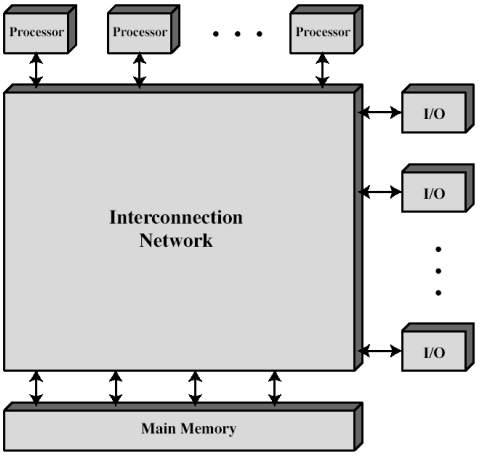
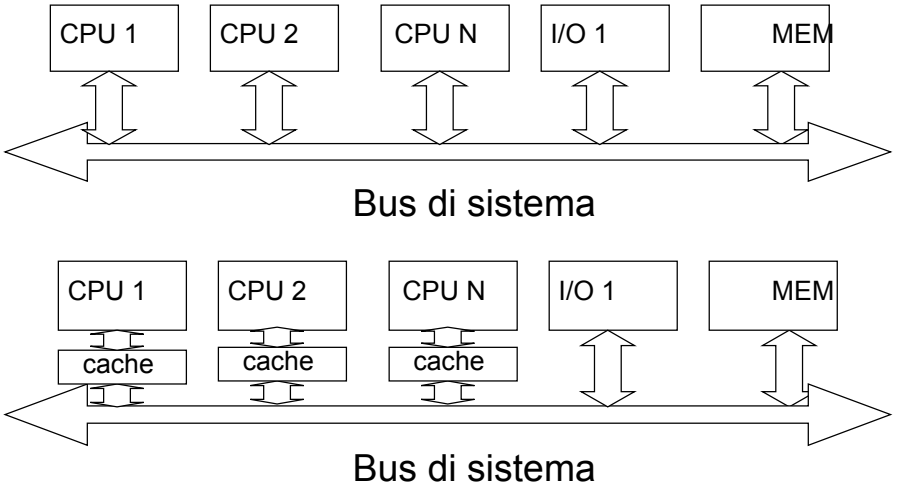
Sistemi paralleli

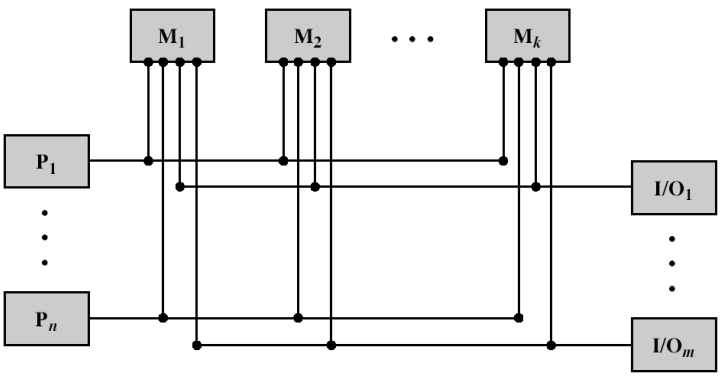
Introduzione



Sistema Multiprocessore a BUS condiviso



Sistemi multiprocessore con memoria multiporta



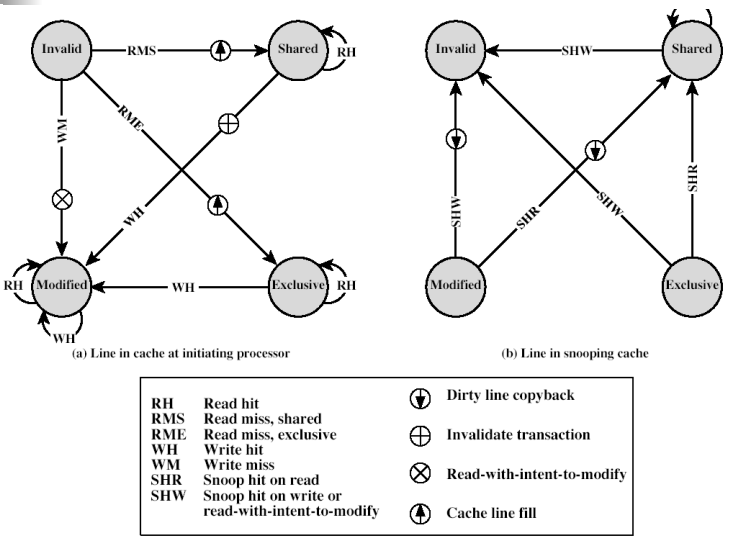
Coerenza della cache

- Soluzione Software
  - a livello di compilazione
- Soluzione Hardware
  - directory protocols
  - snoopy protocols
  - MESI

