

Discovering Obscure Looking Glass Sites on the Web to Facilitate Internet Measurement Research

CoNEXT 21 (提名最佳论文)

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Measurement VPs are important

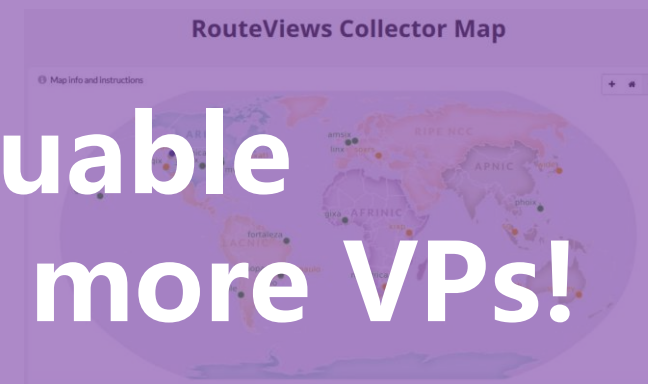
- Vantage points (VPs) **are critical for** Internet measurement researches
 - ✓ Inter-domain topology discovery
 - ✓ Link-level congestion detection
 - ✓ Cyber-attack detection
 - ✓
- Measurement platforms have spent effort in deploying VPs
 - **The number and coverage of the VPs are still limited**



CAIDA Ark VPs (100+)



RIPE RIS VPs (in the upper tier)




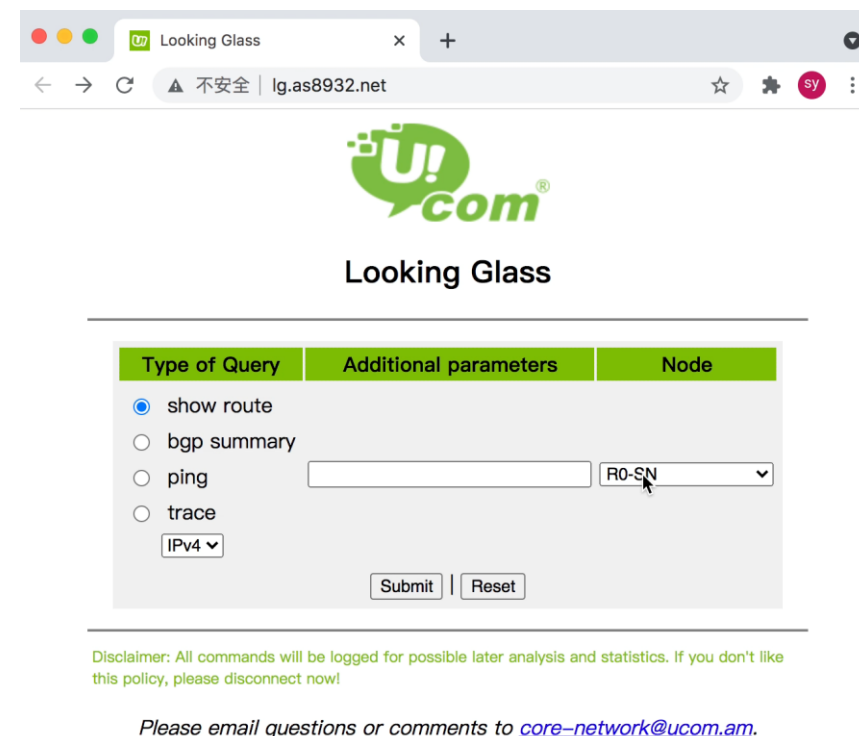
RouteViews VPs (in the upper tier)

It would be very valuable
If researchers can exploit more VPs!



Looking Glass (LG) VPs

- Actively deployed by ISPs
 - ✓ Observe their networks
 - ✓ Troubleshoot connectivity and performance issues
- Beneficial for measurement researches
 - Hosted in critical infrastructures
 - Likely offer both data and control plane views
- **LG pages**
 - Web interfaces to LG VPs that allow the execution of different types of measurement commands
 - E.g. <http://lg.as8932.net> 





Well-known and obscure LG pages

Researchers usually find and use LG pages from several well-known portal pages

Many other available LG pages cannot be found and exploited easily !

tracertool.org

Maintained by [Thomas Kernen](#)

Please feel free to send me updates, links, corrections, extra info
Note that I'm unable to provide support for the linked web pages

Looking Glass

- [GARR \(AS137\)](#)
- [CenturyLink \(AS209\)](#)

