DLC стучится в дверь

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в России и СНГ

Екатеринбург, 25.11.2025

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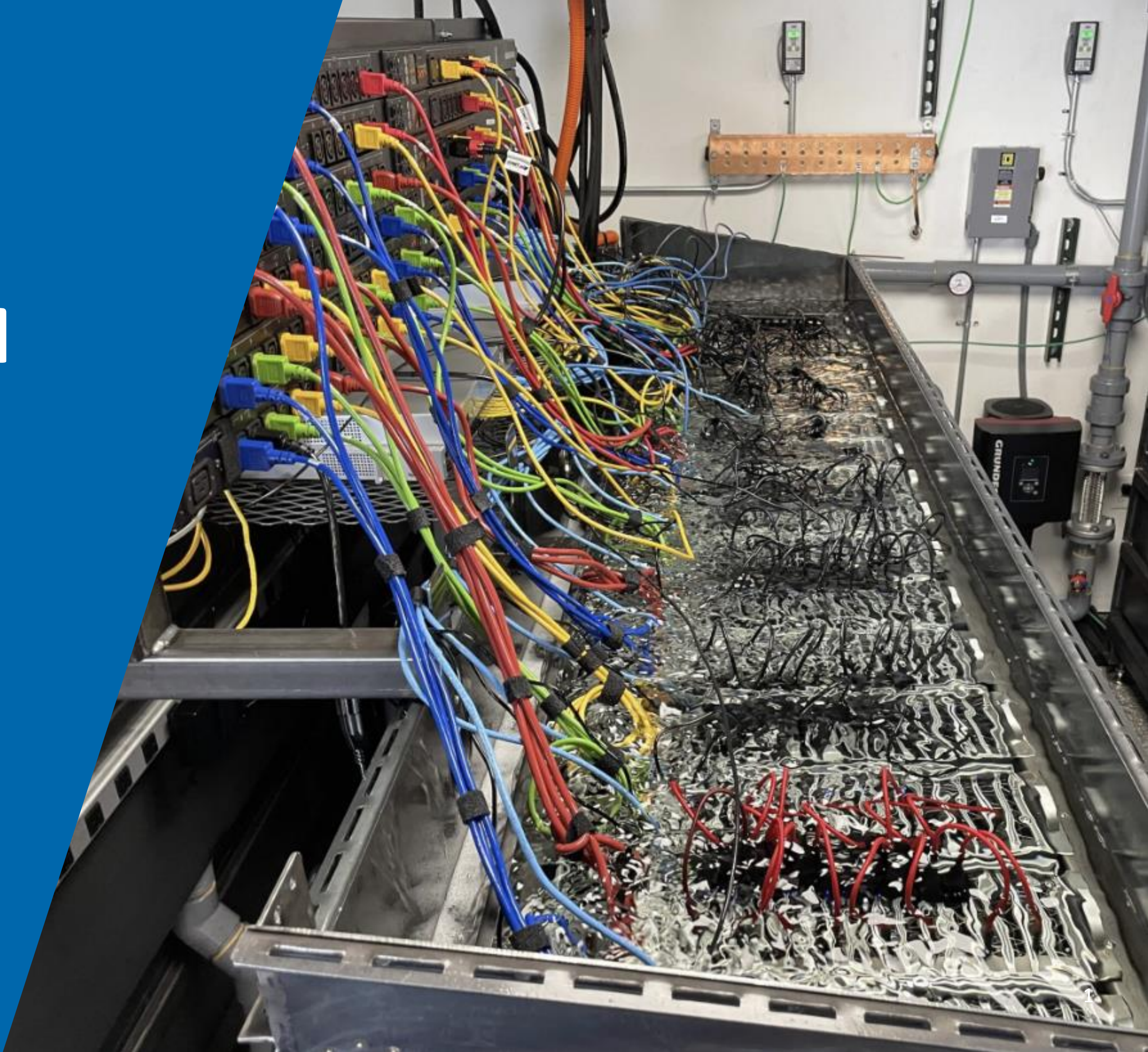

- DLC: какое оно бывает. Краткая классификация
- Какие технологии DLC выбирает сегодня мировой рынок? Результаты трёх лет наблюдений Uptime Institute
- Что делать, если у вас появляются стойки высокой плотности?

