



History of Net Neutrality

CYBR 4400 / 5400: Principles of Internet Policy, Lecture 3-1

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Today's Lecture

- ❖ Project Progress Reports on Wednesday, February 26
 - ❖ Distance students email me on whether you can present via Zoom, or need to establish different time for your progress report
- ❖ Current Events
 - ❖ Lessig Presentation to the FCC (2008)
- ❖ Unit 2 Summary
- ❖ Unit 3 Roadmap
- ❖ History of Net Neutrality Lecture

Unit #2 Summary

- ❖ Understand focus of U.S. national broadband plan
 - ❖ Maximize competition
 - ❖ Add broadband to universal service plan
 - ❖ Efficient allocation of government assets

Unit #2 Summary

- ❖ Universal service
 - ❖ Government-sponsored subsidy to add or keep users of a desirable service by low rates
 - ❖ Principal market / regulatory failures justification: network effects or lack of market solutions
 - ❖ Connect America Fund (CAF) established to fund broadband (fixed and mobile)

Unit #2 Summary

- ❖ Definition of Broadband for universal service
 - ❖ Factors
 - ❖ Speed (advertised and consistency)/ Latency
 - ❖ Usage allowances and price
 - ❖ Policy benchmark (Section 706)
 - ❖ Status of mobile
- ❖ Local access network technologies
 - ❖ Types of local access networks
 - ❖ Comparative advantages of different types

Unit #2 Summary

- ❖ Comparison of international NBPs
 - ❖ Difference between broadband / Internet Access defined as a legal versus human rights
 - ❖ Timeline of focus for NBPs; popularity of NBPs
 - ❖ Best practices of NBPs
 - ❖ Impact of NBPs on fixed and mobile broadband adoption

Unit 3 Roadmap

- ❖ Goals:

- ❖ Understand key terms associated with net neutrality and interconnection
- ❖ Deepen understanding of interdisciplinary policy framework

- ❖ Learning Outcomes

- ❖ Explain the goals and objectives of net neutrality regulations, the problems they address
- ❖ Understand how modern network management practices can coexist with the net neutrality regulatory objectives and regulatory requirements
- ❖ Explain network economics of zero rating or sponsored data plans.
- ❖ Define peering policies and their impact upon Internet interconnection

History of Net Neutrality, or How Did We Get to This Point?



Internet Policy Challenge

- ❖ Internet represents a layered model of protocols
- ❖ Competition and diversity have flourished at higher layers because of the consistent interface to lower layers
- ❖ Policy challenge: when is government intervention needed to prevent dominant provider at one layer from stifling competition at another?

Historical Origins of Net Neutrality

- ❖ Carterfone



- ❖ Produced technologies (answering machine, fax, and modem)—removing barrier to development of packet switched network that eventually would become the Internet (FCC 2015 order)
- ❖ Computer Inquiries separated market for information services from underlying network infrastructure, controlled physical layer monopoly power of AT&T
- ❖ Computer II established basic vs. enhanced service definition
 - ❖ Basic services offered to public is common carriage
 - ❖ Enhanced services offer content or data processing and is unregulated

Historical Origins of Net Neutrality

(cont'd)

- ❖ Service definitions
 - ❖ Enhanced services employ computing to:
 - ❖ “Act on the format, content, code, protocol or similar aspects of the subscriber’s transmitted information;
 - ❖ provide the subscriber additional, different, or restructured information;
 - ❖ Involve subscriber interaction with stored information.”
 - ❖ Basic services: “pure transmission capability over a communications path that is virtually transparent in terms of its interaction with customer supplied information”
- ❖ Computer III relied on “nonstructural” cross-subsidy and nondiscrimination safeguards
- ❖ Telecommunications Act of 1996 renames basic to telecommunications services (Title II), and enhanced to information services (Title I)

Cable “Open Access”

- ❖ For regulatory symmetry with telcos, “open access” on cable systems proposed for unaffiliated ISPs
- ❖ Around 2000, city of Portland tried to impose open access as part of merger approval (overturned) and FCC conditioned TW-AOL merger on offering access to 3 ISPs
- ❖ Vague on technical details...

