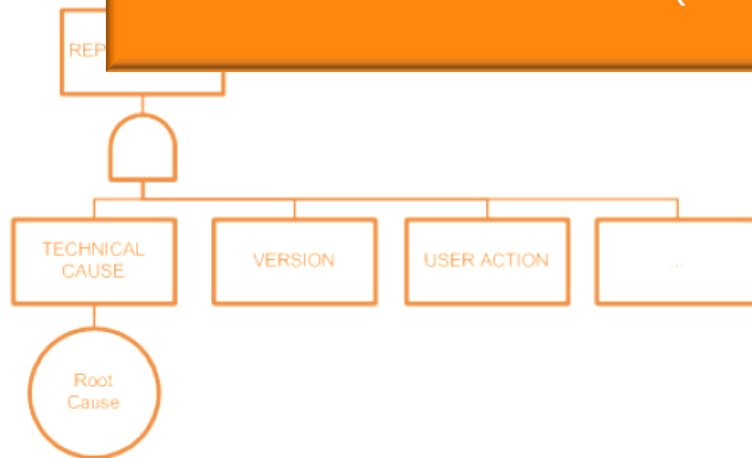


Towards A Software Failure Cost Impact Model For the Customer

Ralf Gitzel (ABB Corporate Research)

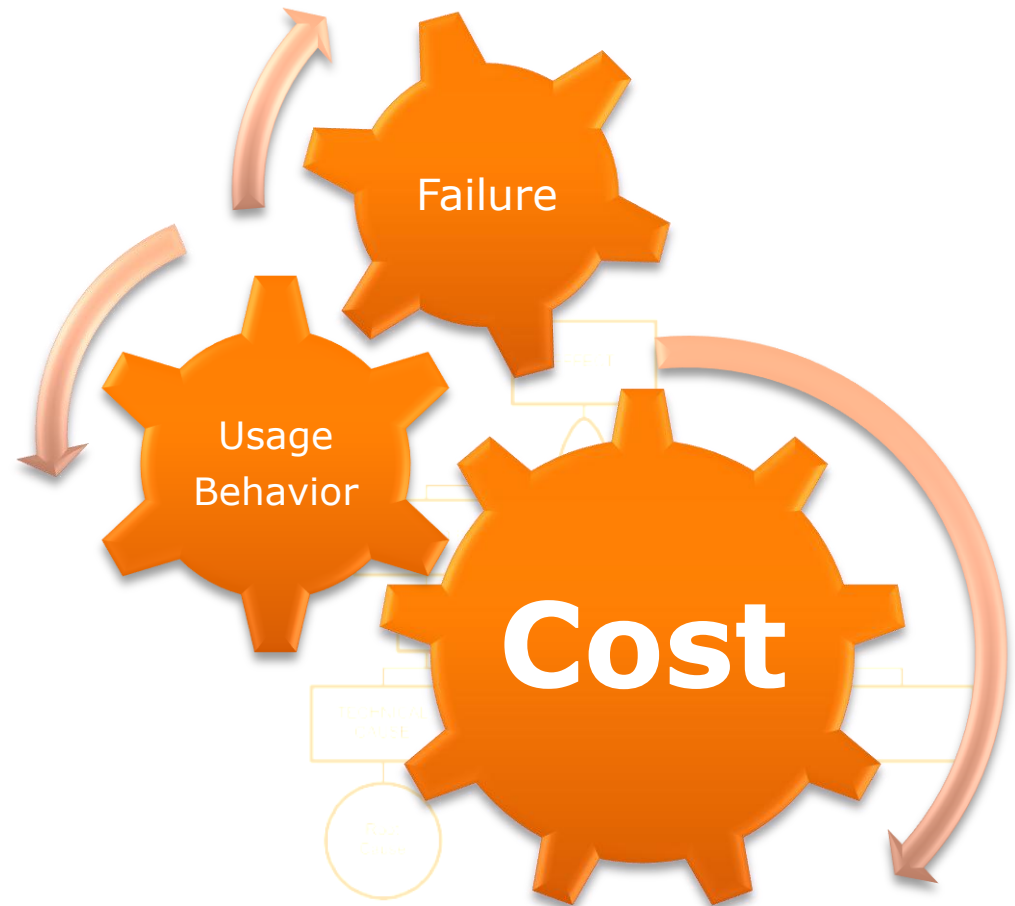
Simone Krug (University of Mannheim, Germany)

Manuel Brhel (University of Mannheim, Germany)

