Implementation of the Power Save Mode 802.11s in NS-3

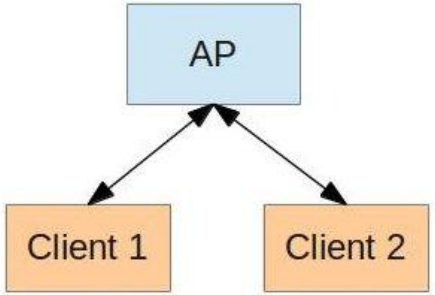
Sholokhova Olga
OSLL, SPbETU “LETI”, Russia
15.11.2013

IEEE 802.11s

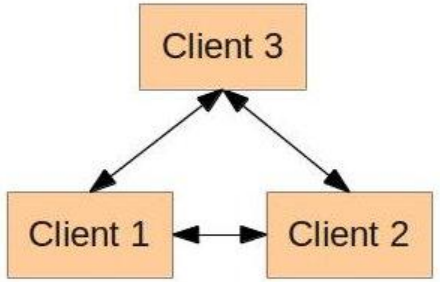
- 802.11 amendment for mesh networking (WMN - wireless mesh network), 2011

[http://www.cwnp.com/cmsAdmin/uploads/802-11s_mesh_networking_v1-0.pdf]

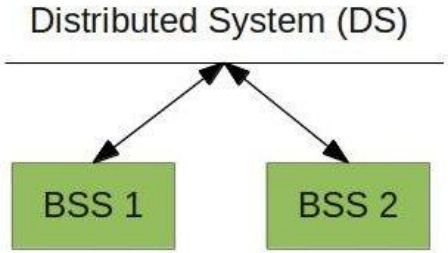
BSS, IBSS and ESS



BSS - Basic Service Set

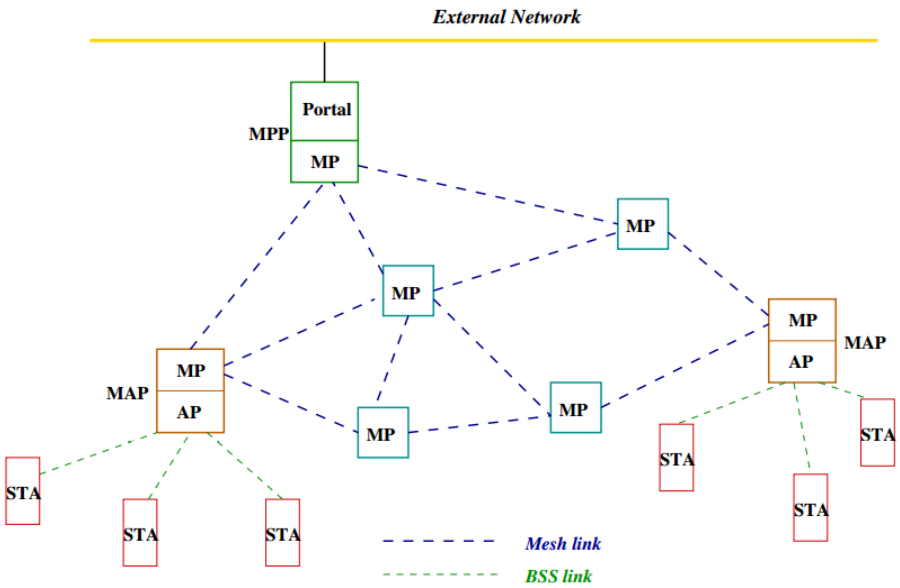


IBSS -Independent Basic Service Set



ESS -Extended Service Set

Wireless mesh network



- Consist of nodes:
  - mesh point (MP)
  - mesh access point (MAP)
  - mesh portal (MPP)

- Combined advantages of ESS and IBSS architectures
  - flexibility
  - self forming
  - self-healing

pic - [http://perso.prism.uvsq.fr/users/mogue/Biblio/MESH/Mesh2/get13.pdf]

Power saving problem

Some MP may be a mobile stations operating on battery

Issue - prolong network lifetime

Solution - routing protocols aimed to efficiently use topology information and the battery charge on the nodes for power saving

pic - [http://blog.supermedia.com/five-ways-you-can-help-your-business-go-mobile/]

Power saving approaches

802.11 allows wireless station to be in one of two power states: active and sleep

During the sleep mode, the wireless device may not transmit or receive any packets, or even sense the channel state

