NATIONAL INSTITUTES OF APPLIED RESEARCH
National Center for High-performance Computing

Peering Development and Future Trends in Taiwan — A Case Study of FOX Internet Exchange

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National Center for High-performance Computing

TAIWAN

Internet Peering Landscape in Taiwan

- Taiwan's Strategic Role in the Asia-Pacific Region
  - Positioned as a key hub in the global digital economy
  - Connected by multiple international submarine cables (e.g., APG, SMW3, FASTER, TPE).
  - Well-developed telecom market with active participation from ISPs and OTT players.
- Current Interconnection Methods in Taiwan
  - **ISP-to-ISP Interconnection**: Domestic traffic exchange.
  - **Public Peering (via IX):** Efficient routing and cost-sharing through shared exchange points.
  - **Private Peering**: Dedicated links between ISPs and content providers for high-performance needs
- Impact on Network Performance
  - Influences routing decisions, bandwidth efficiency, and Quality of Service (QoS).

Peering Models and Trends in Taiwan

Three Main Interconnection Models:

1. Transit via Upstream Providers
   - Smaller ISPs rely on larger Tier 1/2 providers.
   - Simple but costly with higher latency.
2. IP Peering
   - **Public Peering**: Through IXes like FOX and TWIX using BGP.
   - **Private Peering**: Direct connections between major ISPs and content providers.
3. CDN Direct Interconnection
   - Major CDN providers (e.g., Google, Netflix, Facebook) deploy edge servers in Taiwan.
   - Enhances user experience by reducing latency and international transit cost.

About NCHC

National Center for High-performance Computing (NCHC)

NCHC is **Taiwan's primary facility for high performance computing (HPC)** with missions to provide services for large-scale computational science and engineering, AI, visualization and virtual reality, data storage, networking, and HPC training.

NCHC is also responsible for the operation of the **100 Gbit/s Taiwan Advanced Research and Education Network** (TWAREN), the national education and research network of Taiwan.

In addition to providing HPC services, NCHC also **develops HPC-related technologies** that support Taiwan's academia and industry with software platforms, advanced research and application development, and professional training.

Timeline

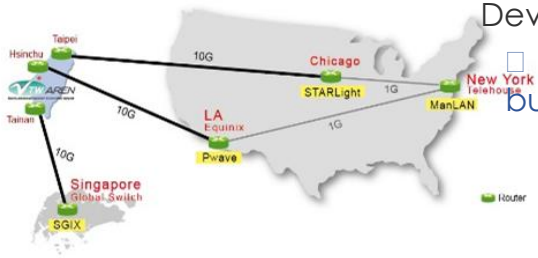
1991
Taiwan's first National level supercomputer Center

2003
NPO under NARLabs

2004
TWAREN Services 10G

2011
御風者 WINDRIDER
177 TF

2016
100G Network Backbone



2017
台灣杉一號
TAIWANIA 1
1.7 PF

2018
台灣杉二號
TAIWANIA 2
9 PF
AI-HPC
NV_V100*2016

2021
台灣杉三號
TAIWANIA 3
2.7 PF

2021
Forward-looking Infrastructure Development Program
- Start building self-build fiber backbone (phase1)

2022
Formosa Open Internet Exchange activated

2023
TAIDE Project
Trustworthy AI Dialogue Engine
NV_ H100*9
3.8 PF

2023
self-build fiber backbone (phase1) activated

2024
Forerunner 1
is expected to begin services
3.53 PF

2025
NCHC IDC (Tainan)
scheduled for opening

2025-2028
To build Chip-based Innovation Advanced GPU Machine
2028 Target 280 PF

1993

Hsinchu Headquarters

2008

Taichung Office

2005

Tainan Office

Certifications

- ISO 9001 (Plus Award)
- ISO 27001
- ISO27017
- ISO27018
- ISO20000
- ISO 27701
- ISO50001
- DCOS(2021)

