ECE 3992

April 11, 2012

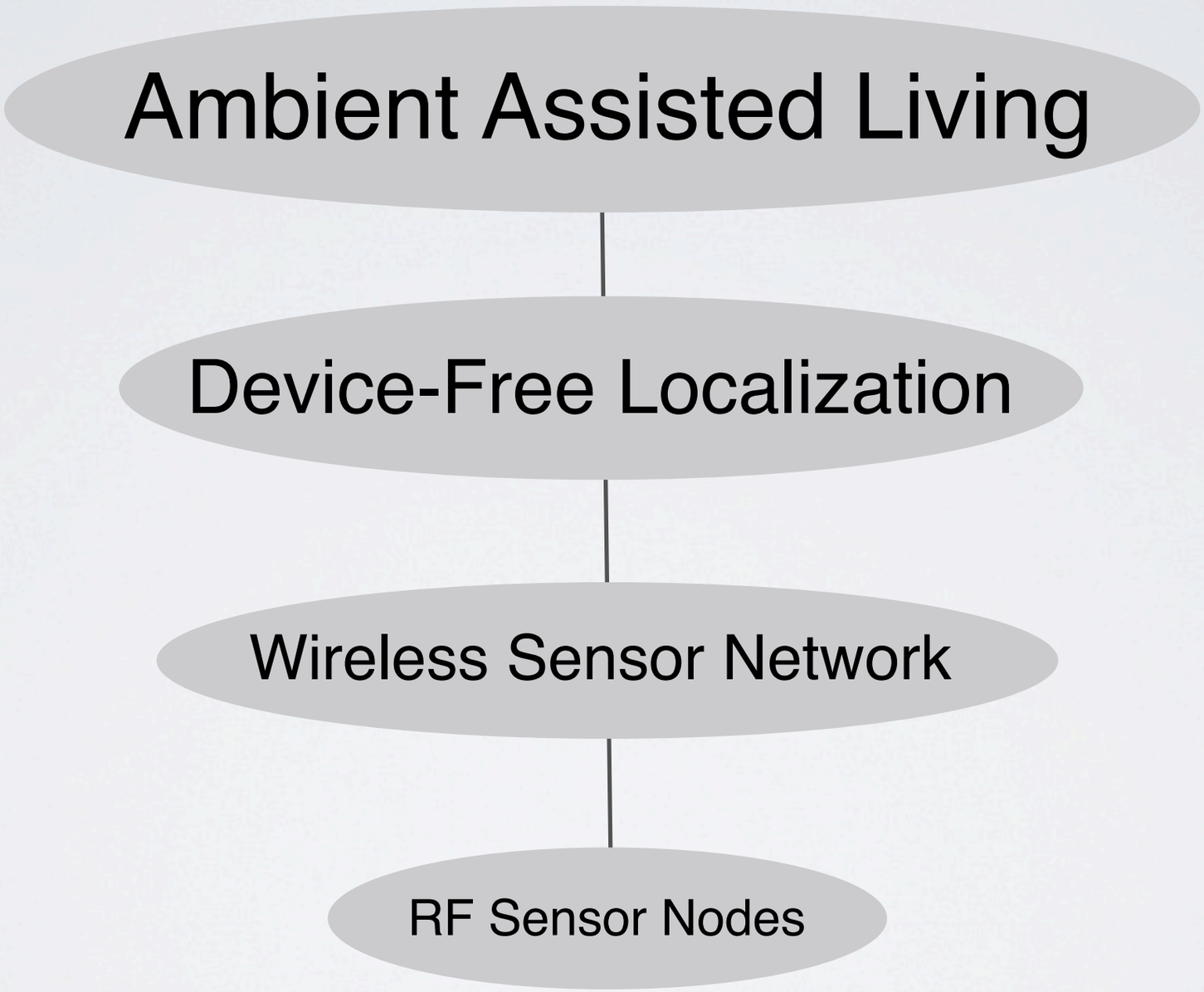
Using Wireless Sensor Networks

to Detect Falling

Brad Mager
Senior Thesis

Advisor: Neal Patwari

The Big Picture



THE COMPONENTS

Node deployment

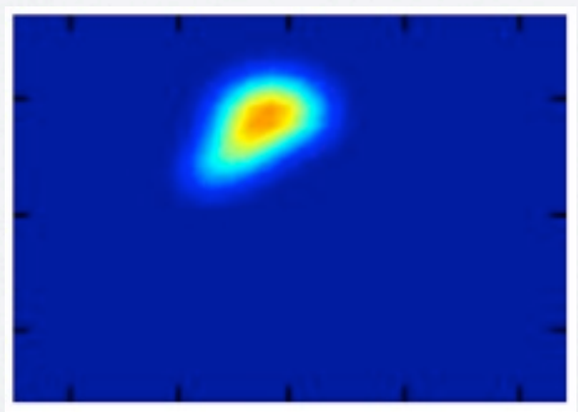
Base station node

Database server

C program on nodes

Python on GuruPlug
& database server

Matlab



Implementation Strategy

Deploy nodes

Run experiments

Collect data

Determine algorithm

Write paper

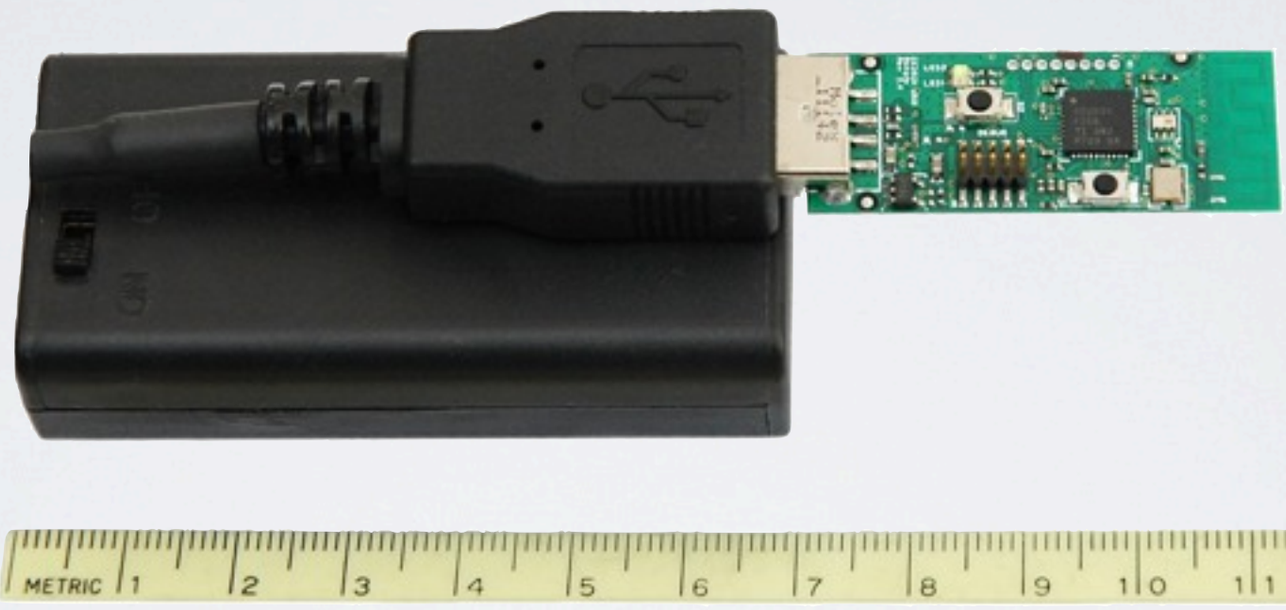
Bill of Materials

30–40 TI CC2531 nodes @$18	$540–$720
30–40 Battery packs @$5	$150–$200
TI CC Debugger	$57
GuruPlug	$99
Total:	$846–$1076

