



HOLISTIX

Automation with HolistIX

An add-on for IXP Manager



Christoff Visser & Marc Bruyere



How can IXPs minimise
Effort, Cost and Risk?

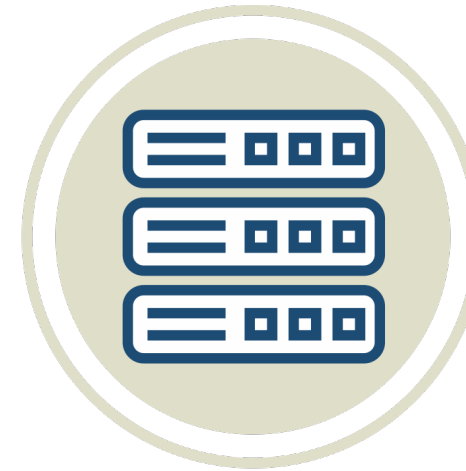
IXP's "Costs and Efforts" are multi-dimensional



**Administrative
Commercial**



**Engineering
Technical**



**Hardware
Infrastructure**

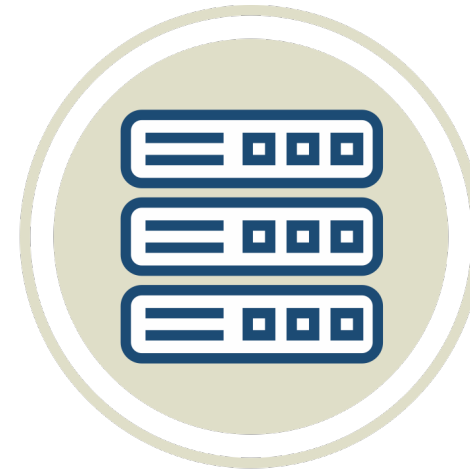
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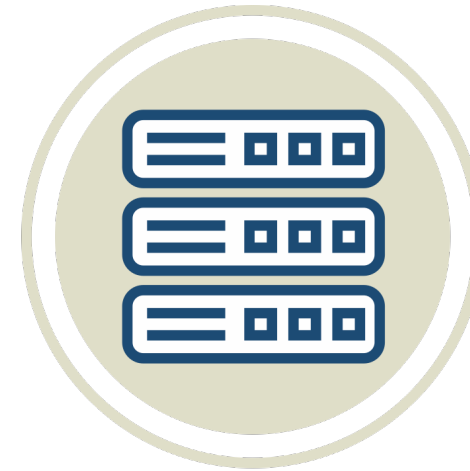
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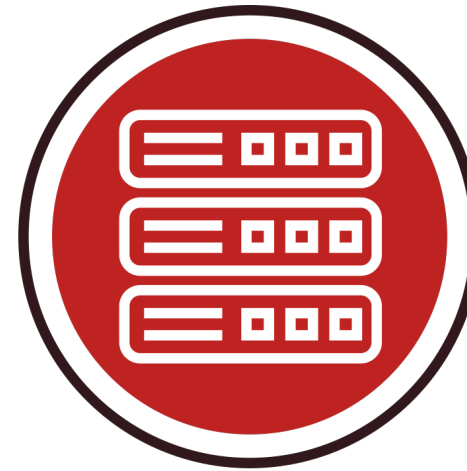
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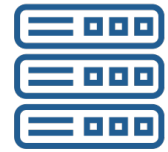


**Engineering
Technical**






**Hardware
Infrastructure**

Cost to connect a new member




		Request To connect	Provisioning	Setup	Validation	Maintenance
	Administration Commercial	Medium	Low	None	None	None
	Engineering Technical	Low to none	Medium	High	High	Medium to high
	Hardware Infrastructure	None	Medium to high	Medium	Low to none	Low to none

Cost to connect a new member

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Our reduction goal



		Request To connect	Provisioning	Setup	Validation	Maintenance
	Administration Commercial	Medium	Low	None	None	None
	Engineering Technical	Low to none	✓ Medium	✓ High	✓ High	✓ Medium to high
	Hardware Infrastructure	None	Medium to high	Medium	Low to none	Low to none

Goal



- **Automation within IXPs**
- **Proactive approach to network management**
- **Enforce IXP best practices**
- **Simplify and generalise network configuration**



HolistIX: Full Stack Automation Platform

Built as an Add-on for IXP Manager

Why IXP-Manager?



Why IXP-Manager?



