DECT

(DECT = Digital Enhanced Cordless Telecommunication)
(previously: Digital European Cordless Telephone)
(Japanese alternative: PHS = Personal Handy phone System)

- more than a simple cordless terminal system!
- 4 basic applications (cordless system, PABX extension, WLL connection, CTM)
- TDD duplex structure (basics, advantages)
- Web sources: www.dect.ch, www.dectweb.com, www.etsi.org

Four application examples of DECT:

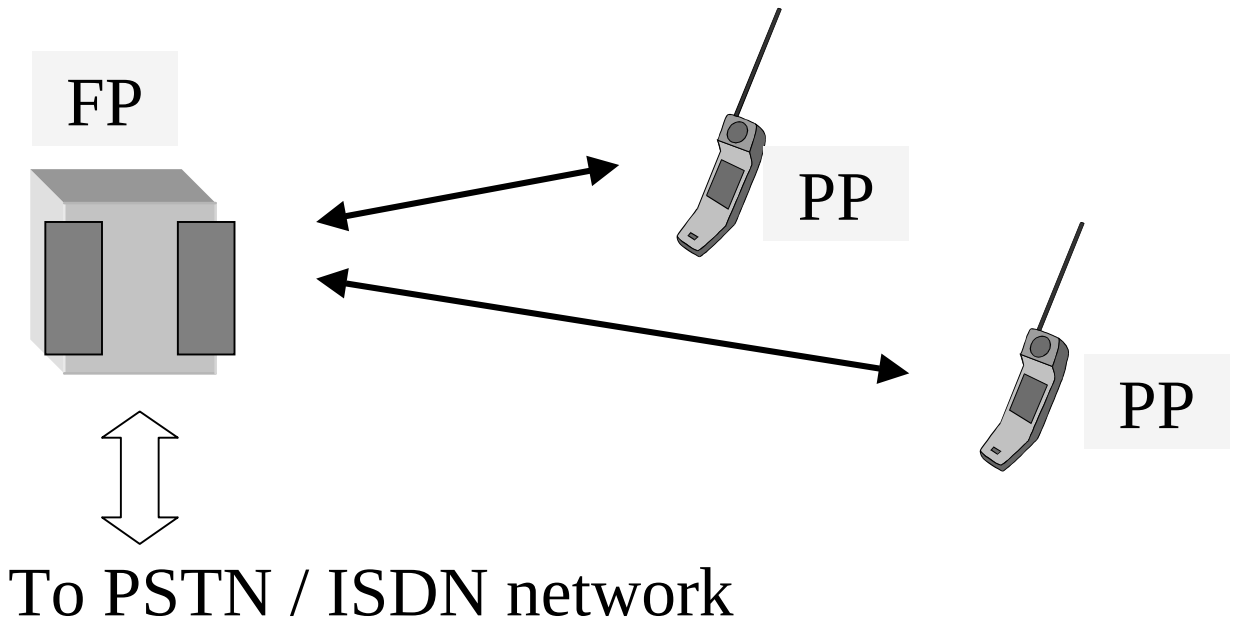
1) Cordless system (residential use), only one base station, only intracell handover

2) PABX wireless extension (business use, e.g., HUT), many base stations, intracell & intercell handover

3) WLL (Wireless Local Loop) connection, instead of wired access lines for connecting users to the PSTN/ISDN

