When Space Elephants Attack

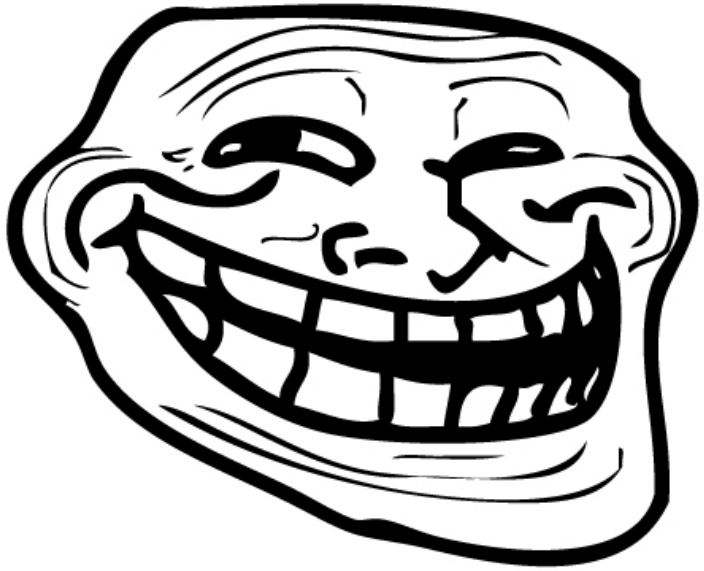
DEFCON 19

Presented by Abstrct

SCHEMAVERSE DEFCON

Who Am I?

- Expert in designing videogame UI
- Specialized in Human-Computer Interaction
- Graphic Designer
- Technical Writer



Who am I really?

Database and Information Security Geek

What is The Schemaverse?

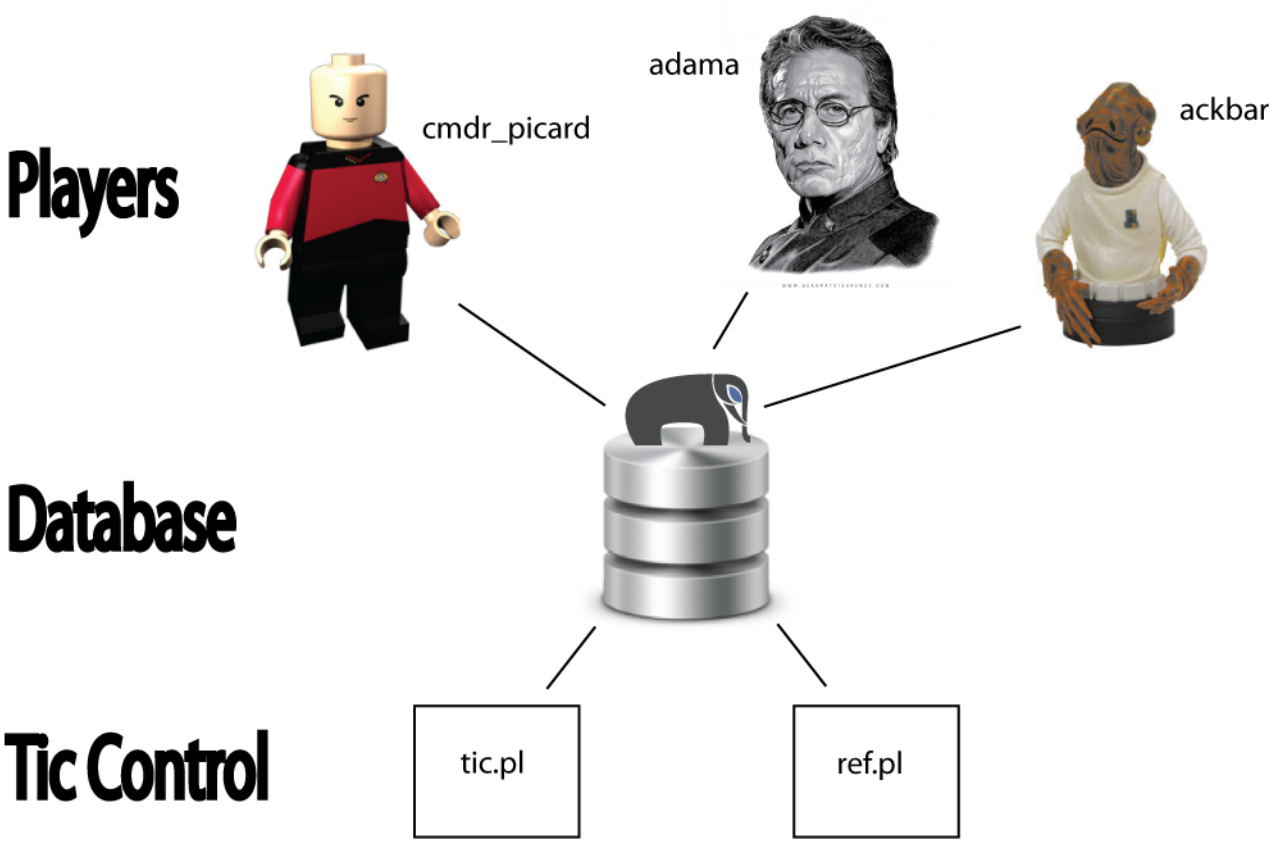
- Space game built entirely in PostgreSQL
- No UI other than the output of SQL queries
- Database is completely open to the Internet
- Security implemented within the database itself
- Unexpectedly addictive, fun and challenging

