ADMISSION CONTROL
IN SERVICE FULFILLMENT SOLUTIONS

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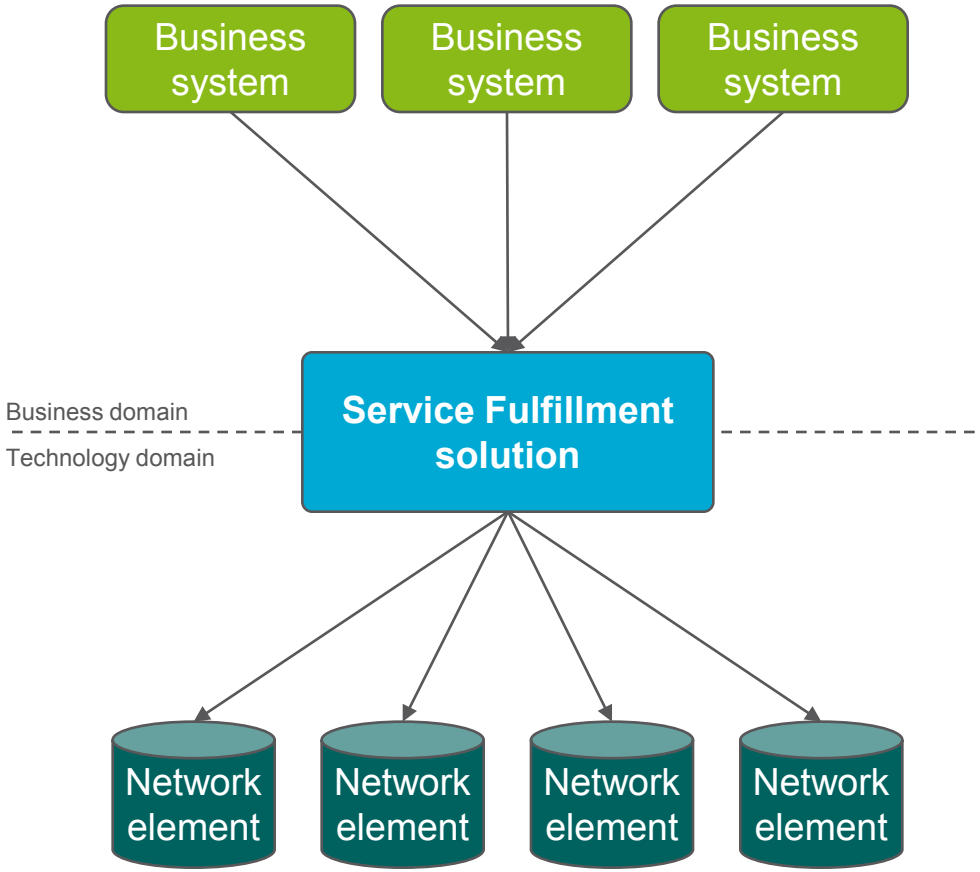
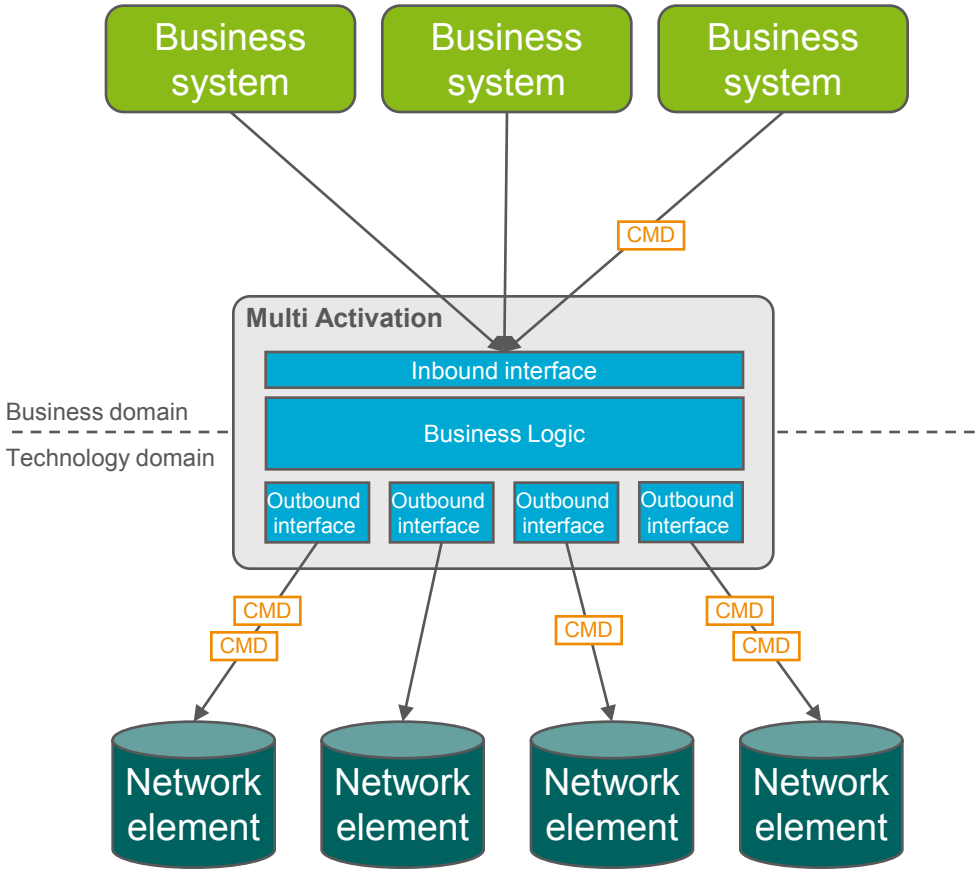
SERVICE FULFILLMENT
OVERVIEW



