Cloud & Big Data

Elasticity in Cloud Computing

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Elasticity: Definition and Differentiation

What It Is Not [3]

Scalability Sustain increasing workloads with adequate performance.

Efficiency Amount of resources consumed for a given amount of work.

Elasticity $\neq$ Scalability

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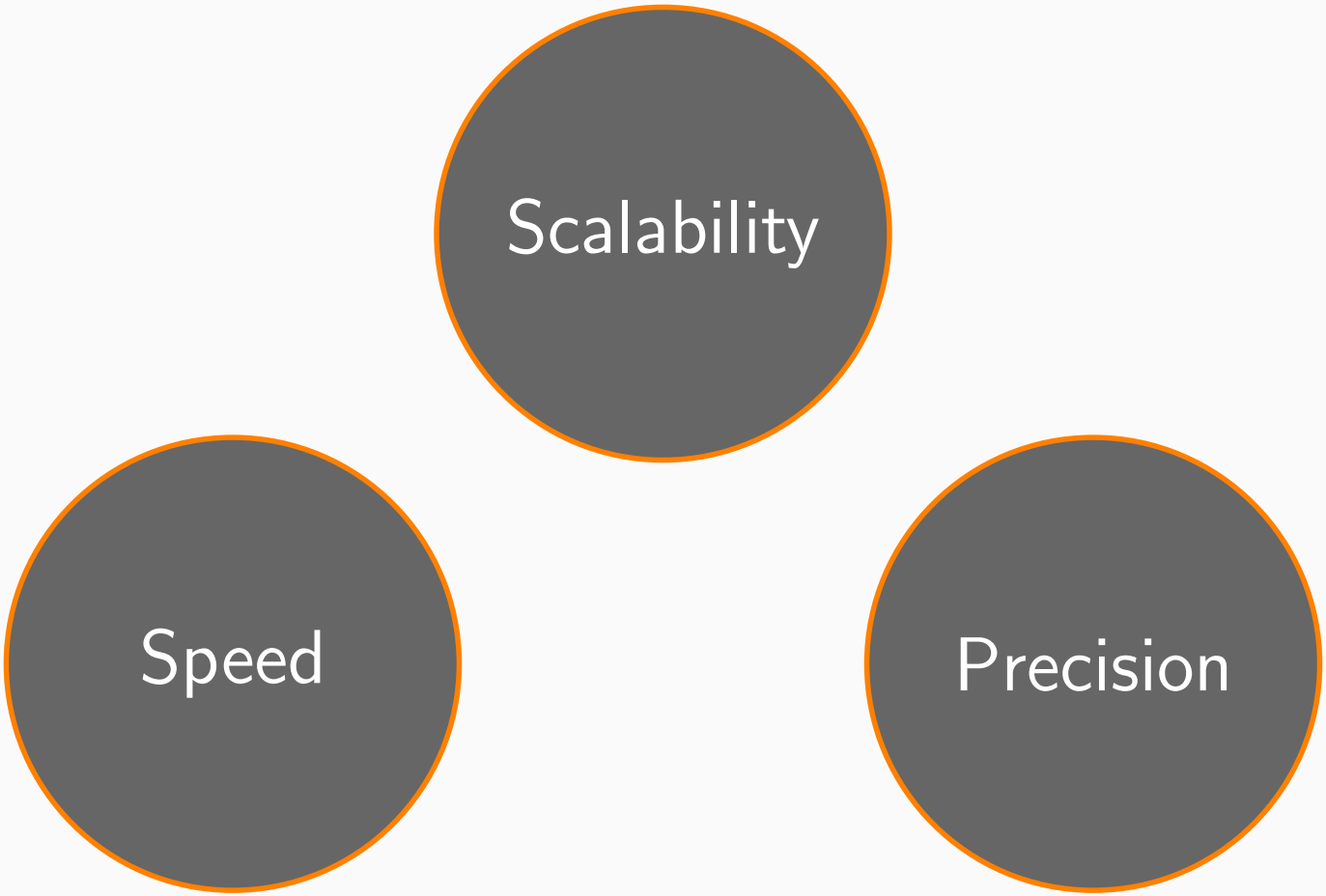
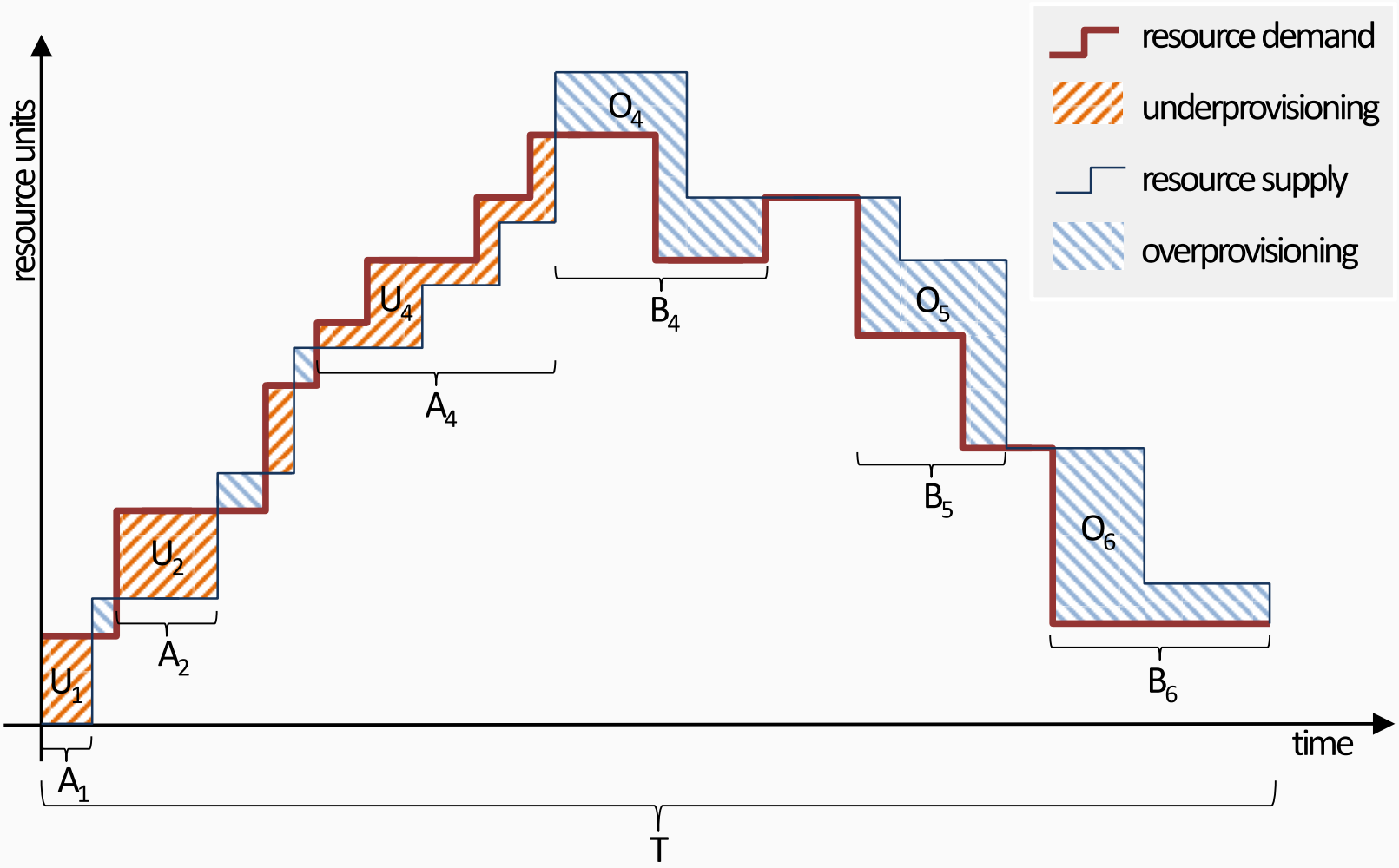
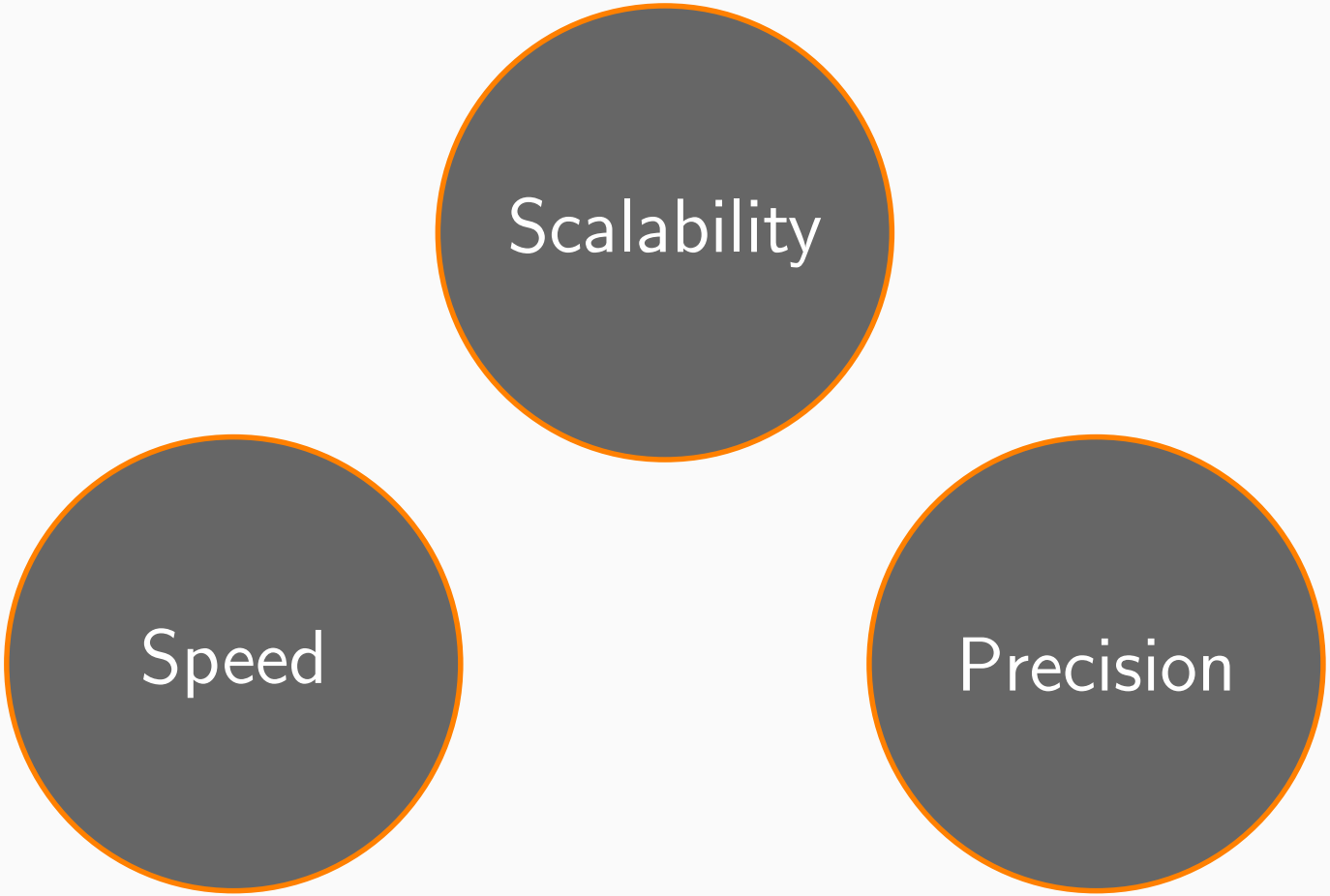
It's more than that. That's the selling point.


