

Game Developers Conference™ Europe 2011

August 15th 2011 | Cologne, Germany

Supersize Your Production Pipe!

Getting the Best from your Studio's
Content Creation Tools and Data Pipeline



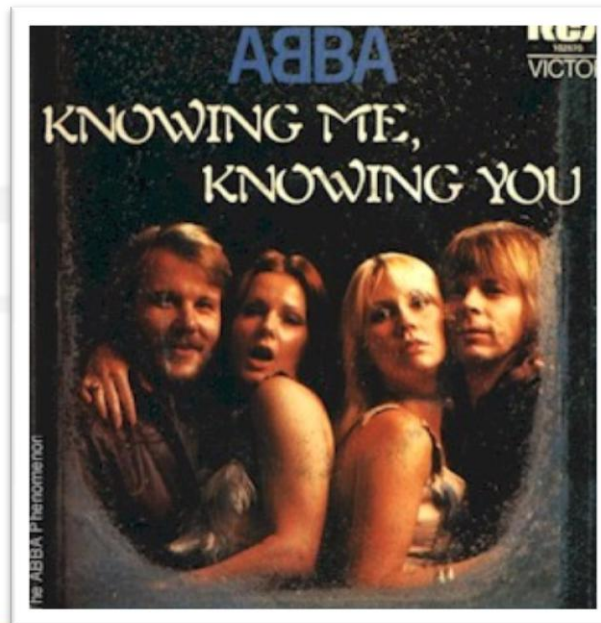
SLANT SIX GAMES

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



Slant Six Games

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



SLANTSIXGAMES



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

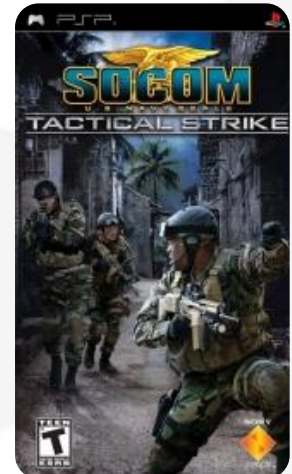
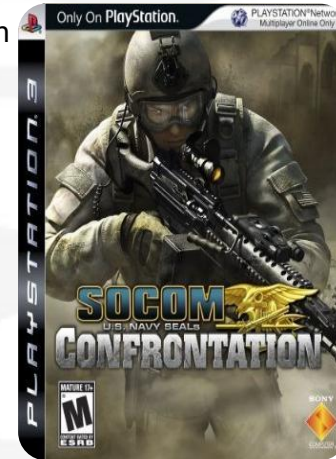


- Awards:

- 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

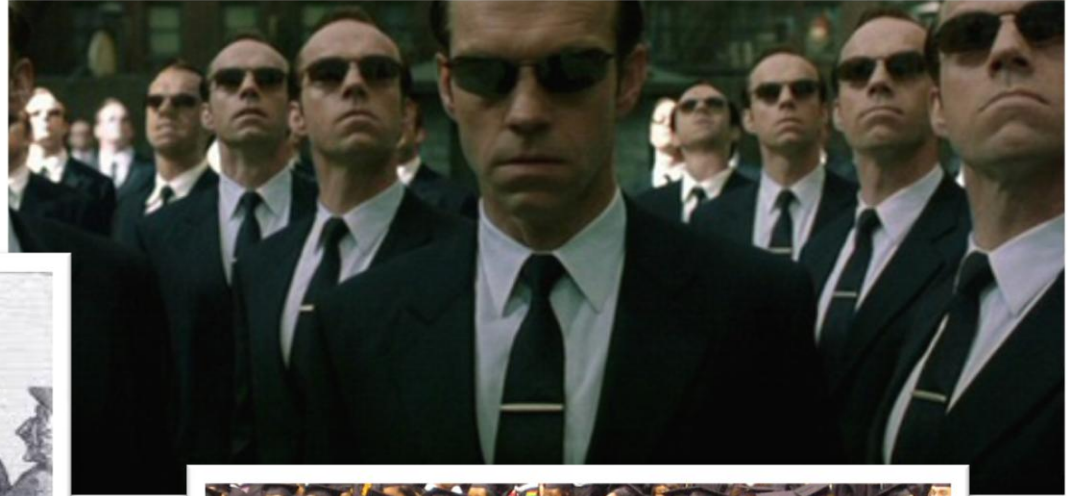
- Technology

- 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...



