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Introduction

The purpose of this course is to define a frame work for building and scaling a digital studio. An individual idea, and depending on the scope and interests in that idea, can evolve from a small personal project between friends to a full studio production involving hundreds of artists and participants. The goal is to touch on key concepts that one will encounter during this journey of building an environment along with a team of collaborators. We will introduce challenges and solutions that will help others through mistakes we made in th past. It is a long path between an idea to a full blown project. We will travel from a small individual project to a large project that might include people distributed in multiple locations. Hopefully this course will help the audience anticipate and be prepared for all the challenges ahead and keep more of their focus on the creative idea that brought them together.

Section I:

Scaling your Studio

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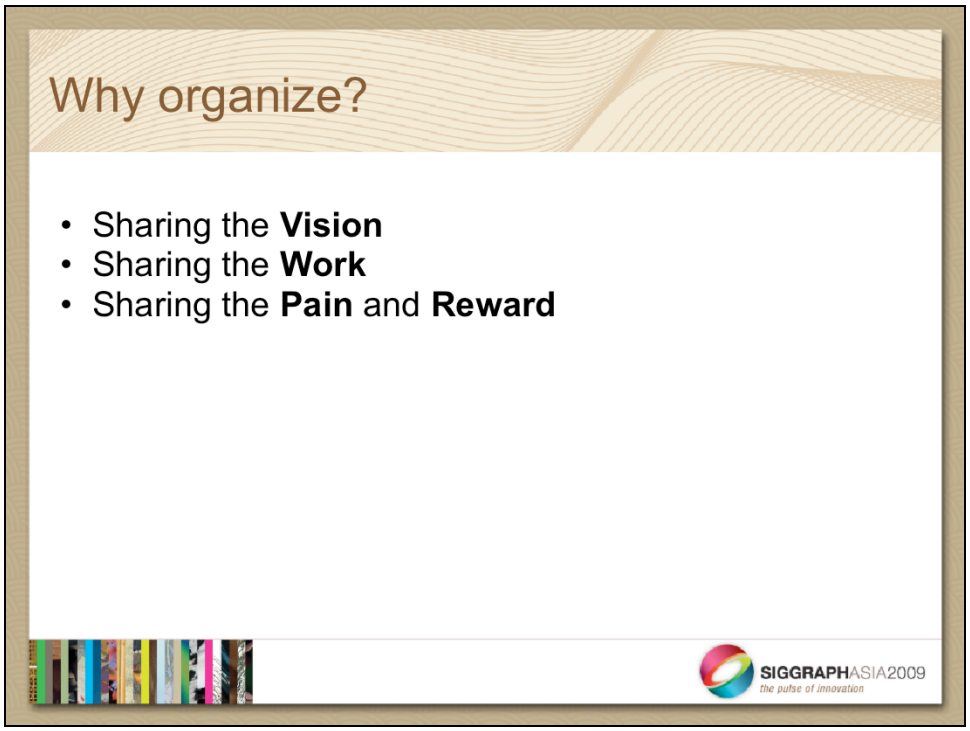
Before we get into building and scaling a digital project we need to set the framework for this discussion. Often people will not get to planning and organizing a project until after they need to. By that time it is often too late. We will discuss the motivation and process to stay ahead of your project so that it can be scaled and expanded with ease.

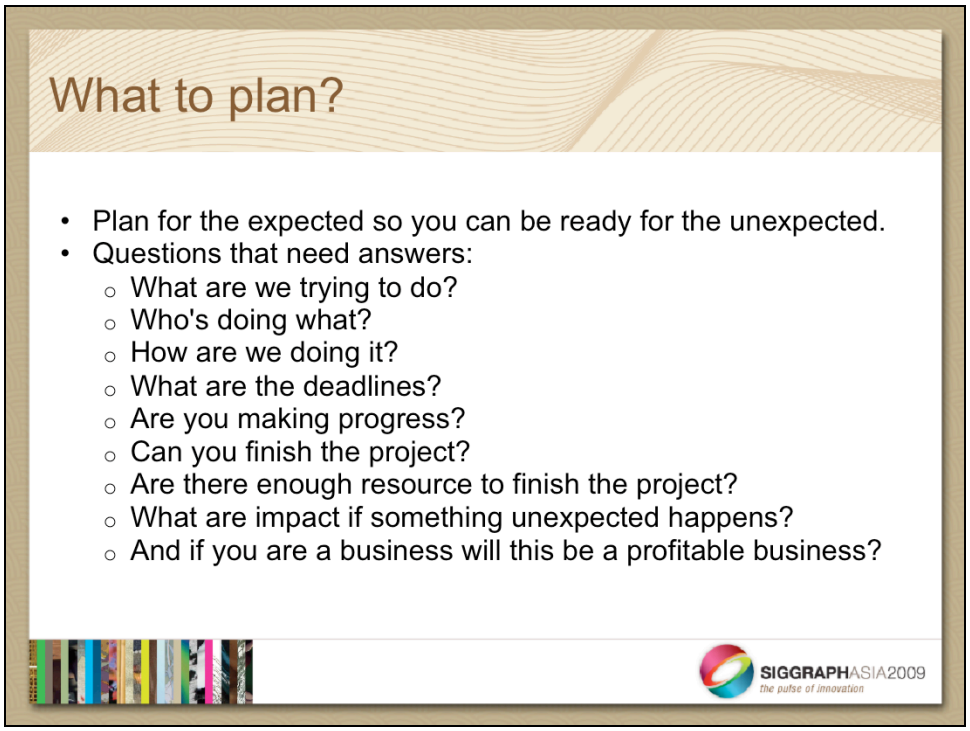
A well organized project will keep everyone involved informed and focused. The formula for a successful project is when the team feels that the project is under control and they can push hard and their work will contribute to the success of the project.

The challenges with scaling from a small project up to a large studio have more to do with organization and planning. The assumption is that you already have the skilled talents working on the project. The goal is to maximize their potential.



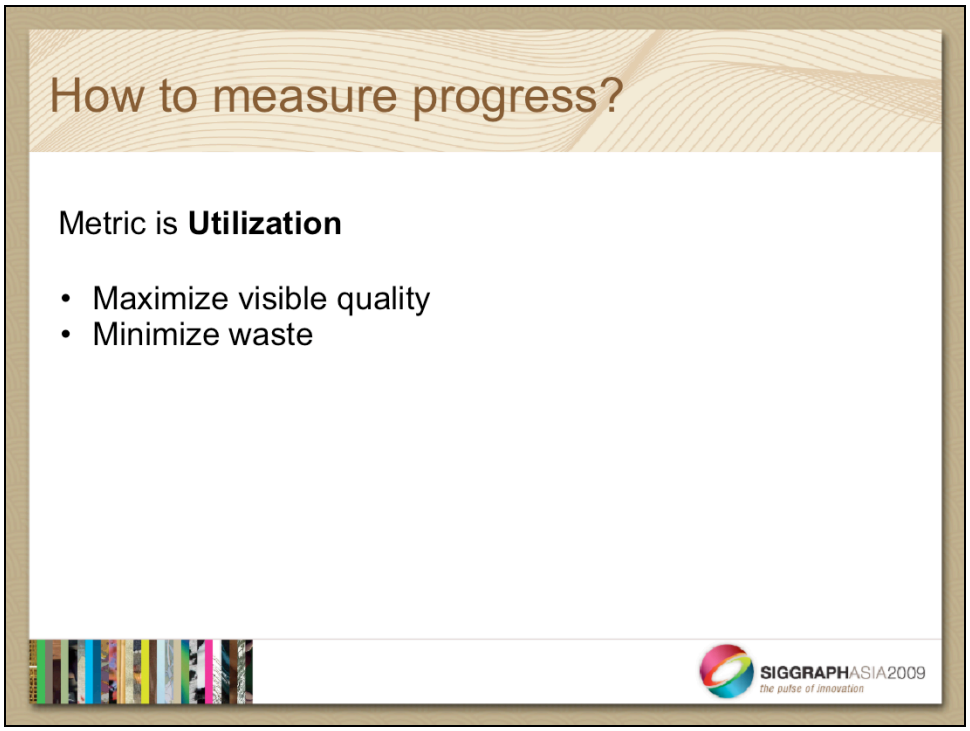
By organizing your **Vision** and planning early it will be much easier to expand your project. This will provide enough background material so when additional people are joining your project you are not spending most of your time repeating the same material to each individual. This will also allow people to work together using a common framework.

When everyone sees clearly the **Work** involved and how they fit into the project each person will take an active role in the final success of the project.



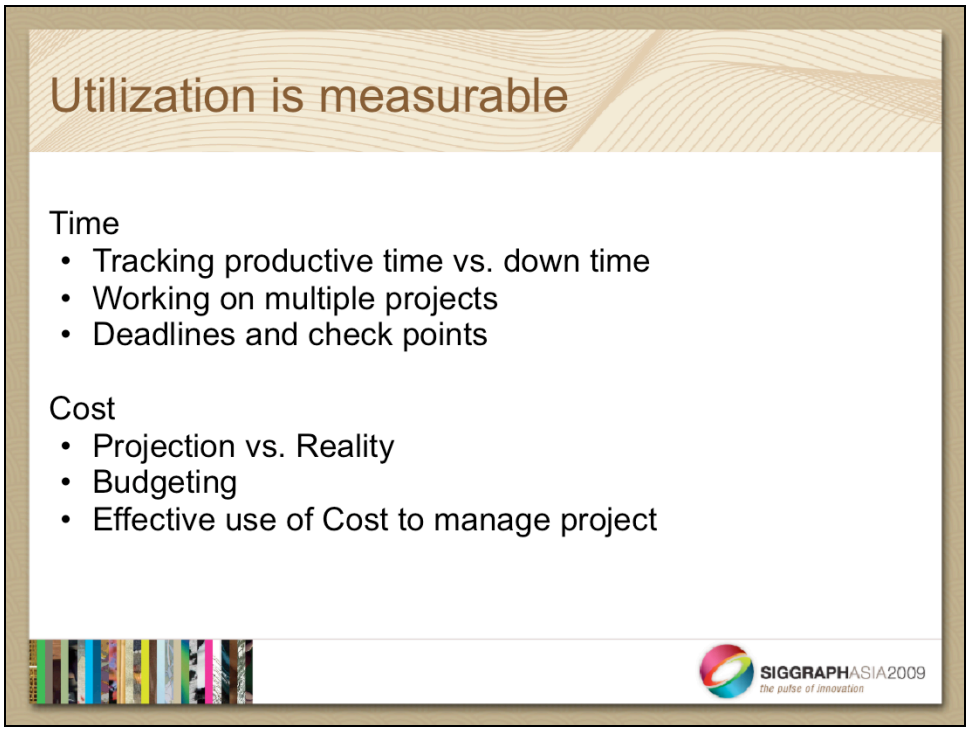
Often you will not recognize the value of planning until something expected happens. Otherwise you will wonder why you need to plan ahead and stop planning. Do not make this mistake because when something unexpected happens you will have many questions that need answers. By having a understanding of your project it will be much easier to get these questions answered.

If you don't plan properly everyone on your team will be asking the same questions.



The goal is to make sure all your pre-planned resources are contributing to putting something useful on the screen. Projects with one person and projects with one thousand people all share the same problem. You want to make sure that all the effort is used. The bigger the project the bigger the waste if not planned properly.

Utilization is the central theme of this course.