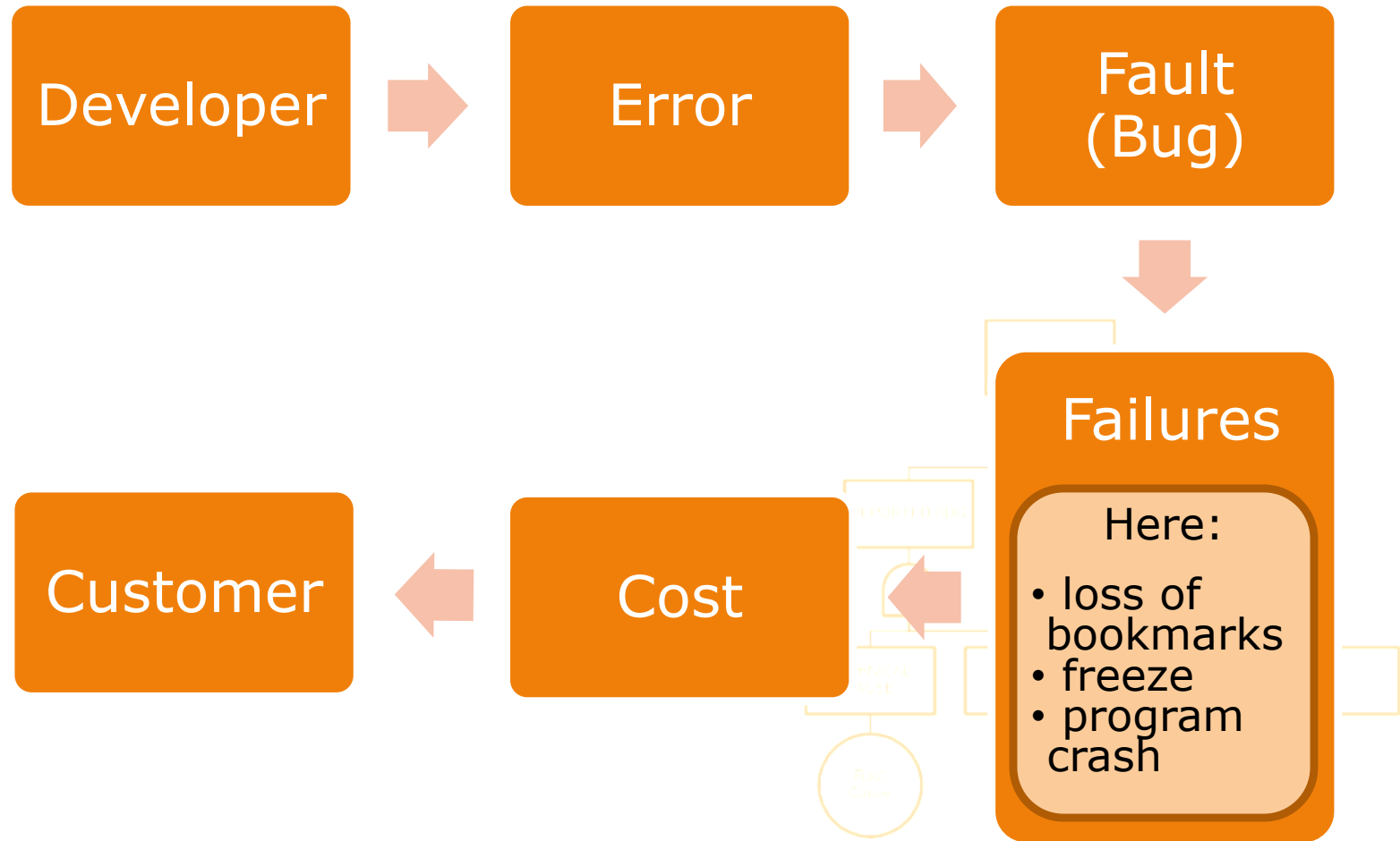


Research Question

What is the cost impact of software failures on the **customer**?



