



Reporting

Data Infrastructure Insights

NetApp
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Reporting

Data Infrastructure Insights Reporting Overview

Data Infrastructure Insights reporting is a business intelligence tool that enables you to view pre-defined reports or create custom reports.



The Reporting feature is available in Data Infrastructure Insights [Premium Edition](#).

With Data Infrastructure Insights reporting you can perform the following tasks:

- Run a pre-defined report
- Create a custom report
- Customize a report's format and delivery method
- Schedule reports to run automatically
- Email reports
- Use colors to represent thresholds on data

Data Infrastructure Insights Reporting can generate custom reports for areas like chargeback, consumption analysis, and forecasting, and can help answer questions such as the following:

- What inventory do I have?
- Where is my inventory?
- Who is using our assets?
- What is the chargeback for allocated storage for a business unit?
- How long until I need to acquire additional storage capacity?
- Are business units aligned along the proper storage tiers?
- How is storage allocation changing over a month, quarter, or year?

Accessing Data Infrastructure Insights Reporting

You can access Data Infrastructure Insights Reporting by clicking the **Reports** link in the menu.

You will be taken to the Reporting interface. Data Infrastructure Insights uses IBM Cognos Analytics for its reporting engine.

What is ETL?

When working with Reporting, you will hear the terms "Data Warehouse" and "ETL". ETL stands for "Extract, Transform, and Load". The ETL process retrieves data collected in Data Infrastructure Insights, and transforms the data into a format for use in Reporting. "Data Warehouse" refers to the collected data available for Reporting.

The ETL process includes these individual processes:

- **Extract:** Takes data from Data Infrastructure Insights.

- **Transform:** Applies business logic rules or functions to the data as it is extracted from Data Infrastructure Insights.
- **Load:** Saves the transformed data into the data warehouse for use in Reporting.

Data Infrastructure Insights Reporting User Roles

If you have Data Infrastructure Insights Premium Edition with Reporting, every Data Infrastructure Insights user on your tenant also has a Single Sign-On (SSO) login to the Reporting application (i.e. Cognos). Simply click the **Reports** link in the menu and you will automatically be logged in to Reporting.

Your user role in Data Infrastructure Insights determines your Reporting user role:

Data Infrastructure Insights Role	Reporting Role	Reporting Permissions
Guest	Consumer	Can view, schedule, and run reports and set personal preferences such as those for languages and time zones. Consumers cannot create reports or perform administrative tasks.
User	Author	Can perform all Consumer functions as well as create and manage reports and dashboards.
Administrator	Administrator	Can perform all Author functions as well as all administrative tasks such as configuration of reports and the shutdown and restart of reporting tasks.

The following table shows the functions available to each Reporting role.

Feature	Consumer	Author	Administrator
View reports in the Team Content tab	Yes	Yes	Yes
Run reports	Yes	Yes	Yes
Schedule reports	Yes	Yes	Yes
Upload external files	No	Yes	Yes
Create Jobs	No	Yes	Yes
Create stories	No	Yes	Yes
Create reports	No	Yes	Yes
Create Packages and Data Modules	No	Yes	Yes
Perform administrative tasks	No	No	Yes

Add/Edit HTML Item	No	No	Yes
Run report with HTML Item	Yes	Yes	Yes
Add/Edit Custom SQL	No	No	Yes
Run reports with Custom SQL	Yes	Yes	Yes

Setting Reporting (Cognos) email preferences

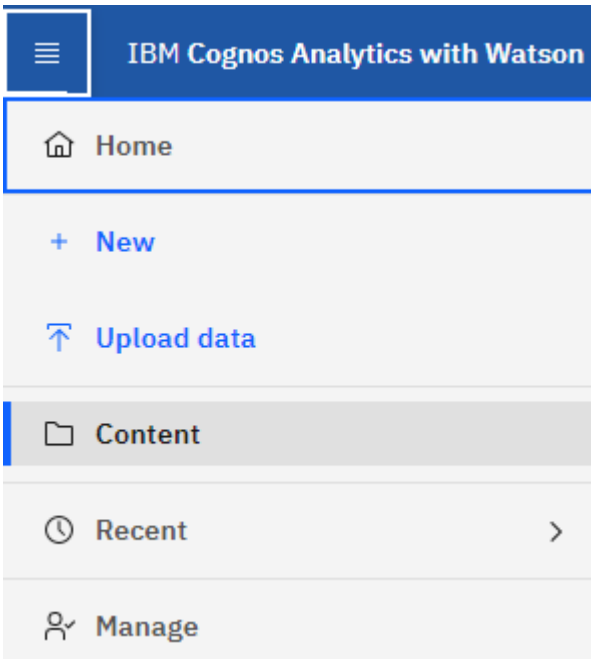


If you change your user email preferences within Data Infrastructure Insights Reporting (i.e. the Cognos application), those preferences are active *only for the current session*. Logging out of Cognos and back in again will reset your email preferences.

What steps should I take to prepare my existing environment for enabling SSO?

To ensure your reports are retained, migrate all reports from *My Content* to *Team Content* using the following steps. You must do this prior to enabling SSO on your tenant:

1. Navigate to **Menu > Content**



1. Create a new folder in **Team Content**
 - a. If multiple users have been created, please create a separate folder for each user to avoid overwriting reports with duplicate names
2. Navigate to *My Content*
3. Select all of the reports you wish to retain.
4. In the upper right corner of the menu, select "Copy or move"
5. Navigate to the newly created folder in *Team Content*
6. Paste the reports to the newly created folder using the "Copy to" or "Move to" buttons

7. Once SSO is enabled for Cognos, log into Data Infrastructure Insights with the email address used to create your account.
8. Navigate to the *Team Content* folder within Cognos, and Copy or Move the previously saved reports back to *My Content*.

Predefined Reports Made Easy

Data Infrastructure Insights Reporting includes predefined reports that address a number of common reporting requirements, providing critical insight that stakeholders need to make informed decisions about their storage infrastructure.



The Reporting feature is available in Data Infrastructure Insights [Premium Edition](#).

You can generate pre-defined reports from the Data Infrastructure Insights Reporting Portal, email them to other users, and even modify them. Several reports enable you to filter by device, business entity, or tier. The reporting tools use IBM Cognos as a foundation and give you many data presentation options.

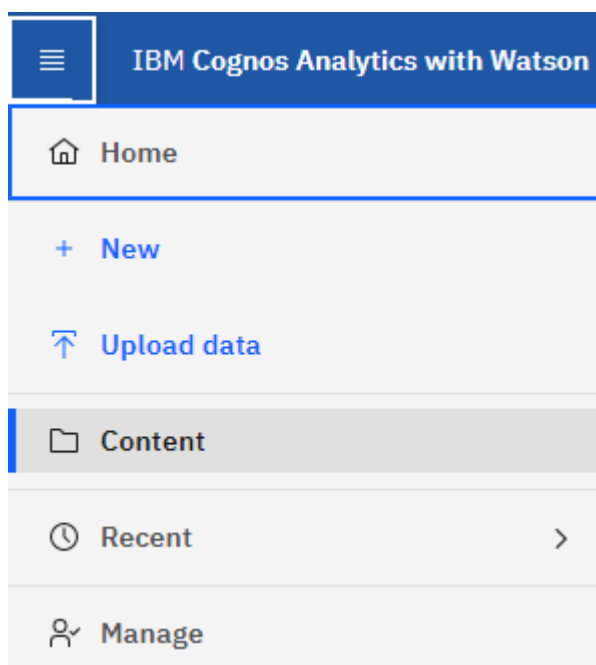
The pre-defined reports show your inventory, storage capacity, chargeback, performance, storage efficiency, and cloud cost data. You can modify these pre-defined reports and save your modifications.

You can generate reports in various formats, including HTML, PDF, CSV, XML, and Excel.

Navigating to Pre-defined Reports

When you open the Reporting Portal, the *Team Content* folder is the starting point for you to select the type of information that you require in the Data Infrastructure Insights reports.

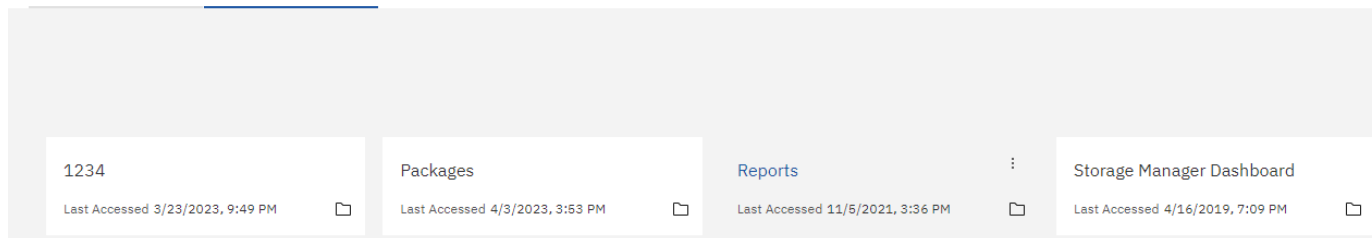
1. In the left navigation pane, select **Content > Team Content**.
2. Select **Reports** to access the pre-defined reports.



Content

My content

Team content



Using predefined reports to answer common questions

The following predefined reports are available in **Team content > Reports**.

Application Service Level Capacity and Performance

The Application Service Level Capacity and Performance report provides a high level overview of your applications. You can use this information for capacity planning or for a migration plan.

Chargeback

The Chargeback report provides storage capacity chargeback and accountability information by hosts, application, and business entities, and includes both current and historical data.

To prevent double counting do not include ESX servers, only monitor the VMs.

Data Sources

The Data Sources report shows all the data sources that are installed on your site, the status of the data source (success/failure), and status messages. The report provides information about where to start troubleshooting data sources. Failed data sources impact the accuracy of reporting and the general usability of the product.

ESX vs VM Performance

The ESX vs VM Performance report provides a comparison of ESX servers and VMs, showing average and peak IOPs, throughput, and latency and utilizations for ESX servers and VMs. To prevent double counting, exclude the ESX servers; only include the VMs.

An updated version of this report is available at the NetApp Storage Automation Store.

Fabric Summary

The Fabric Summary report identifies switches and switch information, including port counts, firmware versions, and license status. The report does not include NPV switch ports.

Host HBAs

The Host HBAs report provides an overview of the hosts in the environment and provides the vendor, model, and firmware version of HBAs, and the firmware level of the switches to which they are connected. This report can be used to analyze firmware compatibility when planning a firmware upgrade for a switch or an HBA.

Host Service Level Capacity and Performance

The Host Service Level Capacity and Performance report provides an overview of storage utilization by host for block only applications.

Host Summary

The Host Summary report provides an overview of storage utilization by each selected host with information for Fibre Channel and iSCSI hosts. The report enables you to compare ports and paths, the Fibre Channel and iSCSI capacity, and violation counts.

License Details

The License Details report shows the entitled quantity of resources you are licensed for across all sites with active licenses. The report also shows a summation of actual quantity across all the sites with active licenses. The summation may include overlaps of storage arrays managed by multiple servers.

Mapped but not Masked Volumes

The Mapped but not Masked Volumes report lists the volumes whose logical unit number (LUN) has been mapped for use by a particular host, but is not masked to that host. In some cases these could be decommissioned LUNs that have been unmasked. Unmasked volumes can be accessed by any host, making them vulnerable to data corruption.

NetApp Capacity and Performance

The NetApp Capacity and Performance report provides global data for allocated, utilized, and committed capacity with trending and performance data for NetApp capacity.

Scorecard

The Scorecard report provides a summary and general status of all assets acquired by Data Infrastructure Insights. Status is indicated with green, yellow, and red flags:

- Green indicates normal condition
- Yellow indicates a potential issue in the environment
- Red indicates an issue that requires attention

All of the fields in the report are described in the Data Dictionary provided with the report.

Storage Summary

The Storage Summary report provides a global summary of used and unused capacity data for raw, allocated, storage pools, and volumes. This report provides an overview of all of the storage discovered.

VM Capacity and Performance

Describes the virtual machine (VM) environment and its capacity usage. VM tools must be enabled to view some data, such as when VMs were powered down.

VM Paths

The VM Paths report provides data store capacity data and performance metrics for which virtual machine is running on which host, which hosts are accessing which shared volumes, what the active access path is, and

what comprises capacity allocation and usage.

HDS Capacity by Thin Pool

The HDS Capacity by Thin Pool report shows the amount of usable capacity on a storage pool that is thin provisioned.

NetApp Capacity by Aggregate

The NetApp Capacity by Aggregate report shows raw total, total, used, available, and committed space of aggregates.

Symmetrix Capacity by Thick Array

The Symmetrix Capacity by Thick Array report shows raw capacity, useable capacity, free capacity, mapped, masked, and total free capacity.

Symmetrix Capacity by Thin Pool

The Symmetrix Capacity by Thin Pool report shows raw capacity, useable capacity, used capacity, free capacity, used percentage, subscribed capacity, and subscription rate.

XIV Capacity by Array

The XIV Capacity by Array report shows used and unused capacity for the array.

XIV Capacity by Pool

The XIV Capacity by Pool report shows used and unused capacity for storage pools.

Storage Manager Dashboard

The Storage Manager Dashboard provides you with a centralized visualization that enables you to compare and contrast resource usage over time against the acceptable ranges and previous days of activity. Showing only the key performance metrics for your storage services, you can make decisions about how to maintain your data centers.



The Reporting feature is available in Data Infrastructure Insights [Premium Edition](#).

Summary

Selecting **Storage Manager Dashboard** from Team Content gives you several reports that provide information on of your traffic and storage.

Storage Manager Dashboard

My content | **Team content**

Team content / Storage Manager Dashboard

Data Center Traffic Details

Last Accessed 4/17/2019, 6:47 PM

Orphaned Storage Details

Last Accessed 5/2/2019, 8:30 PM

[Storage Manager Report](#)

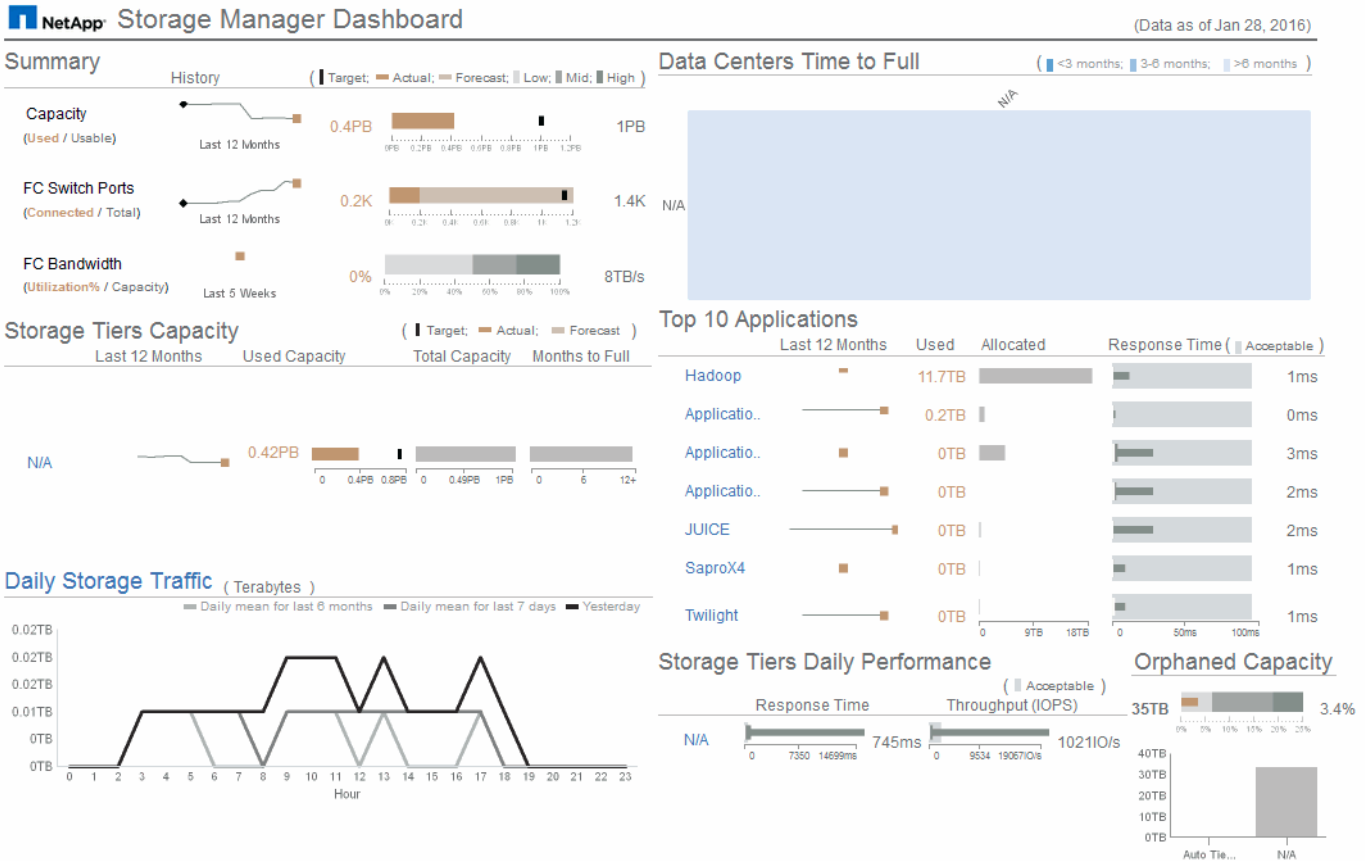
Last Accessed 12/17/2019, 9:44 PM

Storage Pools Capacity and Performance Details

Last Accessed 4/17/2019, 6:47 PM

For an at-a-glance view, the **Storage Manager Report** comprises seven components that contain contextual information on many aspects of your storage environment. You can drill down on the aspects of your storage services to perform an in-depth of analysis of a section that interests you most.

Public Folders | My Folders | **Storage Manager Dashboard**



This component shows the used versus usable storage capacity, total switch ports versus the number of switch ports connected, and total connected switch port utilization versus the total bandwidth, and how each of these trend over time. You can view the actual utilization compared against the low, mid, and high ranges, which enables you to compare and contrast usage between projections and your desired actuals, based on a target.

For capacity and switch ports, you can configure this target. The forecast is based on an extrapolation of the current growth rate and the date you set. When the forecasted used capacity, which is based on future usage projection date, exceeds the target, an alert (solid red circle) appears next to Capacity.

Storage Tiers Capacity

This component shows the tier capacity used versus the capacity allocated to the tier, which indicates how the used capacity increases or decreases over a 12-month period and how many months are remaining to full capacity. Capacity usage is shown with values provided for actual usage, the usage forecast, and a target for capacity, which you can configure. When the forecasted used capacity, which is based on future usage projection date, exceeds the target capacity, an alert (solid red circle) appears next to a tier.

You can click any tier to display the Storage Pools Capacity and Performance Details report, which shows free versus used capacities, number of days to full, and performance (IOPS and Response Time) details for all the pools in the selected tier. You can also click any storage or storage pool name in this report to display the asset page summarizing the current state of that resource.

Daily Storage Traffic

This component shows how the environment is performing, if there is any large growth, changes, or potential issues compared to the previous six months. It also shows the average traffic versus the traffic for the previous seven days, and for the previous day. You can visualize any abnormalities in the way the infrastructure is performing because it provides information that highlights both cyclical (previous seven days) and seasonal variations (previous six months).

You can click the title (Daily Storage Traffic) to display the Storage Traffic Details report, which shows the heat map of the hourly storage traffic for the previous day for each storage system. Click any storage name in this report to display the asset page summarizing the current state of that resource.

Data Centers Time to Full

This component shows all the data centers versus all of the tiers and how much capacity remains in each data center for each tier of storage based on forecasted growth rates. Tier capacity level is shown in blue; the darker the color, the lesser time the tier at the location has left before it is full.

You can click a section of a tier to display the Storage Pools Days to Full Details report, which shows total capacity, free capacity, and number of days to full for all the pools in the selected tier and the data center. Click any storage or storage pool name in this report to display the asset page summarizing the current state of that resource.

Top 10 Applications

This component shows the top 10 applications based on the used capacity. Regardless of how the tier organizes the data, this area displays the current used capacity and share of the infrastructure. You can visualize the range of user experience for the previous seven days to see if consumers experience acceptable (or, more importantly, unacceptable) response times.

This area also shows trending, which indicates if the applications meet their performance service level objectives (SLO). You can view the previous week's minimum response time, the first quartile, the third quartile, and the maximum response time, with a median shown against an acceptable SLO, which you can configure. When the median response time for any application is out of the acceptable SLO range, an alert (solid red circle) appears next to the application. You can click an application to display the asset page summarizing the current state of that resource.

Storage Tiers Daily Performance

This component shows a summary of the tier's performance for response time and IOPS for the previous seven days. This performance is compared against a SLO, which you can configure, enabling you to see if there is opportunity to consolidate tiers, realign workloads delivered from those tiers, or identify issues with particular tiers. When median response time or median IOPS is out of the acceptable SLO range, an alert (solid red circle) appears next to a tier.

You can click a tier name to display the Storage Pools Capacity and Performance Details report, which shows free versus used capacities, number of days to full, and performance (IOPS and response time) details for all the pools in the selected tier. Click any storage or storage pool in this report to display the asset page summarizing the current state of that resource.

Orphaned Capacity

This component shows the total orphaned capacity and orphaned capacity by tier, comparing it against acceptable ranges for total usable capacity and showing the actual capacity that is orphaned. Orphaned capacity is defined by configuration and by performance. Storage orphaned by configuration describes a situation in which there is storage allocated to a host. However, the configuration has not been performed properly and the host cannot access the storage. Orphaned by performance is when the storage is correctly configured to be accessed by a host. However, there has been no storage traffic.

The horizontal stacked bar shows the acceptable ranges. The darker the gray, the more unacceptable the situation is. The actual situation is shown with the narrow bronze bar that shows the actual capacity that is orphaned.

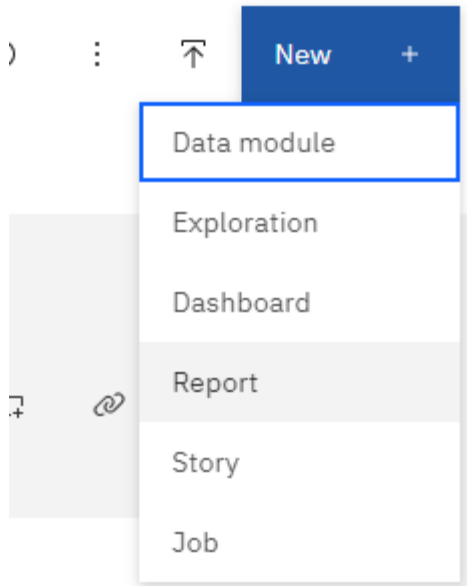
You can click a tier to display the Orphaned Storage Details report, which shows all the volumes identified as orphaned by configuration and performance for the selected tier. Click any storage, storage pool, or volume in this report to display the asset page summarizing the current state of that resource.

Creating a Report (Example)

Use the steps in this example to generate a simple report on physical capacity of storage and storage pools in a number of data centers.

Steps

1. Navigate to **Menu > Content > Team Content > Reports**
2. In the upper-right of the screen, select **[New +]**
3. Select **Report**



4. On the **Templates** tab, select *Blank*

The Source and Data tabs is displayed

5. Open **Select a source +**

6. Under **Team content**, open **Packages**

A list of available packages is displayed.

7. Choose **Storage and Storage Pool Capacity**

The screenshot shows two parts of the application. On the left is a 'Select a source' dialog box with a search icon and a 'Select a source +' button. On the right is the 'Team content / Packages' view, which displays a table of available packages. The table has columns for Name, Type, and Last Accessed. The package 'Storage and Storage Pool Capacity' is highlighted in blue.

Name	Type	Last Accessed
Host Volume Hourly Performance	Package	6/25/2021, 9:36 PM
Internal Volume Capacity	Package	11/4/2021, 4:23 PM
Internal Volume Daily Performance	Package	1/7/2022, 4:23 PM
Internal Volume Hourly Performance	Package	1/6/2022, 11:41 PM
Inventory	Package	12/17/2019, 9:22 PM
Port Capacity	Package	11/20/2019, 4:13 PM
Qtree Capacity	Package	11/4/2021, 6:07 PM
Qtree Performance	Package	11/4/2021, 11:07 PM
Storage and Storage Pool Capacity	Package	12/17/2019, 5:58 PM
Storage Efficiency	Package	12/17/2019, 9:17 PM
Storage Node Capacity	Package	1/13/2023, 4:09 PM
Storage Node Performance	Package	1/13/2023, 6:11 PM

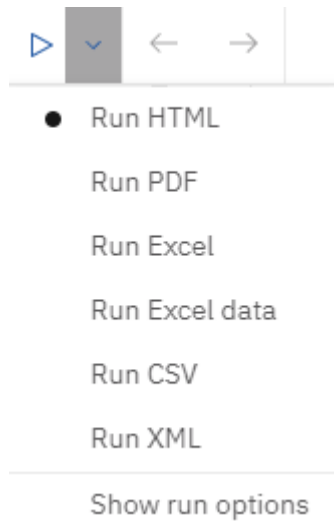
8. Select **Open**

The available styles for your report are displayed.

9. Select **List**







Add appropriate names for List and Query





10. Select **OK**
11. Expand *Physical Capacity*
12. Expand to the lowest level of *Data Center*
13. Drag *Data Center* to the Reporting palate.
14. Expand *Capacity (MB)*
15. Drag *Capacity (MB)* to the Reporting palate.
16. Drag *Used Capacity (MB)* to the Reporting palate.
17. Run the report by selecting an output type from the **Run** menu.



Result

A report similar to the following is created:

	Data Center	Capacity (MB)	Used Capacity (MB)
	Asia	122,070,096.00	45,708,105.00
	BLR	100,709,506.00	54,982,204.00
	Boulder	22,883,450.00	12,011,075.00
	DC01	1,707,024,715.00	1,407,609,686.00
	DC02	732,370,688.00	732,370,688.00
	DC03	314,598,162.00	65,448,975.00
	DC04	573,573,884.00	282,645,615.00
	DC05	89,245,458.00	62,145,011.00
	DC06	19,455,433,799.00	11,283,487,744.00
	DC08	100,709,506.00	44,950,171.00
	DC10	112,916,718.00	43,346,818.00
	DC14	23,565,735,054.00	17,357,431,924.00
	DC56	137,549,084.00	10,657,793.00
	Europe	743,942,208.00	240,369,325.00
	HIO	9,823,036,853.00	4,216,750,338.00
	London	0.00	0.00
	N/A	9,049,939,023.00	5,887,911,992.00
	RTP	12,386,326,262.00	5,638,948,477.00
	SAC	9,269,642,330.00	6,197,549,437.00

 Top
  Page up
  Page down
  Bottom

Managing Reports

You can customize a report's output format and delivery, set report properties or schedules, and email reports.



The Reporting feature is available in Data Infrastructure Insights [Premium Edition](#).

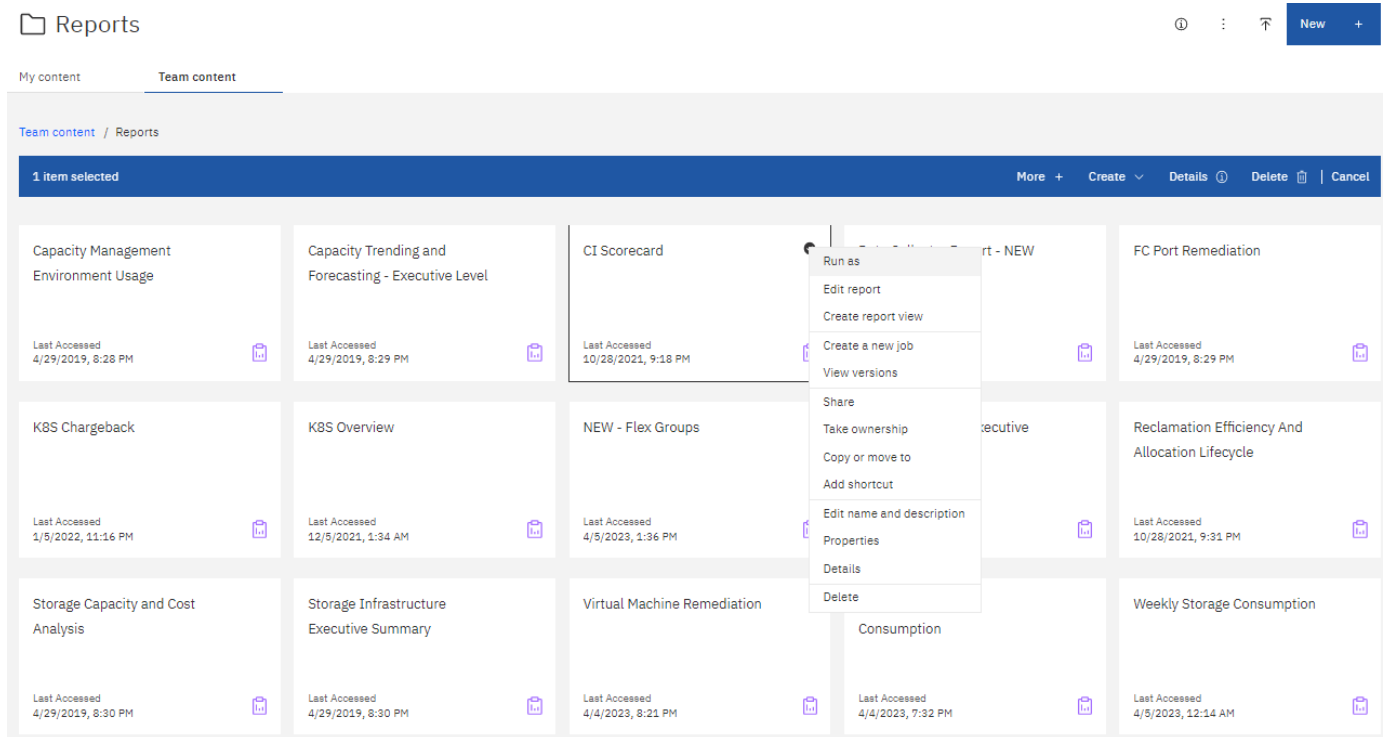


Before making changes to reporting permissions or security, you must copy "My Content" reports to the "Team Content" folder to ensure Reports are saved.

