Supersize Your Production Pipe!

Getting the Best from your Studio's

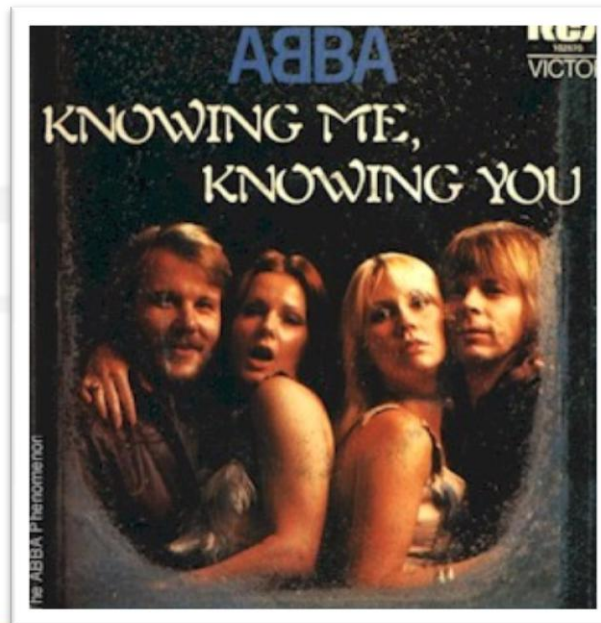Content Creation Tools and Data Pipeline

SLANT SIX GAMES

Paul Simon Martin

Director of Technology

Introduction

- Who am I?
- Who are Slant Six Games?
- Who are you?

Paul Simon Martin

- Director of Technology / Co-founder, Slant Six Games
- 15 years videogame industry experience
- Slant Six Games ('05-Present):
  - Technical Direction: BigBrain Game Engine
  - AAA-quality, cross-platform engine
  - Xbox 360, PS3 & Windows
  - Full suite of content authoring tools
  - Data transformation pipelines
  - Automated build, test & publish environments
- Sony Computer Entertainment America ('00-'05):
  - Developed: PS2 core & graphics engine (Syphon Filter)
  - Developed: PSP core & graphics prototype engine (Syphon Filter)
- Prior ('96-'00):
  - Graphics engines & tools for PS1, Dreamcast & Windows

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Slant Six Games

- Location: Vancouver, British Columbia, Canada
- Founded: 2005
- Staff: ~150

Slant Six Games

- Games:
    - Resident Evil: Operation Raccoon City – PS3/Xbox 360/Windows SOON!
    - SOCOM U.S. Navy Seals Fireteam Bravo 3 – PSP 2010
    - SOCOM Confrontation – PS3 2008 and Cold Front DLC 2009
    - SOCOM U.S. Navy Seals Tactical Strike – PSP 2007
   - Syphon Filter: Dark Mirror - PSP 2006 – Rendering Engine

- Awards:
    - BC Business Magazine - Best of BC Top 10 Companies to work for in British Columbia - 2009
    - Elan Award – Best New Game Company – 2008
    - SOCOM US Navy Seals: Tactical Strike
    - Elan Nominated - Best Hand-Held Game of the Year - 2008
    - BAFTA Nominated - Best Strategy Game - 2009
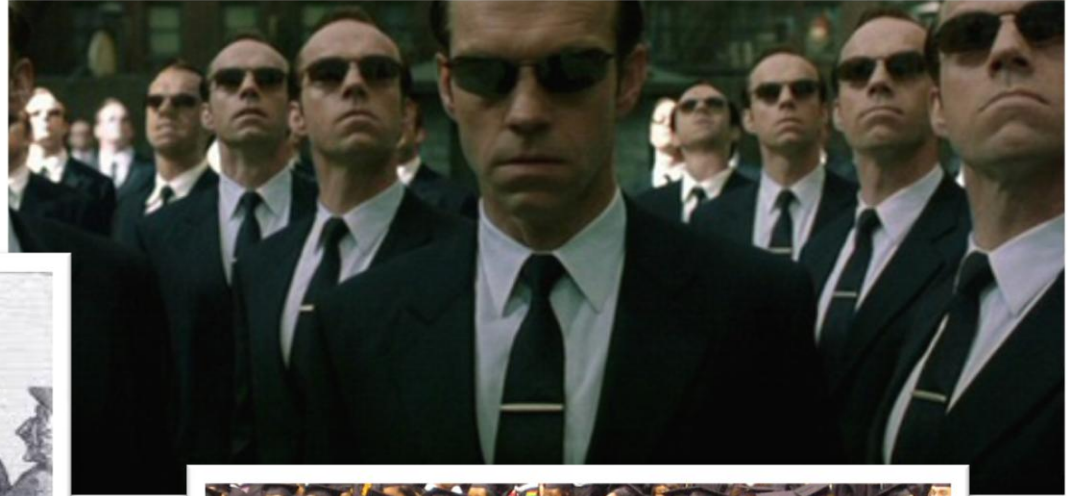   - E3 Best PSP Multiplayer Experience -2007

- Technology
    - AAA class multi-platform (PC, XBOX 360, PS3) Proprietary Game Engine
    - Proprietary Rendering and Animation Engines , Pipelines and Toolsets
    - PSP proprietary Engine and Toolsets
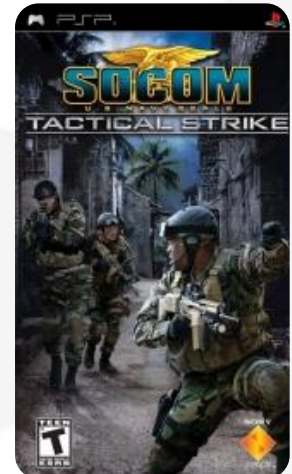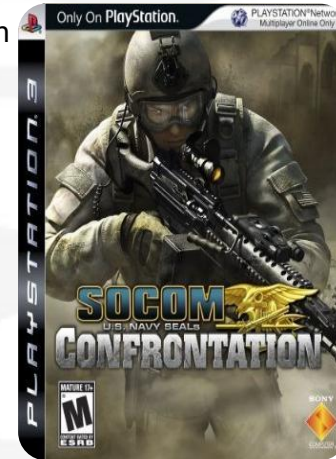
You are...

Glossary of Terms

- Source Content:
  - Any unoptimized game asset file that has not yet gone through data conversion
  - E.g. *.ma, *.dds, *.tga, *.csv

- Game Data:
  - Data file that is ready to be loaded by the game
  - Usually optimized for platform(s)

- Authoring Tools:
  - A tool (usually residing on PC) used to author source content
  - E.g. Maya, Photoshop, CustomStudioTool

- Data Pipeline:
  - A set of tools & scripts that are used to convert Source Content → Game Data
  - Typically driven via a build engine

Glossary of Icons

- Slides

  Online content
  (will discuss during this talk)

  Offline content
  (either hidden slide or will gloss over)

- Suggestions

  Practices that work well for us
  (TODO: xxx)

  Things we learned the hard way
  (TOAVOID: xxx)

Rewind...

