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Next Generation Distributed Animation and Production Computing



Today's Topics of Discussion

- Introduction to Master's Degree in Animation
- Presentation on the Magic of Animation
- How is Animation Created ?
- Problems of the Past
- Pushing the Network Limits
- Meeting the Network Challenges
- Solution for Next Generation Animation Facilities
- The Student Experience and Benefits
- Benefits to University of Technology, Sydney



Introduction to Master's Degree in Animation

- What is this course about ?
 - Traditional Film Animation
 - 2D and 3D Digital Animation
 - Graphic Visualisation
 - Object-Oriented Programming
 - Animation Studies
 - Production and Professional Film Footage
 - Pre and Post Production Techniques



Introduction to Master's Degree in Animation

- What jobs are there for graduates ?
 - Film and Television Graphics
 - Feature Film Production
 - Special Effects
 - Storyboard Design
 - Computer Game Software Design
 - Animation for the Internet
 - Architecture
 - Character Design
 - Experimental Animation



Introduction to Master's Degree in Animation

- Most Graduates Obtain Jobs During Their Course
 - Some companies include
 - Disney
 - Animal Logic
 - Fuel International
 - SBS
 - TV1
 - And Many More



The Magic of Animation

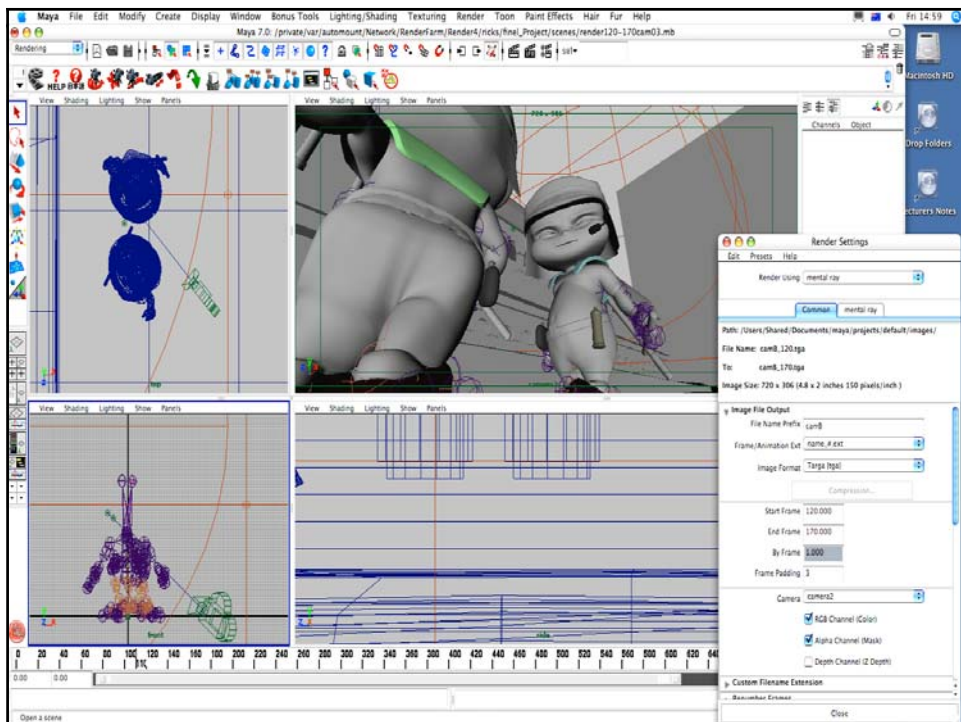
- What is Animation All About ?
 - 3D Animation and Digital Effects Software (Maya)
 - Over 70% of Hollywood Special Effects are produced with 3D Animation Software Maya
 - Most 3D Games are created with Maya
 - Some movies made in Maya include:
 - The Mummy
 - George of the Jungle
 - Jurassic Park 3
 - The Fifth Element
 - Anaconda
 - Shrek
 - Spiderman
 - The Matrix
 - Harry Potter
 - Lord of The Rings



How is Animation Created ?

Step 1: Creating the Scene

- Concept and Storyboard Design
- Frames of Reference are created, involving things like:
 - Virtual Modeling
 - Character and Background Design
 - Texturing, Shading and Animating
- Frames contain series of instructions and pointers
- They define how things should look and be animated
- Many frames are put together to create a 'Scene' File
- Lets look at an example of student experience interface





How is Animation Created ?

Step 2: The Rendering Process

- Transforming Scene file to Images is called Rendering
- Rendering Process:
 - Involves Complex Mathematical Calculations
 - Can take days or weeks on a standalone PC !
- Creates 'Real' Image frames from the 'Raw' Scene Data Files

How can the Rendering Process be performed faster ?



How is Animation Created ?