Customizing a report's output format and delivery

You can customize the format and delivery method of reports.

1. In the Data Infrastructure Insights Reporting Portal, Go to **Menu > Content > My Content/Team Content**. Mouse over the report you want to customize and open the "three dots" menu.



1. Click **Properties > Schedule**

1. You can set the following options:

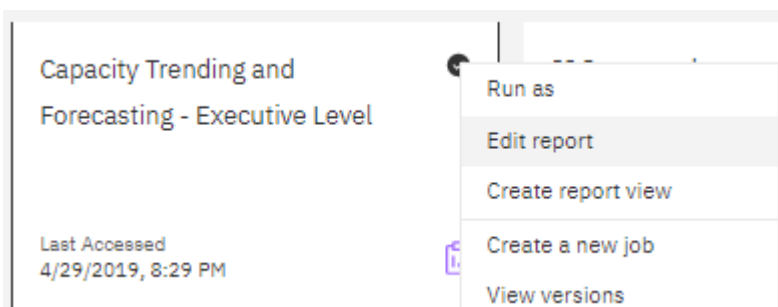
- **Schedule** when you want reports to run.
- Choose **Options** for report format and delivery (Save, Print, Email) and Languages for the report.

2. Click **Save** to produce the report using the selections you made.

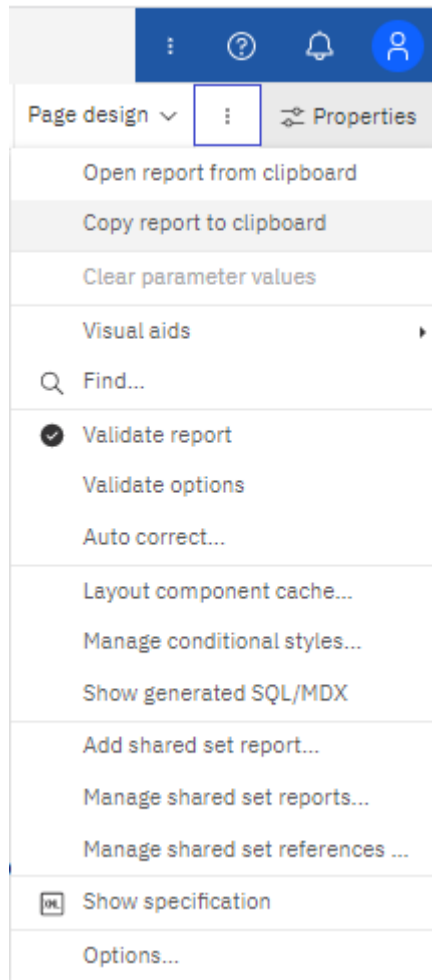
Copying a report to the clipboard

Use this process to copy a report to the clipboard.

1. Select a report to copy from (**Menu > Content > My Content or Team Content**)
2. Choose *Edit report* from the report's drop-down menu



3. In the upper-right of the screen, open the "three dots" menu next to "Properties".
4. Select **Copy Report to Clipboard**.



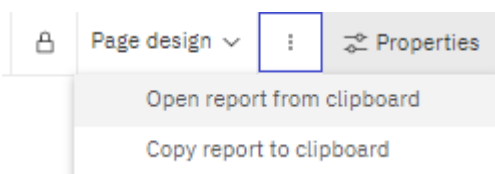
Opening reports from the clipboard

You can open a report specification that was previously copied to the clipboard.

About this task

Start by creating a new report or opening an existing report that you wish to replace with the copied report. The steps below are for a new report.

1. Select **Menu > +New > Report** and create a blank report.
2. In the upper-right of the screen, open the "three dots" menu next to "Properties".
3. Select **Open Report from Clipboard**.



1. Paste the copied code into the window and select **OK**.

2. Select the floppy disk icon to save the report.
3. Choose where to save the report (*My Content*, *Team Content*, or create a new folder).
4. Give the new report a meaningful name and select **Save**.

Editing an existing report

Be aware that editing files in their default location runs a risk of those reports being overwritten upon the next report catalog refresh. It is recommended to save the edited report under a new name or store it in a non-default location.

Troubleshooting

Here you will find suggestions for troubleshooting problems with Reporting.

Problem:	Try this:
<p>When scheduling a report to be sent via email, the name of the user logged in is pre-populated to the email's "To" field. However, the name is in the form of "firstname lastname" (first name, space, last name). Since this is not a valid email address, the email will fail to send when the scheduled report is run.</p>	<p>When scheduling the report to be sent via email, clear the pre-populated name and enter a valid, properly-formatted email address in the "To" field.</p>

Creating Custom Reports

You can use the report authoring tools to create custom reports. After creating reports, you can save them and run them on a regular schedule. The results of reports can be automatically sent by email to yourself and others.



The Reporting feature is available in Data Infrastructure Insights [Premium Edition](#).

The examples in this section show the following process, which can be used for any of the Data Infrastructure Insights Reporting data models:

- Identifying a question to be answered with a report
- Determining the data needed to support the results
- Selecting data elements for the report

Before designing your custom report, you need to complete some prerequisite tasks. If you do not complete these, reports could be inaccurate or incomplete.

For example, if you do not finish the device identification process, your capacity reports will not be accurate. Or, if you do not finish setting annotations (such as tiers, business units, and data centers), your custom reports might not accurately report data across your domain or might show "N/A" for some data points.

Before you design your reports, complete the following tasks:

- Configure all [data collectors](#) properly.
- Enter annotations (such as tiers, data centers, and business units) on devices and resources on your tenant. It is beneficial to have annotations stable before generating reports, because Data Infrastructure

Insights Reporting collects historical information.

Report Creation Process

The process of creating custom (also called "ad hoc") reports involves several tasks:

- Plan the results of your report.
- Identify data to support your results.
- Select the data model (for example, Chargeback data model, Inventory data model, and so on) that contains the data.
- Select data elements for the report.
- Optionally format, sort, and filter report results.

Planning the Results of Your Custom Report

Before you open the report authoring tools, you might want to plan the results you want from the report. With report authoring tools, you can create reports easily and might not need a great deal of planning; however, it is a good idea to get a sense from the report requestor about the report requirements.

- Identify the exact question you want to answer. For example:
 - How much capacity do I have left?
 - What are the chargeback costs per business unit?
 - What is the capacity by tier to ensure that business units are aligned at the proper tier of storage?
 - How can I forecast power and cooling requirements? (Add customized metadata by adding annotations to resources.)
- Identify the data elements that you need to support the answer.
- Identify the relationships between data that you want to see in the answer. Do not include illogical relationships in your question, for example, "I want to see the ports that relate to capacity."
- Identify any calculations needed on data.
- Determine what types of filtering are needed to limit the results.
- Determine if you need to use current or historical data.
- Determine if you need to set access privileges on reports to limit the data to specific audiences.
- Identify how the report will be distributed. For example, should it be emailed on a set schedule or included in the Team content folder area?
- Determine who will maintain the report. This might affect the complexity of the design.
- Create a mockup of the report.

Tips for designing reports

Several tips might be helpful when you are designing reports.

- Determine whether you need to use current or historical data.

Most reports only need to report on the latest data available in the Data Infrastructure Insights.

- Data Infrastructure Insights Reporting provides historical information on capacity and performance, but not on inventory.

- Everybody sees all data; however, you might need to limit data to specific audiences.

To segment the information for different users, you can create reports and set access permissions on them.

Reporting data models

Data Infrastructure Insights includes several data models from which you can either select predefined reports or create your own custom report.

Each data model contains a simple data mart and an advanced data mart:

- The simple data mart provides quick access to the most commonly used data elements and includes only the last snapshot of Data Warehouse data; it does not include historical data.
- The advanced data mart provides all values and details available from the simple data mart and includes access to historical data values.

Capacity data models

Enables you to answer questions about storage capacity, file system utilization, internal volume capacity, port capacity, qtree capacity, and virtual machine (VM) capacity. The Capacity data model is a container for several capacity data models. You can create reports answering various types of questions using this data model:

Storage and Storage Pool Capacity data model

Enables you to answer questions about storage capacity resource planning, including storage and storage pools, and includes both physical and virtual storage pool data. This simple data model can help you answer questions related to capacity on the floor and the capacity usage of storage pools by tier and data center over time.

If you are new to capacity reporting, you should start with this data model because it is a simpler, targeted data model. You can answer questions similar to the following using this data model:

- What is the projected date for reaching the capacity threshold of 80% of my physical storage?
- What is the physical storage capacity on an array for a given tier?
- What is my storage capacity by manufacturer and family as well as by data center?
- What is the storage utilization trend on an array for all of the tiers?
- What are my top 10 storage systems with the highest utilization?
- What is the storage utilization trend of the storage pools?
- How much capacity is already allocated?
- What capacity is available for allocation?

File System Utilization data model

This data model provides visibility about capacity utilization by hosts at the file system level. Administrators can determine allocated and used capacity per file system, determine the type of file system, and identify trending statistics by file system type. You can answer the following questions using this data model:

- What is the size of the file system?
- Where is the data kept and how is it accessed, for example, local or SAN?
- What are the historical trends for the file system capacity? Then, based on this, what can we anticipate for future needs?

Internal Volume Capacity data model

Enables you to answer questions about internal volume used capacity, allocated capacity, and capacity usage over time:

- Which internal volumes have a utilization higher than a predefined threshold?
- Which internal volumes are in danger of running out of capacity based on a trend?
8 What is the used capacity versus the allocated capacity on our internal volumes?

Port Capacity data model

Enables you to answer questions about switch port connectivity, port status, and port speed over time. You can answer questions similar the following to help you plan for purchases of new switches:

How can I create a port consumption forecast that predicts resource (port) availability (according to data center, switch vendor and port speed)?

- Which ports are likely to run out of capacity, providing data speed, data center, vendor and number of Host and storage ports?
- What are the switch port capacity trends over time?
- What are the port speeds?
- What type of port capacity is needed and which organization is about to run out of a certain port type or vendor?
- What is the optimal time to purchase that capacity and make it available?

Qtree Capacity data model

Enables you to trend qtree utilization (with data such as used versus allocated capacity) over time. You can view the information by different dimensions—for example, by business entity, application, tier, and service level. You can answer the following questions using this data model:

- What is the used capacity for qtrees versus the limits set per application or business entity?
- What are the trends of our used and free capacity so that we can do capacity planning?
- Which business entities are using the most capacity?
- Which applications consume the most capacity?

VM Capacity data model

Enables you to report your virtual environment and its capacity usage. This data model lets you report on changes in capacity usage over time for VMs and data stores. The data model also provides thin provisioning and virtual machine chargeback data.

- How can I determine capacity chargeback based on capacity provisioned to VMs and data stores?
- What capacity is not used by VMs and which portion of unused is free, orphaned, or other?
- What do we need to purchase based on consumption trends?
- What are my storage efficiency savings achieved by using storage thin provisioning and deduplication technologies?

Capacities in the VM Capacity data model are taken from virtual disks (VMDKs). This means that the provisioned size of a VM using the VM Capacity data model is the size of its virtual disks. This is different from the provisioned capacity in the Virtual Machines view in Data Infrastructure Insights, which shows the

provisioned size for the VM itself.

Volume Capacity data model

Enables you to analyze all aspects of the volumes on your tenant and organize data by vendor, model, tier, service level, and data center.

You can view the capacity related to orphaned volumes, unused volumes, and protection volumes (used for replication). You can also see different volume technologies (iSCSI or FC), and compare virtual volumes to non-virtual volumes for array virtualization issues.

You can answer questions similar to the following with this data model:

- Which volumes have a utilization higher than a predefined threshold?
- What is the trend in my data center for orphan volume capacity?
- How much of my data center capacity is virtualized or thin provisioned?
- How much of my data center capacity must be reserved for replication?

Chargeback data model

Enables you to answer questions about used capacity and allocated capacity on storage resources (volumes, internal volumes, and qtrees). This data model provides storage capacity chargeback and accountability information by hosts, application, and business entities, and includes both current and historical data. Report data can be categorized by service level and storage tier.

You can use this data model to generate chargeback reports by finding the amount of capacity that is used by a business entity. This data model enables you to create unified reporting of multiple protocols (including NAS, SAN, FC, and iSCSI).

- For storage without internal volumes, chargeback reports show chargeback by volumes.
- For storage with internal volumes:
 - If business entities are assigned to volumes, chargeback reports show chargeback by volumes.
 - If business entities are not assigned to volumes but assigned to qtrees, chargeback reports show chargeback by qtrees.
 - If business entities are not assigned to volumes and not assigned to qtrees, chargeback reports show the internal volume.
 - The decision whether to show chargeback by volume, qtree or internal volume is made per each internal volume, so it is possible for different internal volumes in the same storage pool to show chargeback at different levels.

Capacity facts are purged after a default time interval. For details, see Data Warehouse processes.

Reports using the Chargeback data model might display different values than reports using the Storage Capacity data model.

- For storage arrays that are not NetApp storage systems, the data from both data models is the same.
- For NetApp and Celerra storage systems, the Chargeback data model uses a single layer (of volumes, internal volumes, or qtrees) to base its charges, while the Storage Capacity data model uses multiple layers (of volumes and internal volumes) to base its charges.

Inventory data model

Enables you to answer questions about inventory resources including hosts, storage systems, switches, disks, tapes, qtrees, quotas, virtual machines and servers, and generic devices. The Inventory data model includes several submarts that enable you to view information about replications, FC paths, iSCSI paths, NFS paths, and violations. The Inventory data model does not include historical data. Questions you can answer with this data

- What assets do I have and where are they?
- Who is using the assets?
- What types of devices do I have and what are components of those devices?
- How many hosts per OS do I have and how many ports exist on those hosts?
- What storage arrays per vendor exist in each data center?
- How many switches per vendor do I have in each data center?
- How many ports are not licensed?
- What vendor tapes are we using and how many ports exist on each tape?re all the generic devices identified before we begin working on reports?
- What are the paths between hosts and storage volumes or tapes?
- What are the paths between generic devices and storage volumes or tapes?
- How many violations of each type do I have per data center?
- For each replicated volume, what are the source and target volumes?
- Do I have any firmware incompatibilities or port speed mismatches between Fibre Channel host HBAs and switches?

Performance data model

Enables you to answer questions about performance for volumes, application volumes, internal volumes, switches, applications, VMs, VMDKs, ESX versus VM, hosts, and application nodes. Many of these report *Hourly* data, *Daily* data, or both. Using this data model, you can create reports that answer several types of performance management questions:

- What volumes or internal volumes have not been used or accessed during a specific period?
- Can we pinpoint any potential misconfiguration for storage for an application (unused)?
- What was the overall access behavior pattern for an application?
- Are tiered volumes assigned appropriately for a given application?
- Could we use cheaper storage for an application currently running without impact to application performance?
- What are the applications that are producing more accesses to currently configured storage?

When you use the switch performance tables, you can obtain the following information:

- Is my host traffic through connected ports balanced?
- Which switches or ports are exhibiting a high number of errors?
- What are the most used switches based on port performance?
- What are the underutilized switches based on port performance?

- What is the host trending throughput based on port performance?
- What is the performance utilization for last X days for one specified host, storage system, tape, or switch?
- Which devices are producing traffic on a specific switch (for example, which devices are responsible for use of a highly utilized switch)?
- What is the throughput for a specific business unit in our environment?

When you use the disk performance tables, you can obtain the following information:

- What is the throughput for a specified storage pool based on disk performance data?
- What is the highest used storage pool?
- What is the average disk utilization for a specific storage?
- What is the trend of usage for a storage system or storage pool based on disk performance data?
- What is the disk usage trending for a specific storage pool?

When you use VM and VMDK performance tables, you can obtain the following information:

- Is my virtual environment performing optimally?
- Which VMDKs are reporting the highest workloads?
- How can I use the performance reported from VMDs mapped to different datastores to make decisions about re-tiering.

The Performance data model includes information that helps you determine the appropriateness of tiers, storage misconfigurations for applications, and last access times of volumes and internal volumes. This data model provides data such as response times, IOPs, throughput, number of writes pending, and accessed status.

Storage Efficiency data model

Enables you to track the storage efficiency score and potential over time. This data model stores measurements of not only the provisioned capacity, but also the amount that is used or consumed (the physical measurement). For example, when thin provisioning is enabled, Data Infrastructure Insights indicates how much capacity is taken from the device. You can also use this model to determine efficiency when deduplication is enabled. You can answer various questions using the Storage Efficiency data mart:

- What is our storage efficiency savings as a result of implementing thin provisioning and deduplication technologies?
- What are the storage savings across data centers?
- Based on historical capacity trends, when do we need to purchase additional storage?
- What would be the capacity gain if we enabled technologies such as thin provisioning and deduplication?
- Regarding storage capacity, am I at risk now?

Data model fact and dimension tables

Each data model includes both fact and dimension tables.

- Fact tables: Contain data that is measured, for example, quantity, raw and usable capacity. Contain foreign keys to dimension tables.
- Dimension tables: Contain descriptive information about facts, for example, data center and business units.

A dimension is a structure, often composed of hierarchies, that categorizes data. Dimensional attributes help describe the dimensional values.

Using different or multiple dimension attributes (seen as columns in the reports), you construct reports that access data for each dimension described in the data model.

Colors used in data model elements

Colors on data model elements have different indications.

- Yellow assets: Represent measurements.
- Non-yellow assets: Represent attributes. These values do not aggregate.

Using multiple data models in one report

Typically, you use one data model per report. However, you can write a report that combines data from multiple data models.

To write a report that combines data from multiple data models, choose one of the data models to use as the base, then write SQL queries to access the data from the additional data marts. You can use the SQL Join feature to combine the data from the different queries into a single query that you can use to write the report.

For example, say you want the current capacity for each storage array and you want to capture custom annotations on the arrays. You could create the report using the Storage Capacity data model. You could use the elements from the Current Capacity and dimension tables and add a separate SQL query to access the annotations information in the Inventory data model. Finally, you could combine the data by linking the Inventory storage data to the Storage Dimension table using the storage name and the join criteria.

Access the Reporting Database via API

Data Infrastructure Insights' powerful API allows users to query the Data Infrastructure Insights Reporting database directly, without going through the Cognos Reporting environment.



This documentation refers to the Data Infrastructure Insights Reporting feature, which is available in Data Infrastructure Insights Premium Edition.

Odata

The Data Infrastructure Insights Reporting API follows the [OData v4](#) (Open Data Protocol) standard for its querying of the Reporting database.

For more information or to learn more, check out [this tutorial](#) on OData.

All requests will start with the url `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata`

Generating an APIKey

Read more about [Data Infrastructure Insights APIs](#).

To generate an API key, do the following:

- Log into your Data Infrastructure Insights environment and select **Admin > API Access**.

- Click “+ API Access Token”.
- Enter a Name & Description.
- For type, choose *Data Warehouse*.
- Set Permissions as Read/Write.
- Set a desired Expiration date.
- Click “Save”, then **copy the key and save it** somewhere safe. You will not be able to access the full key later.

APIkeys are good for [Sync or Async](#).

Direct query of tables

With the API Key in place, direct queries of the Reporting database are now possible. Long URLs may be simplified to `https://.../odata/` for display purposes rather than the full `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata/`

Try simple queries like

- `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata/dwh_custom`
- `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata/dwh_inventory`
- `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata/dwh_inventory/storage`
- `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata/dwh_inventory/disk`
- `https://.../odata/dwh_custom/custom_queries`

REST API Examples

The URL for all calls is `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata`.

- GET `/<schema>/**` - Retrieves data from the Reporting Database.

Format: `https://<Data Infrastructure Insights URL>/rest/v1/dwh-management/odata/<schema_name>/<query>`

Example:

```
https://<domain>/rest/v1/dwh-
management/odata/dwh_inventory/fabric?$count=true&$orderby=name
```

Result:

```

{
  "@odata.context": "$metadata#fabric",
  "@odata.count": 2,
  "value": [
    {
      "id": 851,
      "identifier": "10:00:50:EB:1A:40:3B:44",
      "wwn": "10:00:50:EB:1A:40:3B:44",
      "name": "10:00:50:EB:1A:40:3B:44",
      "vsanEnabled": "0",
      "vsanId": null,
      "zoningEnabled": "0",
      "url": "https://<domain>/web/#/assets/fabrics/941716"
    },
    {
      "id": 852,
      "identifier": "10:00:50:EB:1A:40:44:0C",
      "wwn": "10:00:50:EB:1A:40:44:0C",
      "name": "10:00:50:EB:1A:40:44:0C",
      "vsanEnabled": "0",
      "vsanId": null,
      "zoningEnabled": "0",
      "url": "https://<domain>/web/#/assets/fabrics/941836"
    }
  ]
}

```

Helpful Hints

Keep the following in mind when working with Reporting API queries.

- The query payload must be a valid JSON string
- The query payload must be contained in a single line
- Double quotes must be escaped, i.e. \"
- Tabs are supported as \t
- Avoid comments
- Lower-case table names are supported

Additionally:

- 2 Headers are required:
 - Name "X-CloudInsights-ApiKey"
 - Attribute Value "<apikey>"

Your API key will be specific to your Data Infrastructure Insights environment.

Synchronous or Asynchronous?

By default, an API command will operate in *synchronous* mode, meaning that you send the request and the response is returned immediately. However, at times a query may take a long time to execute, which could lead to the request timing out. To get around this, you can execute a request *asynchronously*. In asynchronous mode, the request will return a URL through which the execution can be monitored. The URL will return the result when it is ready.

To execute a query in async mode, add the header **Prefer: respond-async** to the request. Upon successful execution, the response will contain the following headers:

```
Status Code: 202 (which means ACCEPTED)
preference-applied: respond-async
location: https://<Data Infrastructure Insights URL>/rest/v1/dwh-
management/odata/dwh_custom/asyncStatus/<token>
```

Querying the location URL will return the same headers if the response is not ready yet, or will return with status 200 if the response is ready. The response content will be of type text and contains the http status of the original query and some metadata, followed by the results of the original query.

```
HTTP/1.1 200 OK
OData-Version: 4.0
Content-Type: application/json;odata.metadata=minimal
oDataResponseSizeCounted: true

{ <JSON_RESPONSE> }
```

To see a list of all async queries and which of them are ready, use the following command:

```
GET https://<Data Infrastructure Insights URL>/rest/v1/dwh-
management/odata/dwh_custom/asyncList
```

The response has the following format:

```

{
  "queries" : [
    {
      "Query": "https://<Data Infrastructure Insights
URL>/rest/v1/dwh-
management/odata/dwh_custom/heavy_left_join3?$count=true",
      "Location": "https://<Data Infrastructure Insights
URL>/rest/v1/dwh-management/odata/dwh_custom/asyncStatus/<token>",
      "Finished": false
    }
  ]
}

```

How historical data is retained for Reporting

Data Infrastructure Insights retains historical data for use in Reporting based on the data marts and granularity of the data, as shown in the following table.

Data mart	Measured object	Granularity	Retention period
Performance marts	Volumes and internal volumes	Hourly	14 days
Performance marts	Volumes and internal volumes	Daily	13 months
Performance marts	Application	Hourly	13 months
Performance marts	Host	Hourly	13 months
Performance marts	Switch performance for port	Hourly	35 days
Performance marts	Switch performance for host, storage, and tape	Hourly	13 months
Performance marts	Storage node	Hourly	14 days
Performance marts	Storage node	Daily	13 months
Performance marts	VM performance	Hourly	14 days
Performance marts	VM performance	Daily	13 months
Performance marts	Hypervisor performance	Hourly	35 days
Performance marts	Hypervisor performance	Daily	13 months
Performance marts	VMDK performance	Hourly	35 days
Performance marts	VMDK performance	Daily	13 months
Performance marts	Disk performance	Hourly	14 days
Performance marts	Disk performance	Daily	13 months

Capacity marts	All (except individual volumes)	Daily	13 months
Capacity marts	All (except individual volumes)	Monthly representative	14 months and beyond
Inventory marts	Individual volumes	Current state	1 day (or until next ETL)

Data Infrastructure Insights Reporting Schema Diagrams

This document provides the schema diagrams for the Reporting Database. You can also download a file containing the [schema tables](#).

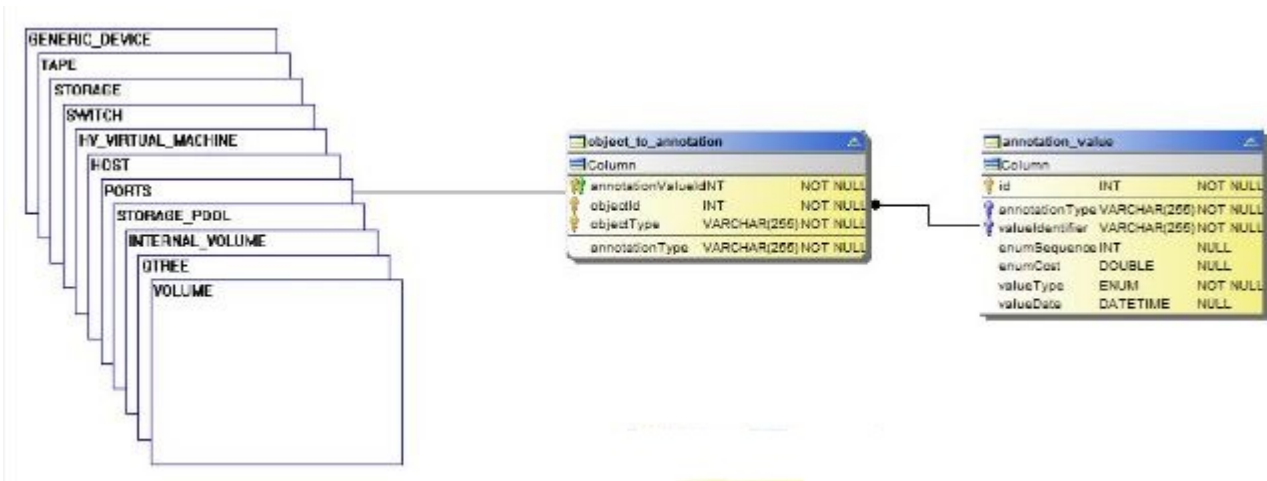


The Reporting feature is available in Data Infrastructure Insights [Premium Edition](#).

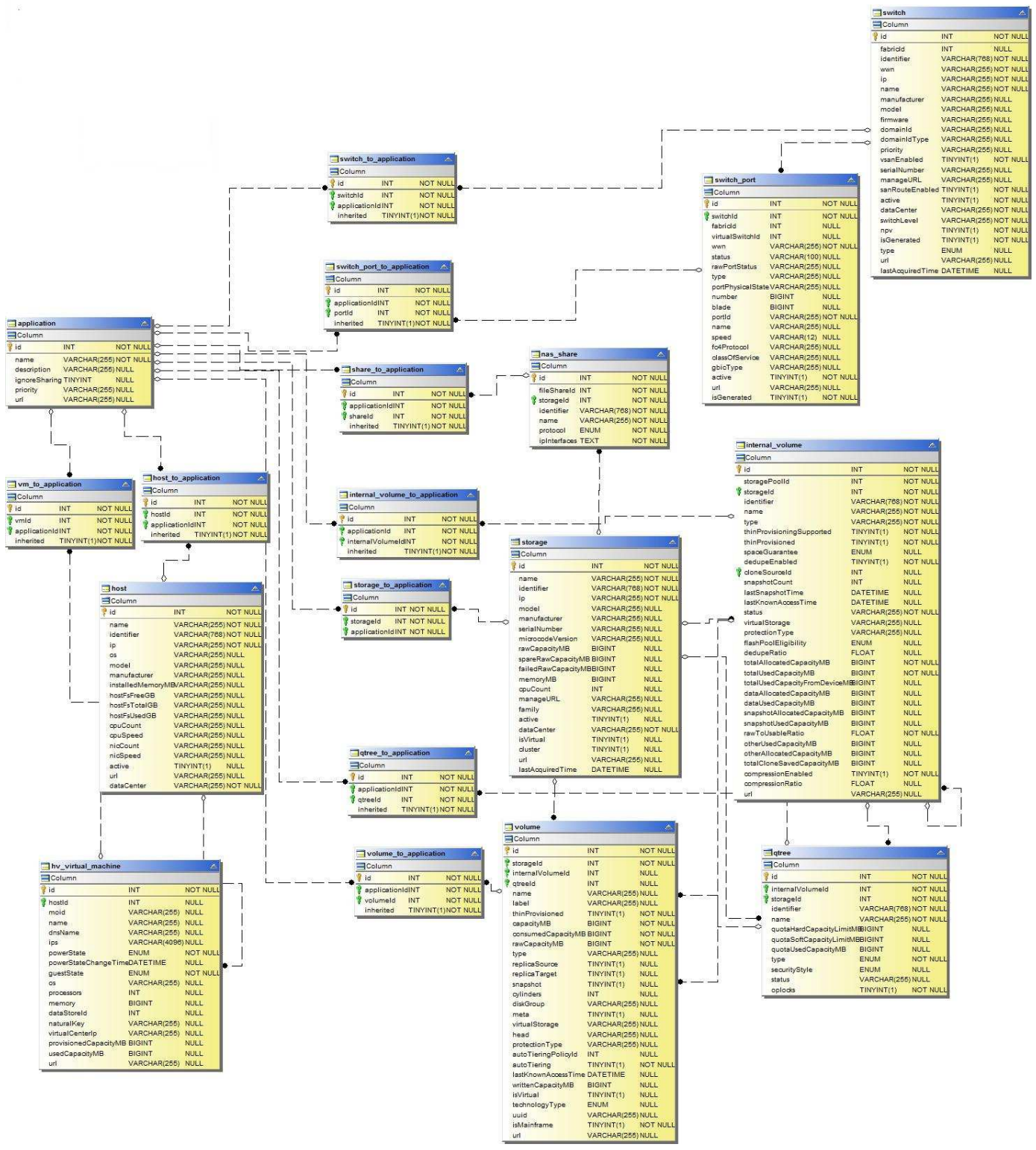
Inventory Datamart

The following images describe the inventory datamart.

