



Protecting your technology investment.

Cómo decidir la potencia por rack

... y las características de los gabinetes en proyectos de Centros de Cómputo modernos



CHATSWORTH
PRODUCTS

An Employee-Owned
Company





Protecting your technology investment.

Víctor Daniel Bañuelos Lugo
Technical Manager – Latin America
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CDCDP™ - ATD™

vbanuelos@chatsworth.com

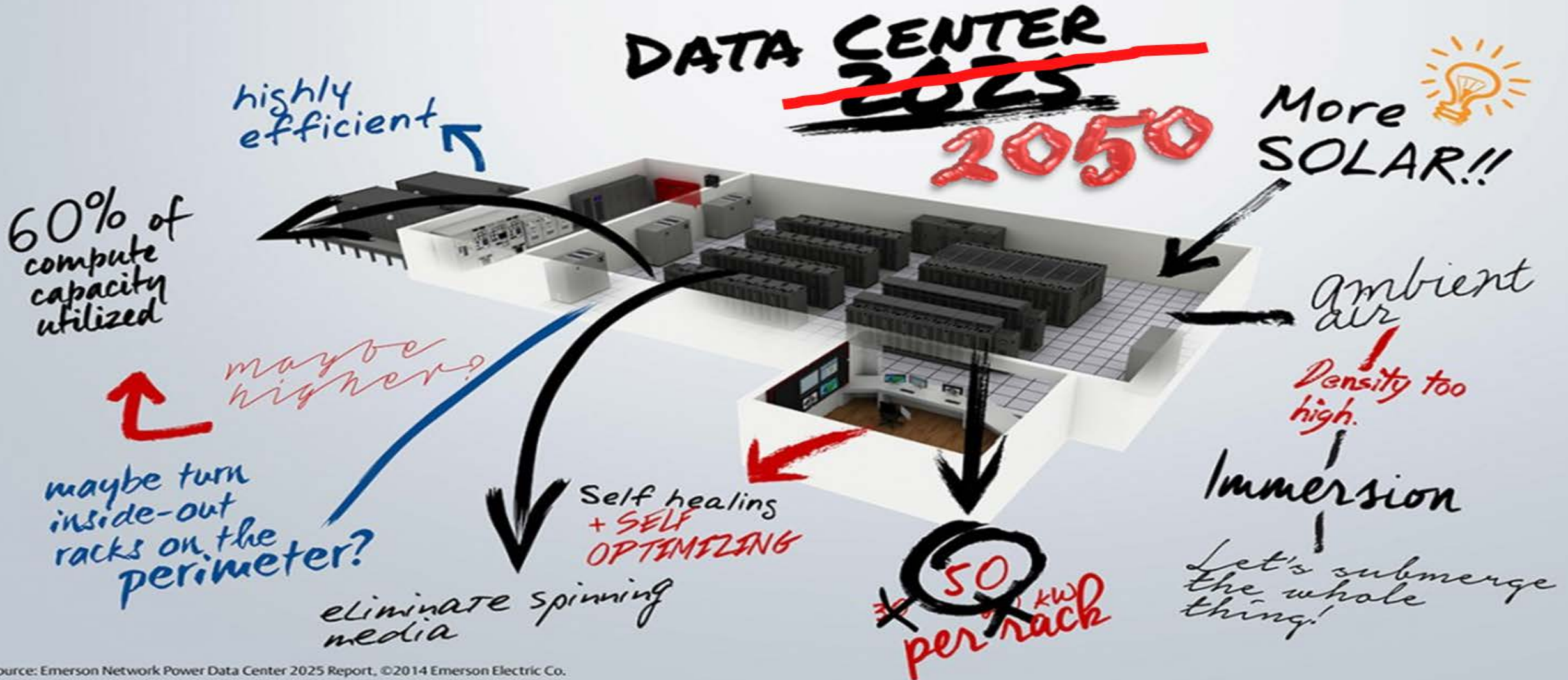
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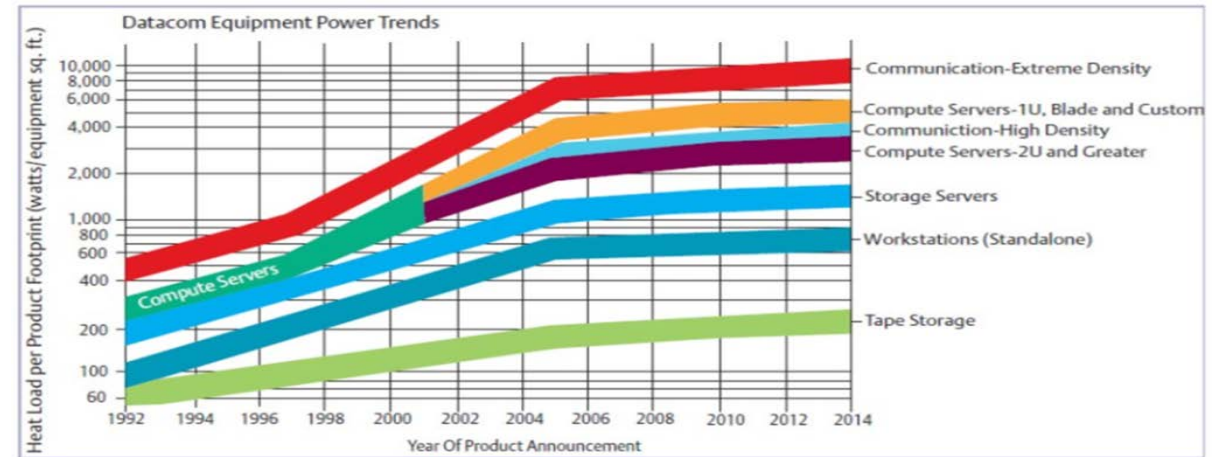


Parámetros Clave

Tiempo



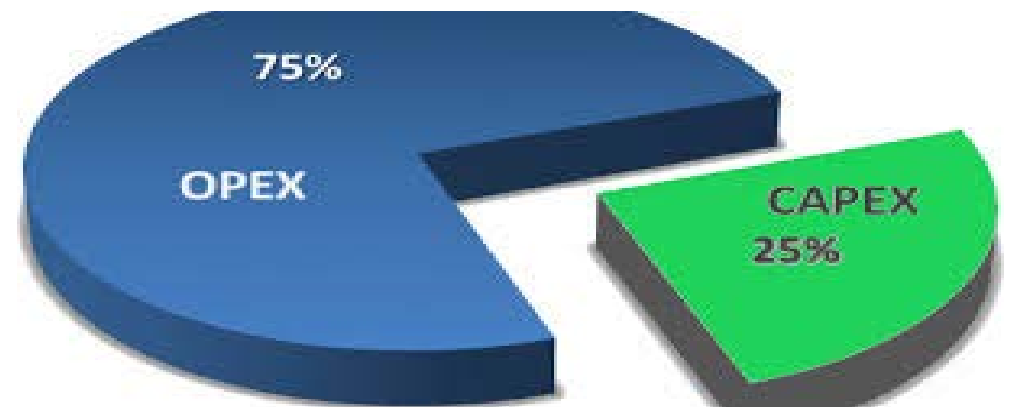
Energía



Eficiencia vs Disponibilidad



Presupuesto





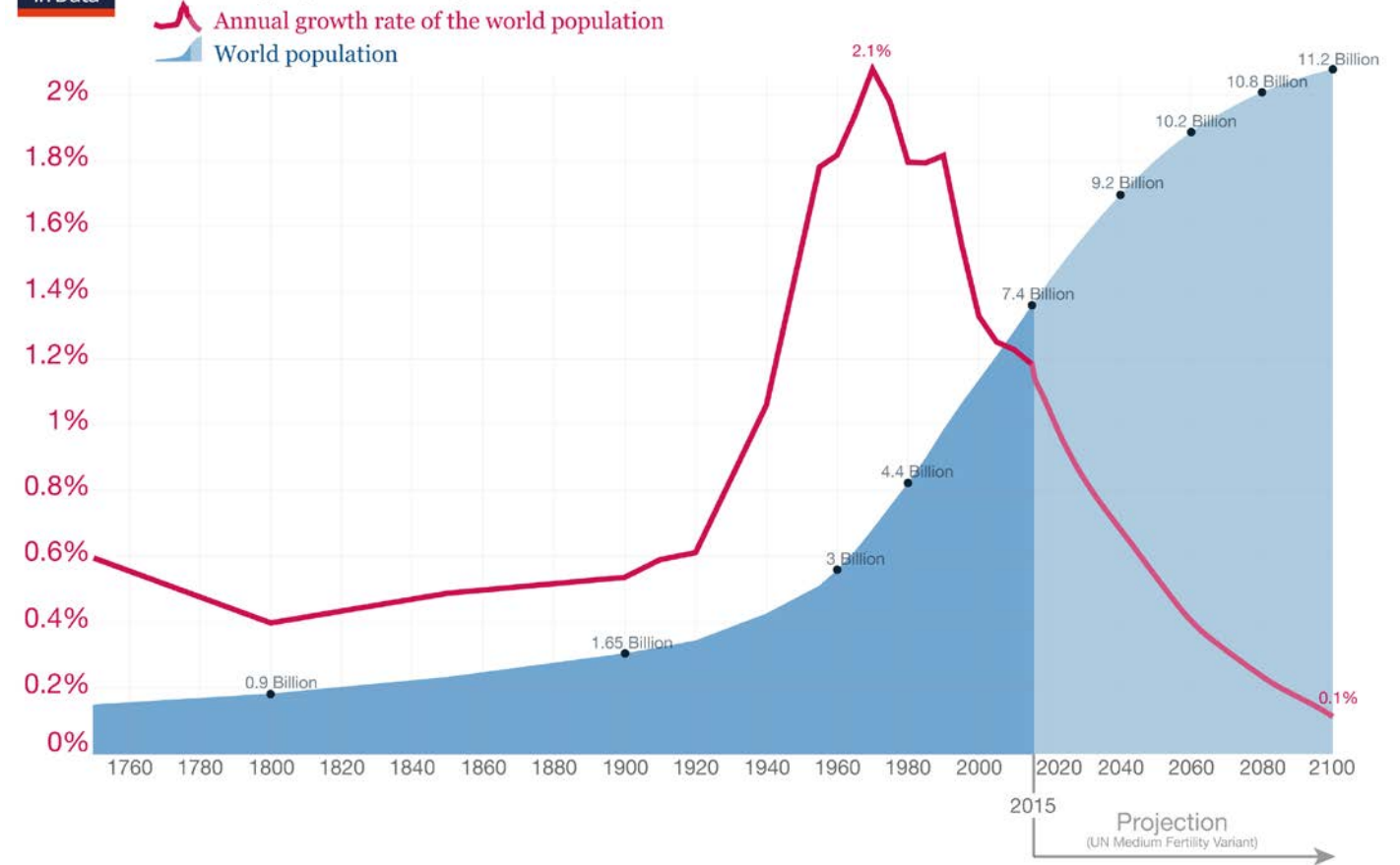
Número de Usuarios

- Clientes Internos
- Clientes Externos
- Sesiones o llamadas simultáneas
- Crecimiento Local, Regional o Global



Our World in Data

World population growth, 1750-2100



Data sources: Up to 2015 OurWorldInData series based on UN and HYDE. Projections for 2015 to 2100: UN Population Division (2015) – Medium Variant. The data visualization is taken from OurWorldInData.org. There you find the raw data and more visualizations on this topic.

Licensed under CC-BY-SA by the author Max Roser.