Time and Money (cost) are the two most basic methods to measure the success of a project. All your resources on a project can be measured by the amount of time and the cost associated with it. Utilization is the result of these metrics. The more accurate you track them the more accurate you result will be.

If your project is part of a business this is even more important. You might lose money on the first project, but hopefully by improving your ability to accurately predict future work your business can be sustained.

Tracking and managing growth is an active process that not only used for planning but also used for day to day management as well as planning for future projects.

Utilization of Resources

What can be tracked

- People
- Assets
- Completion dates and deliverables
- Infrastructures (computer, software, storage, network and facility)

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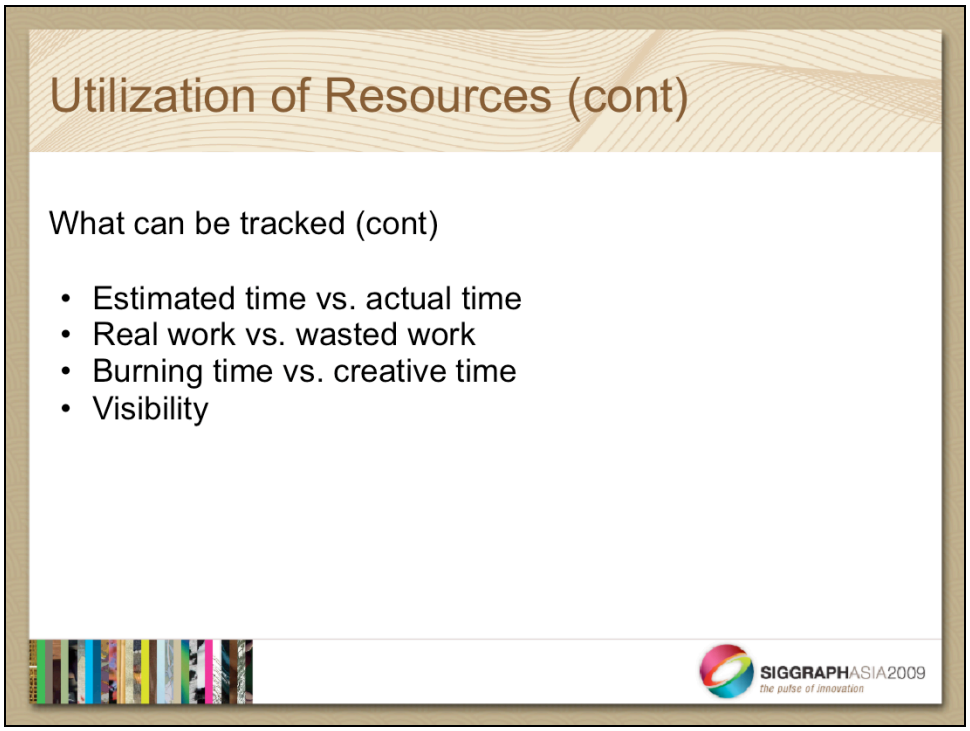
The same questions apply to both people and resources.

- Which resources are on your project?
- When is this resource available on a project?
- What does each resource contribute to the project?
- What are the task completion dates for each resource and task?
- What are the delivery dates?

You need to plan around the availibilities of all your resources as well as all the dependencies. For example: If a person is free but the computer is not available then nothing gets done.

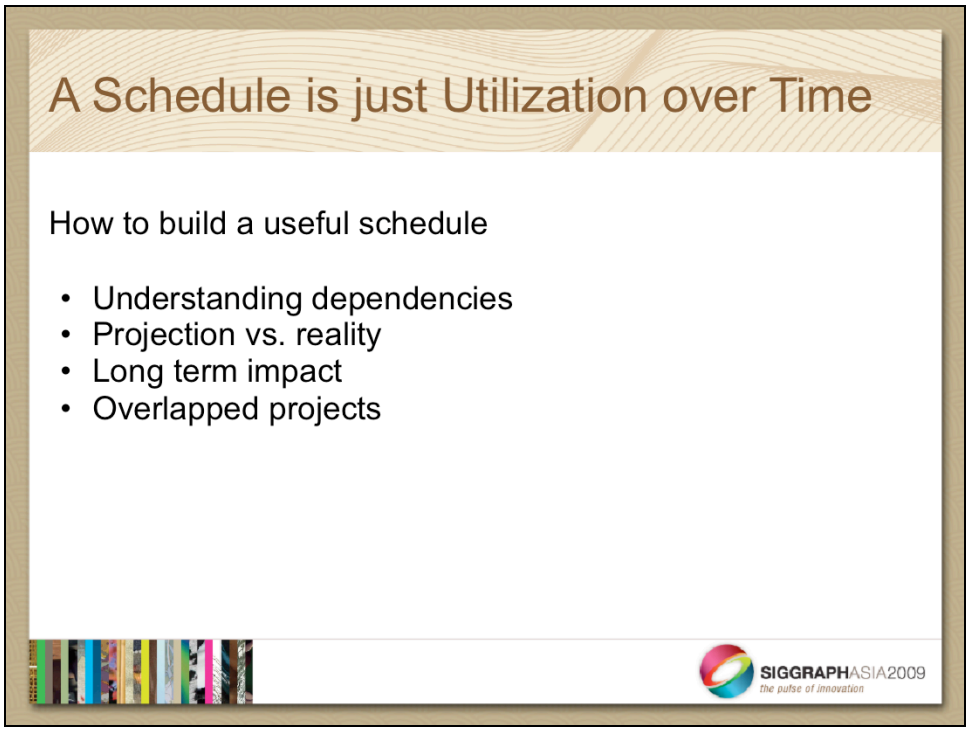


You will need to constantly update the actual time spent on a task against what you projected. If your projection is wrong you need to update your assumptions. Propagating a bad estimate will have negative consequences. Correct your mistakes and update your schedule.

You also need to separate real work from wasted work. Sometimes wasted work is not only wasted time but will distort your planning for future work.

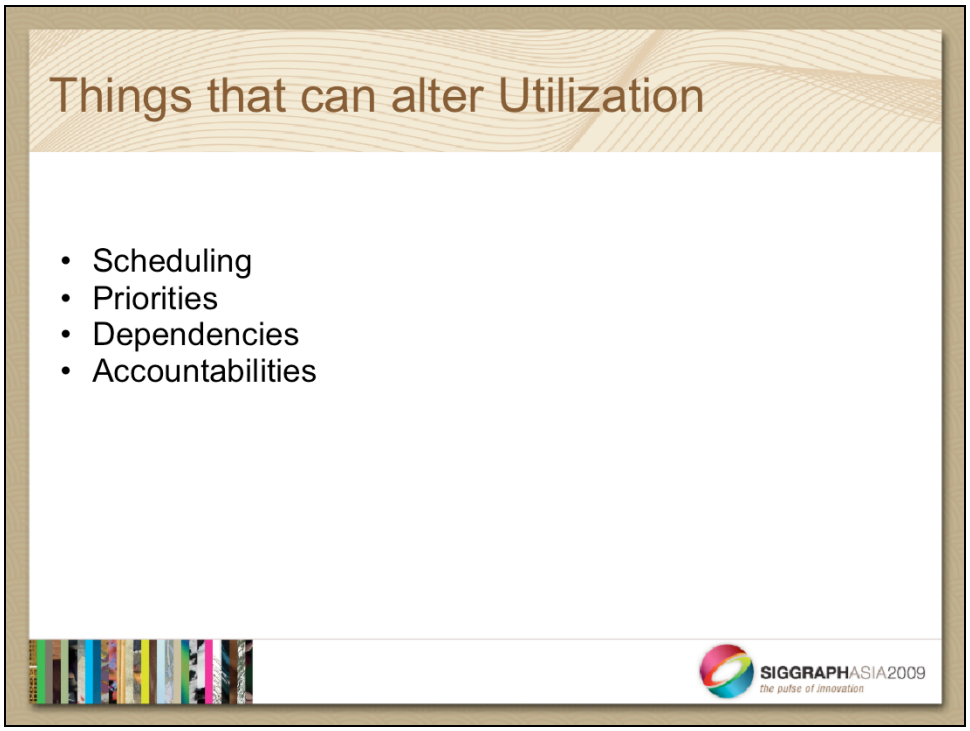
One rule is that a worker will use up all the time you give them. It is important to recognize when someone is just filling time because they were allocated, not because the task need that much time.

Making all this information transparent will make the result much more accurate. Visibility will force people to provide more accurate information.



- Keep your schedule flexible. You'll be changing it a lot. A creative project is evolving constantly. The process to manage it needs to be flexible.
- Keep the scheule up-to-date and accurate in real time.
- Dependencies can be in many forms (examples)
  - Tasks and Dependencies - one cannot be started until others are done
  - Talent - One texture person cannot keep up with many modelers.
  - Resources - Is the number of computers available is not sufficient.
  - Licenses - number of software licenses not enough for critical period.

Each issue will have long term impact on the schedule.



Scheduling - when someone is assigned too many or too few tasks it effect their effectiveness. Utilization goes down when effectiveness goes down.

Priorities - The proper priority ensures that critical tasks are done first. You cannot have multiple people setting priority. A producer or lead person needs to be assigned the responsibllity of setting priorities and balancing them between projects and teams.

Dependencies - Every task is normally dependent on many other tasks. Coordination between different people is essential to maximize utilization. When someone is waiting time is wasted. Tasks are asynchronous and the dependencies can change. They need to be actively managed.

Accountabilities - There needs to be strong enforcement of accountability of individuals. The bigger the project the larger the impact on overall utilization if someone is not accountable.

Section I: Scaling Your Studio

Conclusion

- Scaling can only be successful with proper planning
- Plan needs to be measured through utilization

Wrap-Up and Q&A

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Section II:

Growth Models and Resource Scaling

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Section II: Growth Models

Three basic models:

- Centralized
- Semi-Distributed
- Fully Distributed

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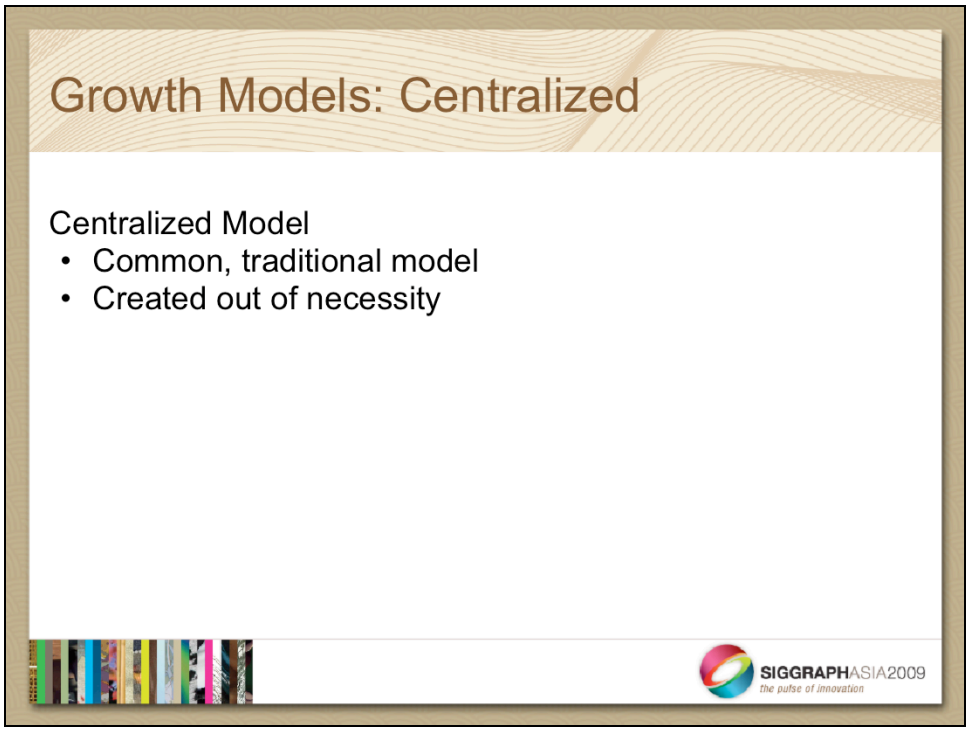
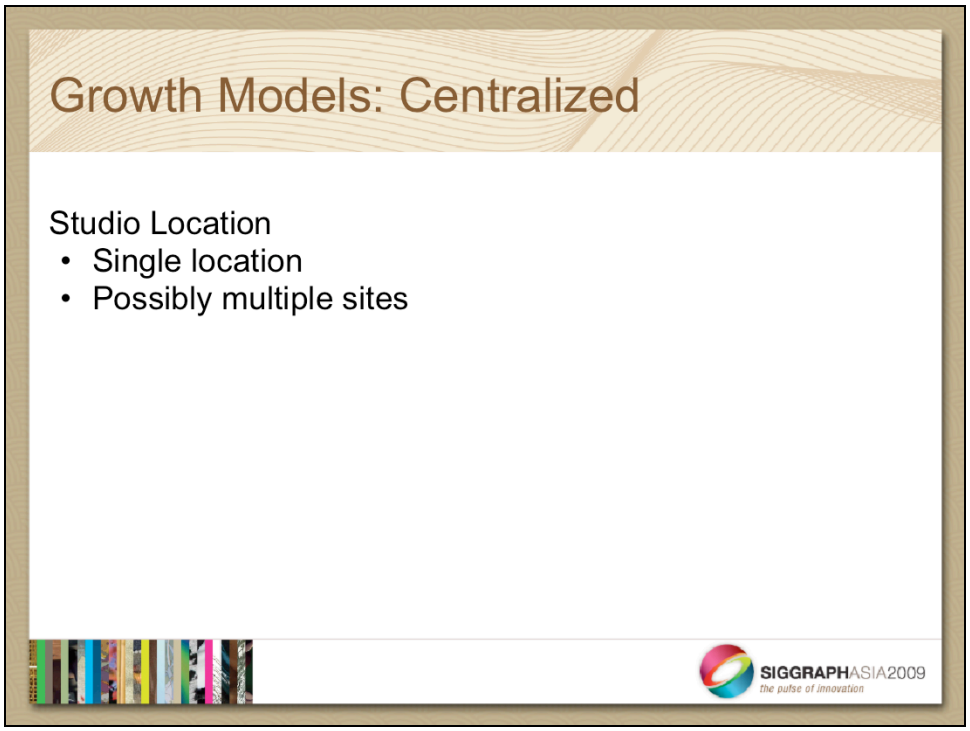
There are 3 main types of production models. These refer to how and where a project would be done.



This is the traditional growth model everyone is familiar with. Don't need to spend too much time here.

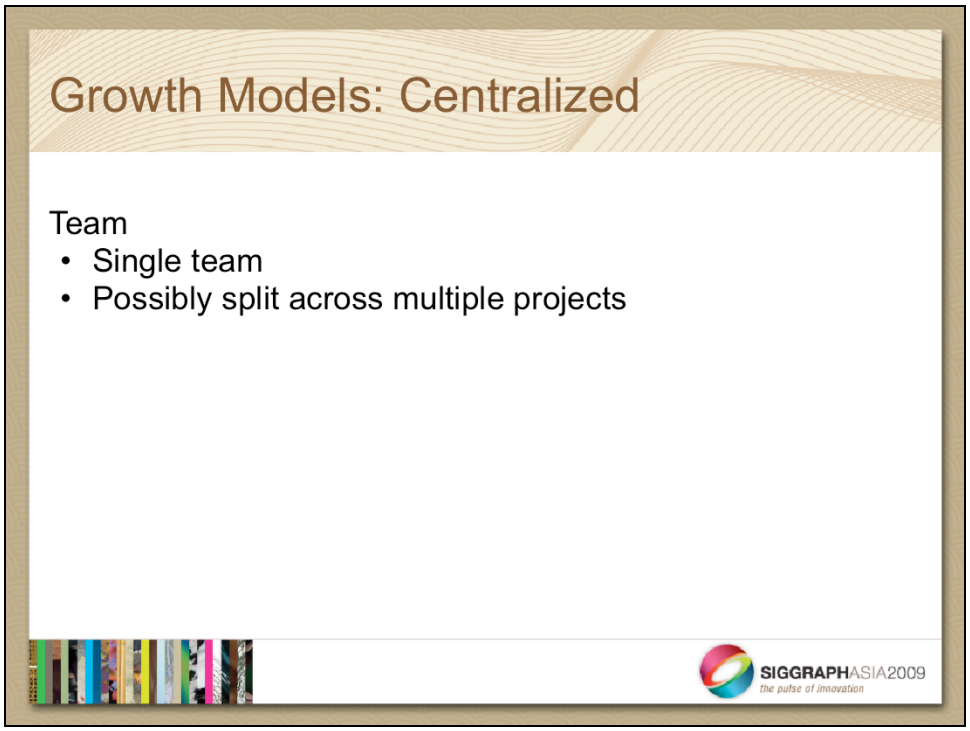
Necessities that made this the tradtional model in the past:

- Internet not feasible solution for moving production-sized data sets on a regular basis
- Limited talent - cheaper to bring talent to you and keep them under one roof because you invest in training....
- No one had really worked on these types of projects before, so by putting them under one roof you facilitated communication



Sites:

- Multiple buildings need to be within walking distance.
- Multiple buildings need to be connected via company-owned/ private network.
- Big enough building to handle "staffing bubbles" yet small enough so that you're not paying for empty space



Team:

- Grows in place
- Nowhere else to go, really

Projects:

- Single location can hold multiple projects
- Team is a resource pool that can be moved between projects

Growth Models: Centralized

Infrastructure
- Single pipeline
- Shared software
- Shared hardware / network

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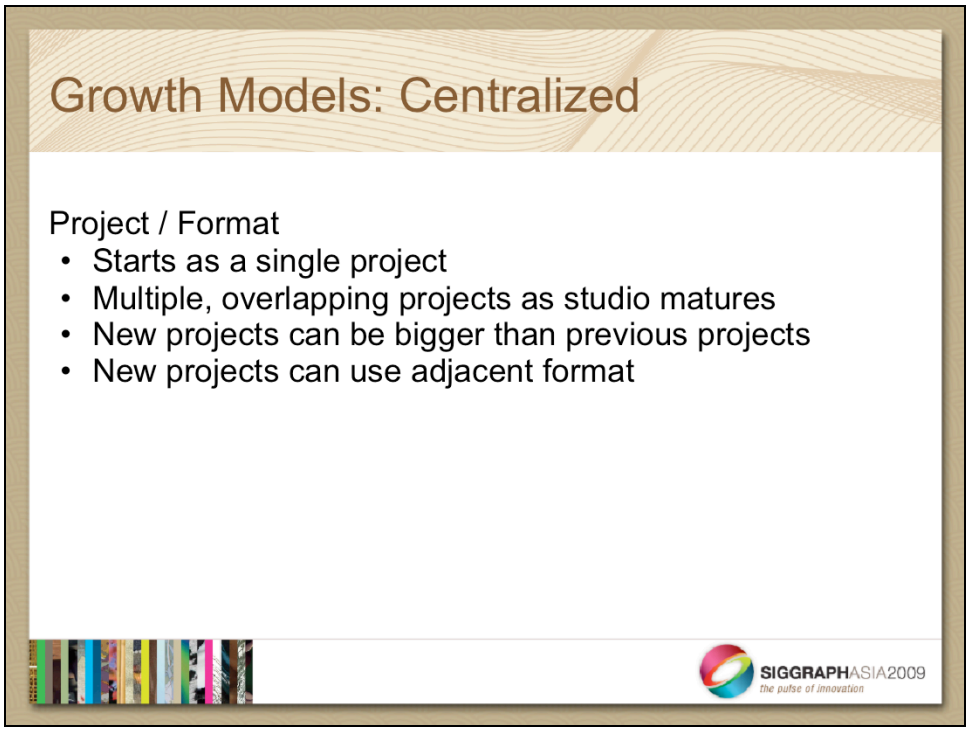
- Pipeline may branch for different projects.
- When pipeline locks for a project, changes need to be folded back into trunk or discarded to maintain studio continuity.
- Maintaining multiple pipelines is expensive.
- If people are jumping between projects, they need a way to switch pipelines if the pipelines have branched.
- Proprietary SW has same issues as pipeline: Development can branch betwen projects.
- Third party SW needs to be locked per-project very early in the project, so everyone is using the same programs.
- Everyone is on the same platform (you can even make sure everyone is on the same version of OS/ drivers).
- Can have a fast LAN / data center. You can plan and build your own network/hardware redundancy.



Format examples:

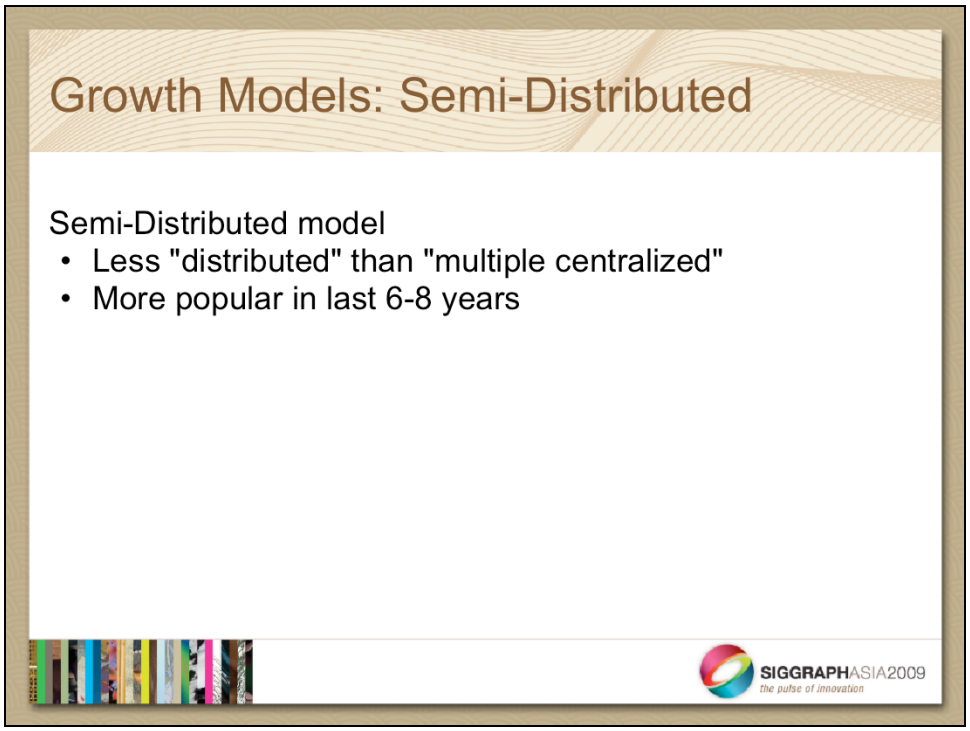
- commercials
- short animated film
- cinematics ("cut scenes") for video games
- visual effects for live action movie
- full length animated feature
- episodic animated television series

- Project is harder to morph, as you either need to scale up in your own studio, or work on the project serially.....

