SECURITY AND PRIVACY AND VIRTUAL WORLDS

NIS '09

17TH SEPTEMBER, 2009

PROF. RICHARD A. **BARTLE**

UNIVERSITY OF ESSEX, UK

INTRODUCTION

- VIRTUAL WORLDS HAVE THE **SAME** SECURITY PROBLEMS THAT **OTHER** ONLINE SERVICES HAVE
  - DENIAL OF SERVICE, DATABASE INJECTIONS, PHISHING, DIRECT ACCESS, BACKDOORS, VIRUSES, TROJANS, ...
  - THE STUFF **OTHER** TALKS HAVE EXPLAINED IN DETAIL
- HOWEVER, THEY **ALSO** HAVE THEIR OWN **PARTICULAR** ISSUES
- THIS TALK CONCERNS THESE **SPECIFIC** ISSUES, AND HOW THE INDUSTRY **ADDRESSES** THEM
  - OR **DOESN'T**...

WHAT ARE VWS?

- WELL, HERE'S WHAT THEY LOOK LIKE TODAY:



- WORLD OF WARCRAFT, BLIZZARD, 2004

DEFINITION

- VIRTUAL WORLDS ARE **PLACES** WITH THE FOLLOWING PROPERTIES:
  - PLAYERS REPRESENT INDIVIDUALS "IN" THE VIRTUAL WORLD (THEIR **CHARACTER** OR **AVATAR**)
  - INTERACTION TAKES PLACE IN **REAL TIME**
  - THE WORLD IS **SHARED**
  - THE WORLD IS **PERSISTENT**
  - THE WORLD HAS AN AUTOMATED **PHYSICS**
- **ALL** OF THESE PROPERTIES **MUST** BE PRESENT
  - OH, PLUS ONE OTHER: THEY'RE **NOT** REALITY

LEISURE TIME

- PEOPLE WHO PLAY VIRTUAL WORLDS DO SO FOR SEVERAL **HOURS** A DAY
  - DAY AFTER DAY
    - MONTH AFTER MONTH
      - YEAR AFTER YEAR...
  - I HAVE PLAYERS FOR MY **OWN** GAME THAT ARE STILL THERE AFTER **TWO DECADES**
- THE **AVERAGE** PLAYING TIME EXCEEDS **20 HOURS** PER **WEEK**
  - YES, **AVERAGE**, AND YES, PER **WEEK**!

STATS

- THEY DON'T JUST SPEND **TIME**, THEY SPEND **MONEY**
- TWO BUSINESS MODELS PREDOMINATE:
- **SUBSCRIPTION**
  - PAY ~**$15** A **MONTH** TO PLAY
  - *WORLD OF WARCRAFT* HAS 11,500,000 SUBSCRIBERS
- **FREE**
  - **PLAY** IS INDEED FREE BUT THE IN-WORLD **STUFF** YOU BUY FROM THE DEVELOPER **ISN'T**
  - *MU ONLINE* HAS 56,000,000 PLAYERS

