Digital Divides: A Connectivity Continuum for the United States.

Data From the 2011 Current Population Survey

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Abstract: Previous research has shown that computer ownership and Internet access are both strongly associated with economic factors such as household and family income, demographic factors like age and race, and social factors such as educational attainment. This research builds on these established findings by presenting national and state level results of a newly created "Connectivity Continuum," a tool developed to place individuals along a range of connectivity outcomes, varying in scope from people with no Internet connection or computer, to those connecting from multiple locations and devices. Preliminary descriptive results indicate that connectivity in America is heavily influenced by where an individual lives. Furthermore, these findings indicate that various social, demographic, and economic characteristics influence both high and low connectivity individuals, some to a greater degree than others. The finalized version of this research includes multivariate analyses in an effort to address the question of which characteristics matter most.

BACKGROUND In 2011 more Americans connected to the Internet than ever before, although differences continued to exist between those with access and those without. Just as with differences in access, variation in the ways that people were connecting online – and the frequency of their use – has remained prevalent as well (File, 2012; Zickuhr and Madden, 2012). Previous research has shown that computer ownership and Internet access are both strongly associated with economic factors such as household and family income (Jansen, 2012; NTIA, 2010), demographic factors like age and race (Zickuhr and Madden, 2012; Day, Janus, and Davis, 2005), and social factors such as educational attainment (Simon and Graziano, 2001). Individual computer ownership and Internet access rates have also historically varied by state and region of residence (Current Population Survey, 2010).

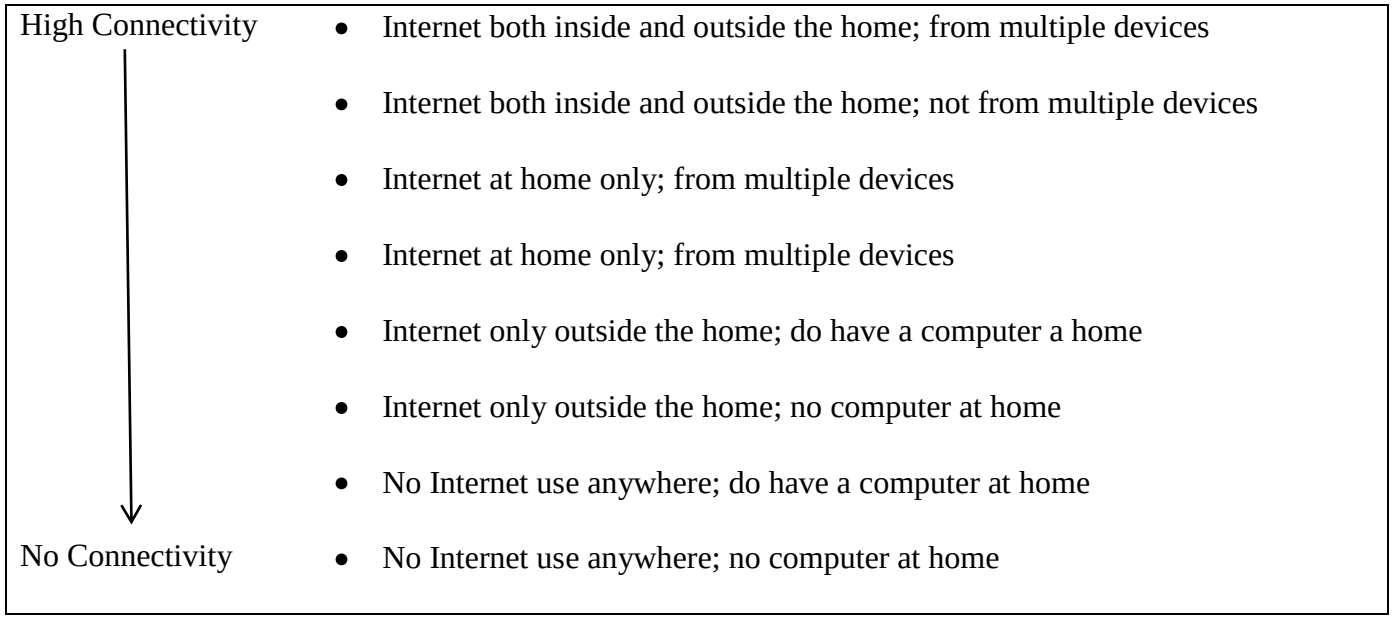
This proposed research builds on these descriptive findings by presenting national and state level results of a newly created "Connectivity Continuum," a tool developed to place individuals along a range of connectivity outcomes, varying in scope from people with no Internet connection or computer, to those connecting from multiple locations and devices. This continuum is particularly relevant given the wide array of established scholarship exploring the importance of digital access, and the negative impacts of virtual inequality, in today's increasingly technological world (Raine and Wellman, 2012; Norris, 2001; Mossberger, Tolbert, and Stansbury, 2003).

