

1.
 - a. A->B: A->B->C, A->B->E
 - b. B->A: B->A->C, B->A->D, B->A->E
2. MACA Protocol grants access for sender to be received. No, the nodes whilst in range request to send data using "Request to Send" (RTS), and the receiver if able must accept using "Confirm to Send" (CTS) allows the packet to be sent. The other nodes "hear" and defer until the network is clear and reply to incoming or request to send once more.
3. Manchester Encoding (Classic Ethernet) => Encode 0001110101



4.
 - a. A->C: B1: 2,3,4
 - b. E->F: H1: B2: 2, H1 rebroadcasts back to F as well.
 - c. F->E: H1, B2: 2, H1 rebroadcasts back to E as well.
 - d. G->E: B2: 3 (Recv), 1,2,4
 - e. D->A: B2: 1 (Recv), 2,3,4 -> (B1: 4(Recv), 1, 2, 3)
 - f. B->F: B1: 2 (Recv), 1,3,4 -> (B2: 4 (Recv), 1, 2, 3)

5. C->B: 6, C->D: 3, C->E: 5

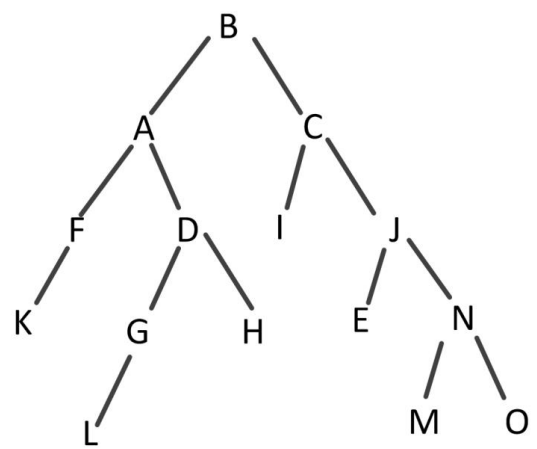
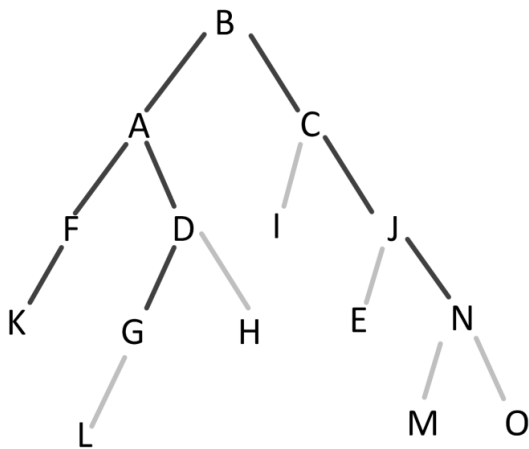
	A	B	C	D	E	F	As C	Route
A		5		16	7		5	B
B		0		12	6		6	B
C		8		6	5		3	E
D		12		0	9		3	D
E		6		9	0		5	E
F		2		10	4		2	B

6. Broadcast from B

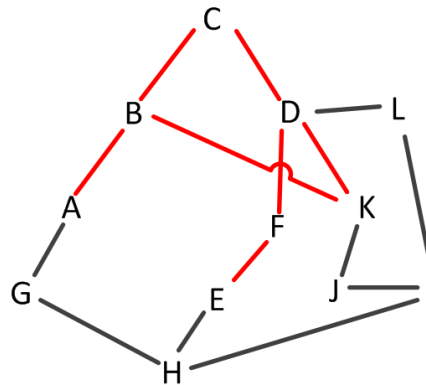
a. Reverse path forwarding: Node receives broadcast packet, if packet arrived on shortest path to B, flood neighbours. Otherwise, ignore broadcast packet.

= 28 (right figure)

b. Sink Tree = 14 (left figure)



