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Performing AI guided real-time colonoscopy over a 5G network

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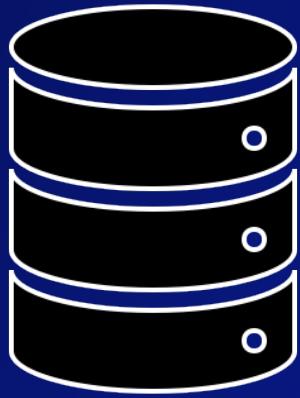
AWS India

Agenda

- AWS healthcare solutions
- AI in medical imaging & investigative procedures
- Architecture patterns for ultra-low latency
- Architectural patterns for AI inference at the Edge
- Real-time Polyp detection during colonoscopy

Healthcare data challenges

Calendar year 2023



118 Zettabytes

1 ZB = 1 trillion GB

30%
of the world's
data is from
healthcare

90%
of healthcare data
is from medical
imaging

Source:

TechJury – world's data volume

RBC Capital Markets – 30%: https://www.rbccm.com/en/gib/healthcare/episode/the_healthcare_data_explosion

GE Healthcare – 90%: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019-chapter8.pdf

AWS healthcare AI services

AWS for Health is a curated collection of solutions and services designed to help innovation by focusing on key use cases that will provide the most value to healthcare providers and patients.



Amazon Comprehend Medical

Understand medical context with advanced text analytics using natural language processing



