

# cs6550

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September 14, 2018

## 1 Implementation

I decided to use a cross-platform MPI library called klyng written for Javascript and Nodejs. I thought it would be interesting to try writing parallel applications for Nodejs which is not usually used for parallel applications.

Installation of klyng was very straightforward using the Node Package Manager (npm). However, I did have some difficulty choosing the right MPI library for Nodejs as there were a few other alternatives. In the end, klyng had the most support and a more complete interface.

## 2 Compile and Run Commands

```
1 mpic++ Assignment2/Assignment2.cpp -o Assignment2/run.out
2 mpirun -np 10 Assignment2/run.out
```

## 3 Compile and Run Commands

```
1 Start timer: 384
2 6 received bomb with 384 seconds left!
3 7 received bomb with 383 seconds left!
4 6 received bomb with 382 seconds left!
5 5 received bomb with 381 seconds left!
6 6 received bomb with 380 seconds left!
7 3 received bomb with 379 seconds left!
8 6 received bomb with 378 seconds left!
9 5 received bomb with 377 seconds left!
10 7 received bomb with 376 seconds left!
11 5 received bomb with 375 seconds left!
12 3 received bomb with 374 seconds left!
13 7 received bomb with 373 seconds left!
14 3 received bomb with 372 seconds left!
15 5 received bomb with 371 seconds left!
16 6 received bomb with 370 seconds left!
17 2 received bomb with 369 seconds left!
18 6 received bomb with 368 seconds left!
19 9 received bomb with 367 seconds left!
```

```
20 6 received bomb with 366 seconds left!
21 1 received bomb with 365 seconds left!
22 6 received bomb with 364 seconds left!
23 2 received bomb with 363 seconds left!
24 7 received bomb with 362 seconds left!
25 5 received bomb with 361 seconds left!
26 2 received bomb with 360 seconds left!
27 5 received bomb with 359 seconds left!
28 9 received bomb with 358 seconds left!
29 7 received bomb with 357 seconds left!
30 6 received bomb with 356 seconds left!
31 7 received bomb with 355 seconds left!
32 2 received bomb with 354 seconds left!
33 3 received bomb with 353 seconds left!
34 5 received bomb with 352 seconds left!
35 1 received bomb with 351 seconds left!
36 7 received bomb with 350 seconds left!
37 9 received bomb with 349 seconds left!
38 5 received bomb with 348 seconds left!
39 2 received bomb with 347 seconds left!
40 5 received bomb with 346 seconds left!
41 7 received bomb with 345 seconds left!
42 1 received bomb with 344 seconds left!
43 5 received bomb with 343 seconds left!
44 0 received bomb with 342 seconds left!
45 7 received bomb with 341 seconds left!
46 2 received bomb with 340 seconds left!
47 6 received bomb with 339 seconds left!
48 0 received bomb with 338 seconds left!
49 5 received bomb with 337 seconds left!
50 9 received bomb with 336 seconds left!
51 3 received bomb with 335 seconds left!
52 6 received bomb with 334 seconds left!
53 9 received bomb with 333 seconds left!
54 5 received bomb with 332 seconds left!
55 3 received bomb with 331 seconds left!
56 2 received bomb with 330 seconds left!
57 9 received bomb with 329 seconds left!
58 6 received bomb with 328 seconds left!
59 3 received bomb with 327 seconds left!
60 9 received bomb with 326 seconds left!
61 2 received bomb with 325 seconds left!
62 1 received bomb with 324 seconds left!
63 3 received bomb with 323 seconds left!
64 1 received bomb with 322 seconds left!
65 5 received bomb with 321 seconds left!
66 6 received bomb with 320 seconds left!
67 0 received bomb with 319 seconds left!
68 3 received bomb with 318 seconds left!
69 2 received bomb with 317 seconds left!
70 7 received bomb with 316 seconds left!
71 0 received bomb with 315 seconds left!
72 5 received bomb with 314 seconds left!
73 0 received bomb with 313 seconds left!
74 6 received bomb with 312 seconds left!
75 2 received bomb with 311 seconds left!
76 0 received bomb with 310 seconds left!
```

```
77 2 received bomb with 309 seconds left!
78 9 received bomb with 308 seconds left!
79 1 received bomb with 307 seconds left!
80 6 received bomb with 306 seconds left!
81 1 received bomb with 305 seconds left!
82 2 received bomb with 304 seconds left!
83 3 received bomb with 303 seconds left!
84 7 received bomb with 302 seconds left!
85 9 received bomb with 301 seconds left!
86 2 received bomb with 300 seconds left!
87 6 received bomb with 299 seconds left!
