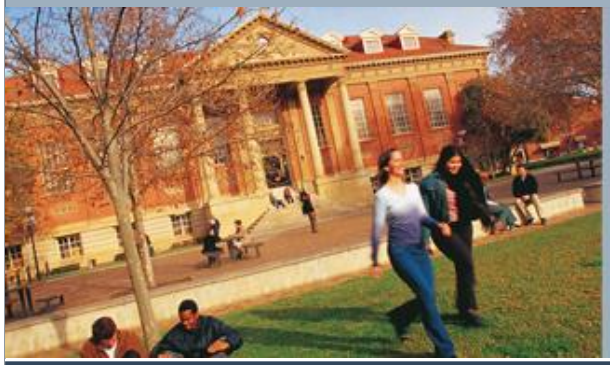
SCHOOL OF
ELECTRICAL AND
ELECTRONIC ENGINEERING

THE UNIVERSITY of ADELAIDE

Is secure communications possible?



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Outline

- Introduction
  - Is communication secure?
  - Power of eavesdroppers
  - Importance of cryptography
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  - One Time Pad
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  - Reliability
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- Project Management
- Questions and References

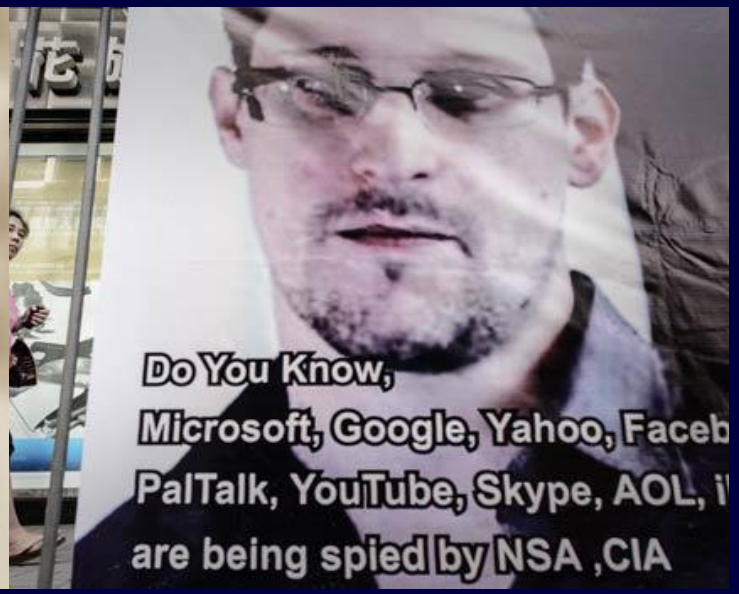
Introduction

Can communication be secure?

Sources: http://physicsworld.com/cws/article/news/2013/apr/16/alice-and-bob-communicate-without-transferring-a-single-photon http://www.viasat.com/information-assurance/network-security-appliances

