CSE 4125: Distributed Database Systems
Chapter – 3 : Part E

Levels of Distributed Transparency

Distribution transparency for update application

Update Sub-tree

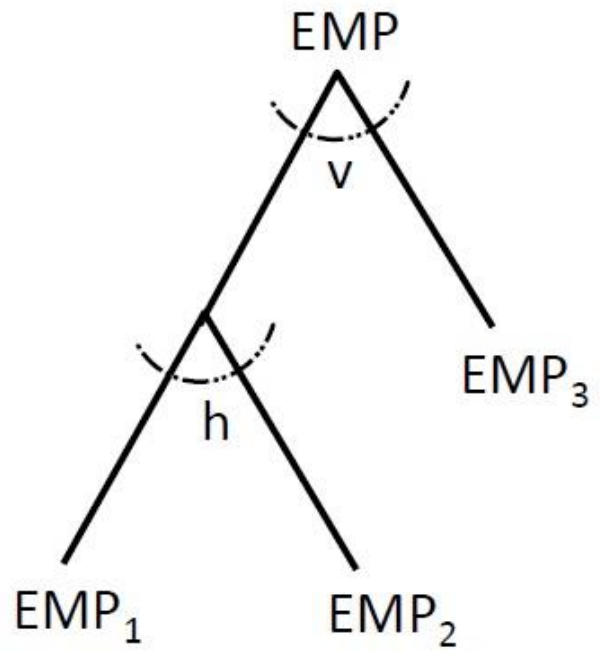
Example:

$EMP_1 = \boldsymbol{SL}_{\text{DEPTNUM} \leq 10} \boldsymbol{PJ}_{\text{EMPNUM, NAME, MGRNUM, DEPTNUM}} (EMP)$

$EMP_2 = \boldsymbol{SL}_{\text{DEPTNUM} > 10} \boldsymbol{PJ}_{\text{EMPNUM, NAME, MGRNUM, DEPTNUM}} (EMP)$

$EMP_3 = \boldsymbol{PJ}_{\text{EMPNUM, NAME, SAL, TAX}} (EMP)$

Which part of the tree will be effected if **DEPTNUM** is updated?



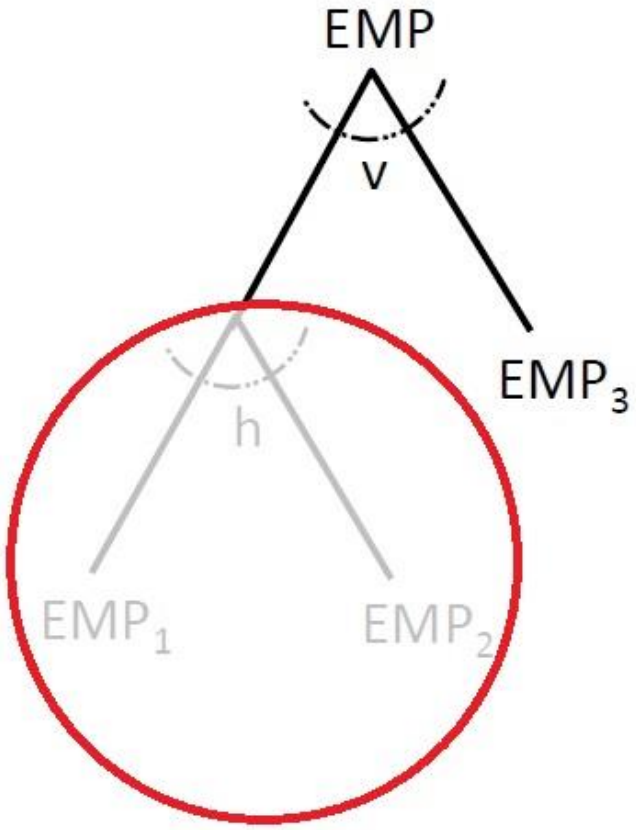
Example:

EMP1 = $\boldsymbol{SL}_{\text{DEPTNUM} \leq 10}$ $\boldsymbol{PJ}_{\text{EMPNUM, NAME, MGRNUM, DEPTNUM}}$ (EMP)

EMP2 = $\boldsymbol{SL}_{\text{DEPTNUM} > 10}$ $\boldsymbol{PJ}_{\text{EMPNUM, NAME, MGRNUM, DEPTNUM}}$ (EMP)

EMP3 = $\boldsymbol{PJ}_{\text{EMPNUM, NAME, SAL, TAX}}$ (EMP)

Which part of the tree will be effected if **DEPTNUM** is updated?



