Wireless testbed federation and why do we (desperately) need better ontologies

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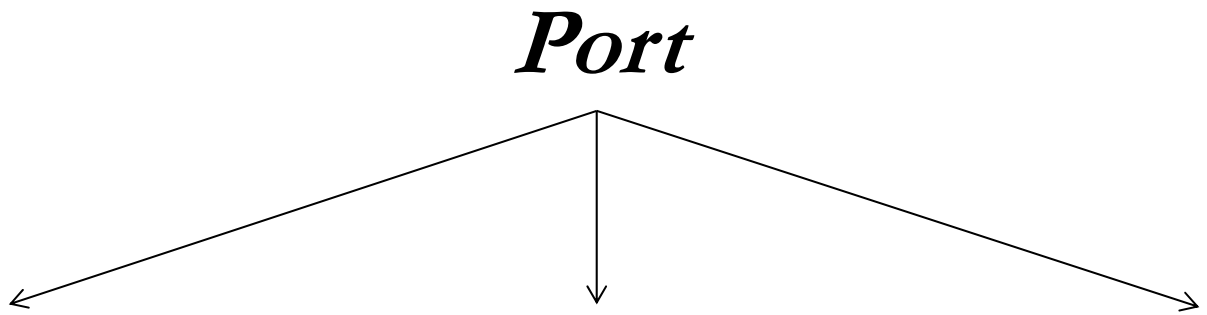
Federated Testbed Experimenter (Nightmare)

A **user** should be able to

- specify experimental requirements in simple (preferably human language) terms
- Obtain necessary collection of resources
- Prepare resources with configurations and programs
- Get a (minimal, critical, etc.) set of measurements (even of they don't know they need them)
- Archive what they did

Need for Ontology



Antenna Port

String describing physical antenna port on a wireless device (“main”,” aux”, ”primary”, ”secondary”, ”port 1”, “port 2”, etc.

Switch Port

Integer: describing physical port on a switch (1, 2, 3, 4, 5, …)

or

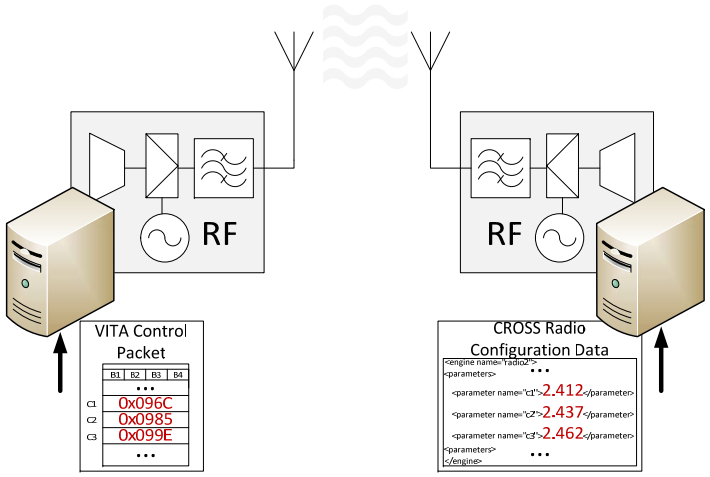
String: SNMP set/get OID

IP Port

“**port** is an application-specific or process-specific software construct serving as a communications endpoint in a computer's host operating system”, 16-bit integer

Other Federation Issues

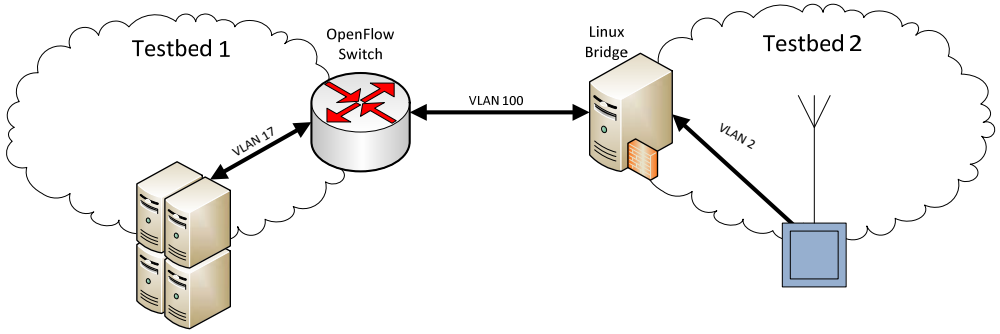
Carrier Frequency Specification



VITA: channels are 32 bit integer (multiple of 100 KHz)

CROSS: channels are floating-point number (in GHz) as an XML attribute

VLAN Stitching



OpenFlow configuration	Linux bridge configuration
flow-entry vlan100-ip active True src-mac 00:15:17:d6:da:4a vlan-id 100 actions set-vlan-id=17,output=all flow-entry vlan17-ip active True src-mac 00:15:17:d6:ce:20 vlan-id 17 actions set-vlan-id=100,output=all	brctl addbr br0 brctl addif br0 eth0.100 brctl addif br0 eth1.2

Immediate Objectives

- **Domain knowledge**: want to do experiments even if I don't know enough about particular technology; ex: multi-site opportunistic social experiment (e.g. using GENI WiMAX meso-scale deployment)
  Objective: Reduce experimenter's barrier to entry by providing technology specific domain knowledge and support for rapid experimentation.
- **RF virtualization**: Large number of parameters/issues that are affecting RF virtualization (channel overlap, conflicting parameter setting on a single resource, etc.);
  Objective: Increase testbed/resource availability by supporting multiple simultaneous experiments including parameter based scheduling.
- **Language development**: e.g. community using variety of hardware (CR) platforms with different service models; facilitate development of a common language.

Approach

- Generate ontologies out of service descriptions (GENI AM => XML,RDF, etc.)
- Enable user interaction/updating of generated ontologies in a social web community manner
- Use ontologies for enabling semantic service annotations and use them to facilitate humanized interaction with experiment controller and resources (including "what parameters may I change?", "do I break some constraints?" "give me range of the parameter")
- Ideally generate specification language and/or control code

TaaSOR: Community built ontology for wireless experimentation