

# Avatar Movement in World of Warcraft Battlegrounds

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By John L. Miller and Jon Crowcroft  
Presented at NetGames 2009

# Motivation

- Lots of Online Game / DVE research proposing new message propagation models
- Typically evaluated against synthetic workloads
  - How do these compare to real workloads?
- Most DVE users play World of Warcraft (WoW)
  - Battlegrounds are a tractable, dynamic scenario

# WoW battlegrounds

- Based in a fantasy environment: knights and wizards...
- Avatars organized into two teams: 'factions'
- Compete over resources or objectives
  - Dominate combat and geography
  - Mixtures of melee and spell/missile combat
- Battle duration: ~5 to ~30 minutes
- Battle participants: 10 - 240
- Both sides rewarded, winner > loser

# Arathi Basin Battleground



500 yards

## Scenario

10-30 players

Control stationary flags

First team to 1600 wins

## Movement

7 yards/s Running

14 yards/s Riding

## Interaction

~5 yard Melee range

30 (45) yard Spell  
range

~500 yard visual range

# A Battle Excerpt

- [Battle Excerpt Video](#)
- [Abstracted Moves \(8x speed\)](#)

# Data Acquisition

- Capture data using Windows Network Monitor 3.3
- Custom move extraction library
  - Parse .cap files into TCP payloads
  - Process payloads and extract movement data
  - Output .csv movement trace
- Gather landmark data
  - Join battle, circle around landmarks 😊

# Data Gathering Methodology

- Join battleground with two grouped Avatars
  - Ensures they join the same battleground
- Move to opposite ends of the map, stealth
- Try not to fight or die
  - Team-mates don't like this
- Save resulting capture, filter observers

# Capture statistics

- Analyzed 13 Battles
  - Scores from 1600-0 to 1600-1590
  - Observer team won 6, lost 7
- 392 unique avatars, 456 avatar instances
- Average avatar play interval: 69% of battle
- Average data continuity: 73% of interval



# Analysis

- Expecting:
  - **Hotspots.** Avatars spend most of their time concentrated in a few common areas
  - **Waypoint navigation.** Avatars move along well-defined paths to well-defined destinations
  - **Grouping.** Avatars move together to their destination
    - Avatars start together: this should be a no-brainer

