ArcGIS Enterprise:
Best Practices for Layers and Service Types

Witt Mathot
Philip Heede

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Agenda

- Introduction and concepts
- Technical foundation
- GIS services – concepts
- GIS services – types
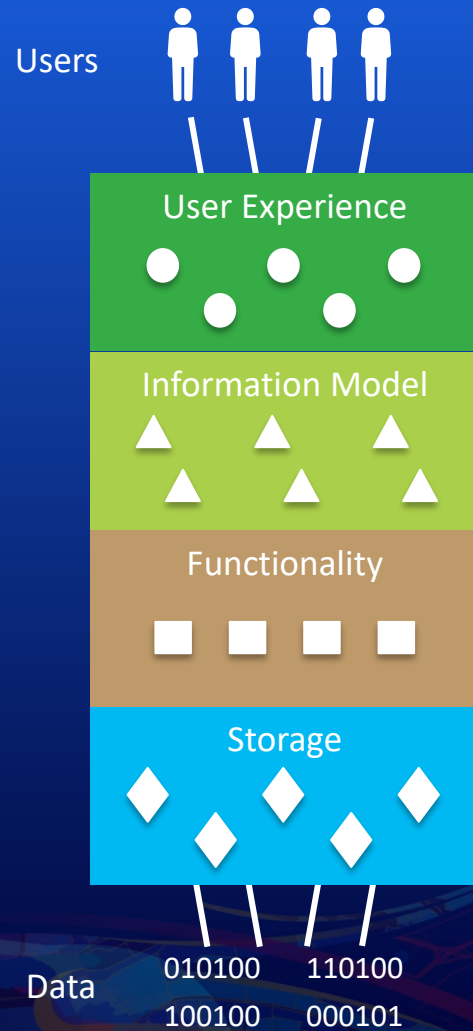- Web maps & layers
- Summary

PLEASE NOTE

This is a nuanced and always <u>evolving</u> topic. Information presented in this session is current as of March 2021 and ArcGIS Enterprise 10.9. Technical details, available options, guidance, and best practices differ from version to version … important to stay current!
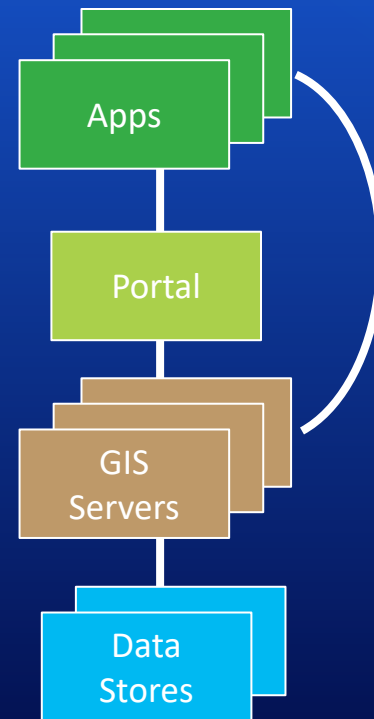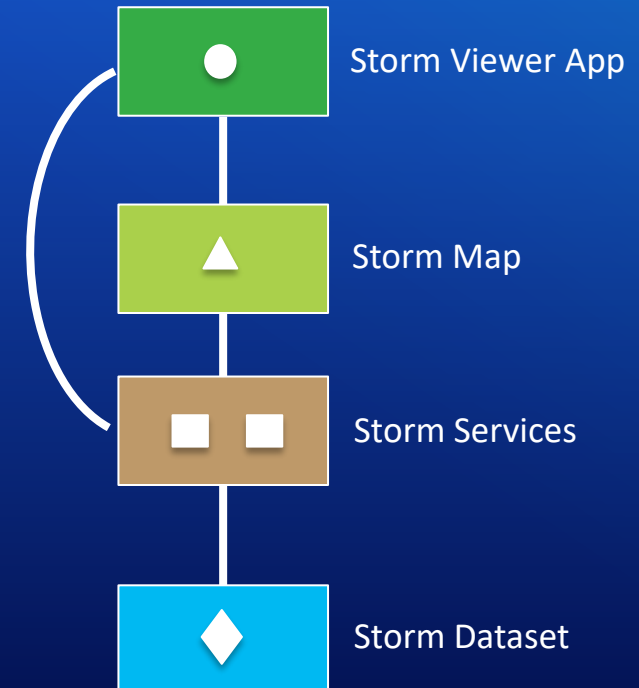
Introduction & Concepts

Conceptual components

Users

User Experience

Information Model

Functionality

Storage

Data

010100
100100

110100
000101

ArcGIS Products

Apps

Portal

GIS Servers

Data Stores

Example

Storm Viewer App

Storm Map

Storm Services

Storm Dataset

Initial considerations

- Audience – Where are they? What is their device? What is their ability?

- Capabilities – requisite functionality

- Performance – End user app / back office system

- Scalability – up or out

- Reliability - SLAs

- Security – Access to content, authorization to functionality, protecting back office

Examples

- Supporting a public facing , highly available, power outage app
- Supporting an internal facing, intermittently connected, field collection app
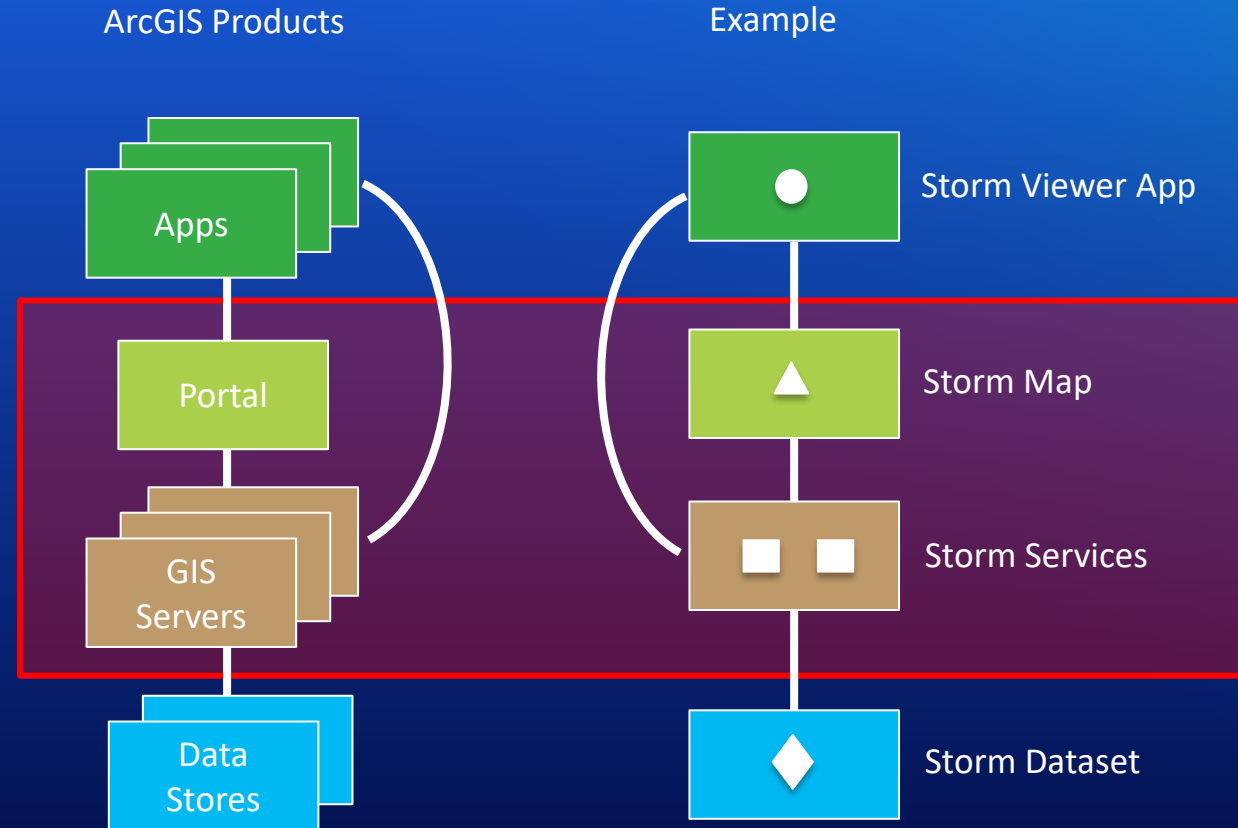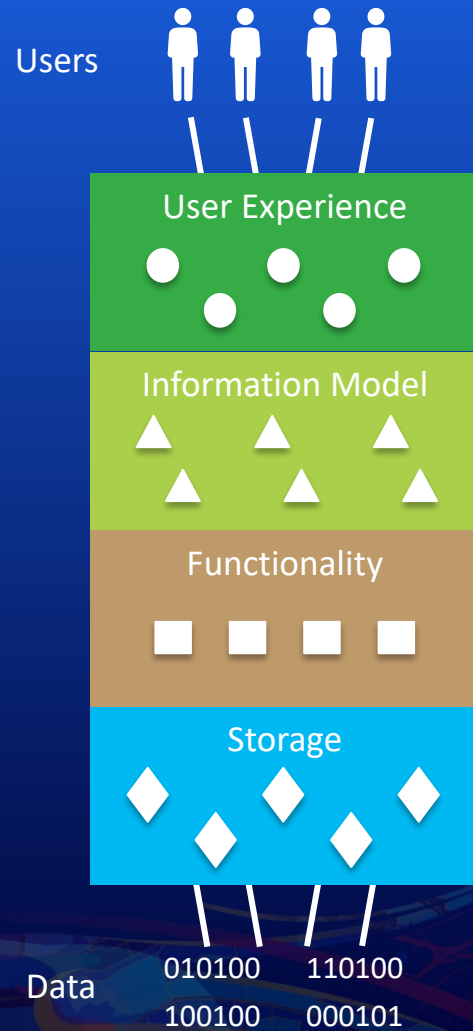
Approach

