DataLink

BuildingLink Analytics

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Apr 2018

BuildingLink

INNOVATIVE. EMPOWERING. SEAMLESS.®

Why (value drivers)

- Existing Customers
  - Vehicle to enhance data for product offerings
  - Fast path to make production data actionable
- Internal Operations
  - Enable executives to play with BuildingLink data
  - Data exploration, self service, non technical
- New markets, potential ideas
  - Report(s): definition, generation, publication and distribution
  - Insights, embedded in the platform, embedded in email
  - Building Data As A Service (BDAAS)

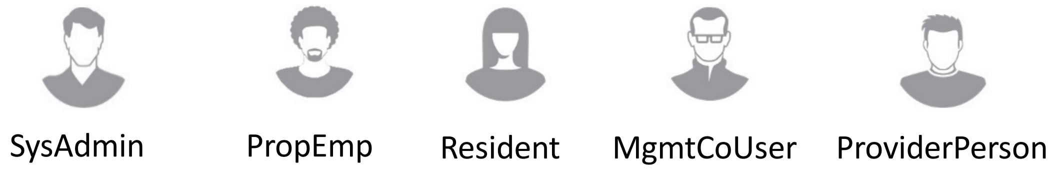
What (content)

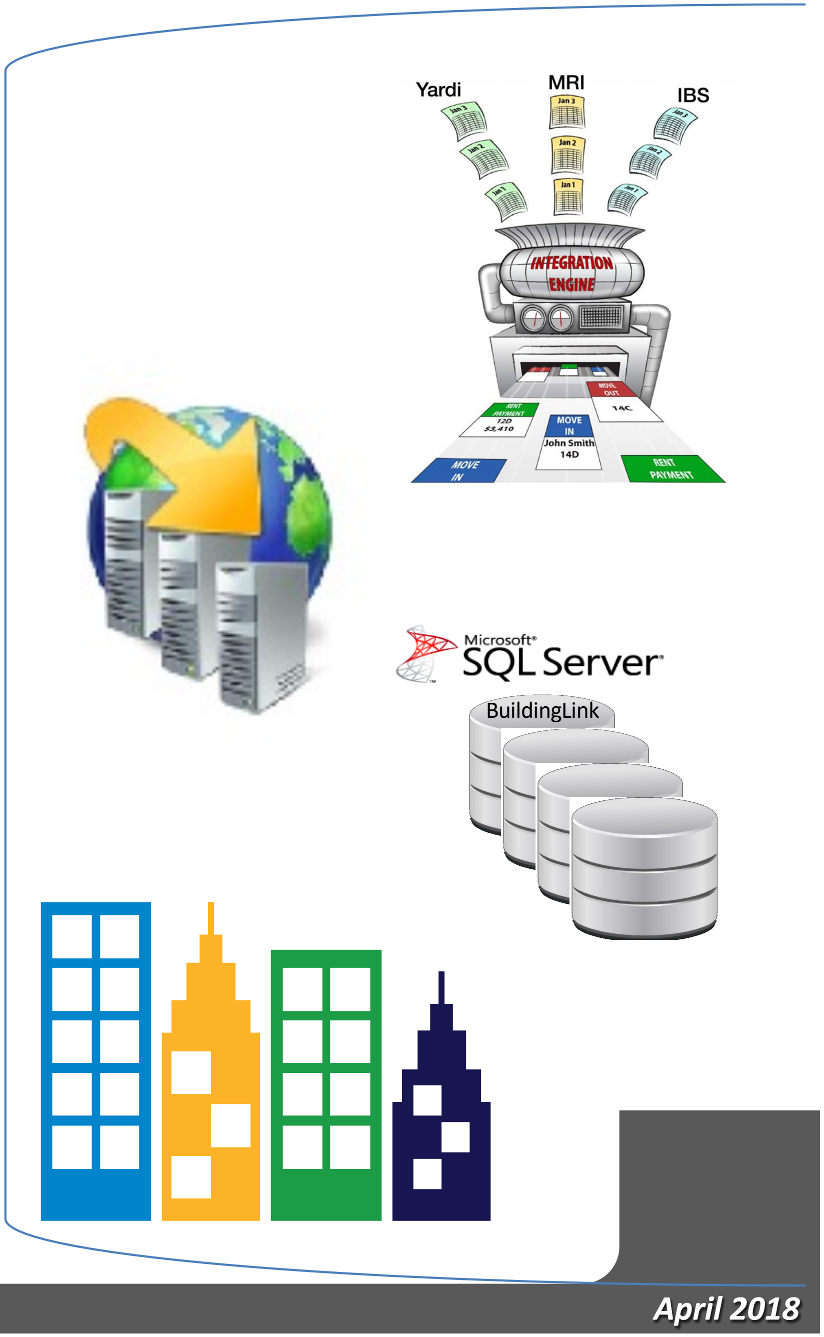
- Multidimensional Tabular Data Models
  - BuildingLink (Internal use only, The whole shebang!)
  - Consumer Based (customer specific, managing agent, building)
  - Provider Specific (app orientated, module based - insurance, pets, etc.)
  - Publically Consumable (anonymized, sanitized, data nuggets)
- DataLink Analytic API's (Data Governance)
  - Authentication (OAuth2 with BuildingLink Identity Services)
  - Authorization (Control thru the BuildingLink API)
- Technical Bits as the Glue
  - BuildingLink! Connector for Microsoft Power BI
  - Embedded Content / Analytic Mashups
  - Analytic Reporting Subscription, (BDAAS)

How (implementation)

Part 1: Technical Architecture

BuildingLink Data Ingestion

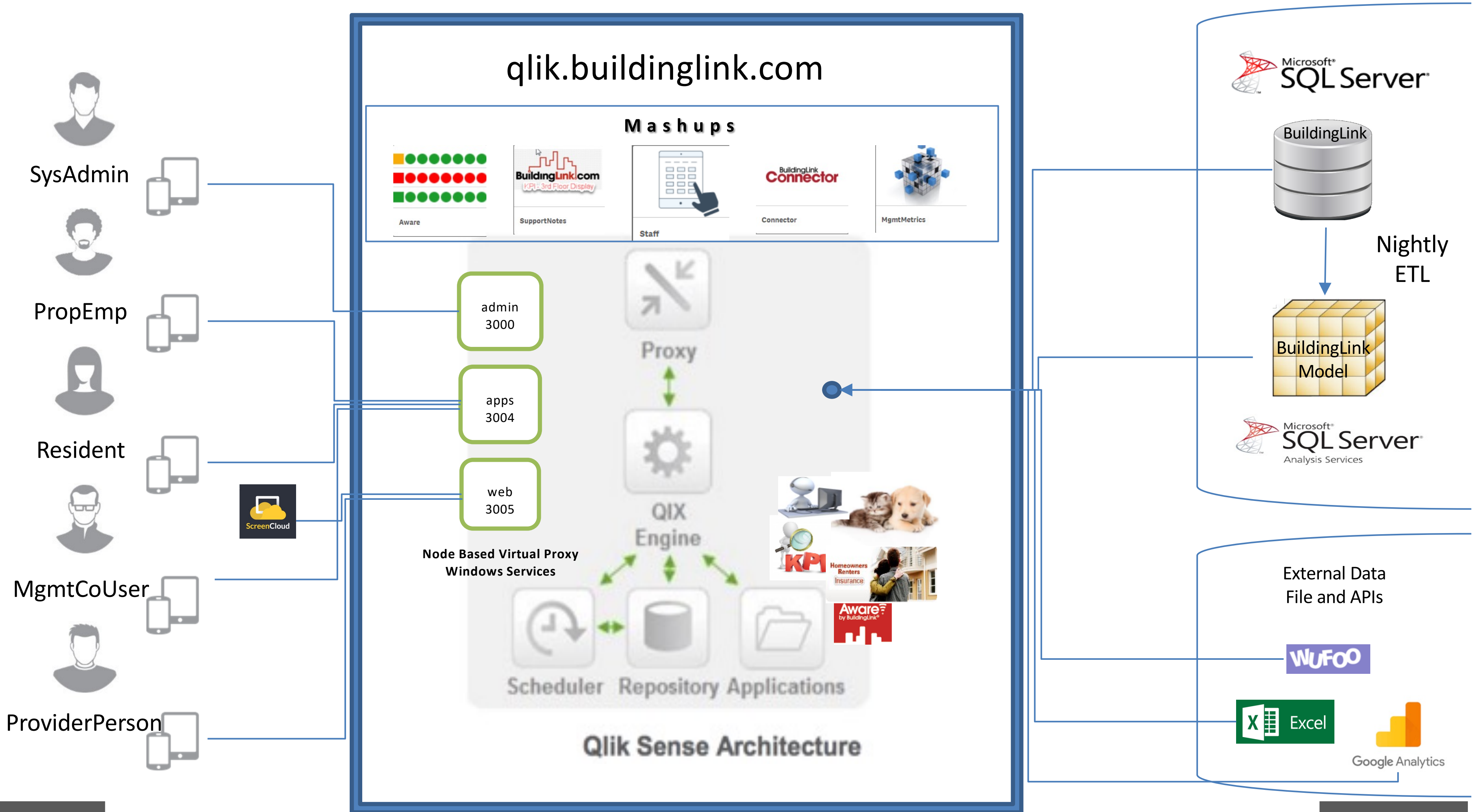




- Data is Ingested as:
  - Buildings are Setup in BuildingLink.com
  - Users Interact with the BuildingLink Website
  - Devices Interact with BuildingLink WebServices
  - Sensors Interact with the BuildingLink Api
  - Integration interacts with External Software Packages

BuildingLink Analytics - it started with a Qlik

Integration with Qlik Sense



SysAdmin

PropEmp

Resident

MgmtCoUser

ProviderPerson

ScreenCloud

qlik.buildinglink.com

Mashups

Aware

SupportNotes

Staff

Connector

MgmtMetrics

admin
3000

apps
3004

web
3005

Node Based Virtual Proxy
Windows Services

Proxy

QIX
Engine

Scheduler

Repository

Applications

Qlik Sense Architecture

Microsoft SQL Server

BuildingLink

Nightly
ETL

BuildingLink
Model

Microsoft SQL Server Analysis Services

External Data
File and APIs

Wufoo

Excel

Google Analytics

BuildingLink Analytics – The QlikWay

Integration with Qlik Sense

- The Good
  - in-memory engine, associative analytics
  - interactive applications
  - governed data discovery, visual exploration
  - design, deploy and manage on premise 1 virtual server

- The Bad
  - While cool, the UI is quirky,
  - Steep learning curve for developer to customize
  - Not the best fit for use with the Microsoft data stack
  - Load script for complex data models and data preparation.
  - Classic BI and Scheduled reports requires additional products (N-Printing)

Enter Microsoft Power BI – moving fast

Power BI Desktop

- Get Data
- Model Relationships
- Define Visualizations

Power BI Service

- Manage access, security, refresh
- Natural language query (Q&A)
- Organizational constructs (workspaces, content packs, email subscriptions,

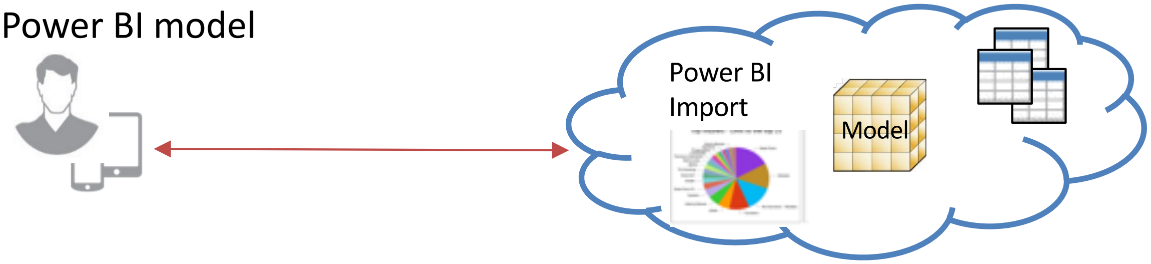
On-Premise

- Data Access Gateway
- MS Sql Server Database, Analysis Services and Report Server

