Um Interface and Radio Channels

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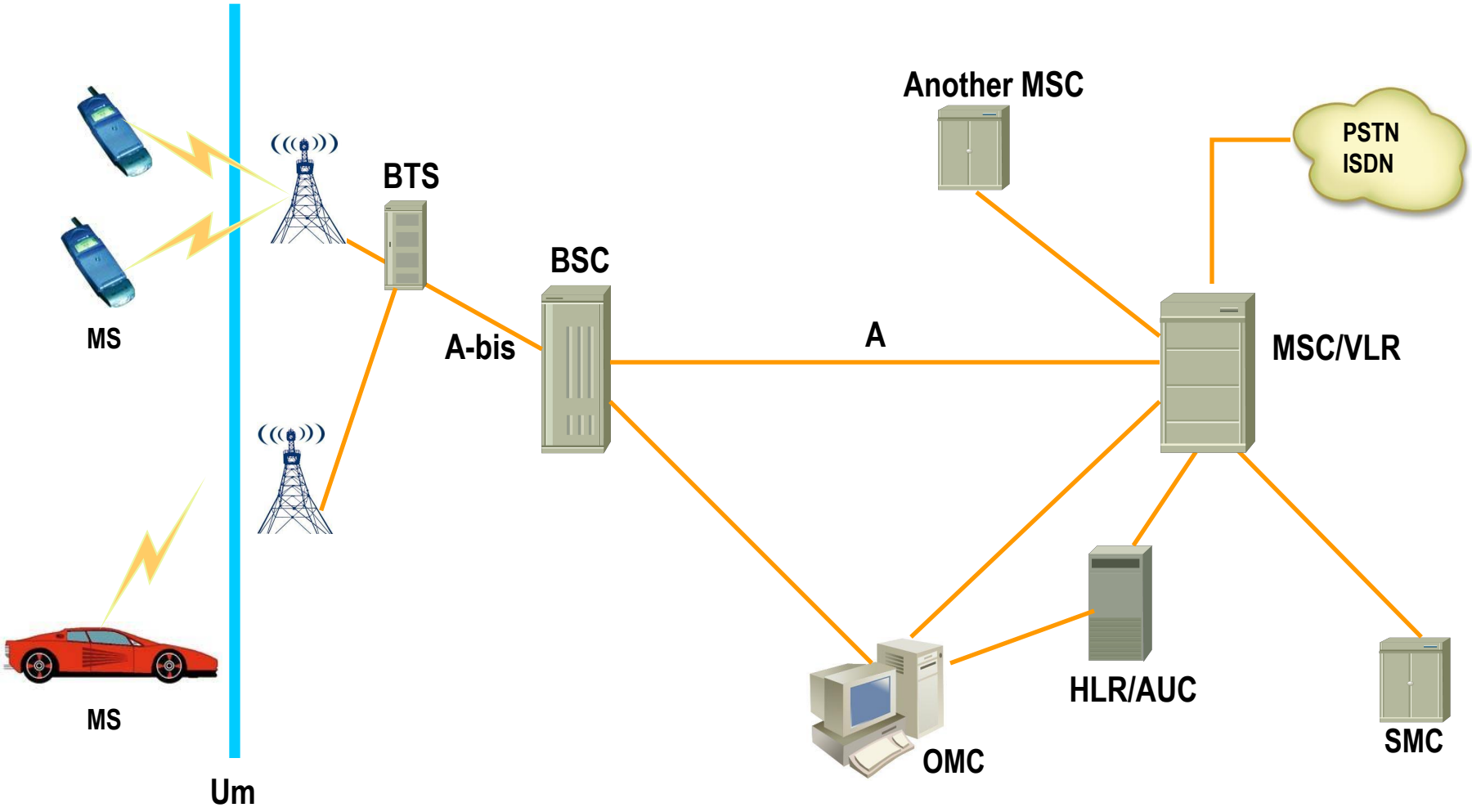
Contents

Radio Interface



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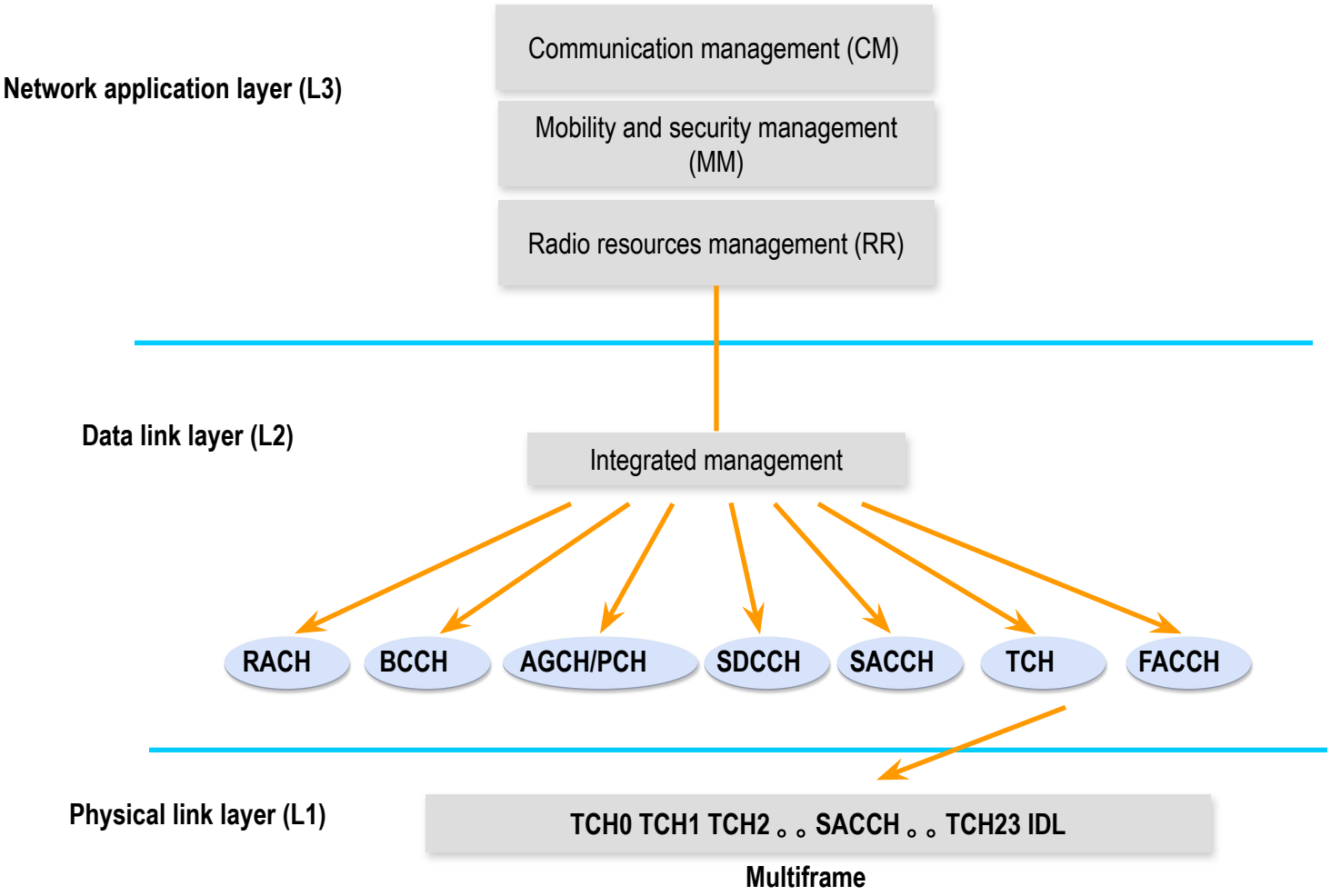
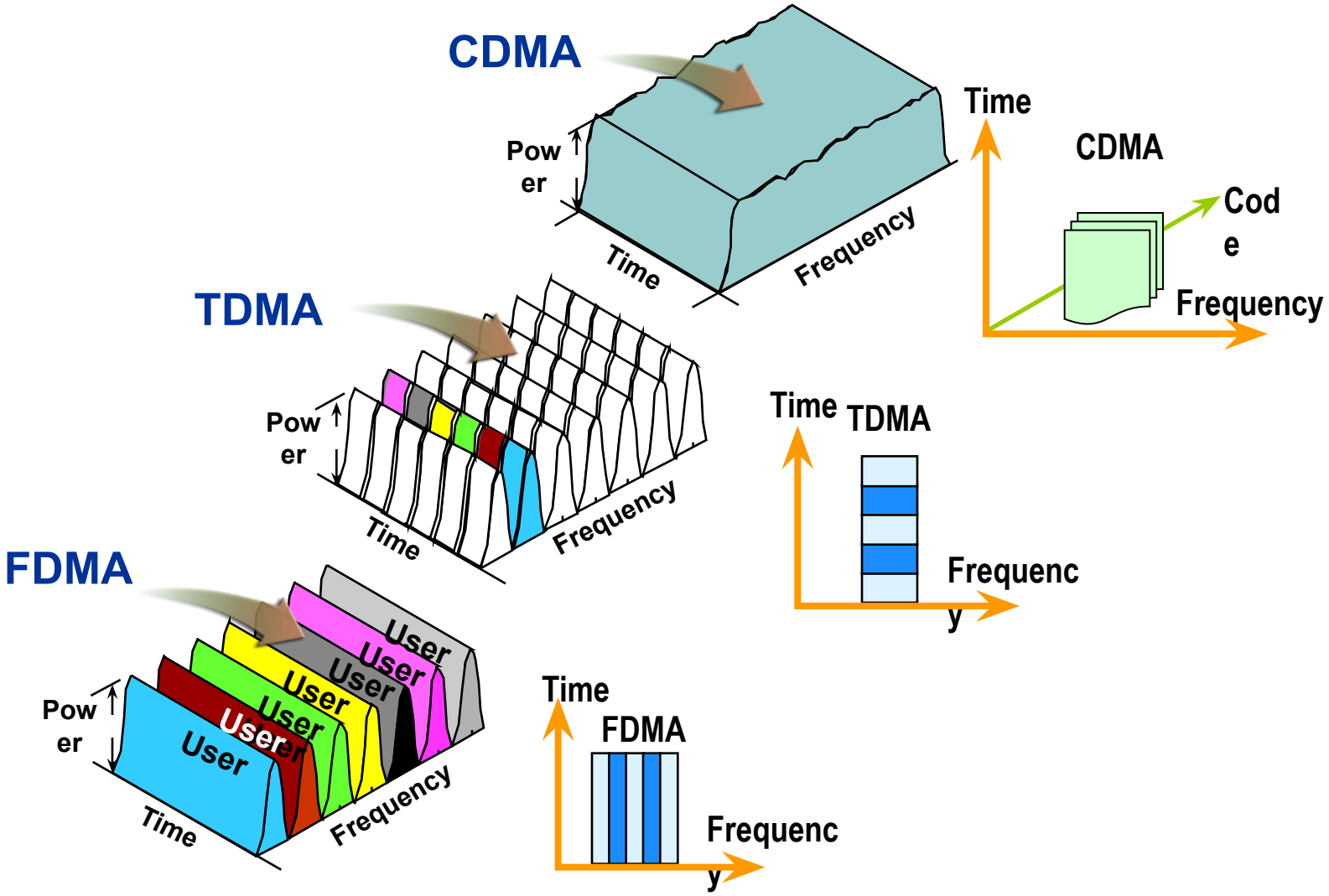
Hierarchical Structure of Um Interface



Radio Access Technology



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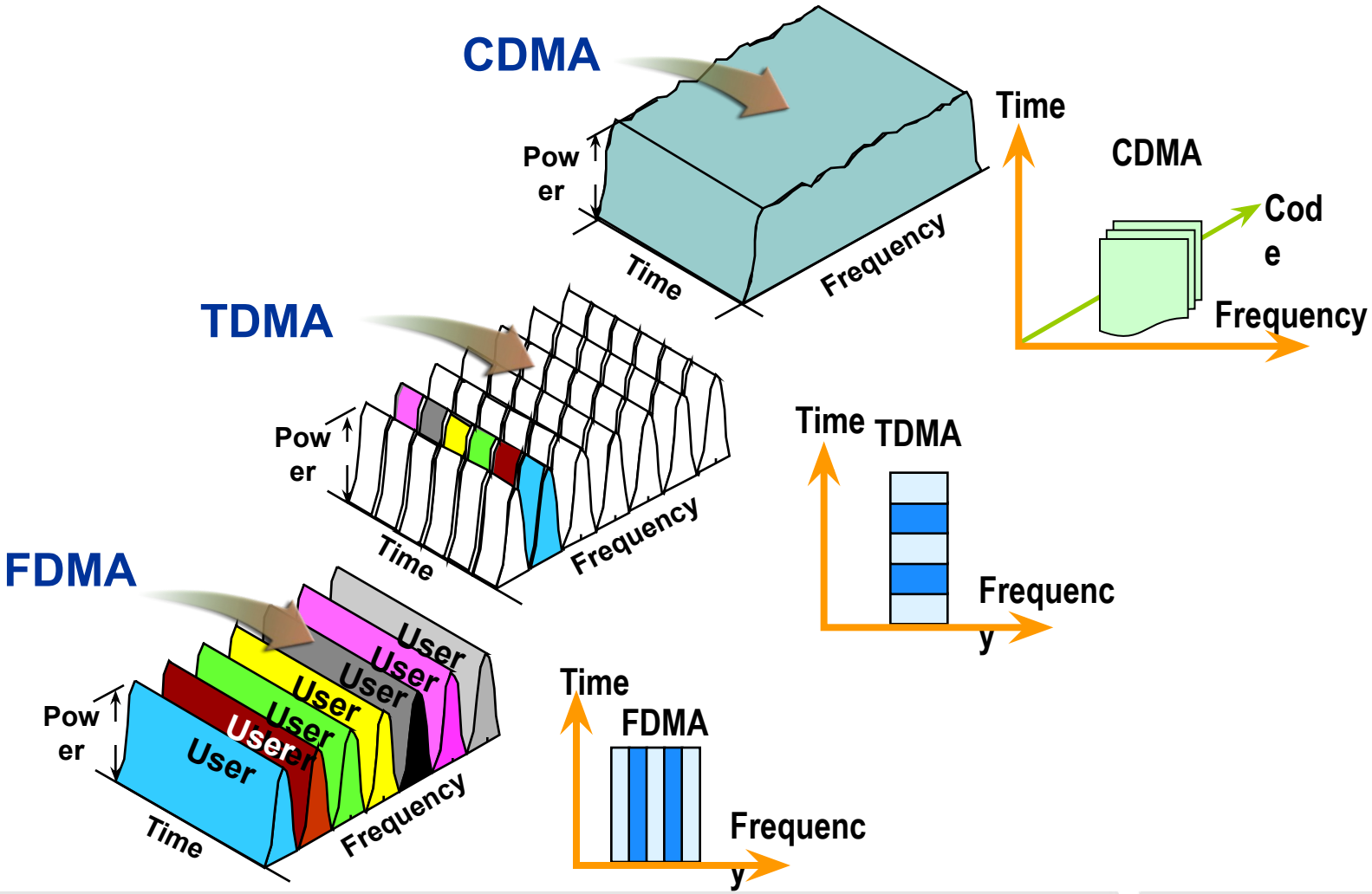
Radio Access Technology



