AI for Service Innovation of Medical Imaging Systems

Challenges in Compliance and Operation

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innovation you

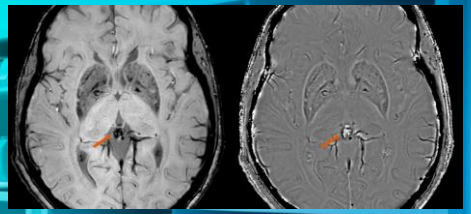
Philips MRI scanner
Ingenia 3.0T

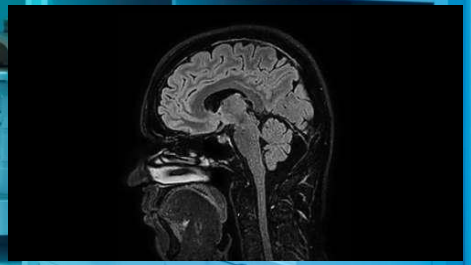
4600 Kg

Occupies 3 rooms:
- Examination (this picture)
- Operations
- Technical

Superconducting magnet cooled with liquid Helium at –269.15 °C

Millions of lines of code





Philips IGT Azurion

Occupies 2 rooms:
- Examination (this picture)
- Technical

6+1 degrees of freedom

Our customer needs

- Optimal clinical performance
- Predictable system operations
- Predictable cost of ownership

Strategic intent

Zero unplanned system downtime

PHILIPS Healthcare

Aiming for zero

At Philips we understand that providing care today means more than just providing technology. It is about making every investment worthwhile and every usable moment count. That's why we are dedicated to working with you to reduce unplanned downtime.

Three ways of increasing your uptime:

1. Reactive customer call handling and maintenance service

Customer informs Philips of a problem experienced with the product. Philips will diagnose the problem remotely and if possible resolves the issue remotely. Otherwise a field service engineer will be dispatched with guidance and needed parts for a single visit repair.

2. Alert response

Alerts that are generated by the device itself or equipment installed at the hospital facility indicating that critical system and/or environmental parameters and conditions are out of specification.

3. Proactive monitoring

By means of data analytics algorithms, machine and service data is constantly analyzed to identify patterns and trends. These notifications are predictive in nature, enabling a service action to be scheduled in advance without interrupting regular clinical workflow.

Predictive maintenance is on the rise. We envision that, by 2018, **one in every five system service events** will be triggered by careful analysis of system data - and will therefore take place before any major issues arise. This maintenance can also be planned so there is no disruption to your workflow.

dedicated monitoring engineers are constantly on the lookout for issues that may impact your uptime