88 8 received bomb with 298 seconds left!
89 6 received bomb with 297 seconds left!
90 7 received bomb with 296 seconds left!
91 3 received bomb with 295 seconds left!
92 0 received bomb with 294 seconds left!
93 9 received bomb with 293 seconds left!
94 7 received bomb with 292 seconds left!
95 6 received bomb with 291 seconds left!
96 9 received bomb with 290 seconds left!
97 0 received bomb with 289 seconds left!
98 1 received bomb with 288 seconds left!
99 0 received bomb with 282 seconds left!
100 2 received bomb with 283 seconds left!
101 9 received bomb with 287 seconds left!
102 9 received bomb with 285 seconds left!
103 3 received bomb with 286 seconds left!
104 6 received bomb with 284 seconds left!
105 1 received bomb with 260 seconds left!
106 5 received bomb with 265 seconds left!
107 0 received bomb with 279 seconds left!
108 0 received bomb with 277 seconds left!
109 0 received bomb with 275 seconds left!
110 0 received bomb with 269 seconds left!
111 2 received bomb with 281 seconds left!
112 2 received bomb with 272 seconds left!
113 2 received bomb with 261 seconds left!
114 2 received bomb with 259 seconds left!
115 9 received bomb with 276 seconds left!
116 9 received bomb with 263 seconds left!
117 7 received bomb with 278 seconds left!
118 7 received bomb with 267 seconds left!
119 7 received bomb with 257 seconds left!
120 8 received bomb with 258 seconds left!
121 3 received bomb with 274 seconds left!
122 3 received bomb with 270 seconds left!
123 6 received bomb with 280 seconds left!
124 6 received bomb with 273 seconds left!
125 6 received bomb with 271 seconds left!
126 6 received bomb with 268 seconds left!
127 6 received bomb with 266 seconds left!
128 6 received bomb with 264 seconds left!
129 6 received bomb with 262 seconds left!
130 3 received bomb with 245 seconds left!
131 3 received bomb with 237 seconds left!
132 1 received bomb with 240 seconds left!
133 5 received bomb with 247 seconds left!
```

```
134 0 received bomb with 250 seconds left!
135 2 received bomb with 256 seconds left!
136 2 received bomb with 253 seconds left!
137 2 received bomb with 251 seconds left!
138 2 received bomb with 246 seconds left!
139 2 received bomb with 236 seconds left!
140 9 received bomb with 252 seconds left!
141 9 received bomb with 243 seconds left!
142 7 received bomb with 255 seconds left!
143 7 received bomb with 241 seconds left!
144 7 received bomb with 239 seconds left!
145 8 received bomb with 248 seconds left!
146 8 received bomb with 238 seconds left!
147 6 received bomb with 254 seconds left!
148 6 received bomb with 249 seconds left!
149 6 received bomb with 244 seconds left!
150 6 received bomb with 242 seconds left!
151 8 received bomb with 224 seconds left!
152 8 received bomb with 214 seconds left!
153 3 received bomb with 228 seconds left!
154 3 received bomb with 221 seconds left!
155 1 received bomb with 233 seconds left!
156 1 received bomb with 226 seconds left!
157 1 received bomb with 222 seconds left!
158 1 received bomb with 220 seconds left!
159 5 received bomb with 230 seconds left!
160 5 received bomb with 223 seconds left!
161 0 received bomb with 232 seconds left!
162 2 received bomb with 231 seconds left!
163 2 received bomb with 218 seconds left!
164 2 received bomb with 215 seconds left!
165 2 received bomb with 211 seconds left!
166 9 received bomb with 234 seconds left!
167 9 received bomb with 225 seconds left!
168 9 received bomb with 217 seconds left!
169 9 received bomb with 212 seconds left!
170 7 received bomb with 235 seconds left!
171 7 received bomb with 216 seconds left!
172 6 received bomb with 229 seconds left!
173 6 received bomb with 227 seconds left!
174 6 received bomb with 219 seconds left!
175 6 received bomb with 213 seconds left!
176 7 received bomb with 204 seconds left!
177 7 received bomb with 196 seconds left!
178 7 received bomb with 188 seconds left!
179 8 received bomb with 206 seconds left!
180 8 received bomb with 200 seconds left!
181 3 received bomb with 207 seconds left!
182 3 received bomb with 197 seconds left!
183 3 received bomb with 190 seconds left!
184 3 received bomb with 187 seconds left!
185 1 received bomb with 202 seconds left!
186 1 received bomb with 193 seconds left!
187 1 received bomb with 185 seconds left!
188 0 received bomb with 209 seconds left!
189 0 received bomb with 203 seconds left!
190 0 received bomb with 201 seconds left!
```

