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Compute Project
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Specification of the Data Center IT Pod

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What is a data center IT pod?

It has existed and been talked about for a number of years.

Most people know it when they see it.

There are several definitions for it.

A Pod is an increment of deployment between rack and room

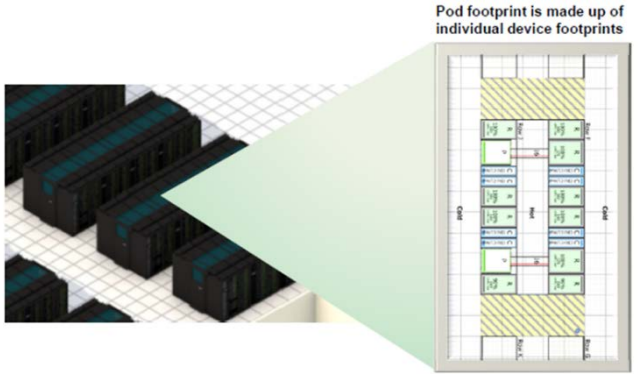
Data Center facility, comprised of

IT Rooms, comprised of

IT Pods, comprised of

IT racks, comprised of

IT devices

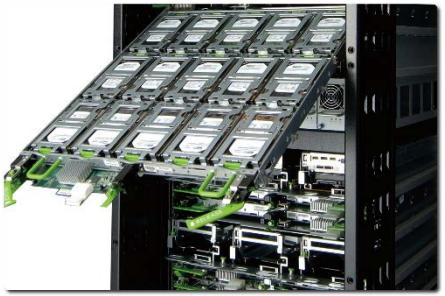


IT pod is a group of IT racks either in a row or (more typically) a pair of rows, that share some common infrastructure elements like PDU, network router, containment system, air handlers, security, etc.

Why care about a pod?

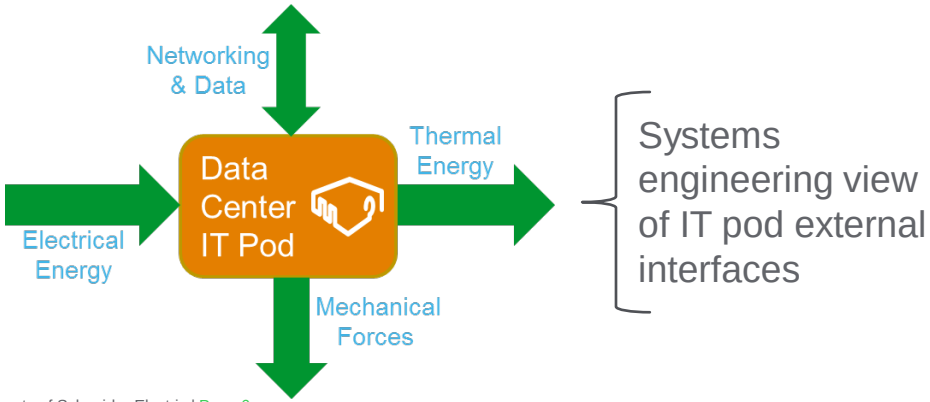
- It is a manageable increment for design, deployment and operation in large data centers.
  - The ability to more easily vary power and cooling architectures by pod in the same room.
- Organizing the IT space into pods brings operational efficiency and reduces human error.
  - Power down maintenance, tracing power & network cabling, etc

The IT rack organizes server, storage & network



There is no standard way to specify an IT pod

- Best practices exist at individual org level, but there's no industry standard.
- If you wanted to deploy a pod,
  - How big should it be? How many racks?
  - How much power should it consume?
  - What attributes describe it?



