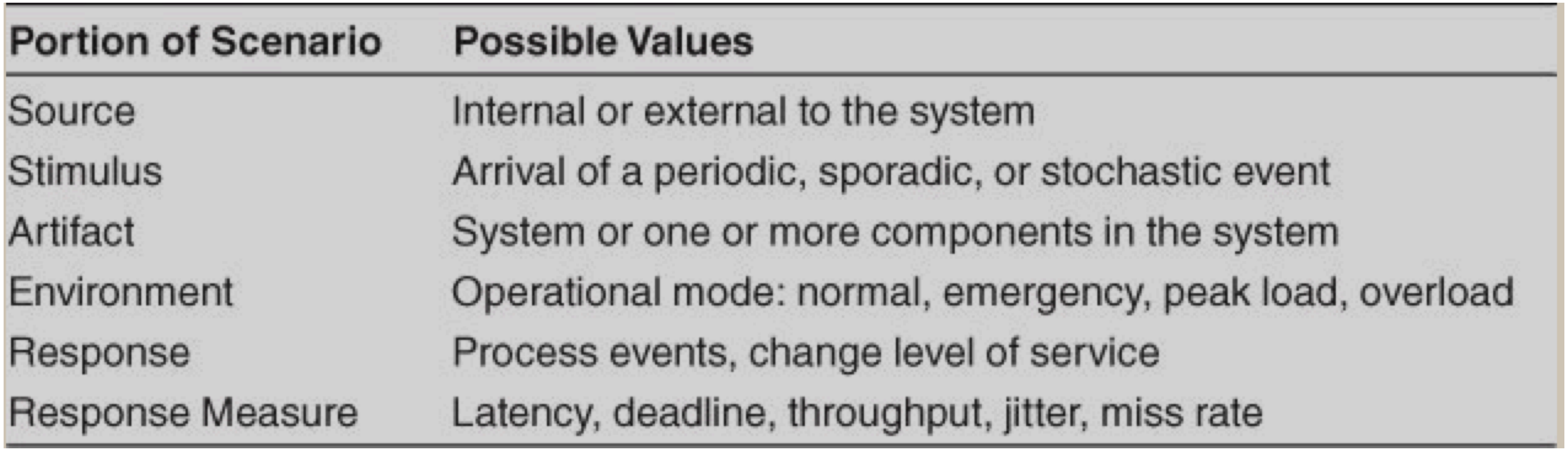
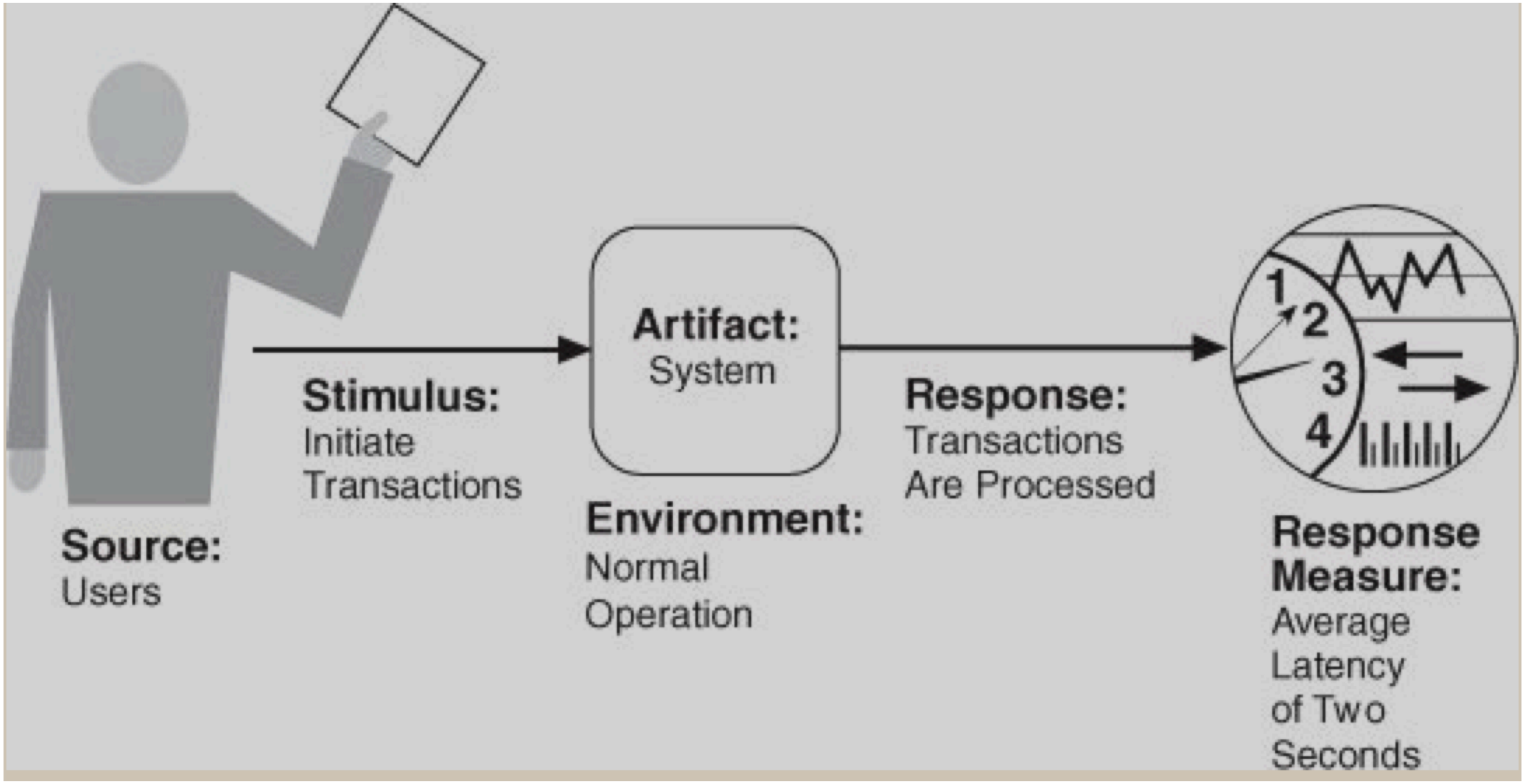
SAPM
Performance

