Ideal Quaternary Semantics of Attack Trees

Ideal Properties [Horne et al.:2016]:

$$((A \odot_I B) \rhd_I (C \odot_I D)) \leq_4 ((A \rhd_I C) \odot_I (B \rhd_I D))$$

$$((A \odot_I B) \rhd_I C) \leq_4 (A \odot_I (B \rhd_I C))$$

$$(A \rhd_I (B \odot_I C) \leq_4 (B \odot_I (A \rhd_I C))$$

$$(A \rhd_I B) \leq_4 (A \odot_I B)$$

Note: Not equivalences!

Filterish Quaternary Semantics of Attack Trees

Choice:

$$A \sqcup_F B = \max(A, B)$$

Parallel:

$$0 \odot_F B = 0$$

$$A \odot_F 0 = 0$$

$$A \odot_F B = \frac{1}{2}$$

Sequence:

$$0 \rhd_F B = 0$$

$$A \rhd_F 0 = 0$$

$$A \rhd_F B = 1, \text{ when } A \in \{\frac{1}{2}, 1\}$$

$$\frac{1}{4} \rhd_F B = \frac{1}{4}$$