802.11s PSM

The 802.11s amendment describes three states for mesh stations:

Active Mode

Light Sleep Mode

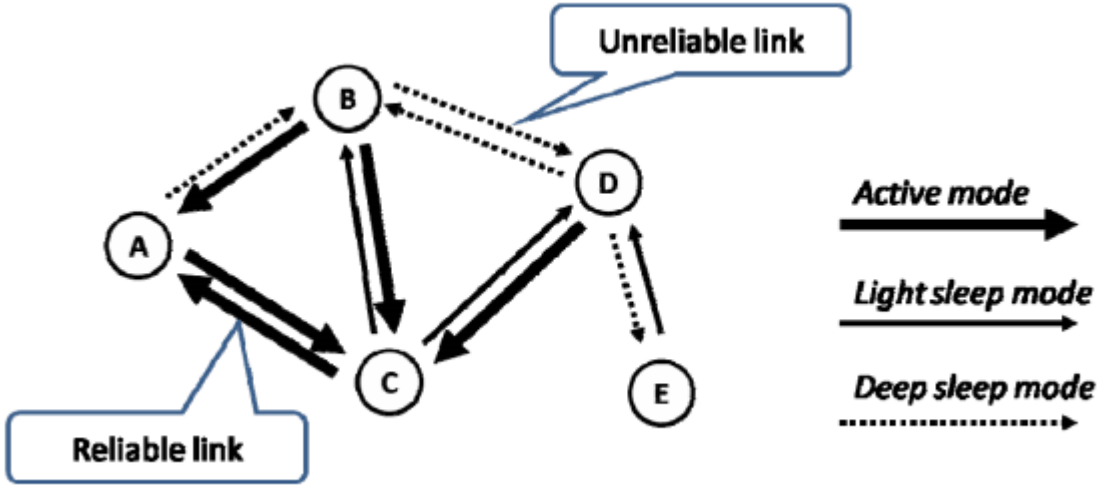
Station tries to conserve battery while still performing some functions

Deep Sleep Mode

Station still has to awaken at a regular interval to send its own messages

Important 802.11s PSM aspect

A very interesting **aspect** of this power management mechanism is that it can be used **globally** (non-peer mesh power mode) or **on a per link** (per mesh neighbor) basis (peer specific mesh power mode) for best path management.



http://www.cwnp.com/cmsAdmin/uploads/802-11s_mesh_networking_v1-0.pdf

Objectives

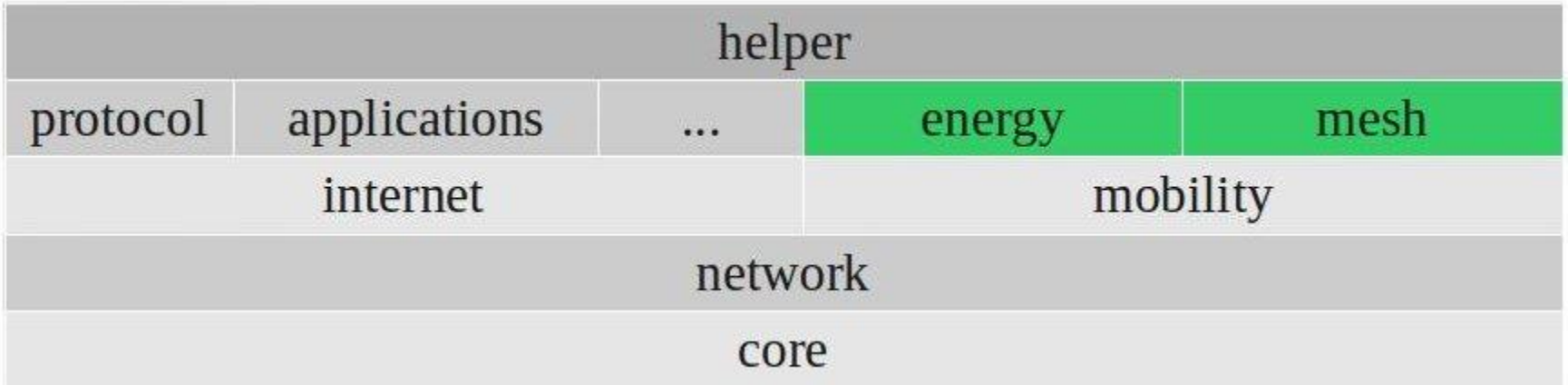
1. Develop routing algorithm bases on 802.11s PSM aspect