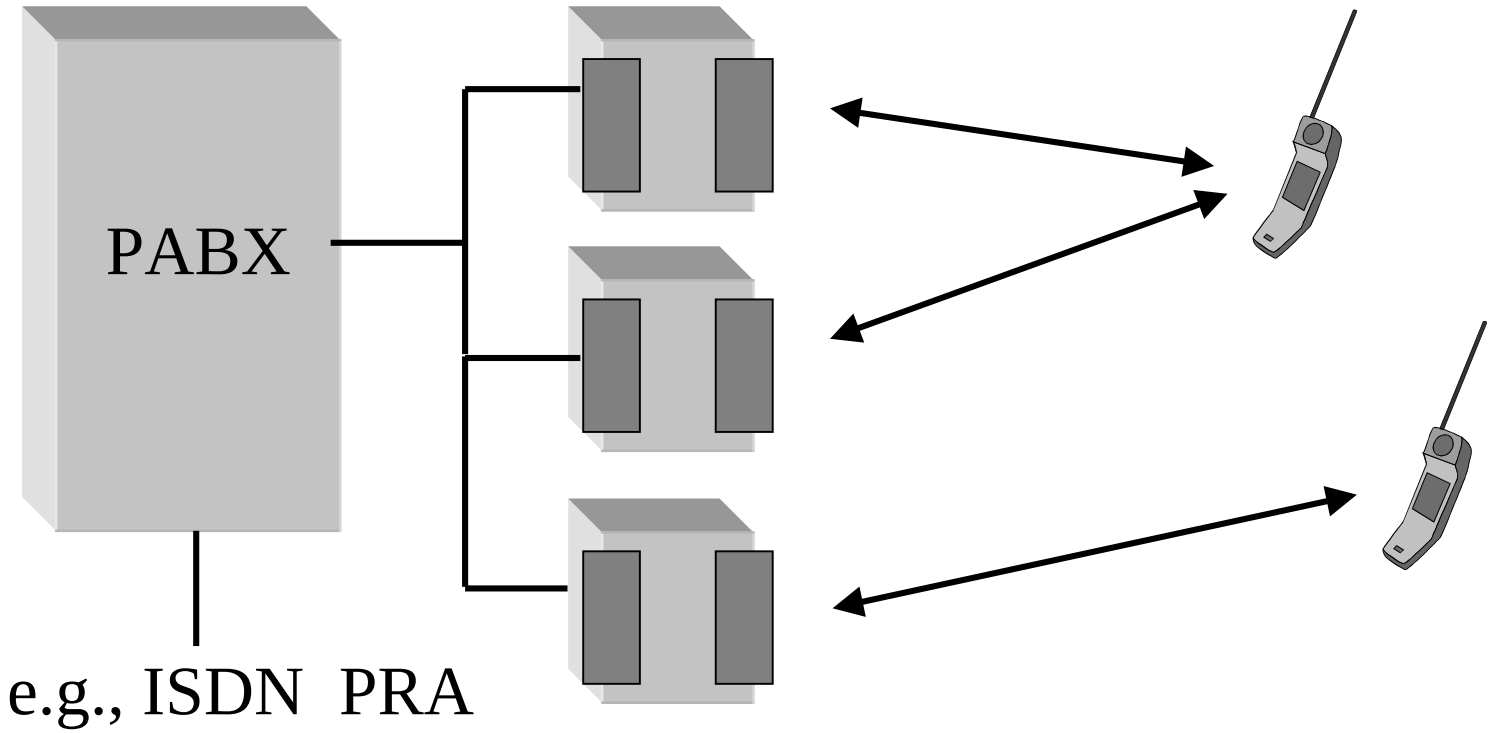
4) CTM (Cordless Terminal Mobility), wide area mobility

Residential use (DECT as cordless terminal)



