ANTop

Adjacent Network Topologies

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Main features

- Decoupling the permanent identifier of a node from the node's topology-dependent address.
- Address space based on hypercubes.
- *Rendez-vous* based indirect routing using DHT (Distributed Hash Tables).

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Plan

- Indirect routing.
- Address mapping.
- Connection process.
- Address space.
- Improving mapping.
- Reactive routing.

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Indirect routing

Three identifiers for each node:

- Universal Identifier ***U***, known by any other node that may communicate with the node.
- Virtual Address ***V***, translation of *U* in the virtual address space. It is used to name the correspondent *rendez-vous* node.
- Relative address ***E***, current topology-dependent address of the node. It changes if the node moves.

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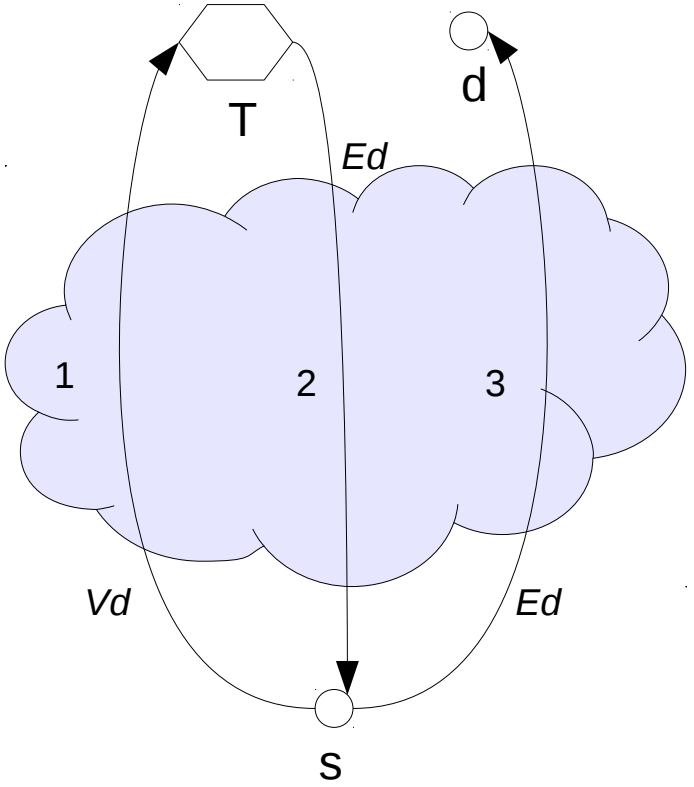
Indirect routing

0- Source node s translates identifier **Ud** into the address space to obtain the virtual address **Vd.**
Vd can be either the main address of the rendez-vous node **Td** or be included in his address space.

1- Source node s asks **Td** for the d relative address **Ed**.

2- **Td** sends the d relative address **Ed** to s.

3- Using the relative address **Ed,** s is now able to communicate with node d.