Traceroute.org

PeeringDB

UCOM AS8932

组织 UCOM,LLC
别名 UCOM CJSC
长名称
公司网站 <http://www.ucom.am>
ASN 8932
IRR as-set/route-set 对象 AS8932:AS-ALL
路由服务器 URL
Looking Glass URL <http://lg.as8932.net>

PeeringDB

Well-known LG pages

CATEGORY 1 - IPv4 AND IPv6 BGP

Please send LG additions and updates to webmaster@bgp4.as. Including NOC whitelist requests

ASN Whois Query Legend (RIRs) | A=ARIN | R=RIPE NCC | P=APNIC | L=LACNIC | F=AFRINIC

CC	Region	BGP Looking Glass website
GLOB	Global	BT Global Services Looking Glass
GLOB	Global	Cogent Communications Looking Glass
GLOB	Global	Deutsche Telekom Looking Glass
GLOB	Global	Easynet Global Services Looking Glass
GLOB	Global	GBLX Global Crossing (Level3) Looking Glass
GLOB	Global	GTT / Tinet Looking Glass
GLOB	Global	Hurricane Electric Looking Glass
GLOB	Global	Inteliquent / Tinet Looking Glass
GLOB	Global	Level3 Looking Glass
GLOB	Global	NTT Communications (NTT America) Looking Glass

BGP4.as

BGP Looking Glass Database

Welcome! We suggest using the classic BGP Looking Glass and Traceroute list in internet. You'll find out 1150 Looking Glass Servers located at 04/04/2020. If you find a broken link, or you want to announce a new looking glass site, please feel free to send us an email to info2@bgplookingglass.com. You can also check now our new route servers list site: www.routeservers.org

Name of ISP	ASN	Looking Glass
Looking Glass University of California, Berkeley AS25	25	https://networks.net.berkeley.edu/pubnet/
Looking Glass Packet Clearing House AS42	42	https://www.pch.net/look/glass
Looking Glass University of Wisconsin-Madison AS59	59	https://www.net.wisc.edu/cgi-bin/public/fg-ws59.pl
Looking Glass University of Washington AS73	73	https://netmon.cac.washington.edu/lookingglass/
Looking Glass Princeton University AS88	88	https://www.net.princeton.edu/traceroute.html

BGPLookingglass.com

Looking Glass - Looking Glass - w9.gubo.org
w9.gubo.org/LookingGlass/en.php

LookingGlass - Open source PHP looking glass. Test IPv4: 23.95.242.173. Test files: 10MB

103.253.27.204 - Cheapwindowsvps_LG - Looking Glass
103.253.27.204

Server Location: Singapore. Test IPv4: 103.253.27.204. Test files: 25MB 50MB 100MB 1000MB Your IP Address: 40.77.167.52

<https://lg-os1.sa.net>

Riven Cloud - Looking Glass

Server Location: Osaka, Japan. IPv4 Address: 103.88.47.47. IPv6 Address: 2400:ddc0:1000::35ed:d9ba. Your IP Address: 66.249.69.151. Network Test Files ...

.....

