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THE HOW? WHEN? AND WHAT? FOR THE PROCESS OF RE-PLANNING FOR PRODUCT RELEASES

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SOFTWARE ENGINEERING
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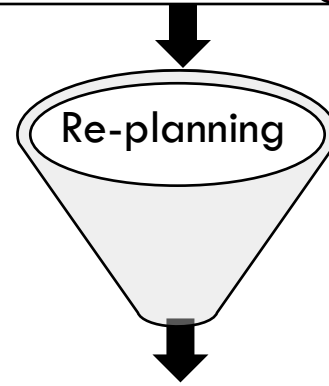
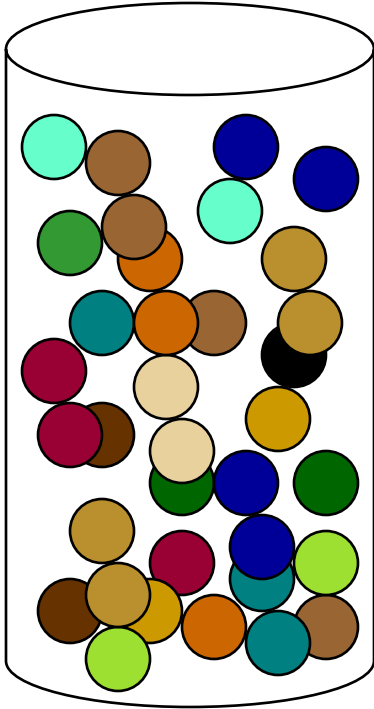
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Introduction

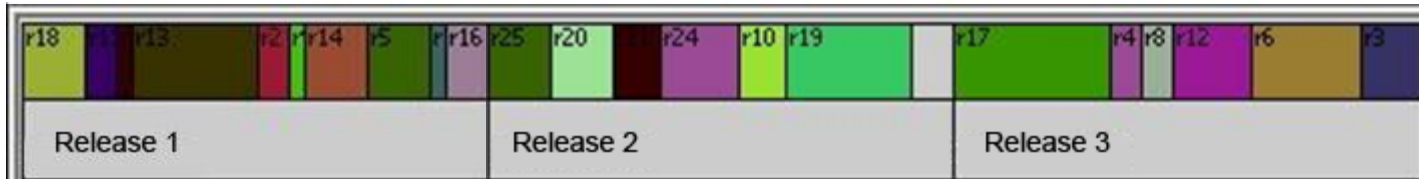
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- Release planning assigns features to a set of releases to address various constraints.
- Requirements are volatile and changing frequently during software development.
- Modifications to the baseline Release plan is needed to accommodate these changes.

Set of features/objects



New Release Plan





Motivation

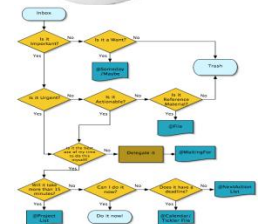
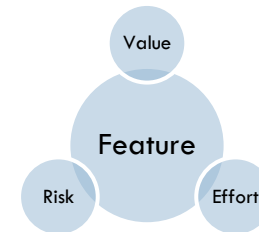
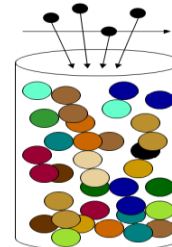
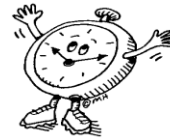
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- Changing requirements is considered as one of the major causes for software product failure[1].
- A well established process for handling re-planning of product releases is strongly needed [2,3,4].

Research Problem

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- Release period
- Release effort capacity
- Set of features
- Set of change requests
- Each feature has its own attributes
- Time to start re-planning is not known
- A well defined process to select best features is needed.
- There is allowed degree of change