Introduction

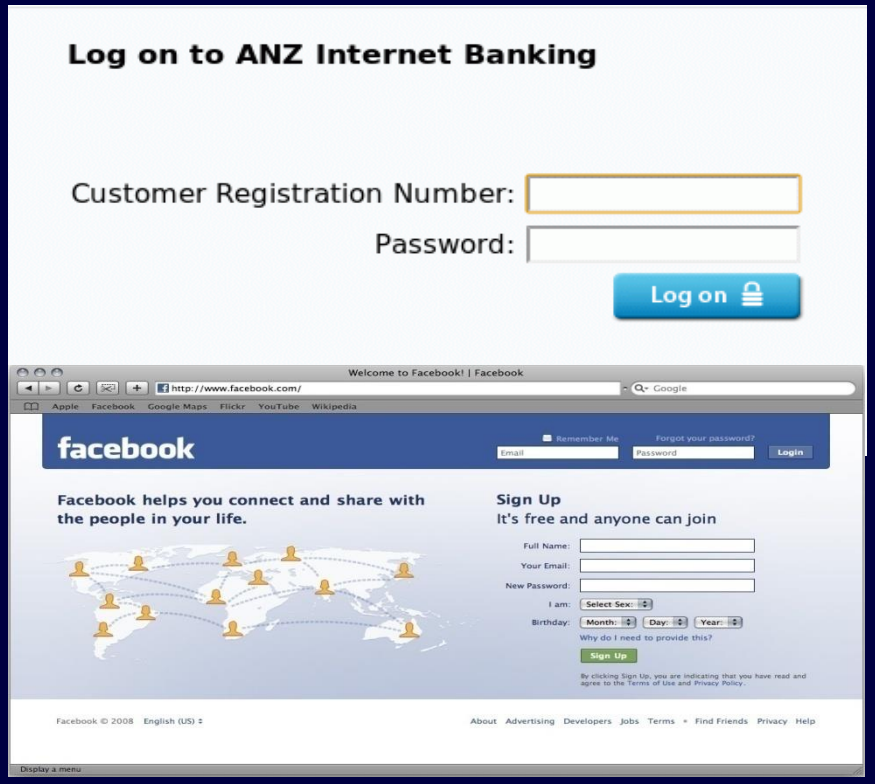
Power of eavesdropping



Sources: http://blog.zap2it.com/pop2it/2013/06/nsa-leaker-edward-snowden-seeks-asylum-in-ecuador-lands-in-moscow-for-the-time-being.html http://rt.com/usa/obama-internet-wiretap-surveillance-009/

Introduction

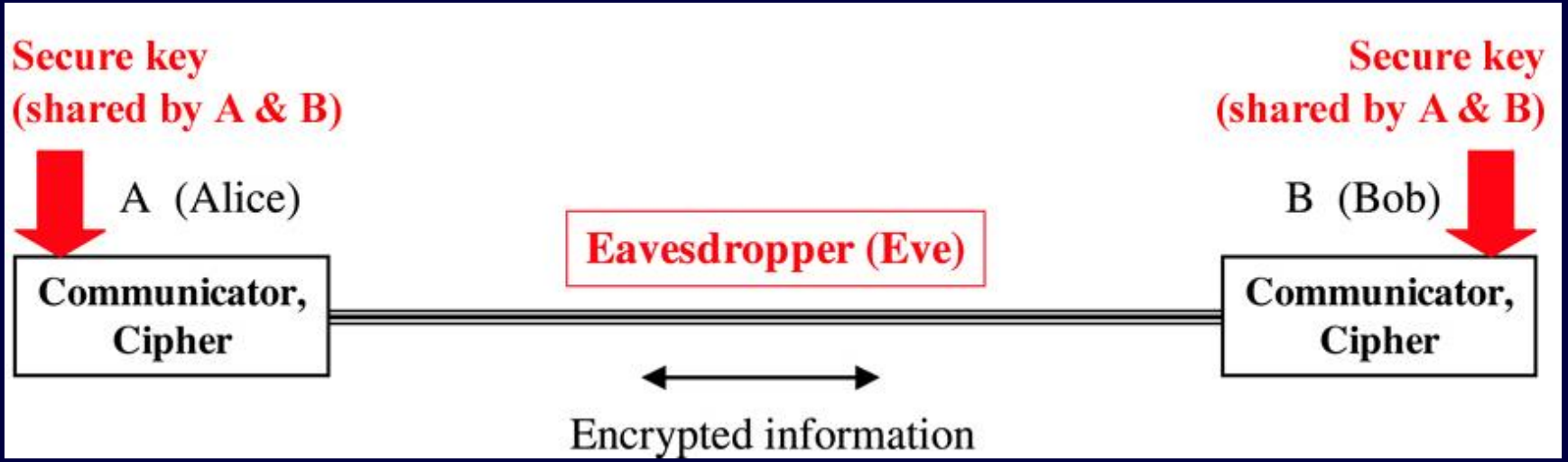
Importance of cryptography



Sources: http://www.lemis.com/grog/photos/Photos.php?dirdate=20131025, http://www.flickr.com/photos/psylum/2982646566/, http://alexansary.tv/george-soros-bet-1-3-billion-stock-market-will-fall/