1. Focus on business
2. Start with the end (consumer), build bottom up (data)
3. Align/select technology accordingly
4. Adjust over time – be agile!

Technical Foundation

Conceptual components

Technical introduction

- Publication Clients
  - ArcGIS Pro = Modern publishing client *(supports new capabilities, e.g. Vector Tiles and Shared Instances)*
  - ArcMap = Traditional GIS publishing client

- Publication & Management Models
  - Hosted Services = ArcGIS-managed *(ArcGIS manages services & data, User via portal)*
  - Traditional Services = User-managed *(User manages data directly)*

- Data Stores
  - ArcGIS Data Store = Storage for ArcGIS-managed data *(supports relational, scenes, and observations)*
  - Registered Data Stores = Enterprise data sources used by reference *(and managed by user)*
    - File based like file geodatabases or in traditional RDBMS such as enterprise geodatabases based on Oracle, SQL Server, PostgreSQL, etc.
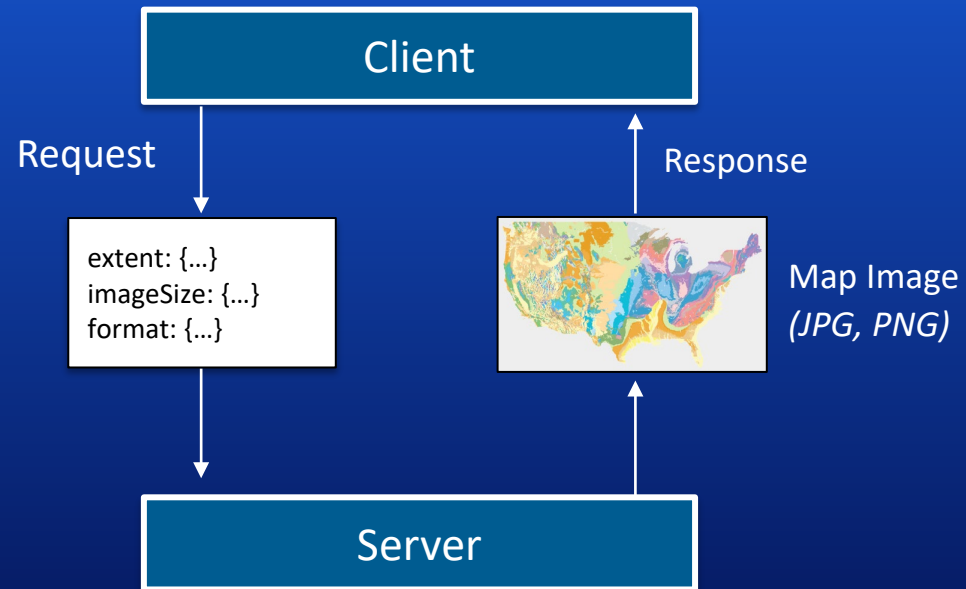
Key concepts

- Features vs. map images
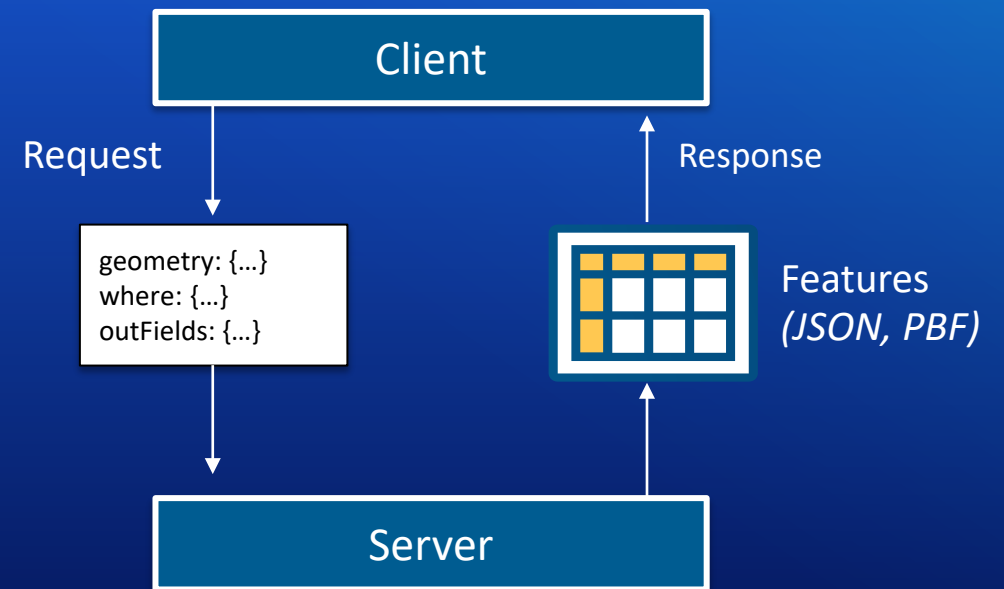- Tiles
- Caching
- Generalization

Features vs. map images

Map Images

Client

Request

Response

```
extent: {…}
imageSize: {…}
format: {…}
```

Map Image
(JPG, PNG)

Server

- Server-side rendering
- Standard (small) payload size
- Limited client experience & interactivity

