



**The Next American Upgrade:**  
The Role of Higher Education in  
Providing the United States a  
Strategic Bandwidth Advantage

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Presentation to the New England Board of Higher Education

Boston, Massachusetts

March 2, 2012

# AGENDA

Introduction: The what and why of a strategic bandwidth advantage



Background and Status of Gig.U



Steps Moving Forward

# **INTRODUCTION: THE WHAT AND WHY OF A STRATEGIC BANDWIDTH ADVANTAGE**

## A Strategic Bandwidth Advantage

What does  
a Farmer  
and a  
Doctor  
need?



25 years ago

Dial tone

Dial Tone

Today

Mobile Data

Enough Bandwidth for  
real time collaboration  
with an MRI

## A Strategic Bandwidth Advantage



**A region or country has a strategic bandwidth advantage when its residents have the appropriate bandwidth to most effectively collaborate with others in improving economic growth and social welfare, with a functionality and at a price superior to those in other regions or countries**

# Does America need a strategic bandwidth advantage? A question in three parts



Ay, there's the rub...



# Question 1: Does America need a strategic bandwidth advantage?

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- Impact of bandwidth on productivity
- Other countries are not waiting
- The coming data deluge



# New inputs drive economic growth

1800's

- Access to new forms of power (steam engines)
- Access to new forms of transportation (canals, then trains)

1900's

- Access to new forms of power (electricity)
- Access to new forms of transportation (cars, trucks and planes)

2000's

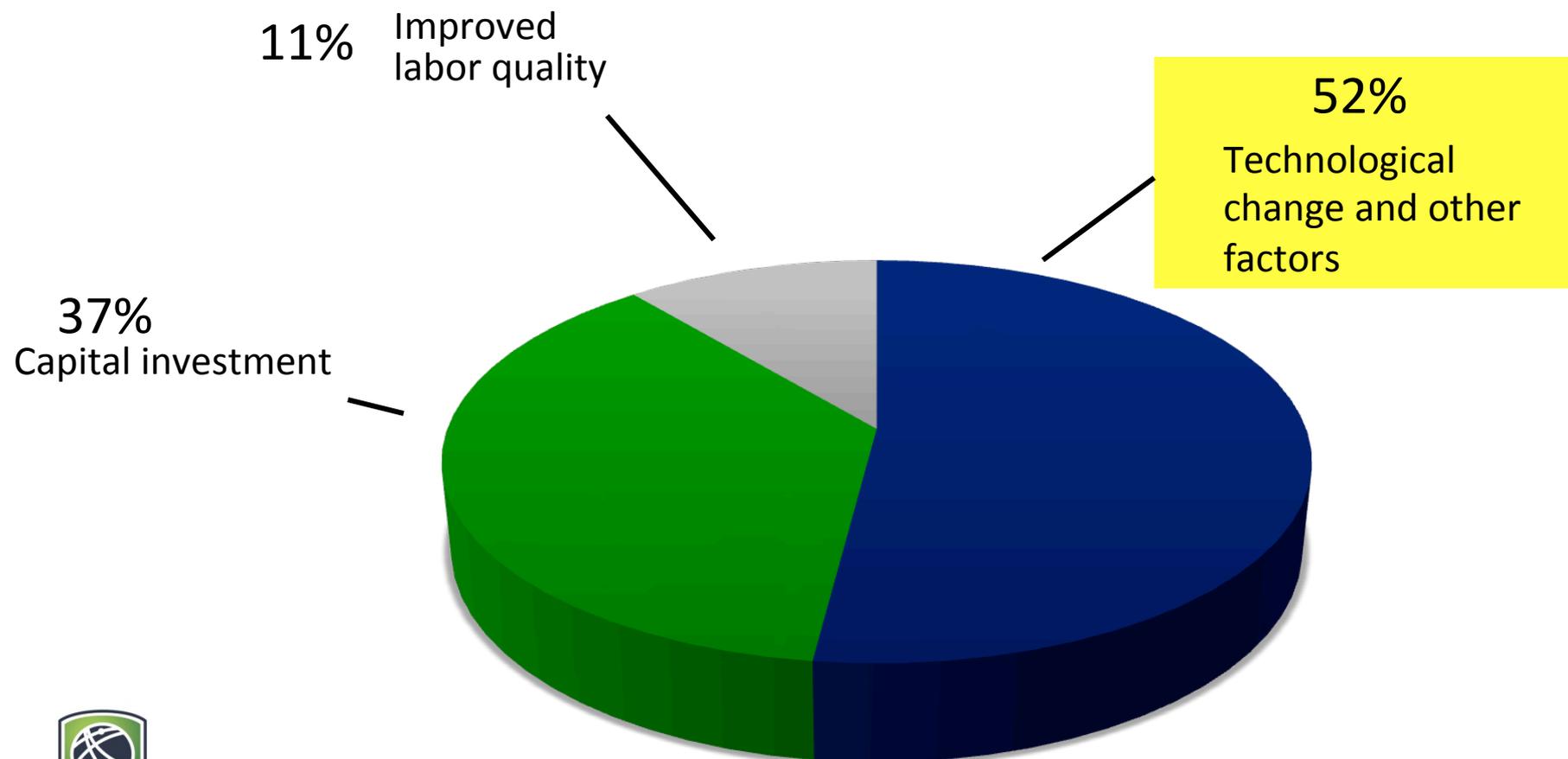
- Access to computing power
- Access to data storage
- Access to digital communications

