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

Levels of Distributed Transparency

Distribution Transparency

The property of DDB by which the internal details of the distribution are hidden from the users (i.e. application programmer).

- A transparent system "*hides" the implementation details from users*.
- The advantage of a *fully transparent DDB is the high level of support that it provides for the development of complex applications.*

Levels of Distribution Transparency:

–Levels at which an application programmer view the DDB, depending on how much distribution transparency is provided by the DDBMS.

Important levels are –

i. Level-1: Fragmentation transparency.

ii. Level-2: Location transparency.

iii. Level-3: Local mapping transparency.

Level-1: Fragmentation Transparency:

–Programmer works on global relation.

–Fragmentation information is hidden.

Enables Programmer to query upon any relation as if it *were not fragmented.*

	Global relation	Fragmentation	Location	Local mapping
Availability to programmer	yes	n/a	n/a	n/a

Example

Global schema:

SUPPLIER (SNUM, NAME, CITY)

Level-2: Location Transparency:

- Fragmentation information is provided. Programmer works on fragments.

–Location (i.e. site name) information is hidden.

Enables Programmer to query upon fragments as if they were stored *locally in the user's site.*

	Global relation	Fragmentation	Location	Local mapping
Availability to programmer	yes	yes	n/a	n/a

Example

Global schema:

$SUPPLIER\ (SNUM, NAME, CITY)$

Fragmentation schema:

$$SUPPLIER_1 = SL_{CITY = \text{“}DHK\text{”}}(SUPPLIER)$$

$$SUPPLIER_2 = SL_{CITY = \text{“}CTG\text{”}}(SUPPLIER)$$

Level-3: Local Mapping Transparency:

–Location information is provided. Programmer works on fragmentation at specific location (site).

–Local DBMS information is hidden.

Enables Programmer to query upon fragments at a site as if the local DBMS is “known” (i.e. Oracle or MySQL) .

	Global relation	Fragmentation	Location	Local mapping
Availability to programmer	yes	yes	yes	n/a

Example

Global schema:

SUPPLIER (SNUM, NAME, CITY)

Fragmentation schema:

$SUPPLIER_1 = SL_{CITY = \text{“DHK”}}(SUPPLIER)$

$SUPPLIER_2 = SL_{CITY = \text{“CTG”}}(SUPPLIER)$

Allocation schema:

$SUPPLIER_1$ *@ site 1.*

$SUPPLIER_2$ *@ site 2, 3.*

Distribution transparency for read-only application.

insert, update, delete -> write application

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 a ***read-only*** application.

Scenario

Global schema:

SUPPLIER (SNUM, NAME, CITY)

Fragmentation schema:

$SUPPLIER_1 = SL_{CITY = \text{“DHK”}}(SUPPLIER)$

$SUPPLIER_2 = SL_{CITY = \text{“CTG”}}(SUPPLIER)$

Allocation schema:

$SUPPLIER_1$ *@ site 1.*

$SUPPLIER_2$ *@ site 2, 3.*

Assume, a SUPINQUIRY application –

Print NAME of a given SNUM.

Example

$SUPPLIER$

SNUM	NAME	CITY
1	A	DHK
2	B	CTG
3	C	DHK
4	D	CTG

$SUPPLIER_1$

SNUM	NAME	CITY
1	A	DHK
3	C	DHK

1

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

2

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

3

Basic Structure

Reading a value from terminal and assigning it to a variable:

```
read(terminal,  $ SNUM);
```

variable

Query: Get *NAME for a given SNUM. Example –*

```
Select NAME into $ NAME
from SUPPLIER [@siteNumber]
where SNUM = $ SNUM;
```

Writing a value of a variable to terminal:

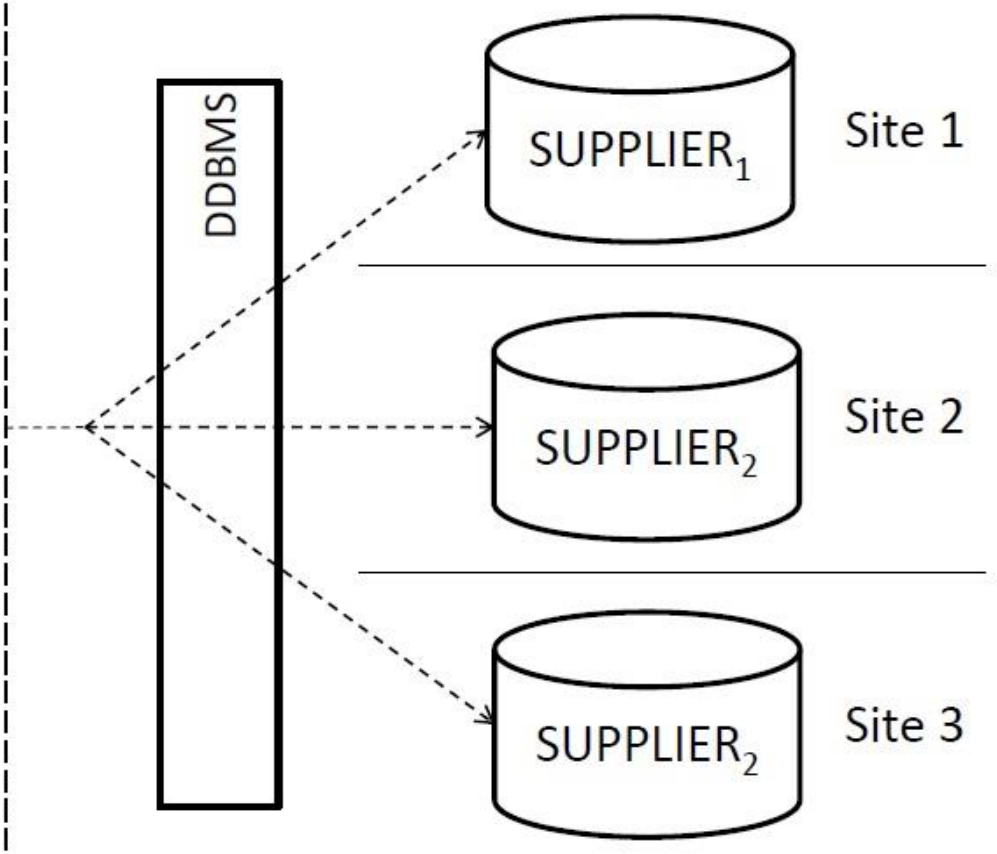
```
write(terminal, $ NAME);
```

Analyzing Level – 1 transparency

SUPINQUIRY

Hint:

Use global relation only. Because fragmentation information is hidden.



Level – 1 Transparency

Reading a value from terminal and assigning it to a variable:

read(terminal, $ *SNUM);*

Query: Get *NAME for a given SNUM. Example –*

Select NAME into $ *NAME*
from *SUPPLIER*
where SNUM = $ *SNUM;*

Writing a value of a variable to terminal:

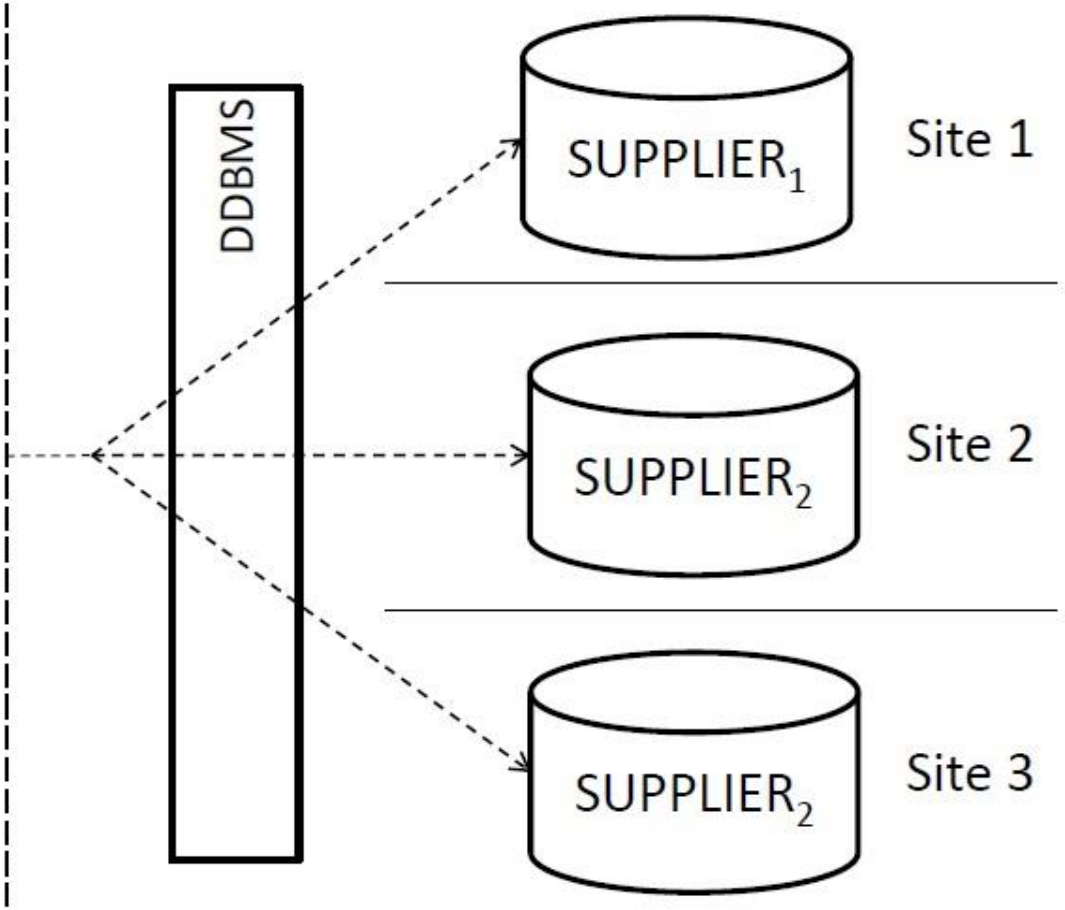
write(terminal, $ *NAME);*

SUPINQUIRY

read(terminal, $ *SNUM);*

Select NAME into $ *NAME*
from *SUPPLIER* where
SNUM = $ *SNUM;*

write(terminal, $ *NAME).*



Example

read(terminal, $ *SNUM);*

Select NAME into $ *NAME*
from *SUPPLIER* where
SNUM = $ *SNUM;*

write(terminal, $ *NAME).*

$SUPPLIER_1$

SNUM	NAME	CITY
1	A	DHK
3	C	DHK

1

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

2

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

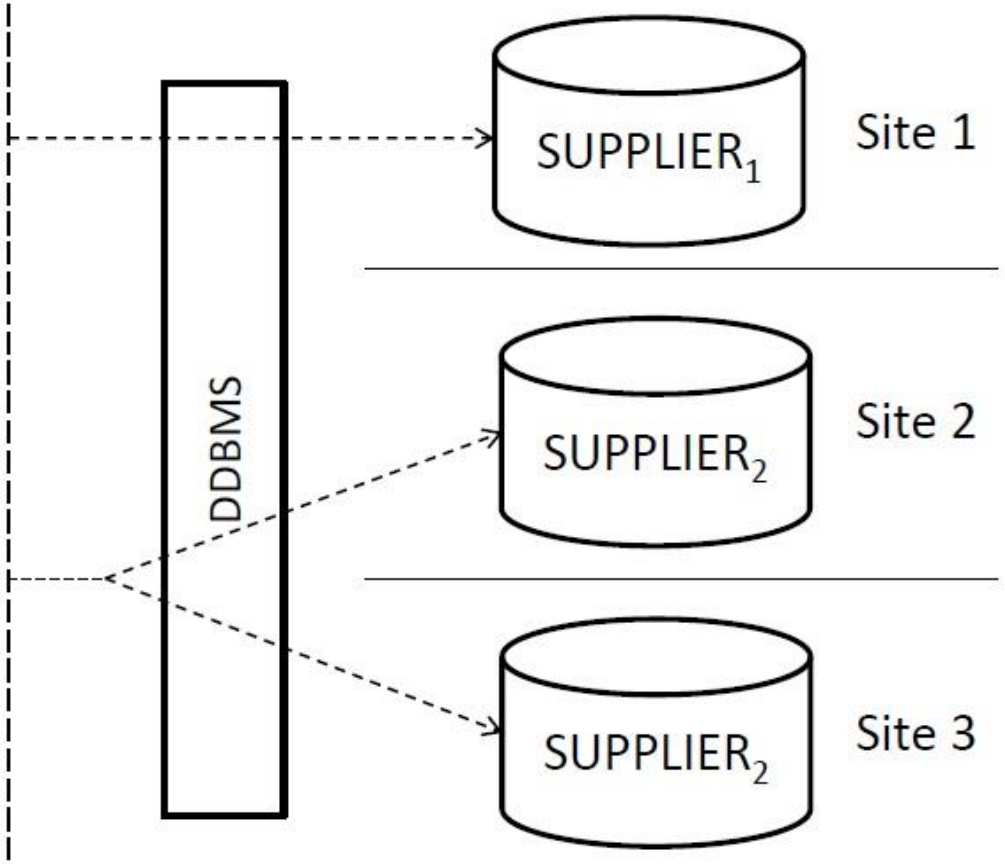
3

Analyzing Level – 2 transparency

SUPINQUIRY

Hint:

Use fragmentation information.



Level – 2 Transparency

