Internet Society
InterPlanetary
Networking SIG

IETF 111

IPNSIG Pilot Projects Working Group

Oscar Garcia
Group Lead
Dr. Ronny Bull
Group Member

July 26th, 2021

IPNSIG DTN Testing Plan

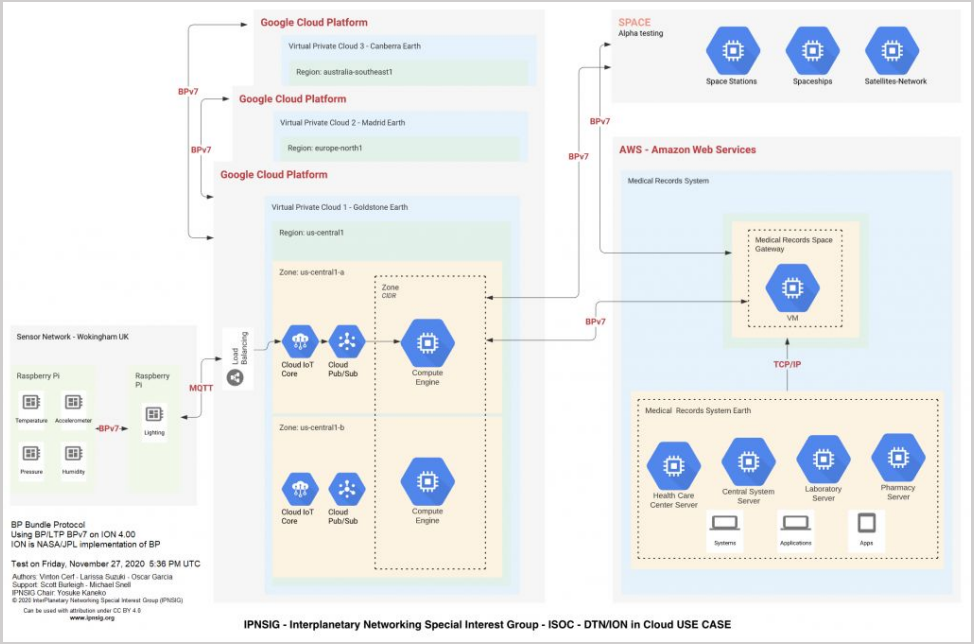
Background

On September 24, 2020 conversations started between Vinton Cerf, Oscar Garcia and Scott Burleigh about testing DTN connectivity and interoperability in cloud servers.

Next weekend, Oscar Garcia made testings and designed a DNS model for determining endpoints DTN locations in an Earth environment and tested bundle transfer between cloud servers with bping and bpecho ION software.

The concept evolved to the development of a tool that could be integrated and simple to use in end user software environments.

FIRST DTN Communication in Cloud Servers



Friday, November 27, 2020

First DTN-enabled interconnection between servers in cloud.

- Dr. Larissa Suzuki
- Oscar Garcia
- Dr. Vinton Cerf

https://ipnsig.org/2020/12/17/connecting-clouds-with-dtn/

IPNSIG DTN Testing Plan

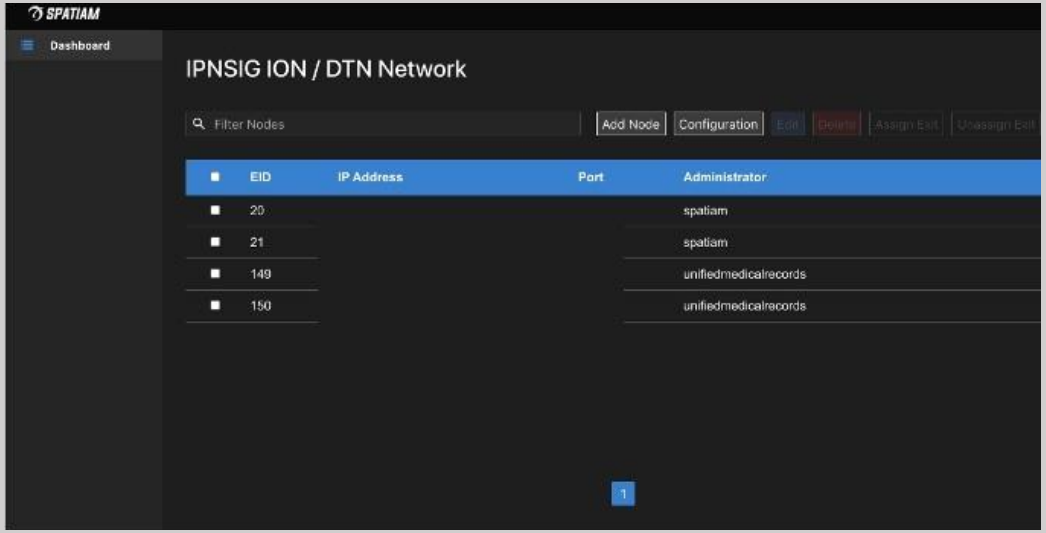
February 1st, 2021 the Pilot Projects Working Group (PWG) of the IPNSIG was launched. http://ipnsig.org/2021/02/01/929/

On March 5th, 2021.Draft of the DTN BP Cloud Connectivity Testing and Network Reliability and Stability Plan Draft PWG-IPNSIG was started by Oscar Garcia.

Project supported by IPNSIG Chair Yosuke Kaneko (JAXA).

Contributions by Vint Cerf, Alberto Montilla Ochoa, Scott Burleigh, Leigh Torgerson, Samo Grasic and Ronny Bull.

