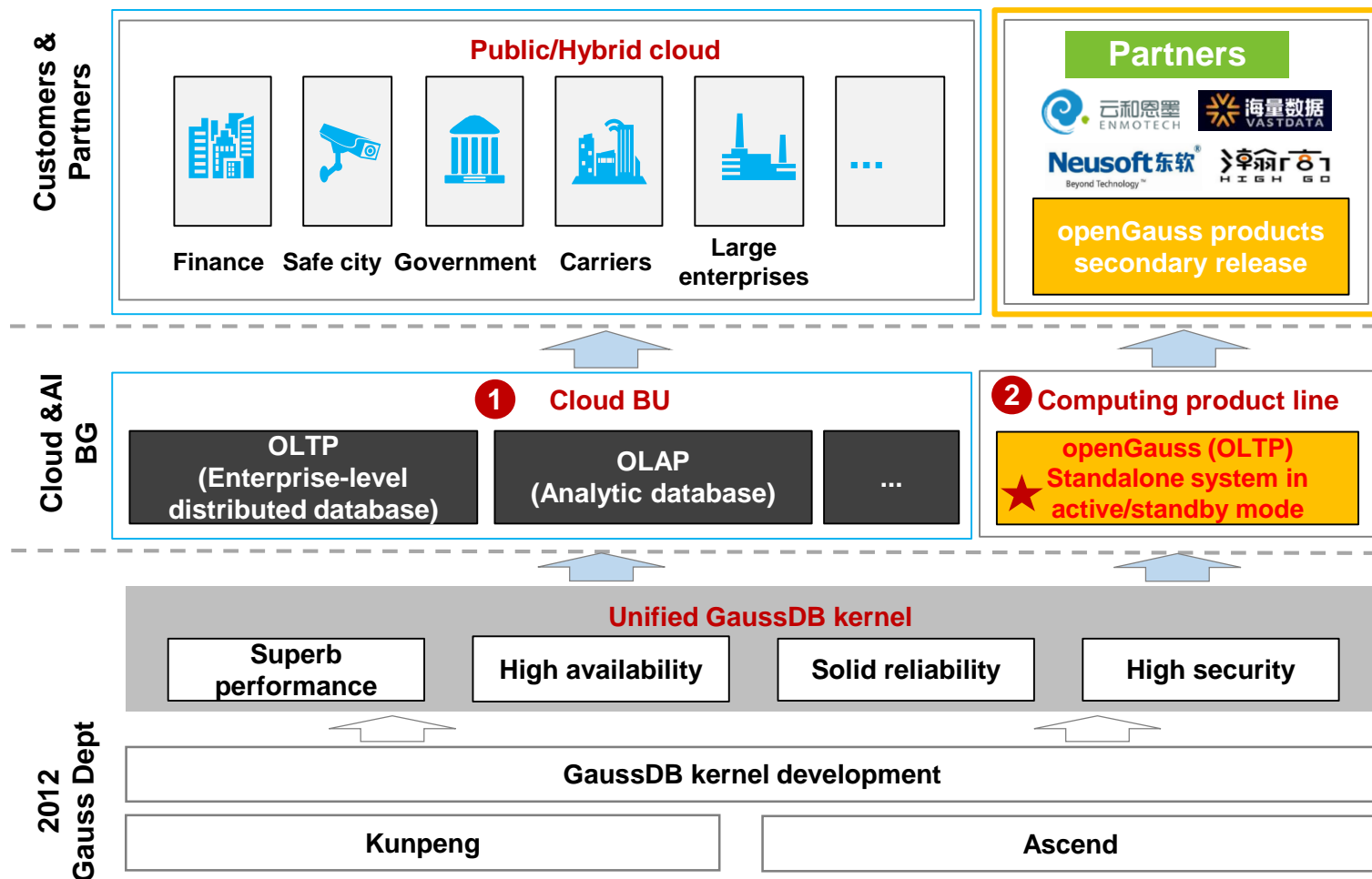# openGauss Overview

Relationship Between Huawei Databases
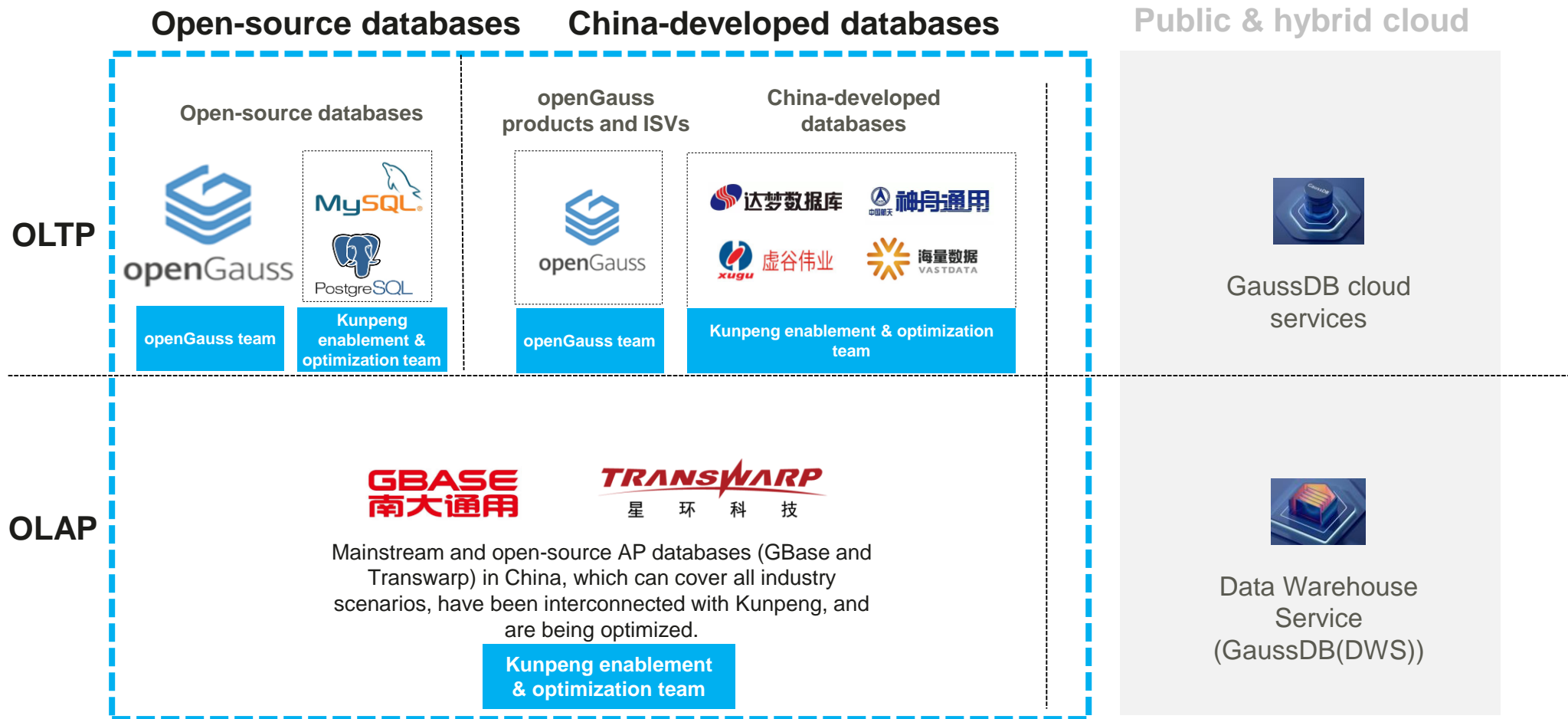
Huawei GaussDB focuses on kernel development, promoting the cloud solution and openGauss.

Customers & Partners

Public/Hybrid cloud

Finance | Safe city | Government | Carriers | Large enterprises | ...

Partners

ENMOTECH 云和恩墨 | 海量数据 VASTDATA
Neusoft 东软 Beyond Technology | HIGH GO

openGauss products secondary release

Cloud &AI BG

① **Cloud BU**

OLTP (Enterprise-level distributed database) | **OLAP (Analytic database)** | **...**

② **Computing product line**

openGauss (OLTP) Standalone system in active/standby mode ★

2012 Gauss Dept

Unified GaussDB kernel

Superb performance | High availability | Solid reliability | High security

GaussDB kernel development

Kunpeng | Ascend

- **①** Huawei focuses on cloud databases and cooperates with HUAWEI CLOUD solutions to sell or provide cloud services.

- **②** The open-source standalone GaussDB OLTP database continuously supports partners in developing diversified database products.

  - ✓ High reliability: 1 + 1 active/standby
  - ✓ High performance: 2-socket Kunpeng offers more than 1,500,000 tpmC (optimal performance in Kunpeng)
  - ✓ High availability: leading fault recovery performance (RTO < 10 seconds)

- Huawei supports mainstream software and application developers in various industries to migrate to Kunpeng databases for free.