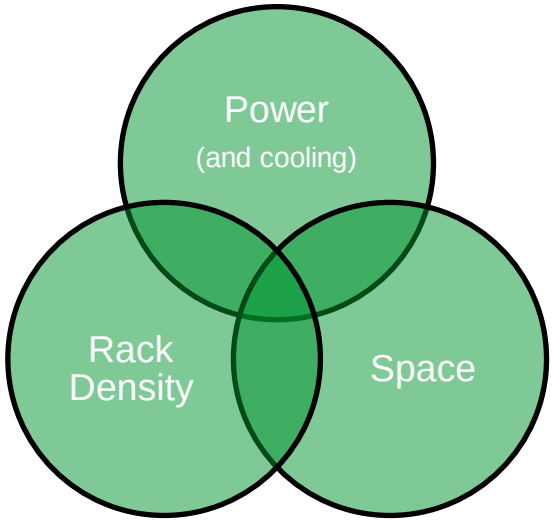
Systems engineering view of IT pod external interfaces

Image courtesy of DPR construction and Facebook

Image courtesy of eWeek and Vapor IO

Three major variables define a pod *size*

1. Total power delivered to the pod
2. Physical size / number of racks
3. Rack density



We will examine the constraints and best practices for specifying a pod size, as well as other required attributes.

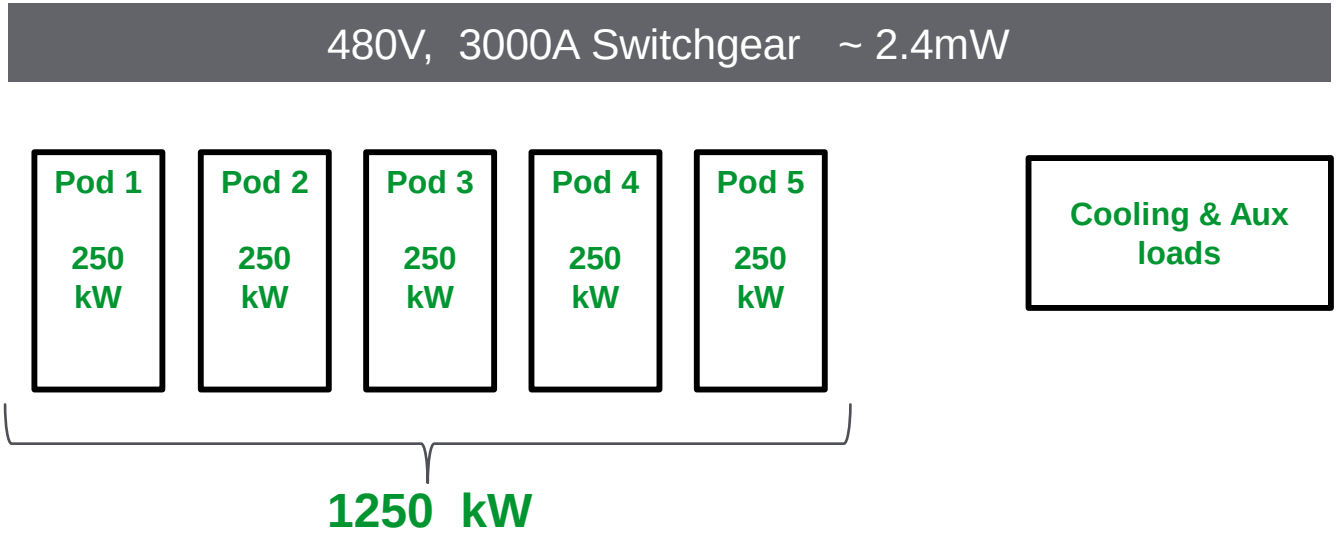
Power to the pod

- The size of the incoming feeder ultimately determines the total power available.
- Matching the pod IT load to the feeder size and/or corresponding transformer mitigates wasted capacity.
- Examining commonly available breaker and panel sizes reveals there are two common categories for pod kW capacity:
  - Low Power Pod: ~ 150kW
  - High Power Pod: ~ 250kW
- These are manageable deployment increments for larger data centers.