Performance General Scenario



Portion of Scenario	Possible Values
Source	Internal or external to the system
Stimulus	Arrival of a periodic, sporadic, or stochastic event
Artifact	System or one or more components in the system
Environment	Operational mode: normal, emergency, peak load, overload
Response	Process events, change level of service
Response Measure	Latency, deadline, throughput, jitter, miss rate

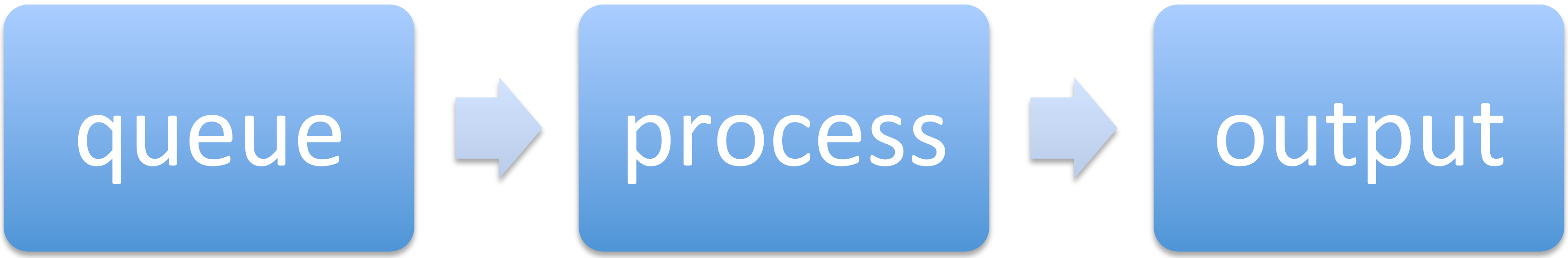
Specific Scenario



Making the Scenario Specific

- We need to say something about the distribution of the arrival of the stimuli
  - E.g. The inter-arrival time is always greater than 1.0 secs
  - How is this different from the arrival rate is less than 1 per second?
- Any stimulus needs to be processed within 2 seconds of arriving.
- The responses should appear in the same order as the stimuli