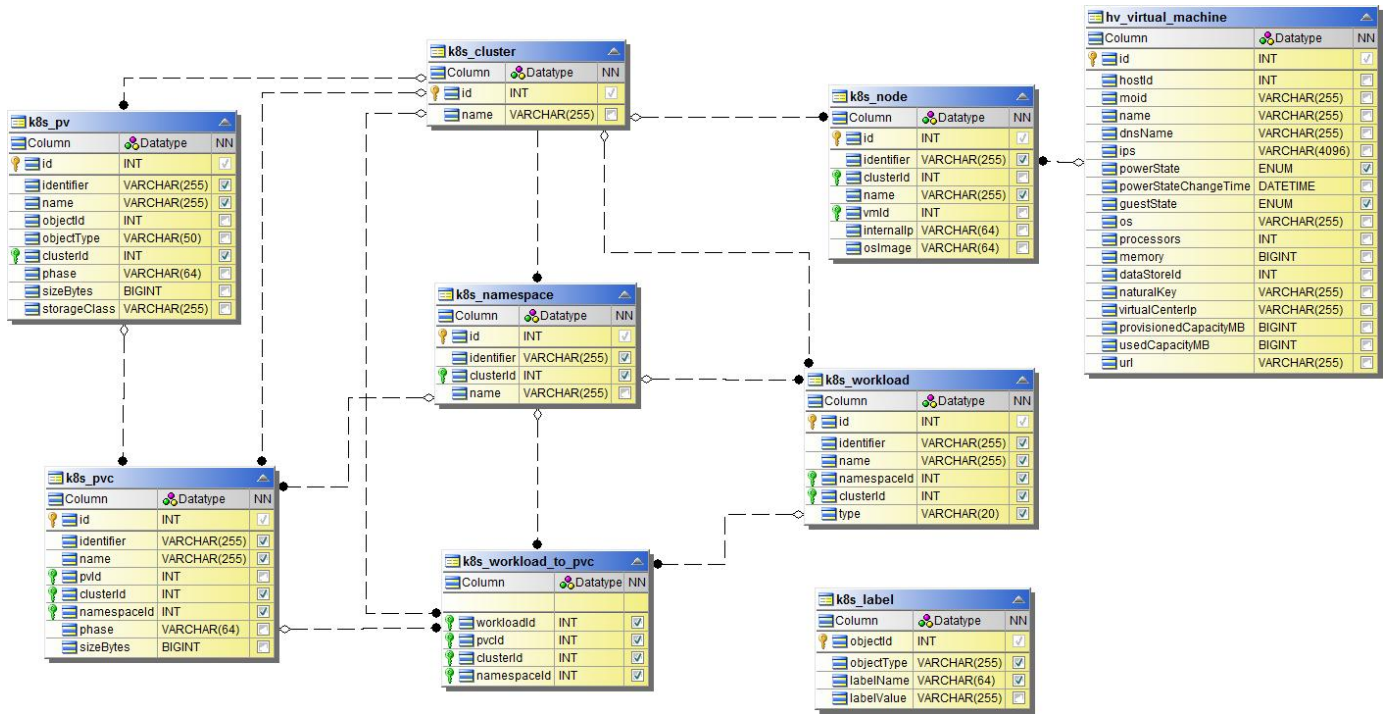
Annotations



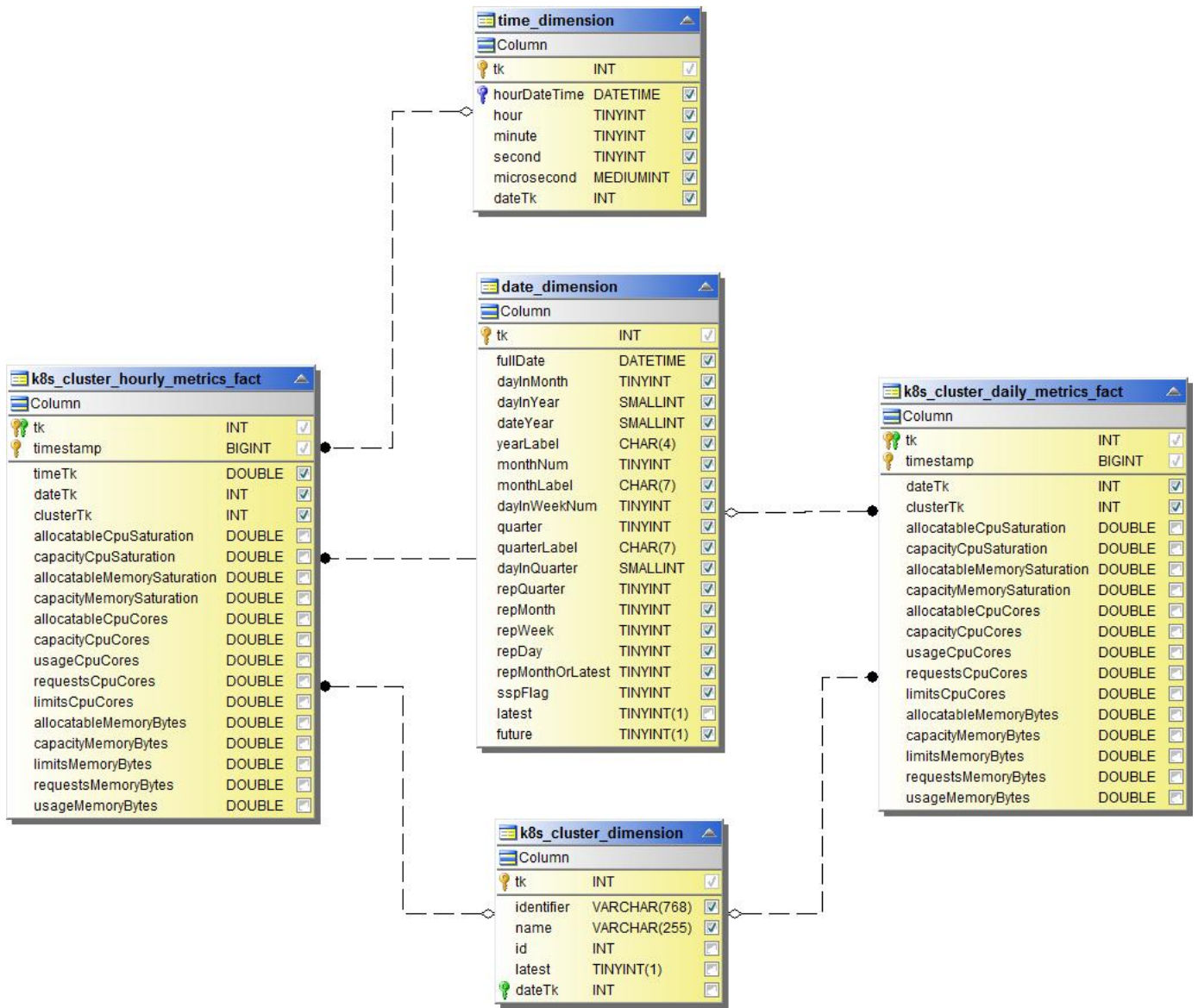
Applications



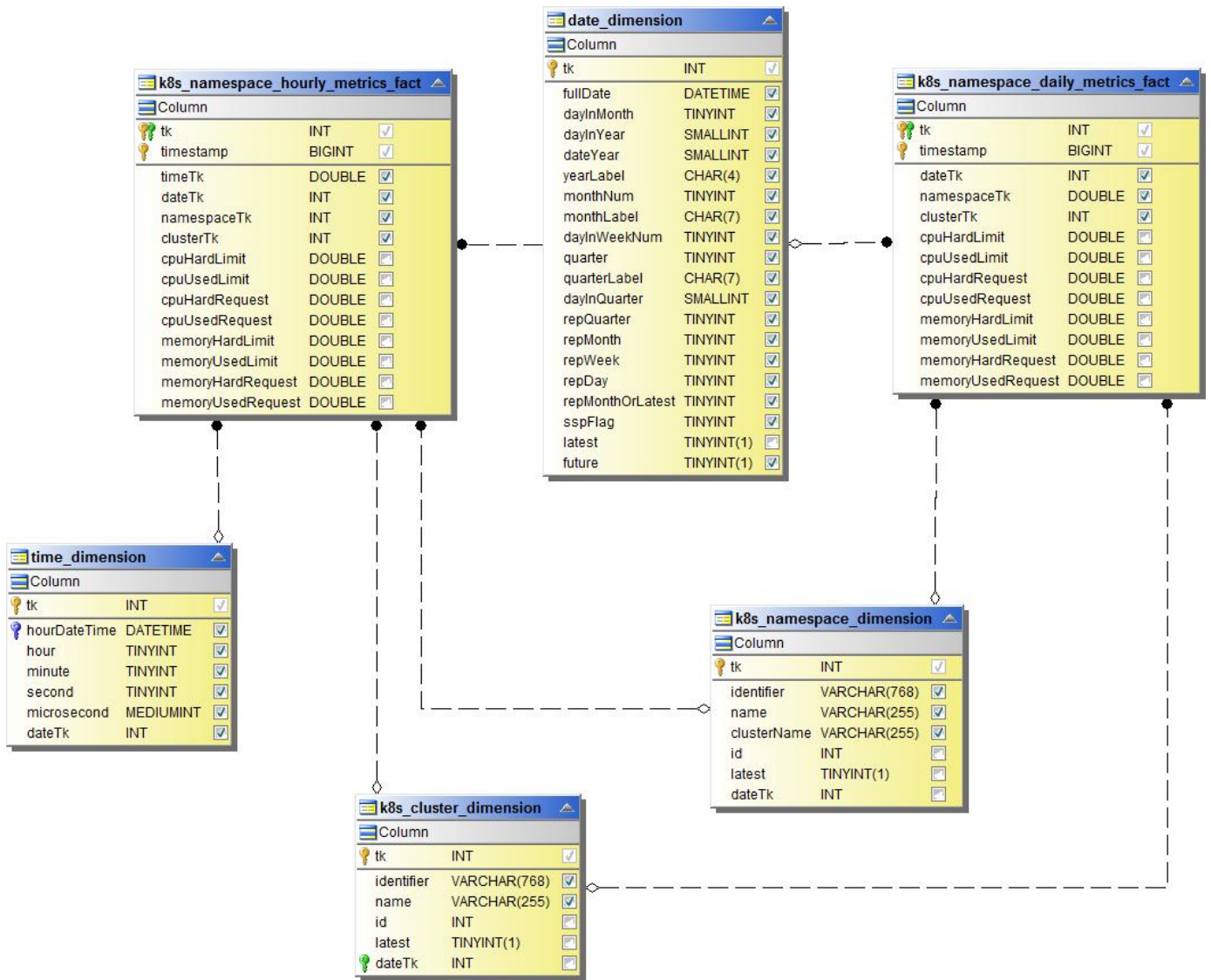
Kubernetes Metrics



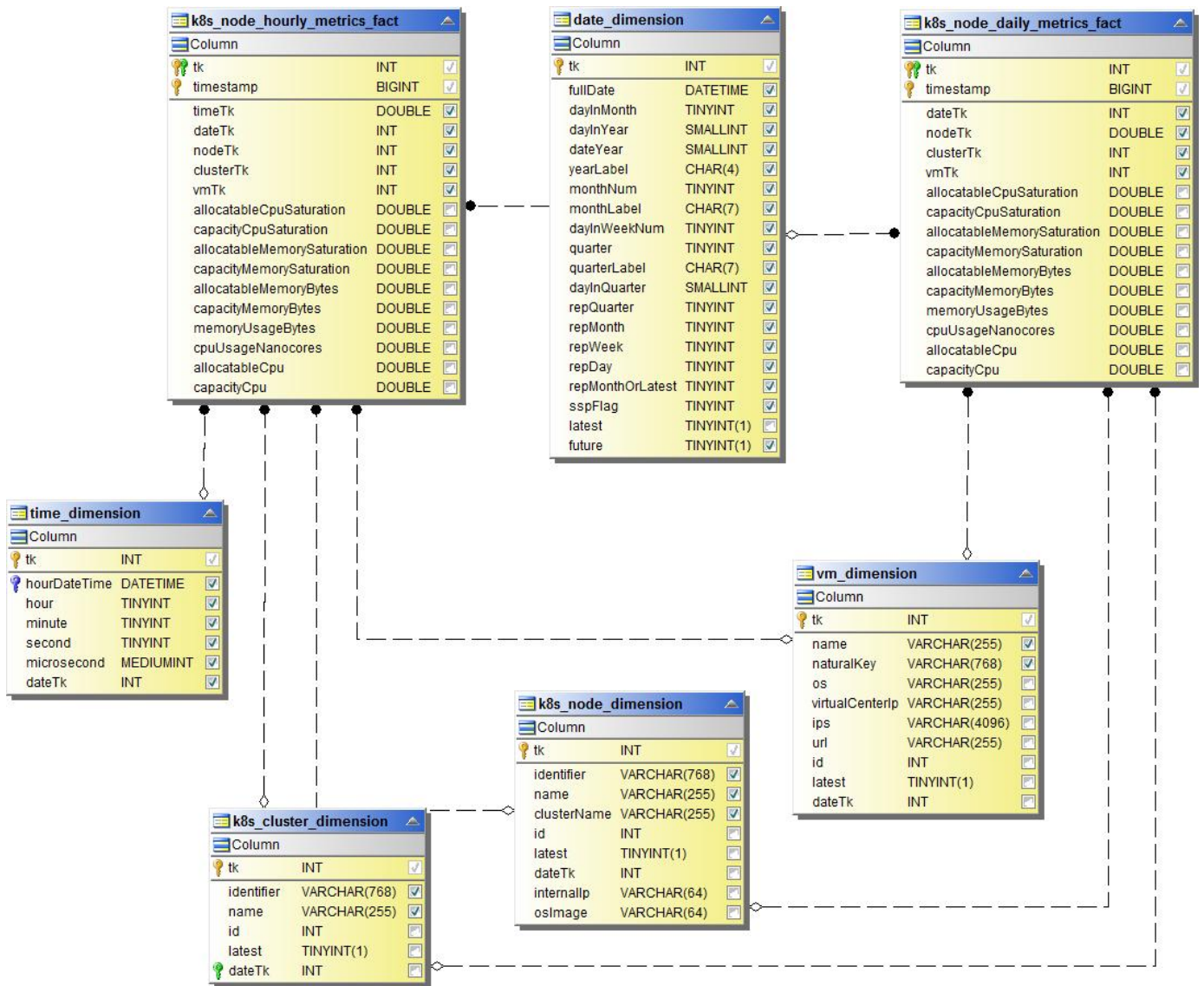
Kubernetes Cluster Metrics Fact



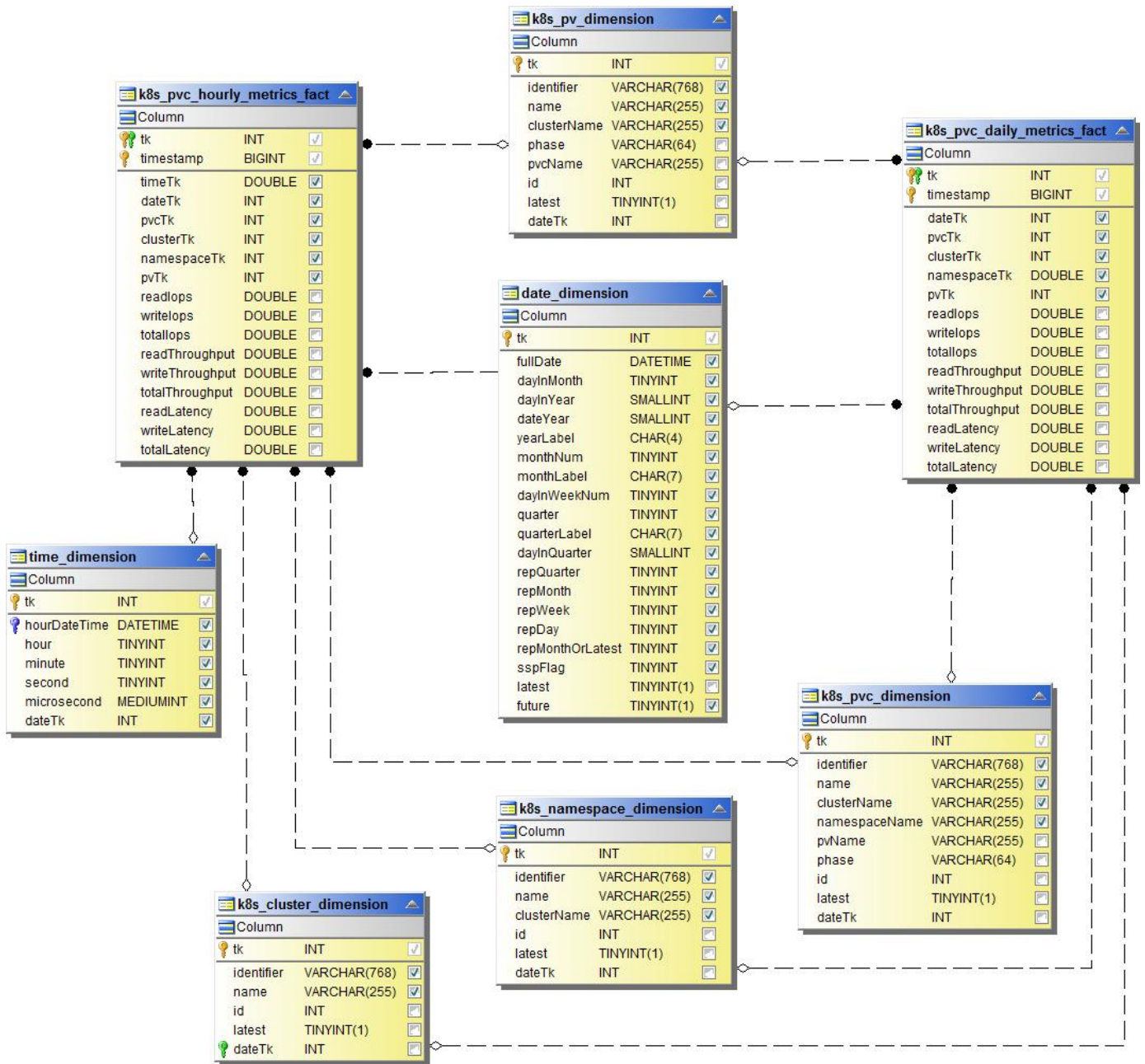
Kubernetes Namespace Metrics Fact



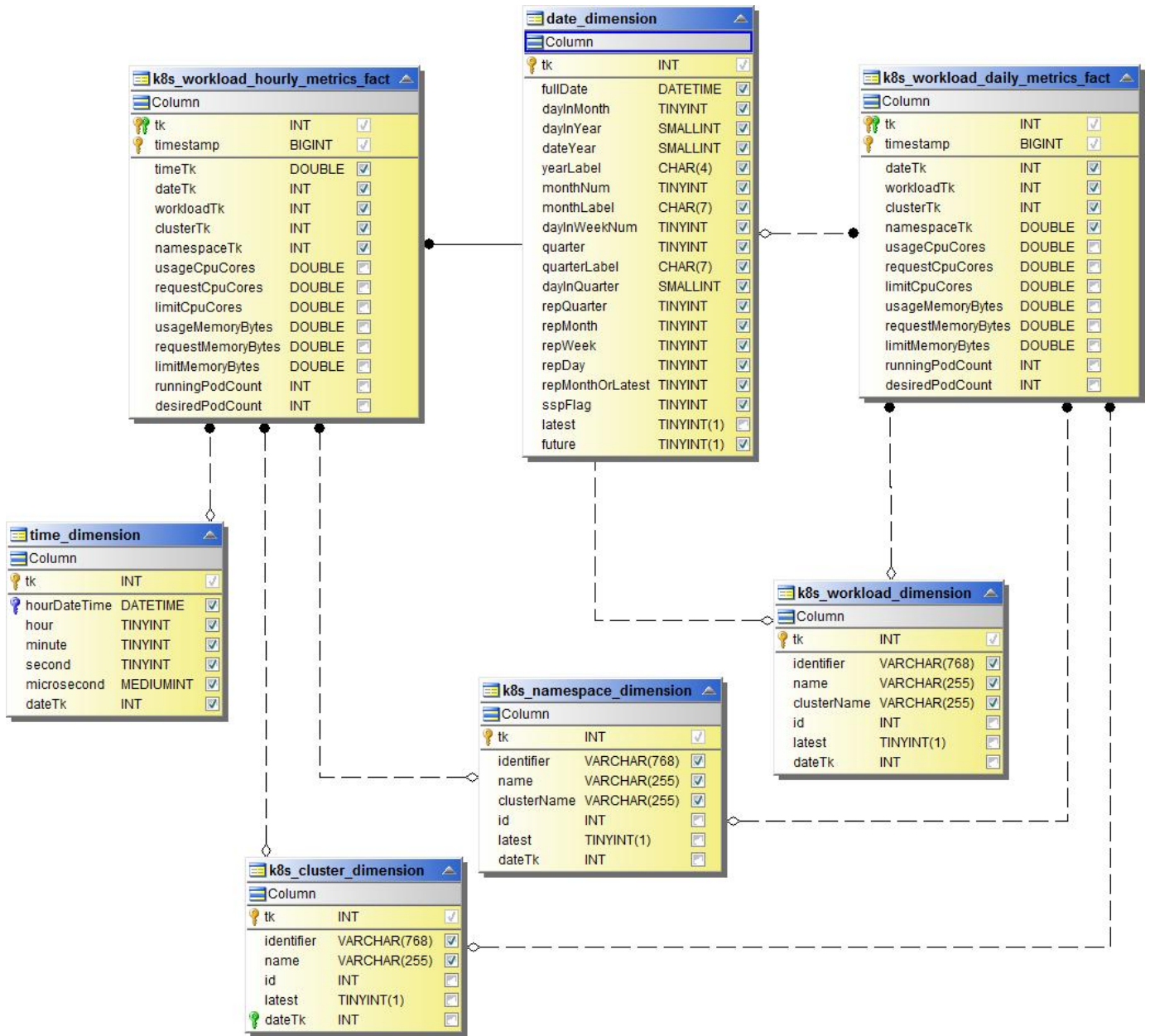
Kubernetes Node Metrics Fact



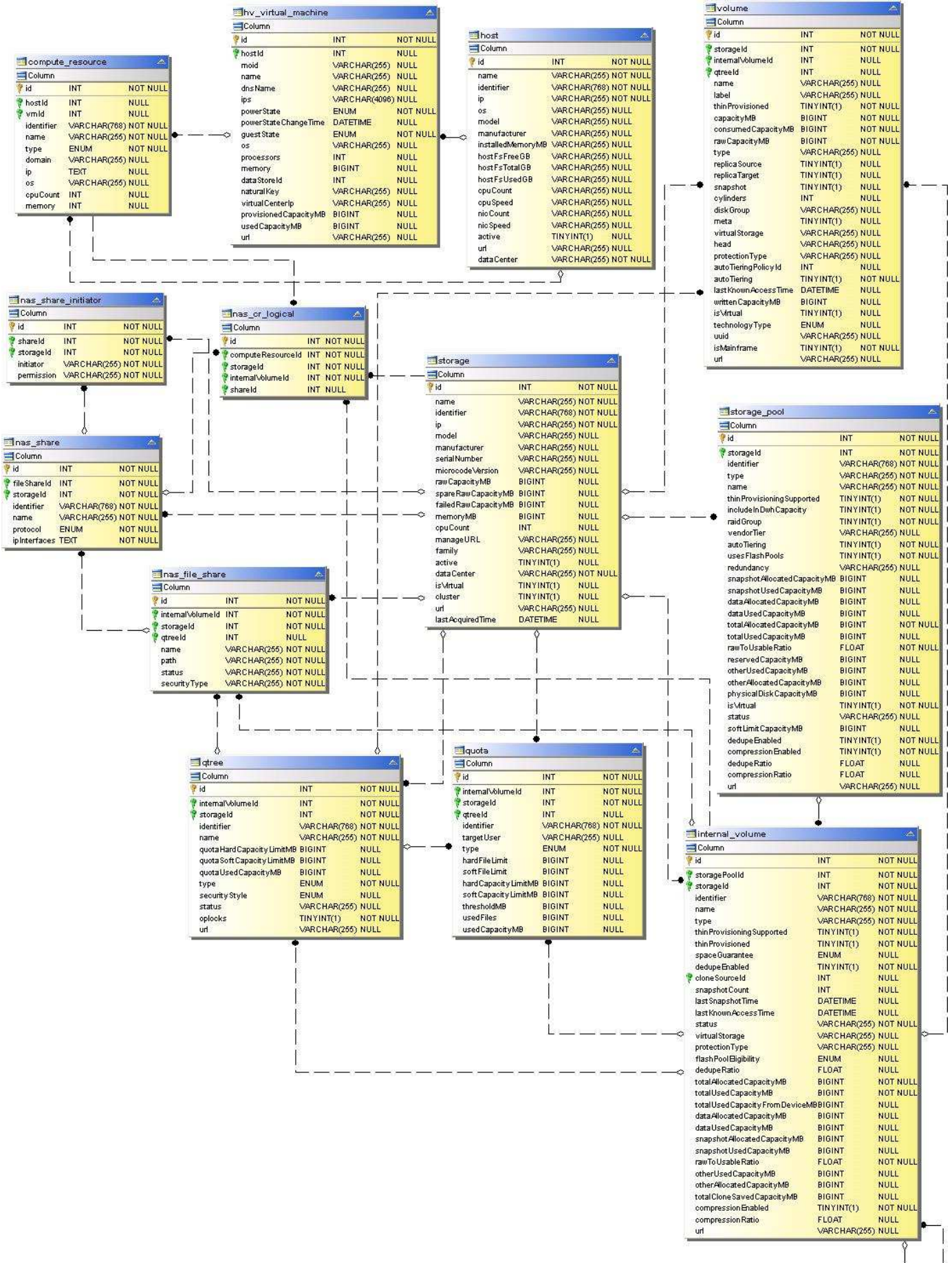
Kubernetes PVC Metrics Fact



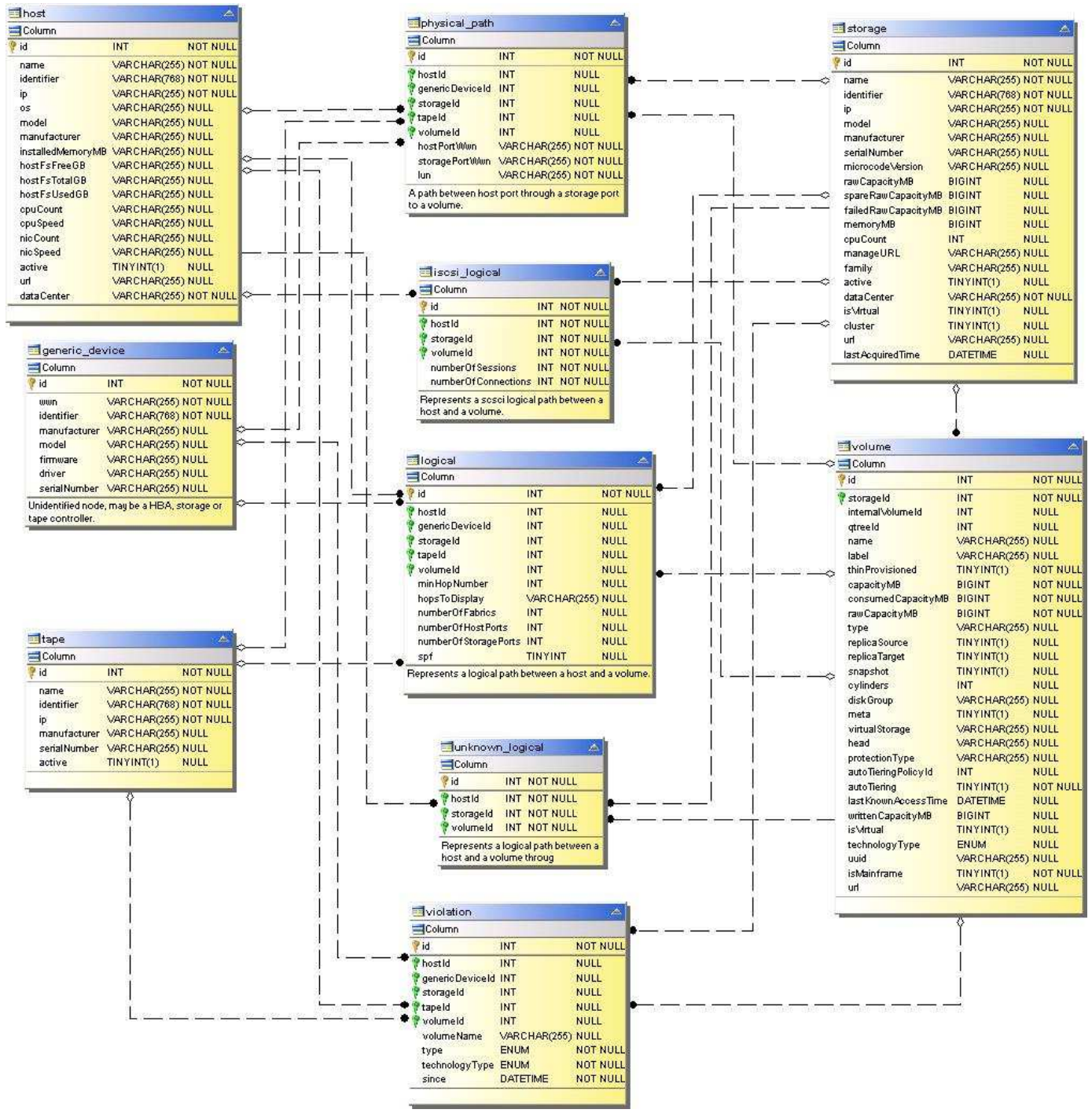
