Federal Communications Commission

BROADBAND.GOV
NATIONAL BROADBAND PLAN

September Commission Meeting

September 29, 2009

141 days until Plan is due

What we hope to accomplish today

- Describe current/near-term state of broadband in the United States
- Enable Commissioner/public feedback for mid-course review
- Lay foundation for gap analysis and solution sets

Outline of presentations

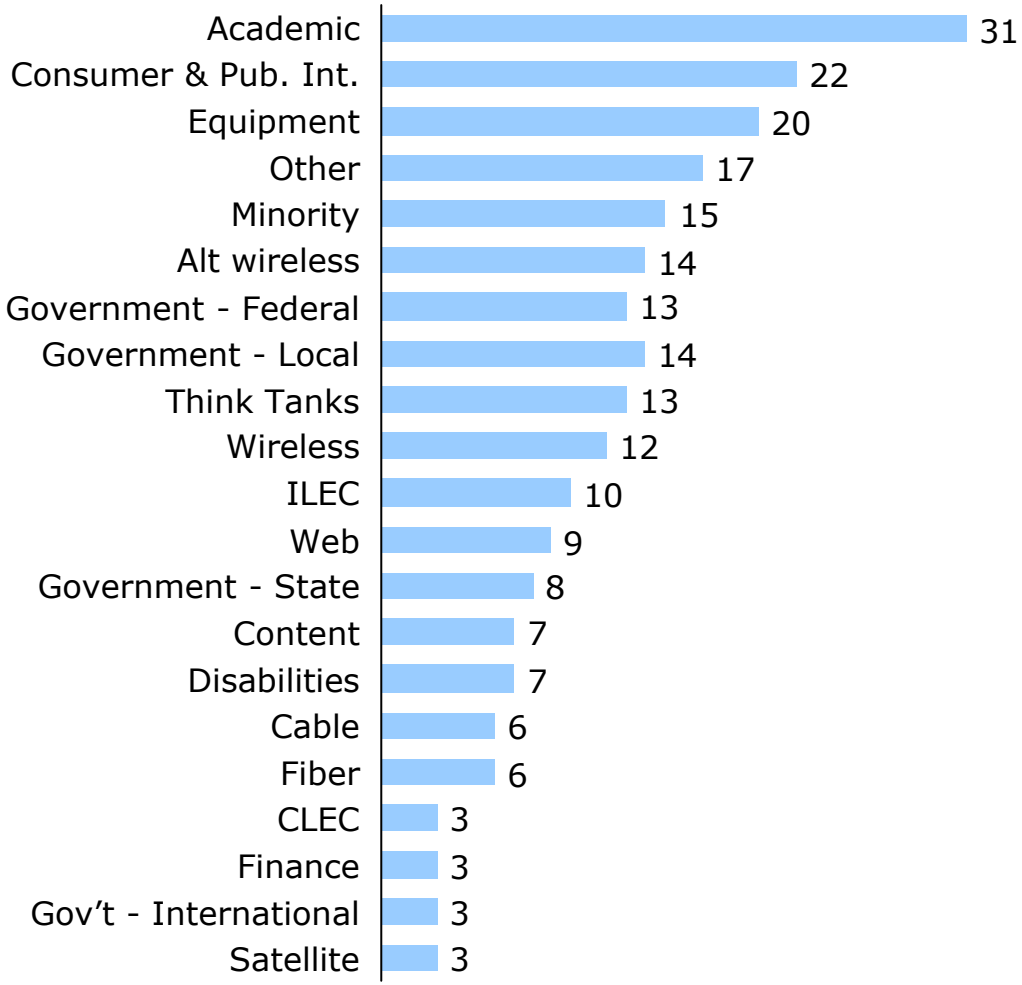
1. Introduction
2. Framework for the National Broadband Plan
3. A Few Highlights
4. Applications
5. Deployment and Future Deployment Plans
6. Lessons from International Studies
7. Spectrum
8. Implications for the PSTN
9. *Break*
10. Adoption—the Cost of Digital Exclusion and Opportunities for Acceleration
11. Introduction to National Purposes
12. Health Care
13. Energy
14. Education
15. Civic Engagement/ Government Performance
16. Innovation and Investment
17. Disabilities
18. Consumers
19. Economic Opportunity
20. Public Safety and Cyber Security
21. Concluding Remarks

Challenges for today's meeting: Distilling the record

Workshops/hearings
- To date: 25
- Scheduled: 4
- Witnesses: 236

The Written Record
- Response to NOI
  - 20,453 records/entries
  - 36,882 pages
- Response to public notices
  - 9 public notices
  - 154 total responses
  - 986 pages
- Blog responses
  - 40 posts
  - 340 comments

Number of hearing witnesses, by organization



Challenges for today's meeting: Historic approach to data

- Good policymaking requires consistently updated data
- Many problems with existing broadband data
- Multiple government agencies conduct surveys for economic indicators
  - Adding broadband questions inexpensive and valuable

Framework for the National Broadband Plan

Today's broadband in America: Workshops told a good news/bad news story

	Good News	Bad News
Education	• 71% of teens say Internet has been primary source for recent school project	• Students not online at growing disadvantage
Jobs	• Most job searches online • Application process increasingly online • Online training improving efficiency	• Those offline find it increasingly harder to search, train, and apply for jobs
Small Business	• Broadband enables faster acceleration, small business to function like large enterprises	• Many small businesses don't have connectivity sufficient for new opportunities, like cloud computing
Health Care	• 61% of Americans search for health information online	• Finding medical information without online access limits patients' knowledge, choices and care
Economic Development	• Many examples of communities using connectivity to lure new business investment	• Current broadband access in many places insufficient to attract new investment
Consumer Welfare	• Broadband-enabling consumer savings and improved product information	• Offline consumers face knowledge and cost gap

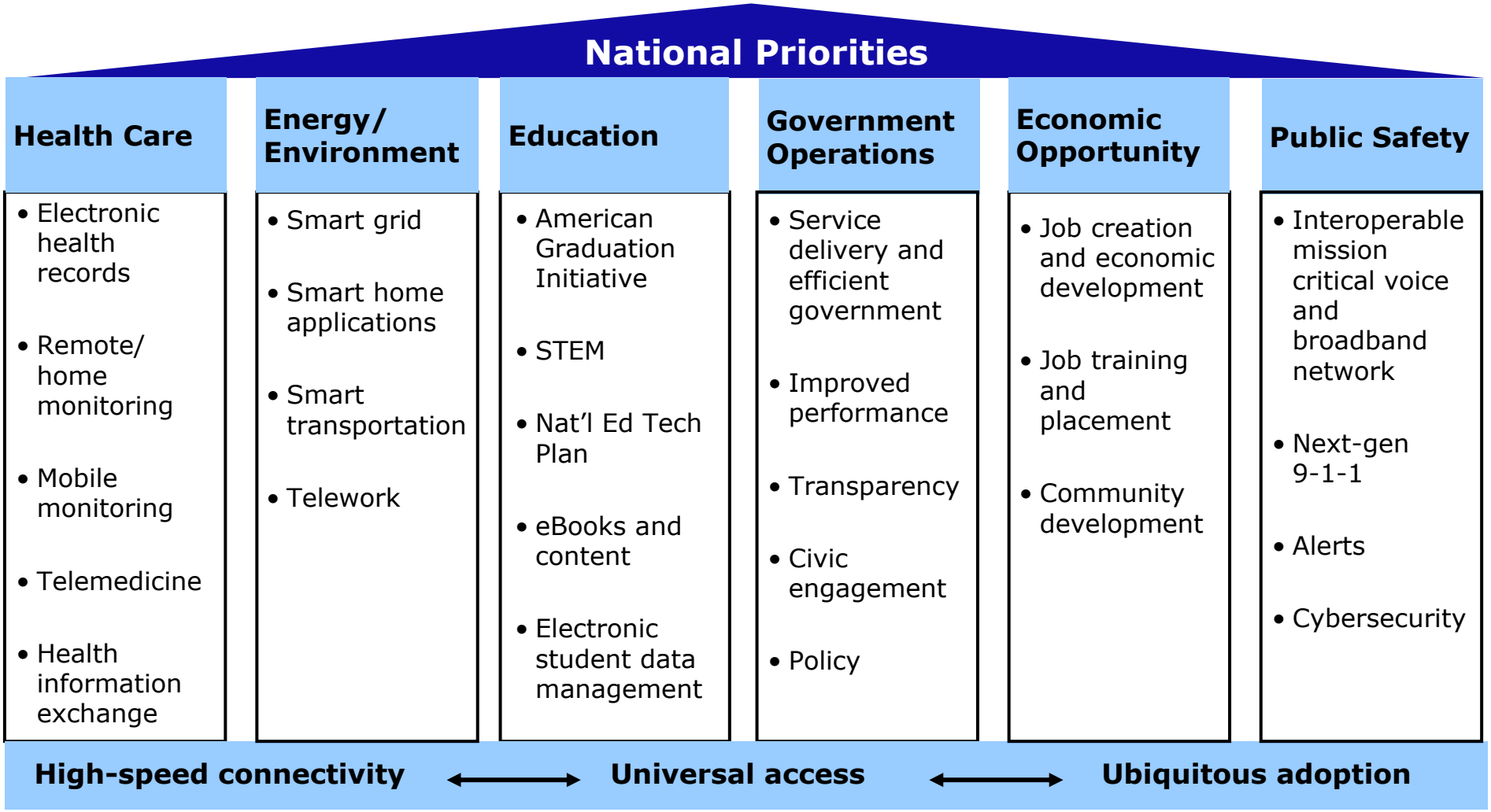
Vision: High-performance America

- For individuals: a platform for education, training, and other tools to create the most opportunity, wherever one lives, whatever one's circumstances

- For businesses: a platform that facilitates innovation, lowers costs, and enables access to markets world-wide

- For governments: a platform that empowers efficiency, responsiveness, and continual improvement on par with advanced enterprises

Broadband enables innovations necessary for the transformation



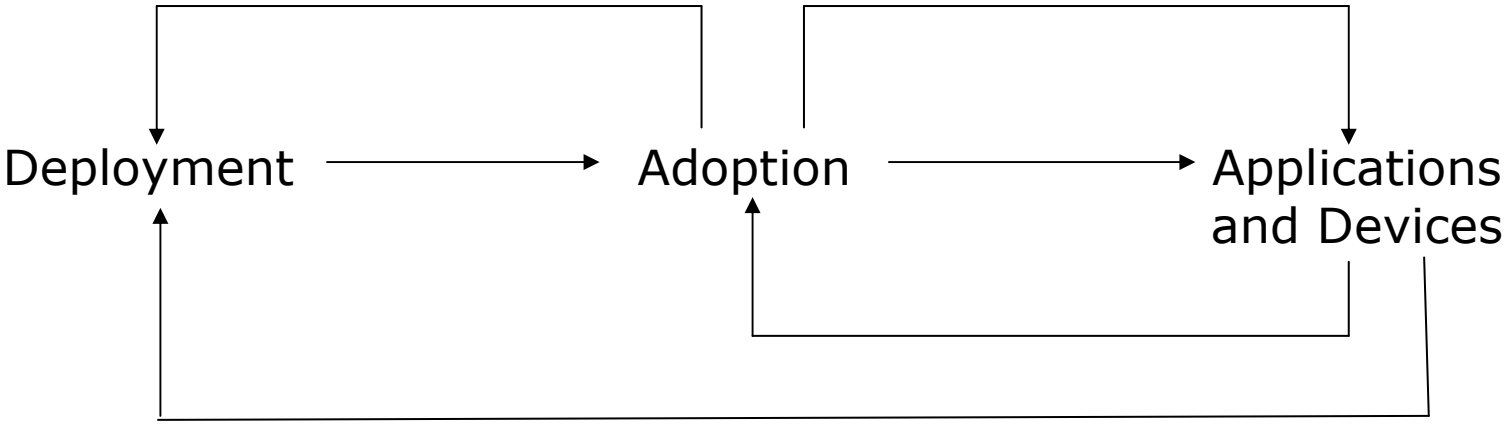
Key concepts in legislation

- Universality
- Affordability and adoption
- Maximum utilization
- Serving national purposes

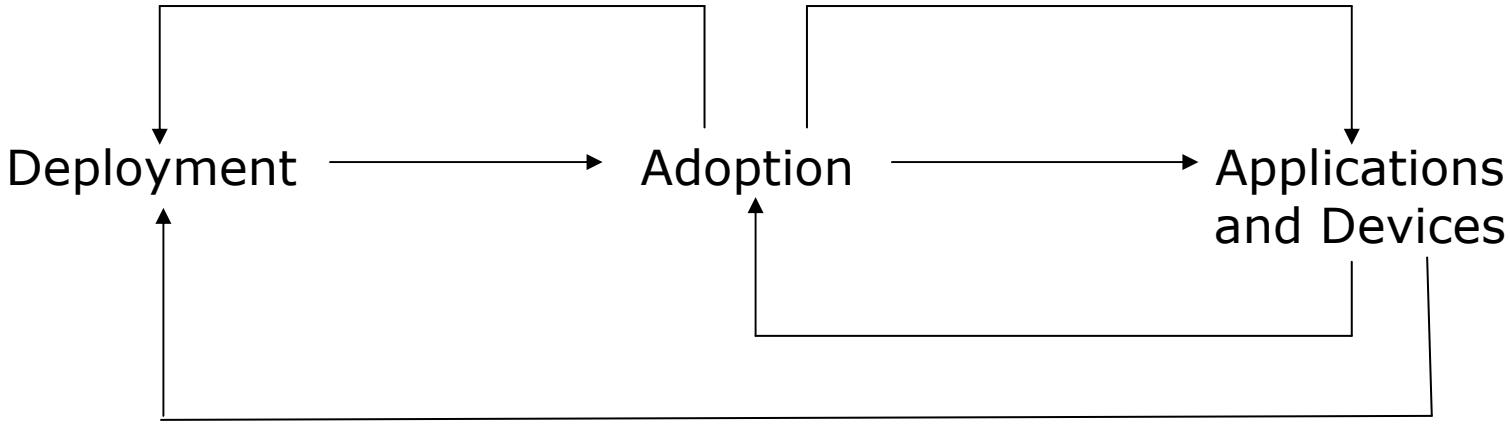
Underlying economic principle: Broadband a key input into the economy

- Broadband likely a general purpose technology
- Broadband a significant part of the economy
- Broadband part of a larger IT framework that has improved productivity

Broadband as foundation for sustained economic success: Accelerating the dynamic of the broadband ecosystem



Broadband as foundation for sustained economic success: Accelerating the dynamic of the broadband ecosystem



- Increase deployment through reduction in cost or increase in supply of key inputs affected by government, such as spectrum, ROWs
- Increase adoption through revenues, such as USF, and targeted programs, such as digital literacy
- Facilitate applications through use of government data, or devices through standard setting process

Examples of government levers

Core challenge for the National Broadband Plan

Current math

Private Investment + USF + BTOP + BIP < Congressional Objectives

Options for rewriting the equation

- Unleash underutilized assets
- Align supply and demand efforts
- Maximize utilization of shared deployment efforts
- Potentially deploy some new assets

Historic examples of unleashing underutilized assets

Carterfone	Unleashed phone network to be a platform for new devices, including modems
Enhanced Service Provider Exception	Unleashed phone network to serve as platform for data network
Program Access Rules	Unleashed a competitive dynamic forcing cable, and then telcos, to upgrade networks
Lowering Wireless to Wired Terminating Access Charges	Unleashed mobile to become mass market product
DTV Transition	Unleashed spectrum for 4G platform
WiFi/Shared Spectrum Orders	Unleashed use of unlicensed spectrum for multiple purposes

A few highlights of what is coming

Applications

1. Wide variation in requirements from current applications, e.g., ~200 kbps to ~10 Mbps
2. Actual maximum download speed about half of advertised at peak hour for median user

Deployment

1. ~5M homes get less than 786 kbps advertised; universalization cost: ~$20Bn
2. ~35M homes get less than 10 Mbps; universalization cost: ~$50Bn
3. One platform capable to meet certain demand scenarios for 50% to 80% of homes
4. Capex and opex drive universalization costs: opex driven by wholesale transport
5. Increasing problems with USF, need reform to fund future network

Adoption

1. Several segments show penetration rates materially below the 63% average
2. Growing social cost: access to jobs, education, government services, information
3. First market research effort focused on non-adopters to design segmented approach

National Purposes

1. Value-creation requires apps, devices, connectivity, processes, and training
2. Health: Broadband enables hosted EHR: 18% savings and higher adoption by doctors
3. Energy: standards and home networking will drive innovation in demand management

Applications

Key Questions to discuss today

- Why is understanding application usage important?
- What applications do Americans use today?
- What network performance do these applications require?
- What network performance do Americans receive today?

Applications drive use of the Internet

- The **utility of the Internet** is an important driver of adoption and usage
  - Applications and bandwidth create a virtuous cycle

- **Applications migrate** from offline to online, from entertainment to utilitarian social benefit
  - The boundary between entertainment and public value applications is artificial

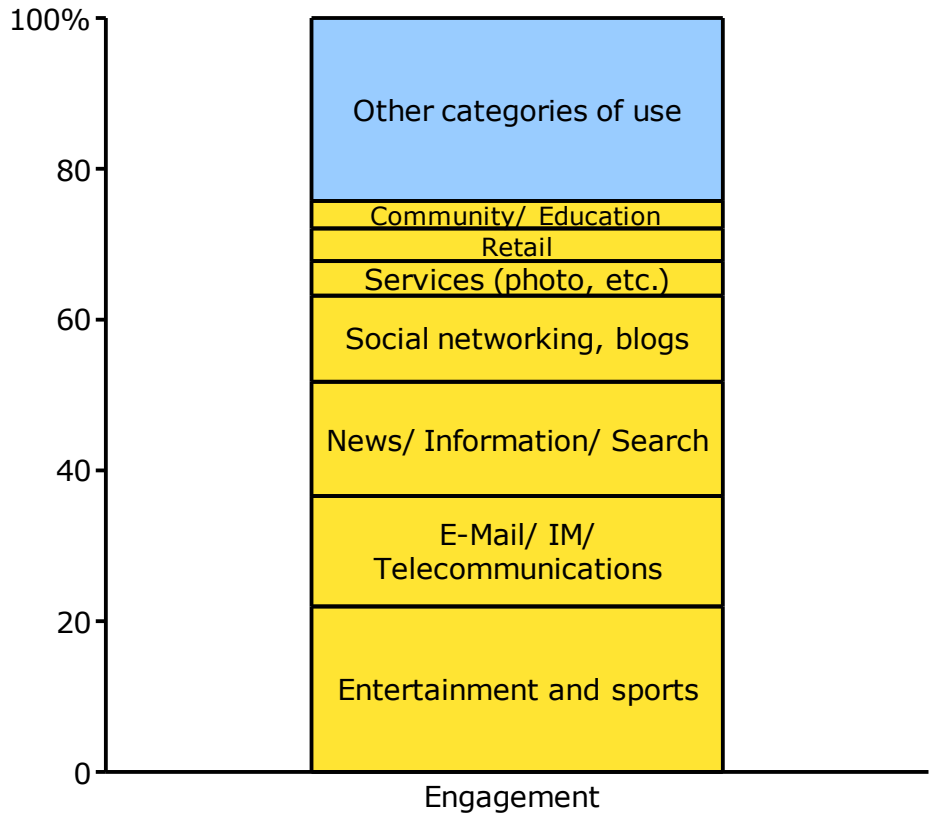
- Different applications require **different performance parameters**

Most application usage today is focused on browsing, communication and entertainment

Web browsing, communication and entertainment are key usage drivers today

Top web sites mirror this focus

Time spent on the internet by application (% of total hours)



Note: "Other" includes long-tail sites with < 100 visitors and traffic from promotional servers
Source: comScore September 2009 panel

Different "use cases" drive application needs (consumer only)

	Utility	Emerging multi-media	Full media	Advanced
Basic email and browsing	Google, CNN, ALEKS, DC DMV, PBS, craigslist			
Advanced browsing, basic download		Library of congress, skype, iTunes, pogo, YouTube		
Advanced Multimedia applications			C-SPAN, Second Life, Sign language video, hulu	
Next-gen and two-way applications				 MIT tele-learning, P2P

New mobile devices are enabling convergence of basic fixed and mobile application profiles

	Example uses	Application and device example	Similarity to fixed
Utility	• Voice • Email • One-way browsing	• Kindle accessing ebooks • Basic smartphones accessing news	 High
Emerging multimedia	• Two-way browsing • Content streaming and download	• Smartphone accessing library to upload/ download photos	 Med
Full media	• SD video streaming • Interactive gaming or physical commands	• iPhone enabling voice recognition for person with disability	 Low
Advanced	• P2P or HD streaming • 2-way HD video teleconferencing	• Minimum today, but emerging (e.g. Videoconferencing)	Minimal

Broadband speed needs vary by application type

	Content type	Example applications	Actual download speed demands (Mbps)*	
Non real-time	• Basic download (or upload) usage	• Basic email, E-book download • Web-browsing, job search, government website access	0.1-0.3 *(Speed impacts down/up time and render)*	
	• Large download (or upload) usage	• Advanced web browsing, iTunes • Social Networking, P2P, etc • Medical Records download/ sharing	0.5-5+ *(Speed impacts down/up time and render)*	
Real-time	• Streamed audio	• PBS, Rhapsody	0.1-0.3	
	• Voice over the Internet (VOIP)	• Skype, Vonage	0.1-0.3	Symm.
	• Basic interaction	• Aleks (Online interactive education) • Pogo online games	0.3-0.5	Symm.
	• Basic streamed video	• Consumer generated education videos	0.3-0.5	
	• Video-conference + VOIP	• Lower definition telemedicine	0.6-1.0	Symm.
	• SD streamed video	• Streamed classroom lectures • Hulu	1-5	
	• IP TV	• IPTV	1-5+	Symm.
	• 2-way advanced video interaction	• Real-time interactive experiences & gaming	2-5+	Symm.
	• Enhanced video teleconferencing	• Video teleconference and TeleLearning • HD Telemedicine (diagnostic imaging)	5-10+	Symm.
	• HD streamed video	• Broadcast quality HDTV • HD streamed University lecture	10+	

Sources: FCC analysis, California Broadband Task Force report, Adtran FCC submission, Speedmatters.com report, Technet Broadband Primer, ITIF report March 2009, Discussions with content providers

Speed is not the only critical characteristic

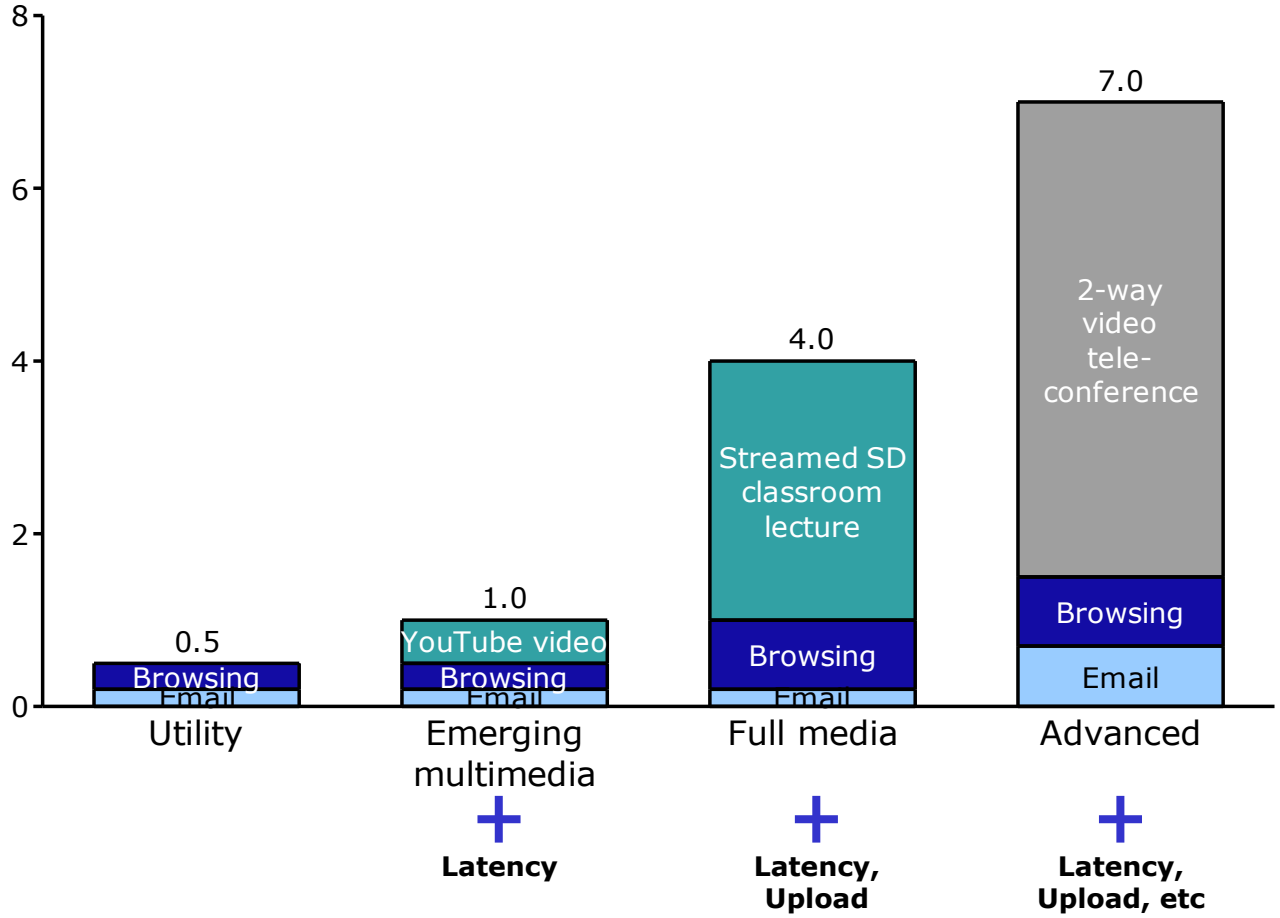
	Non real-time	Real-time
Typical applications:	• Email • Web browsing • SD and HD video download	• Streamed video and music • VOIP (+ video) or teleconference • IP TV • 2-way video gaming
Primary performance drivers:	• Throughput – Download and Upload speeds • Availability/ reliability	• Throughput – Download and Upload speeds • Availability/ reliability • Latency • Packet loss • Jitter
	Speed primarily determines user experience	**Both speed and quality** determine user experience

Sources: FCC analysis; Telcordia PN response filing

Different application use cases result in varied speed and performance demands

Example basket of applications by use case:

Actual download speeds necessary to run concurrent applications (Mbps)

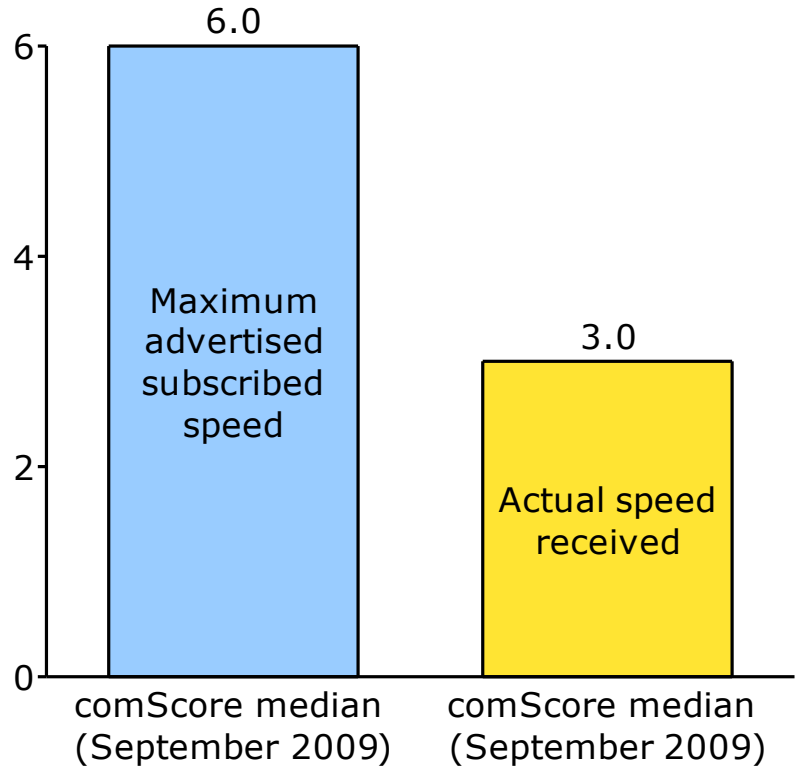


Note: Examples represent ranged estimates of concurrent assumption; For example "Utility" assumes basic email at 0.1-0.3 Mbps and basic browsing at 0.3 Mbps, while "Emerging Multimedia" assumes both of those but a concurrent Youtube video running at 0.5 Mbps; "Advanced Connection" and "Specialized need" assume more robust email and web browsing needs alongside a real-time application such as a streamed SD classroom lecture at 1-5 Mbps or a 2-way video teleconference at 5-10 Mbps

Actual speed varies from advertised; actual speed enables the internet's value

Maximum advertised speed is often cited, but actual is more useful

Consumer fixed broadband download speeds in U.S. (Mbps)



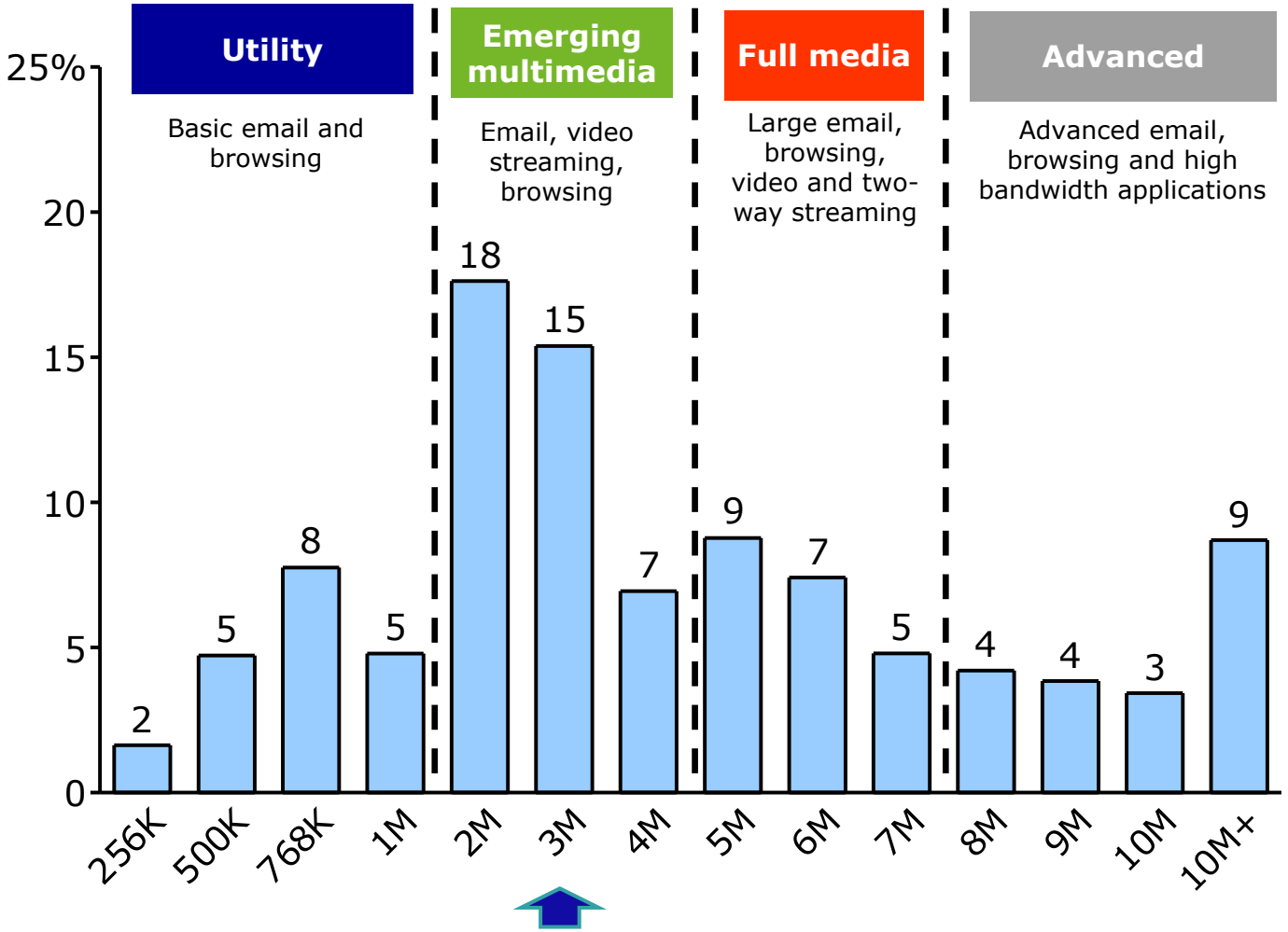
Difference is driven by a number of important factors

- **Maximum advertised** relates to the **theoretical maximum performance of a connection technology (e.g., Digital subscriber line)**
- **Actual median speeds lag advertised by ~50%,** creating consumer confusion
  - Due to general internet congestion, user device processing speed, Connection type, etc.
  - "Busy Hours" create additional congestion and lower median speeds additional 10-20%
- **OFCOM (UK)** did a similar analysis and found that **actual average speed is 57% of advertised**
  - Similarly "actual average" of 4.3 Mbps is ~65% of "advertised average" of 6.6 Mbps
- **Internet Service Providers (ISPs) only control some of these factors**
- However, we will **focus on actual median speeds (at busy hours) to understand network needs and increase consumer transparency**

Note: Busy hours ~7-10PM
Source: OFCOM, comScore September 2009 panel

The speed of the network largely determines what "use cases" can be enabled

Percent of subscribers by ACTUAL top speed received



~50% of U.S. consumers receive less than 3.0 Mbps

Source: comScore September 2009 panel

Summary

- The Internet creates value **only if applications are adopted by consumers**; greater adoption yields greater value
- Internet users spend time browsing, communicating and watching entertainment, but the **utility of the internet is in usage** -- today's streaming video is tomorrow's streaming lecture
- It is critical to **focus on actual end-user speeds during the busy hours of usage**, when typical Americans want to be online; advertised and actual speeds are not the same
- Applications and device use and demands are evolving; **Internet use today will not look like Internet use tomorrow**

Deployment and Future Deployment Plans

Key deployment questions

- How many housing units are passed by selected broadband technologies, and at what speeds?
- What are the economics of providing universal broadband availability at different service levels?
- What are the primary policies and programs impacting the universalization of broadband?

