

THE THEN AND THE NOW OF VIRTUAL WORLDS

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INTRODUCTION

- IT'S **HARD** FOR ORGANISERS OF **BROAD-SPECTRUM** CONFERENCES TO FIND A **KEYNOTE** TOPIC EVERYONE CAN **RELATE** TO
 - **BEER** MIGHT WORK, BUT IT DOESN'T HAVE A FORMAL CS/EE CONNECTION
- **AHA!** HOW ABOUT **COMPUTER GAMES?**
- **EVERY** SW OR HW PERSON PLAYS **GAMES!**
 - EXCEPT THOSE WHO BELIEVE THAT STUFF ABOUT HOW GAMES ARE ADDICTIVE AND MAKE YOU KILL PEOPLE
- SO **HERE** I AM...

SW:TOR

- STAR WARS: THE OLD REPUBLIC, BLOWARE, 2011



- THE MOST **EXPENSIVE** GAME YET MADE
– I PLAYED 6H/DAY FOR **137 DAYS** IN 2012

WOW

- WORLD OF WARCRAFT, BLIZZARD, 2004



- I ACCRUED **225 DAYS** OF /PLAYED FOR THIS
– I QUIT LAST YEAR WHEN **PANDAS** BECAME PLAYABLE

EQ

- EVERQUEST, SONY ONLINE ENTERTAINMENT, 1999



- I NEVER PLAYED EVERQUEST...

DIKUMUD

- DIKUMUD, COPENHAGEN UNIVERSITY, 1990

```
[x2] A barrel has been left here.  
An angry-looking statue of Hoturi is standing here.  
An angry-looking statue of Priapus is standing here.  
A statue of Odin is standing behind the altar.  
A Sign for Newbies is here.  
You are a guest here until you save yourself.
```

```
If you need  
to get to your guild, use the guild medallion in your inventory. If you lose  
it, pray to the statue of Odin for another.
```

```
105m/202e/38hlook  
Temple of Udgaard
```

```
You are inside the small and humble village temple in Udgaard. A simple  
stone altar, with strange stone carvings, is placed against the north wall. A  
small humble donation room is to the east. The temple exit is south to the  
Village Square.
```

```
[x2] A barrel has been left here.  
An angry-looking statue of Hoturi is standing here.  
An angry-looking statue of Priapus is standing here.  
A statue of Odin is standing behind the altar.  
A Sign for Newbies is here.
```

```
105m/202e/38h_
```

ABERMUD

- **ABERMUD, ALAN COX, 1987**

```
Your wimpy value is set to 15. See 'help change' to see what that means.
```

```
The Temple Of Paradise
```

```
You stand in the Temple of Paradise, a huge sandstone structure whose walls are decorated with ancient carvings and runes, some so old that even the priests no longer know their meanings.
```

```
A single set of steps lead south, descending the huge mound upon which the temple is built and ending in the forests below.
```

```
A roaring fire burns here. Its flames make the temple sparkle and glitter.
```

```
At your feet a huge sacrificial pit allows you to give valuables to the gods in the hope of being rewarded.
```

```
A furlled umbrella lies here.
```

```
Obvious exits are:
```

```
North : Welcome Center
```

```
South : Forest Track
```

```
Down : Forest Track
```

```
Last login: Wed Sep 7 17:43:26 2005
```

```
>
```

MUD

- MULTI-USER DUNGEON, ROY TRUBSHAW & RICHARD BARTLE, 1978

Narrow road between lands.

You are stood on a narrow road between The Land and whence you came. To the north and south are the small foothills of a pair of majestic mountains, with a large wall running round. To the west the road continues, where in the distance you can see a thatched cottage opposite an ancient cemetery. The way out is to the east, where a shroud of mist covers the secret pass by which you entered The Land. It is raining.

*w

Narrow road.

You are on a narrow east-west road with a forest to the north and Gorse scrub to the south. It is raining. A splendid necklace lies on the ground.