Voltage	Breaker size (amperes)	Available power (kW)*
400/230	400	275
	250	170
480/277	400	260
	250	165
208/120	400	150
	250	70

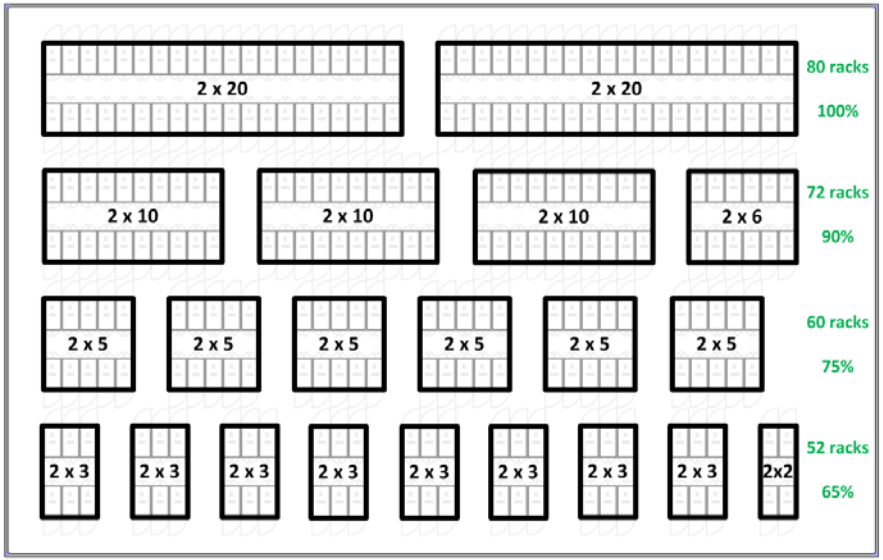
- Available kW is rounded down for simplicity. 400V assumes fully rated breakers. 480V and 208V are de-rated to 80%.
- Distribution amperages > 400A (e.g. 600, 800) can be appropriate for higher density applications

Common example of 1.2MW data center hall



Balancing efficient use of space with density and modularity

- A pod's length, or contiguous row, is theoretically limited by the length of the room, obstructions and accessibility requirements.
  - e.g. OSHA requires rows with 1 exit to be no longer than 6.2m (20')
- Typical continuous row lengths for large data centers 20 – 25 racks. (although longer do exist!)
- Best practice – deploy the largest pod possible for the room size and shape, accessibility, rack density and accounting for required scalability.
  - Uncertain / slow growth requires more modularity to reduce risk and preserve capital



