FIT9137
Introduction to Computer Architecture and Networks

Week 11: Workshop on Virtual Private Network (VPN) & Digital Inclusion

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SETU Feedback

We appreciate your feedback!

Learning Outcomes

- **Properly identify the security and privacy threats in a network environment**
- Understand security enabling techniques
- **Appropriately implement VPN services**

Virtual Private Networks

Virtual Private Networks

Virtual Private Networks - VPN

- establishes a secure, encrypted connection between your computer and the internet.
- creates a private tunnel for your data communications over public networks

Virtual Private Networks

Use Internet as the Packet Switched Network

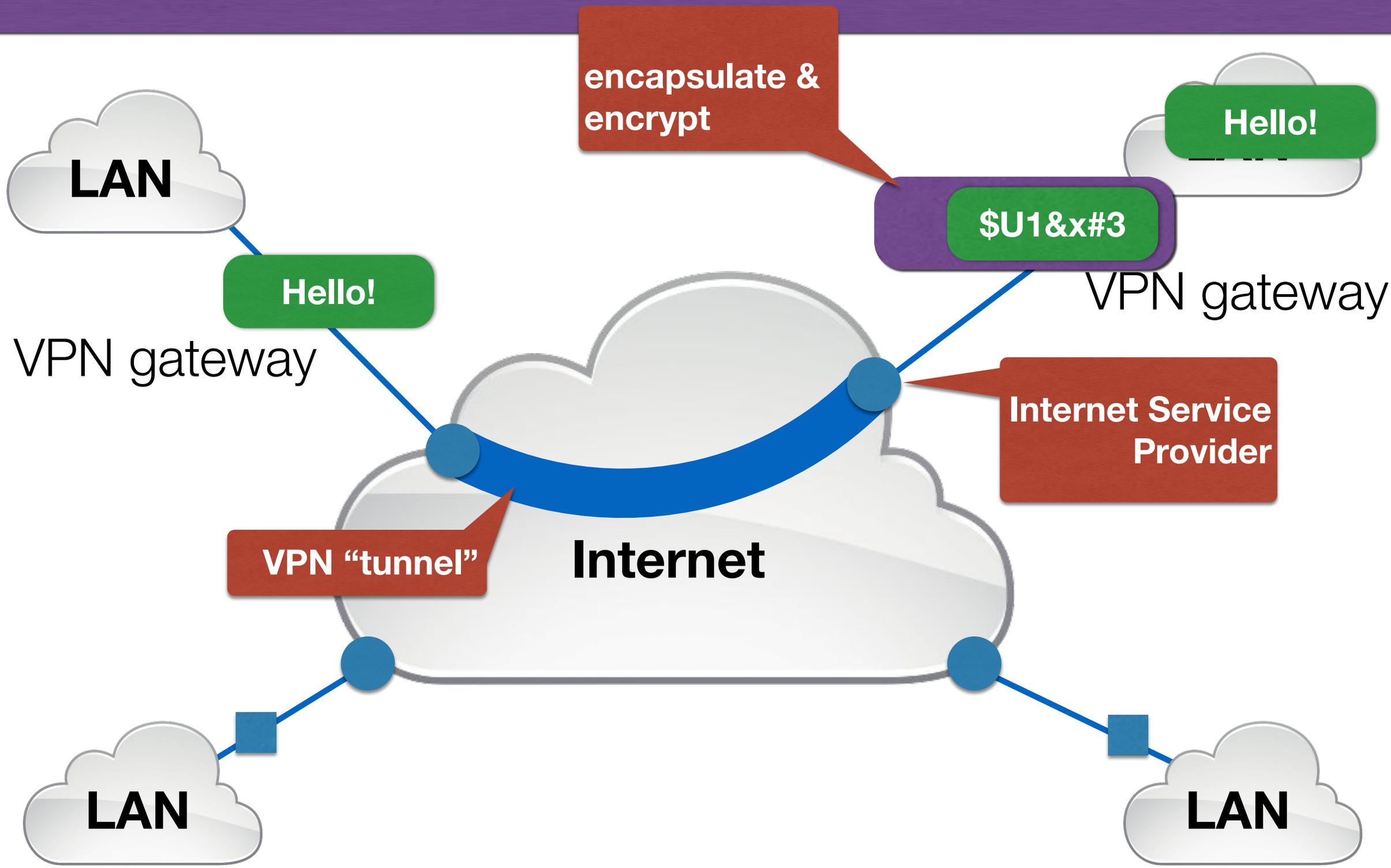
- easily available
- low cost due to lots of competition
- flexible

How does it work?

- software simulates “virtual NIC”
- packets are **encapsulated,** then sent through Internet
- receiver unpacks, then sends into LAN

Note: nothing to do with Virtual LAN!

