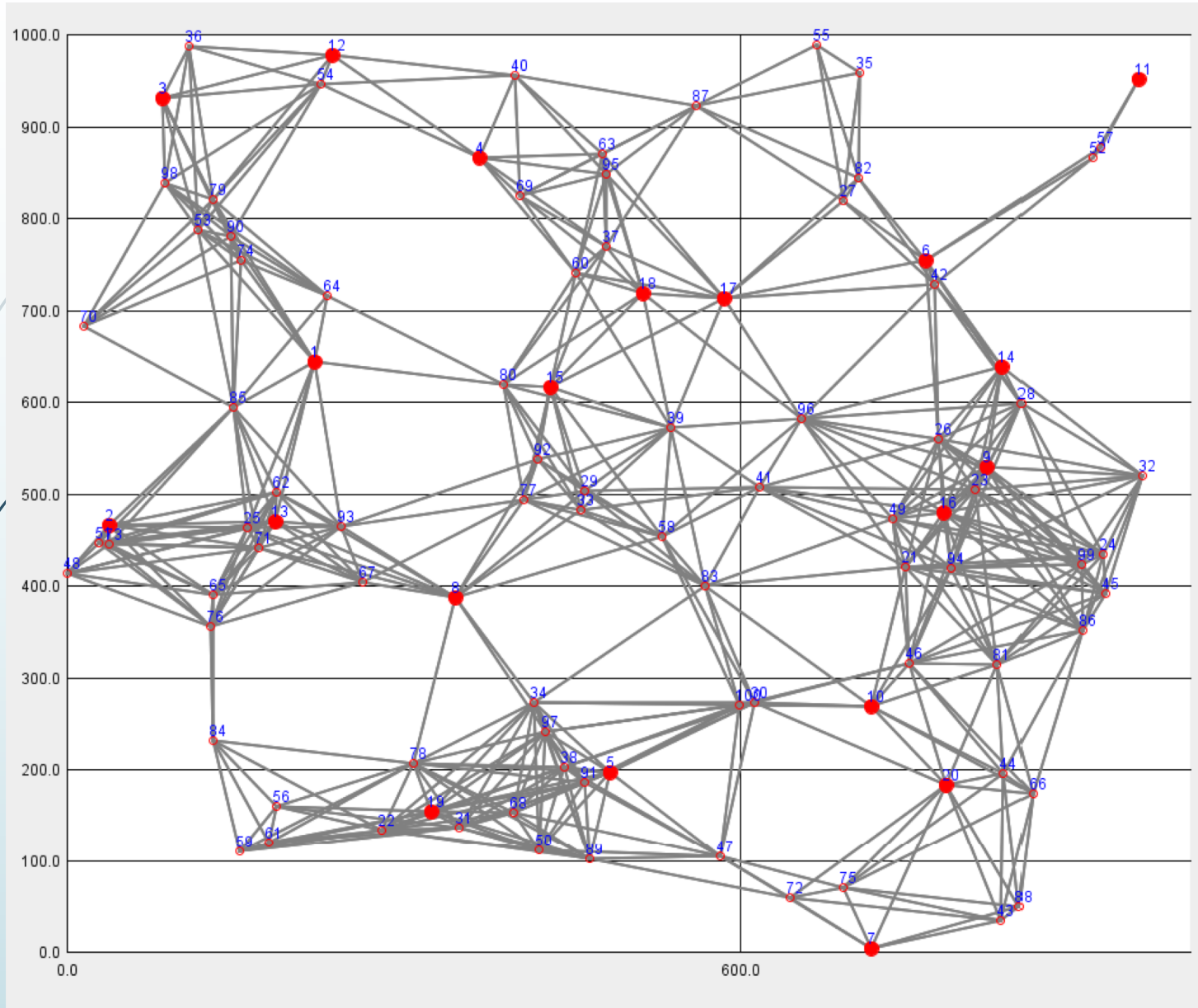




Formulation of data priority problem

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Data priority problem



1. Data generators does not have enough energy to send all the data out.
2. Data item on different data generators have different priority.
3. Maximize the priority on the storages (Minimize the priority on the data generators).

Linear programming (LP) formulation example

Objective function:

Minimize

```
obj1: x01' + x02' + x03' + x04' + x05' + x06' + x07' + x08' + x09' + x010'  
      + x011' + x012' + x013' + x014' + x015' + x016' + x017' + x018' + x019'  
      + x020'
```

x01' (parameter)

numbers of data from 0 to 1

Flow constraint (the number of data comes in = the number of data goes out):

```
c1:  x01' + x3''1' + x4''1' + x86''1' + x56''1' + x9''1' + x61''1' + x93''1'  
     + x14''1' + x78''1' + x79''1' - x1''3' - x1''4' - x1''86' - x1''56'  
     - x1''9' - x1''61' - x1''93' - x1''14' - x1''78' - x1''79' = 0
```

