

The Next Generation Internet and the Future of the Domain Name System

Michael R. Nelson
Visiting Professor, Internet Studies
Communication, Culture and Technology Program
Georgetown University
MNELSON@POBOX.COM

My Background

- **B.S., geology, Caltech**
- **Ph.D., geophysics, MIT**
- **1988 -- Congressional Science Fellow**
- **4 years as Senator Gore's science advisor**
- **4 years as IT policy guru at White House**
- **1998-1999 -- Technologist at FCC**
- **9 years at IBM**
- **Georgetown, Studying future of the Internet**
- **Chairman, Information Section, AAAS**

50 Things I learned in Washington

LESSON #1

ALWAYS have a good bumper sticker

50 Things I learned in Washington

LESSON #5

Always state your conclusions first

Conclusions

- **The Internet Revolution is less than 15% complete**
- **We are seeing a profound paradigm shift:**
 - ❖ **As important as the World Wide Web was in 1995**
 - ❖ **New approaches to business and policy are essential**
- **The Domain Name System will be less important as new applications and new ways to locate online resources online.**
- **When in doubt, empower the user!**

Outline

- **Act I – DNS Past**
- **Act II – Internet Future**
- **Act III – DNS Future**
- **Act IV – Role of governments**

50 Things I learned in Washington

LESSON #9

**When you're not sure what to say,
tell a story**

ACT I – DNS Past -- Origins of ICANN

- **January 1998 – White House “green paper” on DNS**
- **May 1998 – White House white paper on DNS**

The Big Issues Then

- **How to ensure the stability of the Domain Name System?**
- **Can the DNS scale?**
- **Who's in charge?**
 - ❖ **Non-governmental**
 - ❖ **International**
 - ❖ **Ensure legitimacy**
 - ❖ **Prevent capture**
- **How fine-grained to make domain names? What model?**
 - ❖ **Phone book?**
 - ❖ **Zoning?**
- **How to ensure flexibility and evolution?**
- **How to ensure users have a voice?**

ACT II – Internet Future

The Information Explosion Continues...

(Actually, it's accelerating)

Technology Trends

COMPUTING:

- Chips/\$ 10x in 5 years
- Computing power/\$ 10x in 4 years

STORAGE:

- Storage/\$ 10x in 6 years

COMMUNICATIONS:

- Backbone 100x in 5 years
- Local loop 100x in next 5 years

Total Amount of Data Connected to The Internet

2001	1 petabyte	(10^{15} bytes)
2006	1 exabyte	(10^{18} bytes)
2010	1 zettabyte	(10^{21} bytes)

The result of:

- **More people spending**
- **More time using**
- **More data-rich applications**
- **More replication and caching of data**

Much More to Come...

The Internet Revolution is <15% complete

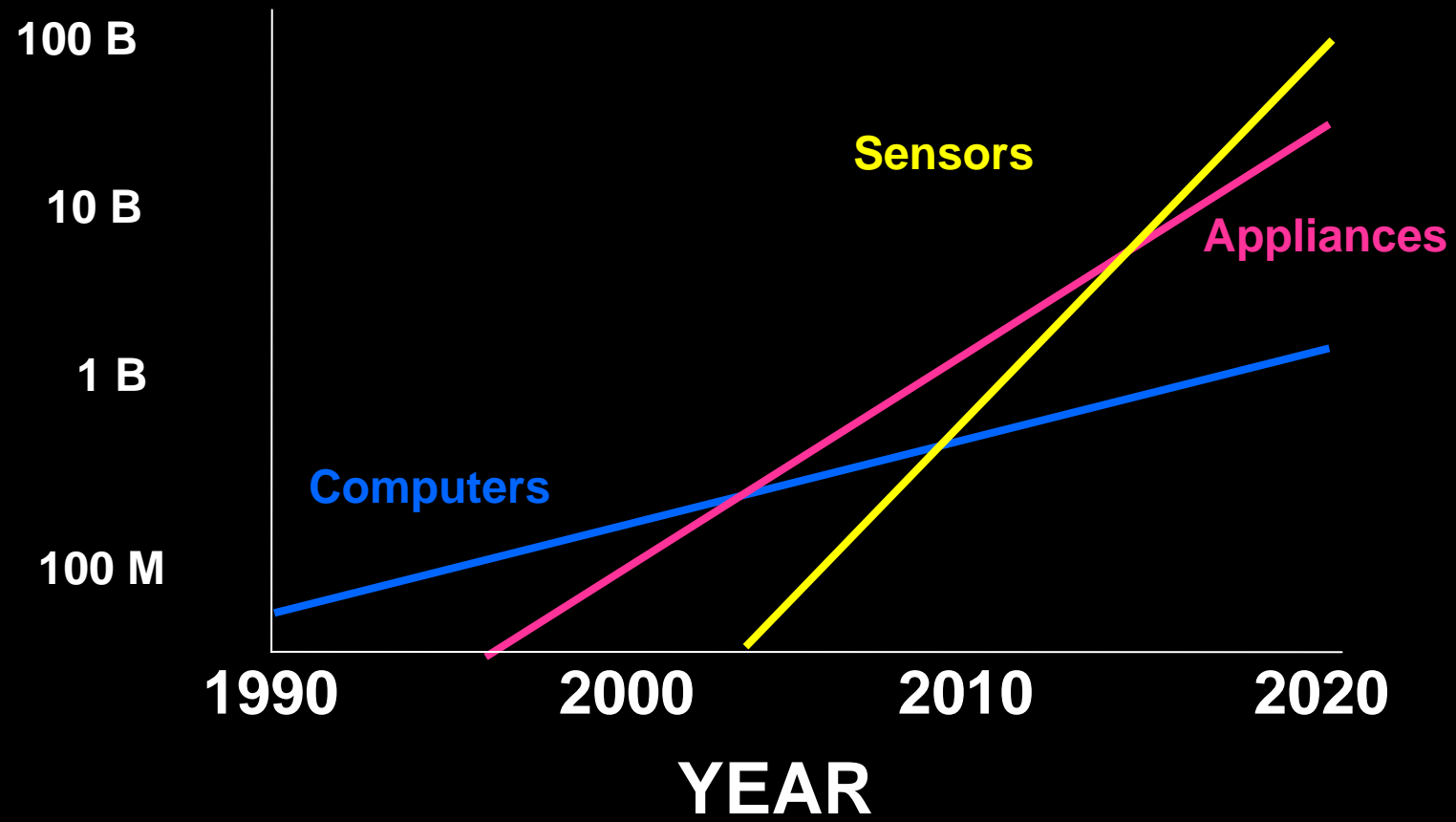
- **Number of users**
- **Number of devices**
- **Speed/bandwidth**
- **Amount of content**
- **Number of applications**

Data, Data Everywhere...

- **Video surveillance**
- **E-commerce**
- **Location-dependent services**
- **Customized video on-demand**
- **Video-conferencing**
- **Networked devices**
- **Embedded sensors**
- **Data mining**

Sensors Will Predominate...