Kubernetes Workload Metrics Fact



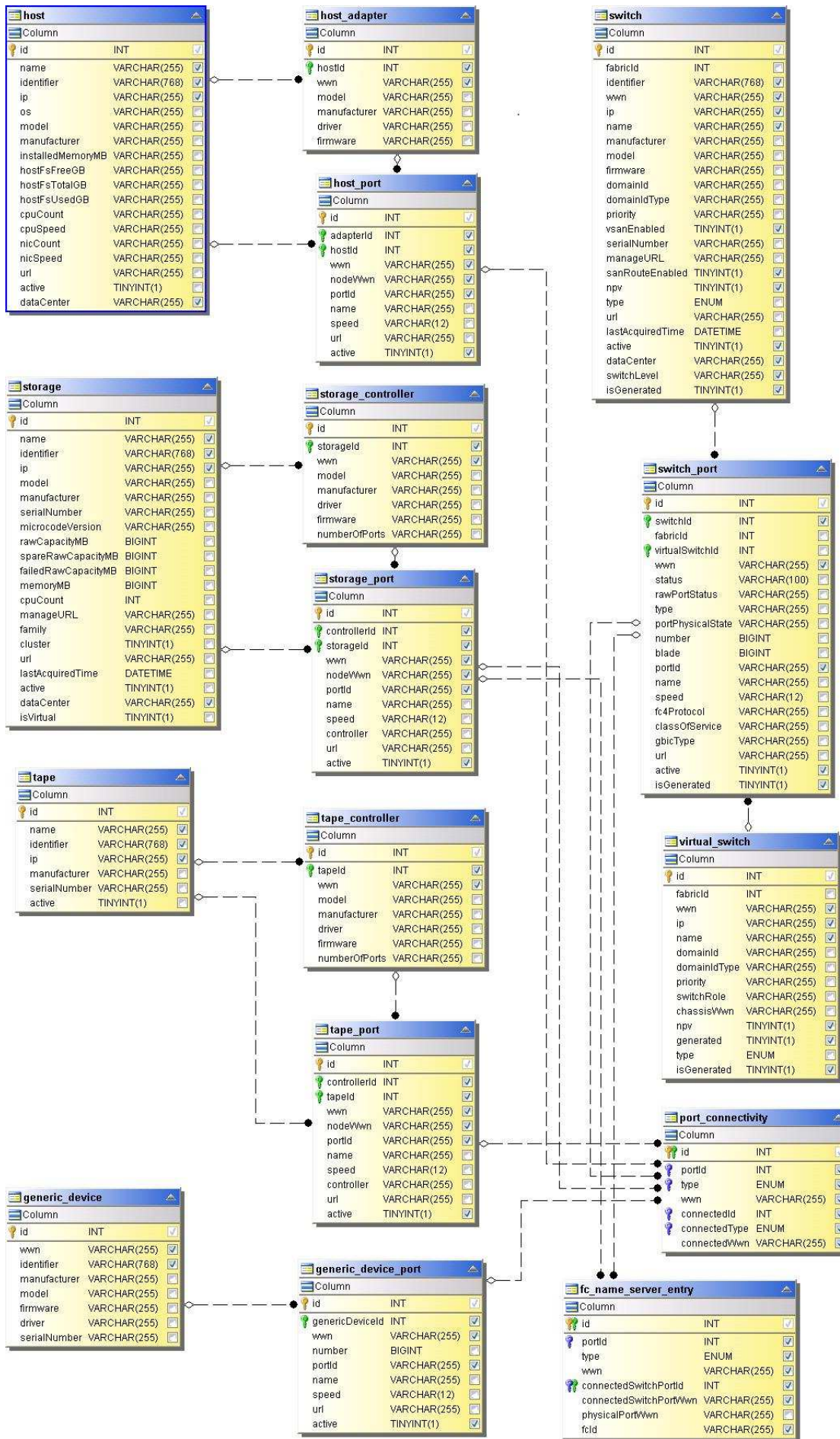
NAS



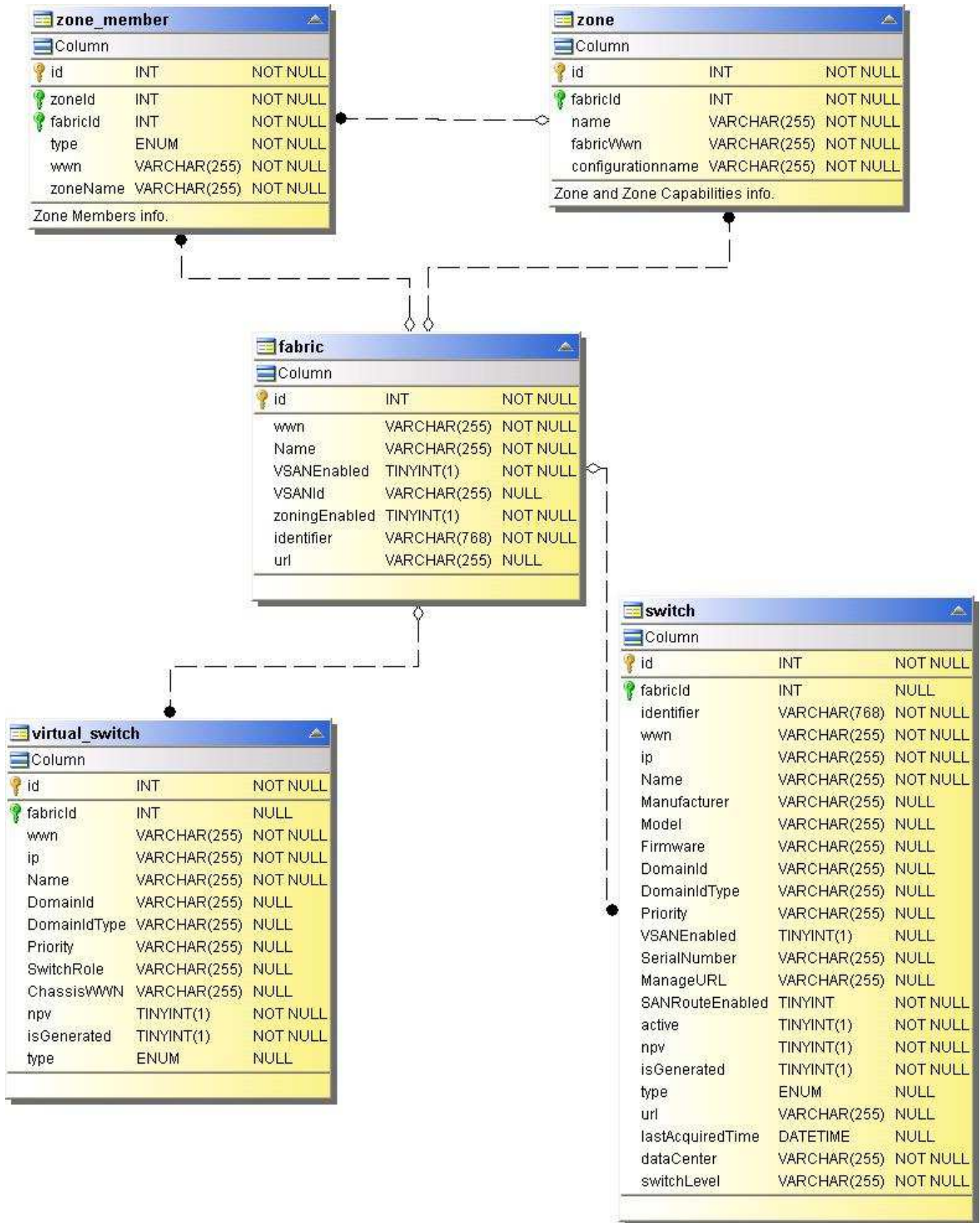
Paths and Violations



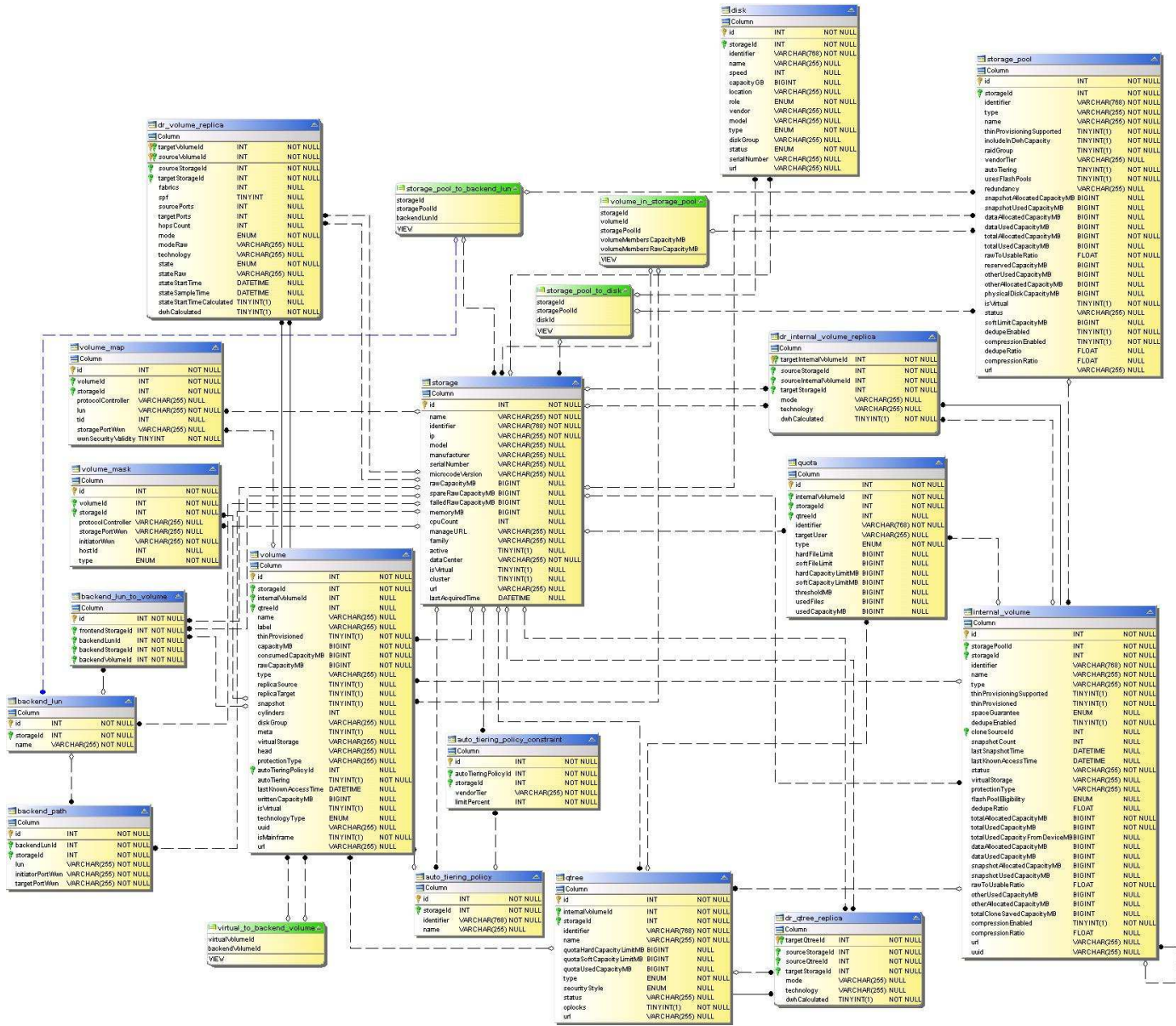
Port Connectivity



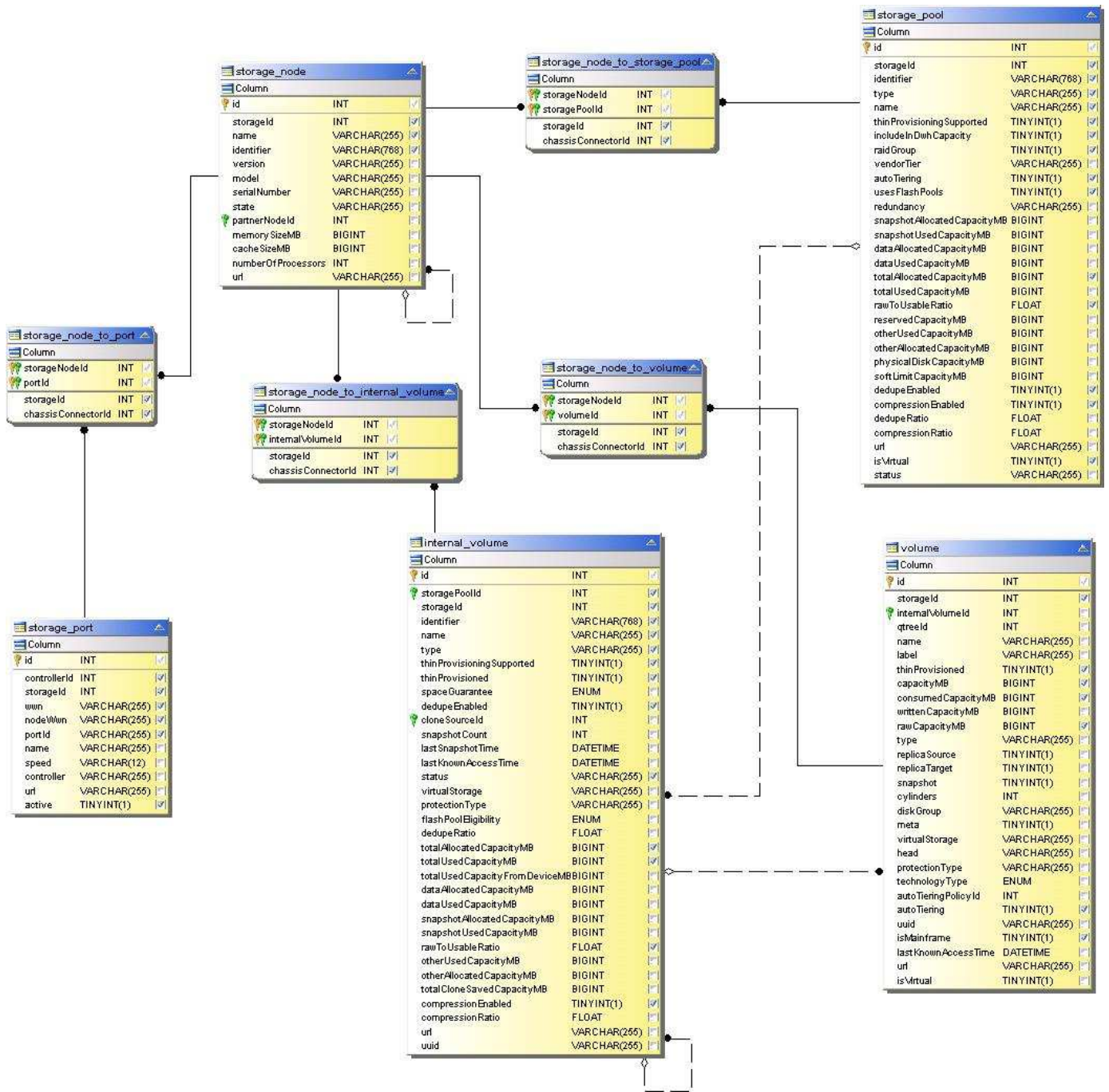
SAN Fabric



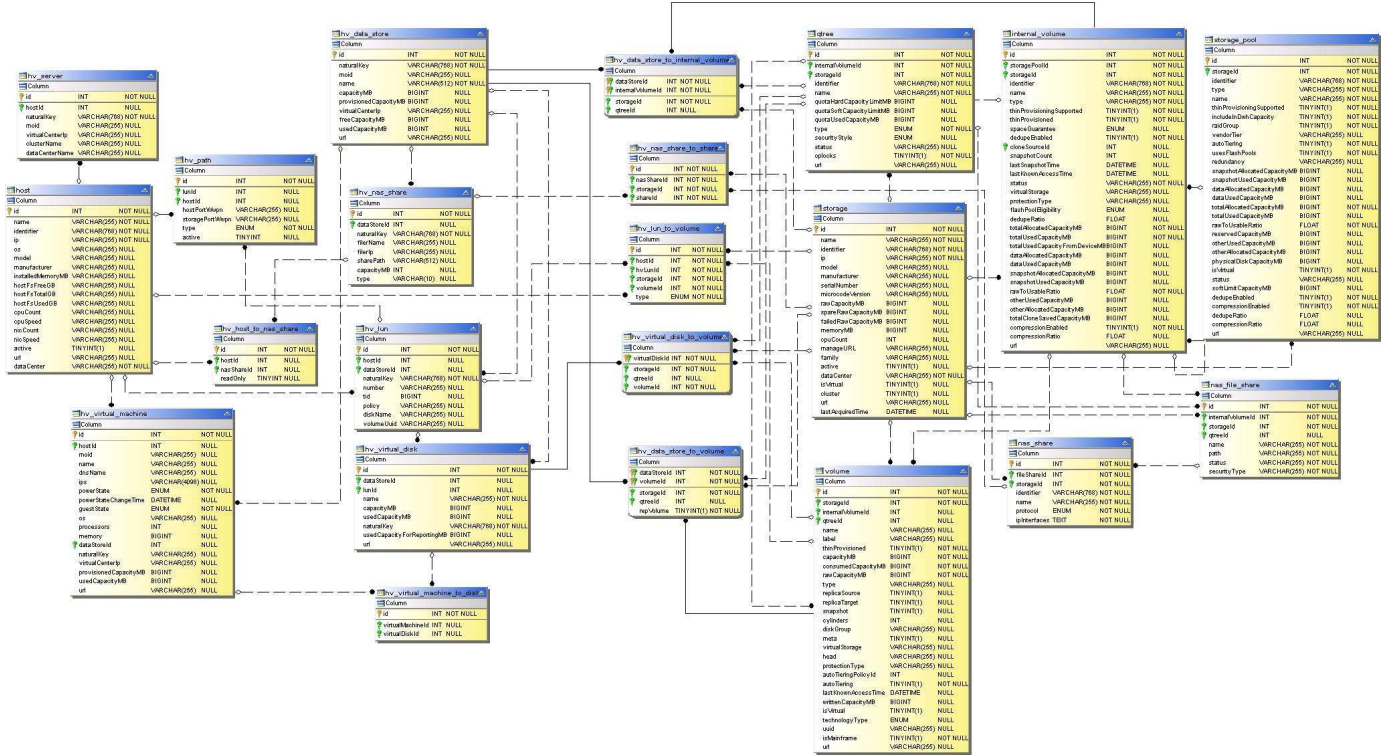
Storage



Storage Node



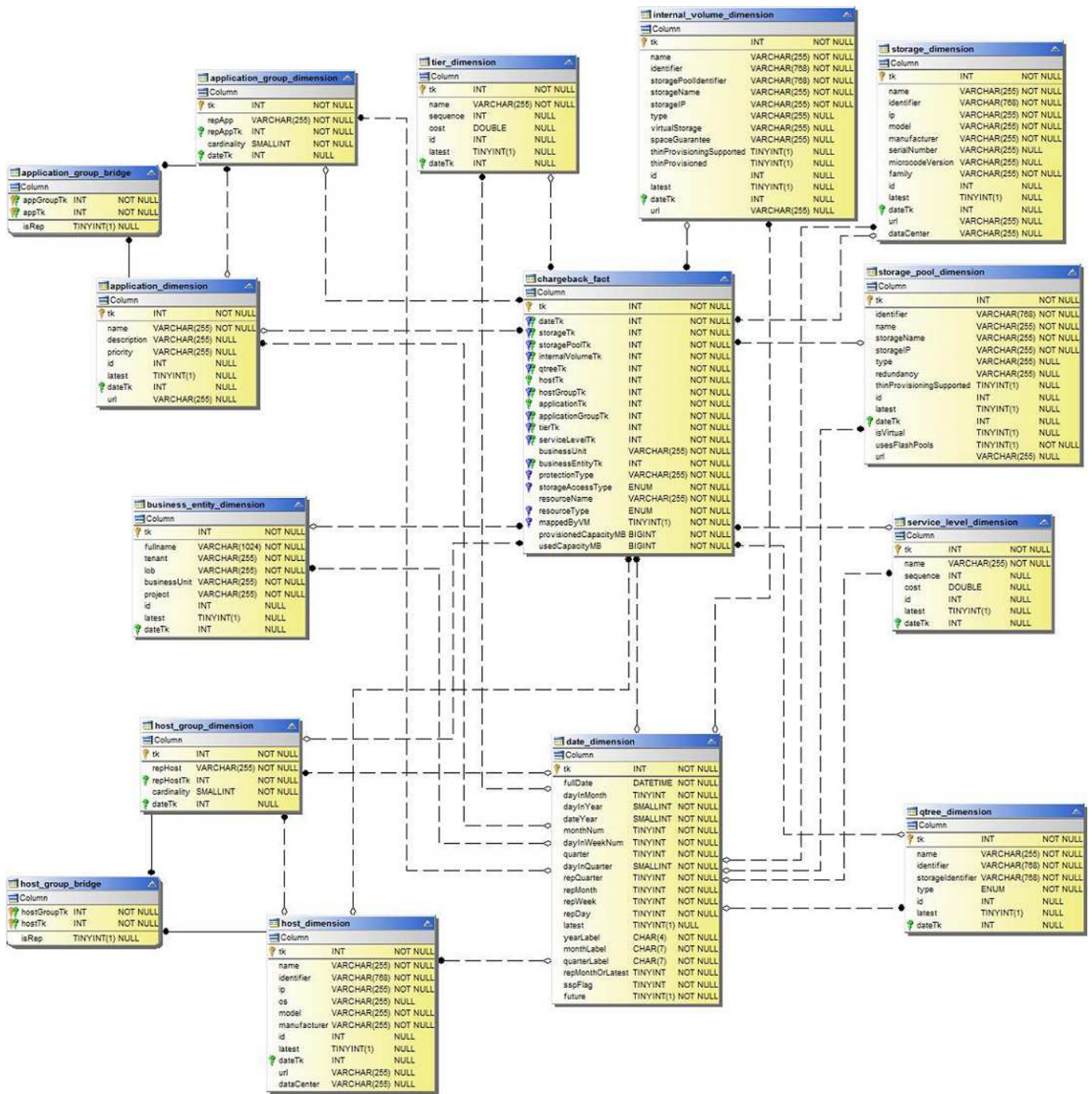
VM



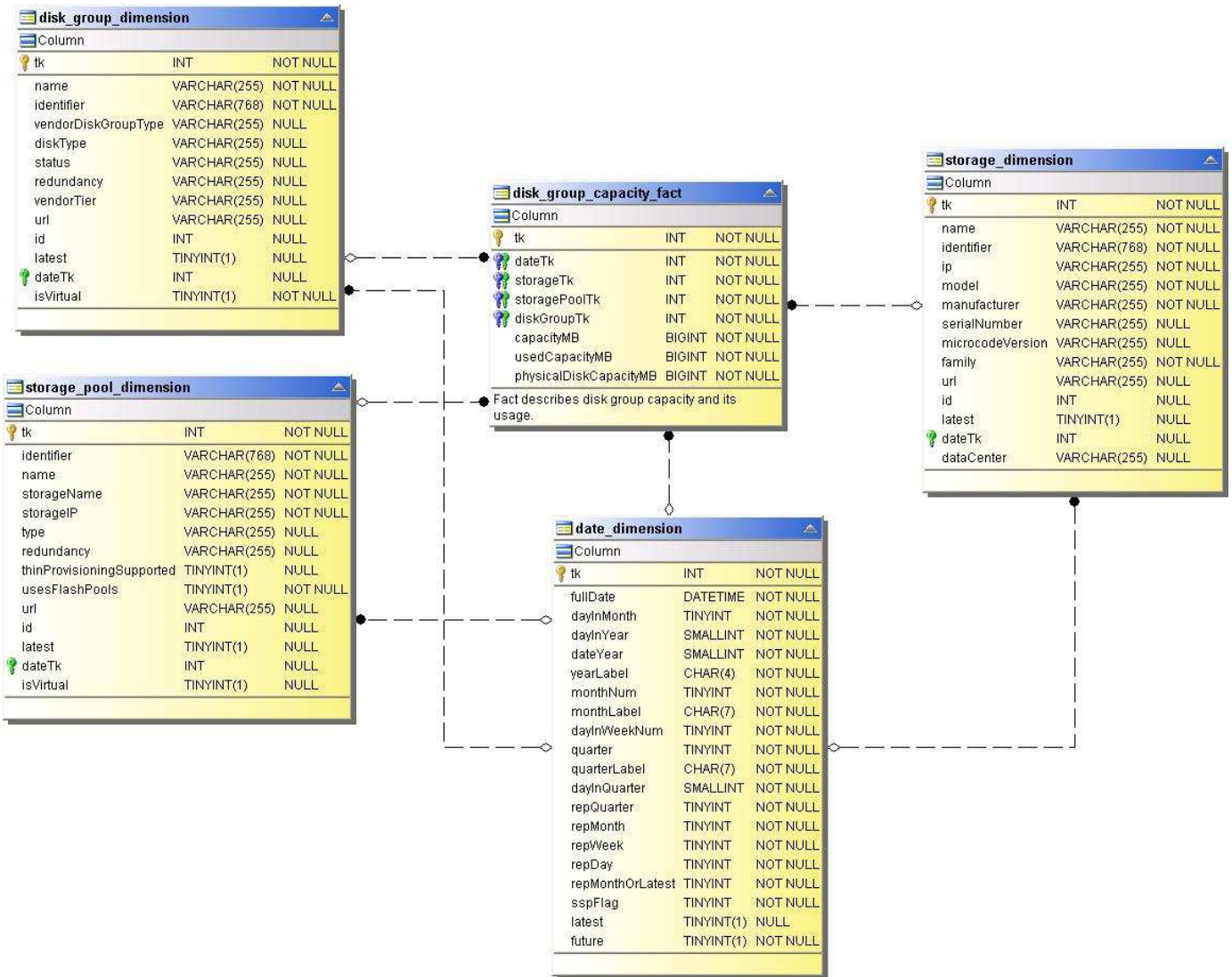
Capacity Datamart

The following images describe the capacity datamart.

