WIRELESS LOCAL AREA NETWORK (WLAN)

Done by

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Outline

- Introduction of WLANs
- Physical Layer of WLANs
- Types of WLANs
- Challenge of WLANs

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  - History
  - IEEE 802.11 family
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History of Wireless LANs

- 1970
  first computer communication network
- 1980s
  first generation of wireless data modems
- 1991
  first of the IEEE workshops on Wireless LANs
  first Wireless LANs product in market
  IEEE 802.11 committee start to develop standard for Wireless LANs

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IEEE 802.11 Family

Protocol	Release	Frequency (GHz	Typical throughput (Mbps)	Max. data rate (Mbps)	Modulation
80211	1997	2.4	0.9	2	IR/FHSS/DSSS
802.11a	1999	5	23	54	OFDM
802.11b	1999	2.4	4.3	11	DSSS
802.11g	2003	2.4	19	54	OFDM
802.11y	2008	3.7	23	54	OFDM
802.11n	2009	2.4/5	74	600	OFDM

IEEE 802.11n (2009)

- Max. data rate: 600 Mbps (currently 300 Mbps)
- based on MIMO (multiple-input multiple-output)technology
  - –multiple transmitter and receiver antennas
- adding Frame Aggregation to MAC:
  - –Packing multiple data units together to reduce overheads

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  - FHSS
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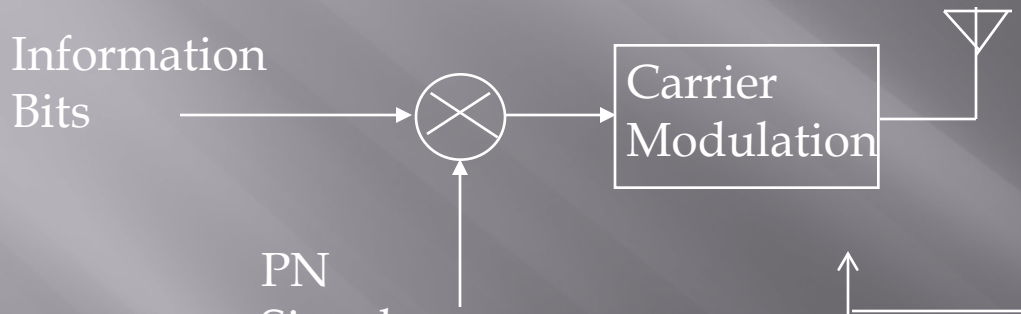
Spread Spectrum

- A transmission technique in which transmission bandwidth (W) >> signal bandwidth (R)

