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SQL Server Partitioning from Zero to Hero

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(he/him)

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I'm a SQL Server consultant with over 20 years of experience.

Data Platform MVP, conference organizer, and blogger.

Big fan of travel, coffee, and dogs.

I live with my wonderful wife in Stockholm, Sweden.

In this session:

Thank you

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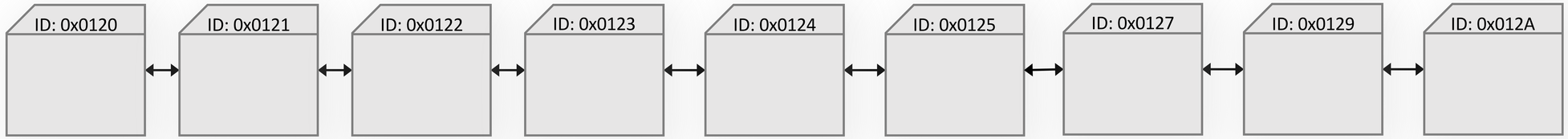
In this session:

- Some queries can be tuned to use a single partition (partition elimination)
- Can solve specific latch contention issues by spreading writes
- You can backup only read-write partitions –> faster backups.
- You can restore the important partitions first –> shorter RTO.

Simplifications ahead

How pages work



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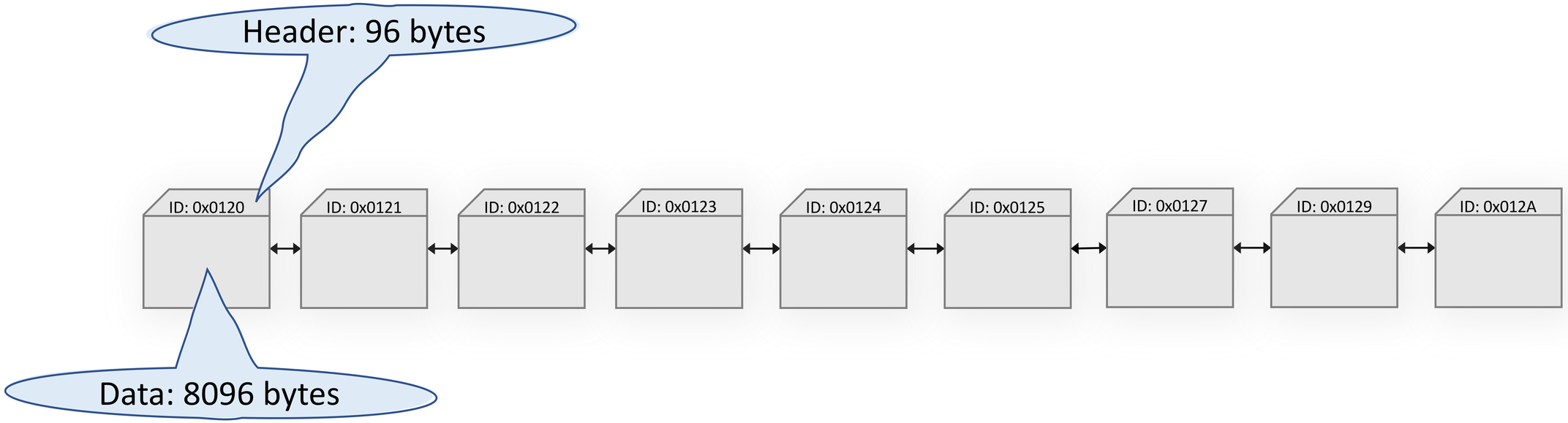
How pages work



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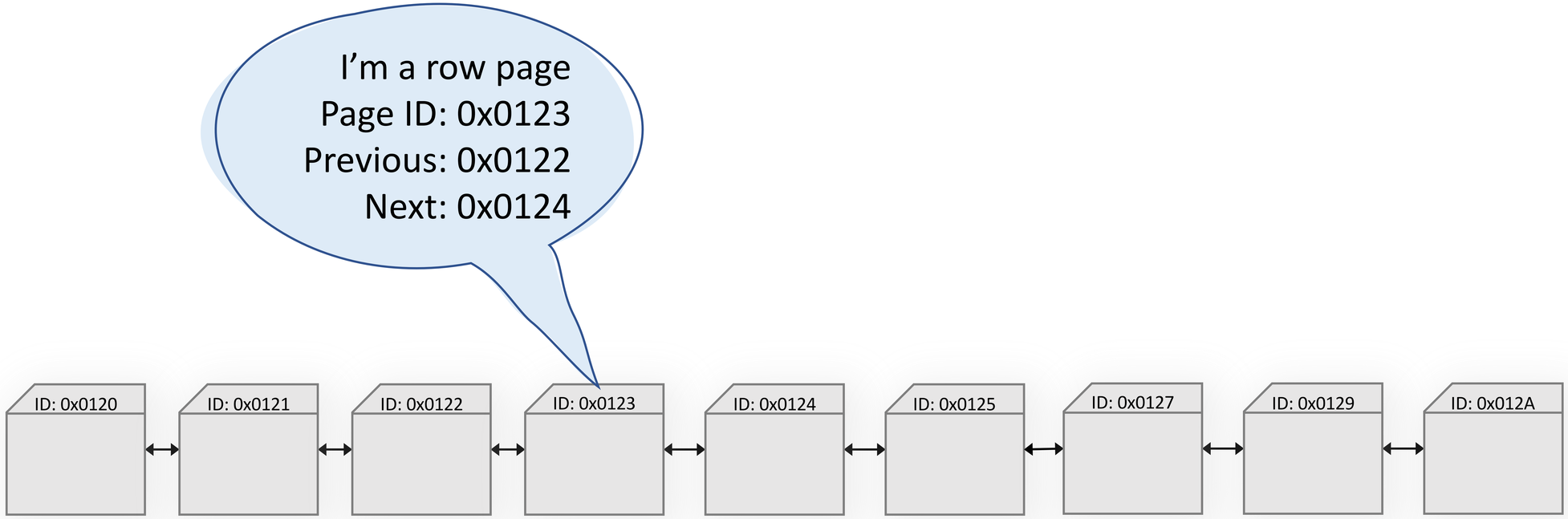
How pages work



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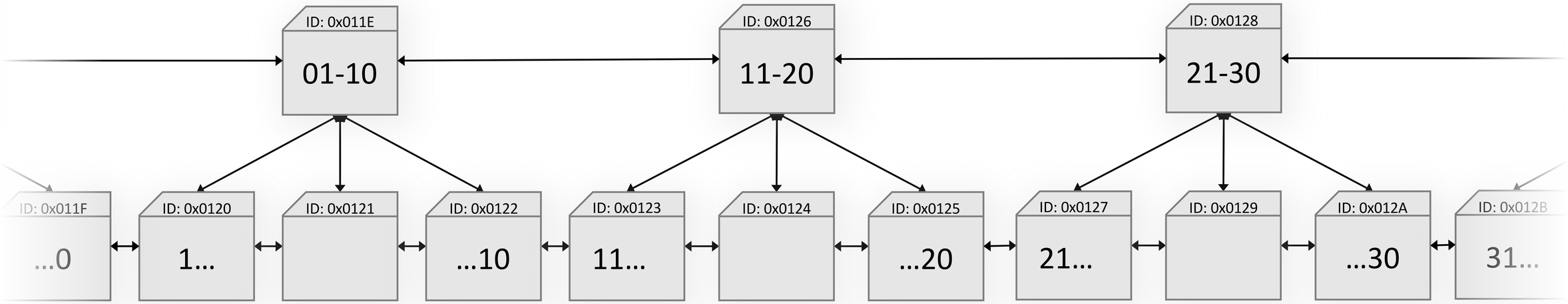
Indexes can have multiple levels



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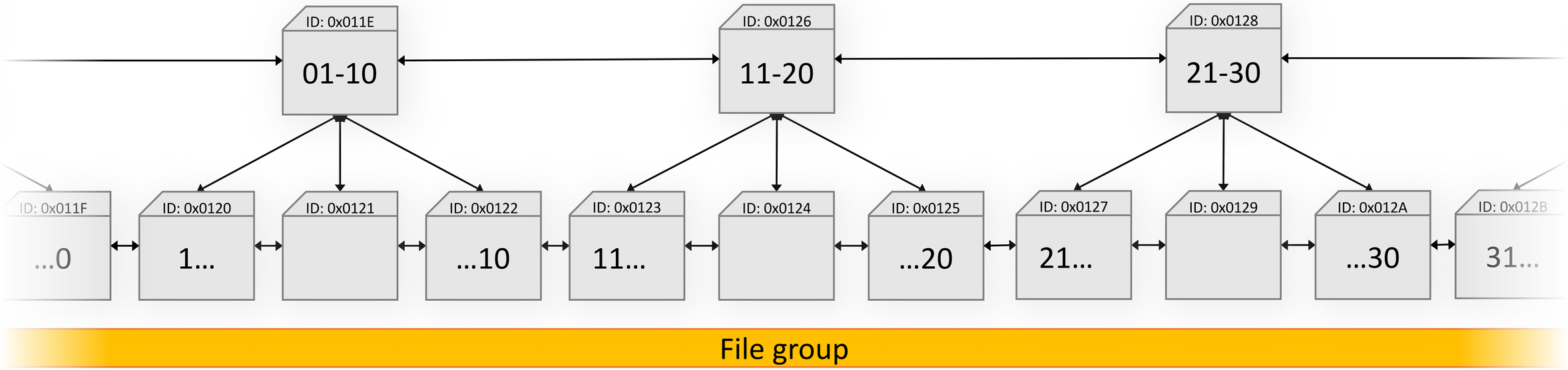
What is partitioning?

Regular table: one partition on one filegroup



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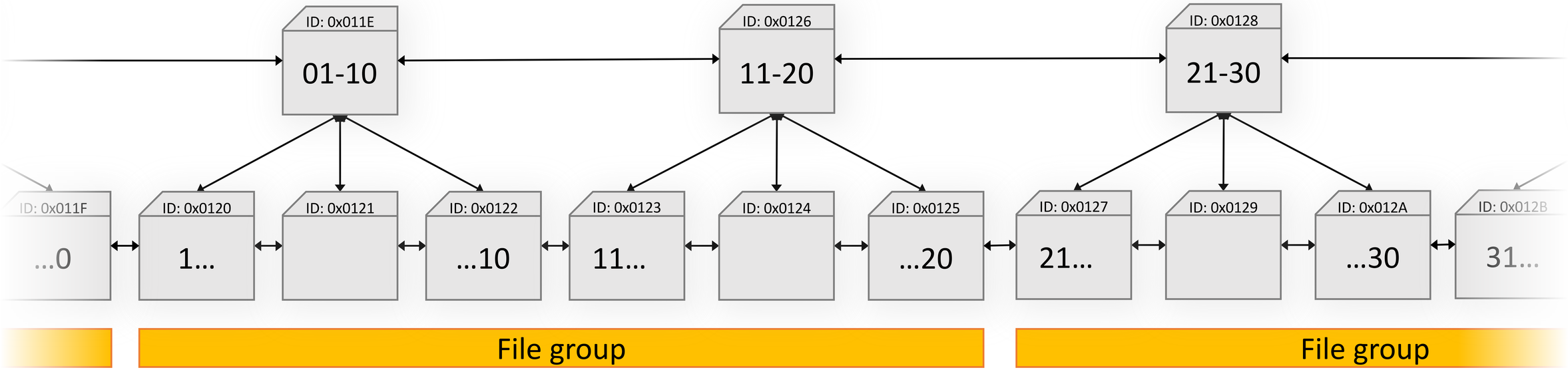
What is partitioning?

Partitioned table: *multiple* partitions, on *one or more* filegroups.