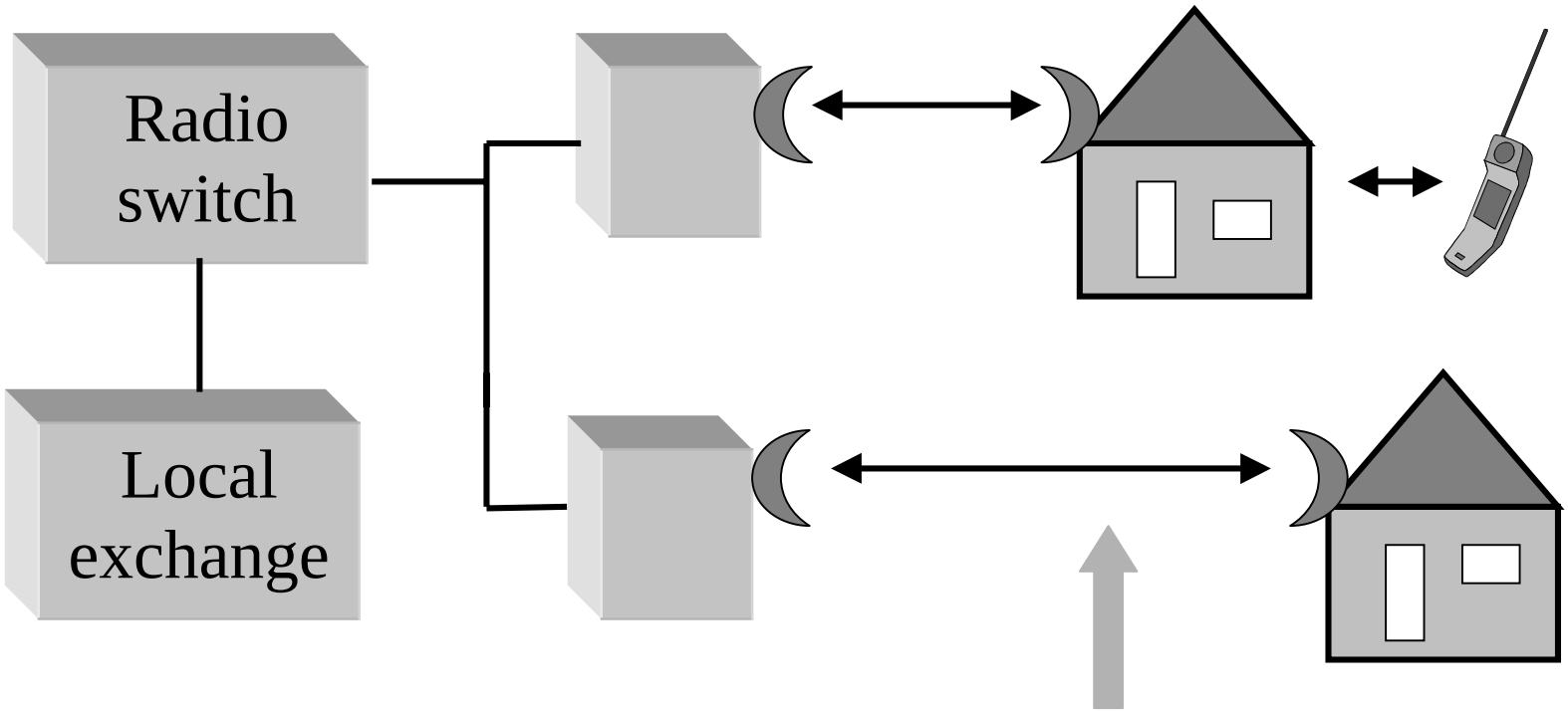
Only one base station, limited mobility, inter-PP traffic

Business use (PABX wireless extension)



Intercell handover between base stations is possible

Wireless local loop (WLL) applications



Up to 5 km possible (utilizing directional antennas, etc.)

Cordless Terminal Mobility (CTM)

=> Portability over a wider area

Examples:

1. Same DECT terminal can be used at home and in office

2. DECT terminal can be used at several locations in a city (no handover functionality between these locations)

Success of DECT ?

(year: 2000; source: DECT Forum)

Residential:

- 25 million terminals sold worldwide
- 60 % of all cordless terminals are DECT
- 90 % in Europe, especially Germany

Business:

- 1 million handsets in business use
- almost 10^5 multicell systems installed

WLL:

