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Automated Coding of Stream-Order or: SQL Magic in GIS

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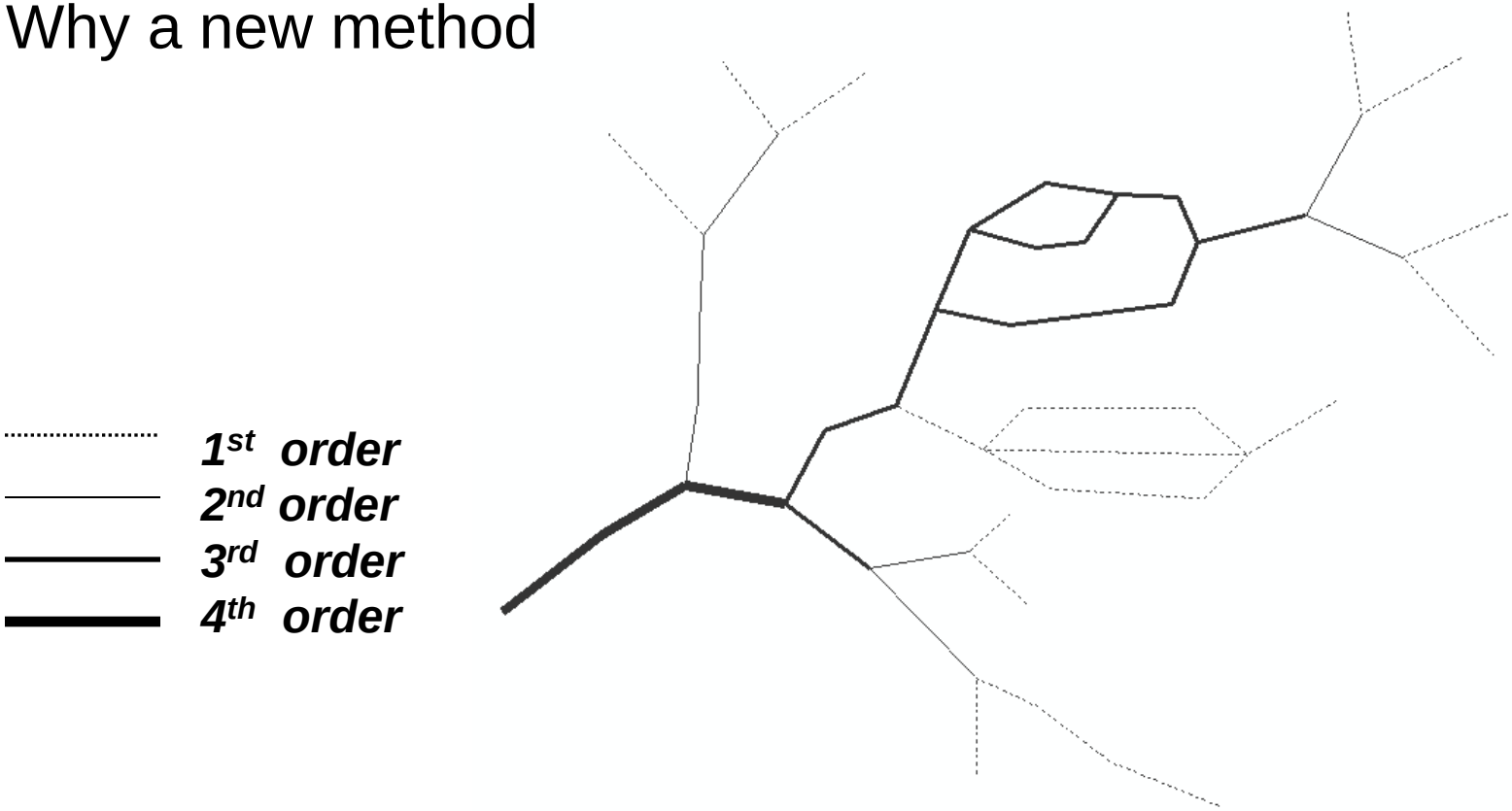
Canada

