Wireless Sensor Networks

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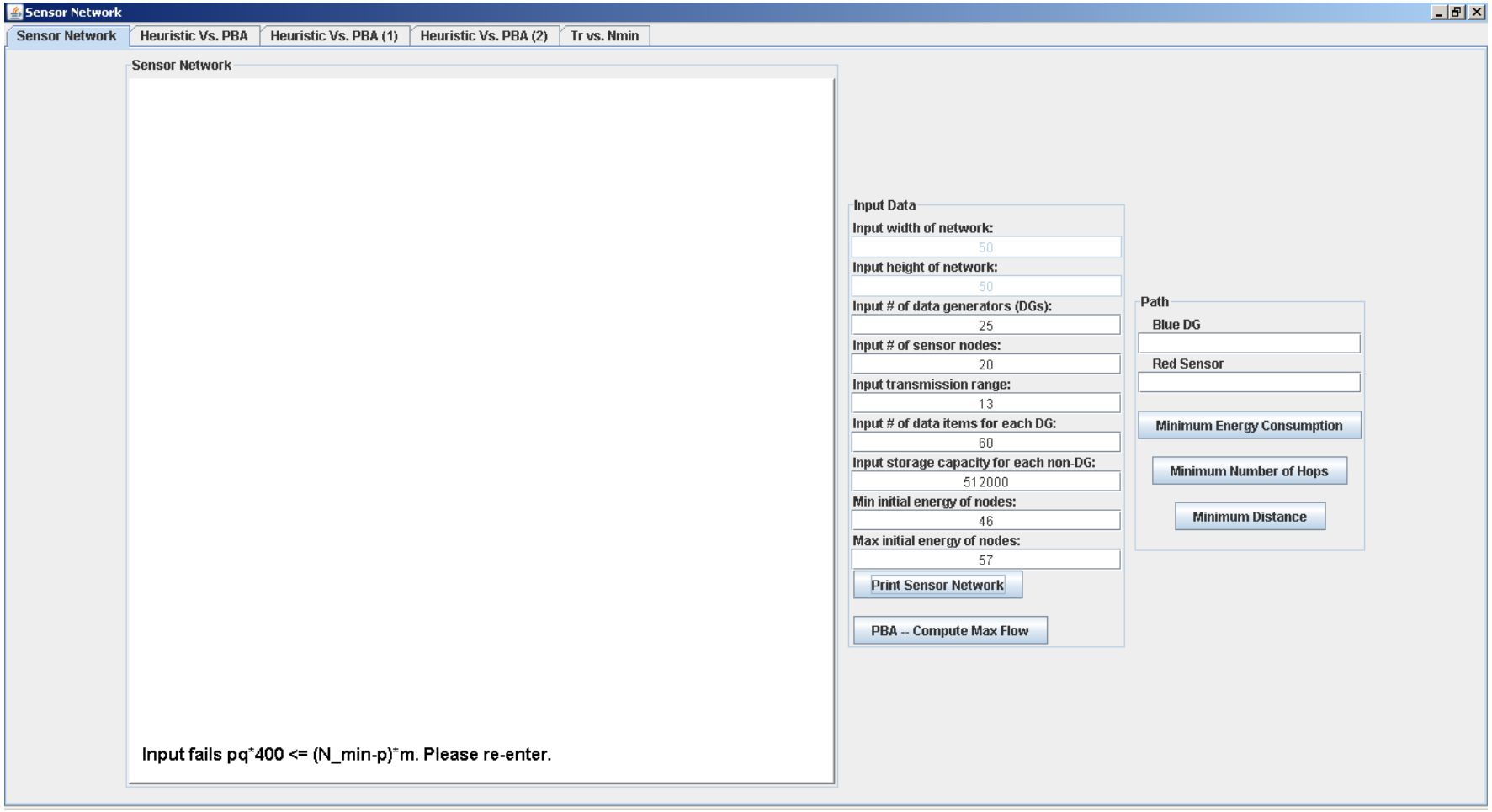
Invalid Input