Virtual Private Networks



Types of VPNs

Intranet VPN

- connect LANs of the **same** organization
- uses special VPN gateway devices

Extranet VPN

- connect **different** organizations (e.g., a company with its customers)
- same technology as intranet

Access VPN

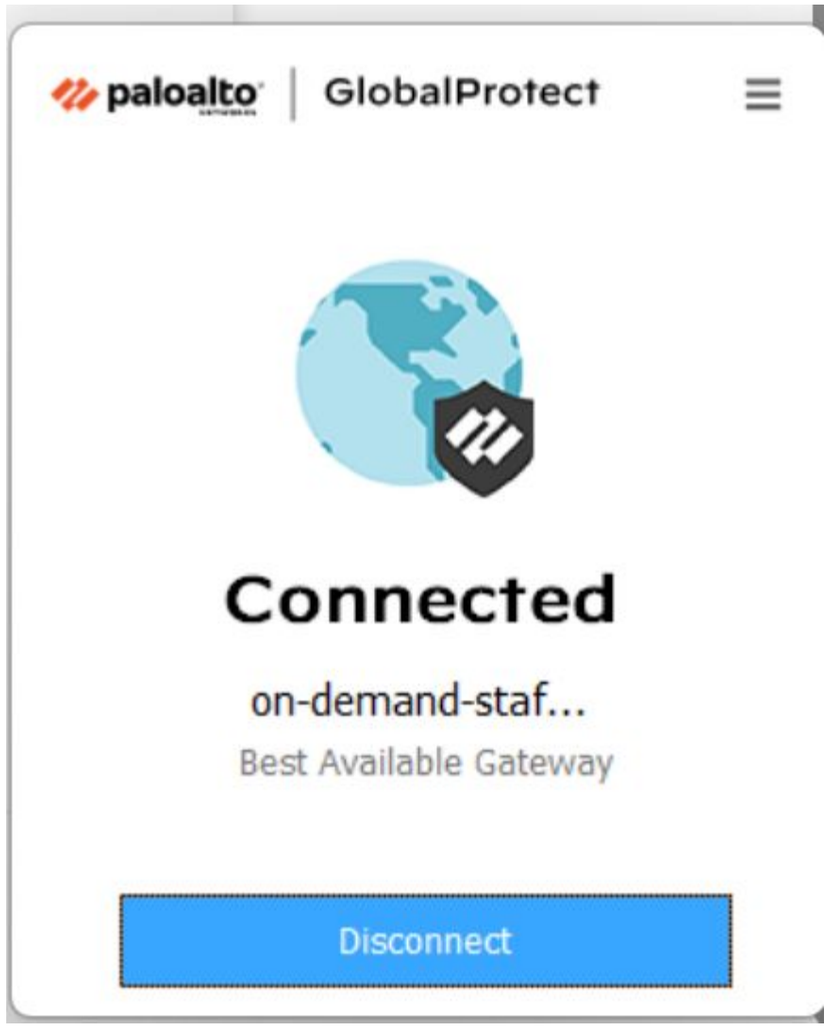
- allows employees to access company intranet over the Internet
- uses special gateway at the company + simple client software for the employees
- Monash offers an Access VPN

Using the Monash VPN

Example: access library resources

- Monash has subscriptions to many online journals
- access is restricted to Monash IPs: 130.194.X.X
- using VPN, you get a Monash IP!

