



Dynamic Links: An Experimentation Automation Tool for SCION

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Supervisor: François Wirz

Outline

Introduction

Design and Architecture

- Link Properties

- Revocations

Video demo

Performance

Future work

Appendix

Outline

Introduction

Design and Architecture

Link Properties

Revocations

Video demo

Performance

Future work

Appendix

Introduction

- Link failures and misconfigurations are common.
- BGP cannot handle these incidents.

Some BGP Incidents

'Screaming car wreck' of internet routing needs a fire brigade: Geoff Huston

After 30 years, this 'massively distributed system that relies on the propagation of rumours' seems unfixable, says APNIC's chief scientist, but digital signatures are starting to help



By Stilgherian | September 13, 2019 -- 05:13 GMT (06:13)

Why the Mediterranean is the Achilles' heel of the web



TECHNOLOGY 12 January 2009

By Colin Barras



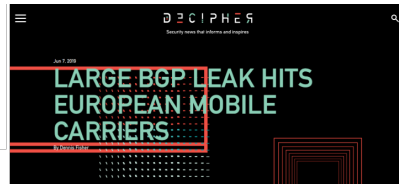
The data cables of the Mediterranean. The main three, recently damaged, cables that connect Europe and the Middle East are shown in grey (Image: WebGeography)

512K day - how one small file broke the internet

Posted August 14, 2014 by Tim Pat

512K day

how one small file broke the internet



HOME > NEWS > OUTAGES

Verizon BGP route leak causes Cloudflare customer outages, AWS issues

Another week, another BGP issue

June 24, 2019 By: Sebastian Moss



Indian ISP's routing hiccup briefly takes Google down worldwide

Broadband provider announced the wrong routes for many Google services.

SEAN GALLAGHER - 3/12/2015, 4:50 PM



For a short time today, people all over the world were unable to access Google services because of what Dyn Research Director of Internet Analysis Doug Madory identified as a "routing leak" from an Indian broadband Internet provider. The leak is similar to a 2012 incident caused by

Khalid Aldughayem

10.10.2019

5

Introduction

- SCION mitigates the effect of such incidents.

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- Problem: Need to be able to easily test these features or new features while connected to SCIONLab.

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- Problem: Need to be able to easily test these features or new features while connected to SCIONLab.
 - Building a local topology connected to SCIONLab is a lengthy and error prone task.

Related Work

Some widely known simulators/emulators:

- Mininet and Mininet-HiFi
- ns-2 and ns-3
- Emulab (previously Netbed)
- PEERING BGP testbed

Outline

Introduction

Design and Architecture

Link Properties

Revocations

Video demo

Performance

Future work

Appendix

Design Goals

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- SCIONLab connectivity

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- SCIONLab connectivity
- AS services isolation
- Interdomain topology control
- Selective failing or degradation of links

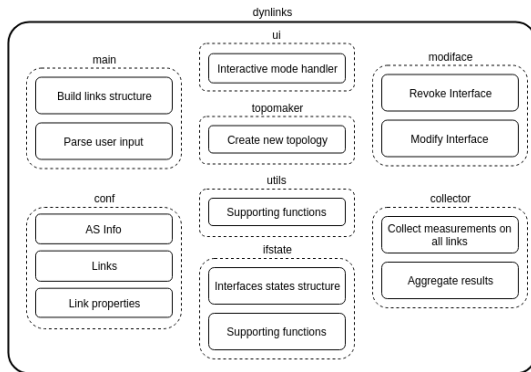
Design Goals

- SCIONLab connectivity
- AS services isolation
- Interdomain topology control
- Selective failing or degradation of links
- Easy configuration

Design Goals

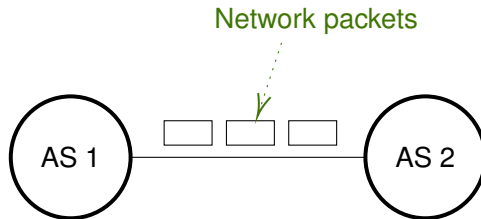
- SCIONLab connectivity
- AS services isolation
- Interdomain topology control
- Selective failing or degradation of links
- Easy configuration
- Portability

Architecture



- Two main components:
 - **topomaker** for topology creation.
 - **modiface** to modify and/or revoke interfaces.