The Evolution of Production
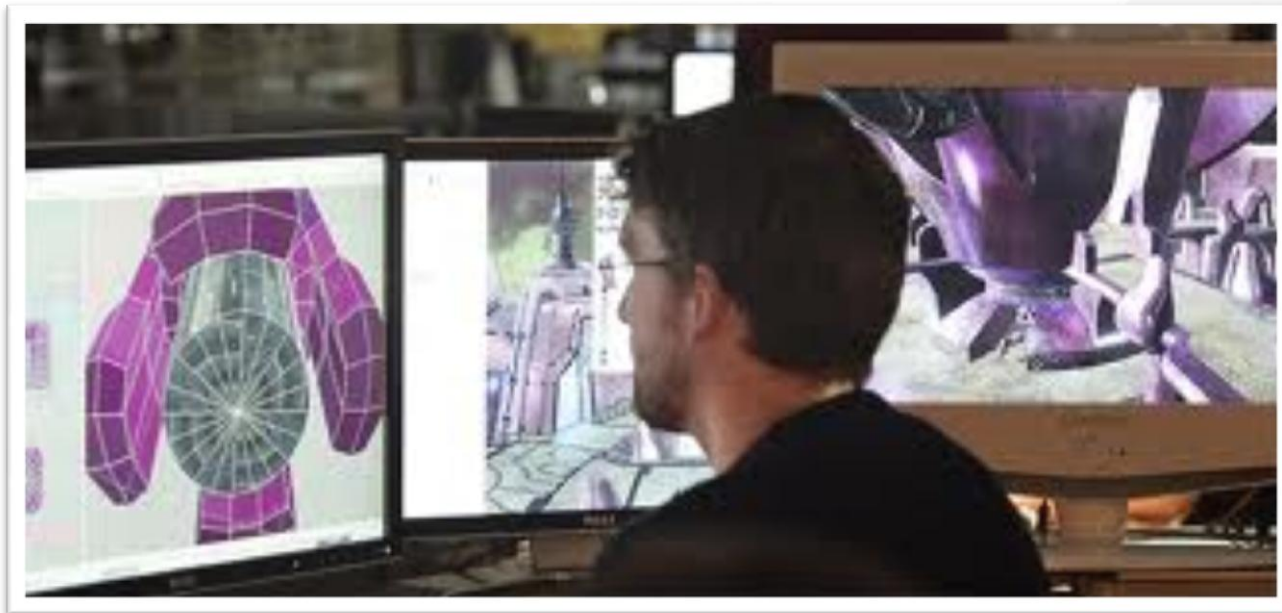## Circa 1980 AD

- Part 1: *The Programmer*

The Evolution of Production
Circa 1985 AD

- Part 2: *The Artist*

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The Evolution of Production
Circa 1994 AD

- Part 3: *Somebody hired a Game Designer*

The Evolution of Production
Circa 2000 AD

- Part 4: Can't we all just get along?

The Evolution of Production
Current Day

- Studios value their artists and designers
- Artists and designers:
  - Build The Game
- Programmers:
  - Support artists and designers
  - Implement core gameplay that can't be data-driven

"Your Studio is as good as your Tools"

- *Paul M, circa 2003*
- "Tools"= Authoring + Infrastructure +

  Pipeline + Packaging
- Today's games must have massively efficient runtime

  => Bake as much optimization into data as possible
- Games built by production teams
  - Faster workflow => more content
  - Faster workflow => more iteration = polish = quality

Iterate!
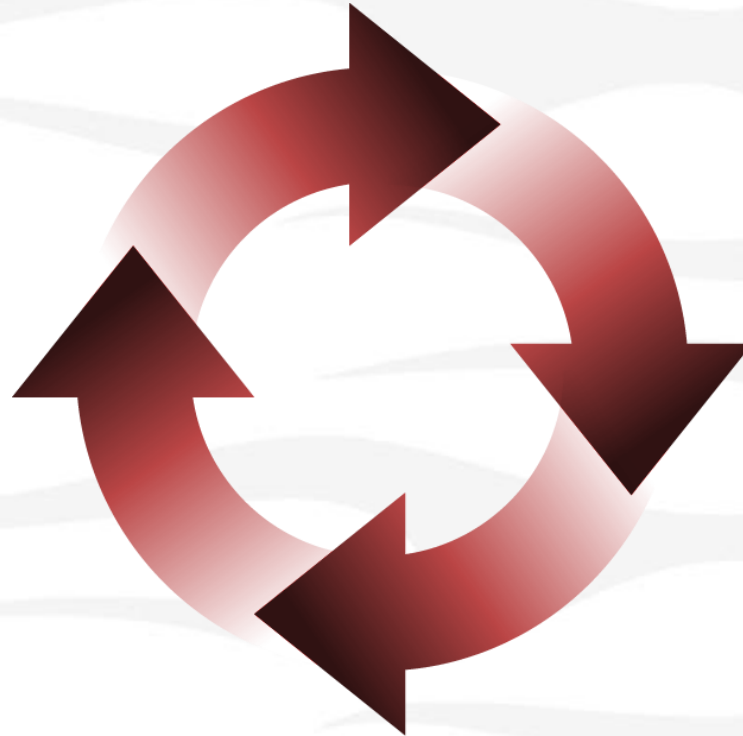
Supersize Your Production Pipe?

Supersize your Production Pipe

- **Production pipe** (prə duk'sʰən, prō- pÄ«p):
  - "The process that generates content for your games"
  - narrow → constrictive → poor flow
  - wide → dilative → good flow
  - Considerations:
    - Internal team process / workflow
    - External team process / workflow
    - Authoring tools / workflow

Supersize your Production Pipe

- **Super-size** (s$\overline{oo}$′pər sīz′):
  - "Increase capacity"
  - "Make bigger"
  - In order to:
    - *Increase flow*