Processing Gain = W/R >> 1

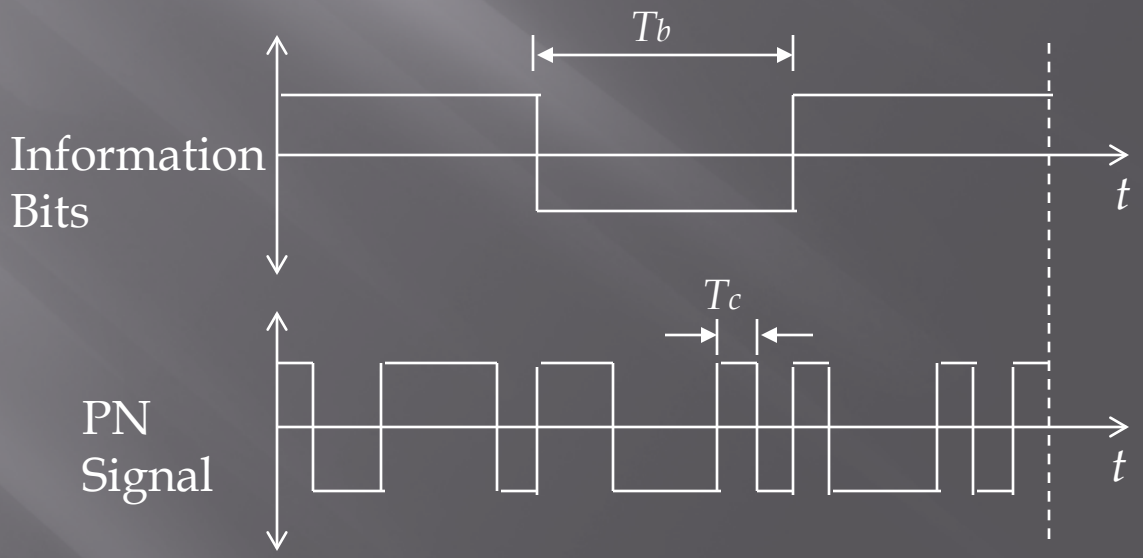
DSSS

- ***Direct Sequence Spread Spectrum***
- DSSS signal is obtained by multiplying the information bits with a wideband PN signal

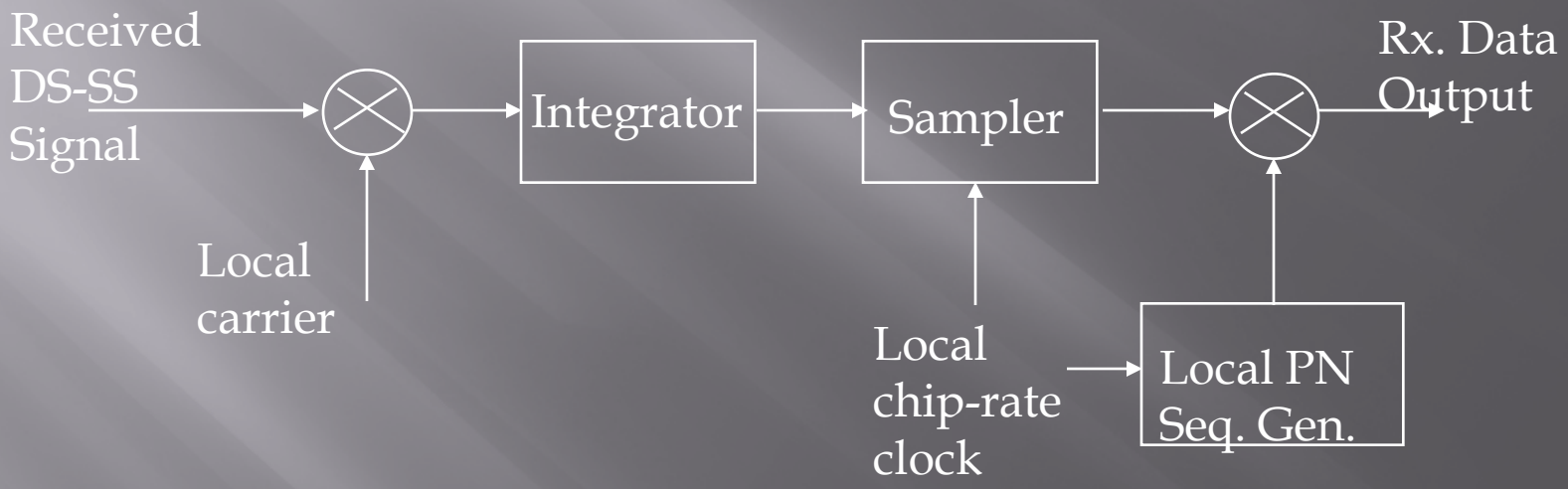


$T_b = N\,T_c$

N : Processing Gain

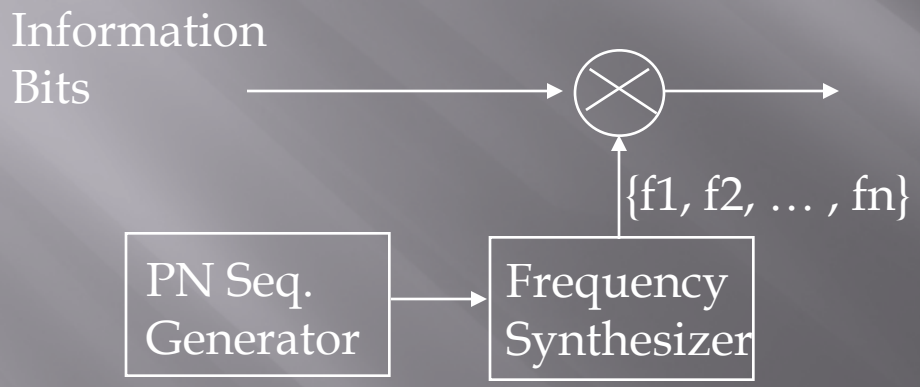


DSSS Receiver



FHSS

- **Frequency Hopping Spread Spectrum**
- FHSS signal is obtained by hopping the carrier frequency over a set of frequencies
  - hopping pattern specified by a PN Sequence



