Internet Futures

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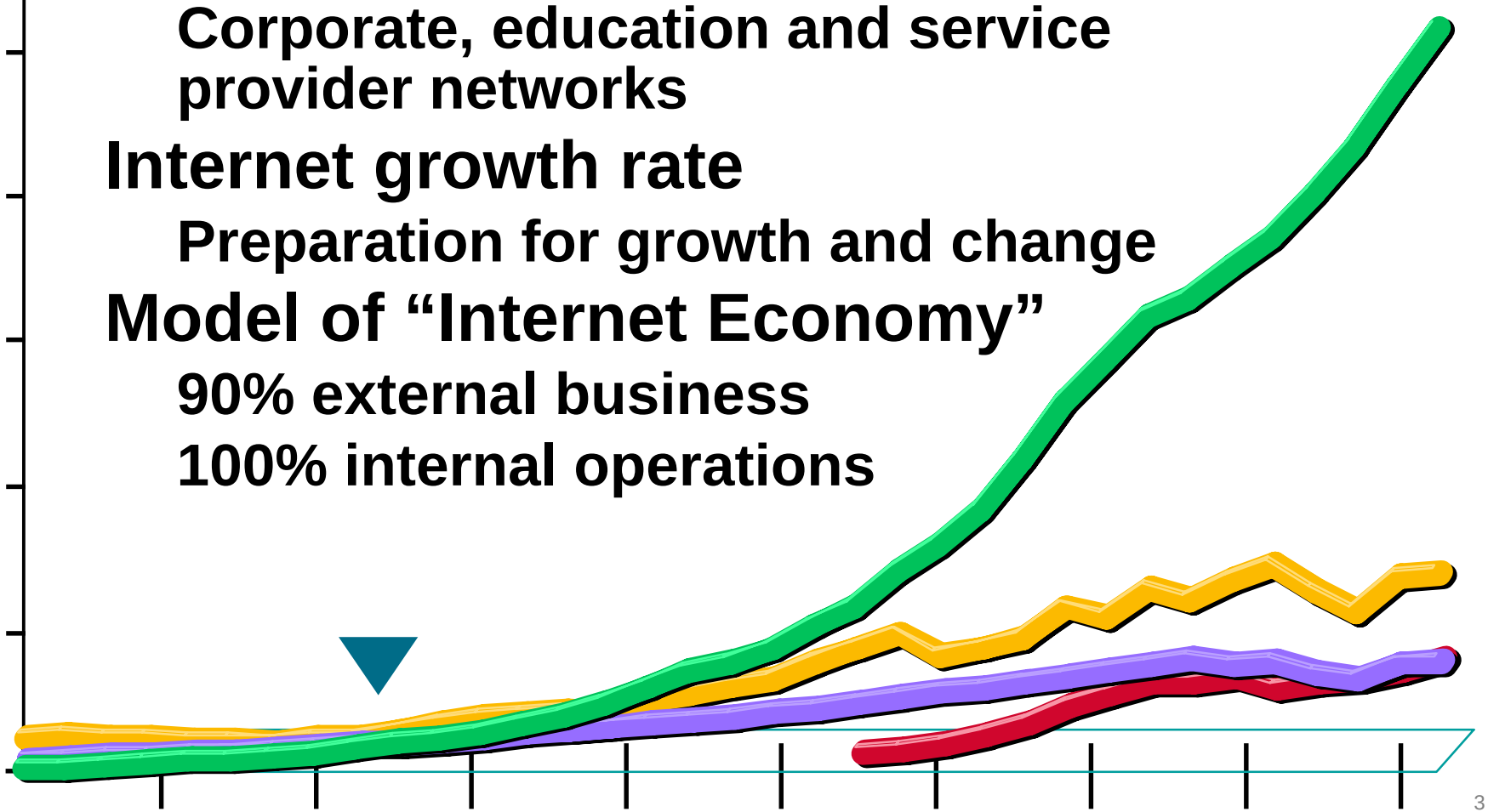
Cisco Systems

