

1250 Bellflower Blvd  
Cal State Long Beach  
Long Beach, CA 90840  
November 27, 2006

Amir Dabirian  
Information Technology Department  
Cal State Fullerton  
P.O. Box 34080  
Fullerton, CA 92834

Dear Mr. Dabirian:

On behalf of our research team, I am happy to submit a copy of our empirical report specifically evaluating the wireless systems at California State University, Long Beach (CSULB) and California State University, Fullerton (CSUF) campuses in terms of signal strength and consumer satisfaction

Our research shows that both campuses have similar consistency in regards to system strength, but Fullerton's system is inferior to Long Beach's system. The signal at CSUF was given an average satisfaction rating of 3.4 out of 5. The signal at CSULB received an average score of 3.9 out of 5. The comparison further notes that CSUF wireless system was virtually unusable outside of the designated wireless building. The CSULB wireless system was only ineffective in weaker signal regions.

Our research team believes that CSUF wireless system should be upgraded. Furthermore, We recommend the CSUF do more research in order to determine cost, efficiency, potential partnership with other companies—such as 5 G Wireless—and a proper timetable that will get the system up and running without debilitating coverage.

If you have any questions or concerns, please contact our research team. Thank you for your time.

Sincerely,

John Doe Smith

Encl: Empirical Report

A Study of the Wireless Internet Signal on the  
campuses of CSUF and CSULB

November 30, 2006

To: Amir Dabirian

Student Writers

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## **Executive Summary of the CSUF/CSULB Wireless Internet Study**

The objective of our study is to give Cal State Fullerton's Information Technology Department an assessment of their current wireless system in terms of signal strength and student satisfaction, and by administering the same assessment onto Long Beach's wireless system, determine whether or not Fullerton should restructure theirs to mimic Long Beach's.

We performed tests at each campus with a wireless device to pick up signal strength and surveyed students at both campuses to find out their general satisfaction level regarding their campus' wireless system. The results gave us information as to the efficiency of Fullerton's current system and suggestions as to what can be done to improve upon it.

Our group spent a night at Cal State Fullerton and Cal State Long Beach with a laptop computer, attempting to receive signals from the campus' wireless network. The laptop would pick-up signals and then rate the signal strength on a scale, with one bar being the weakest and four bars being the strongest. We conducted these tests at both campuses in and around 20 buildings at each.

Our surveys asked questions that were aimed to discover students' general satisfaction with their school's wireless system. We also found out where on campus students felt that they could not receive a proper wireless connection.

Based on our tests and surveys we see that Fullerton's wireless system is inferior to Long Beach's. Both campuses' provided similar signal strengths, but Long Beach did so covering a campus twice the size as Fullerton's. Furthermore, surveys showed that many students felt that Fullerton had many locations outdoors where they couldn't maintain a strong signal, while Long Beach's student population found very few areas with connection issues.

Our ultimate recommendation for Fullerton is to implement Long Beach's wireless system's structure. We recommend that you do further research to determine whether or not this is economically feasible. We recommend researching the cost to upgrade these systems and alternative routes to take to gain funding to make this happen.

## **Introduction**

Over the summer Cal State Long Beach, in a partnership with Aruba Wireless Networks and 5 G Wireless Solutions, installed more wireless access points at various locations on campus to ensure better connectivity for laptop computers. The Network Services Department at Long Beach, who are responsible for the set up and maintenance of the wireless Internet system used, are proud of their new standard and are urging other campuses in the Cal State system to adopt it. Among the campuses that may or may not increase their coverage is Cal State Fullerton. While any improvement to a campus should be welcomed, a complete restructuring of a campus' wireless system and the addition of various wireless access points is a costly and time-consuming endeavor. This report will determine whether or not Cal State Fullerton's wireless system is strong enough to satisfy their student body, and if not, if Long Beach's system is a large enough improvement to warrant a change.

The goal of our report is to determine and evaluate the current state of the wireless systems at both campuses. With all the money that Long Beach has put into upgrading their system, there should be startling differences between their campus and others that have yet to make the change. We intend to bring to light the differences between the two wireless systems in terms of performance and satisfaction. Whether or not the improvements are actually worth the time and trouble for Fullerton to decide to upgrade we will not discuss. Our goal is to highlight the effects that come with having a superior or a standard wireless system installed on campus.

