Living city in Mafia II

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Content

- What are our goals?
- Filling the city with elements
- Create some action
- Car driver
- Bringing order to the city (Police)
- What went wrong

Goals

- Full of life
- Realistic feeling
- Visually attractive
- Player centric
- Symbiotic relationship with the story
- "Unlimited" size
- Seamless streaming

Filling city with elements

- Static geometry
- Grass, garbage, etc
- "Translocated" objects
- Pedestrians
- Cars

Empty city

Static geometry only

City with translocated objects

Enriched by objects that are reused everywhere in the city

City with cars

Few cars on top of that

Spawning

- Prepare the model in memory
- Switching of models
- Selecting best spawn place
- Despawn as soon as possible
- Special system spawning
  - Police
  - Vendors

Human spawn

- Spawn point placement depends on:
  - Player position
  - Visibility
  - Usability
  - Aggregation
- Spawn points
  - Directly on Kynapse nodes

Human despawn

- When to despawn a Pedestrian?
  - Is too far away
  - Is not visible for too long
  - Is not in any action

- Line of death
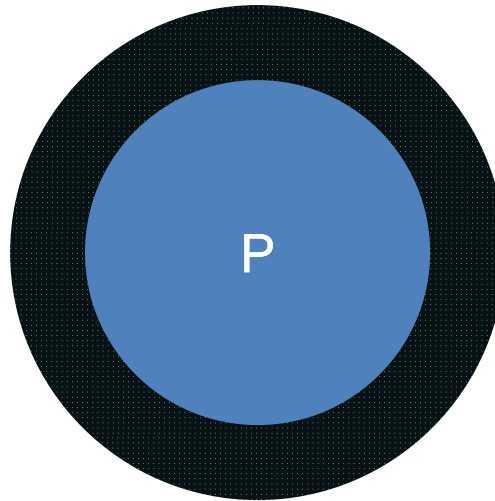 - Most useful when driving a car

