



Proof-Enabled Analysis Center (PEAC)



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CD Project Status Meeting, 12/2003



Why interactive GRID computing?



Significant part of analysis involves interactive visualization of data

But, why not do everything in batch...?

- “Creativity has inertia”

Large ntuples (say 1-100 GB) are essentially inevitable, querying times can be prohibitively long

- “Drag force” on creative momentum

Want to extend concept of batch job parallelization to interactive domain

ROOT has just this capability - PROOF (Parallel ROOT Framework)!

Interactive grid computing comes with extra challenges

- e.g. need uniformity of processing (really hard on WAN)



Computing @ CDF in 2003

<i>Primary Data</i>	<i>"skim"</i>	<i>"ntuple"</i>	<i>Physics Result</i>
$O(100)TB$ $O(1e9)$ evts $O(1)$ GHz sec/evt	$O(1)TB$ $O(1e7)$ evts $O(0.1)$ GHz sec/evt	$O(1)GB$ $O(1e6)$ evts $O(1e-3)$ GHz sec/evt	<i>Result is product of sequence of data analysis steps with varying degrees of coordination among the 767 CDF collaborators.</i>
<i>~30GHz years</i>	<i>~10GHz days</i>	<i>~20GHz min</i>	<i>Final processing requires interactive analysis.</i>
<i>1 in 3 months</i>	<i>100 per day</i>	<i>100 in 10s</i>	<i>Needs outgrow Moore's law for 2004-2006.</i>
<i>0.1THz @ 100% duty cycle</i>	<i>~1THz @ 100% duty cycle</i>	<i>~0.1THz @ 1% duty cycle</i>	
batch	batch	Interactive	



Why PEAC?



Do not want dedicated resources just for PROOF sessions

- borrow CPU from batch processes for brief periods of time - COD

Want single farm for both interactive and batch processing

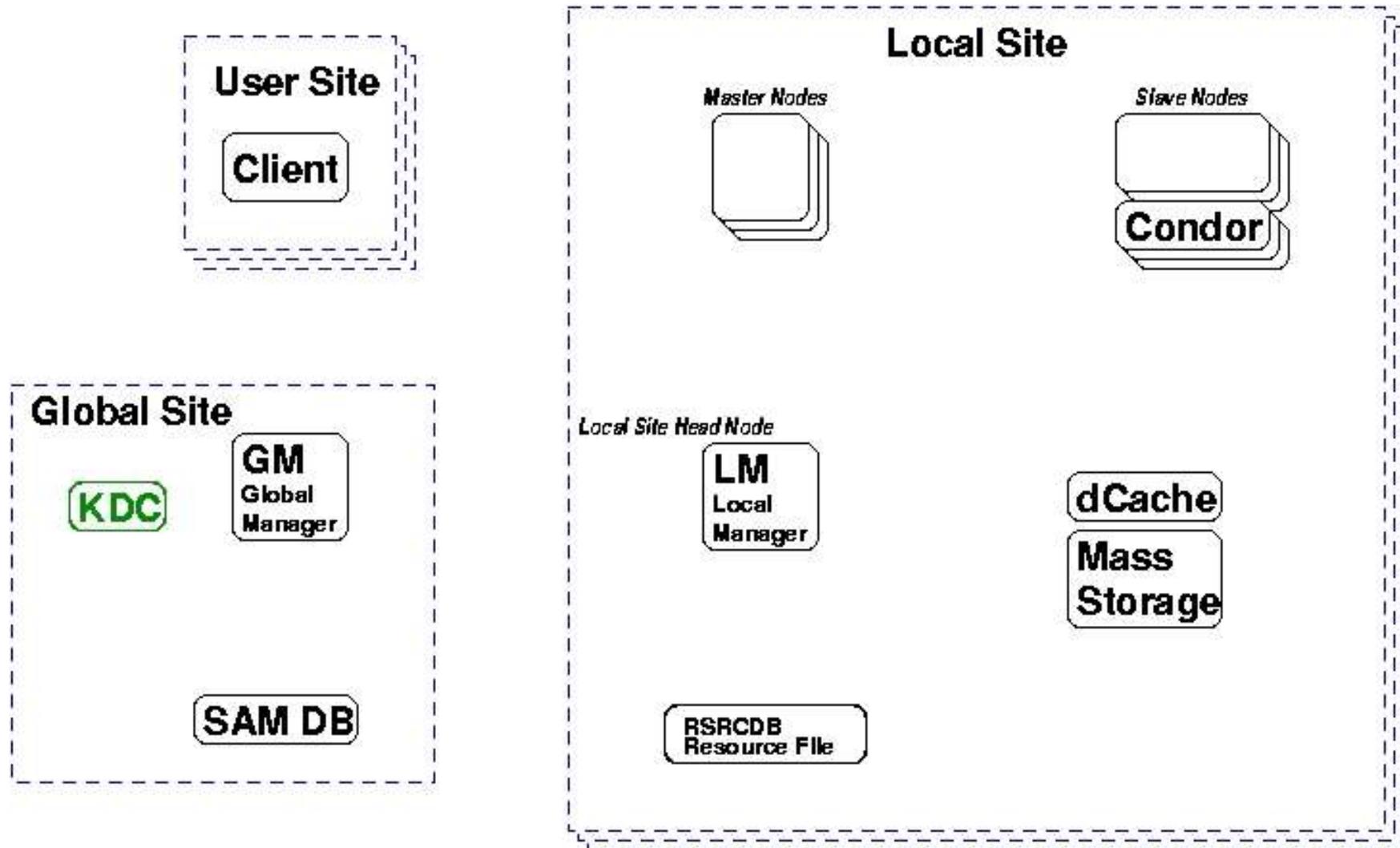
- ease of maintenances, ensure resources are always utilized

PEAC in its current implementation provides:

- CPU resource brokering between multiple sites
- Co-location of data and CPU resources (via SAM)
- Initiation of data movement to PROOF slave nodes for processing
- Communication protocol between PEAC & PROOF sets up client session
- Maintains resource database for bookkeeping allocated CPU resources at each site

