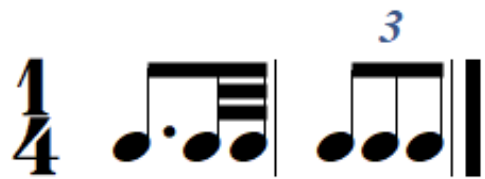# Rhythm Nested Words

- Alur & Madhusudan's [nested words](#) (NW) can be used instead of trees to represent rhythm notation
- and hence weighted NW-automata (or weighted-VPDA) instead of WTA (with attributes)

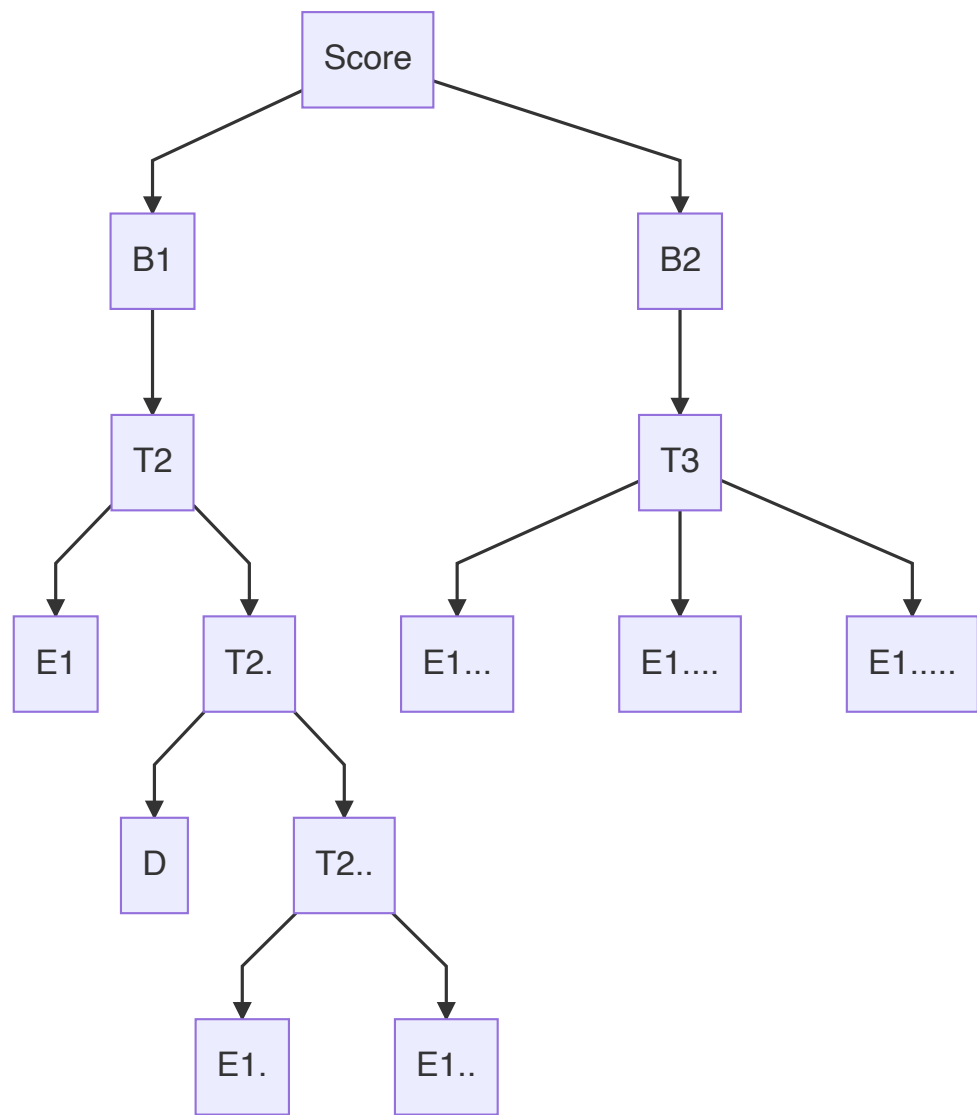advantage: attribute propagation is simpler with W-VPDA: push attributes values to the stack

see also [Nested Words](#)