Scalability
Speed
Precision

Example of matching demand [3]

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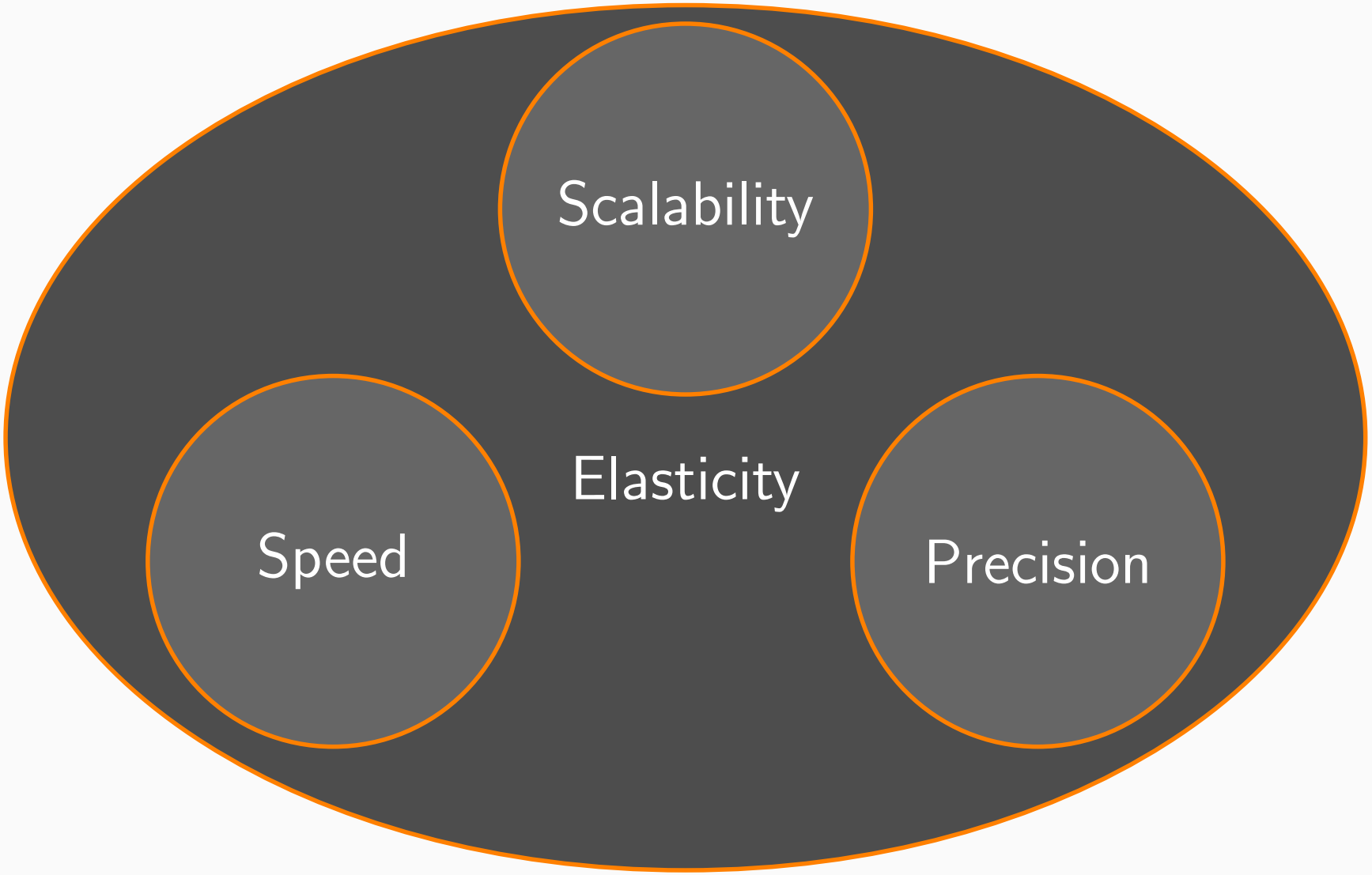
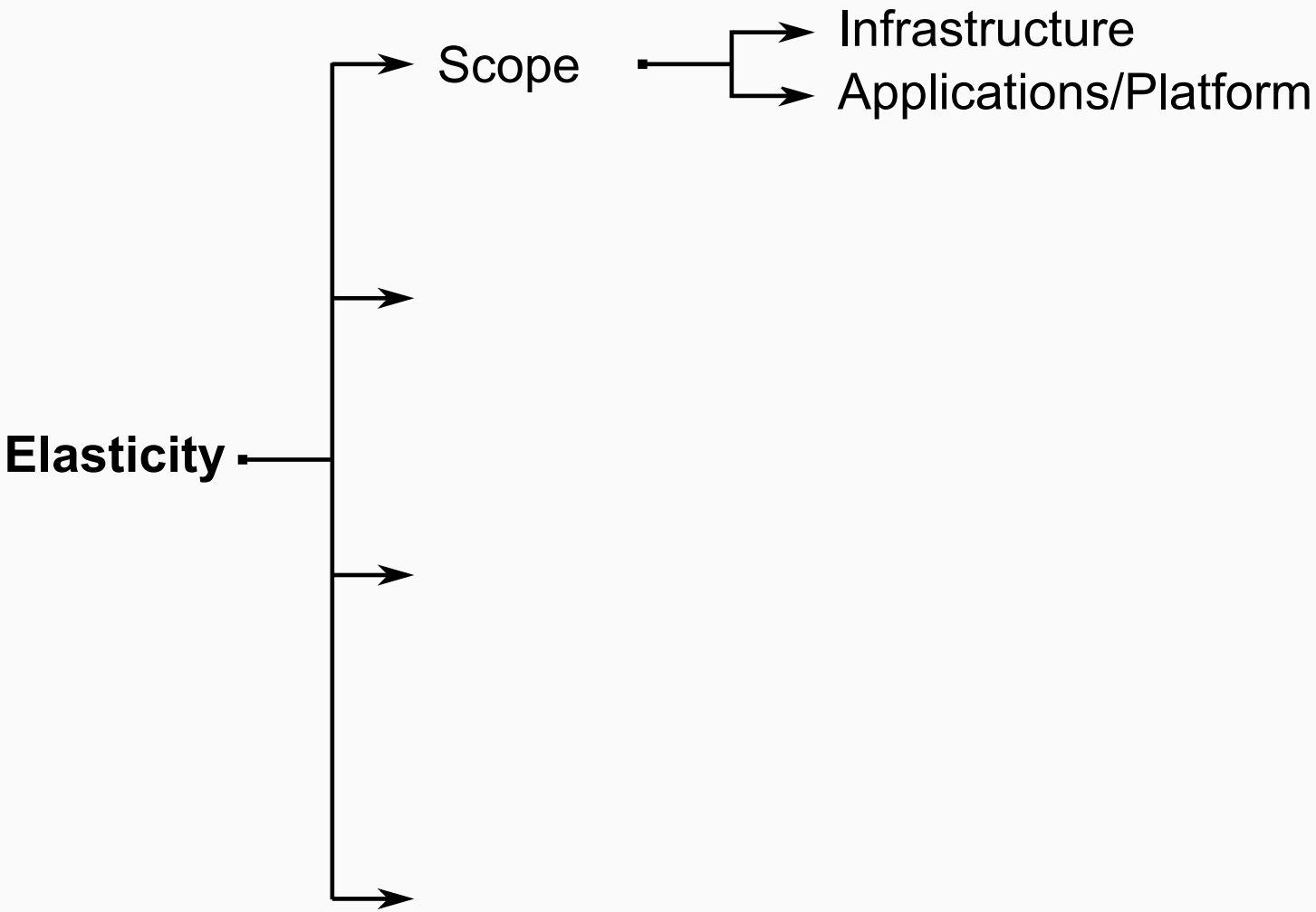

Scalability
Elasticity
Speed
Precision

Elasticity [3]

Definition

Elasticity is the degree to which a system is able to adapt to workload changes by provisioning and de-provisioning resources in an autonomic manner, such that at each point in time the available resources *match* the current demand as closely as possible.

