HARMONIC

SOFTWARE PRODUCTION STUDIOS

presents

The Air We Breathe

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Hi! My name is Steve Sykora. I'm producer, president, and owner of Harmonic Software Production Studios and I've been doing this FileMaker thing for a long time.

More importantly, I'm a dad and a husband. I've literally been remodeling my house, non-stop, since 2009. I LOVE DIY.

Last, I'm a newly diagnosed Type 1 Diabetic. While that may seem unrelated to a talk on an air quality management system, it's more relevant than you might think. As you'll see in my co-worker, Daisy Grave's, session immediately following mine, there's a lot of data coming out of our Diabetes tech, and both of our sessions are asking how we can leverage technology to serve and enhance the human condition.

The Air We Breathe

The Challenge

The Solution

How and Why it Works

My session is titled "The Air We Breathe", and we're going to discuss the challenge, the solution, and how and why it works. Buckle up, and lets go for a ride…

The Challenge – Air Quality affects us All

- growing populace
- increasing pollution sources
- increasing urbanization

Indoor Air Quality

- often worse than outdoor air quality

With a growing populace and rapidly increasing urbanization, most countries face increasing air pollution challenges. Plus, our indoor air quality is often significantly worse than the outdoor air. CO2, particulate matter, and off gassing are the constant byproducts of human habitation.

The Challenge – My Wife's Struggle

This is personal...

- Can my wife breath on waking?

- Can my wife sleep through the night?

- Can my wife exercise outside?

- Does my wife have energy to engage in life?

- (and did I get enough sleep last night to give this presentation?)

For me, this is personal. For many years I've watched as my wife struggles to breathe; an ability I take for granted. Lately, her breathing challenges have gone from an occasional inconvenience to a far more frequent, and unwanted, reality.

As I've listened to my wife and watched her suffering, I've begun to realize that we, as humans, face a number of challenges when attempting to self report our pain, ailments and struggles. This can increase the difficulty of seeking help — whether professional, institutional, or private.

Professionals want to deal with facts, they want to dispense advice and treatments that are safe, risk managed, and peer reviewed. But what if I don't want to live the rest of my life on your steroids?

Gurus would like for you to enlighten your way out of the problem. Which would be great, but what if I don't "get it."

Those of us who are afflicted, especially people with chronic and difficult to diagnose conditions, tend to own our problems. It often seems that NO ONE understands our challenges…
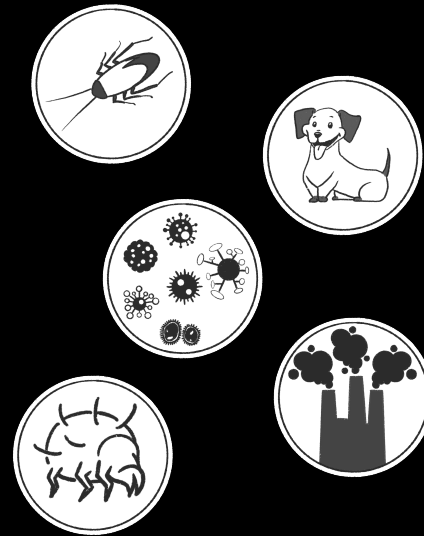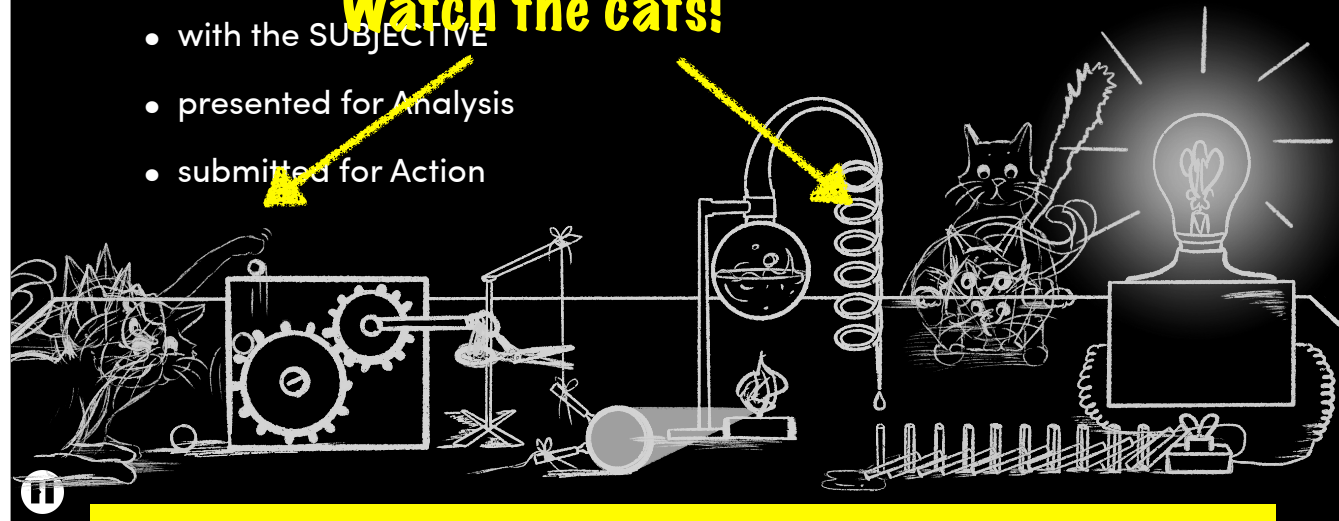
Many hours and dollars have gone into attempts at diagnosis and treatment, but answers remain elusive. We know that she has microbial sensitivities, pet dander is strictly off limits, and outdoor air quality is highly correlative to her ability and capacity to breathe, but nothing we tried really seemed to help…