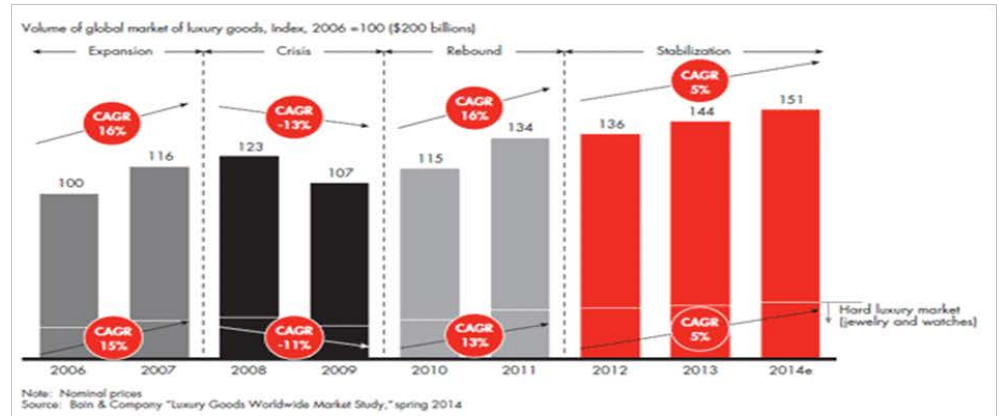
Número de Conexiones



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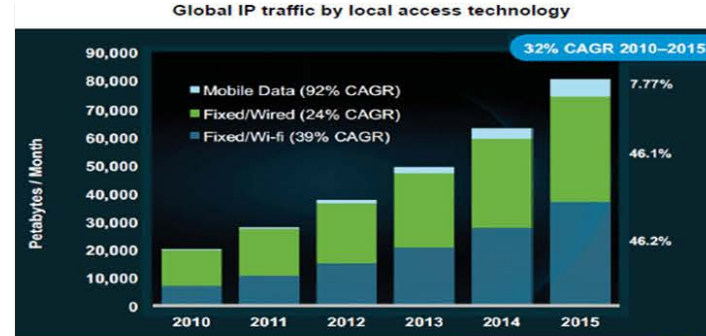
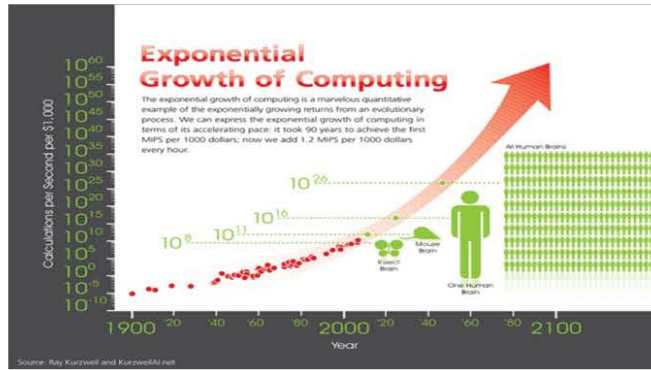
Histórico y Pronóstico



Renovación Tecnológica y Tendencias



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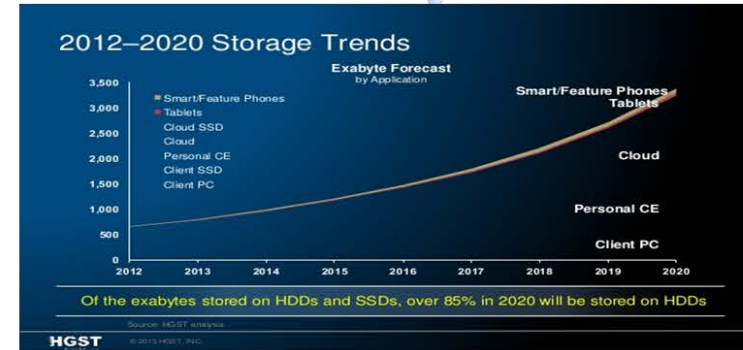
Aplicaciones

Capacidad de Procesamiento

Almacenamiento

Velocidad de Transmisión

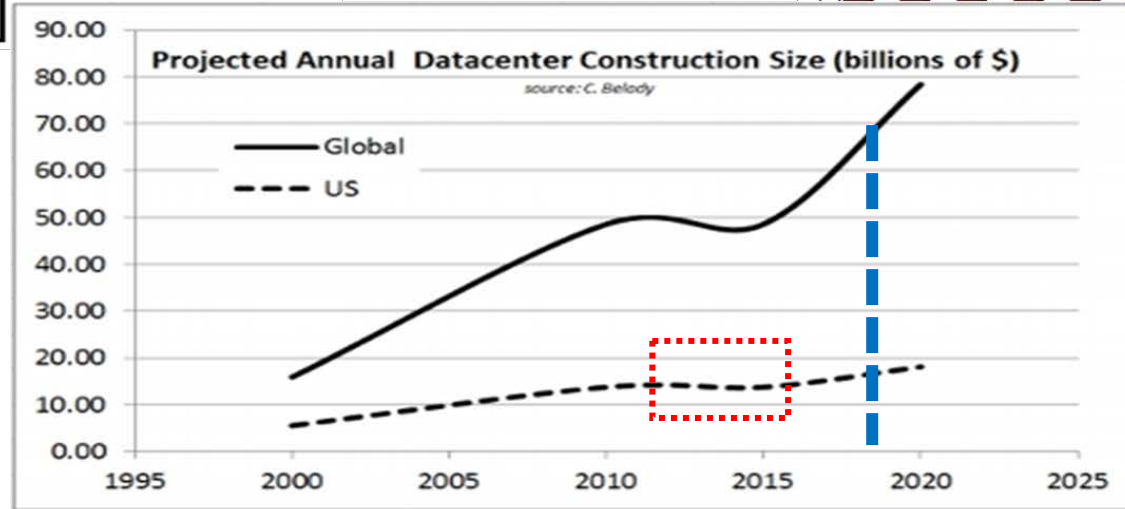
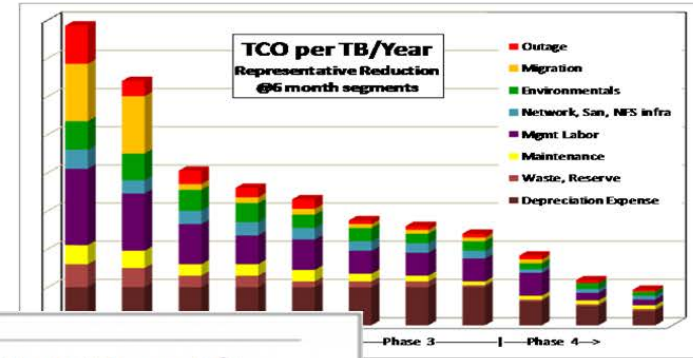
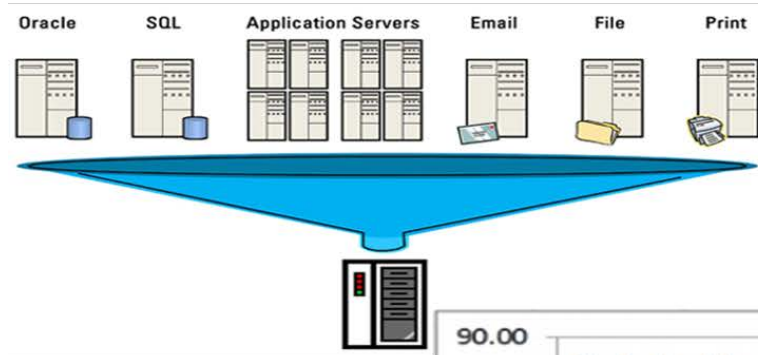
Equipo Activo



Construcción de CPDs & Virtualización



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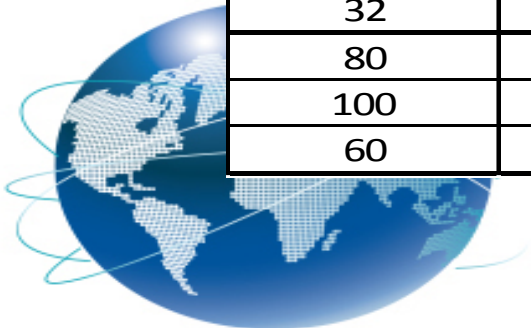


Source: "Projecting annual new datacenter construction market size" by Christian Belady, Microsoft, 2011



Densidad de Potencia

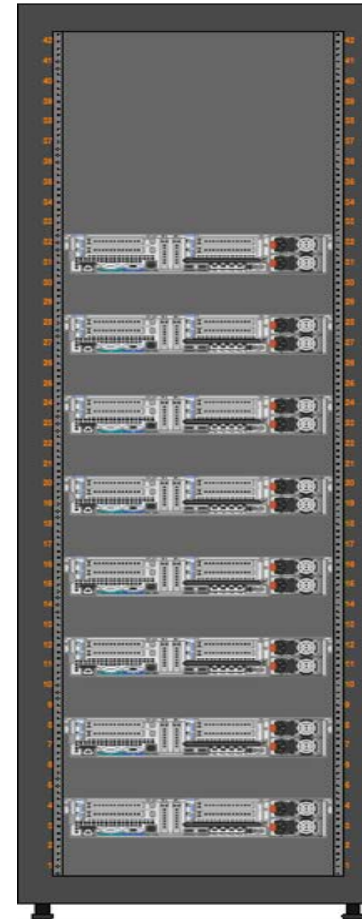
				Servers		
Corriente (A)	Voltage (V)	Fases	Potencia (kW)	(Pizza Box, Rack Mount) @ 360 W	Blades	Densidad
15	120	1	1.44	4		Standard
20	120	1	1.92	5		
30	120	1	2.88	8		
16	230	1	2.94	8		
20	230	1	3.68	10		
30	230	1	5.52	15		
20	208	3	5.76	16		
32	230	1	5.89	16		
30	208	3	8.65	24	1 ⁺	Mid
16	415	3	9.20	26	1 ⁺	
35	208	3	10.09	28	2 ⁺	
50	208	3	14.41		2 - 3	High
60	208	3	17.29		3	
32	415	3	18.40		3 - 4	
80	208	3	23.06		4 - 5	Ultra High
100	208	3	28.82		4 - 5	
60	415	3	34.50		5 - 6	



Lo Mismo de Siempre

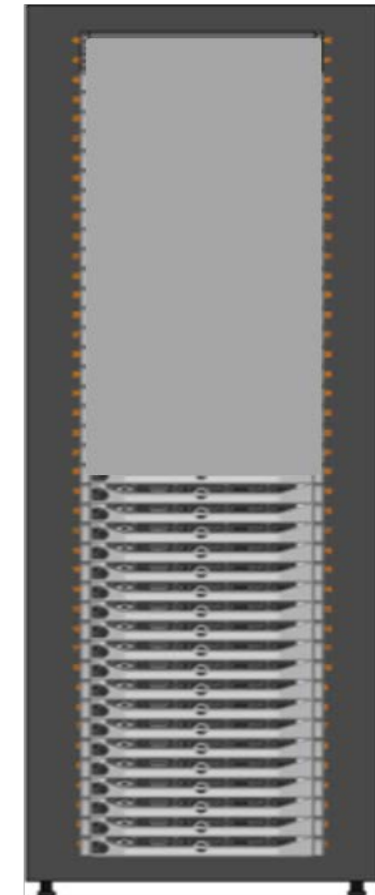
3,3 kW

45U



5 kW

42U



Rank	Average % projected growth in power requirements 2011-2012 across sample (Against % projected facility growth)		Actual projected increase in sample (MW)	Average kW/Rack
1st	Turkey	85% (60%)	110 MW	3.61 kW
2nd	Colombia	50% (40%)	90 MW	3.60 kW
3rd	Brazil	48% (45%)	280 MW	3.05 kW
4th	China	46% (28%)	500 MW	2.75 kW
5th	Argentina	41% (36%)	120 MW	3.14 kW
6th	Nordics	35% (14%)	160 MW	4.74 kW
7th	Middle East	28% (9%)	70 MW	2.88 kW
8th	South East Asia	24% (11%)	180 MW	3.75 kW
9th	Eastern USA	22% (13%)	320 MW	4.35 kW
10th	Russia	22% (29%)	130 MW	4.22 kW
11th	Mexico	18% (17%)	90 MW	3.13 kW
12th	India	16% (12%)	70 MW	3.50 kW
13th	Italy	14% (13%)	140 MW	2.93 kW
14th	Central USA	13% (12%)	400 MW	4.43 kW
15th	Benelux	12% (14%)	100 MW	3.86 kW
16th	Germany	12% (16%)	500 MW	4.38 kW
17th	Australia	11% (11%)	130 MW	4.60 kW
18th	France	10% (7%)	300 MW	3.58 kW
19th	Canada	9% (10%)	120 MW	4.33 kW
20th	Spain	8% (6%)	200 MW	3.77 kW
21th	United Kingdom	7% (5%)	280 MW	4.22 kW
22nd	Western USA	2% (3%)	100 MW	5.32 kW

