

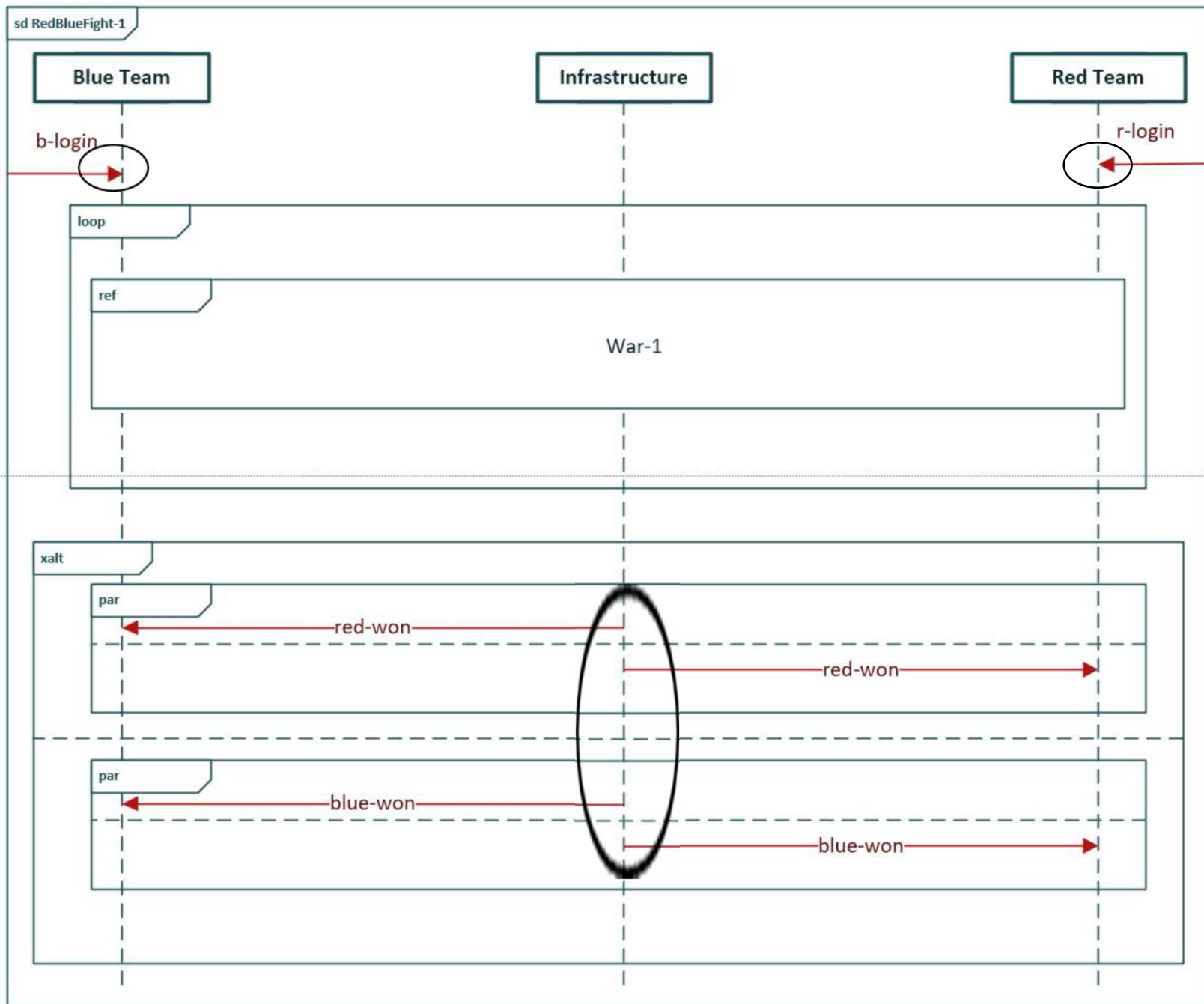
Proposed Solution Oblig-II

Ketil Stølen

1 a) Which events may occur as the first event in a positive trace of sd RedBlueFight-1? Explain your answer.

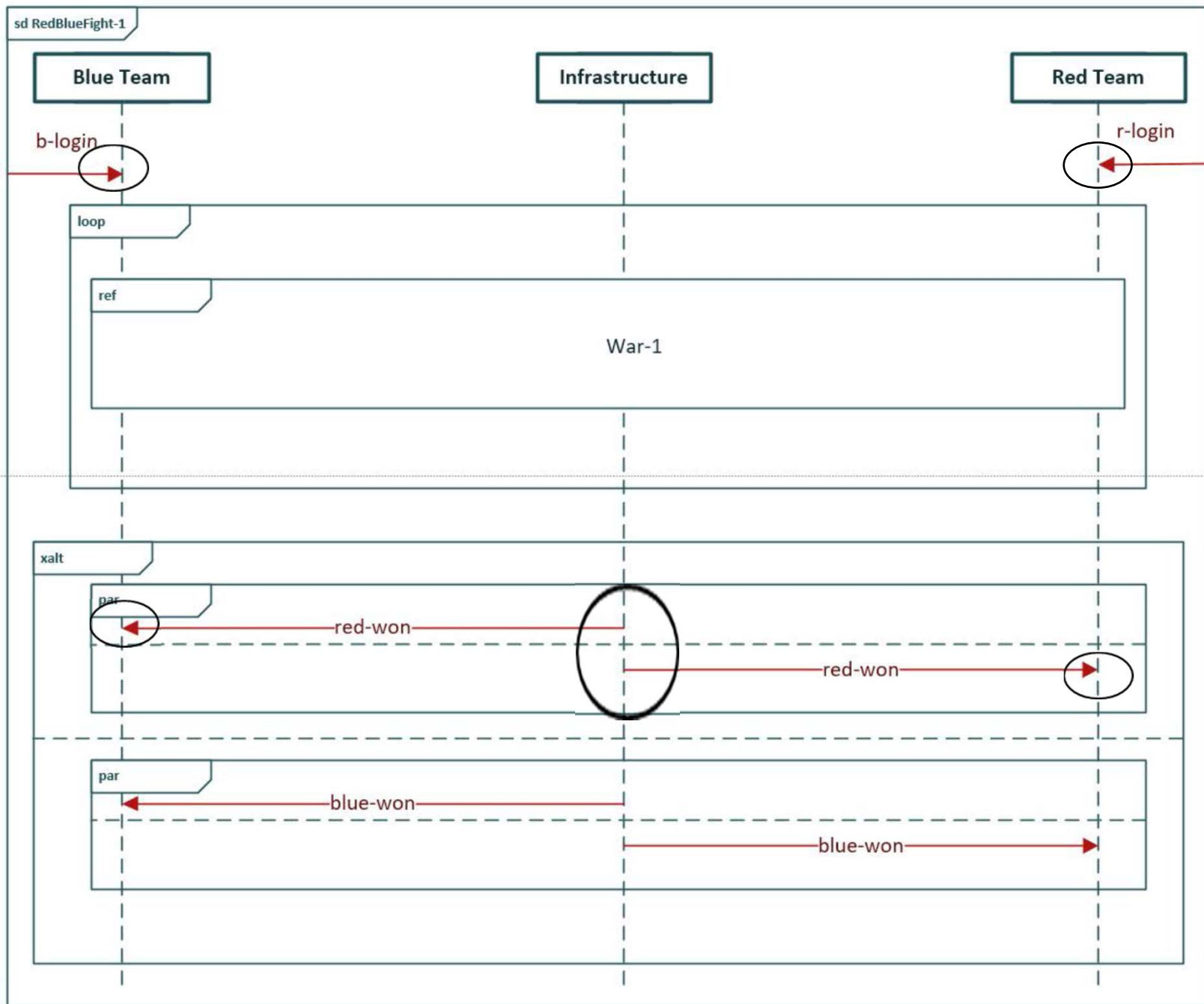
There are 6 possible first events:

- ?b-login on Blue Team
- ?r-login on Read Team
- if the loop iterates zero times, the 4 sending events on Infrastructure within the xalt may also occur as first events



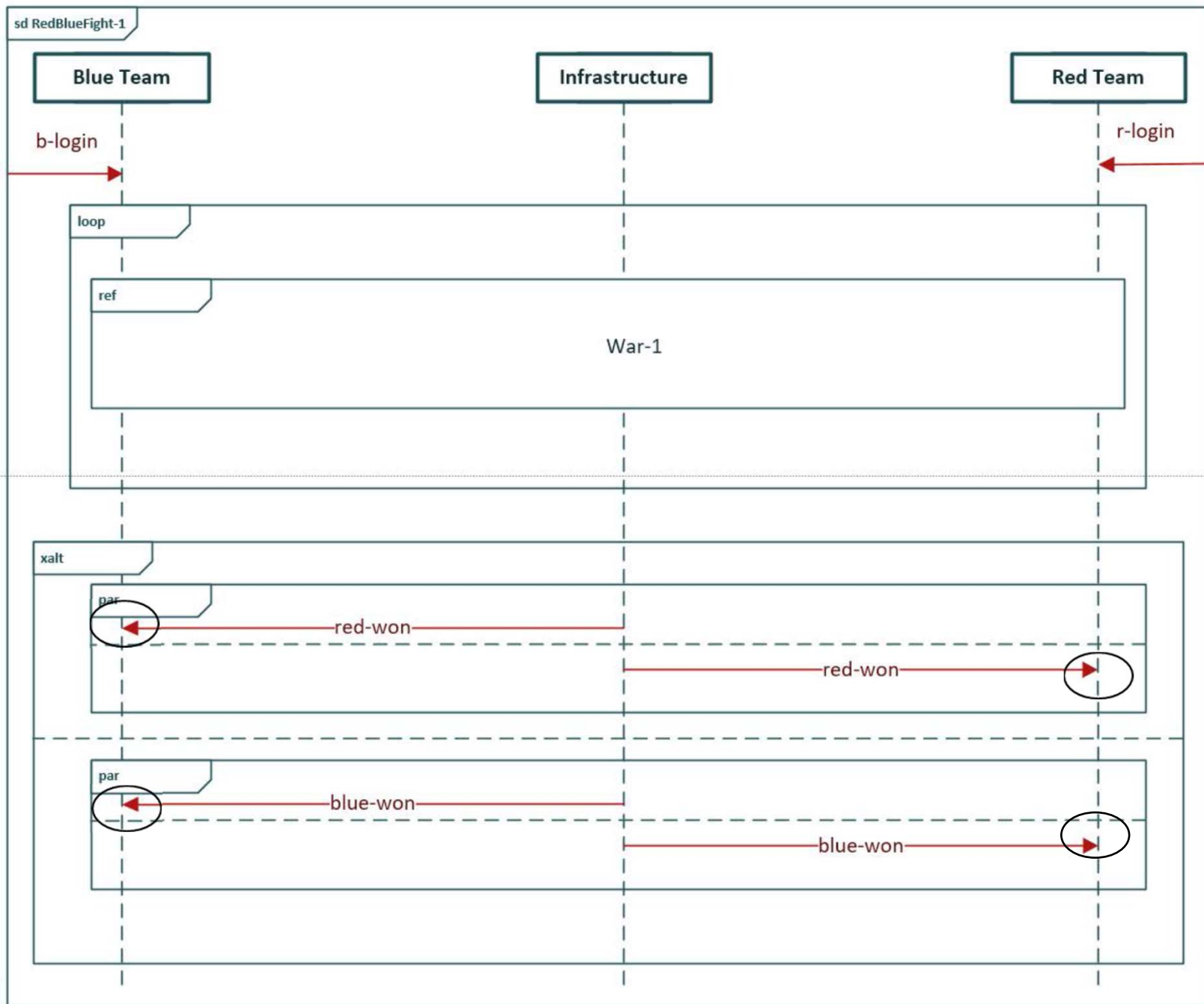
1 b) What is the minimum length of a positive trace of sd RedBlueFight-1? Explain your answer.

- We get a trace of length 6 if the loop iterates zero times.
- If the loop iterates once or more the traces will be longer.



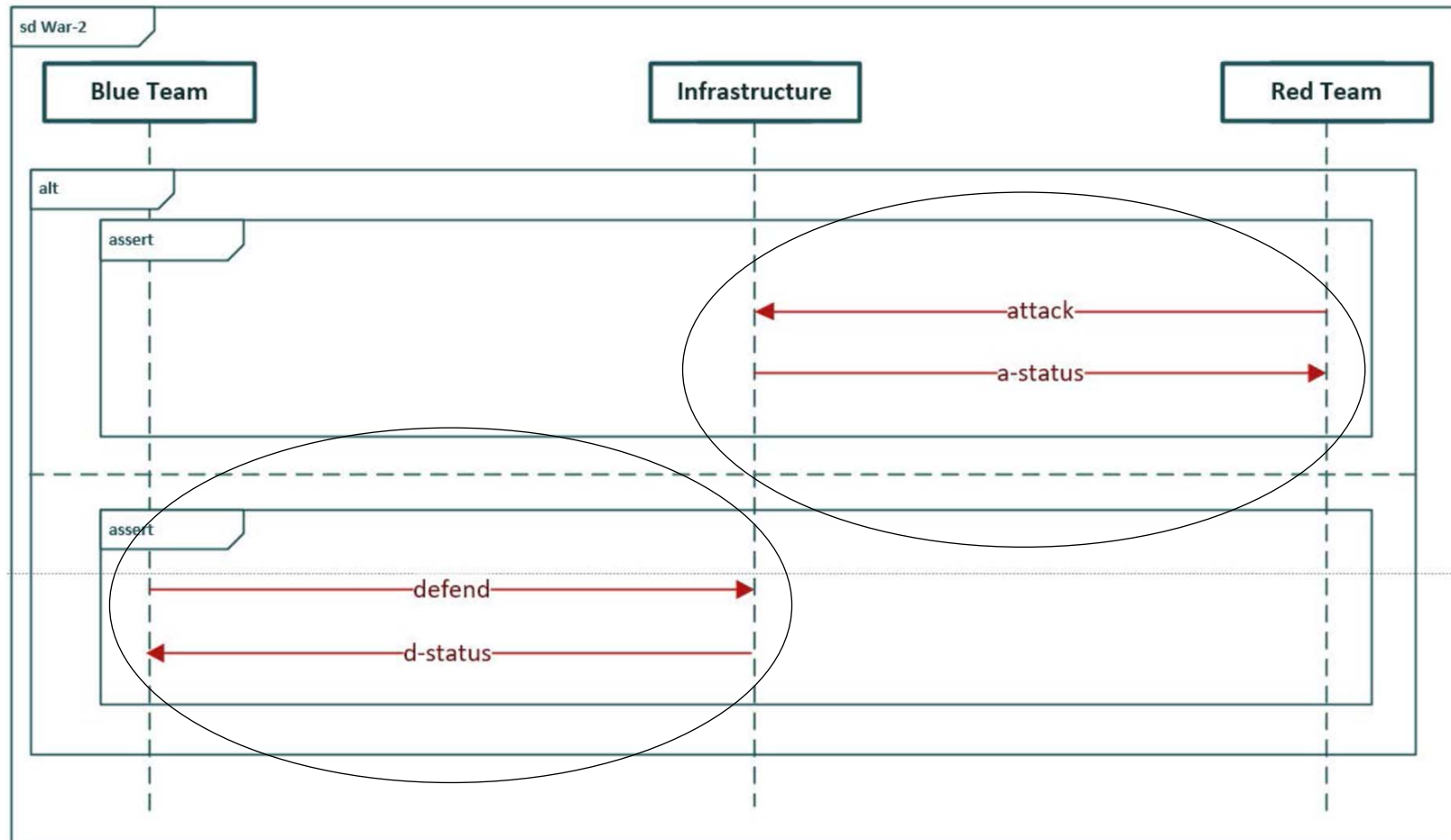
1 c) Which events may occur as the last event in a positive trace of sd RedBlueFight-1? Explain your answer.

