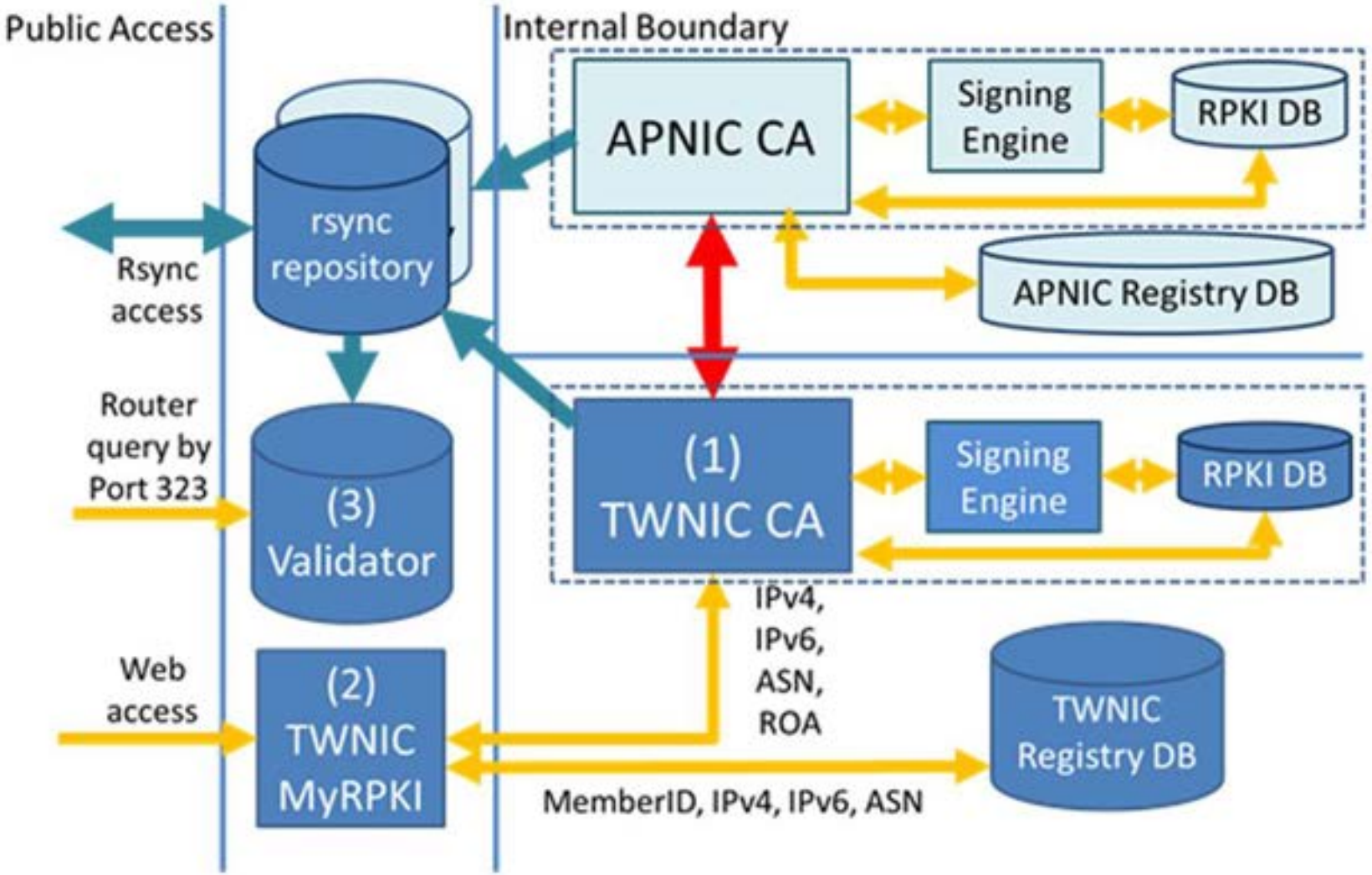
The Deployment Experience on TWNIC ROA_ROV

Tim Wang, TWNIC

TWNIC RPKI Architecture

RPKI Component Elements and Interactions



Strategy of RPKI Deployment

- Awareness for members
  - Importance, Responsibility, Practicality, Technology
- Identification of the involved members
  - Confirm the members with BGP route announcement
  - Confirm the contact person who is in charge of routing work
- RPKI customer service
  - Regularly organize educational training for RPKI concept and ROA setting
  - Set up a dedicated contact window for the ROA setting problem and Proactively notify members with invalid route.
- ROA & ROV statistics and analysis
- Public-Private-Partnership model