Power BI Connection Types

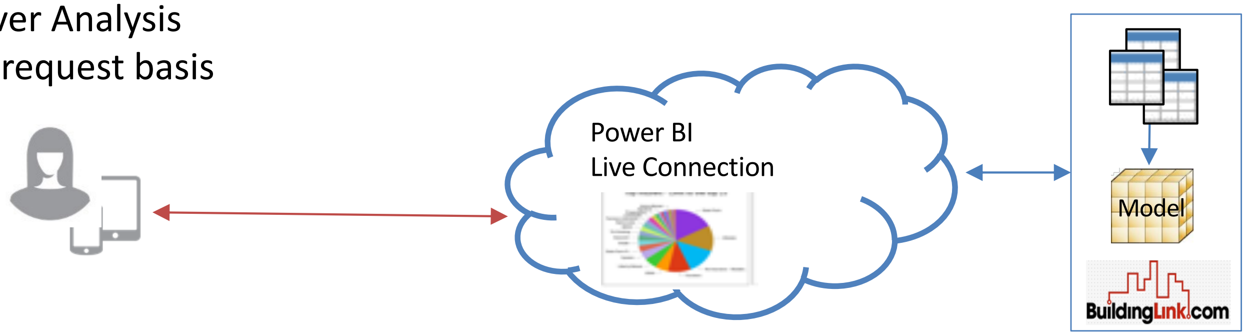
Import

loads and stores the data within the Power BI model
at the time the model is created,
size limit of 1G per model



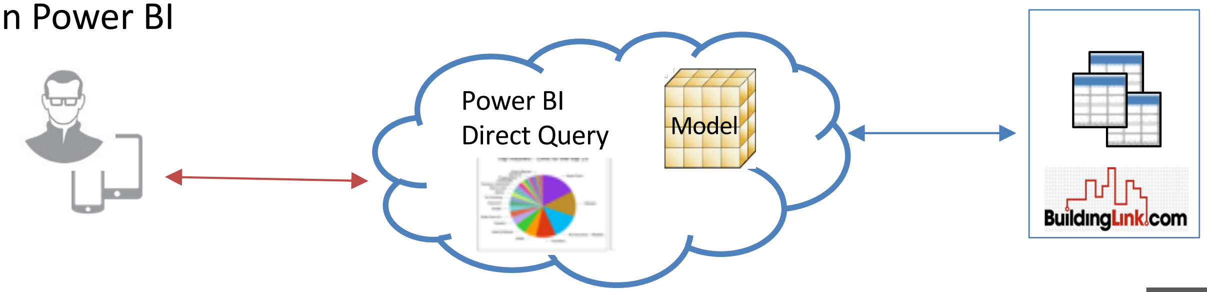
Live Connection

Power BI interacts with the SQL Server Analysis Services model to get data on a per request basis



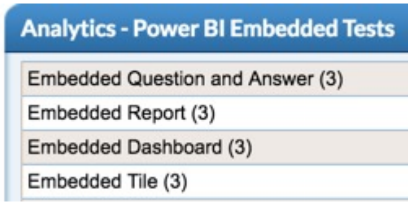
Direct Query

Power BI interacts with the SQL Server get data on a per request basis. Model is stored in Power BI



Power BI Embedded Types

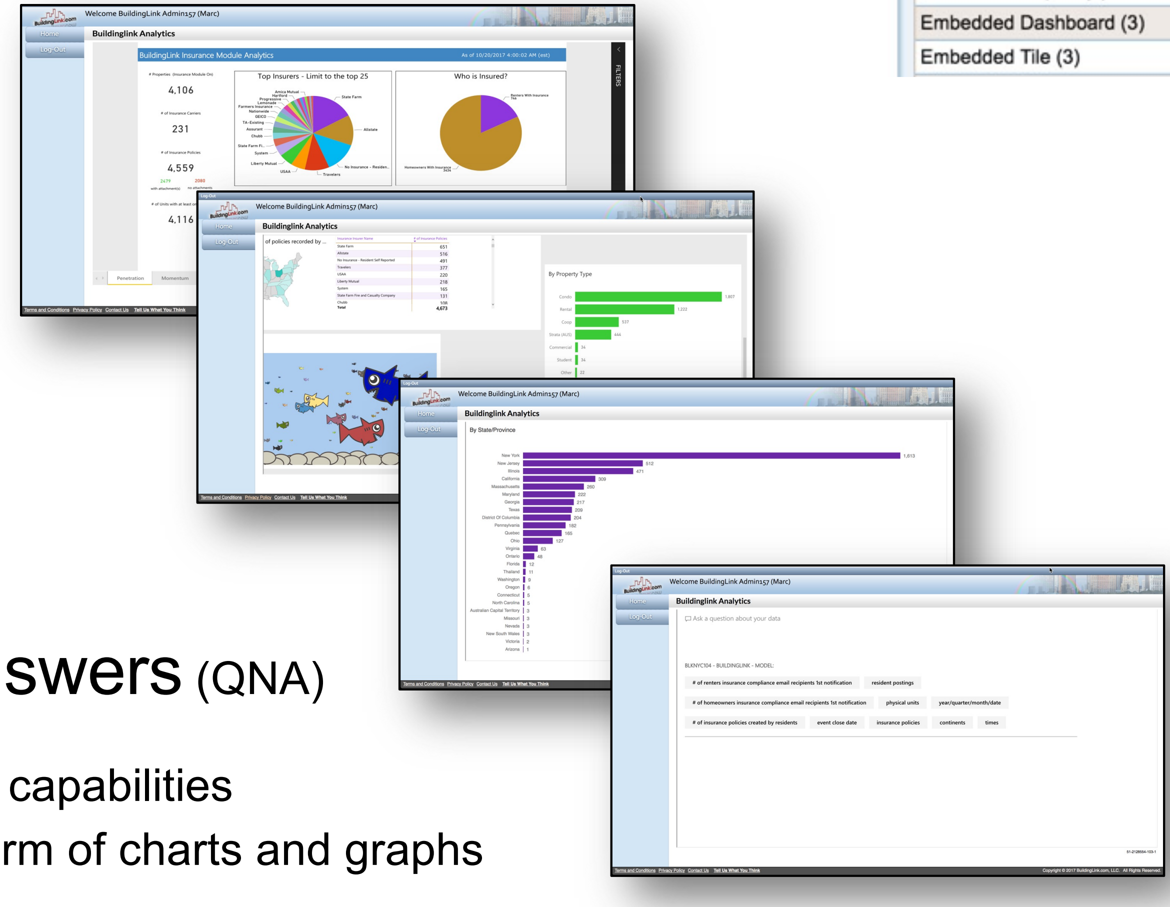
see admin -> analytics submenu



Analytics - Power BI Embedded Tests

- Embedded Question and Answer (3)
- Embedded Report (3)
- Embedded Dashboard (3)
- Embedded Tile (3)

- Report
- Dashboard
- Tile
- Question & Answers (QNA)
  - natural language capabilities
  - answers in the form of charts and graphs


Welcome BuildingLink Admin157 (Marc)
Home
Log-Out
Buildinglink Analytics
BuildingLink Insurance Module Analytics
Top Insurers - Limit to the top 25
Who is Insured?
4,106
231
4,559
4,116
Penetration
Momentum
FILTERS
By Property Type
By State/Province
Ask a question about your data

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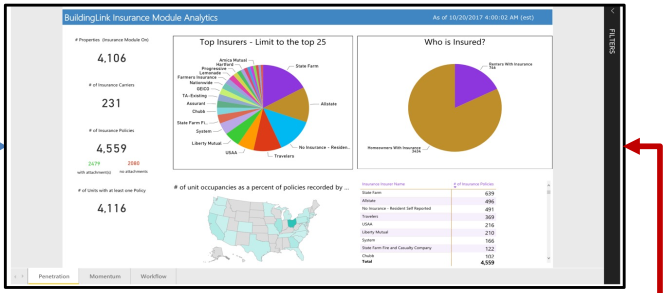
BuildingLink Integration with Power BI

Basic Embedding

SysAdmin

Authenticated as:
powerbiwebsitemaster
@buildinglink.com

buildinglink.com



BuildingLink Insurance Module Analytics — As of 10/20/2017 4:00:02 AM (est)

Properties (Insurance Module On): 4,106

# of Insurance Carriers: 231

# of Insurance Policies: 4,559 — 2479 with attachment(s), 2080 no attachments

# of Units with at least one Policy: 4,116

Top Insurers - Limit to the top 25

Who is Insured?

# of unit occupancies as a percent of policies recorded by ...

Insurance Insurer Name	# of Insurance Policies
State Farm	639
Allstate	496
No Insurance - Resident Self Reported	491
Travelers	369
USAA	216
Liberty Mutual	210
System	166
State Farm Fire and Casualty Company	122
Chubb	102
Total	**4,559**

1. Gain authorized access to Power BI authenticating with Microsoft via OAuth2 https://login.windows.net/common/oauth2/authorize

2. Using the authenticated bearer token, generate / acquire the embed token

3. Passing the embed token to the Power BI client (JavaScript) to retrieve, render and control the report

Developer

Creates and publishes Dashboards, Reports and Visualizations

Microsoft SQL Server

BuildingLink

Nightly ETL

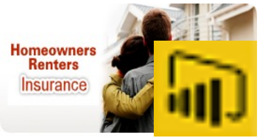
BuildingLink Model

Microsoft SQL Server Analysis Services

Data is refreshed, Live, or on a schedule and cached

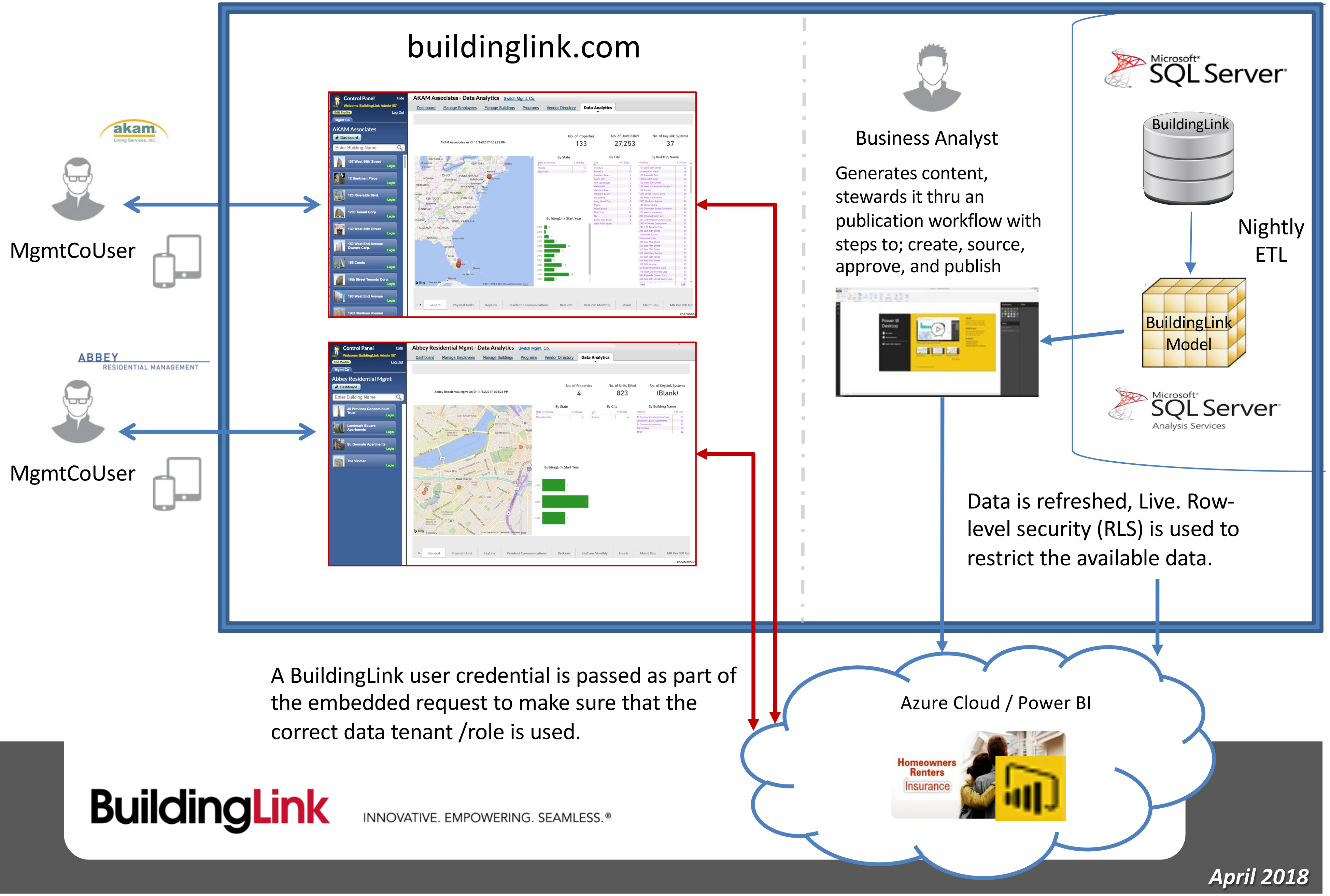
Report is injected into a div on the page

Azure Cloud / Power BI



BuildingLink Integration with Power BI

Advanced Embedding



buildinglink.com

Business Analyst

Generates content, stewards it thru a publication workflow with steps to; create, source, approve, and publish

Nightly ETL

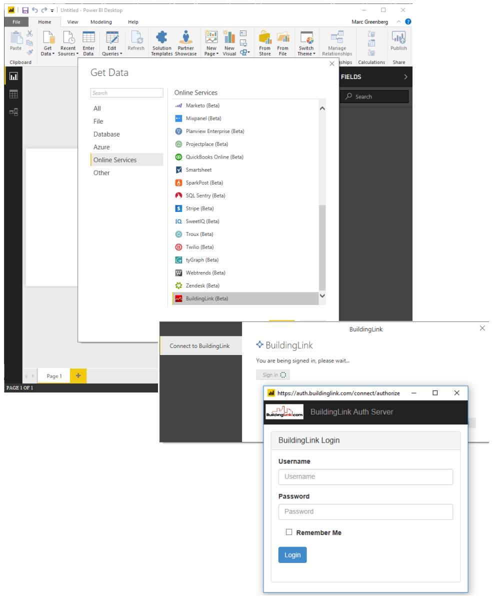
Data is refreshed, Live. Row-level security (RLS) is used to restrict the available data.