Car spawn

- Basics similar to human spawn
- Little bit more difficult
- Data for spawn from our roadmap
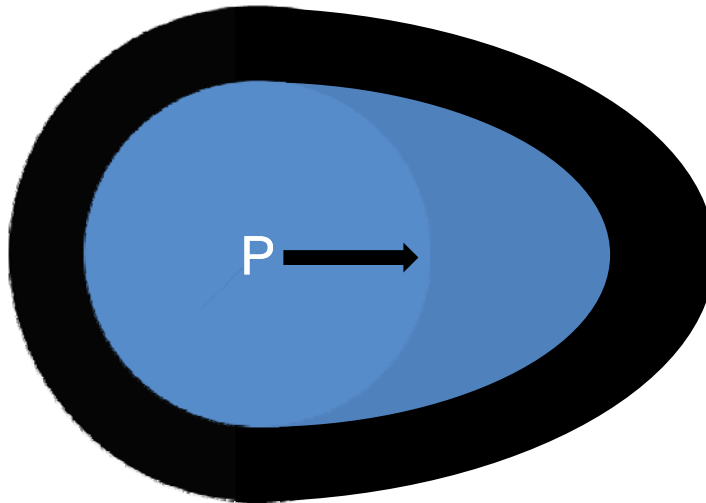- Different types for spawn
  - Moving
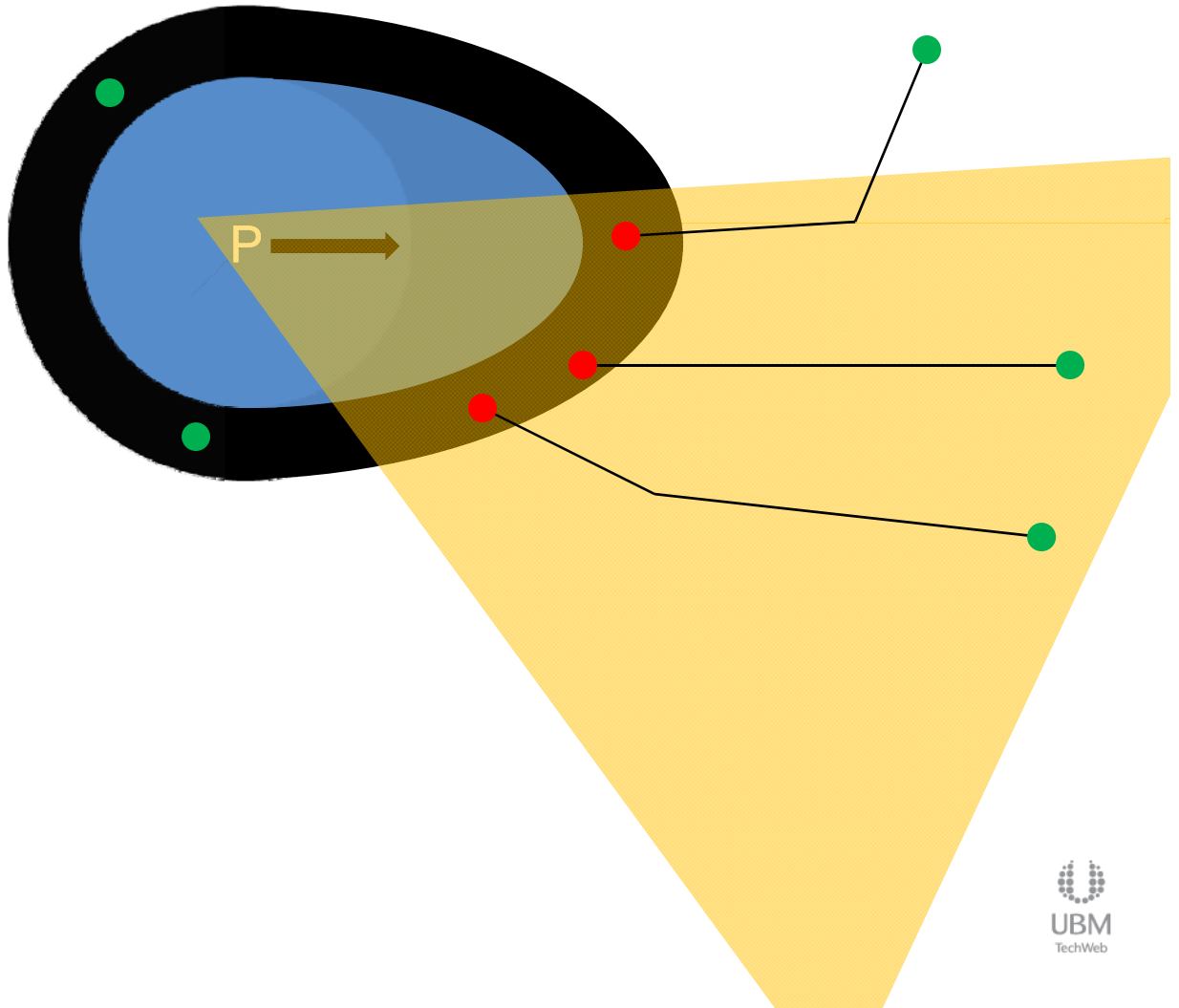 - Parked
  - "Translocated"

Car spawn

Car spawn

Car spawn

Car despawn

- Reasons to get despawned:
  - Not visible and not moving towards player
  - Be too far away and out of sight
- Visible cars are never despawned
- Car makes lot of noise, so you cannot despawn it if it is close
- Police has special rules

Action points in the city

- General mechanism
- Attracts pedestrians
- Fully scripted
- Usually bound to some physical object
- Limited only by amount of memory available in the city
- Lot of work for city content creators

Examples of action points

- Man reading newspapers
- Smoking a cigar
- Looking into the shop window
- Shoe cleaner
- Hot dog stand, Newspaper stand
- Homeless at ash bin digging for a treasure
- Fishing

