THE #RDATATABLE PACKAGE

for fast, flexible and memory efficient data wrangling

Arun Srinivasan

UseR'15

OPEN ANALYTICS

WHO AM I?

- Bioinformatician, Comp. Biologist
- Started using R in mid 2011

WHO AM I?

- Tried plyr and plyr in parallel
- Discovered data.table. Never looked back

WHO AM I?

- data.table developer since late 2013
- Data analyst at Open Analytics since Feb 2015

COME VISIT US

OVERVIEW

- Perform operations straightforward, without compromising in efficiency

1. FREAD

```
fread('file.csv')
```

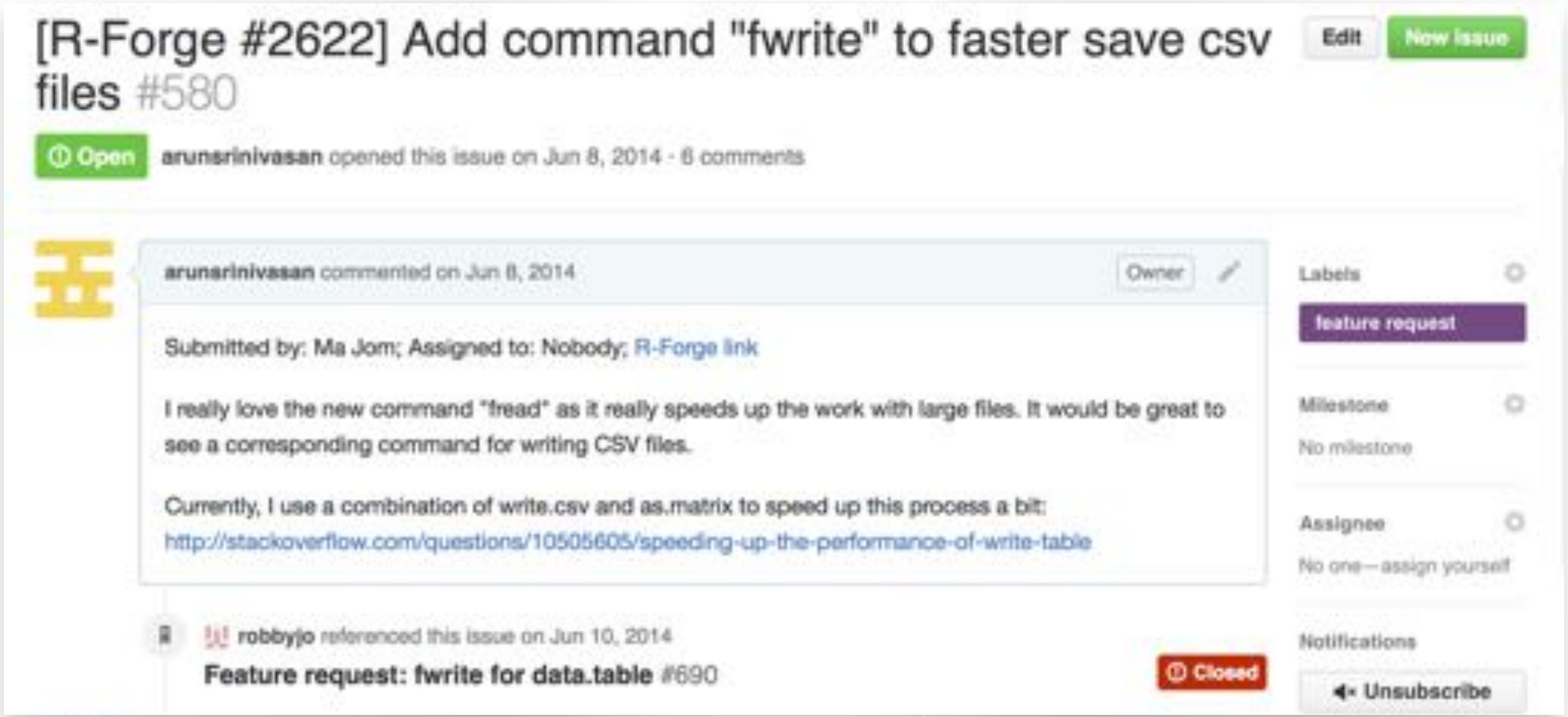
1.8.8, MARCH 2013
67 ISSUES CLOSED
- 26 FEATURES
- 17 BUG FIXES

- `sep, colClasses, rows` automatically detected

BENCHMARK

23GB .csv, 500 million rows, 9 columns		
Method	**Run Time**	**Threadedness**
h2o.importFile	50s	Multiple
fread	5m	Single
readr::read_csv	12m	Single

FWRITE?