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Setting up partitioning

How: the partition function

```
CREATE PARTITION FUNCTION AnnualFunction(date)
AS RANGE RIGHT
        FOR VALUES ( '2020-01-01' , '2021-01-01' , '2022-01-01' );
```

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Setting up partitioning

How: the partition function

```
CREATE PARTITION FUNCTION AnnualFunction(date)
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        FOR VALUES ( '2020-01-01' , '2021-01-01' , '2022-01-01' );
```

2020-01-01 – 2020-12-31 2021-01-01 – 2021-12-31 2022-01-01 – 2022-12-31

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Setting up partitioning

```
CREATE PARTITION FUNCTION AnnualFunction(date)
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        FOR VALUES ( '2020-01-01' , '2021-01-01' , '2022-01-01' );

CREATE PARTITION SCHEME Annual
AS PARTITION AnnualFunction
TO ( [FILEGROUP_A] , [FILEGROUP_B] , [FILEGROUP_C] , [FILEGROUP_D] );
```

Where: the partition scheme

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Setting up partitioning

```
CREATE PARTITION FUNCTION AnnualFunction(date)
AS RANGE RIGHT
       FOR VALUES ( '2020-01-01' , '2021-01-01' , '2022-01-01' );
```

```
CREATE PARTITION SCHEME Annual
AS PARTITION AnnualFunction
TO ( [FILEGROUP_A] , [FILEGROUP_B] , [FILEGROUP_C] , [FILEGROUP_D] );
```

```
CREATE TABLE dbo.partitioned_table (
    TransactionDate    date NOT NULL,
    ...
    ...
    ...
) ON Annual(TransactionDate);
```

What: assigning the index to the partition scheme

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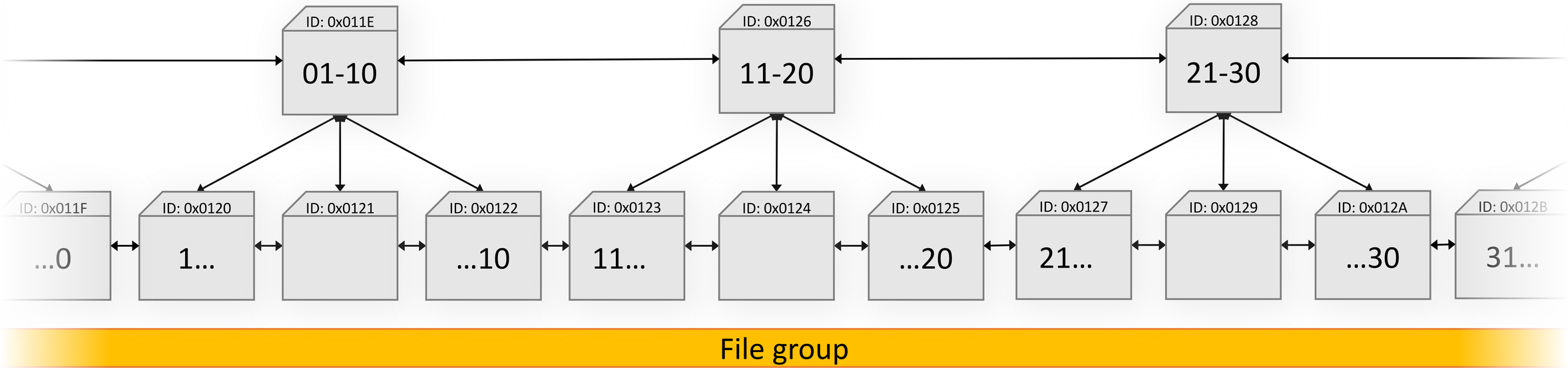
Image credit: Eric Zhang, Unsplash

A regular delete

```
DELETE FROM dbo.regular_table
WHERE id BETWEEN 1 AND 20;
```



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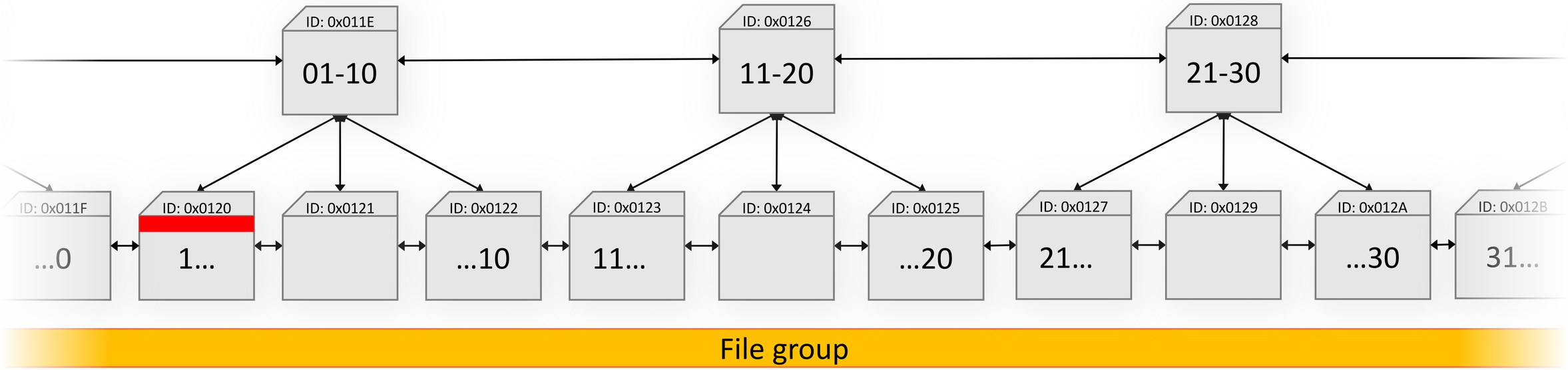
A regular delete



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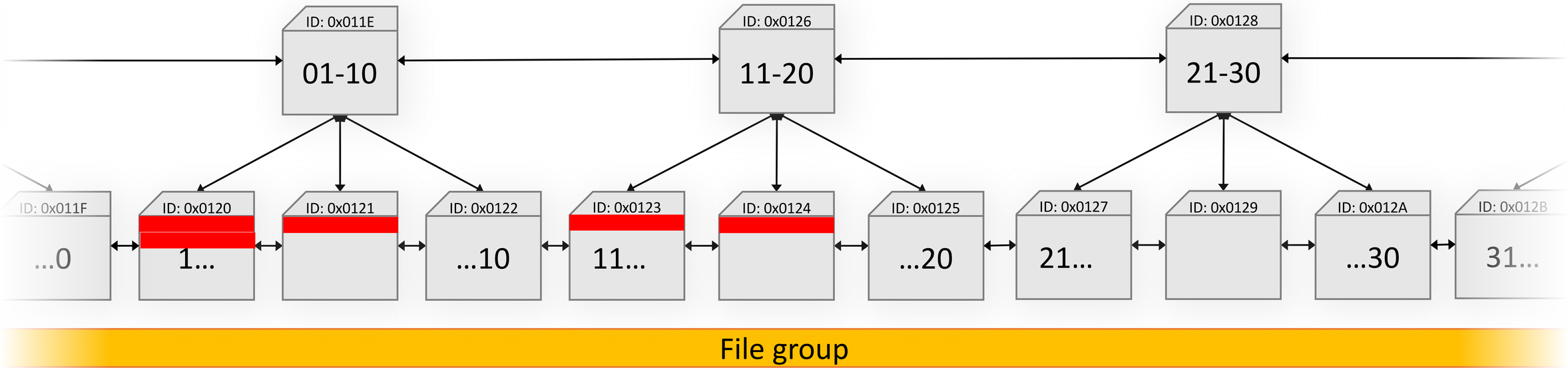

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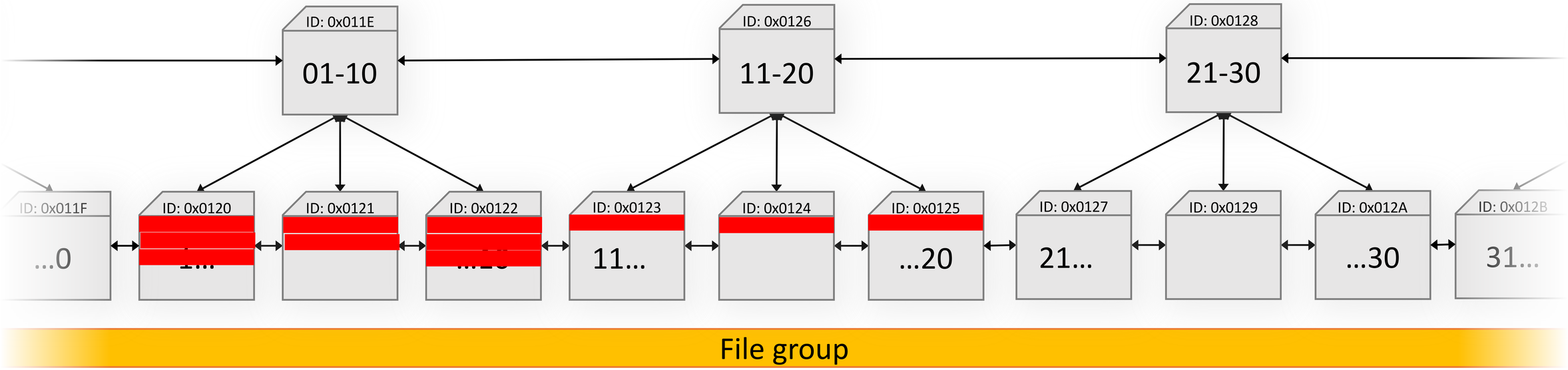

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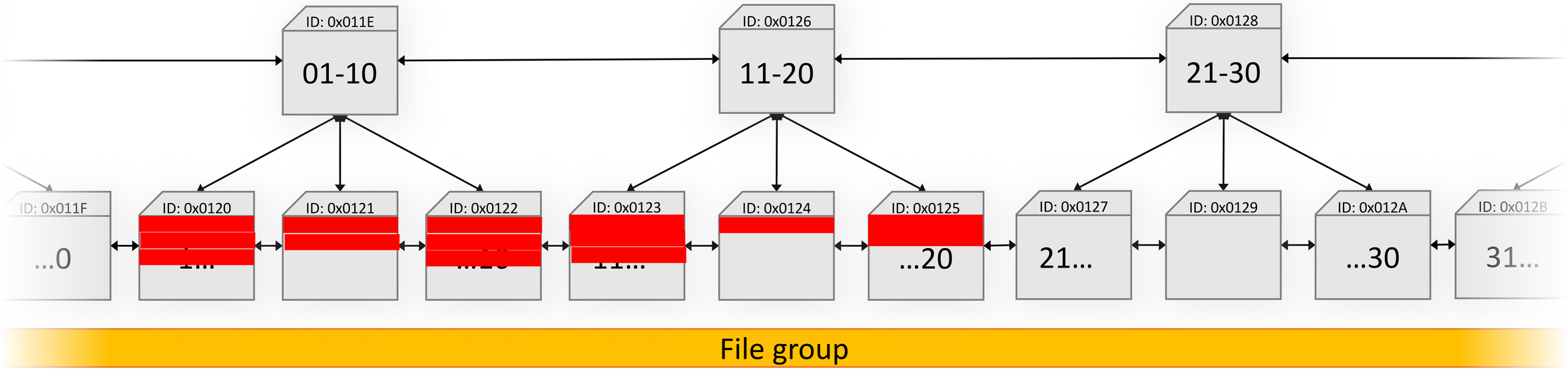

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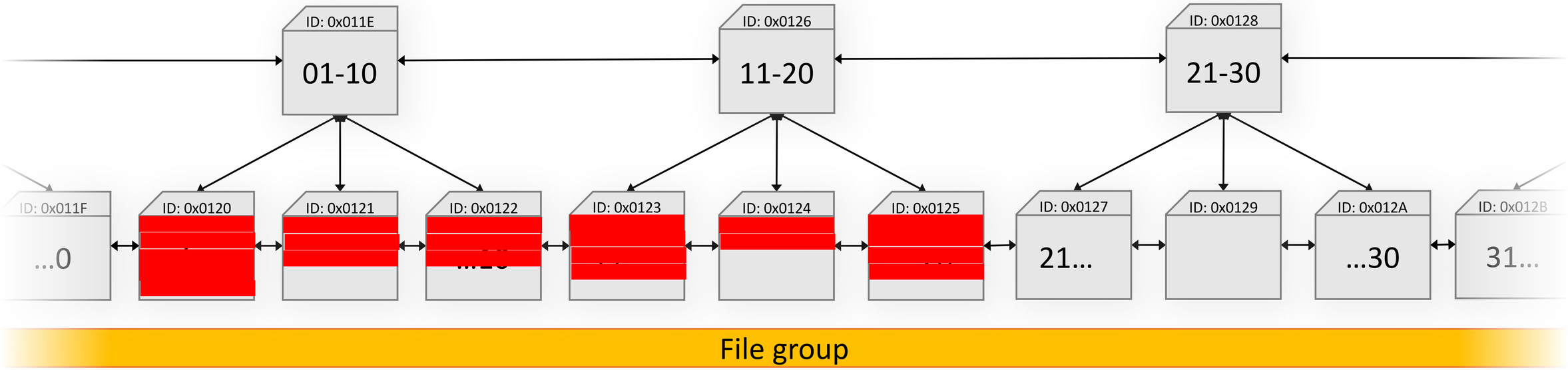

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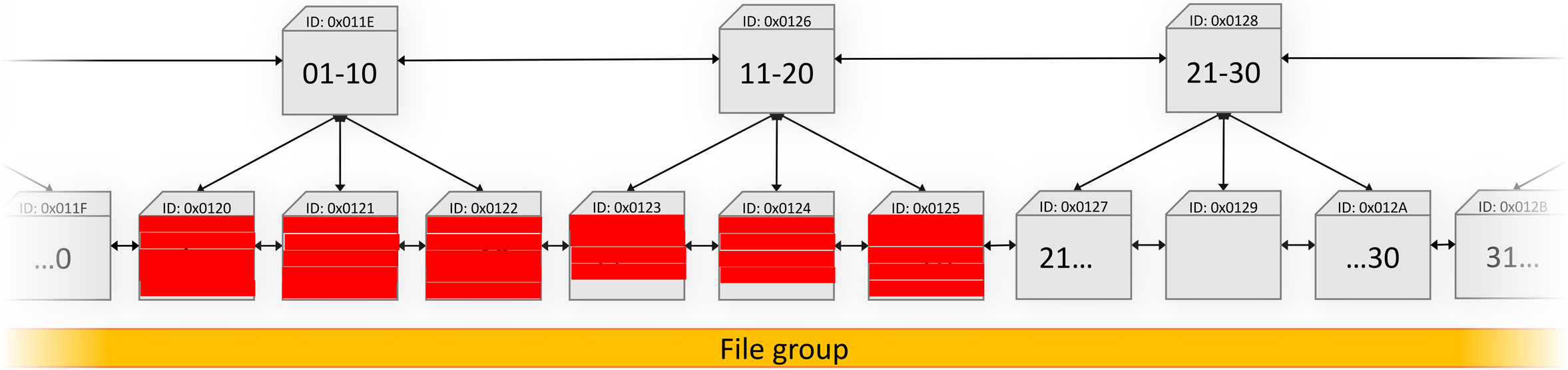

