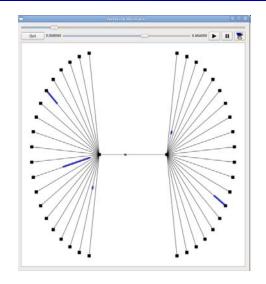
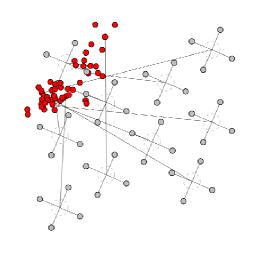
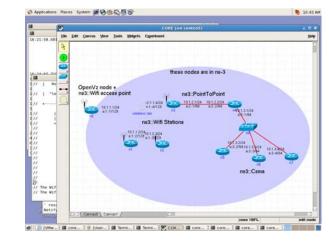
#### ns-3 project introduction





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ns-3 is a free, open source software project building and maintaining a discrete-event network simulator for research and education

#### **Technical goals:**

- Build and maintain a simulation core aligned with the needs of the research community
- Help to improve the technical rigor of network simulation practice

# **GENI meeting goals**

- ns-3 may be of interest to GENI researchers
- ns-3 and GENI are working on similar issues of experimentation workflow
- Several ns-3 events at GENI
  - Control Frameworks WG talk
  - -Experimentation Services WG talk
  - -ns-3 Tutorial, Thursday 3-6pm
  - -ns-3 developers meeting, Friday
    - http://www.nsnam.org/wiki/

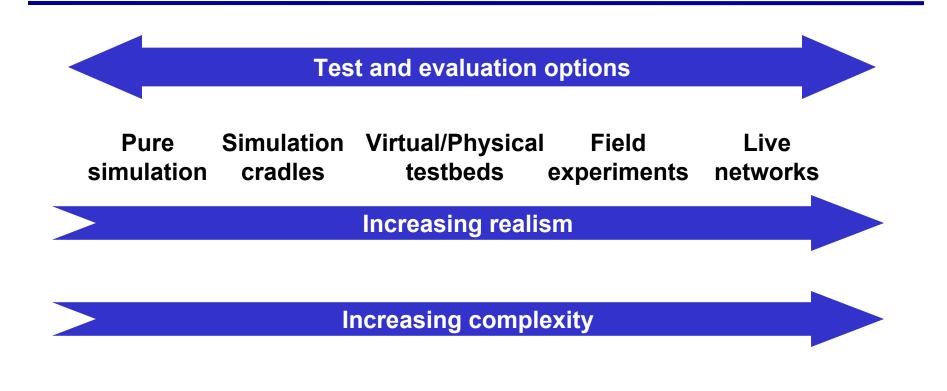
#### ns-3 themes

ns-3

- Research and education focus
  - Build and maintain simulation core, integrate models developed by other researchers
  - Support research-driven workflows
- Open source development model
  - -Research community maintains the models
- Leverage available tools and models

   Write programs to work together
- Enforce core coding/testing standards

## **Test and Evaluation Options**



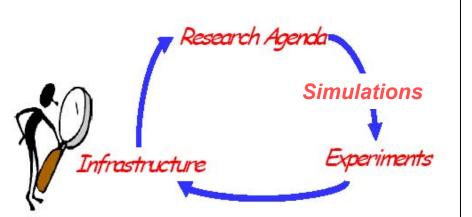
#### Can we develop tools to span this space?

## **Simulators can complement testbeds**



Research Agenda to Experiments to Infrastructure

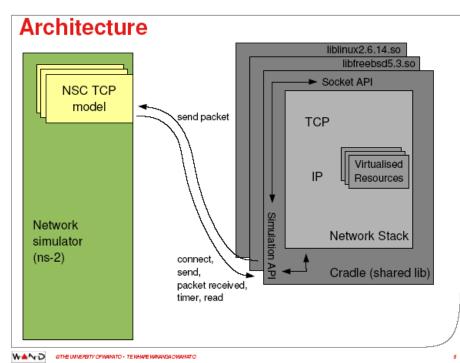
- Research agenda
  - Identifies fundamental questions
  - Drives a set of experiments to validate theories and models
- Experiments & requirements
  - Drives what infrastructure and facilities are needed
- Infrastructure could range from

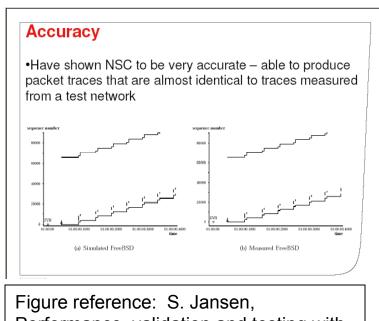


- Existing Internet, existing testbeds, federation of testbeds, something brand new (from small to large), federation of all of the above, to federation with international efforts
- No pre-ordained outcome
- Source: NSF GENI project: http://www.geni.net/docs/GENIOvrvw092908.pdf GENI Eng. Conf., Nov. 2010

## **Simulation Cradles**

• Existing: Network Simulation Cradle (Jansen and Westphal)





Performance, validation and testing with the Network Simulation Cradle. MASCOTS 2006.