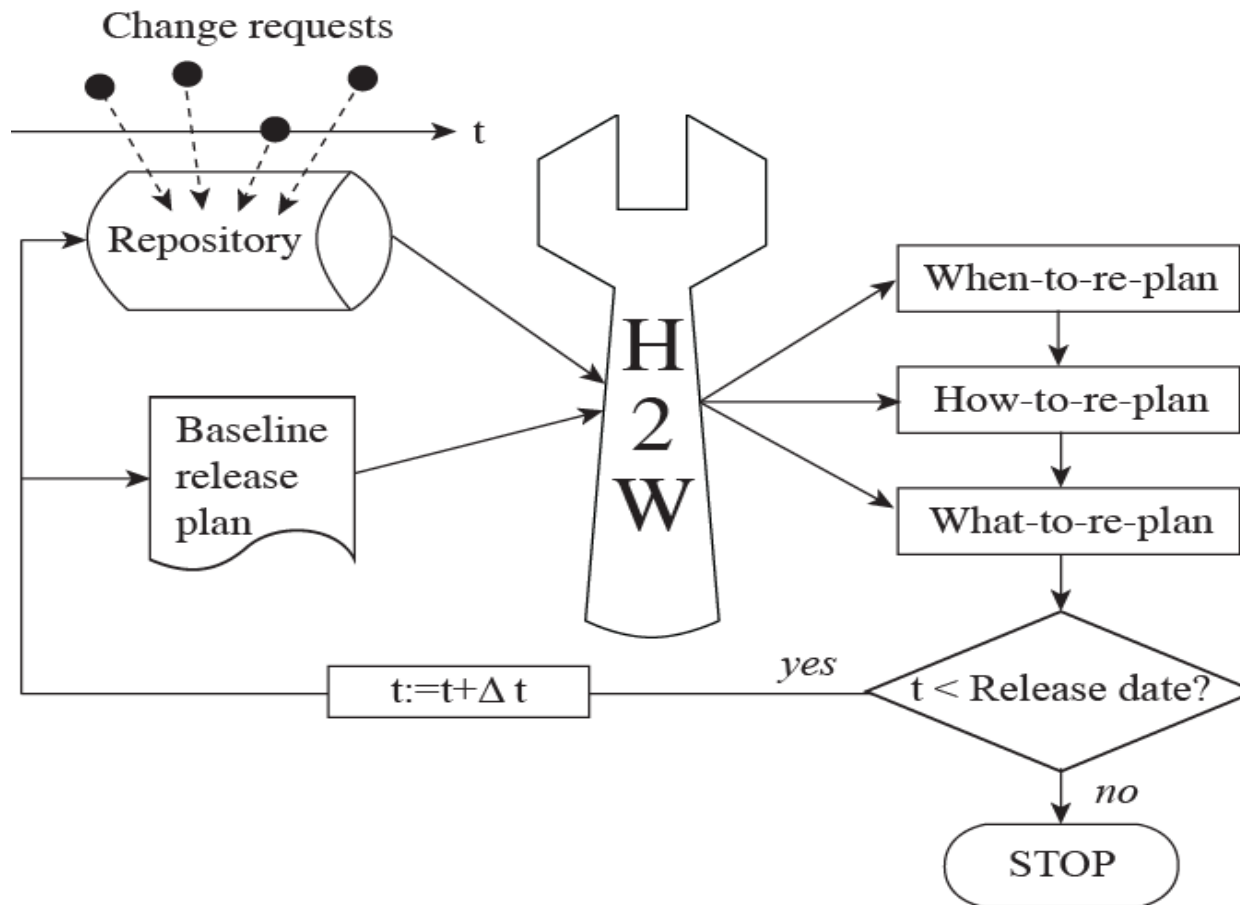
Research Focus

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- **WHEN** shall we start the re-planning process (What triggers the re-planning) ?
- **HOW** can we decide which features or change requests are most attractive to incorporate?
- **WHAT** degree of change in the already announced release plan is acceptable (How to compromise between adding more attractive features and maintaining the release stability) ?

Research Method (H2W)

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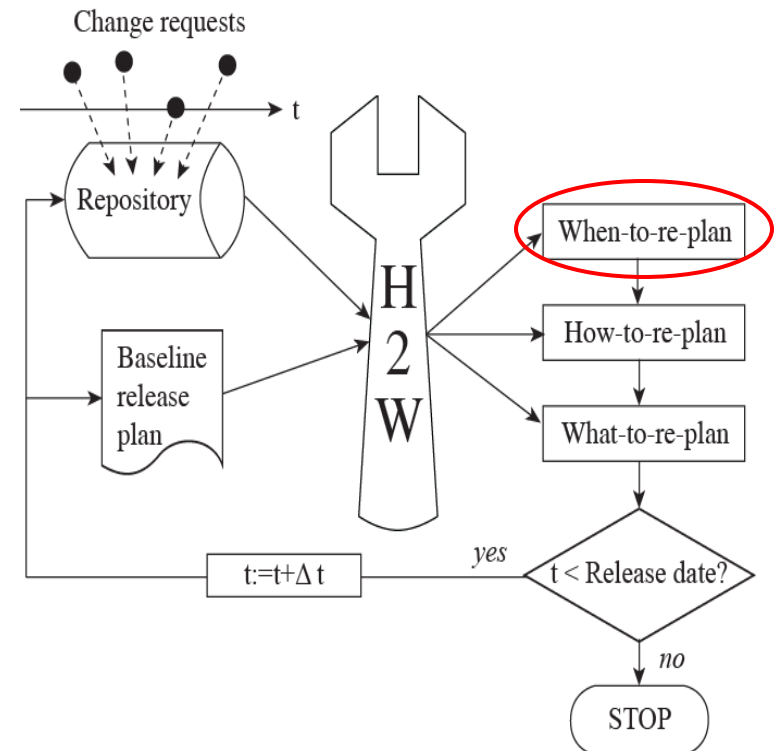




