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CENTRE FOR ADVANCED INTERNET ARCHITECTURES

Dissecting Server-Discovery Traffic Patterns Generated By Multiplayer First Person Shooter Games

Sebastian Zander, David Kennedy, Grenville Armitage

{szander, garmitage}@swin.edu.au

Centre for Advanced Internet Architectures (CAIA)

Swinburne University of Technology

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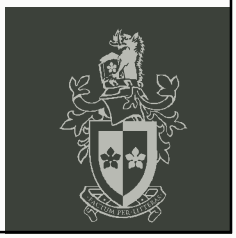


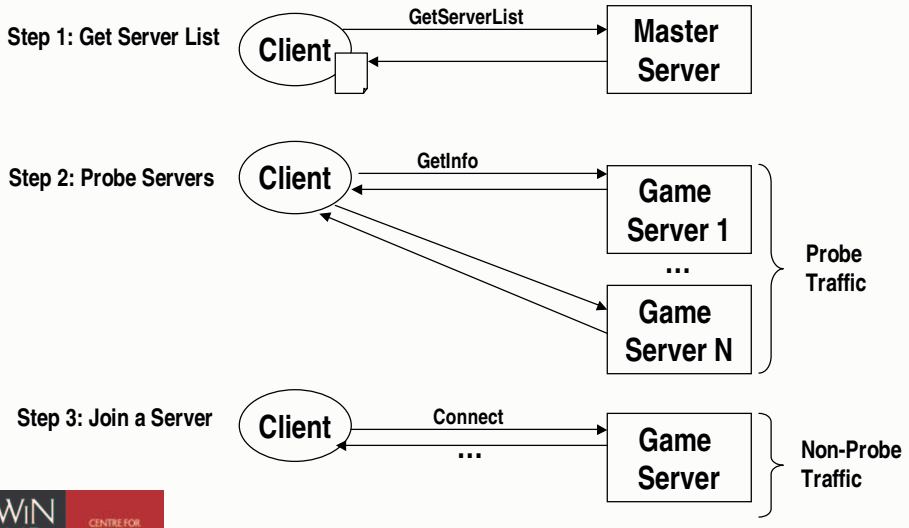
Outline

- Motivation
- Data Collection
- Server-Discovery Traffic Identification
- Analysis
- Improved Server Discovery
- Conclusions and Future Work

Motivation

- First Person Shooters usually based on client server model
- Players need to locate servers and retrieve server information to decide where to play
- Besides the actual game traffic (**non-probe traffic**) there is traffic to locate and query game servers (**probe traffic**)
  - How much probe traffic on typical server?
  - Demographics of probe traffic vs. non-probe traffic?

Motivation Cont'd



Data Collection

- Game: Enemy Territory
  - First person shooter based on Quake 3 engine
  - Team-based with strategic objectives
- Two public (identically configured) game servers
  - **CAIA** server (Melbourne, Australia)
  - **GrangeNet** server (Canberra, Australia)
- Collected traffic flow information over 20 weeks
  - Bidirectional flows
  - Flow key: src IP, src port, dst IP, dst port
  - Flow timeout: 60 seconds
  - Volume (packets, bytes)
  - Packet length, inter-arrival times (min, mean, max, std dev)

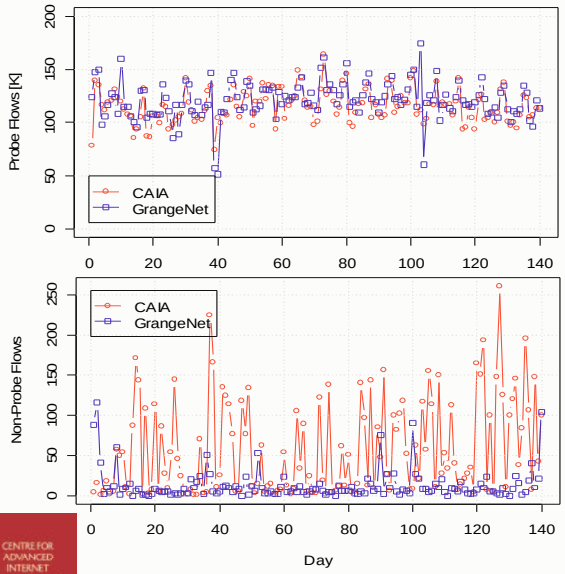
Probe Traffic Identification

- Simple heuristic
  - Packets from server to client < 20
  - Mean inter-arrival time of server to client packets > 500ms
- Based on insights from looking at probe traffic characteristics
- When compared against game server log information there is some error (0.5% of the volume misclassified)