PARADIGMS

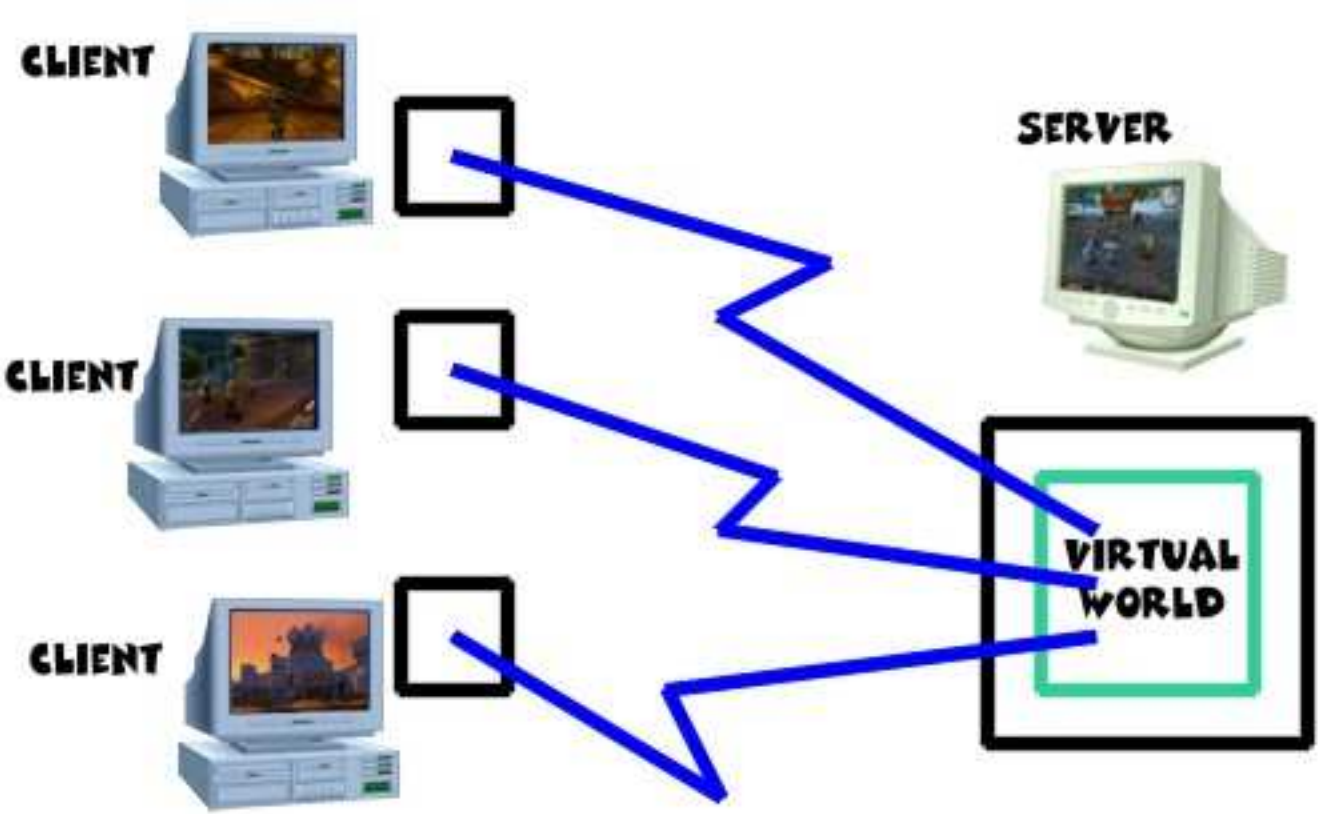
- THERE ARE ALSO TWO MAIN **PARADIGMS**
  - BOTH FACE THE SAME **SECURITY** THREATS, BUT WITH DIFFERENT **EMPHASIS**
- **GAME** WORLDS, OR **MMOS**, HAVE GAMEPLAY BUILT INTO THEIR **FABRIC**
  - *WORLD OF WARCRAFT, EVERQUEST, EVE ONLINE, ...*
- **SOCIAL** WORLDS HAVE **NO** BUILT-IN GAMEPLAY
  - *SECOND LIFE, HABBO, THERE, CLUB PENGUIN, ...*
- GAME WORLDS ARE **VASTLY** MORE POPULAR AND PROFITABLE, SO ARE **TARGETED** MORE

ARCHITECTURES

- THERE ARE (YET AGAIN) **TWO** MAIN **ARCHITECTURES** FOR VIRTUAL WORLDS
- **SHARDED** WORLDS RUN MULTIPLE INDEPENDENT **COPIES** OF THE WORLD AT ONCE
  - *WORLD OF WARCRAFT* HAS **~1,000** OF THESE, EACH HANDLING 5,000-10,000 PLAYERS
- **SINGLE-SHARD** WORLDS HAVE JUST **ONE** COPY OF THE WORLD, WHICH ALL PLAYERS ACCESS
  - *SECOND LIFE* AND *EVE ONLINE* USE THIS APPROACH

