

## Q: NAS + SAN = ?

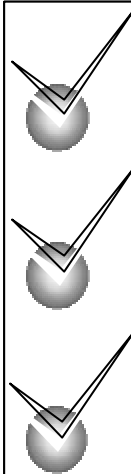
## A: SAN Filesystems

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## NAS

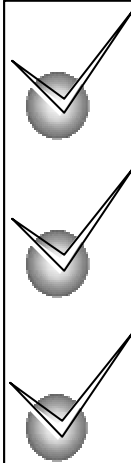
- NAS has been very successful
  - Software development
  - CAD/CAM
  - Telco, billing
  - Finance
  - Internet
  - ...
- NAS market: >\$6B by 2003\*

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\* Dataquest, 2000

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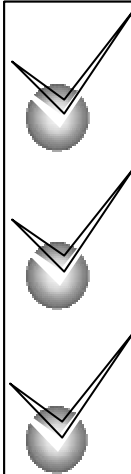
## Victims of our own success?

- Applications are demanding more and more performance
- Will Moore's law continue to work?
  - My guess is not
- It's the software, stupid
  - Features keep growing
  - Filesystems are complex things!
- So, how will the demand be satisfied?

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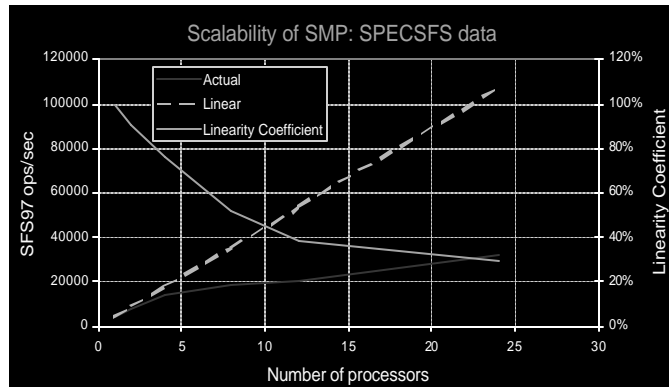
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## Performance Boosters

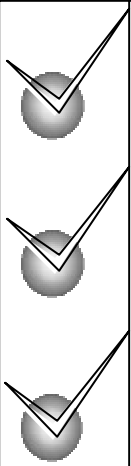
- Multi-processing?



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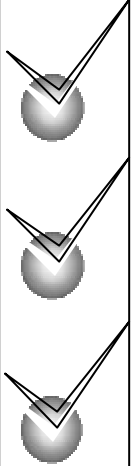


## Performance Boosters

- Clustering?
  - “Pay-as-you-g(r)ow” scaling
  - Very successful
  - Works when application can use multiple filesystems

→ Demand is building up for *scalable* growth in per-filesystem performance

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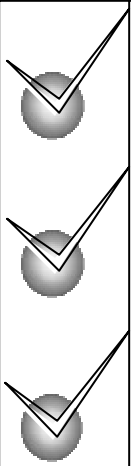


## SAN

- Technology evolution is resulting in very large and scalable SAN's
  - FibreChannel fabric: bandwidth (+ connectivity)
  - Storage systems are getting smarter, bigger, faster
    - Symmetrix 8000 series with Engenuity: 27+ TB
  - Faster devices: 15K RPM drives
- SAN Market: \$27B by 2003\*

➔ A convergence of the storage and IP network fabrics is imminent

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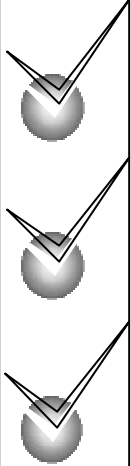


## NAS in SAN environment?

- ☹️ The NAS box will stifle the storage network
- ☹️ Brute force will not work

- We're not alone...
  - ✓ Customers
  - ✓ Other vendors: SNIA

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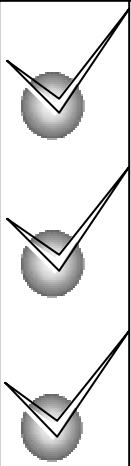
## What's the answer?

