



Cloud and Internet Resilience

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Twente Resilience Meet & Drinks

Monday, 22 May 2023

Hi, I am Yasir!



PHD RESEARCHER AT *IEBIS GROUP* (*I DO ECONOMICS AND DECISION MAKING OF SECURITY STUFF*).



EDUCATIONAL BACKGROUND IN *DATA SCIENCE AND BUSINESS INFORMATION TECHNOLOGY*.



PROFESSIONAL BACKGROUND IN *BIG DATA ANALYTICS*



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Agenda

- Internet as a critical service
- Cloud centralization
- Using Internet measurement to study resilience strategy



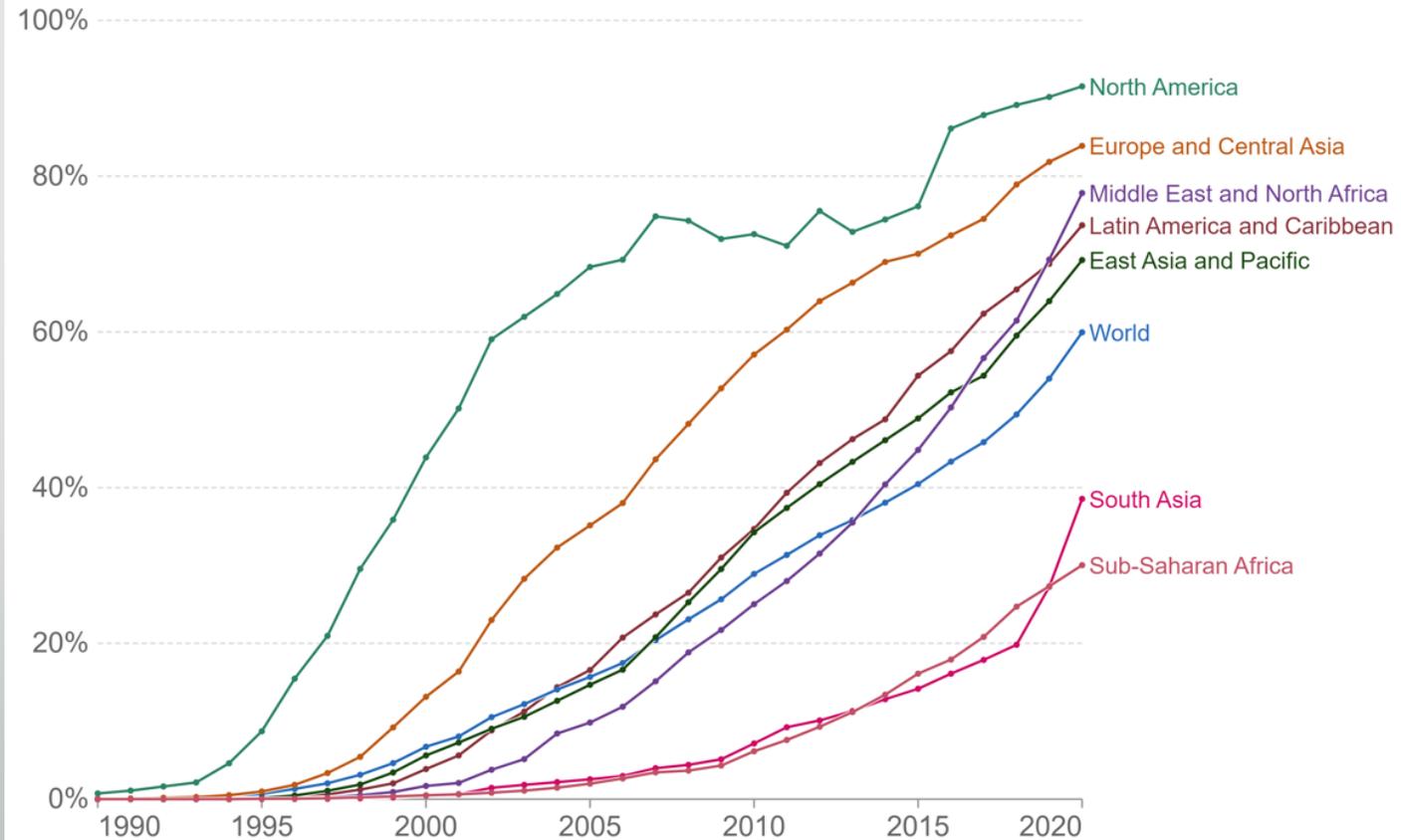
Internet as a Critical Service

Internet as a Critical Service

Share of the population using the Internet

Share of the population who used the Internet¹ in the last three months.