Fastest growing parts of the economy are those that best use new inputs



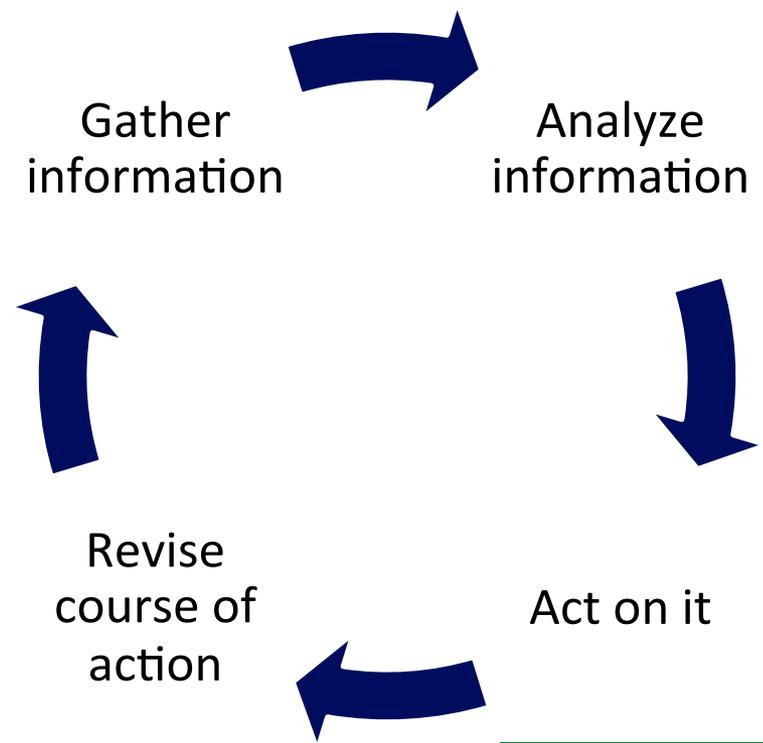
# Such changes are key to productivity growth

## Contribution to long-term productivity growth



# Rebooting the economy requires innovation, for which broadband platform is key

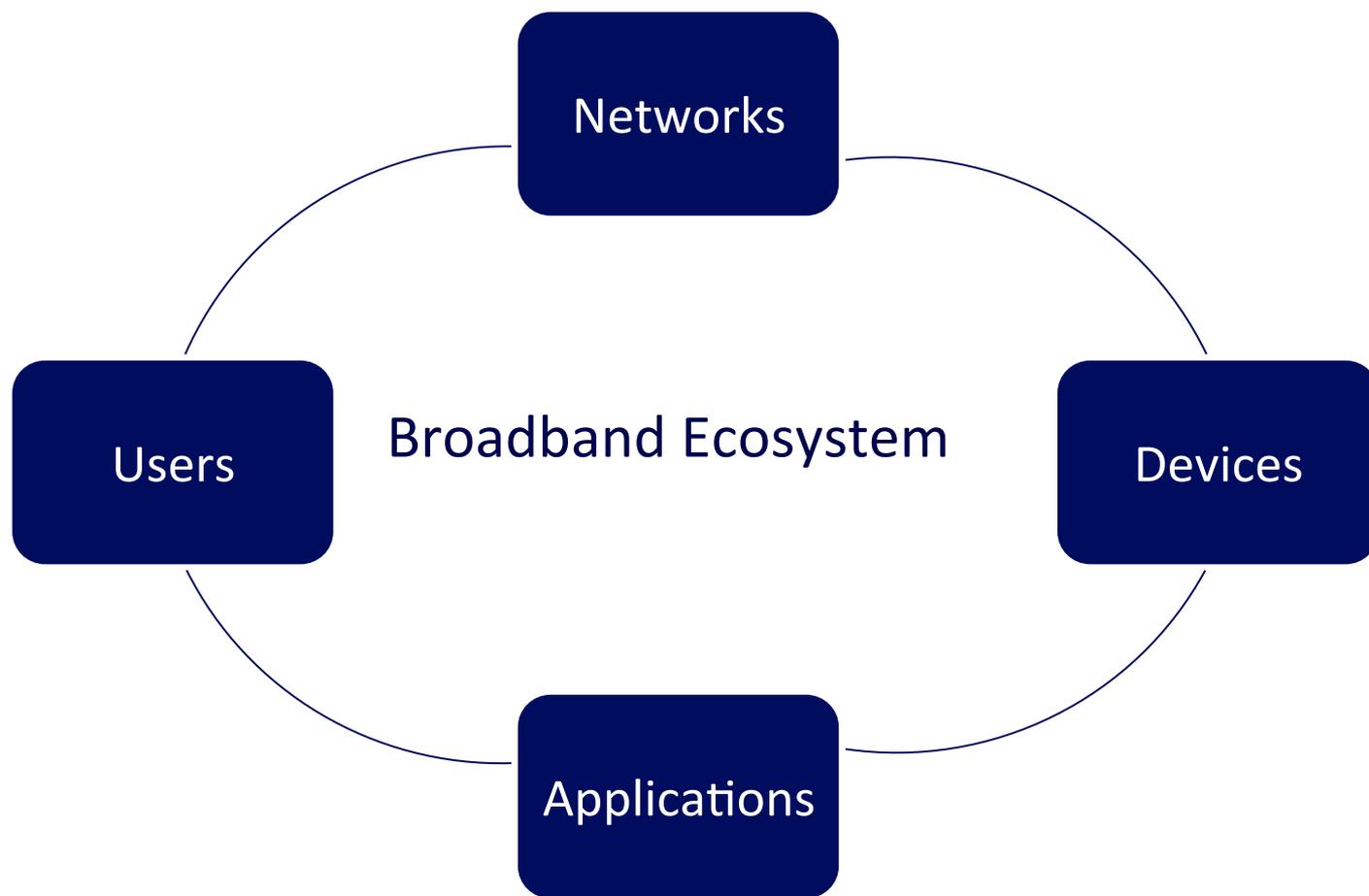
The biggest leaps in growth are driven by meta-ideas...



Improving the exchange of information improves the conditions for innovation.



