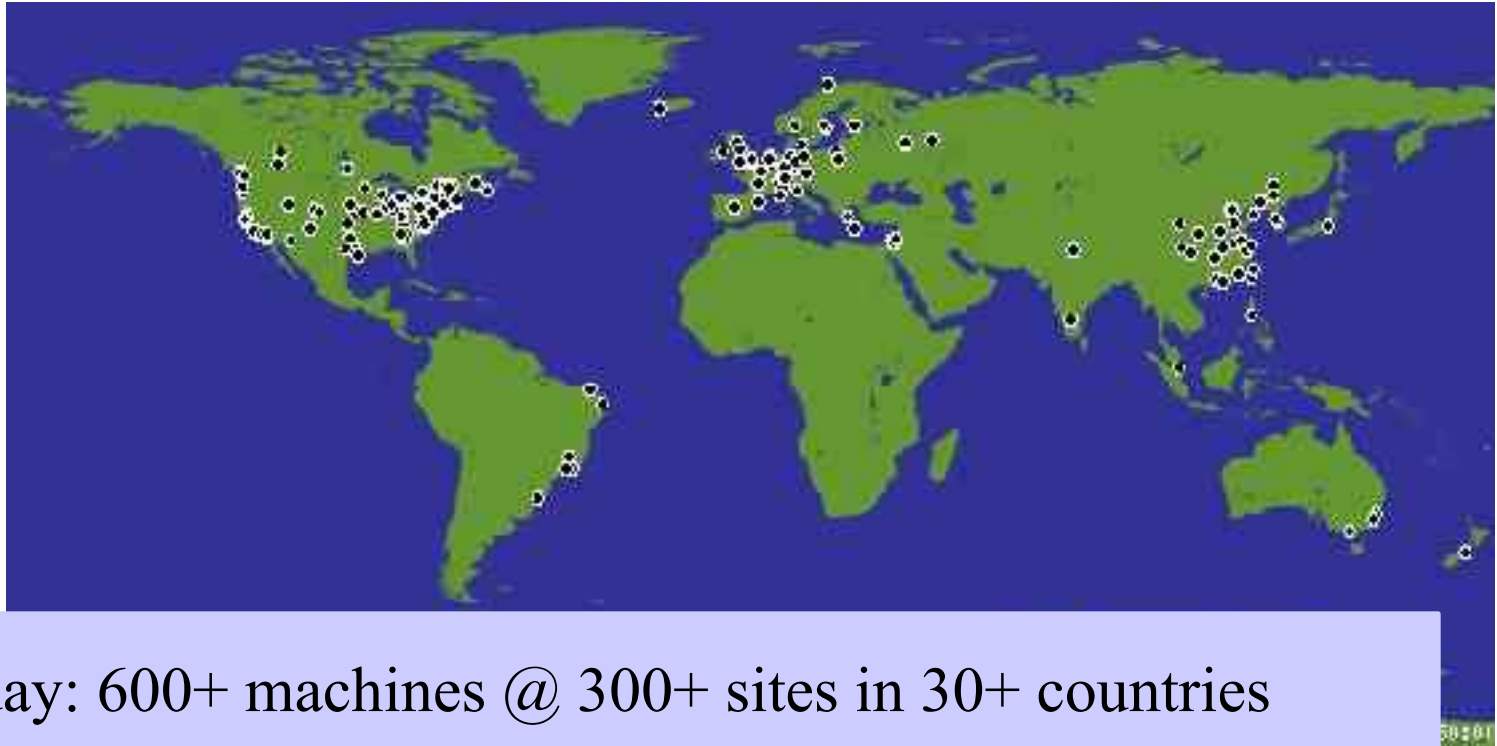




Marc E. Fiuczynski  
Princeton University

# PlanetLab is a... Global testbed

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today: 600+ machines @ 300+ sites in 30+ countries

- at edge sites and network cross-roads
- edge sites with LAN-hop distance to >2M users

# PlanetLab is a... Community...

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- ... of *Network Services* Researchers
  - ~300 institutions, ~1000 researchers, ~300 projects
- Network Service examples:
  - Content Distribution
  - Large File Transfer
  - End System Multicast
  - Network Health Monitoring and Measurement
  - Reliable DNS
  - ...

