LESSONS FROM GHANA

The people you build for *may never know your name.*

Running Open Source Cloud Infrastructure *for Public Health at Scale*

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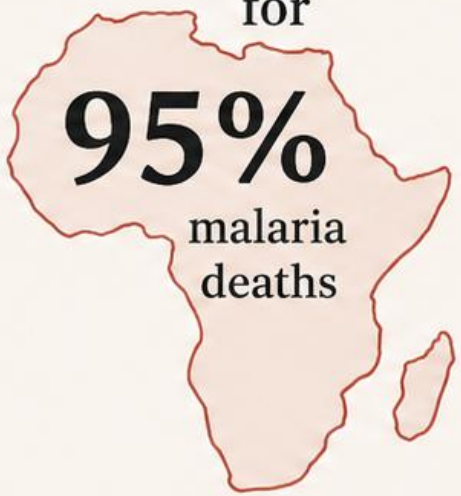
Why Malaria Matters

282 million cases of malaria occurred worldwide

Africa accounts for **95%** malaria deaths



and **75%** of all malaria deaths are among **children**

World Malaria Report 2025

Target Malaria

Meet Abena.

She is six years old.
She lives in a village in the Upper West Region of Ghana.

She has never seen a data centre.
She will never log into a cloud console.
She does not know what Linux is.

— This is who the system is for.

What is at stake

Tonight
the walls of her home will be sprayed against mosquitoes.

This week
her village will be visited by a community health worker with a tablet.

None of this happens
without infrastructure she will never see.

To get to her, you:

This is what standing between infrastructure and Abena looks like.

10 hrs

of road from Obuasi

Then

the road ends

Bad

mobile signal

No

nearest IT support

And when the system fails here, a child like Abena goes unprotected tonight.

“

We go to the communities others don’t reach — *and we protect them.*

— *AGAMal’s working promise*

The infrastructure exists to keep that promise. When it fails, Abena's wall doesn't get sprayed.

AngloGold Ashanti Malaria Control

A Ghana-based public health nonprofit headquartered in a mining town called Obuasi, not in a capital city, not overseas.

1,200
staff deployed across Ghana

15+
remote field sites (and counting)

200+
tablets in the field offline-first

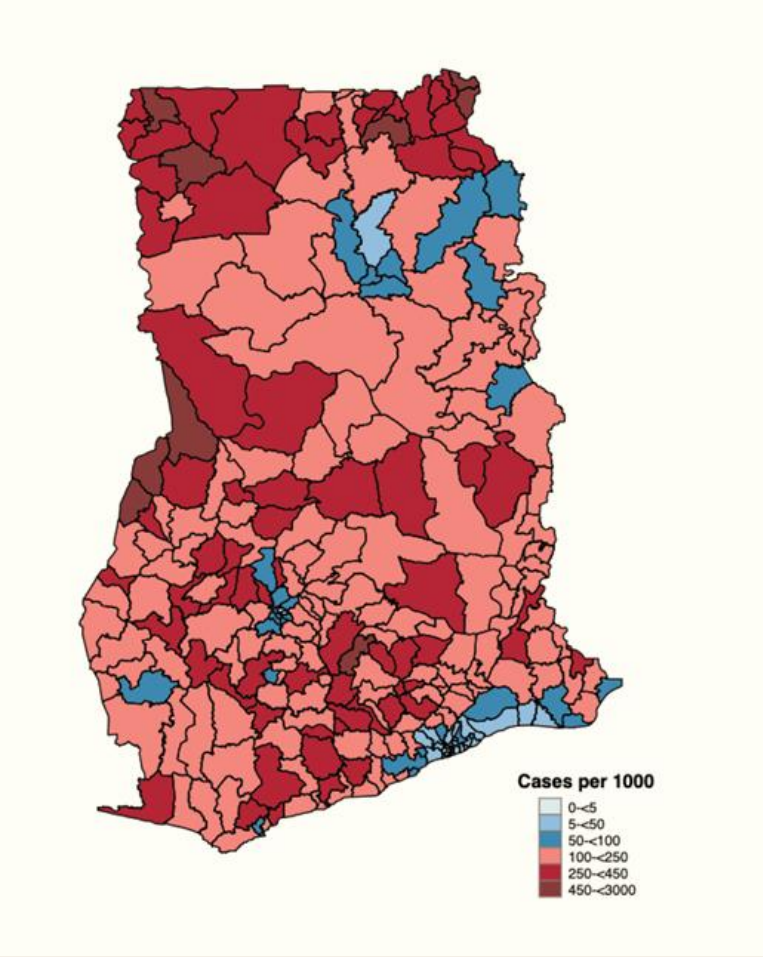
5
public health programs

PROGRAMS WE RUN

- Indoor residual spraying
- Larval source management
- Community education (SBCC)
- Community-led monitoring
- NGO strengthening

All of this depends on infrastructure that works — in communities where the internet doesn't.