- Typical service fulfillment tasks for a telecom operator
  - Customer relationship management
  - Selling and order handling
  - Service configuration and activation
  - Resource provisioning
- Objectives
  - Shorten time from order to delivery
  - Lower OPEX through simplification and increased automation

SERVICE FULFILLMENT
ERICSSON MULTI ACTIVATION

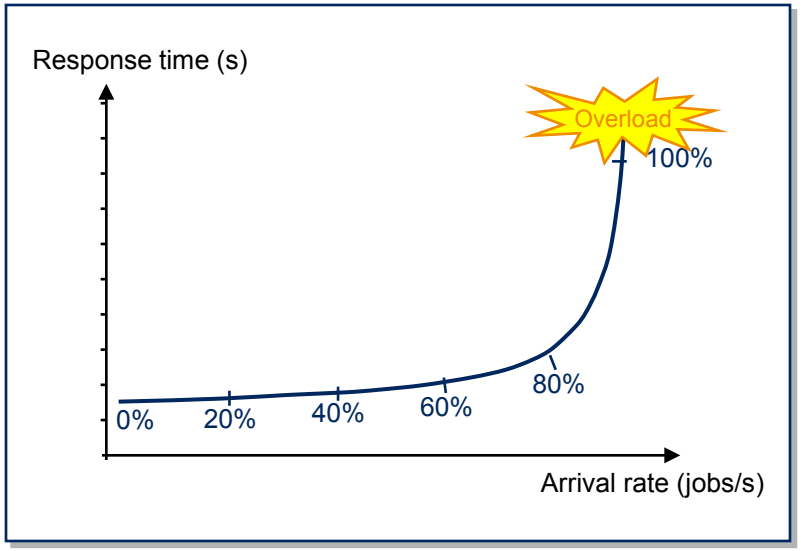


- Provides a gateway between the business and technology
- Used to manage users, services and service preferences in the network
- Exposes network functionality
- Hides implementation details like protocols, redundancy and network element versions
- One inbound command typically corresponds to a number of outbound commands

LOAD DEPENDENCY
MODELING OF A TYPICAL NETWORK ELEMENT

- The network elements can be modeled as load dependent systems
  - Process some kind of jobs and gets more and more overloaded the more jobs they have to process
  - Internal jobs compete for common shared resources, like disk I/O
- Load dependent servers are very sensitive for high loads
  - Easily gets unstable

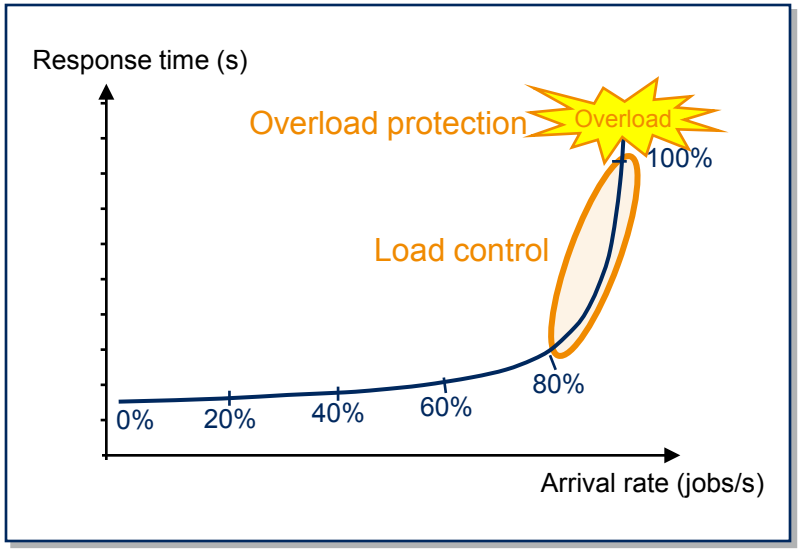
Network element utilization



HANDLING OF OVERLOAD
LOAD CONTROL VS. OVERLOAD PROTECTION

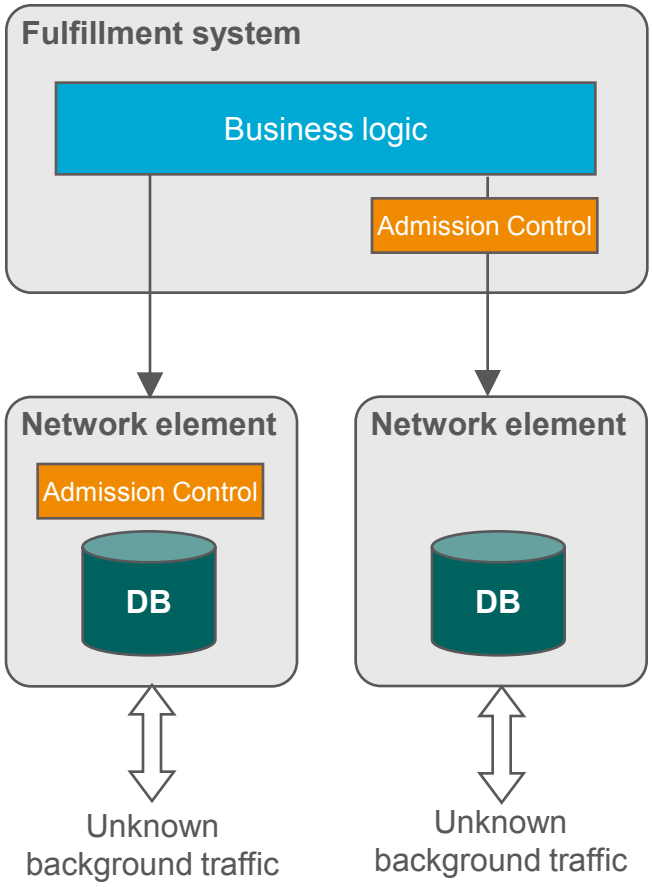
- Load Control
  - Maintains a high throughput of a node at sustained overload
  - Works proactively to avoid overload
  - Takes counteractions when it sees an increased risk or trend towards overload
- Overload Protection
  - Mechanisms by which a network element that has been offered load in excess of its capacity protects itself from failure.
  - This may include instructions to the traffic sources to reject, discard or redirect traffic; simple rejection of traffic, or discarding work.