DTN Network Management - Spatiam Corporation

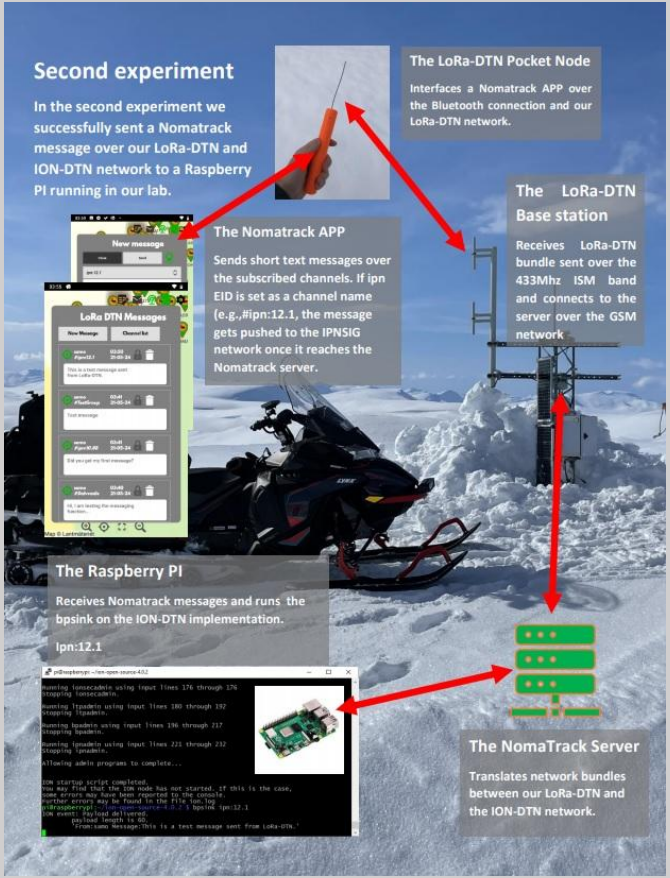


February, 2021

IPNSIG ION DTN Network Manager

- Contact Plan Generator
- Contact Graph Routing
- Exit node implementation

DTN Testing in Artic - Samo Grasic -Dálvvadis Economical Association Sweden



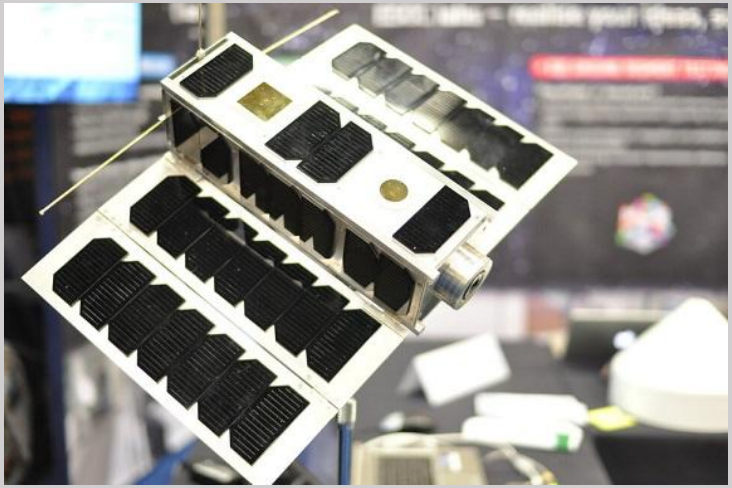
May, 2021

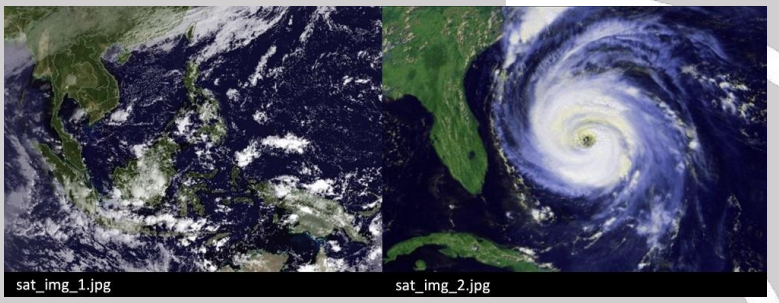
Lora-DTN ION-DTN Interoperability test in Artic

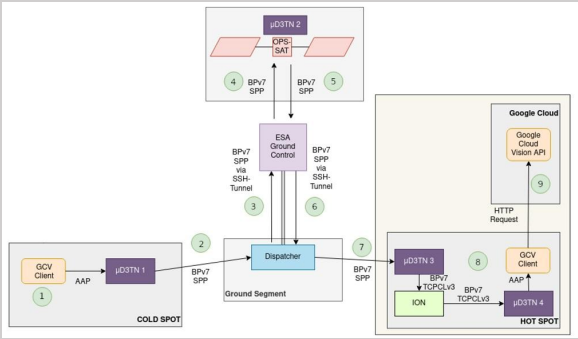
- Messages sent from Nomatrack mobile App on Lora-DTN connecting to ION-DTN to Raspberry Pi running remotely connecting to IPNSIG Network

European Space Agency - IPNSIG - D3TN Gmbh - Spatiam Corp.

ESA OPS-SAT Space Lab Controlled by DTN
Interoperability ION-DTN <=> D3TN DTN







Tweet

ESA Operations ✓
@esaoperations

Our #OPSSAT Space Lab is already being used to test out new software experiments in space.

Find out about one that's just concluded – the first time OPS-SAT was controlled over the internet it tested a new communications technology called the 'Ring Road'
➡ipnsig.org/2021/06/09/esa...

```
Received 'sat_img_1.jpg' from 'dtn://coldspot.dtn/source_cv'
Identified '10' Labels in the image: Water resources, World, Map, Watercourse, Water,
 Fluvial landforms of streams, Natural landscape, Geological phenomenon, Astronomical
 object, Geology
Forwarding labels to 'dtn://coldspot.dtn/source_cv', see logs for more details

Received 'sat_img_2.jpg' from 'dtn://coldspot.dtn/source_cv'
Identified '10' Labels in the image: Tropical cyclone, Water, Cyclone, Whirlpool, Bod
y of water, Vehicle, Astronomical object, Wind wave, Storm, Geological phenomenon
Forwarding labels to 'dtn://coldspot.dtn/source_cv', see logs for more details
```

IPNSIG DTN Testing Plan

Launching of IPNSIG Global DTN Testing Plan

IETF 111 July 26 2021

Test the
Interplanetary Internet
at home before you go to
Space !

IPNSIG DTN Testing Plan

Requirements and Goals

- Ease of Usage
- Global participation and awareness about DTN
- Easy to configure and use by non experts on DTN
- Multipoint
- Easy installation in Servers and PC or laptops
- Interoperability and Compatibility testing
- Automatic Processing
- Low Hardware and connectivity requirements.
- Adaptability to different implementations

IPNSIG DTN Testing Plan
DTN Software for End Users
Development environment

- Linux standard tools and bash programming
  - Windows version planned
- Open source ION tools C code was modified to allow structured output
- Backoffice processing in php and mysql / mariadb
- Reporting and graphics daily and monthly with reportico open source tool.

IPNSIG DTN Testing Plan

Minimum Hardware Requirements

On May 10, 2021 we made the first testing on the DTN Testing Plan software on a $150 laptop running on a virtual machine with Ubuntu,connected to a home coaxial cable with dynamic IP, from Argentina exchanging bundles from the testing plan software to cloud servers in US.