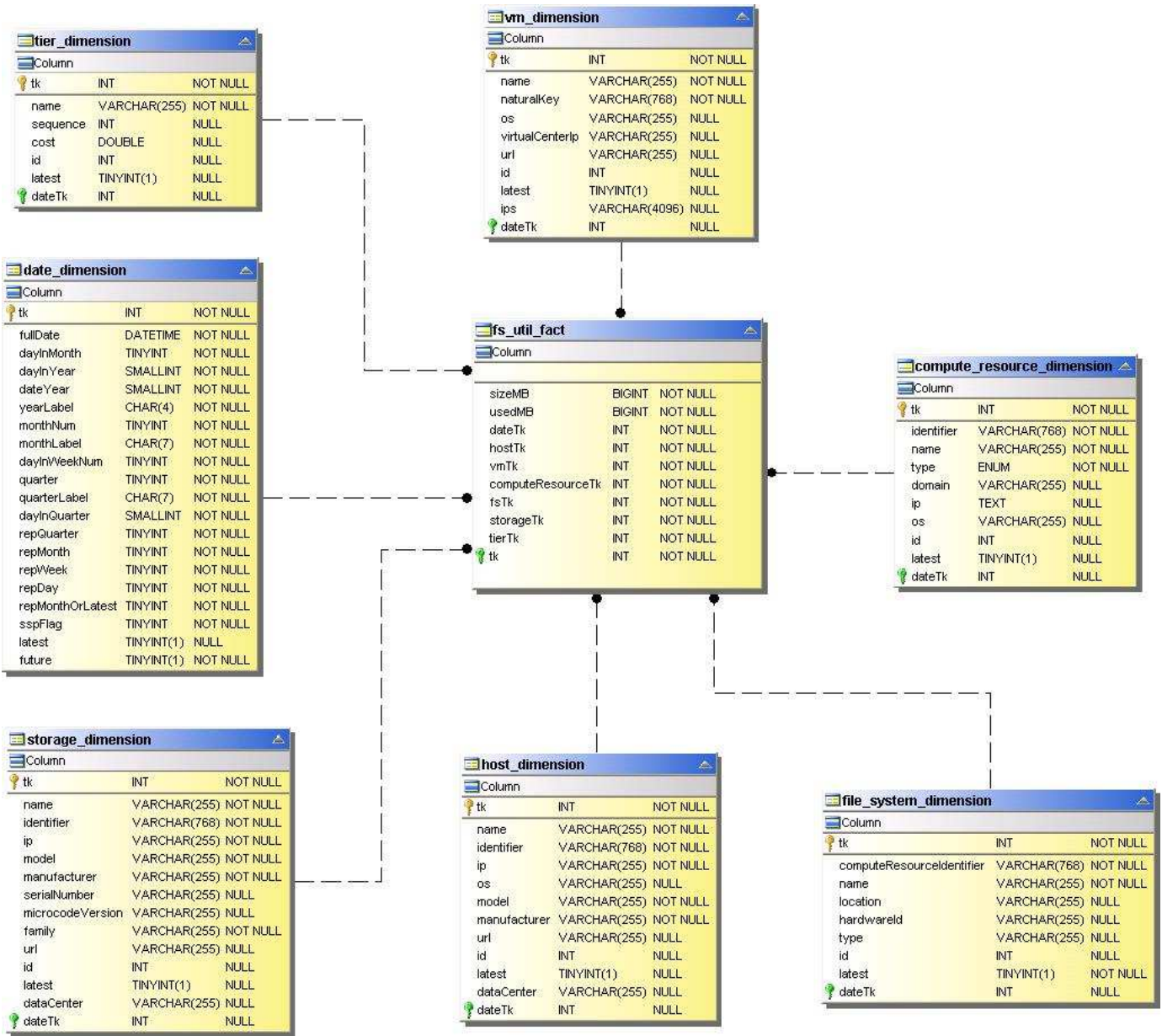
Chargeback



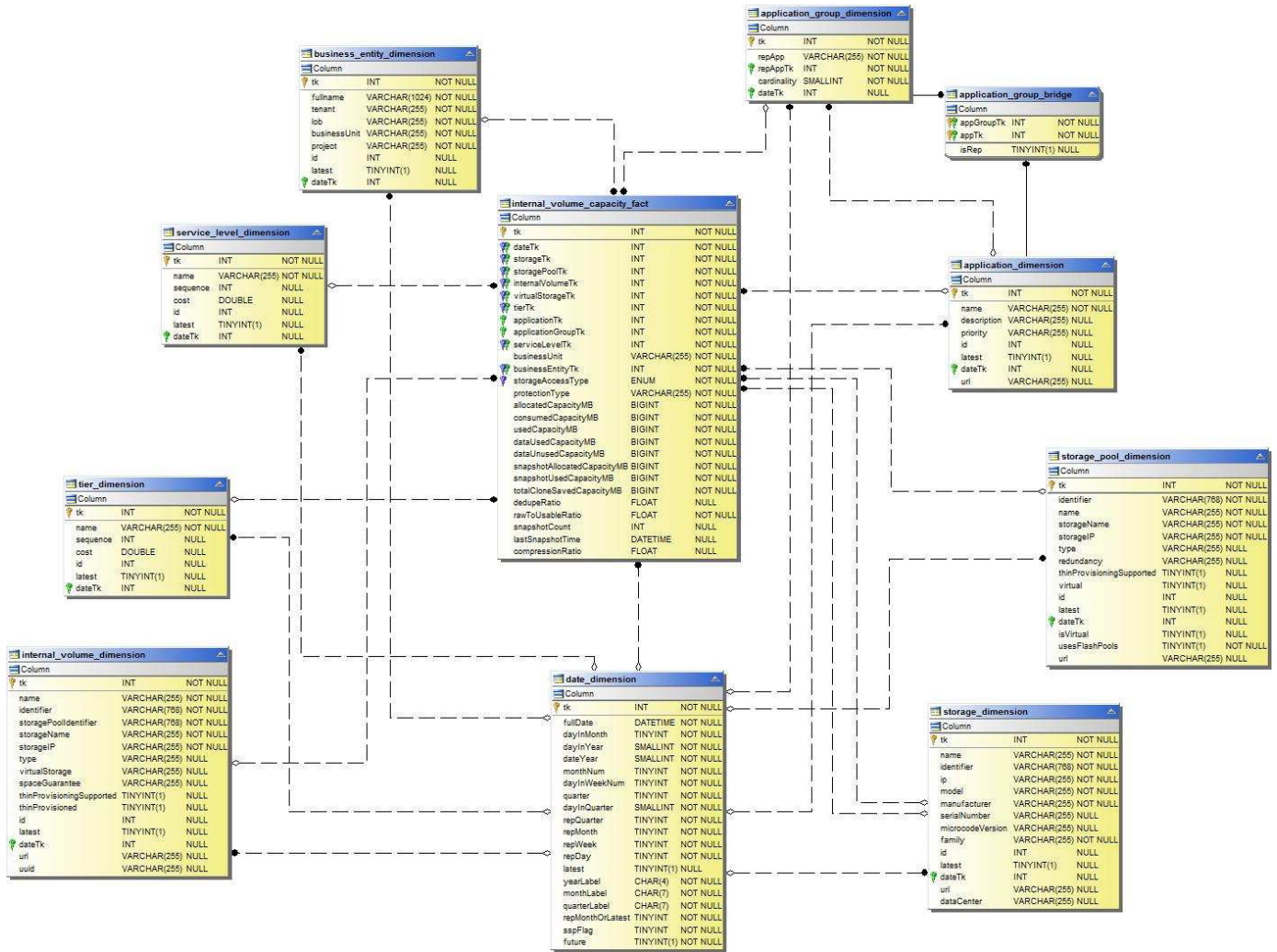
Disk Group Capacity



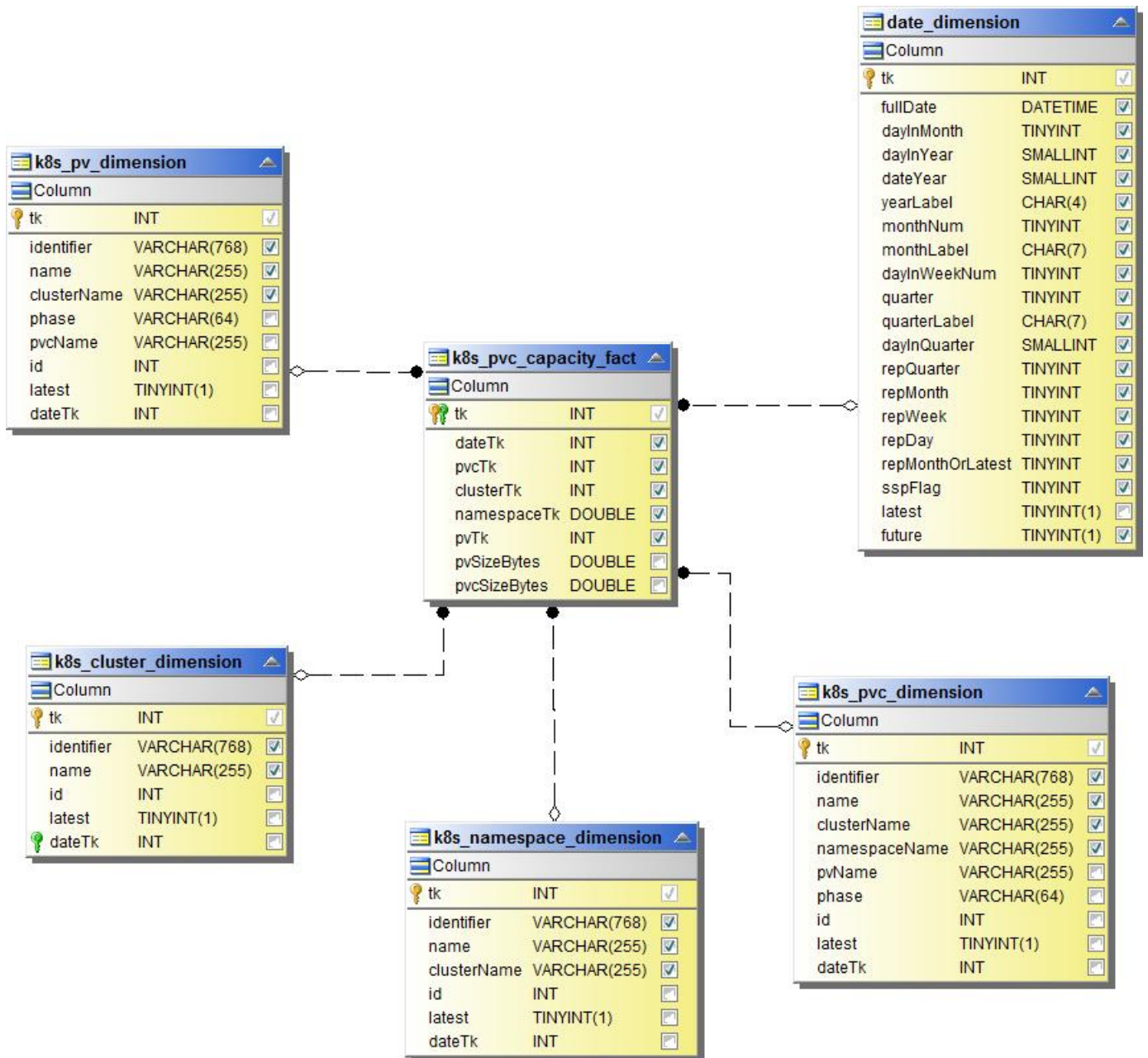
File System Utilization



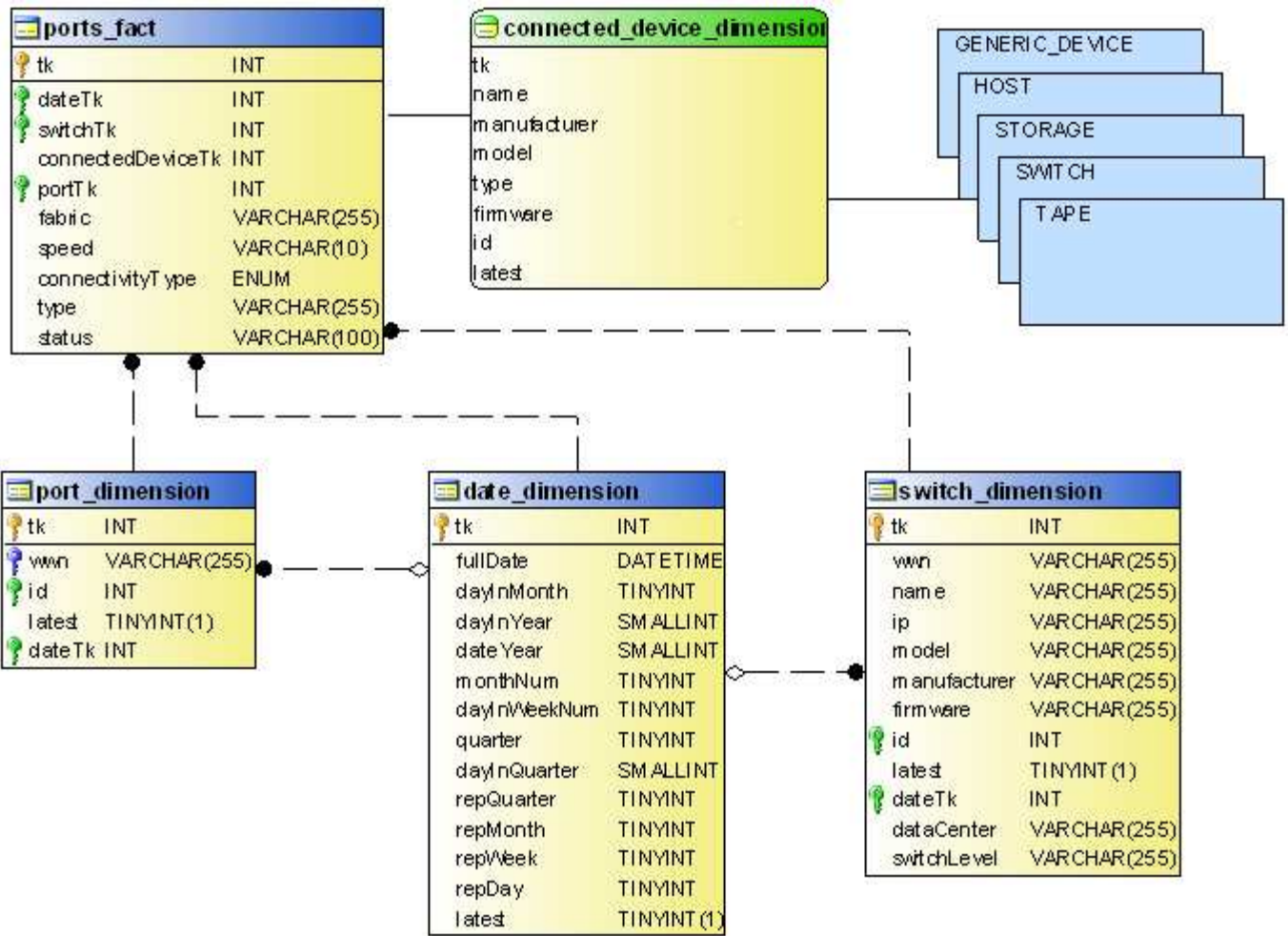
Internal Volume Capacity



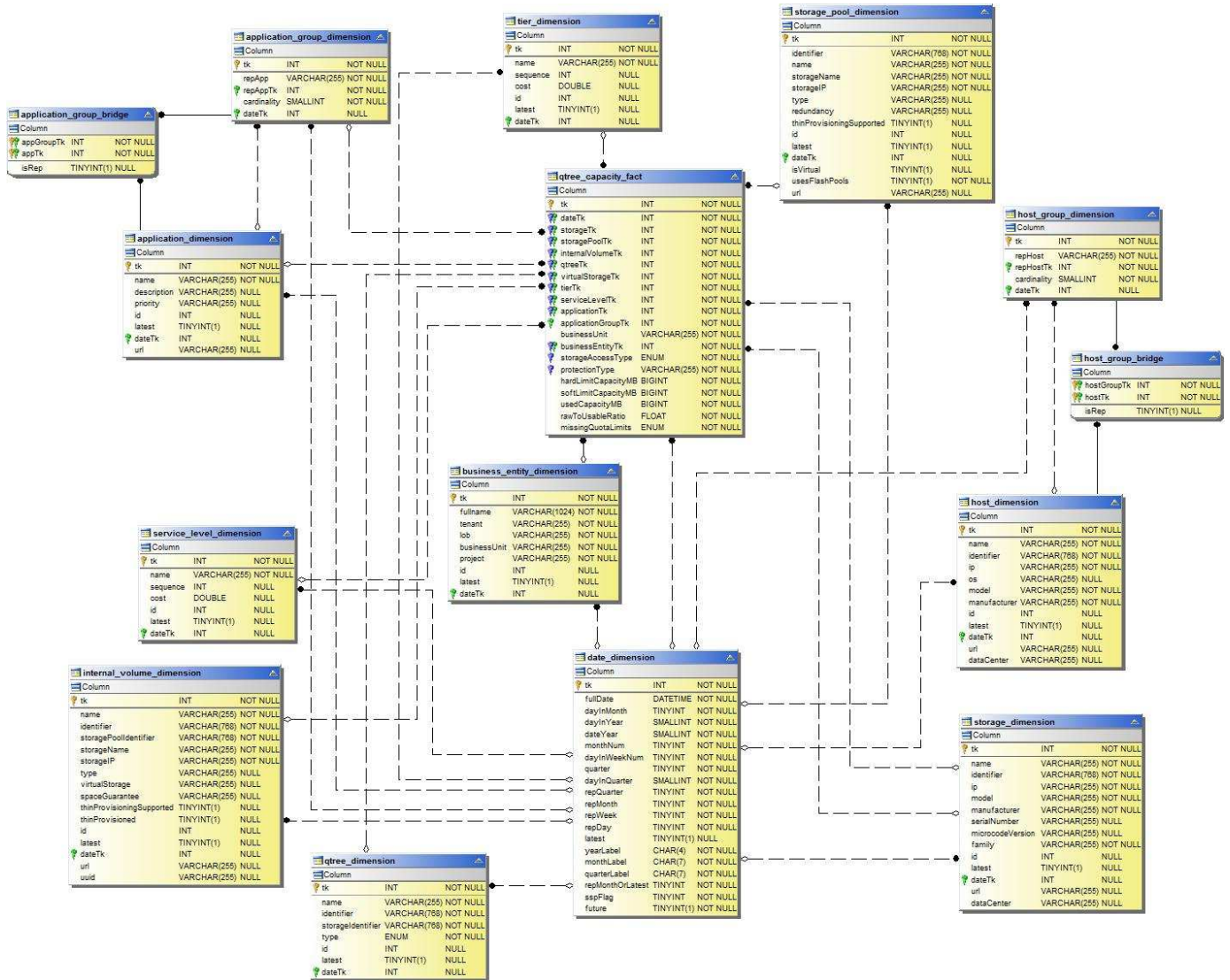
Kubernetes PV Capacity



Port Capacity



Qtree Capacity



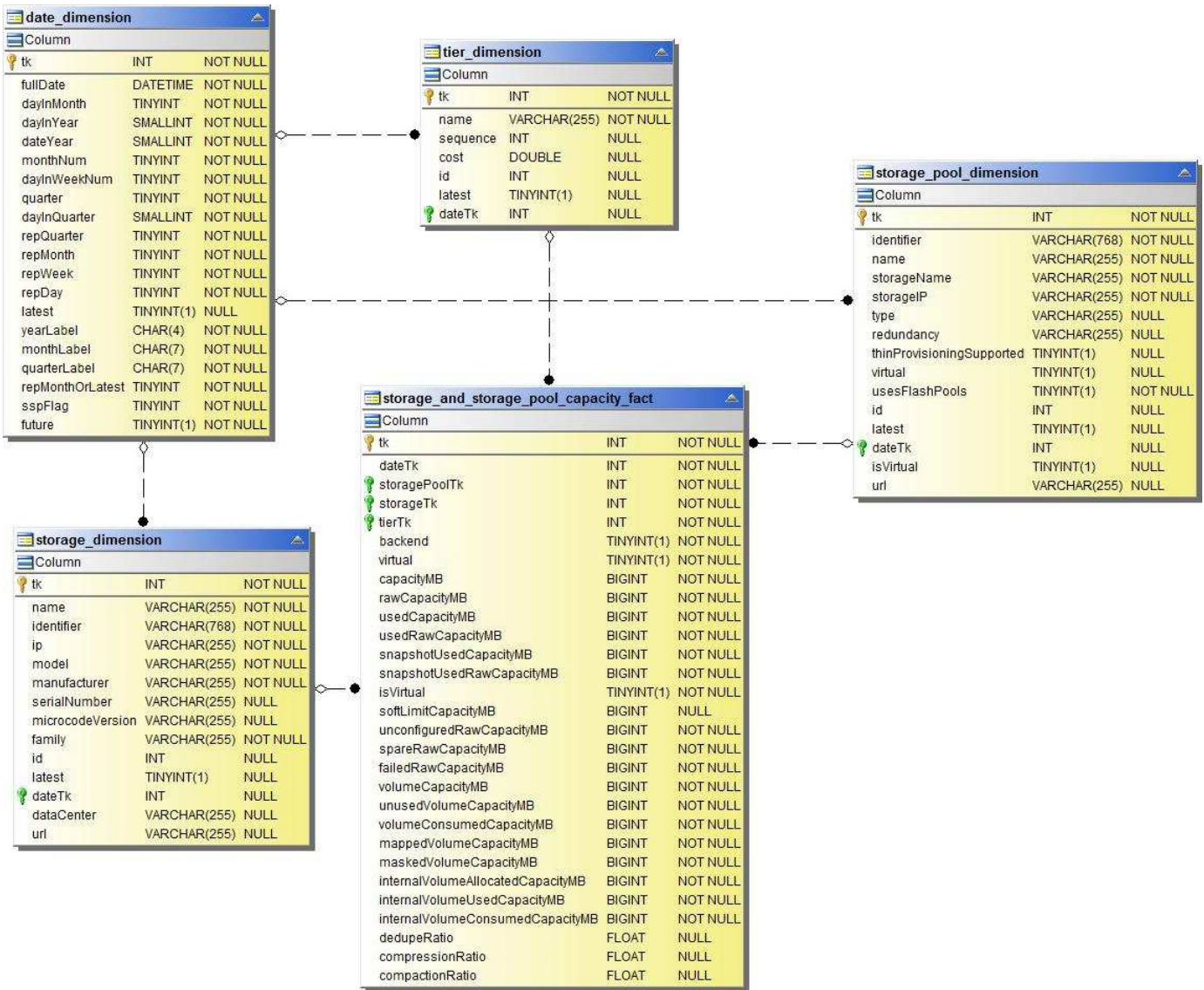
Storage Capacity Efficiency

efficiency_fact			
Column			
tk	INT	NOT NULL	
dateTk	INT	NOT NULL	
storageTk	INT	NOT NULL	
rawCapacityMB	BIGINT	NOT NULL	
backendCapacityMB	BIGINT	NOT NULL	
storageTechnology	VARCHAR(255)	NULL	
gainMB	BIGINT	NOT NULL	
lossMB	BIGINT	NOT NULL	
potentialGainMB	BIGINT	NOT NULL	
potentialLossMB	BIGINT	NOT NULL	

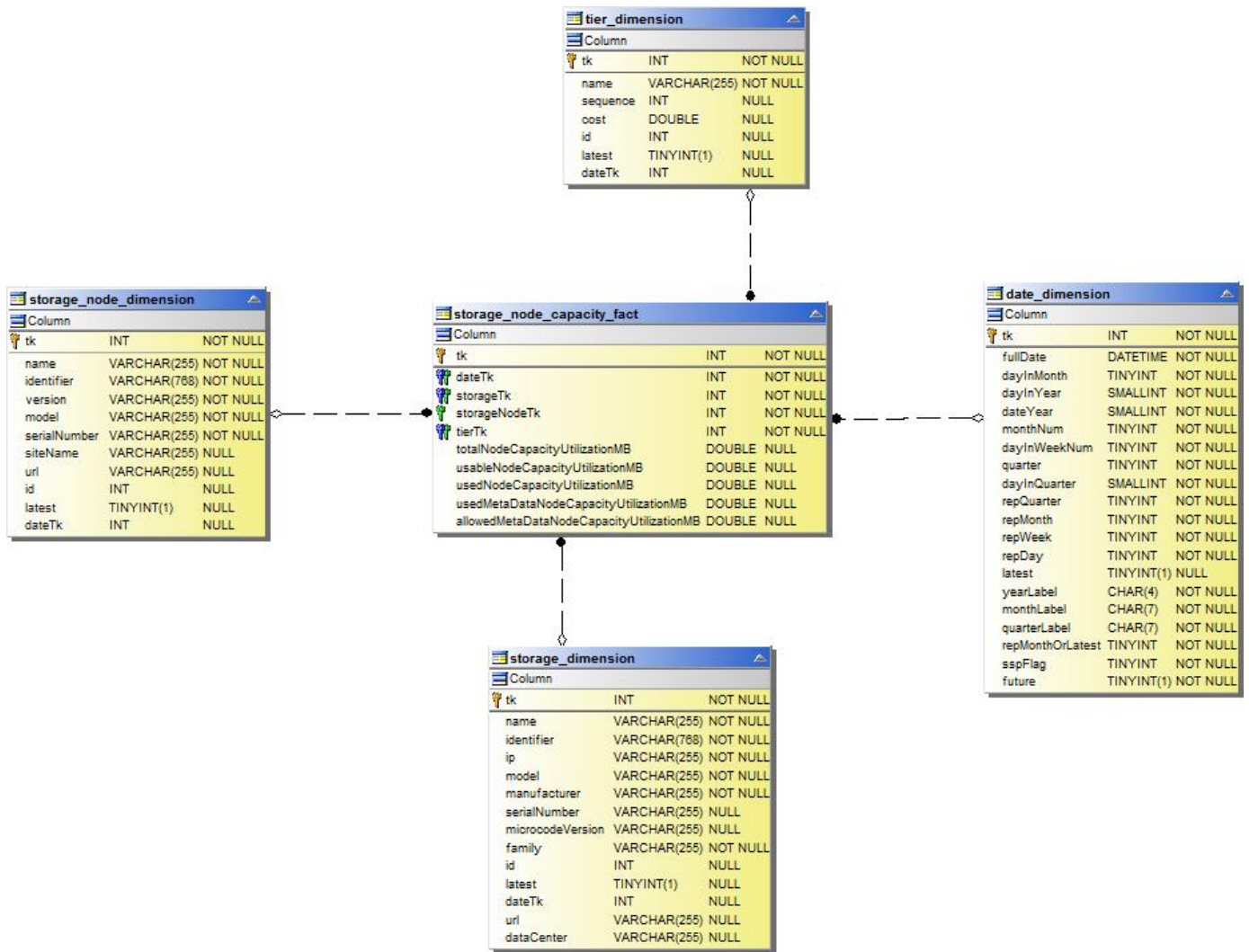
date_dimension			
Column			
tk	INT	NOT NULL	
fullDate	DATETIME	NOT NULL	
dayInMonth	TINYINT	NOT NULL	
dayInYear	SMALLINT	NOT NULL	
dateYear	SMALLINT	NOT NULL	
monthNum	TINYINT	NOT NULL	
dayInWeekNum	TINYINT	NOT NULL	
quarter	TINYINT	NOT NULL	
dayInQuarter	SMALLINT	NOT NULL	
repQuarter	TINYINT	NOT NULL	
repMonth	TINYINT	NOT NULL	
repWeek	TINYINT	NOT NULL	
repDay	TINYINT	NOT NULL	
latest	TINYINT(1)	NULL	
yearLabel	CHAR(4)	NOT NULL	
monthLabel	CHAR(7)	NOT NULL	
quarterLabel	CHAR(7)	NOT NULL	
repMonthOrLatest	TINYINT	NOT NULL	
sspFlag	TINYINT	NOT NULL	
future	TINYINT(1)	NOT NULL	

storage_dimension			
Column			
tk	INT	NOT NULL	
name	VARCHAR(255)	NOT NULL	
identifier	VARCHAR(768)	NOT NULL	
ip	VARCHAR(255)	NOT NULL	
model	VARCHAR(255)	NOT NULL	
manufacturer	VARCHAR(255)	NOT NULL	
serialNumber	VARCHAR(255)	NULL	
microcodeVersion	VARCHAR(255)	NULL	
family	VARCHAR(255)	NOT NULL	
id	INT	NULL	
latest	TINYINT(1)	NULL	
dateTk	INT	NULL	
url	VARCHAR(255)	NULL	
dataCenter	VARCHAR(255)	NULL	