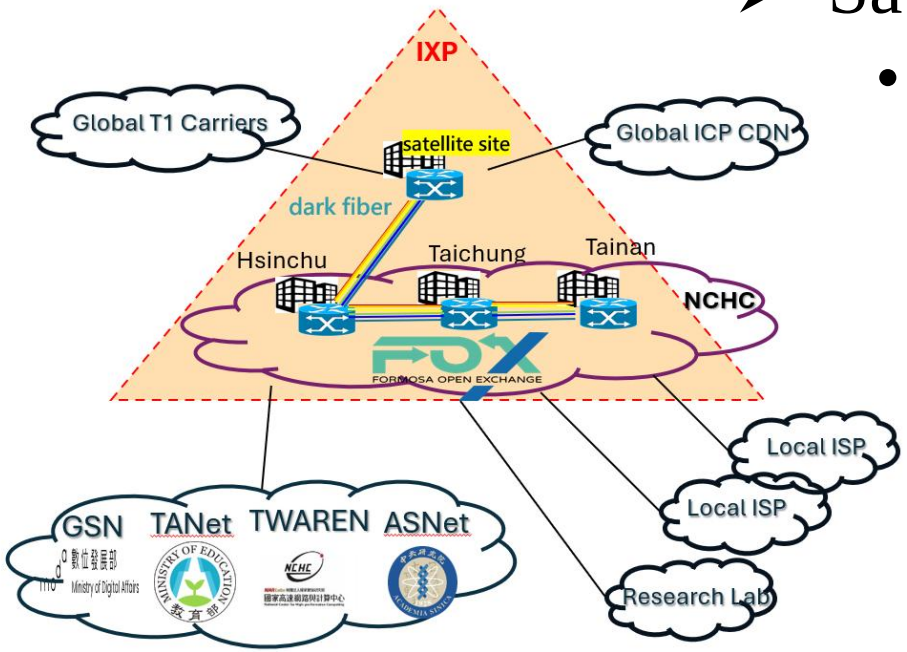
Formosa Open eXchange ; FOX

- A neutral, **non-for-profit** network exchange center
- Funded by DIGI+ Program (Digital Nation and Innovative Economic Development Program)
- Established in **March 2022**,
- **Jan 2023** begin normal operation
- Members ：16 +

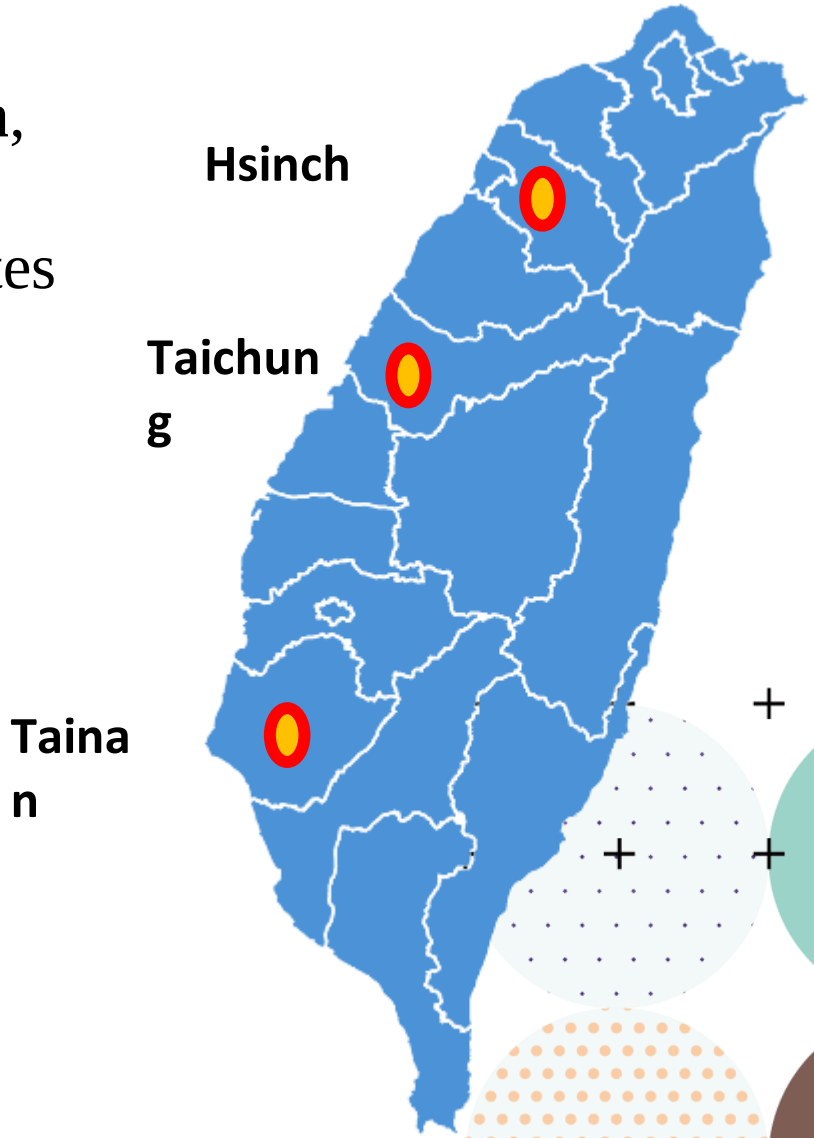
- Main Mission
  - Enhancing the efficiency and resilience of **public service network** transmission
  - Contributing to a robust and sustainable domestic internet ecosystem.

