



逆境下的运维生存之道

党受辉 腾讯IEG技术运营部 助理总经理







党受辉

腾讯IEG技术运营部助理总经理

腾讯蓝鲸负责人



往年的分享主题



2016

2017

2018

2021

•云时代 应用运维升职加薪之路

•如何从零打造<mark>百人级别</mark>的DevOps团队

, ma

• 蓝鲸体系的技术架构和生态结构

• 落地智能运维的平台体系

•运维开发时代

• 腾讯游戏的研发运营PaaS体系

2019

• 研发运营一体化

• 在运维团队中普及DataOps和AIOps

• 数字化转型和数字化挖坑

•研发运营体系的代差

2022年







Contents

- 1 这些年运维与运维团队的变化
- 2 运维和运维团队的降本与增效
- 3 运维和运维团队的 生态协同

/01

这些年运维与运维团队的变化



不同公司运维服务的范围在大范围扩展,SRE也五花八门



代码检查

编译加速

DevOps流水线

CI

定制运营工具

自助应用操作

计算资源调度

CD

用户体验分析

运营成本优化

监控及可观测

CO



运维服务与工具的结合越来越紧密



基础设施

基础设施运维向云供应商或集团科技公司集中,重复建设减少,需求总量降低

跨业务及跨云供应商基础设施标准化程度升高,一体化运维工具建设速度加快

应用架构

应用复杂度升高,微服务容器化业务占比升高,不借助工具的操作可靠性降低

应用运维在基础运维操作领域的可替代性变高,应用运维要借助工具拓展职能

运维策略

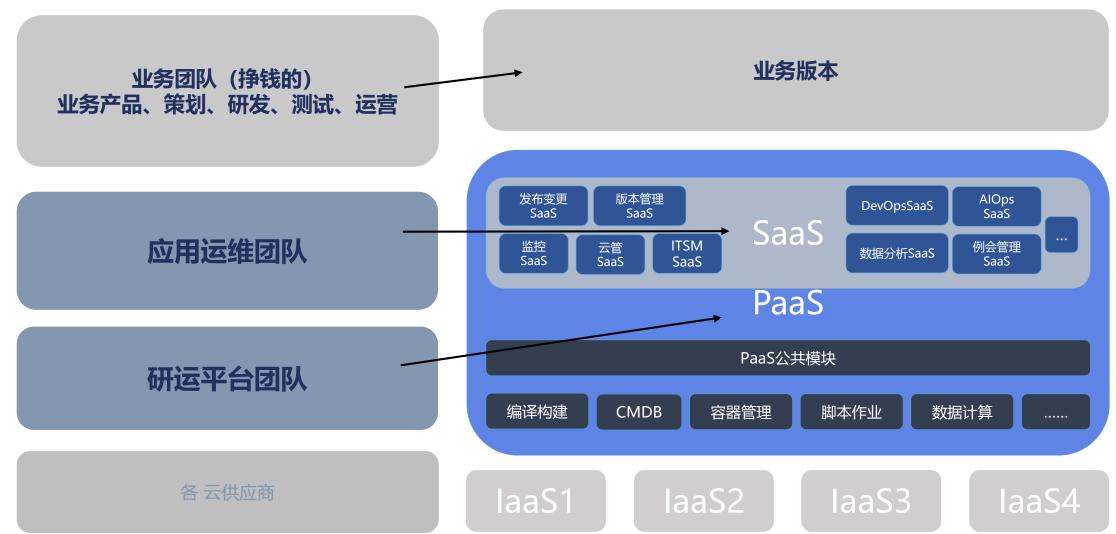
SRE、研发运营一体化等理念已经被广泛接受,研运一体化工具体系开始流行

预算收缩的背景下,人力成本、运营成本的优化开始被重视(分层、自助及AI)