Different parameters involved in elasticity [1]



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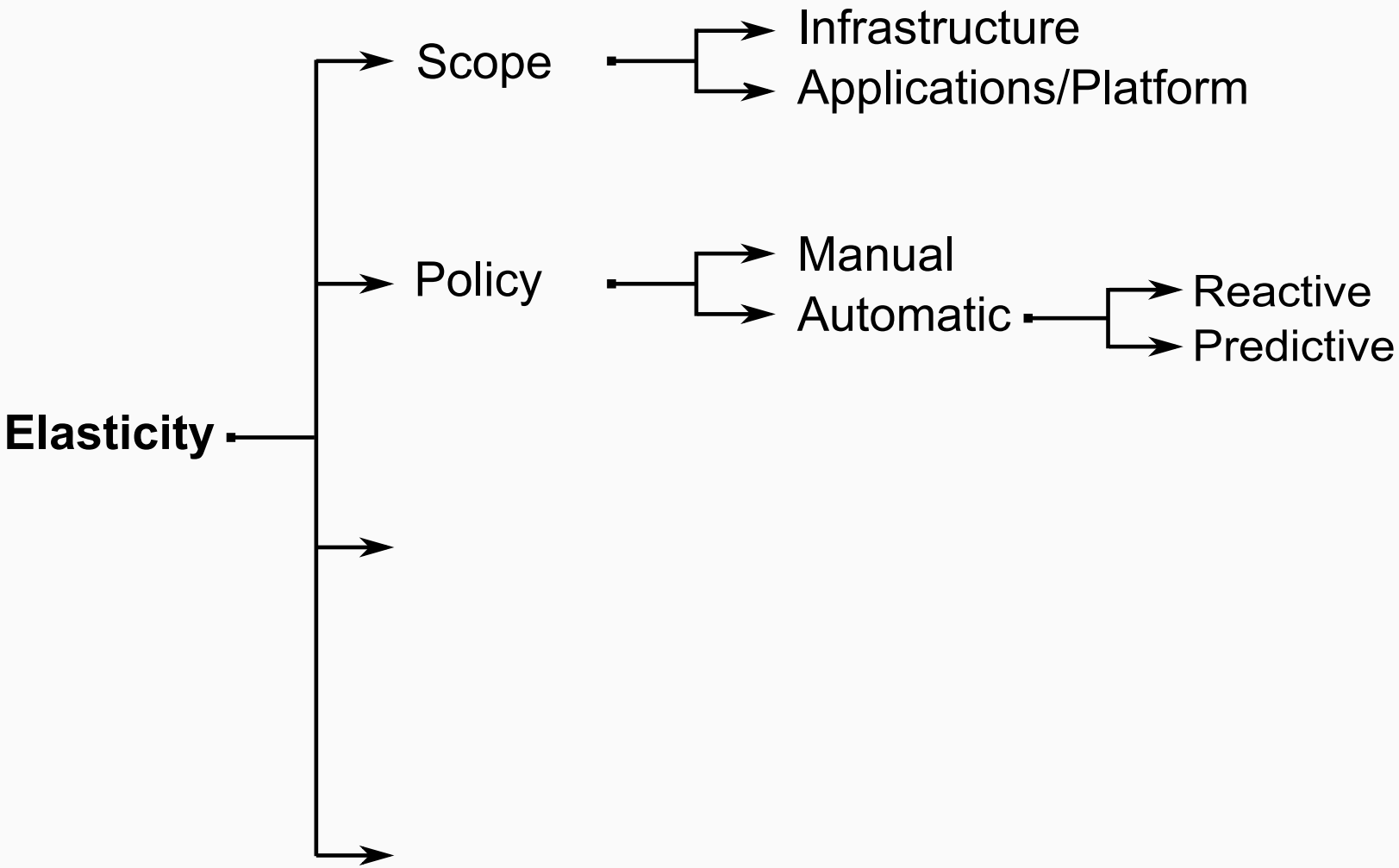