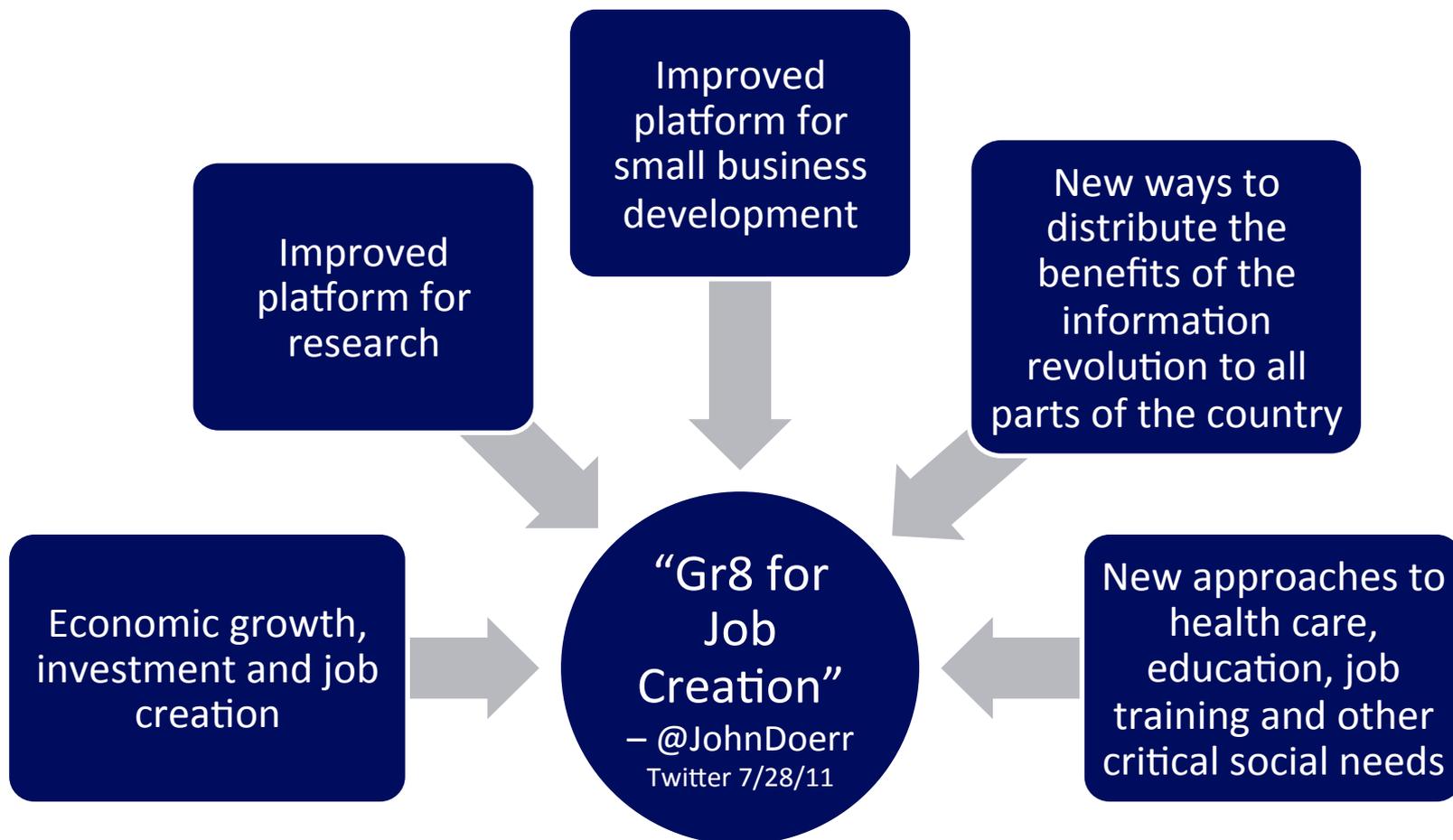
# Broadband is the common platform for knowledge exchange



Improvements in each element of the ecosystem drive improvements in others in a virtuous cycle.



# The benefits of world leading networks



# Other countries are not waiting

Other countries investing in Gigabit connectivity through policy driven actions . . .

## ***“Home Internet May Get Even Faster in South Korea”***

By Mark McDonald, February 21, 2011

South Korea already claims the world’s fastest Internet connections — the fastest globally by far — but that is hardly good enough for the government here.

By the end of 2012, South Korea intends to connect every home in the country to the Internet at one gigabit per second. That would be a tenfold increase from the already blazing national standard and more than 200 times as fast as the average household setup in the United States.

## ***“Cheap, Ultrafast Broadband? Hong Kong Has It”***

By Randall Stross, March 5, 2011

Hong Kong residents can enjoy astoundingly fast broadband at an astoundingly low price. It became available last year, when a scrappy company called Hong Kong Broadband Network introduced a new option for its fiber-to-the-home service: a speed of 1,000 megabits a second--known as a “gig”-- for less than \$26 a month. In the United States, we don’t have anything close to that. But we could. And we should.

. . . Others with Gigabit networks include Japan, Sweden, Spain, Turkey



# Other international efforts

England has different strategies to build faster broadband...

## ***“Osborne announces 10 ‘super connected cities’”***

By Maijia Palmer, November 30, 2011

The chancellor has pledged an additional £100m fund to help create 10 “super-connected” cities across the UK, which will have broadband speeds of 80 to 100 megabits a second...“It means creating new superfast digital networks for companies across our country. These do not exist today. ***See what countries like China or Brazil are building, and you’ll also see why we risk falling behind the rest of the world,***” Mr Osborne said.

## ***“London’s CityFibre to build a \$800 million gigabit network”***

By Om Malik, November 3, 2011

When it comes to fiber-based broadband, the U.K. lags behind its European neighbors, which have been aggressive in rolling out really fast networks. Many critics blame British Telecom dragging its feet mostly because it doesn’t have any real competition.



# Research facilities are moving to 100 Gbps connections

***“National LambdaRail provides 100 Gigabit Connection for NOAA at Supercomputing 2011. Next Generation Research Capabilities Will Be Demonstrated Using Cisco Technology and NLR Transport Network”***

By Bizjournals.com, November 7, 2011

***“Research institute deploys 100 Gigabit Ethernet from core to closet”***

By Shamus McGillicuddy, November 28, 2011



# We know there are bottlenecks ahead...

## ***“DNA Sequencing Caught in Deluge of Data”***

By Andrew Pollack, New York Times, November 30, 2011

BGI, based in China, is the world’s largest genomics research institute, with 167 DNA sequencers producing the equivalent of 2,000 human genomes a day.