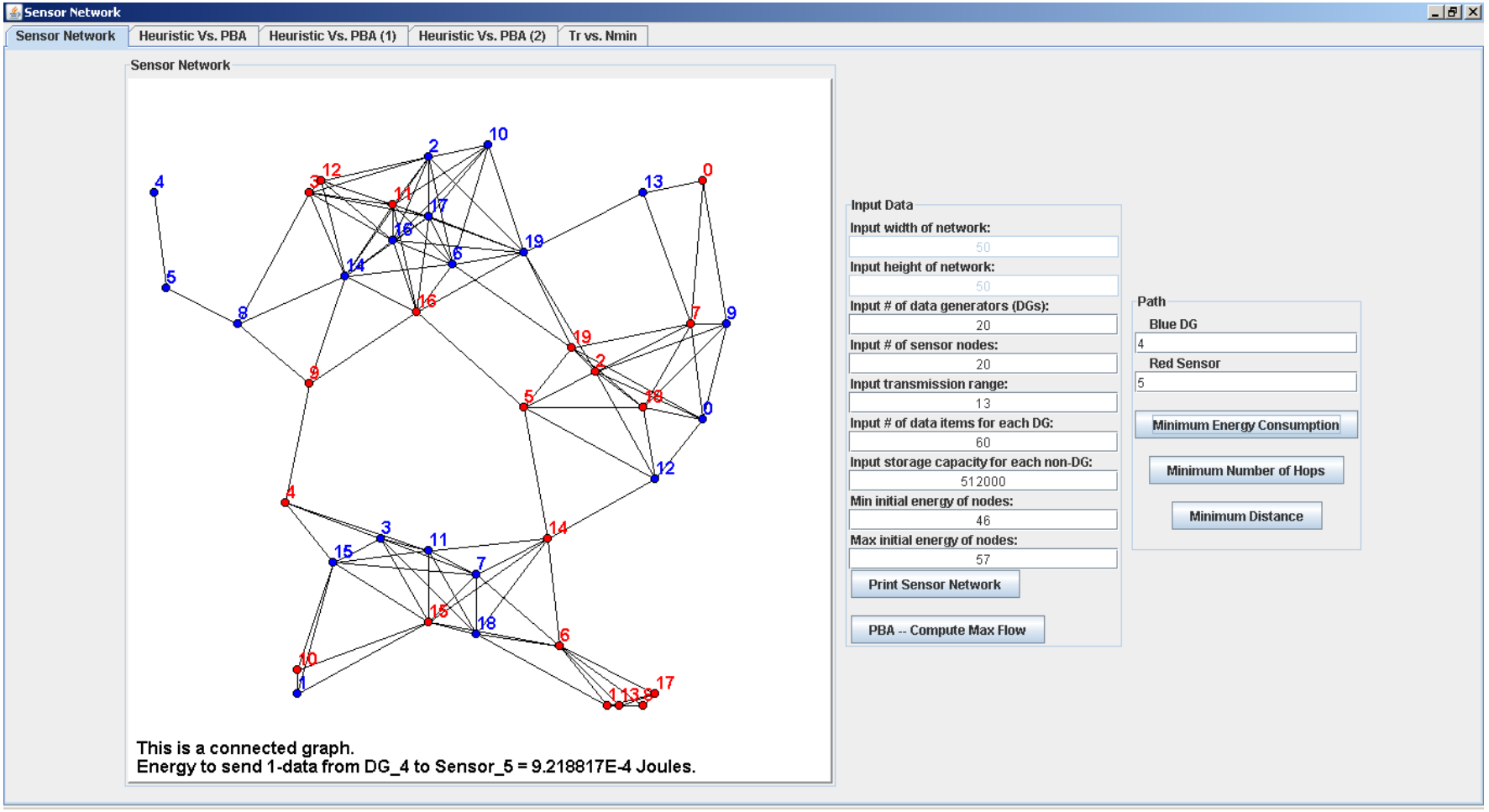
$25 \times 60 \leq (20 - 25) \times 512000$