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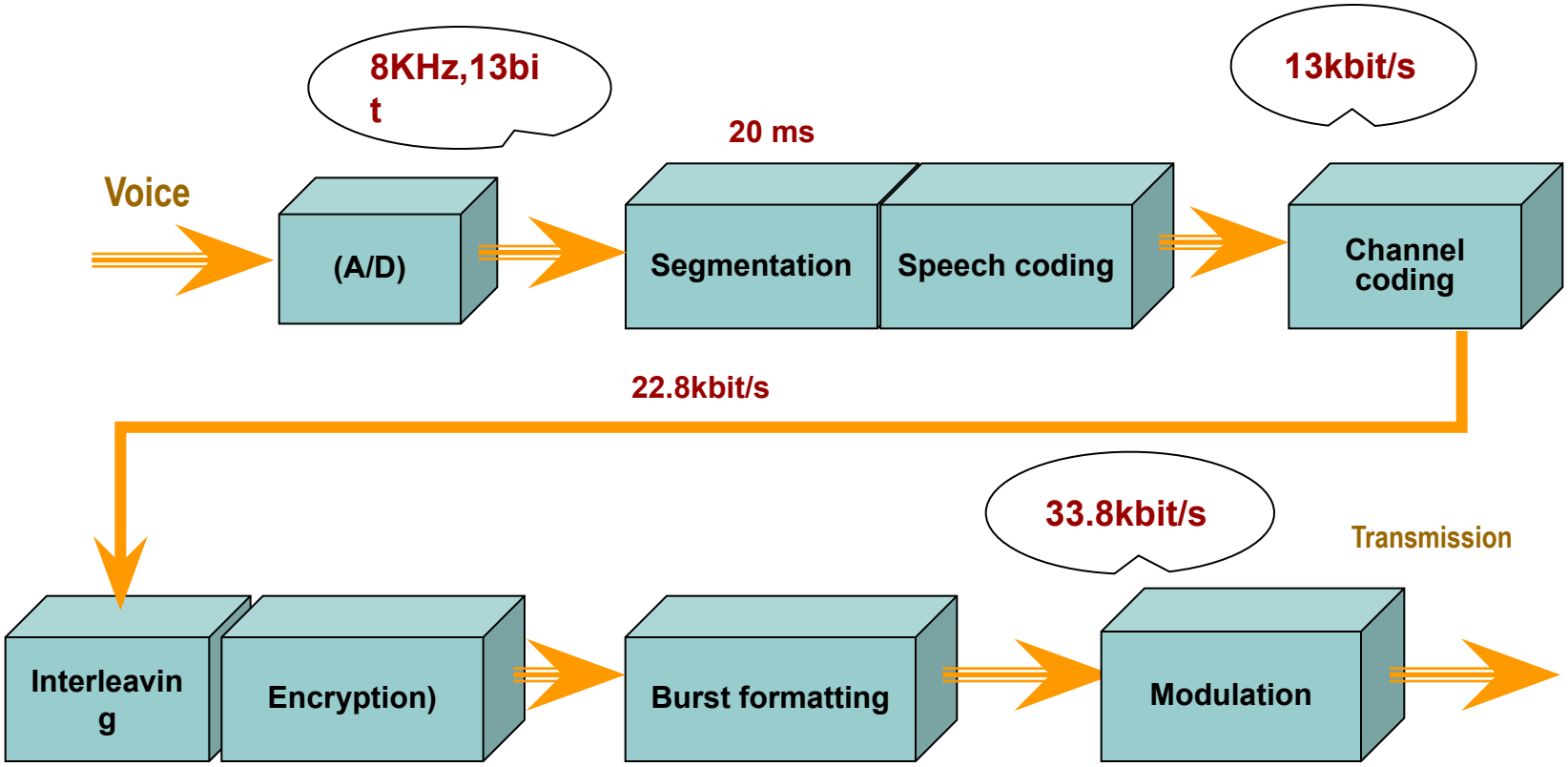
Voice Signal Processing



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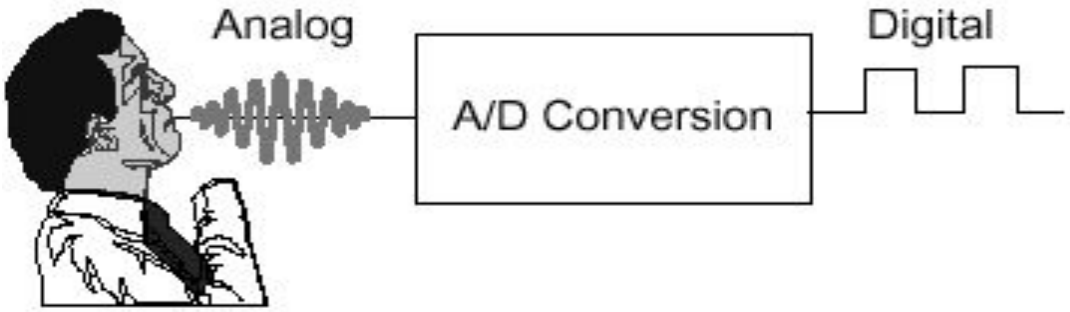
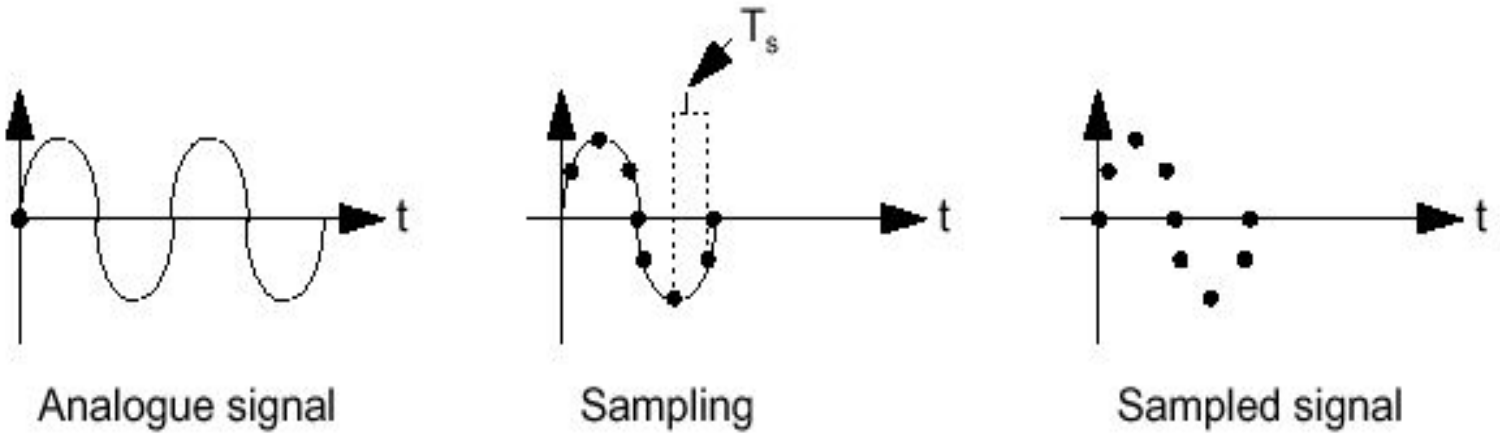
Analog-Digital Conversion





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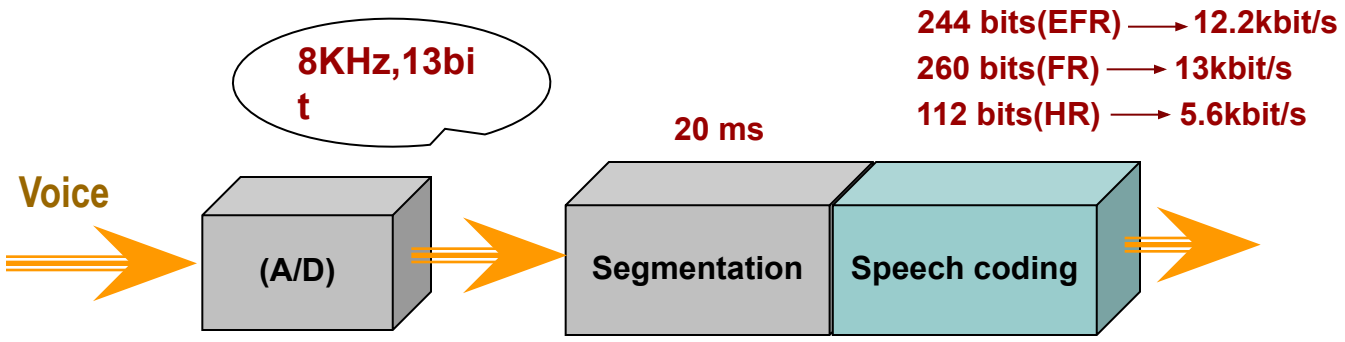
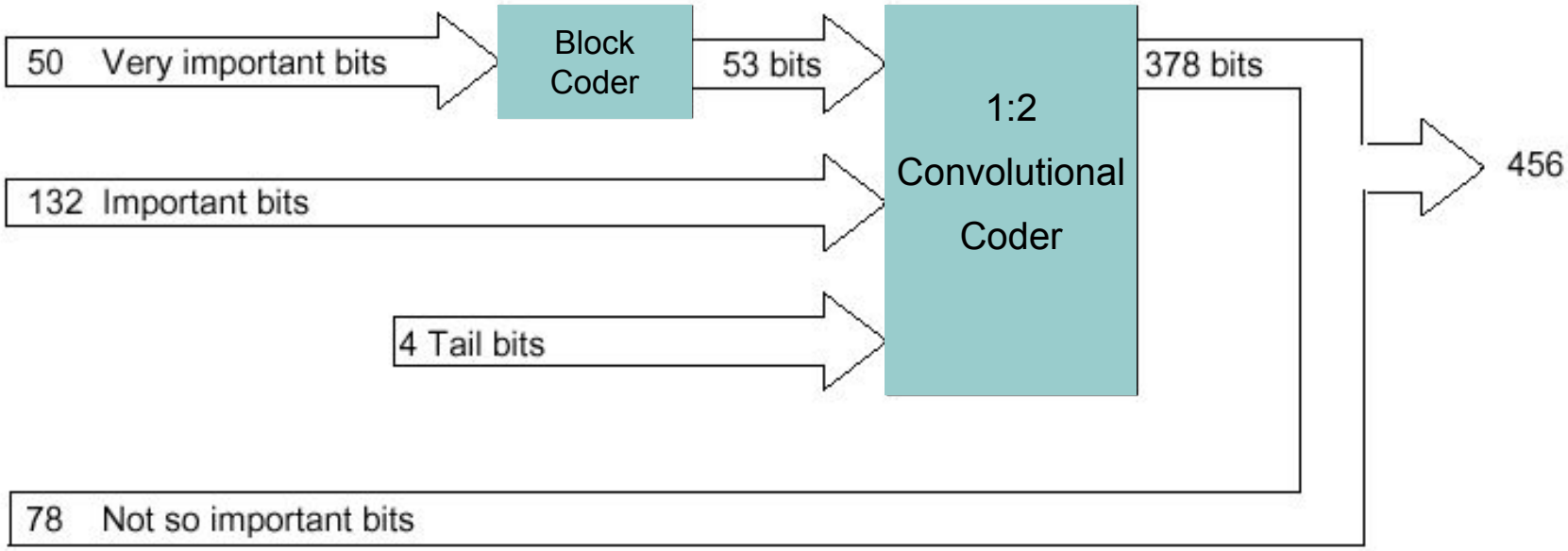
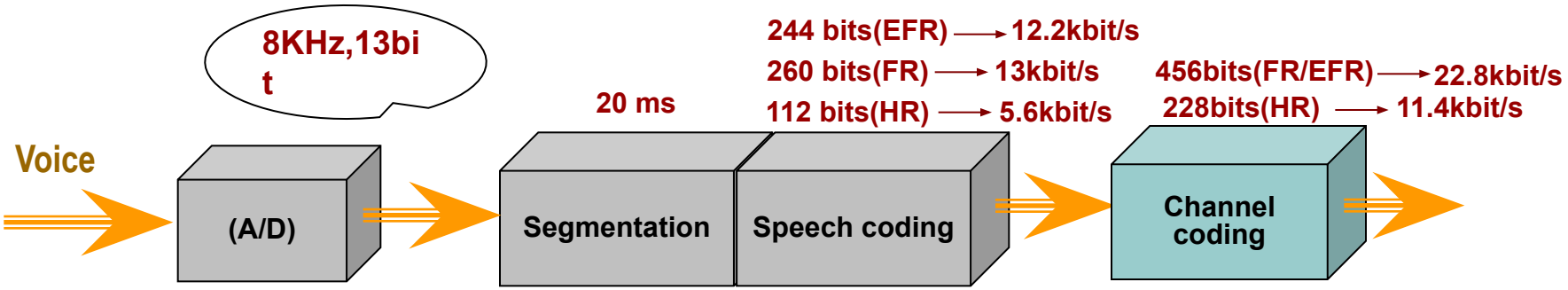
Speech Coding