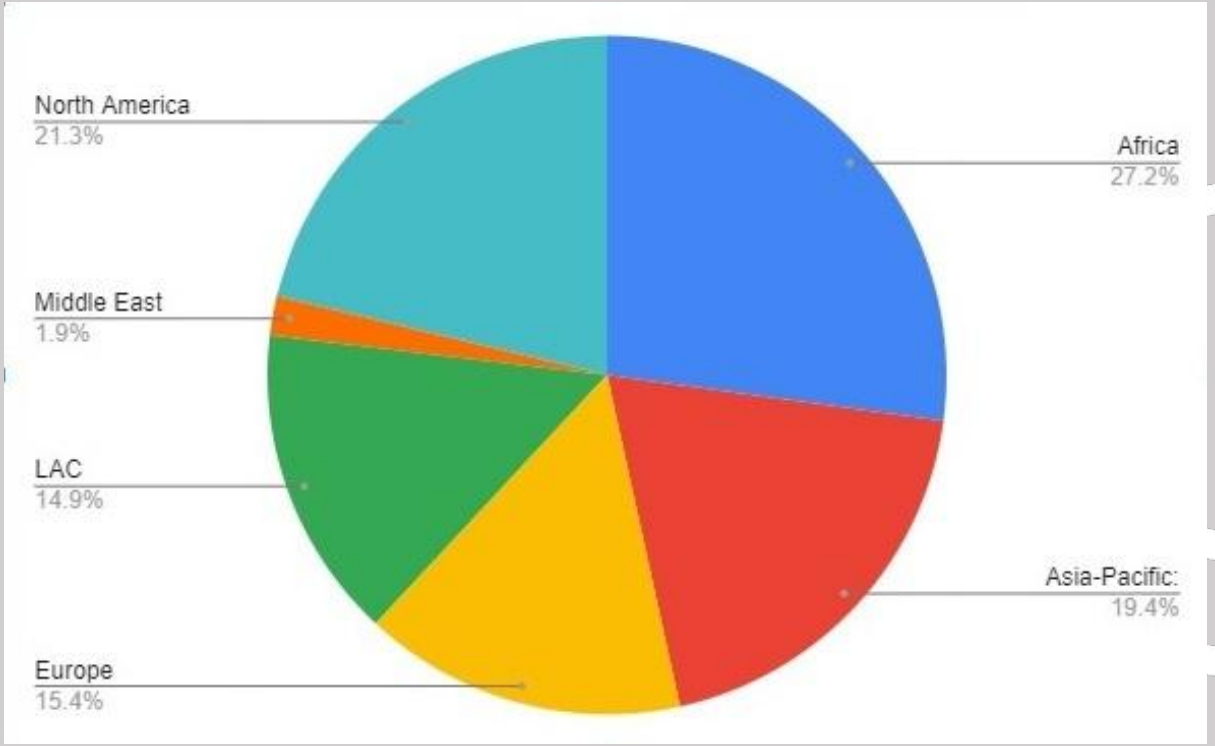
IPNSIG DTN Testing Plan

Development Team

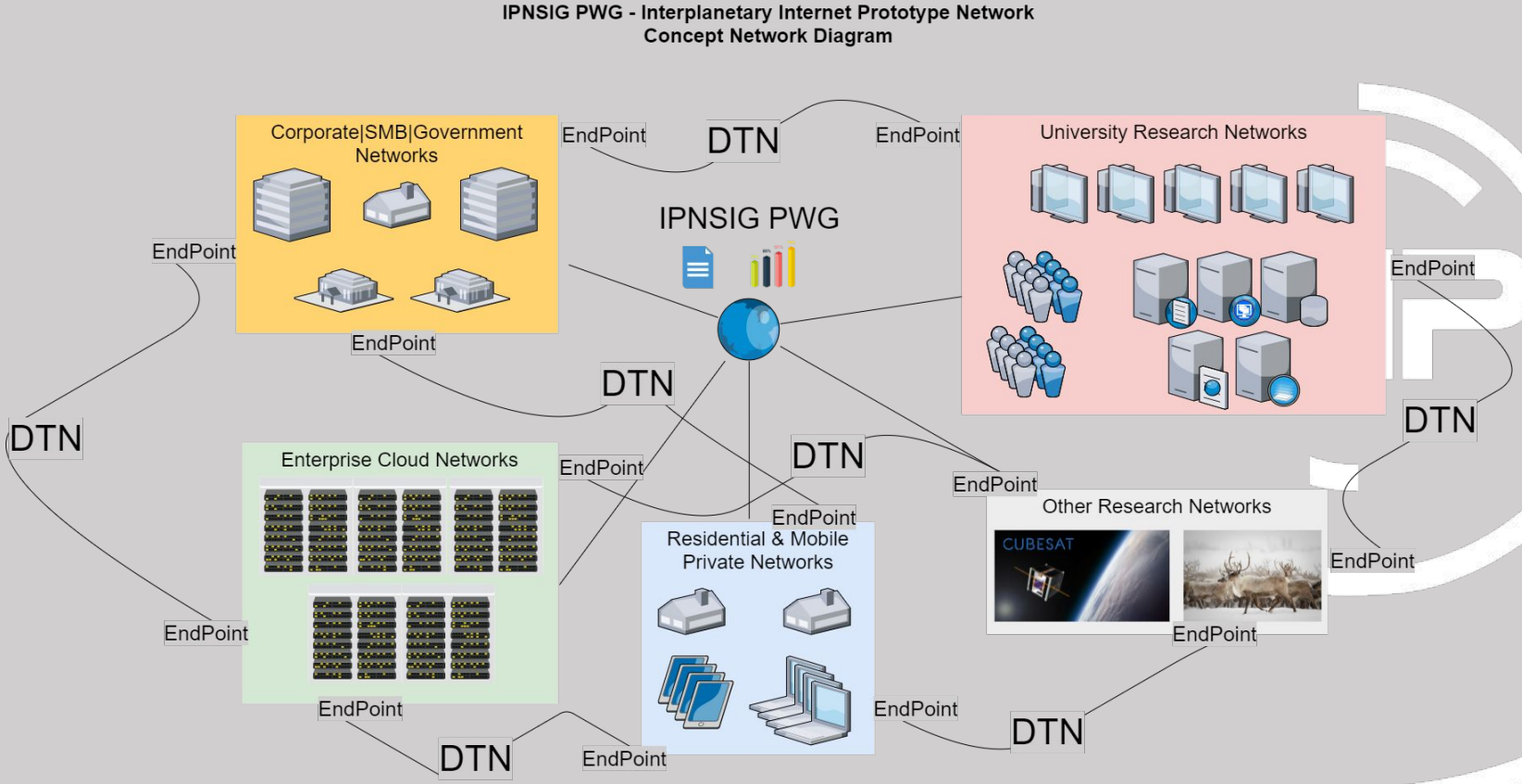
- Design: Oscar Garcia - 38 years developing and deploying applications.
- C programming: Ronny Bull - PHD in Computer Science - 30 years experience.
- Bash programming: Oscar Garcia
- Testing: Facundo Novik - Support manager at Unified Medical Records - Daniela Caula
- Documentation: Facundo Novik Ernesto Yattah (Columbia University)

- Development time supported by Digital Health Information Network & Utica College.
- Development time: 835 hours = 2000 lines coding.
- Creative Commons license planned for distributed software.