Software Failure Impact



Our Data Source

- Bugzilla : Firefox bug repository

Closed Source

Open Source

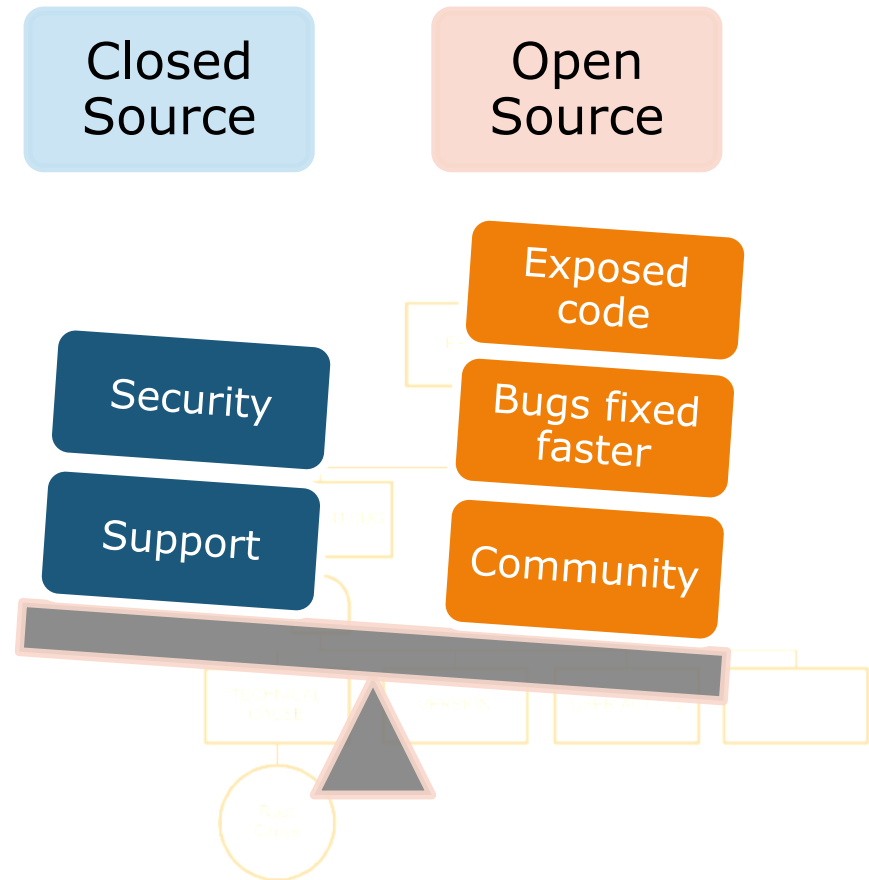
Security

Support

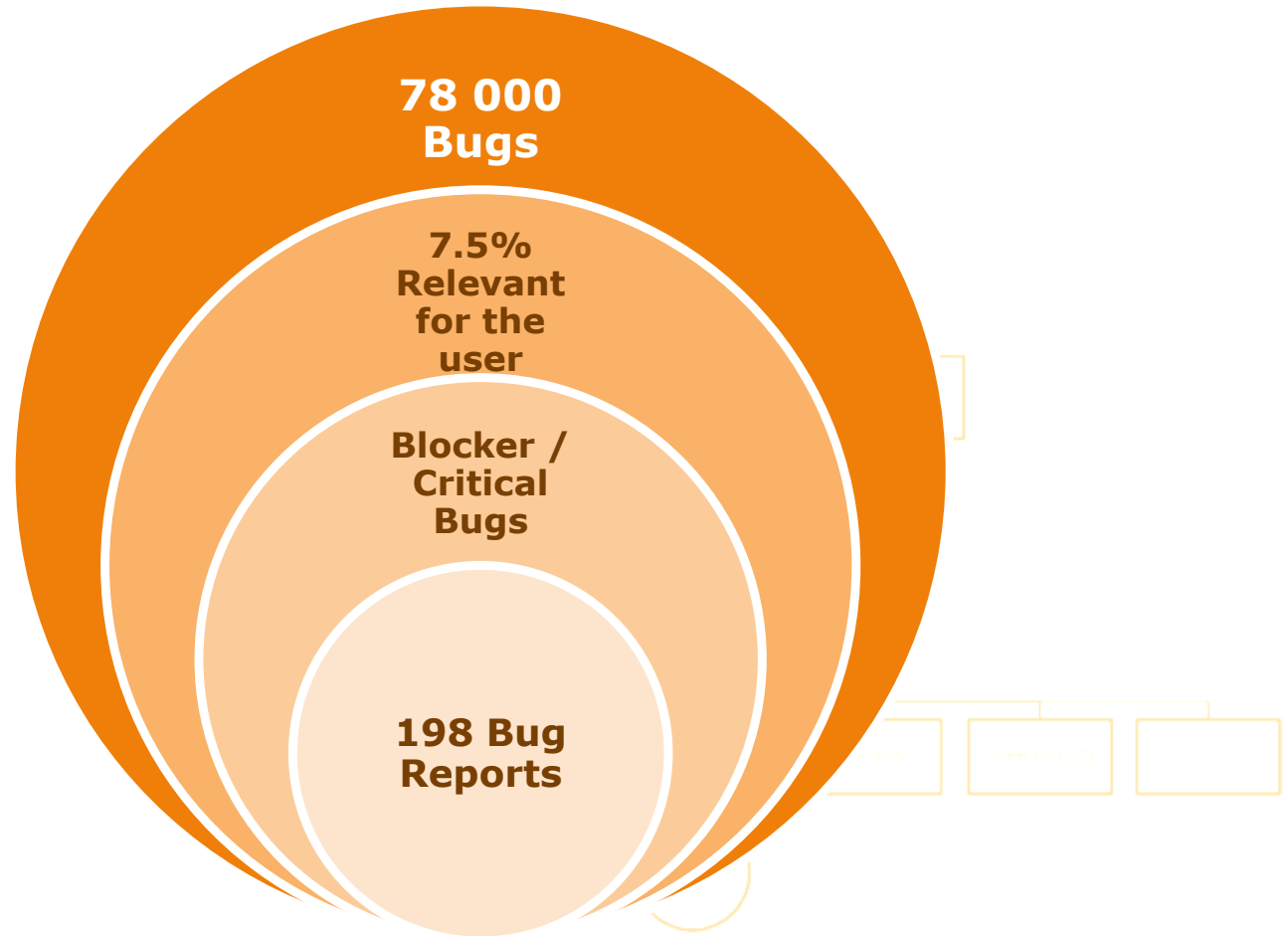
Exposed code

Bugs fixed faster

Community

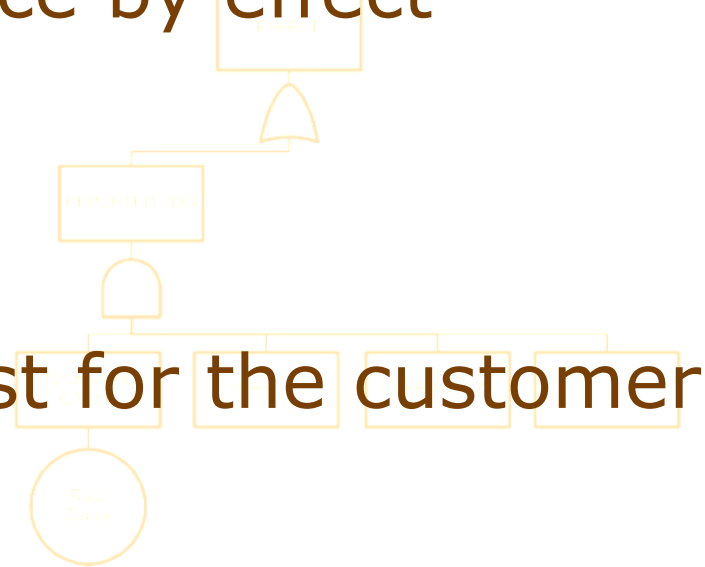


Identifying Relevant Entries



Modeling Customers' Failure Cost

