

Campus Network Deployment in Xi 'an Jiaotong University



西安交通大学
XI'AN JIAOTONG UNIVERSITY



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Outline

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Background: basic Information of the University

- **Campus area:** around **310 hectares**
- **Total construction area:** approximately **4 million square meters**
- **Subsidiary organizations:** 31 colleges (departments, centers), 9 undergraduate schools, 3 directly affiliated hospitals, 1 affiliated kindergarten, and affiliated primary/middle/high schools.
- **Members:** **6,635** faculty members, **54,760** students
- **Residential:** **130** buildings with more than **10,000** households



1. Basic Information of the Campus Network

Since 1999, our university has been providing campus network services to teachers and students. Currently, we have established a converged network that integrates wired, wireless, Internet of Things (IoT), and 4G/5G technologies. This converged network forms a 100G high-speed ring network across our four campuses, with 100G/40G/10G access into each building, and gigabit/megabit speeds directly to desktops. The total export bandwidth of our campus network reaches 50GB.

- **multi-service** : Wired, wireless, Internet of Things (IoT), 5G, high-performance computing, classrooms, campus card, and more than 20 other dedicated networks for various services
- **Bandwidth 50GB** : Multi-operator lines (education network, mobile, telecom), to protect 70,000 teachers and students online teaching, research, study, life, etc.
- **100% wired coverage**: Fiber optic cables reaching every building, 1000M/100M speeds to desktops, over 50 core switches, than 5,000 aggregation and access switches, and over 100,000 information points.
- **100% wireless coverage**: Over 30,000 Access Points (APs) across the four campuses, with concurrent terminal devices exceeding 100,000
- **High-speed interconnection between the four campuses**: 100G high-speed interconnectivity between the cores of the four campuses.