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DLC: немного классификации

Cold Plate

- Вода
- Диэлектрическая жидкость

Full Immersion – полное погружение

- Однофазное
- Двухфазное

Partial Immersion – частичное погружение

Direct-to-chip

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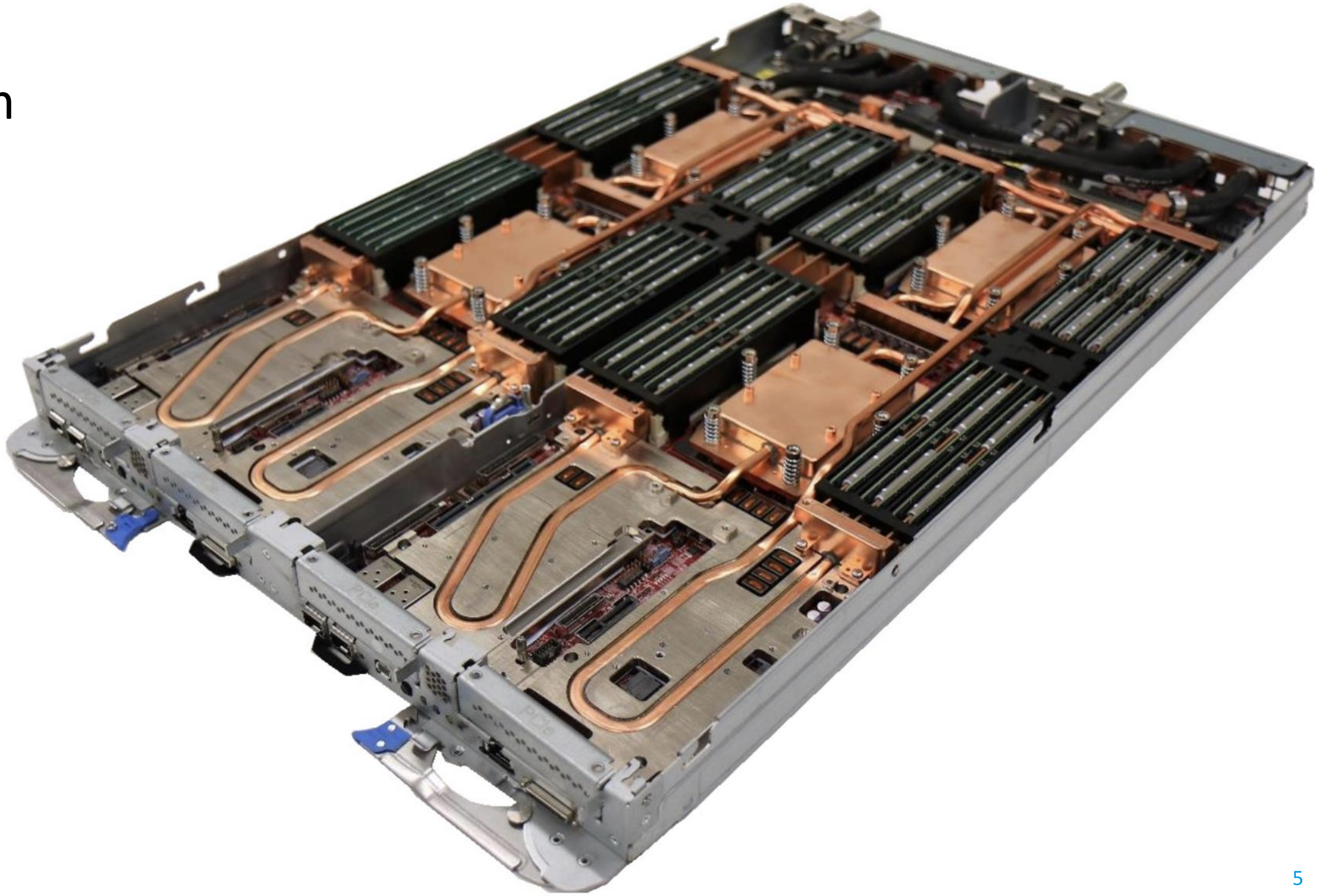
~~RDHx~~