Encryption

One-time pad – share the key



Source: http://spie.org/x16669.xml

The first unbreakable cipher [1]

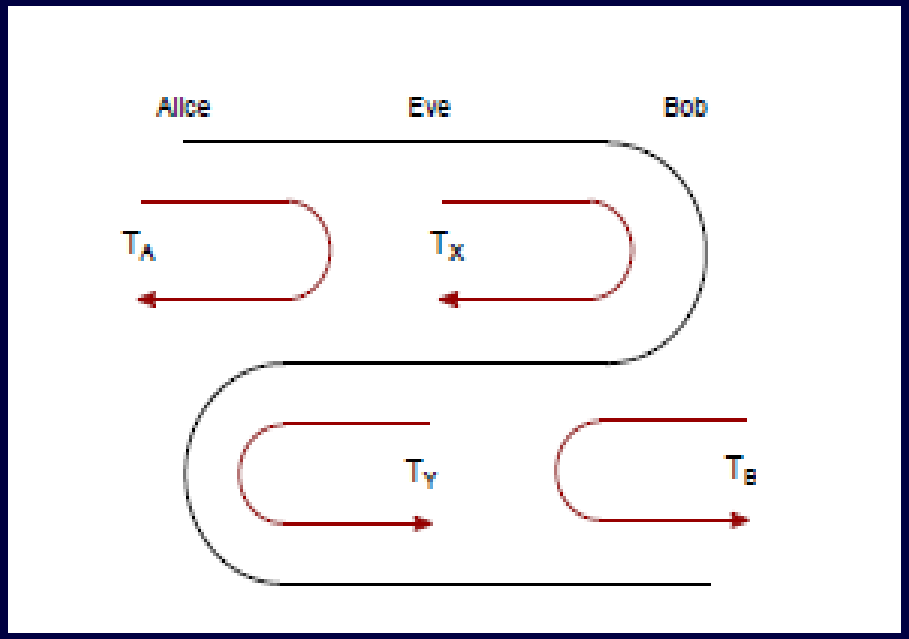
Encryption

Round trip times

Common transit time in theory

Noise disturbance

Different transit time for eavesdropper



Source: L. Gunn, J. Chappell, A. Allison & D. Abbott

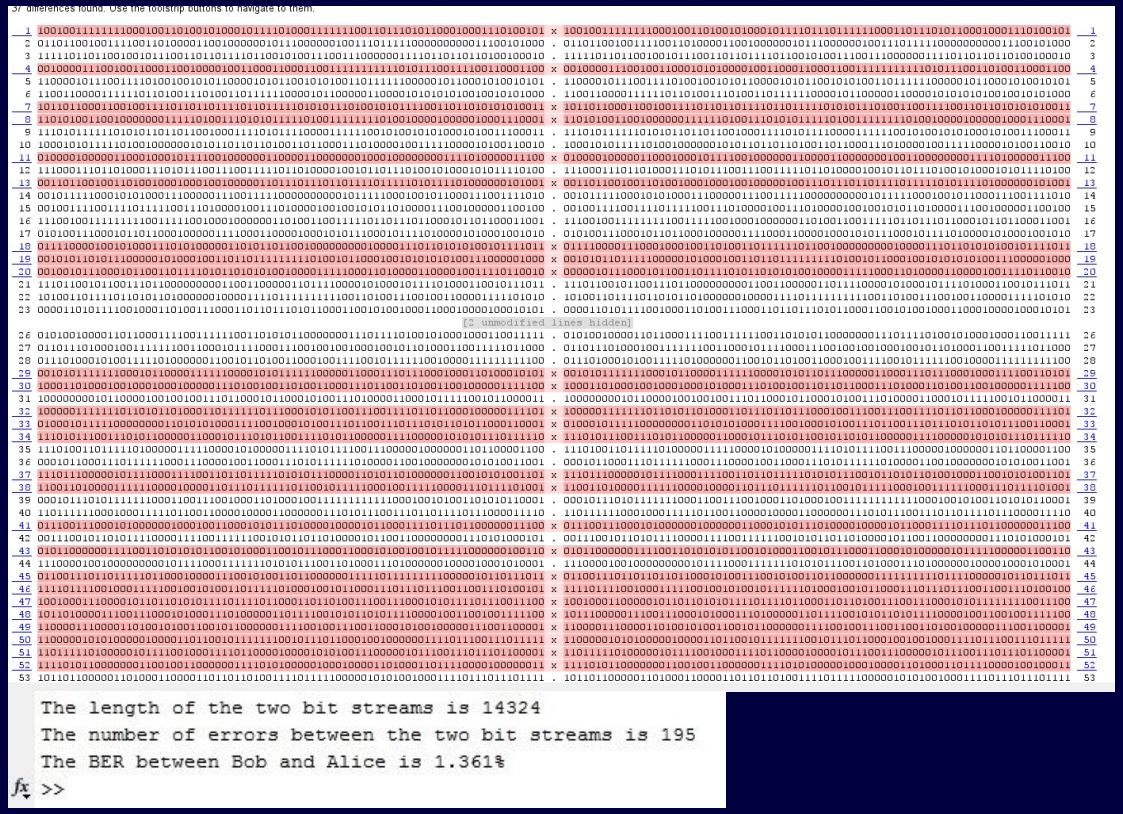
Timing Based Encryption

Steady channel

Source:
https://www.eleceng.adelaide.edu.au/personal/dabbott/wiki/index.php/Timing_Based_Encryption:_Test_Case_5

