Realistic and Repeatable Wireless Experimentation Using Physical Layer Emulation

Peter Steenkiste

Departments of Computer Science and Electrical and Computer Engineering

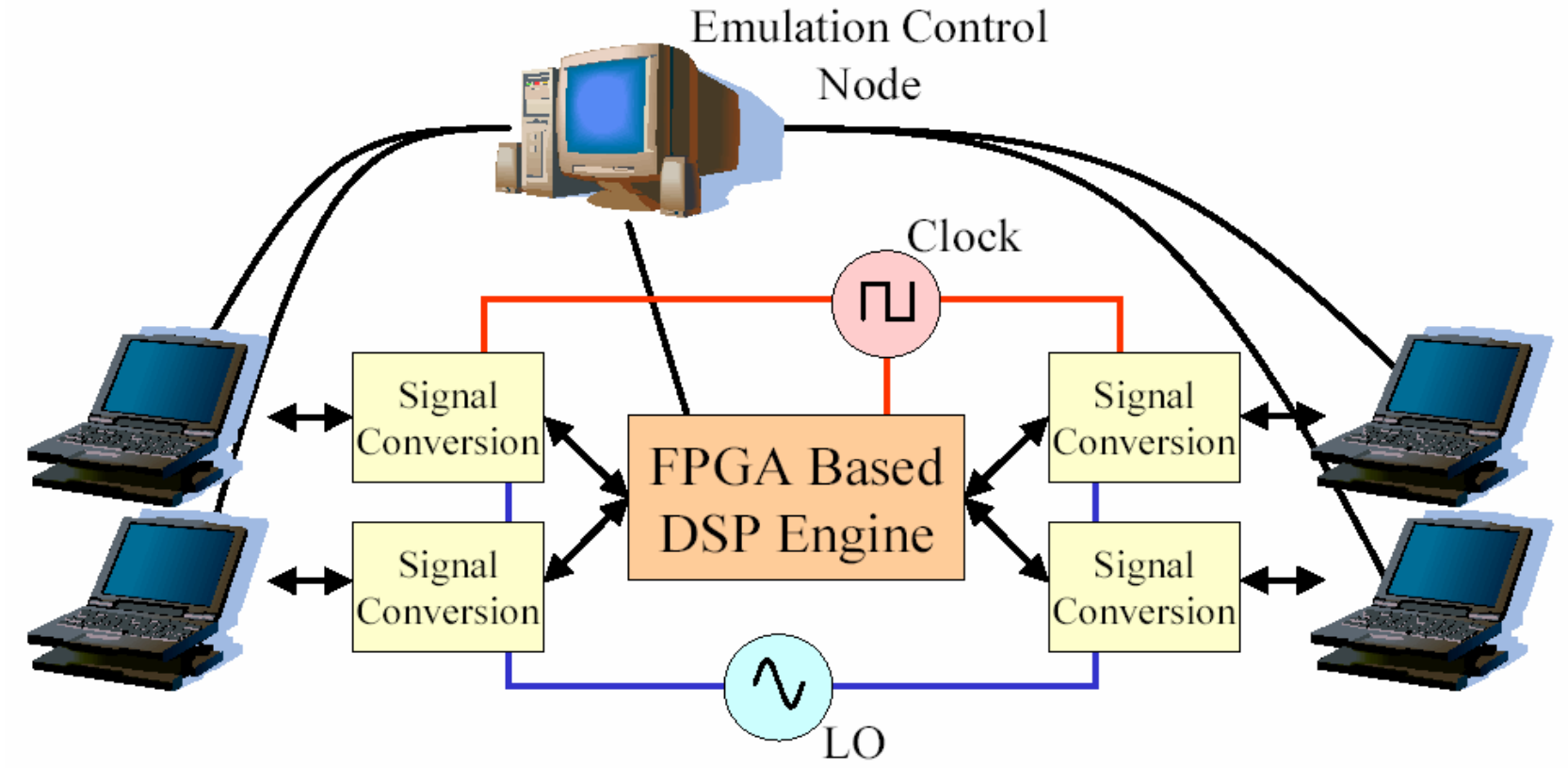
Carnegie Mellon University

intel. XILINX®

Wireless Testbed Challenges

- Lack of isolation from environment
- ➔ Lack of repeatability
- Difficulty of control
- ➔ Limited experimental range, e.g. mobility
- High degree of diversity in environments, devices
- ➔ Narrow testbed focus

Signal Propagation Emulation



- Real hardware ➔ high degree of realism
- Digital emulation of channels ➔ full control
- Isolated from environment ➔ fully repeatability
- Programmable ➔ very diverse experiments

