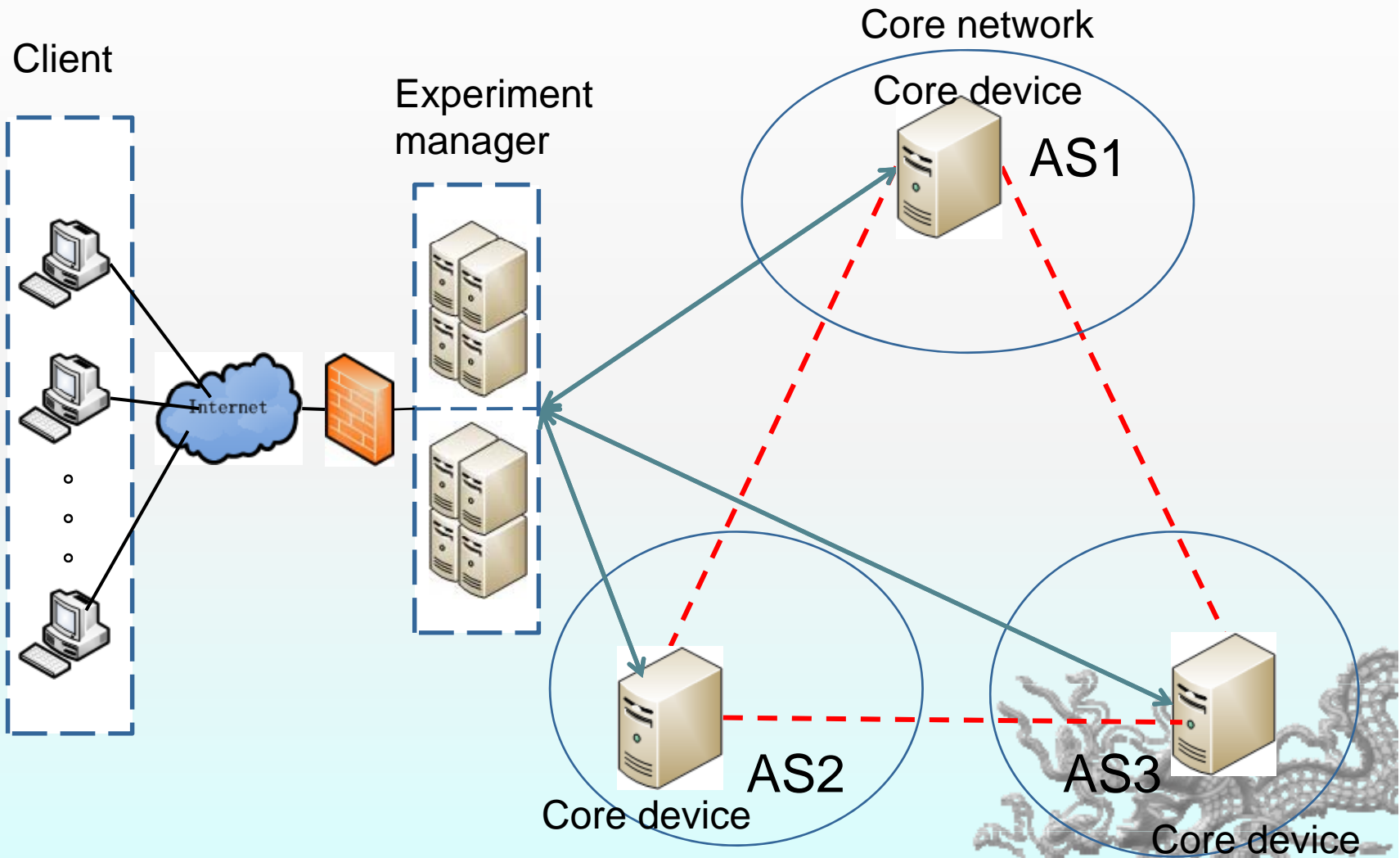