CERSe
a Tool for High Performance
Remote Sensing Application Development

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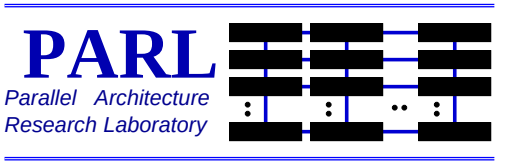
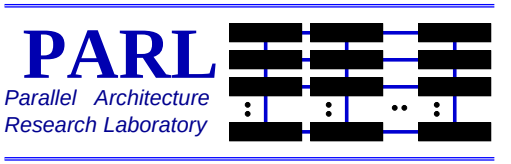
Outline



- Problem
- CERSe
- Applications of CERSe
- Future Work

Problems Facing the RS Community



- Diversifying user base requires lower cost solutions
- Increasing temporal, spectral, and spatial resolution
- Massive data storage and processing power
- Parallel computers are difficult to program
- Rapid code development, execution, analysis, and maintenance

Proposed Solution

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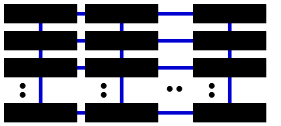

- A Problem Solving Environment (PSE)
- Provide:
  - High performance
    - Parallel computers
    - Usable without advanced parallel computing knowledge
  - Ease of use
    - Development and analysis tools
  - Extensibility
    - Code reuse

CERSe

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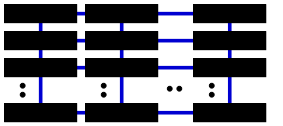
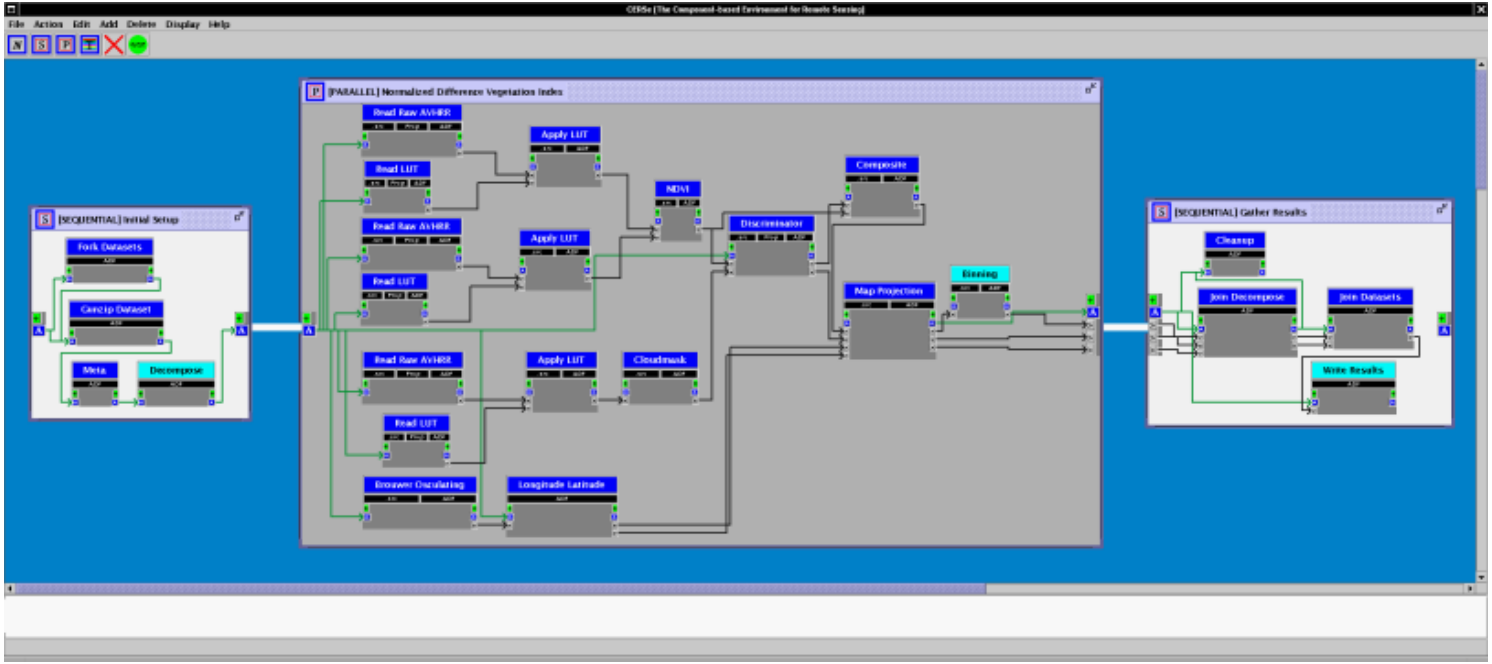


