

# DeltaNI: An Efficient Labeling Scheme for Versioned Hierarchical Data

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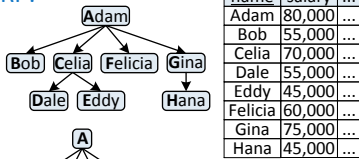
## Motivation

ERP applications use a lot of hierarical data:

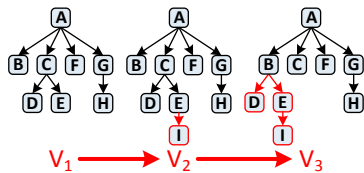
- Versioning required for accountability
- Large hierarchies, long histories
- High transaction and query performance required
- Deep integration into database kernel required

Hierarchies found in ERP:

- Human resources
- Bills of materials
- Asset hierarchies



name	salary	...
Adam	80,000	...
Bob	55,000	...
Celia	70,000	...
Dale	55,000	...
Eddy	45,000	...
Felicia	60,000	...
Gina	75,000	...
Hana	45,000	...



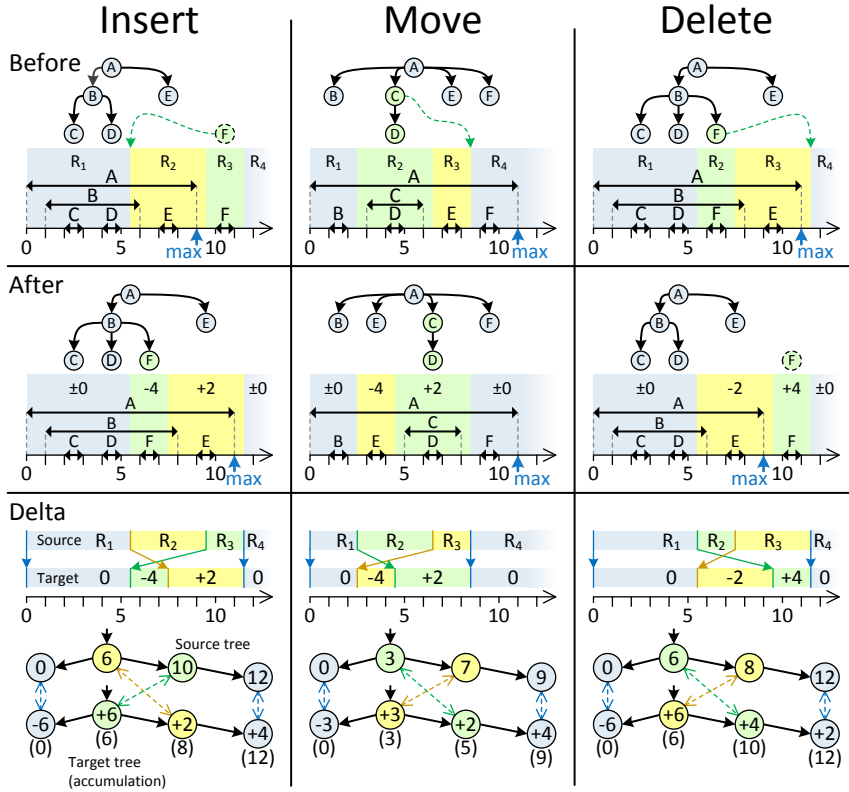
Versioned OLAP style queries over structure and content:

```
SELECT SUM(salary)
FROM employees/**[name="Celia"]/**
IN VERSION V2
```

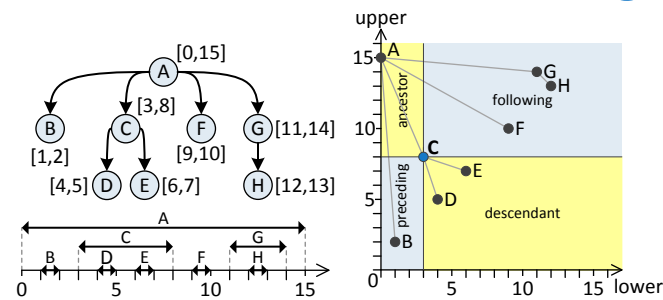
Challenges:

- Space consumption
- Efficient updates (including subtree move)
- Complex queries in each version

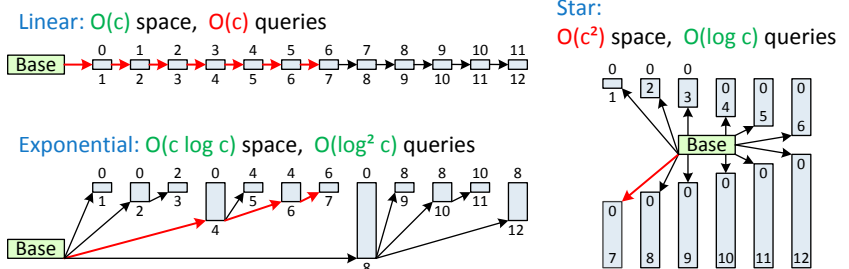
## Nested Interval Deltas



## Nested Intervals Encoding

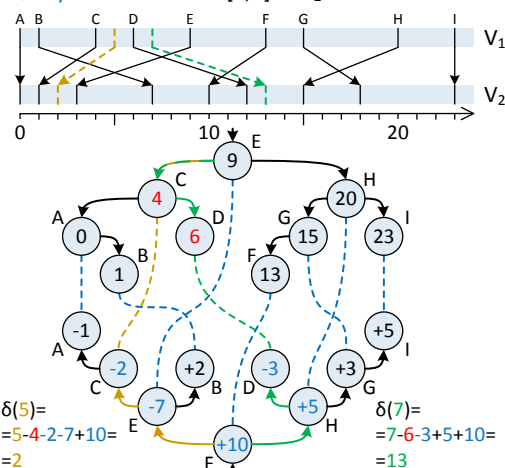


## Encoding Histories



## Querying Deltas

Query: Where is node [5,7] in V2?



## Updating Deltas

Transaction: Apply swap of R2 and R3