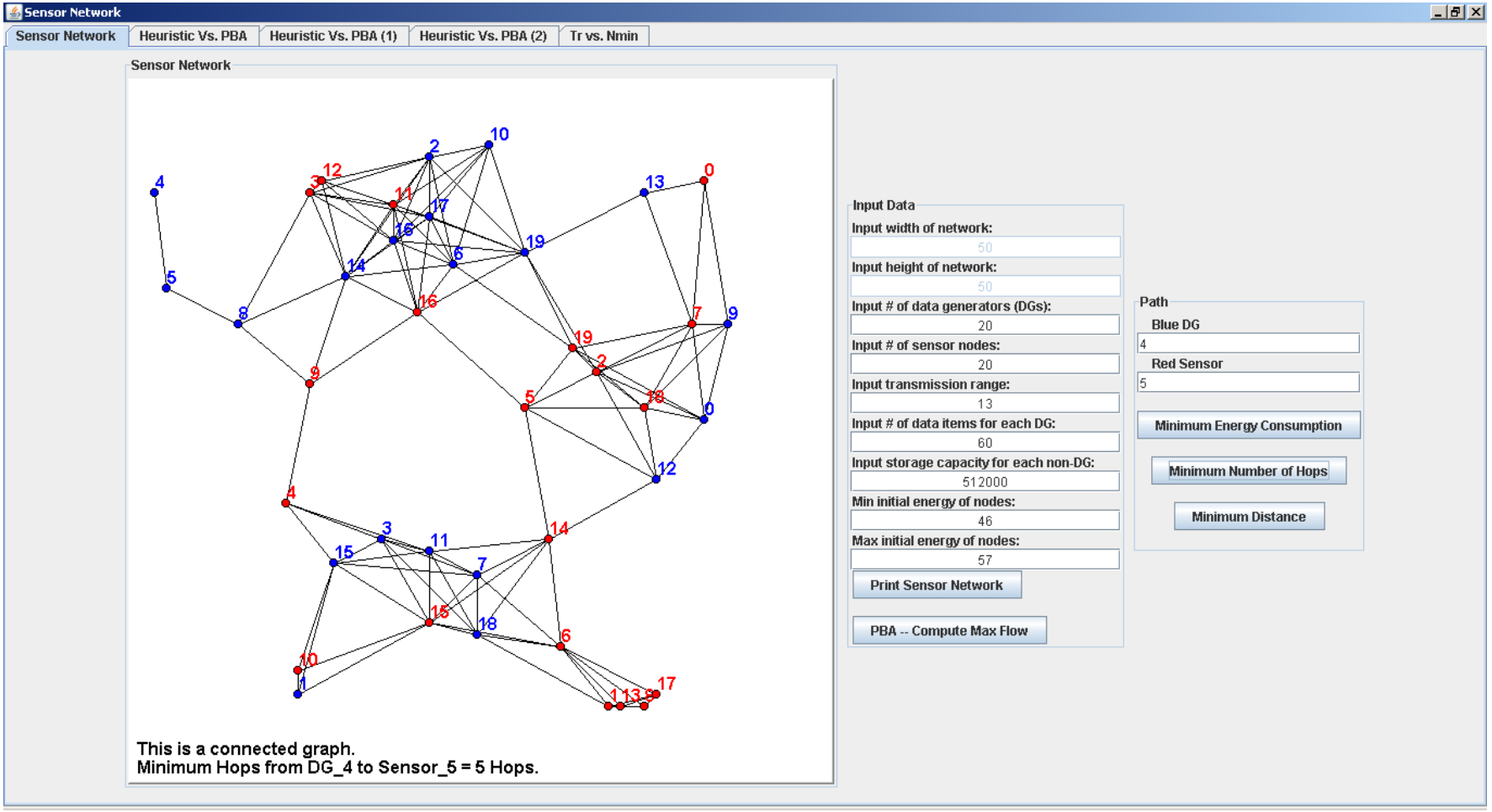
Connected Network

- Shortest path calculations implemented using a minimum priority queue Dijkstra algorithm
- O(log V) running time for traversing the queue with V number of vertices (p+q) + E edges ($E \leq (p+q)^2$)
- O([V+E] log V) = O(E log V) running time

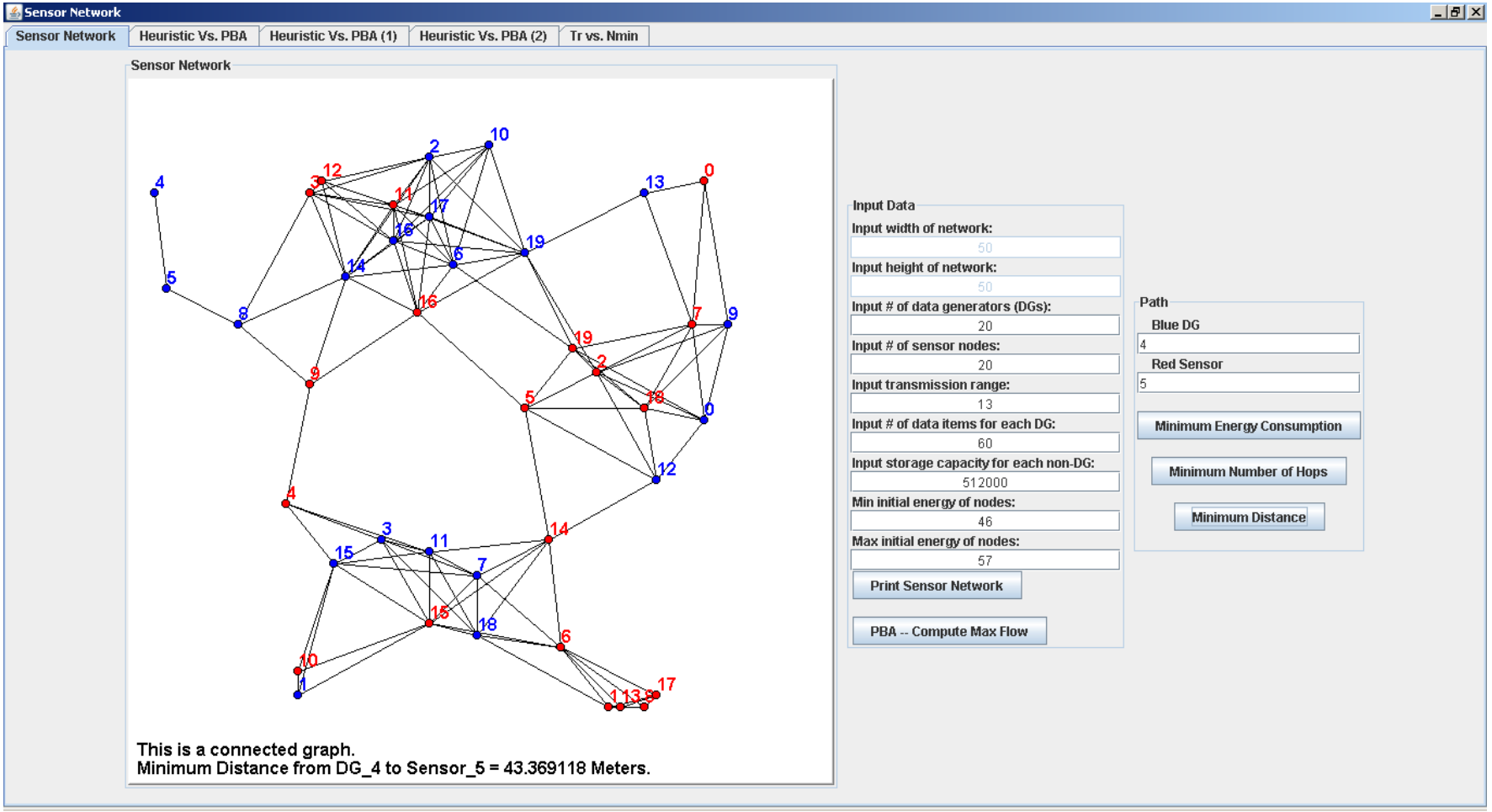
Minimum Energy Consumption
DG 4 to Sensor Node 5
9.218817E-4