IPNSIG Global Participation - 700+ Members



IPNSIG DTN Testing Plan



Implementation

IPNSIG DTN Testing Plan

Backoffice System

Interplanetary Networking Special Interest Group - DTN Endpoints System

Endpoints System Operations

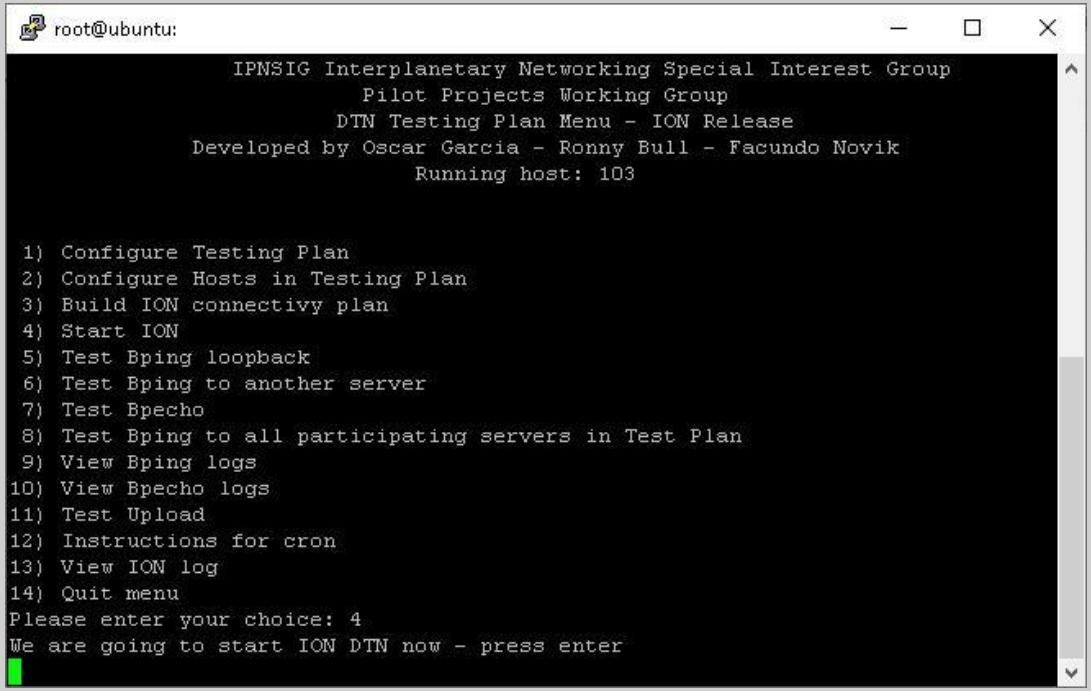
- Endpoint Owners
- Endpoints and Enpoints testing
- Bping Statistics and Reports
- Upload your statistics to this server
- List of registered Endpoints and current IPs txt
- Get the update link for your Endpoints
- Get current IP for an endpoint hash + endpoint id
- List of registered Endpoints and current IPs csv

Endpoints System Documentation

- User Manual
- Bping Bash Script for your server
- Bping database structure for statistics
- CSV structure for uploading your statistics to this server
- Example of script to update ION host configuration