# Hotspots

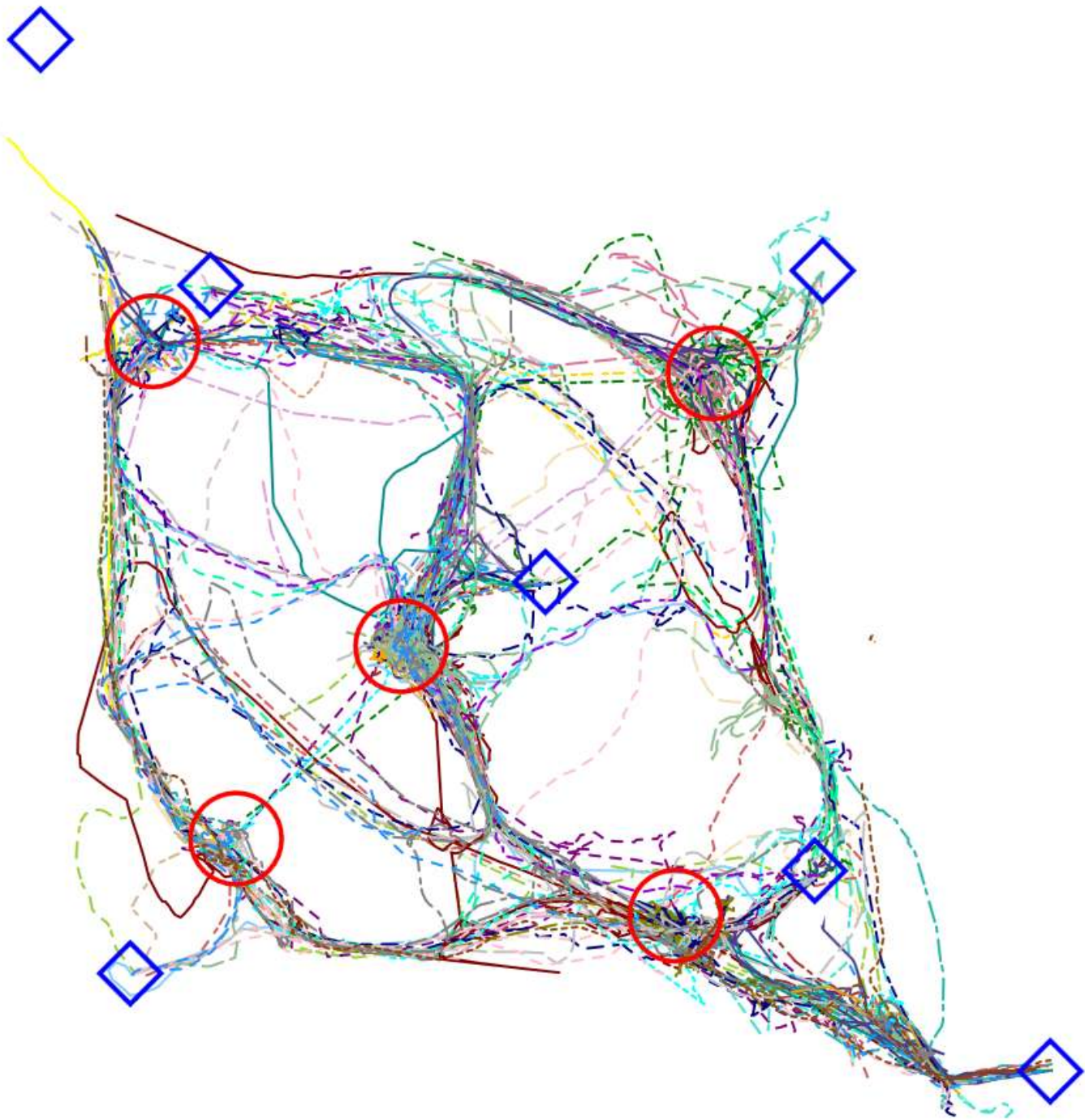
- Determine hotspots by counting seconds spent at each location in the battleground
  - Divide battleground into a grid
  - Sum avatar seconds spent in each cell
  - Cells with highest count are hotspots for that battle
- Hotspots were found where expected, but not in every battle
  - Hotspots typically at flags and graveyards
- Some hotspots on heavy travel paths: ambush!
- Top five hotspots vary battle to battle