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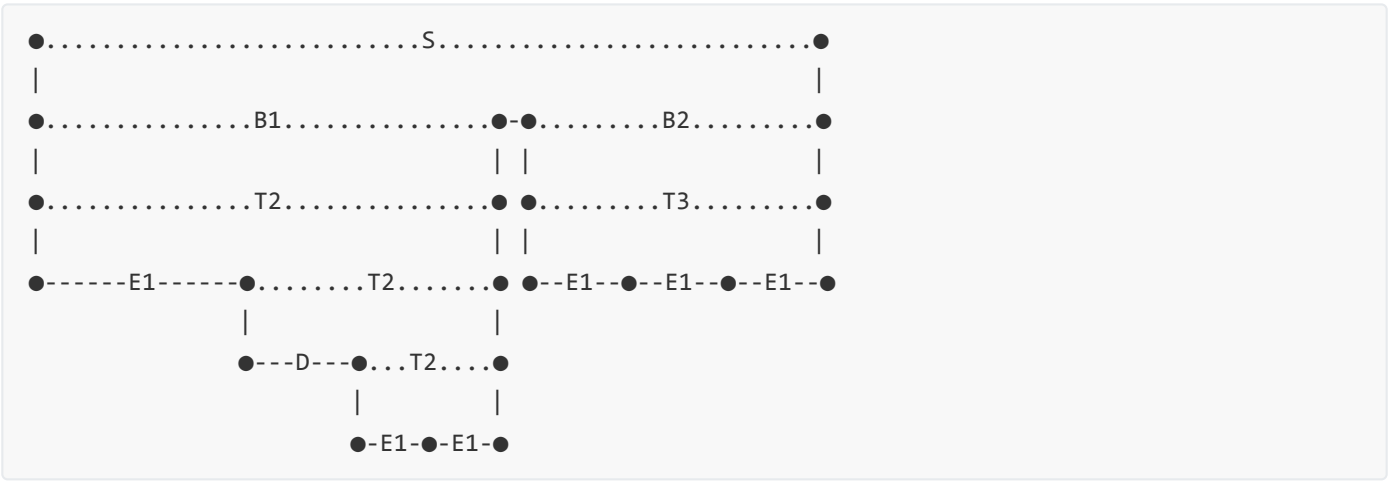example MCM'19 1 see [example MCM'19](#)