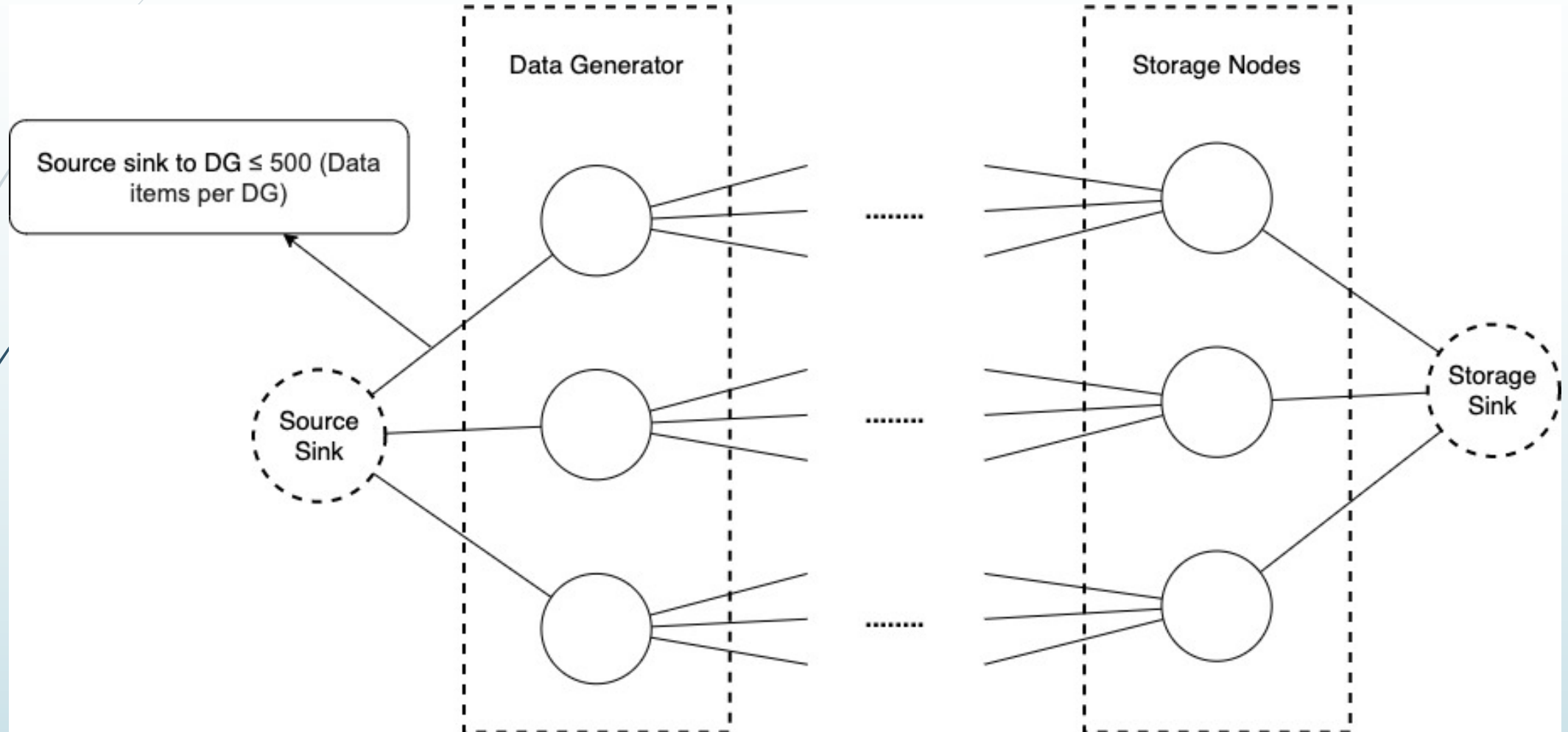
Energy constraint:

```
c101: 0.4096 x3''1' + 0.4096 x4''1' + 0.4096 x86''1' + 0.4096 x56''1'  
      + 0.4096 x9''1' + 0.4096 x61''1' + 0.4096 x93''1' + 0.4096 x14''1'  
      + 0.4096 x78''1' + 0.4096 x79''1' + 14.7251 x1''3' + 0.5535 x1''4'  
      + 14.5839 x1''86' + 4.2637 x1''56' + 14.343 x1''9' + 6.407 x1''61'  
      + 6.1463 x1''93' + 3.2273 x1''14' + 14.186 x1''78' + 15.1805 x1''79'  
      <= 500
```