191 2 received bomb with 205 seconds left!  
192 2 received bomb with 198 seconds left!  
193 2 received bomb with 195 seconds left!  
194 2 received bomb with 186 seconds left!  
195 9 received bomb with 210 seconds left!  
196 9 received bomb with 199 seconds left!  
197 9 received bomb with 191 seconds left!  
198 9 received bomb with 189 seconds left!  
199 6 received bomb with 208 seconds left!  
200 6 received bomb with 194 seconds left!  
201 6 received bomb with 192 seconds left!  
202 9 received bomb with 183 seconds left!  
203 9 received bomb with 173 seconds left!  
204 9 received bomb with 164 seconds left!  
205 7 received bomb with 176 seconds left!  
206 7 received bomb with 174 seconds left!  
207 7 received bomb with 169 seconds left!  
208 8 received bomb with 181 seconds left!  
209 8 received bomb with 166 seconds left!  
210 4 received bomb with 178 seconds left!  
211 3 received bomb with 171 seconds left!  
212 5 received bomb with 182 seconds left!  
213 5 received bomb with 175 seconds left!  
214 1 received bomb with 180 seconds left!  
215 1 received bomb with 167 seconds left!  
216 0 received bomb with 170 seconds left!  
217 2 received bomb with 184 seconds left!  
218 2 received bomb with 172 seconds left!  
219 2 received bomb with 168 seconds left!  
220 2 received bomb with 165 seconds left!  
221 6 received bomb with 179 seconds left!  
222 6 received bomb with 177 seconds left!  
223 2 received bomb with 163 seconds left!  
224 2 received bomb with 160 seconds left!  
225 2 received bomb with 150 seconds left!  
226 9 received bomb with 156 seconds left!  
227 9 received bomb with 153 seconds left!  
228 9 received bomb with 148 seconds left!  
229 7 received bomb with 161 seconds left!  
230 7 received bomb with 159 seconds left!  
231 7 received bomb with 157 seconds left!  
232 7 received bomb with 152 seconds left!  
233 7 received bomb with 146 seconds left!  
234 8 received bomb with 158 seconds left!  
235 8 received bomb with 155 seconds left!  
236 8 received bomb with 149 seconds left!  
237 8 received bomb with 144 seconds left!  
238 4 received bomb with 162 seconds left!  
239 3 received bomb with 151 seconds left!  
240 3 received bomb with 147 seconds left!  
241 0 received bomb with 154 seconds left!  
242 6 received bomb with 145 seconds left!  
243 0 received bomb with 127 seconds left!  
244 2 received bomb with 137 seconds left!  
245 2 received bomb with 129 seconds left!  
246 2 received bomb with 126 seconds left!  
247 9 received bomb with 141 seconds left!

```
248 9 received bomb with 134 seconds left!
249 9 received bomb with 130 seconds left!
250 7 received bomb with 132 seconds left!
251 4 received bomb with 139 seconds left!
252 4 received bomb with 136 seconds left!
253 5 received bomb with 142 seconds left!
254 5 received bomb with 138 seconds left!
255 5 received bomb with 128 seconds left!
256 1 received bomb with 133 seconds left!
257 1 received bomb with 131 seconds left!
258 3 received bomb with 143 seconds left!
259 3 received bomb with 135 seconds left!
260 6 received bomb with 140 seconds left!
261 3 received bomb with 123 seconds left!
262 3 received bomb with 115 seconds left!
263 3 received bomb with 109 seconds left!
264 0 received bomb with 125 seconds left!
265 0 received bomb with 116 seconds left!
266 0 received bomb with 112 seconds left!
267 2 received bomb with 124 seconds left!
268 2 received bomb with 122 seconds left!
269 2 received bomb with 119 seconds left!
270 2 received bomb with 117 seconds left!
271 2 received bomb with 114 seconds left!
272 2 received bomb with 110 seconds left!
273 7 received bomb with 111 seconds left!
274 5 received bomb with 120 seconds left!
275 1 received bomb with 118 seconds left!
276 6 received bomb with 121 seconds left!
277 6 received bomb with 113 seconds left!
278 1 received bomb with 101 seconds left!
279 1 received bomb with 96 seconds left!
280 1 received bomb with 88 seconds left!
281 3 received bomb with 106 seconds left!
282 3 received bomb with 104 seconds left!
283 3 received bomb with 98 seconds left!
284 3 received bomb with 89 seconds left!
285 3 received bomb with 87 seconds left!
286 0 received bomb with 100 seconds left!
287 0 received bomb with 94 seconds left!
288 9 received bomb with 105 seconds left!
289 9 received bomb with 102 seconds left!
290 9 received bomb with 93 seconds left!
291 8 received bomb with 108 seconds left!
292 2 received bomb with 95 seconds left!
293 4 received bomb with 92 seconds left!
294 7 received bomb with 103 seconds left!
295 7 received bomb with 90 seconds left!
296 5 received bomb with 99 seconds left!
297 5 received bomb with 91 seconds left!
298 6 received bomb with 107 seconds left!
299 6 received bomb with 97 seconds left!
300 5 received bomb with 79 seconds left!
301 5 received bomb with 72 seconds left!
302 1 received bomb with 82 seconds left!
303 1 received bomb with 80 seconds left!
304 0 received bomb with 84 seconds left!
```