Car driver

- Physical model
- AI uses "simulation" settings
- Perception of world using dynamic subdivision and roadmap
- Different types of driver
 - Wandering
  - Hunting
  - Escaping

Physical model

- Complex driving model
- Importance of adhesion and tires in general
- Car behaves differently depending on the surface (snow, water, ice, …)
- We need abstraction for AI
  - Wish speed, centripetal acceleration and acceleration
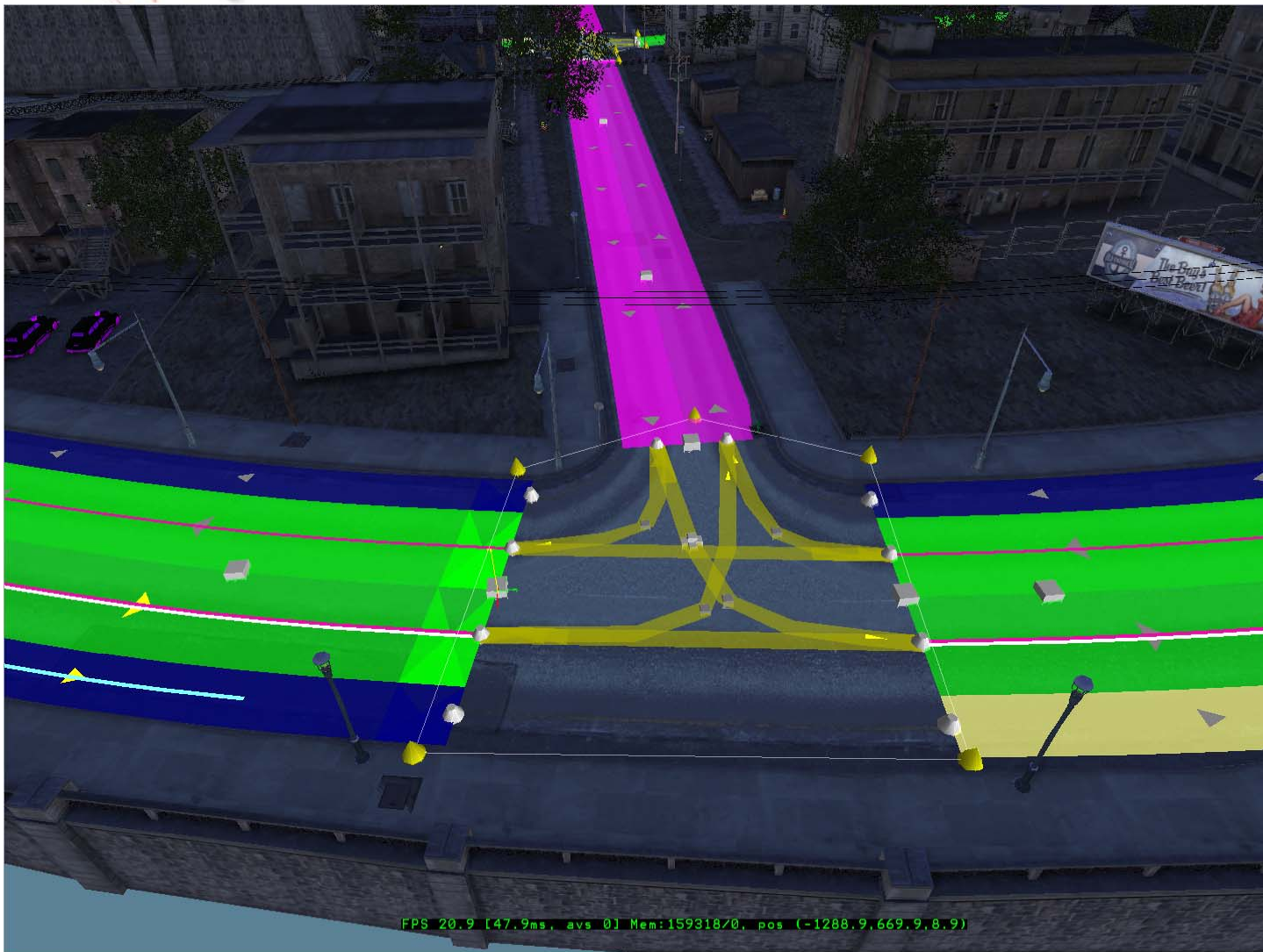 - Tires aim point