The infrastructure has to reach here.



What 'remote' actually means

No reliable internet

Teams collect data offline; sync when they return to connectivity.

Scattered geography

Sites hours apart. No physical IT support on demand.

Real consequences

If the system fails, a child like Abena goes unprotected.

Three hard constraints

Every decision I'm about to show you was made inside these three.

01

Nonprofit budget

No enterprise spending. Every tool justified by cost and mission impact. Commercial licensing at scale is an existential risk.

02

Intermittent connectivity

Field sites have no reliable internet, and rainy-season conditions worsen both connectivity and breeding pressure simultaneously. The system cannot assume a connection — offline-first is not optional.

03

Scattered teams

15+ sites across Ghana. No on-site IT support. Systems must be self healing.

These are not excuses. They are the environment. Everything that follows was built inside them.

So, the real question is not:

"What is the best cloud architecture?"

The real question is:

How do you keep a promise *to someone you cannot reach by phone?*

Three layers, one connected system

Each layer exists to bring Abena's village one step closer to Obuasi.

CLOUD · Azure

VPN servers · backup · data collection · DR failover · community monitoring

~15 servers total

ON-PREMISES · Obuasi HQ

Finance · payroll · analytics · LSM · MDM · DocuSeal · ~10 servers · 6 VMs on one Linux host

Runs the organisation

FIELD · 15 remote sites across Ghana

Offline-first · 200+ tablets · IRS · larviciding · SBCC · community monitoring teams

The last mile

VPN · Meraki S2S + OpenVPN Sync · Offline-first Backup · N-able + offsite replication

The tablet in the village

This is what reaches Abena. Everything else exists to support it.

A TYPICAL FIELD DATA DAY

1. Team travels hours from HQ to a remote community
2. Collects data on tablets · paper backup where needed
3. No internet at the site · works fully offline
4. Returns to connectivity · data syncs automatically
5. Paper records are digitized at HQ , the backup when technology fails in the field

TOOLS IN THE FIELD STACK

✓	**EpiCollect** *open source*	field data
✓	**Survey Solutions** *World Bank*	surveys
✓	**Dimagi / CommCare** *Data Entry*	workflows
✓	**Miradore MDM** *tablet fleet*	200+ devices

The moment the data comes home

Offline-first isn't a workaround. It is the architecture.

Sync is a feature, not a fallback. *The system's default state is disconnected. Everything else follows from that.*

A puddle is not just a puddle.

Field officers photograph water bodies. Where larvae are found, the breeding cycle stops

THE PROBLEM WE COULDN'T SOLVE BY WALKING

Mosquitoes breed in still water — but not all still water breeds mosquitoes.

A trained officer can tell the difference. But Ghana has more puddles than we have officers, and the rainy season turns half the country into one.

Our solution

Field teams photograph each water body and record its characteristics. That data trains Zzapp Malaria's computer-vision model to classify breeding sites. Where larvae are found, the water is treated stopping the breeding cycle before it reaches Abena's village.

THE FIELD APP IN ACTION

GPS coordinates · photo · water-body type · treatment history

All captured offline. Synced when signal returns.

Connecting 15 sites without the enterprise price tag

The decision I get asked about most: why not just use Azure VPN Gateway?

THE COST DECISION

✕ Azure VPN Gateway

Scales expensively with site count. At 15 sites, the cost compounds fast.

✓ Linux + OpenVPN in the cloud

Two VPN servers we run ourselves. Same result, at roughly 10% of the Azure VPN Gateway cost*, and we own the configuration.*

Savings go where? *Back into program delivery.*

THREE VPN PATHS

1. **Meraki site-to-site**

   Regional offices and fixed sites → Obuasi HQ. Hardware-based, managed, reliable.

2. **OpenVPN · self-hosted**

   Remote team access and flexible site connections. 2× Linux servers in cloud.

3. **Azure connectivity**

   Cloud workloads, DR failover, backup replication. Selective — not primary VPN.

What lives on-premises — and why it stays there

One physical Linux host, 6 VMs, 1,200 people depending on it.

OBUASI HQ

6 VMs on one Linux host

- Finance · Infor SunSystems (Win Server VM)
- Payroll · SmartHR for 1,200 staff (Win Server VM)
- Analytics · R processing + Power BI pipeline
- LSM · Larval source management
- MDM · Tablet fleet management
- Documents · DocuSeal (open source, self-hosted)

Why on-prem?

01 **Data control**

Payroll and finance data stays within our physical control — not someone else's jurisdiction.

02 **Latency**

Finance and HR workloads need fast, reliable local access. The HQ LAN is always faster than the uplink.