BGI churns out so much data that it often cannot transmit its results to clients or collaborators over the Internet or other communications lines because that would take weeks. Instead, it sends computer disks containing the data, *via FedEx*.



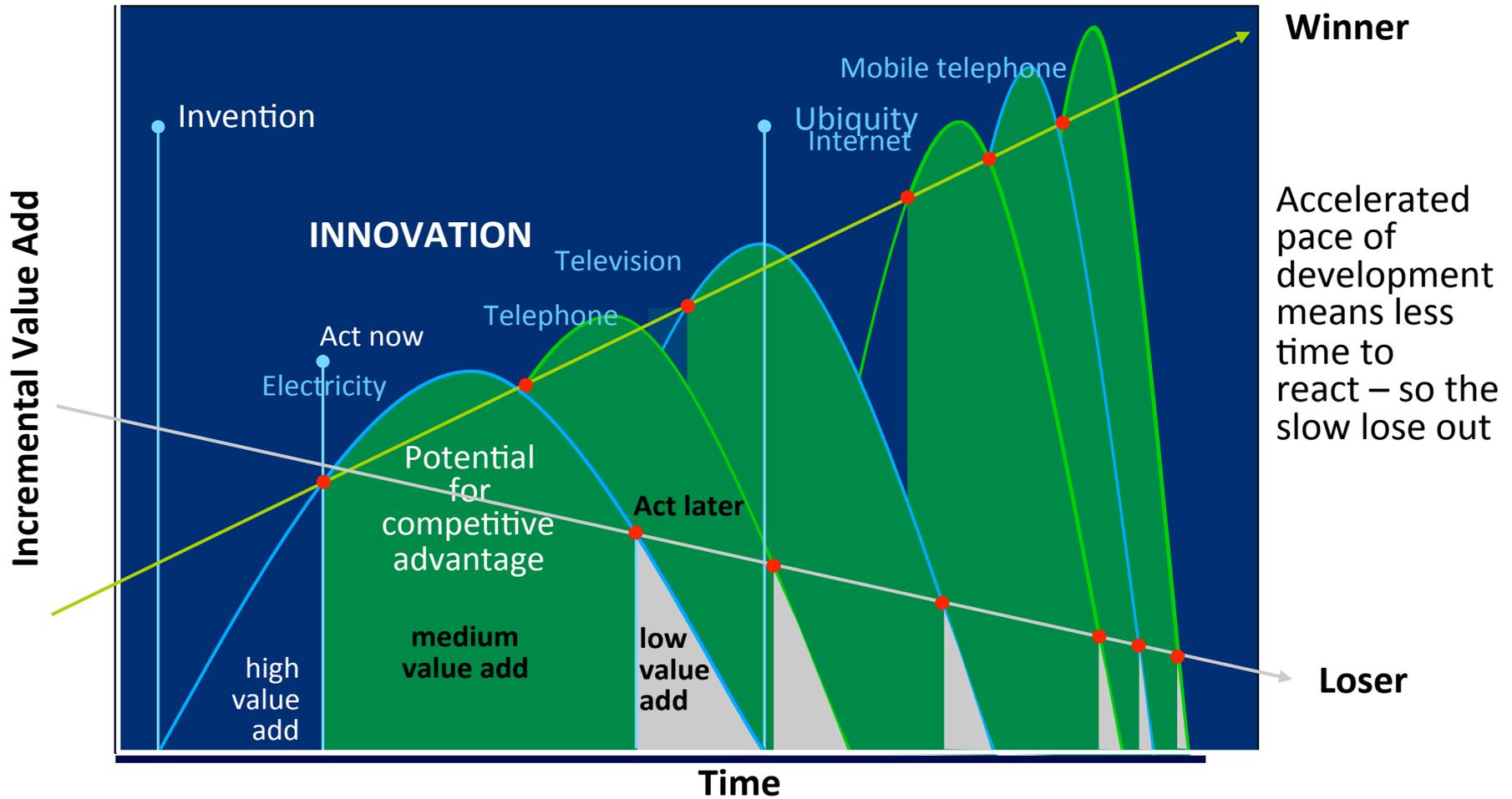
## Question 2: Will current market forces provide one in a timely manner?

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- Timing matters
- What the current market is telling us about the next upgrade



