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# Game Environments Internet Utilisation Study

<http://caia.swin.edu.au/genius/>

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# GENIUS

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- Game Environments Internet Utilisation Study
  - So what are we trying to do?
    - Play Games?
    - Analyse Networking Gaming Traffic
    - More importantly understand characteristics of this traffic
  - Why?
    - PC Gaming/Video console market is lucrative
    - New opportunities for ISPs to offer services targeted at online game players
- Aims
  - To characterize the 'offered load' introduced by popular online, interactive, real-time games.
  - To gain an understanding of how games interact with networks.

# GENIUS – Focus Areas/Games Studied

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- Focus Areas
  - Short timescale game traffic characteristics
  - Long timescale aggregate usage patterns
  - Game player sensitivity to network characteristics
- Games Studied:
  - Xbox – Halo
  - Quake 3 Arena
  - Half Life – Counter Strike (Soon)

# GENIUS – Xbox (Halo) Traffic

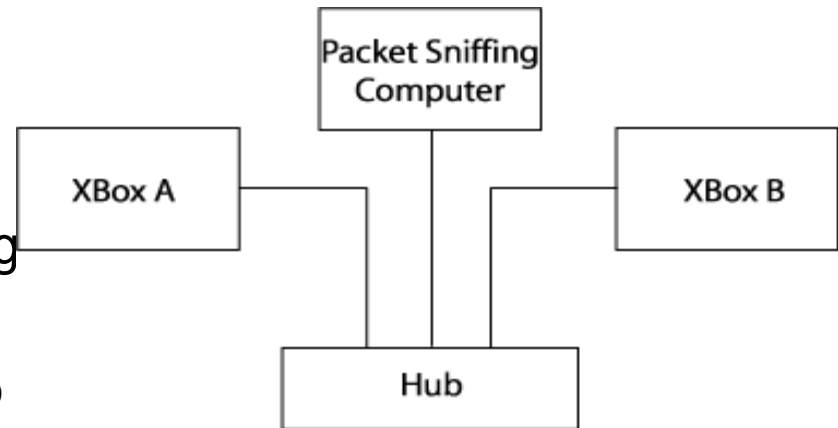
- Preliminary investigation of Xbox in-game network traffic



# GENIUS – Xbox (Halo) Traffic

- **Equipment used**

- 2 Xbox consoles & 2 copies of Halo
- 4 Xbox controllers
- 2 Televisions
- 1 10Mbit/sec Hub
- Packet Sniffing Computer running FreeBSD
  - Running Tcpcmdump and Pkthisto (With some modifications)



# GENIUS – Calibrate Equipment

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- Why?
  - Ensure some level of accuracy in timestamping
- Equipment
  - Netcom System Smartbits 2000 Multiport Port/Stream/Layer Performance Analysis System
  - Tcpdump
    - Timestamp/capture packets
    - Analyse captured traffic.