Protocollo MESI

- M=Modified. La linea in cache è stata modificata ed è disponibile solo in questa cache
- E=Exclusive. La linea in cache è uguale a quella in memoria principale e non è presente in nessuna altra cache
- S=Shared. La linea in cache è uguale a quella in memoria principale e può essere presente in altre cache
- I=Invalid. La linea in cache non contiene dati validi

Protocollo MESI



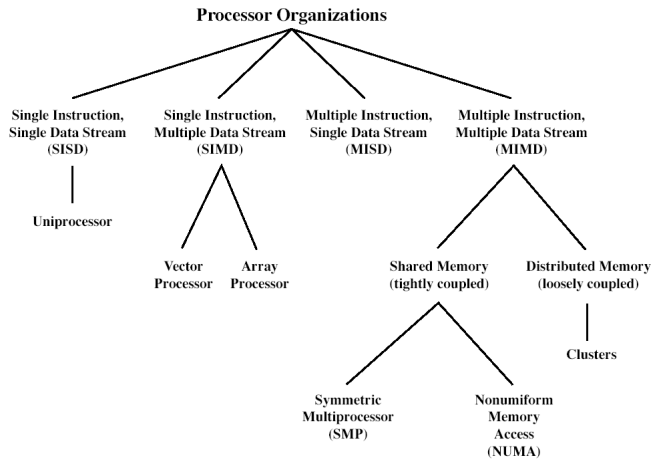
Processori Paralleli

- Sistemi che usano un parallelismo a "basso livello":
  - Pipelining delle istruzioni
  - Multiple Unità Funzionali del processore (es. architetture superscalari).
  - Processori Specializzati (es. processori di I/O)

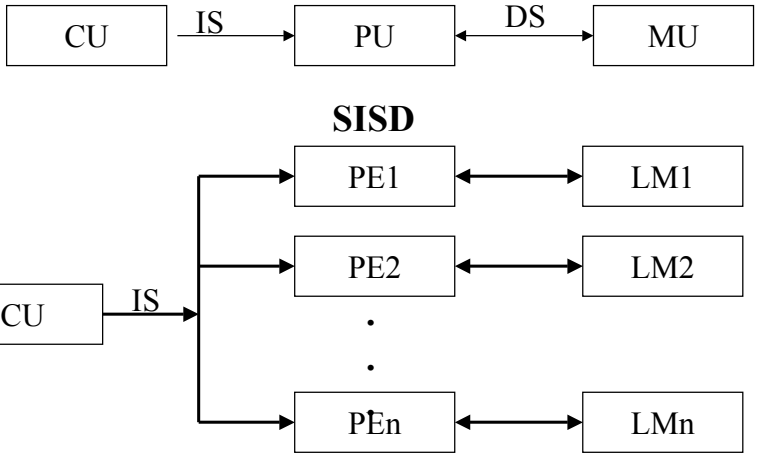
Processori Paralleli

- Sistemi che usano un parallelismo ad "alto livello":
  - *SISD*: Single Instruction Single Data
  - *SIMD*: Single Instruction Multiple Data
  - *MISD*: Multiple Instruction Single Data
  - *MIMD*: Multiple Instruction Multiple Data