Timing Based Encryption

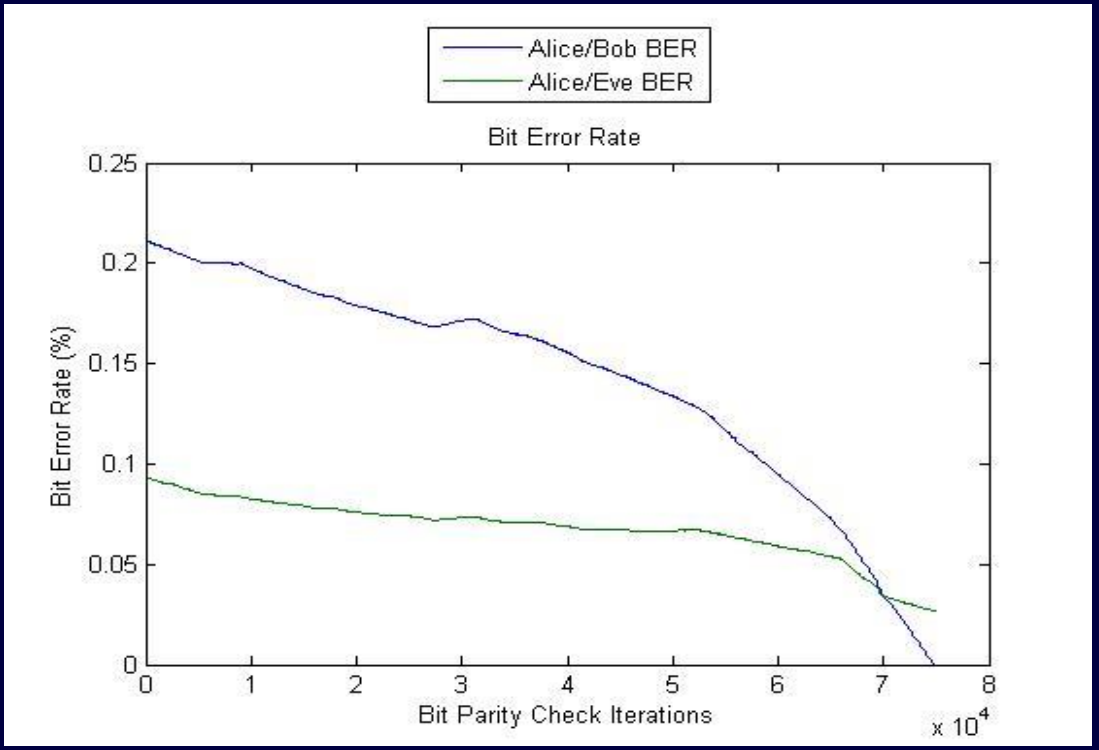
Noise channel



Source:
https://www.eleceng.adelaide.edu.au/personal/dabbott/wiki/index.php/Timing_Based_Encryption:_Test_Case_5

Timing Based Encryption

- Higher BER for Alice/Bob
- Long iteration time
- Similar percentage in BER for Alice/Bob and Alice/Eve



Source:
https://www.eleceng.adelaide.edu.au/personal/dabbott/wiki/index.php/File:Eve_Output.jpg