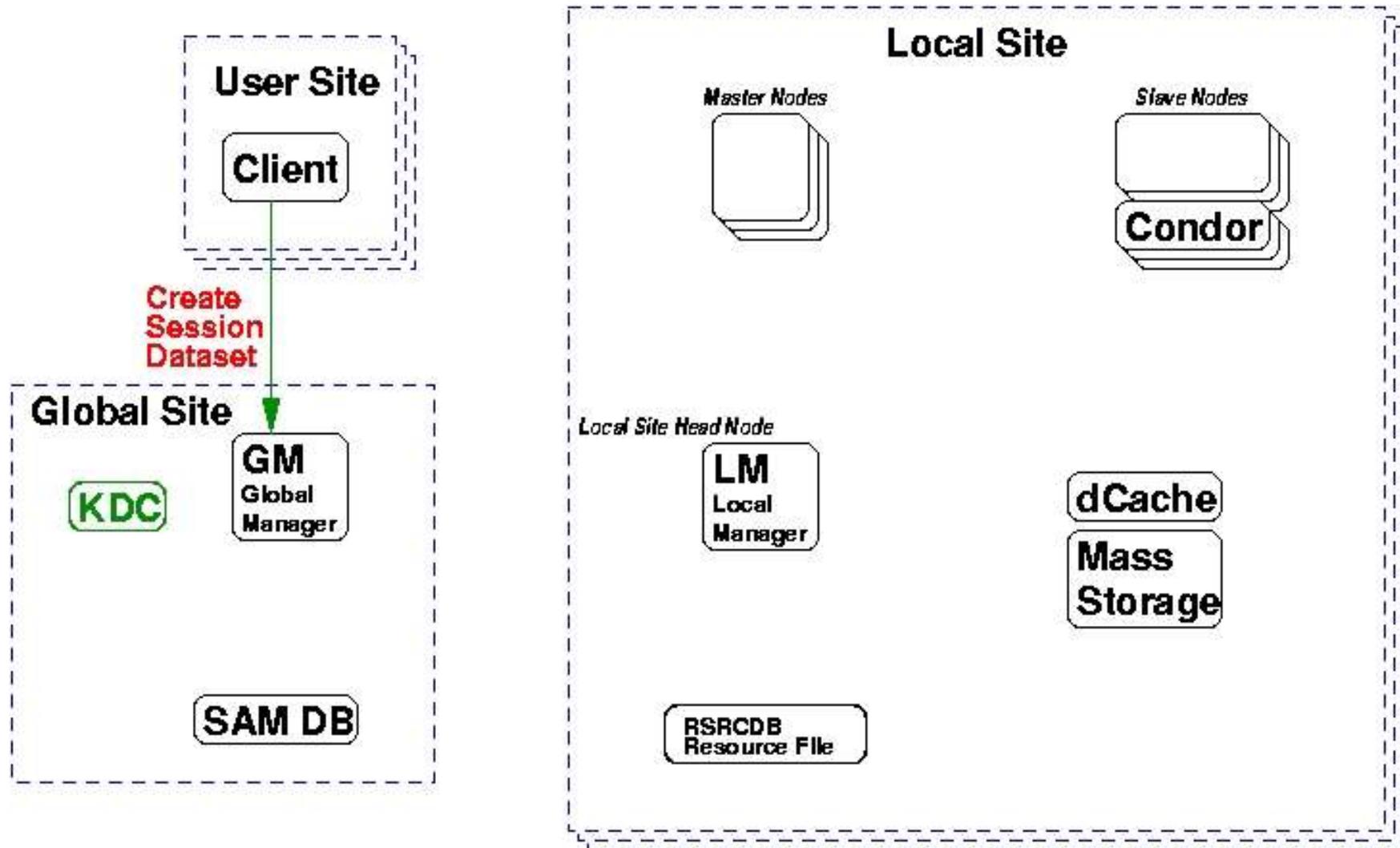


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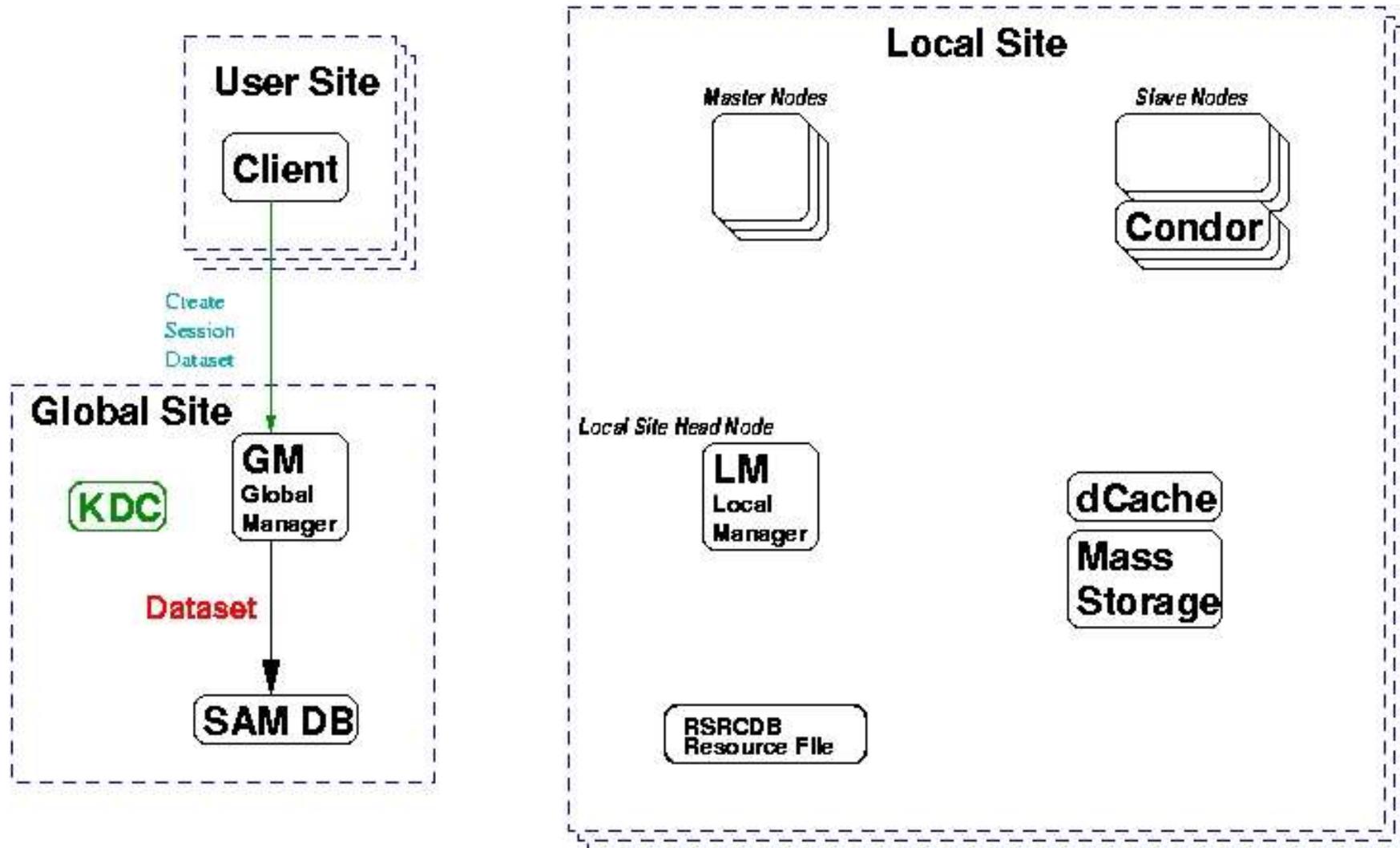