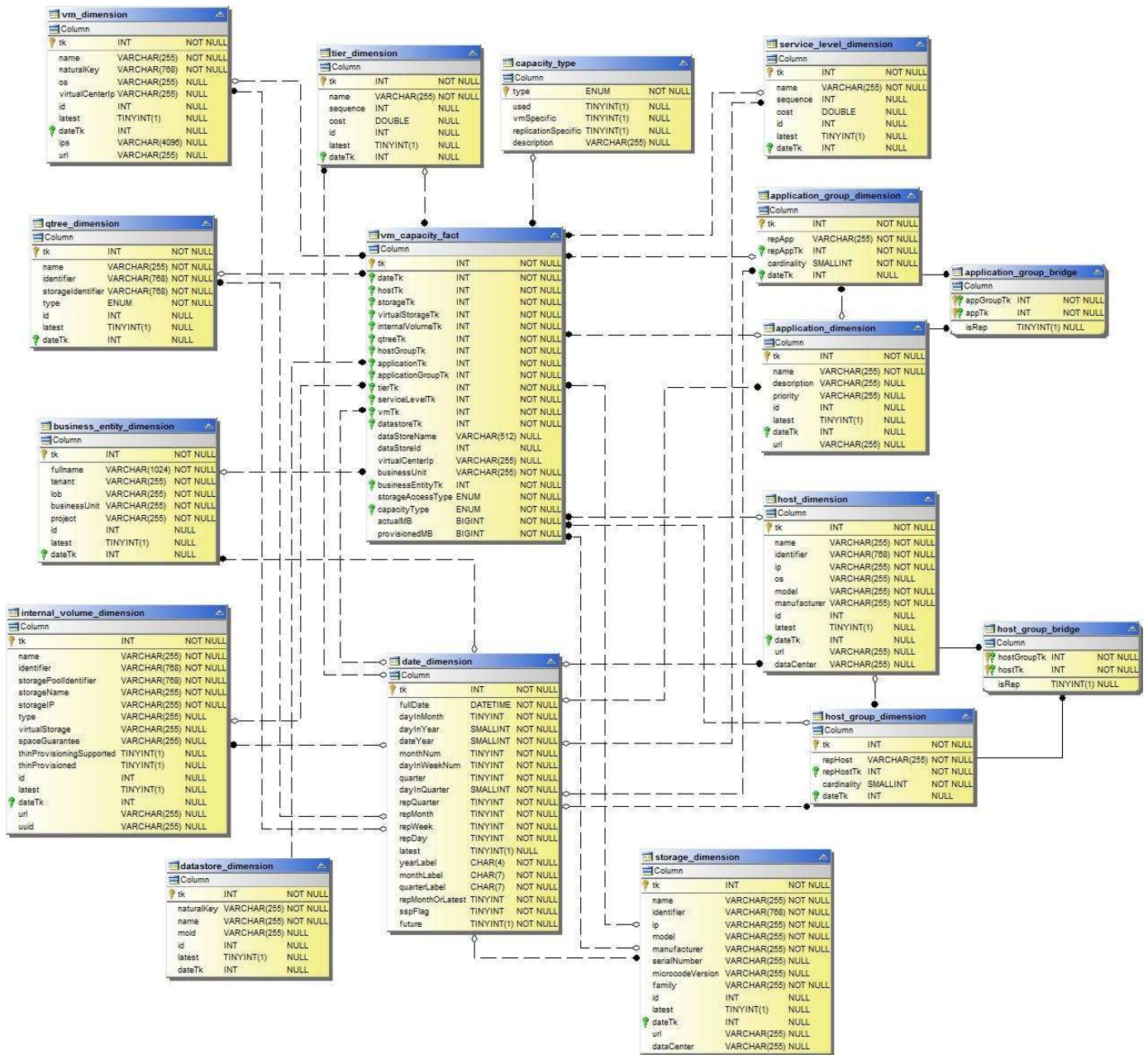
Storage and Storage Pool Capacity



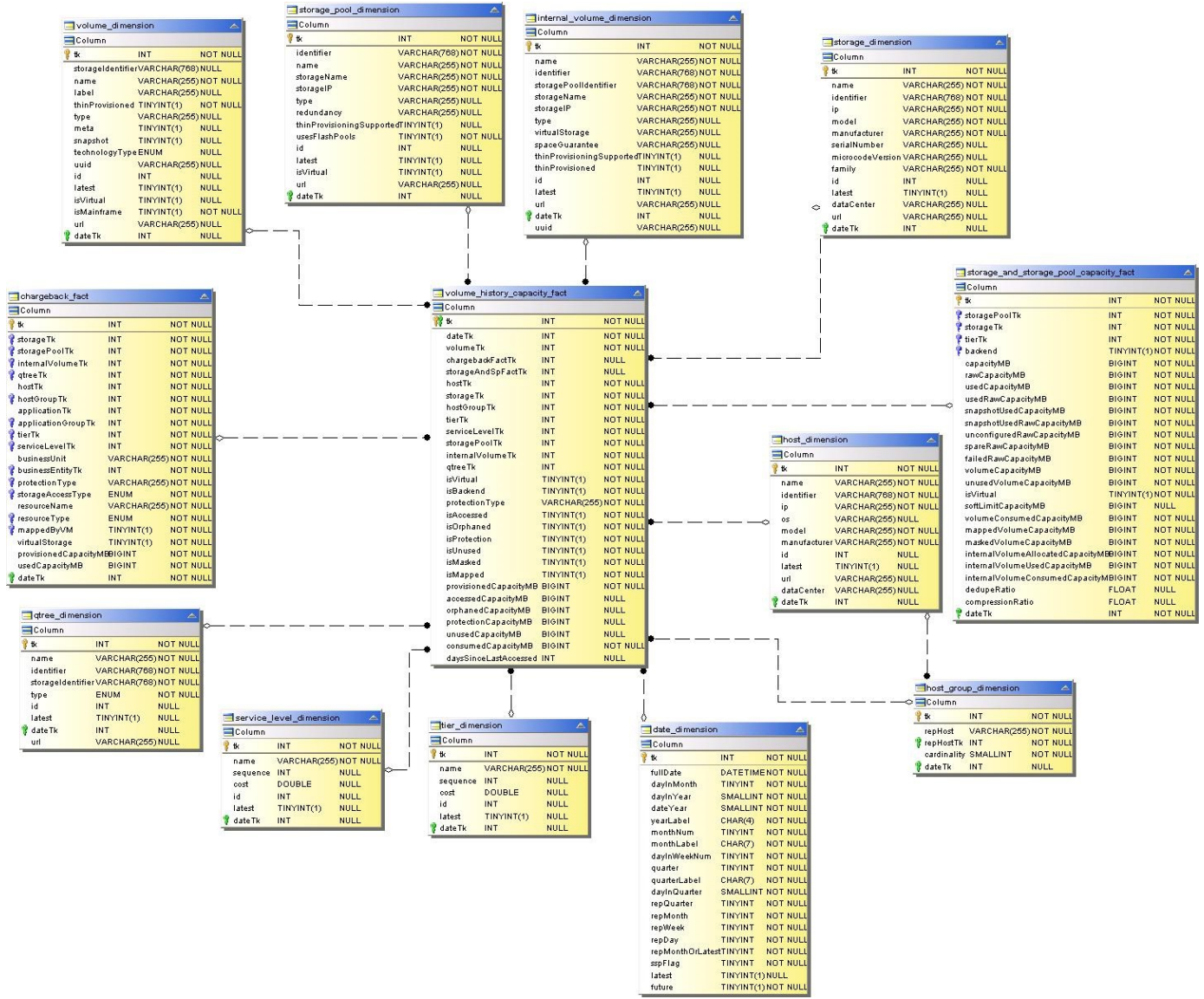
Storage Node Capacity



VM Capacity



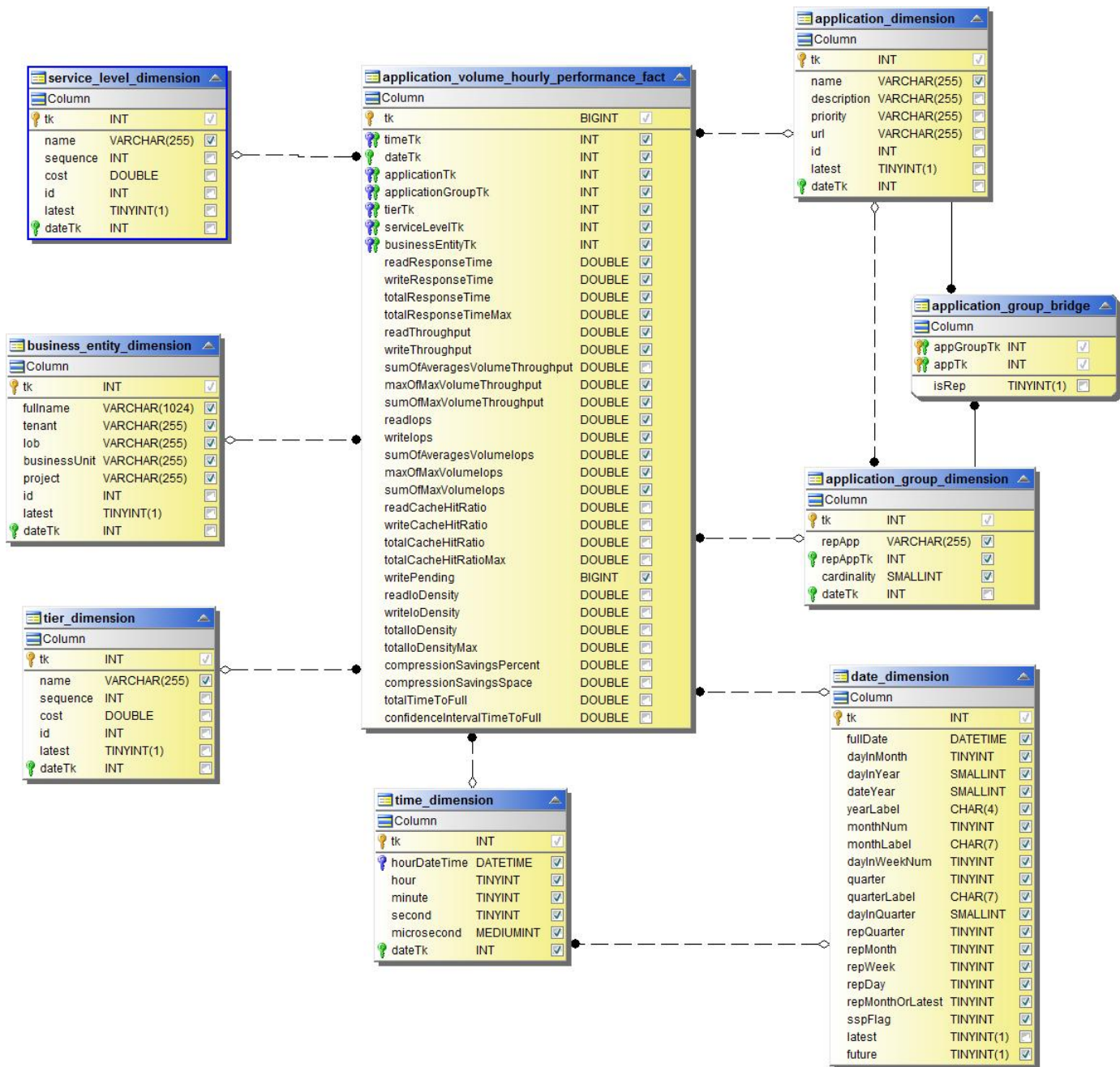
Volume Capacity



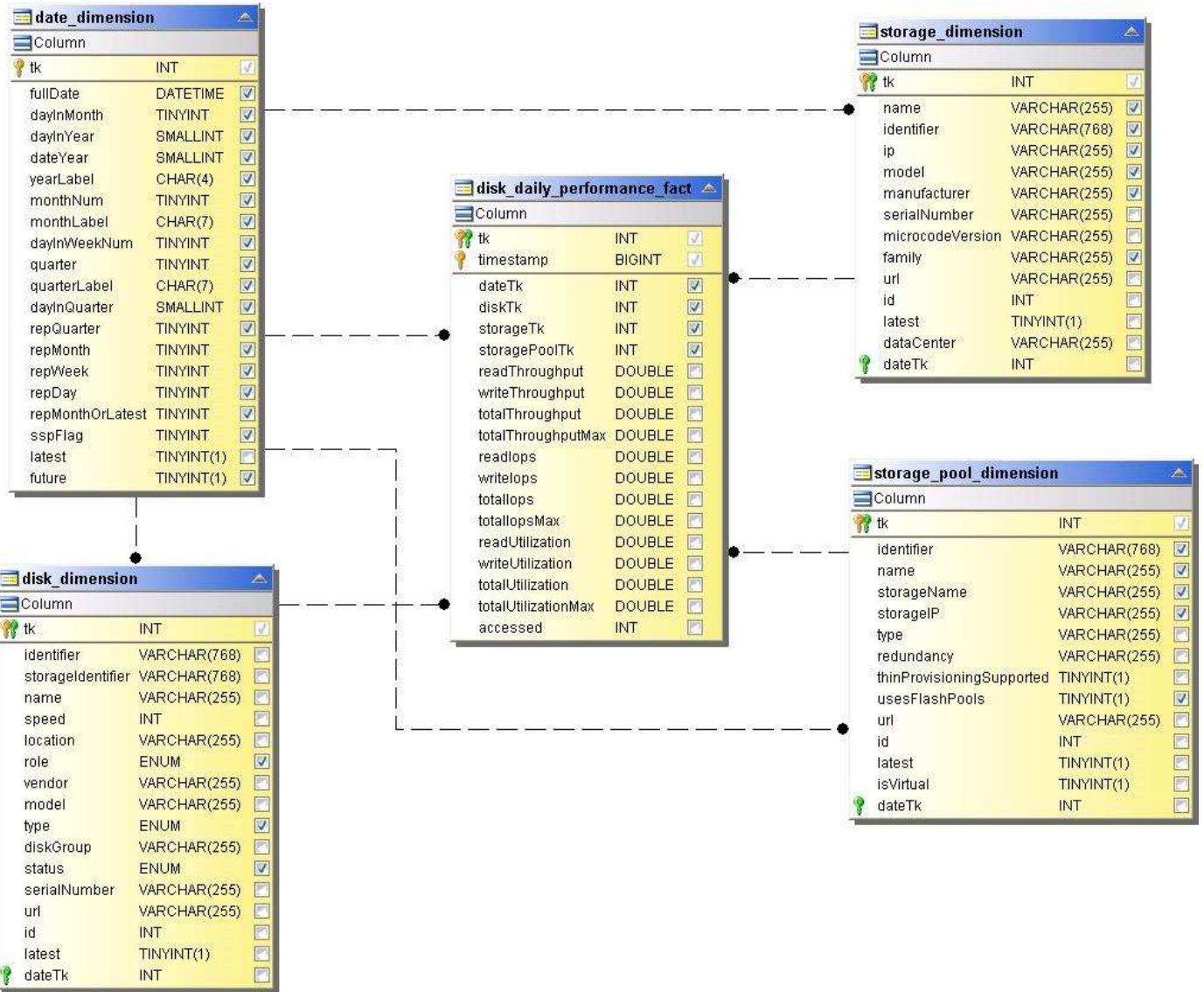
Performance Datamart

The following images describe the performance datamart.

