Wireless testbed federation and why do we (desperately) need better ontologies
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 if they don’t know they need them)
- Archive what they did
Need for Ontology

Port

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

<table>
<thead>
<tr>
<th>OpenFlow configuration</th>
<th>Linux bridge configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>flow-entry vlan100-ip active True src-mac 00:15:17:d6:da:4a vlan-id 100 actions set-vlan-id=17,output=all</td>
<td>brctl addbr br0 brctl addif br0 eth0.100 brctl addif br0 eth1.2</td>
</tr>
<tr>
<td>flow-entry vlan17-ip active True src-mac 00:15:17:d6:ce:20 vlan-id 17 actions set-vlan-id=100,output=all</td>
<td></td>
</tr>
</tbody>
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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 (GENIAM => 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

- Testbed A
  - Resource
- Testbed B
  - Resource
- Heterogeneous Shared Resource Pool
- Experiments
  - Experiment 1
  - Experiment 2
- Experiments Results
  - Experiment provenance
  - Learning/Education
  - Standardization
  - Knowledge sharing
- Updates/Conclusions
  - Datamining experiments

Software agents
  - Semantic experiment specification
  - Testbed Ontology
  - Wireless Ontology
  - Experiment Ontology
  - Software agents

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