Link Properties



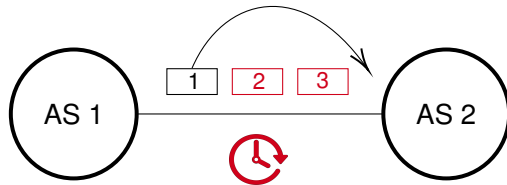
Link Properties - Bandwidth Limiting



Link Properties - Delay

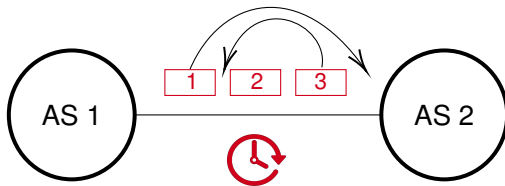


Link Properties - Delay + Reordering



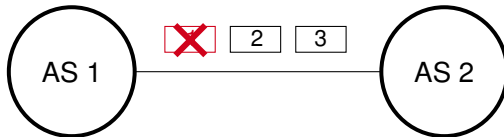
- Packet 1 has no added delay in this case.

Link Properties - Delay + Jitter

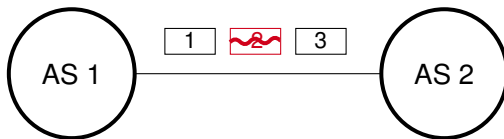


- Packet 1 delay = $10\text{ms} - 3\text{ms}$
- Packet 2 delay = $10\text{ms} + 1\text{ms}$
- Packet 3 delay = $10\text{ms} + 2\text{ms}$

