

The Declarative Approach to Database Schema Upgrades in Magento 2

My XML Schema brings all the boys to the yard...



About Me

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Head of Development at Pinpoint Designs

- Working with Magento for 8 years
- Previously a backend developer
- Single Father to 3 under 3.
- Love PWA

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Some History

Magento 1


Setup Scripts

Don't just cover database structure:

- Attributes being added to Products, Categories, Customers etc
- CMS Block content
- Database data

Blank Files

People include files just because they can or they think they should.

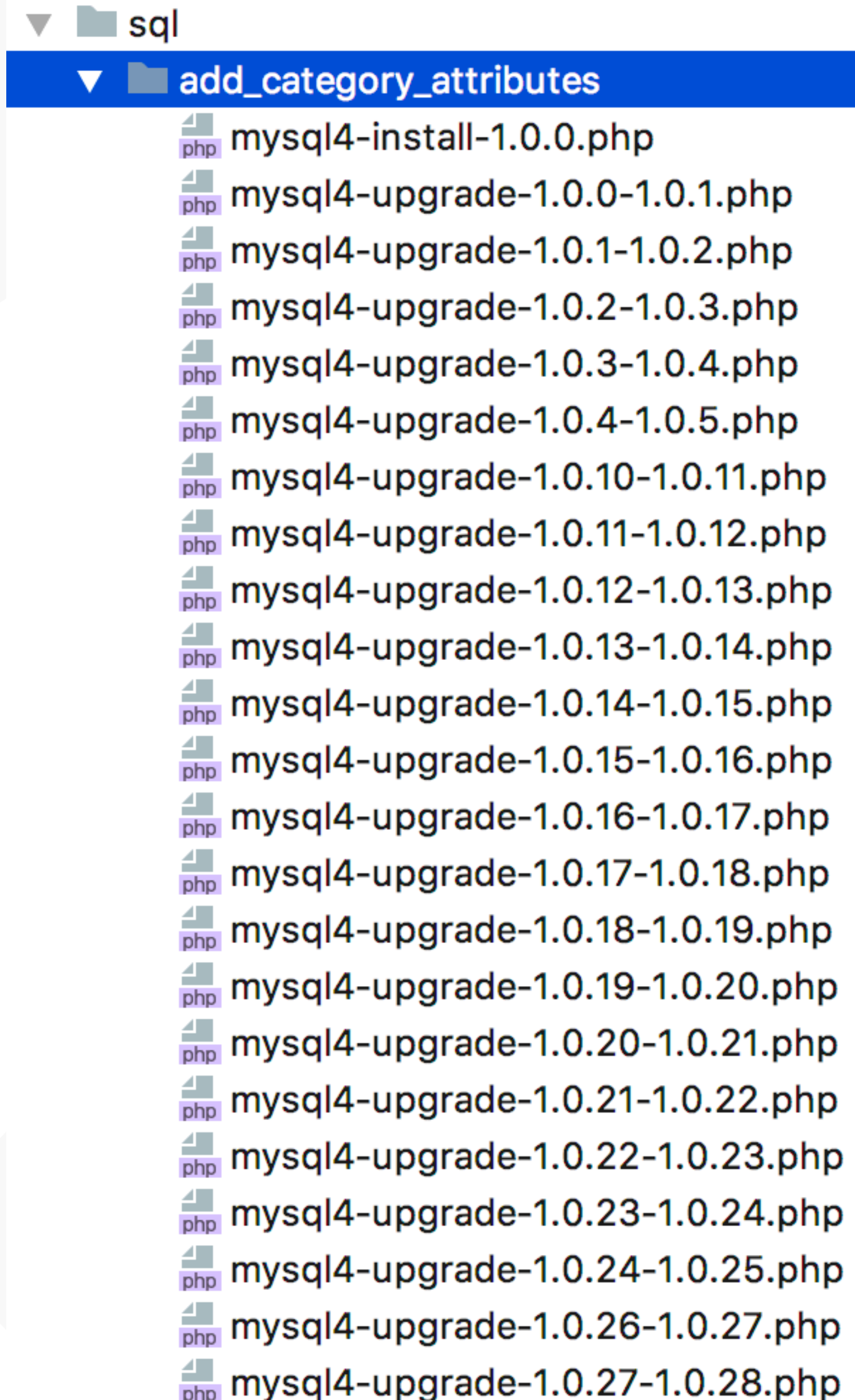


```
mysql4-install-0.0.1.php x
1 <?php
2
3 /** @var Mage_Core_Model_Resource_Setup */
4 $installer = $this;
5
6 $installer->startSetup();
7
8 $connection = $installer->getConnection();
9
10 $installer->endSetup();
```

Lots of Files

In an evolving site, you're going to end up with a lot of setup scripts for some modules, and not so many for others.

Keeping track of these can be a royal pain



File Sequencing

Upgrade scripts will have missing numbers.
























In theory, nothing happened to structure/data in that version.

Or, the dev didn't commit something ...