1. Identify cost drivers
2. Model failure occurrence by effect
3. Model user behavior
4. Calculate expected cost for the customer



1. Identify Cost Drivers

Direct impact

Defective goods

Material for Repair

Resolution

Etc.



Application / business specific

Indirect impact

User dissatisfaction

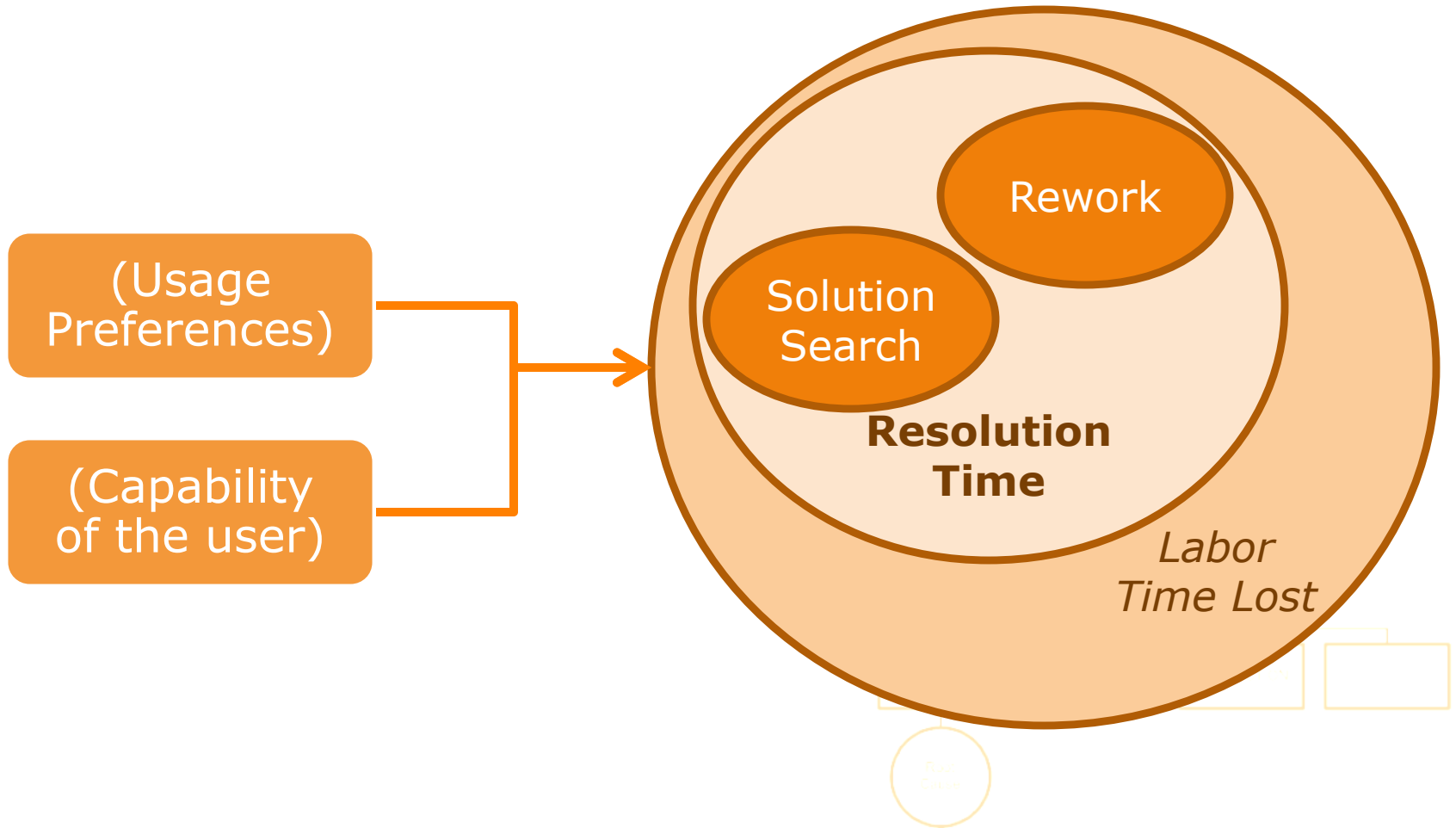
Legal contracts

Etc.



