```
w-match-unique  THM

⊢  ∀the_w:World, e:E, t,t':ℕ.
|  FairFifo
|  ⇒
|  isrcv(kind(e))
|  ⇒
|  match(lnk(kind(e));t;time(e))
|  ⇒
|  match(lnk(kind(e));t';time(e)) ⇒ t = t'
| by Assert
|    ...
|
|\
| .....assertion .....
| ⊢  ∀the_w:World, e:E, t,t':ℕ.
| |  FairFifo
| |  ⇒
| |  isrcv(kind(e))
| |  ⇒
| |  t<t'
| |  ⇒
| |  match(lnk(kind(e));t;time(e)) ⇒ ¬match(lnk(kind(e));t';time(e))
| | by Auto THEN Analyze 0
| |    THEN
| |    All
| |    (RWO
| |     Thm* ∀the_w:World, l:IdLnk, t,t':ℕ.
| |          match(l;t;t')
| |          ⟺
| |          ||snds(l;t)||≤||rcvs(l;t')||
| |          & ||rcvs(l;t')||<||snds(l;t)||
| |            +||onlnk(l;m(source(l);t))||
| |     {assert_DASH_w_DASH_match})
| |    THEN
| |    ExRepD
| |
| 1. the_w : World
| 2. e : E
| 3. t : ℕ
| 4. t' : ℕ
| 5. FairFifo
| 6. isrcv(kind(e))
| 7. t<t'
| 8. ||snds(lnk(kind(e));t)||≤||rcvs(lnk(kind(e));time(e))||
| 9. ||rcvs(lnk(kind(e));time(e))||<||snds(lnk(kind(e));t)||
| |  +||onlnk(lnk(kind(e));m(source(lnk(kind(e)));t))||
| 10. ||snds(lnk(kind(e));t')||≤||rcvs(lnk(kind(e));time(e))||
| 11. ||rcvs(lnk(kind(e));time(e))||<||snds(lnk(kind(e));t')||
| |   +||onlnk(lnk(kind(e));m(source(lnk(kind(e)));t'))||
| ⊢  False
| | by Assert
| |    (||snds(lnk(kind(e));t)||
| |     +||onlnk(lnk(kind(e));m(source(lnk(kind(e)));t))||≤||...||)
| |
```

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| .....assertion .....
| 1. the_w : World
| 2. e : E
| 3. t : ℕ
| 4. t' : ℕ
| 5. FairFifo
| 6. isrcv(kind(e))
| 7. t<t'
| 8. ||snds(lnk(kind(e));t)||≤||rcvs(lnk(kind(e));time(e))||
| 9. ||rcvs(lnk(kind(e));time(e))||<||snds(lnk(kind(e));t)||
| |  +||onlnk(lnk(kind(e));m(source(lnk(kind(e)));t))||
| 10. ||snds(lnk(kind(e));t')||≤||rcvs(lnk(kind(e));time(e))||
| 11. ||rcvs(lnk(kind(e));time(e))||<||snds(lnk(kind(e));t')||
| |   +||onlnk(lnk(kind(e));m(source(lnk(kind(e)));t'))||
| ⊢  ||snds(lnk(kind(e));t)||
| |  +||onlnk(lnk(kind(e));m(source(lnk(kind(e)));t))||≤||...||
| | by RepeatFor 4 (Thin -1)
| |
| 1. the_w : World
| 2. e : E
| 3. t : ℕ
| 4. t' : ℕ
| 5. FairFifo
| 6. isrcv(kind(e))
| 7. t<t'
| ⊢  ||snds(lnk(kind(e));t)||
| |  +||onlnk(lnk(kind(e));m(source(lnk(kind(e)));t))||≤||...||
| | by Unfold `w-snds` 0 THEN Unfold `w-ml` 0
| |    THEN
| |    GenConcl
| |    ((λt1.onlnk(lnk(kind(e));m(source(lnk(kind(e)));t1))) = f)
| |    THENA
| |    (Auto THEN Unfold `w-Msg` 0)
| |    THEN
| |    Subst (onlnk(lnk(kind(e));m(source(lnk(kind(e)));t)) = f(t)) 0
| |
| |\
| | .....equality .....
