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Business Capability Model Development: Utility Archetypes

Abstract

Business capability models are important tools for highlighting the important capabilities that an organization wants to focus on. These models can then be used to perform impact assessments for change initiatives or new technologies. These business impact assessments can help the utility create a ranked list of items in the application portfolio that will need to be addressed, assisting with any roadmap effort. Normally, competitive businesses must generate their own unique business capability models. However, as most utilities are more regulated, in terms of business capabilities, they are often very similar. Therefore, this effort will attempt to create a set of generic business capability models, based on the different utility archetypes, such as electric, gas, generation, transmission, and so on. Providing the enterprise architect practitioner a starting place for creating a business capability model specific to their utility.

Introduction

What is a business capability model? Before answering that question, here is a brief history and "blood lines" for business modeling-description techniques. In the 19th century, business organization charts with named business groups, holding company and owned company ties with operating funds/capital asset diagrams (e.g. railroads, banks) were created and used, some have been scanned and viewable via the web. In late 1800s-into early 1900s with industrialization in high gear, business were focused on increasing productivity, profitability, reducing idle capital equipment/labor, business especially production processing improvements actually became a service industry. "Harmonograms", invented by Karol Adamiecki [1] are credited as being the first diagrams used to help address improving business production. Henry Gantt [2] in 1903 came out with a process, unit of production sequencing chart Gantt chart was documented and popularized in the west (unaware of the harmonograms which in time were also called Gantt charts).

In the 1920s flow charts appeared and in 1950s were PERT and functional flow diagrams. Business Process Modeling was introduced in 1967 [3] but did not become popular until the 1990s [4]. Chris Aitken proposes a way to illustrate the relationships of Business Capability with Business Functions, Services, and Process that is consistent with The Open Group Architecture Framework (TOGAF) 9.1 Content Meta Model [5] In current lingual, business functions get mapped to business processes, and business capabilities get mapped to business services and alternately

TOGAF describes the notion of "Business Capability Management (Figure 1 below), that includes the overlapping processes of architecture development, program management, and operations and business planning.

However, TOGAF does not provide the business capability model, because these are specific to the organization. The organization needs to determine what its capability priorities are. However, two concepts we are leveraging are the concepts of abstraction, and service orientation.

As an example, conceptually a utility can be identified by the commodities they provide to assist in identifying core commonalities and unique services they provide. Table 1 below illustrates this relationship.

To fill this gap, EPRI started with a model originally created within the Utility Communications Architecture Users Group (UCAIUG[1]), and updated it to reflect new needs and capabilities for distribution utilities.

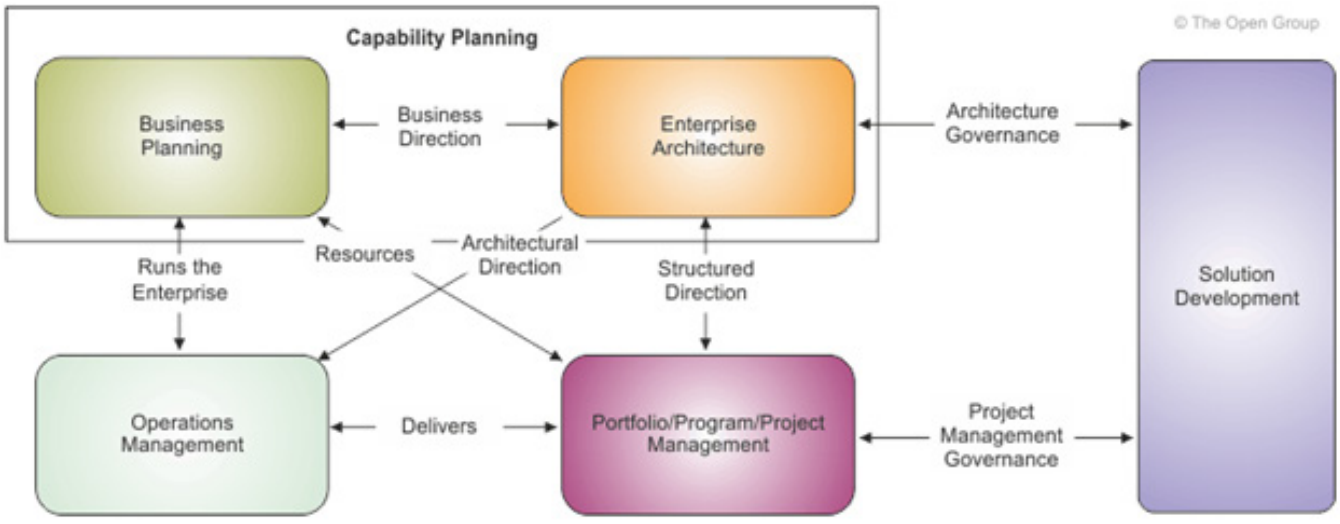

Figure 1. Relationship between Management Frameworks (The Open Group, 2009)

[1] http://www.ucaiug.org

Table 1. Utility Core Commonalities

	Service Commodity					
Level O Service Groups	Electricity	Gas	Water	Telecommunications	Sewer	Chilling/Heat
Generate (source)	Operate generating facilities	Operate refining stations	Operate storage/ reservoirs Operate water treatment plants	Operate communications network	Operate wastewater treatment plants	Operate chilling & heating plants
Transport (deliver and metering)	Operate power grid equipment	Operate gas distribution equipment Manage and operate utility	Operate water distribution network equipment Manage and operate utility metering assets	Operate communications network	Operate sewer system equipment	Operate chilling & heating equipment Manage and operate utility metering assets
Servicing the customer	Develop & manage customer, products & services	Develop & manage customer, products & services	Develop & manage customer, products & services	Develop & manage customer, products & services	Develop & manage customer, products & services	Develop & manage customer, products & services

This generic business capability model is available in the Utility Enterprise Architecture Guidebook [6]. An updated version is shown in Figure 3 below.

While this is a useful model, to assess business capabilities it is more useful to define the services and not common vendor bundling to ensure the true business capabilities are being modelled not IT bundling. For the purposes of