Responsibility Matrix

	Resource CA (Certificate authority)	RPKI/ROA	ROV
APNIC (RIR)	1. Build RPKI CA Server	1. Build RPKI Trust Anchor	1. ROV Deployment Monitoring
TWNIC (NIR)	1. Build CA Server to get Resource Certificate from APNIC 2. Build RPKI sub-CA for members	1. Build RPKI ROA Management System and create account for each member 2. Training Course 3. Customer Service	1. Build up Validator System 2. Training Course
TWNIC's Member	N/A	1. Manage/Maintain the ROA validity 2. Ensure every BGP route is valid for each member	1. Enable Router RPKI function 2. Connection between Router and Validator 3. Set up the filter on router(future work)

Deployment Challenges

- Awareness and Adoption
  - Many network operators were initially unfamiliar with RPKI and ROA concepts, which made adoption slow in the early stages.
- Technical Challenges
  - The setup and maintenance of RPKI CA/RRDP/Validator and MyRPKI system.
  - Configuring routers for ROV.
- Compatibility with Legacy Systems
  - Some older network equipment did not support RPKI or needed substantial updates to be compatible with the RPKI framework.
- Global Coordination
  - Since RPKI is a global initiative, TWNIC would have had to ensure that their efforts align with other RPKI repositories and their ROAs are propagated effectively across the global Internet routing table.

TWNIC RPKI Service Monitoring

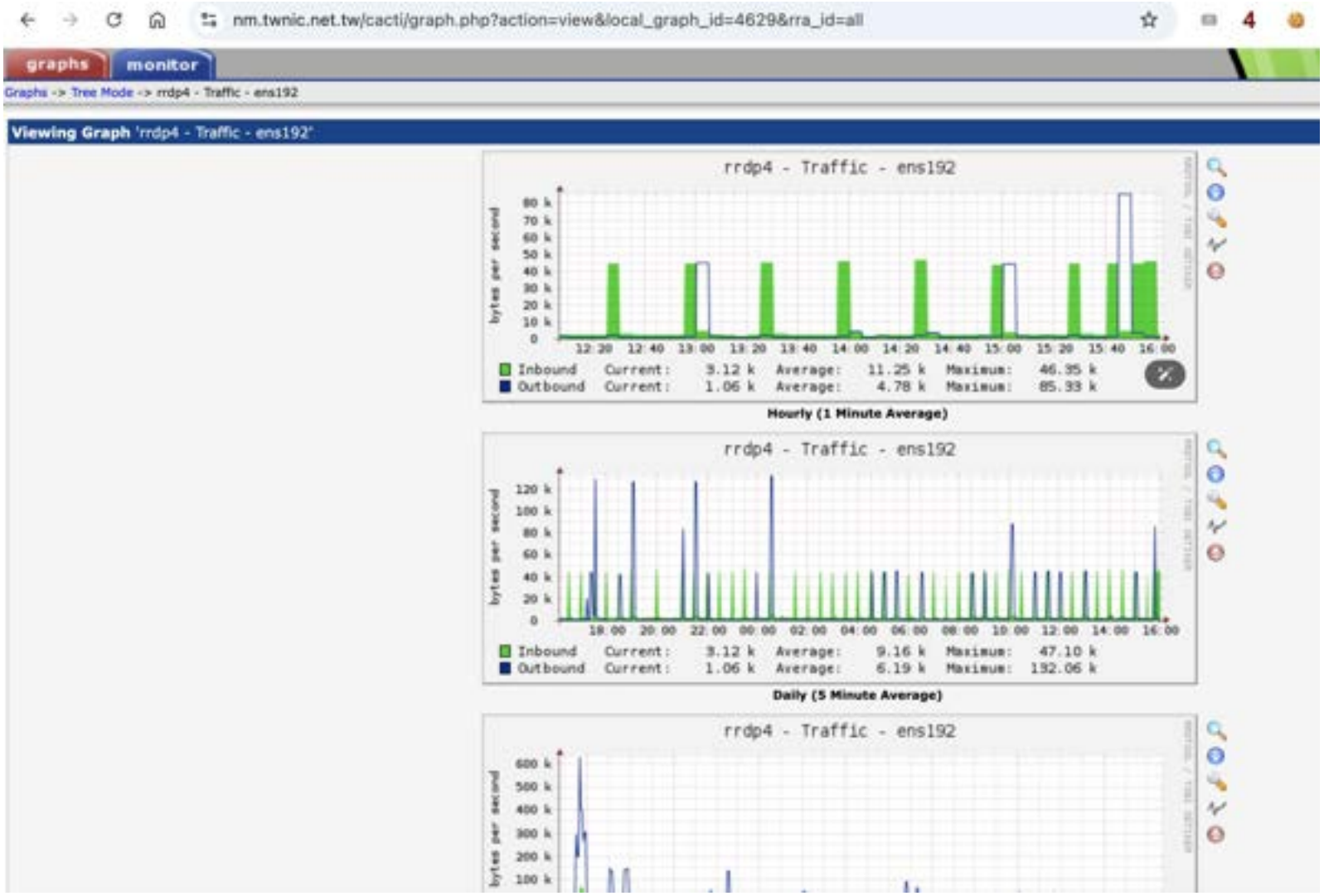
- **Infrastructure & OS Monitoring - Instantly, Hourly**
  - (OS, Network, Traffic, Loading)
  - Availability & Stability
- **Operation Monitoring - Instantly, Hourly, Daily**
  - (CA, RRDP, Validator, MyRPKI Portal, RMS DB)
  - Anomaly Detection & Resilience
- **Promotion Monitoring - Daily**
  - (ROA Validation, ROV Filtering)
  - RPKI Deployment of IP Members