- The Component-based Environment for Remote Sensing
- Modular approach
  - Modules are subroutines in C or Fortran
  - Modules are placed onto a canvas to create a dataflow graph
  - Data passes between modules with an easy-to-use interface
- Programs are created on a workstation and then run on a parallel computer


CEESe [The Component-based Environment for Remote Sensing]
File Actions Edit Add Delete Display Help
[PARALLEL] Normalized Difference Vegetation Index
[SEQUENTIAL] Initial Setup
Fork Datasets
Gunzip Dataset
Meta
Decompose
Read Raw AVHRR
Read LUT
Apply LUT
NDVI
Discriminator
Composite
Read Raw AVHRR
Read LUT
Apply LUT
Map Projection
Binning
Read Raw AVHRR
Read LUT
Apply LUT
Cloudmask
Brouwer Osculating
Longitude Latitude
[SEQUENTIAL] Gather Results
Cleanup
Join Decompose
Join Datasets
Write Results

Graphical User Interface

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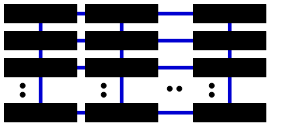
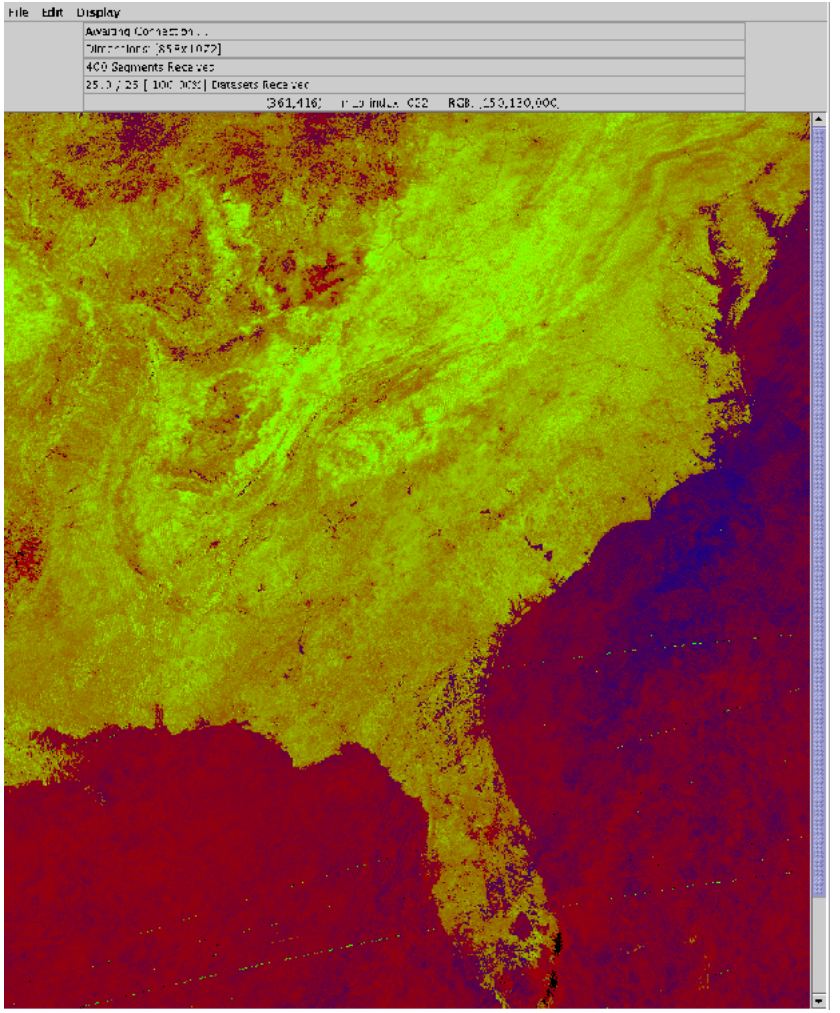
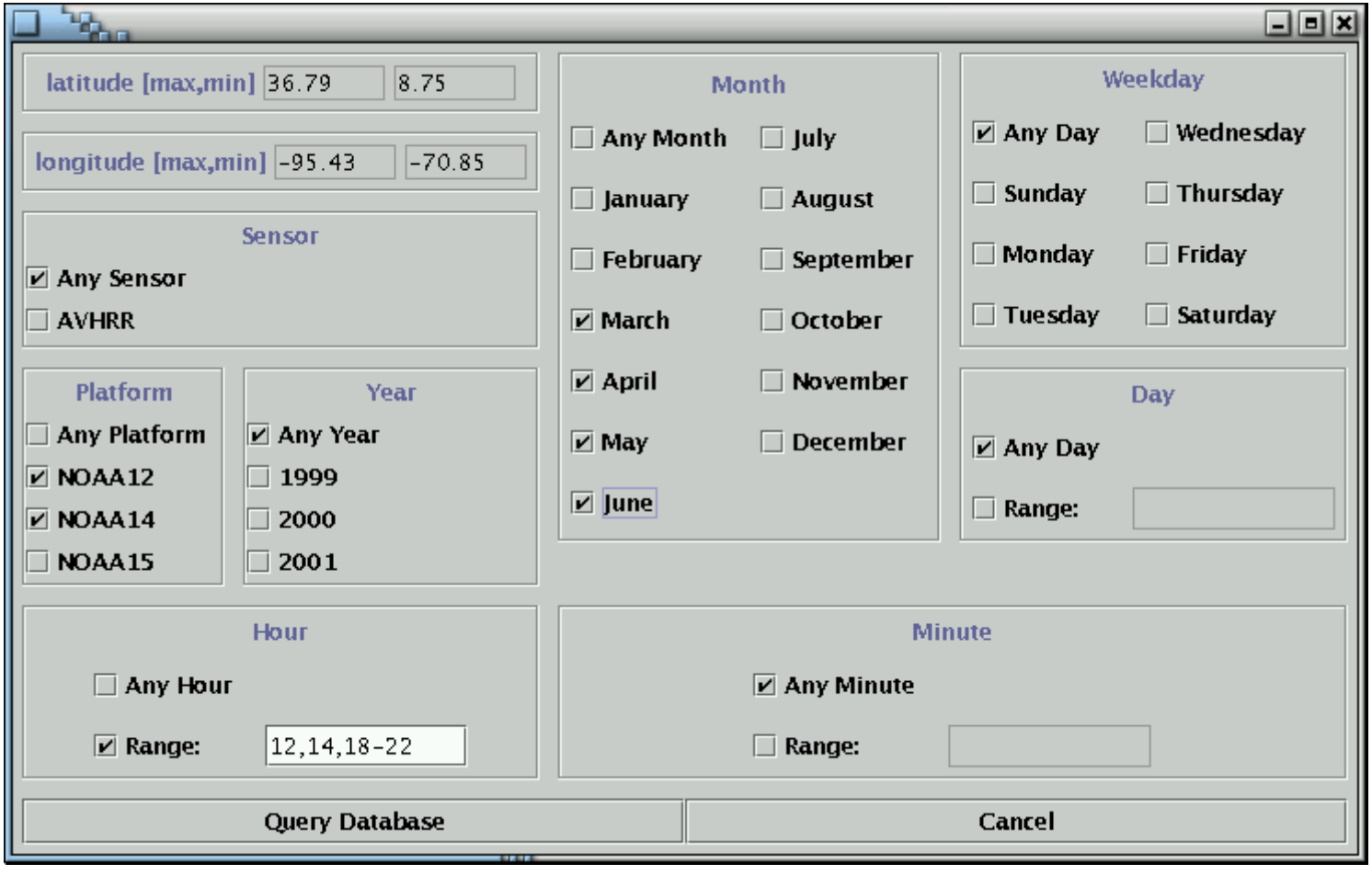