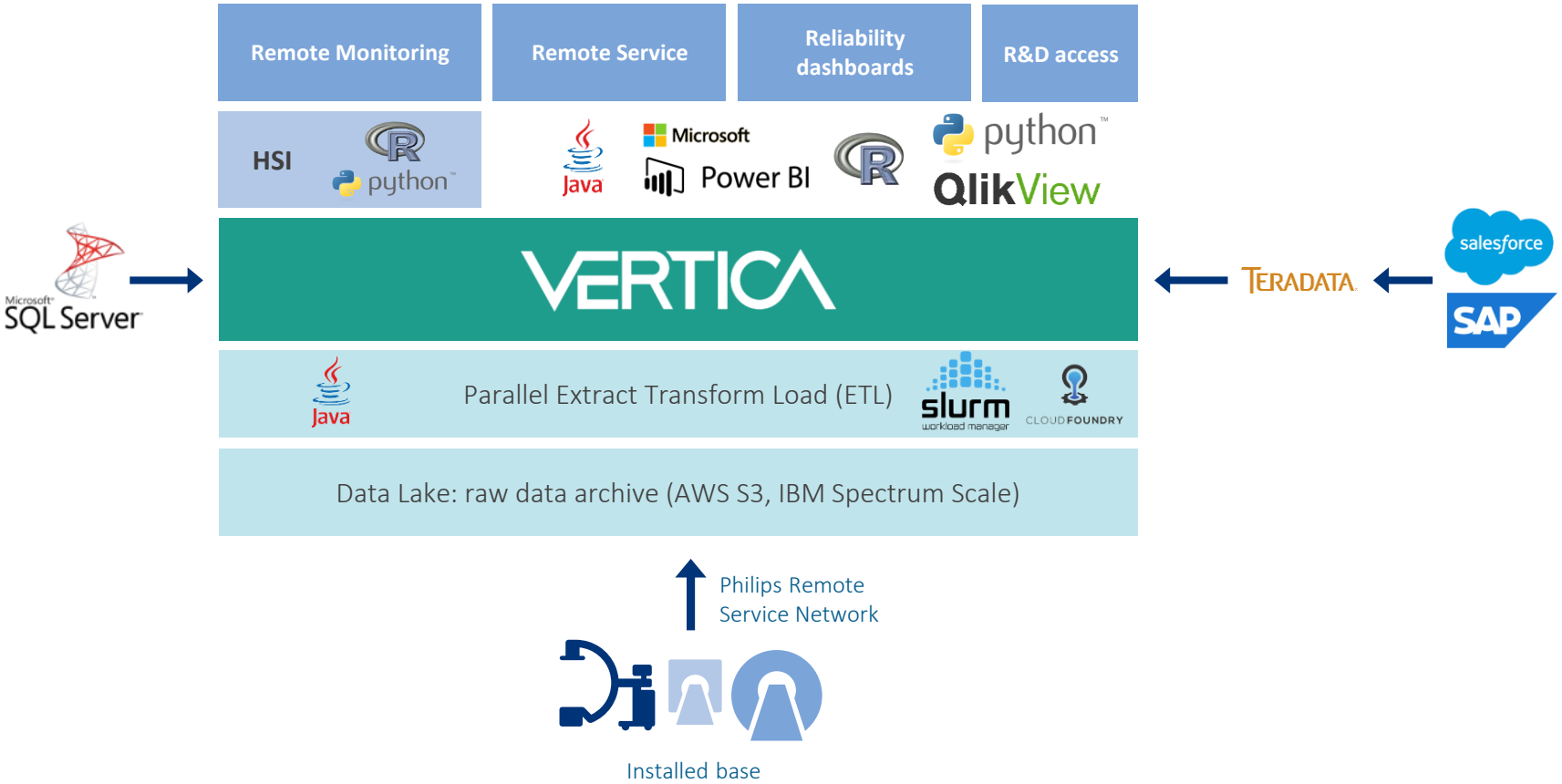
>12,000
Philips imaging systems are monitored daily to identify patterns that could indicate preventive action is required

10,000+
cases are proactively handled every year by our centralized monitoring team to reduce unnecessary downtime

central monitoring locations in major time zones help resolve your problems quickly and effectively