Our aims

- Efficiency
- Reliability
- Utilisation

Approaches

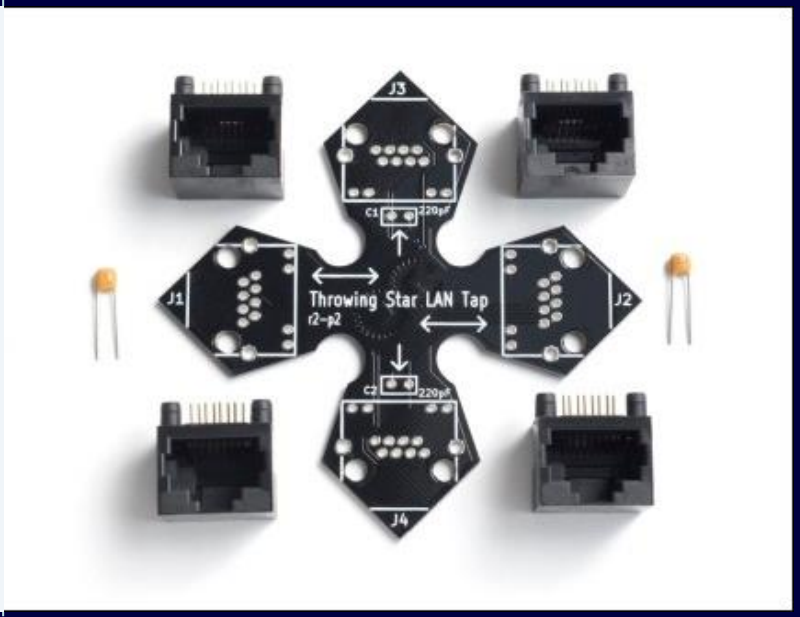
Software

Own Personal Computer

Source:
https://www.enthought.com/products/canopy/

Hardware

Great Scott Gadgets

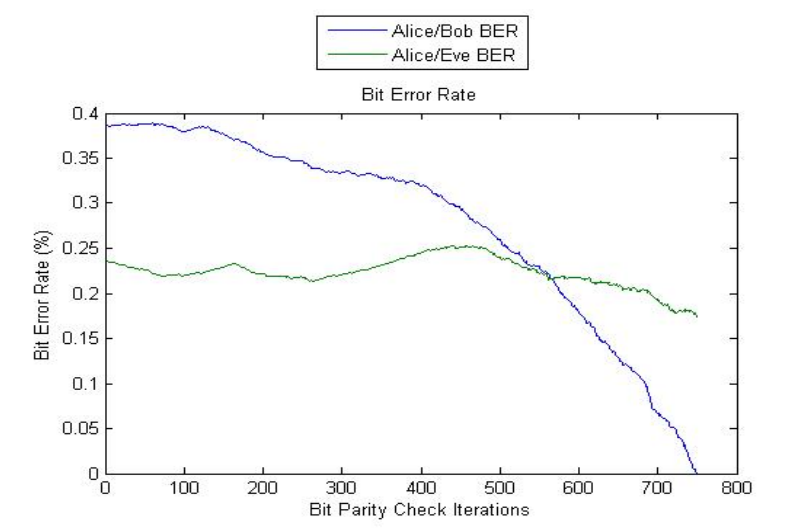


Source:
https://greatscottgadgets.com/throwingstar/

Approaches

```
     Channel BER confidence interval: (1.20e-01,3.52e-01)
Information reconciliation iterations: 4
 Block size for privacy amplification: 4
     Channel BER confidence interval: (1.03e-01,2.30e-01)
Information reconciliation iterations: 3
 Block size for privacy amplification: 4
11111011010001000011110110111000000011001001010110101010001101001011110100100111
11111011101011010011000001011000000111011010000011110000000101111010101000010010111
01000011111111101001011110100100000001011
```

Source: https://www.eleceng.adelaide.edu.au/personal/dabbott/wiki/index.php/File:Program_output.png

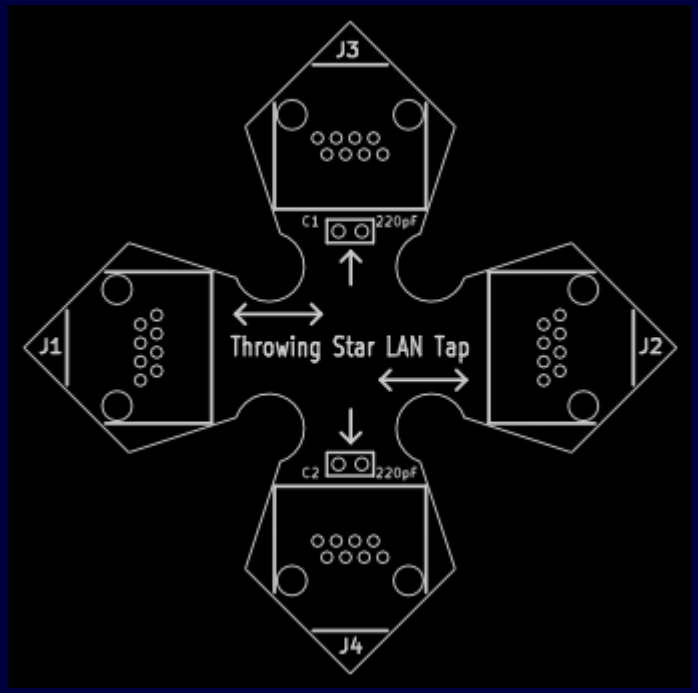


Source: https://www.eleceng.adelaide.edu.au/personal/dabbott/wiki/index.php/File:Eve_Output_Test21.jpg

Approaches

Network Tap (eavesdropper)

- J1, J2 – target network to be monitored
- J3, J4 – monitoring ports
- C1,C2 – forcing target network can be monitored