VPN using GlobalProtect



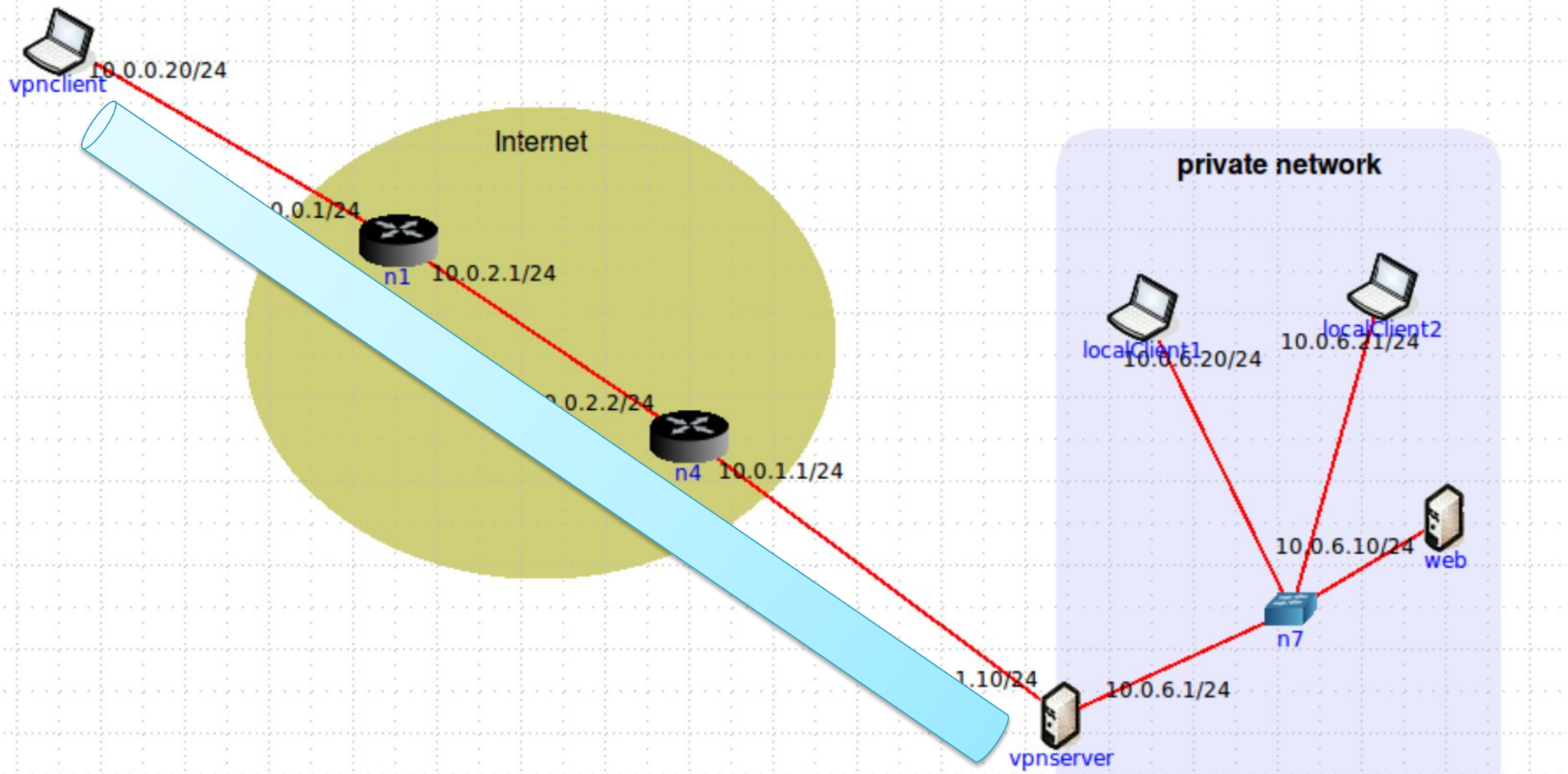
VPN

Advantages	Disadvantages
Low cost	No performance guarantees
Easy setup	Introduces overhead (encryption, encapsulation)
Secure	Many incompatible standards
Flexible (endpoints can move)	

