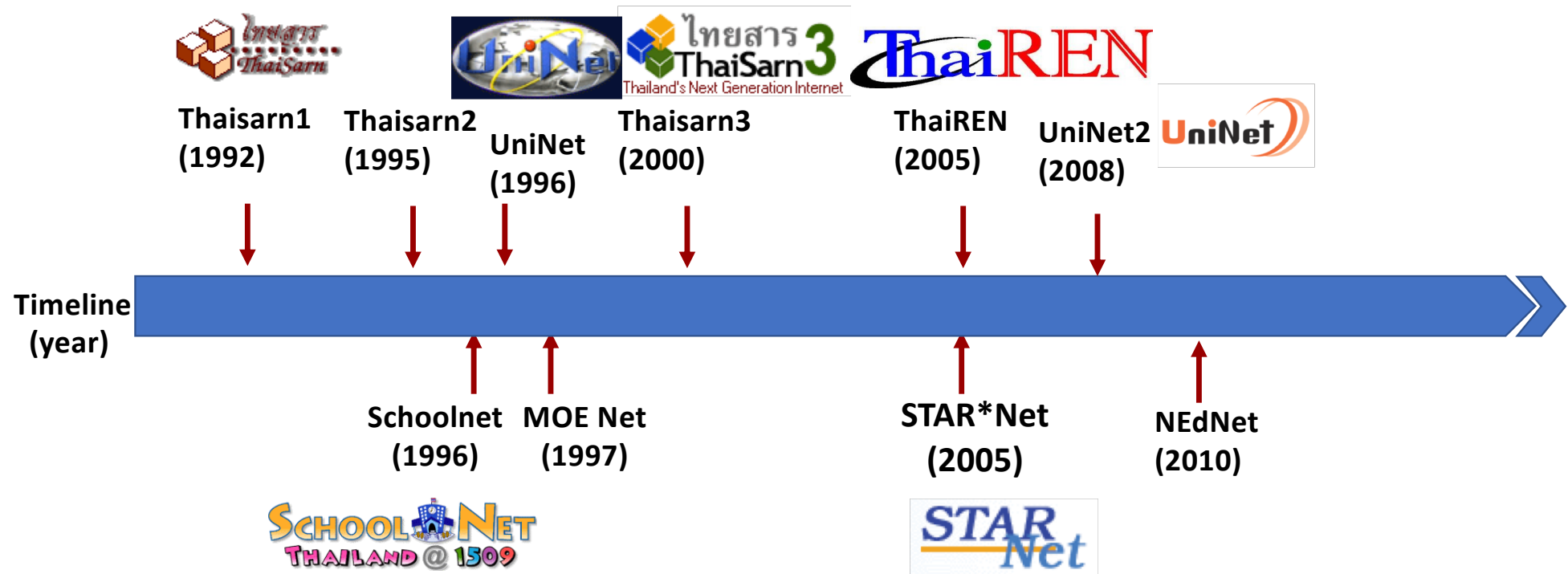


Issues and Challenges for R&E Network Operation, Management and Governance in Thailand

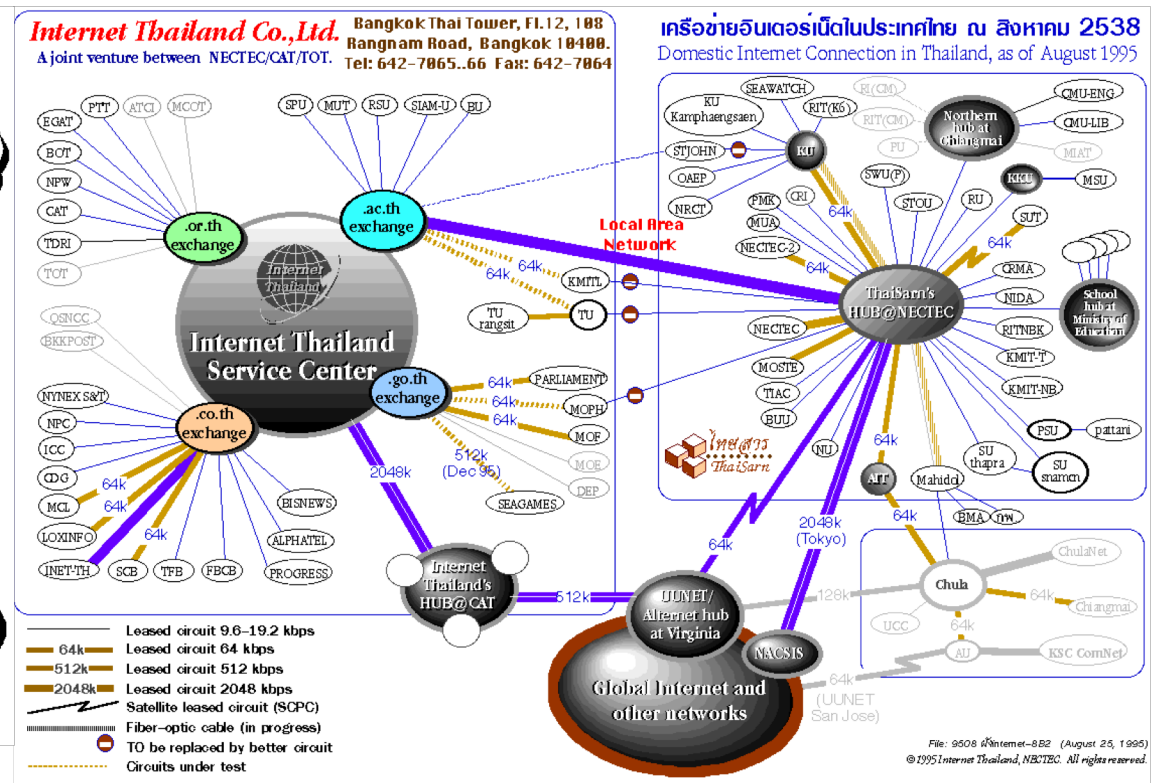
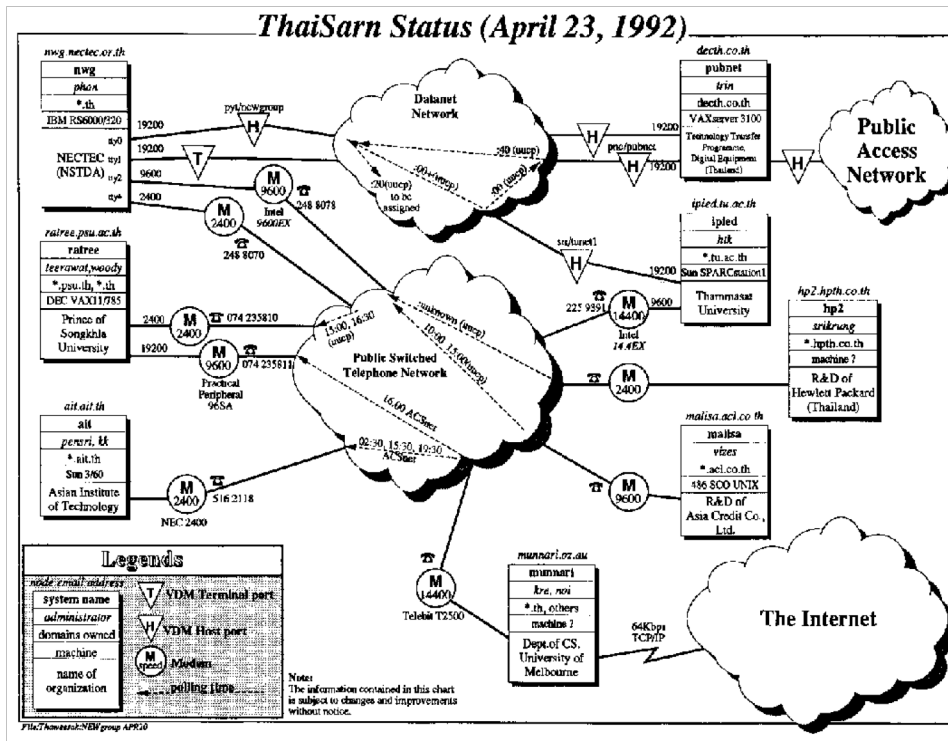
Chalermpol Charnsripinyo

Development of R&E Networks in Thailand

Research and education (R&E) networks in Thailand have been developed nearly thirty years.