Agenda

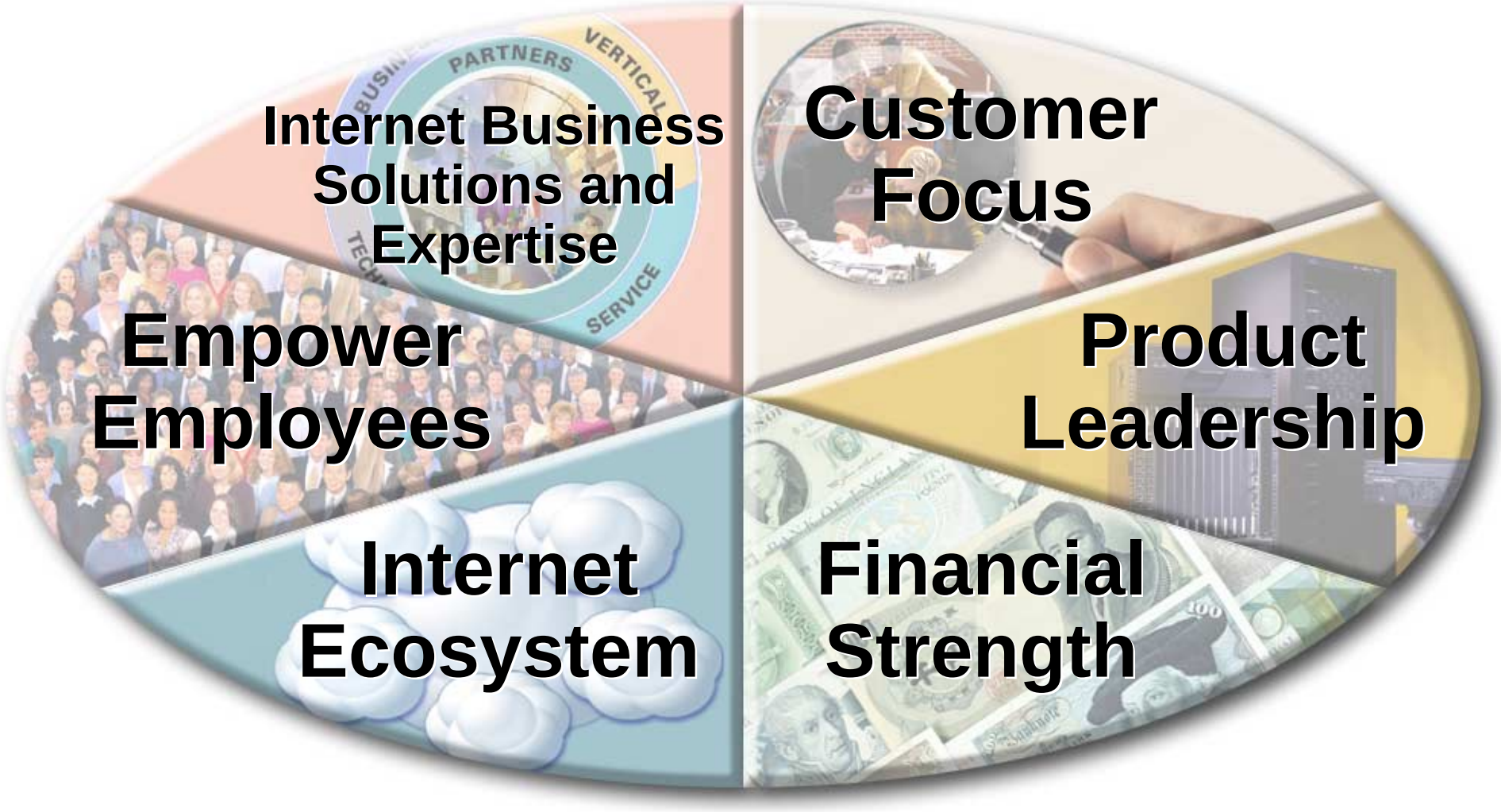
- Introductions
- Technology Directions
- Solutions
- Next Steps

Cisco and the Internet

- **Internet & networks**
  - Corporate, education and service provider networks
- **Internet growth rate**
  - Preparation for growth and change
- **Model of “Internet Economy”**
  - 90% external business
  - 100% internal operations



