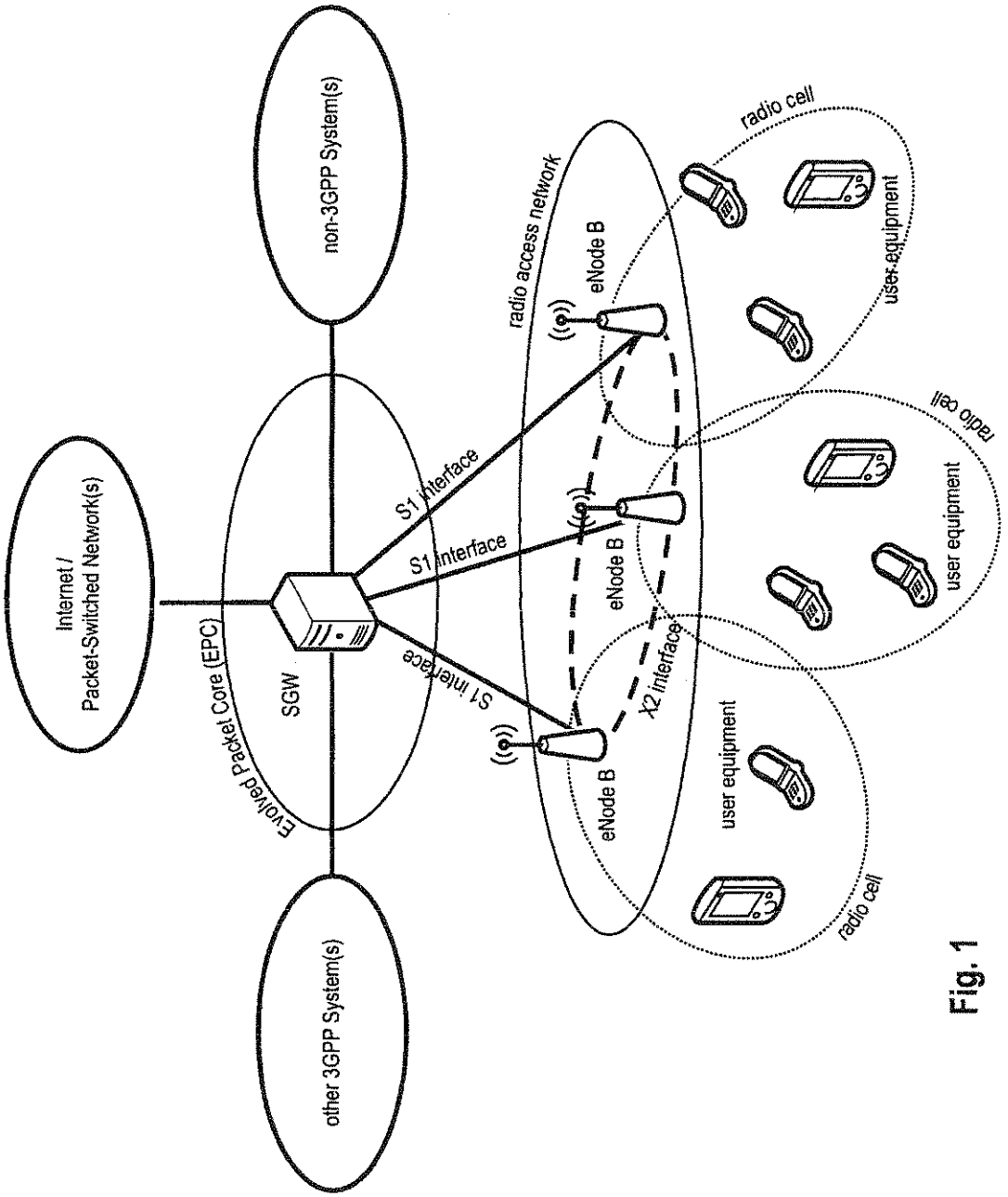

non-3GPP System(s)
Internet / Packet-Switched Network(s)
Evolved Packet Core (EPC)
SGW
other 3GPP System(s)
S1 interface
S1 interface
S1 interface
radio access network
eNode B
eNode B
eNode B
X2 interface
radio cell
user equipment
radio cell
user equipment
radio cell
user equipment

Fig. 1

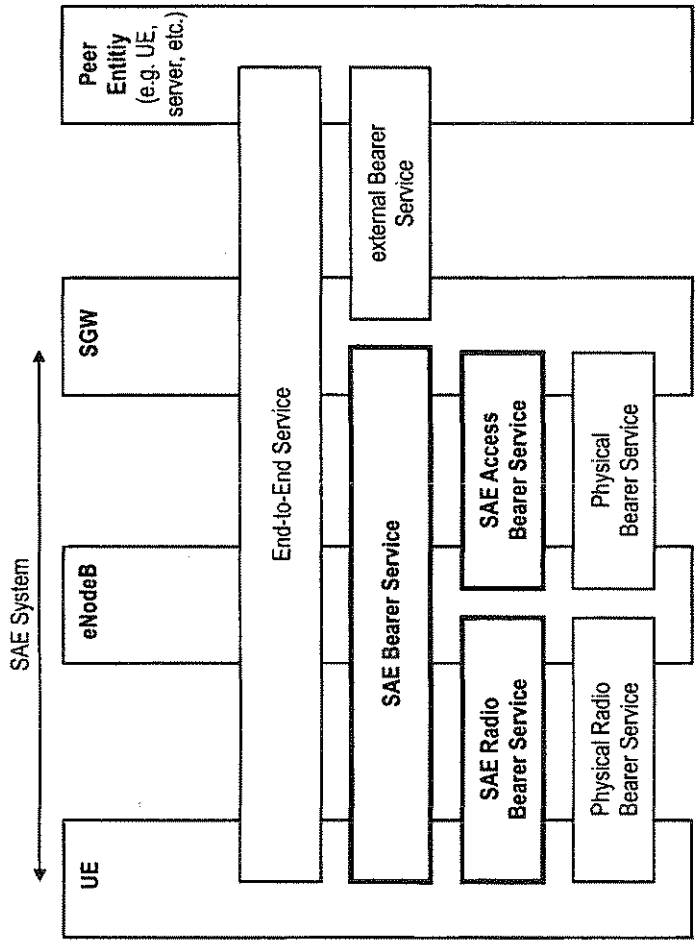

SAE System
UE
eNodeB
SGW
Peer Entitiy (e.g. UE, server, etc.)
End-to-End Service
external Bearer Service
SAE Bearer Service
SAE Access Bearer Service
Physical Bearer Service
SAE Radio Bearer Service
Physical Radio Bearer Service