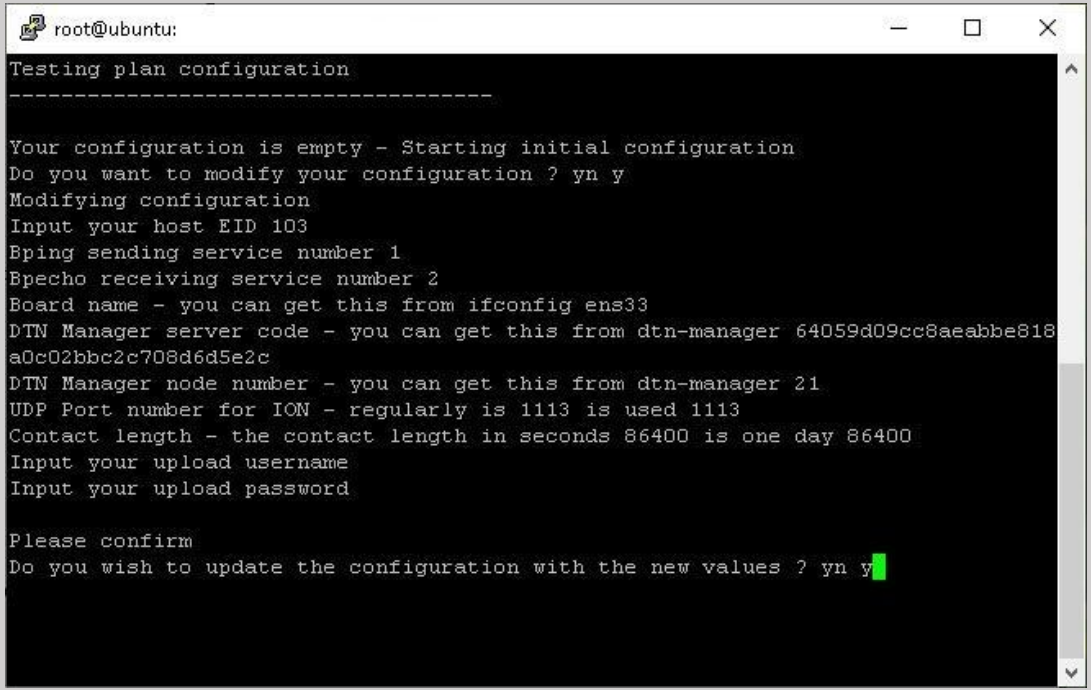
IPNSIG DTN Testing Plan

Client Menu



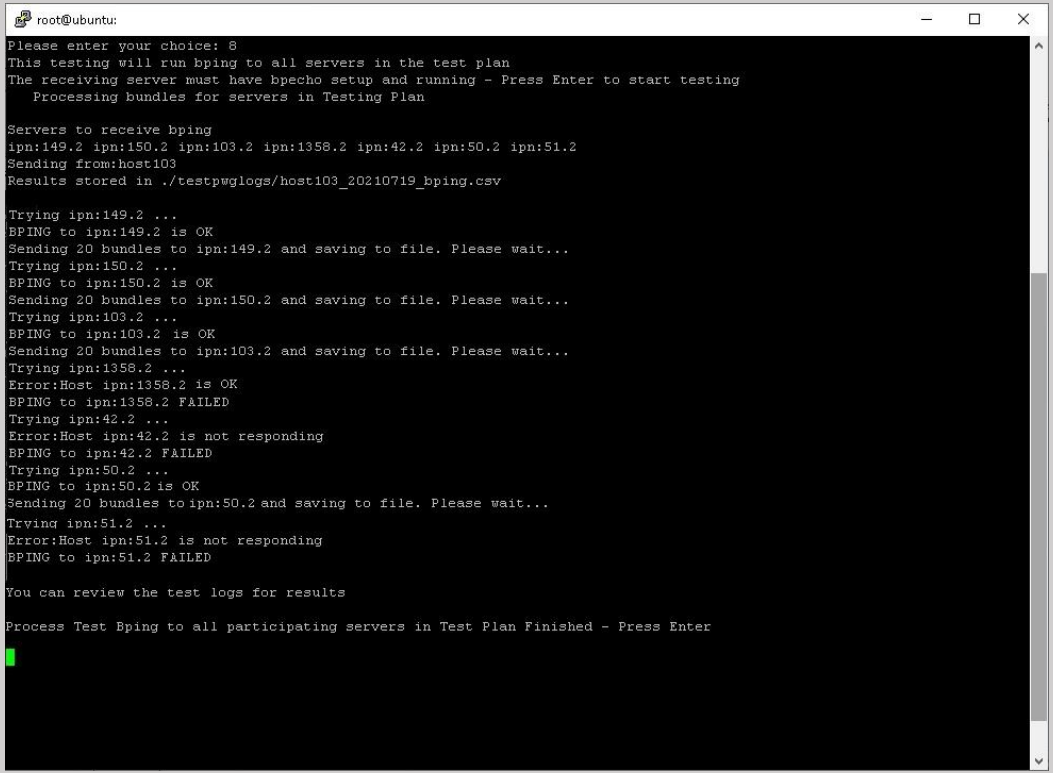
IPNSIG DTN Testing Plan

Easy Configuration



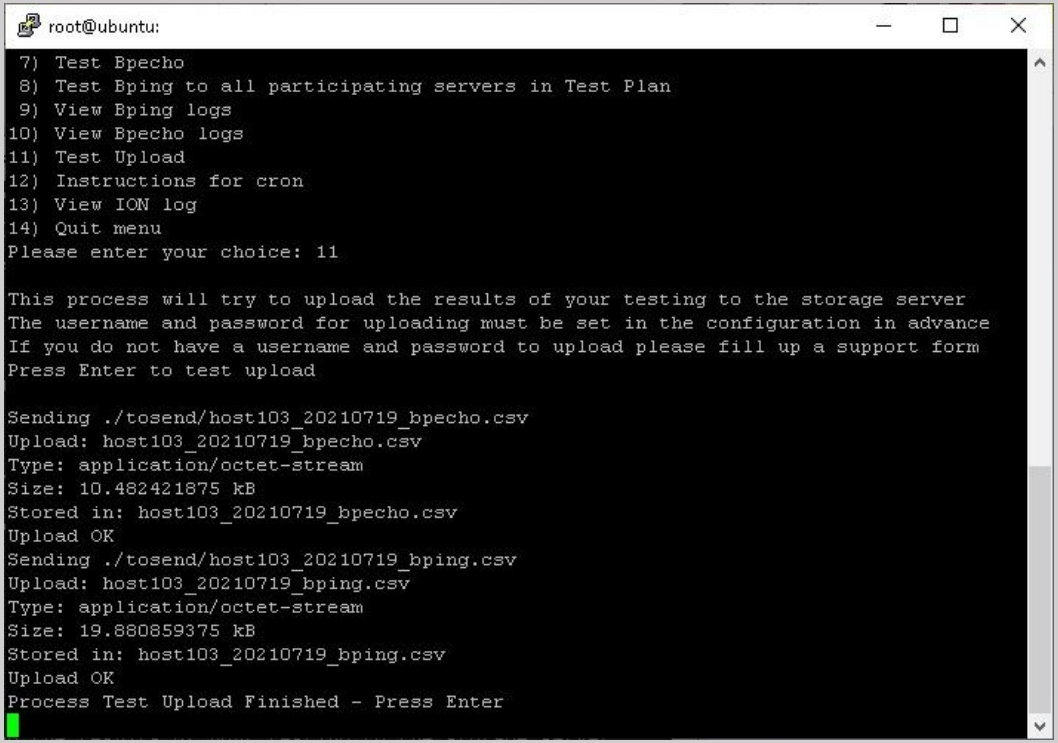
IPNSIG DTN Testing Plan

Testing multiple Servers



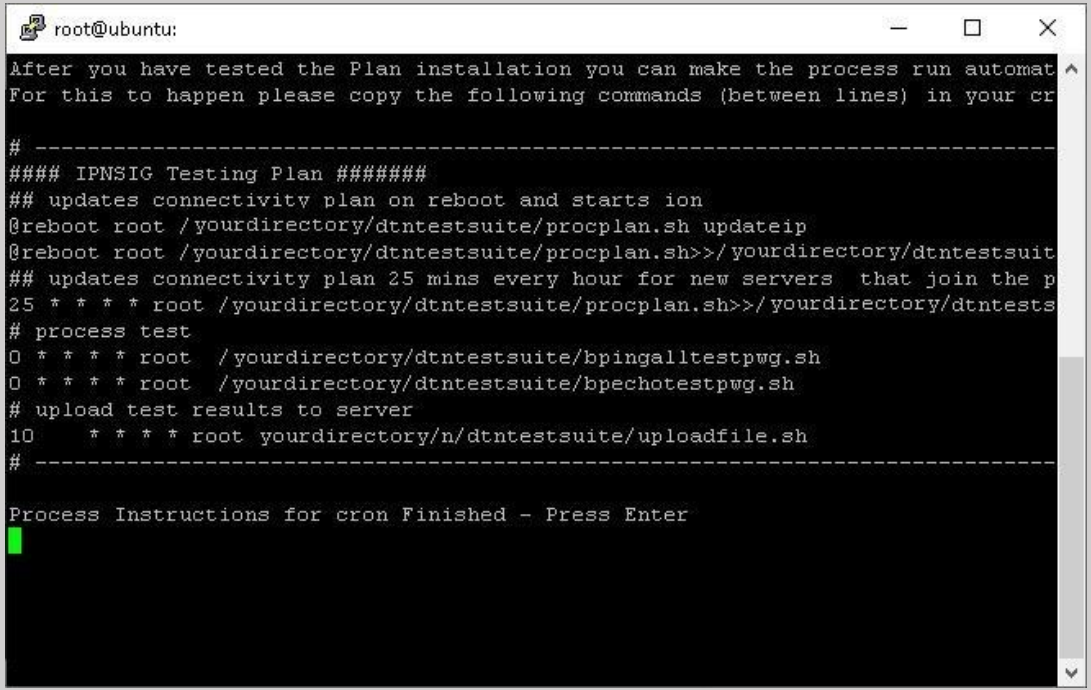
IPNSIG DTN Testing Plan

Upload of testing results



IPNSIG DTN Testing Plan

Unattended operation
Cron setup



IPNSIG DTN Testing Plan

Processing results are emailed to participants

From

Subject **Your file host150_20210719_bping has been processed**

To

host150_20210719_bping
Previous Process

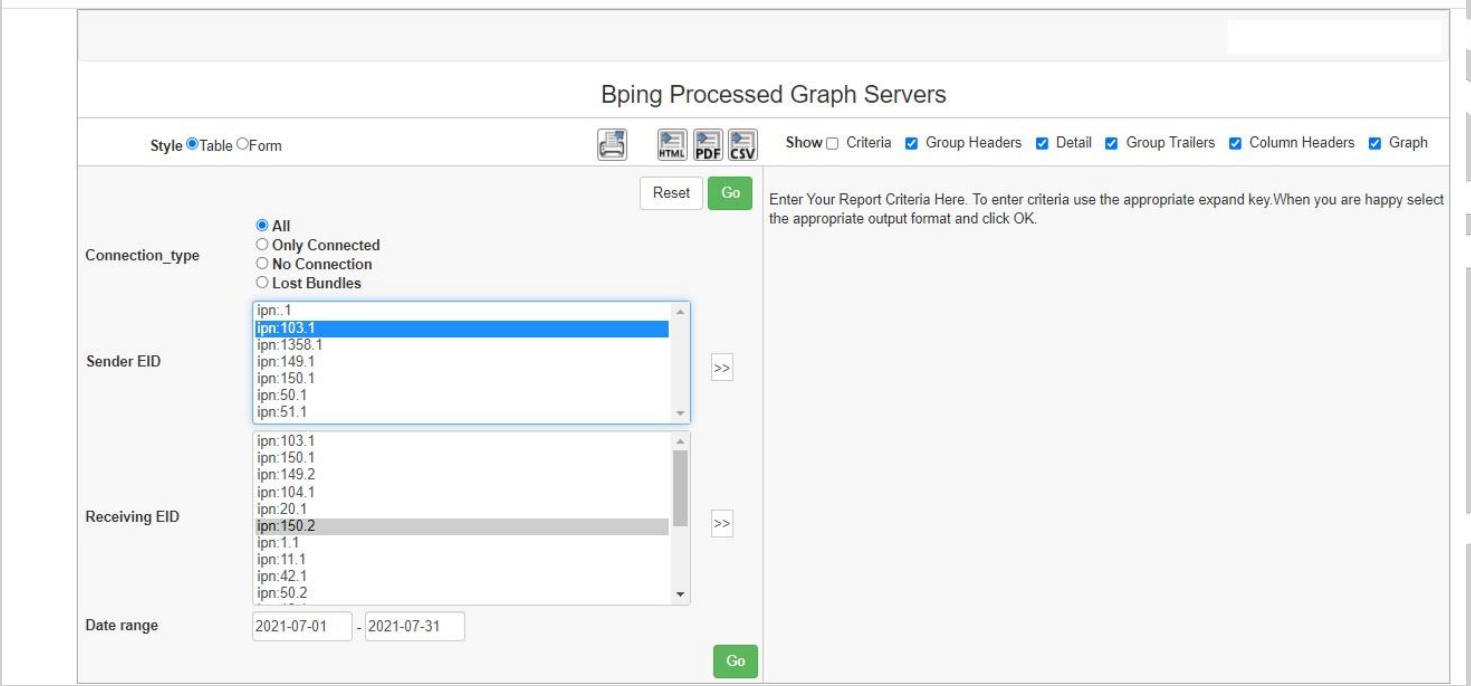
eid	receiving_eid	last_contact	tries	No_connection	Connection
