NEMO, An Intent Oriented Network Wide Programming Language

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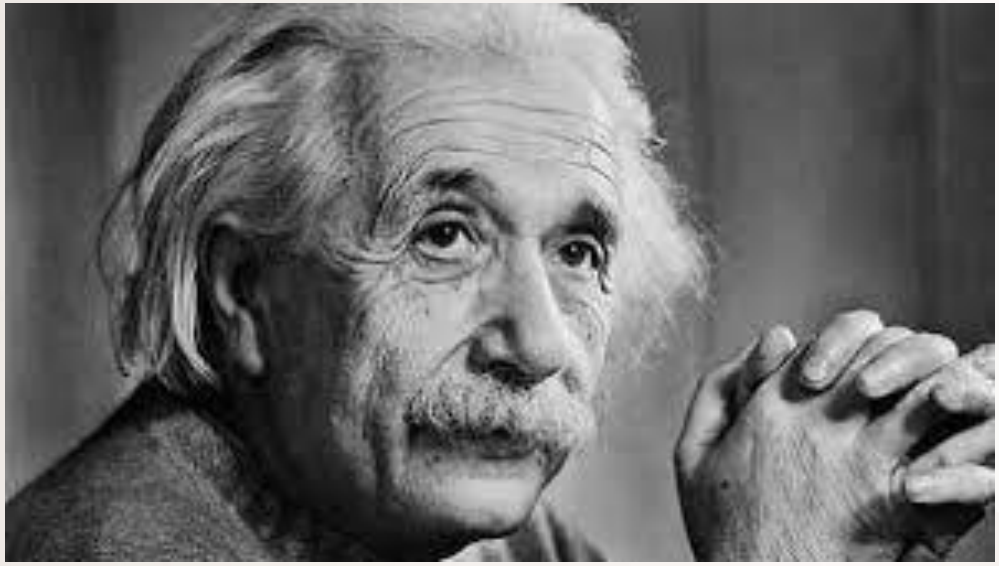
Open - leads to new world !

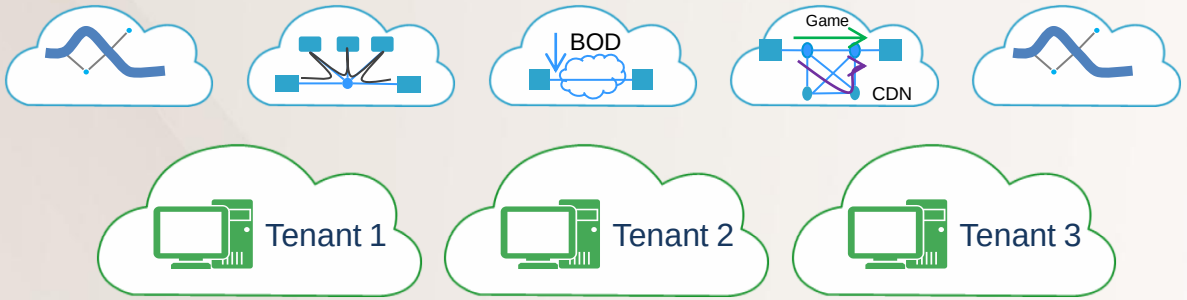


“The mind that opens to a new idea never returns to its original size.”

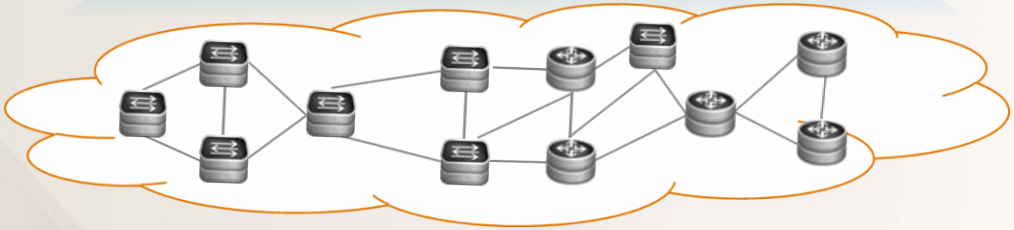
How to programming? API or Language?