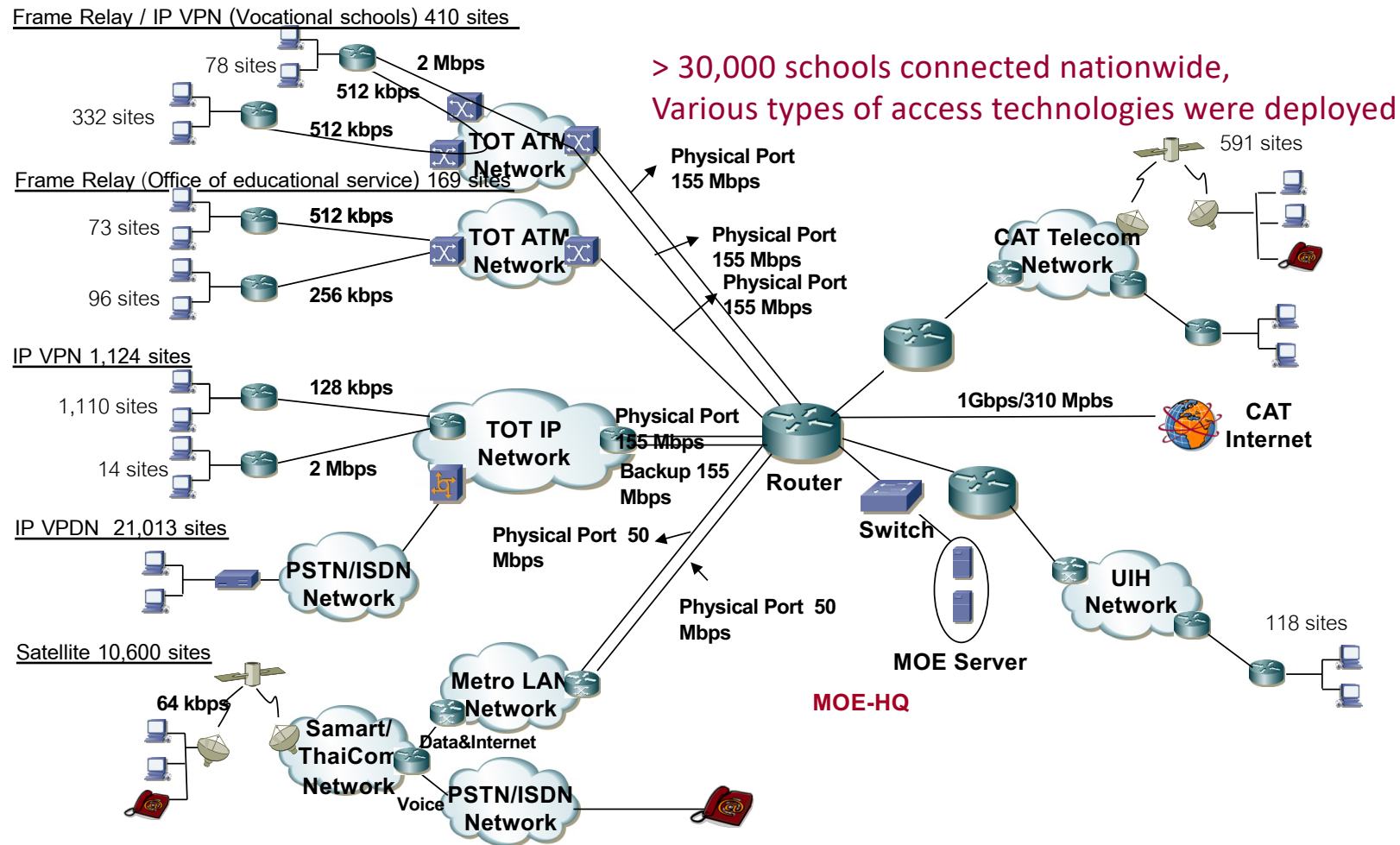
Beginning of R&E Network in Thailand



[Information Source: <http://www.nsrc.org/ASIA/TH/thaisarn.gif>]

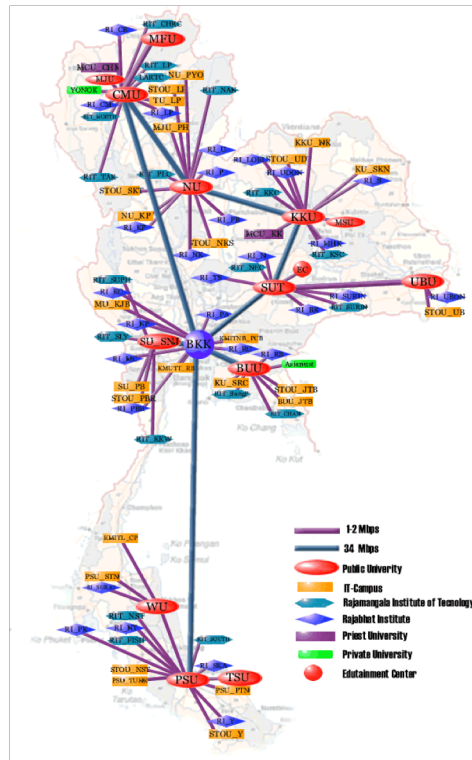
Internet network infrastructure in Thailand IT Year (1995)

A Snapshot of Basic Education Network (MOENet) in 2005



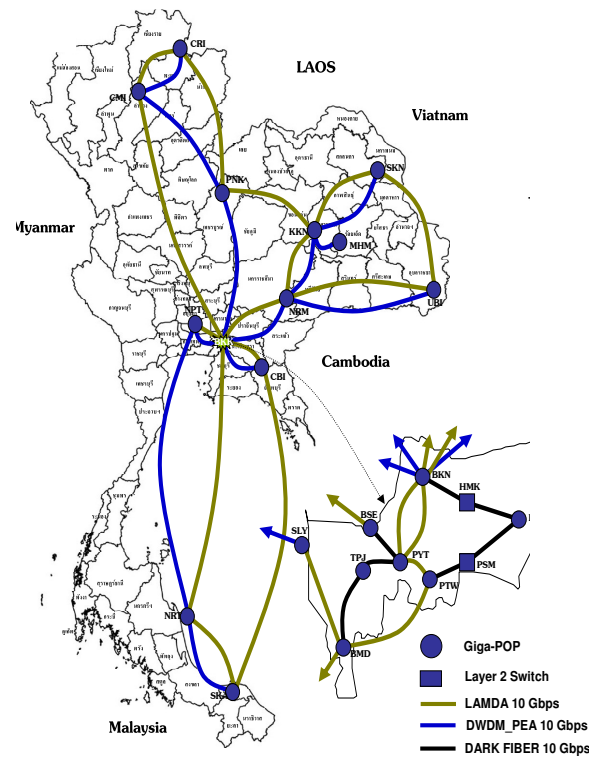
[Information Source: TOT and MOE]

Development of R & E Network Infrastructure



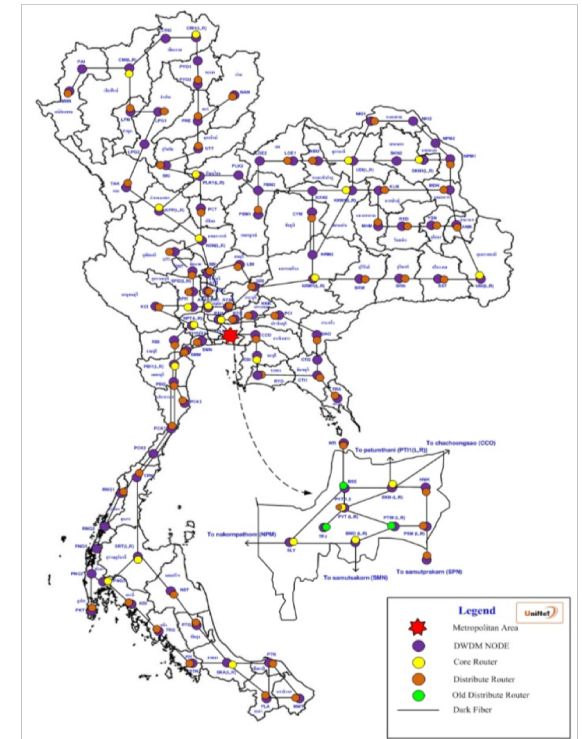
(1996-2004)

Leased circuits from providers



(2005-2009)

Leased circuits & dark fibers from providers



(2010 - present)