Internet-connected devices

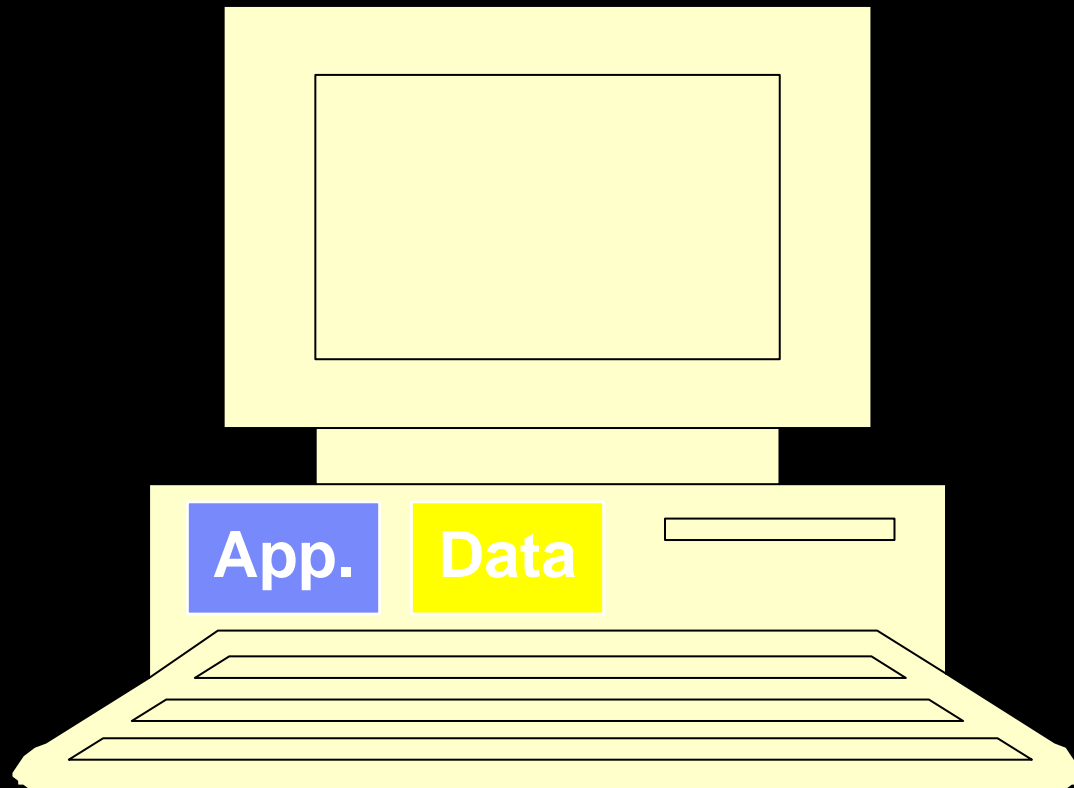


What is the Cloud Computing?

A fundamentally new approach to computing.

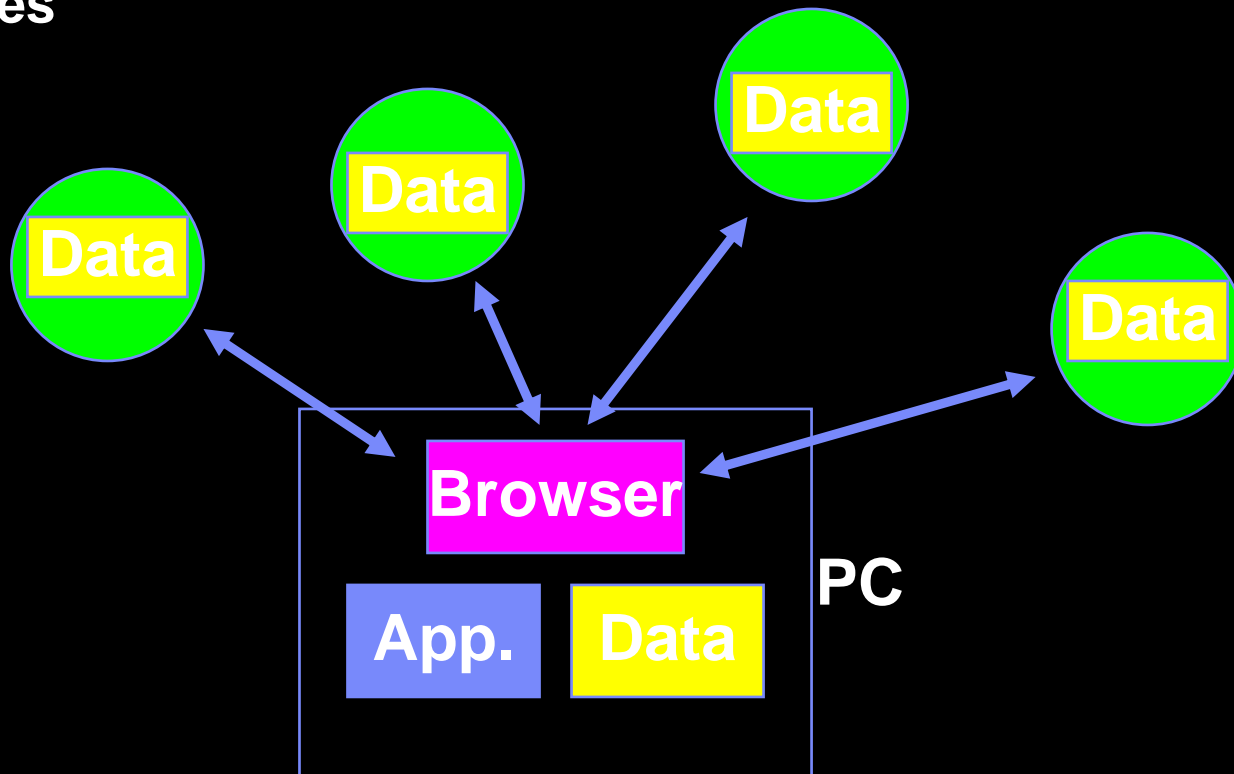
It enables companies and users to use the Internet to almost instantly tap the data, software, storage, and computing power they need to respond to any customer demand, market opportunity, or competitive threat