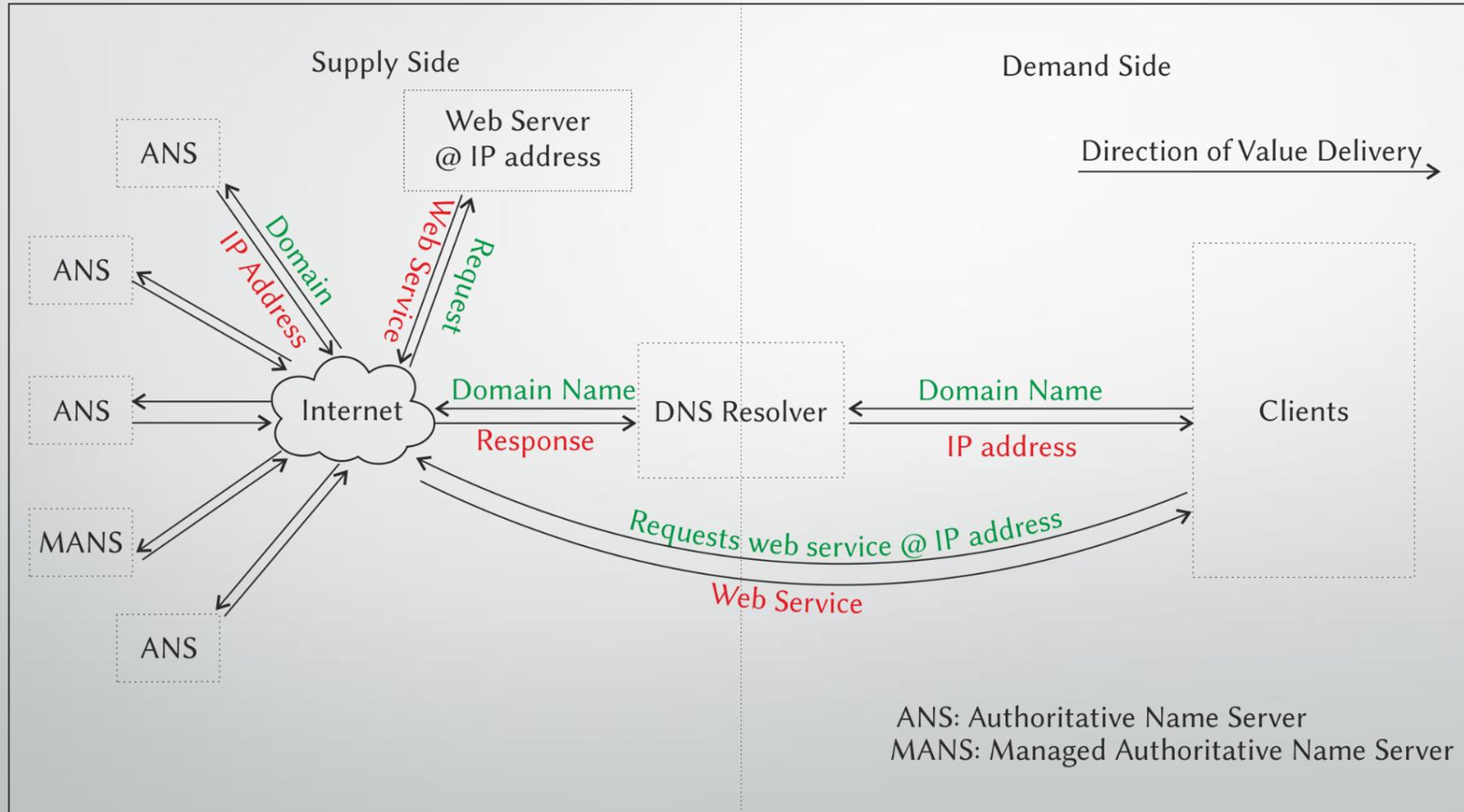
Our World
in Data



Source: International Telecommunication Union (via World Bank)

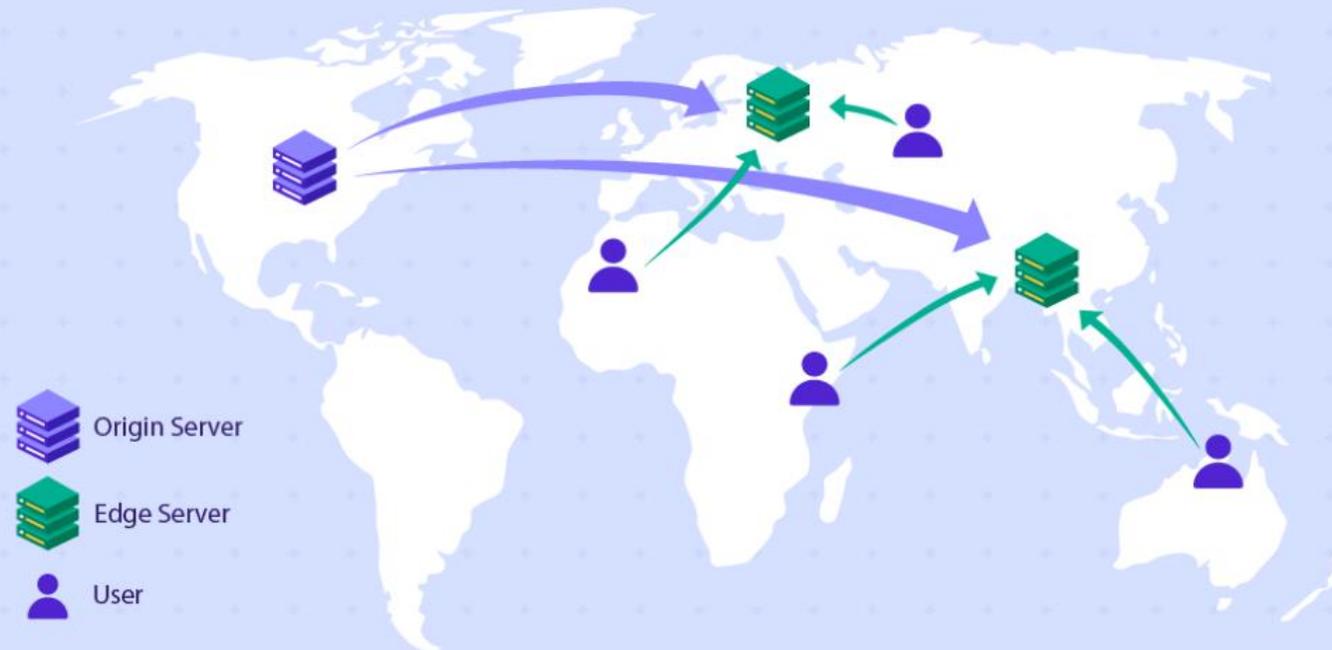
OurWorldInData.org/internet • CC BY

How Internet works: DNS

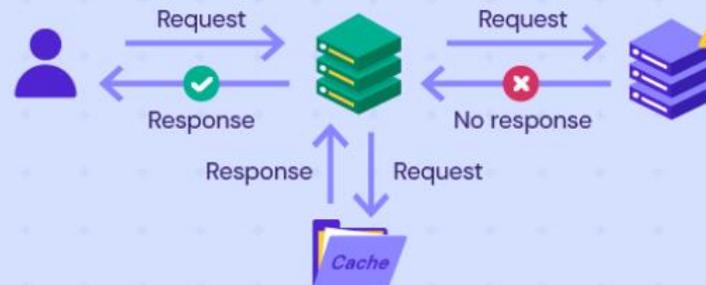


How Internet works: CDN

How Does a CDN Work?

