DYNA26

APL Primitives in the 21st Century

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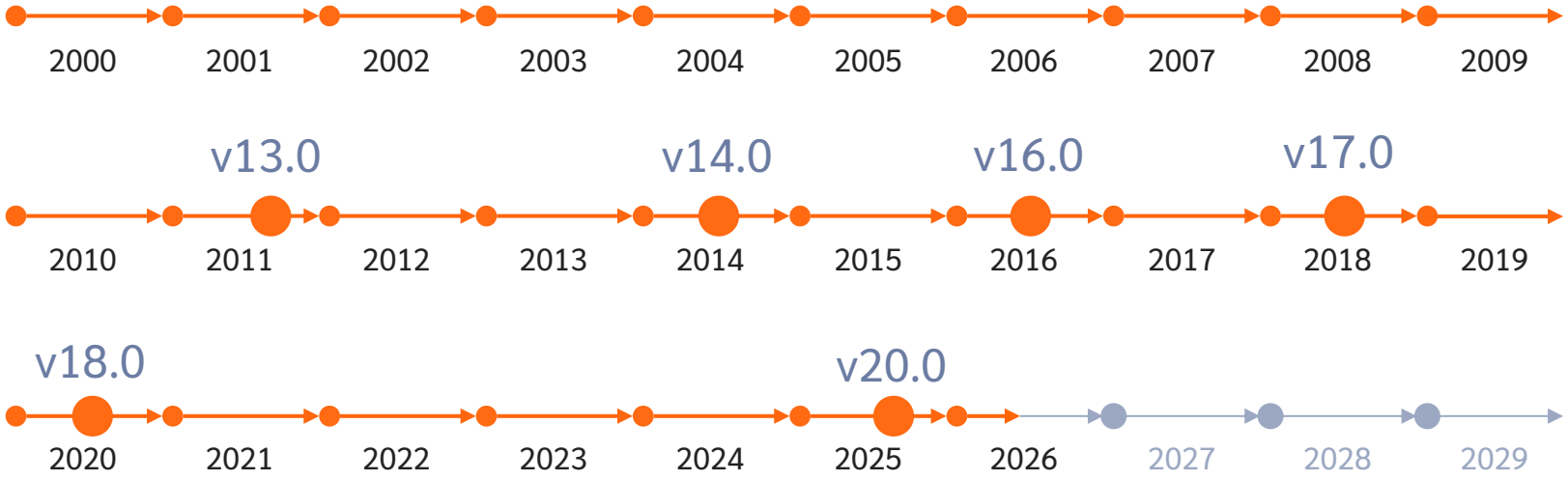
The 21st Century



Leading Axis Theory

- More of a design principle
- Primitives should work with the *major cells* of an array
- The *Rank operator* (⍤) can then be used to work on other axes

What even is a major cell?

```
      ⊢m←4 4⍴⎕A
ABCD
EFGH
IJKL
MNOP
```

```
      m[2 4;]
EFGH
MNOP
```

Working on the leading axis

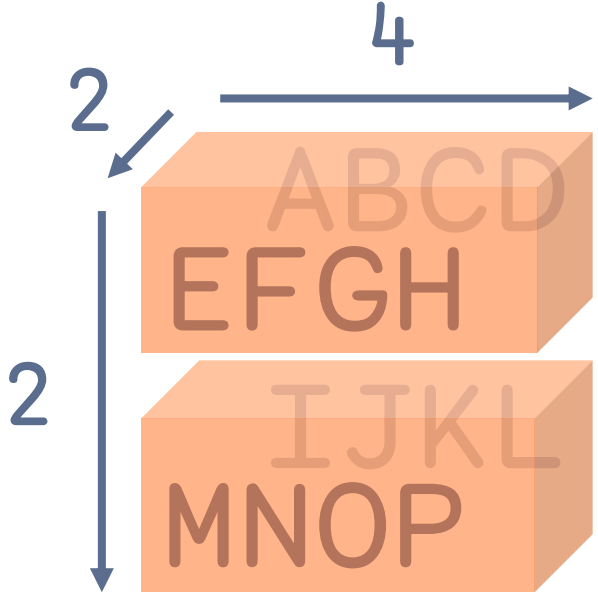
```
      ⊢m←4  4⍴⎕A
ABCD
EFGH
IJKL
MNOP
```

```
      ⌽m
DCBA
HGFE
LKJI
PONM
      ⊖m
QRST
MNOP
IJKL
EFGH
```