F(Ud) = Vd

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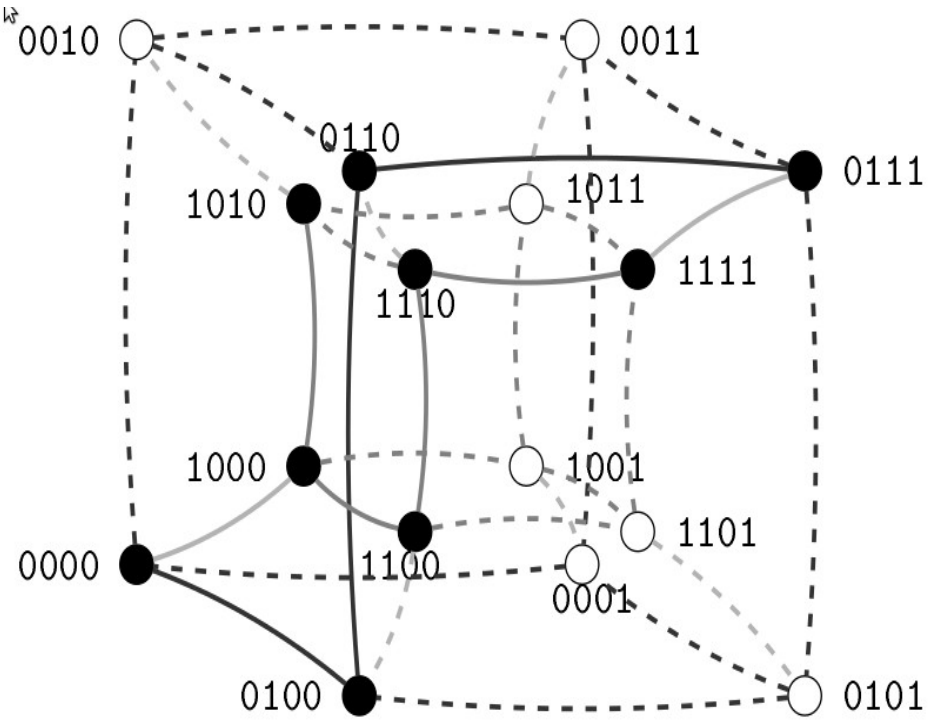
Address mapping

- Virtual address space based on a hybercube structure.
- Each node is directly connected with d neighbors.
- Address long d.
- 2^d nodes (maximum quantity°).
- Distance between two nodes is measured by XORing their two addresses (minimum distance°).



Dimension 4 hypercube.

°Since we are working with **incomplete** hypercubes.

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Connection process

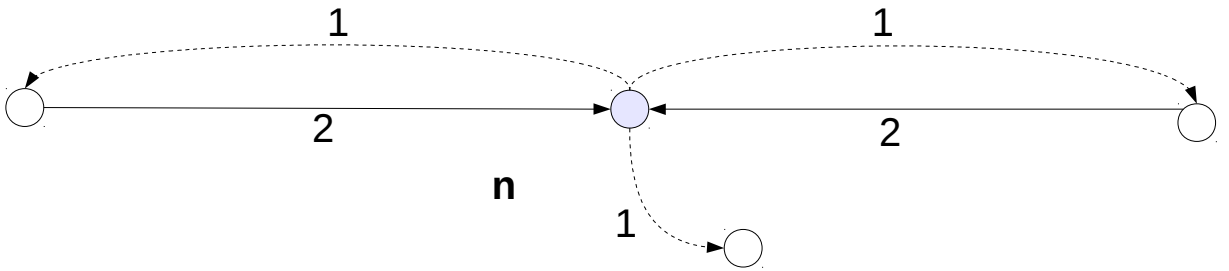
1- New node **n** asks his neighbors for a main address (broadcast message PAR).

2- Neighbors may offer a main address to the new node **n** (PAP)**.**

2- **n** chooses which is the best from all the posibilities. The chosen neighbor becomes the parent node **Pn.**

3- **n** advises all his neighbors about his new address (PAN).

4- **Pn** gives **n** half of his address space (usually upper half).