Classificazione

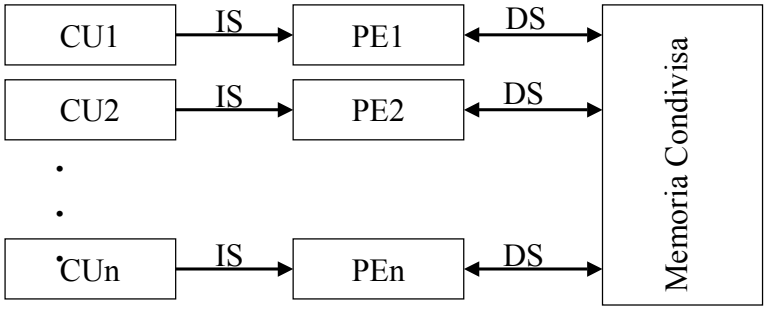


Classificazione: SISD e SIMD



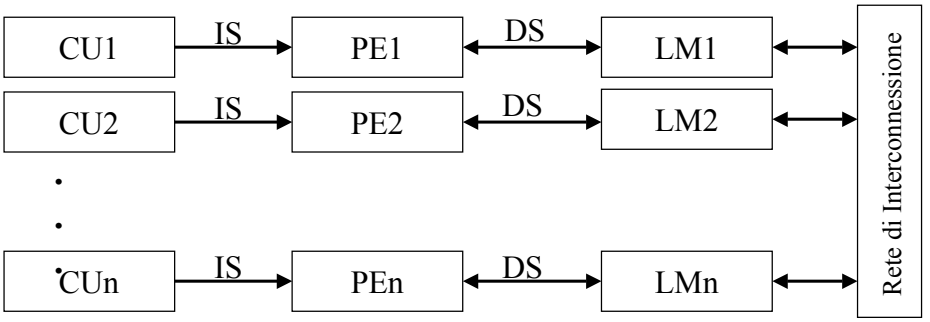
SIMD (topologia a memoria distribuita)

Classificazione: MIMD shared memory



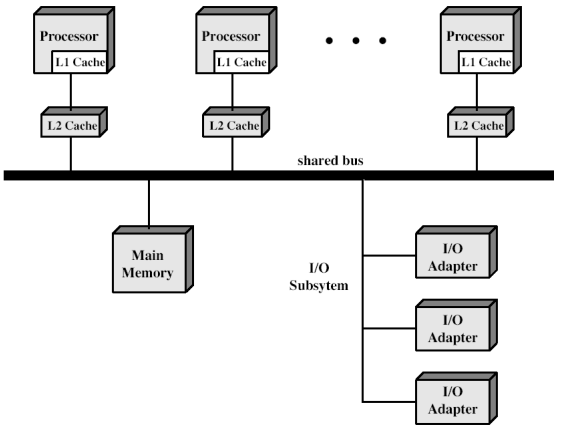
MIMD (a memoria condivisa)

Classificazione: MIMD distributed memory

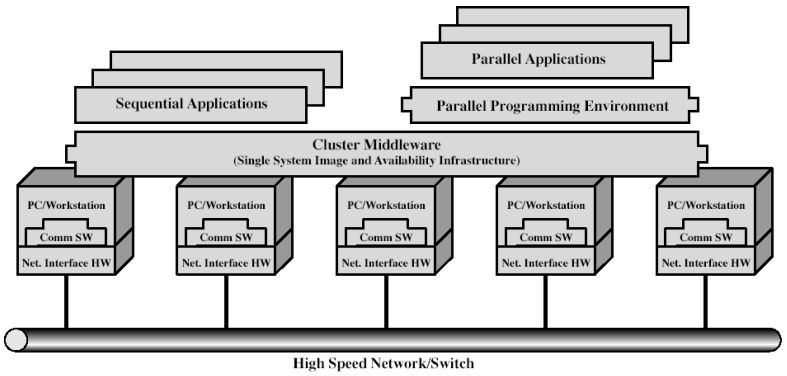


MIMD (a memoria distribuita)

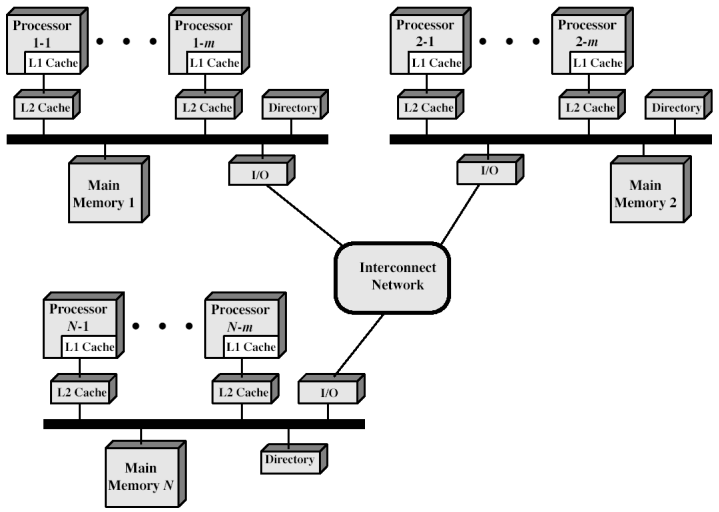
Classificazione: Symmetric Multiprocessor Organization