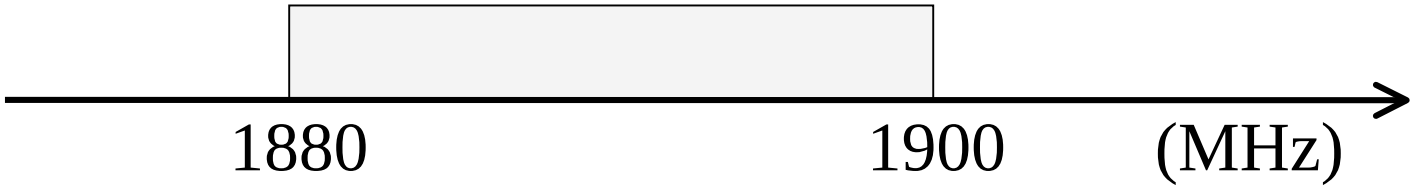
- more than 1 million lines installed
- popular especially outside Europe

TDD (Time Division Duplex) system

(GSM ⇔ FDD, 3G systems ⇔ FDD, TDD)

DECT is a TDD system, which means that down- and uplink use the same frequency (but different time slots).

Frequency band of DECT:

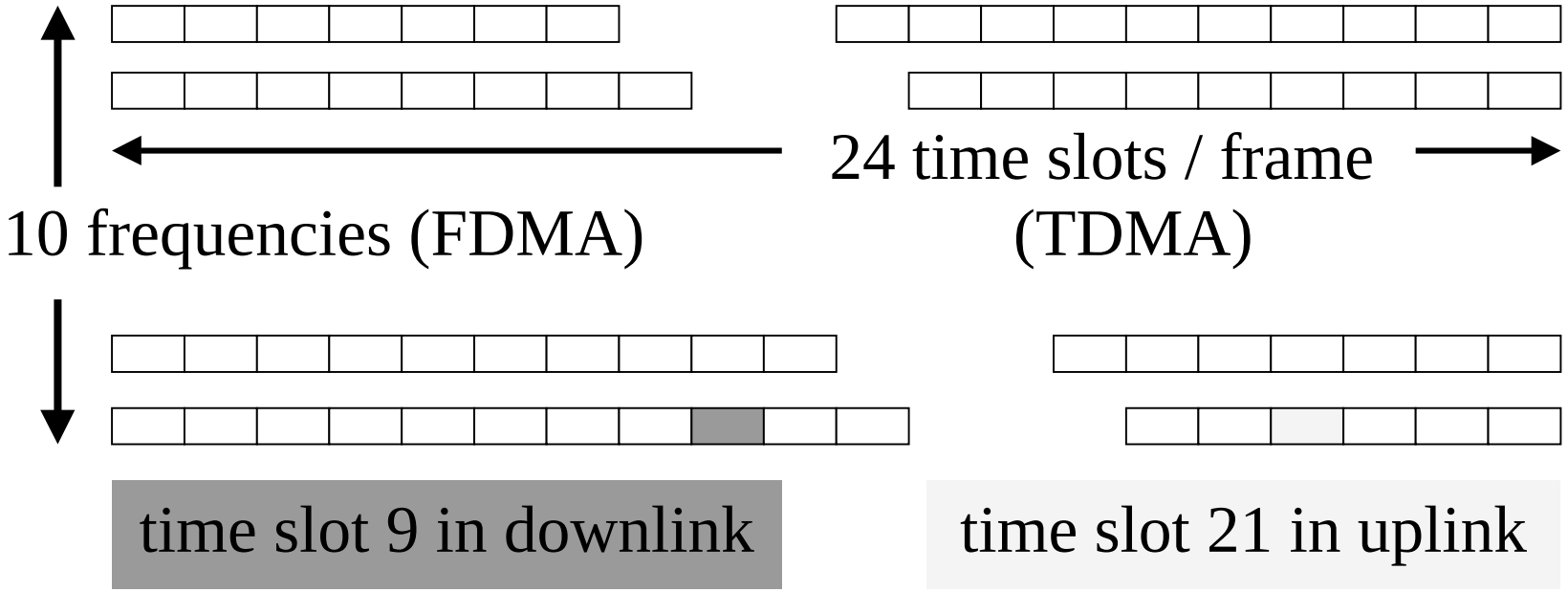


Two advantages of TDD: - can adapt to asymetric traffic

(w.r.t. FDD) - reciprocal radio channel

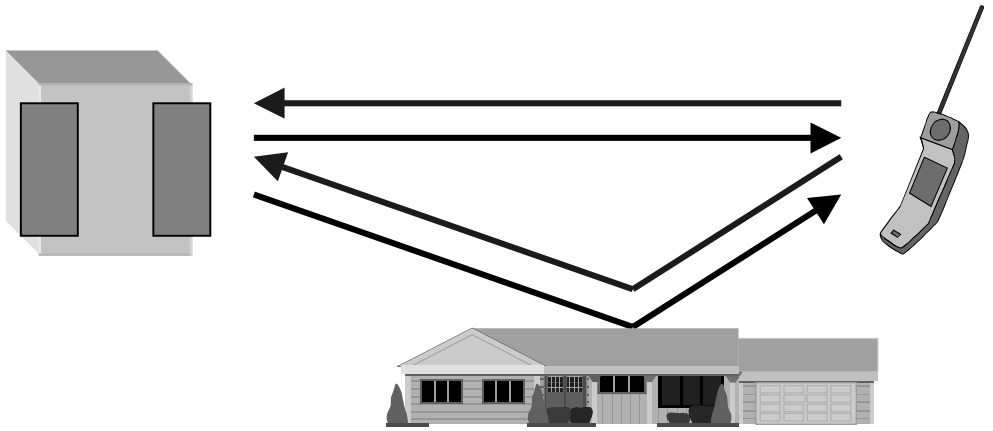
FDMA / TDMA system

Like GSM, DECT is a FDMA/TDMA system. The multiple access structure uses 10 x 12 = 120 bi-directional channels. Each channel can carry 32 kbits/s.



TDD ⇔ reciprocal radio channel

FDD system (e.g., GSM): Signal fading due to multipath propagation is different in uplink and downlink.



closed loop power control needed

TDD system (e.g., DECT): Multipath fading is exactly the same in uplink and downlink.

open loop power control

Multipath mechanism of fading

Suppose the signal arrives via two propagation paths at the receiver, and the received signal replicas have the same strength (a) but arrive after different delays (τ_1 and τ_2)

At frequency f_1 : $$r_1(t) = a\left(e^{j2\pi f_1\tau_1} + e^{j2\pi f_1\tau_2}\right)e^{j2\pi f_1 t}$$

At frequency f_2 : $$r_2(t) = a\left(e^{j2\pi f_2\tau_1} + e^{j2\pi f_2\tau_2}\right)e^{j2\pi f_2 t}$$

When $r_1(t)$ is fading, $r_2(t)$ may be strong (or vice versa), if the frequency and/or delay difference is sufficiently large.

Dynamic channel selection and allocation

1. All idle channels are scanned at regular intervals (30 s).
2. An RSSI (Received Signal Strength Indication) list is generated.
3. When a new channel is needed, the DECT terminal (PP) or base station (FP) selects an idle channel with minimum interference for this purpose, utilizing the RSSI list.
4. In this way, the interference level in the DECT network is kept as low as possible.

