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Solution to exercises

31 October, 2008

INF 5150

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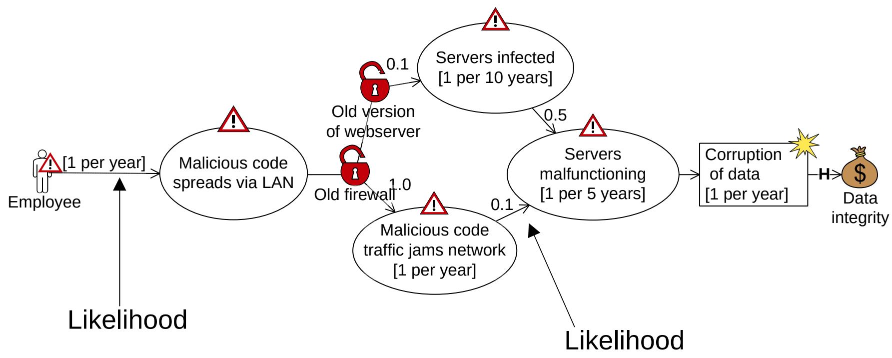
Building a threat diagram (4)



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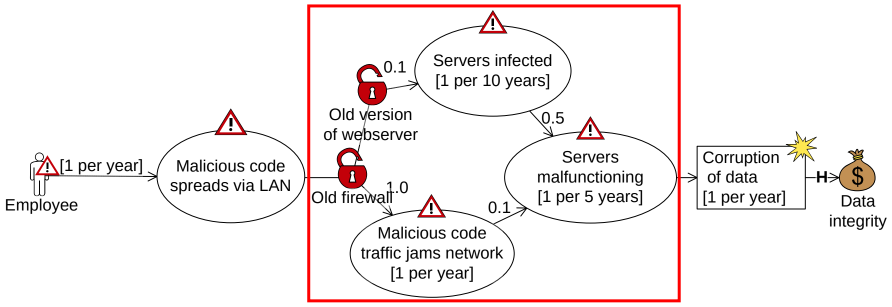
Consistency checking of likelihoods

- Use the CORAS calculus to check the consistency of assigned likelihood values



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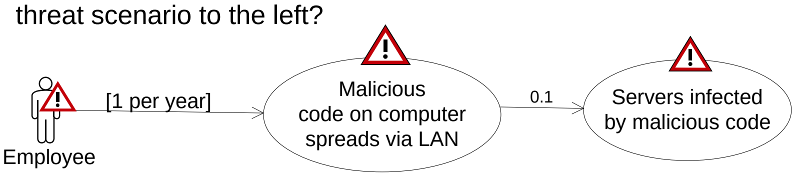
Exercise I, 1a) – initiate rule

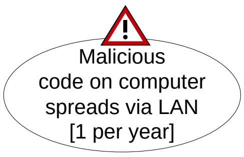
- What is the likelihood of the threat scenario to the left?



- If the vertices t and v are related by initiate, we have:

$$\frac{t \xrightarrow{l} v}{(t \sqcap v)(l)}$$

- I.e.:



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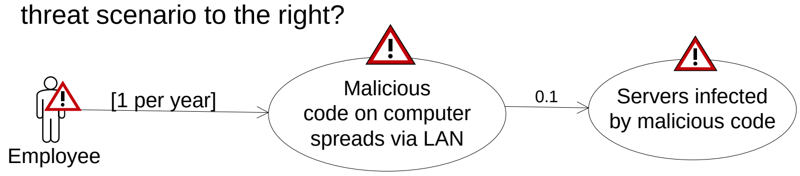
Exercise I, 1b) – leads-to rule

- What is the likelihood of the threat scenario to the right?



- If the vertices v_1 and v_2 are related by leads-to, we have:

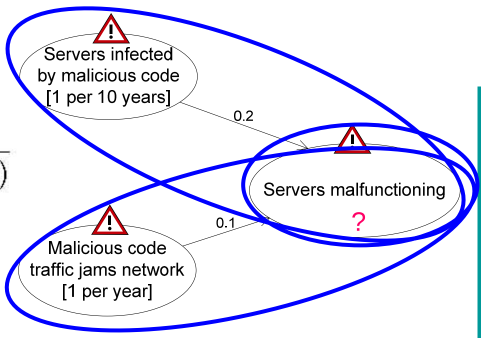
$$\frac{v_1(f) \quad v_1 \xrightarrow{l} v_2}{(v_1 \sqcap v_2)(f \cdot l)}$$