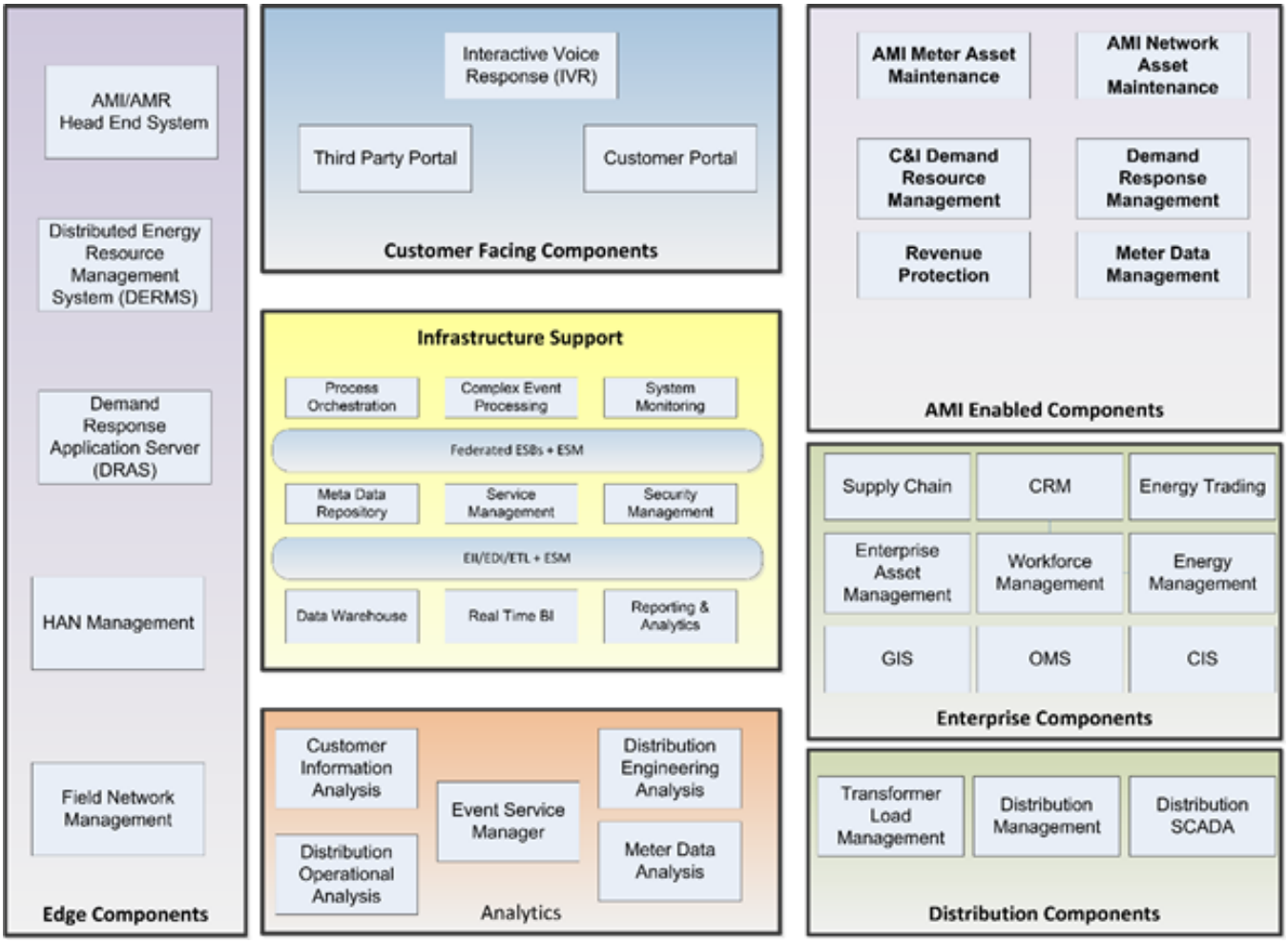

Figure 2. Generic Distribution Utility Business Capability Model

this white paper, we will leverage this diagram, but start with a Logical architectural representation provided in New York Power Authority's Asset Capability Diagram as a basis see Figure 3 below.

The EPRI Enterprise Architecture Collaboration Group will separate out the common conceptual level services: Systems & Market Operations, Generate Power, Maintain & Restore Power, Operate the Grid, Customer Management, (Business) Enterprise Strategy & Planning, Work Execution, Manage Meters & Automation. Then, update these components as needed for the different utility archetypes. Further, utility archetype specific components will be created or updated. For example, for a distribution utility, the Distribution Components, and to a certain extent, the AMI Enabled Components, are unique to distribution utilities (albeit gas and water utilities also use advanced metering so those components will be updated as required).

Finally, with this library of components, the reader will be able to pick and choose the high-level components that best represent their utility, and perhaps substituting in the specific vendor name or local acronyms, that help customize the business capability model to their needs.

Level 0 and Level 1

This white paper distinguishes between Level 0 (highest level capabilities) and Level 1, the next highest capabilities contained within their respective Level 0 "parents". This borrows from the concept of computer-aided software engineering (CASE) [7]. CASE uses the paradigm of decomposing a software from the highest level (0), to successive lower levels until software requirements were considered completely described. For business capability modeling the process will stop at Level 1. If architects want to decompose a capability further, this begins to delve into the "how" of a capability, and an architect would then begin using tools such as ArchiMate to create the associated business and application architectures.