Network element utilization

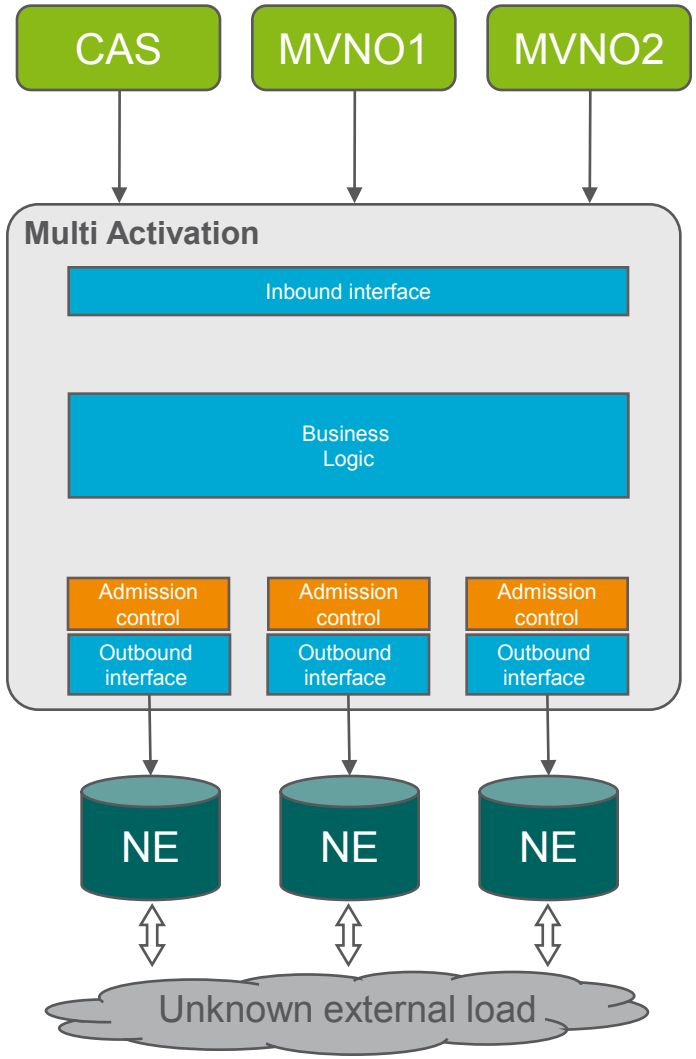


ADMISSION CONTROL
OVERVIEW

- Independent load control component
  - Can be used on both outbound and inbound interfaces
  - No impact on existing protocols
- What makes regulation complex is the dependency to an unknown external load
  - Analytical model results in too complex calculations
  - Control engineering provides a solution possible to use in real-time with little footprint on the hosting system