Infrastructure & OS Monitoring

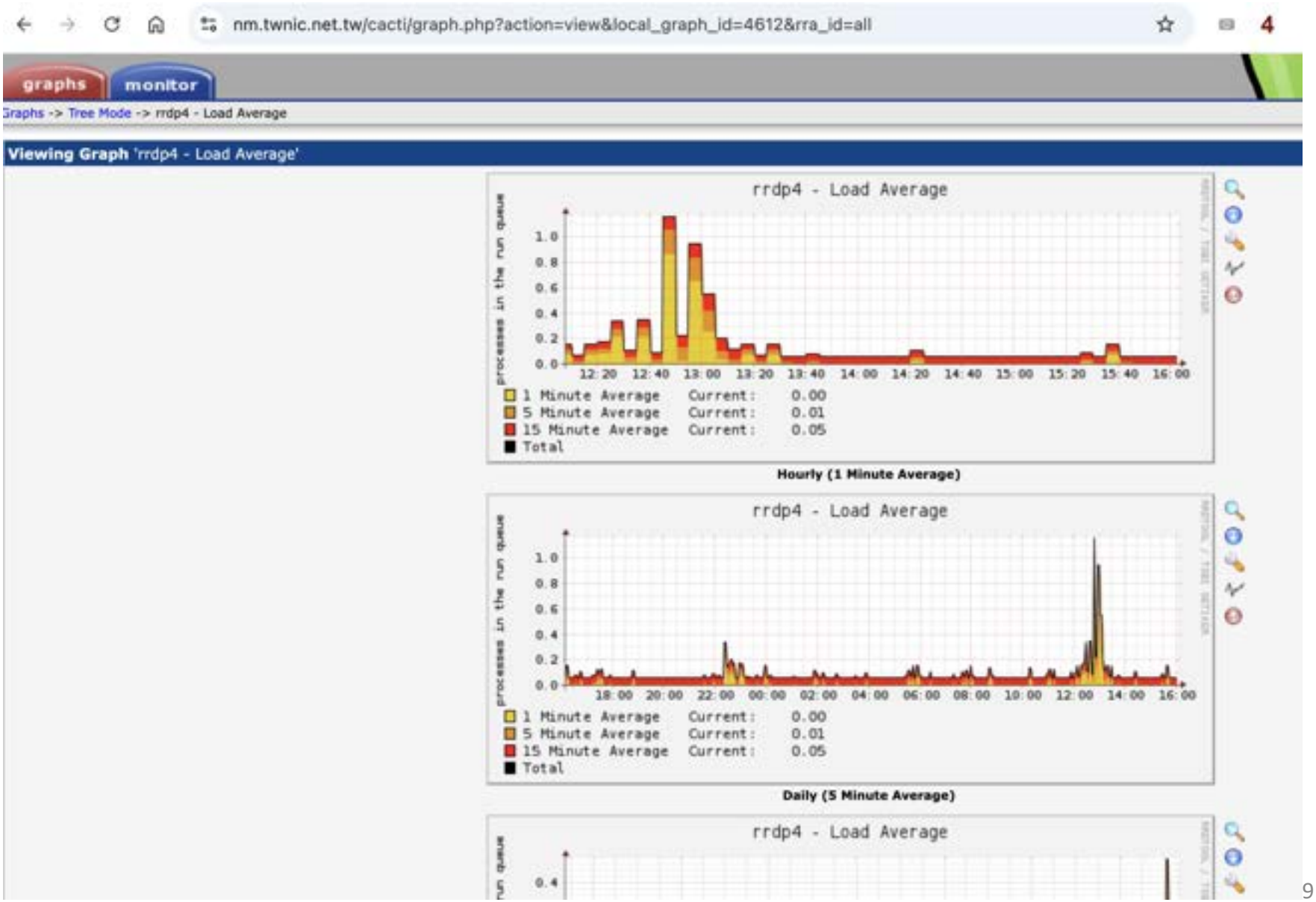
- We monitor the bandwidth, system load, process, memory, disk space for CA, RRDP, Validator, MyRPKI, RMS server