- The *Enhance Full Rate* coding mode is called ***CELP*** (*Code Excited Linear Predictive Coding*)
- The *Full Rate* coding mode is called ***RPE-LTP*** (*Regular Pulse Excited-Long Term Prediction).*
- The *Half Rate* coding mode is called ***VCELP*** *(Vector-Sum Excited Linear Prediction)*



Channel Coding





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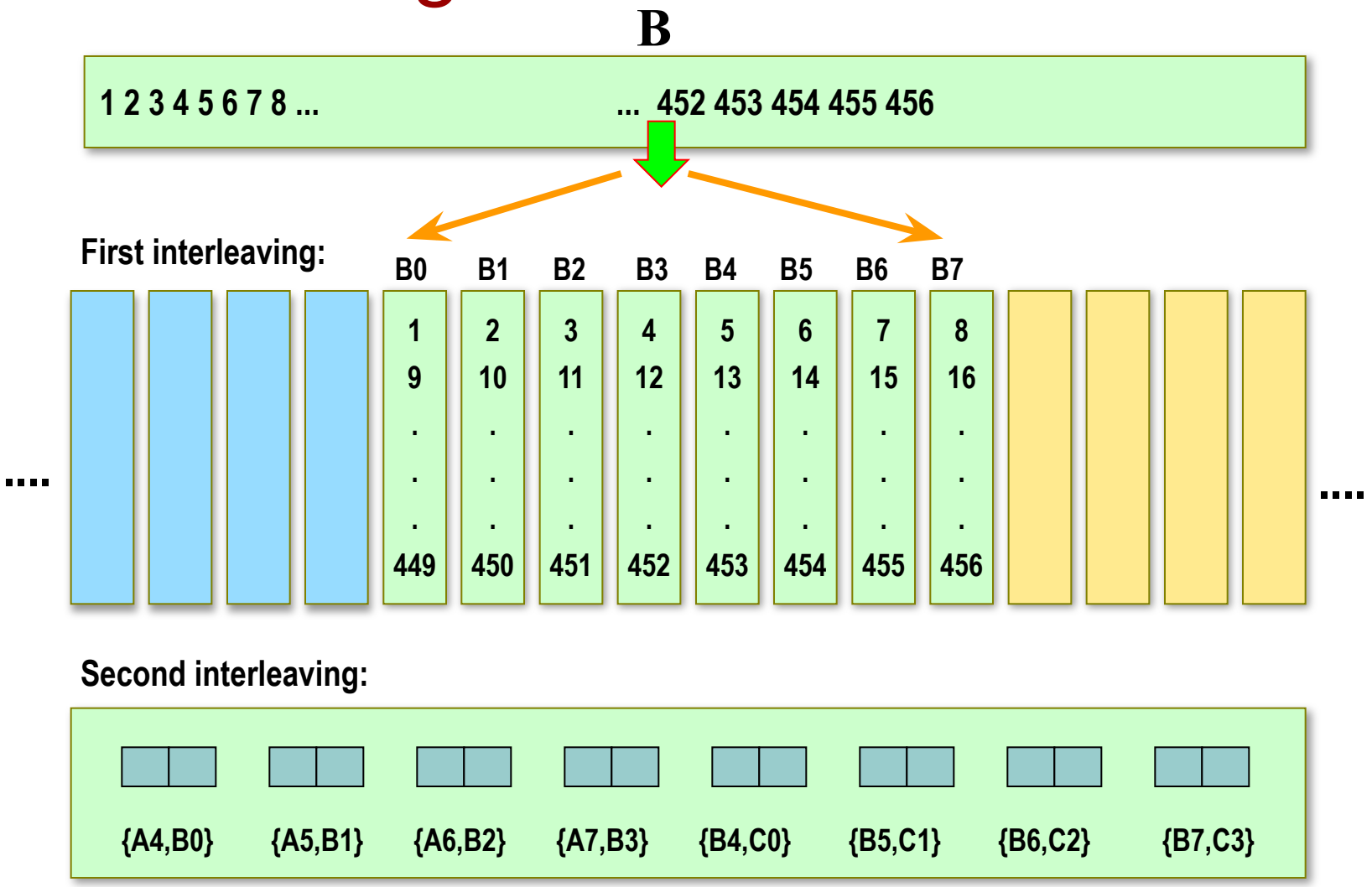
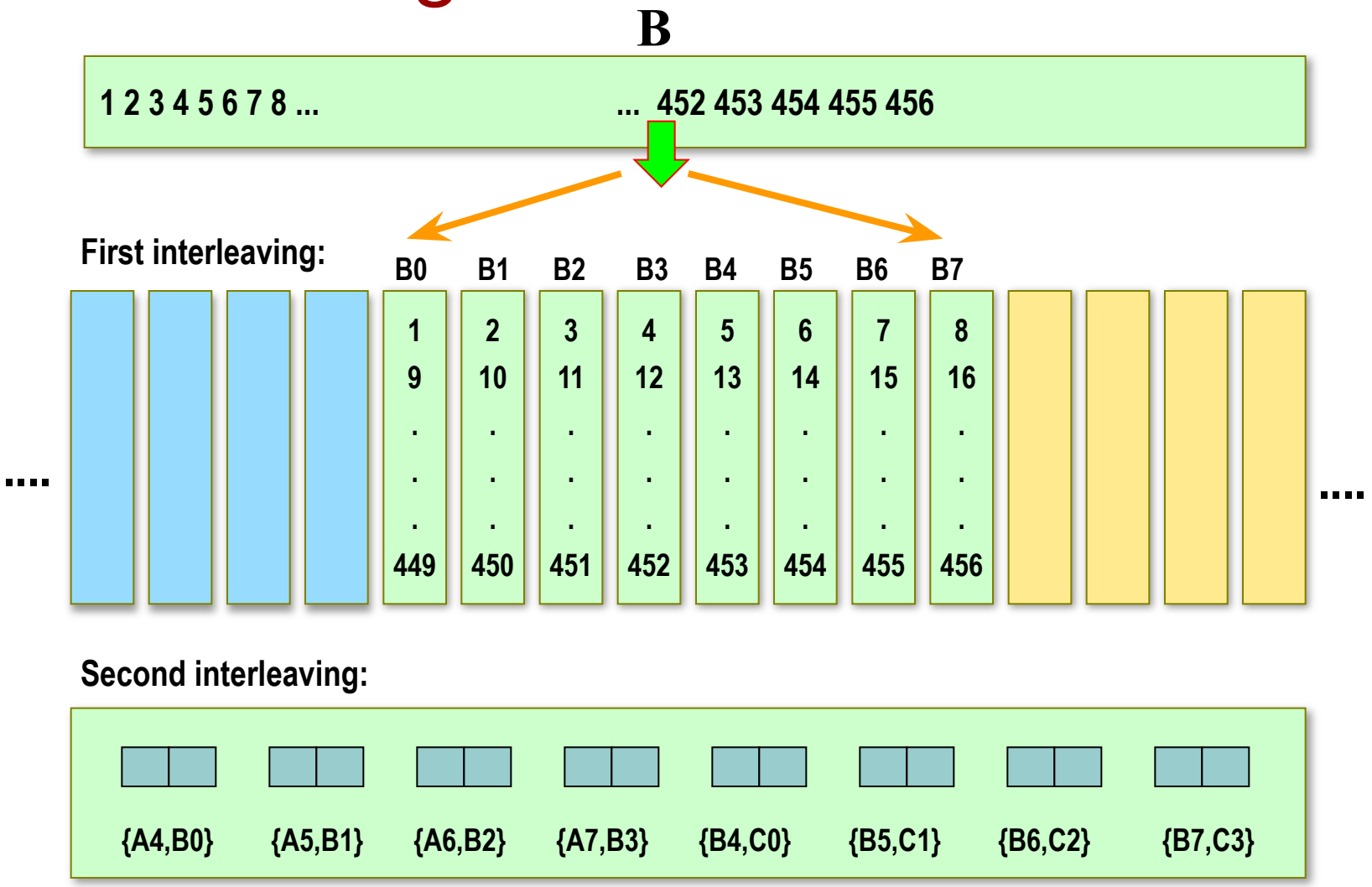
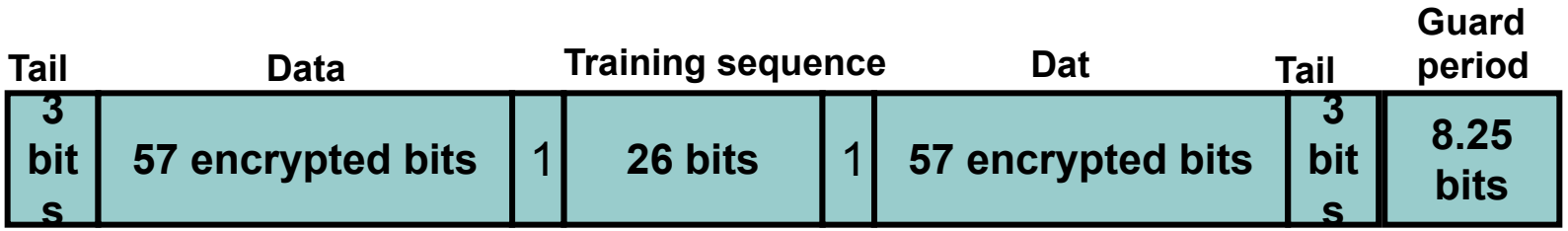
Interleaving