Objective

We analyze with an example the different levels of distribution transparency:

- Level 1: Fragmentation transparency.
- Level 2: Location transparency.
- Level 3: Local mapping transparency.

For an ***update*** application.

Scenario

Global schema:

EMP (EMPNUM, NAME, SAL, TAX, MGRNUM, DEPTNUM)

Fragmentation schema:

$EMP_1 = \mathbf{PJ}_{EMPNUM,\ NAME,\ SAL,\ TAX}\ \mathbf{SL}_{DEPTNUM \leq 10}\ (EMP)$

$EMP_2 = \mathbf{PJ}_{EMPNUM,\ MGRNUM,\ DEPTNUM}\ \mathbf{SL}_{DEPTNUM \leq 10}\ (EMP)$

$EMP_3 = \mathbf{PJ}_{EMPNUM,\ NAME,\ DEPTNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$

$EMP_4 = \mathbf{PJ}_{EMPNUM,\ SAL,\ TAX,\ MGRNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$

Allocation schema:

EMP_1 *@ site 1, 5;* EMP_2 *@ site 2, 6*

EMP_3 *@ site 3, 7;* EMP_4 *@ site 4, 8*

Assume, a **UPDTEMP** application:

Updating DEPTNUM from 3 to 15 where EMPNUM is 100.

Analyzing Level – 1 transparency

Hint:

Use global relation. No concept of fragments.

update *EMP*
set *DEPTNUM = 15*
where *EMPNUM = 100*.

Analyzing Level – 2 transparency

Hints:

Use fragments.

- –Use the concept of *update sub-tree*.
- –Follow the *effect of update*.

Hints: Use fragments. Use the *update sub-tree*. Follow the *effect of update*.

- ***Store*** the necessary record from *fragments* to temporary variables.
- ***Insert*** the records into *the affected fragments* from the temporary variables.
- ***Delete*** the records from *the previous fragments*.

Effect of Update

$$EMP_1 = \mathbf{PJ}_{\underline{EMPNUM,}\ NAME, SAL, TAX}\ \mathbf{SL}_{DEPTNUM \leq 10}\ (EMP)$$

$$EMP_2 = \mathbf{PJ}_{\underline{EMPNUM,}\ MGRNUM, DEPTNUM}\ \mathbf{SL}_{DEPTNUM \leq 10}\ (EMP)$$

$$EMP_3 = \mathbf{PJ}_{EMPNUM, NAME, DEPTNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$$

$$EMP_4 = \mathbf{PJ}_{EMPNUM, SAL, TAX, MGRNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$$

EMP_1

EMPNUM	NAME	SAL	TAX
100	Smith	10000	1000

EMP_2

EMPNUM	MGRNUM	DEPTNUM
100	20	3

Effect of updating *DEPTNUM =15* with *EMPNUM = 100*

Effect of Update

$$EMP_1 = \mathbf{PJ}_{EMPNUM,\ NAME,\ SAL,\ TAX}\ \mathbf{SL}_{DEPTNUM \le 10}\ (EMP)$$

$$EMP_2 = \mathbf{PJ}_{EMPNUM,\ MGRNUM,\ DEPTNUM}\ \mathbf{SL}_{DEPTNUM \le 10}\ (EMP)$$

$$EMP_3 = \mathbf{PJ}_{EMPNUM,\ NAME,\ DEPTNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$$

$$EMP_4 = \mathbf{PJ}_{EMPNUM,\ SAL,\ TAX,\ MGRNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$$

EMP_1

EMPNUM	NAME	SAL	TAX
100	Smith	10000	1000

EMP_2

EMPNUM	MGRNUM	DEPTNUM
100	20	3

15 ?

