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EXTENDS *TLC, Broker, Client*

MODULE *Spec*

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*Init*  $\triangleq$

$\wedge pc = [c \in clients \mapsto \text{"start"}]$   
 $\wedge active = \{\}$   
 $\wedge network = [a \in agents \mapsto \langle \rangle]$   
 $\wedge topic\_subscribers = [t \in topics \mapsto [qos \in \{QoS0, QoS1, QoS2\} \mapsto \{\}]]$   
 $\wedge used\_num = \{\}$   
 $\wedge store =$   
 $\quad [$   
 $\quad \quad a \in agents \mapsto \text{CASE } a \in publishers \rightarrow 1 \dots maxPubNum$   
 $\quad \quad \square a = broker \rightarrow [t \in topics \mapsto [qos \in \{QoS0, QoS1, QoS2\} \mapsto \langle \rangle]]$   
 $\quad \quad \square a \in subscribers \rightarrow \langle \rangle$   
 $\quad ]$

*Next*  $\triangleq$

$\vee PublisherAction$   
 $\vee SubscriberAction$   
 $\vee BrokerAction$   
 $\vee ClientsDone$

*Liveness*  $\triangleq$

$\wedge \forall p \in publishers :$   
 $\quad \wedge SF_{vars}(ReqConnect(p))$   
 $\quad \wedge SF_{vars}(ReqPublishWithQoS0(p) \vee ReqPublishWithQoS1(p) \vee ReqPublishWithQoS2(p))$   
 $\quad \wedge WF_{vars}(PublisherDone(p))$   
 $\wedge \forall s \in subscribers :$   
 $\quad \wedge SF_{vars}(ReqConnect(s))$   
 $\quad \wedge SF_{vars}(ReqSubscribe(s))$   
 $\quad \wedge SF_{vars}(GetMsgWithQoS0(s) \vee GetMsgWithQoS1AndRes(s) \vee GetMsgWithQoS2AndRes(s))$   
 $\quad \wedge SF_{vars}(ReqUnsubscribe(s))$   
 $\quad \wedge WF_{vars}(SubscriberDone(s))$   
 $\wedge SF_{vars}(HandleConnectReq)$   
 $\wedge SF_{vars}(HandleSubscribeReq)$   
 $\wedge SF_{vars}(HandleUnsubscribeReq)$   
 $\wedge SF_{vars}(HandlePublishWithQoS0Req)$   
 $\wedge SF_{vars}(HandlePublishWithQoS1Req)$   
 $\wedge SF_{vars}(HandlePublishWithQoS2Req)$   
 $\wedge SF_{vars}(HandlePubrelReq)$   
 $\wedge SF_{vars}(HandlePushQoS1Res)$   
 $\wedge SF_{vars}(HandlePushQoS2Res)$   
 $\wedge SF_{vars}(HandlePubCompRes)$   
 $\wedge SF_{vars}(PushMsgsWithQoS0)$   
 $\wedge SF_{vars}(PushMsgsWithQoS1)$   
 $\wedge SF_{vars}(PushMsgsWithQoS2)$

$$Spec \triangleq Init \wedge \Box[Next]_{vars} \wedge Liveness$$


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