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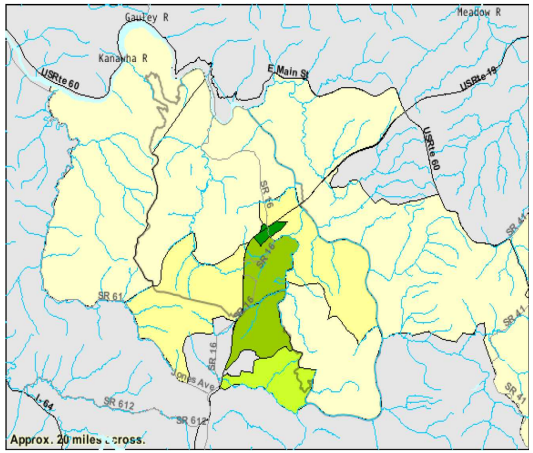
Data currently available to the team are insufficient to conduct analysis at the desired level of accuracy

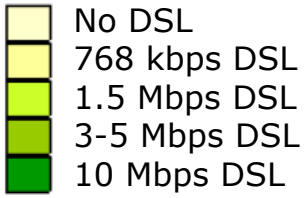
	Data necessary for full analysis	Data currently available
Geographic granularity	• Data at the Census block level (100 times more granular than Census tracts)	• Only national data set is at the Census tract level
Availability (separate from demand)	• Service availability in an area irrespective of take rates or speed of services subscribed	• Only national data set reports households subscribing to certain speeds
Infrastructure data	• Data that: – Verifies information on pricing – Provides a baseline for calculating the cost of building new infrastructure	• No single database of all relevant broadband infrastructure exists
Advertised v. actual	• Information about actual throughput (speed) delivered by access networks	• Information only about advertised, carrier-reported, speed

Source: OBI analysis

Minimally necessary assumptions about service within a tract likely overestimate service availability and speed

In reality, it is **unlikely that service is evenly distributed** throughout a given Census tract





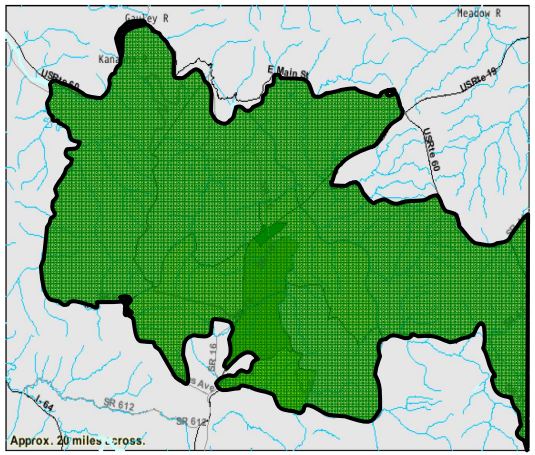
However, Form 477 data was **not designed to address this distribution question**

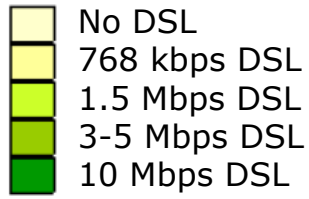
Census tract	Housing units	Total ADSL subs	ADSL: 768k - 1.5Mbps	ADSL: 1.5 - 3.0Mbps	...
3749265	1,229	208	6	97	

As a result, minimal **assumptions are necessary** in order to make any estimate

1. Service available anywhere in a tract is available to every housing unit (HU) in that tract
2. The speed provided to the highest-speed HU in each tract is available to every HU in that tract

These necessary assumptions **probably overstate availability**





Sources: Census Bureau; March 2009 Form 477 data; OBI analysis

Adding these assumptions allows for a preliminary estimate of housing units currently passed

Download speeds (advertised) Mbps	**Number of HUs in tracts where each speed tier is available[1]** Millions	**Number of HUs in tracts where at least this speed tier is available (cumulative)** Millions
< .768[2]	0.9 (0.7% of HUs)	N/A
.768-3	2.8 (2% of HUs)	127.0 (99.3% of HUs)
3-10	33.5 (26% of HUs)	124.2 (97.3% of HUs)
10-100	90.3 (71% of HUs)	90.7 (71.3% of HUs)
100+	0.4 (0.3% of HUs)	0.4 (0.3% of HUs)

This interpretation of the data probably underestimates the number of unserved housing units

- Assumes that availability of service in a tract is indicative of service everywhere in that tract
- Assumes that speed provided to the highest-speed HU in each tract is available to every HU in that tract

[1] Numbers do not add to 100% due to rounding; not additive; based on 2009 Form 477 reports

[2] Current NTIA definition of downstream broadband

Source: 2009 Form 477 data; OBI analysis

Triangulating with other sources allows for significantly better assumptions about availability in the near term

Download speeds (capability)[1] Mbps	**Number of HUs in tracts where each speed tier is available** Millions	**Number of HUs in tracts where at least this speed tier is available (cumulative)** Millions
< .768	3-6 (2-5% of HUs)	N/A
.768-3	1-4 (1-3% of HUs)	121-124 (95-97% of HUs)
3-10	26-29 (20-23% of HUs)	119-122 (93-96% of HUs)
10-100	76-79 (56-59% of HUs)	91-94 (70-72% of HUs)
100+	14-17 (11-13% of HUs)	14-17 (11-13% of HUs)

- **Estimates include impact of DOCSIS 3.0 build-out in HFC[1] footprint, but not 4G build-out**
- **Estimates reflect capability of last-mile and access-network infrastructure, not service offered by providers**

[1] Near-term capability of access plant, given current upgrade path; capabilities may differ materially from actual delivered speeds

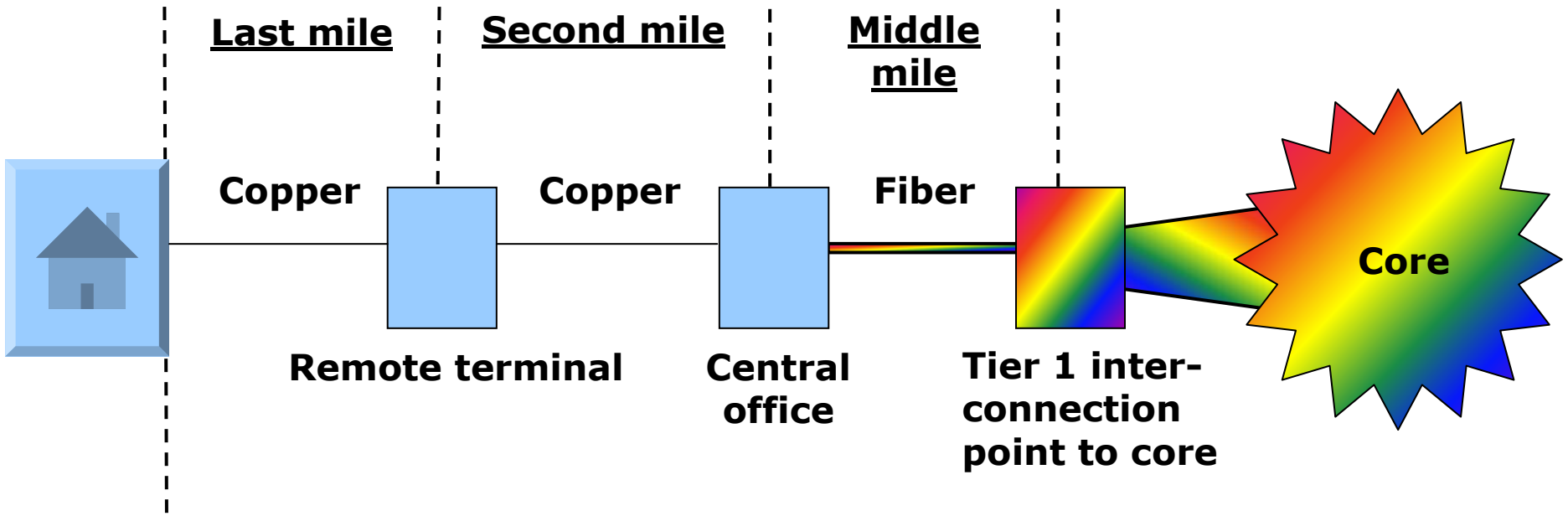
[2] Hybrid fiber coaxial

Sources: 2009 Form 477 data; service provider, equipment manufacturer, and trade association filings and publications; analyst reports; OBI analysis

Network performance levels are substantially driven by how deeply fiber has been driven into the network

① Copper second mile, copper last mile

TELCO EXAMPLE



- **Insufficient copper connectivity between the central office and the remote terminal often limits availability of high-speed internet access**

Source: OBI analysis

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② Fiber second mile, copper last mile

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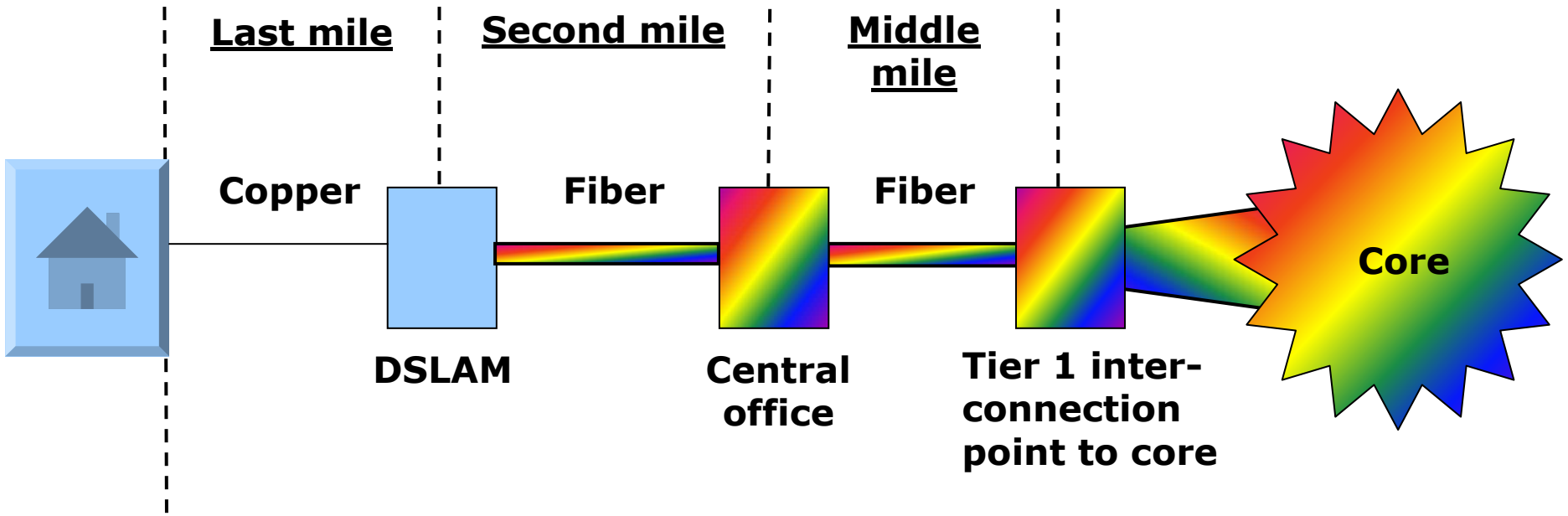

- Deeper fiber can shorten loop lengths
- Extending fiber to cell sites enables 4G
- Node splitting often requires incremental fiber

Incremental download speed increase versus case 1
5-20 Mbps

Source: OBI analysis

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③ Fiber second mile, fiber last mile

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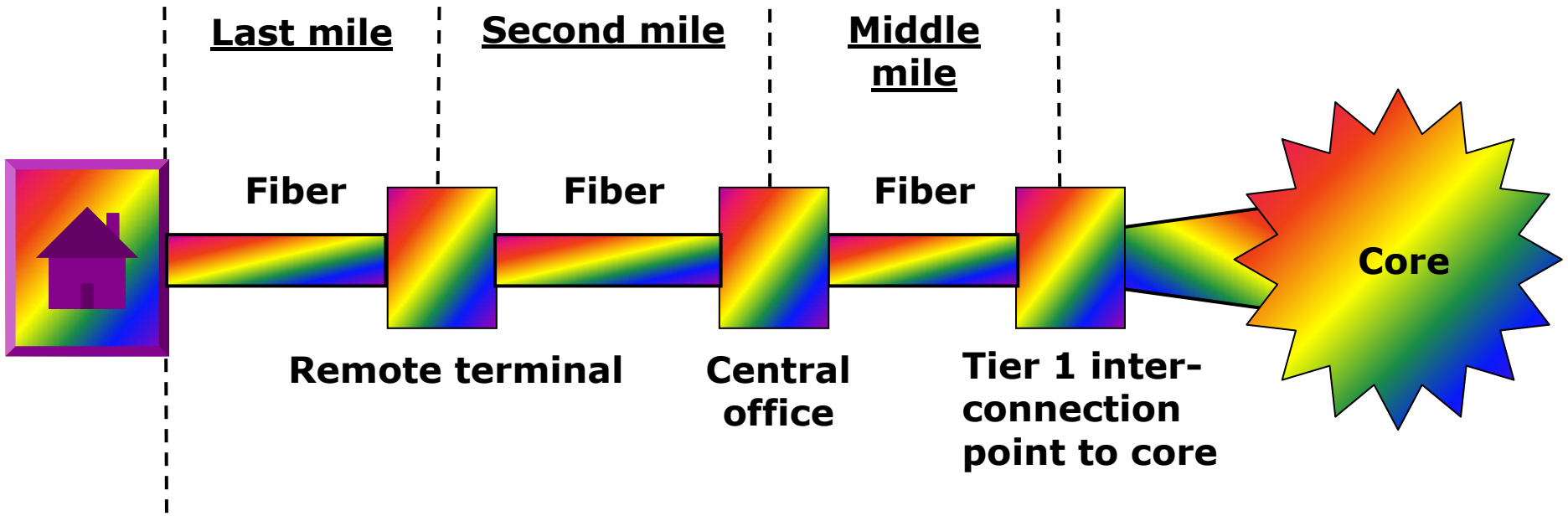


- **End-to-end fiber networks offer nearly unlimited scalability and performance**
- **FTTP[1] is necessary to compete with the fastest national broadband infrastructures (S. Korea/Japan)**

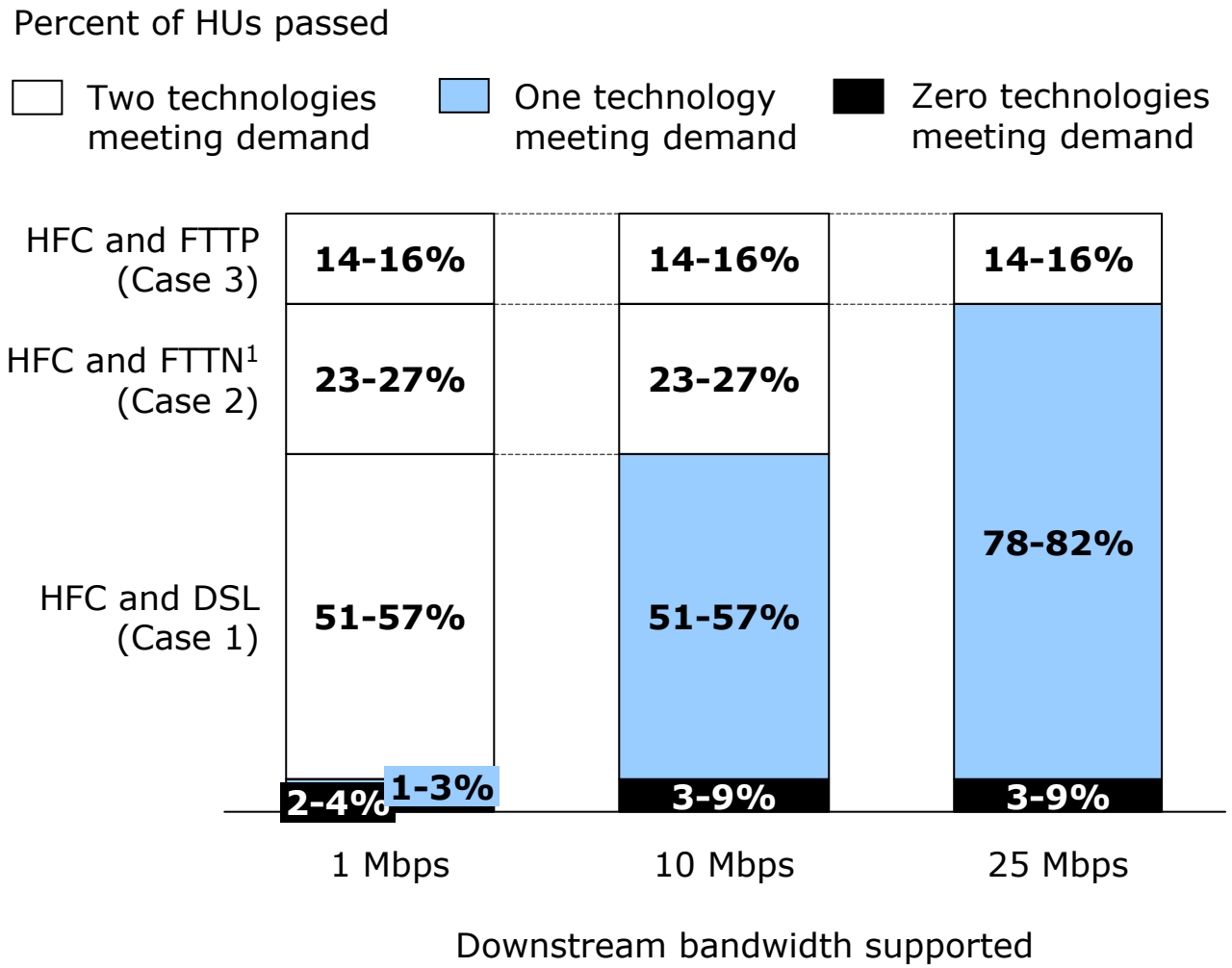
Incremental download speed increase versus case 2
75+ Mbps

[1] Fiber to the premises

Source: OBI analysis

Competitive intensity may depend on different end-user broadband demand scenarios

Wireline broadband technology platform coverage (after completion of announced DOCSIS 3.0 build-out)



- Will low cost/low performance products be available in areas served by high-speed offerings?
- What is the impact of low competitive intensity on price and innovation?
- What is the impact of the planned 4G build-out?

[1] Fiber to the node

Sources: 2009 Form 477 data; service provider, equipment manufacturer, and trade association filings and publications; analyst reports; OBI analysis

Key deployment questions

- How many housing units are passed by selected broadband technologies, and at what speeds?
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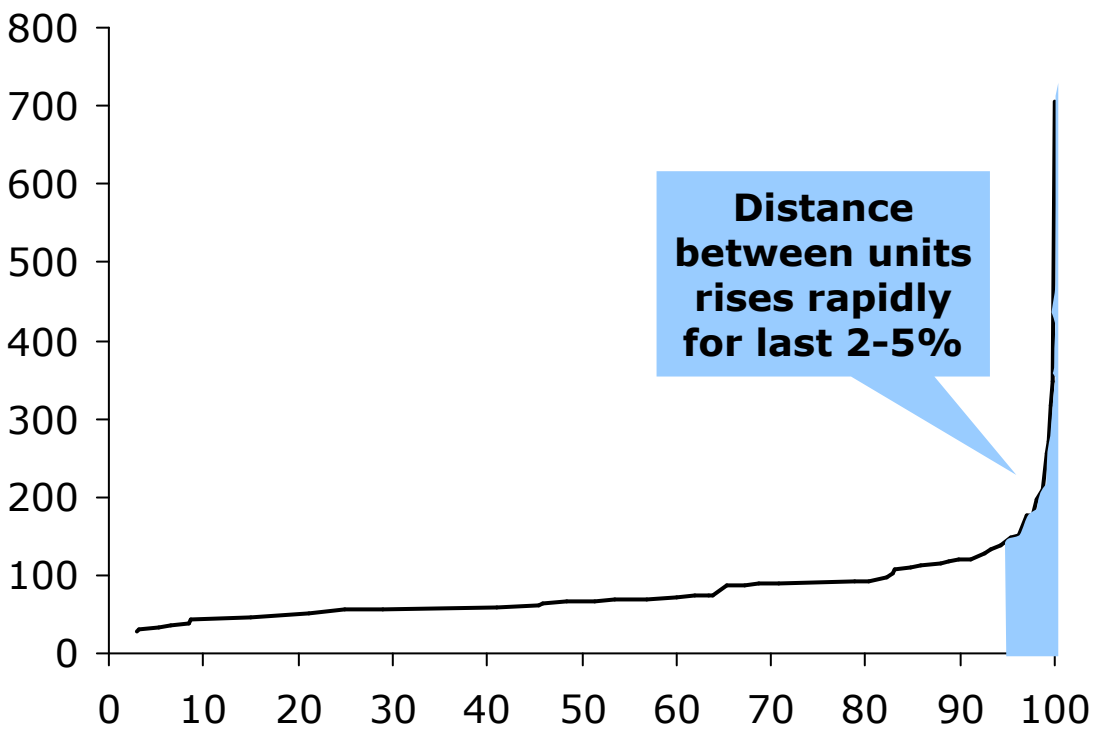
Economics of providing broadband to the rural U.S. are challenging because of low linear density

The average distance between homes increases rapidly from urban to rural areas . . .

Distance between U.S. housing units

Yards; percentile of U.S. households

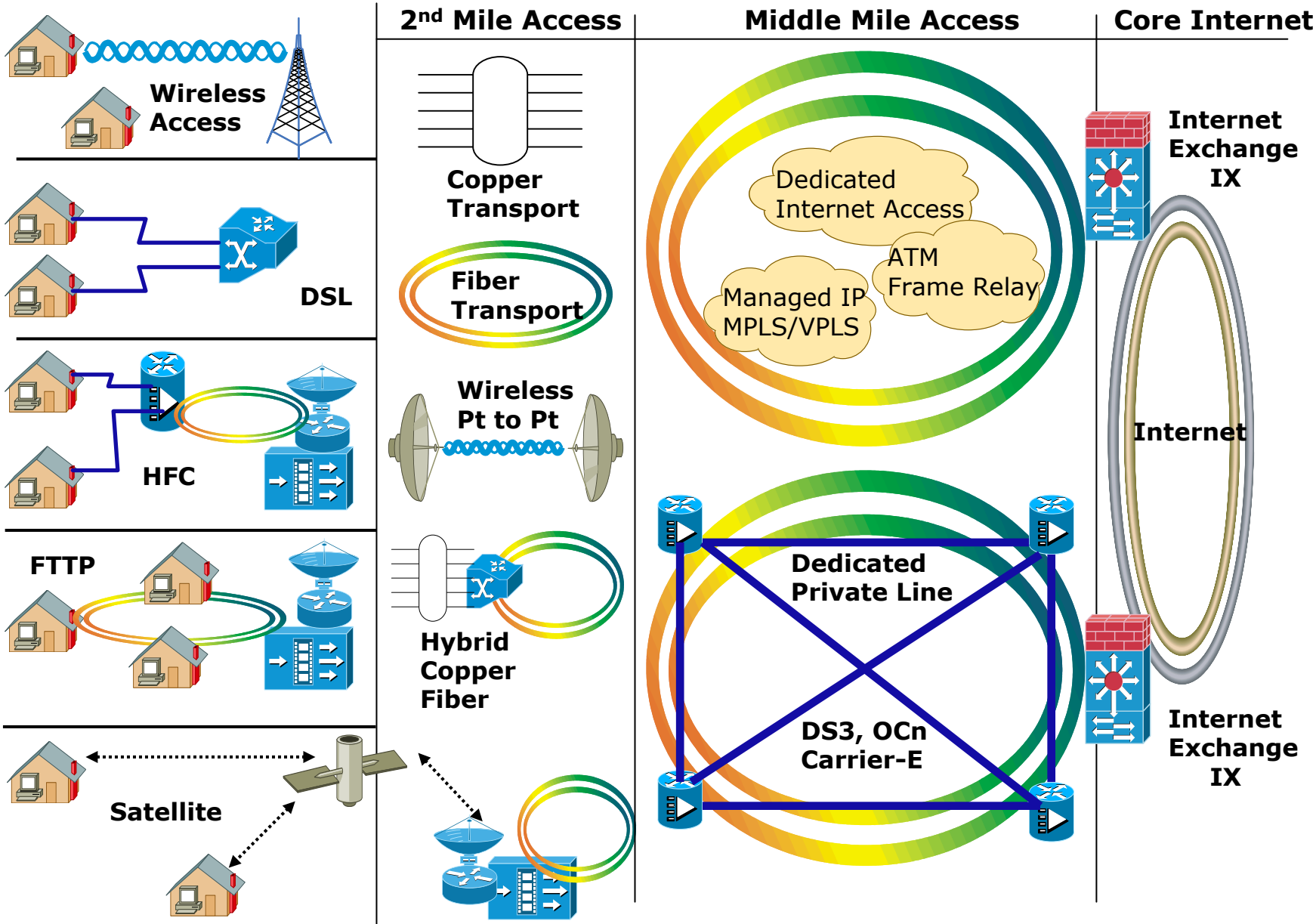


. . . driving up costs and limiting revenue opportunities

- **Higher costs**
  - Last mile plant costs
  - Central office and node electronics density
  - Transport and transit costs
- **Limited revenue**
  - Low revenue density due to fewer homes per mile
  - Lower median income levels

Sources: Census Bureau; NJ Office of State Planning; OBI analysis

U.S. households are part of a complex technology ecosystem that includes diverse broadband infrastructures



Source: OBI analysis

Selected last mile technologies have different cost/performance tradeoffs

	Capability at estimated commercial deployment Mbps	**Average incremental cost/subscriber to move to maximum downstream bit rate[1]** Dollars	**Comments**
FTTP	Down 100+; Up 100+	Capex 2,700; Opex	• High performance capability, but high cost due to new build-out required
HFC (with DOCSIS 3.0 upgrade)	Down 30; Up 10	750	• Cost/performance profile benefits from costs already incurred and low DOCSIS 3.0 upgrade costs
DSL (with FTTN upgrade)	Down 20; Up 2	1,200	• Cost/performance profile benefits from costs already incurred of existing telco plant
4G wireless	Down 4; Up 0.5	900	• 4G build-out benefits from 2G and 3G infrastructure build out • 4G costs do not scale well to FTTN and DOCSIS levels

Final analysis will likely take into account additional technologies (e.g., satellite)

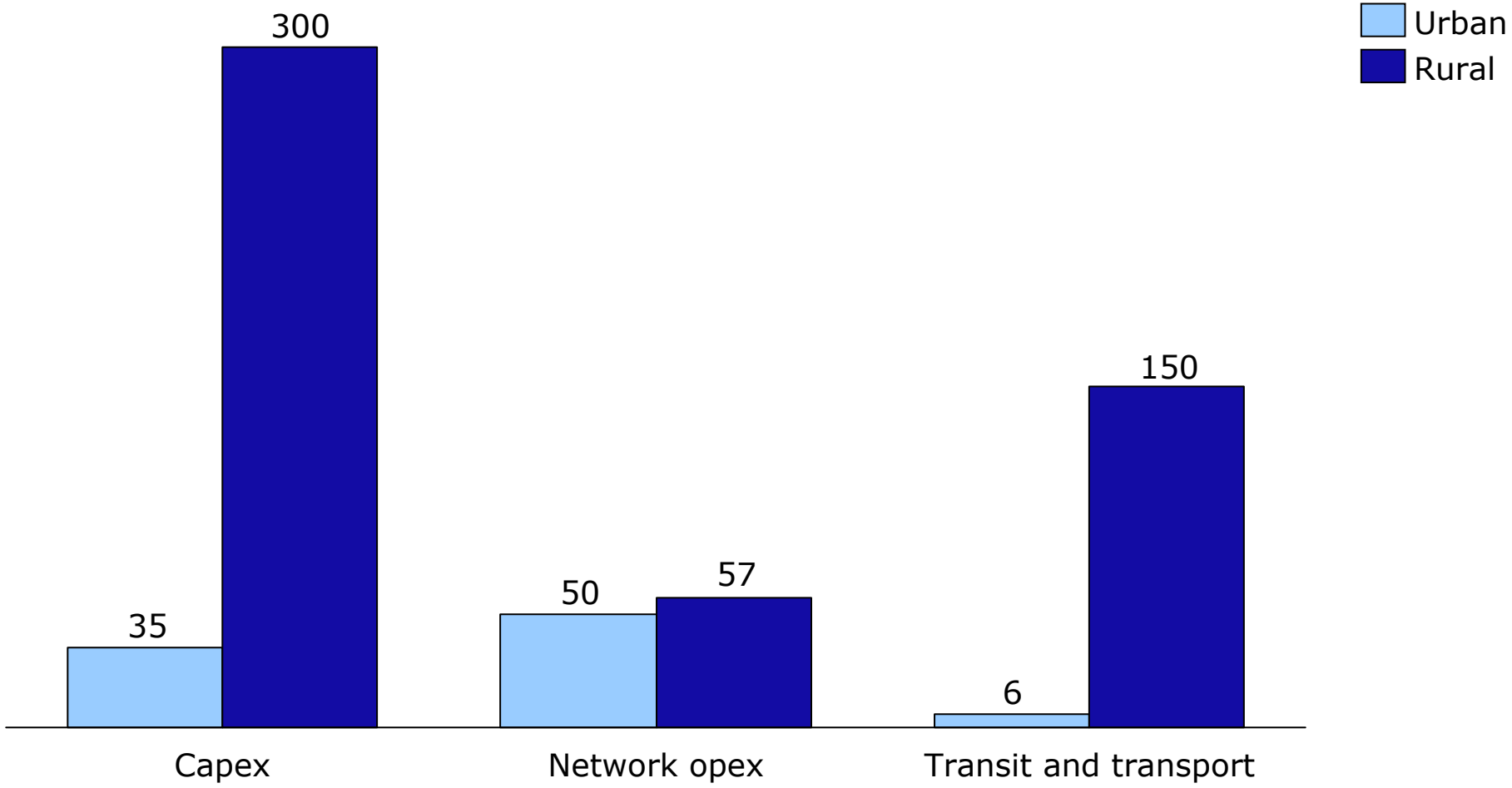
[1] "Opex" refers to present value of operating expenditure. Does not include costs already incurred (e.g., spectrum, prior plant build-out). Assumptions made with regard to oversubscription rates on shared access networks, upgrade path for each technology, cost of equipment, maintenance, operations, urban/rural mix, and discount rate

Sources: Service provider, equipment manufacturer, and trade association filings and publications; analyst reports; OBI analysis

Challenge in rural areas is both capex and opex

Estimated annual cost/subscriber to provide wireline service[1]

Dollars



[1] Does not include costs already incurred (e.g., spectrum, prior plant build-out). Assumptions made with regard to penetration rate, upgrade path, cost of equipment, maintenance, operations, urban/rural mix, length of fiber run, and discount rate

Sources: Service provider, equipment manufacturer, and trade association filings and publications; analyst reports; OBI analysis

The incremental cost to universal availability[1] varies significantly depending on speeds required

Capability at estimated commercial deployment Mbps	**Housing units requiring upgrade to reach each tier** Millions	**Incremental cost to universal availability of these advertised speeds (Best estimate)** $, billions
.768-3	3-6	20
3-10	7-10	35
10-30	33-37	50
100+	111-116	350

Incremental cost will also depend on:

- Costs of upgrading backhaul network
- Required uplink speeds
- Limitations on latency
- Bandwidth usage and over-subscription costs

[1] For one access network. Includes both capex and discounted opex

Sources: 2009 Form 477 data; service provider, equipment manufacturer, and trade association filings and publications; analyst reports; OBI analysis

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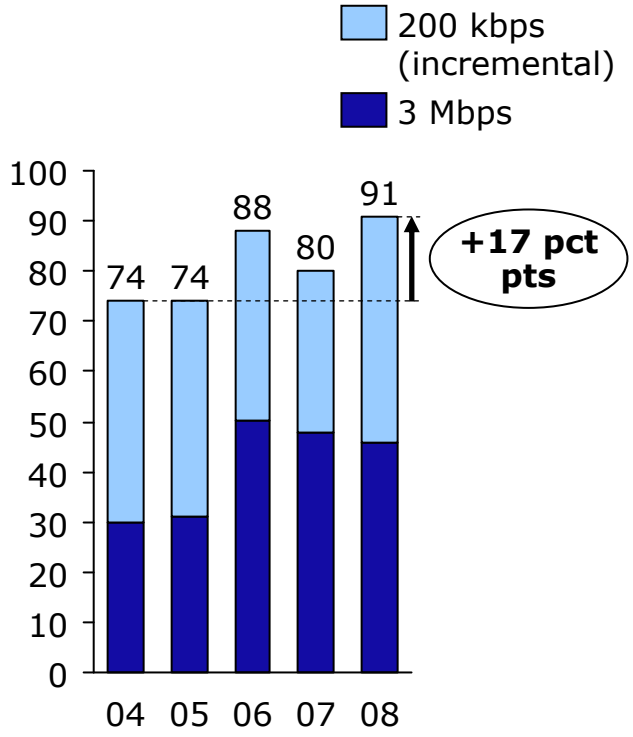
Some USF[1] recipients have made progress in bringing broadband to rural America

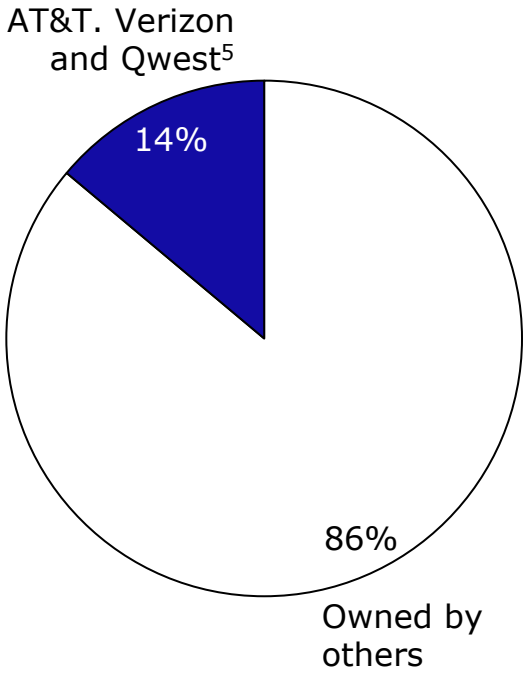
The smallest rural ILECs[2] are upgrading their plant to bring broadband to rural consumers . . .

Percent share of rural coop telco lines that have been upgraded to offer select speeds of internet access[3]



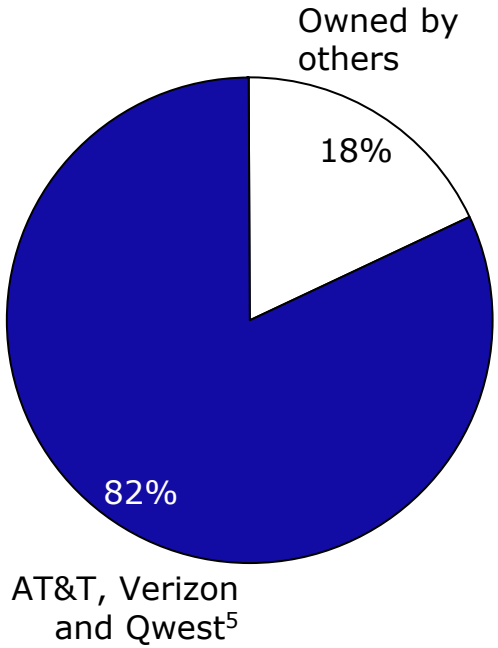
. . . And receive more high-cost support than AT&T, Verizon and Qwest. . .