- 1 per 1 year × 0.1 = 1 per 10 years

2a) Leads-to + statistically independent vertices

- 1 per 10 years × 0.2 = 1 per 50 years
- 1 per 1 year × 0.1 = 1 per 10 years
- If the vertices v_1 and v_2 are statistically independent, we have:

$$\frac{v_1(f_1) \quad v_2(f_2)}{(v_1 \sqcup v_2)(f_1 + f_2 - f_1 \cdot f_2)}$$

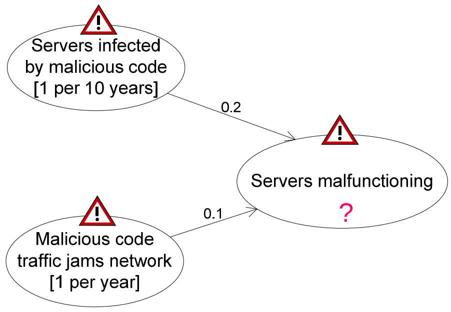


- (1/50 + 1/10) - (1/50 ×1/10) = 1.18 per 10 years

2b) Leads-to + mutually exclusive vertices

- If the vertices v_1 and v_2 are mutually exclusive, we have:

$$\frac{v_1(f_1) \quad v_2(f_2)}{(v_1 \sqcup v_2)(f_1 + f_2)}$$



- (1/50 + 1/10) = 1.2 per 10 years

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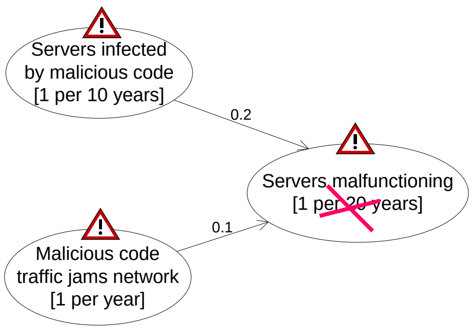
2c) Consistency check

- Both 1.18 per 10 years and 1.2 per 10 years are higher values than 1 per 20 years
- The diagram is inconsistent



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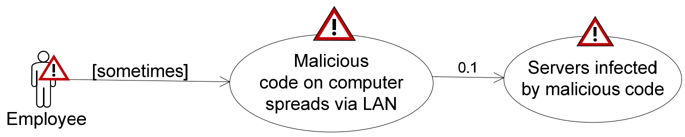
Exercise II – computing likelihood intervals

	Scale	Value
1	Rarely	<= 1 per 10 years
2	Seldom	> 1 per 10 years & <= 1 per 5 years
3	Sometimes	> 1 per 5 years & <= 1 per 1 year
4	Often	> 1 per 1 year

Exercise I, 1a) – initiate rule

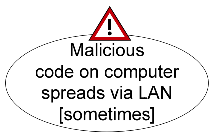
- What is the likelihood of the threat scenario to the left?



- If the vertices t and v are related by initiate, we have:

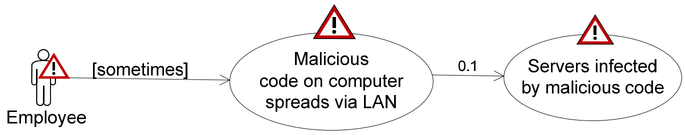
$$\frac{t \xrightarrow{l} v}{(t \sqcap v)(l)}$$

- I.e.:



Exercise I, 1b) – leads-to rule

- What is the likelihood of the threat scenario to the right?



- If the vertices v_1 and v_2 are related by leads-to, we have:

$$\frac{v_1(f) \quad v_1 \xrightarrow{l} v_2}{(v_1 \sqcap v_2)(f \cdot l)}$$

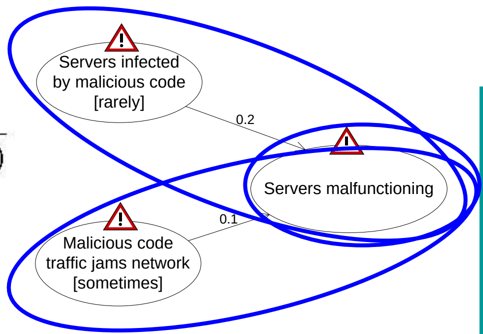
- sometimes = <1/5,1/1]
- 1 per 5 years × 0.1 = 1 per 50 years
- 1 per 1 year × 0.1 = 1 per 10 years
- <1/50,1/10] = rarely