DATA & METHODS This research provides findings based on data collected in a July 2011 supplement to the Current Population Survey (CPS), which includes questions about computer ownership, Internet use both inside and outside the home, and the additional devices

that people are using to go online. The U.S. Census Bureau has asked questions in the CPS about computer use since 1984 and Internet access since 1997.[1]

In 2011, household respondents were asked how many computers were present in their home. Respondents were also asked whether anyone in their household used the Internet from that home. Later in the survey, respondents were asked about the individual Internet activities of all members of the household, including whether they accessed the Internet, where that access took place, and on what types of devices they used.

Based on answers to these questions, we have developed a continuum to place individuals along the following range of connectivity outcomes:



Our analyses will begin with a descriptive presentation of the connectivty continnum at both the national and state levels. Next, we will employ a series of multivariate models predicting both high connectivity and low connectivity, focusing on the effect of various demographic, social and economic characteristics that we believe are associated with these

[1] People in the military, U.S. citizens living abroad, and people in institutionalized housing, such as correctional institutions and nursing homes, were not included in the surveys discussed in this report.

outcomes. The end result will be a multi-tiered portrait of Internet and computer use in America, one that not only accounts for geographic variabibility across the nation, but that also identifies the most important predicitive factors with regards to high and low connectivity.

PRELIMINARY RESULTS Overall, in 2011 a plurality of Americans connected to the Internet from multiple locations and multiple devices (27.0 percent). These were considered "high connectivity" individuals. The second most common position on the continuum was for individuals without any computer or Internet activity (15.9 percent), or "no connectivity" individuals. The remaining 57 percent of Americans were located somewhere between these two continuum extremes.

Table 1 presents the continuum results by geography. States scattered across all regions stood out for their relatively large percentages of highly connected individuals, including Colorado, the District of Columbia, Maryland, Minnesota, Washington, New Jersey, and Connecticut. Meanwhile, on the opposite end of the connectivity continuum, states with large percentages of no connectivity included Texas, Arkansas, Tennessee, West Virginia, South Carolina, New Mexico, and Mississippi.

(TABLE 1)

Map A presents state level estimates of high connectivity for each state, relative to the national average. The 17 states colored green had percentages of high connectivity statistically above the national average of 27.0, whereas the 21 states colored red had lower percentages of highly connected users. The remaining states did not statistically differ from the national average.

With few exceptions, the southern part of the country lagged behind the nation in terms of highly connected individuals. The same can be said for segments of other regions too, as pockets of the West, Midwest and Northeast all contained multiple states with low percentages of high connectivity. Several states on the Pacific coast stood out for having large percentages of high connectivity, as Washington, Oregon, California and Alaska all had significantly large percentages relative to the national average.

(MAP A)

Map B displays state level estimates of no connectivity, or individuals who did not connect to the Internet and lived in a home without a computer. The 27 states colored green had lower percentages of no connectivity than the national average of 15.9 percent, whereas the 21 states colored red had higher percentages. With the exception of Florida, Virginia and Maryland, states in the southern region of the country had large percentages of their populations with no connectivity.

Certain other parts of the country, including the Pacific coast and upper Northeast, showed comparatively small percentages of no connectivity. Similarly small percentages were present in many states in the non-coastal portions of the West and Midwestern regions.

(MAP B)

In a number of states the percentage of high connectivity was large, while the percentage of no connectivity was small. States with large percentages of high connectivity and small percentages of no connectivity were exemplified by Colorado, Kansas, and Nebraska, Pacific coast states, and several states in the Northeastern region. Other states showed an opposite pattern at the two ends of the connectivity spectrum. In Missouri and Nevada, for example, there were relatively large percentages of *both* high connectivity and no connectivity. In Wyoming,

Idaho, and New York, there were simultaneously low percentages of both high connectivity and no connectivity, meaning that in these areas higher percentages of individuals were located somewhere in the non-extreme middle of the connectivity continuum.