# PlanetLab is a... Consortium

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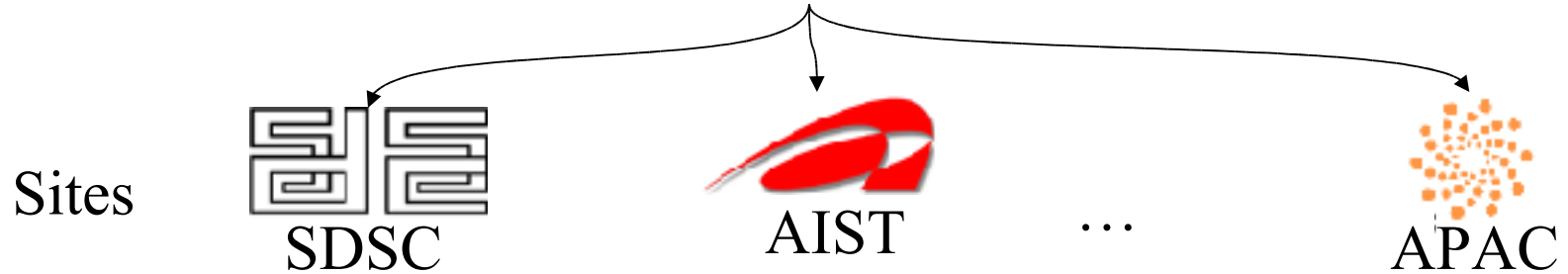
- Organization
  - Formed by UC Berkeley, Princeton, & U. Washington
  - Steering Committee sets policy
  - R&D Team + Central DB hosted by Princeton
    - Larry Peterson (PI), Andy Bavier, Marc Fiuczynski, Steve Muir (Research Staff), Mark Huang, Aaron Klingaman, Martin Makowiecki, Reid Moran (Technical Staff)
- Corporate members
  - Intel and HP are Charter members
  - Google, AT&T, France Telecom, NEC Research, ...
- Institutions (see [www.planet-lab.org](http://www.planet-lab.org) institutions link)

# PlanetLab is a...Platform

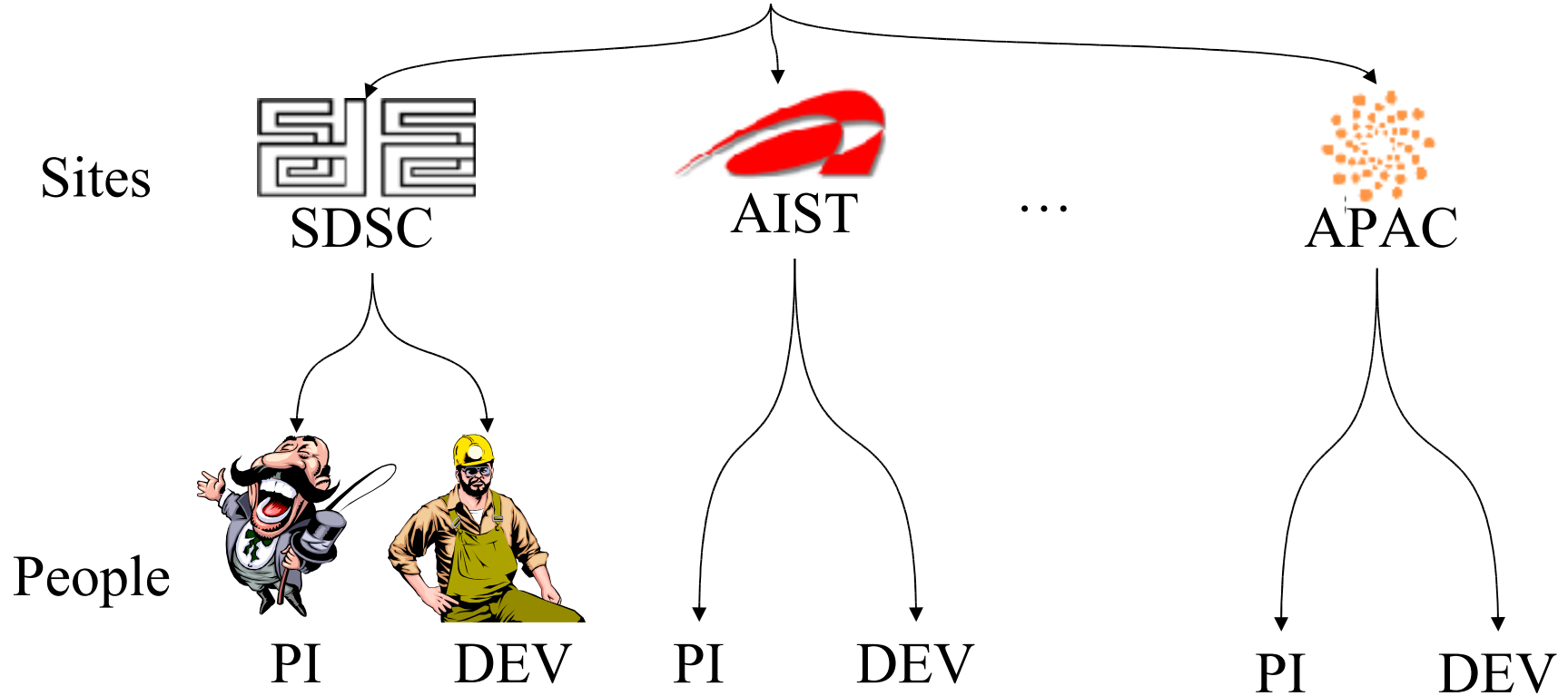
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- VMM-style OS running on each node
- Easy installation mechanism
- Remote management / monitoring capabilities
- Central account management service