*

- MUD WASN'T BASED ON **ANYTHING**
– WHY **I'M** GIVING THIS TALK AND **YOU'RE NOT**

IN PART...

- HERE'S A PICTURE OF THE **HUMBER BRIDGE**



- IT'S STILL BEING **BUILT** AT THIS POINT

IN PART...

- THAT'S **NOT** TO SAY THAT IN 35 YEARS YOU WON'T BE GIVING A TALK **SIMILAR** TO THIS ONE, BUT FOR YOUR OWN FIELD
- THE **BEST** THING ABOUT RESEARCH IS THAT **WHATEVER** YOU'RE DOING, YOU'RE THE **FIRST** PERSON TO DO IT
 - YOU ARE BY **DEFINITION** A **PIONEER**
- ALL **YOU** HAVE TO DO IN ORDER TO BE UP HERE IN 2048 IS **NOT DIE**
- (TELL THEM YOUR DIJKSTRA ANECDOTE)

YET MORE TO IT

- THERE'S ACTUALLY SOMETHING **ELSE** YOU NEED TO DO TO GIVE TALKS LIKE THIS WHEN YOU'RE **OLD AND GREY**
- YOU NEED TO **ENJOY** YOUR SUBJECT
- FOR SOME PEOPLE, RESEARCH IS SIMPLY A **MEANS TO AN END**
- THEY MERELY WANT THE **SALARY** BONUS THAT HAVING A **PHD** BRINGS
 - YOUR CUMULATIVE EARNINGS OVERTAKE THAT OF THOSE WITH **NO** PHD AFTER ABOUT **20 YEARS**

FUN

- IF YOU **DO** ENJOY YOUR SUBJECT, THOUGH, YOU'LL KEEP WORKING IN IT BECAUSE IT'S **FUN**
- NON-PROGRAMMERS FIND IT **ASTONISHING** THAT PROGRAMMERS **LIKE** PROGRAMMING
 - “THEY DO IT IN THEIR **SPARE TIME?!**”
- LOGICALLY, IF YOU **ARE** GOING TO SPEND THE **REST OF YOUR LIFE** THINKING ABOUT SOMETHING, YOU'D **BETTER** FIND IT FUN OR YOU'RE **STUFFED**
- FUN ALONE STILL ISN'T **ENOUGH**, THOUGH

BEYOND FUN

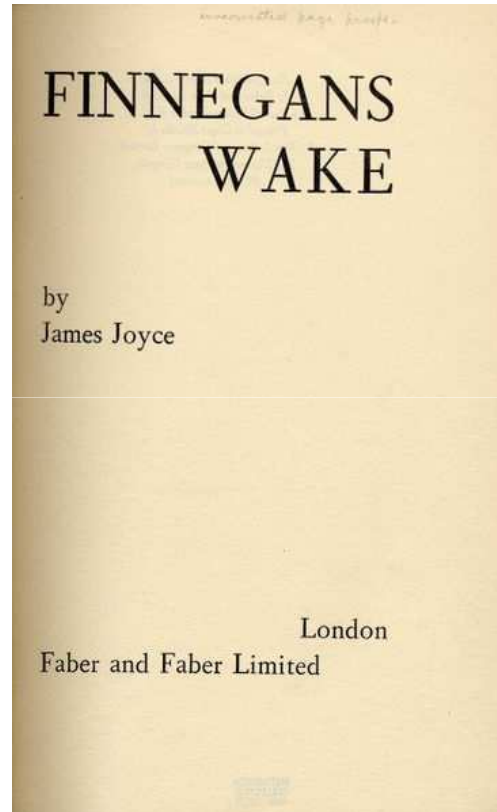
- TO DO SOMETHING **ONLY** BECAUSE YOU LIKE IT IS MERE **HEDONISM**
- THERE'S NO PRESSURE TO **PUSH** AT THE **BOUNDARIES** IF YOU'RE HAPPY WITH THEM WHERE THEY ARE
- THERE'S **SLIGHTLY** MORE IF SOLVING RESEARCH PROBLEMS IS **WHAT** YOU FIND FUN, BUT YOU STILL LACK **DIRECTION**
- IF YOU **REALLY** WANT TO LEAD YOUR FIELD, YOU NEED TO **BELIEVE** IN IT

WHY MUD?