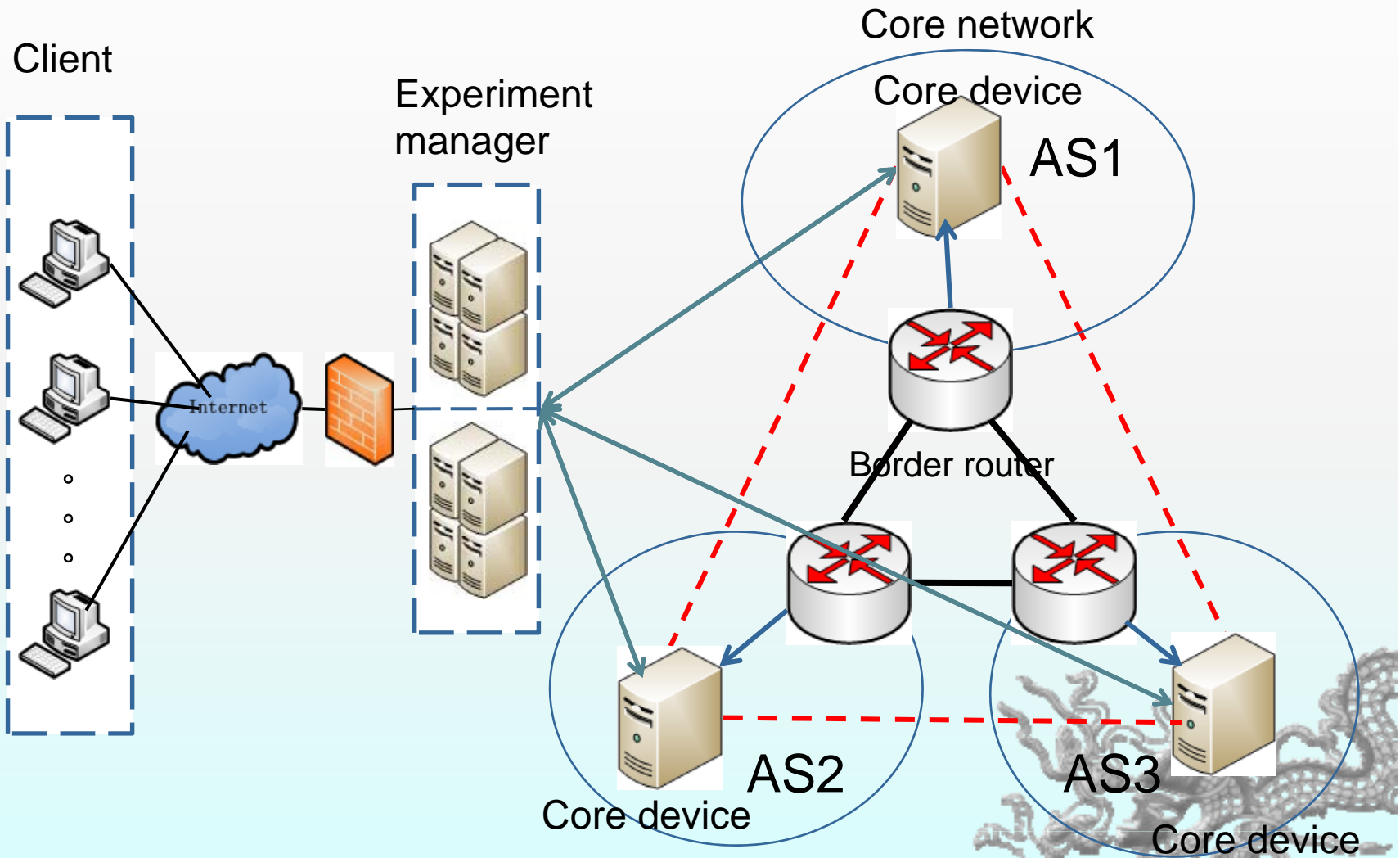# Network architecture