So how can I help

How can I mash up the objective

With the subjective

present it for analysis

and submit it for action

The Solution

Subjective Input

Objective Data Streams

Analysis

Action

Let's see what we have?

We've got subjective input, objective data streams, analysis, and action

That sounds like a mobile app, a database server, a reporting and data manipulation tool, and some API integration.

The Solution – We Need a Platform!

Subjective Input	**Filemaker GO & SDK**	
Objective Data Streams	**FileMaker Server**	
Analysis	**FileMaker Pro Advanced**	
Action	**FileMaker API Integration**	

Claris FileMaker, The world's leading Workplace Innovation Platform

I think we need a Platform!

The Solution – We Need a Platform (& cats)

Introducing The Cat Suite:

The Happy Cat App (Subjective Input)

The Cat Tree Emporium (Objective Data Streams)

The Cat Doctor (Analysis)

The Laser Pointer (Action)

And Cats!

Introducing The Cat Suite

The Solution – We Need Input

Engage the Human

- Technology should serve humanity
- Gamification
- Customizability
- Objectify the subjective

Why cats?

Well, my wife loves cats. I even think my wife may BE a cat. But, we can't have cats because real cats—not great for indoor air quality—especially for someone with my wife's sensitivities.

I had come up with this idea to build my wife an app. I mean, I'm a database guy, right? I wanted to help capture and clarify through some of the subjective fog of the pain and misery of a chronic condition. But I had a problem. You see, my wife is not that fond of technology (she's a cat—remember).

Ask her to put something on her calendar, and she picks up this book?!?
Ask her to turn on the lights, and instead of saying, Hey Siri, like any sane person would, she gets up and presses the button (which she insisted that I put in, by the way).

So, how could I get her, in the middle of the night, when she's totally pissed off, that she woke up, unable to breathe yet again, to click a button on a screen, so that I could capture the when, where, and why around that subjective experience?

I KNEW it had to be RIGHT THERE. I KNEW it had to be ALWAYS ON. I KNEW it had to as few clicks as possible (my wife detests being delayed and made to feel stupid by clumsy and slow tech). AND I KNEW it had to be beautiful. What I didn't know is what would cause her to engage and provide input the 2nd through the Nth time in a row. So I asked her…

She said, well, this is probably silly, but is there some way, after I complete the entry, that you could have a nice cat curl up and go to sleep on the screen? I think that would calm me down and help me go back to sleep.

The Solution – We Need Input

The Happy Cat App

- Dedicated iPad Mini 2 as clock and entry device
- Runs the same app 24/7 on my wife's nightstand
- Beautiful hand drawn art
- Reward images specifically targeted at her "sweet spot"
- Captures the user, the timestamp, and the location
- Automatically uploads entries every 10 minutes
- Away mode for data collection while traveling

The
Happy
Cat

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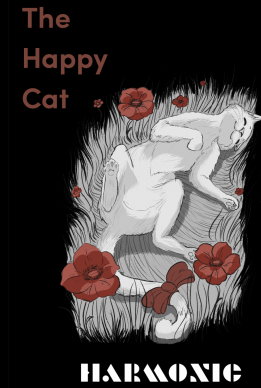
So I built The Happy Cat app.