SLANT SIX GAMES



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*

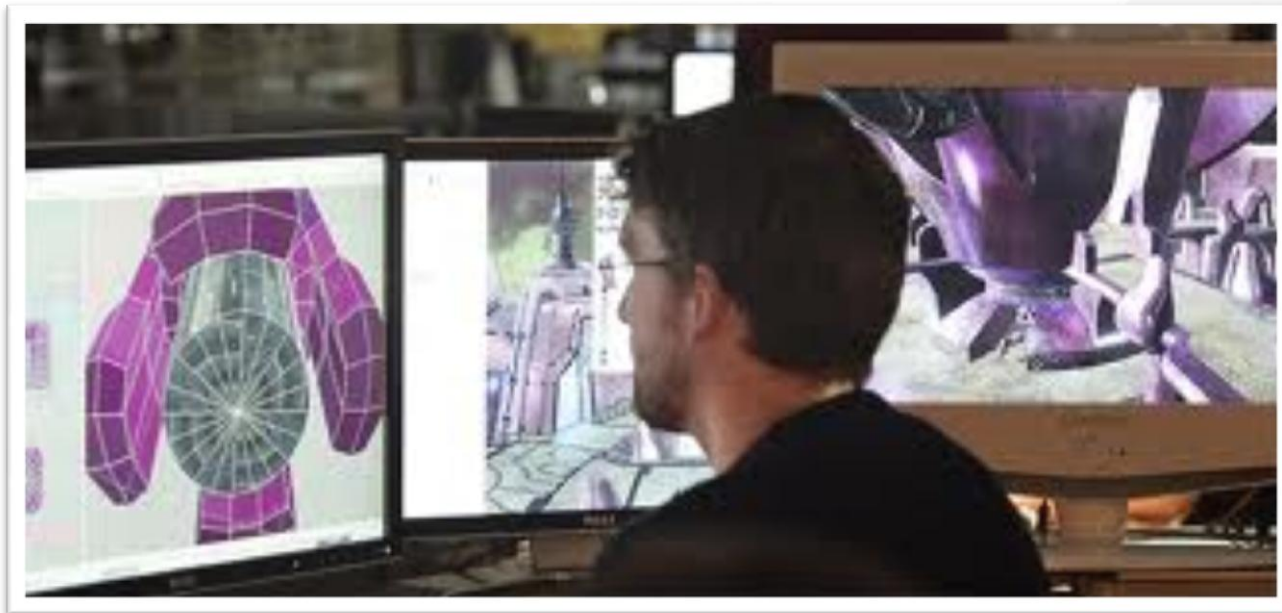




The Evolution of Production

Circa 1985 AD

- Part 2: *The Artist*





The Evolution of Production

Circa 1994 AD

- Part 3: *Somebody hired a Game Designer*





The Evolution of Production

Circa 1998 AD

- Part 3.5: *Artist & Designer Spanking* – popularity diminished





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

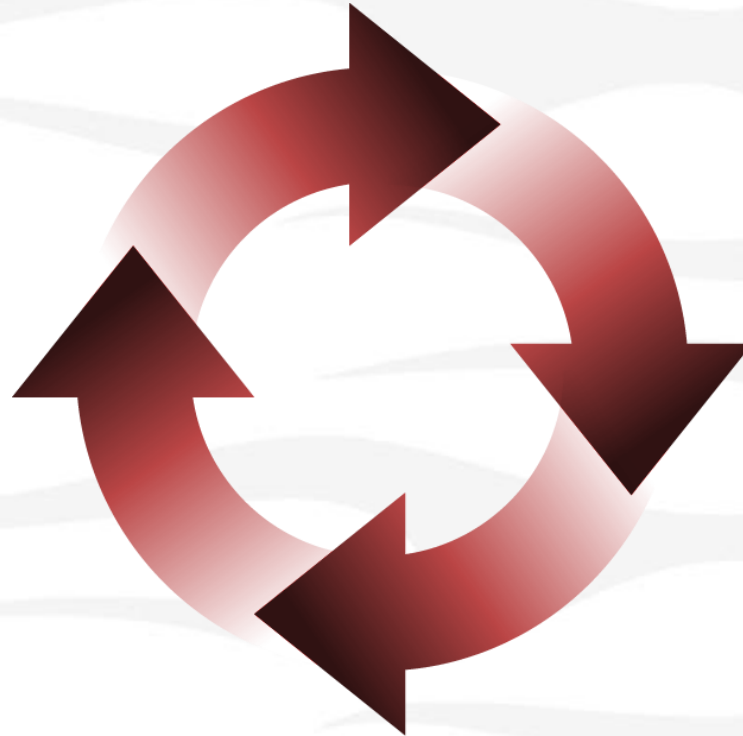


“Your Studio is as good as your Tools”

- *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





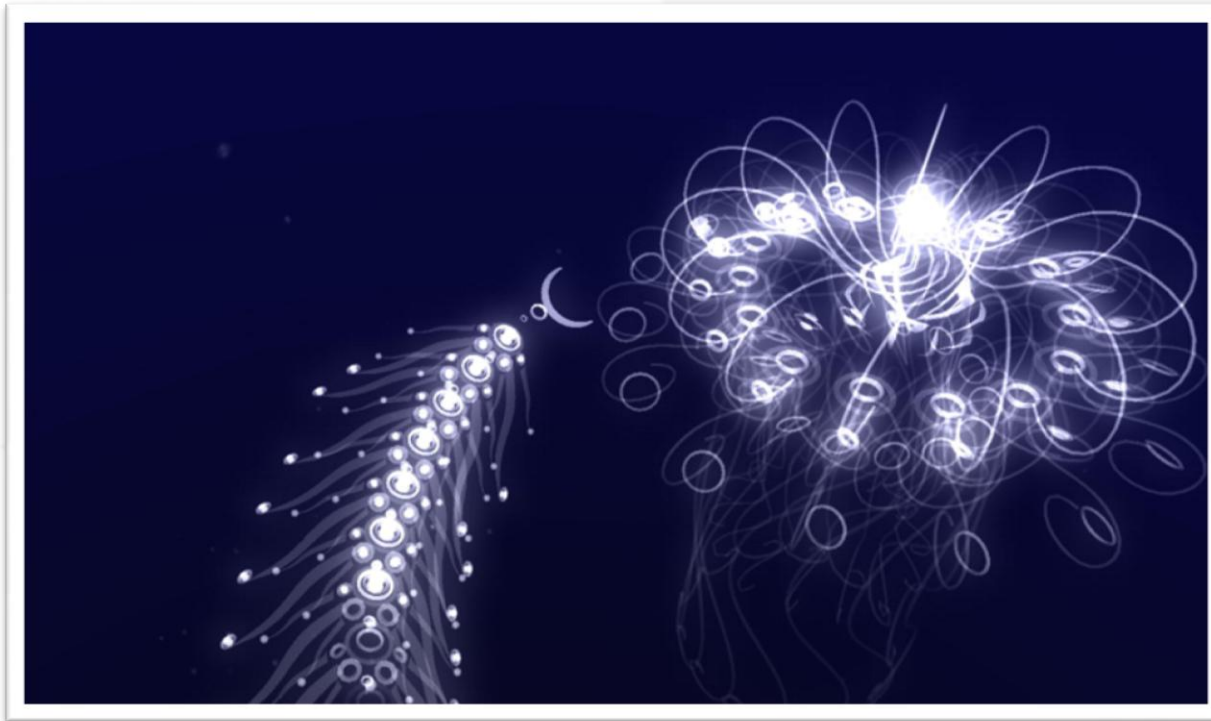
Supersize your Production Pipe

- **Super-size** (sōō'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...





