RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Internet Measurements with RIPE NCC Tools @ MCH2022

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Menu

- Introduction to RIPE & RIPE NCC
  - Community Participation
- *Basics Training Course: "Measurements & Tools"*
- Measuring Websites with RIPE Atlas
  - Ethical Dilemmas
- CLI Tools
- DNS Measurements
- *Use Cases*
- Intro to RIS
- "ObservableHQ" Demo

Documentation & Links

Links 1/n

- Anomaly Alerting for RIPE Atlas, Hoge School Utrecht
  - https://ripe84.ripe.net/presentations/86-RIPE-Alerts-idea-1.pdf
- The RIPE Atlas Population Coverage
  - ttps://sg-pub.ripe.net/petros/population_coverage/
- ObservableHQ prototypes
  - https://observablehq.com/@ripencc/internet-outages-as-seen-by-ripe-atlas
- RIPE Atlas probes deployment stats for large cities
  - https://observablehq.com/@emileaben/ripe-atlas-probes-deployment-stats-for-large-cities

Links 2/n: Articles

- ● "The Resilience of the Internet in Ukraine" (2022-03-10)
  - ○ https://labs.ripe.net/author/emileaben/the-resilience-of-the-internet-in-ukraine/
- ● "The Ukrainian Internet" (2022-02-28)
  - ○ https://labs.ripe.net/author/emileaben/the-ukrainian-internet/
- ● "The Kazakhstan Outage – As Seen from RIPE Atlas" (2022-01-07)
  - ○ https://labs.ripe.net/author/emileaben/the-kazakhstan-outage-as-seen-from-ripe-atlas/
- ● "You are Not Alone: RIPE Community Resilience" (2021)
  - ○ https://labs.ripe.net/author/becha/you-are-not-alone-ripe-community-resilience/
- ● "Our First Glance at the Uganda Internet Shutdown" (2021-01-14), Vesna Manojlovic
  - ○ https://labs.ripe.net/author/becha/our-first-glance-at-the-uganda-internet-shutdown/
- ● "Data Feminism: From Data Ethics to Data Justice"
  - ○ https://labs.ripe.net/author/becha/data-feminism-from-data-ethics-to-data-justice/
- ● "Report from the RIPE Atlas Software Probes Deployathon" (2020-12-11)
  - ○ https://labs.ripe.net/author/becha/report-from-the-ripe-atlas-software-probes-deployathon/
- ● "After the Quake in Croatia" (2020-03-27), Vesna Manojlovic
  - ○ https://labs.ripe.net/author/becha/after-the-quake-in-croatia/
- ● "Measuring your Web Server Reachability with TCP Ping" (2017-09-27)
- ○ https://labs.ripe.net/author/wilhelm/measuring-your-web-server-reachability-with-tcp-ping/

Links 3/n: Presentations

- Emile Aben - Resiliency of the Internet in Ukraine , May 2022, RIPE84:
  - https://ripe84.ripe.net/archives/video/738/
- Wolfram Friele - Anomaly Alerting for RIPE Atlas, May 2022, RIPE84:
  - https://ripe84.ripe.net/archives/video/798/
- Ethics in Technology: Internet Measurements' Ethical Dilemmas and RIPE Atlas - SHA2017, Vesna Manojlovic

  https://www.ripe.net/about-us/press-centre/publications/presentations/2017/ethics-in-technology-internet-measurements-ethical-dilemmas-and-ripe-atlas-sha2017

- Technical Communities Resilience During COVID-19 Pandemic - NLUUG 2021 , Vesna Manojlovic, November 2021 (video: https://youtu.be/2HstoqAFn9g ,

  - slides: https://www.ripe.net/about-us/press-centre/publications/presentations/2021/technical-communities-resilience-during-covid-19-pandemic-nluug-day-2021
- RIPE Internet Measurements - Internet Freedom Festival, Presentation given by Vesna Manojlovic & Emile Aben at the Internet Freedom Festival on 17 June 2020; link
- "State of the Internet in Ukraine", RIPE NCC Days in Kyiv | 2019-09-25 | Alex Semenyaka