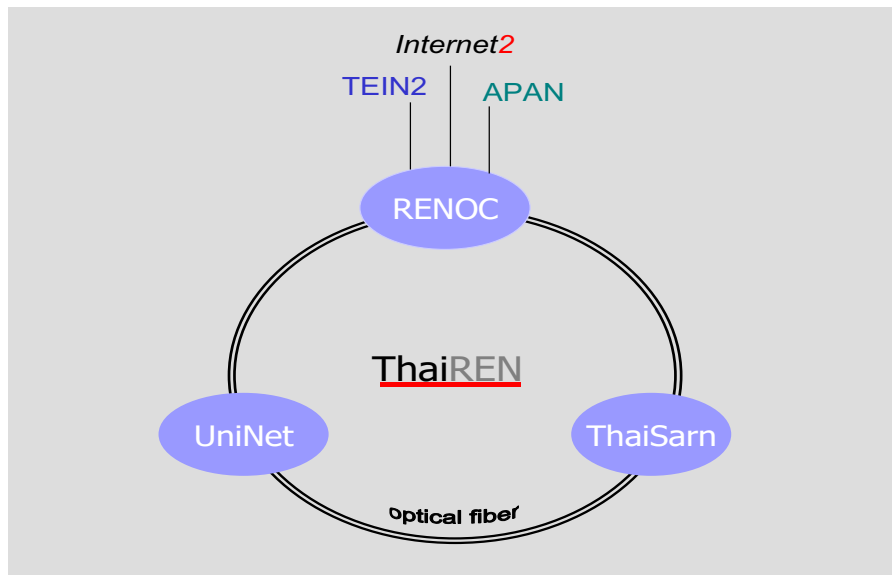
Own fiber optic infrastructure

Thailand Research Education Network



ThaiREN

Thai Research and Education Network



- ThaiREN was established in 2005 to coordinate among research and education networks in Thailand as well as collaborate with international R&E networks.
- ThaiREN was initially set up to join TEIN2 project
- At that time, ThaiSarn connects government institutes for research activities and project collaborations while UniNet connects most higher education universities
- ThaiSarn and UniNet are connected and virtually combined as “ThaiREN”

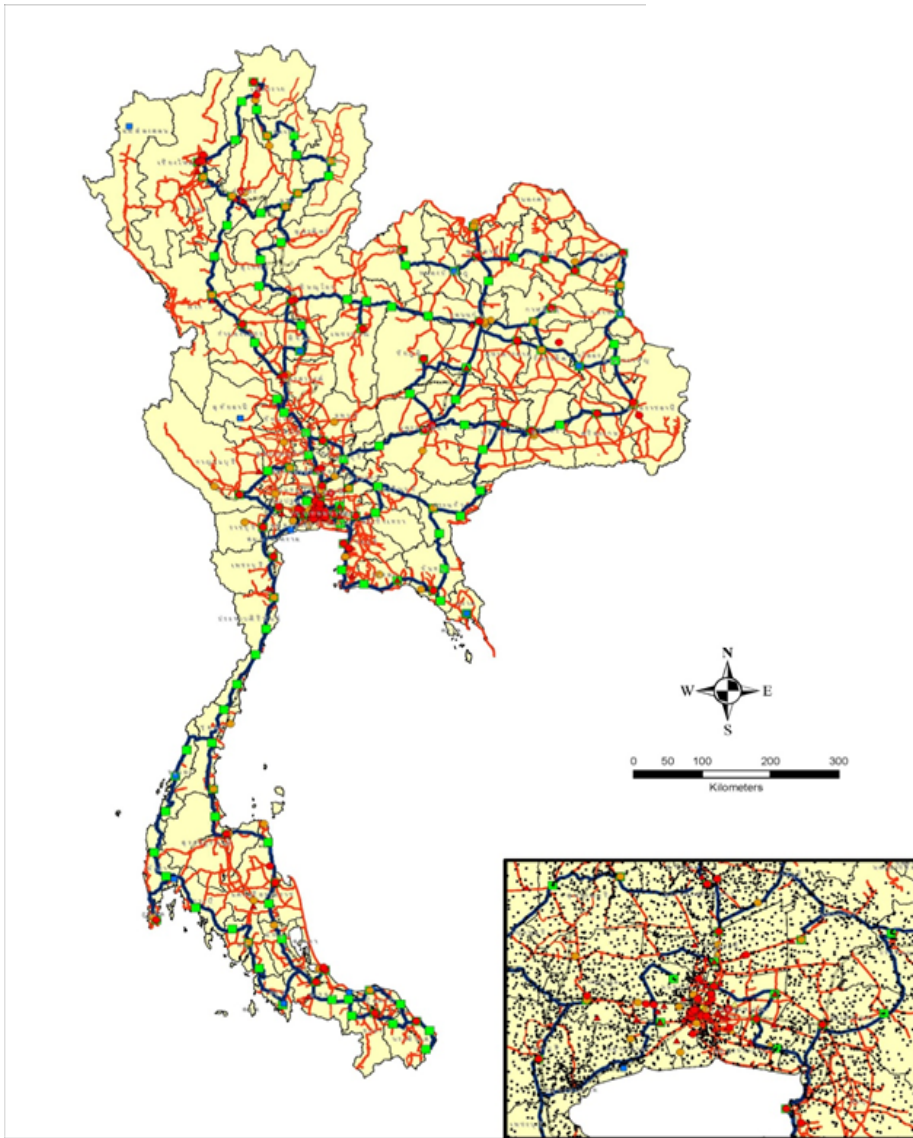
National Education Network (NEdNet)

- There were three levels of education networks
 - MOENet (Primary, Secondary, High School Network)
 - VECNet (Vocational School Network)
 - UniNet (University Network)
- In 2009, Thai Government approved stimulus package (SP2) budget 5,000 Million Baht for integrating all education networks into National Education Network (NEdNet)
- Expansion of UniNet to support the entire education net
 - University connects with bandwidth 1 Gbps – N x 1Gbps
 - Vocational institution connects with bandwidth 100 -1000 Mbps
 - School connects with bandwidth 10 -100 Mbps

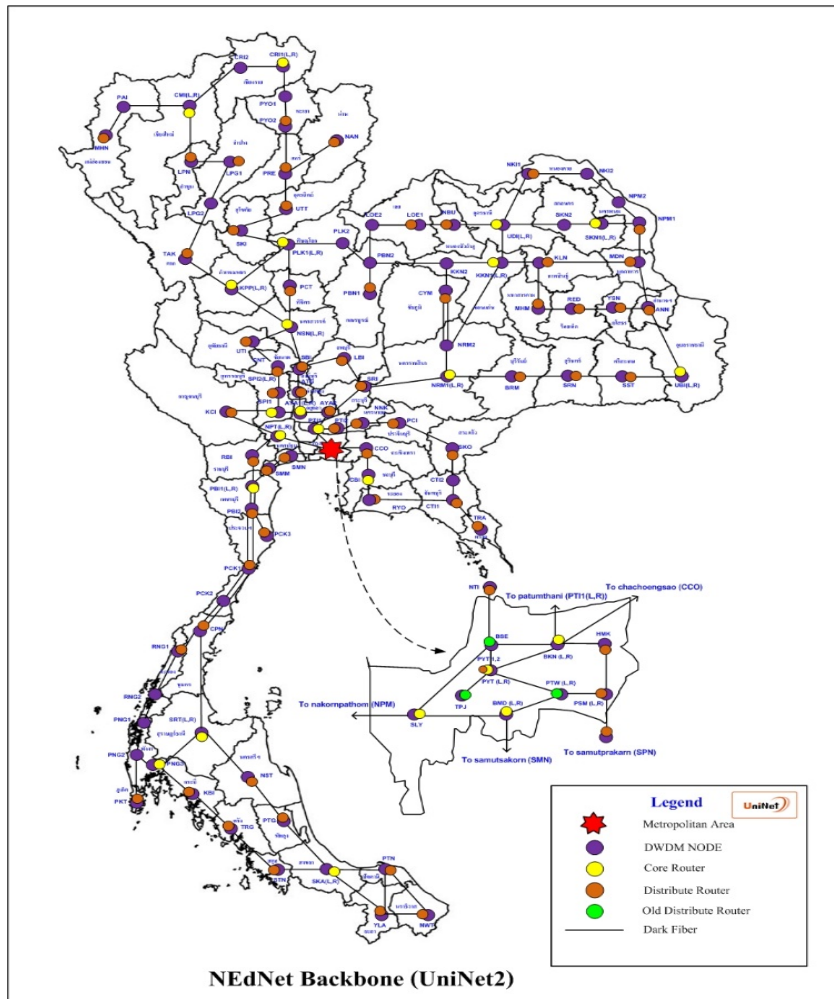


Network Backbone

- Fiber optic cables were laid nationwide (~ 60,000 Km)
 - About 20,000 Km connects core and distribution nodes
 - The rest of cables connects last-mile nodes



