Using Bug Databases for Software Engineering Estimation











Thomas Zimmermann





Software Engineering Chair

Saarland University Saarbrücken, Germany

Development vs. Debugging

Development vs. Debugging



Software Development is a construction process...

Development vs. Debugging



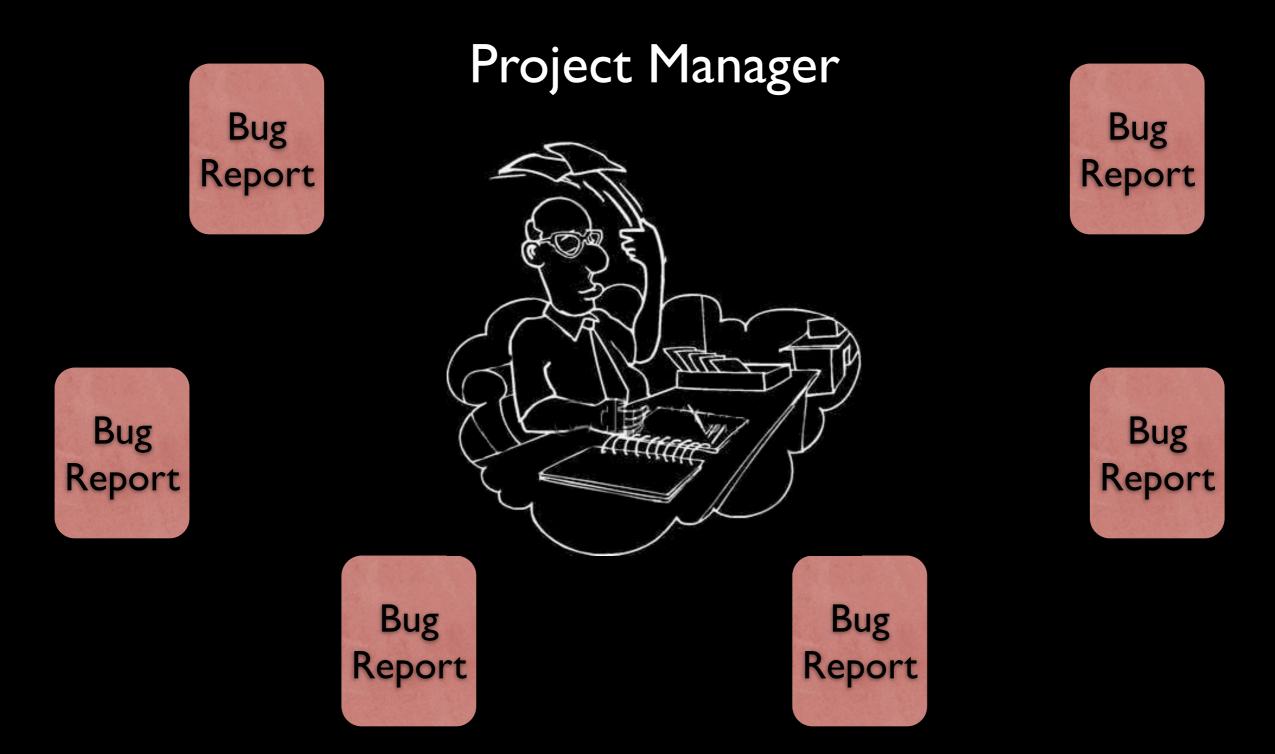
Software Development is a construction process...

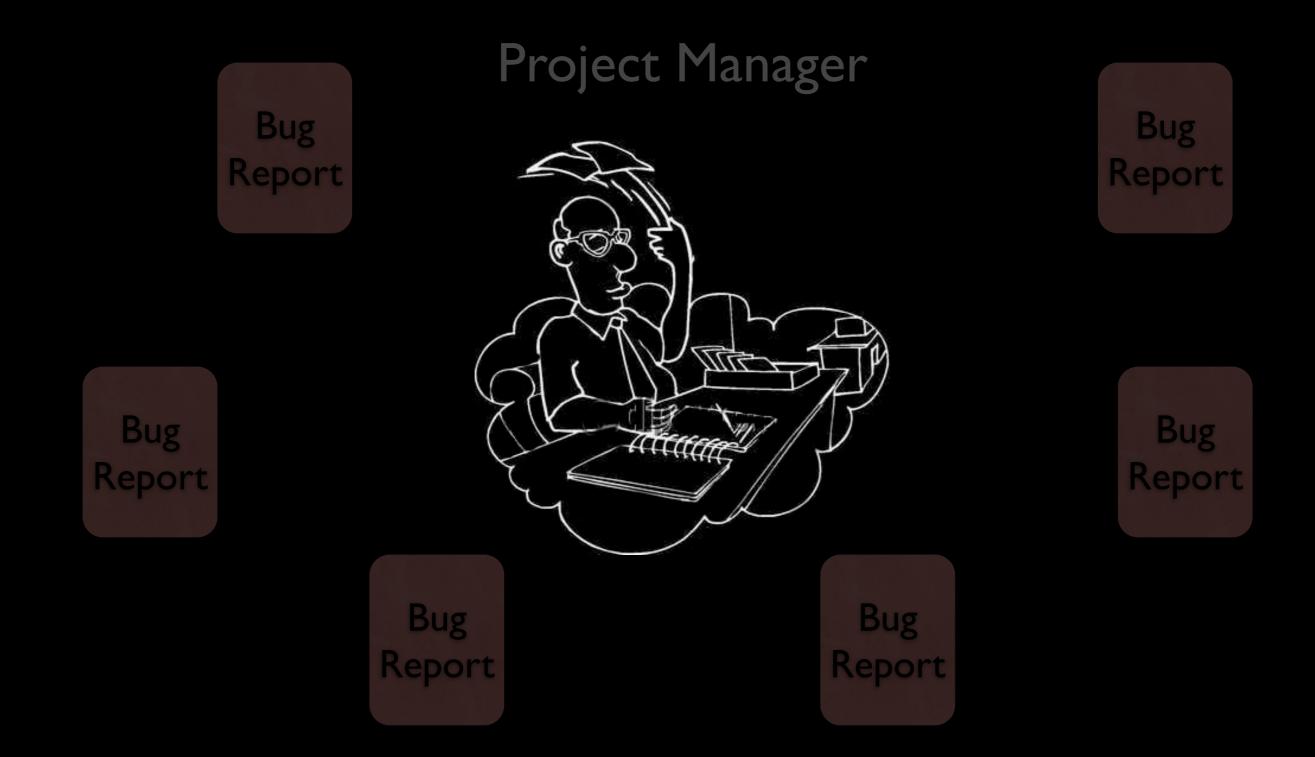


Debugging is a search process...

Project Manager







Project Manager



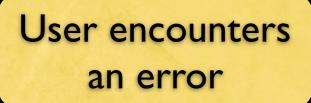
How long will it take to fix a bug?