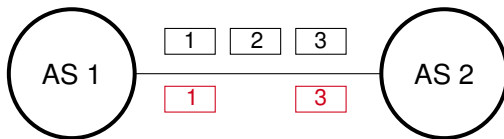
Link Properties - Loss rate



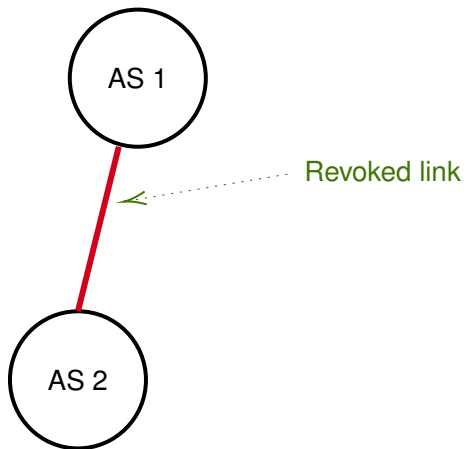
Link Properties - Corruption rate



Link Properties - Duplication rate

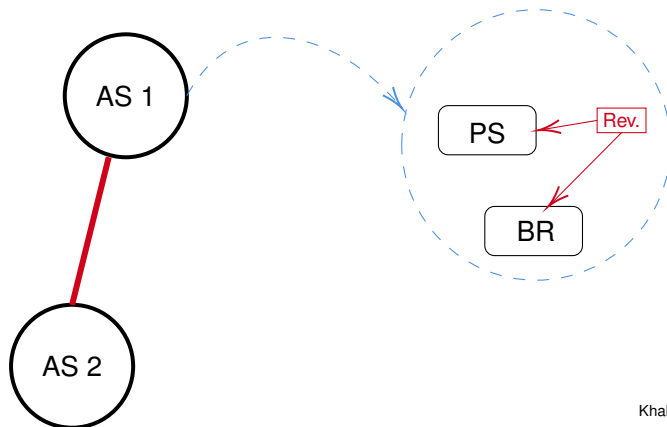


Revocations




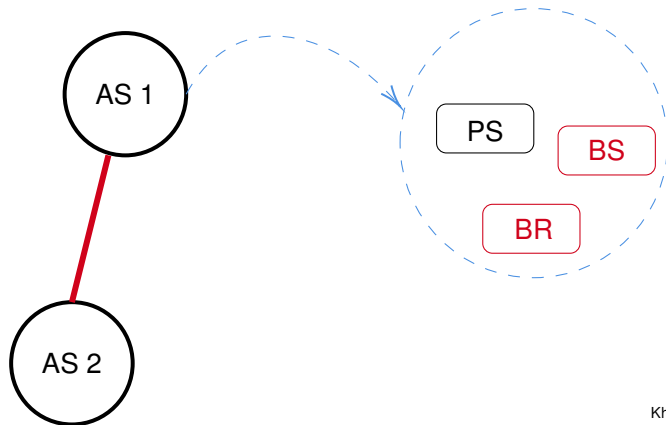
Revocations - Token Revocation

Rev. Revocation message

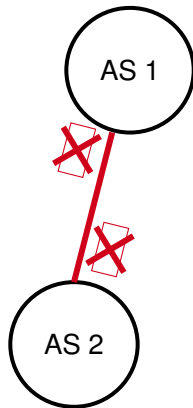


Revocations - Topology Revocation

 Service with modified topology files



Revocations - Block Packets



Outline

Introduction

Design and Architecture

Link Properties

Revocations

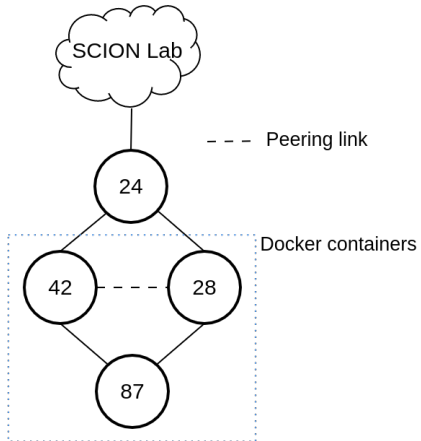
Video demo

Performance

Future work

Appendix

Topology Used



Demo

Video

Outline

Introduction

Design and Architecture

Link Properties

Revocations

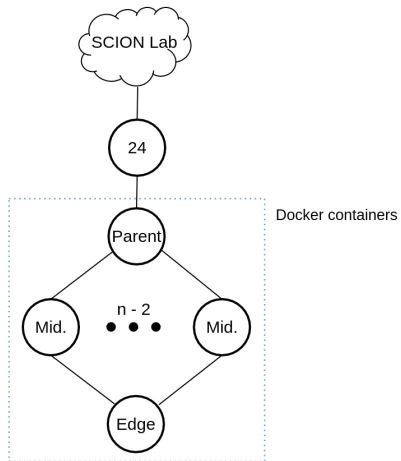
Video demo

Performance

Future work

Appendix

Topology Used



Topology Creation - CPU Usage

