

Microsoft's Tiger Media Server



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Tiger Characteristics

- ◆ *Software-based* solution to video-on-demand (VOD) services
- ◆ *Guaranteed* data rates
- ◆ *Huge* data volumes and *high* bandwidth
- ◆ *Reliable* in the face of hardware failures
- ◆ *Low cost* per stream

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Addressing the “Myths” of Video-on-Demand

- ◆ **Myth: You need supercomputers to generate high bandwidth**
 - **Off-the-shelf, high-volume, low-cost system components can be aggregated to achieve high speed**
- ◆ **Myth: You need special hardware to get fault tolerance (e.g. RAID, Non-Stop)**
 - **A fully redundant system can be built at low cost with the right software**

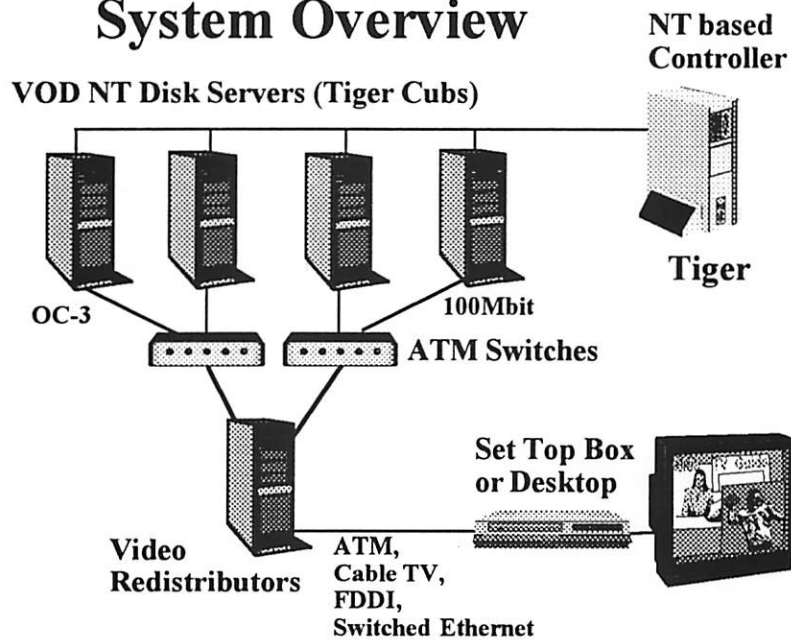
More VOD “Myths”

- ◆ **Myth: You need massive memories to get the bandwidths for VOD**
 - **High-volume, low-costs disks can be aggregated to both store data AND provide high bandwidth to customers**
- ◆ **You only need to support a “few” movies**
 - **A small number of movies get a lot of viewers, but there is a long “tail” where a significant fraction of viewers watch non-top 10 movies.**

Basic Tiger Approach

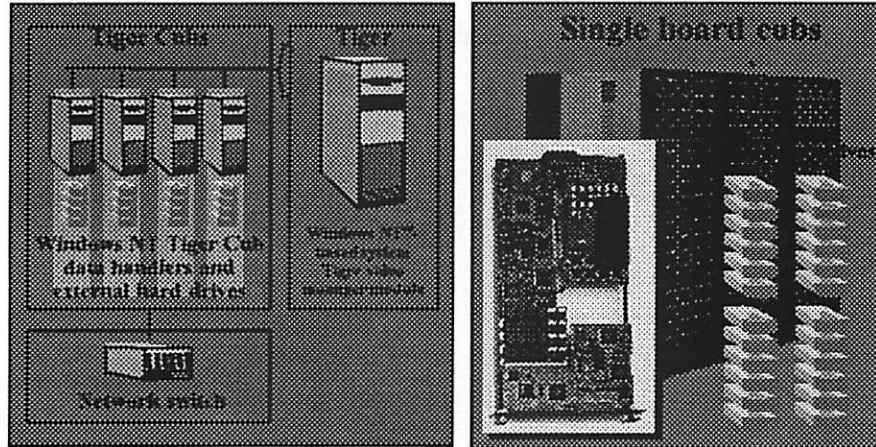
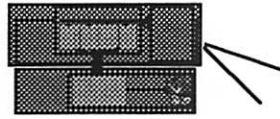
- ◆ Fault-tolerant distributed system design (NOW!)
- ◆ High-volume, low-cost parts
- ◆ Movie load balanced across disks and other system components
- ◆ Viewers scheduled to guarantee bandwidth using time division multiplexing

System Overview



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Tiger Packaging Approaches



Separate components

Single board solution

Tiger Architectural Features

- ◆ **Distributed Load Balancing**
 - Software policy allows *any* active stream to carry *any* on-line movie up to the total capacity of the system
- ◆ **Scalability**
 - Scales to a *huge* numbers of users/movies
- ◆ **Low Latency**
 - Access time less than *1 sec*
 - Allows *all* “virtual VCR” functions