Fig. 2

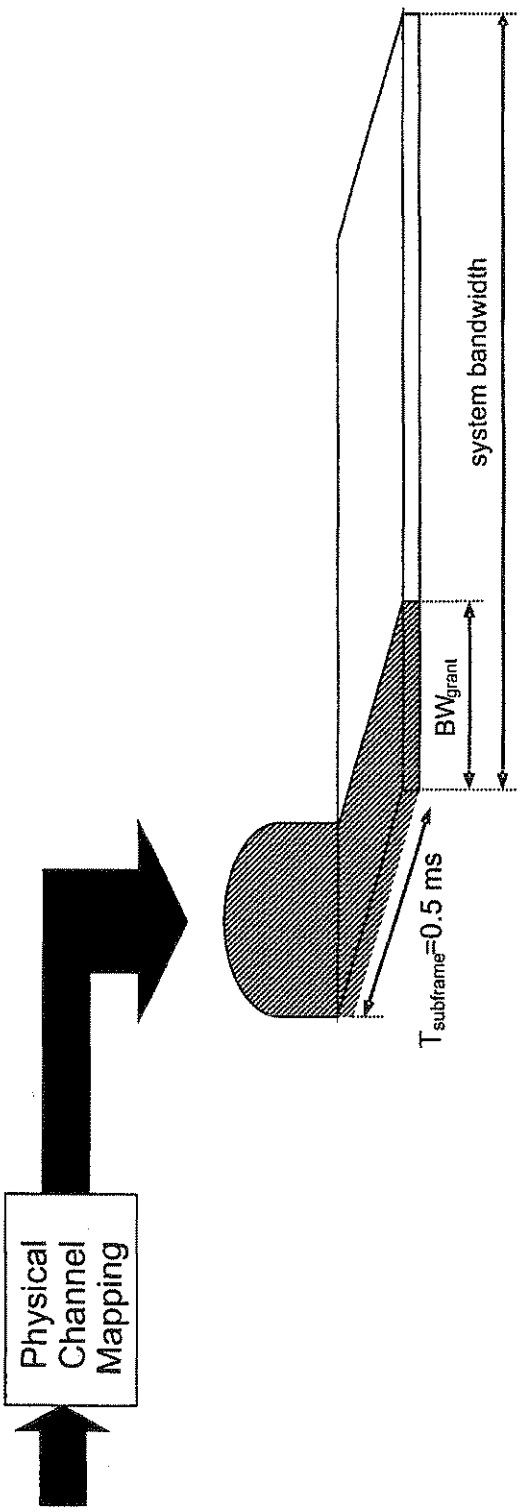

Physical Channel Mapping
system bandwidth
BWgrant
Tsubframe=0.5 ms

Fig. 3

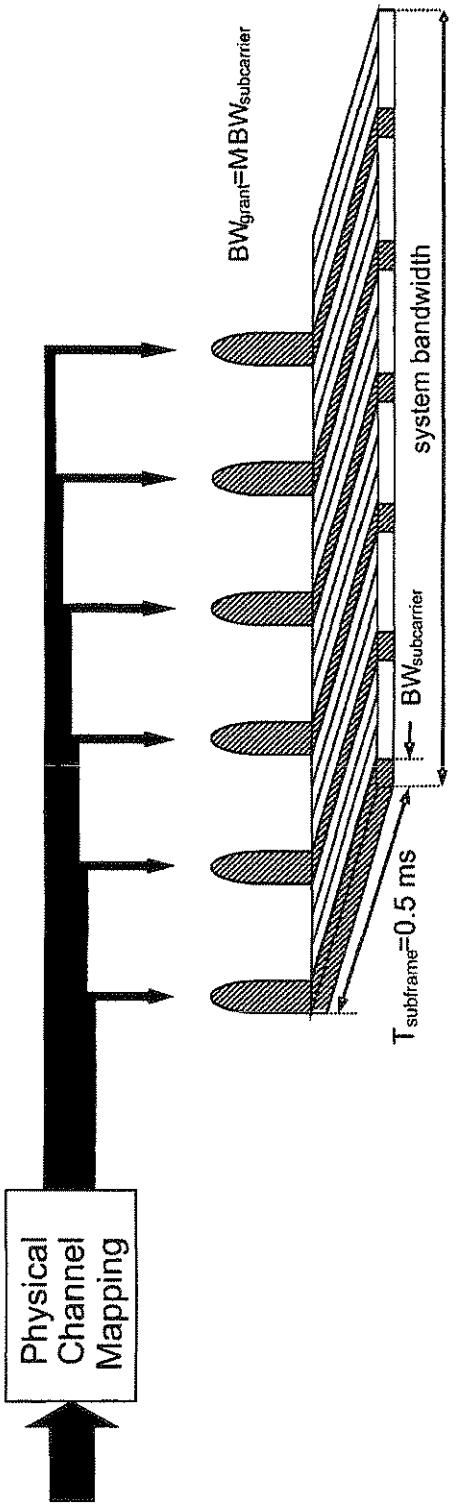

Physical Channel Mapping
BWgrant=MBWsubcarrier
system bandwidth
BWsubcarrier
Tsubframe=0.5 ms

