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Technical Workshops | July 26, 2012

ArcGIS for Server Performance and Scalability—Optimizing GIS Services

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Optimizing map services

Craig Williams

Overview

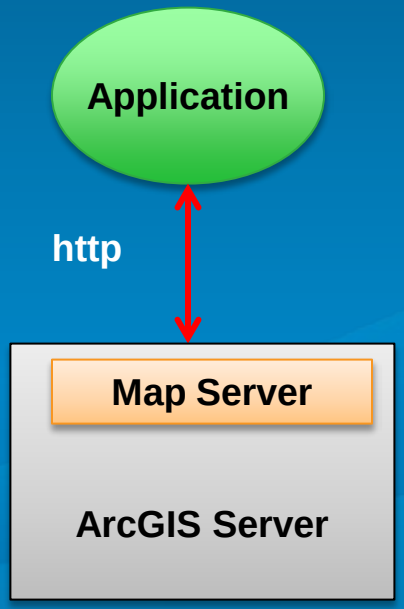
- Types of map services
  - What’s new at 10.1?
- Factors of map service performance
  - Data access
  - Rendering speed
  - Image size/compression

Map services

- 9.3.1 – 10.0
  - MXD based map services
  - MSD based map services (optimized map service)
- Use the optimized map service for best quality and performance
  - Analyzer workflow guides you through potential problems

Map services at 10.1

- One unified map service
  - An updated optimized map service
  - Supports additional capabilities, data types, layers, renderers
- New extension capabilities:
  - Network Analysis
  - Geoprocessing*



Mapping capabilities

- Added data source support
  - XY events
  - Linear referencing events
- Added feature layer renderer support
  - Dot density
  - Charts
  - Geostats
- Added support for layers
  - Dimensions
  - Schematics
  - Network
  - Network Analysis
  - Tin
  - Terrain
  - Tracking

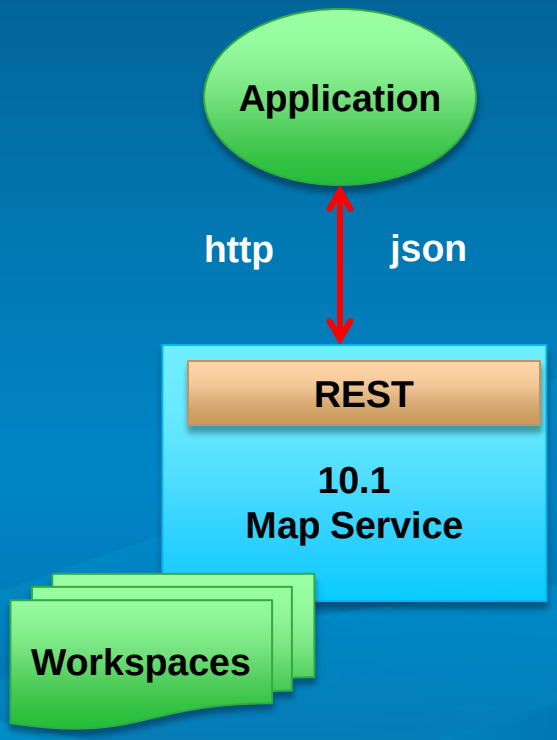
Dynamic Layers: The Concept

- New behavior with the map service that allows for per-request changes to the map
- Optional capability of map services
- May allow you to reduce the total number of services you need

- Allows for:
  - Updating renderers and symbols
  - Removing and reordering layers
  - Changing layer data sources
  - Adding new layers from registered data sources

Dynamic Layers: Use Cases

- Simple updates to the map service
  - Remove layers or reorder layers
- Thematic mapping
  - Updates to renderers
- Adding content from a data library
  - Find data from registered workspaces
    - Including query layers
  - Add to the map on a per-request basis



Factors of map service performance

- Data access
- Rendering
- Image compression / size

- Consider all of these when creating a map service

Data access

- Local data will draw faster than remote data
- Spatial index
  - Do you have one? (e.g. XY Events)
  - Is it sized correctly?
  - Universal features, slow all draws
- Attribute indexing
  - Not always needed

Data access case study : X Y Events

- Often used in cases where data comes from external systems
- A draw typically requires a complete row scan

- Alternative
  - Use a native spatial type in your database
    - -Query layers
  - Insert features via SQL in external systems
  - Features will be indexed and draw much faster

Data access troubleshooting

- Publishing analyzers indicate lack of a spatial index etc.
- Evaluate index efficiency
  - The number of features returned for each draw query
  - Large index grid sizes lead to too many features being drawn
- Evaluate I/O performance if using remote data
- Unnecessary attribute indexes
  - May confuse query plans in some databases
  - Don’t index fields just because they exist in a def query

Rendering speed

- Optimized map services were introduced at 9.3.1 to resolve performance bottlenecks at this stage

- <u>Remaining areas to be concerned with:</u>
- Complex effects (e.g. geometric effects in representations)
- Inline annotation (aka “Bloated” annotation)
- Anti-aliasing performance
  - Higher levels use more RAM and are slower
  - Text anti-aliasing has a negligible effect in most cases
- Layer transparency

Rendering speed: transparency

- Layer transparency is applied to a layer as a whole
  - Involves a full layer blend
- Alternative: Use color transparency
  - Capability of optimized map services
  - Enabled via an option from analyzer warning 10009

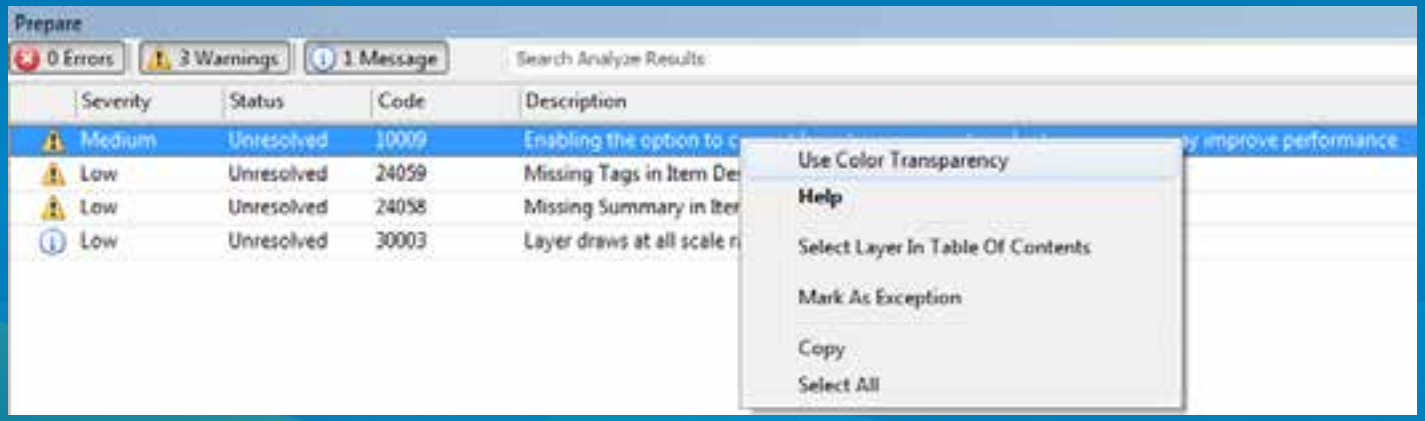


Image compression / size

- Smaller images are faster to download
- Image formats have limitations
  - e.g. limited color palettes, lossy compression
- Image compression itself has a performance penalty
  - Use the preview window to evaluate performance of image type
- Evaluate size and performance in a test service in network conditions
  - Balance size vs. quality when choosing the image type based on your needs

Image compression / size (con't)

- Image type used for cached services affects:
  - Download size
  - Storage size of the cache
    - Portability

- For caching vector data
  - Consider new PNG image type at 10.1
  - Chooses the correct PNG type (8, 24, 32) for each tile based on content
  - Low content areas use less storage.