Amazon Transcribe Medical

Automatically convert medical speech to text



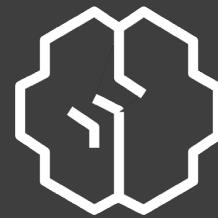
Amazon HealthLake

Store, transform, query, and analyze health data in minutes



Amazon Genomics CLI

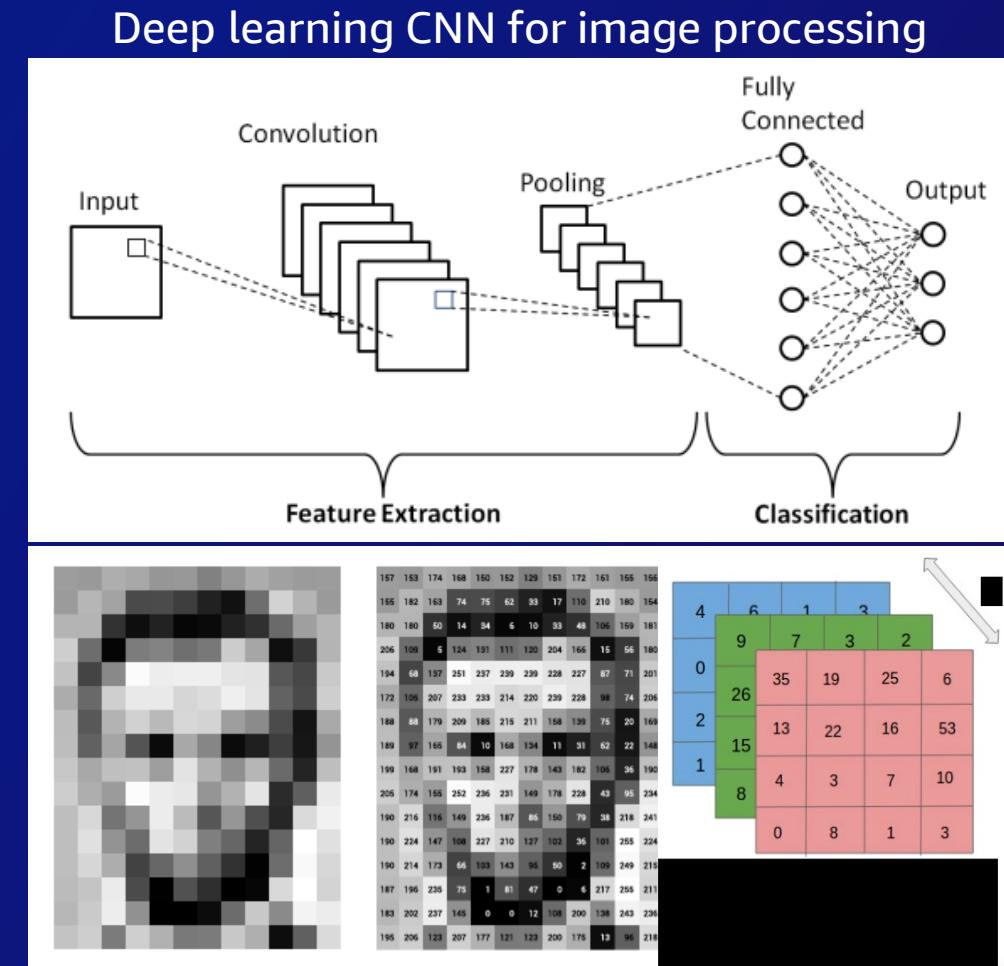
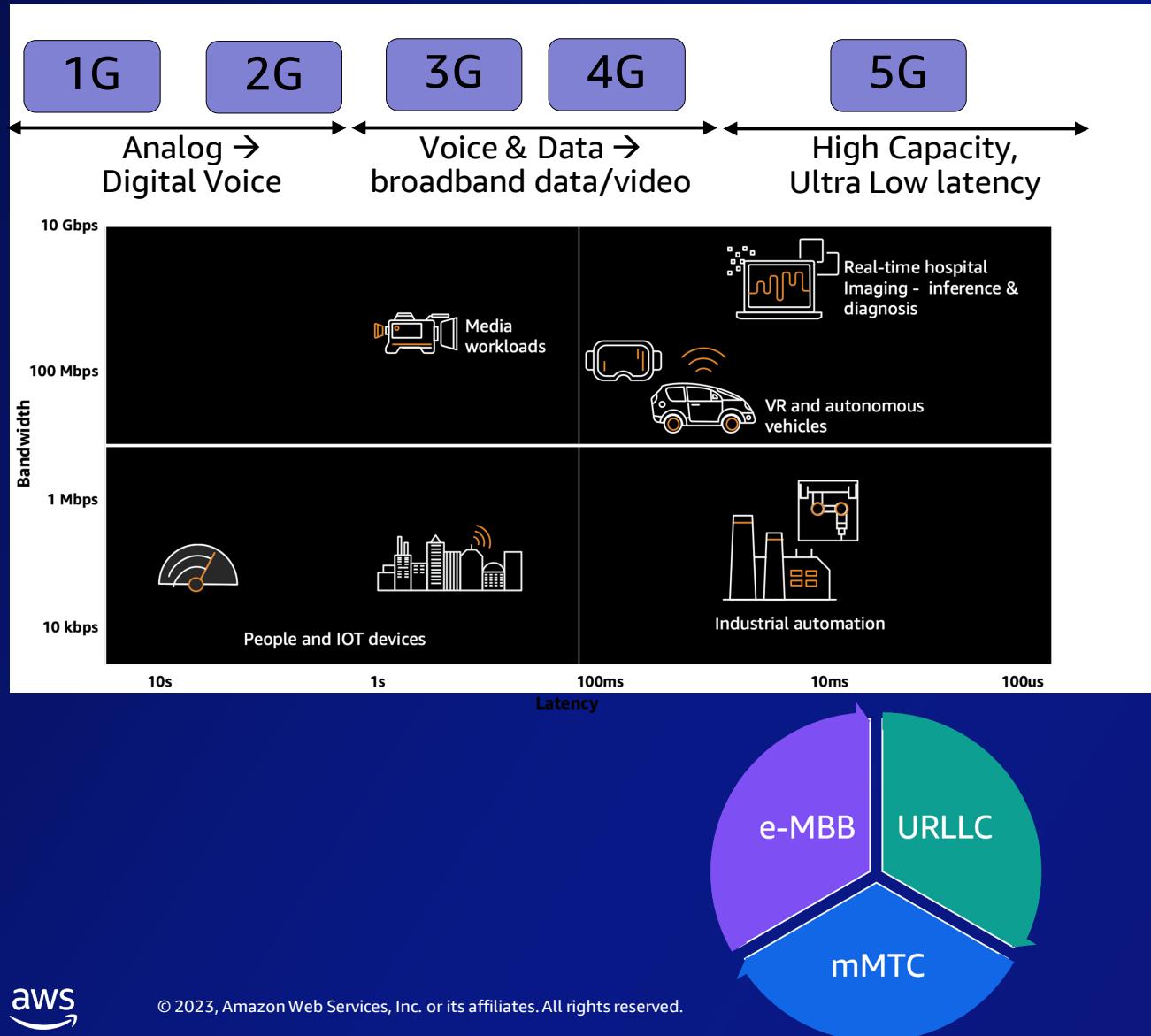
Easily and efficiently process raw genomics and biological data in the cloud