Learn more at **www.philips.com/aimingforzero**

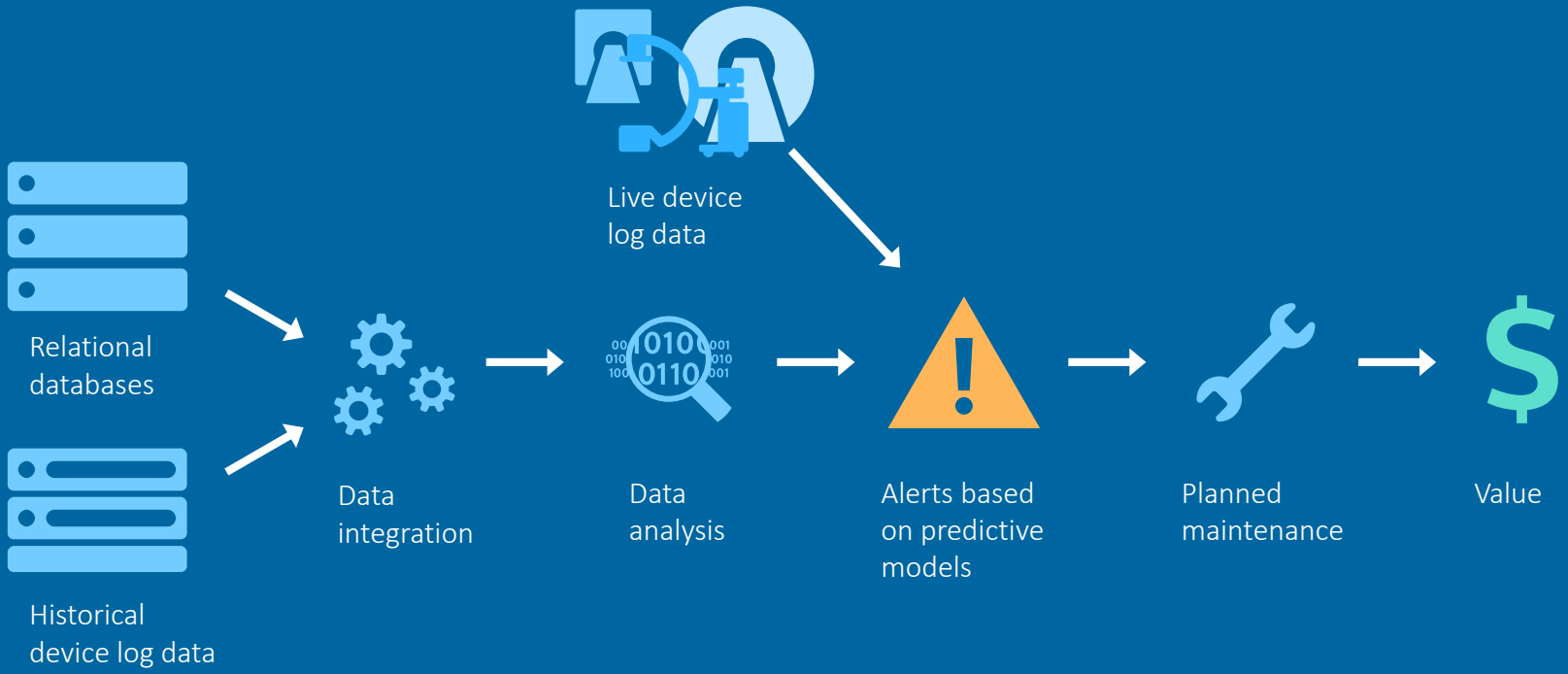
High-level architecture



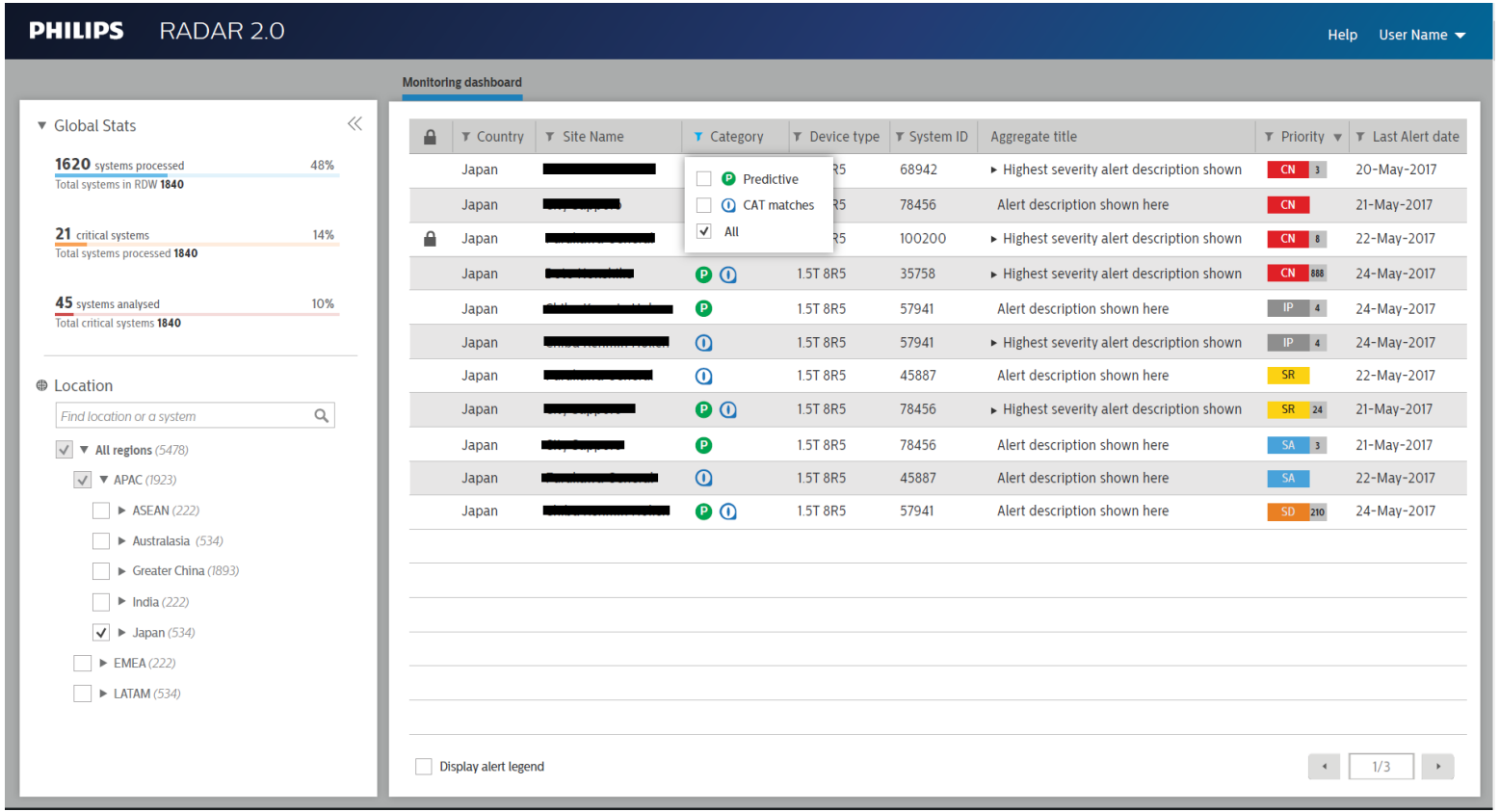
Data integrated

- 1.5 PB in hundreds of tables
- 3 trillion data points
- More than 80 different data sources integrated for the complete connected installed base including CRM system, SAP, factories, repair shops
- 3-9 years of historical data
- 24/7 live data feeds

