End to End Performance Initiative

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NORDUnet 2002

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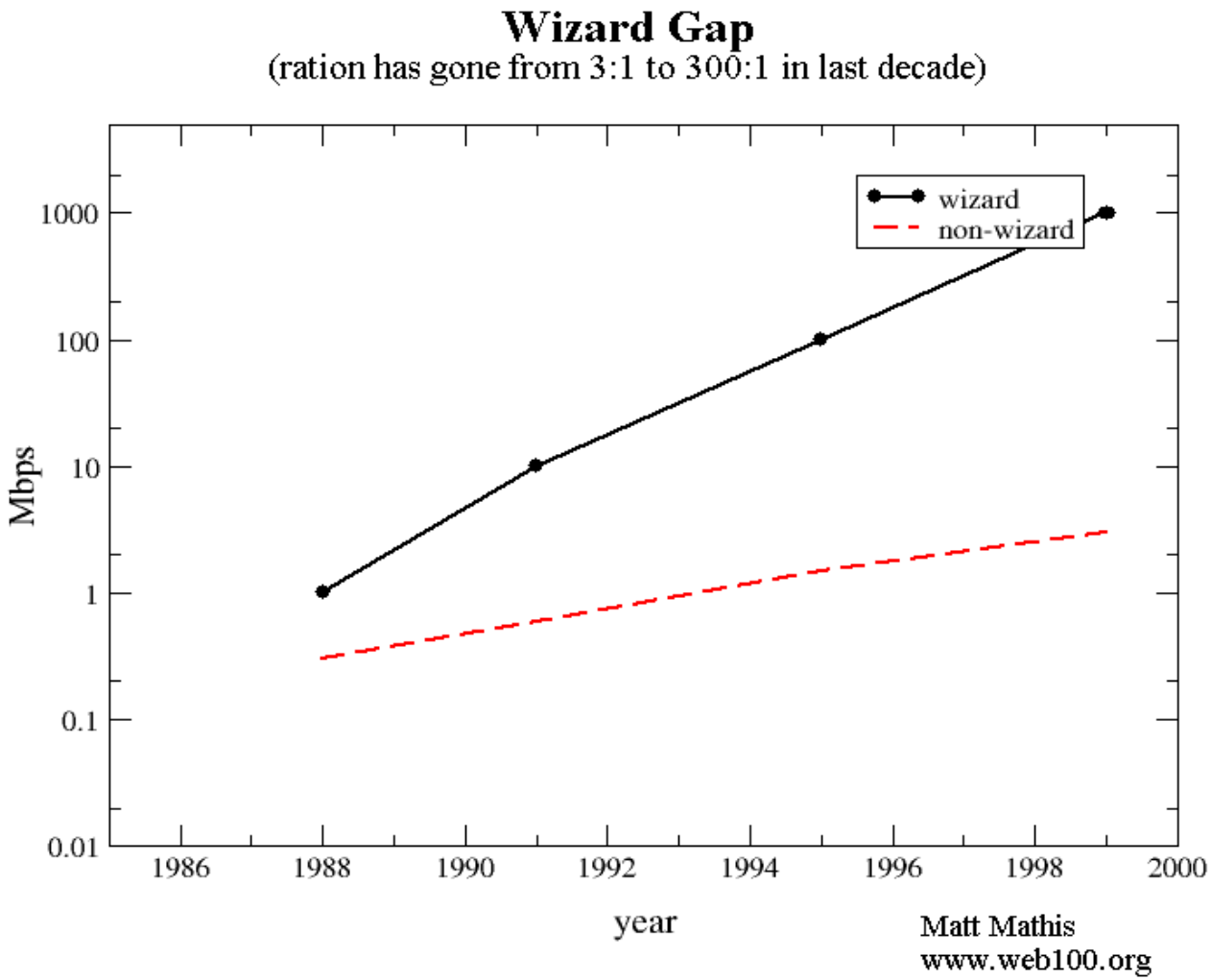
Context for E2E Performance

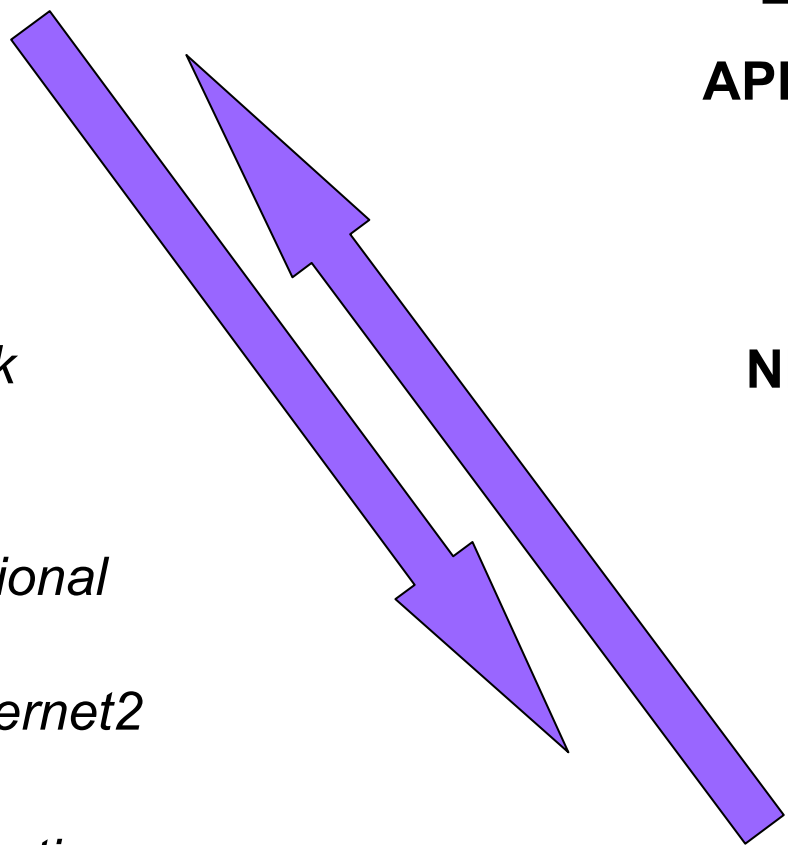
Even with high bandwidth network links, the Internet2 community often does not see expected performance.

The Wizard Gap



True End-to-End Experience

- *User perception*
- *Application*
- *Operating system*
- *Host IP stack*
- *Host network card*
- *Local Area Network*
- *Campus backbone network*
- *Campus link to regional network/GigaPoP*
- *GigaPoP link to Internet2 national backbones*
- *International connections*