Source:
https://greatscottgadgets.com/throwingstar/

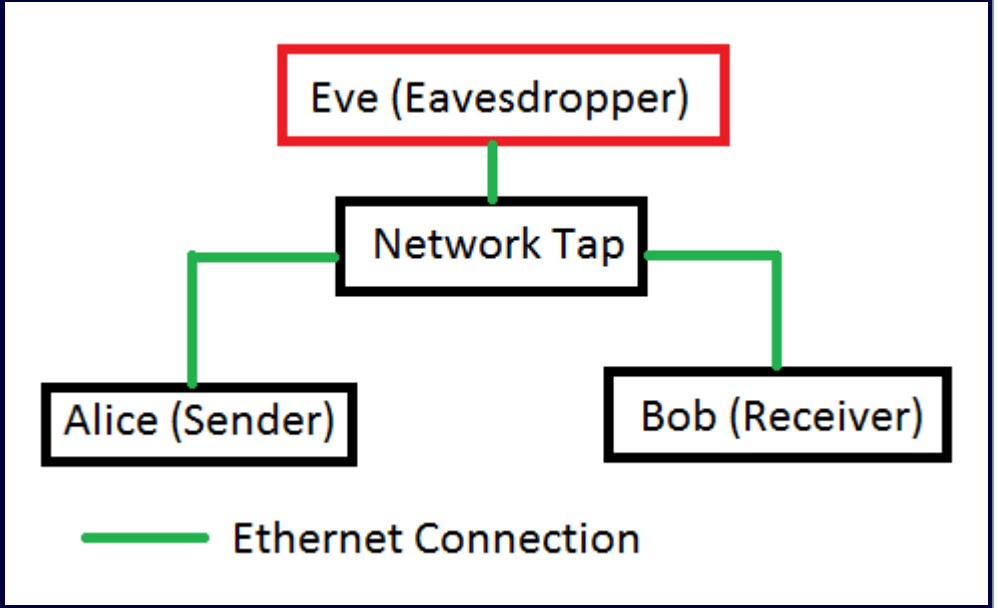
[2] Throwing Star LAN Tap, https://greatscottgadgets.com/throwingstar

Approaches

Sender/Receiver

- Sender – Beagle board / PC
- Receiver – Beagle board / PC
- Eavesdropper – Beagle board