Fig. 4

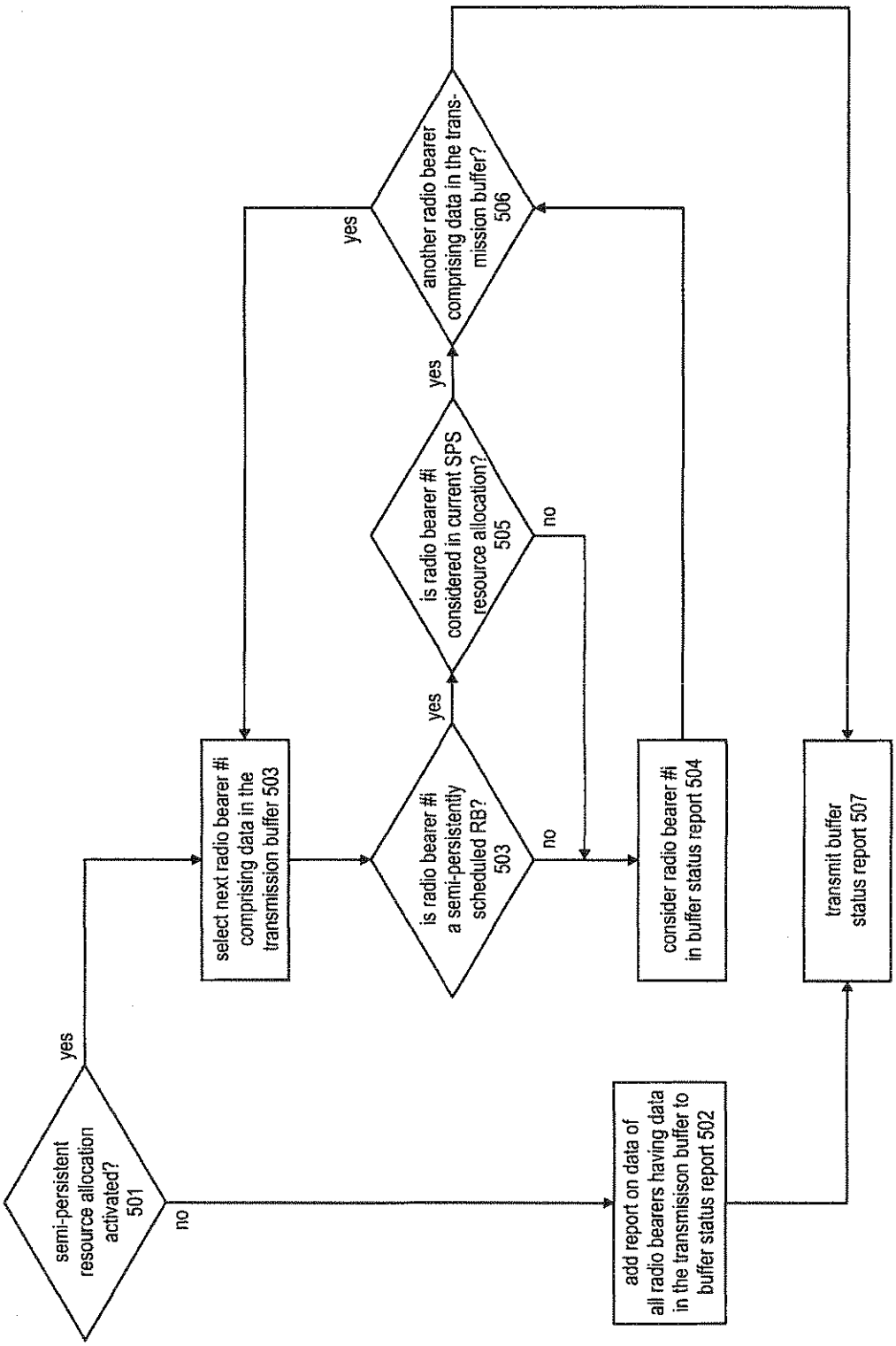
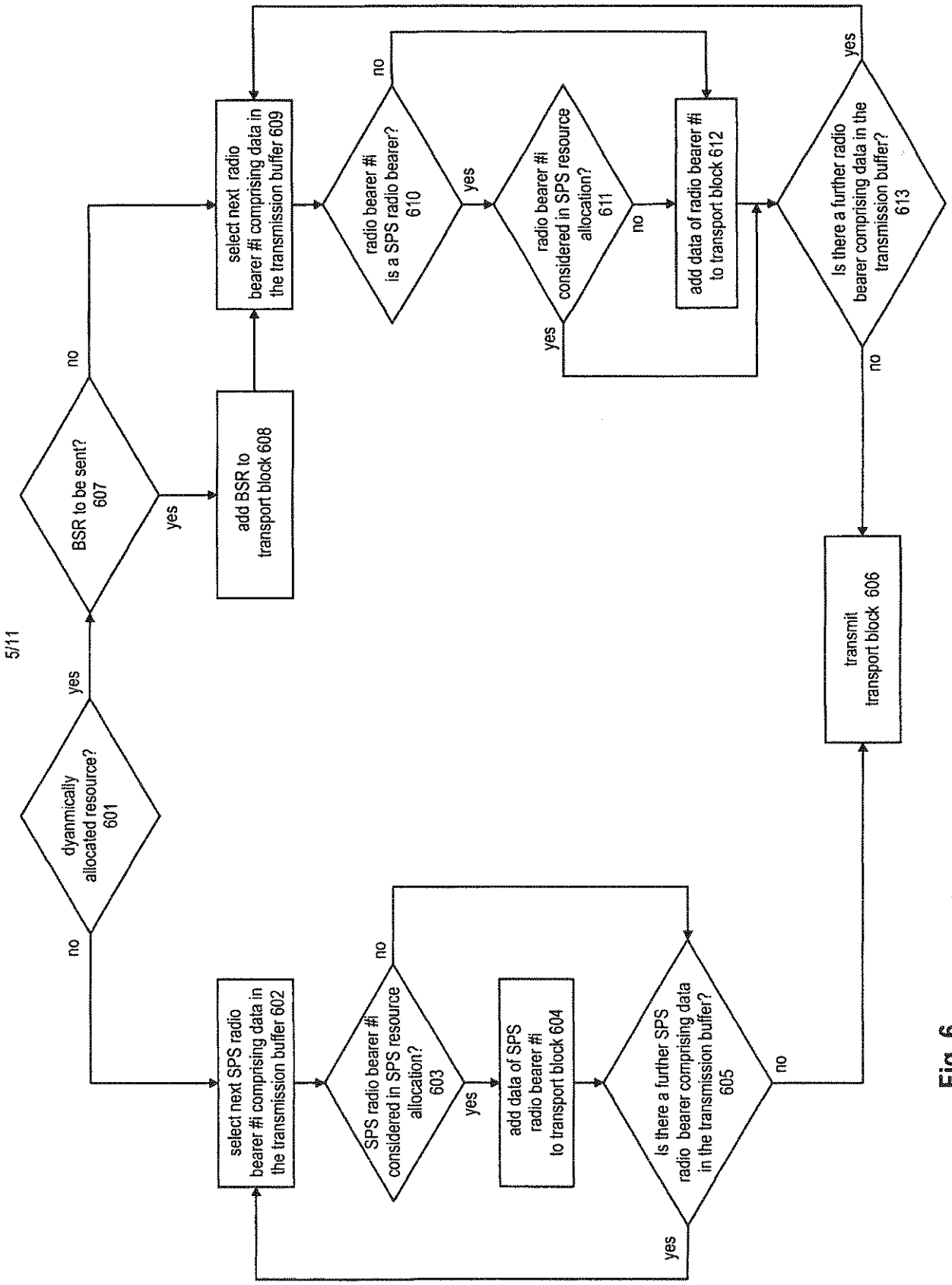