工具体系的设计理念大概有两种 —— PaaS 和 烟囱

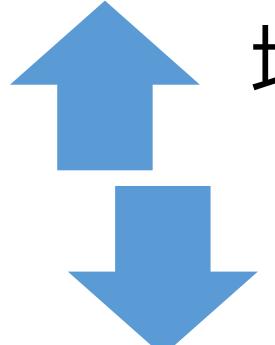




/02

运维和运维团队的降本与增效





增效

提高人效

降本

机器带宽 人员薪资 研发市场





如果公司开始降本增效,运维怎样发展



机器带宽

• 各领域 转向 控制 运营成本

提高人效

- 寻找机会进行 增值服务降级 以增加基础服务带宽
- 寻找机会进行 SaaS场景盘点 以扩充PaaS生态

人员薪资

• 团队服务分层,一线操作,二线解决方案,三线技术平台

研发市场

• 通过外部生态回馈内部



各领域 转向 控制 运营成本



案例列表



- ② 助力游戏地图设计
- ② 化解游戏运营危机事件
- 辅助开发提升用户体验
- ② 提升运维工作效能
- ② 改变运维监控工作方式
- ② 探索海量KPI曲线异常检测方案
- ② 探索数据化运维新方式

GOPS 全球运维大会2020·上海站

编译资源

加速资源

测试环境

生产环境

监控精度

计算资源

CDN

• • • • • • • •

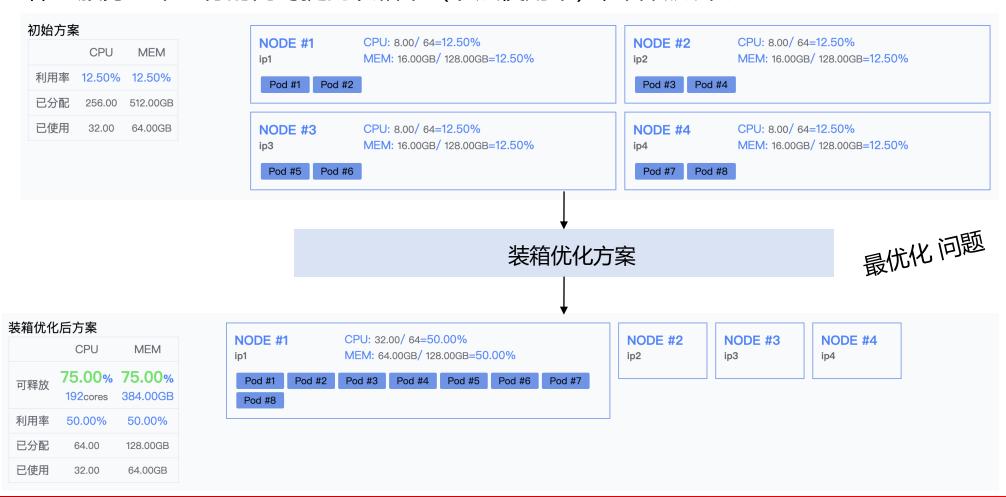


装箱优化 - 背景



通过「装箱优化算法」优化K8S的pod编排

保证服务正常运行的同时提高装箱率(节点使用率),降低成本。





装箱优化 - 问题抽象 - 多目标优化



多目标优化转化为单目标优化问题求解

Minimize
$$\mathbf{f} = [f_1(\mathbf{x}), f_2(\mathbf{x}), \dots, f_m(\mathbf{x})]$$

subject to $\mathbf{x} \in \Omega$

方法一: 非冲突目标加权集成

Minimize
$$\mathbf{f} = w_1 f_1(\mathbf{x}) + w_2 f_2(\mathbf{x}) + \cdots$$

subject to $\mathbf{x} \in \Omega$

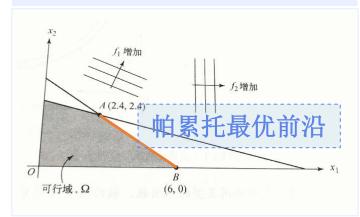
方法二: 选取主目标, 其它目标加入约束集

Minimize
$$\mathbf{f} = f_1(\mathbf{x})$$

subject to $\mathbf{x} \in \Omega$
 $f_2(\mathbf{x}) \le c_2$
...
 $f_m(\mathbf{x}) \le c_m$