Or, two devs committed the same thing

▼ sql

▼ add_category_attributes

 mysql4-install-1.0.0.php
 mysql4-upgrade-1.0.0-1.0.1.php
 mysql4-upgrade-1.0.1-1.0.2.php
 mysql4-upgrade-1.0.2-1.0.3.php
 mysql4-upgrade-1.0.3-1.0.4.php
 mysql4-upgrade-1.0.4-1.0.5.php
 mysql4-upgrade-1.0.10-1.0.11.php
 mysql4-upgrade-1.0.11-1.0.12.php
 mysql4-upgrade-1.0.12-1.0.13.php
 mysql4-upgrade-1.0.13-1.0.14.php
 mysql4-upgrade-1.0.14-1.0.15.php
 mysql4-upgrade-1.0.15-1.0.16.php
 mysql4-upgrade-1.0.16-1.0.17.php
 mysql4-upgrade-1.0.17-1.0.18.php
 mysql4-upgrade-1.0.18-1.0.19.php
 mysql4-upgrade-1.0.19-1.0.20.php
 mysql4-upgrade-1.0.20-1.0.21.php
 mysql4-upgrade-1.0.21-1.0.22.php
 mysql4-upgrade-1.0.22-1.0.23.php
 mysql4-upgrade-1.0.23-1.0.24.php
 mysql4-upgrade-1.0.24-1.0.25.php
 mysql4-upgrade-1.0.26-1.0.27.php
 mysql4-upgrade-1.0.27-1.0.28.php

Hard to follow

If you're looking at your database and your column type is TEXT.

You open `mysql-upgrade-1.0.0-1.0.1.php`

It's defined as a VARCHAR.

You've got 20+ files to look through and see how it made it to a TEXT type (and whether it ultimately should be)

▼ sql

▼ add_category_attributes

- mysql4-install-1.0.0.php
- mysql4-upgrade-1.0.0-1.0.1.php
- mysql4-upgrade-1.0.1-1.0.2.php
- mysql4-upgrade-1.0.2-1.0.3.php
- mysql4-upgrade-1.0.3-1.0.4.php
- mysql4-upgrade-1.0.4-1.0.5.php
- mysql4-upgrade-1.0.10-1.0.11.php
- mysql4-upgrade-1.0.11-1.0.12.php
- mysql4-upgrade-1.0.12-1.0.13.php
- mysql4-upgrade-1.0.13-1.0.14.php
- mysql4-upgrade-1.0.14-1.0.15.php
- mysql4-upgrade-1.0.15-1.0.16.php
- mysql4-upgrade-1.0.16-1.0.17.php
- mysql4-upgrade-1.0.17-1.0.18.php
- mysql4-upgrade-1.0.18-1.0.19.php
- mysql4-upgrade-1.0.19-1.0.20.php
- mysql4-upgrade-1.0.20-1.0.21.php
- mysql4-upgrade-1.0.21-1.0.22.php
- mysql4-upgrade-1.0.22-1.0.23.php
- mysql4-upgrade-1.0.23-1.0.24.php
- mysql4-upgrade-1.0.24-1.0.25.php
- mysql4-upgrade-1.0.26-1.0.27.php
- mysql4-upgrade-1.0.27-1.0.28.php

Database Specifics in M1

Implementation

RAW SQL

```
/* @var $installer Mage_Core_Model_Resource_Setup */
$installer = $this;

$installer->startSetup();

$installer->run( sql: "
CREATE TABLE IF NOT EXISTS `". $this->getTable('xtento_orderexport_des
`destination_id` int(11) NOT NULL AUTO_INCREMENT,
`name` varchar(255) NOT NULL,
`type` varchar(50) NOT NULL,
`hostname` varchar(255) NOT NULL,
`port` int(5) DEFAULT NULL,
`username` varchar(255) NOT NULL,
`password` varchar(255) NOT NULL,
`timeout` int(5) NOT NULL DEFAULT '15',
`path` varchar(255) NOT NULL,
`ftp_type` enum('', 'ftp', 'ftps') NOT NULL,
`ftp_pasv` int(1) NOT NULL DEFAULT '1',
`email_sender` varchar(255) NOT NULL COMMENT 'E-Mail Destination',
`email_recipient` varchar(255) NOT NULL COMMENT 'E-Mail Destination',
`email_subject` varchar(255) NOT NULL COMMENT 'E-Mail Destination',
`email_body` text NOT NULL COMMENT 'E-Mail Destination',
`custom_class` varchar(255) NOT NULL,
`custom_function` varchar(255) NOT NULL,
`do_retry` int(1) NOT NULL DEFAULT '1',
`last_result` int(1) NOT NULL,
`last_result_message` text NOT NULL,
`last_modification` datetime NOT NULL DEFAULT '0000-00-00 00:00:00',
PRIMARY KEY (`destination_id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;
```

Implementation

RAW SQL

```
$this->startSetup();

$sql = array();

$sql[] = "SET foreign_key_checks = 0";

$sql[] = "CREATE TABLE IF NOT EXISTS " . Mage::getTableName('customer_address');
$sql[] = "CREATE TABLE IF NOT EXISTS " . Mage::getTableName('customer_address_entity');
$sql[] = "CREATE TABLE IF NOT EXISTS " . Mage::getTableName('customer_address_entity_varchar');
$sql[] = "CREATE TABLE IF NOT EXISTS " . Mage::getTableName('customer_address_entity_int');

$sql[] = "SET foreign_key_checks = 1";

foreach ($sql as $query)
{
    $this->run($query);
}

$this->endSetup();
```

Implementation

Since version 1.6, Magento (in theory) supports more database backends than MySQL only

DDL (Data Definition Language)