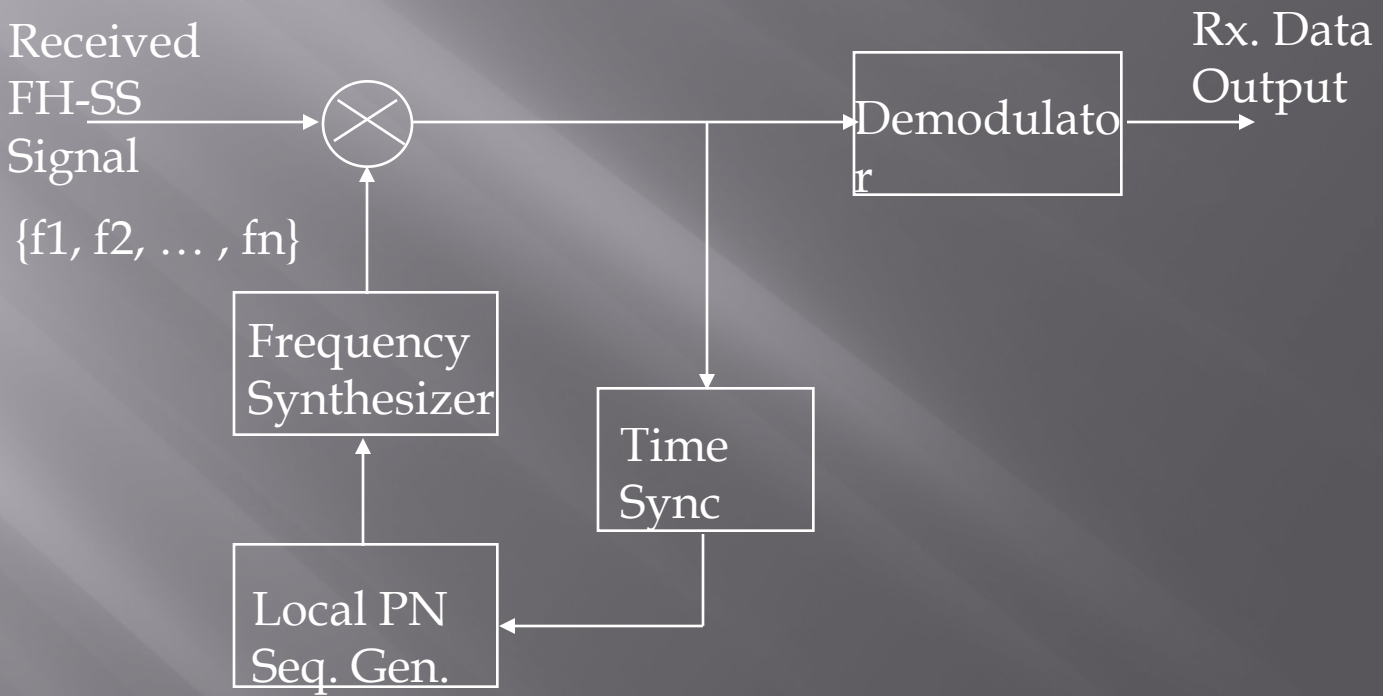
T_b : *Bit duration*

T_h : *Duration of 1 hop*

$T_h < T_b$: *Fast Frequency Hopping*

$T_h > T_b$: *Slow Frequency Hopping*

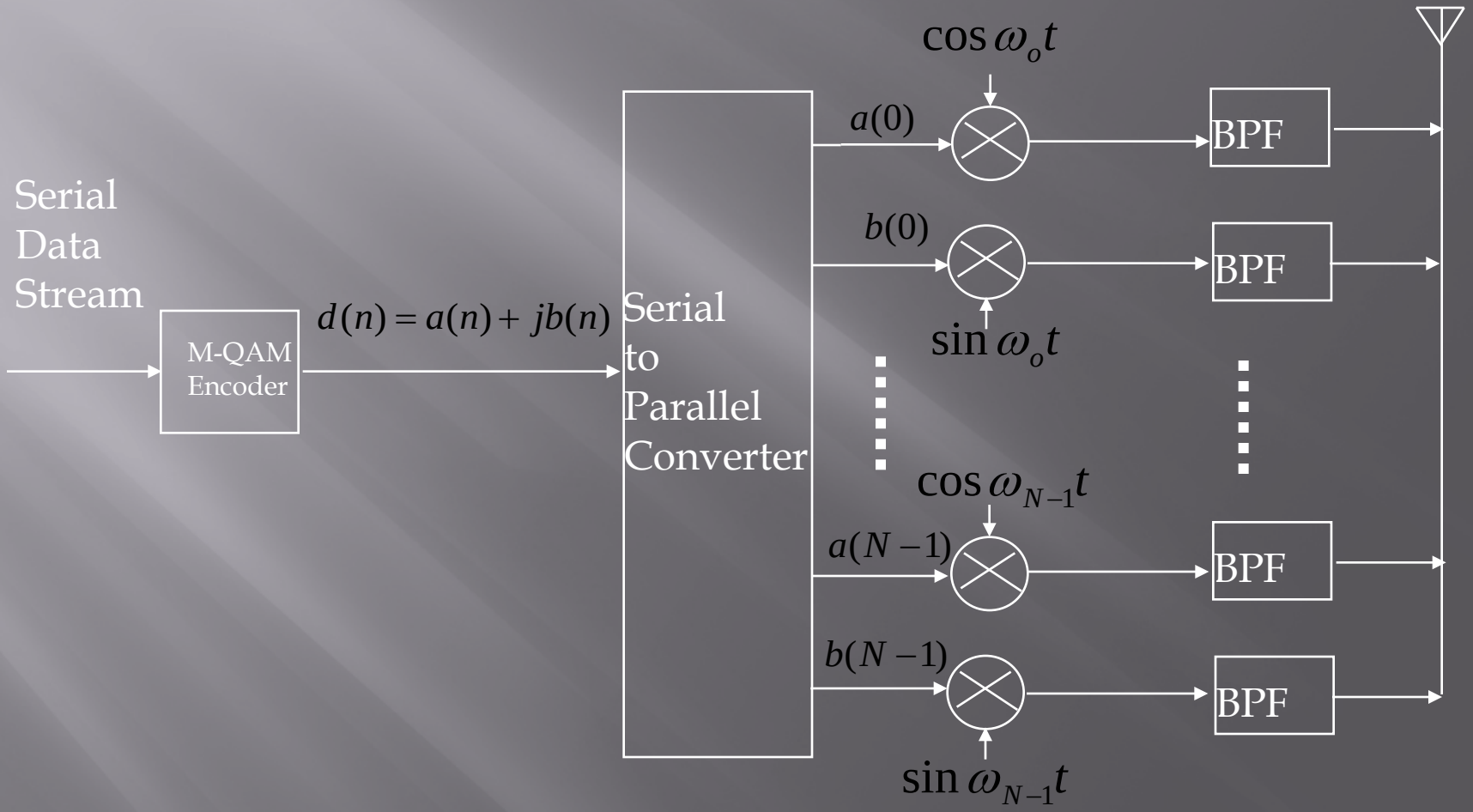
FHSS Receiver



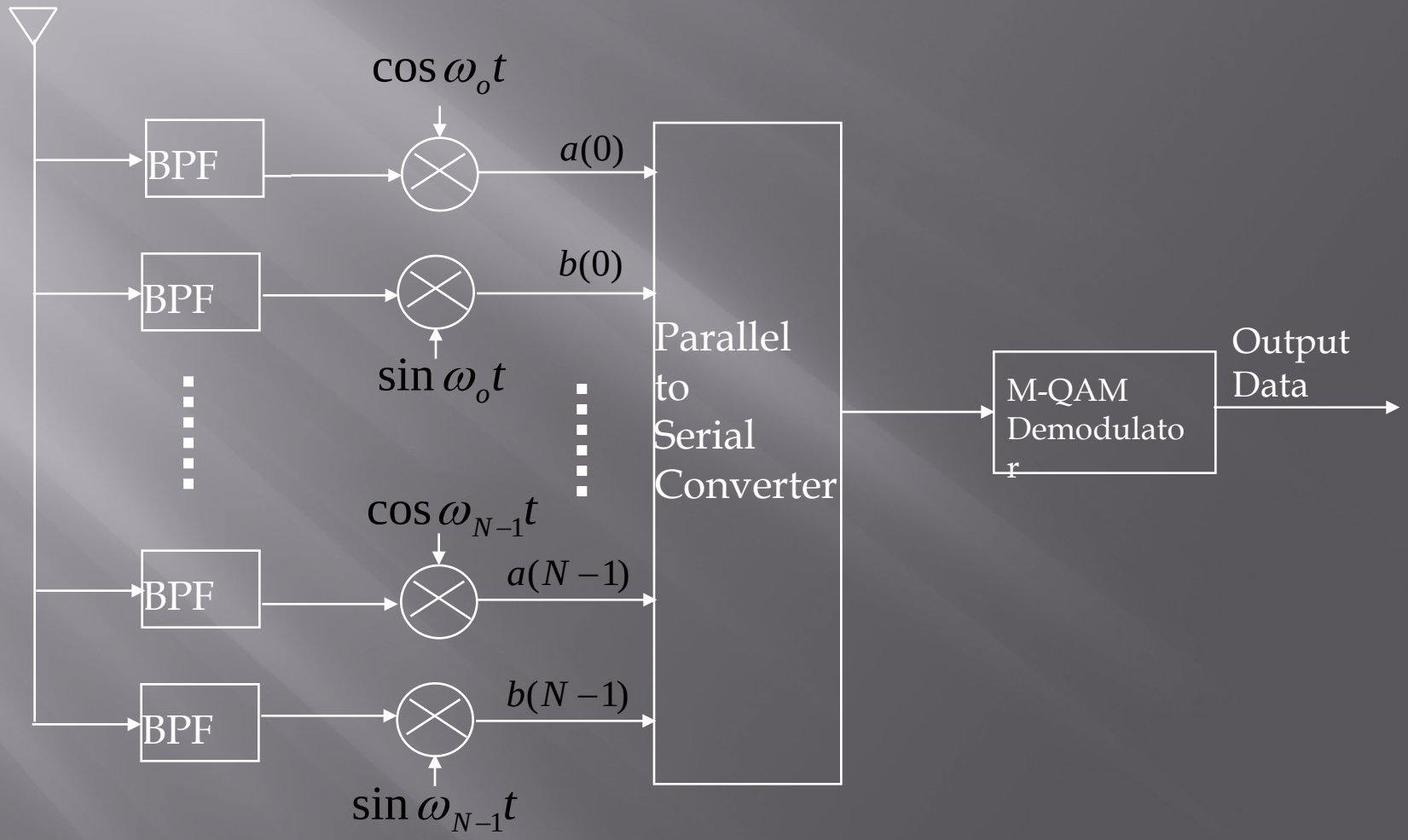
OFDM

- Available system BW is divided into a number of (N) narrower sub-bands
- Input data stream is divided into N sub-streams and the sub-streams are allowed to modulate the N sub-carriers
  - bit interval in the sub-stream is increased by a factor of N
- Channel fading becomes frequency non-selective (flat) than frequency selective
  - since symbol period is increased, delay spread becomes a fraction of the symbol period

OFDM Transmitter



OFDM Receiver



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Types of WLANs

- Peer-to-peer
- Bridge
- Wireless distribution system

CHALLENGES

- Security
- Bandwidth

Questions ?