Rug



User encounters an error



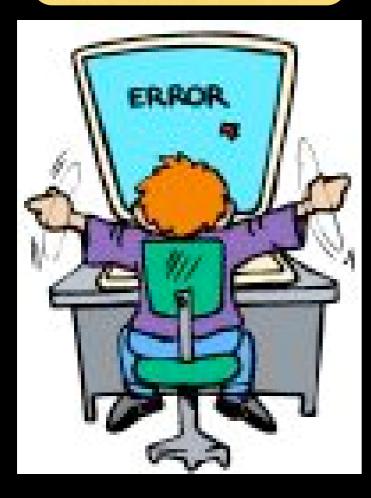


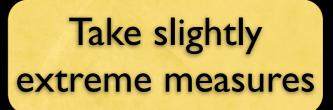
















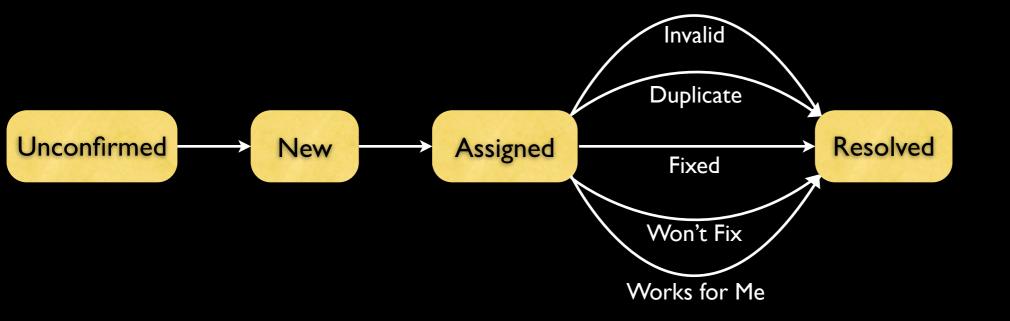


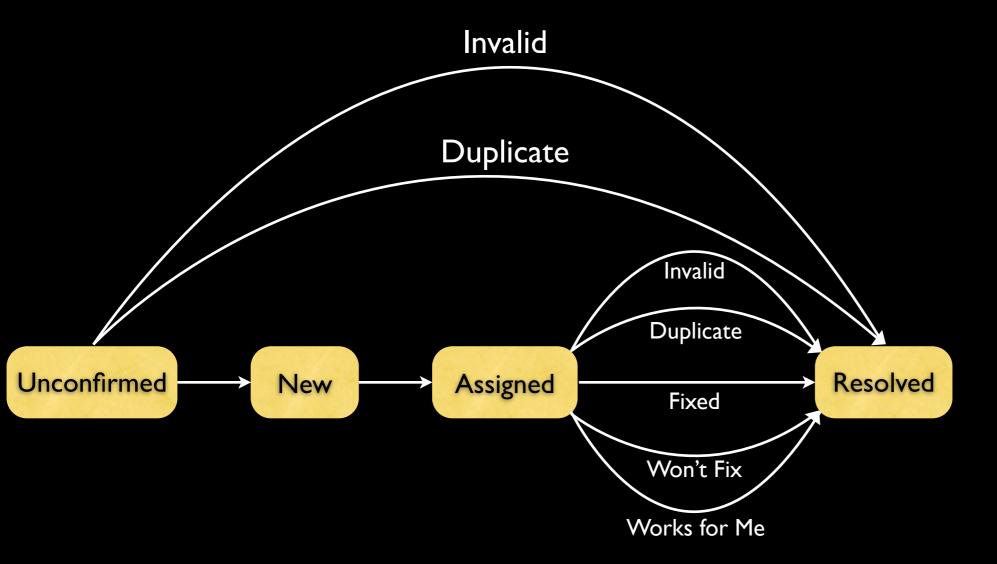


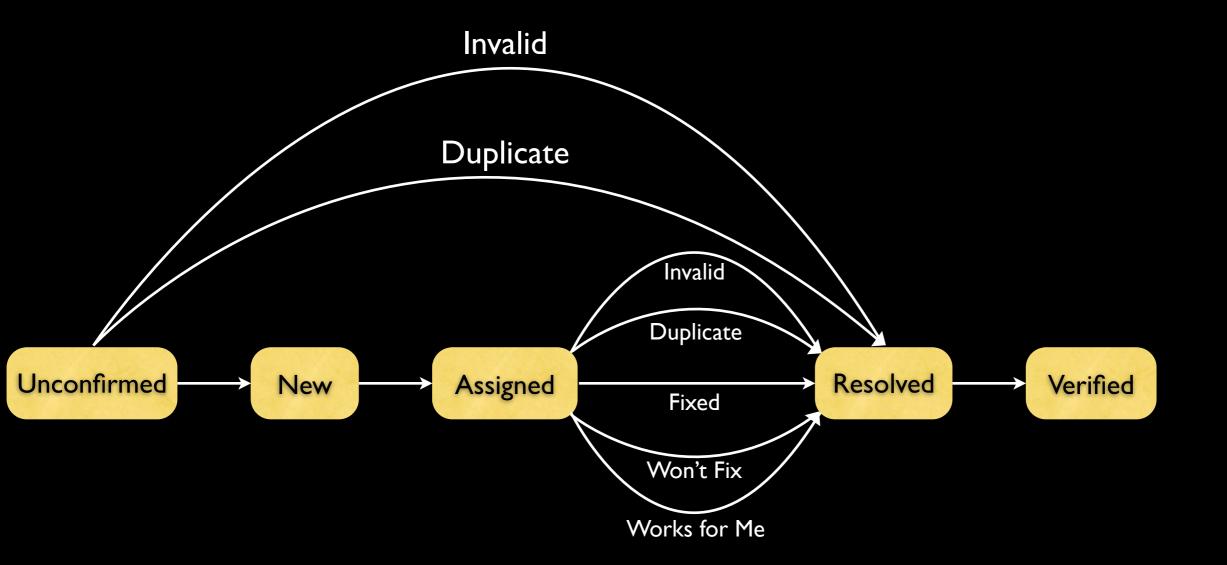
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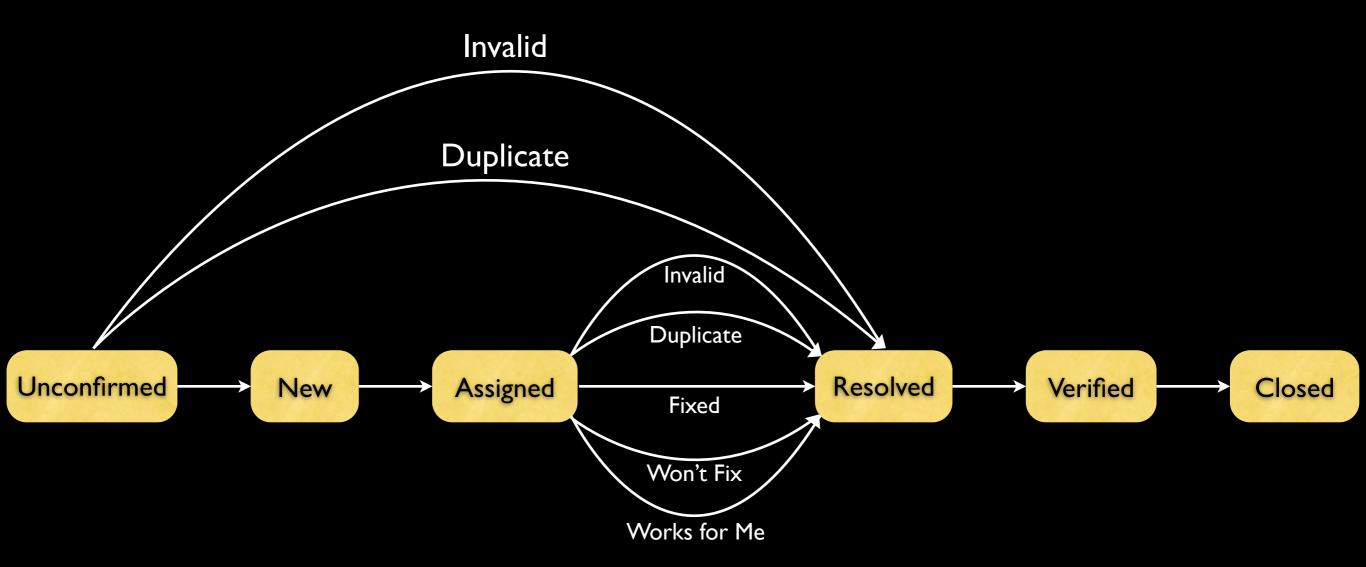