API	Language
Functional interface	Abstraction interface
Standalone	Composable
Exhaustive	Concise
Easy design and provide	Hard, depend on abstraction

Multi Role and Multi Layer Network Programming



SDN



Service network programming

Virtual network programming

Network Wide

Network function programming

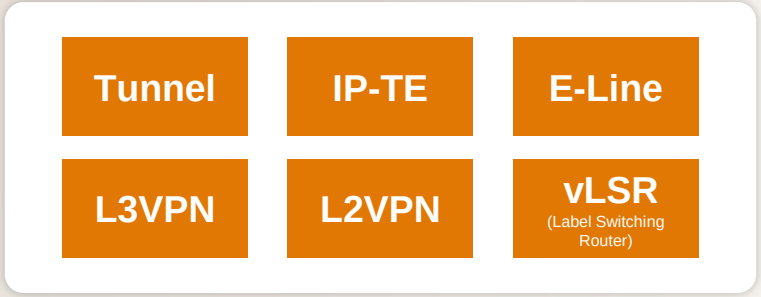
Frenetic

Network forwarding (NP)programming

P4

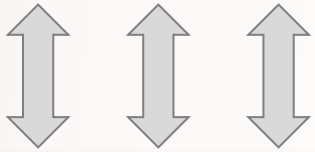
How to abstract network? Bottom-up or Top-down?

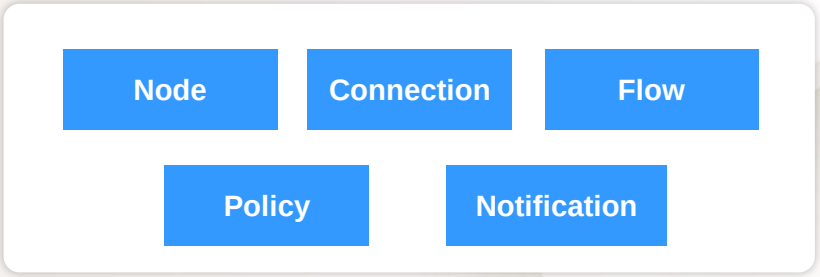
Bottom Up, Network function "What I can do"



Function oriented and technology related Interface

Top Down, Customer Intent "What I want"





Technology-neutral and business oriented NBI

Intent is “what” not “how”

Intent definition

- Intent NBI is a kind of network implementation technology-neutral NBI. It doesn’t need to see VPN, MPLS and router policy etc.
- Express user’s willing (what want to do) , but not how to do.
- A kind of top-down, from requirement view to abstract network objective