What even is a major cell?

```
      ⊢m←2 2 4⍴⎕A
ABCD
EFGH

IJKL
MNOP
```



Working on the leading axis

```
      ⊢m←2 2 4⍴⎕A
ABCD
EFGH

IJKL
MNOP
```

```
      ⊖m
IJKL
MNOP

ABCD
EFGH
```

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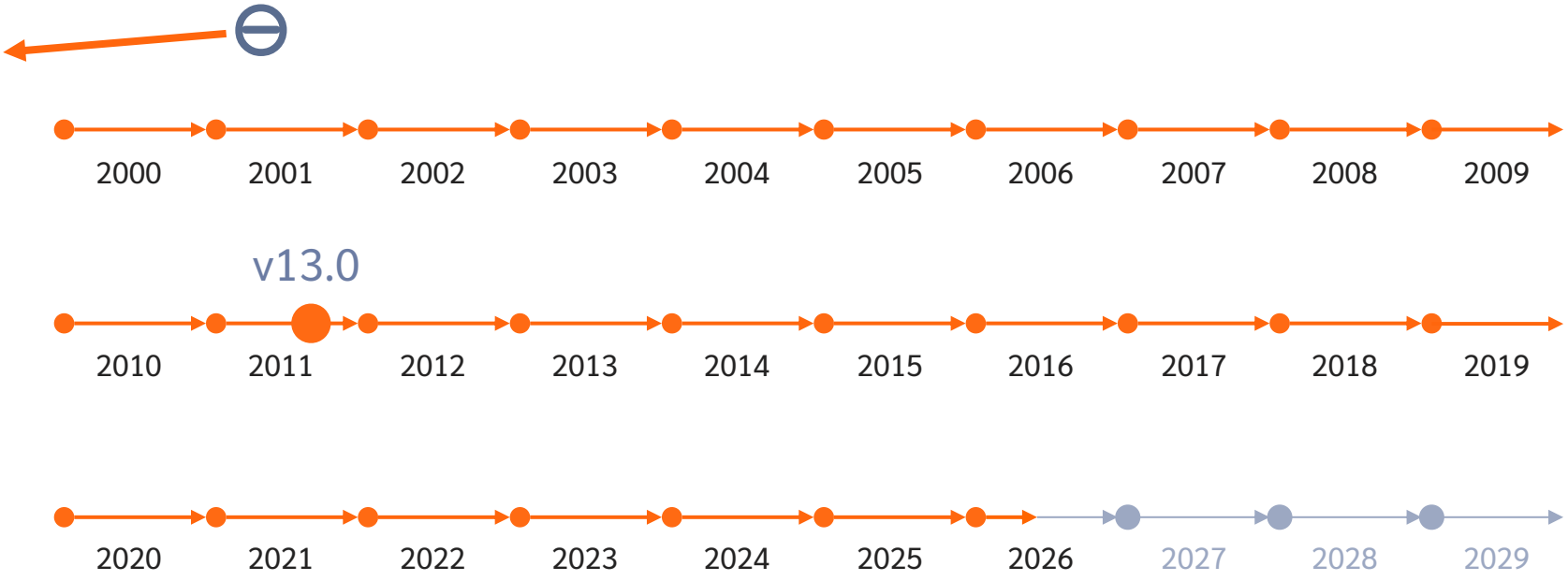

v13.0: Short left arguments

```
      ⊢m←3  3ρ⎕A
ABC
DEF
GHI

      2  2↑m
AB
DE
```

```
      2  3↑m
ABC
DEF

      2↑m
ABC
DEF
```

v13.0: Short left arguments

```
      ⊢m←3 3ρ⎕A
ABC
DEF
GHI
      (1 2)(1 2)⌷m
AB
DE
```

```
      (1 2)(1 2 3)⌷m
ABC
DEF
      (⊂1 2)⌷m
ABC
DEF
```