semi-persistent resource allocation activated? 501
yes
no
select next radio bearer #i comprising data in the transmission buffer 503
is radio bearer #i a semi-persistently scheduled RB? 503
yes
no
is radio bearer #i considered in current SPS resource allocation? 505
yes
no
another radio bearer comprising data in the transmission buffer? 506
yes
consider radio bearer #i in buffer status report 504
add report on data of all radio bearers having data in the transmisison buffer to buffer status report 502
transmit buffer status report 507

Fig. 5


dyanmically allocated resource? 601
yes
no
BSR to be sent? 607
yes
no
add BSR to transport block 608
select next radio bearer #i comprising data in the transmission buffer 609
radio bearer #i is a SPS radio bearer? 610
no
yes
radio bearer #i considered in SPS resource allocation? 611
yes
no
add data of radio bearer #i to transport block 612
Is there a further radio bearer comprising data in the transmission buffer? 613
yes
no
select next SPS radio bearer #i comprising data in the transmission buffer 602
SPS radio bearer #i considered in SPS resource allocation? 603
no
yes
add data of SPS radio bearer #i to transport block 604
Is there a further SPS radio bearer comprising data in the transmission buffer? 605
yes
no
transmit transport block 606

5/11

Fig. 6

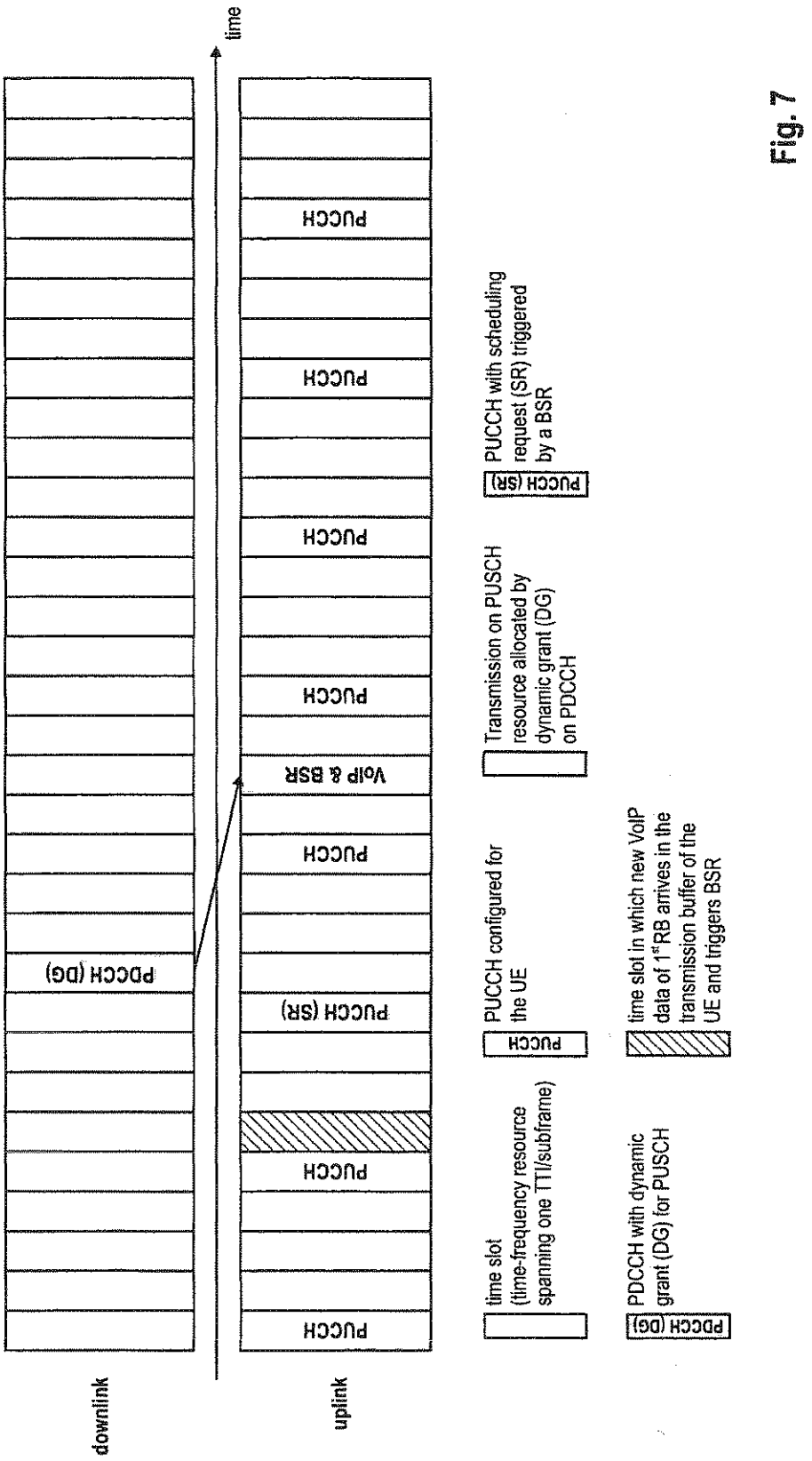

time
downlink
uplink
PDCCH (DG)
PUCCH (SR)
VoIP & BSR
PUCCH
PUCCH
PUCCH
PUCCH
PUCCH
PUCCH
PUCCH
time slot (time-frequency resource spanning one TTI/subframe)
PUCCH configured for the UE
Transmission on PUSCH resource allocated by dynamic grant (DG) on PDCCH
PUCCH (SR)
PUCCH with scheduling request (SR) triggered by a BSR
PDCCH with dynamic grant (DG) for PUSCH
time slot in which new VoIP data of 1st RB arrives in the transmission buffer of the UE and triggers BSR