Infrastructure & OS Monitoring

- We also monitor the traffic of each system



Infrastructure & OS Monitoring



Operation Monitoring-World RRDP

- We monitor the RRDP server and the number of ROAs

全球RPKI RRDP VRP/ROA統計 – World

全球全部共有 671255 個VRP

全球全部共有 292672 個ROA

Updated: 2025-02-17 14:02

Items: 94 Columns▼

	總計		671,255	100.00%		292,672	100.00%	292,665	7
序號	排序	全球RPKI RRDP主機	VRP 數量	VRP 比率	VRP ROA 數量 是否相同	ROA 數量	ROA 比率	ROA Valid	ROA Invalid
1	1	rrdp.ripe.net	269,990	40.2217%	No	41,566	14.2022%	41566	0
2	2	rrdp.arin.net	176,265	26.2590%	No	156,081	53.3297%	156081	0
3	3	rrdp.apnic.net	121,787	18.1432%	No	15,156	5.1785%	15156	0
4	4	rrdp.afrinic.net	19,429	2.8944%	No	16,249	5.5519%	16242	7
5	5	rrdp.lacnic.net	19,087	2.8435%	No	13,776	4.7070%	13776	0
6	6	rpki-repo.registro.br	17,029	2.5369%	No	14,857	5.0763%	14857	0
7	7	repo-rpki.idnic.net	12,494	1.8613%	No	7,907	2.7017%	7907	0
8	8	rrdp.paas.rpki.ripe.net	9,295	1.3847%	No	4,693	1.6035%	4693	0
9	9	rpki-repository.nic.ad.jp	5,139	0.7656%	Yes	5,139	1.7559%	5139	0
10	10	rrdp-rps.arin.net	3,966	0.5908%	No	1,538	0.5255%	1538	0
11	11	rrdp.twnic.tw	3,754	0.5593%	Yes	3,754	1.2827%	3754	0

Operation Monitoring-ROA content

- We can track each ROA

序號	ROA Name	ROA Prefixes	ASN	MaxLength	ASN CC	IP CC	ROA數量
1	seyd36psnZ08XnX_ZMal3fCajSg.roa	2400:c780:fffe:1d64::/64	AS131590	64	TW	TW	1
2	mUHldt19UjWok-JlPO65yAxw3yA.roa	2400:c780:fffe:1d03::/64	AS131590	64	TW	TW	1
3	LuwyQulyJVGwZ50W_3tPKhmM8rI.roa	61.61.168.0/21	AS131627	24	TW	TW	1
4	72TvVv7Ud_0Gk98oLqlhJ3p_iQI.roa	211.78.0.0/18	AS4780	24	TW	TW	1
5	t6vuPXRRg03mksARrrkdMDUMXS4.roa	61.61.44.0/22	AS18049	24	TW	TW	1
6	tC1x02S5yvz3dMqJSdrXCtleVRs.roa	103.227.224.0/23	AS131590	23	TW	TW	1
7	z7lpqAhEDhTMXWKX5hliVN8BAso.roa	123.195.237.128/25	AS38841	25	TW	TW	1
8	R6SYjBP8YXguHdmdpEC7p67vv4E.roa	2400:c780:fffe:1d67::/64	AS131590	64	TW	TW	1
9	4u-8ykdEkZmlxc8G6XB3HRobydM.roa	2400:c780:fffe:1d00::/64	AS131590	64	TW	TW	1
10	Tmz2hGXBW4js03x0b3q4SeAycEg.roa	103.227.224.0/22	AS131590	22	TW	TW	1
11	C3FRe3fQrDiaVE3Xh_o0uijrTig.roa	123.195.236.0/24	AS38841	24	TW	TW	1
12	nWwbUETAECCJdlly-glmYuUcAcg.roa	103.227.226.0/24	AS131590	24	TW	TW	1

