Mesh Streaming in 3D Game

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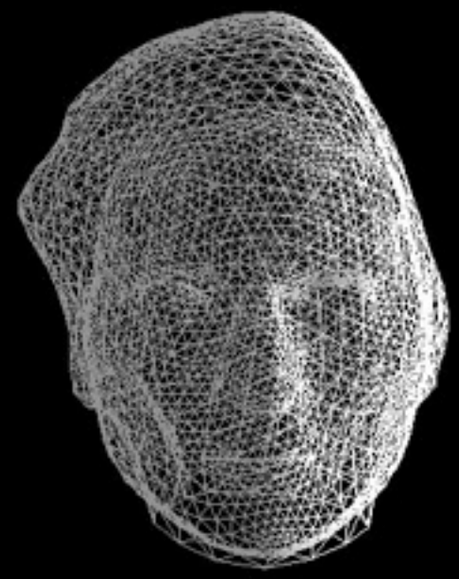
Mesh ?

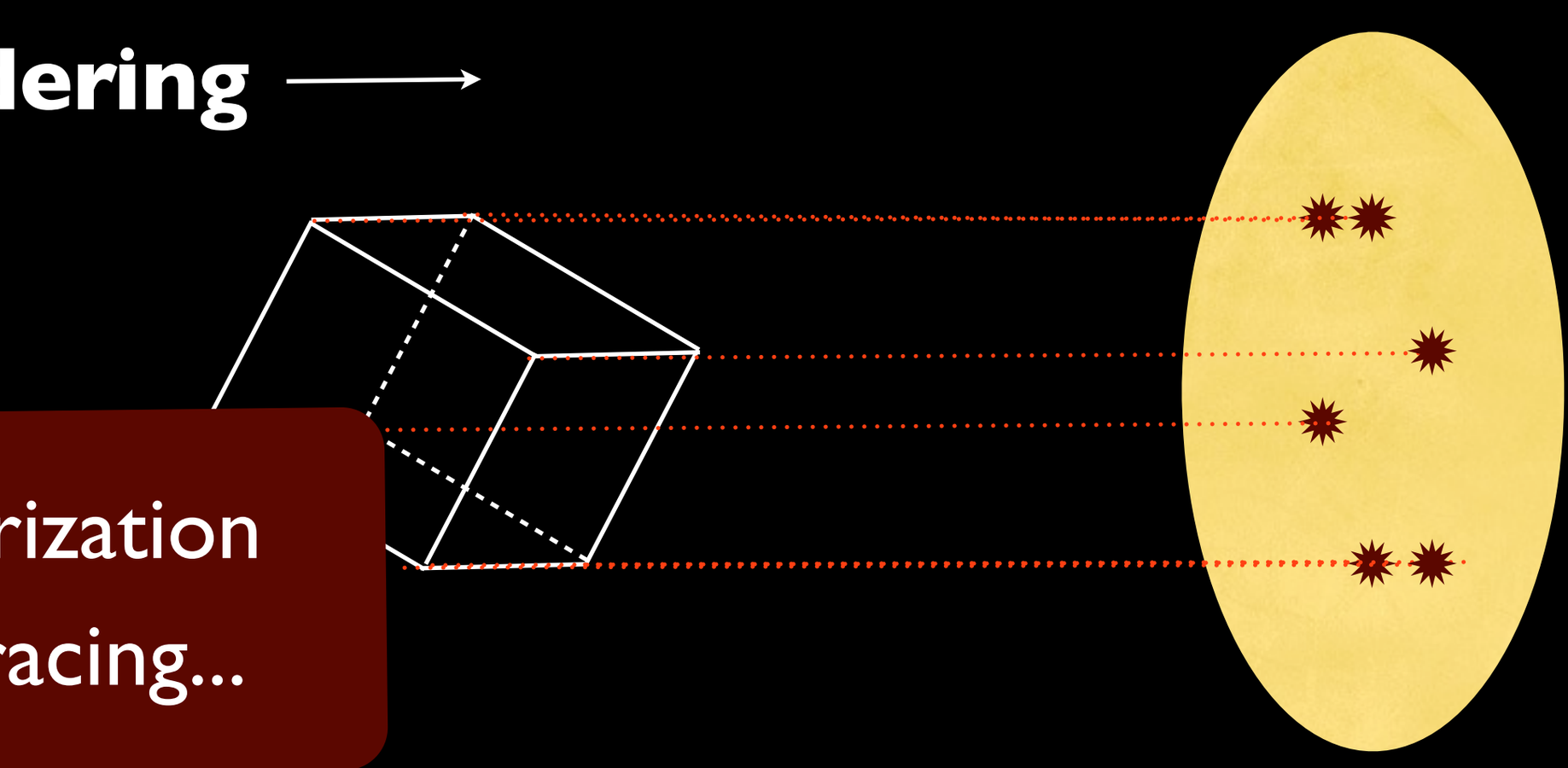
3D ?