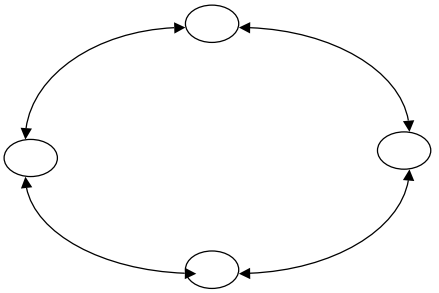
Classificazione: cluster



Classificazione: cache-coherent NUMA

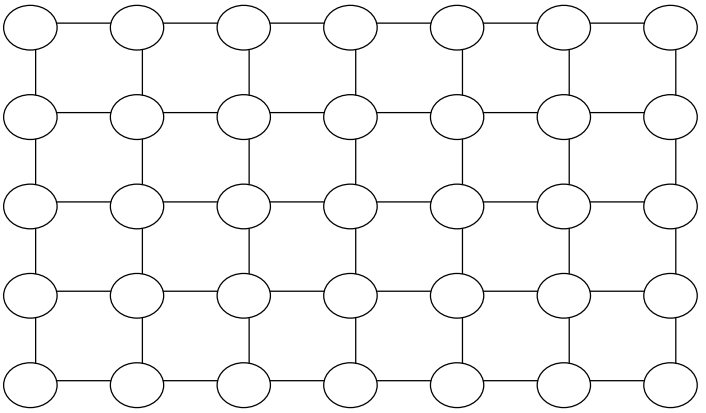


Rete di interconnessione



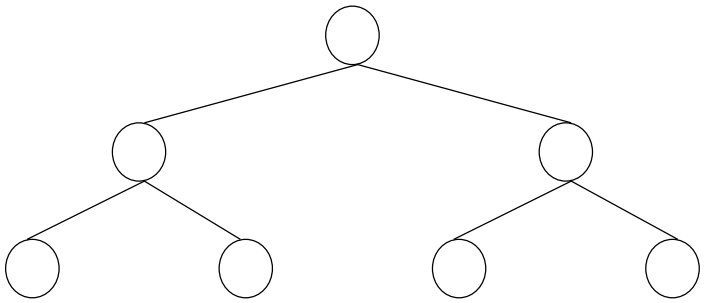
Interconnessione ad anello

Rete di interconnessione



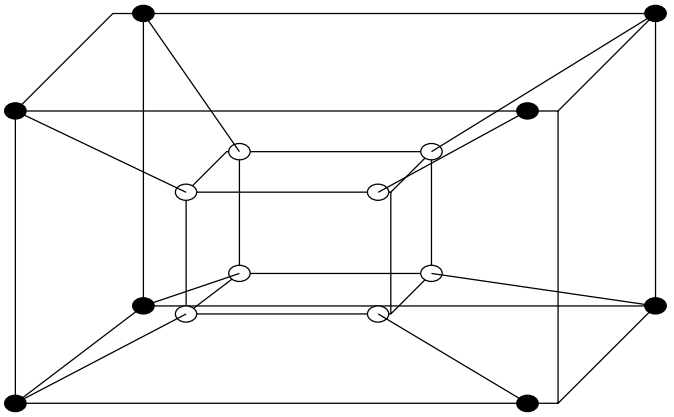
Interconnessione a maglia (Mesh)