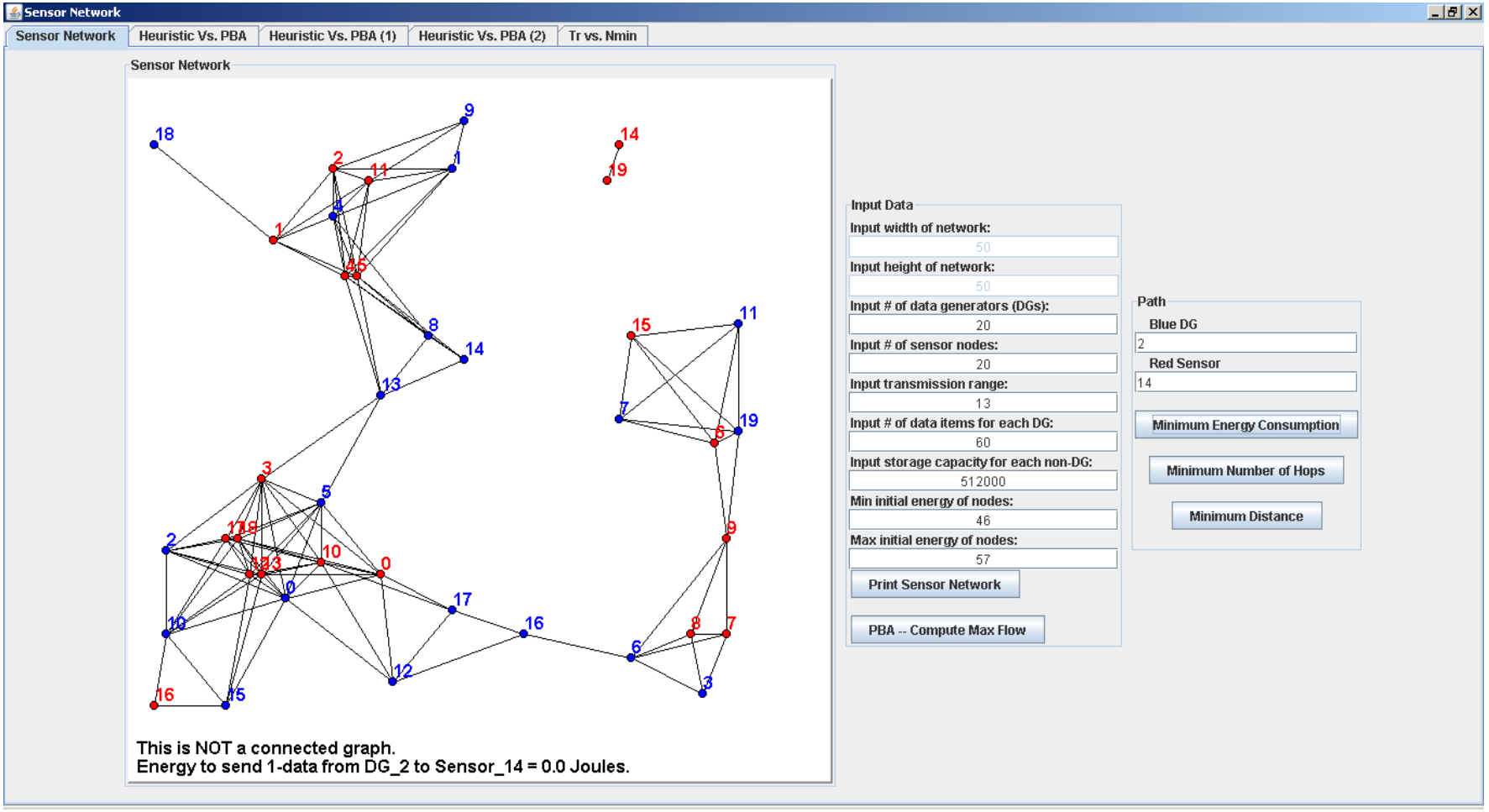
Minimum Number of Hops
Blue DG 4 to Red Sensor Node 5
5 Hops