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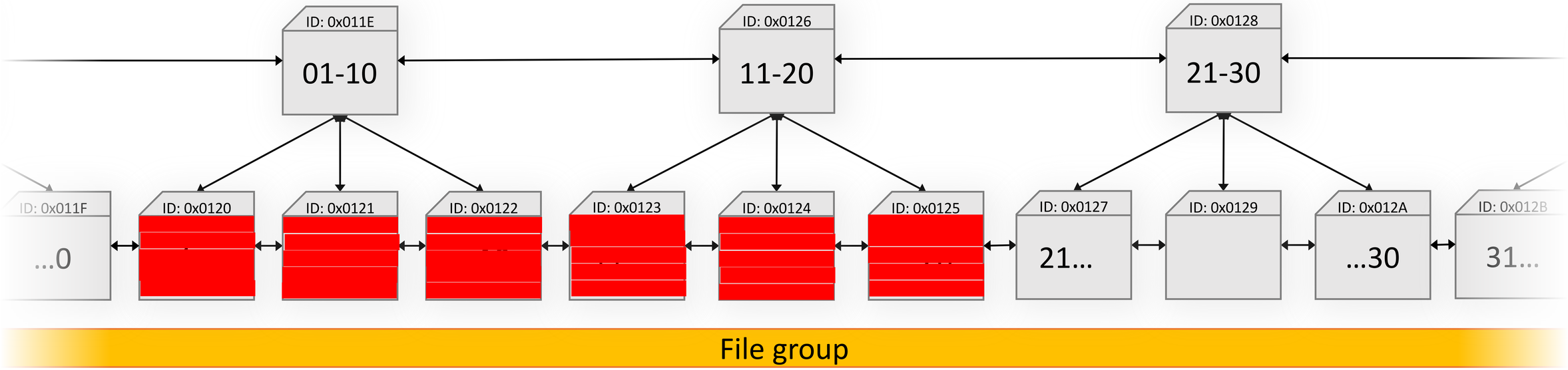

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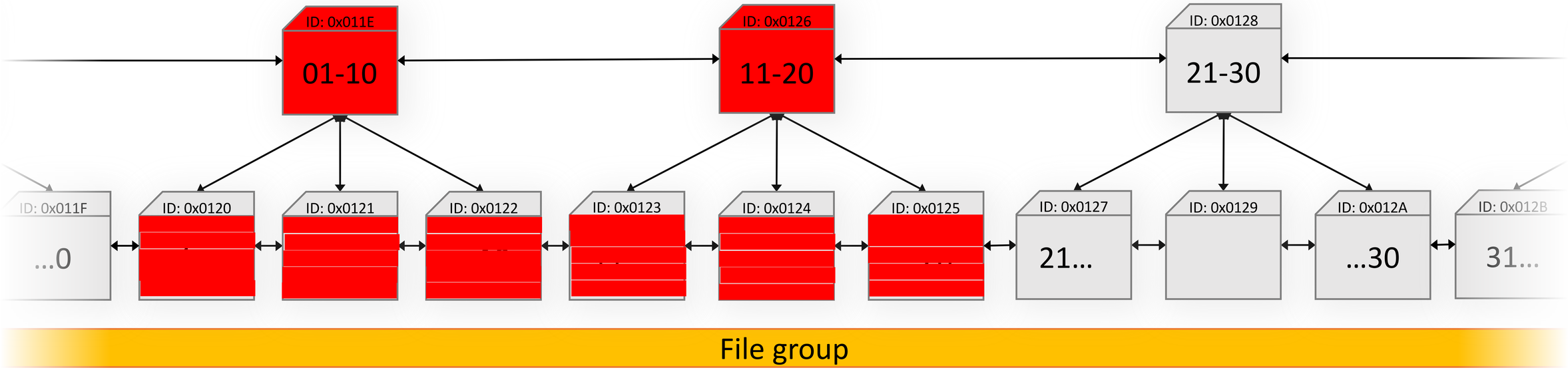

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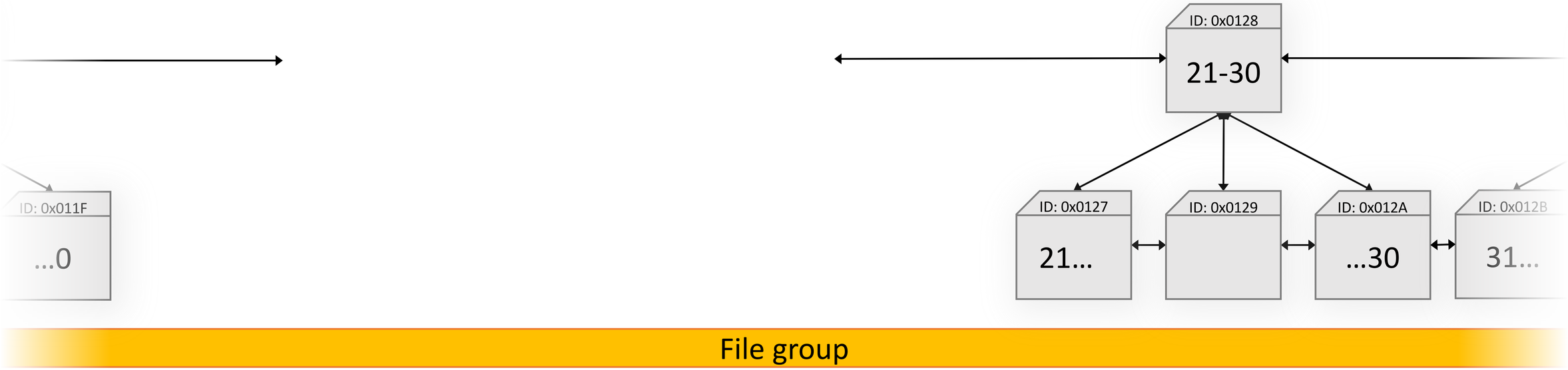

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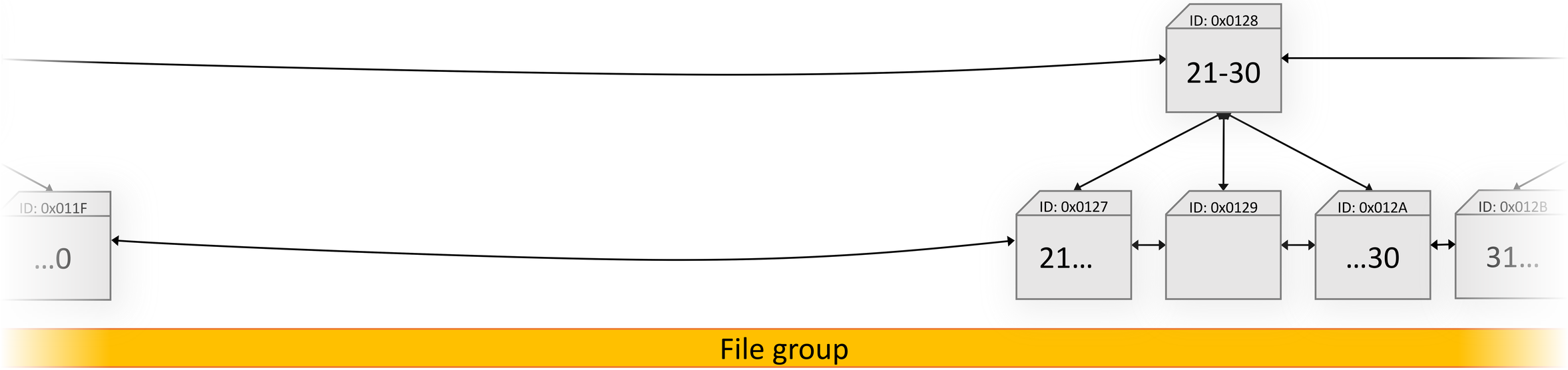

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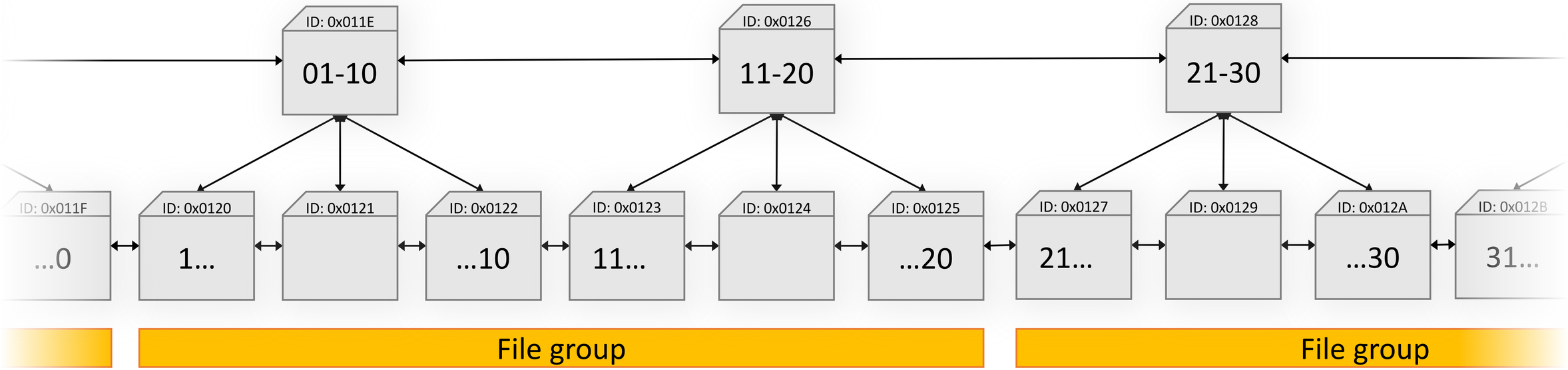
Truncating a partition

```
TRUNCATE TABLE dbo.partitioned_table
WITH (PARTITIONS (2));
```



* Truncating individual partitions is available on SQL Server 2016+

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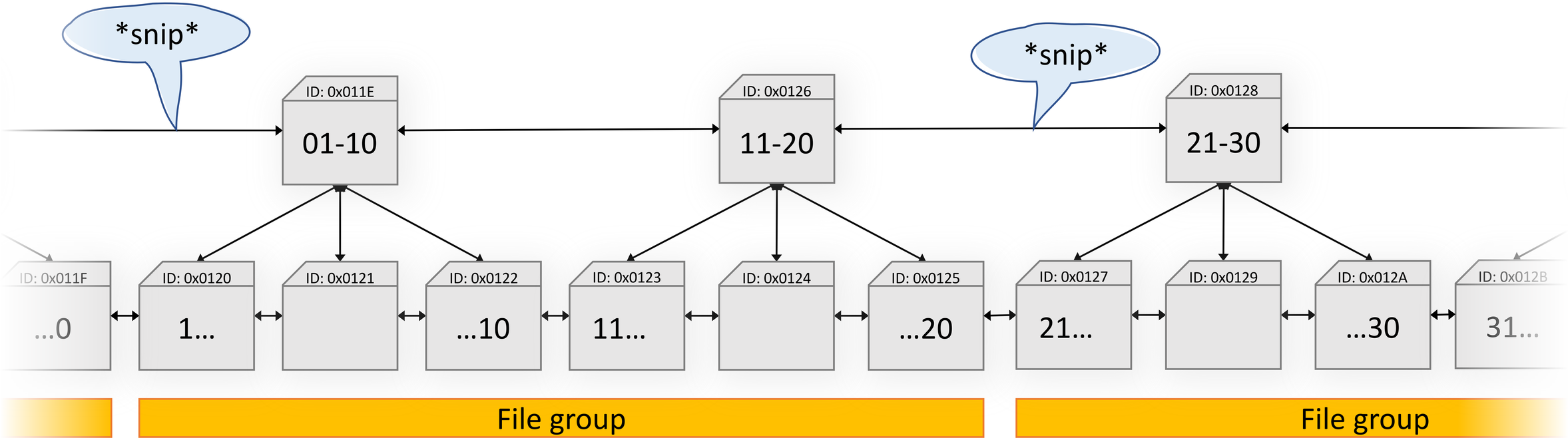
Truncating a partition