# Early action leads to leadership



# Internet Speeds and Costs Around the World

Top 20 Nations in ITIF Broadband Rankings

ITIF RANK

AVERAGE CONNECTION SPEED

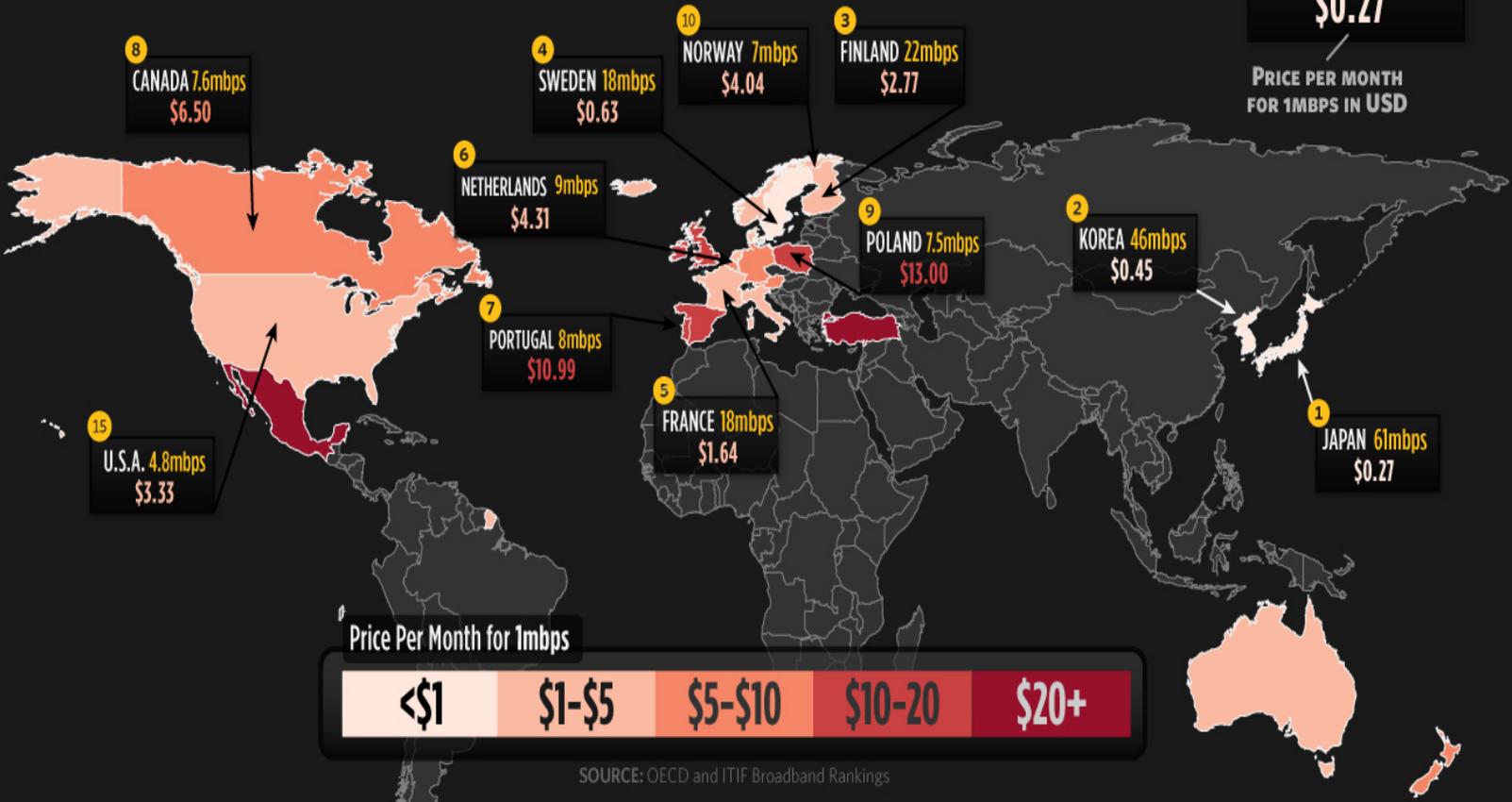
NATION

**1**

**JAPAN 61mbps**

**\$0.27**

PRICE PER MONTH FOR 1MBPS IN USD



SOURCE: OECD and ITIF Broadband Rankings

Second, market forces are not providing critical mass of world leading networks in U.S.

Verizon has stopped the FiOS Build



**Verizon Deal With Cable TV  
Could Be Game-Changer**

Dec 3, 2011 8:40 AM CST

*...we will accelerate our efforts to improve our overall growth profile. We will do that by looking at opportunities to either divest or restructure low performing and nonstrategic assets.*

AT&T Chairman and CEO Randall Stephenson, January 26, 2012

And AT&T is  
looking to sell  
wire line assets



# It is not the fault of the companies

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It is a simple matter of math:

For the investor in the networks, the math usually doesn't work



# The basic equations

Benefits accruing to:

- Investor in the network
- Content and applications
- Equipment and devices
- Local community
- The region
- The country



*Total  
benefits*  
of  
high speed  
networks

But the only benefits that matter for the investment case are the benefits that matter to the investor...



# The returns do not justify the investment

For the investor, the equation usually looks like this:

$$C + O > (r)R + SB + (-CL)$$

C – Capital Expenditures

O– Operating Expenditures

r – Risk

R- Revenues

SB- System Benefits

*(Benefits that drive increased revenues outside the communities where the new or incremental investments are made.)*

CL- Losses due to competition



# Historically, investments are made when this equation is altered

Sector / opportunity	Ecosystem change	CapEx	OpEx	Risk	Revenue	Competitive Losses
Telco	Grant of monopoly			Lower	Raise	
Cable	Grant of monopoly, pole attachment law, compulsory broadcast license			Lower	Raise	
Rural areas	USF	Lower	Lower			
Wireless	Limited # of licenses			Lower		
DBS	Limited # of licenses, program access			Lower	Raise	
Broadband upgrade	Deregulation, two wire policy				Raise	Raise
Wireless upgrade	More licenses, lowered TAC, oversight of siting authority		Lower			Raise



# Today, the equation is worse for broadband in the United States

$$C + O > (r)(.5)R + SB + (-CL)$$



Revenues for underlying wired infrastructure split between two facilities, creating greater risk for long-term financing, but competitive forces not strong enough to compel investment



# And there's the chicken and egg economics

$$C + O > (r)R + SB + (-CL)$$

R won't increase until new applications develop, but the new applications won't develop until new network investments are made.



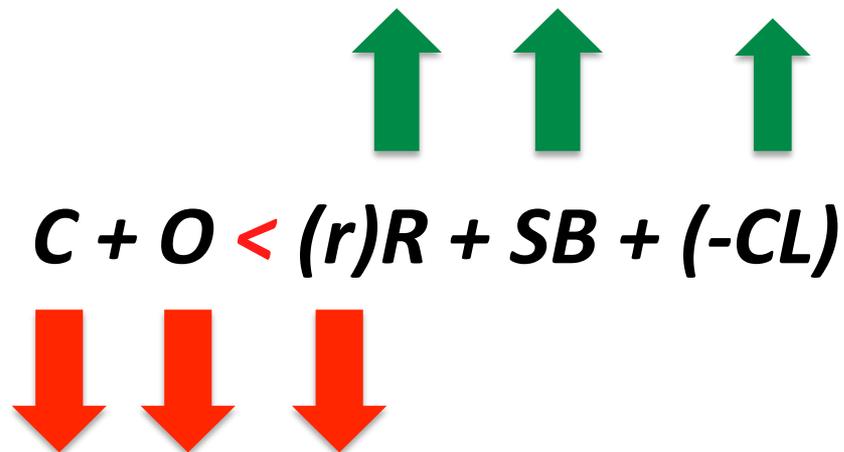
## Question 3: What is the path to achieve an upgrade?