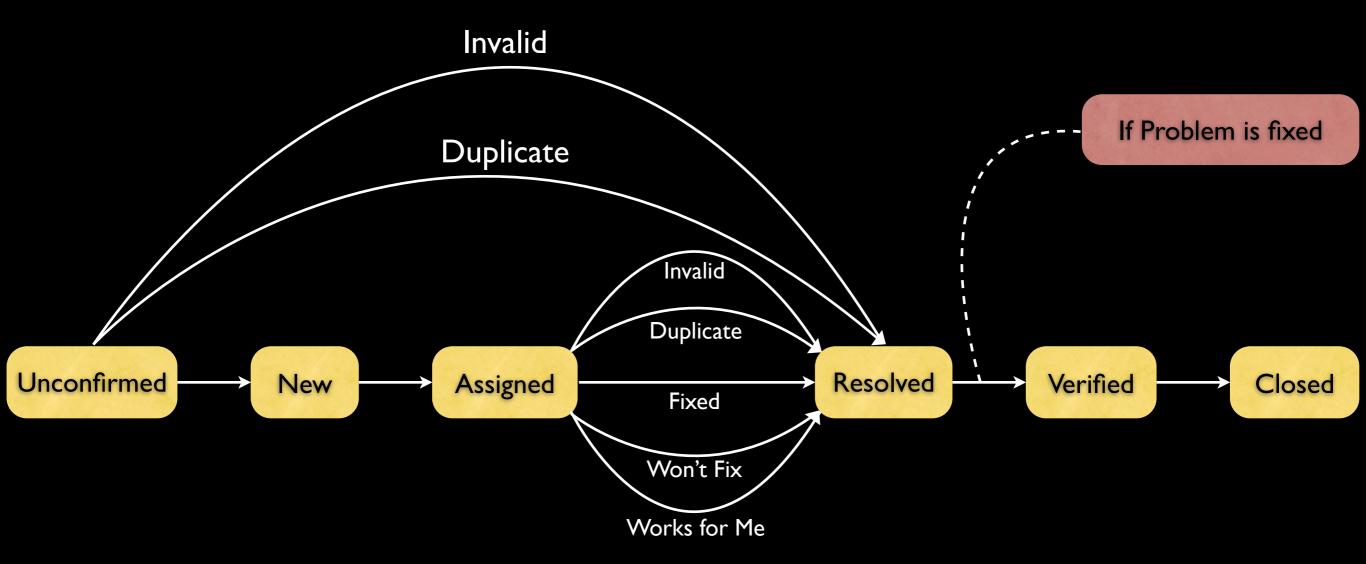


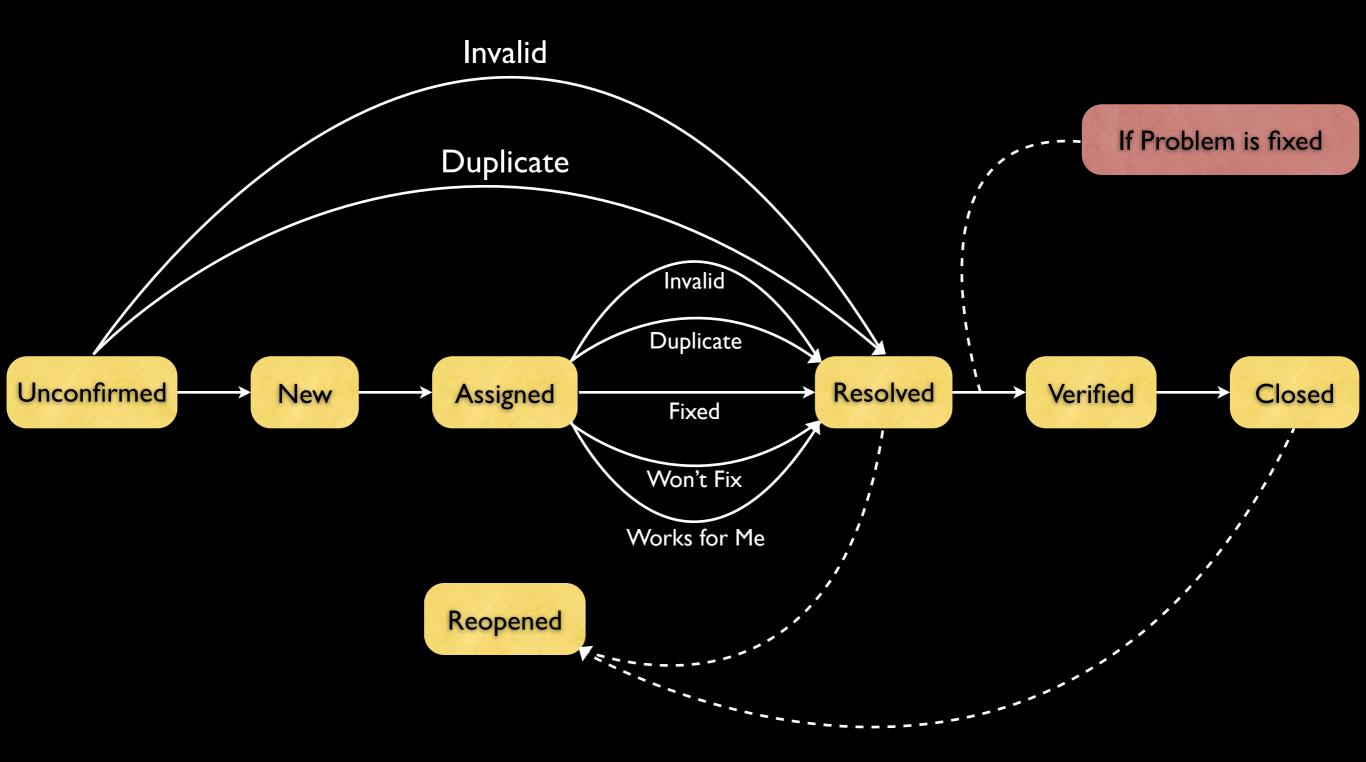


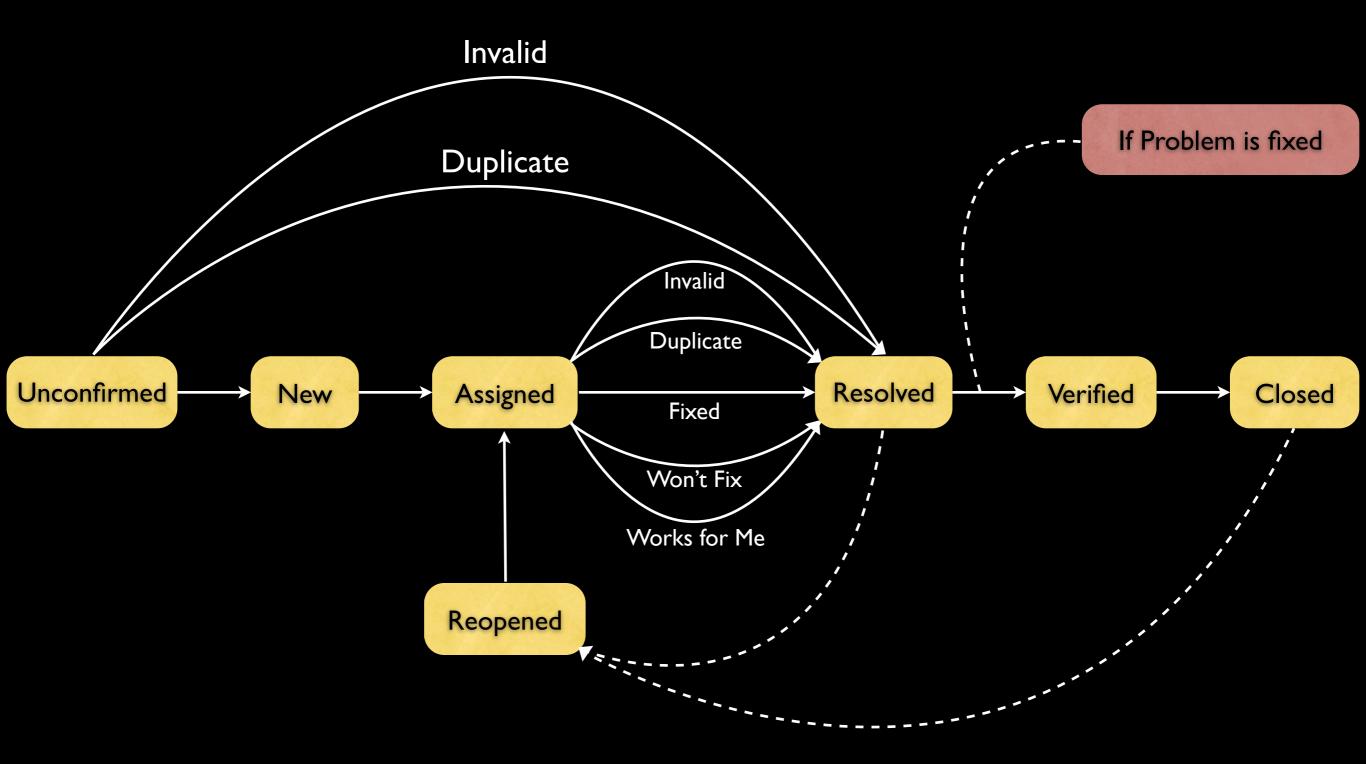


















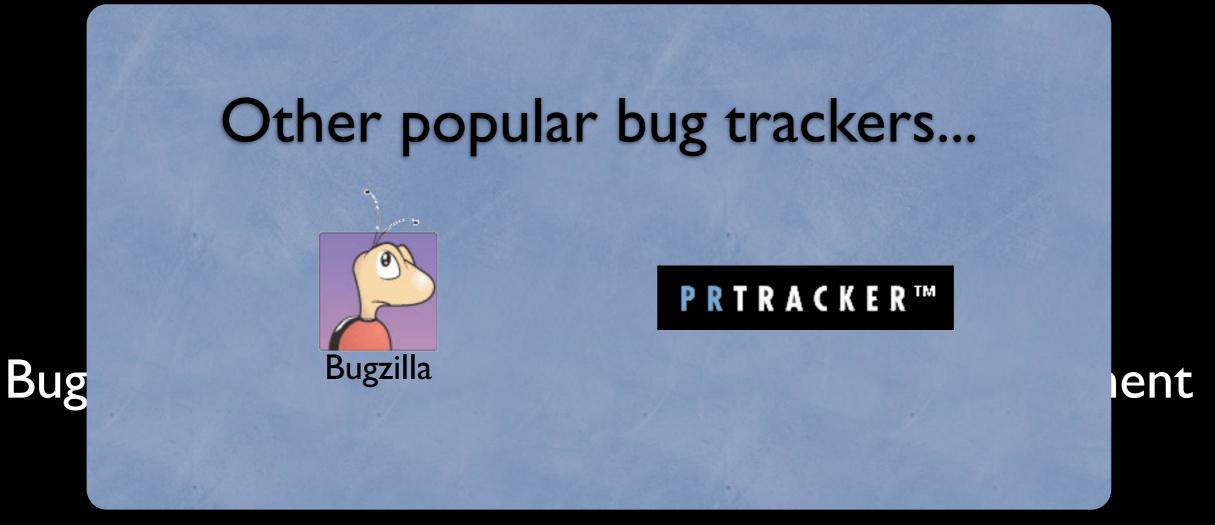


A commercial tool for



Bug Tracking, Issue Tracking and Project Management

Developed by Atlassian <u>www.atlassian.com/software/jira</u>



Developed by Atlassian <u>www.atlassian.com/software/jira</u>

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Issue Details		JBoss Application Server						A Return to search	
-	JBAS-3054	¹ Use of isUserInRole from		vork for JACC					
	Bug	Created: 04/Apr/06 03:17 PM Updated: 22//							
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Resolution:		Affects Version/s:	Affects Version/s: JBossAS-4.0.4.CR2						
	Major Apil Soldboop	Fix Version/s:	JBossAS-5.0.0.Beta,	I, JBossAS-4.0.4.GA					
	Anil Saldhana	Security Level:	Public (Everyone can	a see)					
	Scott M Stark 0								
Watchers:	-	Original Estimate:	4 hours	Remaining Estimate:		ninutes	Time Spent:	1 day, 2 hours	
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		Description						<u>« Hid</u>	
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		Dimitris Andreadis [14/Apr/06 05:50 AM]						[<u>Permlink</u> <u>« Hide</u>	
		Anil, wanna take it?							
		Anil Saldhana [20/Apr/06 02:13 PM]						[<u>Permlink</u> <u>« Hide</u>	
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		Please refer to the forum thread for mor	re details.						
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		Resolved for 4.0.4.GA. Needs to be resolved for jboss-head.							
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		Scott pointed out something that was ar	ddressed in the Appendi	lix B section of the Jacc specification. So the	this issue needs a s	short revisit.			
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Issue Detail										
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Resolution:		Affects Version/s: JBossAS-4.0.4.CR2								
Priority:	û Major	Fix Version/s:	JBossAS-5.0.0.B	Beta, JBossAS-4.0.4.GA						