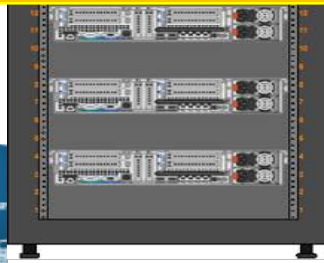
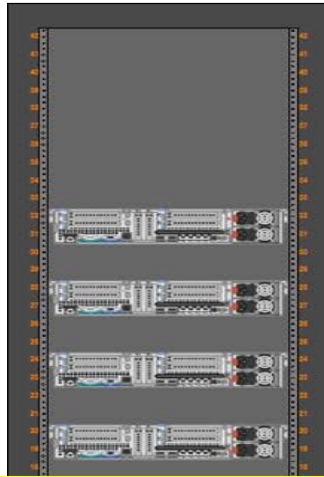
Table 1. World power consumption growth ranking

Consolidación & Optimización

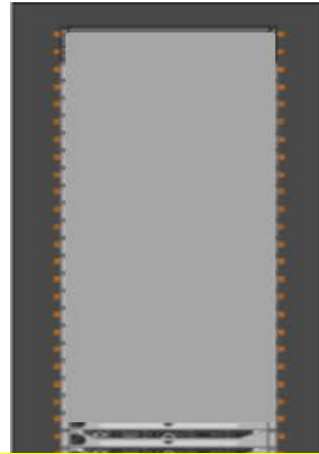


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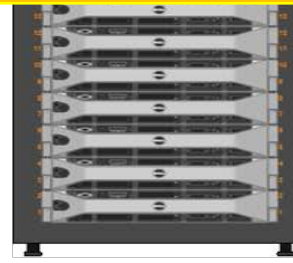
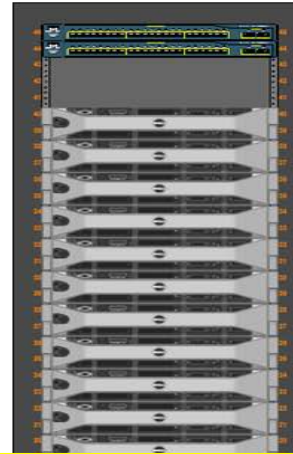
3,3 kW



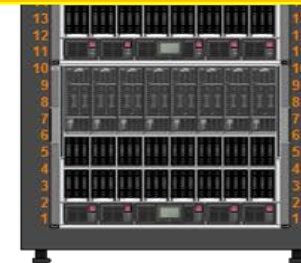
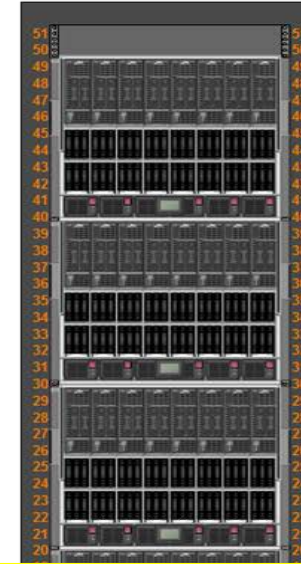
5 kW



8,3 kW



23,75 kW



Conectores Estándar vs. Potencia

Switched eConnect PDUs						
Part Number		Input			Output	
Locking Outlet	Standard Outlet	Amp	kW*	Plug	Breakers (Hydraulic Magnetic)	Outlets
100-240 Volt, Single-Phase Input - Worldwide						
L5-1A1A1	P5-1A1A1	16/20 ¹	3.6****	C20 Inlet**	1 x 2P 20A	(24) C13
L5-1A1C3	P5-1A1C3	16/20 ¹	3.6****	C20 Inlet**	1 x 2P 20A	(18) C13, (6) C19
120 Volt, Single-Phase Input - North America Models						
N/A	P5-1A1A5	20	1.9*	C20 Inlet**	1 x 2P 20A	(24) 5-20R
N/A	P5-1C0A5	20	1.9*	L5-20P	1 x 2P 20A	(24) 5-20R
N/A	P5-1D0A5	30	2.8*	L5-30P	1 x 2P 20A	(24) 5-20R
208 Volt, Single-Phase Input - North America Models						
L5-1E0A1	P5-1E0A1	20	3.3*	L6-20P	1 x 2P 20A	(24) C13
L5-1E0C3	P5-1E0C3	20	3.3*	L6-20P	1 x 2P 20A	(18) C13, (6) C19
L5-1F0A1	P5-1F0A1	30	4.9*	L6-30P	2 x 2P 20A	(24) C13
L5-1F0C3	P5-1F0C3	30	4.9*	L6-30P	2 x 2P 20A	(18) C13, (6) C19



Switched eConnect PDUs

Part Number		Input			Output	
Locking Outlet	Standard Outlet	Amp	kW*	Plug	Breakers (Hydraulic Magnetic)	Outlets
120/208 Volt, Three-Phase Input - North America Models						
L5-1N0A1	P5-1N0A1	20	5.7*	L21-20P	3 x 2P 20A	(24) C13
N/A	P5-1N0A5	20	5.7*	L21-20P	3 x 2P 20A	(24) 5-20R
L5-1N0C3	P5-1N0C3	20	5.7*	L21-20P	3 x 2P 20A	(18) C13, (6) C19
L5-1P0A1	P5-1P0A1	30	8.6*	L21-30P	3 x 2P 20A	(24) C13
N/A	P5-1P0A5	30	5.7*	L21-30P	3 x 2P 20A	(24) 5-20R
L5-1P0C3	P5-1P0C3	30	8.6*	L21-30P	3 x 2P 20A	(18) C13, (6) C19
208 Volt, Three-Phase Input- North America Models						
N/A	P5-1L0A1	20	5.7*	L15-20P	3 x 2P 20A	(24) C13
N/A	P5-1L0C3	20	5.7*	L15-20P	3 x 2P 20A	(18) C13, (6) C19
L5-1M0A1	P5-1M0A1	30	8.6*	L15-30P	3 x 2P 20A	(24) C13
L5-1M0C3	P5-1M0C3	30	8.6*	L15-30P	3 x 2P 20A	(18) C13, (6) C19
L5-1T0A1	P5-1T0A1	50	9.9*	CS8365C	3 x 2P 20A	(24) C13
L5-1T0C3	P5-1T0C3	50	9.9*	CS8365C	3 x 2P 20A	(18) C13, (6) C19
L5-3U0M3	P5-3U0M3	50	14.3*	CS8365C	6 x 2P 20A	(12) C13, (12) C19
L5-3V0M3	P5-3V0M3	60	17.2*	IEC 60A 3P+E	6 x 2P 20A	(12) C13, (12) C19
240/415 Volt, Three-Phase Input - North America Models						
N/A	P5-1Q0A1	20	11.4*	L22-20P	3 x 2P 20A	(24) C13
N/A	P5-1Q0C3	20	11.4*	L22-20P	3 x 2P 20A	(18) C13, (6) C19
L5-2R0M3	P5-2R0M3	30	17.2*	L22-30P	6 x 1P 20A	(12) C13, (12) C19



Conectores Estándar vs. Potencia

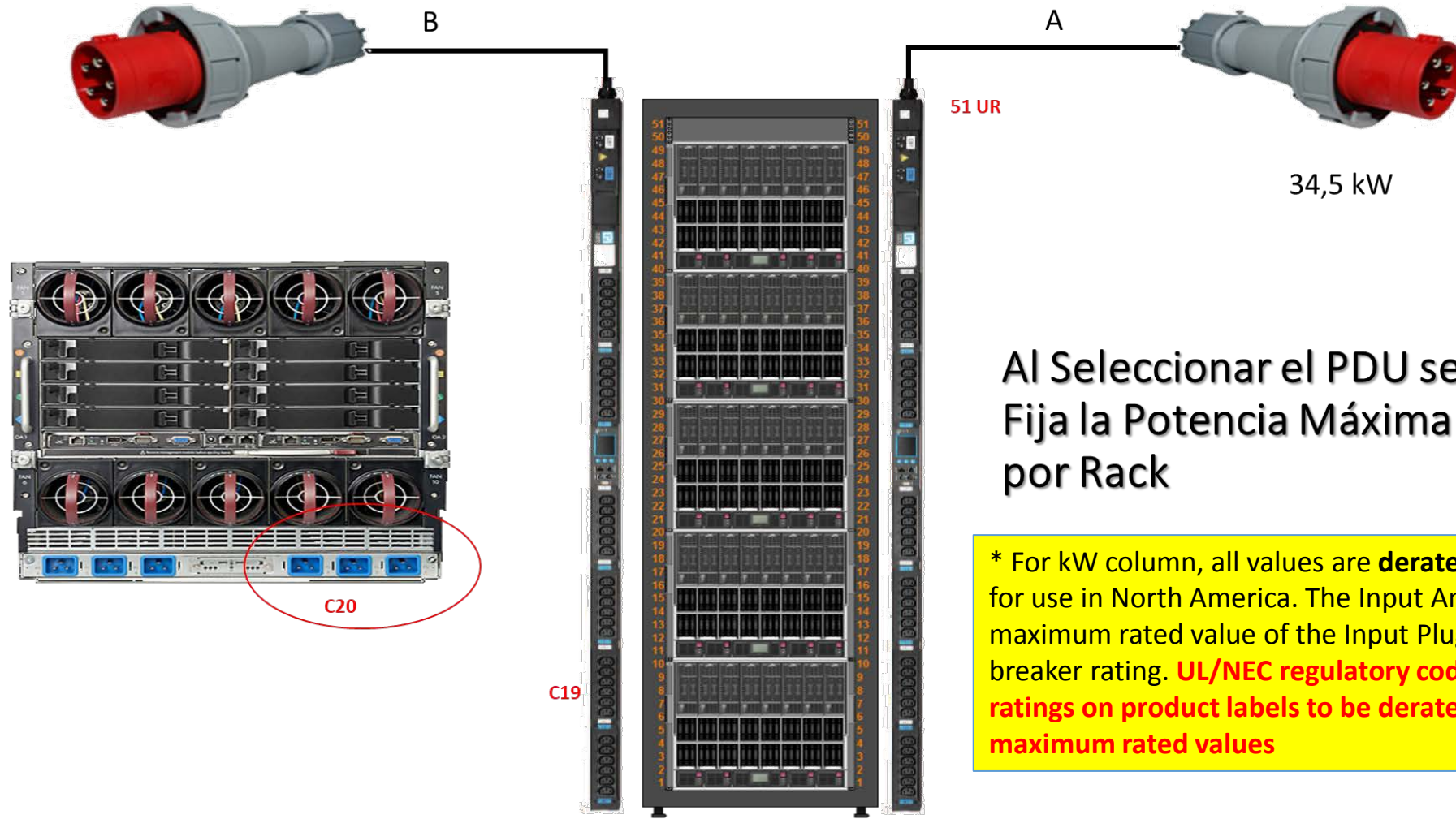
Switched eConnect PDUs - Outside North America

