15-721 Project Final Presentation

By Abigale Kim, Yuchen Liang, Chi Zhang May 5th, 2023



Update on Goals

- Write a framework that determines whether extensions are likely incompatible with each other and fixes some incompatibilities (partially)
- Create an extension that manages extensions, get this to work for pg_stat_statement and pg_hint_plan; only need to #include "pgextmgr.h" without significant code change. (

pgextmgrext

- Postgres Extension Manager as an Extension

















pgextmgrext

- Easy to integrate include a single header to use existing extensions with pgextmgr.
- Easy to adapt no need to build Postgres from source code, it is an extmgr as an extension!
- Extensibility adding new APIs and functionalities over existing Postgres hooks so that developers can build extensions easier and write less code.

Demo Video: here

pg_poop

- Toy extension that uses our extension as a manager to replace all VARCHAR/TEXT output with poop emojis
- 200 LoCs -> 70 LoCs by using pgextmgrext!
- Using pgextmgr's output rewriter APIs (which is build upon existing ExecutorRun hook)



Postgres Extension Compatibility Analysis

- Spent time understanding the extension environment (hook case studies, extension case studies)
- Tested general compatibility (installation, basic tests) of 38 extensions with each other
 - Determined that only 57 of these pairs failed (8% incompatibility)

Extension Compatibility Table

	pgjwt	pg_hint_plan	n orafos	speeds	pgkagkowi	pg_bigm	pg_cron	auto_suplay	in pgcrypto	pg_stat_statements	pg_similarly	piprofiler	citus	pipging_chies	a M	hypopp	ppentatist	inca	pgiantinal	vope	dord_drop_db	pg_variables	shared_spel	polymait_sampling	lam3	logenora	pg_stat_kcac	he pg_qualatata	pg_show_plan	ta pg_quaryid	pg_querylog	set_user	pg_log_userqueres	anon	pg_stat_monitor	r pgt	PQ_hm	halore
pget	nis	no	yes	765	yes	yes	785	765	yes	yes	745	yes	yes	789	768	yes	yes	340	yes	yes	748	bas	yes	Ass.	yes	yes	Ann	yes	yes	yes	yes	yes	yes	985	yes	yes	yes	yes
pg_hint_plan	nia	raia	340	765	yes	yes	yes	788	yes	yes	785	50	00	yes	yes	yes	yea	345	988	788	yes	yes	yes	788	yes	yea	345	yes	yes	110	344	988	yes	765	yes	yes	yes	768
orafea	nia	nia	n's	748	988	yes	782	yes	yes	yes	788	yes	yes	783	yes	yes	988	745	yes	yes	yes	348	yes	yes	yes	yes	788	yes	yes	yes	348	yes	yes	785	yes	yes	yes	yes
pgaudit	nia	nia	n/a	nia	yes	yes	yes	748	yes	yes	yes	yes	110	yes	yes	yes	yes	345	yes	yes	948	3988	598.8	745	yes	yes	344	yes	yes	an	344	548	yes	763	yes	yes	ywa	745
pglogical	nia	nia	n/a	nia	nia	yes	yes	yes	yes	yes	988	yes	00	yes	yes	yes	998	143	348	748	948	yes	yes	788	yes	yes	763	yes	yes	no	340	940	788	988	yes	yes	yes	745
pg_bigm	nia	ala	nia	nia	nia	nia	989	745	yes	yes	785	yes	yes	345	yes	yes	yes	943	346	yes	yes	340	yes	788	yes	yes	343	yes	yes	110	344	345	yes	965	yes	yes	yes	748
pg_cron	nia	rela	nie	n/a	nia	rale	nia	yes	yes	Yes	yes	yes	yves	yes	yes	yes	yes	745	988	yes	yes	745	yes	788	yes	yes	748	yes	yes	190	344	yes	yes	988	yes	yes	yws	745