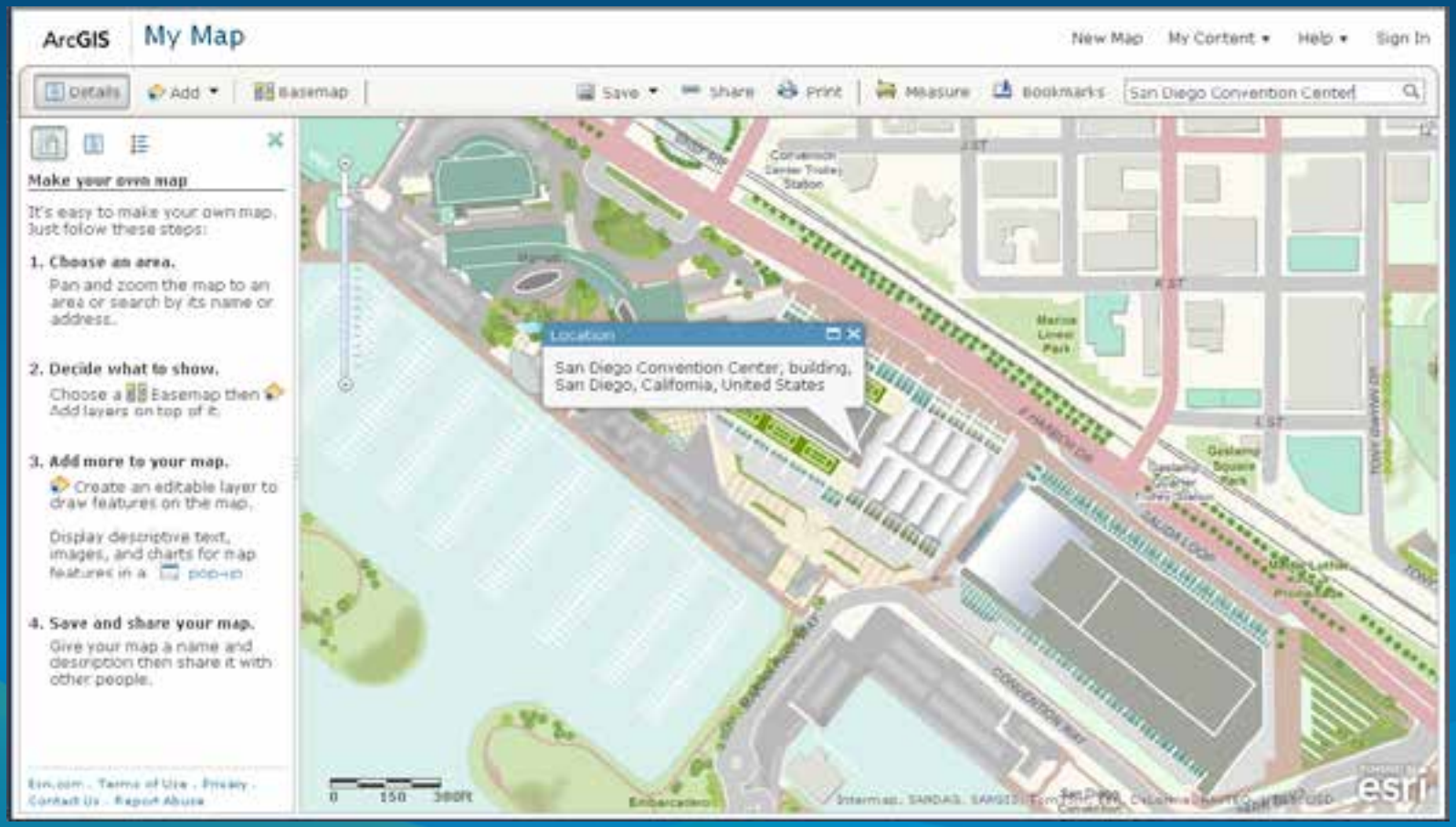
ArcGIS Online

Andrea Rosso

ArcGIS Online as a Case Study

- Very Large Scale deployment
- Multi-tenant

ArcGIS Online as a Case Study



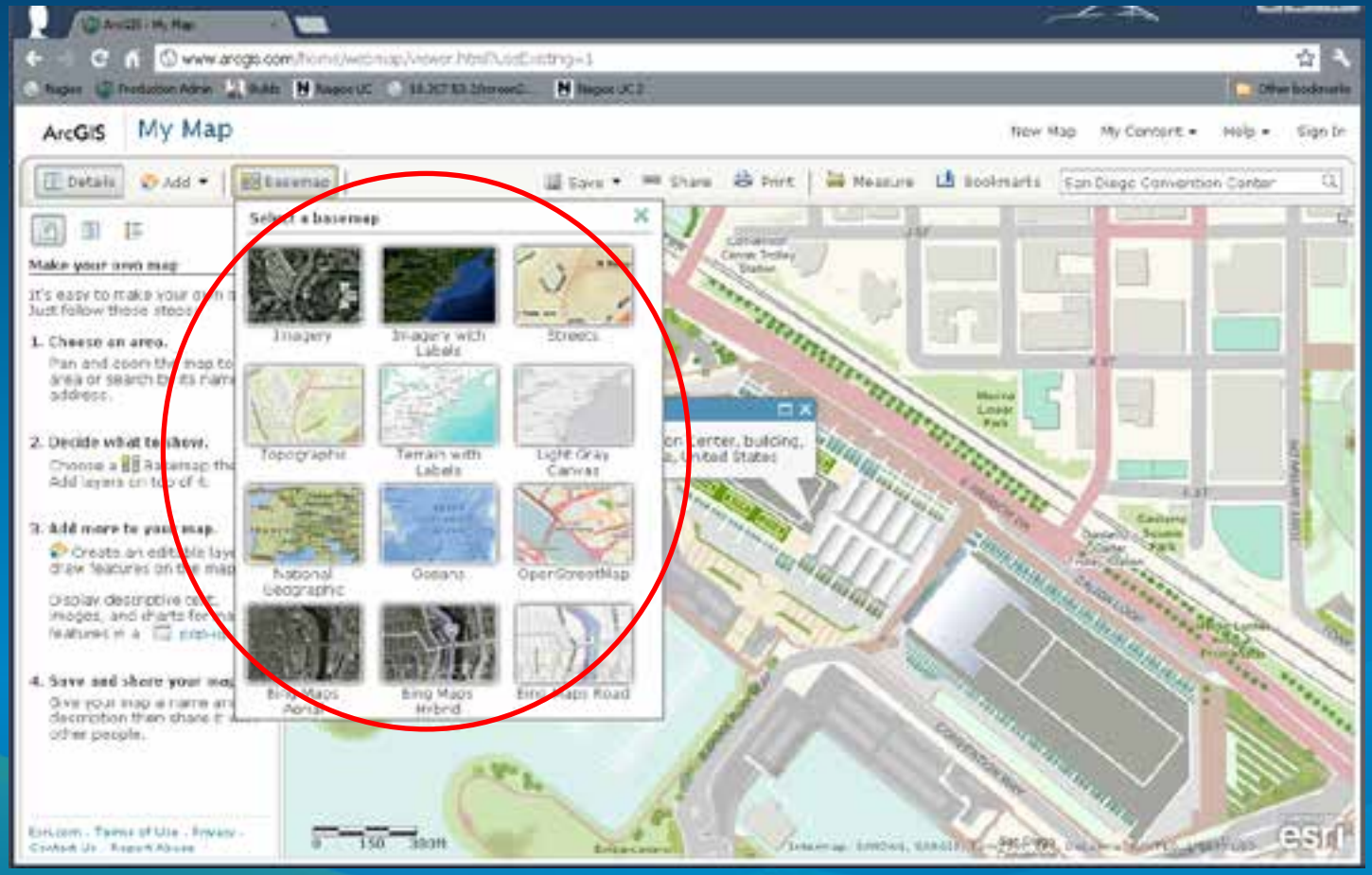
www.arcgis.com Web Site

- The Face of ArcGIS Online
  - Must perform
- Javascript API Front End
  - Dojo
  - REST Client
    - ArcGIS Server APIs
    - Portal API
    - WMS
    - ...

Optimizing the Network

- Builds
  - Coalesce (build) Javascript Files into fewer files to reduce downloads
- Compression
  - Make sure Web Server Gzip compression is enabled
- CDN + Versioning
  - Edge cache static files in a CDN (Akamai, CloudFront, etc.) for faster performance around the world
  - Improvements of 200%+ in page load times
  - Version resources to enable you to update information periodically.
    - /cdn/1916/js/dojo/dojo/dojo.js

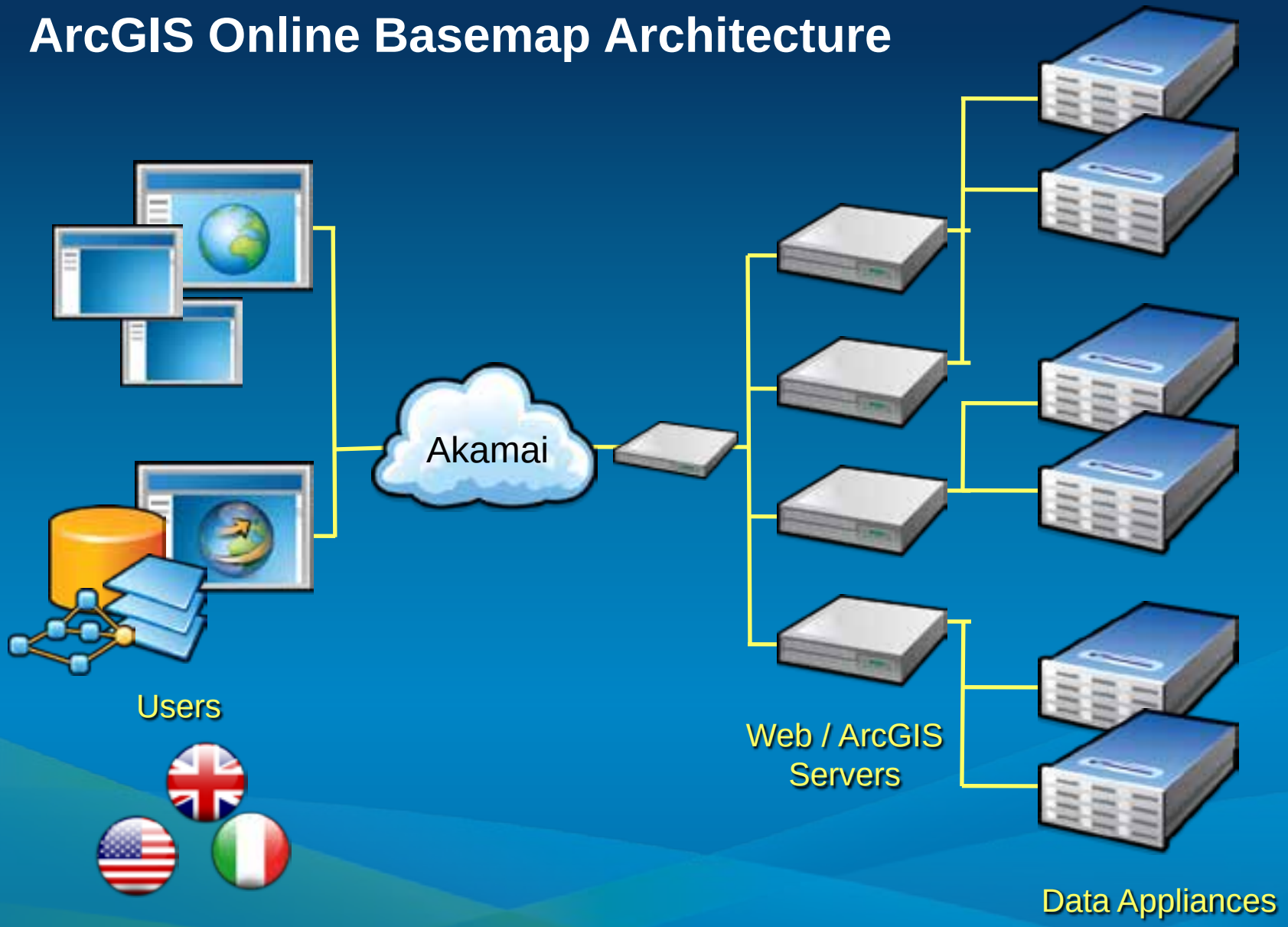
ArcGIS Online Basemaps



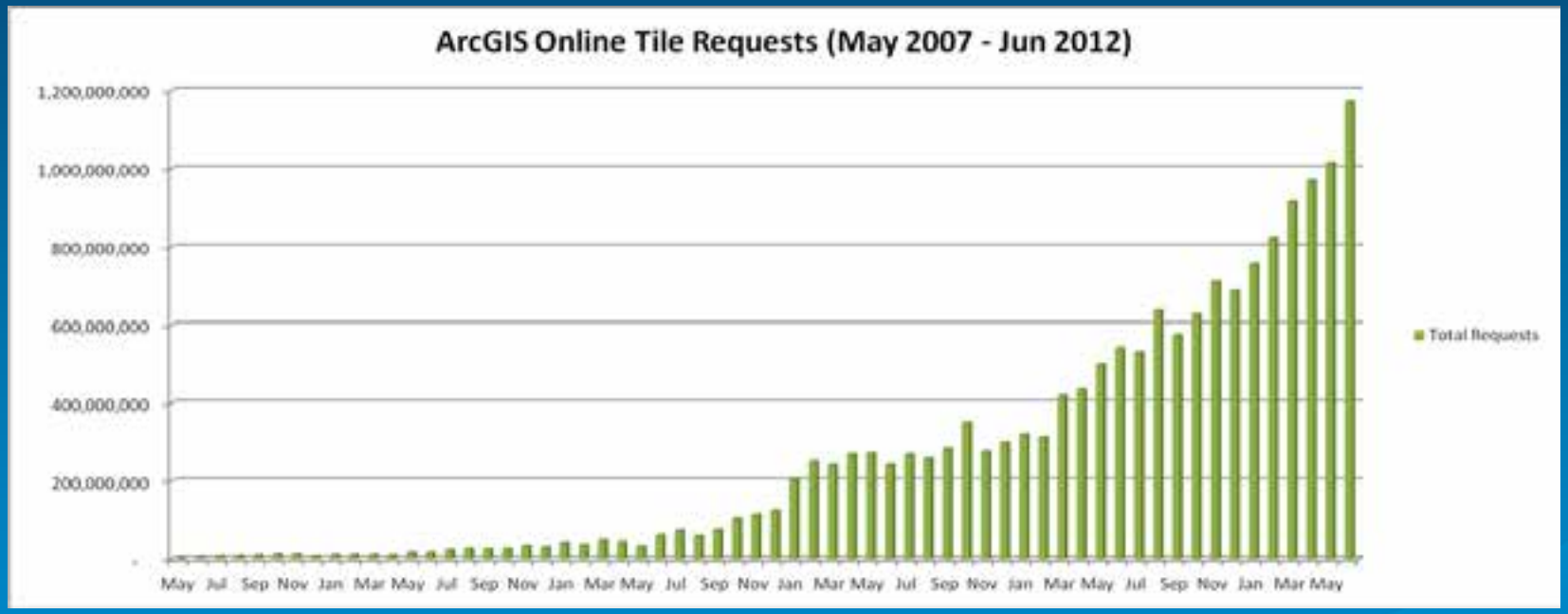
Initial Basemap System Requirements

- Capability: **Publish Map Services for use in all ArcGIS Clients**
- Capacity: **Support > 1,000 Concurrent Users**
- Availability: **Provide 24x7, 99.9% Availability**
- Performance: **Sub-second Response on Server & High-speed access by User**
- Flexibility: **Rapidly Deploy New and Updated Maps**