ipn:150.1	ipn:149.2	2021-07-19 00:50:32	120	0	120
ipn:150.1	ipn:150.2	2021-07-19 00:51:13	120	0	120
ipn:150.1	ipn:103.2	2021-07-19 00:51:21	6	6	0
ipn:150.1	ipn:1358.2	2021-07-19 00:51:32	6	6	0
ipn:150.1	ipn:42.2	2021-07-19 00:51:43	6	6	0
ipn:150.1	ipn:50.2	2021-07-19 00:51:54	6	6	0
ipn:150.1	ipn:51.2	2021-07-19 00:52:05	6	6	0

This Process

eid	receiving_eid	last_contact	tries	No_connection	Connection
ipn:150.1	ipn:149.2	2021-07-19 14:50:33	349	0	349
ipn:150.1	ipn:150.2	2021-07-19 14:51:13	340	0	340
ipn:150.1	ipn:103.2	2021-07-19 14:51:21	165	9	156
ipn:150.1	ipn:1358.2	2021-07-19 14:51:32	17	17	0
ipn:150.1	ipn:42.2	2021-07-19 14:51:43	17	17	0
ipn:150.1	ipn:50.2	2021-07-19 14:51:54	17	17	0
ipn:150.1	ipn:51.2	2021-07-19 14:52:06	17	17	0