Percent share of total USF high-cost support for ILEC lines, 2008[4]



. . . Even though most non-upgraded access lines are owned by those three companies

Percent of total U.S. access lines not upgraded to offer broadband



[1] Universal Service Fund [2] Incumbent Local Exchange Carriers

[3] Survey data. Assumes that if a higher speed is offered, all lesser included speeds are also offered

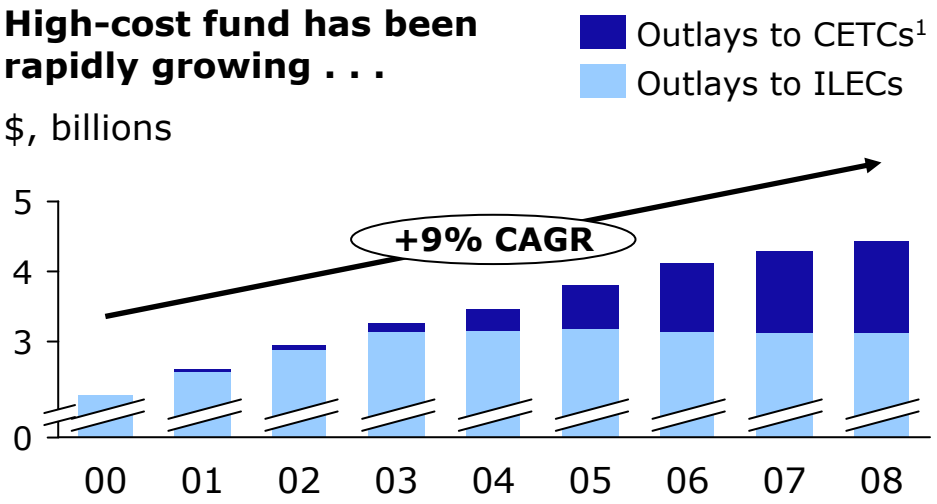
[4] Excludes Competitive Eligible Telecommunications Carrier (CETC) support

[5] Includes lines Verizon is proposing to sell to Frontier

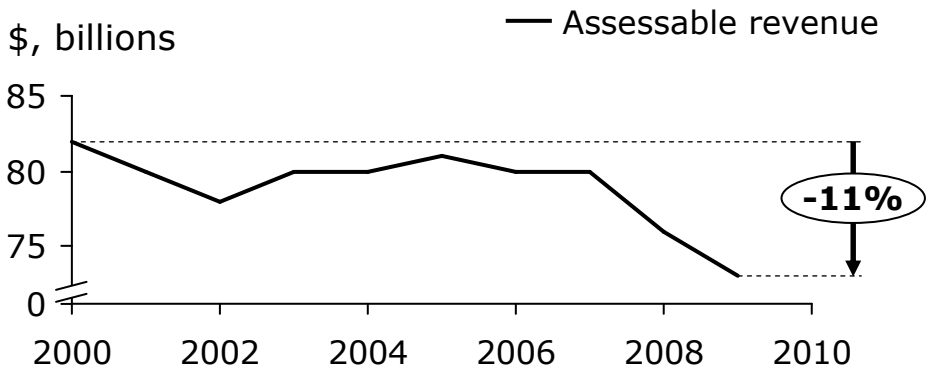
Sources: NTCA Broadband/Internet Availability Survey Reports (2004-2008); FCC data; FCC staff estimates

In addition, the fund faces systemic, structural problems

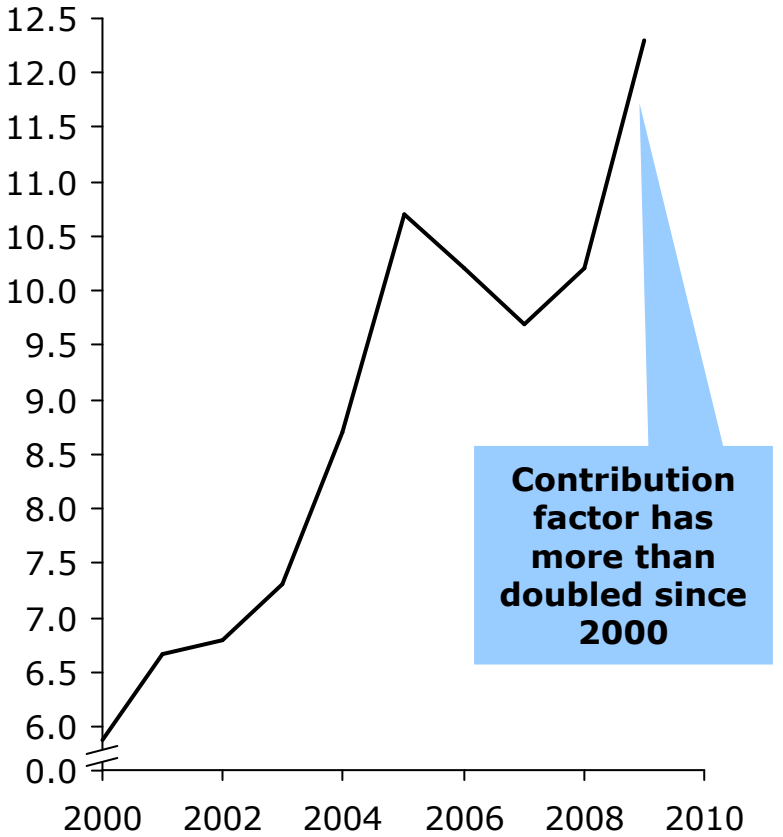
High-cost fund has been rapidly growing . . .



. . . While assessable revenue base declines . . .



. . . Driving a higher USF contribution factor



As demand for funding grows, and the revenue base subject to assessment shrinks, consumers and businesses will face higher contribution factors in the future

[1] CETC funding was capped on a state-by-state basis in 2008

Source: FCC data

Regulatory policies affecting middle mile cost and deployment

Current policy regime

Special access services

- ILEC rates, terms and conditions for time-division multiplexing (TDM) special access services are regulated in many areas
- Flexibility from tariff requirements is currently granted in many metropolitan statistical areas (MSAs) based upon a competitive "trigger" analysis

Forbearance from regulation

- Forbearance from regulation of Verizon's packet and IP transport "deemed granted" in 2006
- AT&T, Qwest, CenturyLink,[1] and Frontier were granted IP/packet forbearance in 2007, but are still subject to Title II regulation

UNE

- High-cap circuits can be purchased at TELRIC2 rates in some circumstances

Rigorous data analysis will be necessary to fully understand and quantify impact of these policy levers

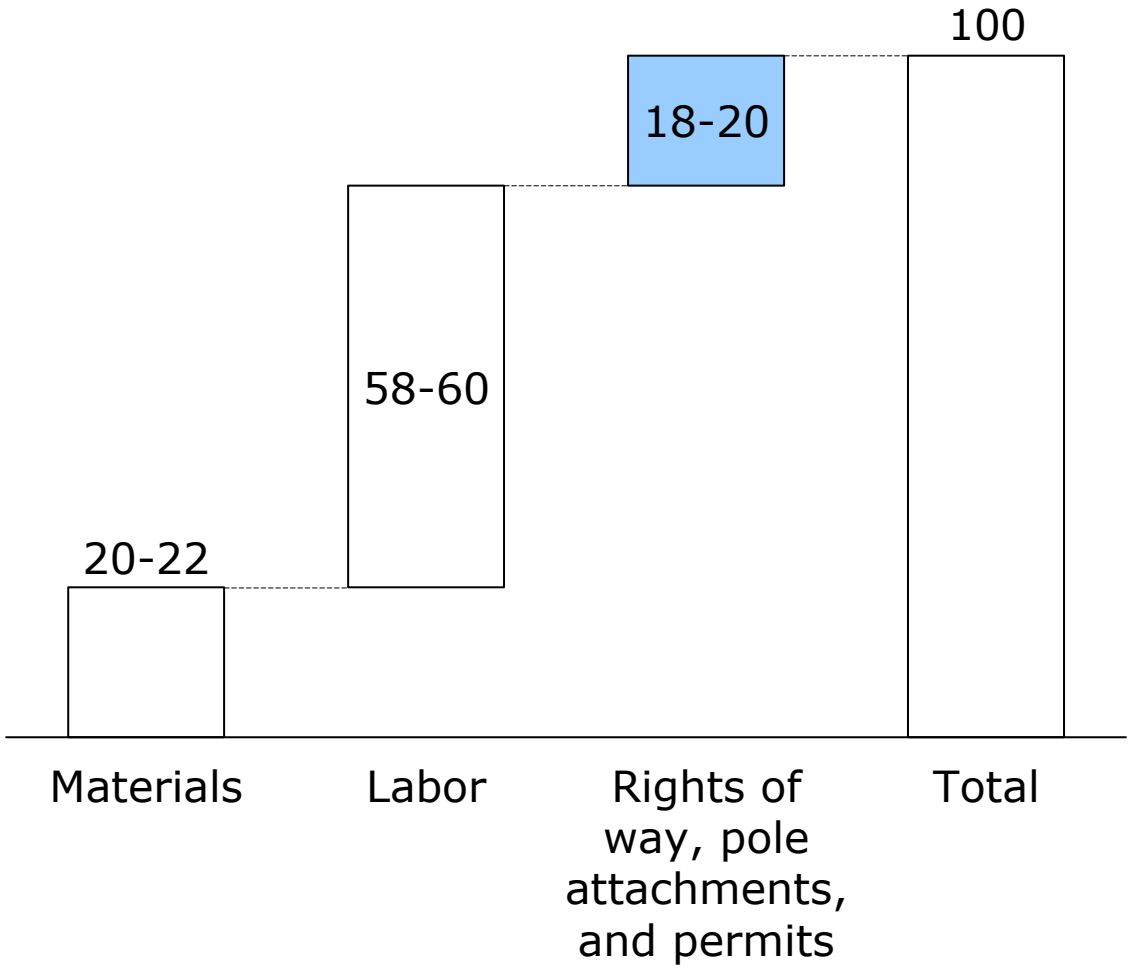
[1] For legacy Embarq exchanges only [2] Total element long run incremental cost

Source: OBI analysis

The cost of obtaining pole attachments and rights of way may have a significant impact on fiber deployment

Estimated total cost of an aerial fiber build

Percent



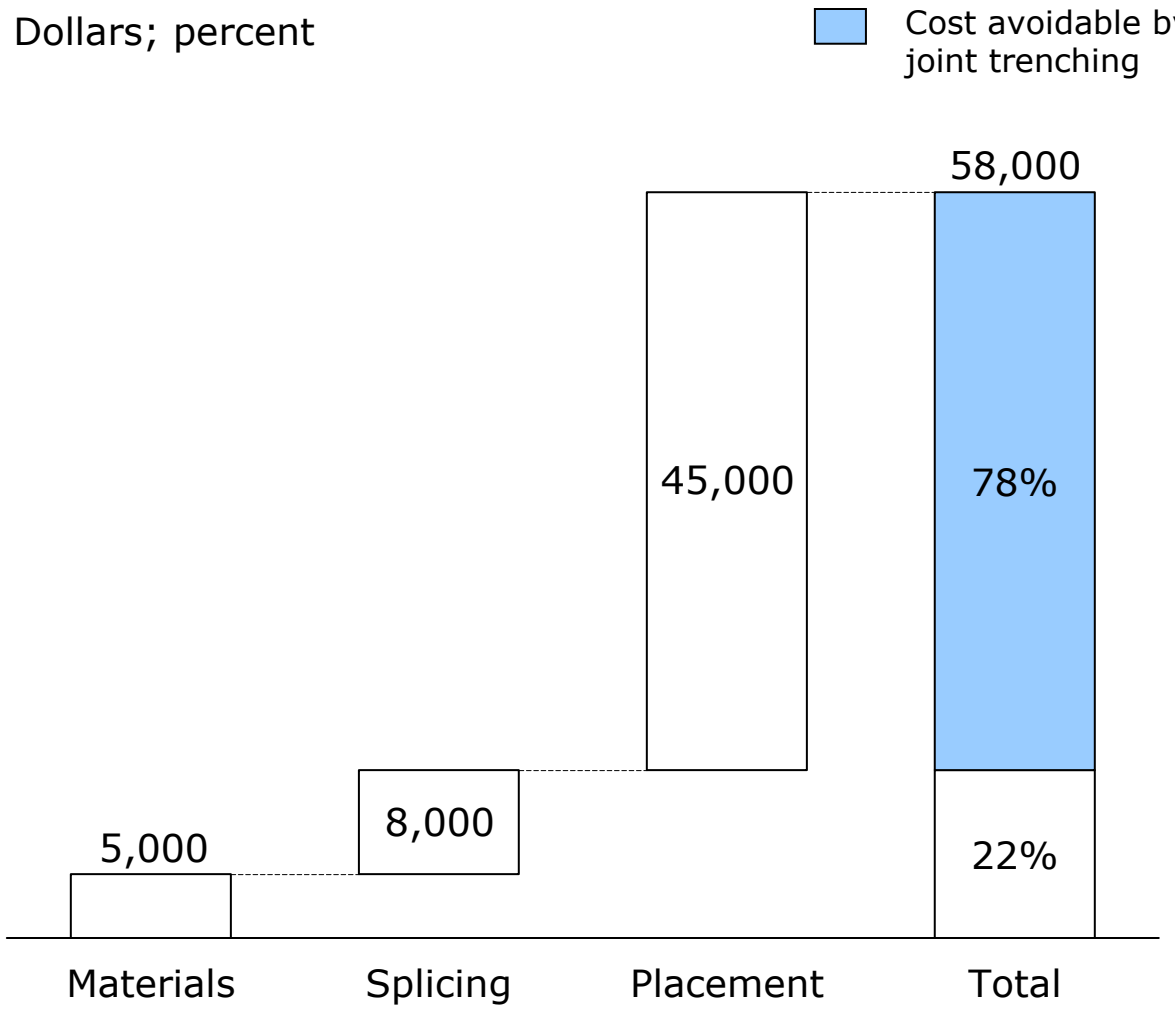
- Make-ready charges can average $4-6,000/mile
- Make-ready delays of up to 18-24 months can also raise cost of fiber deployment
- Rights of way fees are highly variable and can exceed hundreds of dollars per year per foot

Source: OBI analysis

Placing fiber in an open trench can yield efficiency gains when underground/aerial options are not readily available

Estimated total cost of a fiber build[1]

Dollars; percent



- **Joint trenching can often save >50% of the total cost of a fiber build**
- These savings are lessened if:
  - Conduit or aerial placement is available
  - Fiber size increases
- A trench fee may replace some placement expense

[1] 10,000 foot build; assumes 48-fiber strand

Source: OBI analysis

Summary

- The number of homes that do not have broadband depends on the type and amount of broadband required; at least 3-6 million households lack any high-speed access
- The cost to make broadband universally available also depends on the type and amount of broadband required, and probably falls in the $20-350 billion range
    - Different technologies have different upgrade paths, each with its own cost/performance characteristics
    - These costs are often driven more by opex than capex
    - The opex challenge is often magnified in rural areas due to difficult transport economics
- As application use evolves and demand for high-speed services increases, only a small percentage of Americans may have access to a provider able to serve high-speed product markets
    - 4G deployment may affect demand as well as the value pool within any of these high-speed market segments
    - Depending on bandwidth requirements, 4G may even compete in rural areas, but could require large amounts of new spectrum
- Some USF recipients have made progress in bringing broadband to rural America, but the fund faces systemic and structural problems
- There are a number of other policies that potentially impact broadband performance and economics
    - Transport pricing and availability (e.g., special access)
    - Cost of driving fiber deeper into the network (e.g., rights of way and joint trenching)

Lessons from International Studies

International objectives

- Review international broadband plans and related experience
- Examine 22 countries with national broadband strategies
  - Conduct in-depth case studies on at least 10
- Focus on:
  - Innovative policies and tactics
  - Plan results
  - Delivery and execution challenges
- Extract lessons and best practices for the U.S.

Select countries with broadband plans (initial screen)

Australia	Italy
Austria	**Japan**
Belgium	**Korea**
Brazil	Mexico
Canada	Netherlands
Denmark	New Zealand
Finland	Norway
France	**Singapore**
Germany	**Sweden**
Hong Kong	Taiwan
Ireland	**United Kingdom**

Drivers behind broadband plans have generally been:

- National competitiveness
- Human resource development
- Innovation
- Job creation and investment

Bold: Case Studies

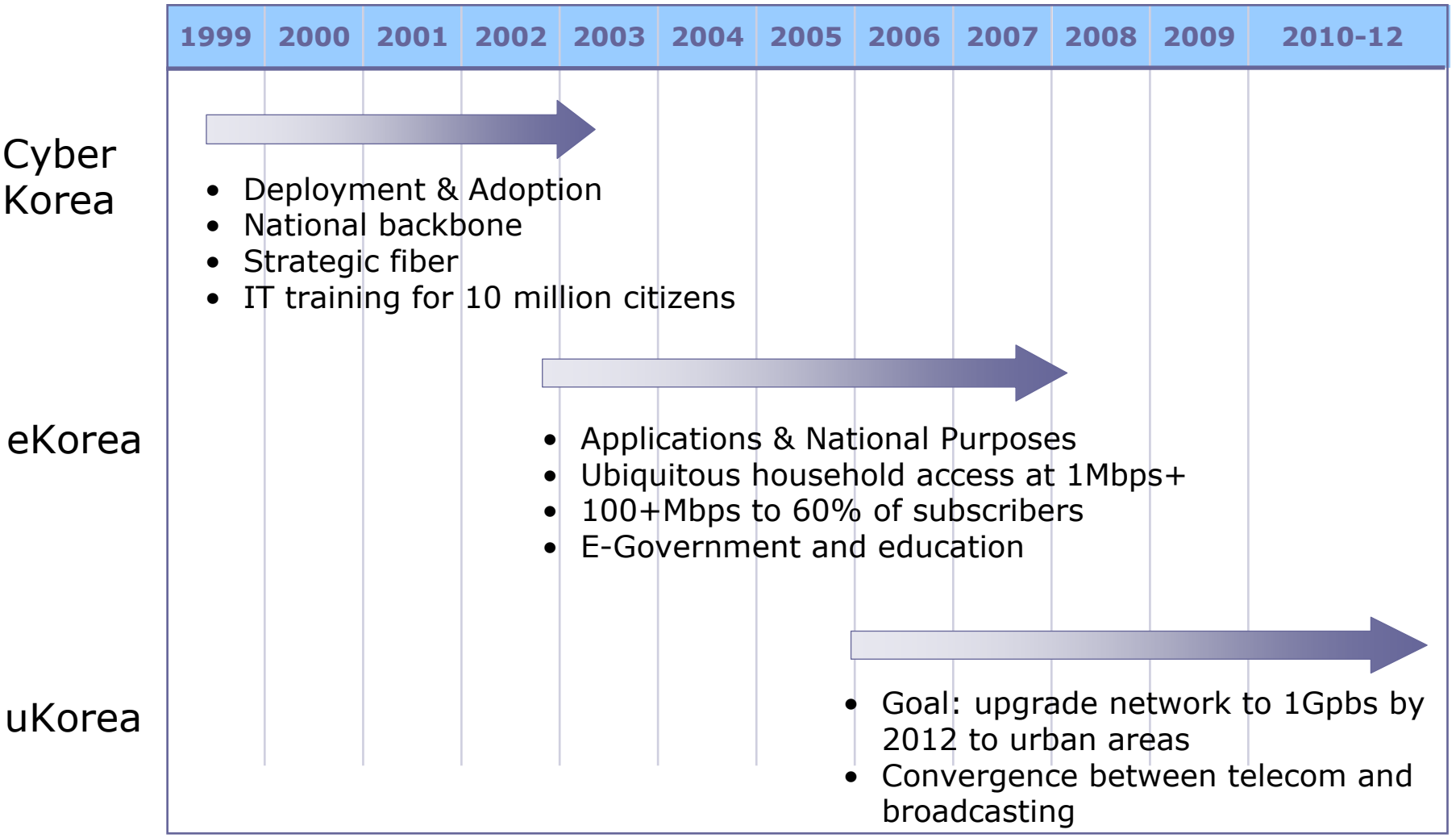
Red: Countries visited so far

We will focus on elements relevant to U.S. plan

Country	Rural Deployment	Network Fiber Upgrade	Successful Adoption Programs	National Purpose Initiatives	Spectrum Reclamation Initiative
Australia					
Canada					
Denmark					
Finland					
France					
Germany					
Japan					
Korea					
Singapore					
Sweden					
U.K.					

Area of focus for International team/IB

Korea: Three national broadband plans



Source: Korean Ministry of Communications and Information

Country program: Korea's 1999 adoption initiative[1]

Goal:

- Increase broadband use and adoption by lower income and elderly households

Tactics:

- Government sponsored free training and ongoing technical support provided to target population
    - Including 20 hour week-long e-literacy courses
- Government facilitated availability of heavily discounted PCs, sold via low-interest loans
- Telco privatization and competition drove down broadband prices to less than $30/month

Outcomes:

- 10M PCs placed into homes increased home PC penetration from 19% in 1999 to 71% in 2000
- Home broadband adoption increased from 4M in 2000 to 12 Million by 2005
- Today, 83% of households in Korea have adopted broadband access

[i]Source: Korean National Information Society Agency

Broadband Data Improvement Act (BDIA) data gathering efforts

The BDIA requires the Commission to include in its annual Section 706 Report a detailed comparison of broadband service capability from 75 communities in at least 25 countries.

- Comparison of U.S. communities with similar foreign communities based on various criteria

Commission staff has gathered sub-national data and information to meet the requirements of the BDIA and to inform the FCC's work on the National Broadband Plan.

- Availability and pricing data
- Demographic (community) data
- Information on national broadband strategies
- Market information

Initial hypothesis

- Broadband plans need to be enduring strategies that require four or more years of continuous effort
  - Coordination and buy-in across Federal agencies and local governments
- Program evaluations are needed to benchmark progress and enable course correction opportunities
  - Benchmarks are as important for national purposes as for deployment and adoption
- Policy changes that are supported by consistent funding sources can enable long-range planning by agencies and the private sector

Spectrum

Discussion overview

- Today we focus on the need for more spectrum

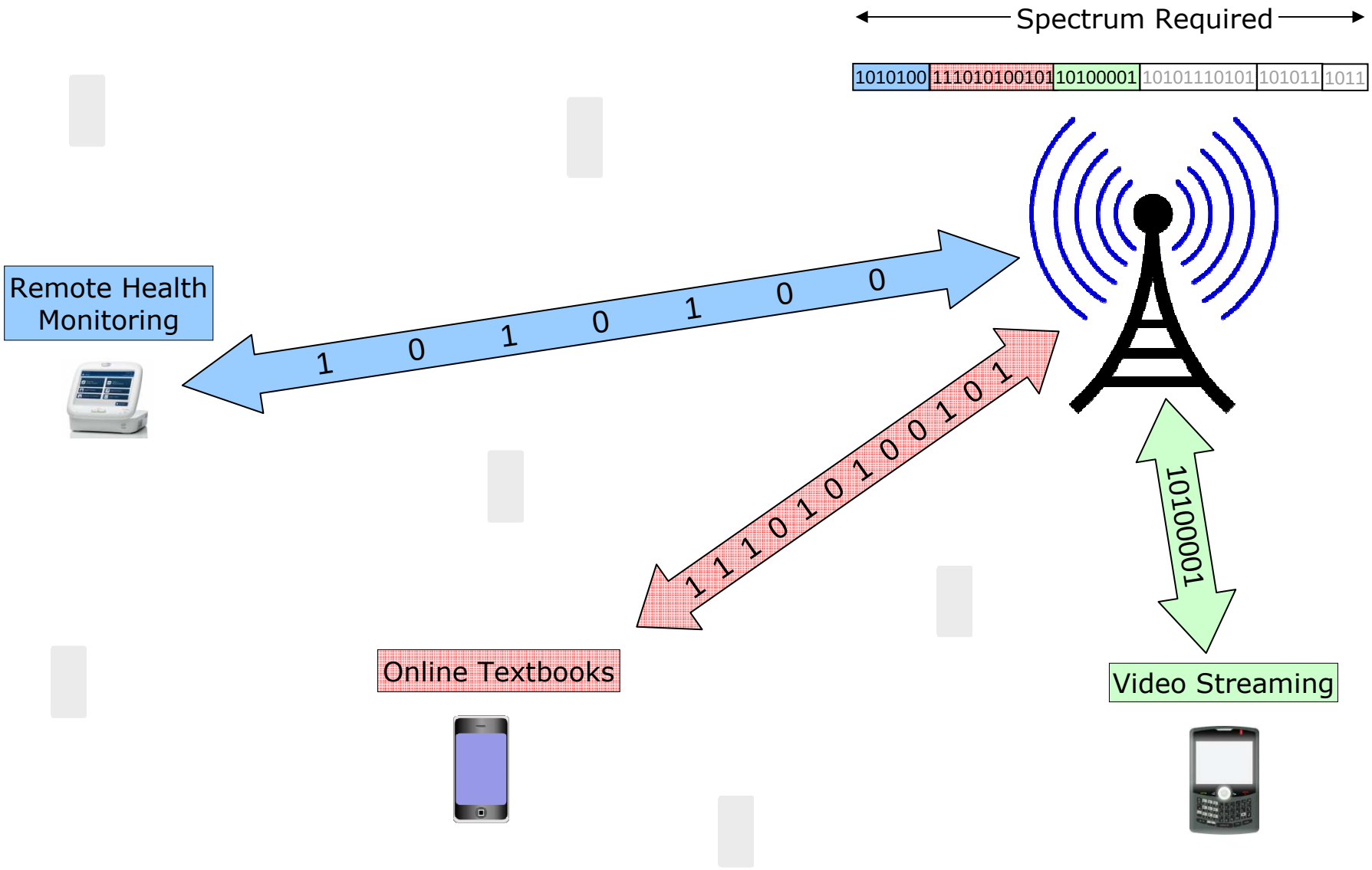
- We are also analyzing options to make more efficient use of existing spectrum, through new technologies and mechanisms, but this is a topic for another day

- Our presentation incorporates learnings from:
  - Workshops (spectrum, wireless deployment, wireless technology)
  - Field hearing (Austin, TX)
  - Submissions in the record
  - Research and team analysis

Summary

- Mobile broadband use is exploding: bandwidth-hungry devices, apps, and users are driving increased demand for spectrum
- Major players have all expressed a need to allocate more spectrum for broadband
- Some models suggest a need for more than 1 GHz of total allocated spectrum
- After decades of new allocations, the spectrum pipeline is drying up
- It will take years for any new spectrum to reach the market, so we must act now

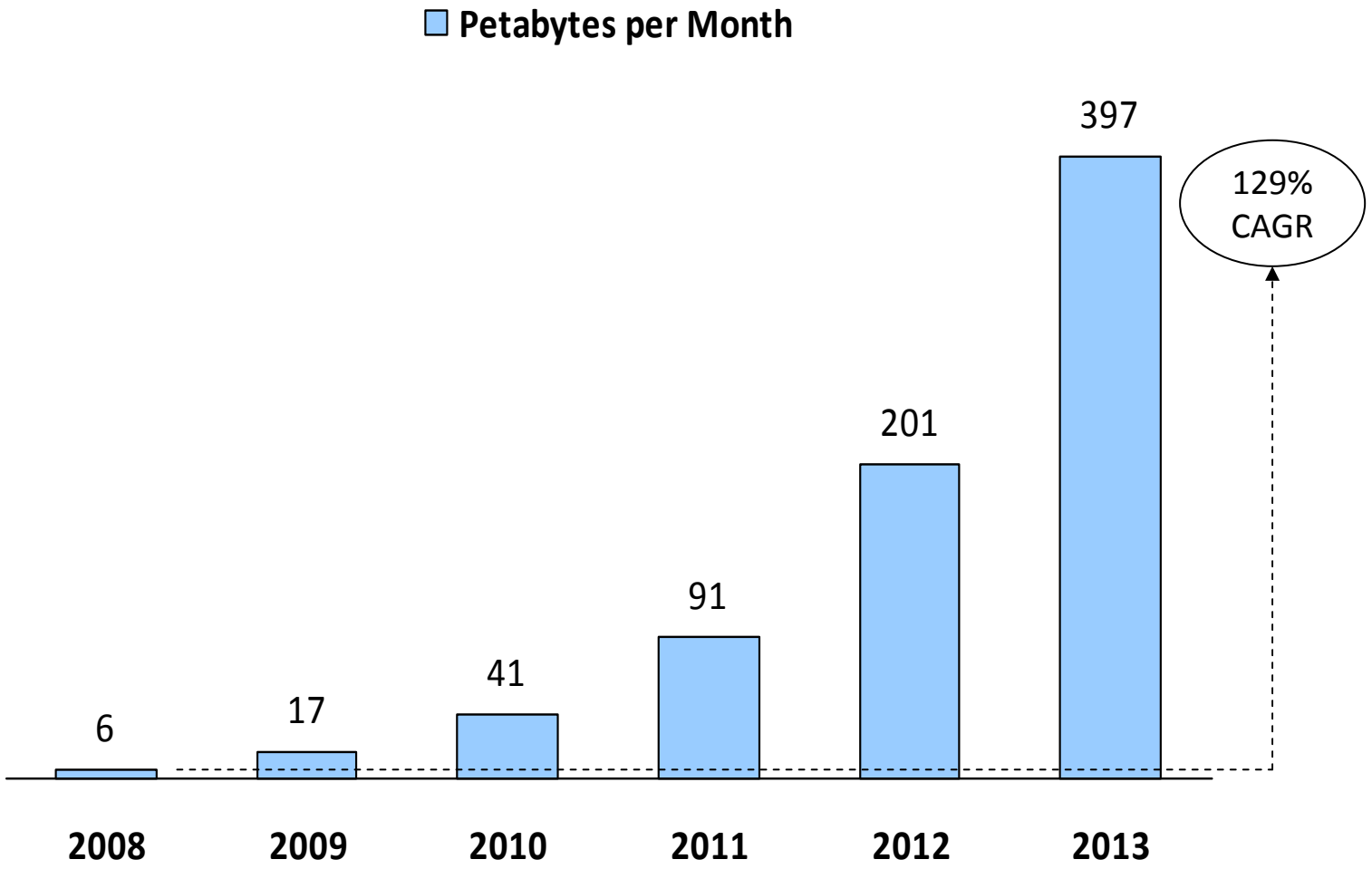
Spectrum is a key enabler



Wireless is moving to broadband

	Yesterday	Today	Tomorrow
Devices			
Apps			
Users	*Business*	*Consumers & Business*	*Consumers, Business & Machines*

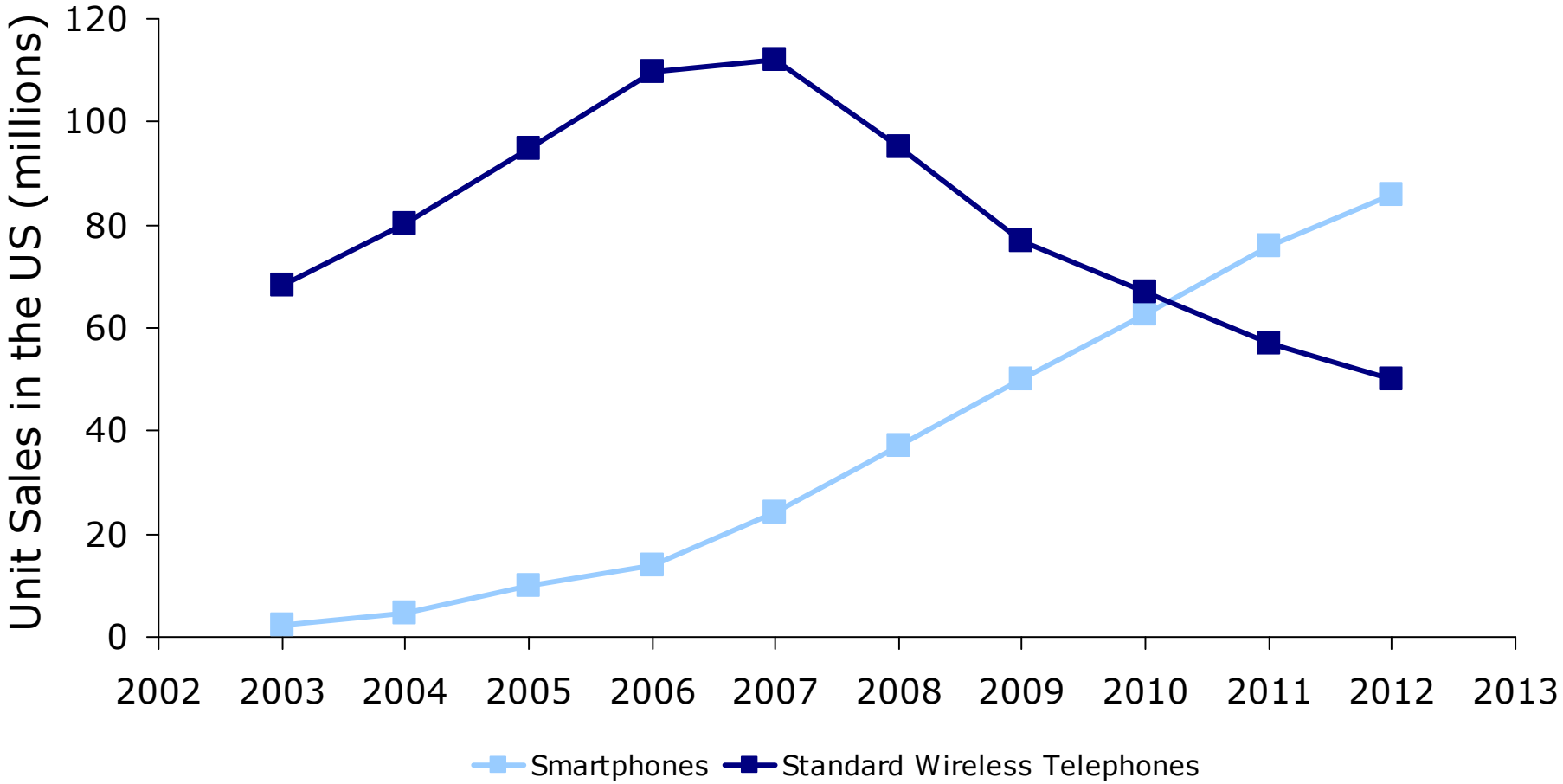
Mobile data usage is exploding



Source: Cisco VNI, 2009

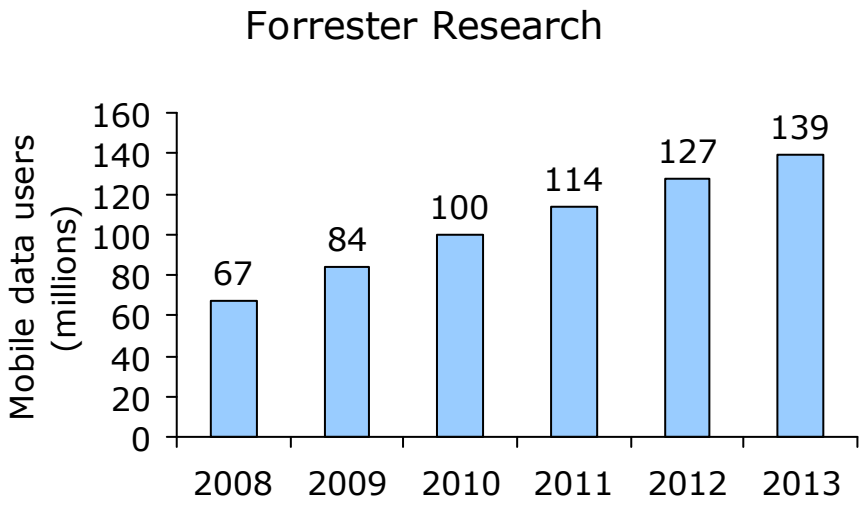
Smartphones are replacing standard phones

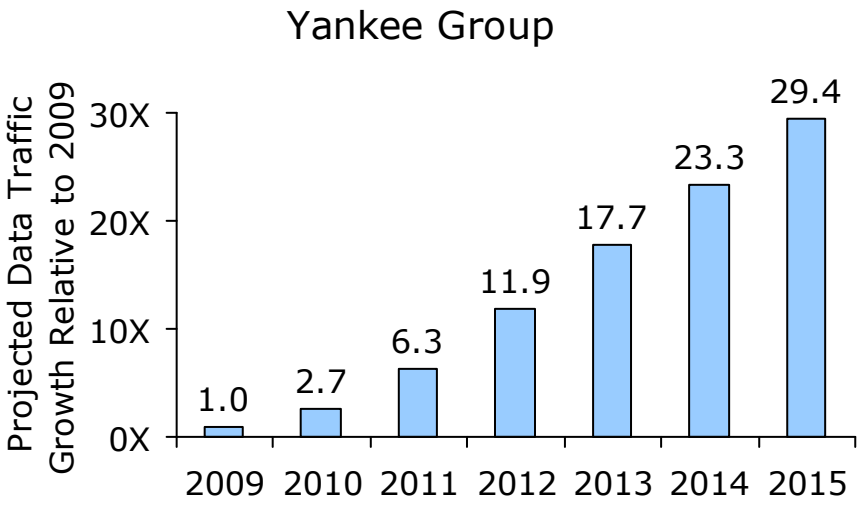
Smartphone sales to overtake standard phones by 2011

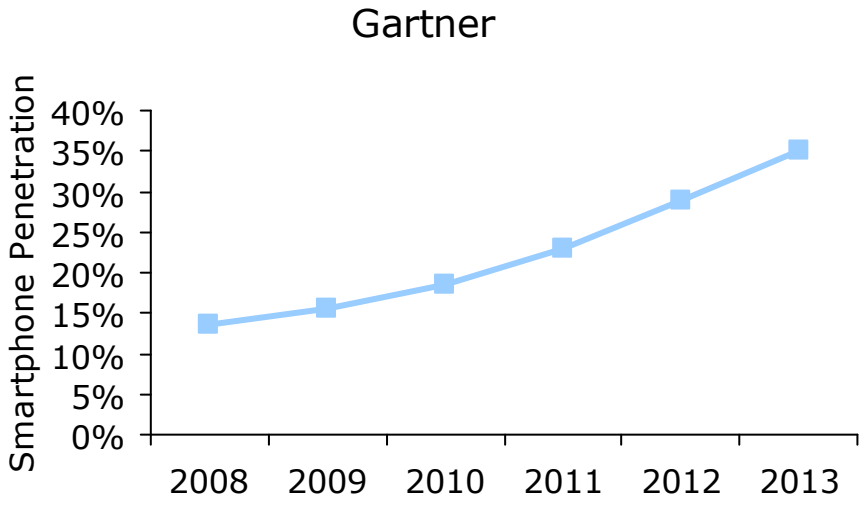


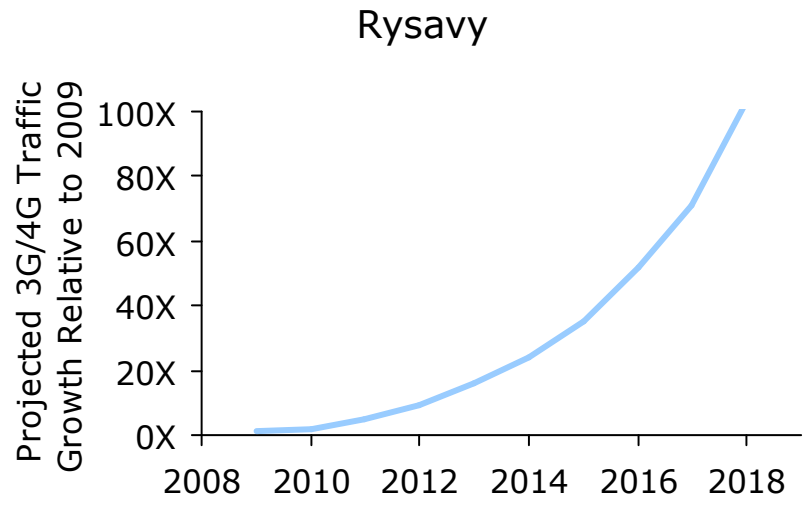
Source: TIA, Wilkofsky Gruen Associates from "TIA's 2009 ICT Market Review and Forecast".