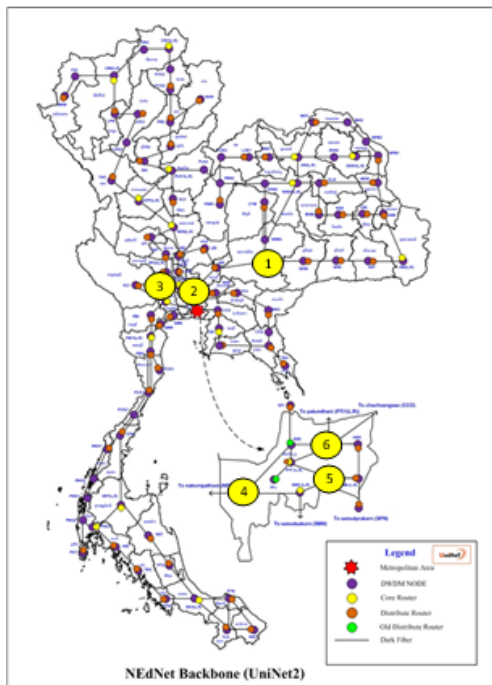
Network Backbone



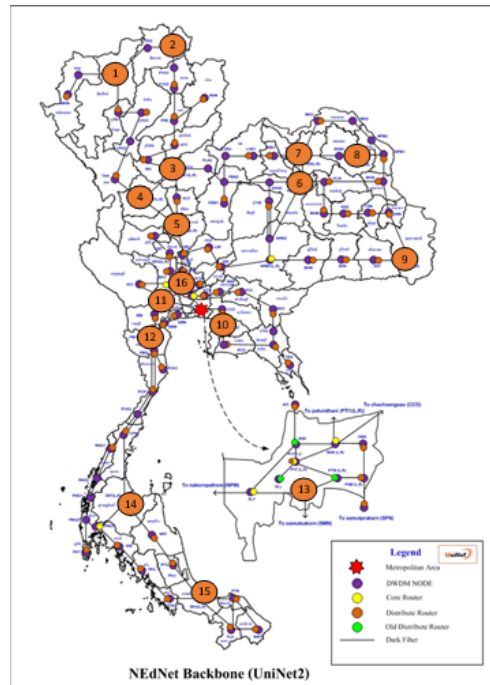
Node	Size	Bandwidth	Nodes
Super Node	Bangkok	50-100 Gbps	6 Nodes
	Regionals		18 Nodes
Province Node	Size XL	N*10 Gbps	90 Nodes
	Size L	10 Gbps	
Distribution Node	Size XL	10 Gbps	1,500 Nodes
	Size L	N*1 Gbps	
Last mile	Size XL	1 Gbps	~10,000 Nodes
	Size L	100 Mbps	

Network Backbone Upgrade

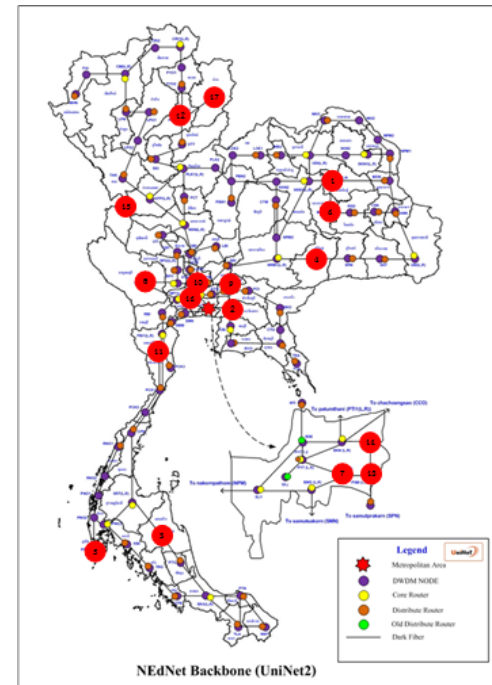
- Network upgrade is divided into several phases