3D



Models ⟶ Image **Mesh** Point

Rendering ⟶



Rasterization
Ray tracing...

Transition:

$$x' = \begin{pmatrix} 1 & 0 & 0 & X \\ 0 & 1 & 0 & Y \\ 0 & 0 & 1 & Z \\ 0 & 0 & 0 & 1 \end{pmatrix} \times x$$

after

before

Scaling:

$$x' = \begin{pmatrix} X & 0 & 0 & 0 \\ 0 & Y & 0 & 0 \\ 0 & 0 & Z & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \times x$$

after

before

Rotation:

$$x' = M \times x$$

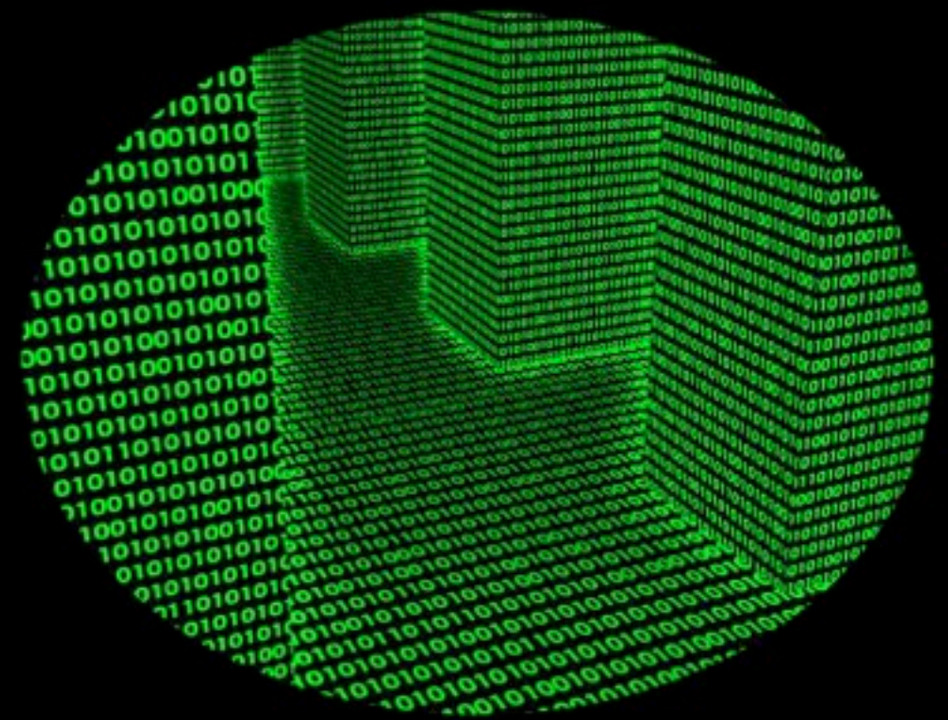
after

before

$$M = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & cos\theta & -sin\theta & 0 \\ 0 & sin\theta & cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \begin{pmatrix} cos\theta & 0 & sin\theta & 0 \\ 0 & 1 & 0 & 0 \\ -sin\theta & 0 & cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \begin{pmatrix} cos\theta & -sin\theta & 0 & 0 \\ sin\theta & cos\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}.$$