Fig. 7

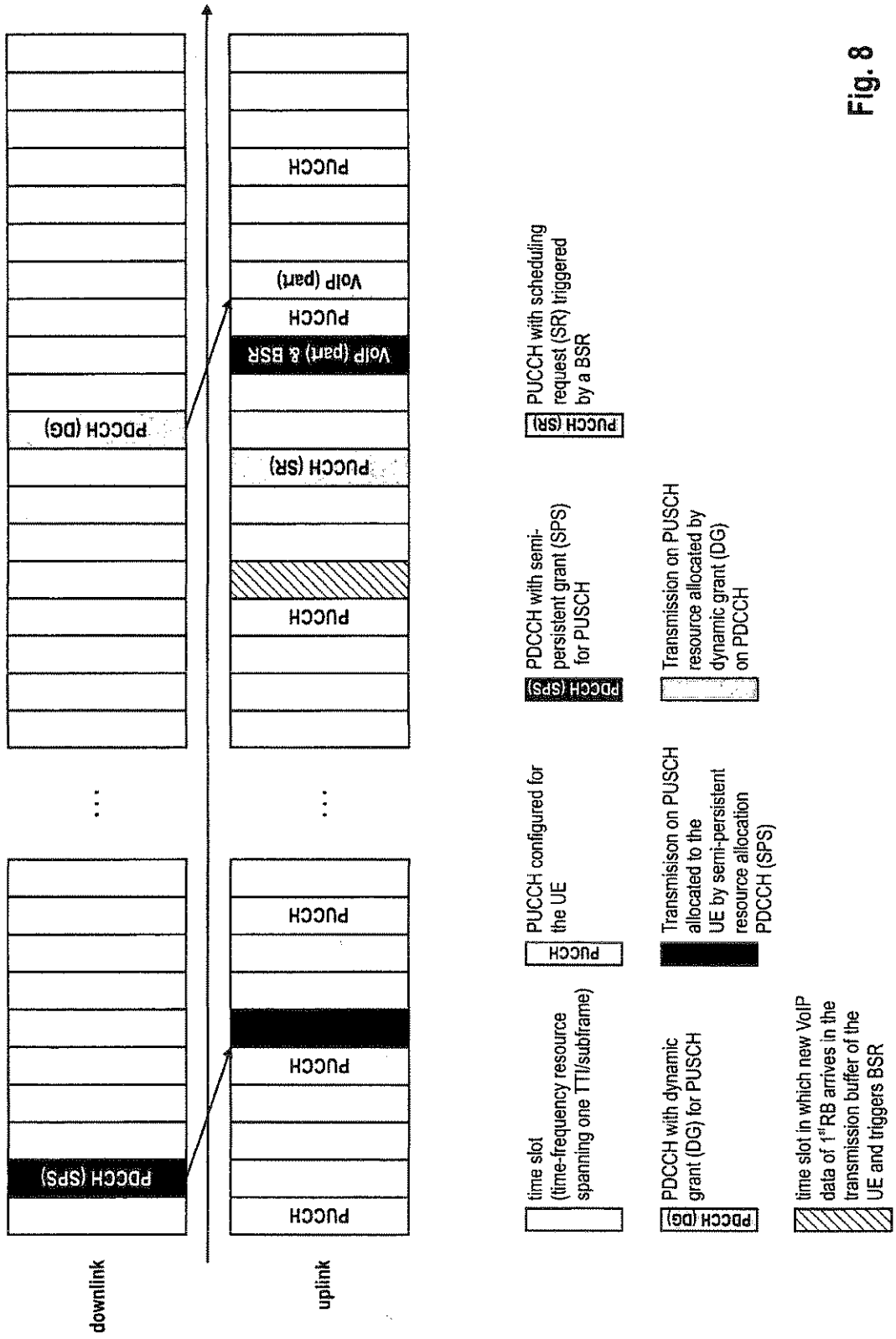

downlink
uplink
PDCCH (SPS)
PUCCH
PDCCH (DG)
VoIP (part) & BSR
VoIP (part)
PUCCH (SR)
time slot (time-frequency resource spanning one TTI/subframe)
PUCCH configured for the UE
PDCCH with dynamic grant (DG) for PUSCH
Transmisison on PUSCH allocated to the UE by semi-persistent resource allocation PDCCH (SPS)
time slot in which new VoIP data of 1st RB arrives in the transmission buffer of the UE and triggers BSR
PDCCH with semi-persistent grant (SPS) for PUSCH
Transmission on PUSCH resource allocated by dynamic grant (DG) on PDCCH
PUCCH with scheduling request (SR) triggered by a BSR