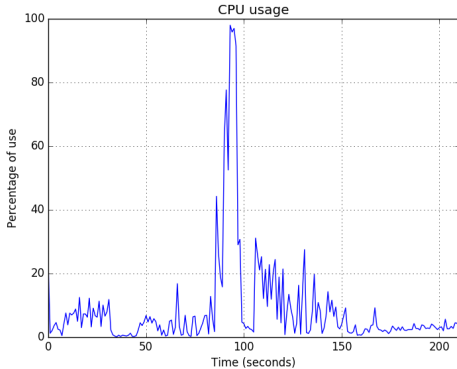


Figure: 10 containerized ASes

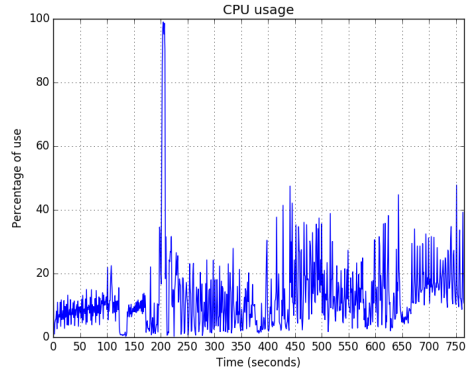


Figure: 50 containerized ASes

Topology Creation - Memory Allocation

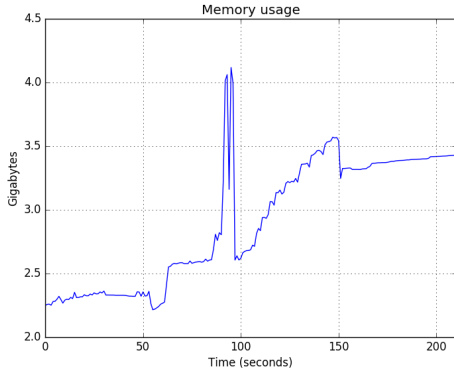


Figure: 10 containerized ASes

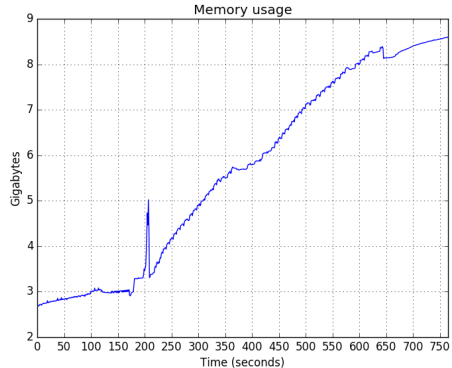


Figure: 50 containerized ASes

Topology Creation - 100 ASes

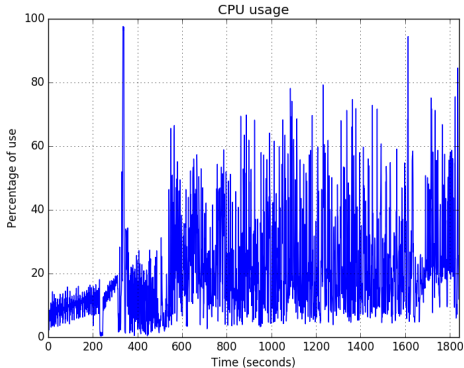


Figure: 10 containerized ASes

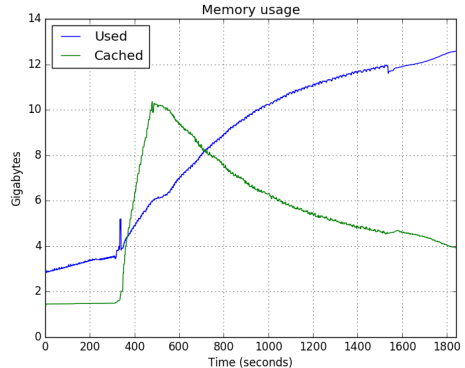


Figure: 50 containerized ASes

Link Modification - CPU Usage

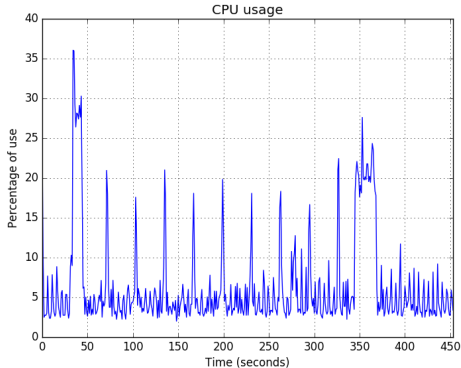


Figure: 10 containerized ASes

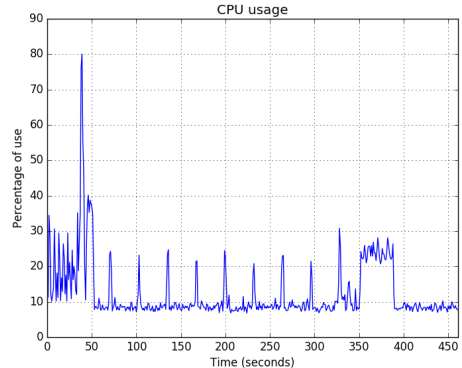


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Link Modification - Memory Allocation

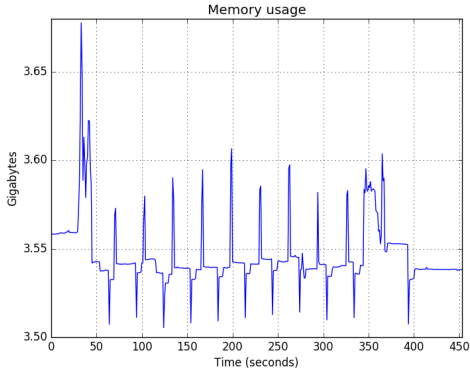


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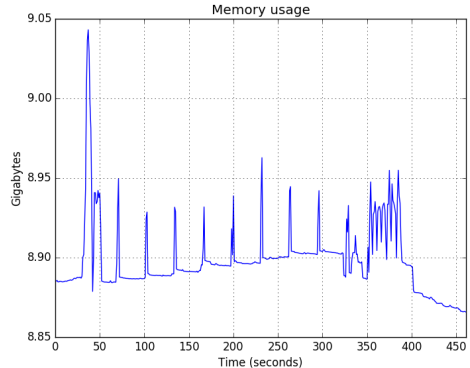