Phase One – Stand Alone Computer

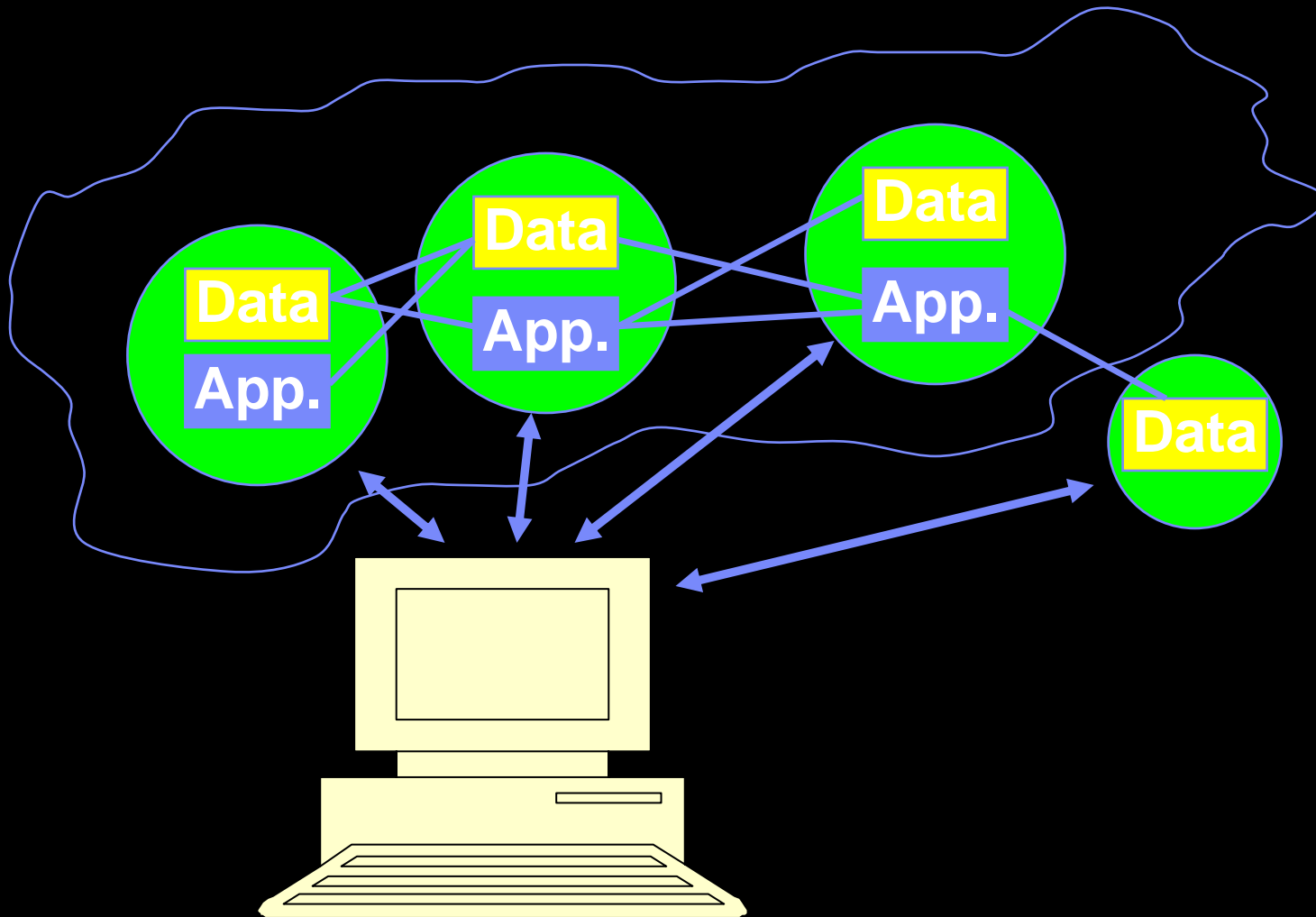


Phase Two – The Web

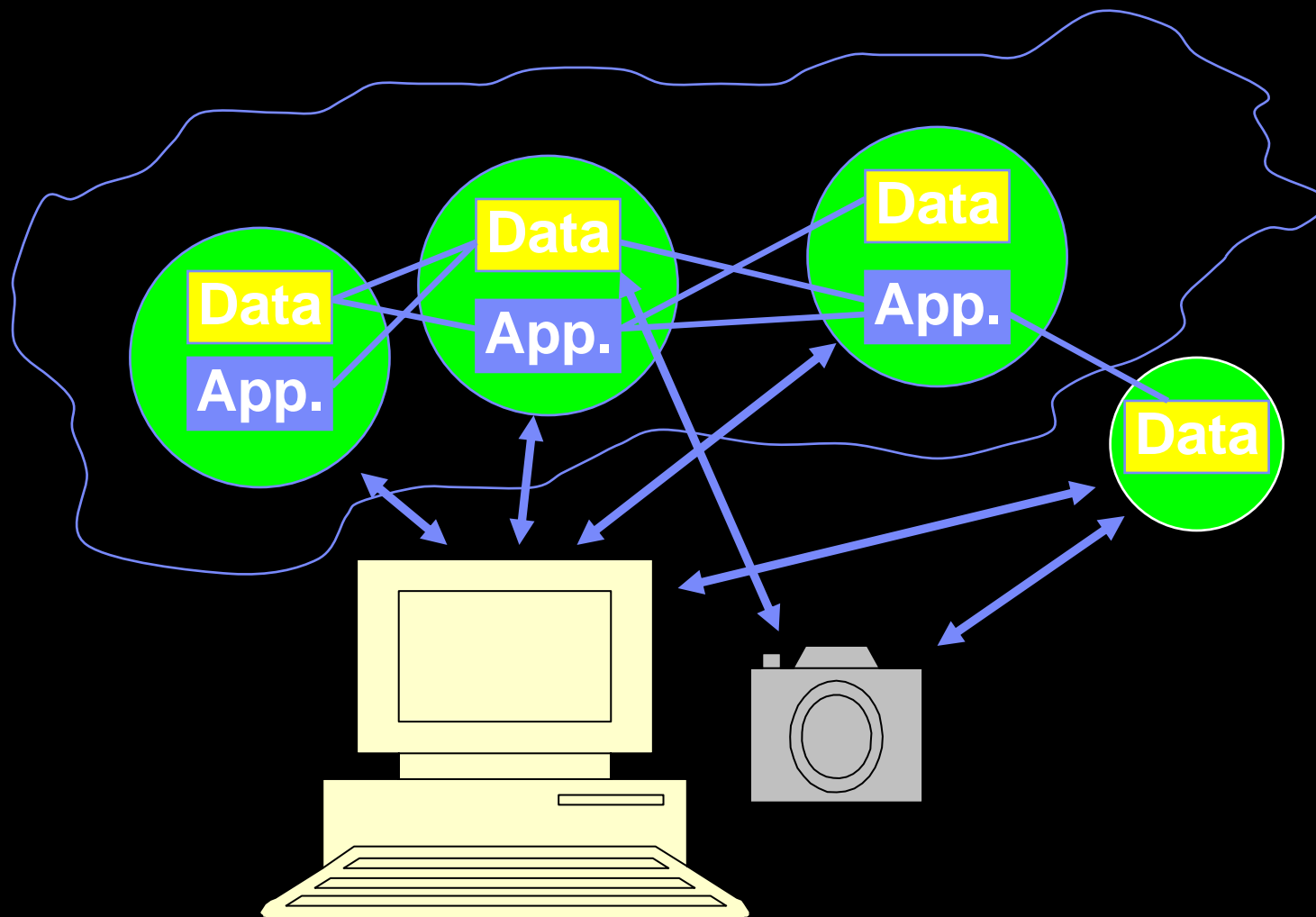
Web sites



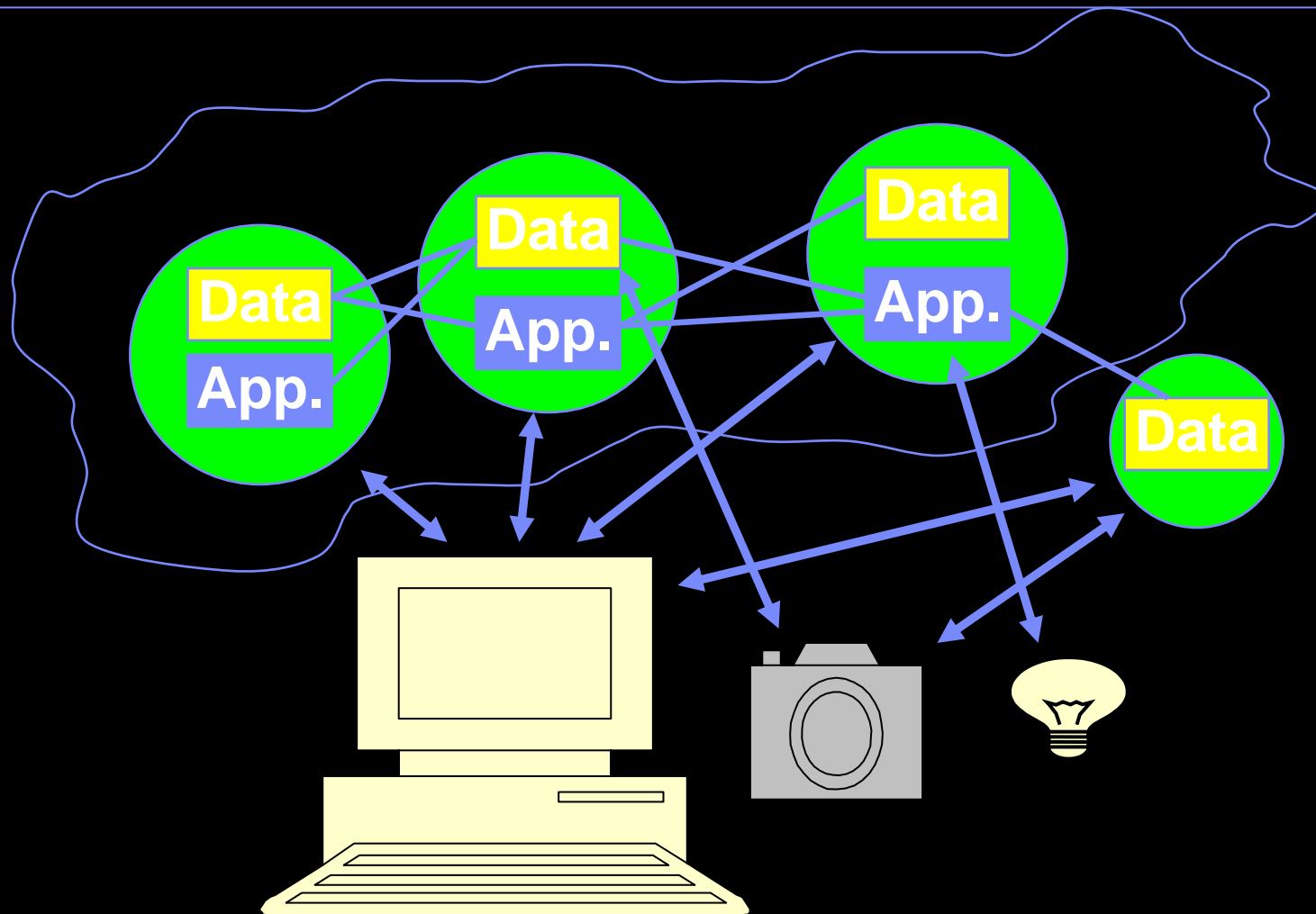
Phase Three – The Cloud