- There are four possibilities, namely the four reception events within the xalt.



1 d) How many positive traces are there for sd War-2?
Explain your answer.

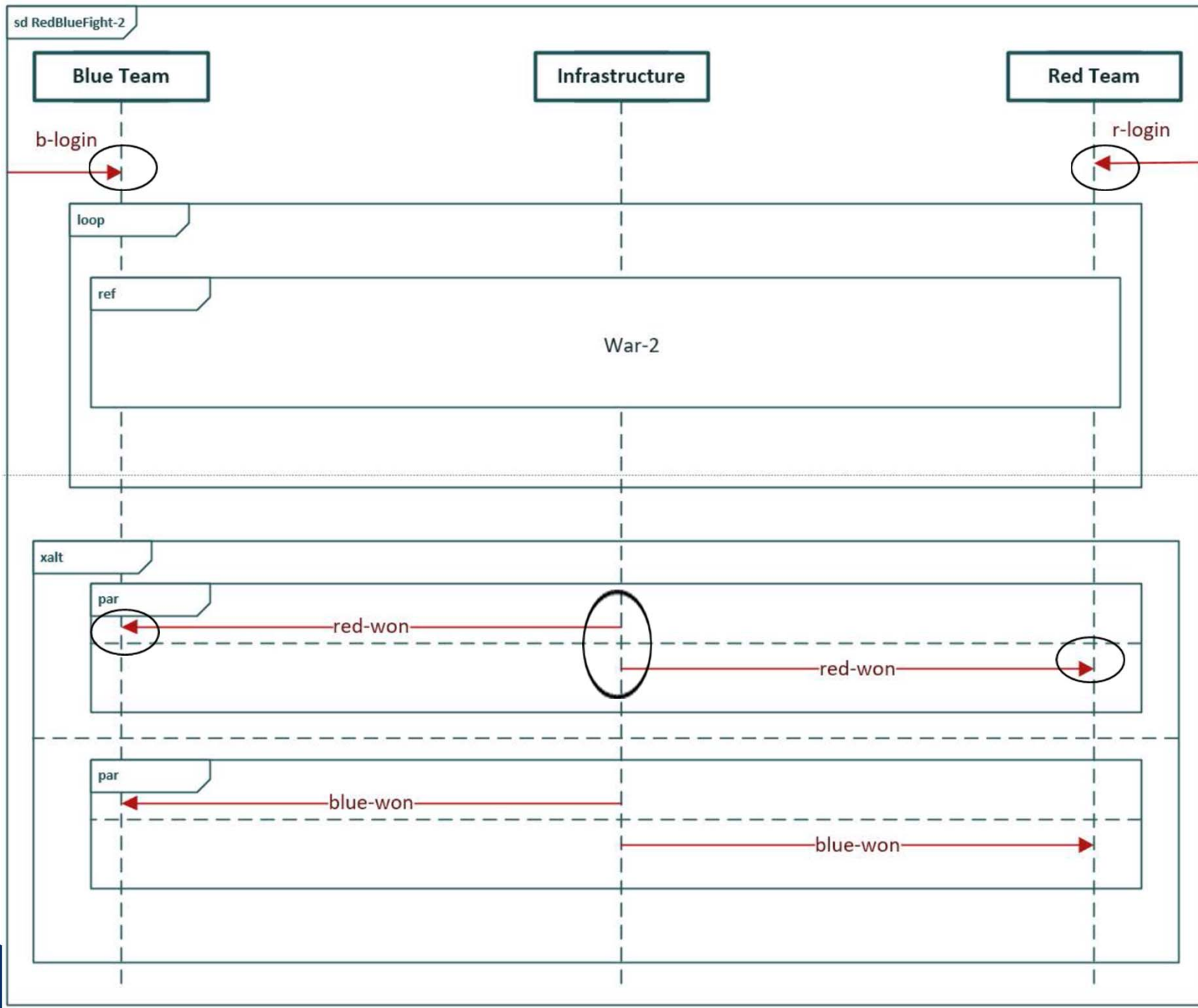
- There are two positive traces of length 4. One for each alt operand.



1 e) Describe one negative trace of sd RedBlueFight-2. Use the $\langle e_1, e_2, \dots, e_j \rangle$ notation where $e_1, e_2, \dots, e_j$ are events.