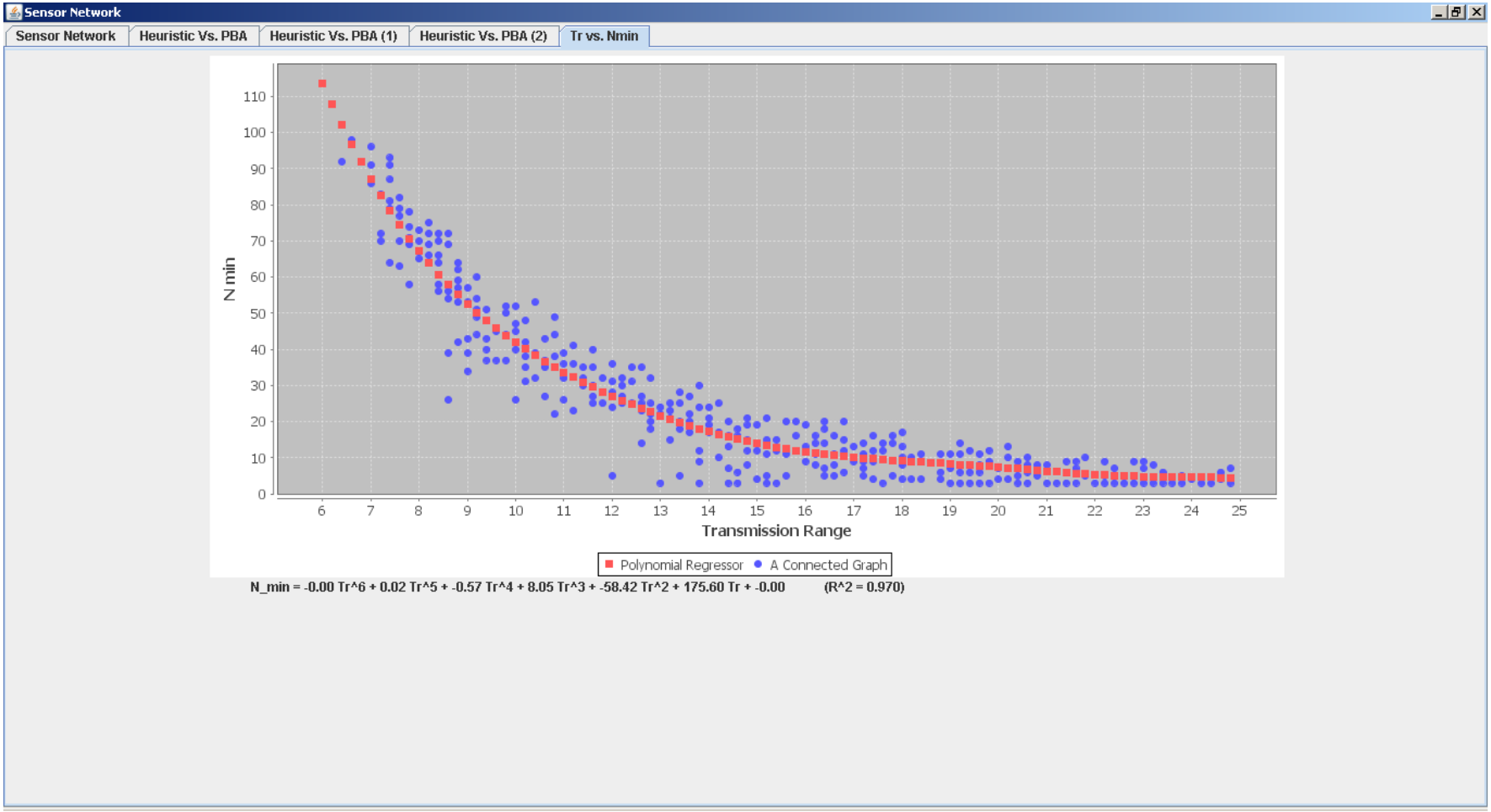
Minimum Distance
Blue DG 4 to Red Sensor Node 5
43.369118 Meters