Analysts project rapid growth in mobile broadband

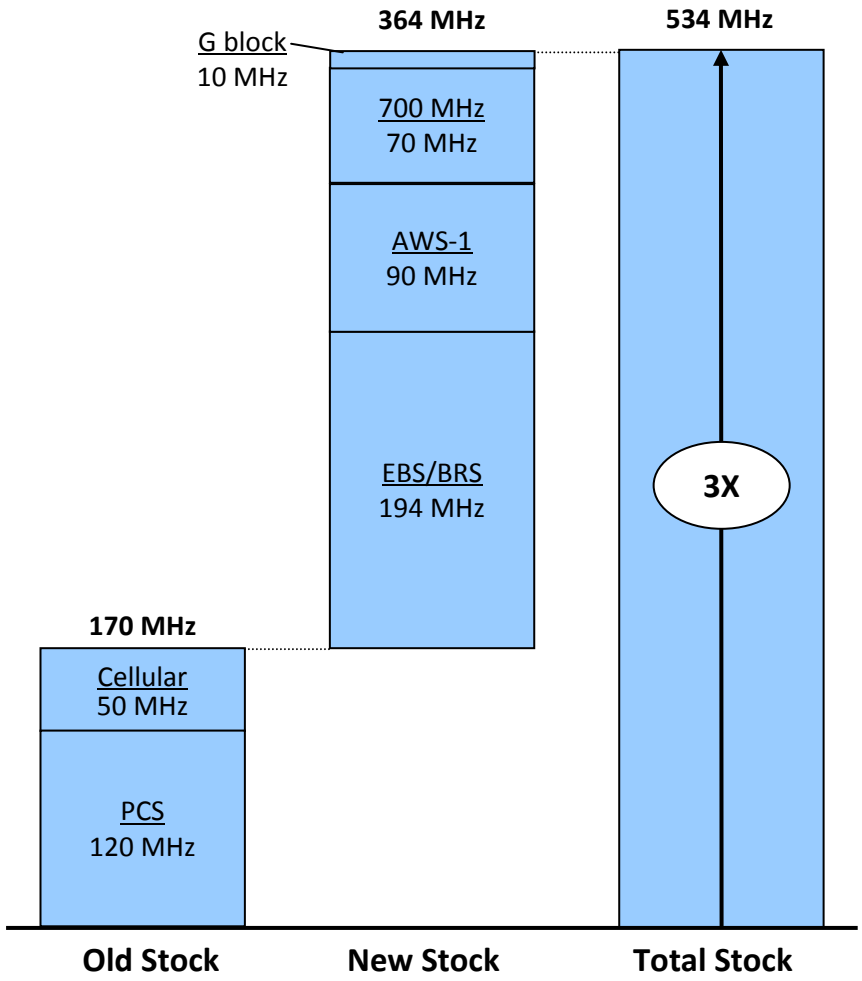




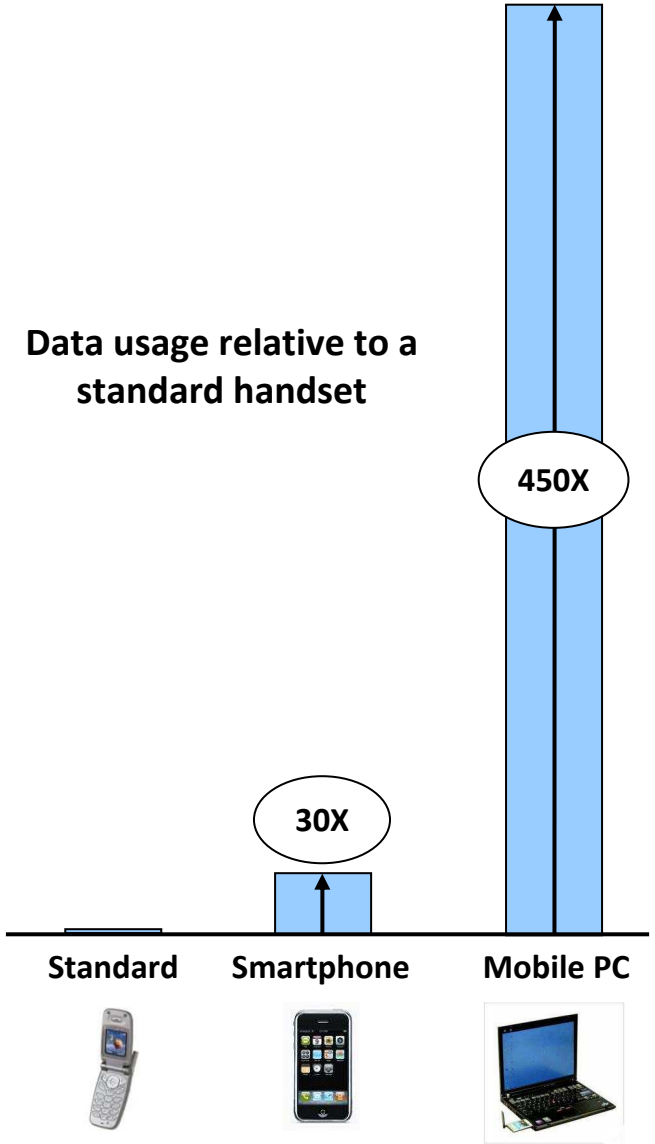




Spectrum available for mobile broadband has tripled



Smartphones and Mobile PCs are driving traffic growth



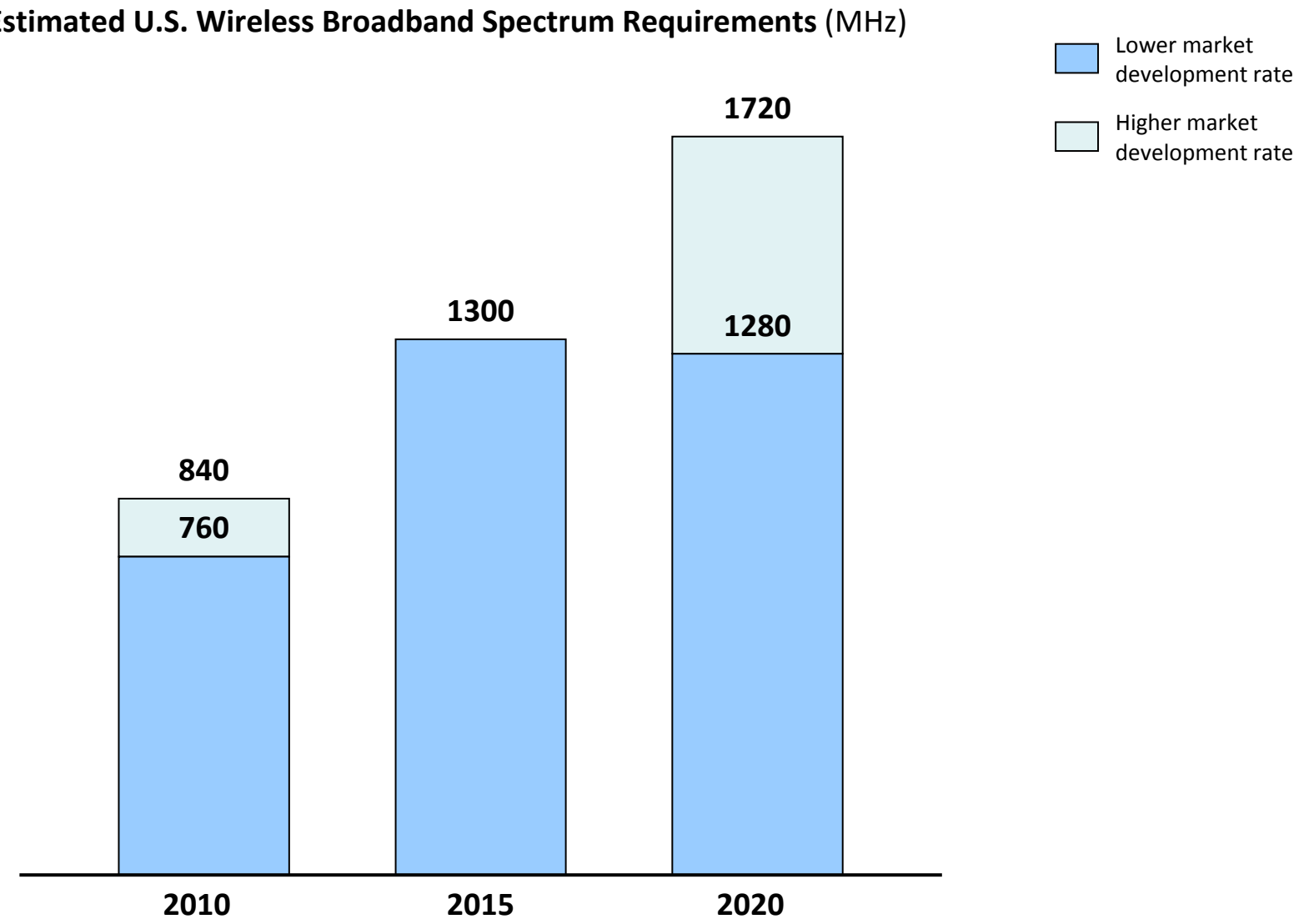
"Mobile broadband handsets (speeds of 3.5G and higher) and portables will account for **83%** of all mobile data traffic by 2013." *Cisco, 2009*

Source: Cisco

Record is clear: More spectrum needed

Party	Record
AT&T	Data usage on AT&T's mobility network has increased 5000% in the past 3 years
Clearwire	120 megahertz of contiguous spectrum is needed for true mobile broadband
Fibertower	100MHz or more will be needed for wireless backhaul in the next few years
NGMN Alliance	Next generation mobile networks require 20 MHz channels and more than 120 MHz of harmonized spectrum
T-Mobile	Minimum 40 MHz deployment is necessary to enjoy the spectral efficiency and trunking benefits of LTE
Verizon Wireless	Might acquire more than 100 MHz of spectrum in the next five years, if it were available
WCAI	Mobile wireless broadband providers will require 150 MHz of spectrum or more to adequately meet consumer needs

ITU projection of future spectrum needs



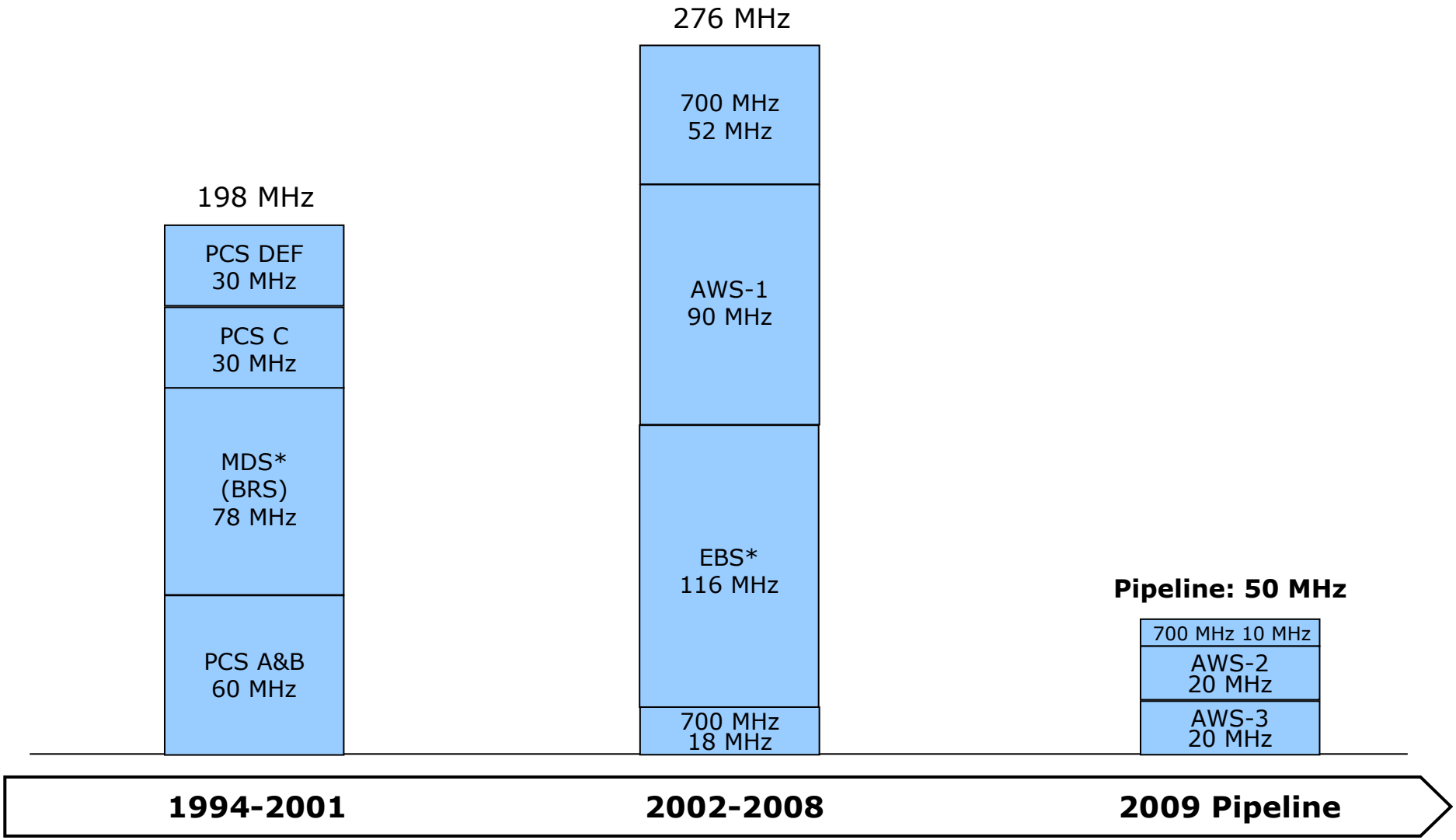
Source: ITU, "Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced"

Spectrum Reallocation Is A Multi-Year Process

Band	First Step	Available for Use	Approximate Lag Time
Cellular (AMPS)	1970	1981	11 years
PCS	1989	1995	6 years
700 MHz	1996	2009	13 years
AWS-1	2000	2006*	6 years

* Incumbent relocation is ongoing

The spectrum pipeline is drying up

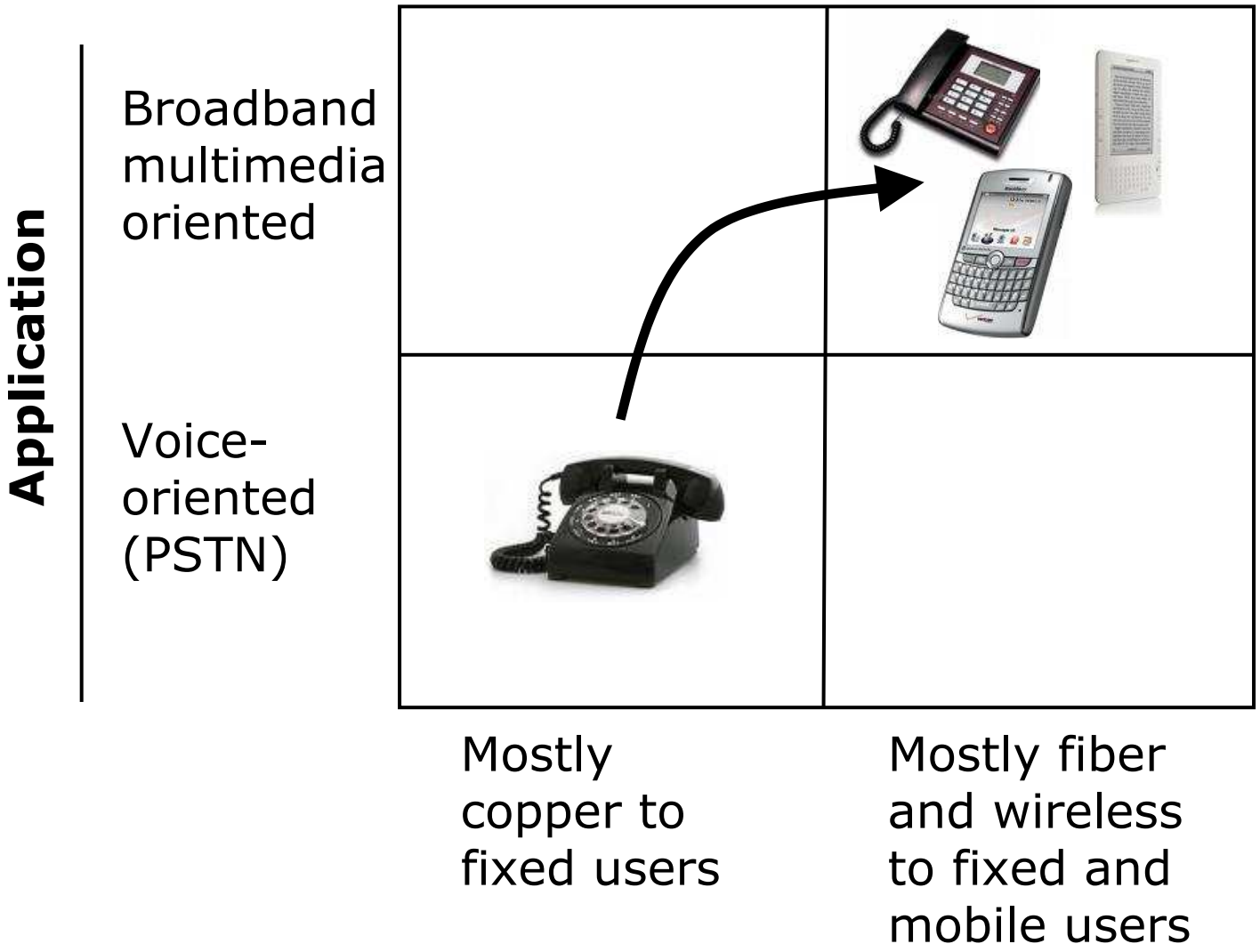


Spectrum Licenses Suitable for Mobile Broadband

** In 2004 MDS/ITFS was rebanded to create the EBS/BRS band*

Implications of the PSTN

The fundamental transition



Implications for policy

- The transition from old to new is technology and market driven, not "managed"

- Regulatory frameworks designed for the old must be actively reshaped to accelerate the pace and universality of the transition. In particular we must:
  - Redirect resources from propping up the old to efficiently encouraging the new (USF, intercarrier comp,…)
  - Decide which legacy policy goals are no longer necessary, and which remain important (emergency services, interconnection, carrier of last resort,…)
  - Ensure that no American is left stranded in the old world

- The more rapidly we move to universal broadband, the lower the legacy costs incurred

Break: Fifteen minutes

Adoption—The cost of Digital Exclusion and Opportunities for Acceleration

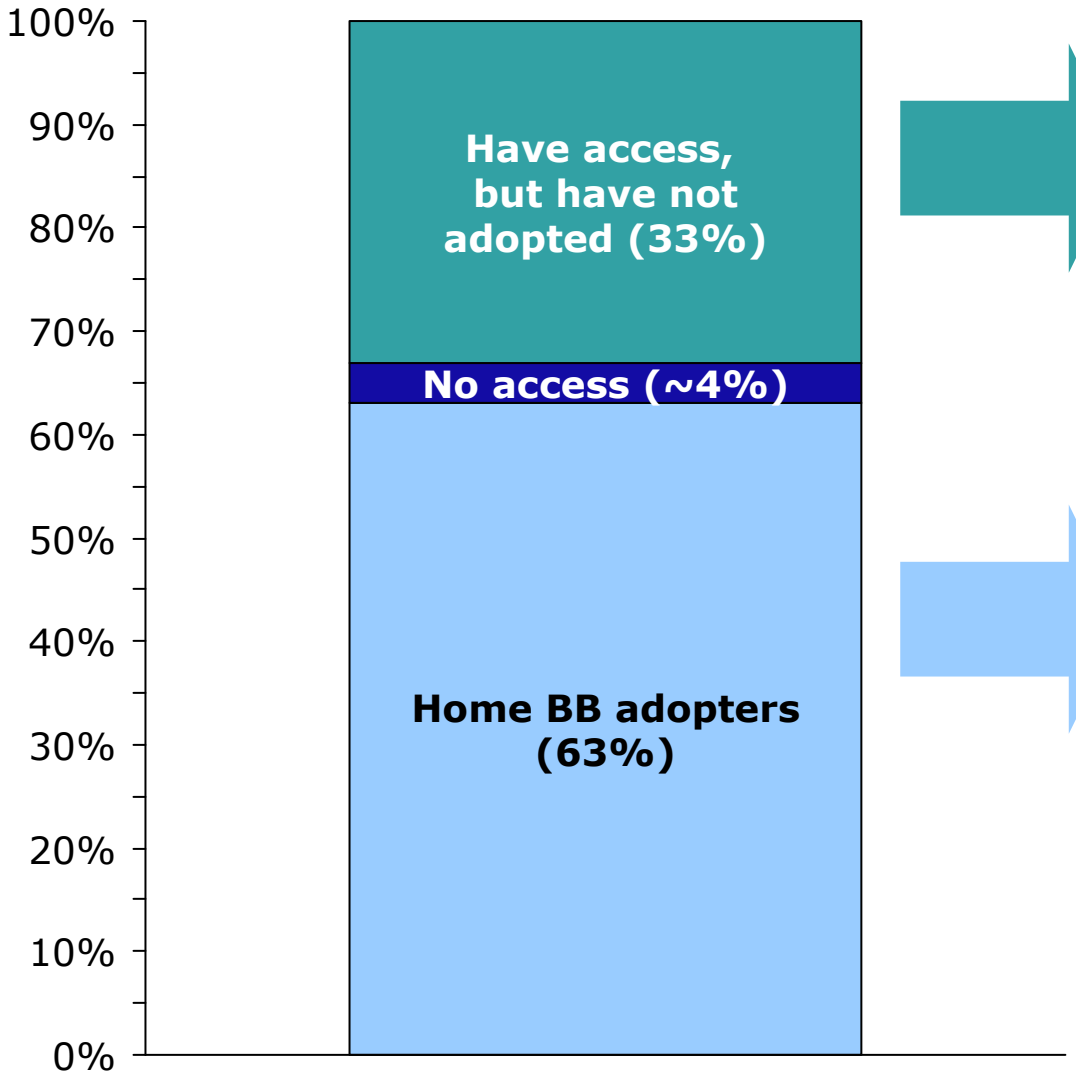
Approximately two-thirds of American adults have adopted broadband at home

Broadband adoption	Year	Data source	Methodology
63%	2009	Pew Internet and American Life	Based on a phone survey of American households and adults
63%	2008	Forrester Research Group	Based on a mail survey of American and Canadian households and adults
64%	2009	Pike & Fischer	Based on subscriber counts from industry reported data
67%	2008	Nielsen	Based on Nielsen in-home media surveys of American households

Reasons the remaining one-third have not adopted are not well understood

Reasons for non-adoption

Percent of U.S. households

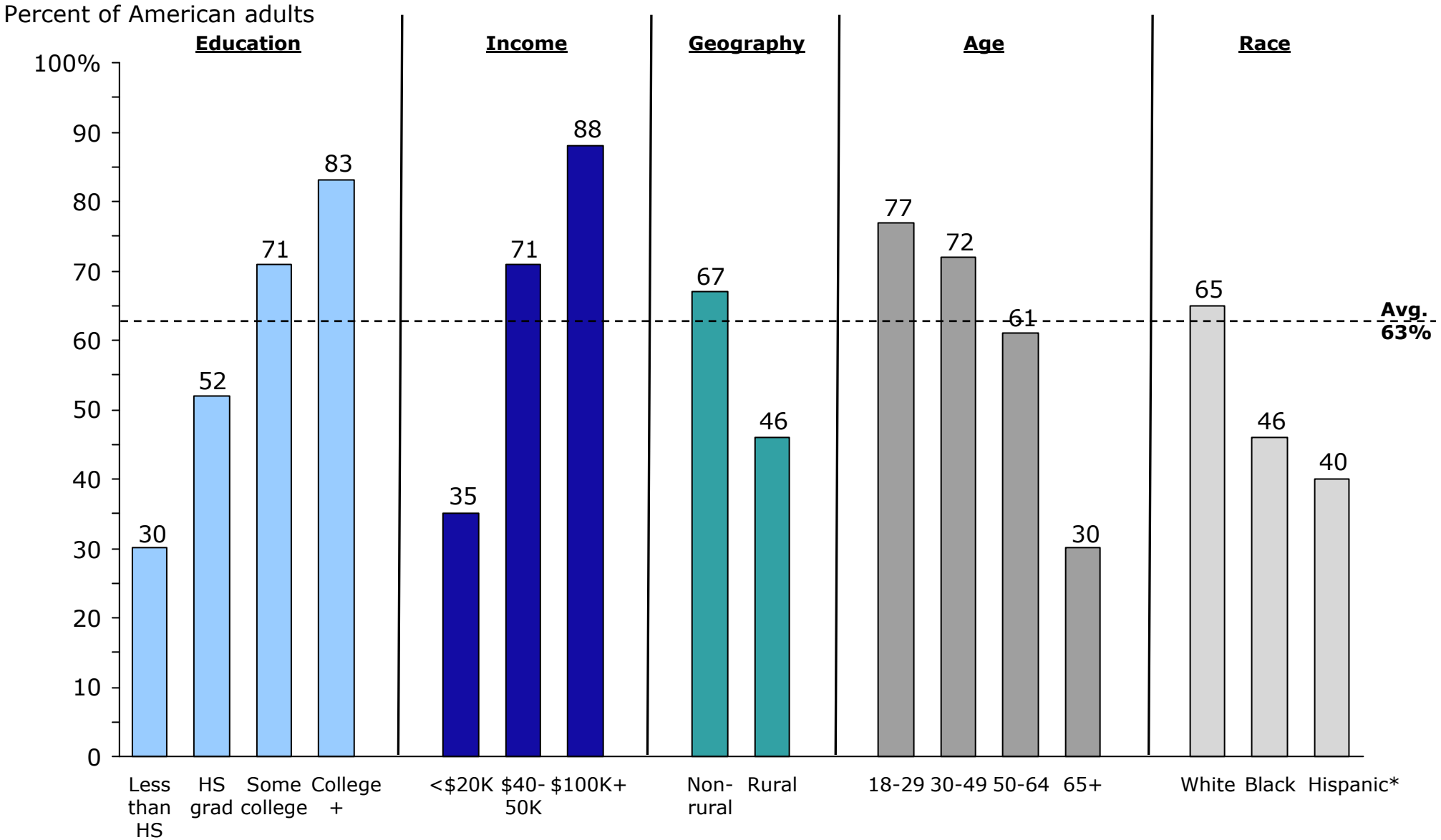


- Limited data on barriers that non-adopters face
- Transitioning non-adopters to broadband is different than technology transitions of the past

- Overall adoption will grow naturally over time

Source: Pew Internet & American Life Project, Home Broadband Adoption, June 2009

Adoption levels vary across demographic groups



*Hispanics includes both English and Spanish speaking Hispanics; 63% based on survey of English-only respondents

Source: Pew Internet & American Life Project, Home Broadband Adoption, June 2009

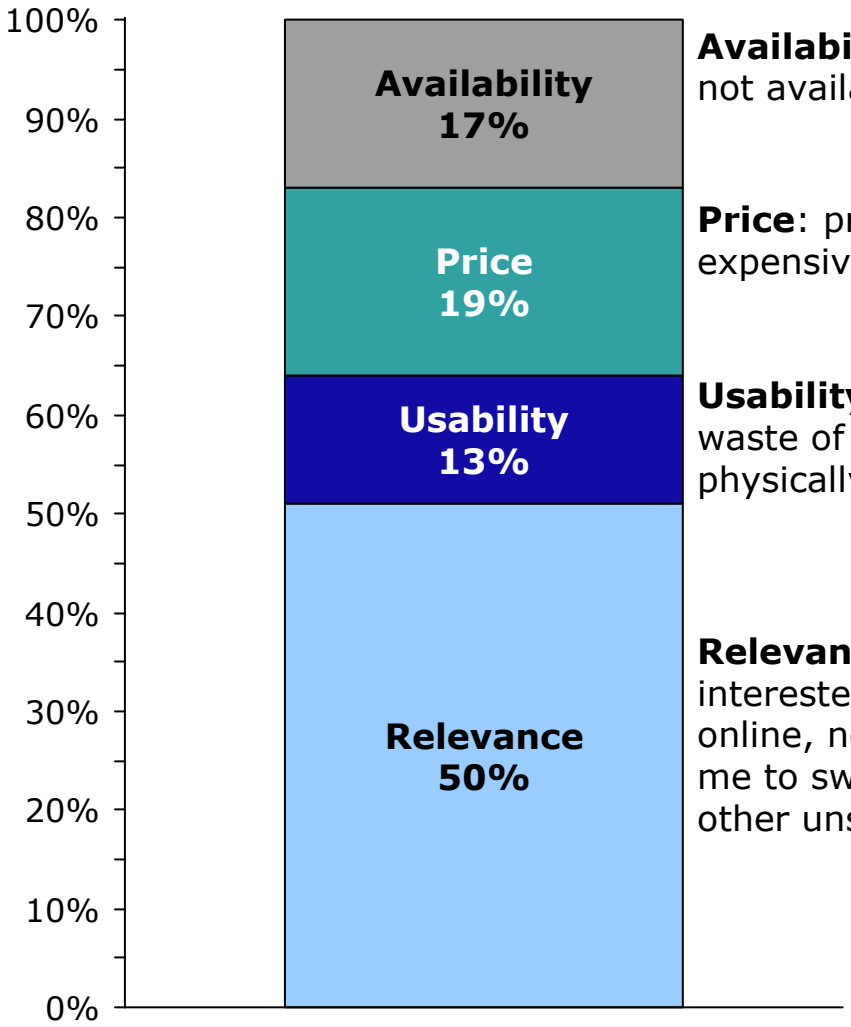
Cost of digital exclusion is large and growing

	Market data	Implication for non-adopters
Employment	• In 2005, 77% of Fortune 500 Companies did not give jobseekers the option of responding offline to positions posted on the corporate careers website[1]	• **Getting a job is more difficult** without access to online postings and the ability to submit applications online
Education	• ~65% of teens go online at home to complete Internet-related homework and 71% of teens say the Internet was their primary source for information for completing a recent school project[2]	• **Students without broadband connections lack access to the same level of information** as their connected peers
News	• 40% of Americans say they get most of their news from the Internet (more than those who cite newspapers); the Wall Street Journal is three inches narrower today than it was in 2004[3]	• Non-adopters have **increasingly limited resources to gather current events information**
Healthcare	• 61% of American adults have searched for health information online; of those 60% say the online information affected a decision about treating an illness or condition[4]	• Finding medical information without access to online health sources **limits patients' knowledge, choices and care**
Consumer welfare	• Study of car buyers showed that those who use online referral services and get price information online pay less than those who do not[5]	• Consumers who comparison shop in brick and mortar stores **pay more for goods & services** than those who comparison shop online

[1] See: http://www.taleo.com/research/articles/talent/don-miss-the-next-strategic-turn-115.html
[2] Natalie Carlson, National Survey Finds Kids Give High Marks to High Speed, Hispanic PR Wire (April 2007)
[3] Pew Research Center for the People and the Press (December 2008); news releases (December 2005)
[4] Pew Internet & American Life Project , The Social Life of Health Information (June 2009)
[5] Scott Morton, Fiona M., Zettelmeyer, Florian and Silva-Risso, Jorge M., Internet Car Retailing (February 2001)

Among non-adopters, lack of relevance cited as main reason for not having broadband at home

Broadband adoption levels
Percent of dial-up or non-Internet users



Availability: broadband not available

Price: price must fall, too expensive, no computer

Usability: too difficult, waste of time, too old, physically unable

Relevance: not interested in getting online, nothing could get me to switch, too busy, other unspecified reasons

Non-broadband or Internet users citing **price** or **availability** as barrier are:

- Older: median age is 51
- Women: 60%
- Black: 23% vs. 11% in sample
- Low income: 39% vs. 16% in sample
- Rural: 33% vs. 19% for sample

Non-broadband or Internet users citing **relevance** or **usability** as a barrier are:

- Older still: median age is 63
- Low income: 32% vs. 16% in sample

Source: Pew Internet & American Life Project, Home Broadband Adoption, June 2009

Survey questions will be designed around three themes for non-adopters

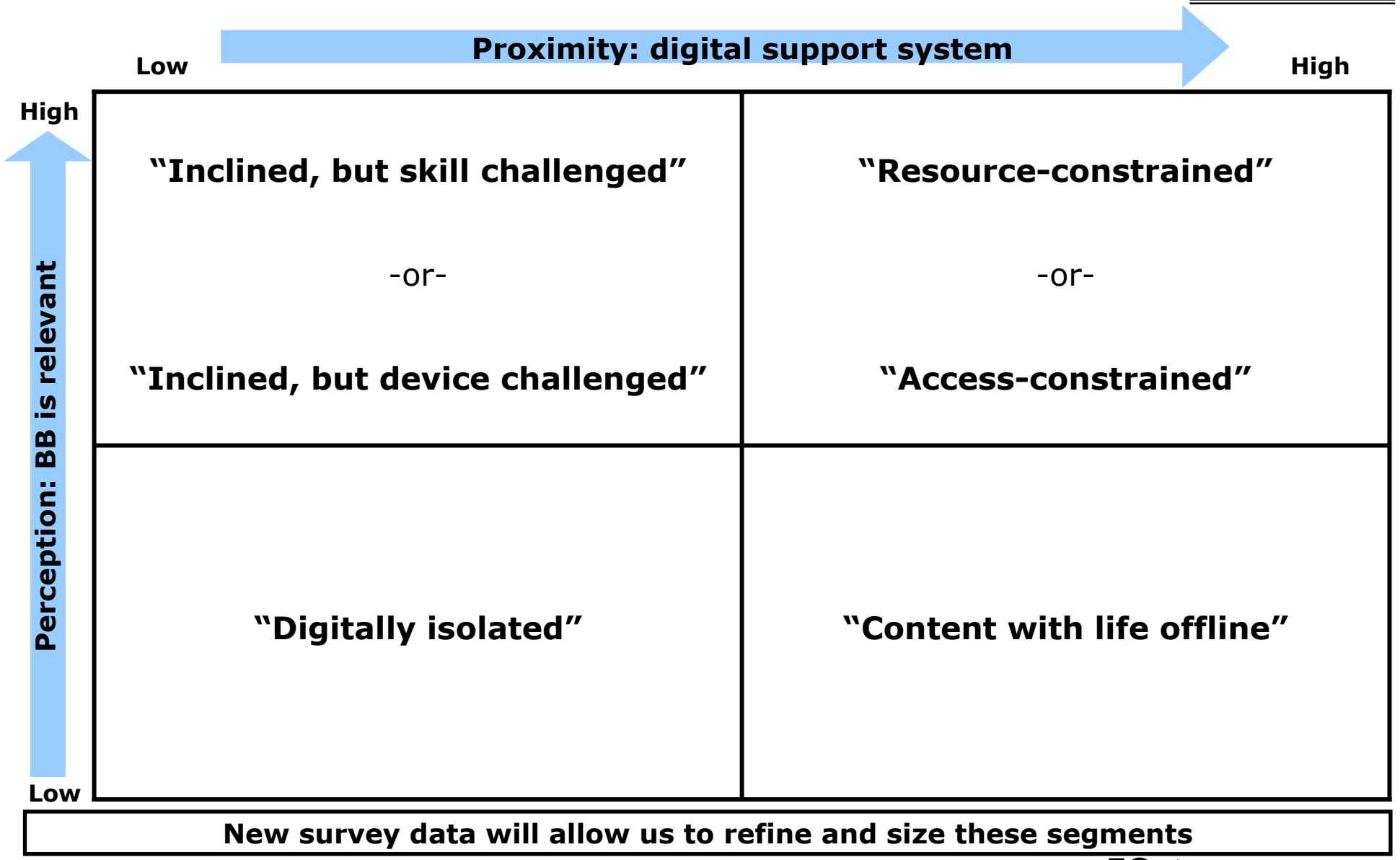
How do **attitudes** about broadband and modern information gadgetry influence adoption?	• Worries about online content • Concerns about sharing personal information online • Difficulty in getting gadgets to work • Unaware of broadband's potential benefits
How does **affordability** figure into adoption?	• Level of monthly bill • Cost of purchasing & owning hardware
How does the **personal context** of a non-adopter influence adoption decision?	• Are there broadband users in non-adopters' homes? • Did non-adopters used to be Internet users? • Do non-adopters frequent places (e.g., libraries) where there are access points? • Do they encounter decision-points in their lives (educational choices, job search) where broadband access would be helpful? • Do they have the digital skills to use broadband? • Are disabilities a barrier to use?