Fig. 8

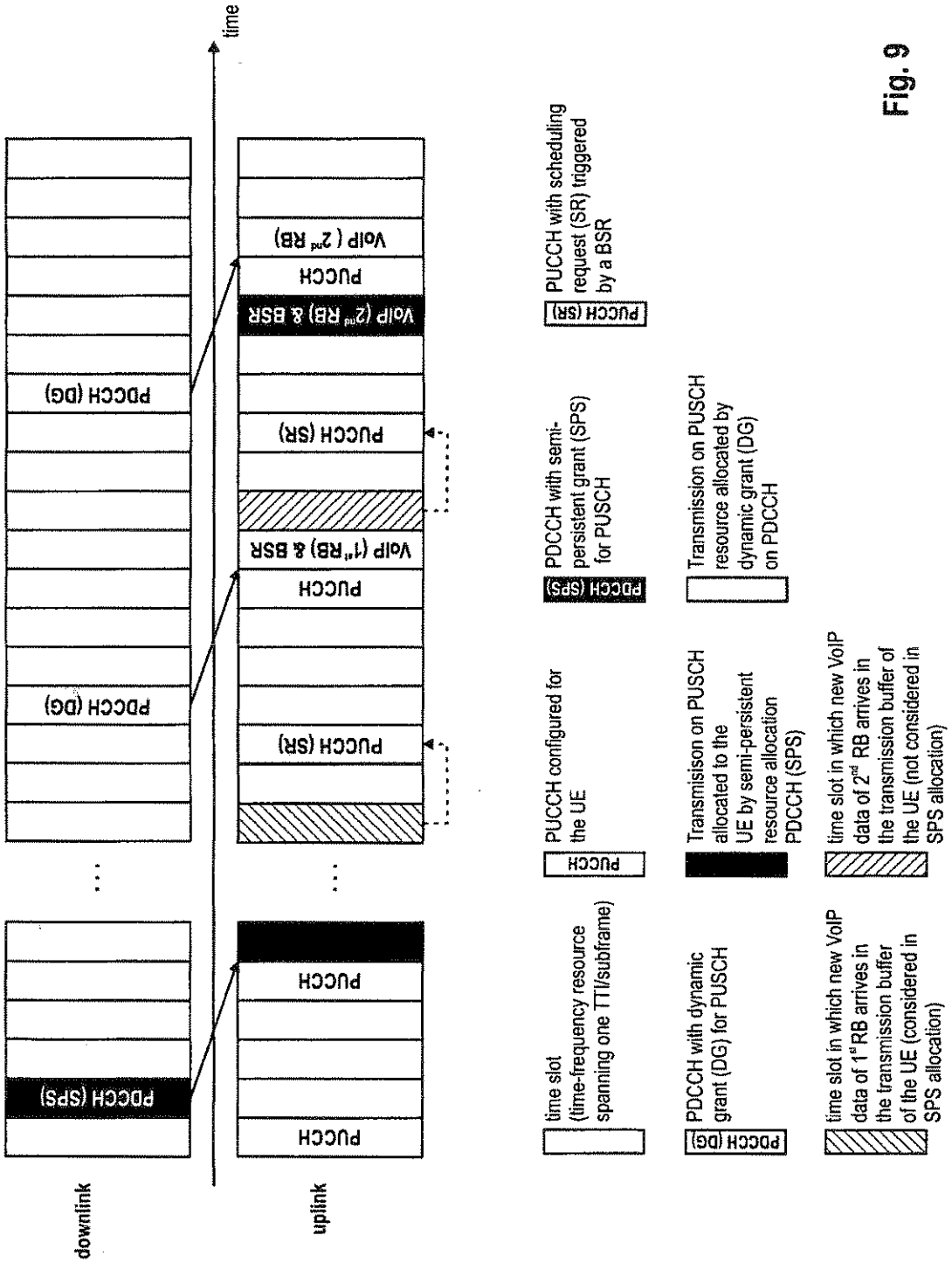

time
downlink
uplink
PDCCH (SPS)
PDCCH (DG)
PDCCH (DG)
PUCCH
PUCCH
PUCCH (SR)
VoIP (1st RB) & BSR
PUCCH
PUCCH (SR)
VoIP (2nd RB) & BSR
PUCCH
VoIP (2nd RB)
PUCCH with scheduling request (SR) triggered by a BSR
PUCCH (SR)
PDCCH with semi-persistent grant (SPS) for PUSCH
PDCCH (SPS)
Transmission on PUSCH resource allocated by dynamic grant (DG) on PDCCH
PUCCH configured for the UE
PUCCH
Transmisison on PUSCH allocated to the UE by semi-persistent resource allocation PDCCH (SPS)
time slot in which new VoIP data of 2nd RB arrives in the transmission buffer of the UE (not considered in SPS allocation)
time slot (time-frequency resource spanning one TTI/subframe)
PDCCH with dynamic grant (DG) for PUSCH
PDCCH (DG)
time slot in which new VoIP data of 1st RB arrives in the transmission buffer of the UE (considered in SPS allocation)