Gotta Have Flow!
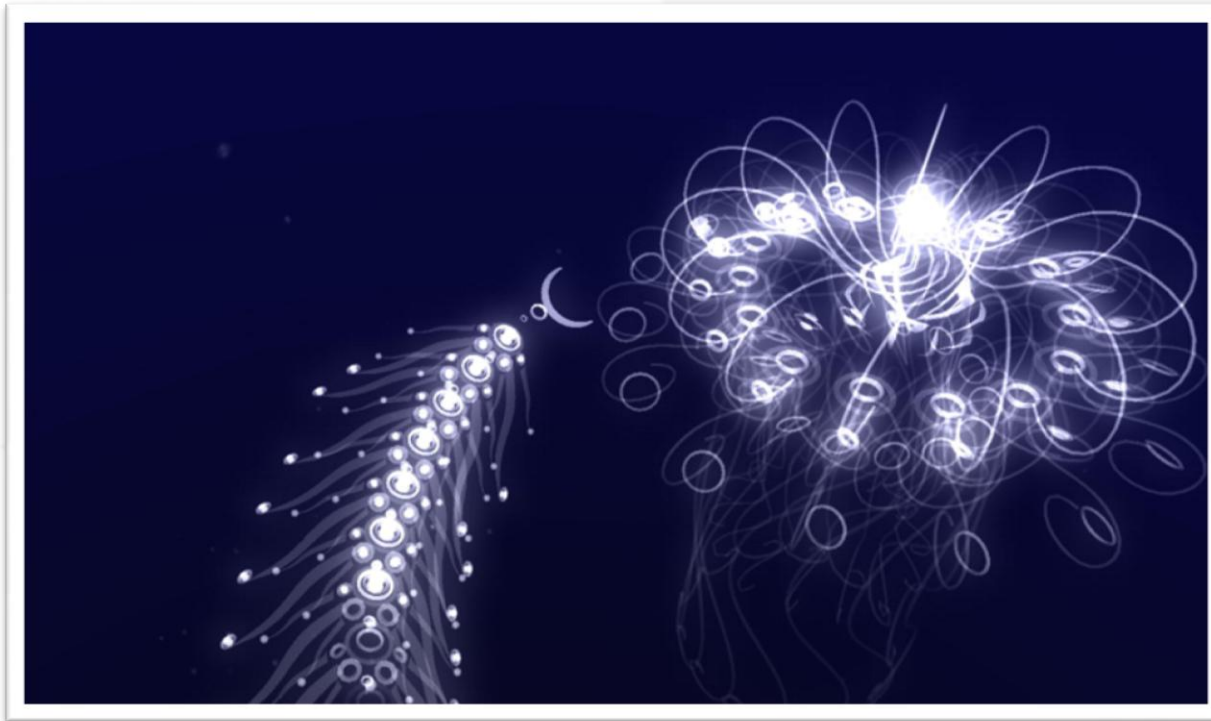
Latency – The Silent Killer

- *Latency*: *A measure of time delay experienced in a system*
- High latency = Low flow
- Identify maximum iteration time
- Identify latency
- Derive a plan
- Re-evaluate

Let's Begin...

"The Production Pipeline"

- Infrastructure **IF**
- Content Authoring **CA**
- Data Conversion **DC**
- Game Runtime **GR**
- Game / Asset Packaging **AP**
- Game / Asset Sharing **AS**

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A Typical Scenario

- EvilThingSpawnTriggerVolume
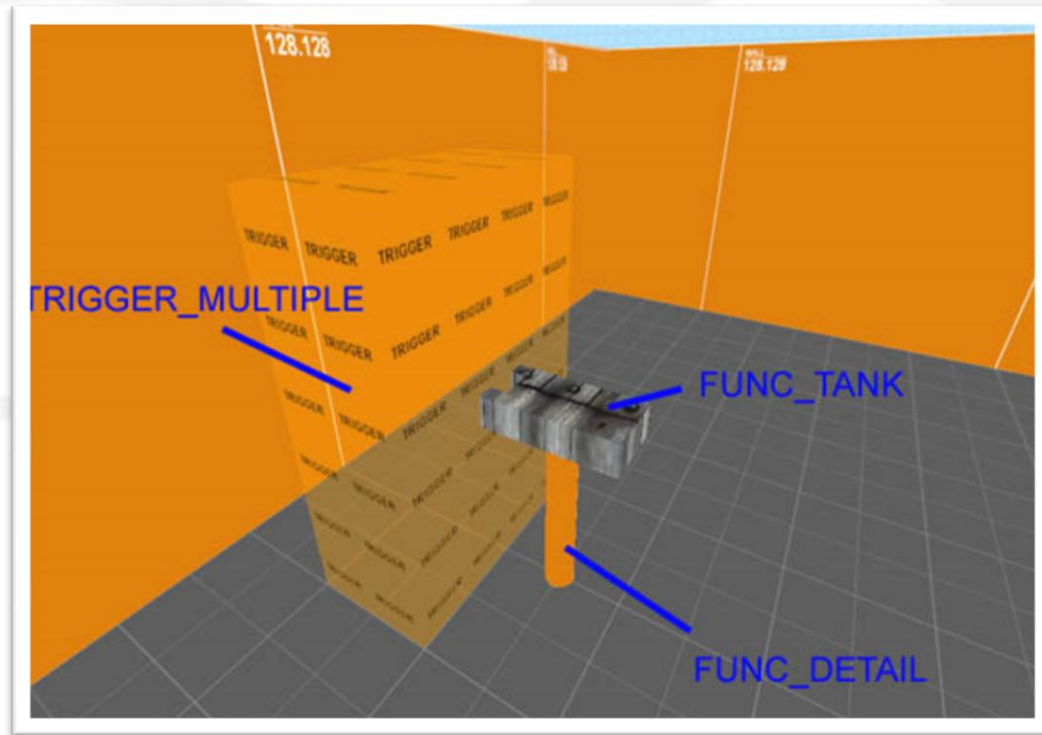
Old School

1. Trigger volume authored/tweaked in the level editor
2. User hits the "export" button
3. User runs a script to re-export the entire world
   - textures converted, visibility map compiled, navigation mesh generated, …
4. User waits 10+ mins
5. User launches the game
6. It takes 5 mins to load
7. User runs player character from level start -> test area
8. Volume was too big/too small? Try again, back to step 1.

CA

DC

GR

15 mins

Much Better

1. Trigger volume authored/tweaked in the level editor
2. User hits the "save" button
3. The build infrastructure detects a file change
   - Triggers fast asset conversion for the new trigger volume alone
   - Signals (already running) game there is a change
   - Game hot-loads new volume and associated scripts
   - Player character (still) in test location
4. Volume too big/too small? Back to step 1.

CA

IF

DC

GR

5-15 secs

Author vs Tweak

- Author:
  - Addition/deletion of *something new*
  - *Latency*: 1-30 seconds
- Tweak:
  - Movement or property change of *something existing*
  - *Latency*: < 5 seconds

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What Happens Next…

Post-iteration, user commits changes…

1. User hits "commit" button
2. New level data committed to asset depot
3. Build/Test Server (BTS) detects a change and begins asset conversion
4. BTS launches an automated test of the game with new asset
5. All happy? BTS sends user a confirmation email
6. Problem? BTS sends user an email with relevant info

User involvement ends here / moves on to new task

IF

IF

IF

IF

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Infrastructure [IF]

Infrastructure

- Asset storage
- Automated building
- Automated testing
- Automated metrics reporting
- Process analysis

Infrastructure – Asset Storage

- Big data, many files, frequent access
- Large capacity, fast access hardware
- Revision control software
  - Perforce
  - Subversion/GIT/Mercurial
  - Alienbrain
  - Homegrown solution

