

Survey v3

siiba

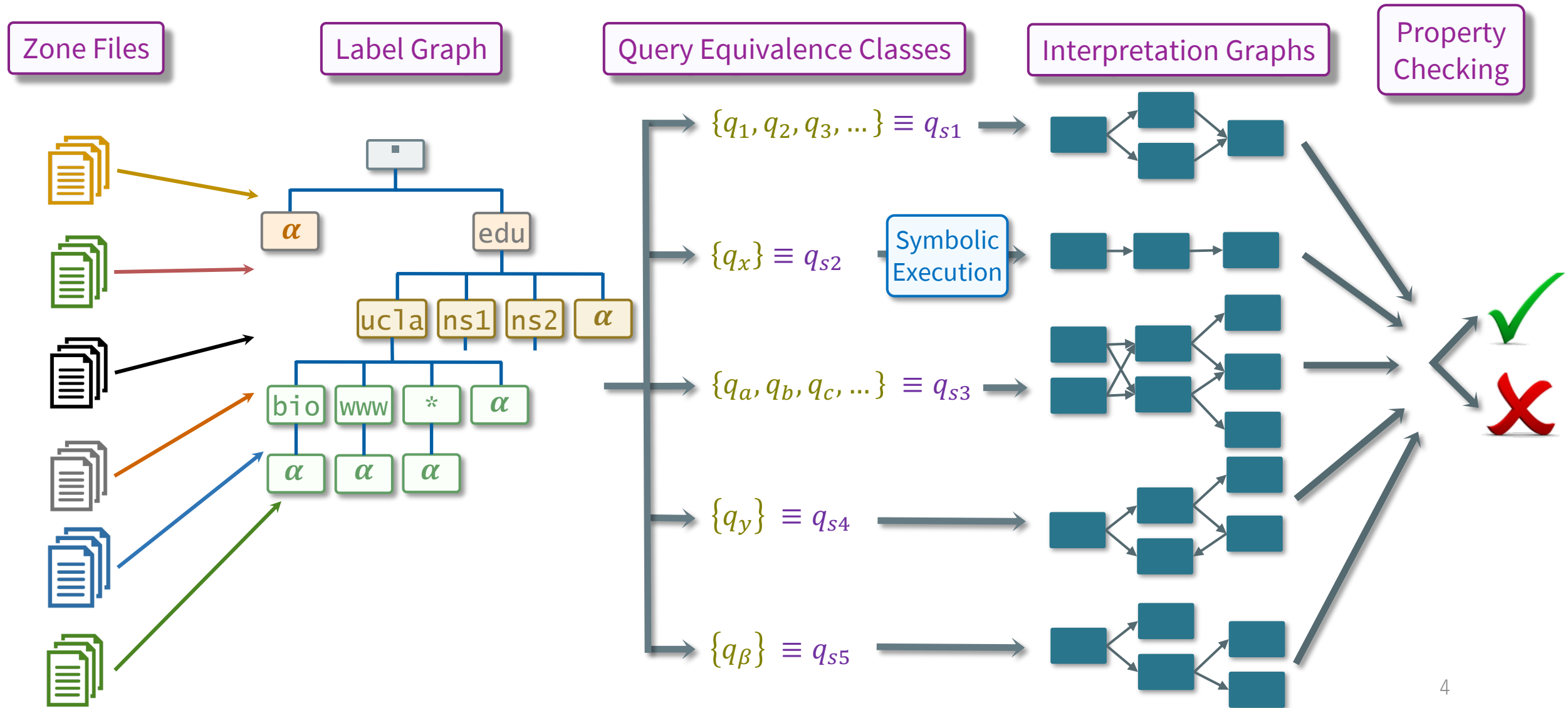
Today's contents

1. Analyzing DNS zone files using GRoot
2. Network modeling using Zen (Microsoft Research)

Today's contents

1. Analyzing DNS zone files using GRoot
2. Network modeling using Zen (Microsoft Research)

Verification flow of the zone files in GRoot



Analyzing com/net/org/se zone files

Property list

- Delegation Consistency
- Response Consistency (CNAME, A, AAAA, MX)
- Rewrite Blackholing
- Lame Delegation
- Structural Delegation Consistency
- Zero TTL
- DNAME Substitution Check

Analyzing com/net/org/se zone files

No error was found in these properties ...