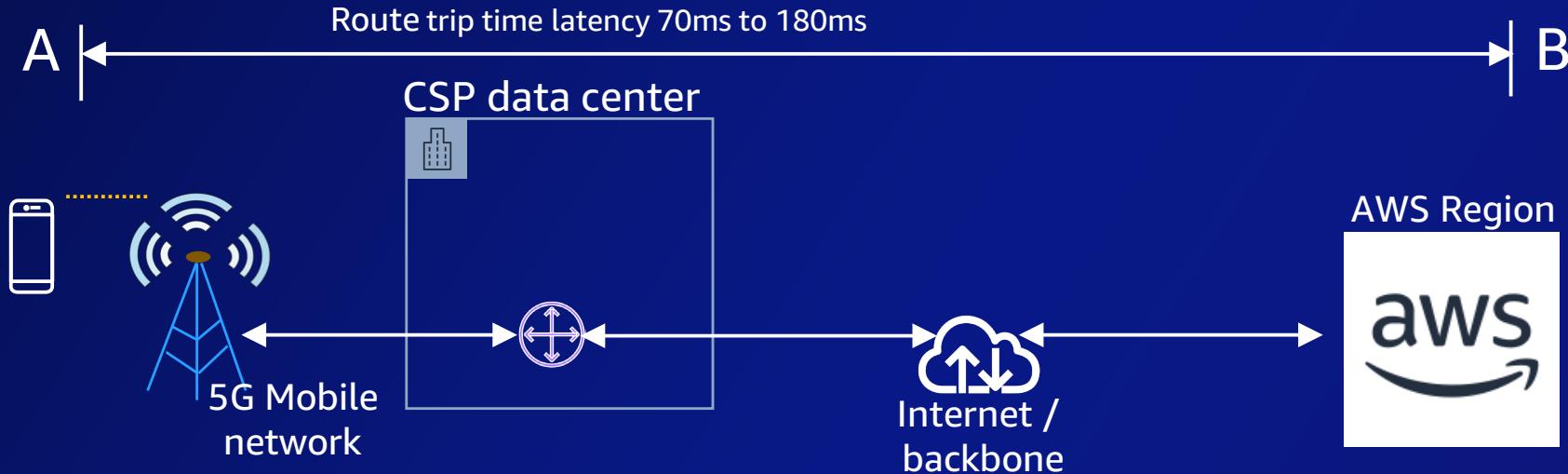
AI in Medical Imaging & Endoscopy

AI solutions for biomedical investigative procedures on AWS

AI in medical imaging

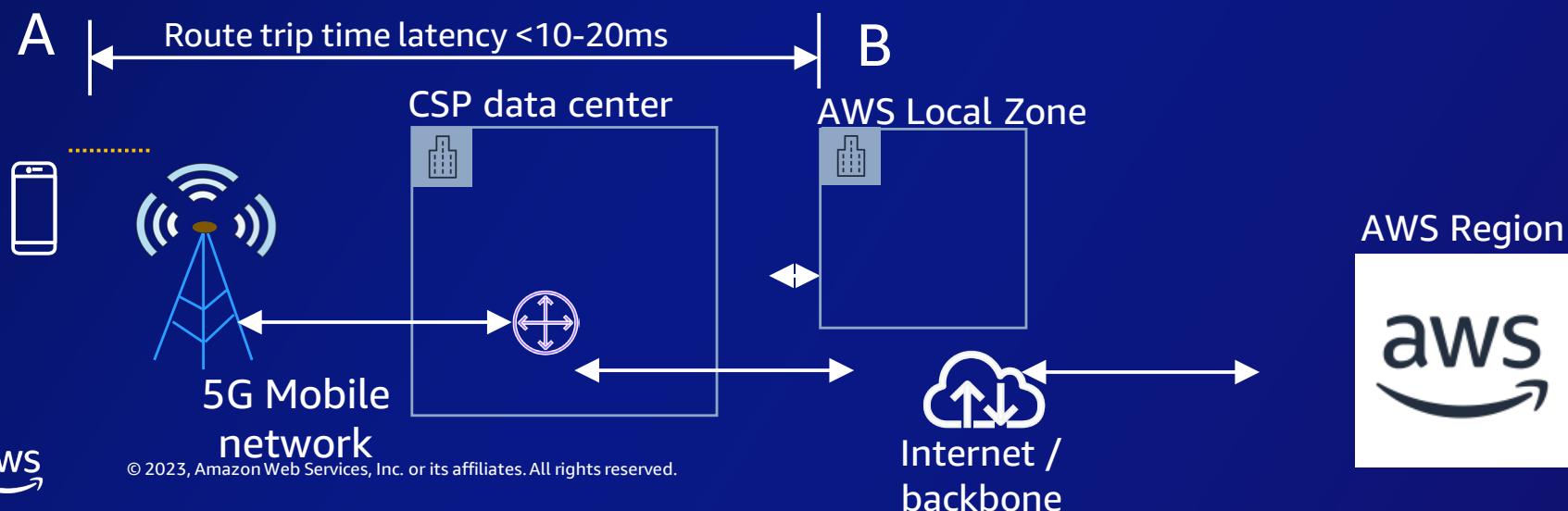


Edge: patterns for ultra-low latency



Latency from mobile end device to AWS Region:

- Depends on the hops over the internet
- Not predictable



Latency from mobile end device to AWS Local Zone:

- Fewer hops
- Geographically closer
- Predictable

AWS for the edge

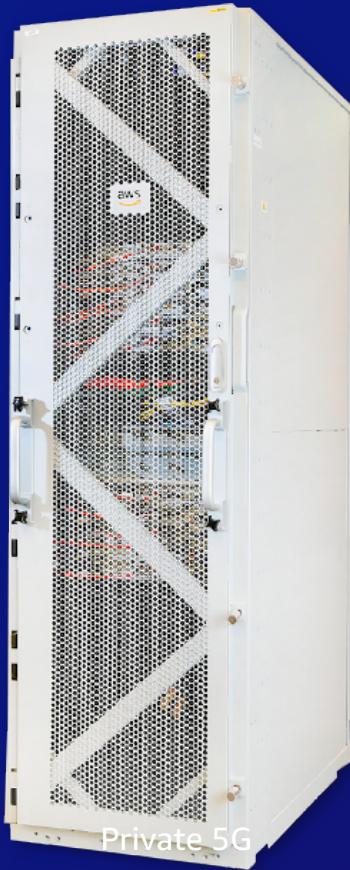
5G mobile infrastructure



AWS Zone in large metro center



AWS Snow Family



AWS Outpost Family

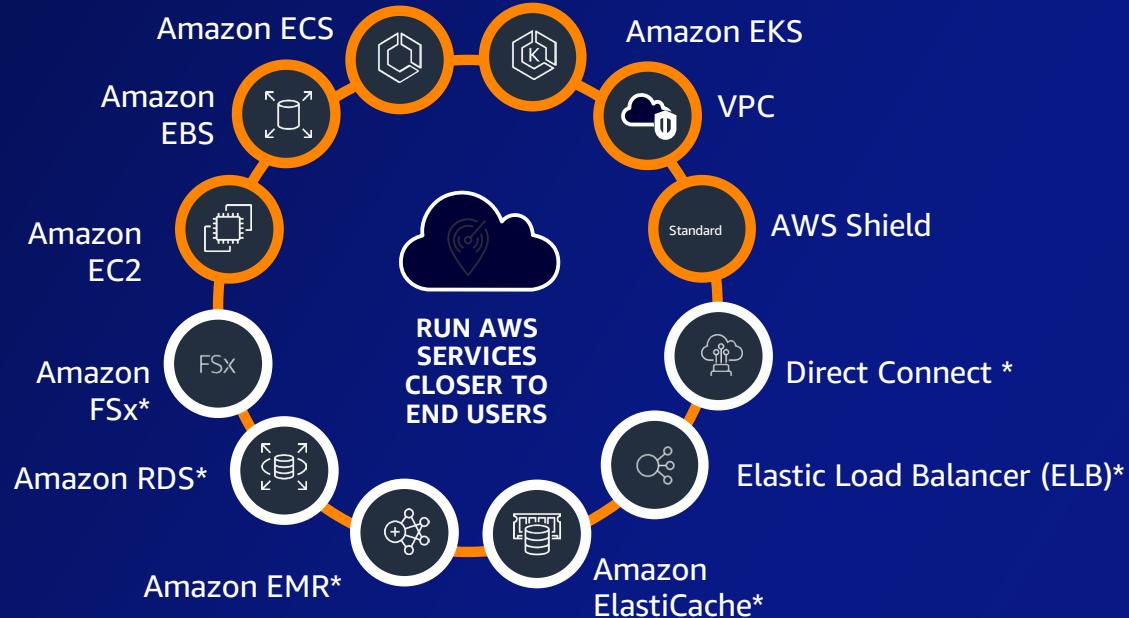


AWS Cloud for Edge

Rugged Edge

AWS Cloud for On-premises

AWS local zones & snowball edge



Services available in Local Zones

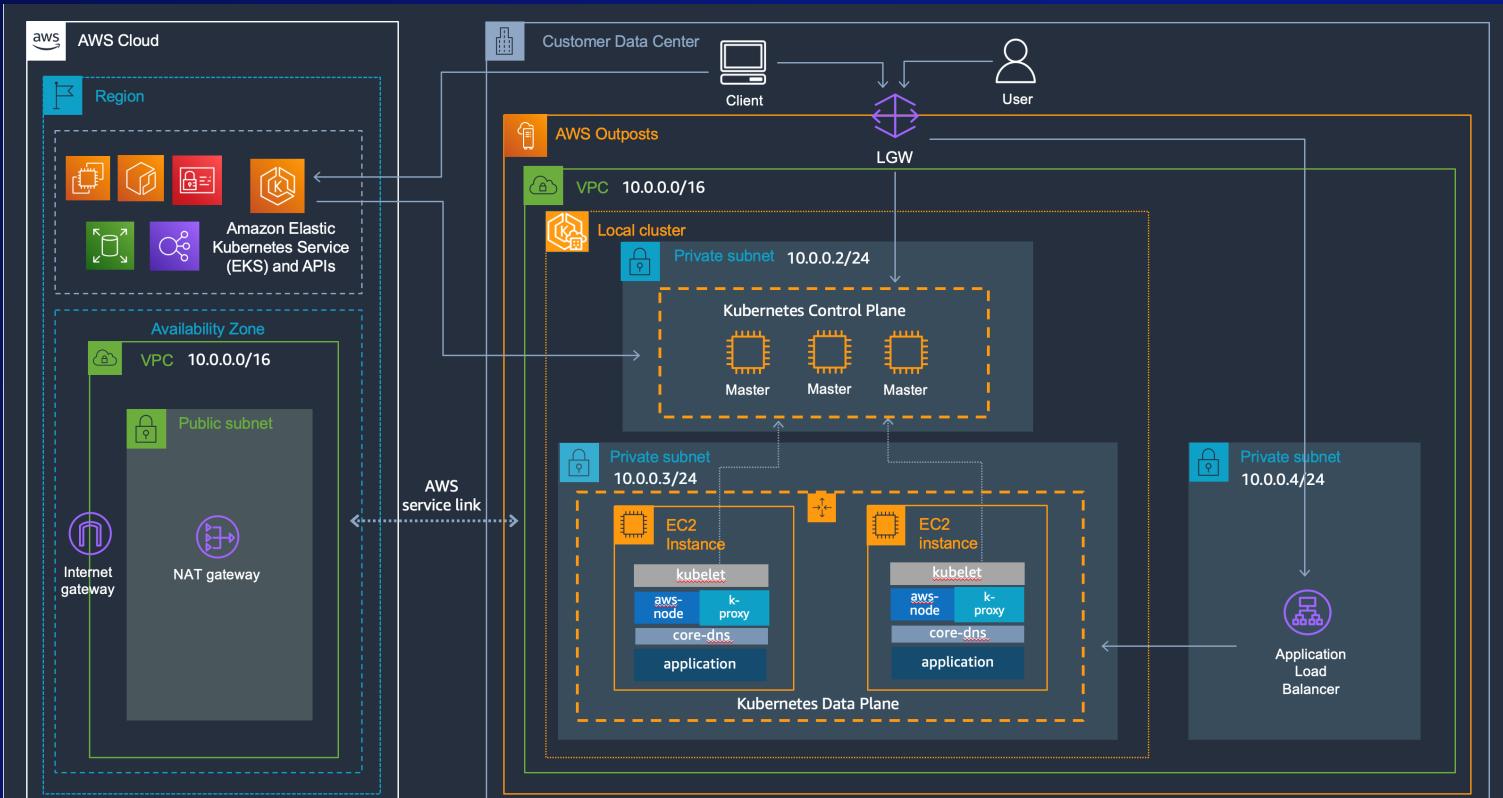
*Upcoming services not currently available in all Local Zones