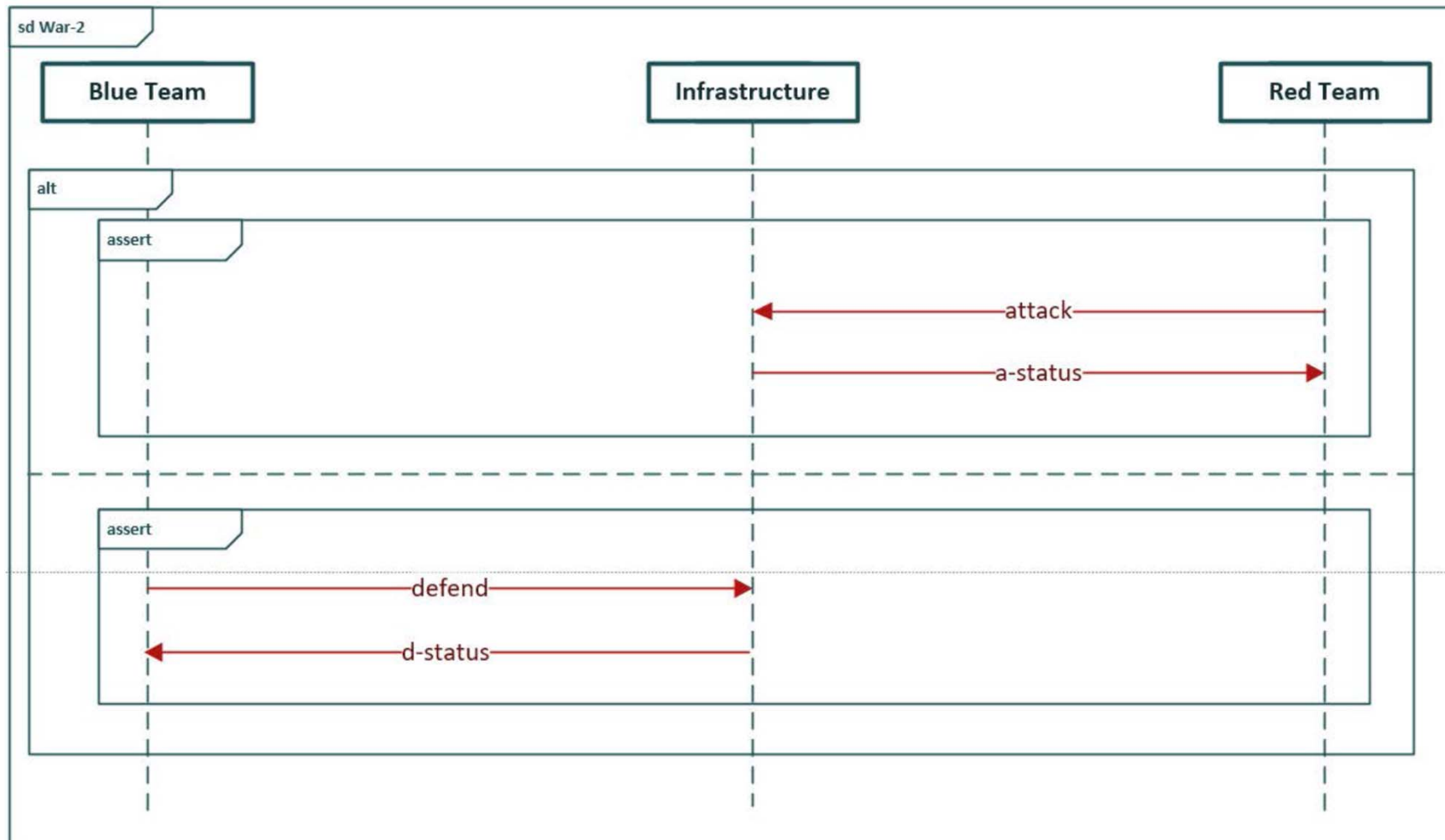
The shortest negative trace for War-2 is the empty trace. If the loop iterates once, we may get the following negative trace

- $\langle ?b\text{-login}, ?r\text{-login}, !red\text{-won}, ?red\text{-won}, !red\text{-won}, ?red\text{-won} \rangle$



1 f) Which events may occur as the first event in a negative trace of sd War-2? Explain your answer.

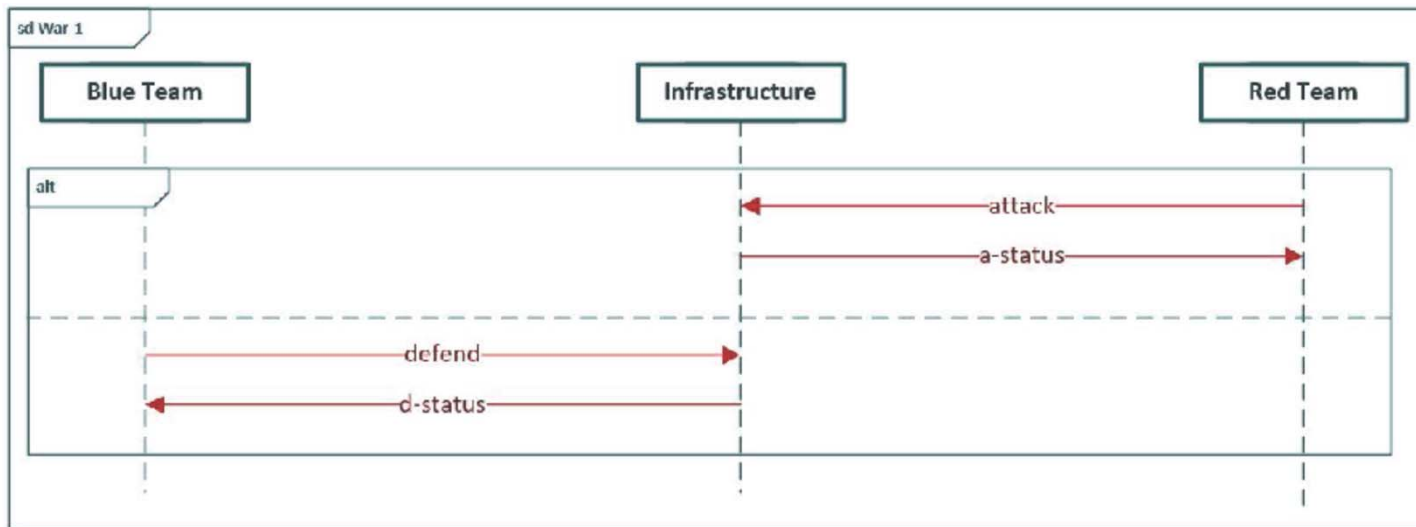
There are infinitely many. It may be any event.



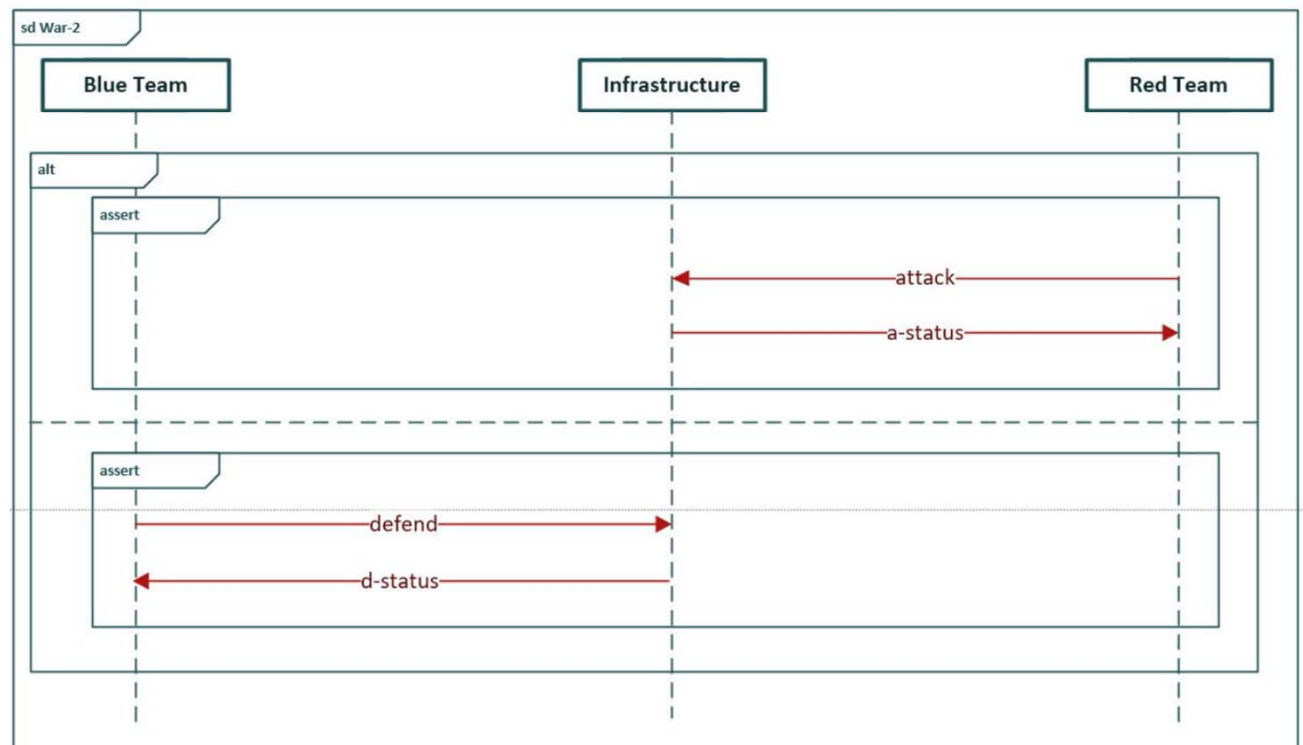
There are infinitely many. It may be any event.