Classifying Cable Modem Service

- ❖ How should cable broadband be classified?
 - ❖ “cable service” subject to Title VI
 - ❖ “telecommunications service” subject to Title II
 - ❖ “information service” subject to Title I
- ❖ FCC Cable Broadband Order (2002) chose information service, but Ninth Circuit nullified
 - ❖ Supreme Court Brand X decision reinstated classification
- ❖ FCC Wireline Broadband Order (2005) eliminated regulatory asymmetry for telcos’ broadband service

Genesis of Net Neutrality Rules (2005)

- ❖ FCC sanctioned small regional telco (Madison River Communications) for port blocking of Vonage VoIP services to stem losses to its voice services
- ❖ FCC issued non-enforceable “four Internet freedoms”:

To encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet, consumers are entitled to:

1. Access the lawful Internet content of their choice
2. Run applications and use services of their choice, subject to the needs of law enforcement
3. Connect their choice of legal devices that do not harm the network.
4. Competition among network providers, application and service providers, and content providers

Comcast Blocking (2008)



- ❖ FCC acted on complaint alleging Comcast wrongfully blocked BitTorrent applications and misled customers why a session had been interrupted
- ❖ FCC found behavior unlawful; criticized Comcast for lack of transparency
- ❖ Defined notion of “reasonable network management”
 - ❖ Service provider must prove “its practice should further a critically important interest and be narrowly tailored to serve that interest”
 - ❖ FCC did not dispute that easing network congestion is critically important interest, but found Comcast's practice was not minimally intrusive, and therefore unlawful
- ❖ U.S. Court of Appeals for the D.C. annulled FCC’s decision in 2010

TCP/IP Packet

IP Header	Version	IHL	Type of Service		Total Length					
	Identification				Flags	Fragment Offset				
	Time to Live		Protocol=6 (TCP)		Header Checksum					
	Source Address									
	Destination Address									
	Options								Padding	
TCP	Source Port					Destination Port				
	Sequence Number									
	Acknowledgement Number									
	Data Offset		U R G	A C K	P S H	R S T	S Y N	F I N	Window	
	Checksum					Urgent Pointer				
	TCP Options								Padding	
	TCP Data									

Comcast v. FCC Decision (2010)

- ❖ Held that FCC failed to cite any statutory authority compelling broadband providers to adhere to open network management practices

FCC's Preserving the Open Internet Rules in 2010

Three basic rules:

- ❖ **Transparency** – Fixed and mobile broadband providers must disclose:
 - ❖ Network management practices / Performance characteristics / Terms and conditions of services
- ❖ **No blocking**
 - ❖ Fixed broadband providers may not block lawful content, apps, or non-harmful devices
 - ❖ Mobile may not block lawful websites, apps that compete with their voice / videophone services
- ❖ **No unreasonable discrimination**

Unreasonable Discrimination

- ❖ Differential treatment of traffic more likely to be reasonable the more transparent it is
- ❖ End-user choice and control central to evaluating reasonableness of discrimination
 - ❖ No ban on usage-based pricing
- ❖ Use or application agnostic discrimination probably reasonable
- ❖ “Pay for priority” is a concern
 - ❖ Raises barriers to entry

ISP engaged in the provision of fixed broadband Internet access service ... shall not unreasonably discriminate in transmitting lawful network traffic over a consumer's broadband Internet access service. Reasonable network management shall not constitute unreasonable discrimination.

Mobile Broadband

- ❖ Rapidly evolving, earlier stage platform
- ❖ Mobile networks present operational constraints not typically faced by fixed broadband
- ❖ Require mobile broadband providers comply with transparency and no-blocking rules
 - ❖ Only prevents blocking of any lawful website or any service that competes with service provided by the mobile operator
 - ❖ Other types of blocking (e.g., downloads of large files) may be allowed
- ❖ Unreasonable discrimination rule does not apply

Statutory Jurisdiction for Open Internet Rules for 2010

- ❖ Section 706(a) of 1996 Act: Remove barriers to infrastructure investment in advanced telecommunications (“virtuous circle of innovation”)
- ❖ Section 706(b): Telecommunications technologies must be deployed to all Americans in reasonable and timely fashion
- ❖ In 2010, FCC found that advanced telecommunications capability not deployed in reasonable and timely fashion, thus required to “take immediate action to accelerate deployment of such capability”

