Chapter 8

- Slowly Changing Dimensions (SCDs)
  - When data changes in the operational systems the change can be propagated to the warehouse in many ways
  - Data warehousing has developed some 'standard' approaches:
    - Type 1, type 2, type 3, hybrids, time-stamped dimensions, and tracking changes via fact tables

Chapter 8

- Consider the Northwind OLTP
  - Product unit price is recorded in the Products table. This is the current price.
  - What happens to the history of price changes
  - Partial information is in the OrderDetails table: we can construct the pricing history of a product, but that can be incomplete …
  - What could we do in our Star Schema to keep a full account of product data?

Tracking Changes via Fact Table

Fig 8-2 shows how a fact table can be used to capture complete information on changes to a dimension

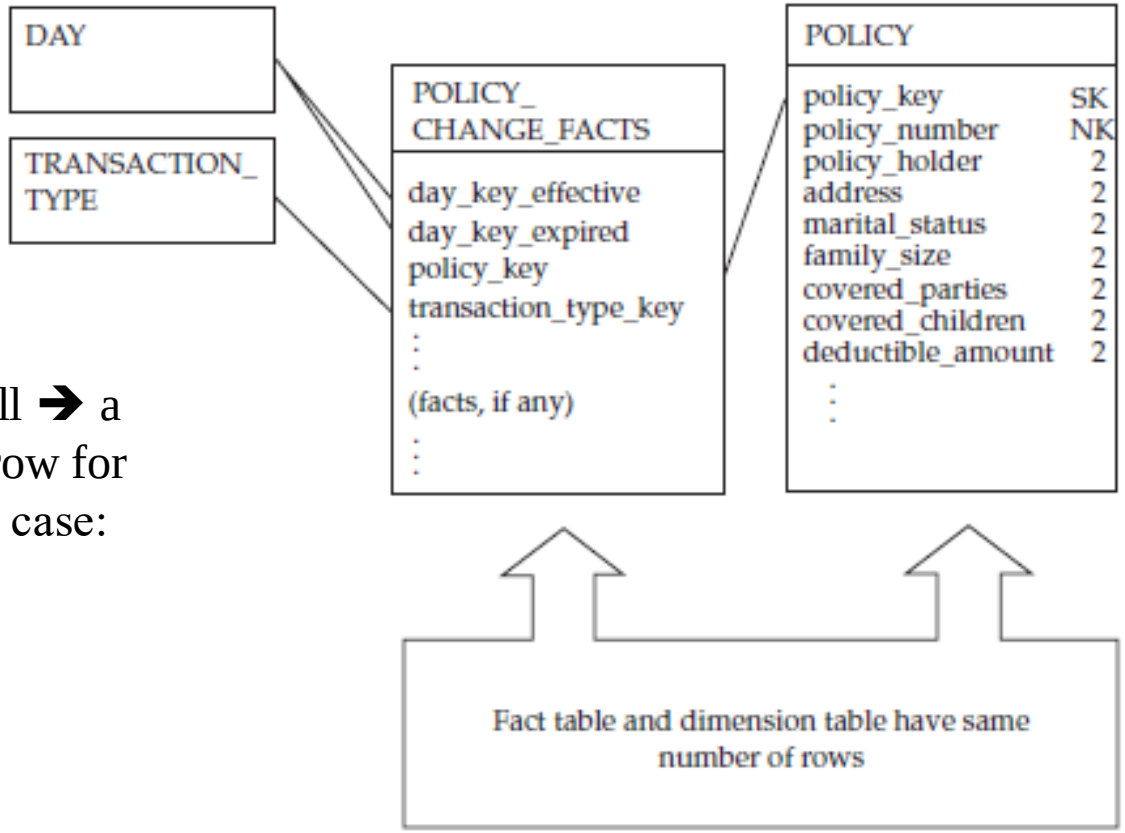


Figure 8-2 A fact table records the change history of the policy dimension

No FK can be null ➔ a need for special row for the "not expired" case: 12/31/9999

Tracking Changes via Fact Table

Fig 8-2 shows how a fact table can be used to capture complete information on changes to a dimension