- You get tight communication between the formats, but do you really have the expertise for each format in studio?

Management

- Project management is done in traditional ways where people / dependencies / time are plotted together.
- Excel and Project are the main tools here
- Throw in Producers, Production Managers, Coordinators and clipboards and you can have things covered



This model covers several different scenarios:

- A larger studio opening a smaller, satellite studio in a distant location.
- A studio subcontracting a portion of a project to a second studio. - aka outsourcing

Growth Models: Semi-Distributed

Studio Location
- Multiple studios / locations
- Each studio follows the Centralized model indepdently

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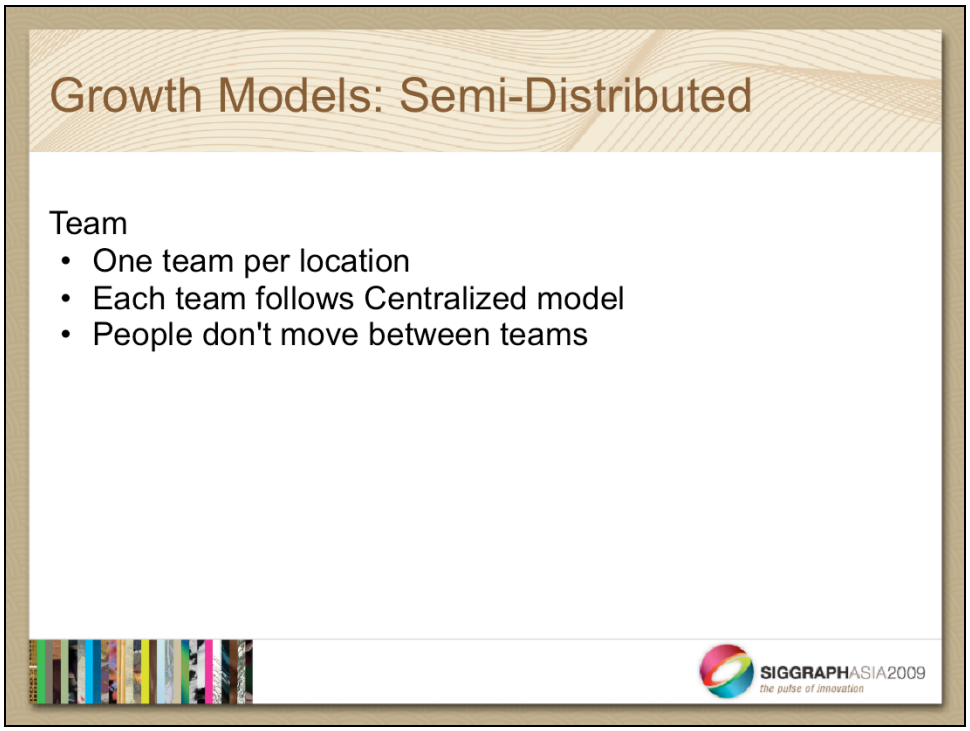
Multiple locations:
- Locations may be distant from each other geographically.
- They might also be close to each other in physical space, but not part of the same company.

Centralized:
- While each studio follows the Centralized model, the studios are not necessarily coupled. Their individual growth is not limited or controlled by other studios in the Semi-Distributed model.



Team follows Centralized model:

- Team-as-resource can be redistributed between any projects being worked on at that location.

People:

- People don't commonly move between studios because of geographical constraints, or because the studios are not part of the same company.
- Other reasons too, coming up in following slides.

Growth Models: Semi-Distributed

Infrastructure

- Pipeline may be shared or propietary
- Shared or non-shared software
- Non-shared hardware / network
- Shared assets (via some sort of syncing software)

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Pipeline:

- Pipelines will be unique to the studio as opposed to the project.
- You work within your own pipeeline, then have clear in and out points where and how an individual studio shares work with another studio

Software:

- Licensing tends to be tied to individual studios, so "shared" means more that the different studios might all be using the same program. (ie Maya)
- More difficult to sync versions of software together.
- Proprietary software tends to not be shard

Hardware

- Each studio has it's own hardware/network. In the past data was shared "sneaker net".. now Internet

Assets

- syncing is oftentimes naming conventions and timestamps.

Growth Models: Semi-Distributed

Project / Format

- Starts as a single project
- Additional studios can be brought in to do other formats
- Project can easily morph is size/scope - but you want relationships

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- Because of the nature, as you want to release different formats, you can bring on additional studios to assist. So the growth is much easier than in a centralized model.
- Can find expertise studios to work on specific formats.
- Finding the "right" studios to work with is sometimes a challenge as well as if you're working with too many studios... keeping continuity of your assets is difficult.

Growth Models: Semi-Distributed

Project Management
- Project has central management
- Studios have redundant local management
- Several configurations

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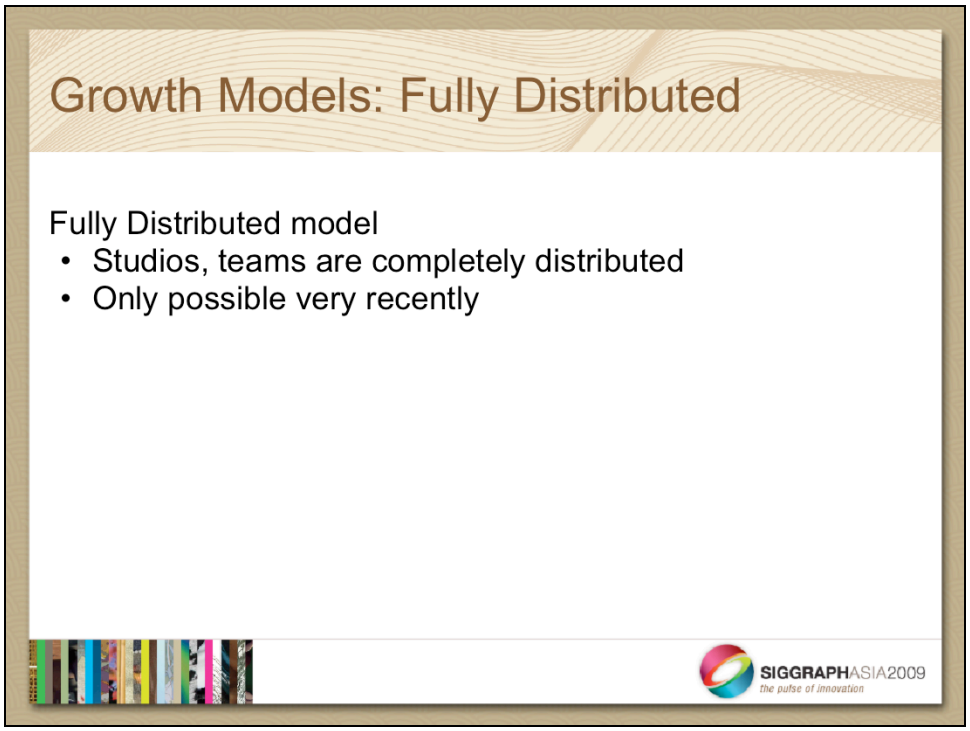
Configuration:
- Central master studio with smaller sub studio or work group with local management
- Outsourcing model - multiple redundant isolated management structures
- Combination of 1 and 2

- Each studio has it's own "central managment"... but the overall project has it's own management. This is much more at the macro level.

- SLA (service level agreements) are put into place to insure work gets done....

- Several different ways to do project management and different views....



- Fully Distributed means no more centralized studios.
- You can have smaller teams/individuals that make up teams now distributed.
- Advances in broadband and production pipelines are the main enablers.

Growth Models: Fully Distributed

Studio Location

- No need for a central location
- Staff can work from home (no need for facility overhead)

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- No longer needing the overhead of a studio facility
- Staff can be anywhere and work anytime

- no _need_ for central location. Can still have one, but not as required anymore

Growth Models: Fully Distributed

Team

- Individuals or groups of individuals can be anywhere in the world
- Dynamic on/off project

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- Staff can work anywhere at anytime
- Staff may have different native languages
- Can hire staff based on expertise / costs
- Can be much more flexible as to your staffing needs
- Might invest less in training staff yourself, as you an hire expertise

Growth Models: Fully Distributed

Infrastructure

- Shared single pipeline
- Common software needs distribution system for remote updates.
- Cloud computing / storage
- Everything sits on a platform that makes the distribution automatic, simple, and invisible.

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- Back to a single shared pipeline to connect the artists
- Data needs to be in many places at the same time (no luxury of centralizing a team of artists around a file server)
- Utilizing the wave of "cloud" services
- Having (possibily) hundreds of people scattared around the world working on the same project is extreemly complex. You need a platform to simplify that and allow your artists to focus on the art.
- The ultimate goal is any place any time.

Growth Models: Fully Distributed

Project / Format

- Can start as a single project
- Has no limits on what it can morph/change into
- Scale is only limited by budget, ambition and finding the right talent.

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- Fully Distributed means your project and morph into an infinite number of formats. It all depends on what you want to do with it. You can open up sharing certain assets to game companies, mobile companies, whatever you need, and be able to control access as desired.
- Base work on dynamic configuring the project to connect the proper expertise when it is needed.

Growth Models: Fully Distributed

Project Management

- Requires distributed management & collaboration
- If you can tie your project management with the actual asset information on disk, you can get real-time info.

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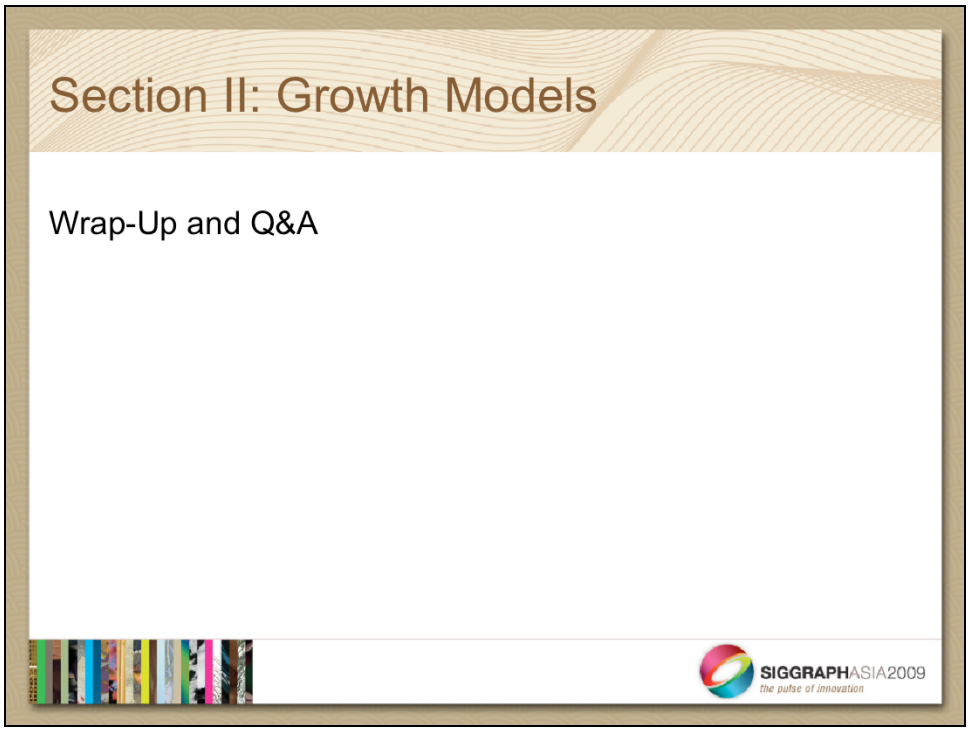
- Becomes very complicated if there are duplicated management structure.
- Gets easier if you can tie the project management to the actual asset information.
- Need real-time info as your staff can be working at anytime ; Zero wait time is the goal. Cannot wait for a coordinator to update a spreadsheet.