Reading a value from terminal and assigning it to a variable:

read(terminal, $ *SNUM);*

Query: Get *NAME for a given SNUM. Example –*

Select NAME into $ *NAME*
from $SUPPLIER_1$
where SNUM = $ *SNUM;*
if not #FOUND then
Select NAME into $ *NAME*
from $SUPPLIER_2$
where SNUM = $ *SNUM;*

Read & Write is same as Level-1

Writing a value of a variable to terminal:

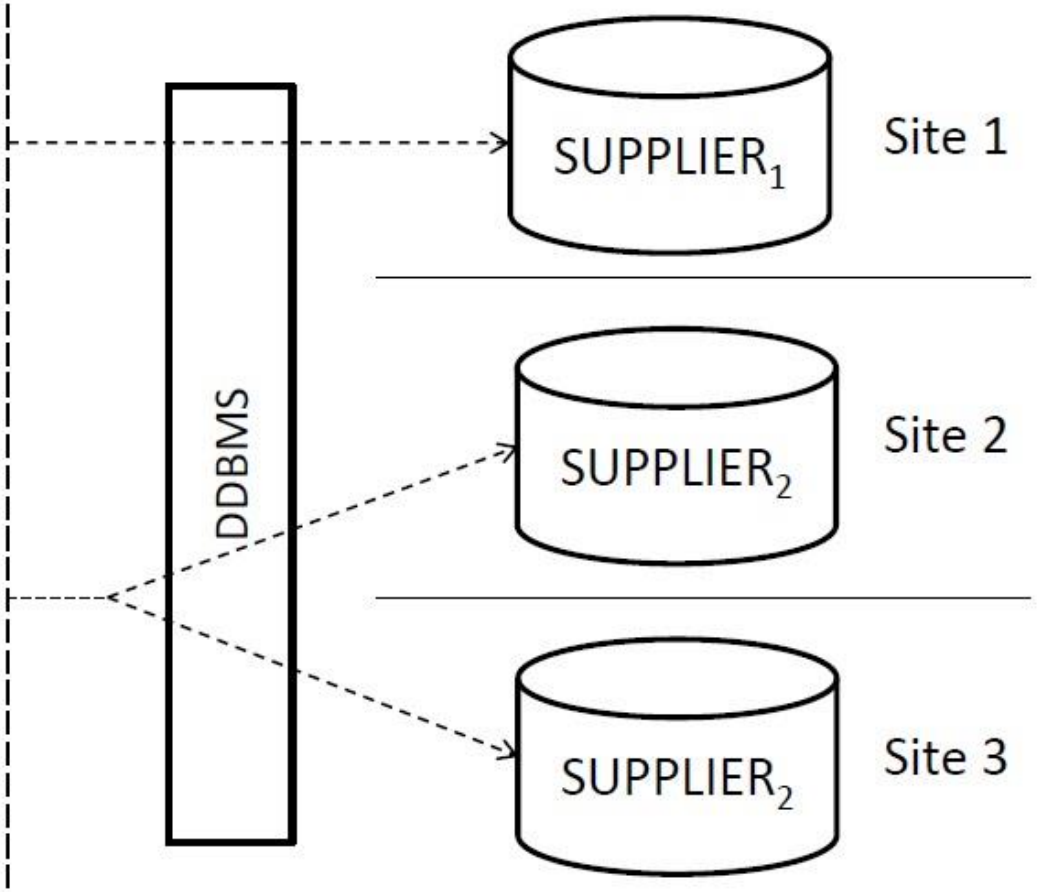
write(terminal, $ *NAME);*

SUPINQUIRY

```
read(terminal,  $ SNUM);

      Select NAME into $ NAME
      from SUPPLIER1
      where SNUM = $ SNUM;
if  not #FOUND then
      Select NAME into $ NAME
      from SUPPLIER2
      where SNUM = $ SNUM;

write(terminal, $ NAME).
```