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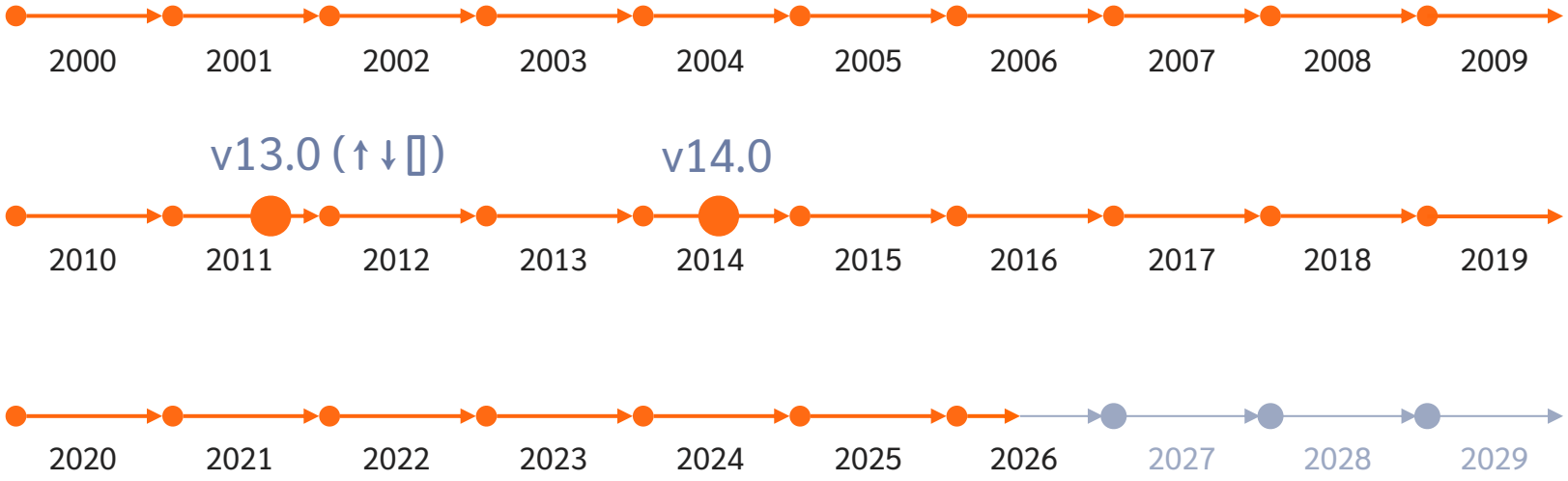

v14.0: ≢

```
      ⊢m←2 3 4⍴⎕A                ≢m
ABCD                             2
EFGH
IJKL

MNOP
QRST
UVWX
```

Index-of

```
        'ABC'⍳'A'
1

        'ABC'⍳'ABBAC'
1  2  2  1  3
```

v14.0: Index-of Extended

```
      ⊢m←↑'Alice' 'Bob' 'Charlie'
Alice
Bob
Charlie

      m⍳↑'Alice' 'Bob' 'Bob' 'Alice' 'Charlie'
1 2 2 1 3
```

v14.0

- The Rank operator (⍤)
- The Key operator (⌸)

