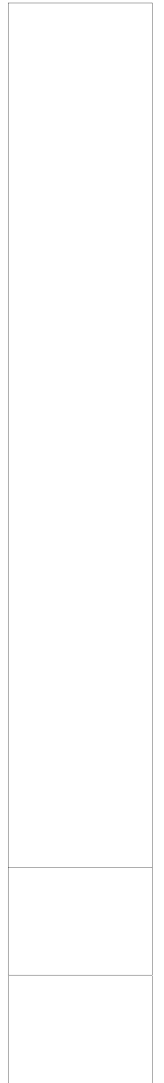


Introduction to 802.11

Foundations of computer networks



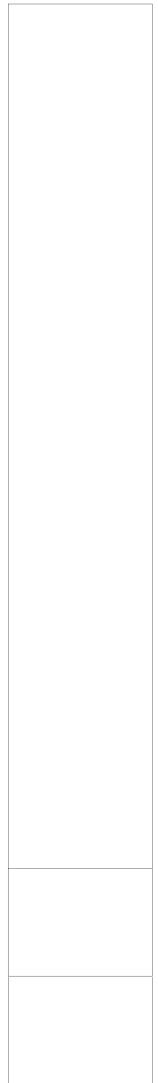
Standards of 802.11

Standard IEEE	Bandwidth	Frequency	Description
802.11	1 Mb/s 2 Mb/s	2,4 GHz	Published in 1997. Modulation with frequency hopping FH or direct switching DS
802.11a	up to 54 Mb/s	5 GHz	Published in 1999. First applications available at the end of 2000
802.11b	5,5 Mb/s 11 Mb/s	2,4 GHz	First applications available before these defined in 802.11a
802.11g	up to 54 Mb/s	2,4 GHz	Faster transmission (2003)
802.11e	Support for QoS.		
802.11f	The compatibility between APs from various manufacturers has been improved		
802.11h	Extension of MAC layer specification according to law in Europe for 5 GHz band		
802.11i	Safety regulation		
802.11n	up to 600 Mb/s	2,4 or 5 GHz	4 chanel with MIMO (2006)
802.11ac	up to 6928 Mb/s	2,4 or 5 GHz	8 chanel with MIMO (2012)

Chanel

Chanel	Low frequency [GHz]	Upper frequency [GHz]
1	2,401	2,423
2	2,406	2,428
3	2,411	2,433
4	2,416	2,438
5	2,421	2,443
6	2,426	2,448
7	2,431	2,453
8	2,436	2,458
9	2,441	2,463
10	2,446	2,468
11	2,451	2,473
12	2,456	2,478
13	2,461	2,483
14	2,473	2,495