Reti di interconnessione



Interconnessione ad albero

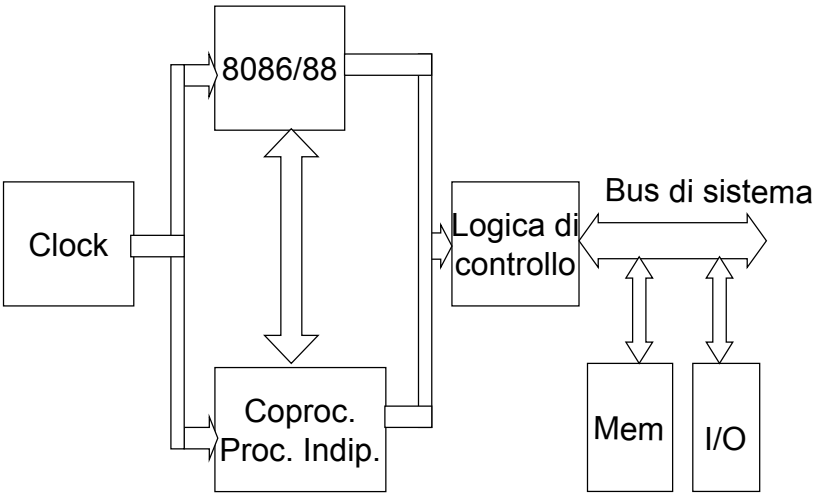
Reti di interconnessione



Interconnessione a ipercubo

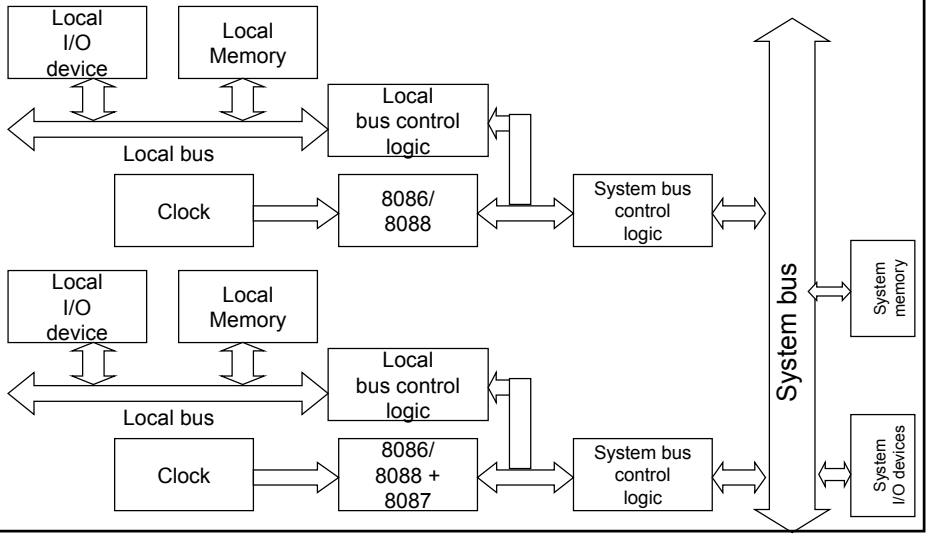
Configurazioni 8086/88 multiprocessore

Strettamente connesso

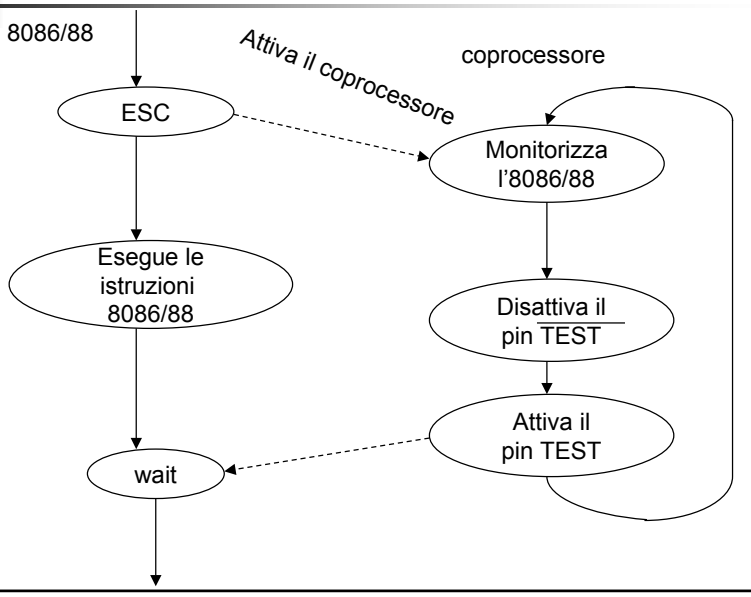


Configurazioni 8086/88 multiprocessore

Lascamente connesso



Sincronizzazione tra 8086/88 e coprocessore



Semafori

```
            MOV     AL, 0
TRYAGAIN:   XCHG    SEMAPHORE, AL
            TEST    AL, AL      ; AND OPERATION
            JZ      TRYAGAIN
            ...
            CRITICAL SESSION
            ...
            MOVE    SEMAPHORE, 1
```