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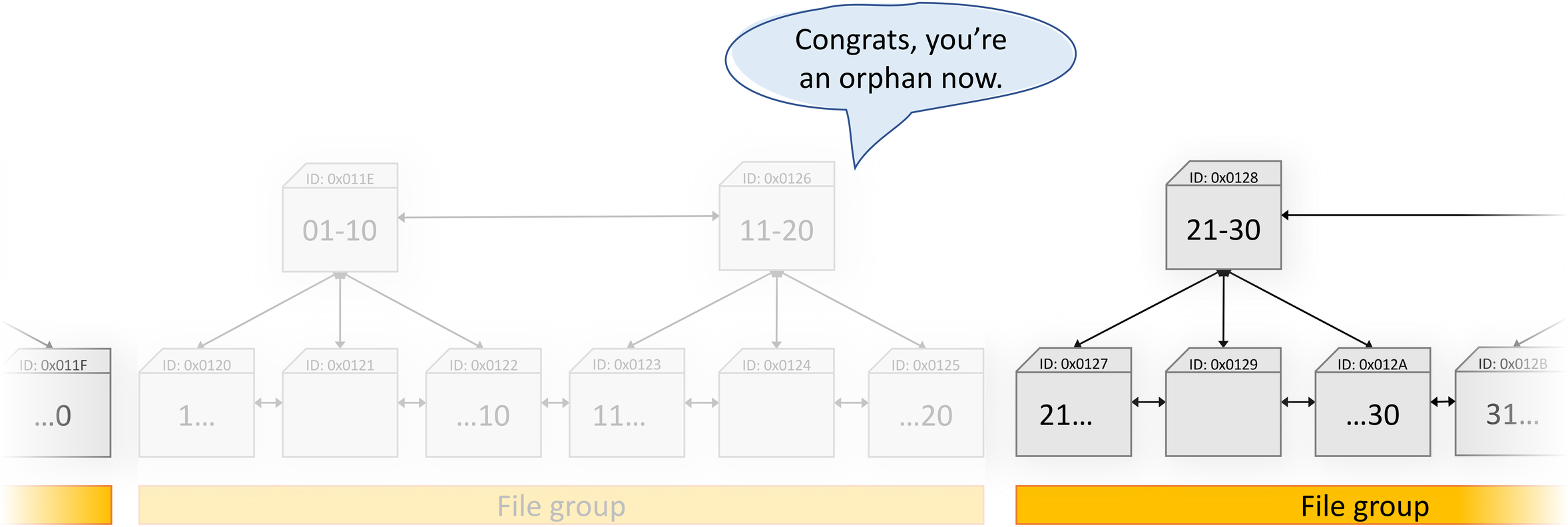
Truncating a partition



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Truncating a partition

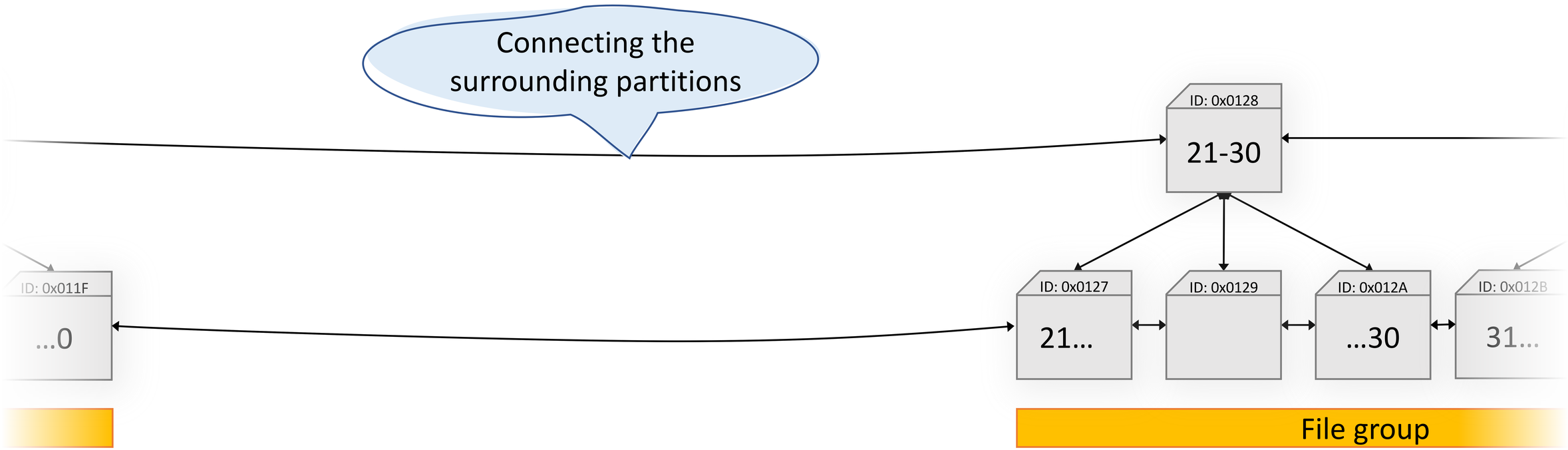

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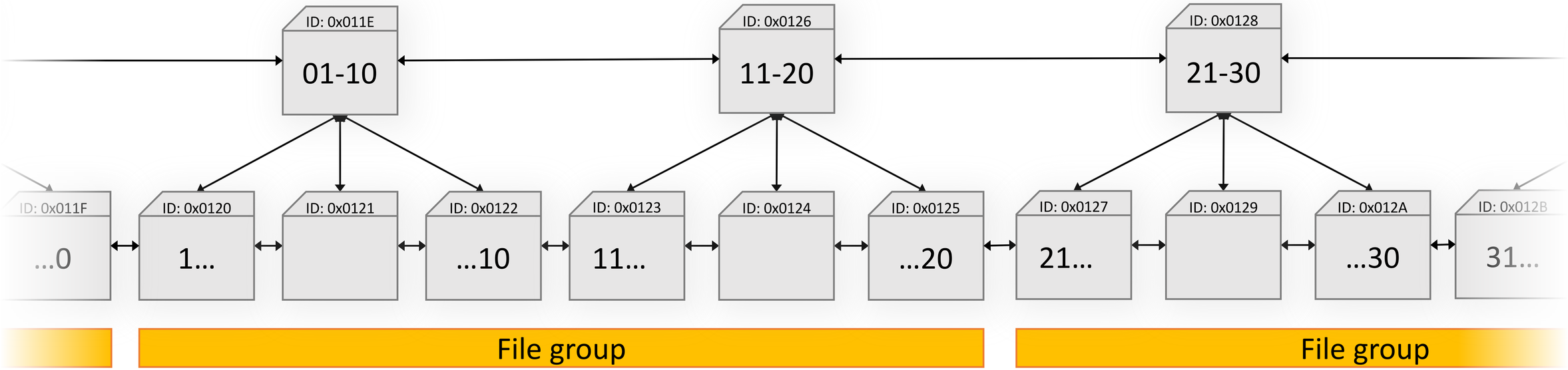
Image credit: Robert Ritchie, Unsplash

Switching a partition

```
ALTER TABLE dbo.partitioned_table
SWITCH PARTITION 2 TO dbo.regular_table;
```



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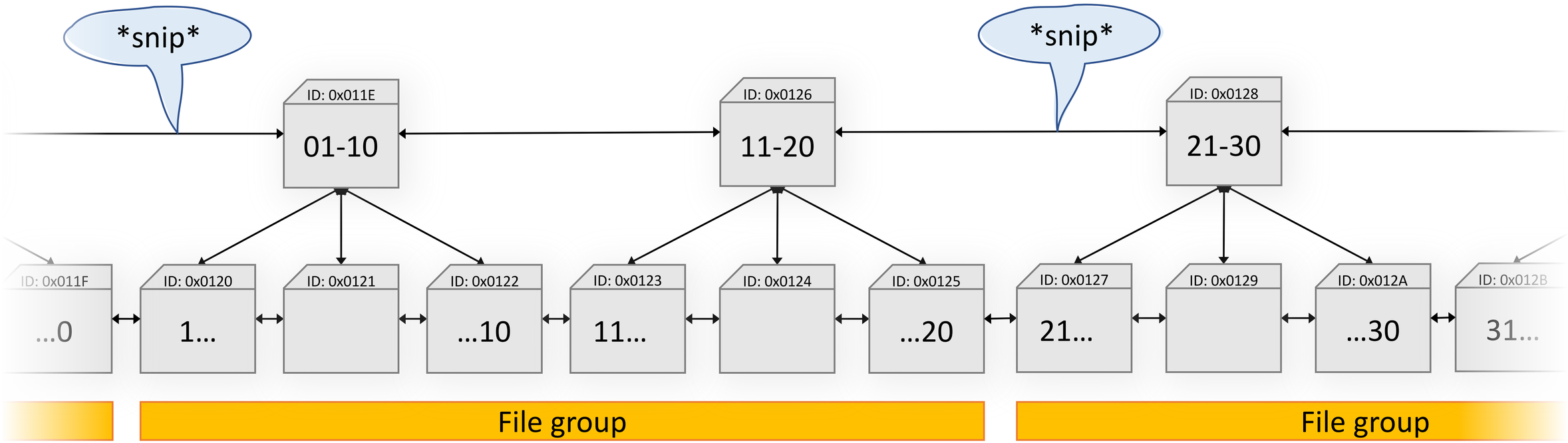

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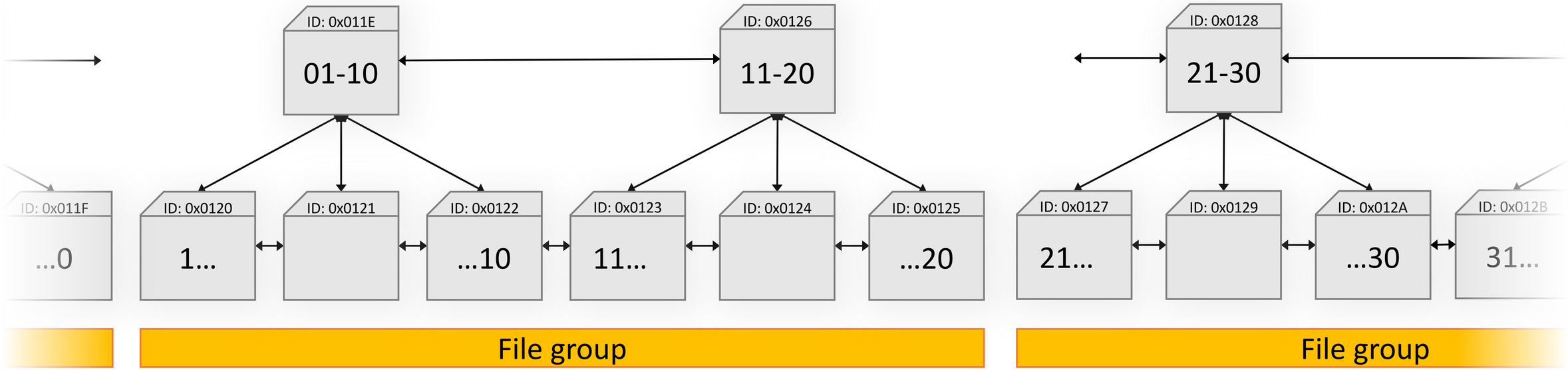

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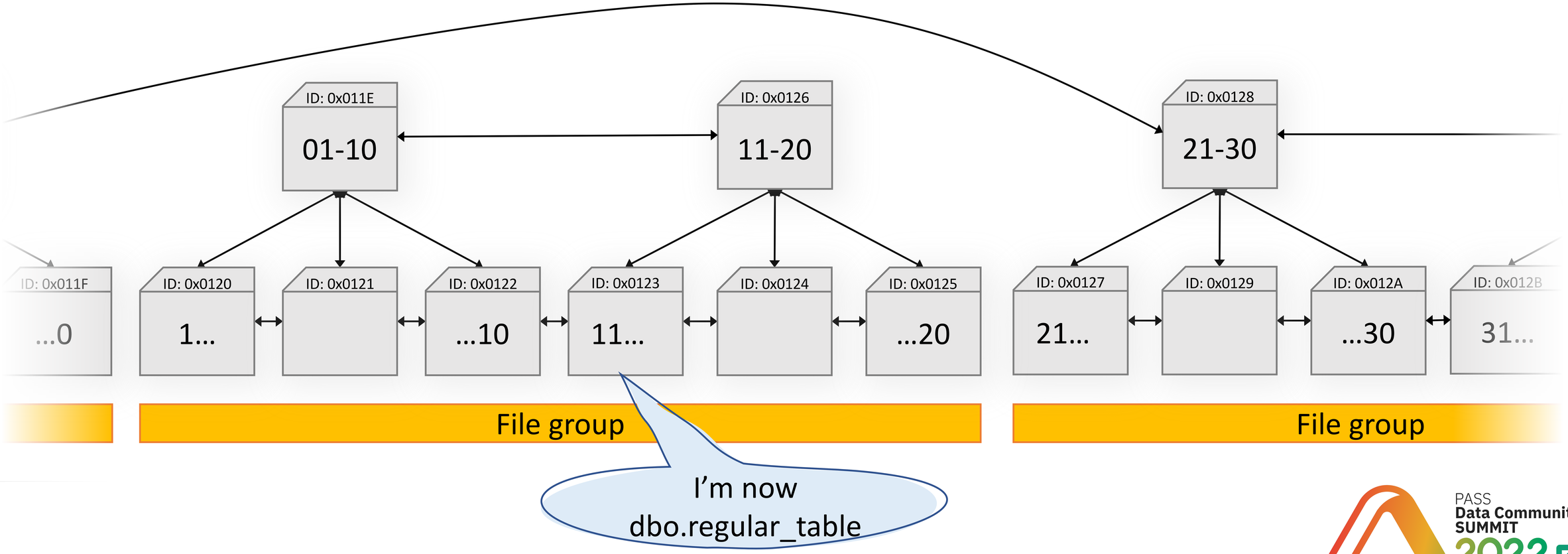