Features

Client

Request

Response

```
geometry: {…}
where: {…}
outFields: {…}
```

Features
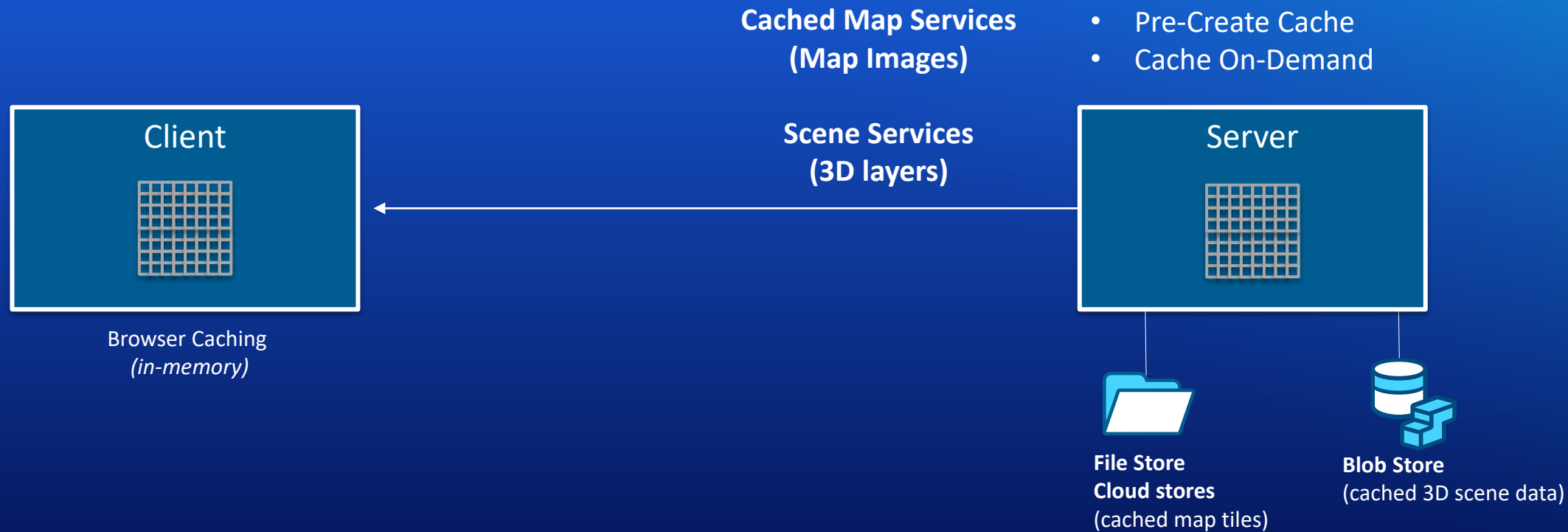*(JSON, PBF)*

Server

- Client-side rendering
- Variable (small-to-large) payload size
- Rich client experience & interactivity

Tiles

L00

01

L02

L03

- Tile Content
  - Raster
  - Vector

- Benefits
  - Parallelization *(client and/or server)*
  - Caching …

Caching on ArcGIS Enterprise

Cached Map Services (Map Images)

Scene Services (3D layers)

- Pre-Create Cache
- Cache On-Demand

Client

Server

Browser Caching
(in-memory)

File Store
Cloud stores
(cached map tiles)

Blob Store
(cached 3D scene data)

Caching _on ArcGIS Enterprise_

Coming at 10.9
Feature Tile Caching
(Features)

- Cached and updated On-Demand

Client

Server

Browser Caching
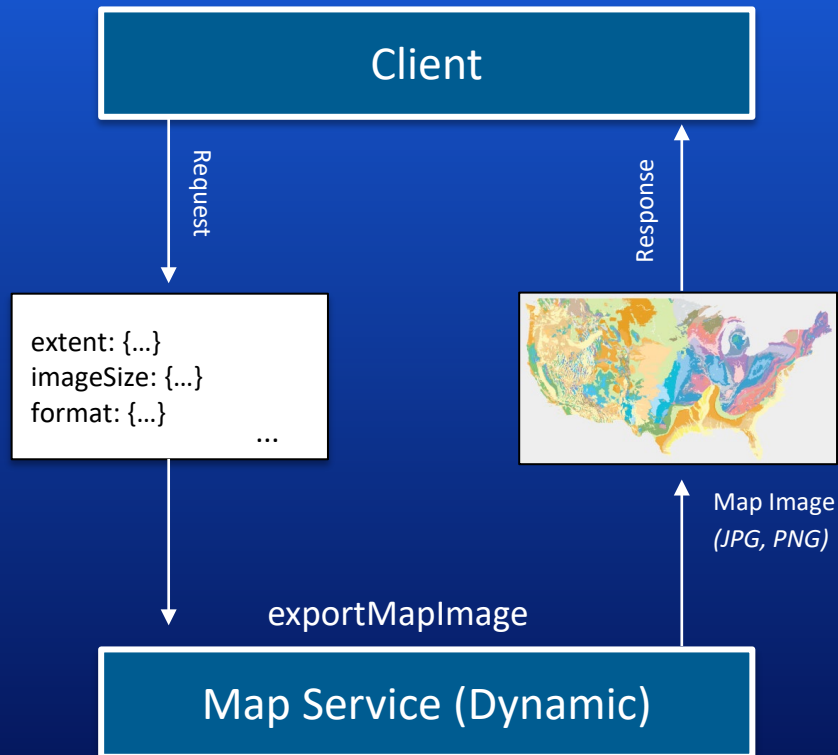_(in-memory)_

Object Store

Types of GIS services

Types of services

- Map Services (Dynamic)
- Map Services (Tiled)
- Vector Tile Services
- Feature Services
- Image Services
- Scene Services
- Stream Services
- Geocode Services

- Utility Network Services
- Parcel Fabric Services
- Version Management Services
- Geometry Services
- Geoprocessing Services
- Network Analyst Services
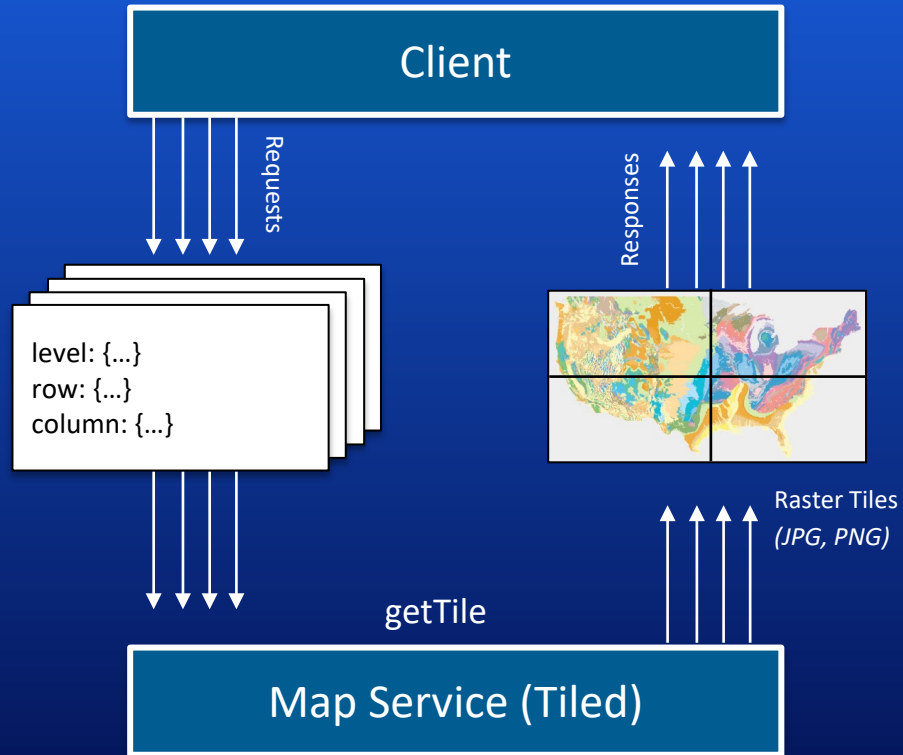- Geodata Services
- Workflow Manager, Maritime, Schematics …