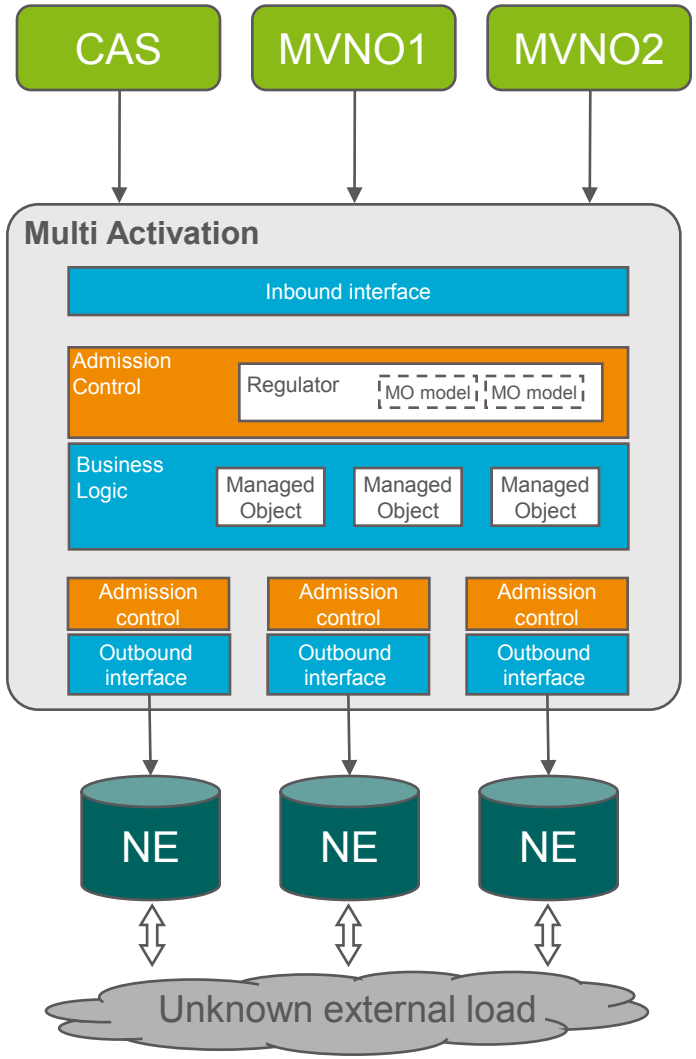


ADMISSION CONTROL
OUTBOUND ADMISSION CONTROL



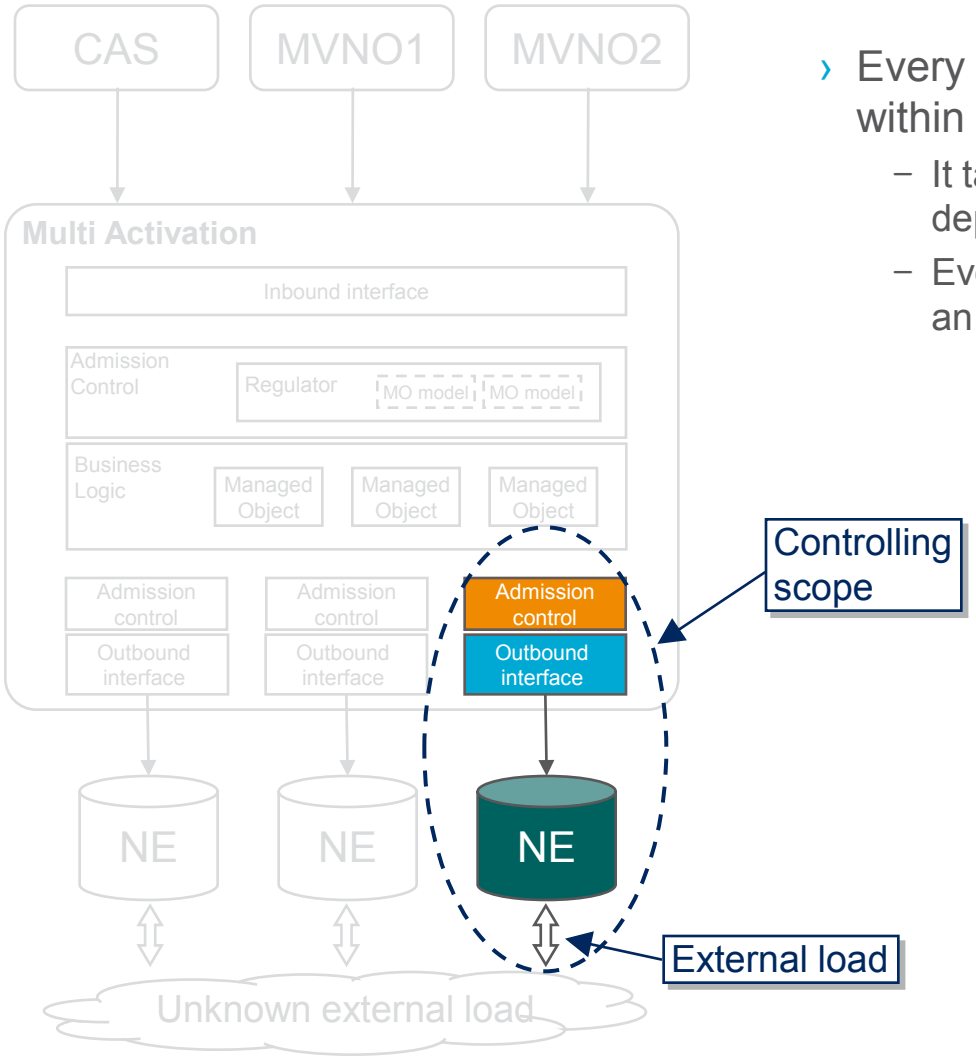
- Admission control introduced to regulate outbound traffic
- Will measure response times from the network elements and regulate load when a trend towards overload is detected.
- The Admission control component is generic and can be reused in different places

ADMISSION CONTROL
REGULATION OF INCOMING TRAFFIC



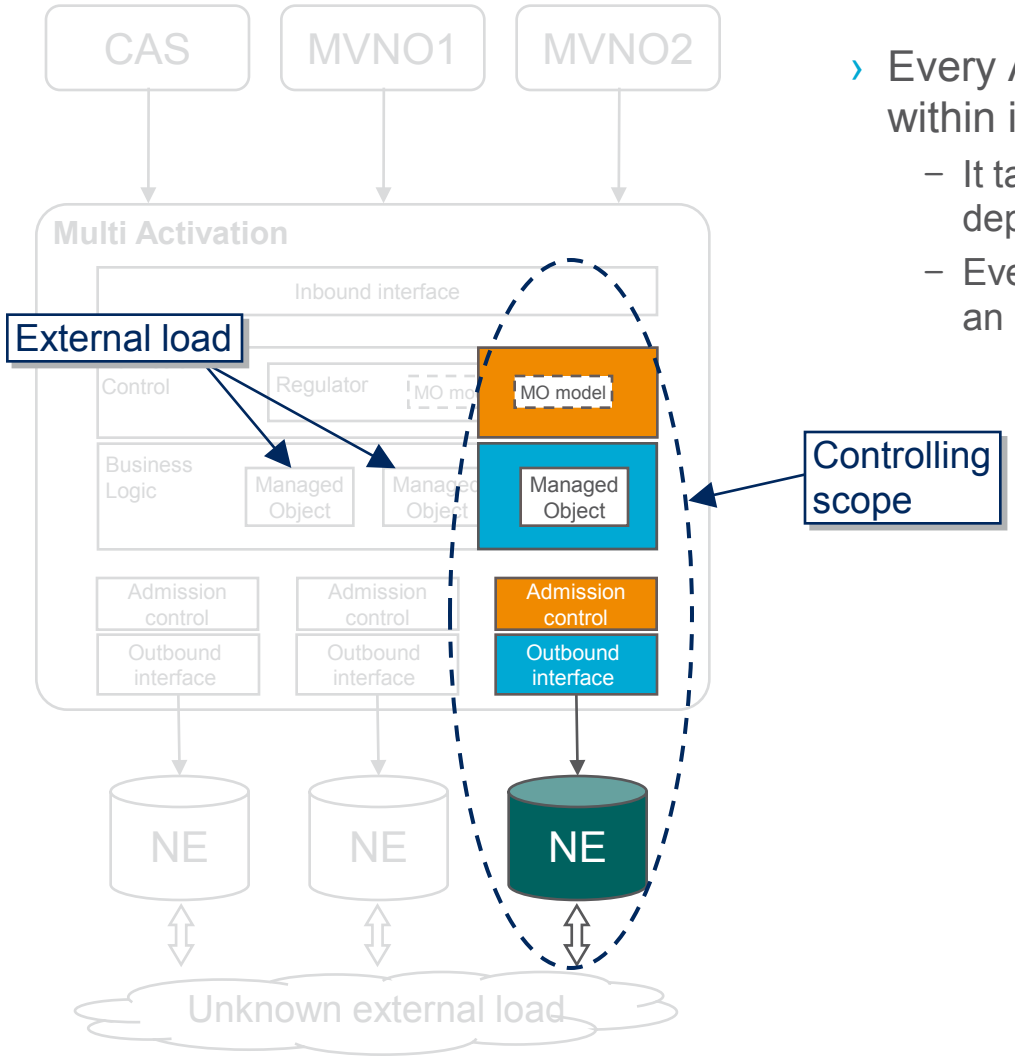
- Make sure that Multi Activation is fully utilized and never get overloaded
- Each business system can make full use of Multi Activation
- When necessary Admission Control gradually degrades performance to avoid any overload in the system.
- Each Managed object (MO) in EMA will require its own set of Admission Control parameters