WE ♥ IXP

MANAGER

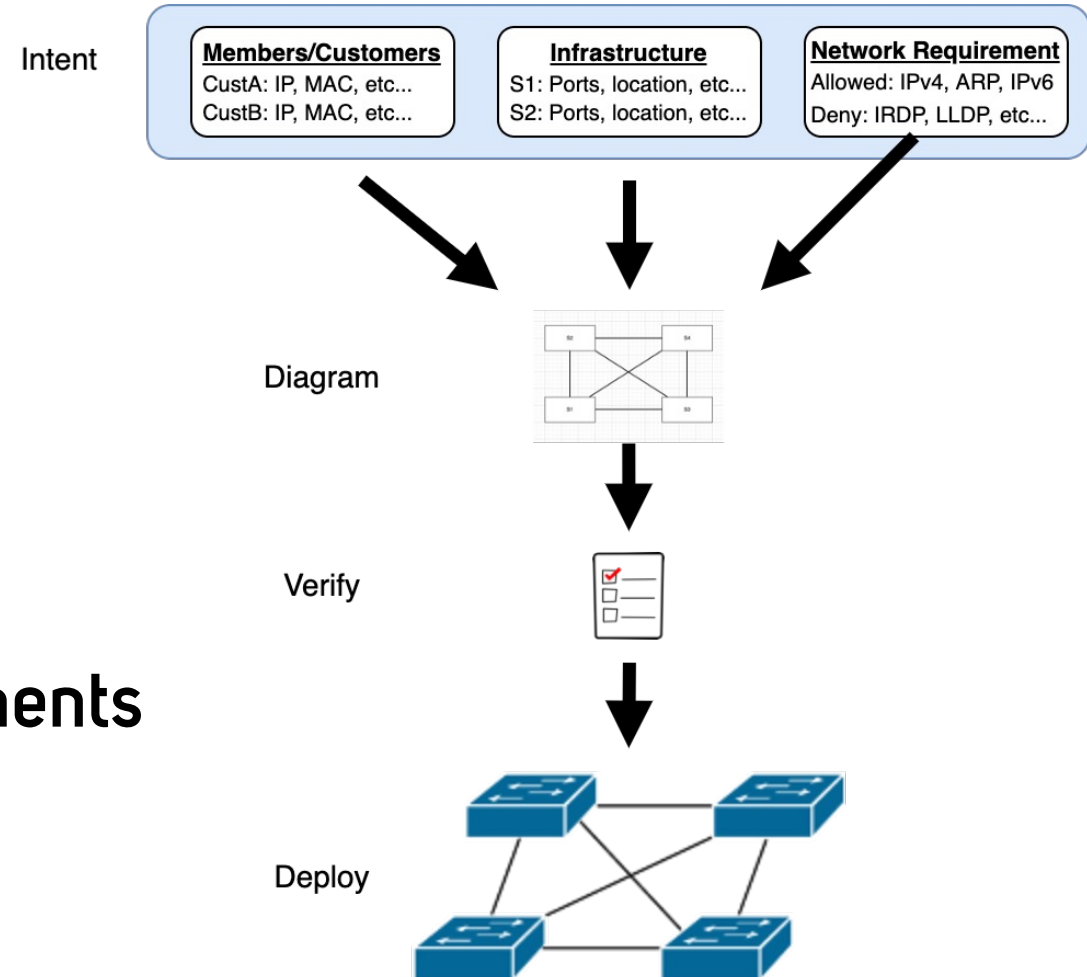


Why IXP-Manager?

- **Free & Open Source Platform for IXPs**
- **Teaches and implements best practice**
- **MANRS Compliant**
- **Full stack management platform**
- **Do more with less**
- **Route server configuration**
- **php based – allows for modules**
- **Everything we require to configure a layer-2 network**

Intent Based Networking

- Translate intentions to configurations
 - Automation from the top down
- Enforce best practices
- Central network management platform
- Simplify network updates and deployments



HolistIX



- IXP Manager
- Miru

HolistIX



- IXP Manager
- Miru



- Athos

HolistIX



- IXP Manager
- Miru



- Athos



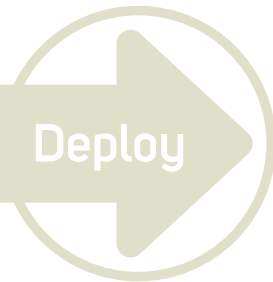
- Cerberus



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Miru: Provisioning & Planning





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Dashboard

Overall Member Numbers

Member Type	Count
Internal	1
Full	20

Members by VLAN

We count full and pro-bono members with at least one connected physical interface.

