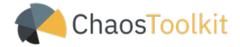
Chaos Engineering

From One to Many

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ChaosIQ CTO and Chaos Toolkit Lead Developer



Demo!

This talk is demo driven so, if you are reading these slides, I encourage you to visit:

https://github.com/chaostoolkit-incubator/community-playground/tree/master/from-local-to-automated-chaostoolkit

or

http://tiny.cc/kubecon-chaos

What is the context?

One service users can query over HTTP to fetch a simple increment counter.

Counter is managed by the service itself.

Decision is made to delegate the counter to another service the first service will fetch data from. Microservice architecture style.

Our application runs on a Kubernetes cluster.

What do we want to learn?

We want to collect evidence on how impactful a rollout is of a new or older version of the new backend service.

What is the protocol followed?

To do this, we'll devise and run experiments that look at the impact on users, and our SLO, under these conditions:

- Rollout the same version of a backend service (null hypothesis)
- Rollout a new version of the backend service
- Rollout a new version, which is reported unhealthy, of the backend service
- Rollout a new version, healthy but with a bug, of the backend service

Throughout, we'll measure the number of errors reported, via Prometheus, and we'll monitor the lifecycle of a request with OpenTracing.

Chaos Toolkit as a protocol for Chaos Engineering

We rely on the Chaos Toolkit support for the Open Chaos definition of a Chaos Engineering experiment to support our effort in collecting evidence.

https://chaostoolkit.org/

https://openchaos.io/

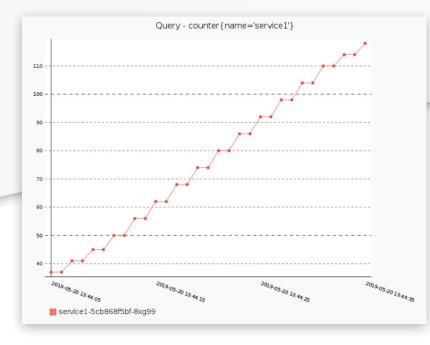
HYPOTHESIS 1 Same version does not impact users

(kubecon) sylvain@sylvain-work:~/dev/demos/kubecon-eu/experiments\$ chaos run --journal-path=v1.json rollout-v1-service2.json [2019-05-20 15:44:08 INFO] Validating the experiment's syntax [2019-05-20 15:44:09 INFO] Experiment looks valid [2019-05-20 15:44:09 INFO] Running experiment: Rollout same version of service 2 is transparent to our users (null hypothesis) [2019-05-20 15:44:09 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services [2019-05-20 15:44:09 INF0] Probe: no-http-errors-returned-from-service [2019-05-20 15:44:09 INFO] Steady state hypothesis is met! [2019-05-20 15:44:09 INFO] Action: initiate-rollout-v1-of-service2 [2019-05-20 15:44:10 INF0] Action: pretend-users-in-background [2019-05-20 15:44:10 INFO] Calling 'http://counter.dev/' for 20s every 1.0s [2019-05-20 15:44:10 INFO] Probe: read-deployment-status [2019-05-20 15:44:35 INFO] Probe: read-counter-for-the-past-30-seconds [2019-05-20 15:44:36 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services [2019-05-20 15:44:36 INFO] Probe: no-http-errors-returned-from-service [2019-05-20 15:44:36 INFO] Steady state hypothesis is met! [2019-05-20 15:44:36 INF0] Let's rollback... [2019-05-20 15:44:36 INF0] Rollback: rollback-service-update [2019-05-20 15:44:36 INFO] Action: rollback-service-update [2019-05-20 15:44:41 INFO] Experiment ended with status: completed