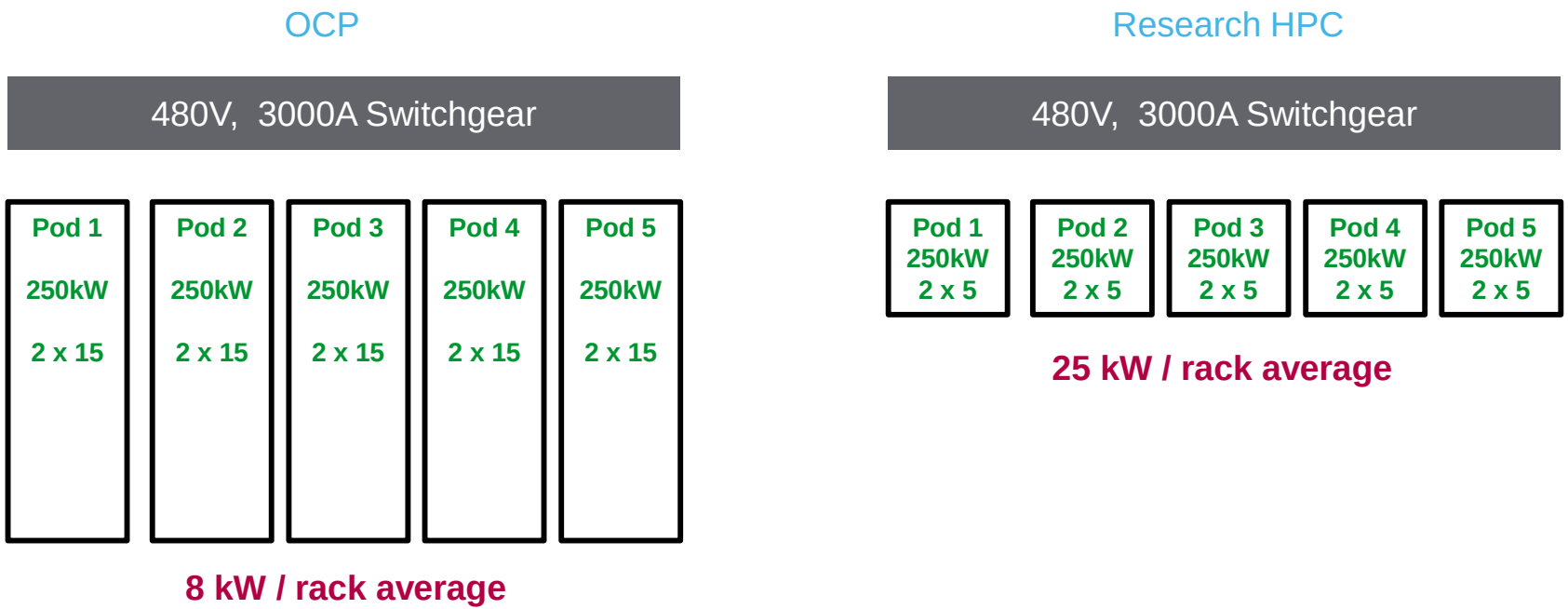
Rack density

- The average rack density is determined by the overall pod power and the number of racks.
- The maximum rack density is determined by the rack's specific branch circuit.
  - A pod with well-engineered air containment, can have a large mix of densities

Image courtesy of VMvault Australia

	Available Power (kW)	Avg Rack Density (kw)	Pod size
Low Power pod	~ 150	6	2 x 12
		12	2 x 6
		20	2 x 3
High Power pod	~ 250	6	2 x 20
		12	2 x 10
		20	2 x 6

Pod deployments scenarios of 1.2MW (IT) data center hall



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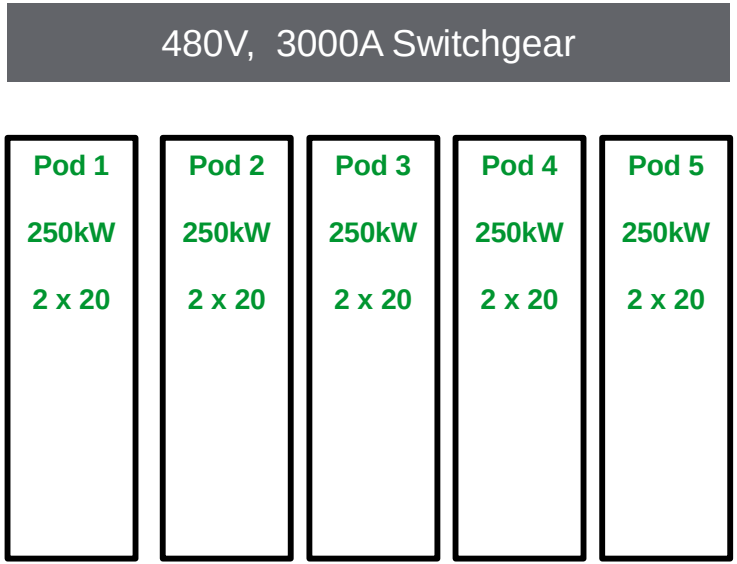
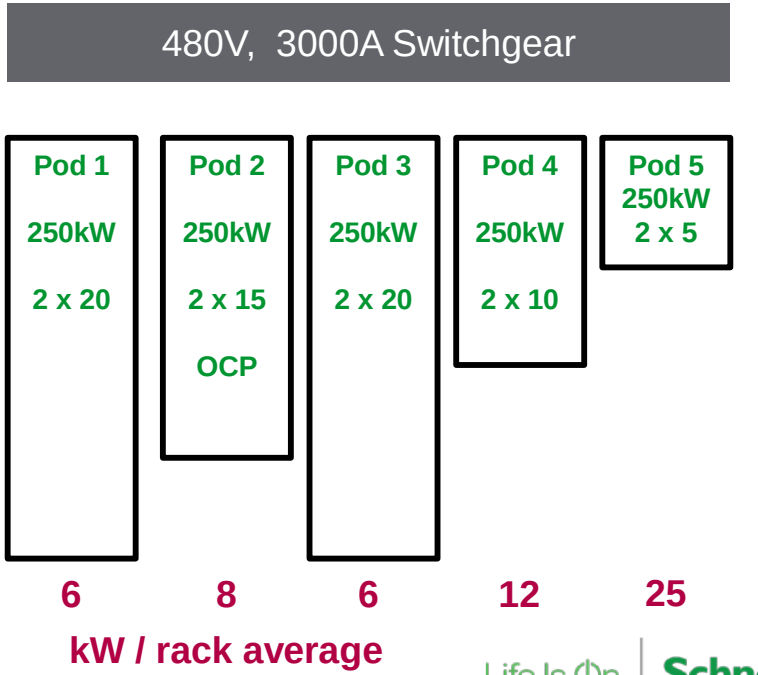
Colocation 1