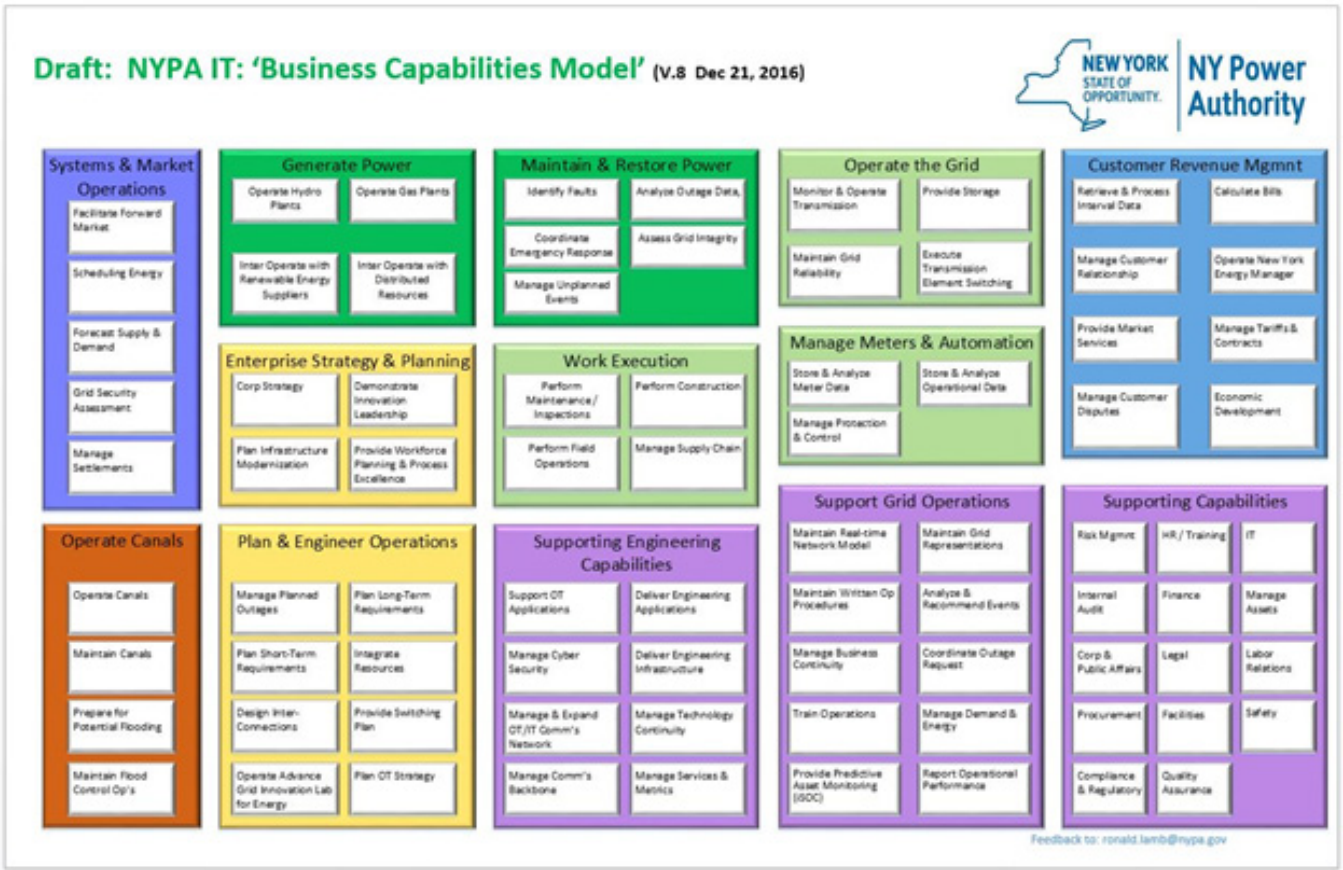

Figure 3. NYPA Business Capability Model

The "Magical" Rule of 7 ± 2

From cognitive science, this is based on the work of George A. Miller, who worked in the Princeton Department of Psychology, that argues that the number of objects an average person can hold in working memory is seven ± 2[2], also known as "Miller's Law". Some User Interface (UI), presentation, and even work group design rules of thumb for sizing, have incorporated Miller's Law well beyond what the original scope of "a limit for the discrimination of unidimensional stimuli (pitches, loudness, brightness, etc) and also a limit for immediate recall, neither of which has anything to do with a person's capacity to comprehend printed text."[3] that Miller admonishes against. Regardless, the 7 ± 2 rule of thumb, is a convenient way for ordering objects such as those being placed in a capability model such as those illustrated in this white paper. These limits help constrain the model from being too "busy". Busy in this case being defined as, more information than the reader can digest at a glance. This constraint has another advantage of limiting the focus of a capability model. Most investor owned utilities have hundreds of applications in their portfolios used to run the business; these provide an even greater number of business services. However, the purpose of the business capability model is not to highlight every application in the portfolio, (an enumeration of these applications if the purpose of the portfolio) it is to be *future looking* (three to five years) and represent where the utility is going to focus its attention. It could be argued that a capability model should not include any support functions, unless the utility is planning on making investments there. If one wanted to decompose a business capability model beyond Level 0 and Level 1, this is where specific applications should be mapped—and not at any higher level.

Once level 0 and 1 capabilities are identified for a specific utility they can be modeled and then be used to set funding priorities, create the corporation's drivers, business organization and processes, and ultimately inform what information technologies are required. To create these capability models, EPRI uses Open Group's enterprise architecture diagramming language: ArchiMate. A cyber security example in Figure 4 illustrates the capabilities and drivers for a specific cyber security use case, New Vendor Remote Access to a Control Device or system. As closely as possible, the Magic rule is applied showing only the capabilities and processes that are directly related to the use case.

In the following sections, some examples of Level 0 and Level 1 business capabilities are provided for different utility archetypes. This list is based in part by contributed artifacts, and prior work such as American Productivity and Quality Center (APQC) Process Control Framework [8] and the National Institute of Standards and Technology (NIST) Conceptual Actors list. However, it is not intended to be exhaustive, but rather, to provide the reader with some examples. For a more exhaustive list, the reader is invited to see the EPRI Business Architecture Service Repository [9] which provides a list of services drawn using the ArchiMate 3 architecture diagramming standard, which has a utility specific list of tasks, from which a business capability model could be based.

In the discussion below there are several capabilities that are shared across all utility types including utility service providers. This is not a complete representation of each type of utility; these represent a sample based upon the APQC capability matrix, and NIST Conceptual Services identified as level 0 capabilities. In this paper, utility firms are identified by a common capability model which describes capabilities shared across all utilities, and the unique capabilities for each type of

[2] *Miller, G. A. (1956). "The magical number seven, plus or minus two: Some limits on our capacity for processing information".* Psychological Review. *63 (2): 81–97. PMID 13310704. doi:10.1037/h0043158.*

[3] *© 2010-2015 Zoltán Gócza and Zoltán Kollin "Myth #23: Choices should always be limited to 7+/-2"* http://uxmyths.com/post/931925744/myth-23-choices-should-always-be-limited-to-seven

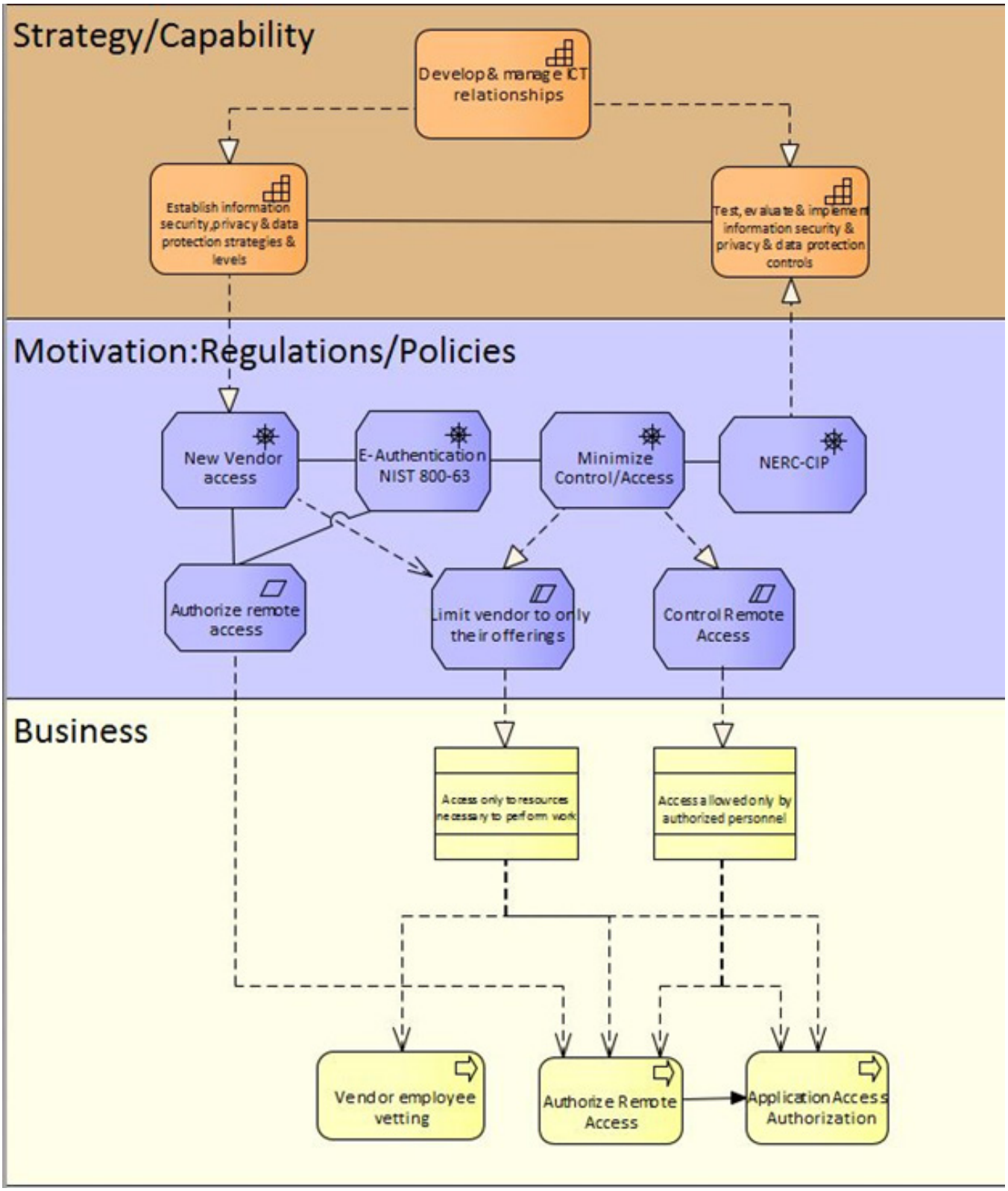

Figure 4. ArchiMate Cyber Security Use Case Capabilities Example

utility. The business models are power distribution, for example, regulated power distribution), water treatment, water delivery, wastewater treatment, gas generation, and service providers such as deregulated distribution companies that rely on a service provider for delivery. In the future other business models may evolve that would change these group capabilities.