FOX PoPs

- Three main POPs
  - located in **Hsinchu**, **Taichung**, and **Tainan**, interconnected by the TWAREN VPLS
  - **Resilient Network Architecture**: Three sites serve as mutual backups for each other



- Satellite site
  - located in Chief Taipei enhances interconnection and collaboration among domestic and international telecom



FOX Peering Policy

➢ Neutral and Strategic Peering Platform

- Operates as a neutral Internet Exchange Point (IX), not intervening in members' peering decisions
- Focuses on enabling **strategic interconnection**, especially for public service networks:
  - ✔ GSN, TANet, ASNet, and TWAREN

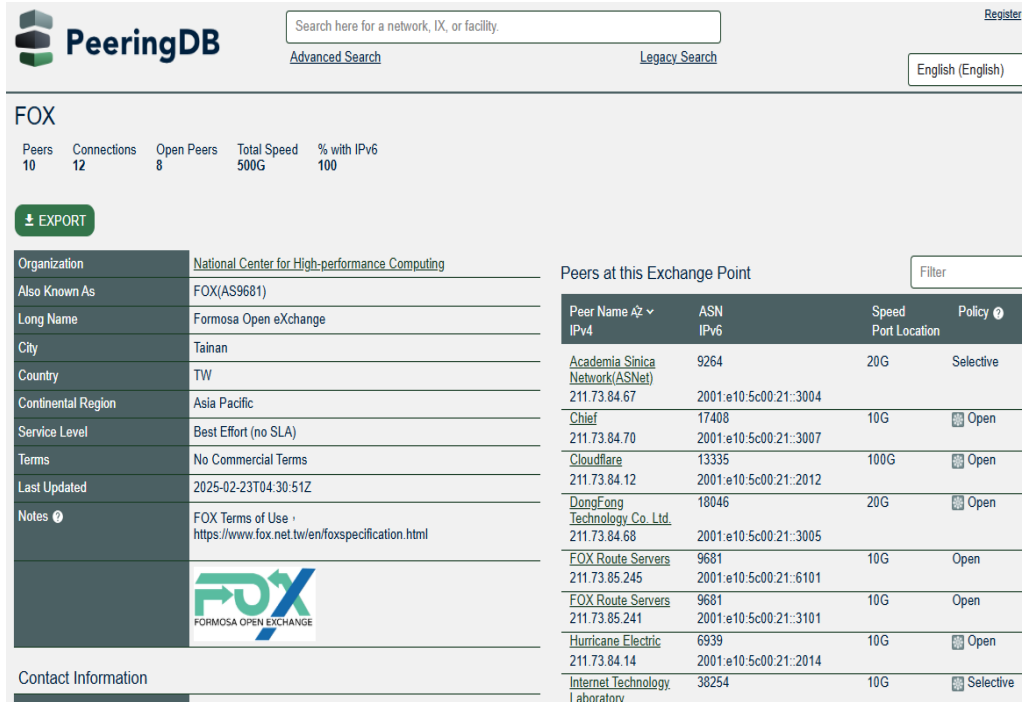
https://www.peeringdb.com/ix/4006

➢ Industry and Academic Collaboration

- Open to industry and research institutions

➢ Operational Model and Transparency

- No provide transit services
- Charges based on **port speed**, not traffic volume — encouraging bandwidth efficiency
- Maintains **PeeringDB** to support transparent and effective peering setups



FOX Security Measures

- Enable OTP authentication for secure logins
- Conduct periodic vulnerability scans and patches
- Deploy Firewall and CDN for enhanced security

- Join MARNS IXP for international security compliance.
- Use IRR/RPKI filtering to prevent BGP hijacking.
- Filter Bogon routes and restrict advertisements.

- Enable CPU/Memory protection to mitigate DDoS impacts.
- Deploy DDoS detection and mitigation via BGP FlowSpec.
- Implement MAC filtering for secure connections.

Build a High-Security, Resilient IXP

- Implement Cyber Monitoring for real-time traffic analysis.
- Establish HA system with redundancy.
- Conduct periodic BCP drills for stability

Conclusion and Future Work

➢ Summary

- explored Taiwan's current interconnection landscape - used FOX IX as a case
- Comparisons with **AMS-IX, SGIX, and JPIX** show that Taiwan has room to grow in **ISP collaboration**, **infrastructure support**, and **regional ecosystem development**.

➢ Future Work

- Explore **SDN** and **AI** in interconnection.
- Analyze **IPv6 transition** impacts to align with global trends.

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Thank you

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