Tiger Architectural Features

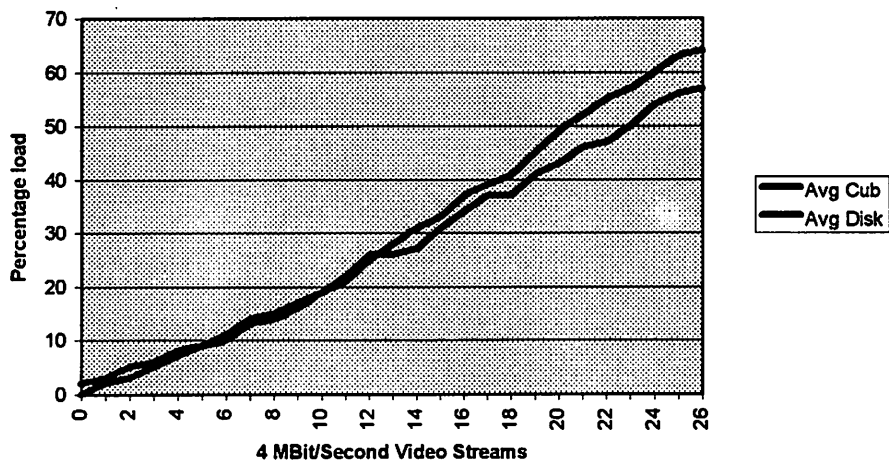
- ◆ **Built-in redundancy against failures**
 - **No single failure stops system or interrupts service to even a single customer**
- ◆ **Self-healing**
 - **Failed components can be automatically replaced by “hot spares”**

Tiger Tales

- ◆ **Real-time resource scheduling**
 - **New viewers scheduled access to resources - Cub, Disk & Network**
- ◆ **Dynamic distribution of resource requests**
 - **Smooth runtime distribution of load over Disks, Cubs, Switches, Tigers**
- ◆ **Fault-tolerance built-in at all levels**
 - **Disk failure, Cub failure, Tiger failure**