- MY DAD WAS A **GAMER**, MY MUM WAS A **STORYTELLER**
- MY DAD WAS A **GAS FITTER**, MY MUM WAS A **SCHOOL MEALS COOK**
- WE **EXISTED** ON A **COUNCIL ESTATE**
- WE **LIVED** IN OUR IMAGINATIONS!
- IN MY FORMATIVE YEARS, I SAW **MISERY** AND **INJUSTICE** IN THE WORLD AROUND ME
 - I WANTED TO MAKE A **BETTER** WORLD
- **SO I DID**

WHY MUD?

- I REALLY OUGHT TO **READ** THIS SOME TIME..



- THEN, I'LL NEVER HAVE TO READ IT **EVER** AGAIN

REINVENTION

- VIRTUAL WORLDS WERE **INDEPENDENTLY** INVENTED ON AT LEAST **5** OTHER OCCASIONS
 - SCEPTRE OF GOTH (ORIGINALLY E*M*P*I*R*E)
 - ALAN KLITZ, 1978
 - AVATAR
 - BRUCE MAGGS, ANDREW SHAPIRA & DAVID SIDES, 1979
 - ISLAND OF KESMAI
 - KELTON FLINN & JOHN TAYLOR, 1981
 - HABITAT
 - RANDY FARMER & CHIP MORNINGSTAR, 1985
 - MONSTER
 - RICH SKRENTA, 1989

REASON

- THIS BEING THE CASE, WHY IS IT THAT ALMOST **ALL** TODAY'S MMOS DESCEND FROM *MUD*?
- YOU DON'T HAVE TO BE A **GENIUS** TO COME UP WITH THE IDEA OF A COMPUTER-MODERATED SHARED PERSISTENT ENVIRONMENT YOU INTERACT WITH USING A SINGLE CHARACTER
- YOU **DO** NEED TO HAVE A **REASON** TO DO SO
- **MY** REASON WAS TO GIVE PEOPLE A **PLACE** THEY COULD GO TO **BE** AND **BECOME THEMSELVES**

LEGACY

- MOST OF THE OTHER PEOPLE WHO INVENTED VIRTUAL WORLDS WANTED TO **PLAY** THEM
 - CHIP AND RANDY WERE THE EXCEPTIONS
- **I** WANTED **OTHER PEOPLE** TO PLAY MUD
- I SAW VIRTUAL WORLDS AS A WAY TO MAKE THE **REAL** WORLD A **BETTER** PLACE
- I THEREFORE **GAVE AWAY** THE CODE TO ANYONE WHO WANTED IT AND MADE IT **FREE**
- THE OTHERS EITHER **GUARDED** THEIR CODE OR IT WAS **NON-TRANSPORTABLE** ANYWAY

HISTORY

- AS IT WAS **FREE**, MANY PEOPLE PLAYED *MUD*
- SOME WROTE THEIR **OWN** VIRTUAL WORLDS BASED ON IT
 - *ABERMUD*, FOR EXAMPLE
- THESE IN TURN INSPIRED **OTHERS**
 - *DIKUMUD*, FOR EXAMPLE
- EVENTUALLY THERE WERE **THOUSANDS** OF MUDS ON THE NASCENT INTERNET
 - IN 1994, THEY ACCOUNTED FOR **10%** OF ALL INTERNET TRAFFIC

COMMERCIALISATION

- BECAUSE OF THIS, THERE WERE **HUNDREDS** OF PEOPLE WHO COULD **CODE** MUDS FOR EVERY **ONE** WHO WORKED ON ANY OF THE OTHERS
- WHEN **PROFESSIONAL** VIDEOGAME DEVELOPERS MOVED IN, THEY GOT ALMOST **ALL** THEIR DESIGNERS AND CODERS FROM **MUDS**
- IF I HADN'T BEEN SO **OUTRAGED** WITH WORKING CLASS LIFE IN 1970S BRITAIN, THIS **WOULDN'T** HAVE HAPPENED
 - THEY'D HAVE COME FROM **10K** OR **SOG** INSTEAD