Not all non-adopters are the same; new survey will help us better understand differences

- Segmentation to be built around non-adopters' responses to questions on:
  - Attitudes
  - Affordability
  - Personal context
- Segmentation of non-adopters helps us:
  - Understand size of various non-adopters groups
  - Determine nature of barriers facing different segments
  - Tailor solutions to address the specific barriers to adoption for each segment
- Survey to be fielded by mid-October; data delivered to us in November
- First time in U.S. this analysis has been done for non-adopters

Based on current data, we have segmented non-adopters and identified their barriers to adoption

HYPOTHESIS



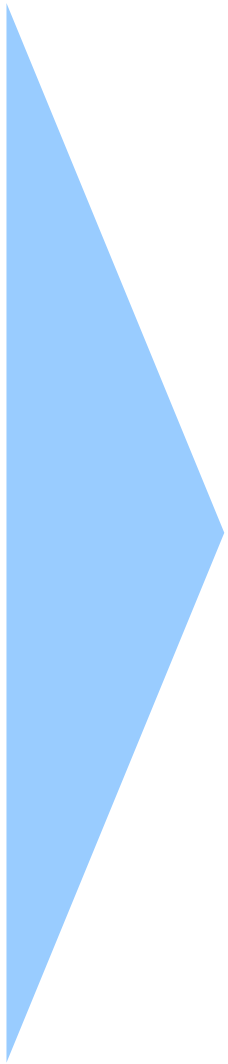
New survey data will allow us to refine and size these segments

Video case study

Video clip for Tech Goes Home

Understanding existing programmatic efforts

- 3 adoption-specific workshops with 21 participants
- Broad discussions included:
  - Building the fact base
  - Importance of applications
  - Existing programmatic efforts
- Majority of workshops discussed adoption or barriers, including:
  - State & local governments
  - Job training
  - Healthcare
  - Disability opportunities
  - Opportunities for small and disadvantaged businesses
  - E-gov/civic engagement



- Current programs are diffuse and fragmented
- Broadband means different things to different people
- Successful programs share certain key elements

Current adoption programs are diffuse & fragmented

Methods of Encouraging Adoption

- Cost support
  - Hardware
  - Service
  - Training
- Access away from home
- Digital literacy
- Content based
  - Relevance
  - Usability
- Adaptive technology

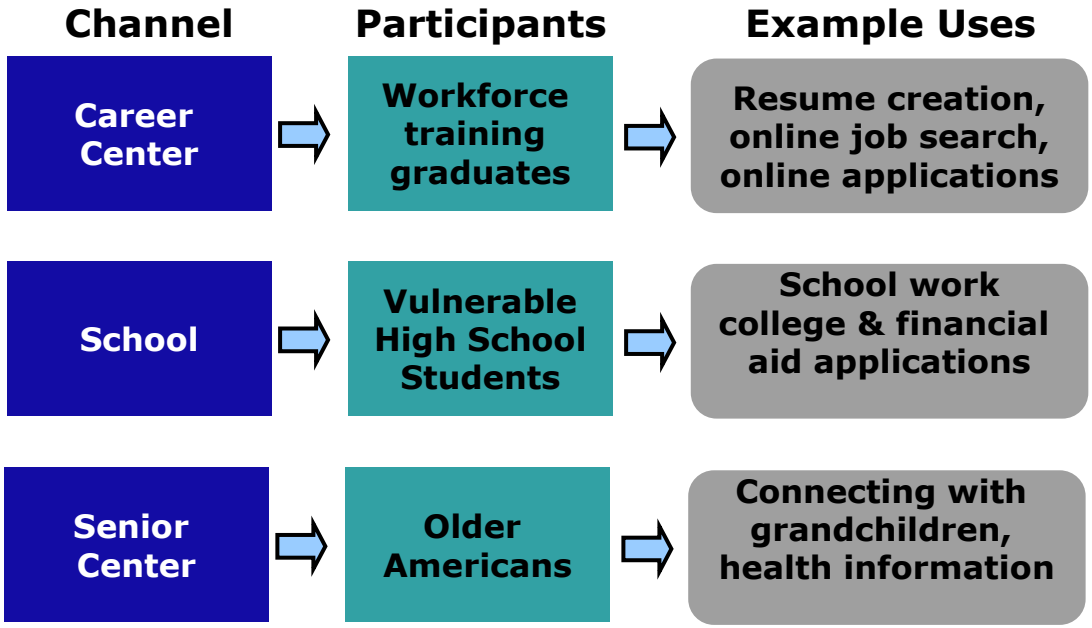
Stakeholders Involved from Every Sector

Successful programs focus on unique needs of target populations

Key Program Elements[1]

- Comprehensive programs and services
- Focus on the household and not just anchor institutions
- Community based services and institutions relevant to target populations
- Intensive services
- Human element is essential

Focus on Individual Needs



Early Signs of Success[2]

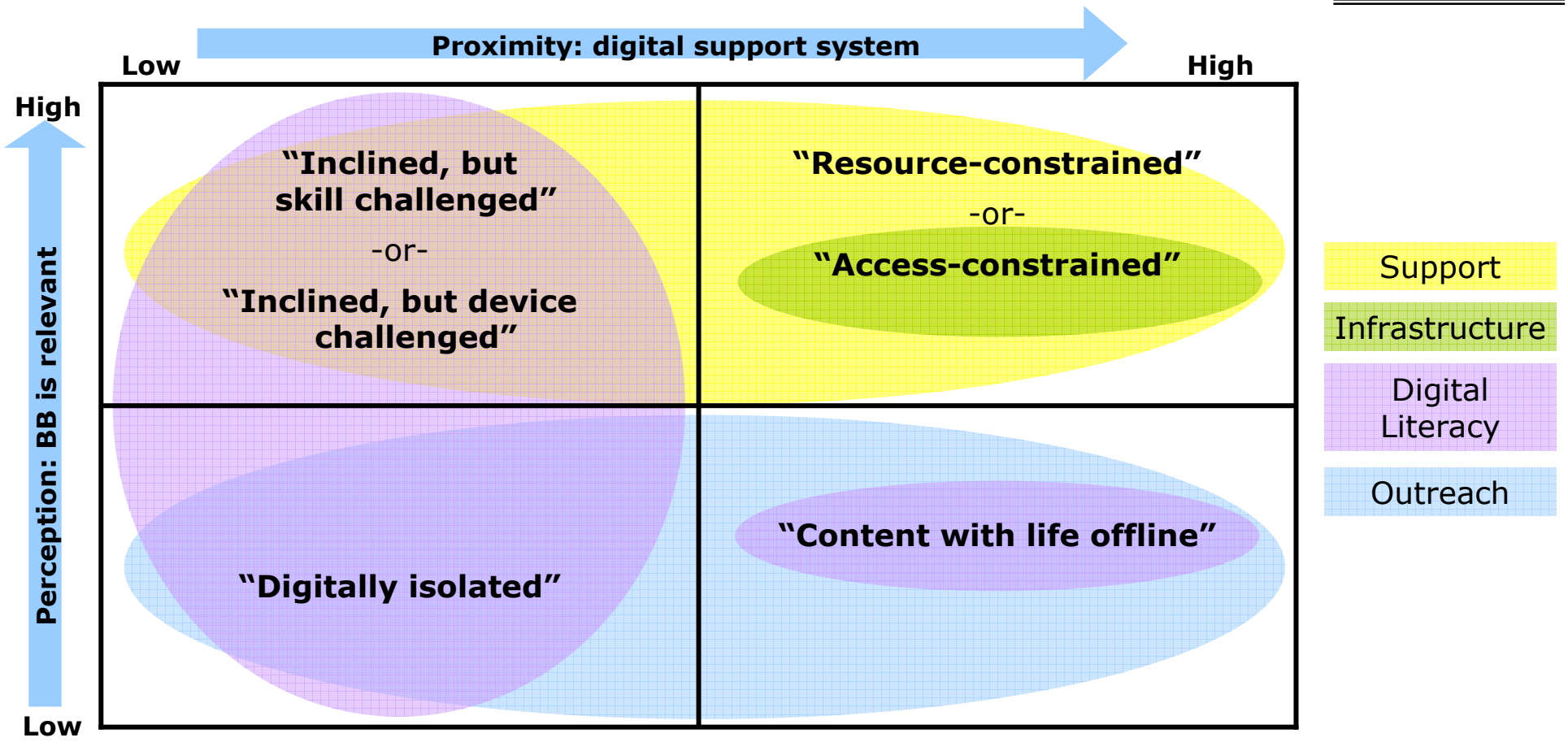
I wanted to learn…	% who learned something about…	% who used materials at least 1x/week since training
Research educational opportunities	82.4%	68.1%
Find and apply for jobs/ internships	86.3%	68.1%
Help my kids/ family with homework	83.3%	68.8%

[1] Greg Goldman, Digital Impact Group, FCC Workshops

[2] OMG Center for Collaborative Learning, "Learning More about What Works: Short-Term Client Outcomes of the Sustainable Broadband Adoption Pilot Program." July 2009. Percentages based on those respondents who cited listed purpose as a reason for participation.

Proposed solutions should address segment-specific needs

HYPOTHESIS



Issues for consideration

Segment size

Government role

Probability of success

Introduction to National Purposes

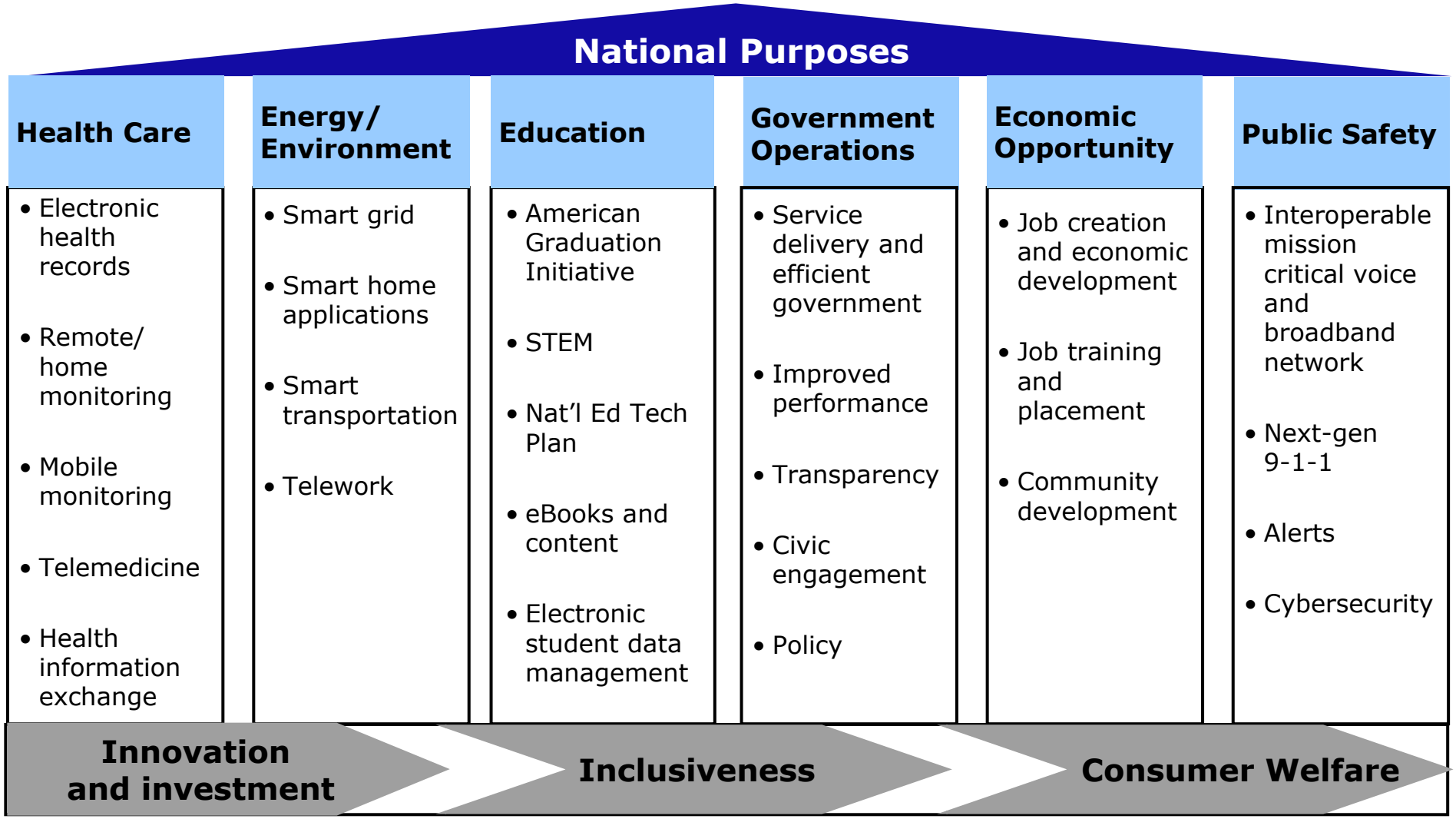
The plan shall include…

d. A plan for use of broadband infrastructure and services in advancing:

- Consumer welfare
- Civic participation
- Public safety and homeland security
- Community development
- Health care delivery
- Energy independence and efficiency
- Education
- Worker training
- Private sector investment
- Entrepreneurial activity, job creation and economic growth
- And other national purposes

Source: American Recovery and Reinvestment Act of 2009, Title IV – Broadband Technology Opportunities Program, §6001(k)(2)(d)

Broadband is part of the solution to many of the country's problems



National purposes framing questions

1. For each area, what are the major priorities requiring broadband connectivity? What are the gaps in connectivity, if any, that need to be addressed?
   - What are the costs and benefits of closing these gaps?
   - How should the federal government proceed?

2. What are compelling applications, emerging technologies, use cases, and other ideas that could be enabled by broadband?
   - What are their costs and benefits?
   - What role should the federal government play in stimulating their development, deployment, and adoption?

Health Care

Health care areas of focus

How broadband can further our nation's goals in health

Electronic Health Records	Telemedicine	Mobile Monitoring	Health Information Exchanges
•Regional Extension Centers •Beacon Communities •$40B adoption incentives – Computerized physician order entries – Drug checks – E-prescribing – Clinical decision support	•Diagnosis and remote monitoring in the home •Online healthcare consultations for rural areas	•Extension of monitoring to even outside the home •Medical device interoperability	•Information sharing •Data fidelity and privacy

Source: IT priorities developed by the Department of Health and Human Services as part of their efforts to define "meaningful use" for the purposes of EHR incentive funding

Broadband speed requirements vary for different applications

	Content type	Example applications	Actual download speed demands (Mbps)[1]	
Non real-time	• Basic download (or upload) usage	• Email communication & scheduling • Wellness programs (e.g. Nike+) • ePrescriptions	0.2-0.5 *(Speed impacts down/up time and render)*	
Non real-time	• Large download (or upload) usage	• Google-Health • Onrad • NightHawk • Singleton Diagnostic • Academic research	1-10+ *(Speed impacts down/up time and render)*	
Real-time	• Voice over the Internet (VOIP)	• Remote consultation	0.2-0.5	Symm.
Real-time	• Video-conference + VOIP	• Basic telemedicine	1.2-2.0	Symm.
Real-time	• SD streamed video	• Real-time online health care consultations	2-10	Symm.
Real-time	• Enhanced video teleconferencing	• Advanced telemedicine • Streamed procedures and diagnostic information	10-20+	Symm.
Real-time	• HD streamed video	• Remote procedures	20+	

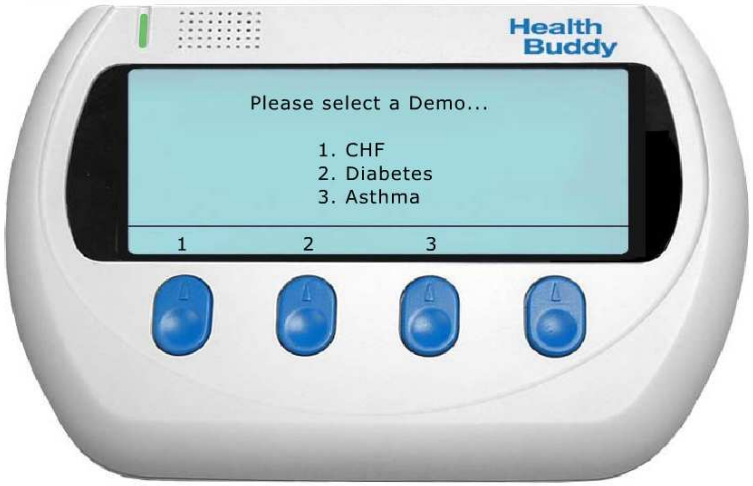
[1] Actual speeds are typically lower than "advertised" ISP speeds – see later materials for details

Sources: California Broadband Task Force report; ADTRAN FCC submission; Speedmatters.com report; Technet Broadband Primer; ITIF report March 2009; FCC analysis; Skype; ITIF; Gary Kim – IPTV drives bandwidth arms

Dramatic results in Veterans Affairs telehealth pilot

Description

- Application of telemedicine to management of chronic diseases
  - Heart failure
  - Diabetes
- Home remote monitoring of dynamic parameters to pick up complications earlier



Results

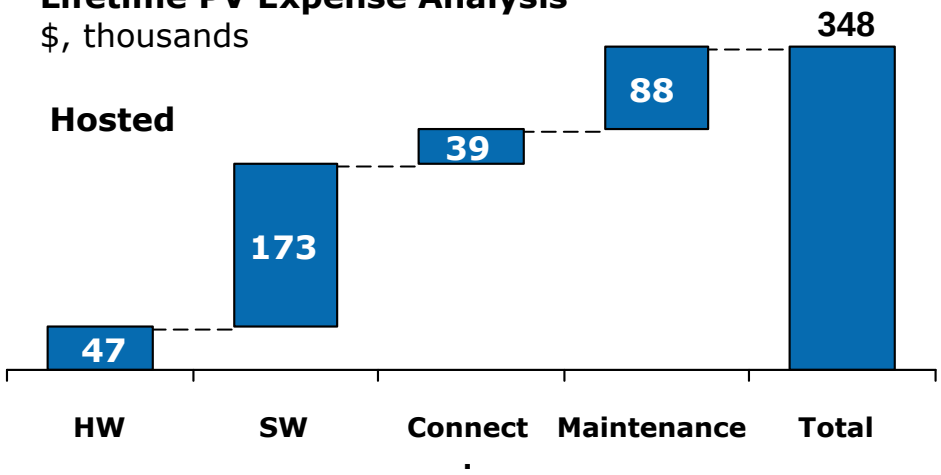
- Chronic disease management
  - 19% decrease in hospitalizations (translates into cost savings of **$2.2B/year**)
  - 25% decrease in bed days of care
- Diabetes-specific results
  - 27% decline in 4 year diabetes mortality rate

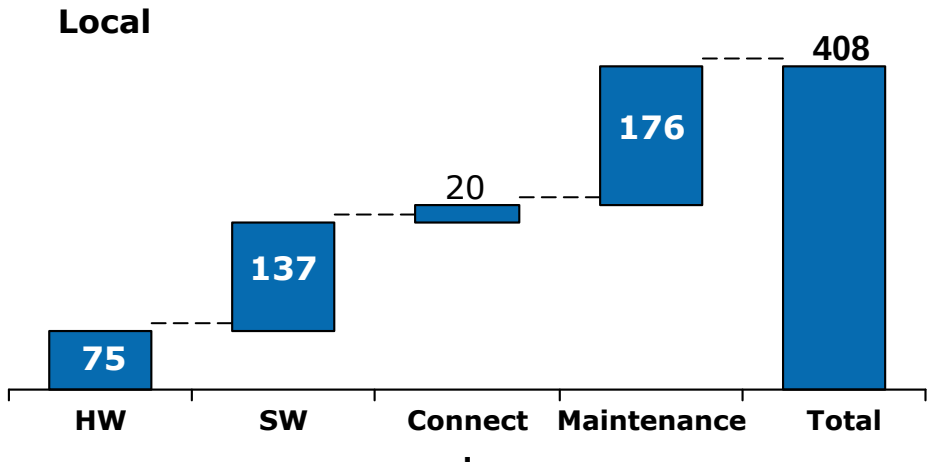
Source: Chumbler NE et al: Mortality risk for diabetes patients in care coordination, home-telehealth program. Journal of Telemedicine and Telecare 2009:15:98-01; Bates DW et al; Veteran senate hearings (http://veterans.senate.gov)

Improved broadband may deliver strong incremental value

Hosted EHR economics ~ 18% cheaper…

2 providers, New York City DHHM estimates
Lifetime PV Expense Analysis[1]
$, thousands





… with clear incremental value

- Less tech expertise required: No need to own, operate, or update server
- Real-time change in reimbursement code & software capability updates
- Scalable offerings: volume and functionality can expand with the practice
- Hosted data more secure than local servers

[1] Assumes 7% discount rate; re-purchase (or significantly upgrade) hardware every 3 years; no price changes
Source: New York City Department of Health and Mental Hygiene

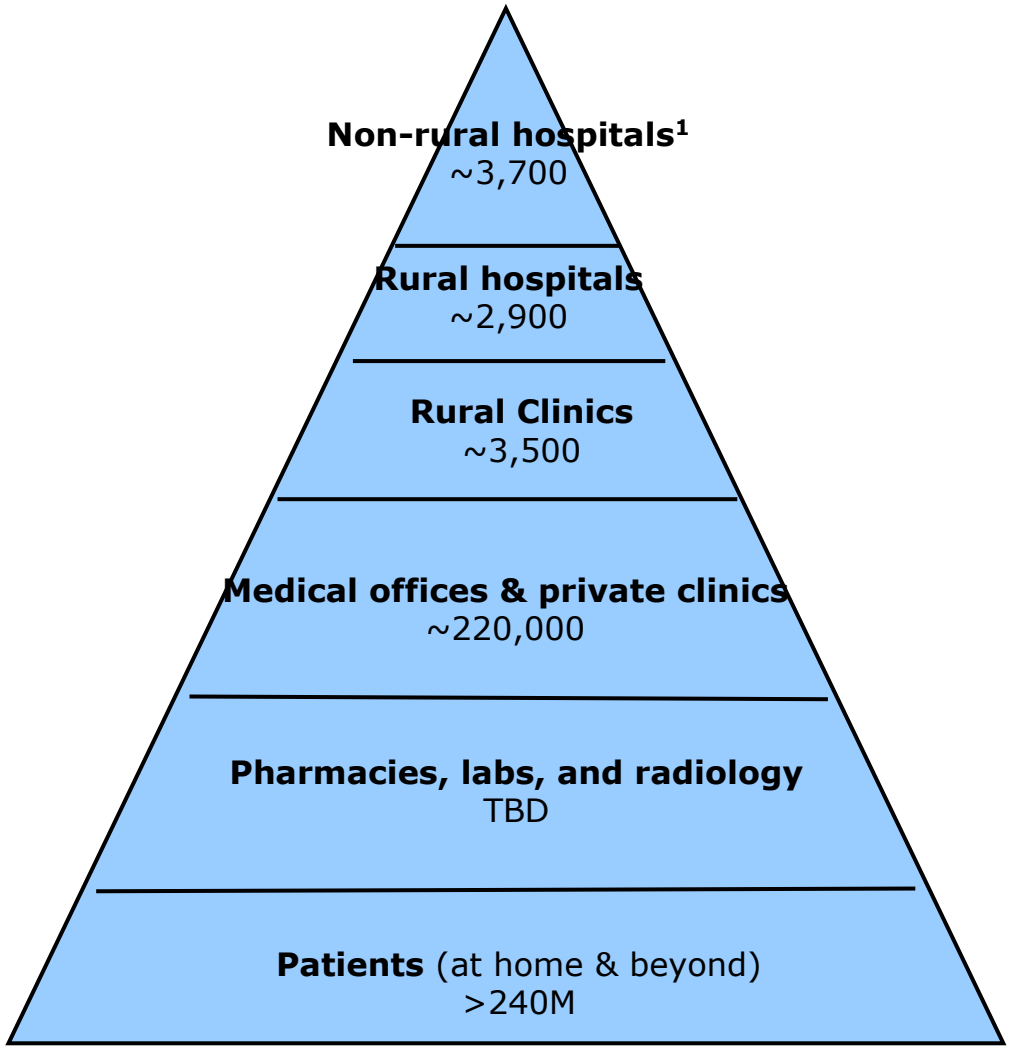
Multiple examples of impact from connectivity

Program	Demonstrated Impact
E-Prescribing BRIGHAM AND WOMEN'S HOSPITAL A Teaching Affiliate of Harvard Medical School	• **55% decrease in serious medical errors** from prescription errors • Net savings of between $5-$10M per year • Nationally would result in **$1B in avoided costs**
Computerized Physician Order Entry VOLUNTEER EHEALTH INITIATIVE	• **13% decline in duplicate tests** over five years • $12.8M annual savings • Nationally would result in **$1.1B in avoided costs**
Mobile Health Innovation	• Congestive heart failure (CHF) is the #1 cause of hospitalization in the U.S. • Trials are testing remote sensors that prompt patients to present earlier therefore allowing earlier intervention • Potential cost savings of **$5 to $7B/year**

Sources: Regenstreif Institute; Chumbler NE et al: Mortality risk for diabetes patients in care coordination, home-telehealth program. Journal of Telemedicine and Telecare 2009:15:98-01; Bates DW et al: Effect of computerized physician order entry and a team intervention on prevention of serious medical errors. JAMA 280(15): 1311-1316 October 21. 1998. Jencks SF, et al: Rehospitalizations among Patients in the Medicare Fee-For-Service Program. N Engl J Med 2009, 360 1418-28. Health Affairs; Hillestad R , et al: Can electronic medical record systems transform health care? Potential health benefits, savings and costs, *www.volunteer-ehealth.org/AHRQ/06072005/session/TN.ppt*

Different connectivity needs are required throughout the system

U.S. health providers
Number



[1] Urban community hospitals, federal government hospitals, no-federal psych hospitals, nonfederal LTC hospitals; hospital units of institutions

Source: American Hospitals Association

Areas of focus and key issues

Areas of focus	Key issues
Value of broadband	• Speed and reliability requirements for national Health IT priorities and private sector innovation • Differences in requirements by segment • Health and financial impact of broadband enabled solutions
Connectivity gaps	• Current state of connectivity for each segment of the healthcare space • Needs that will not be satisfied by commercial carriers • Adoption barriers
Appropriate interventions	• Healthcare-specific infrastructure requirements • Needed changes to existing programs • Additional policy levers to close gaps

The FCC's Rural Healthcare Program supports a pilot for connectivity

Rural Health Care (RHC) Support Mechanism

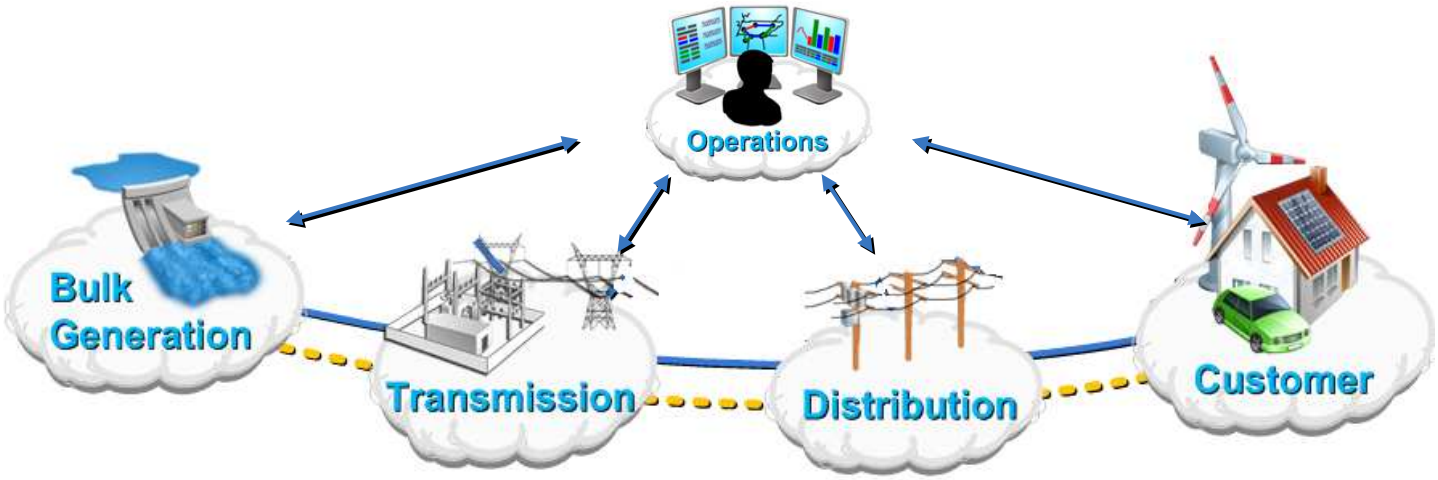
- Part of the FCC's Universal Service Fund
- Provides support for rural healthcare providers for difference (if any) between rural rates and urban rates for telecommunications services
- Monthly support for rural healthcare providers to cover 25% of the cost of Internet access
- $400 million dollars per year has been authorized for funding under the RHC support mechanism
  - Less than 10% per year has been disbursed

Pilot Program

- Pilot program launched to broaden demand for rural health care funding (funds 85% of costs, including network design and build)
- Currently there are 62 participants in the pilot program
- Fifteen projects have received funding commitment letters for a total of $21.4 million
- The Commission will examine ways to reform the RHC support mechanism after the Pilot Program ends on June 30, 2010.

Energy

What is the smart grid?