CONTROLLING SCOPE
OUTBOUND ADMISSION CONTROL



- Every Admission Control component acts within its own controlling scope
  - It takes care of everything downstream that depends on it
  - Everything outside this scope is treated as an unknown external load

CONTROLLING SCOPE
INBOUND ADMISSION CONTROL



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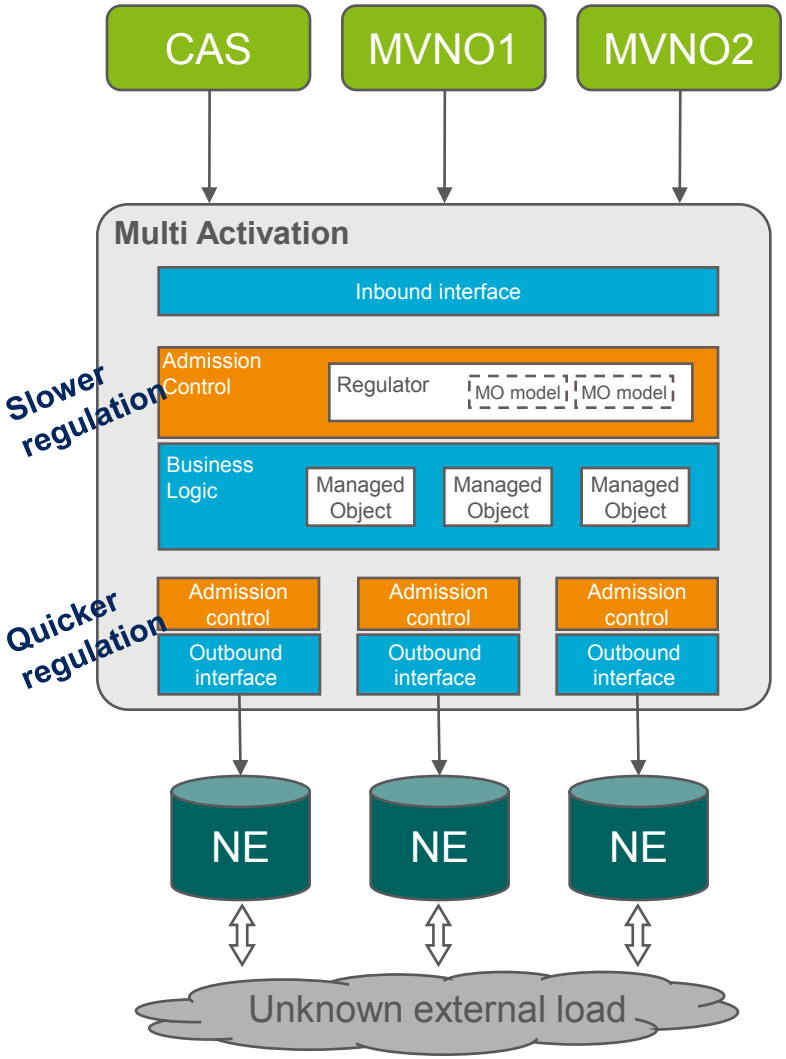
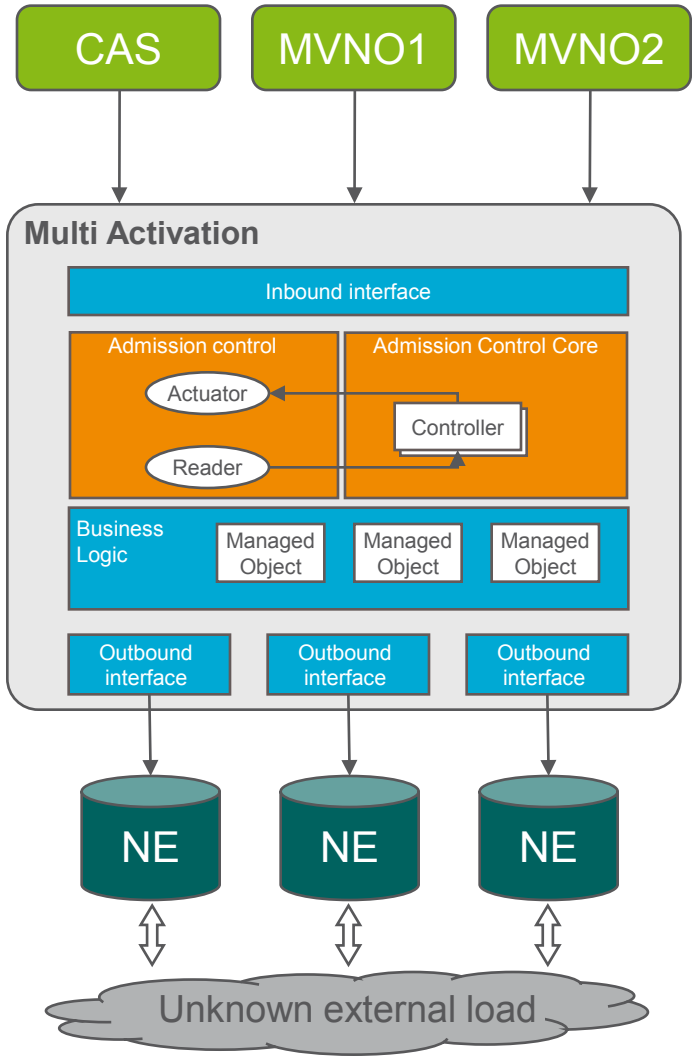
INBOUND VS OUTBOUND
CONCLUSION