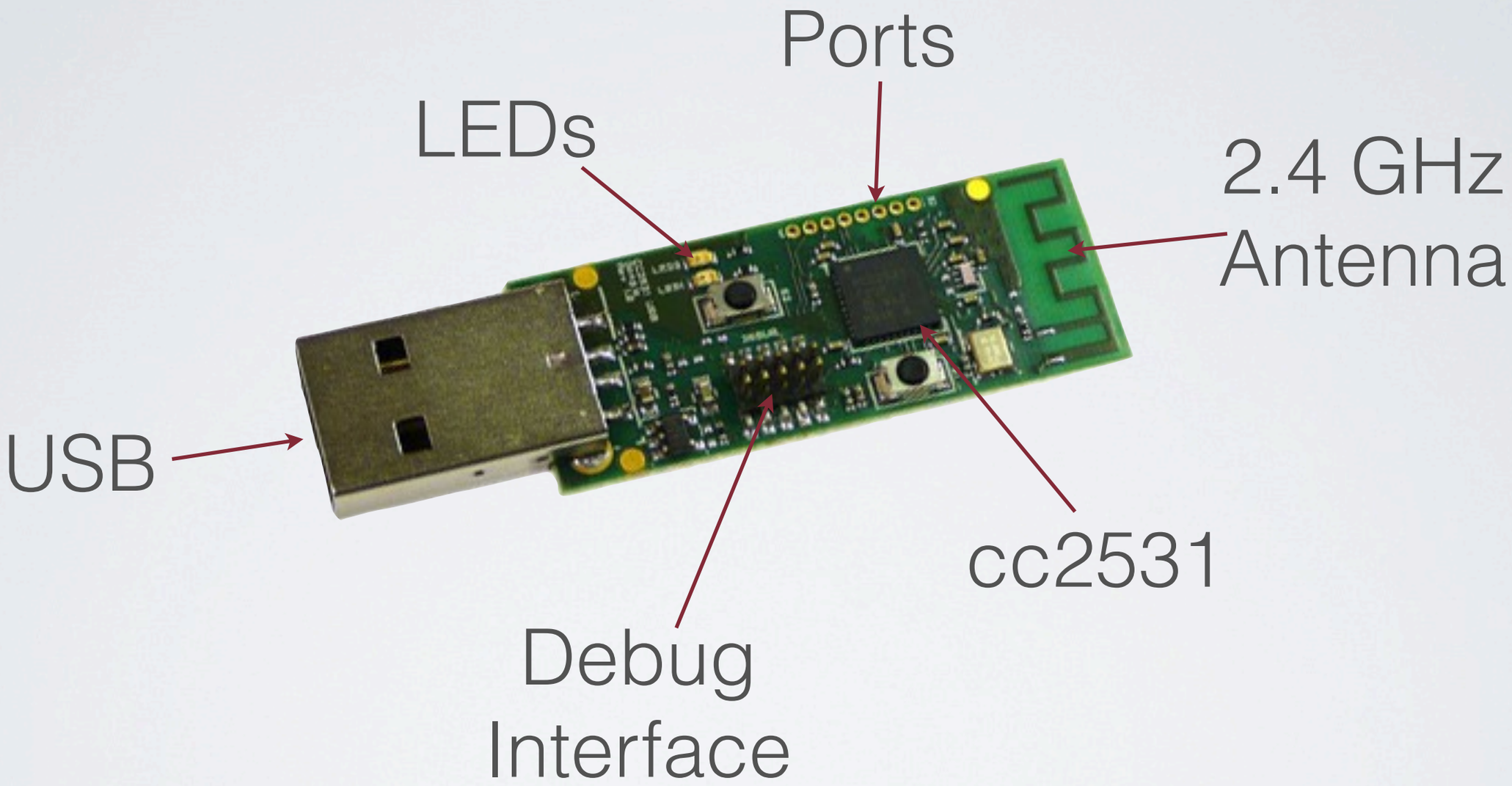
SCHEDULE

May 2012	Get the system ready
June 2012	Programming environment
July–Dec 2012	Perform tests,
	Develop algorithms
Jan 2013	Validate the system
Feb–March 2013	Write up the results