Abstraction from direct SQL

```
$amazon_login_table = $installer->getTable('amazon_payments/login');  
  
if ($installer->getConnection()->isTableExists($amazon_login_table))  
  
    $amazon_table = $installer->getConnection()  
        ->newTable($installer->getTable('amazon_payments/login'))  
        ->addColumn('login_id', Varien_Db_Ddl_Table::TYPE_INTEGER,  
            'identity' => true,  
            'unsigned' => true,  
            'nullable' => false,  
            'primary' => true  
        ), 'Login ID')  
        ->addColumn('customer_id', Varien_Db_Ddl_Table::TYPE_INTEGER,  
            'nullable' => false,  
            'unsigned' => true  
        ), 'Customer Entity ID')  
        ->addColumn('amazon_uid', Varien_Db_Ddl_Table::TYPE_VARCHAR,  
            'nullable' => true,  
            'unsigned' => true  
        ), 'Amazon User ID')  
        ->addIndex($installer->getIdxName('amazon_payments/login'),  
            'login_id')  
        ->addIndex($installer->getIdxName('amazon_payments/login'),  
            'customer_id');  
  
$installer->getConnection()->createTable($amazon_table);  
  
$installer->getConnection()->addConstraint(  
    'fk_amazon_login_customer_entity_id',  
    $amazon_table->getTableName(),  
    'customer_id',  
    $installer->getTable('amazon_payments/login'),  
    'customer_id',  
    true);
```

Keeping Track

Magento keeps track of the “current” version loaded in the `core_resource` table.

Version number tracked against the version supplied in `etc/config.xml` for your extension / for the core module.

```
<config>
  <modules>
    <Mage_Directory>
      <version>1.6.0.3</version>
    </Mage_Directory>
  </modules>
</config>
```

```
mysql> select * from core_resource;
```

code	version	data_version
adminnotification_setup	1.6.0.0	1.6.0.0
admin_setup	1.6.1.0	1.6.1.0
api2_setup	1.0.0.0	1.0.0.0
api_setup	1.6.0.0	1.6.0.0
backup_setup	1.6.0.0	1.6.0.0
bundle_setup	1.6.0.0.1	1.6.0.0.1
captcha_setup	1.7.0.0.0	1.7.0.0.0
catalogindex_setup	1.6.0.0	1.6.0.0
cataloginventory_setup	1.6.0.0.2	1.6.0.0.2
catalogrule_setup	1.6.0.3	1.6.0.3
catalogsearch_setup	1.6.0.0	1.6.0.0
catalog_setup	1.6.0.0.14	1.6.0.0.14
checkout_setup	1.6.0.0	1.6.0.0
cms_setup	1.6.0.0.1	1.6.0.0.1
compiler_setup	1.6.0.0	1.6.0.0
contacts_setup	1.6.0.0	1.6.0.0
core_setup	1.6.0.2	1.6.0.2
cron_setup	1.6.0.0	1.6.0.0
customer_setup	1.6.2.0.1	1.6.2.0.1
dataflow_setup	1.6.0.0	1.6.0.0
directory_setup	1.6.0.1	1.6.0.1
downloadable_setup	1.6.0.0.2	1.6.0.0.2
eav_setup	1.6.0.0	1.6.0.0

Magento 2

Implementation Changes

InstallData and InstallSchema

- Scripts, that are executed on a clean (empty) database

UpgradeData and UpgradeSchema

- Incremental scripts, that update an existing Magento database

Logic

The logic moves from Magento reading file names to Magento utilising version lookups within code using `version_compare`.

DDL still exists

RAW SQL still exists

Problems still exist

```
class UpgradeSchema implements UpgradeSchemaInterface
{
    /**
     * {@inheritdoc}
     */
    public function upgrade(SchemaSetupInterface $setup, ModuleContextInterface $context)
    {
        $setup->startSetup();

        if (version_compare($context->getVersion(), '2.0.1', '<')
            $this->addSupportVideoMediaAttributes($setup);
            $this->removeGroupPrice($setup);
        }

        if (version_compare($context->getVersion(), '2.0.6', '<')
            $this->addUniqueKeyToCategoryProductTable($setup);
        }
        $setup->endSetup();
    }

    /**
     * @param SchemaSetupInterface $setup
     * @return void
     */
    protected function addUniqueKeyToCategoryProductTable(SchemaSetupInterface $setup)
    {
        $setup->getConnection()->addIndex(
            $setup->getTable('catalog_category_product'),
            $setup->getIdxName(
                'catalog_category_product',
                ['category_id', 'product_id'],
                \Magento\Framework\DB\Adapter\AdapterInterface::INDEX_TYPE_COMPOUND_KEY
            ),
            ['category_id', 'product_id'],
            \Magento\Framework\DB\Adapter\AdapterInterface::INDEX_TYPE_COMPOUND_KEY
        );
    }
}
```

Keeping Track

Magento keeps track of the “current” version loaded in the `core_resource` table.

Version number tracked against the `setup_version` supplied in `etc/module.xml` for your extension / for the core module (not composer version)

```
→
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespa
  <module name="Magento_AdminNotification" setup_version="2.0.0">
    <sequence>
      <module name="Magento_Store"/>
    </sequence>
  </module>
</config>
```

```
[mysql> select * from setup_module;
```