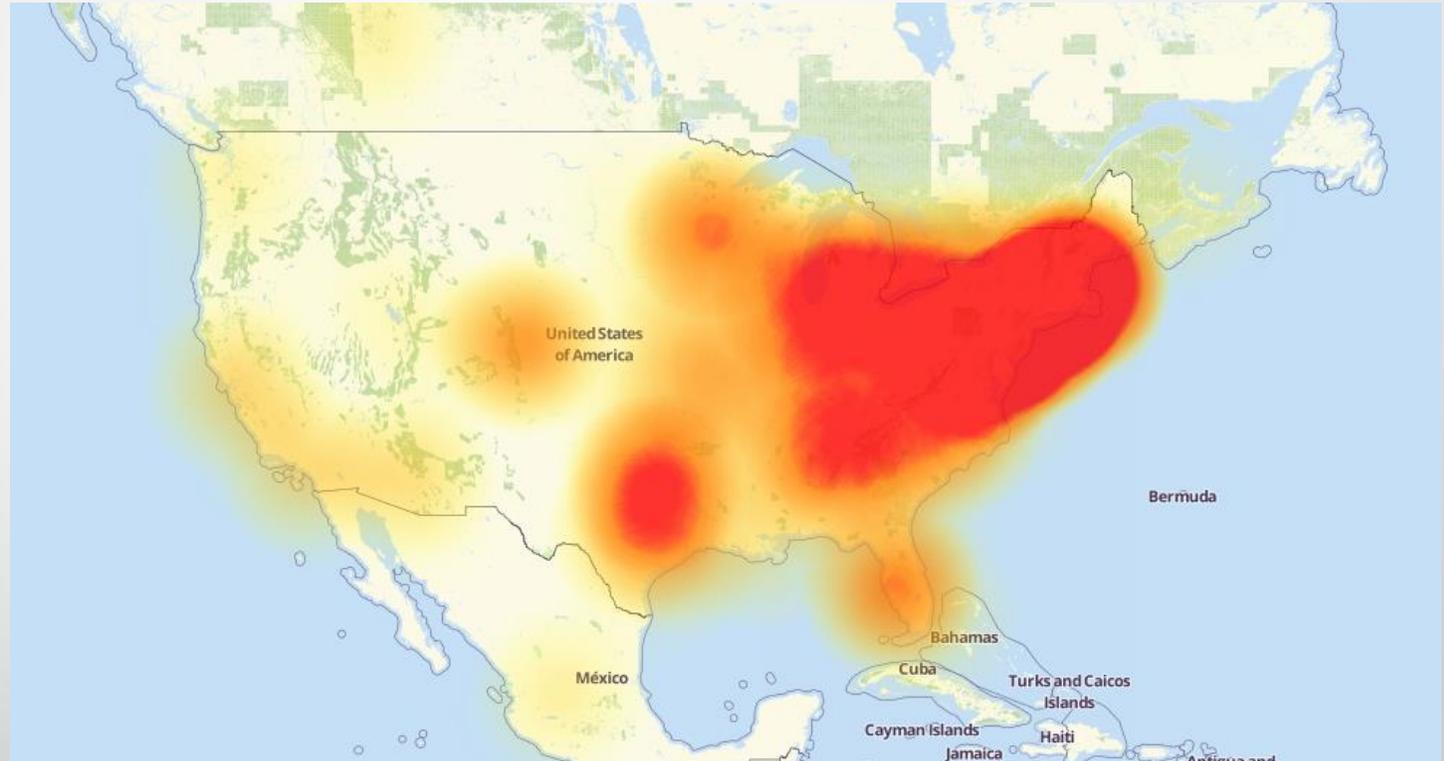


When a user visits a static website for the first time, a CDN server will transfer the files from the origin server. Note that you can access the content even when the origin server is not working since a CDN server typically stores and serves the static cached data.



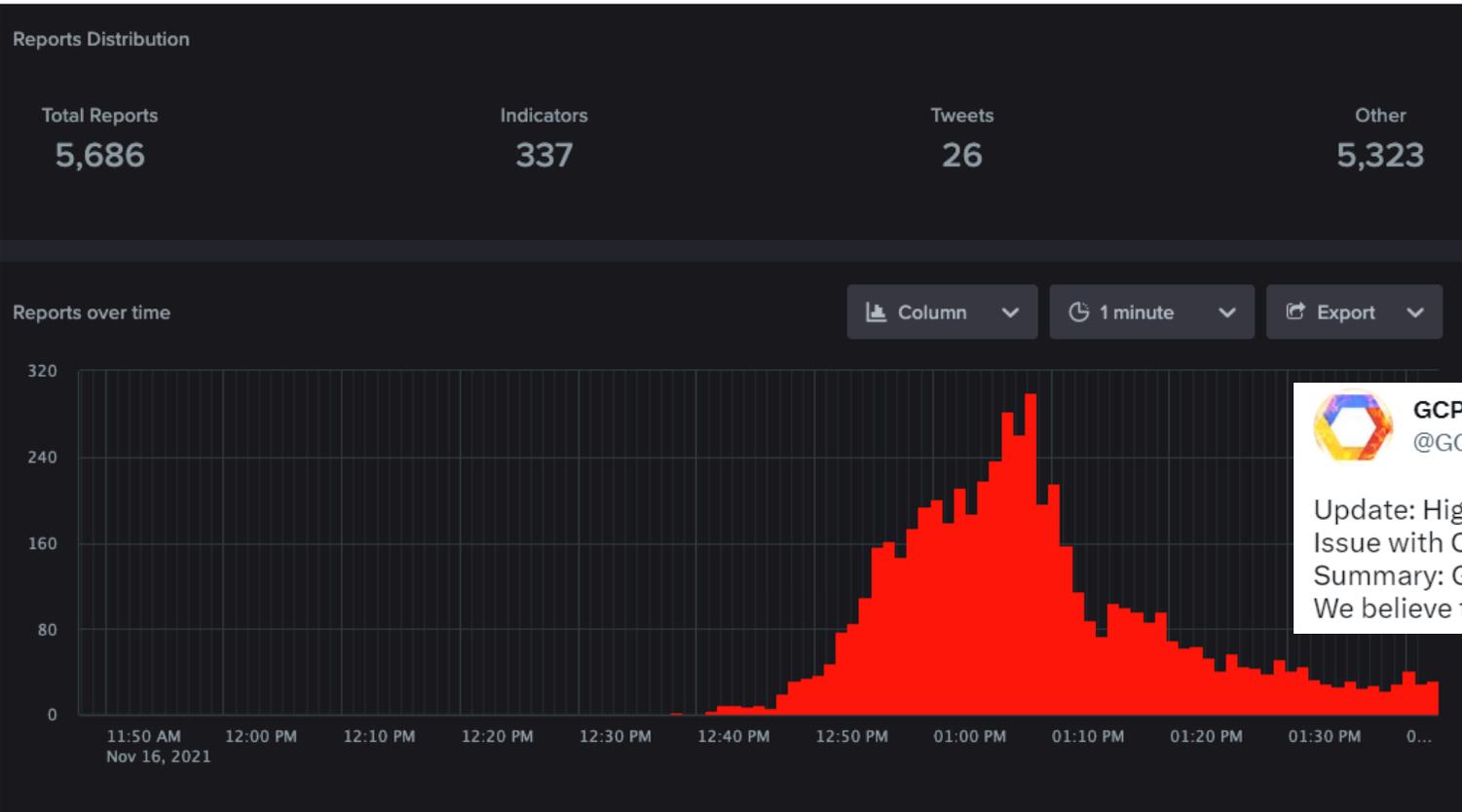
Internet Outage: Dyn -- DNS service provider

- Affecting users of Twitter, SoundCloud, Spotify, Netflix, Reddit, Pagerduty, Shopify, Disqus, Freshbooks, Vox Media, PayPal, Etsy, Github, Heroku, Time, PlayStation, the Intercom app and more.