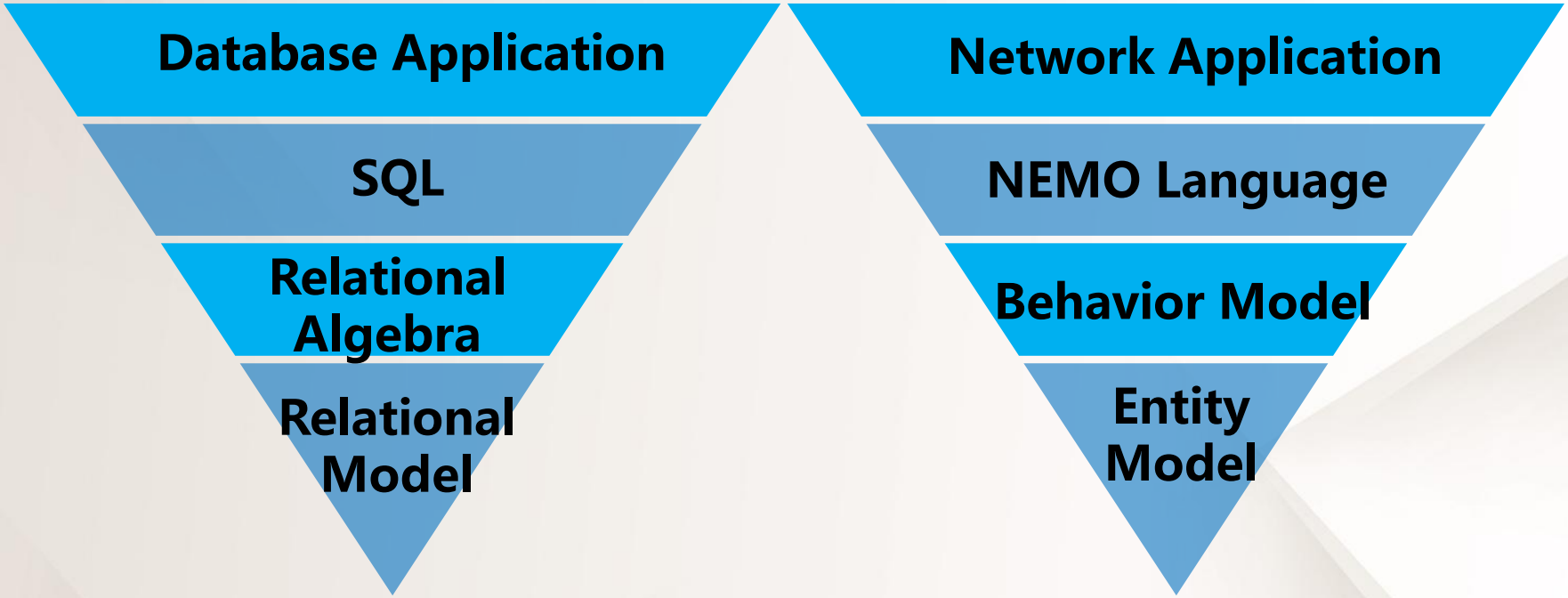
Why Intent NBI is paid attention strongly

- Simple, easy to be used. Through hiding realizing related information, it is lower the entry threshold and enrich application development
- Irrelevant with platform, it improve the transplanting capability of application

Target user

- Carrier business designer, who can quickly build new network business combination and service
- IT Developer, who will merge network resource and capability as part of IT service, e.g. Cloud developer

Learn Language Design from SQL



Network DSL: NEMO Language

Resource Access

Entity Model	node	Node/UnNode entity_id Type {FN|PN|LN} Owner node_id Properties key1 ,value1
	connection	connection/Unconnection entity_id Endnodes (node1_id,node2_id) SLA key,value Properties key1 ,value1 ….
	flow	Flow/UnFlow entity_id Match/UnMatch key1, value1|Range(value, value) |Mask(value, value) Properties key1 ,value1

Policy and Event Handling

Capability Model	Query	Query key Value {value} From entity_id
	Policy	Policy/UnPolicy policy_id Appliesto entity_id Condition {expression} Action { “forwardto” | “drop” | “gothrough” | “bypass” | “guaranteeSLA” | “Set” |“Packetout“| Node | UnNode | Link | Unlink} Commit / Withdraw
	Notification	Notification entity_id On key Every period RegisterListener callbackfunc

Model Definition

Node definition	NodeModel <node_type> Property { <data_type> : <property_name> }
Link definition	LinkModel <Link_type>Property { <data_type> : <property_name> }
Action definition	ActionModel <Action_Name> parameter { <data_type> : <property_name> }