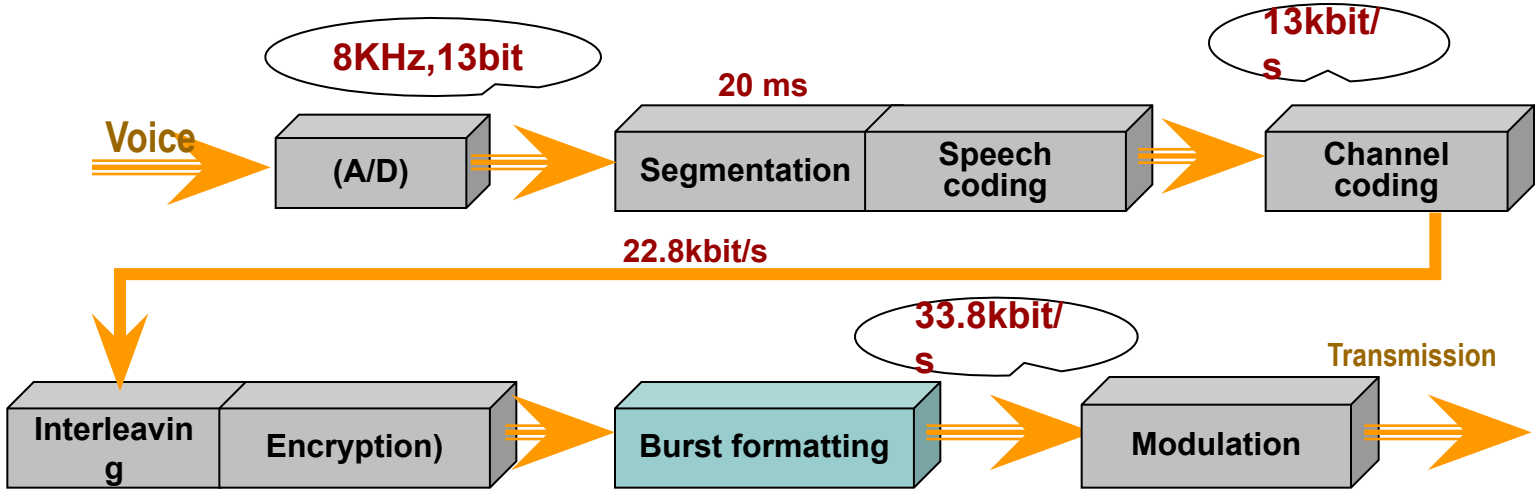


Interleaving



Voice Burst





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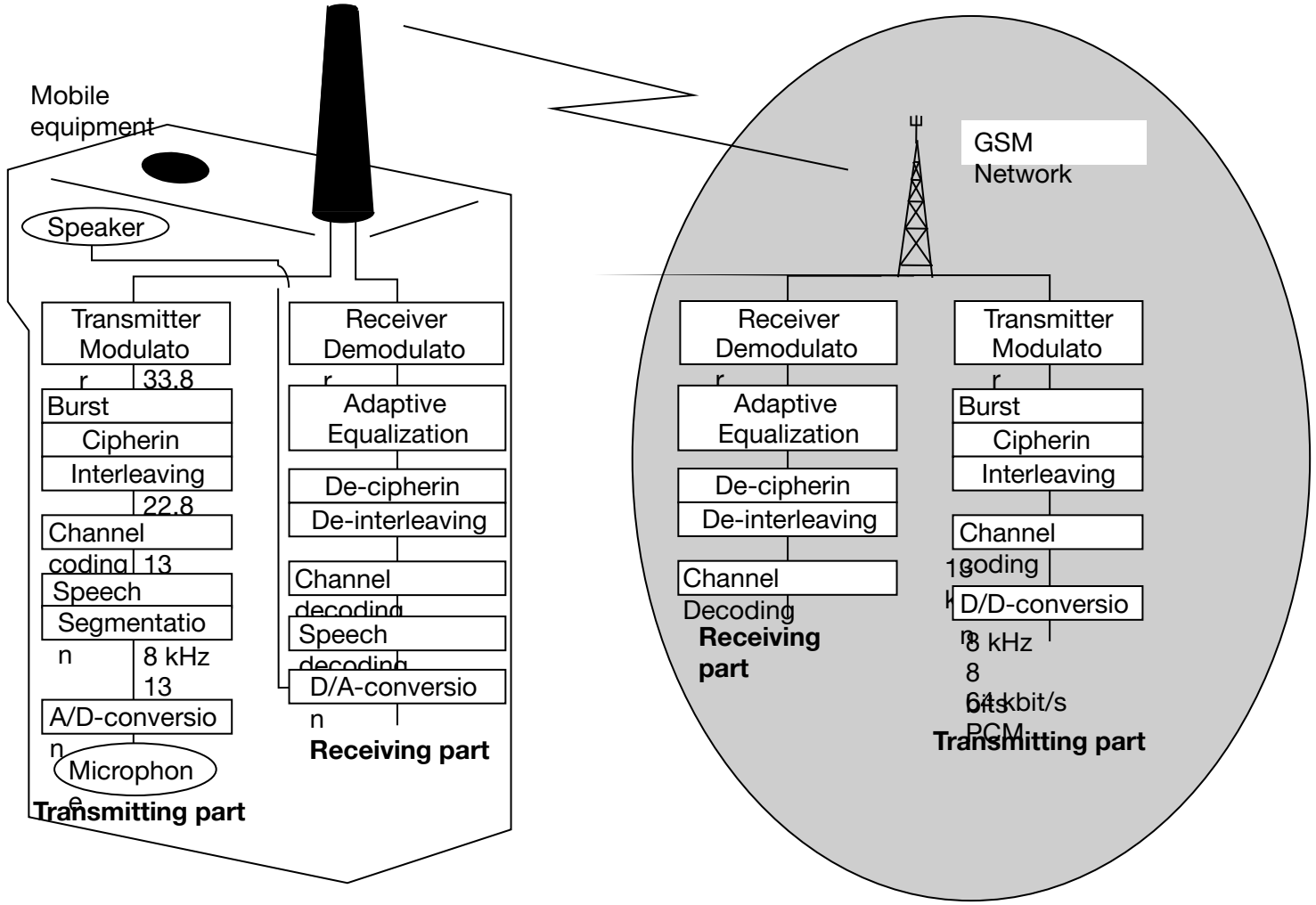
Voice Signal Processing



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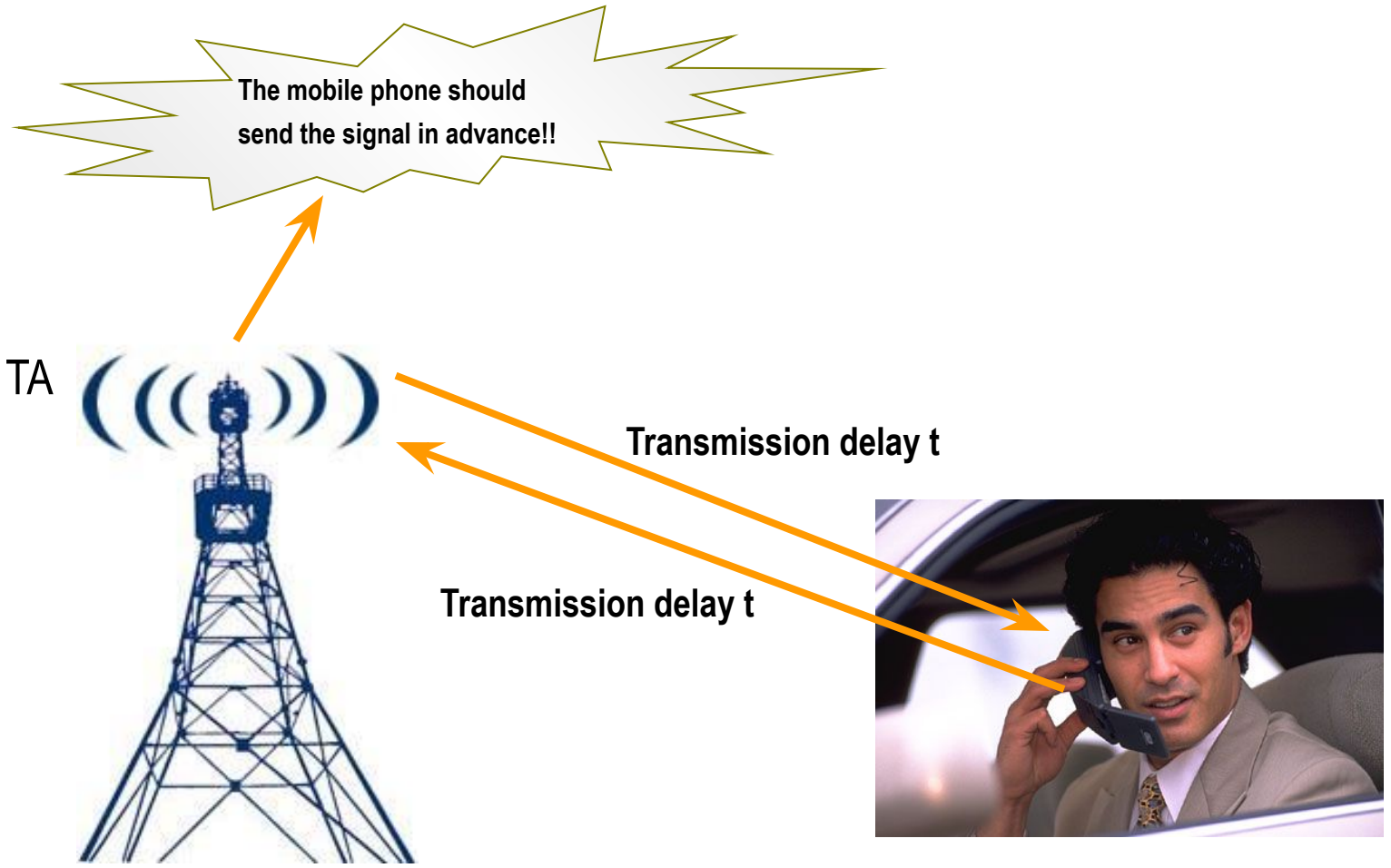
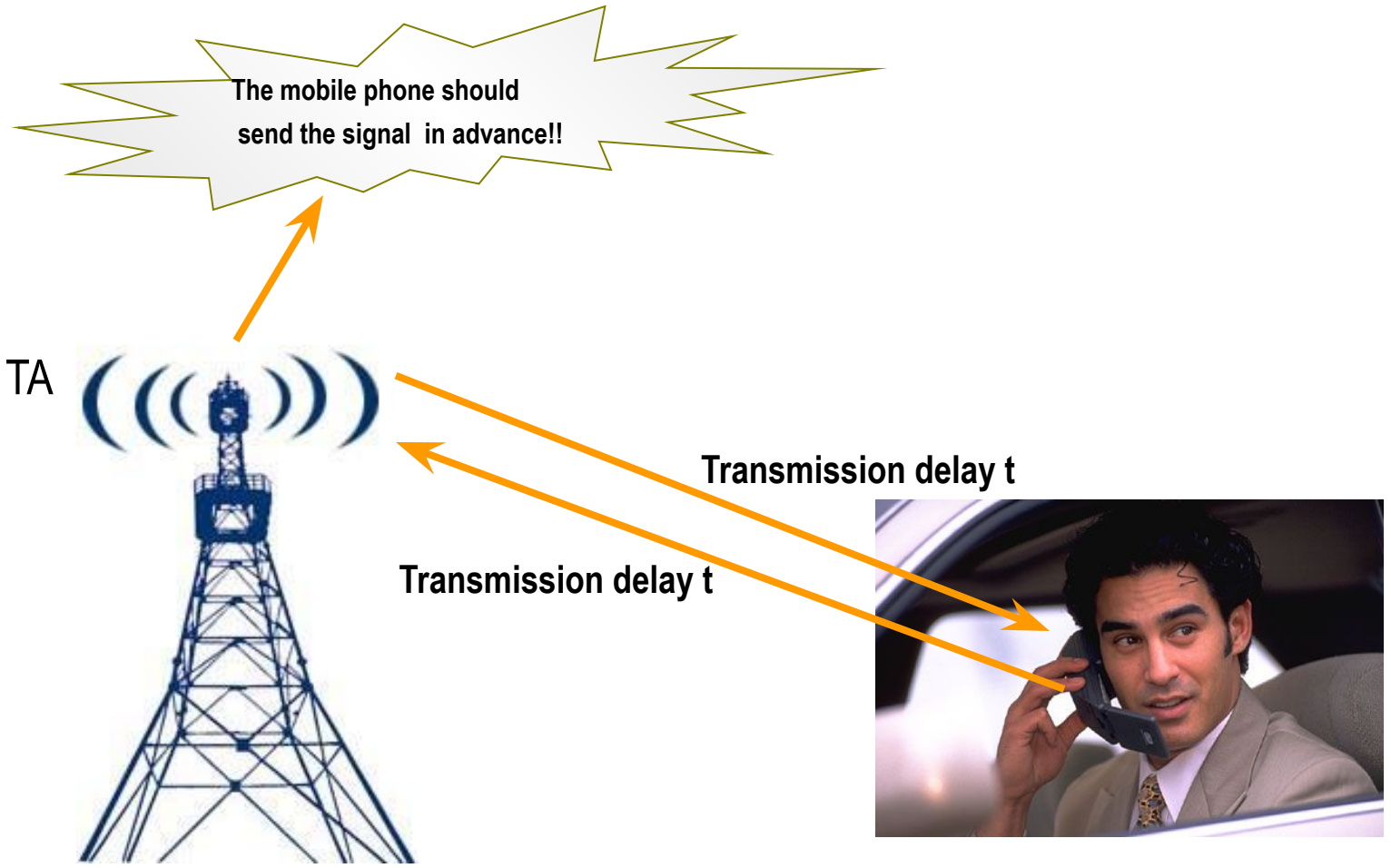
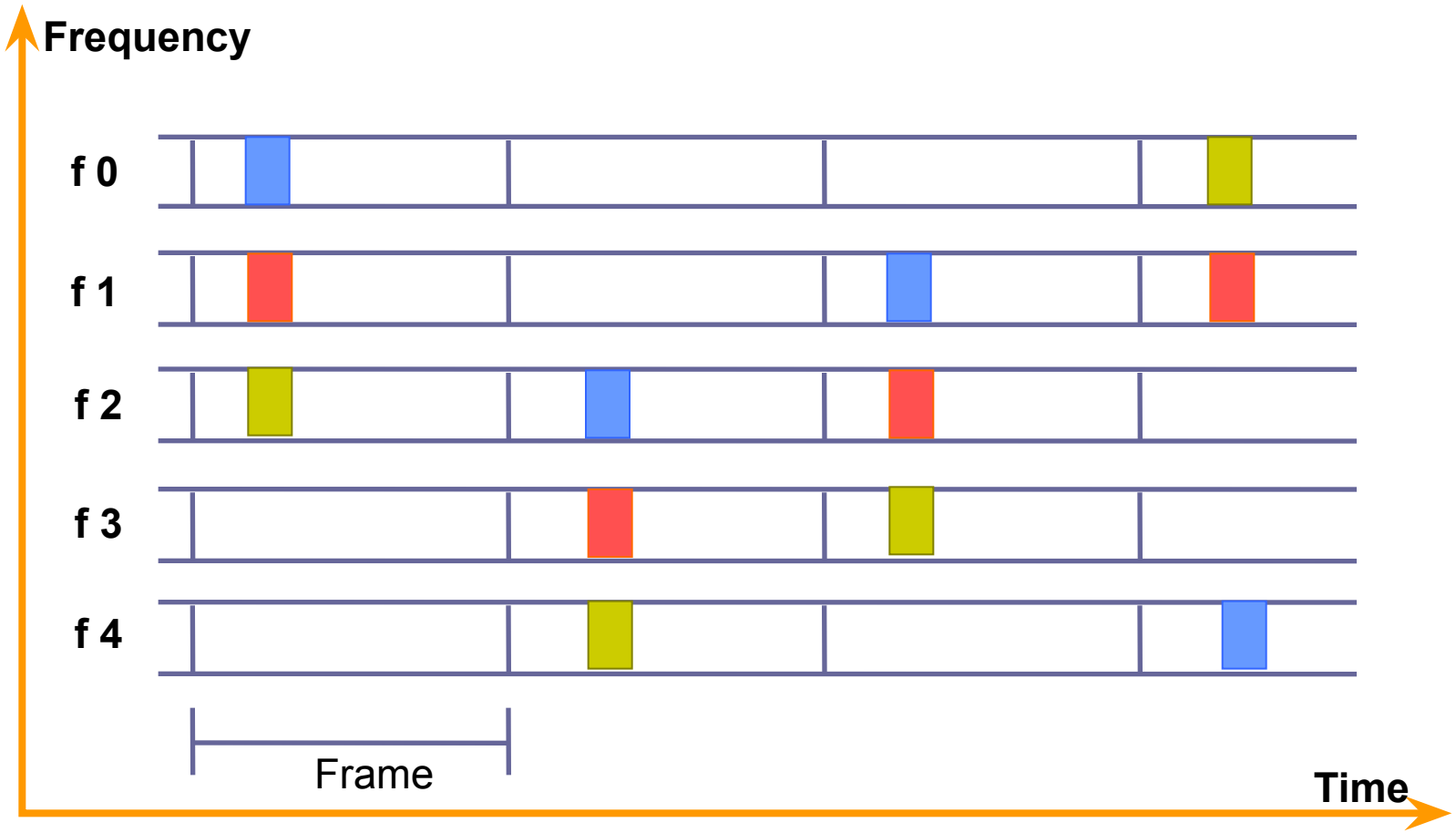
Timing Advance (TA)