Overview of the Kunpeng Databases

Open-source databases　　**China-developed databases**　　**Public & hybrid cloud**

OLTP

Open-source databases

openGauss

MySQL

PostgreSQL

| openGauss team | Kunpeng enablement & optimization team |

openGauss products and ISVs

openGauss

| openGauss team |

China-developed databases

达梦数据库　　神舟通用

xugu 虚谷伟业　　海量数据 VASTDATA

Kunpeng enablement & optimization team

GaussDB cloud services

OLAP

GBASE 南大通用　　TRANSWARP 星环科技

Mainstream and open-source AP databases (GBase and Transwarp) in China, which can cover all industry scenarios, have been interconnected with Kunpeng, and are being optimized.

Kunpeng enablement & optimization team

Data Warehouse Service (GaussDB(DWS))

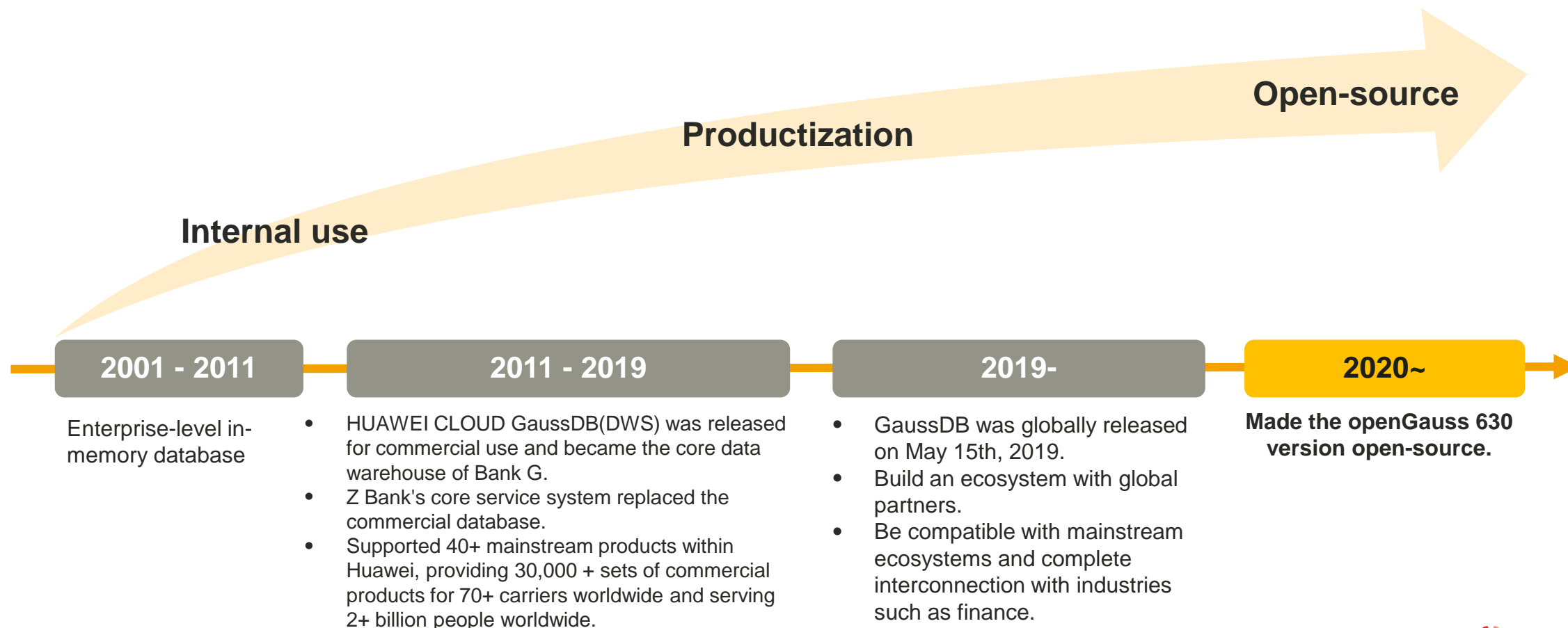**HUAWEI CLOUD Academy**　　**HUAWEI**

Ten Years of Continuous Improvement of Huawei Databases

Fully open standalone kernel for GaussDB to build a prosperous Kunpeng ecosystem.