- Editor allows creation of the dataflow graph
- Results can be visualized in real-time
- Tools for introspection
- Performance analysis


File Edit Display
Awaiting Connection...
Dimensions: [858x1072]
400 Segments Received
25.0 / 25 [100.00%] Datasets Received


latitude [max,min]
36.79
8.75
longitude [max,min]
-95.43
-70.85
Sensor
Any Sensor
AVHRR
Platform
Any Platform
NOAA12
NOAA14
NOAA15
Year
Any Year
1999
2000
2001
Month
Any Month
January
February
March
April
May
June
July
August
September
October
November
December
Weekday
Any Day
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Day
Any Day
Range:
Hour
Any Hour
Range:
12,14,18-22
Minute
Any Minute
Range:
Query Database
Cancel

Achieving Parallelism

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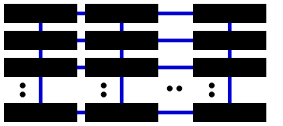

- Distributor modules partitions satellite datasets
- Many drop-in parallel modules available
- Results reassembled by combining modules
- Module designers can use MPI for parallel computation
- Threads, queues, and other internal components increase performance (see paper)

Applications of CERSe

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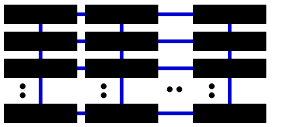

- Existing NASA code has been placed into CERSe
- Very little augmentation of original code required to work with CERSe
- Examples:
  - AVHRR
  - MODIS