7. Multicast Spanning Tree for C in {A, B, C, D, E, F, I, K}

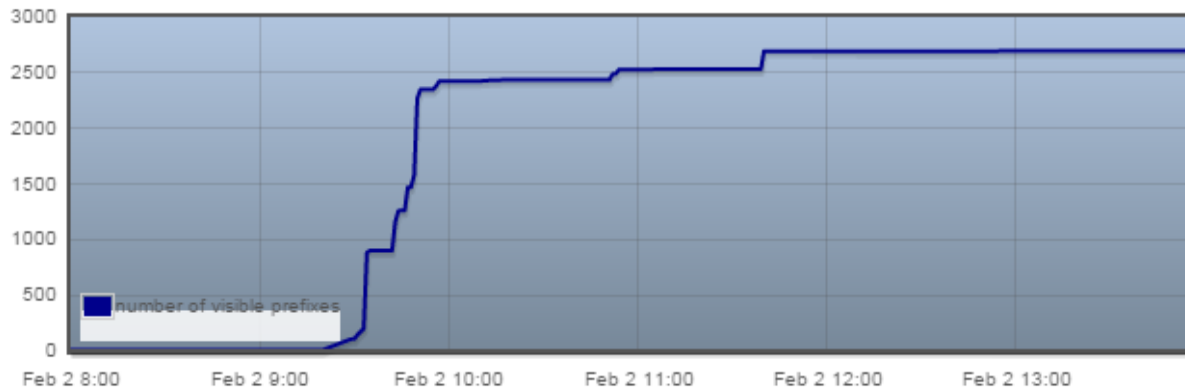


I: Does not multicast, no immediate multi-casted parent.

{G, H, L}: Nodes do not receive. (leaf nodes)

8. Egypt was able to blackout their internet coverage by removing border gateway protocol (BGP) routing information. This was accomplished by mandating minor adjustments to their ISPs (Four main ones: Telecom Egypt, Link Egypt, Vodafone/Raya, and Etisalat Misr, as well as its three main mobile carriers: Vodafone Egypt, Mobinil, and Etisalat). This modification essentially removed pathing and addressing information from the sender so that Egypt was unable to receive network traffic. Days earlier Twitter and Facebook were blocked. However the BGP method of disconnection is most likely the most effective and efficient way of taking down a large network, as simply disconnecting cables may be unpredictable and cause liability issues. The change was able to be accomplished in the matter of minutes to propagate between routers, for a grand impact of wiping out 88% of the countries internet. Interestingly only a single ISP was left standing during the collapse, Noor Data Networks was left functional. It is speculated that this carrier was left running in order to maintain the Egyptian stock exchange [3].





Static view on the number of visible prefixes originating from Egyptian organisations on 2 Feb between 8:00 and 14:00 UTC

[4]

In doing this, piggybacking providers (with as afore questioned countries; Sudan and Eretria) would obviously become disconnected. ISPs to these downstream countries were slowly restored within hours, for those that were affected by Egyptian carriers. The beauty of the BGP methodology is that the ISPs still have complete control of designated areas, ie they may selectively allow the BGP broadcast to resume in certain areas of their network. The truly astonishing factor being that, this outage was by no means legal and following people's rights. It was done in short to attempt to stabilize and maintain order during the chaotic riots in 2011.

References

- [1] <http://www.computerworld.com/article/2512745/internet/how-egypt-pulled-its-internet-plug.html>
- [2] http://en.wikipedia.org/wiki/Internet_in_Egypt
- [3] <http://www.telegraph.co.uk/news/worldnews/africaandindianocean/egypt/8288163/How-Egypt-shut-down-the-internet.html>
- [4] <https://stat.ripe.net/events/egypt>

9. Ad hoc mobile phone networks provide a way for mobile devices to connect without any centralised infrastructure; it is self-configuring and consists of entirely mobile nodes. This network topology makes use of multi-hop relays, similar to peer-to-peer networking, however distance restricted and completely wireless. The implementation of such a network would be most suitable to densely populated areas that is flat and above ground (unless lots of people using the network were underground...). These limitations are implied by the use of mobile technology, as sparse density would lead to dropped network transmissions, or signals generally getting obstructed by terrain, metal or concrete. However, with all this said, this topology is able to be deployed completely by the devices using it, and as such remote or impoverished regions it becomes very useful for communication. Many ethical/legal problems also may arise, as the network is completely unrestricted and unable to be censored and screened by the previous centralised solution. As with any network system, more acronyms have been used to describe this self-configuring topology,

consisting of but not limited to Vehicular Ad hoc Networks (VANET), Smart Phone Ad hoc Networks (SPAN), Internet based mobile ad hoc networks (iMANET), or more generally mobile ad hoc network (MANET). Some other protocols are capable of dealing with short periods of delay (Delay-tolerant networking), provided each node is capable of storing incoming data to later broadcast once able [2].

Other than typical communication via voice or messaging, other data may be carried through this topology, there are systems that are used for data monitoring, where nodes with sensors may interact with one another at mobile locations, this allows for spatial correlation between sensors, making it a very powerful and low cost technique [3].