- The 'controller bandwidth' of each Admission Control component is designed to be as high as possible with respect to the dynamics of its own scope
- Admission Control components at lower levels are designed to respond quicker than the ones at higher levels
  - Guarantees no racing conditions between action and counter action among the controllers
- Distributed control
  - No interconnection between different Admission Control components

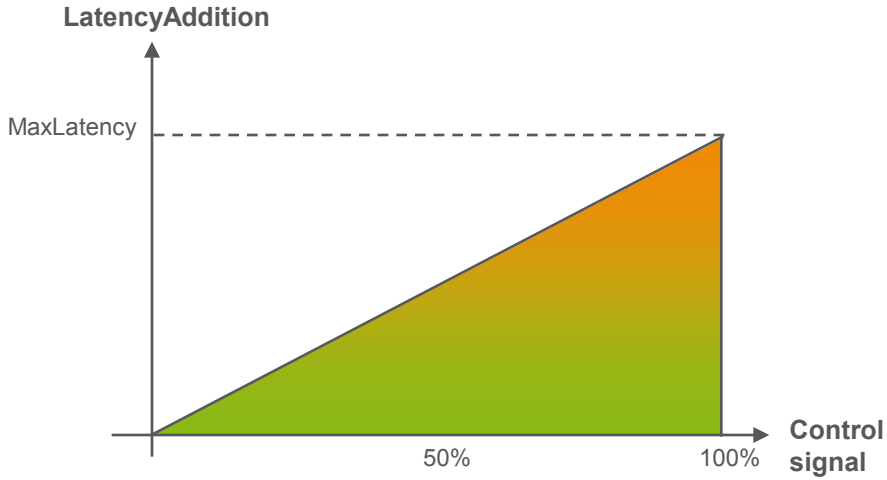
ARCHITECTURE



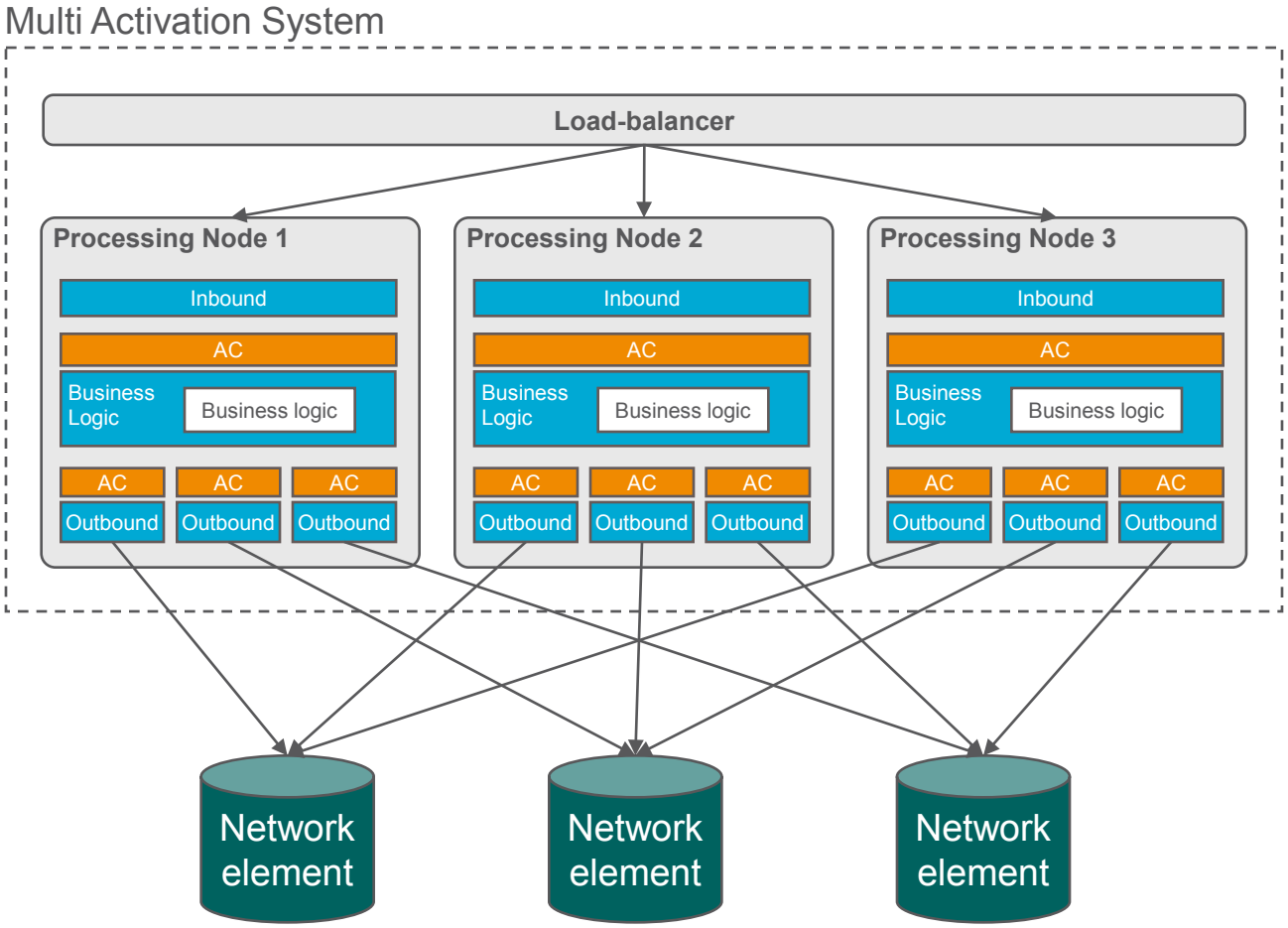
- Reader
  - Sniffs on the communication to get the response times
  - No impact on the existing protocols
- Controller
  - Regulates the traffic
  - Has a model that describes the expected behavior and detects when response times are longer than expected
  - Knows how to get out of current state
  - Contains a Load-adaptive modified PI-controller with anti-windup
- Actuator
  - Executes controller action commands (adding latency or reducing token bucket rate)