[R-Forge #2622] Add command "fwrite" to faster save csv files #580

arunsrinivasan opened this issue on Jun 8, 2014 · 6 comments

arunsrinivasan commented on Jun 8, 2014

Submitted by: Ma Jom; Assigned to: Nobody; R-Forge link

I really love the new command "fread" as it really speeds up the work with large files. It would be great to see a corresponding command for writing CSV files.

Currently, I use a combination of write.csv and as.matrix to speed up this process a bit: http://stackoverflow.com/questions/10505605/speeding-up-the-performance-of-write-table

robbyjo referenced this issue on Jun 10, 2014

Feature request: fwrite for data.table #690

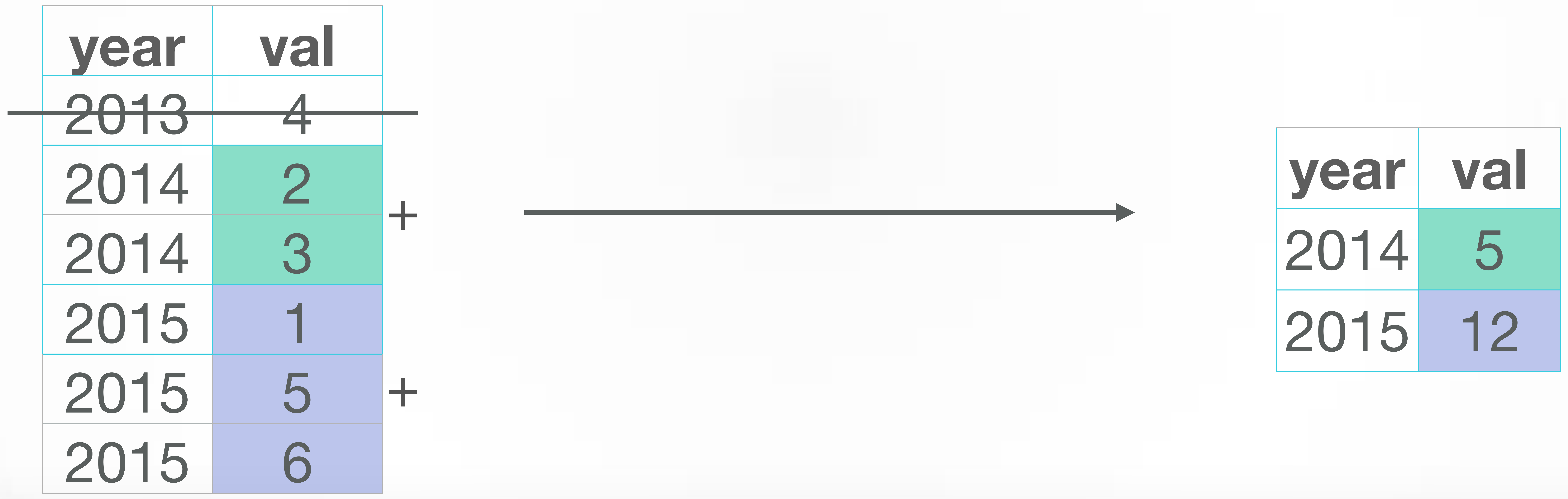
2. GROUPED AGGREGATIONS

year	val
2013	4
2014	2
2014	3
2015	1
2015	5
2015	6

$\longrightarrow$

year	val
2014	5
2015	12

2. GROUPED AGGREGATIONS



year	val
~~2013~~	~~4~~
2014	2
2014	3
2015	1
2015	5
2015	6

year	val
2014	5
2015	12

2. GROUPED AGGREGATIONS

```
X[year %in% 2014:2015, .(val = sum(val)), by = year]
```

year	val	
~~2013~~	~~4~~	
2014	2	+
2014	3	
2015	1	
2015	5	+
2015	6	

$\longrightarrow$

year	val
2014	5
2015	12

2. GROUPED AGGREGATIONS

EXPRESSION

```
X[year %in% 2014:2015, .(val = sum(val)), by = year]
```

NO MORE X$

GROUP BY

2. GROUPED AGGREGATIONS

J, WHAT TO DO?