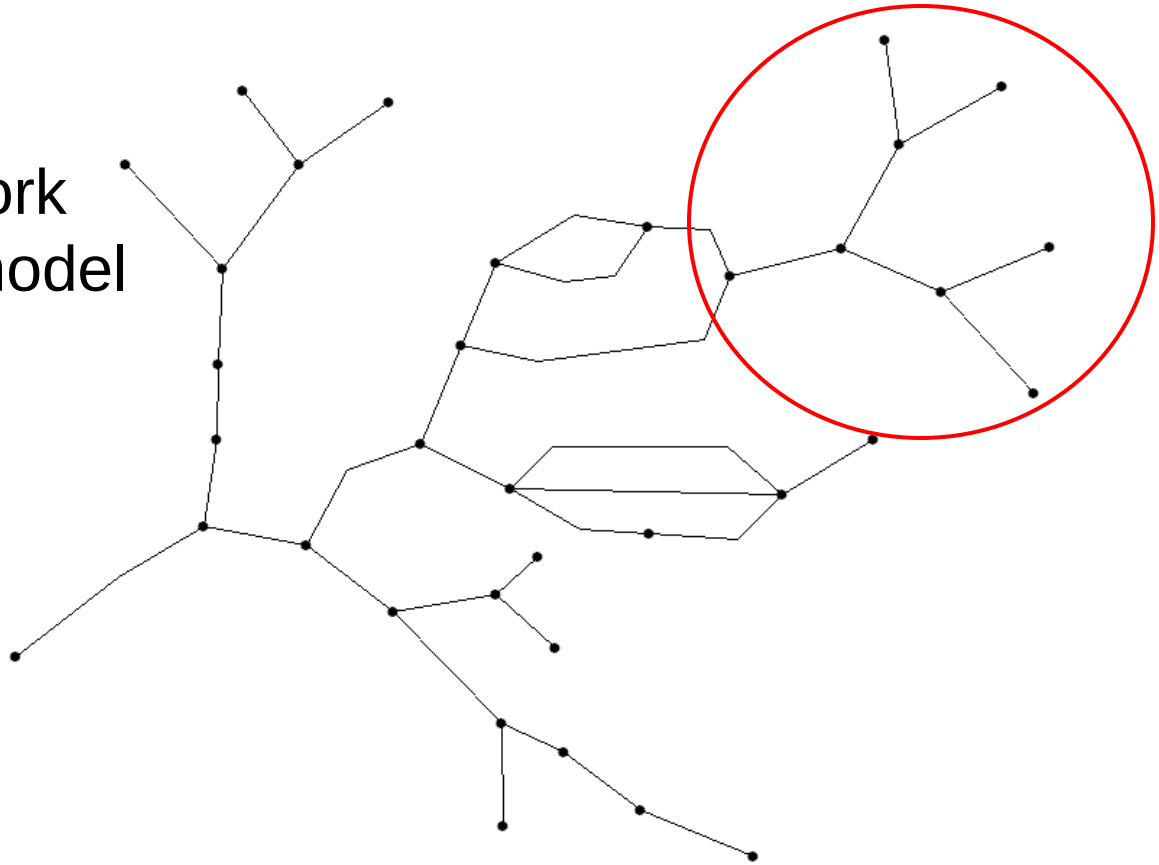
The sample network

- Strahler order coding
- Why a new method



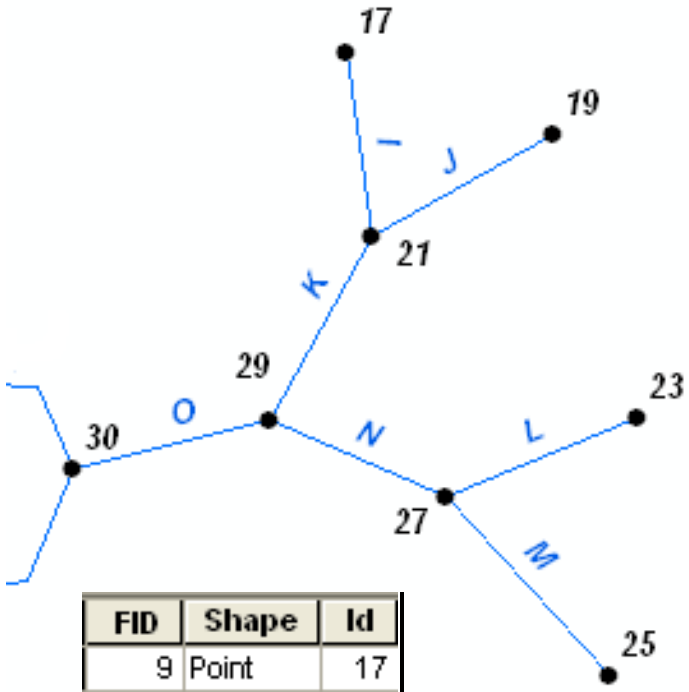
Network representation

- Geometric network
- Implicit network
  data structure
- No explicit network
  data structure/model



Explicit network data model

- Network topology
- Connectivity