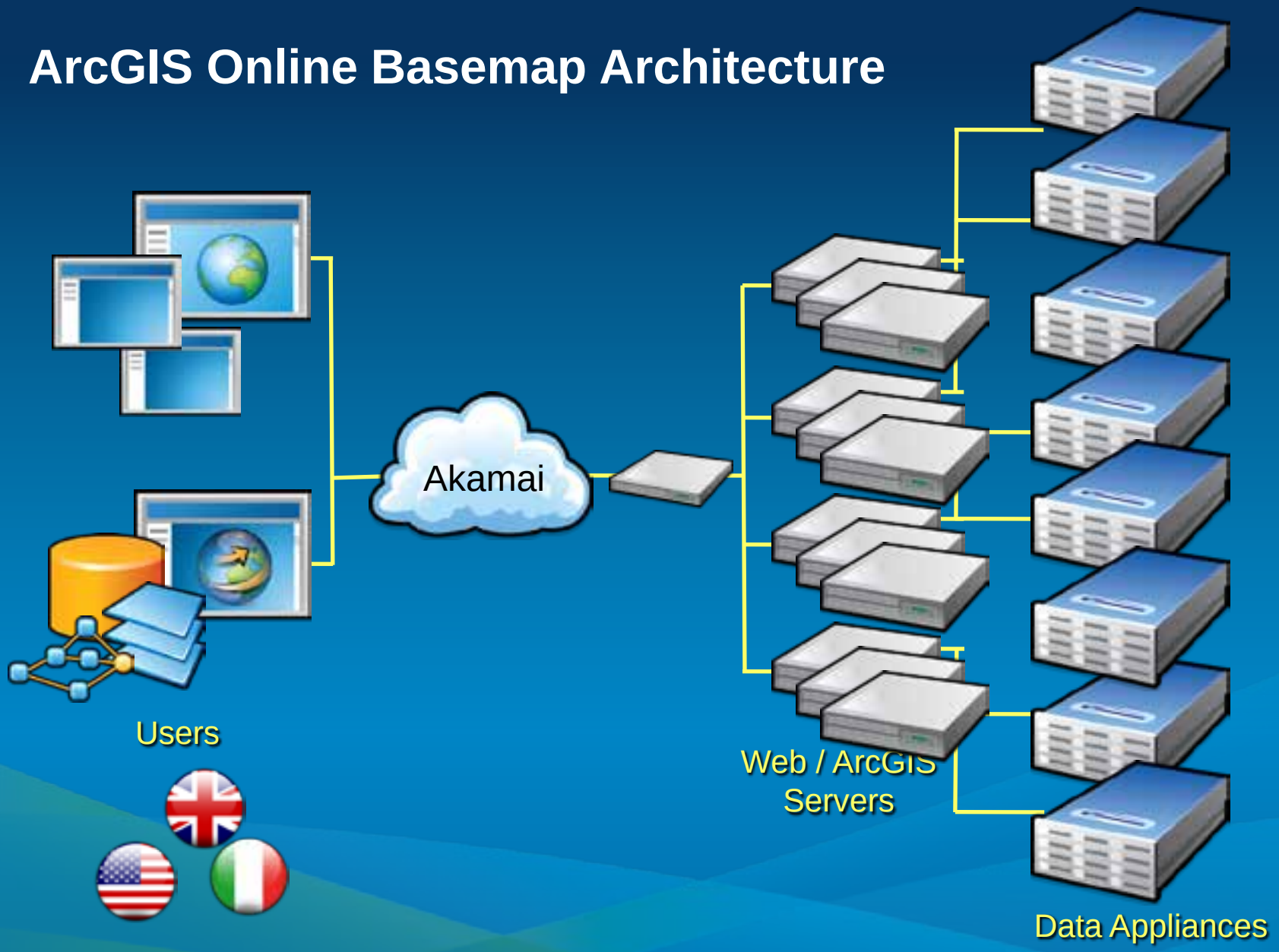
ArcGIS Online Basemap Architecture



ArcGIS Online Basemaps over time



ArcGIS Online Basemap Architecture



ArcGIS Server 10.1 Performance Improvements

Eric Miller (Esri)

Source of 10.1 Performance Improvements

- ArcGIS Server is now fully 64 bit
  - No memory limit per service instance
  - Contributes to improved performance
- DCOM-free framework
  - Number of service instances no longer OS limited
  - Enables more scalability options and better performance not limited by firewall considerations
- Moved most WebService handler processing to core
- More efficient core services

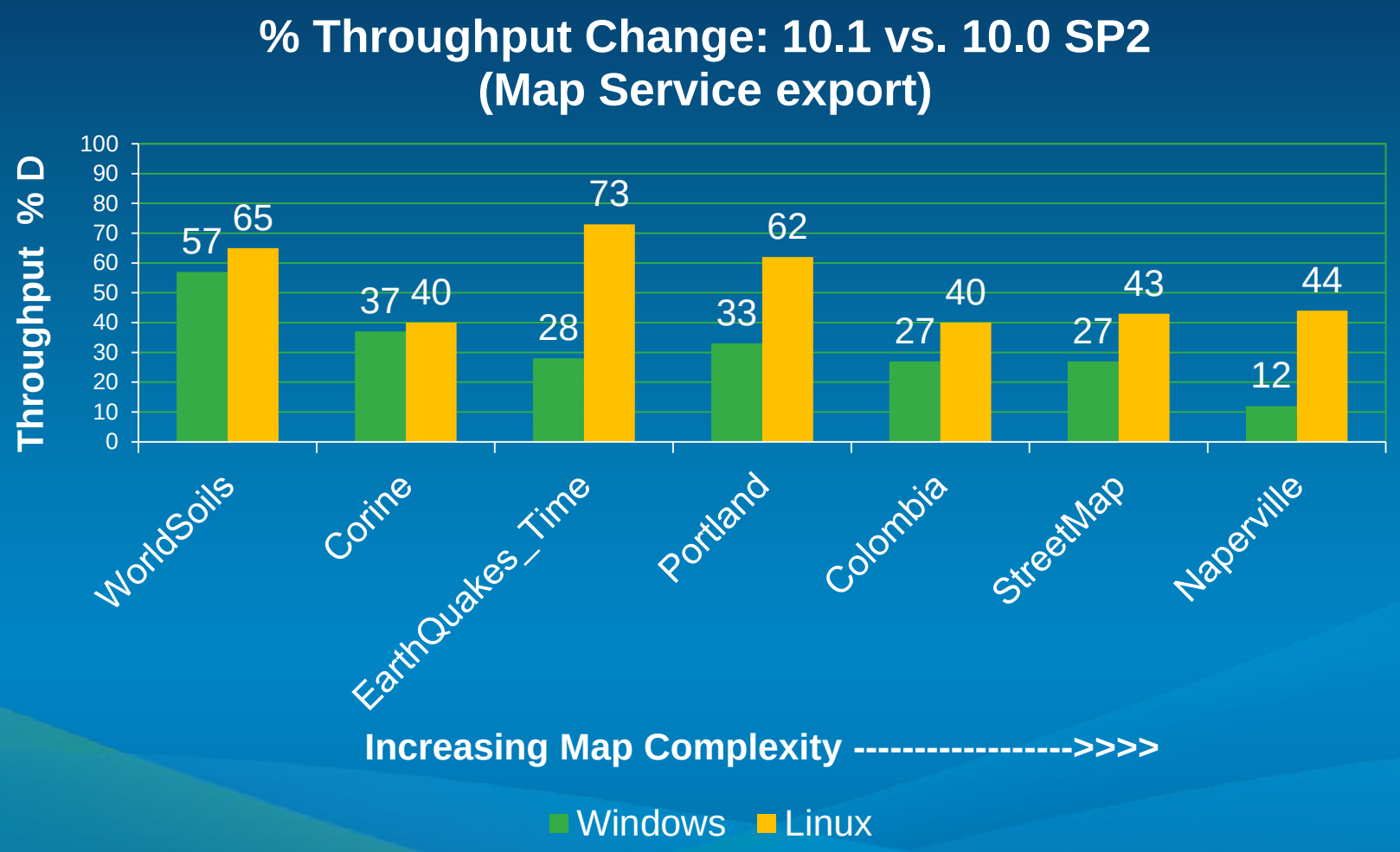
Performance/Scalability improvements

- All services have improved performance
  - Windows
    - Faster transaction times and greater throughput
  - Linux
    - Much faster transaction times and much greater throughput

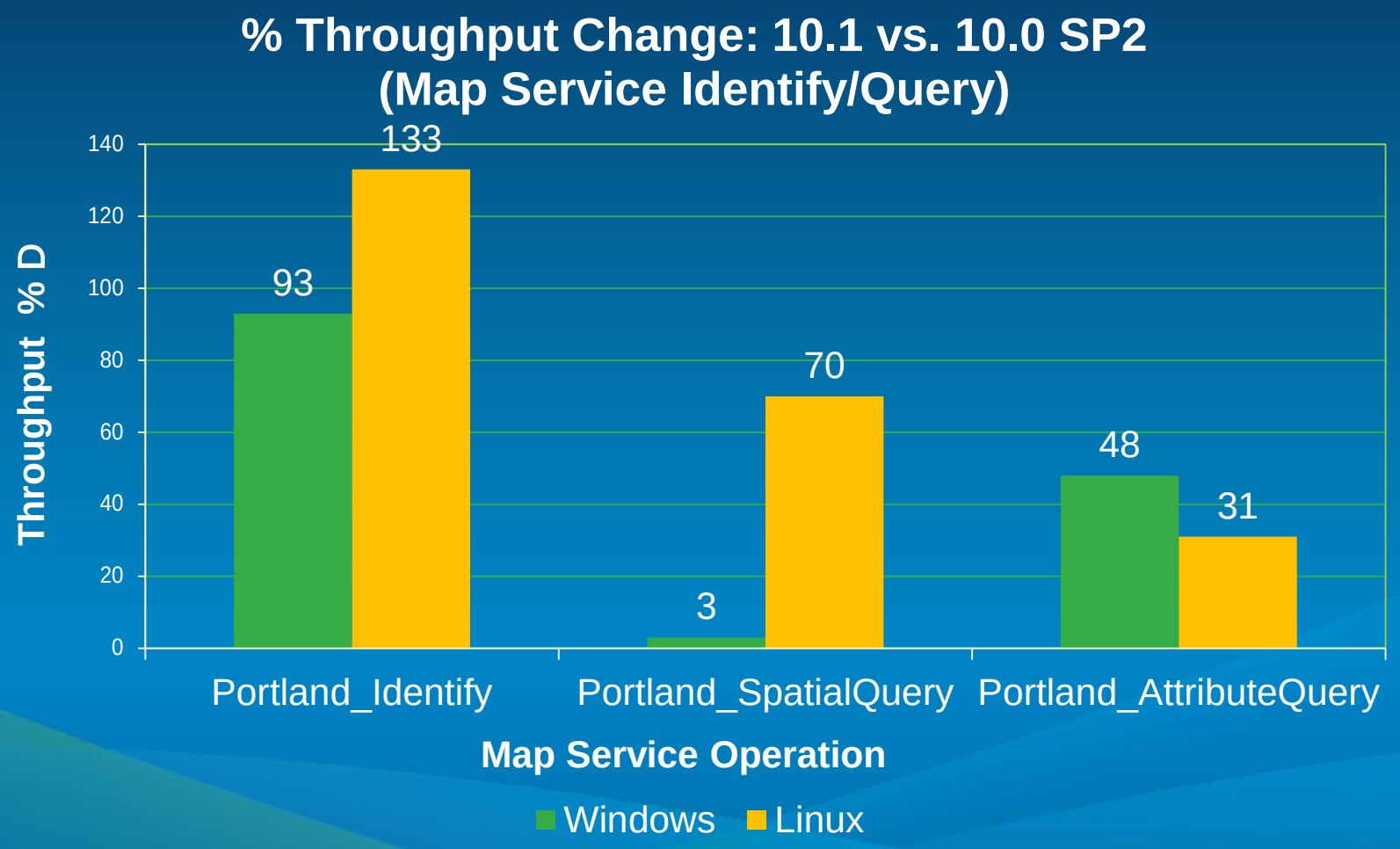
All this despite security being enabled by default