Links 4/n: Training Slides & Events

- Course Materials
  - https://www.ripe.net/support/training/material/measurements-and-tools-training-course
- Webinars: https://www.ripe.net/support/training/webinars/tools-webinars
- Promotional video about RIPE Atlas https://www.youtube.com/watch?v=Z3SW2vO8qW0
- Wikipedia article: https://en.wikipedia.org/wiki/RIPE_Atlas
- Routing Information Service: ripe.net/ris
- All RIPE Labs articles tagged "atlas": https://labs.ripe.net/search/tag/atlas/
- RIPE Community: ripe.net/ripe
- RIPE NCC Hackathons https://labs.ripe.net/hackathons
- RIPE85.ripe.net

Intro to RIPE & RIPE NCC

RIPE and the RIPE NCC

The RIPE NCC

- Independent, not-for-profit, membership organisation

  - Funded by membership fees

- Distributing Internet resources as a Regional Internet Registry (RIR)

  - Policies decided by regional community

  - Through a neutral, impartial, open and transparent process

- Supporting the Internet through technical coordination

Regional Internet Registries (RIRs)

RIPE Database

- <u>The RIPE Database</u> contains registration information for networks in the RIPE NCC service region and related contact details.

- Some uses of the RIPE Database and its contents:

  - Providing accurate registration information of Internet number resources

  - Publishing routing policies by network operators

  - Facilitating coordination between network operators

- Uses the "whois" protocol, data is open

Get Involved

- RIPE meetings attendance support:
  - RACI programme, RIPE Fellowship, Diversity Task Force
- Other events organised by the RIPE NCC
  - Regional meetings, training courses, hackathons
- RIPE NCC's Community support
  - NOG support, Community Projects Fund
- RIPE Labs

RIPE Community

- Started in 1989 by researchers in Europe
- Technical coordination of IP network
- Volunteers, no legal structure
- Open to everybody
  - Meetings
  - Working Groups
  - Mailing lists
- Collaboration and coordination
- **MAT-WG (Measurements, Analysis & Tools Working Group)**

RIPE Working Groups

- Anyone can join the discussion
  - On mailing lists
  - At RIPE meetings (in-person and online)
  - Remote participation
- Read and/or subscribe
  - ripe.net/participate/ripe/wg
- Learning opportunities
- Please contribute!

Address Policy Working Group
Anti-Abuse Working Group
Connect Working Group
Cooperation Working Group
Database Working Group
DNS Working Group
Internet of Things Working Group
IPv6 Working Group
MAT Working Group
Open Source Working Group
RIPE NCC Services Working Group
Routing Working Group

Vesna Manojlovic and Emile Aben | 17 June 2020 | IMV 2020

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Community Participation

with RIPE Atlas

RIPE Atlas Community

- ~30,000 **probes** given to volunteers
  - ~11.000 active at any moment
- 700 **anchors** (physical & virtual) hosted by operators
- ~42 **sponsors** over last 10 years
- 500+ **ambassadors**, at many <u>conferences</u>

GitHub

- Software Probe
  - https://github.com/RIPE-NCC/ripe-atlas-software-probe
- Multilingual documentatation
  - https://github.com/RIPE-NCC/ripe-atlas-probe-doc/tree/master/manuals
- CLI tools for querying RIPE Atlas data & creating measurements
  - https://github.com/RIPE-NCC/ripe-atlas-tools
- Tools contributed by the community
  - https://github.com/RIPE-Atlas-Community/ripe-atlas-community-contrib
- Measurement Source Code for Physical Probe
  - https://github.com/RIPE-NCC/ripe-atlas-probe-busybox

