# *StarBED³*

Hokuriku StarBED Technology Center,
Network Testbed R&D Lab., Network Testbed R&D Promotion Center,
National Institute of Information and Communications Technology (NICT)
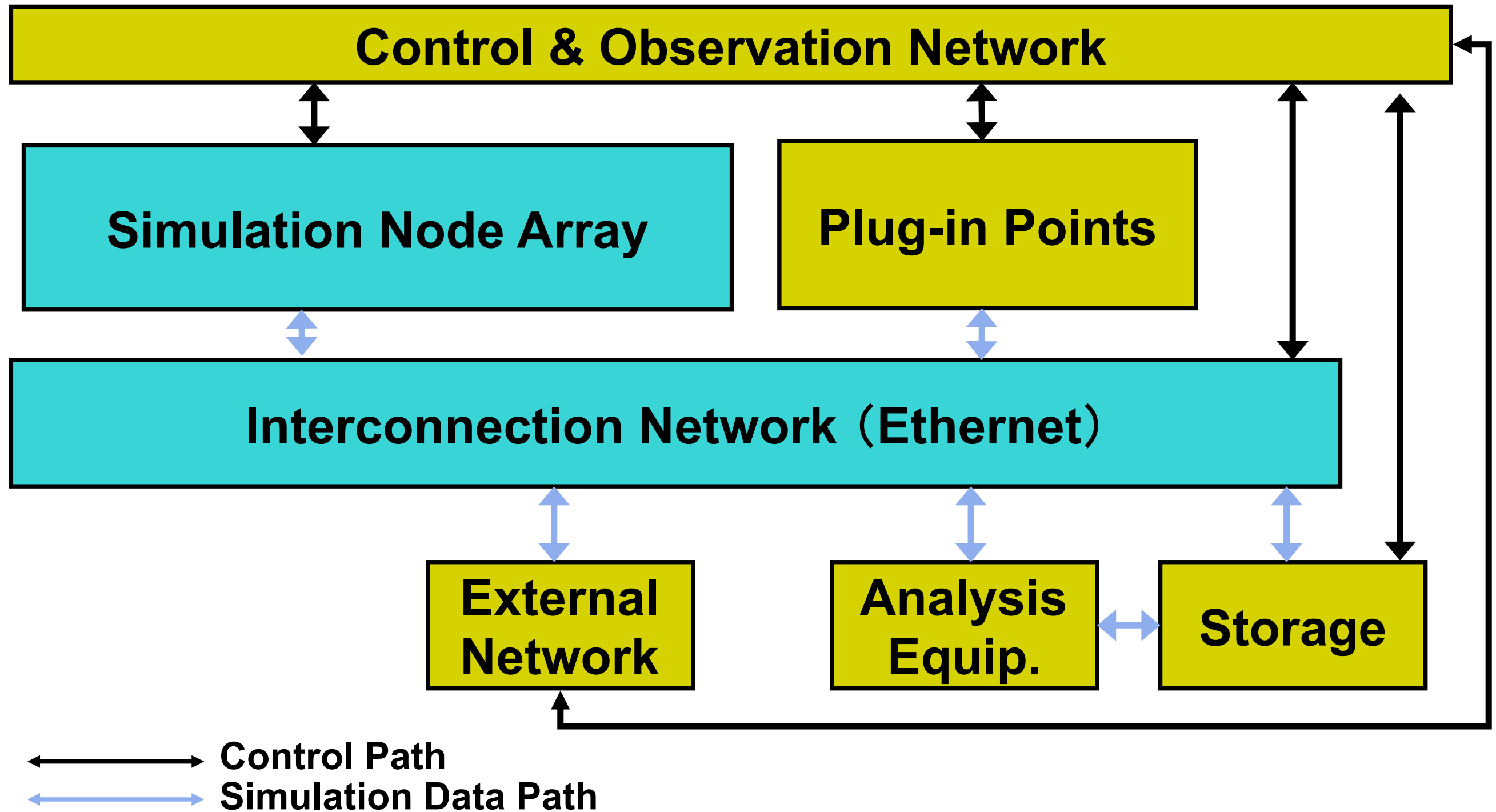
# What is the StarBED (*BED) ?

