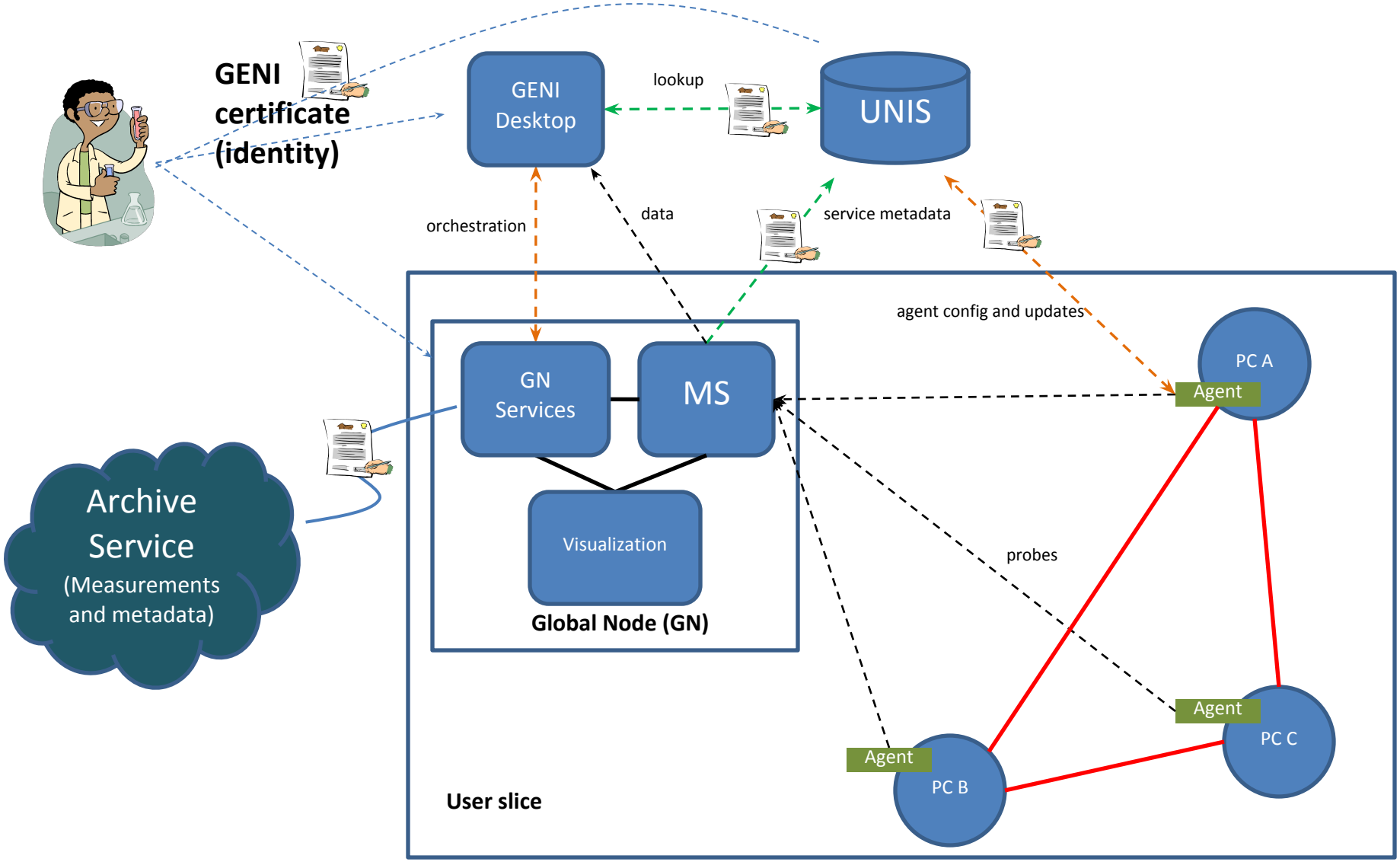
GEMINI

Under the Hood

Measurement components

- Unified Network Information Service (UNIS)
  - Topology and service information plus measurement metadata
  - RESTful implementation, built-in AuthN/AuthZ
- Measurement Store (MS)
  - Stores timestamp-value pairs, validates metadata
  - Configurable data collections
- Measurement collectors (BLiPP)
  - Basic Lightweight Periscope Probes (BLiPP)
  - Active and passive measurements
  - Interacts with UNIS and MS
- Configuration and visualization
  - Web-frontends (GUIs), CLIs, etc.
  - Config updates pushed to UNIS, pulled by collectors