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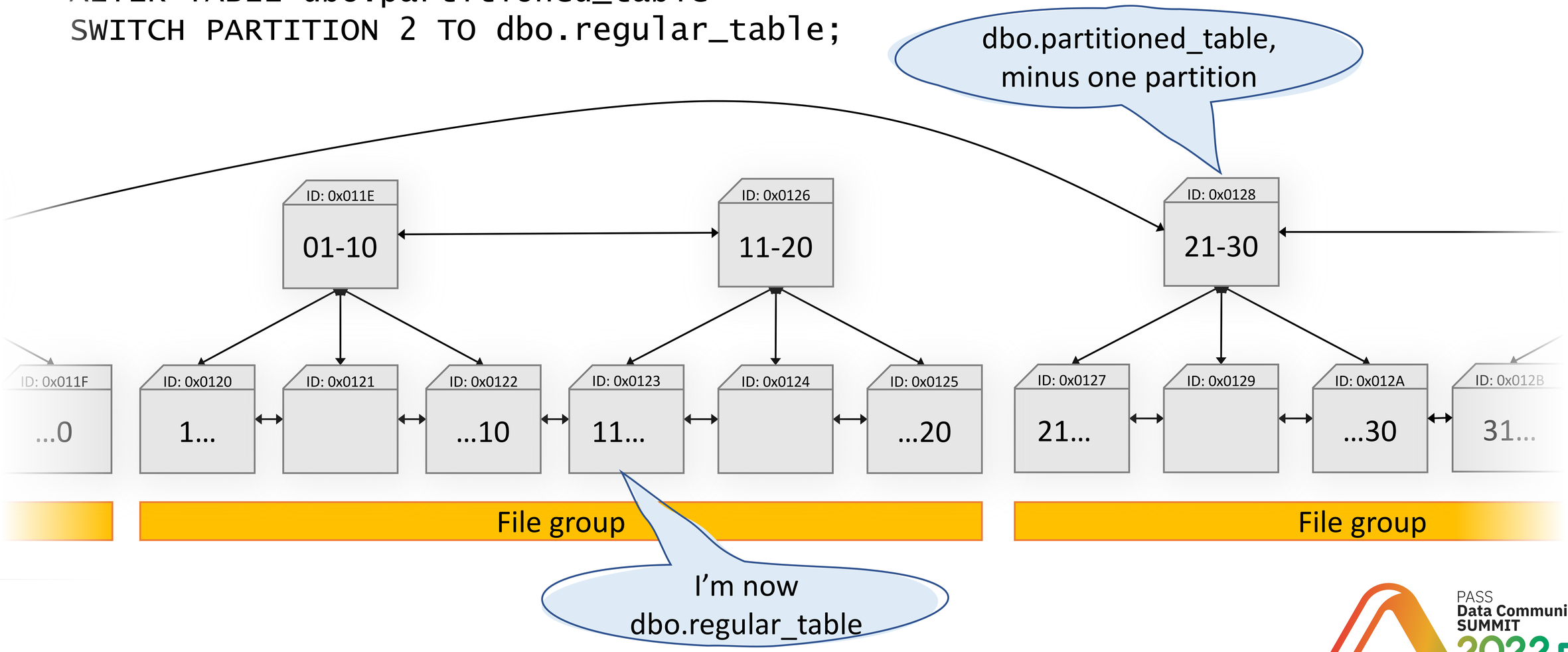

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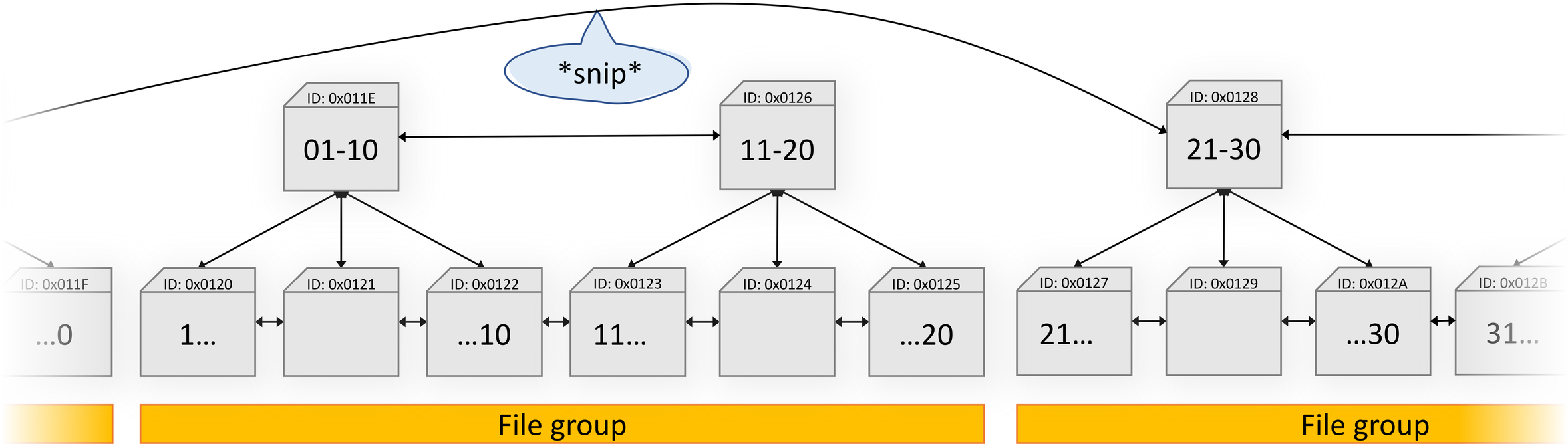
.. and back

```
ALTER TABLE dbo.regular_table
SWITCH TO dbo.partitioned_table PARTITION 2;
```



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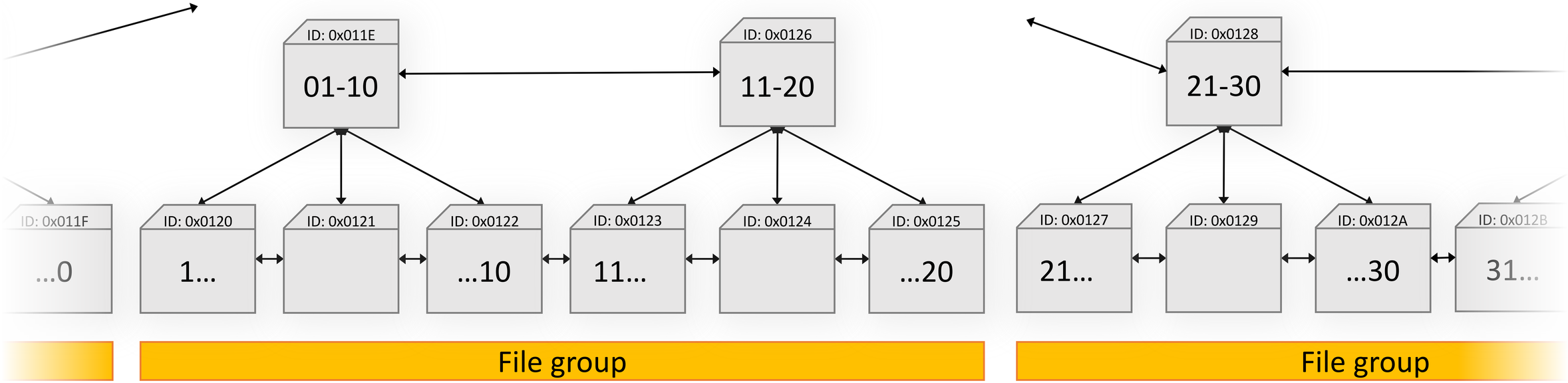

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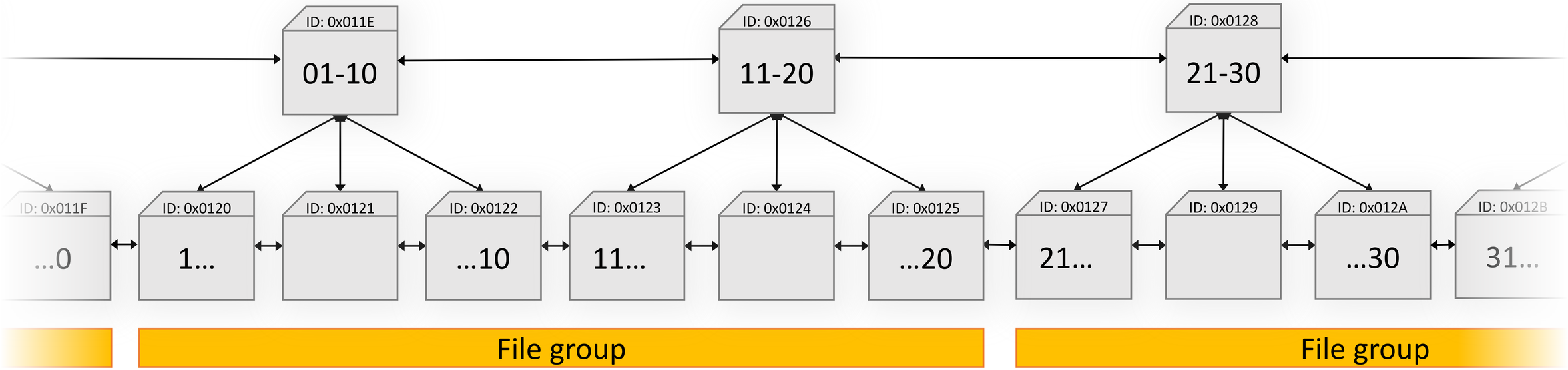
```



* Bonus fact: you can switch two *non-partitioned* tables, too!

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These are metadata operations!

- The data doesn’t move.
- Only the pointers are updated.
- Metadata operations require metadata permissions!

DEMO

Image credit: Zhifei Zhou, Unsplash

"Right is right"

… AS RANGE LEFT
FOR VALUES (100, 200, 300)

		$n \leq$	100
100	$<$	$n \leq$	200
200	$<$	$n \leq$	300
300	$<$	n	

… AS RANGE RIGHT
FOR VALUES (100, 200, 300)

		$n <$	100
100	$\leq$	$n <$	200
200	$\leq$	$n <$	300
300	$\leq$	n	

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"Right is right"

```
CREATE PARTITION FUNCTION AnnualFunction(date)
AS RANGE RIGHT
        FOR VALUES ( '2020-01-01' , '2021-01-01' , '2022-01-01' );

CREATE PARTITION SCHEME Annual
AS PARTITION AnnualFunction
TO ( [FILEGROUP_A] , [FILEGROUP_B] , [FILEGROUP_C] , [FILEGROUP_D] );
```

< 2020-01-01

≥ 2020-01-01
< 2021-01-01

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"Right is right"

```
CREATE PARTITION FUNCTION AnnualFunction(date)
AS RANGE LEFT
        FOR VALUES ( '2020-01-01' , '2021-01-01' , '2022-01-01' );