HYPOTHESIS 1 Same version does not impact users

chaostoolkit: Rollout same version of servic	e 2 is transparent to our users (n	ull hypothesis)		₩ s	iearch A V X View Options V
ce Start: May 20, 2019 3:44 PM Duration: 32.73s Services: 3 Depth: 7 Total Spa	ns: 96				
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rice & Operation	> ¥ ≫ 0ms	8.18s	16.36s	24.5	55s 32.73s
taostoolkit Rollout same version of service 2 is transparent to our users (null hypothesis)					
chaostoolkit If users see errors, it may be due to a rollout breaking the link between services	267.48ms				
chaostoolkit no-http-errors-returned-from-service	2.69ms				
chaostoolkit Method					26.03s
chaostoolkit initiate-rollout-v1-of-service2	18.5ms				
chaostoolkit pretend-users-in-background	2.15ms				
chaostoolkit cal-service1	17.3ms				
v service1 fetch-counter	3.89mg				
v service1 next-count	3.75ms service1::next.count				
service2 next-count	0.07ms				
> chaostoolkit call-service1	6.36ms				
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		8.11ms			
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> chaostoolkit call-service1		1 9.17ms			
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> chaostoolkit cal-service1		6.02ms			
> chaostoolkit call-service1			6.34ms		
> chaostoolkit cal-service1			6.32ms		
> chaostoolkit call-service1			6.52ms		
> chaostoolkit cal-service1			7.37ms		
> chaostoolkit call-service1			5.88ms		
> chaostoolkit call-service1			10.93ms		
> chaostoolkit call-service1			9.57ms		
> chaostoolkit call-service1			8.59ms	1	
> chaostoolkit cal-service1				7.72ms I	
> chaostoolkit call-service1				7.12ms	
chaostoolkit read-deployment-status					26.1a
chaostoolkit read-counter-for-the-past-30-seconds					23.4ms I
chaostoolkit lead-coulder-on-past-au-seconds chaostoolkit if users see errors, it may be due to a rollout breaking the link between services					191.96ms
chaostoolkit no.htp-errors-returned-from-service					2.69ms
chaostockit Rotbacks					
chaostoolkit rolbacks					186.28ms

HYPOTHESIS 1 Same version does not impact users



Findings: No impact.

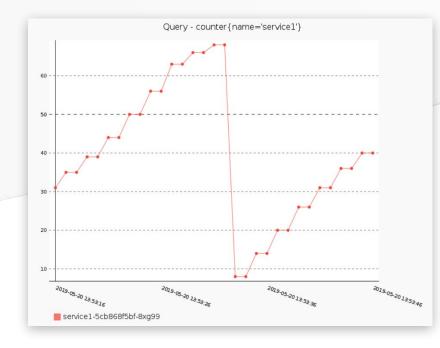
HYPOTHESIS 2 New version does not impact users

(kubecon) sylvain@sylvain-work:~/dev/demos/kubecon-eu/experiments\$ chaos run --journal-path=v2.json rollout-v2-service2.json [2019-05-20 15:53:19 INFO] Validating the experiment's syntax [2019-05-20 15:53:19 INF0] Experiment looks valid [2019-05-20 15:53:19 INFO] Running experiment: Rollout a new working version of service 2 is transparent to our users [2019-05-20 15:53:20 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services [2019-05-20 15:53:20 INFO] Probe: no-http-errors-returned-from-service [2019-05-20 15:53:20 INFO] Steady state hypothesis is met! [2019-05-20 15:53:20 INFO] Action: initiate-rollout-v2-of-service2 [2019-05-20 15:53:20 INFO] Action: pretend-users-in-background [2019-05-20 15:53:20 INFO] Calling 'http://counter.dev/' for 20s every 1.0s [2019-05-20 15:53:20 INFO] Probe: read-deployment-status [2019-05-20 15:53:46 INFO] Probe: read-counter-for-the-past-30-seconds [2019-05-20 15:53:46 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services [2019-05-20 15:53:46 INFO] Probe: no-http-errors-returned-from-service [2019-05-20 15:53:46 INFO] Steady state hypothesis is met! [2019-05-20 15:53:46 INFO] Let's rollback... [2019-05-20 15:53:46 INFO] Rollback: rollback-service-update [2019-05-20 15:53:46 INFO] Action: rollback-service-update [2019-05-20 15:53:46 INFO] Experiment ended with status: completed

