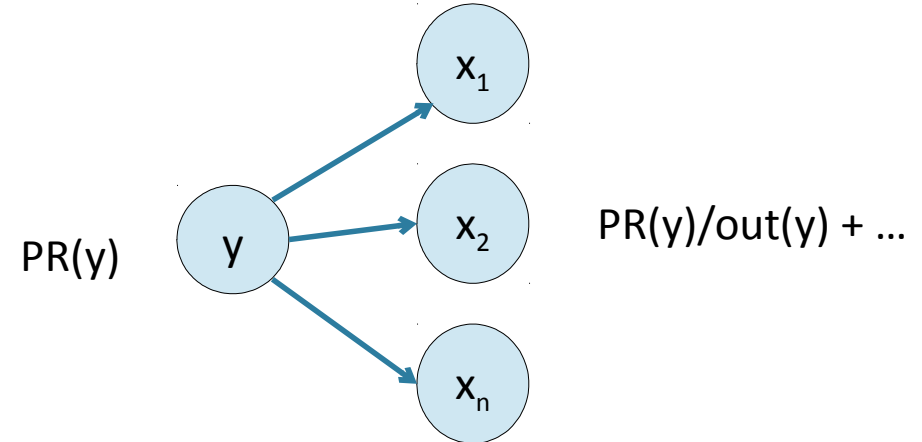# Expressing PageRank with MapReduce

- **Mapper** $\left\langle y, \{x_1, x_{2,} ..., x_n\}\right\rangle$ node, out-links

  - for i =1..n,   yield $\left\langle x_i, \dfrac{PR(y)}{out(y)}\right\rangle$

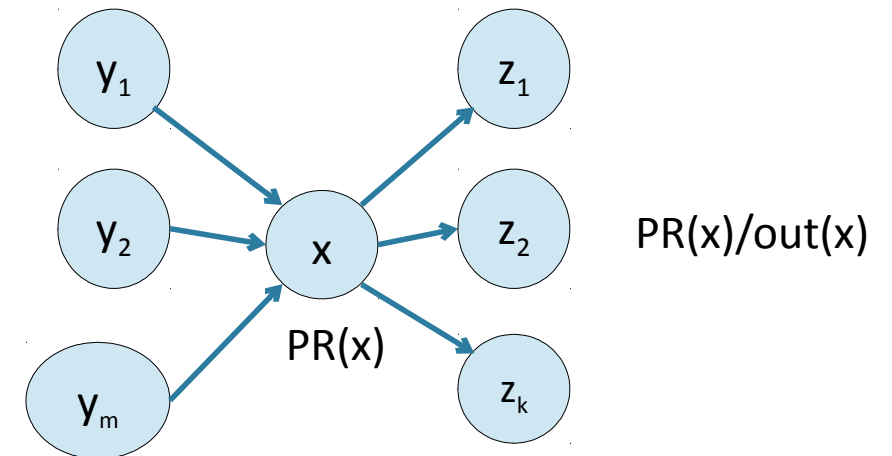 - yield

    $\left\langle y, \{x_1, x_{2,} ..., x_n\}\right\rangle$

PR(y)   y $\rightarrow$ x$_1$, x$_2$, x$_n$ PR(y)/out(y) + ...

- **Reducer**   node, ΔPR from in-links

  $\left\langle x, \left\{ \dfrac{PR(y_1)}{out(y_1)}, ..., \dfrac{PR(y_m)}{out(y_m)}, \{z_1, ..., z_k\} \right\} \right\rangle$

  - compute

    $$PR(x) = \frac{1-\beta}{N} + \beta * \sum_{y->x} \frac{PR(y)}{out(y)}$$

  - for j=1..k,   yield $\left\langle z_j, \dfrac{PR(x)}{out(x)}\right\rangle$

  - yield $\left\langle x, \{z_1, z_{2,} ..., z_k\}\right\rangle$

PR(x)/out(x)

PR(x)

PR(x) = [...] + PR(y1)/out(y1) + ...