Connectivity also varied according to various demographic, social and economic factors (Table 2). Most of the observed patterns by age, race and Hispanic origin, income and education, and other factors lined up in an expected way –groups known to have higher incomes and other resources tended to have greater connectivity. Patterns by age and employment status show slight complications worthy of further exploration.

(TABLE 2)

NEXT STEPS Overall, these initial findings indicate that connectivity in America is heavily influenced by where an individual lives. Furthermore, these findings indicate that various social, demographic, and economic characteristics influence both high and low connectivity individuals. However, these effects may vary when we control for the individual impact of all variables, and our multivariate analyses will help address the question of which characteristics matter most.

Table 3 displays results from logistic regression analyses predicting the connectivity continuum by various population characteristics. Results are presented as odds ratios, which are related to the probability of falling somewhere on the continuum. Specifically, we have results from two preliminary models, one predicting high connectivity individuals, and the other predicting no connectivity individuals.

(TABLE 3)

In Model A, coefficient values above 1.0 indicate that, compared with the omitted reference group, people have lower odds of reporting no connectivity. Alternatively, in Model B,

coefficient values above 1.0 indicate lower odds of reporting high connectivity, relative to the omitted category.

The finalized version of this proposal will include a more detailed narrative exploration of these results, but for now readers can view the tables to get a feel for what that section will ultimately look like. Also, after consulting with my managers, the decision has been made to focus this paper's models on only the 18+ population, leaving an exploration of those 0-17 years of age for future research.

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Table 1: Overall Connectivity Continuum, by State: July 2011 (CPS)
(In thousands.)