▸ Interconnection with real Internet

▸ 5 AS domains

▸ Support flexible configuration of network topology

▸ Support testing of new devices

▸ Support wired and wireless

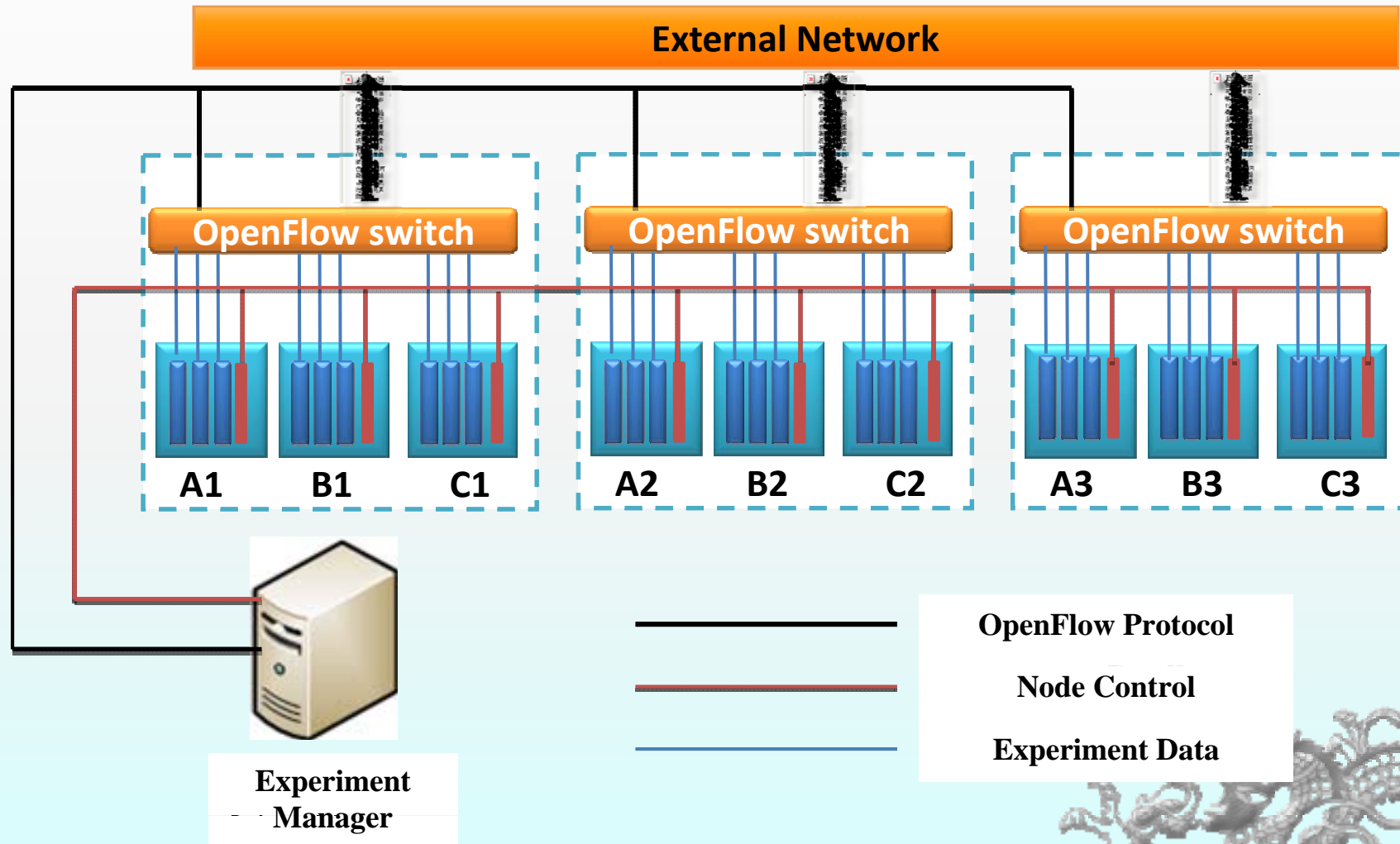▸ Support network time synchronization
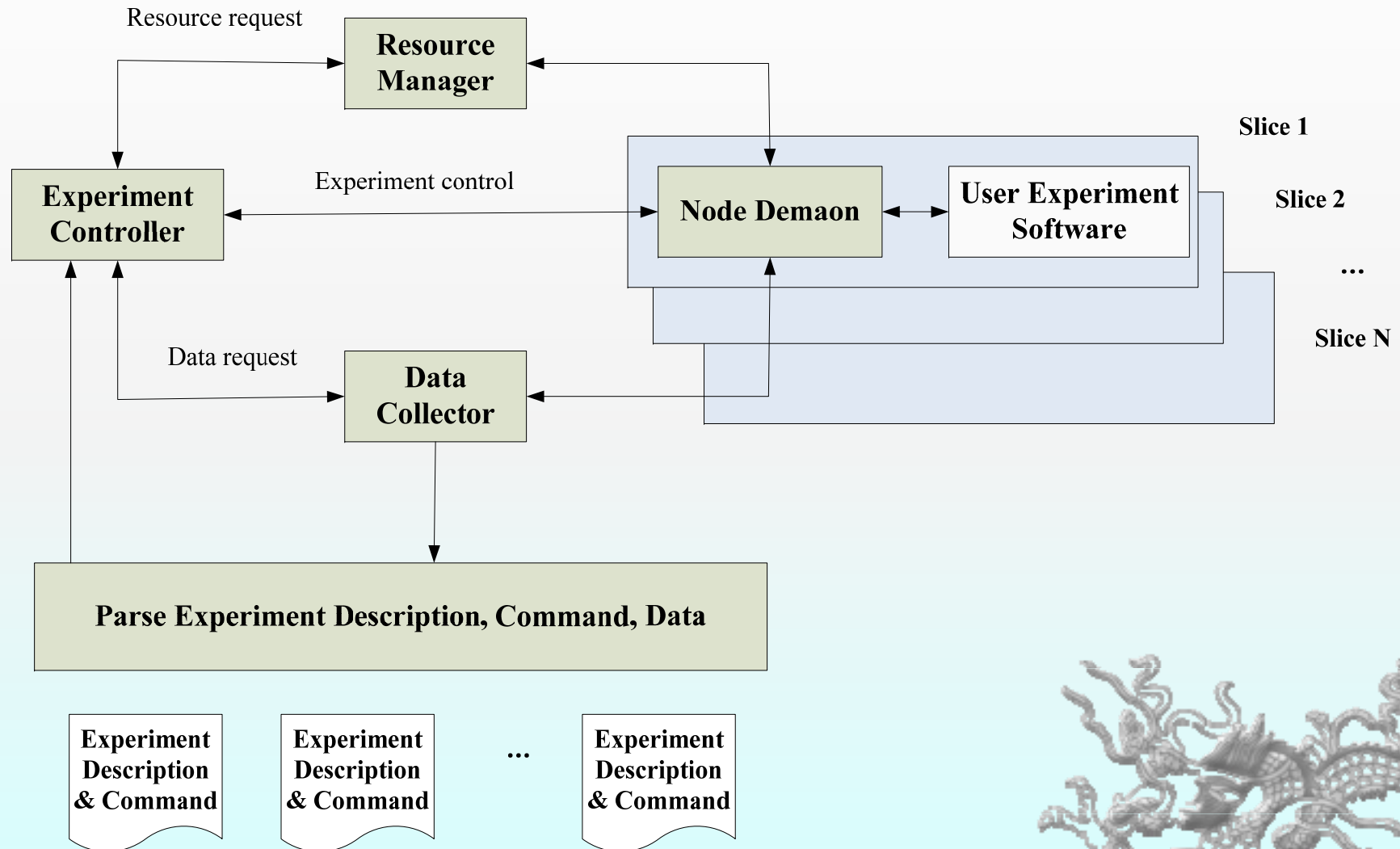
▸ Support the extension to IoT