Cold Plate

Lenovo ThinkSystem

SD 665 V3

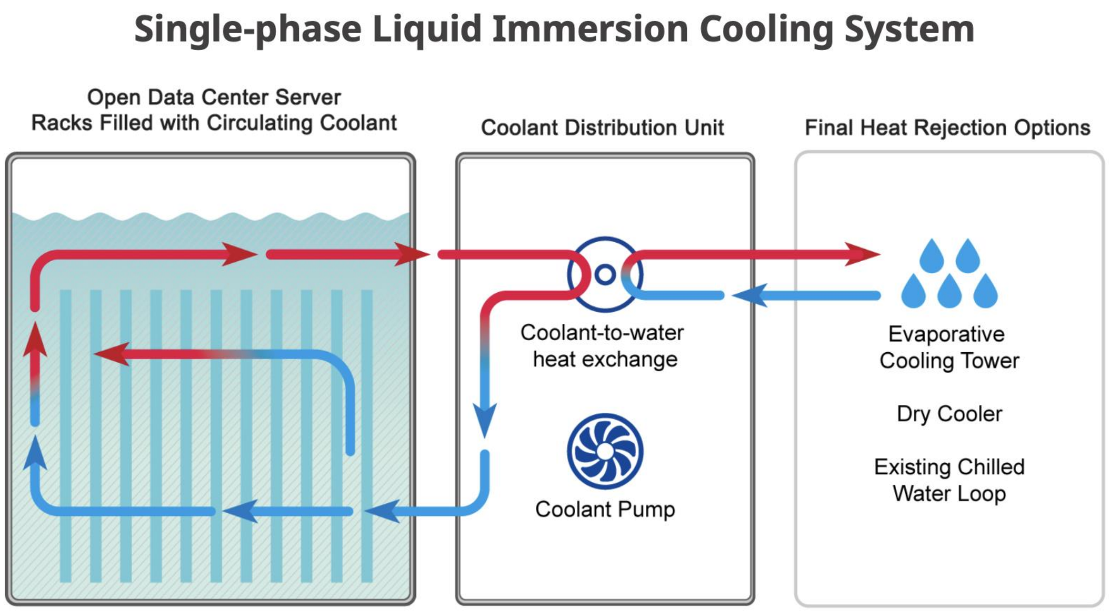


Cold plate. Dell PowerEdge R6715

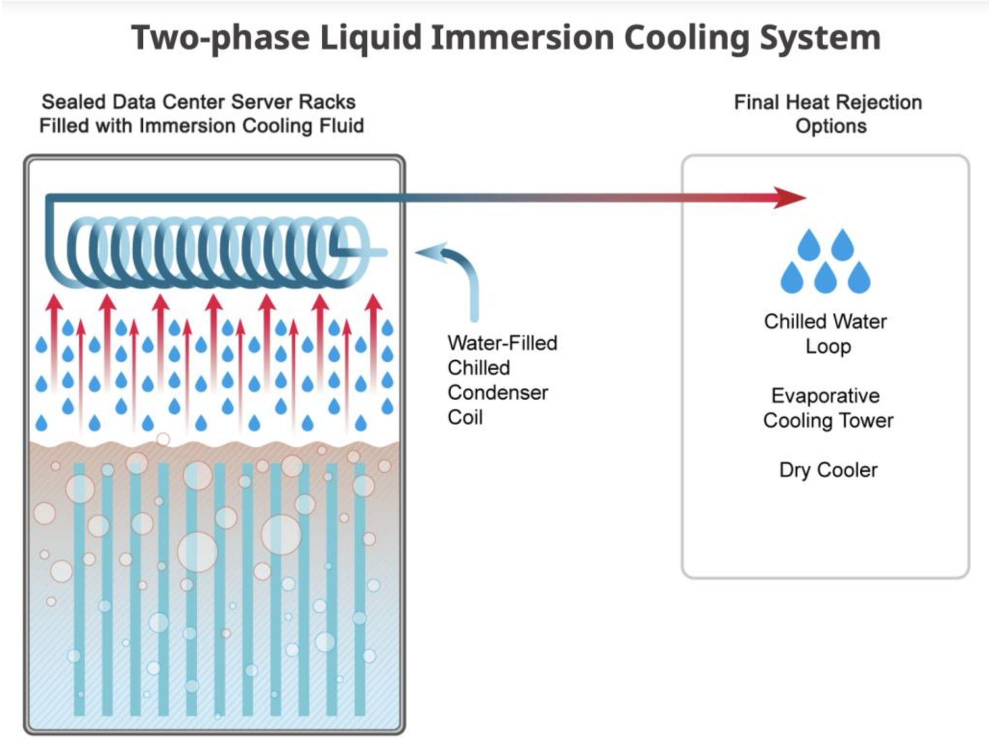
Сервер-лезвие РСК Торнадо TDN531

Full immersion – полное погружение

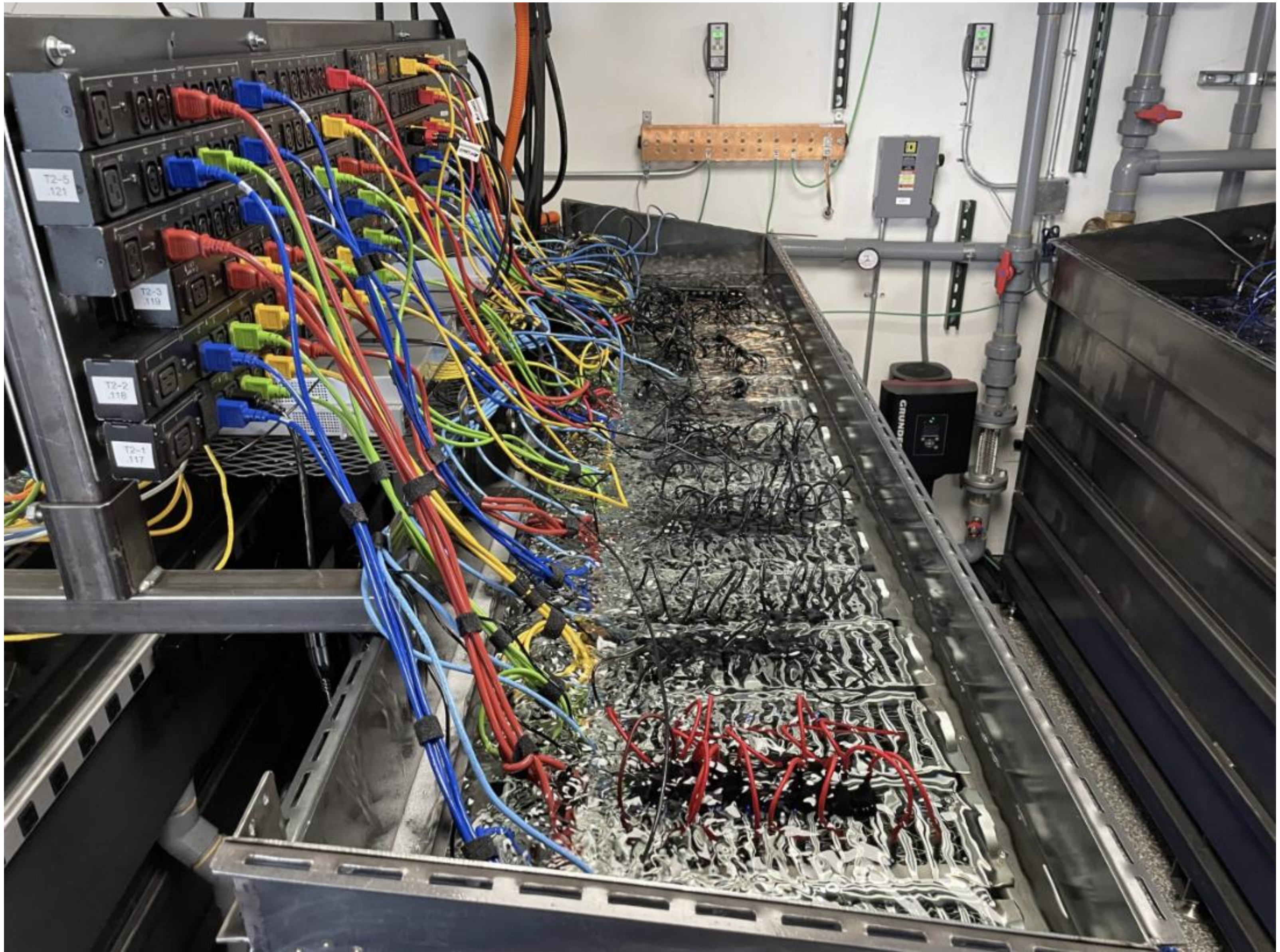
1-фазное



2-фазное



Full immersion - примеры



Full immersion - примеры

San Jose, Calif., June 30, 2025 – Industry First -- Supermicro Systems Certified by Intel for an Immersion Cooling Solution

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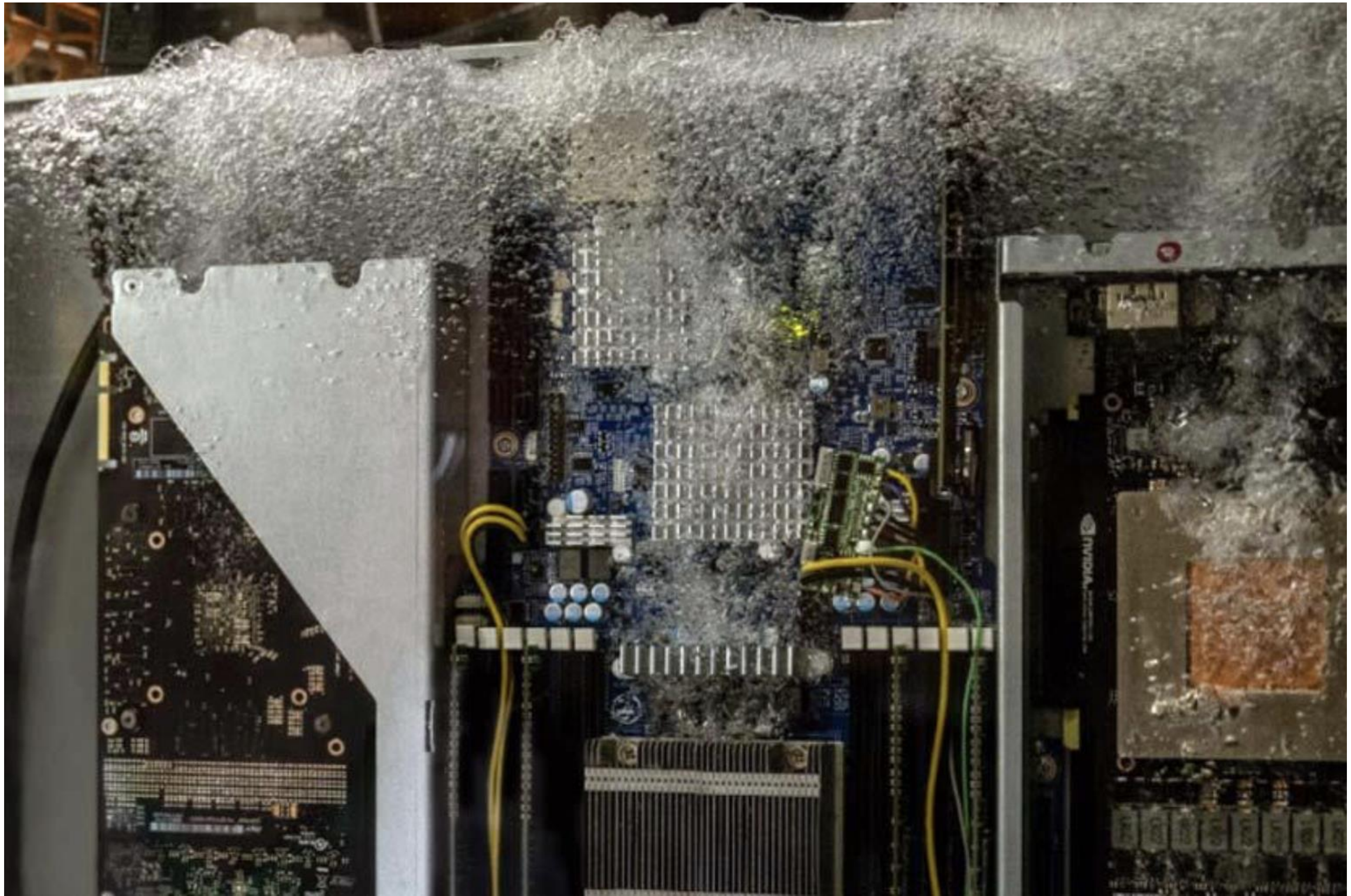
Full immersion – примеры. 2 фазы



Full immersion – примеры. 2 фазы

2025 Uptime Institute Cooling Survey:

некоторые наблюдения

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Более 100 вопросов:

Co-lo; Enterprise + Cloud; пользователи co-lo

Региональный разрез

Давайте-ка проголосуем:
Cold plates vs. full immersion

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Вопросы всем респондентам – владельцам/операторам ЦОД

Q14: Which types of IT cooling does your organization use in its data centers? Choose all that apply.