- All services and map caching scale linearly

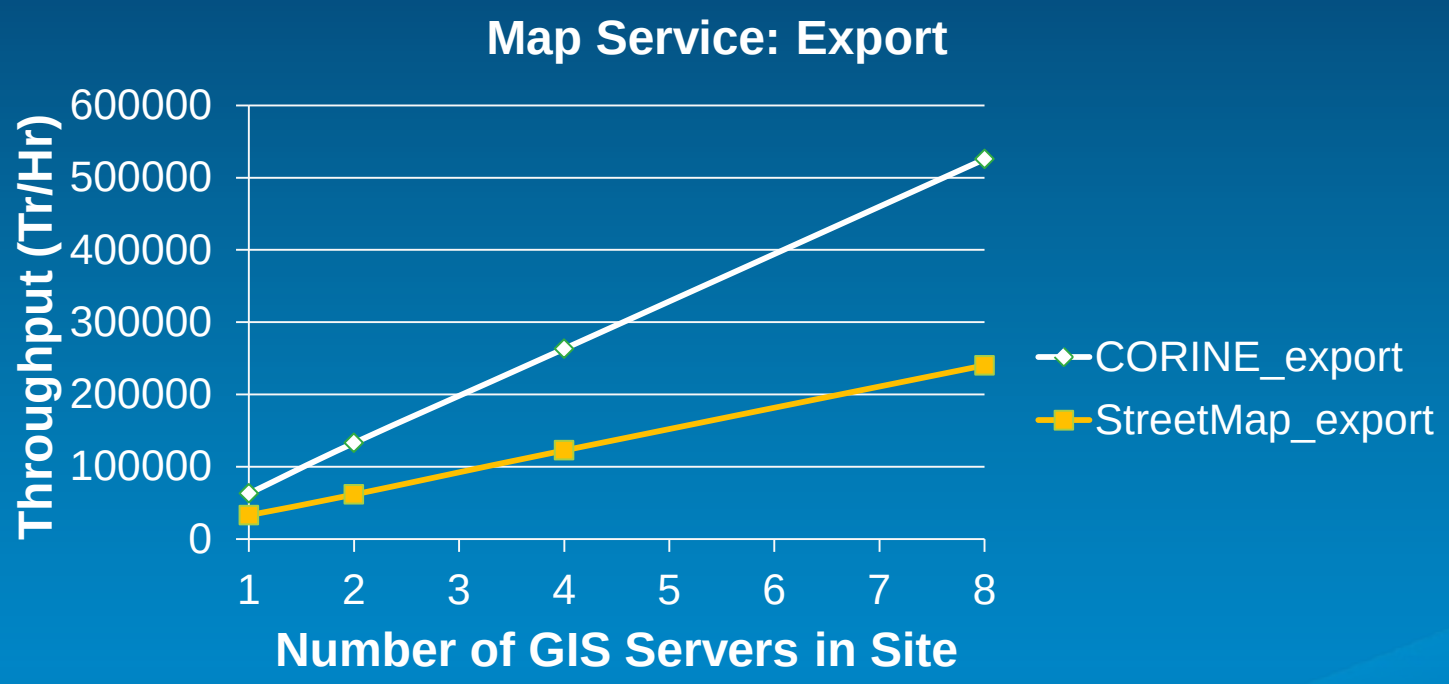
Map Service Performance



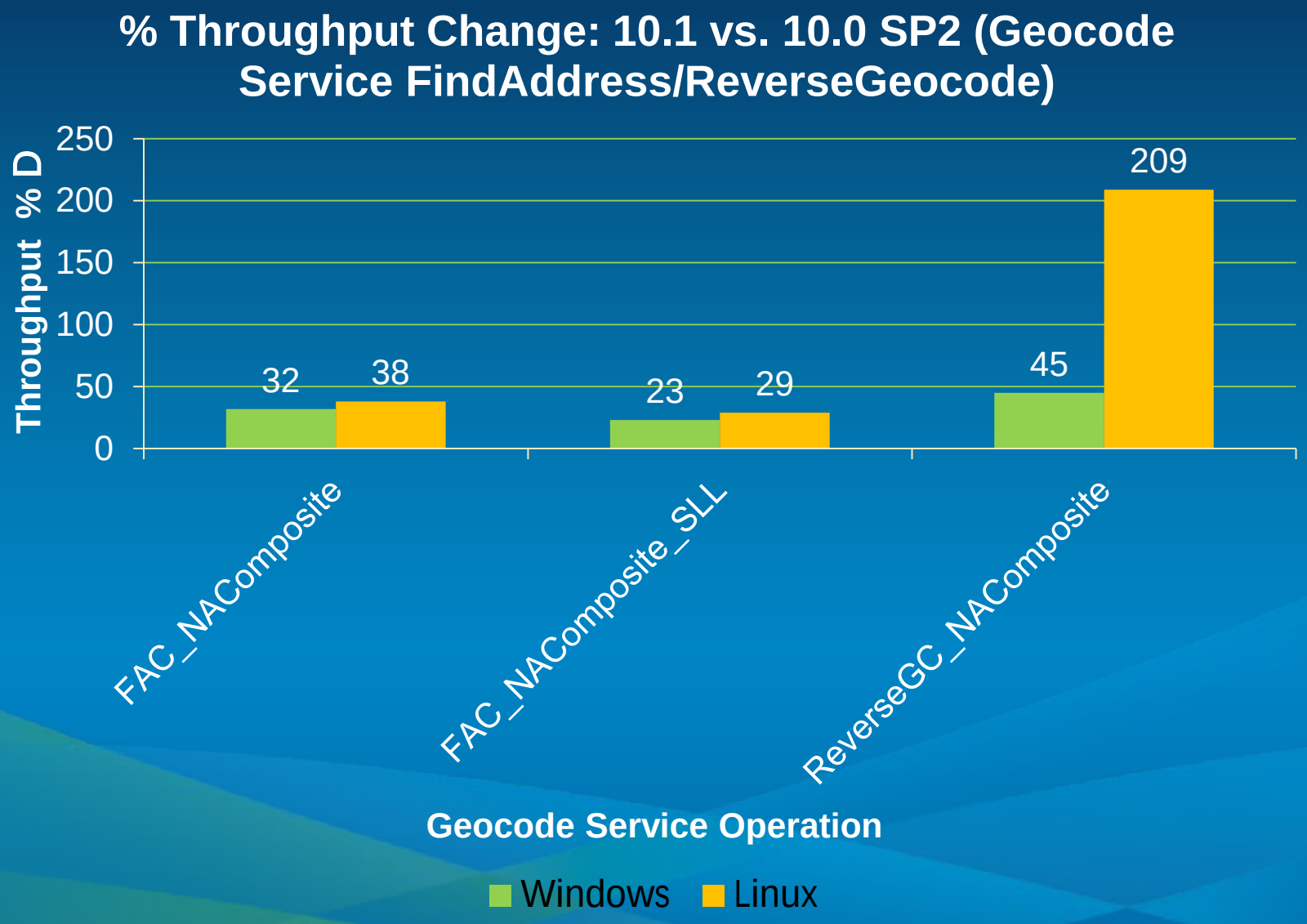
Map Service Performance



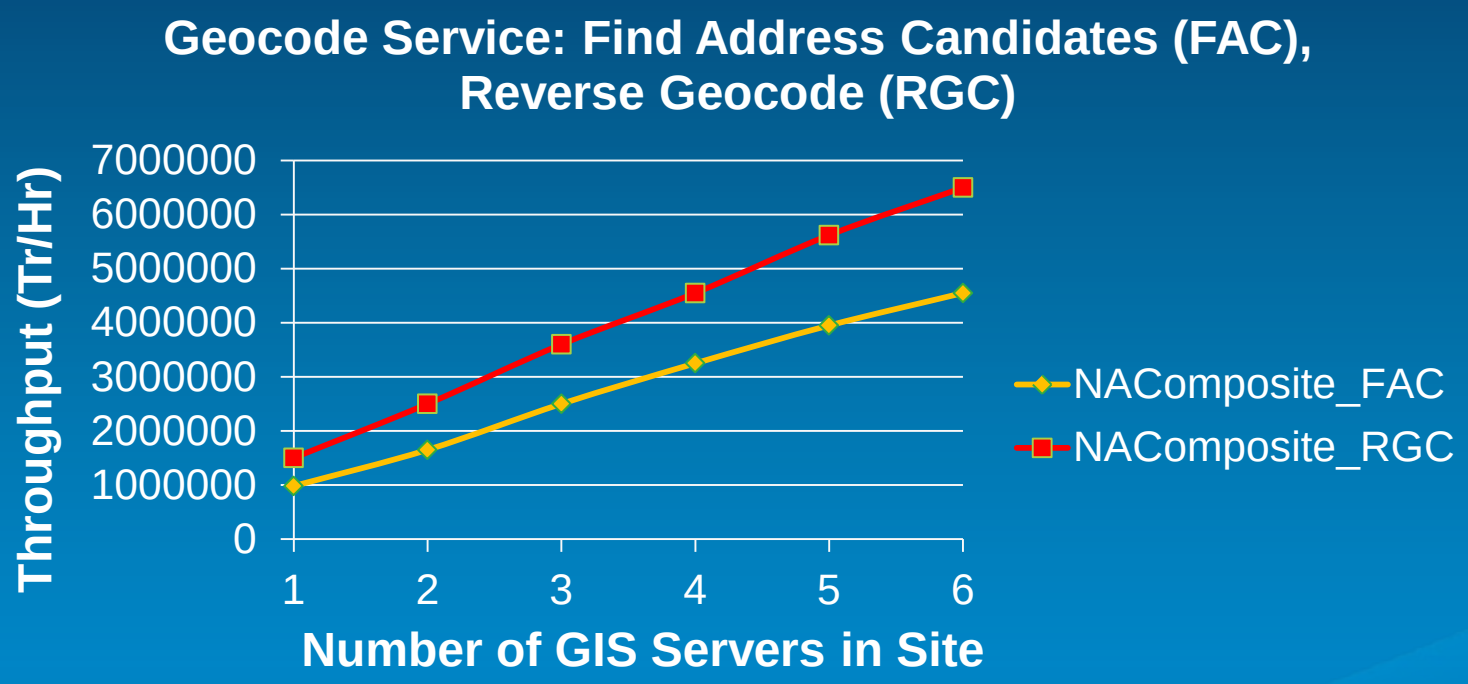
Map Service Scalability (Windows)