EYEBALL

APPLICATION

STACK

JACK

NETWORK

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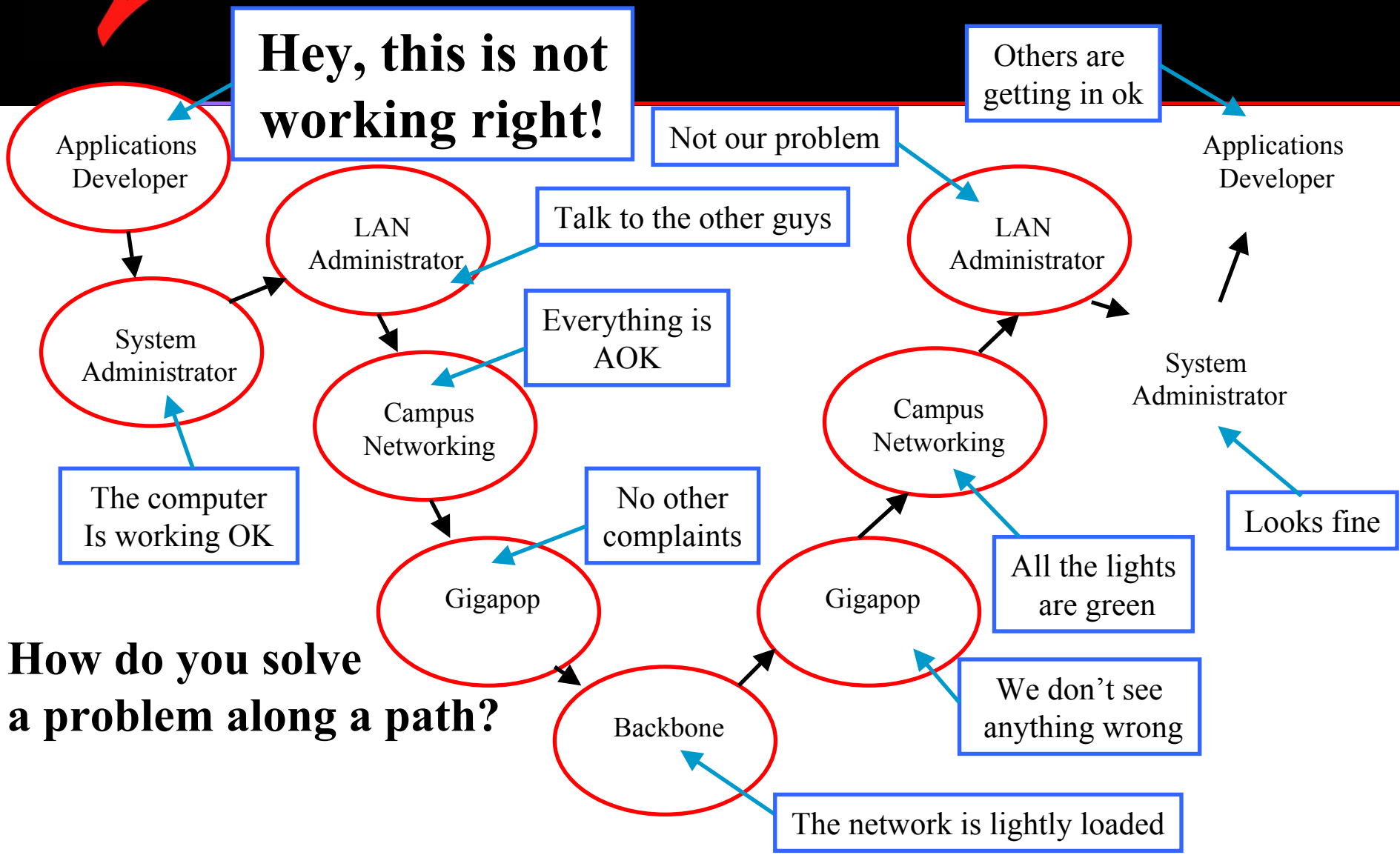
. . .

. . .

. . .

A Problem



How do you solve a problem along a path?

Good Work Already Going On

Many projects and research is underway by others investigating performance on portions of the end-to-end path.

E2Epi seeks to bring these efforts together to look at the end-to-end path as a complete system.

Areas of the Initiative

Applications

Host/OS Tuning

Measurement Infrastructure

Performance Improvement Environment (PIE)

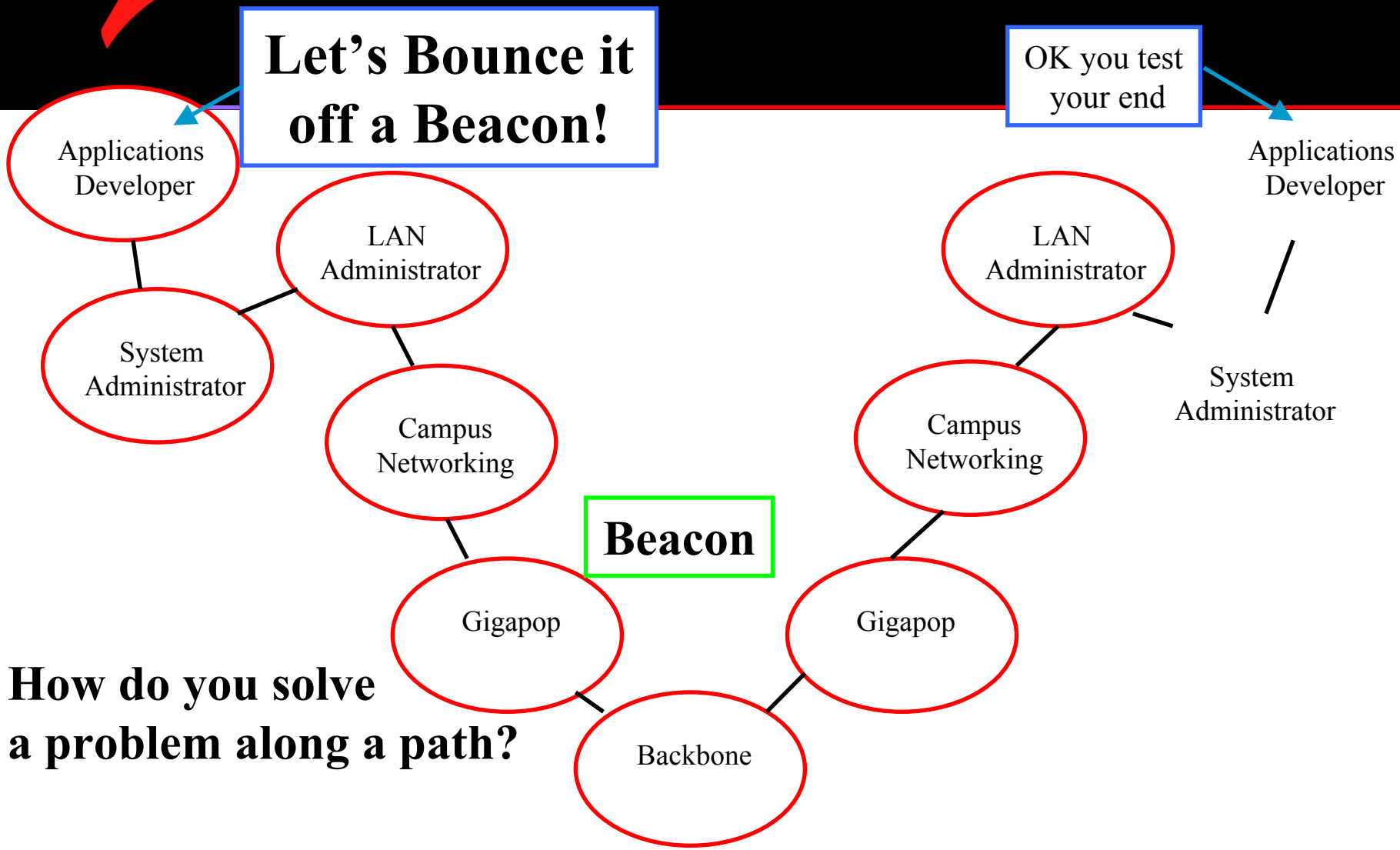
Operations and Human Communications

Performance Evaluation and Review Framework (PERF)

