Building Reliable and Fault Resilient Mobile Ad Hoc Networks

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Mobile Ad-Hoc

- Connected with wireless link

- Union of arbiter graph

- Nodes are Free to move randomly

- Self organizing

- Changing wireless topology

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Characteristics

- Equal node capabilities
  - root node have the capability of initiating enumeration

- Distributed architecture

- Self organizing

- Wireless connectivity

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Reliability Fault Resilience Trade off

- Reliability
  - Extra information on each node
    - Multiple route paths

- Trade off
  - No of route paths to
    - Resolve
    - Maintain

- Suggested Approach
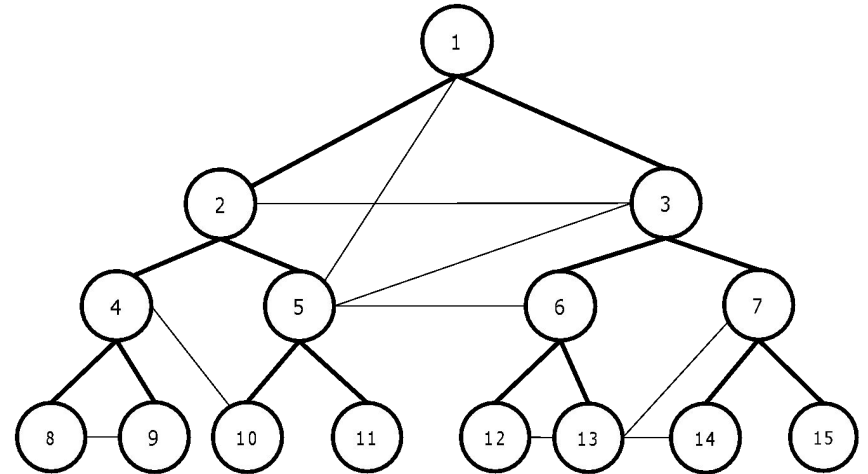 - Utilizing adjacency matrix with special cycles

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Graph Approach

- Each node is aware of its neighbors

- Build tree based on wireless reachable

- A sub graph from the all possible connectivity graph
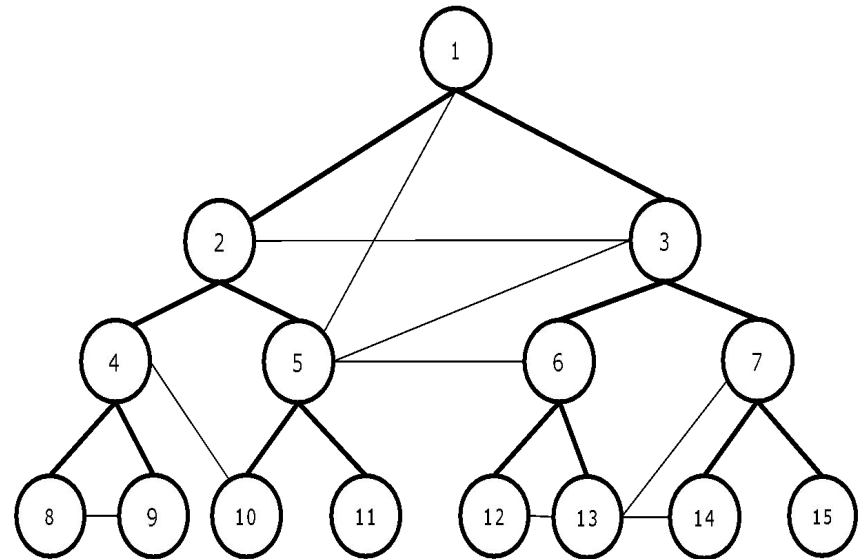
Binary tree and cycle

