Appendix

1、Top-level

Table I: The meaning of places

Places	Meaning
TrainEnterRMURange	The train enters the range of RMU.
Communication1	The request information for the T2G communication sent by the train.
Communication2	The request information for the T2G communication received by RMU.
Wait	The processing result of the communication request.
RUM_res	The response result of the communication request.
State_com	The status indicating the T2G communication connection.
ConnectSuccess	The successful communication connection.
Procedure	The registration/deregistration information sent by the train.
ProcedureResult	The registration/ deregistration results.
RouteInfo	Route Information.
Command1	The resource allocation information sent by the train.
Resource_sw	Switch position and status.
ResourceResult	The feedback result of resource allocation.
Command2	The switch control commands sent by RMU.
TrainPro	Ready state registration for the train.
TrainLeaveRMURange	The train leaves the range of RMU.

Table II: The meaning of substitution transitions

Substitution transitions	Meaning
IC	IC controls switch resources, updates and feeds back switch status.
RMU Procedure	RMU carries out train registration/deregistration.
RMU command	RMU responds to the train's resource requisition commands.
RMU communication	RMU establishes/disconnects communication with the train.
train Procedure	Train registers/deregisters and establishes/disconnects communication with RMU.
train approach	Train running and route resource requisition process.
train_ground communication	Train-ground communication network establishes communication between the train and RMU.

2、train_ground communication

Table I: The meaning of places

Places	Meaning
Communication1	The request information for the T2G communication sent by the train.
Communication2	The request information for the T2G communication received by RMU.
RUM_res	The response result of the communication request.
Result_reps	The result of establishing the communication connection.
flag	The flag of connection timeout.
Wait	The processing result of the communication request.
Time_up	The timeout of the T2G communication connection.
Connected	The result of the T2G communication connection.
State_com	The status indicating the T2G communication connection.

Table II: The meaning of transitions

Transitions	Meaning
transmit_com2	Transmitting the T2G communication request information.

establish	Establishing the T2G communication connection.
success	Successful establishment of communication connection.
no_response	Communication connection not responding.
fail	Failed to establish communication connection.
cycle	Periodically waiting for processing results.
disconnect	Disconnecting the T2G communication connection.
transmit_com1	Transmitting the T2G communication connection status.

3、RMU communication

Table I: The meaning of places

Places	Meaning
Communication2	The request information for the T2G communication received by RMU.
RUM_res	The response result of the communication request.
Wait	The processing result of the communication request.

Table II: The meaning of transitions

Transitions	Meaning
response	RMU responds to the communication request.
recieve	RMU processes the communication request.

4、train Procedure

Table I: The meaning of places

Places	Meaning
TrainEnterRMURange	The train enters the range of RMU.
TrainCom	The ready state of the train communication unit.
State_com	The status indicating the T2G communication connection.
ConnectState	The result of establishing the communication connection.
ConnectSuccess	The successful communication connection.
Communication1	The request information for the T2G communication sent by the train.
TrainID	Train ID.
TrainPro	Ready state registration for the train.
Procedure	The registration/deregistration information sent by the train.
ProcedureResult	The registration/ deregistration results.
OnboardMap	Onboard digital map.
RouteInfo	Route Information.
TrainLeaveRMURange	The train leaves the range of RMU.
TrainDisconnectWithRMU	The train disconnects communication with RMU.

Table II: The meaning of transitions

Transitions	Meaning
establish	The train sends the T2G communication request.
result_estab	The train establishes the communication connection.
re_establish	The train resend the T2G communication request.
successful	Successful establishment of communication connection.
register	The train sends a registration request.
cancel	The train sends a deregistration request.
RenewMap	Updating the digital map.
discom	The train has completed the deregistration.
result_discon	Disconnecting the T2G communication connection.

disconnect	The train sends a request to disconnect T2G communication.
nextRMUrange	The train enters the range of the next RMU.

5、RMU Procedure

Table I: The meaning of places

Places	Meaning
Procedure	The registration/deregistration information sent by the train.
TrainInfo	The registration information of the train.
Map	Digital map.
ProcedureResult	The registration/ deregistration results.
BufferPro	The processing status of registration/ deregistration.
Resource_sw	Switch position and status.

Table II: The meaning of transitions

Transitions	Meaning
register	The train registers.
get_map	Accessing the digital map.
cancel	The train deregisters.
transmit_pro	Transmitting the registration/ deregistration information.

6、train approach

Table I: The meaning of places

Places	Meaning
ConnectSuccess	The successful communication connection.
RouteInfo	Route Information.
Approach	Train operation plan.
RouteList	Route resource list.
Flag2	Route resource number.
ResourceSw	Switch information.
Command1	The resource allocation information sent by the train.
NeedPosition	Required switch positions for train route.
ConvertLock	The operation commands for the switch positions.
StateLock	The locked status of route resources.
TrainOperation	The train running status.
TrainPosition	Train position.
Position	The train clears the switch.
Flag	The record count for the release command.
TrainPro	Ready state registration for the train.
TrainEnterRMURange	The train enters the range of RMU.
TrainLeaveRMURange	The train leaves the range of RMU.

Table II: The meaning of transitions

Transitions	Meaning
getroute	Interlocking route planning.
getswitch	Acquiring switch information.
order	The train sends a request for resource query.
checkposition	Checking the switch position.
Convert	The train sends a request to convert the switch position.
Lock	The train sends a request to lock the switch.
finishlock	The switch is successfully locked.

trainenter	The train enter the interlocking route.
istrack	Occupying the track section.
isswitch	Occupying the switch.
trainlocate	Train positioning.
transmit	The train transmits switch occupancy information.
trainleave	The train sends a request to release the switch.
haveleave	The train resends a request to release the switch.
clear	The switch is successfully released.
trainfinishroute	The train arrives at arrival-departure track.

7、RMU command

Table I: The meaning of places

Places	Meaning
Command1	The resource allocation information sent by the train.
Command2	The switch control commands sent by RMU.
Resource_sw	Switch position and status.
Buffer1	The processing status of resource allocation.
ResourceResult	The feedback result of resource allocation.
Copy_orders	Resource allocation command.
Flag2	The record count for the release command.
WaitConfirm	Confirmation command waiting for the train.

Table II: The meaning of transitions

Transitions	Meaning
order	Ordering the resource.
convert	Converting the switch.
occupy	Occupying the resource.
releaseIC	Releasing the resource.
transmit_result	Transmitting the results of resource allocation.

8、IC

Table I: The meaning of places

Places	Meaning
Command2	The switch control commands sent by RMU.
IC_Control	IC controller.
Need_pos	The switch positions required for the route.
Buffer2	The processing result of the switch status.
Position_sw	Switch position.
State_sw	Switch status.
Resource_sw	Switch position and status.

Table II: The meaning of transitions

Transitions	Meaning
converting	Converting the switch position.
convert	Converting action.
transmit_sta	Transmitting the switch position and status.
locking	Locking the switch position.
occupying	Occupying the switch position.
releasing	Releasing the switch position.