module	schema_version	data_version
Magento_AdminGws	2.0.0	2.0.0
Magento_AdminNotification	2.0.0	2.0.0
Magento_AdvancedCatalog	2.0.0	2.0.0
Magento_AdvancedCheckout	2.0.0	2.0.0
Magento_AdvancedPricingImportExport	2.0.0	2.0.0
Magento_AdvancedRule	2.0.0	2.0.0
Magento_AdvancedSalesRule	2.0.0	2.0.0
Magento_AdvancedSearch	2.0.0	2.0.0
Magento_Amqp	2.0.0	2.0.0
Magento_Authorization	2.0.0	2.0.0
Magento_Authorizenet	2.0.0	2.0.0
Magento_Backend	2.0.0	2.0.0
Magento_Backup	2.0.0	2.0.0
Magento_Banner	2.0.0	2.0.0
Magento_BannerCustomerSegment	2.0.0	2.0.0
Magento_Braintree	2.0.0	2.0.0
Magento_Bundle	2.0.2	2.0.2
Magento_BundleImportExport	2.0.0	2.0.0
Magento_BundleSampleData	2.0.0	2.0.0
Magento_BundleStaging	2.0.0	2.0.0
Magento_CacheInvalidate	2.0.0	2.0.0
Magento_Captcha	2.0.0	2.0.0
Magento_Catalog	2.1.3	2.1.3
Magento_CatalogEvent	2.0.1	2.0.1
Magento_CatalogImportExport	2.0.0	2.0.0
Magento_CatalogImportExportStaging	2.0.0	2.0.0
Magento_CatalogInventory	2.0.1	2.0.1
Magento_CatalogInventoryStaging	2.0.0	2.0.0
Magento_CatalogPermissions	2.0.0	2.0.0
Magento_CatalogRule	2.0.1	2.0.1
Magento_CatalogRuleConfigurable	2.0.0	2.0.0
Magento_CatalogRuleSampleData	2.0.0	2.0.0
Magento_CatalogRuleStaging	2.0.0	2.0.0
Magento_CatalogSampleData	2.0.0	2.0.0

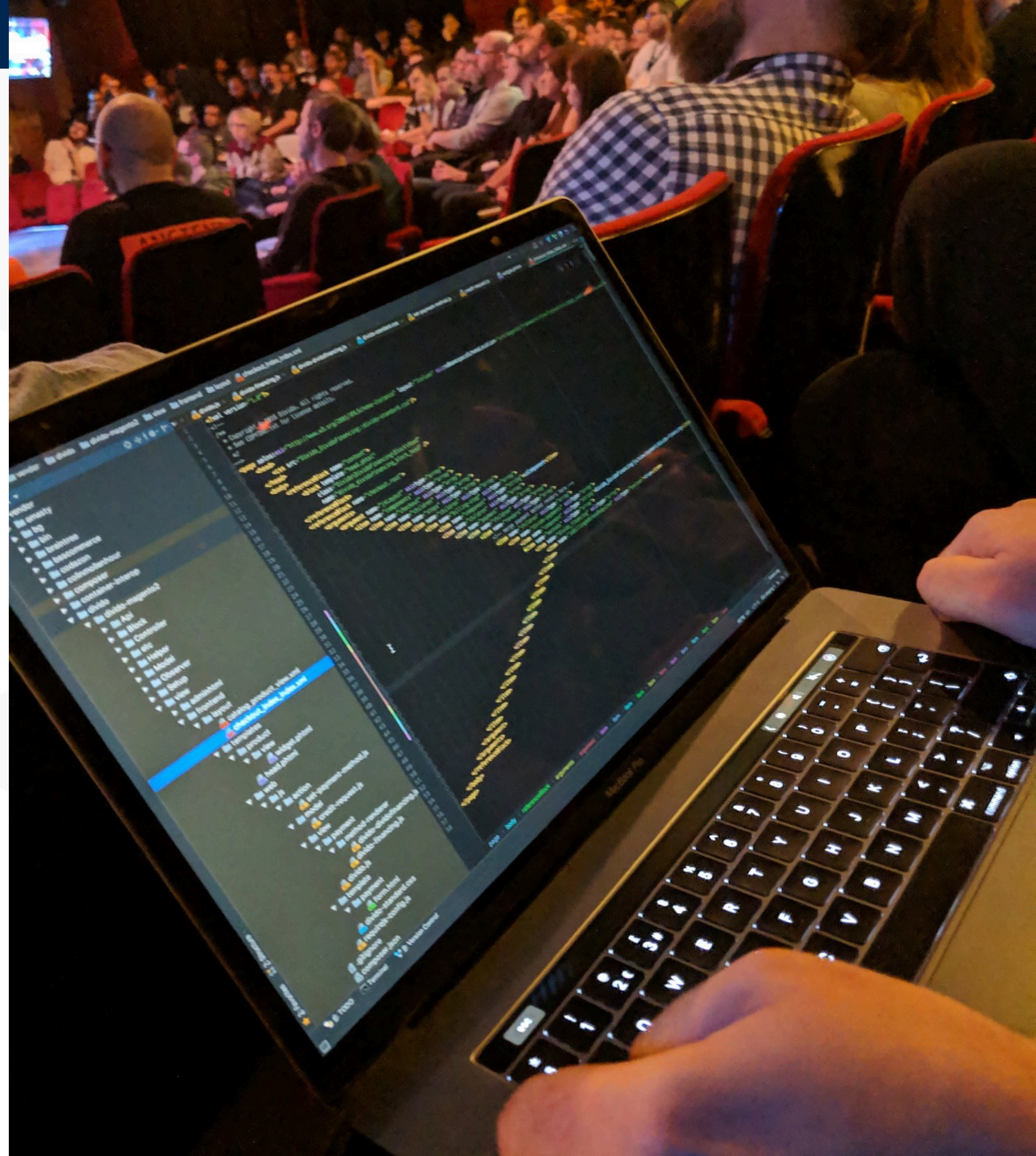
The FUTURE

Structure declarations

Magento has the answer

Everyone knows
that developers

Fucking Love XML



But seriously,
how can structure declarations help?