Obscure LG pages

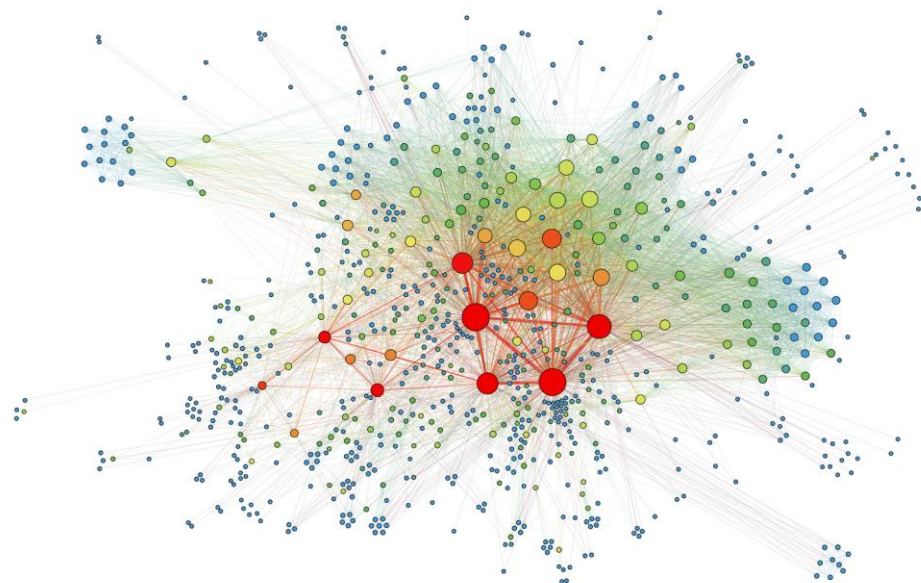


How to discover and exploit these obscure LG pages

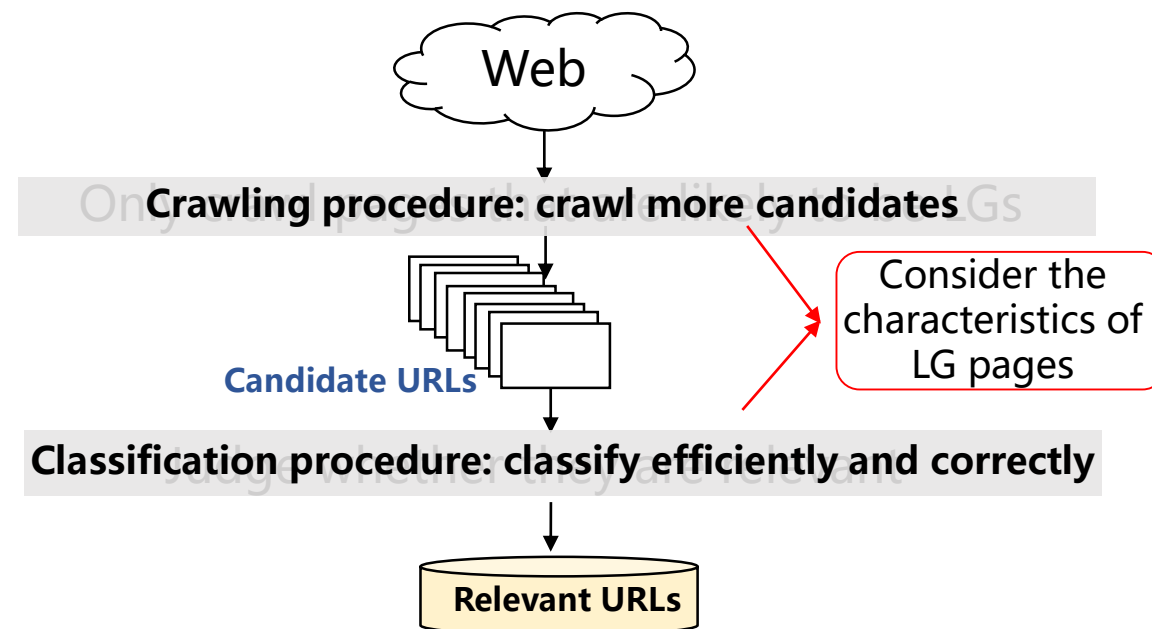
Efficiently discover obscure LG pages

- **The goal of our paper:** develop a method to discover obscure LG pages

How to efficiently discover LG pages? LG focused crawler



Nearly two billion active websites
Traditional web crawler: crawl and judge every page
infeasible!



Discover as many LGs as possible, while avoiding resource consumption on irrelevant pages



Crawling procedure

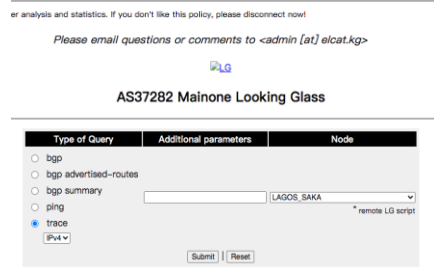
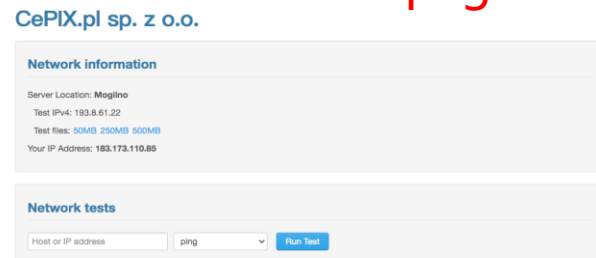
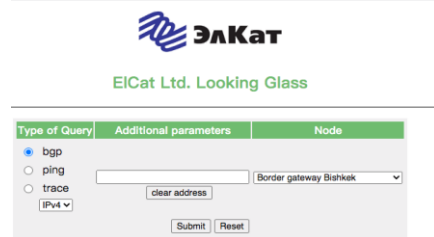


Q1: how to design a crawling procedure to discover more candidate URLs

Pages on the same topic are well connected
widely used hyperlink-guided search

Hyperlink-guided search **insufficient!**

Poor link connections between LG pages



For possible later analysis and statistics. If you don't like this policy, please disconnect now!
Please email questions or comments to igor@mainone.net

