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InetVis – Visualising Scans and Evaluating Scan Detection

Barry Irwin and Jean-Pierre van Riel

Security and Networks Research Group
Department of Computer Science
Rhodes University

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Overview

- Why bother with scan detection?
- IDS and scan detection
- InetVis
  - Concept
  - Visualising different types of scans with InetVis
  - Key features
- Network telescope traffic
- Results
  - False negative for Snort
  - Pseudo-random phenomena
    - Backscatter or stealth scan?
- Conclusion and questions

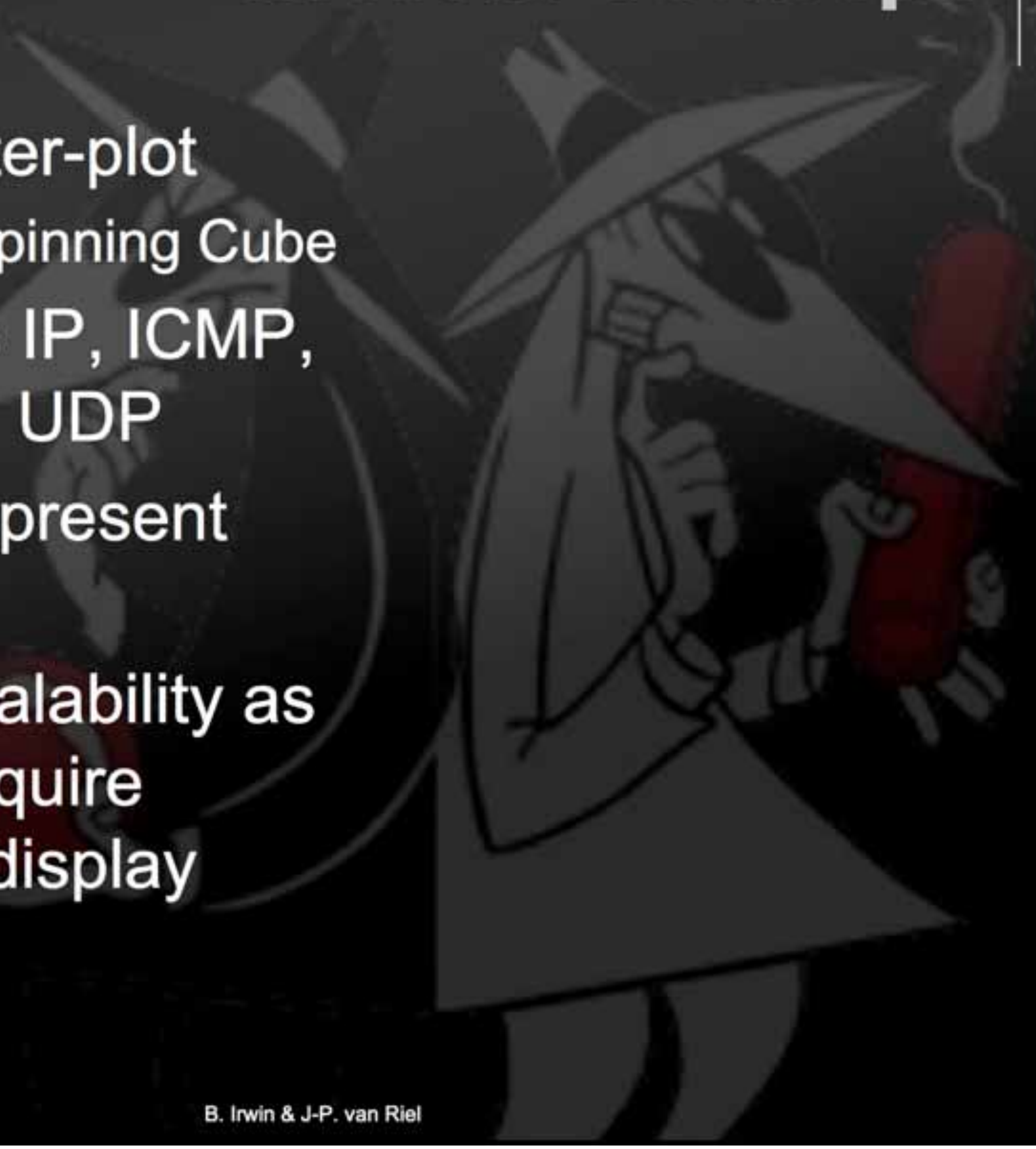
To detect scans or not?