- ▶ 方法一个人倾向不代表物理意义
- ▶ 方法二约束集需要硬指标,并非全 部目标都可以转化为约束条件

帕累托最优性 Pareto Optimality



定义:

点 $\mathbf{x}^* \in \Omega$ 是帕累托最优解,当且 仅当不存在一个点 $\mathbf{x} \in \Omega$ 能够满足

$$f_i(\mathbf{x}) \leq f_i(\mathbf{x}^*)$$
 所有 $i, i = 1, 2, ..., m$
 $f_j(\mathbf{x}) < f_j(\mathbf{x}^*)$ 至少一个 $j, 1 \leq j \leq m$

对于非凸问题、约束不可解等复杂性

工业界已形成使用启发式进化算法求 解帕累托前沿的主流实践



遗传算法 GA

1 基因编码

AutoML所有控制变量编码为实数域基因

② 基因突变 Mutation

1 0 1 1 1 0 Mutation 1 0 0 1 1 0

③ 基因重组 Crossover



- 4 选择 Selection
 - ▶ 物竞 适应性函数(fitness)
 - ▶ 天择 选择函数

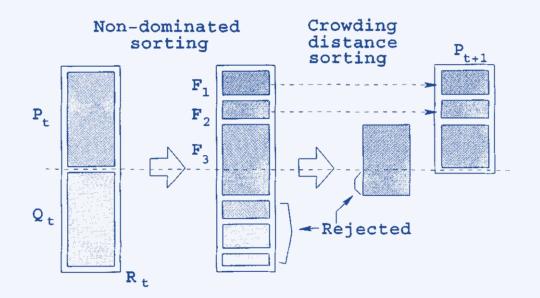


装箱优化 - 论文实现 - 算法介绍 - NSGA-II



NSGA-II 的优势

- 1. 基于快速非支配排序计算帕累托等级 $O(mN^2)$
- 2. 基于拥挤度保持种群多样性
- 3. 引入精英策略,保留父代优良个体



A Fast and Elitist Multiobjective Genetic Algorithm: NSGA-II

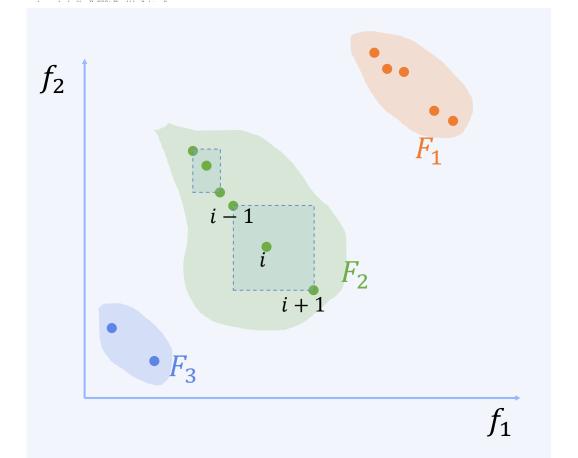
Kalyanmoy Deb, Associate Member, IEEE, Amrit Pratap, Sameer Agarwal, and T. Meyarivan

Abstract—Multiohjective evolutionary algorithms (EAs) at use nondominated sorting and sharing have been criticed mainly for their: 1) $O(MN^3)$ computational complexity here M is the number of objectives and N is the population (n, n) is the population (n, n) is the population (n, n) is a practice (n, n) in the population (n, n) in the population (n, n) is a practice (n, n) in the paper, we suggest a nondominated tring-based multiobjective EA (MOEA), called nondominated (n, n) in the paper (n, n) is a proper (n, n) in the paper (n, n) in the paper (n, n) in the paper (n, n) is a partial parameter. In this paper, we suggest a nondominated (n, n) in the paper (n, n) is a paper (n, n) in the paper (n, n)

subgrithms (EAs)