This report will specifically evaluate the wireless systems at both campuses in terms of signal strength and consumer satisfaction. We determined overall wireless efficiency by taking a wireless device to the major buildings of each campus to see how strong of a signal we could obtain. We also surveyed students at both campuses to see if there was a great disparity of satisfaction between the two. Based on our findings, we will conclude by recommending whether or not upgrading to CSULB's wireless system will significantly improve campus life at Fullerton.

## **Methods for Evaluating Wireless Systems at Each Campus**

Our group conducted field surveys and on-campus tests to determine where each campus stood in terms of wireless system quality. We surveyed 100 students – 50 from each campus – to see whether or not they were pleased with their wireless connection. We also brought a laptop computer with a wi-fi receiver to test the wireless signal strength in prevalent buildings on each campus.

### **Testing Major Buildings for Wireless Access**

On Wednesday night, November 15<sup>th</sup>, between 6PM and 8PM, we visited major buildings on the Cal State Fullerton campus and tested wireless signal strength. We did this by taking a laptop computer and documenting how many “bars” the computer was able to pick up, with zero bars representing no signal strength and four bars representing the most. The computer used was a 15” Macbook, though we do not believe that different laptops pick up different strengths; the results our computer displays should be an accurate representation for any laptop computer used on campus. We conducted our tests in the first-floor lobby of 18 different buildings on the Fullerton campus.

Our methods were very similar for testing signal strength at the Long Beach campus. These tests were conducted throughout the week ending on Sunday, November 19<sup>th</sup>. Most of the tests were performed on Tuesday and Thursday morning, either between 10am-noon or 1:45pm-3:30pm. In total, 24 buildings were tested, all on the first floor.

The signal-strength tests at the Fullerton campus were done at night, where there are far less students taking advantage of the wireless systems than during the day. On the other hand, all of the CSULB tests were done during the late morning to early afternoon, where the increased number of students using the Internet may lead to weaker signals all-around.

### **Surveying Students to Determine Campus Satisfaction with Wireless Systems**

Our surveys were written and were separately given to students at Cal State Long Beach as well as Cal State Fullerton. We first asked whether or not the student used the wireless system at their campus. We felt that it was important to find out whether or not enough students use the wireless systems to warrant the demands that come with restructuring them. The students that did use their campus’ wireless system were then asked to rate their overall satisfaction with it using a scale of 1-5, 1 being completely unsatisfied and 5 being completely satisfied. We then presented open-ended questions such as “Where are some places, if any, on campus that you experience connection issues?” and “How often do you have trouble getting a connection?”

We found most of the students to survey at each campus’ respective Student Hall. At Fullerton we surveyed the most students at the Titan Student Union and at Long Beach we surveyed the most at the University Student Union. Surveys were done on the CSUF campus on Monday, November 6 between the hours of 10am – 12:30pm, while surveys on the CSULB campus were done on Tuesday, November 7 between the hours of 2pm – 6pm.

## **Findings of the Signal Strength Tests and Student Surveys**

This section gives the results of the surveys that were administered and the tests that we conducted regarding the wireless networks at both campuses. We begin by presenting the results of our surveys, followed by the results of our signal strength tests.

### **Comparing Survey Results Between the Long Beach and Fullerton Campuses**

The surveys show that 88% of the total students surveyed use the wireless Internet signal on their campus. This can be further broken down into 86% at CSUF, and 90% at CSULB. Of the students who reported their majors, numerous different ones were listed. This data shows that there is a clear need to offer the highest quality signal possible to the students, because so many of them make use of it on a regular basis.