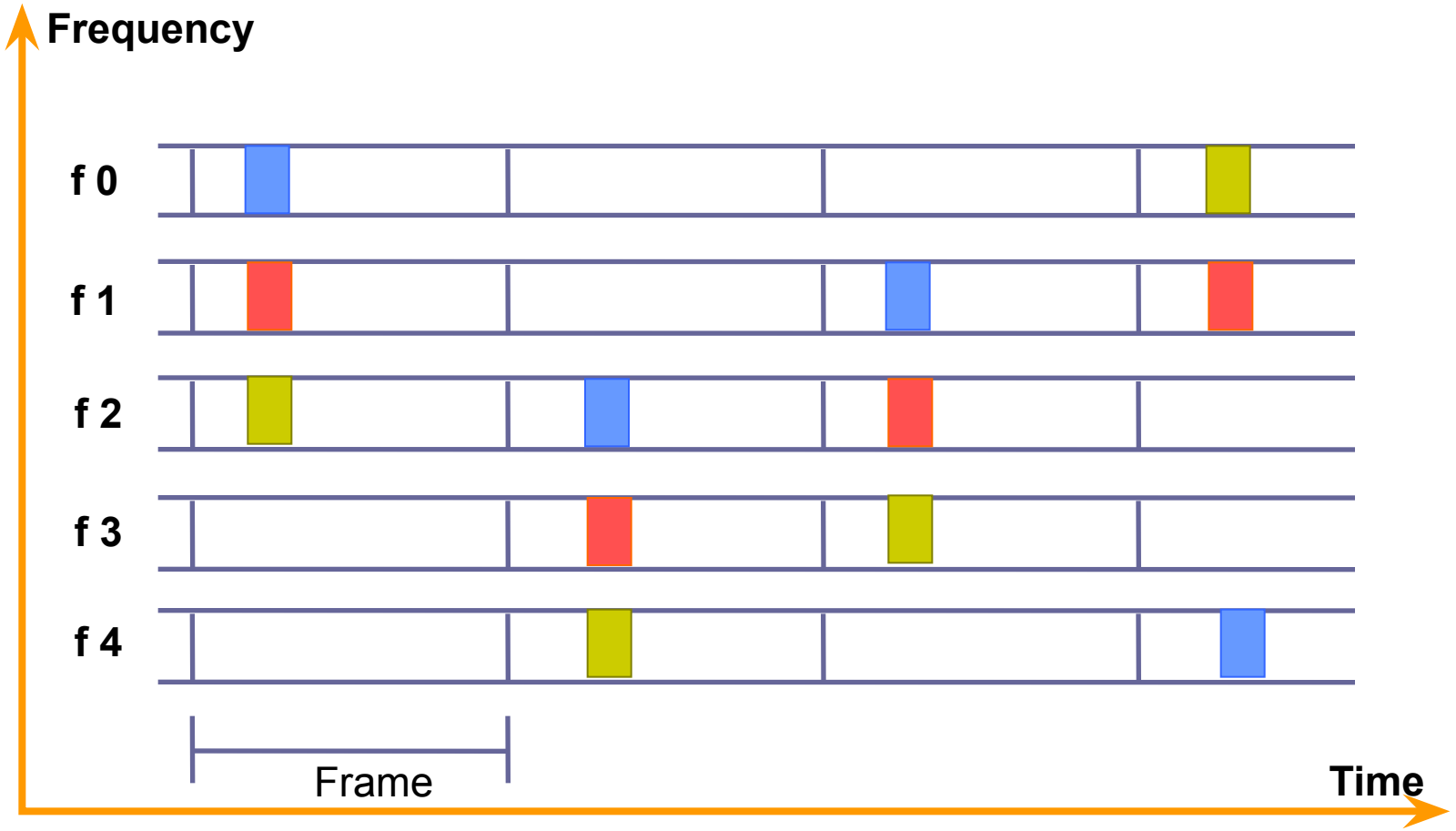
Timing Advance (TA)



Frequency Hopping



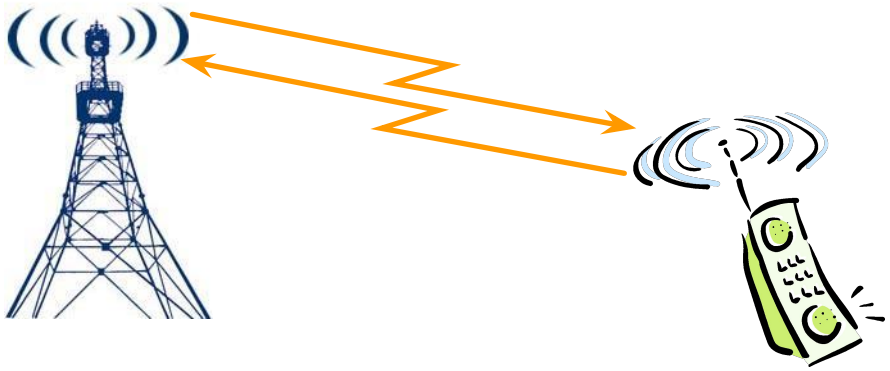
Frequency Hopping



DTX

- DTX: Discontinuous Transmission
  - Shut off the transmission at voice intervals;
  - Only transmit SID frames'
  - The transcoder at the RX terminal produces comfortable noise.
- VAD: Voice Activity Detection
  - Implemented by the transcoder.

Prolong battery life and reduce interference



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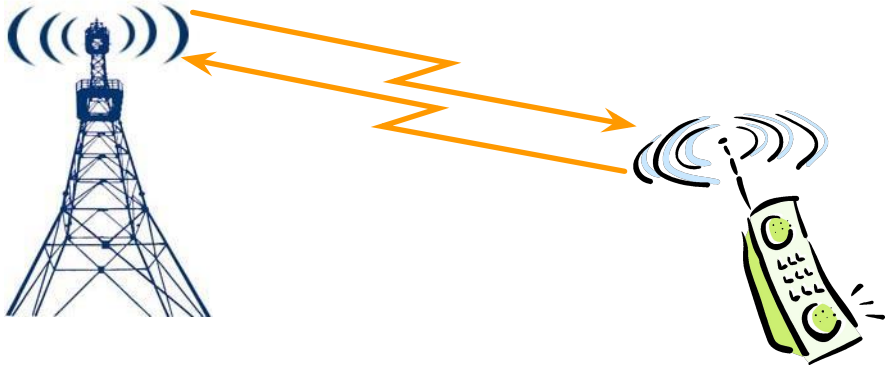
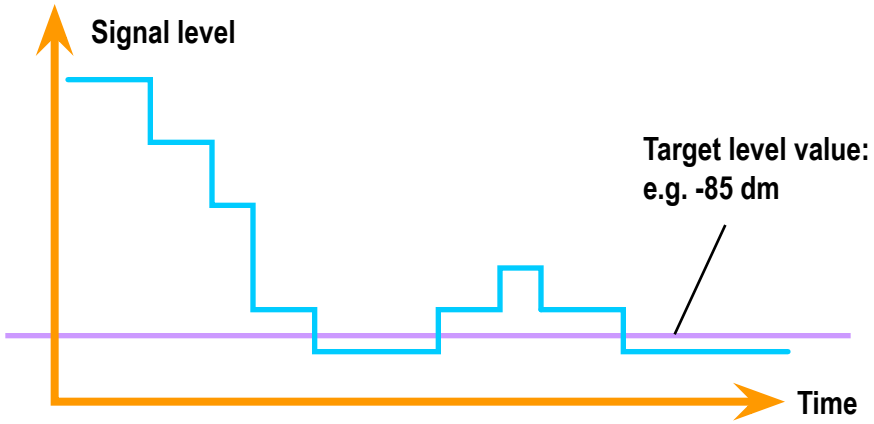


Power Control

- Prolong battery life
- Reduce network interference
- Include both uplink power control and downlink power control
- Level and quality are taken into account
- BSC or BTS is the final adjudicator

BCCH Carrier is not involved in power control.



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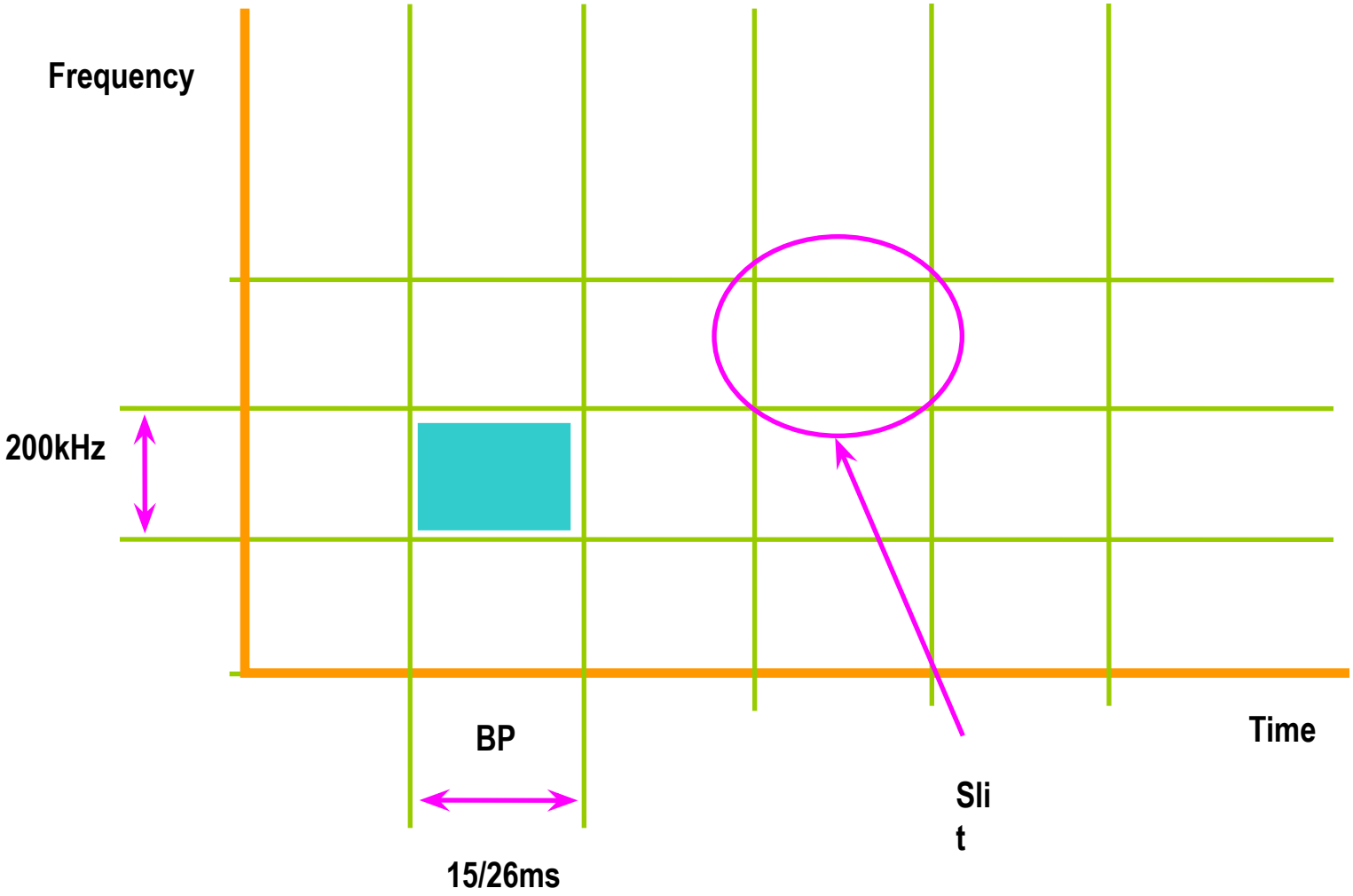
2. Processing of Voice Signal
3. **Radio Channel**