- no parent-relation, simple job setting

Cyclic Zone Dependency in the zone files

	Number of Cyclic Zone Dependency
org	27
net	26
se	7

A process killed
in analyzing .com zone files

Thoughts using Groot

Writing specification and property is hard ...

- Zone files have a lot more relations than network config. Files

Network config. analysis is more fun for me as of now ...

- No experience of operating DNS servers

Today's contents

1. Analyzing DNS zone files using GRoot
2. Network modeling using Zen (Microsoft Research)

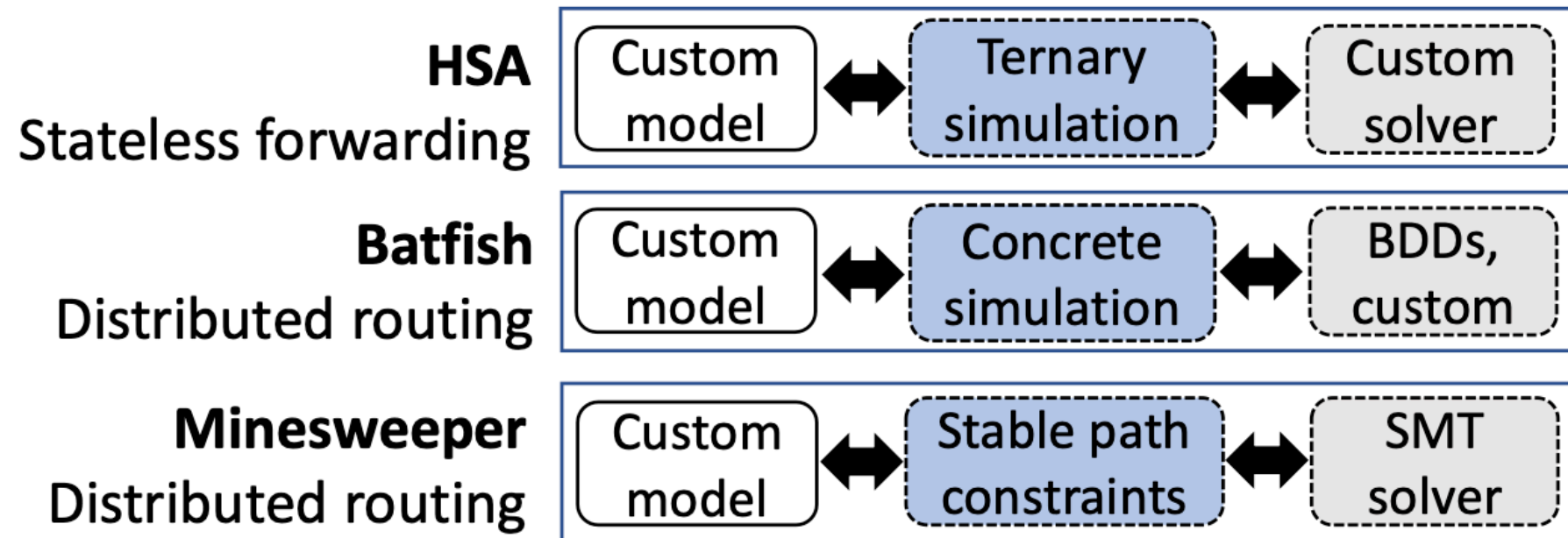
What is Zen ?