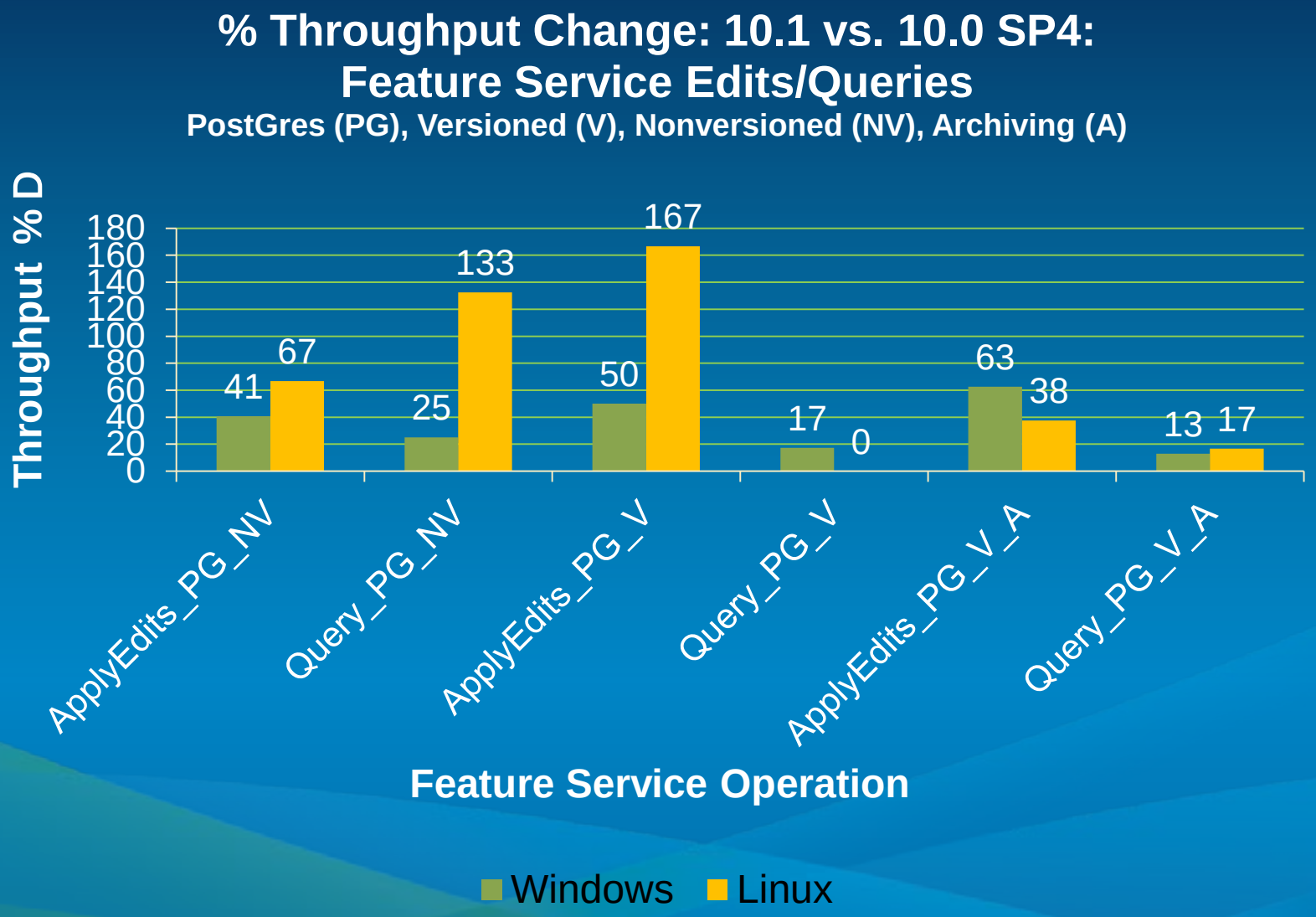
Geocode Service Performance



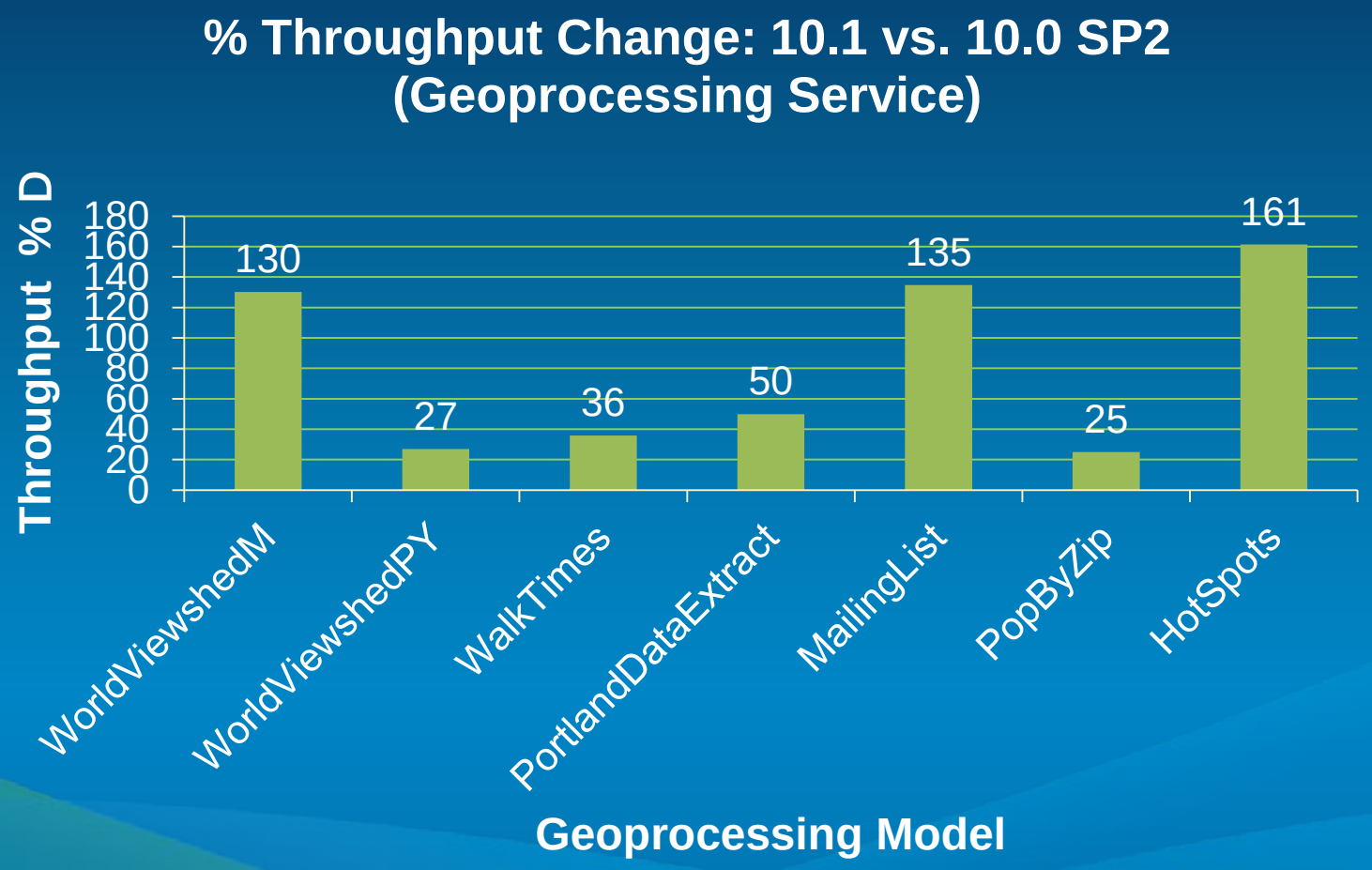
Geocode Service Scalability (Windows)



Feature Service Performance



Geoprocessing Service Performance (Windows)



Geoprocessing Service Scalability (Windows)

