Plano de Consulta

```
customer (ssn, cname, address) employee (eid, ssn, ename, address)
product  (pid, pname, price, type) invoice  (inumber,ssn,eid,date,shiping)
invoiceitem(inumber,pid,qty,dsc)
```

btree ssn on **customer**   btree eid on **employee**
btree pid on **product**   btree inumber on **invoice**
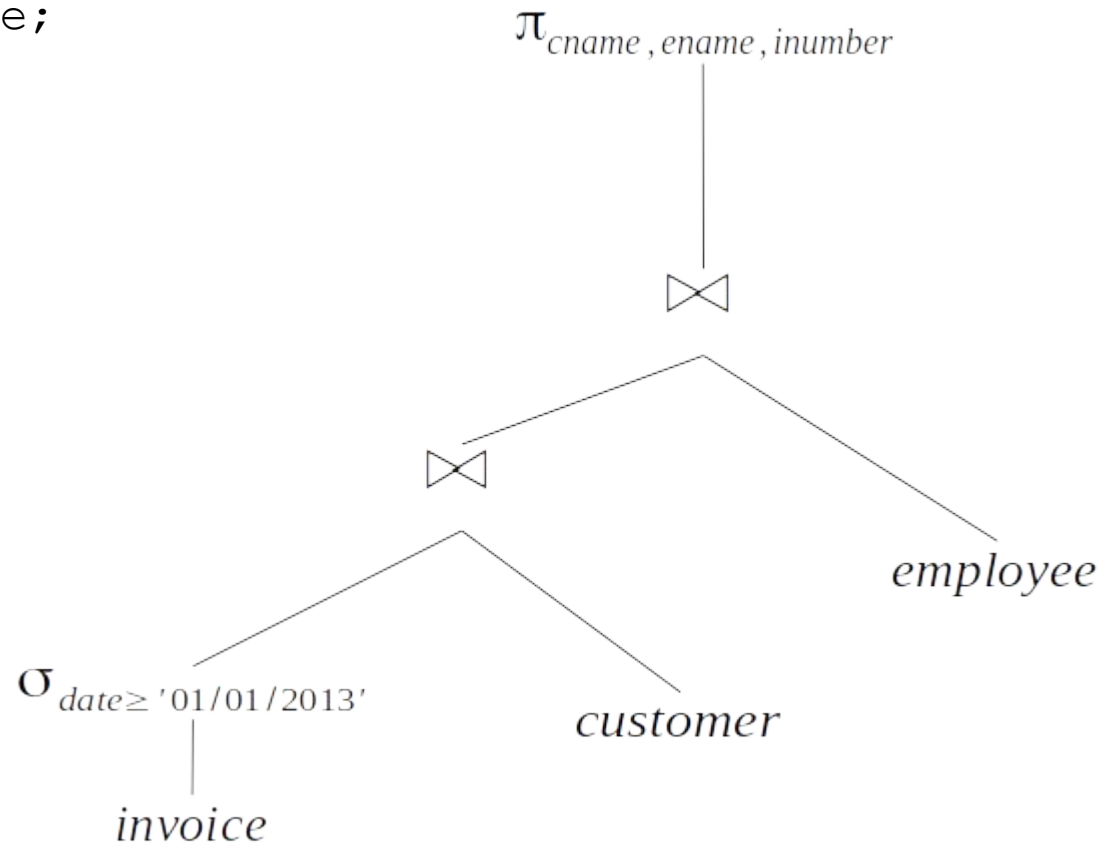btree inumber, pid on **invoiceitem**

ntuples(customer)=10500   **nblocks**(customer)=40
ntuples(employee)=345   **nblocks**(employee)=5
ntuples(product)=45000   **nblocks**(product)=410
ntuples(invoice)=197100   **nblocks**(invoice)=120
ntuples(invoiceitem)=745000   **nblocks**(invoiceitem)=421

distinct values on product.type = 120
min(invoice.date)=10/02/2008   **max**(invoice.date)=21/11/2013

```
select cname, ename, inumber
from   customer  natural join invoice
                 natural join employee
where  date >='01/01/2013'
order  by cname;
```

Plano de Consulta

```sql
select cname, ename, inumber
from   customer natural join invoice
                natural join employee
where  date >='01/01/2013'
order  by cname;
```