System architecture

System architecture

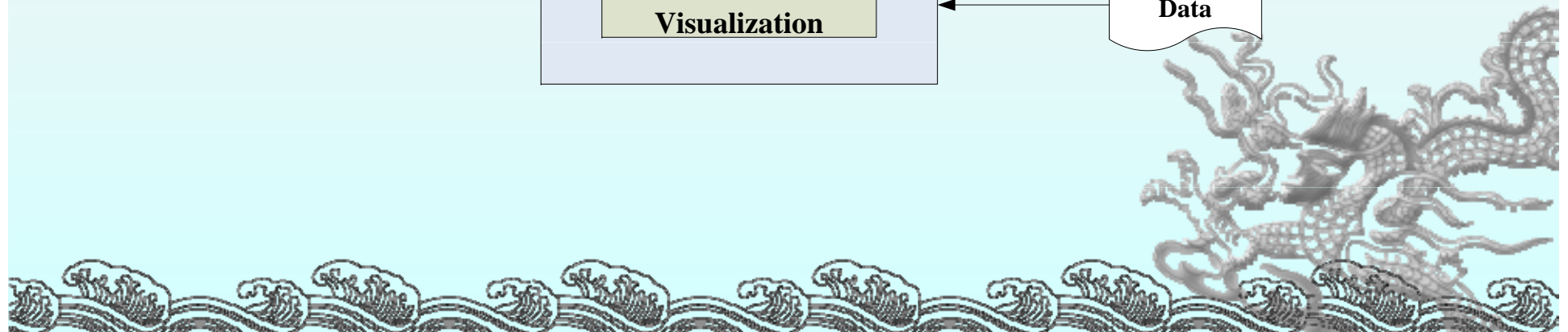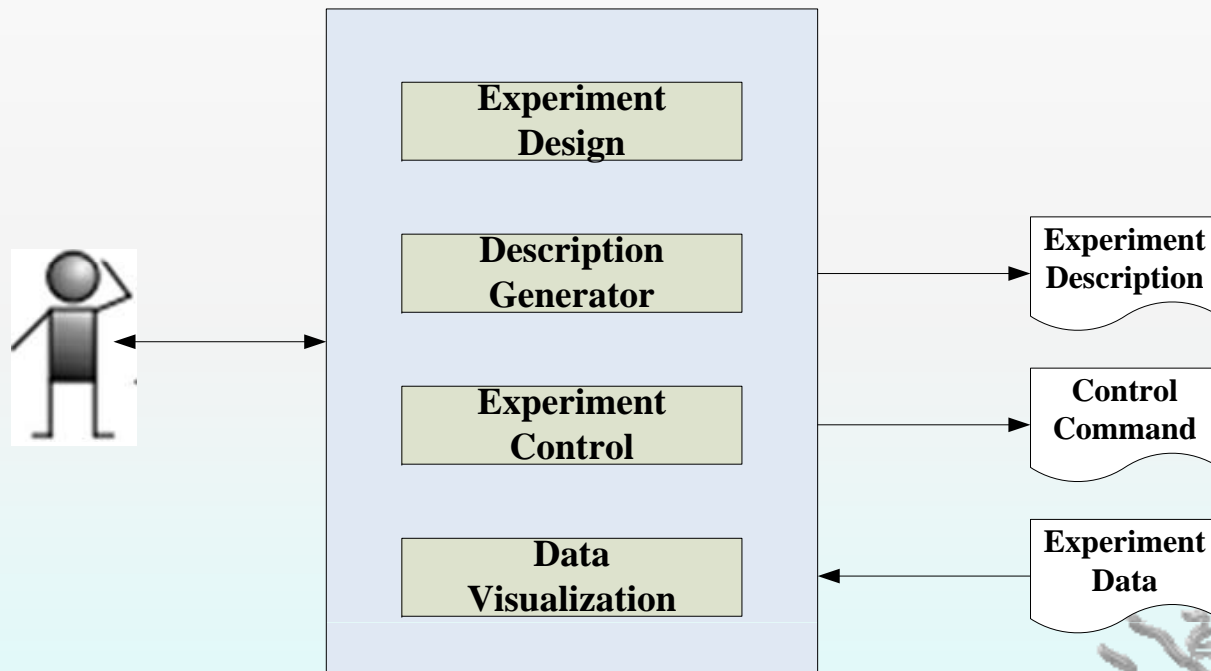# Core network

Experiment manager

Resource request

Resource Manager

Slice 1

Slice 2

...

Slice N

Experiment Controller

Experiment control

Node Demaon

User Experiment Software

Data request

Data Collector

Parse Experiment Description, Command, Data

Experiment Description & Command

Experiment Description & Command

...

Experiment Description & Command

Client

Future work

▸ Incorporate OpenFlow to exsiting network testbeds

▸ Extend OpenFlow to support IPv6

▸ Develop an uniform experiment description language

▸ Failure injection

▸ Evaluate new protocols and algorithms

▸ Collaborate with global testbeds such as GENI and FIRE

Thanks