Highlight description of constrained group placement algorithm

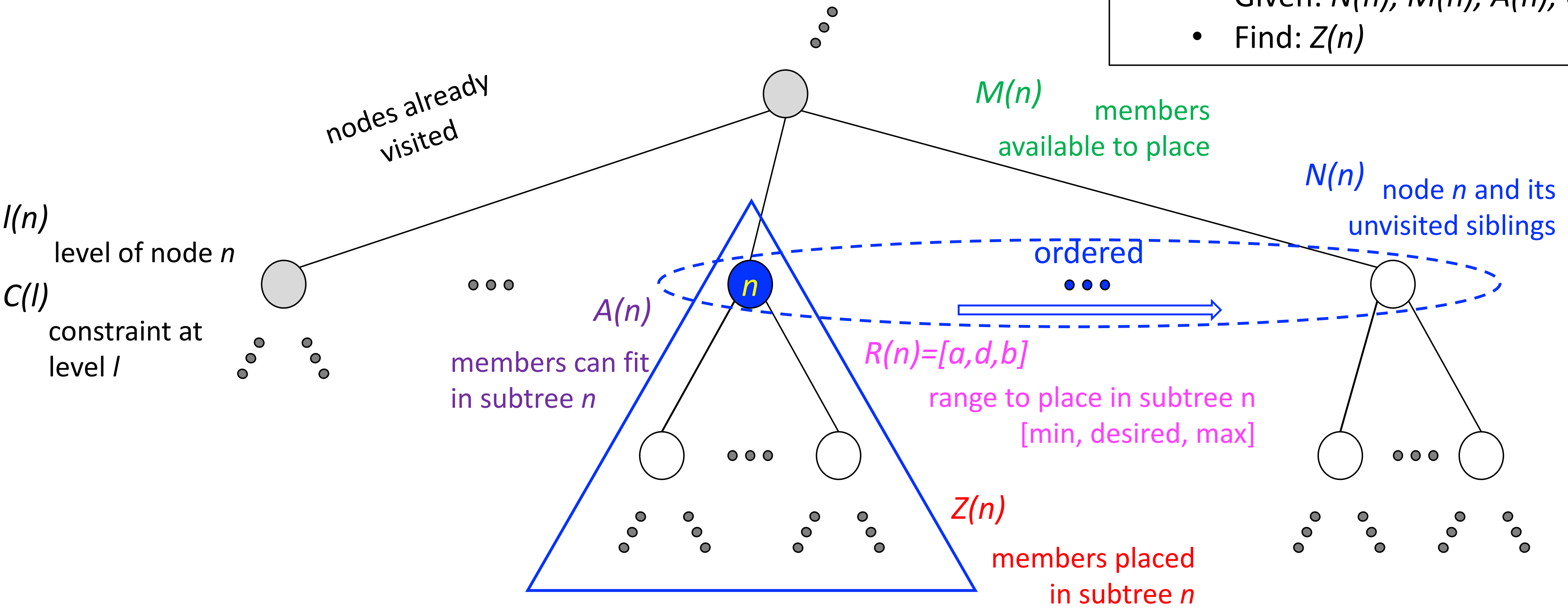
Placement algorithm

- Traverse physical tree in depth first order
- Solve placement subproblem when visiting node n
- Choice of heuristics
  - ordering of sibling nodes
  - determination of placement range
  - selection of best number to place at a node
- Return of logical tree, representing placement result
- Variations of algorithm
  - place a partially placed group
  - place dynamic group (size changes)

Visit node *n*

Placement problem at node *n*:

- Given: *N(n), M(n), A(n), C(l(n))*
- Find: *Z(n)*



Procedure:

- Calculate *R(n)* based on *N(n), M(n), C(l(n))*
- Calculate best choice *Z*(n) based on A(n)* in *R(n)*
- Order and visit children of *n*
  - visit first child with *M(.)=Z*(n)*
  - visit next, subtracting *Z(.)* from *M(.)* and adjusting *N(.)*
- *Z(n)* is total placed in subtree *n*

Initially,

- n = root
- N(n) = 1
- M(n) = group size

Setting range based on level constraint

Let

- M(n) = M
- N(n) = N
- C(l(n)) = C

R = [a, d, b]
[min, desired, max]

Constraint, C	Pack	Spread
Hard	[M, M, M]	[1, 1, 1]
Soft	[1, M, M]	[1, ceil(M/N), M]

Setting best number to place

Let

- A(n) = A
- Z*(n) = Z*

$$Z^* = \begin{cases} \min\{\min\{A, b\}, d\}, & A >= a \\ 0, & A < a \end{cases}$$