Step 1: When to Re-plan

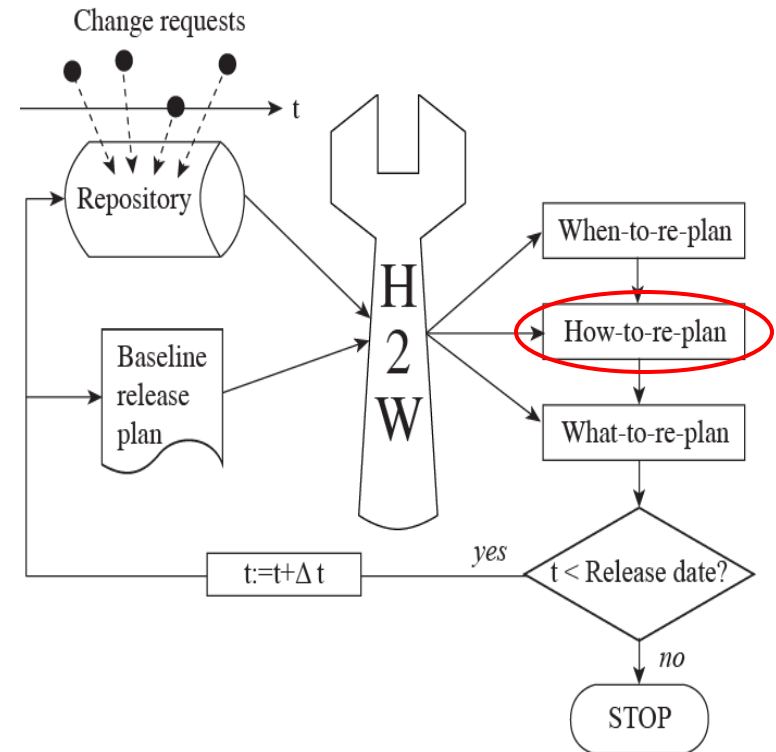
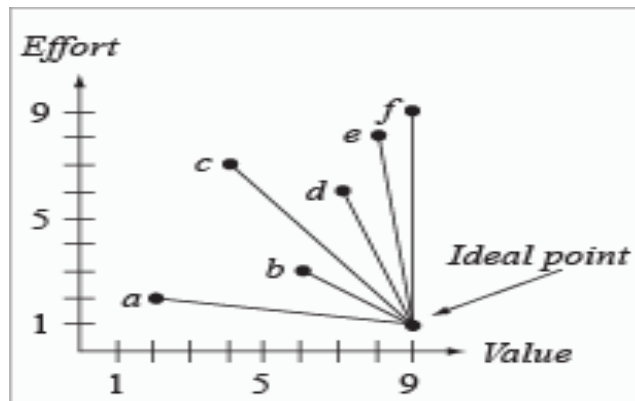
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- This decision is based on a threshold related to the accumulation of all arriving features:
 - ▣ Number of accumulated features
 - ▣ Accumulated value of these features
 - ▣ Defect slippage rate
- We consider a value based threshold (V-THRESHOLD)



Step 2: How to Re-plan

- Each feature is mapped in to a point in a three dimension space.
- Features' attributes are assumed to be as a result of experts' evaluation
- Ideal point is defined as the best artificial solution having
 - ▣ extremely high value
 - ▣ extremely low effort
 - ▣ extremely low risk