<ul style="list-style-type: none"> <li>• NAS               <ul style="list-style-type: none"> <li>✓ Sharing</li> <li>✓ Heterogeneity</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• SAN               <ul style="list-style-type: none"> <li>✓ Direct (single-hop), high-speed data access</li> <li>✓ Scalability</li> </ul> </li> </ul>
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➔ SAN Filesystems

- Network for access control (sharing, heterogeneity)
- Channel for data (speed, scalability)

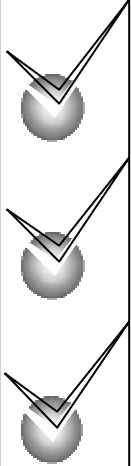
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## SANity check

- We're not alone
  - Tivoli
  - Veritas
  - SGI
  - DataDirect
  - ADIC
  - DataPlow
  - Hewlett-Packard
  - Universities: CMU, Minnesota
- ☛ How many NAS vendors?

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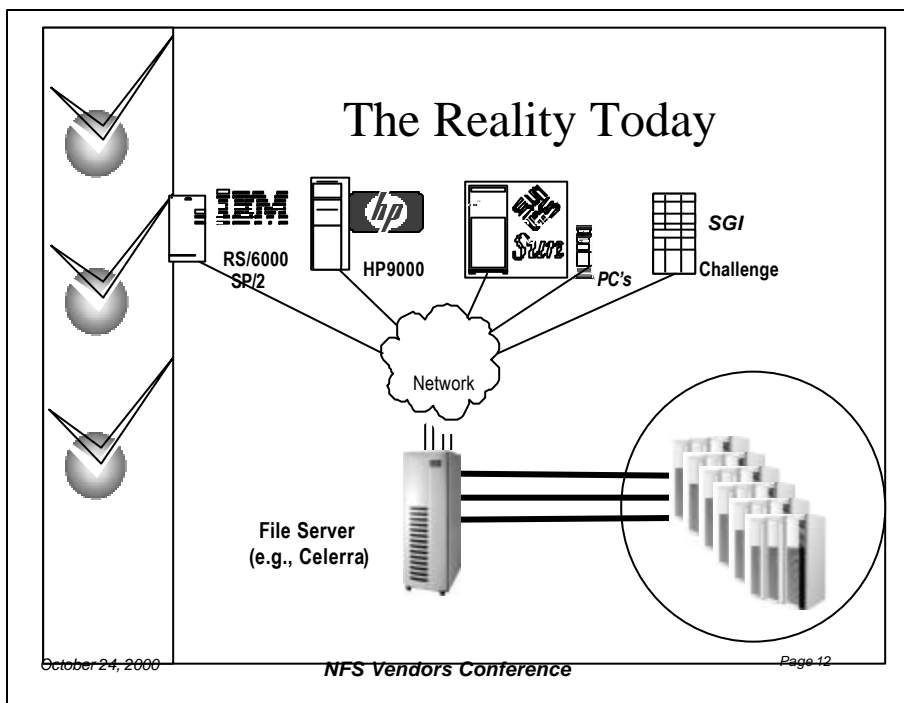
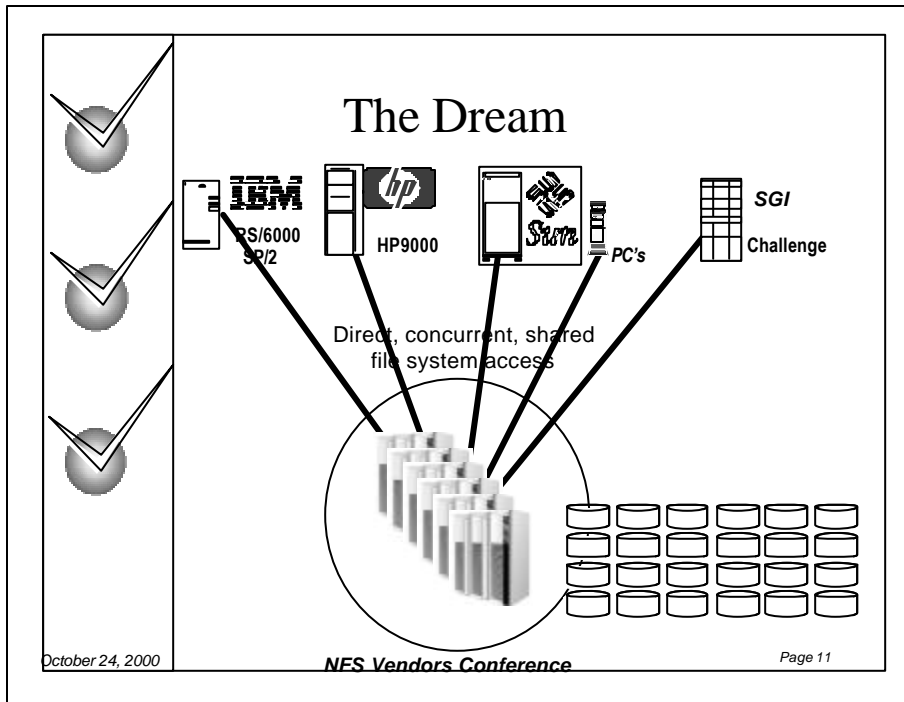