Many LGs do not connect to other LG pages

LG pages are usually similar in some aspects

Key issue



Candidate URLs similar to

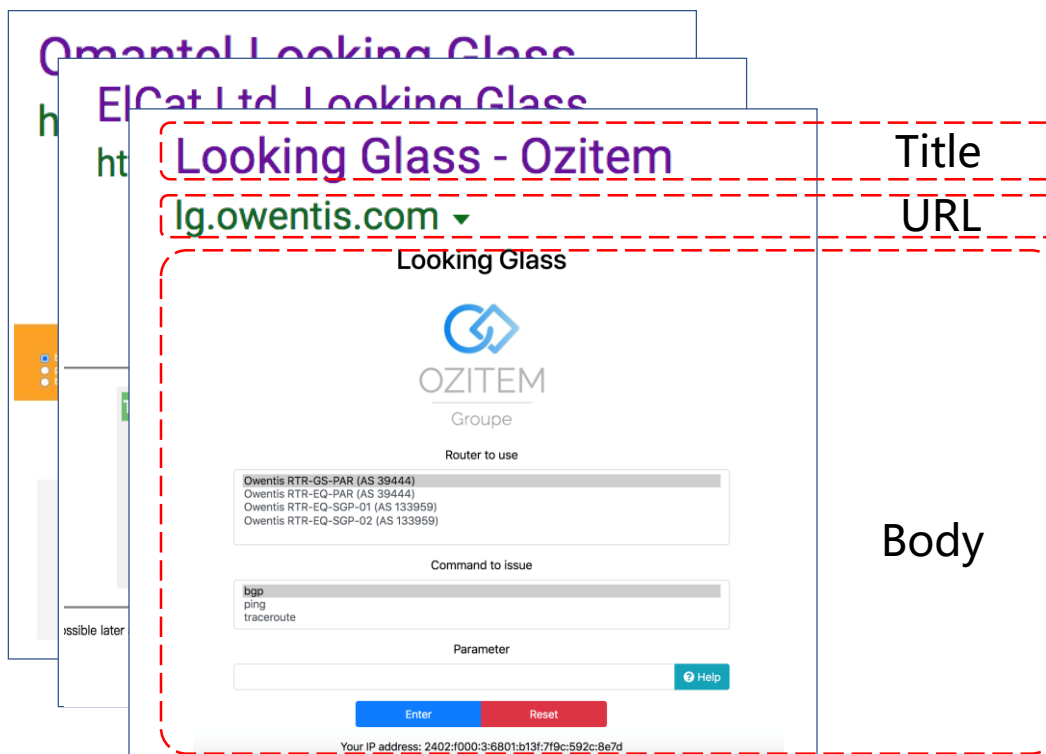


Known LG pages

Similarity-guided search: use search engines to collect pages similar to known LGs

Crawling procedure

- **Similarity-guided search**
 - Mine common features shared by known LGs and transform them into search terms



Looking Glass - Ozitem

lg.owentis.com

Looking Glass

OZITEM

Gruppe

Router to use

Owentis RTR-GS-PAR (AS 39444)
Owentis RTR-EQ-PAR (AS 39444)
Owentis RTR-EQ-SGP-01 (AS 133959)
Owentis RTR-EQ-SGP-02 (AS 133959)