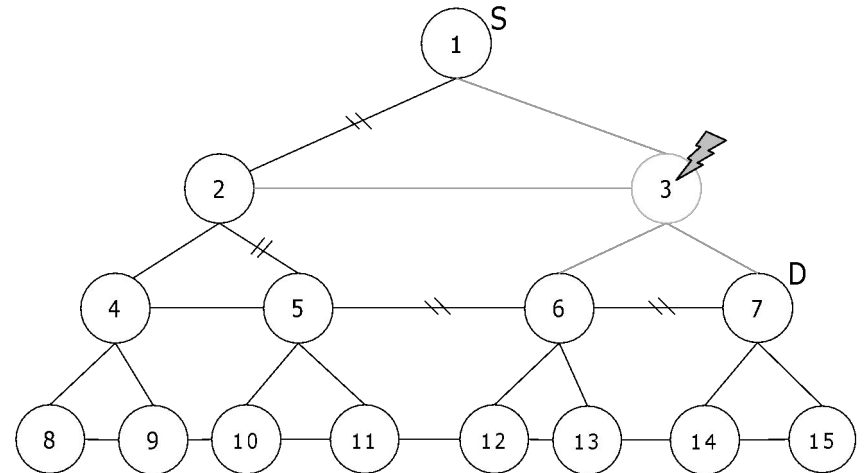- Make adjacency matrix based on first two short paths

- Consider only Node deletion
  - Is consider more severe than edge deletion

- Type 1 and Type 2 cycles also used

Topology Building

Building and propagating of Adjacency matrix

- Tree Pass
  - Simple
  - Good for balanced tree structured network

- Five Pass
  - More broadcast required
  - Good for Unbalanced tree structured network

Three Pass

- – Binary_Enumeration

- – Binary_Enumeration_Reply

- – Binary_Broadcast

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Root Node

1

4

8

2

15

3

9

7

5

6

10

11

12

14

13

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Binary Enumeration

Adjacency matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
3	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0
4	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0
5	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0
6	0	0	1	0	1	0	1	0	0	0	0	1	1	0	0
7	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1
8	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0
9	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0
10	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0
11	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
12	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0
13	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0
14	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1
15	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0

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Binary Enumeration

Adjacency matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
3	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0
4	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0
5	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0
6	0	0	1	0	1	0	1	0	0	0	0	1	1	0	0
7	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1
8	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
9	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0
10	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0
11	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0
12	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0
13	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0
14	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1
15	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0

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Binary Enumeration

Adjacency matrix
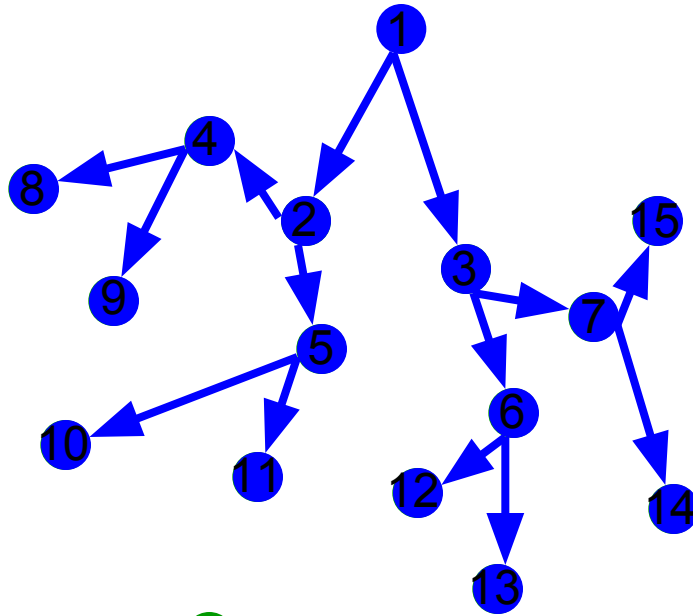
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
3	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0
4	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0
5	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0
6	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Five Pass