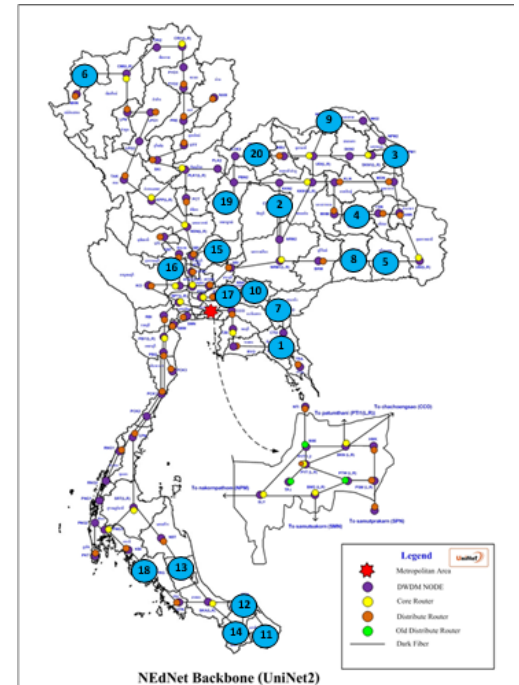
Phase 1



Phase 2



Phase 3



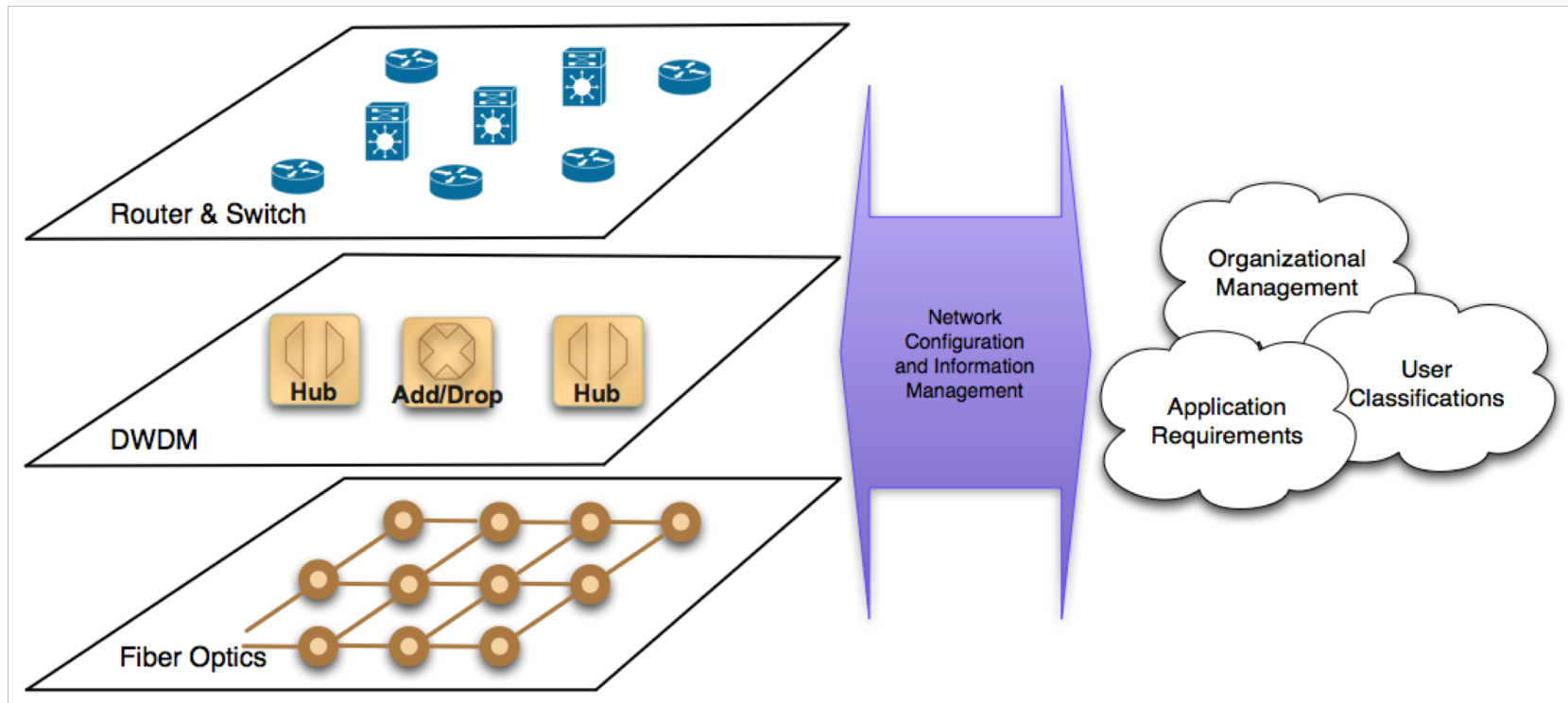
Phase 4

Network Connection to Members

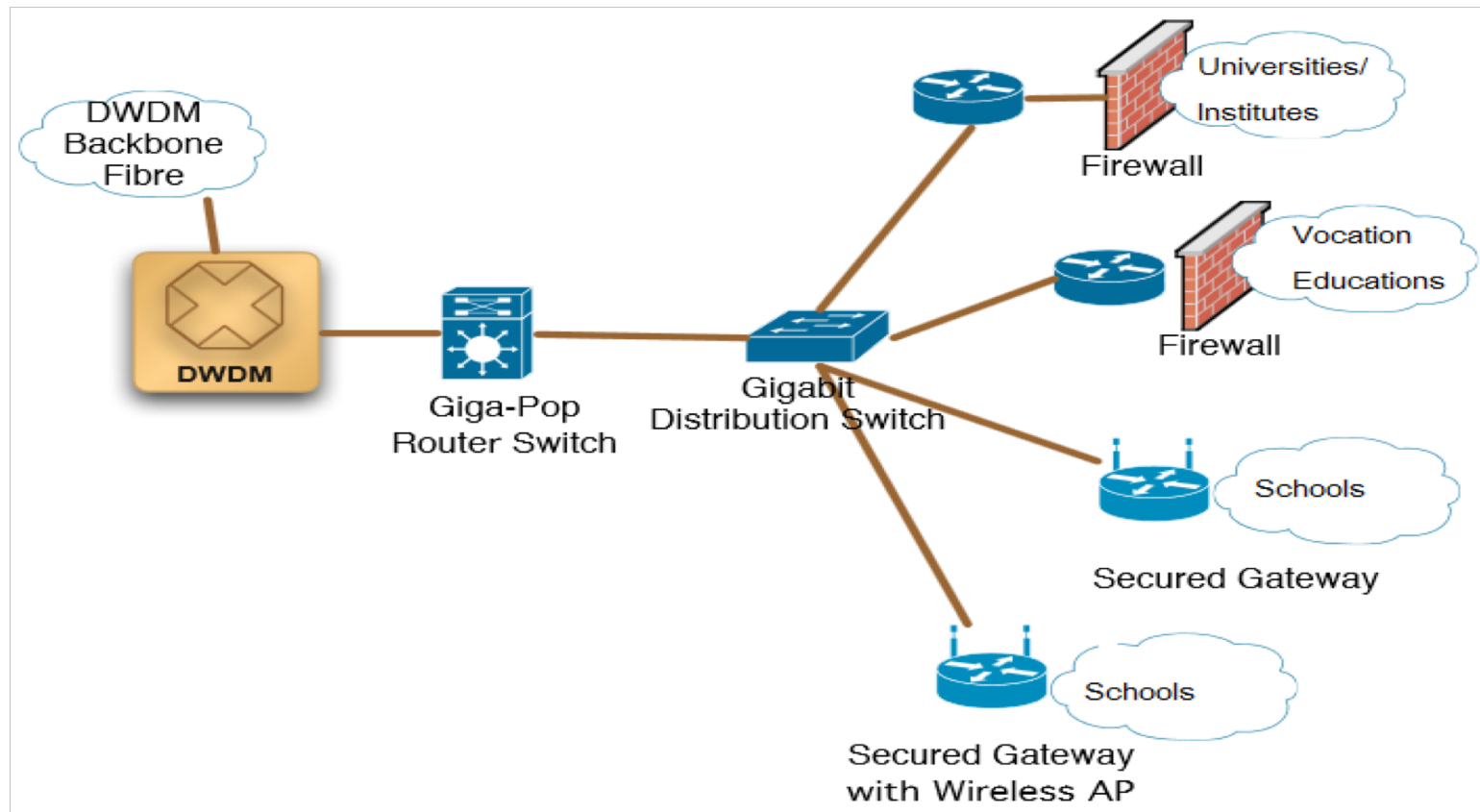
- Fiber to the University/Research Institution @ Gbps
- Fiber to the school @ 100 Mbps
- Fiber to the public library @ 100 Mbps

Members	Number of Member
Universities/Institutes	223
Vocational Education	425
Educational Service Area	225
Basic Education (schools)	9,566
Municipality Public Library	151
Research and other Institutes	199
Total	10,789