Mobile-controlled handover

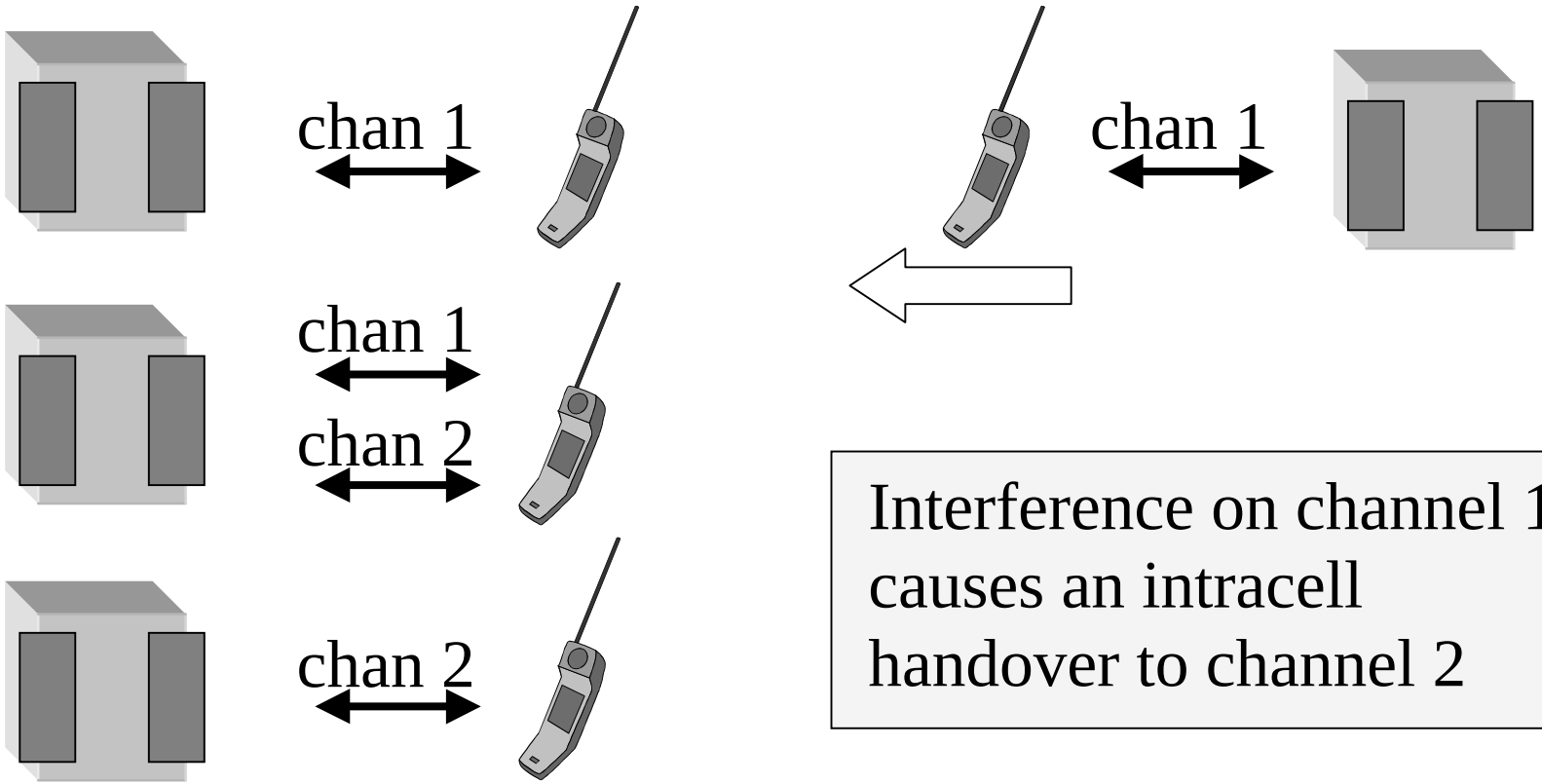
MCHO ⇔ Handover is always initiated by the terminal / PP (PP = DECT portable part)

1) downlink interference => intracell handover to a better channel (at another frequency)

2) uplink interference => Base station (RFP) signals to terminal => intracell handover