auto_explain	nia	nia	n/a	nia	nia	nia	nia.	nik	yes	yes	788	yes	no	yes		yes	943	988	yes	yes	yes	346	yes	yes	yes	yes	345	yes	yes	no	346	345	yes	345	yes	yes	yes	. 788
pgoypto	nia	nia	nie	nia	inia.	nie	nia	nia	nia	yes	785	yes	yes	988	yes	yan	9988	988	yes	944	7988	344	546	785	yes	yes	1988	yes	yes	100	1999	500	785	768	yes	yes	999	788
pg_stat_statements	nia	nia	n/a	nia	nia	nia	mia	nia	nia	nia	yes	00	00	yes	yes	yes	yes	745	348	748	948	344	348	785	yes	yes	763	yes	yes	no	344	342	yes	745	yes	yes	yes	yes
pg_airekarity	nia	nia	rs/a	nia	nia	nie	nia	inia	nia	n/a	inia	740	yes	388	yes	yes	yes	988	yes	788	yes	340	yes	788	yes	yes	788	yes	788	190	344	344	yes	765	yes	yes	785	788
piprofiler	nia	rela :	0/8	nia	nia	nia	nia	nia	rs/a	n'a	nia	nia	yes	no	yes	yes	yes	no	no	yes	yes	yes	no	785	60	100	no		10	110	144	398.8	yes	765	60	yes	385	745
olus	nia	nia	ra/a	nia	rsta	nia	n/a	nia	nia	nia	nia	nia	nia	988	yes	ino	100	344		yes		988	yes	10	no	yes	110	10	10	00	344	10	10	345	no	yes	785	788
plogsol_check	nis.	nia	nia	nia	ola	nia	esta.	nia	nia	nia	nia.	ela	nta	eda.	788	yes	yes	1953	388	745	yes	385	yes	765	yes	yes	763	768	yes	10	388	yes	yes	788	yes	yes	yes	765
NI	nia.	raile	n/a	nia	rsta	nia	nia	nia	rsia	nia	nia	eda	ista	nia	mia	yes	yes	140	100	740	1444	344	yes	748	yes	yes	100	yes	yes	no	1988	144	745	-	yes	yes	yes	788
hypepg	nia	nia	n/e	nia	nia	nia	nia	ela	nia	mia	- 10	nia	nhi	nia	nia	nia	yes	1983	988	785	943	985	yes	768	yes	yes	yes	yes	yes	no	1985	yes	748	988	yes	yes	ywa	783
ppentwist	nia	raia	n/a	nia	nia	min	nia	nia	rsia	nia	nia	nia	nta	nia	nia	nia	mia	100	1988	788	yes	-	-	788	yes	yes	100	745	yes	no	1988	1988	yes	765	yes	yes	7955	788
ITCS	ola.	nia	nia	nia	ola	nia	nia	nia	nia	nia	118	ela	nta	nia	nia	nia	ala	nia	988	788	yes	988	yes	yes	yes	yes	145	788	788	110	788	998	yes	185	yes	yes	yws	788
populational	nia	nia	11/8	nia	nia	nia	nia	nia	nia	m'a	inia	nia	nta	nia	nia	nia	nta	nia	nia	740	yes	144	yes	765	yes	yes	100	768	yes	no	1988	144	yes	188	yes	yes	1955	788
VEEN	nia	nia	nia	nia	nia	nie	n/a	-	nia	nia	118	nia	nia	nia	nia	na	inte	:008	nia	nia	948	1988	998	788	yes	yvira	340	yes	yes	no	199	988	yes	788	yes	yes	980	785
dont_drop_db	nia	nia	nia	nia	nia	nia	nia	nia	nia	nia	nia	nia	rs/a	nia	nia	nia	nia	nia	nia	A 44	nia	-	988	744	yes	yers	100	yes	788	10	-	988	744	100	yes	yes	985	788
pg_variables	nia	nia	nie	nia	nia	nia	nia	-	nia	nhi	118	nia	nte	nia	-	nia	mia	inia	nia	nia	nia	nix	yes	yes	yes	yes	100	yes	yes	110	344	100	yes	955	yes	yes	989	788
stared isosi	ola.	nia	nik	7/8	ola.	0.00	0.0	10	nia	100	-	ala.	0.18	nia.	108	nia	10.00	10	nia	1.00	10/8	nia	Dia .	100	VER	1982	183	100	100	10	1988	100	100	153	VER	VER	192	188
pg welt sampling	nia	nie	n'e	nia	014	19/8	nia	-	nie	n'e	nía	nia	nia	nia	nia	ela	15/4	nia	118	-	nia	nix	nia	n/a	788	1988	199	788	YER	110	199	199	1985	188	788	Ven	199	785
bird Crist	nia	nie	nia	7/8	nie	nie	08	-	nia	0.0	10	n/a	nie	0.0	- 10	nia.	10.04	nia	nia	nia	0.0	nix	Dia	0/8	nia.	VNE	192	188	100	10	199	102	185	153	YES.	VER	192	192
logerrors	nia	mie	n/e	nia	nia	nie	nie	nia	rste	nie	nia	eda	nia	0.0	mia	nia	inte	-	rr/a	nia	11/4	rela	rea	1/8	nia	nia	180	100	788	110	1995	144	1988	100	YES	yes	1995	-