Fig. 9

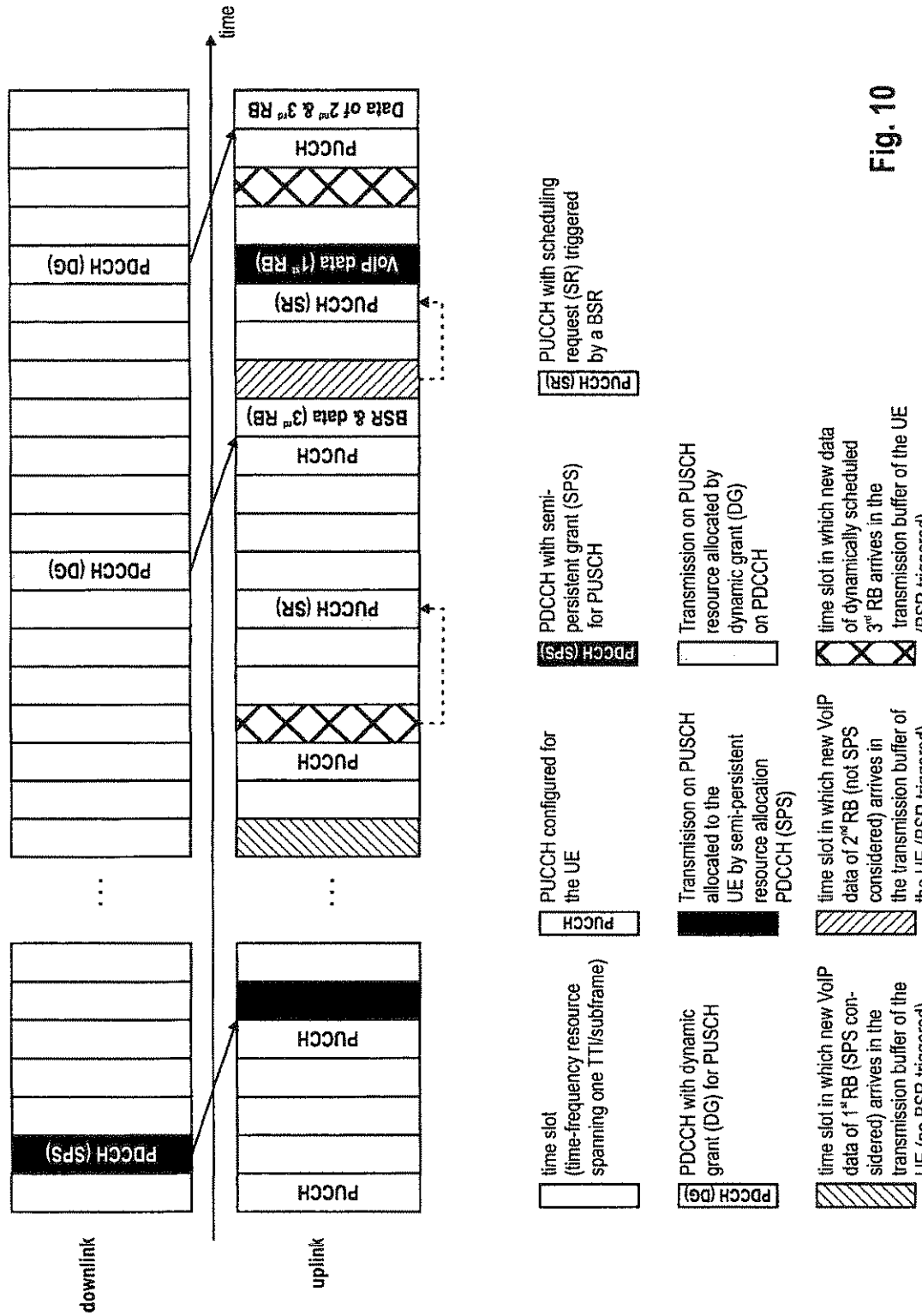

time
downlink
uplink
PDCCH (SPS)
PDCCH (DG)
PDCCH (SR)
PDCCH (DG)
PUCCH
PUCCH
PUCCH
PUCCH
PUCCH
PUCCH
BSR & data (3rd RB)
PUCCH (SR)
VoIP data (1st RB)
PUCCH
Data of 2nd & 3rd RB
time slot (time-frequency resource spanning one TTI/subframe)
PUCCH configured for the UE
PDCCH with semi-persistent grant (SPS) for PUSCH
PUCCH with scheduling request (SR) triggered by a BSR
PDCCH with dynamic grant (DG) for PUSCH
Transmisison on PUSCH allocated to the UE by semi-persistent resource allocation PDCCH (SPS)
Transmission on PUSCH resource allocated by dynamic grant (DG) on PDCCH
time slot in which new VoIP data of 1st RB (SPS considered) arrives in the transmission buffer of the UE (no BSR triggered)
time slot in which new VoIP data of 2nd RB (not SPS considered) arrives in the the transmission buffer of the UE (BSR triggered)
time slot in which new data of dynamically scheduled 3rd RB arrives in the transmission buffer of the UE (BSR triggered)