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- Key elements
- Biggest barrier



We need to change the math

$$C + O < (r)R + SB + (-CL)$$


But how do we do that?



# The only benefits that matter for the investment are benefits to the investor

- Investor in the network
- Content and applications
- Equipment and devices
- Local community
- The region
- The country



Analysis of expected benefit determines investment



Not relevant to investment decision

Other beneficiaries, particularly local communities can dramatically affect the math of the provider



# There are paths for communities to improve investment math

Communities have developed creative partnerships to reducing OpEx, CapEx while raising expected revenues.

***“McGinn: UW, Seattle want great ideas for unused fiber”***

By Todd Bishop, GeekWire, November 14, 2011

***“How Kansas City, Kan., Won Over Google”***

By Jessica Mulholland, Governing, April 19, 2011



To move ahead, we should focus on communities where math is easiest

## Advantages of University-communities

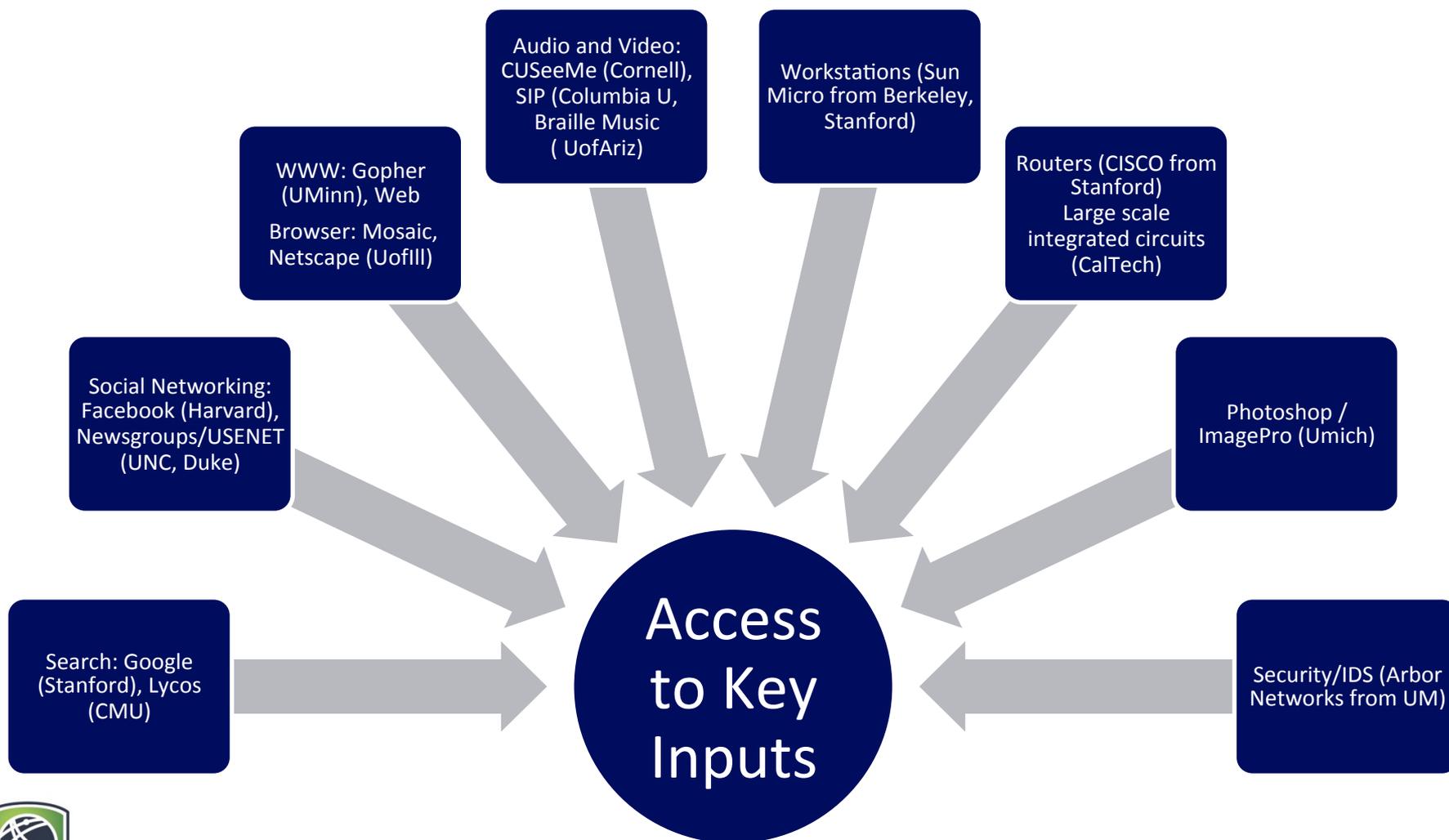
Demand for  
Bandwidth  
=  
**Greatest**

Cost of  
Deployment  
=  
**Least**

Positive Impact  
of Network  
Access Due to  
Innovation  
Culture and First  
Major Use Case  
(Health Care)  
=  
**Greatest**



# University communities are the birthplace of many network-based innovations



# The next step is to organize community effort to change the math

## Reduce Cap Ex

- Build to Demand Model
- Access to ROWs, Facilities
- Reduce Regulatory Time

## Reduce Op Ex

- Access Payments
- Reduce Ongoing Regulatory Costs
- Utilize Existing Billing Platforms