- Arguments against
  - Scan activity is very prevalent but only a vague indication of threat
  - Actual exploit attempts warrant more concern
- Arguments for
  - Detect worm activity without reliance on signatures (and identify infected sources)
  - IPS application – preemptively block scanners (but be careful about DoS)

IDS scan detection

- Snort and Bro are two popular open source IDS solutions
- Both have scan detection algorithms
  - Simply count unique destination IPs and ports
  - Alert at thresholds
  - Include time thresholds
  - Snort’s ‘sfportscan’ detector has 3 preset threshold levels – ‘low’, ‘medium’ and ‘high’
  - The Bro scan policy facilitates variable and multiple thresholds

InetVis concept



- 3-D scatter-plot
  - Lau's Spinning Cube
- Supports IP, ICMP, TCP and UDP
- Points represent packets
- Good Scalability as points require minimal display space

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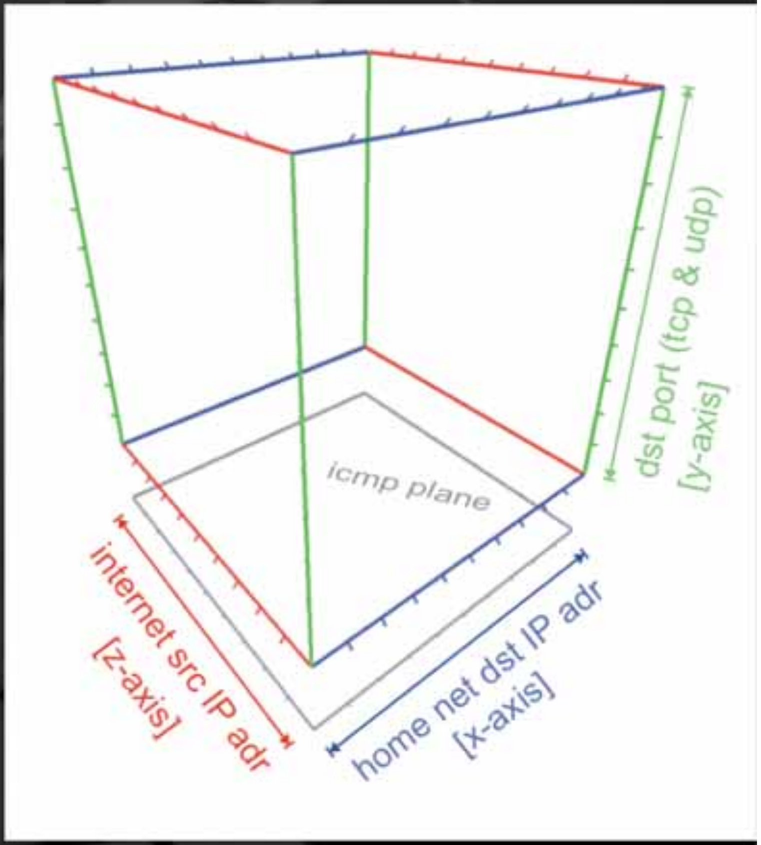
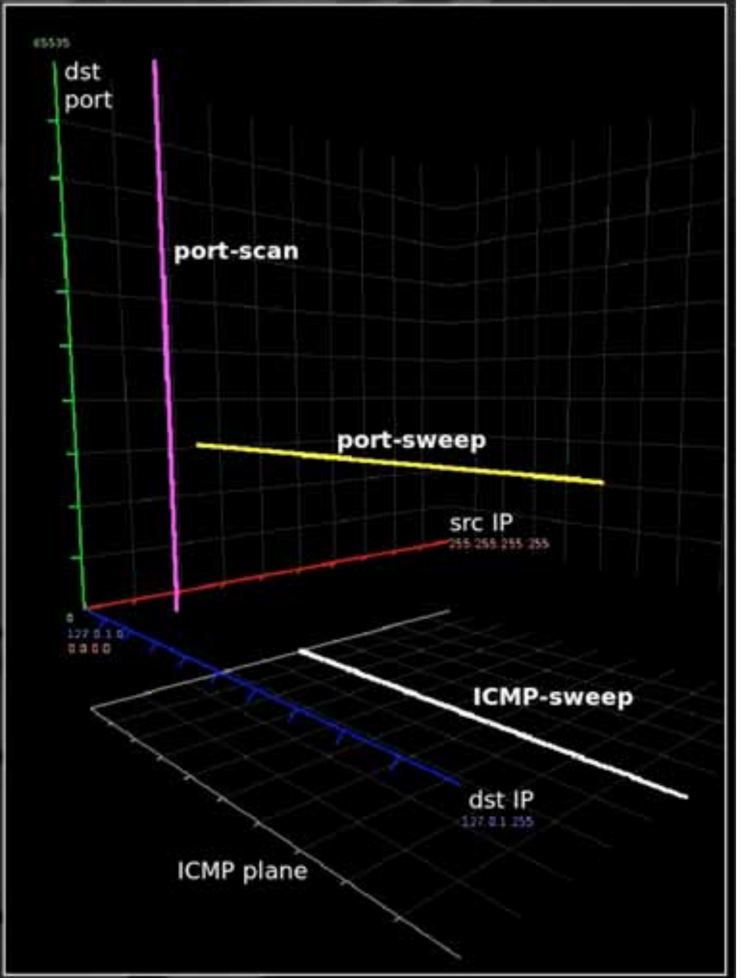