Infrastructure – Automated Building

Infrastructure – Automated Testing

Infrastructure – Automated Metrics
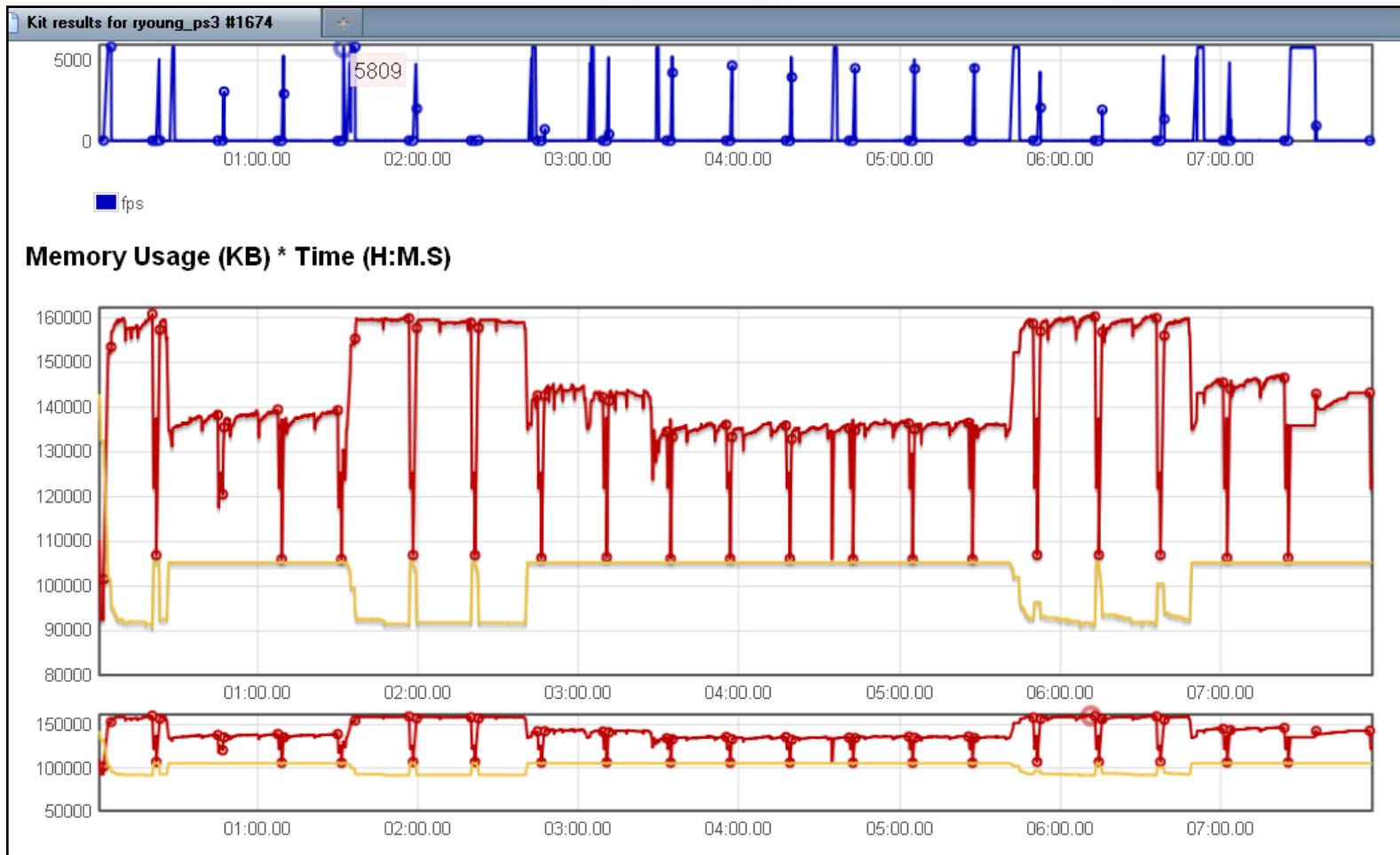
Infrastructure - Analysis
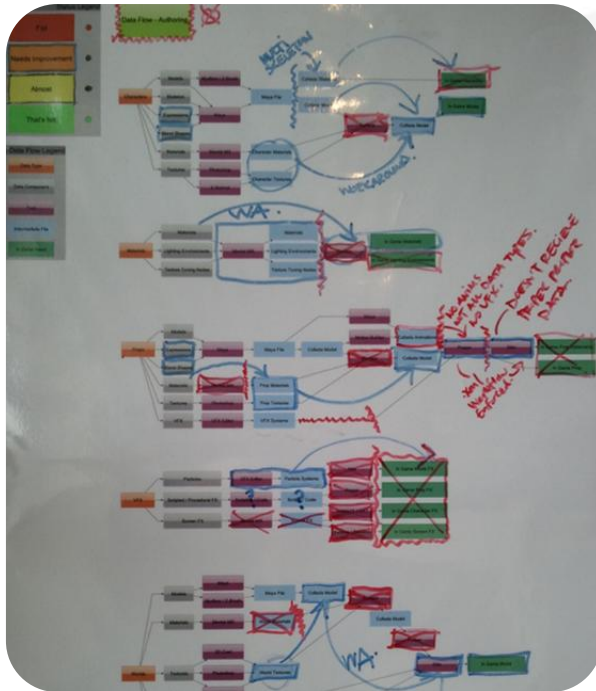
Sharing Boundary
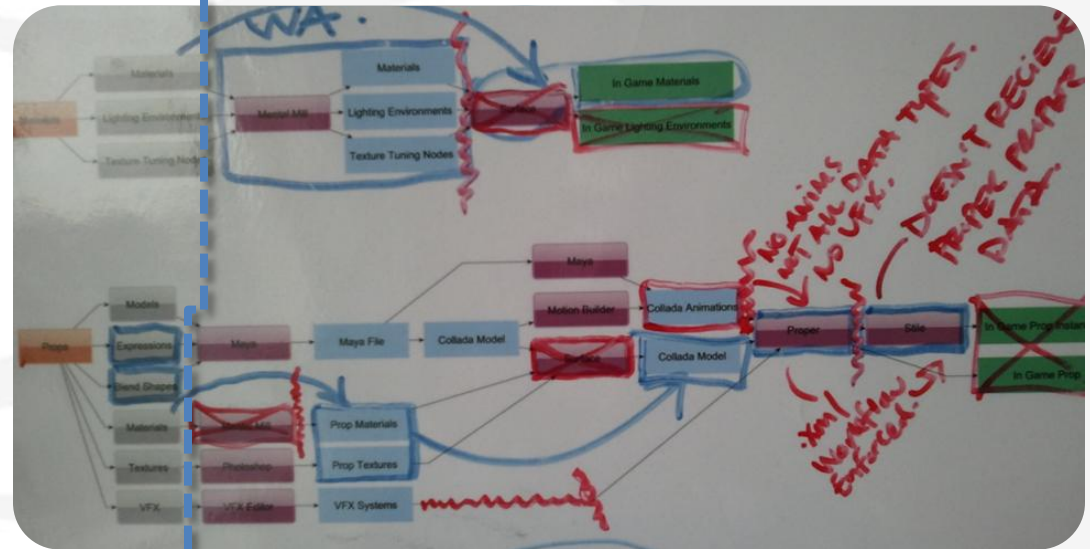
Internal + External