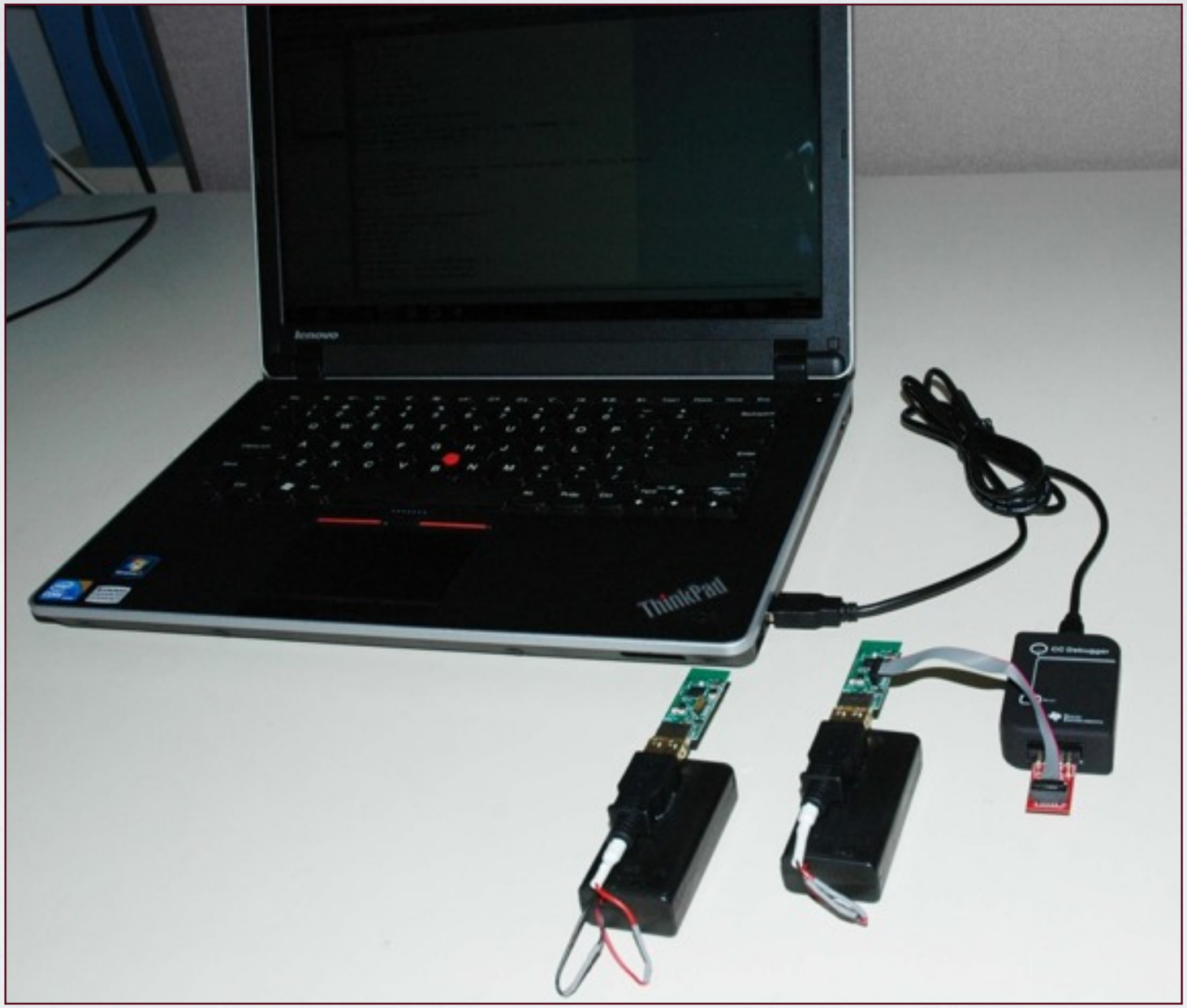
The Nodes



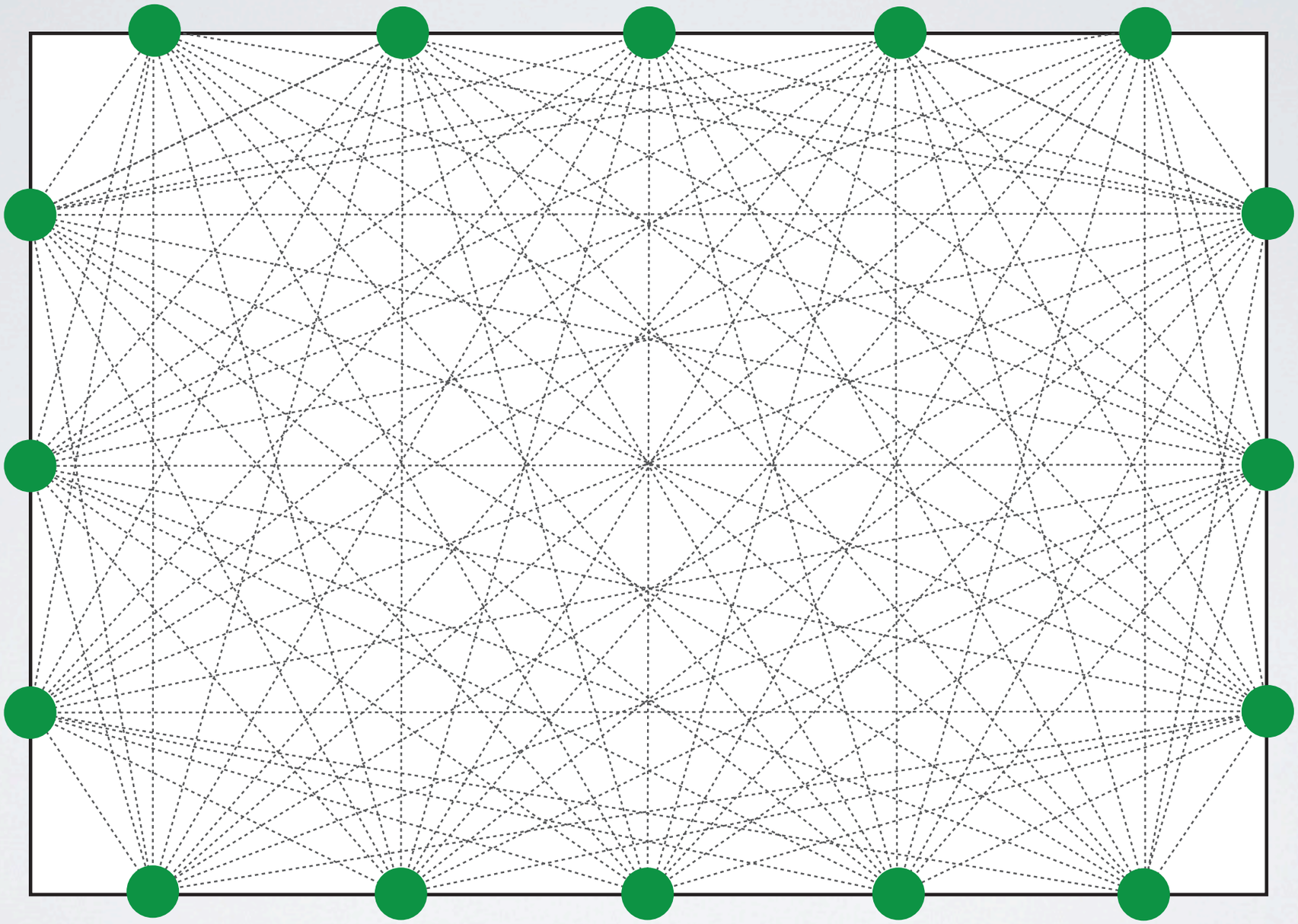
The Nodes



Programming the Nodes



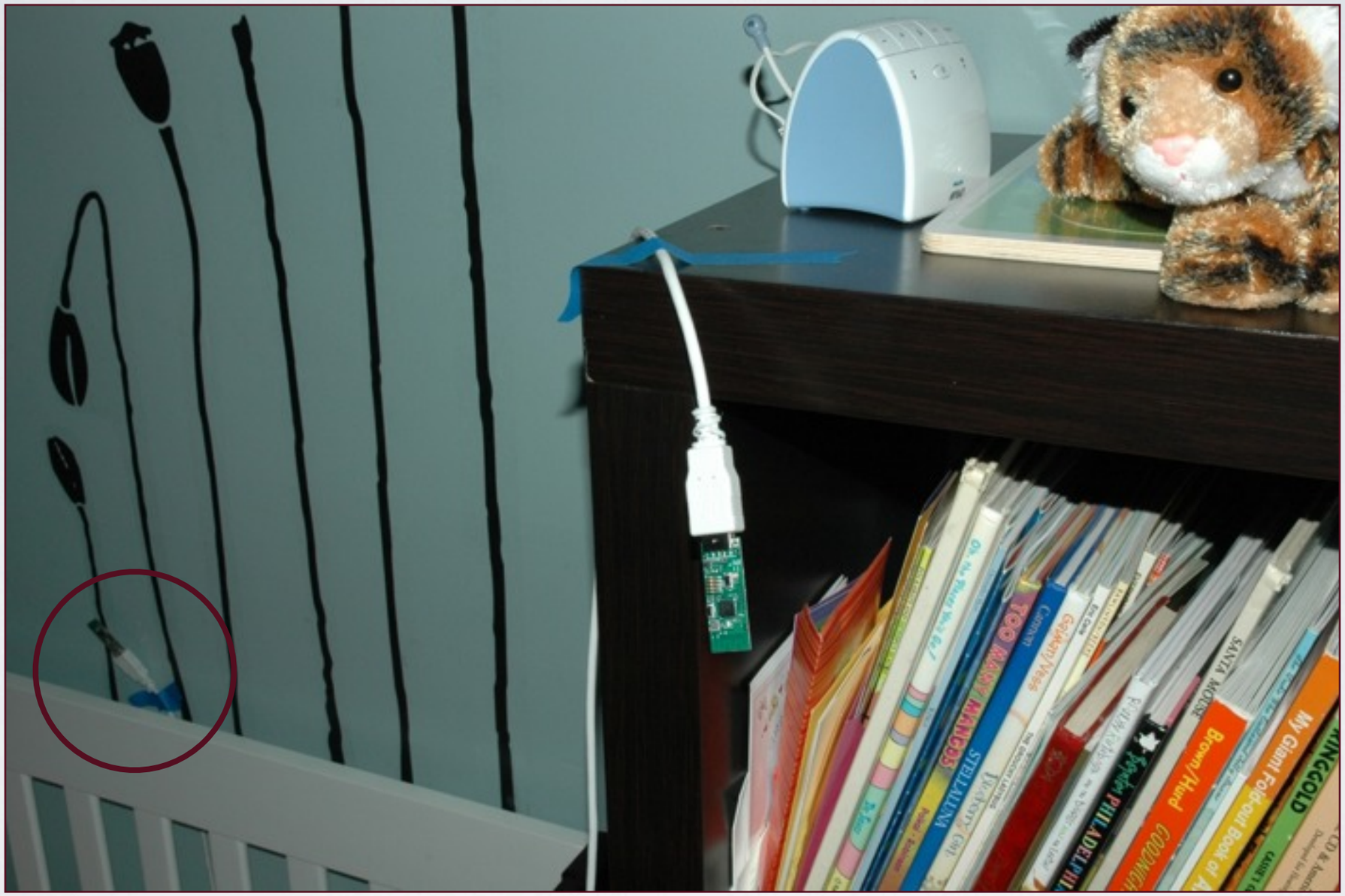
Device-Free Localization



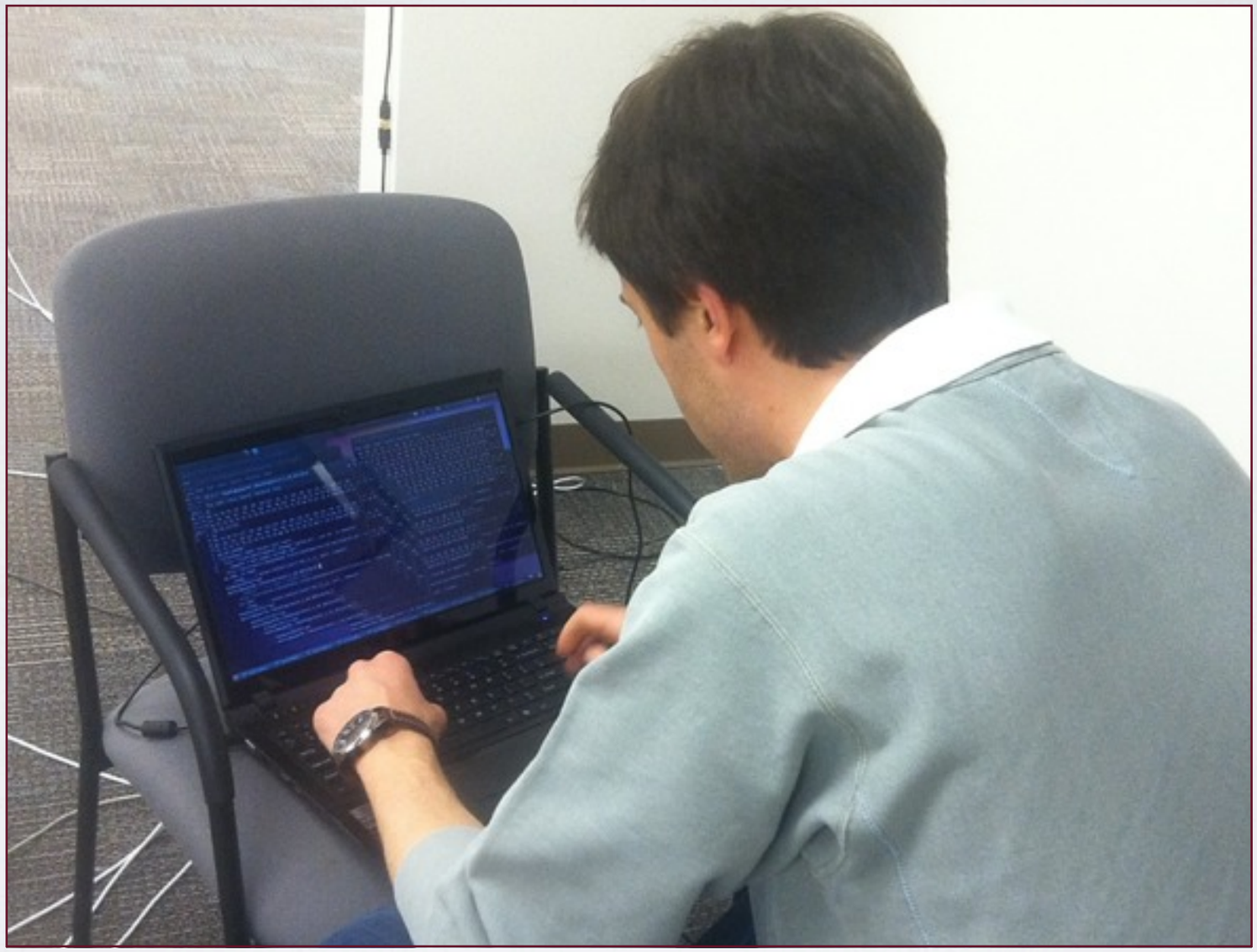
EXPERIMENTS

Experiments

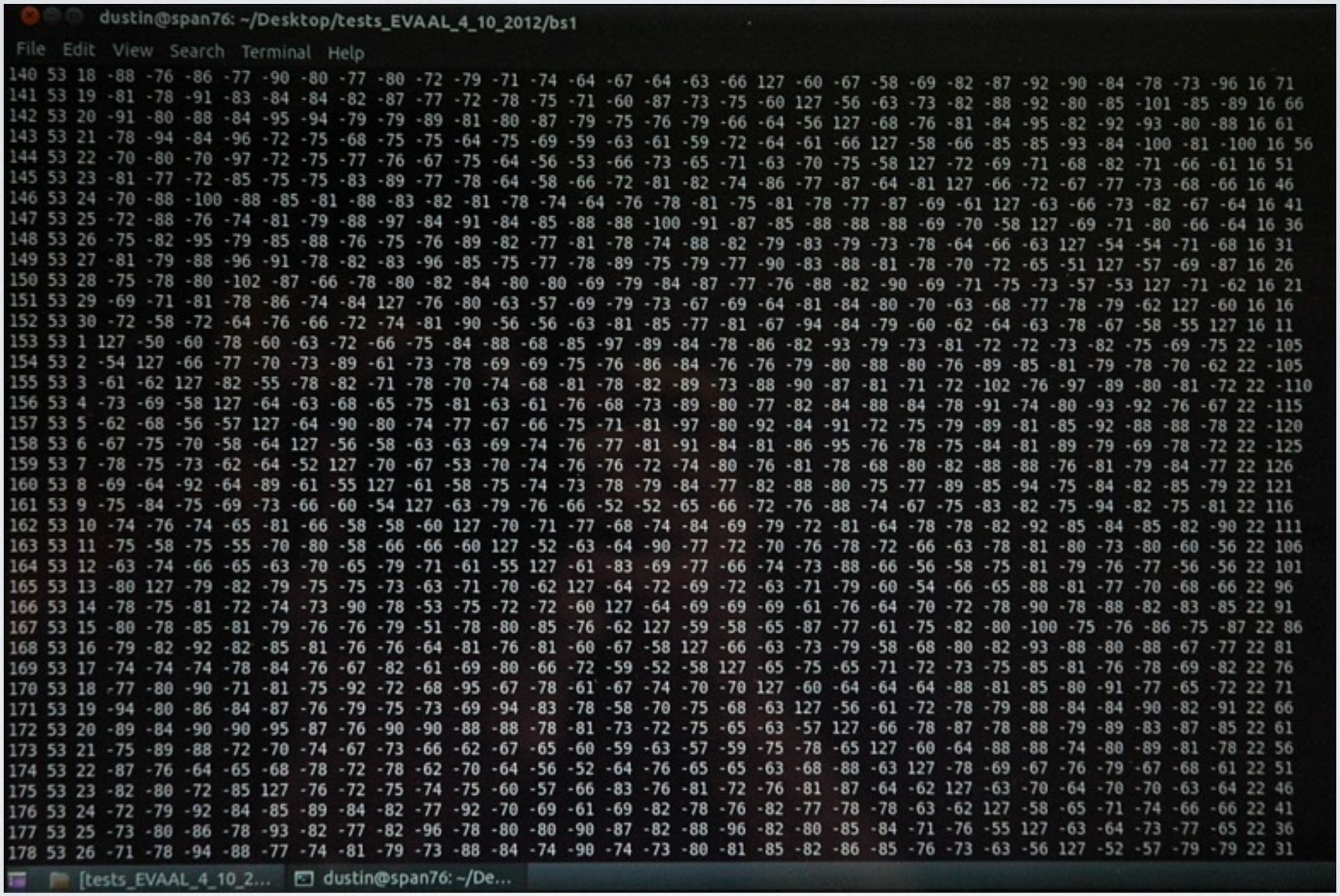
EXPERIMENTS



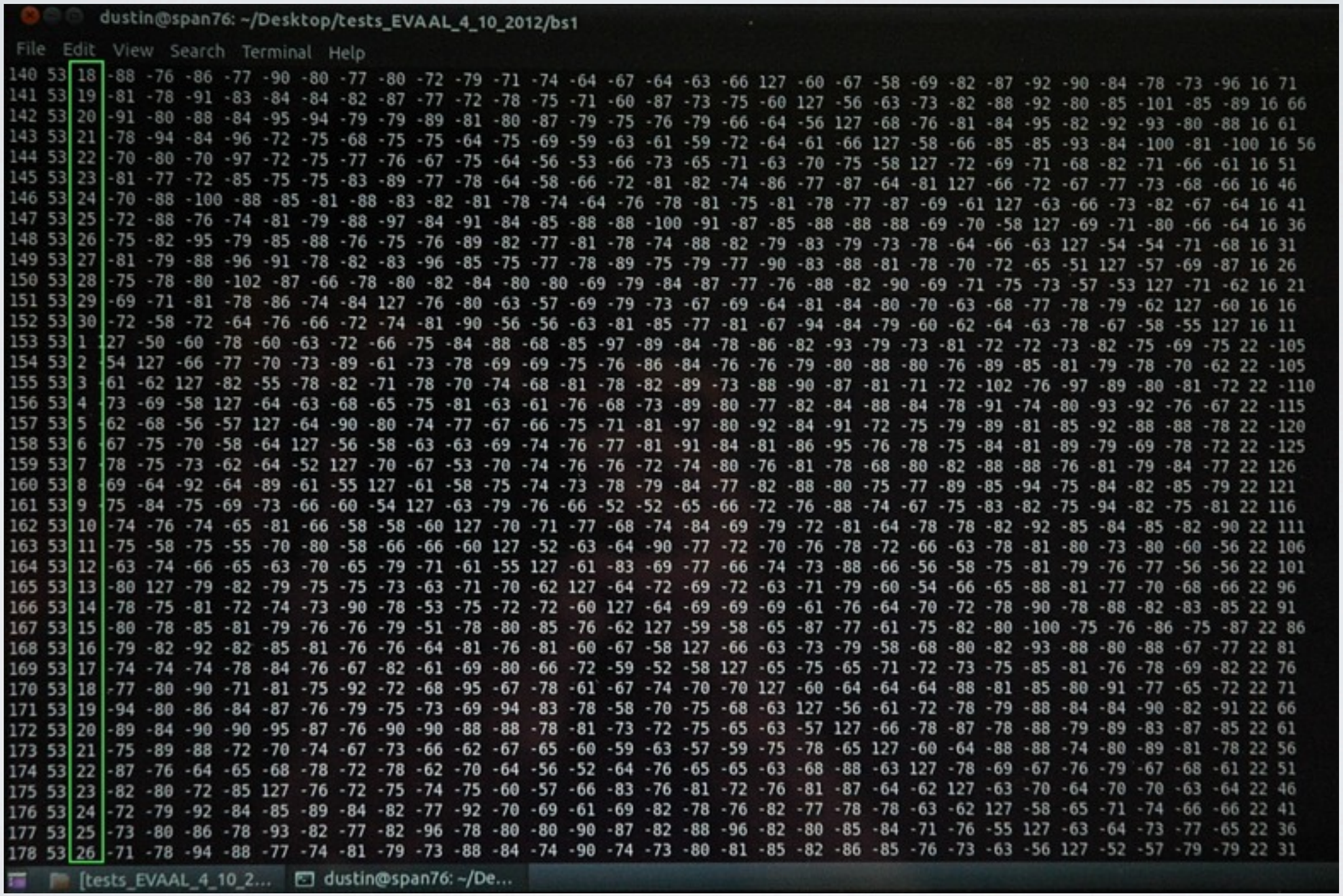
Collecting Data



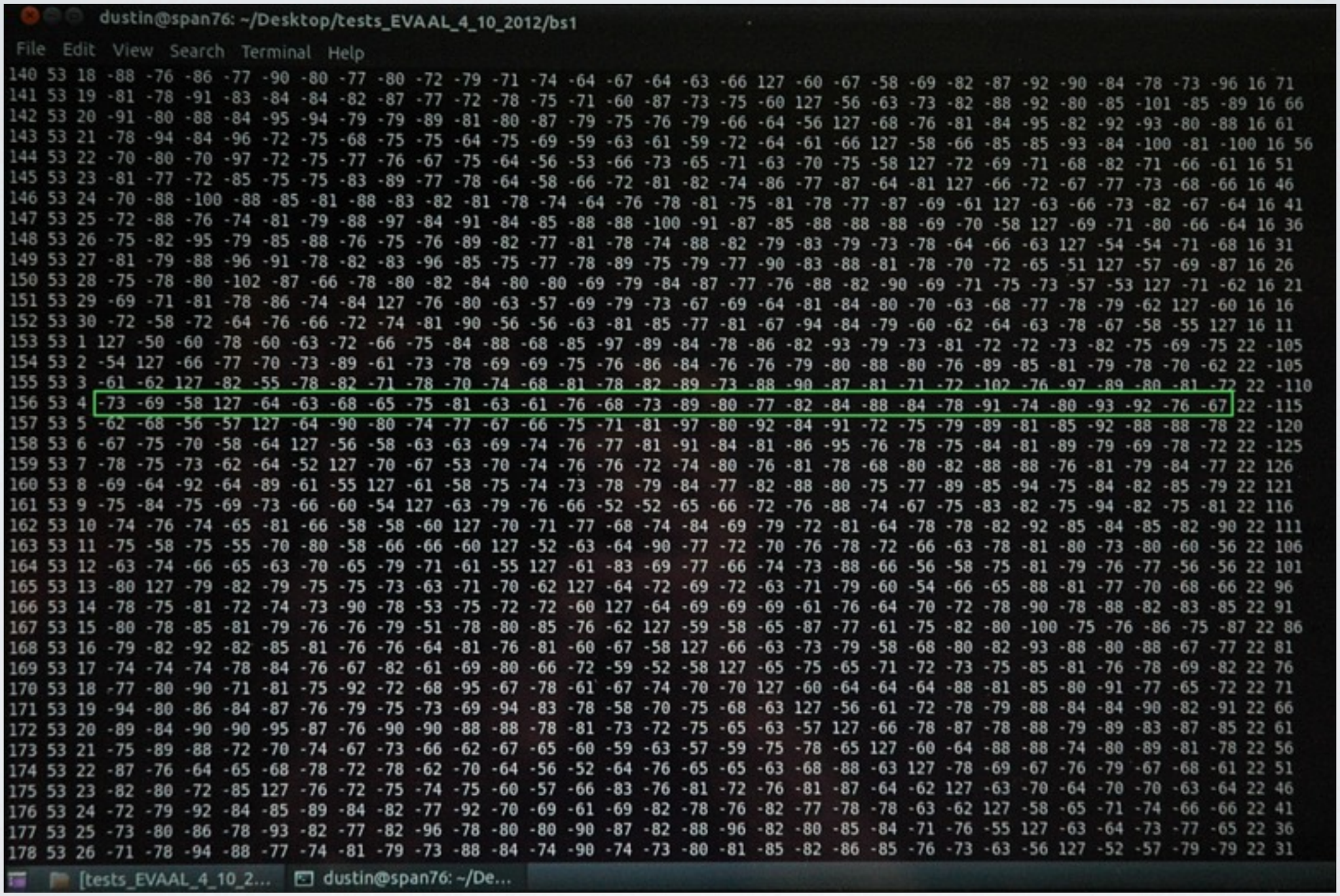
The Data


dustin@span76: ~/Desktop/tests_EVAAL_4_10_2012/bs1
File Edit View Search Terminal Help
140 53 18 -88 -76 -86 -77 -90 -80 -77 -80 -72 -79 -71 -74 -64 -67 -64 -63 -66 127 -60 -67 -58 -69 -82 -87 -92 -90 -84 -78 -73 -96 16 71
141 53 19 -81 -78 -91 -83 -84 -84 -82 -87 -77 -72 -78 -75 -71 -60 -87 -73 -75 -60 127 -56 -63 -73 -82 -88 -92 -80 -85 -101 -85 -89 16 66
142 53 20 -91 -80 -88 -84 -95 -94 -79 -79 -89 -81 -80 -87 -79 -75 -76 -79 -66 -64 -56 127 -68 -76 -81 -84 -95 -82 -92 -93 -80 -88 16 61
143 53 21 -78 -94 -84 -96 -72 -75 -68 -75 -75 -64 -75 -69 -59 -63 -61 -59 -72 -64 -61 -66 127 -58 -66 -85 -85 -93 -84 -100 -81 -100 16 56
144 53 22 -70 -80 -70 -97 -72 -75 -77 -76 -67 -75 -64 -56 -53 -66 -73 -65 -71 -63 -70 -75 -58 127 -72 -69 -71 -68 -82 -71 -66 -61 16 51
145 53 23 -81 -77 -72 -85 -75 -75 -83 -89 -77 -78 -64 -58 -66 -72 -81 -82 -74 -86 -77 -87 -64 -81 127 -66 -72 -67 -77 -73 -68 -66 16 46
146 53 24 -70 -88 -100 -88 -85 -81 -88 -83 -82 -81 -78 -74 -64 -76 -78 -81 -75 -81 -78 -77 -87 -69 -61 127 -63 -66 -73 -82 -67 -64 16 41
147 53 25 -72 -88 -76 -74 -81 -79 -88 -97 -84 -91 -84 -85 -88 -88 -100 -91 -87 -85 -88 -88 -88 -69 -70 -58 127 -69 -71 -80 -66 -64 16 36
148 53 26 -75 -82 -95 -79 -85 -88 -76 -75 -76 -89 -82 -77 -81 -78 -74 -88 -82 -79 -83 -79 -73 -78 -64 -66 -63 127 -54 -54 -71 -68 16 31
149 53 27 -81 -79 -88 -96 -91 -78 -82 -83 -96 -85 -75 -77 -78 -89 -75 -79 -77 -90 -83 -88 -81 -78 -70 -72 -65 -51 127 -57 -69 -87 16 26
150 53 28 -75 -78 -80 -102 -87 -66 -78 -80 -82 -84 -80 -80 -69 -79 -84 -87 -77 -76 -88 -82 -90 -69 -71 -75 -73 -57 -53 127 -71 -62 16 21