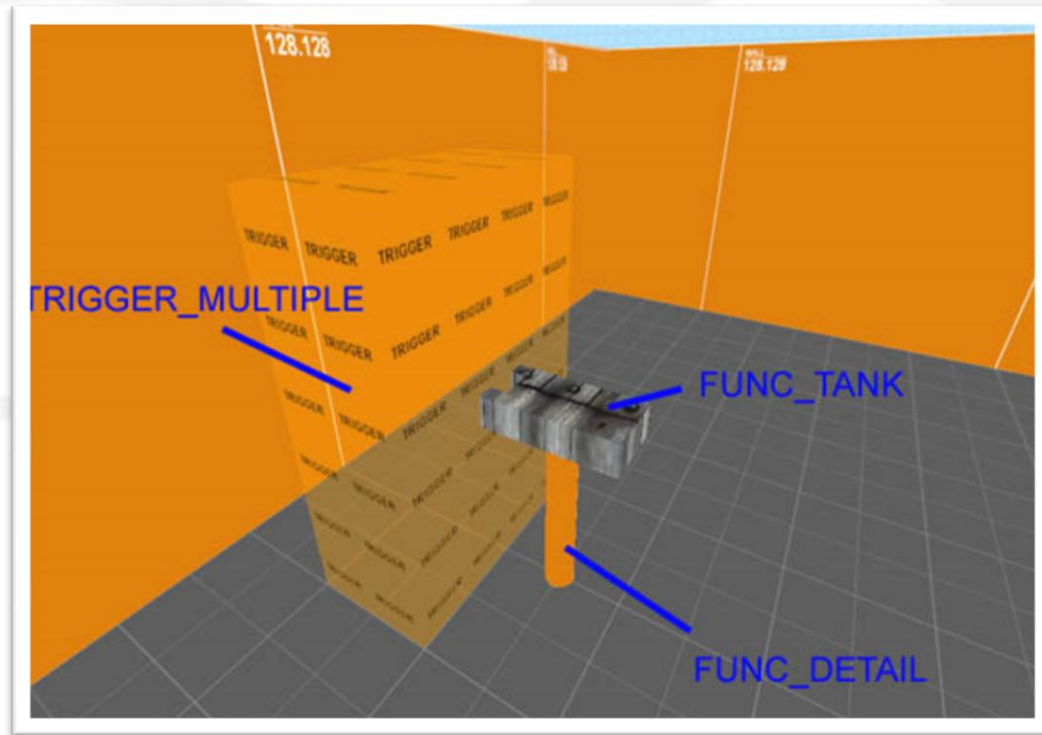
"The Production Pipeline"

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



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



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



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





[Home](#) - [Waterfall](#) [Grid](#) [T-Grid](#) [Console](#) [Builders](#) [Recent Builds](#) [Buildslaves](#) [Changesources](#) - [About](#)

Waterfall

last build		demo1-code1 failed PCDebug_Server PCRelease_Server	demo1-code2 build successful	demo1-art build successful	build-release build successful failed slave lost	test-ps3-release build successful	test-x360-release build successful	publish-release Published [381882]	build-package build successful
current activity		idle	idle	idle	building < 1 min next in ~ 15 hrs 44 mins at 00:30	idle	idle	building < 1 min	idle
Pacific Daylight Time	changes	demo1-code1	demo1-code2	demo1-art	build-release	test-ps3-release	test-x360-release	publish-release	build-package
Tue 02 Nov 2010 15:52:01		Build Server PCRelease stdio	Build Demo1 X360Profile stdio	Build Demo1 ps3 data stdio graph	Build Demo1 pc data stdio graph				
		Build Server PCDebug stdio							
	15:51:35	Build Demo1 PS3Ship failed stdio Sorted stdout							
	15:51:09	Build Demo1 PS3Final failed stdio Sorted stdout							
	15:50:43	Build Demo1 PS3Release failed stdio Sorted stdout							
	15:50:16	Build Demo1 PS3Profile failed stdio Sorted stdout							
		Build Demo1 PS3Debug failed stdio Sorted stdout							
		Build sln stdio							
		Sync stdio							
	15:49:48	Build 2379							
15:49:32		Build Viewer PCRelease stdio							
		Build Viewer X360Release stdio							
		Build Viewer PS3Release							

Infrastructure – Automated Building



Infrastructure – Automated Testing

Recent Test Results - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://die2/c2/recent-tests.php

Recent Test Results

[Back to main](#)

[admin page](#)

[define orange status criteria](#)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 >>

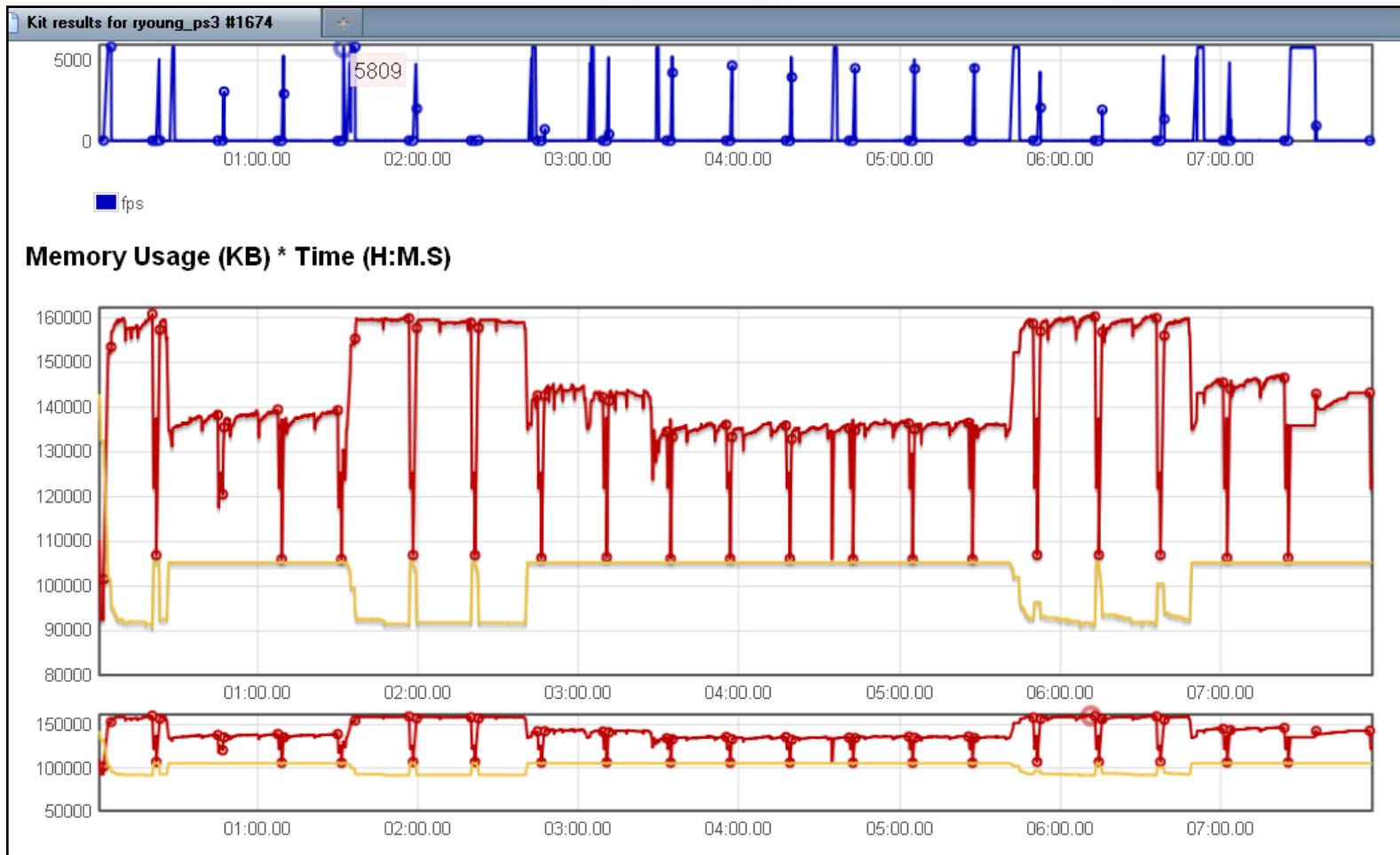
ChangelistBuild TypeTest CaseDateTesterKitsComment