Analysis – Overall Volume

	CAIA		GrangeNet	
	Probe	Non-Probe	Probe	Non-probe
Flows	16.18e6 (99.95%)	7993 (0.05%)	16.93e6 (99.99%)	1757 (0.01%)
Mpackets	36.46 (4.61%)	755.13 (95.39%)	36.94 (25.01%)	110.74 (74.99%)
GBytes	8.18 (6.56%)	116.58 (93.44%)	8.10 (35.75%)	14.56 (64.25%)

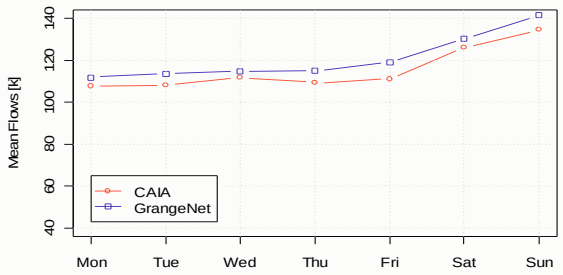
Analysis – Flows over Time



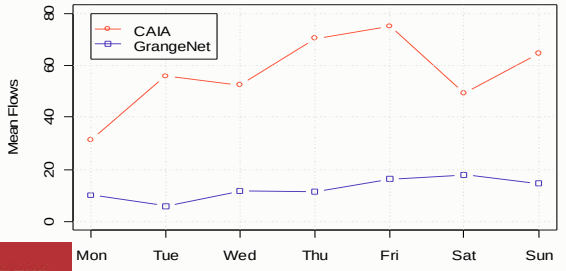
Flow count (10e3) Probe Traffic

Flow count Non-probe Traffic

Analysis – Flows Weekly Pattern



Mean Flows (10e3)
Probe Traffic



Mean Flows
Non-probe Traffic

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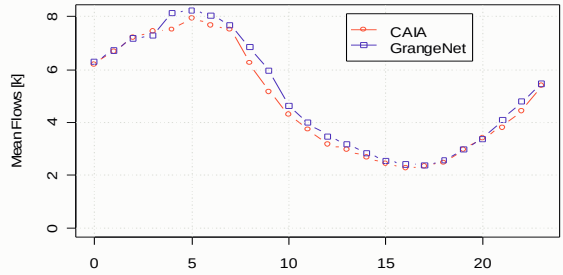
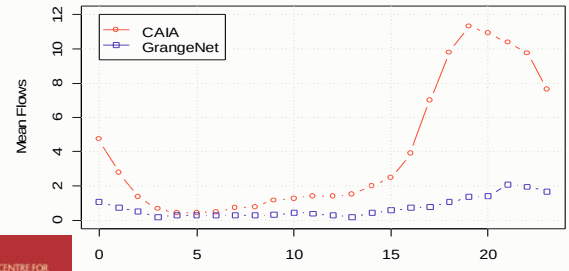
Analysis – Flows Daily Pattern



Mean Flows (10e3)
Probe Traffic



Mean Flows
Non-probe Traffic

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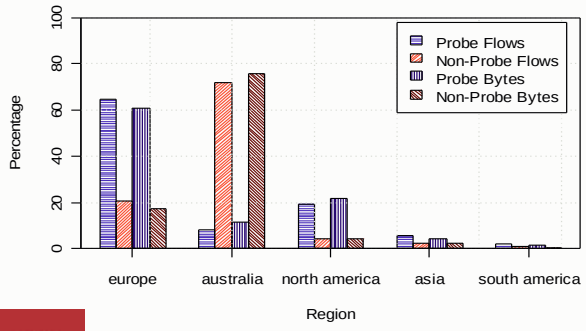
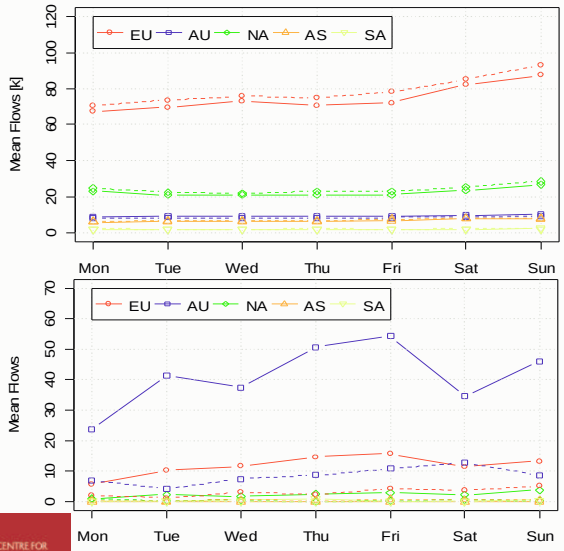
Analysis – Demographics

- Mapped IP addresses to countries using free GeoIP database (claimed 97% accuracy)
- Grouped countries (130+) into geographical regions
- Distribution is very similar for both servers