Operation Monitoring-rpkica.twnic.tw

RPKI ROA – rpkica.twnic.tw

rsync://rpkica.twnic.tw全部共有 3758 個ROA

Updated: 2025-02-17 15:12

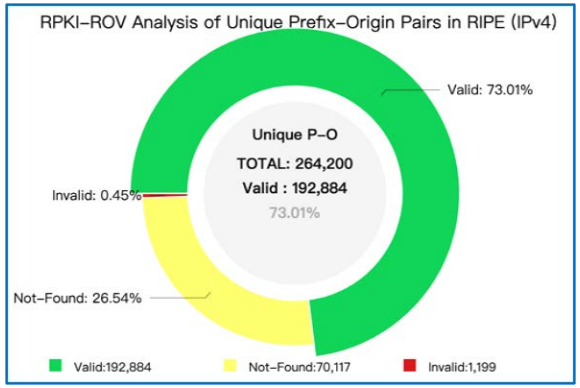
Items: 273 Columns▼

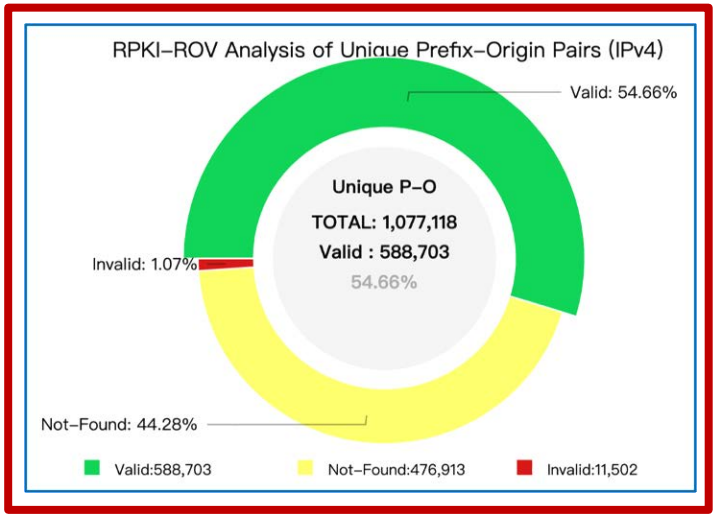
	總計				3,758	100.00%	33,956,352
					>0		
序號	排序	Sub CA	NetName	公司/單位名稱	ROA 數量	ROA 數量 比率	IPv4 IP 數量
1	1	TUNGHO	KBRO-NET	凱擘股份有限公司#	*880*	23.4167%	595,968
2	2	UBBNET	UBBNET-NET	台固媒體股份有限公司	*388*	10.3246%	354,304
3	3	NCIC	NCICNET-NET	新世紀資通股份有限公司#	*297*	7.9031%	2,419,200
4	4	FET	FETNET-NET	遠傳電信股份有限公司#	*288*	7.6637%	3,717,120
5	5	HINET	HINET-NET	中華電信股份有限公司	*190*	5.0559%	14,487,552
6	6	PROFOND	TFN-NET	台灣固網股份有限公司#	*162*	4.3108%	1,910,784
7	7	CHIEF-TW	CHIEF-TW-NET	是方電訊股份有限公司	*123*	3.2730%	239,616
8	8	EMAX	VEETIME-NET	大台中數位有線電視股份有限公司#	*110*	2.9271%	196,608
9	9	TANET	TANET-NET	教育部	*80*	2.1288%	6,004,480
10	10	CGNET	CGNET-NET	大新店民主有線電視股份有限公司	*45*	1.1974%	43,008