Roadmap

- Catmull-Rom splines
- Whole city roadmap is about 400Kb
  - Including all necessary meta information
  - No streaming of roadmap
- Navigation through crossroads is also defined using the same splines

GDC 10 Europe
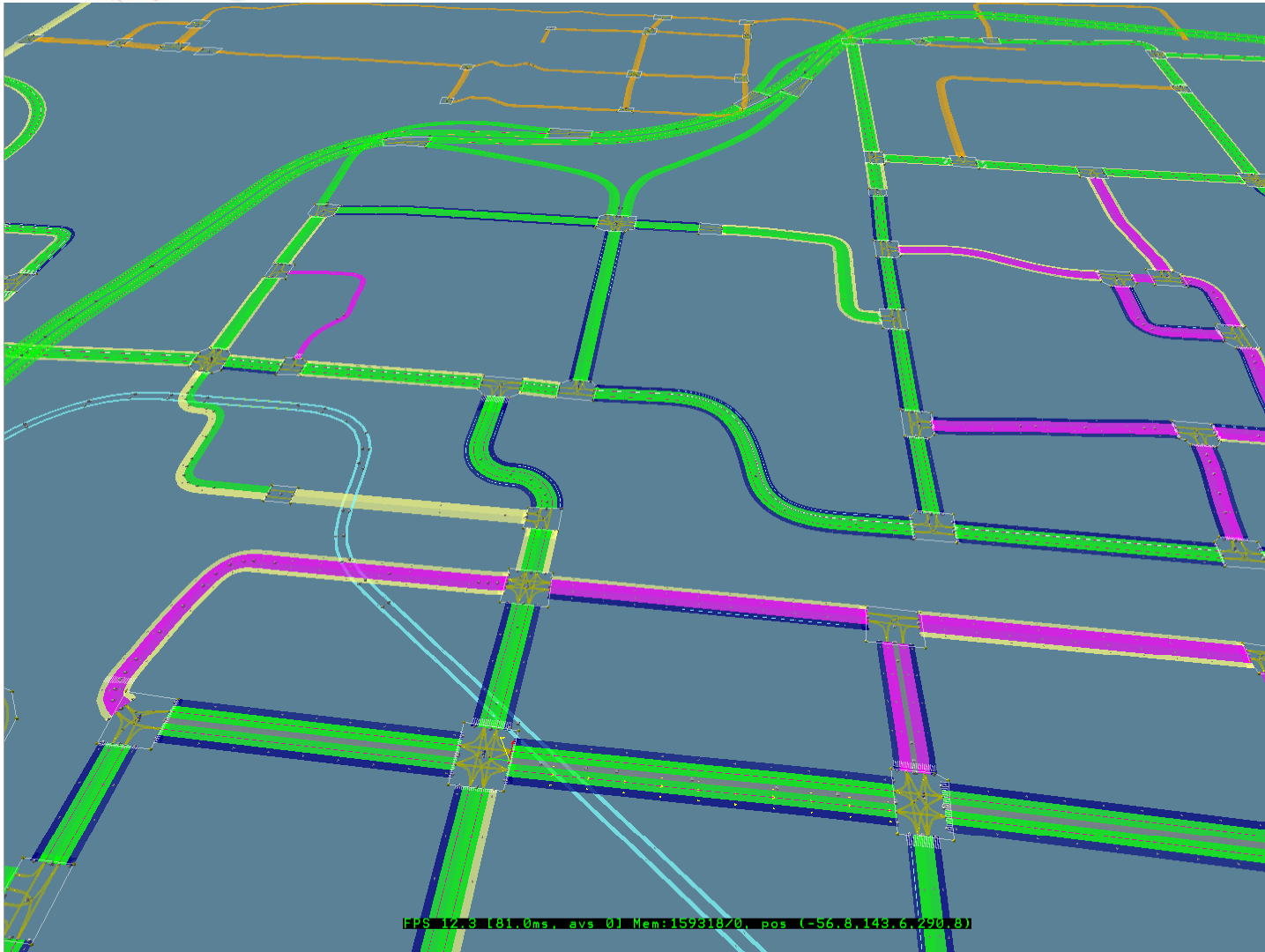
Properties ×

Property	Value		
CRPoint			
Position	-1316.76	665.705	-20.2303
Road			
Road length			169.653
Type	Road		
Max spawned cars			7
Add ranged flag		Do it!	
Direction	Backwards		
Add lane		Do it!	
Lane #0			
Type	Main road		
Width	6.1		
Bus			✔
Truck			✔
Highway			
Remove		Do it!	
Add range flag		Do it!	
Lane #1			
Type	Parking		
Width	3		
Bus			
Truck			
Highway			
Remove		Do it!	
Add range flag		Do it!	
Range flag			
Type	Parking		
From			70
Distance			90
Param			0
Remove		Do it!	

Direction
Select direction of lanes to edit

FPS 20.9 [47.9ms, avs 0] Mem:159318/0, pos (-1288.9,669.9,8.9)

TechWeb

Driver speed

- Actually required speed is set as minimum of:
  - Behavior speed – traffic lights, crossings, …
  - Obstacle speed – some (moving?) obstacle in front of the car
  - Curve speed
- Every desire subsystem can only decrease actual wish speed of the car

Car control

- The AI sets to the car
  - Wish speed
  - Current maximal centripetal acceleration
  - Current maximal acceleration
  - Current maximal deceleration
  - Aim point for the front wheels

Making car traffic alive

- Every car needs to know where the player is
- Player needs to feel like THE King of the road
- Drivers has to react on player if he bumps into them
- We had to introduce diversity in behaviors
- Avoid classic "duck" behavior as much as possible

AI Driver world

- knows about the roadmap
- knows about dynamic objects around him
- doesn't know about the physics scene
  - In very specific situations car is allowed to do asynchronous ray-cast to the static scene

Crossroads

- Team AI