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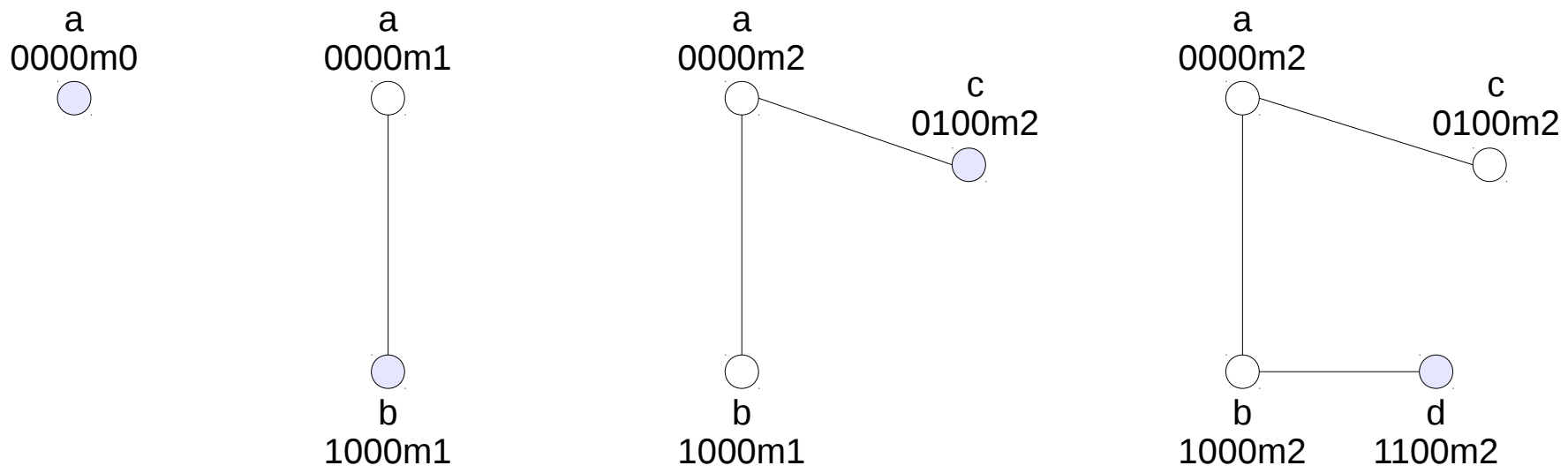
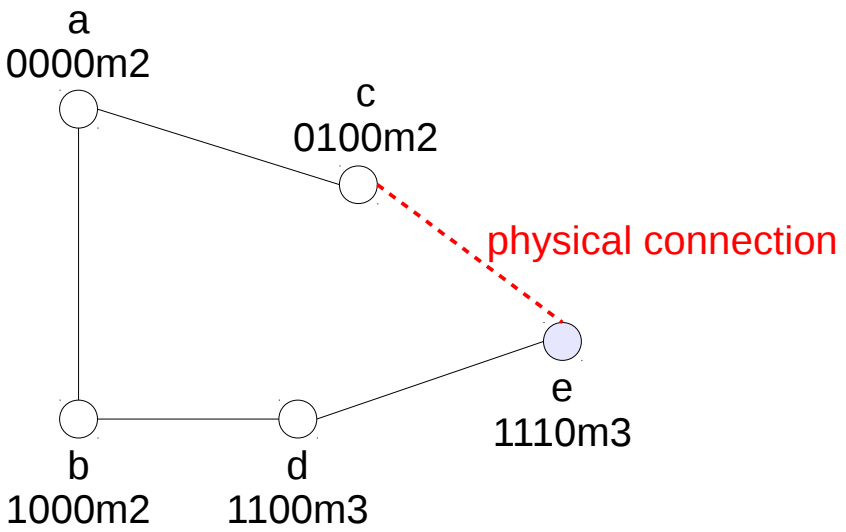
Address space

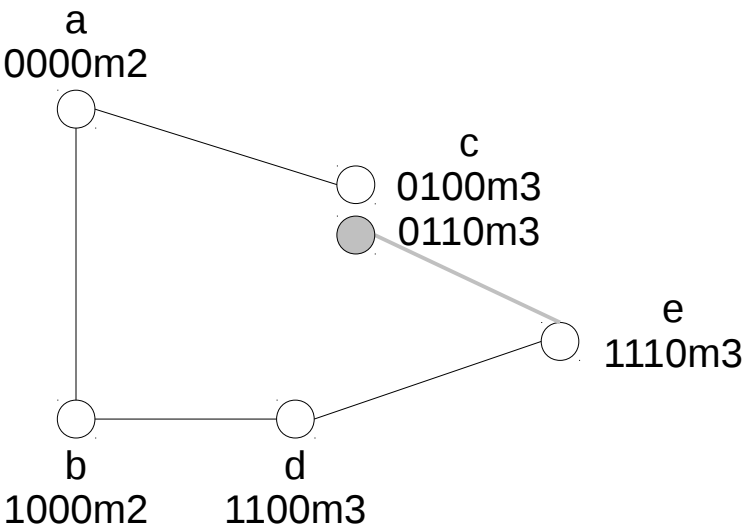
- Connected node must give half (usually upper half) of their address space to the new node.
- Tree distribution of network addresses space.