	Total (n=512)	DC Owner/Ops (n=401)	Colo Providers (n=81)	Cloud Providers (n=30)
Perimeter air cooling (CRACs, CRAHs, fanwalls)	**75%**	75%	82%	67%
Close-coupled cooling (e.g., door heat exchangers, in-row coolers, in-rack coolers)	**32%**	32%	30%	27%
Fresh air cooling (direct)	**29%**	30%	19%	47%
Indirect air cooling (air-air heat exchangers)	**26%**	25%	28%	30%
Direct liquid cooling (e.g., "direct to chip," cold plate, immersion systems, "sidecar" radiators)	**22%**	18%	33%	33%
Don't know	**2%**	2%	1%	3%

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All Owner/Operator Respondents

Q56. Direct liquid cooling (DLC) can include cold plate, direct-to-chip, and immersion systems that circulate liquid cooling in contact with IT components. Which types of direct liquid cooling do you use in this data center? Choose all that apply.

	2025 (n=79)
Water cold plates	56%
Dielectric cold plates (single-phase)	39%
Full immersion systems (single-phase)	25%
Dielectric cold plates (two-phase)	15%
Full immersion systems (two-phase)	9%
Partial Immersion systems	5%
Other (please specify)	0%
Don't know	5%

All owner operators respondents who selected "direct liquid cooling" to Q52 were eligible to answer this question.

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Q57. In this data center, what portion of IT racks would you estimate use some form of direct liquid cooling?

	2025 (n=77)
1%-9%	22%
10-19%	12%
20-29%	16%
30-39%	12%
40-49%	10%
50-59%	8%
60-69%	1%
70-79%	3%
80-89%	5%
90% or greater	12%

All owner/operator respondents who selected "direct liquid cooling" to Q52 were eligible to answer this question.

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Вопросы только для владельцев/операторов собственных ЦОДов (без Colo провайдеров)

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Q23: Do you currently use, or are you considering using, any direct liquid cooling technology in your owned data centers?

	2025 Total (n=388)	Europe (n=104)	U.S. and Canada (n=108)	Asia-Pacific (n=56)	Middle East & Africa (n=76)	Latin America (n=44)
We currently use direct liquid cooling, and plan to expand its use	**13%**	17%	17%	13%	7%	7%
We currently use direct liquid cooling, but have no plans to expand its use	**5%**	4%	5%	5%	5%	5%
We do not use direct liquid cooling, but would consider using it in the future	**62%**	61%	57%	70%	70%	55%
We do not use direct liquid cooling, and would not consider using it in the future	**20%**	18%	21%	13%	18%	34%

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Data Center Owner/Operator Respondents Only
(Not Including Colocation Providers)

LONGITUDINAL COMPARISIONS: Q23. Do you currently use, or are you considering using, any direct liquid cooling technology in your owned data centers?

	2023 (n=340)	2024 (n=367)	2025 (n=387)
We currently use direct liquid cooling, and plan to expand its use	16%	15%	13%
We currently use direct liquid cooling, but have no plans to expand its use	6%	5%	5%
We do not use direct liquid cooling, but would consider using it in the future	57%	62%	62%
We do not use direct liquid cooling, and would not consider using it in the future	21%	18%	20%

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Data Center Owner/Operator Respondents Only
(Not Including Colocation Providers)

Респонденты, рассматривающие использование DLC, но не использующие его на данный момент

Q28: Which types of direct liquid cooling is your organization considering for your enterprise data centers? Choose all that apply.

	2025 Total (n=235)		Europe (n=62)	U.S. and Canada (n=62)	Asia-Pacific (n=38)	Middle East & Africa (n=51)	Latin America (n=22)
Water-cooled cold plates	**40%**		52%	44%	37%	35%	18%
Dielectric cold plates (single phase)	**26%**		15%	34%	32%	29%	18%
Dielectric cold plates (two phase)	**24%**		15%	34%	24%	22%	27%
Full immersion systems (single phase)	**17%**		15%	15%	32%	18%	0%
Full immersion systems (two-phase)	**11%**		10%	10%	11%	18%	5%
Partial immersion systems	**9%**		8%	10%	11%	10%	9%
Other (please specify)	**4%**		5%	3%	0%	8%	0%
Do not believe liquid cooling is viable	**6%**		0%	5%	16%	4%	14%