InetVis key features

- Scaling into network and port ranges
- Logarithmic port axis option
- Time-frame control with replay position and time-window
  - Time-window acts as a filter
- Time-scaling (replay rate)
  - Min = 0.001x = 1 millisecond per second
  - Max = 86400x = 1 day per second
- Transparent decay and new event pulse
- Colour schemes and BPF filtering

Conventional scan types

- Generated with nmap
- Colour by protocol
  - TCP, UDP, ICMP
- Port-scans
  - Vertical
  - Targets host
- Address-scans
  - Horizontal
  - Targets network
  - Port-sweep (TCP/UDP)
  - ICMP-sweep



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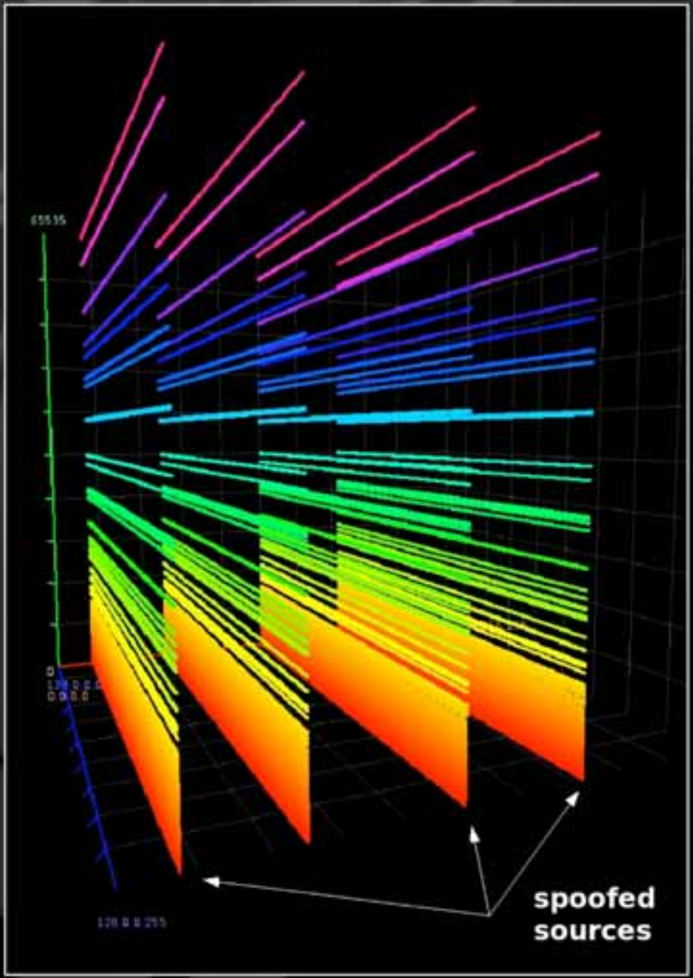
Other types of scans