- It's a Networking System Emulator/Simulator
  - Re-configurable cluster supporting various user requirements
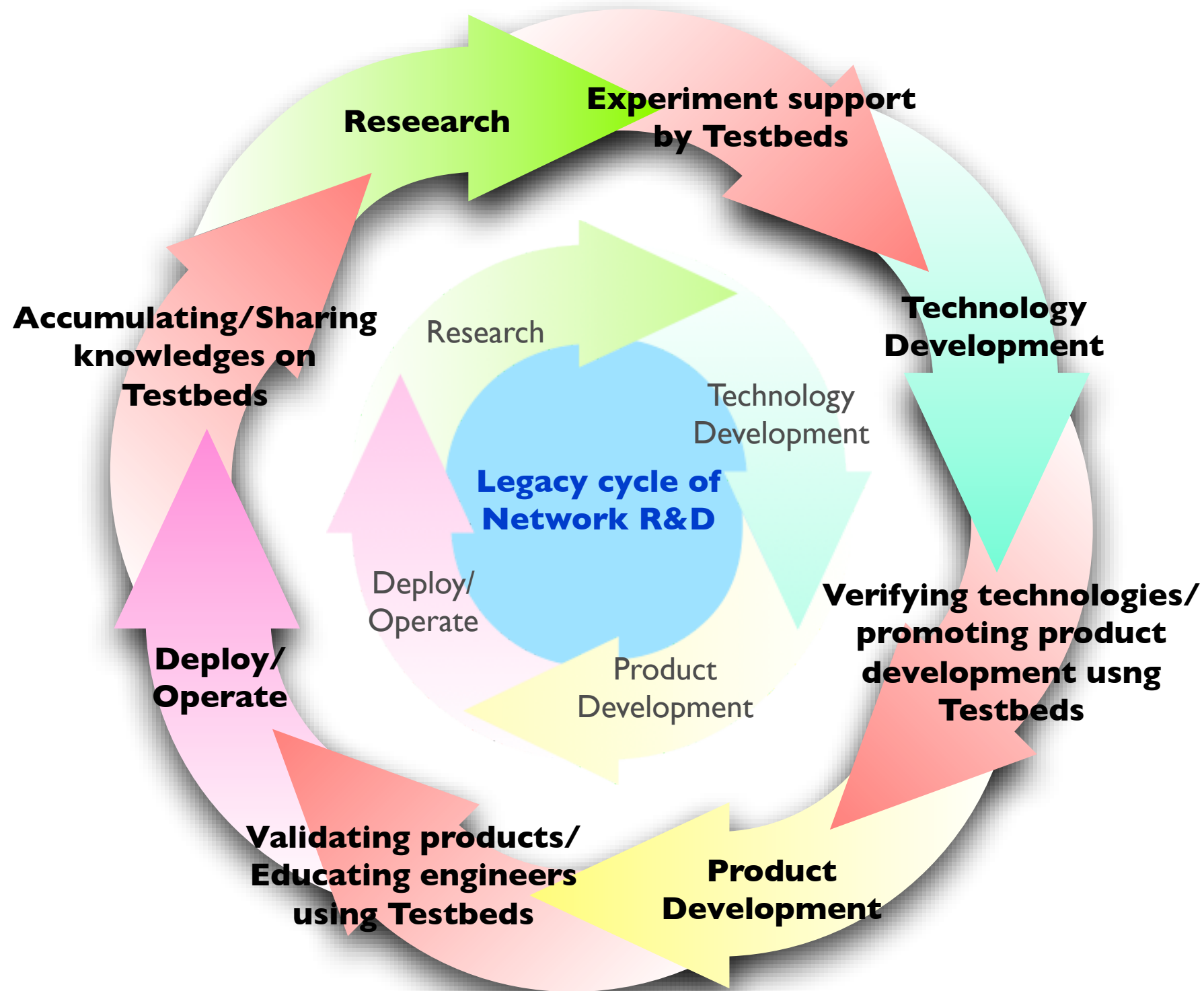  - Large scale
    - over 1000 PCs