- From-to-node notation



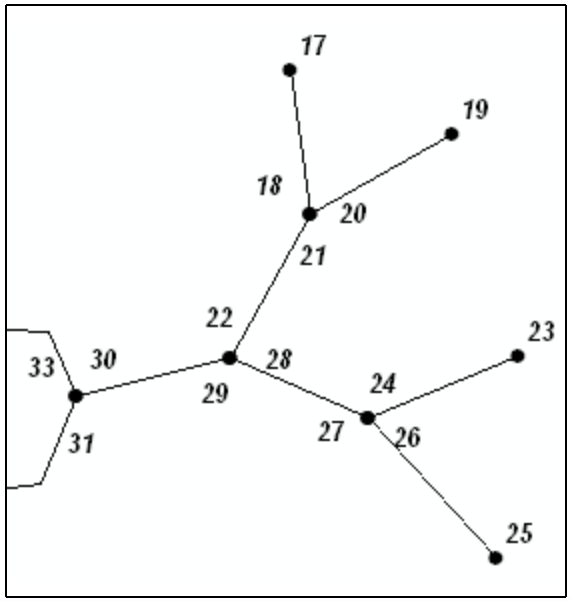
FID	Shape	Segment	From-node	To-node
8	Polyline	I	17	21
9	Polyline	J	19	21
10	Polyline	K	21	29
11	Polyline	L	23	27
12	Polyline	M	25	27
13	Polyline	N	27	29
14	Polyline	O	29	30
15	Polyline	P	30	41

FID	Shape	Id
9	Point	17
10	Point	19
11	Point	21
12	Point	23
13	Point	25
14	Point	27
15	Point	29