- Priority for each car
- Main roads
- Traffic lights
- Aggression & green wave

Crossroads

Police system

- Important part of city game-play
  - Shootouts
  - Car chases
  - Stealth
- Main purpose is to prevent player from killing innocent pedestrians
- AI can be arrested/shot by police as well

Police spawning

- Police is visible on mini map
- Police reinforcements
- Police blocks
- Spike strips
- Chasing police cars

Police car maneuvers

- Follow, Bump, PIT maneuver, Kamikaze, Overtake and block
- We are cheating!
  - We are touching player controls after impact
  - Hunting police car can teleport (under very restricted conditions)

Police issues

- Passive player makes the police look stupid
  - Player staying in the car and waiting is a nightmare to solve in a decent way
- Police is sometime too lethal
  - Actually we had to artificially limit their speed, because it was too difficult to get away
- Cars from traffic prevents precise maneuvers
  - We are lowering traffic while police chases player

What went wrong?

NOTHING

What went wrong?

- Cuts
  - Taxi, subway
  - Instant quests
  - Friendly gangs
  - Motorbikes

What went wrong?

- Bad planning
  - We didn't think about connection of city and mission game-play soon enough
  - Insufficient communication of programmers with designers
  - Police overhaul in very late stage of development

What went good?

- The city looks really good and living
- You can take cover almost everywhere in the city
- Shops in the city are detailed and fun to visit
- Police can do really good looking stunts
- Driving model is really funny to play

What's the lesson?

- Create city is quite simple
  - But lot of work
- Design your features before implementing them
  - It is obvious, isn't it?
- Don't do everything at once

Questions & Answers

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