A possible architecture



queue

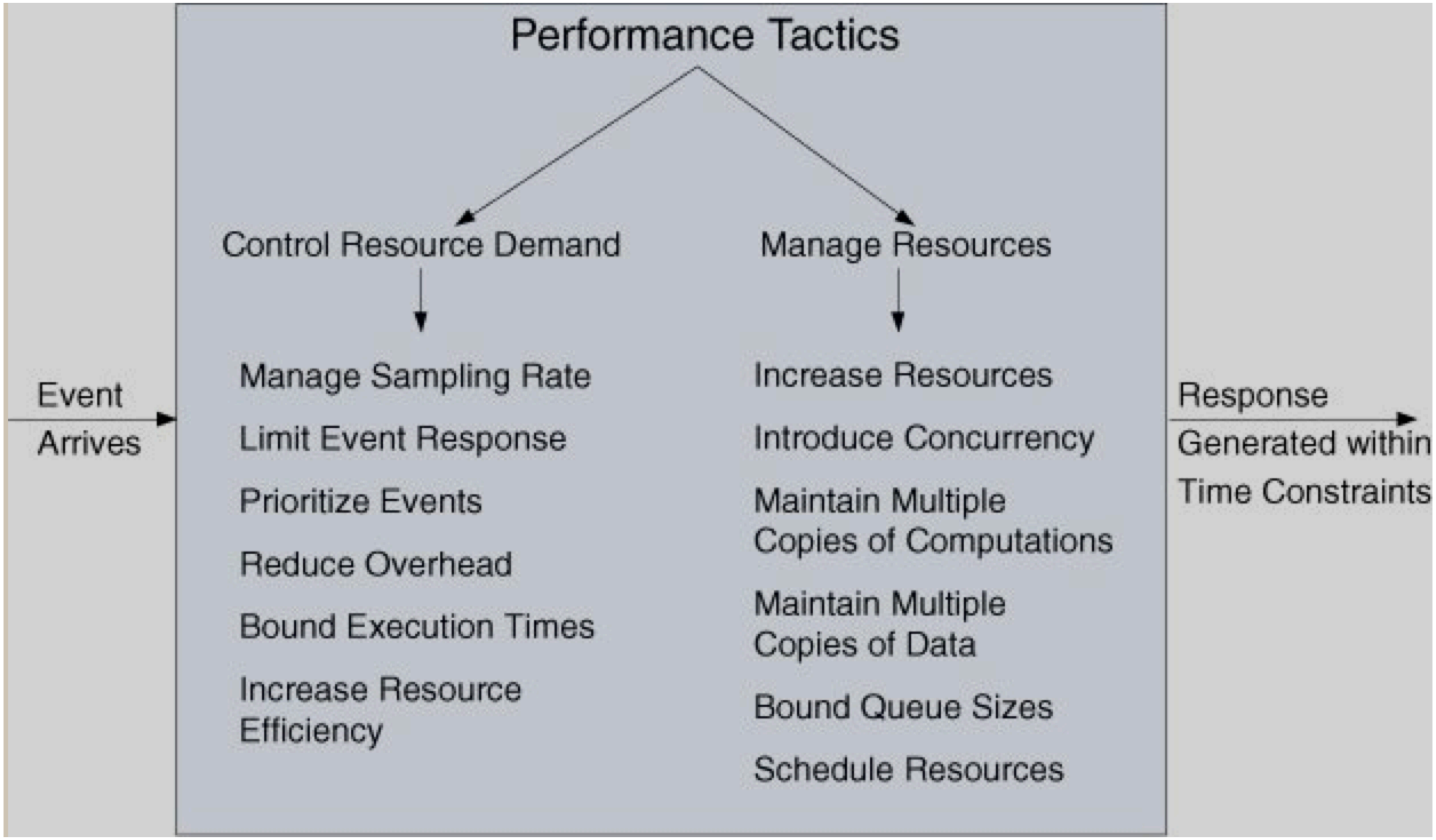
process

output

Be specific about the architecture

- We need to say something about the capacity of the processor:
  - The worst case processing time for a stimulus is 1.5 seconds best case time is 1.0 secs
  - The processor can only process one stimulus at a time.
- We need to say that the queue capacity is 7 stimuli (or some other).
- This architecture fails the scenario (why?)

Performance Tactics



Performance Tactics

Control Resource Demand

- Manage Sampling Rate
- Limit Event Response
- Prioritize Events
- Reduce Overhead
- Bound Execution Times
- Increase Resource Efficiency