2 a) Is sd War-2 a refinement of sd War-1. If so, is it a pure supplementing, a pure narrowing or a combination? Explain your answer.

- Yes. Pure supplementing since the only effect of the two asserts is to make inconclusive traces negative.

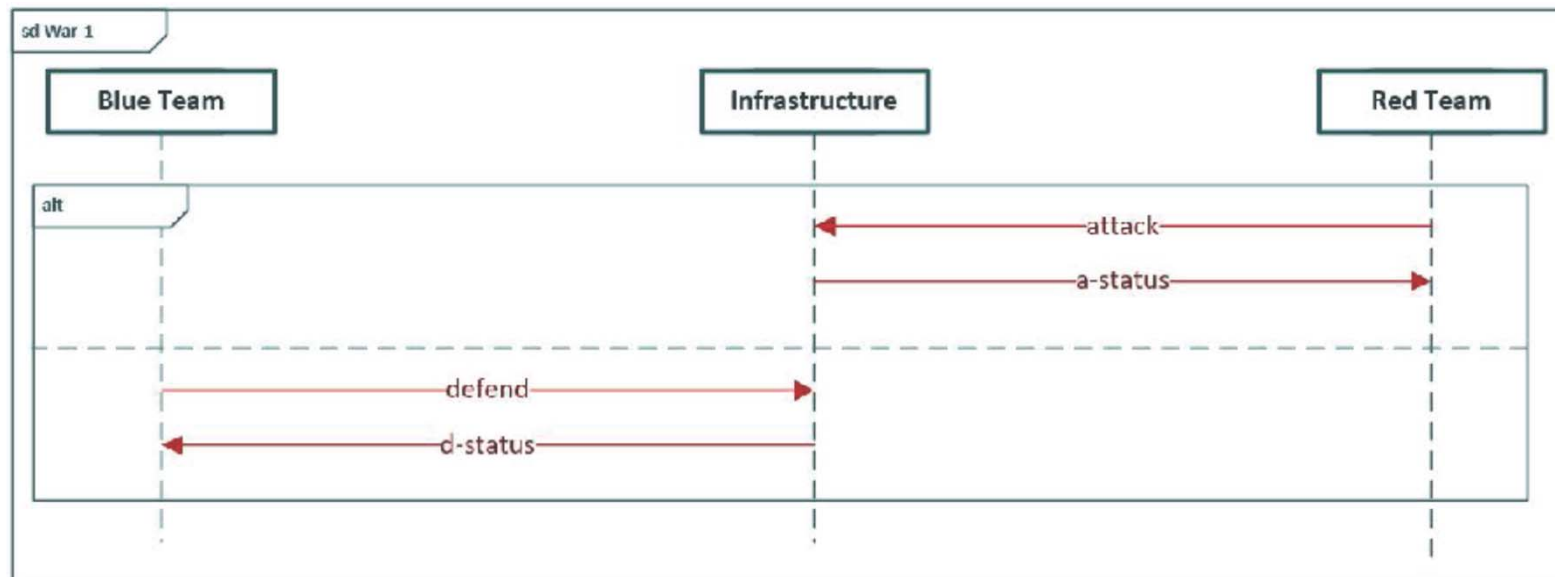


Pure
supplementing
since inconclusive
traces become
negative

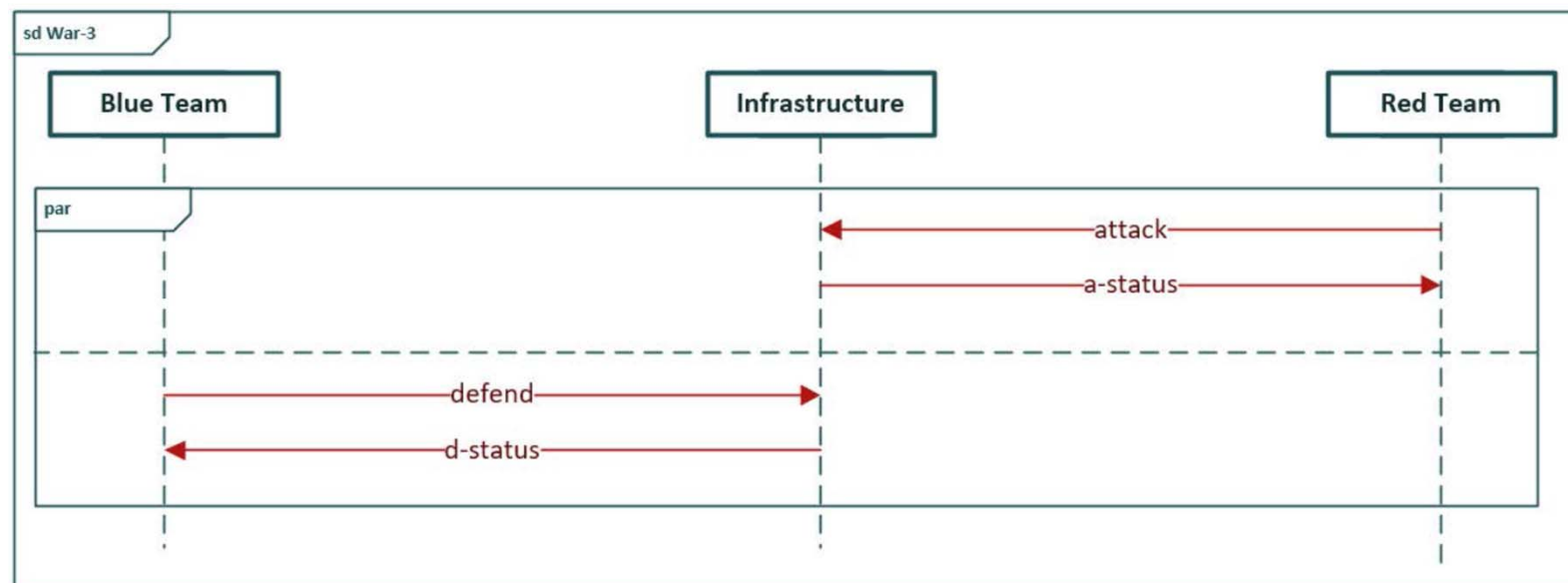


2 b) Is sd War-3 a refinement of sd War-1? If so, is it a pure supplementing, a pure narrowing or a combination? Explain your answer.