802.11a
12 nonoverlapping
chanel

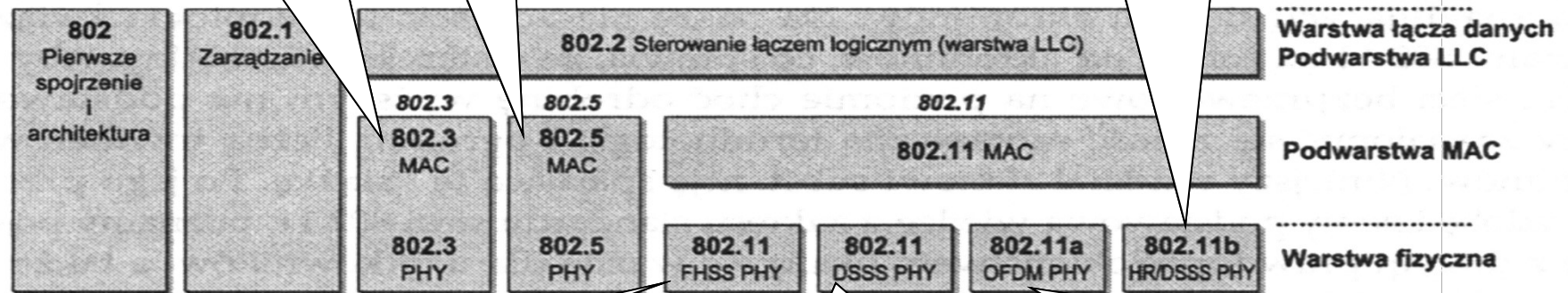


IEEE 802

High-Rate Direct-Sequence

Token Ring

CSMA/CD



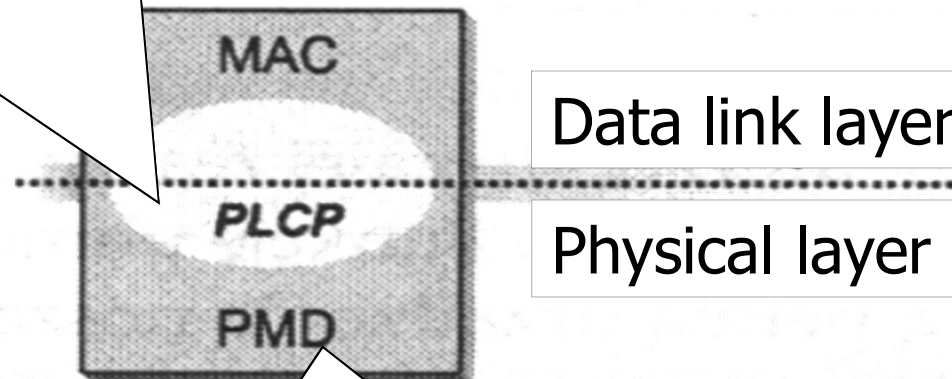
Frequency-Hopping
Spread-Spectrum

Direct-Sequence
Spread-Spectrum

Ortogonal
Frequency Division
Multiplexing

Physical layer

Physical Layer Convergence Procedure

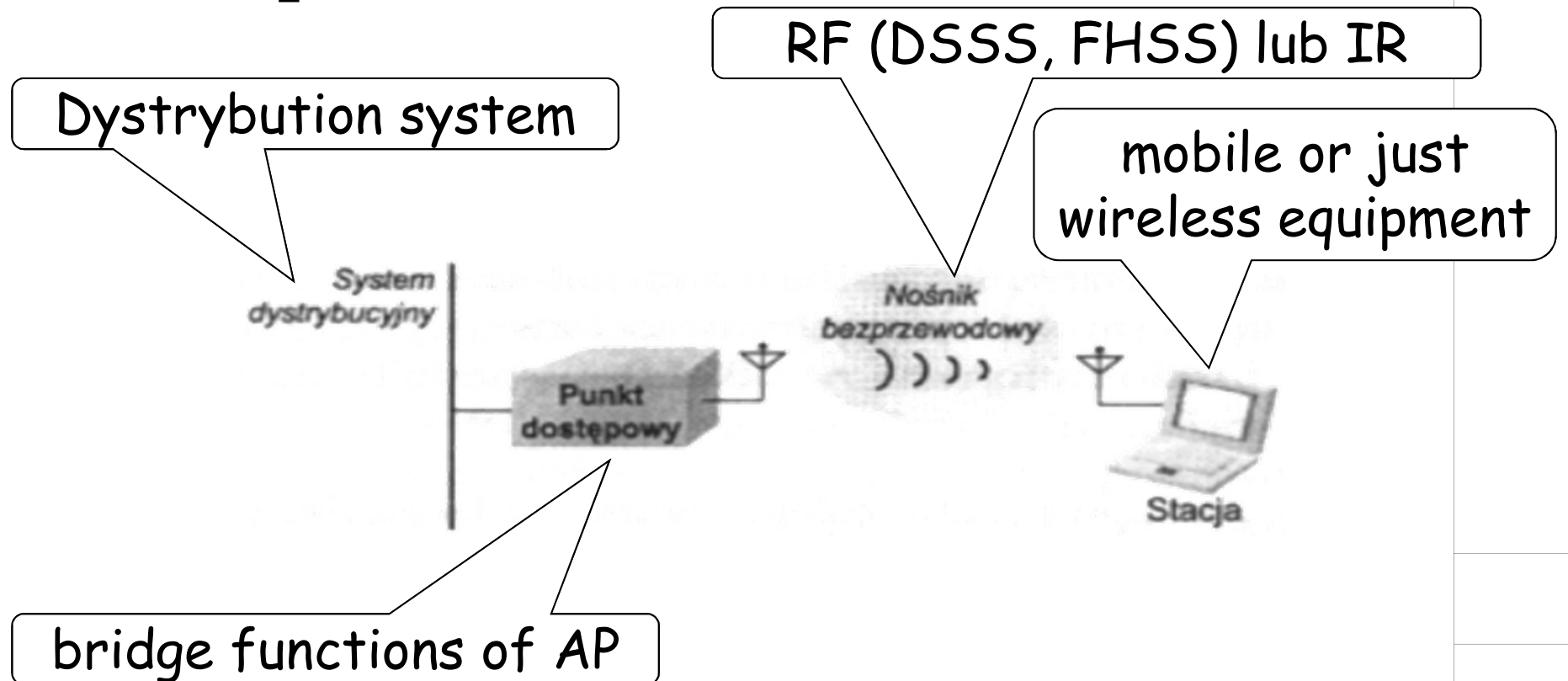


Data link layer

Physical layer

Physical Medium Dependent

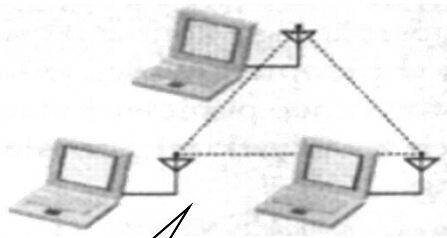