1. Basic Information of the Campus Network

Campus network services provided for teachers and students

Wired/Wireless

Cloud Platform

IoT

VPN

Mail

Network Security

Library Electronic
Resources

One-card

Domain name/fixed
IP address

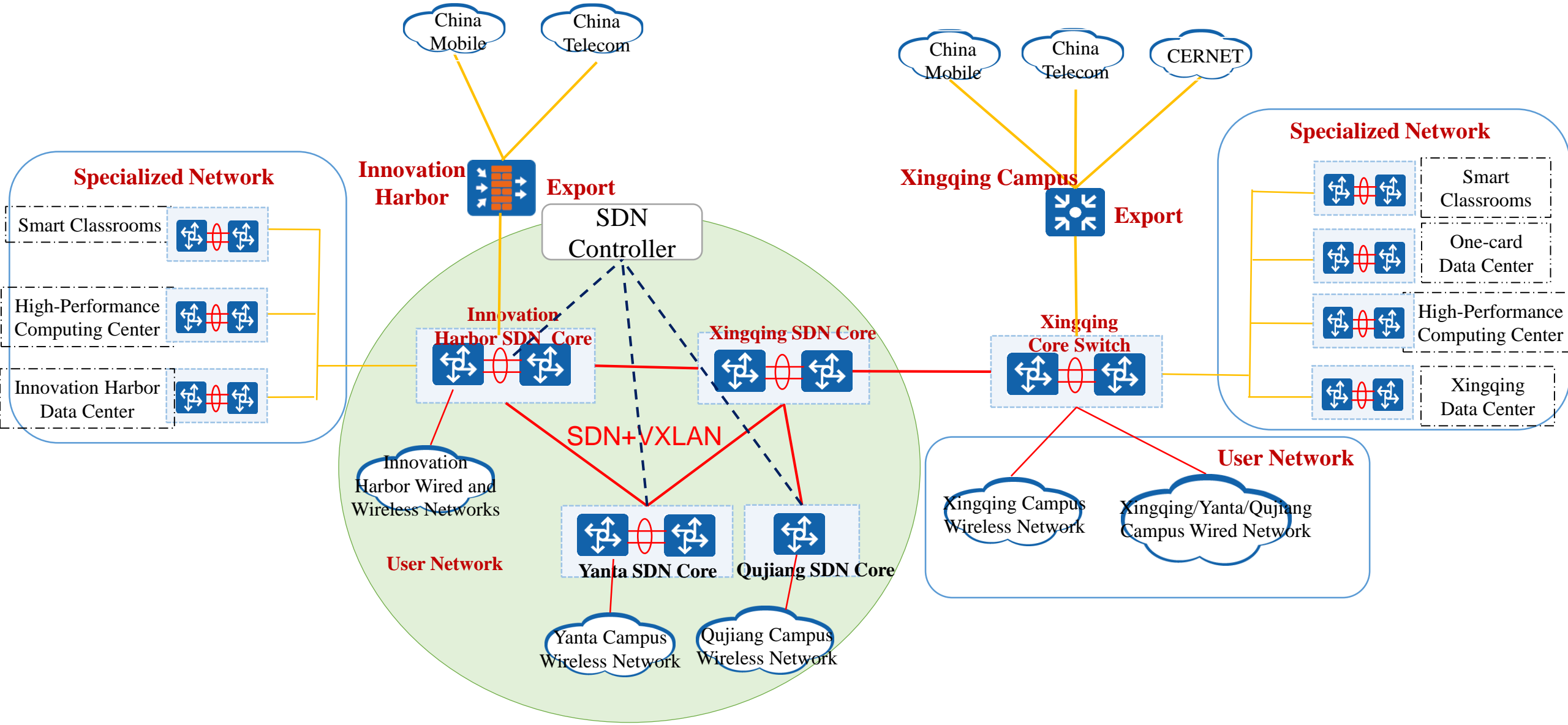
High Performance
Computing

Dedicated Network

Server Hosting

1. Basic Information of the Campus Network

Network Topology Diagram of the Four Campuses

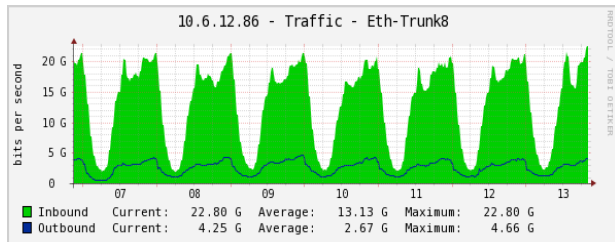




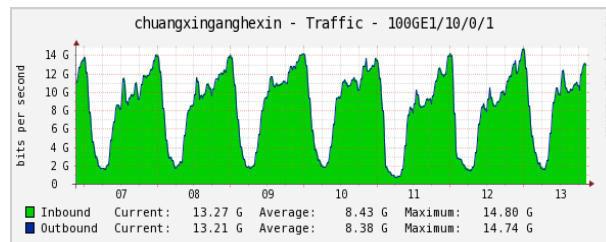
1. Basic Information of the Campus Network

Serial number	Indicator		2024
1	Network infrastructure	Total campus network export bandwidth (bps)	50G
2		Per capita campus network export bandwidth (bps)	815K
3		Campus network trunk interconnection bandwidth (bps)	40G/100G
4		Number of wireless access points (APs)	30K
5		Number of concurrent online devices on the campus network	200K
6	Public platform	Public high-performance computing capability (in teraflops)	1500
7		Data storage capacity (in petabytes)	6
8		Data center floor area (in square meters)	4800
9		Percentage of routine course recording and broadcasting (%)	100%
10		MOOC resources (number of courses)	200

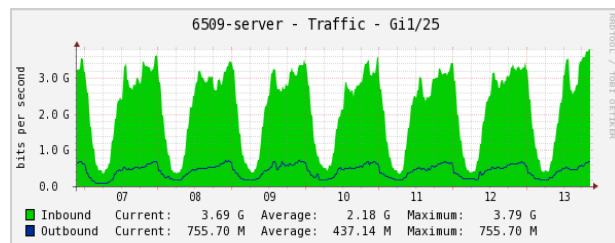
1. Basic Information of the Campus Network