MTU timestamps: 0 3/4 7/8 | 1 4/3 5/3

**rhythm tree**

**nested-word** with explicit symbols for begin and end of match

representation of leaves with 2 symbols (too much nesting) (not exactly original def. of Alur Madhusudan, similar to VPDA)
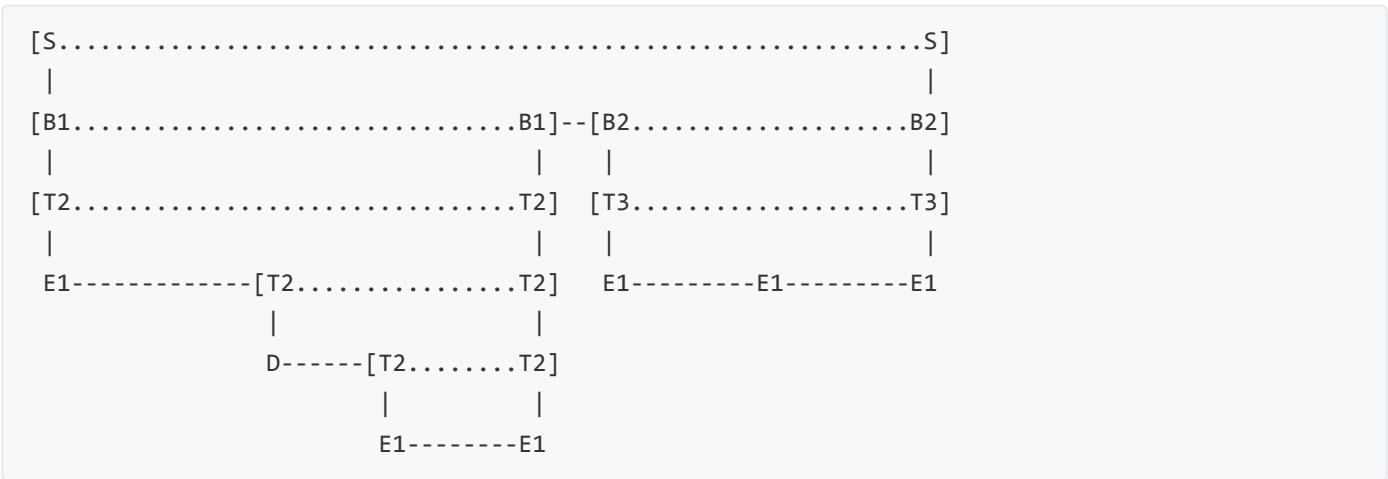
```
●............................S.............................●
|                                                    |
●...............B1.................●-●.........B2.........●
|                               | |                  |
●...............T2.................● ●.........T3.........●
|                               | |                  |
●------E1------●.........T2.......● ●--E1--●--E1--●--E1--●
              |                 |
         ●---D---●...T2....●
              |         |
            ●-E1-●-E1-●
```

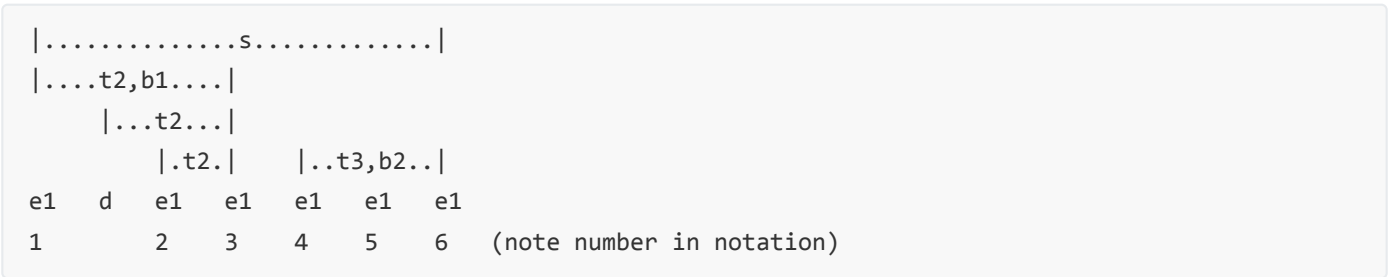**nested-word** with leaves as internals. the word becomes

`[S [B1 [T2 E1 [T2 D [T2 E1 E1 T2] T2] B1] [B2 [T3 E1 E1 E1 T3] B2] S]`

nested presentation:

- the edges `--` and `|` are `next-symbol` relationship in word
- the edges `..` are matching relationship

```
[S.......................................................S]
 |                                                       |
[B1....................................B1]--[B2.....................B2]
 |                                      |    |                       |
[T2....................................T2]   [T3....................T3]
 |                                      |    |                       |
 E1------------[T2................T2]   E1---------E1---------E1
              |                 |
         D------[T2........T2]
              |         |
            E1--------E1
```