2. Implement this routing algorithm in NS-3

3. Analyze algorithm and implementation

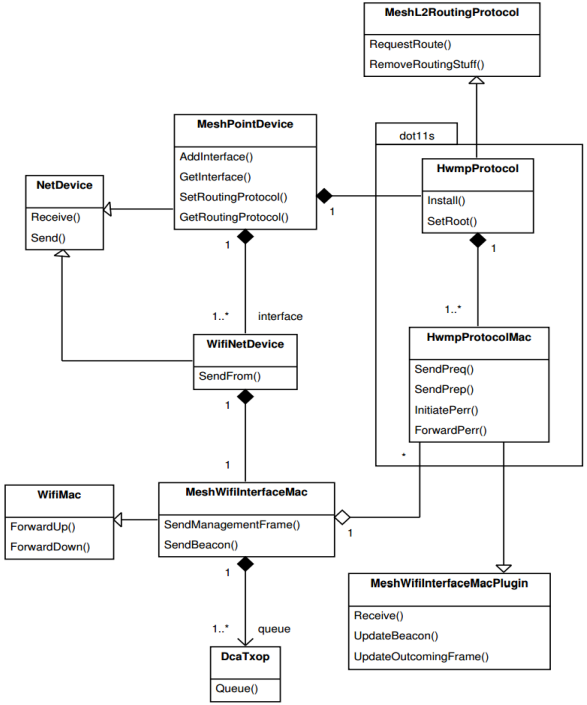
PSM implementation in NS-3

NS-3 is a discrete-event network simulator in which the simulation core and models are implemented in C++



[NS-3 Manual - http://www.nsnam.org/docs/release/3.18/manual/ns-3-manual.pdf]

Mesh model



[http://www.nsnam.org/workshops/wns3-2010/dot11s.pdf]

Easy to add new protocol:

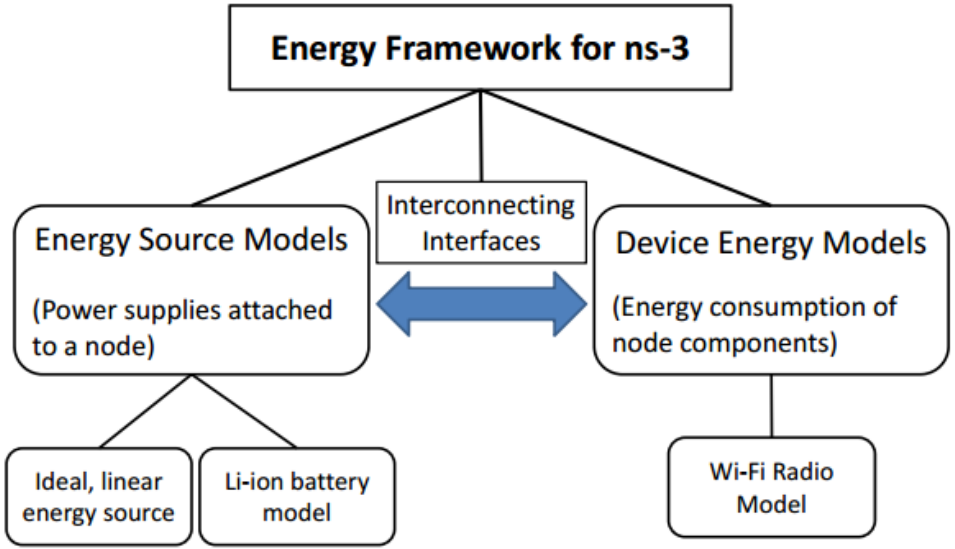
implement *MeshL2RoutingProtocol* -

[all station-level protocol logic and data base]

implement *MeshWifiInterfaceMac* -

[extends mesh interface MACfunctions to support corresponding protocol]

Energy model



It is possible to create mechanism for handle node battery charge changes

[http://www.ee.washington.edu/research/nsl/papers/SIMUTools-11.pdf]

Road map

- Create PSM infrastructure in NS-3
- Implement routing algorithm in NS-3
- Implementation testing

Questions & Answers

Sholokhova Olga

sholokhova.olya@gmail.com
Open Source & Linux Lab,
http://osll.fruct.org, osll@fruct.org