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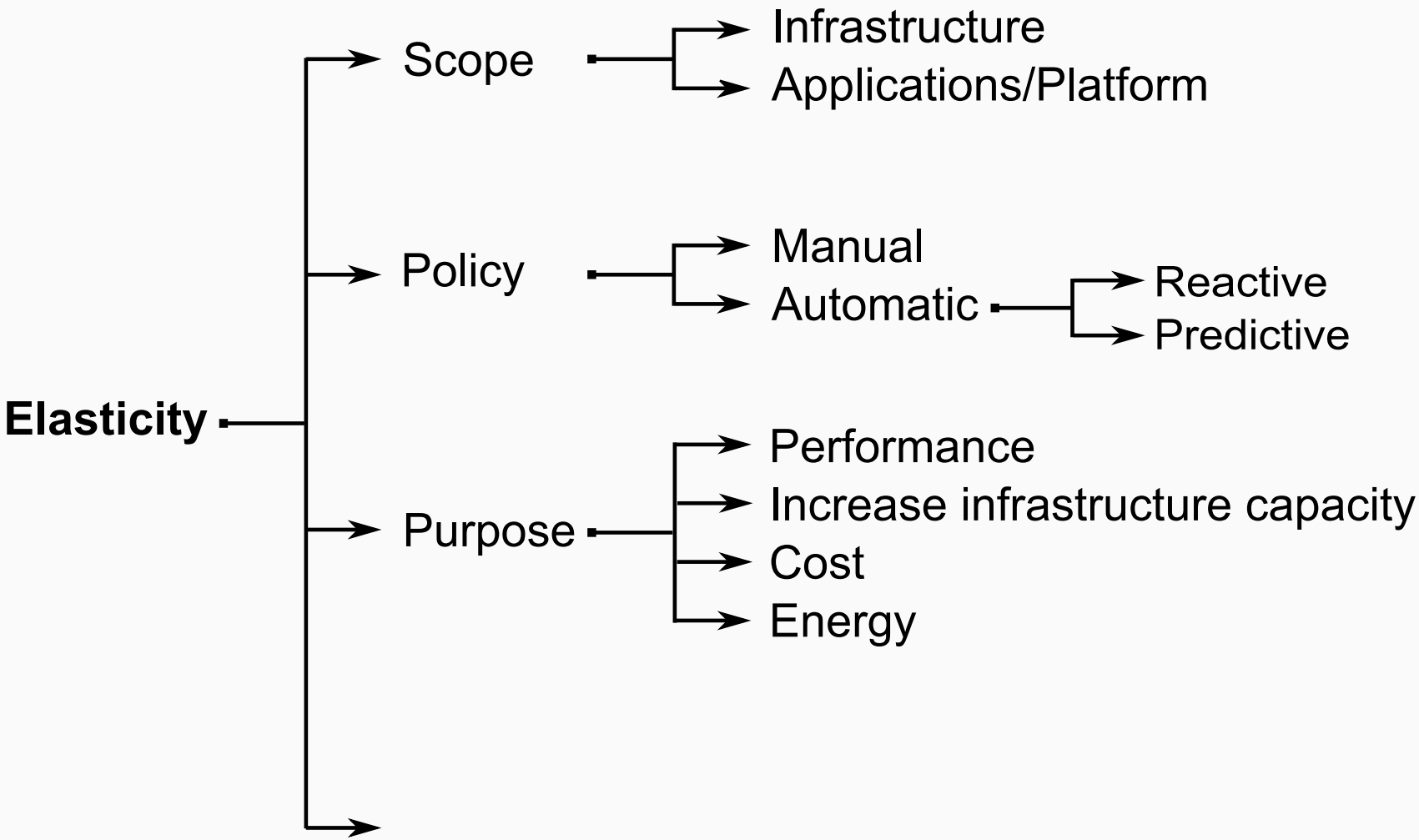

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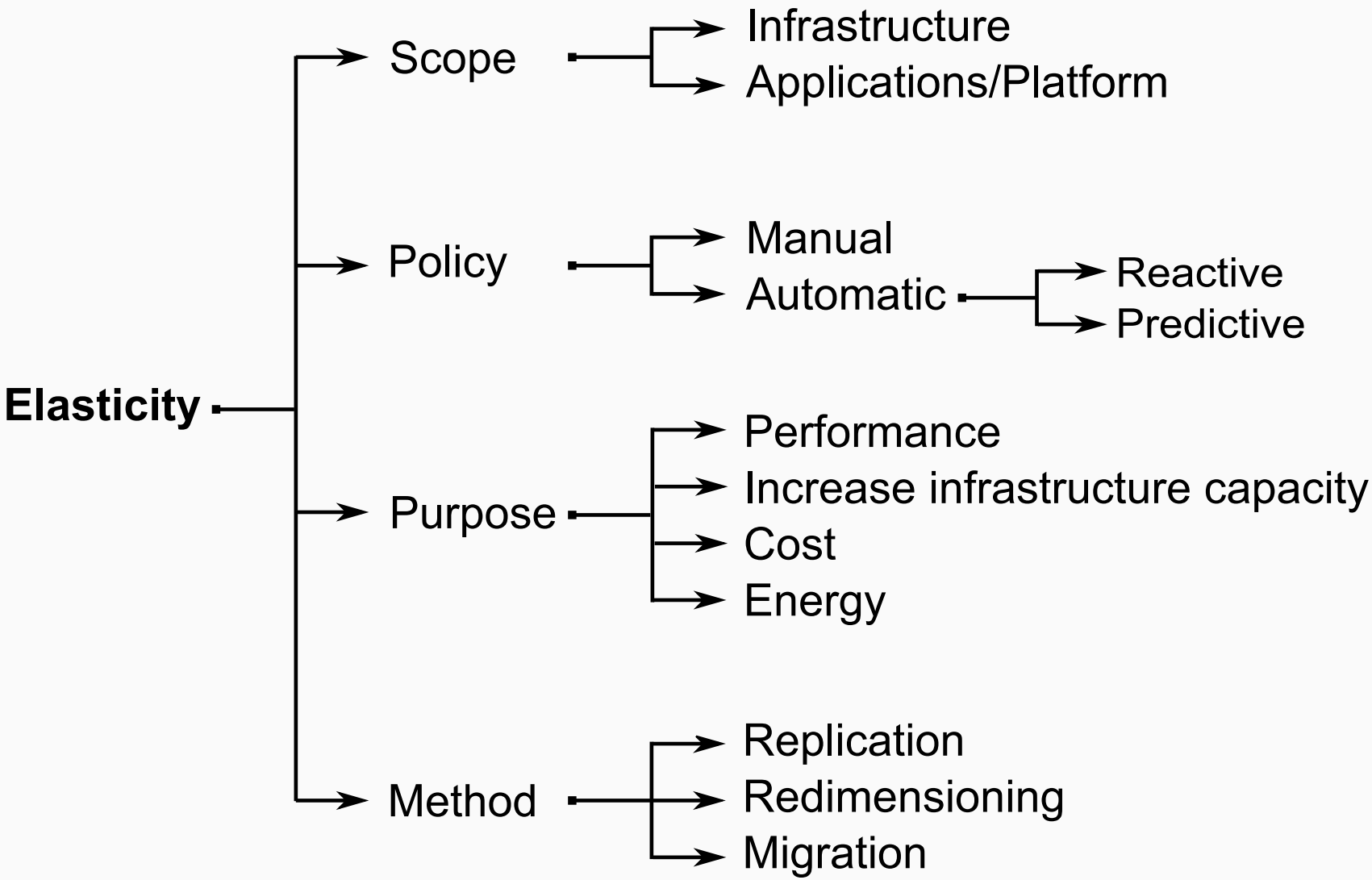