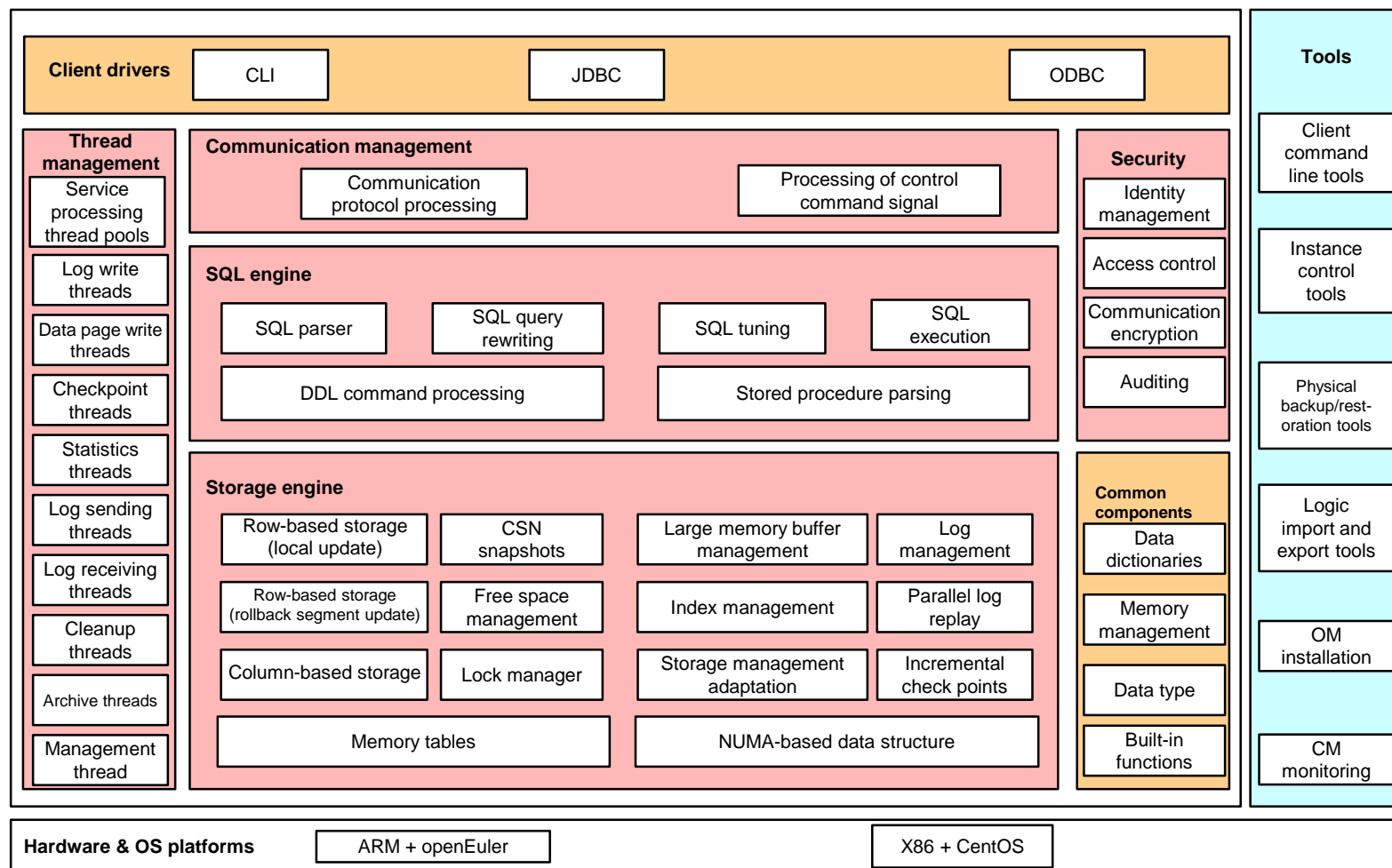Incubation for internal use -> Joint innovation productization -> openGauss

Open-source

Productization

Internal use

2001 - 2011	2011 - 2019	2019-	2020~

2001 - 2011

Enterprise-level in-memory database

2011 - 2019

- HUAWEI CLOUD GaussDB(DWS) was released for commercial use and became the core data warehouse of Bank G.
- Z Bank's core service system replaced the commercial database.
- Supported 40+ mainstream products within Huawei, providing 30,000 + sets of commercial products for 70+ carriers worldwide and serving 2+ billion people worldwide.

2019-

- GaussDB was globally released on May 15th, 2019.
- Build an ecosystem with global partners.
- Be compatible with mainstream ecosystems and complete interconnection with industries such as finance.

2020~

Made the openGauss 630 version open-source.