Components of 802.11



BSS – base service set

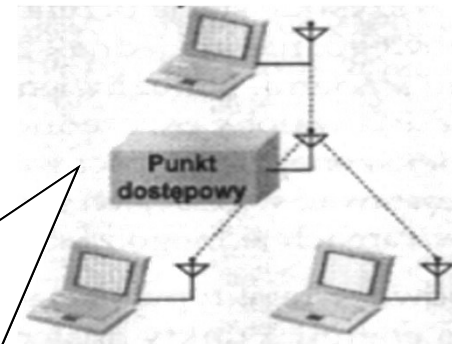
structural BSS

IBSS – independent BSS

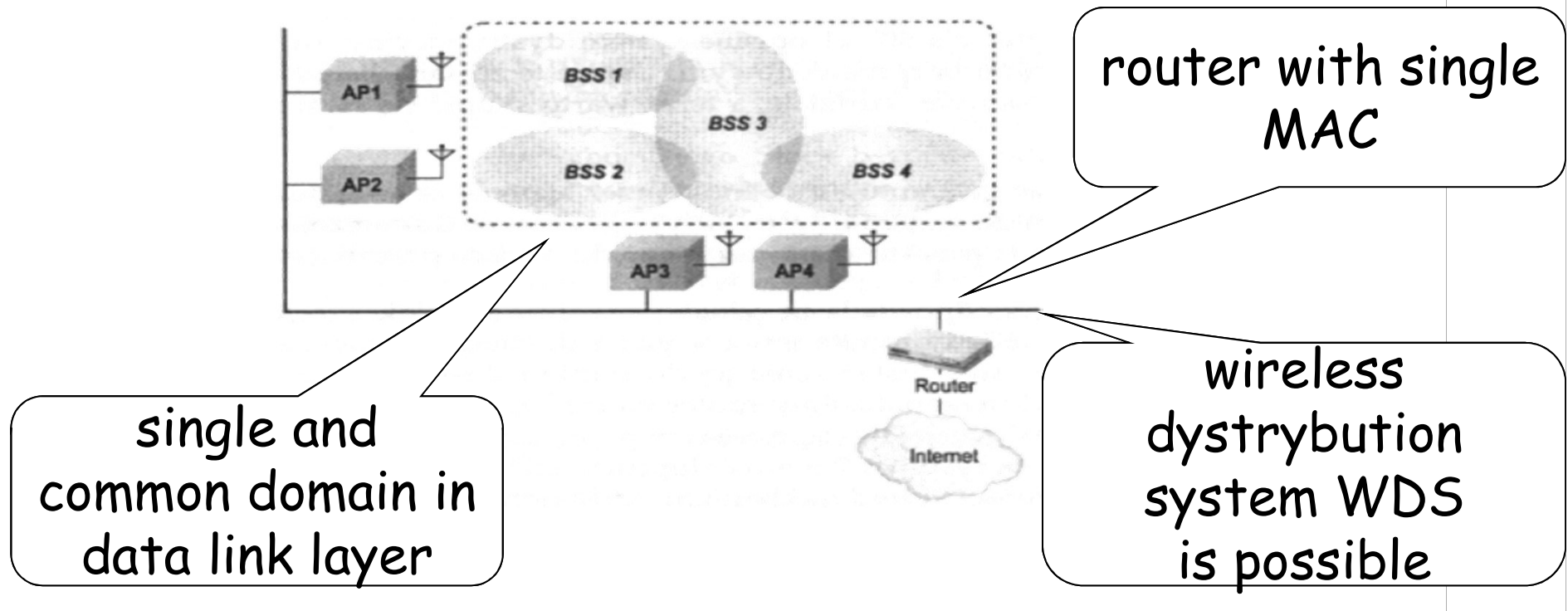


temporary
networks,
ad hoc

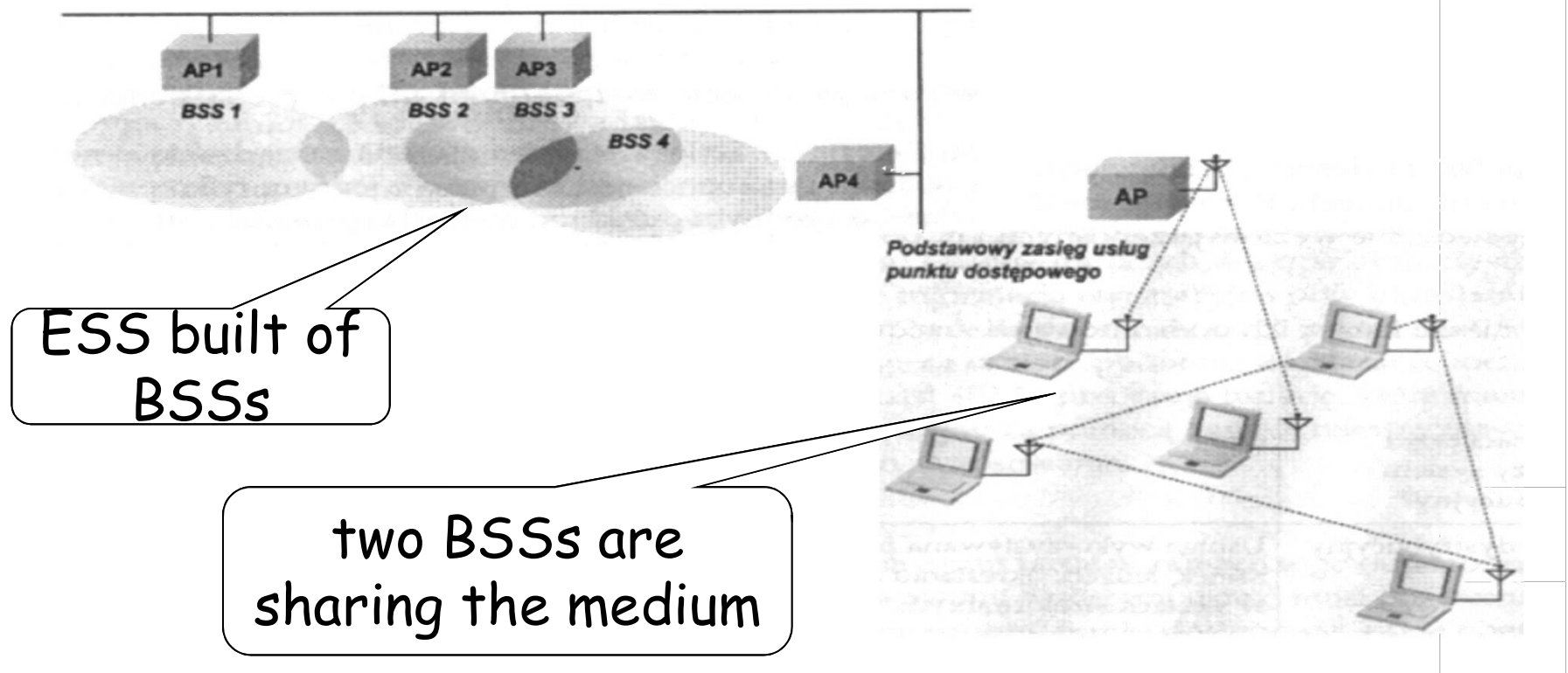
- communication via AP
- range around AP
- buffering in AP
- connection with single AP



ESS – extended service set



Ranges



Services in 802.11

- Distribution
- Integration
- Linking
- Relinking
- Link breaking
- Authentication