Selected Characteristics	Total	No connection anywhere		No connection at home, but		Connection at home only		Connection at home and	
		No computer in household	Computer present in household	No computer in household	Computer present in household	Not from multiple devices	From multiple devices	Not from multiple devices	From multiple devices
Individuals 3 years and older	**293,414**	15.9	14.4	3.0	2.6	13.8	12.9	10.3	27.0
Alabama	4,449	19.9	13.6	4.5	4.8	14.1	12.3	10.7	20.1
Alaska	664	10.4	12.6	4.3	4.4	10.7	15.5	10.8	31.3
Arizona	6,336	16.2	15.4	2.5	2.4	13.3	14.8	7.7	27.8
Arkansas	2,708	20.8	17.9	4.0	2.6	14.0	12.3	8.4	20.1
California	35,459	15.4	16.6	3.2	2.4	11.6	13.2	9.5	28.1
Colorado	4,852	11.0	10.9	2.8	2.6	13.0	12.6	11.3	35.8
Connecticut	3,344	10.1	13.4	1.9	1.6	14.1	15.5	10.6	32.6
Delaware	850	16.6	12.8	3.0	2.5	16.2	14.9	12.1	21.9
District of Columbia	588	17.9	10.3	5.7	2.1	10.7	8.5	10.8	34.0
Florida	17,777	14.0	14.2	3.0	2.7	15.4	14.4	8.8	27.5
Georgia	9,334	16.1	14.0	3.2	3.3	13.3	13.1	9.3	27.7
Hawaii	1,210	18.2	16.1	2.5	2.6	12.0	14.1	8.7	25.7
Idaho	1,475	11.0	15.9	2.1	3.1	16.4	18.5	10.6	22.4
Illinois	12,280	15.5	14.4	2.6	2.9	14.2	11.7	11.3	27.4
Indiana	6,121	18.7	12.9	4.3	2.5	16.4	10.1	11.5	23.6
Iowa	2,881	14.8	12.5	2.7	3.7	13.7	13.9	11.9	26.8
Kansas	2,653	12.6	12.4	2.9	2.7	14.7	12.8	11.2	30.7
Kentucky	4,133	19.6	14.6	2.9	2.7	14.3	11.4	11.4	23.1
Louisiana	4,282	19.0	14.7	4.4	2.3	12.8	13.4	8.7	24.6
Maine	1,252	13.5	13.1	2.7	1.9	17.7	12.2	13.3	25.6
Maryland	5,440	12.5	13.4	2.4	2.3	10.6	14.5	10.8	33.5
Massachusetts	6,341	12.0	13.6	2.6	1.4	14.5	14.7	12.3	28.9
Michigan	9,438	13.5	13.2	2.7	1.8	16.5	13.5	11.6	27.2
Minnesota	5,063	9.8	11.1	2.2	2.3	14.7	13.2	13.2	33.4
Mississippi	2,772	26.8	14.2	4.3	4.4	10.6	11.2	8.6	19.9
Missouri	5,686	18.7	13.0	3.8	2.9	11.9	11.6	9.6	28.6
Montana	933	16.5	15.8	4.9	4.5	16.3	11.7	9.6	20.7
Nebraska	1,694	14.3	11.6	3.2	3.4	15.2	10.1	11.9	30.4
Nevada	2,519	15.3	16.5	2.6	2.4	13.1	15.9	9.4	24.9
New Hampshire	1,273	8.9	11.4	1.6	2.2	16.5	13.9	14.6	31.0
New Jersey	8,261	12.3	14.2	2.1	2.0	12.6	13.4	10.7	32.6
New Mexico	1,942	21.7	17.9	3.8	4.0	10.6	9.4	11.3	21.3
New York	18,637	15.0	15.9	2.5	1.7	16.4	13.2	10.3	24.9
North Carolina	9,005	20.4	13.4	2.8	1.9	15.4	11.2	10.0	24.9
North Dakota	612	14.5	13.7	3.0	3.2	14.9	11.3	11.9	27.5
Ohio	10,967	17.0	13.5	3.0	2.7	14.8	12.9	11.0	25.1
Oklahoma	3,496	18.0	17.4	3.1	3.3	13.8	10.5	9.6	24.2
Oregon	3,713	10.9	12.7	3.5	3.1	12.8	15.2	11.3	30.5
Pennsylvania	12,004	16.3	14.2	2.4	3.1	15.9	13.2	10.1	24.8
Rhode Island	1,008	13.6	14.2	2.4	2.2	15.9	13.2	12.4	26.2
South Carolina	4,344	21.6	13.5	3.8	2.4	15.9	12.3	9.7	20.8
South Dakota	778	13.9	13.1	3.4	3.8	13.9	12.1	12.9	26.9
Tennessee	6,057	21.2	15.7	2.4	4.0	13.0	11.7	9.8	22.2
Texas	23,864	20.5	15.5	4.4	3.3	10.4	11.8	8.2	25.9
Utah	2,693	7.5	16.3	2.4	3.0	13.4	18.1	12.1	27.3
Vermont	599	12.1	12.3	2.8	2.9	15.1	11.2	13.9	29.7
Virginia	7,506	16.6	13.3	2.8	2.1	13.6	11.6	11.3	28.8
Washington	6,453	9.1	10.9	2.1	2.5	16.0	13.4	13.0	33.0
West Virginia	1,748	21.5	14.4	3.3	1.7	18.9	12.2	10.9	17.2
Wisconsin	5,402	13.2	11.6	2.6	2.0	16.2	11.6	15.1	27.6
Wyoming	517	12.7	13.0	2.5	3.6	14.8	13.5	14.7	25.1

Source: U.S. Census Bureau, Current Population Survey, July 2011.
Internet Release date:

Table 2: Overall Connectivity Continuum, by Selected Individual Characteristics: July 2011 (CPS)
(In thousands.)