Introduction to openGauss

Standalone active/standby architecture is derived from PostgreSQL 9.2 and in-depth modification has been performed. The self-developed kernel account for 74%.
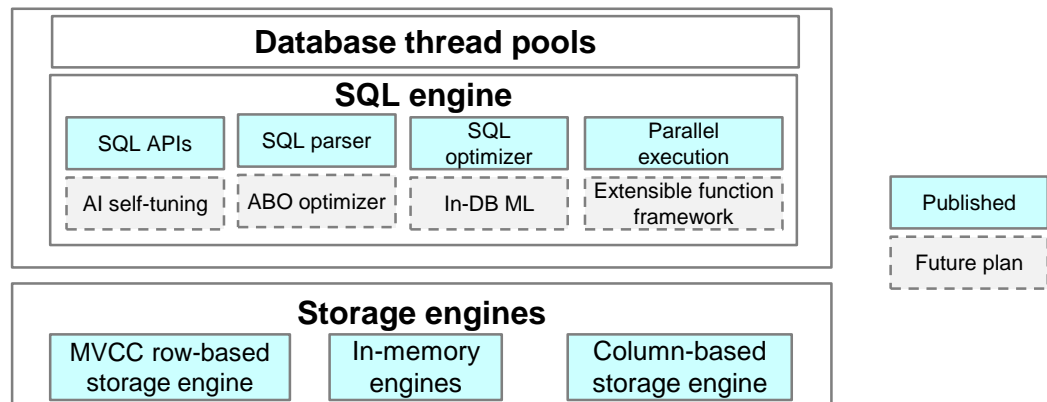
Client drivers — CLI, JDBC, ODBC	**Tools**

Thread management
- Service processing thread pools
- Log write threads
- Data page write threads
- Checkpoint threads
- Statistics threads
- Log sending threads
- Log receiving threads
- Cleanup threads
- Archive threads
- Management thread

Communication management
- Communication protocol processing
- Processing of control command signal

SQL engine
- SQL parser
- SQL query rewriting
- SQL tuning
- SQL execution
- DDL command processing
- Stored procedure parsing

Storage engine
- Row-based storage (local update)
- CSN snapshots
- Large memory buffer management
- Log management
- Row-based storage (rollback segment update)
- Free space management
- Index management
- Parallel log replay
- Column-based storage
- Lock manager
- Storage management adaptation
- Incremental check points
- Memory tables
- NUMA-based data structure

Security
- Identity management
- Access control
- Communication encryption
- Auditing

Common components
- Data dictionaries
- Memory management
- Data type
- Built-in functions

Tools
- Client command line tools
- Instance control tools
- Physical backup/rest-oration tools
- Logic import and export tools
- OM installation
- CM monitoring

Hardware & OS platforms — ARM + openEuler, X86 + CentOS

- **openGauss is derived from PostgreSQL 9.2 and PG XC and in-depth modification has been performed.**
- **openGauss has a total of 1,200,000 lines of code.**
  - **There are 950,000 lines of kernel code. In the kernel, 700,000 lines of core code are modified and added.**
  - **250,000 lines of PostgreSQL interfaces and common functions are reserved.**
- **openGauss is not simply an enhanced version of PostgreSQL. It focuses on the optimization of the architecture, transactions, storage engines, optimizers, and Kunpeng processors. It fundamentally resolves the defects brought by the native architecture of PostgreSQL through in-depth reconstruction.**
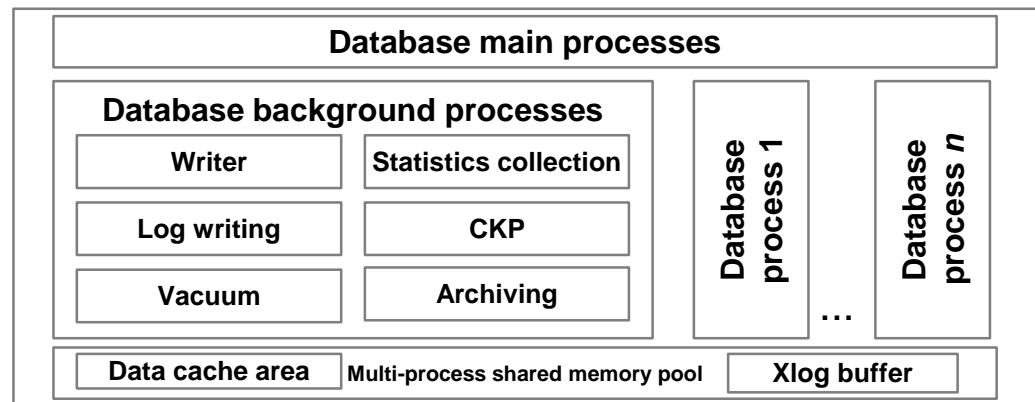
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Key Technologies of openGauss