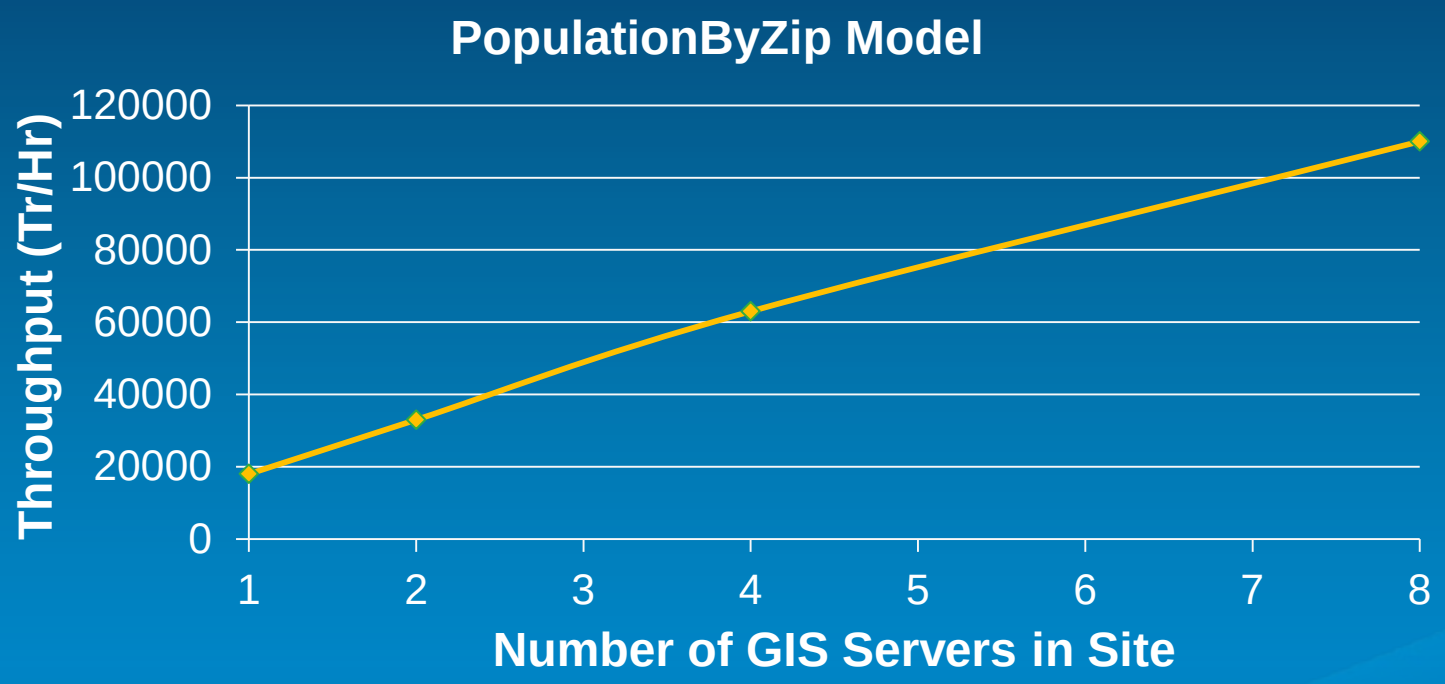


Image Service Performance

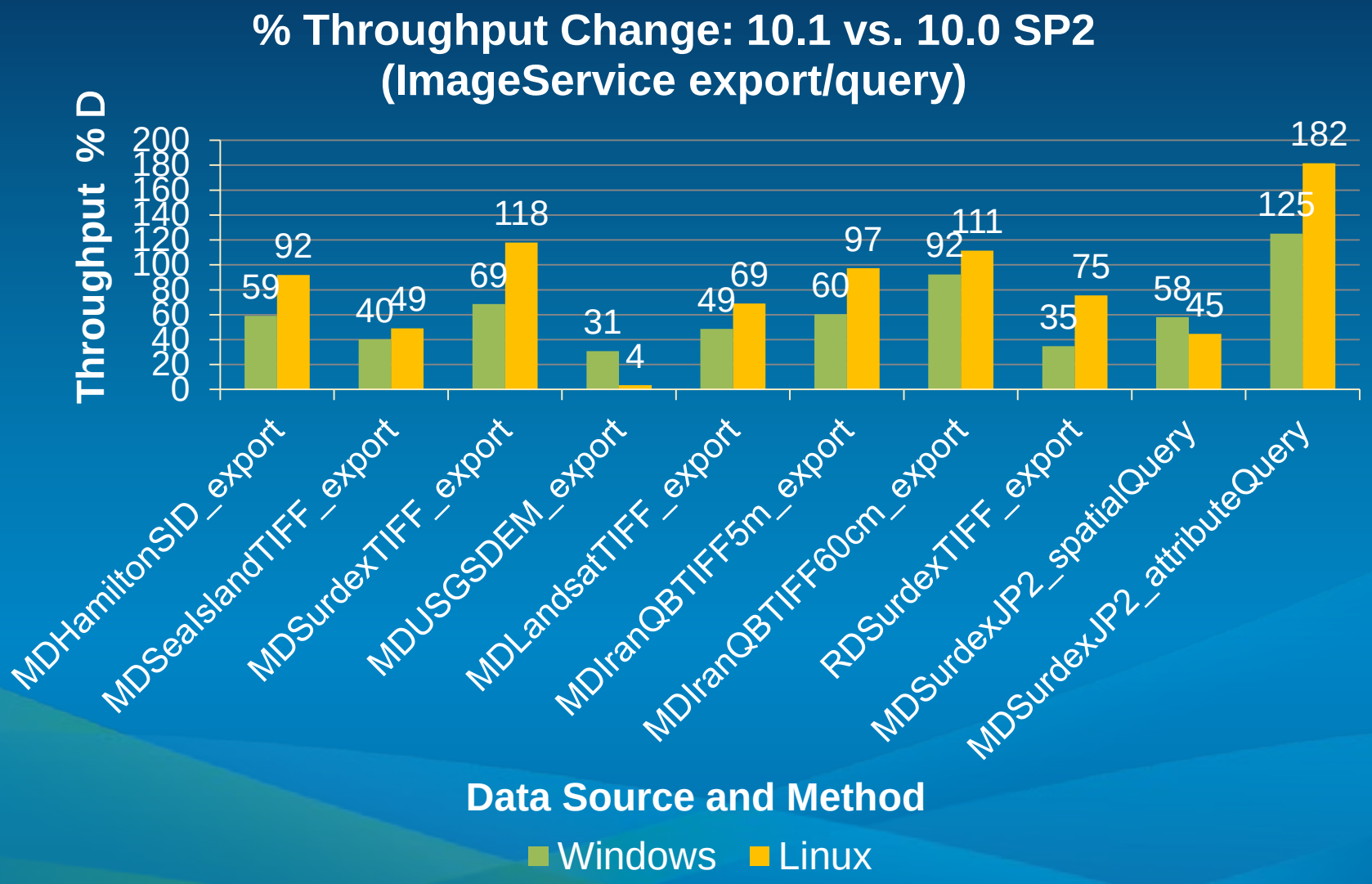
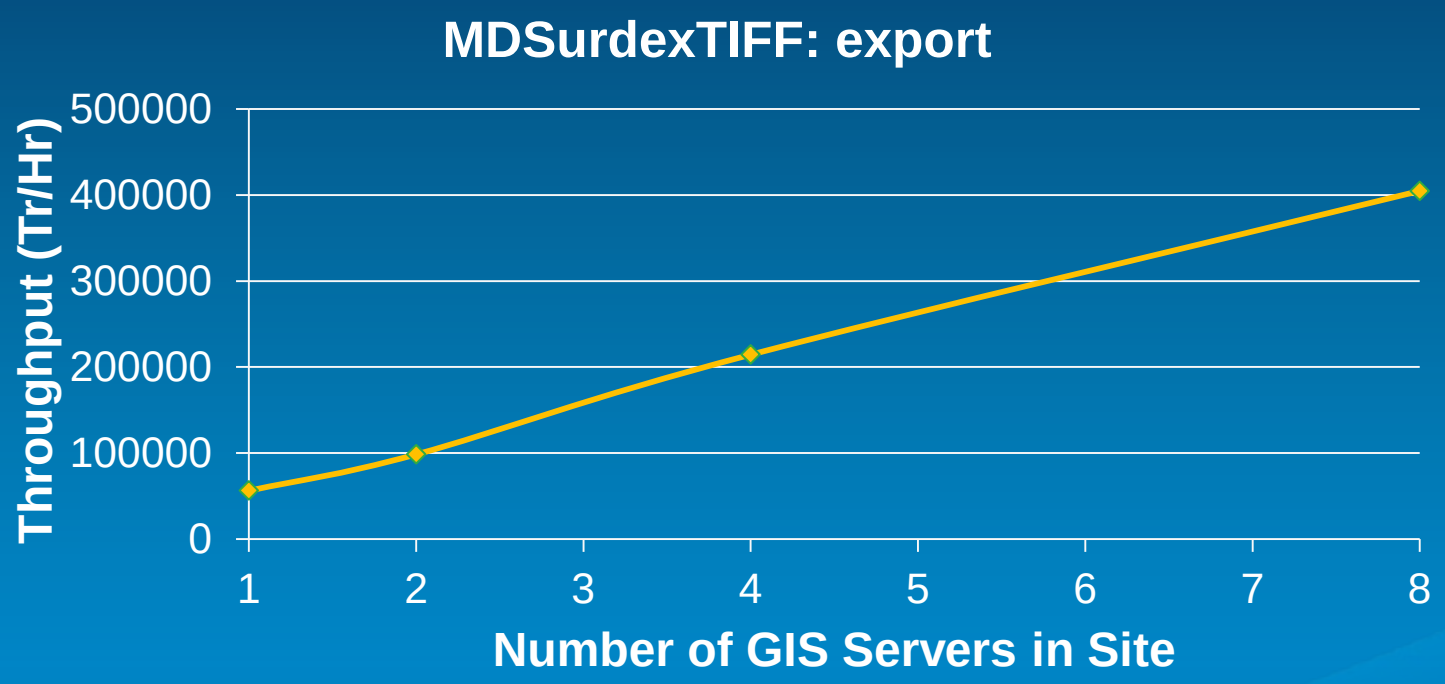
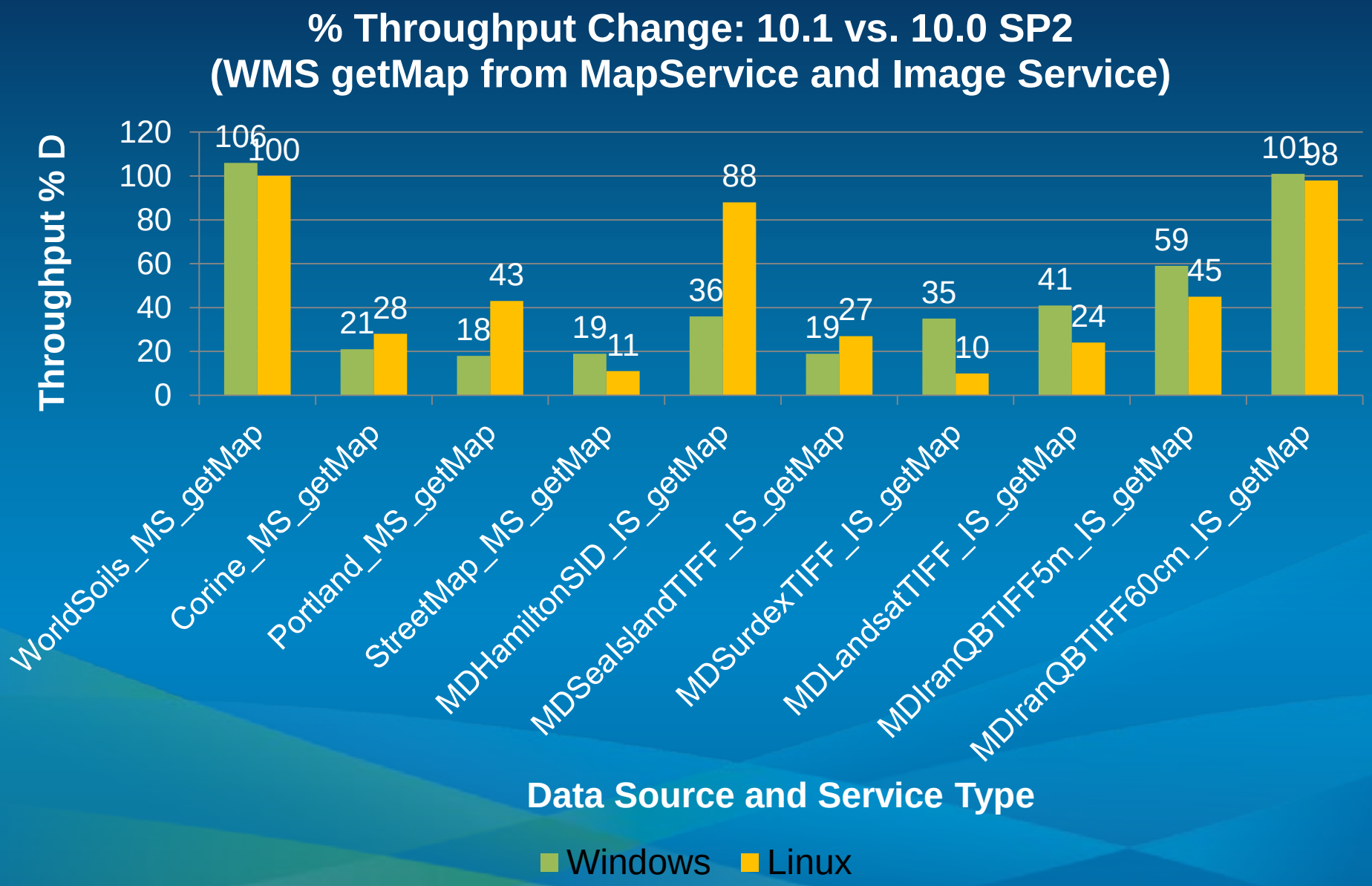