Two-way flow of electricity and information to create an automated, widely distributed energy delivery network[1]

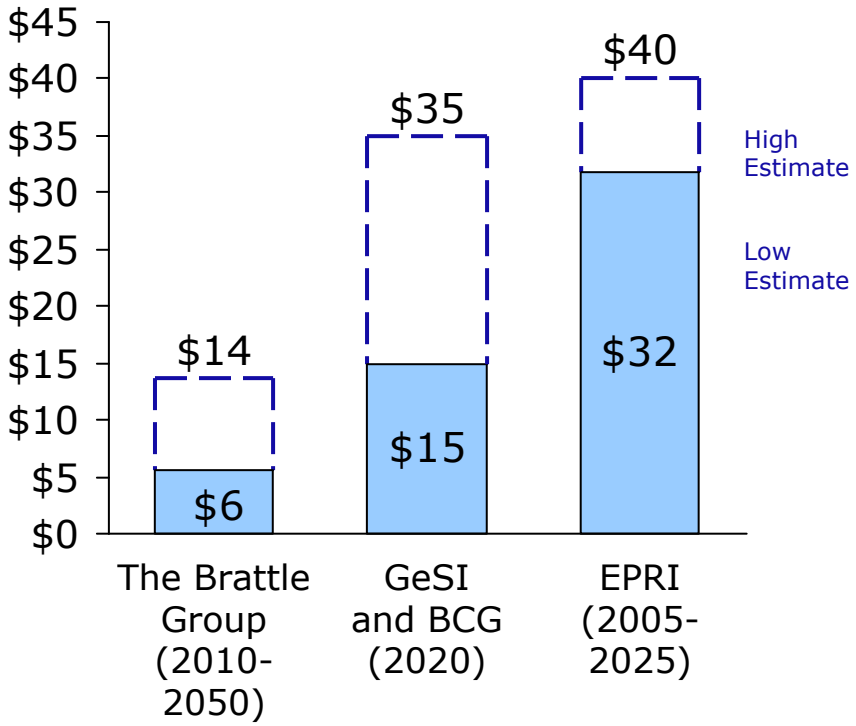
[1] Smart Grid Roadmap, NIST 2009, DOE 2009

Benefits of the smart grid

Smart grid is estimated to create $6-40B value on an annual basis…

Annualized value creation

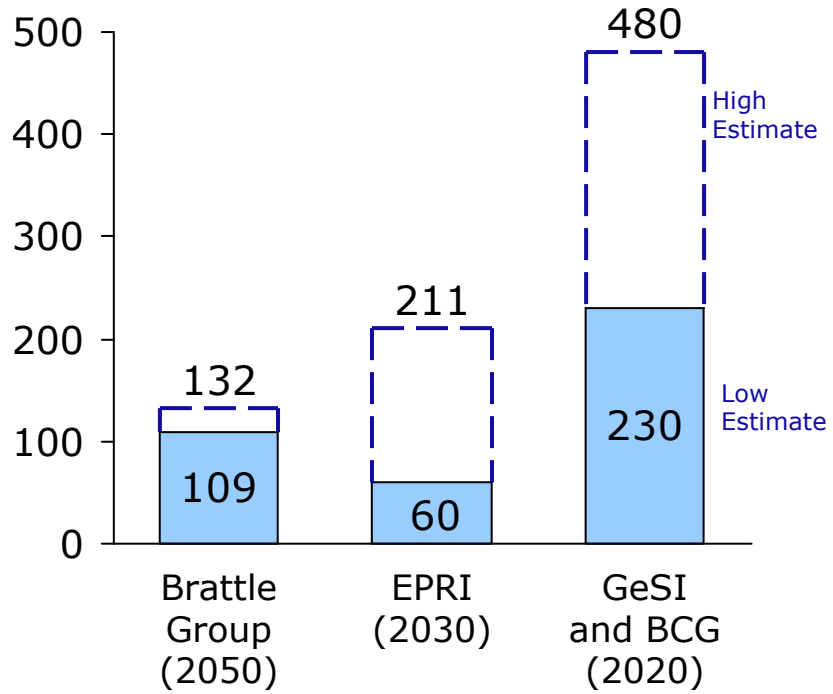
$, billions



…and decrease emissions by 60-480MM tons of CO_2

Annual emissions savings

MM tons CO_2



Sources: Normalized from "The iGrid Project", The Brattle Group, July 2009; "Smart 2020: Enabling the Low Carbon Economy in the Information Age. United States Report Addendum", GESI and BCG, Nov. 2008; "Power Delivery System of the Future: A Preliminary Estimate of Costs and Benefits", EPRI, July 2004; "The Green Grid: Energy Savings and Carbon Emissions Reduced Enabled by a Smart Grid", EPRI, Jun. 2008

Energy & environment areas of focus

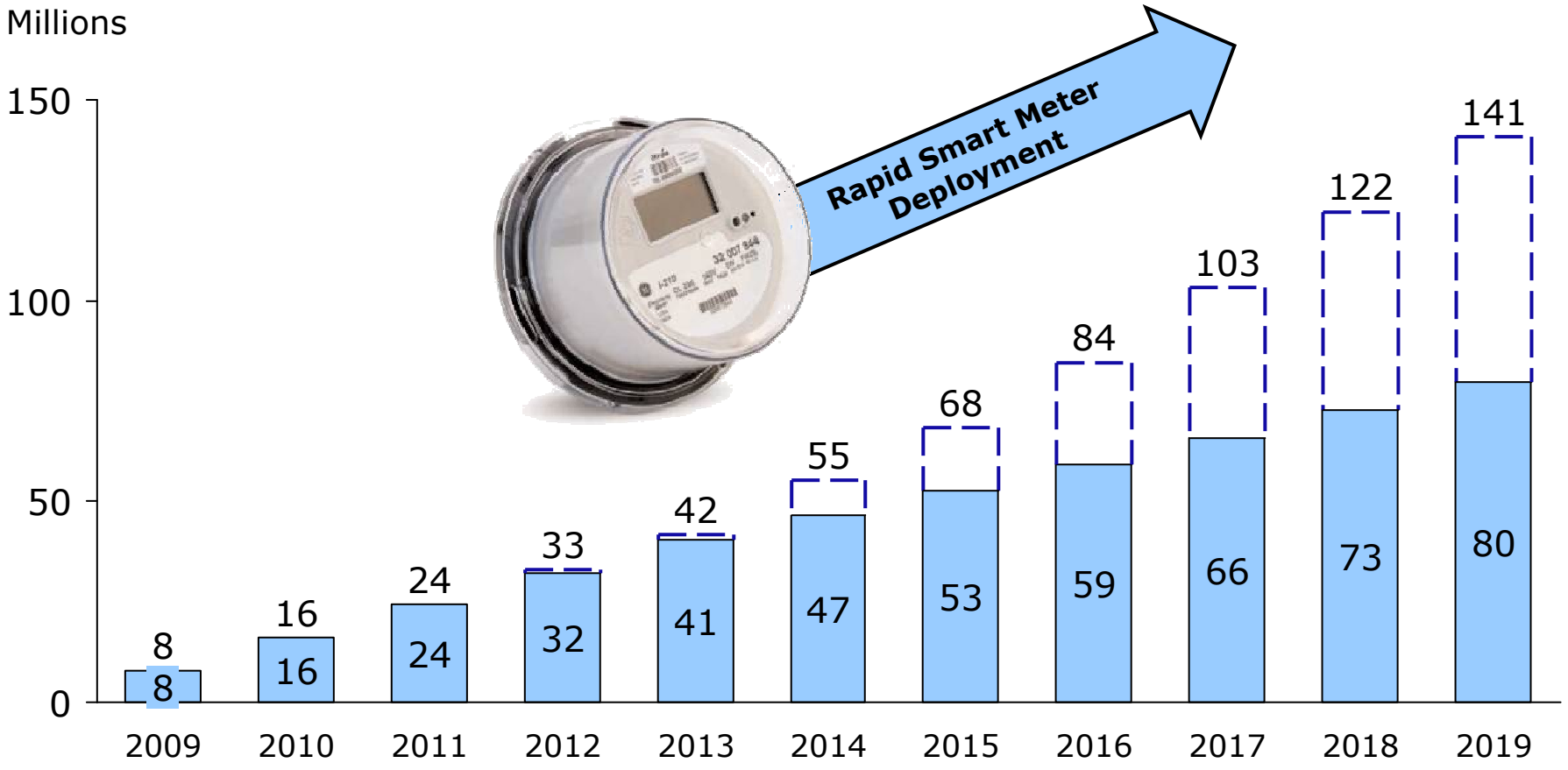
How can broadband and communications further our national goals in energy and the environment?

Smart Grid	Smart Home / Building	Smart Transportation
• What communications networks are optimal for the smart grid? • How available are these networks? • How can these networks be made more available and more suitable?	• How can communications maximize energy efficiency in the home/building? • What types of data will maximize energy efficiency, and how accessible is this data? • How will energy data drive innovation in the home/building?	• What transportation applications are enabled by broadband? • How can advanced communications networks improve the efficiency of the transportation system?

State of the smart grid

Deployment of smart meters is accelerating quickly, laying the groundwork for several consumer-oriented smart grid applications

AMI meters, 2009-2019 (projected)



Source: "National Assessment of Demand Response Potential," FERC, June 2009

The smart grid is being built to meet specific requirements using many different types of networks

Network requirements

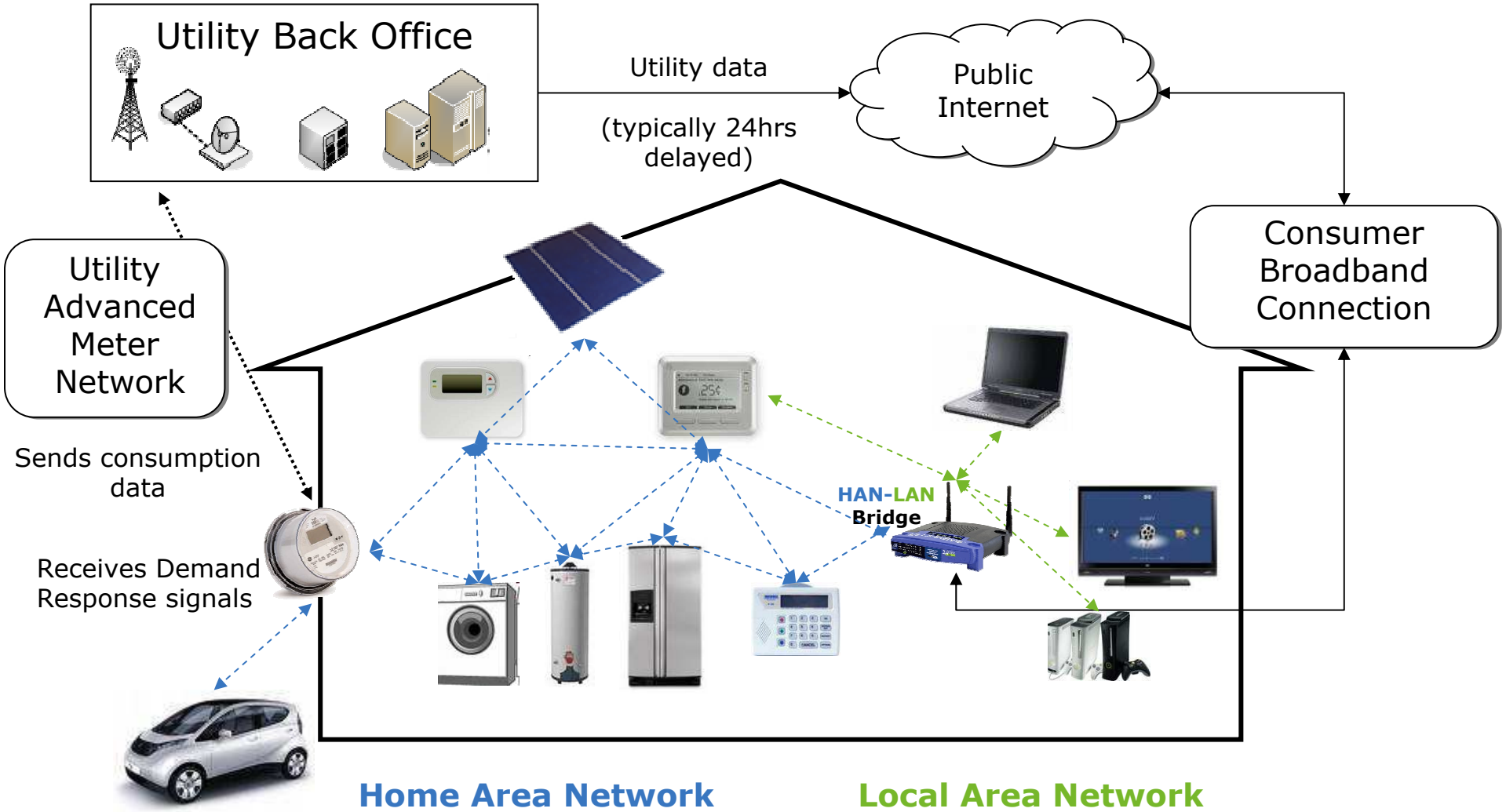
- Capacity
- Latency
- Coverage
- Reliability
- Privacy
- Security
- Cost
- Longevity

Smart grid network types

	Narrowband	Broadband
Commercial	• 2G wireless • Pager networks • POTS	•3G wireless •WiMAX / LTE •DSL •T1 •VSAT •Fiber
Private	•Unlicensed RF mesh •802.15.4 (e.g. Zigbee) •MAS radios •Powerline Carrier (PLC)	•Fiber •Microwave •WiMAX •Wi-Fi •Broadband over powerline (BPL)

Smart home network architecture

A smart home can include a commercial broadband connection to enable advanced consumer energy services



Areas of focus and key issues

Areas of focus	Key issues
Network Requirements	• Identification of network requirements for each smart grid and smart transportation application • Availability of suitable networks
Commercial vs. Private Networks	• Ability for commercial networks to support smart grid and transportation network requirements • Alternatives to commercial networks
Spectrum	• Licensed spectrum needs and usage for smart grid applications • Alternatives to dedicated spectrum approaches • Effect of dedicated spectrum on smart grid deployment
End-User Data & Innovation	• End-user ownership, privacy, security and accessibility of data • Best practices in data accessibility, security and innovation

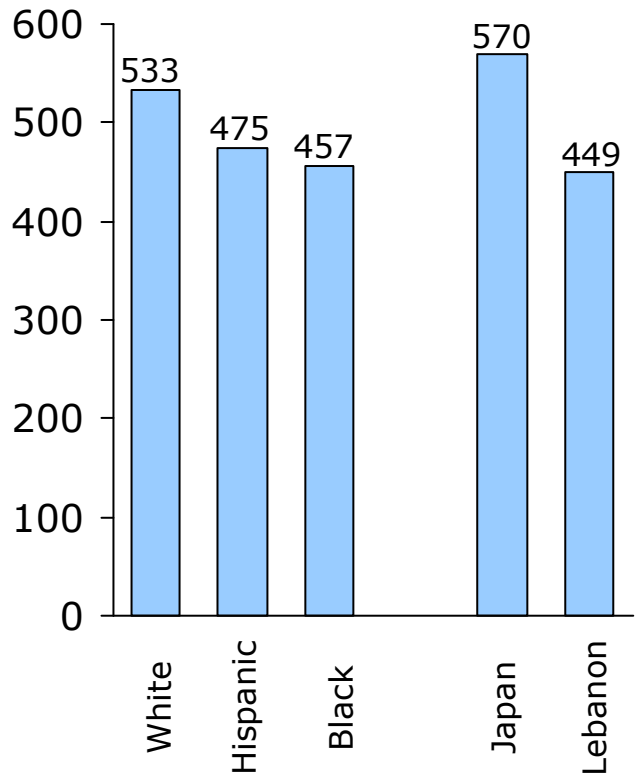
Education

Educational outcomes are weak and the achievement gap is staggering

U.S. performance lags internationally, particularly for our students of color…

Average TIMSS mathematics scores for 8th grade students, 2007

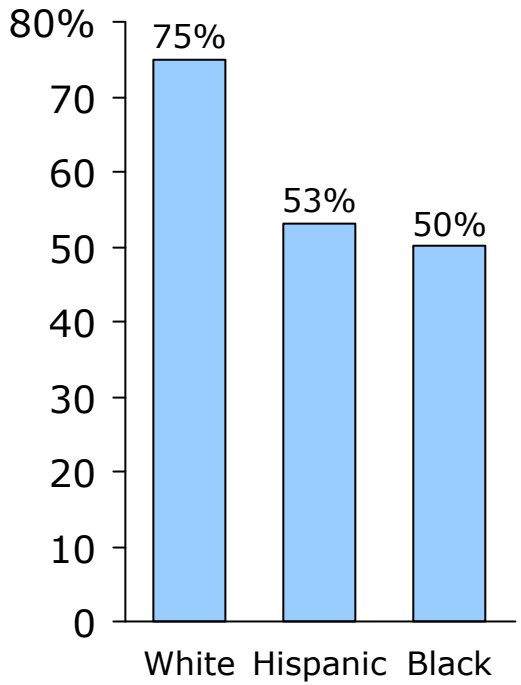
Points



A third of our students never graduate high school; for students of color, only half…

High school graduation rate

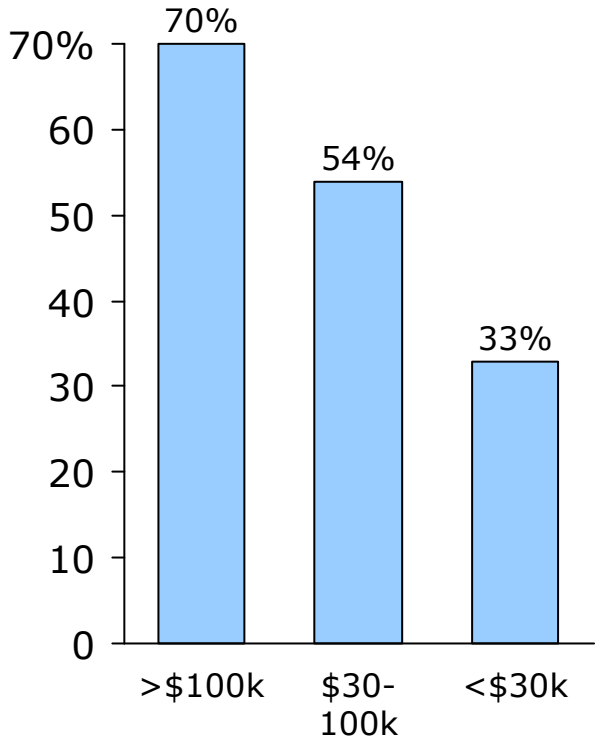
Percent



Not nearly enough of our students graduate high school ready for college…

ACT-tested students with college level literacy skills

Percent

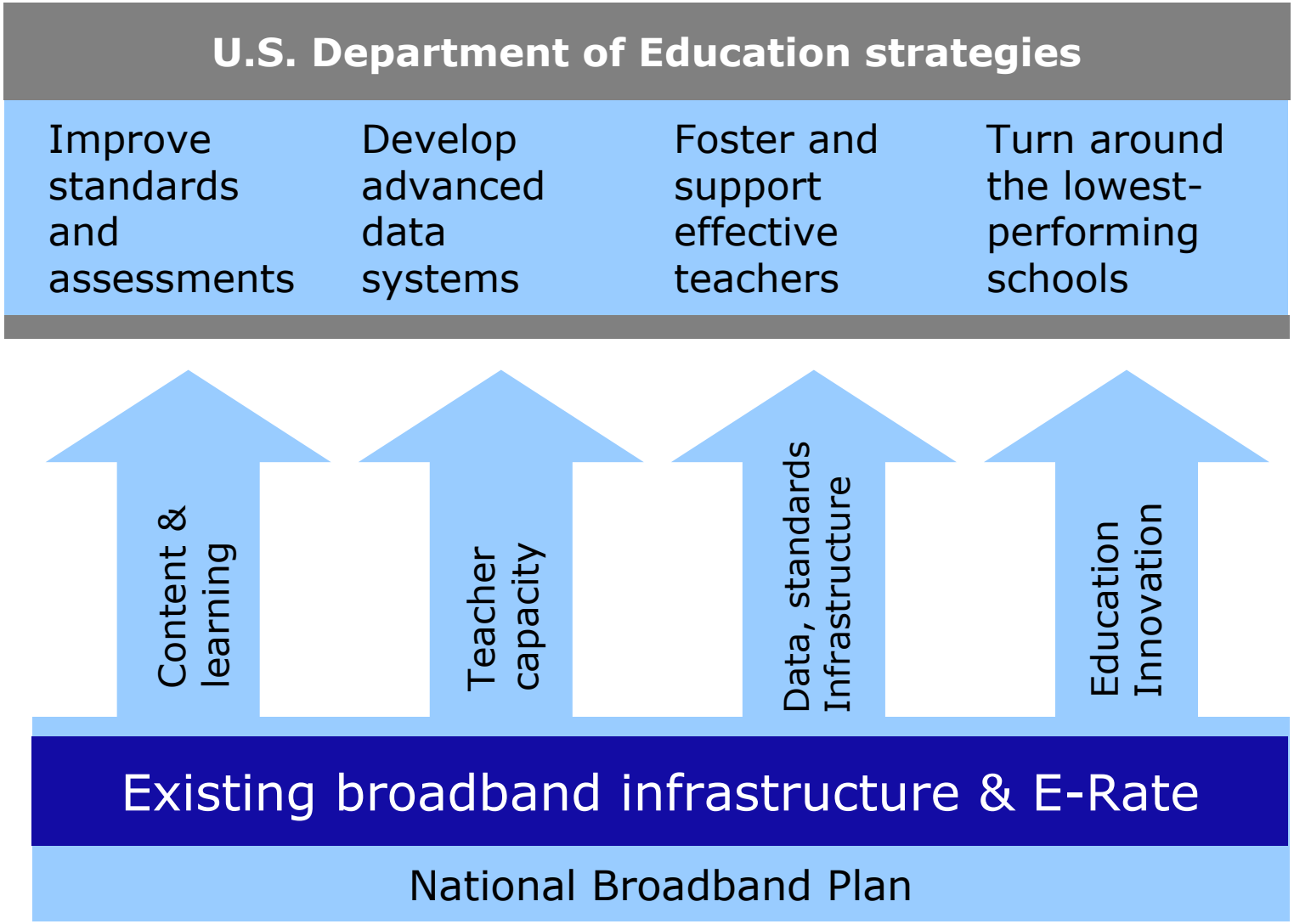


Sources: TIMMS 2007; Urban Institute: Losing Our Future; ACT: Ready for College-level Literacy

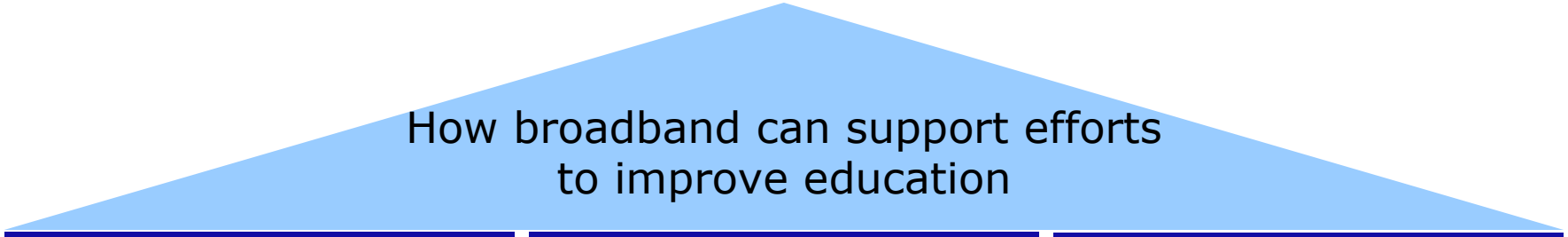
The Department of Education is tackling these challenges through an aggressive reform agenda

U.S. Department of Education strategies			
Improve standards and assessments	Develop advanced data systems	Foster and support effective teachers	Turn around the lowest-performing schools

A national broadband plan could support these efforts



Education key questions



Content and Learning	Teacher Capacity	Data, Infrastructure, and Standards
Key question: **How can broadband support new forms of personalized content and learning resources?**	Key question: **How can broadband help teachers focus on what matters for students?**	Key question: **How can broadband provide a platform to support effective teaching and learning?**

21st Century Innovation

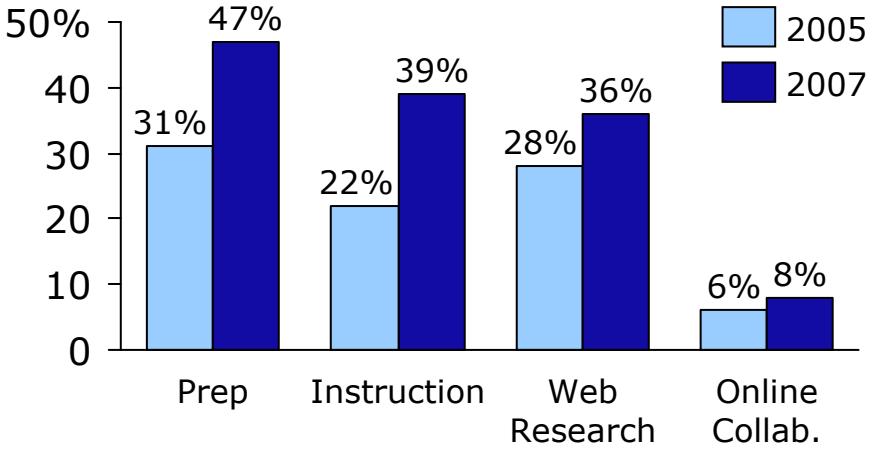
Key question:

How can advances in use cases for broadband in education be supported?

Classroom usage is driving the need for improved connectivity

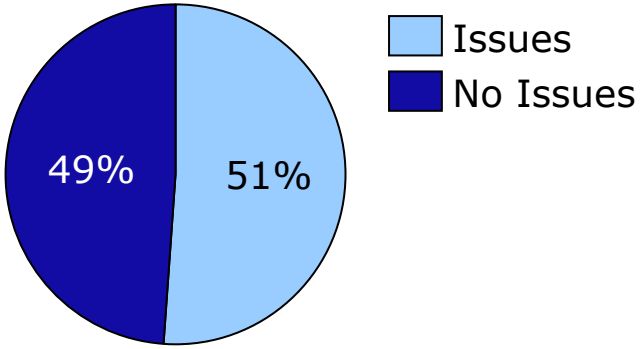
Thanks to E-Rate, 94% of instructional rooms are online, and teachers are increasingly using the Internet…

Teachers using technology for educational tasks
Percent

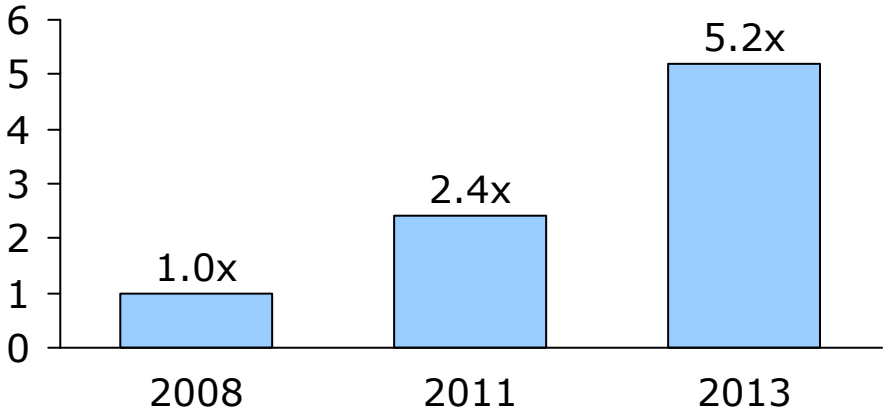


. . . But there is a need for improved connectivity given current and projected usage

Teachers reporting slow Internet issues
Percent



Educational Bandwidth Usage Projection, indexed to 2008



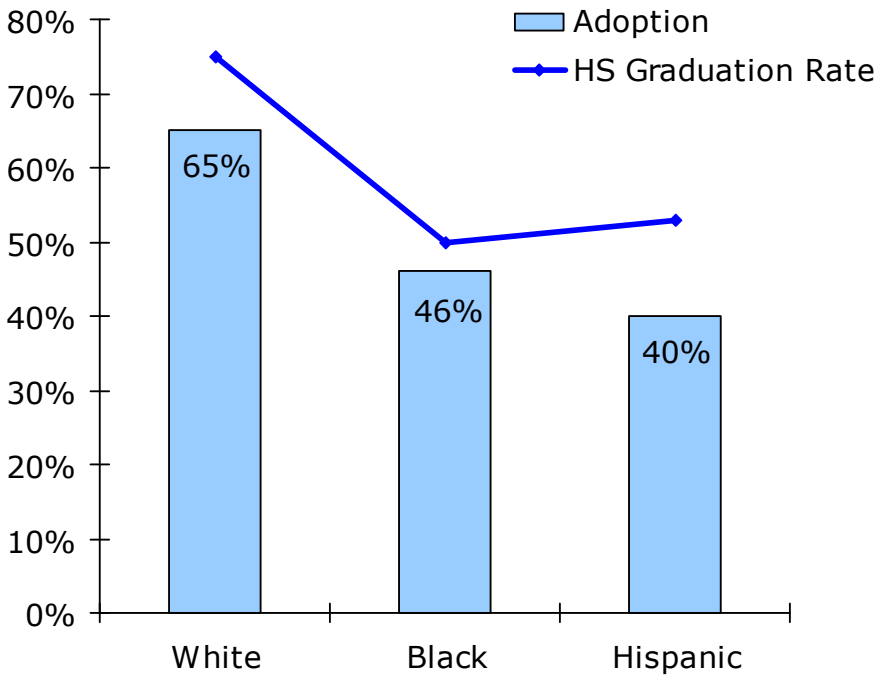
Sources: NETTS 2005 & 2007 Teacher Survey; Evaluation of EETT: EETT Final Report (2009); Final Report US Dept of Ed; Greaves Group; Education Workshop 8/09

The cost of digital exclusion is growing

Underperformers in education outcomes are non-adopters

American adults who have adopted broadband and high school graduation rates

Percent



Non-adopters are at an educational disadvantage

- 78% of students regularly use the Internet for classroom assignments
- 41% of students use email and messaging to contact teachers or classmates about schoolwork
- 80% of parents say the Internet helps children with their schoolwork

Sources: Pew Internet: Home Broadband Adoption 2009; Pew Internet, Internet and Education

Broadband speed needs vary by application type

	Content type	Example applications	Actual download speed demands (Mbps)[1]	
Non real-time	• Basic download (or upload) usage	• E-Book / Digital Textbook downloads • Basic search applications	0.1-0.3 *(Speed impacts down/up time and render)*	
	• Large download (or upload) usage	• Online Learning Systems (LMS) • Student Data Systems (SIS) • Professional Learning and Support systems	0.5-5+ *(Speed impacts down/up time and render)*	
	• Streamed audio	• Replay live educational events & conferences	0.1-0.3	
Real-time	• Voice over the Internet (VOIP)	• Skype, Vonage, Custom VOIP	0.1-0.3	Symm.
	• Basic interaction	• Educational "serious" games (online/flash) • Practice tests / basic interactive content	0.3-0.5	Symm.
	• Basic streamed video	• User created video (classroom demo's, model instruction, certification prof. development)	0.3-0.5	
	• Video-conference + VOIP	• Videoconferences for instruction or professional development	0.6-1.0	Symm.
	• SD streamed video	• Streamed classroom instruction • Multi-cast conferences and meetings	1-5	
	• IP TV	• Self-directed learning modules	1-5+	Symm.
	• 2-way advanced video interaction	• Real-time simulation / learning / games • Remote instruction / classroom interaction • Collaborative professional development	2-5+	Symm.
	• Enhanced video teleconferencing	• Immersive instructional coaching	5-10+	Symm.
	• HD streamed video	• Rich content media for learning	10+	

[1] Actual speeds are typically lower than "advertised" ISP speeds – see later materials for details

Sources: California Broadband Task Force report; ADTRAN FCC submission; Speedmatters.com report; Technet Broadband Primer; ITIF report March 2009; FCC analysis; Skype; ITIF; Gary Kim – IPTV drives bandwidth artic

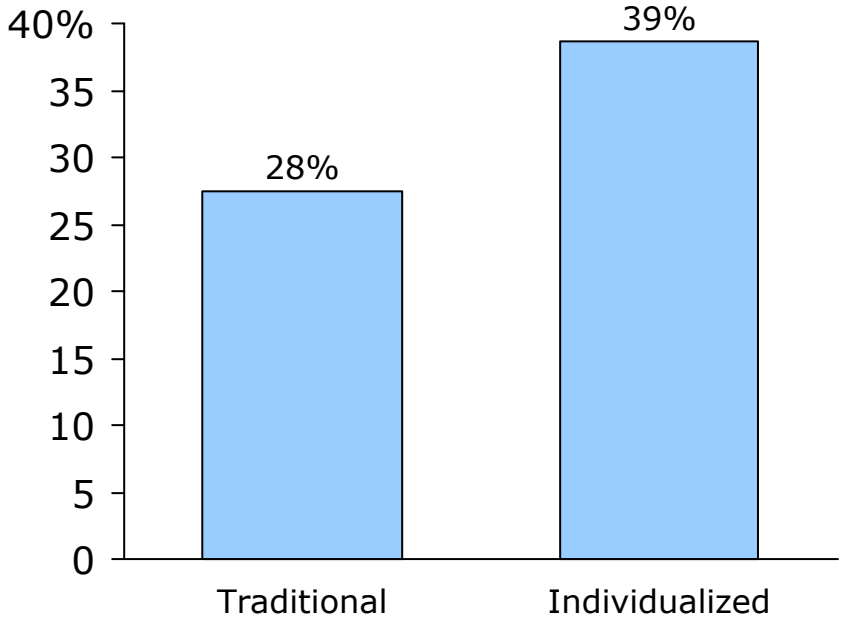
Digital content and learning hold promise

The textbook market focuses on the needs of 37% of students, yet personalized content yields powerful results

Online instruction produces similar performance outcomes and more than double the course completion rate with half the effort

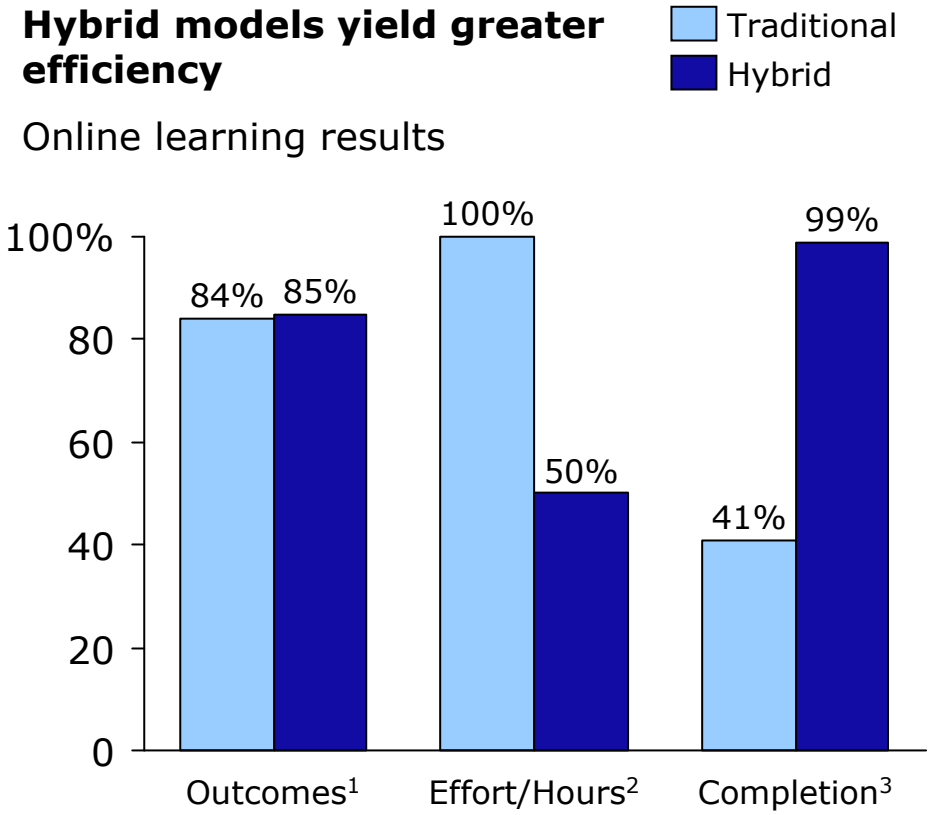
Personalized content yields better student outcomes

Percent of students getting an A or B grade



Hybrid models yield greater efficiency

Online learning results



[1] Percent of students passing the course [2] Percent of "traditional student" hours required to complete the course
[3] Percent of students who completed the course
Sources: McKessock et al: Dynamic online homework system (2005); Carnegie Mellon, Open Learning Initiative, Lovett et al., and Joel Smith testimony to FCC

Areas of focus and key issues

Areas of Focus	Key Issues
Content and learning	• Personalized learning experiences • Digital textbooks and eBook networks • Online learning content and systems • Digital literacy
Teacher capacity	• Teacher support communities with best practices linked to standards and performance benchmarks • Tools to enable data-driven decision-making in the classroom • Online professional learning
Data, infrastructure, and standards	• ERate upgrade • Digital student records linked to standards and assessments, best practices, and personalized learning resources • Purchasing reform
21st Century Innovation	• Investment strategies with a focus on outcomes • Standards that drive entrepreneurial activity and investments

Civic Engagement/ Government Performance

Why broadband matters to government: an example

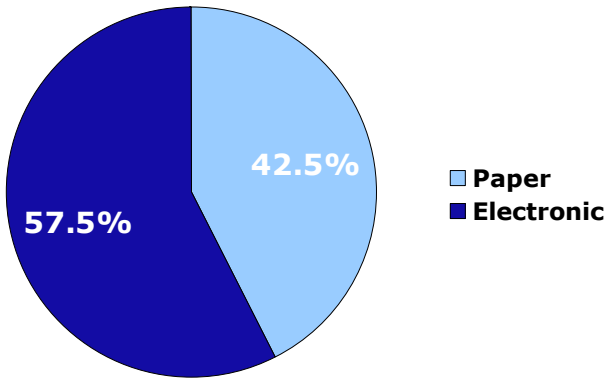
66.4 million paper tax returns were filed in 2008…

… yet it costs almost 8 times as much to process a paper return…

…resulting in an inability to capture savings

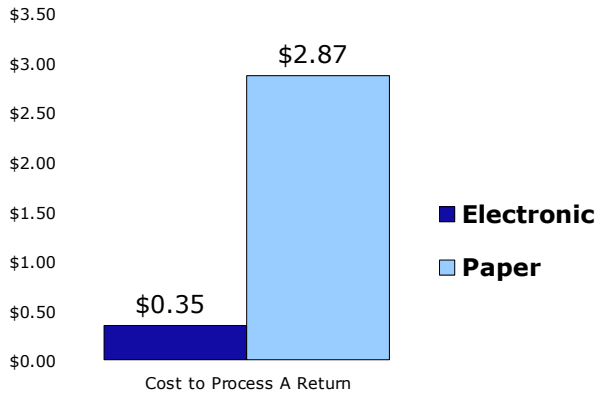
2008 individual tax returns

Percent of returns



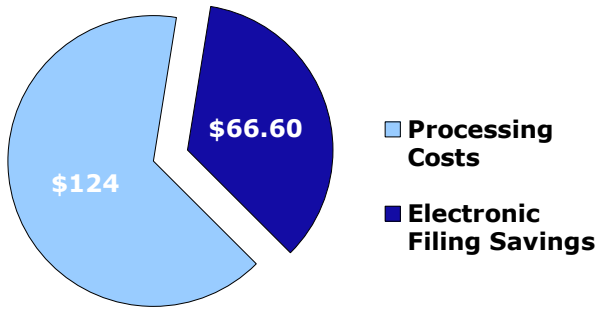
Processing costs for individual tax returns

Dollars



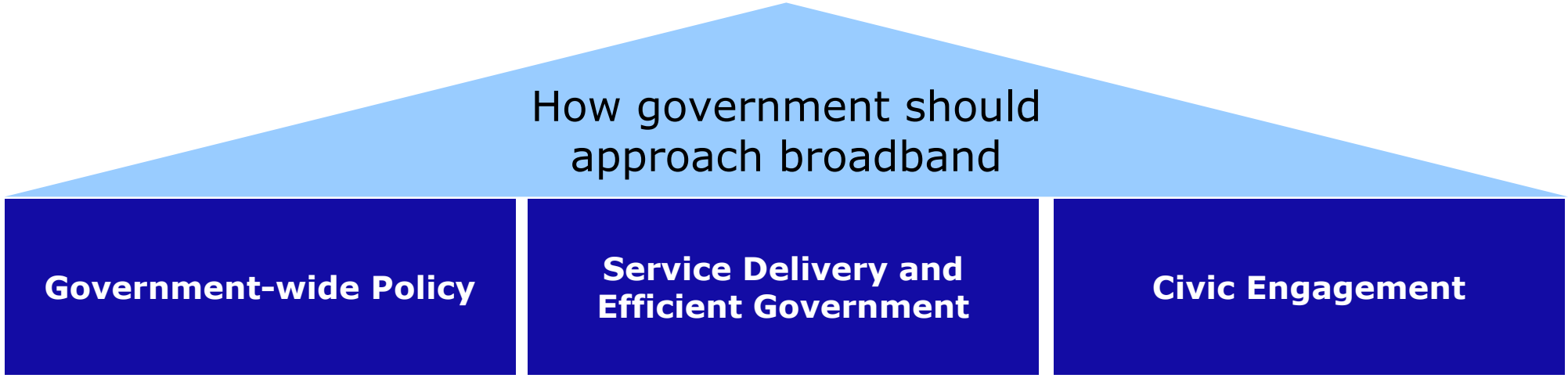
Potential savings from mandating electronic filing

Millions of dollars



Source: IRS Inspector General

Government performance and civic engagement key questions



Key question: How can government policies support the deployment and adoption of broadband?