Conclusion

Fully Distributed is the wave of the future. This is driven by

- Emerging global talents
- Dynamic regional and global market
- Broadband.access
- Commodity hardware and software
- Cloud computing resource
- Costly central infrastructure
- Exponential demand for cost effective quality contents

Section III:

Case Studies

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Section III: Case Studies

Examples of Growth Models

- Centralized
- Semi-Distributed
- Fully Distributed

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Case Studies: Centralized

Centralized: (updated at presentation)

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Case Studies: Semi-Distributed

Semi-Distributed: (updated at presentation)

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Case Studies: Fully Distributed

Fully Distributed: (updated at presentation)

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Section III: Case Studies

Wrap-Up and Q&A

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BREAK

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Section IV:

Catchup after the Break

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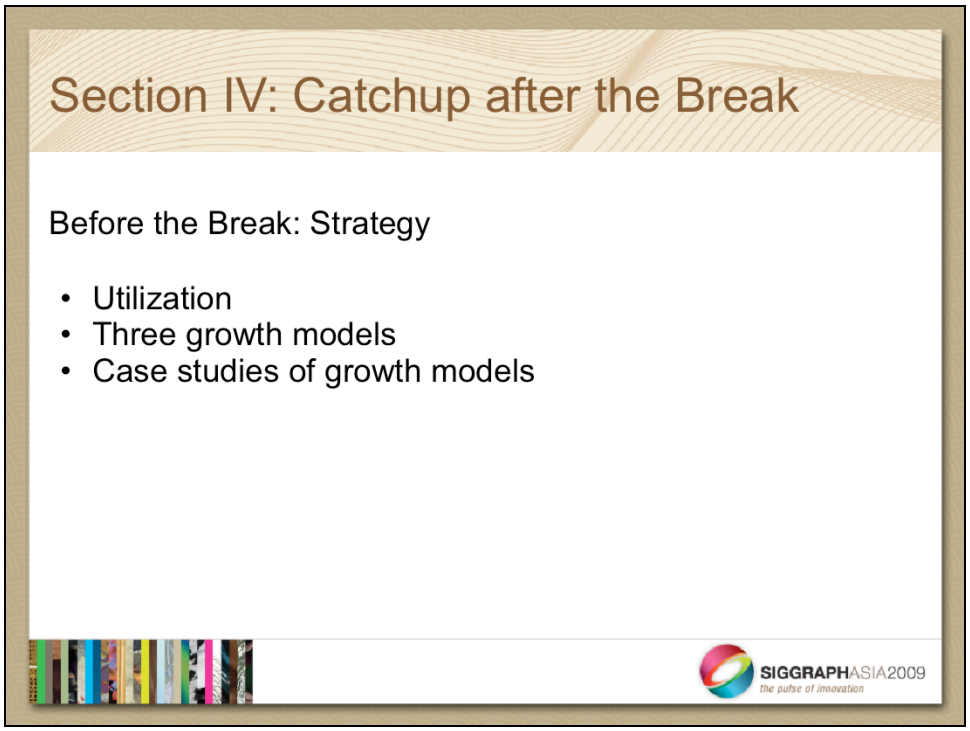
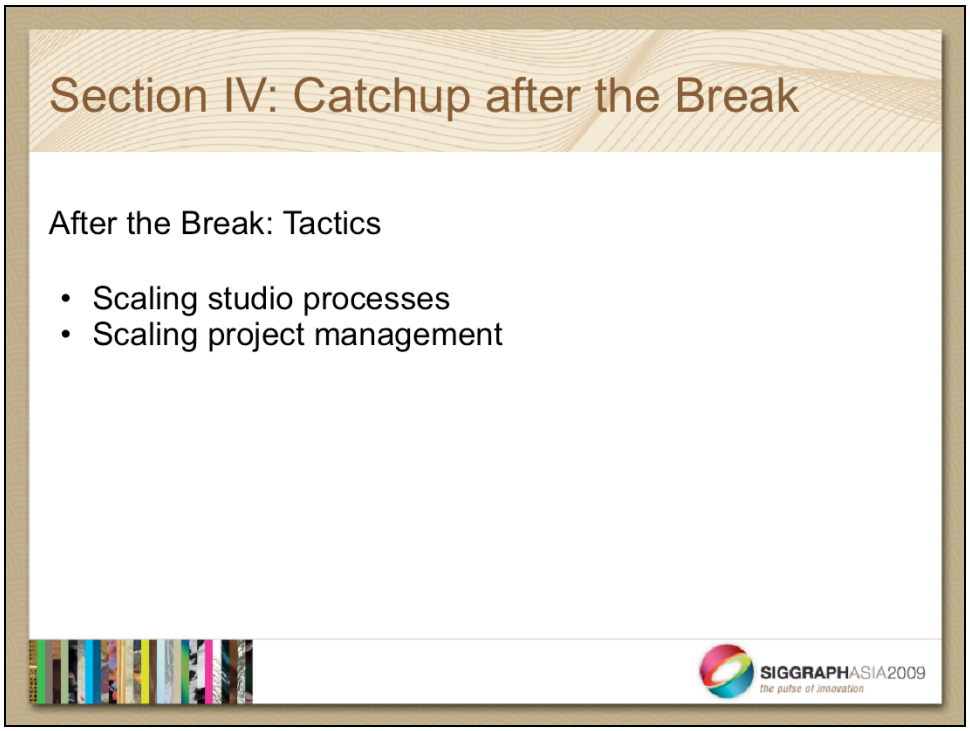


Strategy was the first half.



Tactics are the second half.

Section V:

Scaling Studio Processes in Different Growth Models

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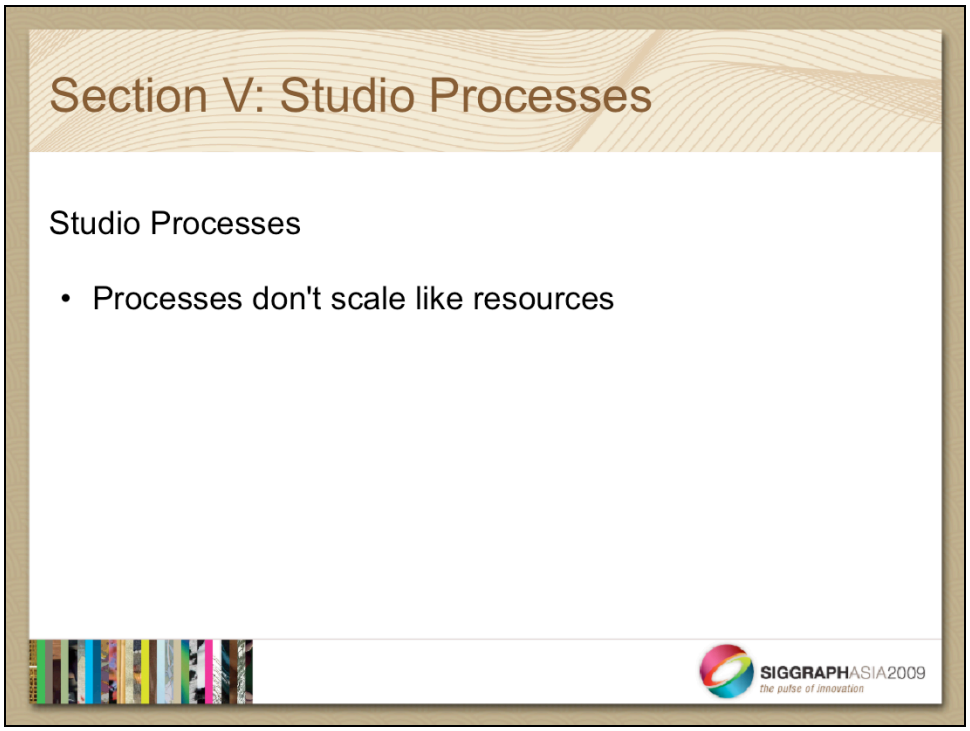
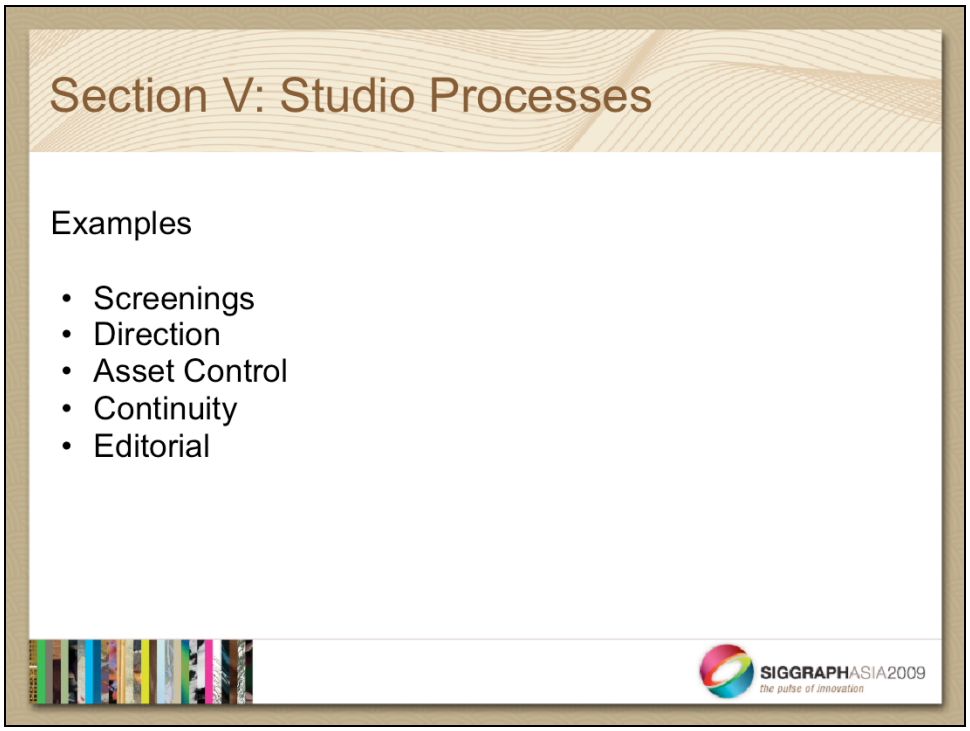