Map Service (Dynamic)

Client

Request

Response

extent: {...}
imageSize: {...}
format: {...}
                        ...

exportMapImage

Map Service (Dynamic)

Map Image
(JPG, PNG)

- Powers the Map Image Layer

- ArcGIS Enterprise only

- Traditionally for user managed data only
  - *New at 10.8: hosted map image layers!*

- Key Capabilities
  - Server-side rendering
  - Supports dynamic layers & rendering
  - Supports identify & query
  - Supports OGC standards* (WMS)
  - **New at 10.7**: support for shared instances
  - **New at 10.7.1**: support for dynamic feature binning with ArcGIS Pro 2.4

*The failsafe option for complex, dynamic data … especially on constrained networks*

Map Service (Tiled or Cached)

Client

Requests

level: {…}
row: {…}
column: {…}

Responses

getTile

Map Service (Tiled)

Raster Tiles
(JPG, PNG)

- Powers the Tiled Layer
- ArcGIS Online & ArcGIS Enterprise
- ArcGIS or User managed data
- Key Capabilities
  - Server-side rendering
  - Cached using tiles *(pre-create or on-demand)*
  - Supports taking data offline
  - Supports OGC standards* (WMTS)

Proven option for complex, static data with high performance needs

Vector Tile Service

Client

Requests

Responses

level: {…}
row: {…}
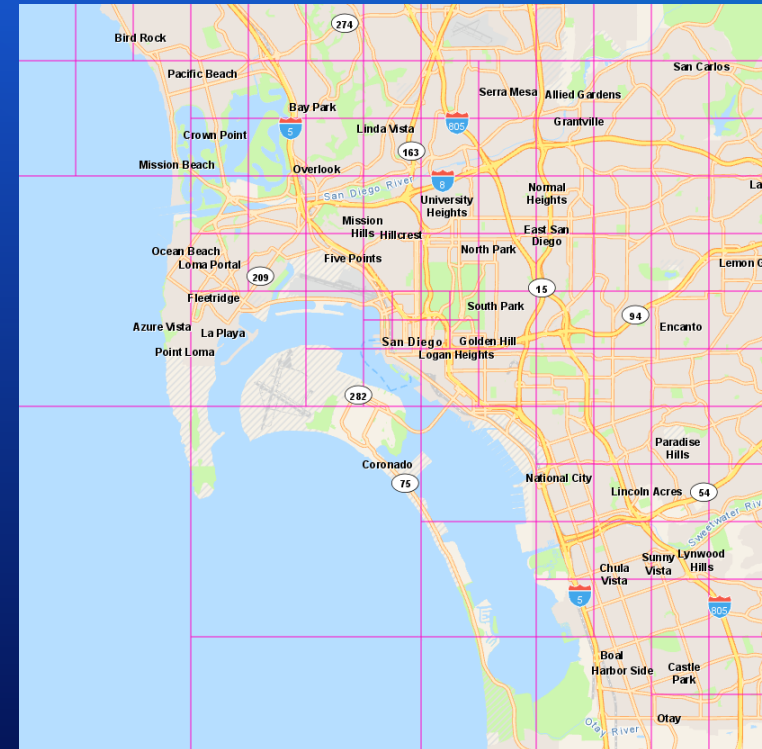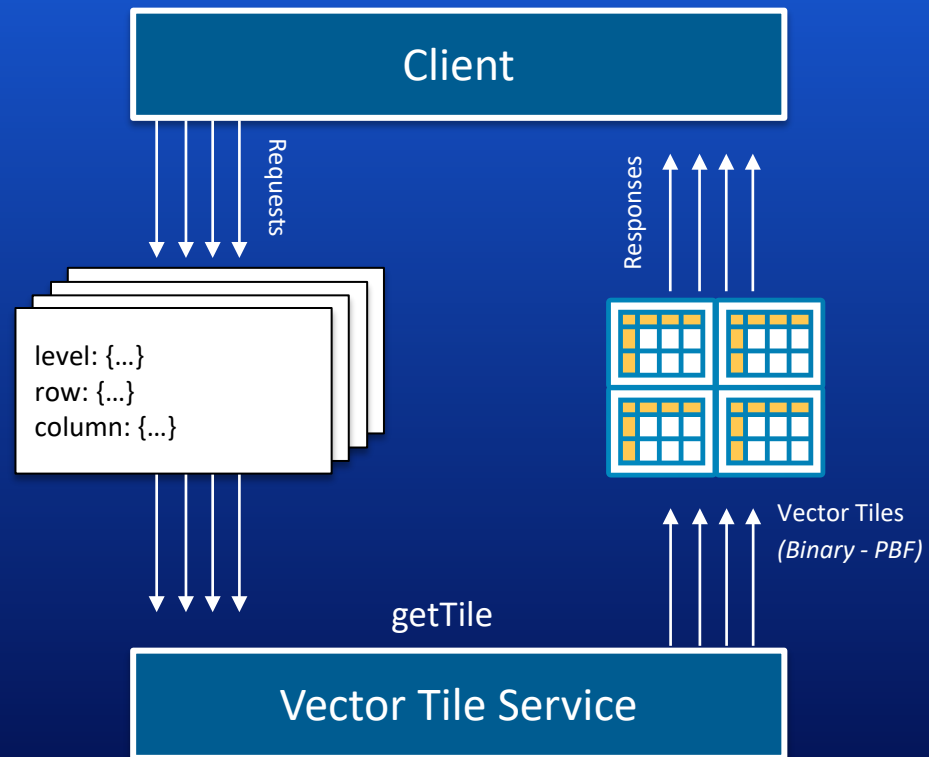column: {…}

getTile

Vector Tiles
(Binary - PBF)

Vector Tile Service
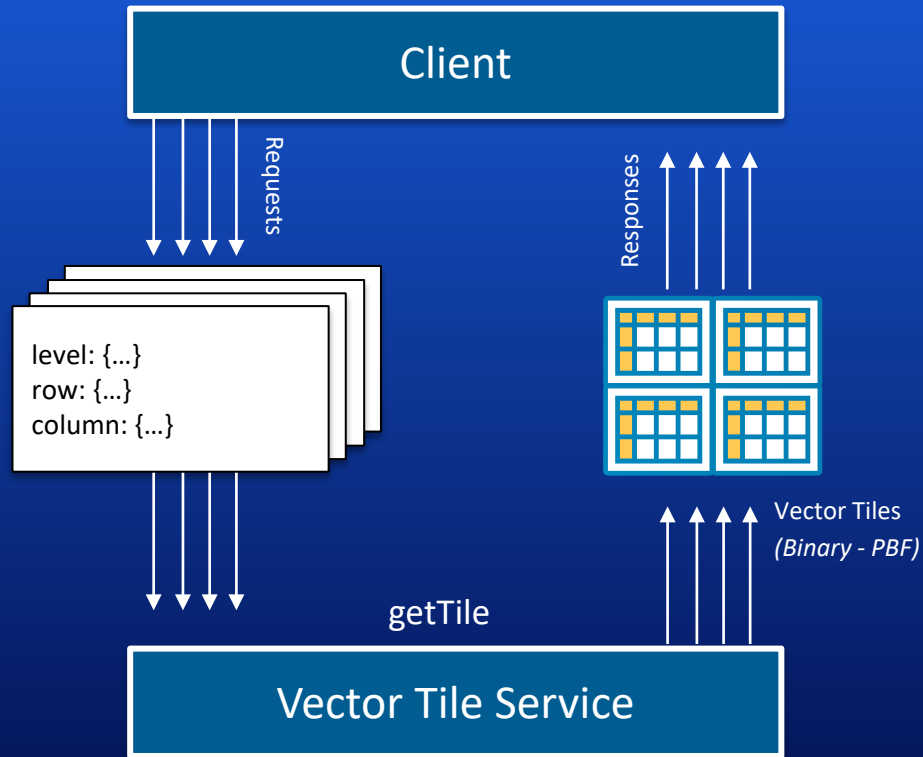
- Powers the Tiled Layer
- ArcGIS Online & ArcGIS Enterprise
- ArcGIS managed data only
- Key Capabilities
  - Client-side rendering
  - Cached using tiles *(pre-create only)*
  - Pre-generalizes features, clips to tile
  - Visualization only, no identify or query
  - Supports taking data offline