Internet Outage: Google Cloud Platform

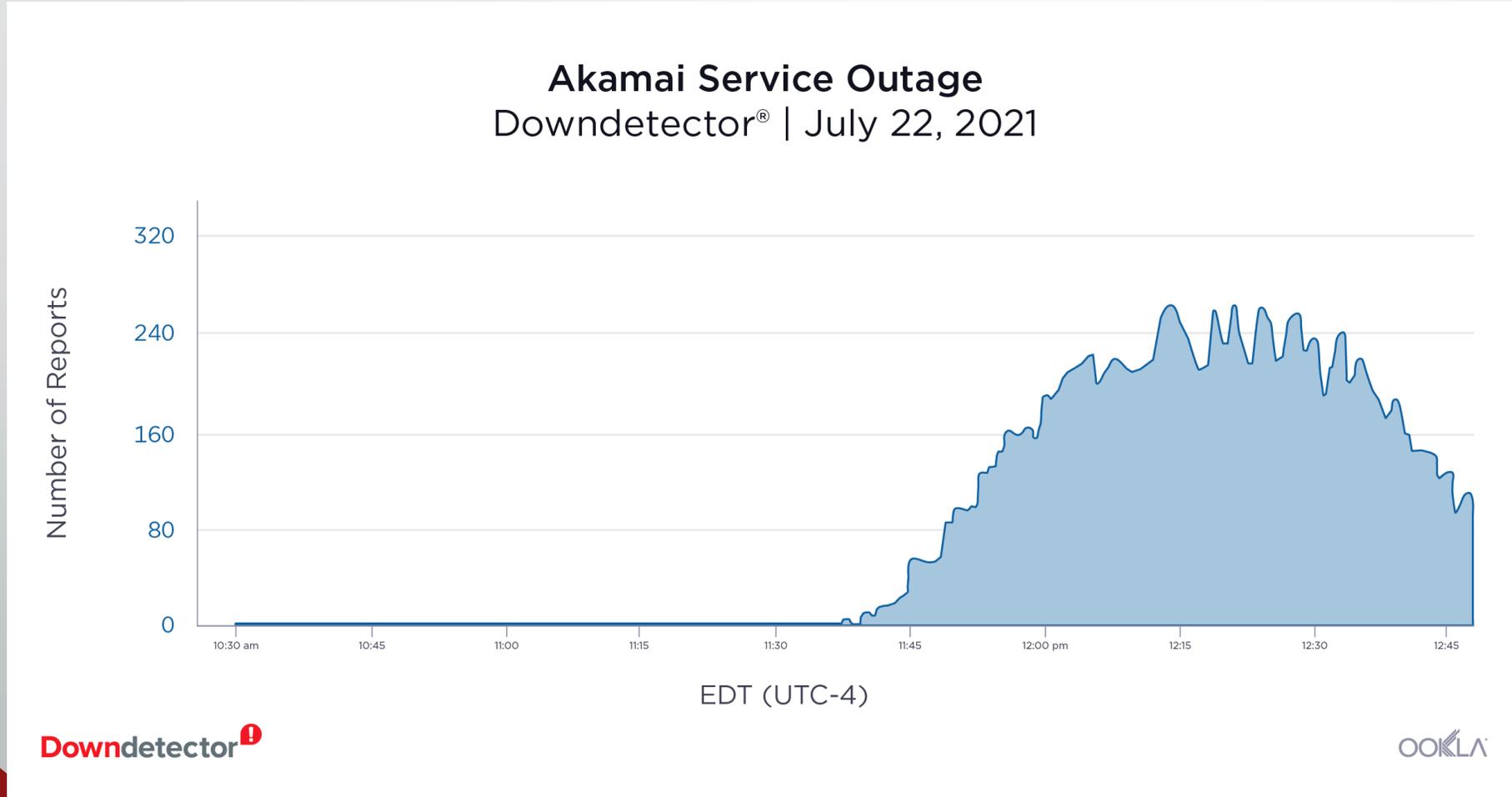
Google Cloud Platform Outage Downdetector® | November 16, 2021

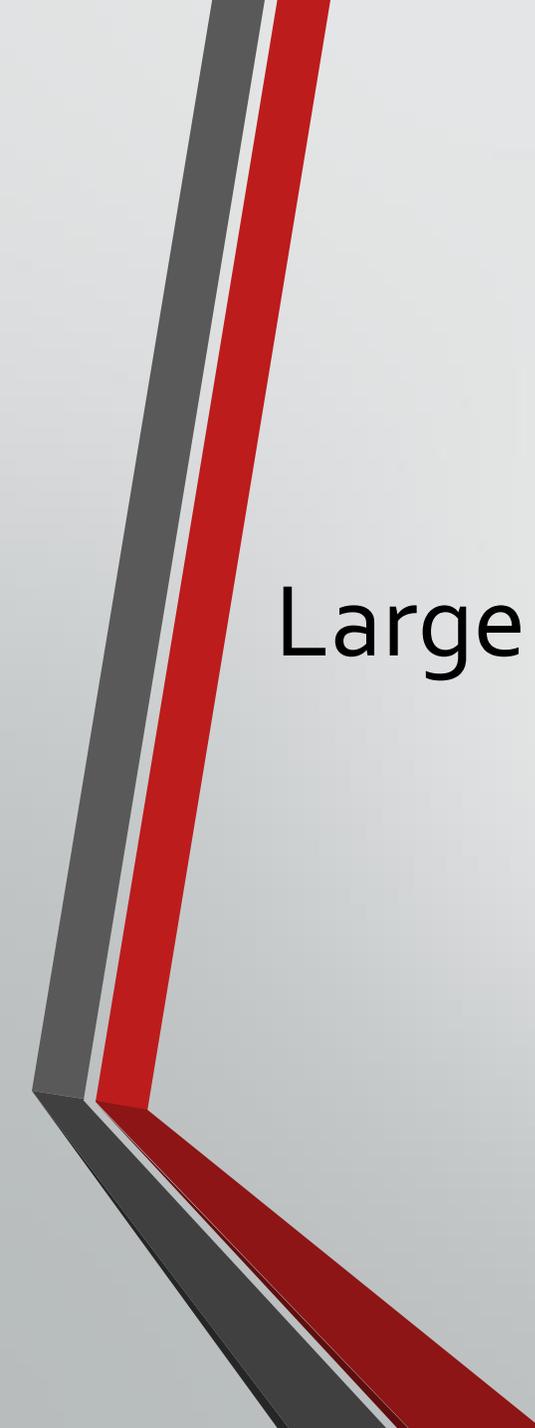


GCP Incidents
@GCP_Incidents

Update: High Google Cloud Networking incident: Global: Experiencing Issue with Cloud networking status.cloud.google.com/incidents/6PM5...
Summary: Global: Experiencing Issue with Cloud networking Description: We believe the issue with Cloud Networking 1/3