# GENIUS – Calibrate Equipment

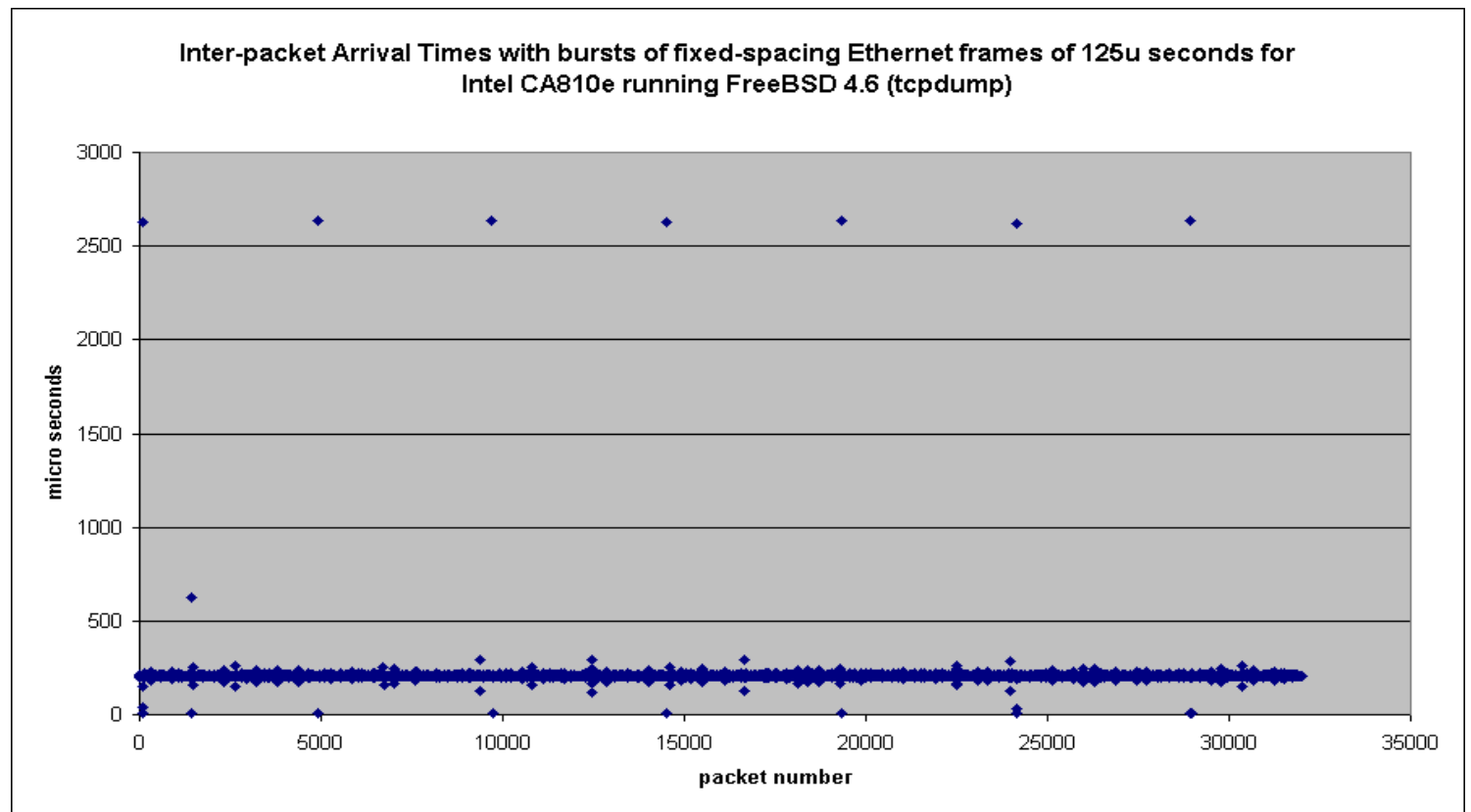
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- Results

- Most lab computer configurations seemed to perform to an adequate level
- Greater variation of interpacket arrivals was present with slower CPU-based machines
- Variation in timestamping between Operating Systems
- **NOTE: Ensure that all configuration changes are noted and tested prior to use for data acquisition**