Why?

- Be Educated and Educate on Database Design and Security
- Push Database Systems

- It’s also pretty funny

Architecture



SECURITY

Securing PostgreSQL.. Insecurely

- Query Limits
- Authentication
- SQL Injections

- some database communities were less than helpful

SQL Injection Example

```
-- Fleet Script Creation
EXECUTE '
CREATE OR REPLACE FUNCTION FLEET_SCRIPT_'|| NEW.id ||'()
   RETURNS boolean as
$fleet_script$
DECLARE
   this_fleet_id integer;
   ' || NEW.script_declarations || '
BEGIN
   this_fleet_id := '|| NEW.id||';
   ' || NEW.script || '
   RETURN 1;
END
$fleet_script$ LANGUAGE plpgsql;'::TEXT;
```

SQL Injection Example

```
-- Fleet Script Creation
EXECUTE '
CREATE OR REPLACE FUNCTION FLEET_SCRIPT_'|| NEW.id ||'() RETURNS boolean as
$fleet_script$
DECLARE
   this_fleet_id integer;
   ' || NEW.script_declarations || '
BEGIN
   this_fleet_id := '|| NEW.id||';
   ' || '
   UPDATE player SET balance=0;
   RETURN 1;
END
$fleet_script$ LANGUAGE plpgsql SECURITY DEFINER;
CREATE OR REPLACE FUNCTION MOVE() RETURNS boolean as
$fleet_script$
BEGIN
  --add the move code but altered slightly to send players backwards
' || '
   RETURN 1;
END
$fleet_script$ LANGUAGE plpgsql;'::TEXT;
```

SQL Injection Fix

```
-- Fleet Script Creation
secret := 'fleet_script_' || (RANDOM()*1000000)::integer;
EXECUTE '
CREATE OR REPLACE FUNCTION FLEET_SCRIPT_'|| NEW.id ||'()
   RETURNS boolean as
$'||secret||'$
DECLARE
   this_fleet_id integer;
   ' || NEW.script_declarations || '
BEGIN
   this_fleet_id := '|| NEW.id||';
   ' || NEW.script || '
   RETURN 1;
END
$'||secret||'$ LANGUAGE plpgsql;'::TEXT;
```

SchemaSecurity

- Roles
- Triggers
- Rules
- Views
- Functions

UNDERSTANDING THE GAME

Getting Started

- Using a client to connect
  - pgAdmin Demo

Sequence of a Tic

- Every Ship Moves
- All Enabled Fleets Execute
- The Perform Mining Function Runs
- Some planets randomly have their fuel increased
- Damage/Repair is committed to the ship table
- Ships damaged for a set time are destroyed
- tic_seq.nextval

Understanding the Relationships

- Ships
- Planets
- Events
- Player
- Fleets

Creating Ships

- *INSERT INTO my_ships(name) VALUES('Shipington');*
- INSERT INTO my_ships(name, attack, defense, engineering, prospecting) VALUES('My First Attacker',15,5,0,0);
  - Total skill on insert must not be greater than 20
- *INSERT INTO my_ships(name, location_x, location_y) VALUES("My Strategically Placed Ship", 100, 100);*
  - You can only create a ship where one of the following is true:
    - location_x and location_y is between -3000 and 3000
    - location_x and location_y are the same coordinates as a planet you are the current conqueror of