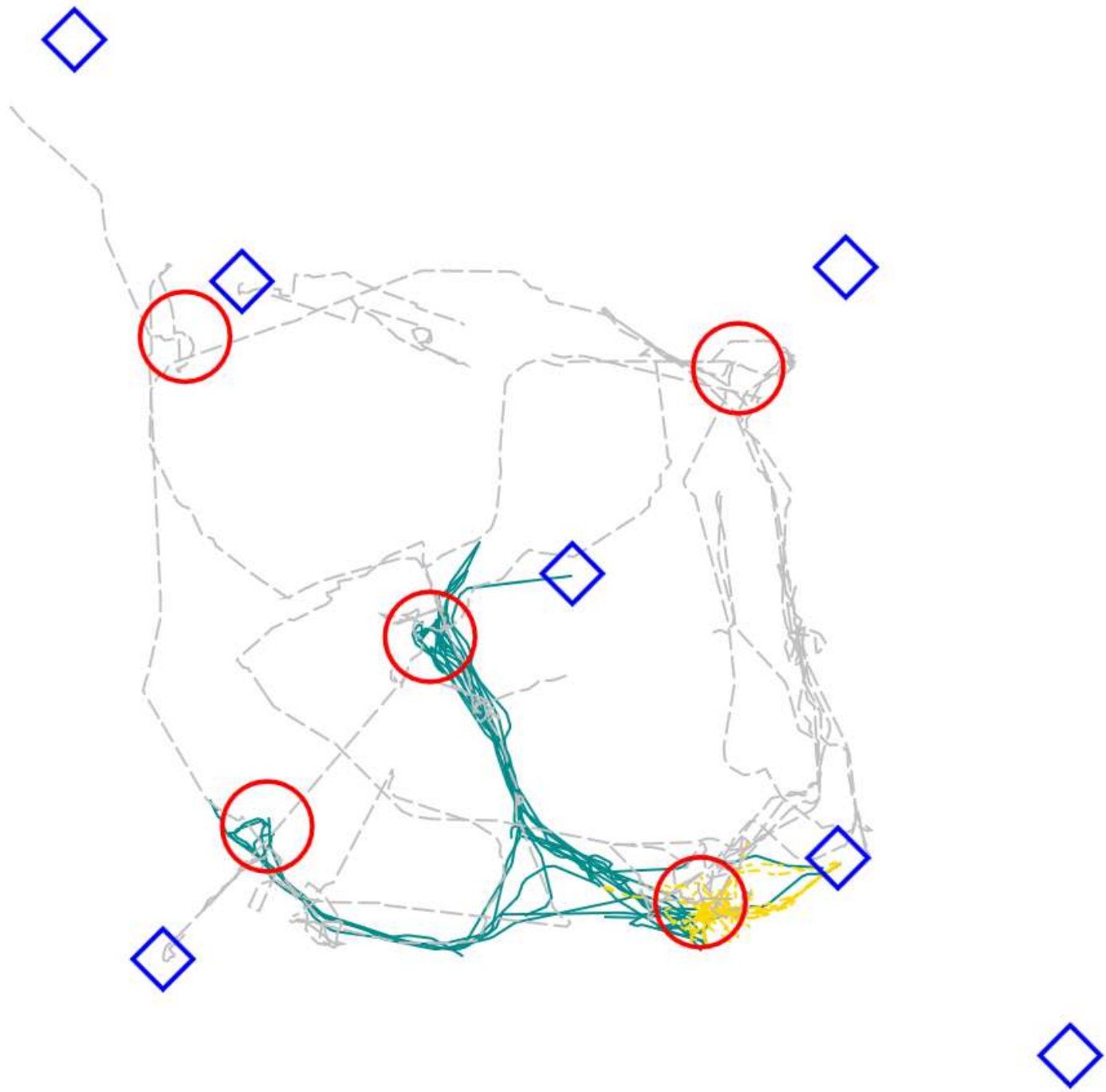
# Two battle hotspot examples



# Waypoint Navigation

- Waypoint movement should follow fixed paths
- Movement geographically constrained
  - Avoid water, which slows to 25% of riding speed
  - Cliffs / hills / rivers channel movement
- We found many paths used between hotspots
  - 'Patrollers' (16% of avatars) follow waypoints
  - 'Guards' (12%) move around a preferred area
  - 'Wanderers' (49%) move throughout the map
  - (23% of avatars observed too little to classify)
- Waypoints useful, but not sufficient