Part Number		Input			Output	
Locking Outlet	Standard Outlet	Amp	kW*	Plug	Breakers (Hydraulic Magnetic)	Outlets
220-240 Volt, Single-Phase Input						
L5-1G0A1	P5-1G0A1	16	3.6¥	IEC 16A 2P+E	1 x 2P 16A	(24) C13
L5-1G0C3	P5-1G0C3	16	3.6¥	IEC 16A 2P+E	1 x 2P 16A	(18) C13, (6) C19
L5-1H0A1	P5-1H0A1	32	7.3¥	IEC 32A 2P+E	2 x 2P 16A	(24) C13
L5-1H0C3	P5-1H0C3	32	7.3¥	IEC 32A 2P+E	2 x 2P 16A	(18) C13, (6) C19
220-240/380-415 Volt, Three-Phase Input						
L5-1W0A1	P5-1W0A1	16	11≠	IEC 16A 4P+E	3 x 2P 20A	(36) C13
L5-1W0C3	P5-1W0C3	16	11≠	IEC 16A 4P+E	3 x 2P 16A	(30) C13, (6) C19
L5-2Y0M3	P5-2Y0M3	32	22.1≠	IEC 32A 4P+E	6 x 1P 16A	(12) C13, (12) C19





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Al Seleccionar el PDU se Fija la Potencia Máxima por Rack

* For kW column, all values are **derated** calculations per UL for use in North America. The Input Amp column lists the maximum rated value of the Input Plug/inlet and circuit breaker rating. **UL/NEC regulatory code requires current ratings on product labels to be derated to 80% of the maximum rated values**



Recuerda las Opciones

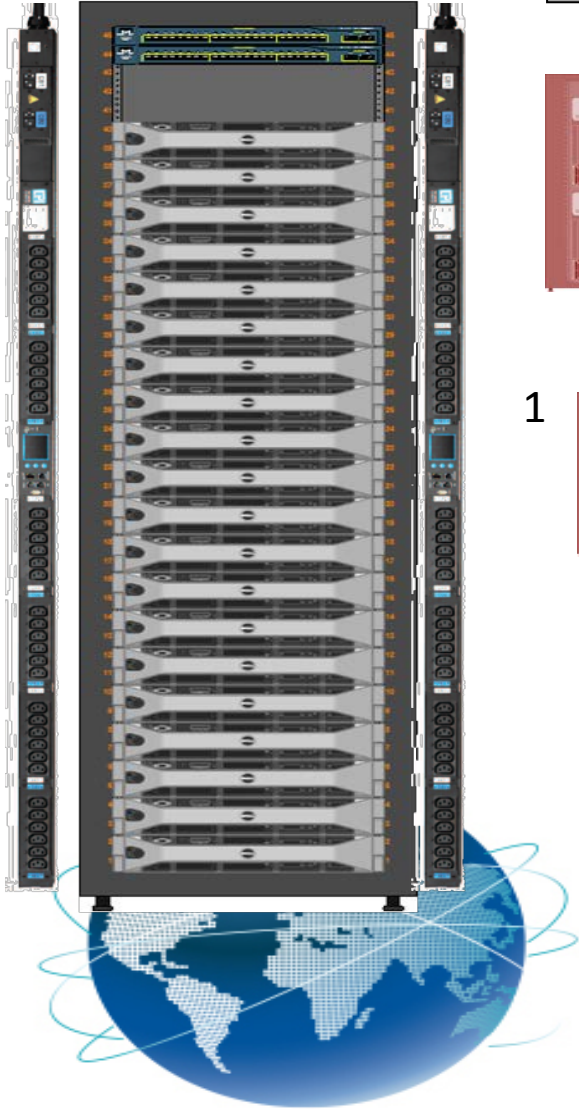
Clavija	Fases	Voltaje (V)	Corriente (A)	Potencia (kW)
L5-20P	1	120	20	1,9
L5-30P	1	120	30	2,8
L6-20P	1	208	20	3,3
IEC 16 A 2P+E	1	230	16	3,6
L6-30P	1	208	30	4,9
L15-20P	3	208	20	5,7
L21-20P	3	120/208	20	5,7
IEC 32 A 2P+E	1	230	32	7,3
L15-30P	3	208	30	8,6
L21-30P	3	120/208	30	8,6
CS8365C	3	208	50	14,3
IEC 60 A 3P+E	3	208	60	17,2
IEC 32 A 4P+E	3	240/415	32	22,1
L22-20P	3	240/415	20	11,4
L22-30P	3	240/415	30	17,2
IEC 60A 3P+E	3	415	60	34,5





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C15



Minimum Rating
320 ekW (365 kVA)

Maximum Rating
500 ekW (550 kVA)



C15

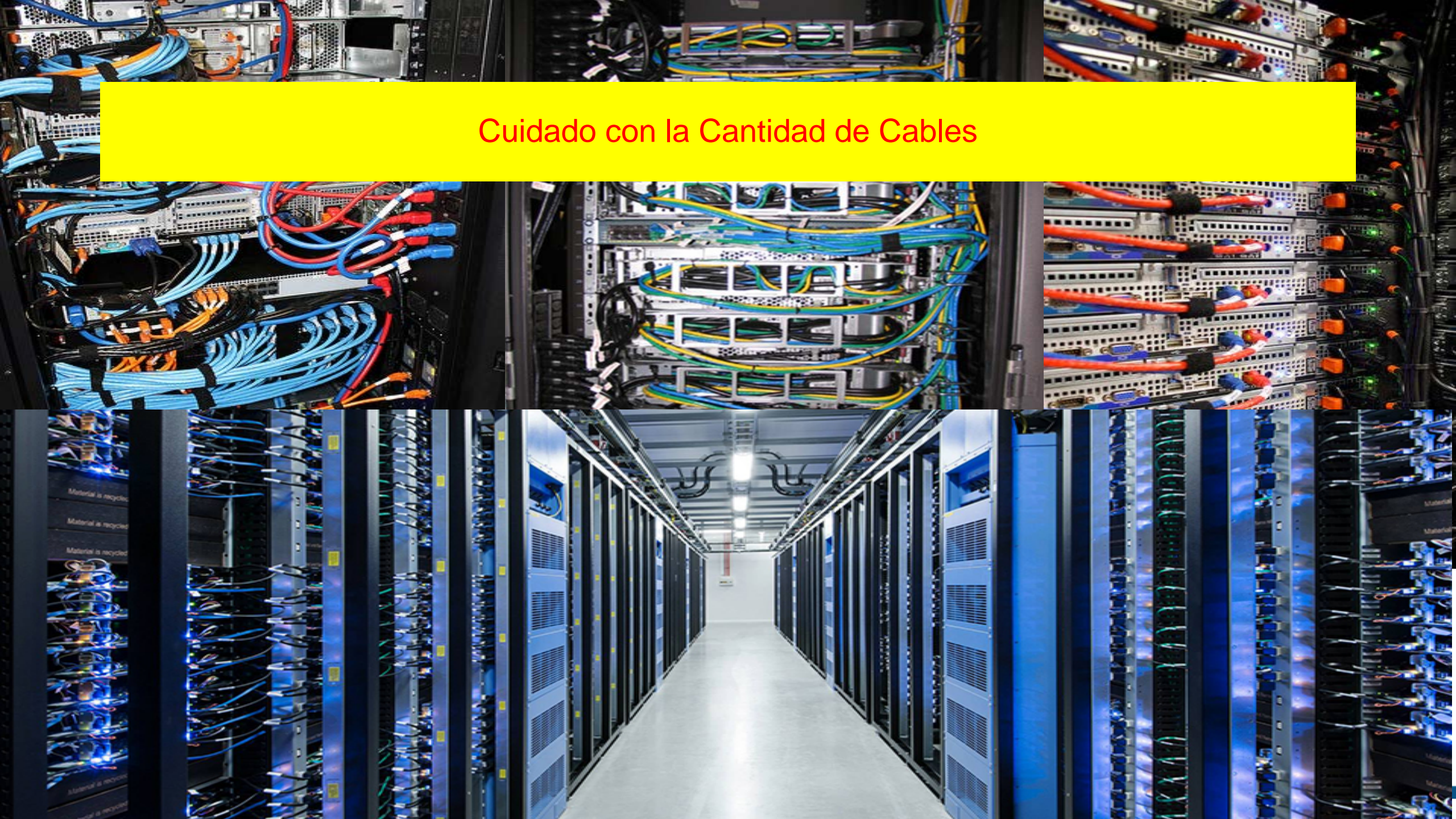


Minimum Rating
320 ekW (365 kVA)

Maximum Rating
500 ekW (550 kVA)



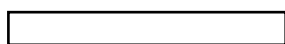
Bicsi

Cuidado con la Cantidad de Cables

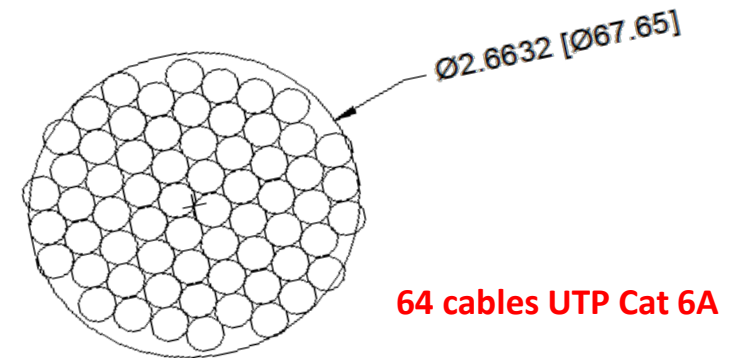


Espacio para los Cables

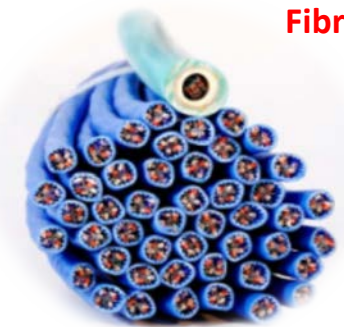
Rack Mount Servers	Cantidad de Cables por Server							
	2	3	4	5	6	7	8	
3	6	9	12	15	18	21	24	
6	12	18	24	30	36	42	48	
9	18	27	36	45	54	63	72	
12	24	36	48	60	72	84	96	
15	30	45	60	75	90	105	120	
18	36	54	72	90	108	126	144	
21	42	63	84	105	126	147	168	
24	48	72	96	120	144	168	192	
27	54	81	108	135	162	189	216	
30	60	90	120	150	180	210	240	
33	66	99	132	165	198	231	264	
36	72	108	144	180	216	252	288	
39	78	117	156	195	234	273	312	
42	84	126	168	210	252	294	336	

-  Ordenador de cables vertical para gabinete de 600 mm
-  Ordenador de cables vertical para gabinete de 700 mm
-  Ordenador de cables vertical para gabinete de 800 mm