	Anil Saldhana	Security Level:	Public (Everyone	can see)						
Reporter: Votes:	Scott M Stark									
Watchers:	°	Original Estimate:	4 hours	Remaining Estimate:	0 minute	S Time S	Spent:	1 day, 2 hours		
Operations		Environment:	org.jboss.test.we	eb.test.UserInRoleUnitTestCase(JACC	C).testConflictingUserInRole					
If you were l	ogged in you would be more operations.	JBoss Forum Reference:	http://www.jboss.	.com/index.html?module=bb&op=view	vtopic&t=81475					
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		Use of isCallerInRole from a jsp page need to create such a permission ma		e (javax.security.jacc.WebRoleRefPern ml security-role element.	nission jsp X) permission refere	ences the page as via the	e name "jsp" and there is n	o default mapping for this. We		
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Type:	Bug	Use of isUserInRole from Created: 04/Apr/06 03:17 PM Updated: 22/Apr/		Ork for JACC					
Status:	Resolved	Component/s:	Security, Web (Tomca	at) service					
Resolution:	Done	Affects Version/s:	JBossAS-4.0.4.CR2						
Priority:	û Major	Fix Version/s:	JBossAS-5.0.0.Beta,	JBossAS-4.0.4.GA					
Assignee:	Anil Saldhana	Security Level: Public (Everyone can see)							
Reporter:	Scott M Stark			, 			<i>a</i>	· · · · · · · · · · · · · · · · · · ·	
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Status: Resolution: Priority:	Resolved Done Major	Component/s: Affects Version/s:	Security, Web (To JBossAS-4.0.4.Cl	<u>R2</u>				
Assignee: Reporter:	Anil Saldhana Scott M Stark	Fix Version/s: Security Level:	Public (Everyone of	eta, <u>JBossAS-4.0.4.GA</u> can see)				
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Resolution:	-	Affects Version/s:	JBossAS-4.0.4.CF				
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Assignee:	Anil Saldhana	Security Level:	Public (Everyone c		ffort Data		
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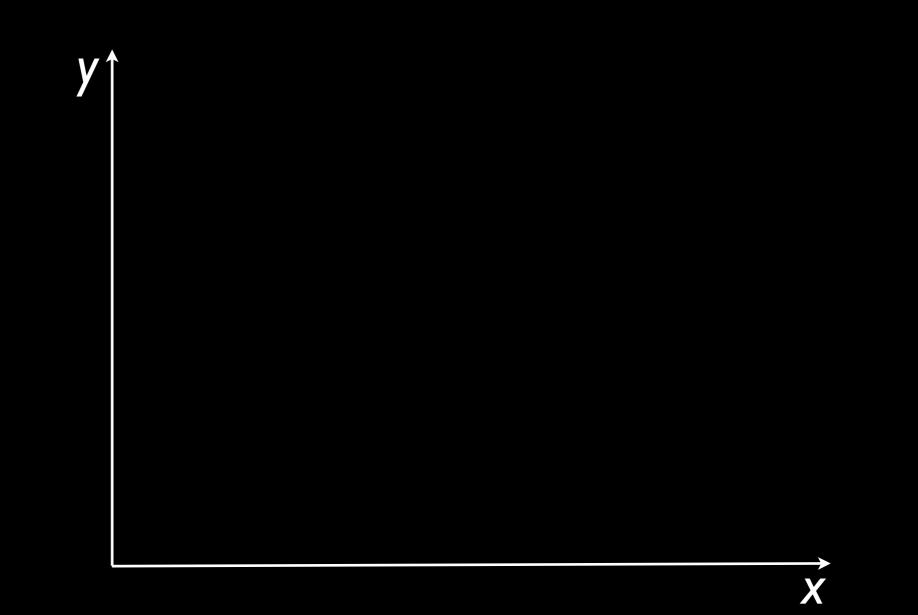
Case Based Prediction

Case Based Prediction

Similar problems have similar solutions...