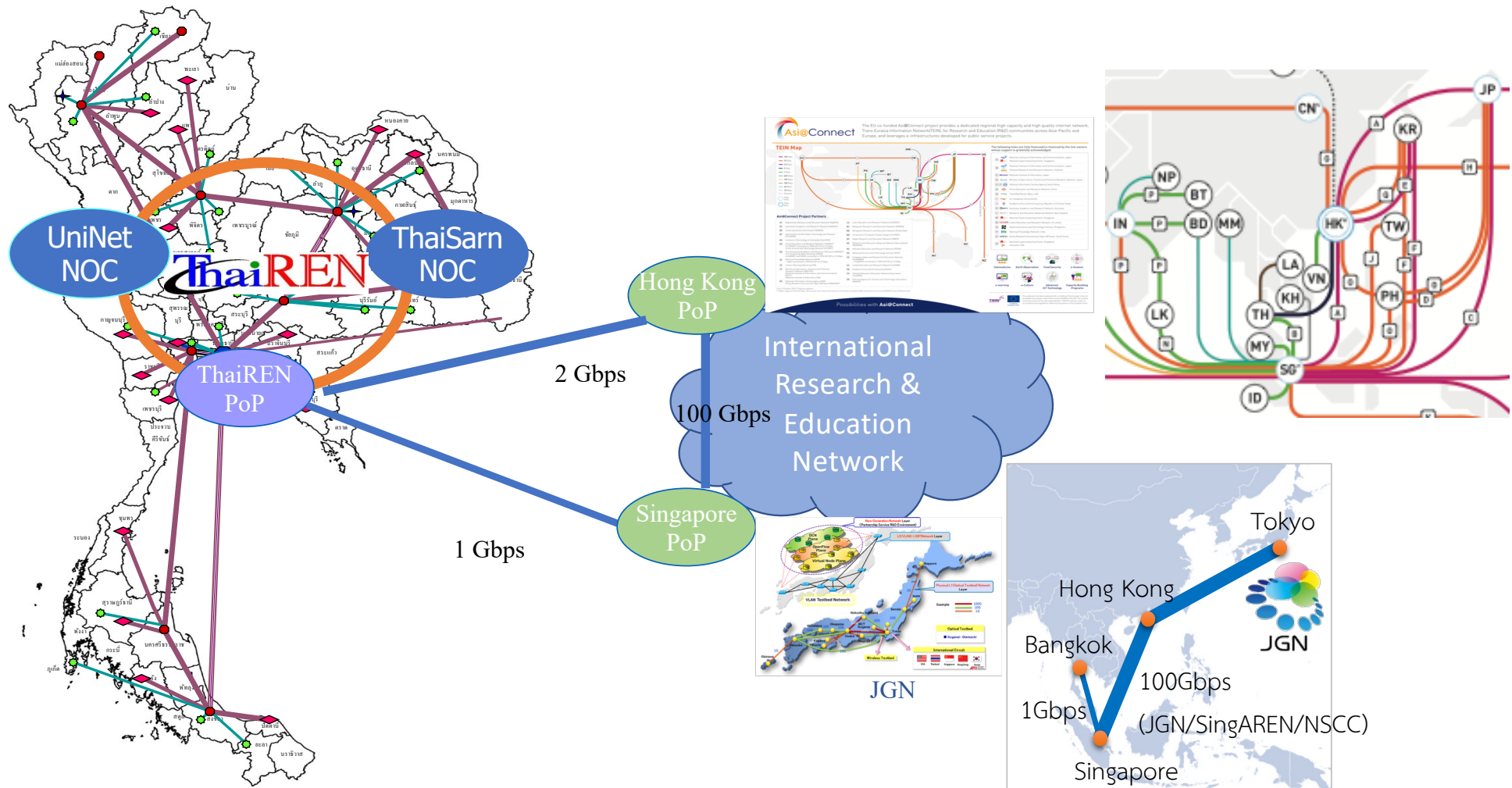
Network Operation and Management



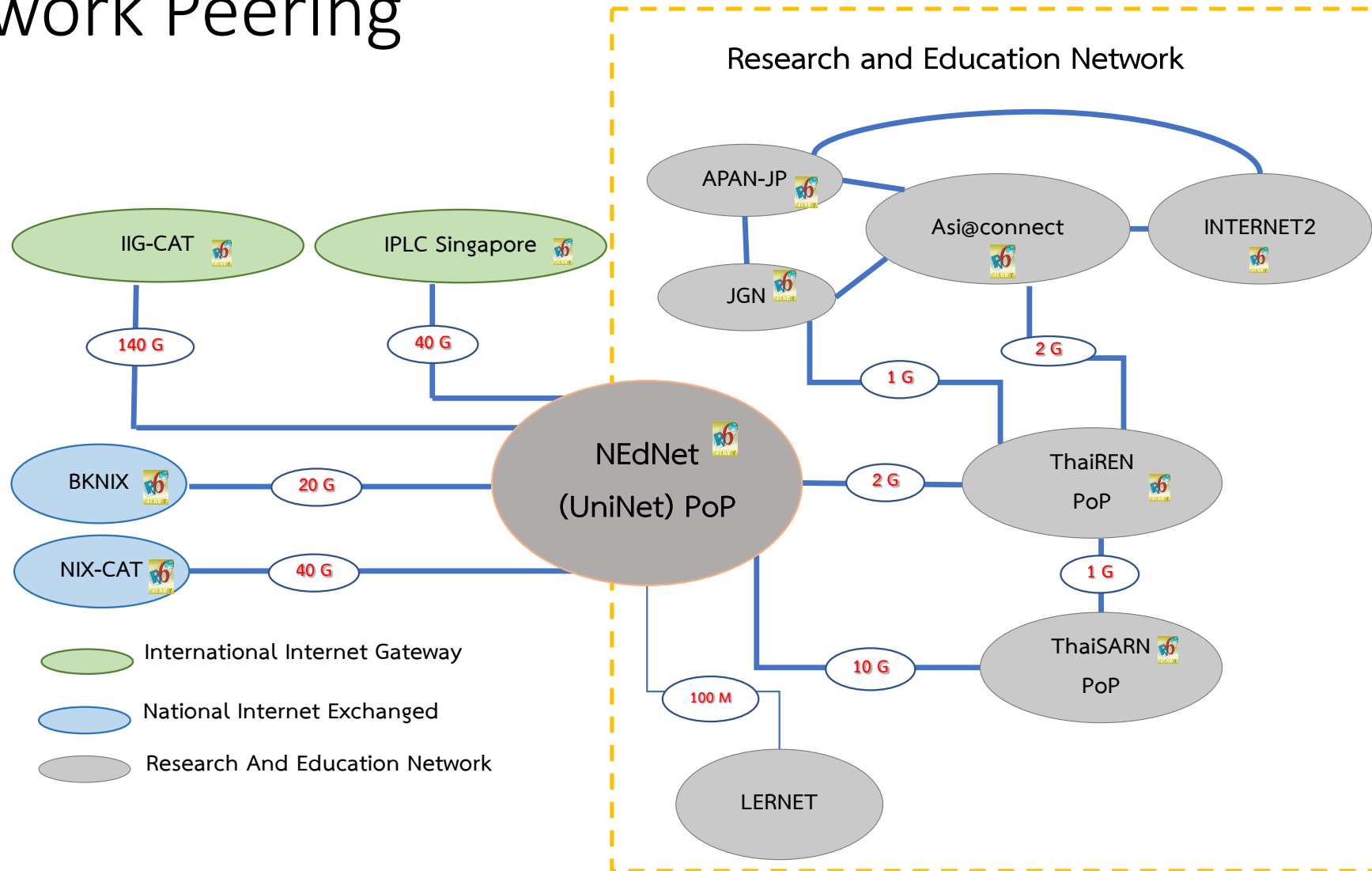
Network Operation and Management



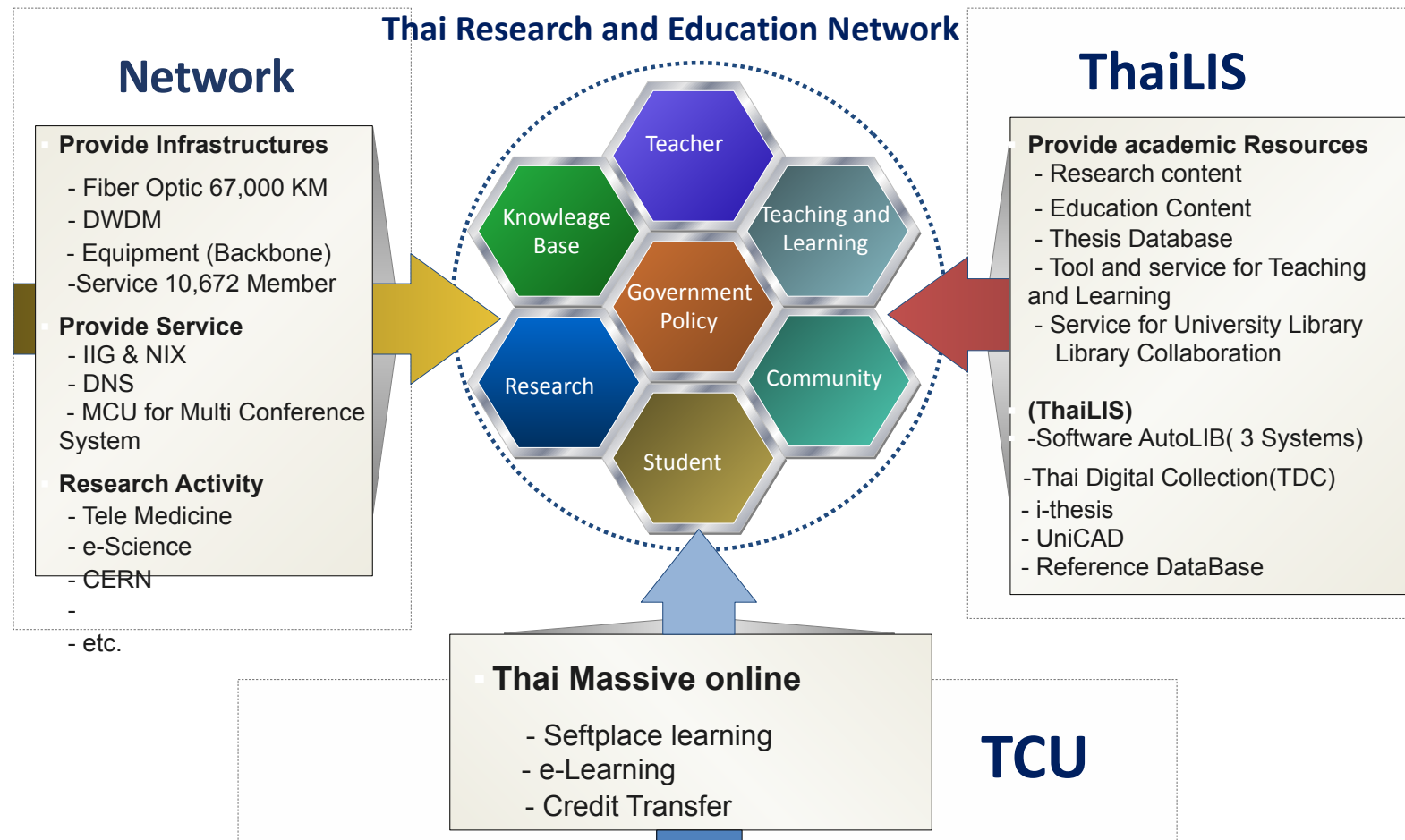
International Research & Education Network Connectivity