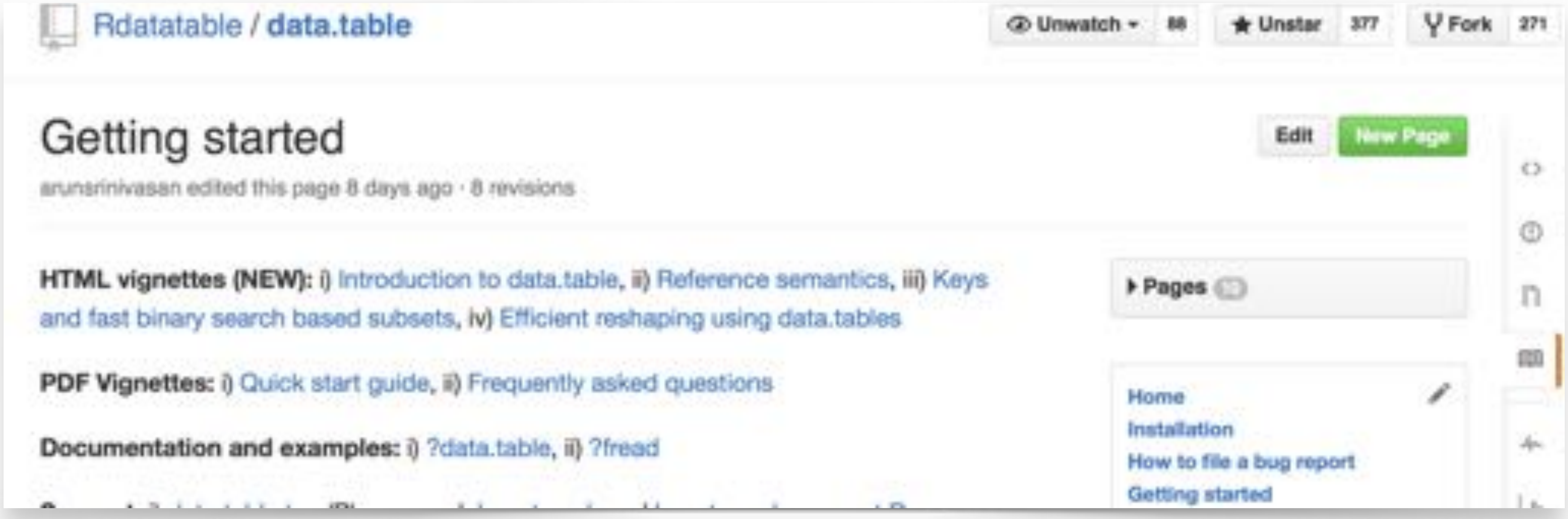
```
X[year %in% 2014:2015, .(val = sum(val)), by = year]
```

I, ON WHICH ROWS?

BY, GROUPED BY WHAT?

VIGNETTES

https://github.com/Rdatatable/data.table/wiki/Getting-started


Rdatatable / data.table

Unwatch 88 | Unstar 377 | Fork 271

Getting started

Edit | New Page

arunsrinivasan edited this page 8 days ago · 8 revisions

HTML vignettes (NEW): i) Introduction to data.table, ii) Reference semantics, iii) Keys and fast binary search based subsets, iv) Efficient reshaping using data.tables