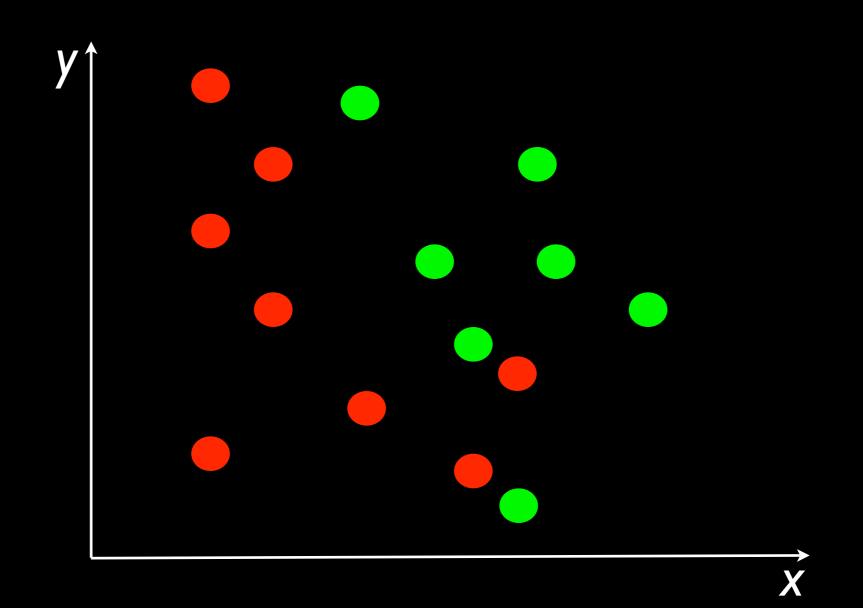
Case Based Prediction

Similar problems have similar solutions...



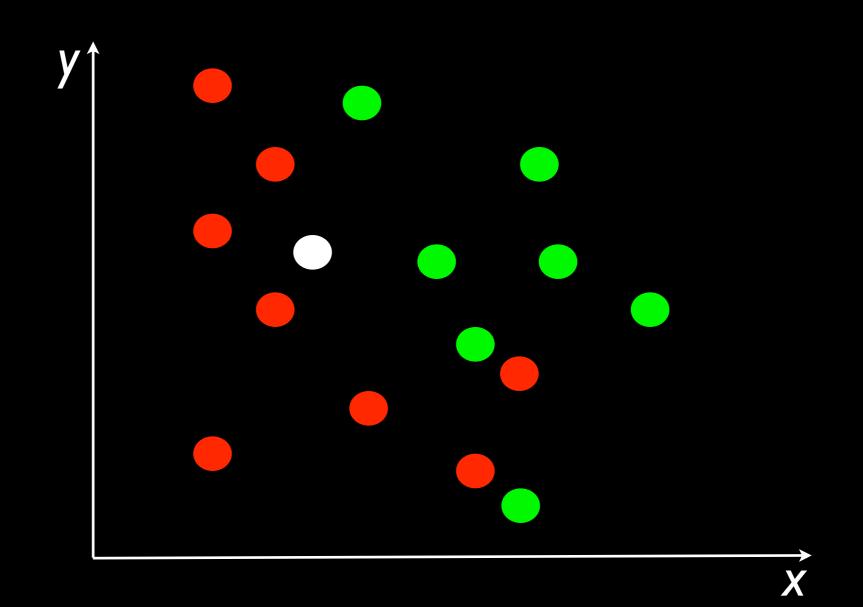
Case Based Prediction

Similar problems have similar solutions...



Case Based Prediction

Similar problems have similar solutions...



Input Data

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-	JBAS-3054 Bug	JBoss Application Server		work for JACC				Return to search
Status: Resolution:	Resolved Done	Component/s: Affects Version/s:	Security, Web (Ton JBossAS-4.0.4.CR					
	Major Anil Saldhana	Fix Version/s:	JBossAS-5.0.0.Bet	a, JBossAS-4.0.4.GA				
Reporter:	Scott M Stark	Security Level:	Public (Everyone ca					
Votes: Watchers:	0	Original Estimate:	4 hours	Remaining Estimate:	0 minutes	Time Spent:	1 day, 2 ho	urs
Operations	U	Environment:	org.jboss.test.web.	test.UserInRoleUnitTestCase(JACC).t	estConflictingUserInRole			
If you were lo	ogged in you would t nore operations.	JBoss Forum Reference:	http://www.jboss.co	om/index.html?module=bb&op=viewto	pic&t=81475			
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Input Data

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	JBAS-3054 Bug Resolved	JBoss Application Server → Use of isUserInRole Created: 04/Apr/06 03:17 PM Updated		work for JACC			A Return to search
Resolution: De Priority: 1 Assignee: A		Component/s: Affects Version/s: Fix Version/s: Security Level:	Security, Web (To JBossAS-4.0.4.CF	R2 eta, JBossAS-4.0.4.GA			
Votes: 0	1	Original Estimate:	4 hours	Remaining Estimate:	0 minutes	Time Spent:	1 day, 2 hours
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a text similarity computing tool



a text similarity computing tool

developed by

The Apache Software Foundation <u>http://www.apache.org</u>



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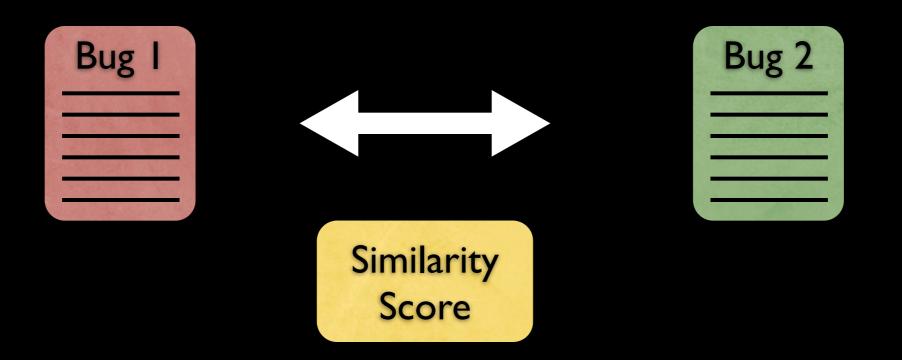