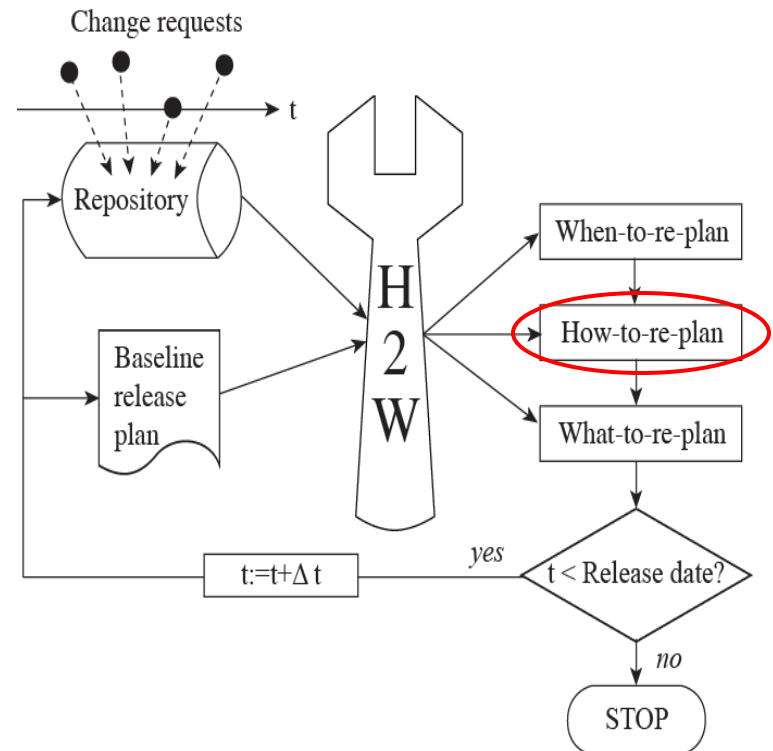




Step 2: How to Re-plan

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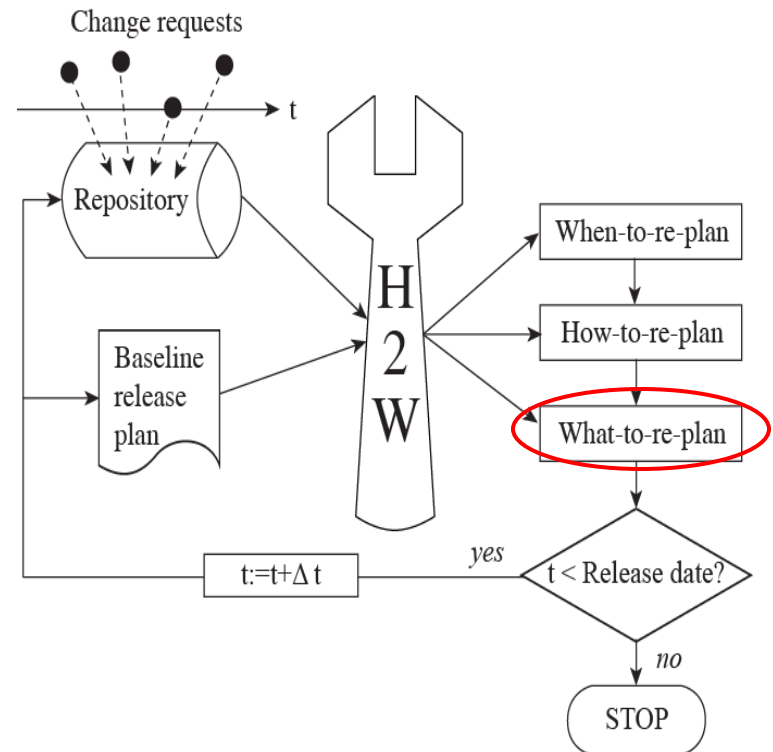
- The Euclidian distance is measured between each feature and the ideal point.
- The goal is to come as close as possible to the ideal solution
- Candidate features are ranked based on their distance to the ideal point.
- Greedy optimization is applied.