Cisco Priorities



Cisco Research

- **Business Units**

  Service Provider, Enterprise, Small/Medium Business, Consumer

- **Chief Strategy Office**

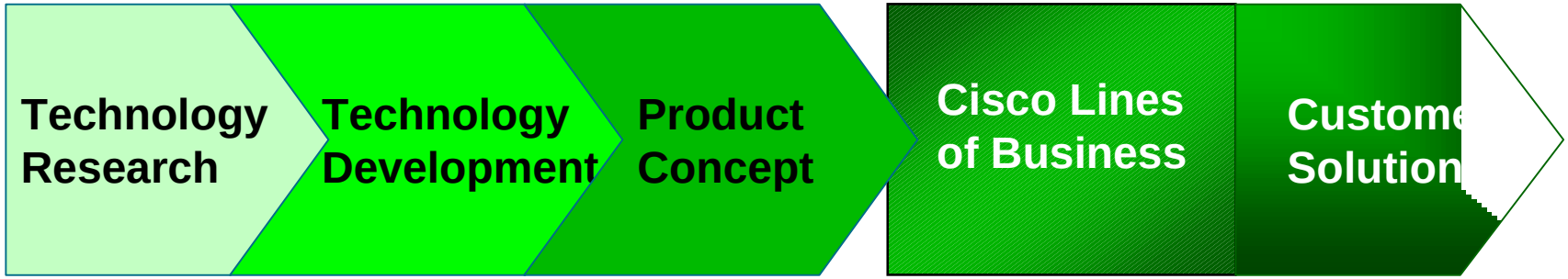
  Acquisitions, Investments, Partners

  Consulting Engineering

  University Research

  Advanced Internet Initiatives

Introductions



Advanced Internet / University Research

Consulting Engineering

Investments

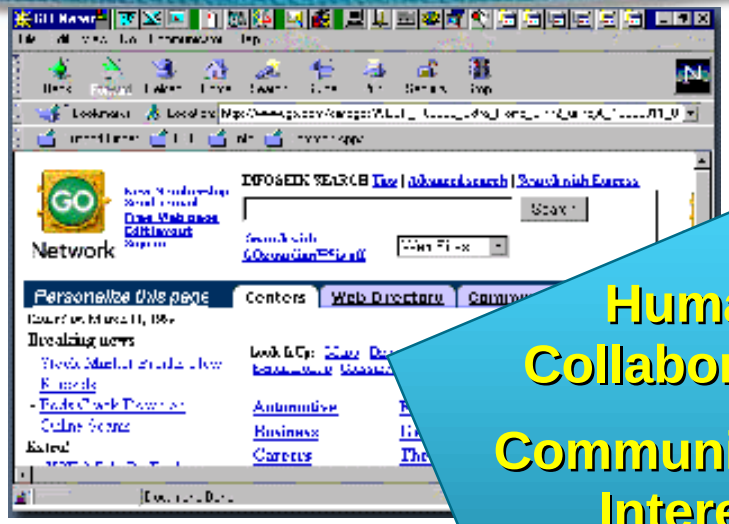
Mergers and Acquisitions

Strategic Partners

Business Units

- **Mission: engage forward-looking projects & topics**
  - **Engineering leadership**
  - **Organizational direction**
  - **Application support**

Evolution of Information Networking



Remote Terminals

E-Mail

File Sharing

Print sharing

Information Search

Customer Service

Business Processes

Electronic Marketplace

Human Collaboration

Communities of Interest

Personalized Portal to the World

Internet Ubiquity

Technologies

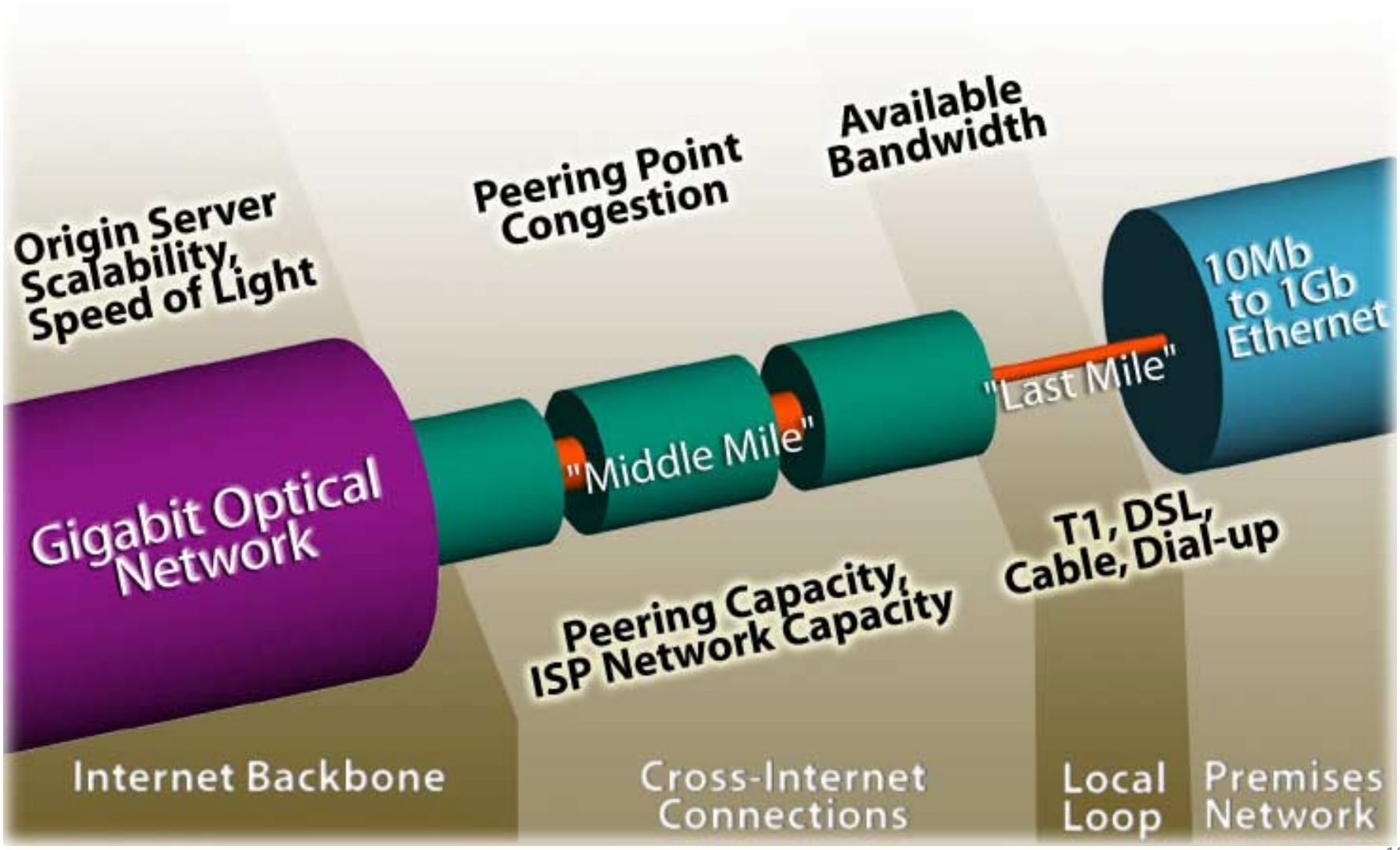
Research Avenues

- **Routing**
- **Optical networking**
- **Wireless networking**
- **IP Telephony**
- **Content networking**
- **Wildcards**