Source:
http://beagleboard.org/Products/BeagleBone

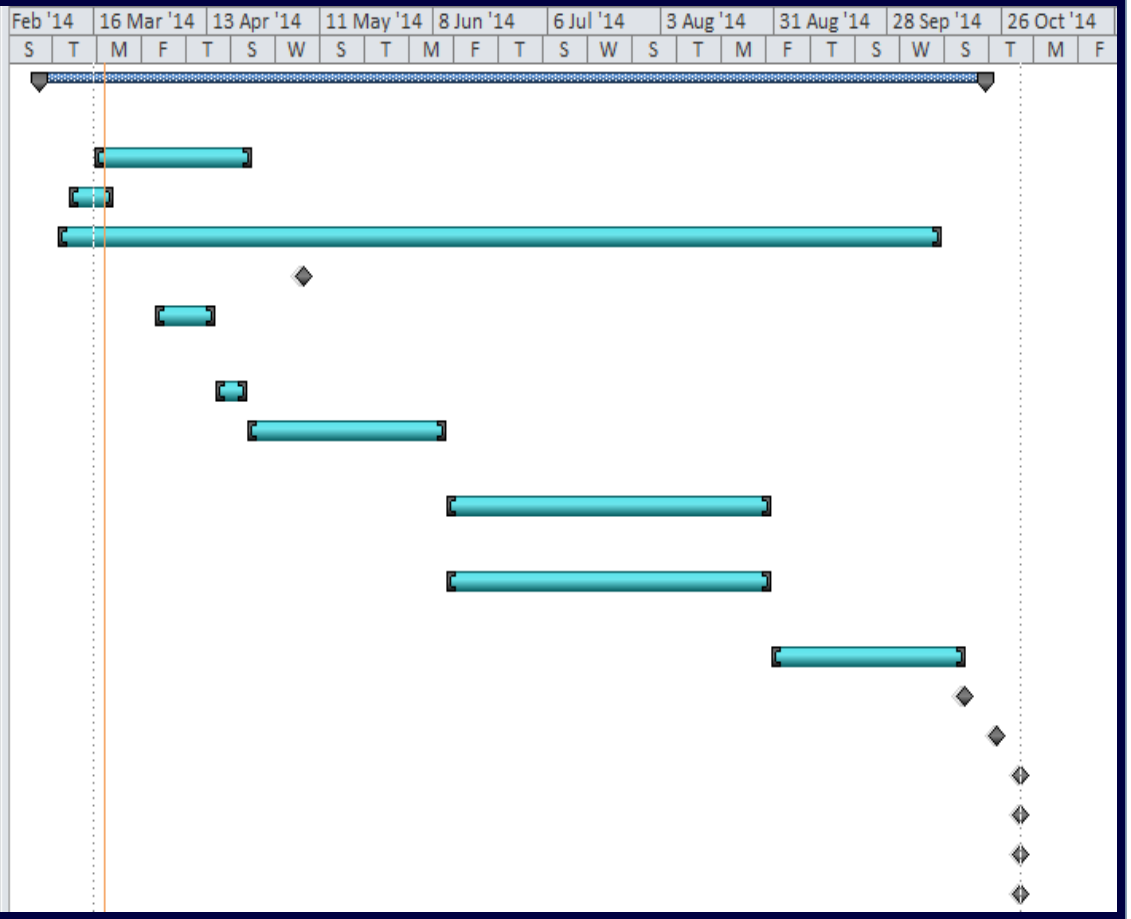


Risk Management

Risk	Likelihood	Severity	Avoidance / Mitigation Strategies
Project files missing or are not accessible	Very Low	Low	We will ensure that all work related to the project is stored on the cloud via the project's Wiki, Google Drive and Dropbox and is accessible by both team members.
Unavailability of team member	Low	Medium	Team members will keep each other informed about their work on the project which will allow their work to continue should a team member be unavailable.
Physical parts do not arrive and/or do not work in time for project completion	High	Medium	Ensure constant communication is sought with the suppliers regarding the progress of the delivery in order to plan for contingencies which include expediting work on improvements to Timing Based Encryption
Falling behind schedule due to increased complexity of work undertaken	Medium	Medium	Revaluate the scope of the project and if necessary restrict the scope to focus, among other things, on improving the functionality of the Timing Based Encryption and the encryption's efficiency.
Not finding a solution to our project	Very High	Very Low	Ensure any progress made is documented and can be used as the basis for the final seminar and exhibition

Time Management

Task Name	Duratic	Start	Finish