Internal Only

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Infrastructure - Sharing Tools

- Which to share and why?
    - Remember that dotted 'sharing' line last slide…
- Establish internal vs external workflow
- Tool & data versioning
    - Developer studio tool versions usually more recent than remote studio's. So…
    - Flexible runtime or…
    - Asset upgrade process

Infrastructure - Analysis

|	A Topologist	B Dae Attribute Filter	C Model MetaGen	D Reanimate Exporter	E ssg	F fbx to edge Anim	G ddscow ddscompress pixter	H Collada ToHKX	I Collada ToEdge	J MaterialC ompiler	K hctSlant Filter Manager	L shc	M Build Model Stats
2	21.5	0.687	0.407	3.375	0.187	1.563	5.14	0.469	3.82	1.164	0.297	3.625	4.14
3	60.047	0.656	0.391		1.42	1.422	5.047	0.422	2.71	0.438	0.266	0.156	0.57
4	154.235	0.469	0.375		0.031	1.422	5.984	0.438	1.515	0.437	0.297	0.218	0.062
5	40.5	0.406	0.375		0.031	1.422	4.859	0.421	1.016	0.422	0.281	0.25	0.969
6		0.406	0.375		0.031	1.41	4.937	0.422	0.719	0.421	0.266	0.03	0.437
7		0.656	0.375		0.032	1.422	2.657	0.421	1.61	0.438	0.265	0.265	3.688
8		0.453	0.375		0.032	1.422	4.109	0.485	0.765	0.437	2.5	0.218	3.609
9		0.422	0.485		0.047	1.422	5.032	0.485	0.75	0.422	0.25	0.203	2.141
10		0.406	0.406		0.031	1.406	3.812	0.485	1.062	0.421	0.266	0.219	13.031
11		0.468	0.391		0.032	1.129	2.39	0.437	0.734	0.438	0.321	0.203	12.5
12		0.422	0.39		0.032	1.128	4.969	0.437		0.43		0.188	8.968
13		0.406	0.391		0.032	1.219	3.078	0.422		0.422		0.187	5.438
14		0.641	0.391		0.031	1.219	3.625	0.391		0.422		0.203	0.29
15		0.391	0.39		0.031	1.203	5.06	0.422				0.188	0.625
16		1.734	0.375		0.031	1.219	3.812	0.422				0.171	0.922
17		1.219	0.375		0.047	1.218	2.64	0.437				0.156	
18		1.125	0.468		0.032	1.203	4.953	0.484					
19		1.11	0.375		0.031	1.42	2.68	0.453					
20		1.562	0.516		0.031	1.422	5.484	0.453					
21		1.469	0.375		0.031	4.031	6.062	0.407					
22													
23	4	114	319	1	595	493	2460	371	437	1766	316	216	16

Content Authoring [CA]

Content Authoring
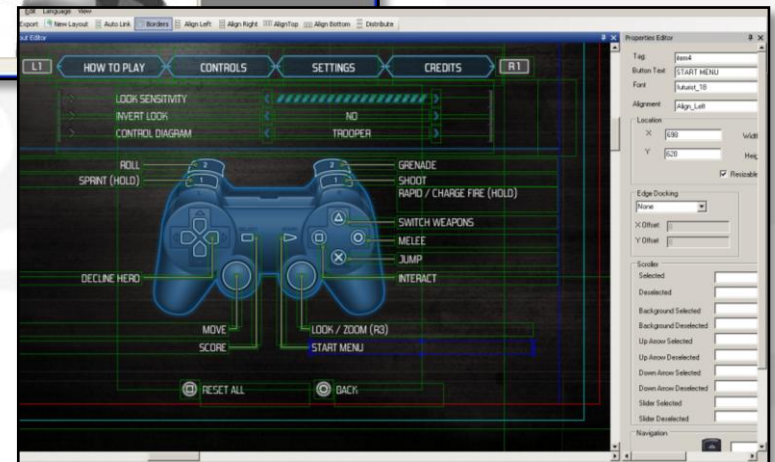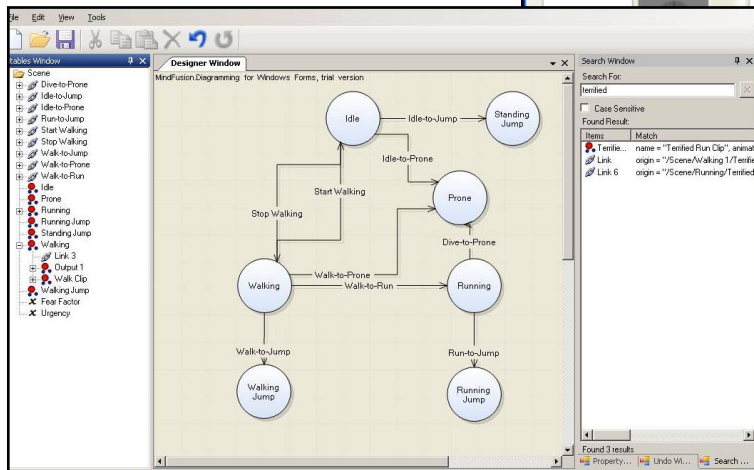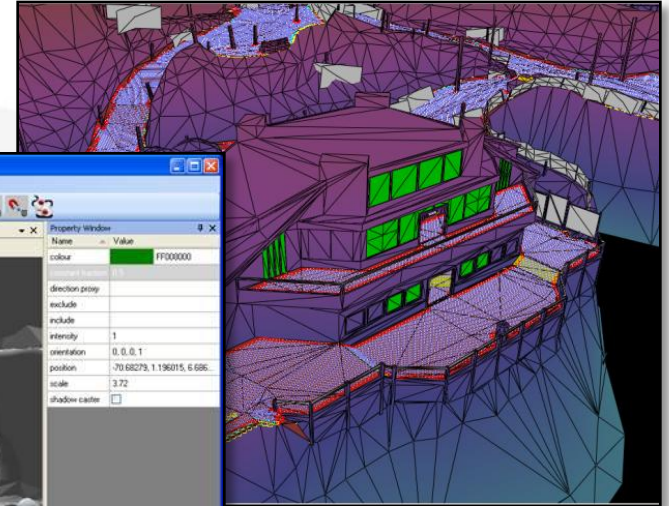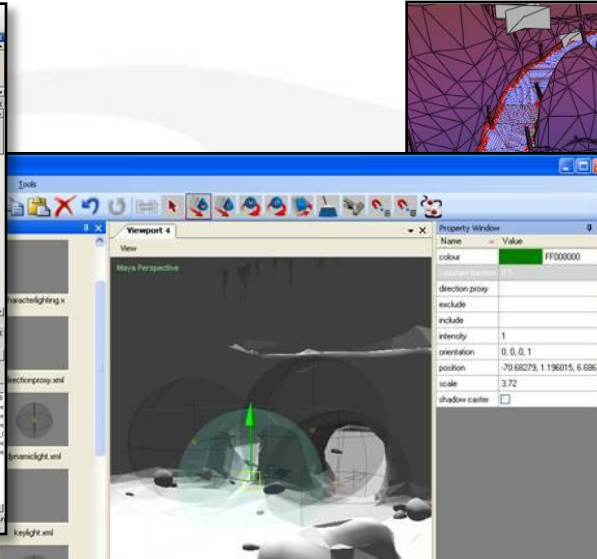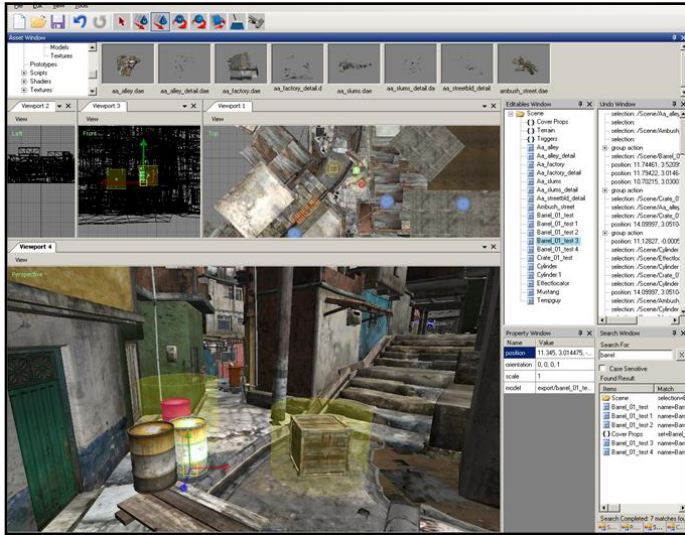
Content Authoring

