Institutionen för mikroelektronik och informationsteknik

2G1330 Mobile and Wireless Network Architectures

Wireless Local Loop (WLL) and Enterprise Networks

Lecture notes of G. Q. Maguire Jr.

For use in conjunction with *Wireless and Mobile Network Architectures*, by Yi-Bing Lin and Imrich Chlamtac, John Wiley & Sons, 2001, ISBN 0-471-39492-0

Lecture 6

- Wireless Local Loop (WLL) (Ch. 23), Enterprise Networks (Ch. 24)
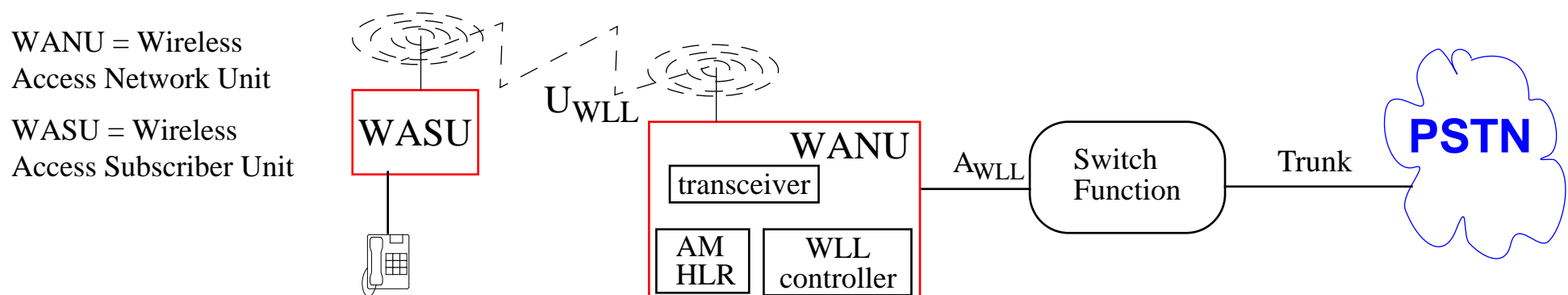
Wireless Local Loop (WLL)

Providing wireless connections to stationary or near stationary stations within a small service area

Generally targeted at the "last mile" or from a point in the neighborhood to the user

Advantages of Wireless local loop:

- ease of installation
  - reducing digging, reduce poles, ducts/conduits, …
  - quick installation of new links (i.e., rapid provisioning)
  - largely distance insensitive pricing - at least up to some limit
- concentration of resources (especially at the multiplexer to the high bandwidth backbone)

IS-54 architecturel reference model for WLL:

WANU = Wireless Access Network Unit

WASU = Wireless Access Subscriber Unit

WASU

U_{WLL}

WANU

transceiver

AM HLR   WLL controller

A_{WLL}

Switch Function

Trunk

PSTN

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Deployment issues

- Spectrum
    - licensed - limited interference, but requires licensing
    - unlicensed - more interference, but no licensing - generally limited in (maximum and average) power

- Service Quality
    - Users expect it is going to be the same as wireline service
    - high reliability
    - low risk of fraud (due to others "hijacking" the link)

- Network planning
    - should support very high penitration levels (for example >90%)
    - exploits the fact that users are not moving (or rarely move)
    - antenna height, etc. is generally derived from user density

Very popular in the former "East block" of Europe - since there was no need to install a local loop cable to bring users to the local exchange of the PSTN; enabled very rapid provisioning to very large numbers of subscribers.

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WLL Technologies

- ## Satellite
  - a great chance for the satellite operators (Hughes Network Systems, Inmarsat Internation Circular Orbit (ICO), Iridium, Globestar, Odyssey, American Mobile Satellite Corporation (AMSC), Asia Cellular Satellite (ACeS), Thuraya, …)
  - note that some of these operators (such as Hughes) used terrestrial versions of their system

- ## Cellular-based
  - used in rural and sparse urban settings

- ## Low Tier PCS or Microcellular based systems
  - PACS, PHS, DECT, …

- ## Fixed Wireless Access (FWA)
  - some times proprietary point-to-point links
  - increasinly LMDS

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Enterprise Networks

Networking within an organization - often campus networking. Traditional voice enterprise networks were based on a PBX, today this often extended by cordless telephony, wired LANs, and WLAN systems.

Enterprise based location systems (such as Ericsson DECT mobility server, which enabled redirecting a DECT call to any Ericsson site from the user's home site).

Olivetti& Oracle Research Labs (now AT&T Research Labs) in Cambridge developed an active badge system which used IR emitting badges (called *active badges*) to locate users with in the building. This enabled delivering a phone call to the nearest fixed line phone, logging who visited who, finding people and equipment, … . Their recent project uses ultrasound for location: *active bat*s.

Theo Kanter and colleagues at Ellemtel showed a system in the mid-1990s which utilized active badges (developed at KTH, HP, and Univ. of Wollongong) to locate users and by providing voice gateways the could direct a user's calls to computers, cordless, or mobile phones as appropriate.

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Cordless PBXs

For example, Ericsson's MD110 Communication System (aka "Consono") -- which is a DECT based system - simply attaches DECT base stations to their PBX.

See `http://www.ericsson.com/enterprise/products/MD110/index.shtml`

Telia provides packages where the user can pay:

- per line/month - fixed
- per line/month - DECT (with local mobility support)
- per line/month - DECT (with mobility support over several exchanges)
- per line - DECT (with local or multiple site mobility) - but only outgoing/incoming trunk costs/month
- …

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Virtual enterprise networks

By utilizing location based billing, it is possible to offer an enterprise a virtual cellular PBX (ala the Centrex systems for fixed telephony). In such a system the operators negociates a price for proviting coverage to a campus or set of coverage areas - typically for a fixed price for a year (or more).

The operator likes this as they know they have a given amount of income and they know what their fixed costs for installing a base station to cover the relevant areas is. As a side effect they may also be able to handle calls for other users -- and not have to pay for renting antenna and other space!

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Remoting the office to where the user is

A rapidly growing area of business utilizes Virtual Private Network technology to extend the corporate netowrk (voice, fax, data, file system, etc.) to where the user is and via what ever communications interconnect that is available.

(See for example: Ericsson's Virtual Office (EVO))

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Unified Communications

- Integrated messaging
  - Cellular, cordless, fixed lines - are share the same voice mailbox, potentially with interface to e-mail, …
- Synchronizing calendars, phone books, …
- Synchronizing services across many devices (which may be using different networks)
- Ericsson's Always Best Connected (ABC) - to use the best technology for the current setting

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