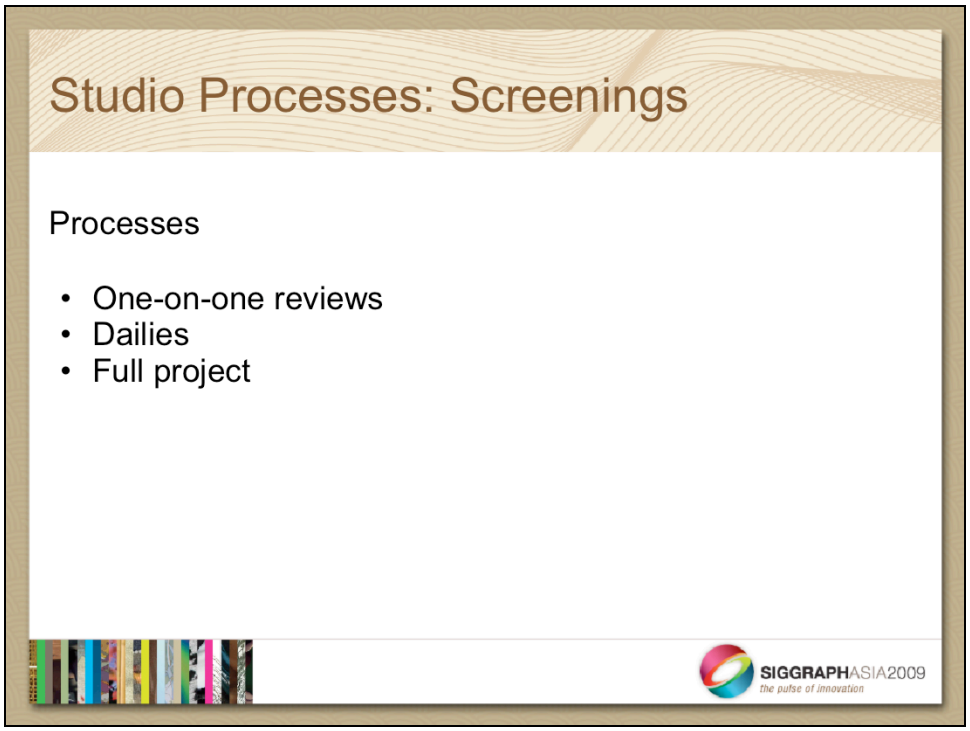
Process:

- Not only do they not scale like resources, sometimes they don't scale at all.
  - (example) Having more animators will not necessary complete a project faster if there are limited number of lighters.
  - (example) Buying more computers also will not speed up a project if the team is overwhelmed supporting the resource.

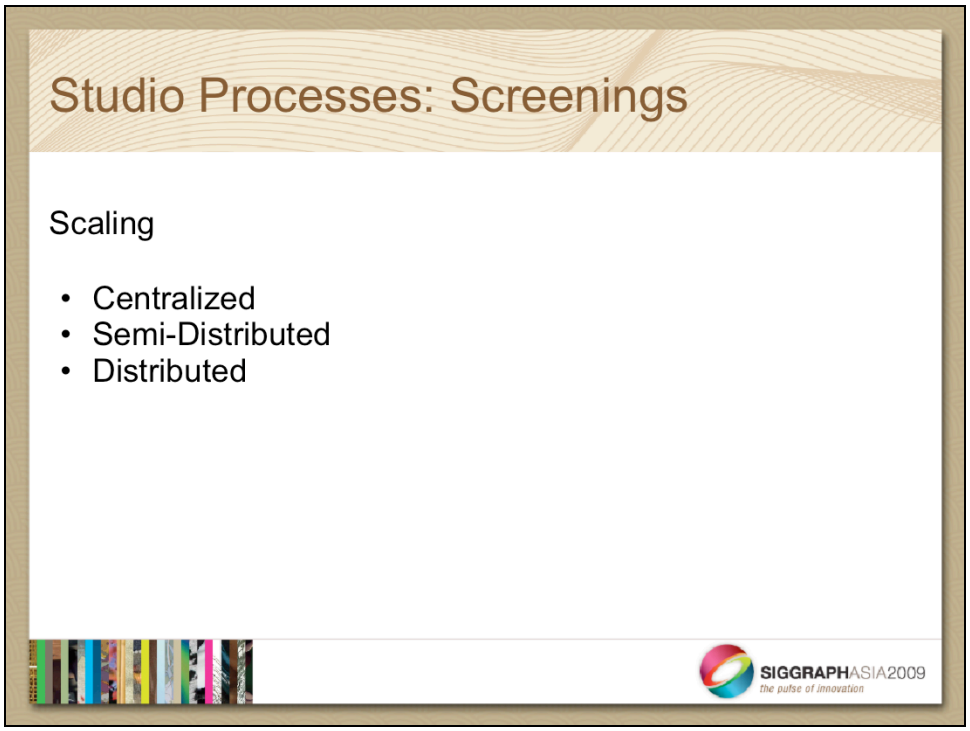
For each resource pool there will be an optimum size for a given project and schedule. And most often people omit the management overhead needed to manage an expanded resource pool. Without proper management more people may actually slow down the process.



As is the case with production, these things all affect each other, so there is no good order to put them in. We will look at a few key areas of digital content production and look at how they scale under the different structure models.

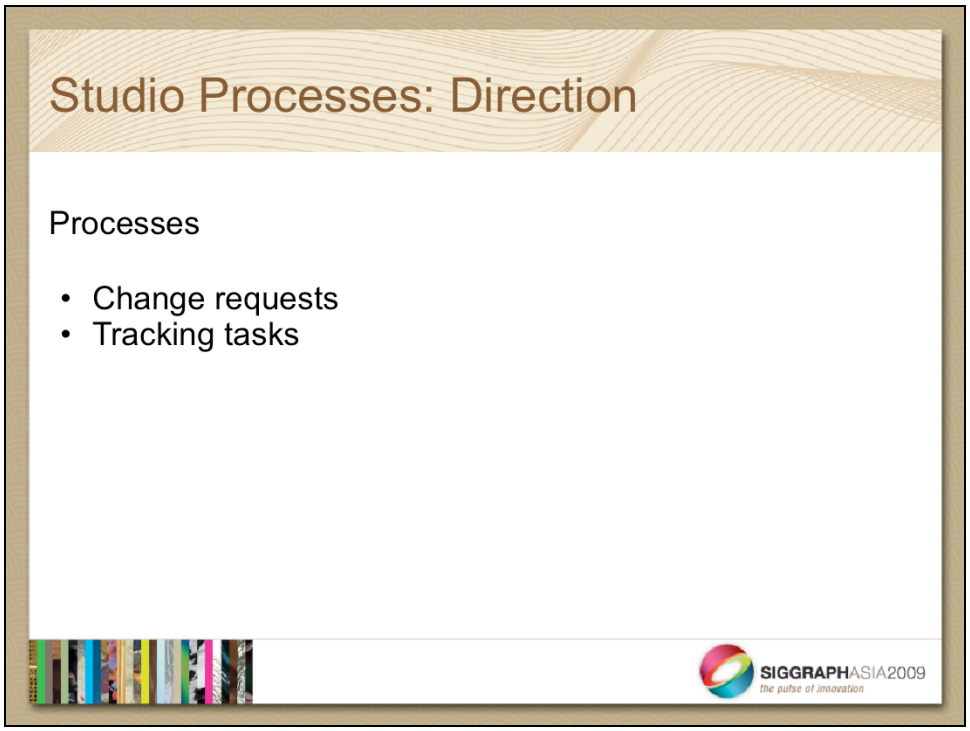


- One-on-one is the process of reviewing an individual's work and providing direction and feedback. This is also the process to make sure the proper work is being completed in context of the overall direction of the project. In larger projects it is even more important to be done in context.
- In a centralized model this scale through delegation through multiple levels of management. For a semi-distributed model this often suffers from critical directions being misinterpreted through multiple duplicate management structures.
- For a fully distributed model this has to done with effective communication, careful planning and structured coordination.
- In all cases clear accounting of the notes and directions is critical to the process. New tasks and their impacts have to be conveyed and make visible to all the people involved.



- For one-to-one screening this is usually done at the desktop by just walking over to someone's desk. For the distributed team this can be done by pre-packaging a media presentation or done in real-time using on-line tools like sharing desktop (iChat, WebEx, Adobe Connect, Remote Desktop) or desktop video conferencing.
- In all the remote cases color and image fidelity is a limiting factor for most real-time collaboration tools. 100% real-time playback and synchronization is not guaranteed over the Internet.
- It is also important that all parties are viewing the images in the same color space.
- Scaling a group screening in the centralized model is limited to physical space planning.
- For a large distributed group, remote conferencing and synchronized screening room are practical solutions. The challenge is to have a information system that can track all the comments and tasks in the distributed environment.

Language and time-zone differences can also complicate the process of a highly distributed team. A clear framework for communication will go a long way to reduce any error in communication.



Issues at any scale:

- Getting the director's notes to the artists. Even in the Centralized model, this often involves one or more intermediary people writing the comments down and passing them to the artist. Lots of information gets lost in the translation.
- Director notes don't automatically become a task for the artists. It's very easy for many of these notes to be lost when there are many shots being reviewed with many notes each.
- Once a note becomes a task, it needs to be tracked to make sure it's completed... and "completed" is a very nebulous term in production.
- Language and time-zone differences can also complicate the process of a highly distributed team. A clear framework for single source communication will go a long way to reduce any error in communication.

Studio Processes: Direction

Scaling

- Centralized
- Semi-Distributed
- Fully Distributed

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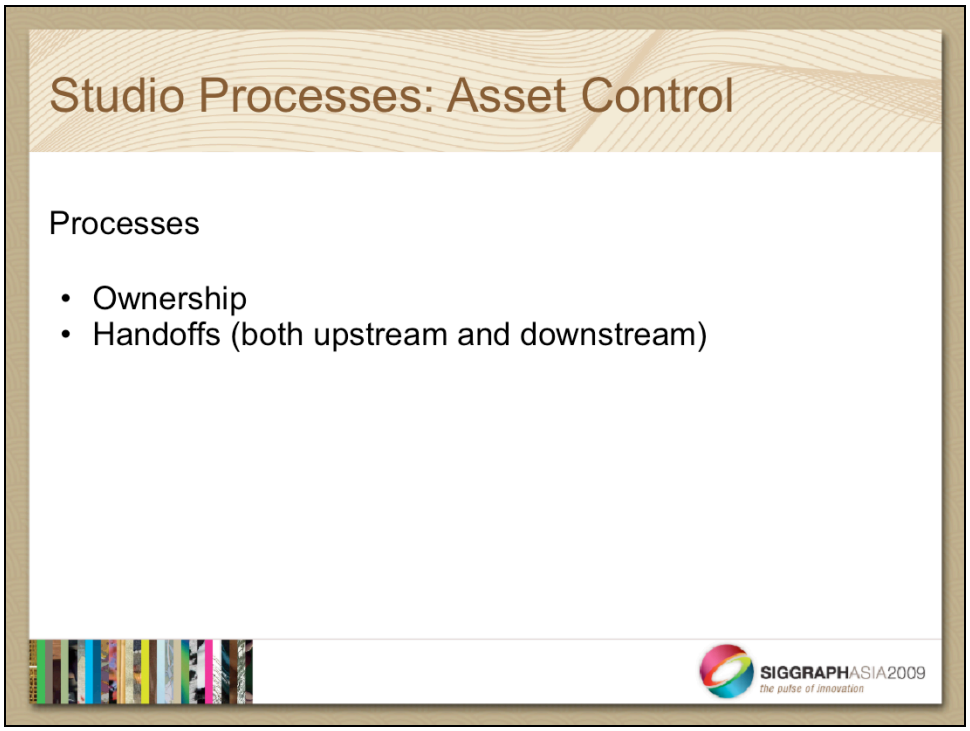
- As a studio progresses from Centralized to Fully Distributed, it becomes more and more important for an automated, robust system to be implemented to capture and track all director notes/tasks.
- The system must not only accurately record the task, but make sure the task is assigned to the correct artists, and then also track the progress the artists make on the task.
- Relationship between the directions and assets will reduce confusion.
- It's also important that the results of this recording and tracking are made available to production management in a way that they can easily process. Thousands of these tasks can be generated each week -- a simple list won't do.