**Avoids missed or repeated SQL
operations**

Dry-run mode for SQL structure and data

Performance improvements

Database data rollback

Ability to revert to a previous version

Database structure validation before installation

Ability to modify core database structure

**Developers can modify
existing columns**

Show Me


```
<Module_Vendor>/<Module_Name>/etc/db_schema.xml
```

Declares a module's database structure

lib/internal/Magento/Framework/Setup/Declaration/
Schema/etc/schema.xsd

Reference for what a module's
database structure can be

Some Examples

Type:

Created at: 19 Jul 2017 at 18:26:45

Encoding:

Updated at: Not available

Collation:

Number of rows: 511

Data size: 48.0 KiB

Row format: Dynamic

Max data size: 0 B

Avg. row length: 96

Index size: 16.0 KiB

Auto increment: Not available

Free data size: 0 B

Comments:

Create syntax:

```
CREATE TABLE `directory_country_region_name` (  
  `locale` varchar(8) NOT NULL COMMENT 'Locale',  
  `region_id` int(10) unsigned NOT NULL DEFAULT '0' COMMENT 'Region Id',  
  `name` varchar(255) DEFAULT NULL COMMENT 'Region Name',  
  PRIMARY KEY (`locale`,`region_id`),  
  KEY `DIRECTORY_COUNTRY_REGION_NAME_REGION_ID` (`region_id`),  
  CONSTRAINT `DIR_COUNTRY_REGION_NAME_REGION_ID_DIR_COUNTRY_REGION_REGION_ID` FOREIGN KEY (`region_id`)  
  REFERENCES `directory_country_region` (`region_id`) ON DELETE CASCADE  
) ENGINE=InnoDB DEFAULT CHARSET=utf8 COMMENT='Directory Country Region Name';
```

```
<table name="directory_country_region_name" resource="default" engine="innodb"  
comment="Directory Country Region Name">
```

```
</table>
```

```
<table name="directory_country_region_name" resource="default" engine="innodb"  
  comment="Directory Country Region Name">  
  <column xsi:type="varchar" name="locale" nullable="false" length="8" comment="Locale"/>  
  <column xsi:type="int" name="region_id" padding="10" unsigned="true"  
    nullable="false" identity="false" default="0" comment="Region Id"/>  
  <column xsi:type="varchar" name="name" nullable="true" length="255" comment="Region Name"/>  
  
</table>
```

```
<table name="directory_country_region_name" resource="default" engine="innodb"
  comment="Directory Country Region Name">
  <column xsi:type="varchar" name="locale" nullable="false" length="8" comment="Locale"/>
  <column xsi:type="int" name="region_id" padding="10" unsigned="true"
    nullable="false" identity="false" default="0" comment="Region Id"/>
  <column xsi:type="varchar" name="name" nullable="true" length="255" comment="Region Name"/>
  <constraint xsi:type="primary" name="PRIMARY">
    <column name="locale"/>
    <column name="region_id"/>
  </constraint>
</table>
```

```
<table name="directory_country_region_name" resource="default" engine="innodb"
  comment="Directory Country Region Name">
  <column xsi:type="varchar" name="locale" nullable="false" length="8" comment="Locale"/>
  <column xsi:type="int" name="region_id" padding="10" unsigned="true"
    nullable="false" identity="false" default="0" comment="Region Id"/>
  <column xsi:type="varchar" name="name" nullable="true" length="255" comment="Region Name"/>
  <constraint xsi:type="primary" name="PRIMARY">
    <column name="locale"/>
    <column name="region_id"/>
  </constraint>
  <constraint xsi:type="foreign"
    name="DIR_COUNTRY_REGION_NAME_REGION_ID_DIR_COUNTRY_REGION_REGION_ID"
    table="directory_country_region_name" column="region_id"
referenceTable="directory_country_region"
referenceColumn="region_id" onDelete="CASCADE" />

</table>
```



```
<table name="directory_country_region_name" resource="default" engine="innodb"
  comment="Directory Country Region Name">
  <column xsi:type="varchar" name="locale" nullable="false" length="8" comment="Locale"/>
  <column xsi:type="int" name="region_id" padding="10" unsigned="true"
    nullable="false" identity="false" default="0" comment="Region Id"/>
  <column xsi:type="varchar" name="name" nullable="true" length="255" comment="Region Name"/>
  <constraint xsi:type="primary" name="PRIMARY">
    <column name="locale"/>
    <column name="region_id"/>
  </constraint>
  <constraint xsi:type="foreign"
    name="DIR_COUNTRY_REGION_NAME_REGION_ID_DIR_COUNTRY_REGION_REGION_ID"
    table="directory_country_region_name" column="region_id" referenceTable="directory_country_region"
    referenceColumn="region_id" onDelete="CASCADE" />
  <index name="DIRECTORY_COUNTRY_REGION_NAME_REGION_ID" indexType="btree">
    <column name="region_id"/>
  </index>
</table>
```

Perform common database operations

Create a table

```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All
 * See COPYING.txt for license de
 */
-->
<schema xmlns:xsi="http://www.w3.
xsi:noNamespaceSchemaLoca
</schema>

1 1 <?xml version="1.0"?>
2 2 <!--
3 3 /**
4 4 * Copyright © Magento, Inc. All rights reserved.
5 5 * See COPYING.txt for license details.
6 6 */
7 7 -->
8 8 <schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
9 9 xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema/etc/schema.xsd">
10 10 <table name="table_name" resource="default" engine="innodb" comment="Adminnotification Inbox">
11 11 <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="false" identity="true"
12 12 comment="Notification id"/>
13 13 <column xsi:type="int" name="severity" padding="10" unsigned="true" nullable="false" identity="false"
14 14 comment="Notification id"/>
15 15 <column xsi:type="timestamp" name="date_added" on_update="false" nullable="false" default="CURRENT_TIMESTAMP"
16 16 comment="Create date"/>
17 17 <column xsi:type="varchar" name="title" nullable="false" length="255" comment="Title"/>
18 18 <column xsi:type="text" name="description" nullable="true" comment="Description"/>
19 19 <constraint xsi:type="primary" name="PRIMARY">
20 20 <column name="id"/>
21 21 </constraint>
22 22 <index name="INDEX_SEVERITY" indexType="btree">
23 23 <column name="severity"/>
24 24 </index>
25 25 </table>
26 26 </schema>
27
```