PDF Vignettes: i) Quick start guide, ii) Frequently asked questions

Documentation and examples: i) ?data.table, ii) ?fread

Pages

Home
Installation
How to file a bug report
Getting started

3. AGGREGATIONS ON JOINS

year	val
2013	4
2014	2
2014	3
2015	1
2015	5
2015	6

year	mul
2014	20
2015	10

3. AGGREGATIONS ON JOINS

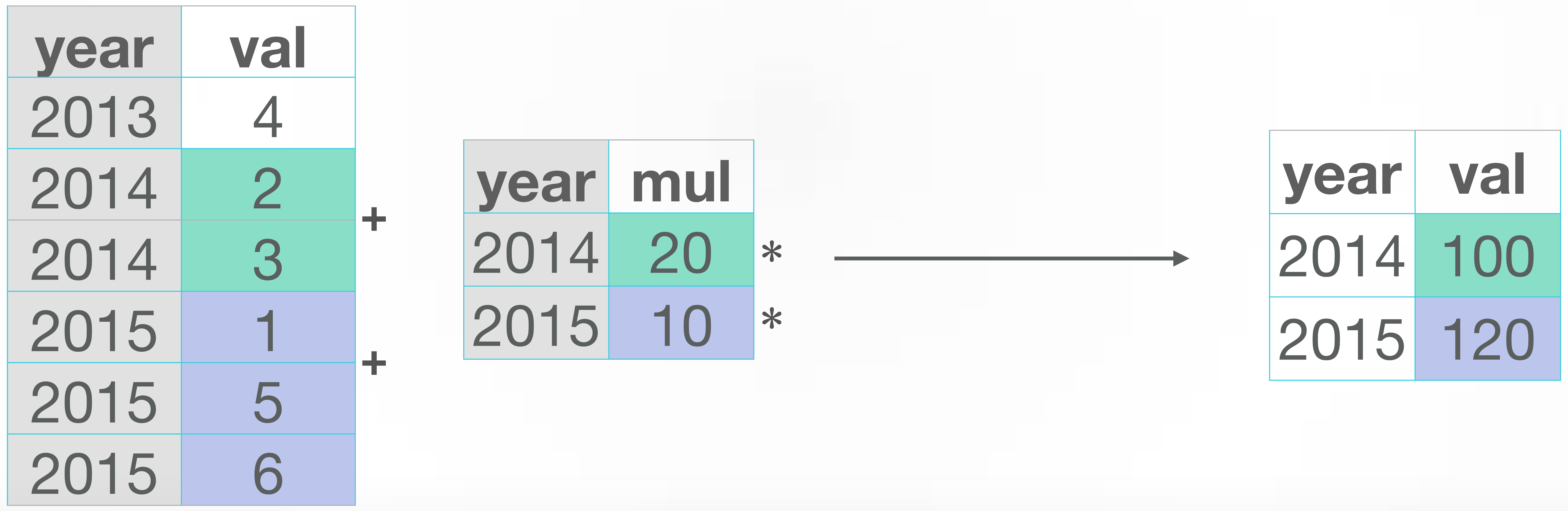
year	val
2013	4
2014	2
2014	3
2015	1
2015	5
2015	6