CREATE PARTITION SCHEME Annual
AS PARTITION AnnualFunction
                TO ( [FILEGROUP_A] , [FILEGROUP_B] , [FILEGROUP_C] , [..._D] );
```

≤ 2020-01-01

> 2020-01-01
≤ 2021-01-01

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Split/merge

- You can *split* an existing partition into two, by adding a new boundary.

… 2018	2019	2020	2021…
Filegroup A	Filegroup B	Filegroup C	Filegroup D

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Split/merge

- You can *split* an existing partition into two, by adding a new boundary.

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Split/merge

- You can *split* an existing partition into two, by adding a new boundary.

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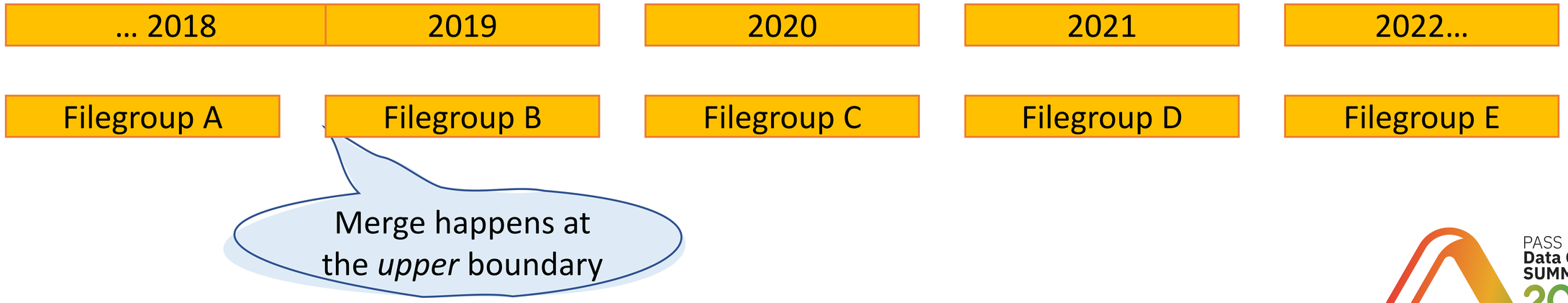
Split/merge

- You can *split* an existing partition into two, by adding a new boundary.
- Two partitions can also be *merged* into one, by removing a boundary.



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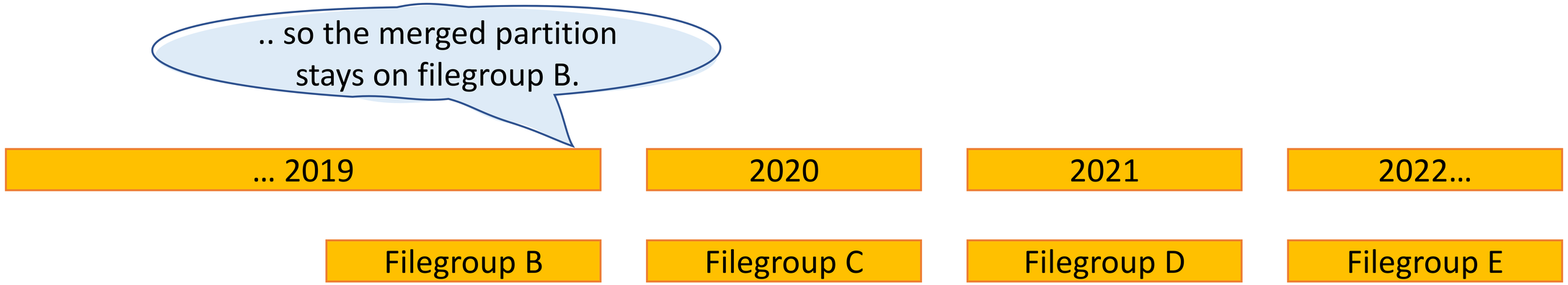

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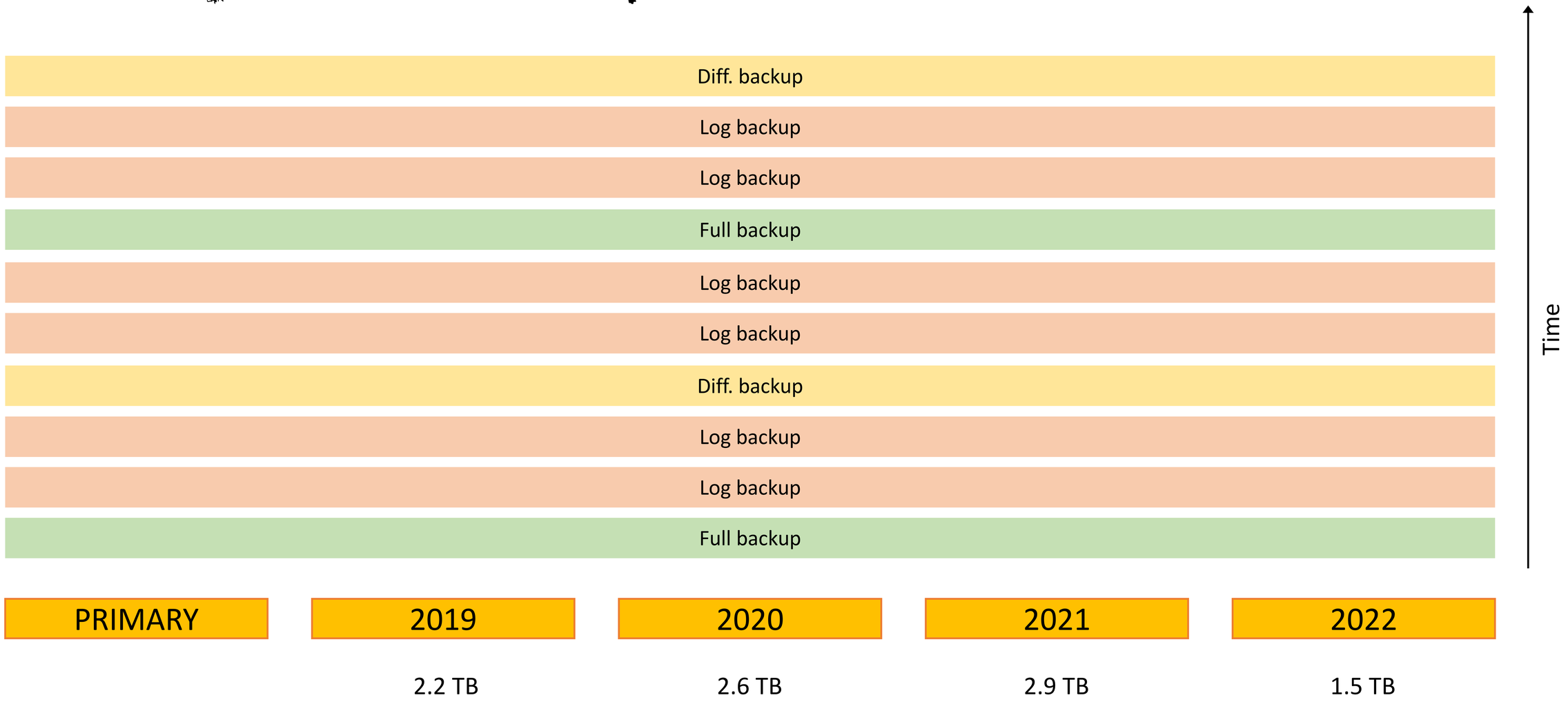
Image credit: Zhifei Zhou, Unsplash

Aligned / non-aligned partitions

- If the table and its indexes all share the same partition scheme, the indexes are “aligned”
- If one or more indexes are not partitioned, or differently partitioned, they are “non-aligned”, and you won’t be able to perform partition-level operations like SPLIT, MERGE, TRUNCATE, SWITCH.

Make your backups smaller



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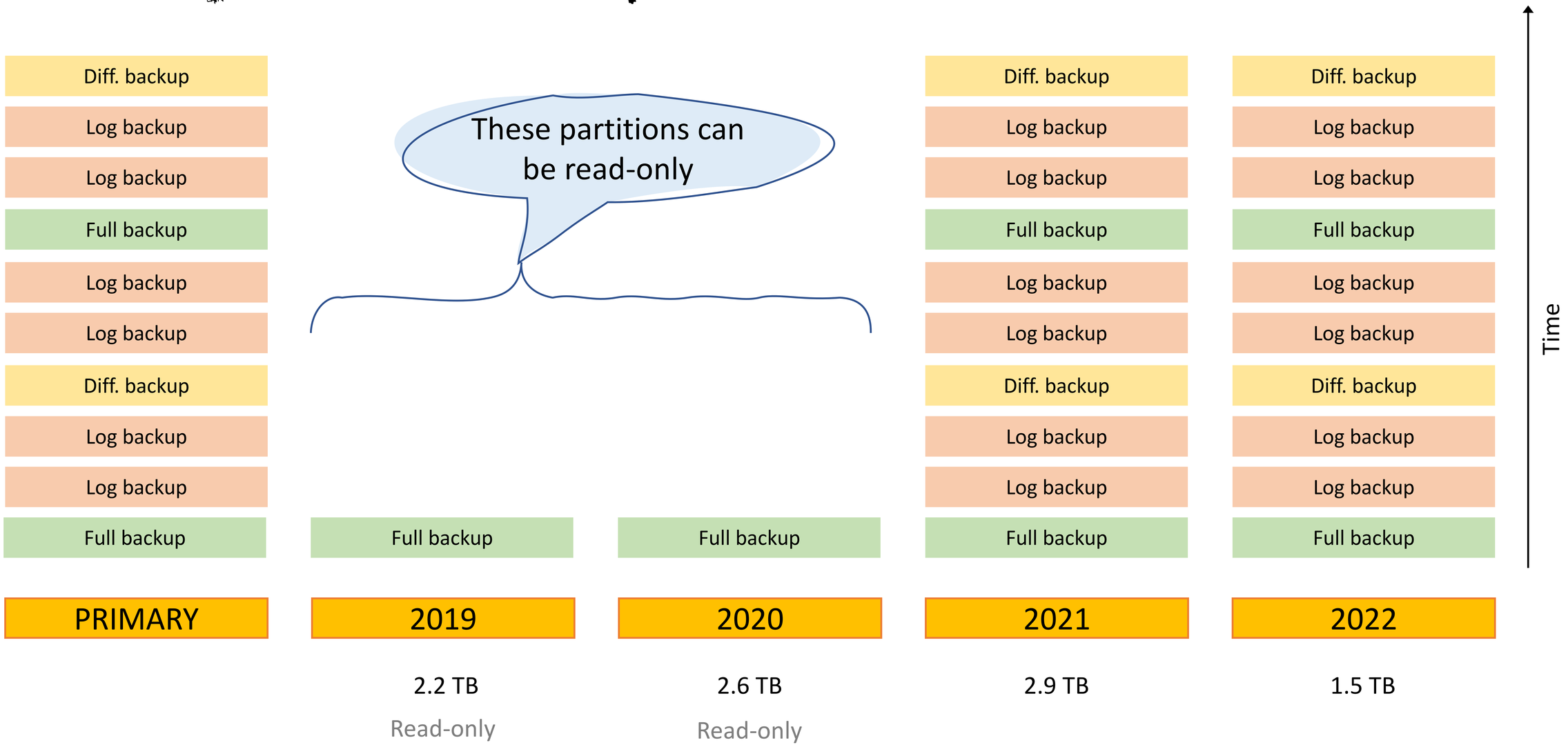

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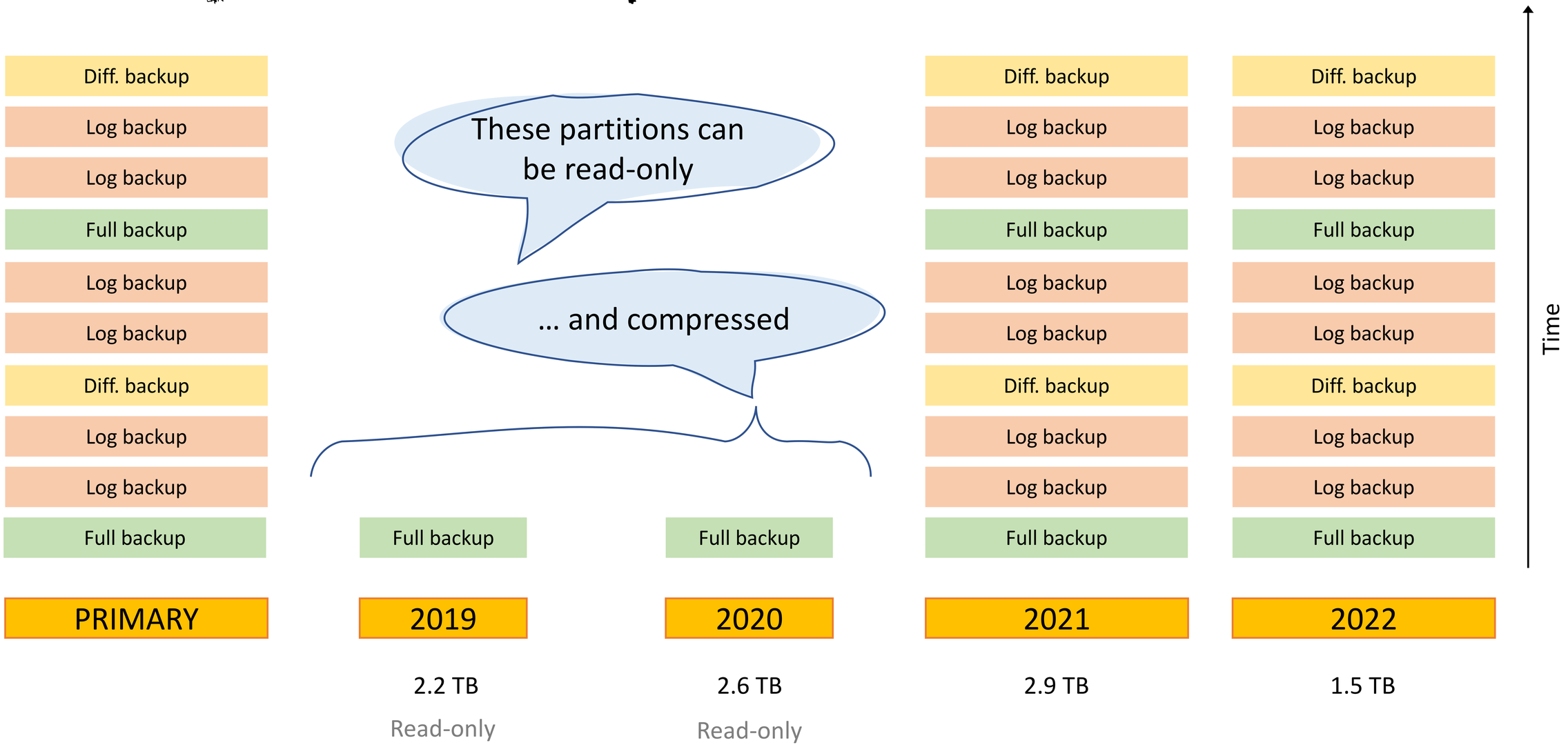

Piecemeal restore (full)

We have:

- An old FULL backup of the read-only filegroups
- A recent FULL backup of the read-write filegroups

PRIMARY	Some file	2019	2020	2021	2022	2023
		Read-only	Read-only			

Piecemeal restore (full)

We have:

- An old FULL backup of the read-only filegroups
- A recent FULL backup of the read-write filegroups

Full backup, partial, recovery

PRIMARY	Some file	2019	2020	2021	2022	2023
		Read-only	Read-only			

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Piecemeal restore (full)