Applications

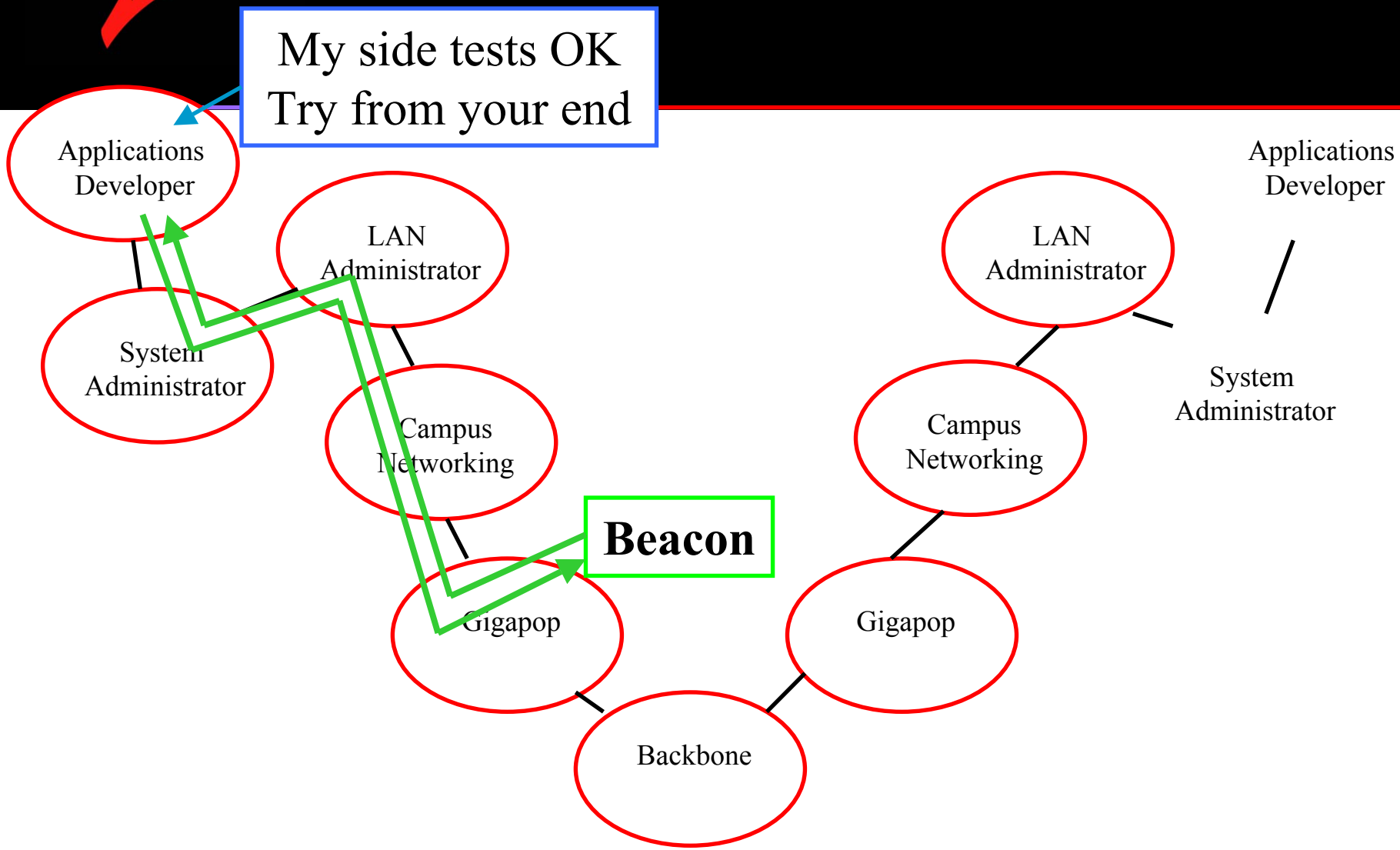
- *Work with specific application communities to help solve their performance problems.*
  - High Energy Physics
  - Medical Sciences – Visible Human Project
- *Use a few key, general purpose applications for performance testing.*
  - FTP
  - Video Conferencing

Beacons

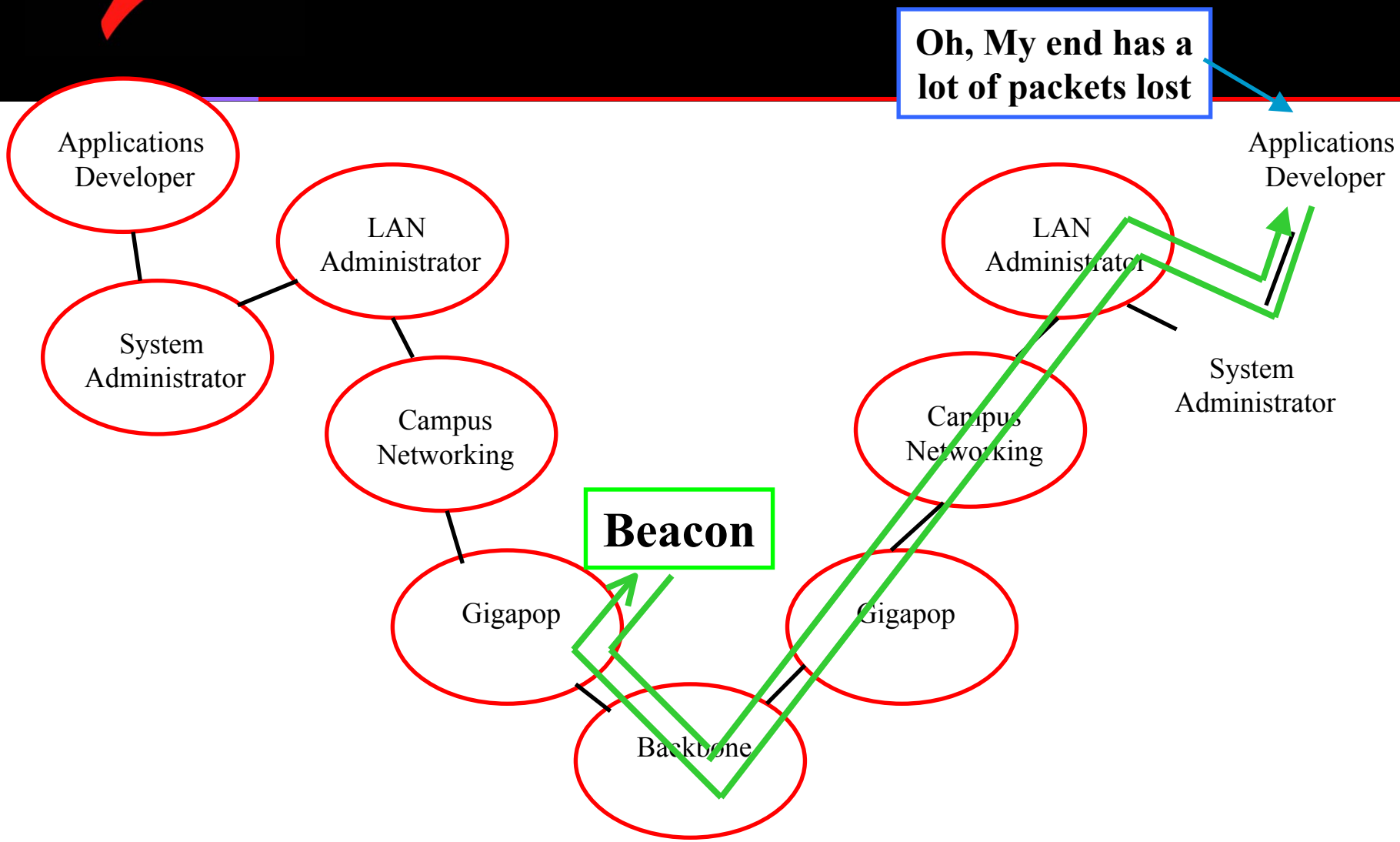


How do you solve a problem along a path?