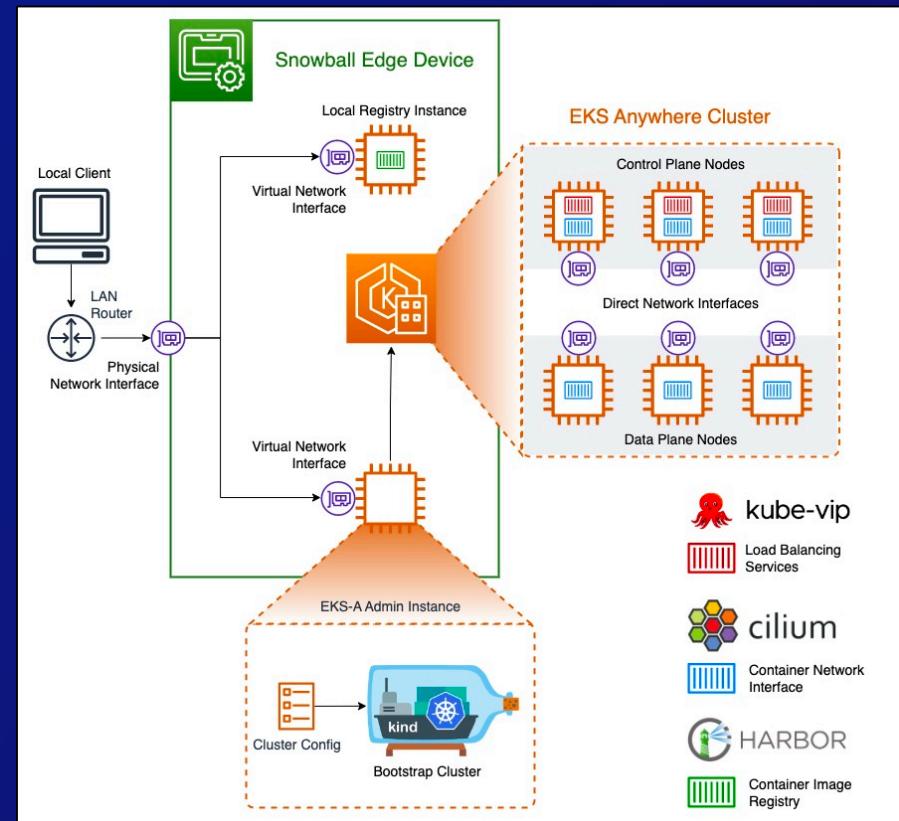
Snowball Edge Compute Optimized

- Portable, rugged, and secure edge computing and data transfer device
- Up to 104 vCPUs
- Up to 512 GiB Memory
- nVIDIA Tesla V100 GPU
- 42TB SSD storage