Ver TIA-569-C - 6.3.9.11 Cable management



64 cables UTP Cat 6A



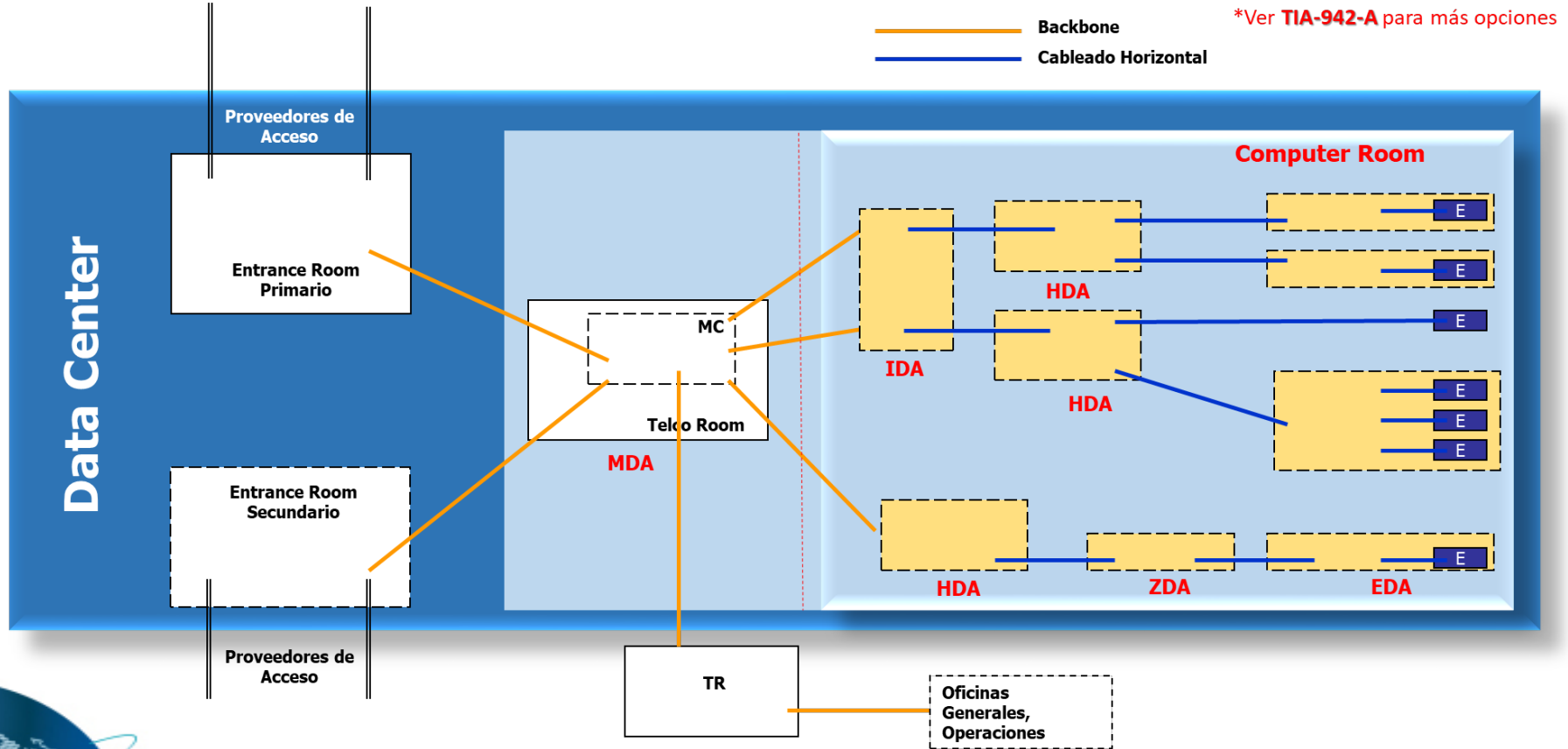
Fibra OM4

48 cables UTP Cat 6A

Cableado Estructurado



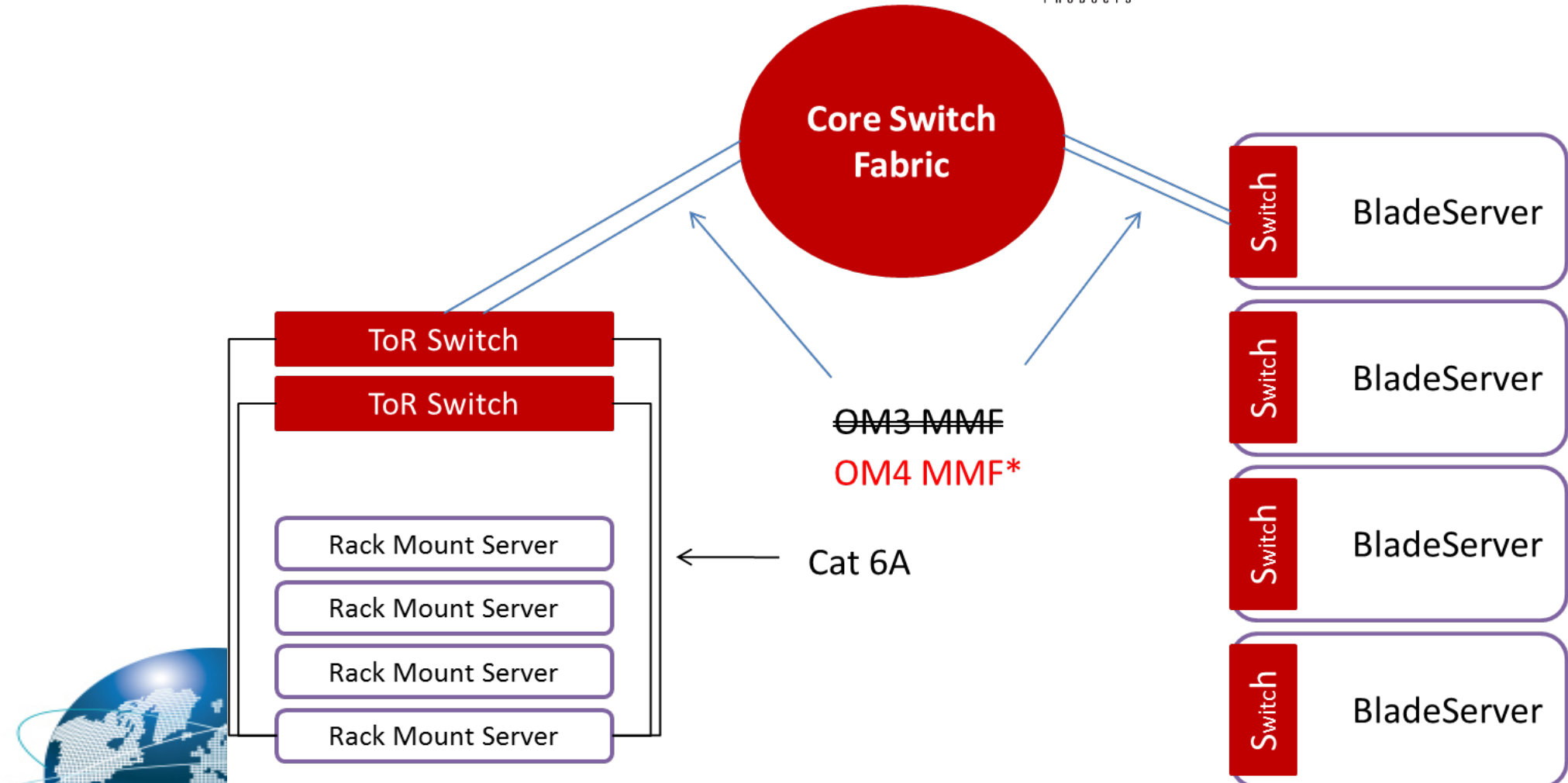
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Tendencia en Cableado



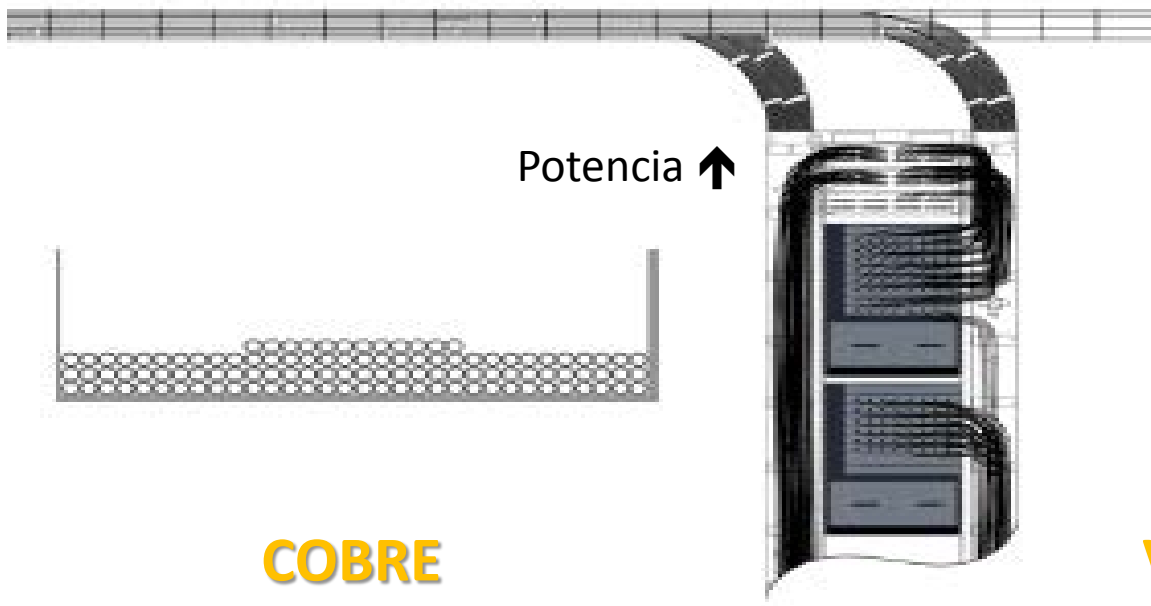
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Gartner Research: 29 July 2010 ID Number: G00205239