year	mul
2014	20
2015	10

$\longrightarrow$

year	val
2014	100
2015	120

3. AGGREGATIONS ON JOINS



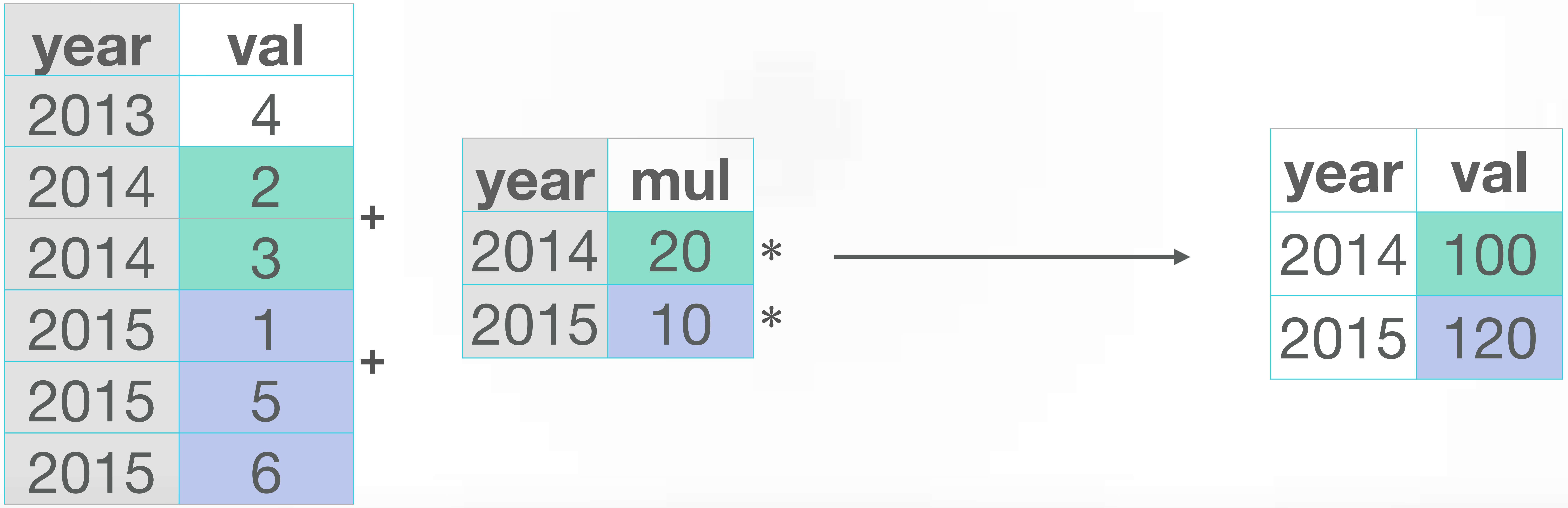
year	val
2013	4
2014	2
2014	3
2015	1
2015	5
2015	6

year	mul
2014	20
2015	10

year	val
2014	100
2015	120

3. AGGREGATIONS ON JOINS

```
X[Y, .(val = sum(val) * mul), by = .EACHI]
```



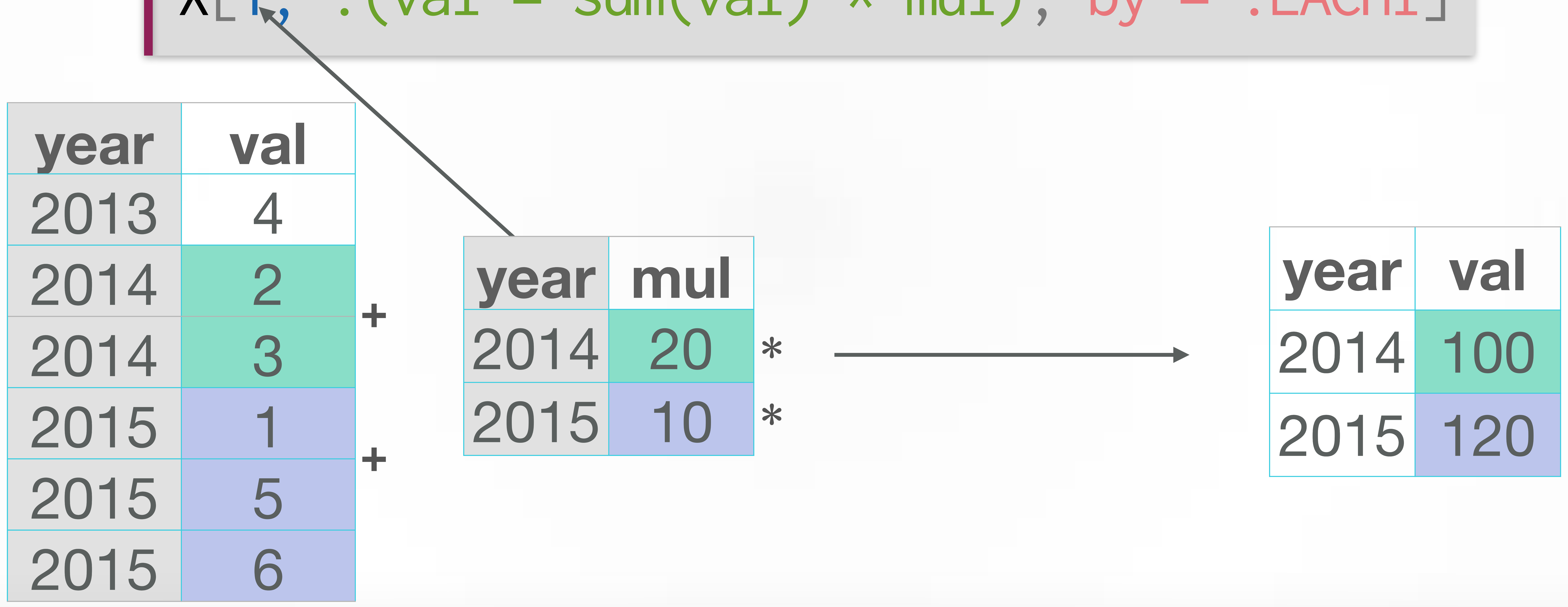
year	val
2013	4
2014	2
2014	3
2015	1
2015	5
2015	6