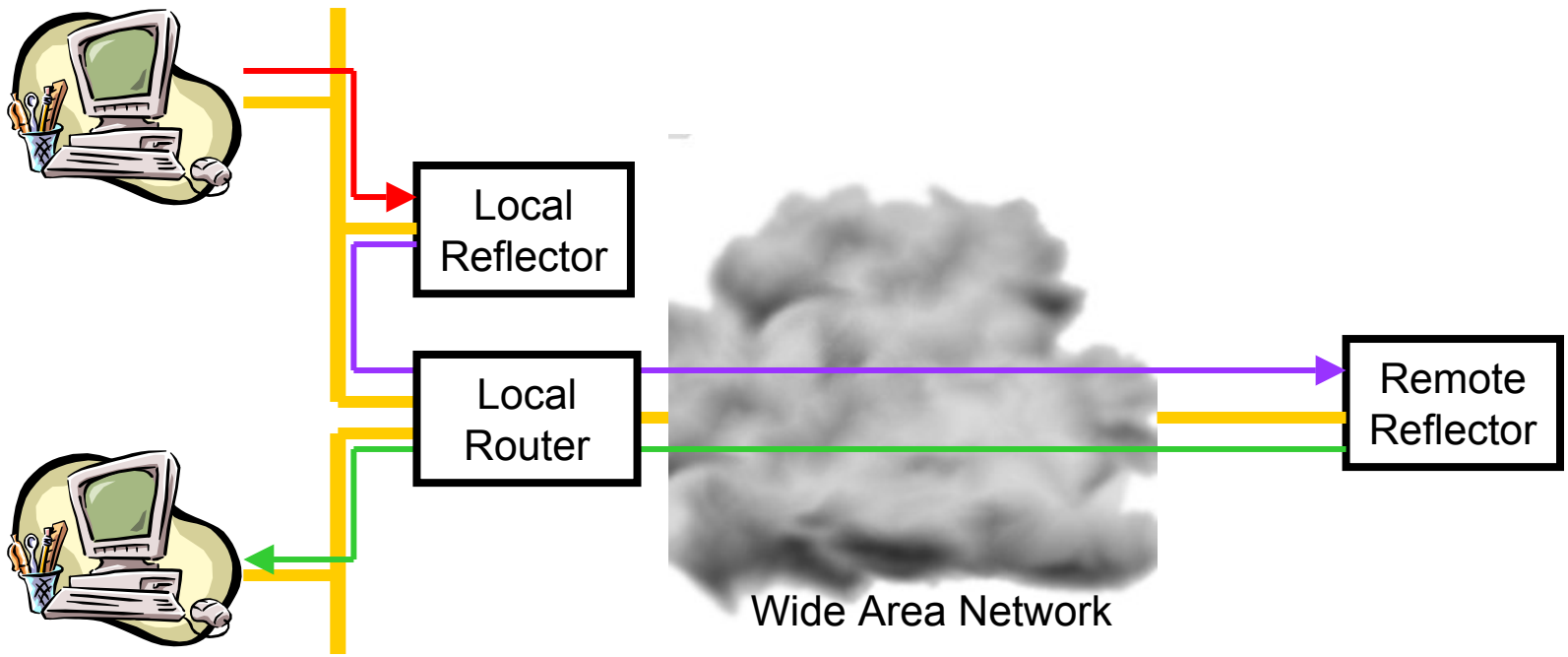
Beacons


My side tests OK
Try from your end
Applications Developer
LAN Administrator
System Administrator
Campus Networking
Beacon
Gigapop
Backbone
Gigapop
Campus Networking
LAN Administrator
System Administrator
Applications Developer

Beacons


Oh, My end has a lot of packets lost
Applications Developer
LAN Administrator
System Administrator
Campus Networking
Gigapop
Beacon
Backbone
Gigapop
Campus Networking
LAN Administrator
System Administrator
Applications Developer

Packet Reflector



Packet Reflector enables wide-area experience when both source and destination are in a lab

Routed by Faking Gateway
Tunneled Traffic
Normal Routing

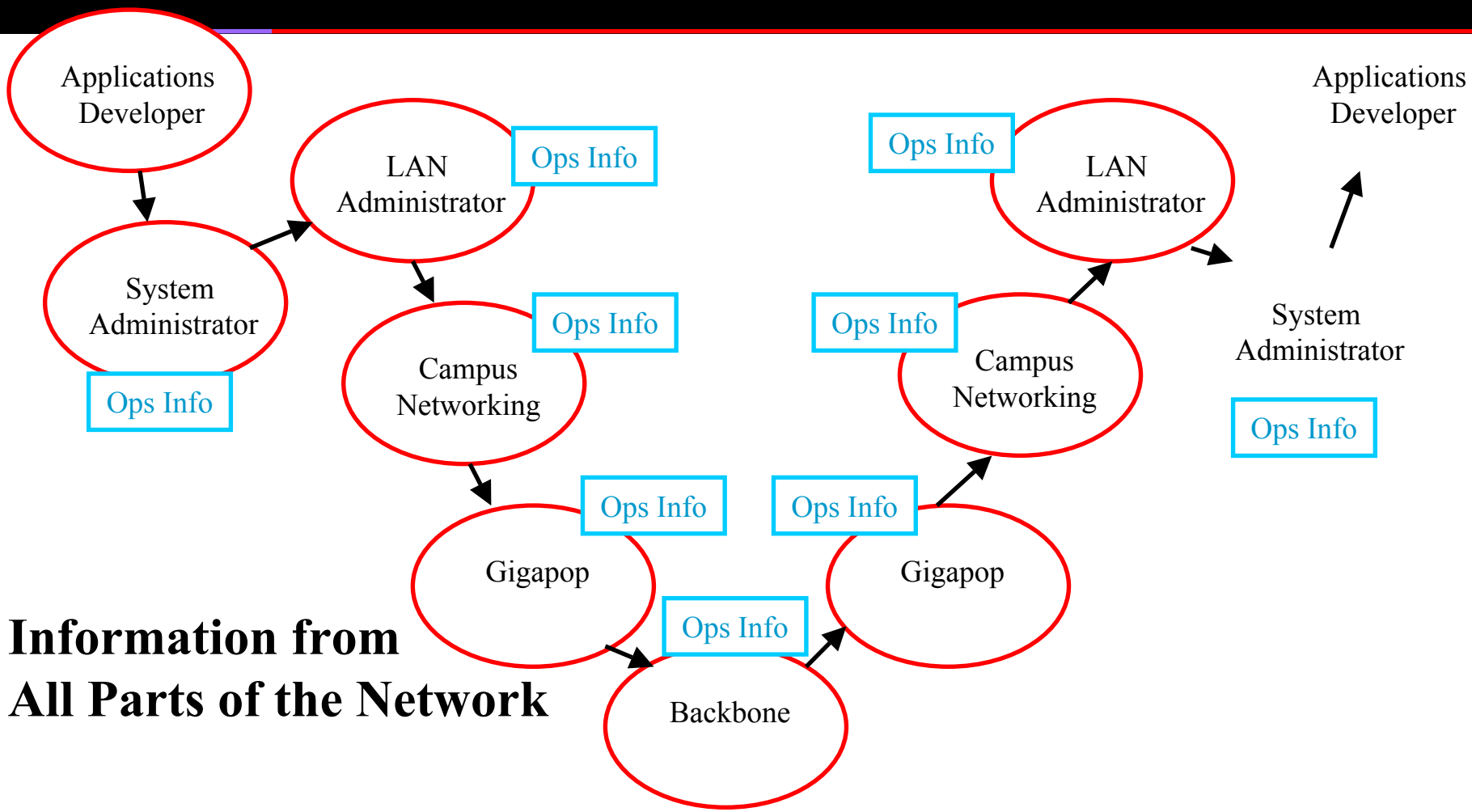
Host/OS Tuning

- *Web100 has a leading role*
- *Provide Best Practices for getting the most from your computer.*
- *Locate or build tools for Host/OS performance diagnostics.*
- *Work with computer vendors on Internet2 Performance Packages.*

Measurement Infrastructure

- *Bring together current measurement efforts and projects in the community.*
- *Establish an End-to-End Measurement Infrastructure from the intersection of these works.*
- *Create diagnostic tools to determine the health of the network and locate performance problems.*