Command to issue

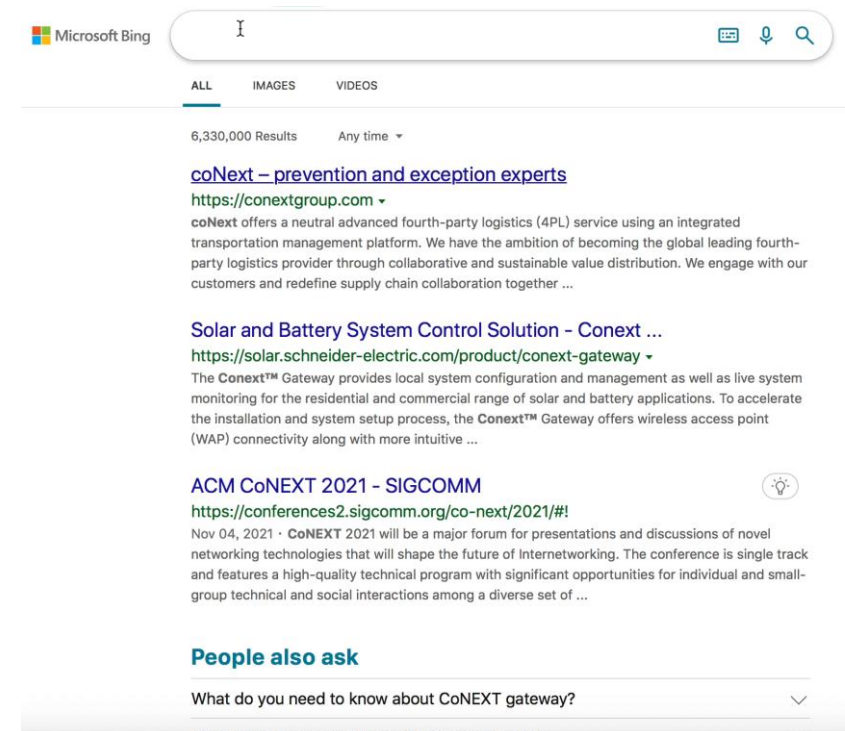
bgp
ping
traceroute

Parameter

Enter Reset

Your IP address: 2402:f000:3:6801:b13f:7f9c:592c:8e7d

Analyze known LG pages



Microsoft Bing

Looking Glass - Ozitem

ALL IMAGES VIDEOS

6,330,000 Results Any time

[coNext - prevention and exception experts](https://conextgroup.com)
https://conextgroup.com

coNext offers a neutral advanced fourth-party logistics (4PL) service using an integrated transportation management platform. We have the ambition of becoming the global leading fourth-party logistics provider through collaborative and sustainable value distribution. We engage with our customers and redefine supply chain collaboration together ...

[Solar and Battery System Control Solution - Conext ...](https://solar.schneider-electric.com/product/conext-gateway)
https://solar.schneider-electric.com/product/conext-gateway

The Conext™ Gateway provides local system configuration and management as well as live system monitoring for the residential and commercial range of solar and battery applications. To accelerate the installation and system setup process, the Conext™ Gateway offers wireless access point (WAP) connectivity along with more intuitive ...

[ACM CoNEXT 2021 - SIGCOMM](https://conferences2.sigcomm.org/co-next/2021/#!)
https://conferences2.sigcomm.org/co-next/2021/#!

Nov 04, 2021 · CoNEXT 2021 will be a major forum for presentations and discussions of novel networking technologies that will shape the future of Internetworking. The conference is single track and features a high-quality technical program with significant opportunities for individual and small-group technical and social interactions among a diverse set of ...

People also ask

What do you need to know about CoNEXT gateway?



Classification procedure



Q2: how to design a classification procedure to classify candidates efficiently and correctly

Select features

Select algorithm

Accuracy

Exploit all information about candidates, including html files



Efficiency

Download html files of many candidates time-consuming and bandwidth-intensive !

To achieve both accuracy and efficiency: a two-step classifier



An LG URL



8

A non-LG URL



Classification procedure

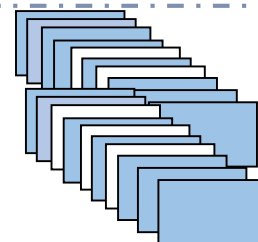
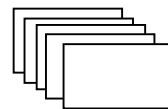


Q2: how to design a classification procedure to classify candidates efficiently and correctly

Select features

Select algorithm

A small set of well-know LGs
(Positive samples)



A large number of candidates
(Unlabeled samples)

- × Supervised algorithms: require positive and negative labeled samples
- × Unsupervised algorithms: classification results may be unsatisfactory
- ✓ **Lack labeled negatives: PU (Positive and unlabeled) learning**
Avoid labeling training samples and achieve good performance