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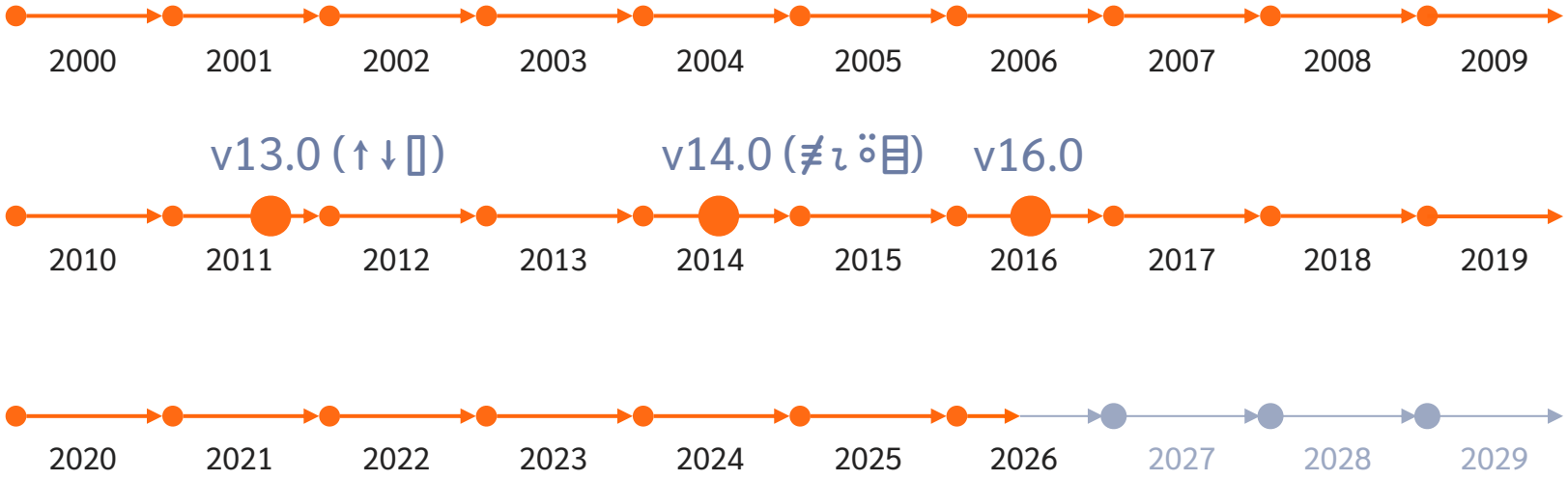

v16.0: Interval Index (⍸)

```
      ⊢m←↑'Alice' 'Bob' 'Charlie'
Alice
Bob
Charlie
      m⍸↑'Andrew' 'Roberta'
1 3
```

v16.0

- The Stencil operator (⍰)
- The At operator (@)