Q	Profile	1674	2009-07-01 17:39:00	abreuks		Nightly soak te
Q	Profile	1673	2009-06-26 17:30:00	abreuks		Nightly soak te
Q	Profile	1674	2009-06-26 10:46:00	abreuks		16player latejd
Q	Profile	1671	2009-06-26 09:40:00	abreuks		16player latejd
Q	Profile	1673	2009-06-26 09:39:00	abreuks		16player latejd
Q	Profile	1669	2009-06-25 17:17:00	abreuks		Nightly soak te
Q	Profile	1669	2009-06-24 17:35:00	abreuks		Nightly soak te
Q	Release	1667	2009-06-23 17:41:00	abreuks		Nightly soak te
Q	Profile	1666	2009-06-22 19:16:00	abreuks		Nightly soak te
Q	Profile	1665	2009-06-22 19:04:00	abreuks		Nightly soak te
Q	Profile	1664	2009-06-22 18:22:00	abreuks		Nightly soak te
Q	Profile	1663	2009-06-22 18:12:00	abreuks		Nightly soak te
Q	Release	1662	2009-06-22 16:48:00	meby		Running front
Q	Release	1661	2009-06-22 16:46:00	meby		Running front
Q	Release	1660	2009-06-22 16:21:00	meby		Running front
Q	Release	1659	2009-06-22 15:42:00	meby		Running front
Q	Release	1658	2009-06-22 15:37:00	meby		Running front
Q	Release	1657	2009-06-22 15:34:00	meby		Running front
Q	Release	1656	2009-06-22 15:26:00	meby		Running front

Test Case	Tester	Kit	Comment	Last Log	Time of last test	Test Case
1674	abreuks	Kit 1	Nightly soak te	2009-07-01 17:39:00	2009-07-01 17:39:00	1674
1673	abreuks	Kit 1	Nightly soak te	2009-06-26 17:30:00	2009-06-26 17:30:00	1673
1674	abreuks	Kit 1	16player latejd	2009-06-26 10:46:00	2009-06-26 10:46:00	1674
1671	abreuks	Kit 1	16player latejd	2009-06-26 09:40:00	2009-06-26 09:40:00	1671
1673	abreuks	Kit 1	16player latejd	2009-06-26 09:39:00	2009-06-26 09:39:00	1673
1669	abreuks	Kit 1	Nightly soak te	2009-06-25 17:17:00	2009-06-25 17:17:00	1669
1669	abreuks	Kit 1	Nightly soak te	2009-06-24 17:35:00	2009-06-24 17:35:00	1669
1667	abreuks	Kit 1	Nightly soak te	2009-06-23 17:41:00	2009-06-23 17:41:00	1667
1666	abreuks	Kit 1	Nightly soak te	2009-06-22 19:16:00	2009-06-22 19:16:00	1666
1665	abreuks	Kit 1	Nightly soak te	2009-06-22 19:04:00	2009-06-22 19:04:00	1665
1664	abreuks	Kit 1	Nightly soak te	2009-06-22 18:22:00	2009-06-22 18:22:00	1664
1663	abreuks	Kit 1	Nightly soak te	2009-06-22 18:12:00	2009-06-22 18:12:00	1663
1662	meby	Kit 1	Running front	2009-06-22 16:48:00	2009-06-22 16:48:00	1662
1661	meby	Kit 1	Running front	2009-06-22 16:46:00	2009-06-22 16:46:00	1661
1660	meby	Kit 1	Running front	2009-06-22 16:21:00	2009-06-22 16:21:00	1660
1659	meby	Kit 1	Running front	2009-06-22 15:42:00	2009-06-22 15:42:00	1659
1658	meby	Kit 1	Running front	2009-06-22 15:37:00	2009-06-22 15:37:00	1658
1657	meby	Kit 1	Running front	2009-06-22 15:34:00	2009-06-22 15:34:00	1657
1656	meby	Kit 1	Running front	2009-06-22 15:26:00	2009-06-22 15:26:00	1656