RPKI ROA Validation Status of Global and 5 RIRs

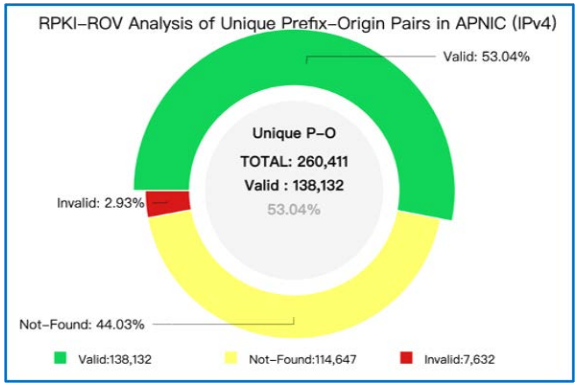
Global Valid: **54.66%**

RIPE Valid: 73.01%

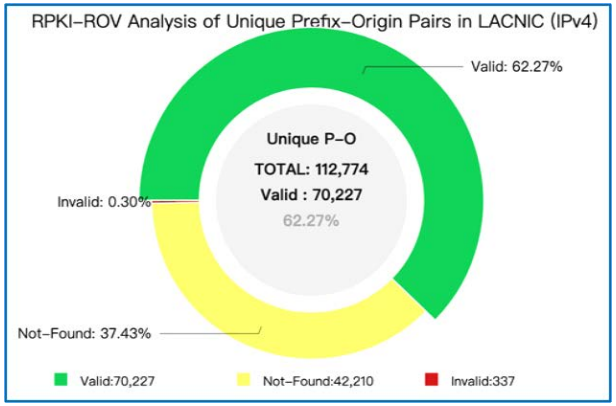




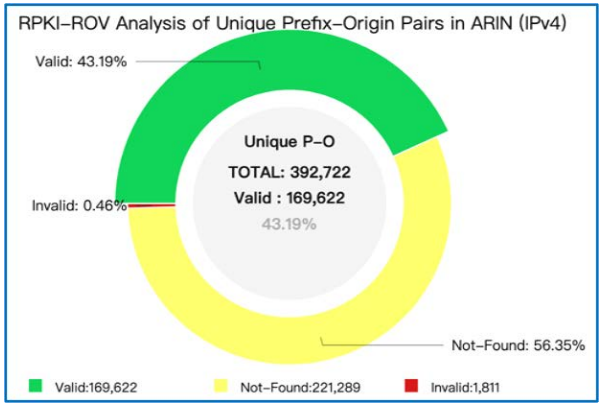
APNIC Valid: 53.04%



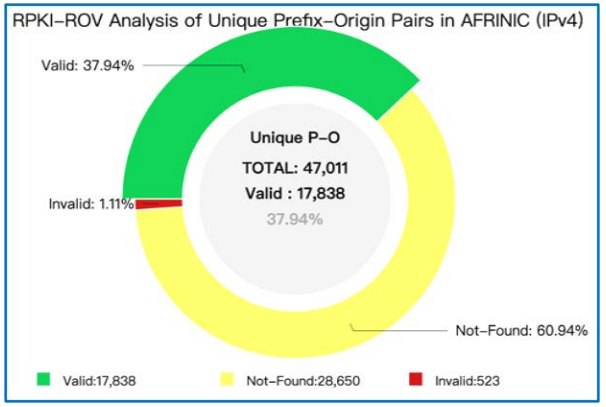
LACNIC Valid: 62.27%



ARIN Valid: 43.19%



AFRINIC Valid: 37.94%



Source: https://rpki-monitor.antd.nist.gov/ROV, on 17 February 2021

Promotion Monitoring-RIPE NCC ROA

Promotion Monitoring-RIPE NCC ROA

Numbers: 236 Columns▼ ?

Rank	CC	Display Name	Chinese Name	RIPE RPKI ROA %	IPv4 Addresses	Population	APNIC ROA ASN
1	TO	Tonga, Oceania	東加	100.00	11,520	109,254	6
2	AD	Andorra, Europe	安道爾	100.00	57,344	80,489	16
3	BQ	Bonaire, Caribbean		100.00	24,832	27,351	5
4	BT	Bhutan, Asia	不丹	100.00	43,776	795,484	27
5	FK	Falkland Islands, Americas	福克蘭群島	100.00	7,168	3,811	1
6	GF	French Guiana, Americas	法屬蓋亞那	100.00	22,528	324,606	14
7	IO	British Indian Ocean Territory, World	英屬印度洋地區	100.00	3,072	0	1
8	MV	Maldives, Asia	馬爾地夫	100.00	93,952	516,218	28
9	NR	Nauru, Oceania	諾魯	100.00	10,240	12,943	7
10	PM	Saint Pierre and Miquelon, Americas	聖皮耶島及密客隆島	100.00	4,608	5,797	5
11	SR	Suriname, Americas	蘇利南	100.00	81,664	632,189	13
12	EC	Ecuador, Americas	厄瓜多	99.79	2,717,440	18,493,874	244
13	LK	Sri Lanka, Asia	斯里蘭卡	99.67	564,480	21,981,199	34
14	GY	Guyana, Americas	蓋亞那	99.62	68,864	823,012	14
15	MO	Macao Special Administrative Region of China, Asia	澳門	99.39	337,664	718,619	31
16	TW	Taiwan, Asia	台灣	99.37	35,713,280	23,965,132	456