A BuildingLink user credential is passed as part of the embedded request to make sure that the correct data tenant /role is used.

Azure Cloud / Power BI

Introducing the BuildingLink Connector for Power BI

Do it yourself to get what you need

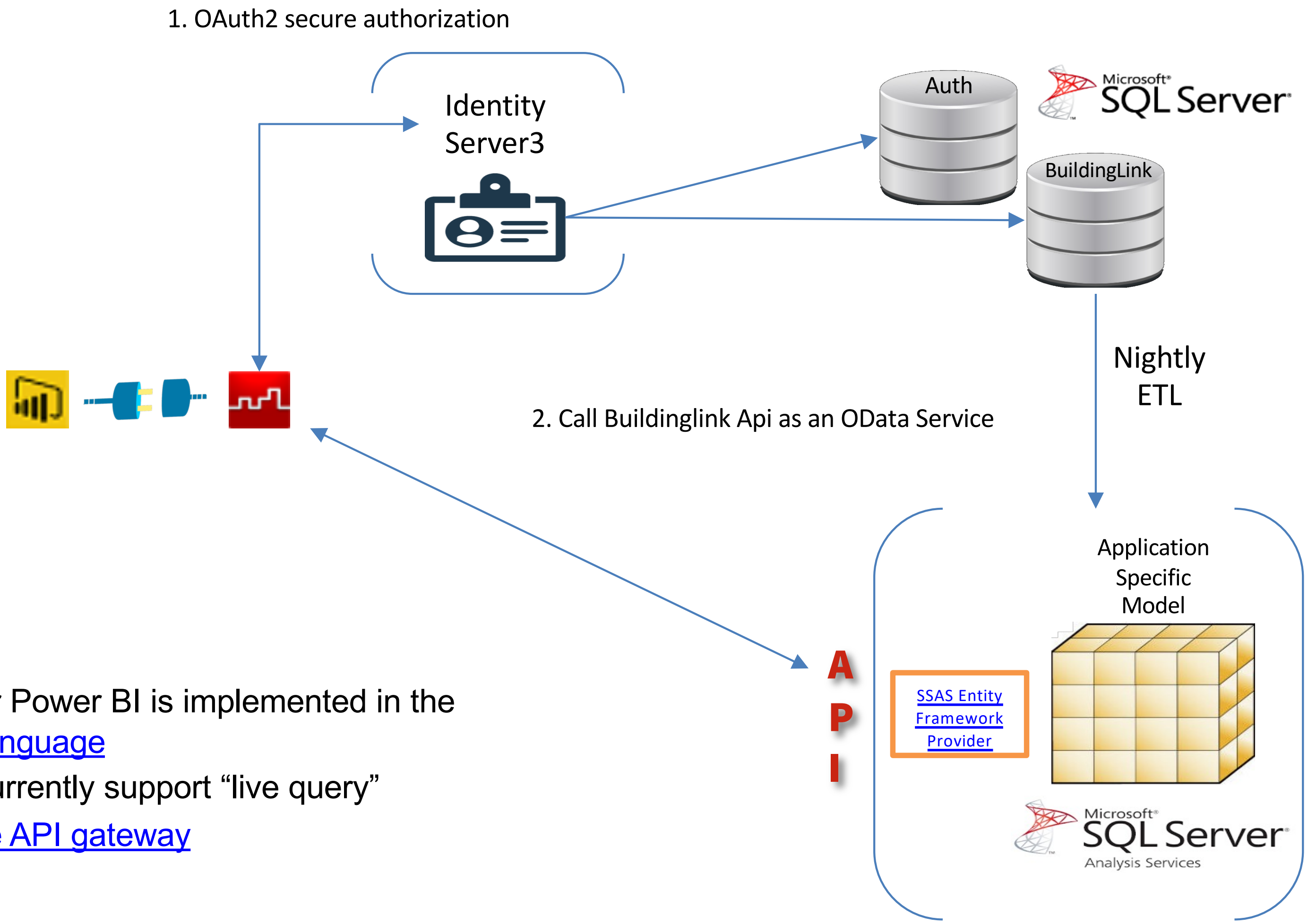


You are being signed in, please wait...

Username: Username

Password: Password

□ Remember Me


1. OAuth2 secure authorization
Identity Server3
Auth
Microsoft SQL Server
BuildingLink
Nightly ETL
2. Call Buildinglink Api as an OData Service
Application Specific Model
SSAS Entity Framework Provider
Microsoft SQL Server Analysis Services
A
P
I

- BuildingLink Connector for Power BI is implemented in the Power Query M formula language
- The connector does not currently support “live query”
- API is served by the Azure API gateway

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Introducing the BuildingLink Analytics API

As Exposed thru the BuildingLink Power BI Connector

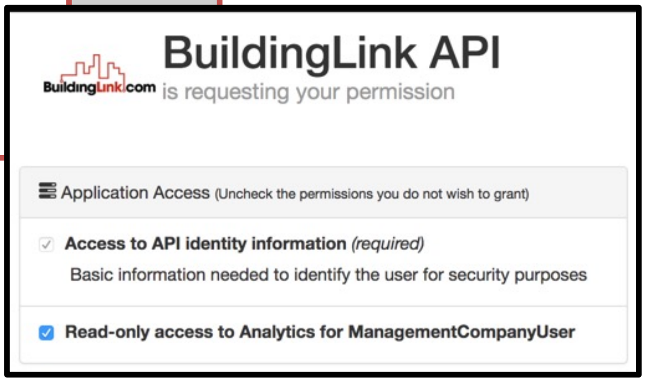
Management Company / MgmtCompanyUser

Monthly Property Metrics

- Resident Info
- Resident Posting
- KeyLink
- Functionality
- Logins
- Movins
- Employees

Properties

- Name
- Latitude
- Longitude
- ManagementCompany
- State
- City



BuildingLink API

is requesting your permission

Application Access (Uncheck the permissions you do not wish to grant)

✓ **Access to API identity information** *(required)*

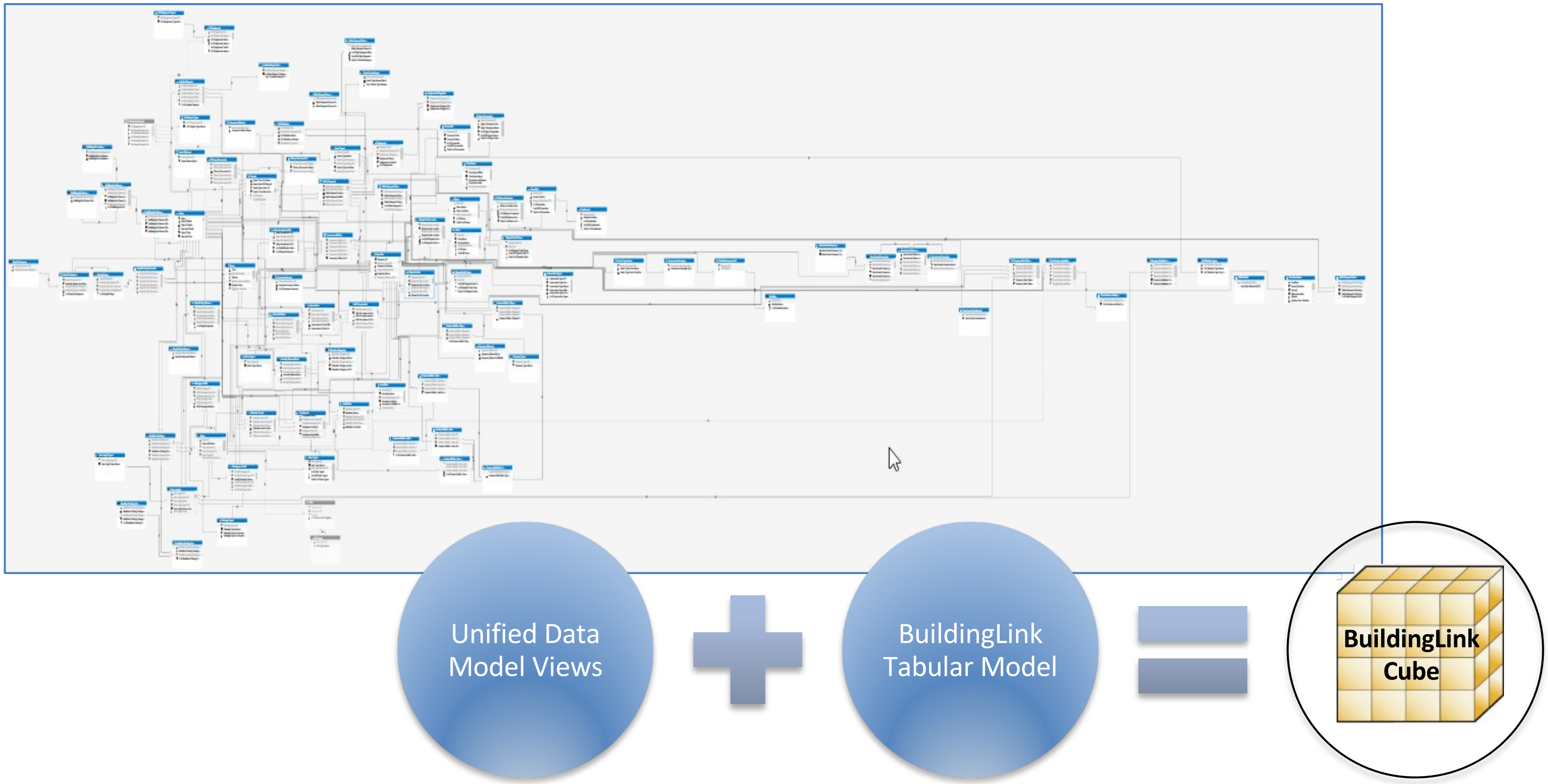
Basic information needed to identify the user for security purposes