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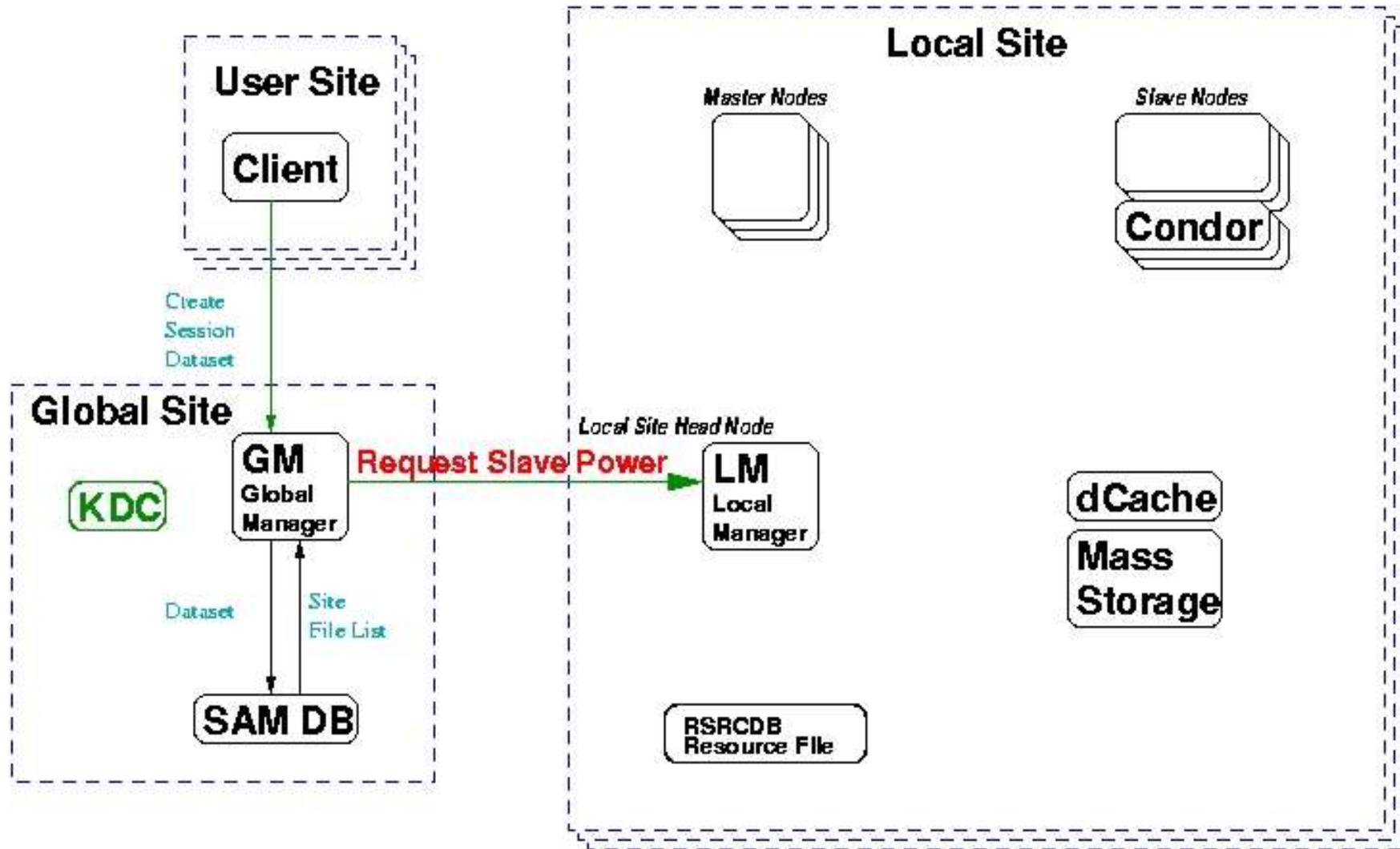


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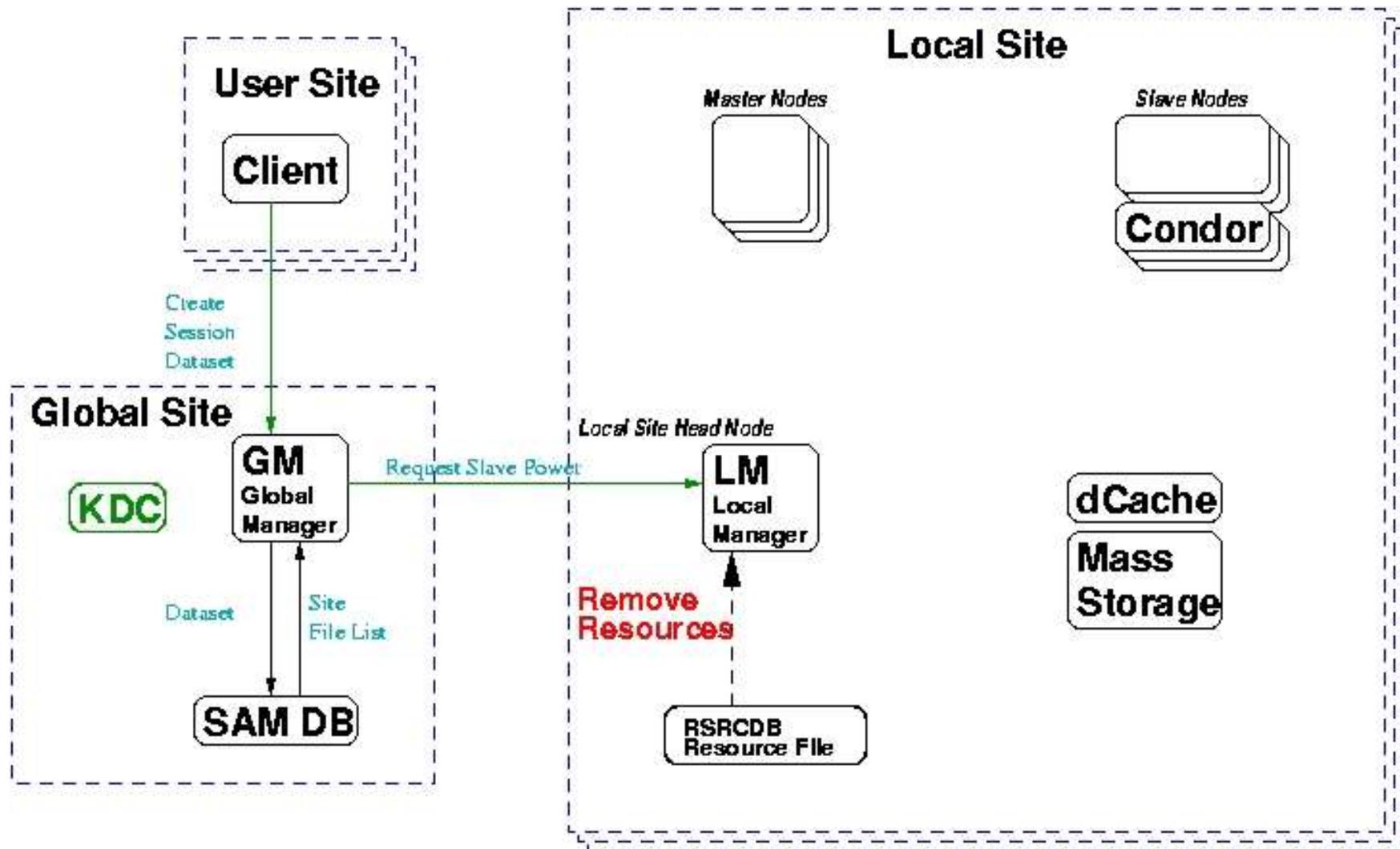