VLAN	Members	Percentage
Peering_VLAN	25	100%
NSPIPX3_VLAN	3	12%

Members by Location

Location	Members
KDDI Otemachi	20
NTTCom Otemachi	8
NTTData Otemachi	1

Member Ports by Location

Location	100 Mbps	1 Gbits	10 Gbits	Total
NTTCom Otemachi	0	6	2	8
NTTData Otemachi	0	0	1	1
KDDI Otemachi	5	11	4	20
Totals	5	17	7	29

Virtual Interfaces / List



Show 10 entries

Search:

Member	Facility	Switch	Port(s)	Speed	Raw Speed	Action
Acme Internet Access	Facility 1	s1	port1.0.1	1 Gbits	1000	
Alpha Corp	Facility 1	s1	port1.0.2	1 Gbits	1000	
Charlie Internet Access	Facility 1	s1	port1.0.3	1 Gbits	1000	
Delta Internet Access	Facility 1	s2	port1.0.1	1 Gbits	1000	
Echo Internet Access	Facility 1	s2	port1.0.2	1 Gbits	1000	
Foxtrot internet	Facility 1	s2	port1.0.3	1 Gbits	1000	
Golf Electric	Facility 1	s3	port1.0.1	1 Gbits	1000	

Plan

Verify

Deploy



HOLISTIX

Miru

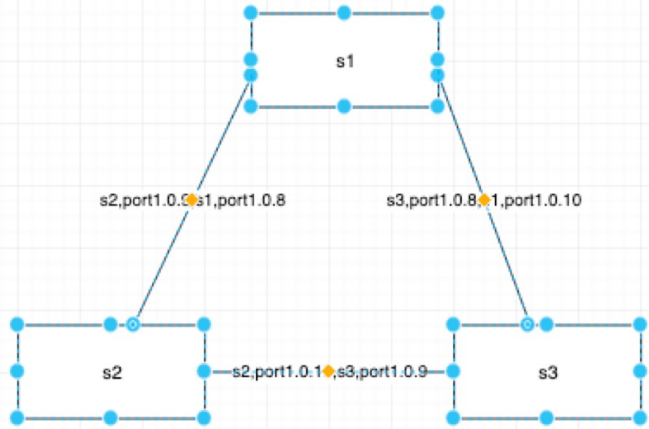
File Edit View Arrange Extras Help



General



Switches



Miru

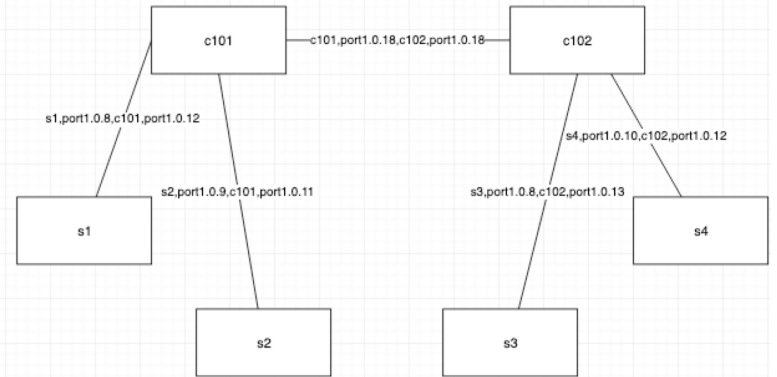
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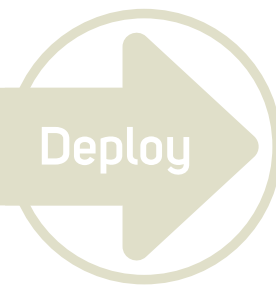


General



Switches





HOLISTIX

Miru

- **Visual network planning**
- **Drag and drop diagramming**
- **Acts as the networks source of truth**
- **Generates network configurations**
- **Emulate and test your network before deploying it**
- **Deploy with a single click**

Athos:
Reduce risk with
verification

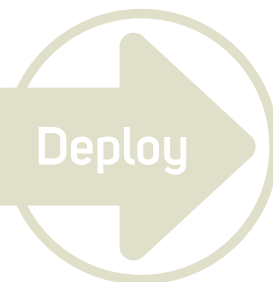




Plan



Verify



Deploy



HOLISTIX

Athos

- Emulates configured network
- Test reachability between members
- Validates Network Redundancy
- OpenFlow + P4 Support
- Docker support