- Authentication interrupt
- Confidentiality
- MSDU – MAC service data unit

(DS) Deliveries of

(DS) Determining the
to LAN,

(DS) Removing
mobile system from a

(stations) Determining the
identity as the linking pre-
process. The „open system“
auth

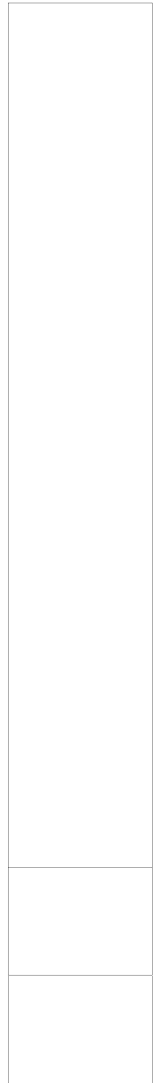
(station) Interrupt of

(station) Protection causes
against eavesdropping - linking

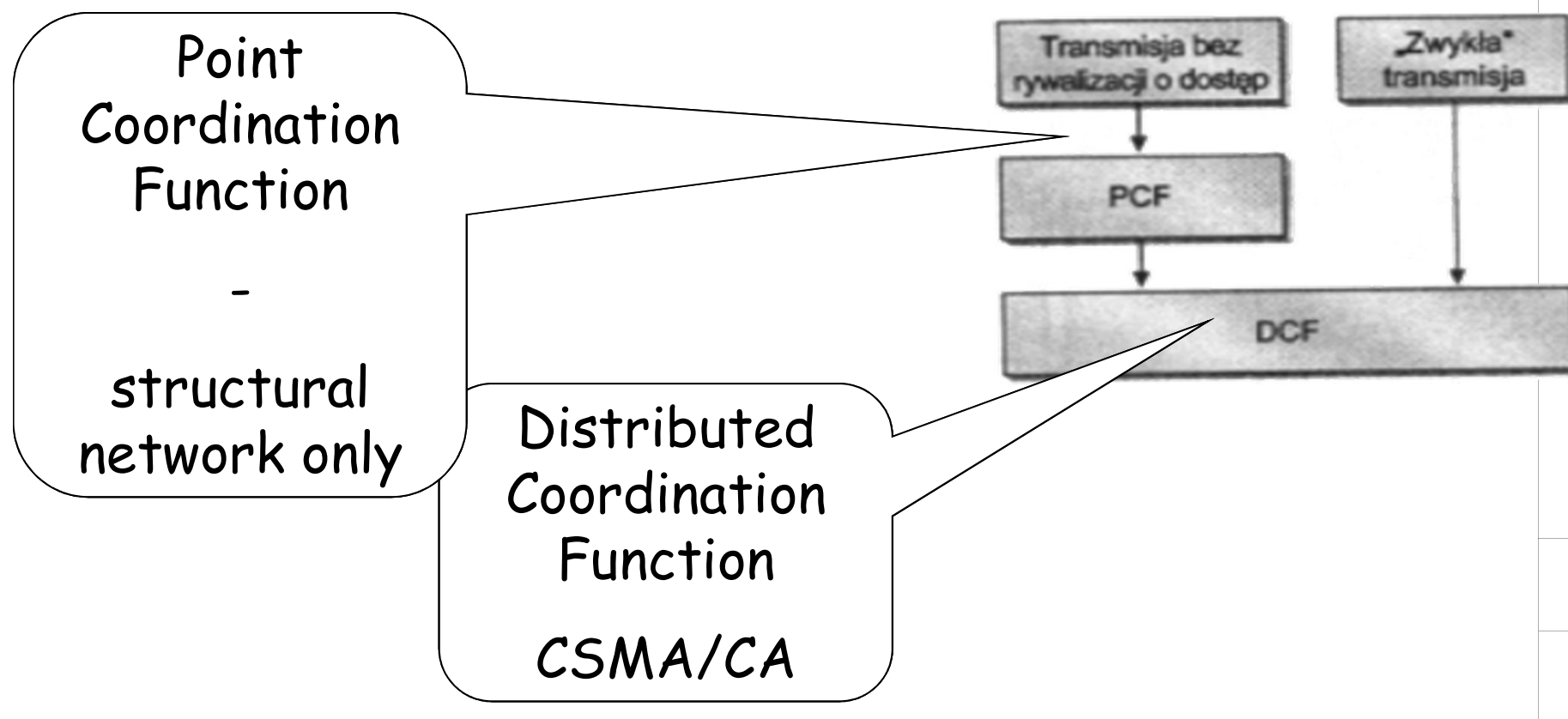
(station) MAC Service
Data Unit allow delivery
data to addressee