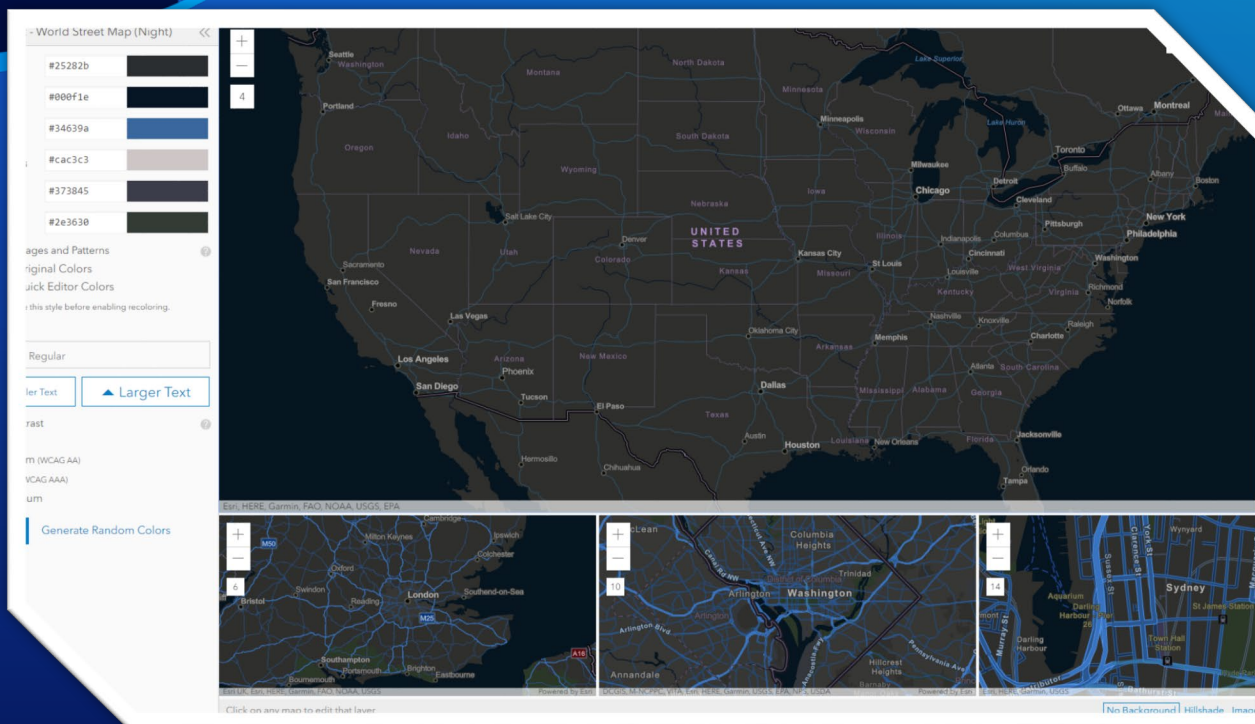*The new kid on the block … great alternative to tiled map services and, in some cases, feature services*
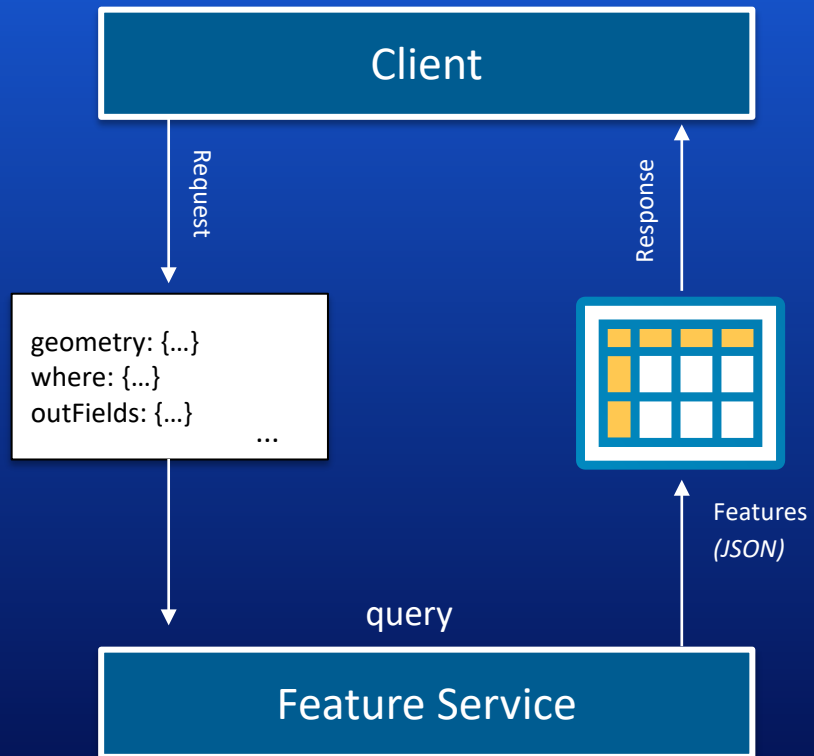
Vector Tile Service

Client

Requests

Responses

level: {...}
row: {...}
column: {...}

Vector Tiles
(Binary - PBF)