Hackathons & Deployathons

- - RIPE Atlas DataViz (March 2015, Amsterdam)
- - RIPE Atlas Tools for Operators (October 2015, Bucharest)
- - RIPE Atlas Interfaces (April 2016, Copenhagen)
- - IXP Tools (October 2016, Madrid)
- - DNS Measurements (April 2017, Amsterdam)
- - Version6 (November 2017, Copenhagen)
- - Network Operators Tools (June 2018, Dublin)
- - IoT Hackathon (November 2019, Rotterdam)
- - RIPE Atlas Deployathon (November 2020, virtual)
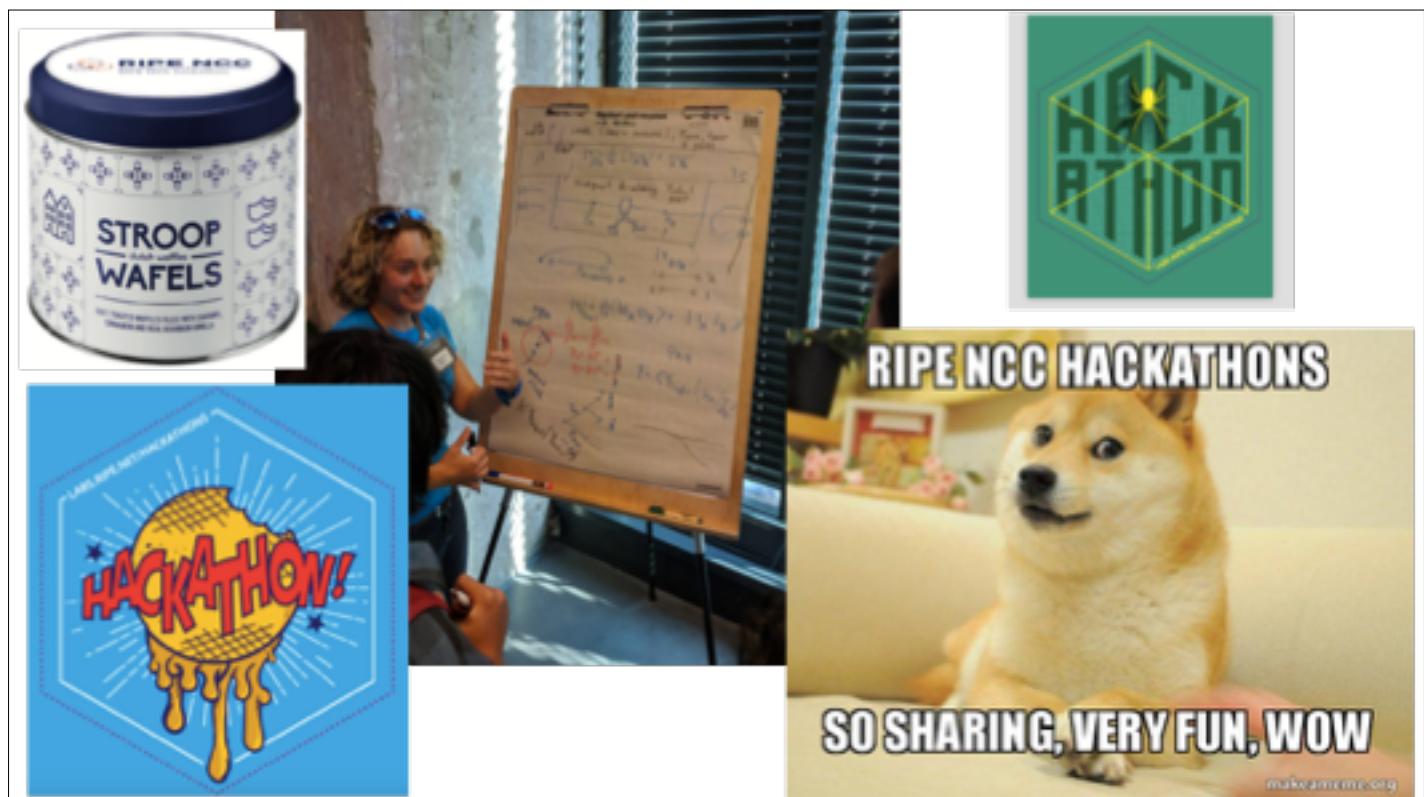
Get Involved

- Use RIPE Atlas and RIS for your purposes: data analysis, network troubleshooting, investigative journalism

- Do scientific research and add your paper to the Wikipedia page

- Contribute to the code and community tools

- Add multi-lingual content / documentation on GitHub

- Co-organise / sponsor / participate in a hackathon!

- Host a RIPE Atlas (virtual) anchor or a (SW) probe

- Write a RIPE Labs article

Feedback Appreciated

- What would you want to do with this data & tools?

- What is missing?

- What could be easier?