Mobility

- Without transition
- With transition between BSSs
 - nie można gwarantować mobilności między punktami różnych producentów
- Transition between ESSs

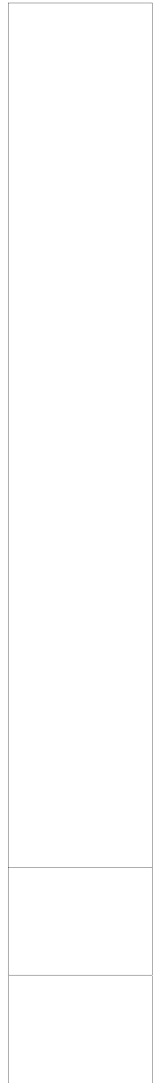


Access mode

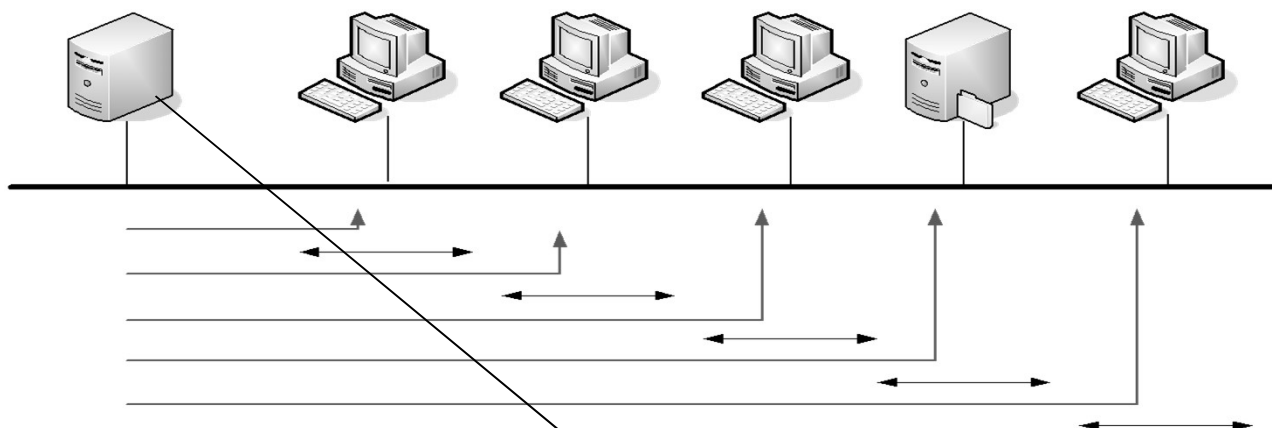


Metody dostępu

- Deterministyczne
 - Przepytывanie (ang. *polling*)
 - Metoda żetonu (ang. *token*)
- Rywalizacyjne
 - CSMA/CD
 - CSMA/CA