Standard Operational Info



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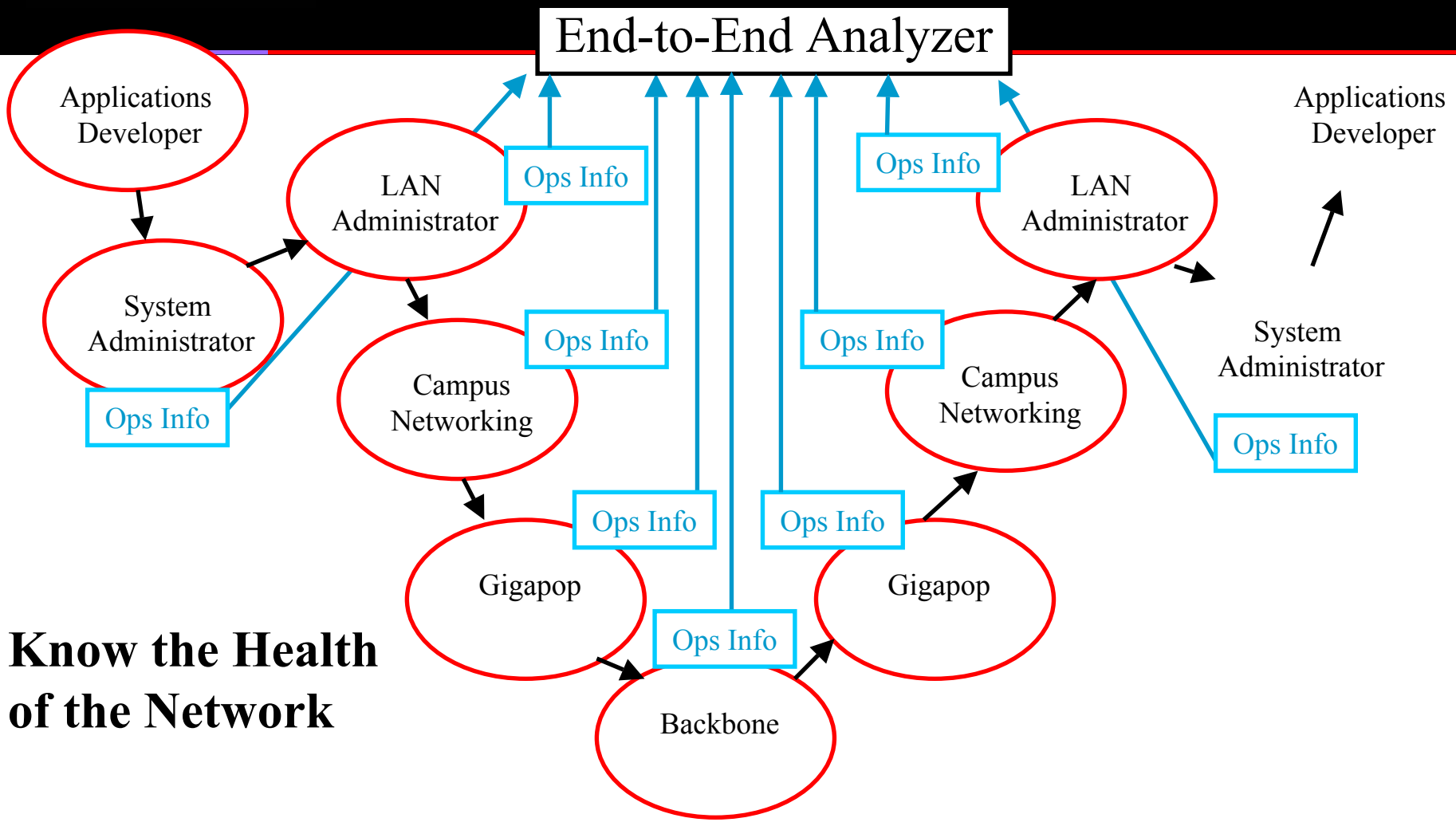
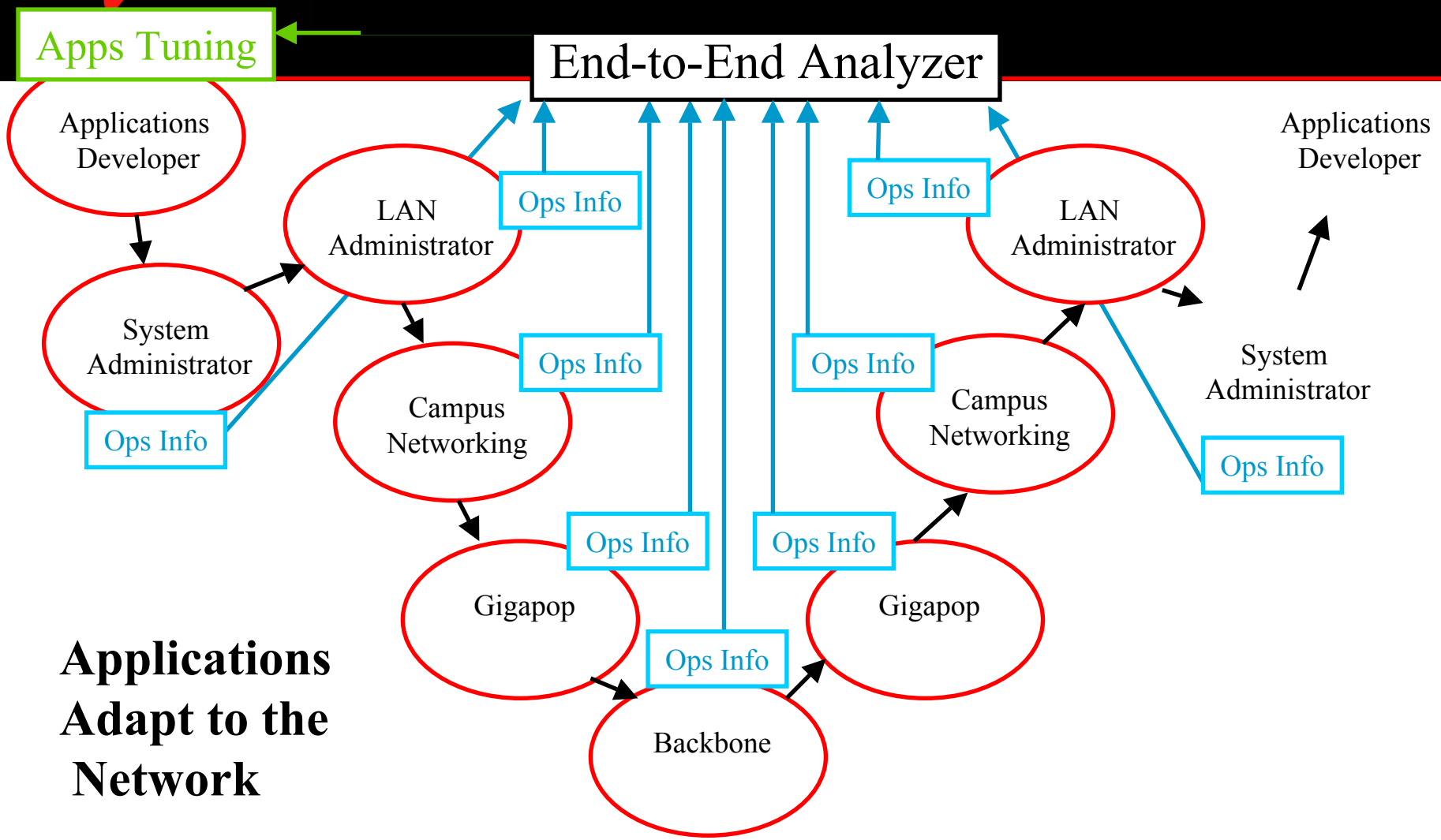


Know the Health of the Network

Standard Operational Info



E2Epi Measurement Workshop

31 January 2002, Tempe Arizona

The workshop brought together those working in the measurement field

Conclusions:

- Packet Loss is the most important attribute
- Need for common schema and exchange format
  - Global Grid Forum to lead effort
- Use Internet2 Measurement WG to continue communication

Performance Measurement Architecture

Measurement Infrastructure

Measurement Analysis

Presentation

Tools and Support

Performance Measurement Architecture

Measurement Infrastructure

- Measurement Attributes
  - Measurement Type – Packet Loss, Latency, …
  - Measurement Scope – Path, Link, Interface, …
  - Measurement Time
  - Measurement Location
- Measurement Method – Active, Passive, …
- Information Schema and Exchange Format
- Measurement Information Exchange Protocol
- Data Repository
- Accesses Control and Security

Performance Measurement Architecture

Measurement Analysis

- Network Status and Capabilities
- Problem Location

Presentation

- Common Presentation Format
- Application API

Tools and Support

- List of common test and analysis routines
- List of presentation tools

Performance Improvement Environment (PIE)

- *Develop a dynamic environment where collaboration and information sharing will happen.*
- *Identify, collect and disseminate appropriate information for end-to-end related information.*
- *Include success stories,measurement statistics, reference materials, measurement tool documentation.*
- *Include pointers to materials already developed by other communities.*