CLIENT/SERVER

- BOTH USE A CLASSIC **CLIENT/SERVER** APPROACH
  - (ACTUALLY, MULTIPLE SERVERS USING 5-10 COMPUTERS EACH)



PROBLEM AREAS

- THAT WILL HAVE TO DO AS AN EXPLANATION AS TO WHAT VIRTUAL WORLDS **ARE**...
  - SO, WHAT SPECIAL **SECURITY** AND **PRIVACY** PROBLEMS DO THEY HAVE?
- **SECURITY** FALLS INTO **FIVE** MAIN AREAS:
  - CHEATING
  - REAL-MONEY TRADING (RMT)
  - GRIEFING
  - PIRACY (YES, REALLY)
  - "OTHER"
- I'LL GO THROUGH THESE **ONE BY ONE**...

21 PCS

- FOR SALE ON EBAY 3 OR 4 YEARS AGO



CHEATING

- CHEATING IS **KNOWINGLY** BREAKING THE **RULES** OF THE GAME WHILE PROFESSING TO **ABIDE** BY THEM
- IT'S **BAD** BECAUSE IT MAKES NON-CHEATERS **LEAVE**
- PEOPLE WHO DON'T **KNOW** THEY'RE CHEATING **AREN'T**, BUT **LOOK** LIKE THEY ARE
- HOWEVER, THEY WILL USUALLY **CONFORM** TO THE RULES ONCE THESE HAVE BEEN FULLY **EXPLAINED** TO THEM

RULE TYPES

- RULES FOR TRADITIONAL GAMES ARE OF **THREE** KINDS:
  - **UNWRITTEN**, BUT IMPOSED BY **PHYSICS**
    - YOU CAN'T PUT ALL YOUR PIECES ON ONE SQUARE IN CHESS BECAUSE THEY **DON'T FIT**
  - **WRITTEN**
    - KINGS CAN MOVE **1** SQUARE IN ANY DIRECTION
  - **UNWRITTEN**, IMPOSED BY SOCIAL **NORMS**
    - "WILL YOU **STOP** HUMMING? I'M TRYING TO **THINK** HERE!"

PROBLEM

- WITH COMPUTER GAMES, THE FIRST TWO KINDS OF RULE ARE OFTEN **CONFLATED**
  - IN **COMPUTER** CHESS, YOU CAN'T PUT ALL YOUR PIECES IN ONE SQUARE **OR** MOVE YOUR KING 2 SQUARES BECAUSE THE **CODE** WON'T LET YOU
- LEADS TO BELIEF THAT IF THE GAME **LETS** YOU DO IT, YOU'RE **ALLOWED** TO DO IT
- BUT NOT **ALL** WRITTEN RULES **CAN** BE CODED
  - NOT A PROBLEM FOR SINGLE-PLAYER
  - **MANAGEABLE** FOR MULTI-PLAYER
  - LARGE **HEADACHE** FOR MASSIVELY MULTIPLAYER

WAYS TO CHEAT

- THERE ARE **MANY** WAYS TO CHEAT, BUT SOME DO MORE **DAMAGE** THAN OTHERS
- MOST OF THE **NUISANCE** ONES CAN BE DEALT WITH BY CUSTOMER SERVICE
  - TYPICALLY BY **BANNING** ACCOUNTS FOR A WHILE
- **SURPRISINGLY**, NOT ALL OF THE MOST WORRYING METHODS TARGET **CODED** RULES
  - SOME TARGET **UNCODED** RULES
- I'M NOW GOING TO GO THROUGH THE TOP **5**
  - IN NO PARTICULAR ORDER...