Functions - Actions

- Attack(AttackerShip, EnemyShip)

  SELECT Attack(ship_in_range_of, id), name FROM ships_in_range;

  Uses my_ships.attack and your enemy ships defense

- Repair(RepairShip, DamagedShip)

  SELECT Repair(10, id) FROM my_ships ORDER BY current_health ASC;

  Uses my_ships.engineering to determine repair amount

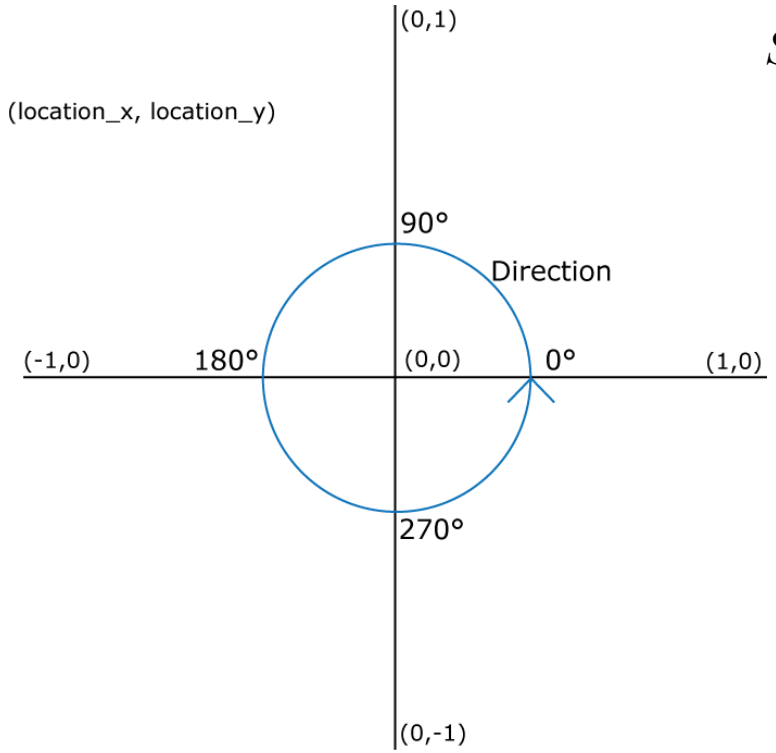
- Mine(MinerShip, Planet)

  SELECT mine(my_ships.id, planets.id) FROM my_ships, planets
  WHERE my_ships.location_x=planets.location_x AND
  my_ships.location_y=planets.location_y;

  Uses luck and my_ships.prospecting when mining is performed

Functions - MOVE

- *Move(Ship ID, Speed, Direction, Destination X, Destination Y)*




```
SELECT
  MOVE(id,100, NULL, destination_x, destination_y),
  id, name, location_x, location_y
  FROM my_ships;
```

```
UPDATE my_ships SET
  direction=90,
  speed=10
WHERE name='Shipington'
```

Functions - Others

- UPGRADE(Ship ID, Code, Quantity)
- REFUEL_SHIP(Ship ID)
- CONVERT_RESOURCE(Resource, Quantity)
- READ_EVENT(Event ID)
- GET_CHAR_VARIABLE(Variable Name)
- GET_NUMERIC_VARIABLE(Variable Name)
- And some more

How to Win

- Conquered Planets
- Most Ships
- Best Ships
- Most amount of destruction

FLEET SCRIPTS

Fleets

- Why
- What
- How

- Demo of creating a script
- Error handling

- First ever Schemaverse Tournament at DEFCON!

- Starts: Thursday afternoon(?)
- Ends: Sunday at Noon

- Registration is in the Contest Area

- Prizes Include…

- The Schemaverse DEFCON Tournament
  - http://defcon.schemaverse.com

- Project Home: http://Schemaverse.com
- Github: http://github.com/Absrtct/Schemaverse
- Wiki: http://github.com/Absrtct/Schemaverse/Wiki

Thank You

DEFCON 19 Organizers!

Tigereye

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