Activity A

VPN

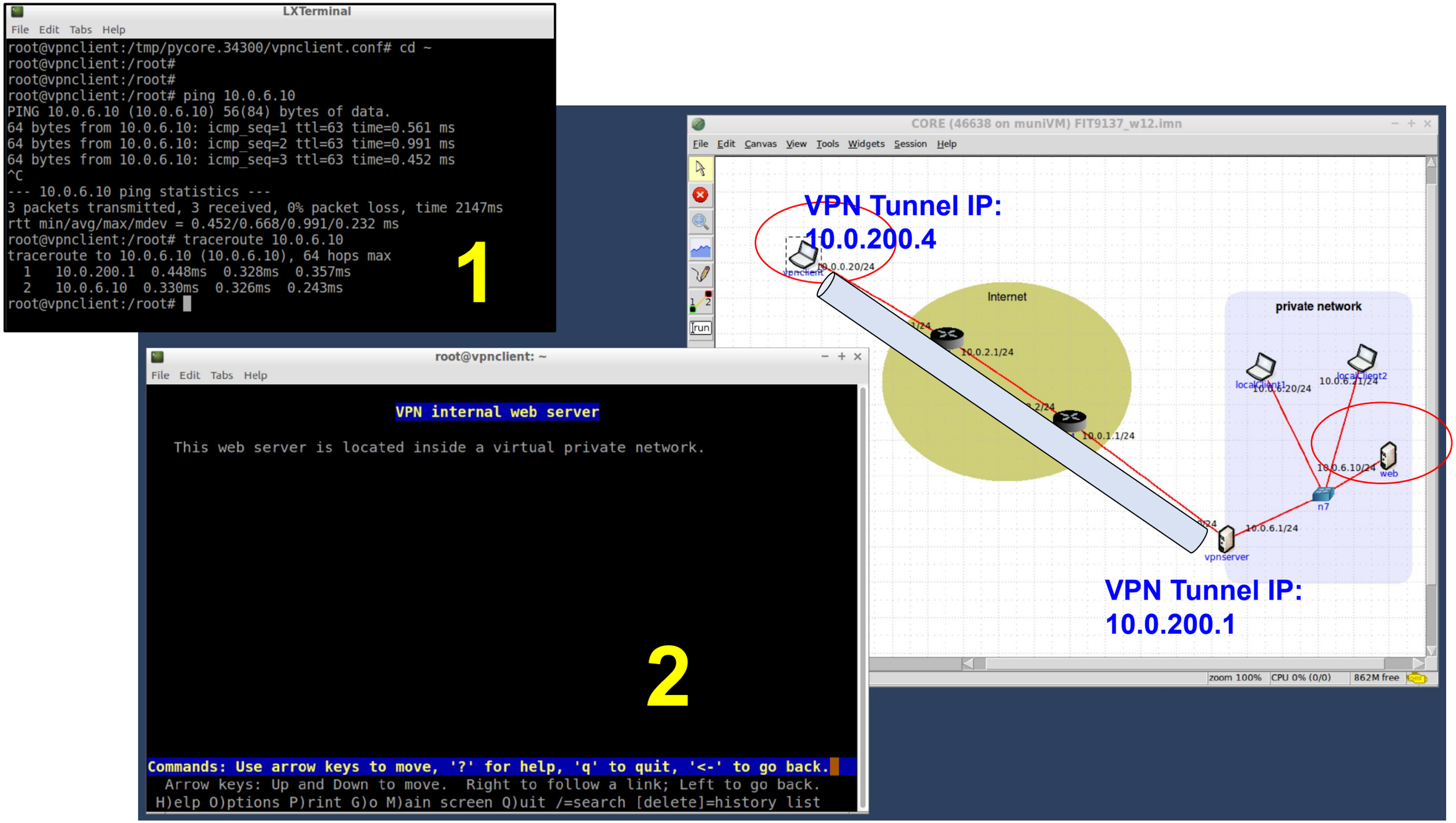
External Network – Home Network



• ACTIVITY A: VPN

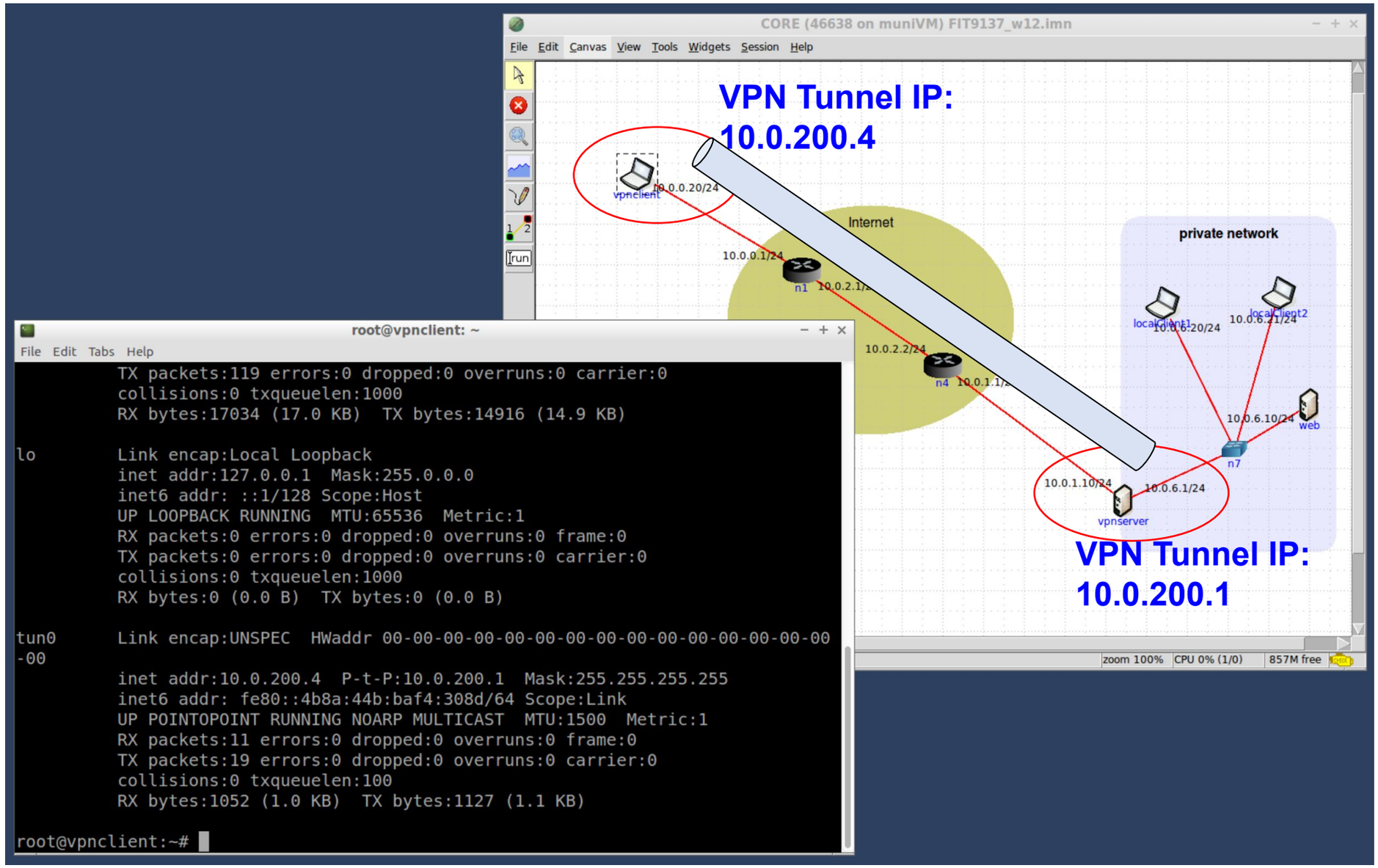
We will use the core file **`FIT9137_Week-11_Activity_VPN.imn`**. Open the file in CORE inside VM. The configuration contains a network design with a private network on the right, some public (Internet) routers in the middle, and a client in the top left that wants to connect to the private network. Start the emulation and perform the following tasks: `lynx 10.0.6.10`