- Intuitive UI
  - Also, mirror existing commercial tools key bindings & shortcuts (Maya, Photoshop, …)
- Consistent UI
- Close to Zero-iteration time
  - The 5 Second Rule
  - Ideally in-game/in-viewer
  - Or in tool viewport

Organizing Assets

- **By meta-tag** (e.g. iTunes)
  - Requires implementation effort
  - Tends towards poor file management
- **By directory** (e.g. Windows)
  - Tough to relocate
- Find a balance
  - <= 200 tagged items per folder
  - Disallow tags defined by user
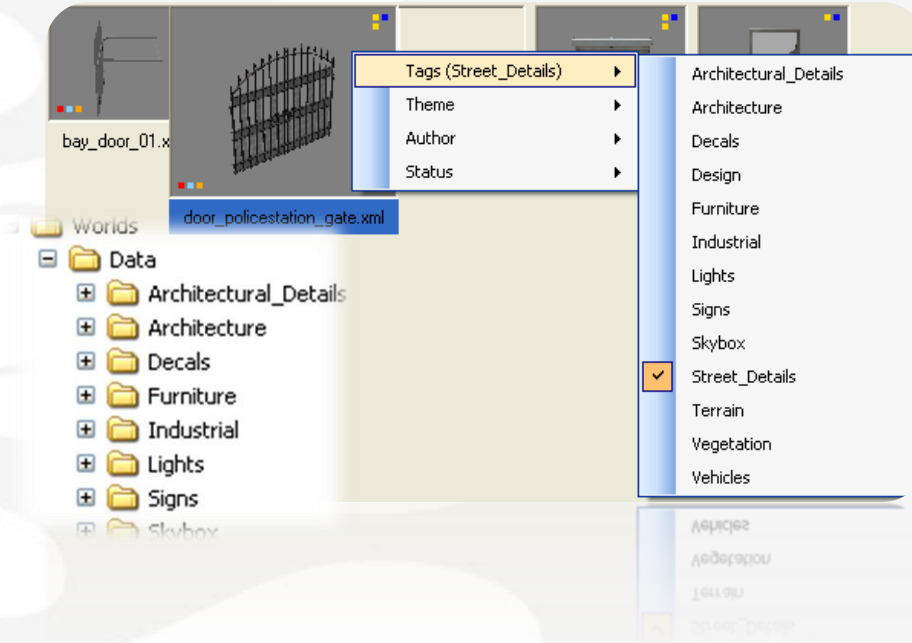
Tracking Assets

- Tracking software/tools
  - ✅ Hansoft
  - – Filemaker Pro
  - ✅ Excel

- Consistent language
  - – Normal map change
  - – Mesh change
  - – Detail change…

Budgets and Metrics

- Establish 'Cost Scores' for all assets
- Find a currency for each asset type
  - E.g.
    - Filesize (Kilobytes)
    - Dimensions (pixels wide/pixels tall/pixels deep)
    - Runtime cost (GPU cycles or even # lines of code!)
- Allow users to evaluate the total cost of a scene
- Document currencies for outsource partners
- Document budgets in asset tracker when outsourcing