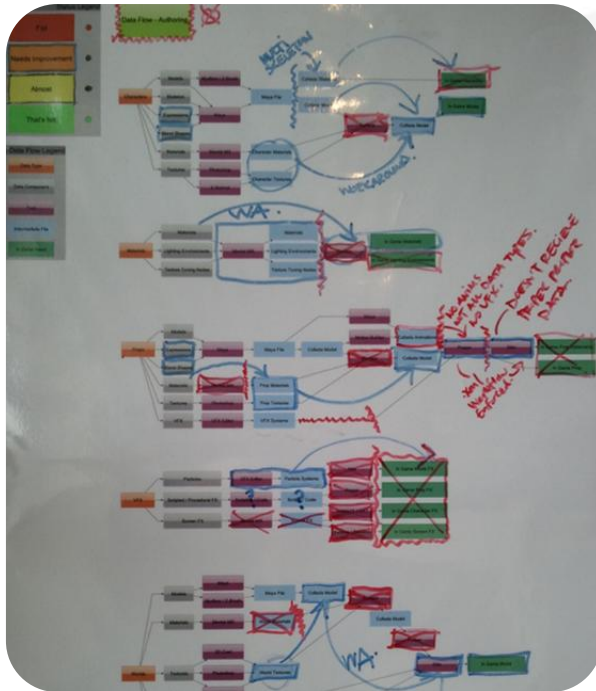


Infrastructure – Automated Metrics

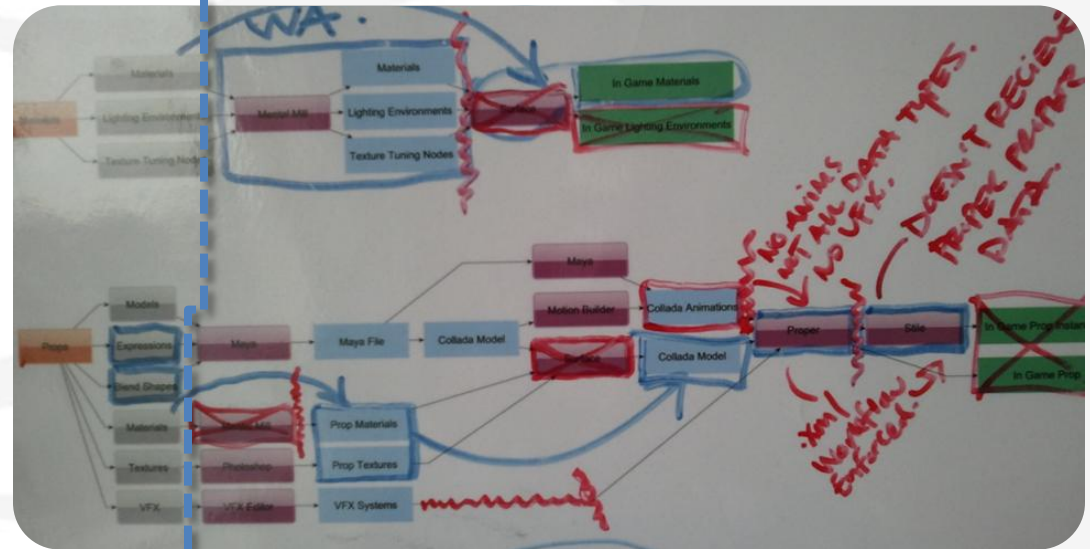




Infrastructure - Analysis



**Sharing
Boundary**



**Internal +
External**

**Internal
Only**



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

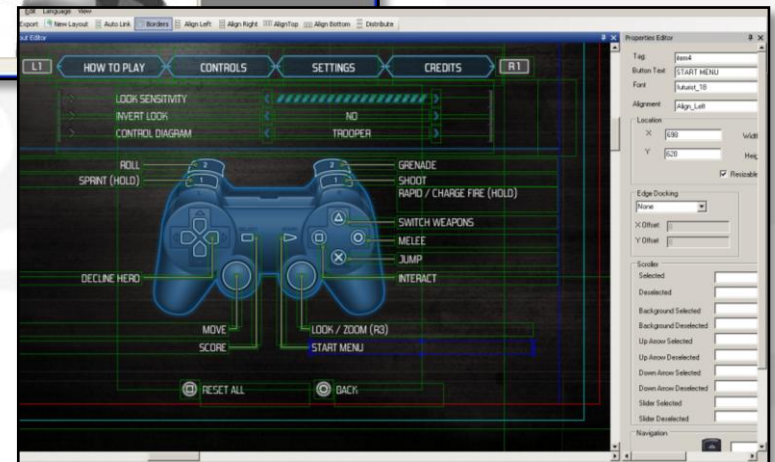
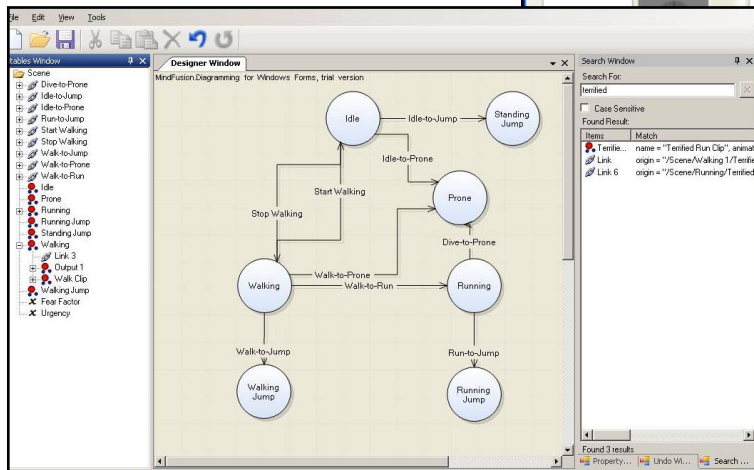
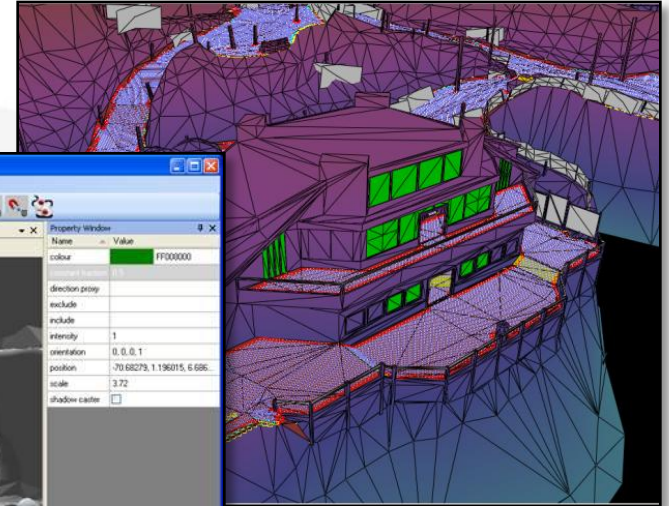
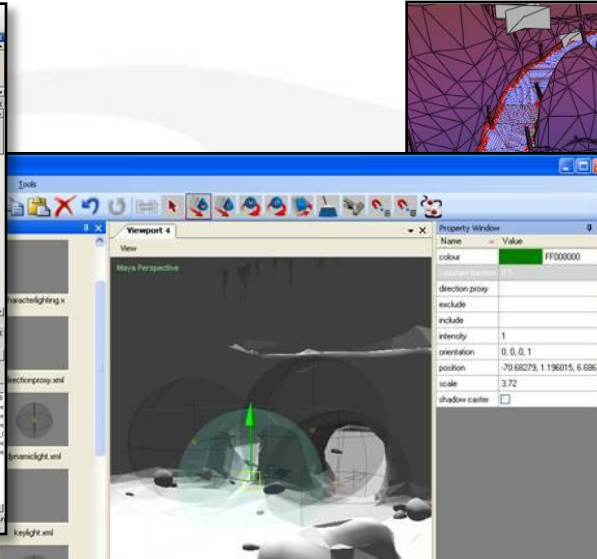
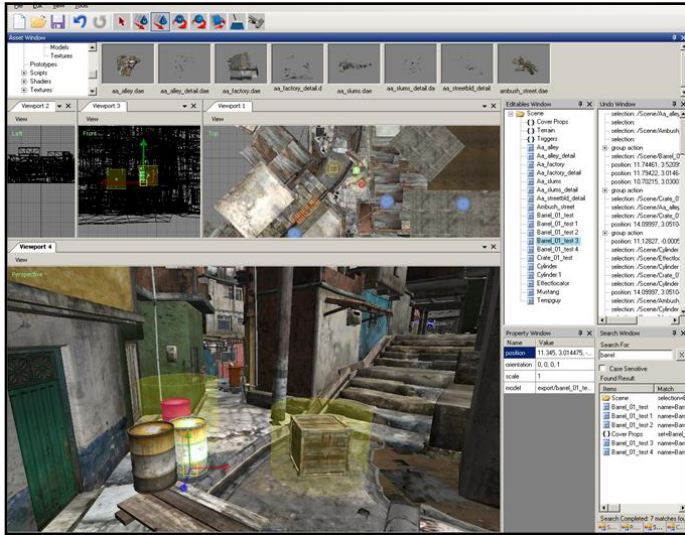
	A	B	C	D	E	F	G	H	I	J	K	L	M
		Dae Attribute	Model	Reanimate		fbx to	ddscow				hctSlant		Build
1	Topologist	Filter	MetaGen	Exporter	ssg	edge	ddscompress	Collada	Collada	MaterialC	Filter	shc	Model
2	21.5	0.687	0.407	3.375	0.187	Anim	pixter	ToHKX	ToEdge	ompiler	Manager		Stats
3	60.047	0.656	0.391		1.42	1.422	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