Improving mapping

- Multiple addresses to some nodes in the hypercube to make more physical connection become edges in the hypercube.





- Node c has a physical connection to node e, but their addresses are not adjacent.

- Address 0110 belongs to the c address space and is adjacent to e main address. 0110 becomes c secondary address.

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Routing

- Proactive routing
  - Builds and maintains routing tables all the time and assures a route for every node in a network.
  - Quite stable networks.

- Reactive routing
  - There is no a-priori information (no routing tables), only keeps temporary track of recently used routes.
  - Highly dynamic networks.

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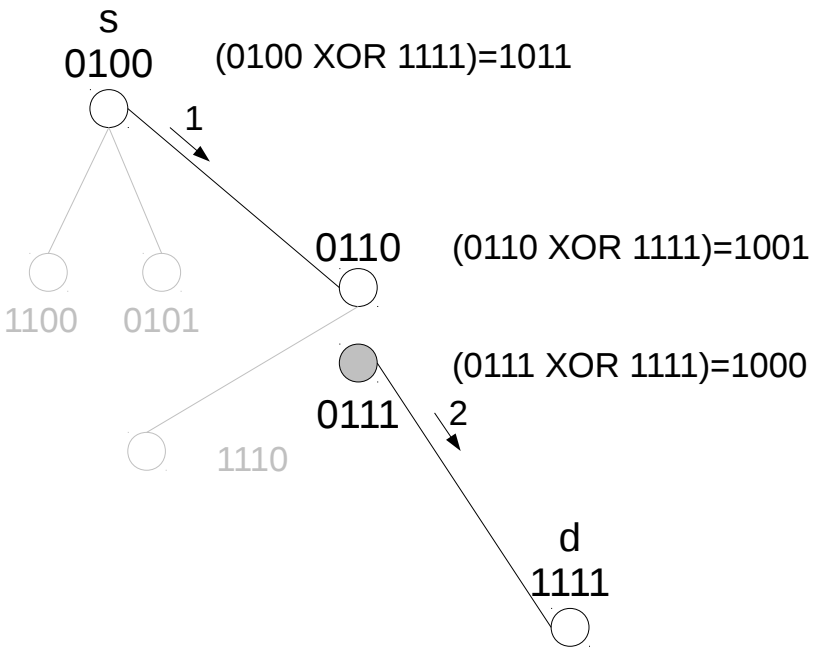