IDEALISM

- IF **YOU** FEEL YOUR RESEARCH LETS YOU **SAY** SOMETHING OR **HELP** SOMEONE OR **BUILD BRIDGES** OR WHATEVER, **YOU** ARE IN A GOOD PLACE
- FULL-TIME RESEARCHERS NEED **IDEALISM** TO DIRECT THEM
- OF COURSE, WHEN YOU REACH **MY** AGE THEN **CYNICISM** AND **DESPAIR** HAVE TAKEN OVER
 - THESE **ALSO** WORK AS DRIVERS, THOUGH!

IN PART...

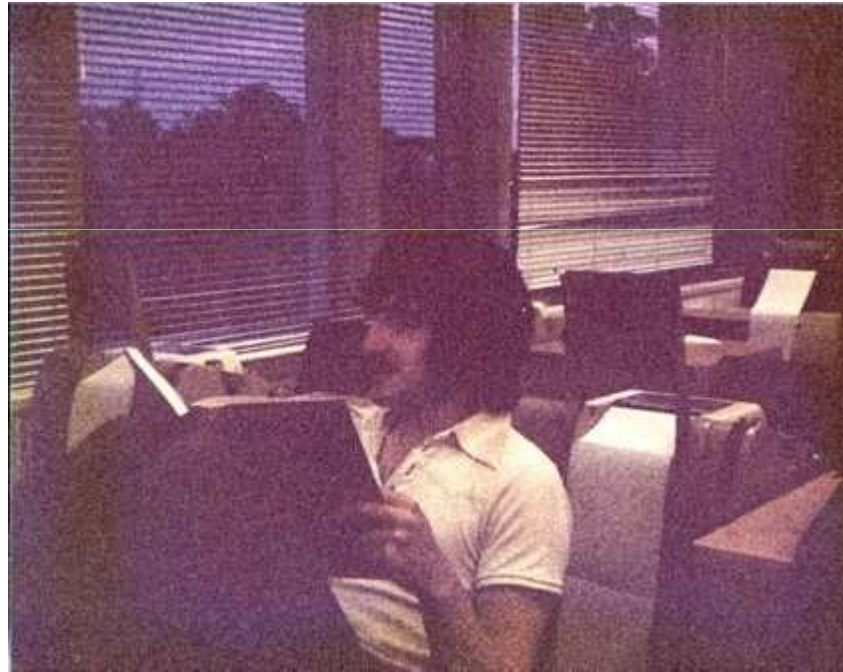
- THIS IS A DEAD ASLAN



- DON'T WORRY, KIDS, HE **SOON** RESPAWNS

EARLY DAYS

- A STUDENT ONCE ASKED ME WHY WE WROTE MUD USING **TEXT** RATHER THAN **GRAPHICS**
- **THIS** IS WHY:



- THOSE MACHINES BEHIND ROY ARE **TELETYPES**

CHANGE

- WHAT YOU THINK OF AS HIGH-TECH **NOW** WILL SOON BE **SUPERSEDED** AND **OBSOLETE**
- IT WILL **DO** SO BECAUSE **OTHER** PEOPLE ARE ADVANCING **THEIR** FIELDS JUST AS **YOU'RE** ADVANCING **YOURS**
- THIS HAS **SOCIAL** EFFECTS TOO
 - MY FRIENDS THOUGHT I WAS **WEIRD** FOR TAKING SNAPS OF THEM IN 1978
- HOWEVER, CONSIDER WHAT ROY AND I **NEEDED** TO KNOW WHEN WE WROTE *MUD*

WHAT YOU NEED TO KNOW TO MAKE A VIRTUAL WORLD (THEN)