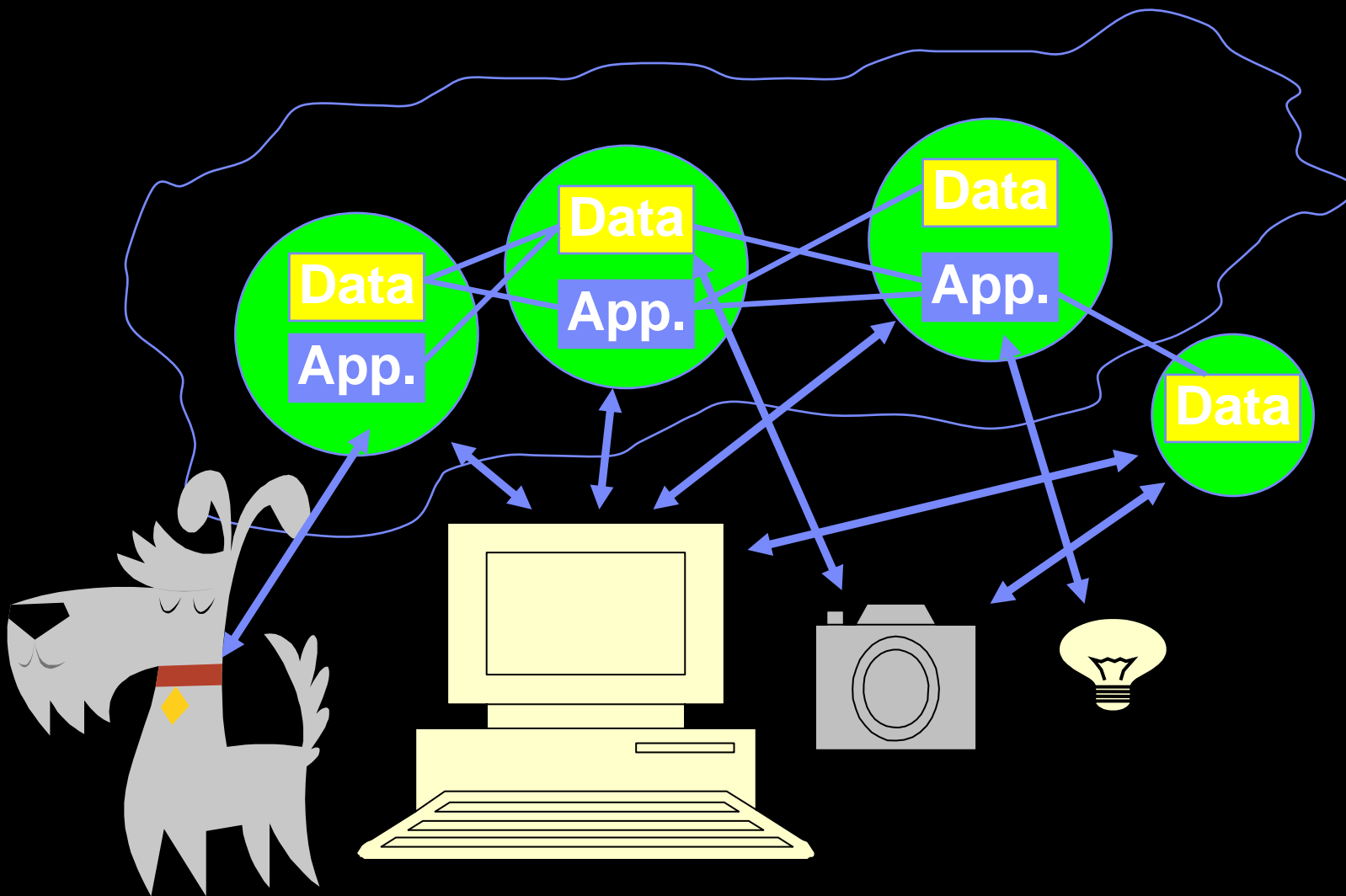
Phase Three – The Cloud



Phase Three – The Cloud



Phase Three – The Cloud



Many Flavors of Distributed Computing

Number of nodes

1 M

100 K

10 K

1000

Peer-to-Peer

(PC-based)

