

*Handouts for: "Synchronization and Scanning in DFWMAC"
IEEE P802.11-93/193 presented November 9, 1993*

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Synchronization and Scanning in DFWMAC

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Basic Synchronization Approach

All stations maintain a local synchronization timer.

Timing Synchronization Function

- keeps timers in synch
- centralized in infrastructure networks
- distributed function for ad hoc networks

Beacons provide timing reference for each BSS.

- not required to hear every Beacon to stay in synch
- Beacons used to calibrate clocks

Flexible Beacon Interval

- BSS parameter

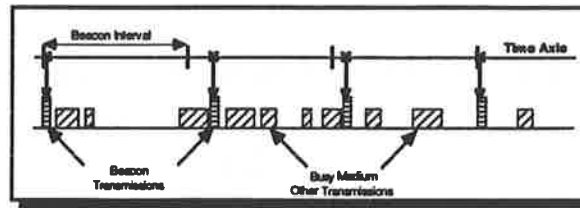
Compatible with CSMA.

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Beacon Generation



**Beacon transmission scheduled at Beacon Interval.
Transmission may be delayed by CSMA deferral .**

- subsequent transmissions at expected Beacon Interval
- not relative to last Beacon transmission

**Timestamp contains timer value at transmit time.
AP sends Beacons in infrastructure networks.**

DFWMAC Proposal

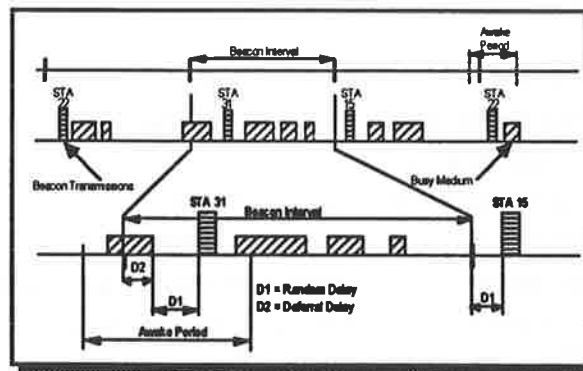
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Ad Hoc Beacons



Distributed Beacons

- any station in BSS may send a Beacon
- randomized Beacon generation

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More Ad Hoc Beaconsing

Ad Hoc Beacon Sender's actions:

- wake up before expected Beacon time
- defer to current transmission if any
- execute access backoff procedure
 - even when network was idle
 - randomizes send attempts
- if heard another Beacon cancel Beacon transmission
 - else transmit Beacon

Beacon collisions are possible.

- Beacons are multicasts, so no retransmission
- other station likely to succeed after collision

Only SYNCed stations send Beacons.

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Beacon Contents

Infrastructure:

1	TYPE
2	CONTROL
2	MPDUID
3	NetworkID
6	Dest
6	Source
4	Timestamp
3	Beacon Interval
Optional Power Management Elements:	
TIM	
DTM Period Broadcast	
4	CRC-32

Ad Hoc:

1	TYPE
2	CONTROL
2	MPDUID
3	NetworkID
6	Dest
6	Source
4	Timestamp
3	Beacon Interval
2	Weight
4	CRC-32

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Timer Accuracy

Timestamp included in every Beacon.

- Sending station's TSF timer in microseconds
- 31 bit value and 1 bit SYNC flag

Beacon sender actions:

- Timestamp is sender's timer at SFD transmission time.

Beacon receiver actions:

- Save local TSF timer when Beacon SFD received.
- Validate received Beacon.
- If OK, compare saved timer with Beacon timestamp
- Difference is amount to adjust local station timer
 - could adjust for propagation and transceiver delay

Precise synchronization is possible.

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Applications of TSF

Power Management

- Beacons are sent at well known intervals
- All station timers in BSS are synchronized
- Beacons may contain TIM element
- Stations can wake up just before expected Beacon

Superframe Timing

- TSF Timer used to predict start of Contention Free burst
- Beacon is not required in each superframe

Hop Timing for Frequency Hopping PHY

- TSF Timer used to time Dwell Interval
- stations' TSF Timers synchronized, so hop at same time
- Beacon is not required on each hop

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