151 53 29 -69 -71 -81 -78 -86 -74 -84 127 -76 -80 -63 -57 -69 -79 -73 -67 -69 -64 -81 -84 -80 -70 -63 -68 -77 -78 -79 -62 127 -60 16 16
152 53 30 -72 -58 -72 -64 -76 -66 -72 -74 -81 -90 -56 -56 -63 -81 -85 -77 -81 -67 -94 -84 -79 -60 -62 -64 -63 -78 -67 -58 -55 127 16 11
153 53 1 127 -50 -60 -78 -60 -63 -72 -66 -75 -84 -88 -68 -85 -97 -89 -84 -78 -86 -82 -93 -79 -73 -81 -72 -72 -73 -82 -75 -69 -75 22 -105
154 53 2 -54 127 -66 -77 -70 -73 -89 -61 -73 -78 -69 -69 -75 -76 -86 -84 -76 -76 -79 -80 -88 -80 -76 -89 -85 -81 -79 -78 -70 -62 22 -105
155 53 3 -61 -62 127 -82 -55 -78 -82 -71 -78 -70 -74 -68 -81 -78 -82 -89 -73 -88 -90 -87 -81 -71 -72 -102 -76 -97 -89 -80 -81 -72 22 -110
156 53 4 -73 -69 -58 127 -64 -63 -68 -65 -75 -81 -63 -61 -76 -68 -73 -89 -80 -77 -82 -84 -88 -84 -78 -91 -74 -80 -93 -92 -76 -67 22 -115
157 53 5 -62 -68 -56 -57 127 -64 -90 -80 -74 -77 -67 -66 -75 -71 -81 -97 -80 -92 -84 -91 -72 -75 -79 -89 -81 -85 -92 -88 -88 -78 22 -120
158 53 6 -67 -75 -70 -58 -64 127 -56 -58 -63 -63 -69 -74 -76 -77 -81 -91 -84 -81 -86 -95 -76 -78 -75 -84 -81 -89 -79 -69 -78 -72 22 -125
159 53 7 -78 -75 -73 -62 -64 -52 127 -70 -67 -53 -70 -74 -76 -76 -72 -74 -80 -76 -81 -78 -68 -80 -82 -88 -88 -76 -81 -79 -84 -77 22 126
160 53 8 -69 -64 -92 -64 -89 -61 -55 127 -61 -58 -75 -74 -73 -78 -79 -84 -77 -82 -88 -80 -75 -77 -89 -85 -94 -75 -84 -82 -85 -79 22 121
161 53 9 -75 -84 -75 -69 -73 -66 -60 -54 127 -63 -79 -76 -66 -52 -52 -65 -66 -72 -76 -88 -74 -67 -75 -83 -82 -75 -94 -82 -75 -81 22 116
162 53 10 -74 -76 -74 -65 -81 -66 -58 -58 -60 127 -70 -71 -77 -68 -74 -84 -69 -79 -72 -81 -64 -78 -78 -82 -92 -85 -84 -85 -82 -90 22 111
163 53 11 -75 -58 -75 -55 -70 -80 -58 -66 -66 -60 127 -52 -63 -64 -90 -77 -72 -70 -76 -78 -72 -66 -63 -78 -81 -80 -73 -80 -60 -56 22 106
164 53 12 -63 -74 -66 -65 -63 -70 -65 -79 -71 -61 -55 127 -61 -83 -69 -77 -66 -74 -73 -88 -66 -56 -58 -75 -81 -79 -76 -77 -56 -56 22 101