[20], [26]. The primary reason for this is their ability to find milipic Pareto-optimal solutions in one single simulation run. Since evolutionary algorithms (EAs) work with a population of dorn specifying a 1 a nondomination of the start of bullots. With an emphasis for moving toward the true

K. Deb, A. Pratap, S. Agarwal and T. Meyarivan, "A fast and elitist multiobjective genetic algorithm: NSGA-II," in *IEEE Transactions on Evolutionary Computation*, vol. 6, no. 2, pp. 182-197, April 2002, doi: 10.1109/4235.996017.





装箱优化 - 项目方案

最优化问题建模

Minimize $\mathbf{f} = [f_1(\mathbf{x}), f_2(\mathbf{x}), ..., f_m(\mathbf{x})]$ subject to $\mathbf{x} \in \Omega$

① 优化目标:

最大**释放资源**(释放node数,CPU核数,内存量) 最小**迁移成本**(迁移任务数)

② 约束条件:

亲和性、反亲和性约束

装箱水位限制

迁移总成本限制

Node, Pod是否允许迁移

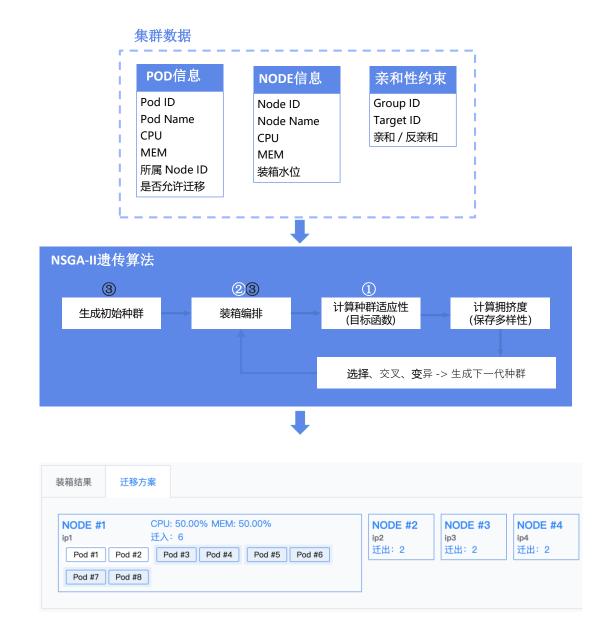
③ 加速收敛的优化:

初始种群过滤:

- 去除不可迁移的node与pod
- 去除pod数超过迁移成本上线的node

装箱顺序优化:

- 优先填满装箱率高的Node



shenzhen



装箱优化 - 效果评估



以hydra集群为例

集群规模: **76 nodes、730 pods**

其中427个有约束

IODE 877 07/0 SW 930-97 77% 100-9						NOTICE E4 CPU (SEV TSSEN TURN LINE AND								
NAMED NAMED DARKE DARKEN DARKE						-	THE							
							THE RESERVE AND ADDRESS.	PLANTE PLANTE		TO BE LESS THE PERSON	NUMBER PLANSES PARAMET FO	SOMEA PLEMES PLEMES		
NODE #50	GPU 1877854-1395				NOOE A	123		SE CON TRANSPORTED						
	DES TAKEN TAKEN TAKEN TAKEN TAKEN TAKEN TAKEN TA	INI PANCE PARE	PARTY PARKS				NI PARK PARK PARK			PARTIE PARTY	NAMES AND ADDRESS OF THE PERSONS ASSESSED.			
NODE 130	CPU CES TROUGHTS MONE ANAMAS DE ENTRAGEMEN				NODE 255		OPU 68/7 MSM 41/8	100-1276 100/200-0376						
Parents Parents Date	AND PARKET PARKE	INSE THERET PROPERTY	Pod MIN		Parket Parkets	Parkett Park	NO. PARKED PARKET PARKET	NAMES OF THE OWNER.	Partie Partie	PACKAGE PACKETS	Part SEE			
NODE NOT	CPU (49) N(64-1,07% MENE 40.4046/ (103.7008-5.70%				NODE PER			194-1,07% MG/ 201,7150-0,78%						
	KEET PARKEET P	FOR PLEMSO PLEMSO	Full RCBI			PACKS PAIN	CO PARES PARES PARES	PLACE PAGE (CO.)	SUPE SUBS	NAMES OF TAXABLE	NA PER			
100E H	CPU 67V Non-distric Mile 38 44M/ 28 0000-d NN				100E #12		MEM primer/secon	4.00%						
	PER PARTY NAMED PARTY PA	THE PERSON NAMED IN				Marie Sale	COLOR DANS		THE REAL PROPERTY.	- Carrier				
HOLE HA	CPUI.CPV NEW-0895 MOR SEAMON SEEKS BARRES NEW MARKET BARRES BARRE	DEST PACKET PACKET			OCC PS OC-179 PARTE BARRE PARTE	PARTIE FACE	CPU, 075' Non-0.00% NEW StrateGY (NEW NO.)		PACKET PACKET	PARKET				
100E 849	CPU 0.75 76-04-03076 Mile 301-8440 203 1008-03175				100E 190									
	AND PROPER PROPER PROPER PROPERTY PROPERTY FROM THE PERSON AND PERSONS AND PER	MADE PLANTED PLANTED			NOCE 959 CPU CPU TRANS JURIS SERVICE S									
NOOE 857	CPU: 074 ¹ N: 04-0.89% MSN: 381-44M6 ² 381-0300-0.39%				IOCE BIT		070, 0.8/1934-0.78% MEM. 31.4990/1933004-0							
PARTY PARTY NO	DIG SARDI SARDI SARDI SARDI SARDI SARDI SA	DESCRIPTION PROPERTY.				SACRES SACR	DE SAME SAME SAME	PACAMET PACAMET	NAME AND ADDRESS					
NODE #97	OPU 030/7884-0-00% MEA: 201-0606/200-2008-0-00%			NODE #68		PLA EST/TORGO SML DELENS/ DE					NODE AT	EPU 641/7600-0 Milet 2014048/20		
	PER THERE PARTY PARTY THERE THERE PARTY PARTY PARTY PA	NOM .					DE PARKET PARKET PARKET	Park ATTER					MARIN PARKET PARKET PARKET	