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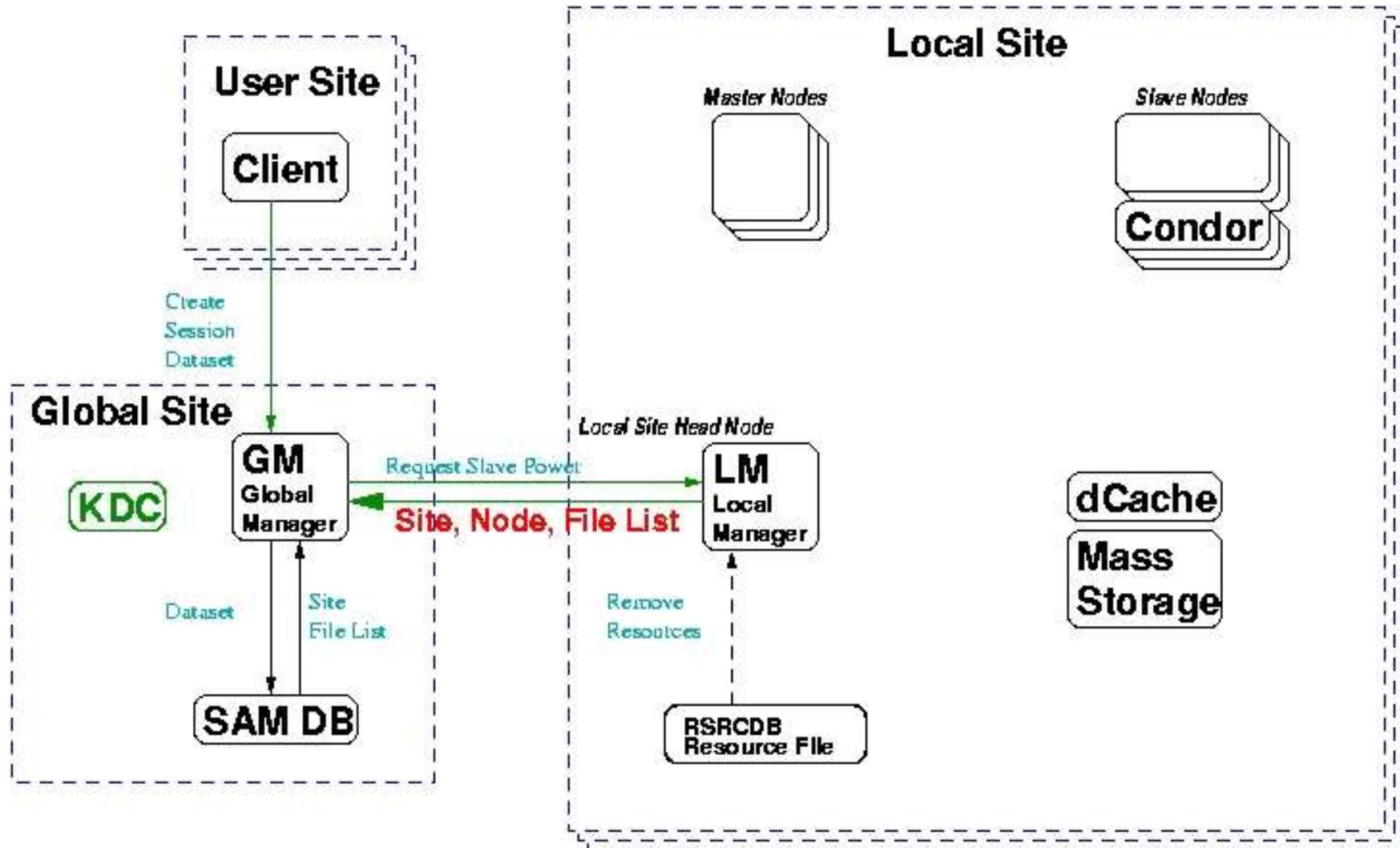


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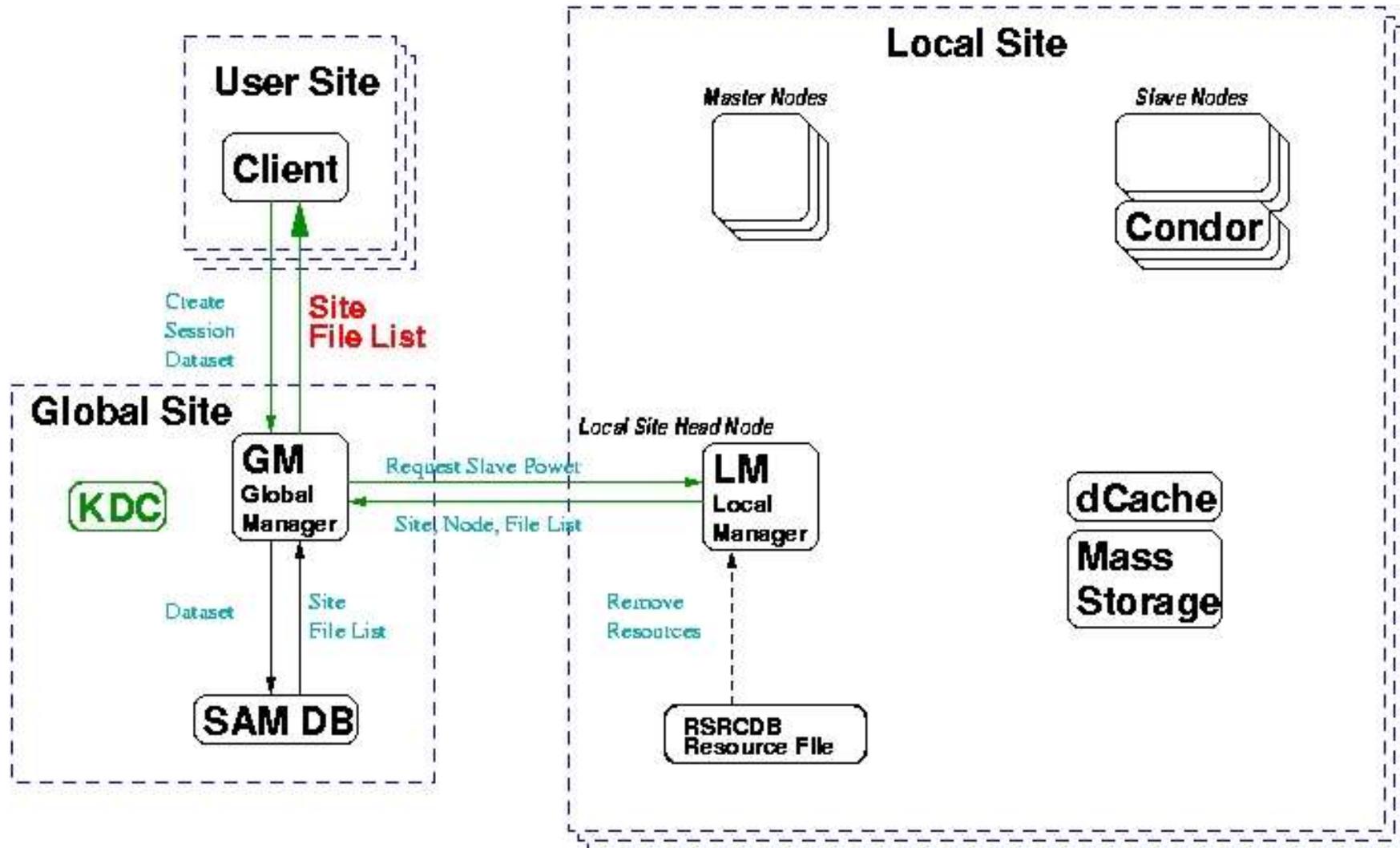