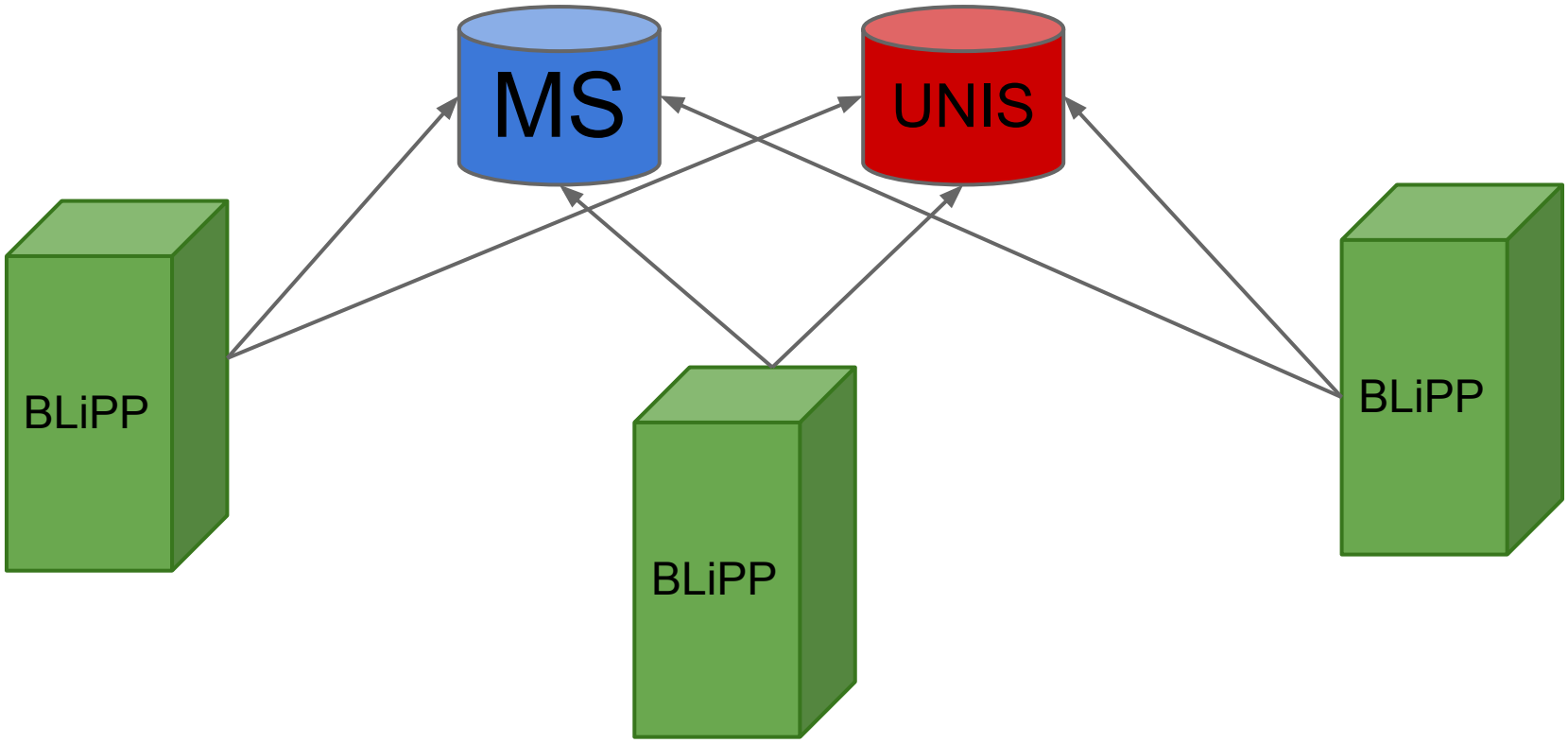
GEMINI measurement architecture



BLiPP

Flexible Host Monitoring

BLiPP runs on your hosts and collects data.



What sort of Data?