Asset control and asset management are hard problems even in a simple Centralized system.

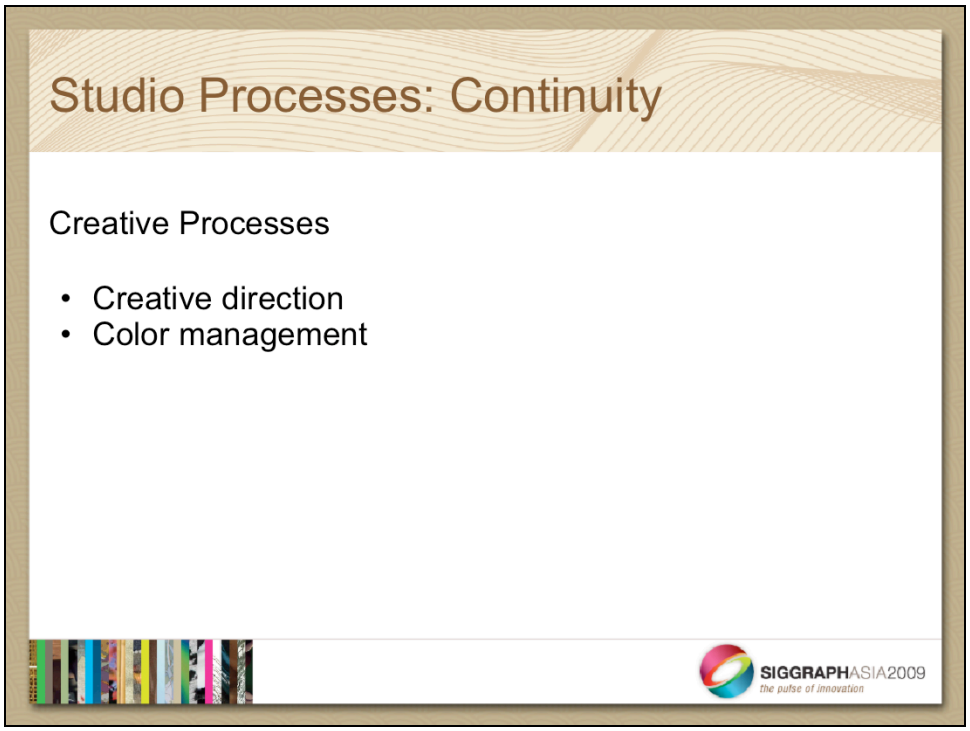
- Who owns an asset any given time?
- What are they responsible for doing to the asset?
- How do you know when their work is complete?
- Who is to receive the asset next?
- How is the handoff to occur?
- What if the asset needs to be moved backwards up the pipeline?
- After all work is done on the asset, how do we find out how much time and money was spent on it?

On a large collaboration project proper asset management is essential to keep people from stepping one each other's work.

Asset Control is a problem that scales up very quickly. The total assets count for a large film project can be millions of files and with over 10 TBytes of data.

This is one instance where manual asset control methods will not scale. An efficient system to allow the management and control of a large asset collection is needed. Assets have to be managed in both scale and time. The needs to go back to previous versions exist in production.

Remote asset management has additional challenges. Keeping everyone informed and up-to-date is complex given the potential global participation. Security also becomes a high priority for global asset management in valued production.



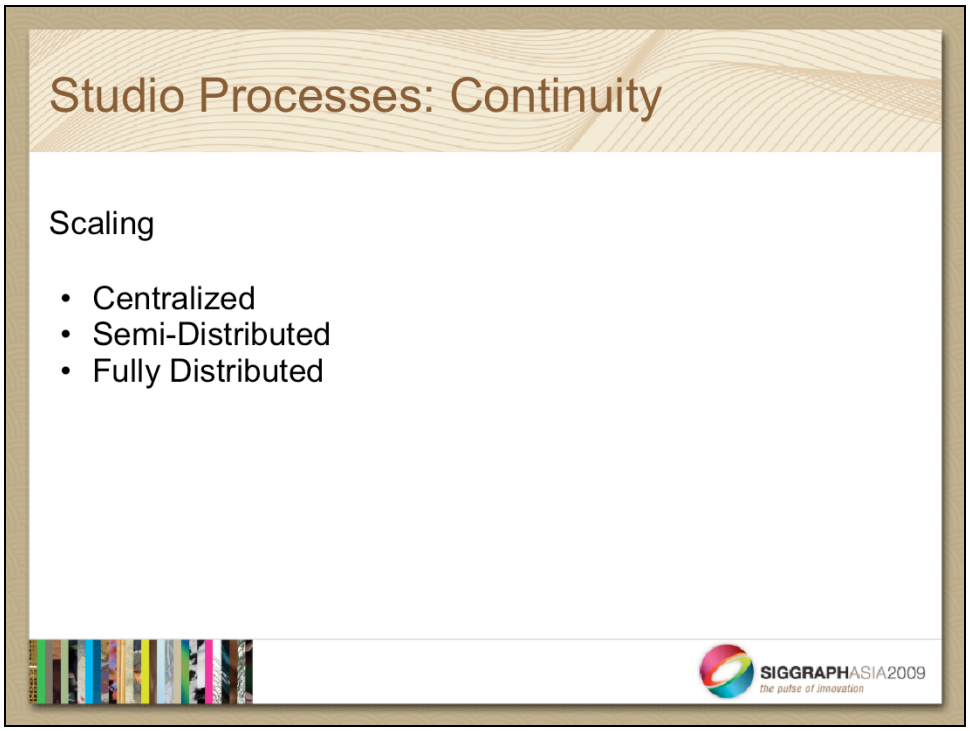
Creative Direction

- Shots done by different artists must all look the same.
- Animation: a given character will be animated by a different artist in each shot.
- Lighting: Different lighters on consecutive shots can lead to mismatched shots.

Color Management

- Make sure everyone is working in the same color space.
- Make sure all monitors are calibrated the same way
- Post color correction for continuity.
- Impose Color management for final delivey dependig on medium (Film vs DVD vs web)

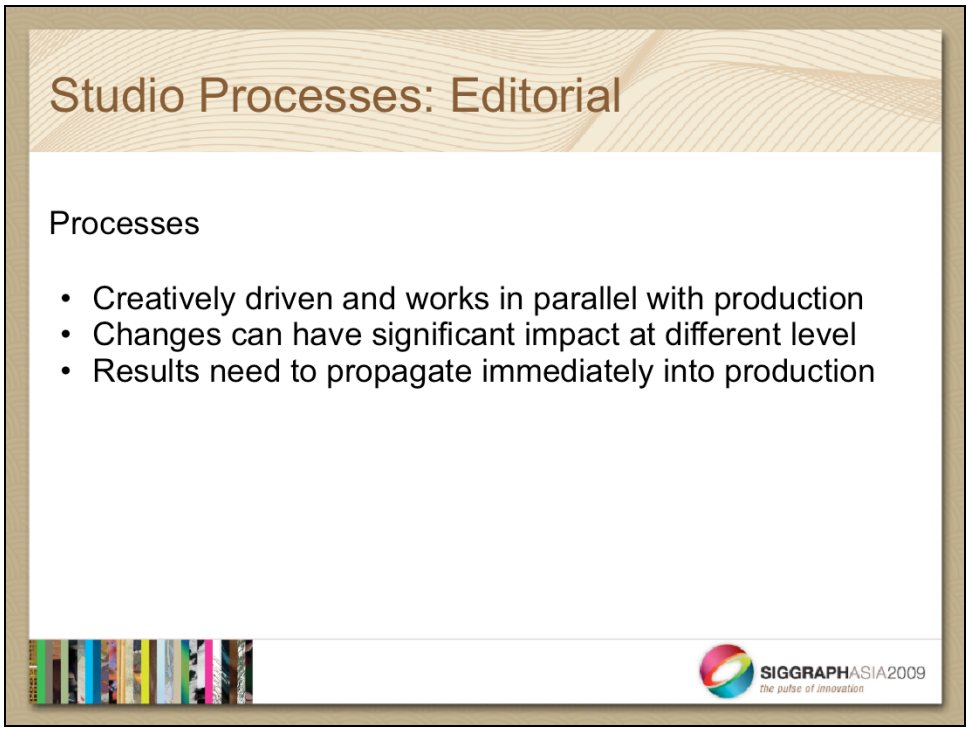
When the viewing process is not standardized one group might see a very different result than another group.



For centralized production multiple review areas can be setup to have the same color management and review environment.

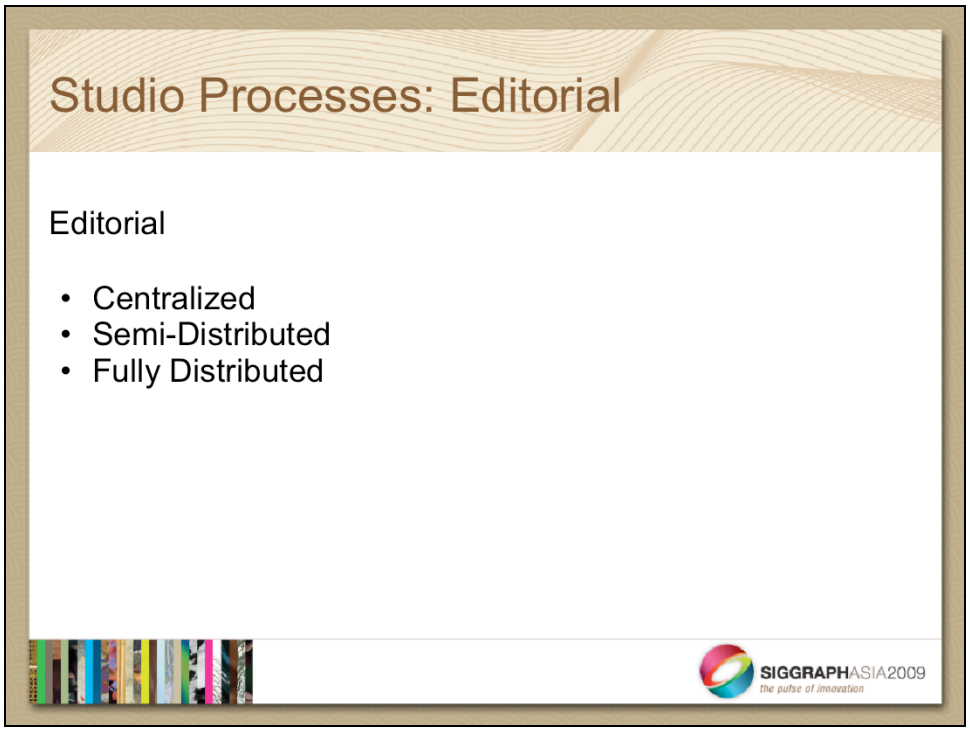
In a distributed environment the problem is that there's no way to guarantee the consistency of the review environment. The simple solution is to use reference images to specify changes based on relative differences along with posting visual direction as reference images.