Amazon EKS at the edge



Amazon EKS cluster on Outpost



Amazon EKS Anywhere cluster on Snowball

Architecture patterns for ML inference at the edge

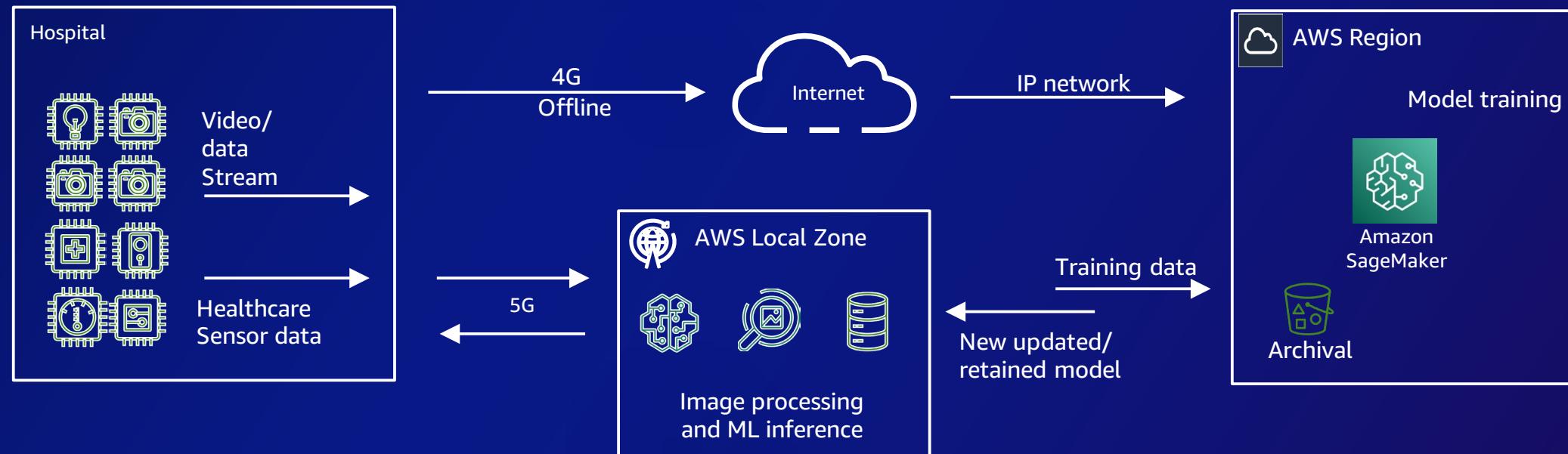
Use case: Real-time diagnosis during radiology/ endoscopy procedures

Latency: Low latency (<20 ms)

Network quality of service (QoS): Consistent bandwidth with QoS is required

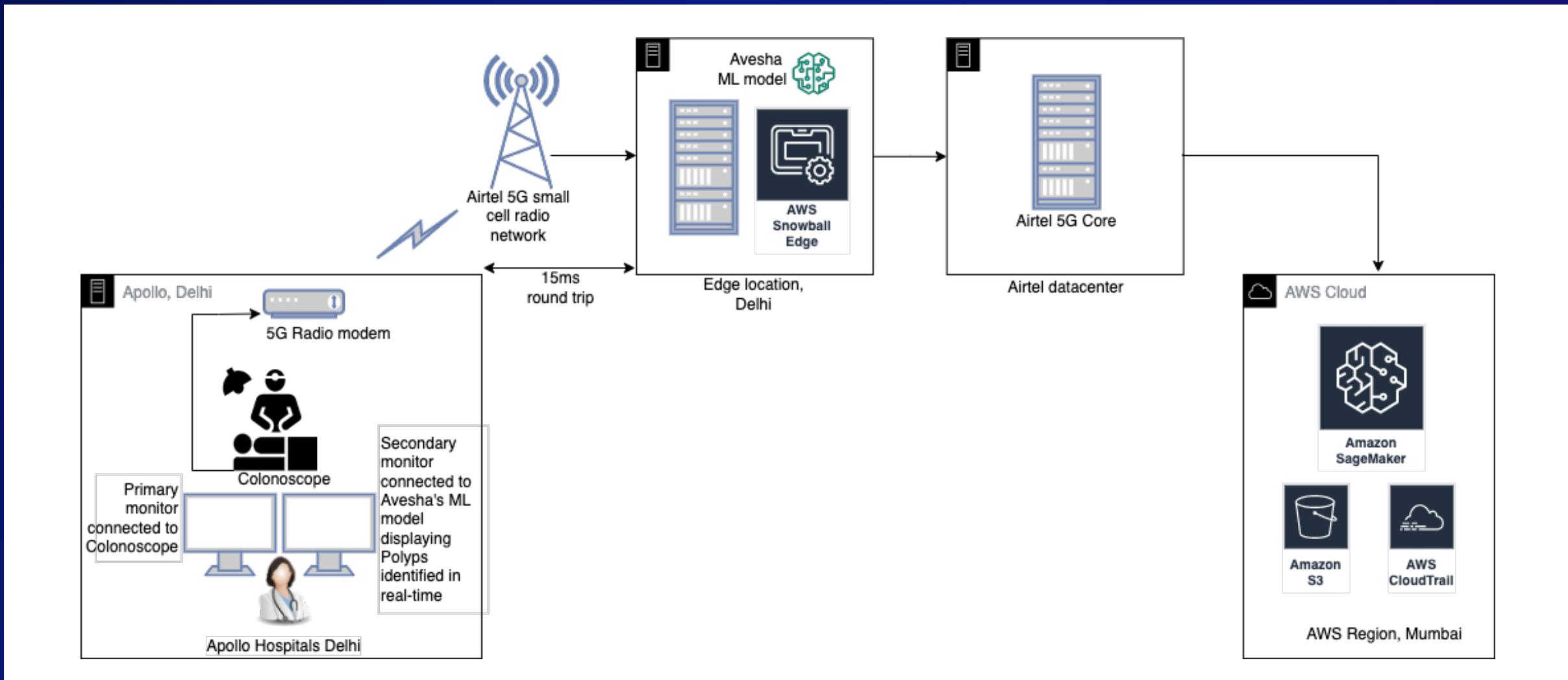
Platform: Overlaid on live streams, inference consumed by diagnostic apps

Devices: Radiology and imaging sensors at the hospital



Architecture - Colonoscopy inference at the edge

PROOF OF CONCEPT AT APOLLO HOSPITALS, DELHI IN PARTNERSHIP WITH AIRTEL AND AVESHA



Actual ML assisted colonoscopy procedure



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About us

Indraprastha Apollo Hospital

Apollo revolutionized healthcare when Dr. Prathap Reddy opened our first hospital in Chennai in 1983. Today Apollo is the world's largest vertically integrated healthcare platform serving over 200 million patients through 10,000 beds across 72 hospitals.