Progressive mesh

View 3D meshes with increasing level of details



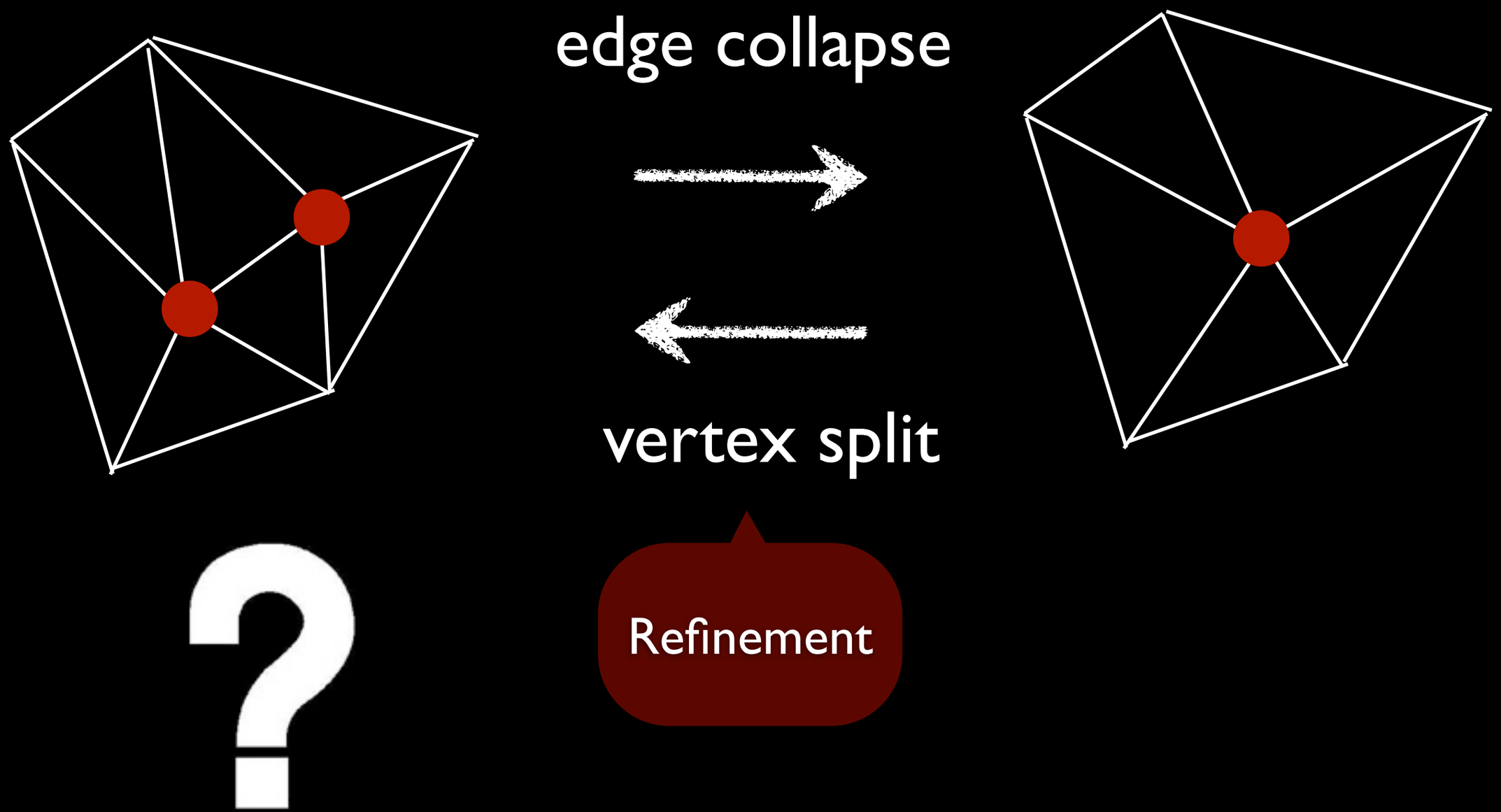
A low definition mesh is transmitted initially

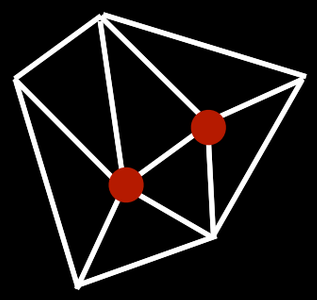
Huge

Progressive mesh streaming

How to get Base Mesh ?

How to get Base Mesh ?





Priority among vertex splits?

Sort vertex splits according to their contributions to the overall quality

The progressive coding introduces **dependencies** among vertex splits.

The descendants can not be decoded before their ancestors are all decoded

Let's go further...

view dependent streaming

How to partition a progressive mesh into chunks?

How to look up the provider of a chunk?