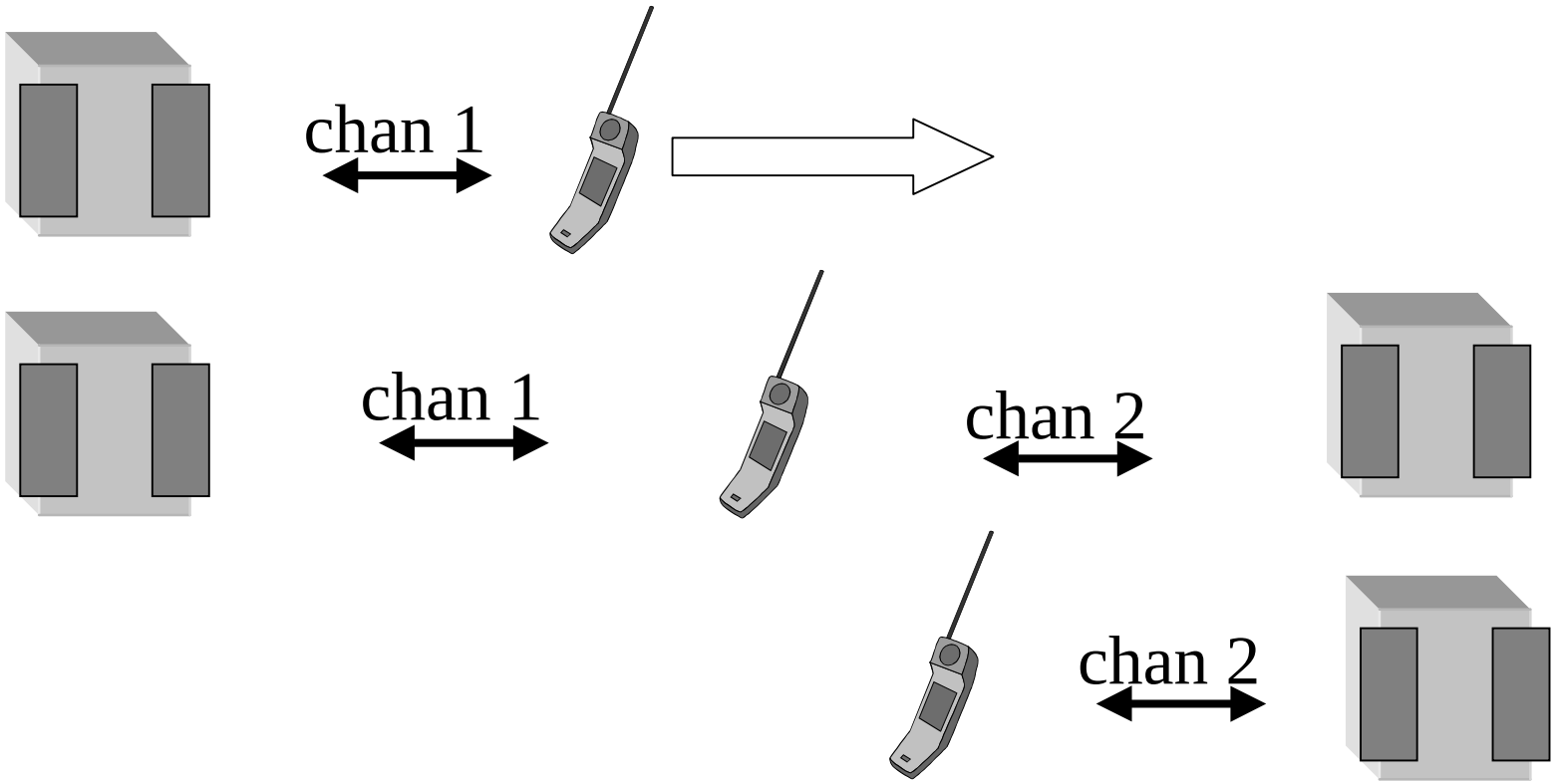
3) intercell handover due to better quality connection to another base station

Intracell handover



Interference on channel 1 causes an intracell handover to channel 2

Intercell handover



GAP (Generic Access Profile)

Minimum mandatory requirements (October 1997) allow a 3.1 kHz teleservice connection to be established, maintained and released between FP and PP with the appropriate access rights, irrespective of whether the FP provides residential, business or public access services.

GIP – DECT/GSM Interworking Profile
IIP – DECT/ISDN Interworking Profile
RAP – Radio Local Loop Access Profile
CAP – CTM Access Profile
DSP => DPRS = DECT Packet Radio Service (new!)

other profiles

Security in DECT

1. User identification (PIN code)	DECT: ? GSM: yes
2. Authentication	DECT: yes GSM: yes
3. Encryption of the air interface during transmission	DECT: optional GSM: yes

Authentication