ACTUATOR
TRAFFIC SHAPING ACTUATOR

- Load regulation in service fulfillment
  - Gate functionality not possible
  - Can not drop requests, since it will create inconsistency in the network
  - All requests must be handled
- Slowing down rate instead of dropping requests
- Traffic shaping actuator
  - Reduces provisioning rate by adding an extra latency to the response (synchronous interfaces)

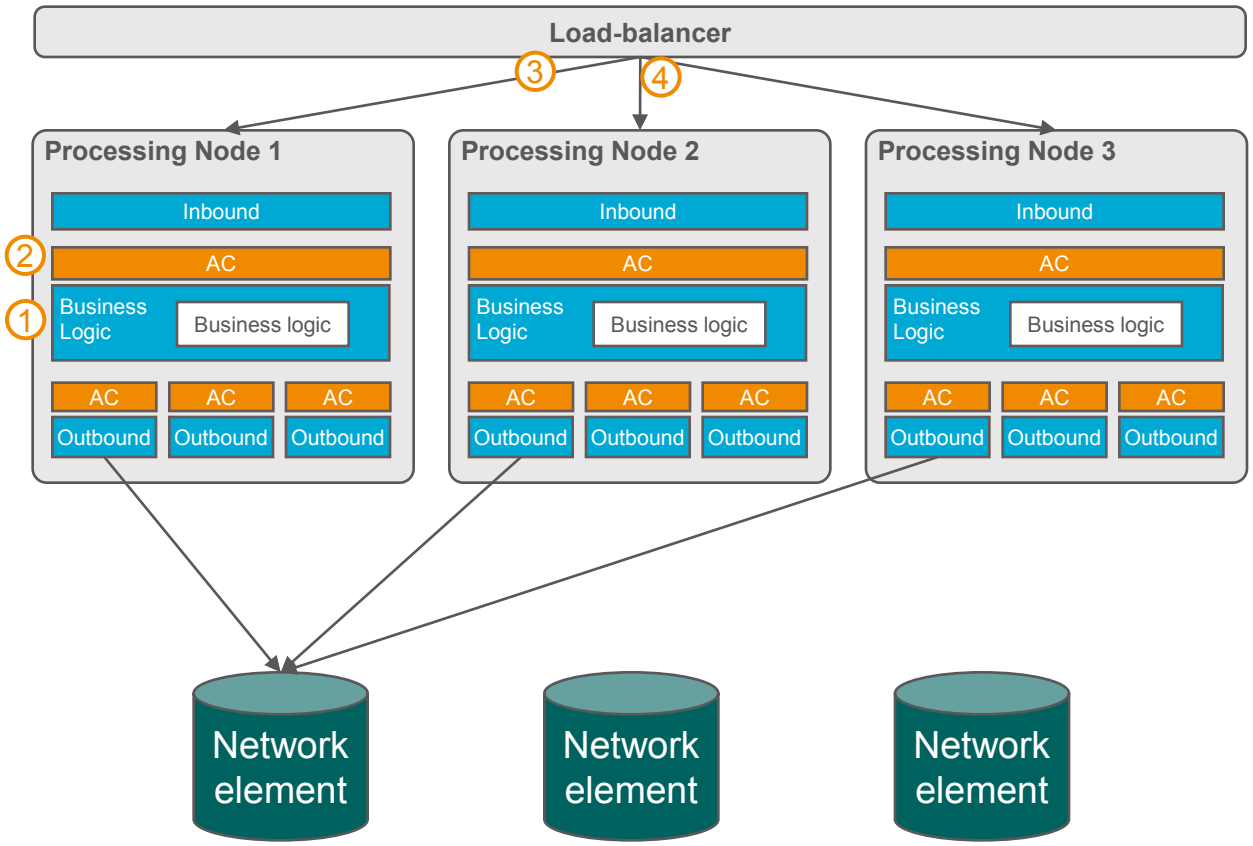


DISTRIBUTED SYSTEMS
SEVERAL PAYLOAD NODES



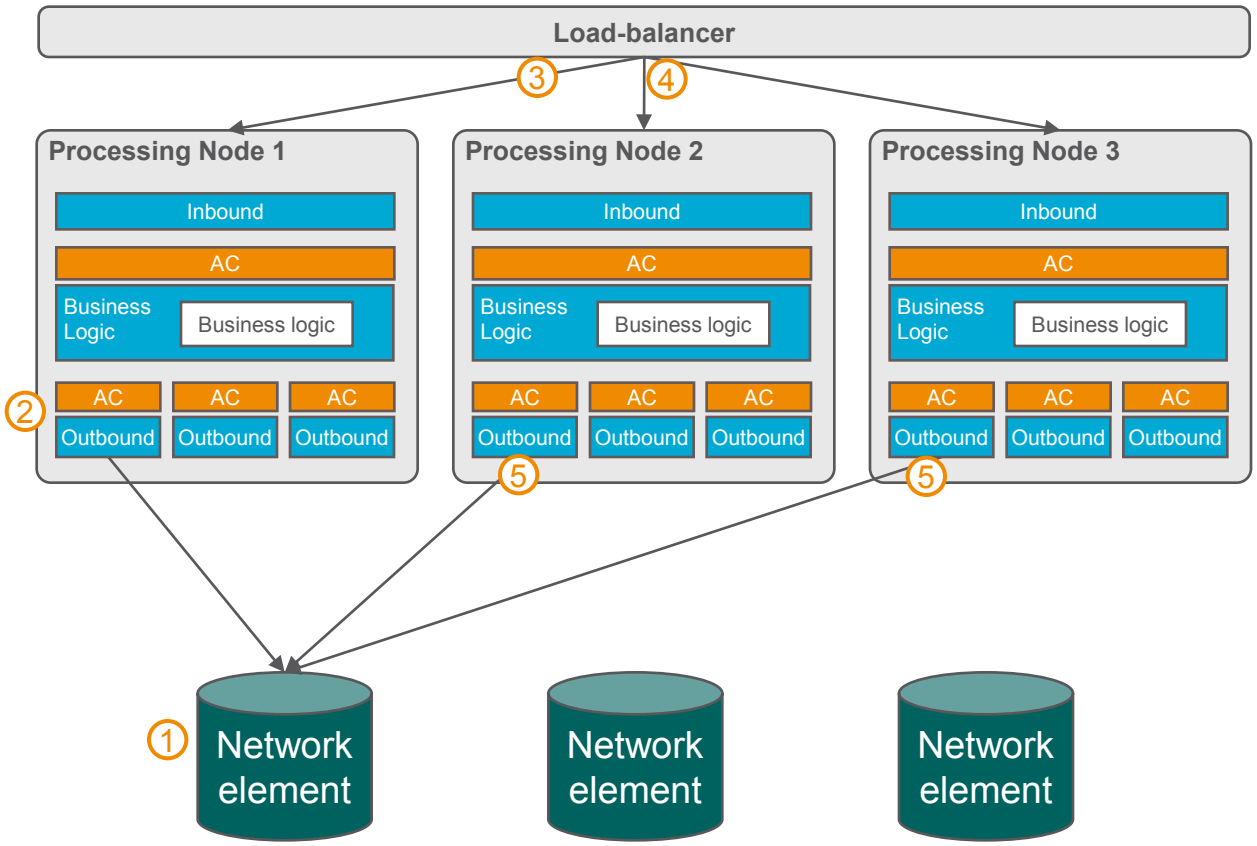
- A typical Multi Activation systems consist of at least three processing nodes
- Load balancer distributes the load between the nodes
- The processing nodes execute business logic independent on each other
- Each processing node needs its own instance of Admission control

DISTRIBUTED SYSTEMS
SCENARIO: PROCESSING NODE OVERLOAD



1. Processing node 1 is getting closer to overload
2. Admission control regulates load by reducing provisioning rate (adding latency to responses)
3. It gets harder for the load-balancer to find free sessions towards Processing Node 1
4. Load balancer directs more requests to Processing Node 2 and 4

