

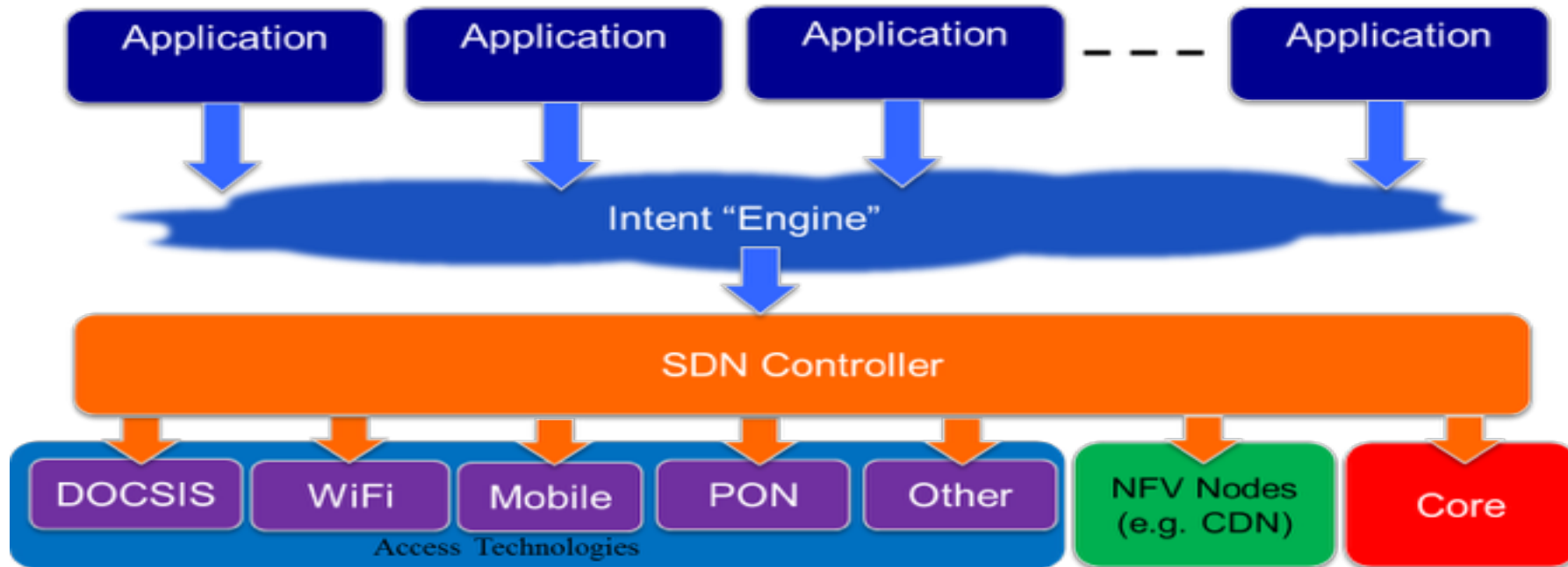
(NEMO) Intent Language

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What is Intent networking?

- “Don’t tell me what to do, tell me what you want.”



NEMO Language: Concise and Flexible

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> }

Entity Access

Entity Model	node	Node entity_id Type {FNIPNILN} Owner node_id Properties key1 ,value1
	link	Link entity_id Endnodes (node1_id,node2_id) SLA key,value Properties key1 ,value1
	flow	Flow entity_id Match/UnMatch key1, value1IRange(value, value) IMask(value, value) Properties key1 ,value1

Policy and Event Handling

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

Composed By

3 Primitive Groups
15 Statements
36 Key Words

Enable Endless Service Defination

Resource Definition
Service Programming
Policy Composition
.....

Example 1: Bandwidth on Demand

- **There is a virtual link between the branch and headquarter offices.**
 - The bandwidth of the vlink can be adjusted on demand
 - The adjustment can be triggered by "conditions" meet
 - E.g. The bandwidth will be adjusted when the timing meets.
 - This use case can also be generalized to more resource (e,g, group) reservation policies.

NEMO Script:

Node branch;

Node headquarter;

Link tunnel

Endnodes branch, headquarter;