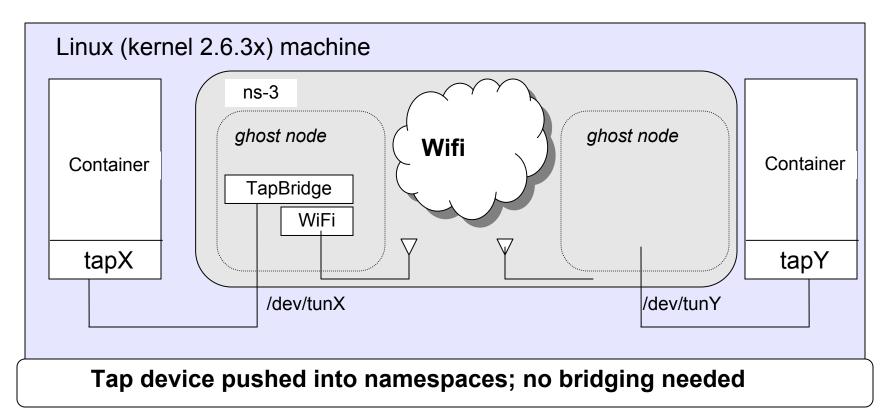
• In development: Full Linux kernel integration, direct code execution environment

GENI Eng. Conf., Nov. 2010

ns-3

# **Virtual Machine integration**

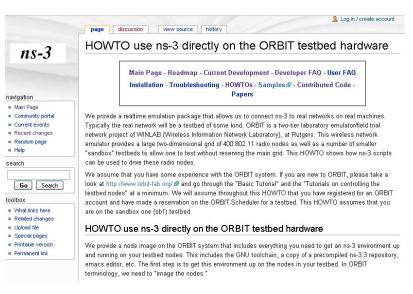
• Several efforts aimed at blending lightweight virtual machines with ns-3



## **Example: ORBIT and ns-3**

 Support for use of Rutgers WINLAB ORBIT radio grid





# **Relationship to ns-2**

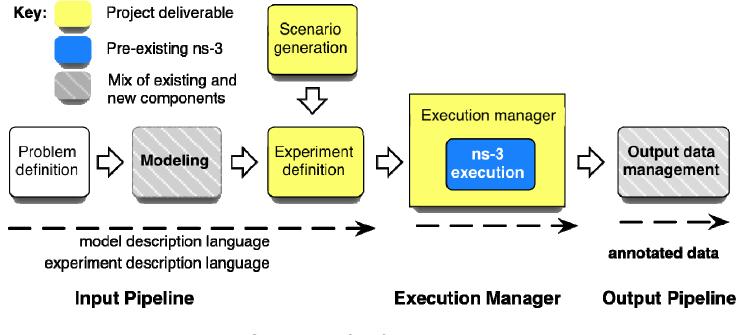
- Decided that we did not have resources to maintain backward compatibility with ns-2

   OTcl and split-implementation models
   Different level of abstraction
- Continuing to maintain ns-2 and nam
  - Possible to construct hybrid simulations
- Several models already ported to ns-3
  - Random number generators, OLSR, error models, recent WiFi Phy models

## **Frameworks for ns-3**

- NSF CISE Community Research Infrastructure
  - University of Washington (Tom Henderson), Georgia Tech (George Riley), Bucknell Univ. (Felipe Perrone)

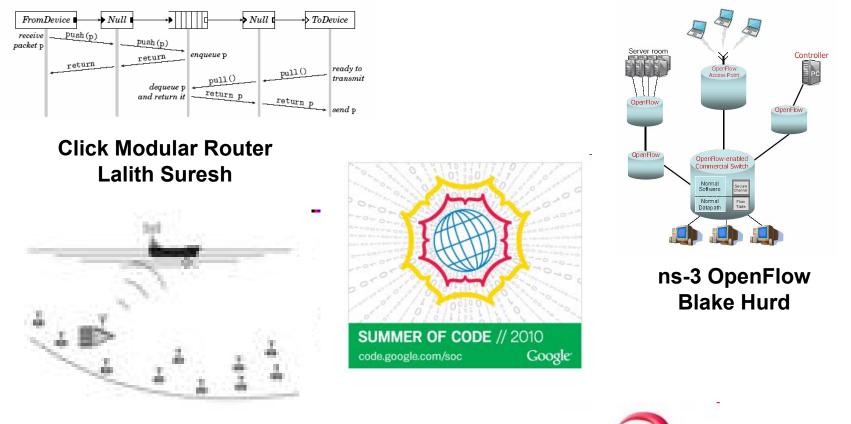
- Project timeline: 2010-14





GENI Eng. Conf., Nov. 2010

## ns-3 and Google Summer of Code



Underwater Acoustic Networking Andrea Sacco



ns-3 LTE Giuseppe Piro



## **Acknowledgment of support**







ns-3