Proper training and support for review must include more than just individual images but also support seeing work in the full context of the project.



Editorial is one part of film and TV production that can have significant impact on utilization. A re-edited sequence can eliminate multiple shots while adding significant work. Work in progress can be wasted if the team is not informed in a timely manner.

- Editorial changes need to be visible and immediate.
- Keeping a standard EDL format so there is an accurate accounting of editorial changes.
- Editorial assets need to be accessible to the whole production team so any context changes will be visible immediately.
- Asset management needs to keep up with editorial so what's in a shot is always up to date.



Editorial is traditionally one of the trickier parts of a production pipeline. The needs of the production department are very different than the needs of most other departments, and changes made in editorial can easily affect departments at the very top of the pipe.

In a semi-distributed or fully distributed scenario, there can be multiple editorial departments, each with conflicting needs. Any system designed to share assets between studios or must take this into account.

Common interchange for EDL (edit list) and media must be seamless to minimize confusion. Everyone needs to be working on the same project at the same time so proper distribution of this information is required to scale up production.

Section V: Scaling Studio Processes

Wrap-Up and Q&A

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Section VI:

Scaling Project Management in Different Growth Models

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Management

Key issues while scaling a project

- Meeting creative objectives with available resources
- Support the team
- Facilitate communication
- Keeping structure intact
- Balance resource and tasks

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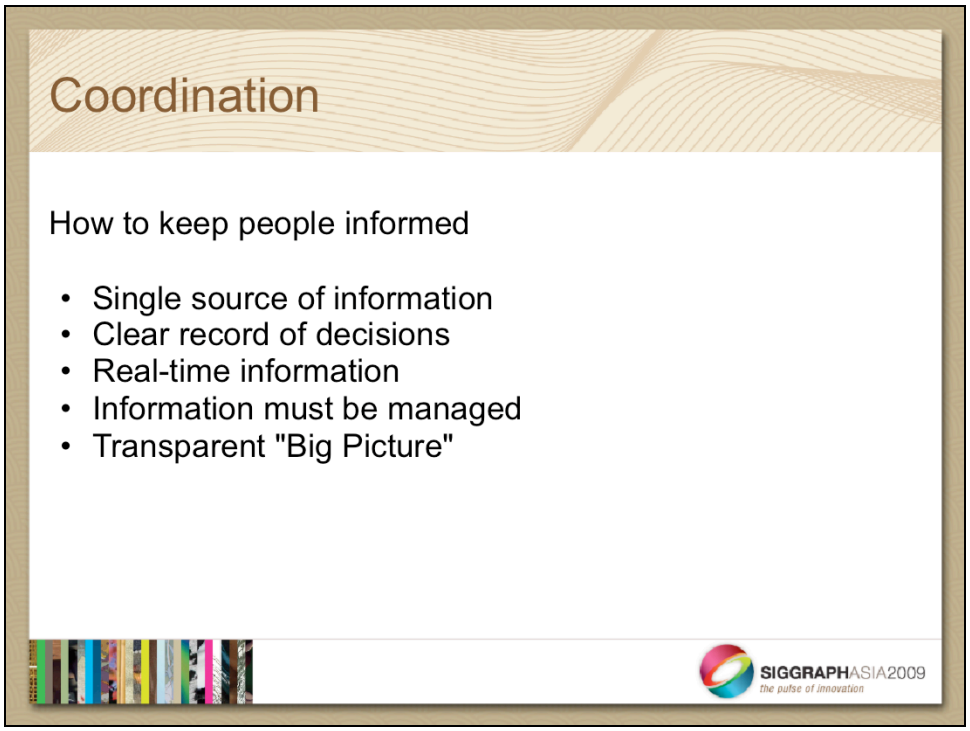


For all the different models it is vital to keep the information flow timely and accurate. The more trust your team has for the information the more they will rely on it. By providing a clear top view of the overall project individuals will feel and see the effects of their contribution. Keeping people informed will serve as a strong motivator to get the best work from your team.

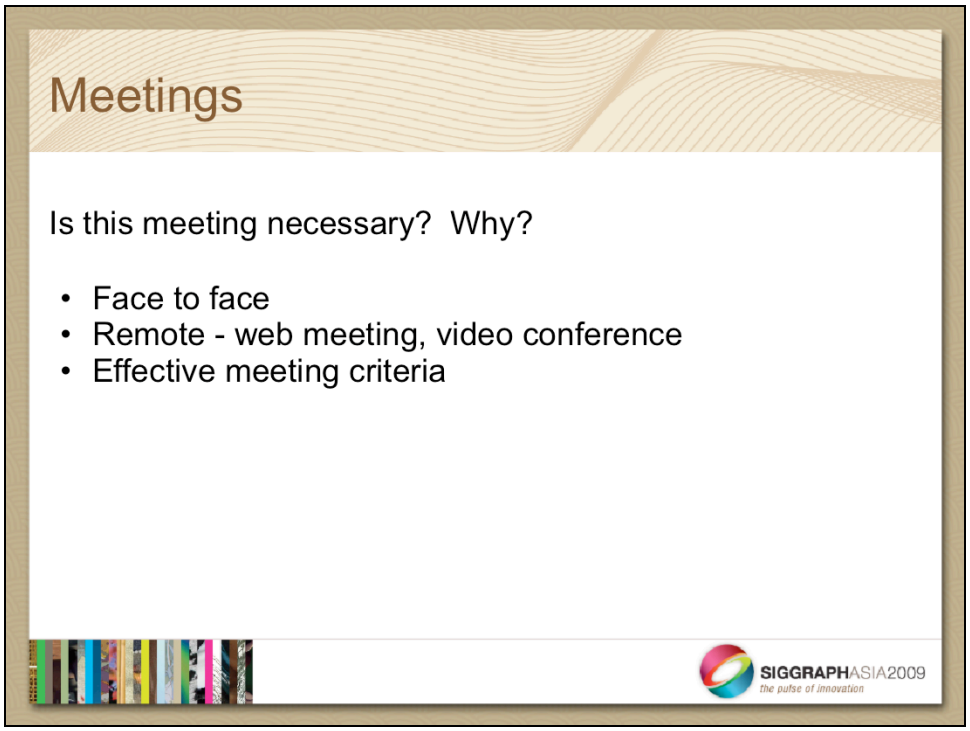
For small projects, Web based applications like Google Docs can go a lone way towards building a collaboration information system. But for larger projects and a more distributed project that might be insufficient in both scale and security.

The only successful way to grow a team is to provide them with the proper support. Problems cannot be solved by just throwing people at it. A small coordinated and well trained team is much more powerful than just a bunch of warn bodies.

Support requires dedicated time and resources that are planned for.

A well prepared and supported program with proper documentation will greatly reduces the amount of time people need to spend repeating the same training program. The time saved in a prepared program will allow for more time to help solve the more difficult problems.

For a small team allocate time for individuals who are effective trainers. On larger project it is well worth the cost of having dedicated resource to support, document, and train new team members.



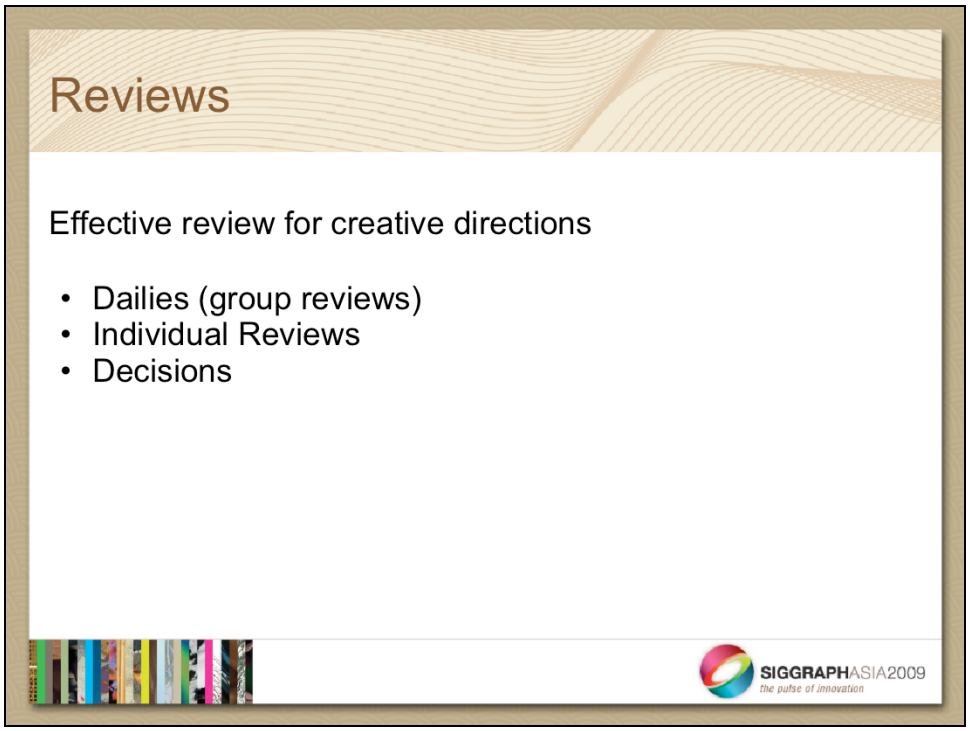
Artists normally do not like meetings. Every hour an artist sitting in a meeting is usually an hour not spent on creative work on a project. Often meetings are used to delivery information that should already be available.

Production management, on the other hand, likes meetings. They use meetings to tell if work is getting done. Meetings are work for PM, meetings prevent artists from working.

Face to face meeting either in person or via video conference is much more effective for critical and emotional decision making. When you need a serious meeting avoid email and chat. But don't forget to take good notes so that you can recap the key discussion and conclusions from a meeting. A meeting is useless unless everyone involved agree on the result and remember it.

Effective Meeting:

- Meeting is not a substitute for information
- Clear pre-published agenda
- Clear action and responsibilities



Dailies:

- Allow everyone to see and share creative vision
- Allow participants to be creative in context of project

Individual Reviews:

- Avoid going through levels of indirection

Decision:

- Keep a clear record of decisions and reasons
- Timely communication of changes and impact

Section VI: Scaling Project Management

Wrap-Up and Q&A

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Section VII:

Wrap-Up and Final Q&A

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Wrap-up

To scale up a studio and projects

- ***Plan*** Ahead
- Measure ***Utilization***
- Consider the models
  - Centralized
  - Semi-Distributed
  - Fully Distributed

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Richard Chuang - CEO Cloudpic Global. Co-founded PDI/ DreamWorks back in the early 80's, Richard have seen over 1000 CG projects in his career and over a dozen CG feature film and TV series as an executive at DreamWorks Animation. He helped build a studio from a start of 3 people to over a thousand artists. He served as visual effects supervisor for 16 live action films, and his accomplishments include authoring PDI's first renderer, lighting tool, compostor and first long format pipeline. Richard receiveda Technical Achievement Award from the Academy of Motion Picture in 1998.

David (grue) DeBry led the design and development of production pipelines at major studios such as PDI and ESC, and has worked as both a digital artist and as an CG supervisor at film and game studios such as Electronic Arts, Tippett Studios, and ILM. He is a published researcher who has worked in many areas of computer graphics for twenty years. A longtime SIGGRAPH volunteer and contributor, he was the 2006 SIGGRAPH Panels chair.