Policy bod_day **ApplyTo** tunnel

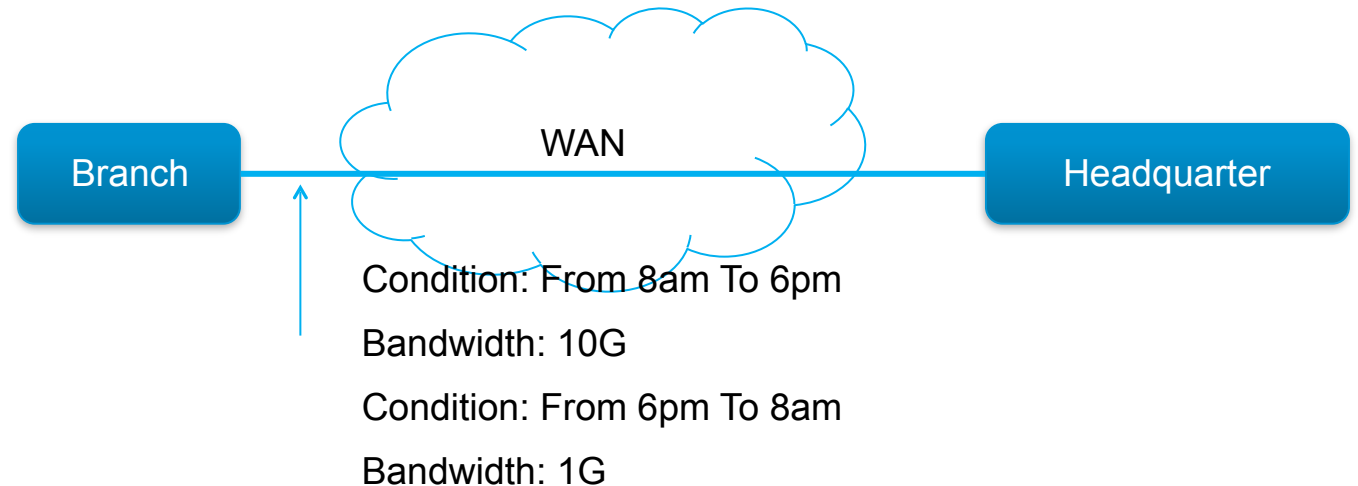
Condition time>8am & time <6pm

Action set:bandwidth=10G;

Policy bod_night **ApplyTo** tunnel

Condition (time>0am & time <8am)
| (time>6pm & time <0am)

Action set:bandwidth=1G;



Example 2: VDC

//nodes within a tenant network

Node internet **Type** ExtLogicNW

Node firewall_1 **Type** Firewall

Node DMZ **Type** LogicNW

Node firewall_2 **Type** Firewall

Node protected_zone **Type** LogicNW

//links for connectivity

Link link_1 **Type** InternalLink **EndNodes** internet, firewall_1

Link link_2 **Type** InternalLink **EndNodes** firewall_1, DMZ

Link link_3 **Type** InternalLink **EndNodes** DMZ, firewall_2

Link link_4 **Type** InternalLink **EndNodes** firewall_2, protected_zone

//configuration

Node protected_zone **Property** subnet:"192.168.1.0/24", services:"DHCP"

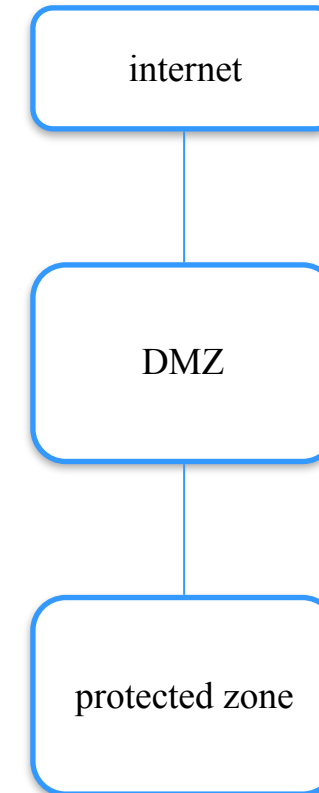
Object rule_1 **Type**: NetRule **Property** from:"protected_zone", to:"DMZ", relation:"NAT"

Object rule_2 **Type**: AccRule **Property** from:"protected_zone", to:"DMZ", sessions:**list**("SSH","HTTP","PING","DNS"), allow:true