Statutory Jurisdiction for Open Internet Rules

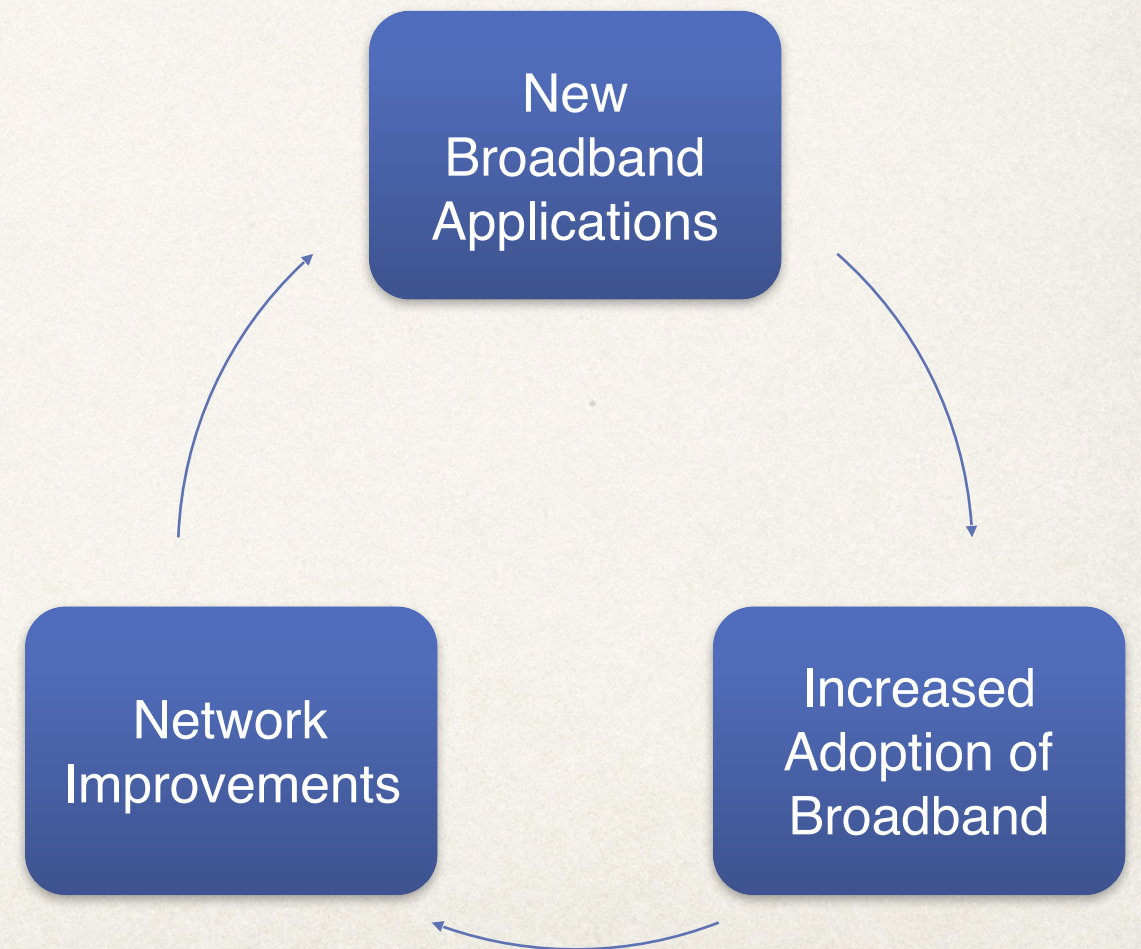
FCC argument in 2010:



Summary Verizon v. FCC Decision (2014)

- ❖ Accepts FCC's authority under Section 706 of Telecom Act of 1996 to enact measures encouraging deployment of broadband infrastructure
- ❖ Empowers rules governing ISPs' treatment of Internet traffic to preserve "virtuous circle" of Internet innovation

Foster cycle of broadband investment and innovation



Summary of Decision (cont'd)

- ❖ FCC cannot, however, contravene statutory mandates
- ❖ Vacates no-blocking and non-discrimination rules because they impose common carrier obligations counter to regulatory classification of broadband providers

Do Open Internet Rules Obligate Broadband Providers to Act as Common Carriers?