A General Framework for Compositional Network Modeling
(HotNets 2020)

- Intermediate language for network modeling and analysis
- Implemented in C#

Current network verification system

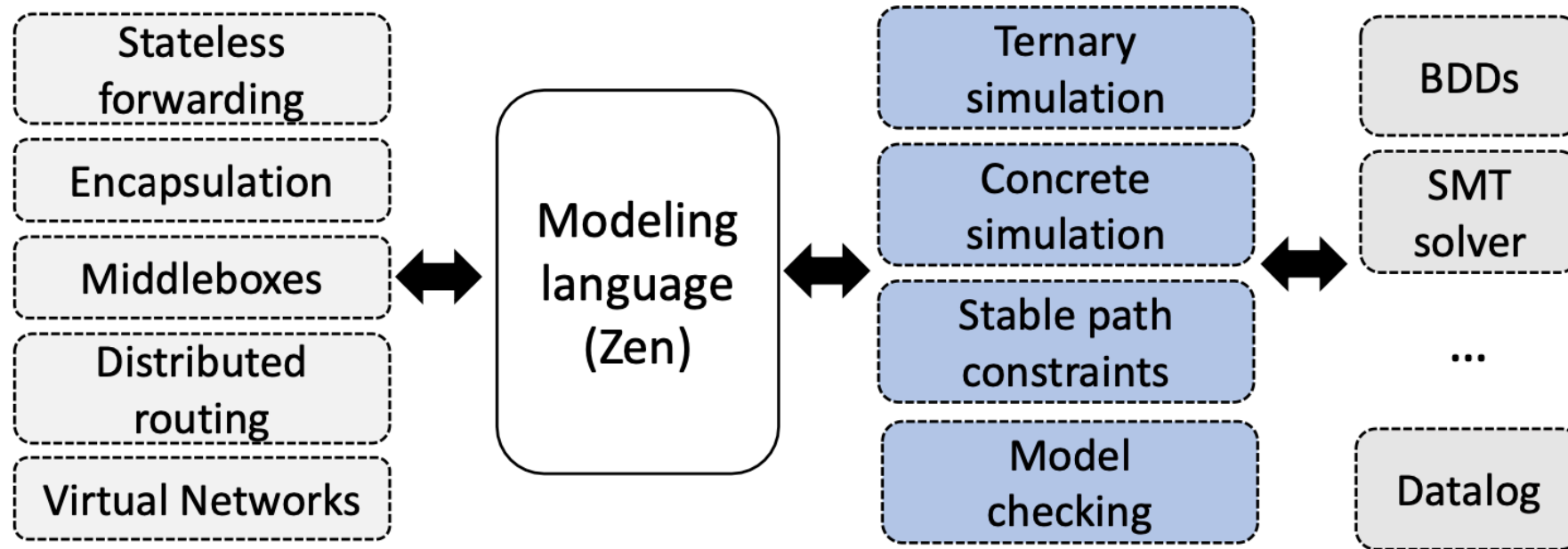
Network model and analysis engine is tightly-coupled



→ hard to develop new functions/protocols

Zen: A language for compositional network modeling

Decupling network functions and analysis engines



Quantitative evaluation of Zen

Network Component	Zen Lines	Existing systems
Access Control Lists	28	> 500 (Batfish)
LPM-based Forwarding	18	> 900 (HSA)
Route Map Filters	75	> 1000 (Minesweeper)