Hard to capture

Main Cost Drivers

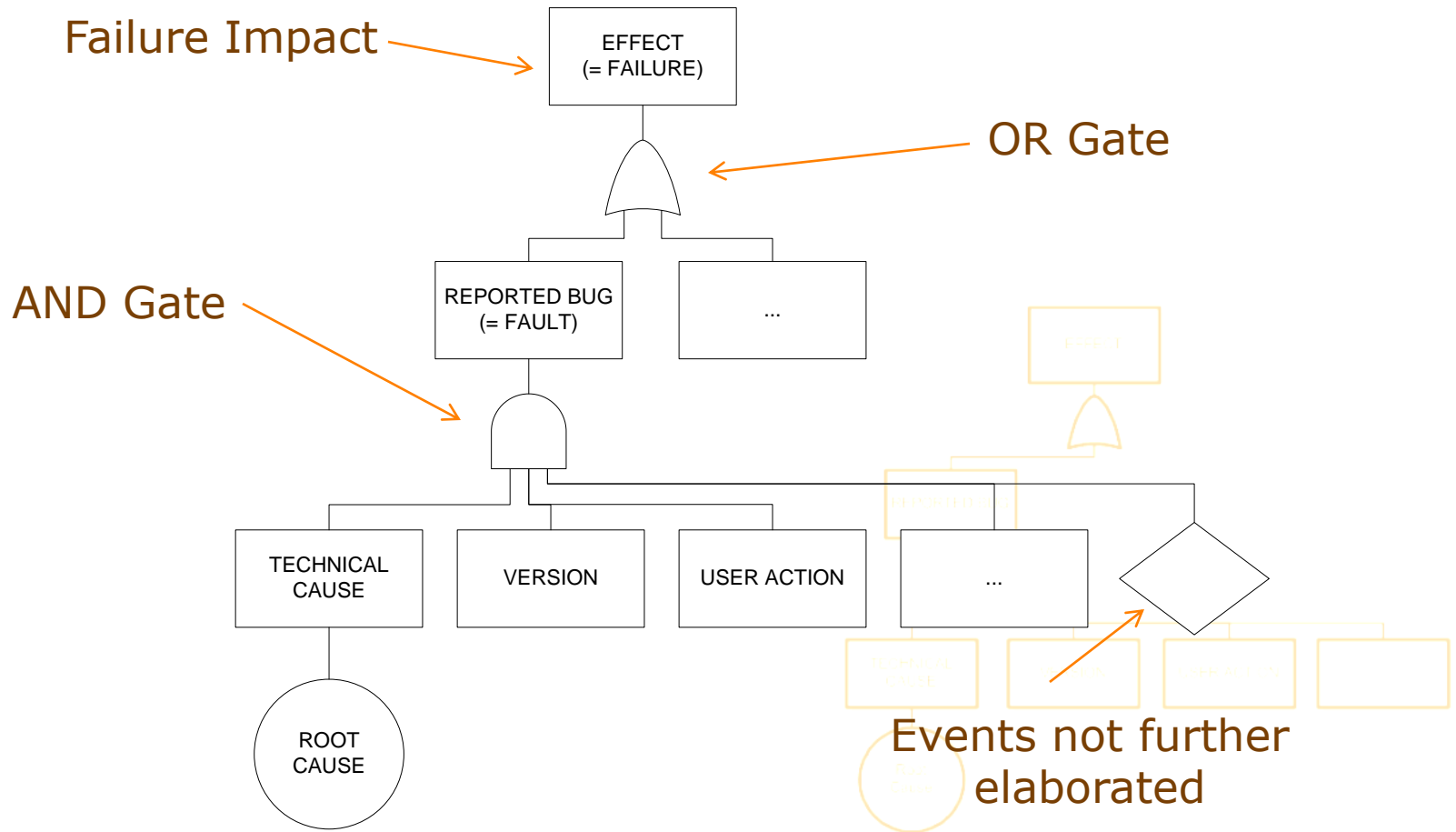


2. Model failure occurrence by effect

Table 1: Relevant Firefox Errors.