Przepytywanie



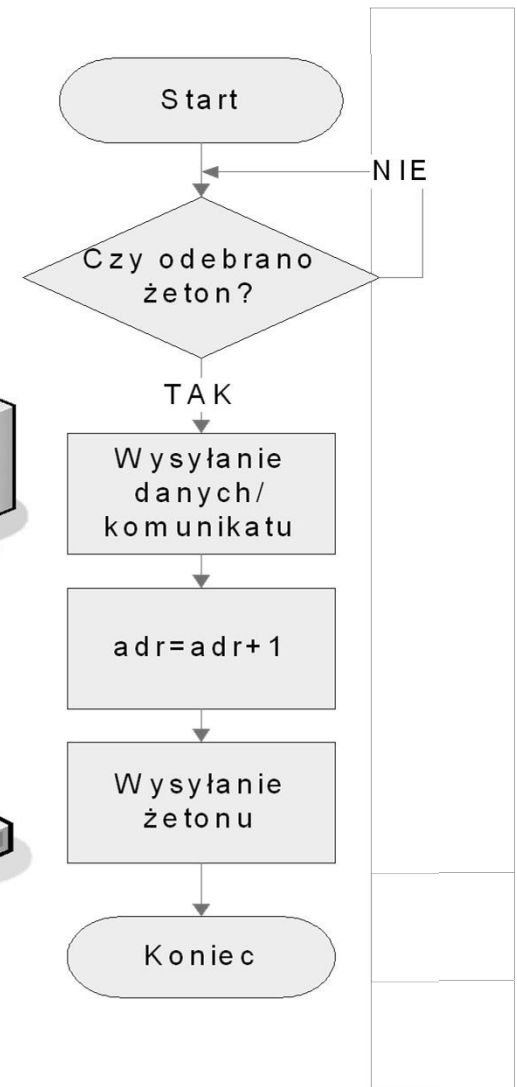
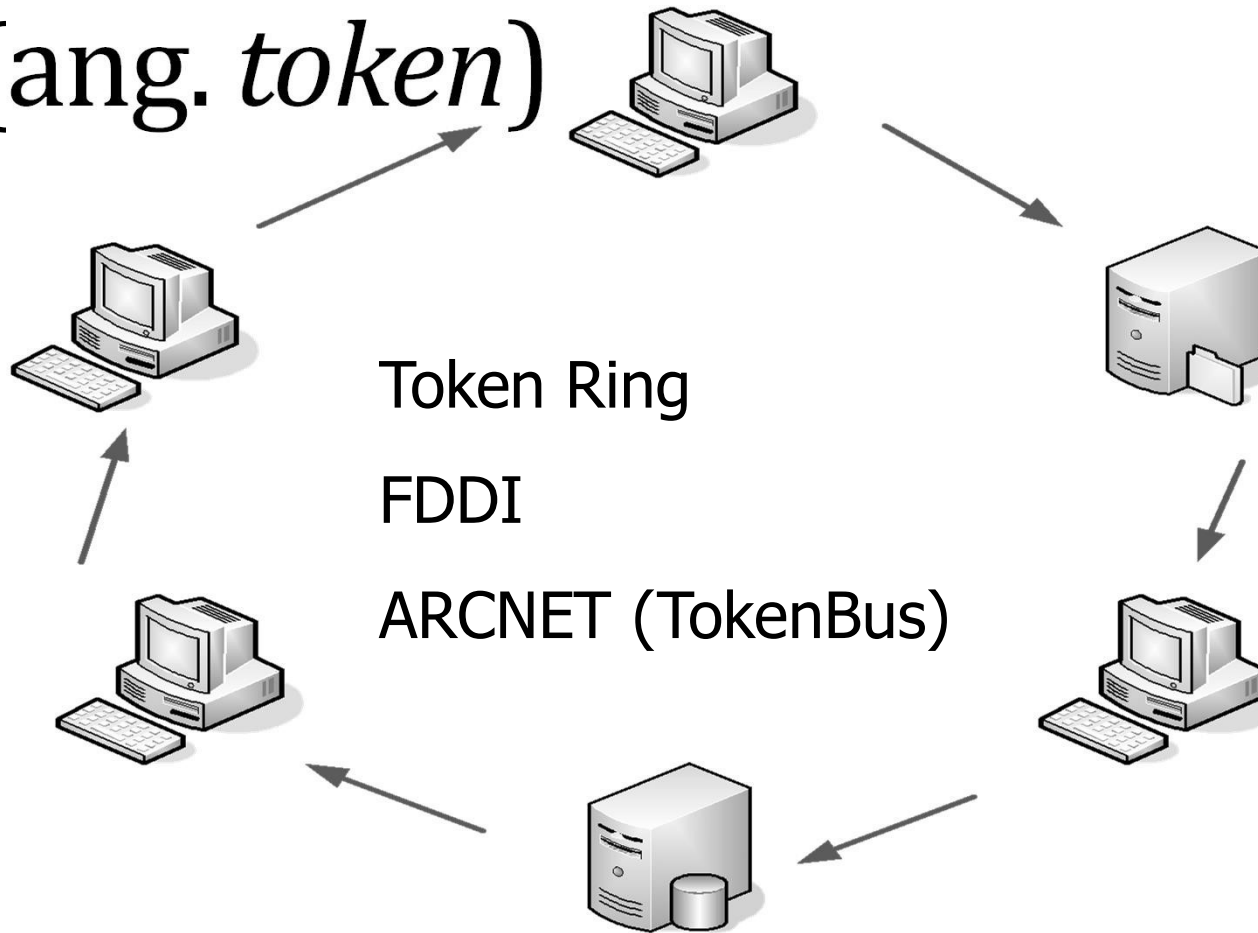
Czas oczekiwania:

$$T_{\max} = N \cdot (T_{\text{wyw}} + T_{\text{nad-max}})$$

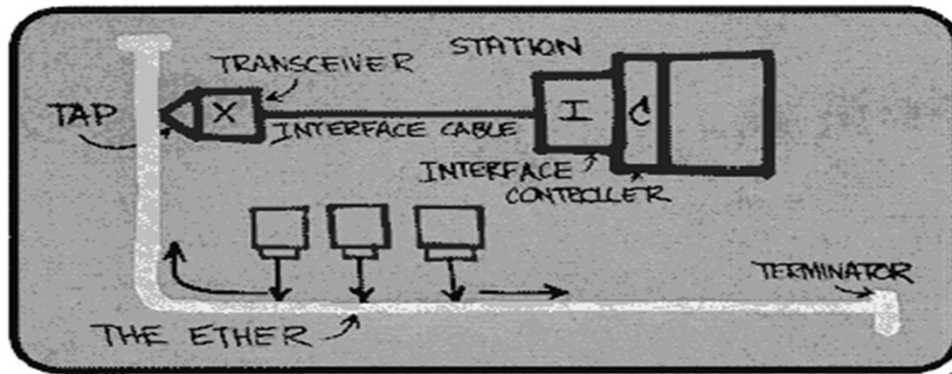
serwer,
inteligentny hub,
wybrany host

100VG-AnyLAN (HP) - DPAM

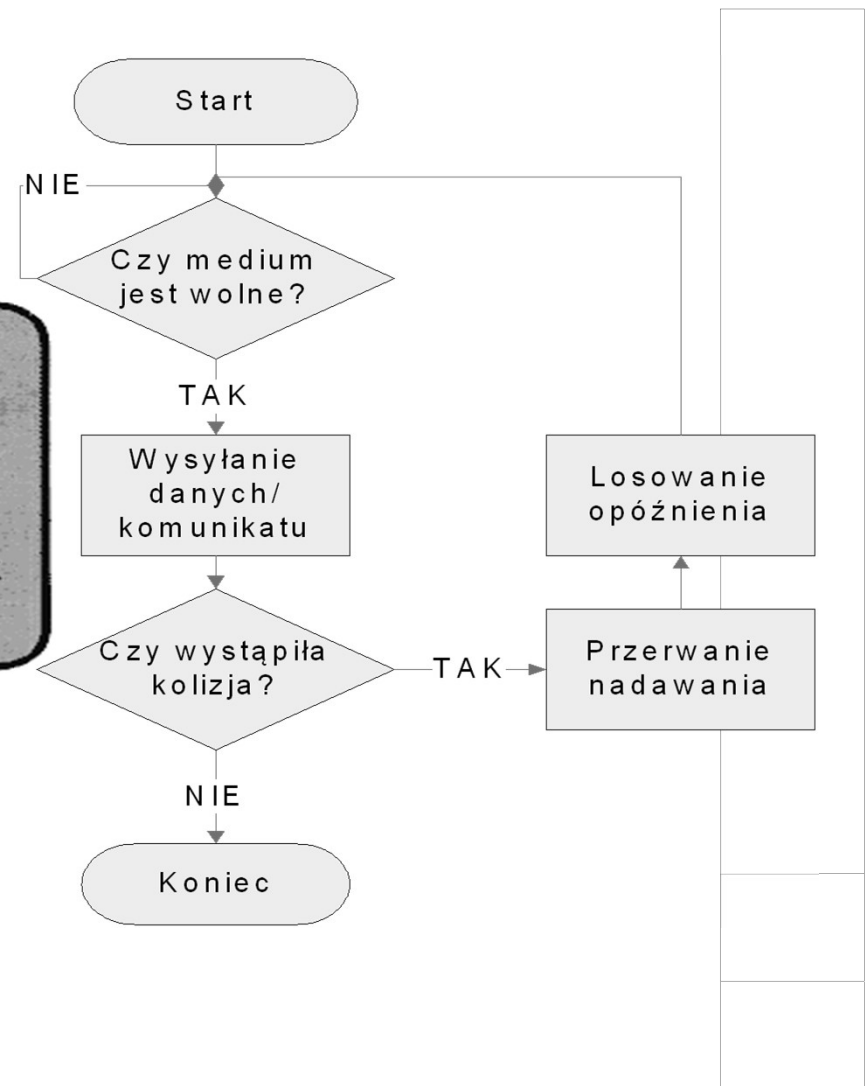
Metoda żetonu (ang. *token*)