Network Peering

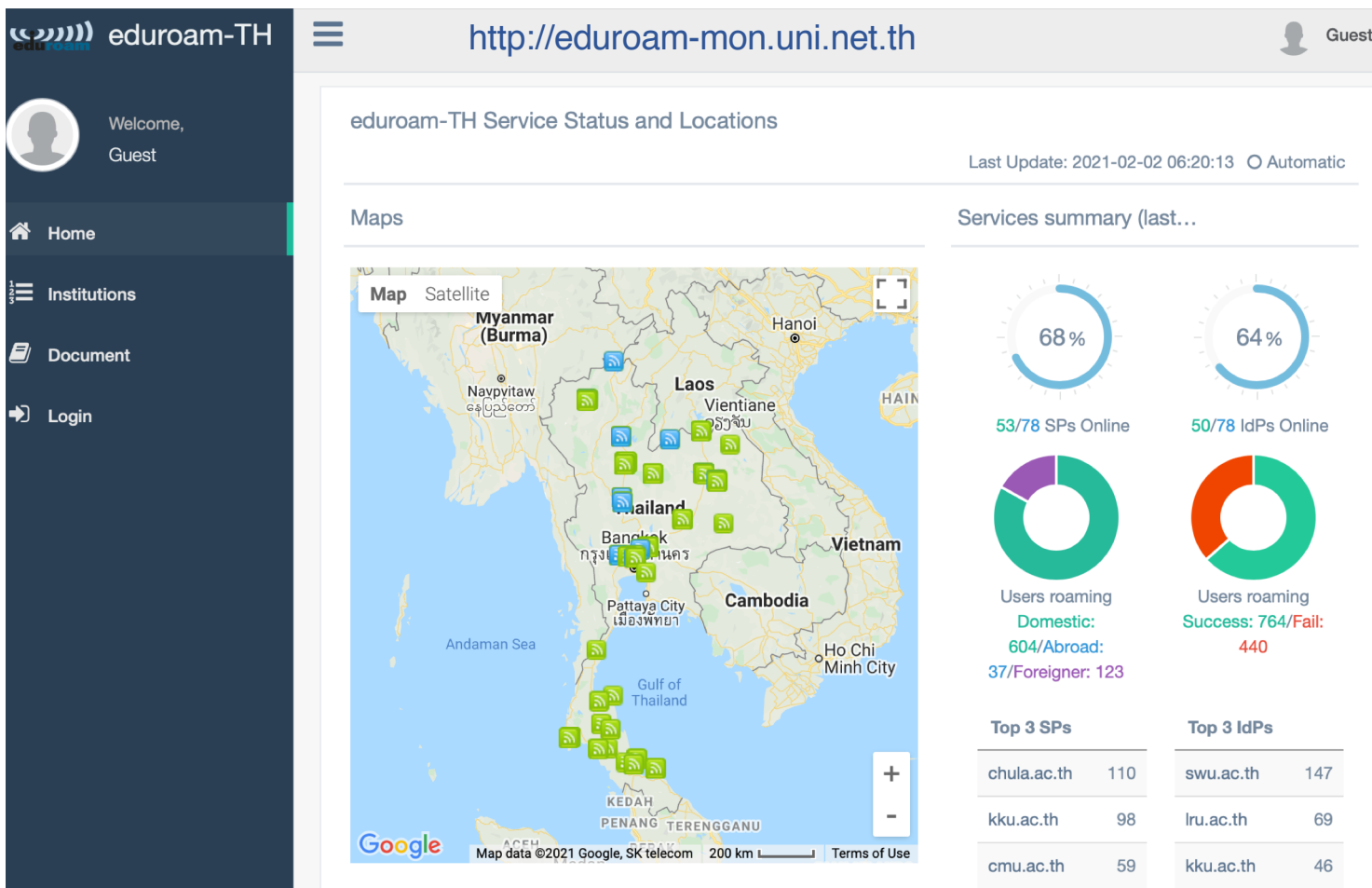


Services

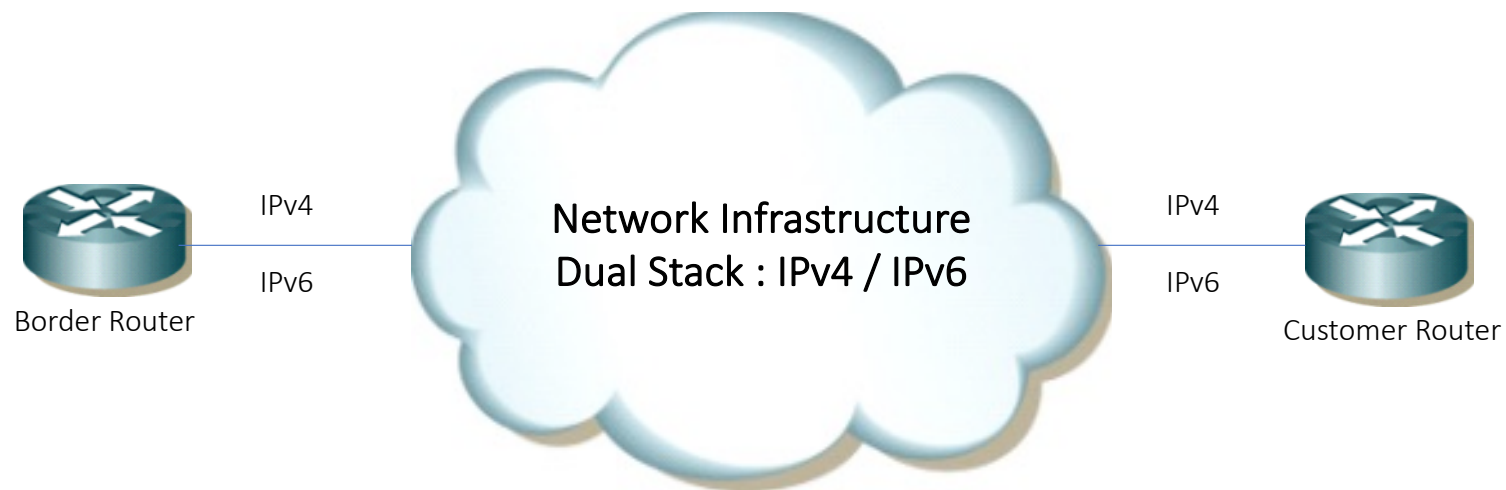




Network Service



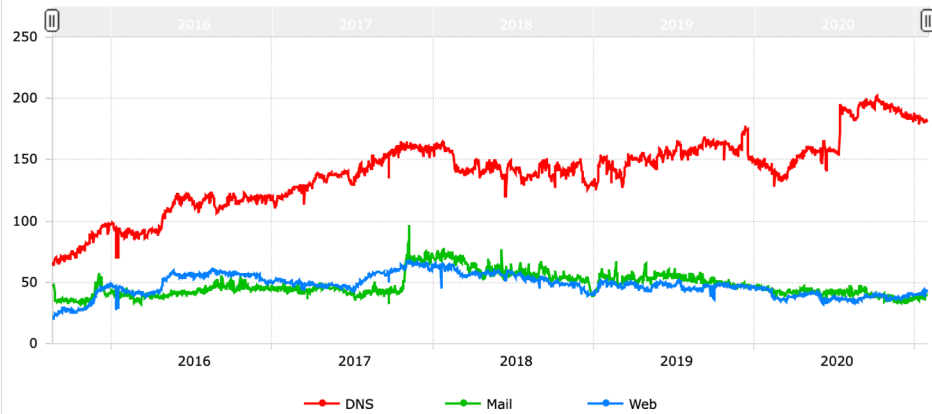
IPv6 Network Service



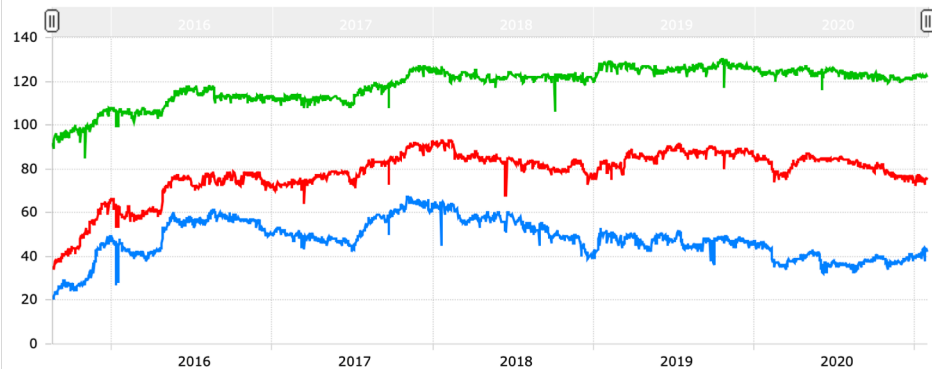
- Dual Stack Service
- GRE Tunneling Service
- Unicast/Multicast Service
- BGP Peering
- Native Service (Future)