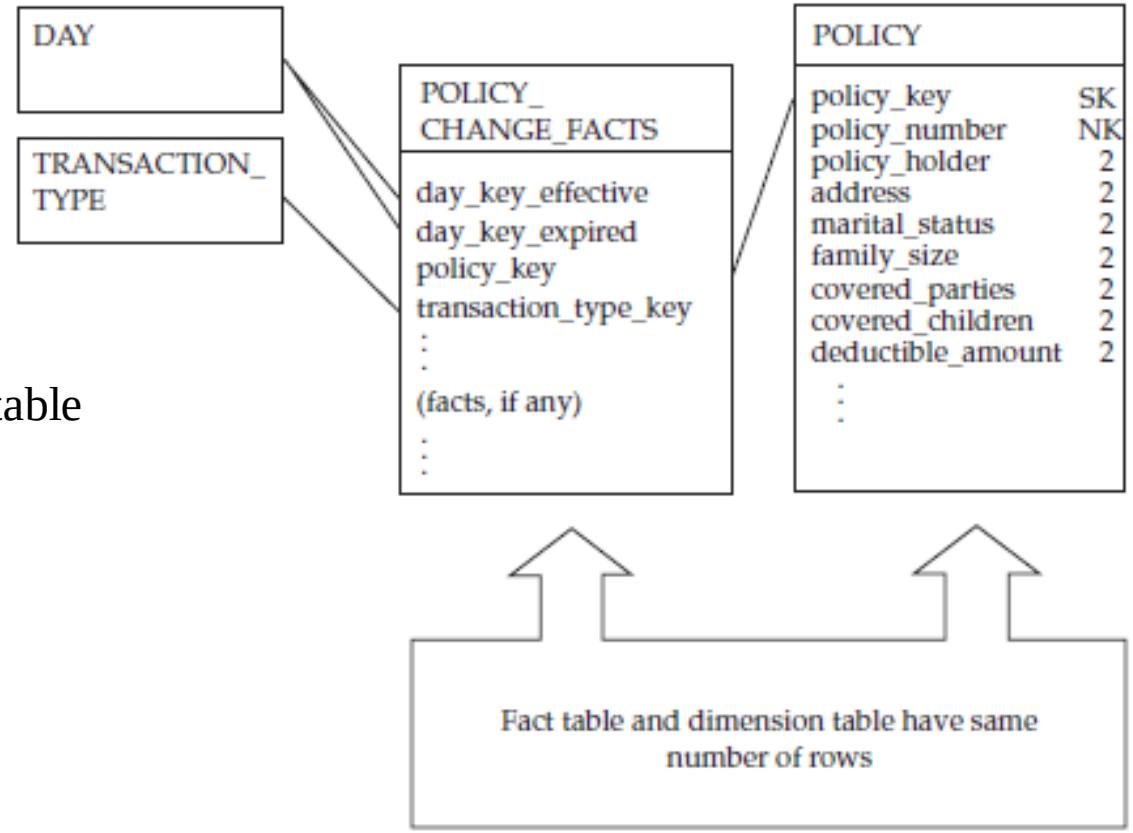


Figure 8-2 A fact table records the change history of the policy dimension

One row in fact table for each row in dimension !!!

Tracking History via Type 1

If something changes in the operational system then a Type 1 response is a simple overwrite in the warehouse