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Outline

Introduction

Design and Architecture

Link Properties

Revocations

Video demo

Performance

Future work

Appendix

Future Work

1. Containerize the whole topology (no need to run SCION AS on host machine)
2. Update to use packaged SCION services
3. Remove dependency on `tcconfig`
4. Deploy in some attachment points

Thank you for listening!

Outline

Introduction

Design and Architecture

Link Properties

Revocations

Video demo

Performance

Future work

Appendix

General Operation

- Two main modes of operation:
 - Topology creation
 - Link modification
- Process:
 1. Setup (e.g. parse user input, and initialize logging).
 2. Start the `collector` to start collecting logs on each of the links.
 3. For each link to be modified, start a `modiface` instance.
 4. Wait for user interrupt or timer to expire, then signal other Goroutines.

Topology Creation - Configuration

- Takes as input a topology configuration file.
- File contents:
 - Path to the gen directories downloaded from the SCIONLab Coordinator.
 - Subnet to use for the new Docker topology.
 - A list of containerized ASes and the links between them.
 - MTU of network, AS, and SCION interfaces (optional).
 - Network name (optional).

Topology Creation - Operation

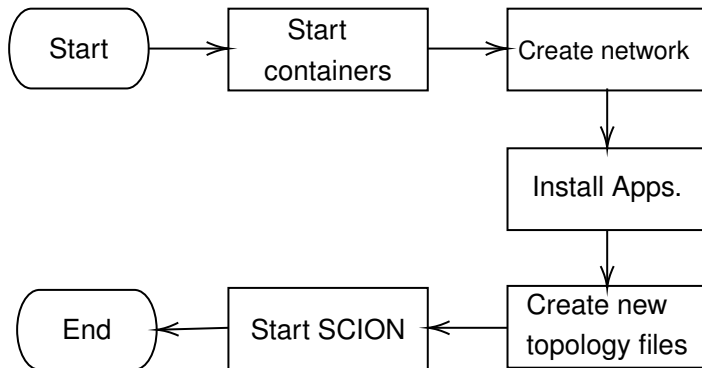


Figure: Topology creation process

Link Modification

- All changes are done by the `modiface` module.
 - Applies the link properties using `tcconfig` tool.
- Revocations are done using the `revoker` module.
 - Different tasks for each revocation method.
 - Periodically revoke the link and revert the changes.
- Takes as input:
 - Path to mounted gen directories.
 - Links' properties file (or the interactive flag must be set).
 - Collector configuration file (optional).
 - Duration (optional).

Link Modification - General Operation

Process:

1. Setup (e.g. parse links' properties file, and initialize logging).
2. Start the `collector` to start collecting logs on each of the links.
3. For each link to be modified, start a `modiface` instance.
4. Start a `revoker` instance for each link to be revoked.
5. Wait for user interrupt, or timer to expire, then signal other Goroutines.