year	mul
2014	20
2015	10

year	val
2014	100
2015	120

3. AGGREGATIONS ON JOINS

```
X[Y, .(val = sum(val) * mul), by = .EACHI]
```



year	val
2013	4
2014	2
2014	3
2015	1
2015	5
2015	6

year	mul
2014	20
2015	10

year	val
2014	100
2015	120

3. AGGREGATIONS ON JOINS

WHAT TO DO?

```
X[Y, .(val = sum(val) * mul), by = .EACHI]
```

ON WHICH ROWS?

GROUPED BY WHAT?

3. AGGREGATIONS ON JOINS

WHAT TO DO?

```
X[Y, .(val = sum(val) * mul), by = .EACHI]
```

ON WHICH ROWS?

GROUPED BY WHAT?

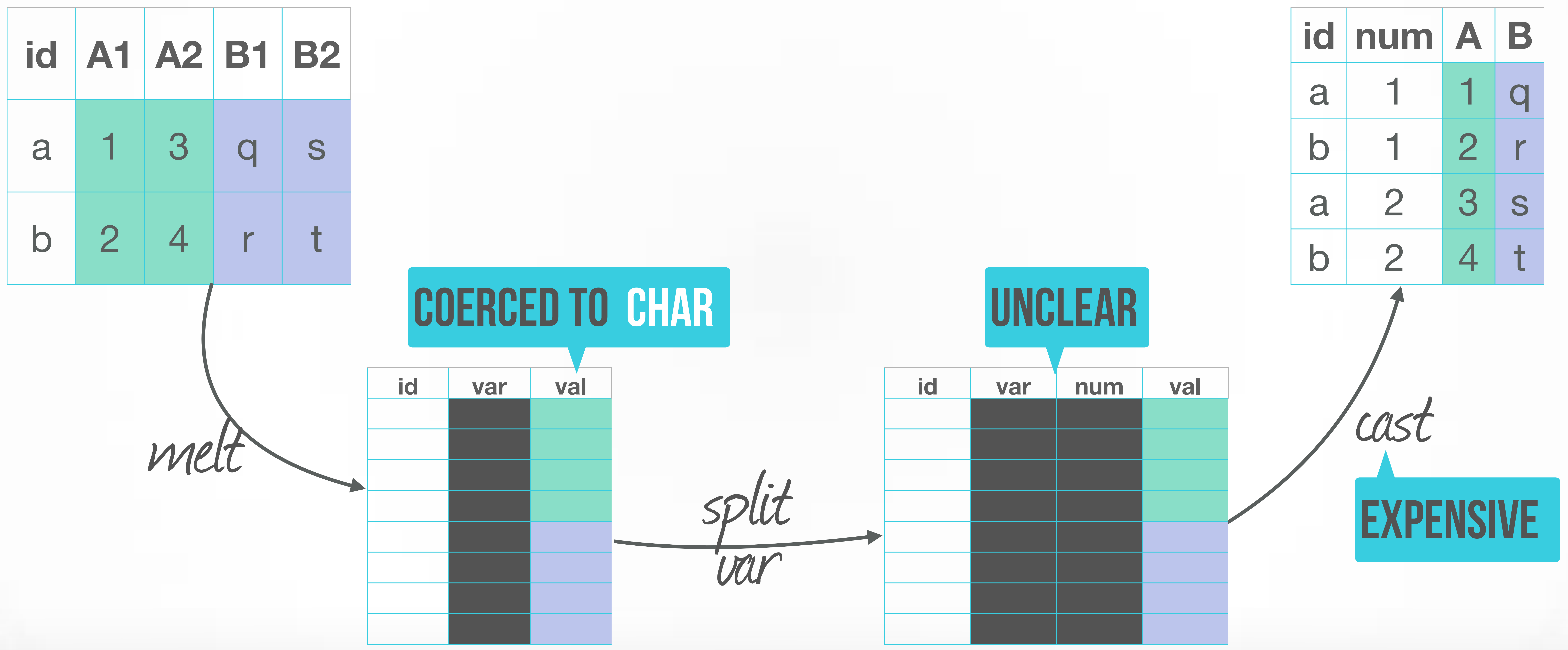
Joins as Subsets

4. RESHAPING

id	A1	A2	B1	B2
a	1	3	q	s
b	2	4	r	t

id	num	A	B
a	1	1	q
b	1	2	r
a	2	3	s
b	2	4	t

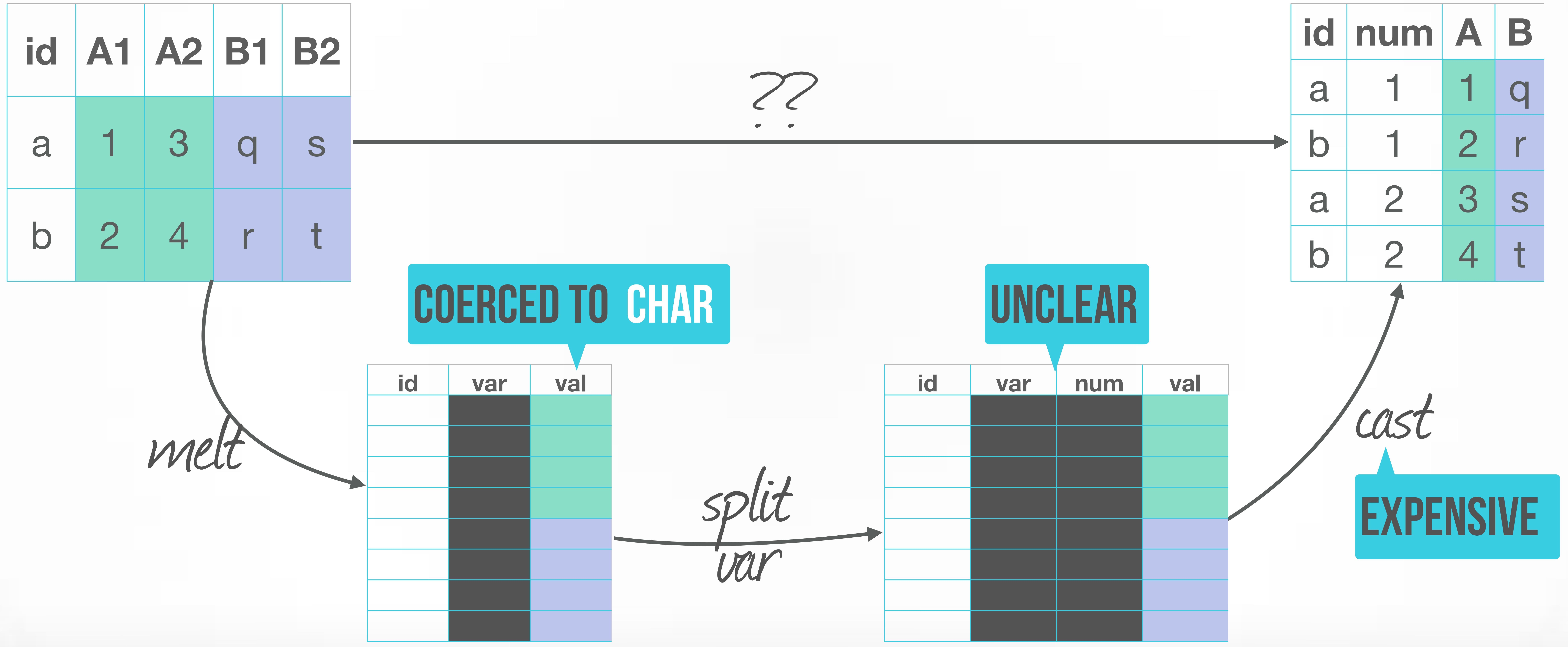
4. RESHAPING



id	A1	A2	B1	B2
a	1	3	q	s
b	2	4	r	t

id	num	A	B
a	1	1	q
b	1	2	r
a	2	3	s
b	2	4	t

4. RESHAPING



id	A1	A2	B1	B2
a	1	3	q	s
b	2	4	r	t

id	num	A	B
a	1	1	q
b	1	2	r
a	2	3	s
b	2	4	t

4. RESHAPING

id	A1	A2	B1	B2
a	1	3	q	s
b	2	4	r	t

NEW FEATURE IN 1.9.6

```
melt(DT, measure = patterns("^A", "^B"))
```

id	num	A	B
a	1	1	q
b	1	2	r
a	2	3	s
b	2	4	t

BENCHMARK

