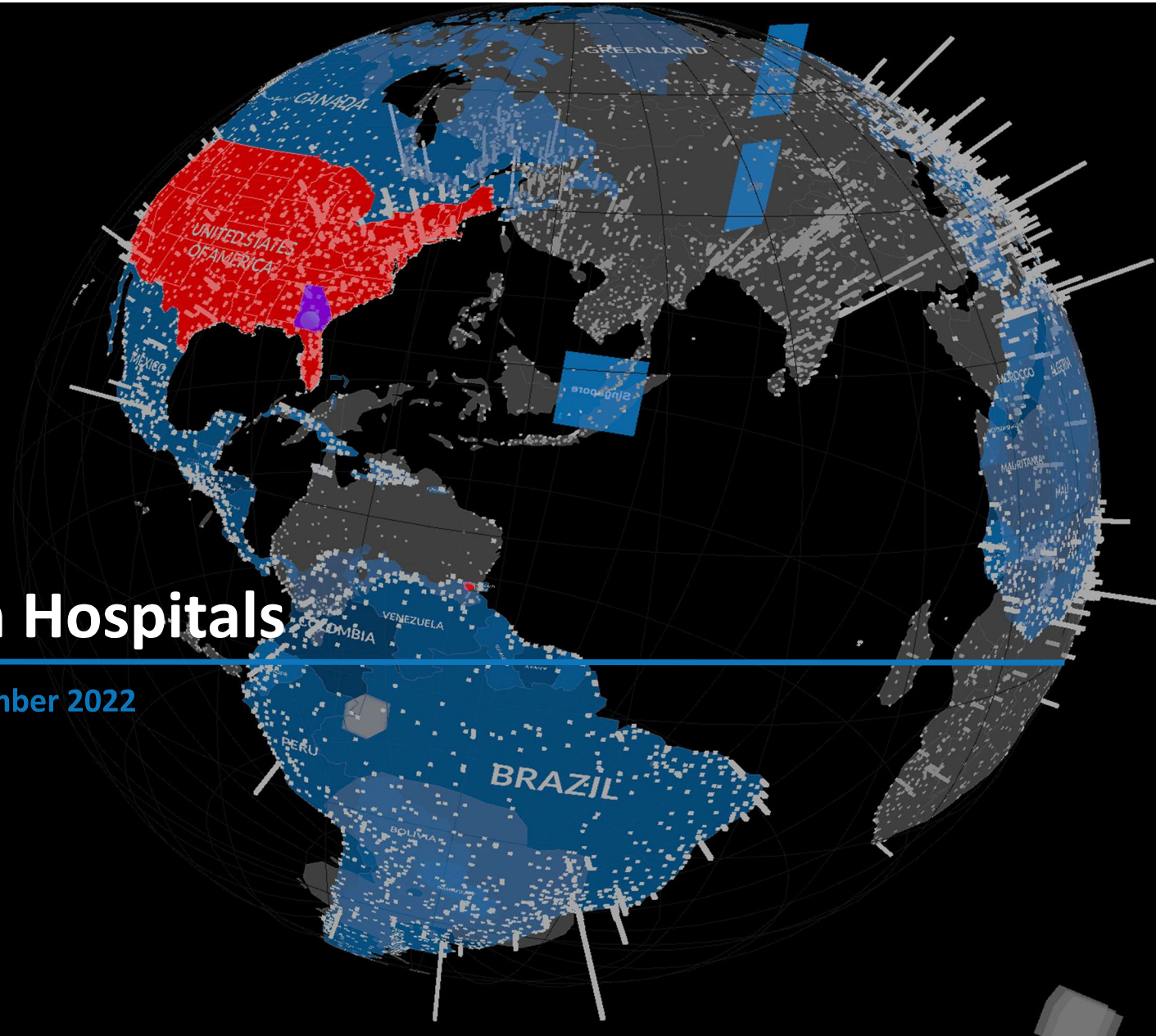


# 3D Digital Twins in Hospitals

Axomem Gemini Introduction November 2022



axomem



# INTRODUCING AXOMEM

Axomem was founded in 2019 with a focus on solving large-scale real-world problems with new technology

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## Company formation

Singaporean company founded in 2019 after R&D. Founder has 25 years in experience in Enterprise IT and Internet product innovation.




## Company focus

Solving large-scale real-world problems with a unique platform built on technology innovations including in memory databases, real-time 3D engines and next-gen mixed reality devices.



## Objective

Significantly reduced time and cost to deliver Enterprise-grade integrated real-time 3D and AI solutions natively supporting multiple device platforms.



The image shows a dark-themed user interface for AxoMem xScape. At the top right, there is a small blue button with an equals sign (=). Below this, a horizontal navigation bar contains five buttons: a back arrow (<), and four buttons labeled SPHERE, TABLE, GRID, and DATASET. The DATASET button is highlighted with a lighter blue background. Below the navigation bar, there is a 2x4 grid of data cards. Each card has a title, a subtitle, and a value. The first row of cards contains: 'Genome Analytics' (22K), 'NetChecker IOT' (206), 'RealTime Customer Manager' (43.2K), and 'WestGate Center Manager' (2.3K). The second row contains: 'World Factbook' (223), 'xFleet Fleet Manager' (2.6K), 'xTrader' (552), and 'ThingBase Manager' (88K). A mouse cursor is visible near the bottom center of the screen.