Measuring Websites

with RIPE Atlas

The Most Wanted Feature…

- By design, RIPE Atlas does not measure "application layer"
  - Operators are happy with transport/network layer
  - Ping, traceroute, DNS, TLS/SSL, NTP
- Users have been asking for HTTP measurements
- Due to <u>ethical reasons</u>, we decided:
  - to not target arbitrary websites with probes
  - that "standard" HTTP measurements are ONLY possible <u>towards RIPE Atlas anchors</u>
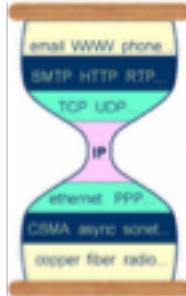
Ethical Reason: Protecting Hosts
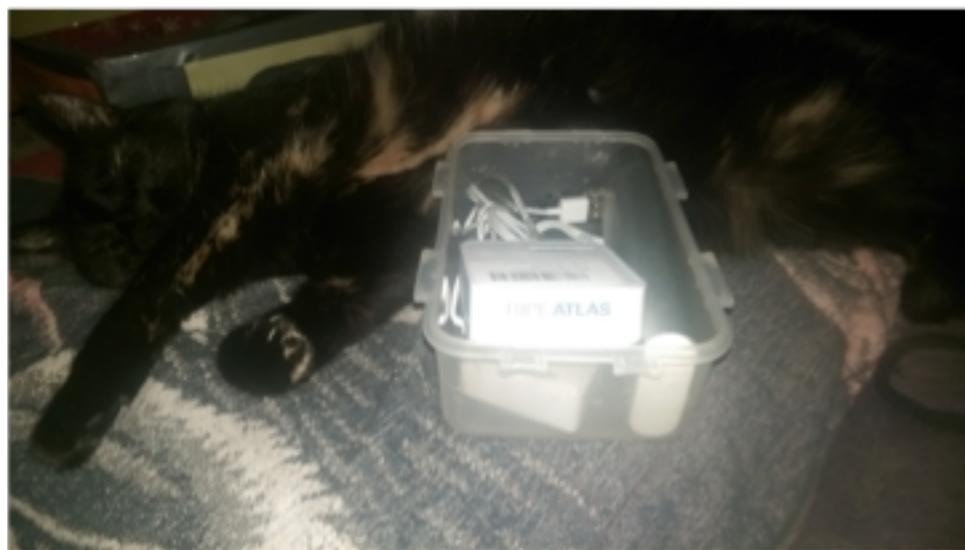
Ethics in Tech

- Ethics in Network Measurements (RIPE Labs)
- Ethics in Technology (RIoT Summit, SHA2017)

Workaround: Using a TCP Ping

- Traceroute (TCP) to the targeted web server

  - Towards IP address: port 80

  - 3 packets; a packet size of zero

  - "maximum hops" = 64, initial time-to-live (TTL) = 64

  - Long enough for the first traceroute attempt to immediately reach the destination address

- Mimics the behaviour of the TCP handshake

  - That takes place when setting up an HTTP connection

- This measures the same network delays!

  - RTT turns out to be equivalent to HTTP connect times

(Getting Started)

- Read the Docs
  - https://beta-docs.atlas.ripe.net/getting-started/
- Watch video :)
  - https://www.youtube.com/watch?v=Z3SW2vO8qW0&t=1s
- First Steps
  - Create an account
  - Log in
  - Look around
  - Get "credits"

Credit System

- Running your own measurements cost credits
  - Ping = 10 credits, traceroute = 20, etc.
- Why? Fairness and to avoid overload
- Limits: daily spending and # of measurement results
- How to get credits?
  - Generated by hosting a probe / anchor
  - Transferred from another user
  - Reclaiming a gift voucher

How to: Web UI

- Go to Measurements

- Click on New msm

- Advanced options

- Add up to 1000 probes

- Choose one off

  - Or continuous / repeated

- Done!

  - You need to have credits

How to: Command Line (CLI)

ripe-atlas measure traceroute --target 82.94.235.165 --protocol TCP --size 1 --first-hop 64 --max-hops 64 --port 80

- "—size" should actually be 0 (will be fixed soon)

  - Please help us by fixing it yourself, make a pull request!