SETI@home

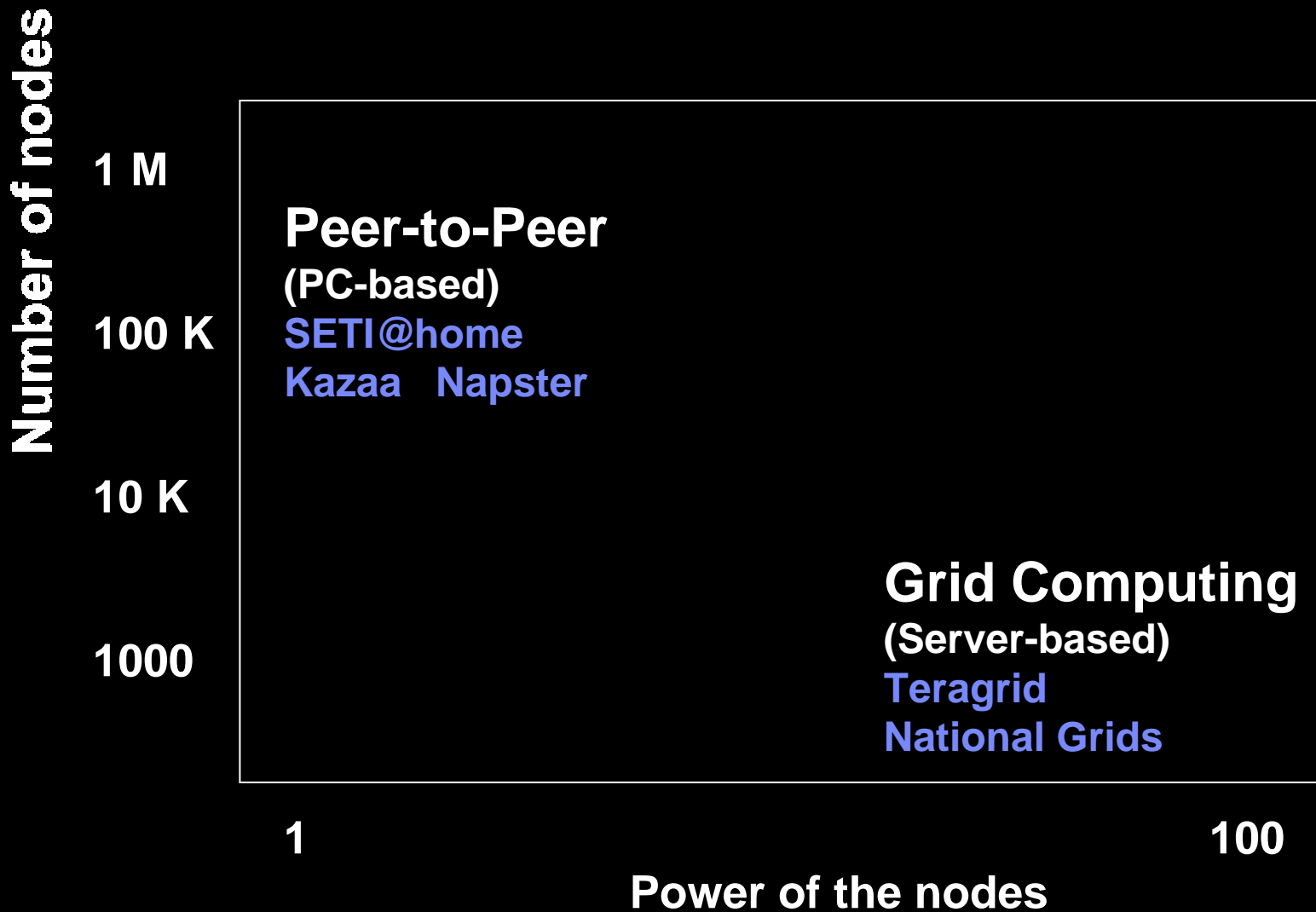
Kazaa Napster

1

100

Power of the nodes

Many Flavors of Distributed Computing



Many Flavors of Distributed Computing

Number of nodes

1 M

100 K

10 K

1000

Peer-to-Peer

(PC-based)

SETI@home

Kazaa Napster

The Holy Grid

Everything integrated
with everything

Grid Computing

(Server-based)

Teragrid

National Grids

1

100

Power of the nodes

ACT III – DNS Future

Myths about DNS

- **DNS and ICANN are the key to Internet governance**
- **People need domain names to find what they want**
- **The DNS is “set in concrete”**

Critical Phase for the Internet

- **New systems developing to:**
 - ❖ **Authenticate people**
 - Microsoft Cardspace
 - Open ID
 - Liberty Alliance
 - Shibboleth
 - ❖ **Identify RFID tags and sensors**
 - ❖ **Find and identify computing resources**
 - ❖ **Identify documents**
 - Amazon
 - Digital Object Identifiers

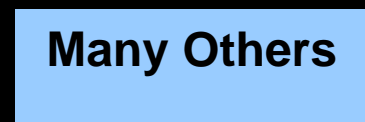
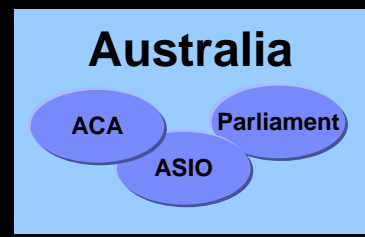
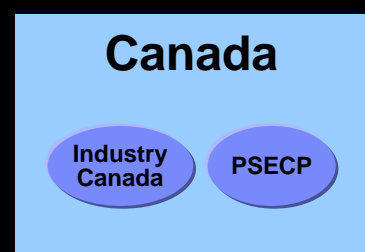
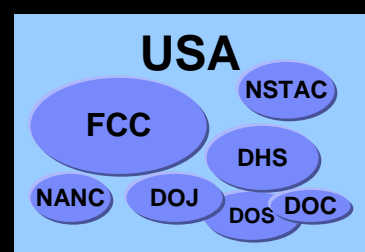
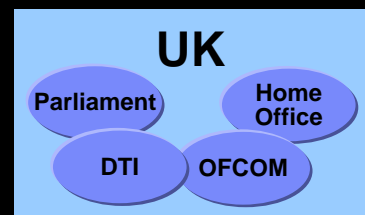
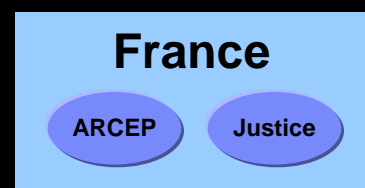
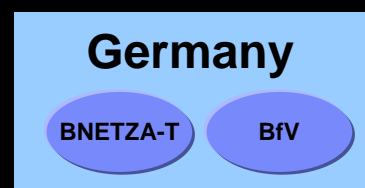
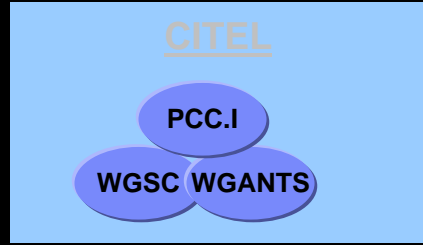
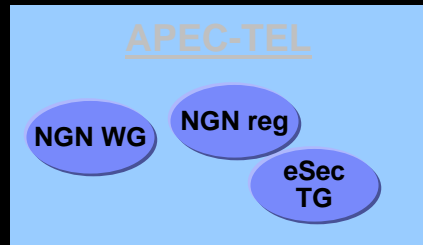
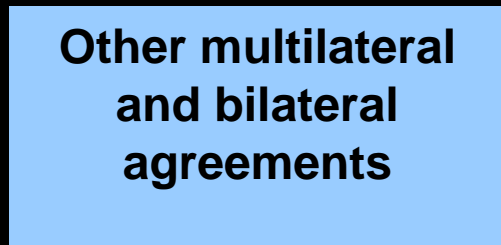
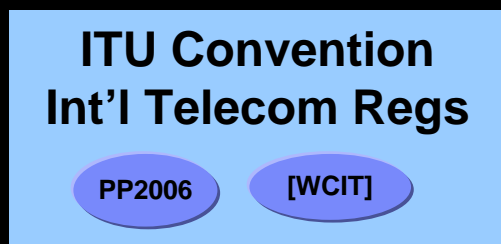
ACT IV – Governments and the Net

- **National policy decisions**
 - ❖ **Convergence of telephone, data, broadcasting**
- **OECD “Future of the Internet Economy” conf.**
 - ❖ **June 2008**
 - ❖ **Seoul, South Korea**
- **WSIS, Internet Governance Forum**
 - ❖ **October 2008 in Delhi, India**
- **Various European Union directives**

Who “manages” the Internet?