Semafori: prefisso di lock

TRYAGAIN: LOCK XCHG SEMAPHORE, AL

- Prefisso di lock:

  11110000

Configurazione con coprocessore

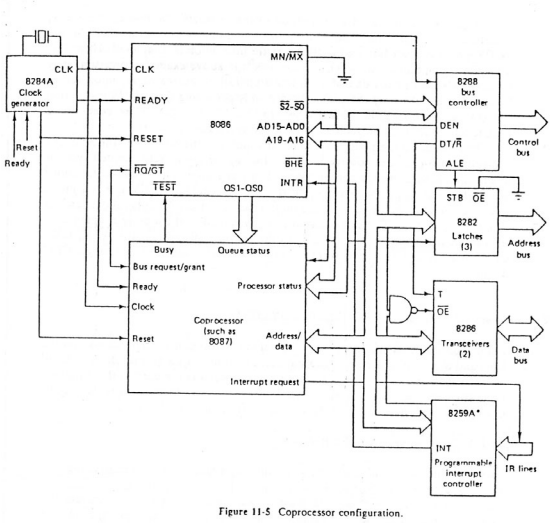
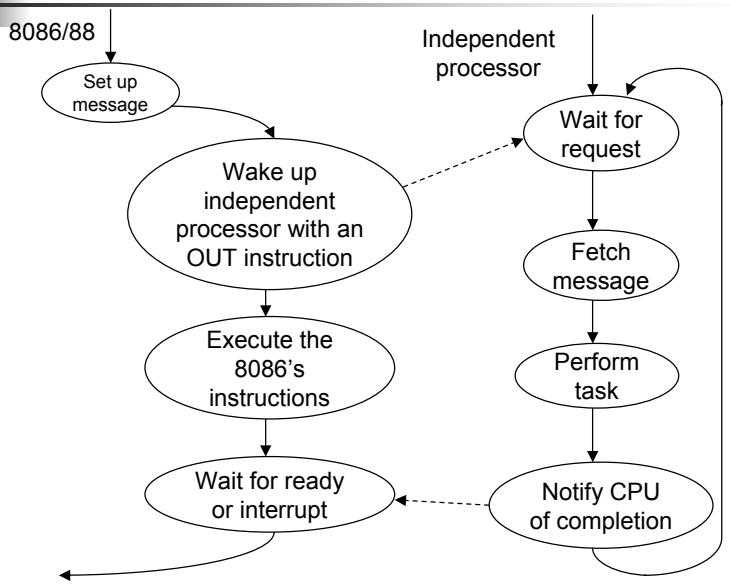


Figure 11-5 Coprocessor configuration.

Sincronizzazione tra 8086/88 e processore indipendente



Configurazione con coprocessore indipendente

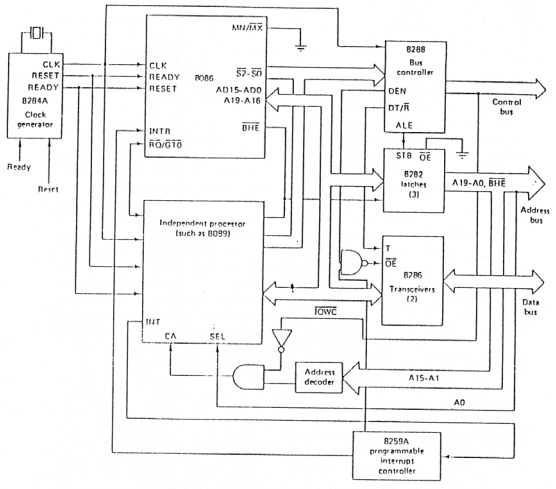
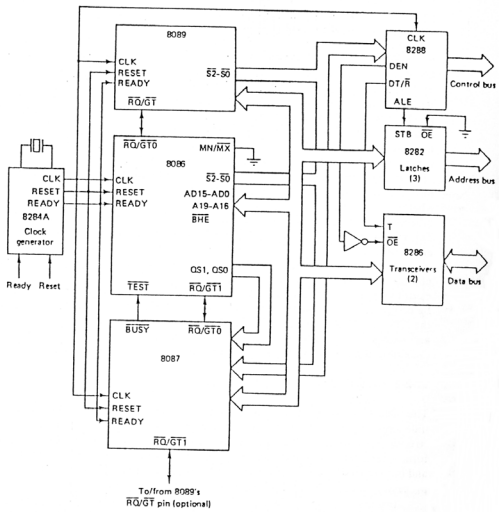