NODE AS	CPS E-et Name-0576 MCM 24-AMED 2015000-0076 EMI THARM THARMS THARMS THARMS THARMS			COC 87 IN-EST NAMES PLANSE PLANSE	CPU 646769 MEM 251466					NODE INS rode-621		DATE AND DESCRIPTION		
NOTE 174														
DANIEL PARKET DA	CPU 6.67 TREE-CSTS MEAN FEARM/ DECIDING THE			COE S44 sis-176 Total Dates Dates (NAME OF STREET	CONTRACTOR OF THE	NIC THE PERSON PROCESSES			NODE 272 HIGH-T-C-		ES/NOL-COM DEADA/DECIDE-COM DEED BEEN BEEN BEEN B	SERVICE PLEXICA	
NODE 874	CPU, 645' Note-0.51% WISH 97: 4946' 108.7908-0.00%			100E #9	OPUS ASHIT RESERVE				MODE		CPU.cov/1604-0 MEM 1014M6/30			
	NOW SHARES SHARES SHARES SHARES SHARES SHARES			NAMED PARTIES PARTIES			CC FACING				PERSONAL PRINCIPAL PRINCIP			
NODE #20	CPU 831 7834-0.30% MDM 98-496/208-0037%		NODE #01		OPU 030/7034-8.30% MEM. 1014066/201300-6	27%			NODE #22		CPU col/ tope-0.38% MEM: WHAMAY STREETS-0.1	25		
Darlott Navittle Dar	AND THEFTO THEFTO THEREOF THEREOF THEREOF		ISSUE I	SERVE SHEET SHEET					Part STOR Part St	III NAME NAME	DATE SAME SAME	Date State S		
NOSE #32 min 9.56	CPU 02/ 8584-038% MSM 1014040/1043400-075%		NODE #42		DFU 030/7034-038% MEM 1014040/2003000-0				NODE 848 red: 640		ON 60/1944-639% Mile trave/200764-60	ans.		
	NO THE RESERVE SHARE SHARE SHARE SHARE			MARKET PARTY PARTY I		PARTIE PART				D PARTS PARTY	NAME AND ADDRESS OF	BARRIS PARRIS		
NODE #51 min-856	CPU 3:97 55.04-0.550% MCN: NA.6060* (04.5400-0.14% MINE THERET THERET THERET THERET THERET		NODE #53 rode 6.42	SERVET PARTIES PARTIES I	PU. 030' 7534-0.30% MDA: 91-4960' 500 7530-0.	07%			NODE #70 min-84L.		OPU E25 74.54-0.305 MCM 19.46AD/ SIL7030-0.3 Facility Parketts Parketts	CA.		
								wore						
NODE STO MARKE BACKER BAC	CPU 6.97 Non-C-37% MAIN W-8467 201 1006-0-27% MAIN RAILENS BARREST BALERON BALERON		NODE #3	SARRIE PARENT PARENT	AN TOTAL PROPERTY OF STREET			NOOE MADE			TO SECULIAR PROCESSION AND ADDRESS OF THE PERSON AND ADDRESS OF T			
NODE PIT	OFU. 02V 19:00-0.28%		NODE PIG	OPU. on/ 76 MEM. gr.ea				NODE #06		OPU ESYNERIOS MON TO AMERICAN				
Bertil Settle Se	NO DANK DANK DANK DAKE BANK			Series Series Series					EZ PAREN PARE	E BOOK DAME				
NODE #27	CPU GD/ 1656-G28% MBM 101-WMD/ 200-GDG%		NODE #26	OFU ES/3	154-020% (6) 201000-020%			NODE ASI		CPU 02/7594-61 MEM 124406/200	8% 2008-0-05%			