ALT: dropping the requirement that match do not share positions (see Blass, Gurevitch 2006),

```
|...............s..............|
|....t2,b1....|
     |...t2...|
        |.t2.|     |..t3,b2..|
 e1   d   e1   e1   e1   e1   e1
 1        2    3    4    5    6    (note number in notation)
```

example MCM'19 2

MTU timestamps: 0 3/4 | 1 1 4/3 5/3

**tree**
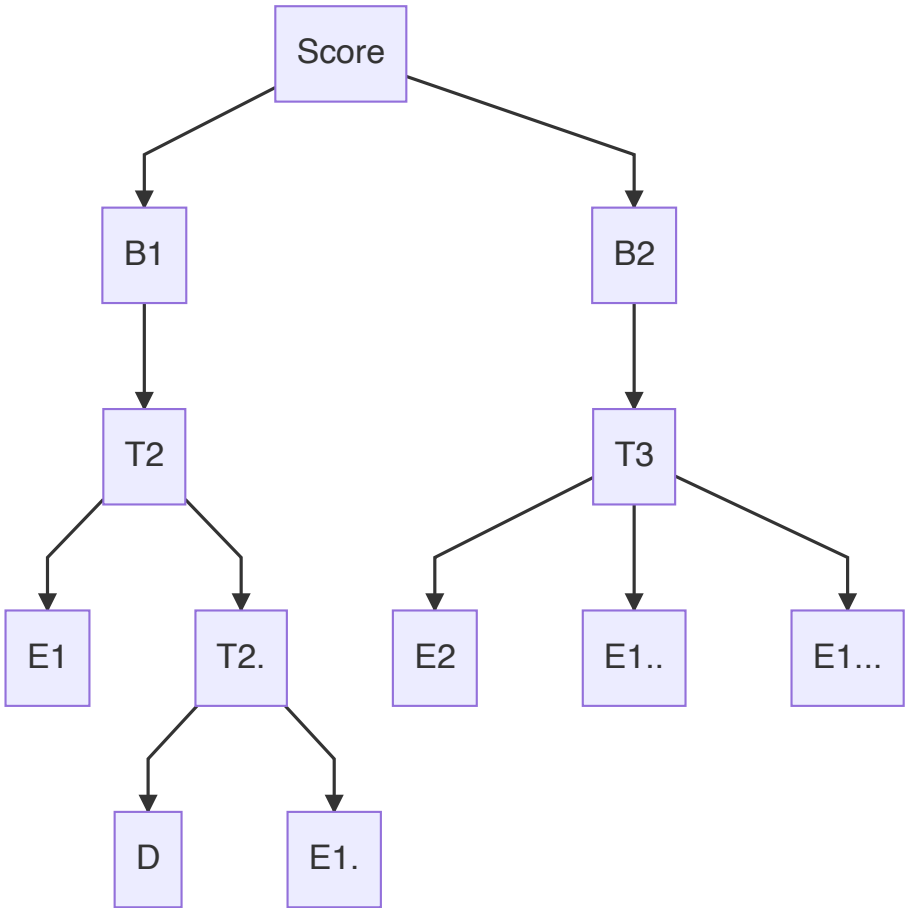


**nested-word** with too much nesting

```
●..........................S........................●
|                                                   |
●............B1............●-●........B2.........●
|                         | |                    |
●............T2............● ●........T3.........●
|                         |                     |
●------E1------●......T2....● ●--E2--●--E1--●--E1--●
              |            |
              ●--D--●--E1--●
```