- **MEMORY** IS MADE OF SOFT-IRON TOROIDAL **CORES** SUSPENDED ACROSS A GRID OF **WIRES**, WITH A DIAGONAL **SENSE/INHIBIT** WIRE TO READ/WRITE THEM.
- **CIRCUITS** ARE MADE OF WIRES AND **GATES**. AN **AND** GATE IS LIKE TWO SWITCHES IN SERIES; AN **OR** GATE IS LIKE TWO SWITCHES IN PARALLEL. BY COMBINING AND GATES AND (RATHER TRICKIER) **NOT** GATES, YOU CAN MAKE **NAND** GATES, FROM WHICH YOU CAN CONSTRUCT ANY LOGIC CIRCUIT. ONE SUCH CIRCUIT IS A **FLIP-FLOP**, WHICH HAS **TWO** STABLE STATES AND SO WORKS AS ANOTHER (MORE POWER-HUNGRY) FORM OF **MEMORY**. YOU CAN CONNECT FLIP-FLOPS IN A CHAIN TO MAKE A **REGISTER**. BY PASSING THE INPUTS TO THESE FLIP-FLOPS THROUGH A SET OF GATES, YOU CAN EFFECT **OPERATIONS** – SHIFTING A REGISTER'S BIT SETTINGS ALL TO THE LEFT, FOR EXAMPLE (WHICH IS THE SAME AS MULTIPLYING THE NUMBER THE REGISTER REPRESENTS BY 2). ANOTHER ARRANGEMENT OF GATES MAKES A CIRCUIT CALLED A **HALF-ADDER**; COMBINING MULTIPLE HALF-ADDERS WILL ALLOW YOU TO ADD THE CONTENTS OF TWO REGISTERS TOGETHER.
- IN ORDER TO DECIDE WHICH OPERATION TO PERFORM ON A REGISTER, YOU HAVE A SPECIAL **INSTRUCTION REGISTER**. BY USING GATES TO DETECT **COMBINATIONS** OF BITS IN THE INSTRUCTION REGISTER, THE OPERATION IT IDENTIFIES CAN BE DETERMINED. INSTRUCTIONS ARE STORED IN MEMORY, AND THE **ADDRESS** OF THE NEXT INSTRUCTION TO FETCH IS KEPT IN A REGISTER CALLED A **PROGRAM COUNTER**. HAVING **FETCHED** AN INSTRUCTION, IT IS **EXECUTED**, AND THEN THE PROGRAM COUNTER IS **INCREMENTED** SO THE NEXT OPERATION CAN BE FETCHED. OPERATIONS ON THE PROGRAM COUNTER, SUCH AS ADDITION, IMPLEMENT CONCEPTS SUCH AS **JUMPS**.
- A SET OF PANEL **SWITCHES** LOAD INITIAL VALUES INTO REGISTERS. THIS IS TEDIOUS, SO JUST ENOUGH ARE LOADED THAT FURTHER INSTRUCTIONS CAN BE READ FROM **PAPER TAPE**. THESE ALLOW MANY MORE INSTRUCTIONS TO BE LOADED INTO MEMORY FROM A **MAGNETIC TAPE**. THE PROGRAM SO LOADED IS THE **OPERATING SYSTEM**, WHICH WILL ADMINISTER THE COMPUTER (FOR EXAMPLE, MANAGE THE **DEVICES** THAT APPLICATION PROGRAMS RUN).