Example

```
read(terminal,  $ SNUM);

      Select NAME into $ NAME
      from SUPPLIER1
      where SNUM = $ SNUM;
if  not #FOUND then
      Select NAME into $ NAME
      from SUPPLIER2
      where SNUM = $ SNUM;

write(terminal, $ NAME).
```

$SUPPLIER_1$

SNUM	NAME	CITY
1	A	DHK
3	C	DHK

1

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

2

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

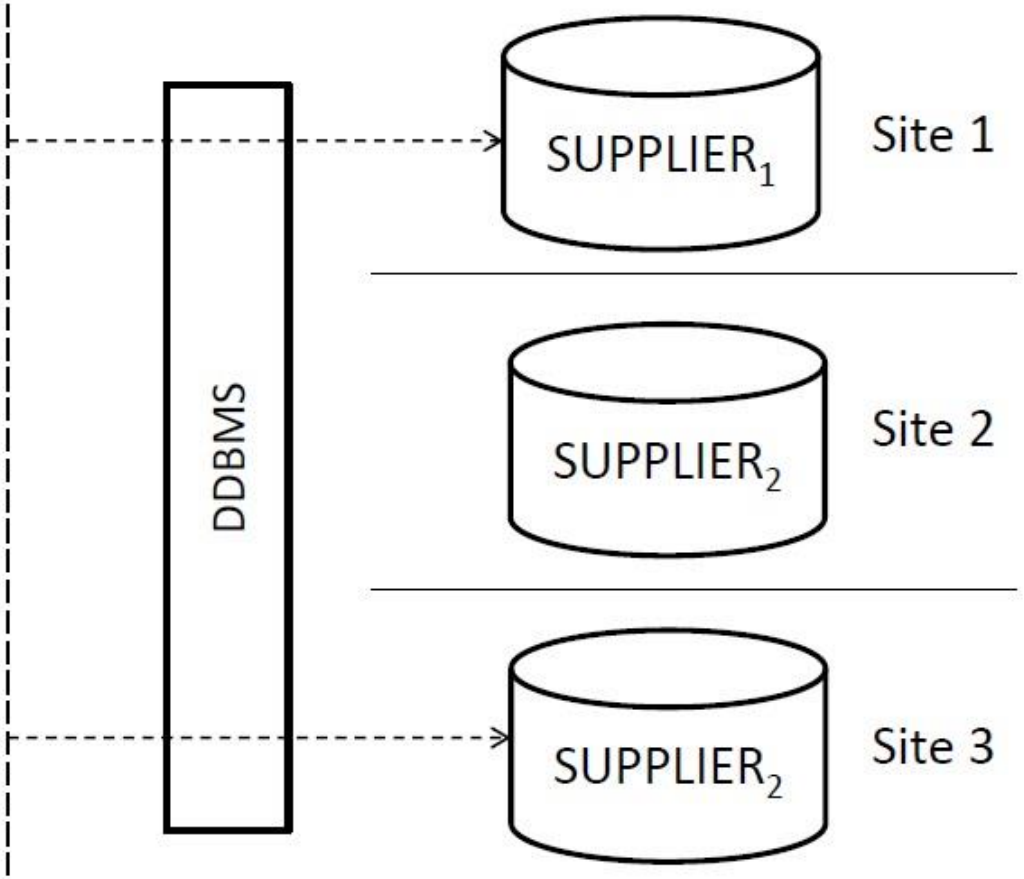
3

Analyzing Level – 3 transparency

SUPINQUIRY

Hint:

Use fragmentation information + location information (i.e. site numbers) .



