Computing Surface Network (CSN)

- produced by Meiko scientific in 1988
  - message passing interprocess and interprocessor communication mechanism
- originally ran on T400 (transputer) based supercomputers
- later ported to
  - T800 (transputer)
  - i860 based supercomputers
  - sparc based supercomputers
  - fugitsu 200 Mflops/sec
- heterogeneous processor based supercomputer

Modula-2 implementation csn.def csn.mod

- almost the same interface as the Meiko CSN
- essentially provides a transport layer service between processes
- communicating processes need to
  - open a transport: `csn.Open(tpt)`
  - register a name for a transport: `csn.RegisterName(tpt, 'sink')`
  - look up the other processes transport: `csn.LookupName (sinkId, 'sink')`
- the lookup function yields the other processes `netid`
- `netid` value is used as a destination in transmitting data

ex1.mod

- sink receives a single string from `source`
-

```
PROCEDURE Sink ;
VAR
   tpt    : Transport ;
   actual: CARDINAL ;
   netid : NetId ;
   status: CsnStatus ;
   buffer: ARRAY [0..80] OF CHAR ;
BEGIN
   IF csn.Open(tpt) # CsnOk
   THEN
      Halt('failed to open transport',
           __LINE__, __FILE__)
   END ;

   (* we register our transport *)
   IF csn.RegisterName(tpt, 'sink') # CsnOk
   THEN
      Halt('failed to register name',
           __LINE__, __FILE__)
   END ;
```


Sink (continued)

-

```
   netid  := NullNetId ;
   status := Rx(tpt, netid, ADR(buffer),
               HIGH(buffer), actual) ;
   IF status=CsnOk
   THEN
      WriteString('sink received string: ') ;
      WriteString(buffer) ; WriteLn
   ELSE
      Halt('Rx failed', __LINE__, __FILE__)
   END
END Sink ;
```

Source

```
PROCEDURE Source ;
VAR
   tpt    : Transport ;
   sinkId: NetId ;
   status: CsnStatus ;
   buffer: ARRAY [0..80] OF CHAR ;
BEGIN
   IF csn.Open(tpt) # CsnOk
   THEN
      Halt('failed to open transport',
           __LINE__, __FILE__)
   END ;

   IF csn.LookupName (sinkId, 'sink') # CsnOk
   THEN
      Halt('failed to lookup filter program',
          __LINE__, __FILE__)
   END ;
```


Source (continued)

```
   StrCopy('Hello world', buffer) ;

   status := csn.Tx(tpt, sinkId,
                    ADR(buffer), StrLen(buffer)) ;
   IF status#CsnOk
   THEN
      Halt('failed to send string to sink process',
           __LINE__, __FILE__)
   END
END Source ;
```


Transmit/Receive

- transmit function: `csn.Tx(tpt, sinkId, address, bytes)`
  - `tpt` is the transport which has been opened
  - `sinkId` is the netid of the destination transport
    - which will have been found using `csn.Lookup`
  - `address` address of variable, array etc.
  - bytes is size of variable
- address and size can be found out by:
  - `ADR(variable)`
  - `SIZE(variable)`

csn.Rx

- receive function:
- `csn.Rx(tpt, sourceId, address, bytes, actual)`
- parameters
  - `sourceId` is the senders netid
  - `address` is where the incoming data will be placed
  - `bytes` the maximum length of incoming message
  - `actual` is the length of data received
- note we can receive <=`bytes` of data
  - why is this useful?

Non blocking communication

- the previous `csn.Tx` and `csn.Rx` functions cause processes to block whilst data is being sent and received
- sometimes may wish allow processing and communication to occur in parallel
  - why?
- non blocking primitives allow this
  - `csn.TxNb`
  - `csn.RxNb`

Non blocking communication

- however if we allow caller of `csn.Tx` to return before data is sent
- then the process may need some method of finding out when the data has been received
  - `csn.Test`
- in fact every non blocking operation (`csn.Tx` and `csn.Rx`) *must* be followed *sometime* by a call to `csn.Test`

ex2.mod

- `ex2.mod` is much the same as `ex1.mod` except:
  - it continually transmits and receives data `"hello world"`
  - it receives data using `csn.RxNb`

ex2.mod: csn.RxNb

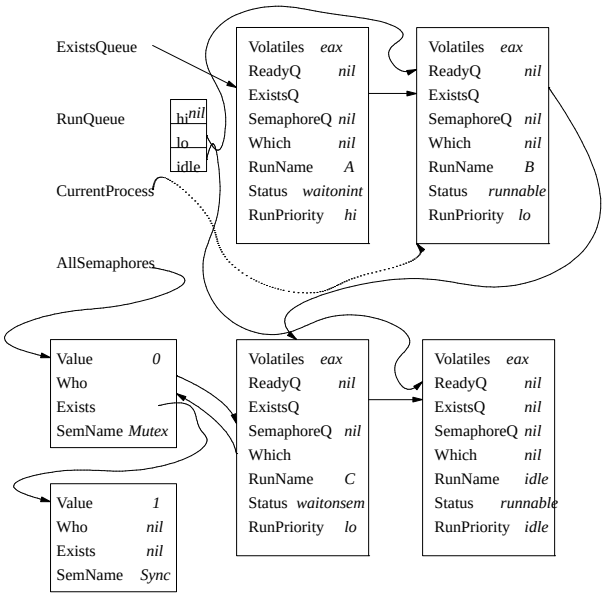
```
IF csn.RxNb(tpt, ADR(buffer),
              HIGH(buffer), actual) # CsnOk
THEN
   Halt('failed to queue buffer',
        __LINE__, __FILE__)
END ;

netid  := NullNetId ;
bufptr := NIL ;
CASE csn.Test(tpt, {CsnRxReady}, MAX(CARDINAL),
              netid, bufptr, status)
OF

CsnRxReady:  WriteString(buffer)

ELSE
   Halt('unexpected return value from csn.Test',
        __LINE__, __FILE__)
END
```

csn.TxNb parameters

- `csn.Test(tpt, {CsnRxReady}, MAX(CARDINAL), netid, bufptr, status)`
- parameters: three refer to the actual `csn.Test`
  - `tpt` transport created by `csn.Open`
  - `flags` must we wait until RxReady or TxReady or both
  - `timeout` value (`MAX(CARDINAL)`) max number of millisecs to wait
- remaining three parameters are filled in by the test but refer to the completed operation
  - `netid` is the netid of the transport communicating with t
  - `bufptr` is the start of the block of memory which has completed
  - `status` is the status of the completed operation

Tutorial: Executive

- draw the executive data structures which coordinate process activity



- draw 4 processes, 2 semaphores
  - you may simplify the list structure to the bare minimum
  - include appropriate global variables:
    - RunQueue, CurrentProcess, ExistsQueue and AllSemaphores

Tutorial: Processes

- draw the runqueue, semaphore queue for the two processes:

```
PROCEDURE Process1 ;
BEGIN
   LOOP
      Wait(Sem) ;
      (* critical region *)
      Signal(Sem)
   END
END
```

```
PROCEDURE Process2
BEGIN
   LOOP
      Wait(Sem) ;
      (* critical r
      Signal(Sem)
   END
END
```

- and redraw the queues showing each change as the processes execute.