- **openGauss is derived from PostgreSQL-XC, and its logical architecture is similar to that of PostgreSQL.**
- **openGauss and PostgreSQL are fundamentally different in their architectures and key technologies, especially in the storage engines and optimizer capabilities.**
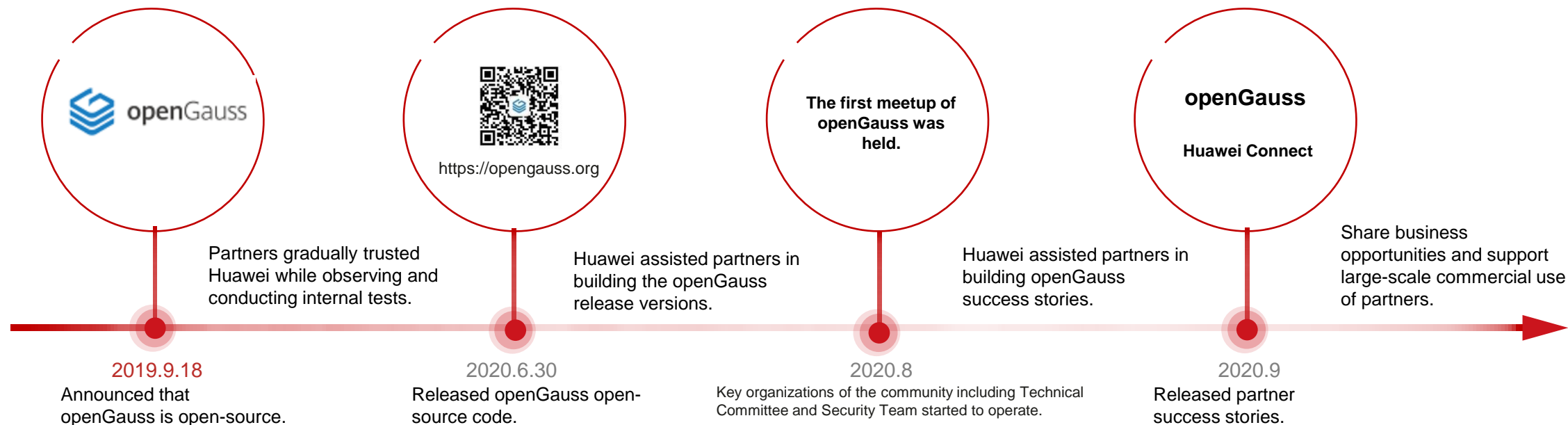
openGauss architecture

Database thread pools

SQL engine

SQL APIs	SQL parser	SQL optimizer	Parallel execution
AI self-tuning	ABO optimizer	In-DB ML	Extensible function framework

Published

Future plan

Storage engines

MVCC row-based storage engine	In-memory engines	Column-based storage engine

PostgreSQL architecture

Database main processes

Database background processes

Writer	Statistics collection
Log writing	CKP
Vacuum	Archiving

Database process 1

Database process *n*

…

Data cache area | Multi-process shared memory pool | **Xlog buffer**

Key Differentiation Factors		openGauss	PostgreSQL
Runtime model	Execution model	Thread pool model, which features low switchover cost during high-concurrency connections, low memory consumption, and high execution efficiency	Process model: The database process uses the shared memory to implement communication and data sharing. Each process corresponds to a concurrent connection, which causes performance loss during switchover and multi-core scalability problems.
Transaction processing mechanism	Concurrency control	64-bit transaction ID. CSN is used to resolve the dynamic snapshot expansion problem. The NUMA-Aware engine is optimized to resolve the bottlenecks in PostgreSQL lock mechanism.	Transaction ID rollback. The long-term running performance fluctuates greatly due to the ID reclamation period. The PostgreSQL lock mechanism has bottlenecks in transaction execution efficiency and multi-processor multi-core scalability.
	Logs and checkpoints	The incremental checkpoint mechanism ensures that the performance fluctuation is less than 5%.	Full checkpoint makes the short-term performance fluctuation be more than 15%.
	Kunpeng NUMA	NUMA reconstruction, cache-line padding, and native spin-lock	The multi-core capability of NUMA is weak. The TPMC of a single server with two-socket CPUs is less than 600,000.
Data storage and organization	Multiple engines	Row-based storage, column-based storage, and memory engines. DFV storage and in-place update are being developed.	Only row-based storage is supported.
Query optimizer	Optimizer	CBO is supported and the optimization capabilities in large enterprise scenarios such as ICBC are adopted.	CBO is supported. However, the optimization capability in complex scenarios is mediocre.
	SQL parser	ANSI/ISO standard SQL92, SQL99, SQL2003, and enterprise extension package	ANSI/ISO standard SQL92, SQL99, and SQL2003

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Roadmap of the openGauss Community

The first meetup of openGauss was held.

https://opengauss.org

openGauss

Huawei Connect

Partners gradually trusted Huawei while observing and conducting internal tests.