Level – 3 Transparency

Reading a value from terminal and assigning it to a variable:

read(terminal, $ *SNUM);*

Query: Get *NAME for a given SNUM. Example –*

Select NAME into $ *NAME*
from *SUPPLIER*$_1$ *AT SITE 1*
where SNUM = $ *SNUM;*
if not #FOUND then
Select NAME into $ *NAME*
from *SUPPLIER*$_2$ *AT SITE 3*
where SNUM = $ *SNUM;*

Writing a value of a variable to terminal:

write(terminal, $ *NAME);*

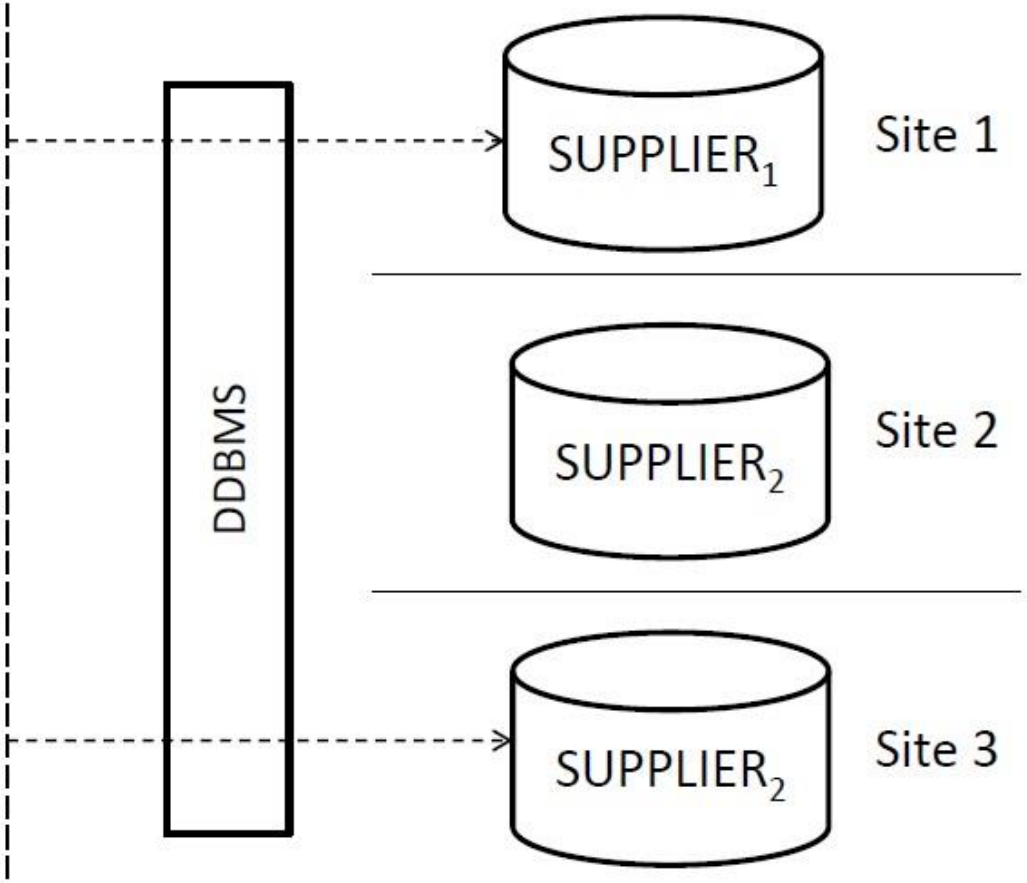
SUPINQUIRY

read(terminal, $ *SNUM);*

Select NAME into $ *NAME*
from *SUPPLIER$_1$ AT SITE 1*
where SNUM = $ *SNUM;*

if not #FOUND then
Select NAME into $ *NAME*
from *SUPPLIER$_2$ AT SITE 3*
where SNUM = $ *SNUM;*

write(terminal, $ *NAME).*



Example

read(terminal, $ *SNUM);*

Select NAME into $ *NAME*
from *$SUPPLIER_1$ AT SITE 1*
where SNUM = $ *SNUM;*

if not #FOUND then
Select NAME into $ *NAME*
from *$SUPPLIER_2$ AT SITE 3*
where SNUM = $ *SNUM;*

write(terminal, $ *NAME).*

$SUPPLIER_1$

SNUM	NAME	CITY
1	A	DHK
3	C	DHK

1

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

2

$SUPPLIER_2$

SNUM	NAME	CITY
2	B	CTG
4	D	CTG

3

Practice

See the provided practice pdf.