165 53 13 -80 127 -79 -82 -79 -75 -75 -73 -63 -71 -70 -62 127 -64 -72 -69 -72 -63 -71 -79 -60 -54 -66 -65 -88 -81 -77 -70 -68 -66 22 96
166 53 14 -78 -75 -81 -72 -74 -73 -90 -78 -53 -75 -72 -72 -60 127 -64 -69 -69 -69 -61 -76 -64 -70 -72 -78 -90 -78 -88 -82 -83 -85 22 91
167 53 15 -80 -78 -85 -81 -79 -76 -76 -79 -51 -78 -80 -85 -76 -62 127 -59 -58 -65 -87 -77 -61 -75 -82 -80 -100 -75 -76 -86 -75 -87 22 86
168 53 16 -79 -82 -92 -82 -85 -81 -76 -76 -64 -81 -76 -81 -60 -67 -58 127 -66 -63 -73 -79 -58 -68 -80 -82 -93 -88 -80 -88 -67 -77 22 81
169 53 17 -74 -74 -74 -78 -84 -76 -67 -82 -61 -69 -80 -66 -72 -59 -52 -58 127 -65 -75 -65 -71 -72 -73 -75 -85 -81 -76 -78 -69 -82 22 76
170 53 18 -77 -80 -90 -71 -81 -75 -92 -72 -68 -95 -67 -78 -61 -67 -74 -70 -70 127 -60 -64 -64 -64 -88 -81 -85 -80 -91 -77 -65 -72 22 71
171 53 19 -94 -80 -86 -84 -87 -76 -79 -75 -73 -69 -94 -83 -78 -58 -70 -75 -68 -63 127 -56 -61 -72 -78 -79 -88 -84 -84 -90 -82 -91 22 66
172 53 20 -89 -84 -90 -90 -95 -87 -76 -90 -90 -88 -88 -78 -81 -73 -72 -75 -65 -63 -57 127 -66 -78 -87 -78 -88 -79 -89 -83 -87 -85 22 61
173 53 21 -75 -89 -88 -72 -70 -74 -67 -73 -66 -62 -67 -65 -60 -59 -63 -57 -59 -75 -78 -65 127 -60 -64 -88 -88 -74 -80 -89 -81 -78 22 56
174 53 22 -87 -76 -64 -65 -68 -78 -72 -78 -62 -70 -64 -56 -52 -64 -76 -65 -65 -63 -68 -88 -63 127 -78 -69 -67 -76 -79 -67 -68 -61 22 51
175 53 23 -82 -80 -72 -85 127 -76 -72 -75 -74 -75 -60 -57 -66 -83 -76 -81 -72 -76 -81 -87 -64 -62 127 -63 -70 -64 -70 -70 -63 -64 22 46
176 53 24 -72 -79 -92 -84 -85 -89 -84 -82 -77 -92 -70 -69 -61 -69 -82 -78 -76 -82 -77 -78 -78 -63 -62 127 -58 -65 -71 -74 -66 -66 22 41
177 53 25 -73 -80 -86 -78 -93 -82 -77 -82 -96 -78 -80 -80 -90 -87 -82 -88 -96 -82 -80 -85 -84 -71 -76 -55 127 -63 -64 -73 -77 -65 22 36
178 53 26 -71 -78 -94 -88 -77 -74 -81 -79 -73 -88 -84 -74 -90 -74 -73 -80 -81 -85 -82 -86 -85 -76 -73 -63 -56 127 -52 -57 -79 -79 22 31
[tests_EVAAL_4_10_2...
dustin@span76: ~/De...