Step 3: Distributed Computing

- Process used to share the load between many hosts
- All hosts are clones of each other
- They form a 'Virtual Processing Cluster' called the Renderfarm
- **The 'RUSH' application**
 - Distributes batches of work to nodes in the Renderfarm
 - Say 5-10 frames in each batch
 - Creates 1000's of images across nodes in the network
 - That's just for a few minutes of footage !
- **Rendered Images are sent by all nodes across network to Central File Storage**



How is Animation Created ?

Step 3 (cont) Centralised File Storage (XRaid)

- Rendered images are transferred by RUSH to XRaid Fileserver
- The collection of images needs to be assembled to form movie

- **Some Stats:**

- A Single Hi-Res Image Frame can be 15MB
- Movie Playback = 25 Image Frames per second
- How large is a 5 minute High-Res Movie File ?

$$15\text{MB} / \text{Frame} \times 25 \text{ Frame} / \text{sec} \times 300 \text{ sec} = 100\text{GB} +$$



How is Animation Created ?

Step 4: From Images to Movie

- Image files on XRaid File Server need to be 'stitched' together
- This means assembling the sequence of image frames
- This is achieved by running the 'F-Check' application
- Movie Footage is created on the XRaid File Server
- Final 2 Products are a Playable Movie File and DVD Version



Problems in the Past

- There were 20 desktops + 1 Rendering Server
- Students waiting many hours or days for work to be processed
- Students working late into the night
- Unavailability of computer resources during processing
- Network performance problems
- Lack of student motivation to explore creativity and complexity
- The production of Low-Res rather than Hi-Res Movies preferred



Pushing the Network Limits

- Imagine 40 Students, each submitting a 10GB rendering job
- At the same time, real time movie playback across network
 - **Can be 600 MB per second for a few hosts !**
- Add Students transferring movie files (can be 100GB) across network from File Server to local workstation or external HDD

This places special and ever increasing demands on the network ... and invariably the budget



Meeting the Network Challenges

- **Distributed Computing Greatly Reduces Processing Time**

- 20 Dedicated Rendering Server Nodes Deployed
- Host Nodes increased to 45 that can also Render
- All 65 nodes are clones of each other and form a 'Virtual Cluster' known as the Renderfarm
- All 65 nodes can share the work -Distributed Computing



Meeting the Network Challenges

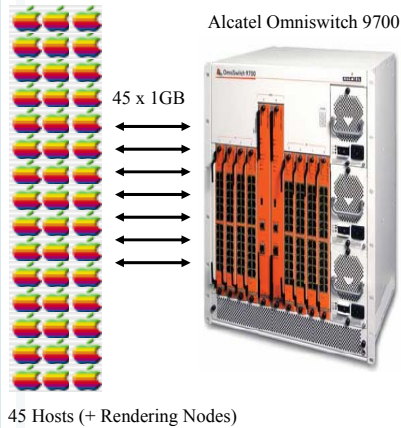
- **Need for Affordable Very High Network Performance**

- **High Speed Network Access**
 - ✓ Gigabit access for every node
 - ✓ 10G access between host and server farm network
- **High Speed Network Processing**
 - ✓ 768Gbps switching capacity over 1.92Tbps backplane on main network platform
 - ✓ 570 Mpps Throughput
- **Best Value**
 - ✓ Advanced Performance and features at lower cost
 - ✓ 10G Interface at 9 x 1G Price !