- 'Grid-sweeps'
  - Combination of port-scan and port-sweep
  - Targets network and hosts for multiple vulnerabilities
- Evasion-techniques
  - Slow
  - Randomized
  - Distributed between sources
  - Spoof multiple sources as decoys



spoofed sources

Network telescope data

- Unallocated/empty address space
  - Class C network telescope (our NetScope)
  - Since August 2005
  - 6.6 million packets captured in 2006 (65% TCP, 20% UCP, 15% ICMP)
- Passive monitoring
  - No responses
  - No connections initiated
- Less traffic to deal with
- Less worry about false positives
- Observations limited to scans and backscatter
  - Address-scans are most common as most port-scans first establish presence of target

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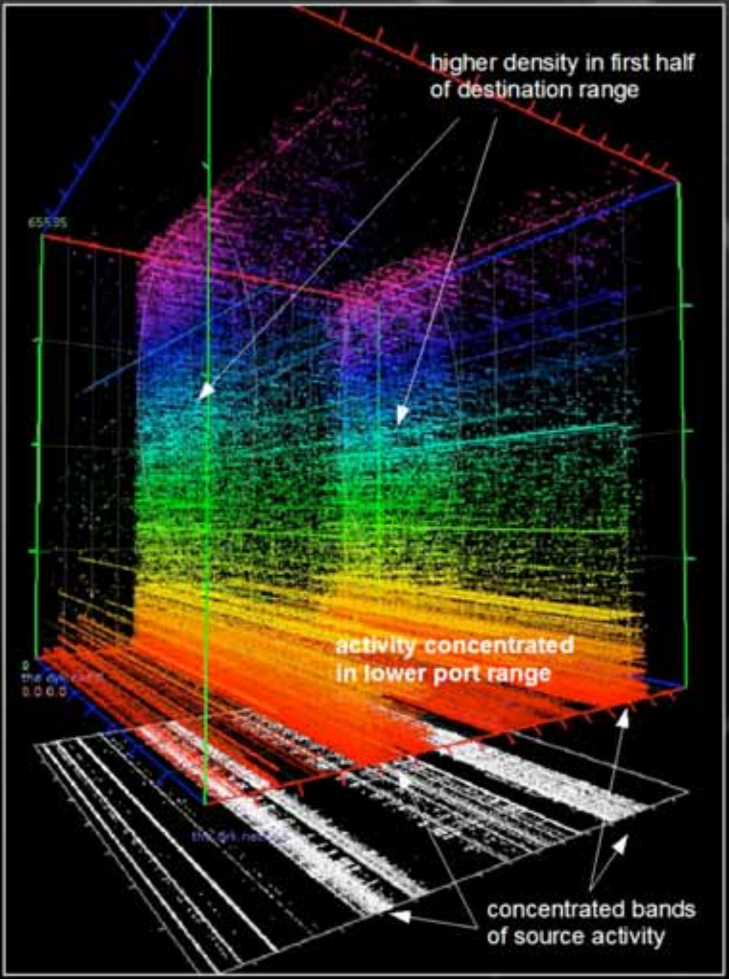
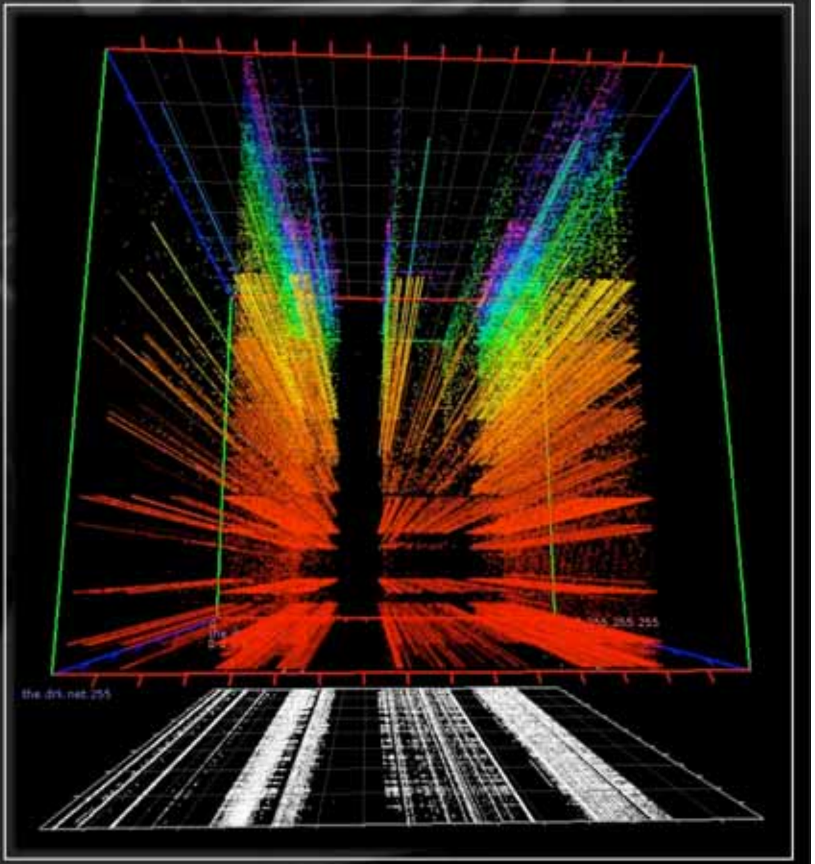
Network telescope data for 2006 visualized