305 0 received bomb with 74 seconds left!  
306 9 received bomb with 78 seconds left!  
307 9 received bomb with 76 seconds left!  
308 8 received bomb with 75 seconds left!  
309 2 received bomb with 86 seconds left!  
310 2 received bomb with 83 seconds left!  
311 2 received bomb with 73 seconds left!  
312 2 received bomb with 71 seconds left!  
313 7 received bomb with 81 seconds left!  
314 7 received bomb with 77 seconds left!  
315 6 received bomb with 85 seconds left!  
316 7 received bomb with 62 seconds left!  
317 5 received bomb with 70 seconds left!  
318 5 received bomb with 59 seconds left!  
319 5 received bomb with 51 seconds left!  
320 3 received bomb with 66 seconds left!  
321 3 received bomb with 47 seconds left!  
322 0 received bomb with 54 seconds left!  
323 0 received bomb with 49 seconds left!  
324 9 received bomb with 65 seconds left!  
325 9 received bomb with 60 seconds left!  
326 9 received bomb with 50 seconds left!  
327 9 received bomb with 48 seconds left!  
328 8 received bomb with 58 seconds left!  
329 8 received bomb with 53 seconds left!  
330 4 received bomb with 68 seconds left!  
331 4 received bomb with 64 seconds left!  
332 4 received bomb with 61 seconds left!  
333 2 received bomb with 69 seconds left!  
334 2 received bomb with 63 seconds left!  
335 2 received bomb with 56 seconds left!  
336 2 received bomb with 52 seconds left!  
337 6 received bomb with 67 seconds left!  
338 6 received bomb with 57 seconds left!  
339 6 received bomb with 55 seconds left!  
340 2 received bomb with 42 seconds left!  
341 2 received bomb with 32 seconds left!  
342 7 received bomb with 39 seconds left!  
343 7 received bomb with 29 seconds left!  
344 5 received bomb with 40 seconds left!  
345 5 received bomb with 36 seconds left!  
346 1 received bomb with 46 seconds left!  
347 1 received bomb with 43 seconds left!  
348 1 received bomb with 33 seconds left!  
349 1 received bomb with 27 seconds left!  
350 1 received bomb with 25 seconds left!  
351 3 received bomb with 35 seconds left!  
352 0 received bomb with 30 seconds left!  
353 9 received bomb with 45 seconds left!  
354 9 received bomb with 34 seconds left!  
355 9 received bomb with 31 seconds left!  
356 9 received bomb with 24 seconds left!  
357 8 received bomb with 38 seconds left!  
358 8 received bomb with 26 seconds left!  
359 4 received bomb with 28 seconds left!  
360 6 received bomb with 44 seconds left!  
361 6 received bomb with 41 seconds left!

```

362 6 received bomb with 37 seconds left!
363 4 received bomb with 22 seconds left!
364 4 received bomb with 19 seconds left!
365 4 received bomb with 2 seconds left!
366 2 received bomb with 21 seconds left!
367 2 received bomb with 0 seconds left!
368 7 received bomb with 18 seconds left!
369 7 received bomb with 15 seconds left!
370 7 received bomb with 12 seconds left!
371 7 received bomb with 9 seconds left!
372 7 received bomb with 5 seconds left!
373 7 received bomb with 0 seconds left!
374 5 received bomb with 17 seconds left!
375 5 received bomb with 7 seconds left!
376 5 received bomb with 0 seconds left!
377 1 received bomb with 6 seconds left!
378 1 received bomb with 4 seconds left!
379 1 received bomb with 0 seconds left!
380 3 received bomb with 20 seconds left!
381 3 received bomb with 13 seconds left!
382 3 received bomb with 11 seconds left!
383 3 received bomb with 3 seconds left!
384 3 received bomb with 0 seconds left!
385 0 received bomb with 14 seconds left!
386 0 received bomb with 1 seconds left!
387 0 loses!
388 9 received bomb with 0 seconds left!
389 8 received bomb with 10 seconds left!
390 8 received bomb with 0 seconds left!
391 6 received bomb with 23 seconds left!
392 6 received bomb with 16 seconds left!
393 6 received bomb with 8 seconds left!
394 6 received bomb with 0 seconds left!
395 4 received bomb with 0 seconds left!