03 **Cost**

Running these workloads in the cloud 24/7 would exceed our budget several times over.

From raw data to a sprayed wall

A program manager makes a decision. A house gets sprayed. A child sleeps safer.

BEFORE · Manual Excel compilation

2 hours

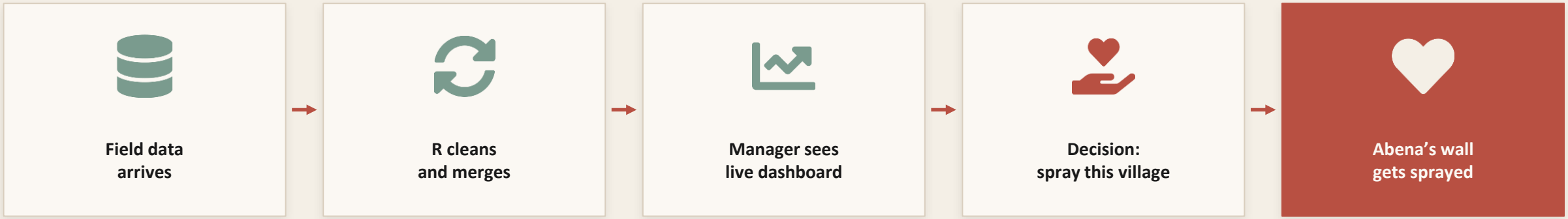
to compile one dataset.
Error-prone. Decisions on stale data.

AFTER · R processing (open source)

Minutes

for the same task.
Reproducible. Decisions on today's data.

WHAT THAT ACTUALLY MEANS



Open source, for us, is not a preference.

Every budget cut pushes us to find another open source answer — and every one we find keeps lives being saved.

The Pattern we repeat

Every time a commercial license becomes unsustainable, we find an open-source alternative, self-host it, and redirect the savings back into program delivery. DocuSeal replaced commercial e-signature tools. OpenVPN replaced Azure VPN Gateway. R replaced manual Excel workflows.

OPEN SOURCE IN OUR STACK

DocuSeal	*Document workflows*
OpenVPN	*Remote access VPN*
EpiCollect	*Field data collection*
R	*Data processing*
Linux	*VM host + VPN servers*

Three copies, two locations, one hard lesson

When everything else fails, this is what keeps the promise.

TIER 1

On-premises

Primary data on local servers at HQ. Fast access, low latency for daily operations.

TIER 2

Cloud backup

N-able cloud backup. Automated, scheduled, offsite. Backup is one place we pay for reliability when 1,200 people's payroll data is at stake, we don't experiment..

TIER 3

Site replication

Replicated servers in Azure. Live replicas that can be activated for DR — not just backup.

THREE LESSONS WE LEARNED THE EXPENSIVE WAY

Replication is not backup. · Test your DR before you need it. · Document recovery at 11am, not 11pm.

LESSON 1 OF 3

Design for the network you have, *not the one you wish you had.*

Offline-first is not a workaround. It is the architecture.

When your teams operate in communities with no internet, the system's default state must be disconnected — not connected. Sync is a feature, not a fallback. Build it as a first-class concern from day one.

LESSON 2 OF 3

Open source doesn’t just lower the cost. *It lowers the floor.*

On a nonprofit budget, open source is not a compromise. It is the only path to resilience.

DocuSeal, OpenVPN, EpiCollect, R, Linux — each one replaced a commercial cost with a capability we fully control. The money freed goes back into protecting communities from malaria. That is the real return on investment.

LESSON 3 OF 3

Your DR is not real *until you have tested it.*

We found out ours worked because we had no other choice. Don’t wait for that moment.

Schedule a DR test. Run it. Fail it intentionally. Document what breaks. Fix it. Then run it again. The two hours you spend testing will save you two months of crisis management. We learned this lesson the expensive way — you don’t have to.

This is what the infrastructure has done.

Operational figures from our most recent season — and one pilot result worth knowing.

1.45M+

people protected
last season

157,965

structures treated
Last season

AGAMal operations · Ghana

60%

fewer mosquitoes
vs. control community

$0.20

cost per person
in pilot operations

Source: Zzapp Malaria pilot results — labeled separately because they belong to a specific pilot, not our day-to-day operations.


This is who
we build for.

THE POINT OF ALL OF THIS

Open source infrastructure, running from a server room in Obuasi, Ghana, *is protecting a child tonight.*

Abena will never know our names.

Not the field officer who walked to her village.
Not the community health worker with the tablet.
Not the engineer in Obuasi who kept the system running.

That is the job.

Thank you.

Questions?

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#OSSummit

TALK DETAILS

Wednesday
May 20, 2026

11:00 – 11:40 AM
Room 101F

Slides and resources available on request.