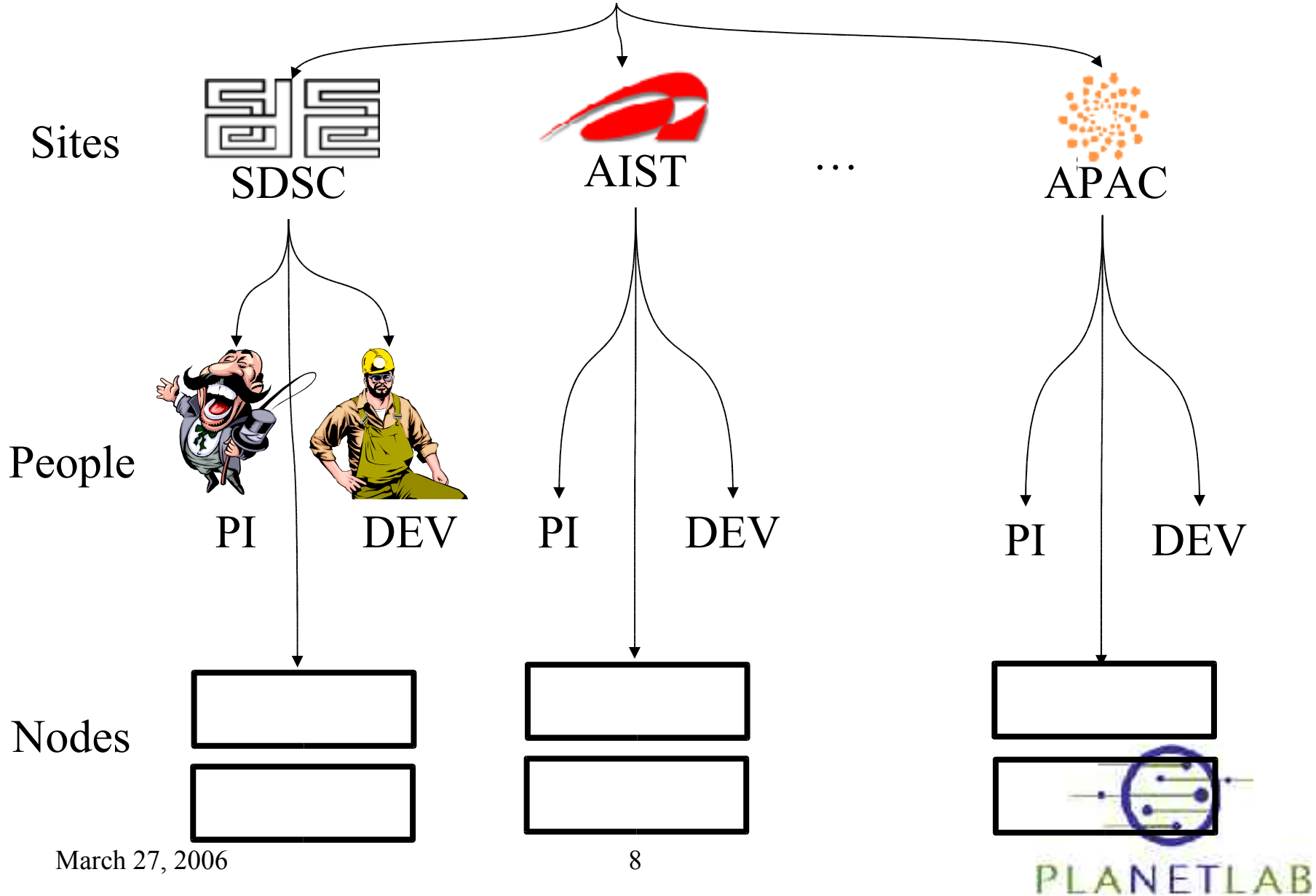
# Distributed Virtual Lab



# Distributed Virtual Lab

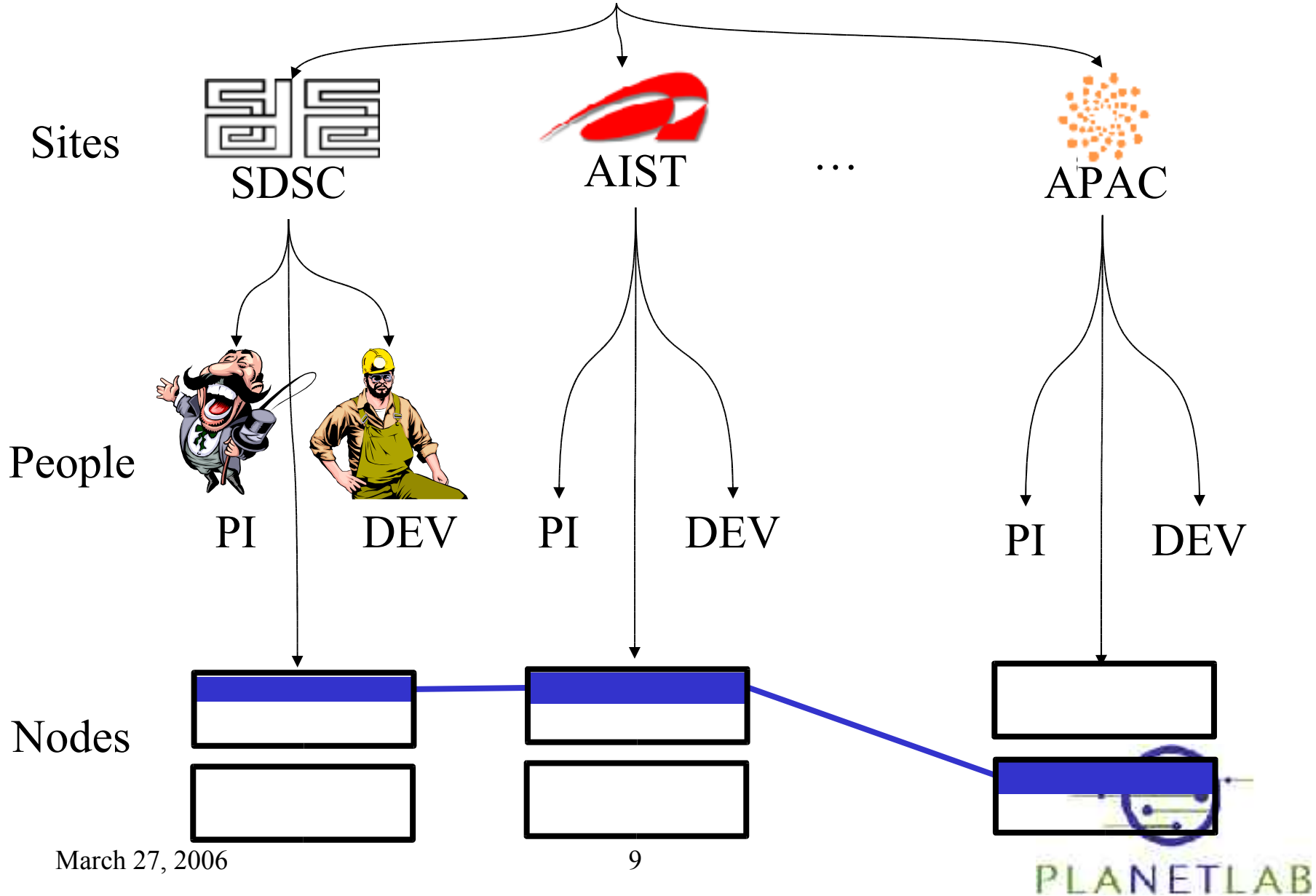


# Distributed Virtual Lab