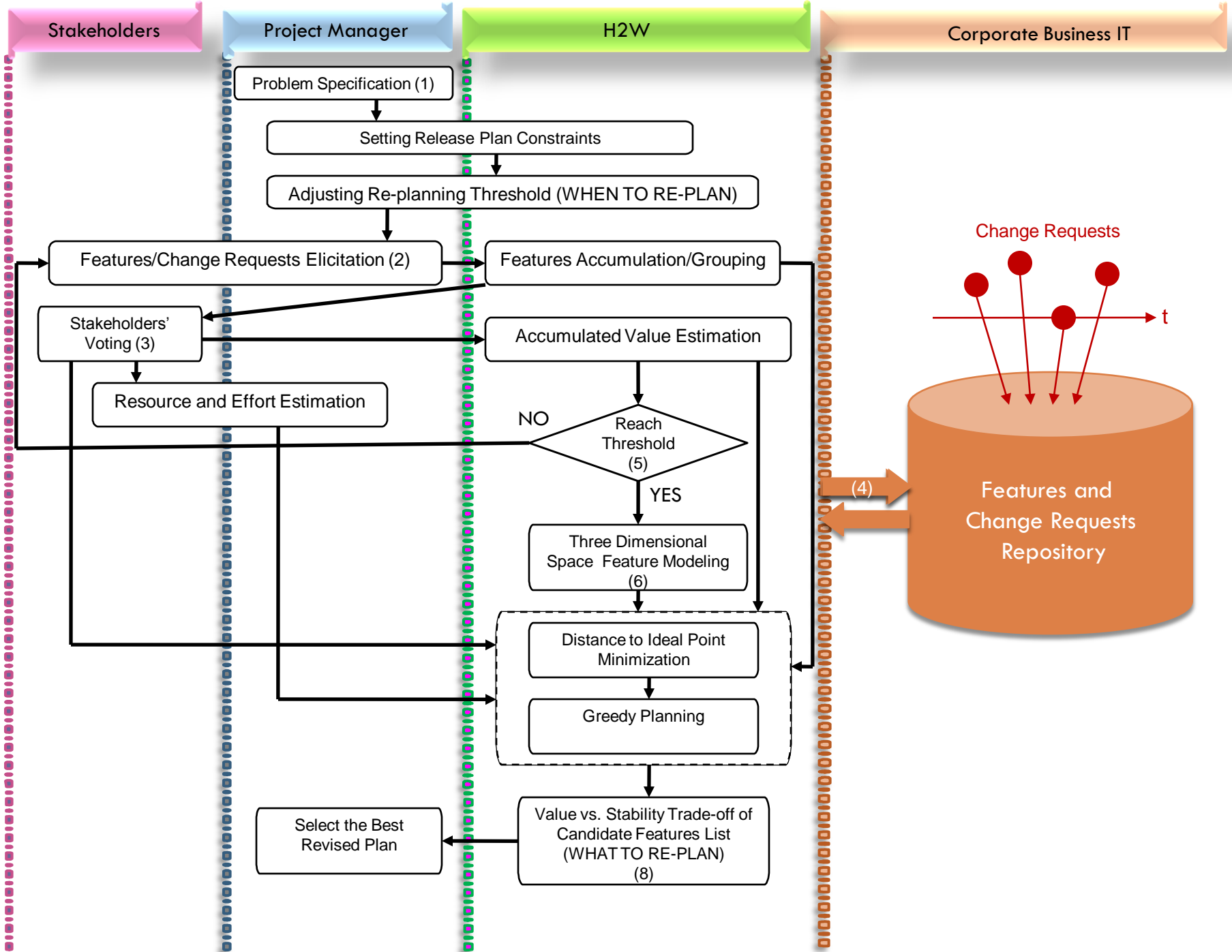


Step 3: What to Re-plan

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- The normalized increase in value is plotted against the normalized decrease in stability of the plan.
- Stability is defined in terms of the number of features changed relative to the total number of possible modifications.
- The point of intersection determines the best number of features to exchange.