- USER PROGRAMS ARE KEPT ON **DISC PACKS, CARDS, PAPER** AND **MAGNETIC TAPE**. TO WRITE A PROGRAM, YOU USE A **PROGRAMMING LANGUAGE**. THE FIRST PROGRAMS ARE ENTERED USING THE PANEL SWITCHES; THEY ULTIMATELY CREATE A PROGRAM CALLED AN **ASSEMBLER**, WHICH CONVERTS HUMAN-READABLE ASSEMBLY LANGUAGE INTO THE **BINARY** THAT THE COMPUTER ACTUALLY EXECUTES. ASSEMBLY LANGUAGE IS USED TO WRITE THE MAKINGS OF A **COMPILER** FOR A **HIGH-LEVEL LANGUAGE**. COMPILERS TAKE HIGH-LEVEL LANGUAGES AND DROP EITHER ASSEMBLER OR DIRECT BINARY. JUST **ENOUGH** OF THE COMPILER IS WRITTEN IN ASSEMBLER THAT THE REST OF IT CAN BE WRITTEN IN THE LANGUAGE **ITSELF**, A PIECE AT A TIME ACROSS MULTIPLE ITERATIONS.
- HIGH-LEVEL LANGUAGES CAN BE USED TO WRITE **GENERAL-PURPOSE** PROGRAMS. ALMOST EVERY PROGRAM IS SOME COMBINATION OF THE ACTIVITIES PERFORMED BY A COMPILER, A **DATABASE** AND/OR AN OPERATING SYSTEM. YOU NEED TO BE **FLUENT** IN A HIGH-LEVEL LANGUAGE BEFORE YOU CAN PROGRAM MUCH IN IT, BUT THEY'RE ALL BASICALLY THE **SAME** WHEN IT COMES DOWN TO IT. CHOICE OF LANGUAGE IS A BALANCE BETWEEN SPEED OF **EXECUTION**, SPEED OF **WRITING** AND SPEED OF **MAINTENANCE**.
- TO CREATE A **VIRTUAL WORLD**, YOU NEED TO DESIGN YOUR OWN **DATA DEFINITION LANGUAGE** TO SPECIFY THE VIRTUAL WORLD. YOU WRITE YOUR **OWN** COMPILER TO CONVERT IT INTO ASSEMBLY LANGUAGE PLUS SOME INTERMEDIATE CODE THAT YOU CAN **INTERPRET** (THAT IS, EXECUTE IN SOFTWARE RATHER THAN IN HARDWARE). YOU STORE **DETAILS** ABOUT THE PLAYERS AND THE WORLD ITSELF IN A **DATABASE**, WHICH YOU **ALSO** WRITE YOURSELF. WHEN THE VIRTUAL WORLD **RUNS**, IT ACTS LIKE AN OPERATING SYSTEM – CONTINUALLY **PROCESSING** UNTIL IT IS STOPPED OR DECIDES TO STOP.
- IF, WHEN YOU CREATE YOUR VIRTUAL WORLD, YOU **DON'T** KNOW THE WHOLE STORY FROM MEMORY CORES (OR THEIR TRANSISTOR EQUIVALENT) RIGHT THE WAY UP TO WRITE-YOUR-OWN-COMPILER, YOU **WON'T** BE ABLE TO TWEAK EVERY **BIT**, STRETCH EVERY **INSTRUCTION**, PACK EVERY **DATA STRUCTURE** OR TAKE EVERY **SHORTCUT**; LESS OF YOUR WORLD WILL FIT IN THE (IN *MUDS* CASE) **70K OF MEMORY YOU GET** IN EVENINGS AND WEEKENDS ON THE TIMESHARING SYSTEM. YOU NEED TO KNOW **ALL** THIS IF YOU'RE GOING TO DO IT.
- OH, YOU **ALSO** NEED THAT LITTLE BIT AT THE END WHERE YOU DESIGN THE GAME WORLD ITSELF.