STEP-1. See if you can reach the devices inside the private network. You can for instance ping the clients or run lynx with the address of the server. Run a traceroute between vpnclient and web. What do you see?



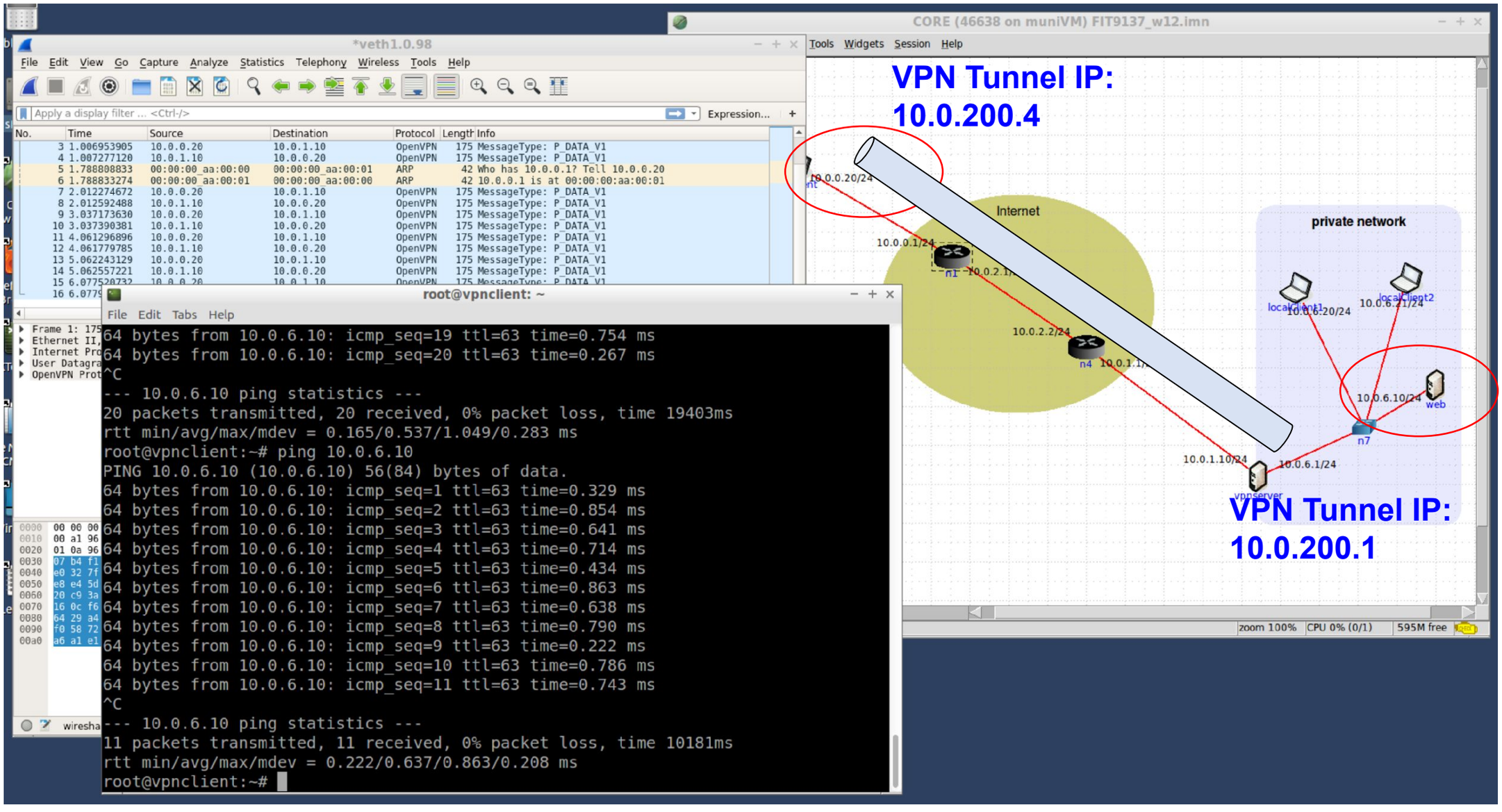
• ACTIVITY A: VPN

STEP-2. Run *ifconfig* for checking local network interfaces we find the tun0 interface:?