<	SPHERE	TABLE	GRID	DATASET	
	Genome Analytics 22K	NetChecker IOT 206	RealTime Customer Manager 43.2K	WestGate Center Manager 2.3K	
	World Factbook 223	xFleet Fleet Manager 2.6K	xTrader 552	ThingBase Manager 88K	

[https://youtu.be/d2z\\_ytTySJw](https://youtu.be/d2z_ytTySJw)

# 3D-DOSS – Using Digital Twins and Spatiotemporal Data Mapping for Infectious Disease Surveillance and Outbreak Investigations.



Singapore General Hospital  
SingHealth

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## Background

The COVID-19 pandemic has brought to light the importance of contact tracing in outbreak management. Digital technologies have been leveraged to enhance contact tracing in community settings. However, within complex hospital environments, where patient and staff movement and interpersonal interactions are central to care delivery, tools for contact tracing and cluster detection remain limited. We aimed to develop a prototype system to promptly, identify contacts in infectious disease exposures and detect infectious disease clusters.

## Methods

We created a 3D mapping tool 3-Dimensional Disease Outbreak Surveillance System (3D-DOSS) prototype, to have a spatial representation of patients in the hospital inpatient locations. The hospital physical spaces are built within a game-development software to obtain accurate digital replicas. This concept borrows from the way gamers interact with the virtual world/space, to mimic the interactions in physical space like the SIMS franchise. Clinical, laboratory and patient movement data is then integrated into the virtual map to develop syndromic and disease-specific surveillance systems. Mathematical modelling is utilized to assign risk to individuals exposed based on distance coordinates, room type and ventilation parameters and whether the disease is transmitted via contact, droplet or airborne route.



Figure 1: Animated representation of clinical hospital blocks

## Results

We mapped acute respiratory illness (ARI) data for the period September to December 2018. This enabled to identify an influenza cluster of 10 patients in November 2018. In a COVID-19 exposure involving a healthcare worker (HCW), we identified 44 primary and 162 secondary contacts who were then managed as per our standard exposure management protocols (Figure 2)



Figure 2: Animated representation showing prototype depiction of primary contacts (red) and secondary contacts (orange) in a COVID-19 exposure.

## Conclusion

Through early identification of at-risk contacts and detection of infectious disease clusters, the system can potentially facilitate interventions to prevent onward transmission. The system can also support security, environmental

cleaning, bed assignment and other operational processes. Simulations of novel diseases outbreaks can enhance preparedness planning as health systems that had been better prepared have been more resilient in this current pandemic.

# DIGITAL TWIN DEMOS

Several demos showcase the current and potential future functionality of the Axoverse platform.

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## xPatient Hospital

Example digital twin showing mapping of simulated data and simulation controls for "DiseaseX".

## xWorld Digital Twin models

Examples of Hotel, Offices, Aviation, City. Hotel model could be used for quarantine tracking, while offices to support tracing for return to work.

## Routing & Simulation

NavMesh data enablement supports routing scenarios for both analysis (eg nearest likely bathroom used) and real-time, for example human or robot routing.

## IOT and Bluetooth

NavMesh data enablement supports routing scenarios for both analysis (eg nearest likely bathroom used) and real-time, for example human or robot routing.

## VR Walkthrough Mode

Walkthrough of a ward in VR. Useful for staff facility familiarisation, clinician training, emergency simulation.

## AR Walkaround mode

Supports AR views of facilities and mapped-in data to explore real time and historical events in context. [Youtube](#)

## Social Digital Twins

Allow teams to engage around data-enabled digital twins through multiple device types

## AR In-situ mode

The future – combining local, building and global positioning with data



# Experimental Remote Option

## xWorld Remote Node IOT Support



# KEY CONSIDERATIONS

Security first, start small, fidelity to match use case are some of the lessons learnt to date

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## Security first but keep it simple

Keep security in mind at all stages of the design and implementation.

## Start small – even disconnected

Being able to start small and iterate helps find unexpected sources of value before scaling

## Fidelity based on use case

High visual fidelity often not be as important as speed and accessibility.

## No existing 3d content is ok

Many older buildings will not have 3D CAD maps – still can build a cost-effective twin. Don't "scan first, ask later"

## Empty space is important

Make it easy for the user to hide unnecessary detail – makes it faster and more understandable.

## Empty space may be a risk

Don't leave secure areas empty – absence attracts attention. Consider alternative fills.

## Simple Real time might be easier

A fast reactive simple solution may be better than a complex AI-based forecast on large historical data.

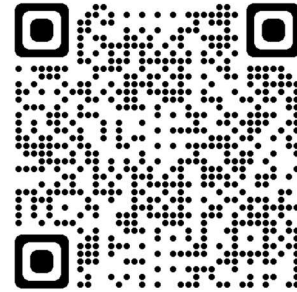
## Aim to close the loop

How will the twin help improve reality? Close the loop – how will the outputs of the twin be useful in the real world?

# GET STARTED

Apply for the Axoverse private preview program

<https://bit.ly/3MIXJWK>



## AUDIENCE

### Hospitals & Healthcare organizations

Establish small scale POCs with in-house teams with options to expand to terabyte scale.

### Consultancies & Systems Integrators

Support accelerated and optionally white-label development of digital twin for clients.

### Game Studios

Expand portfolio of services using existing Unity skillsets building on an enterprise data platform.

### Content Developers

Build content modules for businesses expanding into digital twins.

## BENEFITS

### Co-development opportunities

Potential co-development between hospital and medical research institutions.

### Early Access Private Betas

Get early access to new services and give feedback on directions to meet your needs.

### Community

Join a like-minded community developing digital twins on unique platforms.

### Early adopter discounts

Get discounted access to services and consulting support.

### Referrals

We are looking for partners where we can direct relevant client opportunities globally.