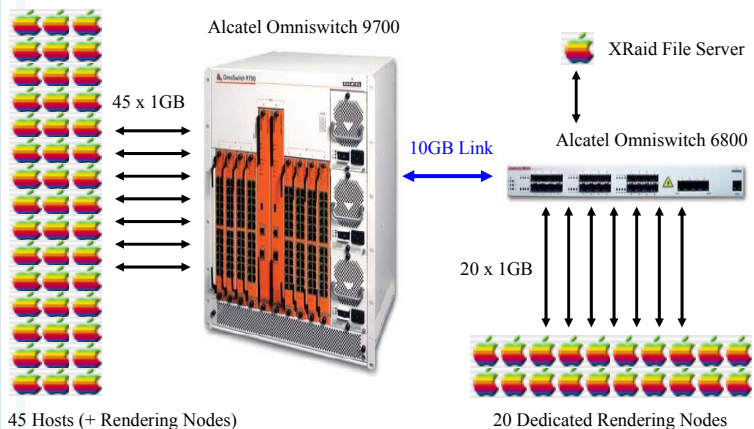
The Solution

45 MAC Hosts are each connected to the Network via dedicated 1 GB links using an Alcatel Omniswitch 9700



The Solution

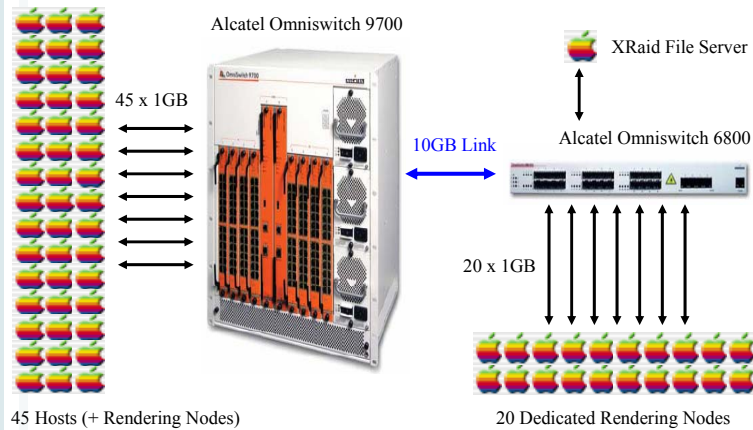
A 10 GB Link is provisioned between the Alcatel Omniswitch 9700 and an Alcatel Omniswitch 6800 Server Farm Switch, For 20 Dedicated Rendering Nodes and Central File Server





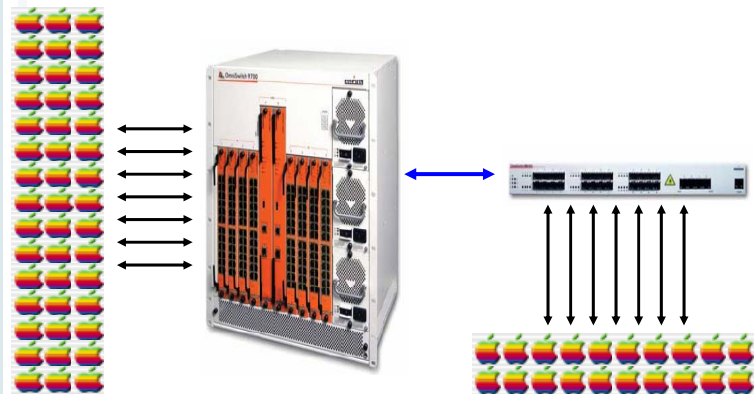
The Solution (in action)

- Host has created a scene file and runs the "RUSH" application



The Solution (in action)

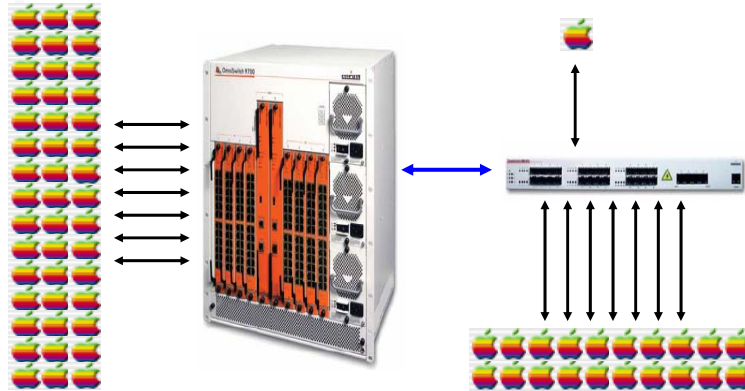
- "RUSH" distributes batches of the work to all available hosts in the Renderfarm





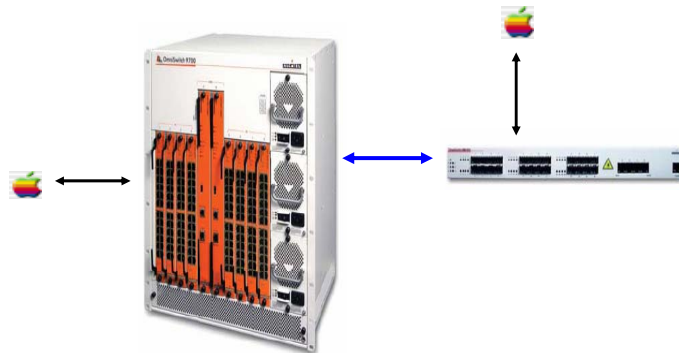
The Solution (in action)

- All Renderfarm Nodes transfer processed images to File Server



The Solution (in action)

- Student runs the F-Check Application to merge images into final playable video





Presentation

Compilation of Student Project Work
(2min DVD)



The Student Experience and Benefits

- Individual (standalone) computing and application processing can take several hours or days
- The new facilities reduce this time to about 1 hour 😊
- Students are able to do more and learn faster
- Students can visualise their results immediately
- Students are more ambitious, creative and will try animations with greater complexity
- High-Res rather than Low-Res animation is produced
- Students receive valuable exposure to facilities which are closer aligned to professional production houses
- There is a high demand in the workplace for students graduating in this course



Benefits to UTS

- The UTS Animation Lab is unique in that there are no facilities of its kind in any other Australian University and only surpassed by professional video production houses like Animal Logic and Fuel International
- UTS is able to closely align the delivery of teaching with industry standards and requirements
- UTS is able to provide its students with state-of-the-art industry experience and relevance

The benefits to UTS include closer alignment to industry/real world operating conditions, with flow on benefits for student creativity and employment opportunities. It has given us a state-of-the-art-facility



QUESTIONS ?