SLANTSIXGAMES



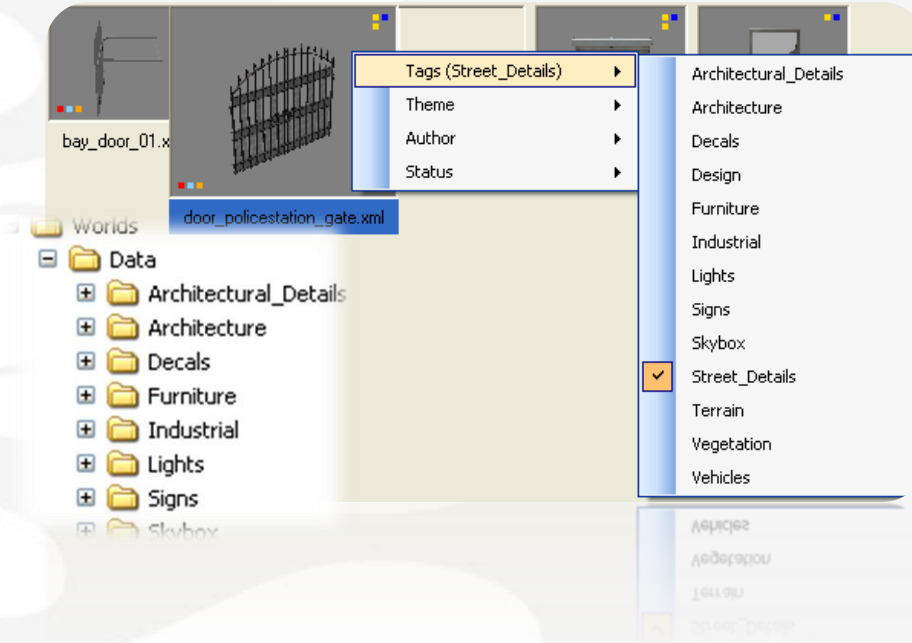
Content Authoring

- 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...

Outsource Tracker.xlsx - Microsoft Excel

Asset Tracker

Manager Jane Doe
Outsourcer Quality Assets Inc.
Project Shiny New Project
Date 12/6/10



Milestone	Category	Prop Name	Start Date	Finish Date	Mesh	Textures	LODs	Collision	Note
	Prop	Flag American Standing	11/01	11/08	Approved	Approved	NA	Approved	
	Prop	Light Overhang	11/08	11/23	Approved	Approved	NA	Approved	
	Prop	Light Overhang 02	11/02	11/17	Approved	Approved	NA	Approved	
	Prop	Rev Model	11/02	11/17	Approved	Approved	NA	Approved	
Billboard	Prop	Phone Office	11/22	11/28	Approved	Approved	NA	Approved	
	Prop	Sign Holder Interior	11/23	11/28	In Workflow	In Workflow	NA	Not In Workflow	
	Prop	Sign Holder Interior 02	11/25	11/28	In Workflow	Not In Workflow	NA	Not In Workflow	
Review, comments									
	Vehicle	Antidrone	11/18	12/8	Awaiting Feedback	Not In Workflow	Not In Workflow	Not In Workflow	
Billboard	Vehicle	Pickup	11/18	12/18	Awaiting Feedback Antidrone	In Workflow	Not In Workflow	NA	
	Vehicle	Pickup Truck	11/18	12/8	In Revision	Not In Workflow	Not In Workflow	NA	
Review, comments									