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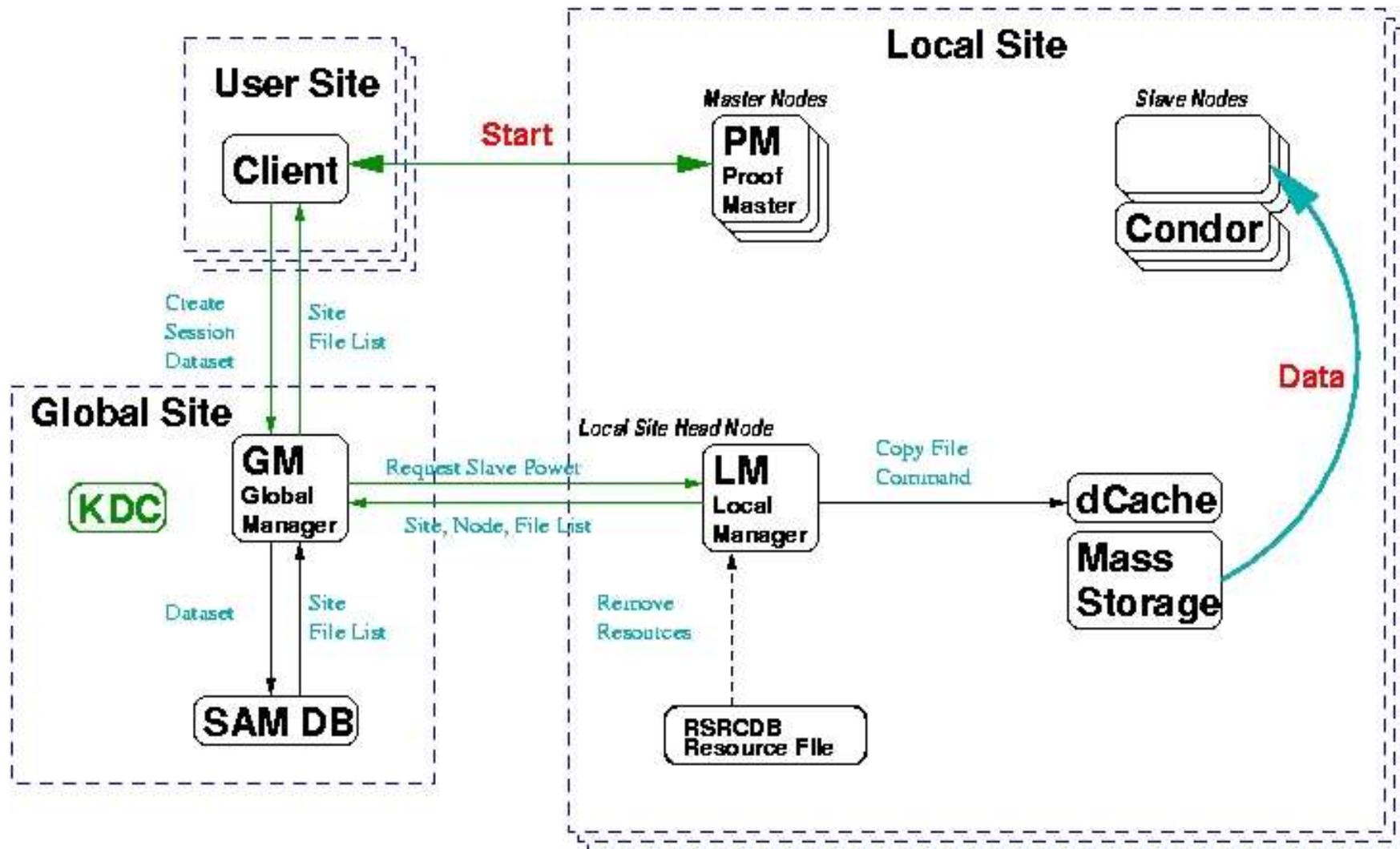


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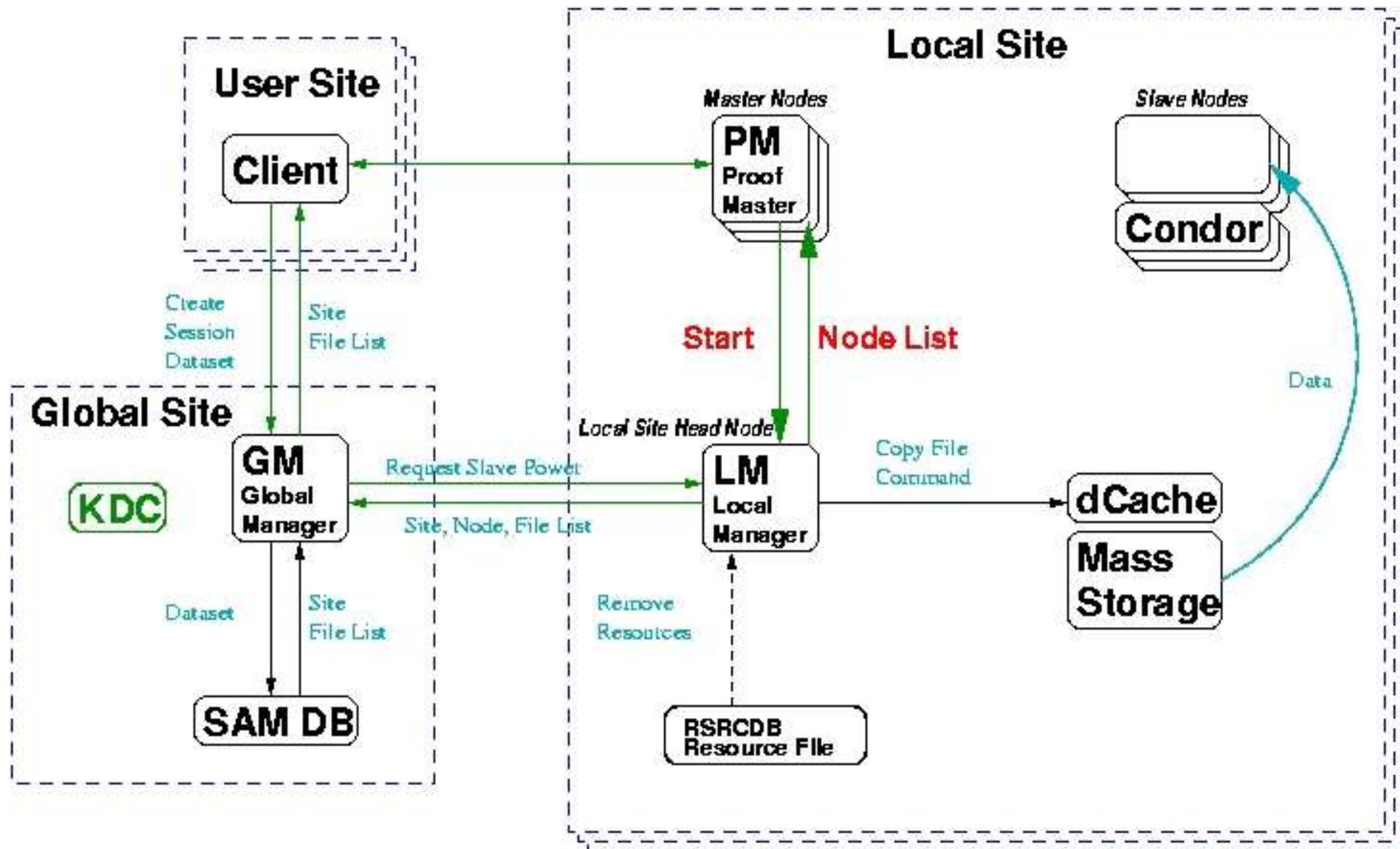