Simple components

3 group primitives

15 piece statements

36 key words

Programming

Variable dynamic objects

Logic support workflow

Unlimited Services

Resource Definition

Service Programming

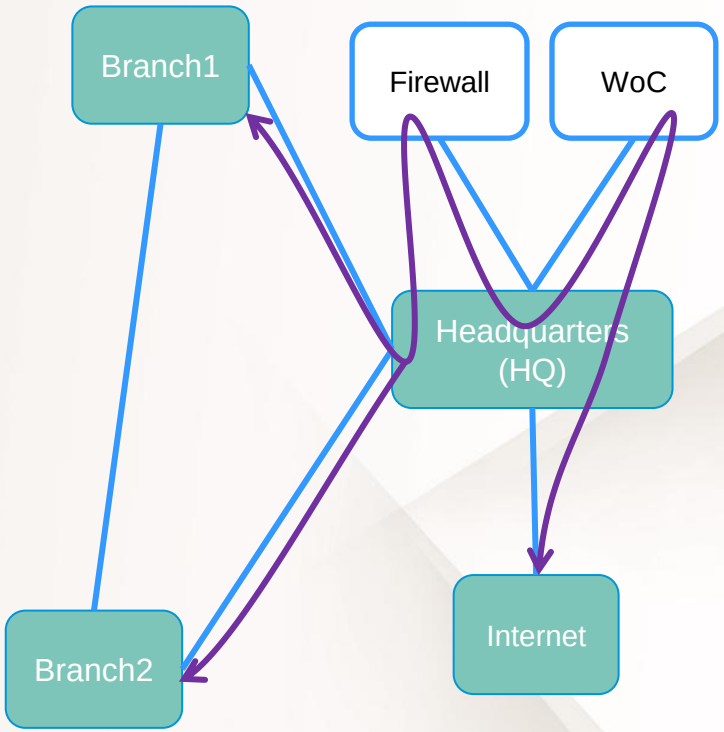
Policy Composition

……

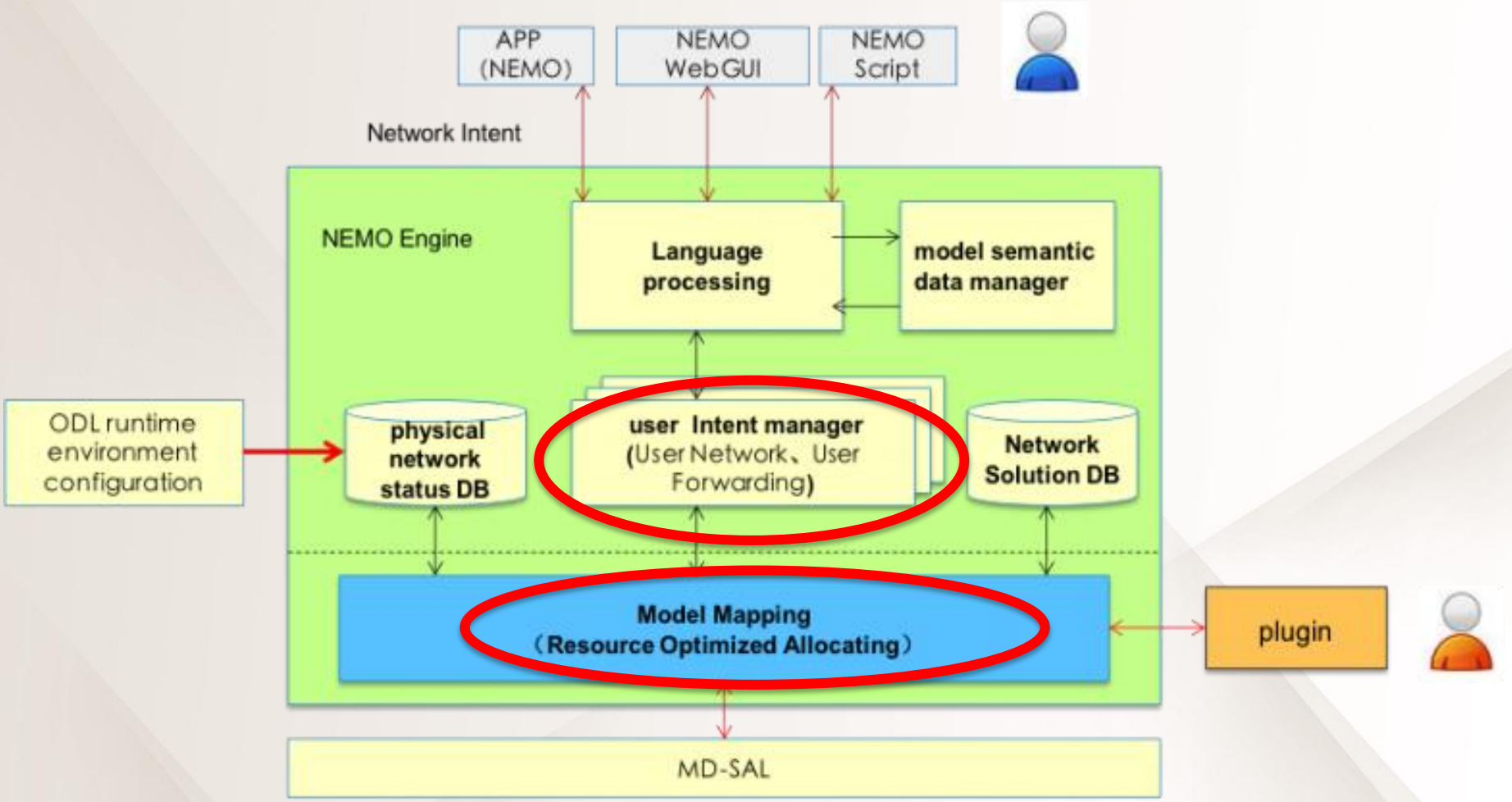
Example：NEMO express user's intent

NEMO script(only demo, not complete)

- Connection c1Endnodes(branch1, HQ) Properties 10G
- connection c2 Endnodes(branch2, HQ) Properties 1G
- ….
- Connection c6Endnodes (Woc,HQ) Properties flow1 inbound flow2 outbound
- Flow f1 match Internet-Traffic Policy ID1
- Policy ID1 apply to f1action gothrough (firewall, WoC)