DARKE DARKE DA	EN PARK TANK BARK BARK BARK		Description of the last of	SARREST TAXABLE PARTY.	PRESENT PRESENT PRESENT	1		Policia Princip	ES DANIES DAN	OR PLANE SAME	Parent Parent			
NODE #33 mile-8.55	CPS: 025/7994-028% MEN: 1914MS/2000009-0.05%		NODE #38 red=615		154-020% M/ (MICHOD-0.00%			NODE 843 rot-8.55		OPU: 025/1934-03 MEM: 131.4646/301				
	DE NAME SAME SAME SAME SAME								500 500 500 500 500 500 500 500					
NODE 843 min-846	CPUI 024/75-04-02876 Meller Uniarray des Productions BASIN STREET, STREET, STREET, STREET, STREET,		NODE 245 rade 676					NODE AND make 9 kill -	25 245 CPV 6.0" NAME DATES DATES DATES (AND DATES DATES DATES DATES DATES DATES (AND DATES DATES DATES DATES DATES (AND DATES DATES (AND DATES (A					
						_								
	MODE 847								NODE 1964 OTAL 0.07 March 1.29% Model-17%. MCM. 10 AMB 0.00 MCM 1.00 MB 0.00 MCM 1.00 MCM					
NODE #56	CPU GS/ T644-GSPN MRN SYLMAN/ JMLTIGO-DSPN		NODE ISS		104-4 20% (II) 200 EXER-0 20%			NODE #63		CPU 625 7506-03				
	AND THE CONTROL OF TH								ARTH BACKER BACKER BACKER BACKER BACKER BACKER					
NODE 895	CPU 122/ 4134-0-40% MCM 12 A046/ 19 J1039-0-10%		NODE 998	OPU.com/ 19 MEM. House	90-0.28% N/ 90-0000-0.05%			NODE MS9		CPU cos' mon-0.0 MDM (1.60m) into	% 108-00%			
Partie Section Sec	PR PART NAME TAXABLE PARTY.			MAN PART PART	SARRE SARRE SARRE			Settl Set	E NAME (NAME	5000 S00	NAME AND ADDRESS OF			
NODE 871	CPU 02/7504-028% MRM 1014MM/2003008-0-08%		NODE #73 reds 610	OPU ESY'S				NODE 875 rade 875		CPU. 0.21/75:00-8: MEM. 131.4546/311				
	MIC SHOWN PROMIT SHOWS SHOULD SHOULD			Series Series Series	NAME OF STREET PARTY.					to here here	Pacettel Pacettel			
NOOE #2 min-854	OPU, 1207/9644-120% MEM-11006/ DRL0008-0-87%	NODE #9		OPU 0.01/76.94-E-07% MEM 31-6960/200-0000-0.0	IN.		NODE INS note-92E		0.81/1934-0.70% 1.540.0346/2010.000			NODE PIO node-658	OF42 038/ 86.8H-0.80% MON: 21.4M6/104.3H08-0.00%	
	THE SALES SALES SALES SALES			200 Sec. 200 Sec. 200 Sec.	_	- Luca	SARE SARE		made model		NO. 121	Desire Said Sa	DES SAINS SAINS SAINS	
NODE #16	WIM DURNE THE PERSON TO THE	NODE #20 rate 416	NAME OF THE PERSON OF	00.64-0.07% NAO/ 104.2408-0.02% NE NOVE TRANSPORT			E ESS CPUI LOL. NEW ME DARME BARNE BARNE	DATASE BARNE	LODN.		NODE #35 rade #35	Mile States States St	EM00	