IPv6 Service Status

- Unique IPv6 Operational Service Interfaces Over Time -



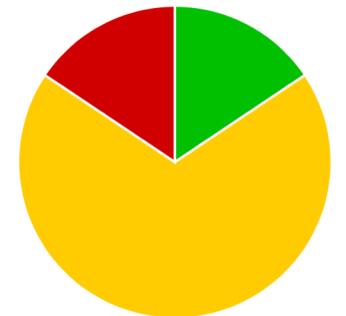
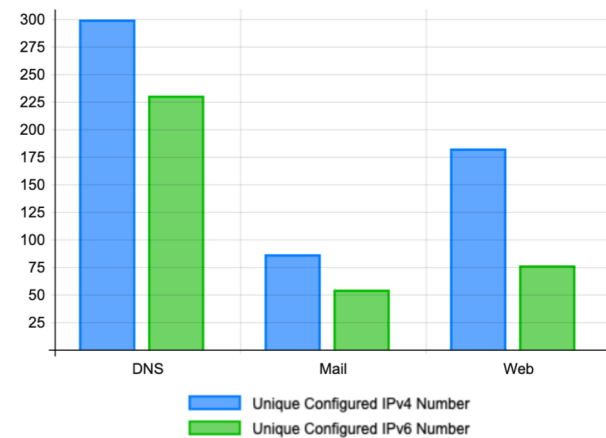
- IPv6 Operational Service Domains Over Time -



Estimating IPv6 & DNSSEC External Service Deployment Status

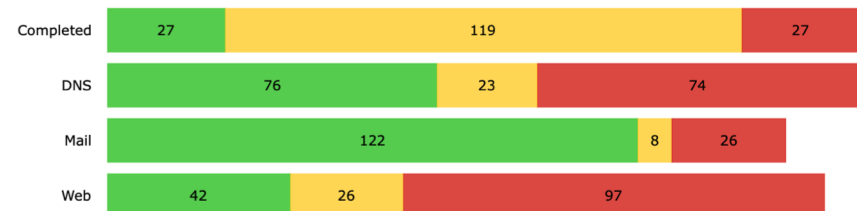
- Unique Configured Service Interfaces for 29th January, 2021 -

- 173 Domains Measured -



- IPv6 Enabled Domains -

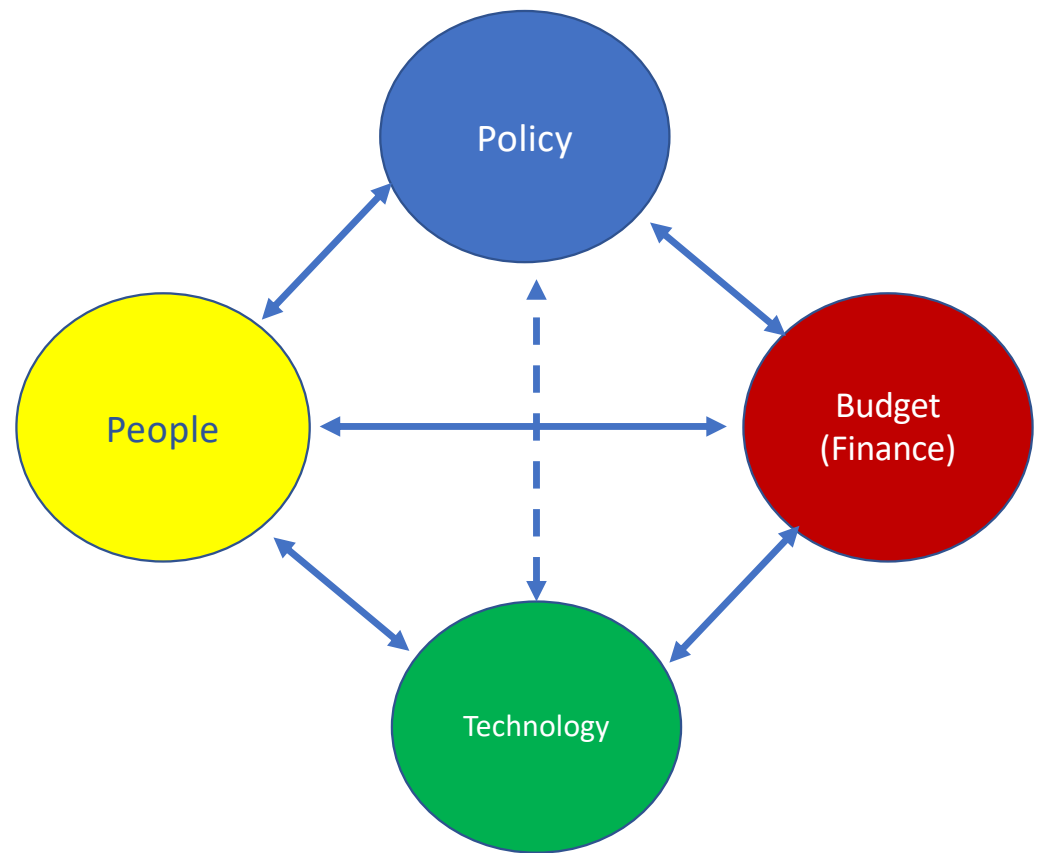
- 173 tested on 29th January, 2021 -



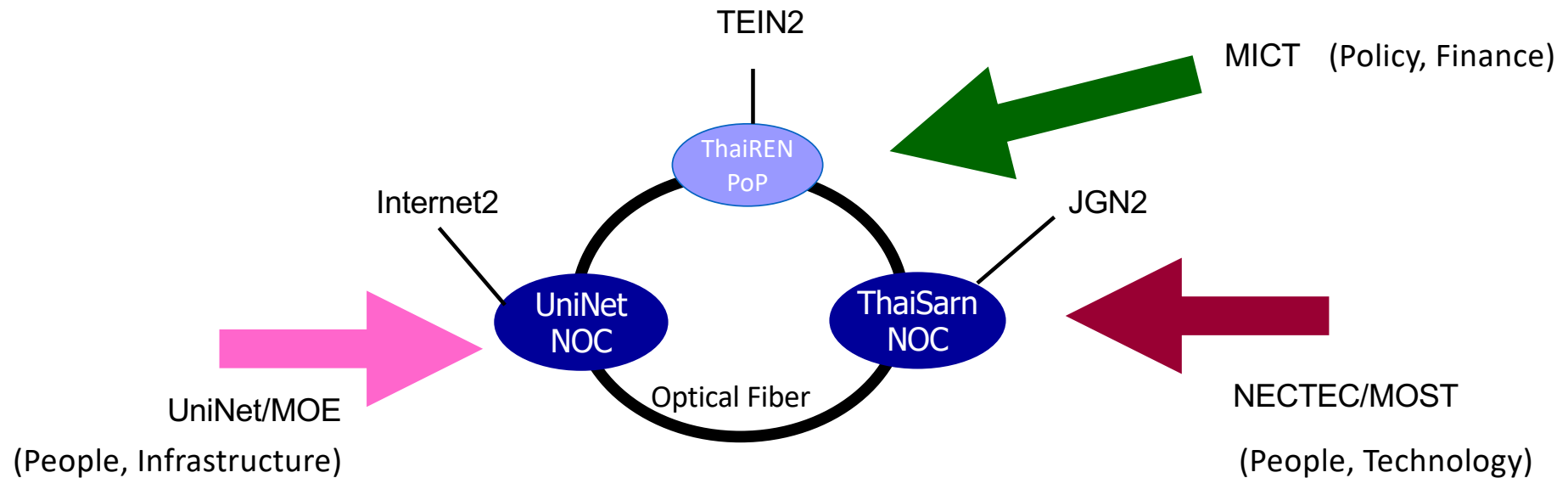
Issues and Challenges

Network operation and management often come up with issues and challenges

- Policy
- Budget (Finance)
- People
- Technology



Past Management and Governance Issues



- **Three Ministries were involved:**
 - Ministry of Science and Technology (MOST)
 - Ministry of Education (MOE)
 - Ministry of Information and Communication Technology (MICT)
- The Research and Education Networks are now under Ministry of Higher Education, Science, Research and Innovation

In Summary

- The development of R&E network takes time and effort
- Policy, budget, people and technology are key factors for R&E network development
- All kinds of supports from government are important
- Co-operations between networks, institutions and staff members are required to provide quality of services and assurance to network services
 - Good coordination can overcome problems

Thank You for Your Attention