It's a dedicated interface—an old iPad Mini 2—that sits permanently on my wife's nightstand and acts as her clock and input device. It has beautiful hand drawn art — by my daughter — and it targets the sweet spot of data capture and motivation. Now, instead of being totally pissed off that she woke up in the middle of the night, she's only mostly pissed off because she at least feels like she's doing SOMETHING by recording why, when, and where she woke up.

And, she loves the cats.

Lets take a look at this app…
[start video]
This is the loading screen, and here's the main menu. The time is always shown at the top. Depending on the time of day, a different default entry will be prompted. Since it was 11:42 at night when we recorded this video, the app assumes that my wife can't get to sleep.

Let's click that entry…

We get a fun intro image channeling the user's experience. We then present a series of choices—pre-selected for the user—that help the user quickly and efficiently provide feedback. Maybe she can't breathe, maybe she had too many cat naps, but tonight, she's too hot. Data captured, she's presented with a reward image, and thanked for her input. Now the app is ready to record the next moment.

The Solution – We Need Data

Enter the Machines

- An authoritative record of the subjective and objective data streams

- Custom mobile applications

- A World of Many APIs

- Internet of Things

Now that we have our subjective data stream, where do we put it? and what kind of other objective data can we mash up to begin looking for trends?

IQAir Air Visual Pro

https://www.iqair.com/air-quality-monitors/airvisual-pro

In order to treat the air quality IN my home I had to understand the air quality both INSIDE and OUTSIDE of my house. I purchased three IQAir Airvisual Pro air quality monitors, and placed them in my Master Bedroom, Living Room, and back yard. I now had real-time data on Temperature, Humidity, CO2, and PM2.5. These components make up the widely agreed upon criteria for air quality measurement and result in an Air Quality Index or AQI score.

My outdoor air quality monitor is now a public Air Quality measurement station and reports up to a cloud of Air Quality data worldwide. This is used in a number of Big Data engines for real time reporting analysis and trends.

So with the combination of my wife's subjective data input, and my air quality monitor's objective data input, I have a large number of disparate data types that need to be stored an in an organized and extensible fashion. The cat tree emporium (CTE for short) is modularly constructed to take any number of reporters and indicators from a variety of data sources and APIs, and store them in a single long and skinny table.

CTE is also responsible for the default Air Management automation through a series of server side scripts.

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The Cat Tree Emporium

Living Room
76.1 °F   55 %RH   17 AQI   964 CO²
Master Bedroom
75.3 °F   63 %RH   13 AQI   800 CO²
Back Yard
83.6 °F   76 %RH   57 AQI   449 CO²

Whole House Fan
0
Whole House Fan
OFF
Fresh Air Intake

Laser Pointer Mode
default

Retrieve Data
Set Fan   Reporters
Refresh   Indicators
Close File   Datapoints

Lets take a closer look at CTE.
[start video]
On the right hand side, you can see a never ending stream of data constantly being pushed in. In the upper left is the dashboard of Air Quality data from my three monitors in the Living Room, Master Bedroom, and Back Yard.

Below those are the indicators for the current Whole House Fan, Fresh Air Mode, and Air Program status.

This is the list of reporters. Currently three air monitors, two apps, and a fan system. These are the data indicators the system is currently parsing. And here are the data. We can see whole house fan data, air mode data, and here's a bunch of subjective data from my wife.

The Solution – We Need Insight

The humans make meaning of the machines

- Leverage human intuition
- A data point is just a comment..
- A dataset is a picture...
- A dataset's trend is a pointer...
- A dataset's trend's correlation is a finding
- We need each other

So now that we have the objective and subjective data streams, we need to analyze and present that data for review and action. This is where the human element comes in and represents, to me, one of the most powerful aspects of Filemaker as a "workforce innovation platform."

The Solution – We Need Insight

Dr. Mewis says...

"It appears that when you have 8 people sleeping in the house during August, we have to run the whole house fan / fresh air recovery mode at 50% speed for an average of 75% of the hours between 11PM to 7AM in order to keep the CO_2 at an acceptable level below 1000 PPM level"

Oh, and "meow"

The Cat Doctor

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Dr. Mewis to the rescue…

While I'm just getting started with the trending and analysis generated by the Cat Suite, I can tell you that I've already come to some very interesting observations, and am using those observations to fine tune my logic tree. It's going to take some additional time to figure out correlation and causation with my wife's conditions, but I finally have a reliable stream of data to begin evaluating.