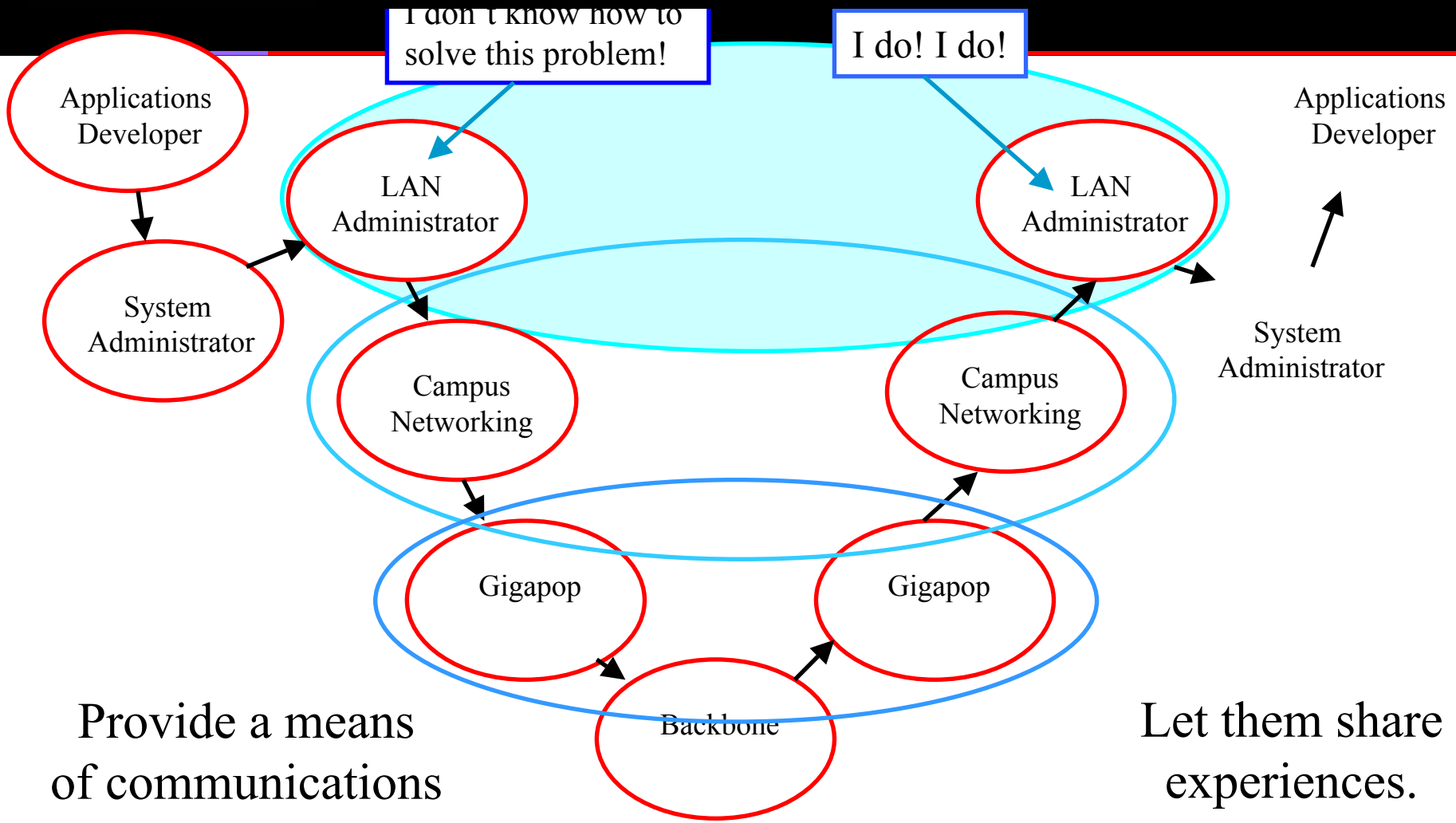
Operations and Human Communications

Establish communications among common interest groups

- System administrators
- LAN administrators
- Campus NOCs
- GigaPoP
- Application support staff

Establish communications between groups for operations and problem resolution.

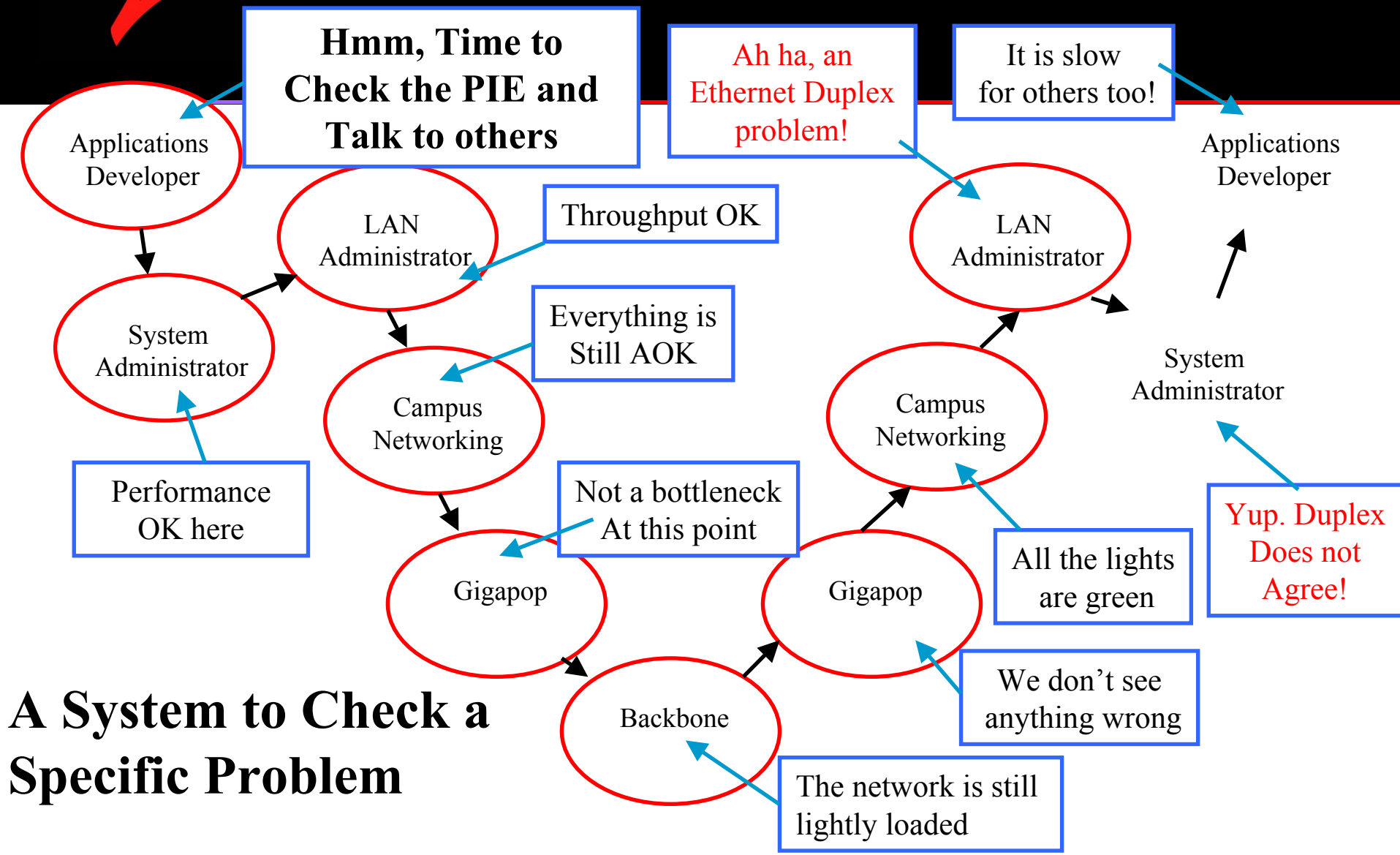
Groups of Common Interest



Provide a means of communications

Let them share experiences.

Find a Solution?



A System to Check a Specific Problem

Can You Go Direct to the Problem?

How can you tell where is the problem?