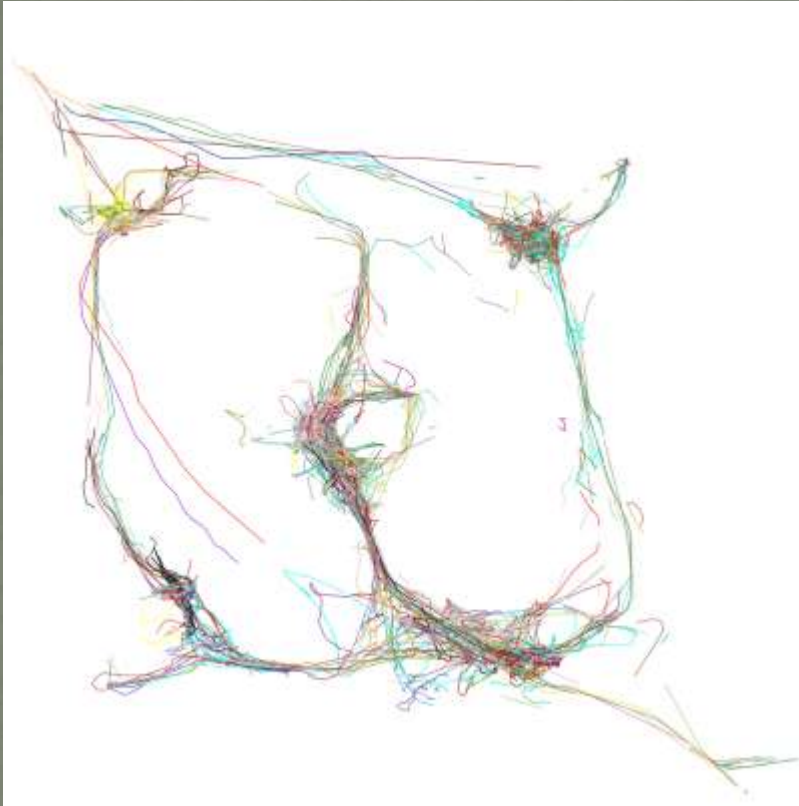




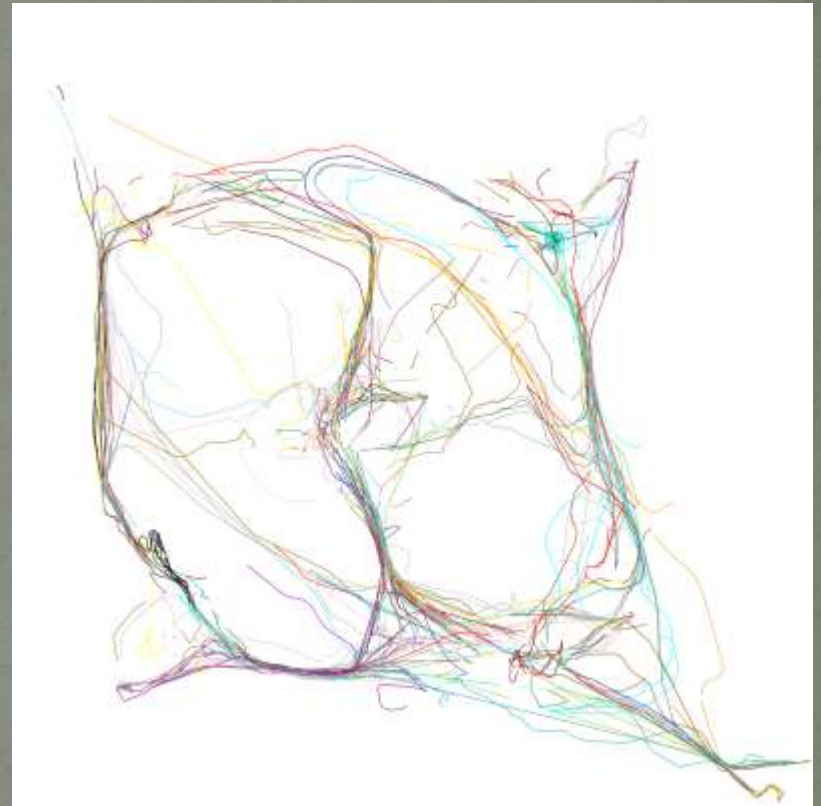
# Group Movement

- Logically, Avatars should stick together
  - They start together, and resurrect together
  - Outnumber the enemy to stay alive
- In fact, they seem to go out of their way NOT to stick together
- Analysis: sum up all player seconds where avatar is within 30 yards of another avatar
  - Ideally, should include movement requirement, but this is a much looser / more generous metric.

# Affinity trace maps



**Affinity Map**



**Non-Affinity Map**



# Conclusions

- Existing Avatar movement models insufficient
  - Hotspots useful, but not consistent
  - Waypoints useful for a (small) subset of avatars
  - Grouping / flocking useful for a minority of avatars
- A new synthetic movement model is needed
  - In the meantime, use real data

# Backup

# Related work

- Pittman / GauthierDickey: “Measurement Study of Virtual Populations” (WoW Census+)
- Suznjevic et. al. “Action specific MMORPG traffic analysis: Case study of World of Warcraft”
- Svoboda et. al. “Traffic Analysis and Modeling for World of Warcraft” (mobile packet traces)
- Thawonmas et. al. “Detection of Landmarks for Clustering of Online-Game Players” (ICE / Angel’s Love)
- Chen and Lei – “Network game design: hints and implications of Player Interaction” (ShenZou network traces)
- La and Michiardi – “Characterizing user mobility in second life”
- Liang et al. – “Avatar Mobility in Networked Virtual Environments: Measurements, Analysis, and Implications” (second life)