- **World Summit on the Information Society**
- **Governments realizing the power of Net**
 - ❖ **Media**
 - ❖ **E-business**
 - ❖ **Threat to monopoly phone company (VoIP)**
 - ❖ **Political speech**
- **So they want to regulate or control it**
- **“Internet governance”**

Policy-Legal-Regulatory Ecosystem



Tony Rutkowski, Verisign, ITU NGN workshop, March 2006

Ten P's of Cyber-policy

Privacy

Piracy

Pornography

Protection

Pricing

Policing

Psychology

Procurement

Payments

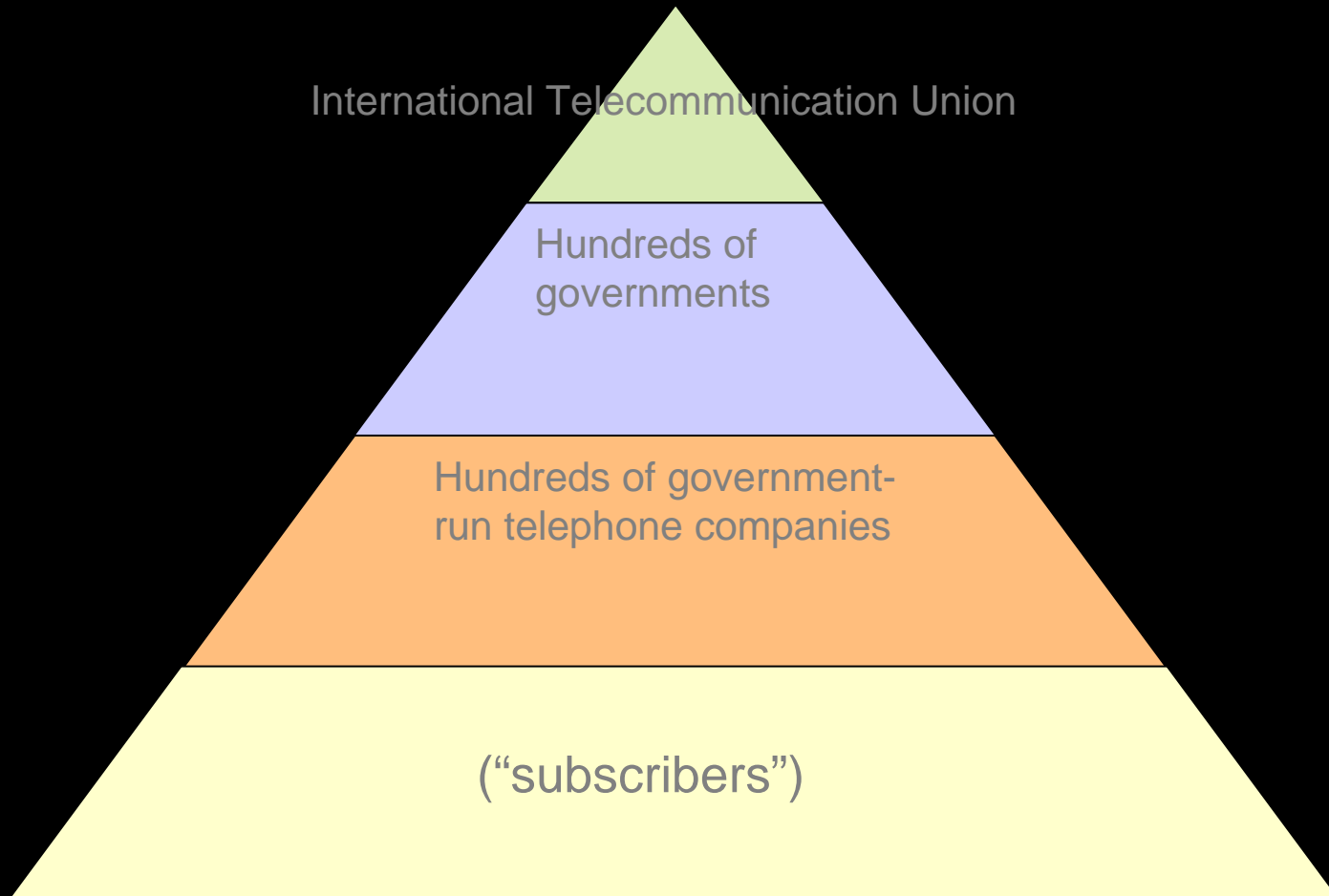
Protectionism

50 Things I learned in Washington

LESSON #17

**There is nothing more dangerous than
an old model applied to a new medium**

“Phone governance” (1970): Who made choices about phone service?



Who makes choices about the Net?