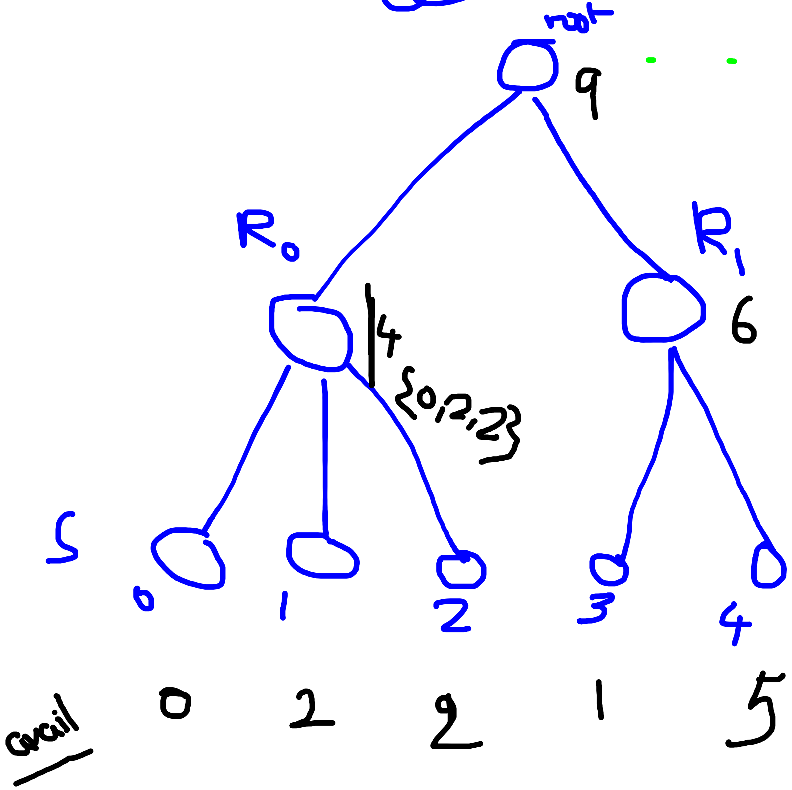
Partial placement

Given a partially placed group, place remainder of group

- Let B(n) be the number of members already placed in subtree rooted at node n
- Modify Visit node n
  - add primary ordering criterion, decreasing B(.)
  - calculation of range R(n) remains same
  - when selecting best choice Z*(n)
    - use (A(n) + B(n)) instead of A(n)
    - if Z*(n) < B(n) then return failure (cannot satisfy constraint given partial placement)
  - on leaf nodes, place over partially placed entities
- Logical tree includes partially and newly placed entities

Background

PTree:



LTree: 4 +C

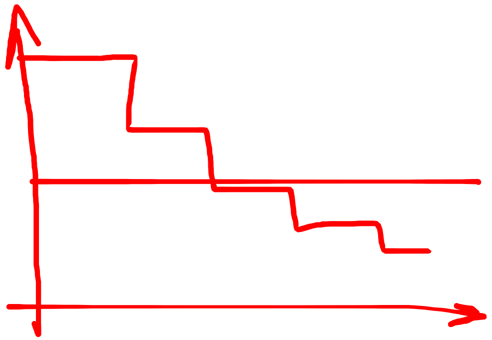
O(root)

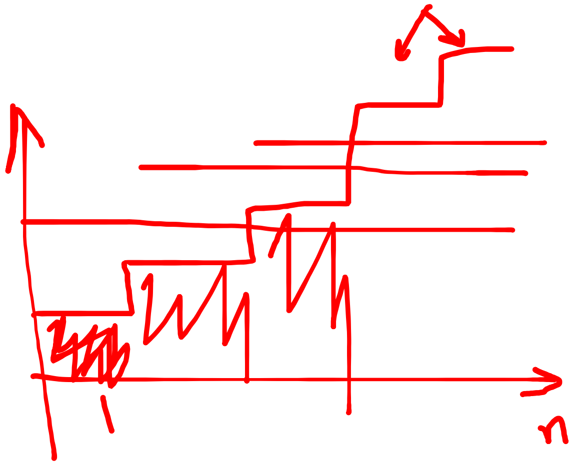
[SAread

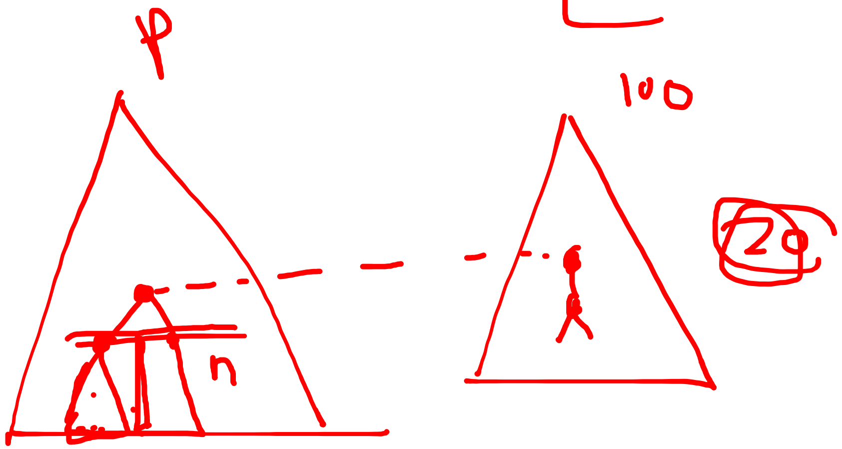
Path

S

level







min * max

[, ,]

PH 20,20,20

PS 1,20,20

SH 1,1,1

SS $1,\frac{20}{n},20$