Min Energy, Hops & Distance all error to 0 between **NONCONNECTED** DG to Sensor Node



Transmission Range vs N_{min}



Theoretical Relationship

- Similar to exponential decay or a polynomial regression

$F(Tr)$ = the function reflecting the minimum number of nodes
Tr = the transmission range
F_0 = a constant
r = decay rate

$$F(Tr) = F_0 \cdot e^{r \cdot Tr}$$

Using the points (15, 15) and (8, 65) off the plot

$$r = \frac{\ln \frac{y1}{y2}}{x1 - x2} = -0.2159$$

which results in constant $F_0 = 382.43$ to produce the approximation:

$$F(Tr) = 382.43 \cdot e^{-0.2159 \cdot Tr}$$

Plot Spread

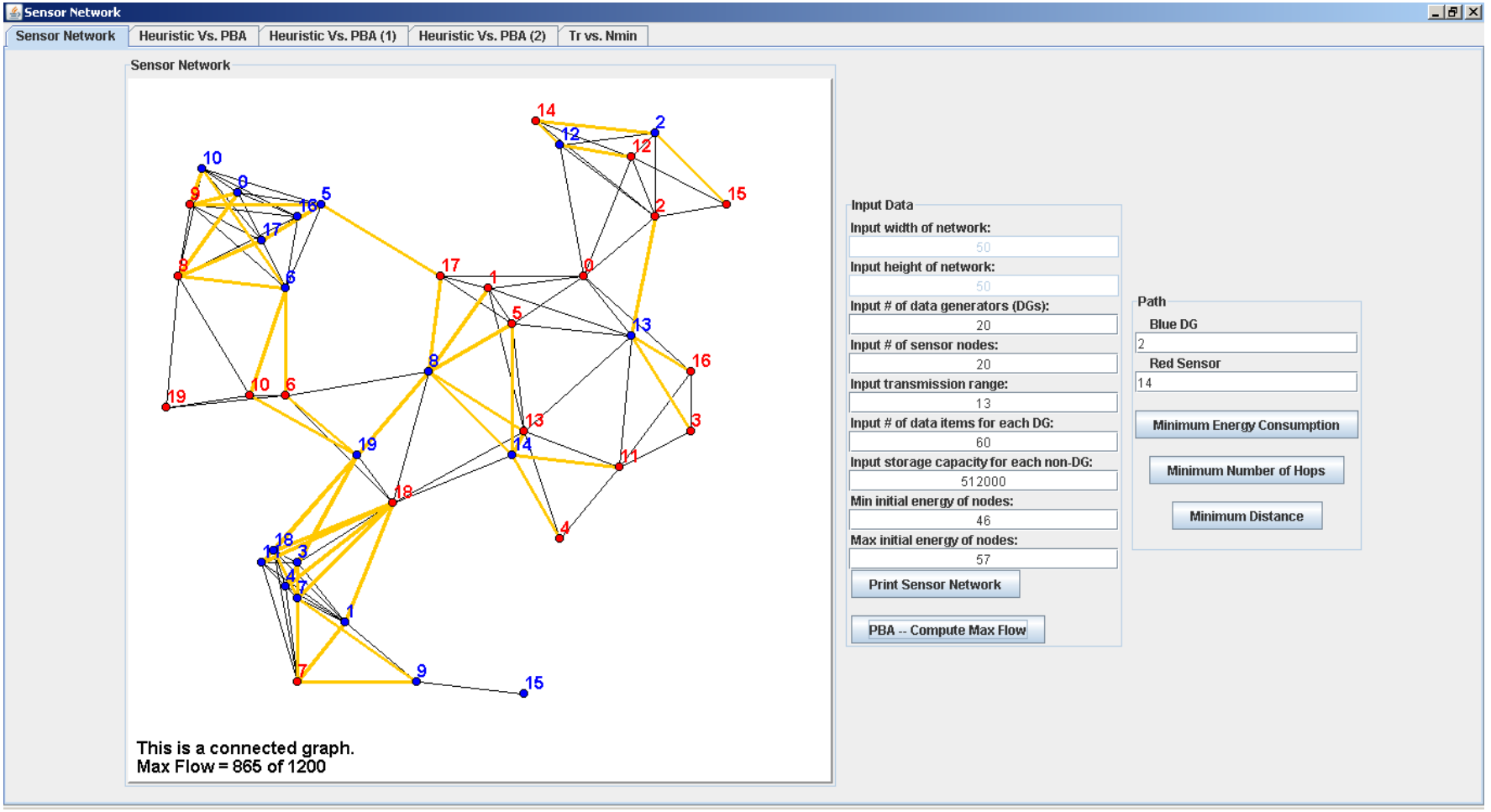
- Similar to a Poisson distribution which predicts a range of output