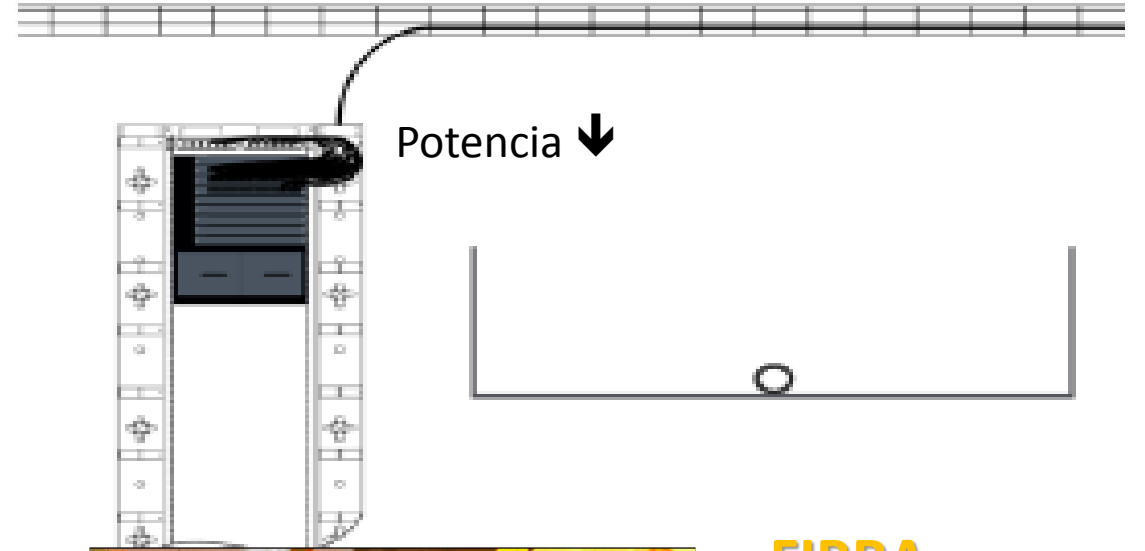
* 2011





COBRE

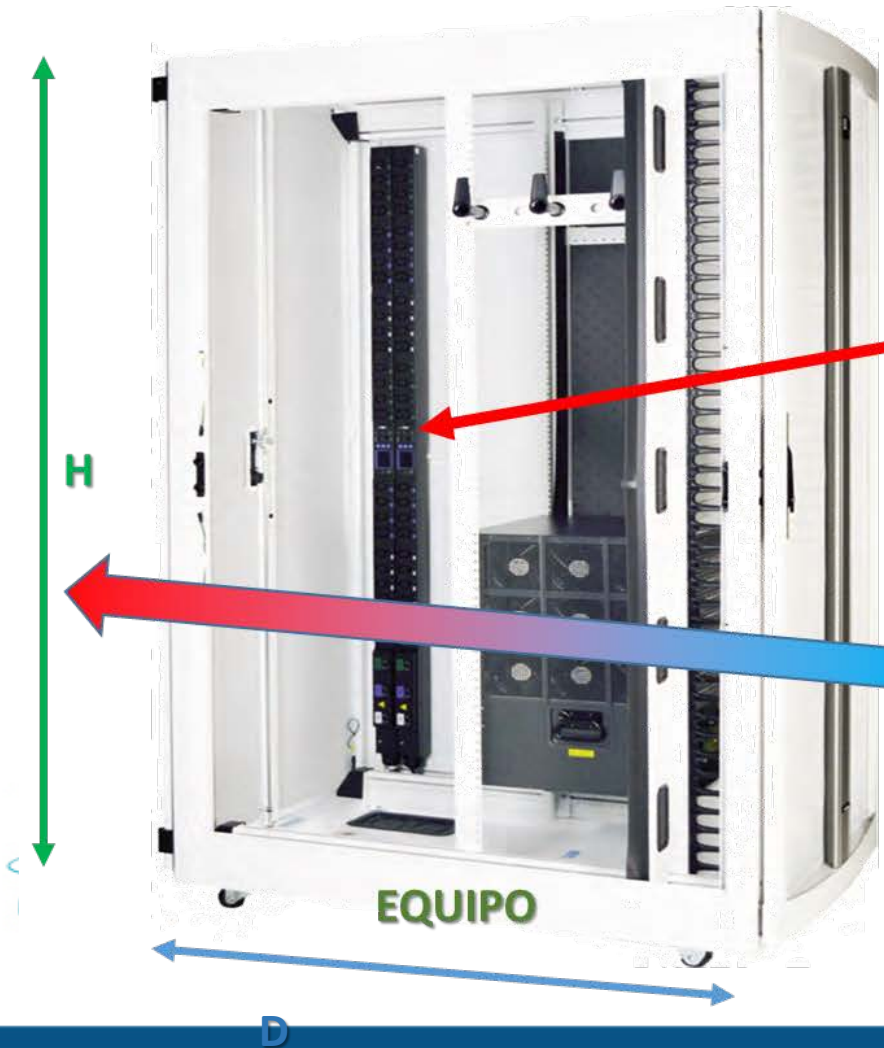
VS



FIBRA



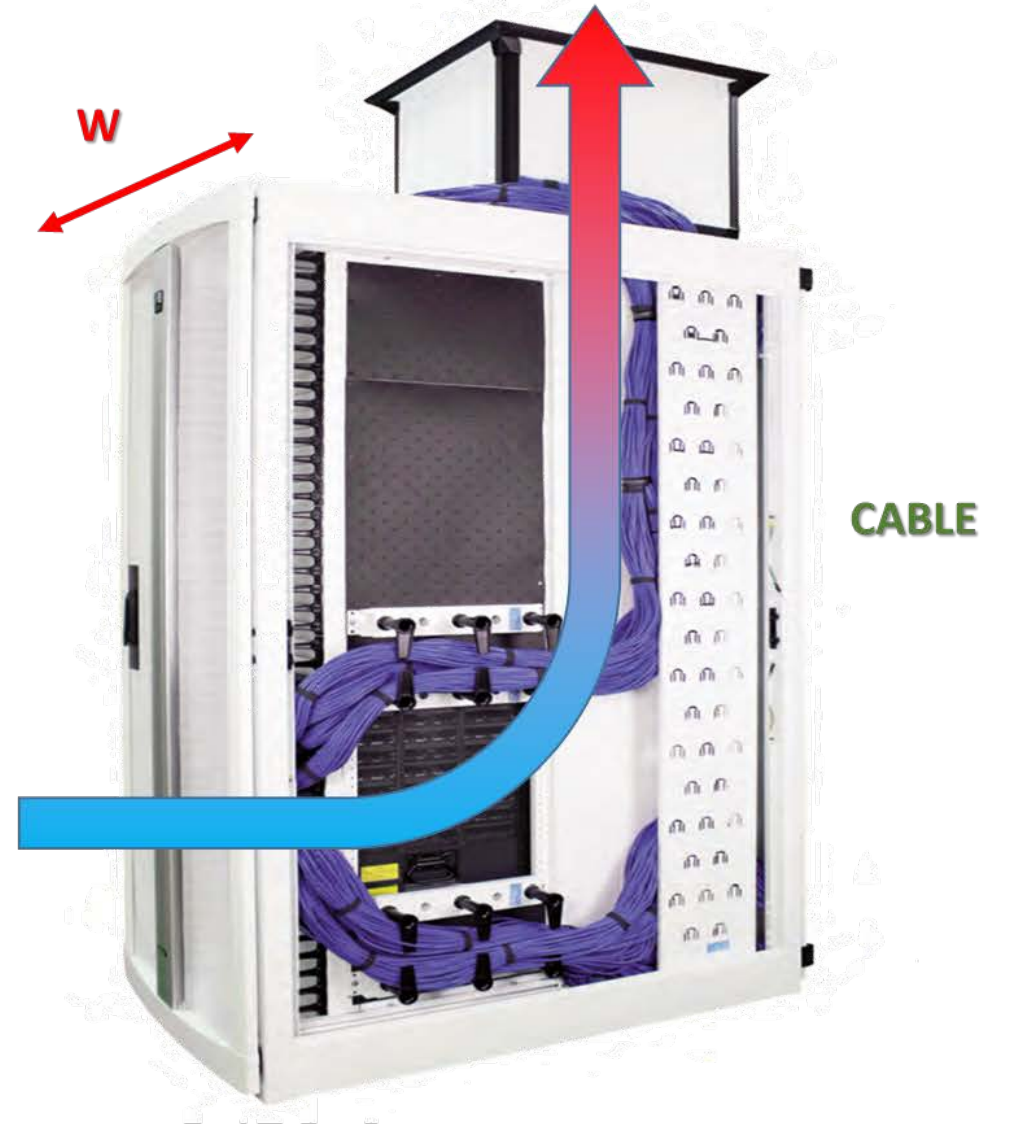
Dimensiones de los Gabinetes



PDU's

FLUJO DE AIRE

$$CFM = \frac{1,8 Q \text{ (watts)}}{\Delta T_c}$$



Impacto en la Arquitectura



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ZDA

700mm

800mm



End of Row

ZDA

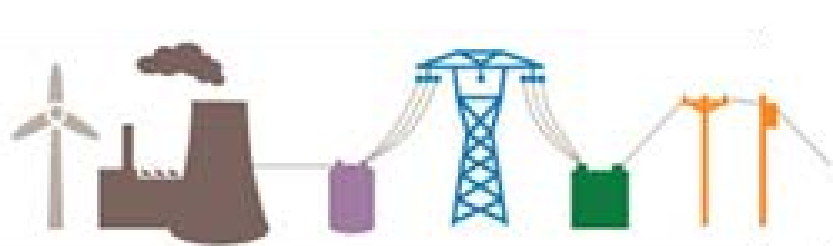
7200 mm



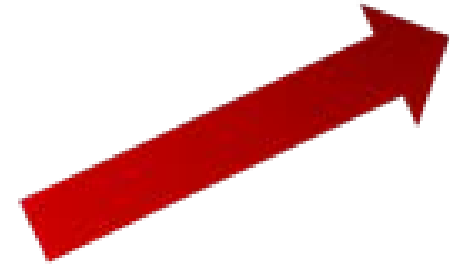
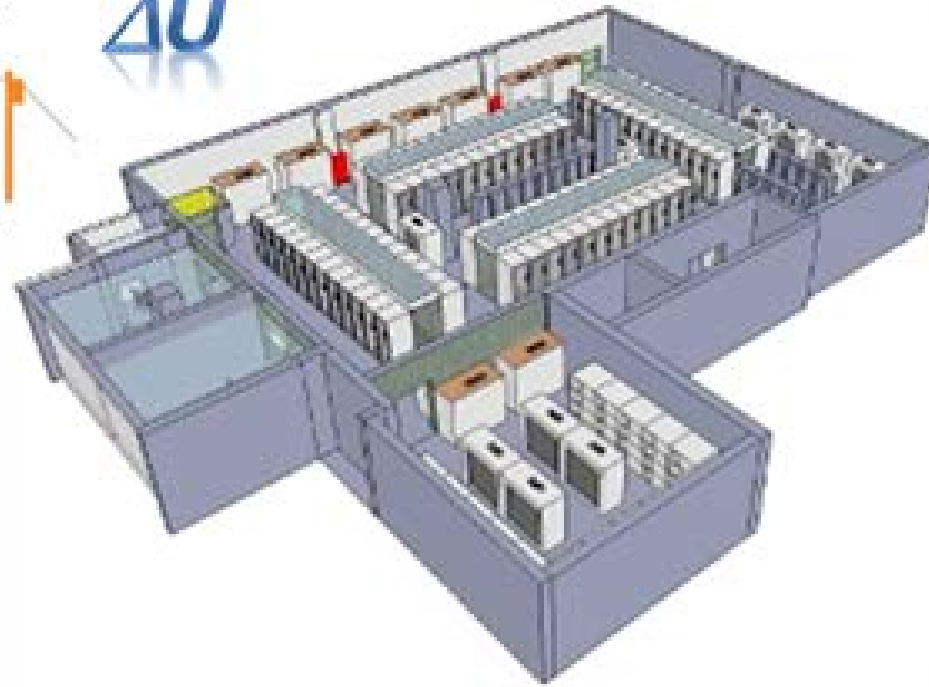
CALOR (Impacto en el AA)



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ΔU



Q



W



Potencia versus AA



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Impacto en los Sistemas de Enfriamiento

Object Count

Summary Counts	
Object	Count
No-Flow Regions	5
Downflow CRACs	8
Perforated Tiles	137
UF Obstructions	32
Server Racks	62
AF Solid Blocks	2

Counts by Style

- Downflow CRACs
- Upflow CRACs
- Perforated Tiles
- Server Racks
- In-Row Coolers