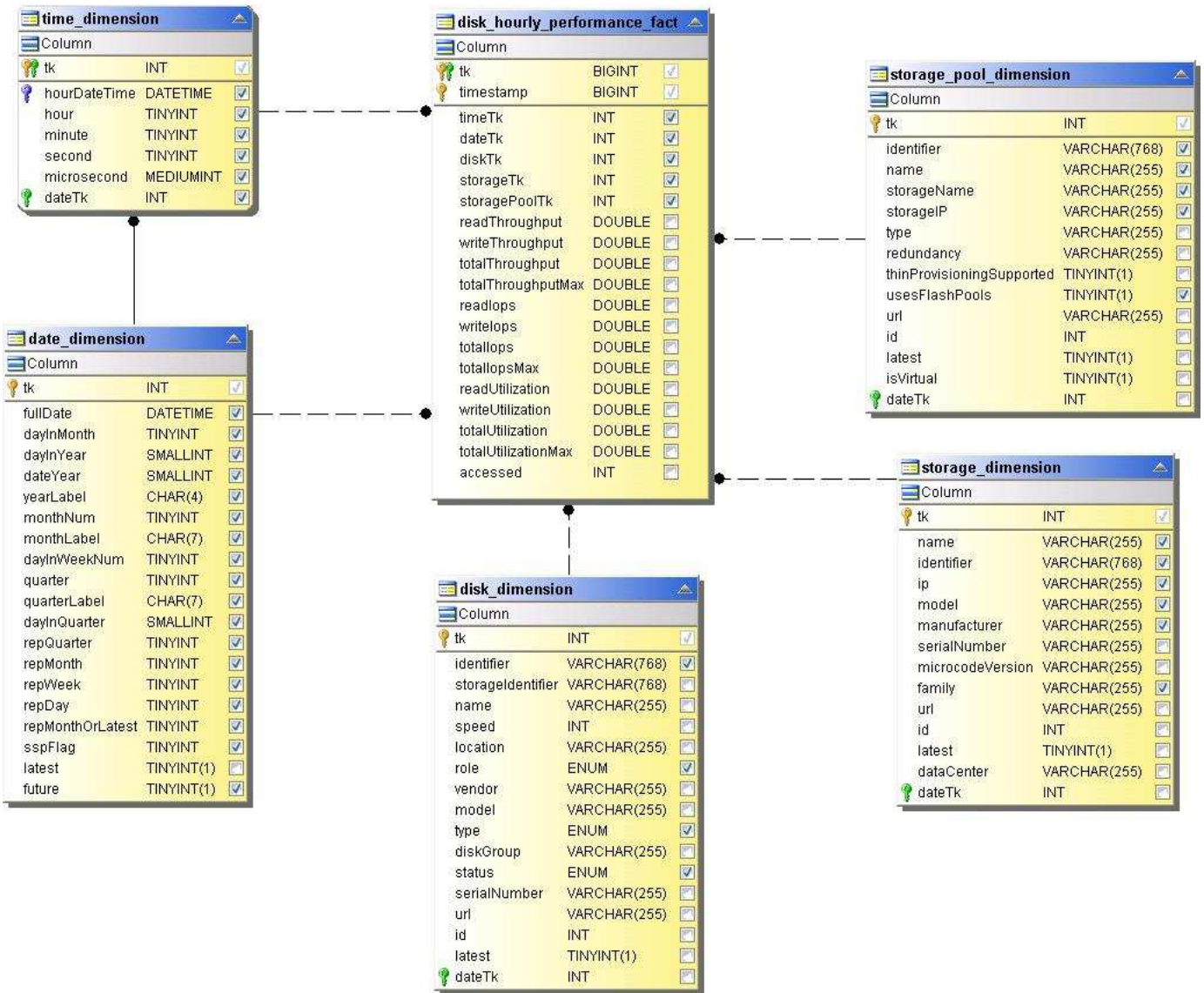
Application Volume Hourly Performance



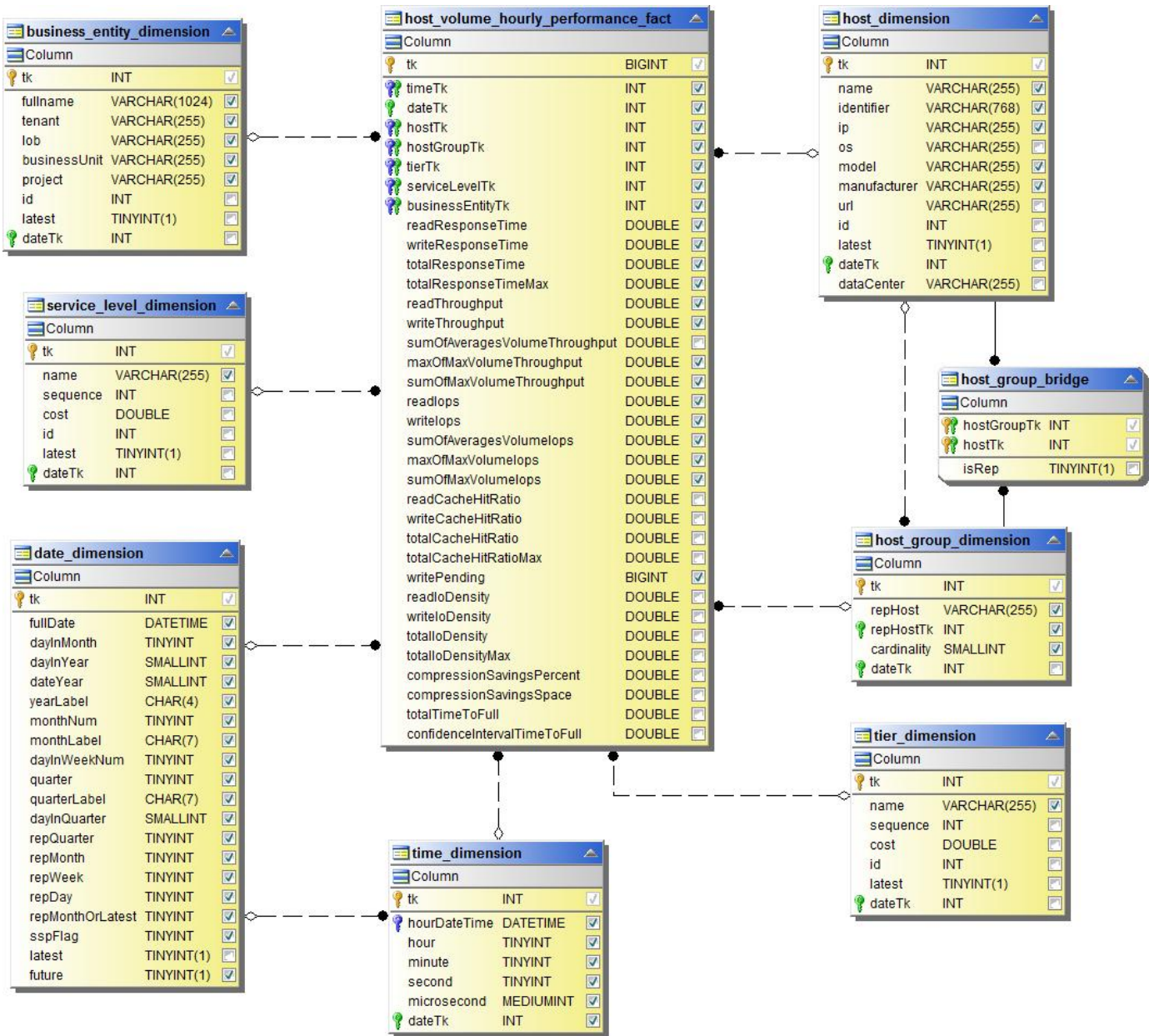
Disk Daily Performance



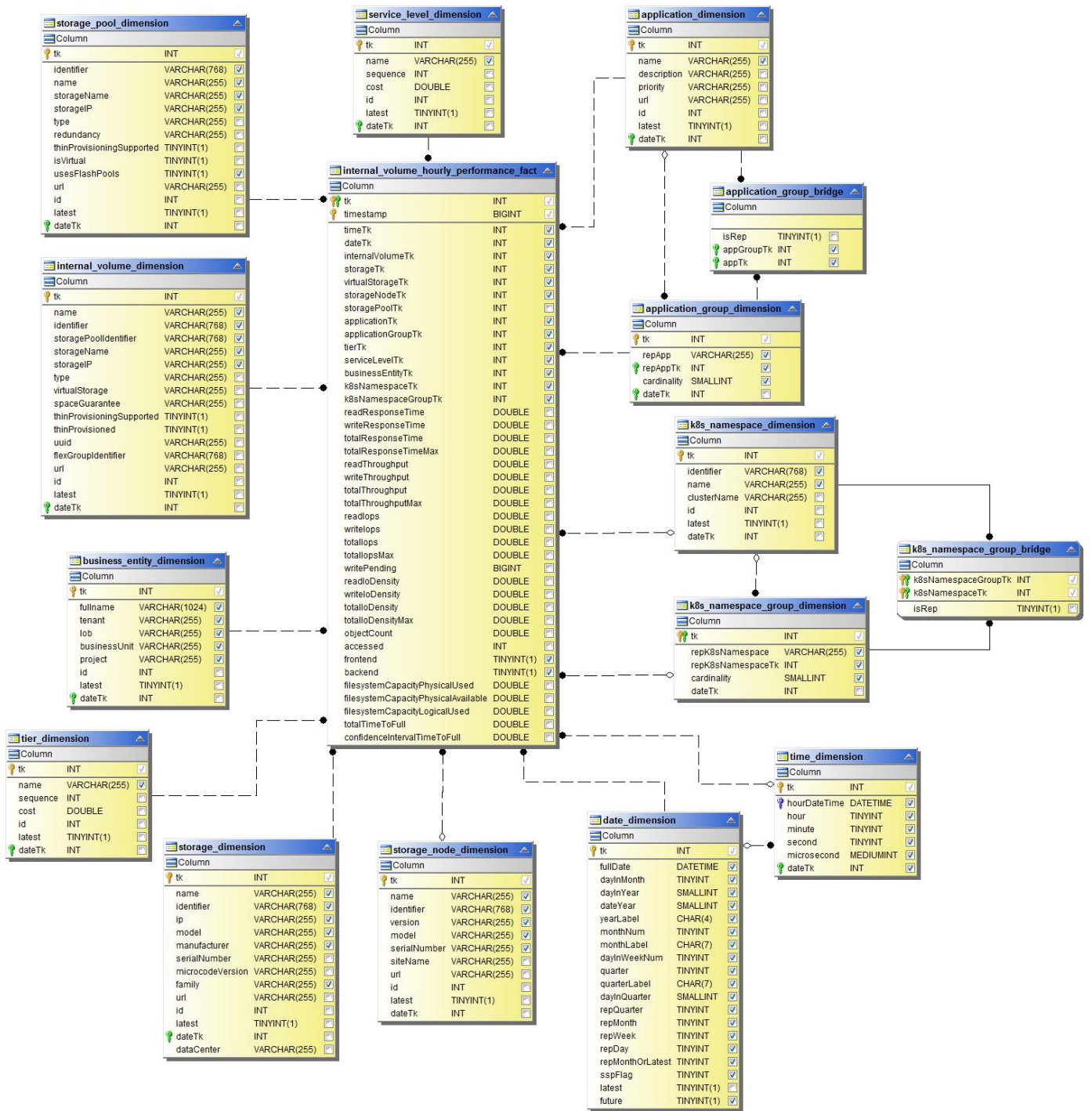
Disk Hourly Performance



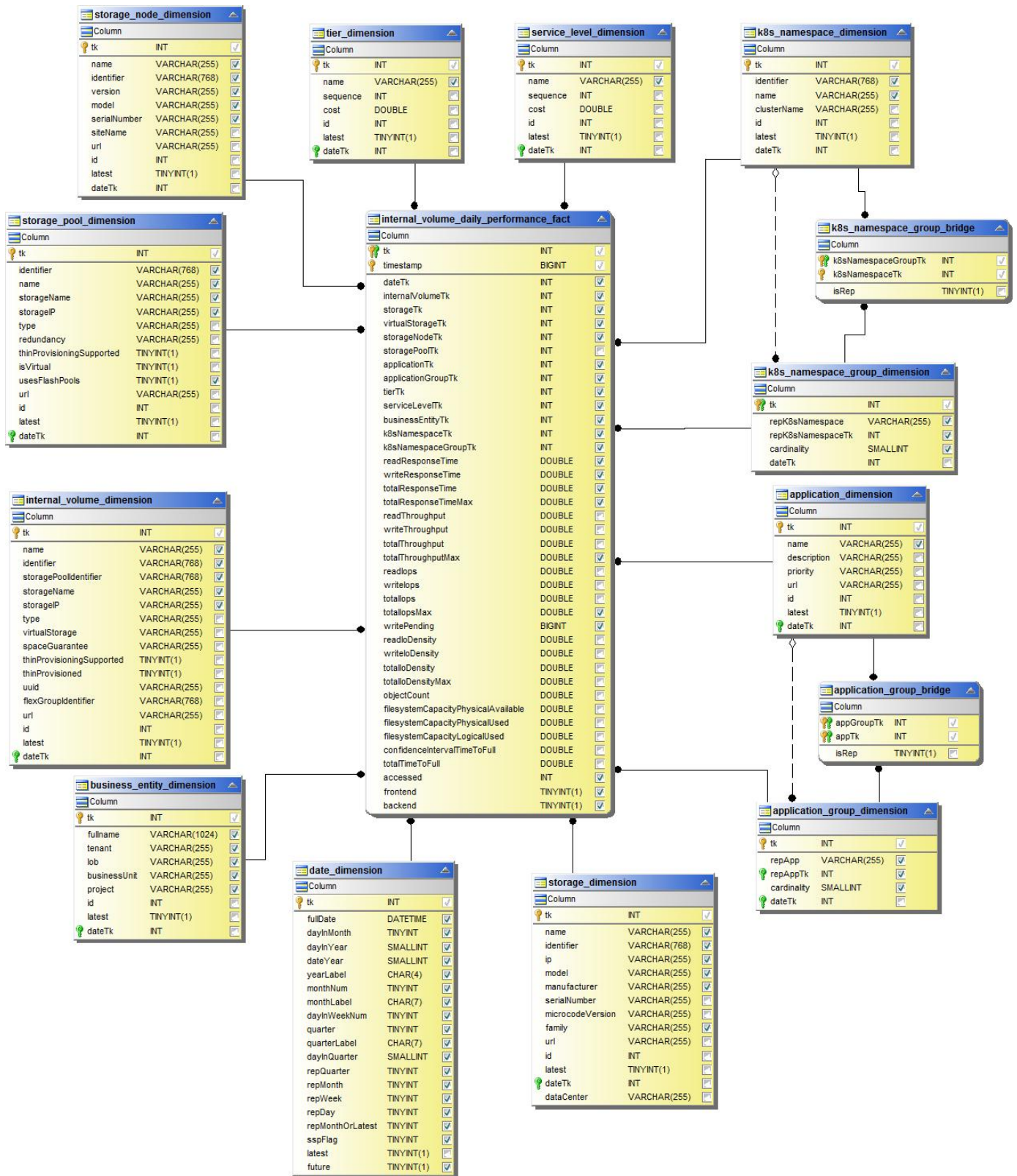
Host Hourly Performance



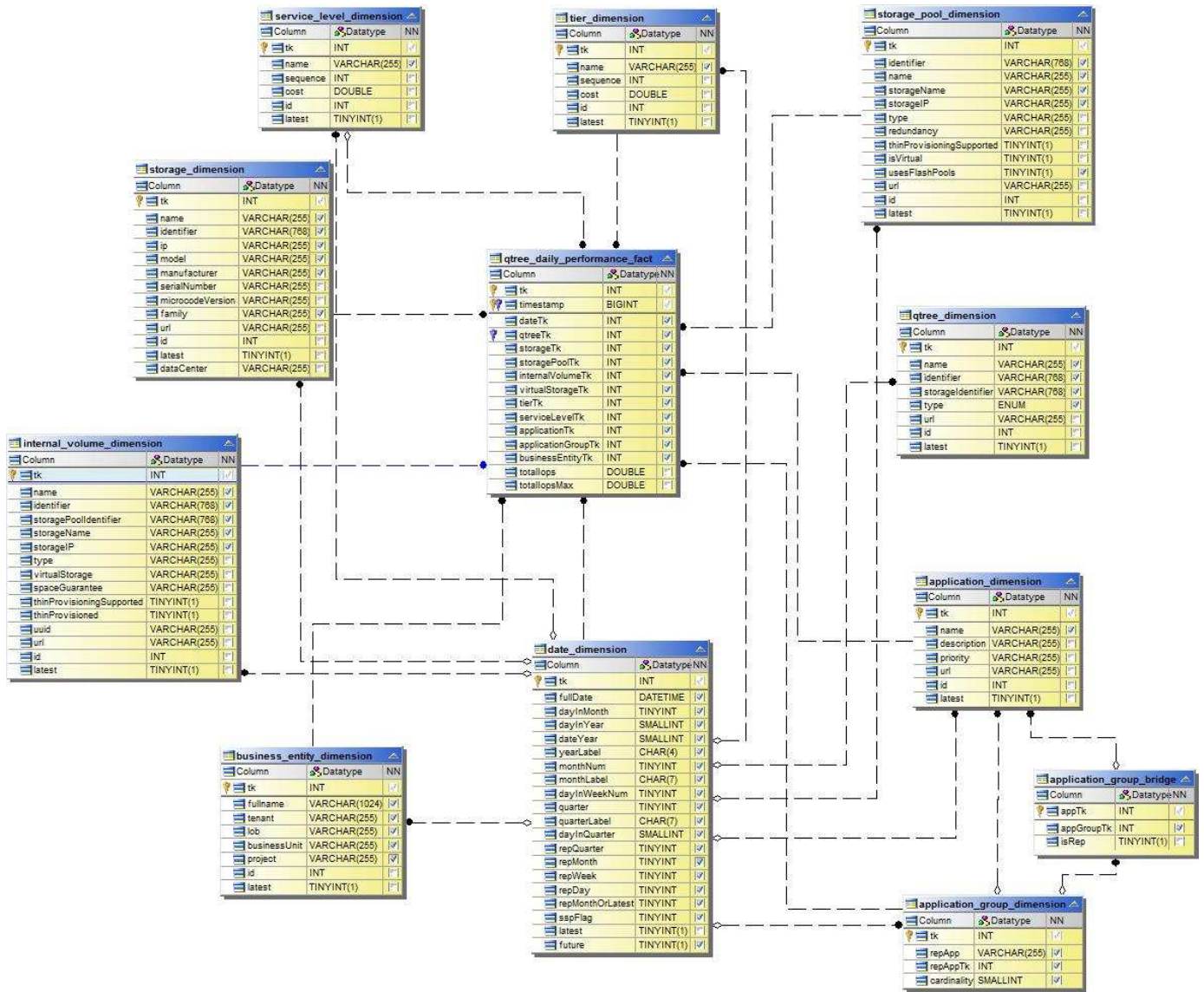
Internal Volume Hourly Performance



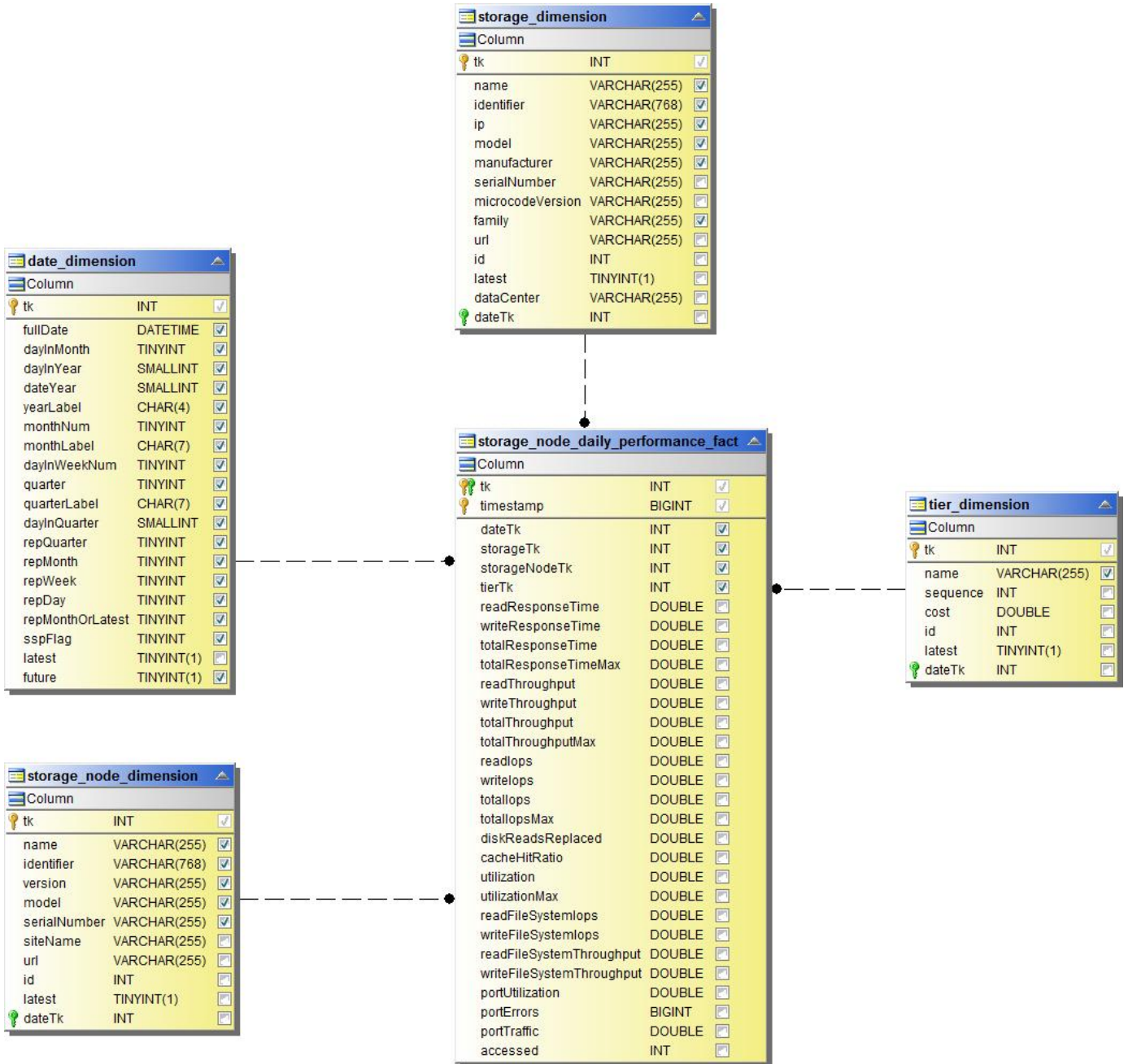
Internal Volume Daily Performance



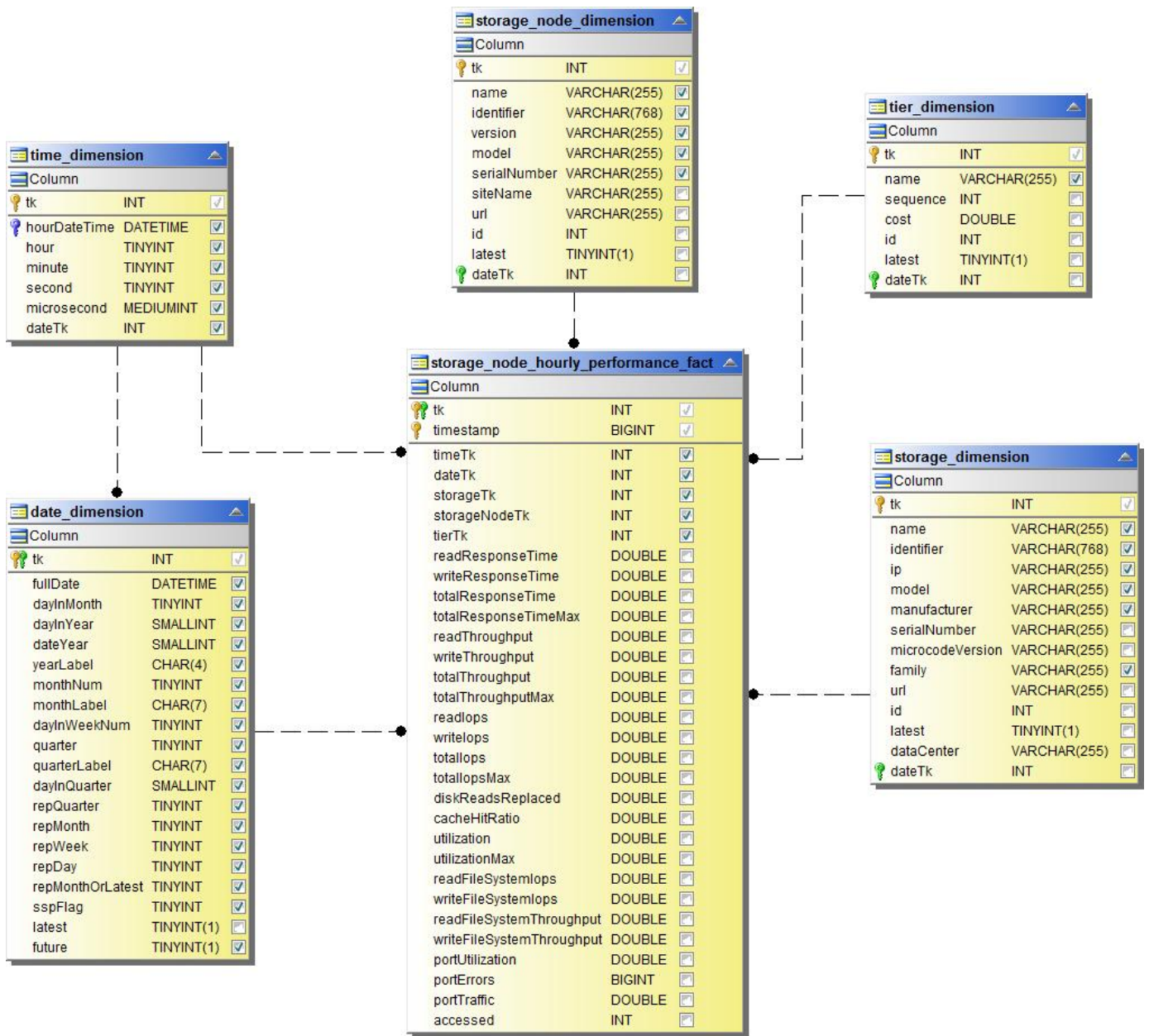
Qtree Daily Performance



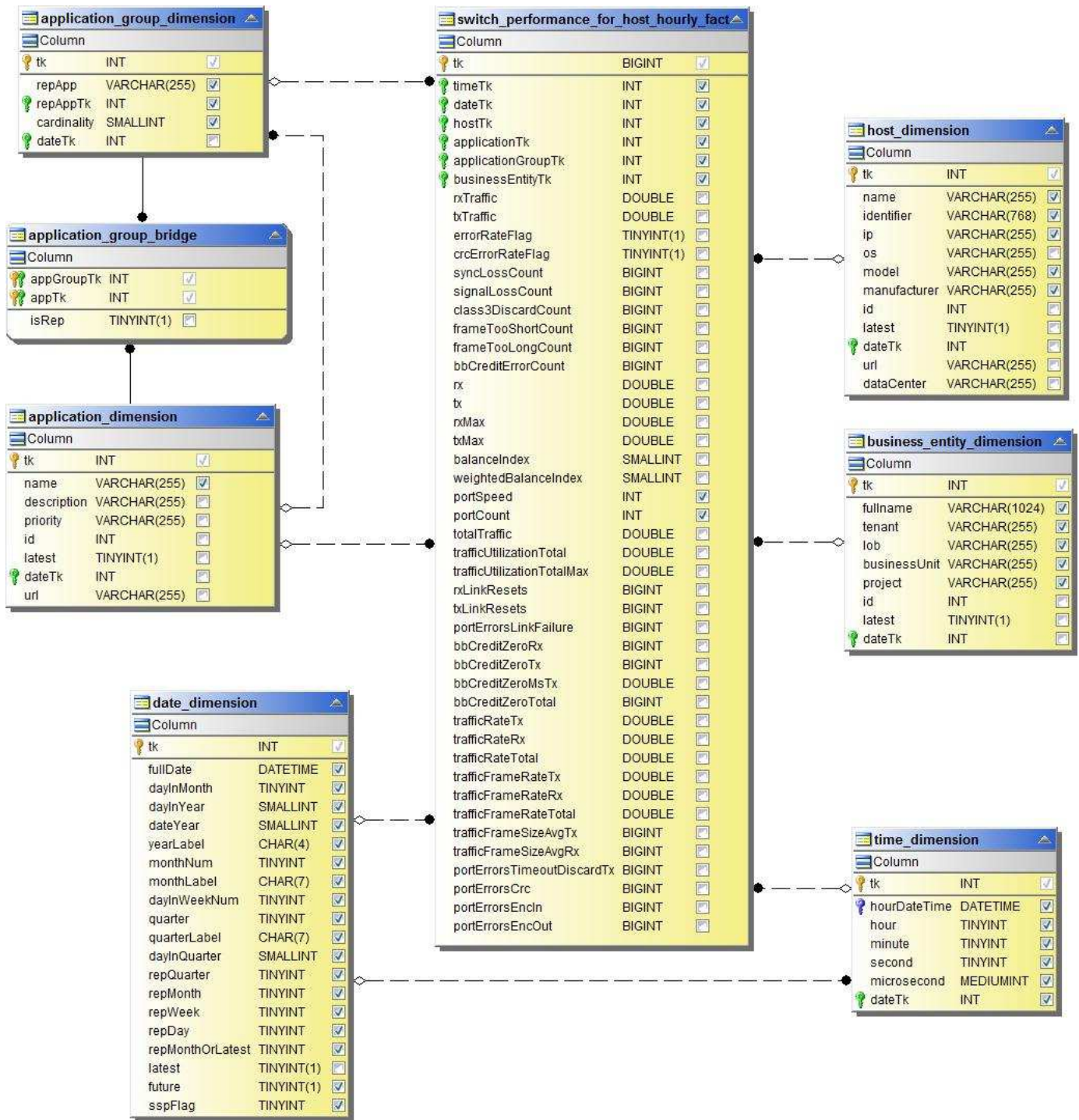
Storage Node Daily Performance



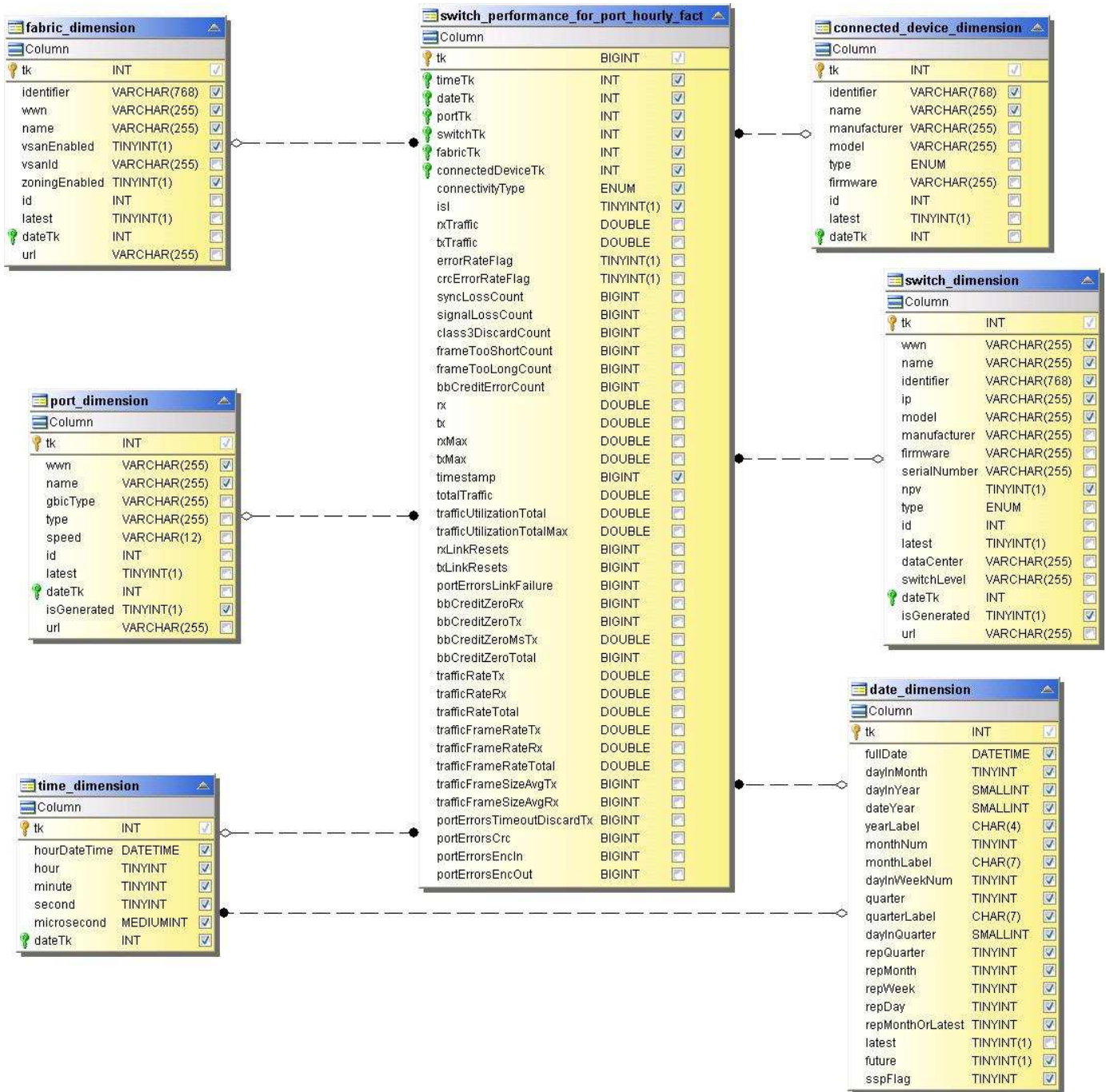
Storage Node Hourly Performance



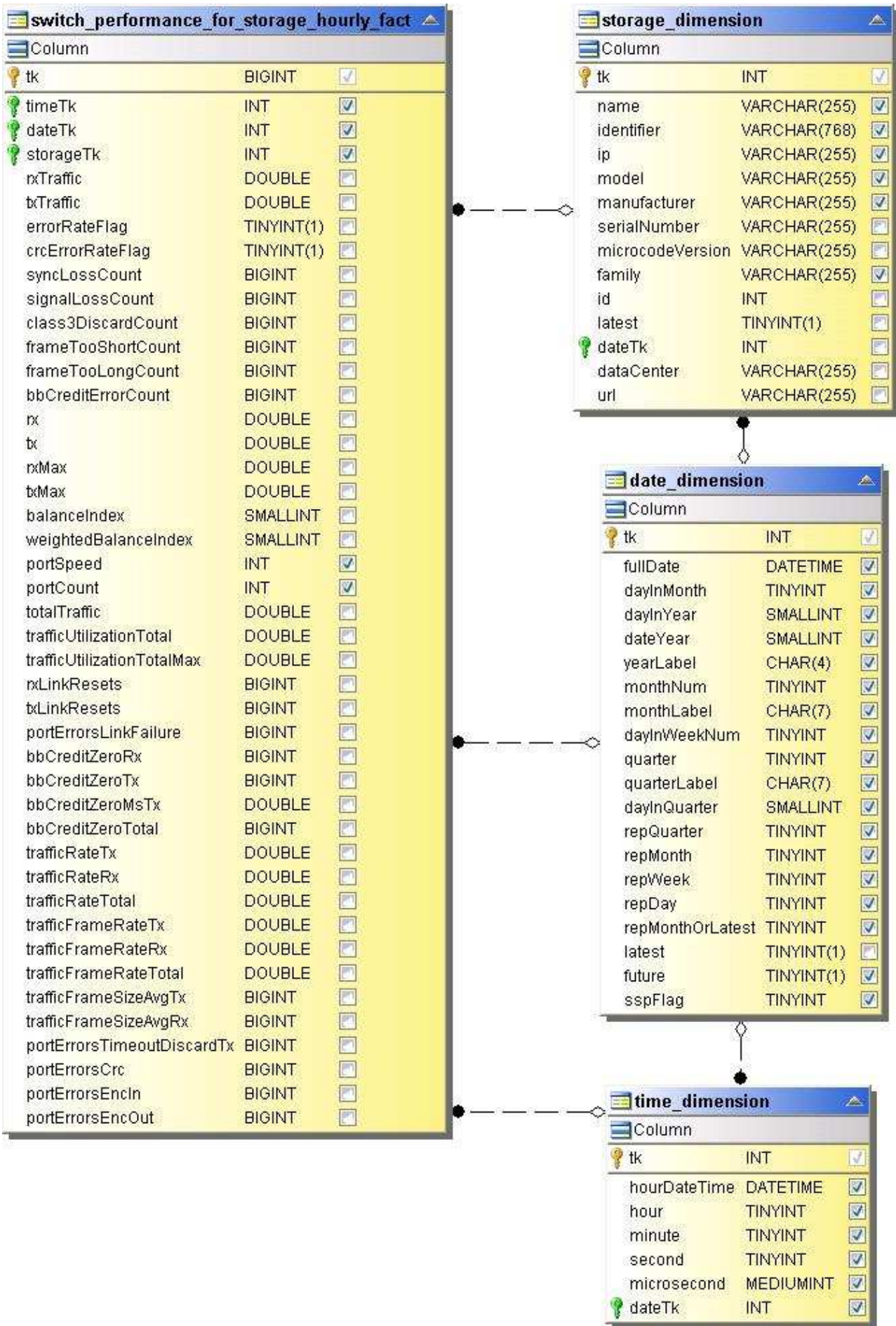
Switch Hourly Performance for Host



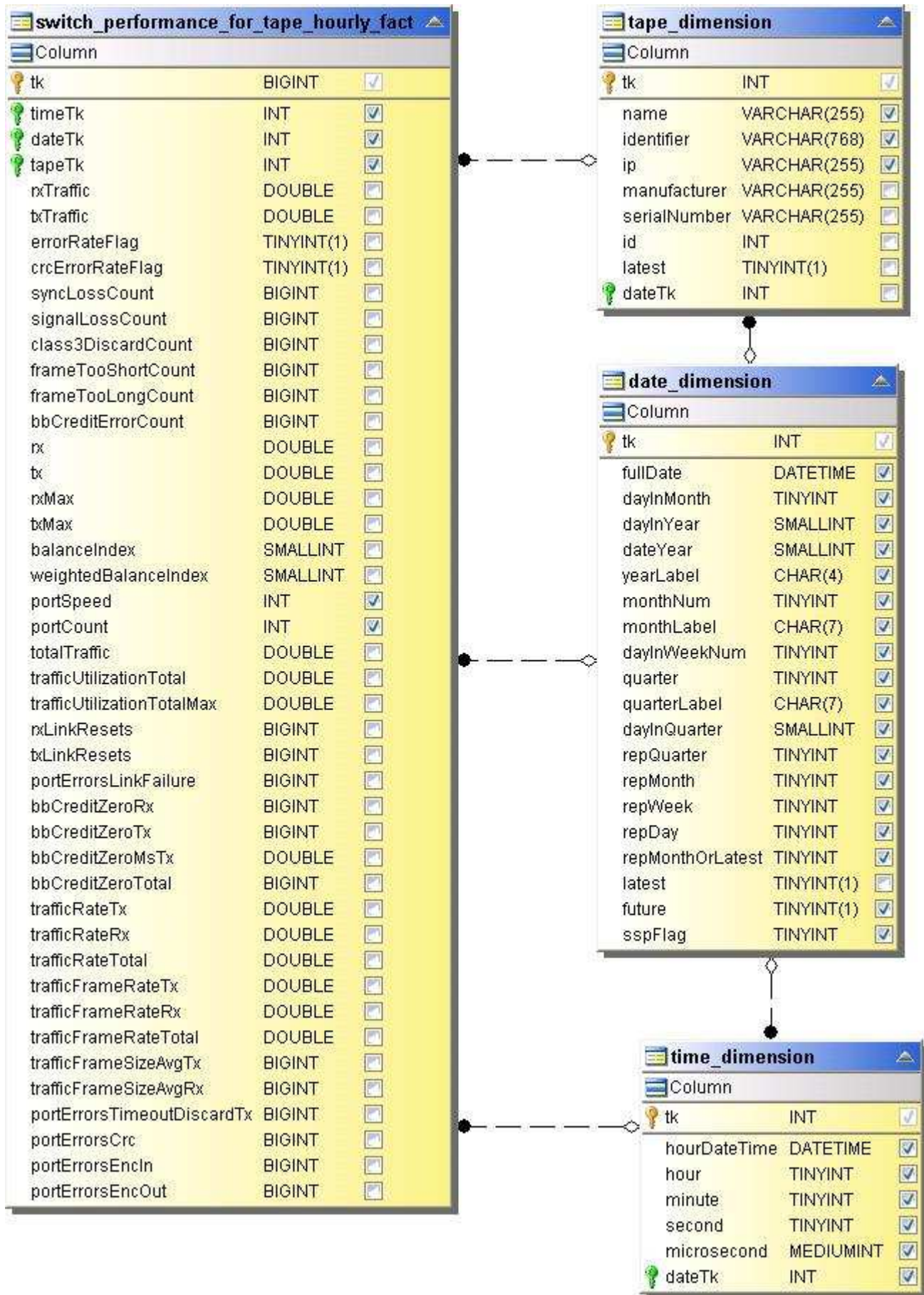
Switch Hourly Performance for Port



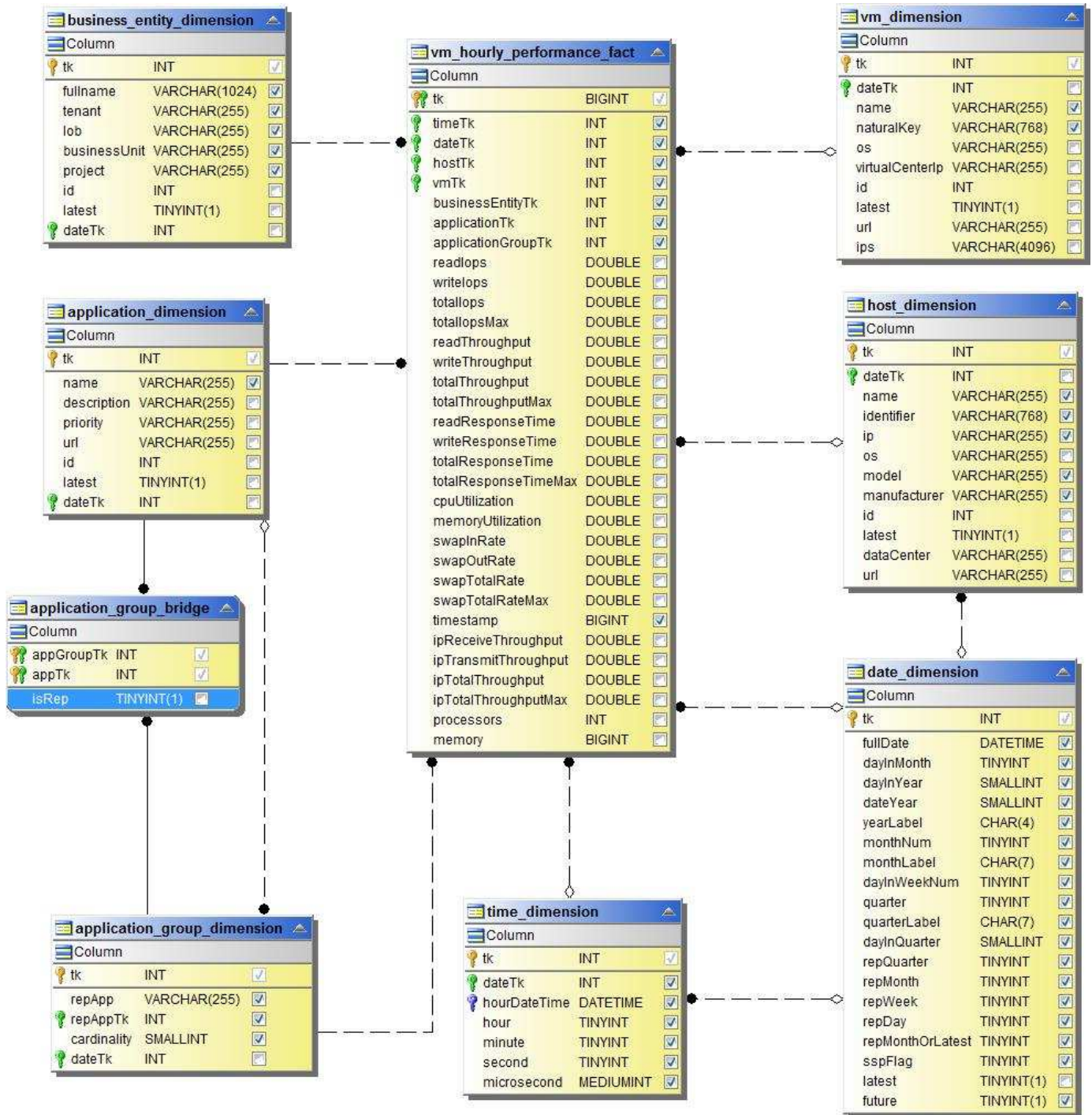
Switch Hourly Performance for Storage



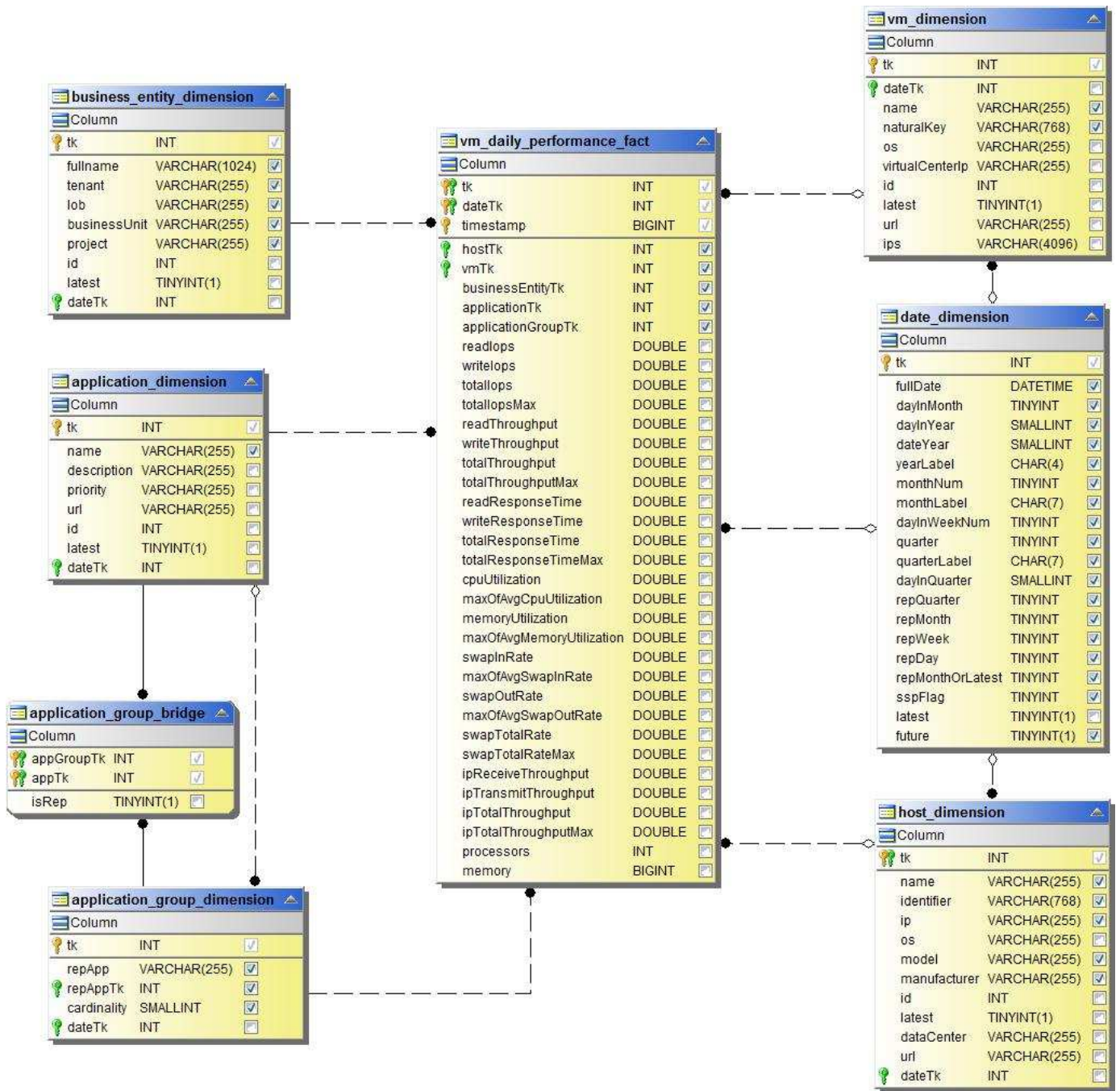
Switch Hourly Performance for Tape