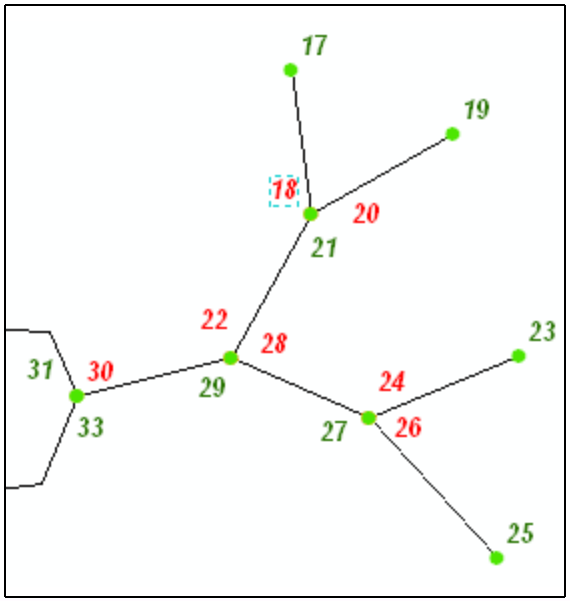
Create network data structure

- From geometric data structure
- To topological network data model

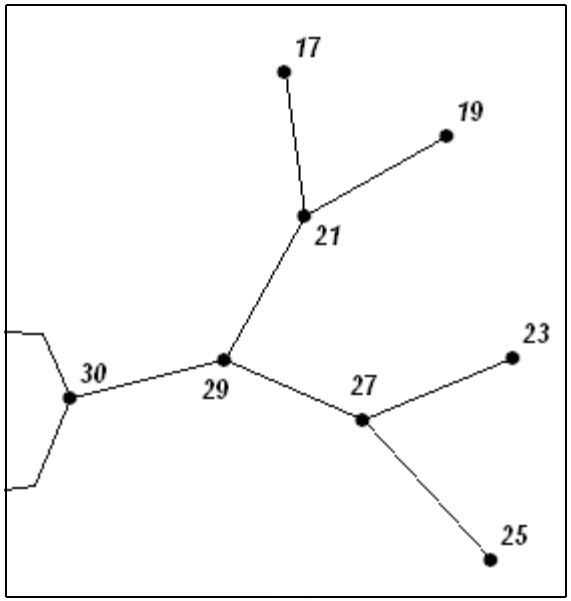
Create nodes
Start & end nodes



Spatial join
Confluence or braiding



Node removal
Remove duplicate nodes

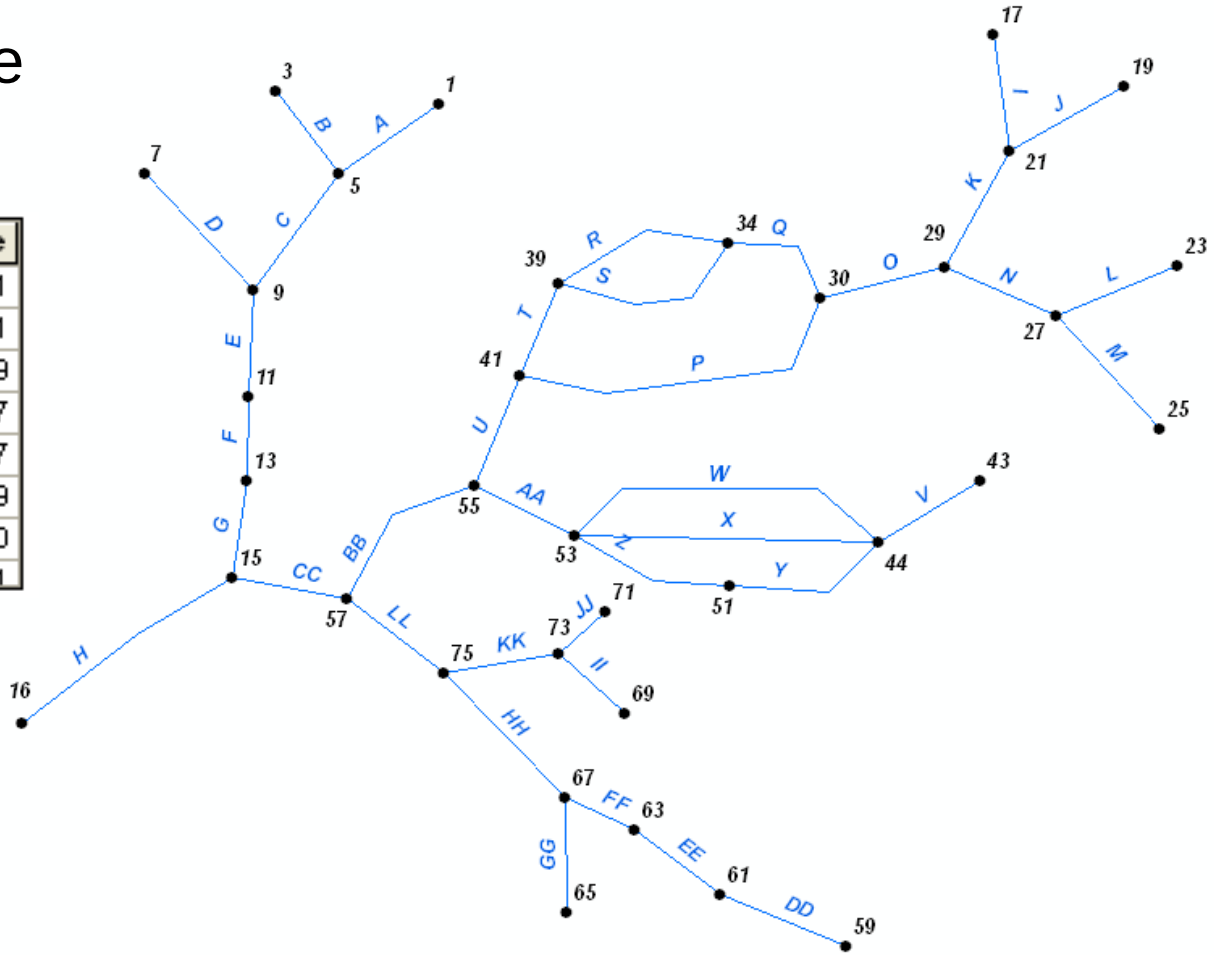


Topological network data model