Frame and Channel



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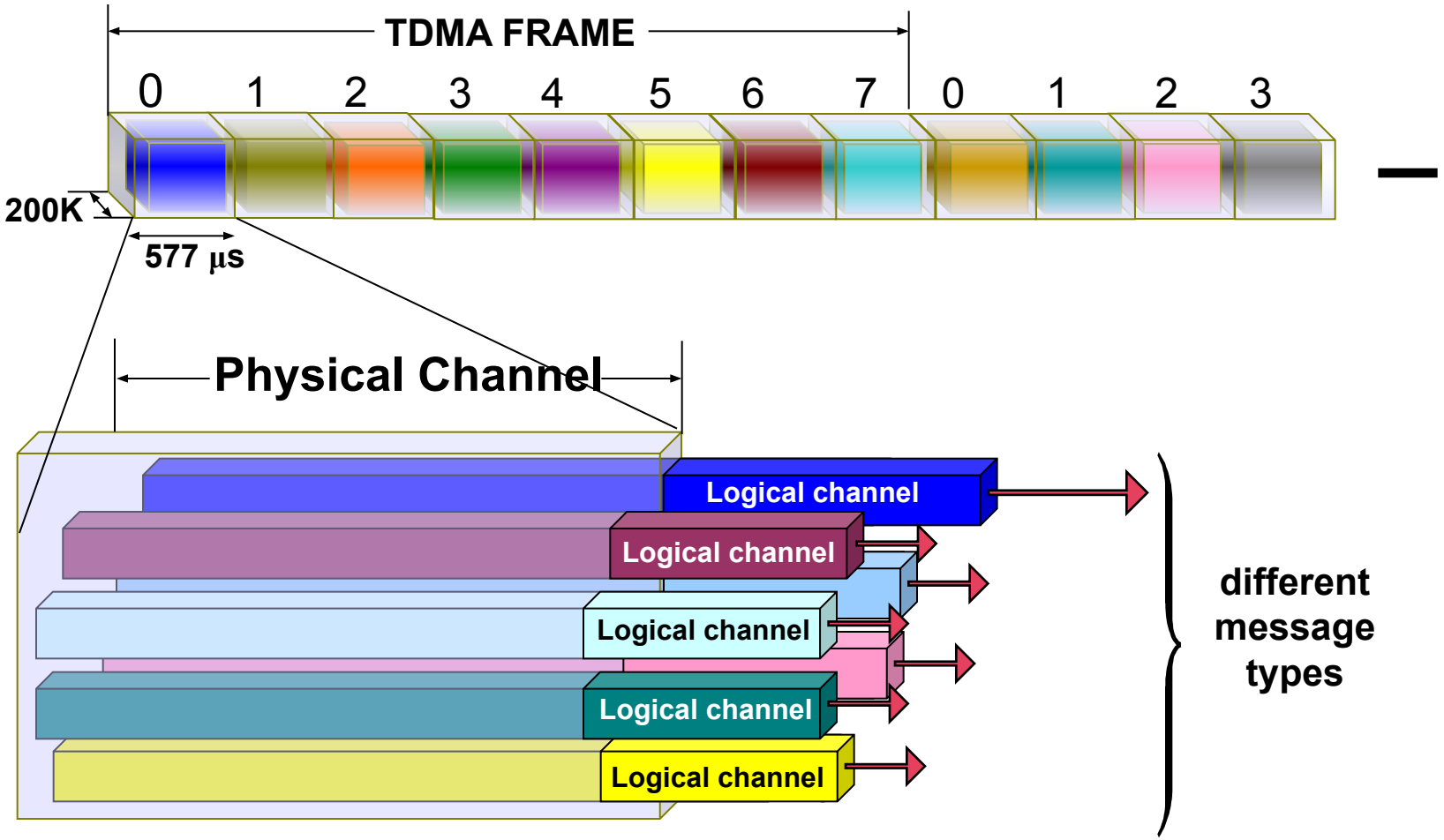
Physical Channel of Logical Channel



Burst

- Access burst (AB): Used in MS initial access

Tail bit		Data	Tail bit	Guard interval
8bit	**41 synchronous bits**	**36 encrypted bits**	**3bit**	**68.25bit**

- Frequency correction burst (FB): Used in frequency synchronization between MS and BTS

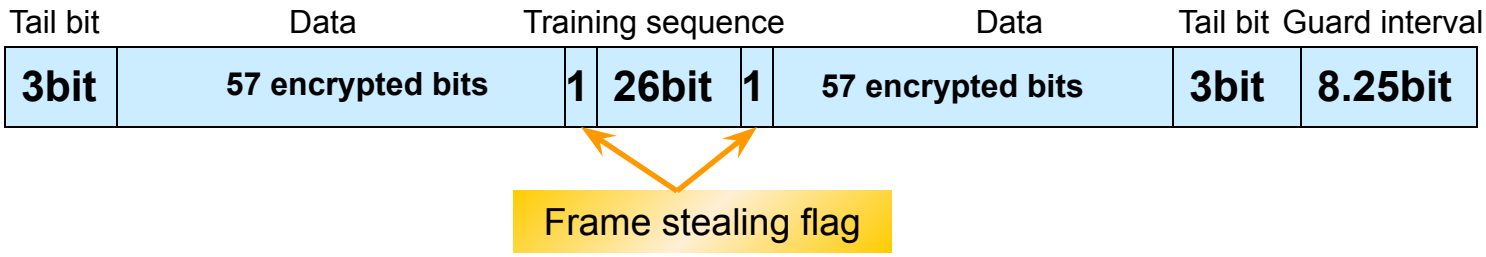
Tail bit	Data	Tail bit	Guard interval
3bit	**142bit**	**3bit**	**8.25bit**

- Synchronous burst (SB): Used in timing synchronization between MS and BTS

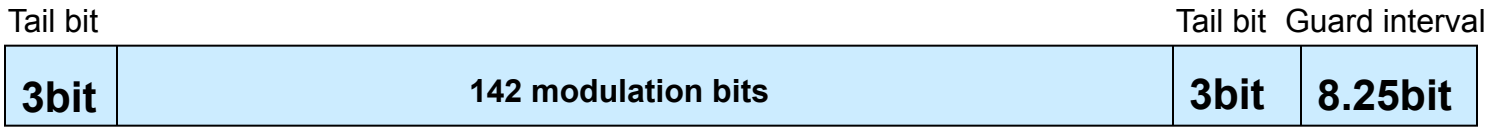
Tail bit	Data		Data	Tail bit	Guard interval
3bit	**39 encrypted bits**	**64 synchronous bits**	**39 encrypted bits**	**3bit**	**8.25bit**

Burst

- Normal burst (NB)
  - Used to carry the information of the traffic channel and the control channel except for RACH



- Dummy burst (DB)
  - Used in transmission of filling frames by BTS at timeslots when there is no information delivered



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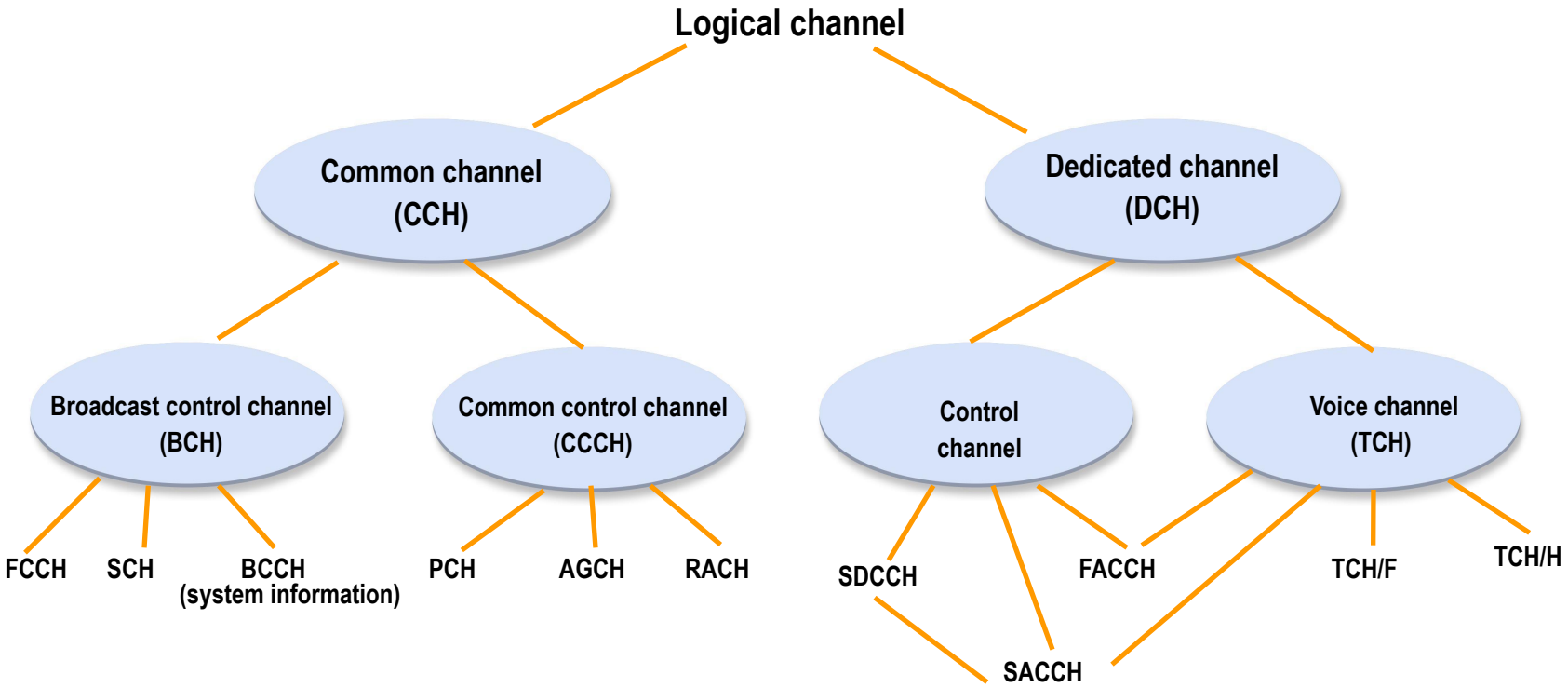
Logical Channel Type

- GSM900 and DCS1800 have the same logical channel category



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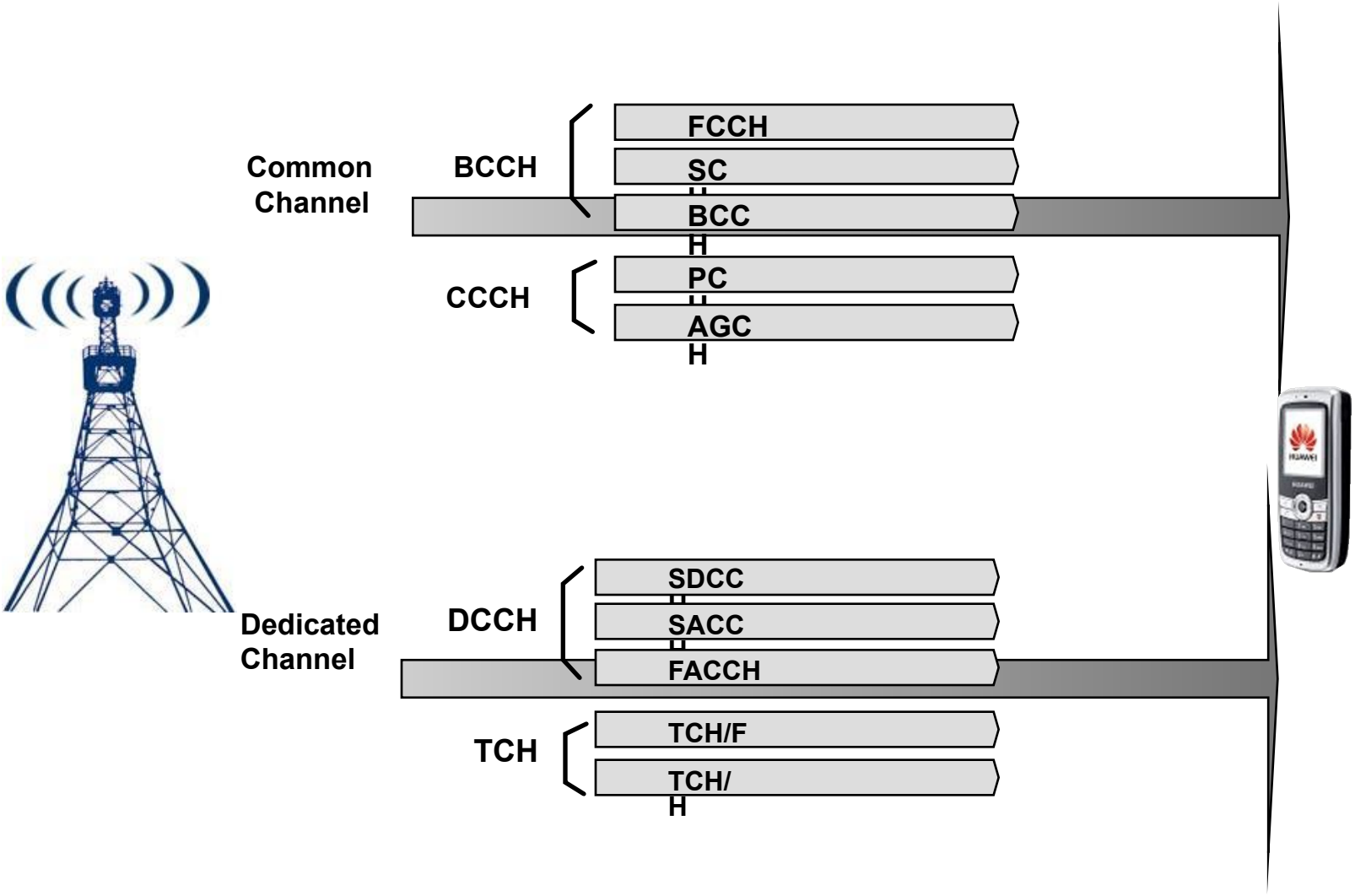
Downlink Logical Channel