Mission Statement

"Our mission is to bring healthcare of international standards within the reach of every individual. We are committed to the achievement and maintenance of excellence in education, research and healthcare for the benefit of humanity"

Apollo Hospitals	
Hospitals	72
No. of beds	Over 12000
No. of Pharmacies	4500+
No. of Primary Care Clinics	120+
No. of diagnostic centers	700+
No. of Medical education centers and research foundations	Over 15
Presence in countries	120+

What is colonoscopy?

Colonoscopy is a medical procedure used to look for changes — such as swollen, irritated tissues, polyps or cancer — in the large intestine (colon) and rectum.

The goal remains to identify and remove benign neoplastic polyps prior to becoming invasive cancers. Colonoscopy is the most effective screening tool to detect polyps and colon cancer

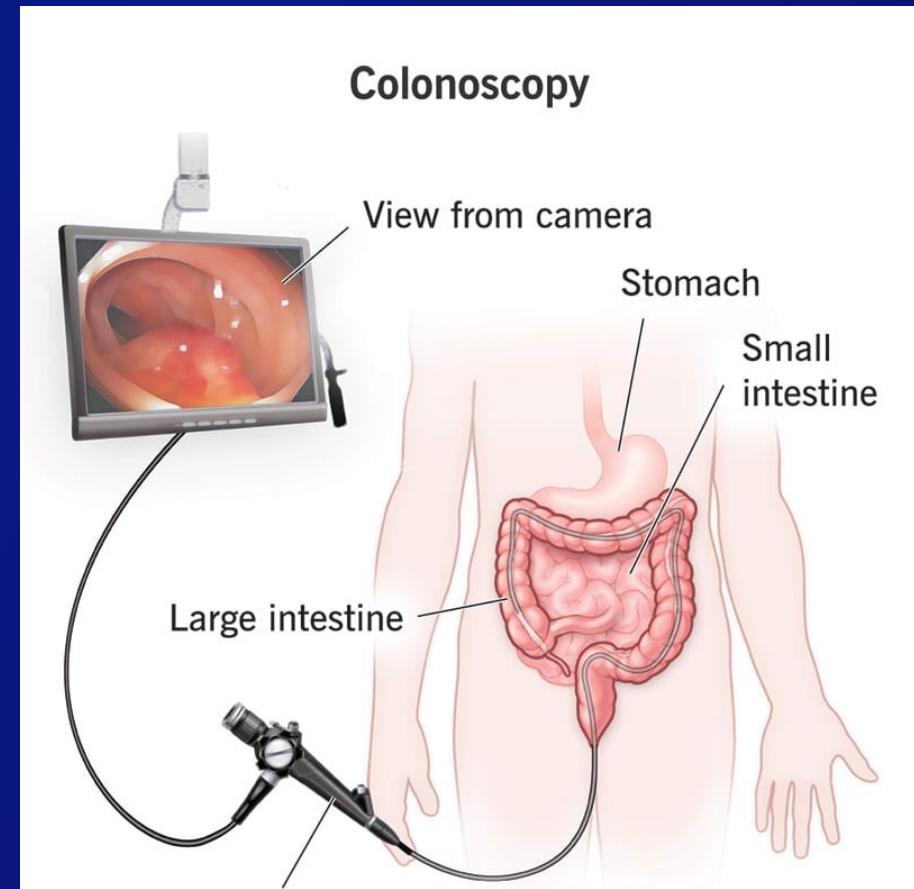


Image source: Cleveland Clinic

Colonoscopy – all about detecting early

Colorectal cancer (CRC) can be prevented as more than 85% of tumours arise in a premalignant polyp. Therefore, the aim of CRC screening is to reduce mortality and, if possible, the incidence of the disease by identifying individuals with pre-symptomatic neoplastic lesions who may require further examination and treatment

Source: NIH Library of Medicine
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3324920/>

Several studies have demonstrated missed polyp rates from 6%-29%, largely due to variations in polyp size. This number can be as high as 40%, even with advanced (>1 cm) adenomas.

Source: NIH Library of Medicine
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3718895/>



Colonoscopy – the evolving future with AI

The screenshot shows a dark blue header with the FDA logo, a search bar, and a menu icon. Below the header, a section titled "IN THIS SECTION" includes a link to "Press Announcements". The main content area is titled "FDA NEWS RELEASE" and features a large, bold headline: "FDA Authorizes Marketing of First Device that Uses Artificial Intelligence to Help Detect Potential Signs of Colon Cancer".