  Permanent presence (Depth of connectivity and breadth)

  Grid – Distributed computing environment

Anatomy of a Network



IP + Optical

Putting the network in optical networking

- DWDM transmission
- Mesh topology
- End-to-end provisioning

- Wavelength switching granularity
- Open protocols

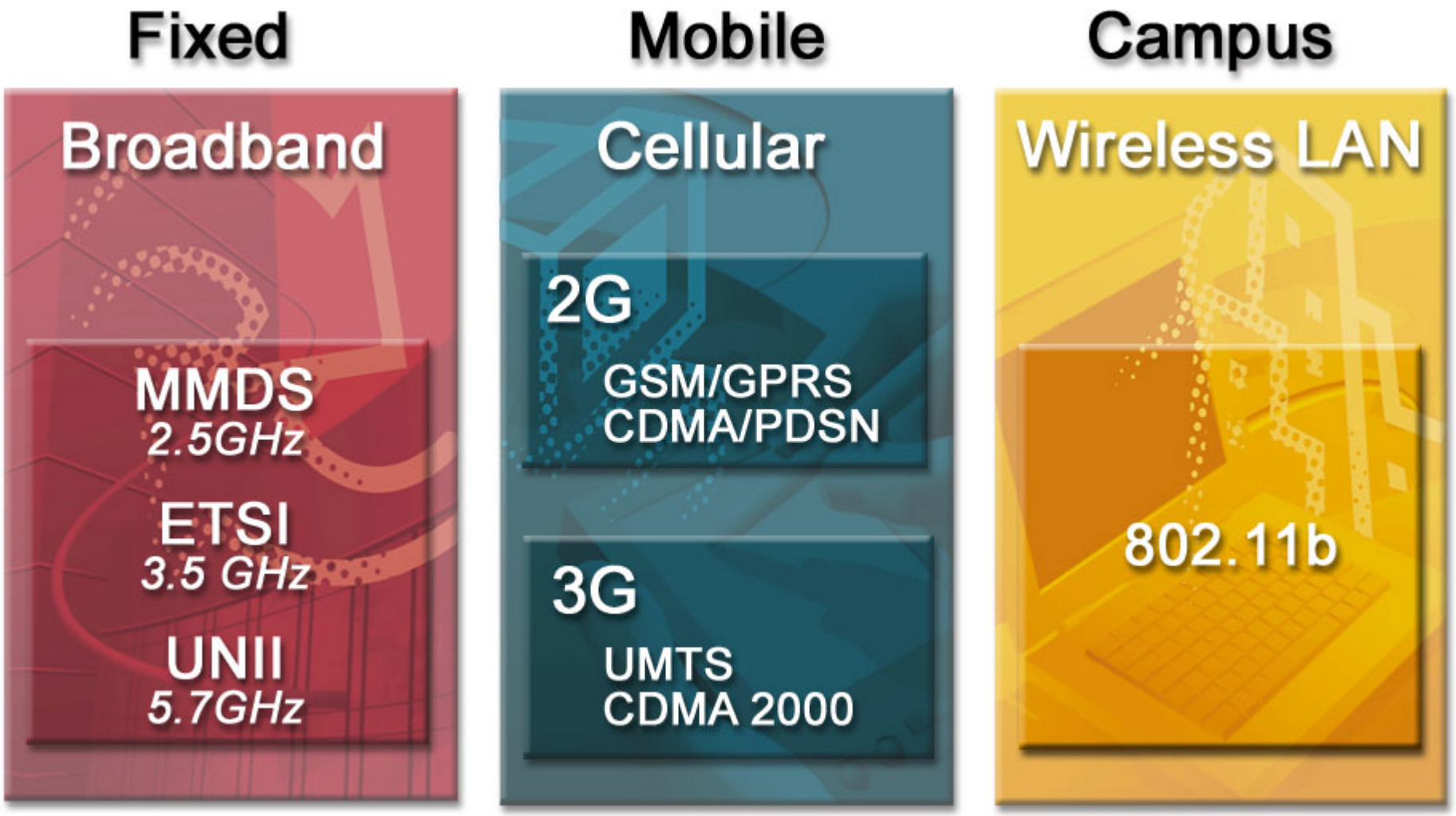
Mobile vs Wireless
What's the Difference?