HYPOTHESIS 2 New version does not impact users

chaostoolkit: Rollout a new working version of	of service 2 is transparent	to our users			Search	∧ ∨ × View Options ∨
ce Start: May 20, 2019 3:53 PM Duration: 27.07s Services: 3 Depth: 7 Total Spans	: 94					
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vice & Operation V >	∀≫ 0ms	6.77s		13.53s	- 20.3s	27.07s
haostoolikit Rollout a new working version of service 2 is transparent to our users						
chaostoolkit If users see errors, it may be due to a rollout breaking the link between services	201.05ms					
chaostoolkit no-http-errors-returned-from-service	1.2.97ma					
chaostoolkit Method						25.745
chaostoolkit initiate-rollout-v2-of-service2	15.86ms					
chaostoolkit pretend-users-in-background	0.86ms					
chaostoolkit call-service1	8.06ms					
v service1 tetch-counter	3.75ms					
v service1 next-count	3.64ms					
service2 next-count	0.06ms					
> chaostoolkit cal-service1	6.24ms					
> chaostoolkit call-service1	7.86ms					
> chaostoolkit call-service1		8.61ms				
> chaostoolkit call-service1		7.93ms				
> chaostoolkit call-service1		7.33ms				
> chaostoolkit call-service1		9.07ms				
> chaostoolkit cal-service1		17.1	2ms			
> chaostoolkit call-service1			6.07ms			
> chaostoolkit cal-service1			6.22ms			
> chaostoolkit call-service1			6.93ms			
> chaostoolkit call-service1			6.79ms			
> chaostoolkit cal-service1			18.0			
> chaostoolkit call-service1				8.17ms		
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> chaostoolkit call-service1				7.48ms		
> chaostoolkit call-service1				6.8ms		
> chaostoolkit cal-service1				6.71ms		
> chaostoolkit cal-service1					79.6ms 🏮	
> chaostoolkit cal-service1					7.01ms	
> chaostoolkit cal-service1					7.35ms	
chaostoolkit read-deployment-status					2.3000	25.1%
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chaostoolkit if users see errors, it may be due to a rollout breaking the link between services						28ms 146.51ms
chaostoolkit if users see errors, it may be due to a rotout breaking the tink between services chaostoolkit no-http-errors-returned-from-service						146.51ms
chaostoolkit Rotbacks						3.87ms
chaostookit rotback-service-update						167.21ms

HYPOTHESIS 2 New version does not impact users



Findings: No impact on availability but reset of counter value.

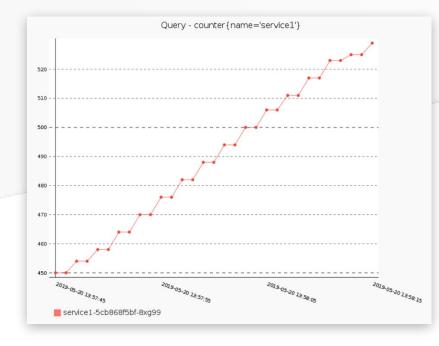
HYPOTHESIS 3 Unhealthy version does not impact users

(kubecon) sylvain@sylvain-work:~/dev/demos/kubecon-eu/experiments\$ chaos run --journal-path=v3.json rollout-v3-service2.json [2019-05-20 15:57:48 INFO] Validating the experiment's syntax [2019-05-20 15:57:48 INF0] Experiment looks valid [2019-05-20 15:57:48 INFO] Running experiment: Rollout unhealthy service 2 is transparent to our users [2019-05-20 15:57:48 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services 2019-05-20 15:57:48 INF0] Probe: no-http-errors-returned-from-service [2019-05-20 15:57:49 INFO] Steady state hypothesis is met! 2019-05-20 15:57:49 INF0] Action: initiate-rollout-v3-of-service2 [2019-05-20 15:57:49 INFO] Action: pretend-users-in-background [2019-05-20 15:57:49 INFO] Calling 'http://counter.dev/' for 20s every 1.0s 2019-05-20 15:57:49 INFO] Probe: read-deployment-status [2019-05-20 15:58:15 INFO] Probe: read-counter-for-the-past-30-seconds [2019-05-20 15:58:15 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services [2019-05-20 15:58:15 INFO] Probe: no-http-errors-returned-from-service [2019-05-20 15:58:15 INFO] Steady state hypothesis is met! [2019-05-20 15:58:15 INF0] Let's rollback... [2019-05-20 15:58:15 INF0] Rollback: rollback-service-update [2019-05-20 15:58:15 INFO] Action: rollback-service-update [2019-05-20 15:58:16 INFO] Experiment ended with status: completed