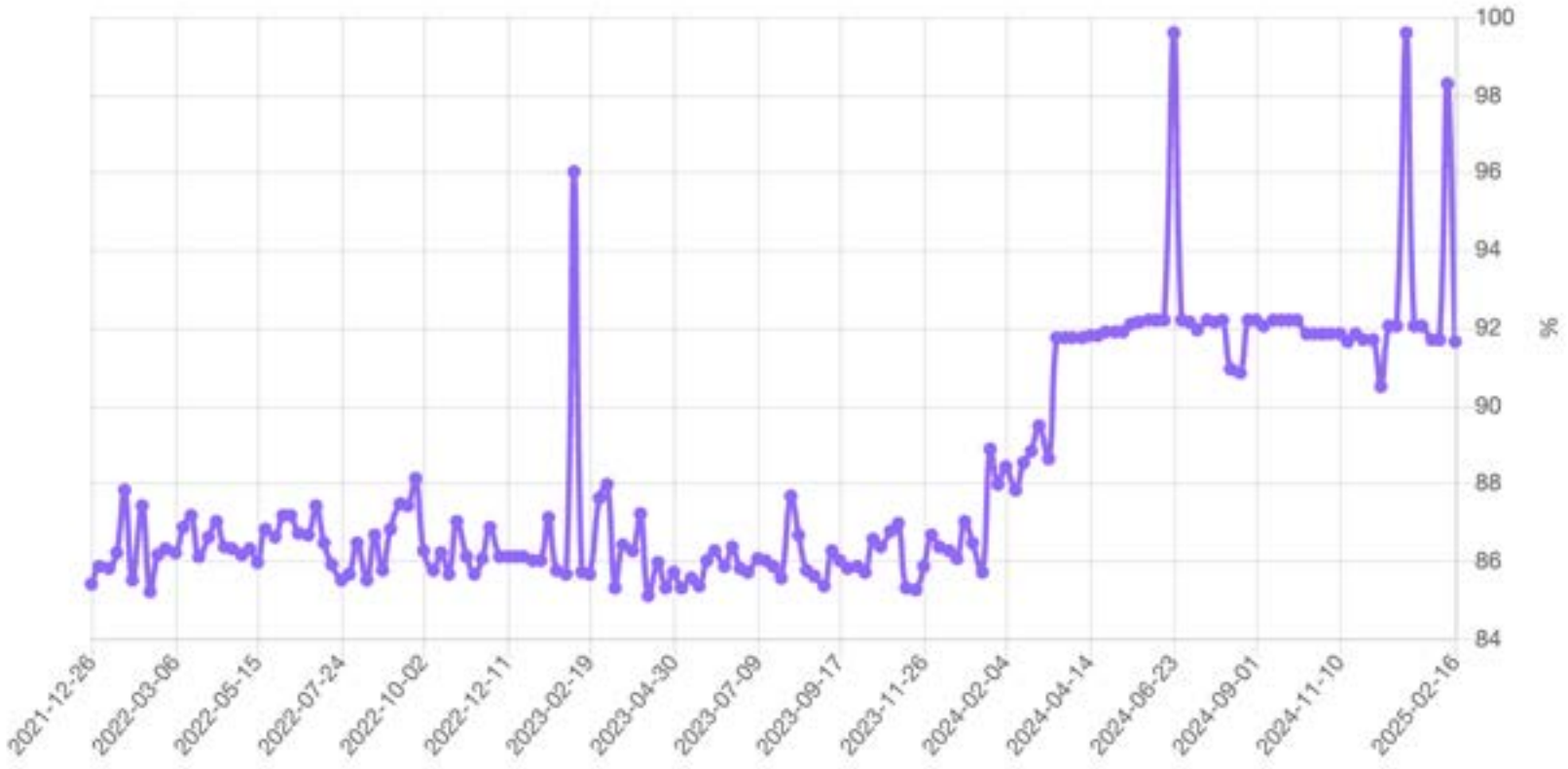
Promotion Monitoring-APNIC ROA

Taiwan RPKI_ROA Global Ranking: 60

2025-02-16 ——台灣全球排名：60名 (RPKI_ROA比例: 91.67%)

Data derived from APNIC by measuring mean value of RPKI_ROA Valid.