CAIA server only

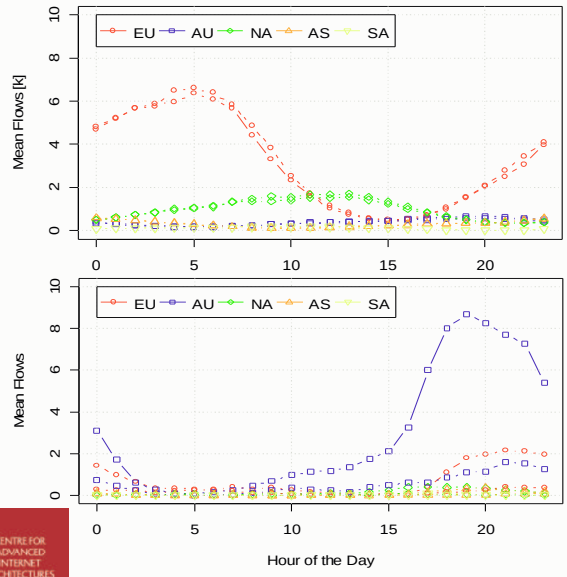
Traffic Analysis – Weekly Again



Mean Flows (10e3) Probe Traffic

Mean Flows Non-probe Traffic

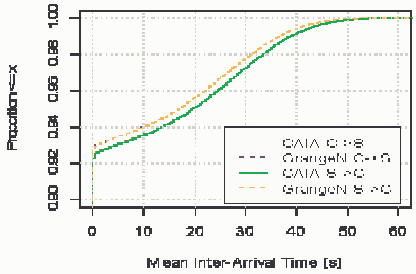
Traffic Analysis – Daily Again



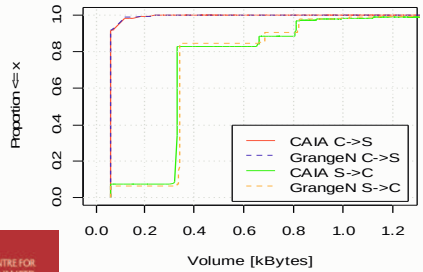
Mean Flows (10e3)
Probe Traffic

Mean Flows
Non-probe Traffic

Analysis – Probe Traffic Characteristics



92% have no inter-arrivals (2-packet flows)



Client-to-server packets are usually 60 bytes
Server-to-client packets are ~330 or ~800 bytes

Improved Server Location

- Distribution of probe traffic depends on order of server list send by master server
- Our data (and some rather unscientific experiments with game client) suggest that the list is not order by location/distance
  - ➢ Unnecessary probe traffic send to servers that players are unlikely to join because of high latency
  - ➢ Players have to wait longer to find suitable (close) servers

Improved Server Location cont'd

- Do not distant servers to client; at least sort server list in order of increasing distance/latency
- Very accurate ordering not required, could just sort by countries or even regions
- How to determine distance?
  - ☐ Clients and servers are configured with their location during installation/configuration
  - ☐ Master server determines locations based on IP addresses
  - ☐ Master server estimates latency between client and servers

Conclusions

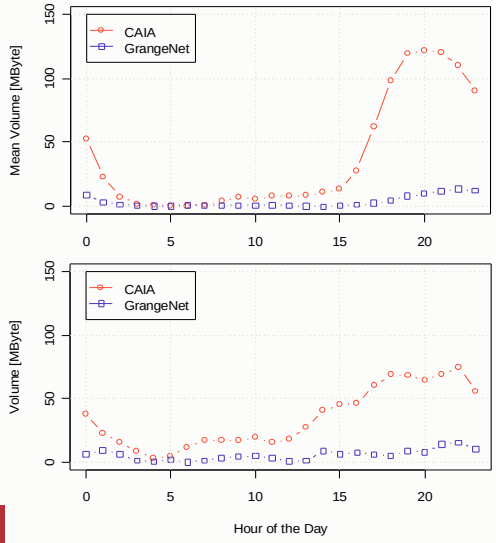
- Amount of probe traffic independent of server popularity → can be significant fraction (7% and 36% on our servers)
- Number of probe flows is very high (99.9% on our servers) → can have significant impact on devices/software that keeps per-flow state
- Geographic origins of probe and non-probe traffic differ greatly
  - Non-probe traffic reflects local player community
  - Probe traffic seems to reveal global player distribution; does not even require popular server!

Future Work

- Compare round-trip times and number of hops of probe and non-probe traffic
- More accurate probe traffic detection based on packet payload
- Study server list distribution and possible performance increase of distance-based ordering
- Study newer games e.g. Half-Life 2
- Real-time player map

Thanks for your attention! Questions?

Analysis – Week vs. Weekend



Monday-Friday

Weekend