☑ **Read-only access to Analytics for ManagementCompanyUser**

Part 2: Data Architecture

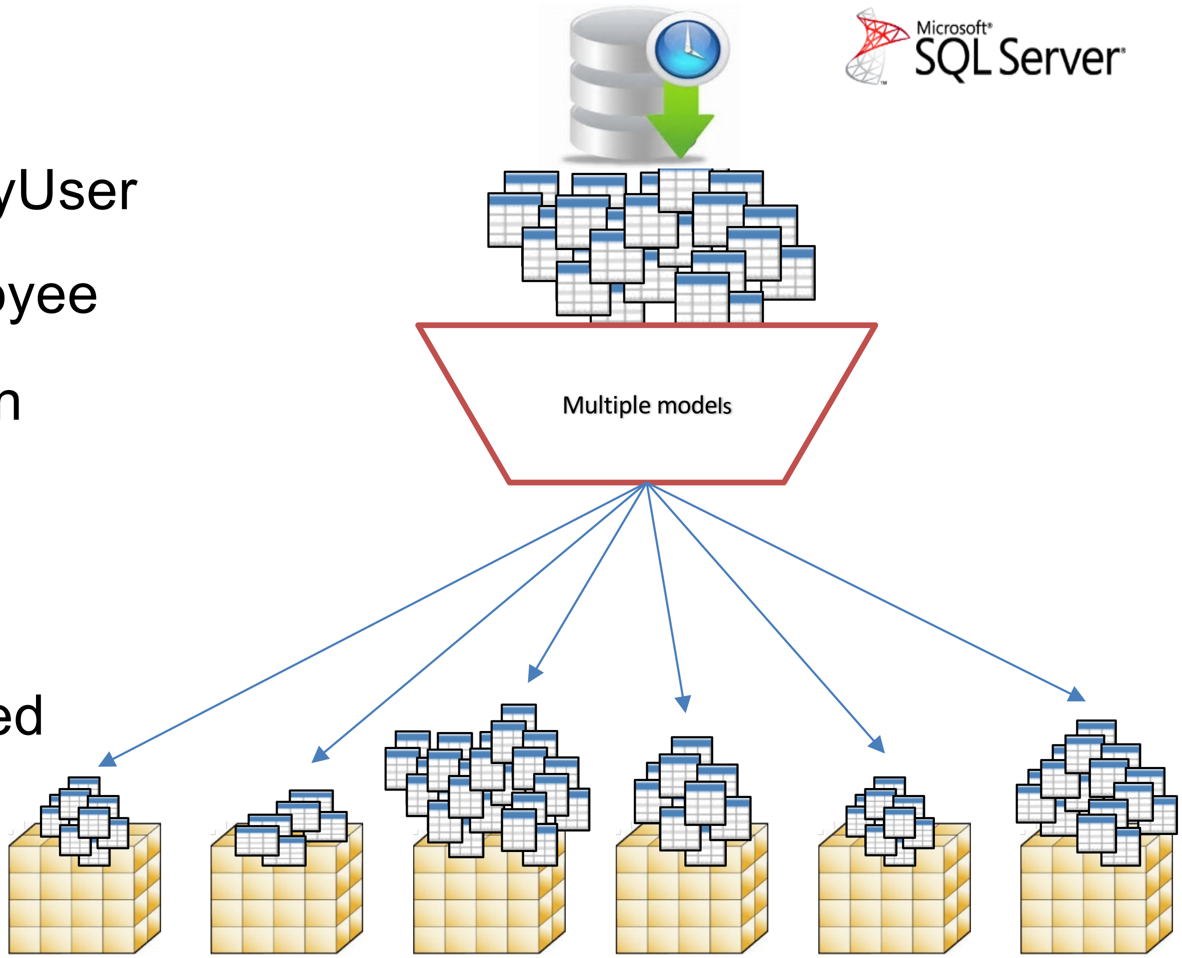
Its all about the data

BuildingLink Operational Datastore
SQL Server Agent for ETL



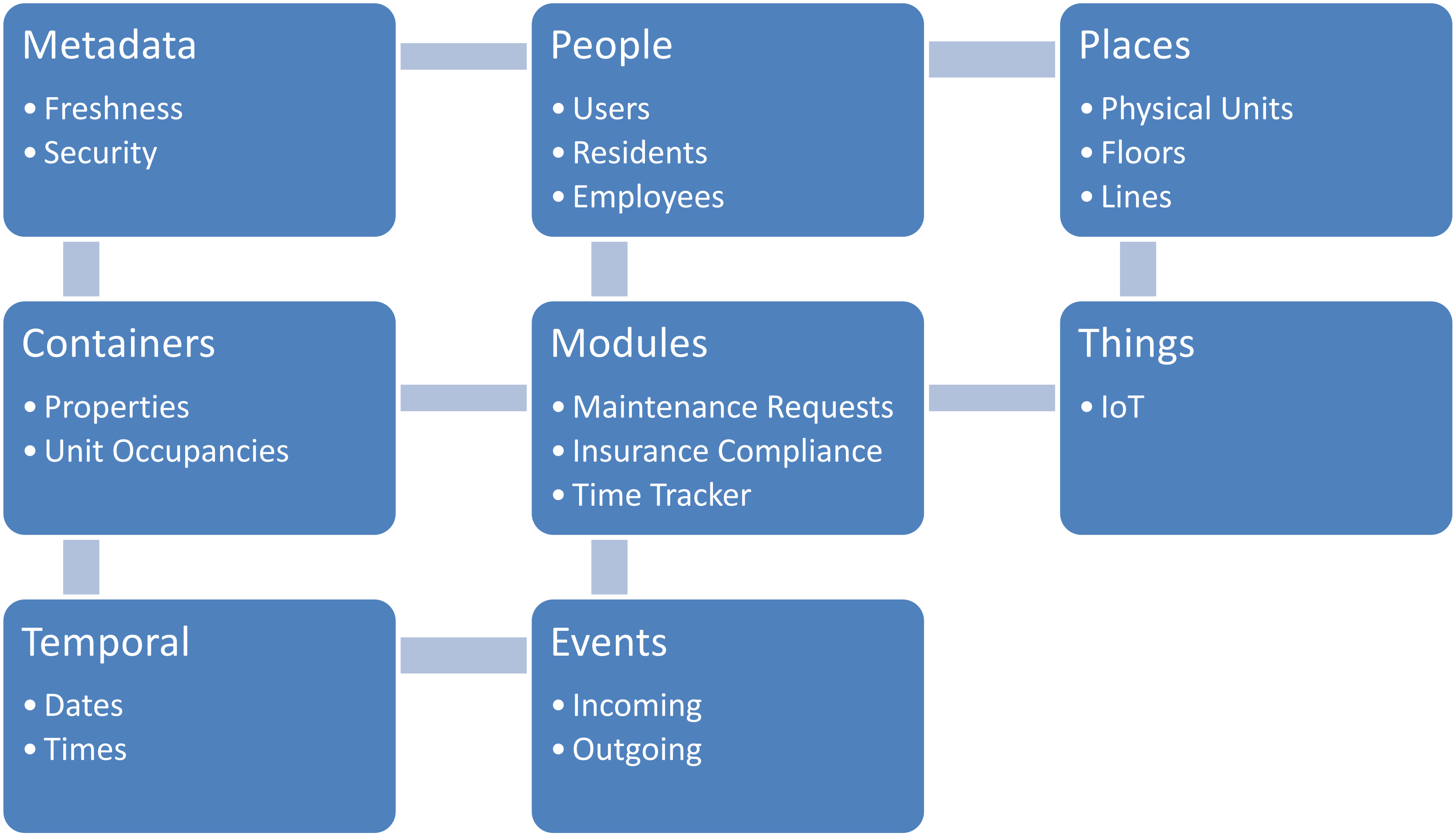
Analytic Models

- BuildingLink
- MgmtCompanyUser
- PropertyEmployee
- ProviderPerson
- Resident
- SystemAdmin
- Unauthenticated



Breaking Down a Model

PropertyEmployee



Metadata
- Freshness
- Security

People
- Users
- Residents
- Employees

Places
- Physical Units
- Floors
- Lines

Containers
- Properties
- Unit Occupancies

Modules
- Maintenance Requests
- Insurance Compliance
- Time Tracker

Things
- IoT

Temporal
- Dates
- Times

Events
- Incoming
- Outgoing

Breaking Down a Model

PropertyEmployee

- Source data is defined using SQL Views in a namespace associated with the model

```
CREATE VIEW pem.[Model Security]
AS
    SELECT
        [Property ID] = u.FacID,
        [Property Name] = p.FacName,
        [User ID] = u.userid,
    FROM tblUser u
        INNER JOIN dbo.tblFacilities p ON u.FacID = p.FacID
        INNER JOIN dbo.UserSubType AS ust ON ust.Id = u.SubTypeId
    WHERE u.delview = 0 AND u.useract = 1
    AND ust.node.IsDescendantOf(CAST('/4/' AS HIERARCHYID)) = 1
    AND ust.Node.IsDescendantOf(CAST('/4/3/' AS HIERARCHYID)) = 0
    AND ust.Node.IsDescendantOf(CAST('/5/' AS HIERARCHYID)) = 0
    -- AND u.FacID IN(217,554,1263,2142,3889,4249)
```

How (implementation)

Data Integration

BuildingLink Deployment Strategy with Power BI

Groups / Workspaces on the Power BI service

http://www.powerbi.com/

BL Web Source

- Can be edited and updated by BuildingLink staff

BL Web Staging

- A testing step for use by the business

BL Web Live

- Embedded Content on the live site meant for the targeted user

All workspace content is sourced at:
https://tfs.buildinglink.com/tfs/BuildingLink/Default/_git/Analytics/PowerBI/Applications

Naming

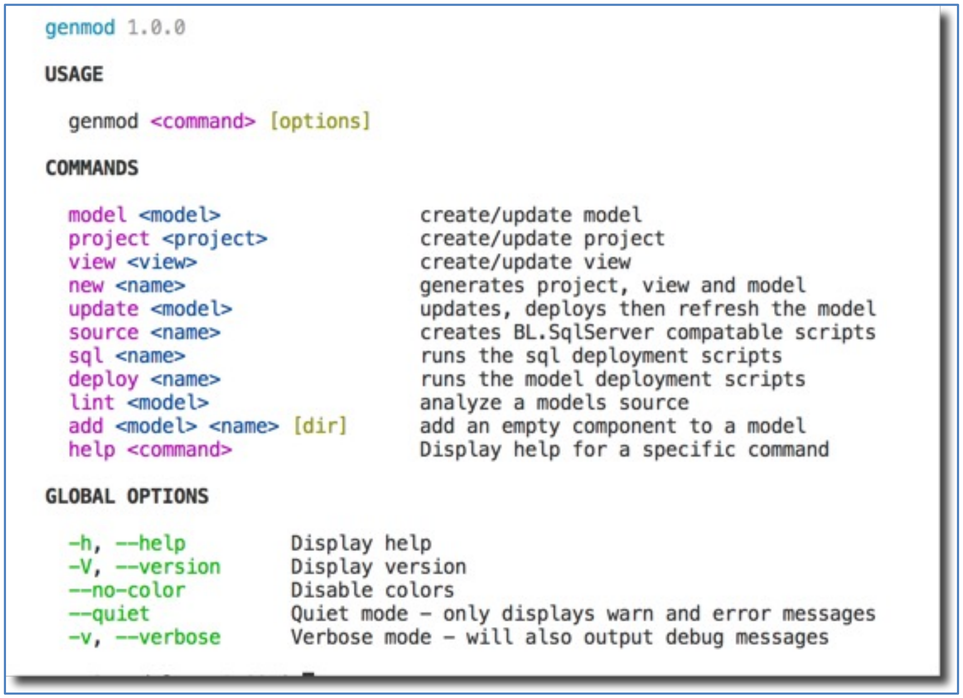
0000 reserved
0100 ManagementCompanyUser
0200 BuildingLink Admin
0300 unassigned
0400 unassigned
0500 Aware
0600 PropertyEmployee
0700 unassigned
0800 unassigned
0900 unassigned
1000 reserved

Part 3: Tool Chain

Introducing GenMod

A Model Maintenance Tool

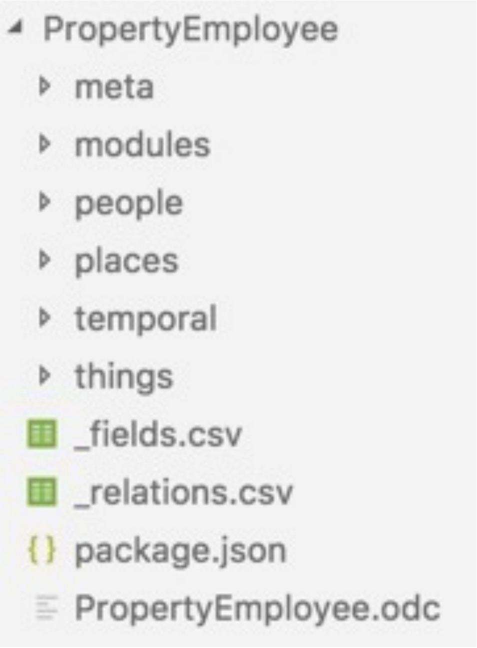
- Node based extensible – expandable
- Generate, Build and Deploy
- Scriptable CLI by design
- Sources: sql, csv, and json
- Targets: bim, smproj, views