As previously mentioned, security is very limited in these networks, it relies much on the same basis that the internet originally was created on, "trust based security". There is a difficult trade-off to consider as with most software, the age-old security vs. performance dilemma, considering that the standard node in a typical communication network is a smartphone, with limited power and resources (even with the drastic performance increase over the last couple of years).

Overall this technique is a great solution for low-cost, high density, low interference solution, where the typical centralised solution is either non-existent, or not within the interest of the user. All of this comes at severe implications to speed, reliability, and security.

References

- [1] http://en.wikipedia.org/wiki/List_of_ad_hoc_routing_protocols
- [2] http://en.wikipedia.org/wiki/Delay-tolerant_networking
- [3] http://en.wikipedia.org/wiki/Mobile_ad_hoc_network

10. IPv4 to IPv6 Address Conversion

```
// COIS-4310H - Assignment #2
// Simon Willshire (0491272)
// #10: IPv4 >> IPv6 Address Converter

#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <stdint.h>

// Assumes valid IPv4 Address
// http://stackoverflow.com/questions/10513841/using-strtok-to-split-the-string
// IN: @addr: IPv4 address (#.#.#.#)
// OUT: @ipv4: unsigned char array [4] with byte values
void strtToIPv4(char* str, unsigned char* ipv4)
{
    int i = strlen(str);
    char* addr = new char[i+1];
    memcpy(addr, str, i);
    i = addr[i] = 0;

    // Loop through segments sep by '.', convert to uchar
    addr = strtok(addr, ".");
    do ipv4[i++] = (unsigned char)(atoi(addr) % 256);
    while(addr = strtok(NULL, "."));

    delete addr;
}

// Assumes argv[1] = IPv4 address with correct formatting (#.#.#.#)
// OUT: Outputs IPv6 address, uses 0-15 hex conversion
int main(int argc, char** argv)
{
    const char* hl = "0123456789abcdef";
    unsigned char* ipv4 = new unsigned char[4];

    strtToIPv4((argc > 2) ? argv[1] : "127.0.0.1", ipv4);
    char ipv6[] = {
        hl[(ipv4[0] / 16)], hl[(ipv4[0] % 16)], // <uchar / 16><uchar % 16> per byte
        hl[(ipv4[1] / 16)], hl[(ipv4[1] % 16)],
        ':', // IPv6 colon formatting in centre
        hl[(ipv4[2] / 16)], hl[(ipv4[2] % 16)],
        hl[(ipv4[3] / 16)], hl[(ipv4[3] % 16)]
    };
    printf("IPv4: %s\nIPv6: 0:0:0:0:ffff:%s\n", argv[1], ipv6);
    return 0;
}
```

Output { 174.142.32.131, 192.168.1.1, 127.0.0.1, 74.125.29.94 }

root@alpha:~/Documents/IPConverter# g++ -std=c++11 ipconv.c -o ipconv

root@alpha:~/Documents/IPConverter# ./ipconv 174.142.32.131

IPv4: 174.142.32.131

IPv6: 0:0:0:0:ffff:ae8e:2083

root@alpha:~/Documents/IPConverter# ./ipconv 192.168.1.1

IPv4: 192.168.1.1

IPv6: 0:0:0:0:ffff:c0a8:0101

root@alpha:~/Documents/IPConverter# ./ipconv 127.0.0.1

IPv4: 127.0.0.1

IPv6: 0:0:0:0:ffff:7f00:0001

root@alpha:~/Documents/IPConverter# ./ipconv 74.125.29.94

IPv4: 74.125.29.94

IPv6: 0:0:0:0:ffff:4a7d:1d5e

11. Traced trentu.ca stream, selected initial HTTP GET request with text/html response:

Wireshark 1.12.4 (v1.12.4-0-gb4861da from master-1.12)