Several sources were used to create these utility models. Where an overlap existed, effort was made to consolidate them into a APQC-based category. The various utility models are identified in the legend Figure 5 below.

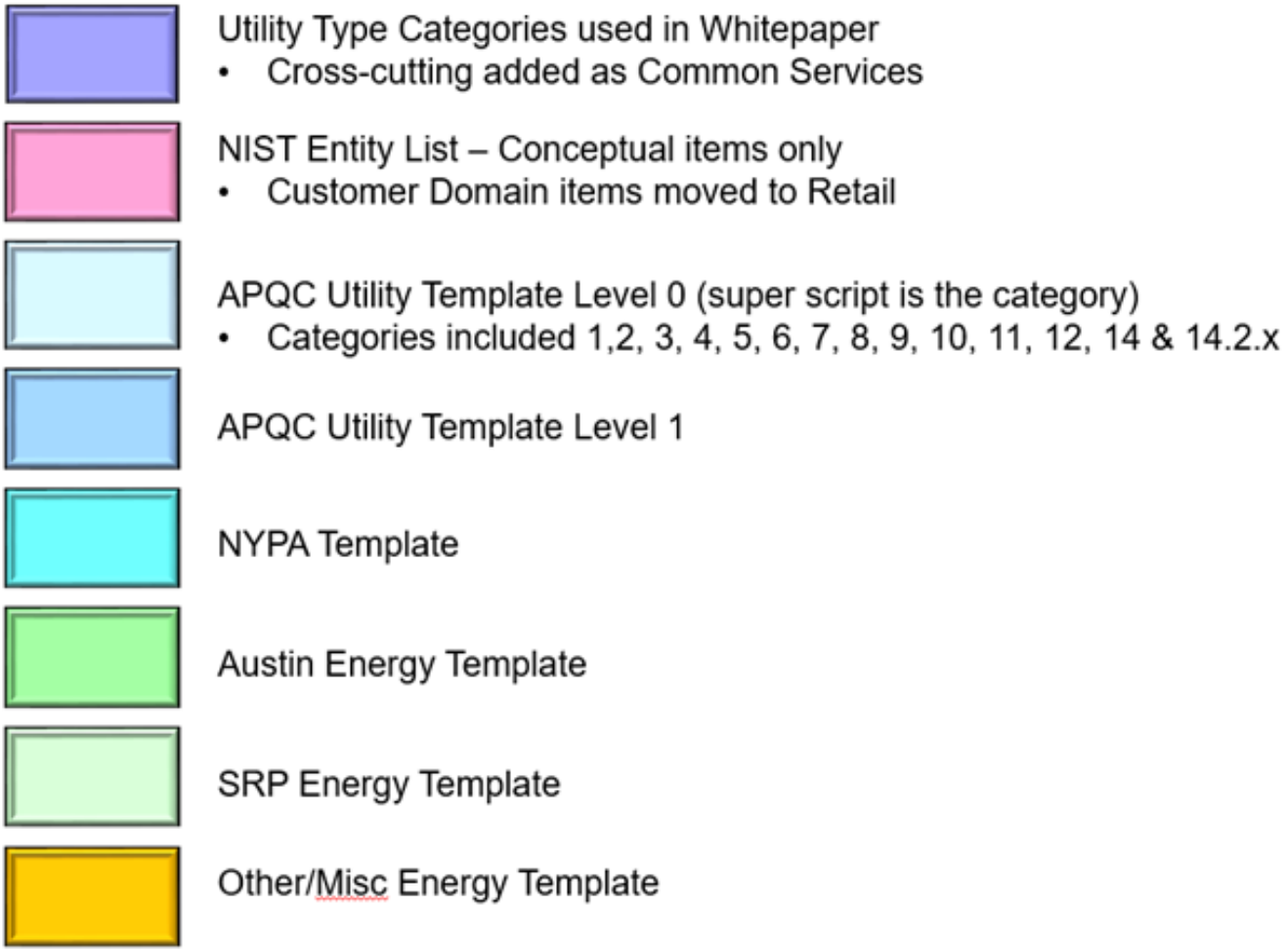

Figure 5. Capability Source

Business Capability Model – Common Components

Common capabilities are specified separately and not duplicated within each business model. Figure 6below outlines common capabilities across all utility type. Since these are level 0 and 1 capabilities, a level 1 capability such as "Acquire, Construct and Manage Assets" could be the physical assets supporting a power grid, gas, water, wastewater or steam distribution network. More detailed level 3 or lower detail brings out unique utility capabilities and drivers which guide business and use case development. For instance,

- Manage Financial Resources 9.0 has at their lower levels Invoice Customer 9.2.2, Manage and Process Collections 9.2.4, and includes further breakdown of the billing/collection processes.
- Manage Resources 5.2, has within it at lower levels, such as capabilities including Managing Deliver Demand 5.2.1, and Resource Planning 5.2.2.