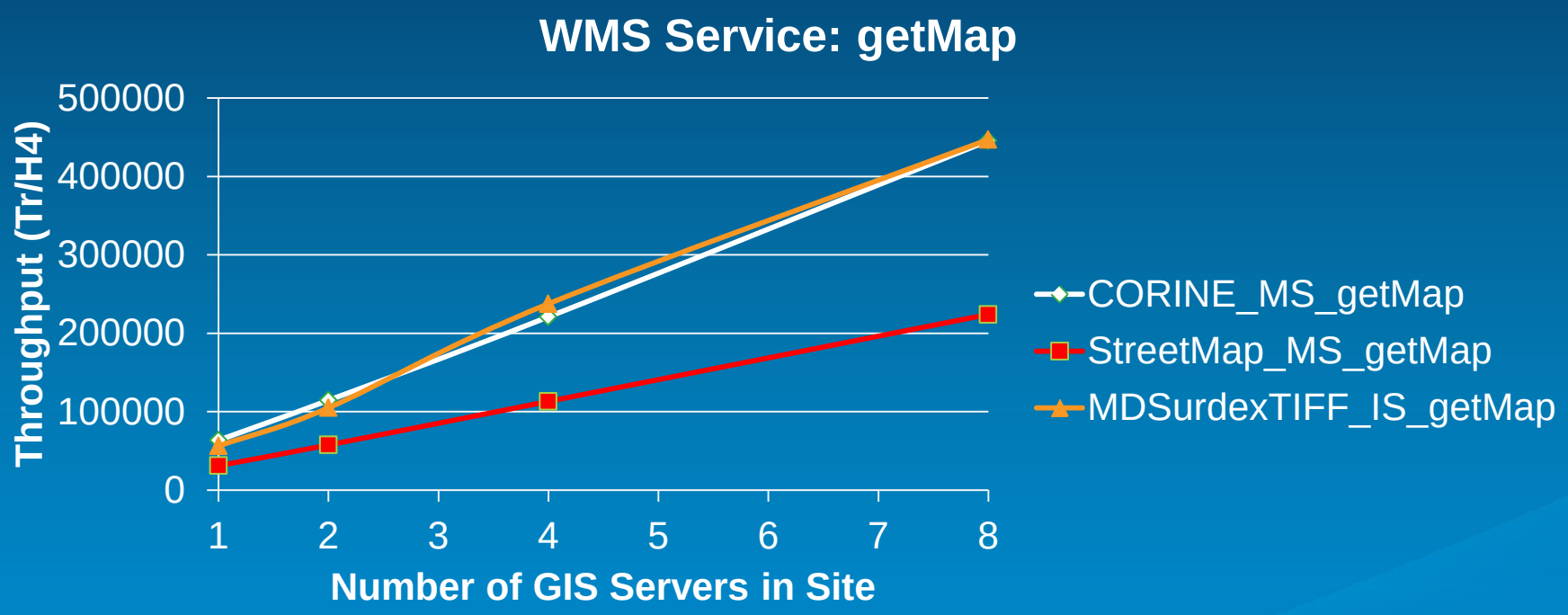
Image Service Scalability (Windows)



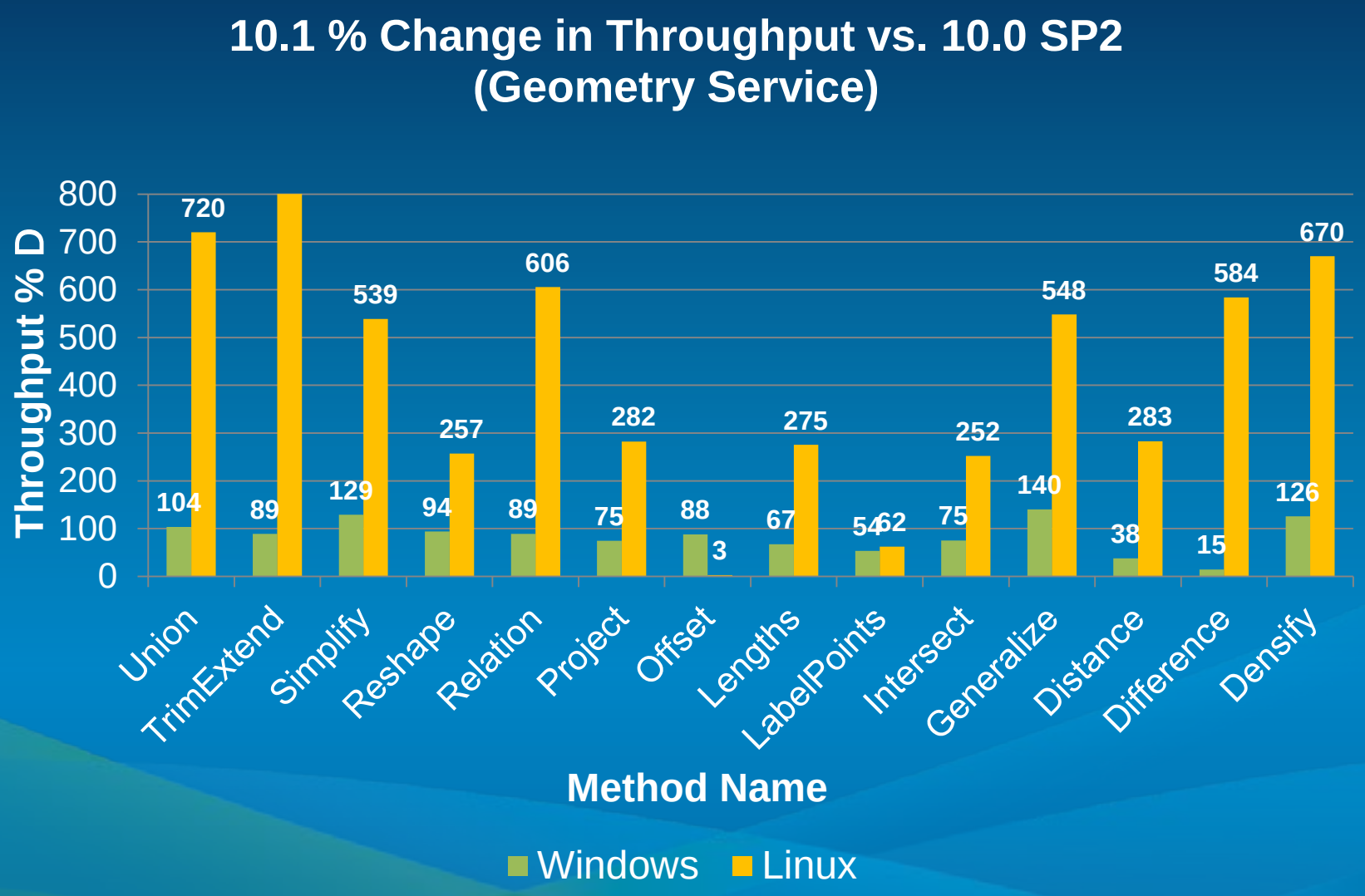
WMS Service Performance



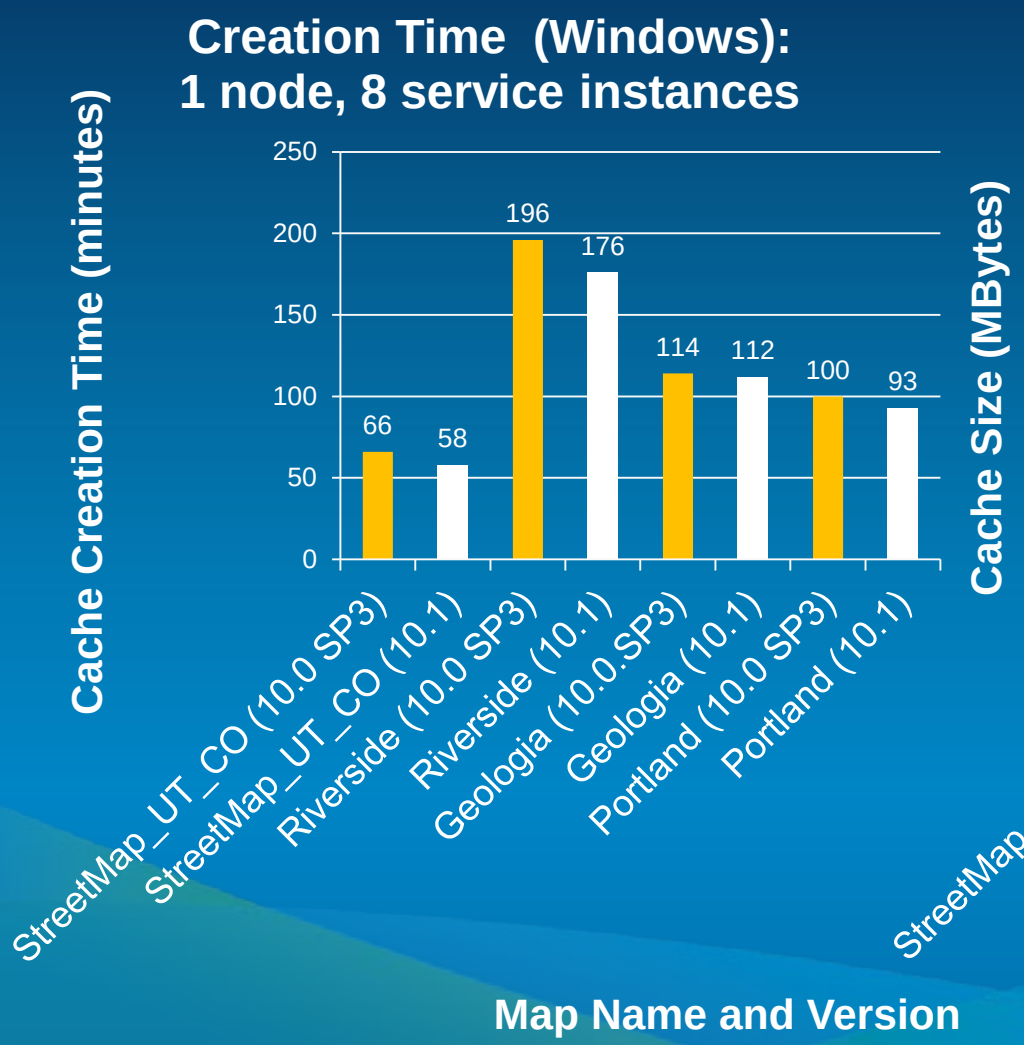
WMS Service Scalability (Windows)