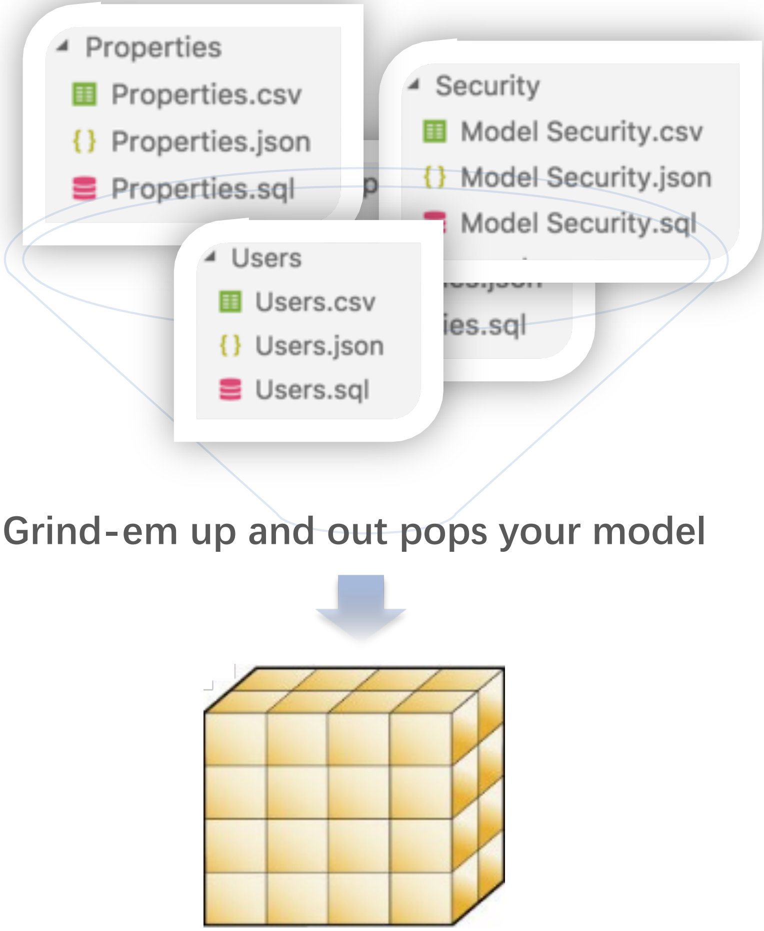
```
genmod 1.0.0

USAGE

  genmod <command> [options]

COMMANDS

  model <model>                  create/update model
  project <project>              create/update project
  view <view>                    create/update view
  new <name>                     generates project, view and model
  update <model>                 updates, deploys then refresh the model
  source <name>                  creates BL.SqlServer compatable scripts
  sql <name>                     runs the sql deployment scripts
  deploy <name>                  runs the model deployment scripts
  lint <model>                   analyze a models source
  add <model> <name> [dir]       add an empty component to a model
  help <command>                 Display help for a specific command

GLOBAL OPTIONS

  -h, --help           Display help
  -V, --version        Display version
  --no-color           Disable colors
  --quiet              Quiet mode - only displays warn and error messages
  -v, --verbose        Verbose mode - will also output debug messages
```

GenMod Design Principles

- Editing text files should be super easy
- Enabling a clean CI / CD flow is a first class goal



- PropertyEmployee
  - meta
  - modules
  - people
  - places
  - temporal
  - things
  - _fields.csv
  - _relations.csv
  - package.json
  - PropertyEmployee.odc



- Properties
  - Properties.csv
  - Properties.json
  - Properties.sql
- Security
  - Model Security.csv
  - Model Security.json
  - Model Security.sql
- Users
  - Users.csv
  - Users.json
  - Users.sql

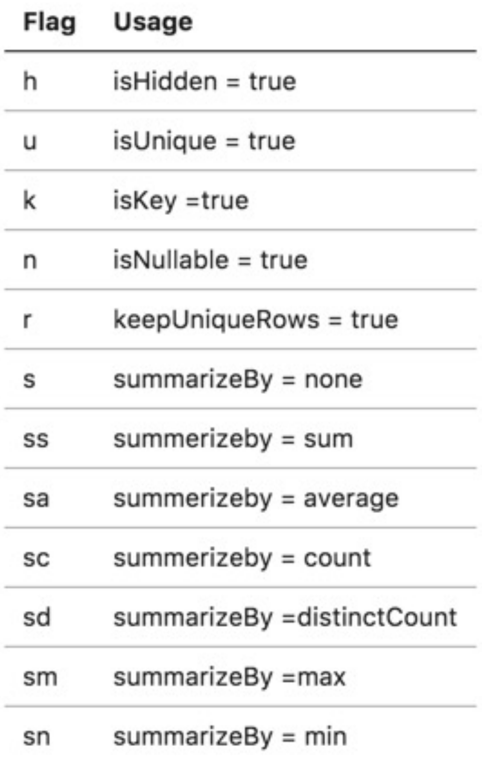
Grind-em up and out pops your model

GenMod – Model Configuration Files

- package.json
  - name on disk and in database
  - view namespace
  - views included
  - perspectives

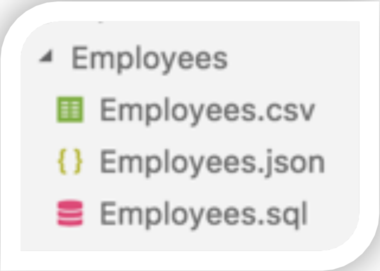
- _relations.csv
  - flags, tables, columns
  - h+u+k+n, table:table, field[:field]

- _fields.csv
  - view, field, description
  - single location for all descriptions

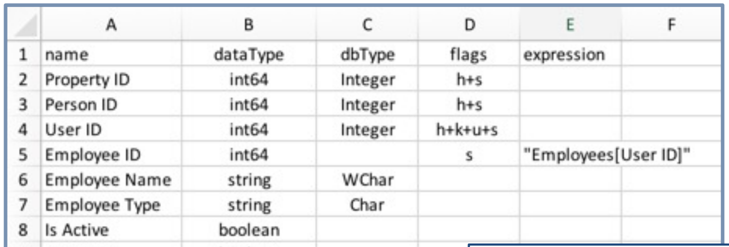


Flag	Usage
h	isHidden = true
u	isUnique = true
k	isKey =true
n	isNullable = true
r	keepUniqueRows = true
s	summarizeBy = none
ss	summerizeby = sum
sa	summerizeby = average
sc	summerizeby = count
sd	summarizeBy =distinctCount
sm	summarizeBy =max
sn	summarizeBy = min

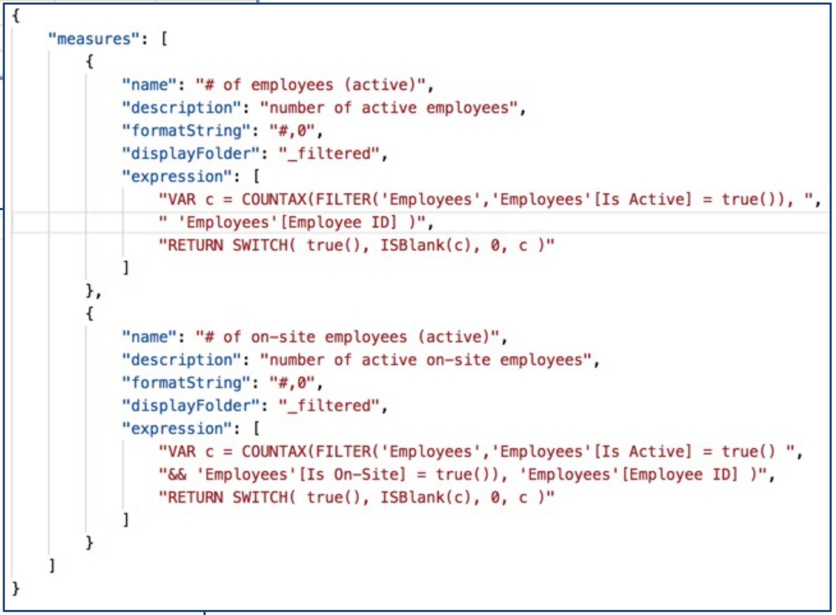
GenMod – Model Component Files



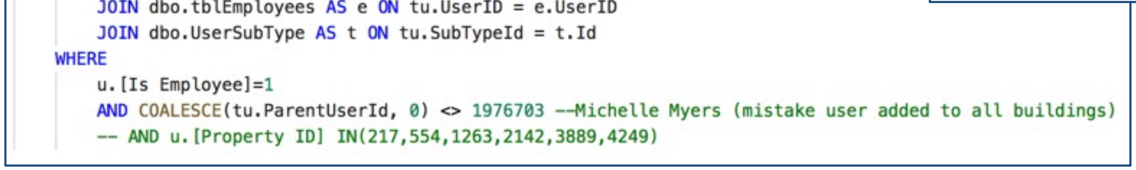
- Employees
  - Employees.csv
  - Employees.json
  - Employees.sql



	A	B	C	D	E	F
1	name	dataType	dbType	flags	expression	
2	Property ID	int64	Integer	h+s		
3	Person ID	int64	Integer	h+s		
4	User ID	int64	Integer	h+k+u+s		
5	Employee ID	int64		s	"Employees[User ID]"	
6	Employee Name	string	WChar			
7	Employee Type	string	Char			
8	Is Active	boolean				
9	Is On-Site	boolean				
10	Start Date	dateTime				
11	End Date	dateTime				



```
{
    "measures": [
        {
            "name": "# of employees (active)",
            "description": "number of active employees",
            "formatString": "#,0",
            "displayFolder": "_filtered",
            "expression": [
                "VAR c = COUNTAX(FILTER('Employees','Employees'[Is Active] = true()), ",
                " 'Employees'[Employee ID] )",
                "RETURN SWITCH( true(), ISBlank(c), 0, c )"
            ]
        },
        {
            "name": "# of on-site employees (active)",
            "description": "number of active on-site employees",
            "formatString": "#,0",
            "displayFolder": "_filtered",
            "expression": [
                "VAR c = COUNTAX(FILTER('Employees','Employees'[Is Active] = true() ",
                "&& 'Employees'[Is On-Site] = true()), 'Employees'[Employee ID] )",
                "RETURN SWITCH( true(), ISBlank(c), 0, c )"
            ]
        }
    ]
}
```



```
CREATE VIEW pem.[Employees]
AS
    SELECT
        u.[Property ID]
        , u.[User ID]
        , [Person ID] = COALESCE(tu.ParentUserId,tu.UserId)
        , [Employee Name] = u.[Full Name]
        , [Employee Type] = u.[Type]
        , [Start Date] = e.EmploymentStartDate
        , [End Date] = e.EmploymentEndDate
        , [Is Active] = u.[Is Active]
        , [Is On-Site] = CAST(CASE e.IsOffSite WHEN 1 THEN 0 ELSE 1 END AS BIT)

    FROM [dbo].tblUser tu
        JOIN [def].Users AS u on u.[User ID] = tu.UserID
        JOIN dbo.tblEmployees AS e ON tu.UserID = e.UserID
        JOIN dbo.UserSubType AS t ON tu.SubTypeId = t.Id
    WHERE
        u.[Is Employee]=1
        AND COALESCE(tu.ParentUserId, 0) <> 1976703 --Michelle Myers (mistake user added to all buildings)
        -- AND u.[Property ID] IN(217,554,1263,2142,3889,4249)
```

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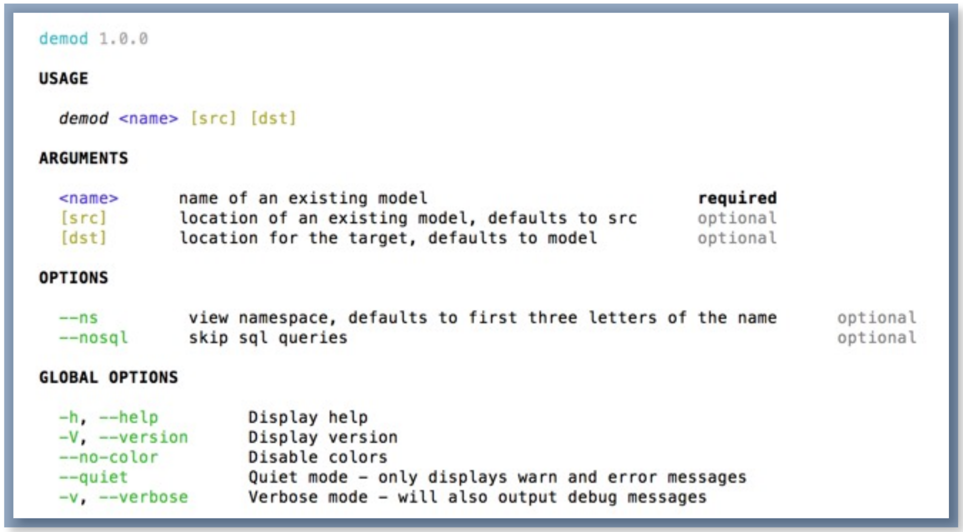
Introducing DeMod