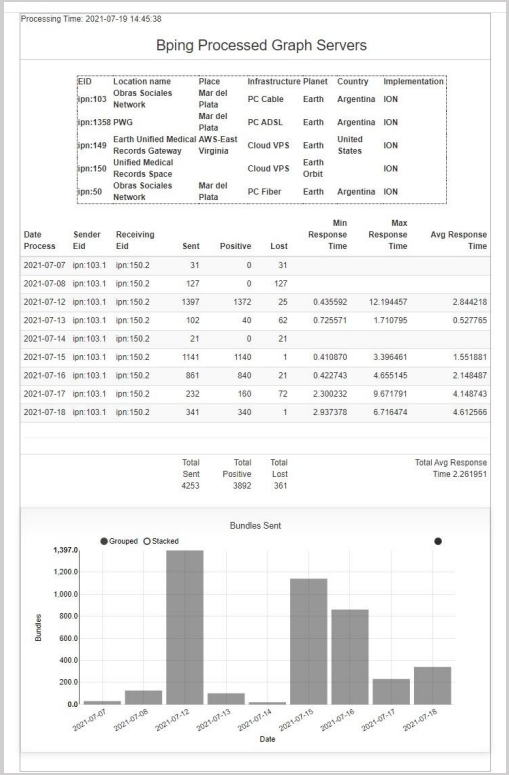
IPNSIG DTN Testing Plan

Reports - Options



IPNSIG DTN Testing Plan

Reports and Graphics



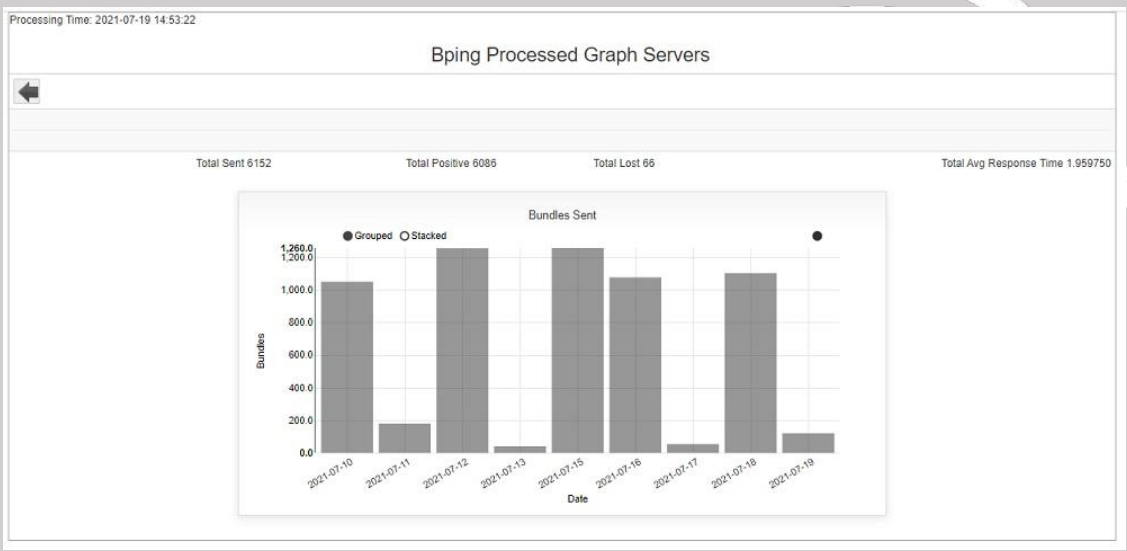
Processing Time: 2021-07-19 14:45:38

Bping Processed Graph Servers

EID	Location name	Place	Infrastructure	Planet	Country	Implementation
ipn:103	Obras Sociales Network	Mar del Plata	PC Cable	Earth	Argentina	ION
ipn:1358	PWG	Mar del Plata	PC ADSL	Earth	Argentina	ION
ipn:149	Earth Unified Medical Records Gateway	AWS-East Virginia	Cloud VPS	Earth	United States	ION
ipn:150	Unified Medical Records Space		Cloud VPS	Earth Orbit		ION
ipn:50	Obras Sociales Network	Mar del Plata	PC Fiber	Earth	Argentina	ION

Date Process	Sender Eid	Receiving Eid	Sent	Positive	Lost	Min Response Time	Max Response Time	Avg Response Time
2021-07-07	ipn:103.1	ipn:150.2	31	0	31			
2021-07-08	ipn:103.1	ipn:150.2	127	0	127			
2021-07-12	ipn:103.1	ipn:150.2	1397	1372	25	0.435592	12.194457	2.844218
2021-07-13	ipn:103.1	ipn:150.2	102	40	62	0.725571	1.710795	0.527765
2021-07-14	ipn:103.1	ipn:150.2	21	0	21			
2021-07-15	ipn:103.1	ipn:150.2	1141	1140	1	0.410870	3.396461	1.551881
2021-07-16	ipn:103.1	ipn:150.2	861	840	21	0.422743	4.655145	2.148487
2021-07-17	ipn:103.1	ipn:150.2	232	160	72	2.300232	9.671791	4.148743
2021-07-18	ipn:103.1	ipn:150.2	341	340	1	2.937378	6.716474	4.612566

Total Sent	Total Positive	Total Lost	Total Avg Response Time
4253	3892	361	2.261951

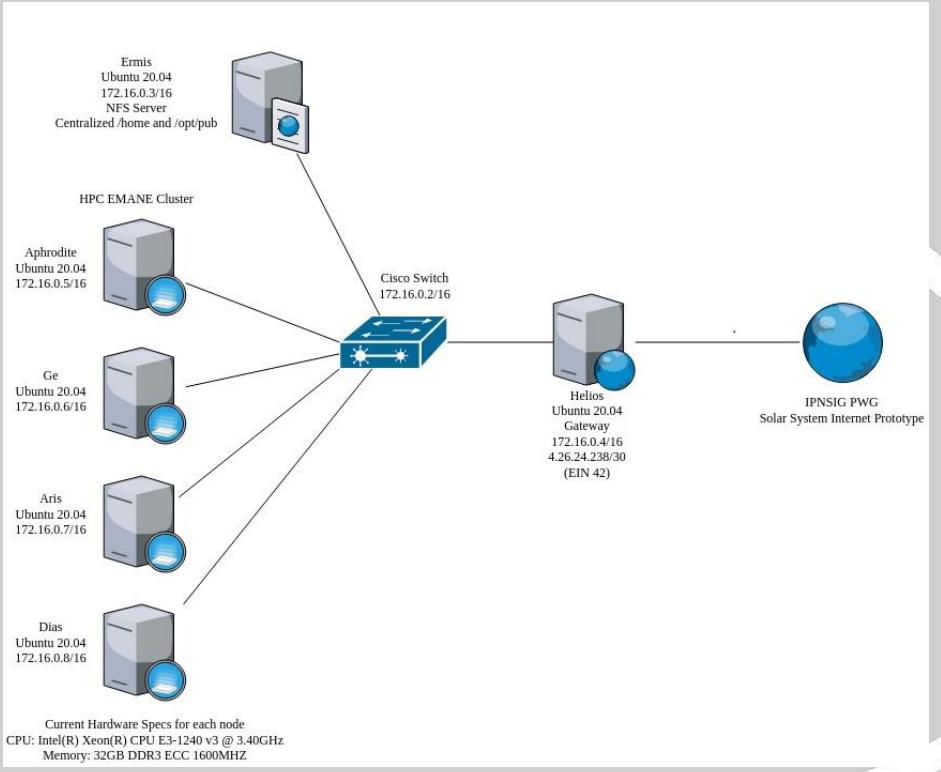


Processing Time: 2021-07-19 14:53:22

Bping Processed Graph Servers

Total Sent 6152 Total Positive 6086 Total Lost 66 Total Avg Response Time 1.959750

Support Infrastructure
DTN Servers - Dr. Ronny Bull
Utica College - US



Virtualized IPNSIG PWG Testbed
Dr. Ronny Bull - Utica College, USA

- 6x - 1U Rackmount Supermicro Servers
  - Ubuntu 20.04 Server
  - Helios - Gateway|Endpont Server (Node ipn:42 on IPNSIG PWG)
  - Ermis - Network & Systems Monitoring + Shared NFS storage
  - EMANE Cluster (Provides 100’s of virtual nodes behind Node 42)
    - Aphrodite
    - Ge
    - Aris
    - Dias