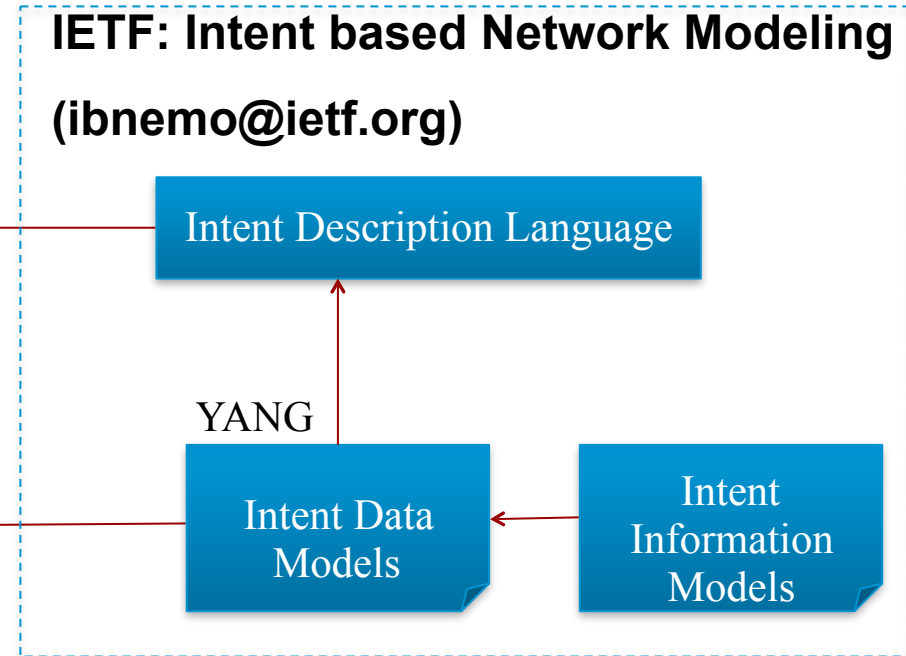
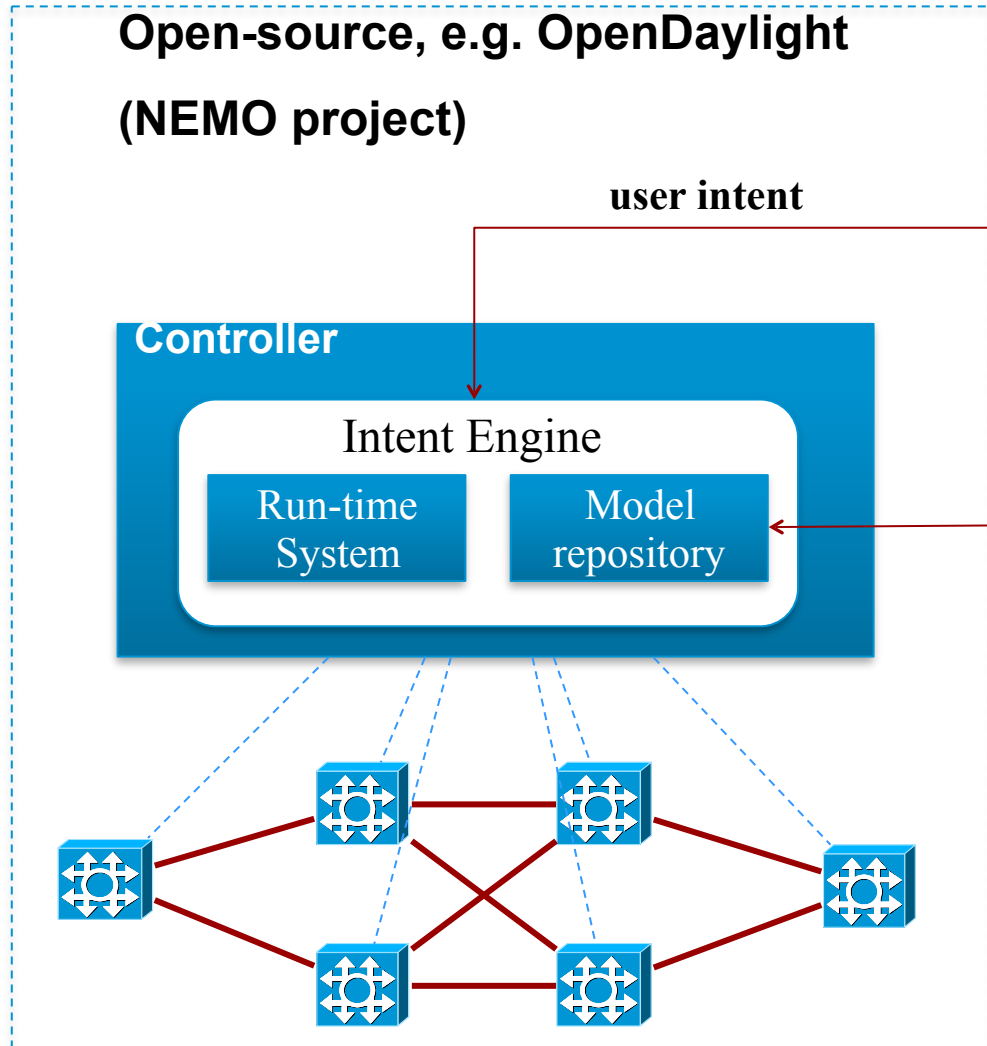
...

Node firewall_2 **Property** net_rules:rule_1, access_rules:rule_2

...



Intent base Networking Architecture



- Use case for intent networking
- Gap analysis to other working groups in IETF
- Clear definition of Intent-Requirement for the NEMO language
- Standardize a language for NEMO
- Data models for each set of role based intent

Thank You