1. HACKED CLIENT

- YOU HAVE CONTROL OF THE **SERVER**, BUT "THE **CLIENT** IS IN THE HANDS OF THE **ENEMY**"
- IF **ANY** GAMEPLAY-SIGNIFICANT DECISIONS ARE MADE IN THE CLIENT, THEN ATTACKS ON IT OR THE NETWORK **WILL** BE MADE
  - THE CASE OF *AIR WARRIOR*
- **GUARDIAN** PROGRAMS CAN HELP, BUT:
  - THEY CAN **THEMSELVES** BE HACKED
  - THEY MAY **INTERFERE** WITH **OTHER** DEFENSIVE SOFTWARE (*EG.* BLIZZARD *V* SONY)

2. NON-INVASIVE

- THIS INVOLVES HACKER **TECHNIQUES**, BUT DOESN'T **CHANGE** DATA OR RESULTS
- VULNERABILITY: THE CLIENT NEEDS TO KNOW **MORE** THAN THE PLAYER, READY FOR WHEN THE PLAYER **DOES** NEED TO KNOW IT
- THEREFORE, YOU CAN EXAMINE MEMORY/PACKET STREAMS AND DISPLAY THIS **EARLY**
- GIVES A KIND OF **RADAR**
  - *SHOWEQ*
- THIS IS THE MMO **EQUIVALENT** OF WALLHACKS AND BOBBLEHEADS IN FPS

3. BOTS

- **BOTS** ARE PROGRAMS THAT **PLAY** THE VIRTUAL WORLD IN THE PLAYER'S STEAD
- AGAIN, MORE POPULAR IN **GAME** WORLDS THAN IN **SOCIAL** WORLDS
- USED FOR **REPETITIVE** TASKS
  - "A RESPONSE TO BAD GAMEPLAY"
  - WELL, BAD FOR **YOU** – IN WHICH CASE, THE CORRECT RESPONSE IS **DON'T PLAY**
- DETECTION CAN **ALSO** BE AUTOMATED
  - FOLLOWED BY CAPTCHA-LIKE CHECKING
  - *ULTIMA ONLINE*, 21 PCS AND COLOURED STICKS

4. PRIVILEGED USERS

- THE **THREAT** FROM **WITHIN**
  - PEOPLE WHO WORK FOR THE **DEVELOPER** OR THE **OPERATOR**
- SOME OF THESE PEOPLE **USE** THEIR PRIVS TO GAIN AN **ADVANTAGE** AS **PLAYERS**
  - THIS HAPPENED IN *EVE ONLINE*
- SOME JUST DO IT TO MAKE **MONEY**
  - THIS HAPPENED IN *ULTIMA ONLINE*
- PLAYERS ARE **LIVID** WHEN THEY FIND OUT
  - YET IT **STILL** GOES ON

5. BUGS & EXPLOITS

- A **BUG** MEANS A FAILURE IN **CODE**; AN **EXPLOIT** MEANS A FAILURE IN **DESIGN**
- FORMALLY, ONLY THE **DESIGNER** CAN SAY IF SOMETHING IS AN **EXPLOIT** OR A **FEATURE**
  - USUALLY, THOUGH, IT'S **OBVIOUS**
  - THE **MAGIC AXE** EXAMPLE
- WORST PROBLEMS ARE DUPE BUGS
  - CAN **TRASH** A VIRTUAL WORLD **OVERNIGHT**
  - IF THE VIRTUAL WORLD HAS **CONVERTIBLE** CURRENCY, COULD BE **FATAL**

WHY CHEAT?

- IF WE KNOW **WHY** PEOPLE CHEAT, IT COULD SUGGEST WAYS TO **STOP** THEM CHEATING:
  - **EGO** ISSUES
    - TO APPEAR TO BE **BETTER** THAN THEY REALLY **ARE**
  - **FRUSTRATION**
    - THE GAMEPLAY IS TOO **HARD** OR **BORING**
  - **FAIRNESS**
    - EVERYONE **ELSE** IS CHEATING
  - FOR **NON-GAME** REASONS
    - TO SELL **VIRTUAL** MONEY FOR **REAL** MONEY
- WHICH **CONVENIENTLY** BRINGS US TO...