Drop a table

```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All rights reserved.
 * See COPYING.txt for license details.
 */
-->
<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/S
  <table name="table_name" resource="default" engine="innodb" comment="Adm
    <column xsi:type="int" name="id" padding="10" unsigned="true" nullab
      comment="Notification id"/>
    <column xsi:type="int" name="severity" padding="10" unsigned="true" :
      comment="Notification id"/>
    <column xsi:type="timestamp" name="date_added" on_update="false" nul
      comment="Create date"/>
    <column xsi:type="varchar" name="title" nullable="false" length="255
    <column xsi:type="text" name="description" nullable="true" comment="
    <constraint xsi:type="primary" name="PRIMARY">
      <column name="id"/>
    </constraint>
    <index name="INDEX_SEVERITY" indexType="btree">
      <column name="severity"/>
    </index>
  </table>
</schema>
```

1	1	<?xml version="1.0"?>
2	2	<!--
3	3	/**
4	4	* Copyright © Magento, Inc. All rights reserved.
5	5	* See COPYING.txt for license details.
6	6	*/
7	7	-->
8	8	<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
9	9	xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/S
10	10	>> </table>
11	11	</schema>
12	12	
13		
14		
15		
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21		
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23		
24		
25		
26		

Create a foreign key

```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All rights reserved.
 * See COPYING.txt for license details.
 */
-->
<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-
  xsi:noNamespaceSchemaLocation="urn:magento:s
  <table name="table_name" resource="default" engi
  <column xsi:type="int" name="id" padding="10
    comment="Notification id"/>
  <column xsi:type="int" name="severity" paddi
    comment="Notification id"/>
  <column xsi:type="timestamp" name="date_adde
    comment="Create date"/>
  <column xsi:type="varchar" name="title" null
  <column xsi:type="text" name="description" n
  <constraint xsi:type="primary" name="PRIMARY"
    <column name="id"/>
  </constraint>
  <index name="INDEX_SEVERITY" indexType="btre
    <column name="severity"/>
  </index>
</table>
</schema>
```



```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All rights reserved.
 * See COPYING.txt for license details.
 */
-->
<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema/etc/schema.xsd">
  <table name="table_name" resource="default" engine="innodb" comment="Adminnotification Inbox">
    <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="false" identity="tru
      comment="Notification id"/>
    <column xsi:type="int" name="severity" padding="10" unsigned="true" nullable="false" identit
      comment="Notification id"/>
    <column xsi:type="timestamp" name="date_added" on_update="false" nullable="false" default="C
      comment="Create date"/>
    <column xsi:type="varchar" name="title" nullable="false" length="255" comment="Title"/>
    <column xsi:type="text" name="description" nullable="true" comment="Description"/>
    <constraint xsi:type="primary" name="PRIMARY">
      <column name="id"/>
    </constraint>
    <constraint xsi:type="foreign" name="FL_ALLOWED_SEVERITIES"
      table="table_name" column="severity" referenceTable="severities"
      referenceColumn="severity_identifier" onDelete="CASCADE"/>
    <index name="INDEX_SEVERITY" indexType="btree">
      <column name="severity"/>
    </index>
  </table>
</schema>
```

Add a column to table

```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All rights reserved.
 * See COPYING.txt for license details.
 */
-->
<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema/etc/schema.xsd">
  <table name="table_name" resource="default" engine="innodb" comment="Adminnotification Inbox">
    <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="false" identity="true"
      comment="Notification id"/>
    <column xsi:type="int" name="severity" padding="10" unsigned="true" nullable="false" identity="false"
      comment="Notification id"/>
    <column xsi:type="timestamp" name="date_added" on_update="false" nullable="false" default="CURRENT_TIMESTAMP"
      comment="Create date"/>
    <column xsi:type="varchar" name="title" nullable="false" length="255" comment="Title"/>
    <column xsi:type="text" name="description" nullable="true" comment="Description"/>
    <constraint xsi:type="primary" name="PRIMARY">
      <column name="id"/>
    </constraint>
  </table>
</schema>
```

1	1	<?xml version="1.0"?>
2	2	<!--
3	3	/**
4	4	* Copyright © Magento, Inc. All rights reserved.
5	5	* See COPYING.txt for license details.
6	6	*/
7	7	-->
8	8	<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
9	9	xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema/etc/schema.xsd">
10	10	<table name="table_name" resource="default" engine="innodb" comment="Adminnotification Inbox">
11	11	<column xsi:type="int" name="id" padding="10" unsigned="true" nullable="false" identity="true"
12	12	comment="Notification id"/>
13	13	<column xsi:type="int" name="severity" padding="10" unsigned="true" nullable="false" identity="false"
14	14	comment="Notification id"/>
15	15	<column xsi:type="timestamp" name="date_added" on_update="false" nullable="false" default="CURRENT_TIMESTAMP"
16	16	comment="Create date"/>
17	17	<column xsi:type="varchar" name="title" nullable="false" length="255" comment="Title"/>
18	18	<column xsi:type="text" name="description" nullable="true" comment="Description"/>
19	19	<constraint xsi:type="primary" name="PRIMARY">
20	20	<column name="id"/>
21	21	</constraint>
22	22	</table>
23	23	</schema>
24	24	
25	25	
26	26	

```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All rights reserved.
 * See COPYING.txt for license details.
 */
-->
<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema/etc/schema.xsd">
  <table name="table_name" resource="default" engine="innodb" comment="Adminnotification Inbox">
    <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="false" identity="true"
      comment="Notification id"/>
    <column xsi:type="int" name="severity" padding="10" unsigned="true" nullable="false" identity="false"
      comment="Notification id"/>
    <column xsi:type="timestamp" name="date_added" on_update="false" nullable="false" default="CURRENT_TIMESTAMP"
      comment="Create date"/>
    <column xsi:type="timestamp" name="date_closed" on_update="false" nullable="true" default="NULL"
      comment="Closed date"/>
    <column xsi:type="varchar" name="title" nullable="false" length="255" comment="Title"/>
    <column xsi:type="text" name="description" nullable="true" comment="Description"/>
    <constraint xsi:type="primary" name="PRIMARY">
      <column name="id"/>
    </constraint>
  </table>
</schema>
```