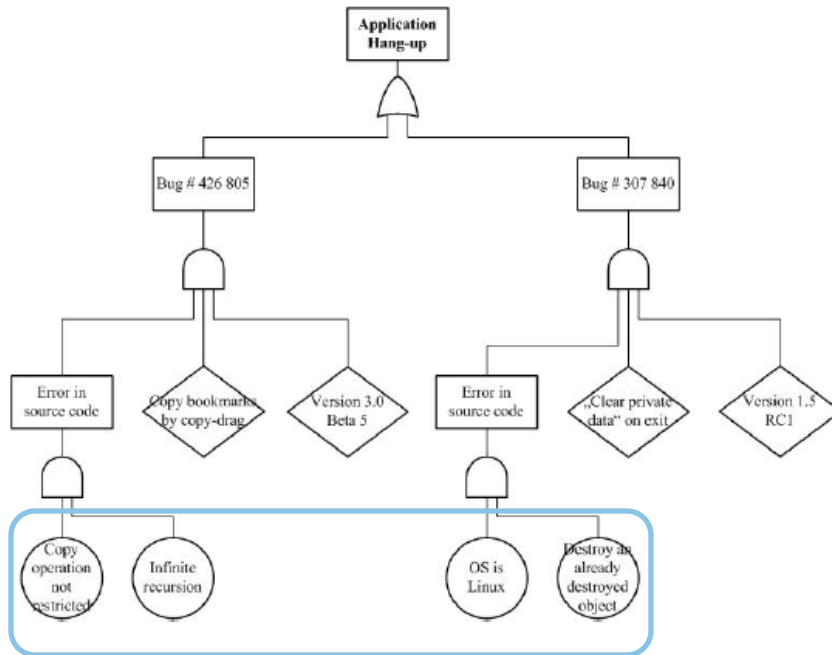
Category	Bugs in Category (Bugzilla IDs)
Crash	455283, 423226, 400744
Halt	426805, 307840
Security risk	339377, 341829
Loss of bookmarks	477739, 478258, 478258, 477739
Cannot save files	263956
Crash during installation	369221, 364710, 285283, 261734
Unable to bookmark URL	264031
Temporarily unable to access bookmarks	452469, 414715
Waste of disk space	271883
No live bookmark functionality	398398
Limited bookmark information loss	473120, 377500
Unable to search bookmarks	336488
Unable to access all tabs	475031
Focus of URL bar must be gained by click	333651
News search does not work	402508
Search engines do not work in the toolbar	342540, 341908
Limited bookmark usability	434749, 330929
Completely trivial bugs	342110, 308743, 423226, 340167, 268144, 475030, 474964 333651, 266983, 360572, 337625, 317060, 258088

Fault Trees

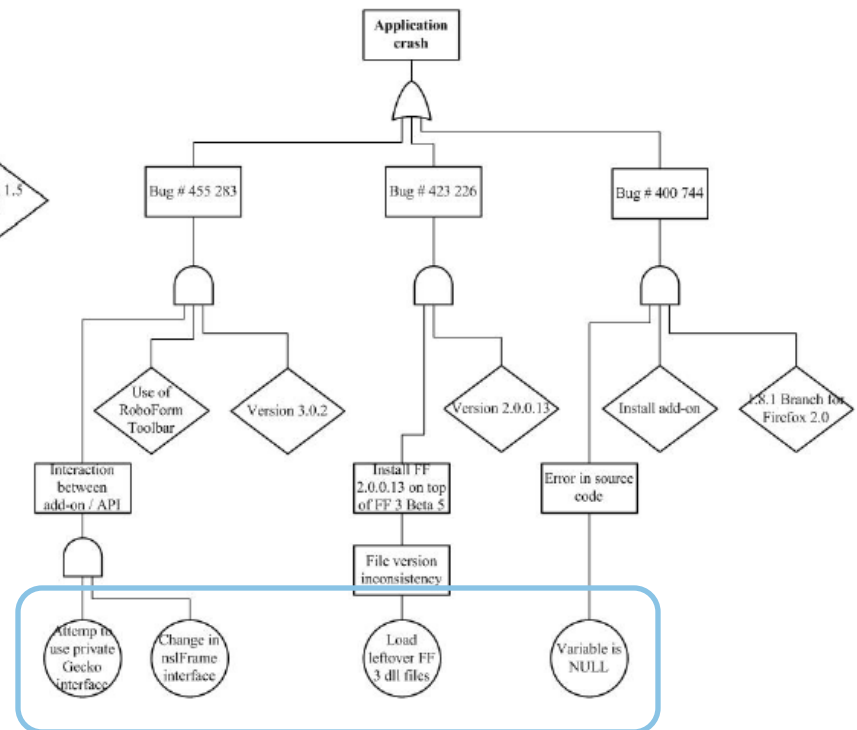


Firefox Failure Analysis

Freeze (Halt)



Crash



3. Model User Behavior

- A User Profile contains:
 - Features of a system and their purpose
 - Frequency of execution
- Each User Profile corresponds to a job specification