A Model Decompiler Tool

- Opposite of Genmod
- Used to deconstruct and existing model to its source components

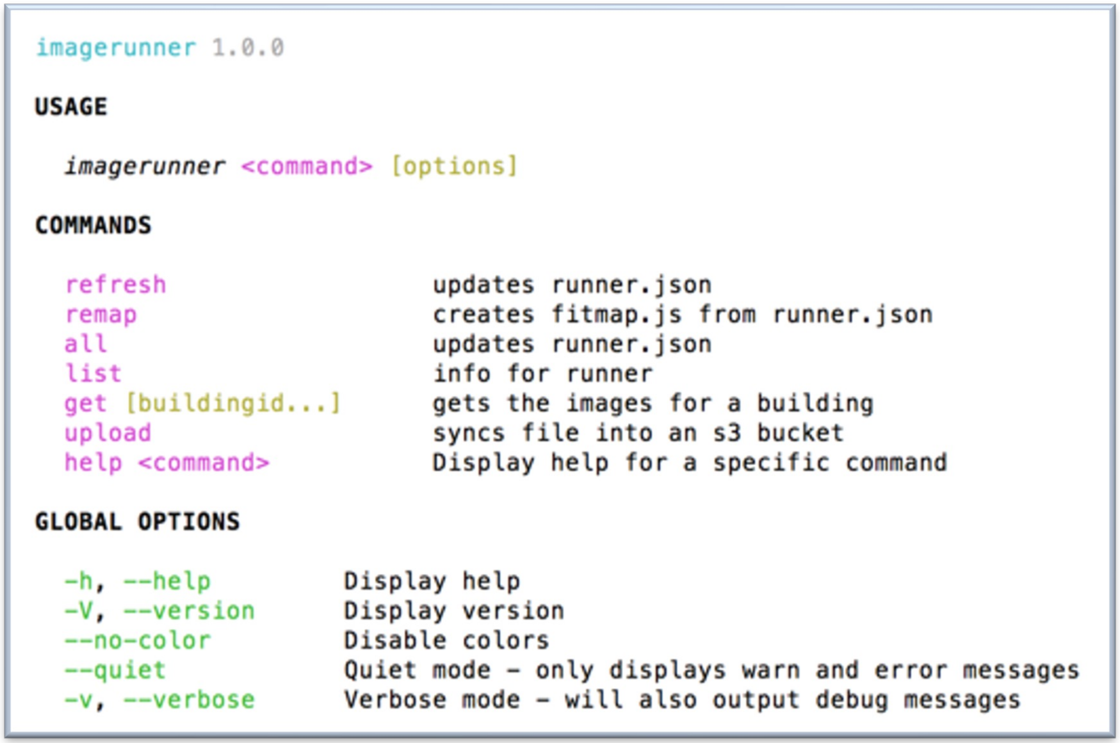


```
demod 1.0.0

USAGE

  demod <name> [src] [dst]

ARGUMENTS

  <name>      name of an existing model                       required
  [src]       location of an existing model, defaults to src  optional
  [dst]       location for the target, defaults to model      optional

OPTIONS

  --ns         view namespace, defaults to first three letters of the name     optional
  --nosql      skip sql queries                                                optional

GLOBAL OPTIONS

  -h, --help         Display help
  -V, --version      Display version
  --no-color         Disable colors
  --quiet            Quiet mode - only displays warn and error messages
  -v, --verbose      Verbose mode - will also output debug messages
```

Introducing Imagerunner

A Image Extraction Tool $/Analytics/PowerBI/scripts

- Use Case – save images generated by Power BI for Email
- Dependent tools selected:
  - PhantomJS a headless WebKit scriptable browser with a JavaScript API
  - casperjs navigation, scripting & testing on top of PhantomJS



```
imagerunner 1.0.0

USAGE

  imagerunner <command> [options]

COMMANDS

  refresh                      updates runner.json
  remap                        creates fitmap.js from runner.json
  all                          updates runner.json
  list                         info for runner
  get [buildingid...]          gets the images for a building
  upload                       syncs file into an s3 bucket
  help <command>               Display help for a specific command

GLOBAL OPTIONS

  -h, --help          Display help
  -V, --version       Display version
  --no-color          Disable colors
  --quiet             Quiet mode - only displays warn and error messages
  -v, --verbose       Verbose mode - will also output debug messages
```

Introducing Imagerunner

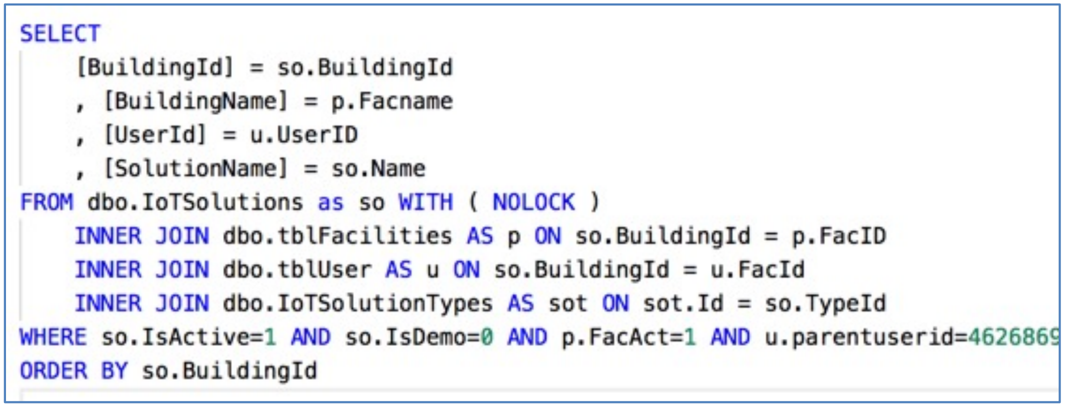
The Fitness Center

$/Analytics/PowerBI/scripts/fitness

$ imagerunner refresh

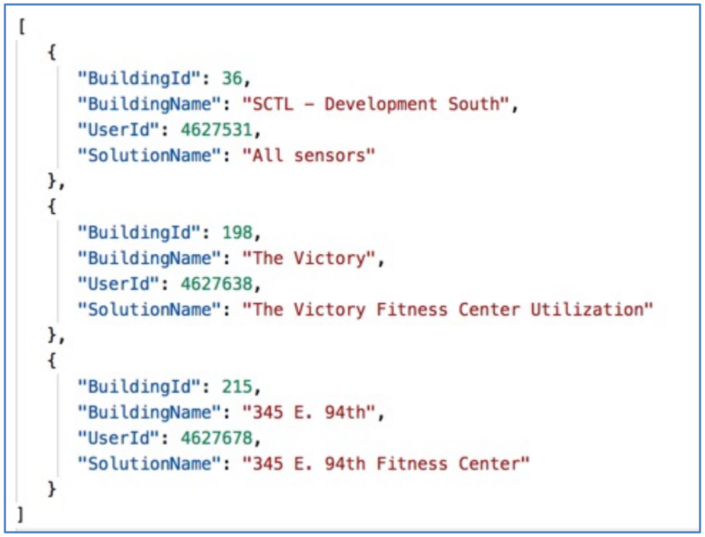
turns runner.sql into runner.json
configuration in package.json

runner.sql



```sql
SELECT
    [BuildingId] = so.BuildingId
    , [BuildingName] = p.Facname
    , [UserId] = u.UserID
    , [SolutionName] = so.Name
FROM dbo.IoTSolutions as so WITH ( NOLOCK )
    INNER JOIN dbo.tblFacilities AS p ON so.BuildingId = p.FacID
    INNER JOIN dbo.tblUser AS u ON so.BuildingId = u.FacId
    INNER JOIN dbo.IoTSolutionTypes AS sot ON sot.Id = so.TypeId
WHERE so.IsActive=1 AND so.IsDemo=0 AND p.FacAct=1 AND u.parentuserid=4626869
ORDER BY so.BuildingId
```

runner.json



```json
[
  {
    "BuildingId": 36,
    "BuildingName": "SCTL - Development South",
    "UserId": 4627531,
    "SolutionName": "All sensors"
  },
  {
    "BuildingId": 198,
    "BuildingName": "The Victory",
    "UserId": 4627638,
    "SolutionName": "The Victory Fitness Center Utilization"
  },
  {
    "BuildingId": 215,
    "BuildingName": "345 E. 94th",
    "UserId": 4627678,
    "SolutionName": "345 E. 94th Fitness Center"
  }
]
```

Introducing Imagerunner

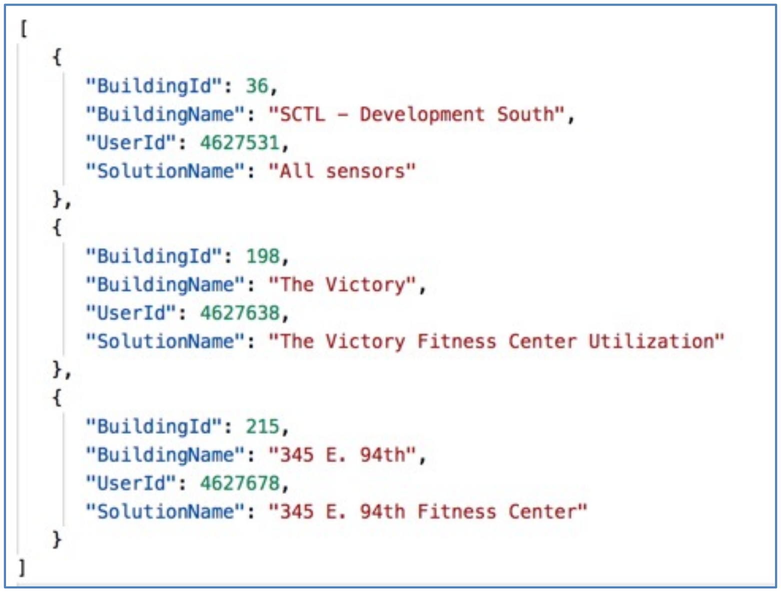
The Fitness Center

$/Analytics/PowerBI/scripts/fitness

$ imagerunner remap

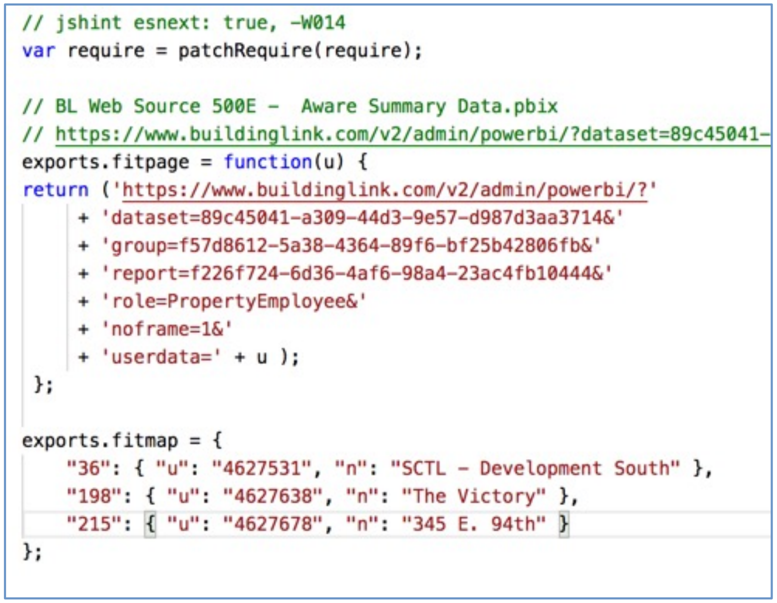
turns runner.json into fitmap.js

runner.json



```
[
    {
        "BuildingId": 36,
        "BuildingName": "SCTL - Development South",
        "UserId": 4627531,
        "SolutionName": "All sensors"
    },
    {
        "BuildingId": 198,
        "BuildingName": "The Victory",
        "UserId": 4627638,
        "SolutionName": "The Victory Fitness Center Utilization"
    },
    {
        "BuildingId": 215,
        "BuildingName": "345 E. 94th",
        "UserId": 4627678,
        "SolutionName": "345 E. 94th Fitness Center"
    }
]
```