When to Scale

Reaction [2]

Set of rules (*thresholds*).

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Different resource managements. [2]

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Hierarchical Management systems built on top of each other.
E.g. cluster level with layer on top.

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Different resource managements. [2]

Hierarchical Management systems built on top of each other.
E.g. cluster level with layer on top.

Flat Completely decentralized management.

Prediction [2]

Models built through analysis, learning, queueing theory. . .

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Another resource managements.

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Statistical Small scale with dynamic clusters. Repeated small scale optimizations attain large scale load and optimal placement.

Example of an elasticity controller [4]

Mixing reactive and predictive methods.

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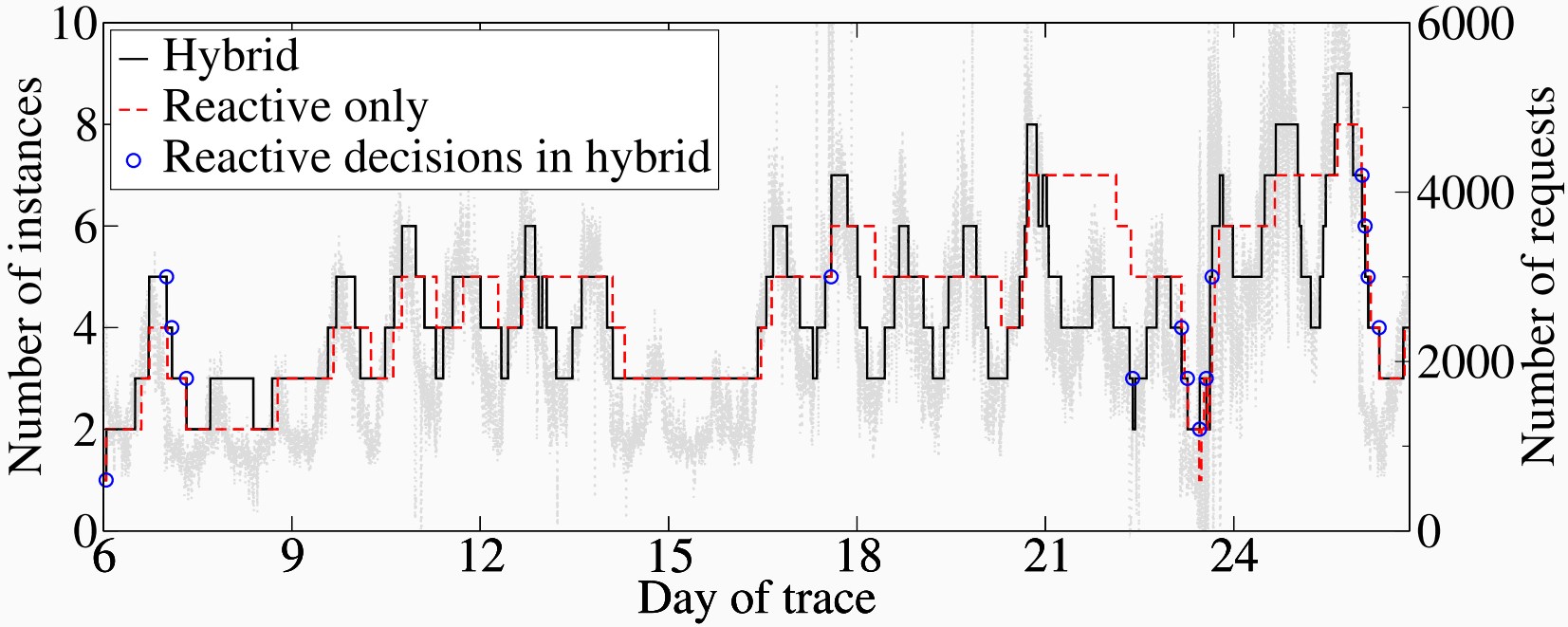

How to Scale

Kinds of scaling / Mechanisms

Horizontal (*Replication*) Adding/Removing instances (e.g. VMs, modules. . .).