Drop a column from a table

```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All rights reserved.
 * See COPYING.txt for license details.
 */
-->
<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema"
  <table name="table_name" resource="default" engine="innodb" comment="Adminnot
  <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="f
  comment="Notification id"/>
  <column xsi:type="int" name="severity" padding="10" unsigned="true" nulla
  comment="Notification id"/>
  <column xsi:type="timestamp" name="date_added" on_update="false" nullable
  comment="Create date"/>
  <column xsi:type="timestamp" name="date_closed" on_update="false" nullabl
  comment="Closed date"/>
  <column xsi:type="varchar" name="title" nullable="false" length="255" com
  <column xsi:type="text" name="description" nullable="true" comment="Descr
  <constraint xsi:type="primary" name="PRIMARY">
    <column name="id"/>
  </constraint>
</table>
</schema>
```

1	1	<?xml version="1.0"?>
2	2	<!--
3	3	/**
4	4	* Copyright © Magento, Inc. All rights reserved.
5	5	* See COPYING.txt for license details.
6	6	*/
7	7	-->
8	8	<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
9	9	xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema"
10	10	<table name="table_name" resource="default" engine="innodb" comment="Adminno
11	11	<column xsi:type="int" name="id" padding="10" unsigned="true" nullable="
12	12	comment="Notification id"/>
13	13	<column xsi:type="int" name="severity" padding="10" unsigned="true" null
14	14	comment="Notification id"/>
15	15	<column xsi:type="timestamp" name="date_added" on_update="false" nullabl
16	16	comment="Create date"/>
17	17	<column xsi:type="varchar" name="title" nullable="false" length="255" co
18	18	<column xsi:type="text" name="description" nullable="true" comment="Desc
19	19	<constraint xsi:type="primary" name="PRIMARY">
20	20	<column name="id"/>
21	21	</constraint>
22	22	</table>
23	23	</schema>
24	24	
25	25	

Change the column type

```
<?xml version="1.0"?>
```

```
Copyright © Magento, Inc. All rights reserved.  
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```

```
<table xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema/etc/s  
  table name="table_name" resource="default" engine="innodb" comment="Adminnotificat  
  <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="false"  
    comment="Notification id"/>  
  <column xsi:type="int" name="severity" padding="10" unsigned="true" nullable="f  
    comment="Notification id"/>  
  <column xsi:type="timestamp" name="date_added" on_update="false" nullable="fals  
    comment="Create date"/>  
  <column xsi:type="varchar" name="title" nullable="false" length="255" comment=""  
  <column xsi:type="text" name="description" nullable="true" comment="Description  
  <constraint xsi:type="primary" name="PRIMARY">  
    <column name="id"/>  
  </constraint>  
</table>  
</table>
```

1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
>> 17	17 <<
18	18
19	19
20	20
21	21
22	22
23	23
24	24

```
<?xml version="1.0"?>
```

```
Copyright © Magento, Inc. All rights reserved.  
See COPYING.txt for license details.
```