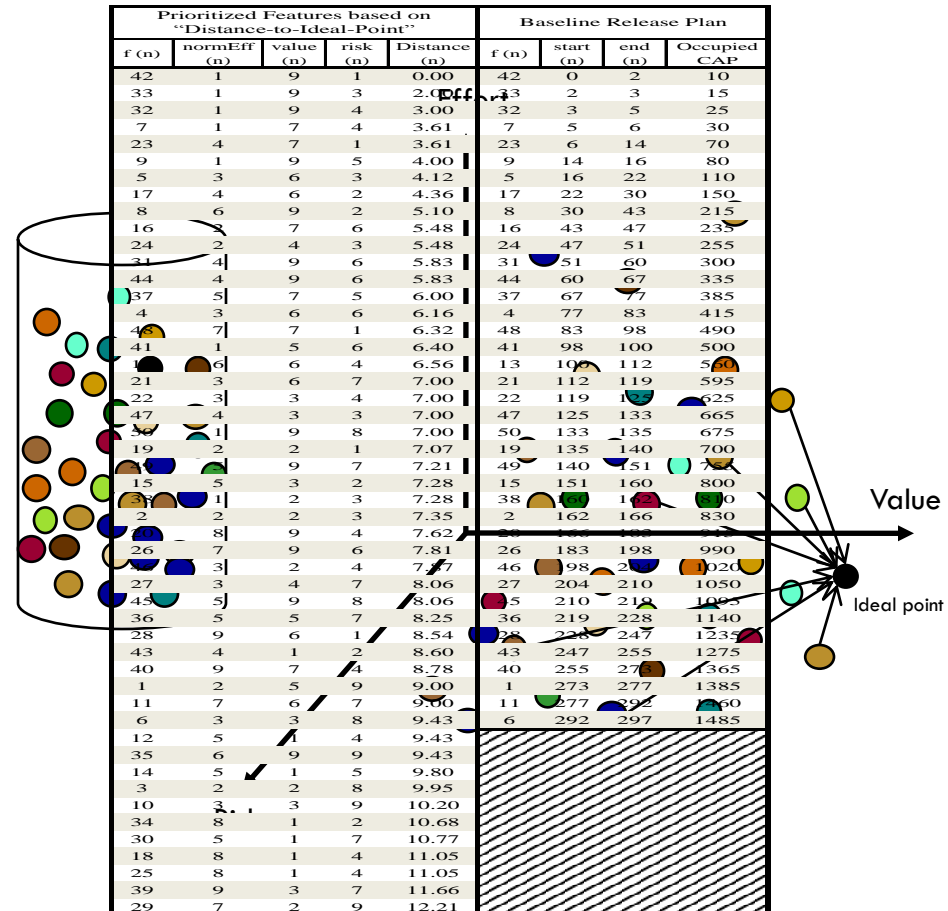
Case Study

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- The studied problem is based on real world data for planning a project for Expert Decision Inc.
- Project: Decision support tool ReleasePlanner® 
- It involves the following initial problem parameters:
 - ▣ Set of fifty features;
 - ▣ Release start time, $T1 = 0$;
 - ▣ Release end time, $T2 = 300$;
 - ▣ Effort capacity, $CAP = 1500$.

Baseline planning

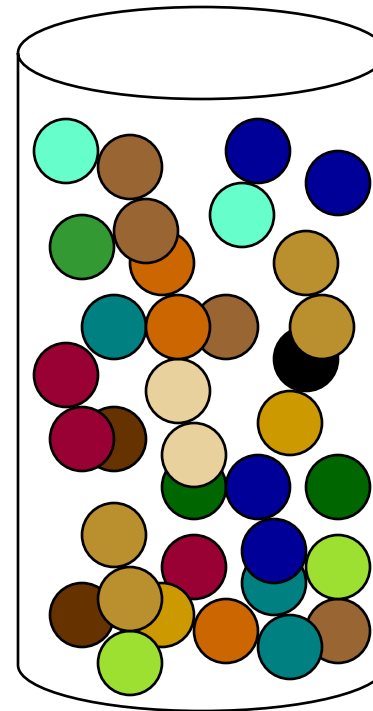
- Each Feature is mapped in to a point in three dimensional space.
- Distance-to-Ideal-Point minimization was applied to rank features.
- Greedy planning was used to select features.
- This results in 39 features to be accommodated in the next release.
- A total of 11 features are rejected from the baseline plan.
- A release value of 236 can be achieved.



STEP 1: When to Re-plan

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- Value based threshold triggers re-planning.
- V-THRESHOLD value is 25% of the baseline release plan.
- 20 change request were stochastically generated to simulate real world situation.



Change Requests					
f(n)	effort (n)	value (n)	risk (n)	time (n)	Cumulative value (n)
51	83	9	3	10	9
52	65	2	4	11	11
53	96	8	3	42	19
54	96	5	8	43	24
55	45	9	8	68	33
56	67	2	8	77	35
57	70	8	7	105	43
58	67	3	7	118	46
59	31	2	2	142	48
60	71	4	9	150	52
61	47	5	8	165	57
62	22	5	5	194	62
63	73	8	4	204	70
64	67	3	2	210	73
65	97	4	6	239	77
66	77	4	6	248	81
67	90	9	6	275	90
68	19	4	8	281	94
69	83	3	9	288	97
70	23	4	6	292	101

