1

a

$$\exists e : \mathrm{call}(s', t', e) \wedge \mathrm{in}(w', e) \wedge \mathrm{PAST}(e)$$

$$\exists e : \mathrm{call}(s', t', e) \wedge \mathrm{in}(w', s') \wedge \mathrm{PAST}(e)$$

In the first case the call happened (originated?) Washington. In the second case, the modifier attaches to the senator, therefore they were in Washington.

b

$$(\lambda E\ .\ \exists e : E(e) \wedge e < e_u)(\lambda z \lambda F \lambda v\ .\ \mathrm{in'}(z)(v) \wedge F(v))(w')((\lambda Q \lambda x \lambda e\ .\ Q(\mathrm{call}(y)(x)(e)))(\lambda S\ .\ \exists m : s'(m) \wedge S(m))(t'))$$

reduction

$$(\lambda E\ .\ \exists e : E(e) \wedge e < e_u)(\lambda z \lambda F \lambda v\ .\ \mathrm{in'}(z)(v) \wedge F(v))(w')(\lambda e\ .\ \exists m : s'(m) \wedge \mathrm{call}(m)(t')(e)))$$

reduction

$$(\lambda E\ .\ \exists e : E(e) \wedge e < e_u)(\lambda v\ .\ \exists m : \mathrm{in'}(w')(v) \wedge s'(m) \wedge \mathrm{call}(m)(t')(v))$$

reduction

$$\exists e : (\exists m : \mathrm{in'}(w')(e) \wedge s'(m) \wedge \mathrm{call}(m)(t')(e)) \wedge e < e_u$$

$$(\lambda E\ .\ \exists e : E(e) \wedge e < e_u)(\lambda Q \lambda x \lambda e\ .\ Q(\mathrm{call}(y)(x)(e)))(\lambda S\ .\ \exists m : s'(m) \wedge S(m))((\lambda z \lambda F \lambda v\ .\ \mathrm{in'}(z)(v) \wedge F(v))(w')(t'))$$

2

The standard model is extended by the following predicate: shortly_after :: (eet) which is an ordering without the mathematical sense, basically only antisymmetry and transitivity. It compares the starts of events and could be denoted as a special comparison operator: $<_{\mathrm{sh.}}$. In a similar way we could introduce twice_as_long :: (eet) though a more elegant solution would be to introduce some formalism for basic timestamp arithmetics, therefore: $-$ :: (eee) (time difference, duration), $\times$ :: (eee) (multiplication) and $\simeq$:: (eee) (coloquial perception of equal quantities[1])

The standard predicates then not only take an event object but two objects: beginning and ending of an event. The binary operators are used with infix notation.

$$\exists e_1, e_2, e_1', e_2' : e_1 <_{\mathrm{sh.}} e_2 \wedge \mathrm{run}(m', e_2, e_2') \wedge \mathrm{run}(j', e_1, e_1') \wedge 2 \times (e_1' - e_1) \simeq (e_2' - e_2)$$

Interpreting even beginning and ending is quite versatile and allows for more precise comparison between events and also to describe e.g. that two things started at the same time. The obvious disadvantage is the excessive descriptiveness which requires an extra event object (ending). Furthermore, the incorporation of arithmetics seems formally unsound, though that's a separate issue and probably solved in some elegant manner.

[1] Since the intended meaning is "roughly twice as long", not "exactly twice as many miliseconds".