The Data


dustin@span76: ~/Desktop/tests_EVAAL_4_10_2012/bs1
File Edit View Search Terminal Help
140 53 18 -88 -76 -86 -77 -90 -80 -77 -80 -72 -79 -71 -74 -64 -67 -64 -63 -66 127 -60 -67 -58 -69 -82 -87 -92 -90 -84 -78 -73 -96 16 71
141 53 19 -81 -78 -91 -83 -84 -84 -82 -87 -77 -72 -78 -75 -71 -60 -87 -73 -75 -60 127 -56 -63 -73 -82 -88 -92 -80 -85 -101 -85 -89 16 66
142 53 20 -91 -80 -88 -84 -95 -94 -79 -79 -89 -81 -80 -87 -79 -75 -76 -79 -66 -64 -56 127 -68 -76 -81 -84 -95 -82 -92 -93 -80 -88 16 61
143 53 21 -78 -94 -84 -96 -72 -75 -68 -75 -75 -64 -75 -69 -59 -63 -61 -59 -72 -64 -61 -66 127 -58 -66 -85 -85 -93 -84 -100 -81 -100 16 56
144 53 22 -70 -80 -70 -97 -72 -75 -77 -76 -67 -75 -64 -56 -53 -66 -73 -65 -71 -63 -70 -75 -58 127 -72 -69 -71 -68 -82 -71 -66 -61 16 51
145 53 23 -81 -77 -72 -85 -75 -75 -83 -89 -77 -78 -64 -58 -66 -72 -81 -82 -74 -86 -77 -87 -64 -81 127 -66 -72 -67 -77 -73 -68 -66 16 46
146 53 24 -70 -88 -100 -88 -85 -81 -88 -83 -82 -81 -78 -74 -64 -76 -78 -81 -75 -81 -78 -77 -87 -69 -61 127 -63 -66 -73 -82 -67 -64 16 41
147 53 25 -72 -88 -76 -74 -81 -79 -88 -97 -84 -91 -84 -85 -88 -88 -100 -91 -87 -85 -88 -88 -88 -69 -70 -58 127 -69 -71 -80 -66 -64 16 36
148 53 26 -75 -82 -95 -79 -85 -88 -76 -75 -76 -89 -82 -77 -81 -78 -74 -88 -82 -79 -83 -79 -73 -78 -64 -66 -63 127 -54 -54 -71 -68 16 31
149 53 27 -81 -79 -88 -96 -91 -78 -82 -83 -96 -85 -75 -77 -78 -89 -75 -79 -77 -90 -83 -88 -81 -78 -70 -72 -65 -51 127 -57 -69 -87 16 26
150 53 28 -75 -78 -80 -102 -87 -66 -78 -80 -82 -84 -80 -80 -69 -79 -84 -87 -77 -76 -88 -82 -90 -69 -71 -75 -73 -57 -53 127 -71 -62 16 21
151 53 29 -69 -71 -81 -78 -86 -74 -84 127 -76 -80 -63 -57 -69 -79 -73 -67 -69 -64 -81 -84 -80 -70 -63 -68 -77 -78 -79 -62 127 -60 16 16
152 53 30 -72 -58 -72 -64 -76 -66 -72 -74 -81 -90 -56 -56 -63 -81 -85 -77 -81 -67 -94 -84 -79 -60 -62 -64 -63 -78 -67 -58 -55 127 16 11
153 53 1 127 -50 -60 -78 -60 -63 -72 -66 -75 -84 -88 -68 -85 -97 -89 -84 -78 -86 -82 -93 -79 -73 -81 -72 -72 -73 -82 -75 -69 -75 22 -105
154 53 2 -54 127 -66 -77 -70 -73 -89 -61 -73 -78 -69 -69 -75 -76 -86 -84 -76 -76 -79 -80 -88 -80 -76 -89 -85 -81 -79 -78 -70 -62 22 -105
155 53 3 -61 -62 127 -82 -55 -78 -82 -71 -78 -70 -74 -68 -81 -78 -82 -89 -73 -88 -90 -87 -81 -71 -72 -102 -76 -97 -89 -80 -81 -72 22 -110
156 53 4 -73 -69 -58 127 -64 -63 -68 -65 -75 -81 -63 -61 -76 -68 -73 -89 -80 -77 -82 -84 -88 -84 -78 -91 -74 -80 -93 -92 -76 -67 22 -115
157 53 5 -62 -68 -56 -57 127 -64 -90 -80 -74 -77 -67 -66 -75 -71 -81 -97 -80 -92 -84 -91 -72 -75 -79 -89 -81 -85 -92 -88 -88 -78 22 -120
158 53 6 -67 -75 -70 -58 -64 127 -56 -58 -63 -63 -69 -74 -76 -77 -81 -91 -84 -81 -86 -95 -76 -78 -75 -84 -81 -89 -79 -69 -78 -72 22 -125
159 53 7 -78 -75 -73 -62 -64 -52 127 -70 -67 -53 -70 -74 -76 -76 -72 -74 -80 -76 -81 -78 -68 -80 -82 -88 -88 -76 -81 -79 -84 -77 22 126
160 53 8 -69 -64 -92 -64 -89 -61 -55 127 -61 -58 -75 -74 -73 -78 -79 -84 -77 -82 -88 -80 -75 -77 -89 -85 -94 -75 -84 -82 -85 -79 22 121
161 53 9 -75 -84 -75 -69 -73 -66 -60 -54 127 -63 -79 -76 -66 -52 -52 -65 -66 -72 -76 -88 -74 -67 -75 -83 -82 -75 -94 -82 -75 -81 22 116
162 53 10 -74 -76 -74 -65 -81 -66 -58 -58 -60 127 -70 -71 -77 -68 -74 -84 -69 -79 -72 -81 -64 -78 -78 -82 -92 -85 -84 -85 -82 -90 22 111
163 53 11 -75 -58 -75 -55 -70 -80 -58 -66 -66 -60 127 -52 -63 -64 -90 -77 -72 -70 -76 -78 -72 -66 -63 -78 -81 -80 -73 -80 -60 -56 22 106
164 53 12 -63 -74 -66 -65 -63 -70 -65 -79 -71 -61 -55 127 -61 -83 -69 -77 -66 -74 -73 -88 -66 -56 -58 -75 -81 -79 -76 -77 -56 -56 22 101
165 53 13 -80 127 -79 -82 -79 -75 -75 -73 -63 -71 -70 -62 127 -64 -72 -69 -72 -63 -71 -79 -60 -54 -66 -65 -88 -81 -77 -70 -68 -66 22 96
166 53 14 -78 -75 -81 -72 -74 -73 -90 -78 -53 -75 -72 -72 -60 127 -64 -69 -69 -69 -61 -76 -64 -70 -72 -78 -90 -78 -88 -82 -83 -85 22 91
167 53 15 -80 -78 -85 -81 -79 -76 -76 -79 -51 -78 -80 -85 -76 -62 127 -59 -58 -65 -87 -77 -61 -75 -82 -80 -100 -75 -76 -86 -75 -87 22 86
168 53 16 -79 -82 -92 -82 -85 -81 -76 -76 -64 -81 -76 -81 -60 -67 -58 127 -66 -63 -73 -79 -58 -68 -80 -82 -93 -88 -80 -88 -67 -77 22 81
169 53 17 -74 -74 -74 -78 -84 -76 -67 -82 -61 -69 -80 -66 -72 -59 -52 -58 127 -65 -75 -65 -71 -72 -73 -75 -85 -81 -76 -78 -69 -82 22 76
170 53 18 -77 -80 -90 -71 -81 -75 -92 -72 -68 -95 -67 -78 -61 -67 -74 -70 -70 127 -60 -64 -64 -64 -88 -81 -85 -80 -91 -77 -65 -72 22 71
171 53 19 -94 -80 -86 -84 -87 -76 -79 -75 -73 -69 -94 -83 -78 -58 -70 -75 -68 -63 127 -56 -61 -72 -78 -79 -88 -84 -84 -90 -82 -91 22 66
172 53 20 -89 -84 -90 -90 -95 -87 -76 -90 -90 -88 -88 -78 -81 -73 -72 -75 -65 -63 -57 127 -66 -78 -87 -78 -88 -79 -89 -83 -87 -85 22 61
173 53 21 -75 -89 -88 -72 -70 -74 -67 -73 -66 -62 -67 -65 -60 -59 -63 -57 -59 -75 -78 -65 127 -60 -64 -88 -88 -74 -80 -89 -81 -78 22 56
174 53 22 -87 -76 -64 -65 -68 -78 -72 -78 -62 -70 -64 -56 -52 -64 -76 -65 -65 -63 -68 -88 -63 127 -78 -69 -67 -76 -79 -67 -68 -61 22 51
175 53 23 -82 -80 -72 -85 127 -76 -72 -75 -74 -75 -60 -57 -66 -83 -76 -81 -72 -76 -81 -87 -64 -62 127 -63 -70 -64 -70 -70 -63 -64 22 46
176 53 24 -72 -79 -92 -84 -85 -89 -84 -82 -77 -92 -70 -69 -61 -69 -82 -78 -76 -82 -77 -78 -78 -63 -62 127 -58 -65 -71 -74 -66 -66 22 41
177 53 25 -73 -80 -86 -78 -93 -82 -77 -82 -96 -78 -80 -80 -90 -87 -82 -88 -96 -82 -80 -85 -84 -71 -76 -55 127 -63 -64 -73 -77 -65 22 36
178 53 26 -71 -78 -94 -88 -77 -74 -81 -79 -73 -88 -84 -74 -90 -74 -73 -80 -81 -85 -82 -86 -85 -76 -73 -63 -56 127 -52 -57 -79 -79 22 31
[tests_EVAAL_4_10_2...
dustin@span76: ~/De...