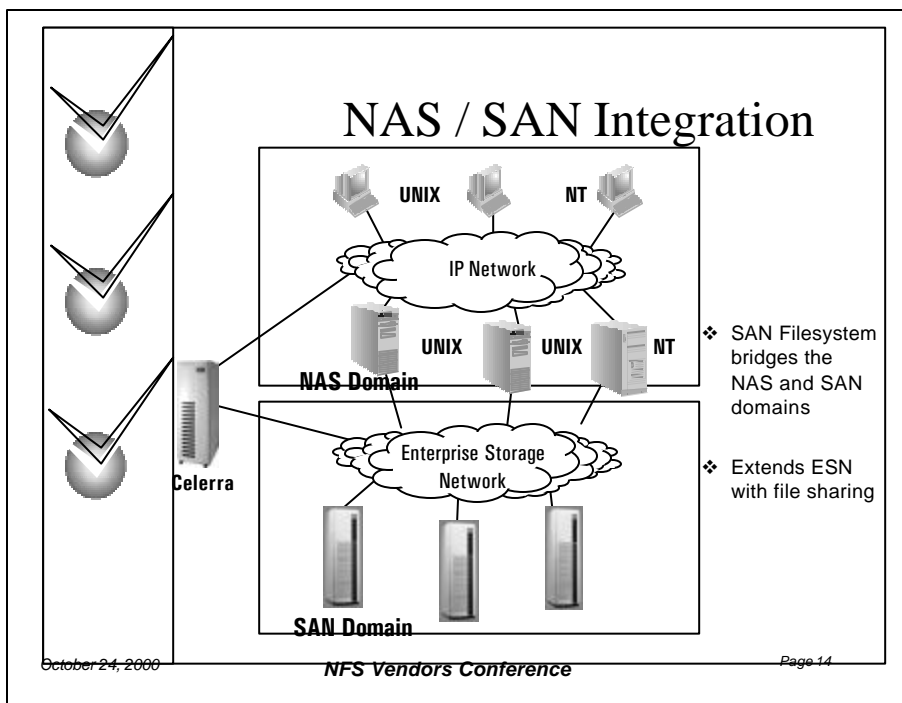
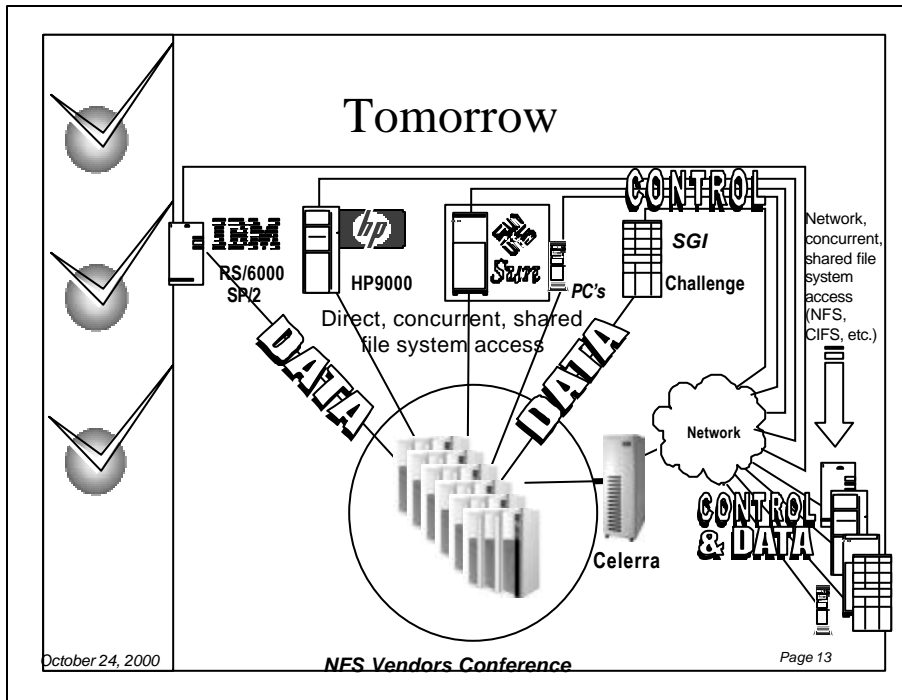
## SAN Filesystems