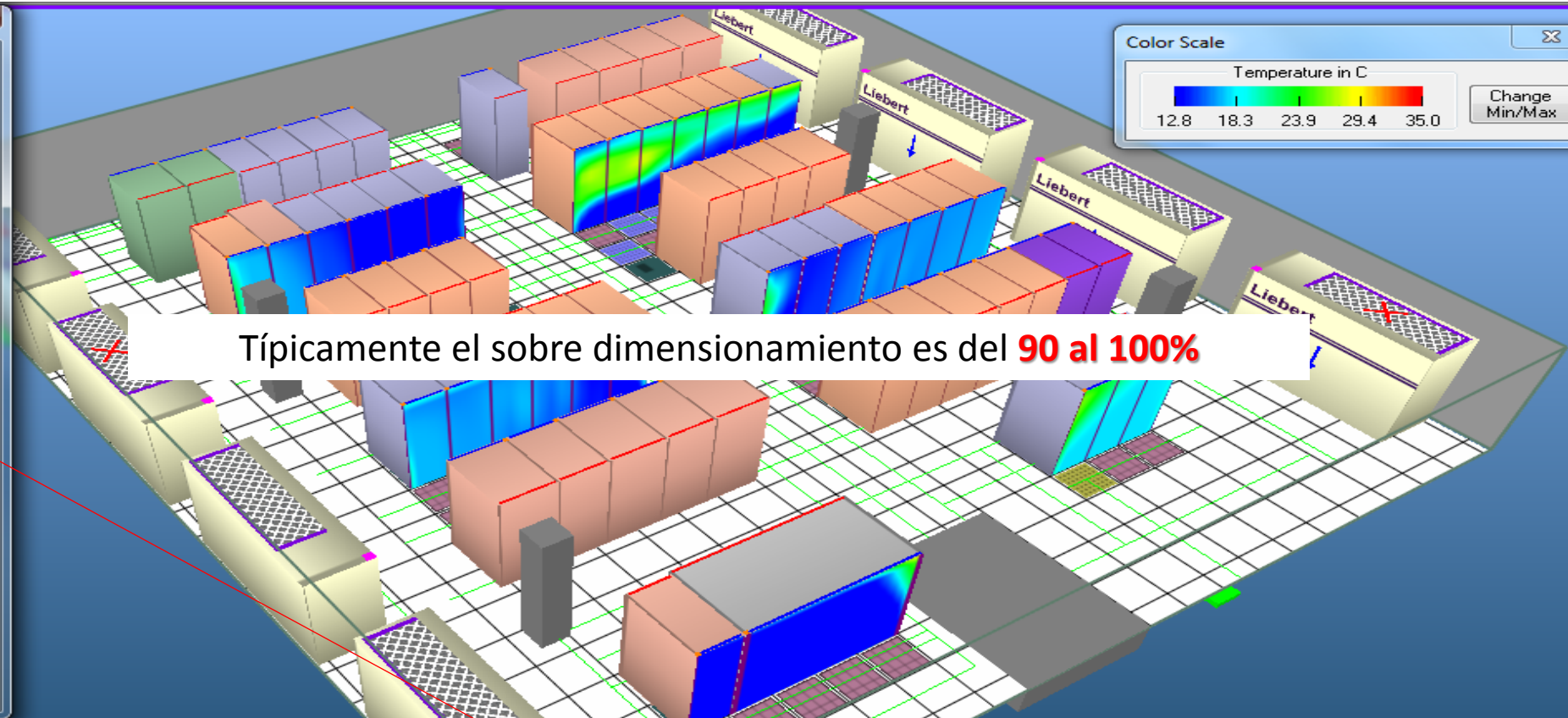
Heat Load Density
 Net Floor Area: 202 sq m
 Heat Load Density: 960 W/sq m

Total Heat Load and Airflow Rates
 Total Heat Load: 194 kW
 Total Airflow Demand: 49,682 CMH
 Total Airflow Supplied: 81,553 CMH

Amount of Cooling Airflow From Different Sources

Source	Value
Downflow CRACs	81,553 CMH
Special CRACs	0.0 CMH
Upflow CRACs	0.0 CMH
In-Row Coolers	0.0 CMH
XDOs and XDVs	0.0 CMH

Close



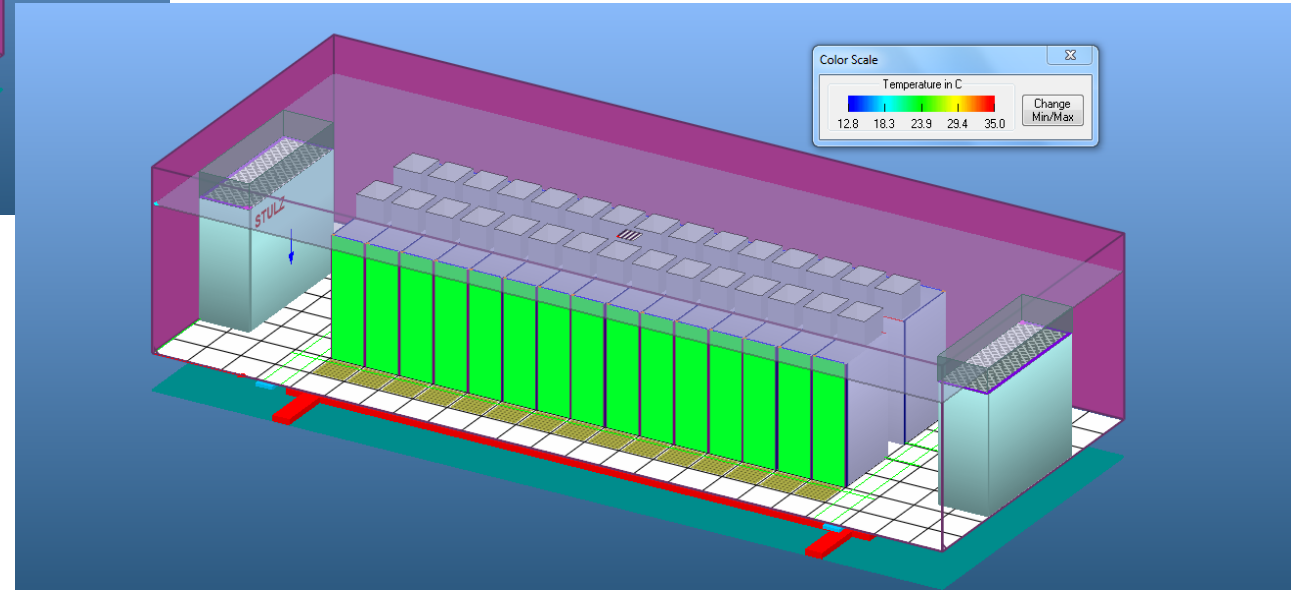
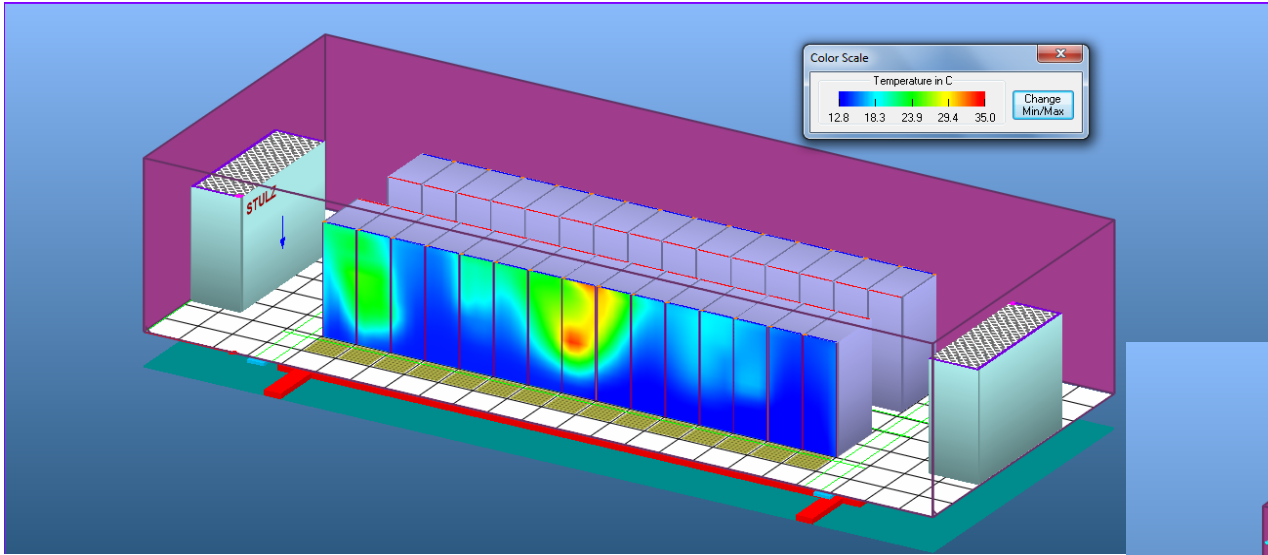
◀ 64% sobredimensionamiento del Flujo de Aire

→ 3,13 kW/rack

Calor vs. Tecnología y Diseño del Rack



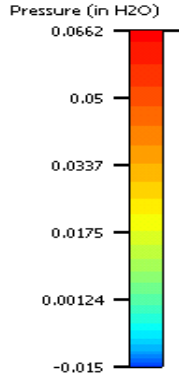
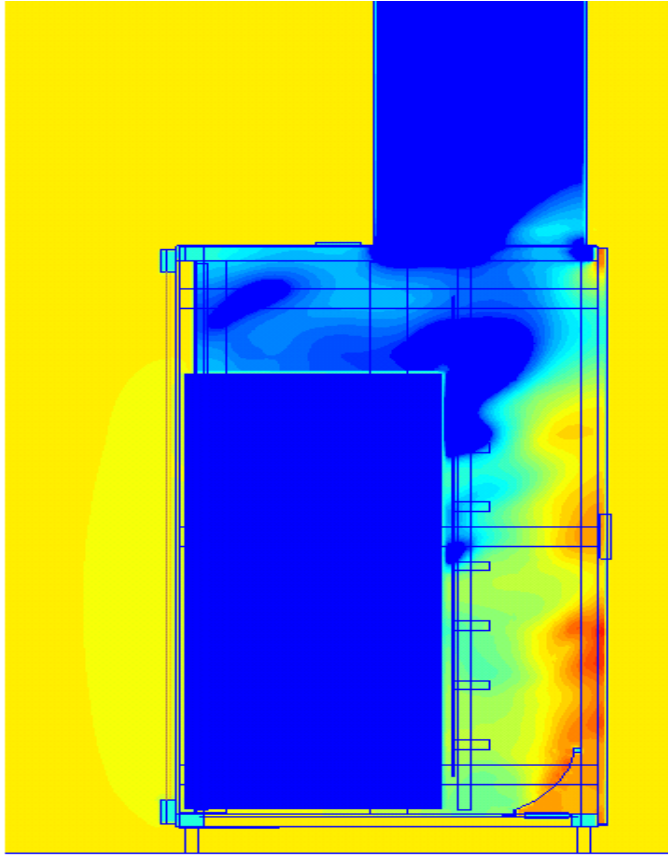
Protecting your technology investment.



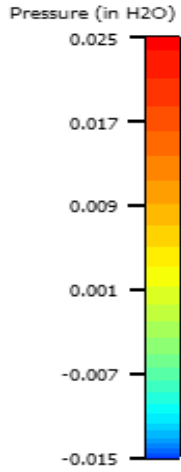
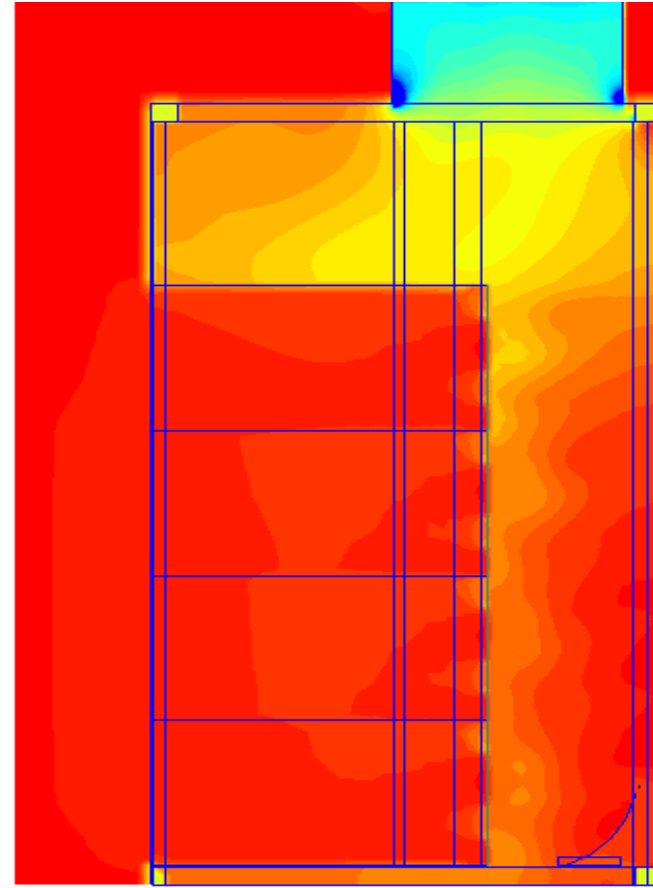
La Clave es la Presión



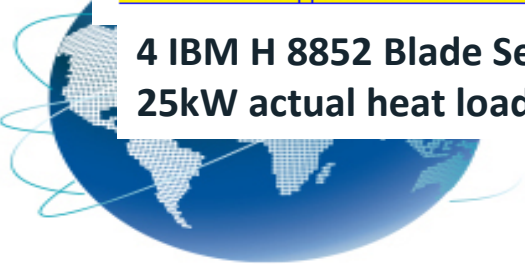
Protecting your technology investment.