Effect of updating *DEPTNUM =15* with *EMPNUM = 100*

Effect of Update

$$EMP_1 = \mathbf{PJ}_{EMPNUM,\ NAME,\ SAL,\ TAX}\ \mathbf{SL}_{DEPTNUM \le 10}\ (EMP)$$

$$EMP_2 = \mathbf{PJ}_{EMPNUM,\ MGRNUM,\ DEPTNUM}\ \mathbf{SL}_{DEPTNUM \le 10}\ (EMP)$$

$$EMP_3 = \mathbf{PJ}_{EMPNUM,\ NAME,\ DEPTNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$$

$$EMP_4 = \mathbf{PJ}_{EMPNUM,\ SAL,\ TAX,\ MGRNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$$

EMP_1

EMPNUM	NAME	SAL	TAX
100	Smith	10000	1000

EMP_2

EMPNUM	MGRNUM	DEPTNUM
100	20	3

EMP_3

EMPNUM	NAME	DEPTNUM
		15

EMP_4

EMPNUM	SAL	TAX	MGRNUM

Effect of updating *DEPTNUM =15* with *EMPNUM = 100*

Effect of Update

$$EMP_1 = \mathbf{PJ}_{EMPNUM,\ NAME,\ SAL,\ TAX}\ \mathbf{SL}_{DEPTNUM \le 10}\ (EMP)$$

$$EMP_2 = \mathbf{PJ}_{EMPNUM,\ MGRNUM,\ DEPTNUM}\ \mathbf{SL}_{DEPTNUM \le 10}\ (EMP)$$

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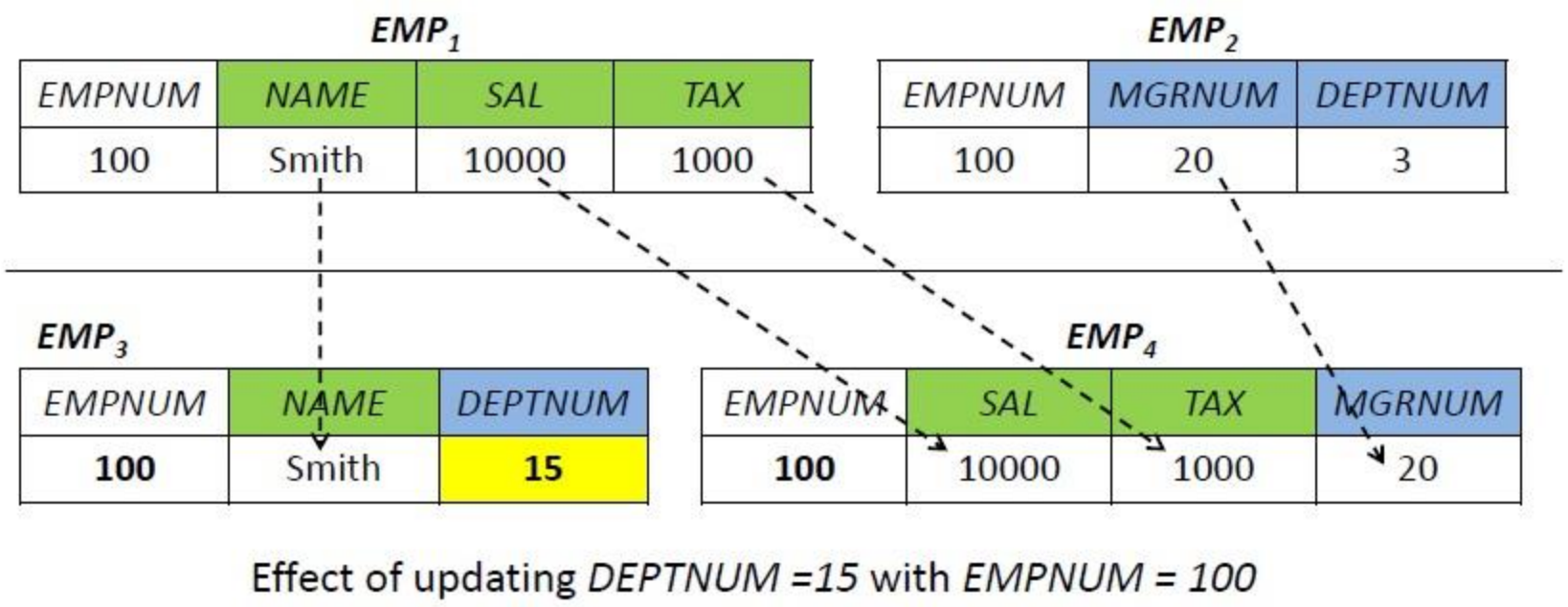