ACTUALLY, FIRST...



- DEAD GNOMES IN *WORLD OF WARCRAFT*

RMT

- THE **SECOND** OF THE PROBLEM AREAS FOR VIRTUAL WORLD SECURITY IS **RMT**
  - AGAIN, MAINLY A **GAME** WORLD ISSUE
- BECAUSE **SOME** PEOPLE **WANT** TO CHEAT, **OTHER** PEOPLE WILL OFFER SERVICES TO **HELP** THEM CHEAT
  - AT A **PRICE**
  - A BIT LIKE **DRUGS** IN **SPORT**
- RMT IS THE **PRESSURE** BEHIND MOST **OTHER** SECURITY PROBLEMS FOR MMOS

WHAT IS RMT?

- RMT IS USING **REAL** MONEY TO BUY **VIRTUAL** GOODS OR SERVICES
  - CURRENCY ("GOLD") AND POWER-LEVELLING
- MOST MMOS **DISALLOW** IT
  - IF IT WERE **HARMLESS**, THE DEVELOPER WOULD PROVIDE THE GOODS AND SERVICES FOR **FREE**
  - THIS MAKES DOING IT A FORM OF **CHEATING**
- PLAYERS **DO** DO IT, ALL THE SAME
  - EVEN WHEN THERE ARE SERVERS WHERE IT **IS** ALLOWED, THEY **STILL** DO IT ON THE OTHER ONES

SIDE-EFFECTS

- RMT ALSO HAS SOME **UNPLEASANT** SIDE-EFFECTS ON THE GAME EXPERIENCE
- **FARMING** GROUNDS CAN BE EFFECTIVELY **OFF LIMITS** TO NON-FARMERS
  - ADENA FARMERS IN *LINEAGE*
  - **CAMPING** IN *EVERQUEST*
    - IF YOU **WANT** IT, YOU HAVE TO BUY IT FROM **US**
- THE RMT INDUSTRY ATTRACTS PEOPLE WITH **FEW** SCRUPLES
  - THEY WILL **REGULARLY** RIP PEOPLE OFF
  - **BIG** DRAIN ON CUSTOMER SERVICE **~40%**

FURTHERMORE

- FARMERS WILL:
  - ACQUIRE YOUR **ACCOUNT** ID AND **PASSWORD**
    - KEYLOGGERS, PHISHING
  - STRIP YOUR CHARACTERS BARE OF **EVERYTHING**
  - TRANSFER THE PROCEEDS TO A LEVEL 1 **MULE**
  - LEAVE YOU **NAKED** AND **DESTITUTE**
- ON THE **BLACK MARKET**:
  - COST OF A STOLEN CREDIT CARD'S DETAILS: $6
  - COST OF A STOLEN *WOW* ACCOUNT'S DETAILS: $10
- NOW, BLIZZARD SELLS A *WOW* **DONGLE**

IT GETS WORSE!

- IN AN EFFORT TO **LEGITIMISE** RMT SO AS TO SAVE ON **CUSTOMER SERVICE** COSTS, SONY SET UP TWO *EQ2* SERVERS THAT CUT OUT THE **MIDDLE** MAN
  - SONY ACTED AS **HONEST BROKER**
- HERE'S WHAT HAPPENED
  - FARMER **BUYS** VIRTUAL GOODS FROM SONY
  - SONY PASSES MONEY TO **SELLER**
  - FARMER **SELLS** THE GOODS TO SOMEONE ELSE
  - SONY PASSES MONEY TO **FARMER**
  - FARMER ISSUES **CHARGEBACK** ON ORIGINAL PURCHASE
  - RESULT: FARMER HAS **OWN** MONEY BACK **PLUS** PROFIT FROM RESELLING GOODS