# Concept of StarBED

- Verification using Accurate Emulation
  - Verify Actual Running-Codes as in Operate, in Wall-Clock
    - PC, Embedded System, ...etc.
  - Large Emulation Capacity
    - PC level: 1000 Physical nodes (over 30K using VM)
    - Micro-sensor level: over 1million nodes
  - Configurable Network topology
    - Flexible L2 topology configuration using Redundant network switches and VLAN
    - L3 Routing emulations
      - PC-based routers
      - Installation of commercial routers at plug-in points
  - External connectivity
    - External connectivities are available for both:
      - Control Path/Simulation Data Path
    - Connection to:
      - JGN-X (10GbE), JAIST (10GbE), and WIDE Project (10GbE)

# StarBED design (conceptual)



| Control & Observation Network |
| --- |

**Simulation Node Array**

**Plug-in Points**

**Interconnection Network（Ethernet）**

**External Network**

**Analysis Equip.**

**Storage**

→ Control Path
→ Simulation Data Path

# Grand Goal: Network R&D process innovation



**Reseearch**

**Experiment support by Testbeds**

**Accumulating/Sharing knowledges on Testbeds**

**Technology Development**

Research

Technology Development

**Legacy cycle of Network R&D**

Deploy/ Operate

Product Development

**Verifying technologies/ promoting product development usng Testbeds**

**Deploy/ Operate**

**Validating products/ Educating engineers using Testbeds**

**Product Development**

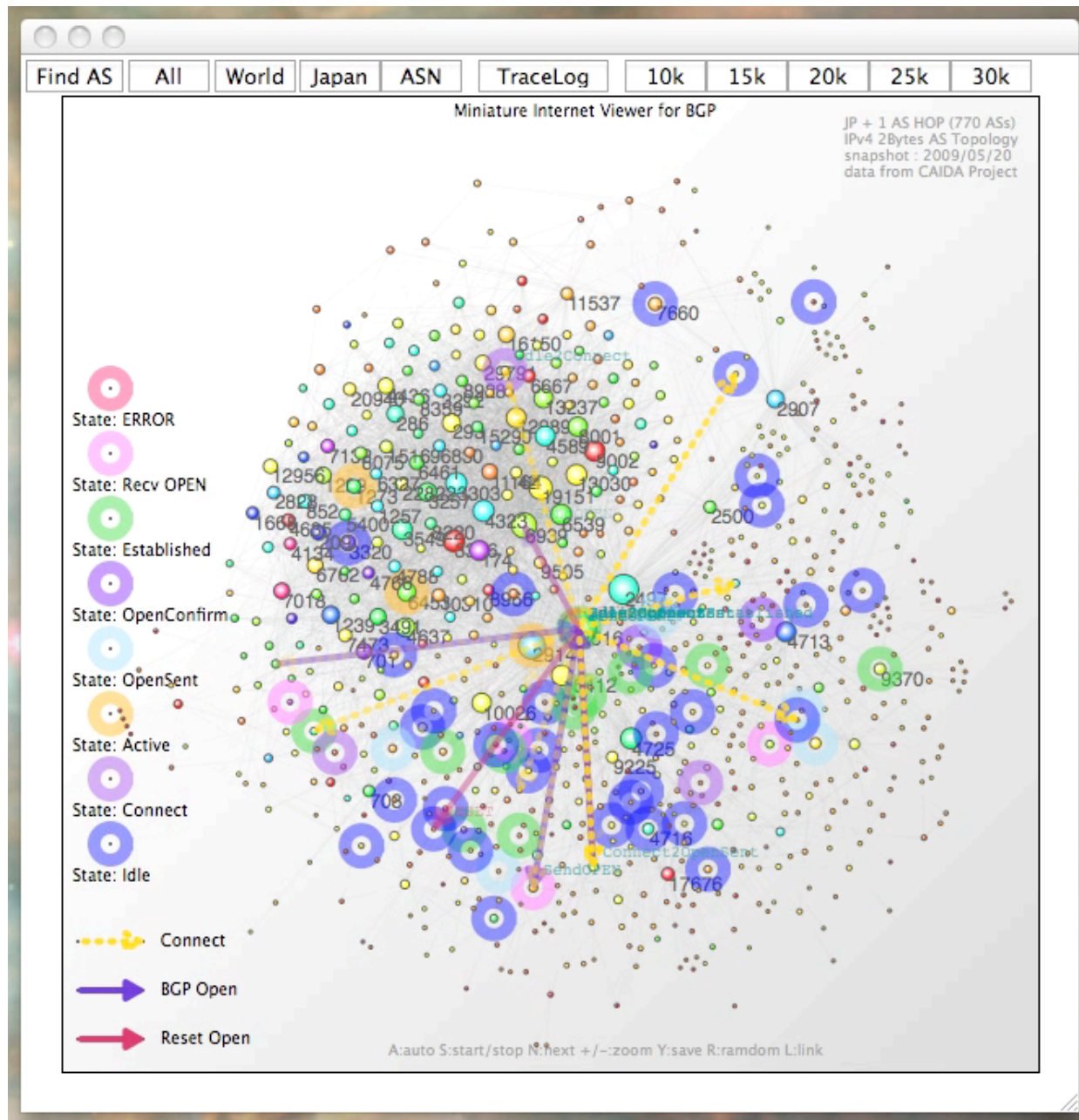Innovating Network R&D process using **StarBED$^3$&JGN-X**