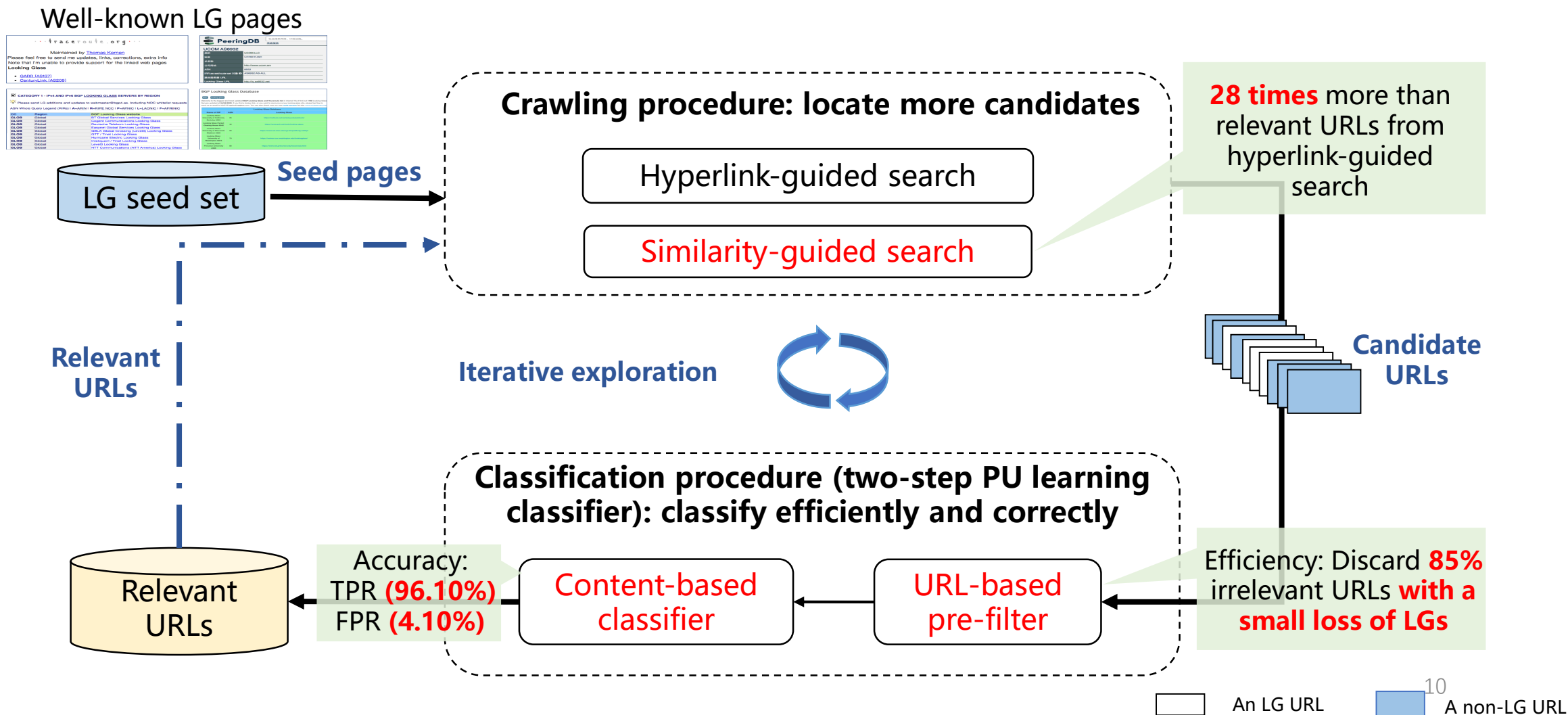
An LG URL



A non-LG URL

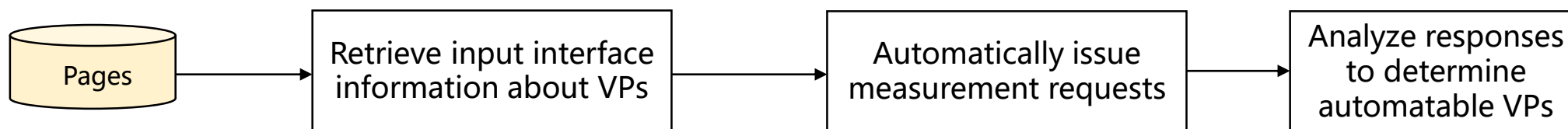


Summarize and evaluate



Automate the use of LG VPs

- It will be more practical if we automatically use VPs of the relevant URLs!
- **Develop an automation tool: retrieve automatable LG VPs**



Input field names	Input field types	Values that can be filled in input fields
query	text	-
command	radio	[bgp, trace, ping]
router	select	[GYNI_BORDER, RVD1_TR, MTV1_TR, BGA1_TR]
protocol	select	[ipv4, ipv6]

```

The required input fields to issue ping measurement requests (name, type, value)
(cmd,select,ping):(host,text,Target IP):(server,select,deimos);
(cmd,select,ping):(host,text,Target IP):(server,select,margaret);
(query,radio,ping):(addr,text,Target IP):(router,select,Border gateway Moscow);
(query,radio,ping):(addr,text,Target IP):(router,select,EICat Core);
(query,radio,ping):(addr,text,Target IP):(router,select,Border gateway Bishkek);
(query,radio,ping):(addr,text,Target IP):(router,select,Border gateway Osh (New));
(query,radio,ping):(addr,text,Target IP):(router,select,Border gateway Osh);
(query,radio,ping):(arg,text,Target IP):(router,select,erdiss-sbr2.ja.net/Juniper);
(query,radio,ping):(arg,text,Target IP):(router,select,glascb-rbr1.ja.net/Juniper);
(query,radio,ping):(arg,text,Target IP):(router,select,stoichb-rbr1.ja.net/Juniper);
  
