

Introduction to Mesh

ICTP

School on Radio-based Computer Networking

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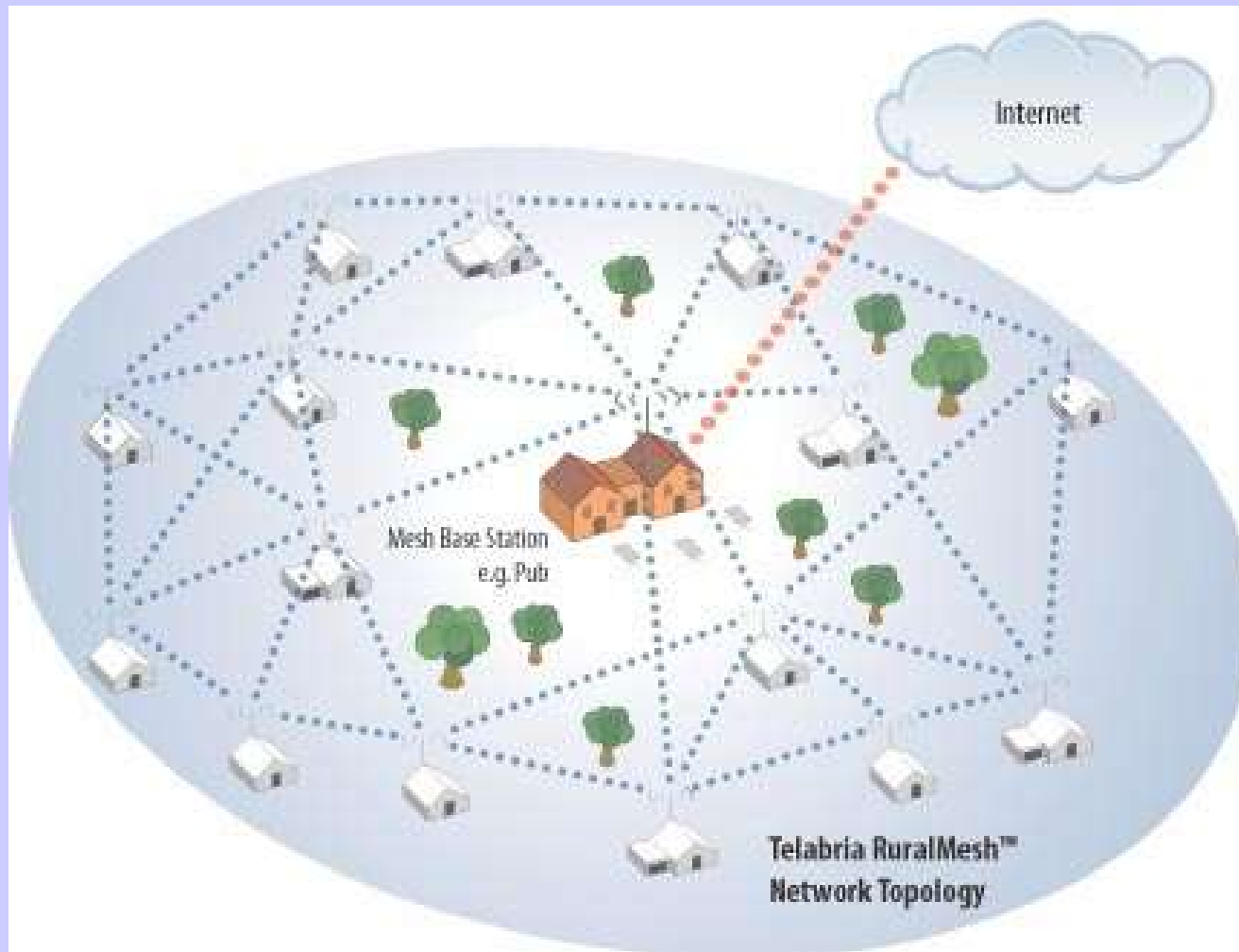
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wire.less.dk