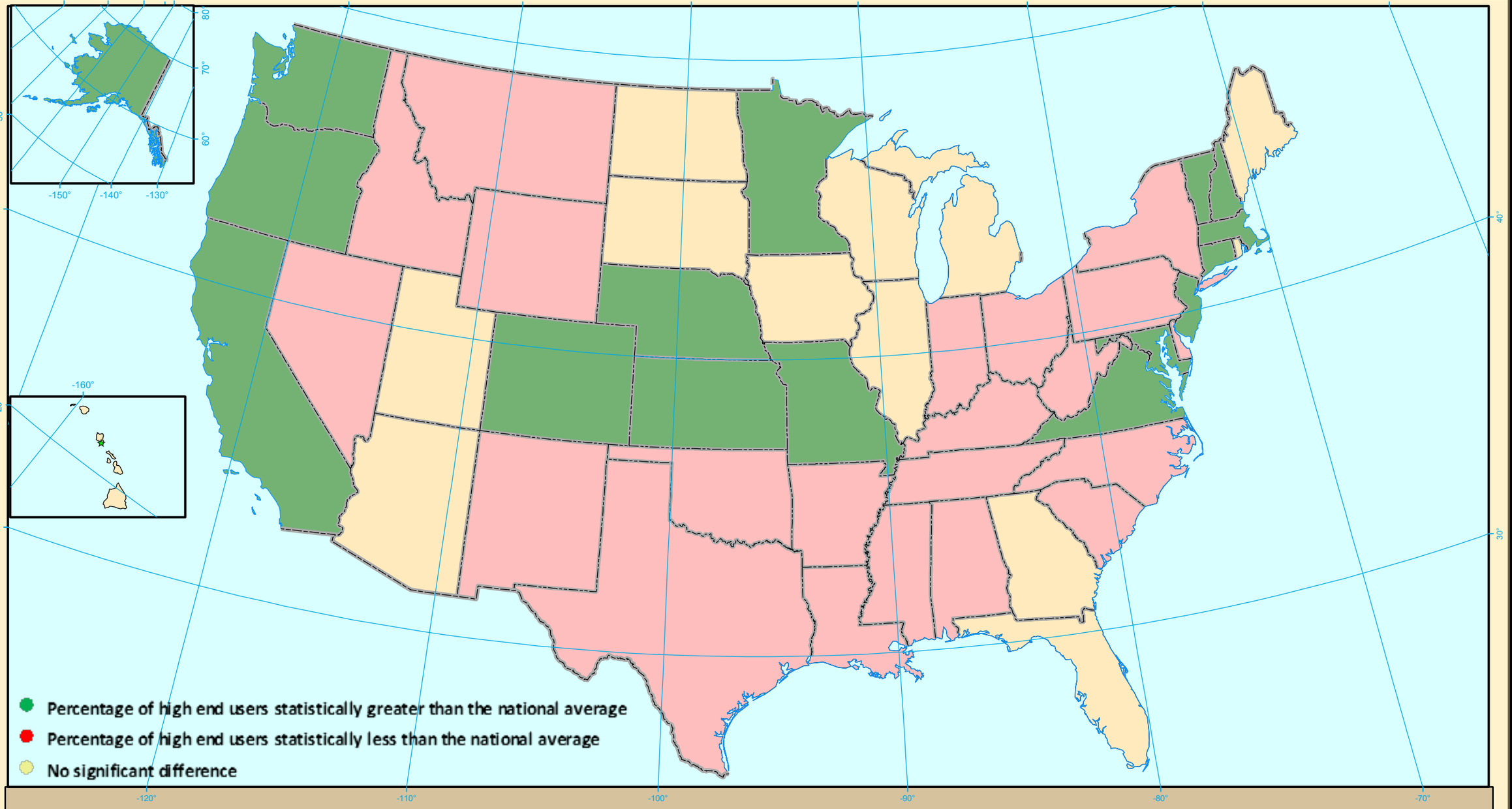
Selected Characteristics	Total	No connection anywhere		No connection at home, but		Connection at home only		Connection at home and	
		No computer	Computer	No computer	Computer	Not from multiple devices	From multiple devices	Not from multiple devices	From multiple devices
Individuals 3 years and older	**293,414**	15.9	14.4	3.0	2.6	13.8	12.9	10.3	27.0
Age									
3-17 years	62,138	13.2	26.6	2.9	2.4	7.0	8.9	13.4	25.7
18-34years	71,210	11.1	6.9	4.5	4.1	10.3	16.7	9.3	37.1
35-44 years	39,478	10.3	8.3	2.8	2.6	13.5	15.6	9.9	36.9
45-64 years	80,947	15.3	12.2	2.4	2.2	18.2	12.7	12.3	24.6
65 years and over	39,641	35.5	19.0	2.2	1.4	22.1	10.4	3.7	5.6
Race and Hispanic Origin									
White alone	233,672	14.9	14.0	2.6	2.5	14.4	13.2	10.5	27.8
White non-Hispanic alone	190,318	12.2	12.8	2.1	2.4	15.4	13.9	11.1	30.1
Black alone	37,117	24.5	15.2	5.7	3.5	10.8	10.7	9.0	20.6
Asian alone	13,891	8.9	17.7	1.2	1.6	13.3	14.3	11.2	31.7
Hispanic (of any race)	47,114	25.9	19.7	4.9	3.0	10.3	10.0	8.1	18.1
Sex of householder									
Male	143,780	15.5	15.1	2.8	2.6	13.0	12.7	9.9	28.4
Female	149,635	16.3	13.7	3.3	2.7	14.6	13.1	10.8	25.6
Household income									