# GENIUS – Calibrate Equipment

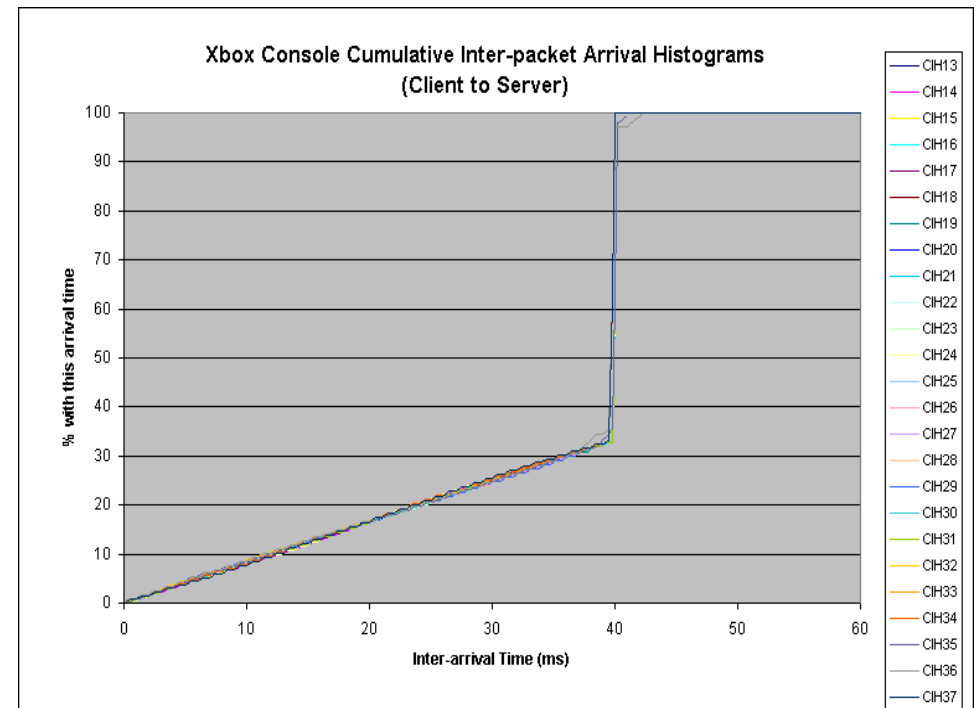
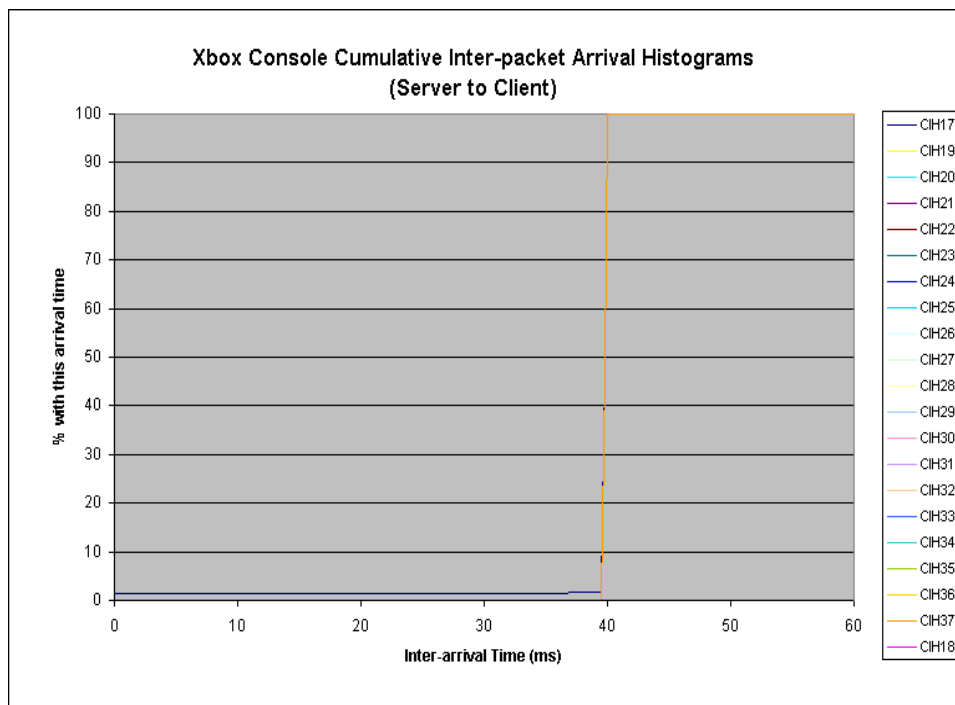
- Results (cont'd)
  - Noticed some peculiar behaviour upon adding a 2<sup>nd</sup> network card to Intel CA810e





