

Connection Modes in Power BI on Fabric

1. Import Mode

- Data is imported from sources into the Power BI semantic model (stored in-memory via VertiPaq).
- Offers very fast query performance, full support for Power Query M and DAX, and features like Q&A and Quick Insights
- Requires scheduling refreshes and sufficient memory capacity. Refreshing replaces table contents entirely unless using incremental refresh.

2. DirectQuery Mode

- No in-memory data—Power BI sends live queries to the underlying data source on demand.
- Ideal for very large datasets or real-time scenarios.
- Performance depends on the source; transformation and DAX capabilities are limited

3. Composite Mode

- Combines Import and DirectQuery in a single model: each table can be configured separately (Import, DirectQuery, or Dual).
- Dual tables allow efficient in-memory querying and fallback to live queries when needed.
- Supports most DAX and calculated tables with flexibility and performance trade-offs

4. Direct Lake Mode (*Fabric-specific*)

- A native Fabric mode that queries Parquet/Delta data stored in OneLake/storage directly—without loading into Power BI's internal store.
- Offers near import-level performance with live freshness—no model refresh needed.
- New semantic model creation within Fabric lakehouses or SQL analytics endpoint defaults to this mode

- Can fall back to DirectQuery if unsupported queries or capacity limits are reached

Summary Table

Mode	Data Location	Performance	Data Freshness	Strengths	Limitations
Import	In-memory (VertiPaq)	Excellent	Refresh-dependent	Full transformations, DAX, fast visuals	Refresh cost, memory constraints
DirectQuery	External data source (live)	Moderate (slow)	Real-time	No duplication, real-time data access	Limited DAX, requires tuning
Composite	Mixed (Import + DirectQuery)	Variable	Mixed	Balanced performance & freshness	More complex model design
Direct Lake	Parquet/Delta in OneLake	Fast	Real-time	No refresh needed, live analytics	Preview mode, some functionality gaps

Want to See It in Action?

Community Insights

- Direct Lake is emerging as the default model for semantic layers built from Fabric lakehouses and warehouses
- Users generally find:

“Import is fastest in visual responsiveness, but Direct Lake supports more frequent updates and handles bigger data volumes—even at the cost of slightly slower performance.”

- Direct Lake currently has some limitations (e.g. no composite capabilities, restricted editing in desktop) but is evolving rapidly.

Best Practices: Choosing the Right Mode

- **Use Import Mode** for moderate-size datasets, maximum performance, full Power BI feature support.
- **Use DirectQuery** when working with massive or real-time data, and transformations are performed upstream.
- **Use Composite Mode** when needing to mix performance of import with real-time access of live data.
- **Prefer Direct Lake** in Fabric when dealing with lakehouse data—enjoy real-time freshness and fast querying without the cost of imports or refreshes.

How to Create These Modes in Fabric

1. **From a Lakehouse or Warehouse:** Click "**New semantic model**"—it defaults to **Direct Lake** mode for you
2. **In Power BI Desktop:**
 - a. For Import, DirectQuery, or Composite mode: connect to SQL endpoints or external sources in the desktop application.
 - b. Composite models can be built by selecting multiple tables from different storage modes.
3. **For large-scale data:** leverage Direct Lake models built in Fabric and consume them via Live Connect in Desktop or browser.

What Is a Semantic Model in Fabric?

A semantic model in Fabric (formerly known as a Power BI dataset) is a centralized, tabular model representing a business domain—typically structured as a star schema of fact and dimension tables. It includes:

- Relationships between tables, KPIs, and business-friendly metadata
- Measures, hierarchies, synonyms, categories, descriptions—to ensure consistent, semantic-aware reporting
- Managed centrally and consumable via Power BI, Excel, third-party tools, and data science experiences

Fabric automatically creates a default semantic model whenever you build a Lakehouse or Warehouse. It uses Direct Lake mode by default for real-time, performant querying, with no import or refresh required

Key Features & Capabilities

- **OneLake + Direct Lake Mode:** Live query of Parquet/Delta files without duplication, combining speed and freshness. Includes automatic fallback to DirectQuery if limits are exceeded
- **Semantic Link:** Enables data scientists to query the semantic model directly using Spark or Python via SemPy library or native Spark connector—includes preserving DAX logic and metadata propagation
- **Governance & Security:** Model-level RLS enforcement, auditing, lineage and cataloging via Purview integration
- **AI-enabled Modeling:** Descriptive metadata—like KPIs, synonyms, hierarchies—makes models accessible to Copilot and AI agents

Limitations to Be Aware Of

- **Direct Lake models do not support calculated columns or calculated tables referencing Lakehouse data**—you'll need to build those in Lakehouse or import-mode models
- **Composite models are not supported with Direct Lake**—meaning you can't mix tables in Import, DirectQuery, or Dual mode
- **Certain data types and column formats (e.g. GUIDs, binary types)** may not be supported
- **Model editing via Power BI Desktop is limited**—initial creation is only via Fabric, though editing support in Desktop is improving

How to Create a Semantic Model: Step-by-Step

Option A: Via Fabric (Direct Lake mode)

1. In Fabric, build a Lakehouse or Warehouse with curated tables.
2. Open the SQL analytics endpoint of that workspace and click "**Manage default semantic model**" or choose **New semantic model → Direct Lake**.
3. Select tables, define relationships, hierarchies, and measures; semantic model is auto-generated and immediately available for consumption

Option B: Via Power BI Desktop (for more control or Import/Composite mode)

1. Enable the *Direct Lake* preview feature in Power BI Desktop (April 2025 update onwards).
2. Create a new semantic model that connects live to Lakehouse/warehouse tables across multiple sources if needed.
3. Add DAX measures, calculated tables, hierarchies, and manage metadata.
4. Publish the model back to Fabric workspace—it becomes a managed semantic model in your tenant

Best Practices & Optimization Tips

- **Build a proper star schema:** Separate fact and dimension tables, avoid many-to-many relationships, and plan hierarchies upfront.
- **Define RLS early:** Enforce row-level security at the semantic layer (especially with Direct Lake mode) for performance and consistency.
- **Use standard naming and descriptive metadata:** Add synonyms, descriptions, and display folders to enhance usability and AI integration.
- **Monitor model usage:** Use Performance Analyzer or Azure Monitor, prune unused columns, and optimize aggregations to maintain speed.
- **Version control & CI/CD:** Leverage XMLA endpoints or Tabular Editor for scripted deployment and integration with Git and Fabric pipelines.

Community Notes & Insights

- As of mid-2025, **Power BI Desktop editing** of Direct Lake models is newly supported and evolving. Complex model adjustments may still require Desktop or Tabular Editor and XMLA endpoints
- Semantic models are typically **created in the same workspace as the Lakehouse**, though developers can create them in separate workspaces using shortcuts or workspace viewer roles, maintaining separation while avoiding unnecessary permissions