- **Connected while moving**
- **Connecting from various locations – wired or unwired**
- **Connected without wires – while moving *or* fixed**

Mobility


FUNCTIONS
POWER
COST
MOBILITY
Notebook
PC Companion
Data *Plus*
Plus Data
Voice *Plus*

Wireless Technologies



New End-device Internet

Trends

Advanced services

Multimedia services

Universal usage

Small form-factor & low weight

Excellent stand-by and talk-time

Multi-culture user interface

Low price

Attractive industrial design & accessories

Impact

Open architecture
Generic application environment

Wideband

ASIC design
International Frequencies

Reduced power consumption
Improved batteries

Voice recognition
Display technology
Hand writing recognition

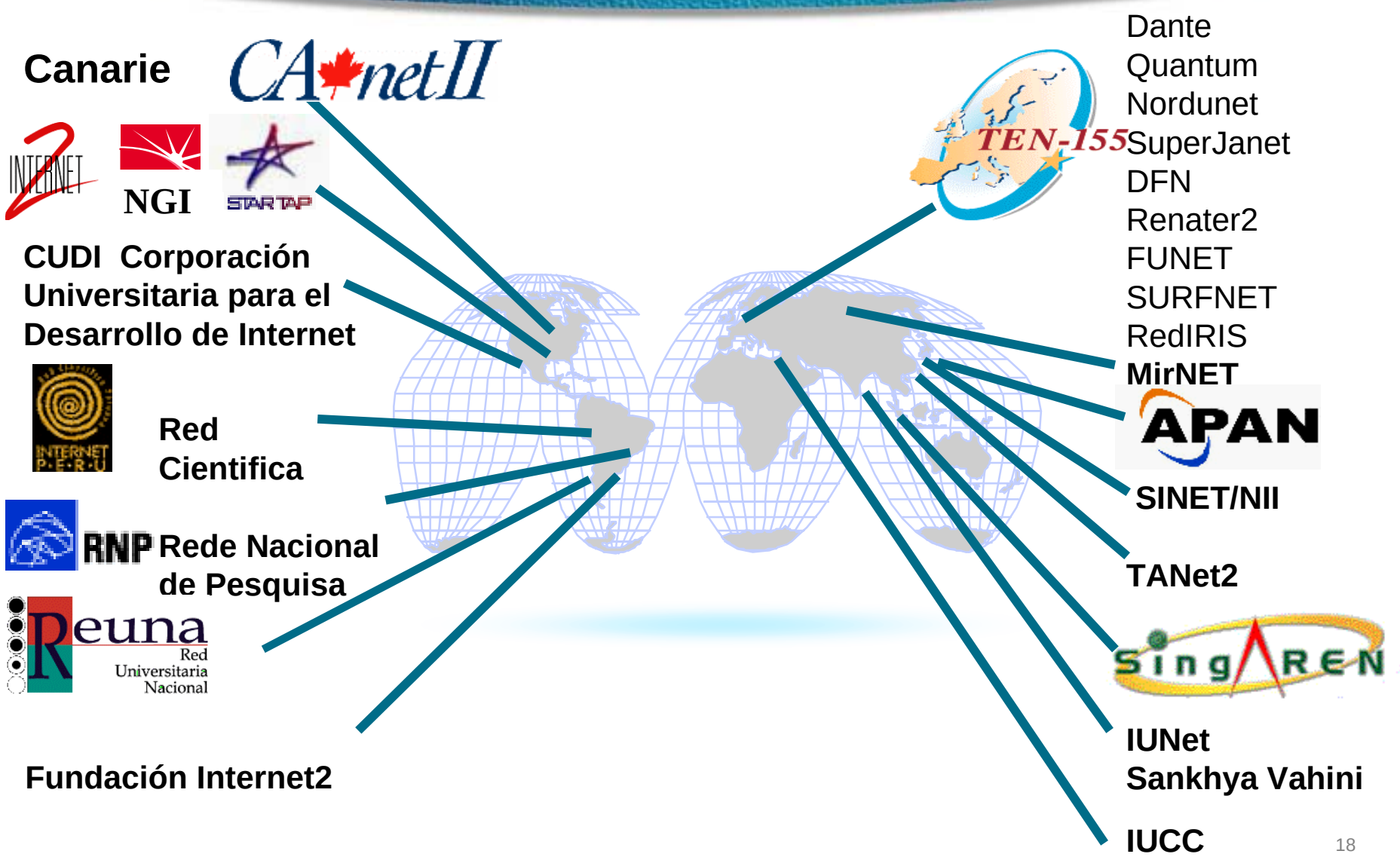
Cost efficient design
Cost efficient production


Solutions for the Future

Advanced Internet Initiatives

- **Vision: Laboratories to study evolution**
- **Advances in architecture, services and operations**
- **Applications to measure the advances**