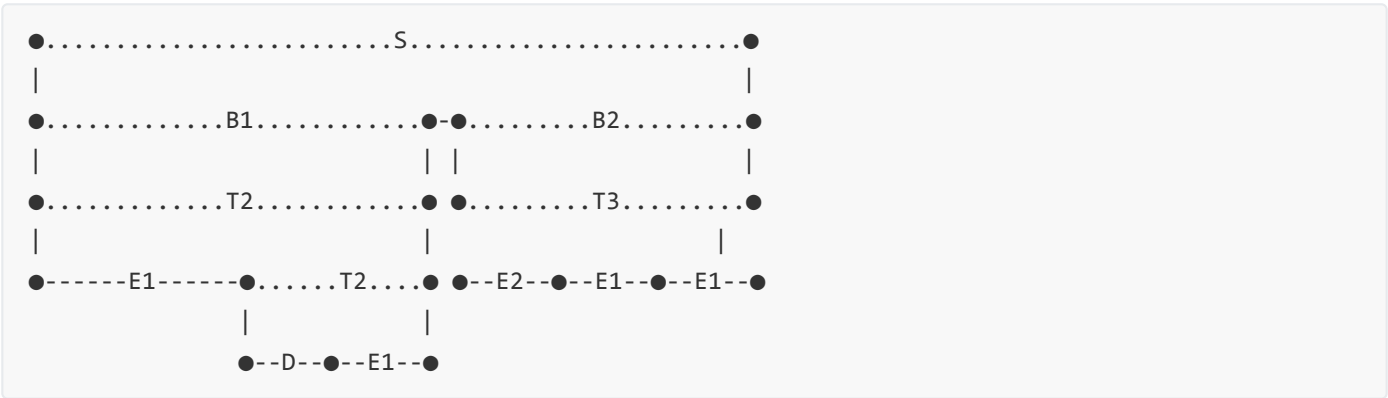
**nested-word** with leaves internal

```
[S [B1 [T2 E1 [T2 D E1 T2] T2] B1] [B2 [T3 E2 E1 E1 T3] B2] S]
```

nested presentation:

```
[S.................................................S]
 |                                                 |
[B1........................B1]--[B2....................B2]
 |                        |     |                       |
[T2........................T2]  [T3....................T3]
 |                        |     |                       |
 E1------------[T2........T2]   E2---------E1---------E1
                   |         |
              D---------E1
```
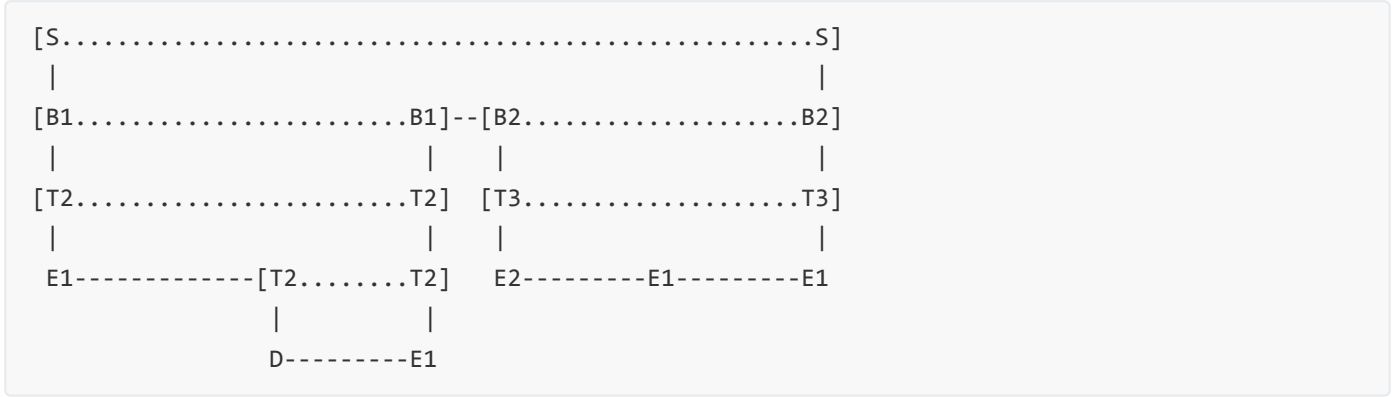
**ALT**

```
|............s............|
|..t2,b1..|      |..t3,b2..|
    |.t2.|
e1    d    e1    e2   e1    e1
1          2     3,4  5     6
```

DRAFT: first **nested-word** (sequence chart version)