Key question: How can broadband deliver high performance and transform government?

Key question: How can broadband transform civic engagement?

Broadband speed requirements vary for different applications

Content type	Sample applications	Actual download speed demands (Mbps)[1]
• Basic download (or upload) usage	• E-Government 1.0 • Basic email, web-browsing • Downloading basic government forms	0.1-0.3 *(Speed impacts down/up time and render)*
• Voice over the Internet (VOIP)	• Advanced telecommunications	0.1-0.3
• Basic streamed video	• C-SPAN, YouTube (White House, Congress)	0.3-0.5
• Large download (or upload) usage	• Advanced, interactive online transactions • Social networking	0.5-5+ *(Speed impacts down/up time and render)*
• 2-way video interaction	• Real-time interactive simulation training (Department of Defense, Department of Homeland Security)	2-5+
• Remote Access Data	• Telecommuting / Continuity of government	2-10
• Enhanced video teleconferencing	• Real-time video teleconferencing • Remote imaging (National Institutes of Health, Veterans Affairs)	5-10+
• High Definition streaming video	• Broadcast quality High Definition Television (HDTV) (NASA Multimedia)	10+
• Cloud Computing	• Cloud-based applications • Consolidation of data centers	20+

[1] Advertised speed is calculated at roughly 2x "actual" speed

Sources: California Broadband Task Force report; ADTRAN FCC submission; Speedmatters.com report; Technet Broadband Primer; ITIF report March 2009; FCC analysis; Skype; ITIF; Gary Kim – IPTV drives bandwidth article; OfCom; FTTH FCC submission

Broadband policy is determined by multiple entities

Federal Government	**President of the United States** **Congress** **Department of Commerce – NTIA** **Department of State** **Federal Communications Commission**
State Government	**Governor** **Legislature** **Department of Commerce** **Department of Information Technology** **Public Utility Commission**
Local Government	**Mayor** **City Council** **Zoning Board** **Planning Commission**

Problems noted in the record

- Implementation of broadband policy has been hindered due to lack of coordination
- Federal government agencies have worked at cross-purposes on broadband policy due to different agency priorities
- Federal government policies have led state and local governments to implement inefficient and duplicative broadband deployment and adoption programs

Government performance and service delivery

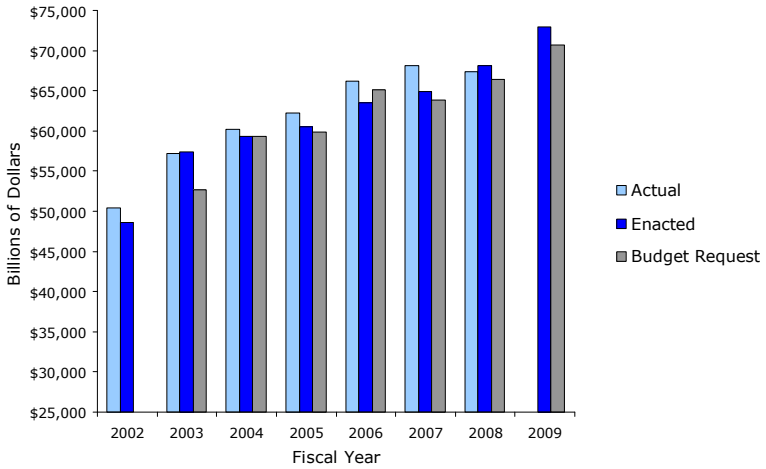
Federal IT spend is over $70 billion per year…

… and the number of government websites offering three or more services online grows…

…yet satisfaction with online government services lags the private sector

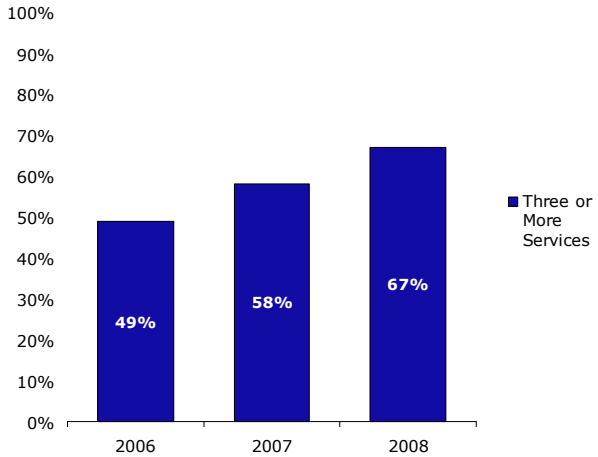
Federal IT expenditures

Billions of dollars



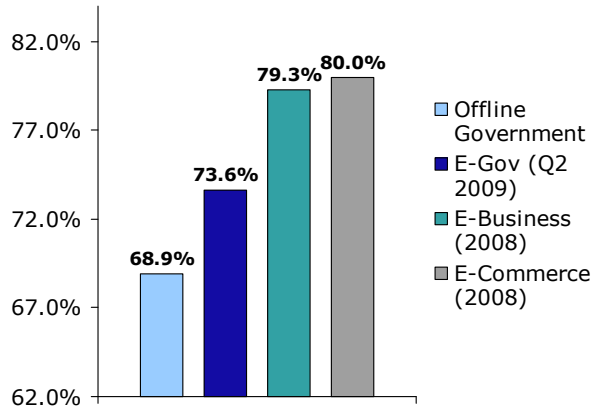
Federal and state government websites offering online services

Percent of websites



Public satisfaction with online services

Percent of public

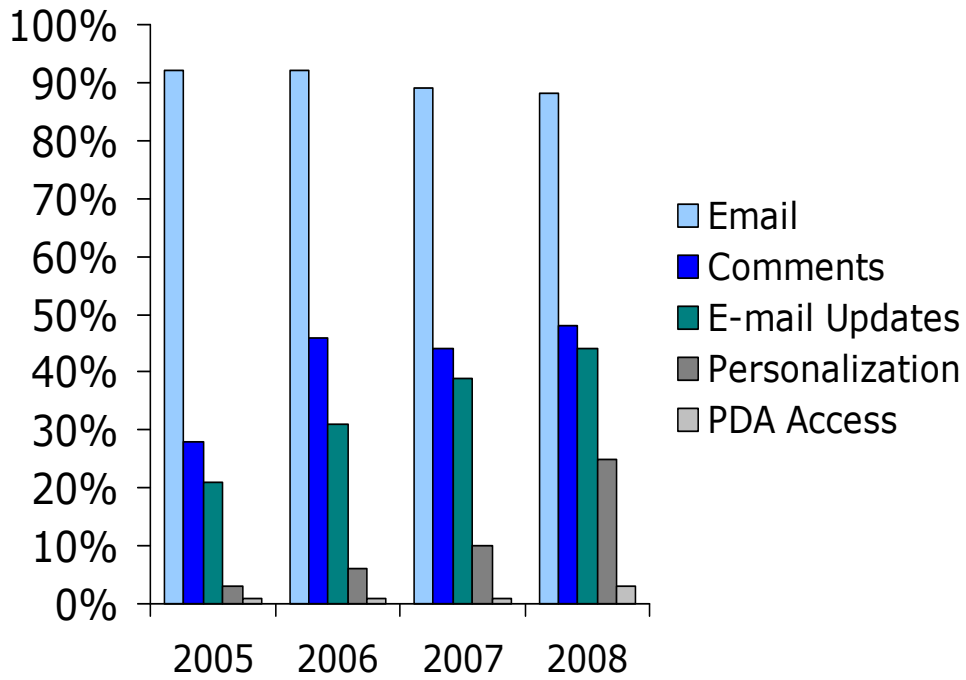


Sources: Office of Management and Budget Federal IT Spending Reports; Governance Studies - The Brookings Institution; ForeSee Results – American Customer Satisfaction Index: E-Government Satisfaction Index (2009)

From Gov 1.0 to Gov 2.0: Civic engagement and the potential for digital exclusion

Federal and state government websites offering public outreach

Percent



- 54% of Americans who sent a "letter to the editor", contacted a government official, or signed a petition did so online
- 31% of bloggers have used their blog to explore political or social issues
- 33% of Internet users had a profile on a social networking site and 31% of these social networking site members had engaged in activities with a civic or political focus

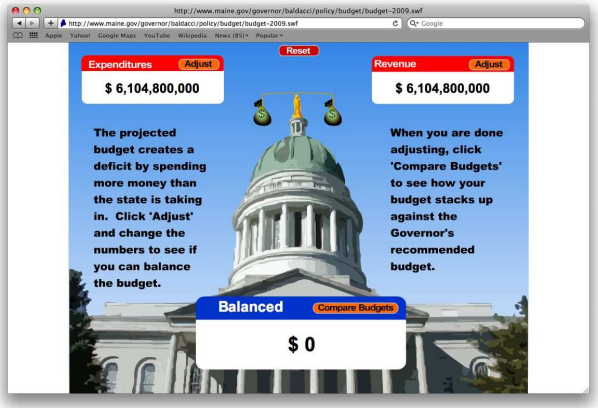
Sources: 2007 Pew survey; Governance Studies - The Brookings Institution

Citizen engagement success stories and challenges

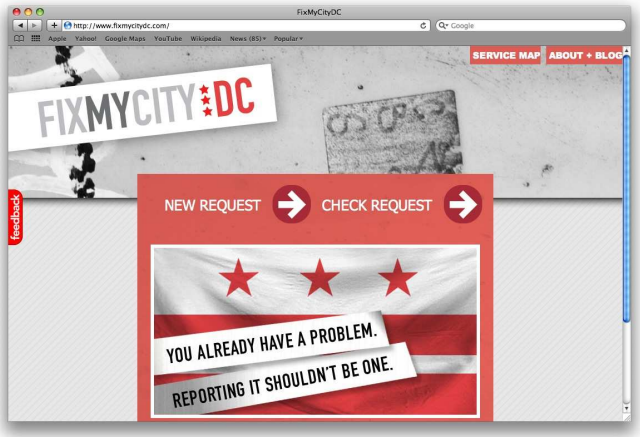
Apps for Democracy Contest

Applications:	47
Total Days:	30
Total Cost:	$50,000
Total Value:	$2 million
Return on Investment:	4,000%

Changing Civic Engagement: Maine Balanced Budget Tool



Changing Service Delivery: Washington, D.C.



Honorable Mention: Apps for Democracy 2 Contest
Results: Over 100 requests sent to DC city government
Examples: Fixing potholes and streetlights

Challenges

- Availability and quality of government data
- Lack of coordination and best practice clearinghouses
- Incorporating social media / web 2.0 technologies
- Legislative impediments

Source: Government of the City of Washington, D.C.

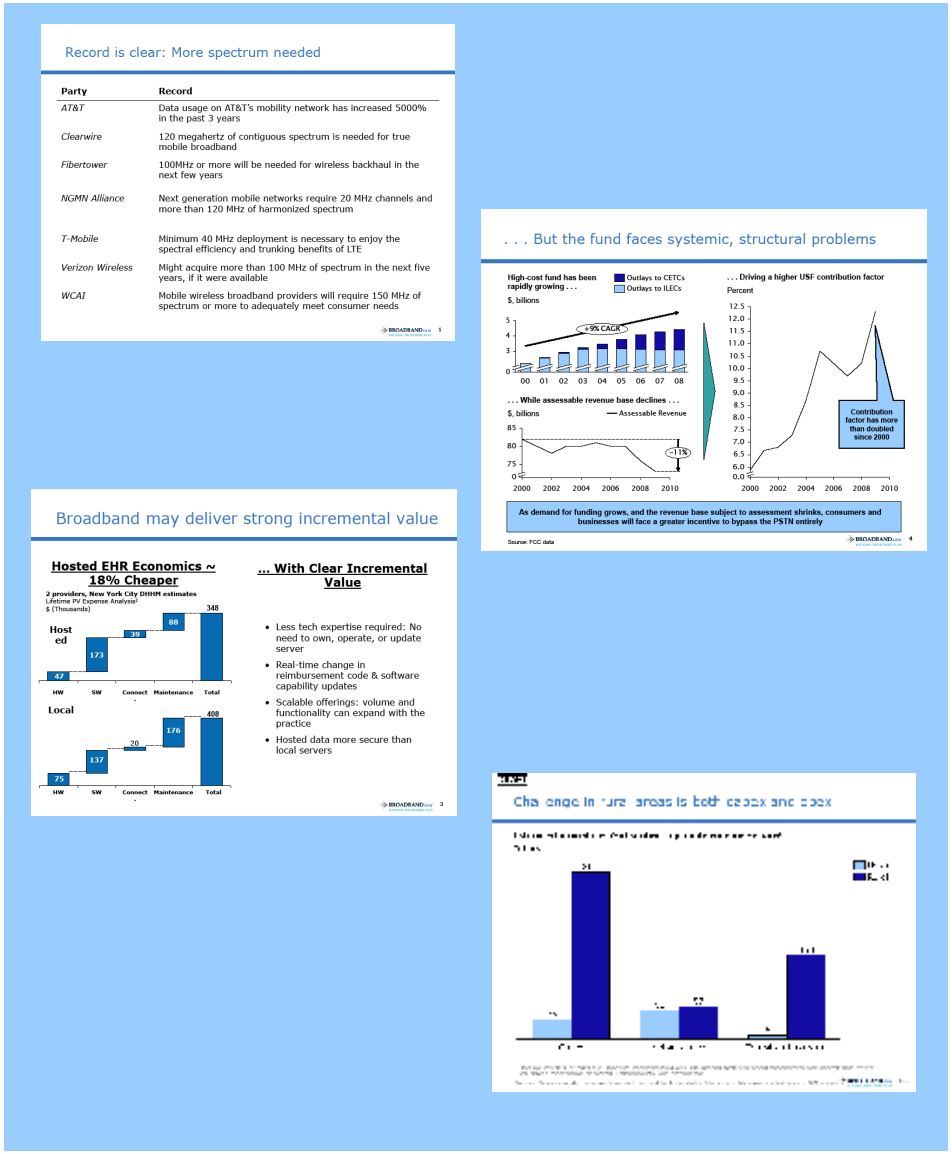
Areas of focus and key issues

Areas of focus	Key issues
Government-wide Policy	• How federal government coordination of broadband policy could assist state and local efforts to promote broadband deployment and adoption
Government Services	• How delivery of government services online could improve services and interactions between citizens and government
Government Efficiency and Effectiveness	• How adopting broadband-enabled technologies throughout government and institutionalizing technology-based innovation could make government more efficient and productive
Civic Engagement	• How broadband-enabled technologies could transform the way governments and citizens connect with each other, both domestically and internationally

Innovation and Investment

What we've learned

- Previous presentations detailed the challenges:
  - Deployment:
    - ➢ Service must be available
    - ➢ Economic prices
    - ➢ High Performance – high speed & capacity, low latency, etc
    - ➢ Attractive devices and applications
  - Spectrum: More is needed
  - Investment : Needs to be motivated by RoI
  - National purposes such as education, health care also require investment
  - And more . . .
  - Innovation is critical for addressing all of these elements



The current landscape

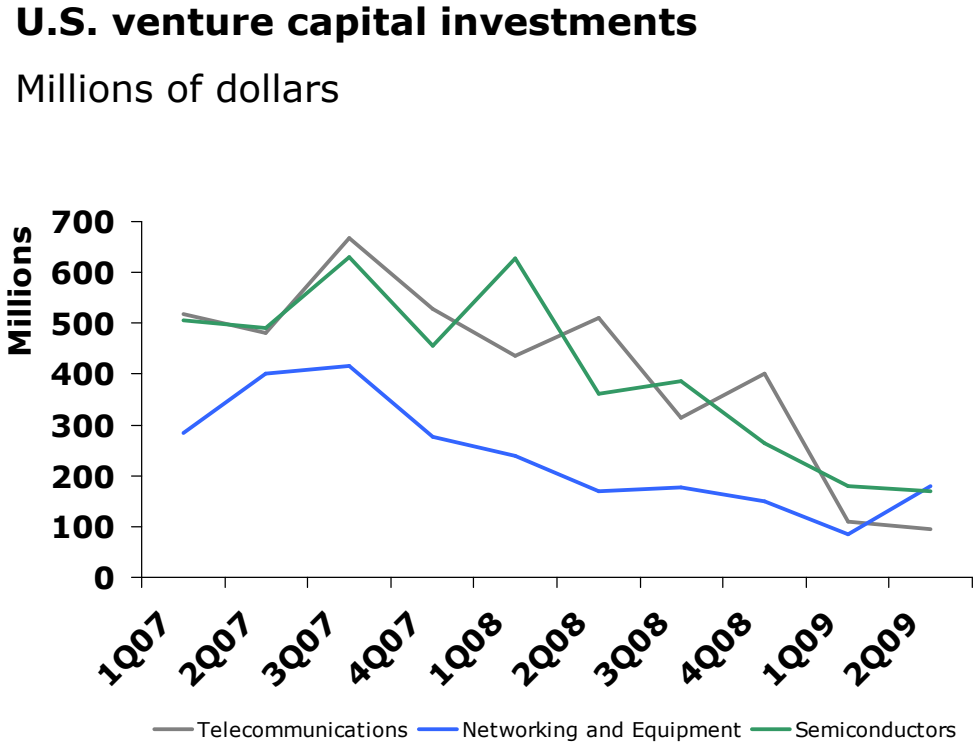
- Great News: U.S. leads in many areas
  - Chipsets; software; applications and Internet services; Internetworking equipment

- Not So Great News:
  - At most 2 providers of fixed broadband services will pass most homes
  - 50-80% of homes may get speeds they need from only one provider
  - Deployment costs for various geographies are significantly different
  - Broadband adoption is lagging in certain customer segments
  - Industry consensus that more spectrum is needed to meet future requirements

The need for investment

- Investment has declined
- Investment and innovation required across ecosystem:
  - Value to users & providers depends on end to end performance
  - Must invest in all areas: chipsets, user interface, software, network equipment and services, devices; etc
- Rapid innovation in some sectors must not be limited by bottlenecks in others
- Storm clouds may make investment more difficult:
  - Universal Service Fund
  - Public Switched Telephone Network

U.S. venture capital investments across communications sectors has declined

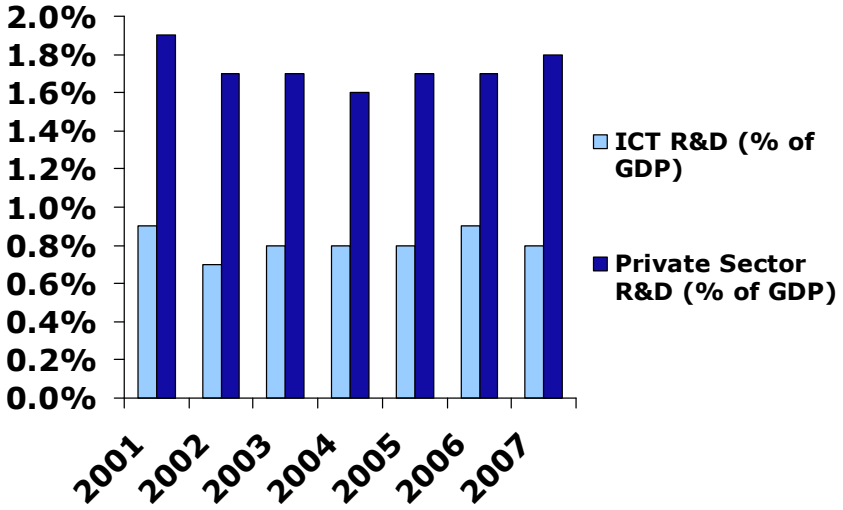


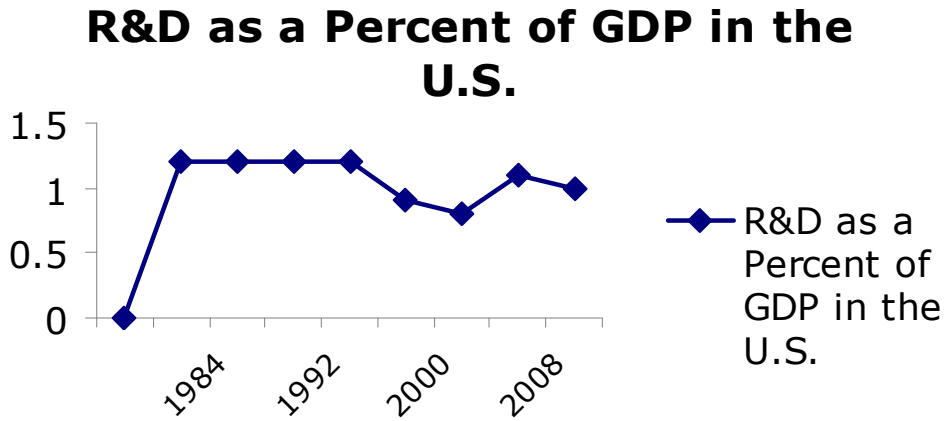
Telecommunications: Companies focused on the transmission of voice, data, wireless, and components. *Networking and Equipment*: Providers of data communication and fiber optics products and services. *Semiconductors*: Design, develop or manufacture semiconductor chips/microprocessors, diodes, and transistors. Source: MoneyTree Report, 2009.

Innovation depends on research and development

- Long-term innovation depends on R&D
- U.S. does not have the R&D institutions it once did
  - Bell Labs, DARPA et al, no longer play the same role
  - In 1990s, research focused on short-term gains
- As noted by TIA (Telecommunications Industry Association):
  - Research is the backbone of the communications industry—a building block for the future development of advanced communications products and services
  - Developing leading-edge communications applications is complex, requiring time, money and long-term vision
  - The U.S. government must make long-term communications research a funding priority to sustain the advancement of information and communications technology as a vital area of long-term economic and societal growth

U.S. private sector R&D spending





Private Sector R&D has returned its 2002 level

Information and communications technology R&D has remained flat and is modestly less than in 2002

Sources: National Science Foundation, 2008, ICT Report, TIA

Tools to promote investment in R&D

- Federal Communications Commission
  - Address major issues such as interconnection, openness to devices
  - Encourage competition
  - Provide flexible rules & standards

- Federal Government Intervention:
  - ARRA & BTOP
  - Legislation
  - Economic incentives

- Federal Government investment in R&D

Government role in R&D

- Government has always played strong role in supporting fundamental science
  - How much of this is directed to ICT? Is it enough?
  - Has government been focusing too heavily on commercializable technologies rather than R&D that private sector will not undertake?

- Federal government can provide the bridge between industry and academia to develop and execute an ICT R&D roadmap
  - Agencies can provide test beds for next-generation networks
  - Funding sources can offer longer-term funding opportunities – giving researchers the five-year research blocks they need for high-risk, high-reward initiatives

- Broadband team will focus on how to promote R&D

Disabilities

Broadband usage and people with disabilities

- U.S. population with disabilities: **54 million**
  - 35 million with severe disabilities
  - Include speech, hearing, vision, mobility, and intellectual disabilities

- Internet usage: **less than half**
  - Fewer than 30.8% v. more than 63.6%
  - Research from 2003; needs updating

Sources: Brault, Matthew, *Americans with Disabilities: 2005,* Current Population Reports, P70-117, U.S. Census Bureau, Washington, D.C. 20008 at 3; Dobrasky, Kerry & Hargittai, Eszter, "The Disability Divide in Internet Access and Use." *Information, Communication and Society.* 9(3):313,325. June 2006 at http://eszter.com/research/a18-disabilitydivide.html

Deployment and people with disabilities

Key Comments from Record

- Accessibility embedded in design and development can be more efficient than retroactive solutions
- Potential for "functionally equivalent infrastructure" though building accessibility directly into infrastructure and "cloud computing"
- Need for Next Generation 9-11 for reliable, real-time, interoperable voice, text and video emergency communications priority for many, including disability community
- Need speed of service must be fast enough across all platforms to support accessible applications across multiple platforms

Sources: Telecommunications for the Deaf and Hard of Hearing Comments at 5; Gregg Vanderheiden Comments, Workshop Transcript at 25-37; National Emergency Numbering Association Comments; Coalition of Organizations for Accessible Technology (COAT) Comments at 11

Adoption and usage barriers for people with disabilities

Affordability Barriers

- Poverty rate 2-3 times higher for people with disabilities

- Specialized equipment, software adds to cost concerns
  - Screen readers **>** $1,000
  - Assistive deaf-blind technologies: $5,000-$10,000
  - Additional ongoing expenses (software maintenance, hardware repair, training)

Sources: Erickson, W. and Lee, C (2008). 2007 Disability Status Report: United States, Ithaca, NY: Cornell University Rehabilitation Research and Training Center on Disability Demographics and Statistics at 34; COAT Comments at 7; Karen Peltz Strauss Comments, Workshop Transcript at 56-57

Adoption and usage barriers for people with disabilities (cont'd)

Accessibility Barriers

- Equipment, services, devices, and software
  - Lack of universal design for mass market products
  - Lack of interoperability with specialized equipment
- Content
  - Captioning and video description of video programming transmitted on the Internet
  - Web pages
  - Social media platforms
- User interfaces, programming guides and menus, tech support

Opportunities for advancing national purposes for people with disabilities

Broadband as platform to close the already existing gaps for people with disabilities

- Health care – Telemedicine/psychiatry with video sign language
- Education – Bookshare provides largest accessible digital library for people with vision and learning disabilities
- Public Safety – Potential of Next Generation 9-11 could be fully accessible

Sources: World Institute on Disability Comments at 2; ZeroDivide Comments at 7; NENA Comments at 3

Next steps

Building a record:

- Released PN on critical issues
- Established separate disabilities access category on Blogband
- Full-day workshop on October 20 to elicit policy recommendations from a broad range of stakeholders

Consumers

Consumers in the digital economy: The potential to empower

What do the statistics tell us?	What do online buyers say about their experiences?	What are the positive impacts?
• 66% of Internet users have made a purchase online	• 78% like the convenience	• Reduces search costs
• Internet users spend 3% of their time at retail sites	• 68% say it save time	• Improves bargaining position
• 7th most popular destination in terms of users' online time budget	• As many as 40% (depends on type of purchase) believe online information gets them better deals	• Enables participation through rating products

Sources: ComScore July 2009 panel data; Pew Internet & American Life Project, Online Shopping, February 2008; Pew Internet & American Life Project, The Internet & Consumer Choice, May 2008

Consumers in the digital economy: The potential for concern

Overall, 39% of online buyers have strong worries about giving out personal or credit card information online

Transactional security particularly worries low income Americans…

- 44% of low income Americans have strong concerns about giving out personal or credit card information online
- 25% of upper income Americans have this level of concern

…which creates a paradox

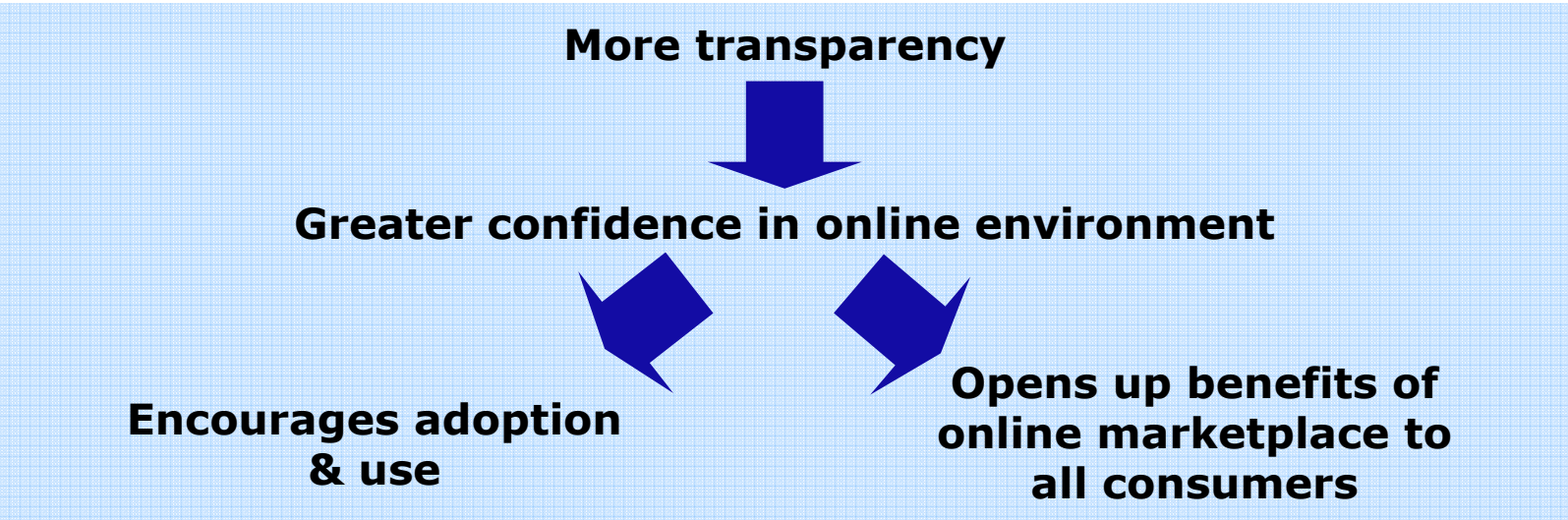
- Poor might benefit more than well-off from convenience and cost-saving of online commerce
- But their heightened security concerns linked to lower incidence of online shopping:
  - 29% of low-income broadband users have bought something online
  - 82% of upper-income broadband users have purchased online

Source: Pew Internet & American Life Project, Online Shopping, February 2008

More transparency can address consumer issues

- Better understanding of their broadband service:
  - Elements of monthly bill
  - Difference between real and advertised speeds

- Tools to protect privacy of personal information
  - 53% of Internet users have used tools & technologies to limit collection of data from their personal computer
  - Consumers want even more education on privacy protection tools, including: where to find, whether to trust them, how to use them
  - Workshop on consumer issues emphasized these points



Source: Consumer Reports Internet Privacy Poll, September 2008

Economic Opportunity

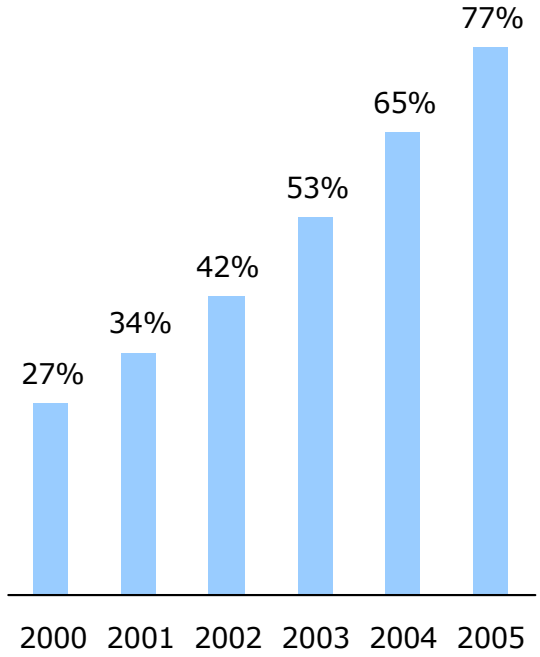
The nature of work is changing rapidly in the digital age