higher density in first half of destination range

activity concentrated in lower port range

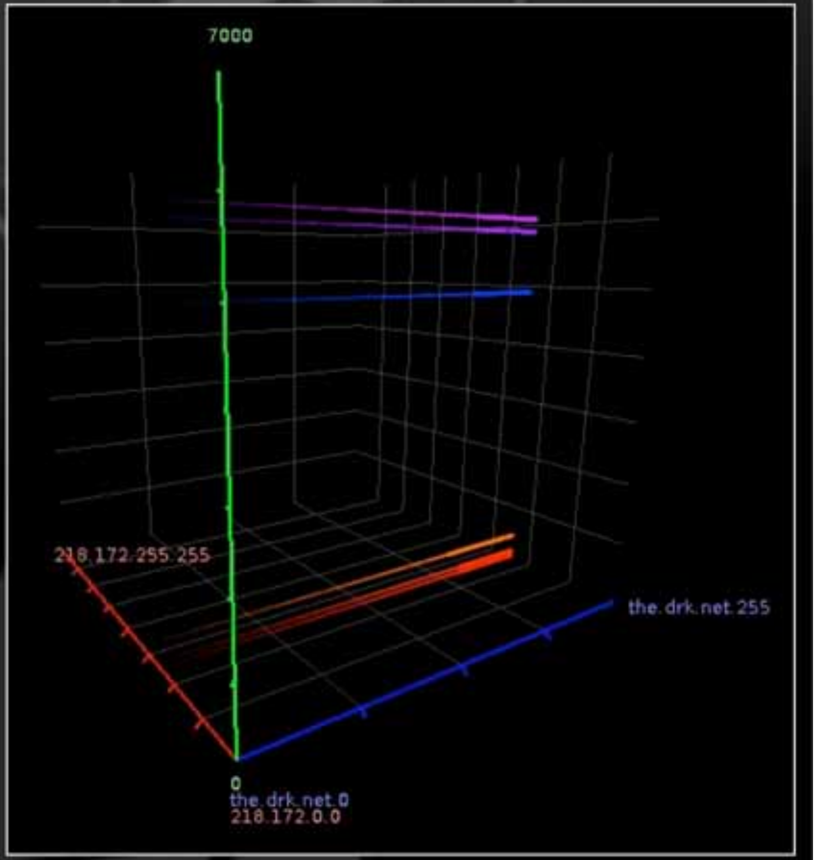
concentrated bands of source activity



Logarithmic plot

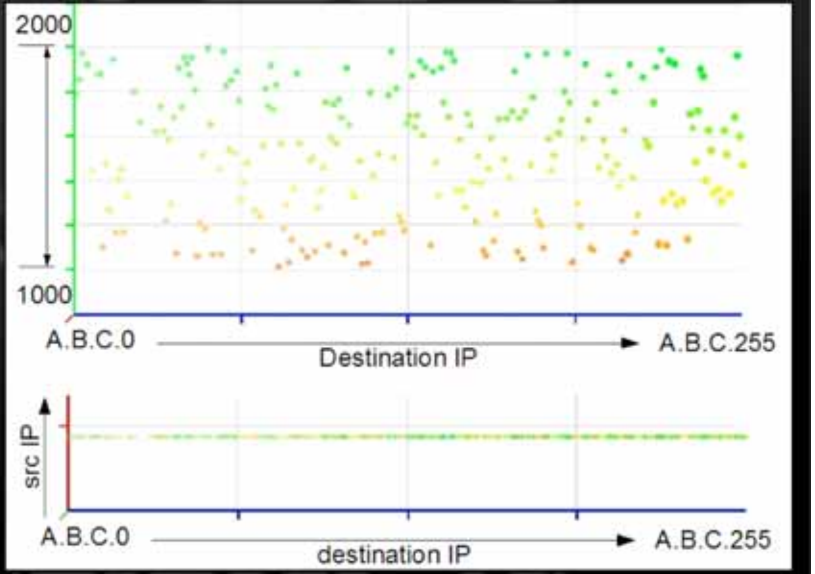
Snort False Negative

- 6 simultaneous port-sweeps
  - All ports have known vulnerabilities
- Snort fails to alert
  - flaw in counting unique destination addresses and ports
- Snort does alert on just one port-sweep



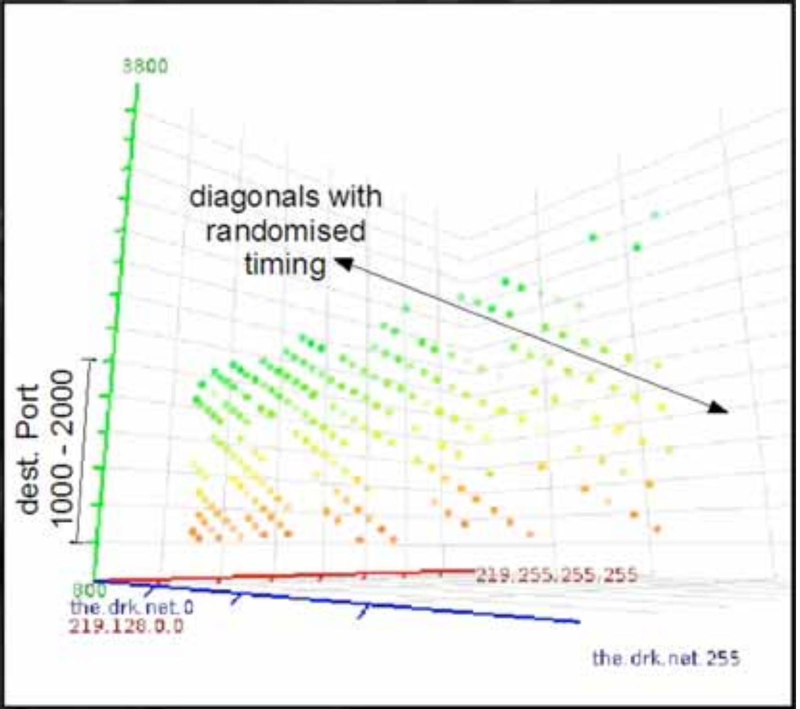
Pseudo-random Patterns – backscatter or stealth scan?

- Scattered between port 1000-2000
- Very rapid (50ms)
- Each packet strikes a unique IP address
- Source port 80 with SYN/ACK flags set
- Pattern can be detected by Bro* as an address scan
- Not detected by Snort



Pseudo-random Patterns – backscatter or stealth scan?

- Also occurs between port 1000 and 2000
- Much slower (36hr)
- Less random, with clear diagonal pattern
- Not every packet hits a unique address



Conclusion (and Future Work)

- Without the insights provided by InetVis, the flaw in the Snort IDS would not have been discovered
- Future work
  - Add scan detection overlay that superimposes detected scans over the backdrop of the raw traffic
  - Evaluate additional scan detection algorithms

Questions?

Barry Irwin

- b.irwin@ru.ac.za
- Project supervisor

Jean-Pierre van Riel

- jp.vanriel@gmail.com
- Final year M.Sc. Student