## Reduce Risk

- Build to Demand
- Standardize Functions Across Areas, Vendors

## Increase Revenues

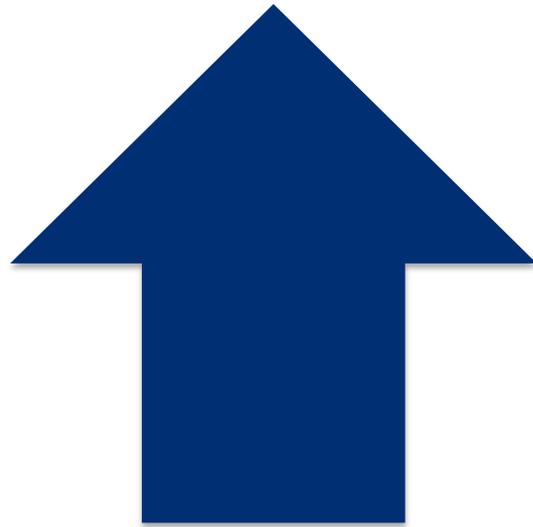
- Demand Acceleration
- Marketing Platform
- New Services

## Increase Ecosystem Benefits

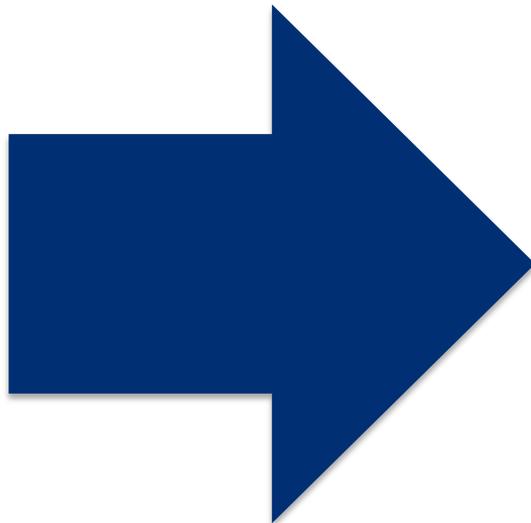
- Distributed Innovation
- Seeding Long-Term Growth



# Asymmetry is key to changing the math in local policy



Large out of pocket dollar benefits for provider



Very small out of pocket costs to community institutions



States can also play a role in changing the math

Hawaii

A Gigabit to Anchors Initiative

Illinois

Gigabit Incentive Fund

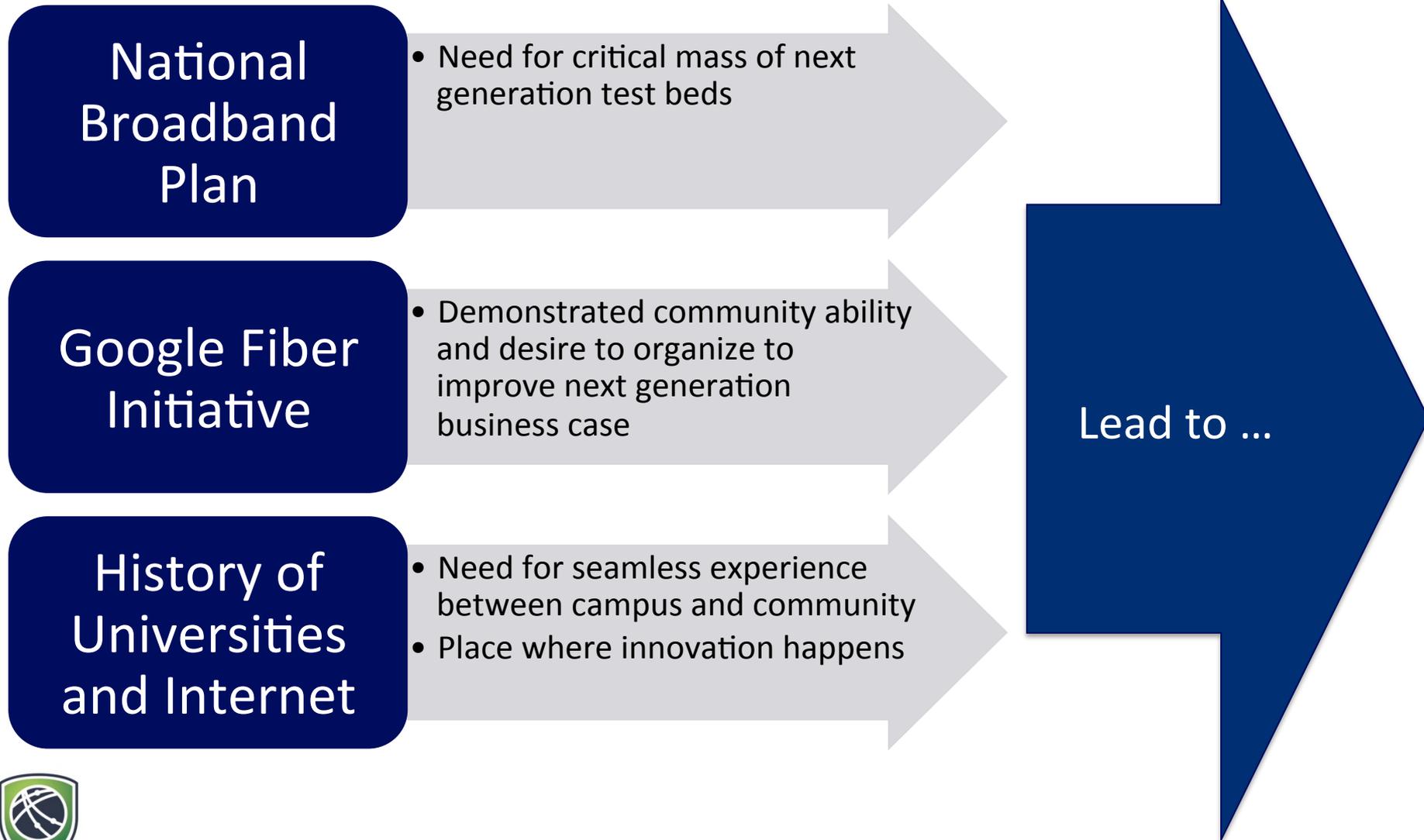
Ohio

10x increase in state research backbone



# **BACKGROUND AND STATUS OF GIG.U**

# Background for Gig.U



# The University Community Next Generation Innovation Project

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Over the spring and summer of 2011, 37 leading research universities, working in partnership with their local communities, formed Gig.U