```
<table xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema/etc/s  
  table name="table_name" resource="default" engine="innodb" comment="Adminnotificat  
  <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="false"  
    comment="Notification id"/>  
  <column xsi:type="int" name="severity" padding="10" unsigned="true" nullable="f  
    comment="Notification id"/>  
  <column xsi:type="timestamp" name="date_added" on_update="false" nullable="fals  
    comment="Create date"/>  
  <column xsi:type="tinytext" name="title" nullable="false" comment="Title"/>  
  <column xsi:type="text" name="description" nullable="true" comment="Description  
  <constraint xsi:type="primary" name="PRIMARY">  
    <column name="id"/>  
  </constraint>  
</table>  
</table>
```


Rename a column

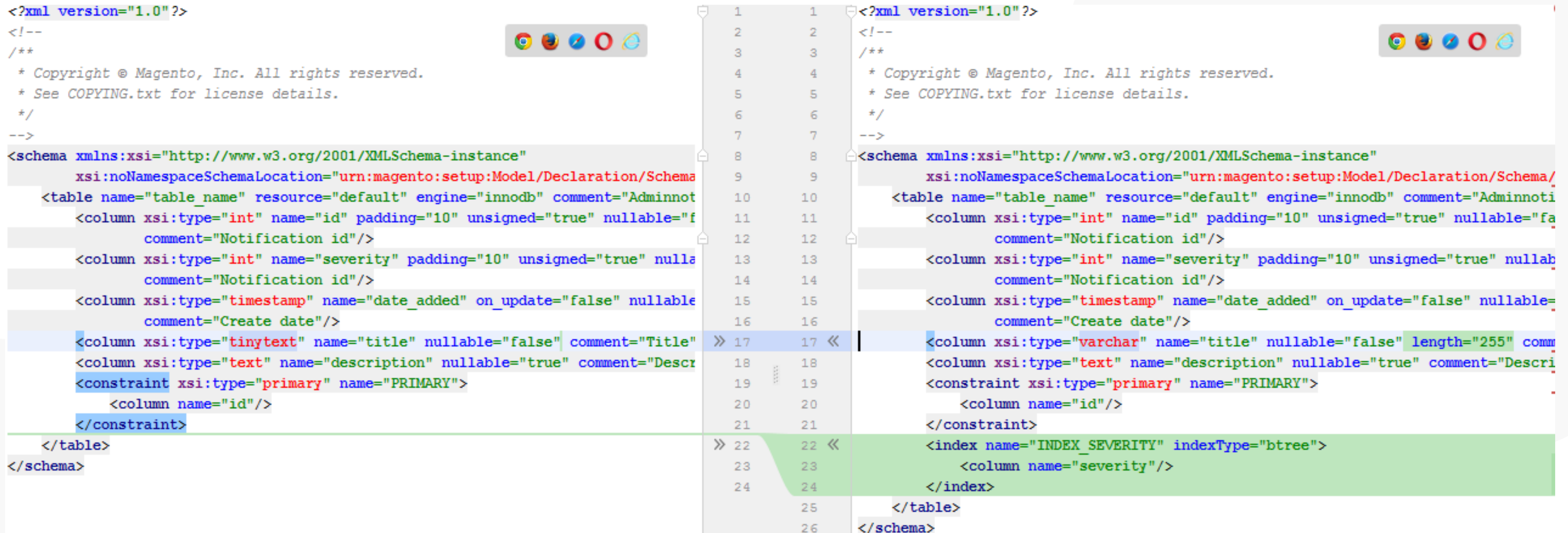
To rename a column, delete the original column and create a new one.

Use

```
onCreate="migrateDataFrom(entity_id)"
```

```
onCreate="migrateDataFromAnotherTable(catalog_category_entity,entity_id)"
```

Add an index



The image shows a side-by-side comparison of two XML schema files. The left window shows the original schema, and the right window shows the modified schema with an index added. The diff tool highlights the changes in green.

```
<?xml version="1.0"?>
<!--
/**
 * Copyright © Magento, Inc. All rights reserved.
 * See COPYING.txt for license details.
 */
-->
<schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="urn:magento:setup:Model/Declaration/Schema"
  <table name="table_name" resource="default" engine="innodb" comment="Adminnoti
    <column xsi:type="int" name="id" padding="10" unsigned="true" nullable="fa
      comment="Notification id"/>
    <column xsi:type="int" name="severity" padding="10" unsigned="true" nullab
      comment="Notification id"/>
    <column xsi:type="timestamp" name="date_added" on_update="false" nullable=
      comment="Create date"/>
    <column xsi:type="tinytext" name="title" nullable="false" comment="Title"
    <column xsi:type="text" name="description" nullable="true" comment="Descri
    <constraint xsi:type="primary" name="PRIMARY">
      <column name="id"/>
    </constraint>
  </table>
</schema>
```

The modified schema on the right includes an additional index definition:

```
<index name="INDEX_SEVERITY" indexType="btree">
  <column name="severity"/>
</index>
```

Things you can't do

Converting to DB Schema

To prepare a module for declarative schema, you must:

Develop a data patch and/or a schema patch

Configure the declarative schema for your module

Convert upgrade scripts to declarative schema- if your module already has upgrade scripts.

Once a module is converted to the declarative schema approach, it cannot be reverted to upgrade scripts.

Magento provides a Schema Listener Tool to convert pre-Magento 2.3 migration scripts into declarative schema

```
magento setup:install --convert-old-scripts=1
```

```
magento setup:upgrade --convert-old-scripts=1
```

The tool supports only DDL operations from
`\Magento\Framework\DB\Adapter\Pdo\Mysql`.

The tool ignores all raw SQL in your `InstallSchema` or
`UpgradeSchema` scripts.

Any DDL statements in a `Recurring` file will not be transferred to the
new schema, because this file should be designed to run during
each installation or upgrade.

Safe Installations

```
magento setup:upgrade --safe-mode  
magento setup:install --safe-mode
```

Rollback

```
setup:upgrade --data-restore
```


Backward Compatibility

Declarative schema does not automatically delete database tables, columns or keys that are not defined in a db_schema.xml

```
<module_vendor>/<module_name>/etc/db_schema_whitelist.json
```

Can be generated with

```
magento setup:db-declaration:generate-whitelist --module-name=MODULENAME
```

JSON Format

We essentially list out all of the elements we've created via XML schema declarations.

```
    "directory_country_region_name": {  
      "column": {  
        "locale": true,  
        "region_id": true,  
        "name": true  
      },  
      "index": {  
        "DIRECTORY_COUNTRY_REGION_NAME_REGION_ID": true  
      },  
      "constraint": {  
        "PRIMARY": true,  
        "DIR_COUNTRY_REGION_NAME_REGION_ID_DIR_COUNTRY_REGION_REGION_ID": true  
      }  
    },  
  },  
},
```

Keeping Track

This is now a lot harder...

Nothing is stored in setup_module anymore as it is state dependant on the db_schema.xml during setup:upgrade.

```
[mysql> select * from setup_module;
```

module	schema_version	data_version
Pinpoint_CarouselManager	1.0.7	1.0.7
Pinpoint_Testing	0.1.0	0.1.0

```
2 rows in set (0.00 sec)
```

Summary

That's all folks

Twitter: @douglasradburn