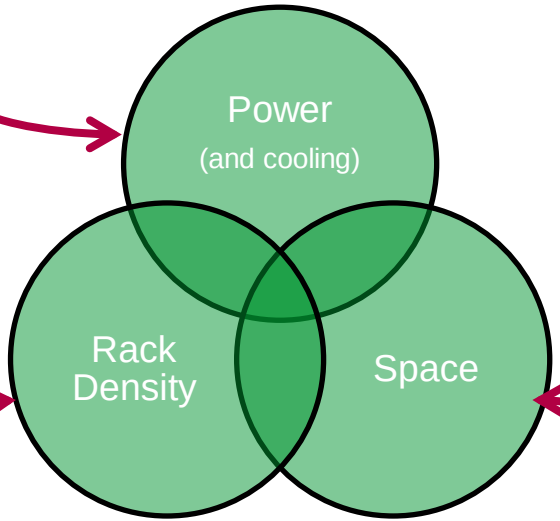


Colocation 2



Best practice to optimize pod size

Maximize this first



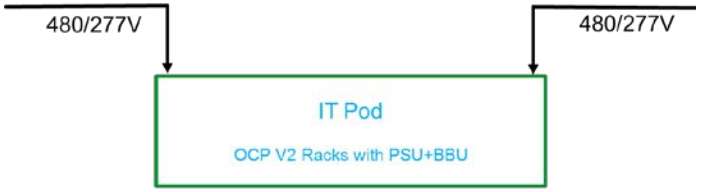
Under estimate the average density

This is usually your cheapest resource

This data center might be full. Looks can be deceiving.

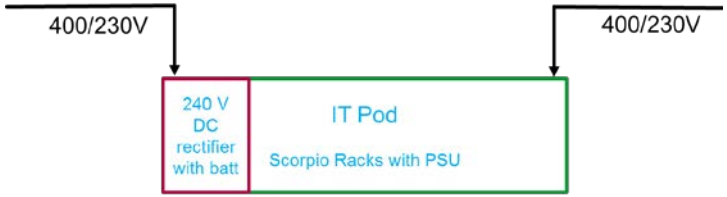
But size is not everything. Other attributes are needed to fully specify a pod...

Example Pod Power Configurations

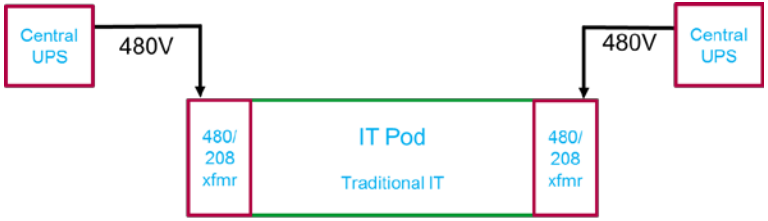


Rack based energy storage

Pod based energy storage with AC distribution to racks



Pod based energy storage with DC & AC distribution to racks



Centralized energy storage

Pod Frame Structural Support System

- Services to the racks are traditionally under a raised floor and hung overheard from the ceiling.
- Pod support frames can simplify room design and aid in modularity
    - Facilitates mounting of all cabling, power, busway, copper, fiber.
    - Options for frame mounting switch allowing the network to be configured before racks arrive.
    - All services can be installed before racks arrive, allowing pre-integrated racks to be ‘plugged into” the pod.