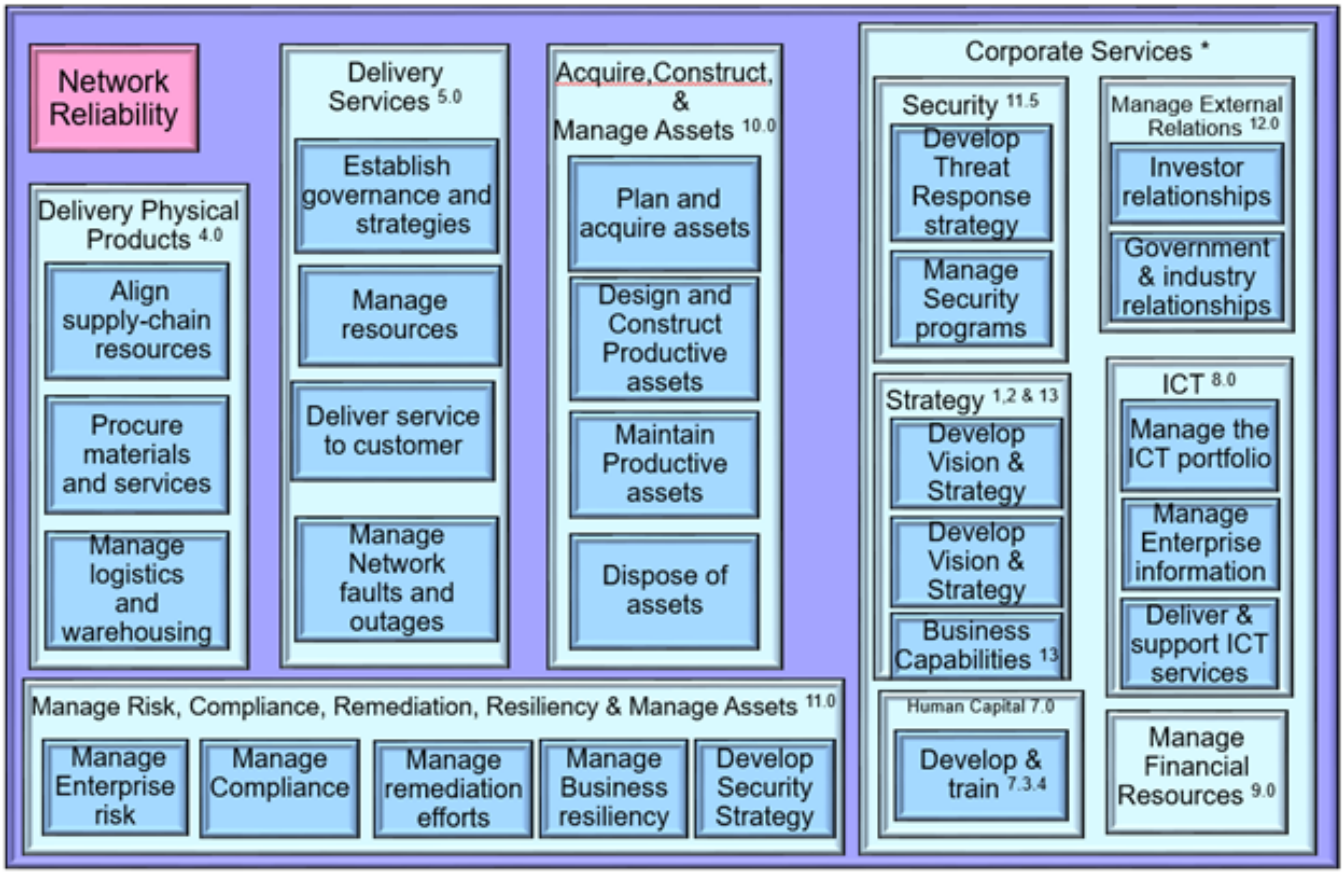

Figure 6. Common Utility Capabilities

Business Capability Model – Transmission

A Transmission utility may be regulated or unregulated, in addition to the Common Capabilities illustrated in Figure 7, their unique APQC capabilities are: Operate Assets is at a level of abstraction that unique operation capabilities are detailed at the more granular lower levels (level 2, 3, etc. within the APQC model). There are unique capabilities not part of the APQC model that were identified by utilities which are included in the Transmission Capability diagram for completeness. These capabilities are color-coded to the Legend in Figure 6 above.

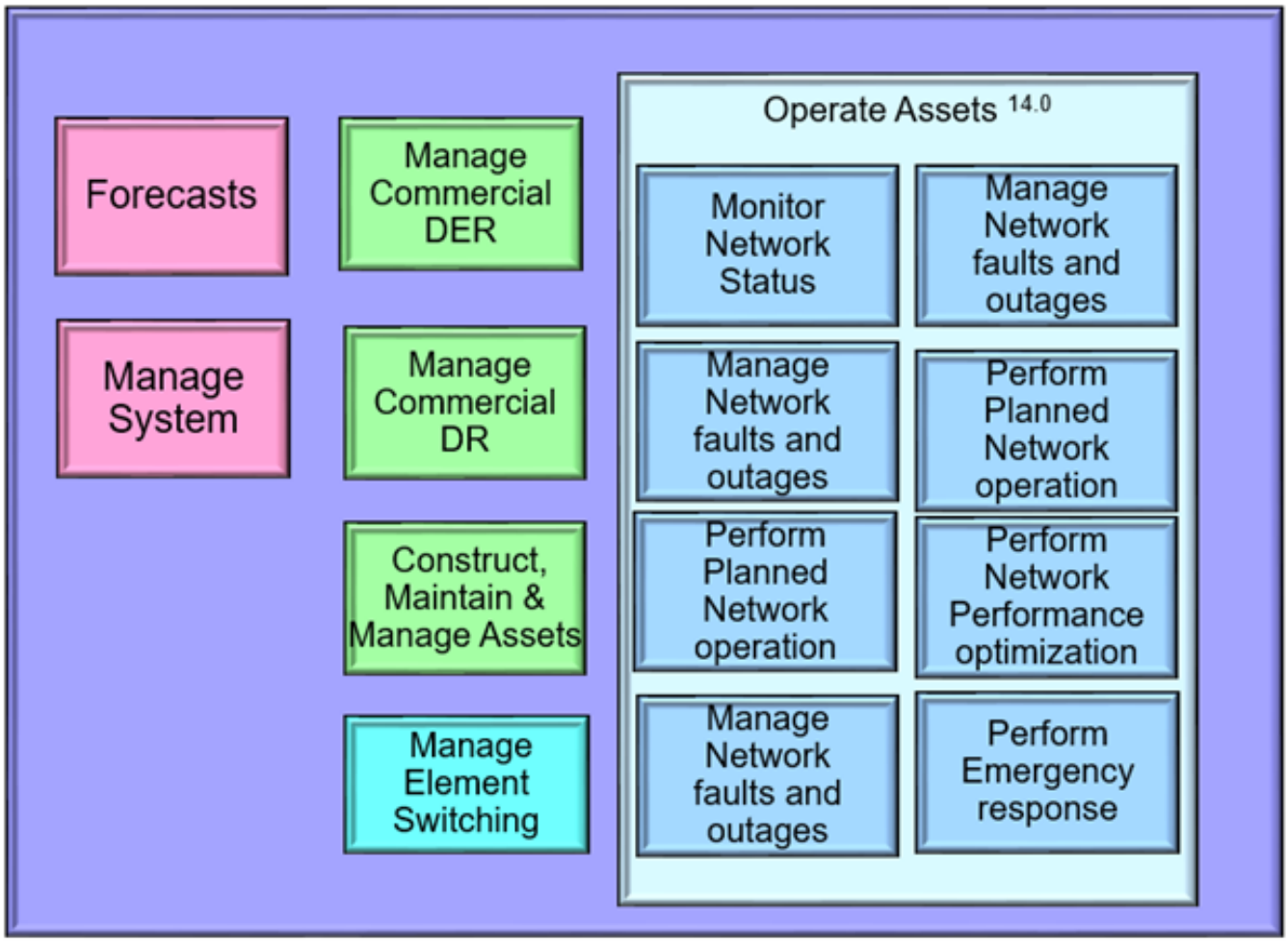

Figure 7. Transmission Business Capabilities

Business Capability Model – Distribution

For this discussion, EPRI assumes this is the "traditional" regulated Distribution company model, un-regulated power distribution companies, are considered a Retail providers and are detailed separately. APQC's model identified several Level 0 and 1 capabilities, in addition to the Common Capabilities illustrated in Figure 7, their unique Level 1 include Operate assets 14.0, Collect and Manage Meter Data 14.3, Manage and Operate Metering Assets 14.4. These level 1 capabilities achieve a good representation for further modelling at more granular level of detail (level 2, 3, etc. within the APQC model). Several other Distribution unique capabilities were identified by the utilities shown in the Legend Figure 6 above, they are included in the Distribution Capability diagramme cover capabilities that are not highlighted in the APQC model.