- Binary_Join_Cycle

- Binary_Node_Count

- Binary_Second_Numbering
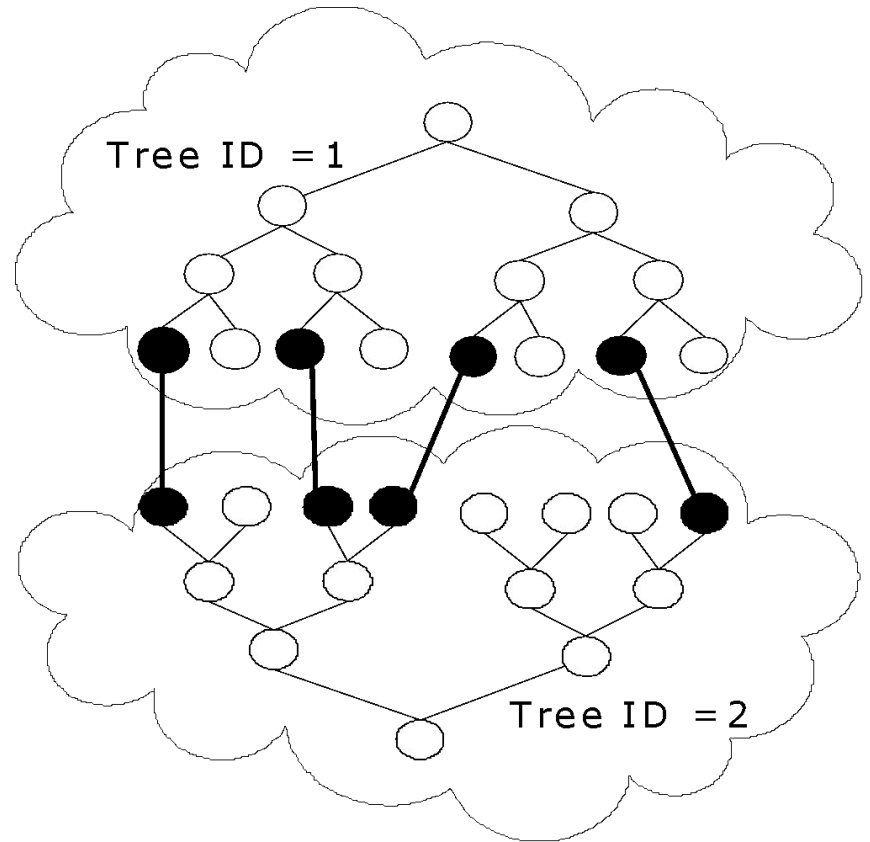
- Binary_Consolidate_Toplogy

- Binary_Broadcast_Topology

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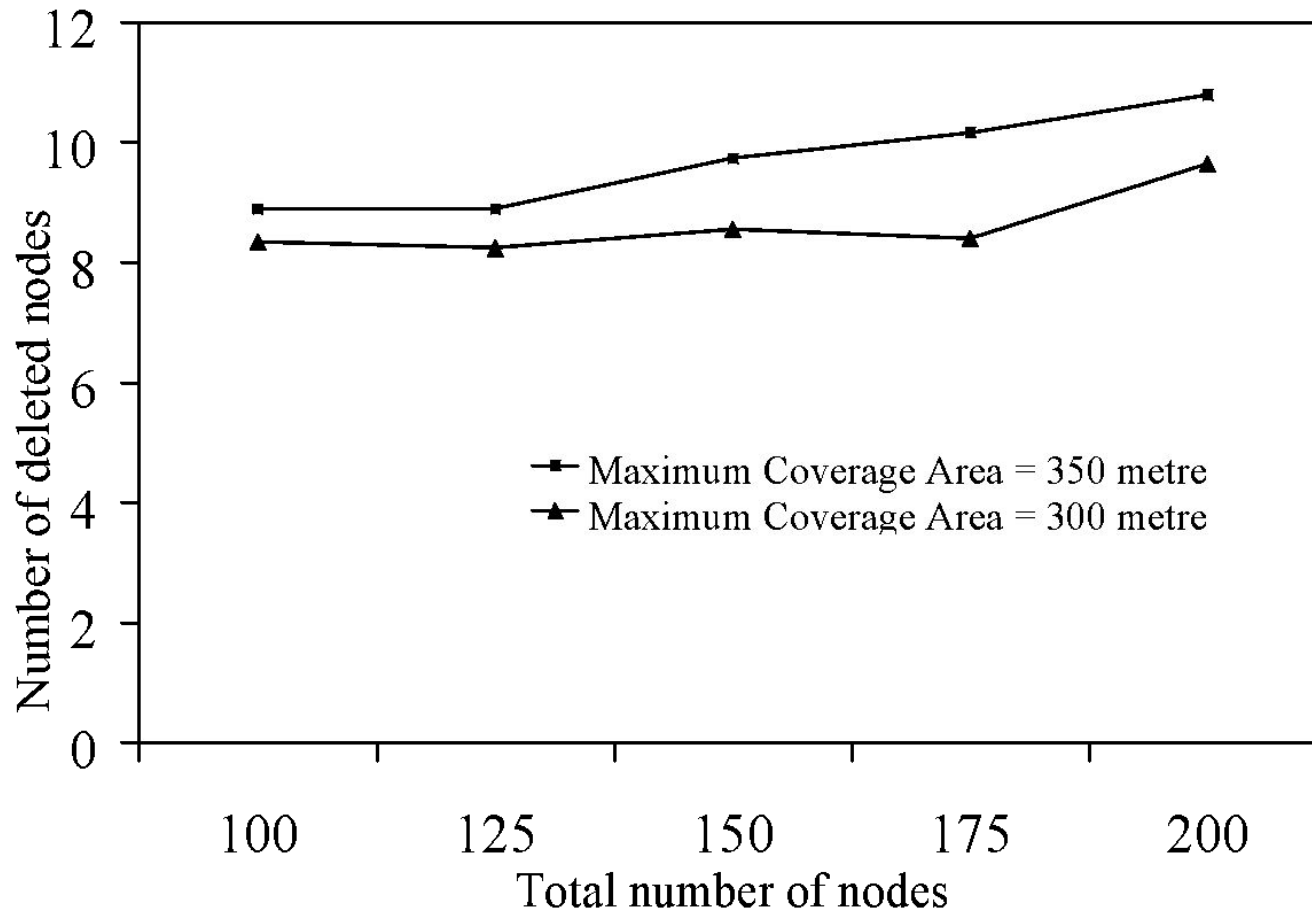# Why require five pass