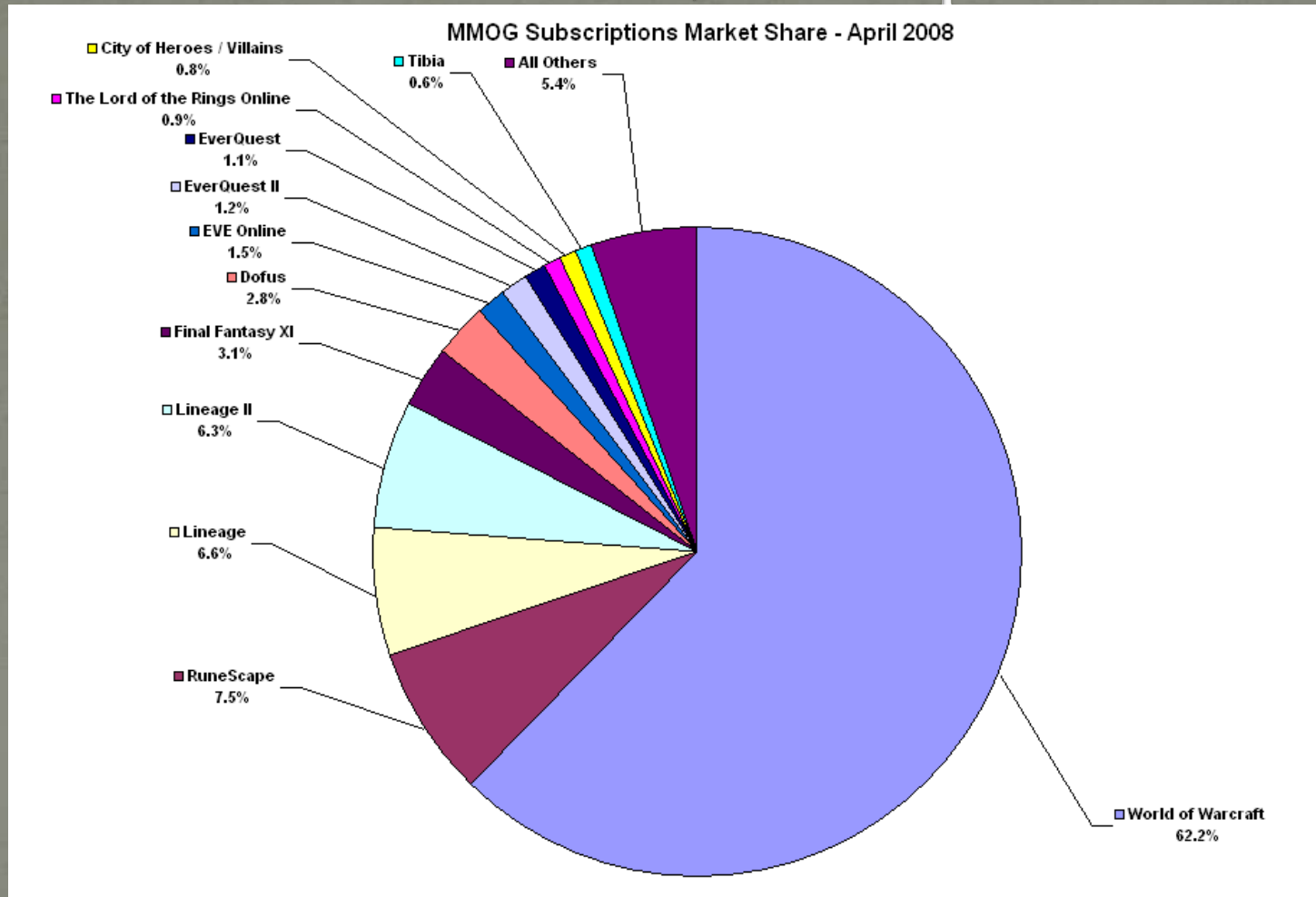
# Future Work

- Further analysis of network traces
  - Message attribution
- Simulate proposed DVE architectures
  - Client-server, application-layer multicast, mesh
  - Aggregation / per message transmission
- Capture Wintergrasp data
  - Most challenges are practical, not technical
- Contact me for access to anonymized traces:  
*[johnmil@microsoft.com](mailto:johnmil@microsoft.com)*

# WoW Battlegrounds

Battleground	Players	Type
Warsong Gulch	20	Flag Capture
Arathi Basin	30	Territory
Alterac Valley	80	Kill the General
Eye of the Storm	30	Territory + Flag Capture
Strand of the Ancients	30	Assault
Isle of Conquest	80	Kill the General
Wintergrasp	240	Assault

# Wow Market Share, ca. April 2008



Source: [www.mmogchart.com/Chart7.html](http://www.mmogchart.com/Chart7.html) (Bruce Woodcock)