$\pi_{cname,ename,inumber}$

Plano Lógico

$\bowtie$

$\bowtie$

employee

$\sigma_{date \geq '01/01/2013'}$

customer

invoice

Plano de Consulta

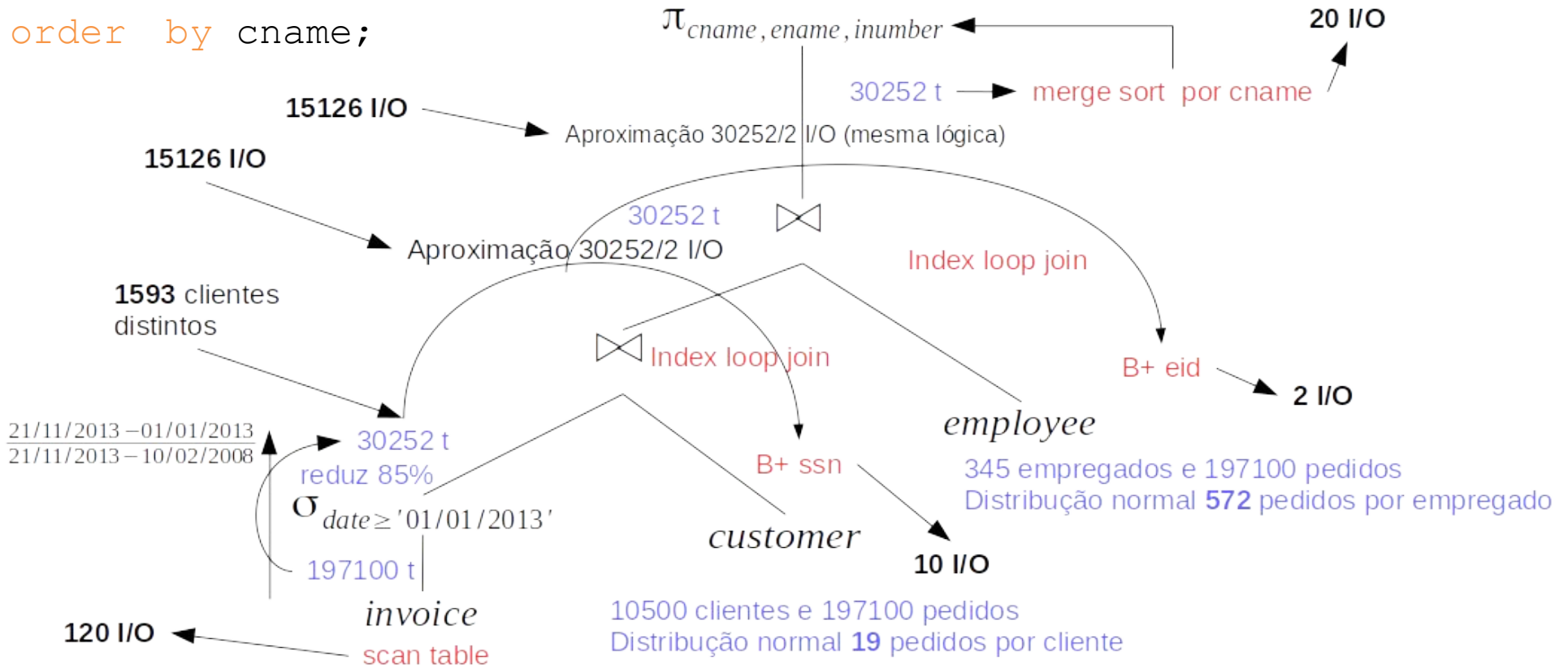```
select cname, ename, inumber
from   customer natural join invoice
                  natural join employee
where   date >='01/01/2013'
order   by cname;
```



$\pi_{cname, ename, inumber}$ ← 20 I/O

30252 t → merge sort por cname

15126 I/O → Aproximação 30252/2 I/O (mesma lógica)

15126 I/O

30252 t ⋈ Index loop join

1593 clientes distintos → Aproximação 30252/2 I/O

⋈ Index loop join

B+ eid → 2 I/O

employee

$\frac{21/11/2013 - 01/01/2013}{21/11/2013 - 10/02/2008}$ → 30252 t reduz 85%

$\sigma_{date \geq '01/01/2013'}$

B+ ssn

345 empregados e 197100 pedidos
Distribução normal **572** pedidos por empregado

197100 t

invoice

customer

10 I/O

120 I/O ← scan table

10500 clientes e 197100 pedidos
Distribução normal **19** pedidos por cliente

Resultado:
I/O's: 120+10+2+15126+15126+20= 30404
Tuplas: 30252

# *Plano de Consulta*

```sql
select distinct c.cname, p.pname
from    customer c natural join invoice i
                   natural join invoiceitem ii
                   natural join product p
where  p.type='UN';
```