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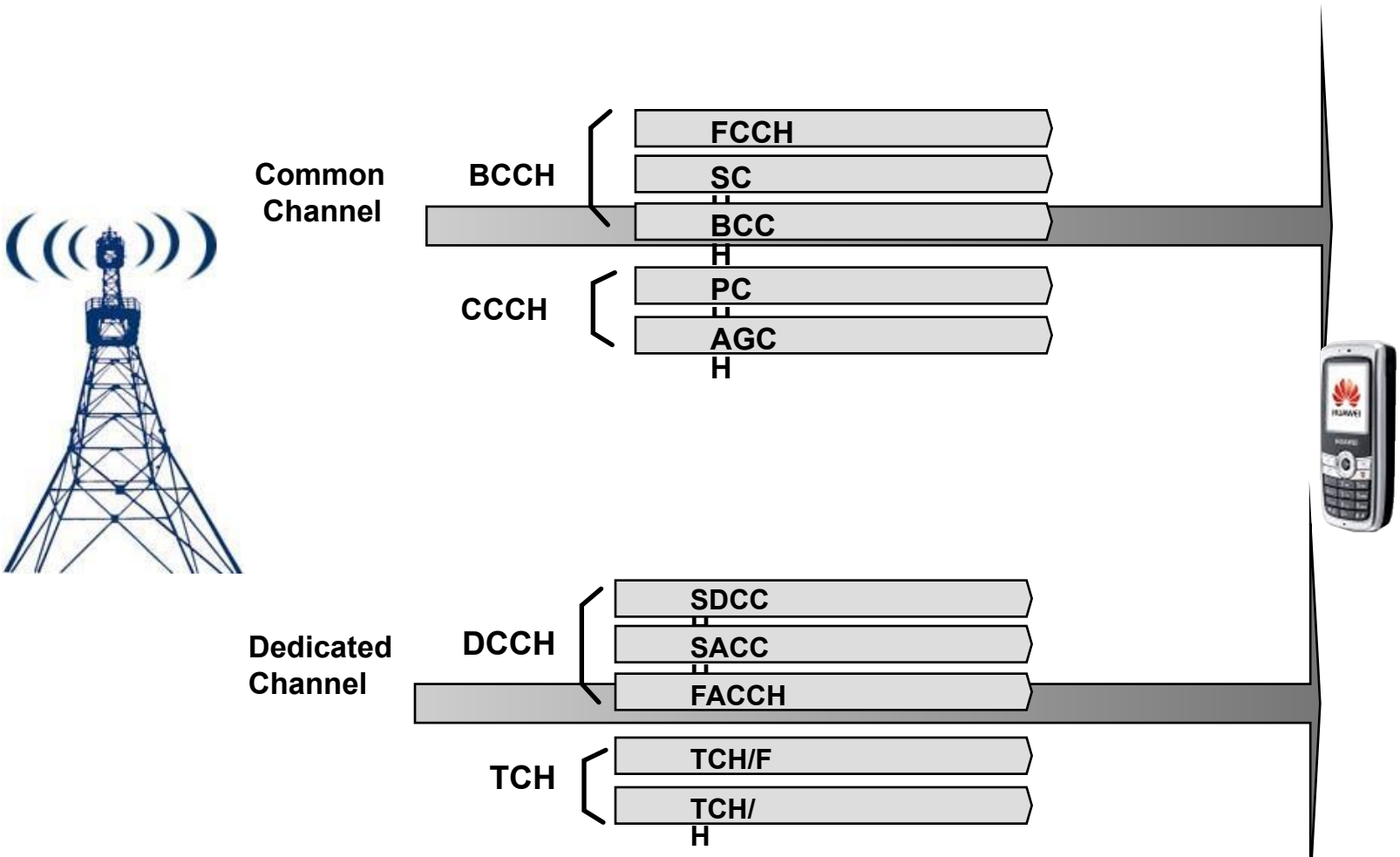
Downlink Logical Channel



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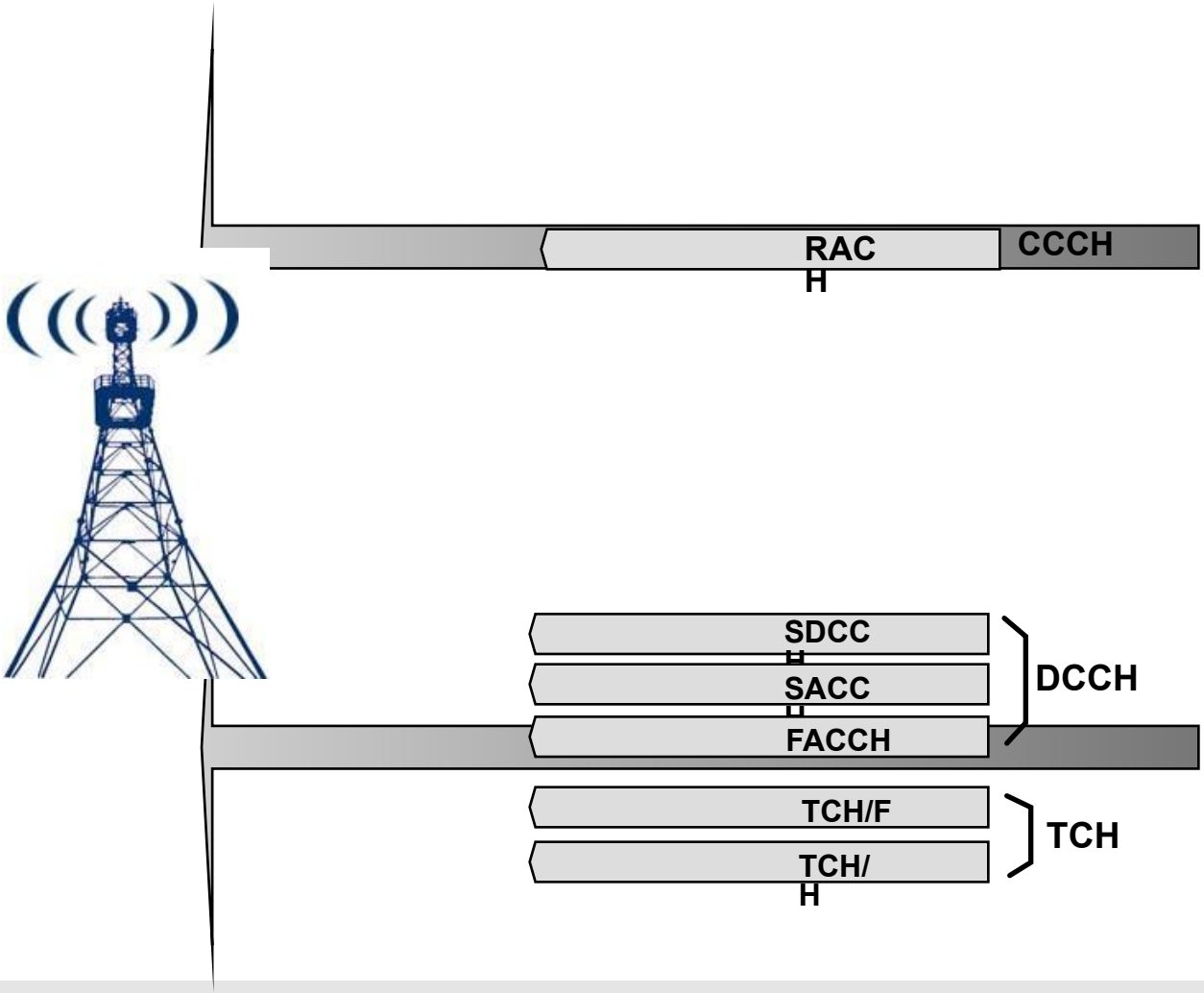
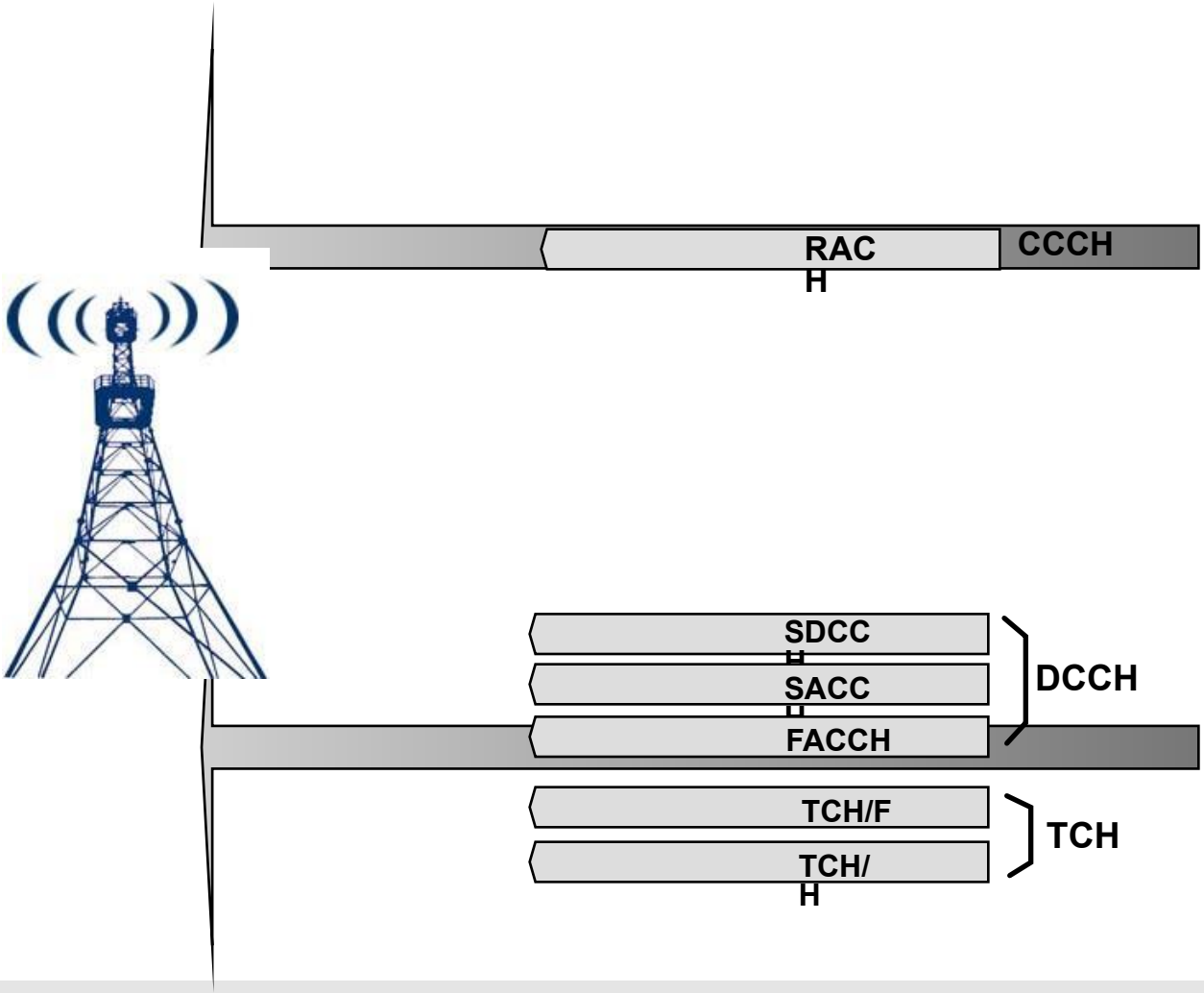
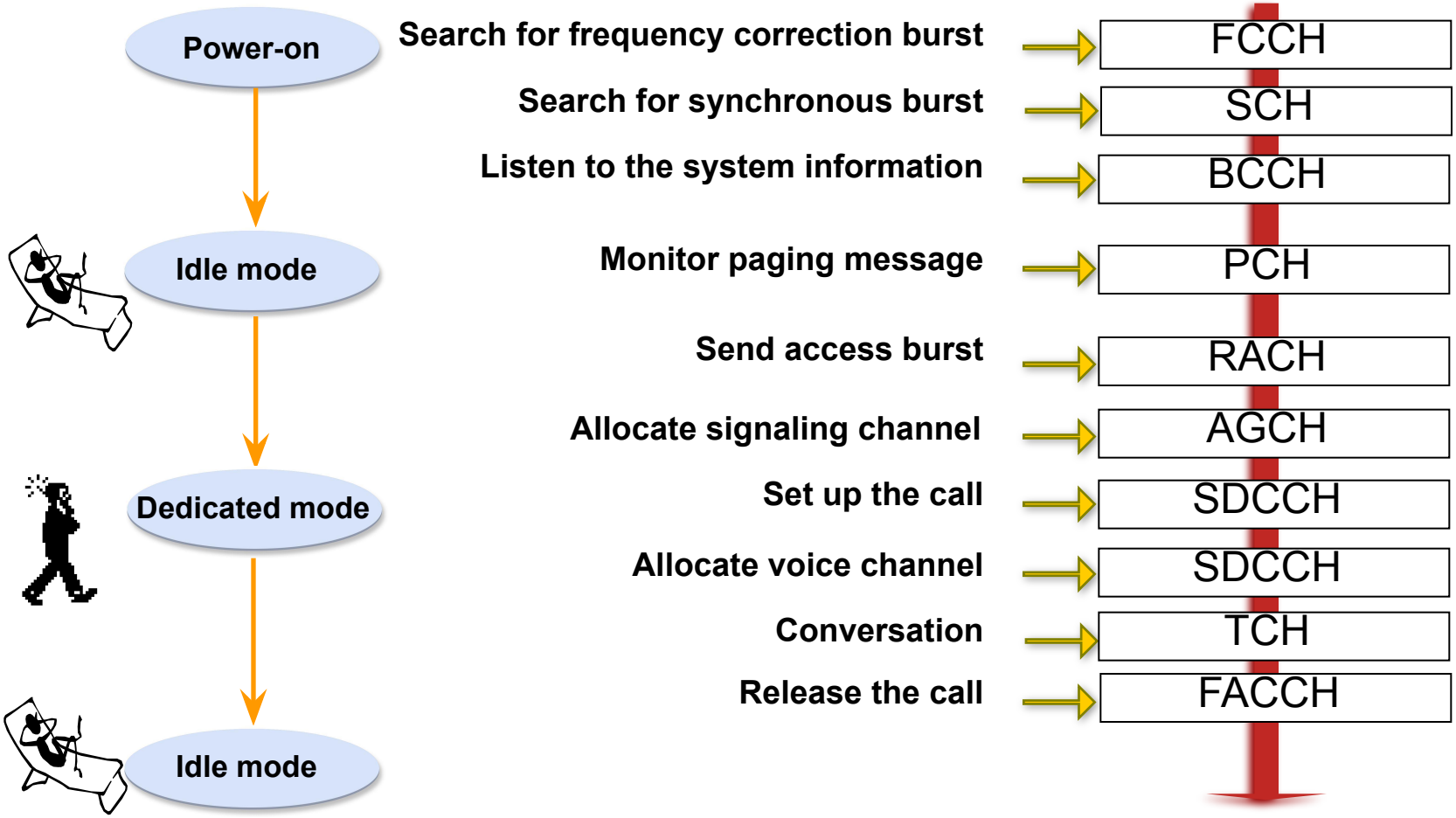
Uplink Logical Channel