$Less than $25,000	70,352	35.6	14.7	6.3	3.8	12.7	9.1	6.3	11.6
$25,000-$49,999	76,985	19.3	17.0	3.7	3.1	16.3	12.6	9.9	18.1
$50,000-$99,999	89,514	5.9	14.2	1.4	2.2	15.0	15.5	12.9	33.0
$100,000-$149,999	33,157	2.7	10.4	0.8	1.4	11.6	14.0	12.8	46.3
$150,000 and more	23,407	2.8	11.0	0.7	1.3	7.7	13.9	10.9	51.8
Region of household									
Northeast	52,720	13.9	14.6	2.4	2.1	15.3	13.5	10.9	27.3
Midwest	63,575	15.2	13.0	3.0	2.6	14.9	12.2	11.7	27.4
South	108,353	18.4	14.5	3.5	2.9	13.3	12.5	9.4	25.5
West	68,766	14.1	15.2	3.0	2.6	12.6	13.8	10.1	28.6
Total 15 years and older	243,689	16.2	10.9	3.2	2.7	15.2	13.8	9.9	28.1
Employment status									
Employed	140,696	9.9	8.5	2.9	2.9	11.5	11.1	13.5	39.6
Unemployed	14,711	15.1	9.3	6.3	4.8	19.7	25.6	5.1	14.1
Not in labor force	88,282	26.3	14.9	3.1	2.2	20.3	16.1	5.0	12.1
Total 25 years and older	201,475	17.6	11.7	2.8	2.4	16.7	13.7	9.3	25.7
Educational attainment									
Less than high school graduate	24,960	44.9	23.6	3.4	1.8	12.3	8.0	2.2	3.8
High school graduate or GED	61,952	24.7	16.6	3.4	2.4	20.9	14.1	6.7	11.2
Some college or associate degree	53,255	11.2	8.1	3.4	3.3	18.4	16.6	11.1	27.9
Bachelor's degree or higher	61,308	4.8	5.2	1.5	2.0	12.6	13.3	13.3	47.3