| | 1. the_w : World
| | 2. e : E
| | 3. t : ℕ
| | 4. t' : ℕ
| | 5. FairFifo
| | 6. isrcv(kind(e))
| | 7. t<t'
| | 8. f : ℕ→(Msg List)
| | 9. (λt1.onlnk(lnk(kind(e));m(source(lnk(kind(e)));t1))) = f
| | ⊢  onlnk(lnk(kind(e));m(source(lnk(kind(e)));t)) = f(t)
| |   by RevHypSubst -1 0 THEN Reduce 0 THEN Unfold `w-Msg` 0
| |
| .\
| . 1. the_w : World
| . 2. e : E
| . 3. t : ℕ
| . 4. t' : ℕ
```

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| . 5. FairFifo
| . 6. isrcv(kind(e))
| . 7. t<t'
| . 8. f : ℕ→(Msg List)
| . 9. (λt1.onlnk(lnk(kind(e));m(source(lnk(kind(e)));t1))) = f
| . ⊢  ||concat(map(f;upto(t)))||+||f(t)||≤||concat(map(f;upto(t')))||
| . | by Thin -1
| . |
| . 1. the_w : World
| . 2. e : E
| . 3. t : ℕ
| . 4. t' : ℕ
| . 5. FairFifo
| . 6. isrcv(kind(e))
| . 7. t<t'
| . 8. f : ℕ→(Msg List)
| . ⊢  ||concat(map(f;upto(t)))||+||f(t)||≤||concat(map(f;upto(t')))||
| .   by Inst
| .      Thm* ∀f:(ℕ→(T List)), t,t':ℕ.
| .           t<t'
| .           ⇒
| .           concat(map(f;upto(t)))
| .           @ (f(t)) ≤ concat(map(f;upto(t')))
| .      {concat_map_upto}
| .      [Msg;f;t;t']
| .      THEN
| .      FwdThru
| .      Thm* ∀l1,l2:T List. l1 ≤ l2 ⇒ ||l1||≤||l2||    {iseg_length}
| .      [-1]
| .      THEN
| .      RWO
| .      Thm* ∀as,bs:T List. ||as @ bs|| = ||as||+||bs|| ∈ ℤ
| .      {length_append}
| .      -1
|
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. 1. ∀the_w:World, e:E, t,t':ℕ.
. |  FairFifo
. |  ⇒
. |  isrcv(kind(e))
. |  ⇒
. |  t<t'
. |  ⇒
. |  match(lnk(kind(e));t;time(e)) ⇒ ¬match(lnk(kind(e));t';time(e))
. ⊢  ∀the_w:World, e:E, t,t':ℕ.
. |  FairFifo
. |  ⇒
. |  isrcv(kind(e))
. |  ⇒
. |  match(lnk(kind(e));t;time(e))
. |  ⇒
. |  match(lnk(kind(e));t';time(e)) ⇒ t = t'
. | by Auto THEN Decide (t<t')
. |
. |\
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. | 1. ∀the_w:World, e:E, t,t':ℕ.
. |    FairFifo
. |    ⇒
. |    isrcv(kind(e))
. |    ⇒
. |    t<t'
. |    ⇒
. |    match(lnk(kind(e));t;time(e))
. |    ⇒
. |    ¬match(lnk(kind(e));t';time(e))
. | 2. the_w : World
. | 3. e : E
. | 4. t : ℕ
. | 5. t' : ℕ
. | 6. FairFifo
. | 7. isrcv(kind(e))
. | 8. match(lnk(kind(e));t;time(e))
. | 9. match(lnk(kind(e));t';time(e))
. | 10. t<t'
. | ⊢  t = t'  by InstHyp [the_w;e;t;t'] 1
. |
. .\
. . 1. ∀the_w:World, e:E, t,t':ℕ.
. . |  FairFifo
. . |  ⇒
. . |  isrcv(kind(e))
. . |  ⇒
. . |  t<t'
. . |  ⇒
. . |  match(lnk(kind(e));t;time(e))
. . |  ⇒
. . |  ¬match(lnk(kind(e));t';time(e))
. . 2. the_w : World
. . 3. e : E
. . 4. t : ℕ
. . 5. t' : ℕ
. . 6. FairFifo
. . 7. isrcv(kind(e))
. . 8. match(lnk(kind(e));t;time(e))
. . 9. match(lnk(kind(e));t';time(e))
. . 10. ¬t<t'
. . ⊢  t = t'  by Decide (t'<t)
. . |
. . 1. ∀the_w:World, e:E, t,t':ℕ.
. .    FairFifo
. .    ⇒
. .    isrcv(kind(e))
. .    ⇒
. .    t<t'
. .    ⇒
. .    match(lnk(kind(e));t;time(e))
. .    ⇒
. .    ¬match(lnk(kind(e));t';time(e))
. . 2. the_w : World
. . 3. e : E
```

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. . 4. t : ℕ
. . 5. t’ : ℕ
. . 6. FairFifo
. . 7. isrcv(kind(e))
. . 8. match(lnk(kind(e));t;time(e))
. . 9. match(lnk(kind(e));t’;time(e))
. . 10. ¬t<t’
. . 11. t’<t
. . ⊢  t = t’  by InstHyp [the_w;e;t’;t] 1
END
```