## **Revealing Software Development Work Patterns** with PR-Issue Graphs

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*To appear in FSE 2024* 

Longer talk by Emilie at *https://bit.ly/3UDwyRJ* 









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dubbo-common	feat: add tracing starters && add zipkin auto configur	ation (#12013) 13 hours ago



### About

Apache Dubbo is a high-performance, java based, open source RPC framework.

### & dubbo.apache.org/



### Issues: bug reports, feature requests

### Support for super reacts #9309

HereComesTheMoon opened this issue last month · 1 comment



HereComesTheMoon commented last month

Summary

Support for super reactions.

What is the feature request for?

The core library

### The Problem

Discord is apparently rolling out super reactions—11 days too early, according to some people. Super reacts are "animated" reactions with limited uses. Ordinary users can use two super reacts a week, nitro users have five per week.

Currently there seems to be no way to distinguish between ordinary and super reactions using discord.py, nor to use them. It'd be great if this functionality existed. So far (after a bit of personal testing) it appears that both super reacts and ordinary reacts are basically both seen as reacts. Super reacts also trigger the on\_react\_add listener, for example.





### osrm-extract failed to extract a large pbf file #6533

Try to use docker to extract brazil pbf file (1.5G) but it quits without producing correct files. Previously it succeeded for smaller pbf files (200 MB). I have tried to run with dockers with memory allocation 8G and 16G but the problem remain

It may be an out of memory issue. But it does not output any error message.

### Project-OSRM/osrm-backend

### Issues: bug reports, feature requests





### osrm-extract failed to extract a large pbf file #6533

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### Project-OSRM/osrm-backend

## Pull Requests: work addressing an Issue

Fix: "Source Run" field in Model Version UI page points to wrong run model artifact in Run UI page #8156

WeichenXu123 merged 10 commits into mlflow:master from WeichenXu123:bug-8150 [ 3 days ago

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	What changes are proposed in this pull request?		Assignees	
	Fix: "Source Run" field in Model Version UI page points to wrong run model artifact in Run UI page		No one assigned	
	Closes #8150		Labels	
			m/bug-fix	
	How is this patch tested?			
	Existing unit/integration tests		Projects	
	New unit/integration tests		None yet	
	Manual tests (describe details, including test results, below)			

*mlflow/mlflow* 





## Pull Requests: work addressing an Issue

work was accepted  $\rightarrow$ possible statuses: open, closed, merged

Fix: artif	"Source Run" field in Model Version UI page fact in Run UI page #8156	points to w	rong run mode	<> Code ▼
<mark>}⊷</mark> Me	WeichenXu123 merged 10 commits into mlflow:master from WeichenXu123:bug-8150 [] 3 da conversation 36 - Commits 10 [] Checks 24 E Files changed 4	iys ago		+61 -3
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mlflow/mlflow





### **Issue ↔ PR = A link!**

### Fix: "Source Run" field in Model Version UI page artifact in Run UI page #8156



### ↑ PR 8156 explicitly linked to Issue 8150 ↑

### [BUG] "Source Run" field in Model Version UI page points model artifact in Run UI page #8150

If you have logged more than one model artifact in a run, the "Source Run" field of the Model Version UI page always

### **Issue ↔ PR = A link!**

### Fix: "Source Run" field in Model Version UI page artifact in Run UI page #8156



New unit/integration tests

### [BUG] "Source Run" field in Model Version UI page points model artifact in Run UI page #8150

O Closed amesar opened this issue 2 weeks ago - 4 comments - Fixed by #8156

amesar commented 2 weeks ago

### Willingness to contribute

No. I cannot contribute a bug fix at this time.

### MLflow version

2.2.2

### System information

- OS Platform and Distribution (e.g., Linux Ubuntu 16.04):
- Python version:
- · yarn version, if running the dev UI:

### Describe the problem

If you have logged more than one model artifact in a run, the "Source Run" field of the Model Version UI page always links to the last model artifact in the Run UI page.



### Issue 8150



### Another explicit link: "duplicate"



Rapptz/discord.py

### Missing Message.stickers #7140

O 3 tasks done ) attendeany opened this issue on Jun 30, 2021 · 6 comments

attendeany commented on Jun 30, 2021

discord.Message.stickers is always empty

### Another explicit link: "duplicate"



Rapptz/discord.py

### Missing Message.stickers #7140

O 3 tasks done ) attendeany opened this issue on Jun 30, 2021 · 6 comments

### ↑ created earlier

attendeany commented on Jun 30, 2021

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### Another explicit link: "duplicate"



*Rapptz/discord.py* 



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# Prior work has focused on these links.



("@alex, this fixes #9...", Chopra et al., CSCW 2021; "How Are Issue Units Linked?...", Li et al., APSEC 2018; "Understanding shared links and their intentions...", Wang et al., ESE 2021; "The review linkage graph for code review analytics...", Hirao et al., ESEC/FSE 2019; "Traceability Network Analysis..." Nicholson et al., AIRE 2020)

...

?

## Going beyond links: Graph Perspective





## Going beyond links: Graph Perspective



do developers break their work up?

> graph perspective = more context = richer understanding of work practices

## is there a lot of competition?



## Analyzing 90K+ Issues and PRs with Neo4j



## Workflow type definitions



- associated with work practices
- has prototypical graph structure
- described as a combination of
  - some constraints (e.g. an Issue/PR
  - with some given status fixes
  - another Issue/PR)

Example: Competing PRs

## Nine workflow types





## **Competing PRs**



### • one Issue connected to multiple

- only one PR merged
- "wasted" work due to poor
- alternatively: finding the "best"



## **Duplicate Issue Hub**



- one Issue with multiple outgoing 'duplicate' Issue links
- contributors not being aware of other work
- additional maintenance burdennot as frequent as you'd think!

## What did developers think?

### Rapptz/discord.py Workflow Type Matches



- 6 interviews: 3 with maintainers of projects we studied; 3 with engineers using GitHub in a closed-source context
- centred around WorkflowsExplorer tool customized for their project

## What did developers think?

- Help make better decisions in development process
- Duplicate Issue Hubs → change in documentation or bug reporting process
- Help understand inter-dependencies visually
- Are limited due to not examining contents of Issue or PR

process tation or bug reporting

ly f Issue or PR

## Contributions

Longer talk at *https://bit.ly/3UDwyRJ* To appear at FSE 2024

- Novel graph-based perspective
- Workflow type definitions and attributes
- Automatable queries and interactive tool



## Implications

Can inform prioritization Can improve code review/PM practices Can identify areas of wasted work Can extend duplicate/first issue detection tools (Hirao et al., 2019)

("The review linkage graph for code review analytics...", Hirao et al., ESEC/FSE 2019)