HYPOTHESIS 3 Unhealthy version does not impact users

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chaostoolkit: Rollout unhealthy service 2 is tr						H Search	∧ ∨ × View Options
e Start: May 20, 2019 3:57 PM Duration: 27.22s Services: 3 Depth: 7 Total Spans	6.8s		13.61s		20.41s		2
	· · · ·	17 - K. K.					
vice & Operation V >	¥≫ 0ms	6.8s		13.61s		20.41s	27
haostoolkit Rollout unhealthy service 2 is transparent to our users							
chaostoolkit If users see errors, it may be due to a rollout breaking the link between services	180.68ms						
chaostoolkit no-http-errors-returned-from-service	1 3ms						
chaostoolkit Method							
chaostoolkit initiate-rollout-v3-of-service2	16.48ms						
chaostoolkit pretend-users-in-background	1.55ms						
chaostoolkit call-service1	29.02ms						
 service1 tetch-counter 	25.42mg						
 service1 sect-counter service1 next-count 	25.31ms						
service2 next-count							
> chaostoolkit call-service1	0.09ms						
chaostoolkit cal-service1 chaostoolkit cal-service1							
	1 8.65ms						
> chaostoolkit call-service1		18.91ms					
> chaostoolkit call-service1		13.6ms					
> chaostoolkit cal-service1		7.23ms					
> chaostoolkit call-service1		1 7.14ms					
> chaostoolkit cal-service1			29.76ms				
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> chaostoolkit call-service1			88.25ms				
> chaostoolkit call-service1			1 7.32ms				
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> chaostoolkit call-service1				9.4ms			
> chaostoolkit call-service1				10.52ms			
> chaostoolkit call-service1				8.73m			
> chaostoolkit call-service1					7.23ms		
> chaostoolkit call-service1					9.91ms		
> chaostoolkit cal-service1					6.96ms		
> chaostoolkit call-service1					11.09	ns I	
> chaostoolkit call-service1						8.86ms	
chaostoolkit read-deployment-status							25.13
chaostoolkit read-counter-for-the-past-30-seconds							31.93ms
chaostoolkit If users see errors, it may be due to a rollout breaking the link between services							196.12ms
chaostoolkit no-http-errors-returned-from-service							3.03ms
chaostoolkit Rotbacks							
chaostoolkit rollback-service-update							

HYPOTHESIS 3 Unhealthy version does not impact users



Findings: No impact.

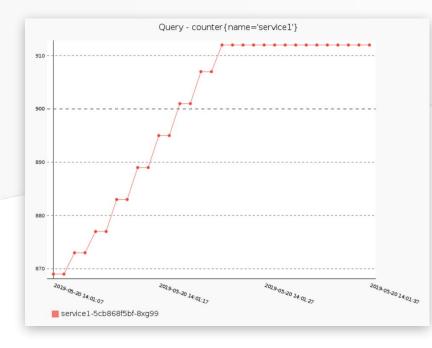
HYPOTHESIS 4 Slower version does not impact users