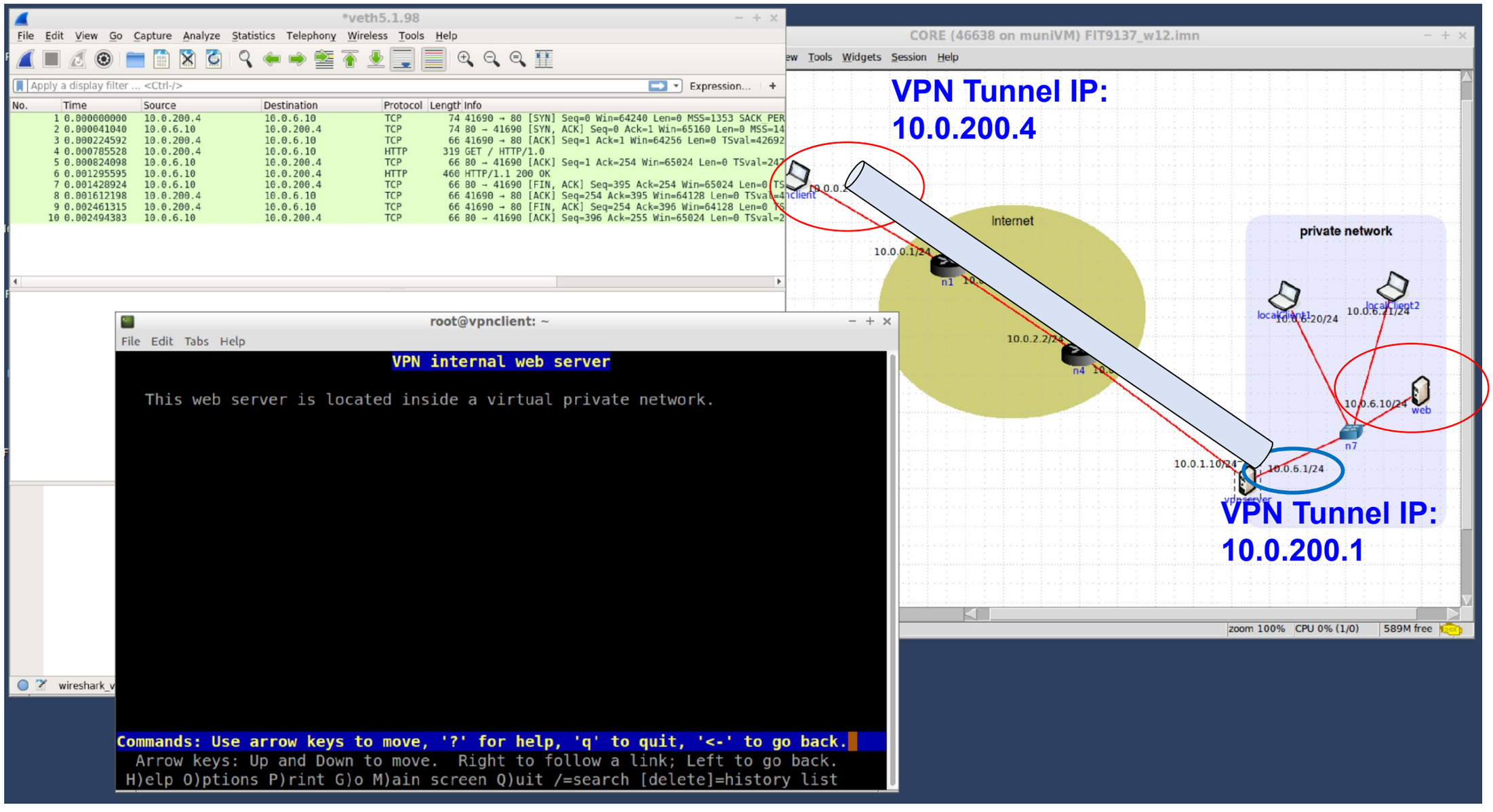
• ACTIVITY A: VPN

STEP-3. Run Wireshark on one of the routers. Then run lynx again from vpnclient accessing web or ping webServer. Can you see the HTTP protocol messages or the ICMP echo request and replies?