```

VPs in LG page <http://lg.infortek.net.br>

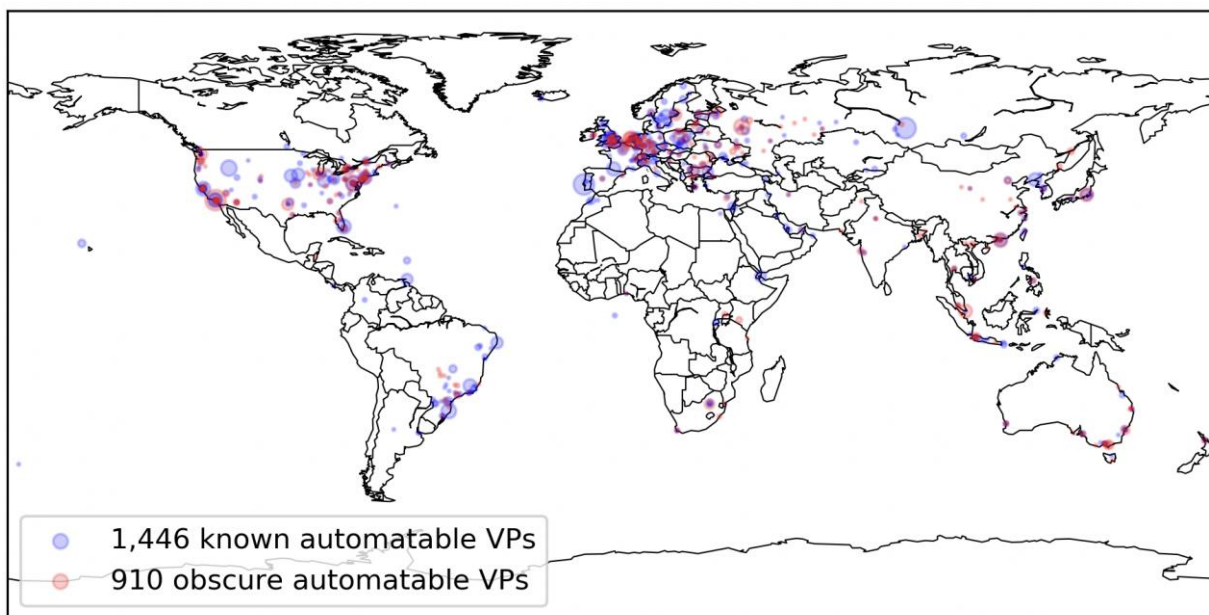
Programmatically fill in required input fields

- Results
 - 1,446 known automatable VPs from the well-known LG pages
 - **910 obscure automatable VPs** from the relevant pages ↪ 60%