Figure 11-7 8086 connections in a closely coupled configuration.

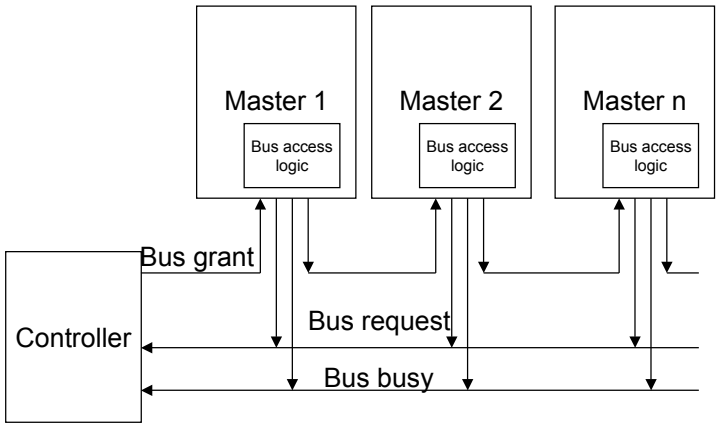
Configurazione con coprocessore e processore indipendente



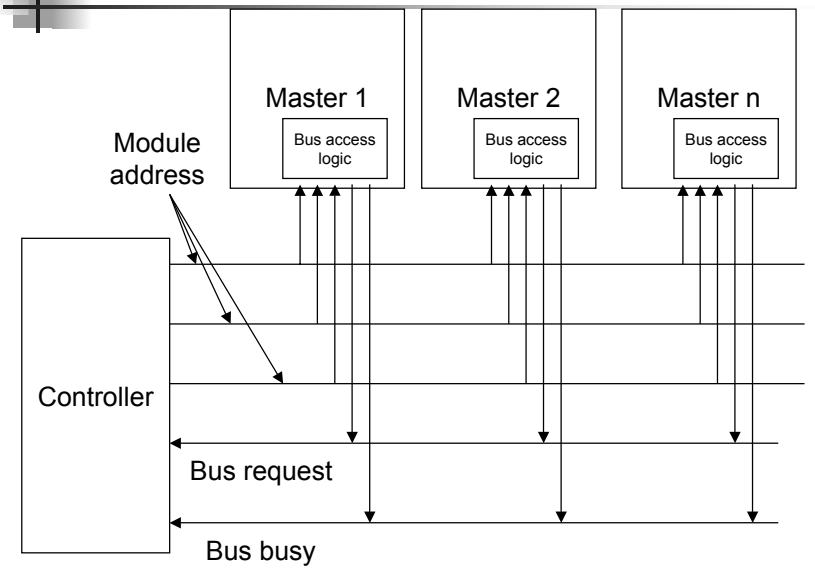
NOTE: Interrupt system and other details are not shown.

Figure 11-8 Configuration involving both a coprocessor and an independent processor.