Court's view:

- ❖ Anti-blocking and anti-discrimination rules require broadband providers to “furnish...communication service upon reasonable request” (Section 201) to edge providers
- ❖ Compelling service at no cost (e.g., discouraging pay for priority) does not avoid common carriage
- ❖ No unreasonable discrimination compels broadband providers to “serve the public indiscriminately”

Do Open Internet Rules Obligate Broadband Providers to Act as Common Carriers? (cont'd)

- ❖ Court finds that non-blocking and non-discrimination rules do constitute common carriage
 - ❖ FCC's classification of fixed broadband service as information service, and mobile broadband service as "private" mobile service, do not permit this treatment
 - ❖ "Remand this case to the Commission for further proceedings consistent with this opinion."
- ❖ Court ruling does NOT address wisdom of Open Internet regulations, but statutory grant of authority to implement them



Protecting and Promoting the Open Internet (2015)





“America needs more broadband, better broadband, and open broadband networks.”

- ❖ Three overarching policy objectives of 2015 Report and Order
- ❖ Two key findings to justify new rules
 1. Broadband providers—both fixed and mobile—have both the incentives and ability to harm the open Internet
 2. Relatively small incremental burdens imposed by rules outweighed by benefits of preserving the open nature of the Internet

Sustainable Open Internet Rules

- ❖ Retail broadband Internet access service (BIAS) best viewed as separately identifiable offers of
 - ❖ a BIAS that is a telecommunications service (including assorted functions and capabilities used for the management and control of that telecommunication service)
 - ❖ Various “add-on” applications, content, and services that generally are information services
- ❖ Mobile BIAS is interconnected with public switched network, therefore a Commercial Mobile Service

“Strong Rules” to Protect Consumer from Open Internet Threats by fixed and mobile BIAS Providers

❖ No Blocking ...

Of “lawful content, applications, services, or non-harmful devices, subject to reasonable network management”

- ❖ Can refuse unlawful content (e.g., child pornography, copyright-infringing materials)
- ❖ Cannot charge edge providers fee to avoid blocking of content, service, or app
- ❖ No minimum level of access standard

“Strong Rules” to Protect Consumer from Open Internet Threats by fixed and mobile BIAS Providers

❖ No Throttling ...

To “impair or degrade lawful Internet traffic on the basis of Internet content, application, or service, or use of a non-harmful device, subject to reasonable network management”

- ❖ Throttling must be reasonably and primarily for network management, not business purposes
- ❖ Prohibits charging edge providers fee to avoid throttling of their content, service, or app

“Strong Rules” to Protect Consumer from Open Internet Threats by fixed and mobile BIAS Providers

❖ No paid prioritization

No “management of a broadband provider’s network to directly or indirectly favor some traffic over other traffic, including through use of techniques such as traffic shaping, prioritization, resource reservation, or other forms of preferential traffic management”

(a) “in exchange for consideration (monetary or otherwise) from a third party”

(b) “to benefit an affiliated entity”

- ❖ Priority treatment can cause higher latency, more packet loss, less bandwidth for others
- ❖ If allowed, damage to Internet openness could be difficult to reverse (no “fast lanes”)
- ❖ Allows waiver if significant public interest benefit and no harm to the open Internet
- ❖ NO reasonable network management exception - business practice