- ## Unbalance tree

- ## Reduce the size of adjacency matrix
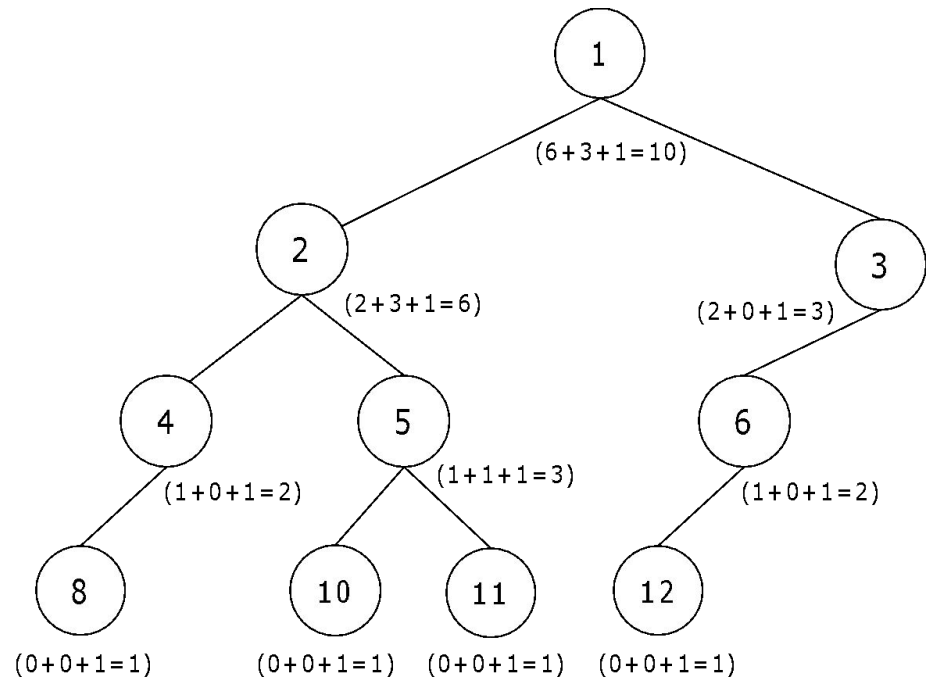
Interconnecting Tree