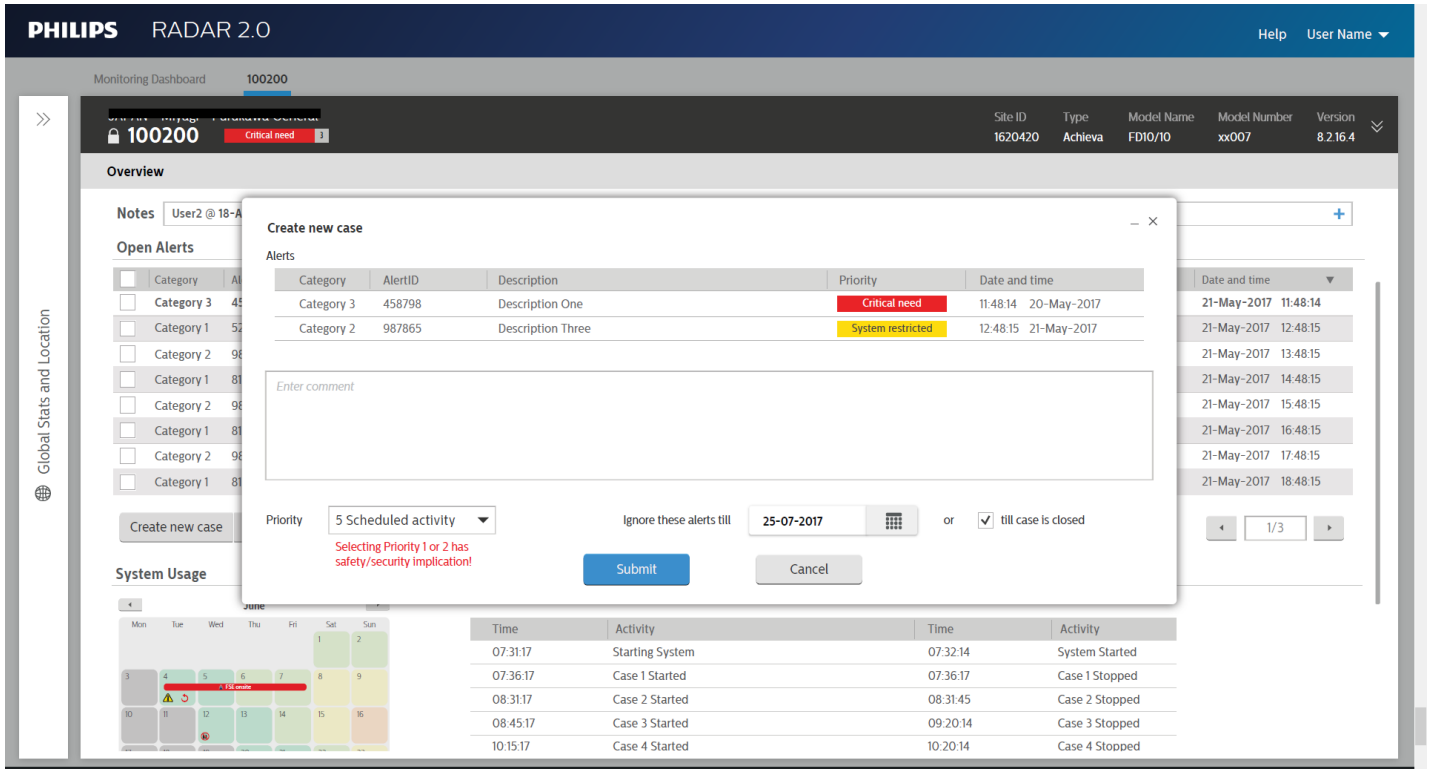
Use case 1: proactive maintenance



Remote monitoring dashboard

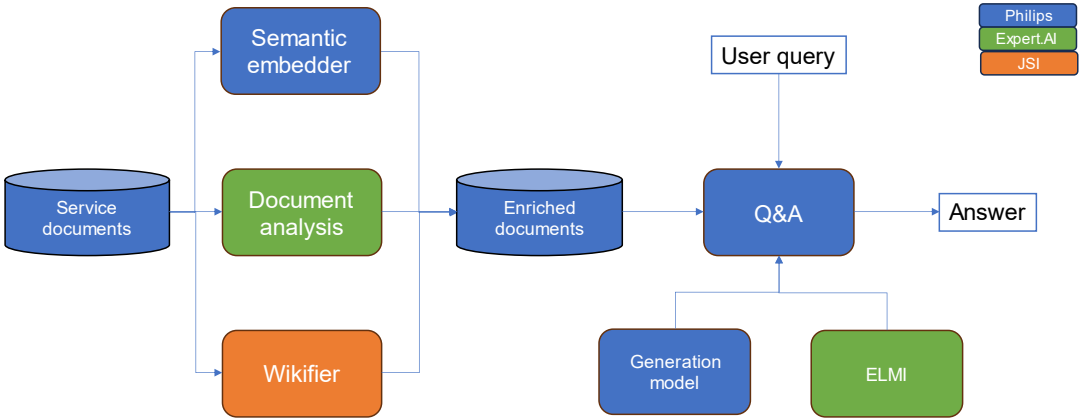


Remote monitoring dashboard



Use case 2: Knowledge search using GenAI

- Problem: find relevant information given a problem in service documentation
- Approach: information extraction & enrichment, search and Q&A using LLM
- Challenge: (pdf) documents contains domain specific languages, tables and figures, customize GenAI solution to domain specific use case



# Samples	Retrieval		Question answering		
	Recall@top5	MRR	Correct (%)	Partially correct (%)	Wrong (%)
55	1	0.92	78.17	12.73	9.09

Supported by enrichMyData

Challenge in compliances

- Servicing of medical devices is regulated by government agencies (FDA, EMA, NMPA etc.)
  - Servicing is “the repair and/or preventive or routine maintenance of one or more parts in a finished device, after distribution, for purposes of returning it to the **safety** and **performance specifications** established by the OEM and to meet its **original intended use**.” [FDA]

Challenge in compliances

- Data capture & pipeline:
  - Data capture needs to be compliant on privacy and availability
  - Balance these aspects with regulatory obligations and Philips' intellectual property interests

- AI applications:
  - Model selection/reuse
  - Traceability
  - Trustworthiness
  - Explainability
  - Reliability
  - Data quality

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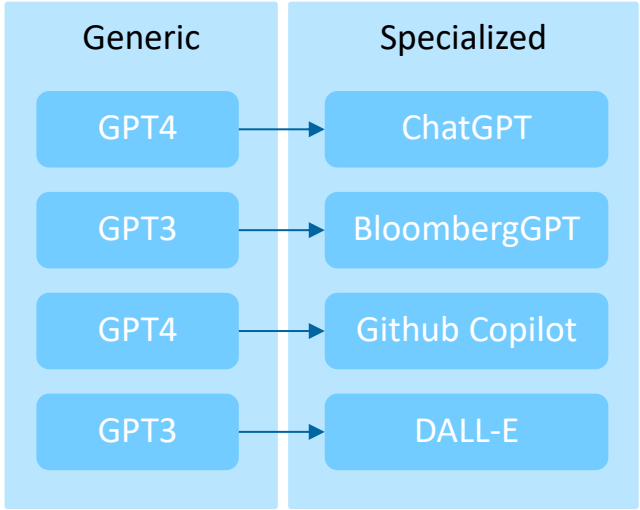
Challenges in development and operation for GenAI solutions