DISTRIBUTED SYSTEMS
SCENARIO: NETWORK ELEMENT OVERLOAD

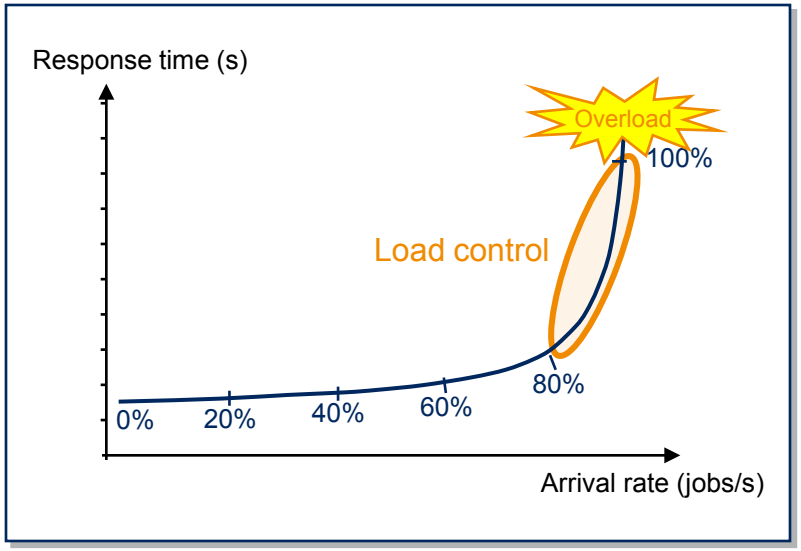


1. Network Element is getting overloaded
2. Processing node 1 detects longer response times and start to regulate load
3. It gets harder for the load-balancer to find free sessions towards Processing Node 1
4. Load balancer directs more requests to Processing Node 2 and 4
5. The other Processing Nodes also detect the longer response times from the Network element and starts regulating load

SUMMARY

- Regulation of the inbound traffic
  - Makes sure that Multi Activation is fully utilized and never gets overloaded
  - Provides early warnings about necessary expansions
- Regulation of outbound traffic
  - Makes sure that Multi Activation does not overload the network elements.
  - Needs to consider the unknown background load.
- Admission control technology
  - Evaluates load and capacity of a network element
  - Mathematical model that describes how the response time depends on the current load
  - Combination of Control Engineering and Telecom Engineering

Network element utilization



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