Wei Cheng et al., Peer-Assisted View-Dependent Progressive Mesh Streaming, MM'09

Wei Cheng et al., Peer-Assisted View-Dependent Progressive Mesh Streaming, MM'09

Each vertex split splits a vertex into two vertices

Only the visible region needs to be sent

Peer assisted

Wei Cheng et al., Peer-Assisted View-Dependent Progressive Mesh Streaming, MM'09

Unique challenges

View point changes continuously

Short sojourns

Non-trivial visible region calculation

Wei Cheng et al., Peer-Assisted View-Dependent Progressive Mesh Streaming, MM'09

Solutions proposed

Receiver driven

Heuristic visible region estimation

Hierarchical chunking

User lead for each chunk

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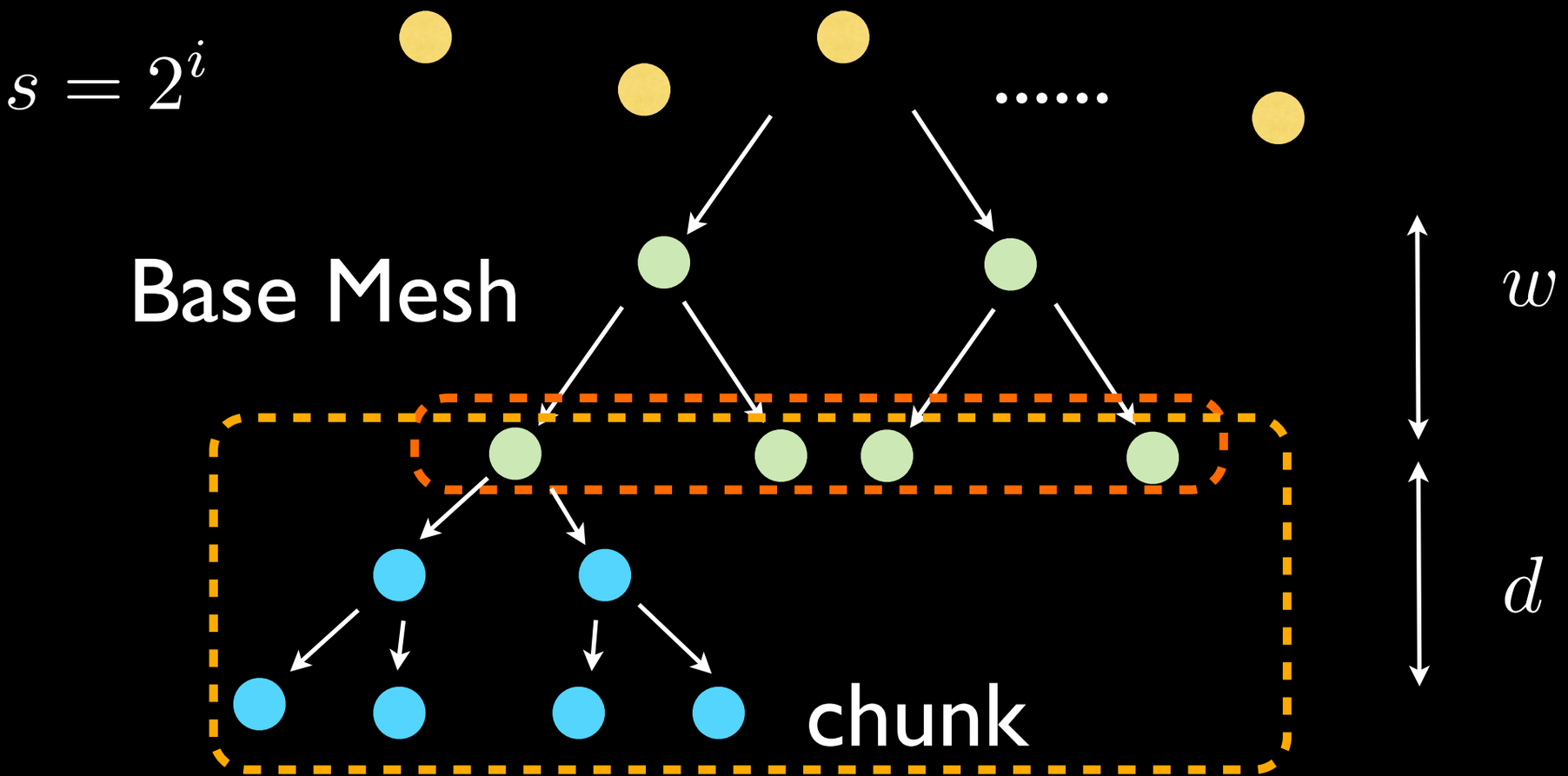
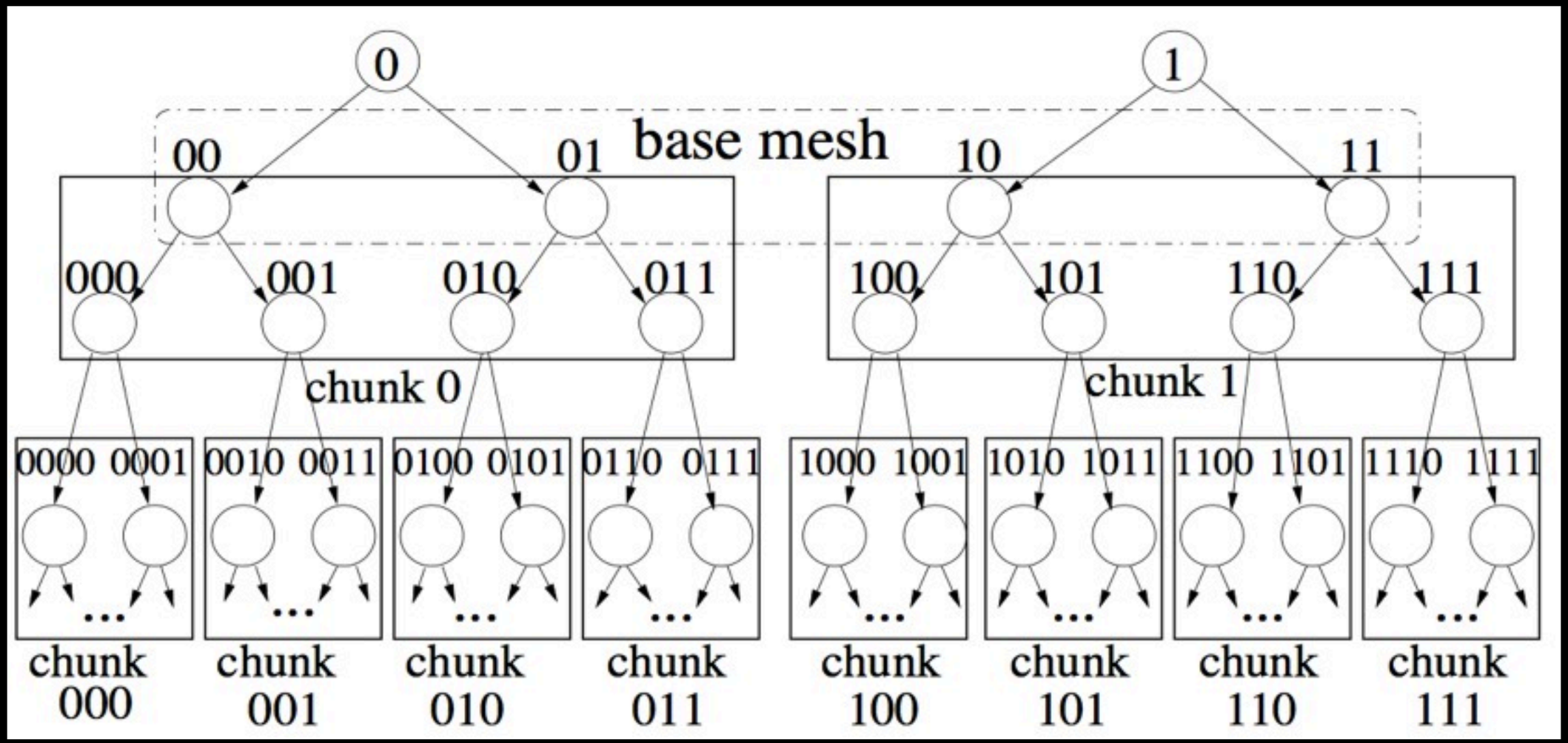
Hierarchical chunking

$s = 2^i$



Each chunk has $2^w \times (2^d - 1)$ vertex splits

Wei Cheng et al., Peer-Assisted View-Dependent Progressive Mesh Streaming, MM'09



$$i = 1, w = 1, d = 2$$

2^w root chunks

Each chunk has 2^d children chunks

Thanks !