Filter: tcp.stream eq 14

No.	Time	Source	Destination	Protocol	Length	Info
674	102.066181000	192.168.2.19	192.197.151.10	TCP	54	3111→80 [ACK] Seq=374 Ack=5809 Win=17424 Len=0
675	102.076571000	192.197.151.10	192.168.2.19	TCP	1506	[TCP segment of a reassembled PDU]
677	102.081996000	192.197.151.10	192.168.2.19	TCP	1506	[TCP segment of a reassembled PDU]
678	102.082036000	192.168.2.19	192.197.151.10	TCP	54	3111→80 [ACK] Seq=374 Ack=8713 Win=17424 Len=0
683	102.092460000	192.197.151.10	192.168.2.19	TCP	1506	[TCP segment of a reassembled PDU]
684	102.092461000	192.197.151.10	192.168.2.19	HTTP	352	HTTP/1.1 200 OK (text/html)
685	102.092493000	192.168.2.19	192.197.151.10	TCP	54	3111→80 [ACK] Seq=374 Ack=10463 Win=17424 Len=0
686	102.102341000	192.168.2.19	192.197.151.10	HTTP	531	GET /modules/system/system.menus.css?nkp9fv HTTP/1.1
710	102.194450000	192.197.151.10	192.168.2.19	TCP	54	80→3111 [ACK] Seq=10463 Ack=851 Win=16768 Len=0
711	102.200113000	192.197.151.10	192.168.2.19	HTTP	1128	HTTP/1.1 200 OK (text/css)
712	102.200496000	192.168.2.19	192.197.151.10	HTTP	591	GET /sites/all/modules/jquery_update/replace/ui/themes/base/minified/jquery.ui.resizable.min.css?nkp9fv HTTP/1.1
736	102.399327000	192.197.151.10	192.168.2.19	HTTP	829	HTTP/1.1 200 OK (text/css)
737	102.400366000	192.168.2.19	192.197.151.10	HTTP	521	GET /modules/node/node.css?nkp9fv HTTP/1.1
761	102.613949000	192.197.151.10	192.168.2.19	HTTP	575	HTTP/1.1 200 OK (text/css)
762	102.614947000	192.168.2.19	192.197.151.10	HTTP	539	GET /sites/all/modules/ctools/css/ctools.css?nkp9fv HTTP/1.1
789	102.761750000	192.197.151.10	192.168.2.19	HTTP	719	HTTP/1.1 200 OK (text/css)
790	102.762604000	192.168.2.19	192.197.151.10	HTTP	567	GET /sites/all/modules/views_slideshow/views_slideshow_controls_text.css?nkp9fv HTTP/1.1
808	102.862369000	192.197.151.10	192.168.2.19	HTTP	567	HTTP/1.1 200 OK (text/css)
809	102.863392000	192.168.2.19	192.197.151.10	HTTP	537	GET /sites/all/themes/trent/css/blocks.css?nkp9fv HTTP/1.1
823	102.968720000	192.197.151.10	192.168.2.19	HTTP	906	HTTP/1.1 200 OK (text/css)
824	102.969107000	192.168.2.19	192.197.151.10	HTTP	536	GET /sites/all/themes/trent/css/views.css?nkp9fv HTTP/1.1
845	103.063375000	192.197.151.10	192.168.2.19	HTTP	557	HTTP/1.1 200 OK (text/css)
846	103.064397000	192.168.2.19	192.197.151.10	HTTP	565	GET /sites/all/modules/jquery_update/replace/ui/ui/minified/jquery.ui.widget.min.js HTTP/1.1
890	103.257464000	192.197.151.10	192.168.2.19	TCP	1506	[TCP segment of a reassembled PDU]
891	103.262564000	192.197.151.10	192.168.2.19	HTTP	1486	HTTP/1.1 200 OK (text/x-javascript)
892	103.262598000	192.168.2.19	192.197.151.10	TCP	54	3111→80 [ACK] Seq=4329 Ack=18250 Win=17424 Len=0
893	103.263128000	192.168.2.19	192.197.151.10	HTTP	568	GET /sites/all/modules/jquery_update/replace/ui/ui/minified/jquery.ui.resizable.min.js HTTP/1.1
942	103.479329000	192.197.151.10	192.168.2.19	TCP	1506	[TCP segment of a reassembled PDU]
943	103.487444000	192.197.151.10	192.168.2.19	TCP	1506	[TCP segment of a reassembled PDU]
944	103.487476000	192.168.2.19	192.197.151.10	TCP	54	3111→80 [ACK] Seq=4843 Ack=21154 Win=17424 Len=0
945	103.495193000	192.197.151.10	192.168.2.19	TCP	1506	[TCP segment of a reassembled PDU]

Frame 684: 352 bytes on wire (2816 bits), 352 bytes captured (2816 bits) on interface 0

Ethernet II, Src: Zwire_79:b0:41 (00:1b:5b:79:b0:41), Dst: Tp-LinkT_0d:99:a6 (90:f6:52:0d:99:a6)