- Policy ID2 apply to c2 condition { if timer>22:00 or timer<7:00 action set c2.bandwidth=100M; else action set c2.bandwidth=1G}

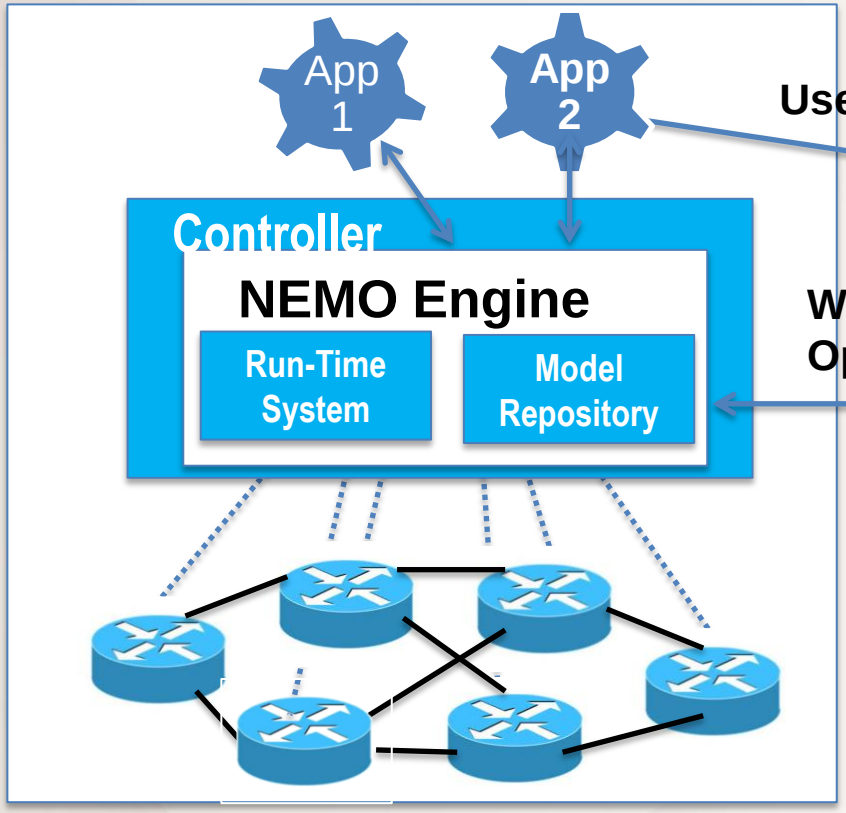


Compiler/ Engine



Work Areas

on Open sources



Use the Intent NBI

Write Code for Open Source

on Standards

IETF Work (ibnemo)

- Intent Language
- Intent Yang Models for specific role
- Intent Common Info Models

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Future works

- Conflict resolver
  - Object overlap
  - Conditional expression
  - Action conflict
- Debugger
- Simulation

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Thanks