Source: U.S. Census Bureau, Current Population Survey, July 2011.
Internet Release date:

Table 3: Logistic Regression Results

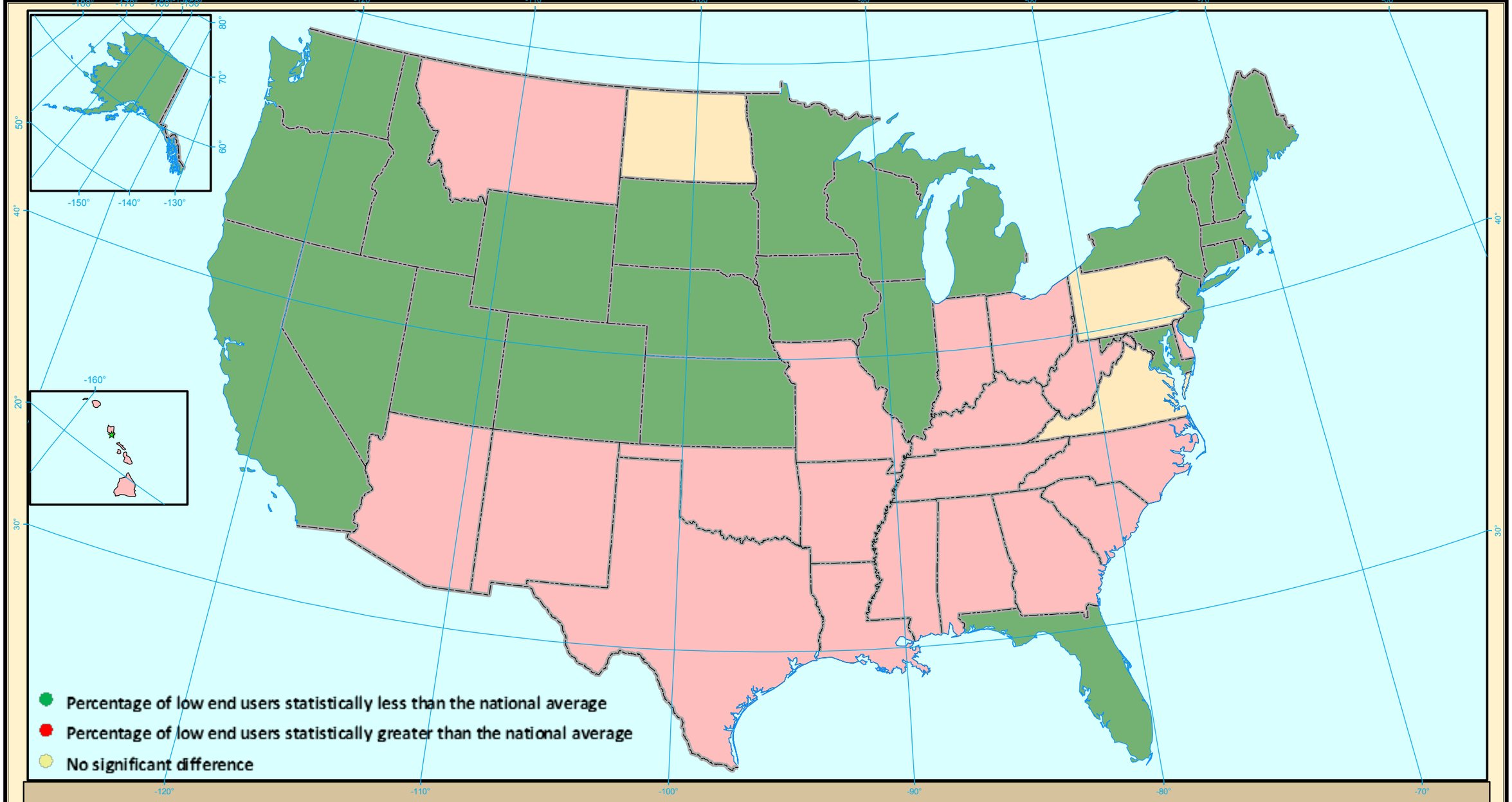
Model A-No Connectivity			
Characteristics	Odds Ratios		Chi-sq
Age			
3 to 17	R		
18 to 34	1.209	***	<.0001
35 to 44	1.07	*	0.079
45 to 64	0.57	***	<.0001
65 and older	0.216	***	<.0001
Race & Hispanic Origin			
White along, non Hispanic	R		
BNH	0.51	***	<.0001
ONH	0.866	**	0.001
HISP	0.367	***	<.0001
Sex			
Male	R		
Female	1.086	***	<.0001
Income			
Less than $25K	R		
25K-$49,999	2.282	***	<.0001
50K-$99,999	7.662	***	<.0001
Over $100k	15.375	***	<.0001
Region			
South	R		
Northeast	1.163	***	<.0001
Midwest	1.05	*	0.071
West	1.305	***	<.0001

Model B-High Connectivity			
Characteristics	Odds Ratios		Chi-sq
Age			
3 to 17	R		
18 to 34	0.522	***	<.0001
35 to 44	0.628	***	<.0001
45 to 64	1.239	***	<.0001
65 and older	5.496	***	<.0001
Race & Hispanic Origin			
White along, non Hispanic	R		
BNH	1.333	***	<.0001
ONH	1.17	***	<.0001
HISP	1.811	***	<.0001
Sex			
Male	R		
Female	1.093	***	<.0001
Income			
Less than $25K	R		
25K-$49,999	0.607	***	<.0001
50K-$99,999	0.292	***	<.0001
Over $100k	0.152	***	<.0001
Region			
South	R		
Northeast	1.11	***	<.0001
Midwest	1.009		0.69
West	0.899	***	<.0001



Map A. 2011 Connectivity Continuum: Percentage of High End Users by State

Source: July 2011 Currently Population Survey.



Map B. 2011 Connectivity Continuum: Percentage of Low End Users by State

Source: July 2011 Currently Population Survey.