Internet Outage: Akamai – CDN service provider





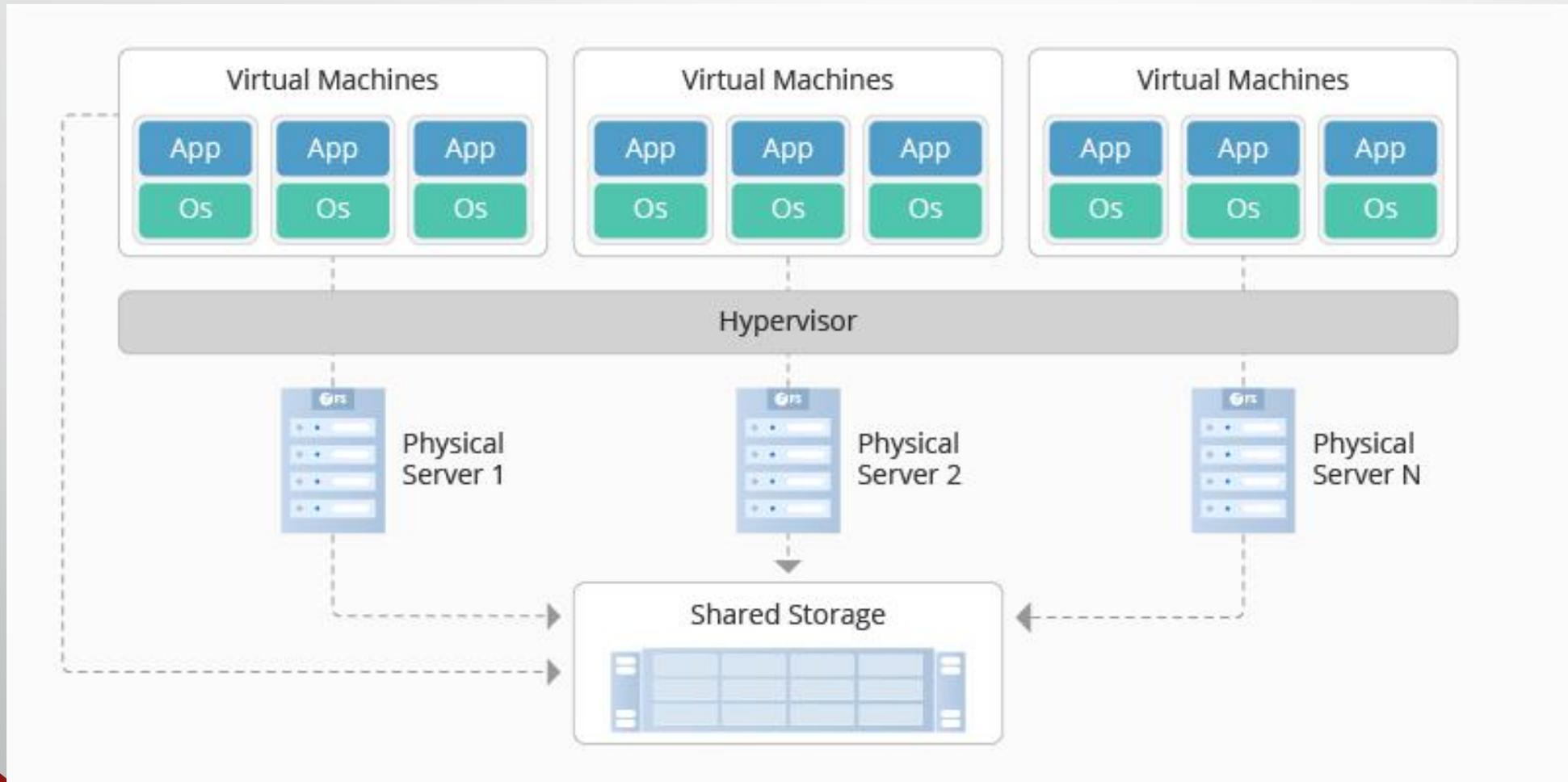
Large Cloud Outages = Larger Internet Outages