Current System

Remotely Accessible

Internet

Emulation Controller

ProtoGENI: Other Testbeds

Diverse Wireless Devices

Control Network

Signal Conversion

SDR

Signal Conversion

Signal Conversion

FPGA-based Signal Propagation Emulation

Software-Controlled Signal Propagation Environments

Signal Conversion

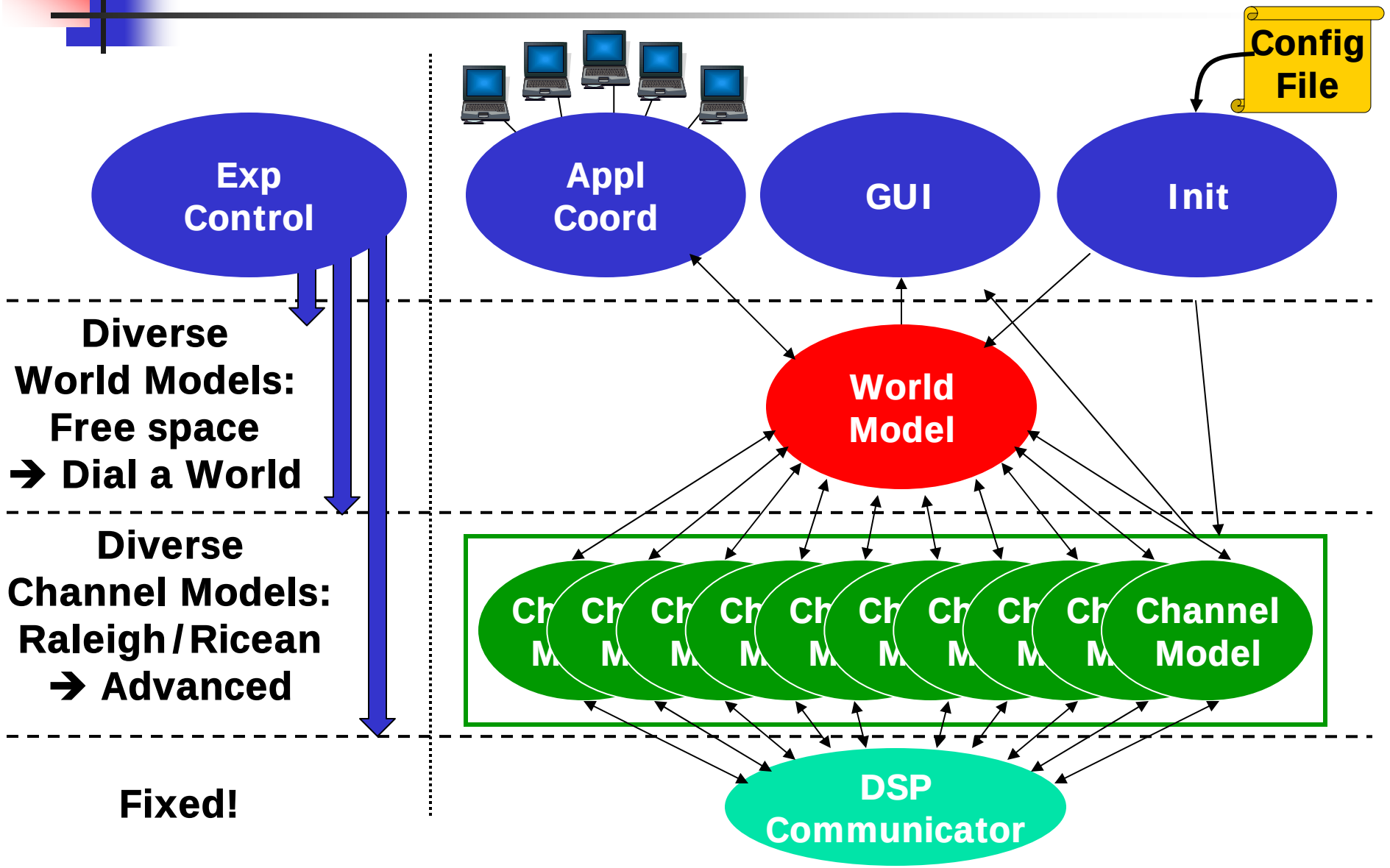
Signal Conversion

Signal Conversion

Signal Conversion

MIMO

Controlling Experiments



Technology Roadmap

- Deployment
  - Stand alone ☞ hybrid testbeds with Emulab
- Devices
  - WiFi ☞ software radio ☞ MIMO ☞ ???
  - 2.4 GHz ☞ ???
- Channel models☞
  - Ricean/Raleigh ☞ Mobile-Mobile ☞ MIMO ☞ ???
- Environments
  - Free space ☞ dial a world
- Scale
  - 15 ☞ 64?

Relevance to GENI