Source: US Food and Drug Administration
<https://www.fda.gov/news-events/press-announcements/fda-authorizes-marketing-first-device-uses-artificial-intelligence-help-detect-potential-signs-colon>

"Artificial intelligence has the potential to transform health care to better assist health care providers and improve patient care. When AI is combined with traditional screenings or surveillance methods, it could help find problems early on, when they may be easier to treat," –

Courtney H. Lias, Ph.D.
Acting director of the GastroRenal, ObGyn,
General Hospital and Urology Devices Office in the FDA's
Center for Devices and Radiological Health.

The computer-aided detection system is not meant to replace lab analyses of retrieved tissue nor to help classify lesions or suggest a proper course of treatment, but to act as an automated second observer to help catch precancerous tissues and smaller, flatter polyps that may slip by unnoticed.

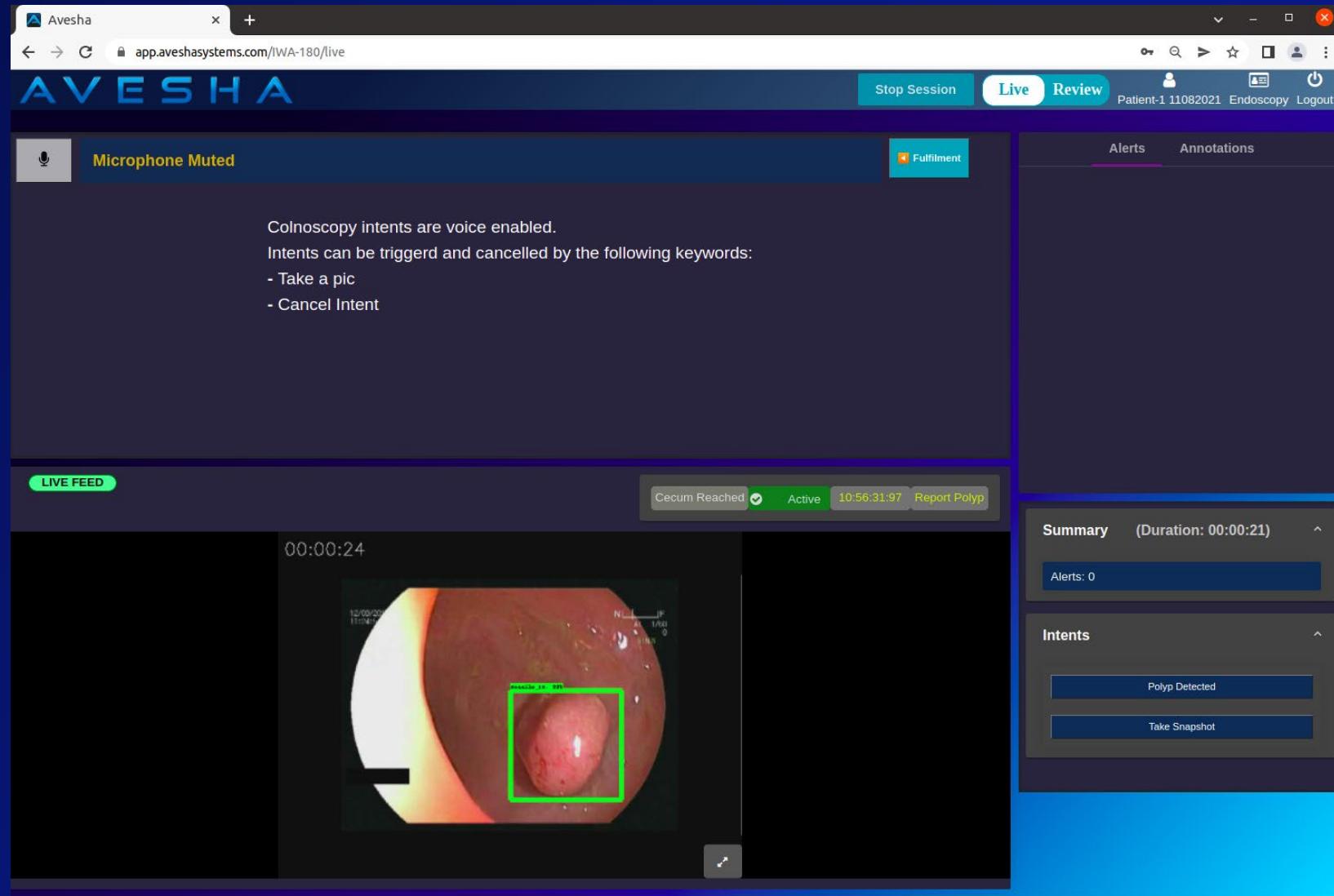
Apollo at the forefront of using AI



"By augmenting doctor's ability to detect, AI has been proved to improve physician's accuracy. Early detection and removal of polyps can easily avoid them becoming cancerous. Apollo has always been a fore runner in adoption of technology. Our patient centric approach keeps us on an outlook for technologies which can make outcomes better."

Dr. Sangita Reddy,
Joint Managing Director,
Apollo Hospitals Group.

Initial tests conducted at Apollo using AI



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Please complete the
session survey

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