Athos output

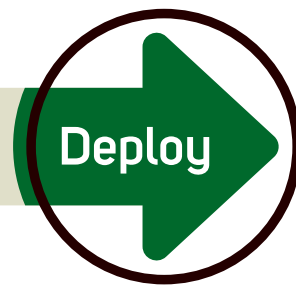
```
Echo Internet Access -> Acme Internet Access Alpha Corp Charlie Internet Access Delta Internet
Access Foxtrot internet golf IJ SCIX test VEON Group
Foxtrot internet -> Acme Internet Access Alpha Corp Charlie Internet Access Delta Internet
Access Echo Internet Access golf IJ SCIX test VEON Group
golf -> Acme Internet Access Alpha Corp Charlie Internet Access Delta Internet Access Echo
Internet Access Foxtrot internet IJ SCIX test VEON Group
IJ -> Acme Internet Access Alpha Corp Charlie Internet Access Delta Internet Access Echo
Internet Access Foxtrot internet golf SCIX test VEON Group
SCIX -> Acme Internet Access Alpha Corp Charlie Internet Access Delta Internet Access Echo
Internet Access Foxtrot internet golf IJ test VEON Group
test -> Acme Internet Access Alpha Corp Charlie Internet Access Delta Internet Access Echo
Internet Access Foxtrot internet golf IJ SCIX VEON Group
VEON Group -> Acme Internet Access Alpha Corp Charlie Internet Access Delta Internet Access
Echo Internet Access Foxtrot internet golf IJ SCIX test
*** Results: 0% dropped (110/110 received)
*** Stopping 1 controllers
faucet
*** Stopping 16 links
.....
*** Stopping 6 switches
c101 c102 s1 s2 s3 s4
*** Stopping 11 hosts
h1 h2 h3 h4 h5 h6 h7 h8 h9 h10 h11
*** Done
Success with no packet loss
```



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Cerberus:
Simplifying
deployments





Cerberus

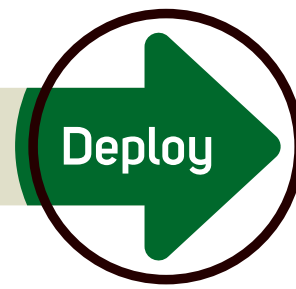
- API support to deploy from IXP Manager
- Rollback and fail state integration
- Proactive configures switches
 - No more MAC learning on the switches
 - Any unknown traffic gets dropped
 - All links are active and used
 - No overhead from VXLAN etc



Plan



Verify



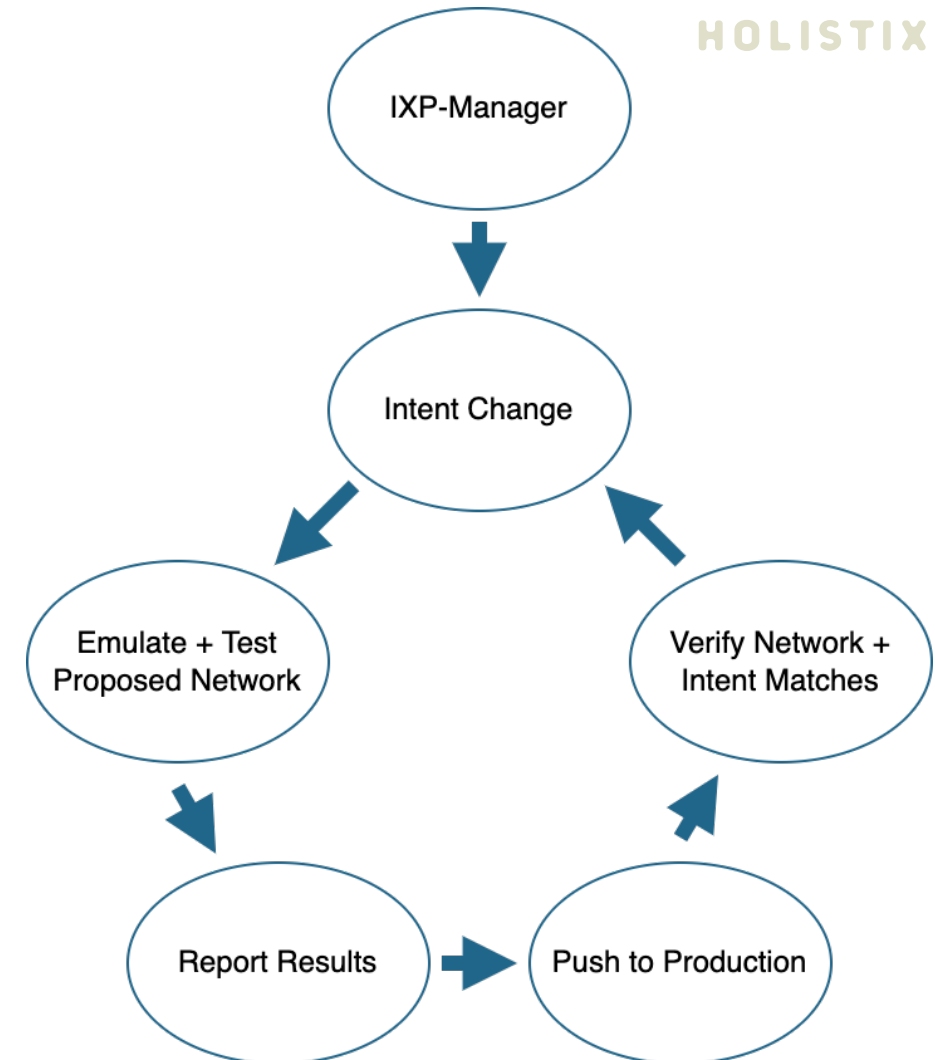
Deploy

Test Driven Design

- Simplify network configuration
- Automated Deployment
- "Push on Green"