The Data


dustin@span76: ~/Desktop/tests_EVAAL_4_10_2012/bs1
File Edit View Search Terminal Help
140 53 18 -88 -76 -86 -77 -90 -80 -77 -80 -72 -79 -71 -74 -64 -67 -64 -63 -66 127 -60 -67 -58 -69 -82 -87 -92 -90 -84 -78 -73 -96 16 71
141 53 19 -81 -78 -91 -83 -84 -84 -82 -87 -77 -72 -78 -75 -71 -60 -87 -73 -75 -60 127 -56 -63 -73 -82 -88 -92 -80 -85 -101 -85 -89 16 66
142 53 20 -91 -80 -88 -84 -95 -94 -79 -79 -89 -81 -80 -87 -79 -75 -76 -79 -66 -64 -56 127 -68 -76 -81 -84 -95 -82 -92 -93 -80 -88 16 61
143 53 21 -78 -94 -84 -96 -72 -75 -68 -75 -75 -64 -75 -69 -59 -63 -61 -59 -72 -64 -61 -66 127 -58 -66 -85 -85 -93 -84 -100 -81 -100 16 56
144 53 22 -70 -80 -70 -97 -72 -75 -77 -76 -67 -75 -64 -56 -53 -66 -73 -65 -71 -63 -70 -75 -58 127 -72 -69 -71 -68 -82 -71 -66 -61 16 51
145 53 23 -81 -77 -72 -85 -75 -75 -83 -89 -77 -78 -64 -58 -66 -72 -81 -82 -74 -86 -77 -87 -64 -81 127 -66 -72 -67 -77 -73 -68 -66 16 46
146 53 24 -70 -88 -100 -88 -85 -81 -88 -83 -82 -81 -78 -74 -64 -76 -78 -81 -75 -81 -78 -77 -87 -69 -61 127 -63 -66 -73 -82 -67 -64 16 41
147 53 25 -72 -88 -76 -74 -81 -79 -88 -97 -84 -91 -84 -85 -88 -88 -100 -91 -87 -85 -88 -88 -88 -69 -70 -58 127 -69 -71 -80 -66 -64 16 36
148 53 26 -75 -82 -95 -79 -85 -88 -76 -75 -76 -89 -82 -77 -81 -78 -74 -88 -82 -79 -83 -79 -73 -78 -64 -66 -63 127 -54 -54 -71 -68 16 31
149 53 27 -81 -79 -88 -96 -91 -78 -82 -83 -96 -85 -75 -77 -78 -89 -75 -79 -77 -90 -83 -88 -81 -78 -70 -72 -65 -51 127 -57 -69 -87 16 26
150 53 28 -75 -78 -80 -102 -87 -66 -78 -80 -82 -84 -80 -80 -69 -79 -84 -87 -77 -76 -88 -82 -90 -69 -71 -75 -73 -57 -53 127 -71 -62 16 21
151 53 29 -69 -71 -81 -78 -86 -74 -84 127 -76 -80 -63 -57 -69 -79 -73 -67 -69 -64 -81 -84 -80 -70 -63 -68 -77 -78 -79 -62 127 -60 16 16
152 53 30 -72 -58 -72 -64 -76 -66 -72 -74 -81 -90 -56 -56 -63 -81 -85 -77 -81 -67 -94 -84 -79 -60 -62 -64 -63 -78 -67 -58 -55 127 16 11
153 53 1 127 -50 -60 -78 -60 -63 -72 -66 -75 -84 -88 -68 -85 -97 -89 -84 -78 -86 -82 -93 -79 -73 -81 -72 -72 -73 -82 -75 -69 -75 22 -105
154 53 2 -54 127 -66 -77 -70 -73 -89 -61 -73 -78 -69 -69 -75 -76 -86 -84 -76 -76 -79 -80 -88 -80 -76 -89 -85 -81 -79 -78 -70 -62 22 -105
155 53 3 -61 -62 127 -82 -55 -78 -82 -71 -78 -70 -74 -68 -81 -78 -82 -89 -73 -88 -90 -87 -81 -71 -72 -102 -76 -97 -89 -80 -81 -72 22 -110
156 53 4 -73 -69 -58 127 -64 -63 -68 -65 -75 -81 -63 -61 -76 -68 -73 -89 -80 -77 -82 -84 -88 -84 -78 -91 -74 -80 -93 -92 -76 -67 22 -115
157 53 5 -62 -68 -56 -57 127 -64 -90 -80 -74 -77 -67 -66 -75 -71 -81 -97 -80 -92 -84 -91 -72 -75 -79 -89 -81 -85 -92 -88 -88 -78 22 -120
158 53 6 -67 -75 -70 -58 -64 127 -56 -58 -63 -63 -69 -74 -76 -77 -81 -91 -84 -81 -86 -95 -76 -78 -75 -84 -81 -89 -79 -69 -78 -72 22 -125
159 53 7 -78 -75 -73 -62 -64 -52 127 -70 -67 -53 -70 -74 -76 -76 -72 -74 -80 -76 -81 -78 -68 -80 -82 -88 -88 -76 -81 -79 -84 -77 22 126
160 53 8 -69 -64 -92 -64 -89 -61 -55 127 -61 -58 -75 -74 -73 -78 -79 -84 -77 -82 -88 -80 -75 -77 -89 -85 -94 -75 -84 -82 -85 -79 22 121
161 53 9 -75 -84 -75 -69 -73 -66 -60 -54 127 -63 -79 -76 -66 -52 -52 -65 -66 -72 -76 -88 -74 -67 -75 -83 -82 -75 -94 -82 -75 -81 22 116
162 53 10 -74 -76 -74 -65 -81 -66 -58 -58 -60 127 -70 -71 -77 -68 -74 -84 -69 -79 -72 -81 -64 -78 -78 -82 -92 -85 -84 -85 -82 -90 22 111
163 53 11 -75 -58 -75 -55 -70 -80 -58 -66 -66 -60 127 -52 -63 -64 -90 -77 -72 -70 -76 -78 -72 -66 -63 -78 -81 -80 -73 -80 -60 -56 22 106
164 53 12 -63 -74 -66 -65 -63 -70 -65 -79 -71 -61 -55 127 -61 -83 -69 -77 -66 -74 -73 -88 -66 -56 -58 -75 -81 -79 -76 -77 -56 -56 22 101
165 53 13 -80 127 -79 -82 -79 -75 -75 -73 -63 -71 -70 -62 127 -64 -72 -69 -72 -63 -71 -79 -60 -54 -66 -65 -88 -81 -77 -70 -68 -66 22 96
166 53 14 -78 -75 -81 -72 -74 -73 -90 -78 -53 -75 -72 -72 -60 127 -64 -69 -69 -69 -61 -76 -64 -70 -72 -78 -90 -78 -88 -82 -83 -85 22 91
167 53 15 -80 -78 -85 -81 -79 -76 -76 -79 -51 -78 -80 -85 -76 -62 127 -59 -58 -65 -87 -77 -61 -75 -82 -80 -100 -75 -76 -86 -75 -87 22 86
168 53 16 -79 -82 -92 -82 -85 -81 -76 -76 -64 -81 -76 -81 -60 -67 -58 127 -66 -63 -73 -79 -58 -68 -80 -82 -93 -88 -80 -88 -67 -77 22 81
169 53 17 -74 -74 -74 -78 -84 -76 -67 -82 -61 -69 -80 -66 -72 -59 -52 -58 127 -65 -75 -65 -71 -72 -73 -75 -85 -81 -76 -78 -69 -82 22 76
170 53 18 -77 -80 -90 -71 -81 -75 -92 -72 -68 -95 -67 -78 -61 -67 -74 -70 -70 127 -60 -64 -64 -64 -88 -81 -85 -80 -91 -77 -65 -72 22 71
171 53 19 -94 -80 -86 -84 -87 -76 -79 -75 -73 -69 -94 -83 -78 -58 -70 -75 -68 -63 127 -56 -61 -72 -78 -79 -88 -84 -84 -90 -82 -91 22 66
172 53 20 -89 -84 -90 -90 -95 -87 -76 -90 -90 -88 -88 -78 -81 -73 -72 -75 -65 -63 -57 127 -66 -78 -87 -78 -88 -79 -89 -83 -87 -85 22 61
173 53 21 -75 -89 -88 -72 -70 -74 -67 -73 -66 -62 -67 -65 -60 -59 -63 -57 -59 -75 -78 -65 127 -60 -64 -88 -88 -74 -80 -89 -81 -78 22 56
174 53 22 -87 -76 -64 -65 -68 -78 -72 -78 -62 -70 -64 -56 -52 -64 -76 -65 -65 -63 -68 -88 -63 127 -78 -69 -67 -76 -79 -67 -68 -61 22 51
175 53 23 -82 -80 -72 -85 127 -76 -72 -75 -74 -75 -60 -57 -66 -83 -76 -81 -72 -76 -81 -87 -64 -62 127 -63 -70 -64 -70 -70 -63 -64 22 46
176 53 24 -72 -79 -92 -84 -85 -89 -84 -82 -77 -92 -70 -69 -61 -69 -82 -78 -76 -82 -77 -78 -78 -63 -62 127 -58 -65 -71 -74 -66 -66 22 41
177 53 25 -73 -80 -86 -78 -93 -82 -77 -82 -96 -78 -80 -80 -90 -87 -82 -88 -96 -82 -80 -85 -84 -71 -76 -55 127 -63 -64 -73 -77 -65 22 36
178 53 26 -71 -78 -94 -88 -77 -74 -81 -79 -73 -88 -84 -74 -90 -74 -73 -80 -81 -85 -82 -86 -85 -76 -73 -63 -56 127 -52 -57 -79 -79 22 31
[tests_EVAAL_4_10_2...
dustin@span76: ~/De...