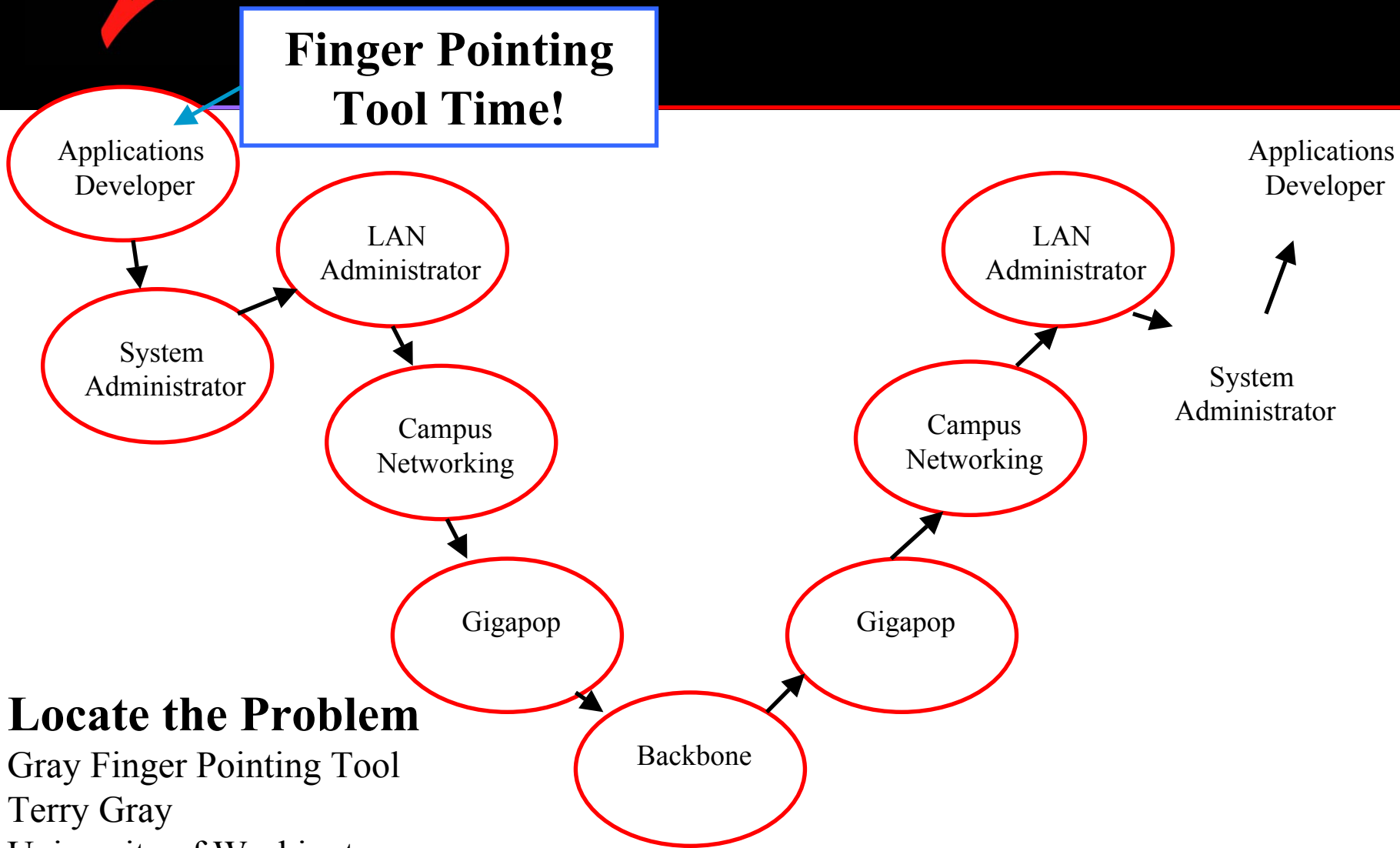
Need a tool to tell you:

- Where the problem is.
- The type of problem
- Who to contact to get it fixed

Terry Gray, University of Washington

"We Need a Finger Pointing Tool"

