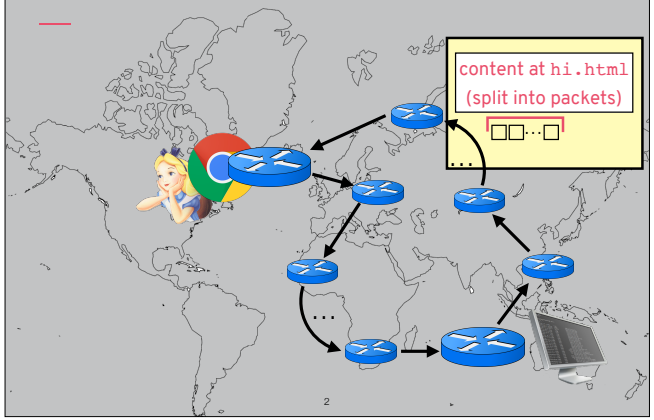
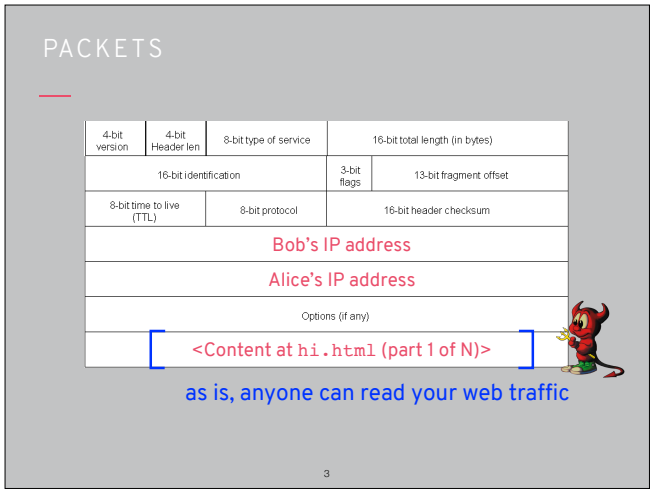
SECURITY (COMP0141): ENCRYPTED WEB TRAFFIC

UCL

STEP 3: RECEIVE CONTENT

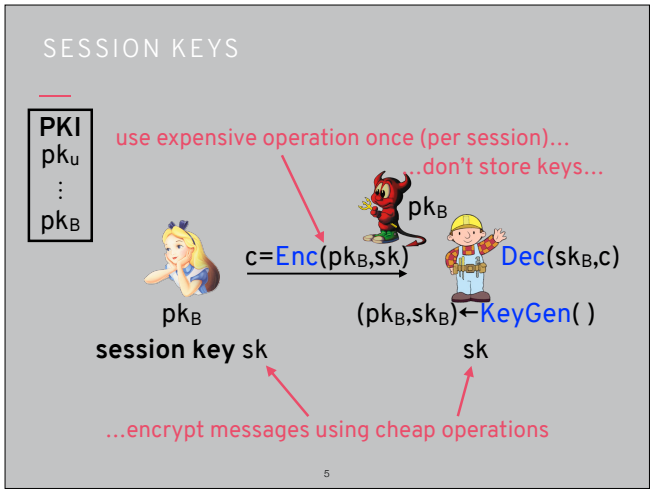


Remember from last week that packets are sent all around the internet

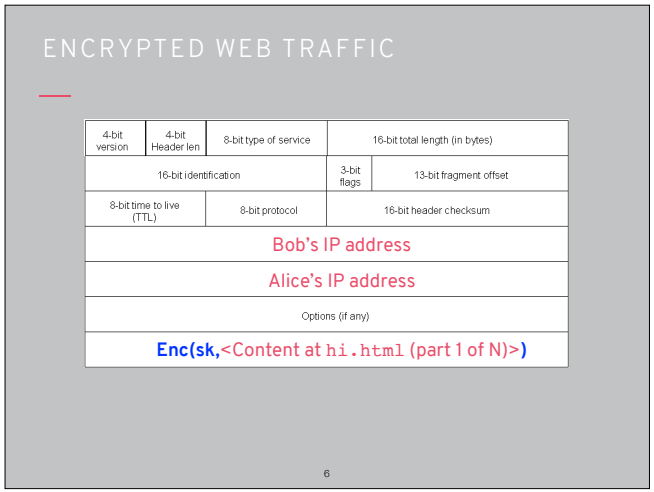


If we don't encrypt them, anyone can read them

Going back to threat model, there are obvious motivations ranging from curiosity to state-level attacks, and there are a lot of tools that make this easy so don't need specialist capabilities



In practice, we combine the advantages of both by using public-key encryption once to establish a shared session key



The session key is then used to encrypt all our packets, and at the end of the session it is discarded

HYBRID ENCRYPTION

This general method is called **hybrid encryption**

To encrypt a long message m:

- Pick a random (symmetric) session key K
- Encrypt K with c_1 = PKE.Enc(pk,K)
- Encrypt m with c_2 = SKE.Enc(K,m)
- The ciphertext is c = (c_1,c_2)

To decrypt and recover m:

- Compute K = PKE.Dec(sk,c_1)
- Compute m = SKE.Dec(K,c_2)
- The ciphertext is c = (c_1,c_2)

On the Internet we do this for multiple messages in a given session, but it can even be beneficial for single long messages as well. The overall cryptographic primitive this exemplifies is called hybrid encryption

LINGERING QUESTIONS

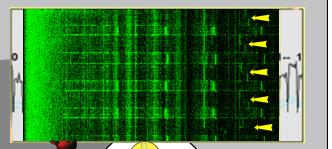
q: does encrypted web traffic still reveal IP addresses?
a: yes! to avoid this, use proxies or **onion routing** (e.g., Tor).

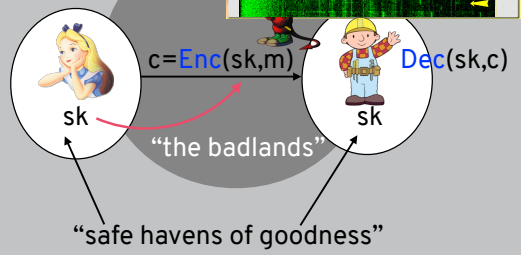
q: is communication channel the only attack surface?
a: no! **side channels** exploit weaknesses on either side.

We'll see Tor later on, remember that packet is an envelope and a letter and we haven't yet hidden the address information

SIDE CHANNELS

- timing
- power draw (DPA)
- acoustics





Side channels are prevalent and demonstrate that the communication channel isn't the only thing that can be attacked (again, need to consider attacker capabilities)

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q: how does Alice actually know it's Bob?
a: stay tuned for next week!

We still don't know who we're talking to though, this will be addressed with integrity next time