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Horizontal (*Replication*) Adding/Removing instances (e.g. VMs, modules...).

Vertical (*Resizing*) Adding resources (e.g. processing, memory...). *Not always available.*

Migration (*Scaling Out*) Transferring a VM from one physical server to another one.

Configurations & Transitions

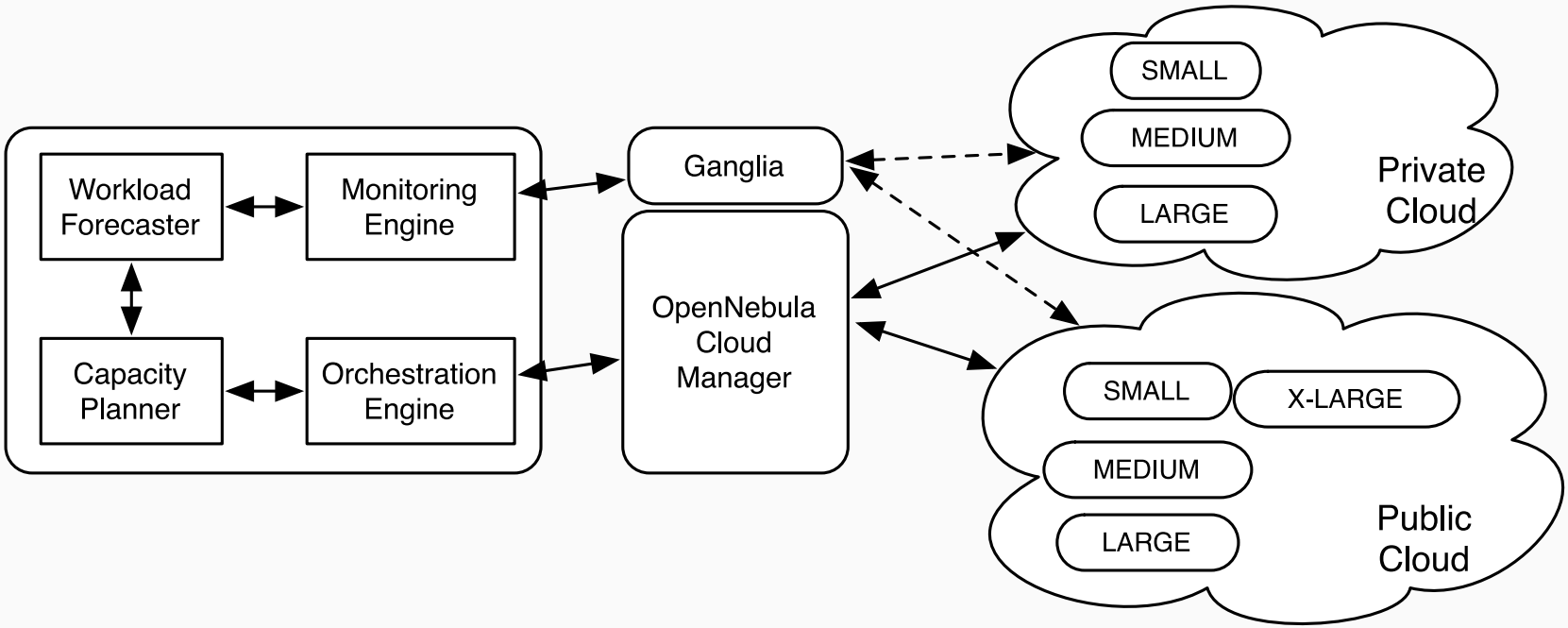
Amazon EC2 Cloud Platform			
Server size	Configuration	Cost/hr	$/core
Small	1 ECU, 1.7GB RAM, 160GB disk	$0.085	$0.085
Large	4 ECUs, 7.5GB RAM, 850GB disk	$0.34	$0.085
Med-Fast	5 ECUs, 1.7GB RAM, 350GB disk	$0.17	$0.034
XLarge	8 ECUs, 15GB RAM, 1.7TB disk	$0.68	$0.085
XLarge-Fast	20 ECUs, 7GB RAM, 1.7TB disk	$0.68	$0.034
New Server's NS Cloud Platform			
Small	1-core 2.8GHz, 1 GB RAM, 36GB disk	$0.11	$0.11
Medium	2-core 3.2 GHz, 2 GB RAM, 146GB disk	$0.17	$0.085
Large	4-core 2.0GHz, 4GB RAM, 250 GB disk	$0.25	$0.063
Fast	4 core 3.0 GHz, 4 GB RAM, 600GB disk	$0.53	$0.133
Jumbo	8 core 2.0GHz, 8GB RAM, 1TB disk	$0.60	$0.075

There is also cost for transition.

Example of a provisioning system [5]

Integer Linear Program to take into account multiple parameters.

Example of architecture [5]



Conclusion

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Not there yet.

- Elements tightly coupled but studied independently.
- Mechanisms conceived with assuming other elements in the workflow to be perfect.
- Overhead can be a problem (frequency, decomposition, failures. . .).

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