优化效果: 装箱优化后,可释放 9个nodes, 12%

CPU **671core** (占比11.74%) MEM **2.15TB** (占比11.50%)







装箱优化 - 平台参与 - 方案升级



基于历史经验学习优化过程,以解决静态最优化求解时间较长的问题



原理	准确度	是否有训练过程	预测耗时
随机搜索	高	否	长



提高预测性能



原理	准确度	是否有训练过程	预测耗时
从离线样本学习 经验知识	高	有	短



如果公司开始降本增效,运维怎样发展



机器带宽

• 各领域 转向 控制 运营成本

提高人效

- 寻找机会进行 增值服务降级 以增加基础服务带宽
- 寻找机会进行 SaaS场景盘点 以扩充PaaS生态

人员薪资

• 团队服务分层,一线操作,二线解决方案,三线技术平台

研发市场

• 通过外部生态回馈内部



寻找机会进行增值服务降级以增加基础服务带宽







寻找机会进行SaaS场景盘点以扩充PaaS生态





- 稳定性
- 需求迭代



- 架构调整
- 方向调整



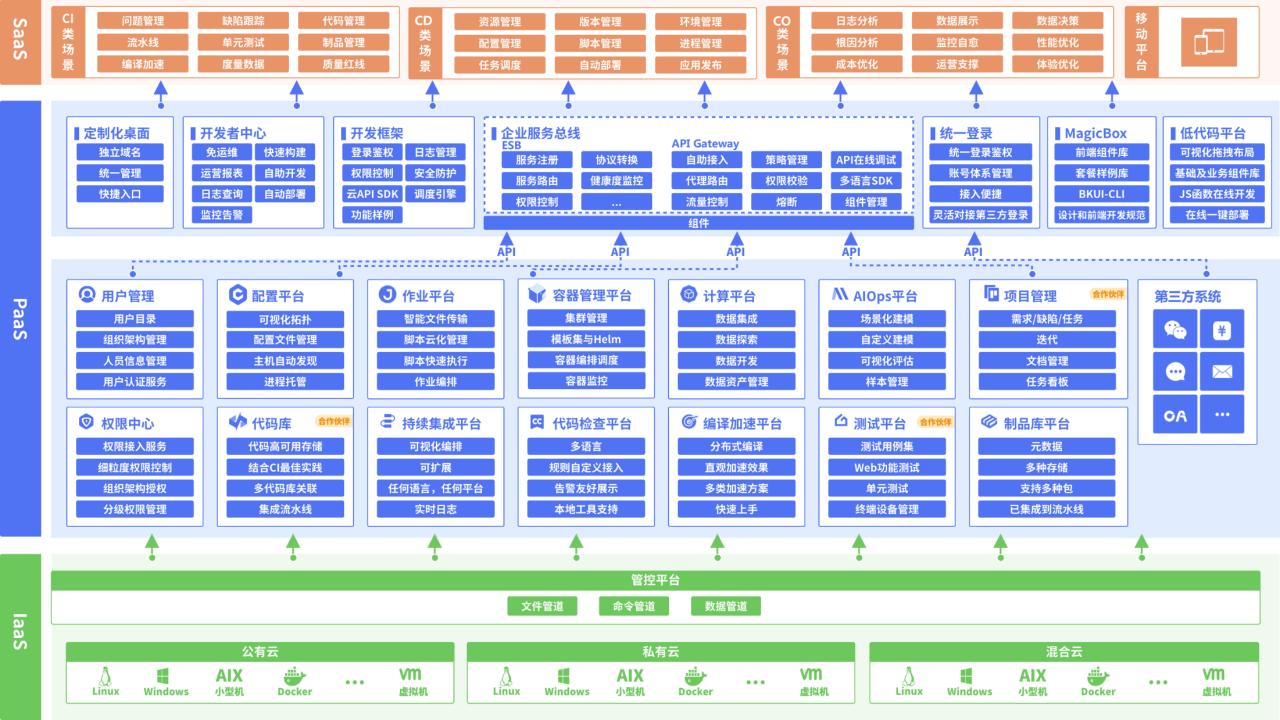
- 负责人跑路
- 技术瓶颈



- 运维成本
- 私有化需求







/03

运维和运维团队的生态协同



通过外部生态回馈内部



國河區

端

人性化门户

业务/项目用户

云服务门户

(8)

云运维门户

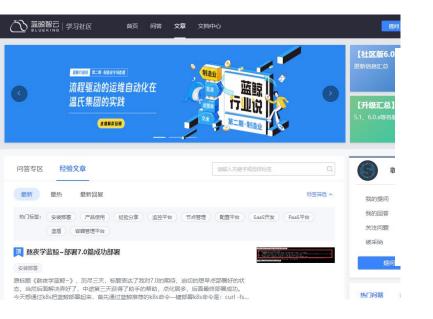
运营管理员

云运营门户

高层主管领导

可视化大屏/驾驶舱

蓝鲸社区



开源社区



低成本行业交流 节省测试预算 双赢合作 节省研发人力 减少市场预算 节约产研人力及时间

合作伙伴



我们亲身体验过的 《逆境下的 运维生存之道》



机器带宽 —— 拓展技术优化场景

• 各领域 转向 控制 运营成本

提高人效 —— 加量不加价

- 寻找机会进行 增值服务降级 以增加基础服务带宽
- 寻找机会进行 SaaS场景盘点 以扩充PaaS生态

人员薪资 —— 服务货币化

• 团队服务分层,一线操作,二线解决方案,三线技术平台

研发市场 —— 不加人,不采购

• 通过外部生态回馈内部







Thanks

开放运维联盟

高效运维社区

荣誉出品

DevOps 时代