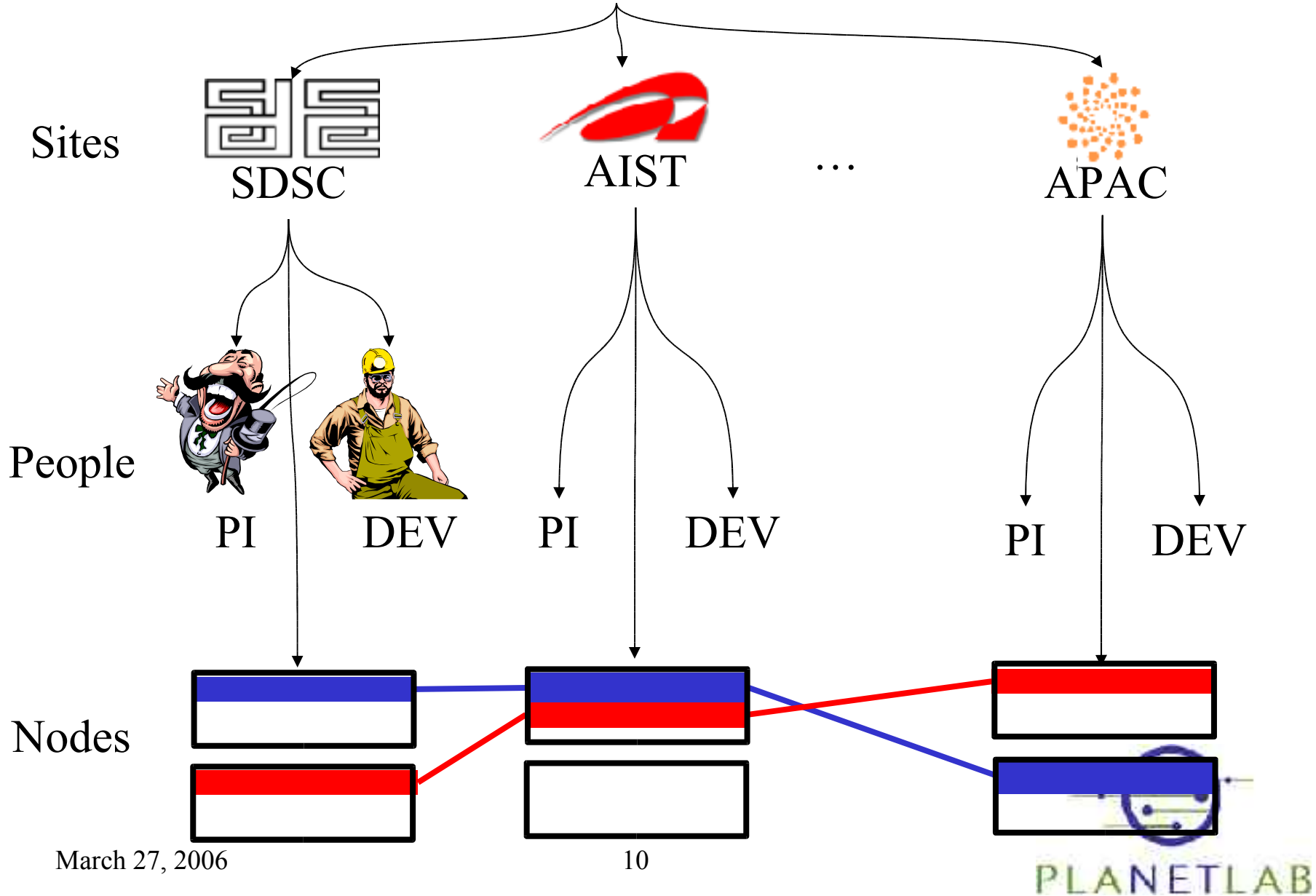


# Distributed Virtual Lab



March 27, 2006

# Distributed Virtual Lab



# Trust Relationships

## SITES

Princeton  
Berkeley  
Washington  
MIT  
Brown  
CMU  
NYU  
ETH  
Harvard  
HP Labs  
Intel  
NEC Labs  
Purdue  
UCSD  
SICS  
Cambridge  
Cornell

Trusted  
Intermediary  
(PLC)