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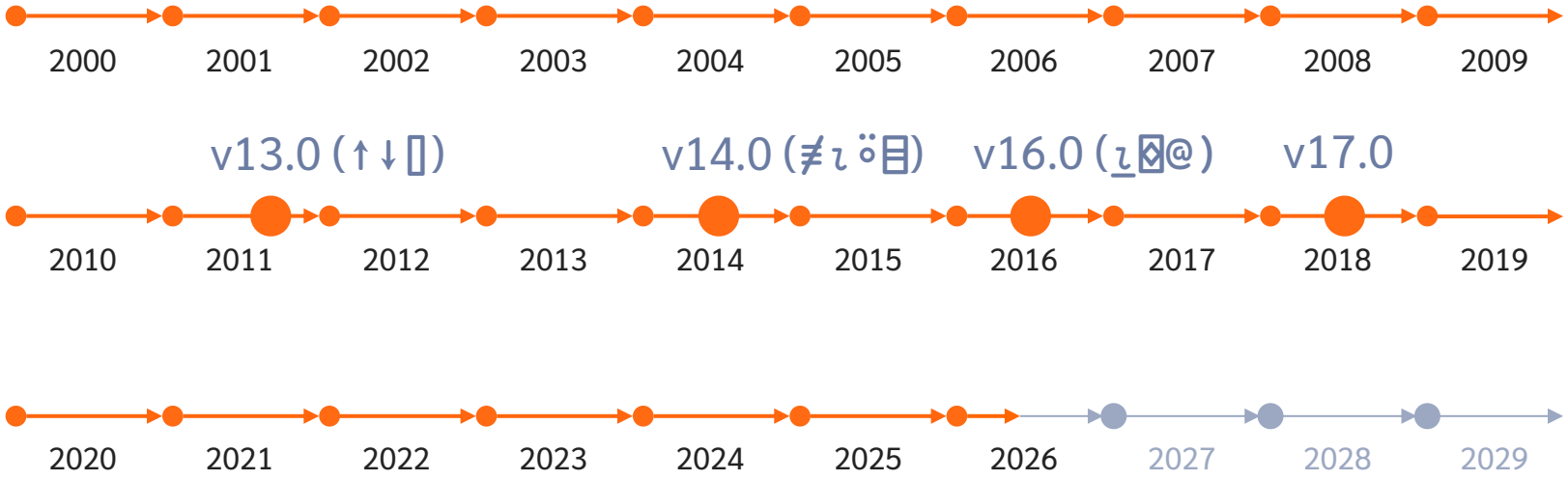


v17.0: Unique (ᴜ)

```
      ᴜ'MISSISSIPPI'
MISP
```

v17.0: Unique (∪)

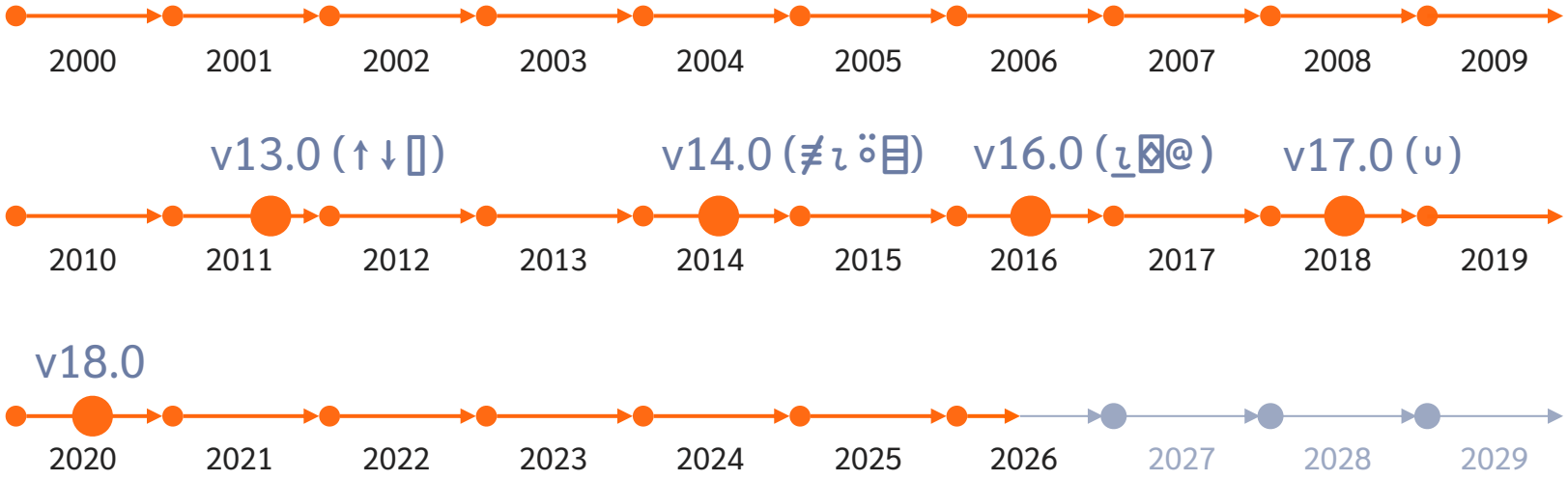
```
m←1 4⍴'CATS'
m⍪←'DOGS'
m⍪←'CATS'
m⍪←'BIRD'
m⍪←'CATS'
m⍪←'FISH'
m⍪←'DOGS'
m⍪←'FROG'
```