Pod Specification table

Category	Item	Notes	OCP Example
Power	Pod power capability	Based on feeder circuit, panelboard, or pod UPS	250kW
	Input voltage & circuit(s)	208/400/415/480 ; Required feeder circuit to the pod	480/277 VAC 5-wire 400A
	Number of feeds to rack and Redundancy	1N or 2N	2N
	UPS location & type	Location of UPS: Upstream, Pod, Rack, none	Rack BBU with 2N PSU
	Transformer	If a pod based/ PDU transformer exists	none
	Final dist voltage & type	Voltage to the rack	480/277 5-wire, panelboard + cables
Rack / Space Requirement	Total racks and row length	Total racks in pod	30: 2 rows of 15
	Rack type / size	OCP V2, 600mm, 800mm, etc	OCP: 24” wide x 47” deep x 90” tall
	Inner aisle width	Width of the hot or cold aisle	26”
	Clearance	Required clearance in front of racks and end of pod	48” in front of racks. Can be shared.
	Average rack density	Based on total pod power and # racks	8.3kW
	Max rack density	Based on max circuit to racks	25kW based on 40A 480/277 feed
Network	Method	e.g. Leaf and Spine, etc	TBD
Services Support Structure	Method	racks, pod frame, ceiling, underfloor, etc	Pod frame to support overhead power, network, air duct
Cooling	Architecture	Air cooled; Water cooled: in-row, overhead, rear door; DX; Liquid	Hard floor, flooded room, ducted hot air
	Air / water flow	Volumetric flowrate required to remove pod heat	30,000 – 40,000 CFM
	Containment type	Hot Aisle, Cold Aisle, Rack, none	Hot Aisle
Environment & Security	Physical security	Locked doors, cage, proximity sensor, room	Room security, pod security cameras
	Monitoring	Pod monitoring via IP network / BMS, etc	Pod sensors aggregated at pod, IP connection to supervisory

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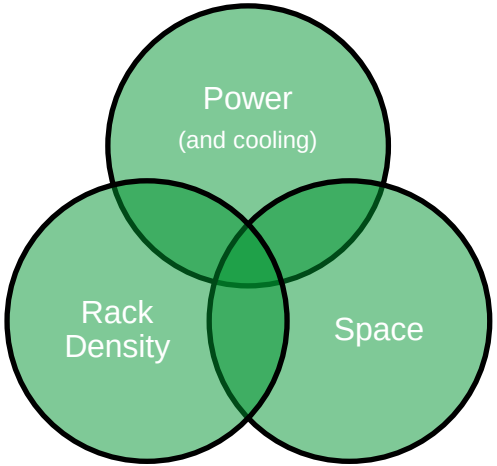
Summary

- Specifying at the pod level within the IT space
  - Brings design efficiency and flexibility to large data centers
  - Provides operational efficiency and reduced risk

- Designs can be based on two common simplified pod power sizes:
  - 150kW and 250kW

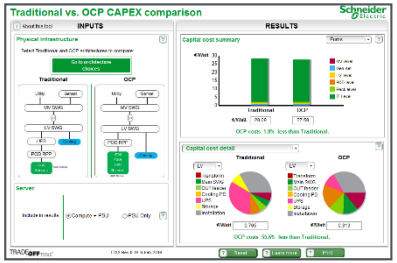
- In design & deployment, under estimate density to minimize underutilized infrastructure. Space is typically the cheapest resource!