Top 300 List



Promotion Monitoring-APNIC ROV

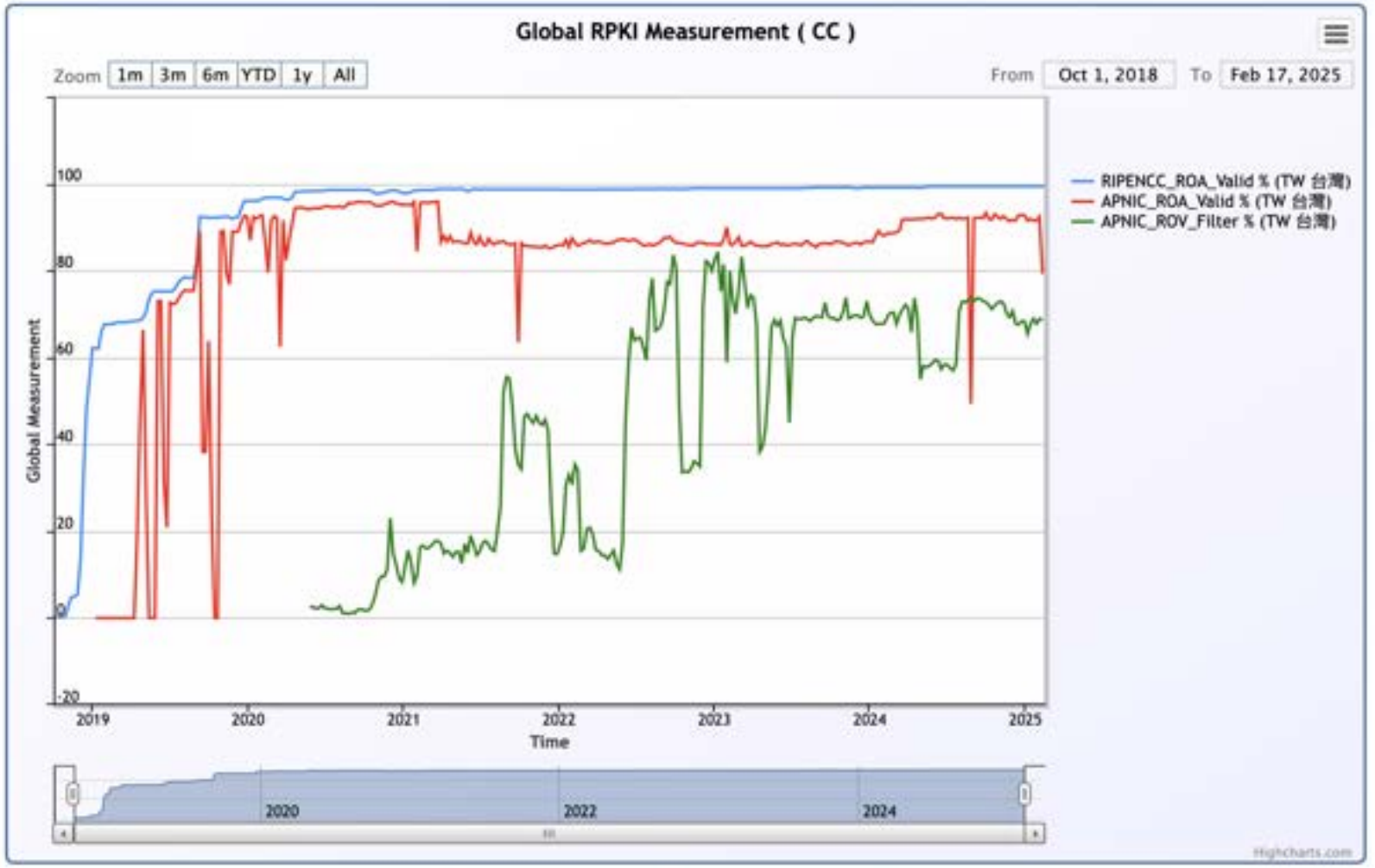
Taiwan RPKI_ROV Global Ranking: 22

2025-02-16 —台灣全球排名：22名 (RPKI_ROV比例: 68.16%)

Data derived from APNIC by measuring mean value of RPKI_ROV Filter.

Top 300 List

Promotion Monitoring-Taiwan RPKI



Lessons Learned and Future Work

- Early Collaboration is Key
  - Engaging with stakeholders early in the process helped ease the deployment and encourage adoption.
  - Public-Private-Partnership model is helpful.
- Training and Education
  - Providing technical training and educational resources for network operators is essential for a smooth transition to RPKI.
- Continuous Monitoring
  - Continuously monitor RPKI validation results and troubleshoot any validation failures that occur in the network.
- Community Engagement
  - Continue holding seminars, trainings, and workshops to engage with local ISPs and network operators and ensure they remain informed about the latest RPKI developments and best practices.

Thank you