Advanced Internet Initiatives



http:// ... Advanced Internets

www.canarie.ca

www.internet2.edu
www.ngi.gov
www.startap.net

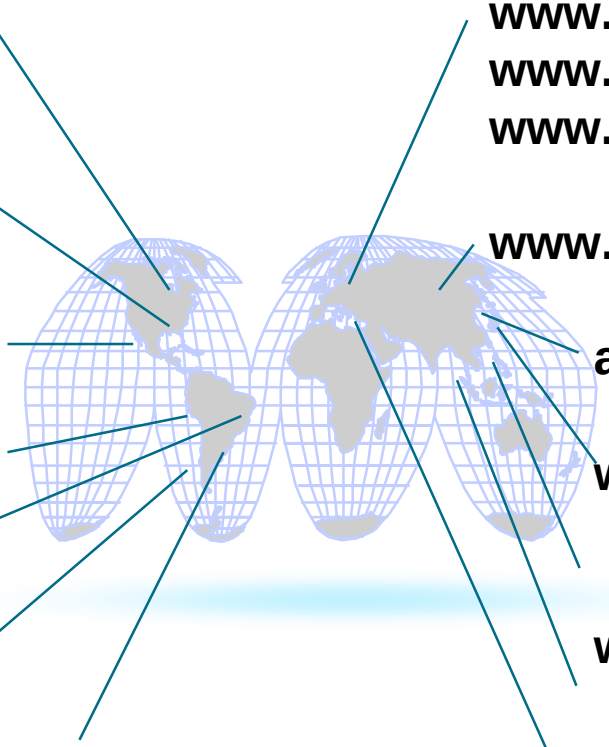
www.cudi.edu.mx/

ekeko.rcp.net.pe/

www.rnp.br/

www.reuna.cl/

www.secom.gov.ar/html/orgaframe.html



www.dante.net/ten-155.html
www.dante.net/quantum.html
www.nordu.net
www.ukerna.ac.uk www.dfn.de
www.renater.fr www.surfnet.nl
www.csc.fi/english/funet