...CONT

- SONY **GAINED**
  - REDUCTION IN CS COSTS
  - TRANSACTION FEES FOR HANDLING SALES
  - TOTAL: ~$400,000 (ESTIMATE)
- SONY **LOST**
  - THE MONEY FROM THE **FIRST** SALE, CHARGED BACK
  - THE MONEY FROM THE **SECOND** SALE
  - A FIXED **FEE** FOR HAVING BEEN CHARGED BACK
  - $1,000,000 IN **FINES** FOR HAVING **>10%** OF PURCHASES CHARGED BACK

GENERAL

- CHARGEBACKS ARE A **GENERAL** PROBLEM FOR VIRTUAL WORLDS
- THAT SAME BASIC ANTI-**SONY** SCAM WOULD WORK FOR **LAND** SALES IN *SECOND LIFE*
- IT CAN **EVEN** BE USED **WITHOUT** THE INTENT OF MAKING A PROFIT – JUST TO **HURT** AN OPERATOR
  - THE FACT THAT SONY WAS TAKING A PIECE OF THE FARMERS' ACTION **WAS** A CONTRIBUTORY FACTOR IN THEIR CHARGEBACK ATTACK

DEALING WITH RMT

- IF YOU WANT TO **STOP** RMT, YOU CAN:
  - TARGET THE **FARMERS**
  - TARGET THE **PLAYERS** THEY SUPPLY
  - TARGET **BOTH**
- MOST OPERATORS ARE RELUCTANT TO TARGET PLAYERS BECAUSE OF THE BAD **PUBLICITY**
  - IN REAL LIFE, POLICE USUALLY TARGET DRUG **DEALERS**, NOT DRUG **USERS**
- USUAL PUNISHMENT IS A **BAN**
  - WHICH ALMOST **NEVER** STOPS THE PROBLEM

GRIEFING

- ORIGINALLY, GRIEFING WAS DOING SOMETHING TO **ANNOY** SOMEONE ELSE SIMPLY BECAUSE THE KNOWLEDGE THAT IT ANNOYED **THEM** GAVE **YOU** PLEASURE
- NOW, IT'S MORE OF A **CONTINUUM**
  - "YOU STOLE THE HERB I WAS GOING TO PICK AFTER THE ONE I WAS GOING TO PICK AFTER THIS ONE I'M PICKING NOW - YOU **GRIEFER**!"
- I'LL USE "DOING THINGS YOU **KNOW** WILL ANNOY OTHERS, FOR THE **FUN** OF IT"

LEGITIMATE?

- IMPORTANT: IT DEPENDS ON THE VIRTUAL WORLD AS TO WHETHER GRIEFING IS **OK** OR NOT
  - IT **MAY** BE PART OF THE GAME..!
- EARLY TEXT-BASED VIRTUAL WORLDS HAD A **STEAL** COMMAND
  - IMPLIES **IN-WORLD** SECURITY CONSIDERATIONS!
- SOME MODERN MMOS ALLOW YOU TO TAKE THE BELONGINGS OF PEOPLE DEFEATED IN COMBAT
- IF THE RULES **PERMIT** IT, YOU NEED ONLY **MONITOR** IT

UCC

- THE REASON GRIEFING IS A **SECURITY** ISSUE IS **USER-CREATED CONTENT**
- SOMETIMES, USERS CREATE CONTENT YOU REALLY WISH THEY **WOULDN'T**
- "TIME TO COCK"
  - **MCDONALDS** PROTESTS IN *SIMS ONLINE*
  - ORAL SEX IN *SHIP OF FOOLS*
  - GOLD FARMERS SPELLING THEIR URL USING **DEAD GNOMES** IN *WOW*
- THERE COULD BE **LEGAL LIABILITY** FOR DEVELOPERS HERE!