Figure: Lines of code to express common network functions

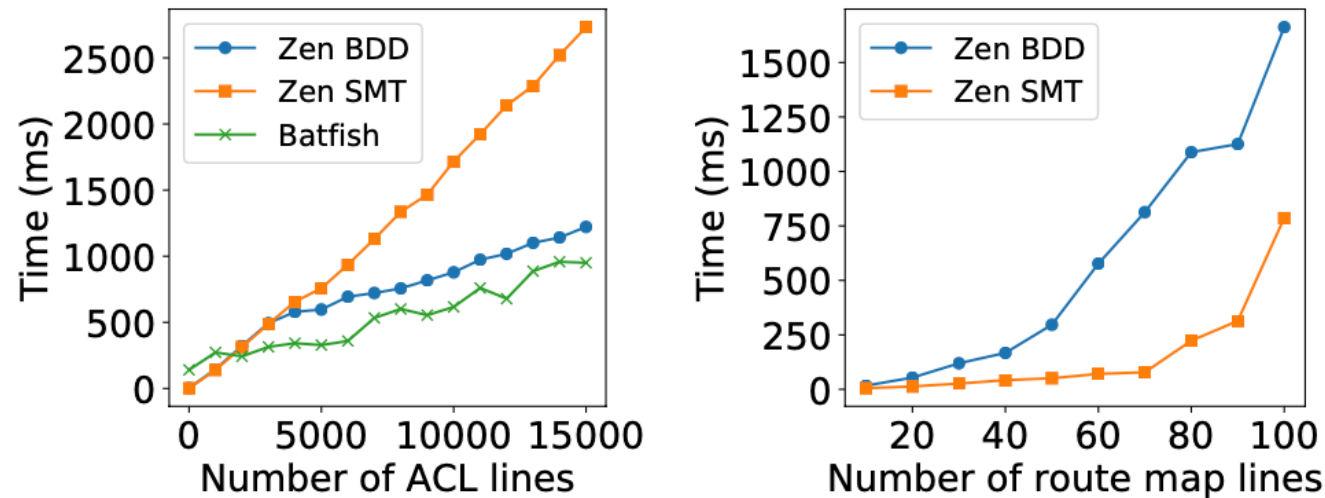
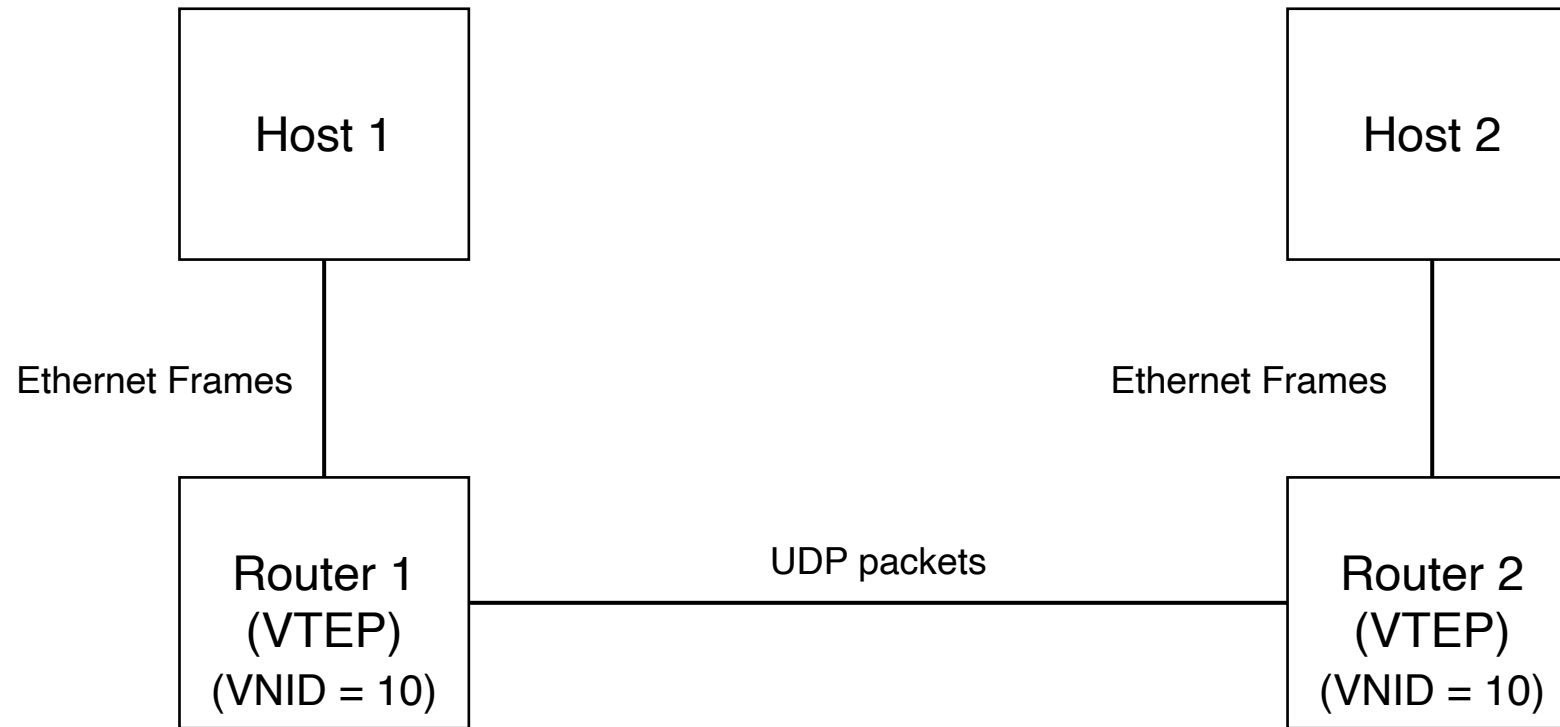