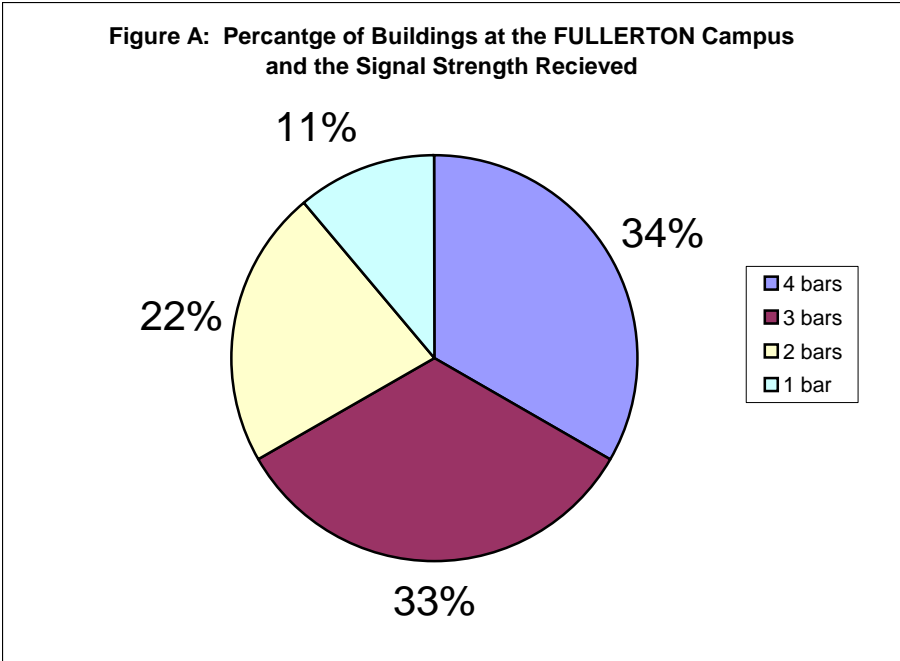
The signal at CSUF was given an average satisfaction rating of 3.4 (out of 5). The signal at CSULB received an average score of 3.9. The most commonly requested improvement for both campuses was for an increase in speed. This may be a difficult improvement to make, simply due to the sheer amount of users online at one time. However, CSUF students also frequently requested better reception inside classrooms. In addition, students replied that they would use the wireless signal on campus more frequently if they were able to connect inside their classrooms. CSULB students did not report problems inside classrooms. The higher satisfaction rating is in part due to the fact that the signal coverage reaches more spots that students tend to use their laptops.

### **Comparing Signal Strength Results Between the Long Beach and Fullerton Campuses**

While our signal-testing was limited to the indoors, many people who took the survey at Fullerton gave evaluations of signal strength outside. At Fullerton, many students said that it was difficult to find a connection outside of the major buildings where wireless support was given. Fullerton's Wireless Networking department only guarantees wireless service in the following outdoor spots:

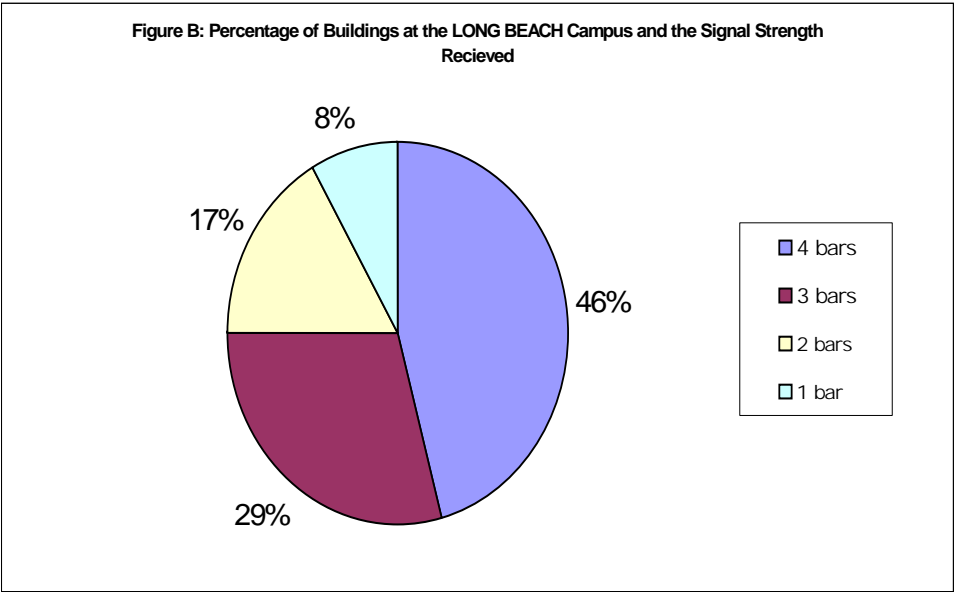
- The Quad
- The area between the Humanities Building and the Education Classroom
- The area between Pollack Library and the Education classroom
- The area between Langsdorf Hall and University Hall

There should be no other places outdoors where a student can receive a wireless signal, and according to our survey, the places listed above are still susceptible to problems. In these areas, some students reported connection issues as much as 75% of the time. One student added, "If you aren't inside a lounge, it's nearly impossible."