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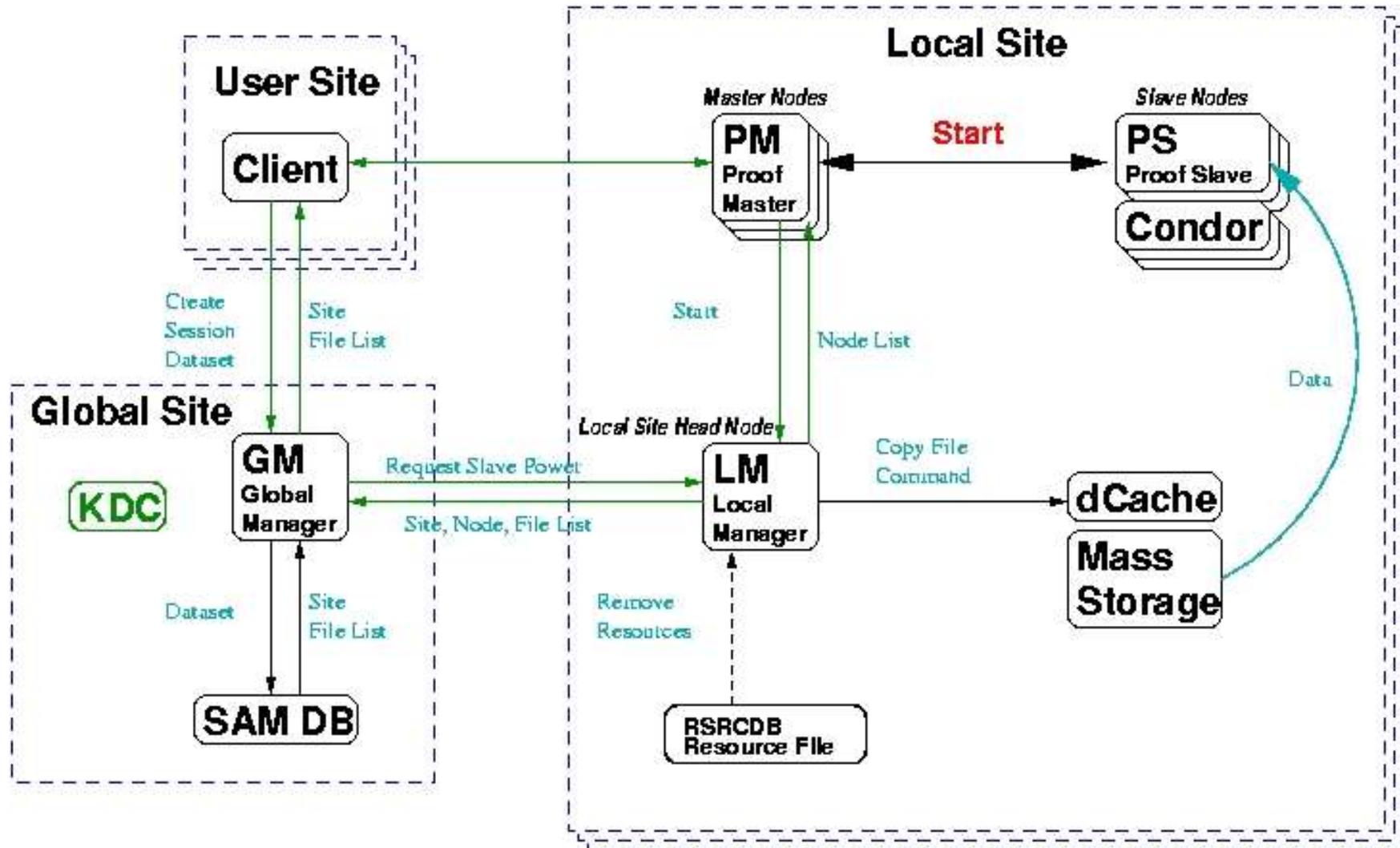


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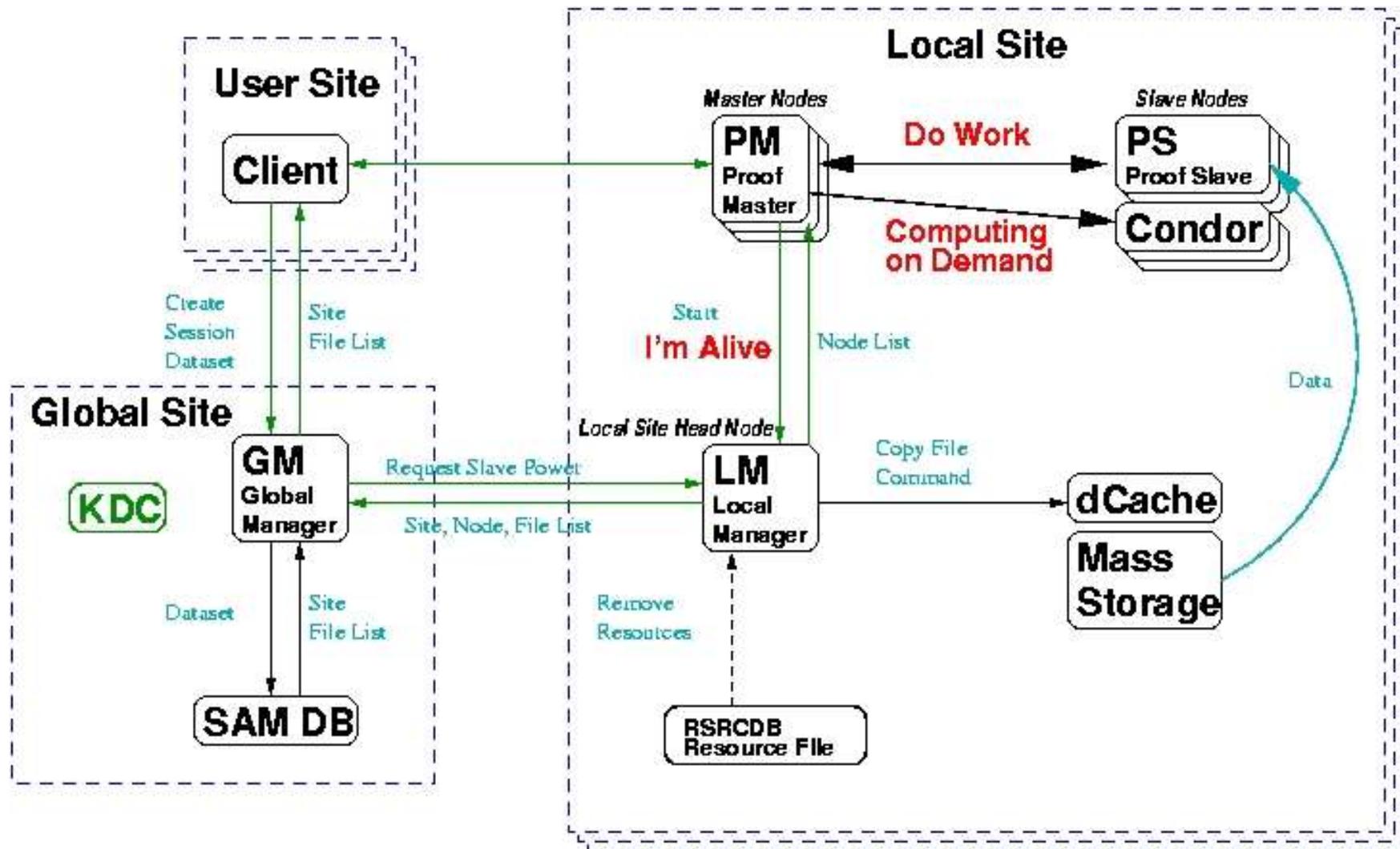