- CLI tools:

  - Source: github.com/RIPE-NCC/ripe-atlas-tools/

  - Documentation: ripe-atlas-tools.readthedocs.org

  - Included in many Linux/BSD distributions

Results

- Reachability Map
- Colour-coded for latency
- List of probes and latencies
- Download as JSON
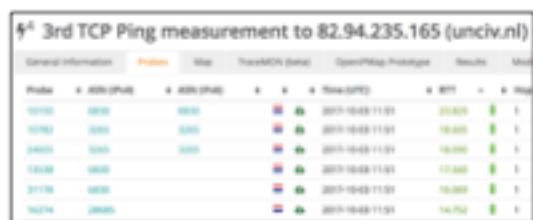
Detailed Technical Information

- For 68% of the probe/destination pairs, median values differ by less than 1ms

- Interdecile ranges differ by less than 6ms

- When compared to RTT of 100 milliseconds, a difference in spread of 5-15ms may still be acceptable to assess network performance

- https://labs.ripe.net/Members/wilhelm/measuring-your-web-server-reachability-with-tcp-ping

Command-line Interface
(CLI) Toolset

CLI Toolset: Benefits

- Access RIPE Atlas from the terminal / shell console

- Quick and dirty shortcuts for network troubleshooting

- FLOSS (open-source) tools

  - Written and maintained by RIPE NCC

  - Open to community contributions

- Before you can use the toolset:

  - Download the tools

  - Install

  - Configure

CLI Toolset: Links

- Source:
  - https://github.com/RIPE-NCC/ripe-atlas-tools/

- Documentation:
  - https://ripe-atlas-tools.readthedocs.org/

- Included in the Linux / BSD distributions:
  - OpenBSD, FreeBSD, Gentoo, Arch, Debian & Ubuntu
  - (in progress: Fedora, Windows)

Create a ping measurement

- Simplest: one-off, using default values (50 probes to "target")
- $ ripe-atlas measure ping --target wikipedia.org

Other examples of ping

- Geo-specific using 20 probes from Canada:
  - $ ripe-atlas measure ping --target example.com --probes 20 --from-country ca
- 20 Canadian probes that support IPv6:
  - $ ripe-atlas measure ping --target example.com
    -- probes 20 --from-country ca —include-tag system-ipv6-works
- Create a recurring measurement:
  - $ ripe-atlas measure ping —target example.com --interval 3600

Traceroute

```
$ ripe-atlas measure traceroute google.ca
```

Search for existing **measurements**

$ ripe-atlas measurements --af 6 --status ongoing --limit 15
--search google

```
Filters:
  Search: google
  Af: 6
  Status in: (2,)

Id       Type       Description                                           Status
================================================================================
1004805 ping       google - v6                                          Ongoing
1004732 traceroute google v6 traceroute                                 Ongoing
1007128 dns        Google.fi AAAA reply                                 Ongoing
1012449 sslcert    www.google.com                                       Ongoing
1024911 ping       IPv6 Google DNS                                       Ongoing
1404300 ping       IPv6 Ping to Google                                   Ongoing
1665737 ping       google.com - 2404:6800:4003:c00::71                  Ongoing
1796260 ping       Ping measurement to www.google.com                   Ongoing
1889006 traceroute Traceroute measurement to ipv6.google.com            Ongoing
2062542 traceroute Traceroute measurement to ipv6.google.com            Ongoing
2062543 ping       Ping measurement to ipv6.google.com                  Ongoing
2143865 ping       Ping measurement to ipv6.google.com                  Ongoing
2486602 traceroute IPv6 Traceroute measurement to snapchat.com          Ongoing
2486820 ping       Google IPv6                                          Ongoing
2929651 ping       campaign:th-mon-run2 type:ping host:plus.goog        Ongoing
================================================================================
                                      Showing 15 of 18 total measurements
```