No history kept … only most current value

May be appropriate for some attributes

Tracking History via Type 2

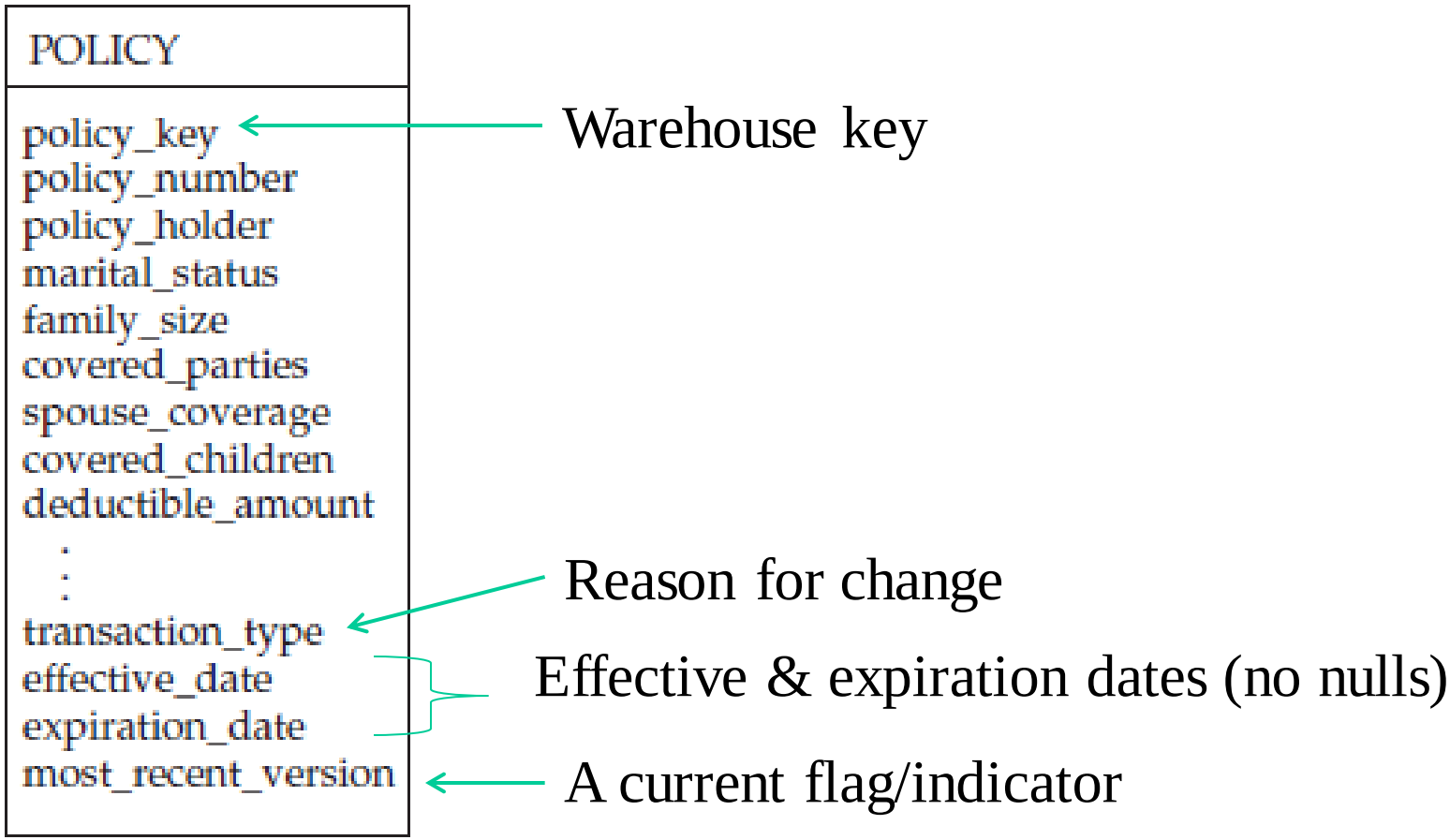
Most common approach, but note the structure of type 2 examples so far in the text … fig 8-1

The design does not let us get a full picture of anyone's policy at a particular point in time.

Through the connection to Payment_Facts we can get partial information.

Type 2

Time-stamped Type 2



Type 2

Time-stamped Type 2

POLICY

policy_ key	policy_ number	policy_ holder	transaction_ type	effective_ date	expiration_ date	most_ recent_ version	marital_ status	family_ size	covered_ parties
12882	40111	Smith, Hal	New Policy	2/14/2005	2/11/2006	Expired	Single	1	1
12911	40111	Smith, Hal	Policy Change	2/12/2006	3/30/2006	Expired	Married	2	1
13400	40111	Smith, Hal	Policy Renewal	3/31/2006	12/19/2007	Expired	Married	2	2
14779	40111	Smith, Hal	Policy Change	12/20/2007	2/3/2008	Expired	Married	3	3
14922	40111	Smith, Hal	Policy Change	2/4/2008	12/31/9999	Current	Married	4	4

Use to order a change history

Use for point-in-time analysis across policies

Use to filter for current status

Type 2

Time-stamped Type 2

```
SELECT
 policy_holder,
 transaction_type,
 marital_status
   :
   .
ORDER_BY
 effective_date
```

A *picture* of a policy holder over time

```
SELECT
   policy_holder,
   marital_status
     :
     .
WHERE
 12/31/2006 >= effective_date AND
 12/31/2006 <= expiration_date
```

A *picture* of a policy holder at a point in time

```
SELECT
   policy_holder,
   marital_status
     :
     .
WHERE
 most_recent_row
     = "Current"
```

A *picture* of a policy holder at the current time

Type 2

Time-stamped Type 2

Suppose there are multiple changes on one day

A variation:

… utilize another dimension for time …

… utilize another flag for last_change_of_day and having possible values *final* / *expired*

Type 2

Some refer to “time-stamped type 2” is “**the** type 2” :

A dimension with *effective* & *expired* dates plus a *current* indicator.

In 4904 we only concern ourselves with Type 2 having *effective* & *expired* dates plus a *current* indicator

Tracking History via Type 3

Occasionally an attribute of a dimension has special analytic requirements

Analysts want to understand some business process as things were before a change, and then as well after the change.