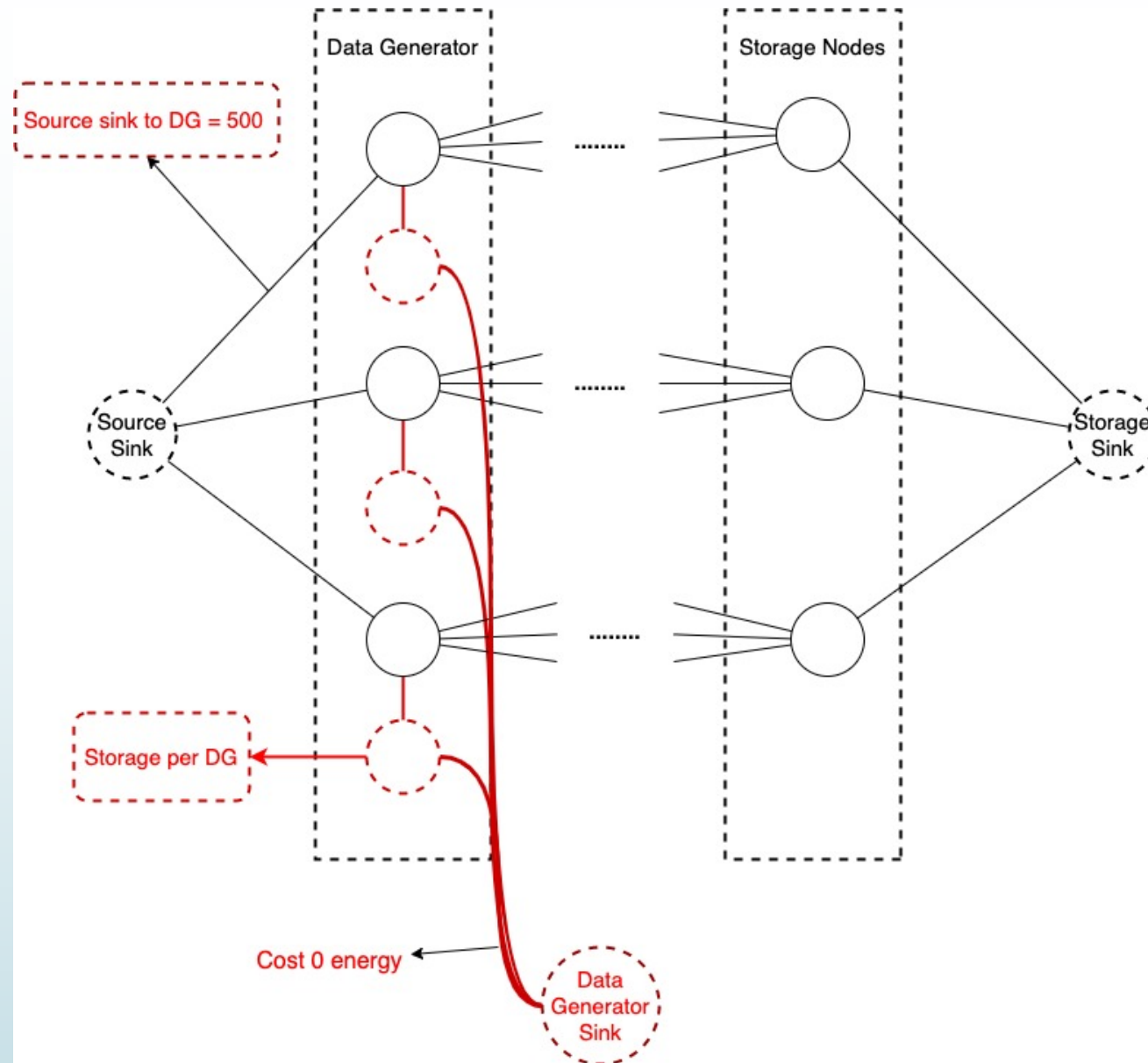
Single node constraint:

```
c220: x020' <= 500    0 is source sink  
c221: x21''101 <= 128 101 is storage sink
```

Data priority problem (old model)



Data priority problem (current model)



Data priority problem (LP formulation)

Objective function:

Minimize **priority**

$$\begin{aligned} \text{obj1: } & 27 x1''102 + 17 x2''102 + 24 x3''102 + 69 x4''102 + 96 x5''102 \\ & + 27 x6''102 + 9 x7''102 + 46 x8''102 + 91 x9''102 + 14 x10''102 \\ & + 15 x11''102 + 24 x12''102 + 14 x13''102 + 81 x14''102 + 39 x15''102 \\ & + 17 x16''102 + 20 x17''102 + 22 x18''102 + 15 x19''102 + 20 x20''102 \end{aligned}$$

102 is data generators' storage

Flow constraint (the number of data comes in = the number of data goes out):

$$\begin{aligned} \text{c1: } & x01' + x100''1' + x69''1' + x22''1' + x73''1' + x45''1' + x78''1' \\ & - x1''100' - x1''69' - x1''22' - x1''73' - x1''45' - x1''78' - x1''102 \\ & = 0 \end{aligned}$$

Single node constraint:

$$\begin{aligned} \text{c201: } & x01' = 500 \\ \text{c202: } & x1''102 \leq 500 \end{aligned}$$



Parameters

width = 2000

high = 2000

number of nodes = 100

transmit range = 100

data generators = 20

data items per DG = 500

storage per node = 128 (storage capacity)

energy capacity = 500 mJ



Parameters

width = 1000

high = 1000

number of nodes = 100

transmit range = 200

data generators = 20

data items per DG = 500

storage per node = 128 (storage capacity)

energy capacity = 500 mJ



Generated data