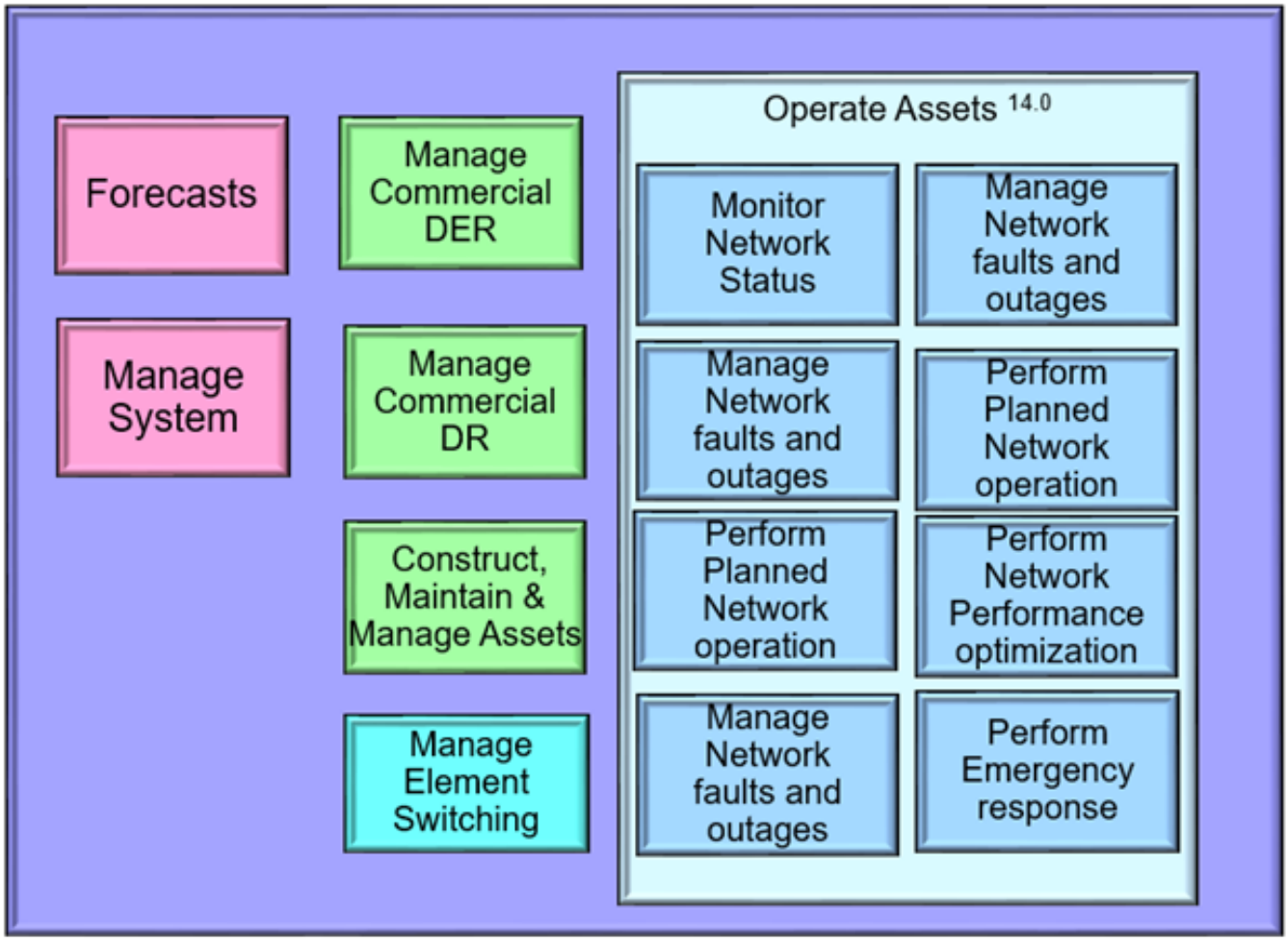

Figure 8. Distribution Business Capabilities

Business Capability Model – Generation

A Generation entity may be regulated or unregulated. Many of the capabilities that affect a Generation utility are covered by Common Capabilities covered above. APQC's Operate generation stations capability is more a level 0 description than level 1, which means more unique capabilities are not illustrated. To aid in adding detail, several other generation unique capabilities are from several utility sources, their source is identified and color-coded in Legend, Figure 6 above. They help provide a better view of appropriate level 1 capabilities. Of note, Generation is not exclusively power generation, but also includes generation capabilities unique to Gas, Water, Wastewater, and Chilling/Heating providers.

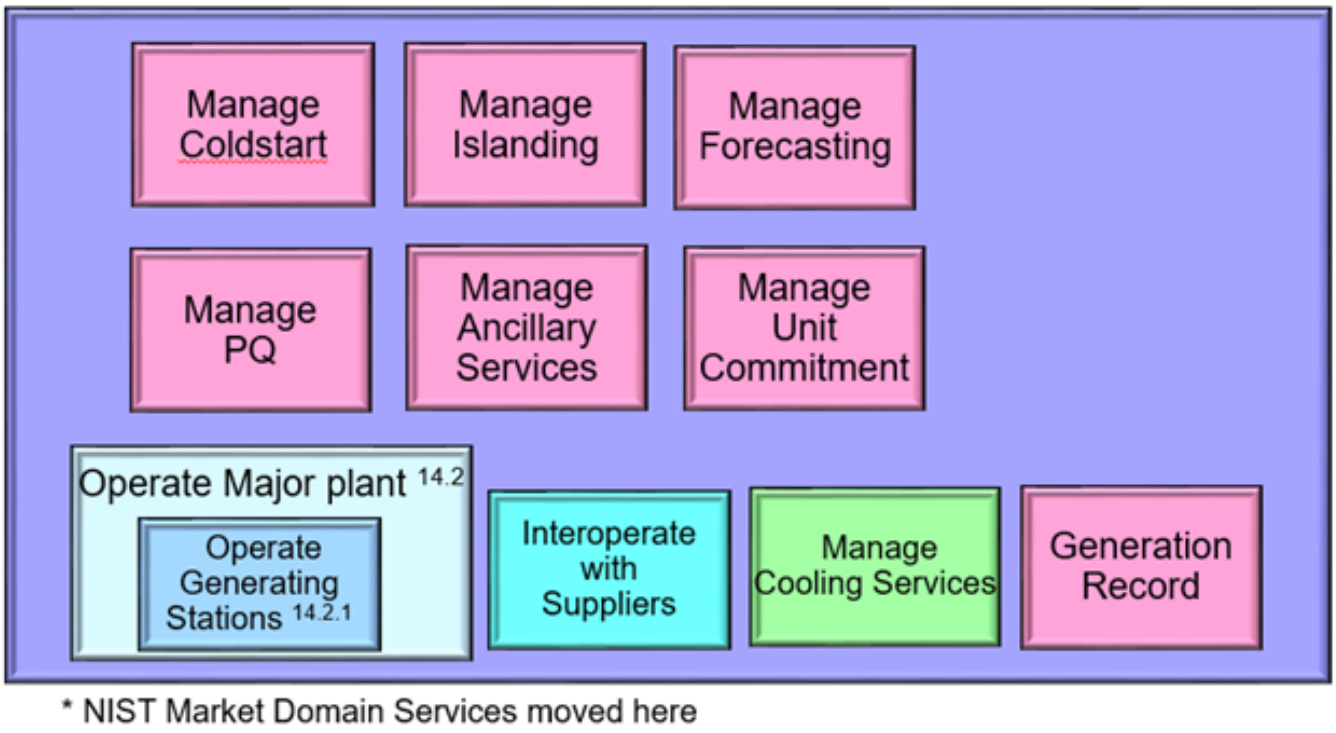

Figure 9. Generation Business Capabilities

Business Capability Model – Gas

If a Gas utility is considered a traditional utility that may have the capability to refine gas, in addition to owning a distribution network, many of the capabilities such as their distribution network are covered by Common Capabilities (APQC 5.1). Unregulated gas companies may fit more into the Retail Service Provider model. APQC's Operate Storage Stations capability is extended using input from several utilities to include two capabilities that are unique to the gas industry: capability to refine gas, and gas production, for example, methane gas.