- CPU, Memory, Network - gathered from /proc

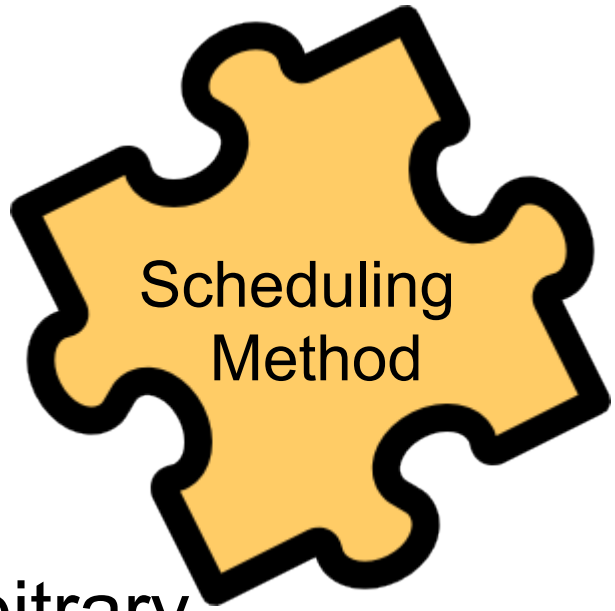
- and user configurable to just about anything else...

```
ping -c 1 emulab.net
```

```
iperf -c 10.10.1.27
```

When is the data collected?

Drop in a scheduling method.



Scheduling methods return the next run time for a metric.

Scheduling method can run arbitrary code

- return random times
- fetch from DB
- react to measurement data

So BLiPP is a framework that allows you to collect *whatever* data you want *whenever* you want.

Example - Adding your own metric

```
"cmd_line_probe":{ // a more generic way to do ping... or anything else
    "kwargs":{
        "command": "ping -c 1 www.google.com", // some command to be executed
        // a regex to extract data from the output of command
        "regex": "ttl=(?P<ttl>\d+).*time=(?P<rtt>\d+\.\d+) ",
        // map regex captures to event Types
        "eventTypes": {"ttl": "ps:tools:blipp:linux:net:ping:ttl",
                       "rtt": "ps:tools:blipp:linux:net:ping:rtt"}
    }
}
```

All data is stored *in the same way.*
...*Separate* from metadata


```
[
  {
    "ts": 1358192313855857.0,
    "value": "0.027"
  },
  {
    "ts": 1358192303855847.0,
    "value": "0.028"
  },
  {
    "ts": 1358192293855861.0,
    "value": "0.028"
  },
  {
    "ts": 1358192283855603.0,
    "value": "0.018"
  },
  {
    "ts": 1358192273855606.0,
    "value": "0.018"
  },
  {
    "ts": 1358192263855848.0,
    "value": "0.028"
  },
]
```



```
{
   "$schema": "http://unis.incntre.iu.edu/schema/20120709/metadata#",
   "selfRef": "http://dev.incntre.iu.edu/metadata/51451333e779891245000670",
   "parameters": {
    "config": {
      "collection_ttl": 1500000,
      "name": "mem",
      "schedule_params": {
        "every": 2
      },
      "collection_schedule": "builtins.simple",
      "ssl_cafile": "",
      "properties": {
        "summary": {
          "metadata": []
        }
      },
      "unis_url": "http://dev.incntre.iu.edu",
      "node_id": "5142264de779891245000648",
      "location": {},
      "collection_size": 10000000,
      "ms_url": "http://dev.incntre.iu.edu",
      "host_urn": "urn:ogf:network:domain=newblipptest.emulab-net.emulab.net:node=VM:",
      "unis_poll_interval": 300,
      "reporting_params": 1,
      "hostname": "VM.newblipptest.emulab-net.emulab.net",
    },
    "datumSchema": "http://unis.incntre.iu.edu/schema/20120709/datum#"
   },
   "eventType": "ps:tools:blipp:linux:memory:utilization:cache",
   "ts": 1363481395249373,
   "id": "51451333e779891245000670",
   "subject": {
    "href": "http://dev.incntre.iu.edu/nodes/5142264de779891245000648",
    "rel": "full"
   }
}
```