For such attributes we include 2 attributes, such as

region_current *region_previous*

Type 3

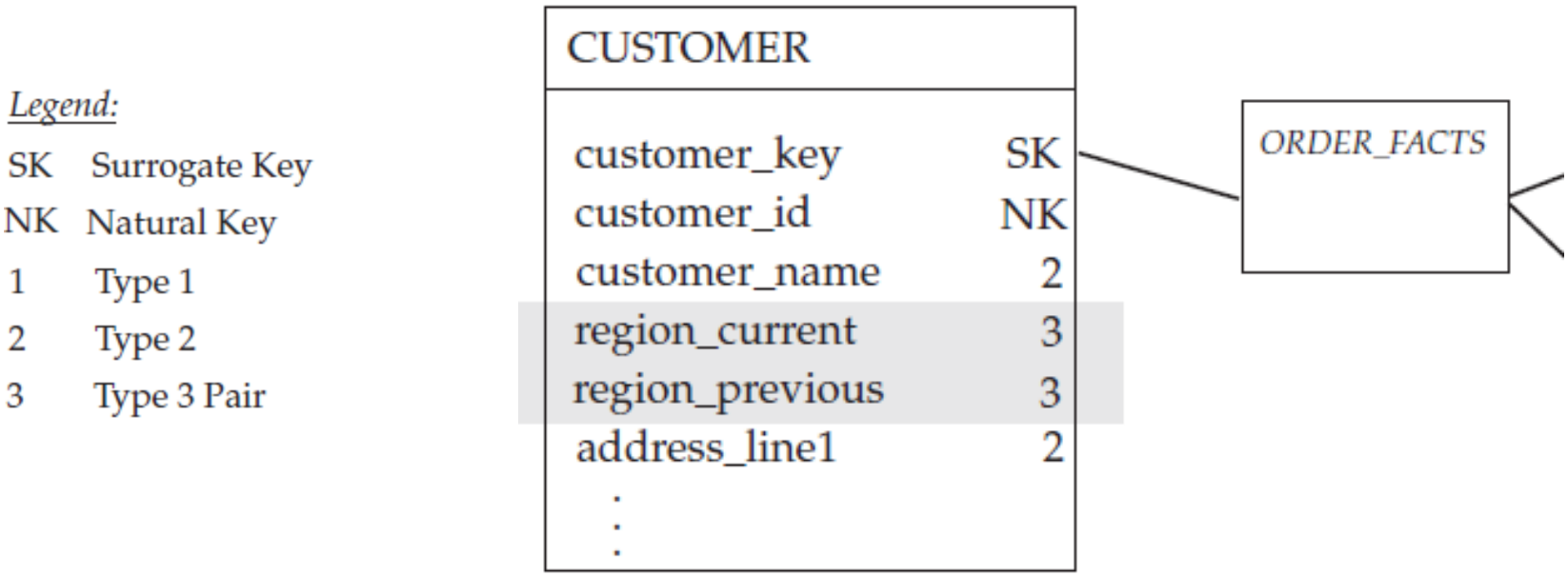


Figure 8-4 A type 3 attribute in the customer dimension

Type 3

Before

Customer dimension table

customer_ key	customer_ID	customer_name	region_ current	region_ previous
1011	1140400	Davis, Robert	East	East
1022	3305300	Nguyen, Tamara	East	East
1302	7733300	Rodriguez, Jason	West	West
1499	9900011	Johnson, Sue	West	West

initially

Orders fact table

customer_ key	day_key	order_ dollars
1011	2322	2000
1011	3422	1000

Type 3

After

Customer dimension table

customer_ key	customer_ID	customer_name	region_ current	region_ previous	
1011	1140400	Davis, Robert	Northeast	East	
1022	3305300	Nguyen, Tamara	Southeast	East	
1302	7733300	Rodriguez, Jason	West	West	
1499	9900011	Johnson, Sue	West	West	

Later on

Analysis with new values

Analysis with old values

Orders fact table

customer_ key	day_key	order_ dollars	
1011	2322	2000	
1011	3422	1000	
1011	6599	1200	
1011	8211	2000	

facts in place before the change

facts added after the change

Type 3

SQL for total sales by Region

by regionCurrent

```
Select  regionCurrent,
        sum(orderDollars)
From Customer  ….join Sales
        on(…)
Group by regionCurrent
```

by regionPrevious

```
Select  regionPrevious,
        sum(orderDollars)
From Customer  ….join Sales
        on(…)
Group by regionPrevious
```