# New H/W of StarBED

- 552 nodes of Cisco UCS C200M2: Intel 6-core Xeon X5670 x2, 48GB Mem, SATA 500GB x2 HDD, 4GbE NIC
- Interconnect via Brocade MLXe32 x2 with 100GbE
- Cisco Nexus SWs as Control Path
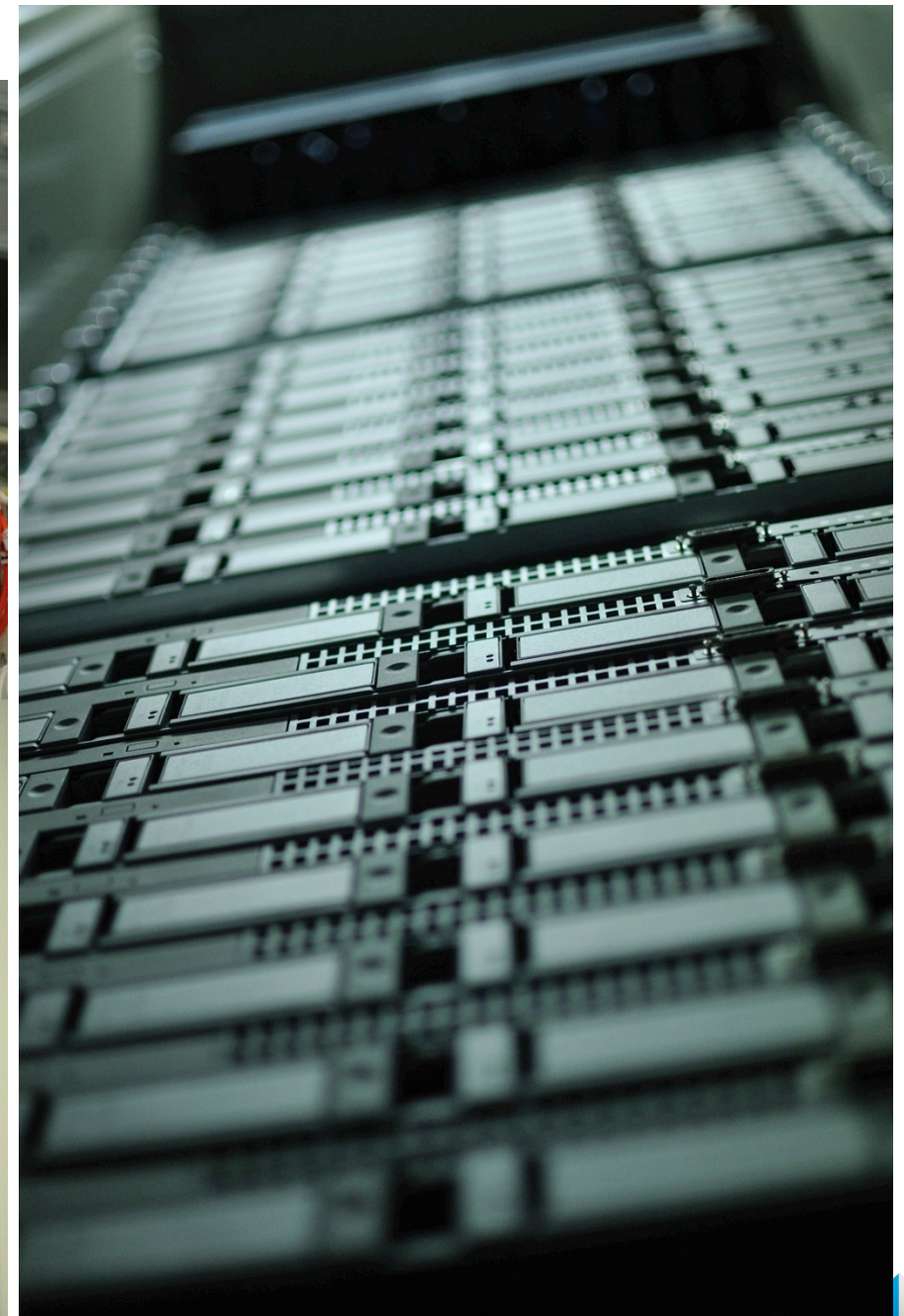
# StarBED capability: The Scale
## Global Internet Routing Emulation