getTile

Vector Tile Service

Supports overzooming & indexed tiling scheme

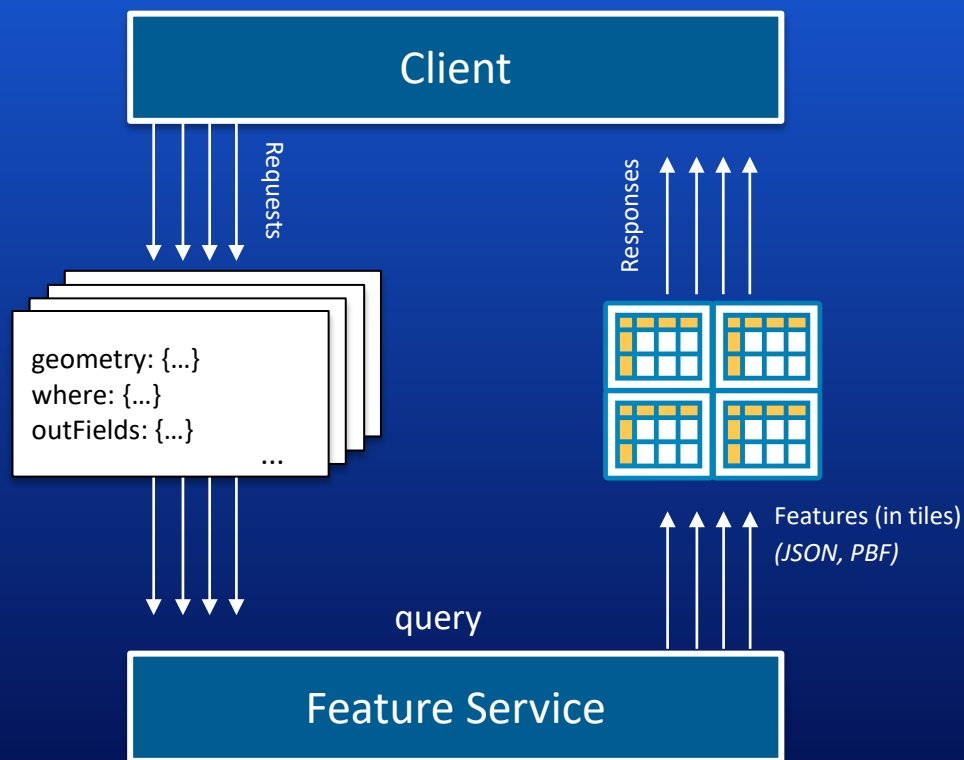# Map Services & Vector Tile Services
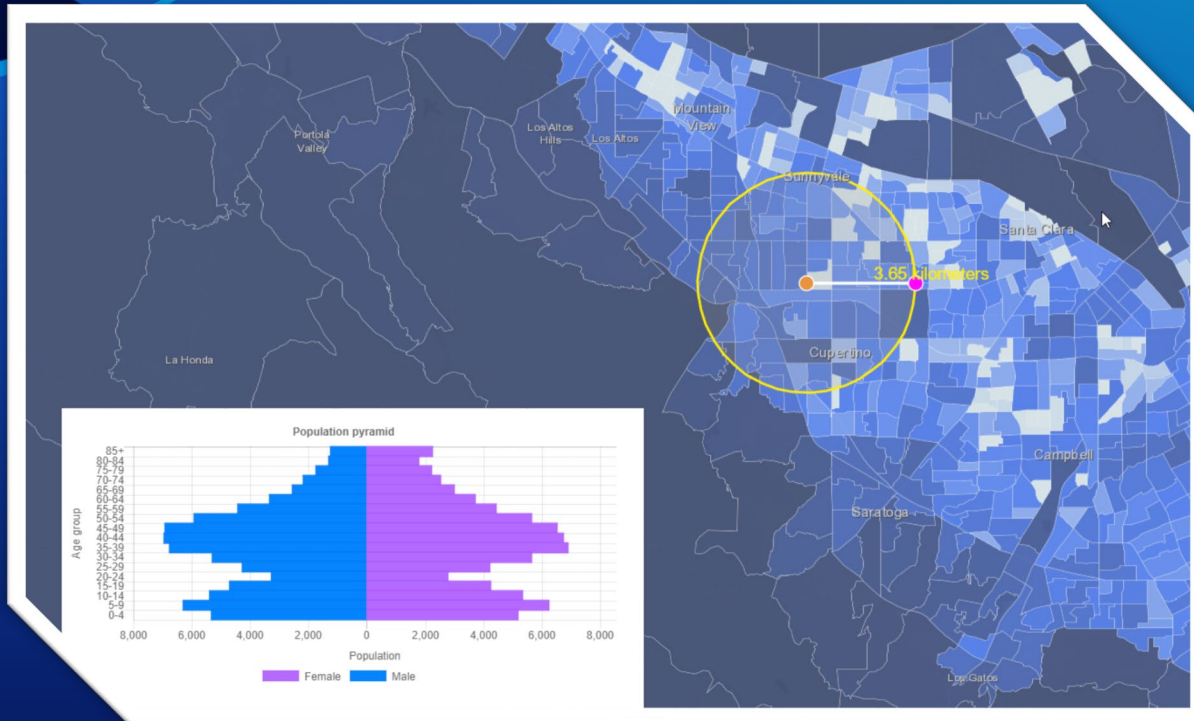
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Feature Service

Feature Service

- Powers the Feature Layer & Table

- ArcGIS Online & ArcGIS Enterprise

- ArcGIS or User managed

- Key Capabilities
  - Client-side rendering
  - Supports identify and query
  - Supports generalization *(on-demand)*
  - Supports editing
  - Supports taking data offline
  - Supports some OGC standards* (WFS)
  - **New at 10.6.1:** optimized geometry format (quantization)
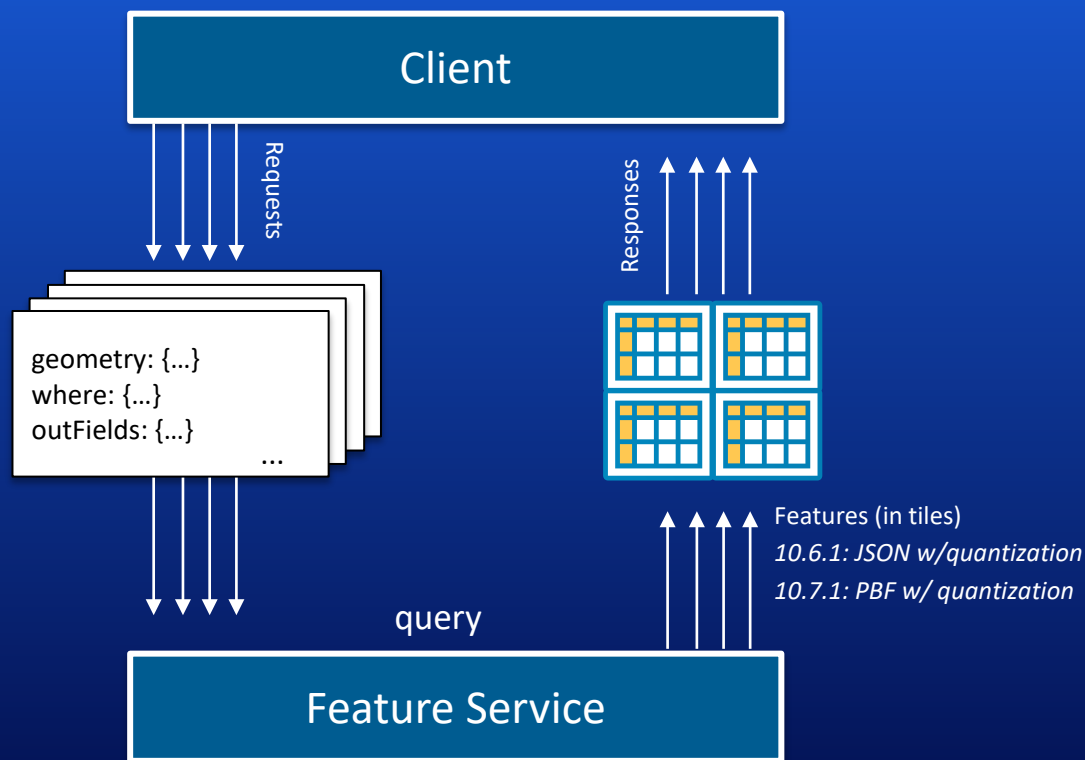 - **New at 10.7.1:** optimized transport format (pbf)

Current standard for dynamic, operational layers & editing

Feature Services:
# Tiling & Quantization

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Feature Service

- *Massive* performance benefits realized by using **ArcGIS Enterprise 10.6.1+** along with **JS API 3.24+** and **JS API 4.7+**
  - Faster processing on the server
  - Significantly smaller payloads transferred over the network because of quantization generalization support
  - Faster rendering in particularly web clients (note: JS APIs pre-3.27 and pre-4.9 may require explicit opt-in to WebGL rendering)

- **ArcGIS Pro 2.2+** and the **Enterprise portal map viewer** (from 10.6.1+) makes use of this feature natively

- **Additional** performance improvements beginning at **10.7** for services published from ArcGIS Pro because of use of pbf transport format instead of JSON