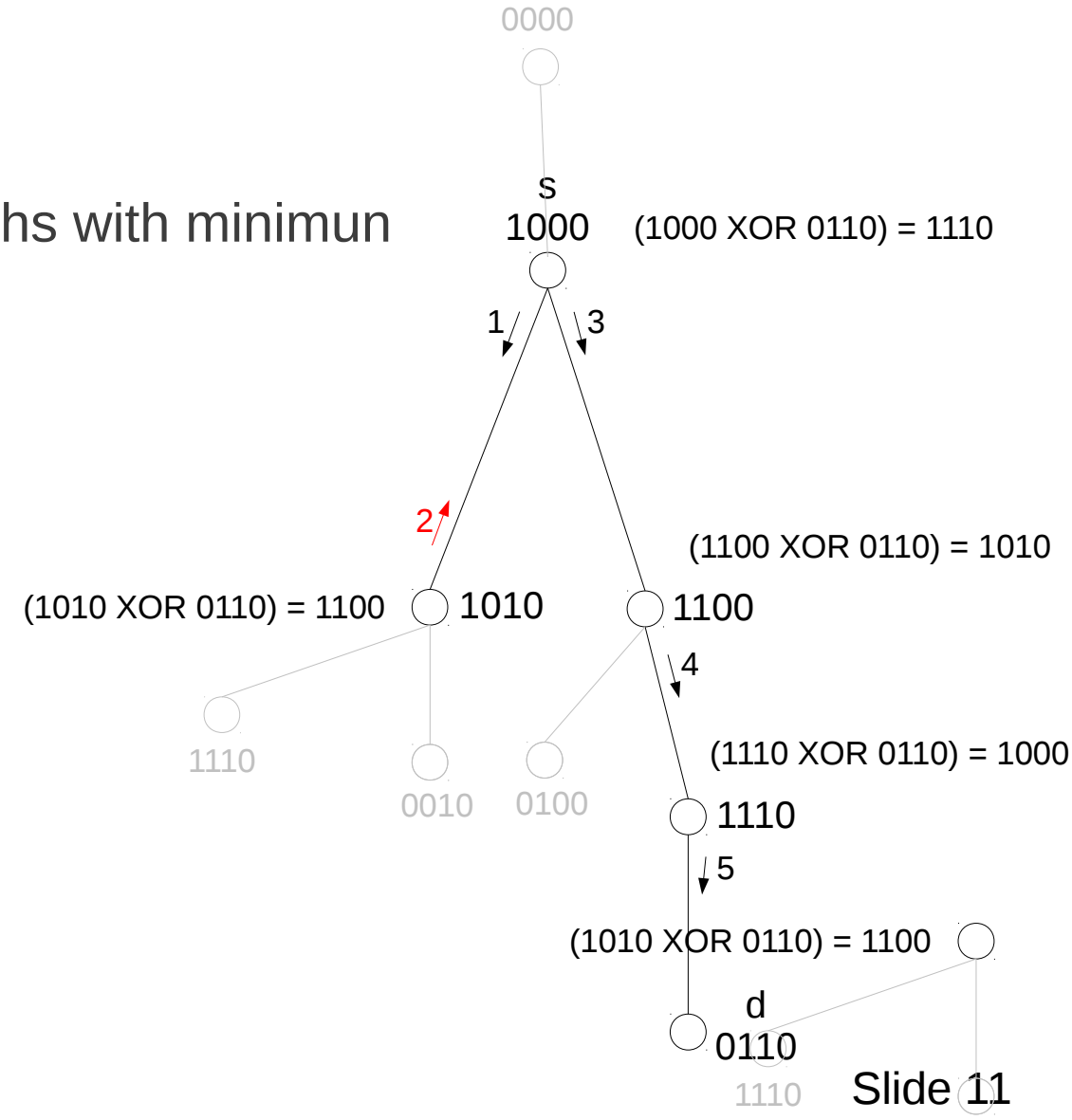
Reactive routing

- No a-priori knowledge.
- Standard hypercube routing.
- Stores unsuccessful paths.
- Routes messages through paths with minimun distance to the destination.





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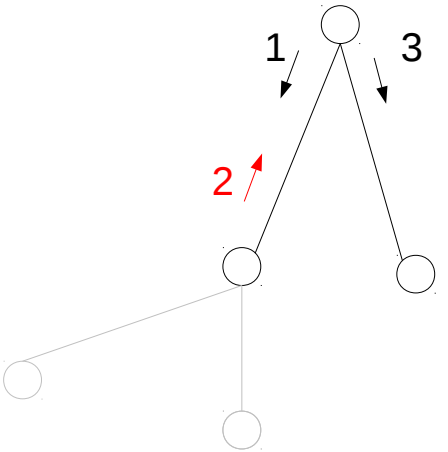
Reactive routing

- If a message cannot be routed, it should be sent backwards and then send it through a differente route.
- The message is marked as 'returned' to prevent loops.



- To mark the message is not enough to guarantee the correct delivery of all messages.
- All used routes are stored in a *Visited BitMap.*

Visited Bitmap

Destinations			
1000	0	1	0
0101	1	0	0

Neighbors Map		
0100	1100	0111

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- Q&A