Is secure communication possible?	167 days	Mon 3/03/14	Tue 21/10/14
documentation	29 days	Sun 16/03/14	Wed 23/04/14
proposal seminar	9 days	Mon 10/03/14	Thu 20/03/14
weekly report	156 days	Fri 7/03/14	Fri 10/10/14
progress report	1 day	Tue 6/05/14	Tue 6/05/14
understanding the example code	11 days	Mon 31/03/14	Mon 14/04/14
network construction	6 days	Tue 15/04/14	Tue 22/04/14
decrease BER in the first transmition (Alice/Bob)	35 days	Wed 23/04/14	Tue 10/06/14
decrease BER after blocking the information	58 days	Wed 11/06/14	Fri 29/08/14
increasing BER for Eve after the blocking	58 days	Wed 11/06/14	Fri 29/08/14
reducing interation times	35 days	Sat 30/08/14	Thu 16/10/14
final seminar	1 day	Thu 16/10/14	Thu 16/10/14
final report	1 day	Fri 24/10/14	Fri 24/10/14
poster	1 day	Thu 30/10/14	Thu 30/10/14
project exhibition	1 day	Thu 30/10/14	Thu 30/10/14
Labelled CD or USB stick	1 day	Thu 30/10/14	Thu 30/10/14
YouTube video	1 day	Thu 30/10/14	Thu 30/10/14



Questions and References

[1] L. Gunn, J. Chappell, A. Allison & D. Abbott, 'Physical-layer encryption on the public internet: a stochastic approach to the Kish-Sethuraman cipher'(June 2013)

[2] Throwing Star LAN Tap, https://greatscottgadgets.com/throwingstar/

[3] Derek Abbott's Wiki Project, 'Secure communications without key exchange', https://www.eleceng.adelaide.edu.au/personal/dabbott/wiki/index.php/Main_Page