Virtualized IPNSIG PWG Testbed
Dr. Ronny Bull - Utica College, USA

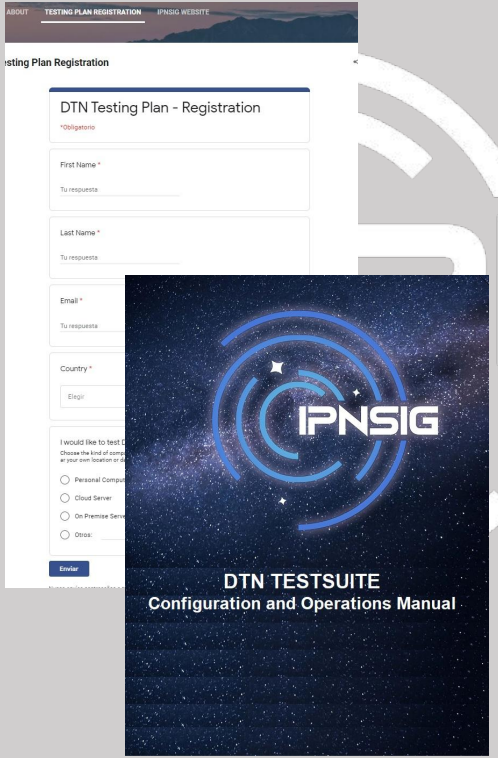
- Each EMANE cluster node is capable of launching up to 200+ virtual nodes.
- All physical servers are connected on a isolated network with a single public IP on the gateway node
  - Virtual EMANE networks|nodes can be bridged to the physical backbone network
  - Virtual EMANE nodes can be arranged in clusters (regions) located on their own individual subnets simulating an Internet
  - Highly complex and dynamic network configurations are possible
  - Ability to add latency, delay, jitter, etc. to network segments
  - Can assign multiple network cards to each virtual node, each on their own subnet

Virtualized IPNSIG PWG Testbed
Dr. Ronny Bull - Utica College, USA

- Automated node configuration and scenario deployment
  - Python-etce control framework
    - Python 3 based
    - Automate node configuration, network setup and topology
    - Automate configuration, startup, and shutdown of applications on nodes
    - Automate data collection processes

IPNSIG DTN Testing Plan
Complete System

- Registration forms
- Downloadable software
- Installation manual
- User manual
- Support Form
- Support personnel
- Feedback of results to users
- Statistics publication



IPNSIG DTN Testing Plan

To Do List

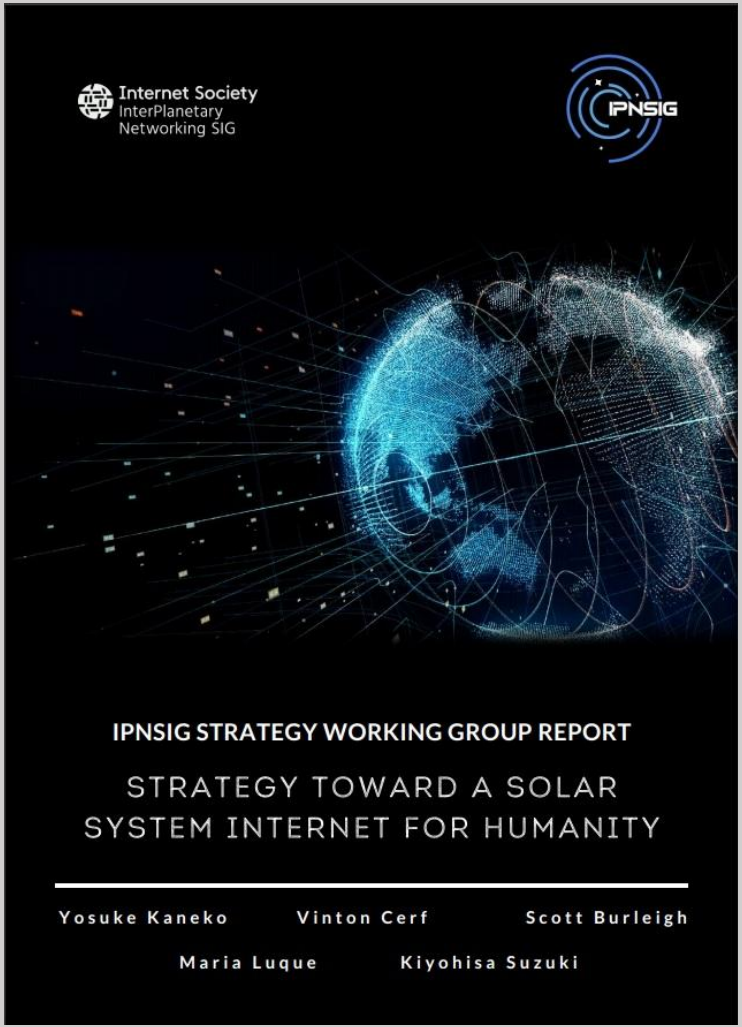
Translation of end user system to different languages

Incorporate more DTN implementations

Add more testing functionality

Generate wider statistics

- 1. delivery completion time (start of message send, last bit received at destination)
- 2. amount of data sent
- 3. statistics of bundle sizes (average, distribution)
- 4. effective data rate
- 5. retransmissions
- 6. if LTP lywe statistics



IPNSIG

Strategy Working Group Report

- EVOLUTION OF THE SOLAR SYSTEM INTERNET (SSI)
- KEY PROPERTIES OF AN SSI
- STRATEGIC PRINCIPLES FOR PUBLIC-PRIVATE DEPLOYMENT OF AN SSI
- OPEN ISSUES
- A ROADMAP IN SUPPORT OF THE EVOLUTION OF THE SSI
- IPNSIG ROLES

Download from
http://ipnsig.org/2021/06/30/announcing-strategy-working-group-report/

IPNSIG DTN Testing Plan

Advisors

Vinton Cerf
Yosuke Kaneko
Scott Burleigh
Kiyohisha Suzuki
Keith Scott
Michael Snell
Leigh Torgerson

PWG Team

Lead: Oscar Garcia
Alberto Montilla Bravo
Ronny Bull
Larissa Suzuki
Alberto Montilla Ochoa
Facundo Novik
Samo Grasic
Pablo Reda
Daniela Caula
Juan Fraire
Jesus David Terrazas Gonzalez

IPNSIG DTN Testing Plan

Register to
test the
Interplanetary Internet
at home
before you go to
Space

https://ipnsigpwg.blogspot.com/p/testing-plan-registration.html

dtntestingplan@gmail.com

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www.ipnsig.org