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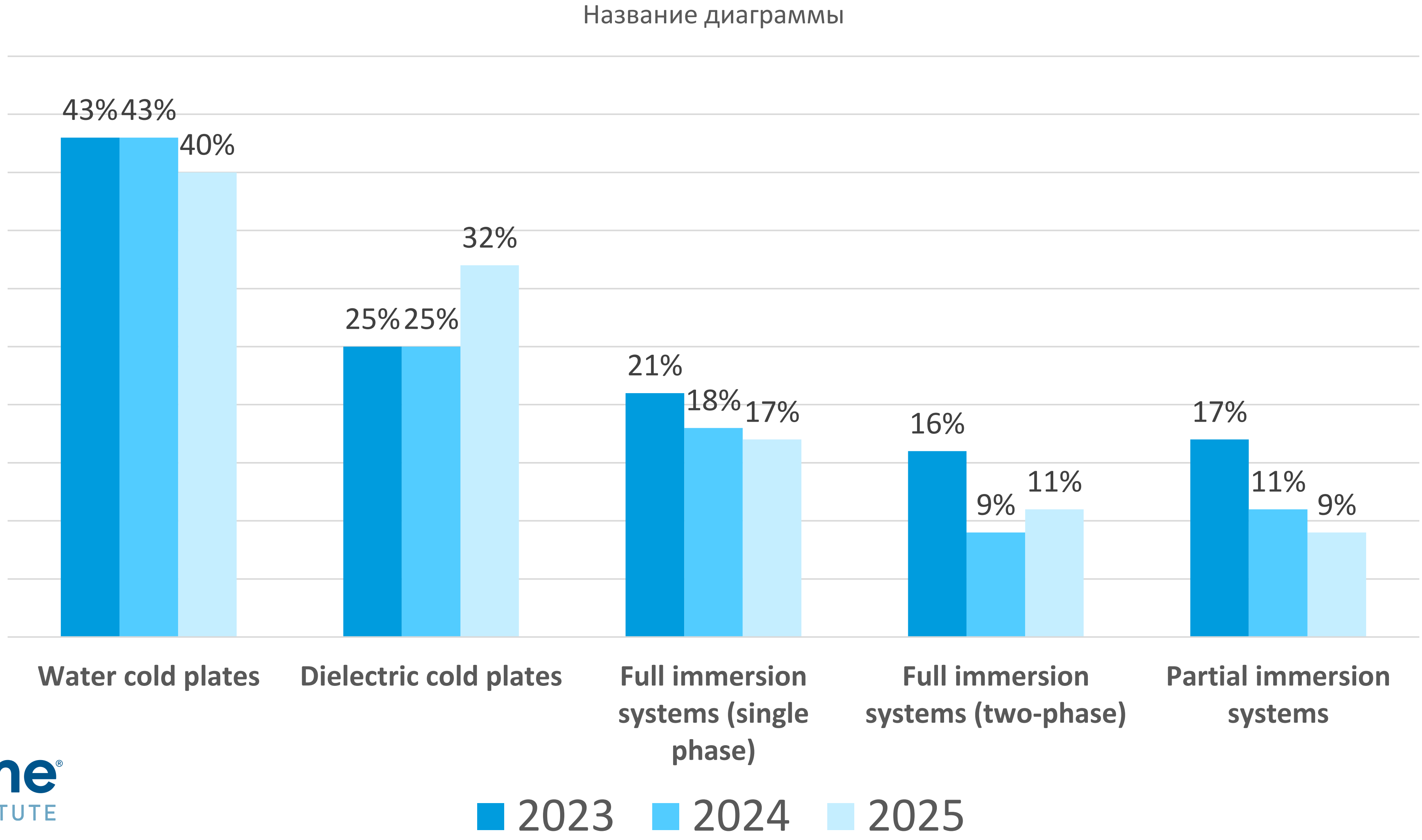
Only Data Center Owner/ Operators who said "We do not use direct liquid cooling, but would consider using it in the future" to Q23 were eligible to answer this question.

Data Center Owner/Operators Only (Not Including Colo Providers): Considering but Not Using Direct Liquid Cooling

То же, в динамике за 3 последних года



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Q29: Which of the following best describes the typical IT workload you expect to support with liquid cooling in the future in your owned data centers? Choose no more than three.

	2025 Total (n=232)	Europe (n=60)	U.S. and Canada (n=62)	Asia-Pacific (n=38)	Middle East & Africa (n=50)	Latin America (n=22)
Generative AI model training (LLMs and other)	**45%**	50%	48%	50%	36%	45%
Generative AI model inference (LLMs and other)	**45%**	50%	45%	39%	38%	45%
Enterprise server applications (e.g., database engines, analytics, general consolidation)	**39%**	38%	42%	34%	46%	27%
High-performance technical / scientific computing (engineering, research)	**38%**	30%	37%	50%	38%	36%
Mainframe workloads	**11%**	10%	8%	13%	10%	18%
3D rendering/video processing	**10%**	8%	6%	13%	12%	14%
Virtual desktop infrastructure	**8%**	7%	6%	5%	12%	14%
All other machine learning (not generative)	**22%**	25%	18%	32%	20%	14%
Other (please specify)	**0%**	0%	0%	0%	2%	0%
Don't know / my team does not have access to this information	**18%**	17%	18%	11%	28%	14%

Only Data Center Owner/Operators who said "We do not use direct liquid cooling, but would consider using it in the future" to Q23 were eligible to answer this question.

Data Center Owner/Operators Only (Not Including Colo Providers): Considering but Not Using Direct Liquid Cooling

Q25: Which of these best describes the typical IT workload supported by your liquid-cooled racks in your owned data centers? Choose no more than three.

	2025 (n=65)
High-performance technical / scientific computing	63%
Generative AI model training	42%
Enterprise server applications	35%
Generative AI model inference	35%
Mainframe workloads	15%
Virtual desktop infrastructure	14%
3D rendering/video processing	12%
All other machine learning	22%
Other (please specify)	6%
Don't know	2%

Only Data Center Owner/ Operators who said "We currently use direct liquid cooling, and plan to expand its use" OR "We currently use direct liquid cooling, but have no plans to expand its use" to Q23 were eligible to answer this question.