Search for very specific probes

$ ripe-atlas probes --asn 3333 --field id --field asn_v6 --field
country --field is_public --field description --field status

```
Filters:
  ASN: 3333

ID      Asn_v6 Country Public Description                          Status
=========================================================================
9       3333   nl      ✓      SG office 1                          Connected
14      3333   nl      ✓      vty probe                            Connected
15      3333   nl      ✓      SG office 2                          Connected
111     3333   br      ✗      NCC.br                               Abandoned
237     3333   nl      ✓      The Traveling Probe                  Connected
1188    3333   us      ✓      probe 1                              Abandoned
2009    3333   nl      ✓      NCC Office 2009                      Connected
3497    3333   nl      ✗                                           Abandoned
4040    3333   nl      ✗                                           Abandoned
6001    3333   nl      ✓      AA nl-ams-as3333                     Connected
6012    3333   nl      ✗      AA pre-production                    Connected
6018    3333   nl      ✗                                           Abandoned
6019    3333   nl      ✓      RIPE NCC Anchor v2                   Connected
6137    3333   nl      ✓      nl-ams-as3333-preprod                Connected
10004   3333   nl      ✓      RIPE NCC R&D Office                  Abandoned
10105   3333   nl      ✗                                           Abandoned
10106   3333   nl      ✗                                           Abandoned
10808   3333   nl      ✓      Ridderkerk - UPC 120/10Mbits        Abandoned
11107   3333   nl      ✗                                           Disconnected
11203   3333   gb      ✗      DUFFPROBE                            Disconnected
12009          de      ✓      TeraStream Test Lab                  Abandoned
13343   3333   ch      ✓      FSIT AG - CH-010001 - out of 0      Abandoned
14004   3333   nl      ✗                                           Abandoned
14013   3333   nl      ✗                                           Abandoned
14020   3333   nl      ✗                                           Abandoned
=========================================================================
                                        Showing 25 of 39 total probes
```

DNS Related Measurements

by RIPE Atlas

Maps Based on DNS Measurements

- DNS Root Instances

- Comparative DNS Root RTT

- Root Server Performance
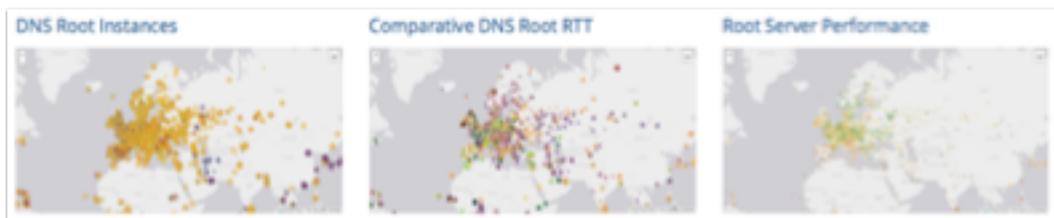
DNSMON

- From anchors to ccTLDs

- An Updated DNS Monitoring Service

DomainMon

- Like "DNSMON", but
  - From probes
  - To second-level domains

- RIPE Atlas: DomainMON is Here

User Measurements Visualisations

- List of probes: sortable by RTT
- Map: colour-coded by RTT
- LatencyMON: compare multiple latency trends
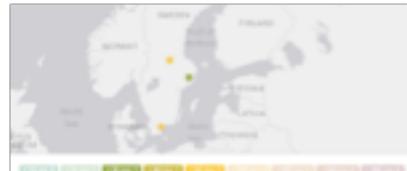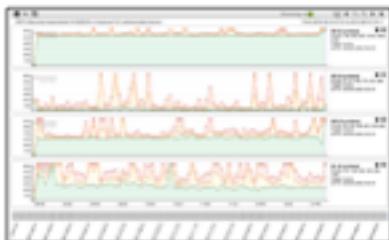
Additional System and Global DNS Measurements

- Measuring random domains
- Measuring popular domains
    - New RIPE Atlas Root Zone DNS Measurements
- Instead of setting-up your own measurements, use the existing data!

DNS Measurements Analysis

- DNS Censorship (DNS Lies) As Seen By RIPE Atlas (Stéphane Bortzmeyer)

- Orange Blacklisting: A Case for Measuring Censorship (Stéphane Bortzmeyer, Oct 2016)

- Operator Level DNS Hijacking (Babak Farrokhi, Jul 2016)

- Dissecting DNS Defenses During DDoS Attacks (Giovane Moura, May 2018)

DNS Measurements Hackathon, April 2017

- Results of the DNS Measurements Hackathon

- DNS resolver hijack tester

  - Out of 6,700 probes, 113 were "suspicious" or "being weird",

- DNS Fingerprinting to identify hijacked resolvers

  - Top-5 countries were: VN, MG, IQ, ID and KR

- Data sets for researchers, Dec 2018

Stay in touch!

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