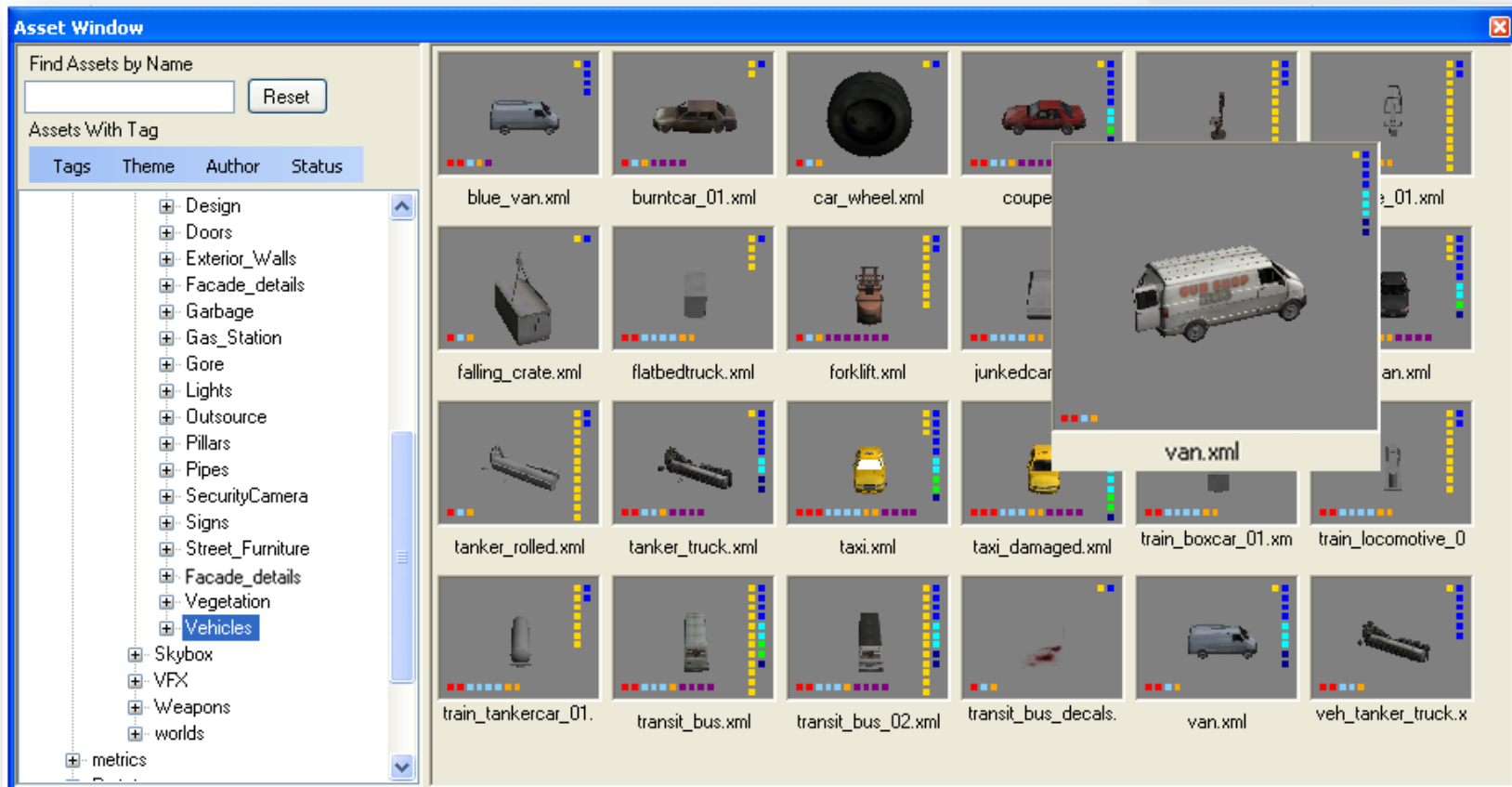
Budgets and Metrics

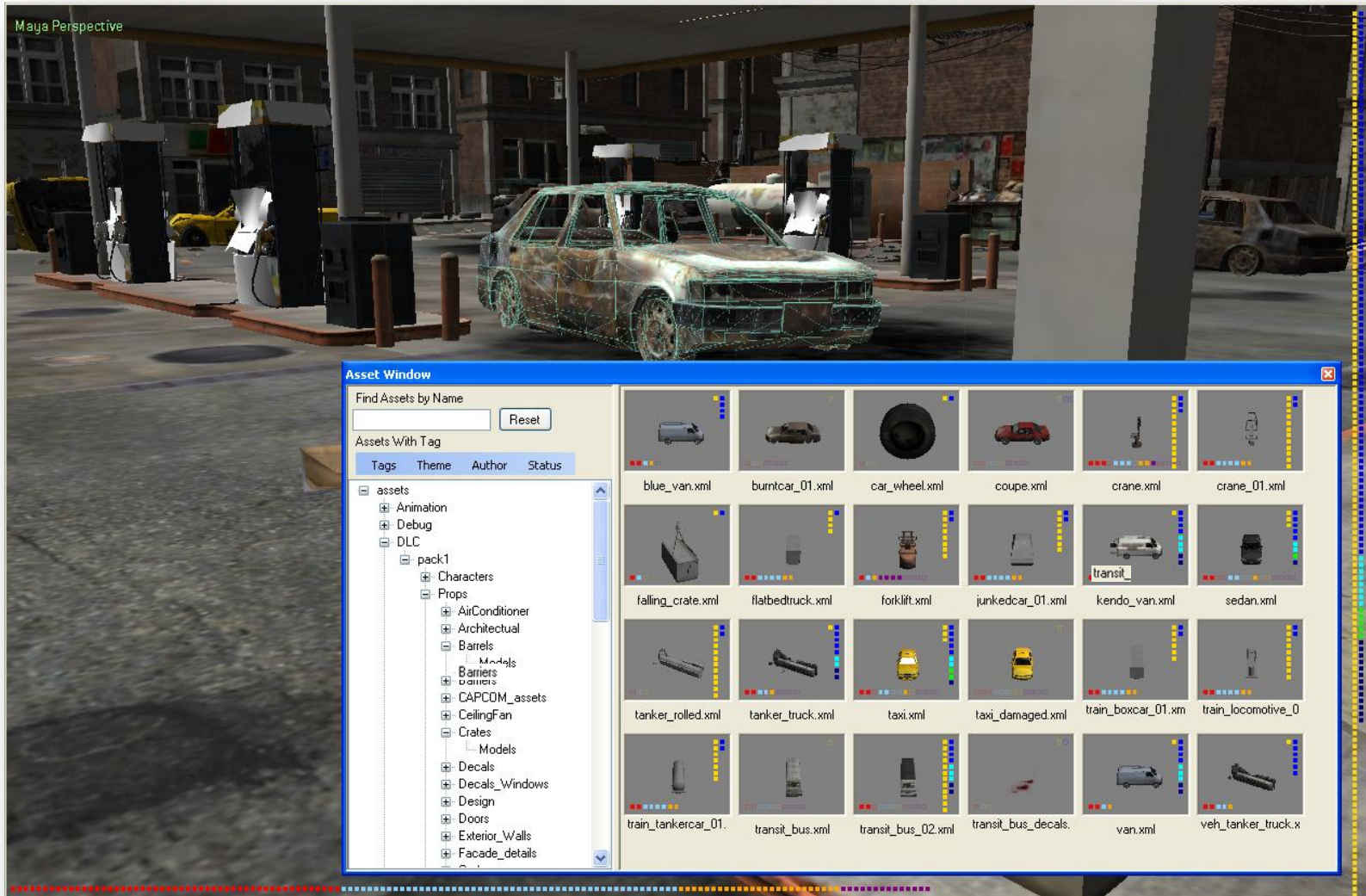
- Establish 'Cost Scores' for all assets
- Find a currency for each asset type
 - E.g.
 - Filesize (Kilobytes)
 - Dimensions (pixels wide/pixels tall/pixels deep)
 - Runtime cost (GPU cycles or even # lines of code!)
- Allow users to evaluate the total cost of a scene
- Document currencies for outsource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