www.friends-partners.org/friends/mirnet/

apan.or.kr

www.nii.ac.jp

www.tanet2.net.tw/

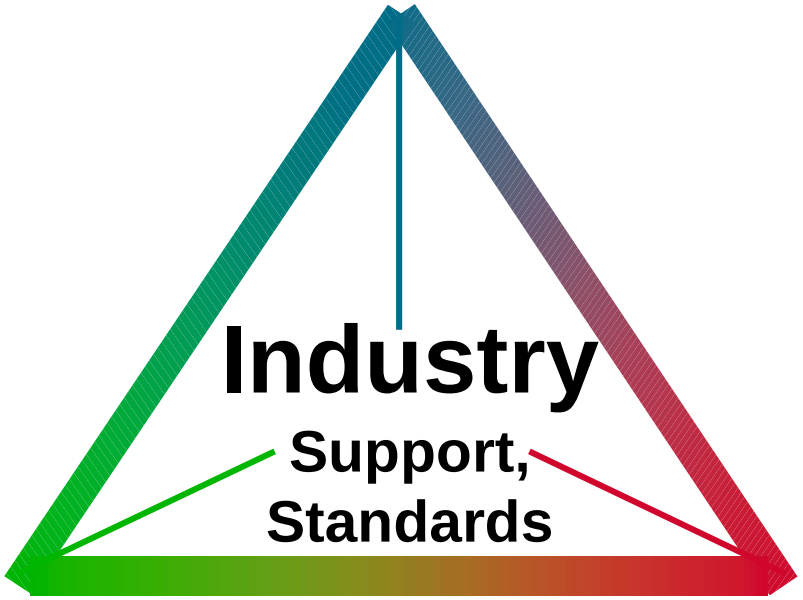
www.singaren.net.sg

www.machba.ac.il/index.html

Partners for Success

Government

Vision, Seed funding



Universities / Labs

Applications, Research, Local Access

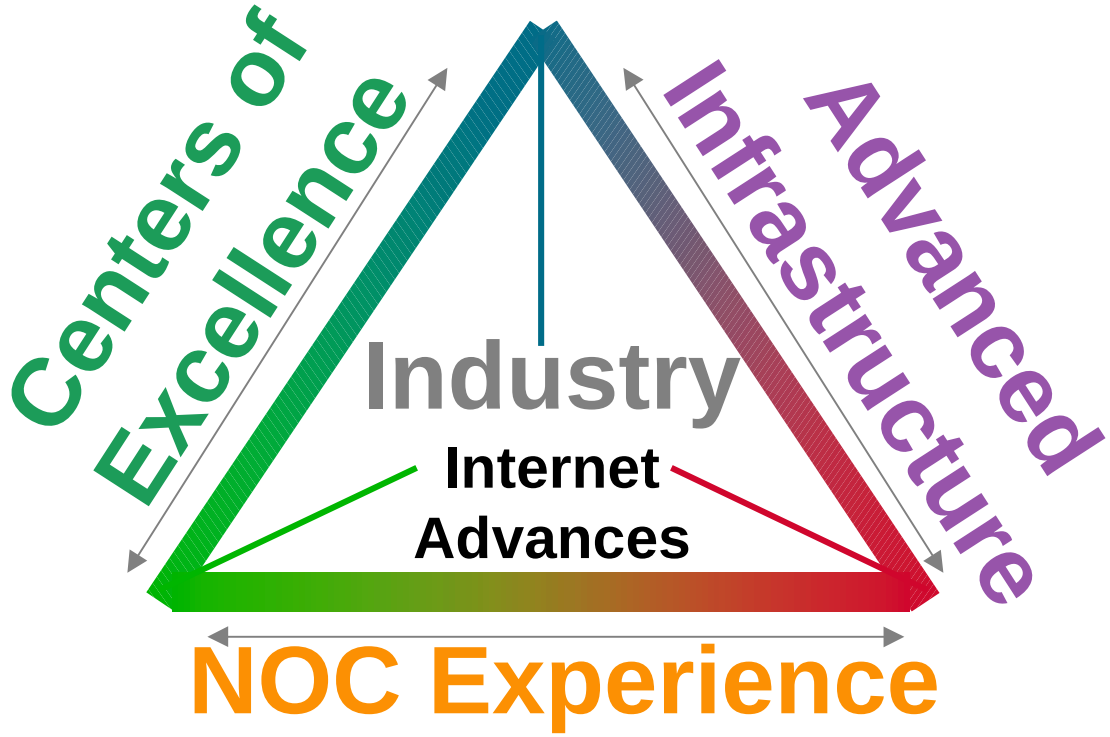
Service Providers

Backbone, Scaling

Partner Issues and Shared Goals

Government

Positioning for Information Economy



Universities / Labs

Academic Fields; IT Operations

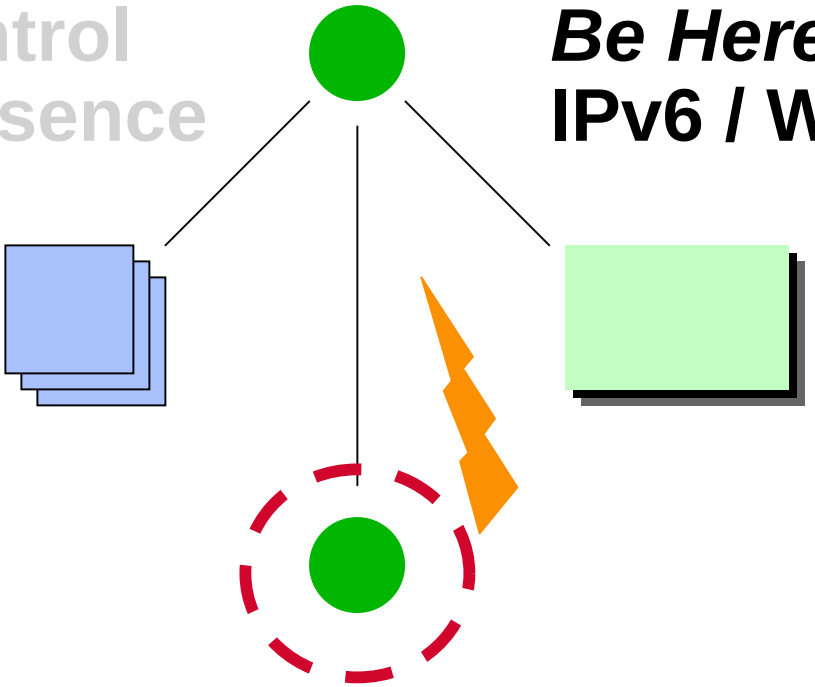
Service Providers

Preparation for Competition

Application Classes

Large Files
Distributed Use
Collaboration
Real Time Control
Persistent Presence

Multicast / *NetCapita*
Napster
Dialpad / Roger Wilco
Be Here
IPv6 / Wireless



Issues: Security, Stability, Traffic Priority, Last Mile Access and Bandwith, Scaling, IP

Common Lessons

- **Balancing Autonomy & Cooperation**
  - **Centralized Vision and Common Goals**
  - **Decentralized Research and Communication**
- **Supporting Production & Research**
  - **Experimentation, Operations and Support**
  - **Partner Roles**
- **Planning for the Unplanned**
  - **Infrastructure and Applications / Services**
  - **Flexibility and Stability: Standards**
  - **Speed of Response**

University Research Program Charter & Goals

- **Promote & encourage directed research on topics of current and future interest**
- **Provide a venue for "risky" or orphaned research topics (25% of URP budget)**
- **Develop promising opportunities in academia for research faculty & staff**
- **Engage top industry-bound students**

www.cisco.com/go/research ***research@cisco.com***

Elements of URP/CARD Success

- **Research plan**
- **Graduate students and resources**
- **Cisco champion**
- **Outcome**