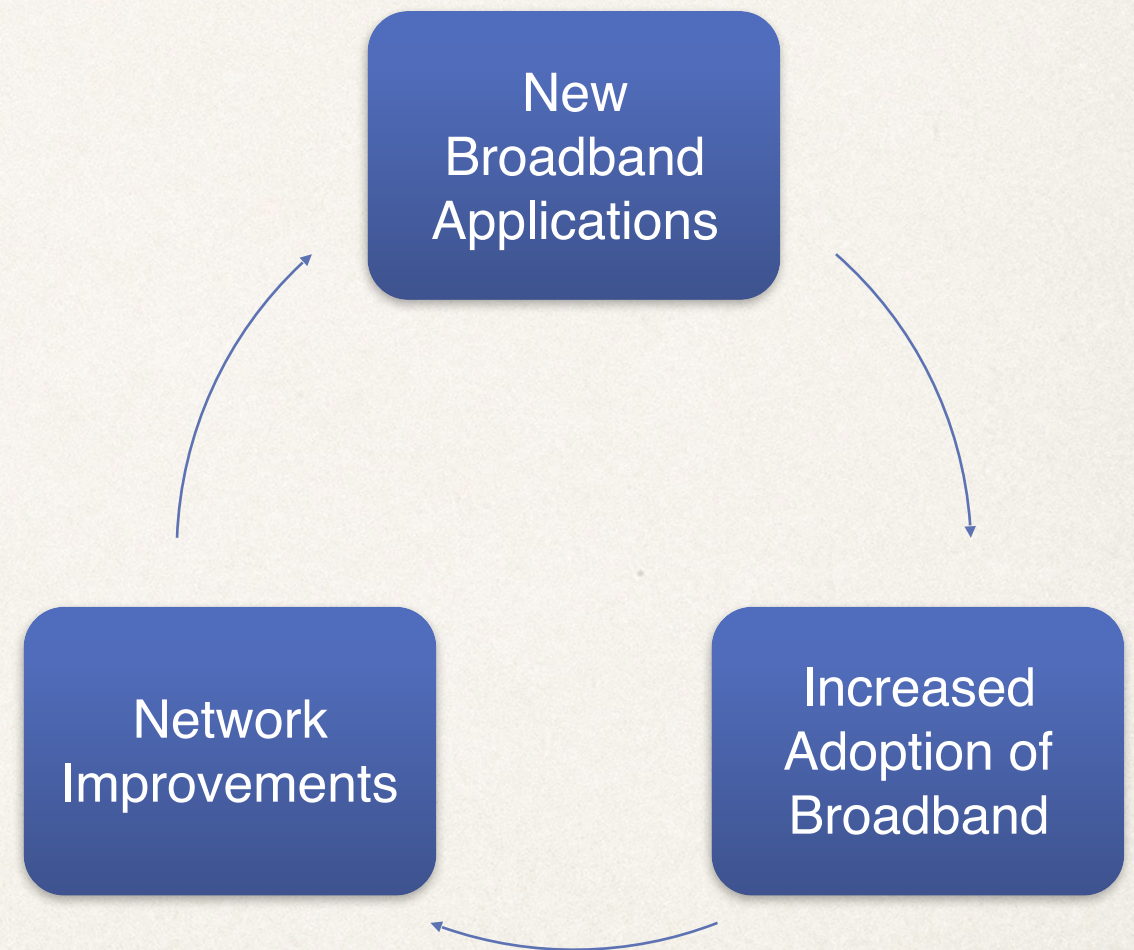
Specialized Services (aka Non-BIAS Data Services)

- ❖ Services that share capacity with BIAS over last-mile facilities
 - ❖ Some existing facilities-based VoIP and IP-video offerings
- ❖ May deliver valued services to end users, but also raise concerns by bypassing Open Internet rules
 - ❖ Develop more capacity for special services at expense of available broadband service capacity
 - ❖ Exacerbated by market power limiting choice
- ❖ FCC to monitor developments rather than adopt specific policies

Reason for Rules: Preserving the “Virtuous Cycle”

- ❖ Internet is level playing field
- ❖ Thrives due to “freedom and openness”
- ❖ No gatekeepers blocking lawful network uses or picking online winners or losers
- ❖ Openness promotes competition

Foster cycle of broadband investment and innovation



No Unreasonable Interference or Disadvantage Standard

- ❖ Broadband and mobile ISPs shall not unreasonably interfere with or unreasonably disadvantage
 - ❖ *“end users’ ability to select, access, and use broadband Internet access service or the lawful Internet content, applications, services, or devices of their choice”*
 - ❖ *“edge providers’ ability to make lawful content, applications, services, or devices available to end users”*
- ❖ Subject to reasonable network management
- ❖ May be other practices that cause harms to Open Internet beyond the rules created
- ❖ Balance end user control, competitive effects, consumer protection, free expression, app agnostic, and standards practices against effect on innovation, investment, or broadband deployment
- ❖ Will apply to sponsored data and usage allowance plans on a case-by-case basis given “unresolved debate concerning the benefits and drawbacks”

Prior Transparency Rules (2010)

- ❖ Exclusions include info that:
 - ❖ May be competitively sensitive
 - ❖ May compromise network security
 - ❖ Undermine efficacy of reasonable network management
- ❖ Network practices disclosure
 - ❖ Congestion management
 - ❖ Application-specific behavior
 - ❖ Device attachment rules
 - ❖ Network security

“ISP engaged in the provision of broadband Internet access service shall publicly disclose accurate information regarding the network management practices, performance, and commercial terms of its broadband Internet access services”

Prior Transparency Rules (2010) (cont'd)