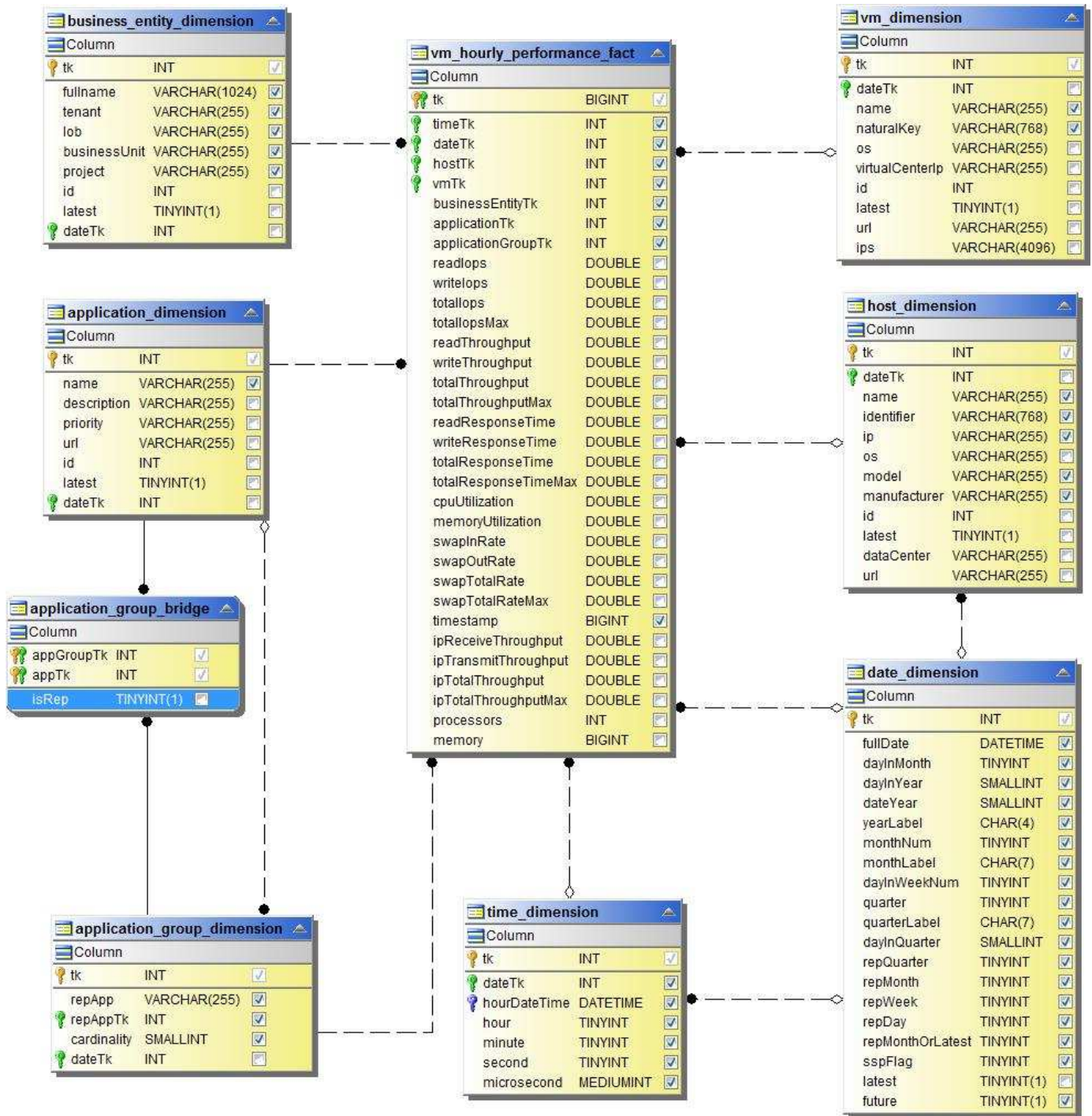
VM Performance



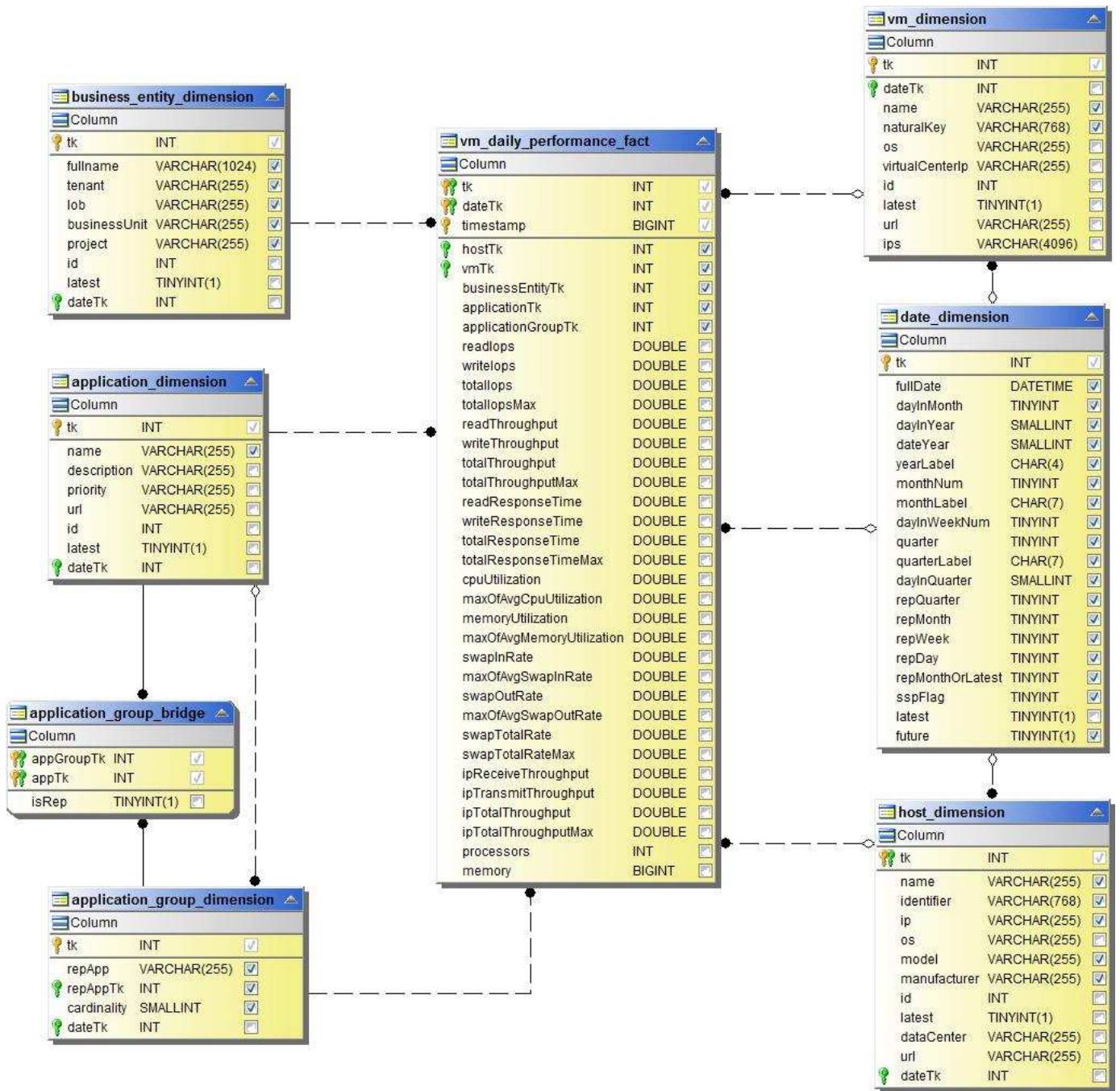
VM Daily Performance for Host



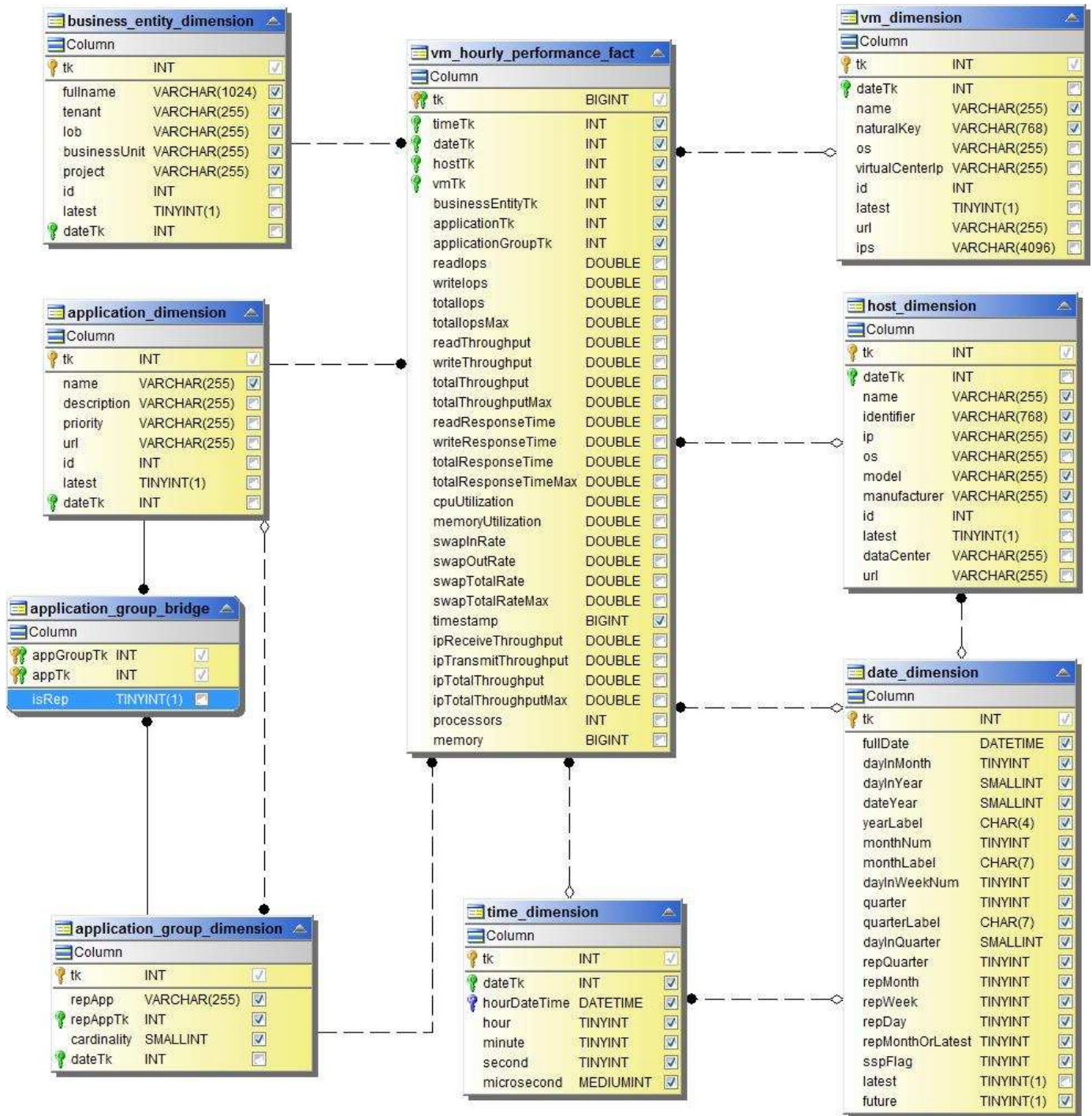
VM Hourly Performance for Host



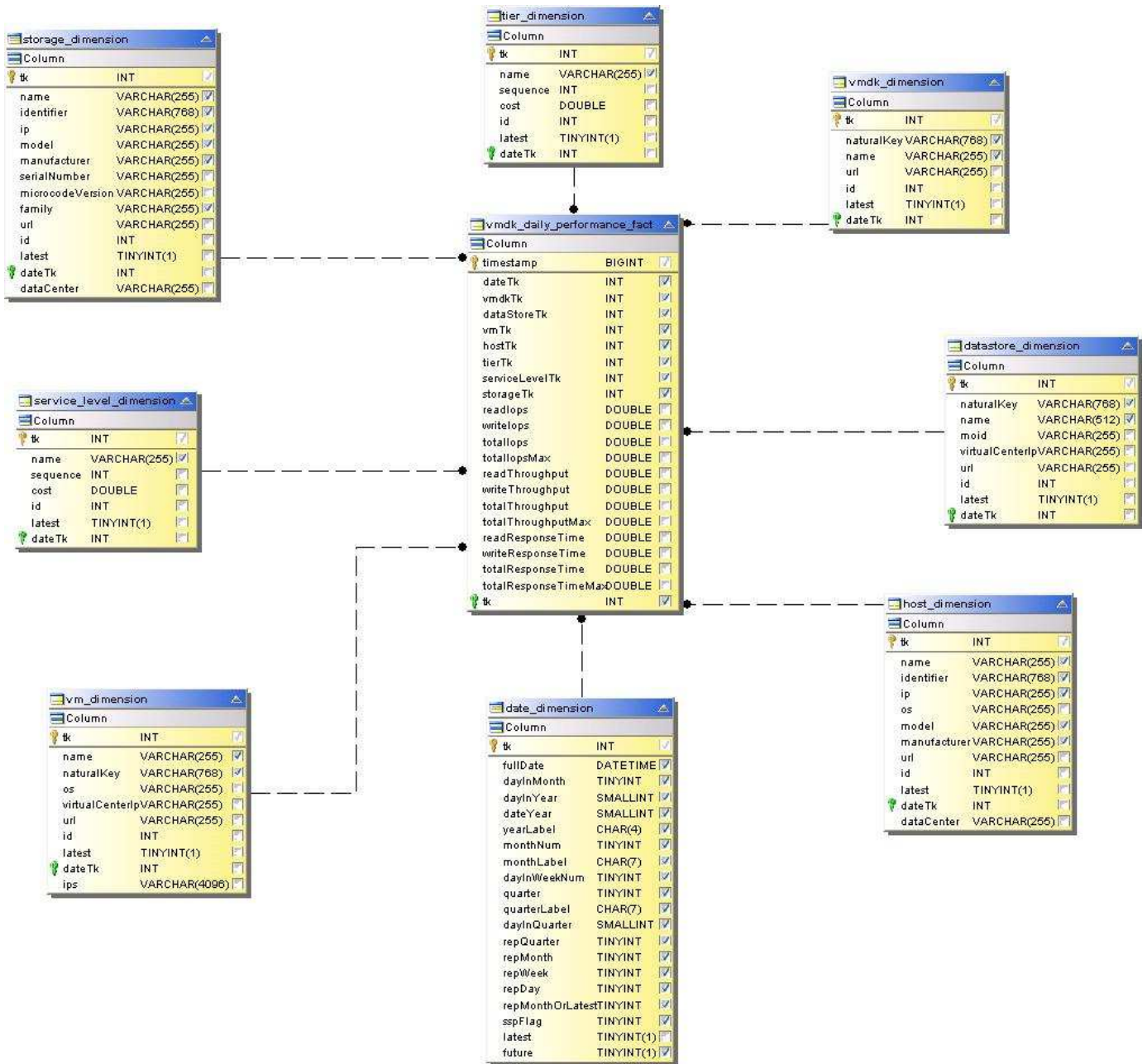
VM Daily Performance for Host



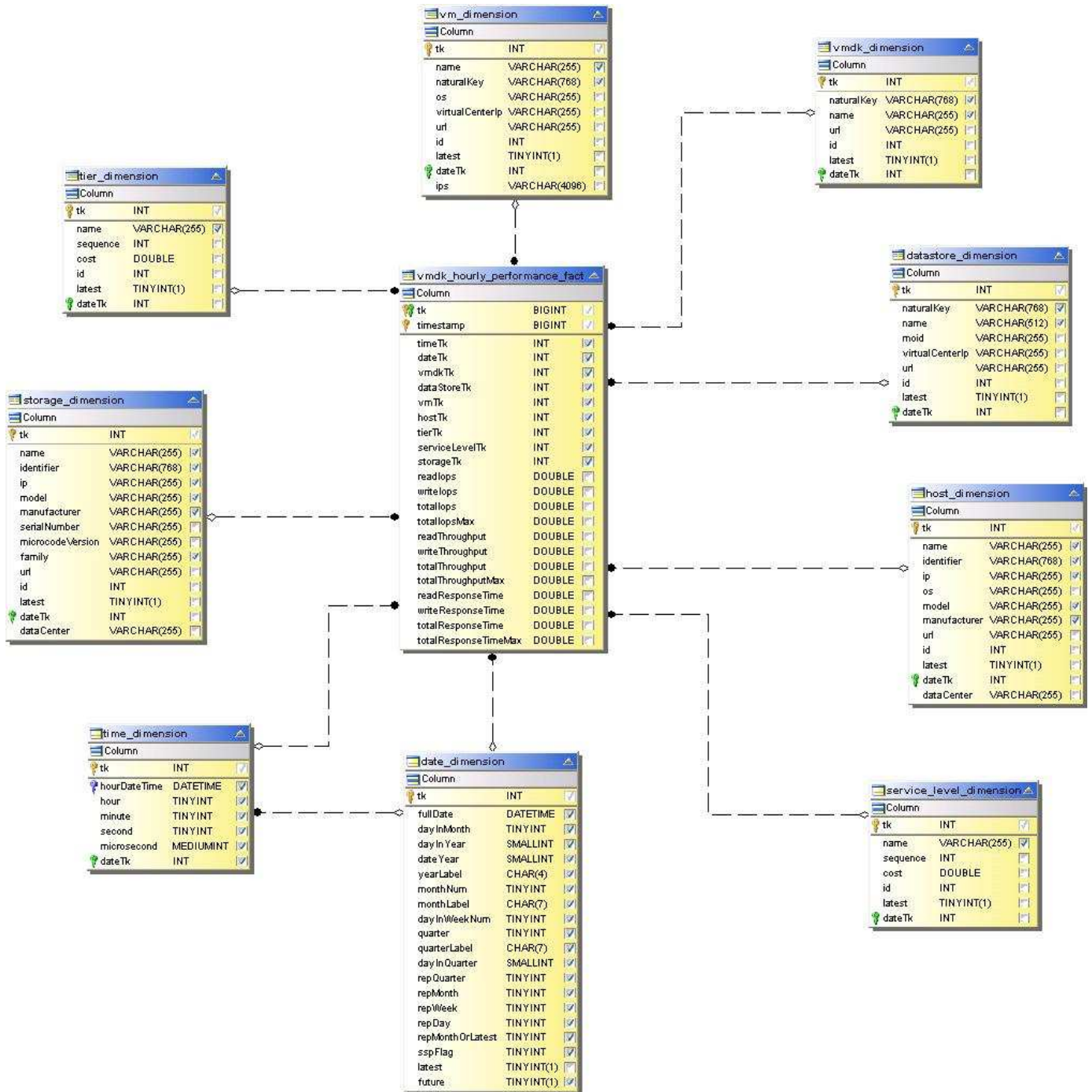
VM Hourly Performance for Host



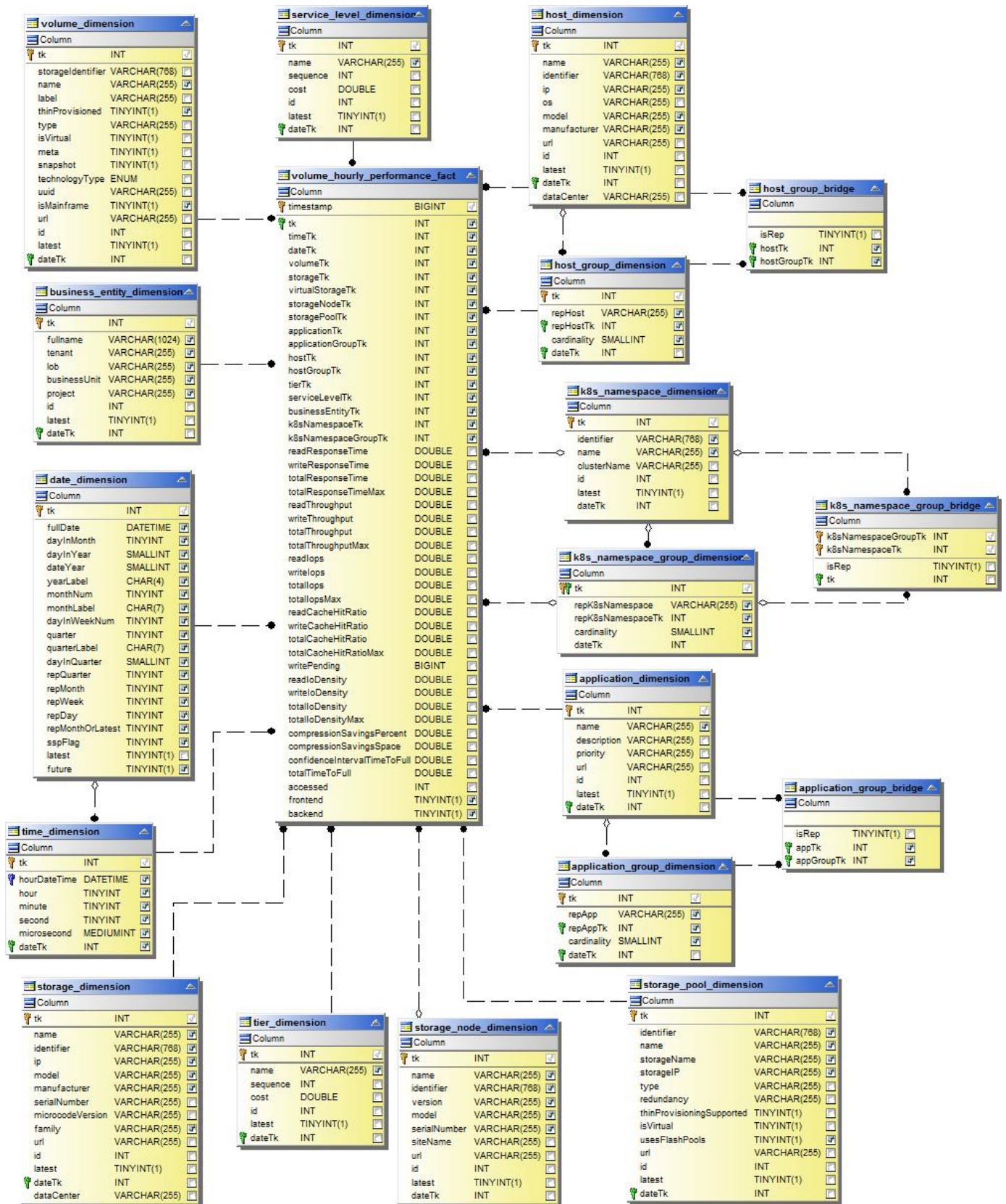
VMDK Daily Performance



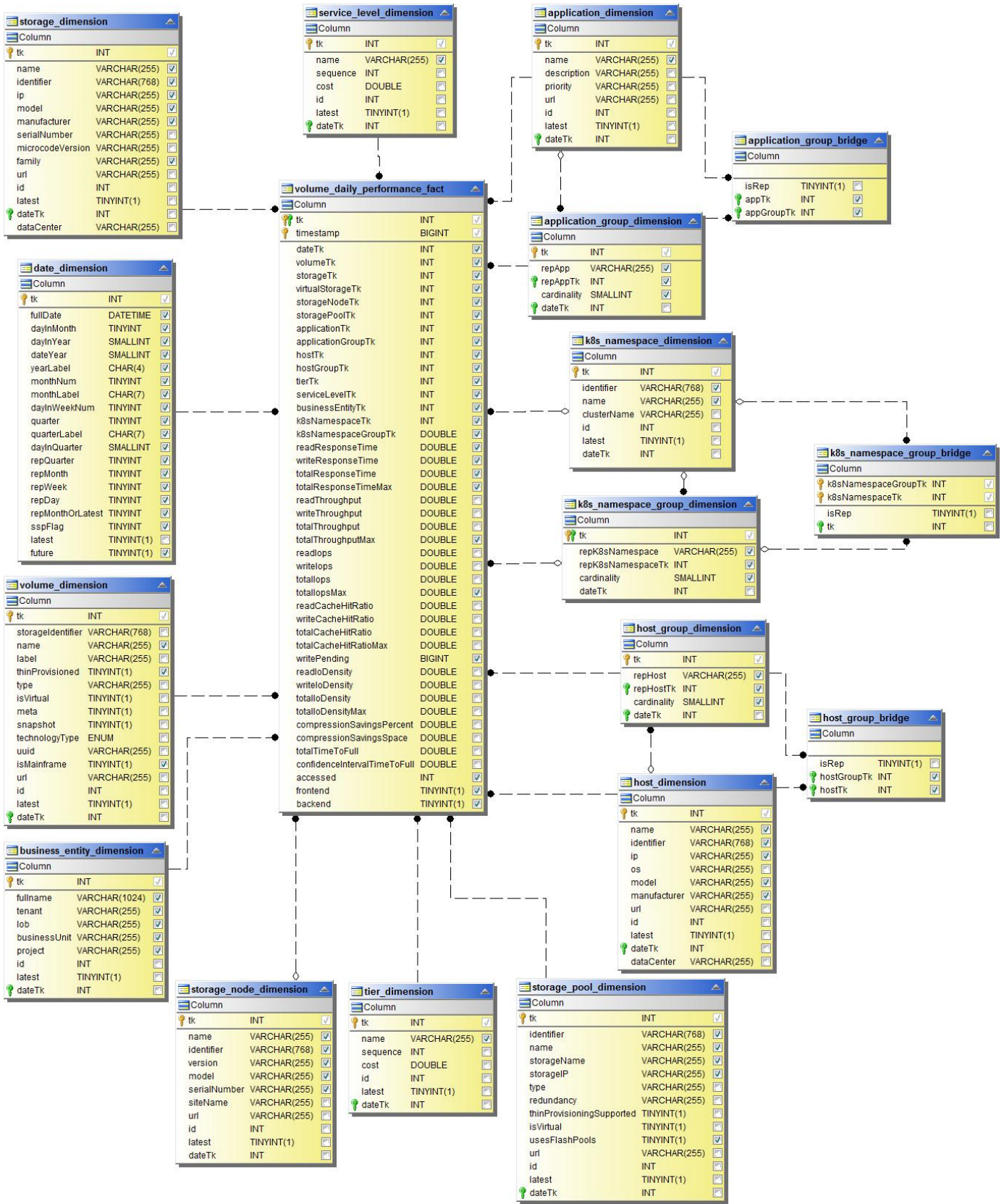
VMDK Hourly Performance



Volume Hourly Performance



Volume Daily Performance



Data Infrastructure Insights Schemas for Reporting

These schema tables and diagrams are provided here as a reference for Data Infrastructure Insights Reporting.

Schema Tables in .PDF format. Click the link to open, or right-click and choose *Save as...* to download.

Schema Diagrams



The Reporting feature is available in Data Infrastructure Insights [Premium Edition](#).

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