We have:

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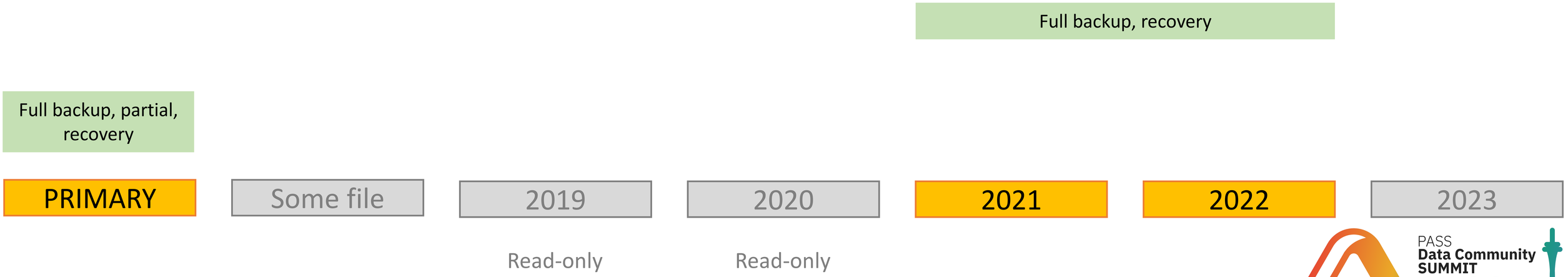

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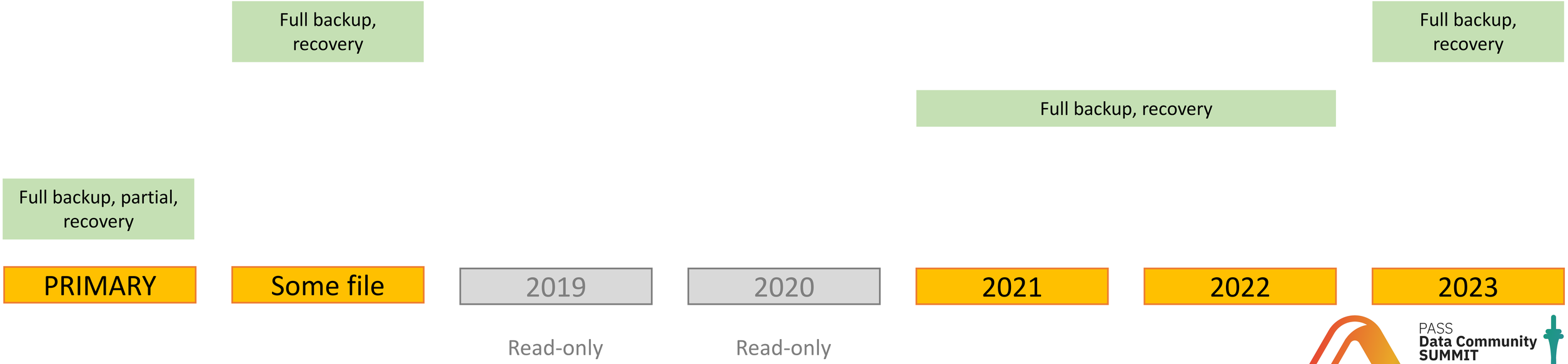

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Piecemeal restore (full)

We have:

- An old FULL backup of the read-only filegroups
- A recent FULL backup of the read-write filegroups

This can be a really old backup

Full backup, recovery

Full backup, recovery

Full backup, recovery

Full backup, recovery

Full backup, partial, recovery

PRIMARY	Some file	2019	2020	2021	2022	2023
		Read-only	Read-only			

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DEMO

Image credit: Timothy Eberly, Unsplash

Piecemeal restore (full + log)

We have:

- An old FULL backup of the read-only filegroups
- A recent FULL backup of the read-write filegroups
- Transaction log backup(s) for the read-write filegroups

PRIMARY	Some file	2019	2020	2021	2022	2023
		Read-only	Read-only			

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Piecemeal restore (full + log)

We have:

- An old FULL backup of the read-only filegroups
- A recent FULL backup of the read-write filegroups
- Transaction log backup(s) for the read-write filegroups

Full, partial, norec.

PRIMARY	Some file	2019	2020	2021	2022	2023
		Read-only	Read-only			

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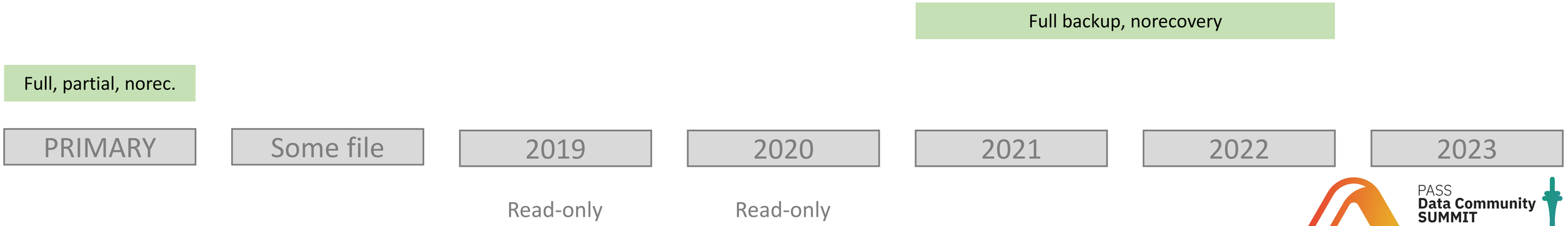
Piecemeal restore (full + log)

We have:

- An old FULL backup of the read-only filegroups
- A recent FULL backup of the read-write filegroups
- Transaction log backup(s) for the read-write filegroups



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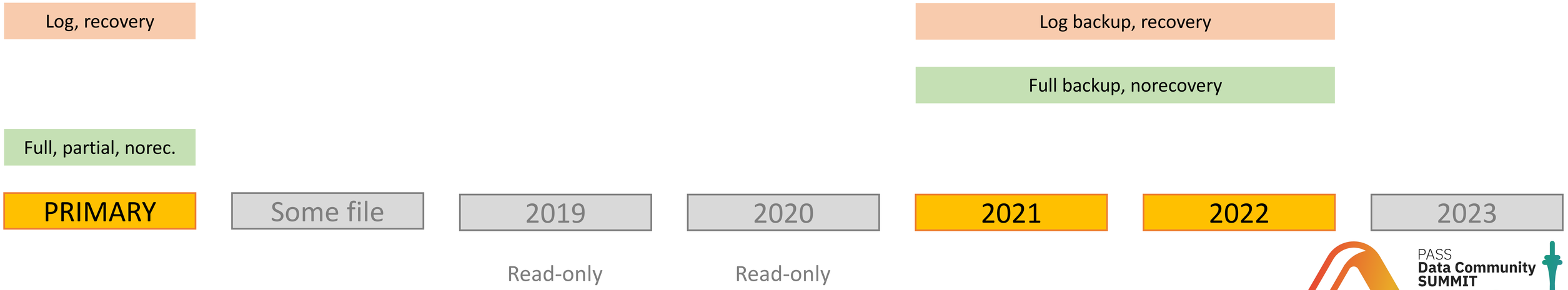

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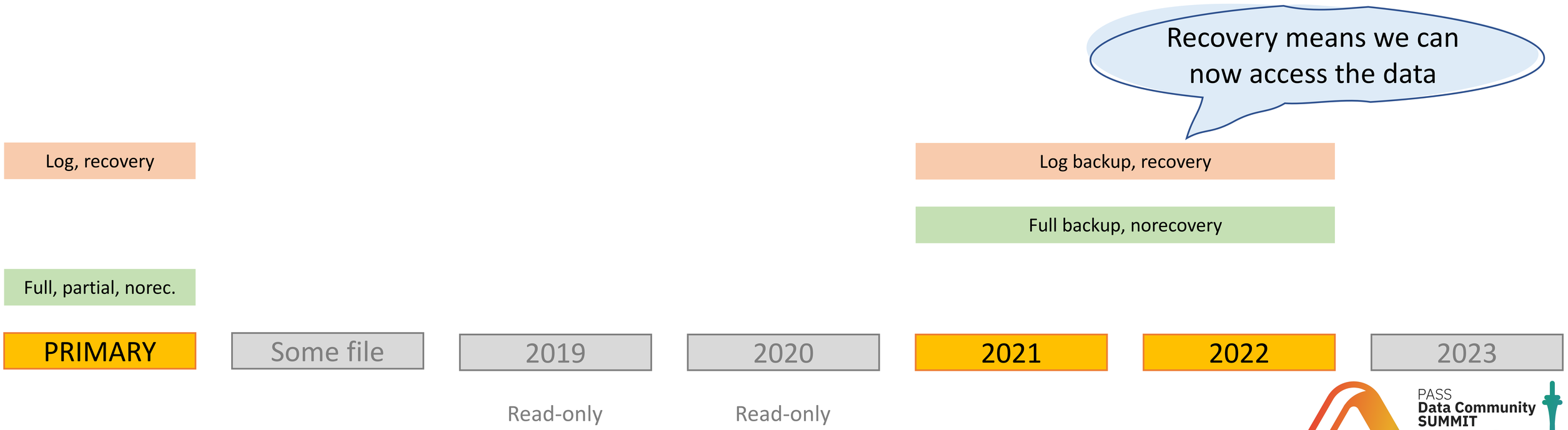

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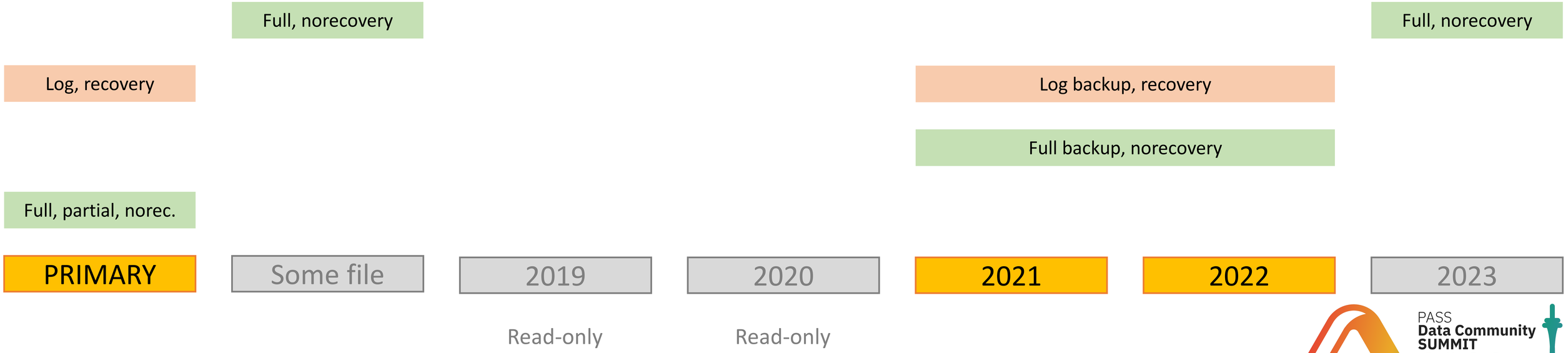

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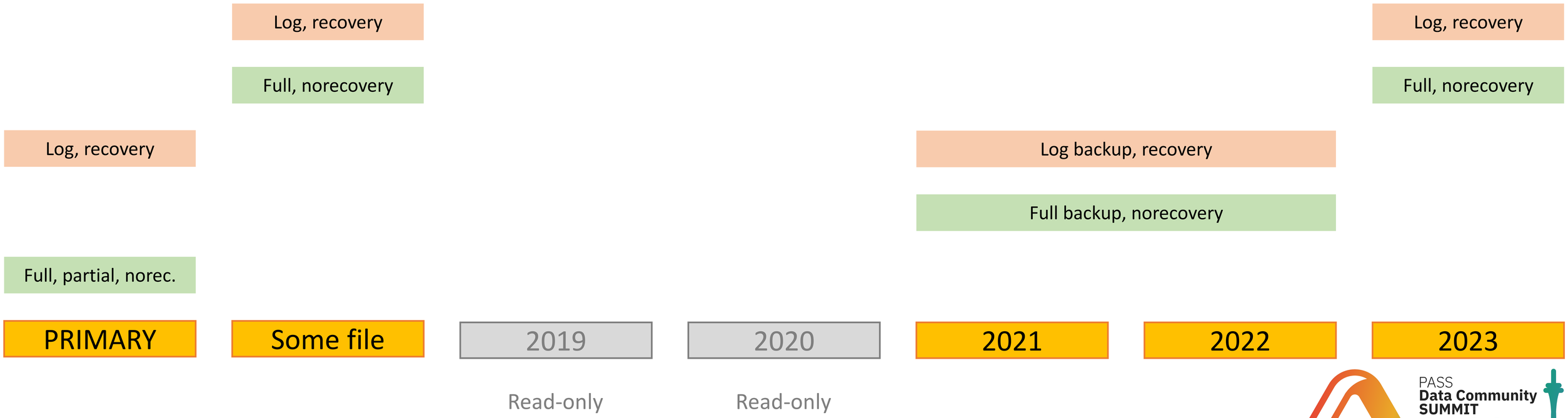

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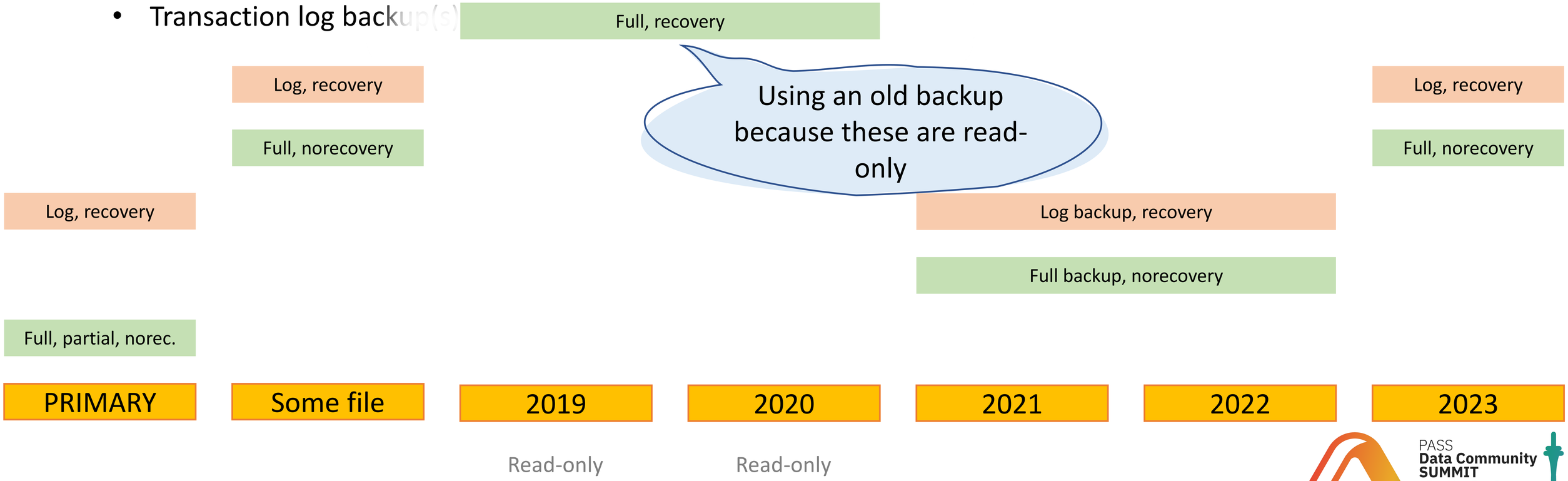

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Image credit: Eric Zhang, Unsplash

Seeks & scans work differently