λ = the number of minimum nodes
k = the expected number of minimum nodes

$$\text{Probability} = \frac{\lambda^k}{k! \cdot e^{\lambda}}$$

- Transmission range of 20 results in $\lambda = 5$
- Expected result of 4 and 5 are 17.6% likely
- Expected result of 6 is 14.6%
- 17.6 + 17.6 + 14.6 indicates just under 50% of the results should be right around 5

Maximum Flow
Priority Based Algorithm



Priority Based Algorithm

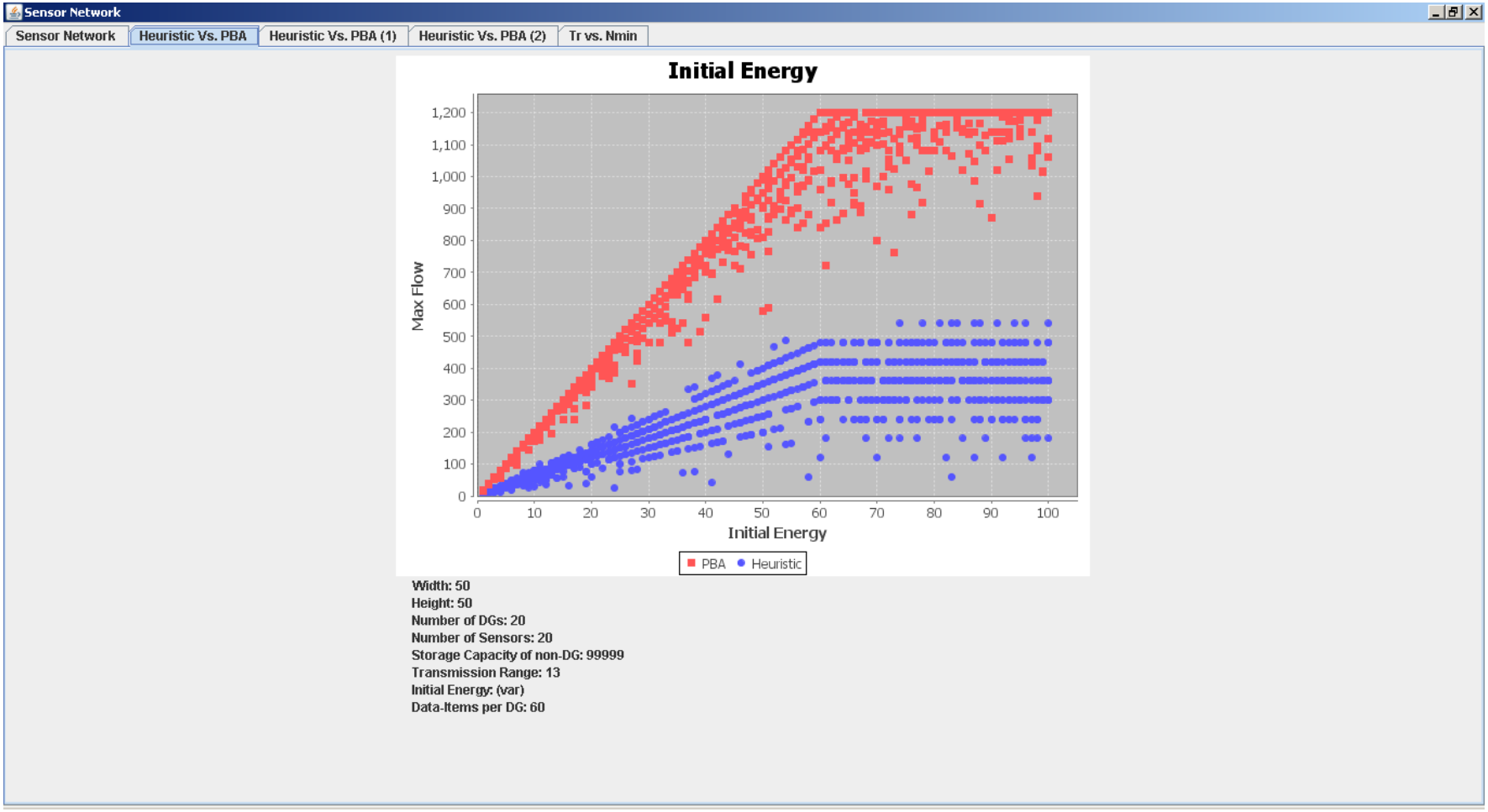
- Implemented using Edmonds-Karp algorithm
- Offload maximum number of data items from the highest priority data generator
- Continue to the second highest priority data generator and descending down until completed