Gray Finger Pointing Tool

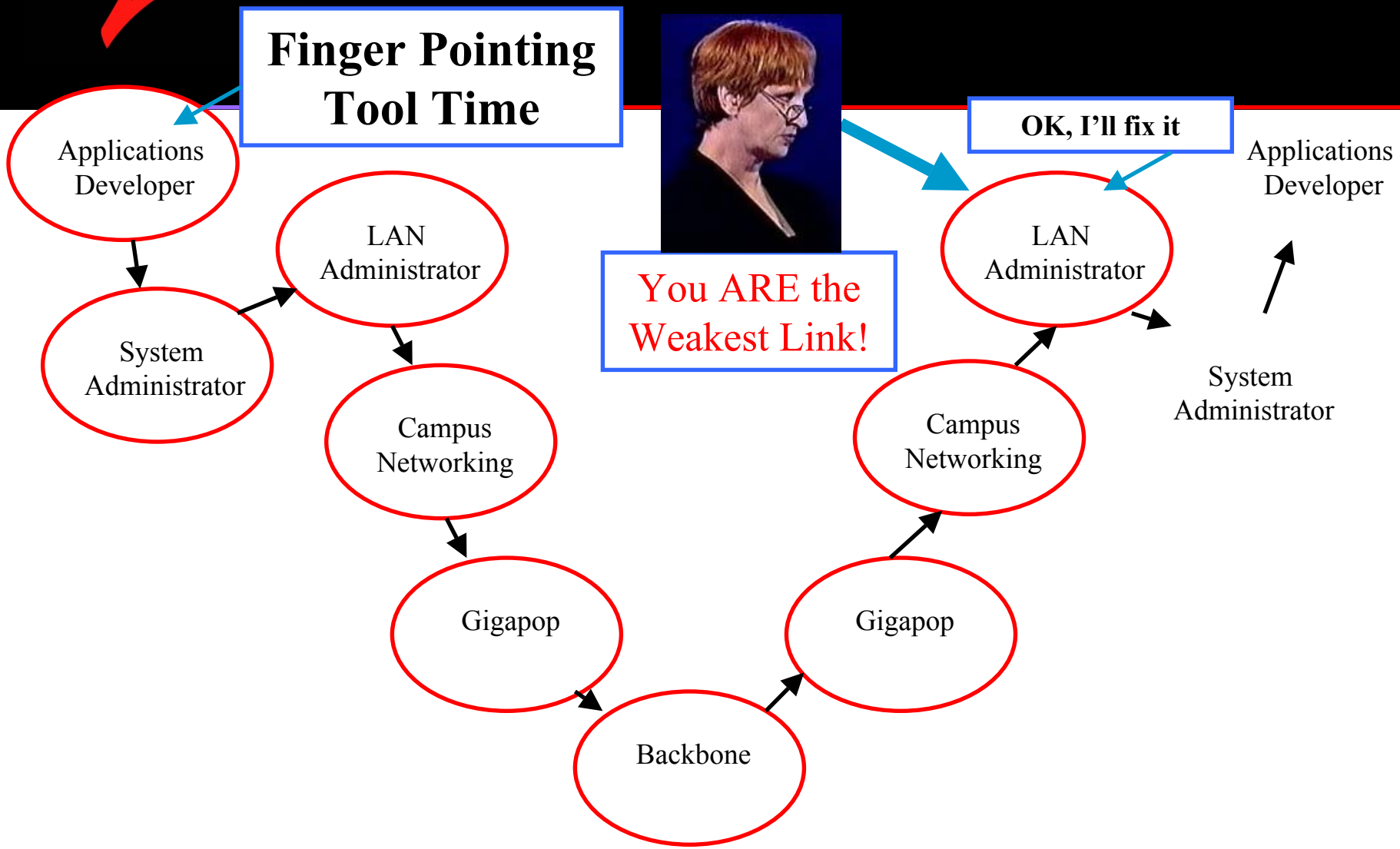


Locate the Problem

Gray Finger Pointing Tool

Terry Gray
University of Washington

Gray Finger Pointing Tool

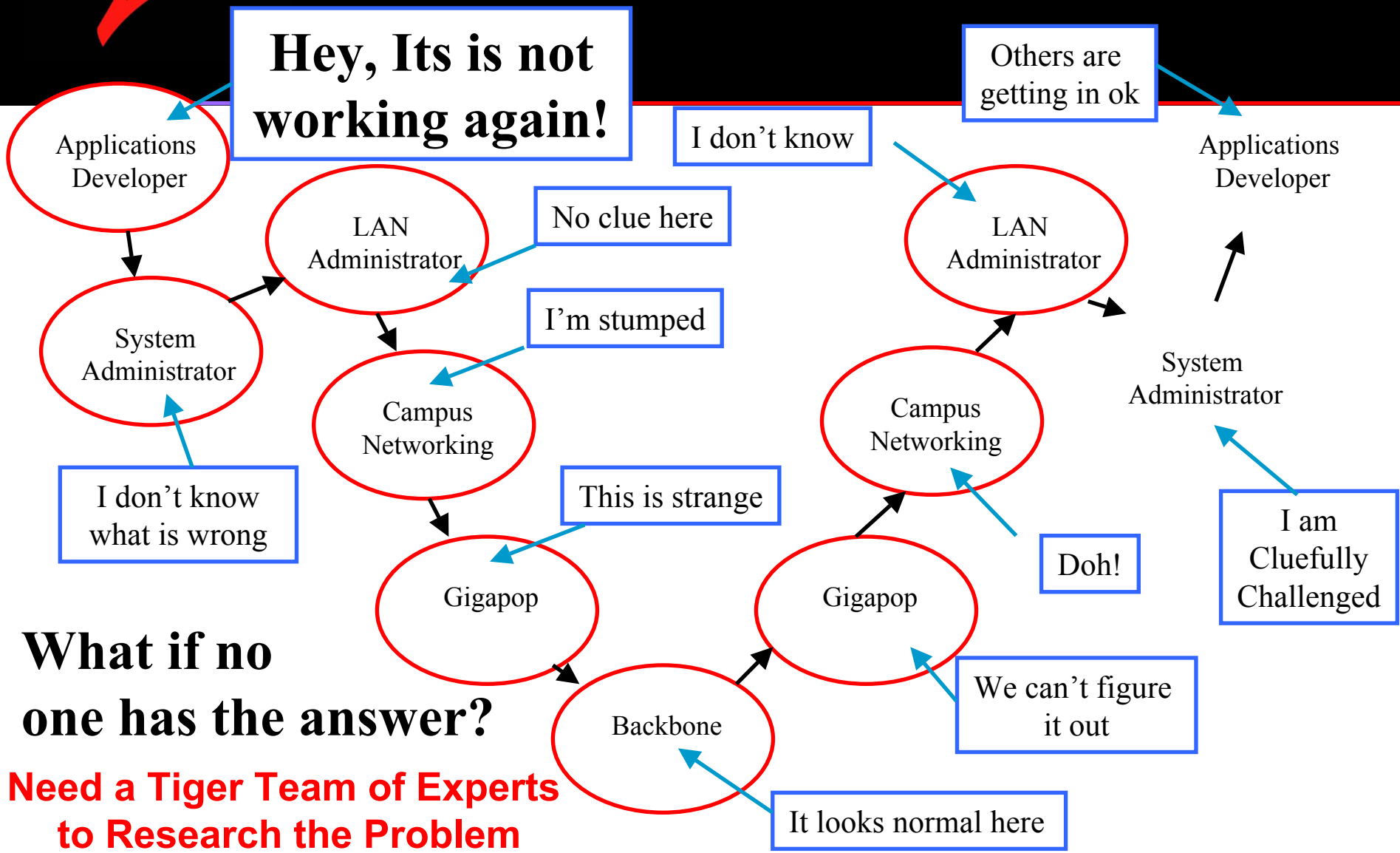


Performance Evaluation and Review Framework (PERF)

Establish a framework for resolving performance problems

- Provide known solutions by using the PIE
- Tap community knowledge by facilitating group communications
- Coordinate a team of experts to solve hard problems

The Hard Problems



What if no one has the answer?

Need a Tiger Team of Experts to Research the Problem

Partners

Campuses

Faculty and discipline communities

GigaPoPs

International partners

NSF-sponsored engineering efforts

- NLANR, www.nlanr.net
- Web100 Project, www.web100.org

Internet2 corporate members

Federal labs and agencies

Calls For Participation

Seek participants in the various work areas

- *Internet2 Measurement Working Group*
- *Campus Participation in E2Epi*
- *Internet2 Performance Packages*

Seek stories and best practices

- Current Call for Experiences

Internet2 Organization Role

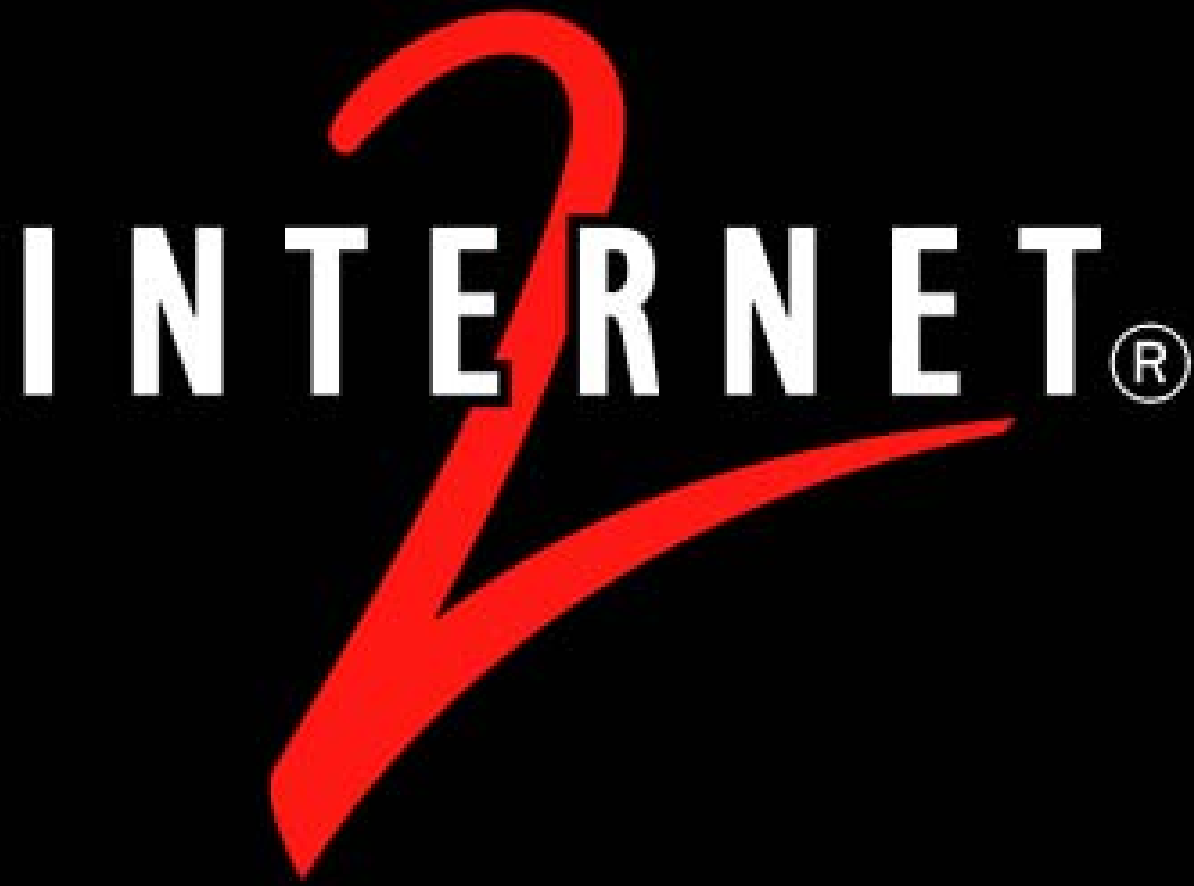
Staffing

- Cheryl Munn-Fremon, Initiative Director
- Russ Hobby, Technical Architect
- George Brett, Information Architect
- Eric Boyd, Network Engineer
- Lisa Wilberding, Communications Coordinator
- Terri Saarinen, Program Assistant

For More Information

Info-E2Epi@internet2.edu

http://www.internet2.edu/e2e/



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