v17.0: Unique (u)

```
      m
CATS
DOGS
CATS
BIRD
CATS
FISH
DOGS
FROG
```

```
      um
CATS
DOGS
BIRD
FISH
FROG
```

The 21st Century



v18.0: Unique Mask (≠)

```
      ≠'MISSISSIPPI'
1 1 1 0 0 0 0 0 1 0 0
```

v18.0: Unique Mask (≠)

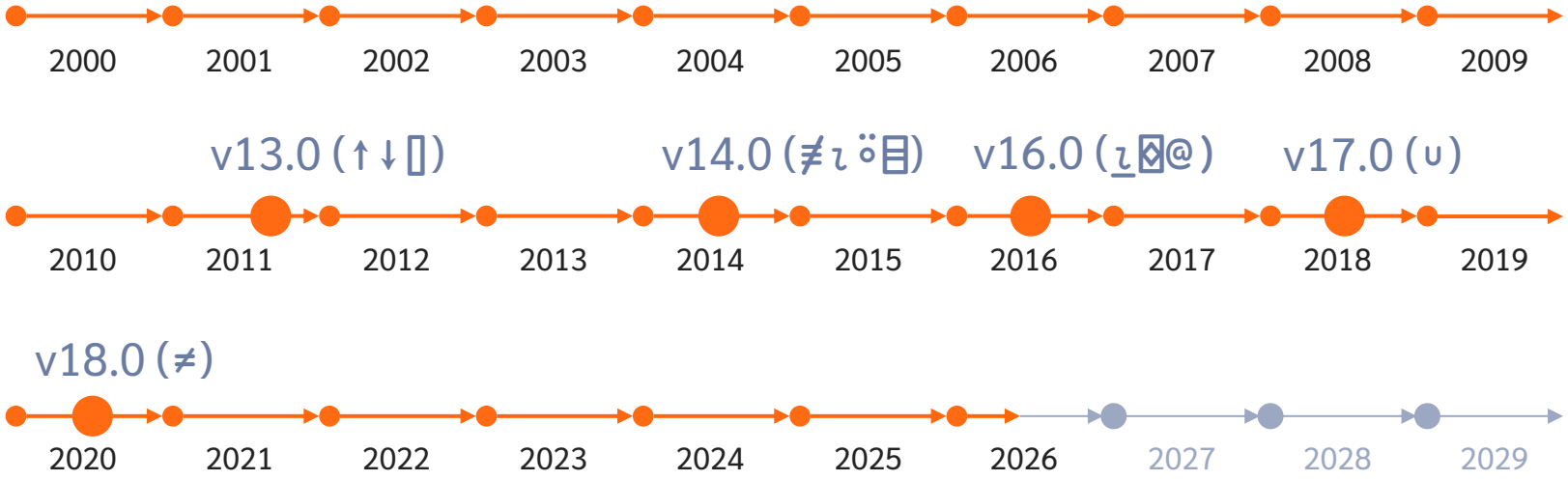
```
      m
CATS
DOGS
CATS
BIRD
CATS
FISH
DOGS
FROG
```

```
      um
CATS
DOGS
BIRD
FISH
FROG
```

v18.0: Unique Mask (≠)

m	≠m
CATS	1 1 0 1 0 1 0 1
DOGS	
CATS	
BIRD	
CATS	
FISH	
DOGS	
FROG	

The 21st Century



The Rank operator (⁘)

- What makes the leading axis special?
- What if I want to work on another axis?

There’s a reason it looks like ¨