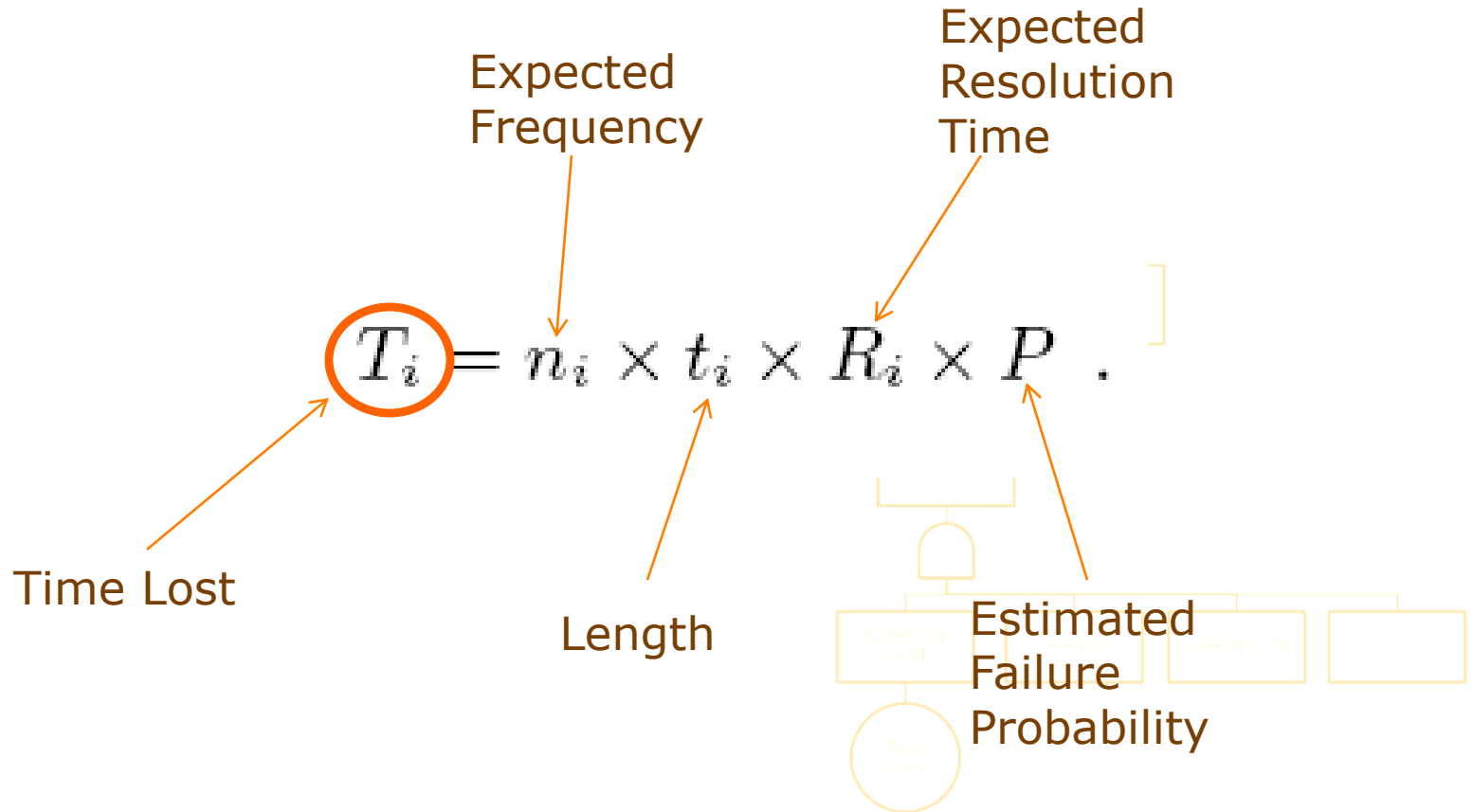


User Behavior Example

Table 2: Example User Profiles

Activity	Frequency (per week)	Length (min.)	Recovery Time (min.)
<i>User: Procurement Worker</i>			
Research offers online (e.g. compare prices)	10	30	5
Visit online shops	20	15	5
Order online	1	15	15
Use online auctions	5	15	5
<i>User: Secretary</i>			
Search for information online	10	30	5
Online banking	2	15	15
Use online dictionary	10	3	3
Online booking	2	15	15
<i>User: Marketing</i>			
Search online (e.g. competitor's pricing)	10	30	5
Create online polls	1	30	30
Update website information	2	15	15