Emulation of JP's Inter-AS network (eBGP)

❖ **Target:**
  ❖ Routing system composed by massive (actual Internet AS: 35K-40K) routing entities
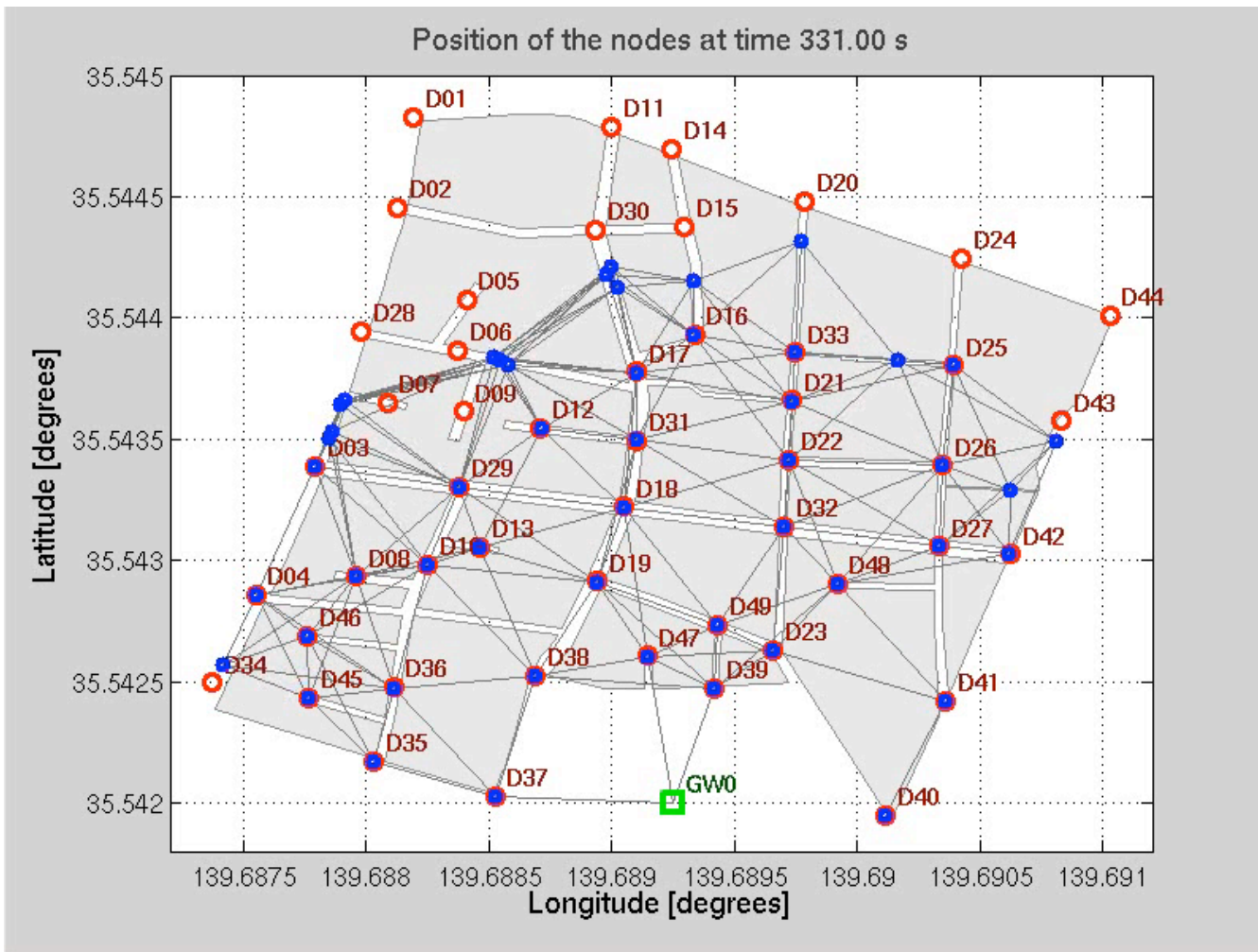
❖ **Technology Highlights:**
  ❖ Successfully constructed full scale Inter-AS network
  ❖ Massive VM multiplexing and control, AS topology generator

❖ **Applications:**
  ❖ Routing system in Future Network, Inter-AS IP traceback, countermeasure for route high-jacking, etc.

# StarBED Capability: Various Networks
## OLSR ad-hoc wireless network emulation



Emulation of Search & Rescue using OLSR

❖ **Target System:**
  ❖ ad-hoc wireless network controlled by OLSR

❖ **Technology:**
  ❖ Wireless link emulator(QOMET)
    ❖ 802.11a/b/g
    ❖ inner channel interference
    ❖ mobility support
    ❖ obstacles (2D/3D)

❖ **Assumed Applications:**
  ❖ Wireless routing system, Mobile networking, Vehicle networking, etc.

# StarBED capability:
# Accuracy & Vertical Integration

Large, integrated, and accurate emulation of active tag

## ❖ Target:

- ❖ Pedestrian localization with Inter-communicating active tags and localization engine
- ❖ System elements: tags (mobiles, fixed, gw), localization engine and search engine service