The Solution – We Need Action

The machines and humans execute the learning

- – wouldn't it be great if...
- – Use APIs and IOT devices
- – Use Reminders and Notifications

Now that we think we know what we want to do, and when we want it done, how do we automate the mundane, and remind the forgetful?

As everyone here knows, FileMaker comes equipped with a powerful set of tools for API integration and procedural control.
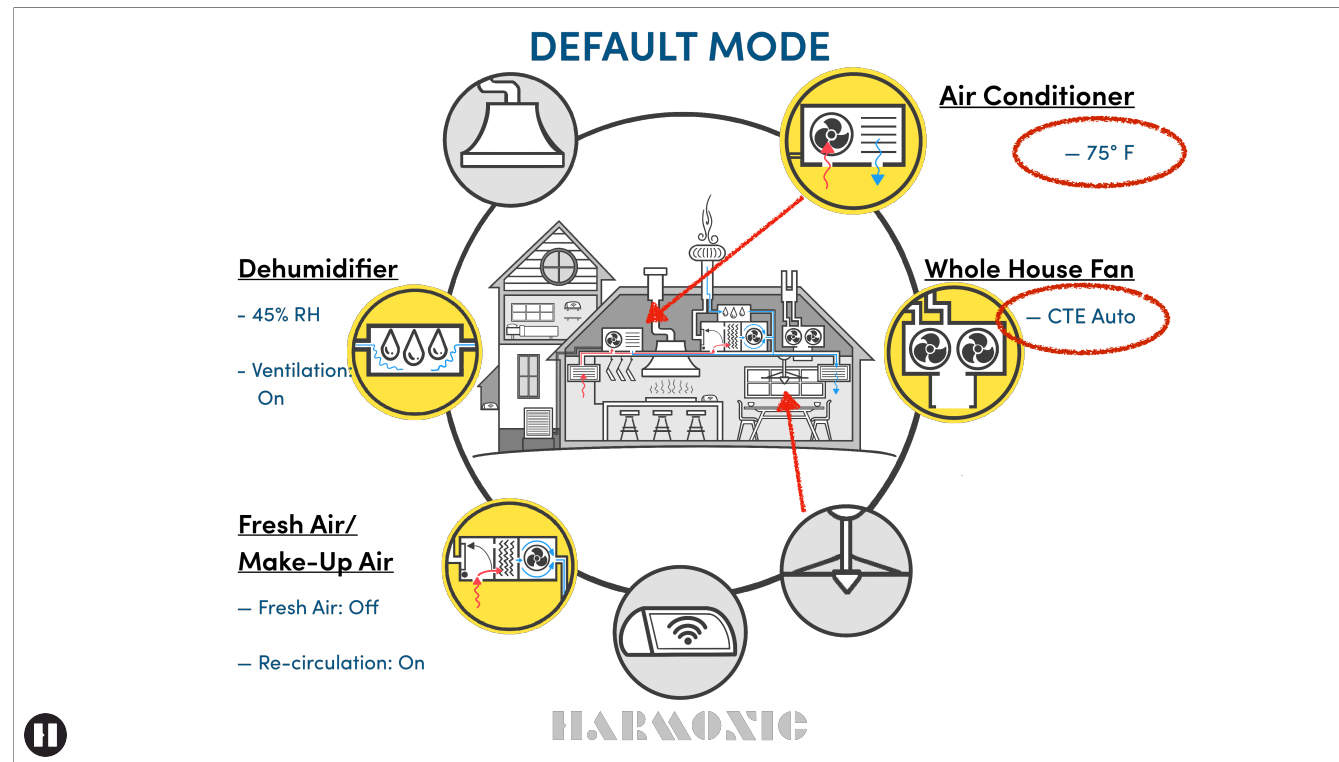
In my house, there are a number of mechanical systems used to manage the air quality. I go into depth on what these are, and how they work, in an accompanying video that I'll provide a link to at the end of the session. For now, however, let's concentrate on the three bubbles to the right.

First, my air conditioner is normally set to 75 degrees F. Next, my whole house fan is set to auto-mode.