➤ Requirements:

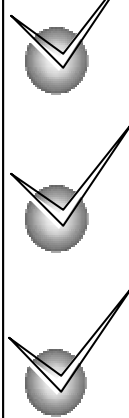
- ❶ Remote data access and sharing, at channel speeds
- ❷ Traditional full-featured filesystem
- ❸ Enterprise-level scalability and reliability
- ❹ Use and extend existing protocols for file sharing

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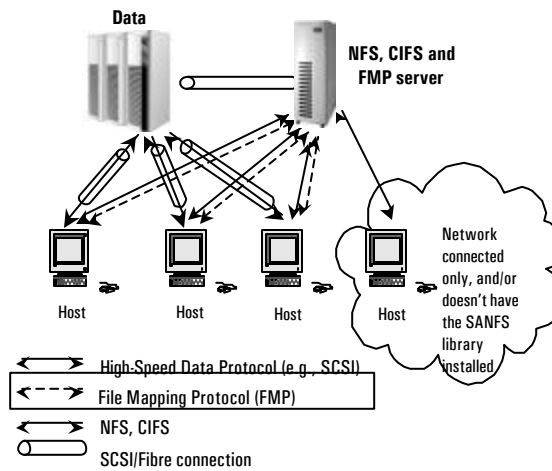




Backup



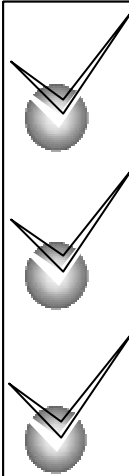
## Implementation



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## Performance Expectations

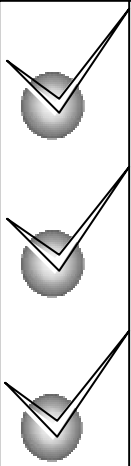
- Approaching channel speeds
  - For large files, large data accesses
- No worse than NFS
  - For small files, small data accesses
- Huge increase in server scalability
  - Can deliver much higher throughput

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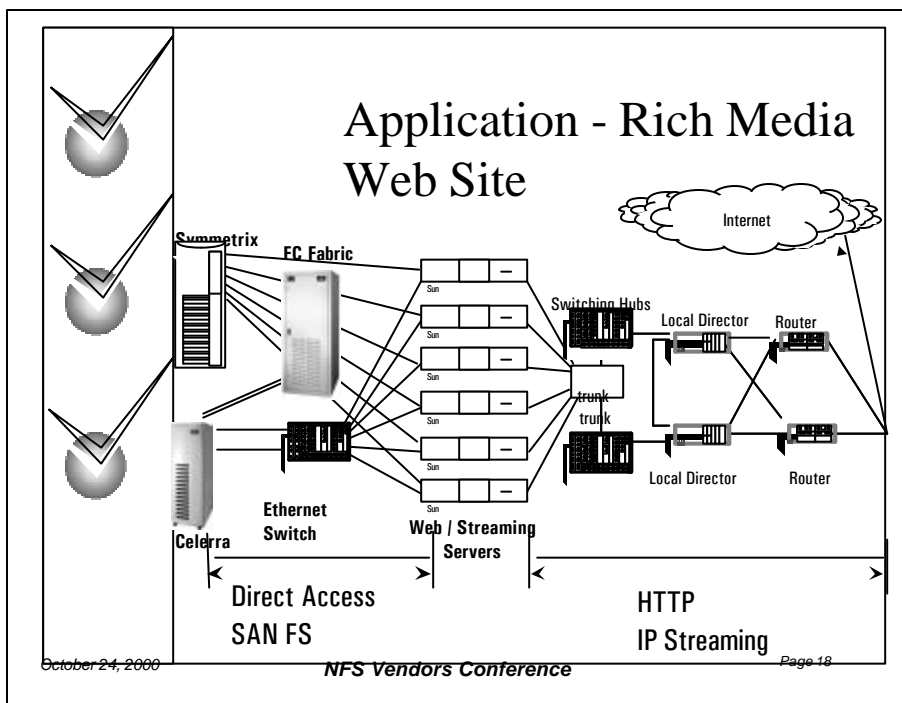