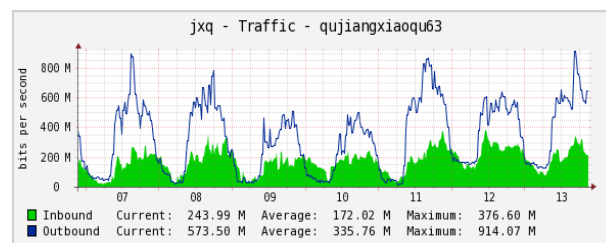
Total traffic in Xingqing campus,
peaking at 23G



Total traffic in the Western China
Science And Technology Innovation
Harbor campus, peaking at 15G

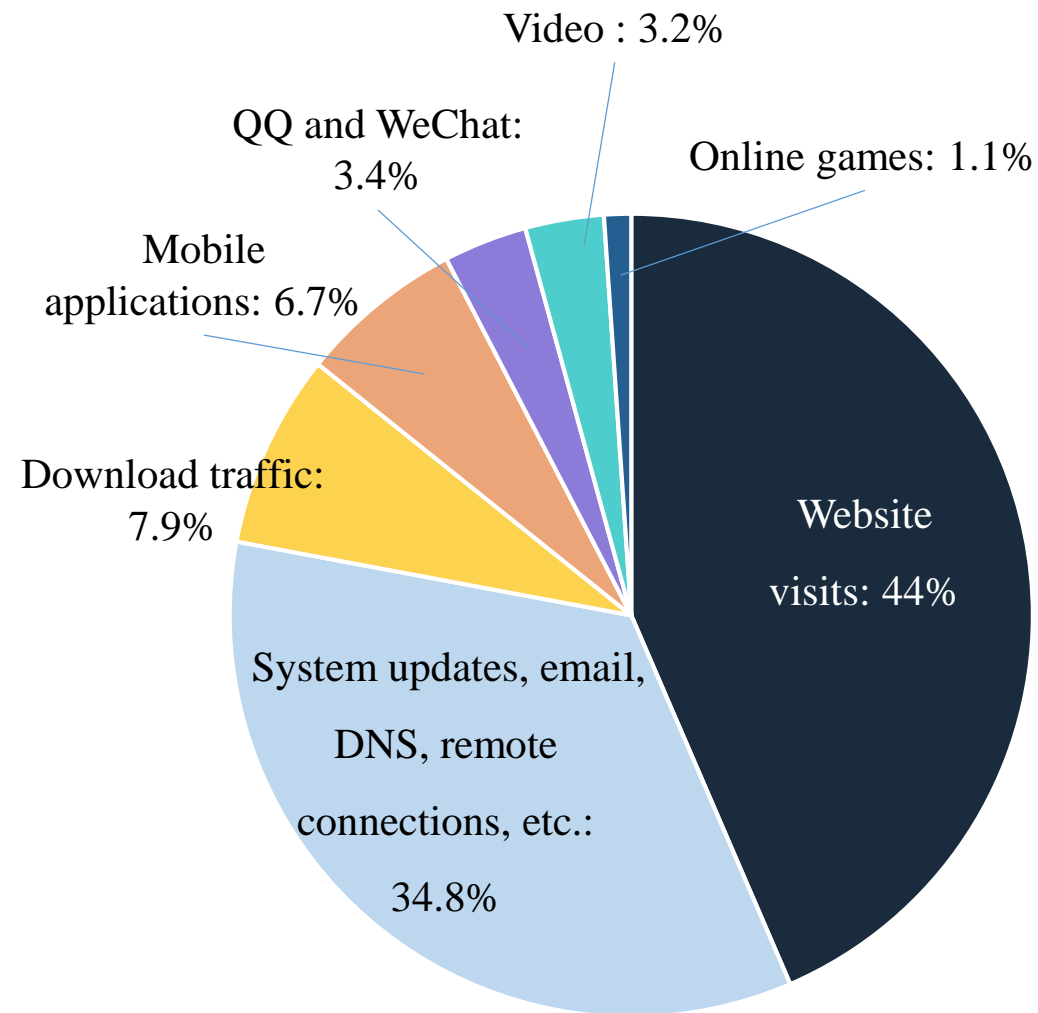


Total traffic in Yanta campus,
peaking at 4G



Total traffic in Qujiang
campus, peaking at 1G

Peak traffic chart for each campus



Web access remains the most popular application, followed by video downloads, mobile applications, and others.