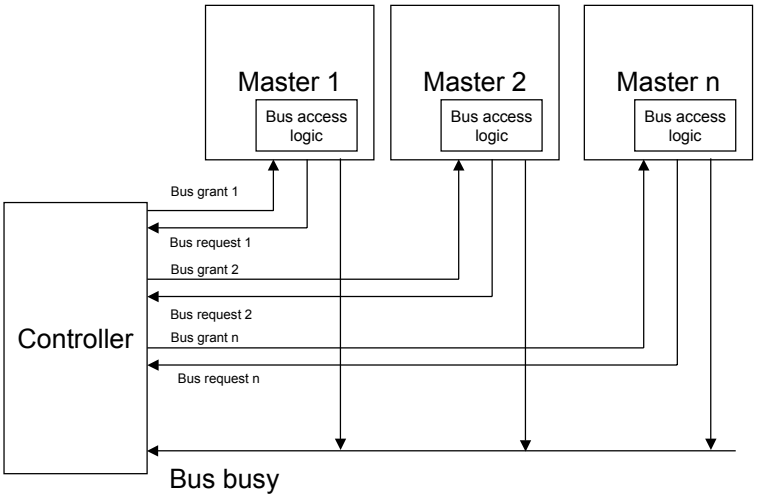
Tecniche di arbitraggio: daisy chain



Tecniche di arbitraggio: polling



Tecniche di arbitraggio: independent request



8289: bus arbiter

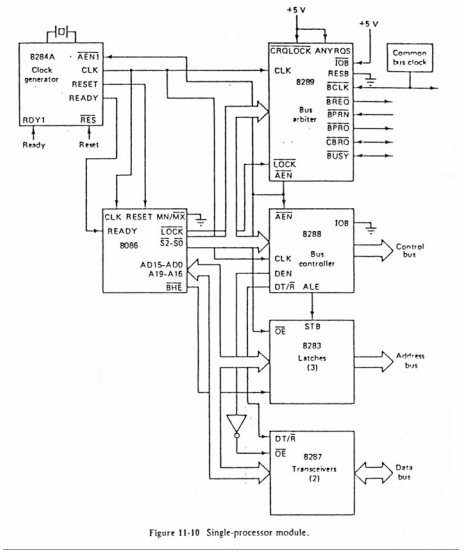


Figure 11-10 Single-processor module.

8289: independent request

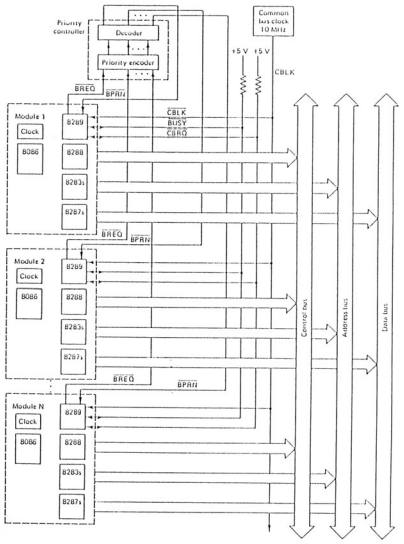
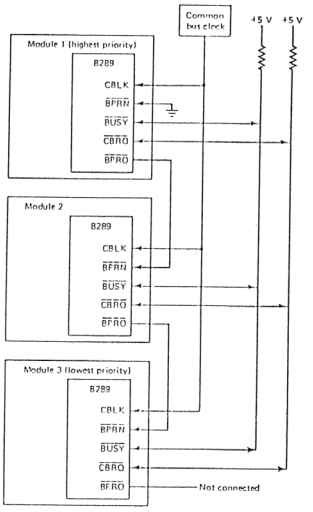


Figure 11-11 8289 connections to a priority controller.

8289: daisy chain



8086/88: bus locale e bus di sistema

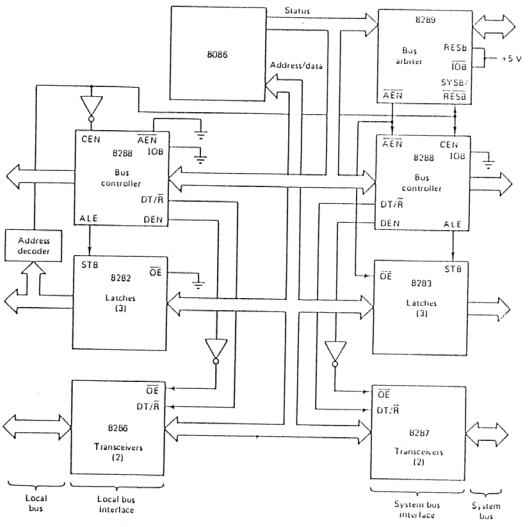


Figure 11-14 Configuration with both a local bus and a system bus.