# Protocols

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Before continuing, we need to explain what a protocol is ...

In communications theory a **protocol** is a recipe for parties to connect and exchange information

Standardization of protocols are needed for communications

- with equipment from different vendors
- with network operated by different service providers

Certain issues need to be solved by most if not all protocols, e.g.,

- peer discovery
- negotiation (handshake)
- keep-alive (heartbeat)
- extensibility (TLVs, objects) and versioning
- framing, formatting, data representation
- resilience
- security

yet protocols are not (yet) universally designed for re-use

This is one of the motivations behind SDN ...

# Protocols and Algorithms

Once there was no overlap
between *communications* (telephone, radio, TV)
and *computation* (computers)

Actually communications devices always ran complex algorithms
but these are hidden from the user

This dichotomy has certainly blurred !

Most home computers are not used for *computation* at all
rather for entertainment and communications (email, chat, VoIP)

Cellular telephones have become computers

The differentiation can still be seen in the terms *algorithm* and *protocol*

In communications theory a **protocol** is a recipe for parties
to connect and exchange information

In computer science an **algorithm** is a recipe for a computational device
to carry out a task

*Protocols* are to *communications* what *algorithms* are to *computation*

# Some important SDOs

Protocols are *standardized* by:

- Standardization Development Organizations
- Industry Standards Groups
- Government agencies
- Leading players
- Open Source Communities

Some important SDOs

- **I**nternet **E**ngineering **T**ask **F**orce (RFCs)
- **I**nternational **T**elecommunication **U**nion (Recommendations X.###)
- **E**uropean **T**elecommunications **S**tandards **I**nstitute
- **A**merican **N**ational **S**tandards **I**nstitute

# Exercise – Analog protocols

1busy 2ans

Why is dial-tone needed? Who sends it? Why does it have 2 tones ?
When does it start/stop? What algorithm does the exchange use ?
What happens if you don't dial?

dtmf123

Why do DTMFs have 2 tones ? How does the exchange decode them ?

3T30

Is this a fax or a modem ? What is answer tone ? ans123
Try to recognize the signals (calling tone, answer tone, handshake)
Who sends each signal? Why is each needed ? What must be standardized ?
Why is the negotiation so slow (300 bps) ?
What algorithms are needed to support the protocols ?

4v34

How/why is this scenario different?

# Research topics

- A popular lecture on SDN is entitled

  *The future of networking is the past of protocols*

  - can a network really function without (any/distributed) protocols?
- Telephony protocols were hacked by blue-boxes
  - how can protocols be made safe?
- How can *boot* and *autodiscovery* be safely performed ?
- How can transaction-based management be performed ?