2a) Leads-to + statistical independence

- [0,1/10] × 0.2 = [0,1/50]
- <1/5,1/1] × 0.1 = <1/50,1/10]
- If the vertices v_1 and v_2 are statistically independent, we have:

$$\frac{v_1(f_1) \quad v_2(f_2)}{(v_1 \sqcup v_2)(f_1 + f_2 - f_1 \cdot f_2)}$$

- ([0,1/50] + <1/50,1/10]) - ([0,1/50] × <1/50,1/10]) = <1/50,1.18/10]
- 1.18 per 10 years ∊ seldom
- we interpret this as seldom

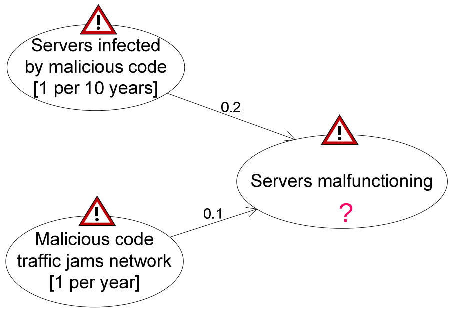


2b) Leads-to + mutually exclusive vertices

- If the vertices v_1 and v_2 are mutually exclusive, we have:

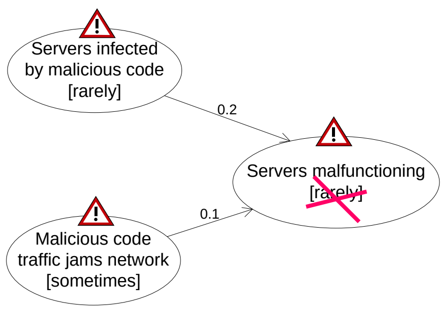
$$\frac{v_1(f_1) \quad v_2(f_2)}{(v_1 \sqcup v_2)(f_1 + f_2)}$$

- ([0,1/50] + <1/50,1/10]) = <1/50,1.2/10]
- 1.2 per 10 years ∈ seldom
- we interpret this as seldom

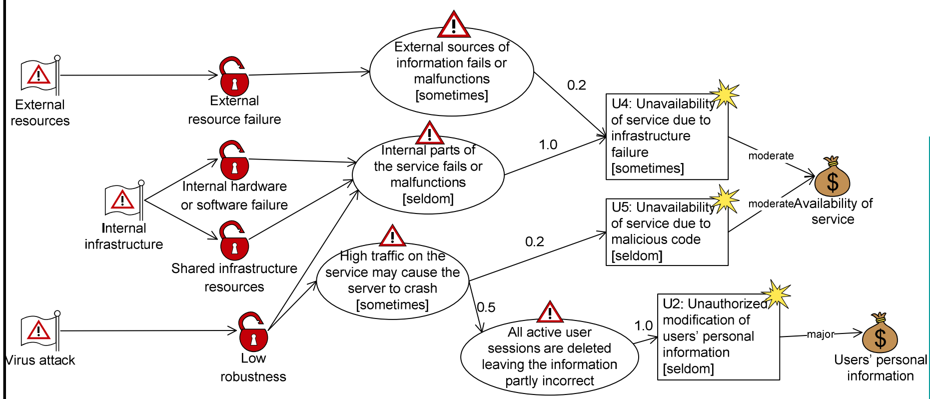


2c) Consistency check

- seldom > rarely
- The diagram is inconsistent

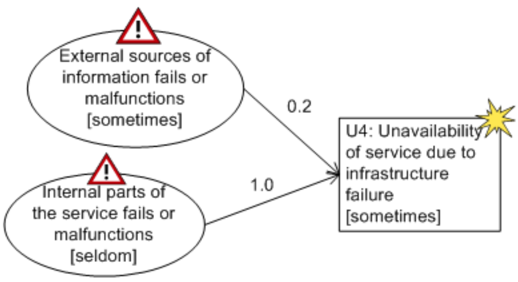


3a) Consistency check



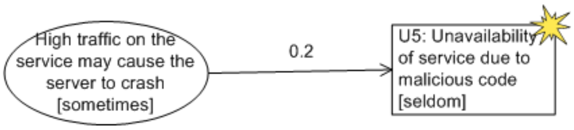
Consistency check

- We look at max values:
- 1 per 1 year × 0.2 = 1 per 5 years
- 1 per 5 years × 1.0 = 1 per 5 years
- (1 per 5 years + 1 per 5 years) - (1 per 5 years + 1 per 5 years) = 1.8 per 5 years ∈ sometimes OK



Consistency check

- 1 per 1 year × 0.2 = 1 per 5 years ∈ seldom OK



- 1 per 1 year × 0.5 = 1 per 2 years × 1.0 = 1 per 2 years ∉ seldom Not OK