- It cannot be a refinement since War-1 have two positive traces of length four that are both inconclusive in War-3.



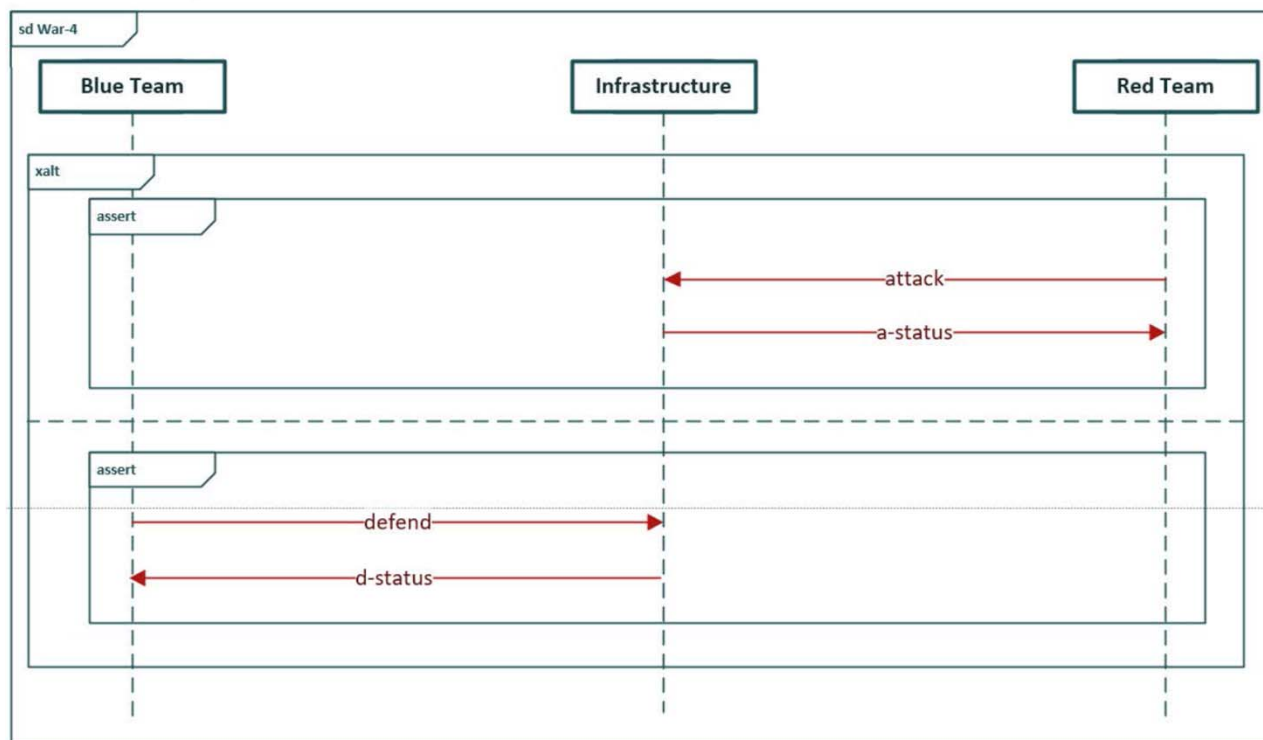
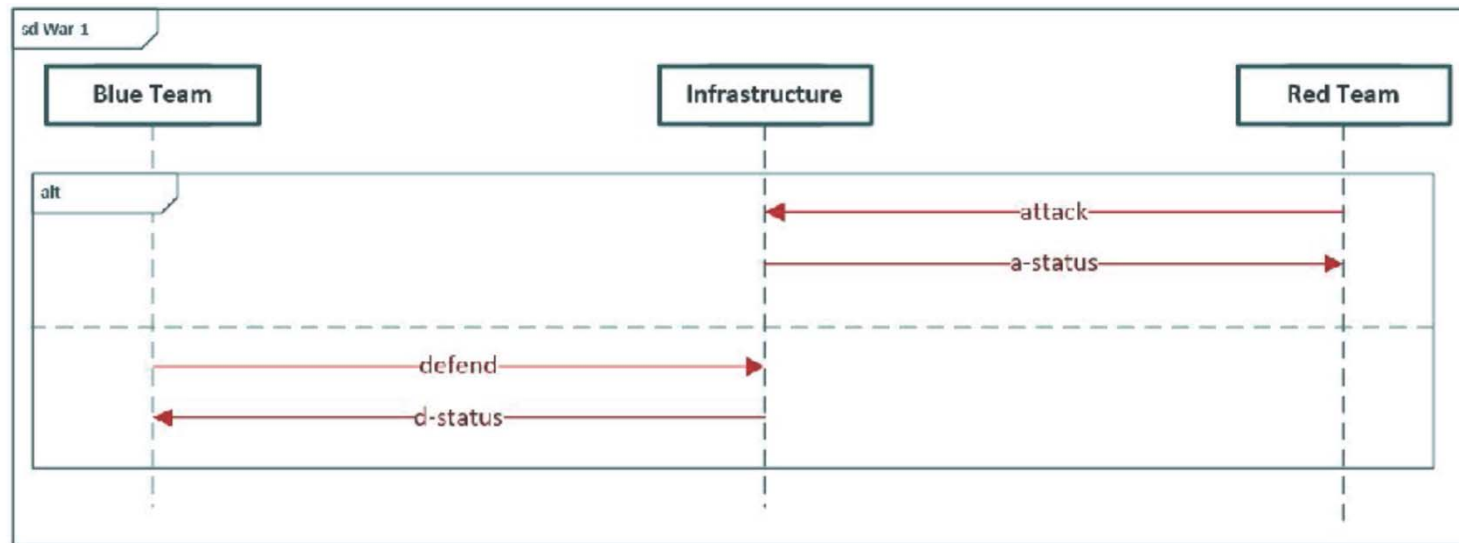
Positive
traces
of
length
four



Positive
traces
of
length
eight

2 c) Is sd War-4 a refinement of sd War-1? If so, is it a general refinement or a limited refinement? Explain your answer.

