

# Unit 20

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## **Wireless Network Planning**

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# Objectives



Understanding that:

- A good **plan** needs a good budget
- A **good budget** demonstrates that you have a **good plan**

# The objectives are NOT



- To provide the **plan** for its implementation
- To provide **the budget** for its implementation



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- ◆ Implementation plan
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# Viability study

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- ♦ Where is the nearest Internet access point located?
- ♦ Weather and terrain conditions
- ♦ Transport accessibility
- ♦ Legislation (radio/towers)



# Implementation plan

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- 1) Network topology
- 2) Radio simulations
- 3) Equipment selection



# Implementation plan

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- ♦ Network Topology
  - ✓ Central tower/mast
  - ✓ Wireless repeaters
  - ✓ Clients



# Implementation plan

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- ◆ Radio simulations
  - ✓ Radio Mobile
  - ✓ GPS coordinates
- ◆ Radio link budget calculation
- ◆ Available line of sight

# Equipment selection

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- ♦ Functionality (Quality of service, traffic conformation)
- ♦ Price range
- ♦ Availability
- ♦ Indoors or outdoors?

# Budget

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- ◆ Hardware budget
- ◆ Human resources



# Hardware budget

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- ♦ Radio and network equipment
  - ✓ Electric grounding, lightning protection
- ♦ Hand tools
- ♦ Climbing gear, walkie-talkies, aluminum ladder, backpack to carry equipment, GPS, maps, binoculars, flashlights, ropes, tape, standard tool box.



# Hardware budget

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- ◆ Power
  - ✓ UPS, solar panels and charge regulator, storage battery
- ◆ Infrastructure (tower / masts)

# Equipment kits

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- ◆ Central hub
- ◆ Wireless repeater
- ◆ Outdoor CPE
- ◆ Indoor CPE

# Central hub



- ♦ Radio: outdoor access point(s)
- ♦ Power: Solar or grid
- ♦ Antenna: Depends on expected area coverage
- ♦ Mounting: To be mounted in central tower

# Central hub



- ♦ Electric power fluctuation: Surge protection
- ♦ Power backup: Generator, storage battery, solar panel and charge regulator

# Wireless repeater



- ♦ Radio: Two outdoor units
- ♦ Power: Solar or grid
- ♦ Antenna: Depends on expected area coverage
- ♦ Mounting: Pole and wall mount brackets (typically)

# Wireless repeater



- ♦ Electric power fluctuations and Lightning protection
- ♦ Power backup: generator, backup battery, solar panel and regulator, etc.

# Wireless outdoor CPE



- ♦ Radio: One outdoor unit
- ♦ Power: Grid
- ♦ Antenna: Internal or external directional antenna type depending on gain and distance

# Wireless outdoor CPE



- ♦ Mounting: Pole and wall mount brackets
- ♦ Electric power fluctuations and lightning: Surge protection
- ♦ Power backup: UPS

# Wireless indoor CPE



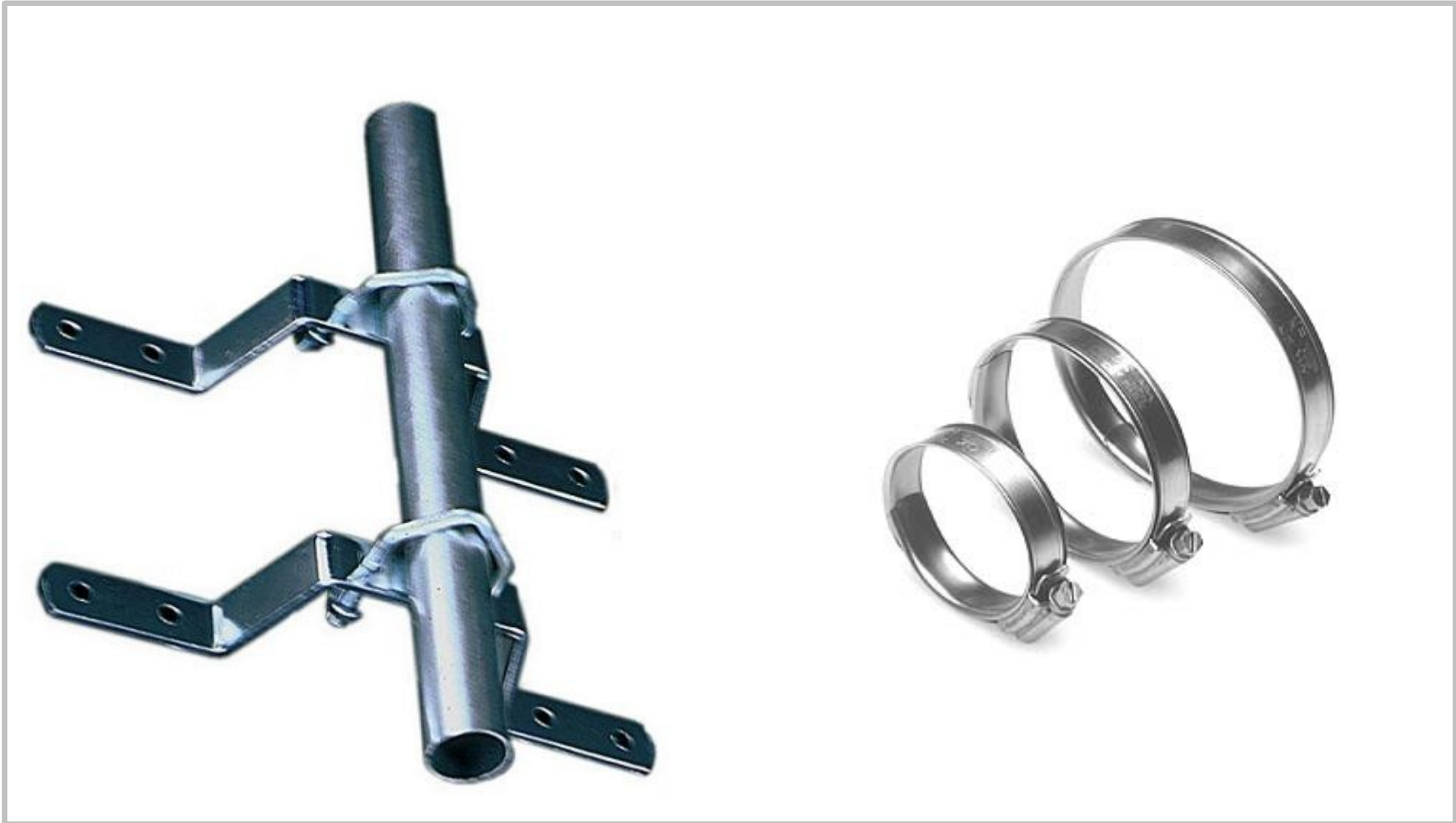
- ◆ Power: regular power cord
- ◆ Antenna: Internal or external directional antenna with RF cable.
- ◆ Mounting: Pole and wall mount brackets