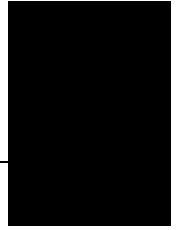
# GENIUS – Xbox (Halo) Traffic

- What did we see?
  - 2 Player Game



# GENIUS – Xbox (Halo) Traffic

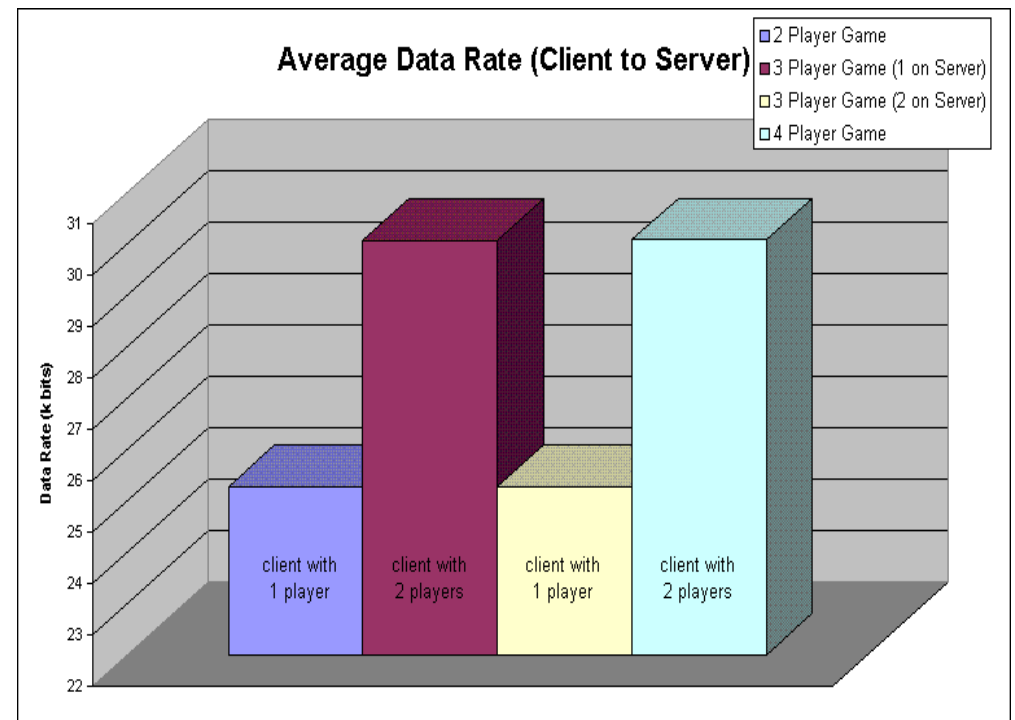
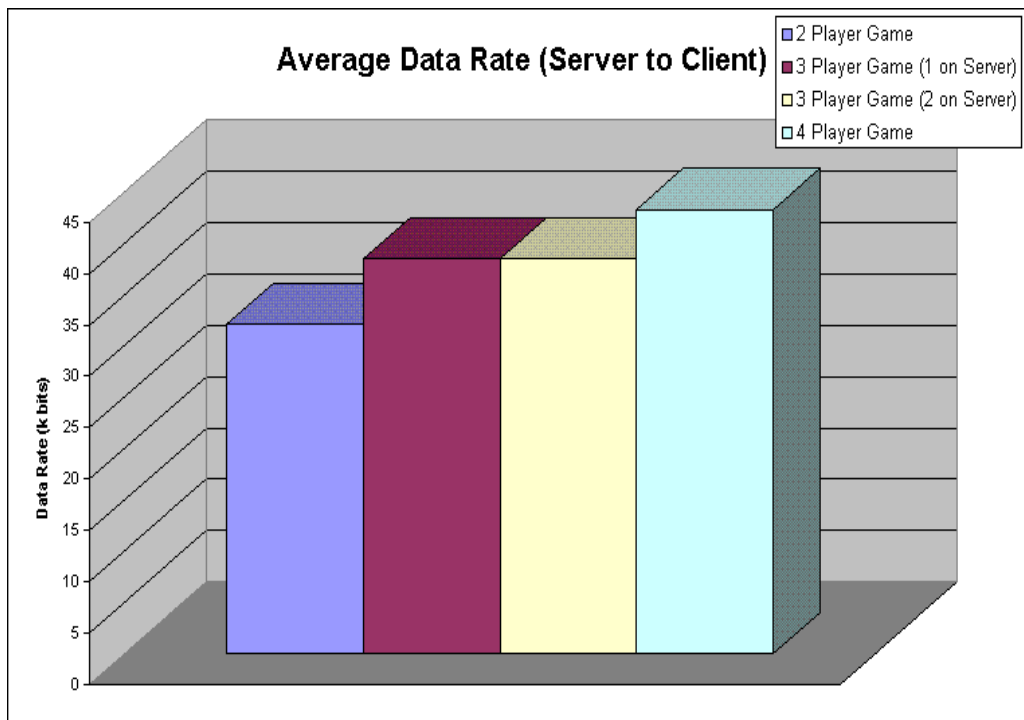
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- What did we see?
  - Similar results for 3 & 4 player games
  - Packet per second rates (Overall)
    - Server to Client: 25 packets per second
    - Client to Server: 30 packets per second

# GENIUS – Xbox (Halo) Traffic

- What did we see?
  - Data Rates (Overall)



# GENIUS – Xbox (Halo) Traffic

- Xbox Traffic Summary

	Server to Client	Client to Server
<b>Inter-packet Arrival Times</b>	On average 40ms	On average 40ms
<b>Packet Lengths</b>	Typically 160, 192 or 216 bytes depending on number of players	Typically 72, 112 or 136 bytes depending on number of players
<b>Packets per second</b>	25 packets per second	30 packets per second
<b>Data Rate</b>	32+ kbit/sec, depending on number of players	25+ kbit/sec, depending on number of players