```
SELECT AccountID, SUM(Amount) AS Net_balance_change
FROM dbo.AccountTransactions
WHERE TransactionDate BETWEEN '2021-07-01' AND '2022-06-30'
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AccountID
TransactionDate
TransactionID

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AccountID
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TransactionID

YEAR(TransactionDate)
AccountID
TransactionDate
TransactionID

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AccountID
TransactionDate
TransactionID

YEAR(TransactionDate)
AccountID
TransactionDate
TransactionID

29 600 pages

- Seek AccountID 810000000-820000000

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AccountID
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AccountID
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YEAR(TransactionDate)
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TransactionDate
TransactionID

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600 pages

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100000000	AccountID	999999999

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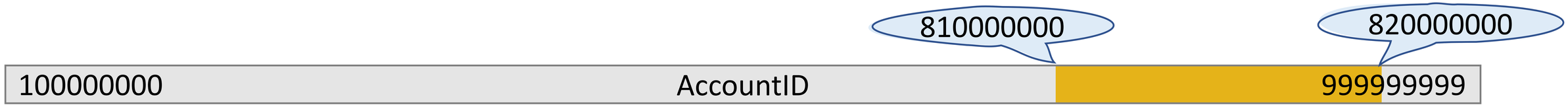

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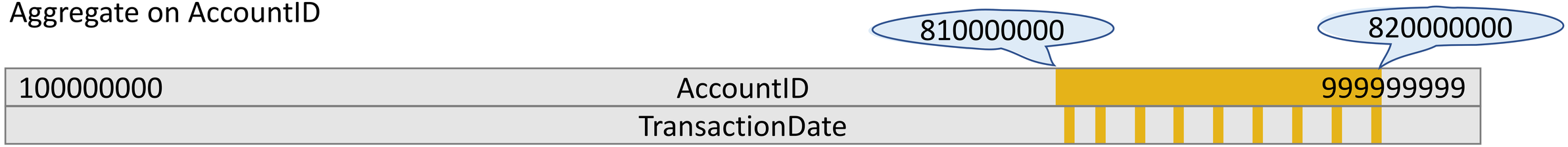

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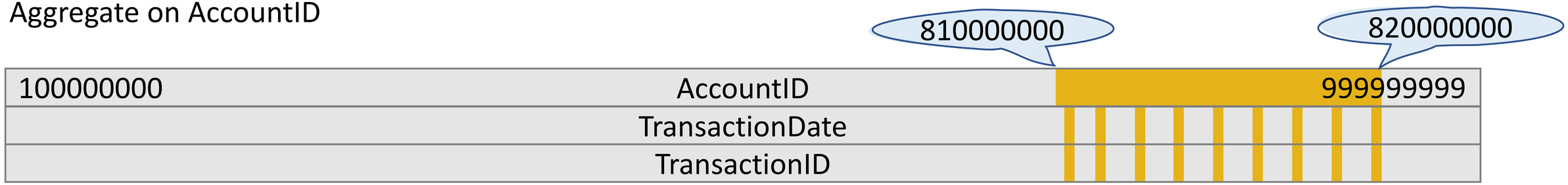

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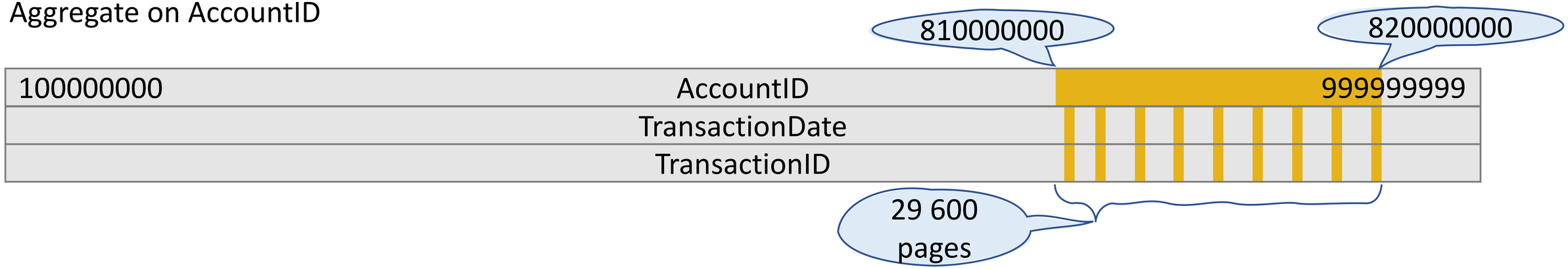

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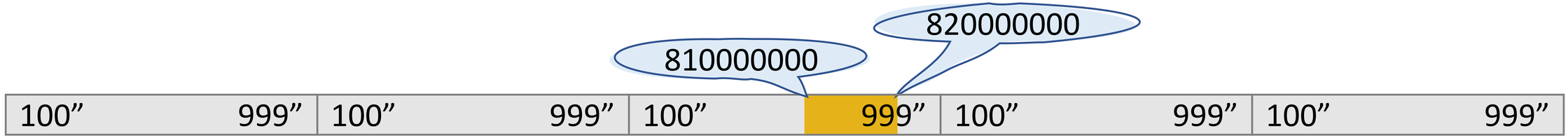

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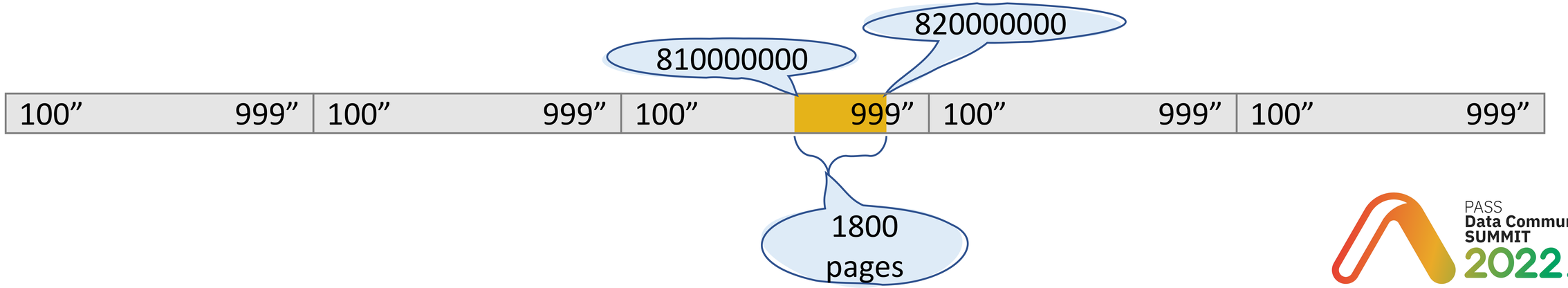

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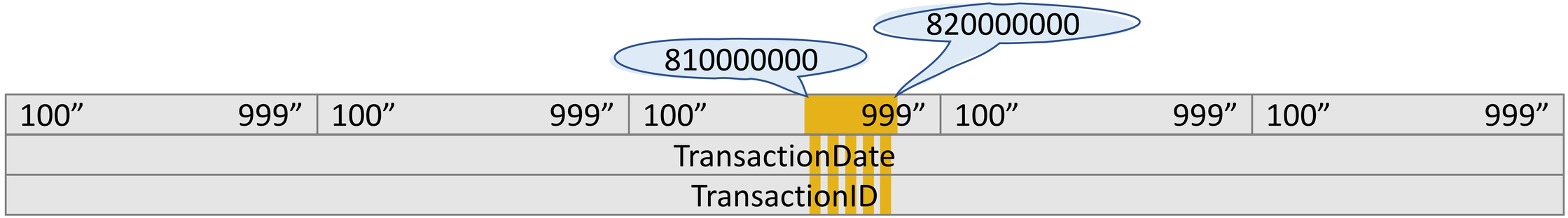

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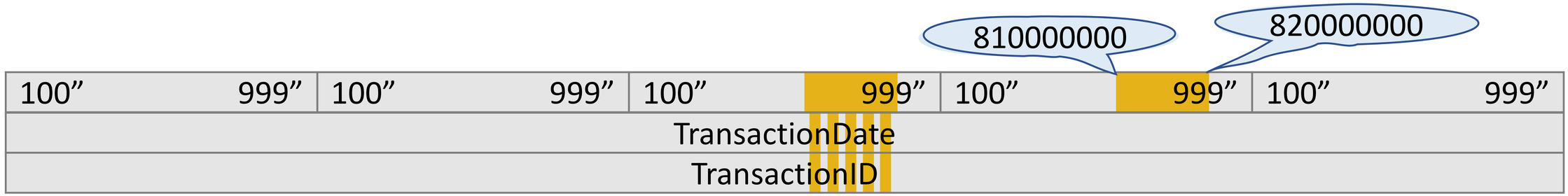

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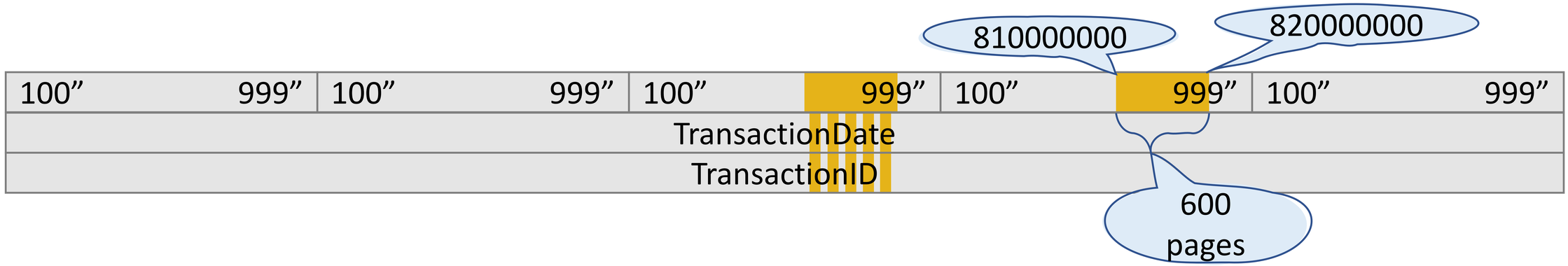

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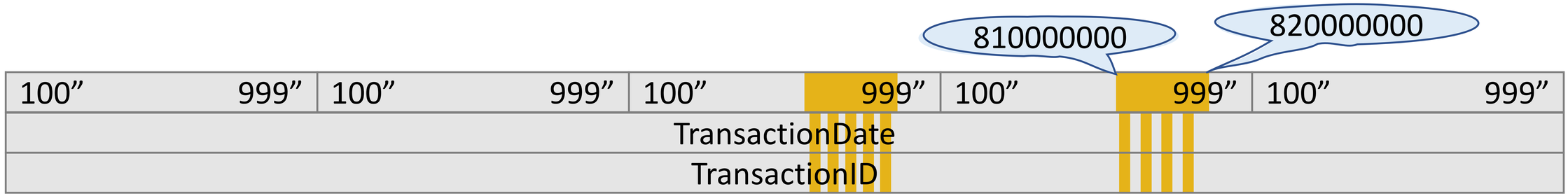

DEMO

Image credit: Robert Ritchie, Unsplash

Takeaway: Why partitioning?

- Some costly DML operations can be turned into super-fast DDL statements
- Some queries can be tuned to use a single partition (partition elimination)
- Can solve specific latch contention issues by spreading writes
- You can backup only read-write partitions – faster backups
- You can restore the important partitions first – shorter RTO

… or maybe not?

- More complex to maintain
- More complex to develop
- Tuned for non-partitioned ≠ tuned for partitioning

Standing on the shoulders of giants

I found inspiration in blogs, presentations and more from:

- Kendra Little
- Cathrine Wilhelmsen
- Uwe Ricken

Session evaluation

Your feedback is important to us

Evaluate this session at:

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Thank you

Enjoy the rest of the conference!

Daniel Hutmacher

daniel@strd.co

@dhmacher

sqlsunday.com

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