Huawei assisted partners in building the openGauss release versions.

Huawei assisted partners in building openGauss success stories.

Share business opportunities and support large-scale commercial use of partners.

2019.9.18
Announced that openGauss is open-source.

2020.6.30
Released openGauss open-source code.

2020.8
Key organizations of the community including Technical Committee and Security Team started to operate.

2020.9
Released partner success stories.

Official website: https://opengauss.org/en/

openGauss organization repository: https://gitee.com/opengauss
openGauss image repository: https://github.com/opengauss-mirror

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openGauss Community: Active Community with Continuously Improved Content

Operation data

From June 30 to July 26:

➢ Visits to the official website: 196,444

➢ Number of visitors to the official website: 15,789

➢ Number of videos views on the official website: 48,008

➢ Number of downloads of installation packages on the official website: 10,369

数据库介绍

[北京] openGauss Meetup
构建企业级开源数据库生态

openGauss性能调优

https://opengauss.org/en/events.html

https://opengauss.org/en/video.html

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openGauss Partner Benefits: MulanPSL v2

	MulanPSL	BSD 3-clause License	Apache License V2.0
Declaration obligations	The license is delivered with the product, and disclaimers are retained.	1. The license is delivered with the product, and disclaimers are retained. 2. Licenses and disclaimers are provided for other use.	1. A license is delivered with the product. 2. When distributing the revised version, the revised documents should be clearly stated. 3. All statements are retained when the modified source code is distributed. 4. If the licensed software contains a notice, the ownership statement must be included in the notice when the revised version is distributed.
Patent licensing	1. The original licensor and its associated entities provide patent licensing. 2. Subsequent contributors and associated entities provide patent licenses.	No specific patent license	1. The original licensor provides the patent license. 2. Subsequent contributors and associated entities provide patent licenses.
Restrictions on users' patent rights protection	1. The patent licensing is terminated when the user and its associated entities directly file a patent lawsuit against the licensed software. 2. The patent licensing is terminated when non-litigation rights defenses (such as administrative rights defense) are initiated. 3. The patent licensing is terminated when the above actions are indirectly initiated.	None	If the user and its associated entities directly file a patent lawsuit against the licensed software, the patent licensing is terminated.
Copyright	1. The original copyright owner and its associated companies provide the copyright licenses. 2. Subsequent contributors and their associated entities provide the copyright licenses.	Copyright licensing is provided by all contributors.	1. The original licensor provides the copyright license. 2. Subsequent contributors and their associated entities provide the copyright licenses.
Trademark licensing	None	None	None

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Comparison of Common Open-source Database Protocols

Open-source Database	License
MySQL	GPL v2
MariaDB	GPL v2
PostgreSQL	PostgreSQL
TBase	BSD 3-Clause
TiDB	Apache 2.0

Open-source licenses

BSD licenses

- BSD license
- FreeBSD
- MIT license
- Apache license
- X11 license
- OpenSSH license
- **MulanPSL license**
- ...

Random business integration is allowed.

MPL licenses

- NOSL V1.0
- IPL V1.0
- Sun Public License
- Nokia Open Source License
- NPL
- CDDL
- EPL

The modified source code must be disclosed.

GPL licenses

- GNU GPL
- Qt Non-Commercial License
- LGPL

Infectious, business-unfriendly

PostgreSQL is released under the PostgreSQL License, a liberal Open Source license, similar to the BSD or MIT licenses.