Figure: microbenchmarks for random ACLs and route maps

Modeling a simple Vxlan network



VTEP = Vxlan Tunneling Endpoint

VNID = Vxlan Network Identifier

Modeling a simple Vxlan network

Implemented Vxlan features using only 100-200 lines of code

```
> wc *.cs
1908 23 574 v1.57 f      518 Device.cs
2010 25 11-98-48 65.p 557 Eth.cs
3365 44 3365 88.pdf 1200 EthHeader.cs
3422 69 3425 169.pdf 1866 ForwardingTable.cs
3426 62 3434 140.pdf 1662 Interface.cs
Algor 81 hem 265 2419 Ip.cs
Bl-4 132 352 3931 IpHeader.cs
Eu5va 26 XUAIm 50.jpg 580 Udp.cs
Netw 52 97 1329 UdpHeader.cs
Prof 24 ional 48 L_TL 568 Vxlan.cs
SFC_ 45 80 1071 VxlanHeader.cs
> 220 568 7072 VxlanNetworkTest.cs
> 34 61 953 VxlanOuter.cs
> s 34 61 970 VxlanPacket.cs
zsh: 57 mmand 110 t fo 1679 VxlanTunnelEndPoint.cs
> 44 83 1192 sPacket.cs
~/De 972 bad: 2277 27567 total
```

Weak points of Zen

```
> wc *.cs
1908 23 574 v1.57 f 518 Device.cs
2010 25 11-98-48 65 pc 557 Eth.cs
3365 44 3365 88 pdf 1200 EthHeader.cs
3422 69 3425 169 pdf 1866 ForwardingTable.cs
3426 62 3434 140 pdf 1662 Interface.cs
Algo 81 hem 265 2419 Ip.cs
B1-4 132 352 3931 IpHeader.cs
Eu5v 26 XUAIm 50 jpg 580 Udp.cs
Netw 52 97 1329 UdpHeader.cs
Profe 24 ional 48 L_TL 568 Vxlan.cs
SFC_ 45 80 1071 VxlanHeader.cs
220 568 7072 VxlanNetworkTest.cs
34 61 953 VxlanOuter.cs
> s 34 61 970 VxlanPacket.cs
zsh: 57 mmand 110 t fo 1679 VxlanTunnelEndPoint.cs
> 44 83 1192 sPacket.cs
~/Dc 972 pad: 2277 27567 total
```