27MB .csv, 500 thousand rows, 8 cols	
Method	**Run Time**
base::reshape	4.48s
melt (v1.9.6)	0.05s
tidyr	9.41s

4. RESHAPING

NEW FEATURE IN 1.9.6

id	A1	A2	B1	B2
a	1	3	q	s
b	2	4	r	t

```
dcast(DT, id ~ num, value.var = c("A", "B"))
```

id	num	A	B
a	1	1	q
b	1	2	r
a	2	3	s
b	2	4	t

THANKS TO

ANANDA MAHTO for ideas on reshaping enhancements.
Also check out SPLITSTACKSHAPE.

5. OVERLAPPING RANGE JOINS

A

	chr	start	end
1:	1	5	11
2:	1	10	20
3:	2	1	4
4:	2	25	52
5:	2	50	60

B

	chr	start	end
1:	1	1	4
2:	1	15	18
3:	2	1	55

```
foverlaps(A, B, which=TRUE)
```

SINCE V1.9.4. BUILT USING ROLLING JOINS.

RESULT

xid	yid
1	NA
2	2
3	3
4	3
5	3

5. OVERLAPPING RANGE JOINS

A

	chr	start	end
1:	1	5	11
2:	1	10	20
3:	2	1	4
4:	2	25	52
5:	2	50	60

B

	chr	start	end
1:	1	1	4
2:	1	15	18
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SINCE V1.9.4. BUILT USING ROLLING JOINS.

RESULT

xid	yid
1	NA
2	2
3	3
4	3
5	3

5. OVERLAPPING RANGE JOINS

A

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	chr	start	end
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2:	1	15	18
