

## send-minimal-lemma<sup>0,22</sup>

$\forall es:ES, T:\text{Type}, l_1, l_2:\text{IdLnk}, tg, a:\text{Id}, ds_1, ds_2:x:\text{Id fp} \rightarrow \text{Type}, P:(\text{State}(ds_1) \rightarrow \mathbb{N} \rightarrow \text{Prop}),$   
 $Q:(\text{State}(ds_2) \rightarrow \mathbb{N} \rightarrow \text{Prop}), f:(\text{State}(ds_1) \rightarrow \mathbb{N} \rightarrow T).$   
 $\text{weak-precond-send-p}(es;T;\mathbb{N};l_1;tg;a;ds_1;\lambda s,m. \neg P(s,m) \ \& \ (\forall n:\mathbb{N}. n < m \Rightarrow P(s,n));f)$   
 $\Rightarrow \text{weak-precond-send-p}(es;\mathbb{N};\mathbb{N};l_2;tg;a;ds_2;\lambda s,m. \neg Q(s,m) \ \& \ (\forall n:\mathbb{N}. n < m \Rightarrow Q(s,n));\lambda s,m. m)$   
 $\Rightarrow \text{destination}(l_1) = \text{source}(l_2) \in \text{Id}$   
 $\Rightarrow \text{destination}(l_2) = \text{source}(l_1) \in \text{Id}$   
 $\Rightarrow (\forall s:\text{State}(ds_1), k:\mathbb{N}. \text{Dec}(P(s,k)))$   
 $\Rightarrow (\forall s:\text{State}(ds_2), k:\mathbb{N}. \text{Dec}(Q(s,k)))$   
 $\Rightarrow (\forall k:\mathbb{N}. @\text{source}(l_1) \text{ stable } s.P(s,k) )$   
 $\Rightarrow (\forall k:\mathbb{N}. @\text{source}(l_2) \text{ stable } s.Q(s,k) )$   
 $\Rightarrow \forall e@source(l_2). \text{kind}(e) = \text{locl}(a) \in \text{Knd} \Rightarrow \neg Q(\text{state after } e, \text{val}(e))$   
 $\Rightarrow (\forall k:\mathbb{N}. \forall e@source(l_1). P(\text{state after } e, k) \Rightarrow \exists e'@destination(l_1). Q(\text{state after } e', k))$   
 $\Rightarrow (\forall e:E. \text{kind}(e) = \text{rcv}(l_2, tg) \in \text{Knd} \Rightarrow (\forall k:\mathbb{N}. k < \text{val}(e) \Rightarrow P(\text{state after } e, k)))$   
 $\Rightarrow (\forall k:\mathbb{N}, e:E.$   
 $\quad \text{kind}(e) = \text{rcv}(l_1, tg) \in \text{Knd}$   
 $\quad \Rightarrow \text{val}(e) = f((\text{state when sender}(e)), k)$   
 $\quad \Rightarrow Q(\text{state after } e, k))$   
 $\Rightarrow \exists e@destination(l_1). \text{True}$   
 $\Rightarrow (\forall k:\mathbb{N}. \exists e@destination(l_1). Q(\text{state after } e, k))$