fitmap.js

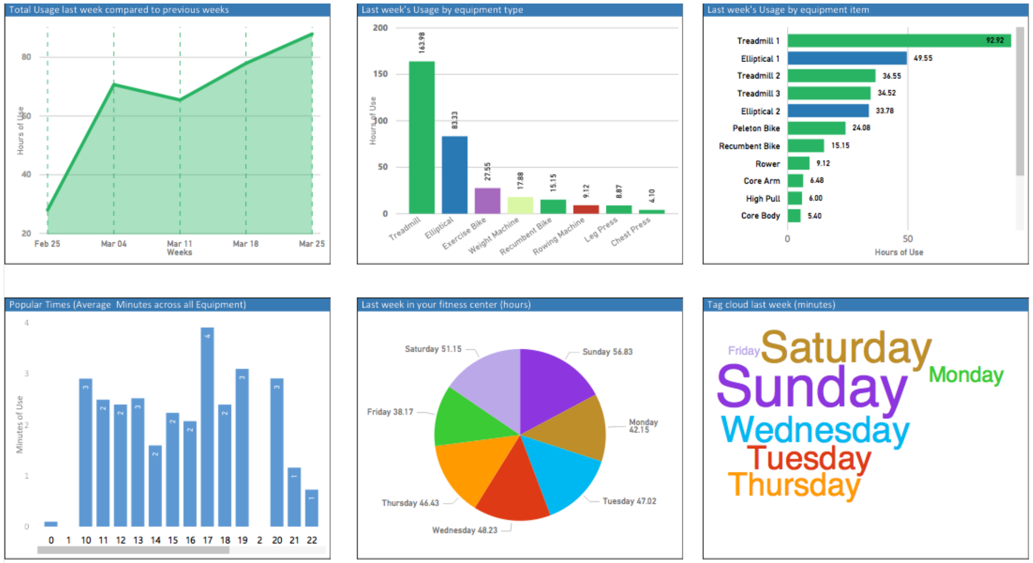


```
// jshint esnext: true, -W014
var require = patchRequire(require);

// BL Web Source 500E -  Aware Summary Data.pbix
// https://www.buildinglink.com/v2/admin/powerbi/?dataset=89c45041-
exports.fitpage = function(u) {
return ('https://www.buildinglink.com/v2/admin/powerbi/?'
        + 'dataset=89c45041-a309-44d3-9e57-d987d3aa3714&'
        + 'group=f57d8612-5a38-4364-89f6-bf25b42806fb&'
        + 'report=f226f724-6d36-4af6-98a4-23ac4fb10444&'
        + 'role=PropertyEmployee&'
        + 'noframe=1&'
        + 'userdata=' + u );
 };

exports.fitmap = {
    "36": { "u": "4627531", "n": "SCTL - Development South" },
    "198": { "u": "4627638", "n": "The Victory" },
    "215": { "u": "4627678", "n": "345 E. 94th" }
};
```

Introducing Imagerunner

The Fitness Center

$/Analytics/PowerBI/scripts/fitness


Total Usage last week compared to previous weeks

Last week's Usage by equipment type

Last week's Usage by equipment item

Popular Times (Average Minutes across all Equipment)

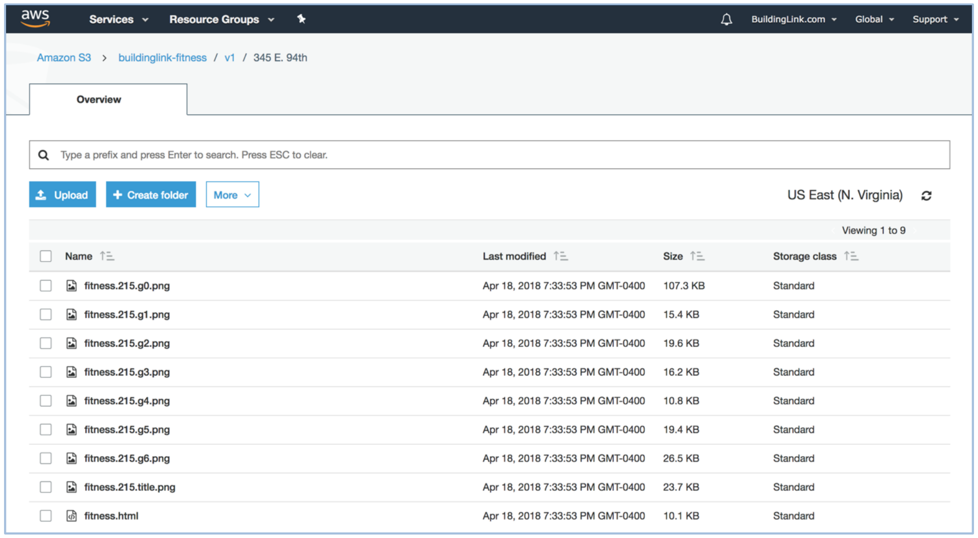
Last week in your fitness center (hours)

Tag cloud last week (minutes)

```
quasar-3:fitness$ imagerunner refresh
Wednesday, April 18th 2018, 7:20:39 pm
saving runner.json


quasar-3:fitness$ imagerunner remap
saving fitmap.js


quasar-3:fitness$ imagerunner list
36        SCTL - Development South
198       The Victory
215 345 E. 94th

quasar-3:fitness$ imagerunner get 215
Wednesday, April 18th 2018, 7:21:56 pm
215 4627678 '345 E. 94th' '345 E. 94th Fitness Center’

Running: casperjs fitness.js 215
split time 00:00:24
elapsed time 00:00:24

quasar-3:fitness$ imagerunner upload
Wednesday, April 18th 2018, 7:33:51 pm Upload Starts
elapsed time 00:00:01
```

Introducing Imagerunner

The Fitness Center – the final product ready to mail!



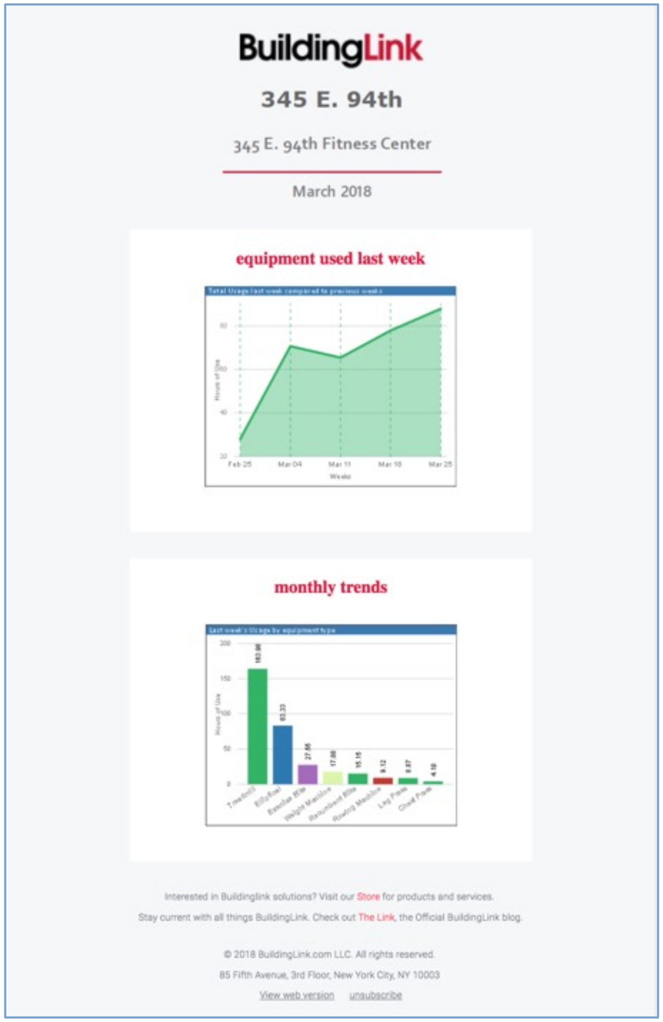
Amazon S3 > buildinglink-fitness / v1 / 345 E. 94th

Overview
Type a prefix and press Enter to search. Press ESC to clear.
Upload
Create folder
More

US East (N. Virginia)

Viewing 1 to 9

□	Name	Last modified	Size	Storage class
□	fitness.215.g0.png	Apr 18, 2018 7:33:53 PM GMT-0400	107.3 KB	Standard
□	fitness.215.g1.png	Apr 18, 2018 7:33:53 PM GMT-0400	15.4 KB	Standard
□	fitness.215.g2.png	Apr 18, 2018 7:33:53 PM GMT-0400	19.6 KB	Standard
□	fitness.215.g3.png	Apr 18, 2018 7:33:53 PM GMT-0400	16.2 KB	Standard
□	fitness.215.g4.png	Apr 18, 2018 7:33:53 PM GMT-0400	10.8 KB	Standard
□	fitness.215.g5.png	Apr 18, 2018 7:33:53 PM GMT-0400	19.4 KB	Standard
□	fitness.215.g6.png	Apr 18, 2018 7:33:53 PM GMT-0400	26.5 KB	Standard
□	fitness.215.title.png	Apr 18, 2018 7:33:53 PM GMT-0400	23.7 KB	Standard
□	fitness.html	Apr 18, 2018 7:33:53 PM GMT-0400	10.1 KB	Standard