# GENIUS – Xbox (Halo) Traffic

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- Where to next?
  - Analysing the effects of jitter, packet loss and link latency on game play
  - Routing System Link traffic over public Internet paths
  - Explore traffic patterns by adding a third Xbox

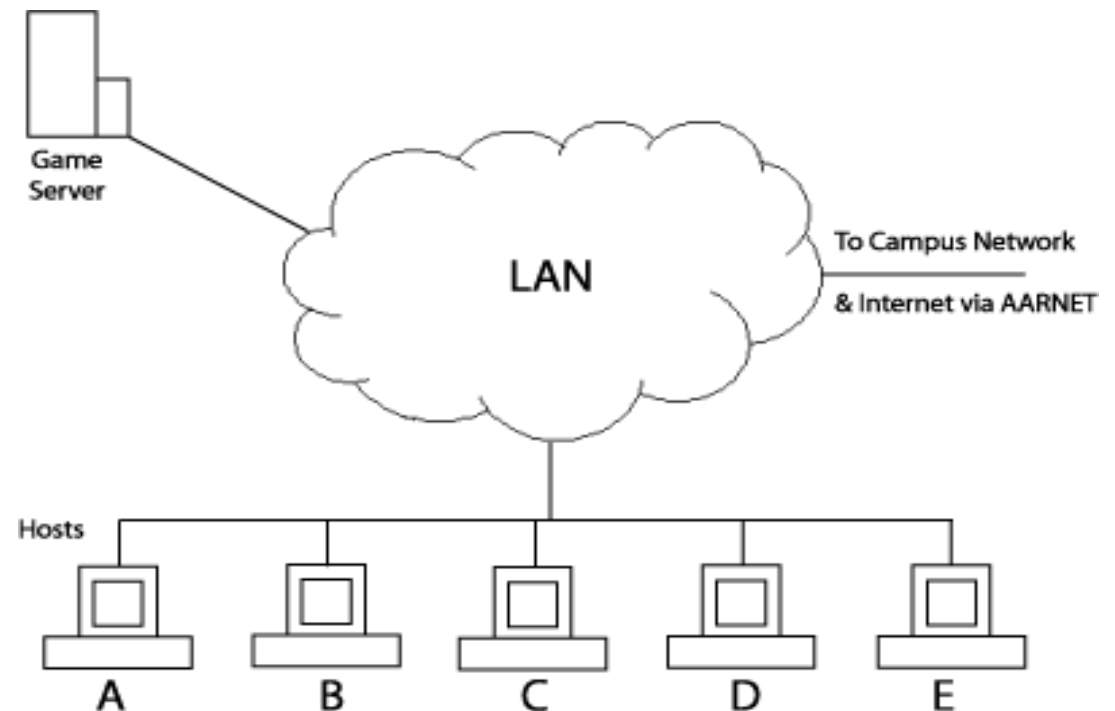
# GENIUS – Quake 3

- Preliminary investigation of Quake in-game network traffic



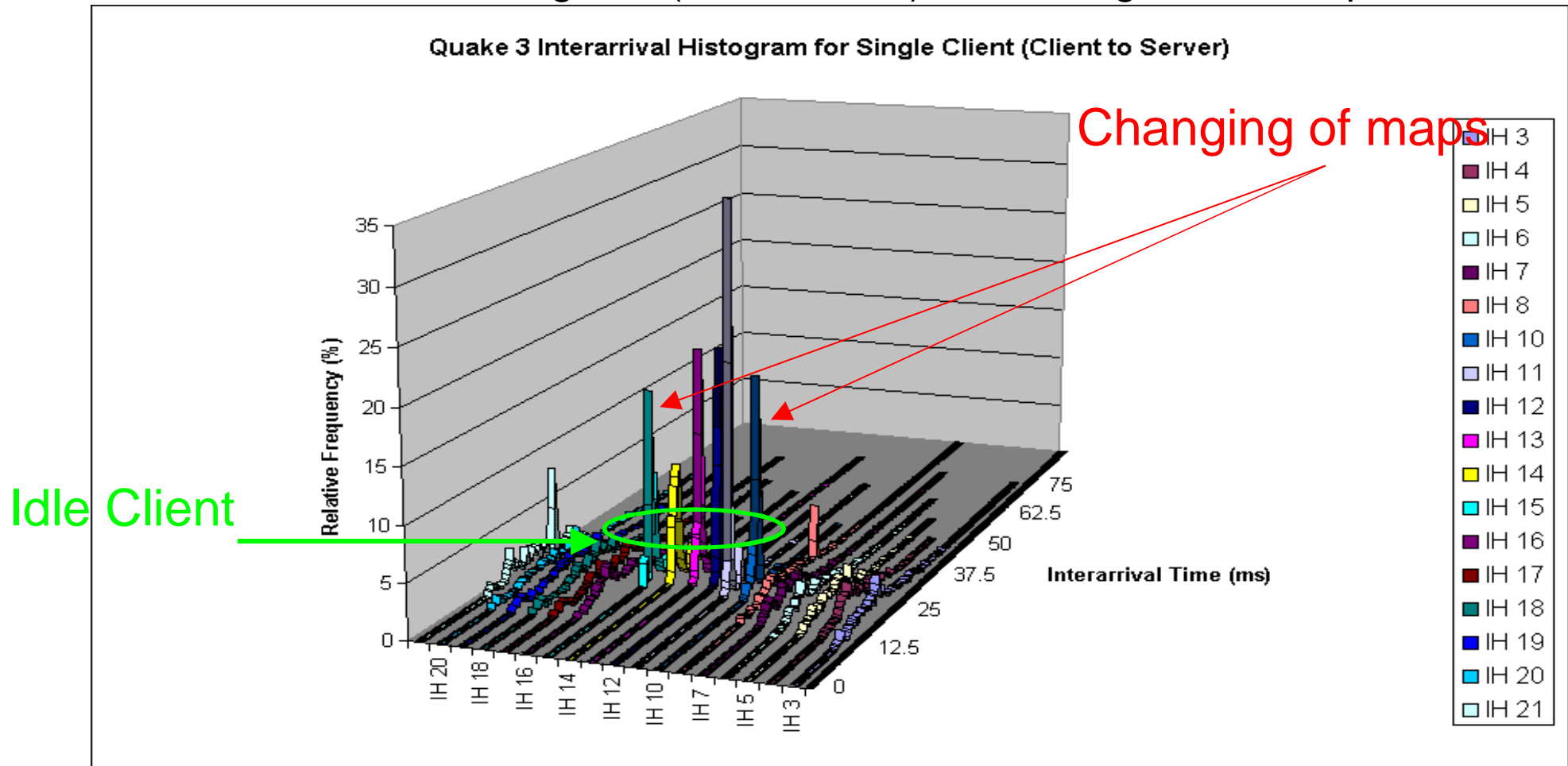
# GENIUS – Quake 3 Traffic

- Traffic captured in LAN environment
- Typically 2 - 5 players 1 hop from the server (~2ms).
- Game Server/Packet Sniffing Computer ([gs.caia.swin.edu.au](http://gs.caia.swin.edu.au))
  - Compaq EVO
  - Quake 3 (v1.31)
  - Pkthisto 0.1.2



# GENIUS – Quake 3 Traffic

- Controlled (Single Client) test sequence performed
  - Illustrates in-game (active & idle) and inter-game traffic patterns





# GENIUS – Xbox (Halo) Traffic

- Quake 3 Aggregate Traffic (at Server)
  - Important to observe because it affects:
    - Network components near server
    - Affects network performance and Internet
  - Traffic Results/Summary

	Server to Client	Client to Server
<b>Inter-packet Arrival Times</b>	Many back-to-back packets (< 100usec) and 50msec  Depending upon number of players	100usec – tens of milliseconds  Upper limit dependent on the number of players
<b>Packet Lengths</b>	mean of 100 bytes	mean of 60 bytes

# GENIUS – Quake 3 Traffic

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- Where to next?

- Look at player sensitivity to jitter, latency and packet loss
- Develop some type of model(s) for traffic seen
  - Useful for identifying & monitoring game traffic on a network
  - Ability to deliver the correct Quality of Service

# GENIUS – Next?

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- Further development of Pkthisto
- Simulating packet latency & loss (Dummynet)
- Half Life – Counter Strike Game Server
- Xbox game play over the Internet

# GENIUS – Special Thanks

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- weasel
- Saucy/Walla Walla
- Frenchy/Unnamed Player
- Stumpy/Inspector Gadget
- StRikeR