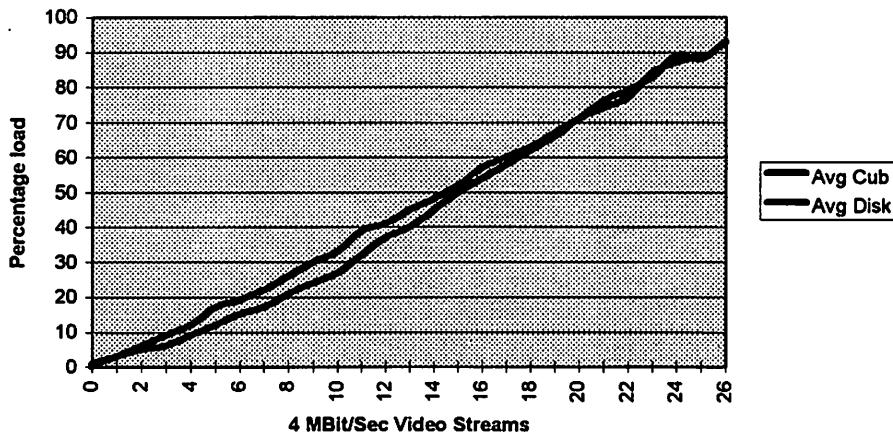
Tiger Behavior Under Load

Tiger Load vs. Streams for 3 Cub EISA System



Tiger Behavior Under Failure

Tiger Load Under Failure: 1 of 3 Cubs Failed



Tiger Summary

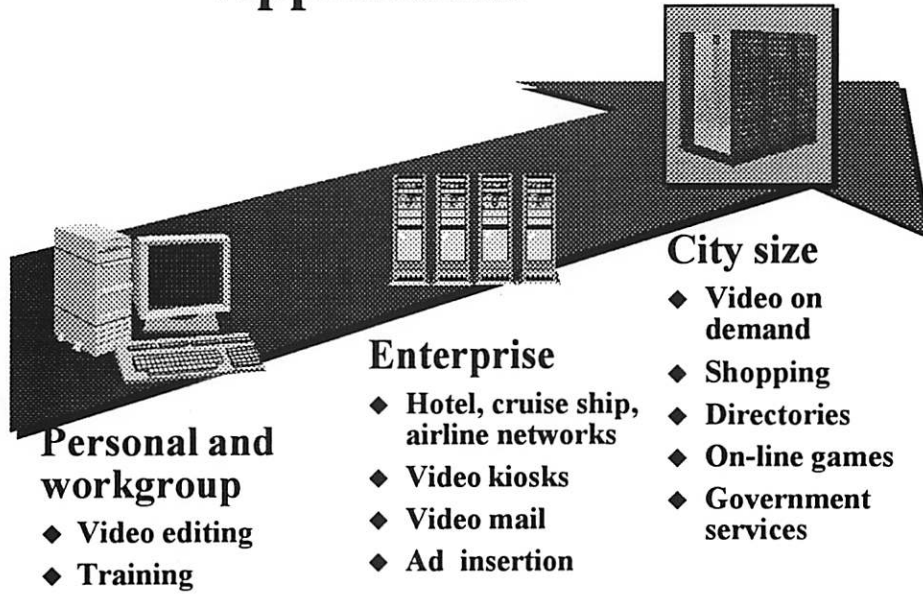
- ◆ **Software *not* Hardware**
- ◆ ***Anyone* can enter video server market with existing hardware**
- ◆ ***Economical* for small & large systems**
 - **Startup costs within reach of schools, small businesses, small cable companies**
 - **Non-disk hardware costs per subscriber less than cost of low-end phone**
 - **Storage costs less than what a single Blockbuster Video outlets pays for a hit movie today**

Tiger Is Not Just for VOD

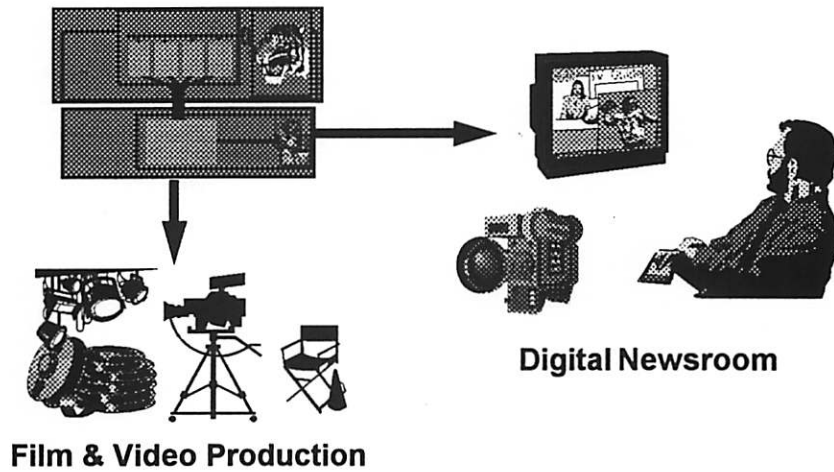
- ◆ **Tiger makes sense for:**
 - **Audio**
 - **Animation**
 - **Any kind of continuous data with real time delivery requirements**
- ◆ **Broad range of interactive applications**



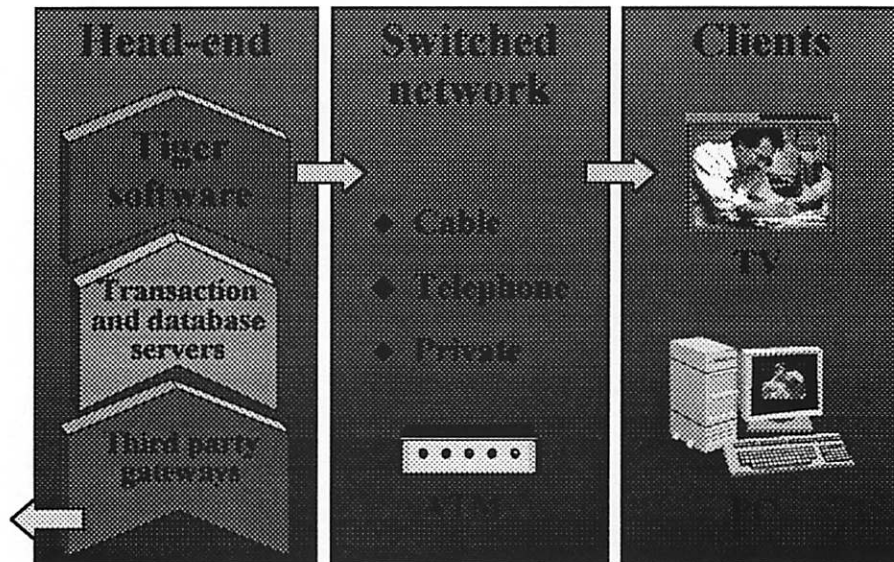
Applications



Tiger Applications



Part of a Total System



Tiger Status

- ◆ Tiger systems running at Microsoft since 1993
- ◆ Announced Tiger partnerships
 - US - TCI
 - First customer trials in early 1995
 - Canada - Roger's Cable
 - Japan - NTT
- ◆ Major Manufacturers
 - Compaq
 - Intel

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