STEP 2: How to Re-plan

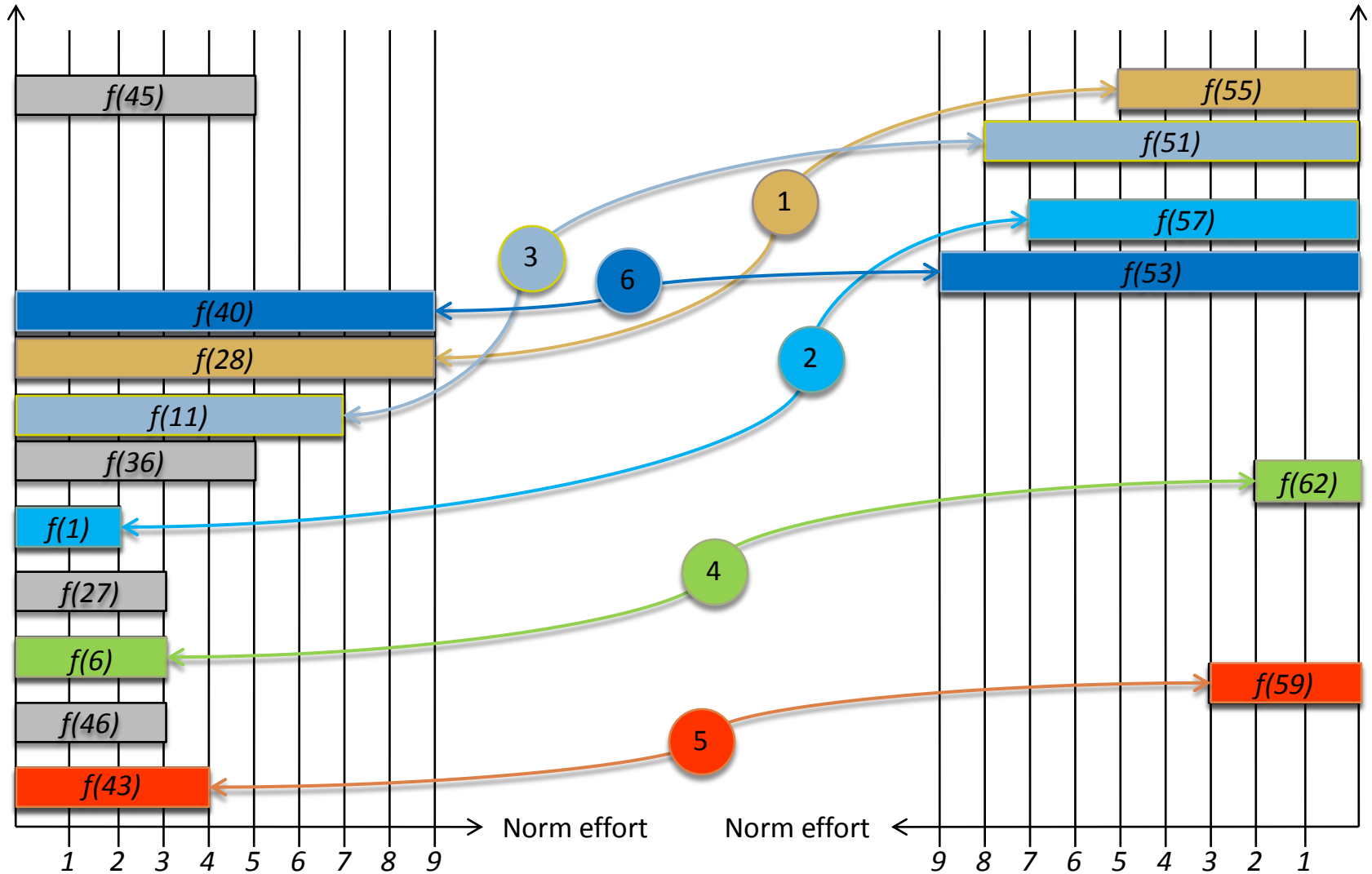
At the time of re-planning:

- 29 out of 39 features were implemented.
- The remaining effort Capacity was 510
- Rank candidate features and change requests by their distance to ideal point.
- Greedy optimization is applied again.