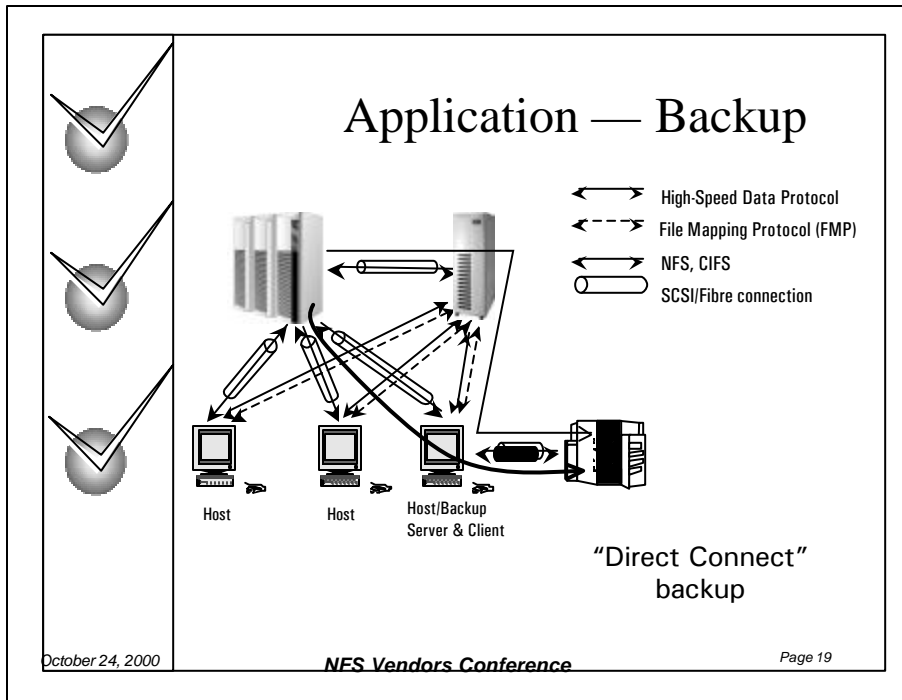


## Key Benefits

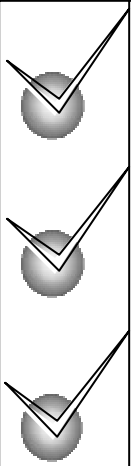
- ✓ Data access at channel speeds
- ✓ File sharing among heterogeneous clients, on SAN and on IP network
- ✓ Full filesystem functionality
- ✓ Interoperates with clients that use traditional protocols only
- ✓ Entirely transparent to applications

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- ## Change is coming...
- We must act!
    - SAN filesystems are inevitable
    - Non-NAS vendors want to eat your lunch
    - Must interoperate
  - How to interoperate?
    - Keep on-disk filesystem proprietary
    - Standardize protocol for:
      - Communicating file mappings
      - Locking and concurrent access
  - Incorporate protocol into NAS protocols: NFSv4, CIFS
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**We must act, NOW!**

- Standardize mapping/locking protocol
- NFSv4:
  - Sideband protocol?
  - Protocol extension?

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