2. Current Issues and Considerations

➤ SDN/VXLAN

1. **High bar for operation:** SDN/VXLAN technology has a high technical threshold, and operation and maintenance require a high level of technical proficiency and extensive operational experience. Locating problems with SDN/VXLAN can be difficult, and most universities do not have the professional technical teams to support it.;
2. **High cost:** Compared to traditional networks, implementing an SDN/VXLAN architecture carries a higher cost. Due to cost considerations, many universities choose to manage only up to the aggregation switches with their SND, leaving the access switches unmanaged. This approach does not fully leverage the capabilities of SDN.
3. **Limited scenarios:** The network scenarios in universities are complex, and many of them are not suitable for SDN/VXLAN. This includes small local area networks in laboratories, campus card networks, and various dedicated networks. Additionally, using SDN/VXLAN for networks involving sensitive data or critical business operations significantly increases security risks.
4. **Vendor-lock:** Universities often have a variety of different devices, and SDN controllers may not be compatible with equipment from other vendors. Choosing an SDN/VXLAN solution often means being tied to a single vendor.



2. Current Issues and Considerations

➤ Wireless Network Issues

1. **Difficulties in Coverage and Signal Stability:** The large campus area and complex building layout, especially within large structures such as libraries, teaching buildings, and megastructures, pose challenges. There are numerous wireless devices installed in these buildings, such as small routers, as well as outdoor factors like terrain and vegetation.
2. **Severe Wireless Usage Tide Phenomenon:** The tide phenomenon is particularly evident during class changes, exams, and various events in universities. Proper planning for wireless network redundancy is crucial as the tide phenomenon can have a significant impact on the stability of the entire wireless network.
3. **Poor Wireless Network Roaming Experience:** Issues such as dense deployment of APs, overlapping and intersecting signals, wireless interference, the impact of the tide phenomenon on wireless devices, and incompatibility between different vendor brands can all contribute to a poor roaming experience.
4. **Significant Differences in Wireless User Perception:** Factors like personal device capabilities (wireless protocols, negotiation rates, etc.), usage locations, and usage habits can lead to varying perceptions of wireless network quality, making it difficult to establish a unified evaluation standard.
5. **Challenges in Wireless Authentication:** Universities have a complex personnel structure and require multiple authentication methods, including seamless authentication and visitor authentication, which can be difficult to implement.



2. Current Issues and Considerations

➤ **Server/Printer Management**

1. **Challenges in Deploying Printers/Servers:** Difficulties arise binding IP addresses/ports/MAC addresses, meeting diverse service requirements, and developing access restriction policies.
2. **Severe Network Security Issues:** Most servers are managed by users themselves, resulting in inadequate protective measures on the servers and prominent security issues.

➤ **Utilization of Campus Network Export Bandwidth**

1. Currently, campus networks have multiple export lines, including those provided by China Mobile, China Unicom, China Telecom, and CERNET (China Education and Research Network). There are difficulties in optimizing the utilization of bandwidth and network path selection. Therefore, there is an exploration of applying SD-WAN technology to the network exports of universities.



3. Future development vision

- **Efficiency:** The network architecture is simple and easy to use, with various network devices and systems highly integrated. Unified management is achieved through a centralized management platform, enabling real-time monitoring, fault warning, and automatic repair of network devices through an intelligent management system.
- **Security:** Establish a comprehensive, multi-layered, and highly effective security protection system, coupled with a robust security management system and emergency response mechanism.
- **Convenience:** Simplified device access authentication, a one-click service experience for users, and personalized service customization.
- **Intelligence:** Utilize advanced technologies such as artificial intelligence and big data to achieve intelligent scheduling of network resources, intelligent diagnosis and repair of faults, and intelligent analysis of user behavior.

Thank You



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