Budgets and Metrics





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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



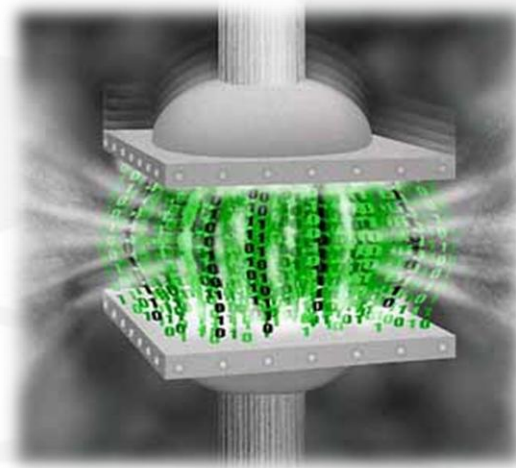


Game and Asset Packaging [AP]



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]



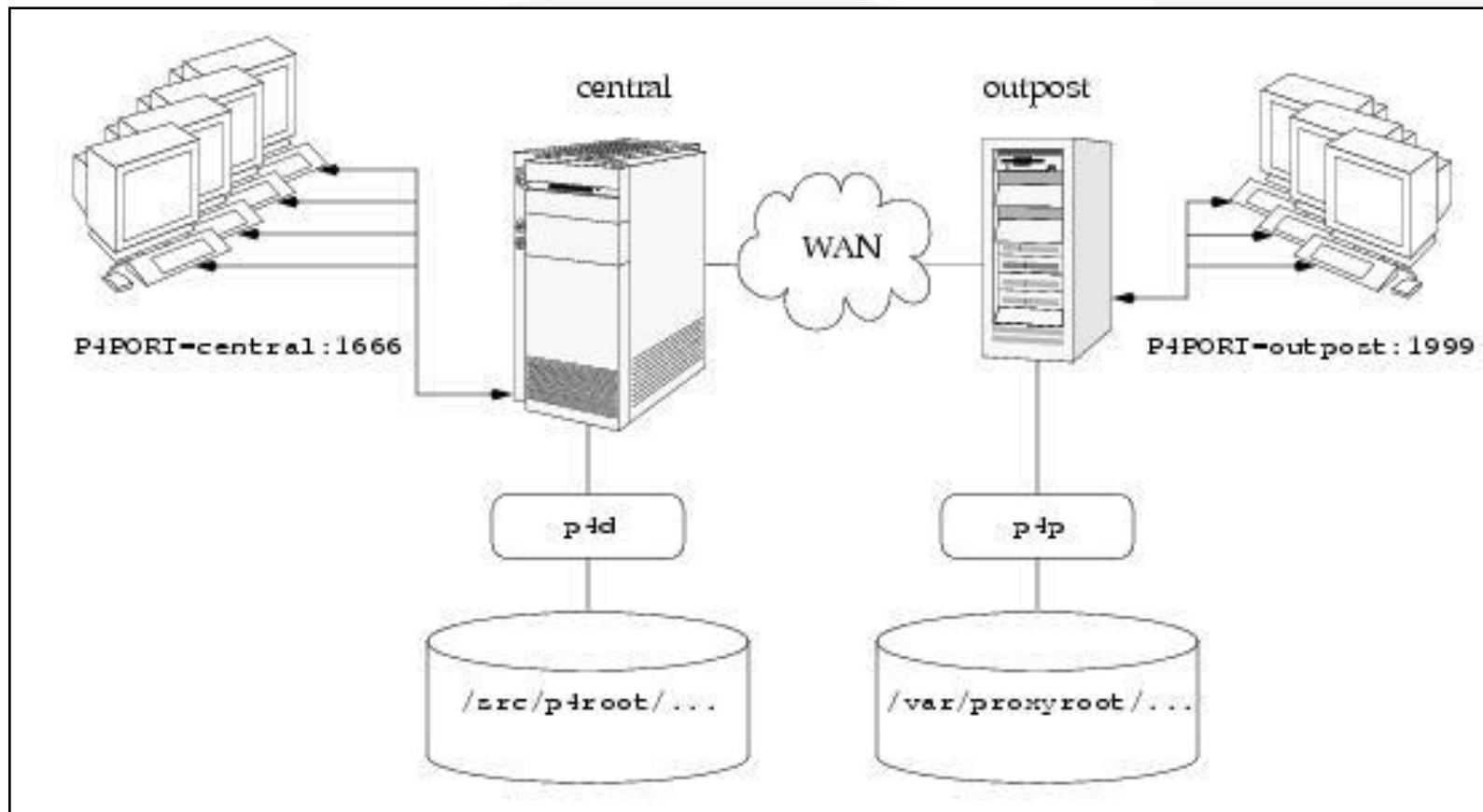
Game/Asset Sharing

- Shared Server
 - ✓ Perforce + P4 Proxy
 - Visual SourceSafe + SourceOffsite
- Package Drop
 - FTP
 - ✓ Aspera *fast*[™]
 - HDD Courier
- Carrier pigeon?





Asset Sharing – P4 Proxy





FTP/Aspera *fasp*TM





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!



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