Metadata example

port description

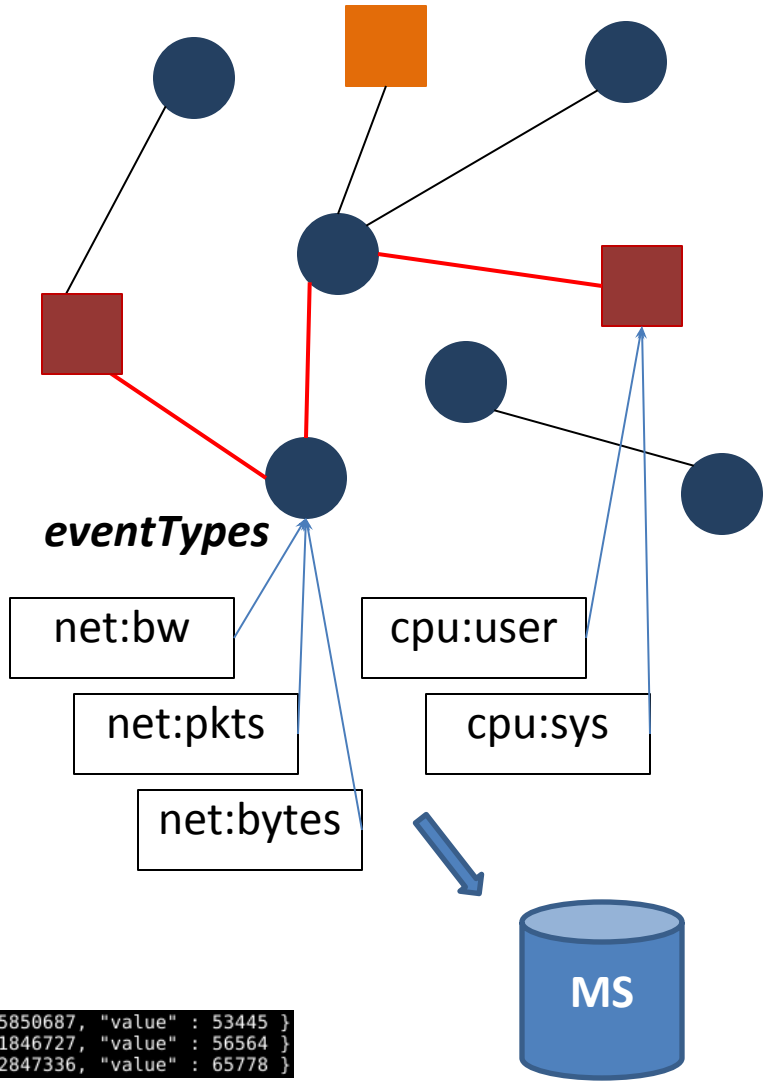

```
"ports": [
 {
  "name": "VM-1:if0",
  "selfRef": "https://unis.incntre.iu.edu:8443/ports/emulab.net_slice_gemslice4_interface_VM-1:if0",
  "urn": "urn:publicid:IDN+emulab.net+slice+gemslice4+interface+VM-1:if0",
  "ts": 1360600508457460,
  "relations": {
   "over": [
    {
     "href": "urn:publicid:IDN+uky.emulab.net+interface+pc73:lo0",
     "rel": "full"
    }
   ]
  },
  "id": "emulab.net_slice_gemslice4_interface_VM-1:if0",
  "address": {
   "type": "ipv4",
   "address": "10.128.2.2"
  },
  "$schema": "http://unis.incntre.iu.edu/schema/20120709/port#",
  "properties": {
   "geni": {
    "component_id": "urn:publicid:IDN+uky.emulab.net+interface+pc73:lo0",
    "ip": {
     "type": "ipv4",
     "address": "10.128.2.2"
    },
    "slice_urn": "urn:publicid:IDN+emulab.net+slice+gemslice4",
    "slice_uuid": "58665b24-6b2a-11e2-a39d-001143e453fe",
    "sliver_id": "urn:publicid:IDN+uky.emulab.net+sliver+65608",
    "client_id": "VM-1:if0",
    "mac_address": "00000a800202"
   }
  }
 },
```


metadata (packets-in on port)


```
{
  "$schema": "http://unis.incntre.iu.edu/schema/20120709/metadata#",
  "selfRef": "https://unis.incntre.iu.edu:8443/metadata/51196567377f9710fd5310af",
  "parameters": {
    "geni": {
      "slice_uuid": "58665b24-6b2a-11e2-a39d-001143e453fe"
    }
  },
  "eventType": "ps:tools:blipp:linux:network:ip:utilization:packets:in",
  "ts": 1360618855814283,
  "id": "51196567377f9710fd5310af",
  "subject": {
    "href": "https://unis.incntre.iu.edu:8443/ports/51196560377f9710fd53103b",
    "rel": "full"
  }
},
```


<id:ts:value> in MS


```
{ "_id" : ObjectId("5147b364efadad2651b5ed4e"), "ts" : 1360618855850687, "value" : 53445 }
{ "_id" : ObjectId("5147b364efadad2651b5ed4f"), "ts" : 1360618871846727, "value" : 56564 }
{ "_id" : ObjectId("5147b364efadad2651b5ed50"), "ts" : 1360618872847336, "value" : 65778 }
```

More Information

Info about GEMINI Components
https://github.com/GENI-GEMINI/GEMINI/wiki

UNIS Encoder on Github
https://github.com/periscope-ps/unisencoder

Feedback Questionnaire

http://tinyurl.com/GEC16-Tut-Feedback