more at downdetector.com

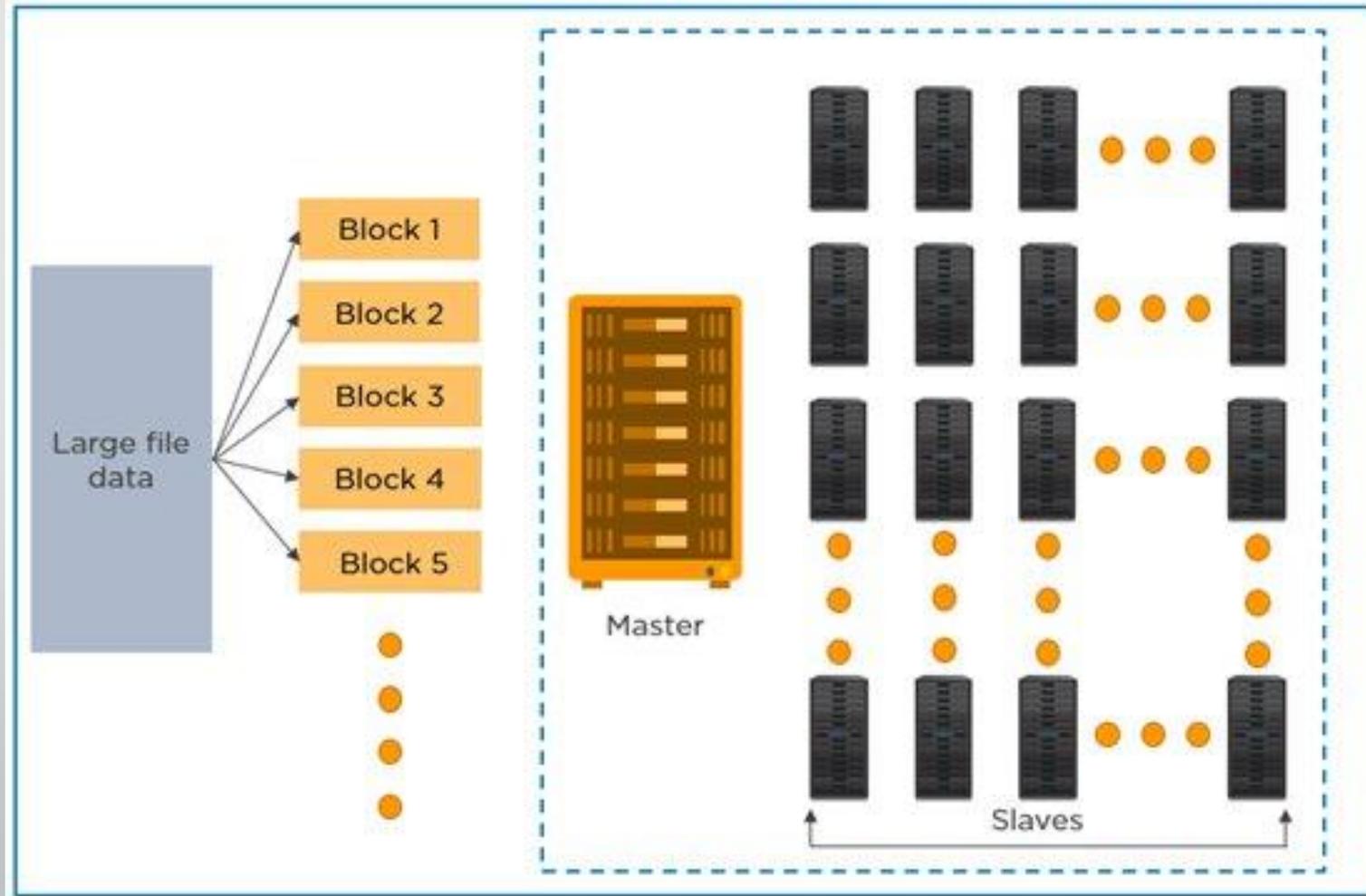


Cloud centralization

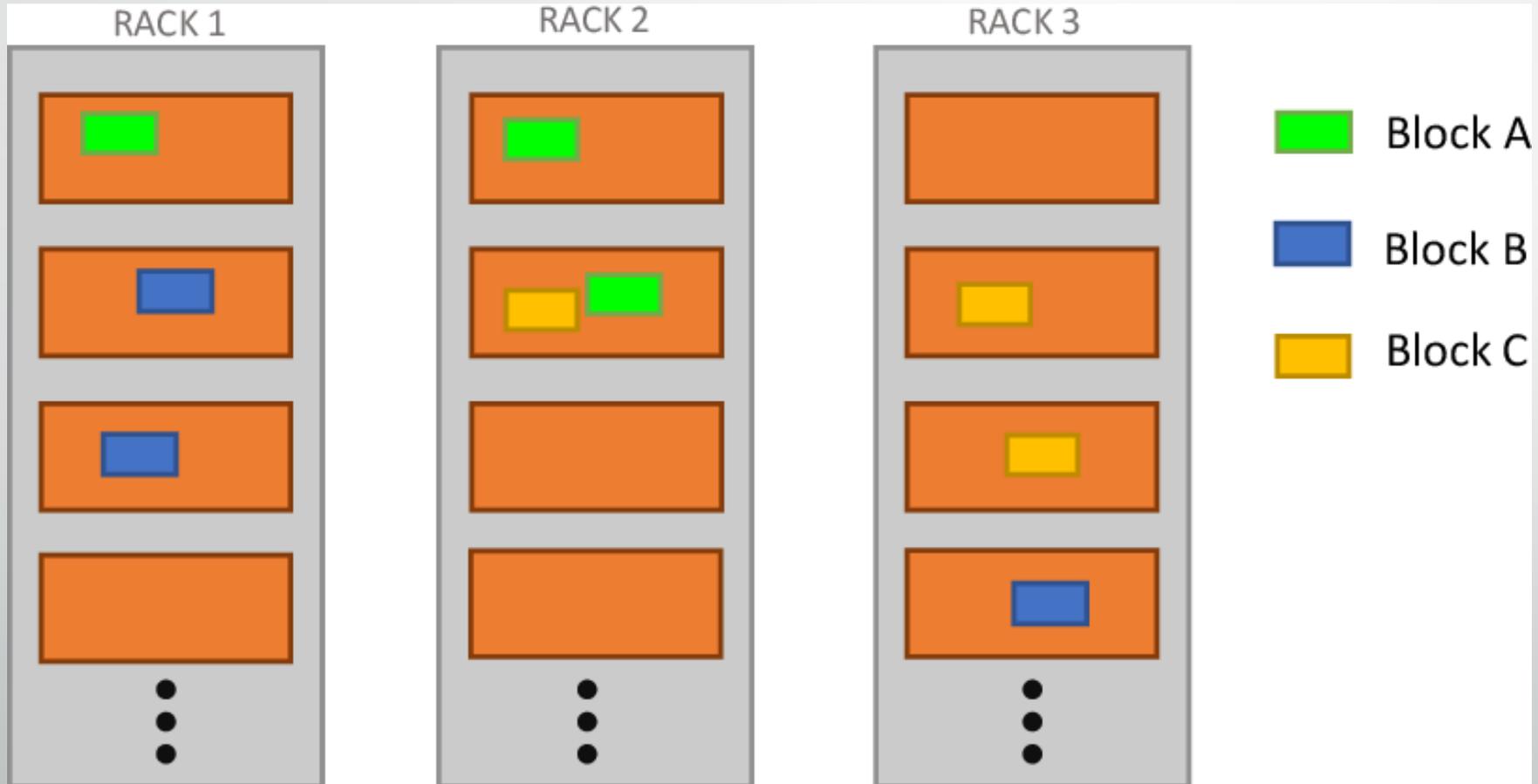
Basic Concept of Cloud: Virtualization



Basic Concept of Cloud: Distribution



Basic Concept of Cloud: Distribution

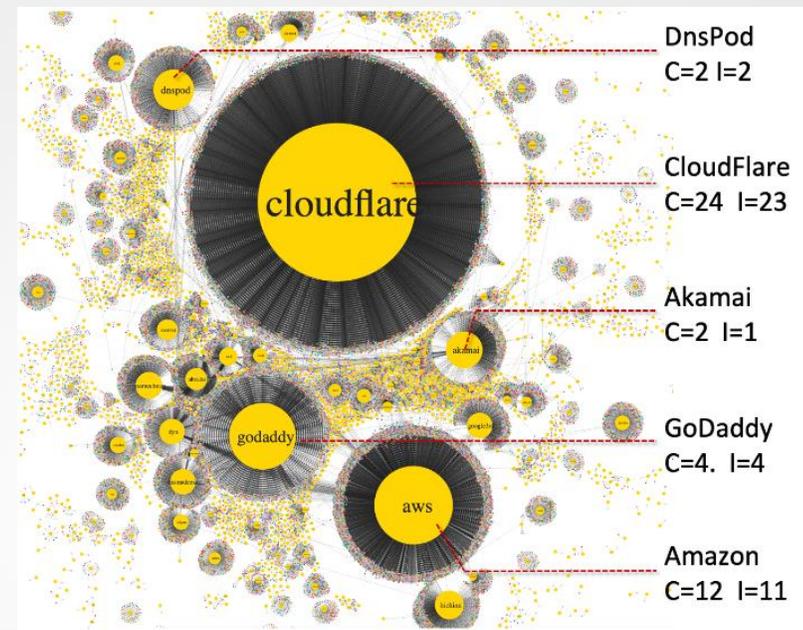


What's the catch?

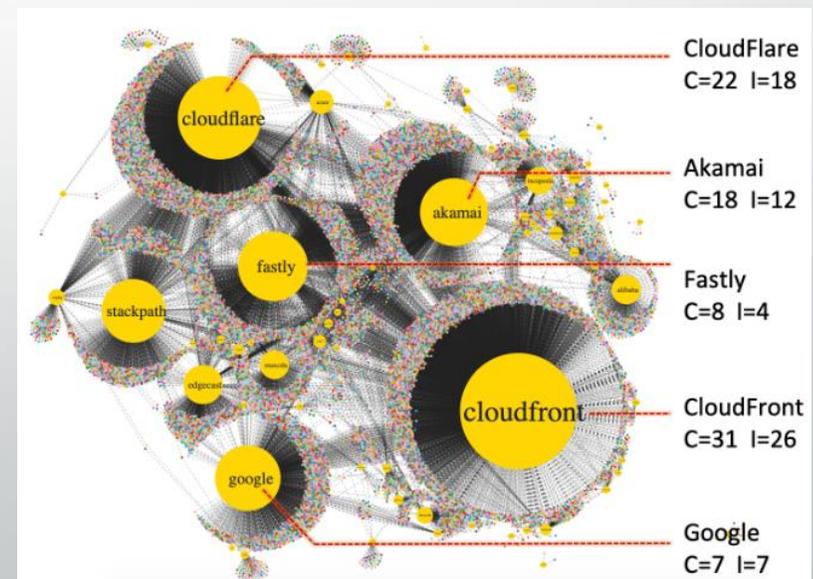
- Multitenancy → isolation failure, co-resident attack, collateral damages
- Distributed → cross-border data location, compliance
- Replicated → permanent deletion problem
- Outsourcing → cloud malicious insider, business termination, compliance