Last, the ceiling fan in the living room is turned off.
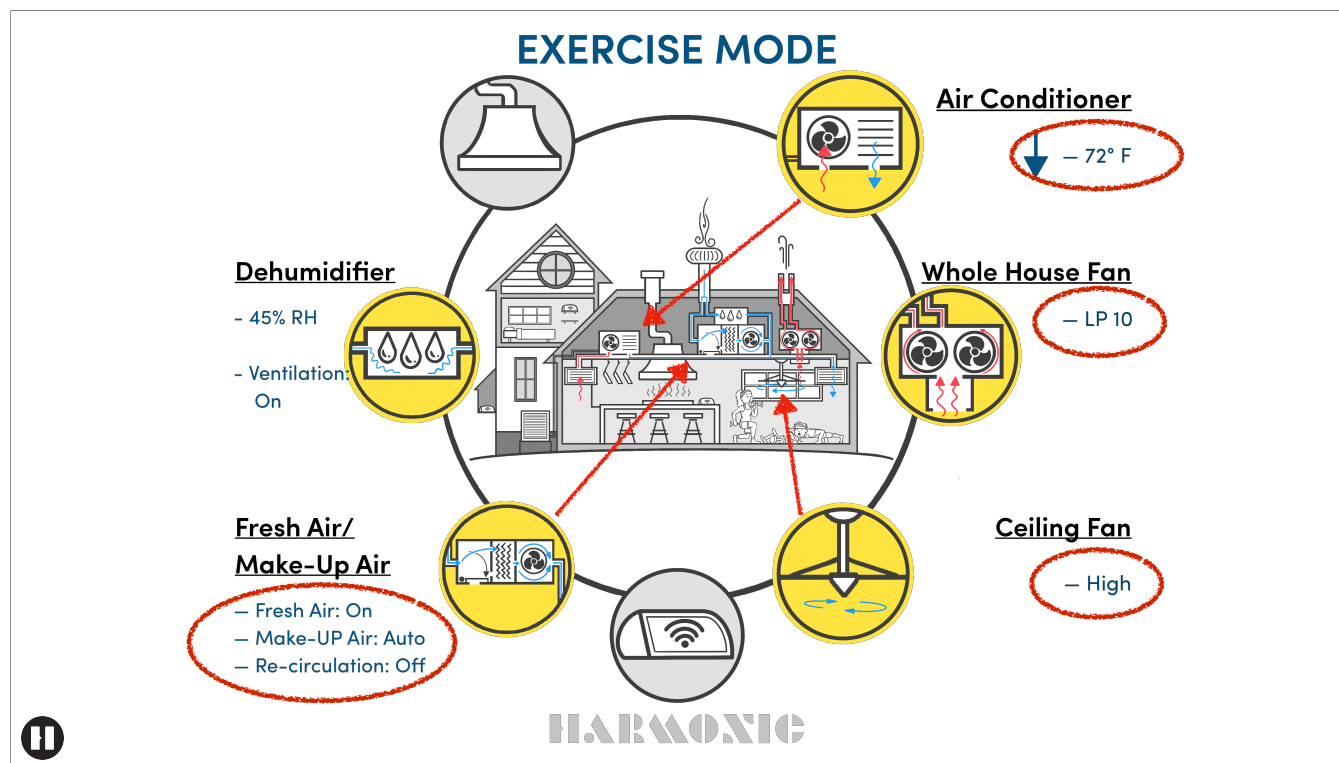
Now lets compare exercise mode. Here, I've turned down the A/C to 72 degrees F. I've switched the Whole House fan to 10 which has activated fresh air makeup mode, and I've turned the ceiling fan on high.
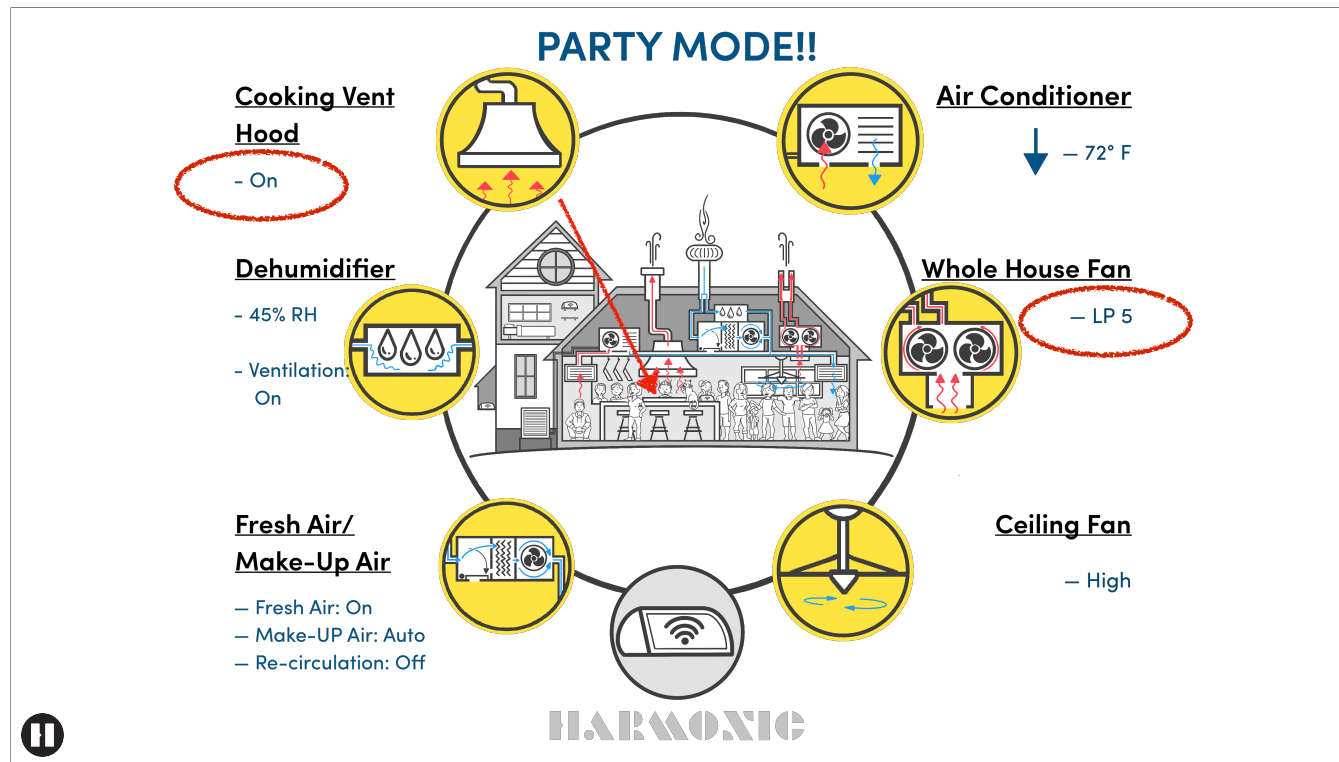
Finally, there's party mode. Here, we're also cooking, so all of the mechanical systems are active. The other difference, is that the Whole House Fan is running at speed 5 to reduce the noise.