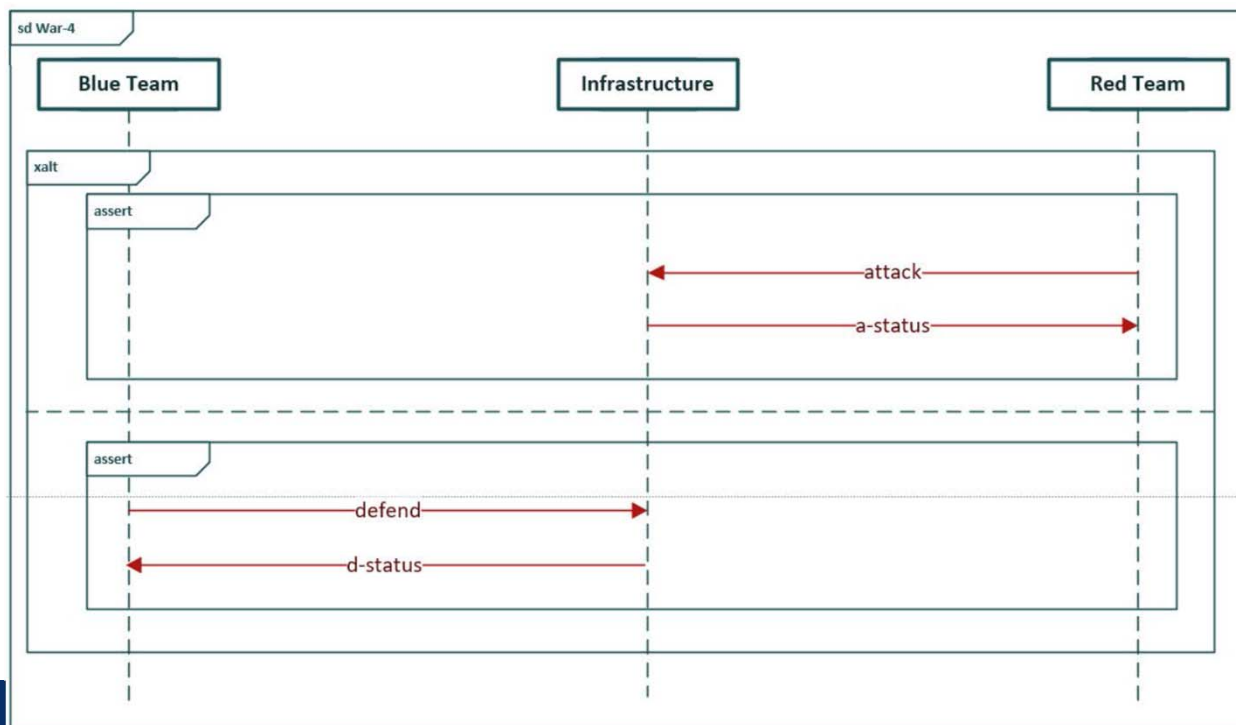
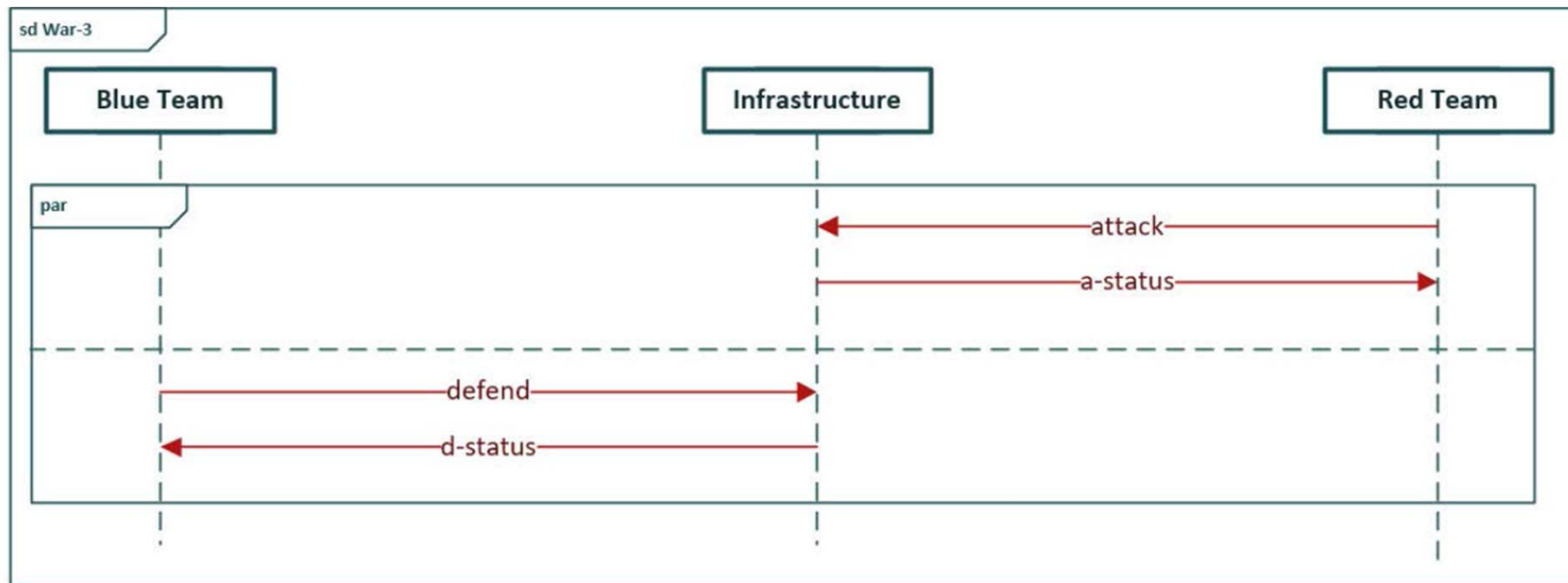
- It is a general as well as a limited refinement since each of the two interaction obligations of War-4 are refinements (supplementing since inconclusive traces are made negative and narrowing since one positive trace is made negative) of the only interaction obligation of War-1.



Note that each interaction obligation of War-4 is both a narrowing and supplementing of the only interaction obligation of War-1.

2 d) Is sd War-4 a refinement of sd War-3? If so, is it a general refinement or a limited refinement? Explain your answer.

- It is a general and limited refinement since each of the two interaction obligations of War-4 are refinements (supplementing since inconclusive traces are made negative and positive, and narrowing since positive traces are made negative) of the corresponding interaction obligation of War-3.



Note that the positive traces of War-3 become negative in War-4

Note also that the positive traces in War-4 are inconclusive in War-3.