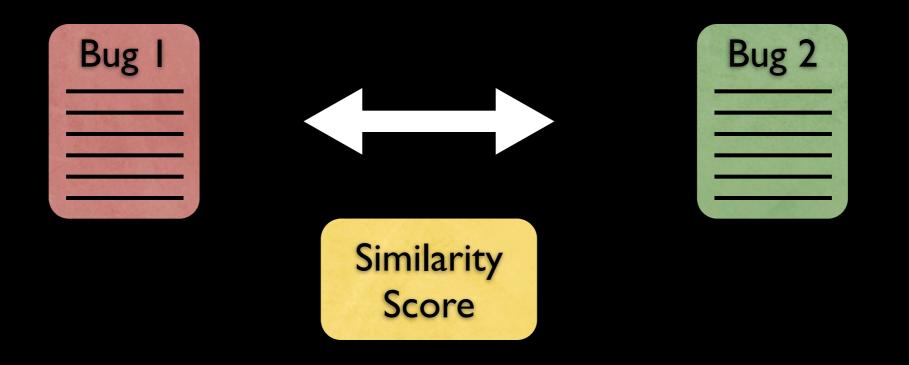




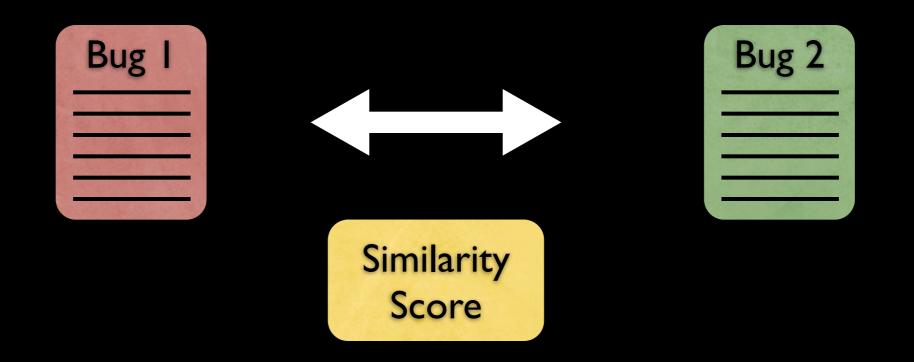






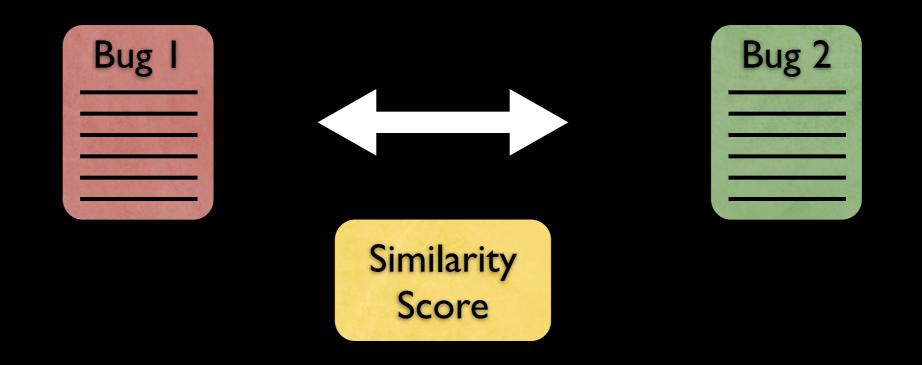






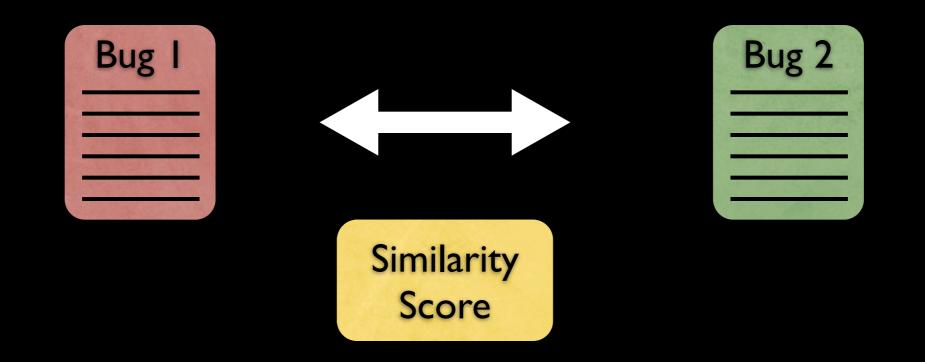
Stemming

educate: educating, education, educated



Field Comparison

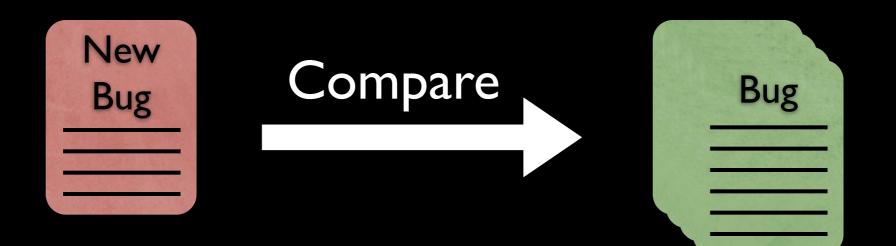
title: "The Right Way" AND text: "go"

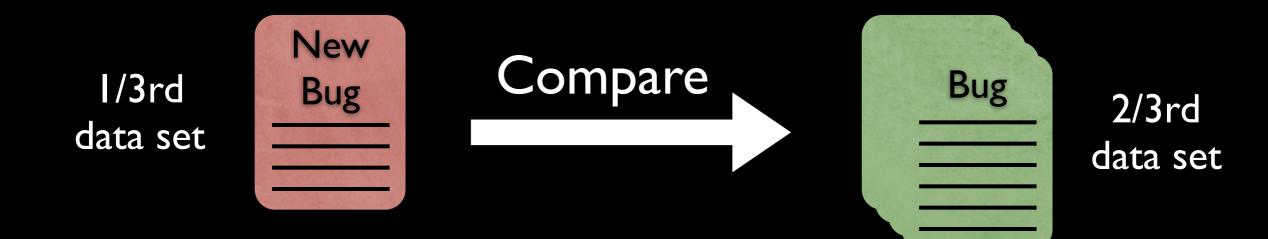


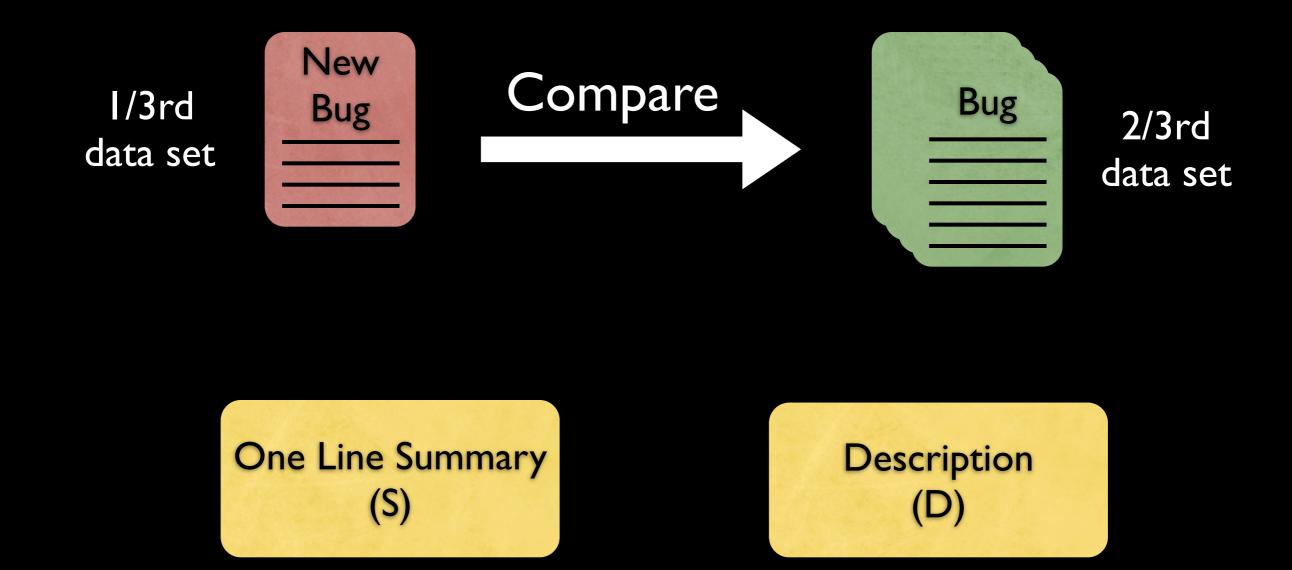
Fuzzy and Wildcard

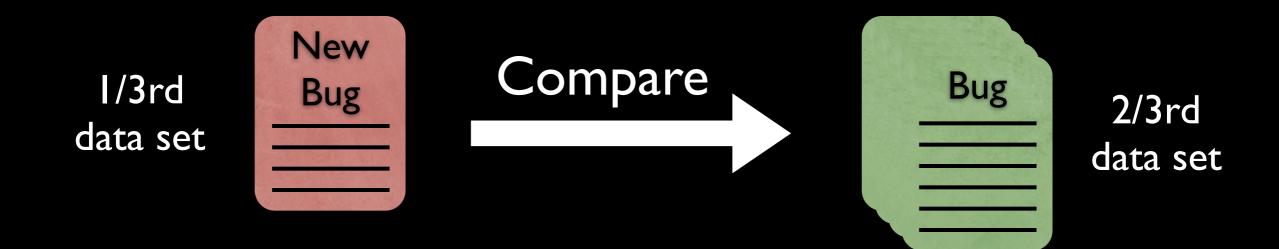
te?t, te*t, text* roam~

New Bug





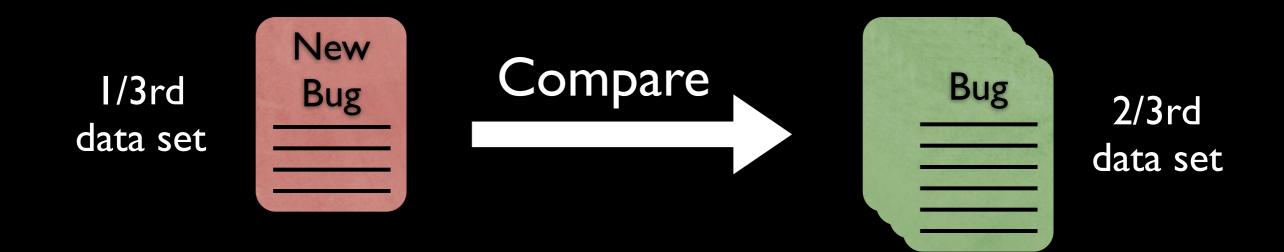




Feature Weights (1:1, 1:2, 2:1)