Feature Service
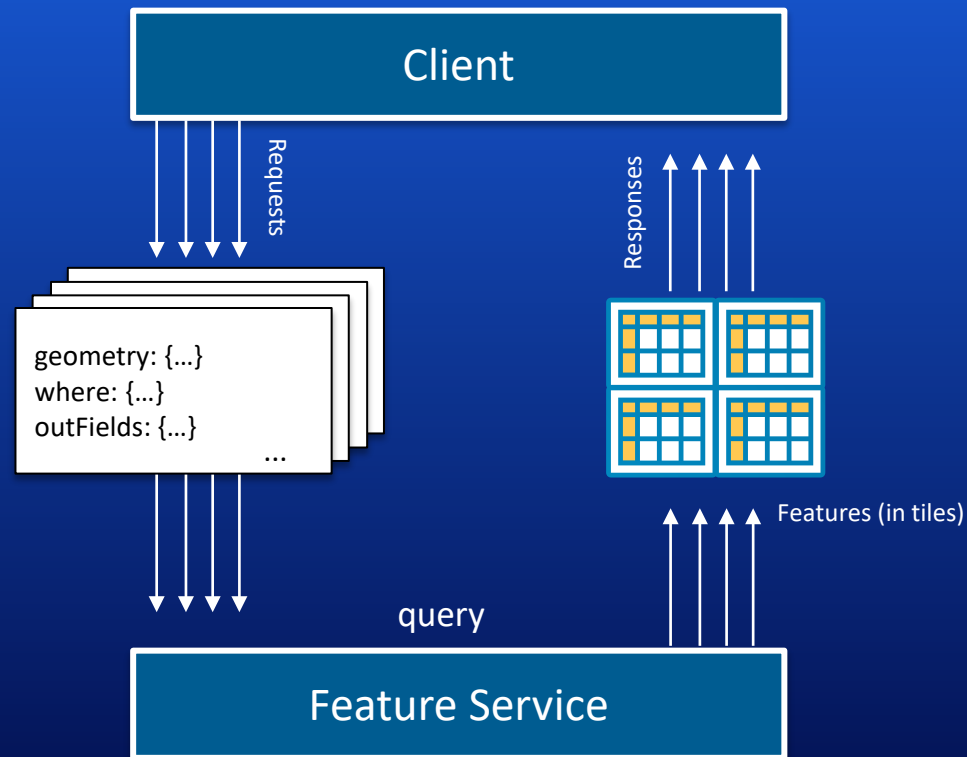
- ***Coming at 10.9:*** ability to setup a caching mechanism for hosted feature tile requests.

- *Advanced* option for deployments with high throughput and scaling requirements for *hosted feature services* that do not change often.
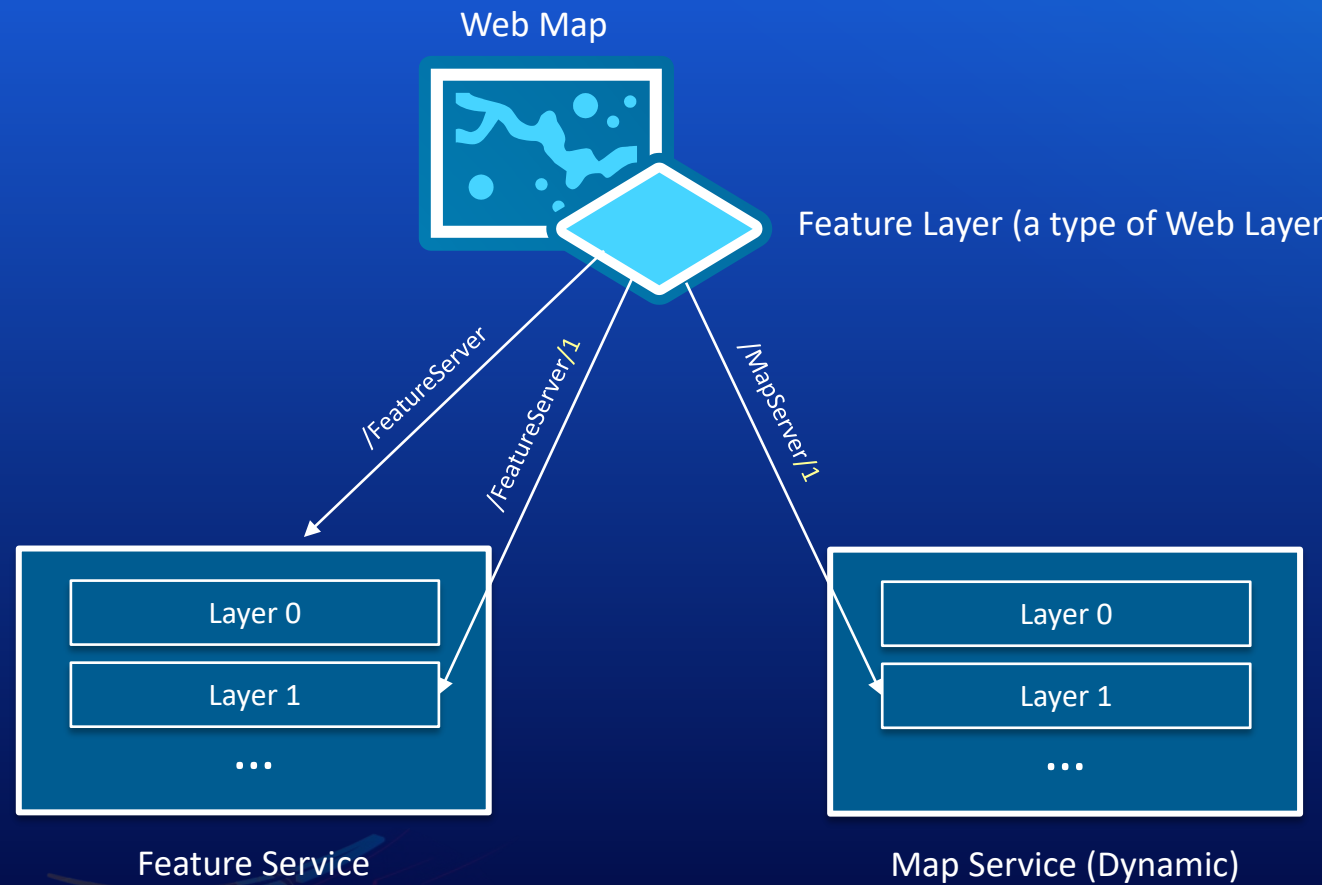 - I.e. not necessarily appropriate for layers with frequent edits.

Quantization support (map + feature services)

	ArcMap-based map services	ArcMap-based feature services	ArcGIS Pro-based map services	ArcGIS Pro-based feature services	Hosted feature layers
10.5.1 and prior	not supported	not supported	not supported	not supported	not supported
10.6	not supported	not supported	not supported	not supported	supported - disabled by default
10.6.1	supported + enabled	supported + enabled	supported + enabled	supported + enabled	supported + enabled
10.7	supported + enabled	supported + enabled	supported + enabled	supported + enabled	supported + enabled
10.7.1	supported + enabled	supported + enabled	supported + enabled	supported + enabled	supported + enabled
10.8	supported + enabled	supported + enabled	supported + enabled	supported + enabled	supported + enabled
10.8.1	supported + enabled	supported + enabled	supported + enabled	supported + enabled	supported + enabled
10.9	supported + enabled	supported + enabled	supported + enabled	supported + enabled	supported + enabled

PBF support (map + feature services)