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Data Center Owner/Operators Only (Not Including Colo Providers): Currently Using Direct Liquid Cooling

DLC: какое оно бывает. Краткая классификация

Какие технологии DLC выбирает сегодня мировой рынок? Результаты трёх лет наблюдений Uptime Institute

Что делать, если у вас появляются стойки ОЧЕНЬ высокой плотности?

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Спокойствие, только спокойствие! (©)

Пределы работоспособности технологий охлаждения

Cooling methods	Typical rack power
Air cooling	
Perimeter cooling *(CRAHs with containment system or fan walls)*	Up to 20 kW to 25 kW per rack
In-row	10 kW to 50 kW per rack
RDHx	20 kW to 50 kW per rack
Hybrid air and liquid cooling	
Sidecar (<70% DLC)	40 kW to 70 kW per rack
DLC (<70%) and perimeter cooling	50 kW to 70 kW per rack
DLC (<70%) and RDHx	70 kW to 150 kW per rack
DLC (>90%) and perimeter cooling or RDHx	150+ kW per rack
Total liquid cooling	
100% DLC coverage	150+ kW per rack
Single-phase immersion	50 kW to 150+ kW per vat
Two-phase immersion	50 kW to 150+ kW per vat

CRAH: computer room air handlers; DLC: direct liquid cooling; RDHx: rear-door heat exchanger

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Что делать, если у вас одна-две-три ОЧЕНЬ горячих стойки с Cold Plates?

Что делать, если у вас одна-две-три ОЧЕНЬ горячих стойки с Cold Plates?

Вам поможет Sidecar!