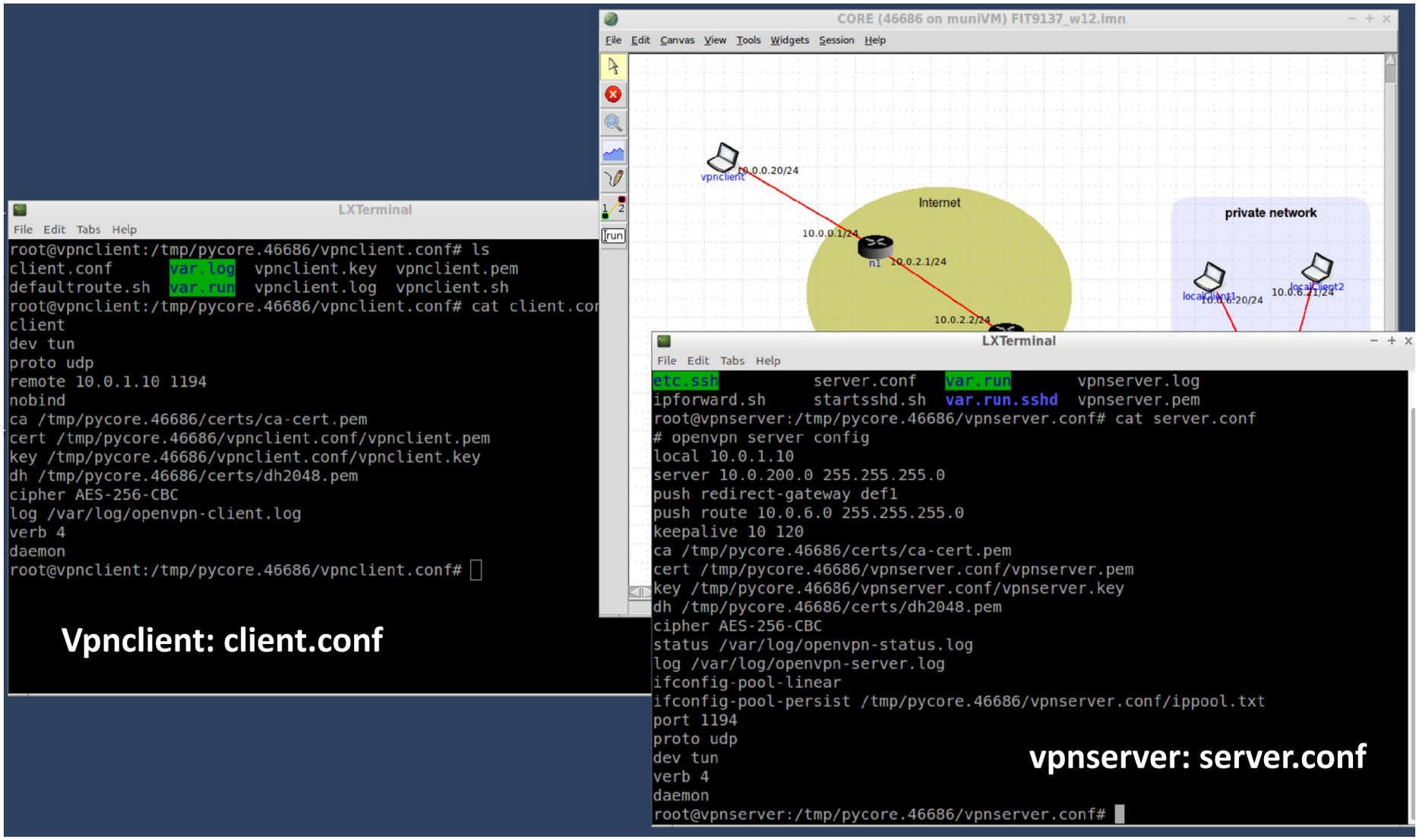
• ACTIVITY A: VPN

STEP-4. Run Wireshark on the interface eth1 (with IP 10.0.6.1) of the vpnserver. Run lynx as before. What can you see in the captured traffic?



• ACTIVITY A: VPN

STEP-5. Check the file client.conf on vpnclient and server.conf on vpnserver and use openvpn manual (man openvpn) to learn more about the settings. For instance, what encryption algorithm is used, what key exchange algorithm is used, what are the client and server key pairs etc.