WHAT YOU NEED TO KNOW TO MAKE A VIRTUAL WORLD (NOW)

- HOW TO RAISE £25,000,000.
- ON THE TECHNICAL SIDE, YOU NEED TO DECIDE WHICH **KITS, TOOLS, LIBRARIES** AND **MIDDLEWARE** YOU'RE GOING TO BUY IN TO GET THE FOLLOWING FUNCTIONALITY:
 - 3D/GRAPHICS ENGINE/RENDERER**
 - AI ENGINE**
 - ANIMATION PACKAGE**
 - ART PACKAGE**
 - ASSET MANAGEMENT SOFTWARE**
 - AUDIO PACKAGE**
 - BACK-END **BILLING** SYSTEM
 - COMMUNITY **MANAGEMENT** TOOLS
 - COMPILER/**DEVELOPMENT ENVIRONMENT**
 - DATABASE**
 - LOAD-BALANCING** SYSTEM
 - NETWORK** LIBRARY
 - OBJECT** MODELLING/SPECIFICATION SYSTEM
 - PATCHING** SOFTWARE
 - PHYSICS** ENGINE
 - PROJECT DEVELOPMENT** TOOLS
 - SECURITY** SYSTEM
 - TREE-CREATION** TOOLS
 - WEB-CREATION** TOOLS
- HAVING **BOUGHT** THEM IN, YOU AND YOUR **TEAM** OF PROGRAMMERS NEED TO KNOW HOW TO **SEW** THE EXECUTABLE ONES TOGETHER WITH YOUR **OWN** PROGRAM CODE, THEN HOW TO CODE THE GAME **MECHANICS** ON TOP OF THAT, PLUS ALL THE **PROJECT-SPECIFIC** TOOLS YOU REQUIRE, WHILE YOUR **VAST ARMY OF ARTISTS** ARE CREATING THE GRAPHICS YOU'VE SPECIFIED.
- TO DO THIS, YOU HAVE TO HAVE KNOWLEDGE OF EVERY **API** (APPLICATION PROGRAMMING INTERFACE) FOR **EVERY** KIT, TOOL, LIBRARY AND MIDDLEWARE YOU'RE USING.
- IF, WHEN YOU CREATE YOUR VIRTUAL WORLD, YOU **DON'T** KNOW THE WHOLE STORY FROM AUDIO PACKAGE RIGHT THE WAY UP TO WRITE-YOUR-OWN-PLANET-CREATION-TOOLS, YOU **WON'T** BE ABLE TO TWEAK EVERY **OBJECT**, STRETCH EVERY **SCRIPT**, PACK EVERY **DATA STRUCTURE** OR TAKE EVERY **SHORTCUT**; LESS OF YOUR WORLD WILL APPEAR IN THE **3-YEAR WINDOW** YOU GET FOR ITS CONSTRUCTION. YOU NEED TO KNOW **ALL** THIS IF YOU'RE GOING TO DO IT.
- OH, YOU **ALSO** NEED THAT LITTLE BIT AT THE END WHERE YOU DESIGN THE GAME WORLD ITSELF.

WHAT YOU NEED TO KNOW TO MAKE A VIRTUAL WORLD (TOMORROW)

- THAT LITTLE BIT AT THE END WHERE YOU DESIGN THE GAME WORLD ITSELF.

PAST PASSED

- WHAT WE **NEEDED** TO KNOW IN 1978 IS NOW **ARCANE**
 - IT READS LIKE SOMETHING OUT OF *FINNEGANS WAKE*
- IN **TECHNICAL** TERMS, **NO** MMO DEVELOPER NEEDS TO KNOW **ANY** OF THIS TODAY
- HOWEVER, SOMEONE **NEEDS TO HAVE KNOWN IT**
- IT'S A **DEEPER** MAGIC FROM **BEFORE** THE DAWN OF TIME
 - IT **INFORMS** ALL BUT IS ABSTRACTED **AWAY**

CONCLUSION

- SO IT IS WITH WHAT **YOU'RE** DOING **NOW**
- IT'S PROBABLE THAT **NO-ONE** WILL NEED TO KNOW **ANY** OF IT IN 35 YEARS
- HOWEVER, SOMEONE – YOU! – **WILL NEED TO HAVE KNOWN IT**
- **YOU'LL** HAVE INFLUENCED THE FUTURE
 - THIS GIVES YOU **POWER** TODAY!
- YOU MAY BE A LOWLY **CEEC GEEK**, BUT IF YOU **BELIEVE** IN WHAT YOU DO, YOU **CAN** CHANGE THE WORLD
- I **KNOW**, BECAUSE I DID IT **MYSELF**