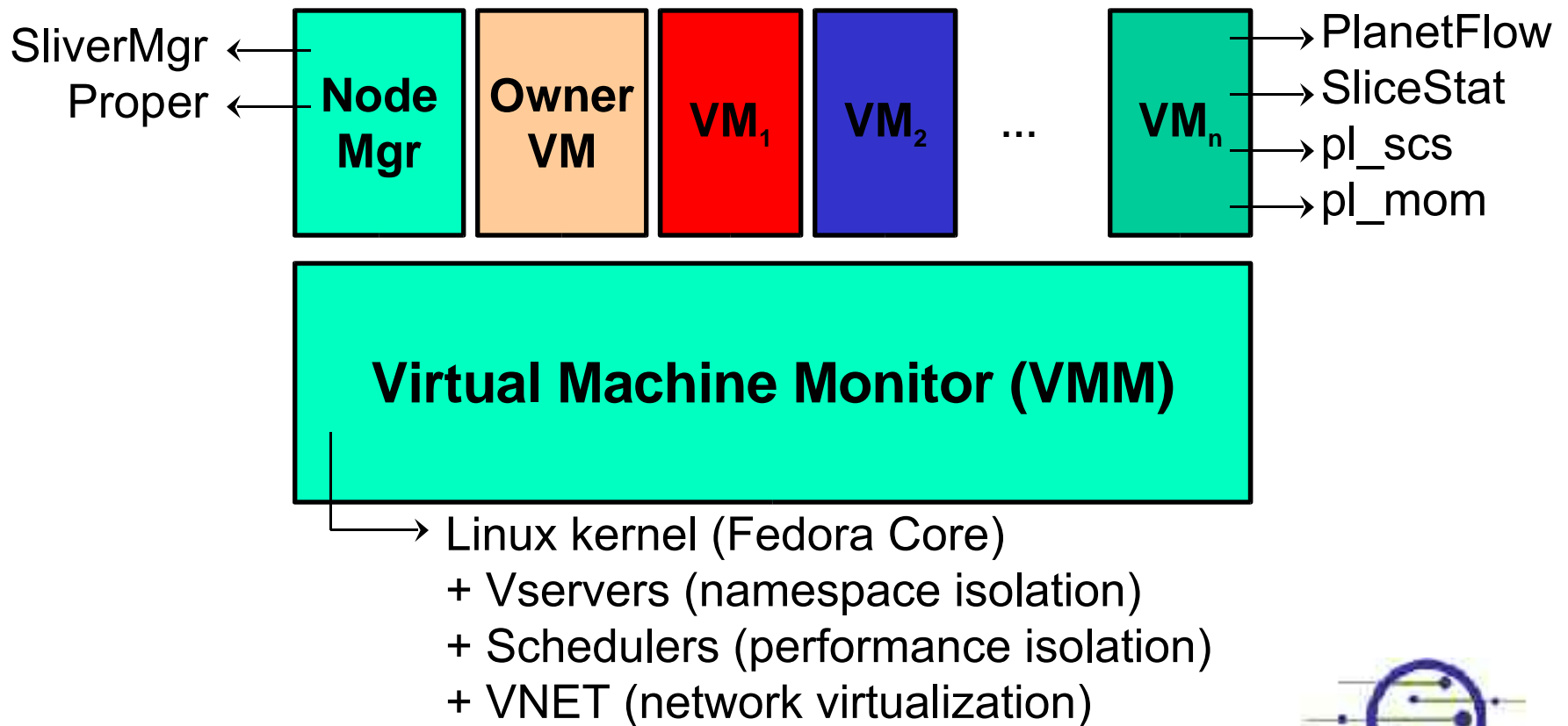
## SLICES

princeton\_codeen  
nyu\_d  
cornell\_beehive  
att\_mcash  
cmu\_esm  
harvard\_ice  
hplabs\_donutlab  
idsl\_psepr  
irb\_phi  
paris6\_landmarks  
mit\_dht  
mcgill\_card  
huji\_ender  
arizona\_stork  
ucb\_bamboo  
ucsd\_share  
umd\_scriptroute