CSMA/CD

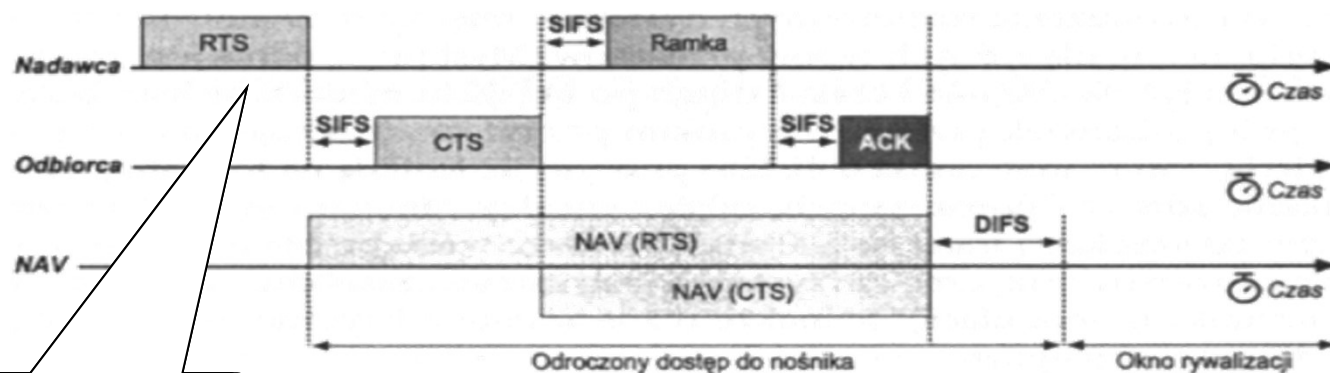


szkic sieci Ethernet
Roberta Metcalfe'a z roku 1976



NAV – network allocation vector

physical and virtual
medium accessibility

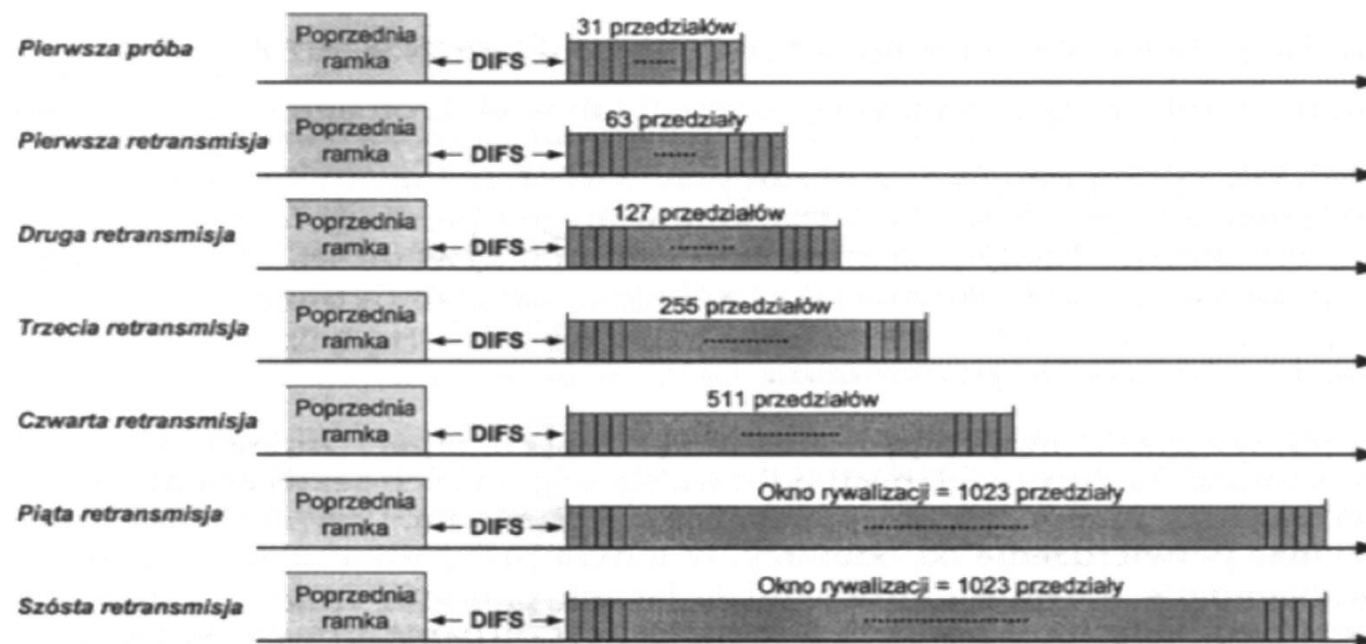


duration field
reserves the
medium for
specified time

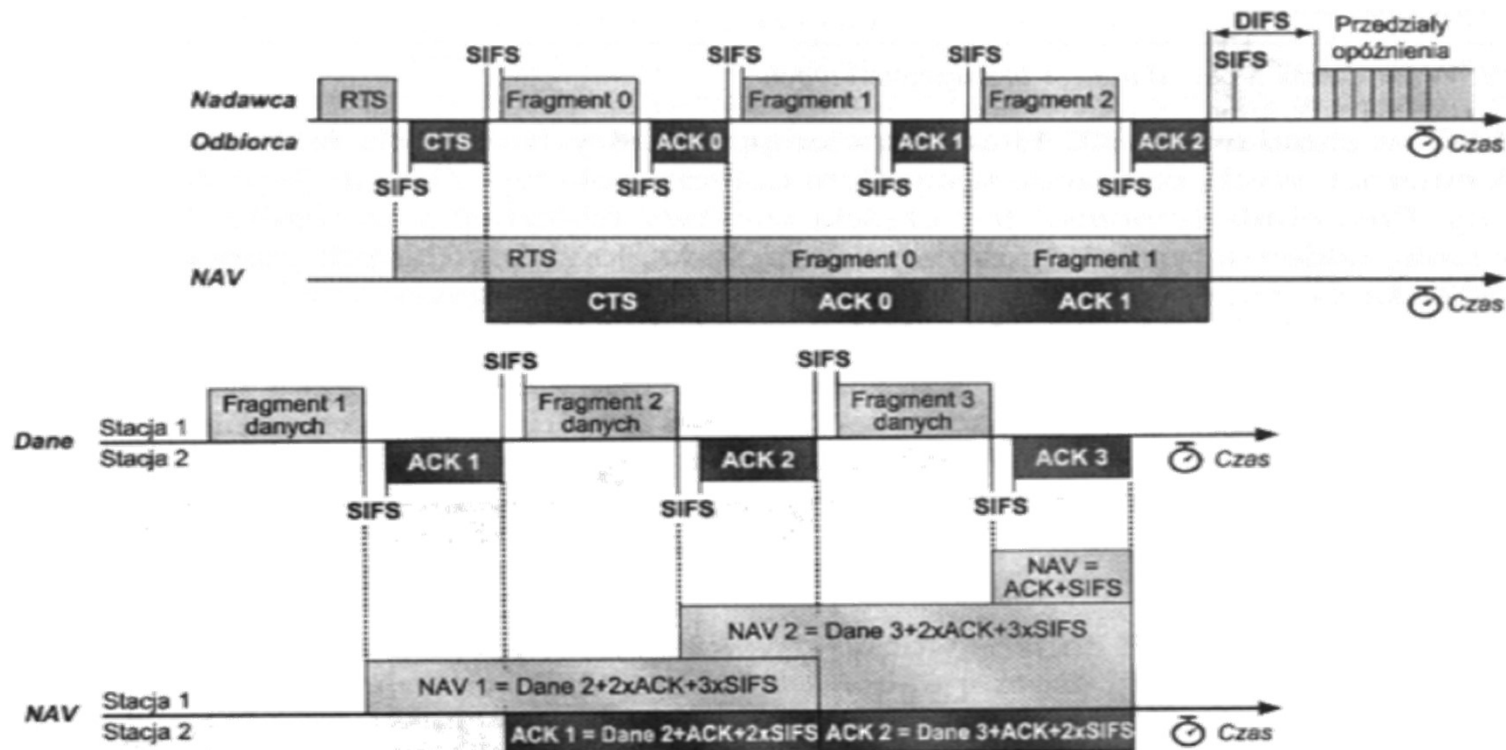


EIFS - after error

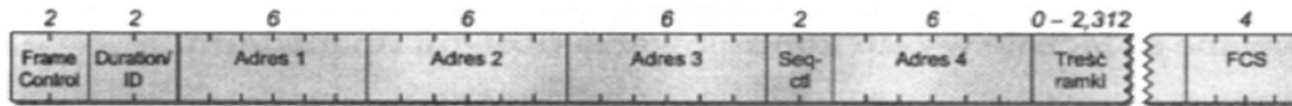
Retransmissions



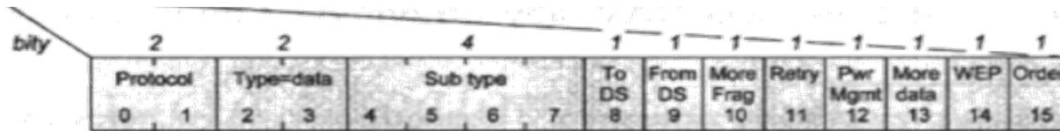
Fragmentation



The frame

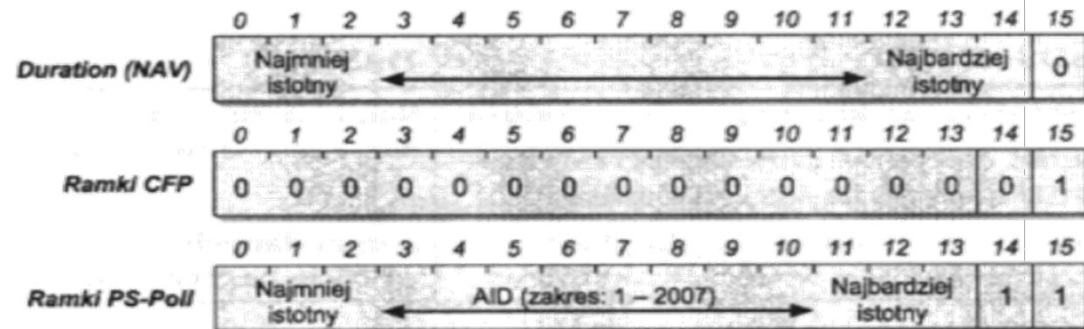


Seq-ctl - Sequence control

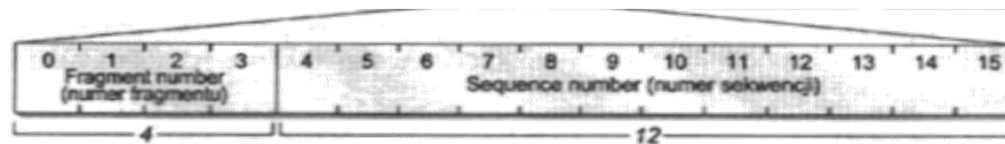


address fields:

- destination,
- source,
- receiver,
- sender,
- BSSID



Seq-ctl - Sequence control



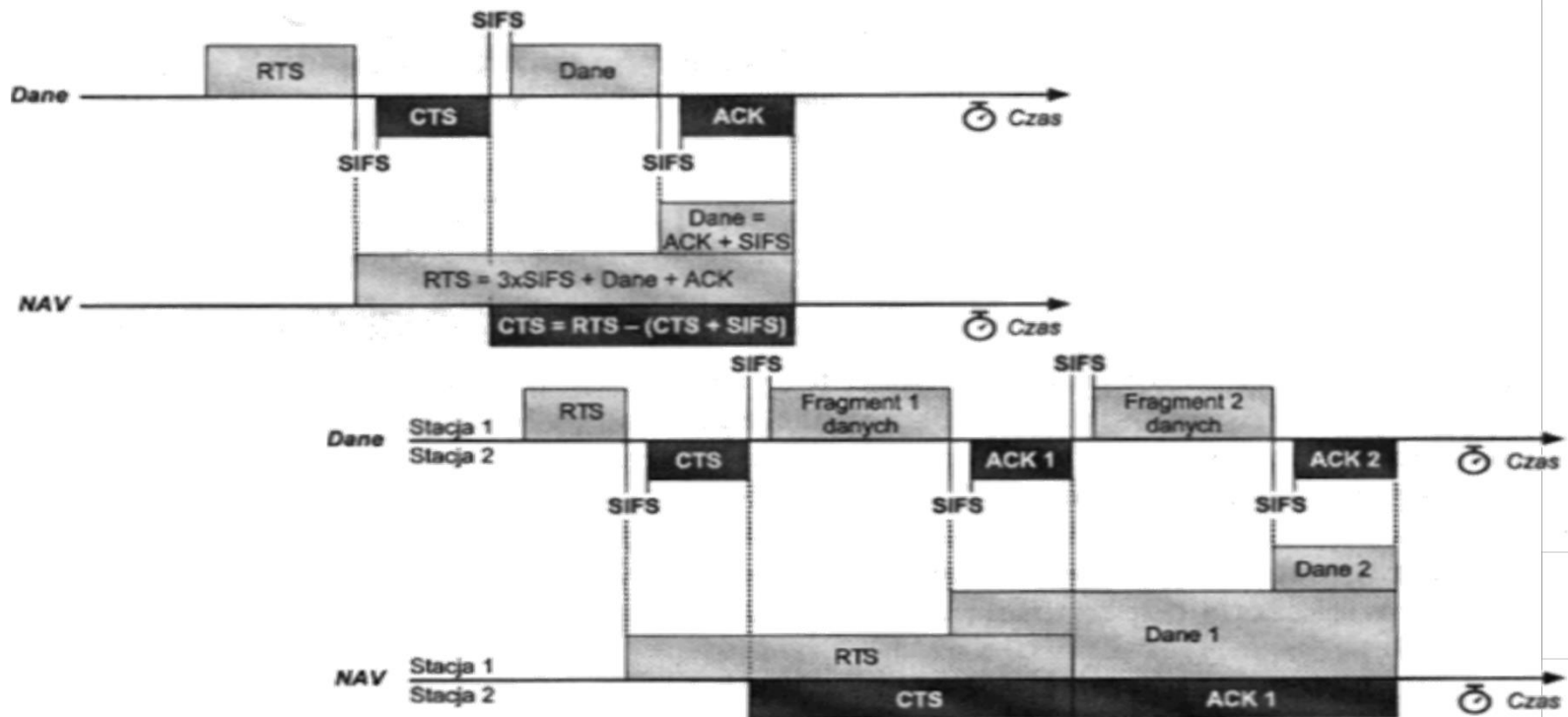
Broadcast and multicast frames



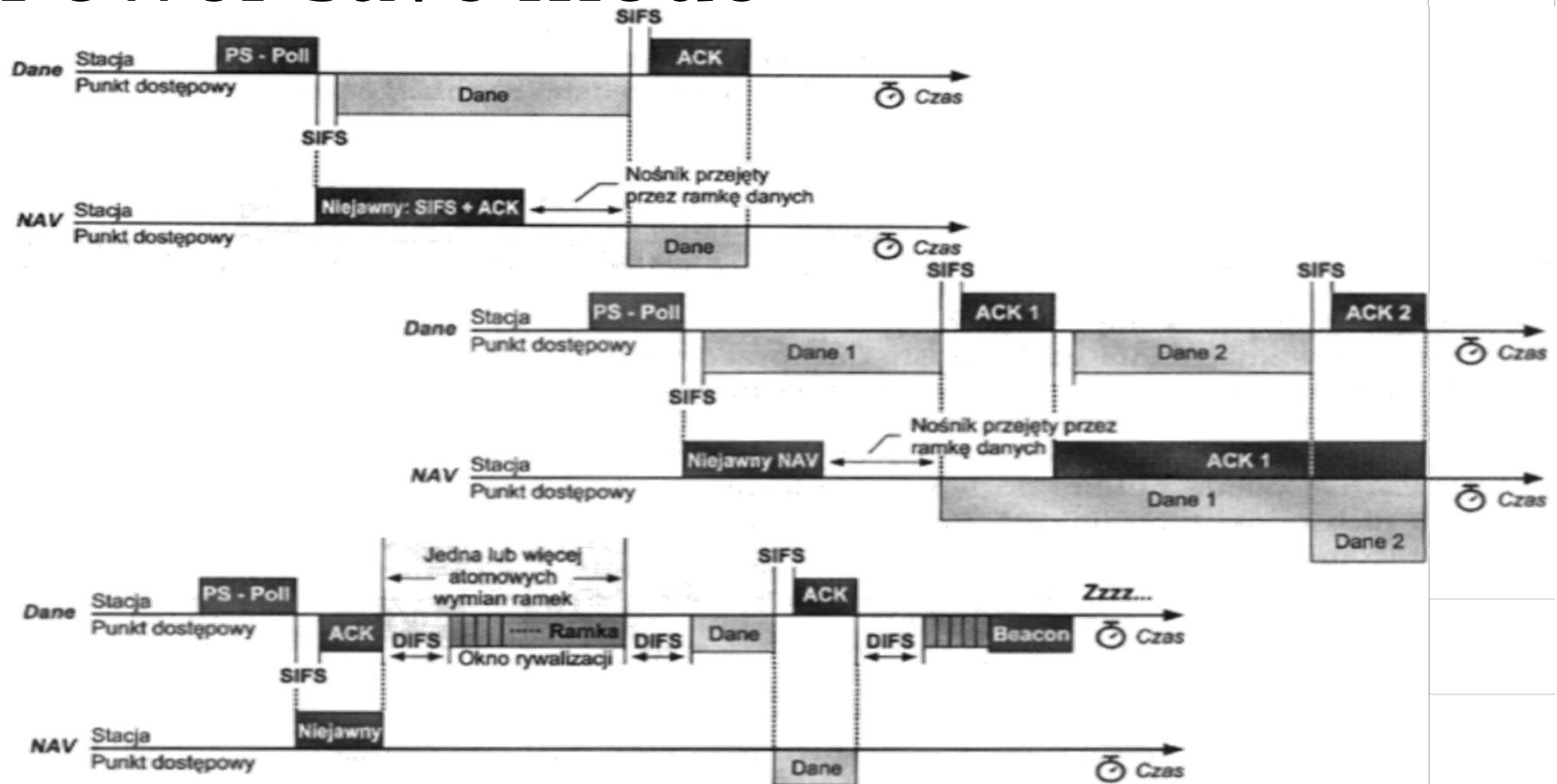
Unicast frames



RTS/CTS



Power save mode



Processes in 802.11

- Passive scanning
- Active scanning
 - Probe request – Probe response
- Open-system authentication
- Shared-key authentication
- Linking
- Time synchronisation