Internet Protocol Version 4, Src: 192.197.151.10 (192.197.151.10), Dst: 192.168.2.19 (192.168.2.19)

Transmission Control Protocol, Src Port: 80 (80), Dst Port: 3111 (3111), Seq: 10165, Ack: 374, Len: 298

[8 Reassembled TCP Segments (10462 bytes): #669(1452), #670(1452), #672(1452), #673(1452), #675(1452), #683(1452), #684(298)]

Hypertext Transfer Protocol

HTTP/1.1 200 OK\r\n

Date: Tue, 10 Mar 2015 02:00:52 GMT\r\n

Server: Apache/2.2.12 (Linux/SUSE)\r\n

X-Powered-By: PHP/5.3.17\r\n

Expires: Sun, 19 Nov 1978 05:00:00 GMT\r\n

Last-Modified: Tue, 10 Mar 2015 02:00:52 GMT\r\n

Cache-Control: no-cache, must-revalidate, post-check=0, pre-check=0\r\n

ETag: "1425952852"\r\n

Content-Language: en\r\n

Set-Cookie: SE55b8ffff8c5bf06b5fce66e3f3f7dc2180=2Td9grFMgw9vtmwi0o9vPFOHrESgEQDIwiRcp_1PPVc; expires=Thu, 02-Apr-2015 05:34:13 GMT; path=/; domain=.trentu.ca; HttpOnly\r\n

X-Generator: Drupal 7 (http://drupal.org)\r\n

Vary: Accept-Encoding\r\n

Content-Encoding: gzip\r\n

Content-Length: 9768\r\n

Keep-Alive: timeout=15, max=100\r\n

Connection: Keep-Alive\r\n

Content-Type: text/html; charset=utf-8\r\n

0000 48 54 54 50 2f 31 2e 31 20 32 30 30 20 4f 4b 0d HTTP/1.1 200 OK.
0010 0a 44 61 74 65 3a 20 54 75 65 2c 20 31 30 20 4d .Date: Tue, 10 M
0020 61 72 20 32 30 31 35 20 30 32 3a 30 30 3a 35 32 ar 2015 02:00:52
0030 20 47 4d 54 0d 0a 53 65 72 76 65 72 3a 20 41 70 GMT. Server: Ap
0040 61 63 68 65 2f 32 2e 32 2e 31 32 20 28 4c 69 6e ache/2.2 .12 (Lin
0050 75 78 2f 53 55 53 45 29 0d 0a 58 2d 50 6f 77 65 ux/SUSE) ..X-Powe
0060 72 65 64 2d 42 79 3a 20 50 48 50 2f 35 2e 33 2e red-By: PHP/5.3.
0070 31 37 0d 0a 45 78 70 69 72 65 73 3a 20 53 75 6e 17. Expires: Sun
0080 2c 20 31 39 20 4e 6f 76 20 31 39 37 38 20 30 35 , 19 Nov 1978 05
0090 3a 30 30 3a 30 30 20 47 4d 54 0d 0a 4c 61 73 74 :00:00 GMT..Last
00a0 2d 4d 6f 64 69 66 69 65 64 3a 20 54 75 65 2c 20 -Modified: Tue,
00b0 31 30 20 4d 61 72 20 32 30 31 35 20 30 32 3a 30 10 Mar, 2 015 02:0
00c0 30 3a 35 32 20 47 4d 54 0d 0a 43 61 63 68 65 2d 0:52 GMT ..Cache-
00d0 43 6f 6e 74 72 6f 6c 3a 20 6e 6f 2d 63 61 63 68 Control: no-cach
00e0 65 2c 20 6d 75 73 74 2d 72 65 76 61 6c 69 64 61 e, must- revalida
00f0 74 65 2c 20 70 6f 73 74 2d 63 68 65 63 6b 3d 30 te, post -check=0
0100 2c 20 70 72 65 2d 63 68 65 63 6b 3d 30 0d 0a 45 , pre-ch eck=0..E
0110 54 61 67 3a 20 22 31 34 32 35 39 35 32 38 35 32 Tag: "14 25952852
0120 22 0d 0a 43 6f 6e 74 65 6e 74 2d 4c 61 6e 67 75 "...Conte nt-Langu

File: C:\Users\Admin\AppData\Local\Temp\... Packets: 6456 · Displayed: 187 (2.9%) · Marked: 1 (0.0%) · Ignored: 2 (0.0%) Profile: Default