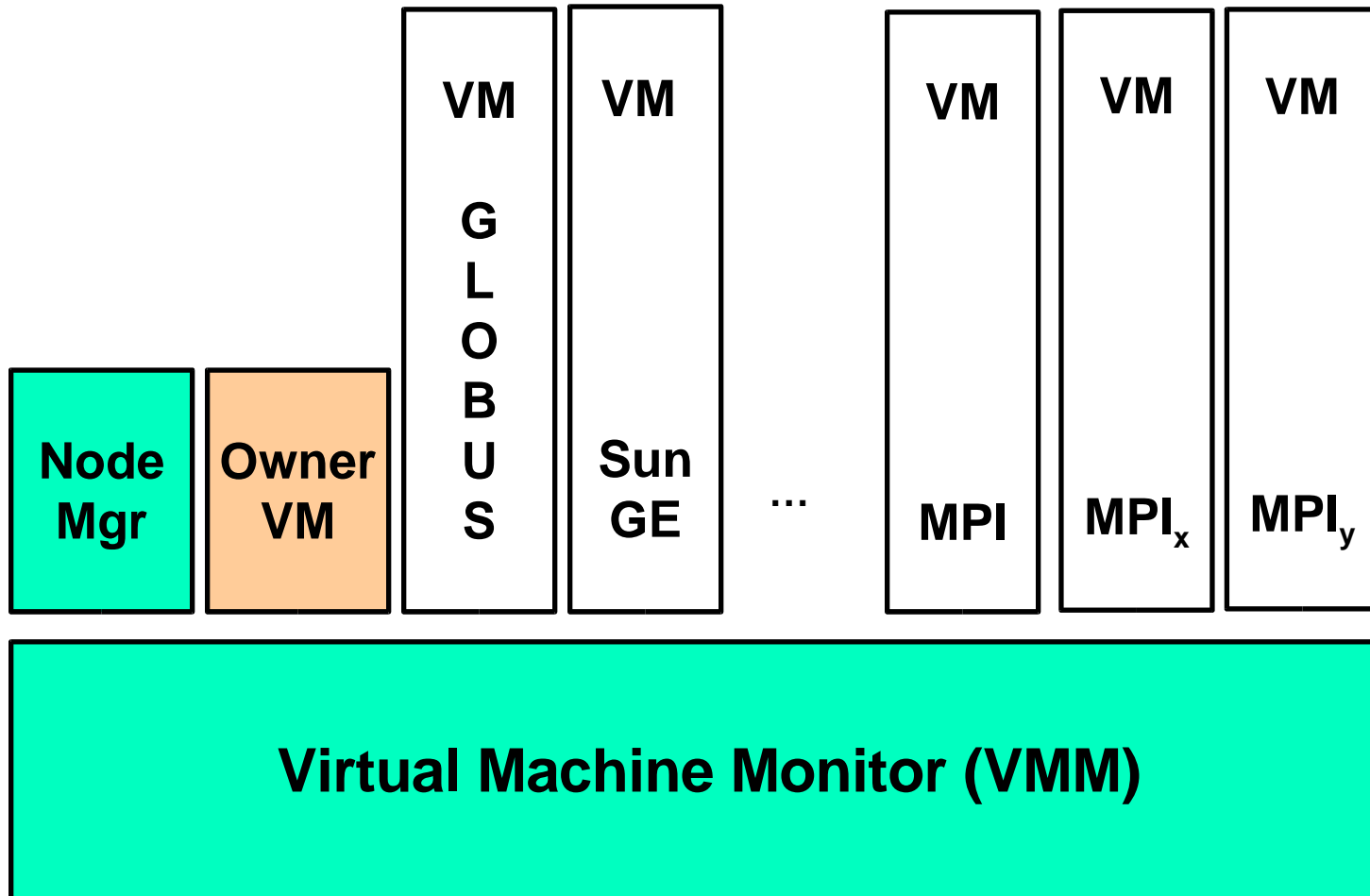
# Per-Node Mechanisms

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# Supports Side-by-side Stacks

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# VMM

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- Linux: significant mind-share
- Vserver: scales to hundreds of VMs per node
- Resource Scheduling
  - CPU: fair share per slice (guarantees possible)
  - Disk space: quota per slice (limit run-away log files)
  - link bandwidth
    - fair share per slice
    - average rate limit: 1.5Mbps (24-hour bucket size)
    - peak rate limit: set by each site (100Mbps default)
  - memory
    - no limit
    - pl\_mom resets biggest user at 90% utilization

# VNET

---

- socket programs “just work”
  - including raw sockets
- slices should be able to send only...
  - well-formed IP packets
  - to non-blacklisted hosts
- slices should be able to receive only...
  - packets related to connections that they initiated (e.g., replies)
  - packets destined for bound ports (e.g., server requests)
- essentially a switching firewall for sockets
  - leverages Linux's built-in connection tracking modules

# Long-Running Services

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- Storage & Large File Transfer
  - LOCI: Tennessee
  - CoBlitz: Princeton
  - Shark: NYU
- Content Distribution
  - CoDeeN: Princeton
  - Coral: NYU
  - Cobweb: Cornell
- DHT
  - Bamboo (OpenDHT): Berkeley, Intel
  - Chord (DHash): MIT
- Internet Measurement
  - ScriptRoute: Washington, Maryland



# Services (cont)

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- Multicast
  - End System Multicast: CMU
  - Tmesh: Michigan
- Anomaly Detection & Fault Diagnosis