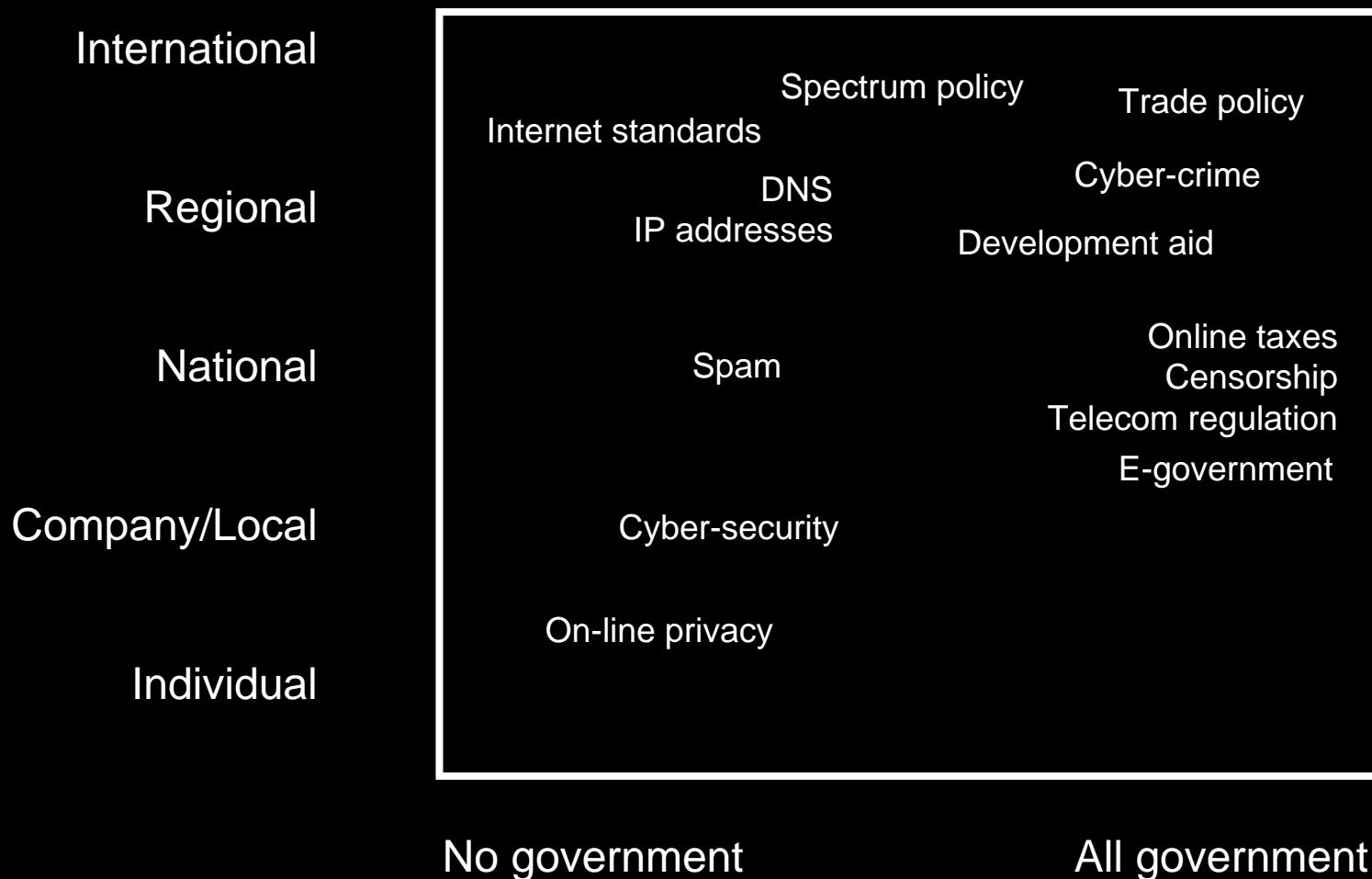
Millions of Internet users

Thousands of IT vendors,
network providers, ISPs...

Hundreds of governments
and national consortia

Dozens of intergovernmental organizations,
standards bodies, and international NGOs

