Miranda CPU Mesh

: SST 4x4 Miranda CPU Mesh
: `cpu_mesh_miranda.py`
: 2025 7 25
: v1.0

SST (Structural Simulation Toolkit) 4x4 CPU Miranda CPU

- **CPU** : Miranda BaseCPU
- : 4
- : 2D Mesh
- :
- :

4x4 Miranda CPU Mesh

CPU : 16 Miranda BaseCPU + L1
: 24 2D Mesh
: +
:

1. **Miranda CPU** : 16 2.4GHz CPU
2. : 16 hr_router

3. **L1** : 32KiB L1
4. : 2GiB
5. : 40GiB/s 50ps

Miranda CPU

CPU

	2.4GHz	CPU
	64	
Load	16	
Store	16	
Custom	16	
	16	

1.   (CPU 0, : 0,0)

- : STREAM

- :

- :

```
"generator": "miranda.STREAMBenchGenerator"
"max_reqs_cycle": "2"
"generatorParams.n": "10000"          #
"generatorParams.operandwidth": "8"   # 8
"generatorParams.iterations": "100"   #
```

- :   STREAM

2.   (CPU 15, : 3,3)

- :

- :

- :

```
"generator": "miranda.RandomGenerator"
"max_reqs_cycle": "4"                   #
"generatorParams.count": "5000"        #
"generatorParams.max_address": "1048576"  # 1MB
"generatorParams.length": "64"         # 64
```

- :

3. I/O   ( )

- :

- : I/O

- :

```
"generator": "miranda.SingleStreamGenerator"
"max_reqs_cycle": "1"                    #   I/O
"generatorParams.count": "2000"          # I/O
"generatorParams.length": "32"           # 32 I/O
"generatorParams.stride": "32"           #
```

- :   I/O

4.   ( )

- : GUPS

- :

- :

```
"generator": "miranda.GUPSGenerator"
"max_reqs_cycle": "2"
"generatorParams.count": "3000"         #
"generatorParams.max_address": "524288"    # 512KB
"generatorParams.iterations": "50"      #
```

- : GUPS (Giga Updates Per Second)

2D Mesh

- : 4×4 = 16
- :
- : 24
- :   (Dimension-ordered routing)

	40GiB/s
	50ps
Flit	8
	1KiB
	1KiB
	40GiB/s

```python
router = sst.Component(f"router_{i}", "merlin.hr_router")
router.addParams({
    "id": i,
    "num_ports": "5",              # 4    + 1
    "link_bw": "40GiB/s",
    "flit_size": "8B",
    "xbar_bw": "40GiB/s",
    "input_latency": "50ps",
    "output_latency": "50ps",
    "input_buf_size": "1KiB",
    "output_buf_size": "1KiB",
})
```

L1

CPU   L1

32KiB
8
1
LRU

2.4GHz   CPU

```python
memory_controller = sst.Component("memory_controller", "memHierarchy.MemController")
memory_controller.addParams({
    "clock": "1GHz",                    #
    "backing": "none",                  #
    "verbose": "0",                     #
    "addr_range_start": "0",            #
    "addr_range_end": "2147483647",     #    (2GB)
})
```

```python
shared_memory = memory_controller.setSubComponent("backend", "memHierarchy.simpleMem")
shared_memory.addParams({
    "access_time": "100ns",             #
```

```
    "mem_size": "2GiB",                          #
})
```

CPU- -

1. **CPU L1** : standardInterface
2. **L1**   :   MemNIC
3.   :

```
CPU_i ↔ L1Cache_i ↔ MemNIC_i ↔ Router_i ↔ Mesh
                                        ↓
```

```python
# CPU L1
cpu_cache_link = sst.Link(f"cpu_cache_link_{i}")
cpu_cache_link.connect(
    (mem_iface, "port", "50ps"),
    (l1_cache, "high_network_0", "50ps")
)

# L1
cache_router_link = sst.Link(f"cache_router_link_{i}")
cache_router_link.connect(
    (net_iface, "port", LINK_LATENCY),
    (router, "port4", LINK_LATENCY)
)
```

---

1. **CPU**

   - **cycles**: CPU
   - **reqs_issued**:
   - **reqs_returned**:

2.

- **send_packet_count**:
- **recv_packet_count**:

3.

- **Cache** :
- **MemController** :

```
sst.setStatisticLoadLevel(5)
sst.setStatisticOutput("sst.statOutputCSV", {
    "filepath": "./miranda_mesh_stats.csv"
})

#
sst.enableAllStatisticsForComponentType("miranda.BaseCPU")
sst.enableAllStatisticsForComponentType("merlin.hr_router")
sst.enableAllStatisticsForComponentType("memHierarchy.Cache")
sst.enableAllStatisticsForComponentType("memHierarchy.MemController")
```

---

1. Miranda CPU

Miranda CPU   CPU   -   :   -   :   STREAM GUPS   -
   :   standardInterface

2.

- :
- : 40GiB/s
- : 50ps

3.

- : L1
- :
- : 2GB

4.

SST   -   :   -   :   MemNIC   -   :

1: memHierarchy

: Cache
 : MemNIC

2:

: CPU
 : (0)

3:

: merlin.endpoint
 : MemNIC L1

4:

: CPU
 :

- **CPU** : 16 × 2.4GHz = 38.4 GIPS
- : 24 × 40GiB/s = 960 GiB/s
- : 2GiB
- : 16 × 32KiB = 512KiB L1

1. **STREAM** :
2. **GUPS** :
3. : I/O
4. :

---

1. : 16 CPU
2. : 24
3. :
4. :

5. : Miranda CPU

- : 16 Miranda CPU
- : 4x4 Mesh
- : 4
- : 977.59

```
cd /home/anarchy/sst_simulations/my_first_mesh
sst cpu_mesh_miranda.py
```

- **miranda__mesh__stats.csv**:
- :

- MESH_SIZE_X/Y: - LINK_BANDWIDTH: - LINK_LATENCY:
- CPU   :

1.

- mesh (8x8, 16x16)
- CPU
-

2.

- L2/L3
-
-

3.

-
-
-

4.

-
-
-

SST

- **miranda.BaseCPU**: CPU
- **merlin.hr_router**:
- **memHierarchy.Cache**:
- **memHierarchy.MemController**:

- **STREAM**:
- **GUPS**:

- **SingleStream**:
- **Random**:

- **2D Mesh**:
- **Dimension-ordered routing**:
- **Flit-based switching**:　flit

SST　　4x4 Miranda CPU Mesh

1. ：　Miranda CPU
2. ：　 CPU
3. ：
4. ：

: GitHub Copilot
: SST Structural Simulation Toolkit
:
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