**Localization Engine**

**Data Gathering Network**

**Internet**

**c-Tag (GW)**

**c-Tag (Fixed)**

**c-Tags**

**c-Tag in the Wide Area**

## ❖ Technology Highlights:

- ❖ Verification of the tag software and communication protocol with bus-cycle accuracy by CPU emulation
- ❖ Large and Vertically Integrated emulation, from CPU bus-cycle to service on the Internet in a single frame work with real space emulation
- ❖ solved many problems, ranging from microscopic to macroscopic, feedback to the actual product (protocol timing problems & scalability issues)
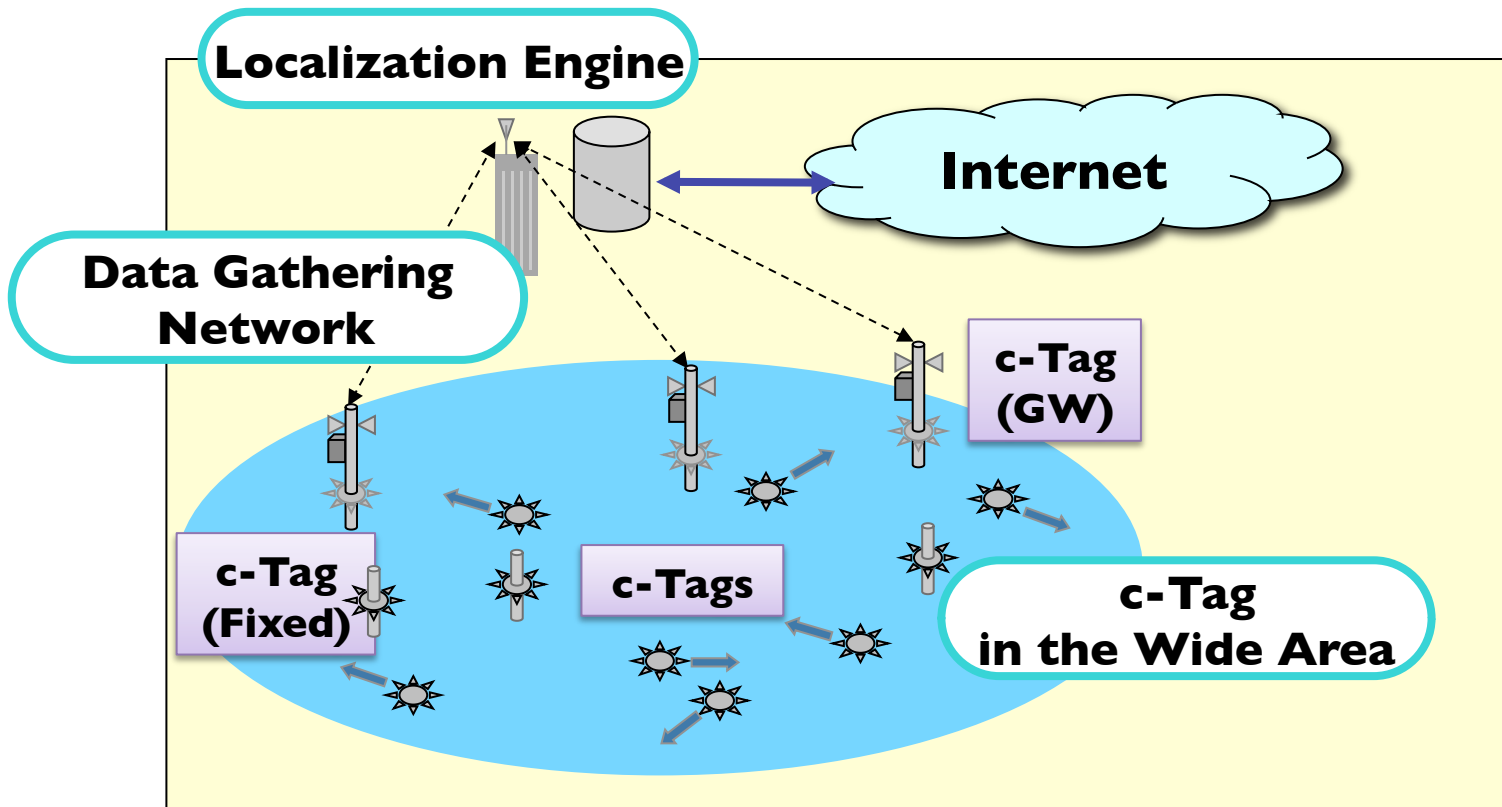
# You are Welcome at the StarBED!

❖ Experiments and ideas that can be qualified as: New, Big, or First.

❖ Participation in supporting tools/UI design and implementation

❖ Please contact to:

  `info@starbed.org`