(kubecon) sylvain@sylvain-work:~/dev/demos/kubecon-eu/experiments\$ chaos run --journal-path=v4.json rollout-v4-service2.json [2019-05-20 16:01:05 INFO] Validating the experiment's syntax [2019-05-20 16:01:05 INF0] Experiment looks valid [2019-05-20 16:01:05 INFO] Running experiment: Rollout a slower service 2 is transparent to our users [2019-05-20 16:01:05 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services [2019-05-20 16:01:05 INFO] Probe: no-http-errors-returned-from-service [2019-05-20 16:01:06 INFO] Steady state hypothesis is met! [2019-05-20 16:01:11 INFO] Action: initiate-rollout-v4-of-service2 [2019-05-20 16:01:11 INFO] Action: pretend-users-in-background [2019-05-20 16:01:11 INFO] Calling 'http://counter.dev/' for 20s every 1.0s [2019-05-20 16:01:11 INFO] Probe: read-deployment-status [2019-05-20 16:01:37 INFO] Probe: read-counter-for-the-past-30-seconds [2019-05-20 16:01:37 INFO] Steady state hypothesis: If users see errors, it may be due to a rollout breaking the link between services [2019-05-20 16:01:37 INFO] Probe: no-http-errors-returned-from-service [2019-05-20 16:01:37 CRITICAL] Steady state probe 'no-http-errors-returned-from-service' is not in the given tolerance so failing this experiment 2019-05-20 16:01:37 INF0] Let's rollback... [2019-05-20 16:01:37 INFO] Rollback: rollback-service-update [2019-05-20 16:01:37 INFO] Action: rollback-service-update [2019-05-20 16:01:38 INFO] Experiment ended with status: deviated [2019-05-20 16:01:38 INFO] The steady-state has deviated, a weakness may have been discovered

HYPOTHESIS 4 Slower version does not impact users

 chaostoolkit: Rollout a slower service 	2 is transparent to our users	;		H Search	∧ ∨ × View Options ∨
race Start: May 20, 2019 4:01 PM Duration: 32.62s Services: 3 Depth: 7		16.31s		24.473	
9 	8.10s			26.473	32.62s
ervice & Operation	✓ > ♥ ≫ 0ms	8.16s	16.31s	24.478	32.628
chaostoolkit Rollout a slower service 2 is transparent to our users					
chaostoolkit If users see errors, it may be due to a rollout breaking the link between serv	ices 184.15ms				
chaostoolkit no-http-errors-returned-from-service	3.44ms				
chaostoolkit Method		25.995			
chaostoolkit initiate-rollout-wi-of-service2		20.56ms			
chaostoolkit pretend-users-in-background		2.14ms			
chaostoolkit call-service1		10.06ms			
service1 tetch-counter		4.7ms			
v service1 next-count		4.52mis			
service2 next-count		0.06ms			
> chaostoolkit cal-service1		1.7.72m8			
> chaostoolkit call-sentce1		7.96ms			
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> chaostoolkit cal-service1		9.38ms			
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service2 next-count			23		
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> 0 chaostoolkit call-service1				18	
> chaostoolkit call-service1				15	
chaostoolkit read-deployment-status		25.125			
chaostoolkit read-counter-for-the-past-30-seconds					24.5ms
chaostoolkit If users see errors, it may be due to a rollout breaking the link between serv	ices				212.46ms
chaostoolkit no-http-errors-returned-from-service					4.22ma
chaostoolkit Rolbacks					215.39ms
chaostoolkit rolback-service-update					15.89ms

HYPOTHESIS 4 Slower version does not impact users



Findings: Impacts on availability and thus returned counter value too.



What we've learnt is that Kubernetes can certainly help us preventing downtime or impact on users when our service declare an appropriate health reporting. Indeed, in that case, the rollout will no complete.

Chaos Toolkit as a protocol for Chaos Engineering

Through the experiment protocol, you can automate not only impacting your system but also collecting data that can help you making a sound analysis afterwards.

Chaos Toolkit as a platform for Chaos Engineering

Chaos Toolkit is great tool to start on your own but can scale up in your organization by integrating naturally with your platform:

- Observability: sending metrics, logs and traces
- Automation: run as part of your CI/CD or as a Kubernetes Job...
- Report nicely for team analysis



@lawouach