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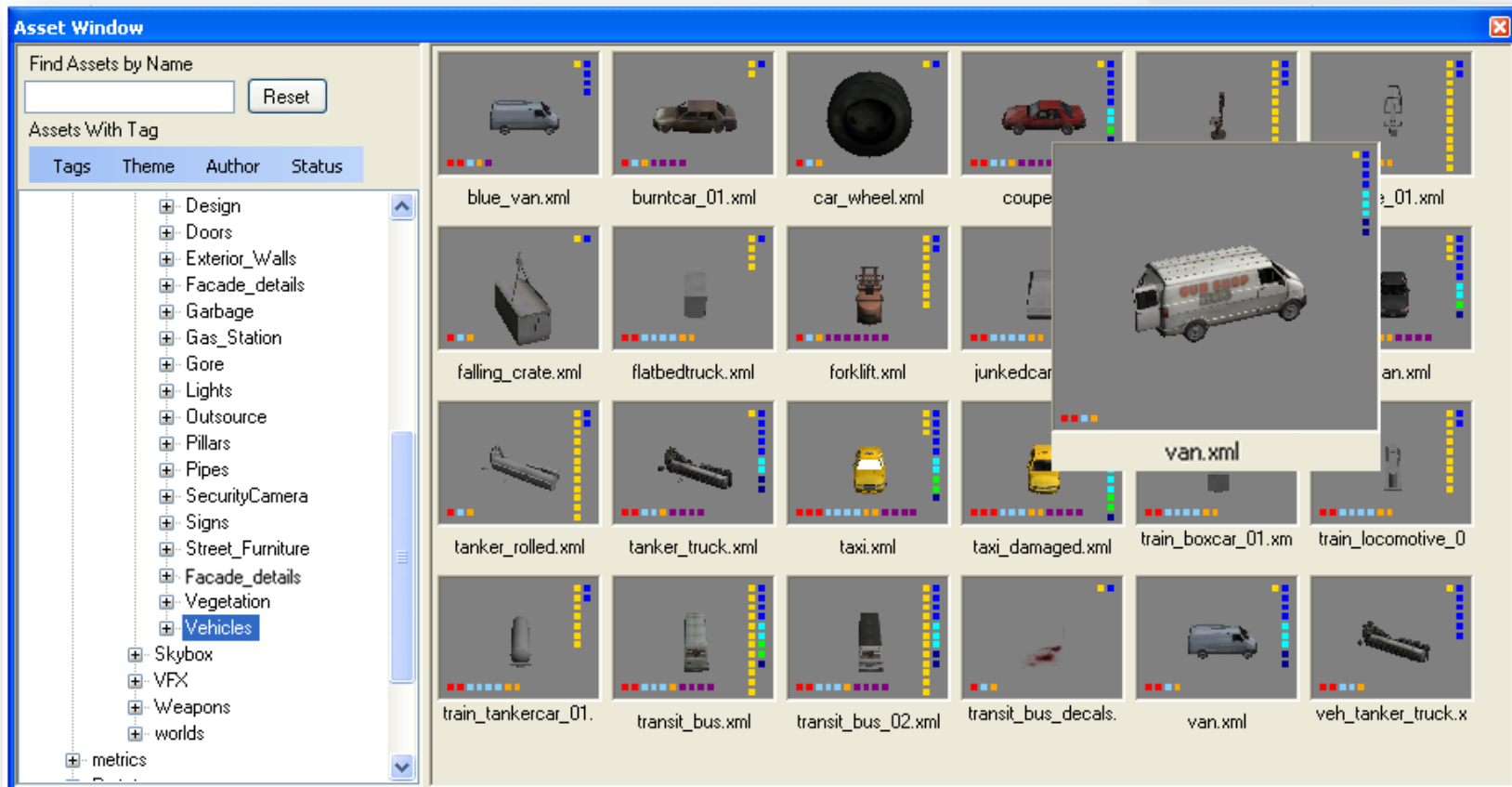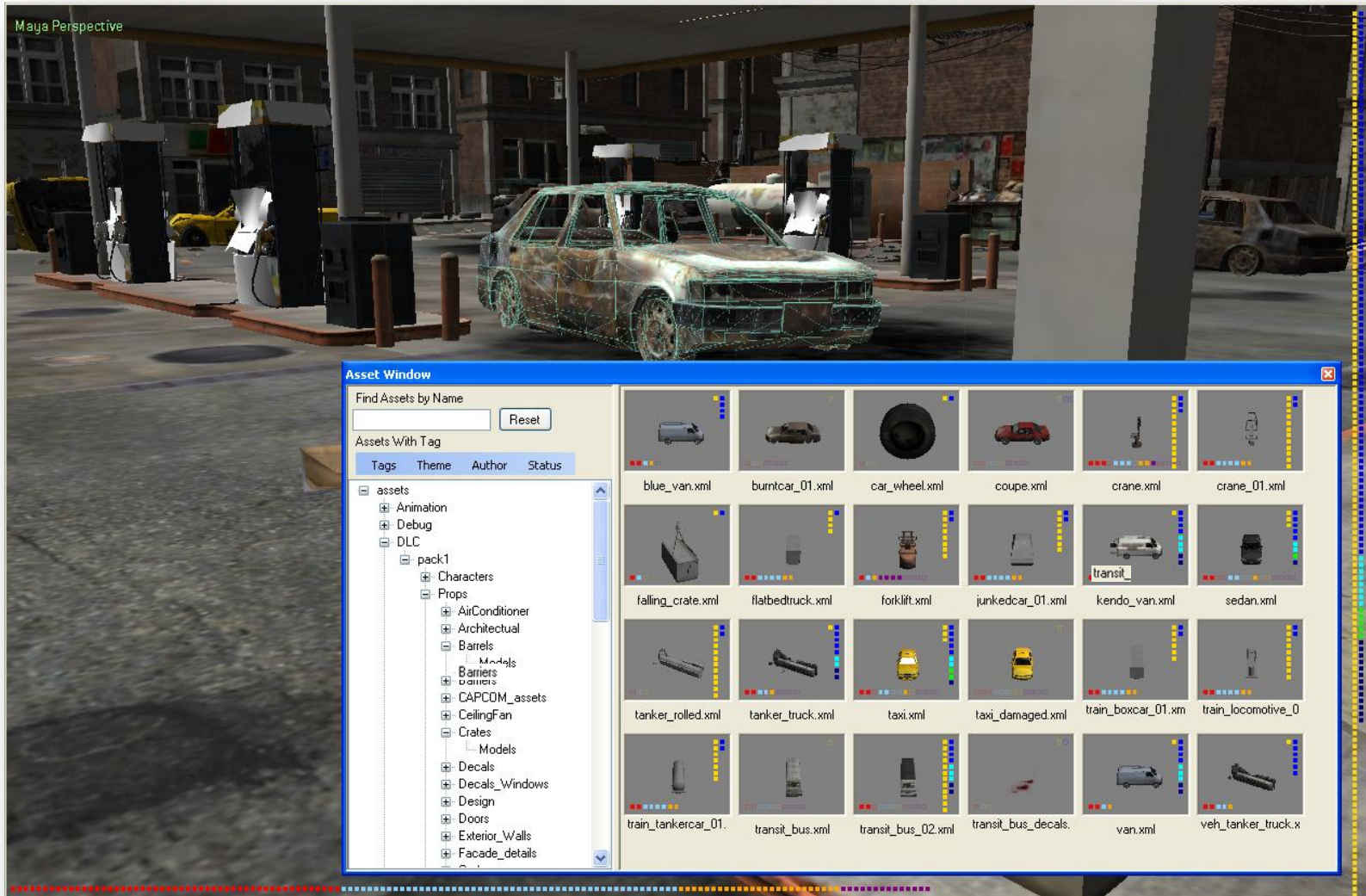
Budgets and Metrics

Data Conversion [DC]

Data Conversion

⚠️ DOS Batch files are evil!
- – Limited functionality
- – Poor scripting language
- – Slow to execute
- – No data dependency checking => each build takes as long as the previous
- – Hard to debug

Data Conversion

- Many better options available:
  - ✅ Scons (we like this ☺)
    - – MSBuild
    - – Ant/NAnt
    - – Jam
    - – Make
- Wrap in a UI

Data Conversion

- Error Checking:
  - As much as possible
  - Report in a timely manner
    - Often convenient to check for missing assets in data conversion pipe but…
    - Try to prevent errors getting this far
    - Better to report errors at authoring time
  - Report errors clearly!