  - PIER: Berkeley, Intel
  - PlanetSeer: Princeton
- Routing
  - i3: Berkeley
  - Virtual ISP: Princeton
- DNS
  - CoDNS: Princeton
  - CoDoNs: Cornell

# Middleware (Infrastructure Svcs)

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- Brokerage Services
  - Sirius: Georgia
  - Bellagio: UCSD, Harvard, Intel
  - Tycoon: HP
- Environment Services
  - Stork: Arizona
  - AppMgr: MIT
- Monitoring/Discovery Services
  - CoMon: Princeton
  - PsEPR: Intel
  - SWORD: Berkeley
  - IrisLog: Intel

# Collaboration Touch Points

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- PlanetLab Services
  - Large file transfer & Network embedded storage
- PlanetLab Linux Kernel + Vserver
- Private PlanetLab
  - Small scale: at individual PRAGMA member sites
  - Medium scale: Private PlanetLab integration w/ Rocks
  - Large scale: PRAGMALab
- Federation (Interoperation)

# Private PlanetLabs

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- Software freely available [www.planet-lab.org](http://www.planet-lab.org)
  - Still alpha; come talk to me.
- Others actively setting up large-scale private PlanetLab:
  - EverLab (Hebrew U, SICS, Tel-Aviv U., ...)
  - OneLab (Inria, ...)
  - CERNETLab (25 Chinese Universities)
  - EPFL CampusLab (Lausanne Switzerland)
- Others evaluating private PlanetLab
  - Intel, Hewlett Packard, AT&T, Panasonic Research
  - FusionLab (fusion scientist @ PPPL, MIT, ORNL, LLNL, ...)
  - A-Star

# Contact Info

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- PlanetLab Workshop: May 11<sup>th</sup> and 12<sup>th</sup>  
California Bay Area
- [www.planet-lab.org](http://www.planet-lab.org)
- [mef@planet-lab.org](mailto:mef@planet-lab.org)