Heuristic Algorithm

- Offload data in descending order from highest to lowest priority similar to the priority based algorithm
- Path dictated by closest distance
- Algorithm often cut short when there are no longer any adequate nodes to offload data to

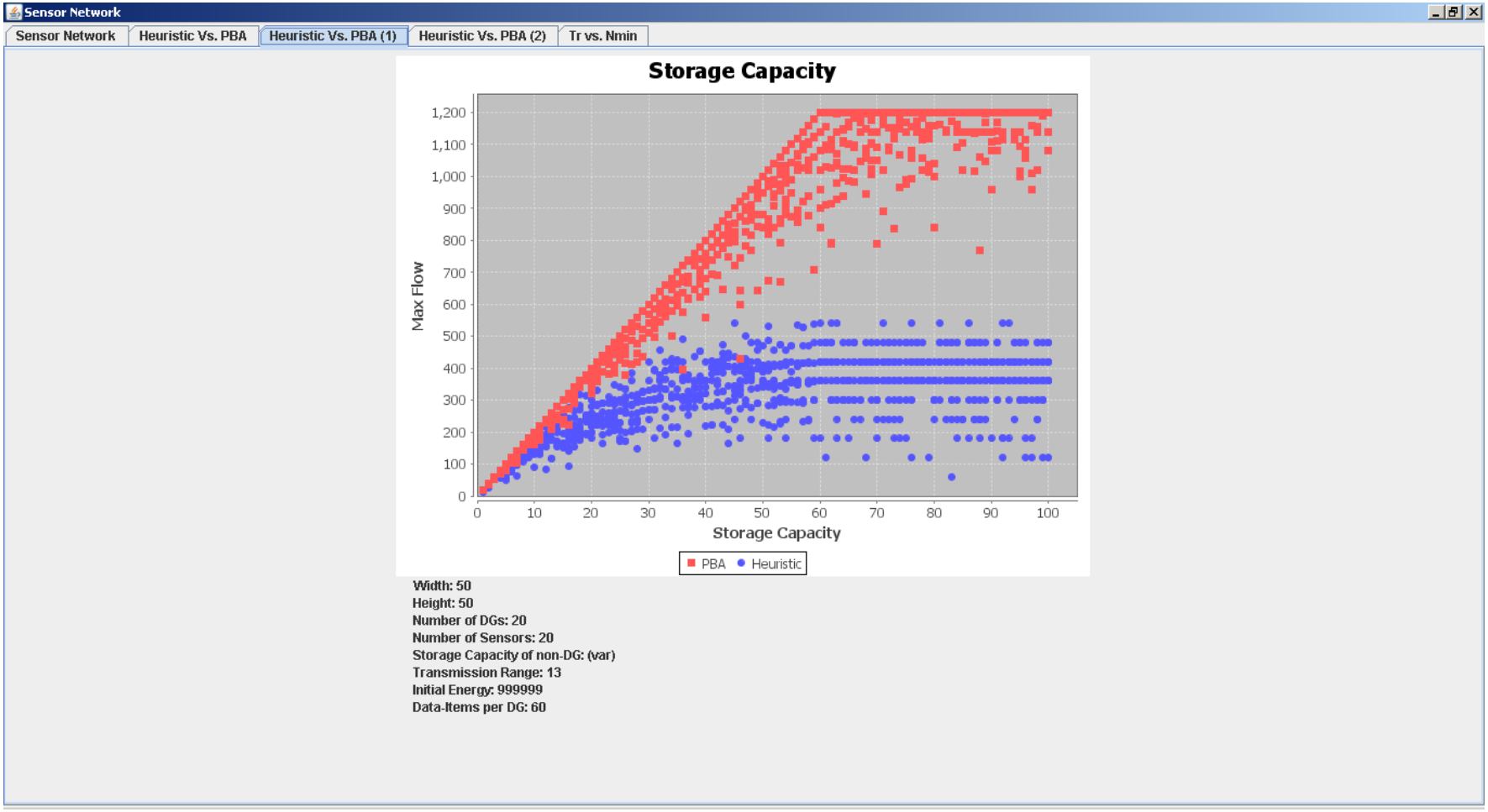
Heuristic Algorithm vs PBA Initial Energy

- Heuristics equals PBA if energy to transfer data is 0



Heuristic Algorithm vs PBA Storage Capacity

- Heuristics equals PBA if energy to transfer data is 0



Heuristic Algorithm vs PBA Data Items

- Heuristics equals PBA if energy to transfer data is 0