- Edge nodes are responsible for inter tree communication
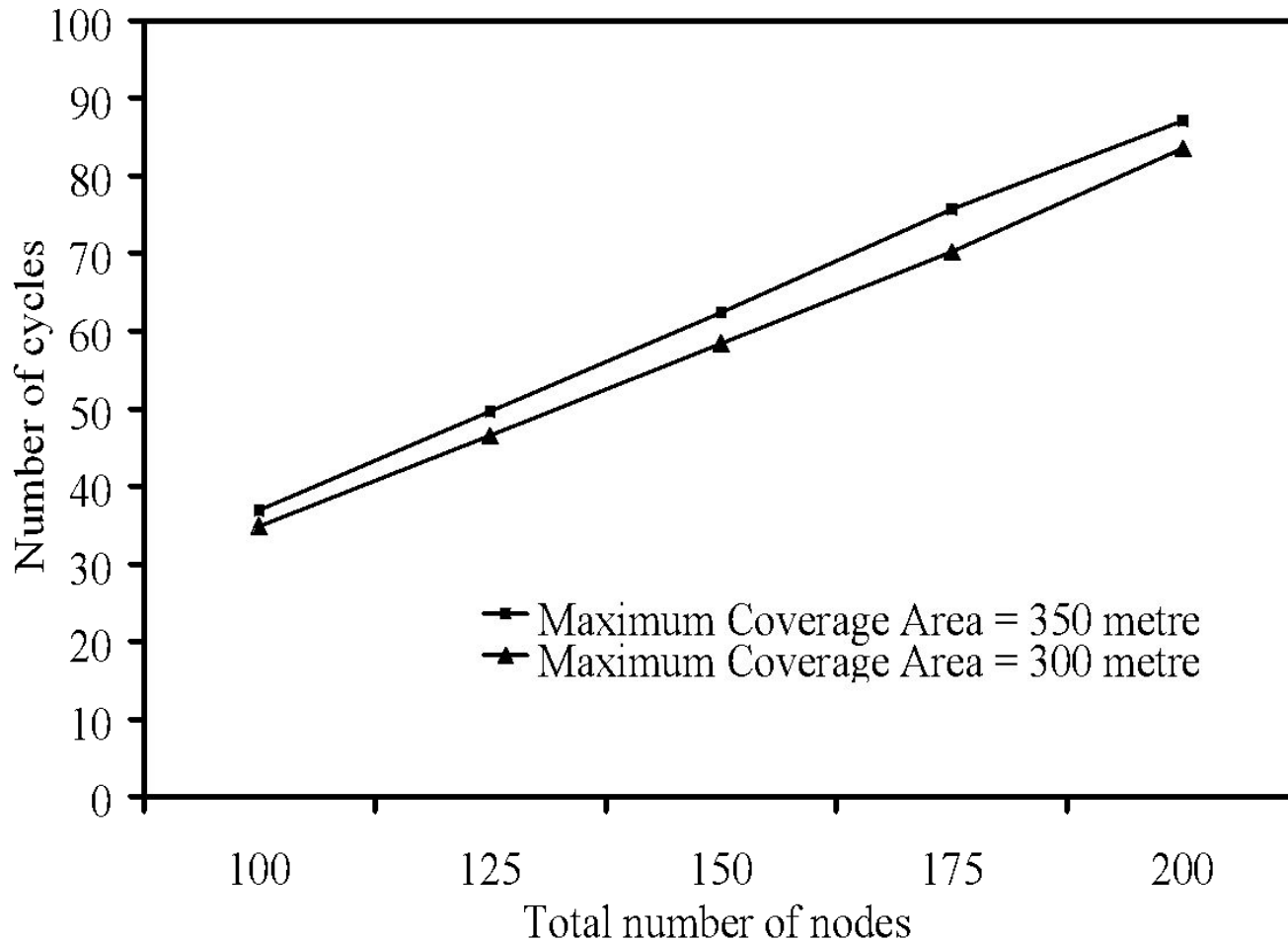
- Differentiated based on Tree ID

Tree ID = 1

Tree ID = 2

Simulation results

Total number of nodes vs. Number of deleted nodes

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Total number of nodes vs. Number of cycles

Total number of nodes vs. Number of deleted nodes

Number of nodes deleted for a sample of 100 nodes	Number of nodes deleted for a sample of 200 nodes	Number of Unreachable nodes
20	24	5
41	45	10
57	62	15
59	67	17
-	72	18
-	76	20
-	75	22
-	-	23

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Thank You

Questions ?

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