Freely available resources to help with planning decisions

Reference Designs

- Designs to support OCP
- One-line diagrams, bill of materials, layout drawings
- www.schneider-electric.com/datacenterdesigns



TradeOff Tools

- Data Center IT Pod Specification Calculator
- Traditional vs Open Compute Capital Cost
- www.tools.apc.com

White Papers

- WP160, Specification of Modular Data Center Architecture
- WP260, Specification of the Data Center IT Pod
- www.whitepapers.apc.com

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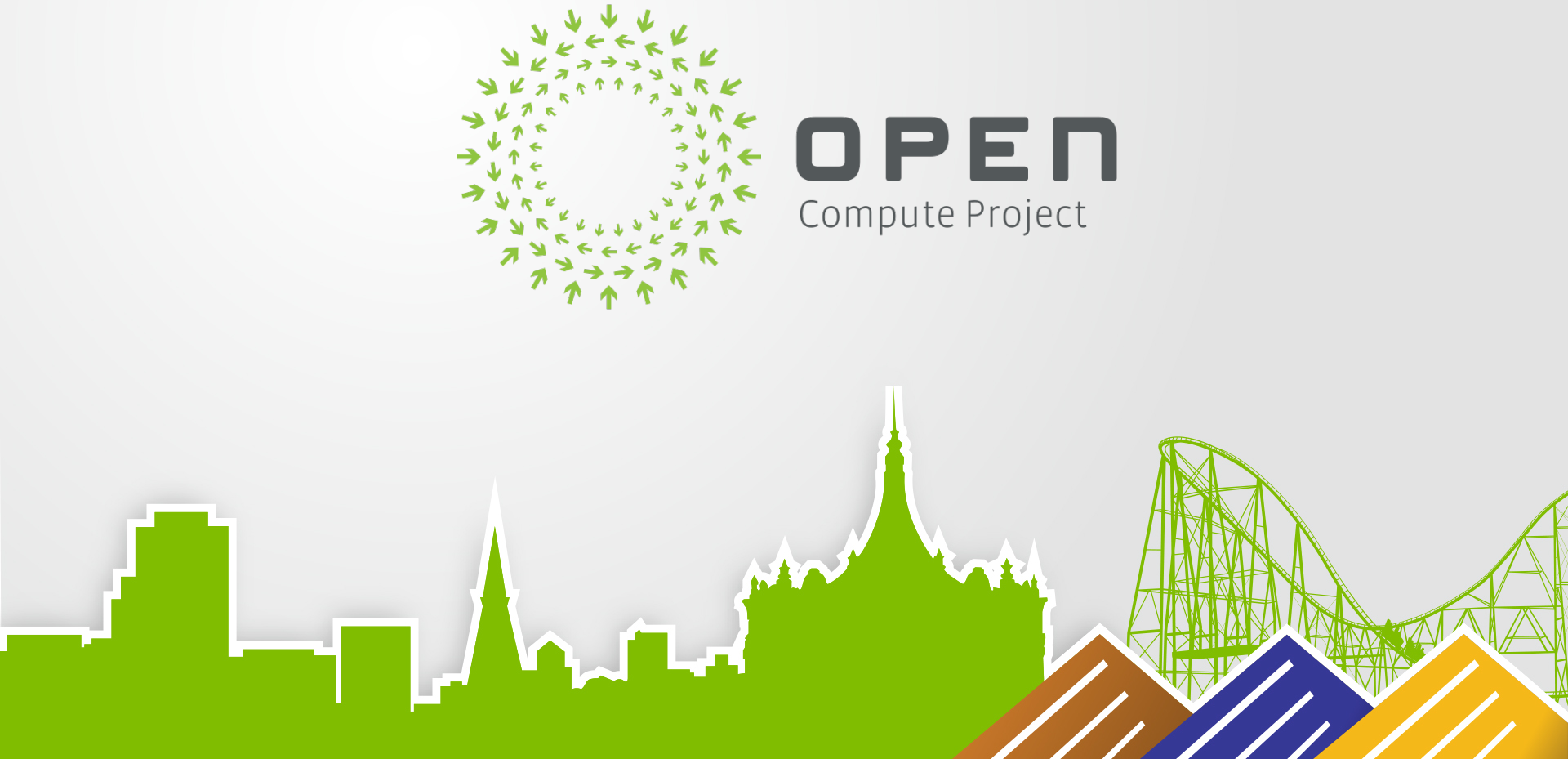
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