FUNCTIONALITY

- IF YOU GIVE PLAYERS THE ABILITY TO **CODE** AS WELL AS **CREATE** THINGS, BEWARE!
- NOT **SO** BAD FOR CODING THE CLIENT
  - EXCEPT FOR OFFERING A VECTOR FOR INSTALLING **TROJANS**
- IF THEY CAN WRITE CODE THAT RUNS ON THE **SERVER**, THERE ARE **DANGERS**
- *SL* WAS BROUGHT TO ITS **KNEES** BY SELF-REPLICATING OBJECTS
  - I **WARNED** THEM IT WAS POSSIBLE, BUT THEY THOUGHT NO-ONE WOULD ACTUALLY **DO** IT...

PIRACY

- VIRTUAL WORLDS ARE CLIENT/SERVER, SO WHY WOULD **PIRACY** BE A PROBLEM?!
  - AFTER THE FIRST FEW WEEKS FOLLOWING LAUNCH, WHO EVEN **CARES** IF THE CLIENT IS PIRATED?
- WELL, IT'S THE **SERVER** THAT GETS PIRATED...
- RAPH KOSTER FOUND HE WAS **FAMOUS** IN CHINA FOR DESIGNING *ULTIMA ONLINE*, EVEN THOUGH IT **NEVER LAUNCHED** IN CHINA
  - THERE WERE **300** PIRATED SERVERS THERE
- USUALLY, BUT NOT ALWAYS, AN **INSIDE** JOB

ALSO

- SERVER AUTHENTIFICATION CAN **HELP**, BUT SOMETIMES PEOPLE WRITE THEIR **OWN** SERVERS
  - HEY, THE CLIENT AND ALL THE ASSETS ARE ON THEIR PC...
- THESE CAN BE **HIGHLY** PROFITABLE
  - SOME IN CHINA HAVE **TENS OF THOUSANDS** OF PLAYERS
- THERE'S A BIG PROBLEM WITH WHAT TO **DO** IF YOU **FIND** A ROGUE SERVER
  - BASICALLY, CALL IN LOCAL **LAW ENFORCEMENT** AND HOPE...

OTHER

- A QUICK LIST OF **OTHER** SECURITY ISSUES I DON'T HAVE TIME TO DETAIL...
- **IDENTITY** THEFT
  - IN *SL*, YOUR AVATAR COULD BE YOUR **BUSINESS**
- **PRIVACY**
  - DATA-MINING TO ASCERTAIN YOUR **LIFESTYLE**
- MAD **PATENTS**
  - THEY'LL GRANT THEM TO **ANYTHING**
- THE **LAW**

THE LAW

- **PARTICULAR** WORRIES FOR **STRANGE** LEGAL JUDGMENTS REGARDING:
  - **AGE** VERIFICATION
  - **LOGGING** VERSUS **DELETING** DATA
  - INTELLECTUAL **PROPERTY** RIGHTS
  - **DISPUTE** RESOLUTION
  - SANCTITY OF THE **EULA**
  - BRITTLENESS OF **COMMON CARRIER** LEGISLATION
  - **JURISDICTION**

PRIVACY

- SO FAR, I'VE TALKED ONLY ABOUT **SECURITY**
- I'M GOING TO END BY DISCUSSING **PRIVACY**
  - AS MUCH OF THIS **FOLLOWS** FROM SECURITY...
- **PLAYERS** INTERACT WITH VIRTUAL WORLDS THROUGH **CHARACTERS**
- IMPORTANT: CHARACTERS HAVE **NO** RIGHTS
  - IT'S **PLAYERS** WHO HAVE THE RIGHTS
- AS WITH SECURITY, **SOME** PRIVACY PROBLEMS ARE THE SAME AS FOR OTHER ONLINE IDENTITIES
  - I'M GOING TO LOOK AT THE **DIFFERENT** ONES

WALLS HAVE EARS

- CONVERSATION IN VIRTUAL WORLDS **FEELS** LIKE CONVERSATION IN THE REAL WORLD
  - YOU CAN SAY THINGS "IN PRIVATE" THAT YOU DON'T EXPECT TO BE **OVERHEARD**
- BUT THE VIRTUAL WORLD DEVELOPER HEARS **ALL**
  - NEARBY **PLAYERS** MAY HEAR IT, TOO
  - NEARBY OBJECTS MAY **ALSO** HEAR IT – BUGS!
- THIS DATA CAN BE **COLLATED** AND USED FOR BEHAVIOURAL **MARKETING**
  - OR MORE **NEFARIOUS** PURPOSES...

