Basic System Property: $_{atis}$BasicProperties

(*Basic system properties* are those properties that are part of the theory and describe the basic components of a system.)

Basic Properties:

The ***Basic Properties*** of a system define the initial attributes required to identify and analyze a system. They are basic to the concept of *system*, $\mathbb{S}$; that is, they are the *system object-set* and *system relation-set*.

We will make explicit the formal definitions of *system object-set*, $\mathbb{S}_{\mathsf{O}}$, and *system relation-set*, $\mathbb{S}_{\phi}$.

DEFINITION: System object-set, $\mathbb{S}_{\mathsf{O}}$, $=_{\mathrm{df}}$ A set with at least two components within the universe of discourse.

$$\mathbb{S}_{\mathsf{O}} =_{\mathrm{df}} \{x \mid x \in \mathfrak{S} \in \mathcal{U}\} \wedge |\mathfrak{S}| > 1$$

In this definition, '$=_{\mathrm{df}}$' is to be read "is defined as," '$\mathcal{U}$' is the universe of discourse, '$\mathfrak{S}$' is an object-set of $\mathcal{U}$, and '$|\mathfrak{S}|$' is the set-cardinality function.

For example, for educational systems, $\mathbb{S}_{\mathsf{O}}$ consists of *students*, *teachers*, *administrators*, *instructional materials*, *volunteer personnel*, *community support personnel*, and any other community-based or school-based personnel or materials required for the educational system.

The above list indicates the great complexity of a school system, and other systems with which we are concerned. Yet, such systems are manageable. It is the purpose of general systems theory to describe how to manage a system by predicting what will happen under varying conditions.

DEFINITION: System relation-set, $\mathbb{S}_{\phi}$, $=_{\mathrm{df}}$ A non-empty set of ordered pairs of components from the object-set.

$$\mathbb{S}_{\phi} =_{\mathrm{df}} \{(x,y) \mid \exists x,y(x \in \mathbb{S}_{\mathsf{O}x} \wedge y \in \mathbb{S}_{\mathsf{O}y})\}$$