Cloud Centralization

- Highly centralized market
- Large cascading effect
- Single points of failure
- Outage triggers
 - Accidental errors
 - Malicious attack



(a)



(b)

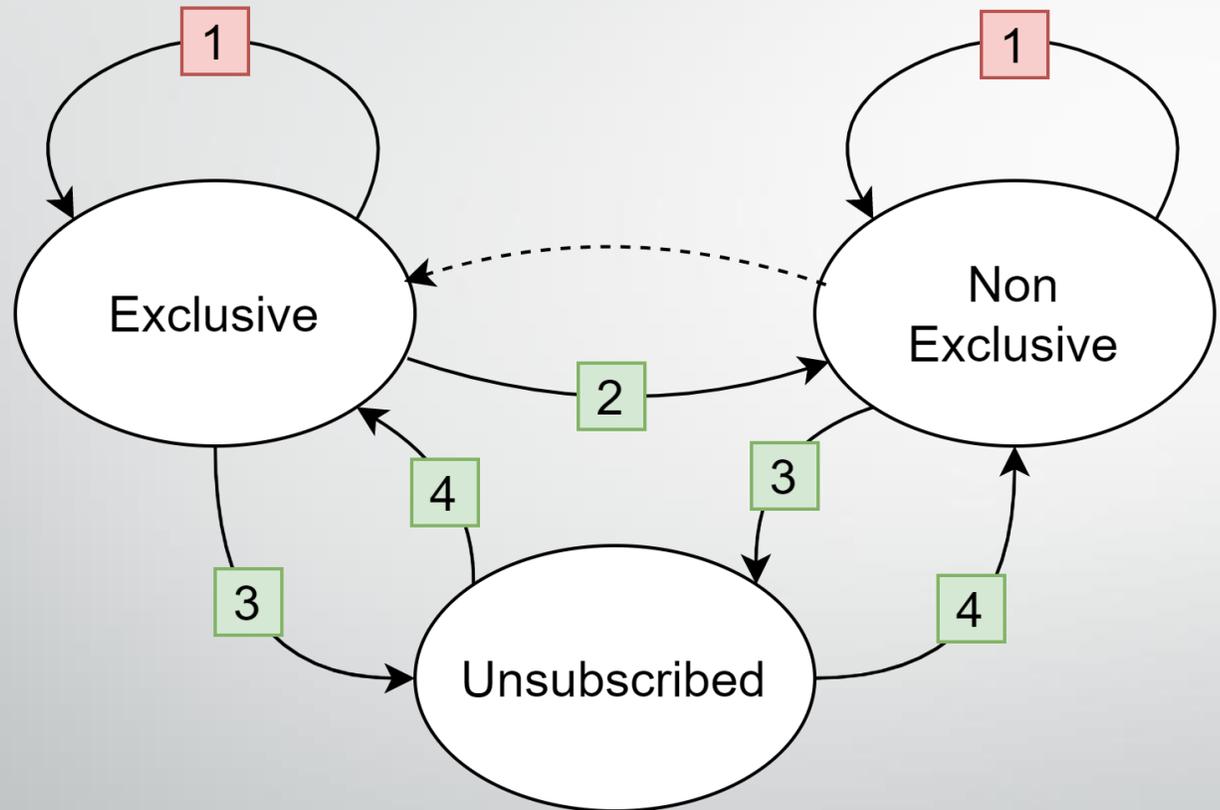
Verdict

- Using cloud with caution and awareness
- Implement additional measures for better resilience
- Network managers make decisions to promote resilience
- Understanding resilience strategy using Internet measurement
 - Cloud provider selection
 - Infrastructure location
 - Infrastructure replication and distribution



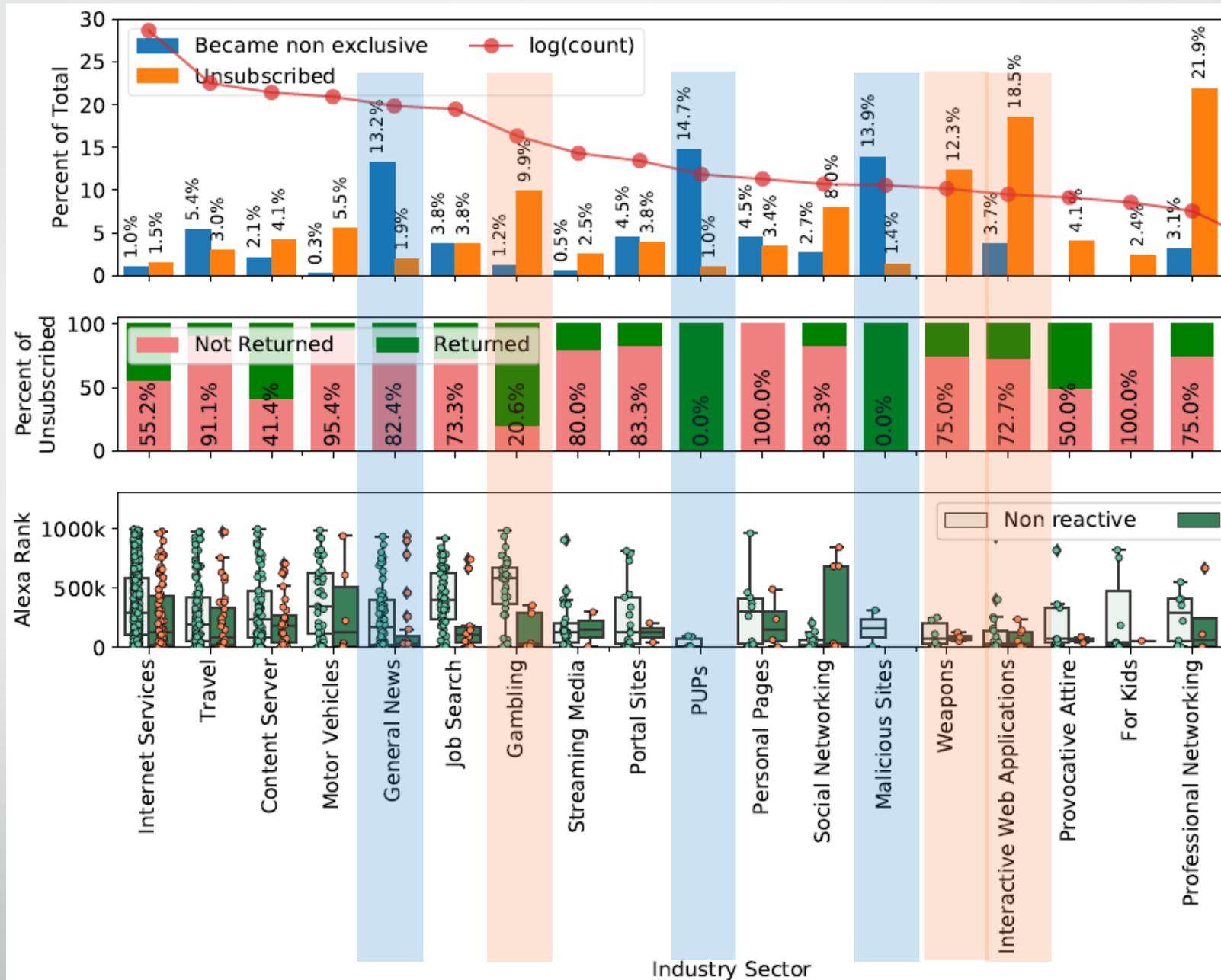
Using Internet measurement to study
resilience strategy