Key American firms moving hiring processes online…

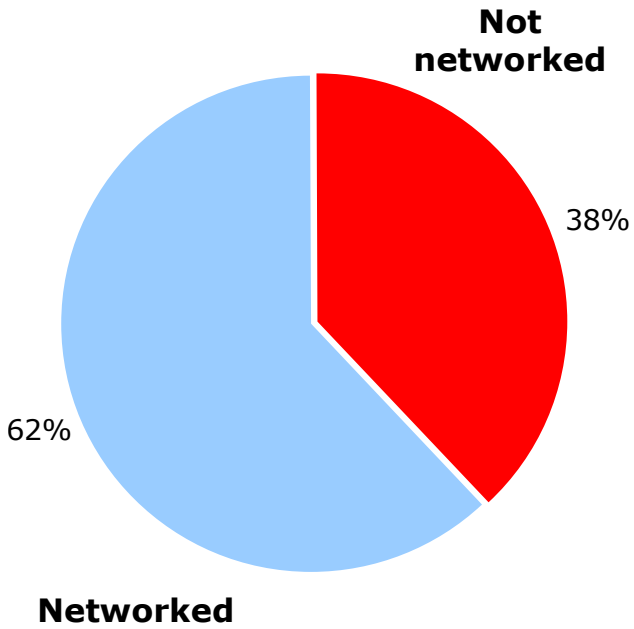
…while requiring "networked workers"…

…in more professional and service-oriented jobs

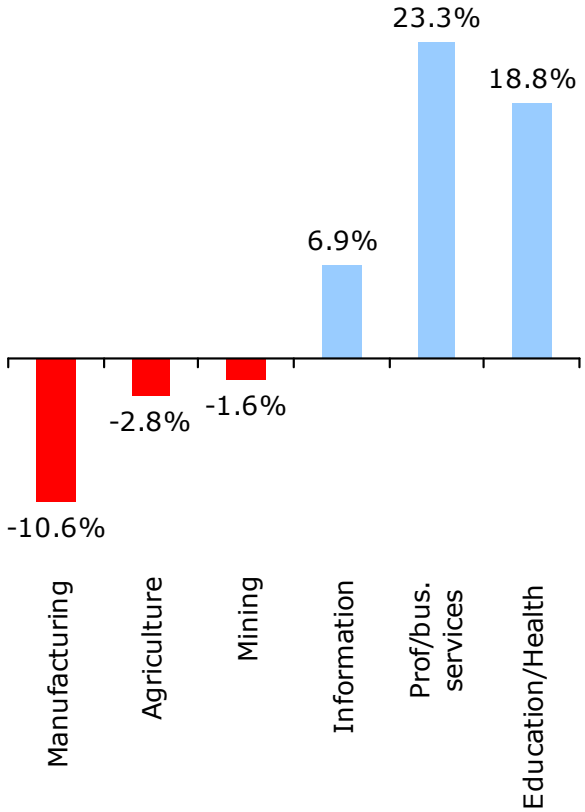
Fortune 500 companies with online job postings and applications only[1]
Percent



2008 Percentage of employed using Internet as part of work[2]
Percent

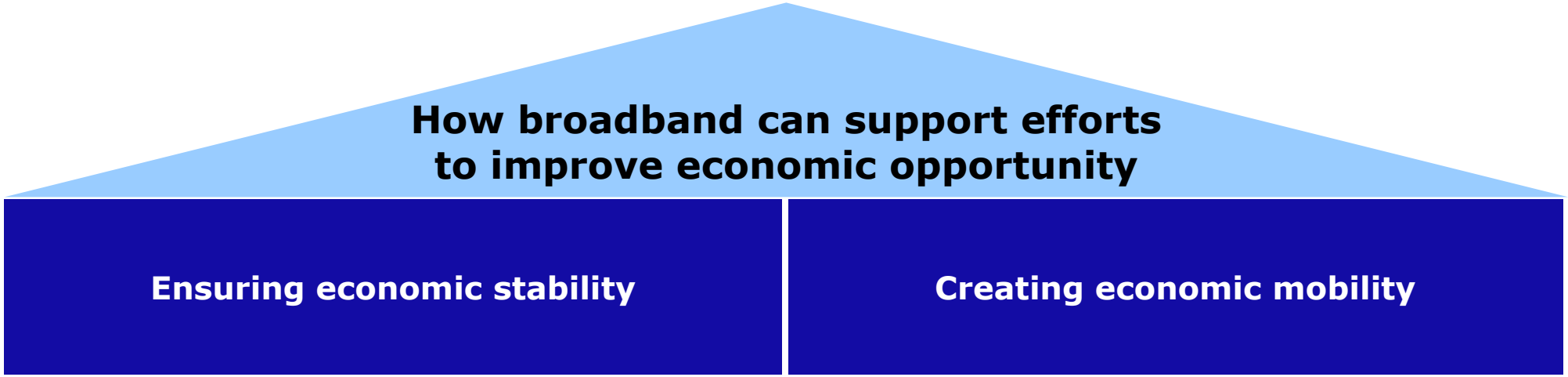


Projection of future areas of job growth/loss, 2006-16[3]
Percent change



Sources: Taleo; Pew Internet and American Life Project; Bureau of Labor Statistics

Economic opportunity key questions



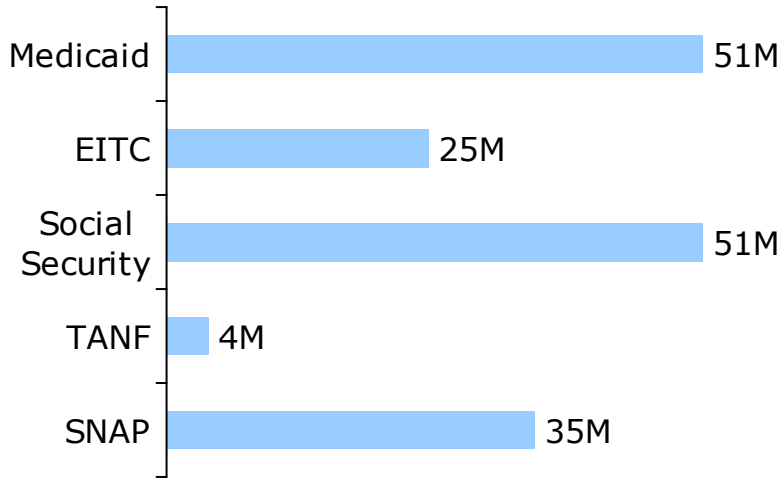
Key question: How can individuals and communities get access to critical economic stability services through broadband?

Key question: How can broadband applications help more people find and train for employment opportunities?

Tens of millions of Americans could benefit from better access to safety net benefits but many are non-adopters

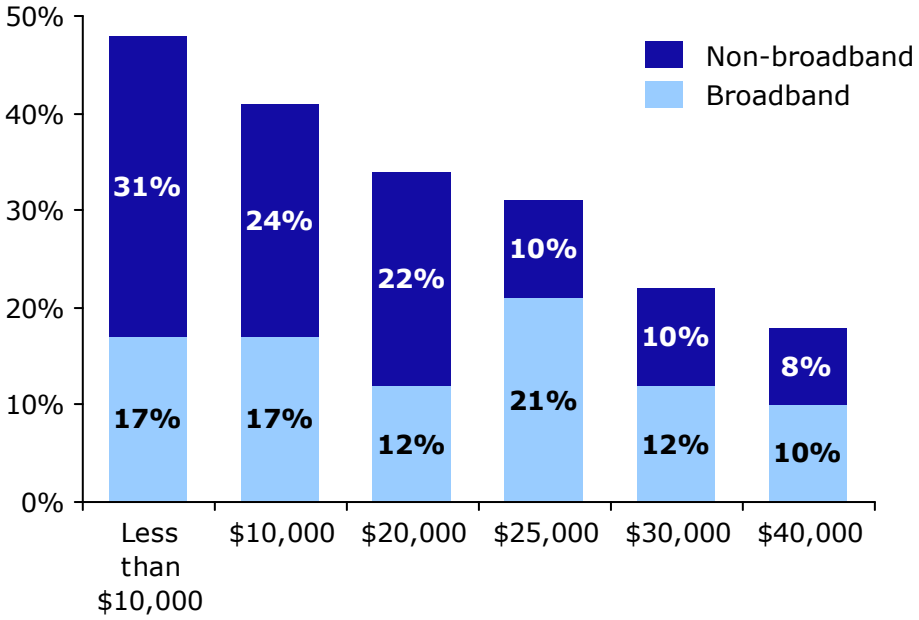
At least 17% of all Americans are recipients of key government benefits

Current numbers of Americans receiving benefits (estimated)[1]
Millions



Many who seek information about benefits online lack broadband

Profiles of individuals seeking Medicare, Medicaid, or Food Stamps (SNAP) information online (by income)[2]
Percent

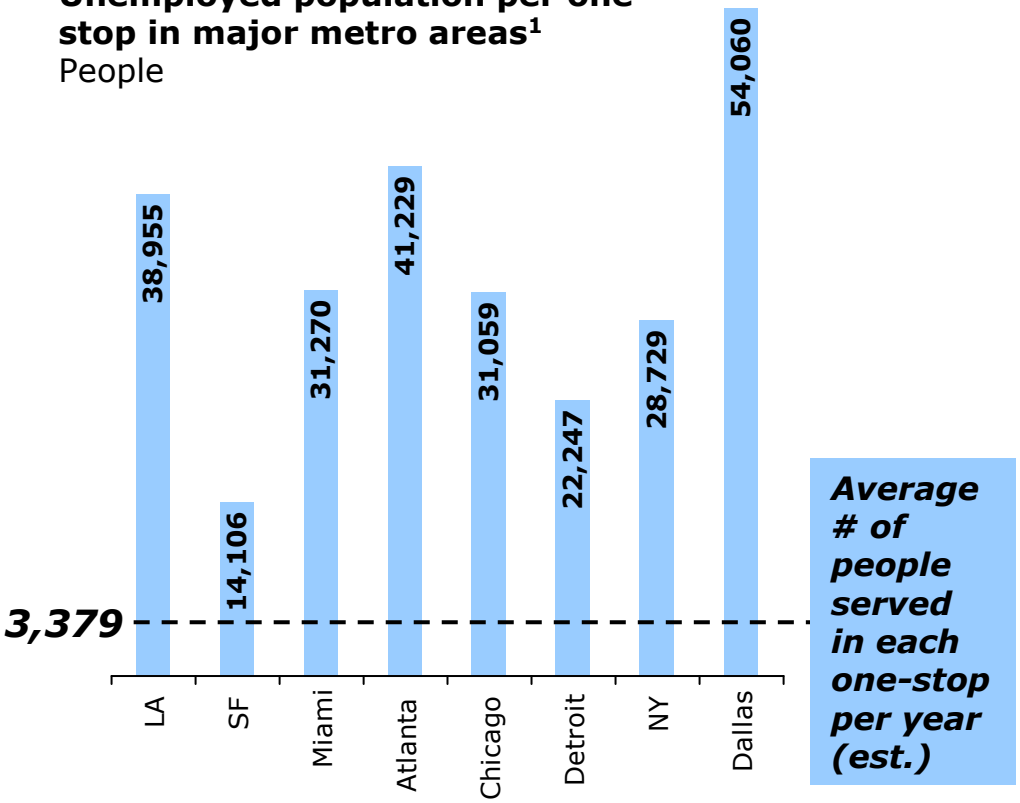


Sources: Office of Management and Budget; Social Security Administration; Pew Internet & American Life Project

There is significant unmet demand for job training and placement services

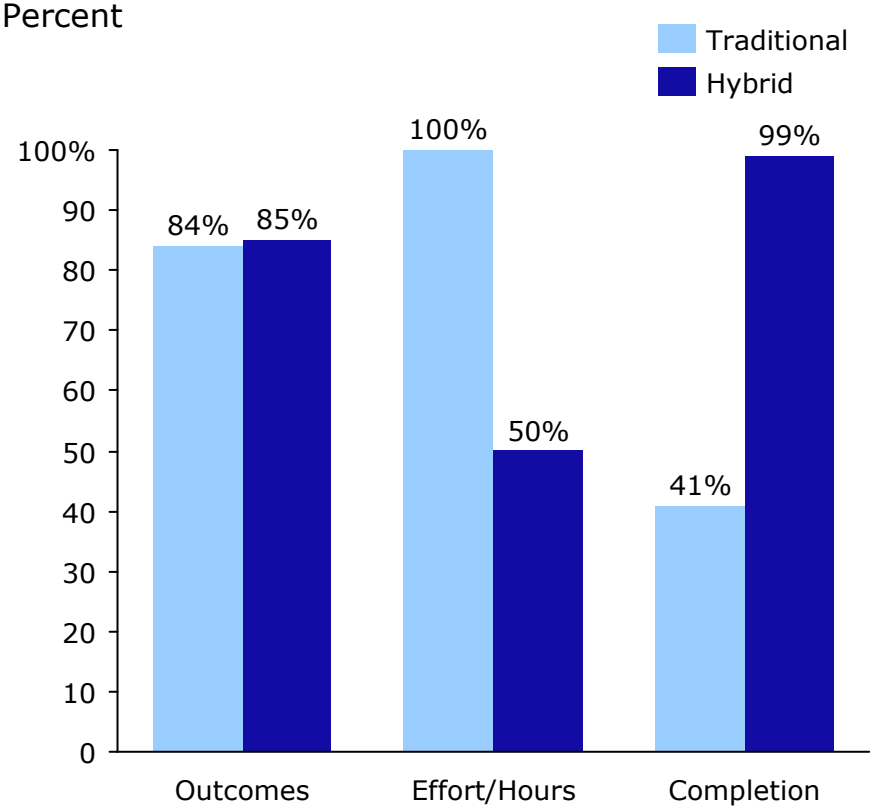
Number of unemployed far exceeds ability for one-stops to serve adequately…

Unemployed population per one-stop in major metro areas[1]
People



…While online instruction offers the potential for superior outcomes

Online learning results
Percent



[1]Equals number of unemployed in major metro areas divided by number of one-stops within 10 miles of metro area
Sources: Department of Labor, http://www.careeronestop.org, FCC analysis; Carnegie Mellon, Open Learning Initiative, Lovett et al., and Joel Smith testimony to FCC

Broadband speed requirements vary for different economic opportunity applications

	Content type	Economic opportunity applications	Actual download speed necessary (Mbps)[1]	
Non real-time	• Basic download (or upload) usage	• Basic email/browsing for job search • UL/DL forms for work support benefits • UL/DL online job training documents	0.1-0.3 *(Speed impacts down/up time and render)*	
	• Large download (or upload) usage	• Specialized telework situations (graphic design, video editing)	0.5-5+ *(Speed impacts down/up time and render)*	
Real-time	• Voice over the Internet (VOIP)	• Basic teleworking • Live credit counseling and financial education • ESL training	0.1-0.3	Symm.
	• Interactive Applications	• Real-time skills assessment and score assessment for job seekers	0.3-0.5	Symm.
	• Basic streamed video	• Watching job training videos	0.3-0.5	
	• Video-conference + VOIP	• Online meetings with unemployment and SNAP benefits counselors	0.6-1.0	Symm.
	• 2-way video interaction	• Specialized work-at-home situations	2-5+	Symm.
	• Enhanced video teleconferencing	• Real-time interactive workforce development classes • Specific industry needs (TBD)	5-10+	Symm.

[1] Advertised speed calculated at roughly 2x "actual" speed

Sources: California Broadband Task Force report; ADTRAN FCC submission; Speedmatters.com report; Technet Broadband Primer; ITIF report March 2009; FCC analysis; Skype; ITIF; Gary Kim – IPTV drives bandwidth article; OfCom; FTTH FCC submission

Areas of focus and key issues

	Areas of focus	Key issues
Economic stability	Access to services	• Key bottlenecks and barriers to access in current benefits disbursement process • Interdependencies between state and federal agencies for data collection and administration
Economic stability	Community institutions	• Those currently unserved by in-unit access or community hubs (e.g. libraries, community centers, public housing projects) • Effectiveness of community institution sites in driving economic opportunity
Economic mobility	New methods of work	• Extent to which broadband is creating new demands for certain skill sets, new businesses and localized industries • Impact of broadband on alternative and flexible work arrangements
Economic mobility	Workforce development	• The reach and effectiveness of our federally-supported workforce development system • Potential for broadband applications to more precisely assess skills and match unemployed persons to jobs

Public Safety and Cyber Security

Public safety, homeland security and cyber security key questions

How broadband can support efforts to improve public safety and homeland security

Public Safety Network	Next-Generation 9-1-1	Cyber Security and Commercial Network Survivability	Alerts
•What are the requirements for broadband public safety communications?	•How should the 9-1-1 system be upgraded to support users of next generation broadband devices?	•How do we ensure that broadband communications networks are protected?	•How can broadband be best utilized to support and enhance alerting?

Ensuring public safety requires a high quality network

Today:

- Access only to mobile, wireless, commercial broadband
- No specialized mobile, wireless broadband
- Applications developing

GOAL

- Interoperable
- Nationwide
- Resilient
- Reliable
- Specialized
- Enhances mission critical voice over time

Broadband speed needs vary by application type

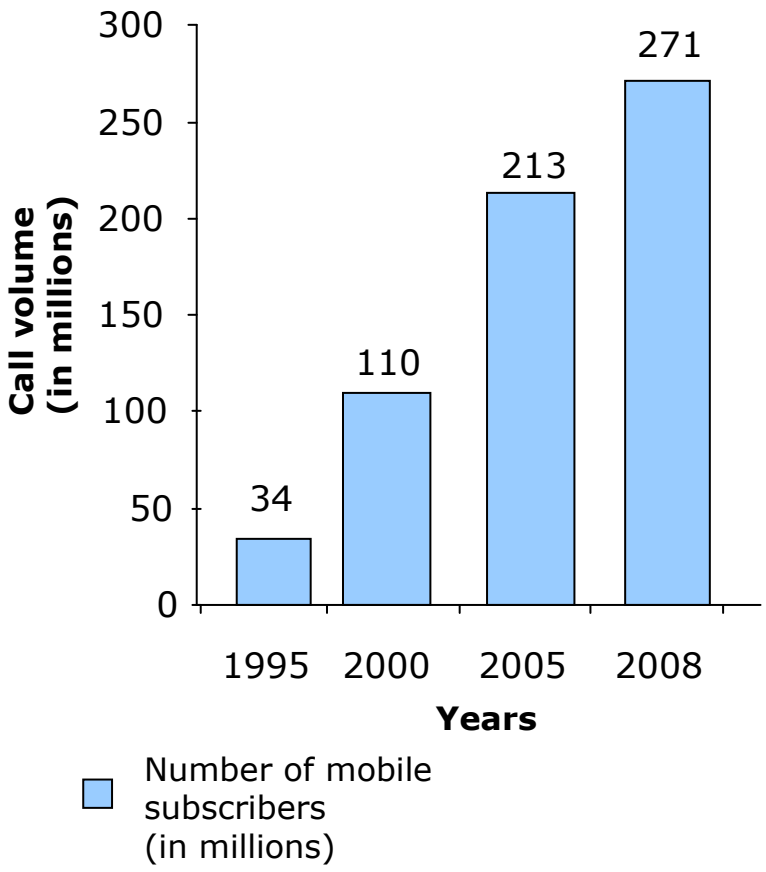
	Content type	Sample applications	Actual download speed demands (Mbps)[1]	
Non real-time	• Basic download (or upload) usage	• E-mail • Web-browsing, government data base access	0.1-0.3 *(Speed impacts down/up time and render)*	
	• Large download (or upload) usage	• Advanced web browsing, building schematics, site plans	0.5-5+ *(Speed impacts down/up time and render)*	
	• Streamed audio	• Wiretapping	0.1-0.3	
Real-time	• Voice over the Internet (VOIP)	• Non-mission critical voice such as evacuation planning or tactical discussions	0.1-0.3	Symm.
	• Basic interaction	• On-line interactive training, public safety answering point usage	0.3-0.5	Symm.
	• Basic streamed video	• Monitoring of high-risk target (e.g., nuclear facility)	0.3-0.5	
	• Video-conference + VOIP	• Lower definition telemedicine	0.6-1.0	Symm.
	• SD streamed video	• Incident based-response (e.g., views of accident scene)	1-5	
	• IP TV	• Tactical briefings	1-5+	Symm.
	• 2-way advanced video interaction	• Tele-medicine, interactive briefing	2-5+	Symm.
	• Enhanced video teleconferencing	• HD Telemedicine (diagnostic imaging)	5-10+	Symm.
	• HD streamed video	• Evacuations, hostage situations, terrorist investigations	10+	

[1]Actual speeds are typically lower than "advertised" ISP speeds – see later materials for details

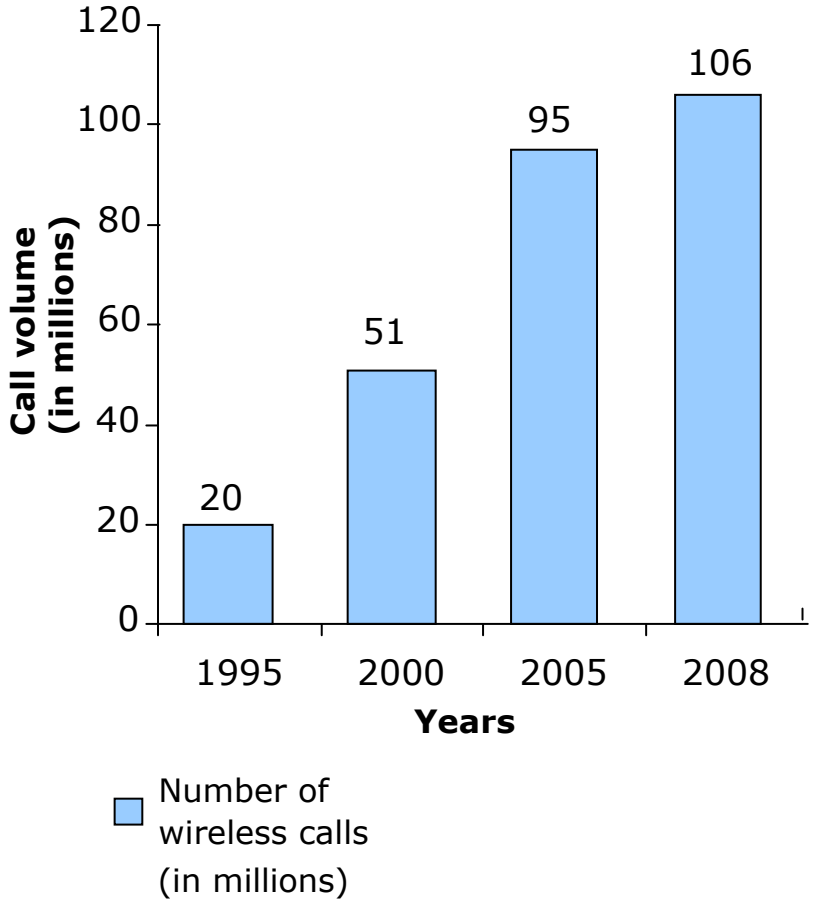
Sources: California Broadband Task Force report; ADTRAN FCC submission; Speedmatters.com report; Technet Broadband Primer; ITIF report March 2009; FCC analysis; Skype; ITIF; Gary Kim – IPTV drives bandwidth article

9-1-1 calling patterns are changing as consumers adopt wireless

Uptick of mobile wireless subscribership[1]



Progression in number of E-911 calls[1]

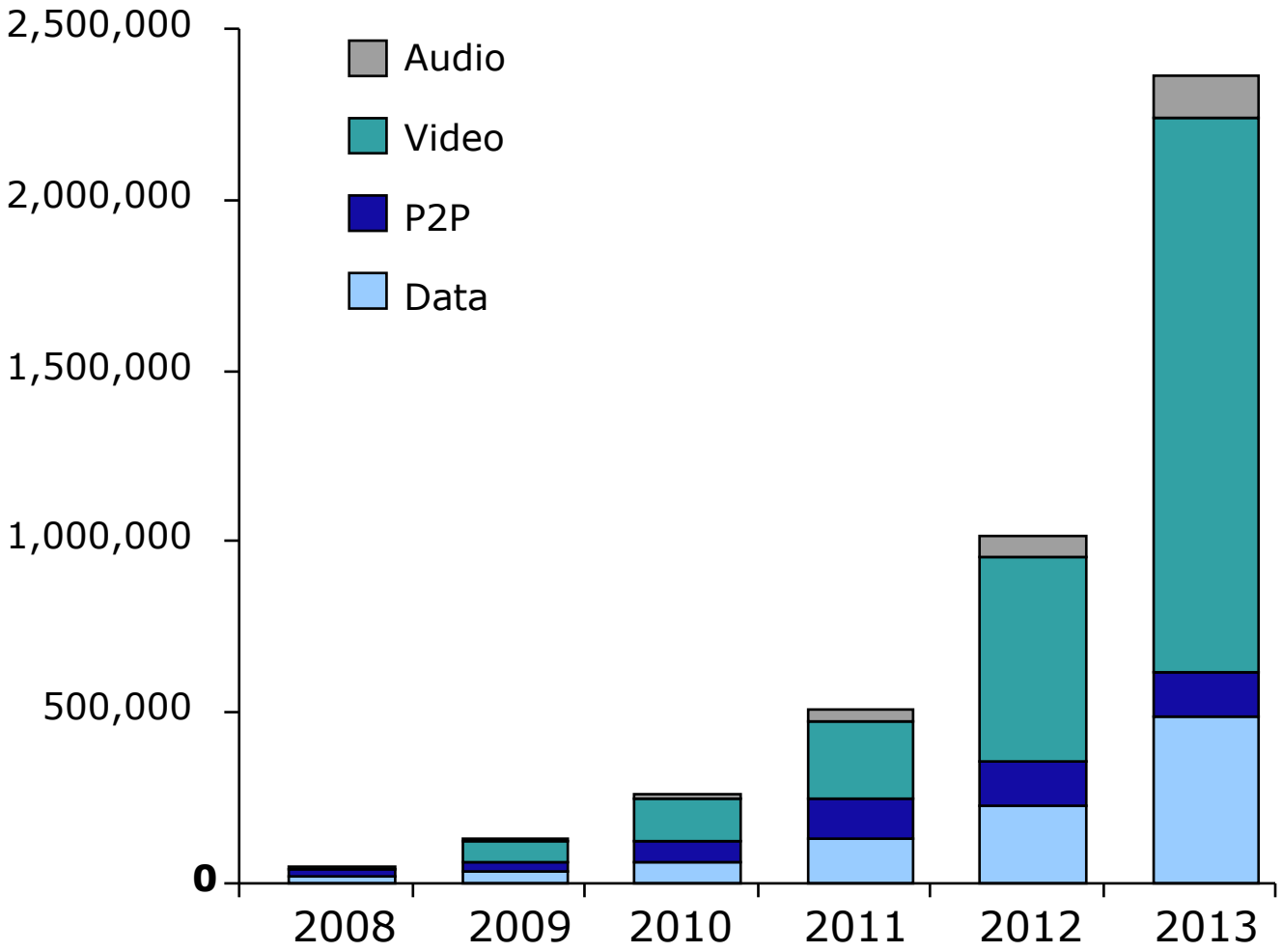


[1] Year-end figures
Sources: FCC Wireless Communications Bureau; CTIA – The Wireless Association

Mobile data traffic is projected to increase significantly

Cisco forecasts two exabytes per month of mobile data traffic in 2013

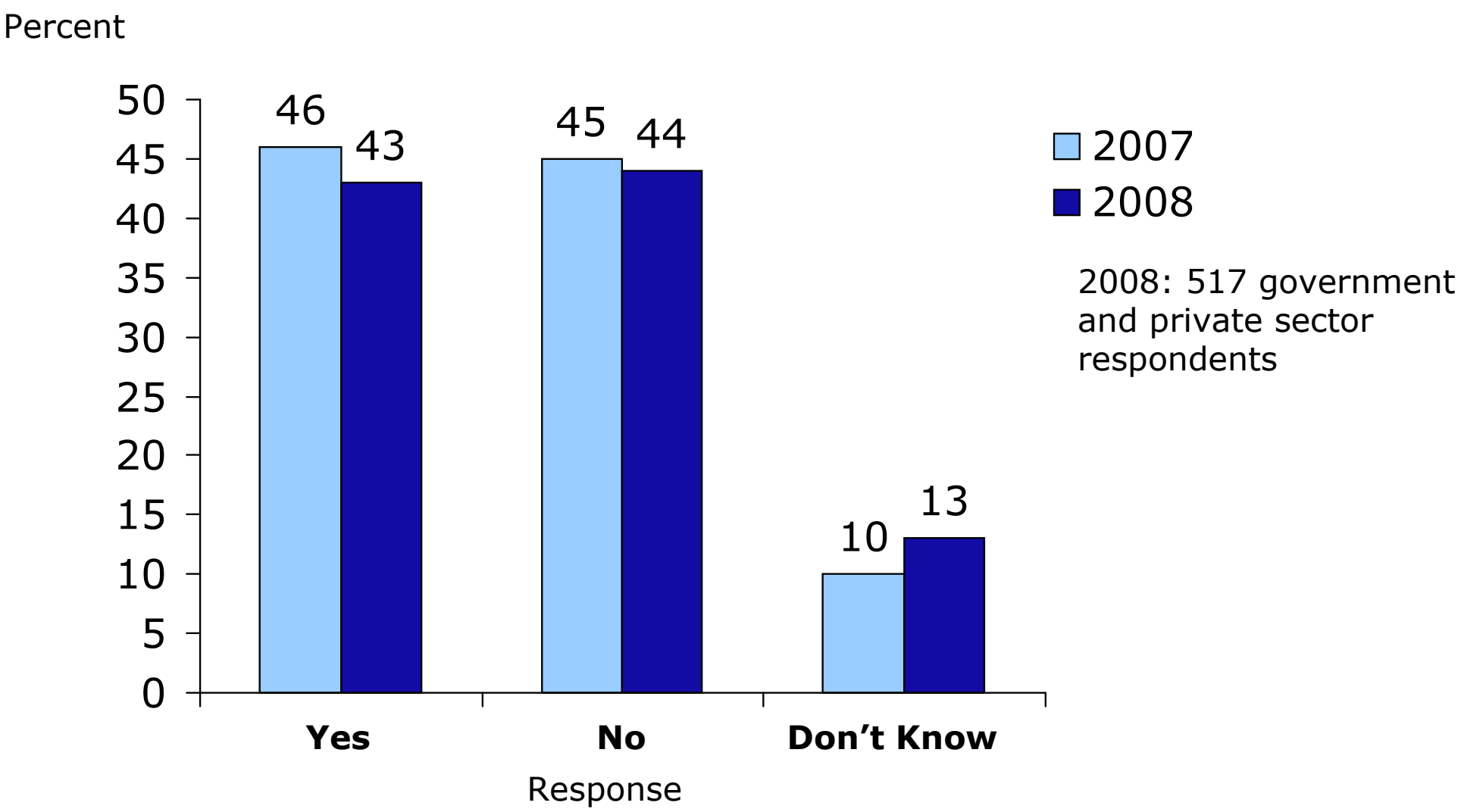
TB of data/month



Source: Cisco, 2009

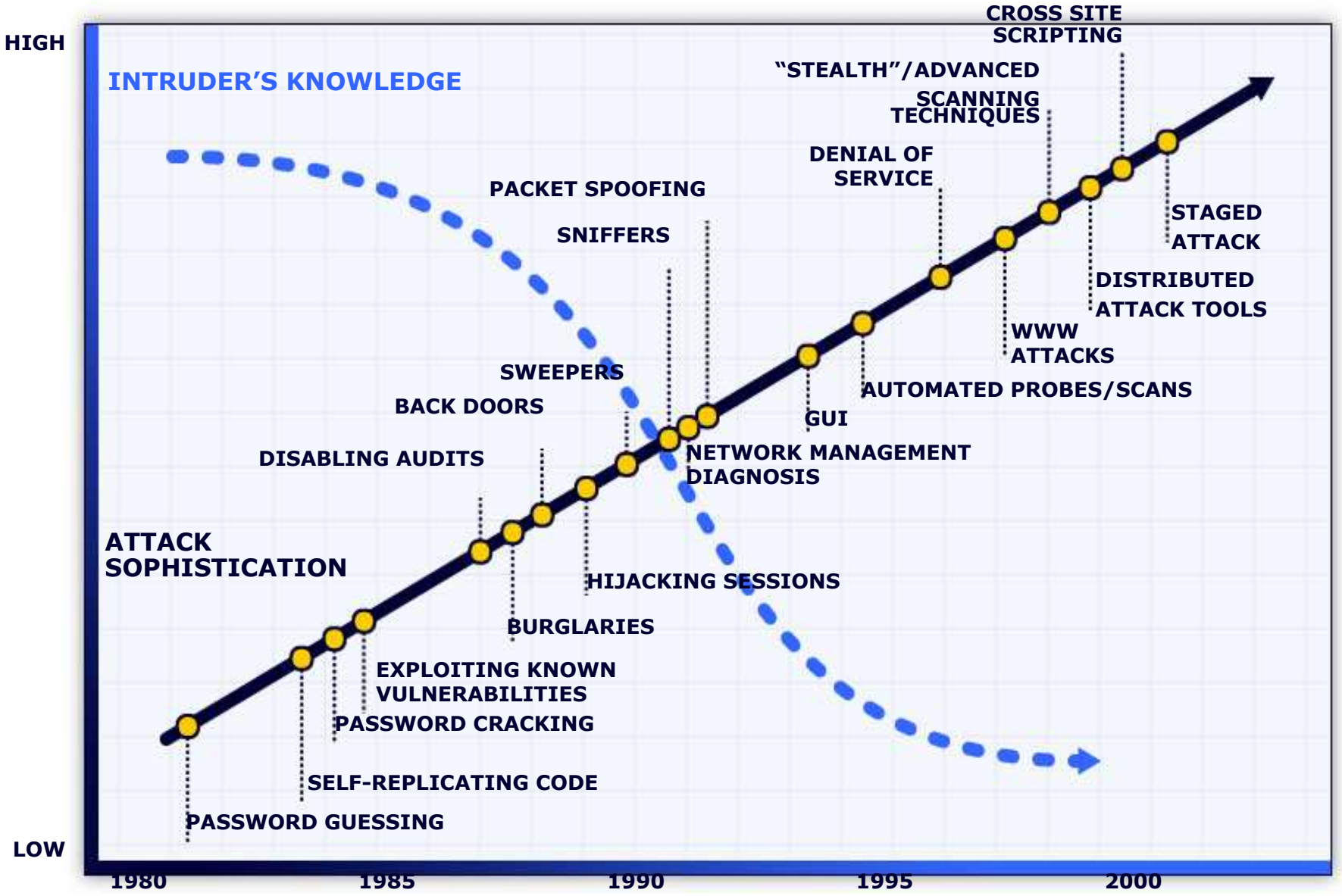
Cyber security issues affect nearly one-half of enterprises

Government and private sector respondents that experienced security incidents



Source: CSI Crime & Security survey

Cyber security attacks are becoming more sophisticated but easier to execute



Source: FCC NRIC

Cyber security workshop

- Workshop will take place on September 30, 2009
- Welcoming comments by Commissioner Meredith Attwell Baker
- Panels will discuss:
  - "How Broadband Technologies, Tools and Innovations Can Aid in Preventing Cyber Attacks on the Nation's Critical Communications Infrastructure"
  - "How Broadband Technologies, Tools and Innovations Can Aid in Detecting Cyber Attacks and Aid in Restoring Systems After Attacks Occur"

Panelists include:

- Dale Drew, Level 3
- Marc Donner, Google
- John Nagengast, AT&T
- Andy Ogielski, Renesys
- Richard Pethia, CERT
- Allan Sadowski, North Carolina State Highway Patrol
- Greg Schaffer, DHS
- Don Welch, Merit Network, Inc

Areas of focus and key issues

Areas of focus	Key issues
Nationwide Public Safety Network	• Costs and resources necessary to satisfy broadband needs • Whether specialized broadband needs can be satisfied by commercial broadband service provider
Next Generation 911	• Extent to which Next-generation 9-1-1 technologies and services are being deployed today • Regulatory roadblocks that may restrict more vigorous deployment
Cyber Security And Commercial Network Survivability	• Agency collaboration necessary to prevent, detect, and respond to cyber attacks • Extent to which cyber security best practices are being implemented by communications providers
Alerting	• Broadband technologies that could best enable improvements in alerting