Research Programs

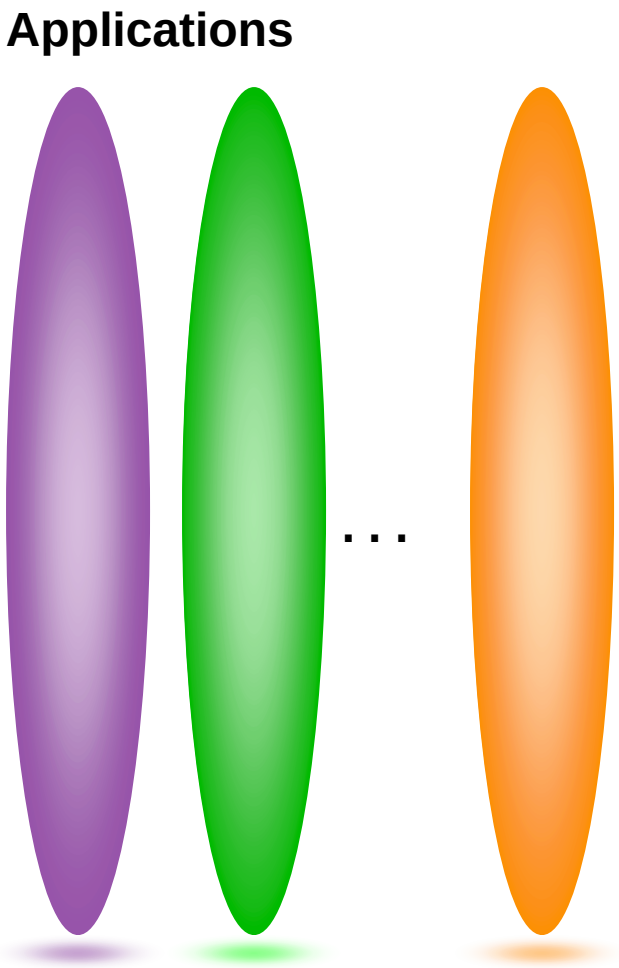
- Electronic Persistence
- Ubiquitous Computing
- Instant Messaging
- Mobile, wireless & nomadic access
- Personal Locator Services

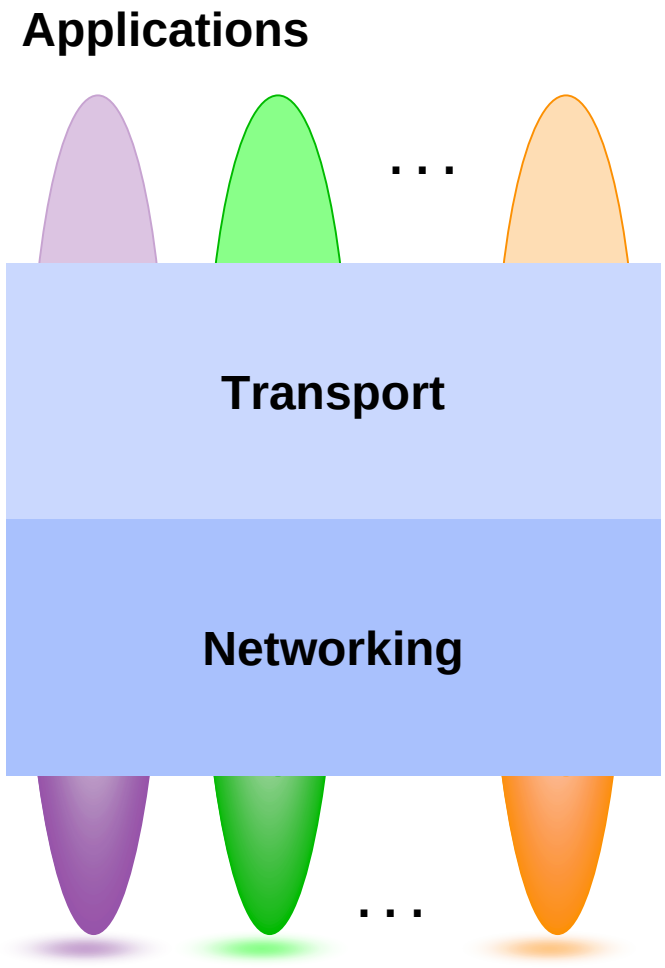
- Optics, DWDM, Switched DWDM
- L3 restoration
- Lambda switching
- Metropolitan
- Mirrors & Lasers
- Network Processor
- Optics manufacturing
- H/W Simulation tools
- ASICS and beyond

- DIFFSERV, MPLS, QoS
- Web Caching, ORBs
- Routing/Congestion Control
- Active Routing
- Micronets

- Middleware (Directories, Policy Servers)
- Network Management (Agent-based, Smart Nets)
- Security, Multicast
- SOHO services

TCP/IP: Currency of Information





The Internet Tornado Waves

Web Browser
(1994-1997)

E-Commerce
(1997- 2001)

Voice/Video/Data Convergence
(1998-2003)

Diverse Access
(1999-2003)

Decentralized Content/Media
(2000-2005)

Measuring Progress in the Information Age

“Bandwidth" and "degree of connectivity" are the new measures of power…

Three distinguishing factors to harness power

- **culture to exploit & share knowledge**
- **competitive setting that embraces change**
- **ability to partner**

Thomas Friedman
New York Times
p.11 4/11/98

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