Analyzing the Data

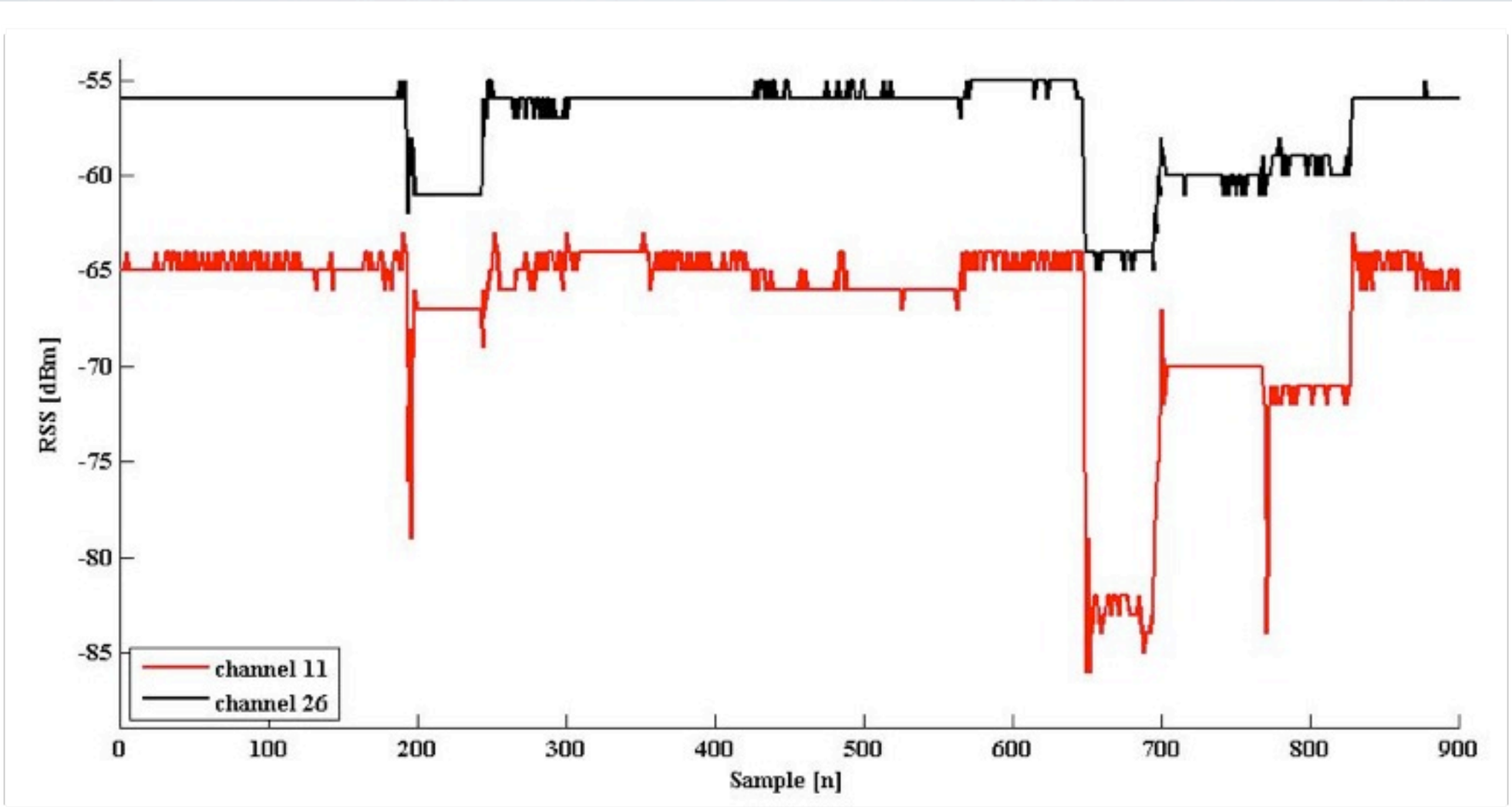


Image courtesy of Ossi Kaltiokallio

Analyzing the Data

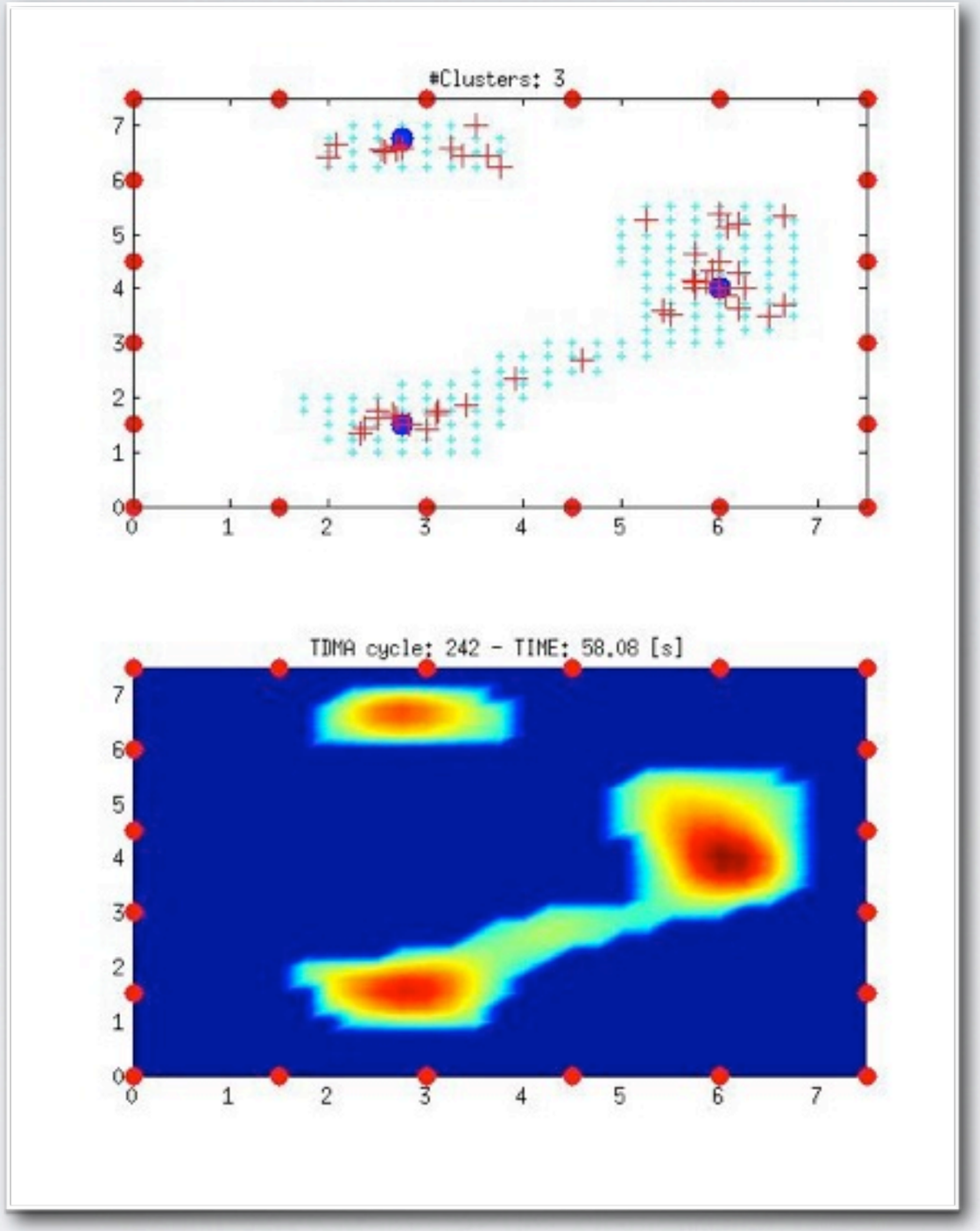


Image courtesy of Dr. Maurizio Bocca

QUESTIONS