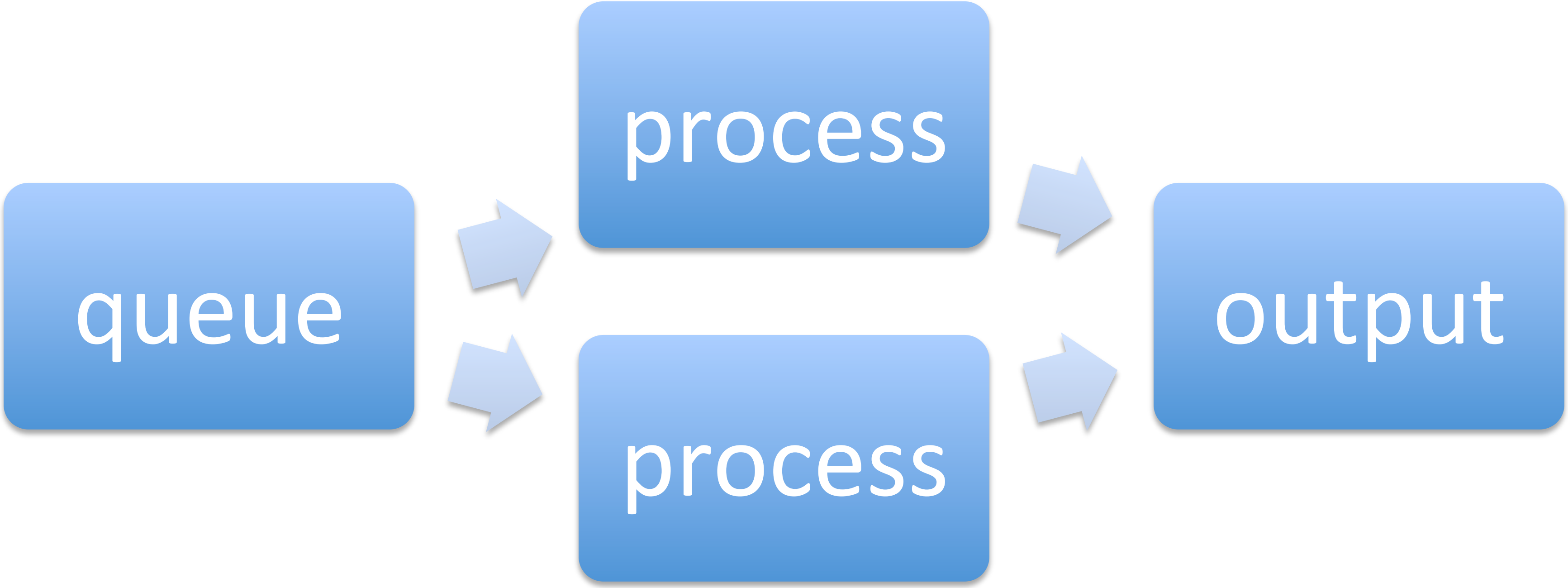
Manage Resources

- Increase Resources
- Introduce Concurrency
- Maintain Multiple Copies of Computations
- Maintain Multiple Copies of Data
- Bound Queue Sizes
- Schedule Resources

Event Arrives

Response Generated within Time Constraints

A possible architecture



queue

process

process

output

New Architecture

- This passes the scenario – why?
- Suppose the processing time for the stimulus was much more variable (e.g. 0.2 secs to 1.5 secs) – does the architecture still satisfy the scenario?

Control Resource Demand Tactics

- **Manage the sampling rate** (not always applicable) – ensure you do not have too much to handle.
- **Limit the event response –** if you are receiving too many events, throw some away.
- **Prioritize events –** some need a respons in a certain time – some don't
- **Reduce overhead –** can you take resource out of handling an event?
- **Improve the efficiency of processing –** so you can handle more with the same processing

Manage Resources

- Increase resources
- Introduce concurrency
- Maintain multiple copies of compute and/or data
- Bound queue sizes
- Schedule resource when there is contention (hard scheduling for highest priority events)

Checklist: Allocation of Responsibilities

- Work out areas responsibility of that require heavy resource use to ensure time-critical events take place.
- Work out processing requirements.
- Take account of:
  - Responsibilites arising from threads crossing boundaries of responsibility
  - Responsibilities for thread management
  - Responsibilities for scheduling shared resources

Checklist: Coordination Model

- What needs to coordinate.
- Is there concurrency? Ensure it is safe.
- Ensure coordination is appropriate for the style of stimulus.
- Ensure the properties of the coordination model are good for the stimuli and concurrency control?

Checklist: Data Model

- Determine what parts of the data model will be heavily loaded or have tight time constraints.
- Then:
  - Would keeping multiple copies help?
  - Would partitioning the data help?
  - Is it possible to reduce processing requirements for the data?
  - Does adding resource help deal with data bottlenecks?

Checklist: Mapping Among Architecture Elements

- Does colocation of some components reduce latencies?
- Ensure components with high processing needs are allocated to big processors
- Consider introducing concurrency when you map.
- Consider whether some mappings introduce bottlenecks (e.g. allocating non-interfering tasks to the same thread)

Checklist: Resource Management

- Work out what needs high levels of resource
- Ensure these are monitoredand managed under all operating modes.
- For example:
  - Time critical components
  - Thread management
  - Prioritization
  - Locking and scheduling strategies
  - Deploying additional resource to meet elevated load.

Checklist: Binding time

- Look at when you bind.
- Consider the cost of binding at different times
- Try to avoid performance penalties caused by late binding.

Checklist: Choice of Technology

- Is the technology right to let you meet hard deadlines and resource use (e.g. use a real-time OS with proper scheduling).
- You need:
  - Good scheduling
  - Priorities
  - Policies for demand reduction
  - Allocating processing to tasks
  - Other performance-related measurement and management.

Summary

- For performance you need to ensure resource is effectively monitored and managed.
- Architecture gives you a good level to do this.
- Next we consider Security.