- Segment table
- Node table

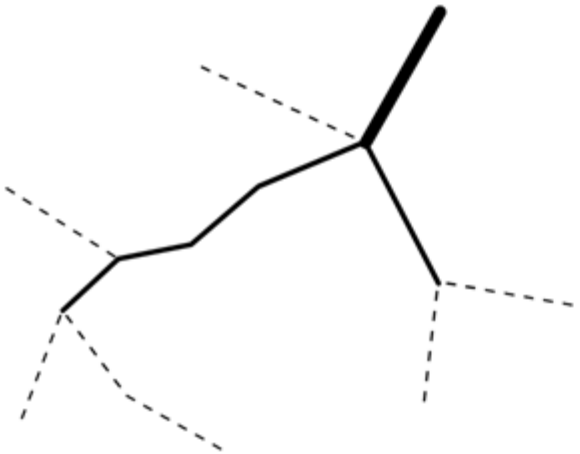
Segment	From-node	To-node
I	17	21
J	19	21
K	21	29
L	23	27
M	25	27
N	27	29
O	29	30
P	30	41

Node-ID
17
19
21
23
25
27
29

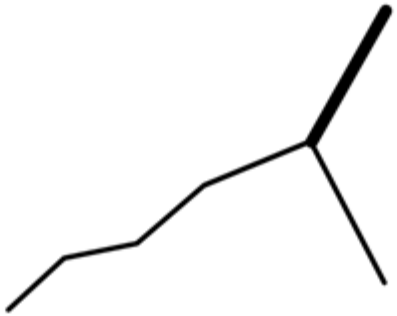


Strahler order coding rules

- Iterative elimination of upper-most branches
- Special cases: bridges, braided streams