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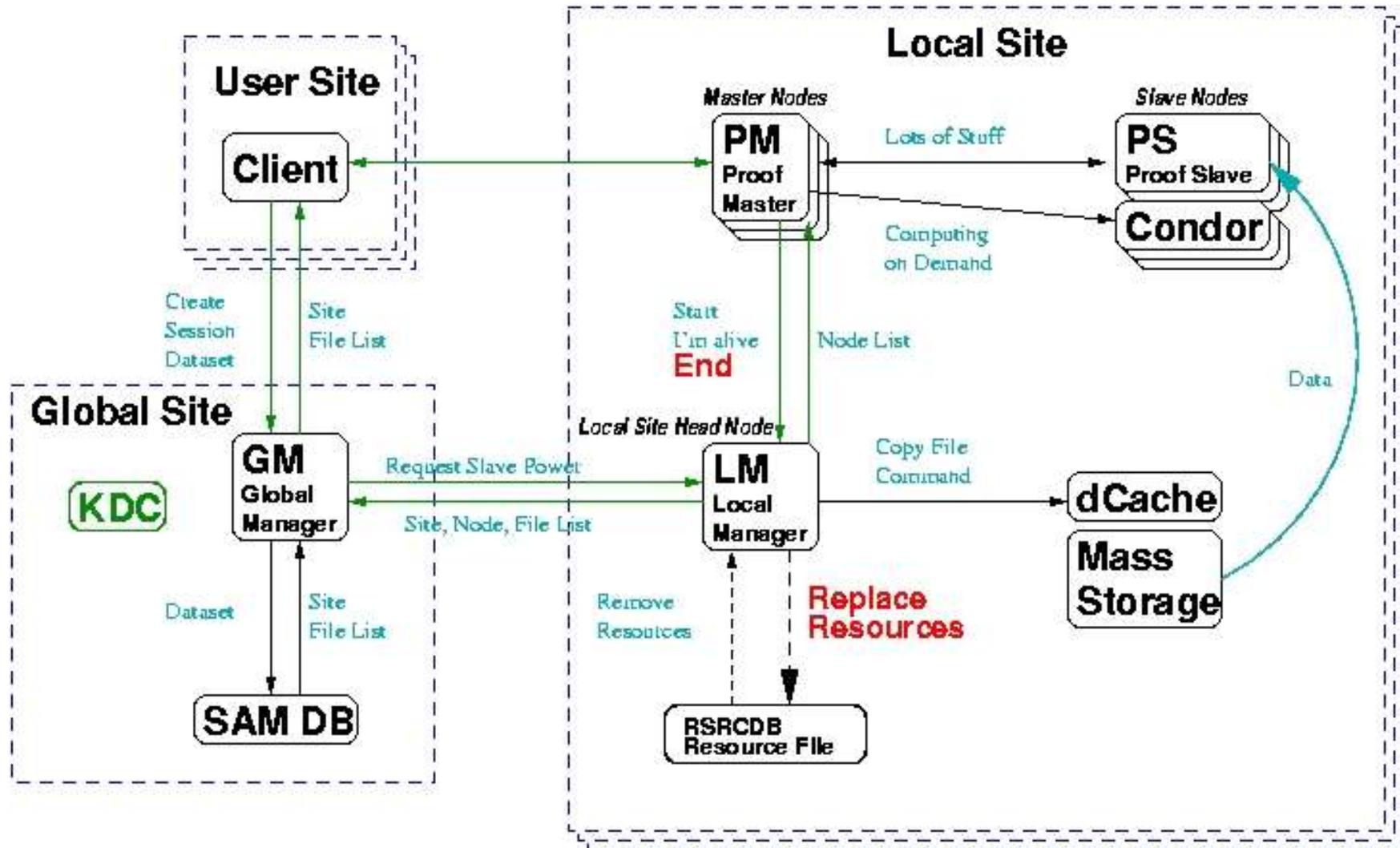