Uplink Logical Channel



Use of Logical Channels



Physical Combination of Logical Channel

26-frame multi-frame

TCH/F+FACCH/F+SACCH/F (full-rate TCH)

TCH/H+FACCH/H+SACCH/H (half-rate TCH)

51-frames multi-frame

FCCH+SCH+BCCH+CCCH (main BCCH)

FCCH+SCH+BCCH+CCCH+SDCCH/4+SACCH/4 (combined BCCH)

BCCH+CCCH (extended BCCH)

SDCCH/8+SACCH/8 (main SDCCH)

Structure of Main BCCH

1 multi-frame (51TDMA Frames) 235.38ms Downlink															
Group	Group1				Group2				Group3,4 (same as Group2)	Grpup5					
Channel	F	S	BX4	CX4	F	S	CX4	CX4	……	F	S	CX4	CX4	I	
Frame Number	0	1	2-5	6-9	10	11	12-15	16-19	20-39	40	41	42-45	46-49	50	

1 multi-frame (51TDMA Frames) 235.38ms Uplink																	
Channel	R	R	R	R	R	R	R	R	R	R	R	R	R	R……R	R	R	R	R
Frame Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13-46	47	48	49	50

F:FCCH; S:SCH; B:BCCH; C:CCCH; R:RACH; I:IDLE

Structure of Combined BCCH

1 multi-frame (51TDMA Frames) 235.38ms Downlink																			
Group	Group1				Group2				Group3				Group4				Grpup5				
Channel	F	S	B×4	C×4	F	S	C×4	C×4	F	S	D0×4	D1×4	F	S	D2×4	D3×4	F	S	A0×4	A1×4	I
Channel	F	S	B×4	C×4	F	S	C×4	C×4	F	S	D0×4	D1×4	F	S	D2×4	D3×4	F	S	A2×4	A3×4	I
Frame Number	0	1	2-5	6-9	10	11	12-15	16-19	20	21	22-25	26-29	30	31	32-35	36-39	40	41	42-45	46-49	50

1 multi-frame (51TDMA Frames) 235.38ms Uplink											
Channel	D3×4	R	R	A2×4	A3×4	R……R	D0×4	D1×4	R	R	D2×4
Channel	D0×4	R	R	A0×4	A1×4	R……R	D0×4	D1×4	R	R	D2×4
Frame Number	0-3	4	5	6-9	10-13	14-36	37-40	41-44	45	46	47-50

F:FCCH; S:SCH; B:BCCH; C:CCCH; D:SDCCH ;A:SACCH; R:RACH; I:IDLE

Structure of Logical Channel Combination Frame-Main SDCCH

1 multi-frame (51TDMA Frames) 235.38ms Downlink															
Channel	D0×4	D1×4	D2×4	D3×4	D4×4	D5×4	D6×4	D7×4	A0×4	A1×4	A2×4	A3×4	I	I	I
Channel	D0×4	D1×4	D2×4	D3×4	D4×4	D5×4	D6×4	D7×4	A4×4	A5×4	A6×4	A7×4	I	I	I
Frame Number	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39	40-43	44-47	48	49	50

1 multi-frame (51TDMA Frames) 235.38ms Uplink															
Channel	A5×4	A6×4	A7×4	I	I	I	D0×4	D1×4	D2×4	D3×4	D4×4	D5×4	D6×4	D7×4	A0×4
Channel	A1×4	A2×4	A3×4	I	I	I	D0×4	D1×4	D2×4	D3×4	D4×4	D5×4	D6×4	D7×4	A4×4
Frame Number	0-3	4-7	8-11	12	13	14	15-18	19-22	23-26	27-30	31-34	35-38	39-42	43-46	47-50

D:SDCCH; A:SACCH; I:IDLE

Structure of Logical Channel Combination Frame-TCH

Case of one full rate TCH

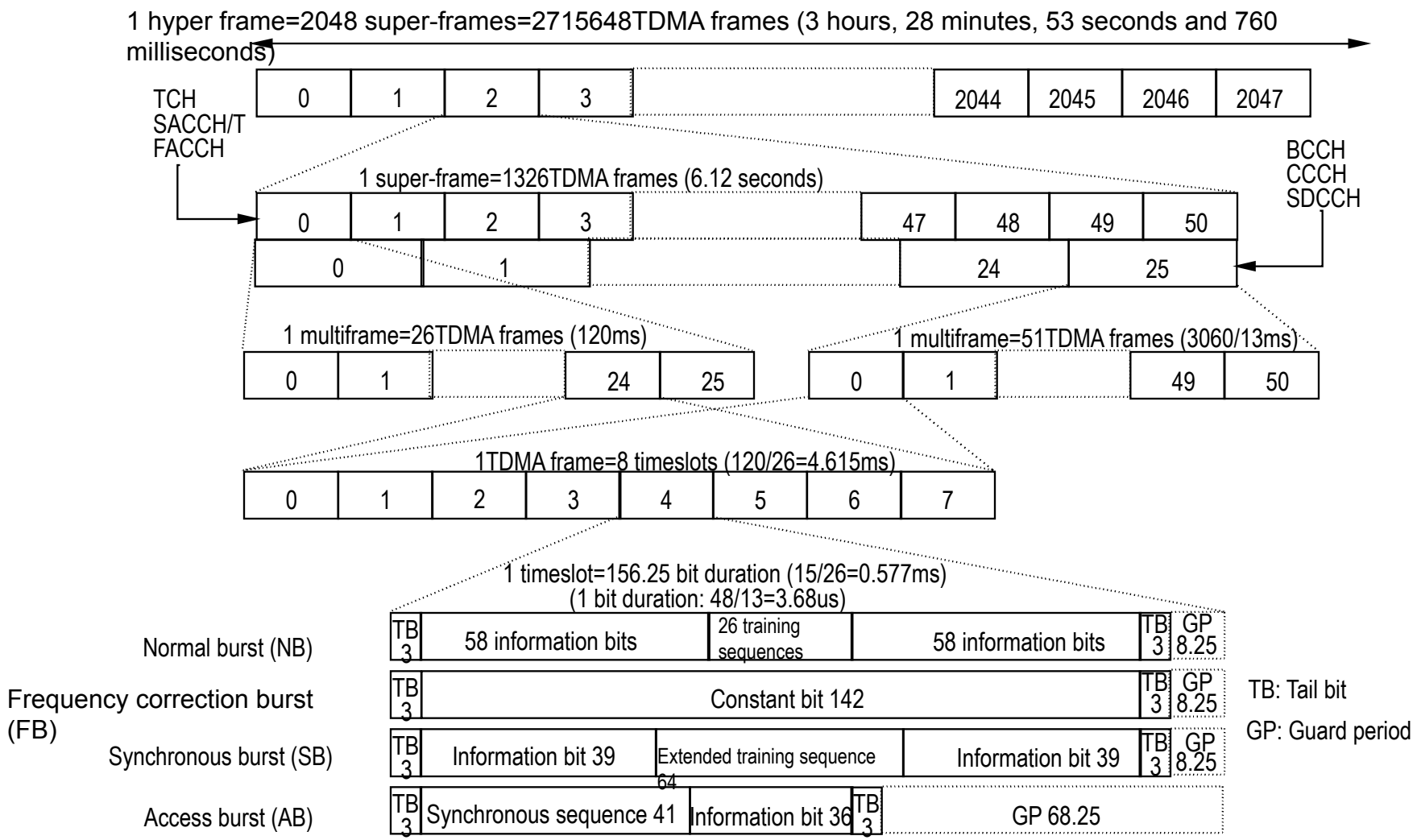
1 multi-frame (26TDMA Frames) 120ms															
Channel	**T**	**T**	**T**	**T**	**T**	**T**	**T…T**	**A**	**T,,,T**	**T**	**T**	**T**	**T**	**T**	**T**	**I**
Frame Number	**0**	**1**	**2**	**3**	**4**	**5**	**6…11**	**12**	**13…18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**

Case of two half rate TCHs

1 multi-frame (26TDMA Frames) 120ms															
Channel	**T**	**t**	**T**	**t**	**T**	**t**	**T…t**	**A**	**T,,,t**	**T**	**t**	**T**	**t**	**T**	**t**	**a**
Frame Number	**0**	**1**	**2**	**3**	**4**	**5**	**6…11**	**12**	**13…18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**

T:TCH;A:SACCH; I:IDLE

Frame



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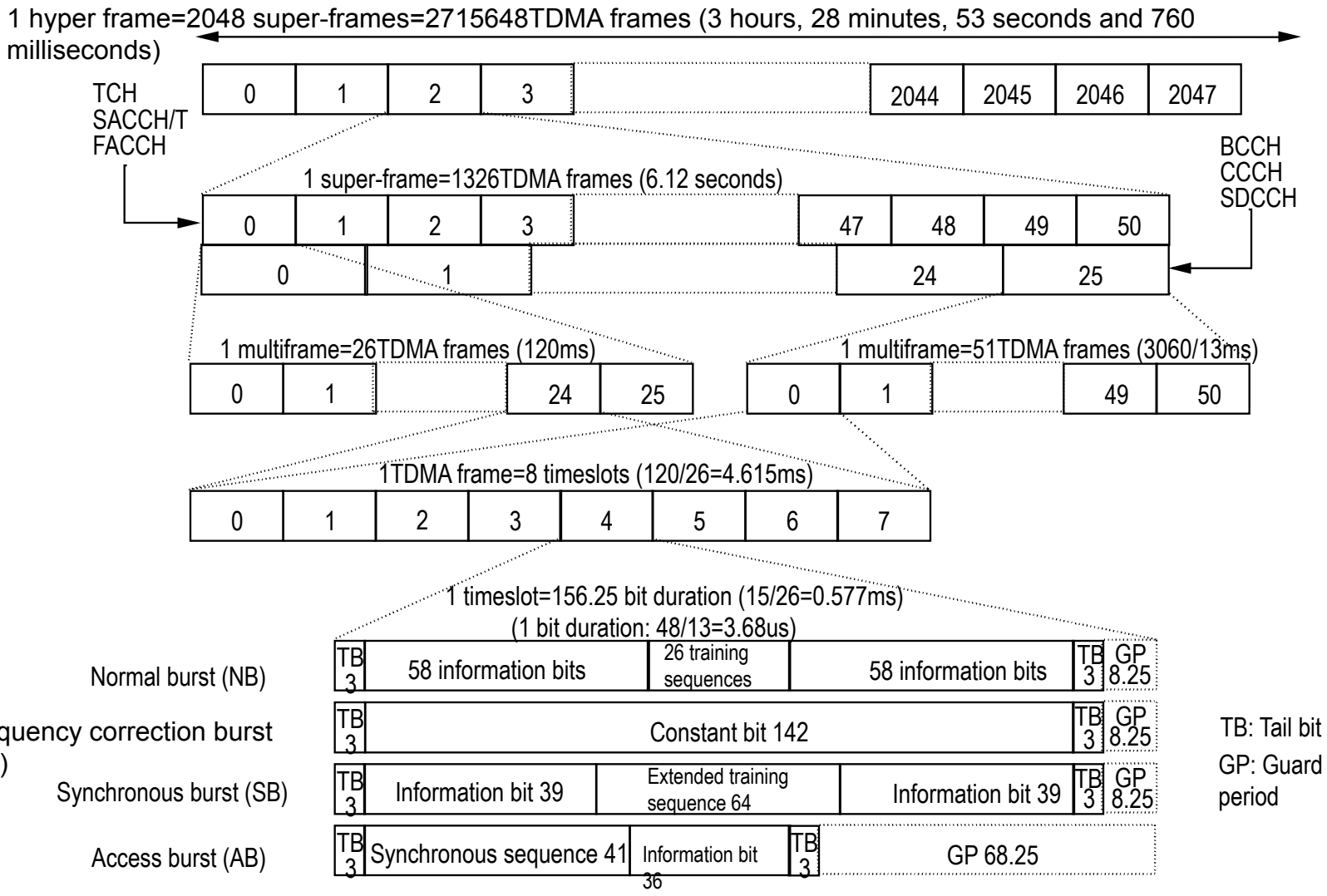
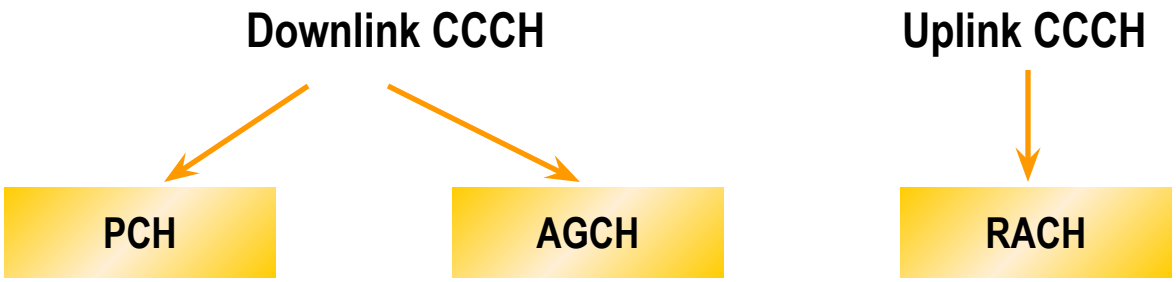
Frame



Configuration of Common Control Channel



How to determine the total CCCH resources of the cell? How to allocate AGCH and PCH reasonably?

Summary

- In this course, we have learned:
  - Processing of Voice Signal
  - Radio Channel in Um Interface
  - Key Technical in Um Interface

Thank you

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