Game Runtime [GR]

Engine Considerations

- Middleware:
  - Not inherently evil 😛 but don't rush into it
  - Consider: Tools authoring process (identify any latency!)
  - Consider: Interoperability with your runtime
  - Consider: Integration with your tools & data pipeline
  - Consider: Support?
  - Consider: Source code?

Middleware @ Slant 6

CA/GR   Collision, rigid body physics, ragdoll

CA/GR   Audio asset management, audio runtime

GR   Low-level networking

DC   Maya export via Fcollada

DC   Mesh LoD

Engine Considerations

- Live update:
  - Tuning variables
  - Object position/scale/rotation
  - Object creation/deletion
  - Object refresh
- Live variable introspection/reflection
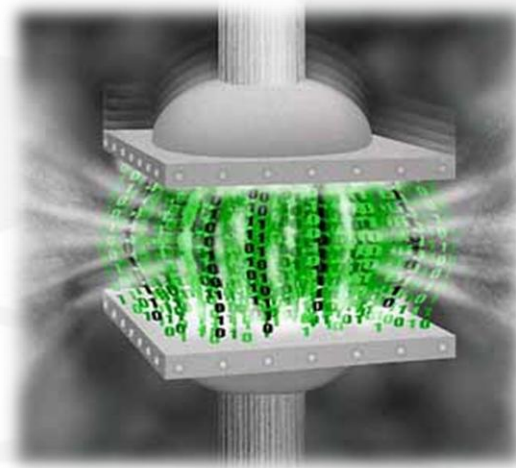 - Game variable state reflected in authoring tools

Game and Asset Packaging [AP]

Game/Asset Packaging

- Which format?
  - MSI / ZIP / RAR
  - PSN package
  - XBL package

⚠️ Configuration TRC/TCR complexity

⚠️ Configuration combination explosion
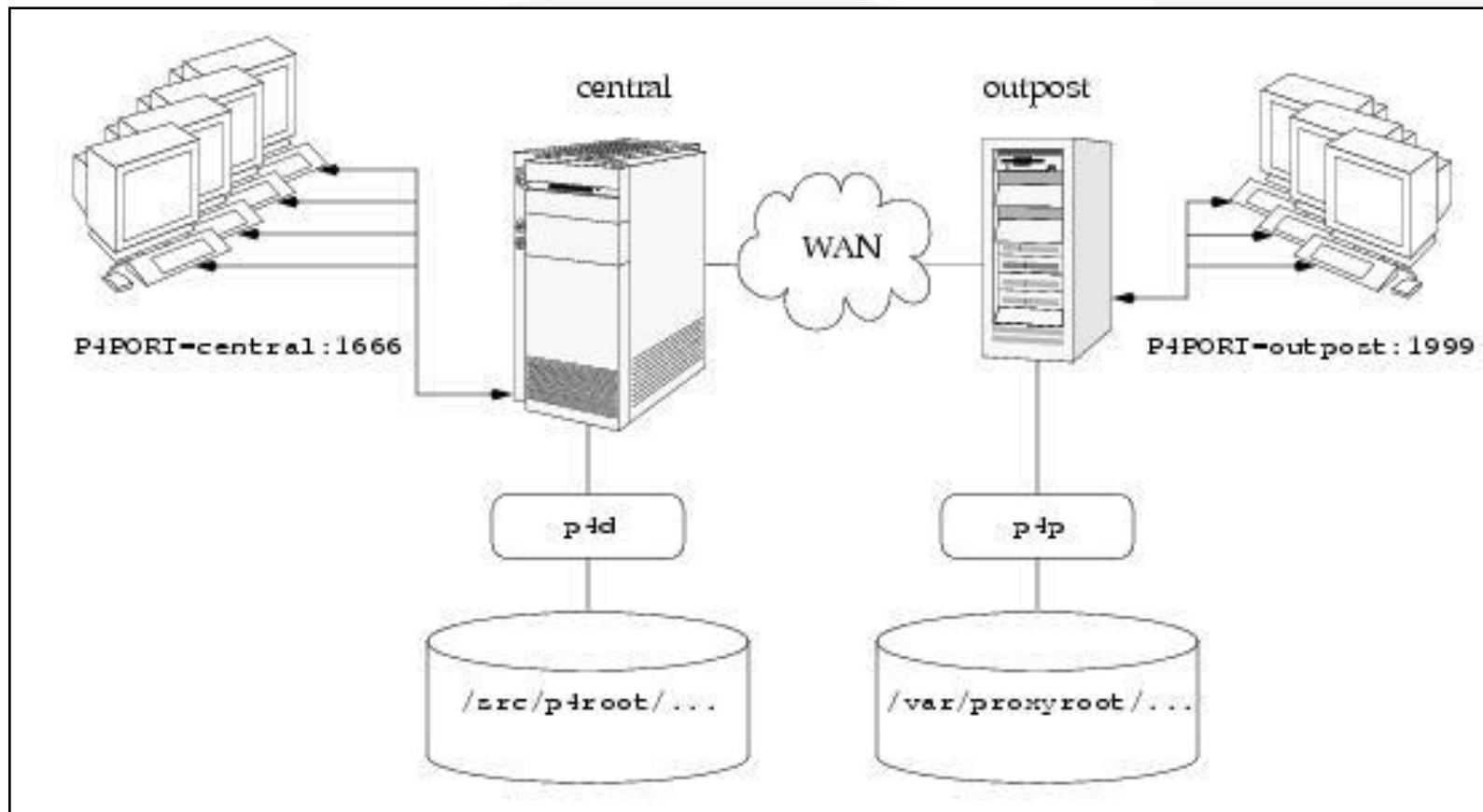
🛡️ Automate!

Game and Asset Sharing [AS]

Game/Asset Sharing

- Shared Server
  - ✅ Perforce + P4 Proxy
    - Visual SourceSafe + SourceOffsite
- Package Drop
  - FTP
  - ✅ Aspera *fasp*™
  - HDD Courier
- Carrier pigeon?

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Asset Sharing – P4 Proxy

Asset Sharing – Package Drops

FTP/Aspera *fasp*™

Asset Sharing – Package Drops

- Problem:
  - Long build process for packages
  - Usually commence late in the work day
  - Someone needs to work late!
- Solution:
  - Automate the package shipping!

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In Summary

⚠ **Don't**

- Let production process evolve on its own
- Always prioritize game features over tools & workflow improvements
- Ignore your production team's workflow requests
- Underestimate management effort for outsourcing

✅ Do

- Identify latency in your production pipeline
- Automate as much as possible
- Have regular 'asset authoring priorities' meetings
- Hire an army of tools engineers!
- Create an outsourcing plan
- Treat outsourcing partners like part of the team
- Regular status meetings with outsourcing partners
- *MAXIMIZE YOUR PRODUCTION PIPE!*

Talk to me...

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Q & A