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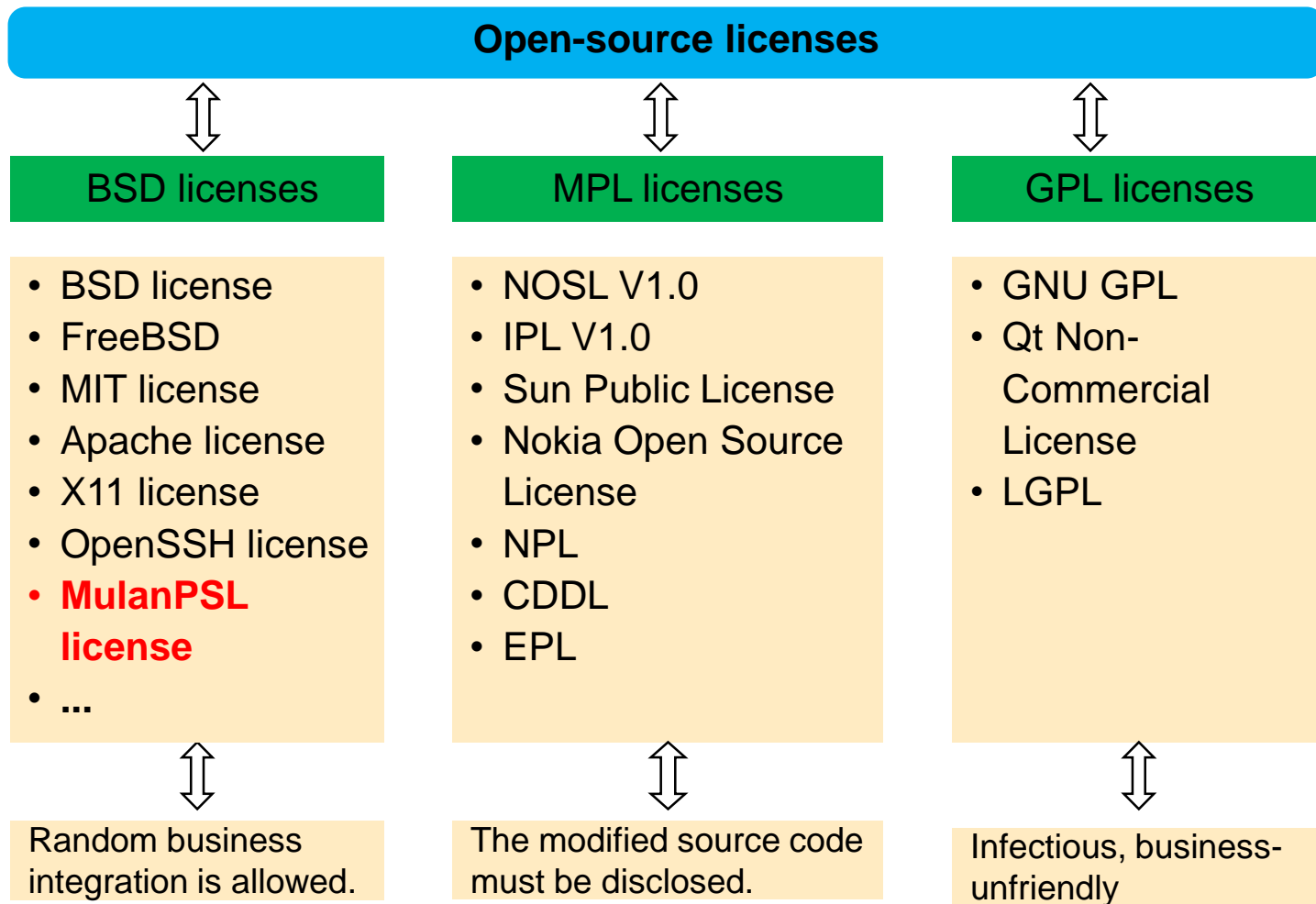
Multiple Cooperation Modes Meet Partners' Requirements

Cooperation Mode	Business Value	Maintenance and Service Mode
Mode 1: Partners release commercial products of their own brands based on the source code of the openGauss community.	The enterprise-class OLTP database capability of openGauss is used to quickly build a commercial edition.	Partners of the release version directly provide maintenance and services for customers, and openGauss provides community-based support.
Mode 2: ISVs cooperate with release vendors in mode 1 to integrate the openGauss commercial release into their solutions.	The technical competitiveness of ISVs' solutions is enhanced and the solution costs are reduced.	Partners of the release vendors in mode 1 provide maintenance and services for customers indirectly or directly, and openGauss provides community-based support.
Mode 3: ISVs directly integrate the openGauss community edition into their solutions.		**Method 1**: ISVs directly provide maintenance and services for customers, and openGauss provides community support. **Mode 2**: The partners of the release version in mode 1 provide maintenance and services for customers, and openGauss provides community-based support.
Mode 4 The partner's self-developed database product remains unchanged, and only some openGauss source code is referenced.	The source code of openGauss can be referred to enhance the competitiveness of self-developed products.	Partners directly provide maintenance and services for customers.

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Thank You.

WeChat account

openGauss community assistant

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