- **Specialized** models for **specific** tasks
- Specialization achieved by additional domain-specific data and/or modified model architecture
- Multiple deployment options
  - **Private APIs** (e.g. OpenAI ChatGPT)
  - **Cloud APIs** (e.g. AWS Bedrock – models by Anthropic, Stability AI etc)
  - **Self-hosted** (e.g. Meta LLaMa2)

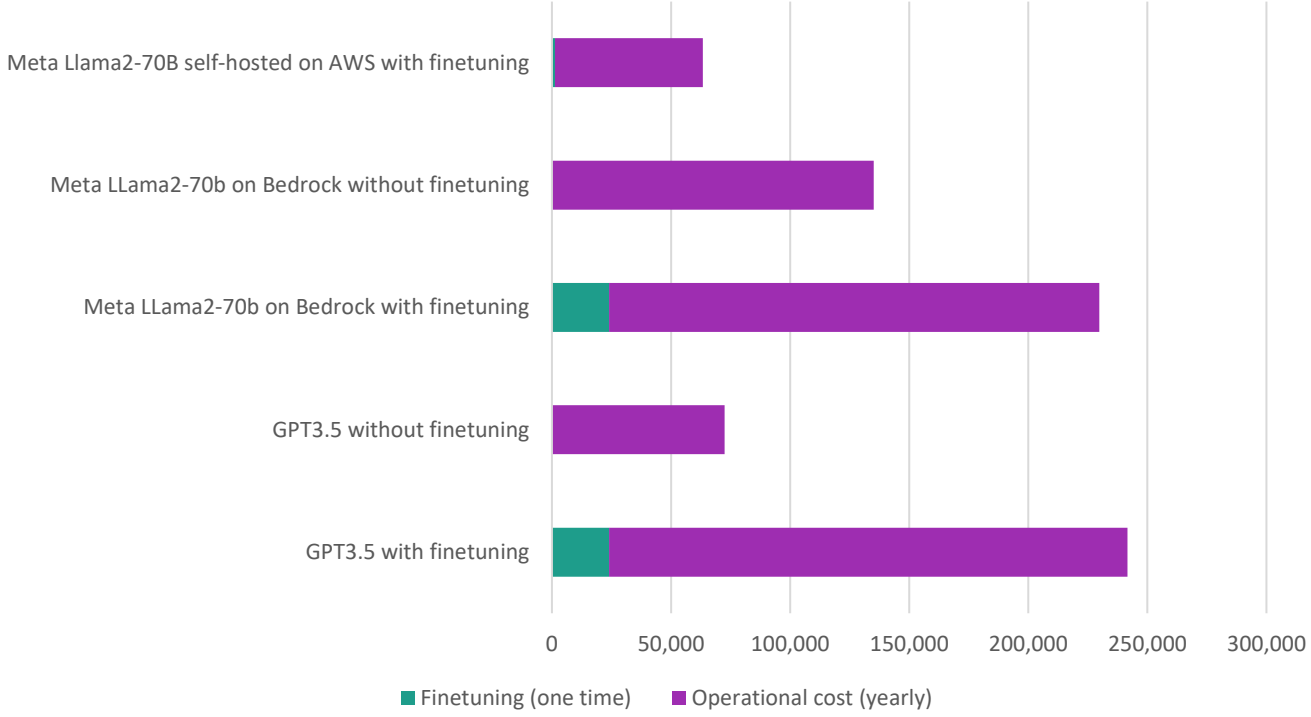


Customization of GenAI model for specific tasks/domain

- Implementation on new tasks (e.g. new domain) requires adaptation

	Prompting	Finetuning
What	Changing/extending prompt to steer LLM or to include supplementary data	Re-training of (a portion of) the model with additional data
Pros	• Fast to implement • No (re)training • No technical expertise required	• High adaptability • Better performance • Can learn from large dataset
Cons	• Prompt size limits additional data • Limited adaptability • Hallucinations	• Requires additional data • Computationally expensive • Requires deep technical expertise
When	• Same or similar tasks/data • Fast prototyping	• Novel task • Novel domain • High precision

Cost analysis for development and deployment



Input parameters	
Training	
# Training tokens	1000000000
# Training epochs	3
Inference	
Average #requests per hour	1800
Average #input tokens per request	4000
Average #output tokens per request	300

Thank you!

- If you are interested in collaboration, please reach out to q.gao@philips.com

enRichMyData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