3:	2	1	55

```
foverlaps(A, B, which=TRUE)
```

SINCE V1.9.4. BUILT USING ROLLING JOINS.

RESULT

xid	yid
1	NA
2	2
3	3
4	3
5	3

5. OVERLAPPING RANGE JOINS

A

	id	start	end
1:	1	0.5	1.1
2:	1	1	2
3:	2	0.1	0.4
4:	2	2.5	5.2
5:	2	5	6

B

	id	start	end
1:	1	0.1	0.4
2:	1	1.5	1.8
3:	2	0.1	5.5

```
foverlaps(A, B, which=TRUE)
```

RESULT

xid	yid
1	NA
2	2
3	3
4	3
5	3

Not limited to `integer` ranges, but `numeric, POSIXct, Date` ranges work just the same.

6. AUTO-INDEXING

SINCE V1.9.4

1.2GB .csv, 100 million rows, 2 columns			
data frame	`DF[DF$id %in% c("KIC", "HEJ"), ]`	Run 1	4.7s
		Run 2	4.8s
data table	`DT[id %in% c("KIC", "HEJ")]`	Run 1	3.7s
		Run 2	0.002s

INDEXING + SUBSET

VERSION 1.9.6

- ~80 bug fixes and >20 new features
- many new functions : rleid(), tstrsplit(), shift(), frank(), na.omit()
- melt() and dcast()

ACKNOWLEDGEMENTS

- Thanks to users and contributors
- Package authors who use data.table (CRAN - 84, bioconductor - 32)
- My colleagues and Matt
- And you for listening! :-)

QUESTIONS?