Prioritized Candidates at Re-planning Point Based on "Distance-to-Ideal-Point"					Prioritized Candidates at Re-planning Point Based on "Distance-to-Ideal-Point"				
f (n)	normEff (n)	value (n)	risk (n)	Distance (n)	f (n)	normEff (n)	value (n)	risk (n)	Distance (n)
62	2	5	5	5.74	6	3	3	8	9.43
51	8	9	3	7.28	12	5	1	4	9.43
59	3	2	2	7.35	35	6	9	9	9.43
46	3	2	4	7.87	14	5	1	5	9.80
27	3	4	7	8.06	3	2	2	8	9.95
45	5	9	8	8.06	10	3	3	9	10.20
55	5	9	8	8.06	58	7	3	7	10.39
36	5	5	7	8.25	34	8	1	2	10.68
53	9	8	3	8.31	30	5	1	7	10.77
28	9	6	1	8.54	18	8	1	4	11.05
57	7	8	7	8.54	25	8	1	4	11.05
43	4	1	2	8.60	60	7	4	9	11.18
40	9	7	4	8.78	54	9	5	8	11.36
1	2	5	9	9.00	56	7	2	8	11.58
11	7	6	7	9.00	39	9	3	7	11.66
61	5	5	8	9.00	29	7	2	9	12.21
52	6	2	4	9.11					

Features ranked by their value

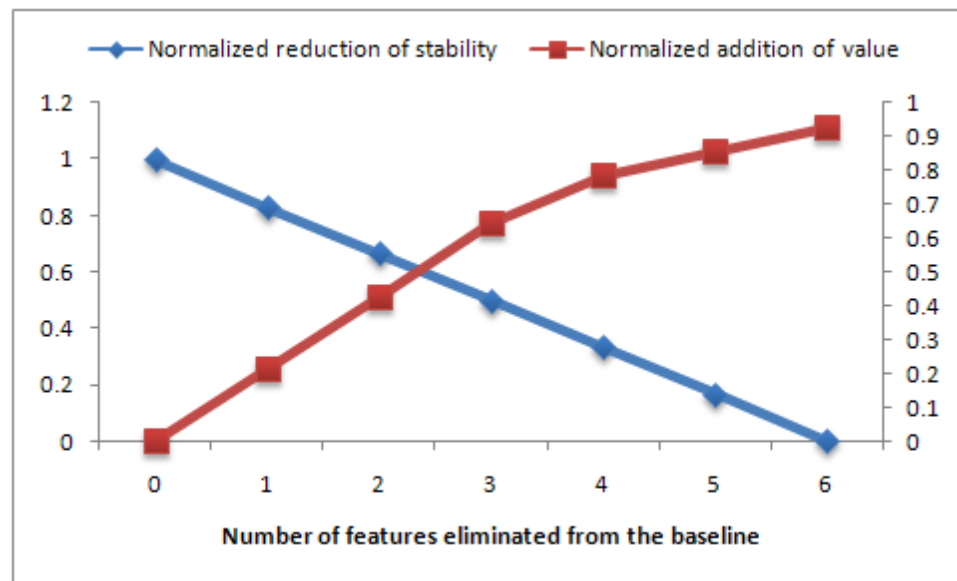
Features ranked by their value



STEP 3: What to Re-plan

□ Compromising the added value with the degree of Change

Number of features eliminated from baseline	Set of eliminated features	Set of replacement features	Added value
1	{28}	{55}	3
2	{28,1}	{55,57}	3+3
3	{28,1,11}	{55,57,51}	3+3+3
4	{28,1,11,6}	{55,57,51,62}	3+3+3+2
5	{28,1,11,6,43}	{55,57,51,62,59}	3+3+3+2+1
6	{28,1,11,6,43,40}	{55,57,51,62,59,53}	3+3+3+2+1+1





Conclusion

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- Re-planning is important, otherwise significant information is not taken into account
- The usefulness of this approach is that it:
 - ▣ Provides a comprehensive method for re-planning.
 - ▣ Allows easy and quick re-planning for problems of at least 50 + 20 features.
 - ▣ Compromises between common issues in re-planning (value-based plans) and practical managers concerns (changing announced plan)
- Limitations of the internal validity of the results :
 - ▣ Simplified model for representing the effort.
 - ▣ Some form of operational planning needs to be in place to track features status at re-planning time.
 - ▣ The greedy optimization may not necessarily produce optimal results



Future Work

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- Considering dependencies between features.
- Creating additional functionality Vs. stabilizing the existing code and fixing detected defects.
- Considering other types of re-planning thresholds.
- Investigate the sensitivity of solutions depending on determined threshold value.
- Industrial evaluation of the H2W method.
- Tool support for H2W method.



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