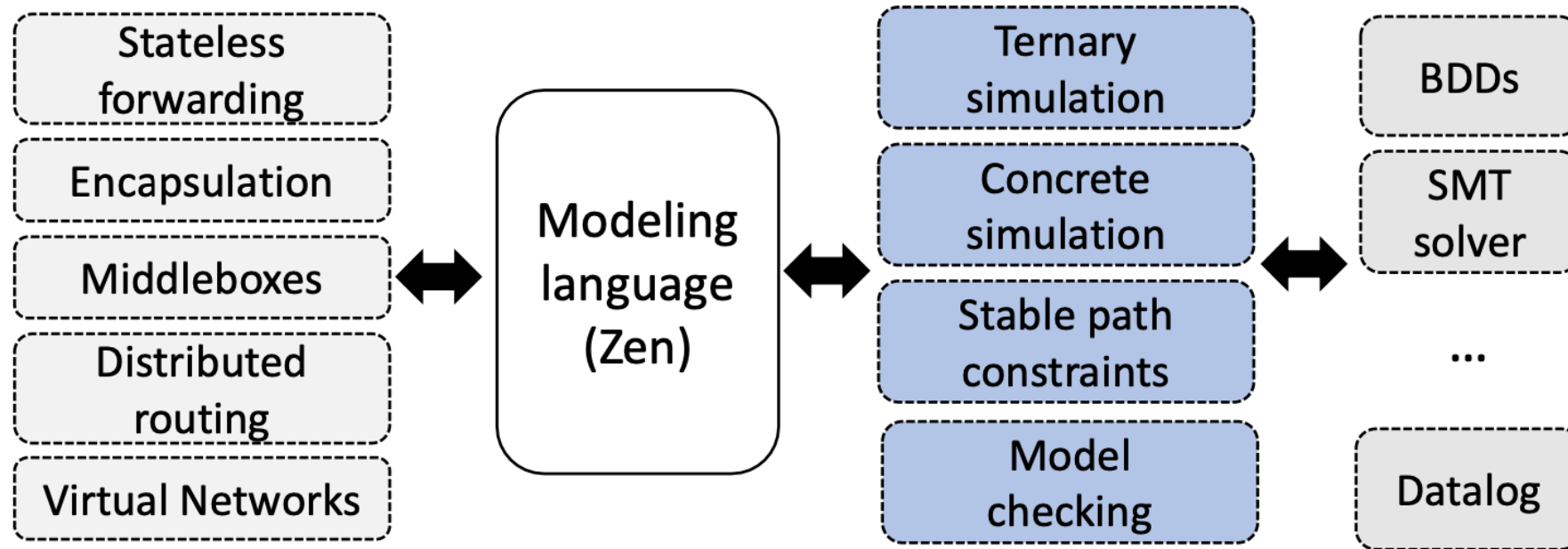
We need to implement a model of network for the verification

- 200 lines of code for the simple topology ...