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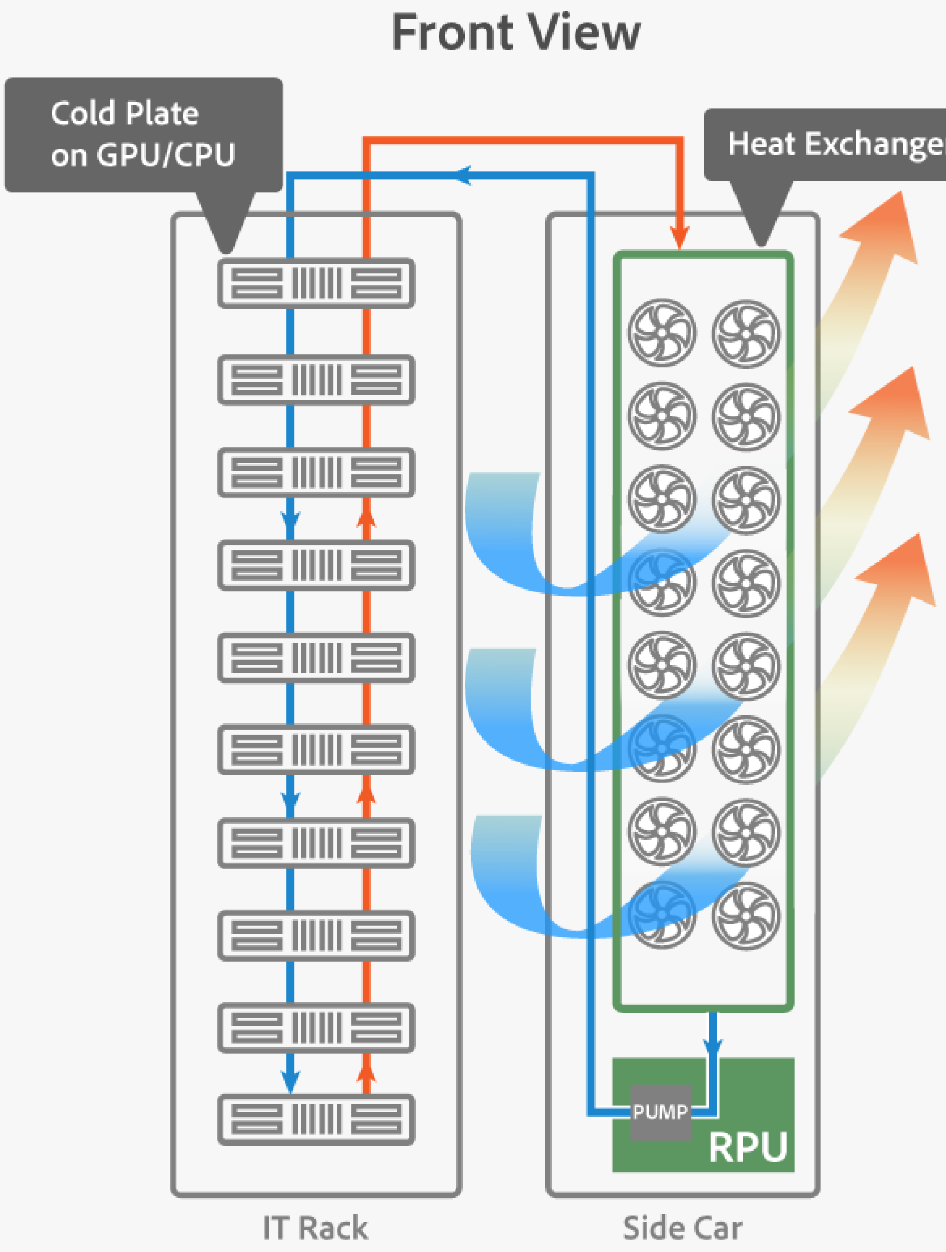
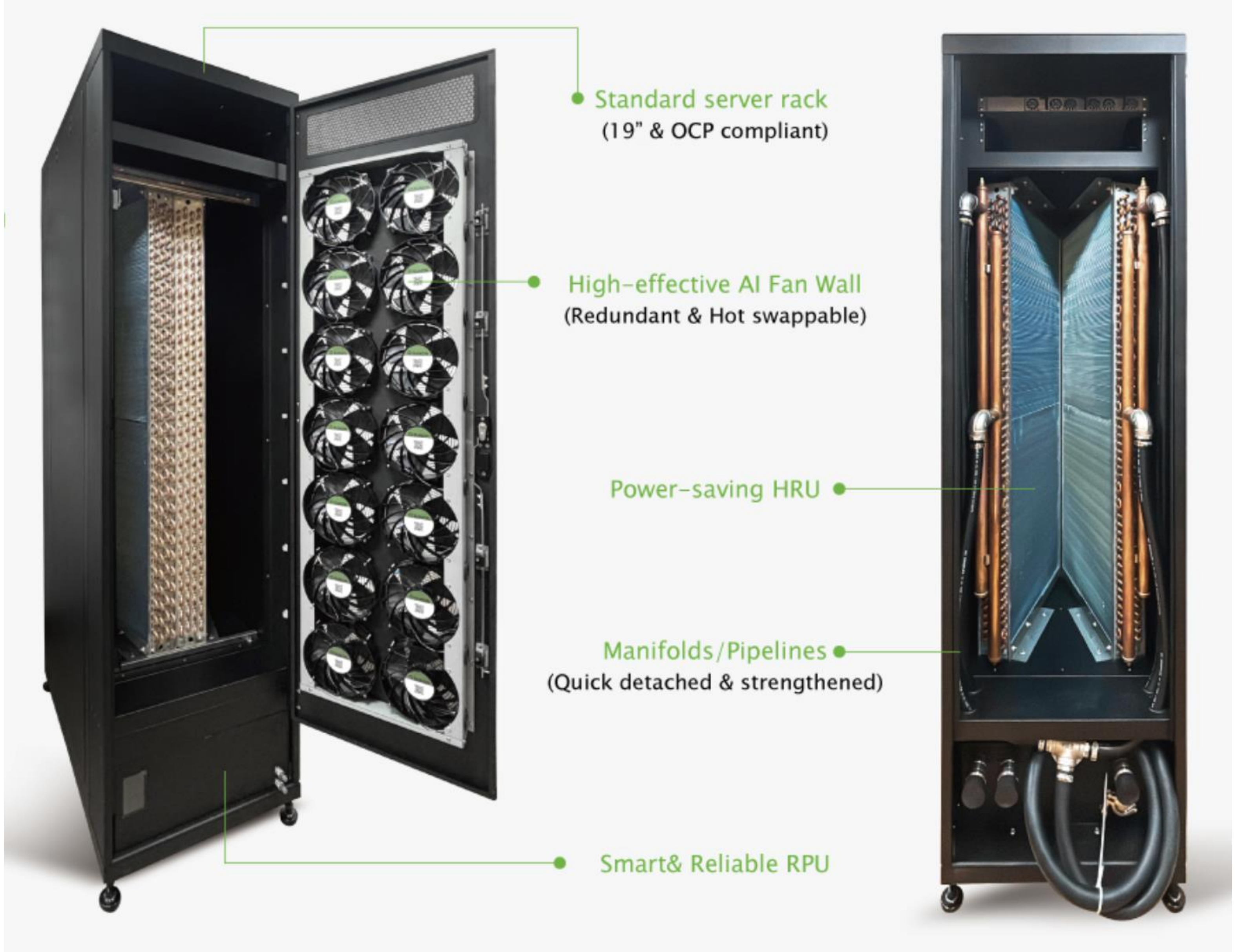
Sidecar



*RPU (Reservoir and Pumping Unit)

«Фанкойл наоборот»



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Выводы

1. DLC стучится в дверь, но пока не слишком громко. Оно по большей части всё ещё на пороге машзала
2. Лидер симпатий – cold plates (до 150 кВт/стойку в сочетании с InRow, RDHx и т.п.). Быстрее всех набирают очки 2-фазные cold plates с диэлектрической жидкостью
3. Спокойствие, только спокойствие (©). Из привычных воздушных технологий можно выжать до 50 кВт/стойку. Если нужно заметно больше и в заметных масштабах – тогда вам нужно DLC

В заключение

- Вряд ли нам стоит ожидать формирования в ближайшие месяцы и даже годы консенсуса по поводу «наилучшей из технологий DLC»
- Многие операторы будут реализовывать пилотные проекты, пробуя и сравнивая разные виды DLC, внимательно изучая опыт первопроходцев
- Популярные сегодня технологии вовсе необязательно окажутся наилучшими как с технической точки зрения, так и с экономической
- Любая DLC-система должна быть экономически эффективной для поддерживаемой ей ИТ-задачи; предлагать адекватную надёжность и отказоустойчивость; быть понятной в эксплуатации. Всё это требует опыта и времени

Спасибо за внимание!

Вопросы?

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