4 IBM H 8852 Blade Servers
25kW actual heat load

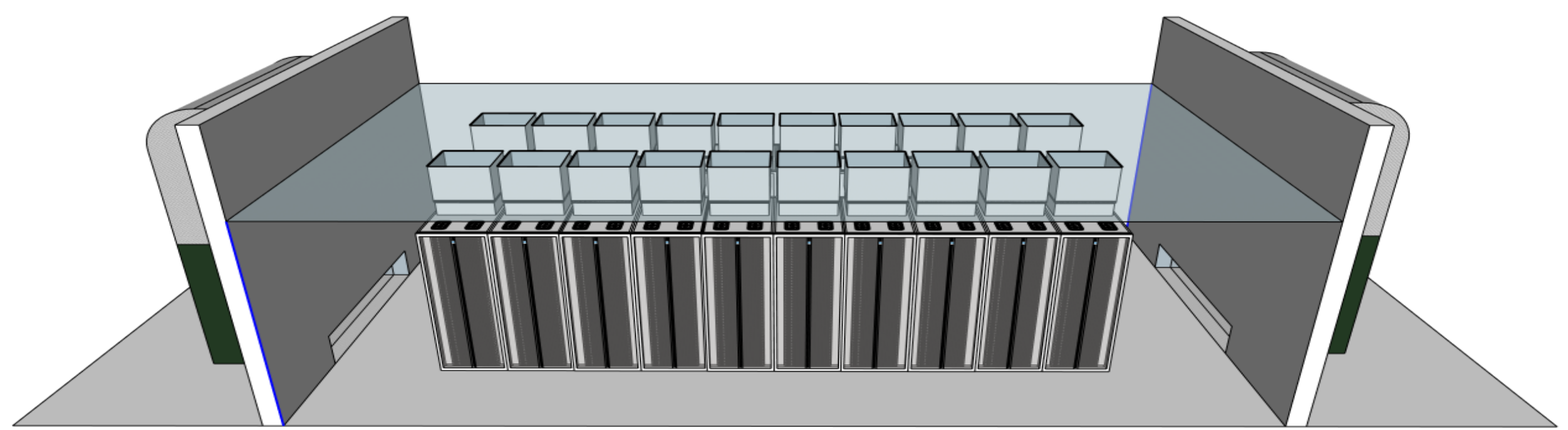


4 HP c7000 Blade Servers
22kW actual heat load

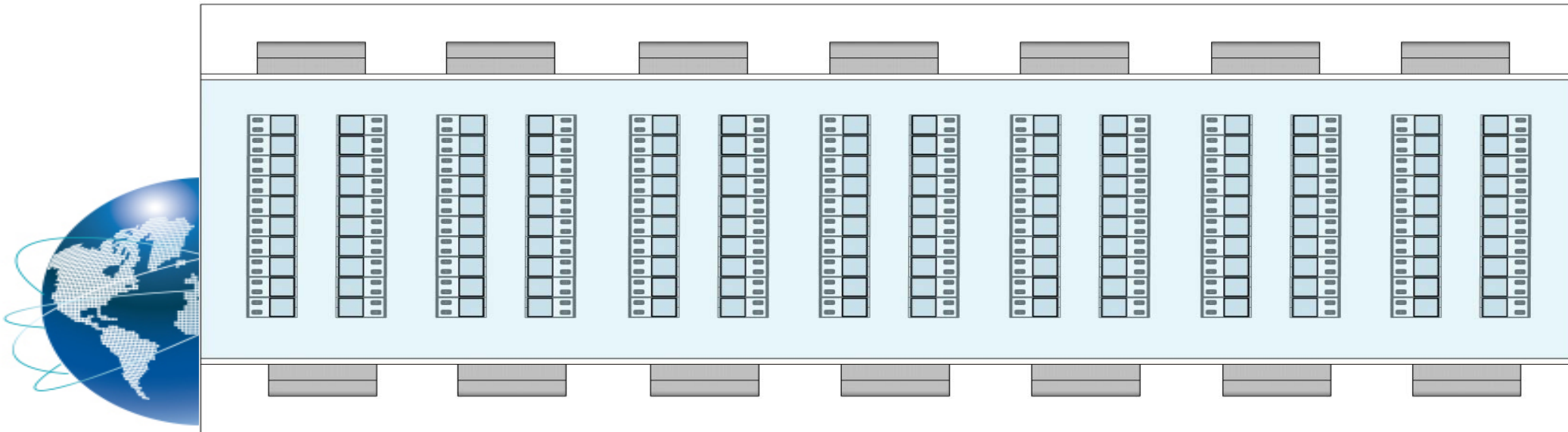


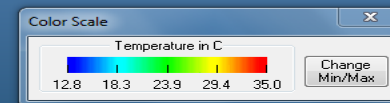
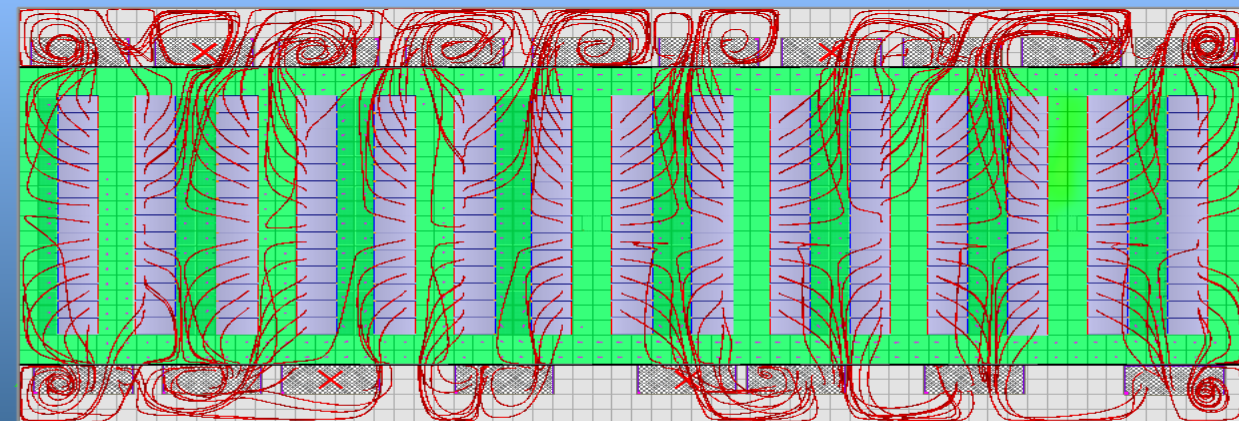
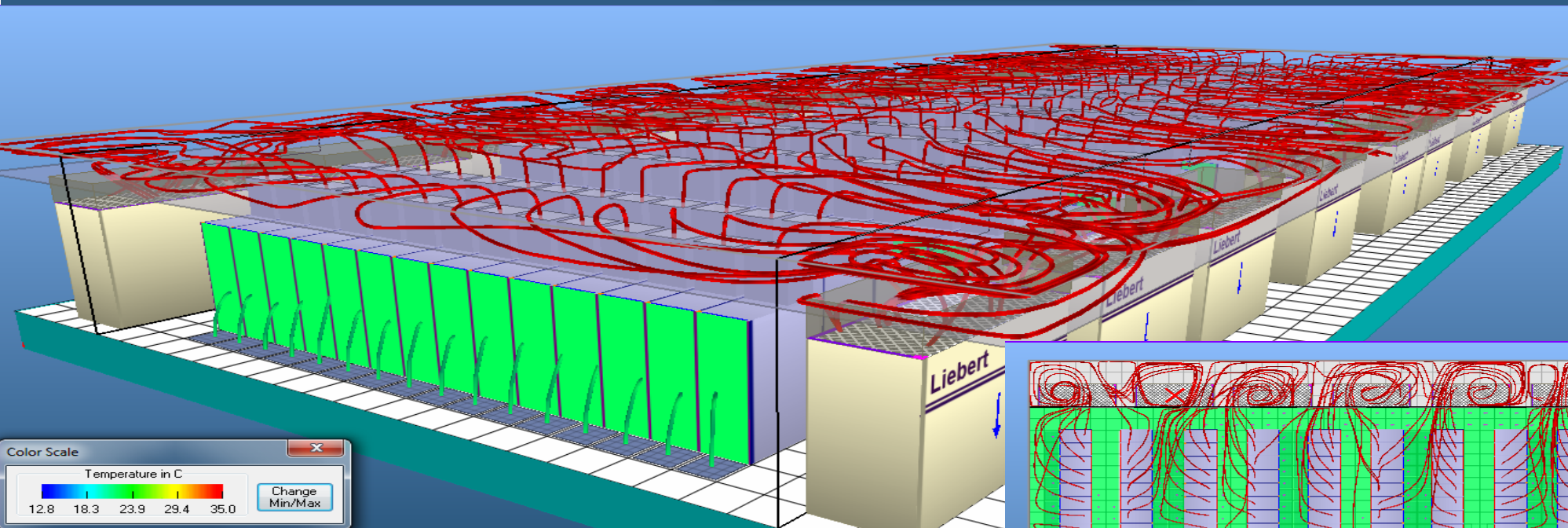
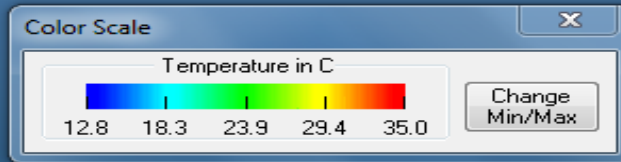
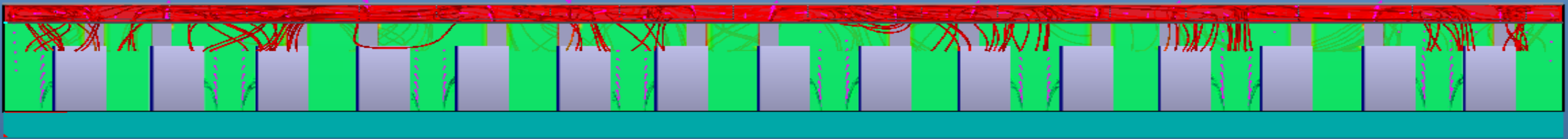
Impacto en la Ubicación / Ahorro





Diseño: Holístico – Modular – Robusto – Flexible – Confiable





Modelar con CFD (Computer Fluid Dynamics)
antes de tomar decisiones, comprar o construir





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Gracias por su atención!

Víctor Daniel Bañuelos Lugo

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