Effect of updating *DEPTNUM =15* with *EMPNUM = 100*

Effect of Update

$$EMP_1 = \mathbf{PJ}_{EMPNUM,\ NAME,\ SAL,\ TAX}\ \mathbf{SL}_{DEPTNUM \le 10}\ (EMP)$$

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$$EMP_4 = \mathbf{PJ}_{EMPNUM,\ SAL,\ TAX,\ MGRNUM}\ \mathbf{SL}_{DEPTNUM > 10}\ (EMP)$$

EMP_1

EMPNUM	NAME	SAL	TAX
~~100~~	~~Smith~~	~~10000~~	~~1000~~

EMP_2

EMPNUM	MGRNUM	DEPTNUM
~~100~~	~~20~~	~~3~~

EMP_3

EMPNUM	NAME	DEPTNUM
100	Smith	15

EMP_4

EMPNUM	SAL	TAX	MGRNUM
100	10000	1000	20

Effect of updating *DEPTNUM =15* with *EMPNUM = 100*

Hints: Use fragments. Use the *update sub-tree*. Follow the *effect of update*.

- ***Store*** the necessary record from EMP_1 and EMP_2 to temporary variables.
- ***Insert*** the records into EMP_3 and EMP_4 from the temporary variables.
- ***Delete*** the records from EMP_1 and EMP_2.

Select *NAME, SAL, TAX into $NAME, $SAL, $TAX*

from EMP_1

where *EMPNUM = 100;*

Select *MGRNUM into $MGRNUM*

from EMP_2

where *EMPNUM = 100;*

Insert into EMP_3 *(EMPNUM, NAME, DEPTNUM):*

(100, $NAME, 15);

Insert into EMP_4 *(EMPNUM, SAL, TAX, MGRNUM):*

(100, $SAL, $TAX, $MGRNUM);

Delete EMP_1 where *EMPNUM* = 100;

Delete EMP_2 where *EMPNUM* = 100;

Analyzing Level – 3 transparency

Hints: Use fragments + locations. Follow the effect of update (like previous level), but this time locations will be considered.

- ***Store*** the necessary record from EMP_1 and EMP_2 from any of the corresponding sites to temporary variables.
- ***Insert*** the records into EMP_3 and EMP_4 at corresponding sites from the temporary variables.
- ***Delete*** the records from EMP_1 and EMP_2 at corresponding sites.

Select *NAME, SAL, TAX into $NAME, $SAL, $TAX*
from EMP_1 at site 1
where *EMPNUM = 100;*
Select *MGRNUM into $MGRNUM*
from EMP_2 at site 2
where *EMPNUM = 100;*

Insert into EMP_3 *(EMPNUM, NAME, DEPTNUM)*
at site 3 : (100, $NAME, 15);
Insert into EMP_3 *(EMPNUM, NAME, DEPTNUM)*
at site 7 : (100, $NAME, 15);
Insert into EMP_4 *(EMPNUM, SAL, TAX, MGRNUM)*
at site 4 : (100, $SAL, $TAX, $MGRNUM);
Insert into EMP_4 *(EMPNUM, SAL, TAX, MGRNUM)*
at site 8 : (100, $SAL, $TAX, $MGRNUM);

Delete EMP_1 at site 1 where *EMPNUM* = 100;
Delete EMP_1 at site 5 where *EMPNUM* = 100;
Delete EMP_2 at site 2 where *EMPNUM* = 100;
Delete EMP_2 at site 6 where *EMPNUM* = 100;

Practice Problems/ Questions

a) For the example provided in the lecture slides, determine the effect of updating *DEPTNUM = 5* where *EMPNUM = 100 (assume, the record is initially found in* EMP_3 *and* EMP_4 *with DEPTNUM = 19).*

b) Text book:

- Exercise: 3.2 (a, b, c) and 3.3

c) Create your own scenario and analyze the different levels of distribution transparency for read-only and update application.