Time Lost Per Week

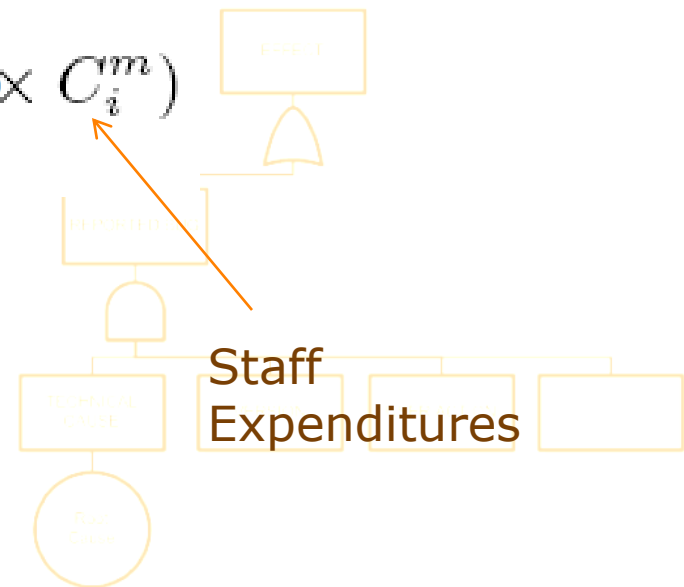


Expected Cost for the Customer

Expected
Cost for the
Customer

$$C = C^r + \sum_{i=1}^N (T_i \times C_i^m)$$

Repair Cost



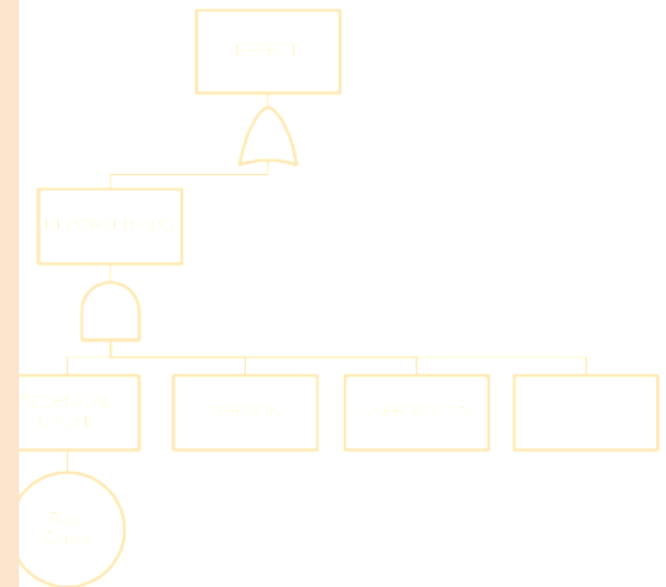
4. Calculate expected cost for the customer

- $P = \frac{1}{300}$ per hour

User	T
Procurement Worker	12 min
Secretary	8.3 min
Marketing	9.5 min

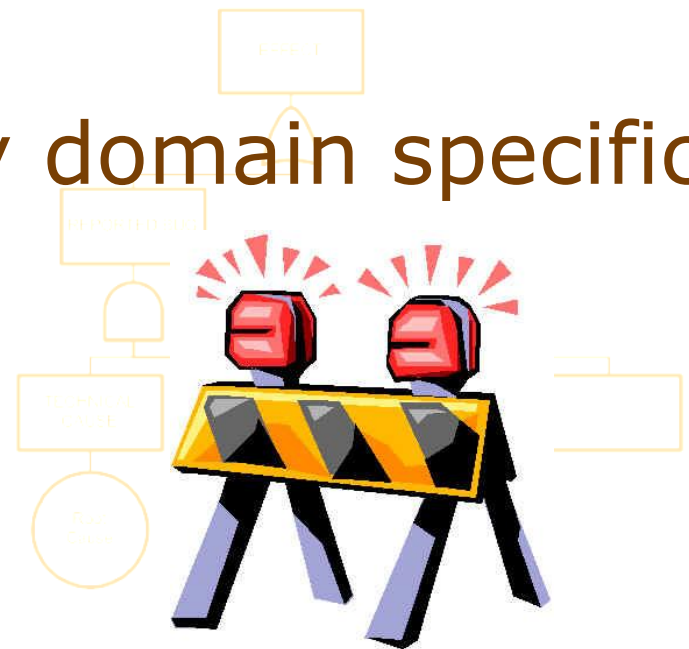
- $C^r = 0 \$$ $C^m = 100 \$$

$$\Rightarrow C = 49.67 \$$$



Assumptions and Limitations

- Producer-Consumer gap leads to limited empirical data on failure-induced cost
- Cost drivers are very domain specific
- Legal implications



Lessons Learned and Future Work

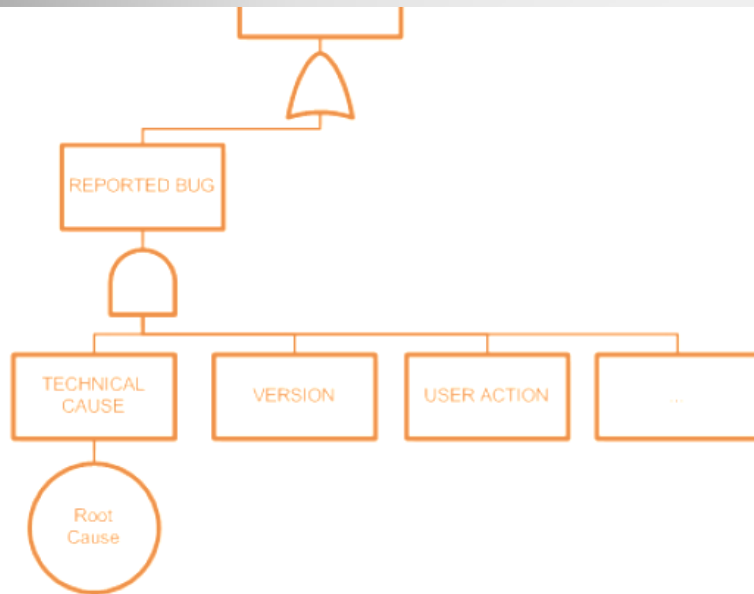
Most high impact bugs are eliminated prior to release

However, minor failure effects accumulate over time!

Include software defect prediction techniques

Industrial case study

Thank you for your attention!



Questions / Comments?