In our tests, Fullerton’s campus delivers satisfactory wireless service. Over half of the buildings tested returned with a strong signal or 3 or 4 bars. The weakest signals came from the East side of campus at the Student Health & Counseling Center, the Engineering & Computer Science Center, McCarthy Hall and the Carl’s Jr. The strongest signals were close to the Titan Student Union, near the West side of the campus. The northern half of campus has no wireless service, because it’s mostly parking lots and the athletic field, although the dorms on the north-east side of campus was said to have good wireless service.





Long Beach’s wireless service is slightly better than Fullerton’s, with higher percentages at the upper-end of the performance scale. Only a quarter of the buildings experienced poor (1-2 bars) service, as opposed to a third at Fullerton’s.

## Discussion of Results

There are many different variables one must take into account when discussing the before-mentioned findings:

We kept in mind that it was more difficult to receive a strong signal during peak hours than at night and expected numbers for CSULB to be weaker than Fullerton's. However, this was not the case. Both campuses' wireless systems performed comparably even though the systems at CSULB were tested during peak hours and Fullerton's was tested while their wireless system was not seeing heavy traffic.

It also should be noted that Long Beach is able to maintain a competitive wireless system despite having to offer support to a markedly larger campus. At 323 acres, the Long Beach campus is the second largest in the Cal State System, while the Fullerton campus is only 236 acres. That Long Beach's wireless system is strong enough to cover that much area is commendable.

The signal-strength tests were all conducted on the first floor where the wireless signals are strongest. It should also be noted that many students at Fullerton said that they had trouble picking up signals in upper floors. While both campuses have found it difficult to ensure perfect wireless connectivity in upper floors, Fullerton's wireless signals appear to be spottier. According to Fullerton's own Wireless Networking department, there are a few places where wireless service is not guaranteed, such as:

- In College Park, where there is only coverage on the Southside of the first floor, no coverage on the 2<sup>nd</sup> and 5<sup>th</sup> floors and coverage only in the study halls of the 4<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> floors.
- In Langsdorf Hall, where there is no coverage from floors 4 to 8.
- In McCarthy Hall, where only "most floors" have coverage.

At the Fullerton campus, there are only five buildings that are claimed to have complete coverage: the Titan Student Union, the Bookstore, Pollack Library, the Education Classroom and the Kinesiology Building. Even then, surveys showed that students at Fullerton still encountered problems in the before-mentioned locations.

With over 300 wireless network points, it's much harder to find a building in CSULB that doesn't have wireless support. While students at Long Beach - like the ones at Fullerton - have complained about getting connections in a few places, according to the floor plans on CSULB's Administration and Finance's web page, every building on campus should have at least one floor with wireless network access, with many buildings offering complete coverage on all floors.

## **Conclusion**

Our research has led to the conclusion that:

- Both campuses' student bodies use the wireless system extensively.
- Both campuses have similar consistency in regards to system strength, but Fullerton's system is inferior due to the fact that:
  - There is no wireless access inside Fullerton classrooms
  - Access is limited to indoor lounges/lobbies and in a small number of outdoor environments
  - Wireless access to many upper-floors are not supported
  - Cal State Long Beach is almost twice the size of Fullerton which makes it twice as hard to produce the consistent campus-wide coverage that it has managed to create
- Students at Fullerton are less satisfied by their wireless system and would like a system that can cover more ground. If campus coverage were extended to the outdoors, more students at Fullerton would be apt to use the wireless network.

## **Recommendations**

Clearly, upgrading to Long Beach's wireless system will dramatically expand coverage throughout the campus and better service Fullerton's student body. Now, you must:

1. Research the cost of upgrading your wireless system and determine whether or not the improvement documented above will justify the price tag.
2. See if you can pass the cost of upgrading to your student population through a small "Technology Fee" at the beginning of the year. This may or may not be popular, but judging by how many of the students do take advantage of the wireless system, it is not totally unjustified.
3. You can also look into developing a partnership with a wireless company that will provide its services pro-bono in exchange for recognition (such as 5 G Wireless).
4. Determine a proper timetable that will get the system up and running without debilitating coverage for your students while the upgrade is taking place. CSLUB did this by scheduling their installations to be done over the summertime.

## References

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