How would you do the above if the dimension was Type 2

…by regionCurrent
…doable

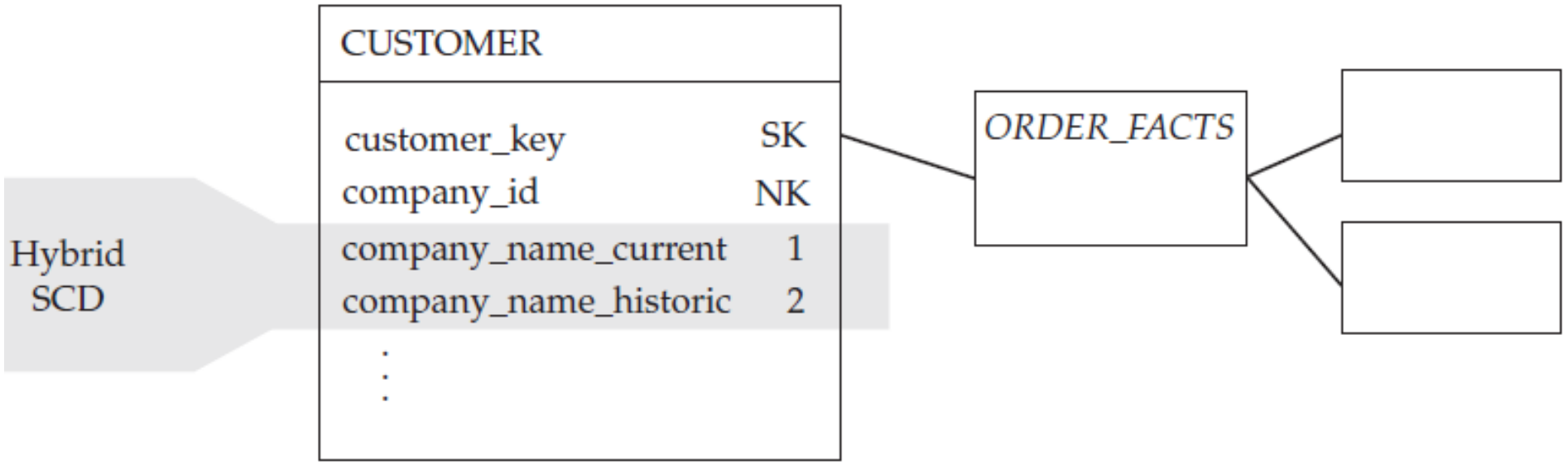
…by regionPrevious
…more difficult

Type 3

Variations …. 3 attributes instead of 2

regionCurrent, regionLastYear, regionTwoYearsAgo

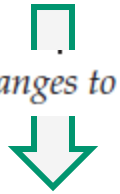
Type 1 / 2 Hybrid page 186++



Type 1 / 2 Hybrid

CUSTOMER

customer_ key	company_ id	company_name _current	company_name _historic
1011	BB770	Apple Computer, Inc.	Apple Computer, Inc.



CUSTOMER

customer_ key	company_ id	company_name _current	company_name _historic
1011	BB770	~~Apple Computer, Inc.~~ Apple Inc. (1)	Apple Computer, Inc.
(2) 2822	BB770	Apple Inc.	Apple Inc.

1 Old row(s) updated with new company_name_current

2 Row is added with new name in both positions

Type 1 / 2 Hybrid

CUSTOMER

customer_ key	customer_ id	company_name _current	company_name _historic
1011	BB770	~~Apple Computer, Inc.~~ Apple Inc.	Apple Computer, Inc.
2822	BB770	Apple Inc.	Apple Inc.

ORDER_FACTS

customer_ key	date_ key	order_ dollars	
1011	1211	200	Facts in place before change
1011	1221	400	
2822	1344	400	Fact added after change

Type 1 / 2 Hybrid

Current info

```
SELECT
  company_name_current,
  sum(order_dollars)
FROM
   :
   :
```

COMPANY_NAME_CURRENT	ORDER_DOLLARS
Apple Inc.	1000

Historically acurrate

```
SELECT
  company_name_historic,
  sum(order_dollars)
FROM
   :
   :
```

COMPANY_NAME_HISTORIC	ORDER_DOLLARS
Apple Computer, Inc.	600
Apple Inc.	400

Type 1 / 2 Hybrid

Current info

```
SELECT
  company_name_current,
  sum(order_dollars)
FROM
   :
   :
```

Historically acurrate

```
SELECT
  company_name_historic,
  sum(order_dollars)
FROM
   :
   :
```

How would we do the above if we only had a type 2 dimension?

Current…. doable

Historic …. difficult

Type 1 / 2 / 3 Hybrid

3 columns for an attribute

current value, previous value, historic value