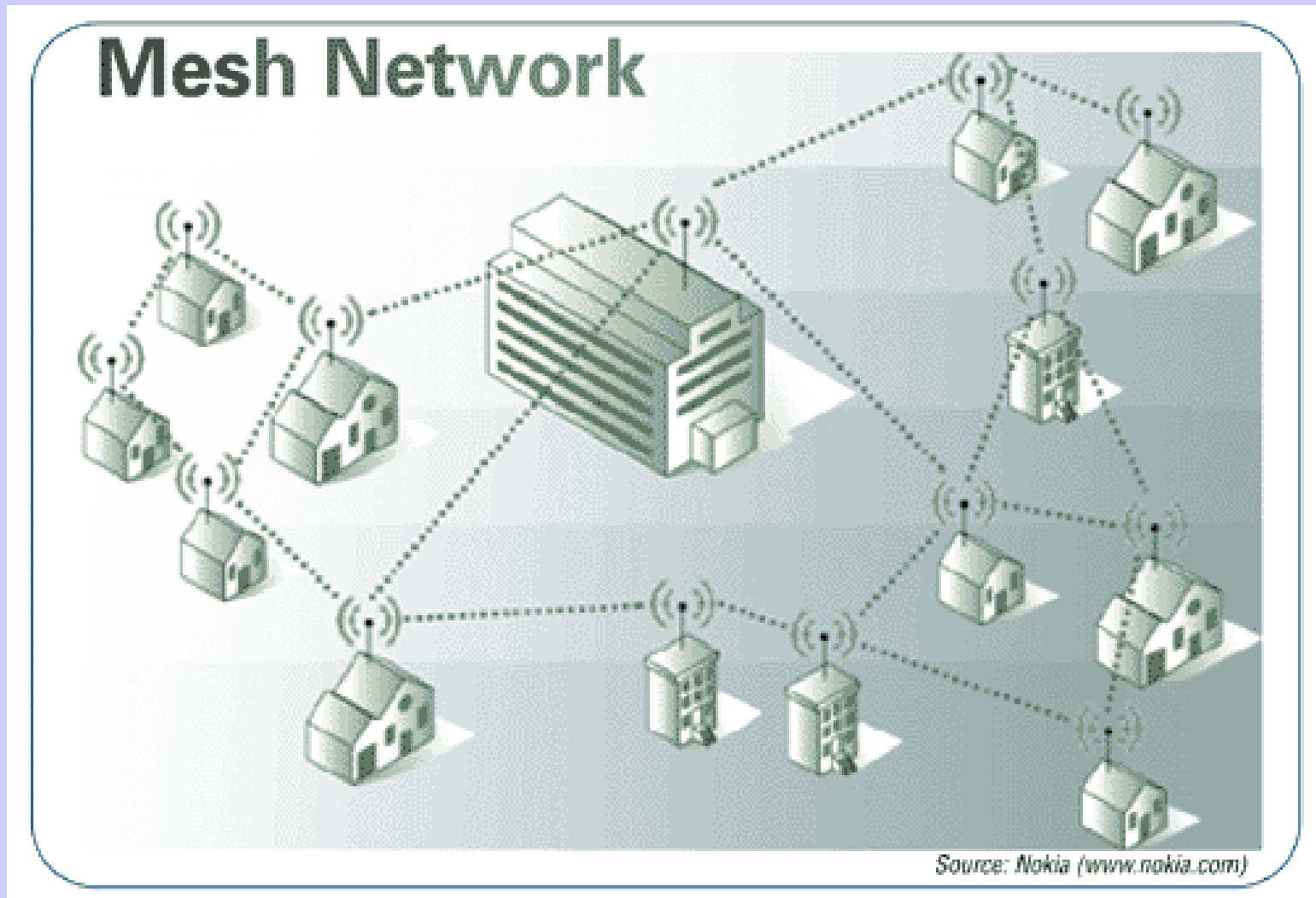
What is Mesh?

"A mesh network is a network that employs one of two connection arrangements, full mesh topology or partial mesh topology. In the full mesh topology, each node is connected directly to each of the others. In the partial mesh topology, nodes are connected to only some, not all, of the other nodes."

Mesh Diagrams



Mesh Diagrams



Strengths and Advantages

- ◆ Self Organizing
- ◆ Wide Ranging
- ◆ Scalable
- ◆ Resilient/Self Healing
- ◆ Affordable
- ◆ Useful in high-noise environments

Disadvantages of Mesh

- ◆ No DHCP?
- ◆ Vulnerable to Attacks?
- ◆ Scalability issues with single half-duplex radios
- ◆ Difficult to do proper Authentication
- ◆ No single dominant standard

Mobile Mesh

- ◆ Link Discovery
 - ◆ Simple “Hello” Protocol
- ◆ Routing
 - ◆ Link State Packet Protocol
- ◆ Border Discovery
 - ◆ Enables external tunnels

Mesh Protocols (Examples)