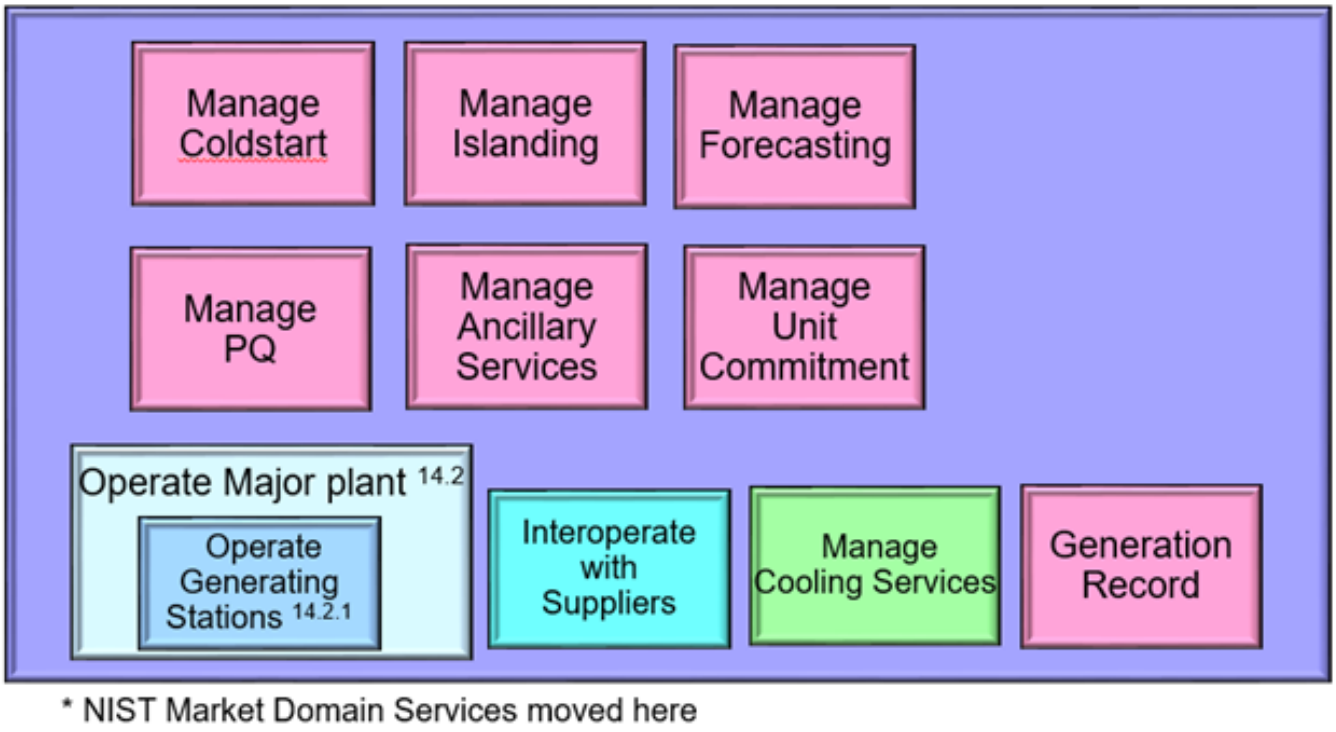

Figure 10. Gas Business Capabilities

Business Capability Model – Water

Salt River Project's (SRP) capability summary provides incremental level 0 and 1 capabilities not found in the APQC utilities matrix. For bulk water treatment providers, there maybe not a delivery system as part of their business. Conversely there maybe instances where retail/regulated does not have water treatment or bulk water purification as part of their business model. Several of SRP's capabilities may be considered level 2.

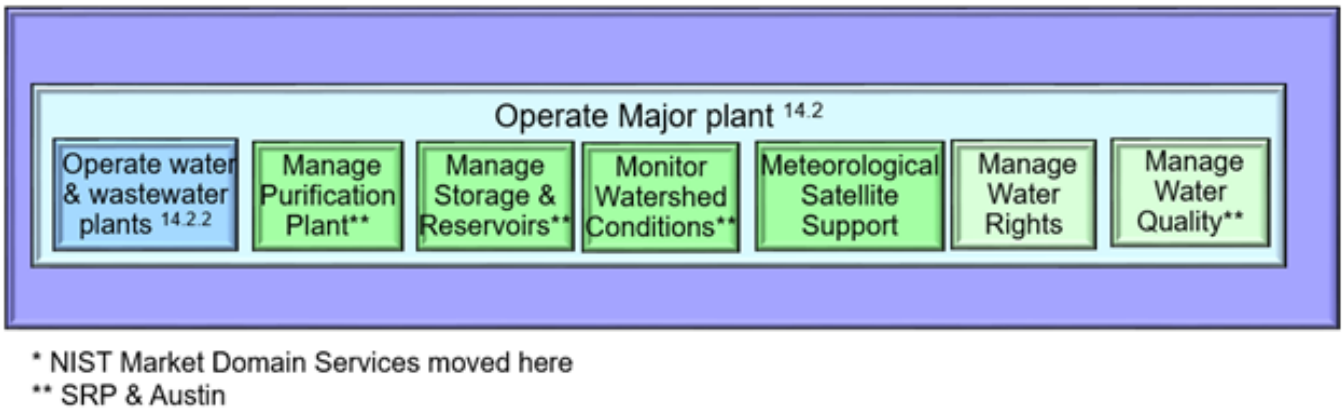

Figure 11. Water Capabilities

Business Capability Model – Retail

Retail companies are generically known as service providers. They provide non-regulated services but may also include offerings usually provided by a regulated utility. Examples include

- A deregulated energy provider using the regulated distribution company's network to deliver their contracted energy.
- They may offer tangential offers such as home energy management.
- An incremental energy related service such as DER aggregation, or demand response programs.

For these reason, several capabilities are in their matrix due to the more unique level 1 offerings that may be present in their portfolio, which needed to be highlighted.