600 hours of video uploaded to YouTube every minute

1.75 billion daily active users on Facebook

225 exabyte of worldwide Internet traffic per month

5.0 trillion US$ in online sales expected in 2023


Mornington Island
Surabaya
BALI
EAST NUSA TENGGARA
Timor-Leste
Arafura Sea
Merauke
Guinea
Port Moresby
Solomon Sea
Solomon Islands
Timor Sea
Darwin
Kununurra
Derby
Broome
Port Douglas
Cairns
Townsville City
NORTHERN TERRITORY
Coral Sea
Port Hedland
Karratha
Exmouth
Mount Isa City
Mackay
QUEENSLAND
Alice Springs
Yulara
Australia
WESTERN AUSTRALIA
Brisbane
SOUTH AUSTRALIA
Perth
NEW SOUTH WALES
Sydney
Adelaide
Canberra
ACT
Great Australian Bight
VICTORIA
Melbourne
Google
Tasman Sea

PollEv Question: Indigenous Peoples

Which of the following is/are true about Indigenous Peoples/Cultures in Australia:

A. The Aboriginal and Torres Strait Islander people of Australia are **the oldest continuous civilisation on earth,** extending back over **65,000 years**.

B. They could become Australian Citizens from the very beginning

C. Aboriginal and Torres Strait Islander art is among the **oldest forms of art in the world**

D. There are **less than 100,000** Indigenous People in Australia

Activity B

Activity Steps

<u>Problem:</u> How to provide proper Internet access to remote Indigenous communities

1. Form groups of 5-8 students
2. Pick a “cool” group name and a representative
3. Read the two main articles (and more as you like)
4. Discuss potential issues (financial, technical, cultural, etc) around the problem
5. Come up with solutions to the problem
6. Bring something from your own cultural, educational, professional background
7. Report the following in PollEv:
   a. Your group name
   b. List of issues identified (with brief explanations)
   c. Proposed solutions
   d. Input from your own background

Activity: Digital Inclusion

Resources

- https://theconversation.com/for-remote-aboriginal-families-limited-phone-and-internet-services-make-life-hard-heres-what-they-told-us-201295
- https://www.creativespirits.info/aboriginalculture/economy/internet-access-in-aboriginal-communities

Additional resources

- https://www.niaa.gov.au/sites/default/files/documents/publications/indigenous-digital-inclusion-plan-discussion-paper.pdf
- https://researchbank.swinburne.edu.au/file/a67b7e2c-0717-4974-8c98-06730bd91426/1/PDF%20(Accepted%20manuscript).pdf

Sample Answer

- Group name
- List of potential issues
  - Issue 1, brief explanation
  - Issue 2, brief explanation
- List of proposed solutions issues
  - Solution 1, brief explanation
  - Solution 2, brief explanation
- Individual 1’s personal input
- Individual 2’s personal input
- …

internet connectivity. • Issue 2: High costs and affordability Many Aboriginal families in remote communities cannot afford internet plans or digital devices, even when services are technically available. • Issue 3: Lack of culturally appropriate digital content Most online content is not available in Aboriginal languages or aligned with cultural contexts, reducing its relevance and usability. • Issue 4: Digital literacy and training gaps There is a lack of digital skills and confidence, especially among older generations and those with limited literacy. List of proposed solution issues • Solution 1: Satellite and community-based Wi-Fi Deploy satellite internet services (e.g. Starlink) and establish free or low-cost Wi-Fi hubs at community centres to provide stable access in remote areas. • Solution 2: Government-subsidised access and devices Introduce affordable internet plans and device subsidies to lower entry barriers and encourage long-term usage. • Solution 3: Local content development Support the creation of digital resources in Aboriginal languages and cultural contexts, focusing on education, health, and local services. • Solution 4: Digital education and local tech support Train local community members as digital ambassadors who can provide hands-on support and build community-wide digital literacy. Individual 1's personal input I believe simply installing internet infrastructure isn't enough. We need to empower local communities by training young people to become tech support and content creators, so they can both help others and find meaningful work. Individual 2's personal input The government must listen to the voices of

Learning Hubs Establish Wi-Fi access centers in community locations with shared computers or tablets. Provide digital literacy training in local languages to improve long-term engagement and skills. Solution 3: Community-Driven Engagement Hire and train local "digital ambassadors" to manage the technology, lead workshops, and ensure that all digital content and support are culturally appropriate and trusted by the community. 3. Personal Contributions Qianli Huang With my background in IT, I suggest implementing a local content caching system to preload educational and health resources. This would ensure access even with limited or intermittent internet connectivity. Yicheng Gao Coming from a rural area in China, I understand the consequences of digital inequality. I recommend government-subsidized digital devices for students and a centralized remote education platform to ensure equitable access. Kangsen Huang As an education major, I believe that teacher training is essential. By equipping local teachers with digital tools and strategies, we can ensure that communities benefit sustainably from improved internet access.

- Group name: CompArch student • Issue 1: Infrastructure: an indigenous Australian community, mostly living in remote areas, and it's costly to build such infrastructure, and it has the longest BEP. • Issue 2: Digital Literacy: living in remote areas means a lack of exposure to digital devices such as computers and phones. • List of proposed solutions issues • Solution 1: using a satellite-based internet connection, such as Starlink. • Solution 2: Ensure that schools in remote communities are equipped with computers and provide training for both students