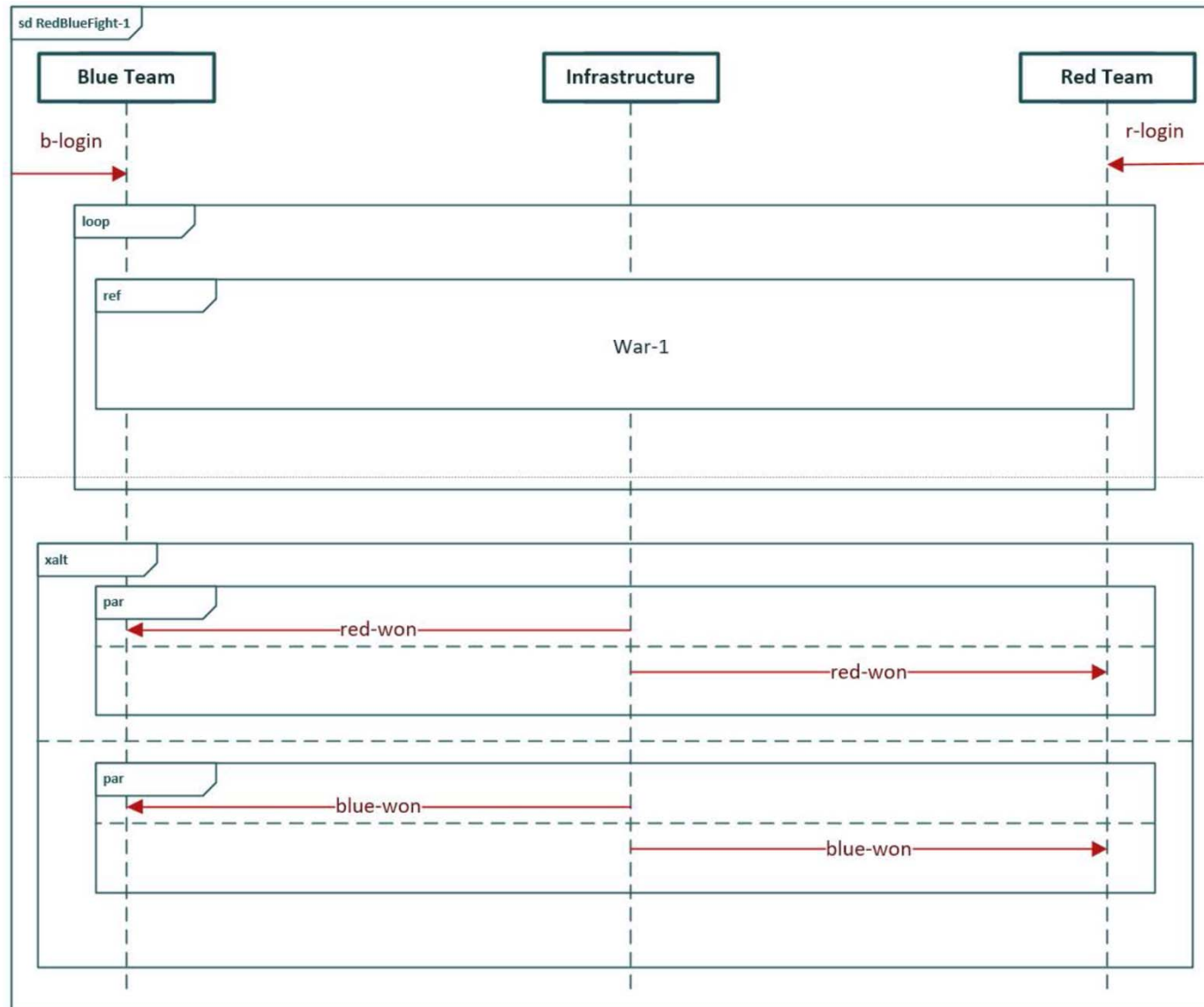
2 e) Is sd RedBlueFight-2 a refinement of sd RedBlueFight-1? If so, is it a pure supplementing, a pure narrowing or a combination? Explain your answer.

It is a supplementing, general refinement and limited refinement. Argument:

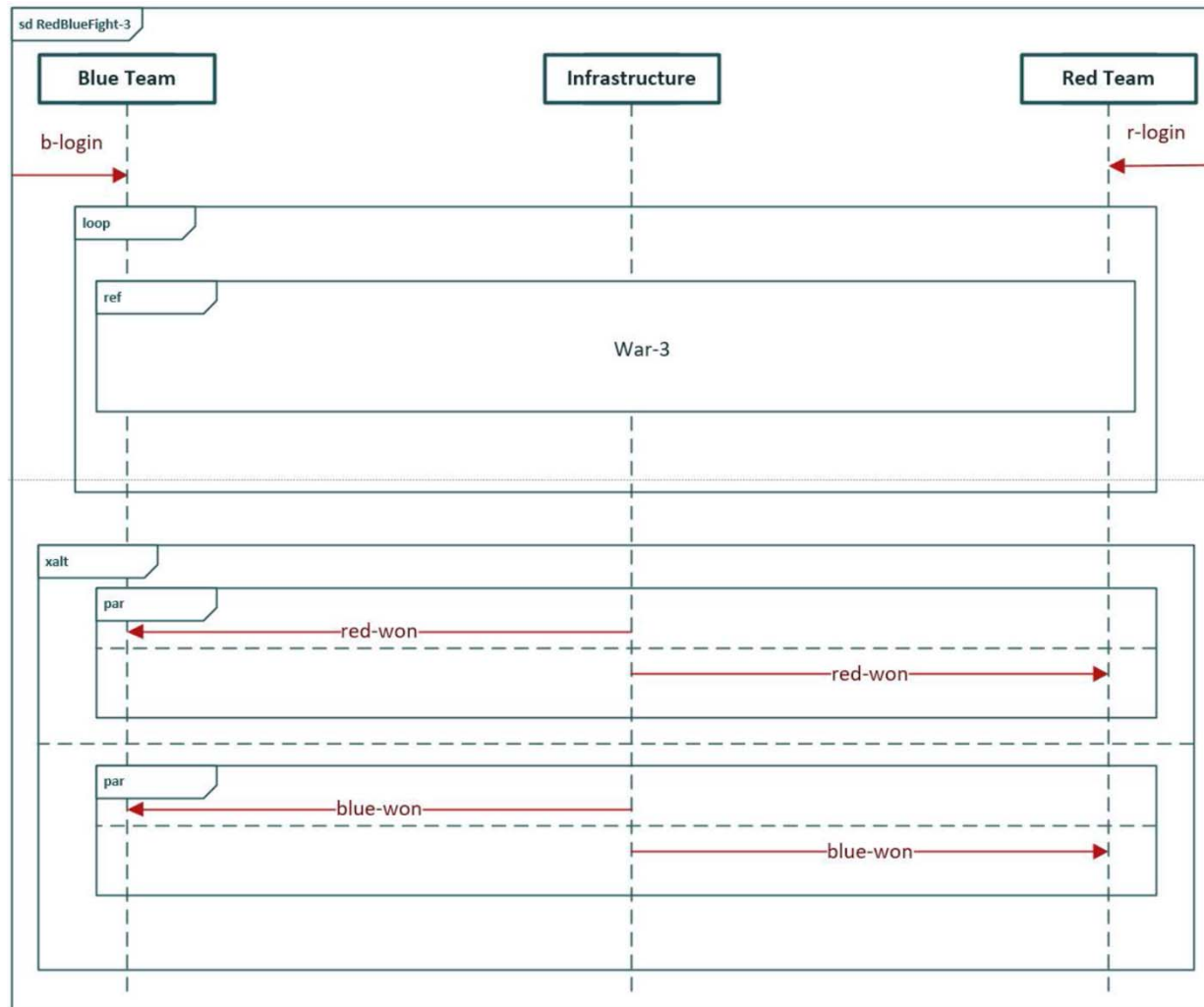
- It follows from 2a) that War-2 is a supplementing of War-1.
- Any other fragment of RedBlueFight-2 is a refinement of the corresponding identical fragment of RedBlueFight-1. This follows by the reflexivity property (see slide 35 in Refinement III).
- From this we may conclude that RedBlueFight-2 is a supplementing, general refinement and limited refinement of RedBlueFight-1 by the monotonicity property (see slide 35 in Refinement III).

2 f) Is sd RedBlueFight-3 a refinement of sd RedBlueFight-1? If so, is it a pure supplementing, a pure narrowing or a combination? Explain your answer.

- It is not a refinement. If the loop iterates an odd number of times RedBlueFight-1 will generate positive traces that cannot be produced by RedBlueFight-3.



If the loop iterates exactly once, we get positive traces of length 10. The diagram has no negative behaviour.



No trace of length 10 is positive wrt this diagram. The diagram has no negative traces. Hence, any trace of length 10 is inconclusive.

Since positive traces become inconclusive, sd RedBlueFight-3 is not a refinement of sd RedBlueFight-1