One Line Summary (S)

Description (D)

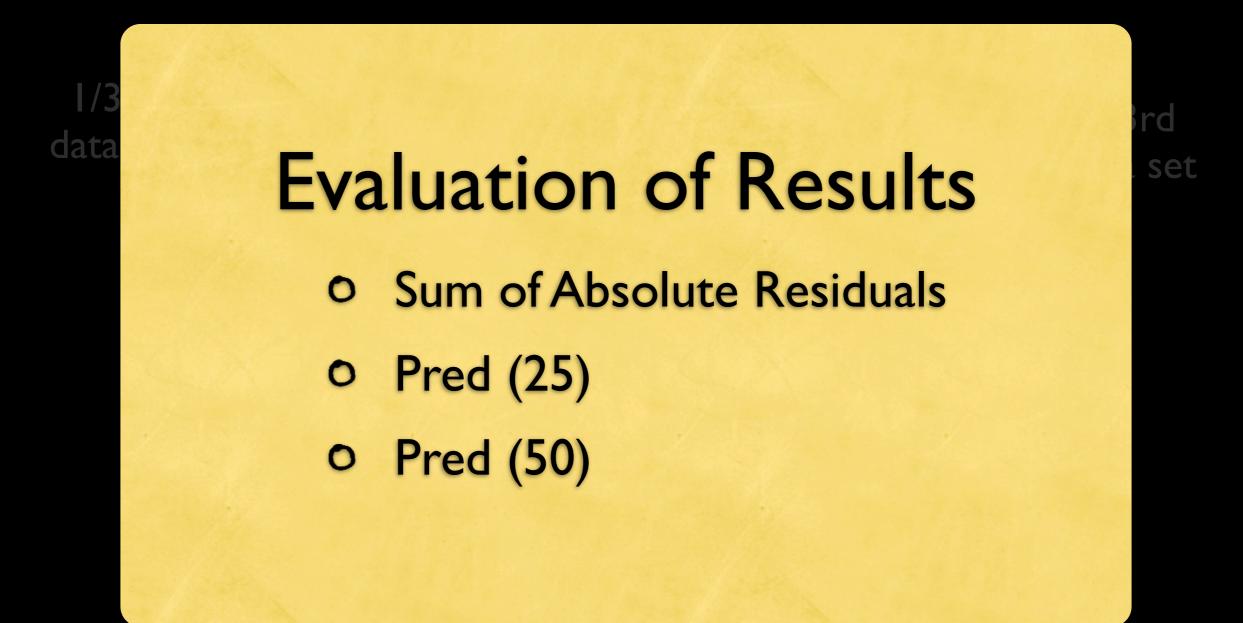


Feature Weights (1:1, 1:2, 2:1) One Line Summary (S) Description (D)

Average k nearest neighbours using simple, distance weighted and rank-weighted average



Average k nearest neighbours using simple, distance weighted and rank-weighted average



Average k nearest neighbours using simple, distance weighted and rank-weighted average



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Example Products -

- JBoss Application Server
- JBoss Cache
- JBoss Portal

- JBoss Messaging
- JBoss Eclipse IDE

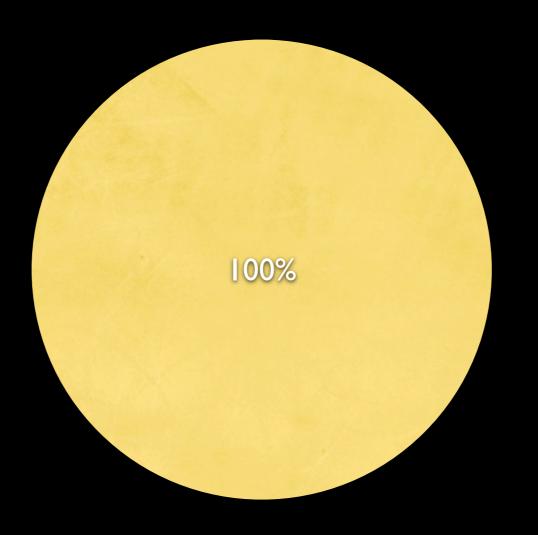
JBoss Data Set

As of 15th April 2006,

JBoss Data Set

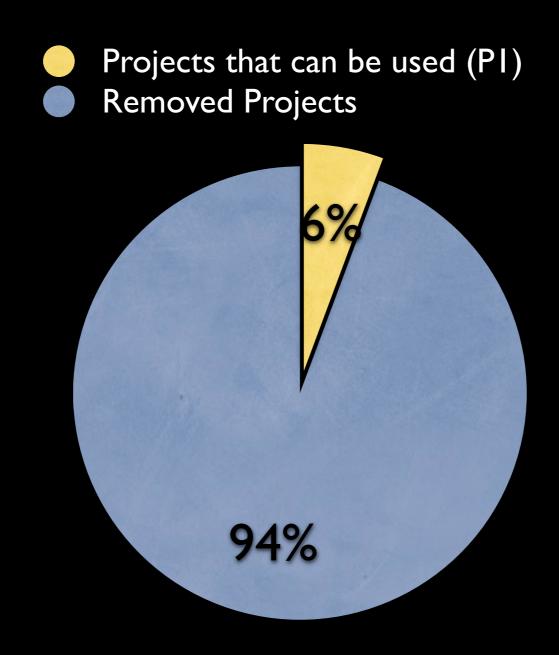
As of 15th April 2006,

Total Number of Bugs (11185)



JBoss Data Set

As of I5th April 2006,



Results using Pl

Results using Pl

Using Average as a Predictor

- Sum of Absolute Residuals 10,354 hours
- Pred (25) 13%
- Pred (50) 28%

Results using Pl

Using Average as a Predictor

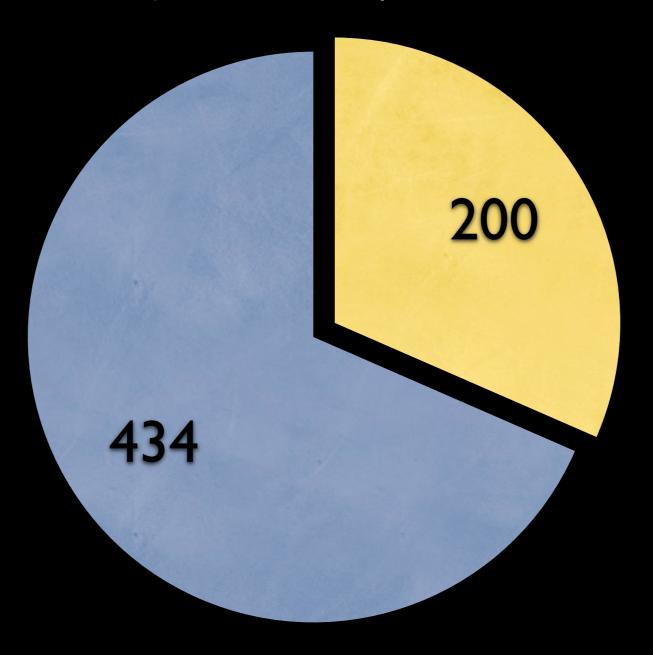
- Sum of Absolute Residuals 10,354 hours
- Pred (25) 13%
- Pred (50) 28%