	ArcMap-based map services	ArcMap-based feature services	ArcGIS Pro-based map services	ArcGIS Pro-based feature services	Hosted feature layers
10.5.1 and prior	not supported	not supported	not supported	not supported	not supported
10.6	not supported	not supported	not supported	not supported	not supported
10.6.1	not supported	not supported	not supported	not supported	not supported
10.7	not supported	not supported	supported + enabled	supported + enabled	not supported
10.7.1	not supported	not supported	supported + enabled	supported + enabled	not supported
10.8	not supported	not supported	supported + enabled	supported + enabled	supported + enabled
10.8.1	not supported	not supported	supported + enabled	supported + enabled	supported + enabled
10.9	not supported	not supported	supported + enabled	supported + enabled	supported + enabled

Feature Service (server) vs. Feature Layer (client)

Web Map

Feature Layer (a type of Web Layer)

/FeatureServer

/FeatureServer/1

/MapServer/1

| Layer 0 |
| Layer 1 |
| ... |

Feature Service

| Layer 0 |
| Layer 1 |
| ... |

Map Service (Dynamic)

More or less the equivalent of a read-only feature layer

Does not support:
- *Editing*
- *Offline Sync*

Putting It All Together

Publication strategy
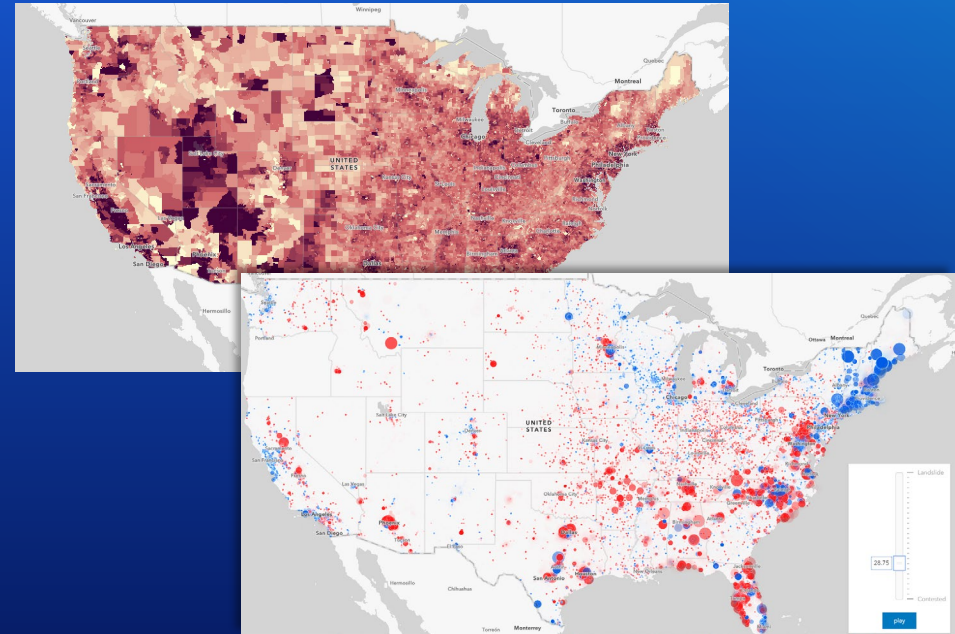
Driven by business & IT requirements
- Use case, and user "tolerance"
- Data type & update frequency
- Network bandwidth
- Client device
- Compute speed

Your options include …
- GIS service type selection
- Caching
- Generalization
- Making use of web map styling features
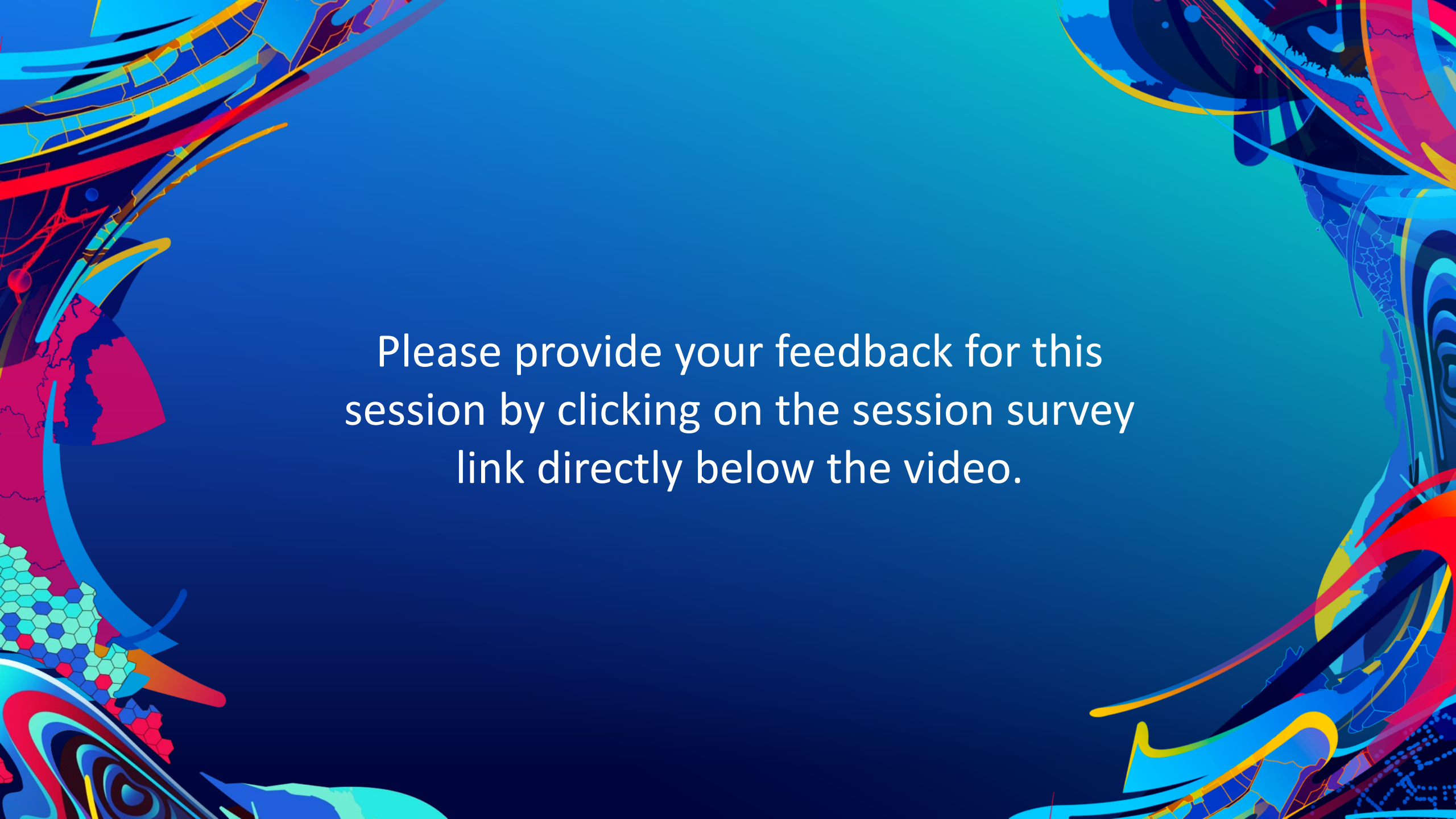

Performance matters now more than ever

Key takeaways

- Good publication strategies ensure that appropriate content is delivered to consumers in a well performing, scalable, reliable, and secure manner

- Take a "Business First" approach, focusing on the consumer

- Leverage ArcGIS Pro as your primary publishing application

- Focus and emphasis needs to be placed on the ArcGIS geoinformation model- web maps and layers provide often overlooked capabilities

- Trends towards Feature and Vector Tile services offer new technical opportunities, but requires considering target client capabilities and server-side version

- Publication is a nuanced and evolving topic that requires research and planning. Do your homework!

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