```

## 4 Code

```

1  #include <iostream>
2  #include <mpi.h>
3  #include <stdlib.h>
4  #define MCW MPI_COMM_WORLD
5
6  using namespace std;
7
8  int main(int argc, char **argv){
9      int rank, size;
10     int data;
11     int bomb = std::rand() % 1000 + 1; // Random timer from 1 - 1000
12
13     MPI_Init(&argc, &argv);
14     MPI_Comm_rank(MCW, &rank);
15     MPI_Comm_size(MCW, &size);
16
17     if (rank == 0)
18     {

```



```

19     MPI_Send(&bomb, 1, MPI_INT, std::rand() % size, 0, MCW);
20     std::cout << "Start timer: " << bomb << std::endl;
21 }
22
23
24 while (true)
25 {
26     MPI_Recv(&bomb, 1, MPI_INT, MPI_ANY_SOURCE, 0, MCW,
27             MPI_STATUS_IGNORE);
28     if (!bomb)
29     {
30         break;
31     }
32     std::cout << rank << " received bomb with " << bomb << "
33         seconds left!" << std::endl;
34     bomb--;
35     if (!bomb)
36     {
37         std::cout << rank << " loses!" << std::endl;
38         for (int i = 0; i < size; i++)
39         {
40             if (i != rank)
41             {
42                 MPI_Send(&bomb, 1, MPI_INT, i, 0, MCW);
43             }
44             break;
45         }
46     }
47     int target = std::rand() % size;
48     while (target == rank)
49     {
50         target = std::rand() % size;
51     }
52     MPI_Send(&bomb, 1, MPI_INT, target, 0, MCW);
53 }
54
55 MPI_Finalize();
56
57 return 0;
58 }

```