So lets build an app…

I do like tech, so the idea of being able to pick up my iPad, click one button, and have it automatically switch modes and set the mechanical systems accordingly is very compelling. Further, I do want to be able to tell Siri to launch party mode.

I call this final app "The Laser Pointer" because, well, laser pointers are how we get cats to do what we want, right?

This is a simple app doing powerful things. On the right you can see the settings associated with Default mode. Now let's switch to exercise mode and see what happens.

[button press to exercise mode]

Note that the temp setting has been lowered, the whole house fan has been set to 10, fresh air mode is ON, and the ceiling fan is on high. Now, I can do that plank.

[cut to raspberry pi]

How does this work? There's a Raspberry Pi in my attic. It's running Django to support a REST call from FileMaker and activate a python script. When activated, that python script sets the Digital to Analog control board (on the right) to a voltage based on the parameter of the REST call, it also closes a relay on the relay board you see on the left.

[cut to air vent above]

That voltage control board has activated these inline fans which are now pulling stale air out of the top of my living room

[cut to door swing]

The relay closing has alerted my make-up air system that it needs to switch to fresh air mode. Here you can see the door swing closed on the house return and open to the outside air inlet.

[cut to graph]

Switching to our monitoring system, which is sped up for this video, in the middle graph, we can see the building's pressure start to drop. The make-up air system then increases the fan speed to bring the home's pressure back to neutral.

[cut back to app in Exercise mode]

Switching back to the app, lets turn off exercise mode and see what happens. Note that the mechanical systems go back to their default settings.

[cut to graphs]

We can see the fans and building pressure returning to normal.

[cut back to LP app / default mode]

But since this is Devcon, lets leave the system in party mode!

[click party mode]

How and Why it Works

Store it NOW, Query it Later

Keep the Data Fast and Flexible

Leverage the Machines to Serve the Humans

Analyze the Inscrutable / Automate the Mundane

Find out more at har.fm/steve

So why does this work?

First special thanks goes out to Filemaker, my daughter and her art, as well as my wife and her inspiration. It works, because all of them are awesome!

It works, because we store the data when it happens, not when we need it, or can't clearly remember.

It works, because we're keeping the data modular, fast, and extensible.

It works, because we're leveraging technology for a real and valuable purpose—not simply because we can.

And that purpose is to analyze the inscrutable, and automate the mundane.

Find out more at har.fm/steve

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