## Our Mission

Accelerate the deployment of world-leading, next generation networks in the United States

## Our Strategy

Use university communities as test beds for the acceleration of deployment of ultra-high speed network services and applications



# Gig.U Member Institutions

For new test-beds to foster experimentation and innovation, it makes sense to work with communities that have strong traditions of experimentation and innovation



# Efforts to date

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# Goals of the RFI Process

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- Promote the deployment of next-generation networks and services across member communities to stimulate economic development
- Identify creative approaches to design, operate and finance self-sustaining next-generation networks for member communities while evaluating the trade-offs between these different approaches
- Gain an understanding of how differences between member communities influence the level of private sector interest in working with any individual community
- Consider ways in which multiple Project communities can work together beyond the RFI process to improve the private sector business case for next-generation networks and services



# Interest in working with universities and communities to break traditional molds

Type of Respondent	Number
Operators & service providers	24
Network equipment	14
Consultant, content & services, user equipment	8
Research & education network	2
Other	9



# Gig.U's guiding premises were validated by the RFI process

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Premise 1: University communities are incubators of networked-based innovations

Validated: number and quality of responses

Premise 2: The current market will not produce world-leading networks in the near term

Validated: content of responses



# Important themes across results

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- Interest in working with universities and communities to break traditional molds
- Investment analysis depends on market advantages, assets
- Need for more community information, use cases and involvement
- Value in Gig.U as a platform for new technologies
- Importance of scale, scope and well defined organization



# Importance of scale, scope and well defined organization

As consumers

- Economies of scale
- Influence on the value chain

As information holders

- Lowered transaction costs through standardized operations

As a learning organization

- Shared experiences
- Best practices

As a voice

- Outreach to vendors
- Community engagement



Clear organization is critical for success

Collaboration, done right, is effective



# Gig.U in a Single Slide

Organize those who benefit, but are not part of the investment equation.....

Content and applications  
 Equipment and devices  
 Local community (*particularly those with the best economics and innovative cultures*)  
 The region/state  
 The country

...to change the math

$$C + O < (r)R + SB + (-CL)$$



# Which, as the Google fiber project demonstrates, is often within the power of the local community

Sector / opportunity	Ecosystem change	CapEx	OpEx	Risk	Revenue	System Benefits
Google	Deals with City, State, and Utilities	Lower	Lower	Lower	Raise	Raise



# STEPS MOVING FORWARD

# The path ahead

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Presentation to members: 1/23/12

Community Consultations

Vendor Meeting: March 20-21

Begin Phase Two



# Multiple Potential Upgrade Paths

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Multi-vendor Competition

Local vendor partnership

Utilization of Existing Assets (Utilities)

Consortium Pilots

High Bandwidth Health Care Model

Open Business Models

Innovation Hub

White Spaces



# White Spaces

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## New Wireless Technology

- Dynamic Access to Spectrum
- Trials Underway

## Strongest Potential for Specific Communities

- Underserved Areas
- High Demand Communities
- Few TV Broadcasters/Lots of Spectrum



# Innovation Hub

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## Existing Centers of Excellence

- Areas of Greatest Strength
- Areas most likely to benefit from advent of Big Data Revolution

## Mapping Exercise

- Areas of business and residential concentration
- Areas of network assets

## Partnership Building

- Typical exercise in organizing community to attract economic development asset
- Non-typical exercise in that there are multiple technological paths to achieving success



# What Now on the Local Level?

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- Every Gig.U community has new options
  - Are any appealing?
  - What more do we need to learn?
- Can your community define its preferences?
  - Networking objectives
  - Procedural/organizational preferences?



# Community and university preferences will define the universe of acceptable options

## Architecture

Reference architecture & operating model

## Ownership

Municipal, private or other

## Geography

Total 1 sq. block or to demand in 10 sq. miles

## Construction

Micro-trenching, sewer systems, etc.

## Incentives

Streamlined permitting, rights of way

## Use cases

Health information exchange, community services

## Services

Data only, triple play, wireless, etc.

## Technologies

Desire to focus on white spaces, lasers

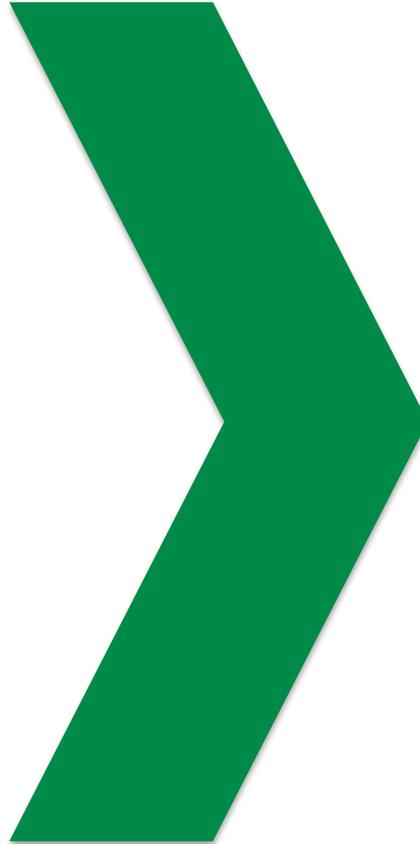


# What Now on A National Level?

National  
Efforts to  
Assist Local  
Organizing

National  
Messaging

National  
Assistance with  
Transactions



- Phase Two of Gig.U
- To be Resolved at and Immediately After March Meeting



In closing, the world is wondering.....

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## 所美国大学筹备各自建立1Gbps网络社区“GigU”

*Headline from Chinese Newspaper day after Gig.U launch*