Case: Dyn

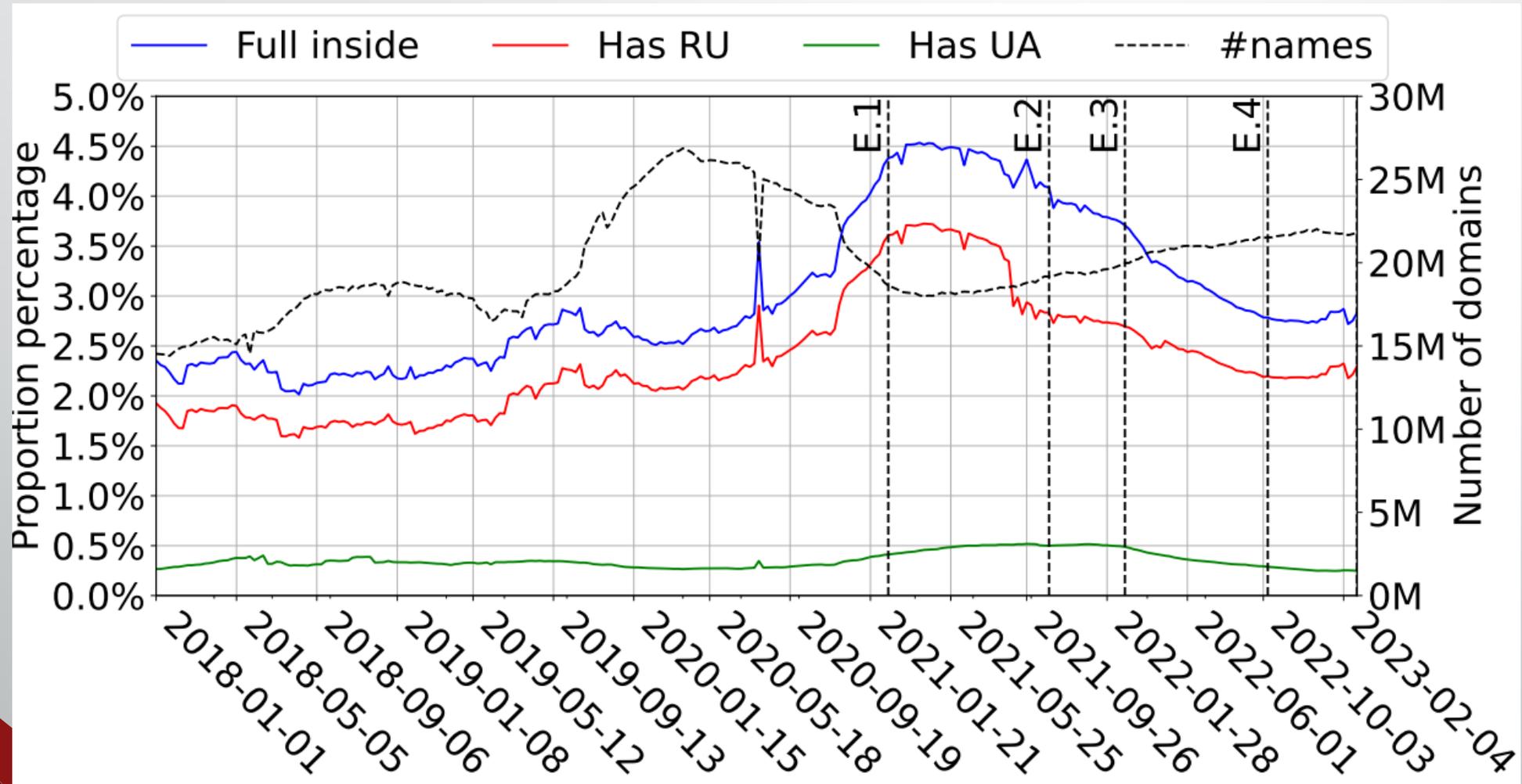


- 1 Do nothing (Non-reactive)
- 2 Become Non-exclusive
- 3 Unsubscribe
- 4 Return
- .-.- Less likely

Case: Dyn



Case: Russia-Ukraine conflict



Case: Russia-Ukraine conflict

Initial Location	Registrant Country	#names	Final Location					
			RU	US	DE	UA	AU	NL
RU	RU	25,249	93%	3%	1%	0%	0%	2%
	US	9,742	34%	32%	16%	0%	13%	2%
	IS	1,925	14%	65%	9%	1%	0%	4%
	JP	1,511	0%	24%	75%	0%	0%	0%
	UA	1,204	37%	11%	11%	29%	0%	5%
	CN	1,081	7%	47%	41%	0%	2%	0%
	PL	719	0%	2%	82%	0%	0%	0%
UA	UA	4,273	1%	3%	4%	86%	0%	2%
	US	1,244	5%	43%	16%	15%	12%	5%
	IS	496	1%	58%	7%	22%	1%	6%
	RU	471	66%	10%	5%	9%	0%	5%
	JP	240	0%	18%	81%	0%	0%	0%
	CN	191	0%	56%	34%	1%	4%	0%
	PL	84	0%	6%	65%	6%	0%	1%

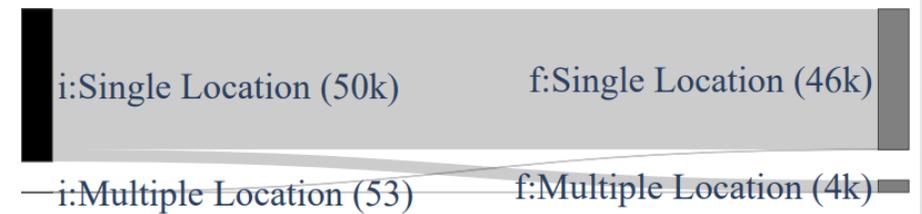
Case: Russia-Ukraine conflict



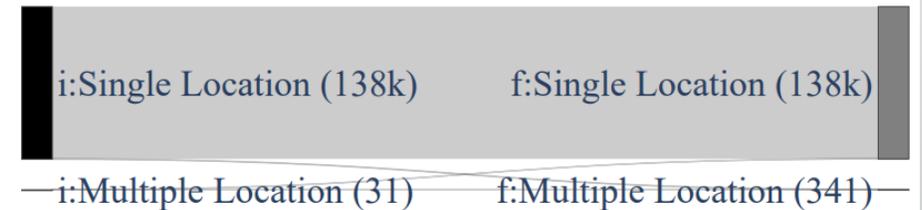
(a) Move away



(b) Stay inside or move into



(a) Move away



(b) Stay inside or move into



Thank you!

Contact: m.y.m.haq@utwente.nl