Fig. 10

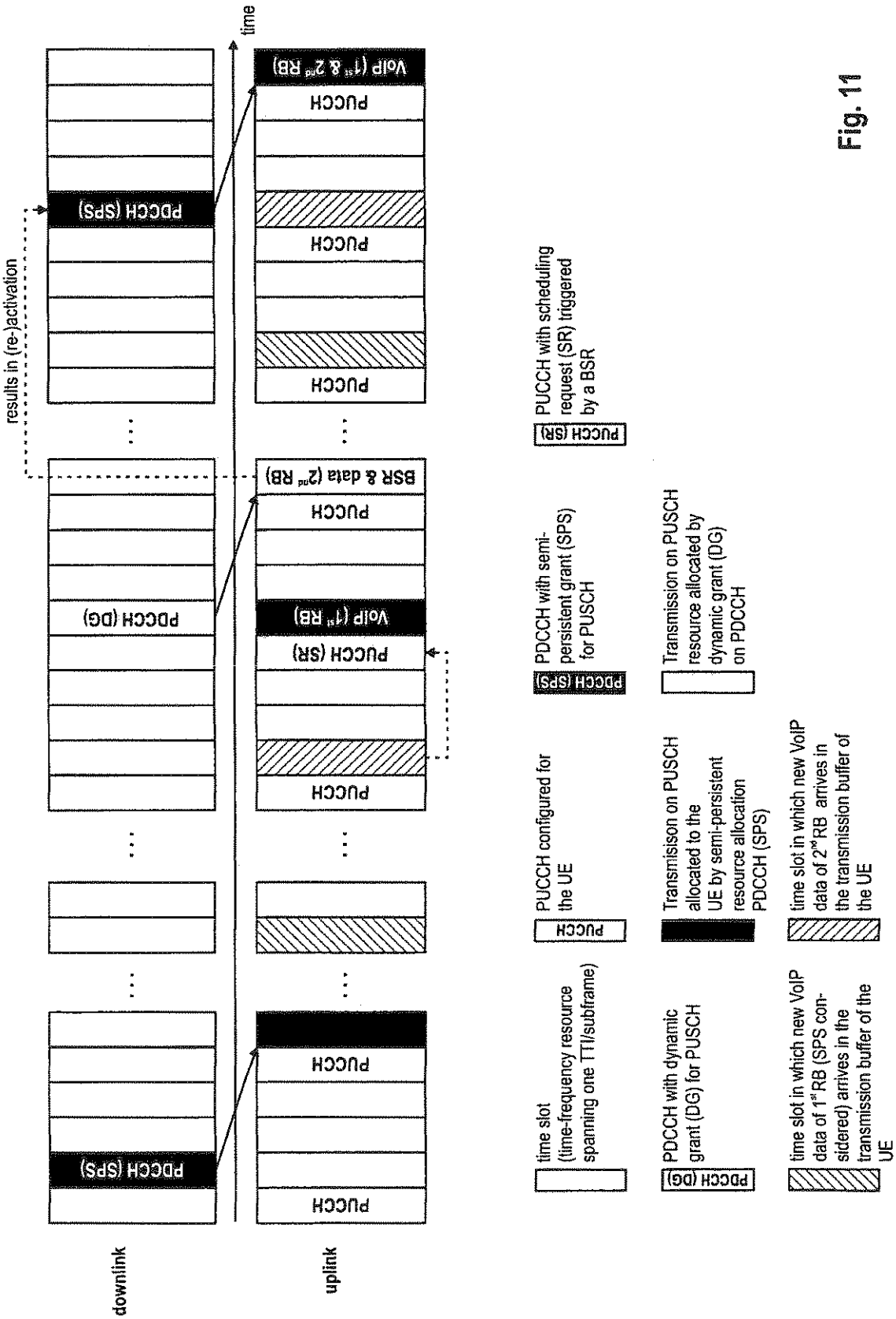

downlink
uplink
time
PDCCH (SPS)
PDCCH (DG)
BSR & data (2nd RB)
VoIP (1st RB)
PUCCH (SR)
VoIP (1st & 2nd RB)
PUCCH
results in (re-)activation
PUCCH configured for the UE
PDCCH with semi-persistent grant (SPS) for PUSCH
PUCCH with scheduling request (SR) triggered by a BSR
time slot (time-frequency resource spanning one TTI/subframe)
Transmisison on PUSCH allocated to the UE by semi-persistent resource allocation PDCCH (SPS)
Transmission on PUSCH resource allocated by dynamic grant (DG) on PDCCH
PDCCH with dynamic grant (DG) for PUSCH
time slot in which new VoIP data of 1st RB (SPS con-sidered) arrives in the transmission buffer of the UE
time slot in which new VoIP data of 2nd RB arrives in the transmission buffer of the UE

Fig. 11

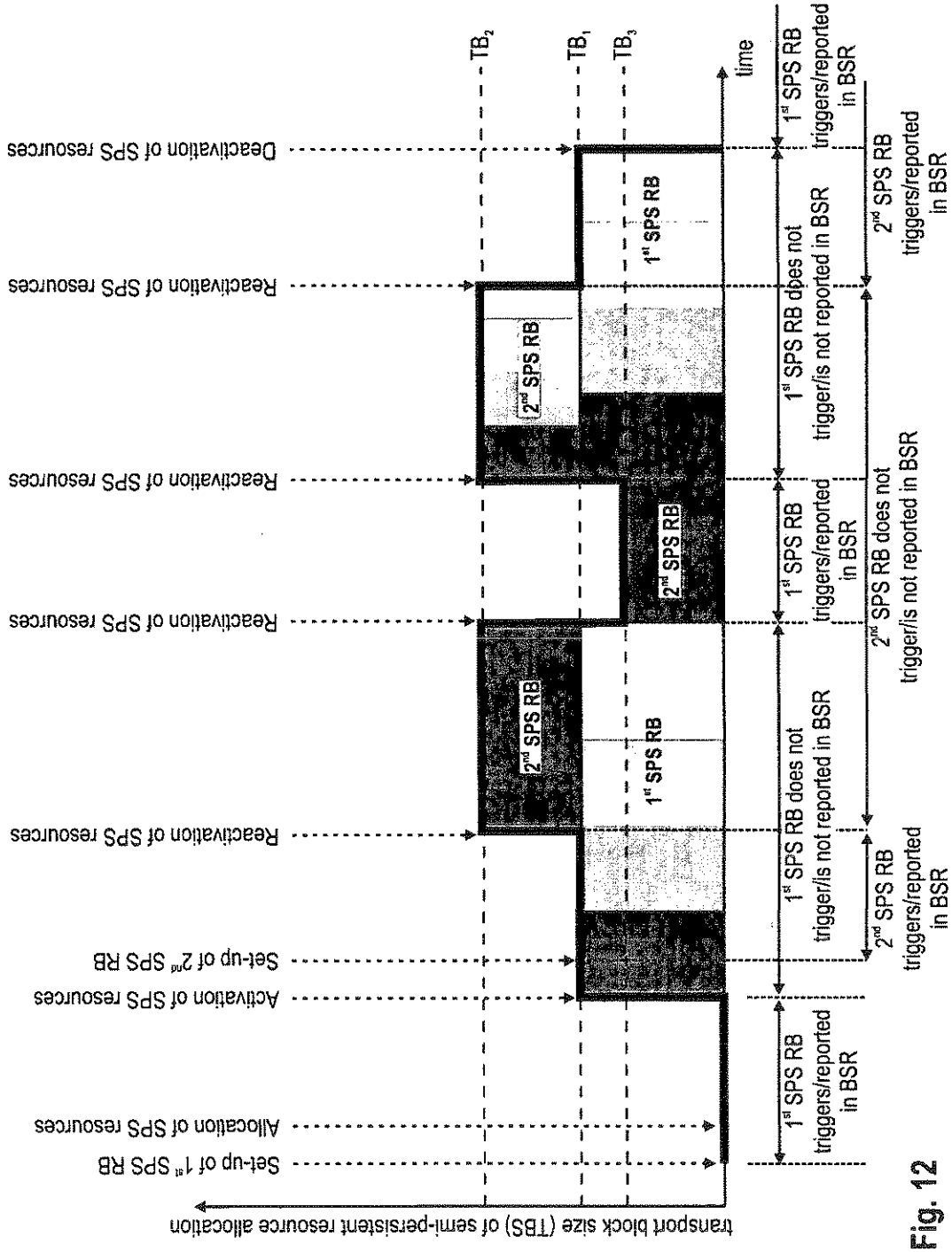

transport block size (TBS) of semi-persistent resource allocation
time
TB2
TB1
TB3
Set-up of 1st SPS RB
Allocation of SPS resources
Activation of SPS resources
Set-up of 2nd SPS RB
Reactivation of SPS resources
Reactivation of SPS resources
Reactivation of SPS resources
Deactivation of SPS resources
1st SPS RB
2nd SPS RB
1st SPS RB triggers/reported in BSR
1st SPS RB does not trigger/is not reported in BSR
2nd SPS RB triggers/reported in BSR
2nd SPS RB does not trigger/is not reported in BSR

Fig. 12