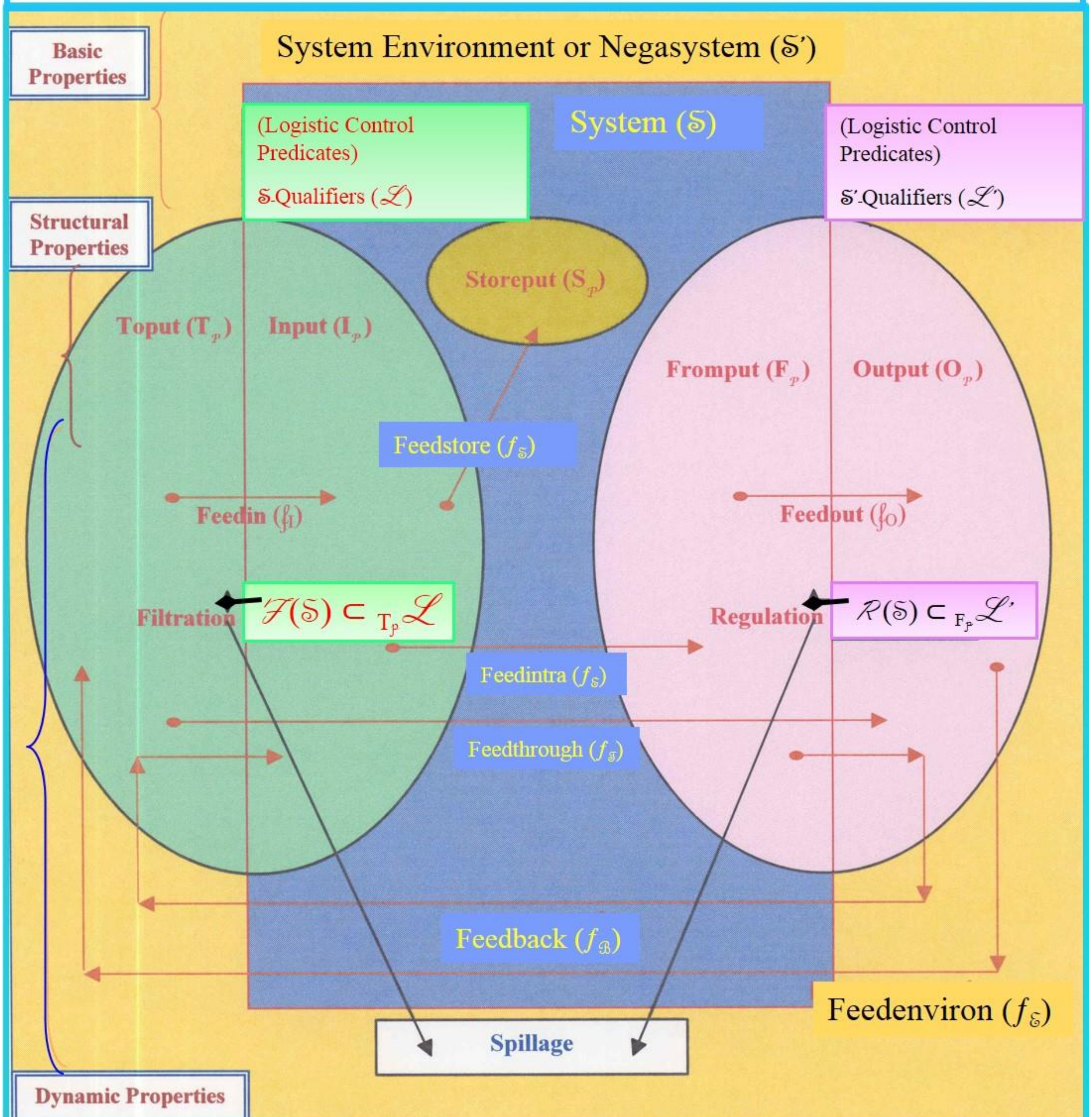
'$\mathbb{S}_{\mathsf{O}x}$' and '$\mathbb{S}_{\mathsf{O}y}$' identify the specific *object-sets* of $\mathcal{U}$ that contain x and y, respectively. $\mathbb{S}_{\mathsf{O}x}$ and $\mathbb{S}_{\mathsf{O}y}$ are not necessarily disjoint.

For example, for educational systems, $\mathbb{S}_{\phi}$ consists of *students learn from textbooks*, *teachers instruct students*, *administrators control student-enrollment*, *school security personnel protect students*, and any other community-based or school-based affect relations required for the educational system.

The following diagram of a *system*, $\mathbb{S}_{\mathsf{O}}$, and its *negasystem*, $\mathbb{S}'_{\mathsf{O}}$, within a universe of discourse will help to put the components of a system and their relations into perspective. As this report is restricted to those considerations required to define *general system*, it will be restricted to defining and considering the various concepts indicated in the diagram below.

Diagram of System Properties

Universe of Discourse ($\mathscr{U}$) $\mathcal{G} =_{df} (\mathcal{A}, \mathcal{P}, \mathcal{Q}, \mathcal{T}, \mathscr{T}, \sigma)$ [1,2]



[1] $\mathcal{G}$ is the *General System*, $\mathcal{A}$ is the *Family of Affect Relations Set*, $\mathcal{P}$ is the *Object Partitioning Set*, $\mathcal{Q}$ is the *Qualifier Set*, $\mathcal{T}$ is a *Transition Functions Set*, $\mathscr{T}$ is a *Linearly-Ordered Time Set*, and σ is the *System State Transition Function*.

[2] $\mathcal{A}_1, \mathcal{A}_2, \ldots, \mathcal{A}_n \in \mathcal{A}$; $T_p, I_p, F_p, O_p, S_p, L_p, \mathbb{S}_{BX}, \mathbb{S}'_{BY} \in \mathcal{P}$; $\mathscr{L}, \mathscr{L}' \in \mathcal{Q}$;

$f_\mathfrak{I}, f_\mathfrak{O}, f_\mathfrak{T}, f_\mathfrak{B}, f_\mathfrak{E}, f_\mathfrak{S} \in \mathcal{T}$; and $t_1, t_2, \ldots, t_k \in \mathscr{T}$.