Link Modification - Simple Revocation

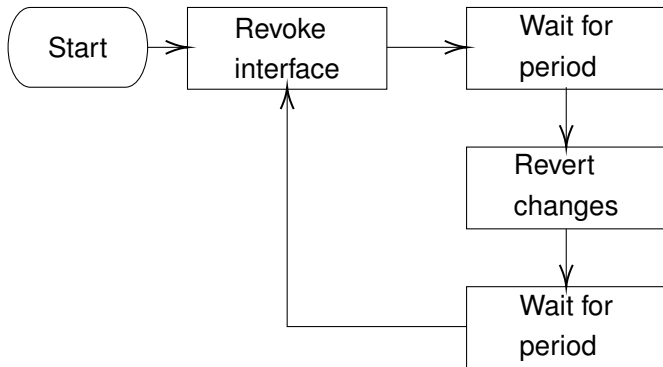
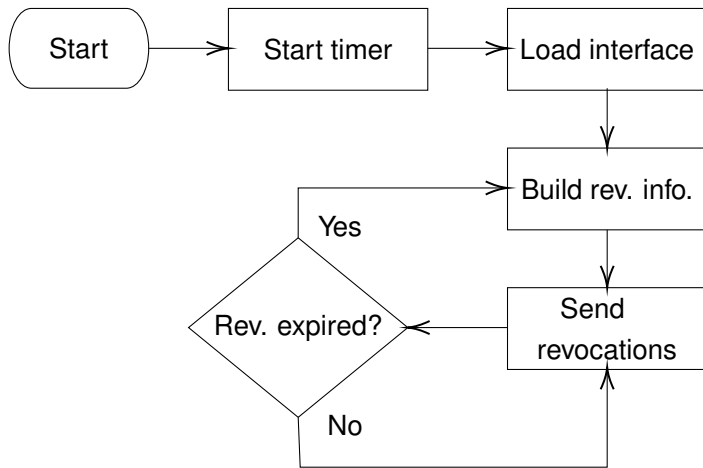


Figure: Simple revocation process

Link Modification - Token Revocation



Link Modification - Collector Operation

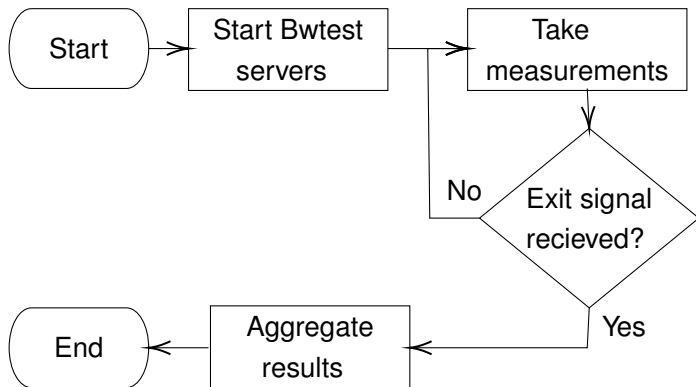
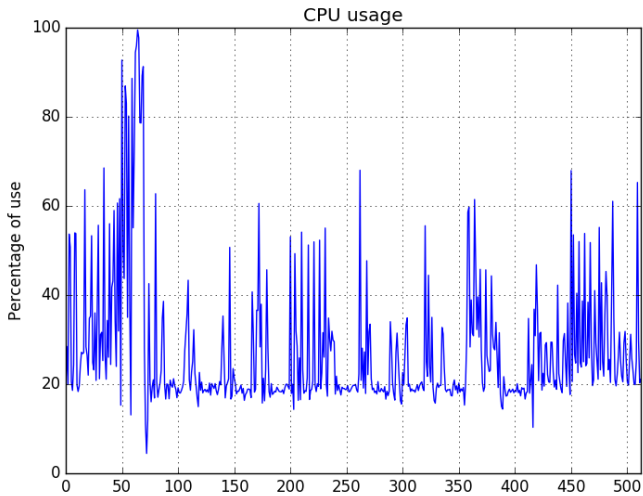
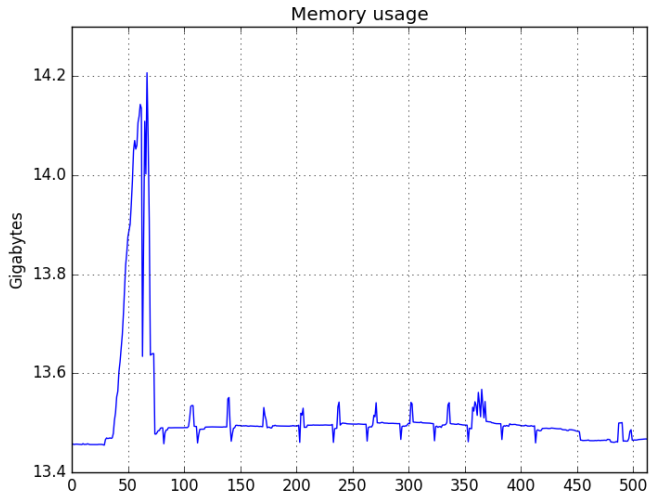


Figure: Measurements collection process

Link Modification - CPU Usage



Link Modification - Memory Allocation



Experiment 1 -