Geographic coverage improvements

The obscure VPs can bring significant coverage improvements



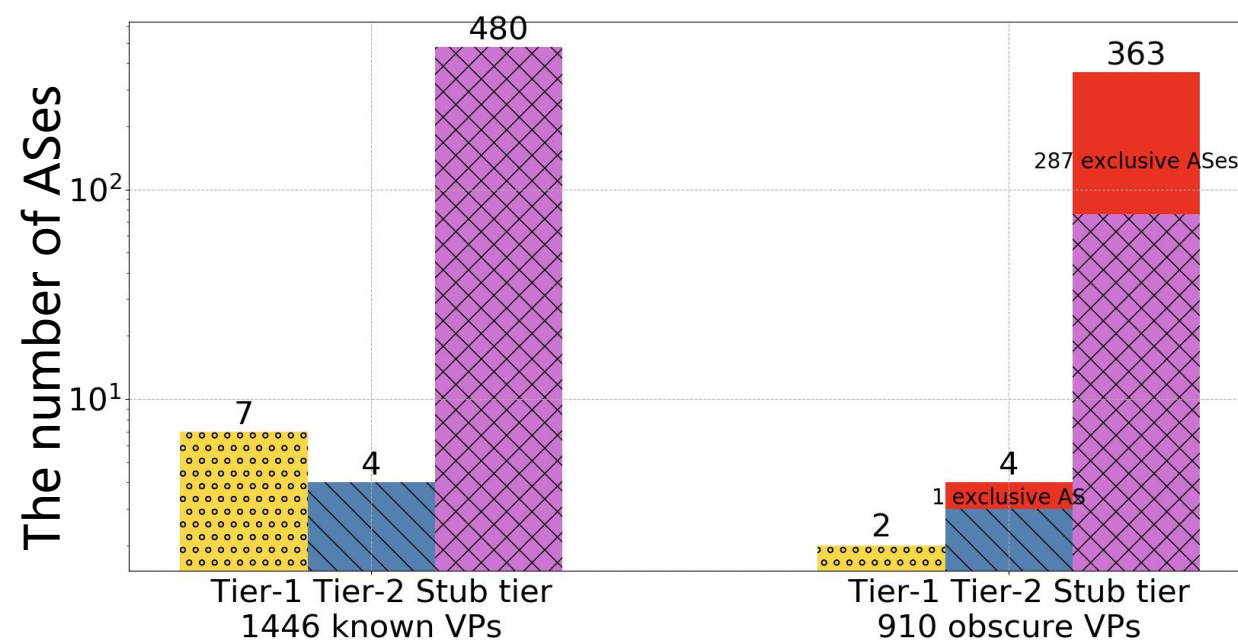
1,446 known LG VPs in 386 cities of 75 countries
910 obscure LG VPs in 282 cities in 55 countries

- ✓ The 910 obscure VPs cover **8 exclusive countries** and **160 exclusive cities**, where no known LG VPs have been found before
- ✓ The 8 countries are mainly distributed in **East Africa** and **South Asia**



Network coverage improvements

The obscure VPs can bring significant coverage improvements



1,446 known LG VPs in 491 ASes
910 obscure LG VPs in 369 ASes

- ✓ The 910 obscure VPs cover **288 exclusive ASes**
- ✓ 287 of the 288 exclusive ASes **are in the stub tier**
- ✓ The 910 VPs are valuable for improving the completeness of Internet topology



A case study

- Use obscure LG VPs to improve the completeness of AS-level topology

Collect AS paths from LG VPs

RUB Looking Glass - **show bgp ipv4 unicast neighbors 10.12.1.163 advertised-routes**

Router: RUB Border Router 2

Command: show bgp ipv4 unicast neighbors 10.12.1.163 advertised-routes

BGP table version is 36248632, local router ID is 10.12.0.14

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
x best-external, a additional-path, c RIB-compressed,
t secondary path, L long-lived-stale,

Origin codes: i - IGP, e - EGP, ? - incomplete

RPKI validation codes: V valid, I invalid, N Not found

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.0.0.0/24	188.1.245.93	0	100	100	0 680 13335 i
*> 1.0.4.0/24	188.1.245.93	0	100	100	0 680 6939 4826 38803 i
*> 1.0.4.0/22	188.1.245.93	0	100	100	0 680 6939 4826 38803 i
*> 1.0.5.0/24	188.1.245.93	0	100	100	0 680 6939 4826 38803 i

Automatically collect AS paths from 14 known LG VPs and **8 obscure VPs**

Improve AS-level topology completeness

		Known LG VPs	Obscure LG VPs	RIPE RIS	RouteViews	ALL
ASes	Observed	44,955	44,355	44,952	45,339	45,635
	Exclusive	247	10	12	271	-
AS links	Observed	100,356	76,907	154,828	204,889	253,719
	Exclusive	8,318	1,428	37,383	85,450	-

Table 6: The number of observed and exclusive ASes, AS links extracted from each dataset.

Compare with AS topologies collected from known LG VPs, RIPE RIS and RouteViews

Show their potential values in facilitating Internet measurement research



Update the list of LG VPs

- The full experiments were carried out last year (2020)
- Some of the obscure VPs that are previously found may disappear

Re-conduct the automation tool and find about 70% of the VPs are still available

- Some newly created LG pages may appear on the web

Repeat our method recently and find 518 new obscure automatable VPs



The list of LG VPs:
https://github.com/zhuangshuying18/discover_obscure_LG



Conclusion & Future Work

Conclusion

- Design **a focused crawler** to discover obscure LG sites
- Find **910** obscure automatable LG VPs
- **Artifacts** of our paper
 - https://github.com/zhuangshuying18/discover_obscure_LG

Future work

- Regularly **update the list** of LG VPs
- Explore potential methods to **expand the list** of LG VPs
- Use the LG VPs to conduct large-scale measurements

Thanks for your attention!
Q & A

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