# Wireless indoor CPE



- ◆ Radio: One indoor unit
- ◆ Electric power fluctuations and lightning:  
Surge protection
- ◆ Power backup: UPS

# Practical installation





# Human resources

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- ◆ Estimated work load
- ◆ Local transportation
- ◆ Accomodation and permits
- ◆ Communications
- ◆ Administrative expenses

# Licences and permits



- Permission to build a tower (see “Communication Tower”)
- Owner of the premises / tower / plot
- Authorities that regulate the airspace in the country

# Licences and permits



- ♦ Requirements to operate IEEE 802.11 equipment
  - ✓ Unlicensed (free licence with limitations )
  - ✓ Licence required

# Licences and Permits



- ♦ “Unlicenced” implies that a license is not required
- ♦ “Unlicenced” **does not** mean unregulated
- ♦ Maximum power output is regulated

# Licences and Permits

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- ♦ Regulations vary from country to country
- ♦ Normally, licenses are handled by the “Ministry of Communications”

# Licences and Permits



- ♦ Brazil, Honduras, Nicaragua, Anguila, Jamaica, Colombia, México, Perú(\*) and Venezuela
    - ✓ Free use of 2.4 and 5.8 GHz with some constraints: maximum power, antenna gain, open spaces.
- (\*) rural areas

# Licences and Permits



- ♦ Argentina, Ecuador, Costa Rica, El Salvador
  - ✓ 2.4 and 5.8 GHz require registration, with constraints
- ♦ Paraguay
  - ✓ 2.4 requires concession, licence or authorization

# Equipment acquisition



- ◆ Local acquisition
  - ✓ Heavy and bulky equipment
  - ✓ Locally manufactured
- ◆ Imports
  - ✓ Equipment not available in local markets

# Imports



- ◆ Rules and regulations
  - ✓ Revenue Authority
  - ✓ Chamber of Commerce
  - ✓ Trade Council

# Most common import documents



- ♦ Pre-shipment inspection
- ♦ Proof of origin
- ♦ Trading invoice
- ♦ Transport insurance



# Import tax and VAT

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- Based on **cost** of equipment
- Based on **type** of equipment
- Ranges from 0% to 20-30%
- Make sure that your imported goods are correctly classified



# Import tax and VAT

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- VAT adds to import tax
- VAT varies from 10 to 20%



# Implementation phase

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- ♦ Before starting up:
  - ✓ Acquisition and shipment of equipment
  - ✓ Licences and permissions obtained and payed
- ♦ Implementation time (weather conditions)
- ♦ Team project (expertise)

# General advice about contracts

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- ◆ Delivery time
- ◆ Transportation
- ◆ Installation
- ◆ Guarantee
- ◆ Exchange rate

# Public tenders

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- ◆ Prepare in advance a good specification
- ◆ Specify what you want and what you **do not want**
- ◆ Let someone with more experience revise your specification. Involve external experts

# Public tenders

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- ◆ Do not forget: tests and evaluation
- ◆ **Expect quality, demand quality!**

# Quality assurance



- ♦ Test the equipment and compare labels
- ♦ Revise specifications
- ♦ ¿What do you want? ¿How can it be measured ?
- ♦ ¿What can be guaranteed?
- ♦ ¿Who's to be blamed? :-)



# Conclusions

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- You do not need to be a genius to plan and budget a wireless network implementation. Be realistic and a bit “pessimistic”
- A good implementation plan from the beginning will save you lots of trouble (and money) at the end of the project



# Conclusions

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- ♦ Budget must include bringing internet and electricity to the site, obtaining licences, ensure lightning protection, transportation, tools
- ♦ A budget *per se* is not a good plan. But a good plan has a good and detailed budget