- ◆ Pro-Active
 - ◆ OSLR – Optimized Link State Routing
 - ◆ HSLS – Hazy Sighted Link State
 - ◆ TBRPF - Topology Broadcast based on Reverse-Path Forwarding
 - ◆ Mobile Mesh
- ◆ Geographic
 - ◆ SCR – Short Cut Router
- ◆ Reactive
 - ◆ AODV – Ad-hoc, On-demand, Distance Vector

See also http://en.wikipedia.org/wiki/Ad_hoc_protocol_list

OLSR

The Optimized Link State Routing Protocol (OLSR) is developed for mobile ad hoc networks. It operates as a table driven and proactive protocol, thus exchanges topology information with other nodes of the network regularly. The nodes which are selected as a multipoint relay (MPR) by some neighbor nodes announce this information periodically in their control messages. Thereby, a node announces to the network, that it has reachability to the nodes which have selected it as MPR. In route calculation, the MPRs are used to form the route from a given node to any destination in the network. The protocol uses the MPRs to facilitate efficient flooding of control messages in the network.

from <http://hipercom.inria.fr/olsr/#intro>

OLSR Cont'd

<http://www.olsr.org/>

- ◆ Cross-platform implementation
 - ◆ Runs on at least the following platforms
 - ◆ Linux PC's, Windows, Mac OSX, FreeBSD
 - ◆ Linux PDA's
 - ◆ OpenWRT
 - ◆ Metrix Boxes
- ◆ User Space binary program
- ◆ Very simple to use
- ◆ Used by the German FreiFunk Wireless Community

PicoPeering Agreement

- ◆ Free Transit
- ◆ Open Communication
- ◆ No Warranty
- ◆ Terms of Use
- ◆ Local Amendments



For the Lab

- ◆ We will be using version 0.4.9-pre of olsrd from <http://www.olsr.org>
- ◆ Install olsrd on all the Metrix boxes
- ◆ Install olsrd on my laptop
- ◆ Look at the way the protocol adapts it's routing tables as computers enter and leave the network
- ◆ If we have time: Install olsrd on some of the ubuntu machines

- ◆ get the file at http://192.168.89.11/matrix_olsr/olsrd.tar.gz or from my usb-stick
- ◆ Connect a machine to the matrix box
- ◆ ssh to the matrix box
 - # ssh -l root xxx.xxx.xxx.xxx
- ◆ # remountrw
- ◆ Copy the file to the matrix box (from the desktop machine)
 - # scp olsrd.tgz root@xxx.xxx.xxx.xxx:/root/
 - password: root
- ◆ # ssh -l root xxx.xxx.xxx.xxx
- ◆ unzip the file on the matrix box
 - # tar -xvzf olsrd.tgz
- ◆ copy the files to the tight locations
 - # cp olsrd /usr/local/sbin/
 - # cp olsrd_httpinfo* /usr/local/sbin/
 - # cp olsrd.conf /etc/
 - # remountro
- ◆ go to the Metrix web interface and configure the wlan0/ath0 interface
 - ◆ essid: olsr
 - ◆ ip: 10.10.10.groupNumber
 - ◆ netmask: 255.255.255.0
 - ◆ mode: ad-hoc
 - ◆ channel: 1
- ◆ Back to the ssh session: olsrd

Protocol Implementations And Information (Open Implementations and services)

http://en.wikipedia.org/wiki/Ad_hoc_protocols_implementations

http://en.wikipedia.org/wiki/Ad_hoc_protocol_list

<http://wire.less.dk/wiki/index.php/MeshLinks>

OLSR:

<http://www.olsr.org/>

<http://hipercom.inria.fr/olsr/>

Mobile Mesh

http://www.mitre.org/work/tech_transfer/mobilemesh/index.html

<http://ipmesh.sourceforge.net/>

AODV:

<http://www.ics.uci.edu/~atm/adhoc/paper-collection/perkins-draft-ietf-manet-aodv-00.txt>

<http://sourceforge.net/projects/meshbox/>

<http://core.it.uu.se/AdHoc/ImplementationPortal>

TBRPF:

<http://www.erg.sri.com/projects/tbrpf/>

HSLs:

Hardware/Software with Free Mesh Implementations

OLSR on Metrix:

<http://www.metrix.net/support/dist/>

OLSR on WRT54G:

<http://www.seattlewireless.net/index.cgi/OpenWrt>

OLSR on MeshCubes:

<http://meshcube.org/>

AODV on LocustWorld MeshAP:

<http://locustworld.com/>

AODV on Linksys WRT54G

<http://www.seattlewireless.net/index.cgi/OpenWrt>

HSLs on Metrix or PC hardware from Champaign-Urbana Wireless:

<http://www.cuwireless.net/index.html>