Network at
Strahler-Order 1



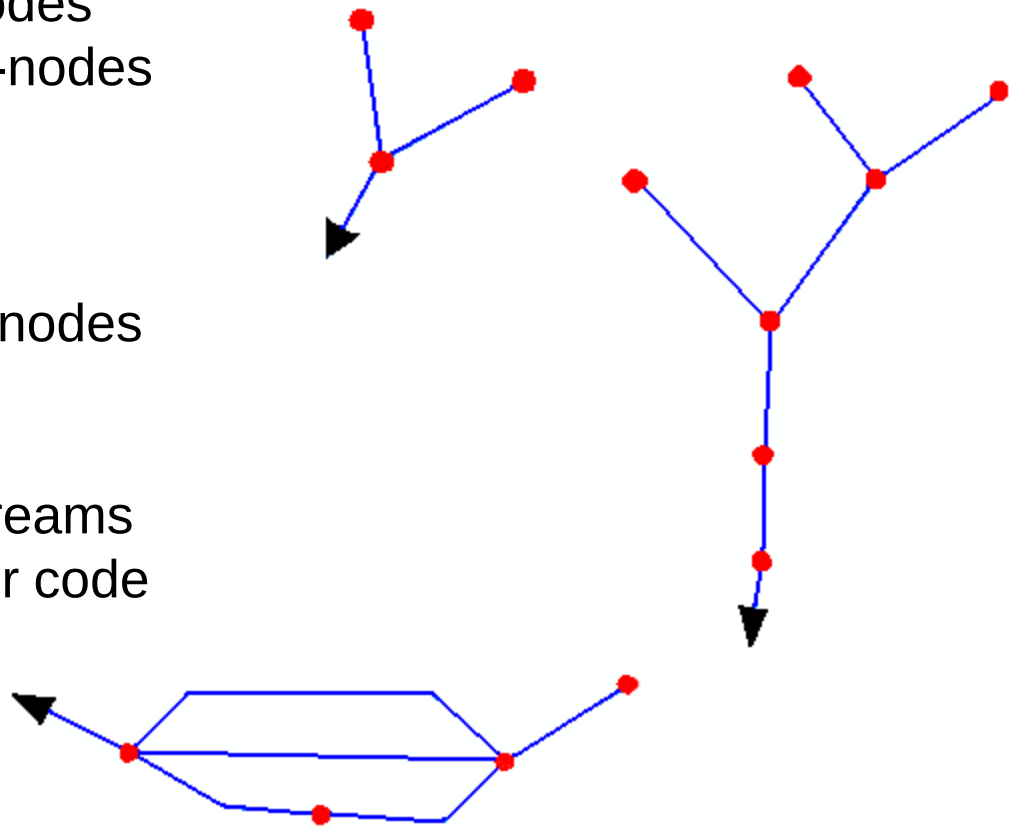
Network at
Strahler-Order 2

Network at
Strahler-Order 3

Strahler order coding rules

- SQL implementation

- Segments whose From-nodes have no corresponding To-nodes
- Find bridge segments
- Find nodes that are From-nodes of more than one segment
- Confluences of braided streams keep highest Strahler order code



Uppermost segments

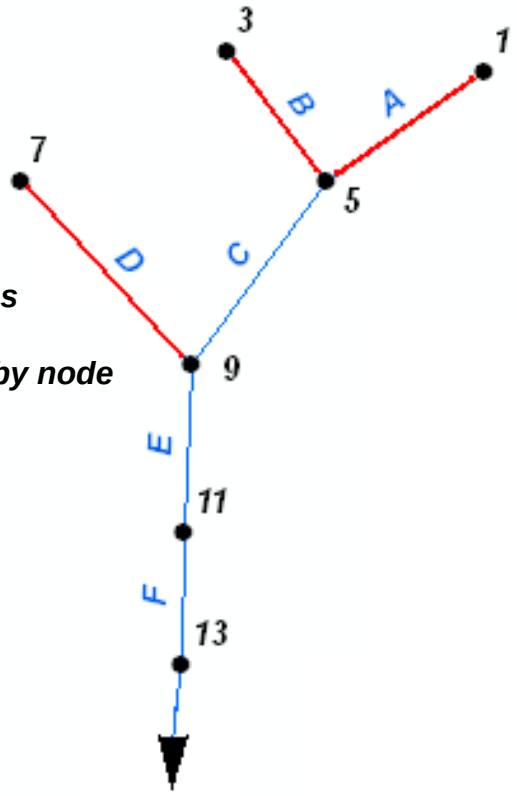
- From-nodes without corresponding To-nodes

- Summarize To-nodes
- Relate From-nodes to To-nodes
- “Unrelated” From-nodes are part of uppermost segments
- Code segments

create view end_node_frequency as
select node, count(node) as
frequency from end_nodes group by node