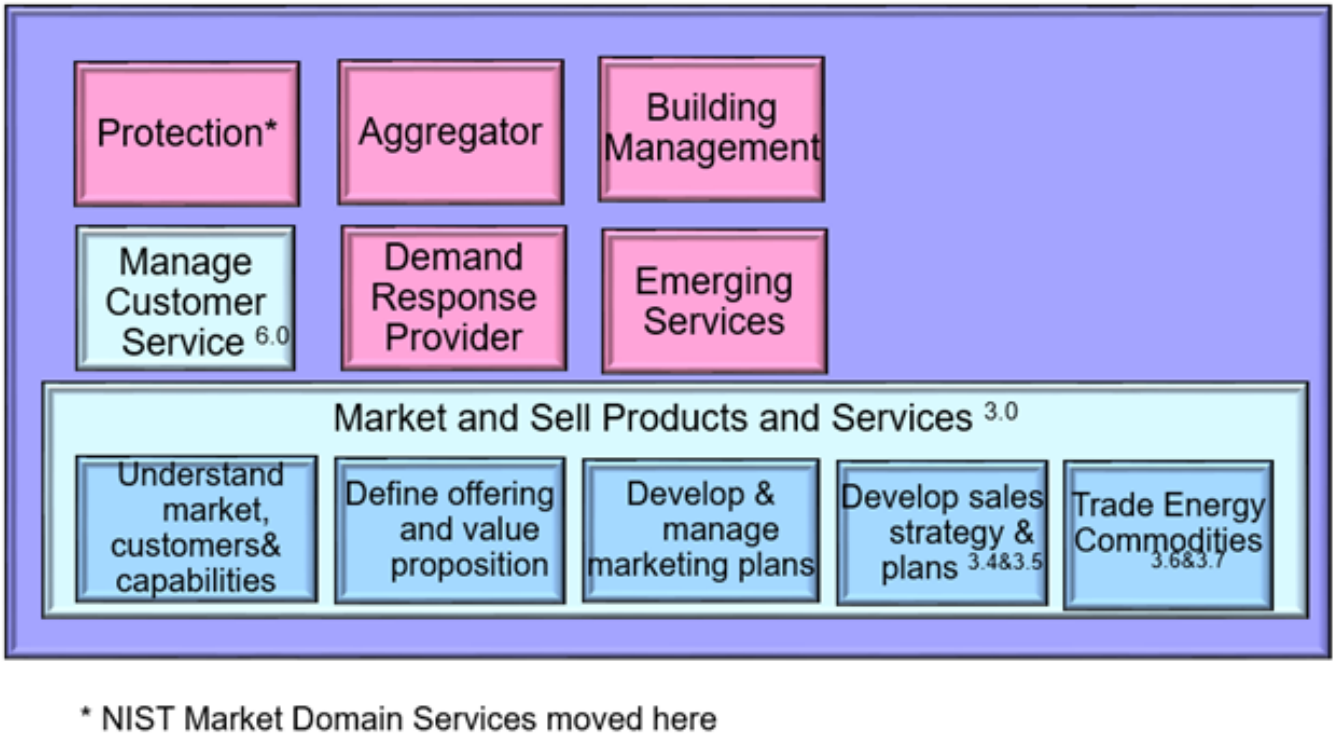

Figure 12. Retail Service Provider Capabilities

Local Application

When using these archetypes to create your own business capability model remember that these examples are not exhaustive or definitive. Feel free to delete, change, or add per the needs of your organization. William Ulrich [10] has a short list of things to keep in mind when selecting elements for inclusion in a business capability model, adapted for this discussion below:

- Determine if a capability is actually a capability because it describes what—not how—something is being done.
- Capabilities set expectations—not necessarily outcomes.
- Make sure a capability is not a process or value stream.
- Capabilities must be clearly defined. This does not occur in the model, but should be referenced. For

example, if a business capability model is built in ArchiMate, then the associated definitions should be included so the viewer can understand what is meant by the name of any given "box".

- Capabilities are unique in terms of intent. If two capabilities seem alike, question their intent. Make sure there is clear understanding about the differences. This goes back to having clear definitions for any given capability.
- Capabilities are framed by their parents. If a name is like another capability, it may mean something else if it is contained in a different Level 0 element.
- Capabilities are unique based on the information they require and use. However, keep in mind some capabilities may work in concert for a business process (again, something that will be modeled at the business architecture level and considered when doing an impact assessment, but *not* modeled in the business capability diagram)
- Capabilities are purely business views of the business. It does not matter if a capability is automated or not. It is a capability if the business can and does have this ability—even if it is weak. Keep the discussion of systems on the sidelines as you go through this exercise. Later, when your capability map has matured, you can begin validating and using it through value stream, organization and IT asset mappings.

Adapted from Ulrich (2016) [ibid]

Summary

Business capability models have traditionally caused some angst among architects. As one of the initial phases, the TOGAF architectural development method calls for a business capability assessment. However, there were limited examples available to see what one looked like or how it might be used. Further, some suggested that since a business capability model should be based on where an organization would make investments and hence, reflect where that organization felt their competitive advantage resided, and should then, not be shared. The difference in the utility industry, being traditionally regulated, is that most utilities, from a capability perspective, look like other utilities. Therefore, having a generic model of business capability, from which a utility could develop their own, does not represent an existential threat.

This has been the reason behind this effort: To arm architects and other stakeholders with some examples to accelerate the development or refinement of their own business capability model. This takes some of the mystery out of the process. Further, business capability models can be used to perform an impact analysis. Any new technology can be evaluated for impacts to the business capability model. This can be used to quickly generate a list of impacted systems. This does not determine what needs to be done with its system—that is another work item. But this helps determine the scope of a technology impact.

This white paper provides a set of "starter" business services based on the different utility archetypes. The architect practitioner can select from this list to quickly get started with their own model, determine additional services that will be the focus of investment, and perhaps, map these to their strategic vendors for execution. If a utility is a water utility, the practitioner could merely start with the water capabilities shown here; if they were a combination gas and electric utility, they could start with those services, and so on, matching service selection to the utility archetype that matches.

References

1. Marsh, E. R. (1974). The Harmonogram of Karol Adamiecki. *Academy of Management Proceedings* (00650668);1974, p32. Conference Proceeding.
2. Gantt, H. L. (1910). "Work, Wages and Profit". *Engineering Magazine*. New York.; republished as Work, Wages and Profits. Easton, Pennsylvania: Hive Publishing Company. 1974. ISBN 0-87960-048-9.
3. Williams, S. (1967) "Business Process Modeling Improves Administrative Control," In: Automation. December, 1967, pp. 44–50
4. Asbjørn Rolstadås (1995). "Business process modelling and re-engineering". in: Performance Management: A Business Process Benchmarking Approach. p. 148–150
5. TOGAF (2009). The Open Group Architecture Framework, Version 9.01. Available [Online]: www.togaf.org
6. Gray, G. R. (2016). Utility Enterprise Architecture Guidebook, 2nd Edition. Electric Power Research Institute (EPRI). Palo Alto, CA. Product ID: 3002007873. Available [Online]: https://www.epri.com/#/pages/product/000000003002007873/
7. Kuhn, D.L (1989). "Selecting and effectively using a computer aided software engineering tool". Annual Westinghouse computer symposium; 6–7 Nov 1989; Pittsburgh, PA (U.S.); DOE Project
8. APQC's Process Classification Framework® , https://www.apqc.org/pcf
9. Utility Business Architecture Service Repository. Electric Power Research Institute (EPRI). Palo Alto, CA. Product ID: 3002011054. Available [Online]: https://www.epri.com/#/pages/product/000000003002011054/
10. Ulrich, W. (2016, August 1). Defining the Business Capability – A Cheat Sheet. Available [Online]: http://www.bainstitute.org/resources/articles/defining-business-capability-cheat-sheet

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3002009987 December 2017

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