BuildingLink

345 E. 94th

345 E. 94th Fitness Center

March 2018

equipment used last week

monthly trends

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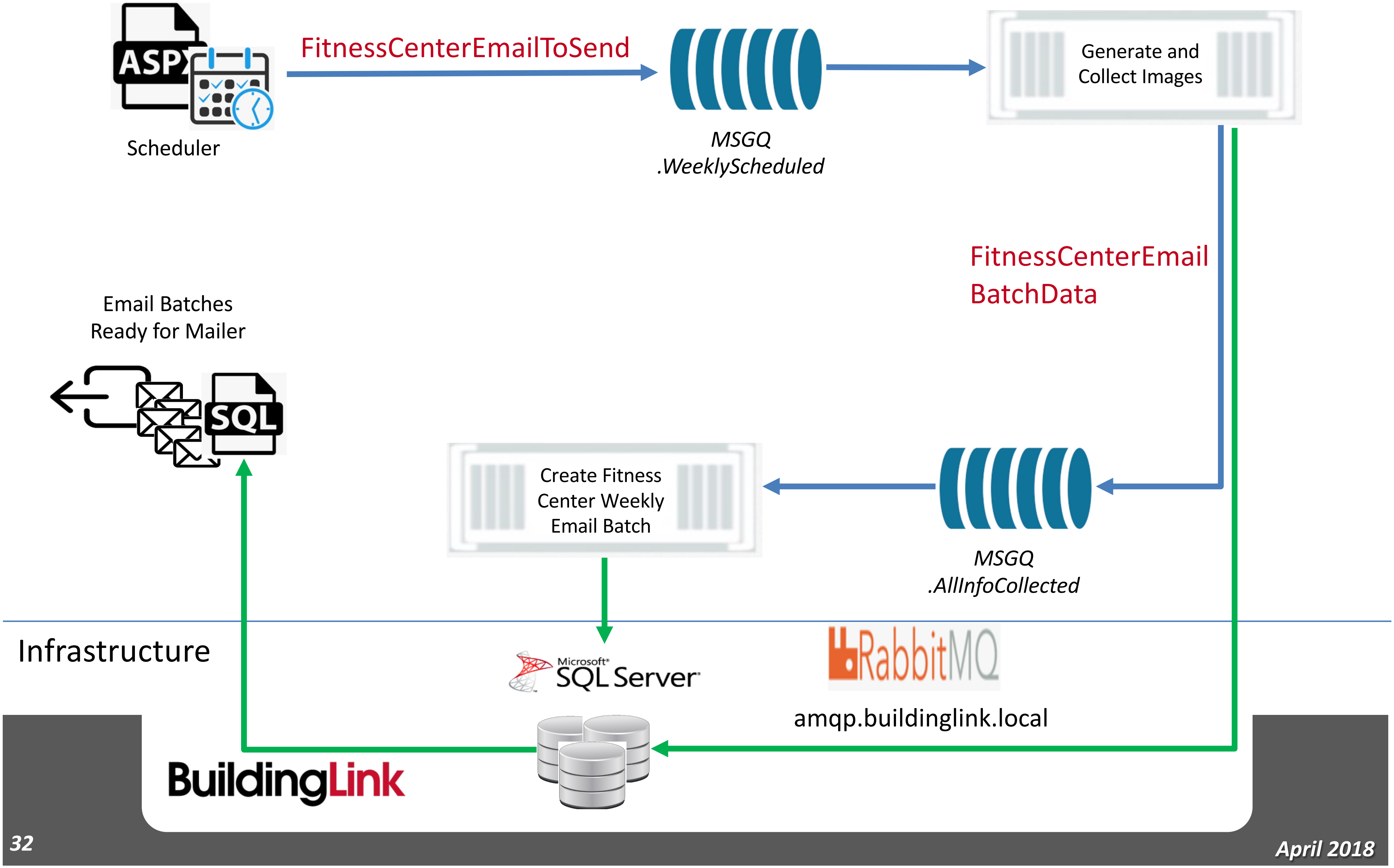
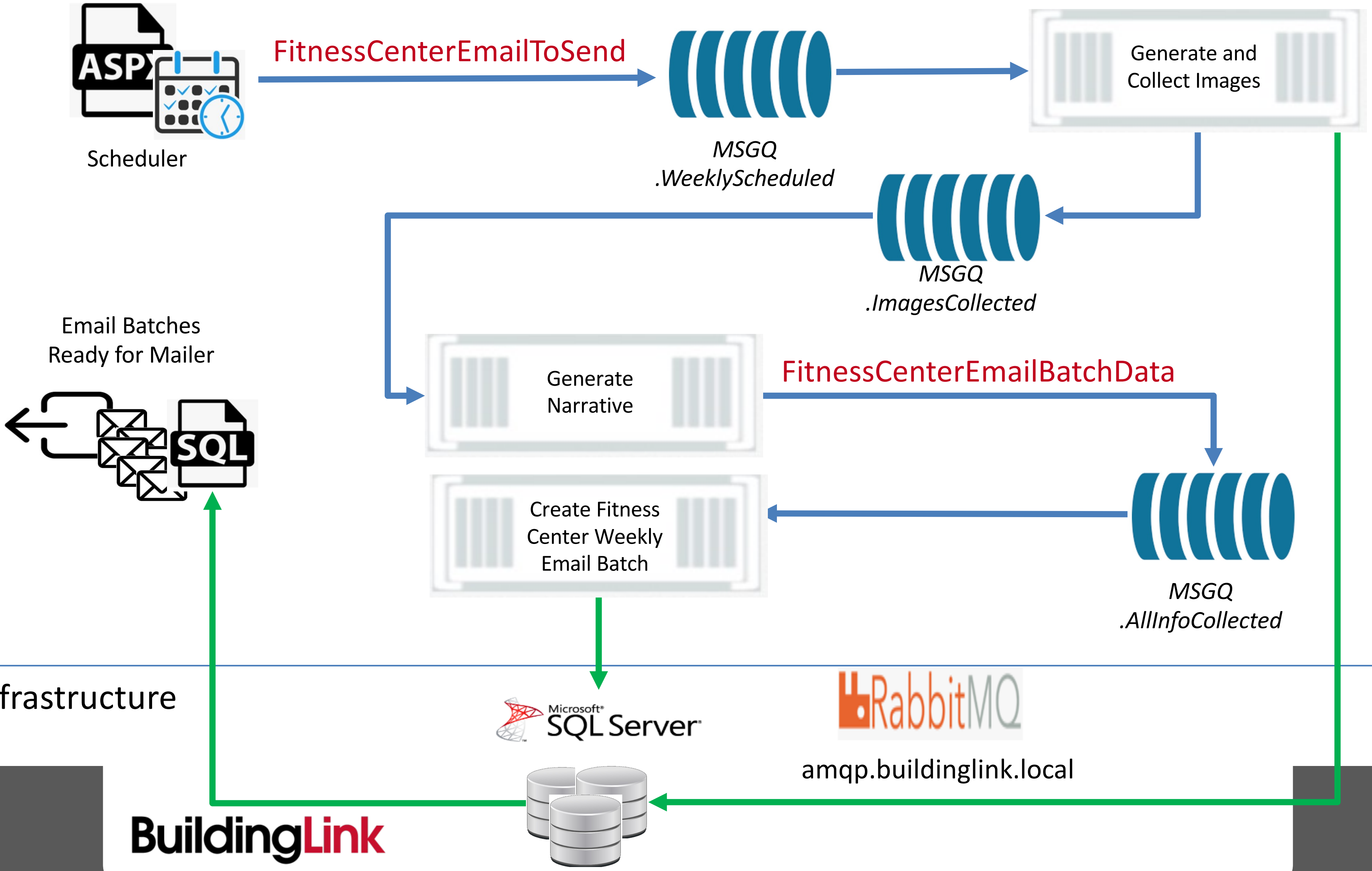
View web version   unsubscribe

Integration into the BuildingLink Mailer



Integration into the BuildingLink Mailer



Scheduler

FitnessCenterEmailToSend

MSGQ
.WeeklyScheduled

Generate and
Collect Images

MSGQ
.ImagesCollected

Email Batches
Ready for Mailer

Generate
Narrative

FitnessCenterEmailBatchData

Create Fitness
Center Weekly
Email Batch

MSGQ
.AllInfoCollected

Infrastructure

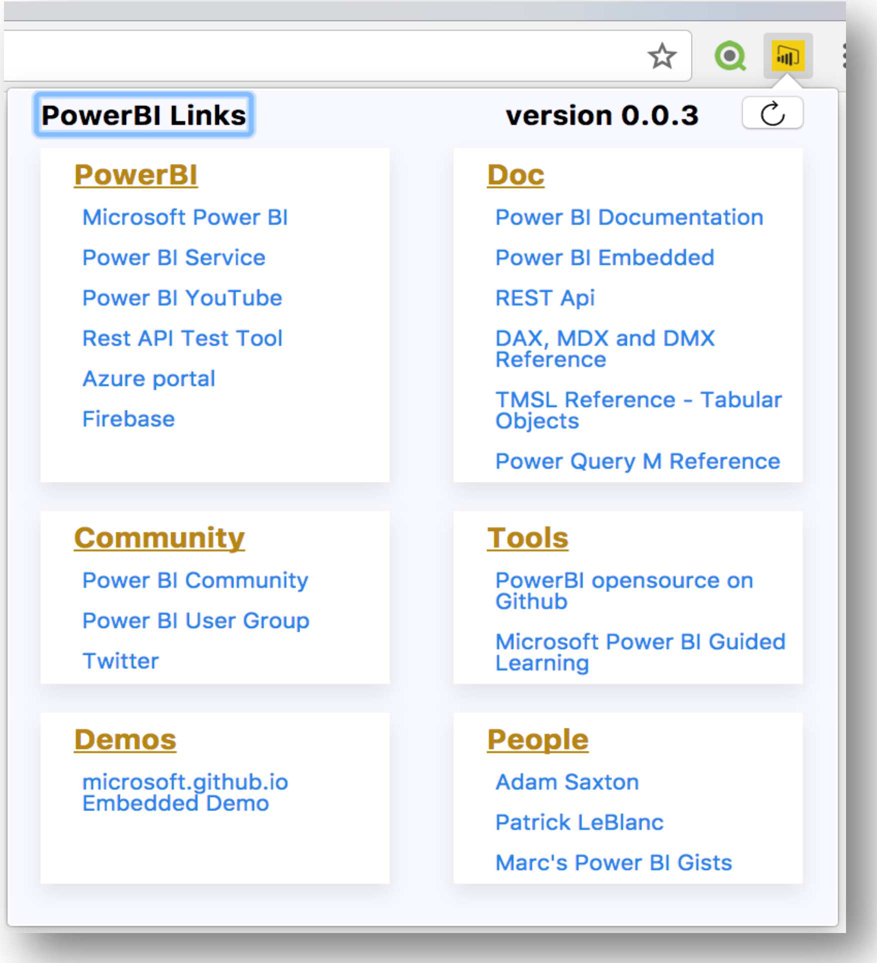
Microsoft SQL Server

RabbitMQ

amqp.buildinglink.local

BuildingLink

Chrome Extensions



PowerBI Links version 0.0.3

PowerBI
- Microsoft Power BI
- Power BI Service
- Power BI YouTube
- Rest API Test Tool
- Azure portal
- Firebase

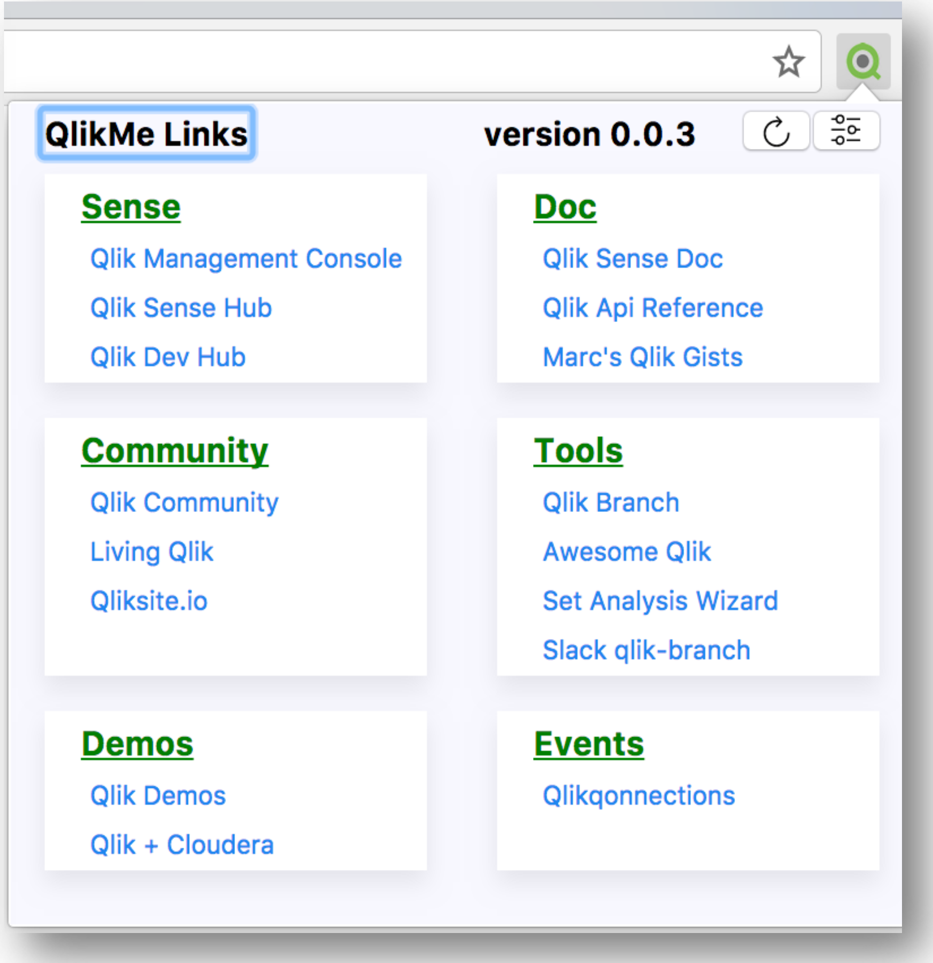
Doc
- Power BI Documentation
- Power BI Embedded
- REST Api
- DAX, MDX and DMX Reference
- TMSL Reference - Tabular Objects
- Power Query M Reference

Community
- Power BI Community
- Power BI User Group
- Twitter

Tools
- PowerBI opensource on Github
- Microsoft Power BI Guided Learning

Demos
- microsoft.github.io Embedded Demo

People
- Adam Saxton
- Patrick LeBlanc
- Marc's Power BI Gists



QlikMe Links version 0.0.3

Sense
- Qlik Management Console
- Qlik Sense Hub
- Qlik Dev Hub

Doc
- Qlik Sense Doc
- Qlik Api Reference
- Marc's Qlik Gists

Community
- Qlik Community
- Living Qlik
- Qliksite.io

Tools
- Qlik Branch
- Awesome Qlik
- Set Analysis Wizard
- Slack qlik-branch

Demos
- Qlik Demos
- Qlik + Cloudera

Events
- Qlikqonnections

PowerBi Me chrome webstore

QlikMe chrome webstore