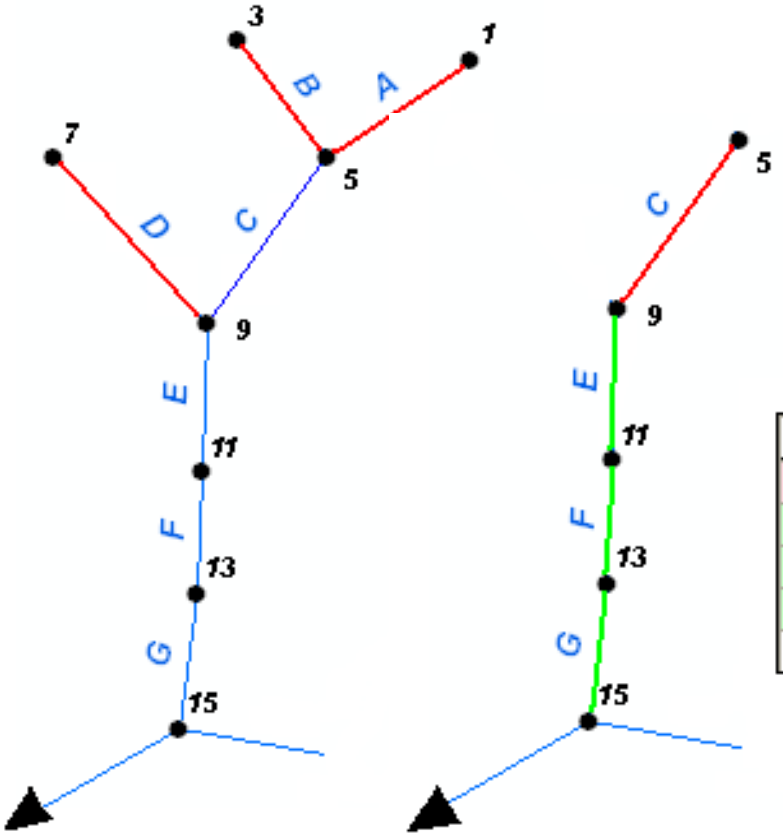
Segment	From-node	To-node
A	1	5
B	3	5
C	5	9
D	7	9
E	9	11
F	11	13
G	13	15
H	15	16

To-node	Frequency
5	2
9	2
11	1
13	1
15	2
16	1
21	2
27	2



Bridge segments

- From-nodes with a single To-node



create view bridge_nodes as
*select * from end_node_frequency*
inner join segments on
end_node_frequency.node = segments.to_node
where end_node_frequency.frequency = 1 and
segments.code = segments.curr_ord

Segment	From-node	To-node
C	5	9
E	9	11
F	11	13
G	13	15
H	15	16

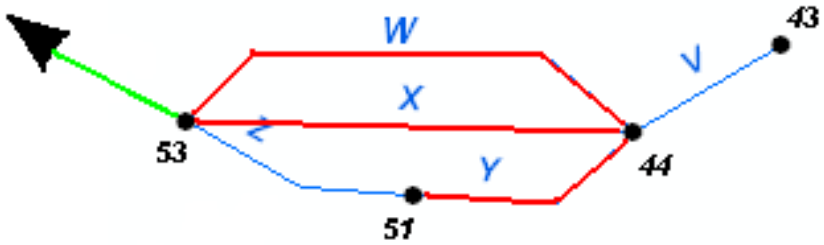
To-node	Frequency
9	1
11	1
13	1
15	2
16	1

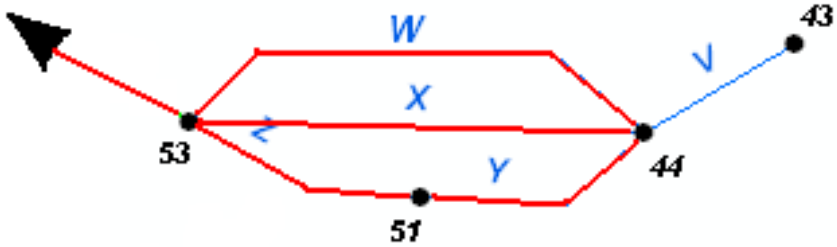
Braided streams

- Start at To-nodes with multiple From-nodes
- Code bridge segments
- Keep highest order at downstream confluences