Rank-based Avg., 2:1 (S:D) weights, k = 1

- Sum of Absolute Residuals 10,451 hours
- Pred (25) 18%
- Pred (50) 30%

JBoss (PI) Data Set

Projects with Expert Estimates (P2)
Projects with no Expert Estimates



Results using P2

Results using P2

Using Expert Estimates

- O Sum of Absolute Residuals 2,211 hours
- Pred (25) 40%
- Pred (50) 63%

Results using P2

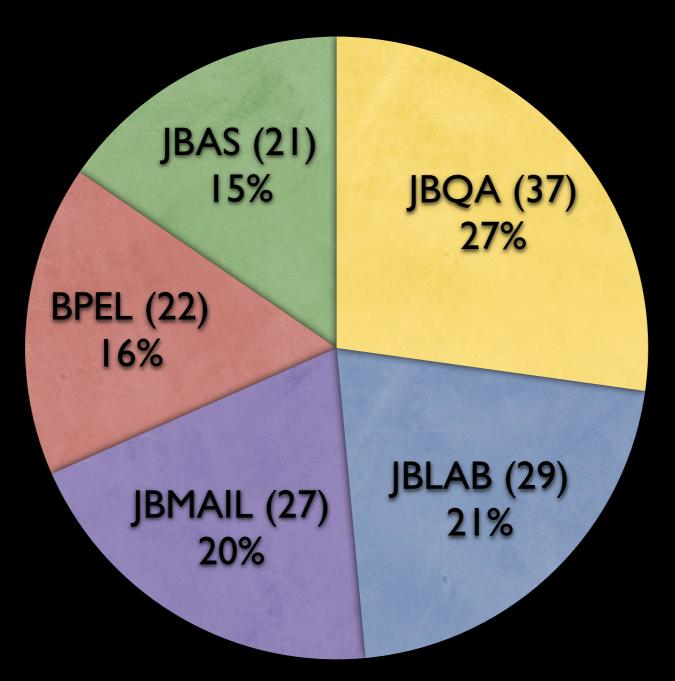
Using Expert Estimates

- Sum of Absolute Residuals 2,211 hours
- Pred (25) 40%
- Pred (50) 63%

Weight-based Avg., I:I(S:D) weights, k = 9

- Sum of Absolute Residuals 3,291 hours
- Pred (25) 16%
- Pred (50) 27%

JBoss Data Set

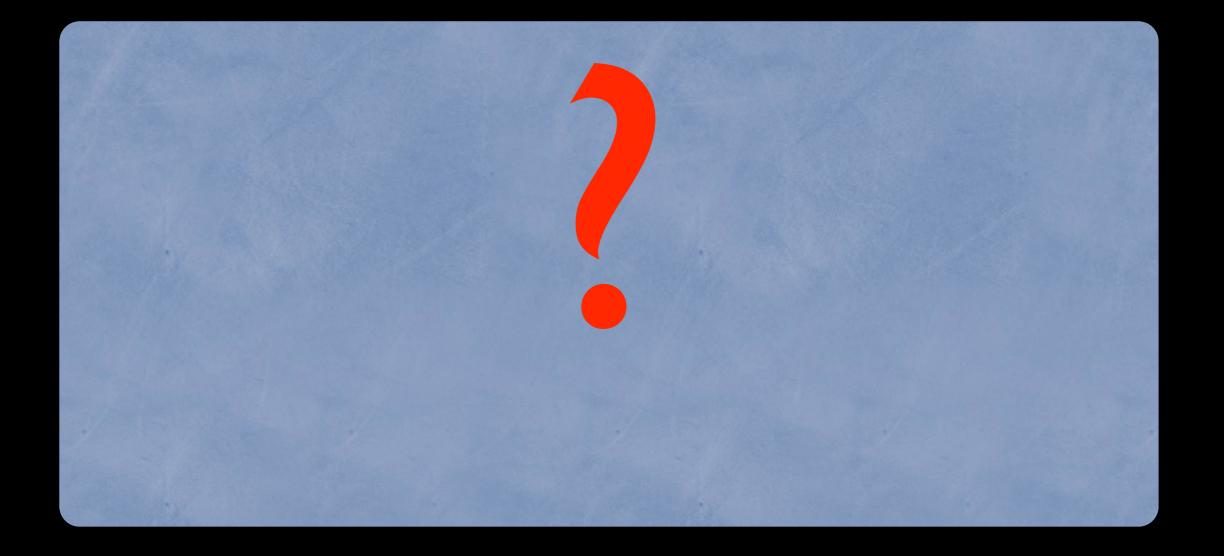


Results from Sub-Projects

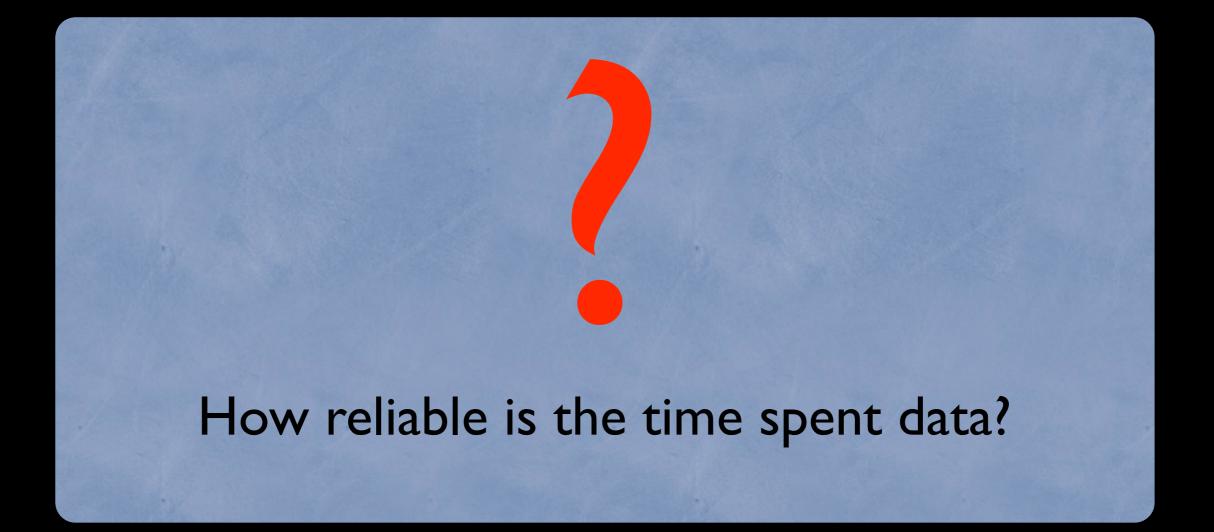
	Expert Est.		Prediction	
Project	Pred(25)	Pred(50)	Pred(25)	Pred(50)
JBQA	32%	51%	24%	29%
JBLAB	24%	52%	30%	39%
JBMAIL	56%	78%	31%	38%
BPEL	55%	86%	30%	40%
JBAS	48%	67%	27%	27%

JBoss Data Set

JBoss Data Set



JBoss Data Set



A boss at JBoss...





"... I would not rely on the data at all."



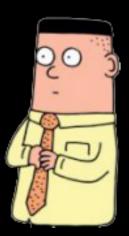
A boss at JBoss...

"... I would not rely on the data at all."





Some JBoss lead developers...



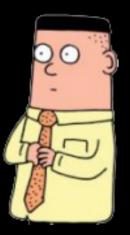
A boss at JBoss...

"... I would not rely on the data at all."





Some JBoss lead developers...



"...if the time spent data has been entered, I would consider it fairly reliable."



Eclipse



Eclipse



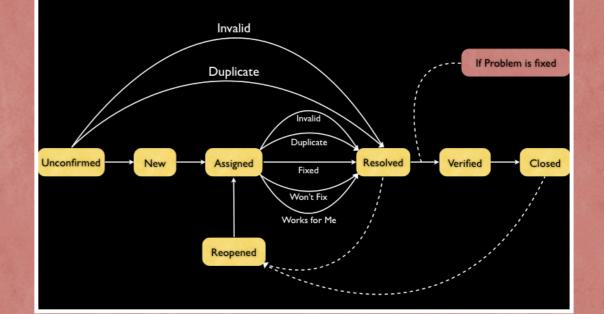


Eclipse



No Effort Data





Predict the lifetime of a bug!



Eclipse





In comparison to using Avg. bug lifetime as predictor, our sum of residuals was lower by 66,387 days for the Eclipse data set.





In comparison to using Avg. bug lifetime as predictor, our sum of residuals was lower by 66,387 days for the Eclipse data set.



For Mozilla, the same is true by 496,526 days.

Conclusions

- It is possible to predict effort at the very moment when a bug is reported.
- Our models performance is more surprising considering only two data points are used.

Conclusions

- It is possible to predict effort at the very moment when a bug is reported.
- Our models performance is more surprising considering only two data points are used.

In the future, test other prediction techniques and use other useful data in bug reports intelligently.