Additional Technologies

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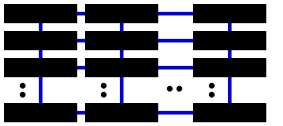
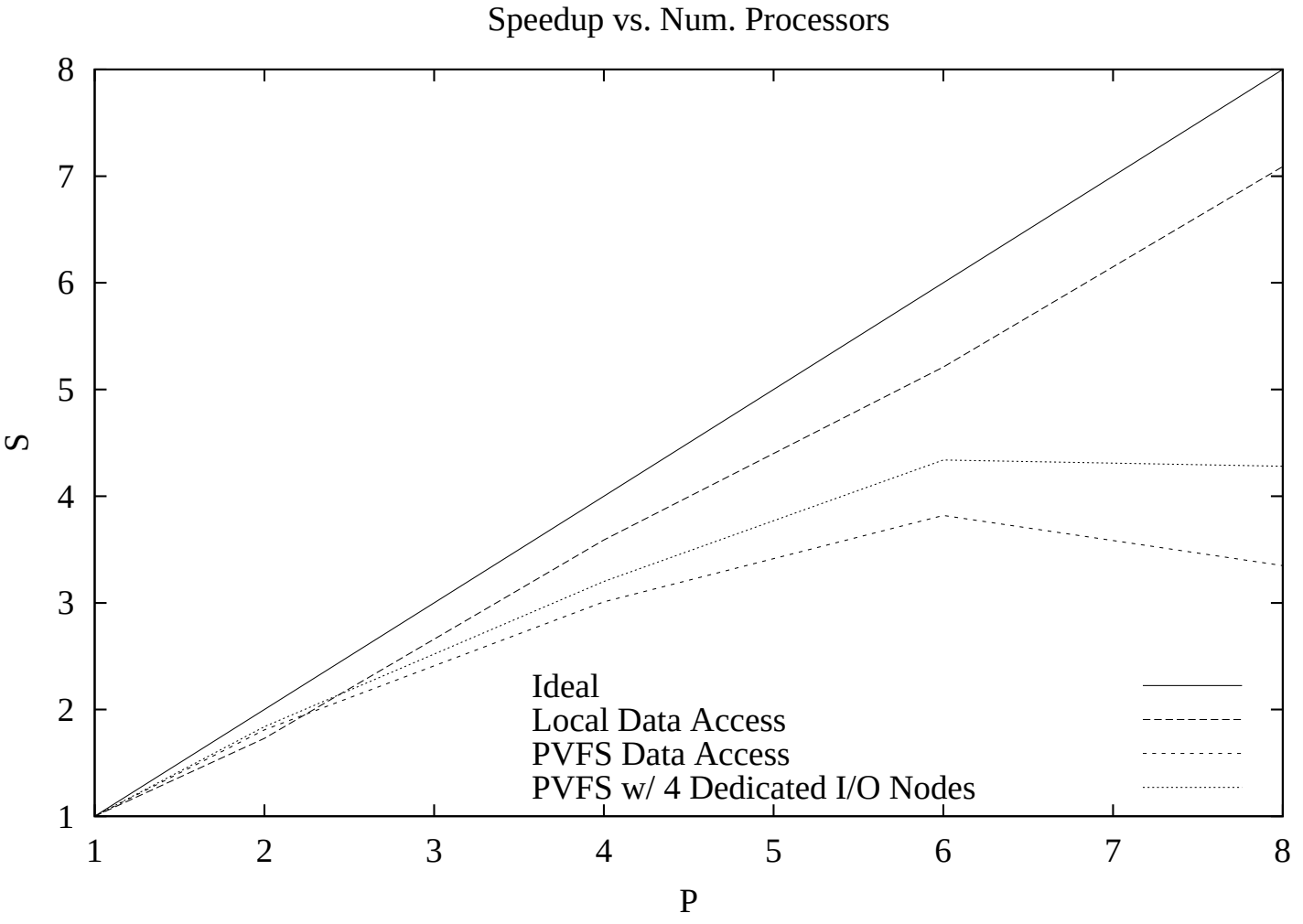


- CERSe is built upon Coven
- Coven is a framework for developing PSEs for parallel computers
- Coven provides a runtime driver and GUI can be extended for specific PSEs
- Coven is built upon The Algorithm Description Format (ADF)
- CERSe customizes Coven framework to the RS domain by changing the terminology presented in the interface


Speedup vs. Num. Processors
S
P
1
2
3
4
5
6
7
8
Ideal
Local Data Access
PVFS Data Access
PVFS w/ 4 Dedicated I/O Nodes

Conclusions

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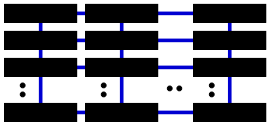
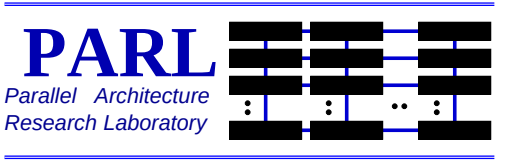


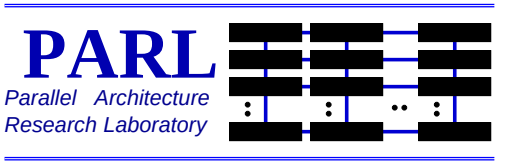
- The RS community faces a number of challenges which CERSe addresses
- Good scalability is achieved and explained in paper
- The GUI assists in usability and extensibility
- Advanced problems still require someone who understands parallel computers

Future Work



- Advanced profiling of jobs
- Advanced use of parallelism between components
- Applications in other problem domains

Acknowledgements



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