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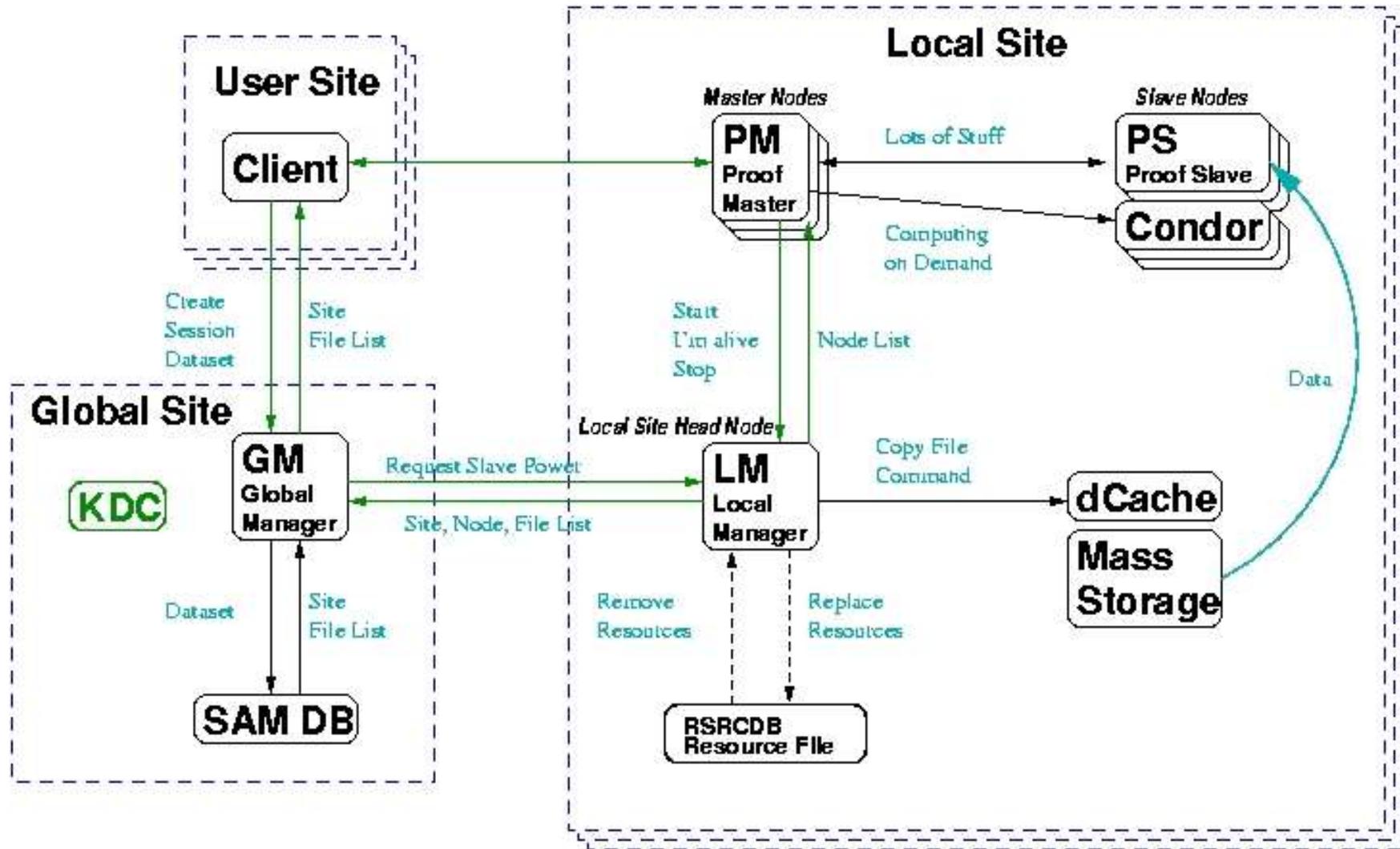


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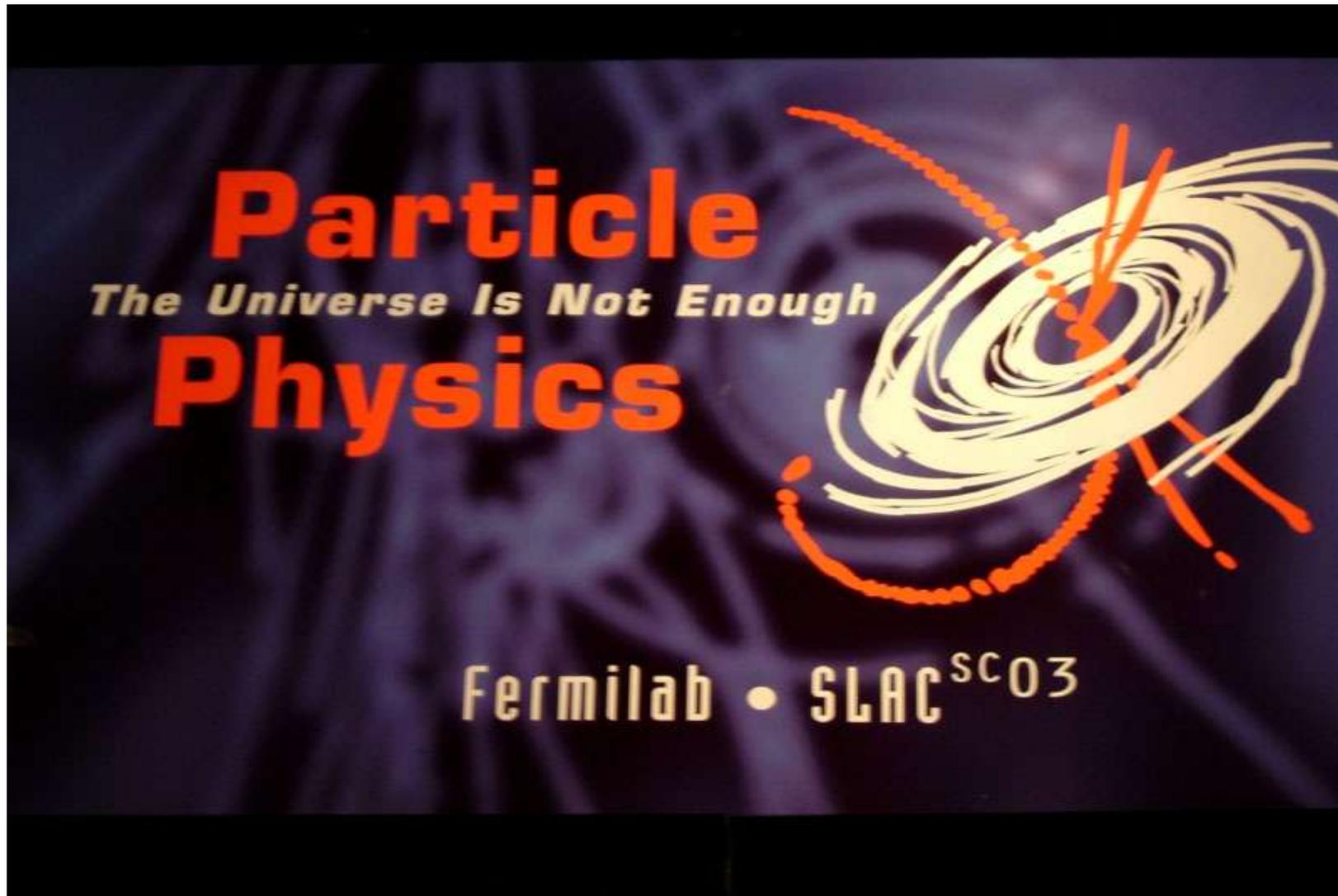


PEAC





SC2003 PEAC Demo



please see <http://hepweb.ucsd.edu/fkw/sc2003/authors.html> for list of contributors



SC2003 PEAC Demo





SC2003 PEAC Demo





SC2003 PEAC Demo



Four prototype PEAC sites: FNAL, UCSD, INFN, MIT

Three different analysis jobs:

B⁺→D⁰ pi 6 GB of Stntuples
B⁰→D pi 5 GB of Stntuples
B_s→D_s pi 1 GB of Stntuples

Demonstrated:

- CPU resource brokering
- Co-location of data and CPU
- Parallelization:

B⁺ mass plot takes 10 mins on 2.6 GHz P4

On INFN farm with 12 PROOF slaves

1st pass: **39sec**

- Caching:

2nd pass: **22sec**



Conclusions/Plans



Prototype PEAC successfully demonstrated at SC2003

Present all of this to CDF to probe:

- **Interest in PEAC within the collaboration**
- **Level of involvement by others to make all of this work**