- ❖ Performance characteristics

- ❖ Service description

- ❖ Impact of specialized services

- ❖ Commercial terms

- ❖ Pricing

- ❖ Privacy policies

- ❖ Redress options

“..sufficient for consumers to make informed choices regarding use of such services and for content, application, service, and device providers to develop, market, and maintain Internet offerings”

Enhanced Transparency (2015)

- ❖ Publicly disclose network management practices, performance, and commercial terms of broadband service
- ❖ Enhanced by new requirements of disclosure
 - ❖ Promotional rates, fees and / or surcharges, and data allowances
 - ❖ Adding required disclosure of packet loss
 - ❖ Requiring specific notification to consumers that a “network practice” is likely to significantly affect their use of the service

Transparency Rule Enhancements (2015)

- ❖ Commercial terms

- ❖ Price – full monthly service charge
- ❖ Other Fees – additional fees consumer incurs to initiate, maintain, or discontinue service
- ❖ Data Caps and Allowances – any data caps or allowances the consumer is purchasing, and consequences for exceeding
- ❖ Privacy Policies – whether network management practices include network traffic inspection, and if traffic data is stored, provided to third parties, or used by the carrier for non-network management purposes

Transparency Rule Enhancements (2015)

- ❖ Network Performance

- ❖ Must disclose packet loss in addition to speed and latency
- ❖ Disclosure should apply to geographic area of the consumer
- ❖ Measure average performance over a reasonable period of time and during times of peak usage
- ❖ Mobile: separate disclosures for services with each technology (e.g., 3G and 4G)

Transparency Rule Enhancements (2015)

❖ Network Practices

- ❖ Existing rules require disclosure of congestion management, application-specific behavior, device attachment rules, and security.
- ❖ Further require disclosure of network practices applied to traffic associated with a particular user or user group, including any application-agnostic degradation of service to a particular end user



“Modern” Title II



- ❖ Forbearance of over 700 rules
- ❖ No unbundling of last-mile facilities
- ❖ No tariffing
- ❖ No rate regulation
- ❖ No cost accounting rules
- ❖ Application of Sections 201, 202, and 208 of Communications Act

Section 201 of Title II

- ❖ Requires common carriers to furnish communications services “upon reasonable request”
- ❖ Carriers must establish physical connections with other carriers where the Commission finds it to be in the public interest
- ❖ Charges shall be just and reasonable

Section 202/208 of Title II

- ❖ Section 202: Unlawful for any common carrier to make any unjust or unreasonable discrimination in charges, practices, classifications, regulations, facilities, or services
- ❖ Section 208: provides complaint process for enforcement of applicable provisions of the rules (establishing any person/entity can file)

Exceptions to Forbearance

- ❖ Section 222: Protecting consumer privacy
- ❖ Sections 225 / 255 / 251(a)(2): Ensuring disabilities access
- ❖ Section 224: Ensuring Infrastructure Access (pole attachments)
- ❖ Section 254: Promoting universal broadband

Timeline Summary

- ❖ Computer Inquiry II established 2 service types
 - ❖ Basic (subject to Title II common carrier regulation of 1934 Act) or Enhanced (ill-defined Title I rules) services
- ❖ Telecom Act of 1996 defined two entities
 - ❖ Telecommunications carriers (Title II) or Information service providers (Title I unregulated)
- ❖ FCC classified DSL as a telecommunications service (1998)
- ❖ FCC classified cable broadband as an information service (2002)

Timeline Summary (cont'd)

- ❖ FCC classified DSL (2005) and wireless (2007) broadband as information services
- ❖ FCC ordered Comcast to new network management approach and transparency based on “ancillary jurisdiction” (2008)
 - ❖ Vacated because FCC failed to identify statutory authority that was reasonable ancillary
- ❖ FCC’s Preserving the Open Internet rules based upon same theory of ancillary jurisdiction (2010)

Timeline Summary (cont'd)

- ❖ FCC sought comment on reclassification of broadband Internet services in 2010, but adopted Open Internet rules instead
- ❖ Also in 2010, FCC concluded “broadband deployment to all Americans is not reasonable and timely” in Sixth Broadband Deployment Report
- ❖ U.S Court of Appeals rules in Verizon v. FCC (2014) vacates portions of Open Internet Order (2010) that could only be applied to common carriers
- ❖ FCC’s Protecting and Promoting the Open Internet rules based upon Title II statutory authority (2015)