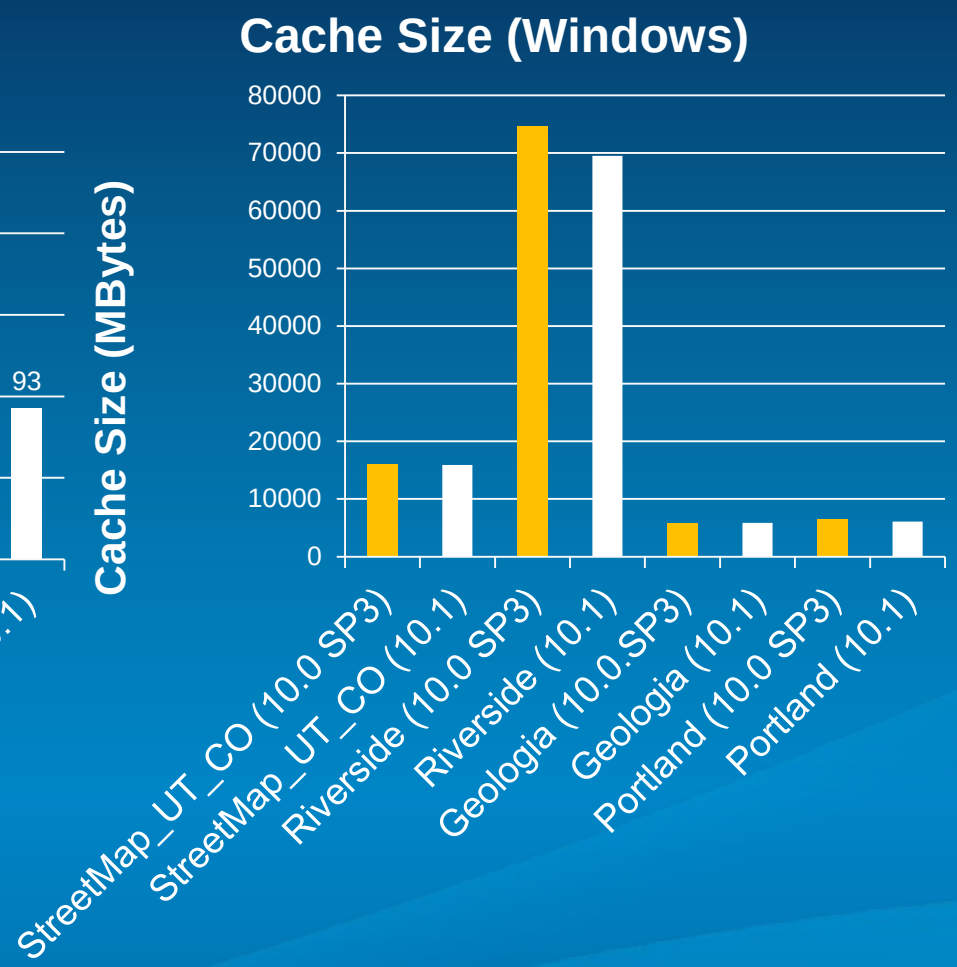


Geometry Service Performance

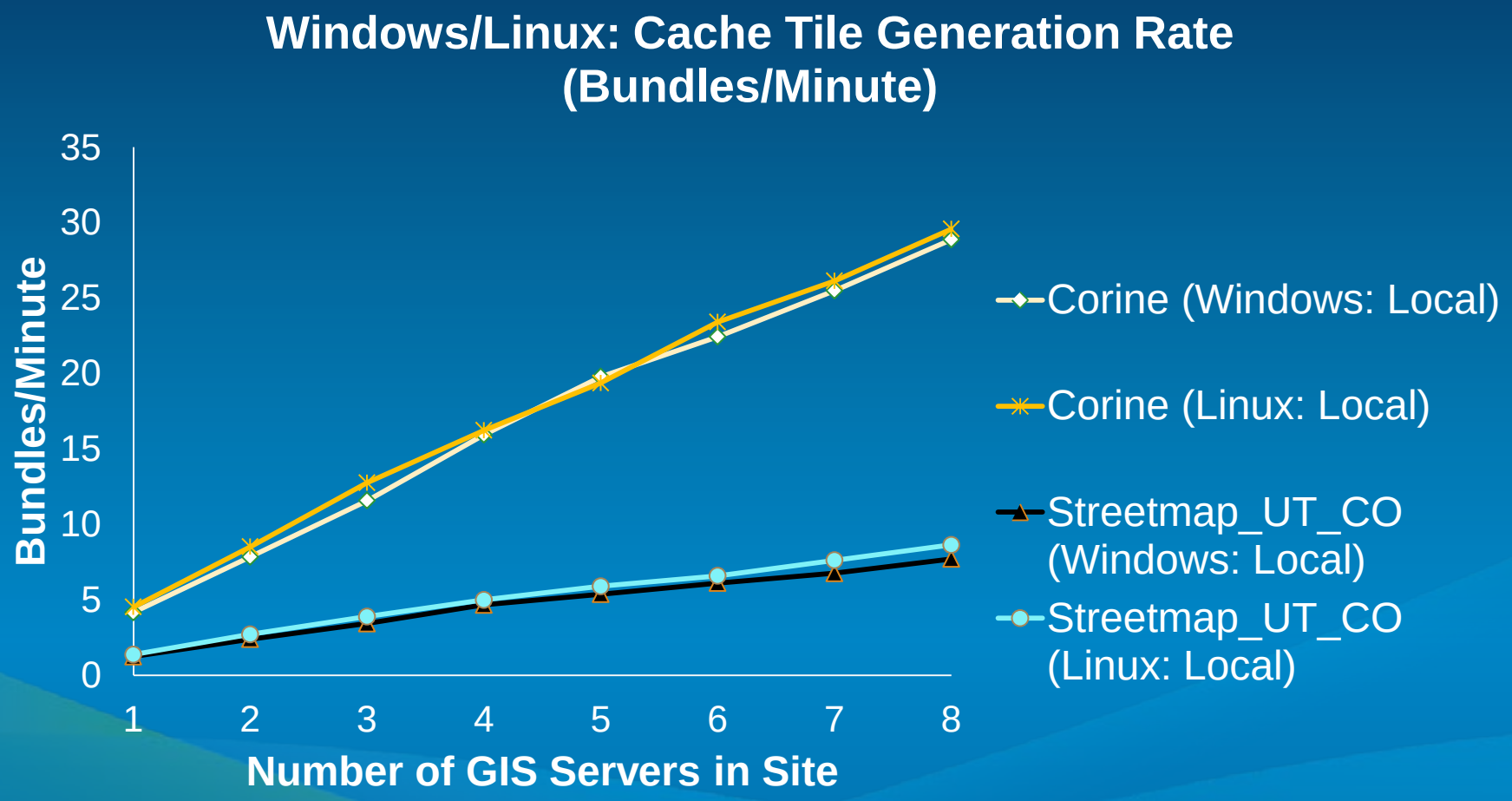


Cache Size and Completion Time (Windows)





Cache Creation Scalability



ArcGIS Server 10.1 Managing Performance

David Cordes (Esri)

Managing Performance at 10.1

- Managing Service Instances
- Managing Machines using Clustering

Managing Service Instances at 10.1

- **10.0: min/max instance settings are total *for all machines***
- **10.1: min/max instance settings are *per-machine***

- **Simplifies sizing – removes the guess work**
- **Scales as your hardware scales**

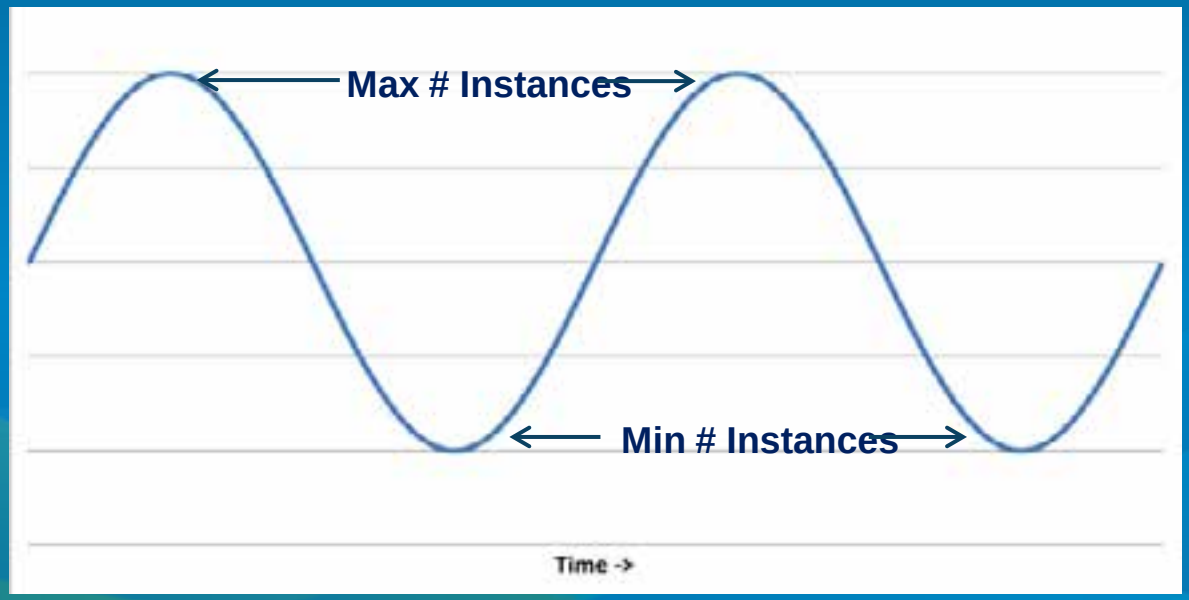
Managing Service Instances at 10.1

On each machine

- Start min # instances when service starts
- Start another instance *if*
  - All existing instances busy
  - Less than max # of instances
- Stop an instance *if*
  - Idle time for instance > idle time out
  - More than the min # of instances

Managing Service Instances at 10.1

- Typical use: cyclic and gradual
- Usually min instance at least 1.
- Hardware or license constrained?
  - Max instances less than natural
  - Idle time out may be less (default 30 min, but maybe 5,10, or 15)



Managing Service Instances at 10.1

- Two other common use patterns
  - Blip
  - Constant
- Blip
  - Service is pre-dominantly not used.
  - Used for short periods of time by few people.
  - Min/Max is usually 0/1.
  - Idle time-out depends on business needs.
- Constant
  - Service usage does not vary much day-to-day. Usage often tied to a resource – workers, trucks, etc.
  - Min/Max are usually set to be equal. Variability is not desired.

Managing Machines through Clustering at 10.1

- Cluster is a set of ArcGIS Server machines.
- Each service is assigned to a cluster.

- Example:
  - Cluster default has Sample service
    - Machine1
    - Machine2
  - Cluster 2
    - Machine3
    - Machine4

When you publish a service S1 to cluster 2, the service will run on Machine3 and Machine4

Managing Machines through Clustering at 10.1

- You can move machine between clusters on the fly.

- Example continued – move machine2 from default cluster to cluster 2.
  - Cluster default has sample and publishing services
    - Machine1
    - ~~Machine2~~
  - Cluster 2 has service S1
    - Machine2
    - Machine3
    - Machine4
  - When you publish a service S1 to cluster 2, the service will run on Machine3 and Machine4

Managing Machines through Clustering at 10.1

- You can move services between clusters on the fly (requires service to be stopped and restarted).

- Example continued – move sampl e service from default cluster to cluster 2
  - Cluster default has publishing service
    - Machine1
    - ~~Machine2~~
  - Cluster 2 has S1 and sample services.
    - Machine2
    - Machine3
    - Machine4
  - When you publish a service S1 to cluster 2, the service will run on Machine3 and Machine4

Managing Machines through Clustering at 10.1

- **Performance implications:**
  - **More important services can have dedicated resources.**
  - **Heavy services (caching or geoprocessing) can be isolated from lighter services (map)**
  - **You can rebalance load as needed.**
  - **Important: All machines in a cluster should have identical hardware.**

Further Reading & Sessions

Performance Related UC Sessions

Session	Time & Place	Short URL
ArcGIS for Server Performance and Scalability—Testing and Monitoring Tools	Wed 3:40 20 min Room 03	http://bit.ly/NMRH5o
ArcGIS for Server Performance and Scalability—Testing Methodologies	Thur 1:30 75 min Room 32B	http://bit.ly/NrSVo6

Performance Related Reading

Resource	URL
Enterprise GIS Resource Center	http://resources.arcgis.com (Enterprise GIS Community)
Map Services	http://bit.ly/LJsJnC
Geoprocessing Services	http://bit.ly/NrUGSb

Evaluation & Questions

Evaluation

- Your feedback is extremely important
- Please fill out evaluations online
- **http://Esri.com/ucsessionsurveys**
  - **Offering ID (Wednesday): 672**
  - **Offering ID (Thursday): 1938**