DATA GATHERING

- OPERATORS COLLECT DATA TO PREVENT **CHEATING**
- THEY **COULD** IN **THEORY** USE IT FOR **PROFILING**, THOUGH
  - HOW WOULD WE KNOW THEY **DON'T** DO THIS?
  - ACTUALLY, FEW DO – THEY HAVE A HARD ENOUGH TIME AS IT IS...
- THEY'D **LIKE** TO BE OPEN, BUT NEED TO KEEP **SOME** TECHNIQUES SECRET
  - OTHERWISE THE CHEATS WILL **CHANGE** TACTICS

SELF-PRESENTING

- MANY PLAYERS CREATE AVATARS THAT ARE **IDEALISED** VERSIONS OF THEIR RL SELVES
  - ESPECIALLY IN **SOCIAL** WORLDS
- THIS **IMMEDIATELY** REVEALS PRIVATE DATA!
- POSSIBLE TO **MASQUERADE** ROUND THIS
  - ROLE-PLAYING AS A REAL PERSON ROLE-PLAYING...
- BUT SOME FAR-EASTERN MMOS DEMAND **WEBCAM** EVIDENCE THAT FEMALE **CHARACTERS** HAVE FEMALE **PLAYERS** BEHIND THEM..!

DATA EXPOSURE

- SOME SOCIAL WORLDS MAKE DATA AVAILABLE SO THEIR PROCESSES ARE **TRANSPARENT**
- PLAYERS CAN **HARVEST** THIS AND **USE** IT
- EXAMPLE: FINDING OUT WHO **OWNS** WHAT LAND IN *SECOND LIFE*
- EXAMPLE: FINDING OUT WHO IS **LOGGED IN**
- SOMETIMES, DETAILS SUCH AS **IP ADDRESS** CAN BE PICKED UP INCIDENTALLY
  - EG. BY OFFLOADING **VOICE CHAT** FROM THE SERVER

SELF-REVEAL

- IT'S **ALWAYS** OK TO REVEAL PRIVATE DATA **YOURSELF** IF YOU KNOW WHAT YOU'RE DOING, **RIGHT**?
- **WRONG**!
- SOME WORLDS HAVE **RULES** THAT SAY YOU **CAN'T** REVEAL YOUR **OWN** PRIVATE DATA!
- STRONG **ROLE-PLAYING** GAMES
  - RL INFORMATION BREAKS THE **IMMERSION**
- THERAPY WORLDS
  - ALCOHOLICS **ANONYMOUS**

SUMMARY

- VIRTUAL WORLDS HAVE FEATURES THAT RAISE **PARTICULAR** SECURITY/PRIVACY CONCERNS
  - IN **ADDITION** TO THE **USUAL** ONES
- THEY ARE ATTEMPTING TO ADDRESS THESE, BUT
  - ARE WORRIED ABOUT THE **COST**
  - ARE WORRIED ABOUT THE EFFECTS ON THE VIRTUAL WORLD **ITSELF**
  - ARE WORRIED ABOUT **LEGAL** IMPLICATIONS
  - DON'T USUALLY **THINK** ENOUGH ABOUT SECURITY UNTIL IT'S **TOO LATE**..!

REFERENCES

- TO FIND OUT **MORE** ABOUT THIS, TRY:
- ENISA: *VIRTUAL WORLDS, REAL MONEY*
  - HTTP://WWW.ENISA.EUROPA.EU/DOC/PDF/DELIVERABLES/ENISA_PP_SECURITY_PRIVACY_VIRTUALWORLDS.PDF
- STEVEN DAVIS: *PROTECTING GAMES*