po stat koache	nix	nia	nie	10	nia	n)a	08	10.0	ola.	100	-	nia	ala	nia	104	nia	inte	nia	nia	nia	104	nix	nia	0/8	nia	nia	100	148	742	100	192	192	763	153	VIE	VER	183	183
PQ_qualitate	nia	rein	nie	nia	nia	rale	nia	nia	rsia	nia	mia	nia	nia	inia.	nia	nia	nia	eda.	reia	nia	nia	nia	nia	nia	mia	nta	n/a	nia	yes	190	344	988	788	-	yes	yes	985	745
po altow plana	ole .	nie	D)k	7/8	ole.	nia.	08	0.0	nia	n's	7/8	cia :	13/8	0.0	108	cla	158	nia	ria.	cia	0.0	nix	nia	0/8	cia	1558	100	7/8	cia	00	1951	100	100	188	YES	VE	182	185
(sp. suveryid	nia	rale	11/8	nia	nia	nia	mia .	nia	nia	19.90	infa	nia	rs/a	n/a	nia	nia	mia	nia	nia	nia	1/14	rula	rva.	*/8	nia	nta	m/a	nia	nia	ev/a	1988	100	785	188	yes	yes	145	788
pg querylog	nis.	nie	nia	-	nie	nie	nia	-	nie	0.0	-	ela .	n/a	2018	-	nia	0/8	108	nia	104	208	nix	nia	0/8	nie	n/a	100	-	10	110	nia	198	1988	192	YES	VER	1988	1988
set user	nia	mia	n/e	nia	rsta	nia	nia	nia	nia	m'a	nia	nia	15/4	nia	nia	nla	nia	nia	nia	nia	nia	rula	rea	1/8	nia	nia	m/a	nia	nla	nia	nia	rea.	745	-	yes	yes	940	788
pg log usergueries	nix	nie	0/8	nia	nia.	nie	nie	-	nia	10	-	10	nia	nia	-	0.00	nia	nix	ria	0.00	nia	nia	rein.	1/8	10	nis	10	nia	10	nia	10	ria	nia	1953	788	VER	1993	188
anon	nia.	nia	nie	Na	nia	rela	nia	nia	nia	m'a	nia	ela	nia	nia	nia	nia	inte	n/a	r/a	nia	114	nia	rea	16	nia	nla	n/a	ela	nia	114	nia	ria	nia	nia	yes	yes	1985	744
pg stat monitor	ola.	nie	0.0		D)#	018	nie	els.	nie	10	118	ela	nia	nia	nia	ola.	nia	nix	nia	nia	-	nix	rein.	0/8	ola .	nia	018	nia	-	- 10	nia.	118	-	nia	nia	VER.	183	100
poll	nia	nia	0.0	nia	016	0.0	00	10	nia	0.0	nia	0.04	13/8	100	10	14	10/4	nia.	ria.	1.64	0.0	nia.	ria	0/8	14	13/4	nia.	nia	10	0/4	nia.	108	-	10	104	mia	190	788
no are	nia	nia	nie	-	mia	10/10	nia	-	mia	min .	-	nia	19/10	-	-	-	nia	-	rda		inte	eda.	ria	1/2	nia	nia	-	ela	-	mia	-	100	-		-	mite	0.10	
halong	nia	min	0.00	nia	nia	ale.	min .	-	nia	ala	nia	-	ala	n/a	-	nia	inte	and a	rda.	ala	and a	esta.	10		ala	ala	inda .	and a	ala	min	eda.	100	-	-	-	ole	0.10	nia

... since that is mostly unreadable...

- TLDR: 8% is a *low* result–we're aiming for a higher incompatibility rate!
- Potentially interesting findings
 - Some extensions have checks to ensure that proper ordering (e.g. pg_queryid)
 - Some heavyweight extensions tend to clash with a lot of other extensions (Citus, plprofiler)
 - These are pretty good leads!

Testing + Code Quality

- General extension testing framework is well-tested (interface works for a lot of different extensions)
- pgextmgrext has a proof of concept implementation (pg_poop) but is otherwise not tested much (not production ready!)
- Code quality:
 - Ran cargo fmt + cargo clippy to ensure decent code style
 - We have validation of arguments in our software
 - Code is not documented very well 😭

Future Work

- Focus extension compatibility testing to extensions that share the same hooks, and extend testing to try to catch more conflicts
- Redesigning PostgreSQL extensions API using findings from pgextmgrext and related work (e.g. MySQL server, Redis modules, eBPF)

Thank you for listening!