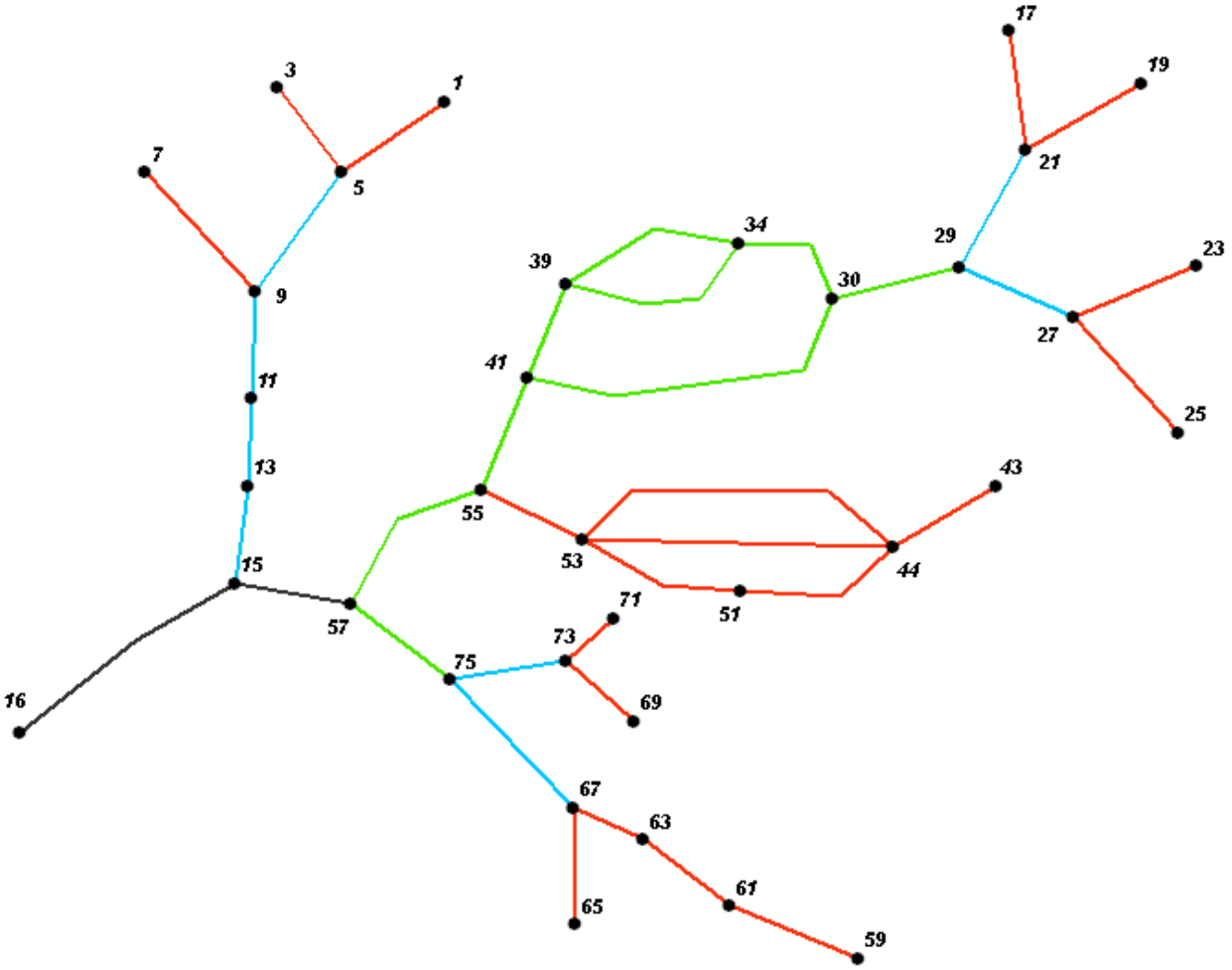
Segment	From-node	To-node
V	43	44
W	44	53
X	44	53
Y	44	51
Z	51	53
AA	53	55
BB	55	57

Start-node	Frequency
44	3
51	1
53	1
55	1
57	1





Resulting Network



Magic of Attribute

- Quality control & efficiencies

- Find gaps easily
- Nightly updates of database because of attribute changes
- Good database design/database normalization
- Faster more reliable updates