→ can not scale to large networks

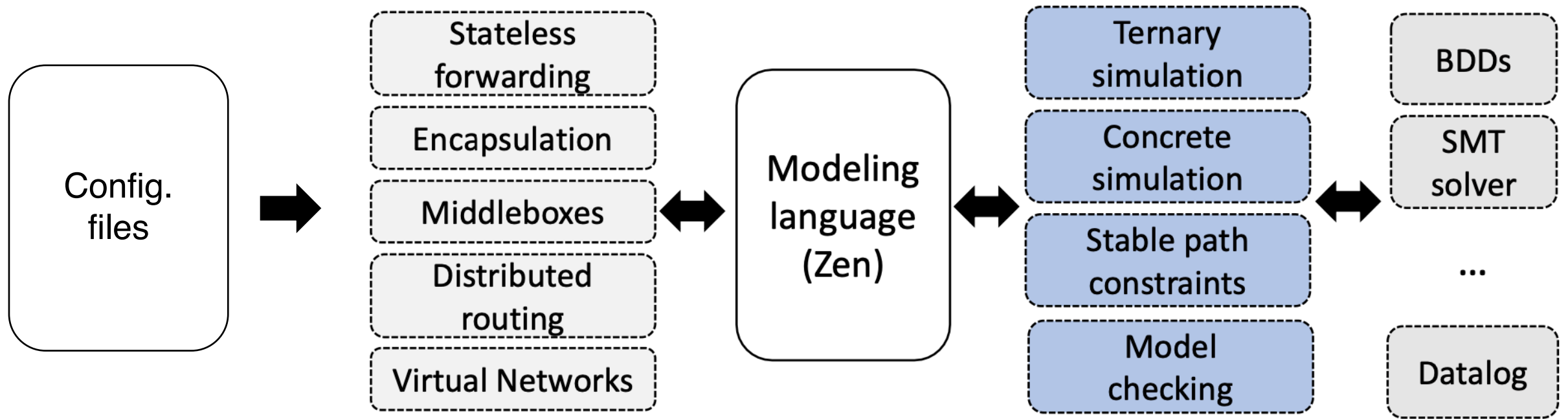
Weak points of Zen

No support for the network configuration currently



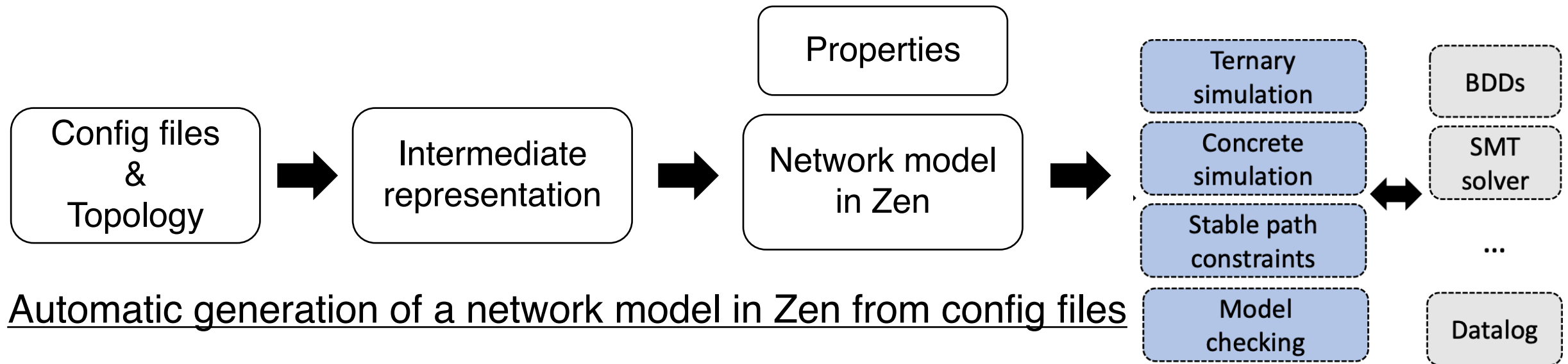
New research point ... ?

Bridging the gap between config. files and Zen modeling



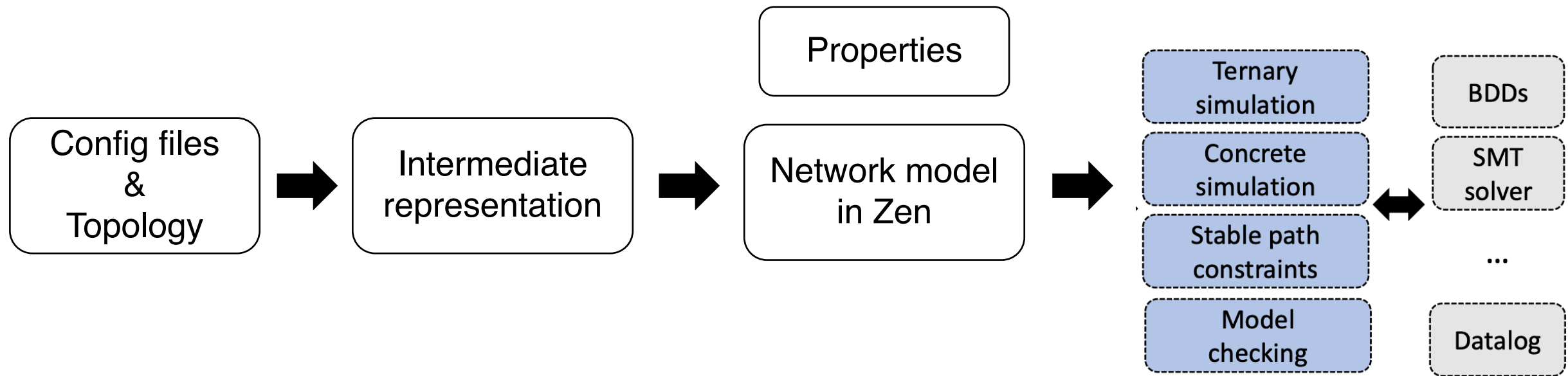
New research point ... ?

Bridging the gap between config. files and Zen modeling



New research point ... ?

Achieve useability for the verification in the real operation env.
while providing extensibility for the new functions



Reference

- [1] GRoot: Proactive Verification of DNS Configurations
Siva Kesava Reddy Kakarla et al.,(SIGCOM'20)
- [2] A General Framework for Compositional Network Modeling