Locus of Decision-making



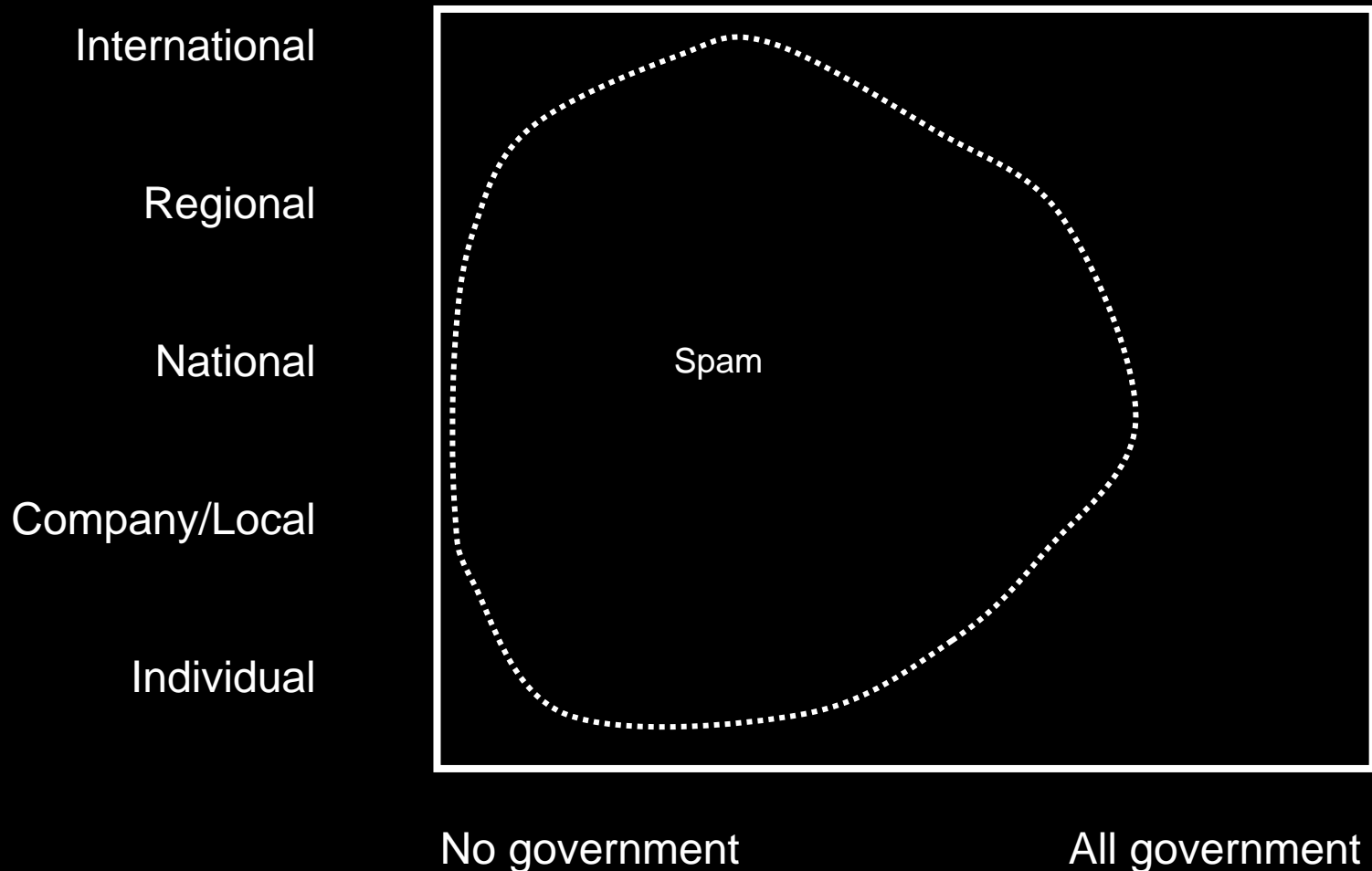
50 Things I learned in Washington

LESSON #25

**Politicians look for one SOLUTION.
Techies look for SOLUTIONS.**

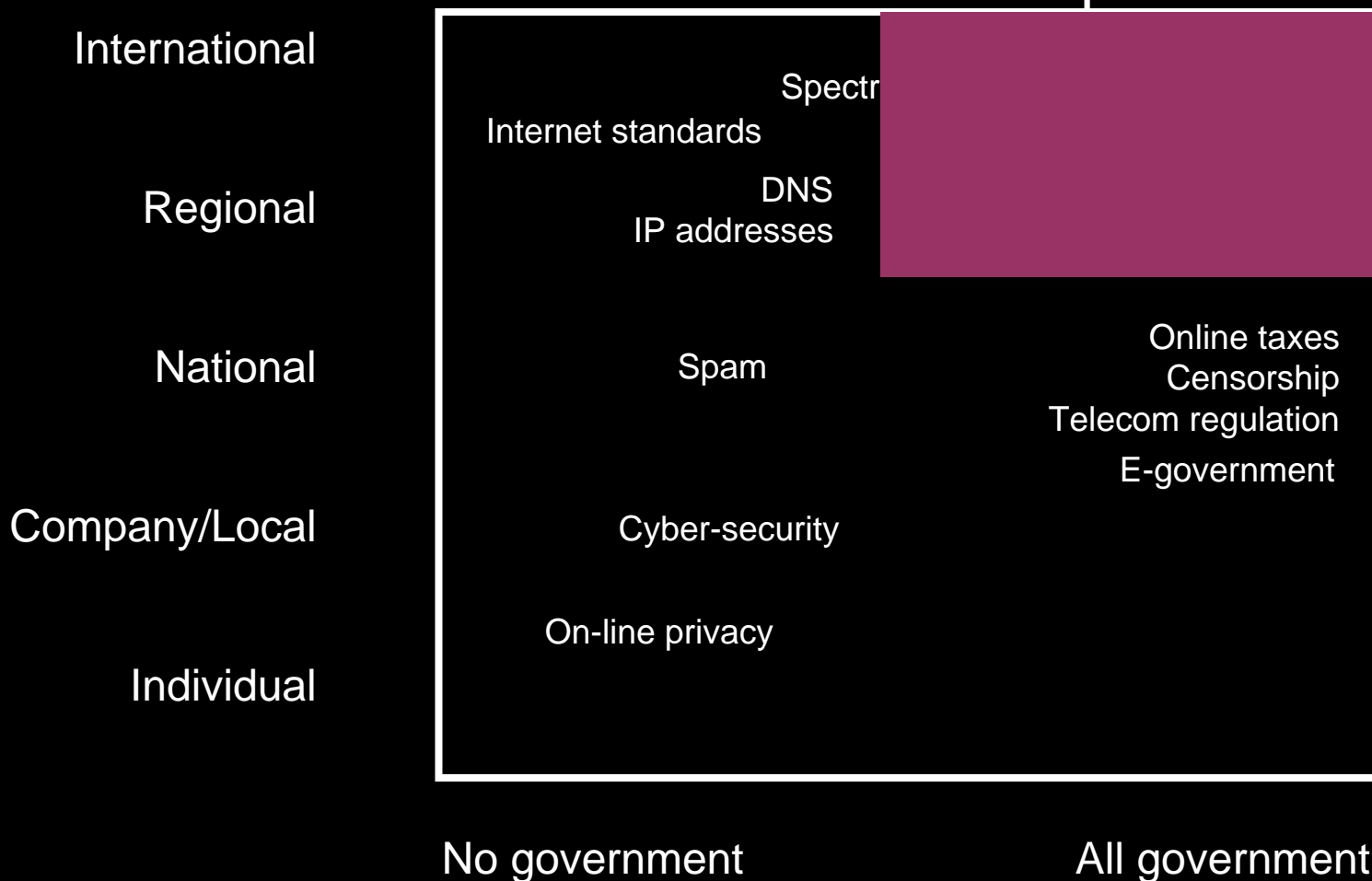
Locus of Decision-making

(Many different decisions in many different places)

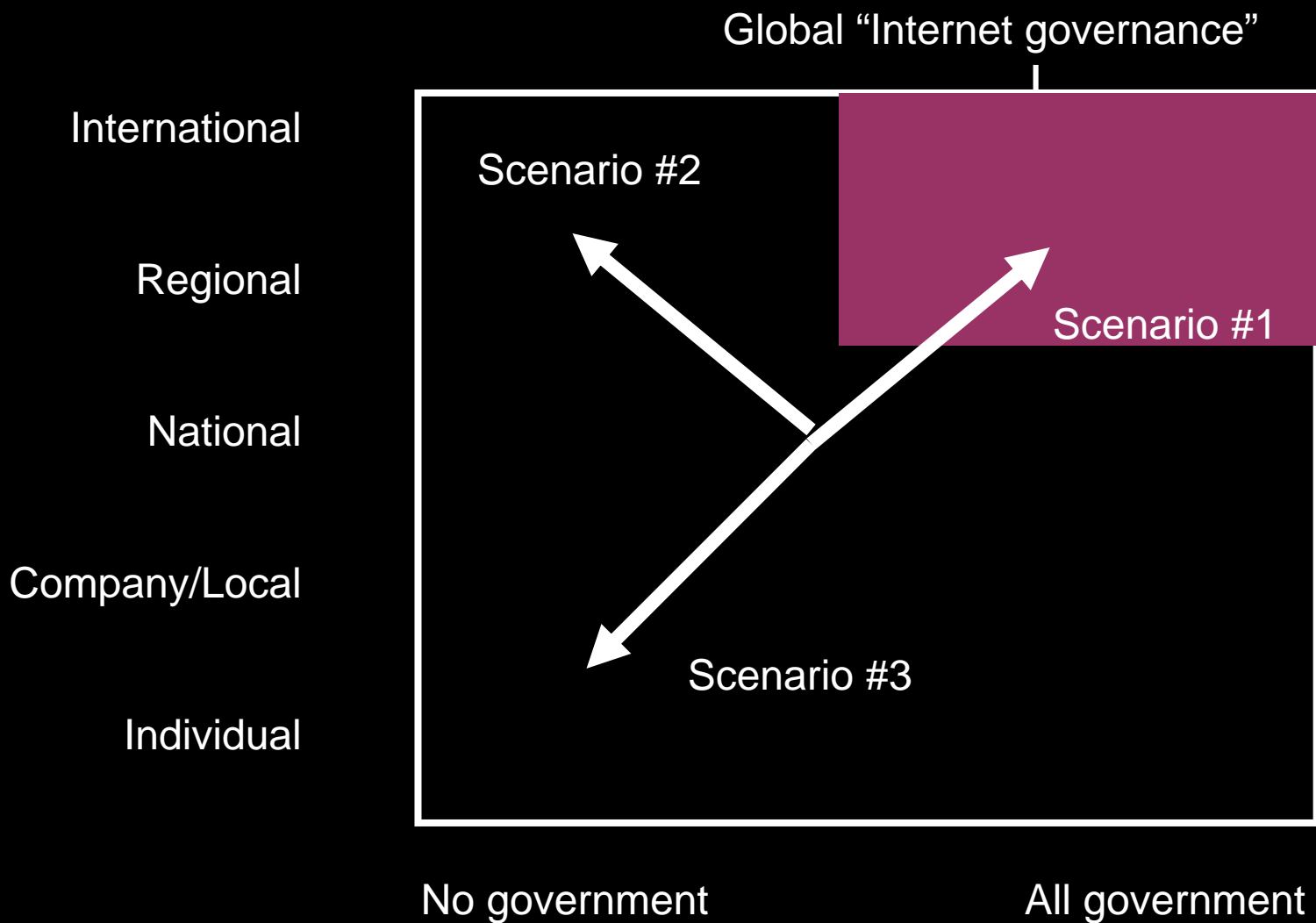


Locus of Decision-making

Where "Internet governance" is needed



Where are we headed?



Conclusions

- **The Internet Revolution is less than 15% complete**
- **We are seeing a profound paradigm shift:**
 - ❖ **As important as the World Wide Web was in 1995**
 - ❖ **New approaches to business and policy are essential**
- **The Domain Name System will be less important as new applications and new ways to locate online resources online.**
- **When in doubt, empower the user!**