HOLISTIX





Deployments and Collaboration

- **WIDE Project IXP Collaboration**
- **HolistIX testbeds**
 - France-IX
 - CIVIX
- **Discussions with KINIX**



Sustaining The Peering Community

- Looking for testing and demoing with IXPs and ISPs
- Aim to build a long-term initiative
- Publish Academic papers such as:

<https://ieeexplore.ieee.org/document/9615540>

Questions?



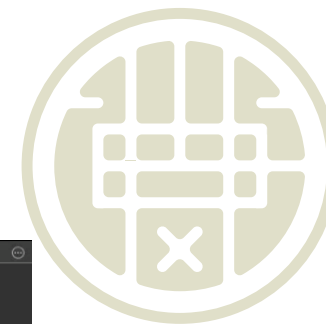
<https://holistix.iijlab.net>

contact@holistix.email



@IxHolist

Demo



HOLISTIX

```
MemberA:~$ ip a
1: lo: <LOOPBACK> mtu 65536 qdisc noop state DOWN group default qlen 1000
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
   link/ether 3c:fd:fe:02:05:06 brd ff:ff:ff:ff:ff:ff
   inet 10.200.0.1/24 scope global eth1
       valid_lft forever preferred_lft forever
   inet6 fd80:9cb1:aeff:8181::10/64 scope global
       valid_lft forever preferred_lft forever
   inet6 fe80::3efd:feff:fe02:506/64 scope link
       valid_lft forever preferred_lft forever
MemberA:~$ ping 10.200.0.2
PING 10.200.0.2 (10.200.0.2) 56(84) bytes of data.
[]

MemberB:~$ ip a
1: lo: <LOOPBACK> mtu 65536 qdisc noop state DOWN group default qlen 1000
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: eth1.1234@eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
   link/ether 00:0c:29:af:0a:bb brd ff:ff:ff:ff:ff:ff
   inet 10.200.0.2/24 scope global eth1.1234
       valid_lft forever preferred_lft forever
   inet6 fd80:9cb1:aeff:8181::11/128 scope global
       valid_lft forever preferred_lft forever
   inet6 fe80::8678:acff:fe3c:8b03/64 scope link
       valid_lft forever preferred_lft forever
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
   link/ether 84:78:ac:3c:8b:03 brd ff:ff:ff:ff:ff:ff
MemberB:~$ ping 10.200.0.3
PING 10.200.0.3 (10.200.0.3) 56(84) bytes of data.
[]

MemberC:~$ ip a
1: lo: <LOOPBACK> mtu 65536 qdisc noop state DOWN group default qlen 1000
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
9: ens9f0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
   link/ether 00:0f:1f:67:32:ea brd ff:ff:ff:ff:ff:ff
   inet 10.200.0.3/24 scope global ens9f0
       valid_lft forever preferred_lft forever
   inet6 fd80:9cb1:aeff:8181::12/64 scope global
       valid_lft forever preferred_lft forever
MemberC:~$ ping 10.200.0.4
PING 10.200.0.4 (10.200.0.4) 56(84) bytes of data.
[]

MemberD:~$ ip a
1: lo: <LOOPBACK> mtu 65536 qdisc noop state DOWN group default qlen 1000
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: ens9.1234@ens9f1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
   link/ether b8:c2:53:30:ac:5b brd ff:ff:ff:ff:ff:ff
   inet 10.200.0.4/24 scope global ens9.1234
       valid_lft forever preferred_lft forever
   inet6 fd80:9cb1:aeff:8181::13/64 scope global
       valid_lft forever preferred_lft forever
   inet6 fe80::bac2:53ff:fe30:ac5b/64 scope link
       valid_lft forever preferred_lft forever
10: ens9f1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
   link/ether b8:c2:53:30:ac:5b brd ff:ff:ff:ff:ff:ff
MemberD:~$ ping 10.200.0.1
PING 10.200.0.1 (10.200.0.1) 56(84) bytes of data.
[]
```