AEROSPACE
Assuring Space Mission Success

Welcome

A Modest Proposal to Transition from Stovepipes to an Enterprise

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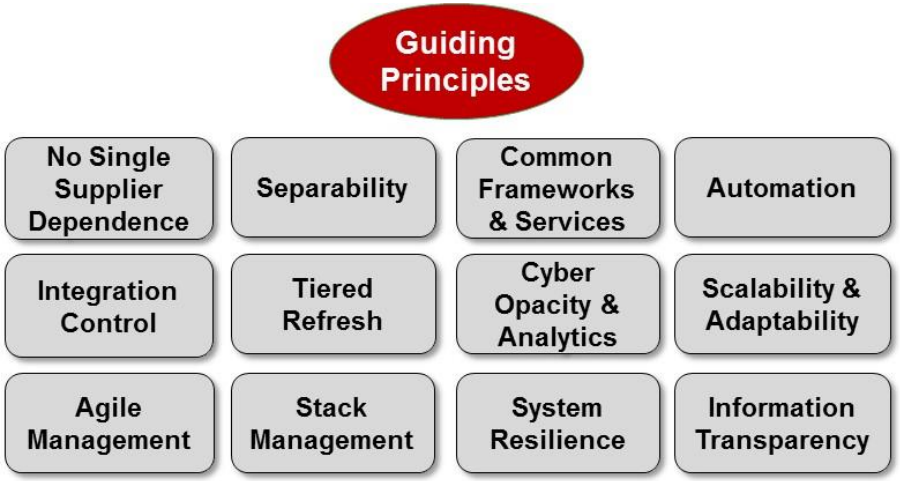
Purpose

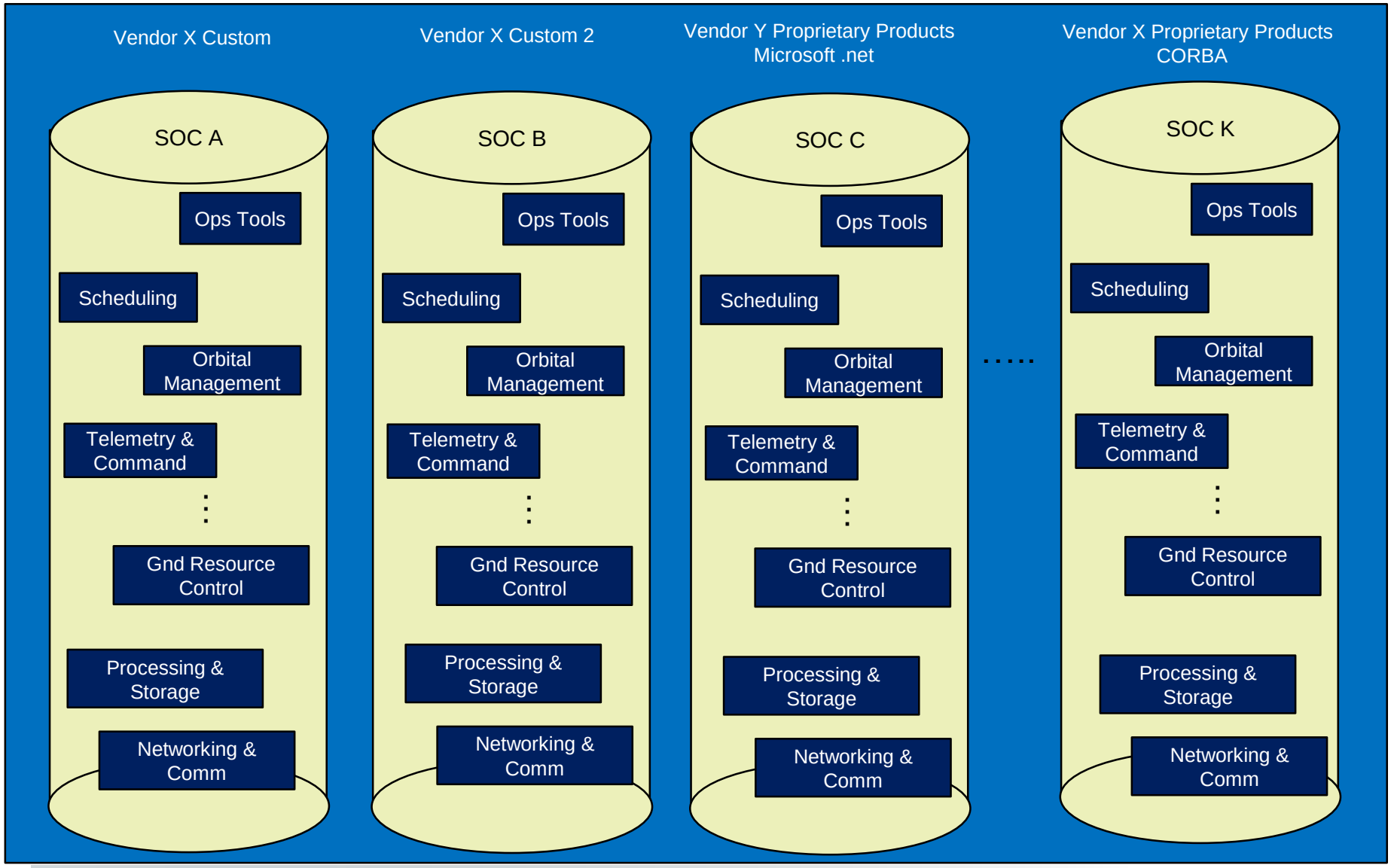
- Present current architecture and possible future enterprise alternatives for satellite telemetry, tracking & commanding (TT&C) as well as mission planning
  - *General framework approach may be applicable to mission (payload) data processing – but probably a different framework*

- Present an implementable reference transition plan for telemetry & command systems
  - *Initially leverages existing systems as currently constituted & funding lines*
  - *Adheres to the "12 Guiding Principles"**



*Graphic and term taken from TOR-2015-00801, "*Framework for an Affordable and Resilient Satellite Ground Enterprise for National Security Space Missions", The Aerospace Corporation*

Legacy Situation – Mission "Stovepipes"



Systems individually procured to fulfill a specific mission - each having their own infrastructure

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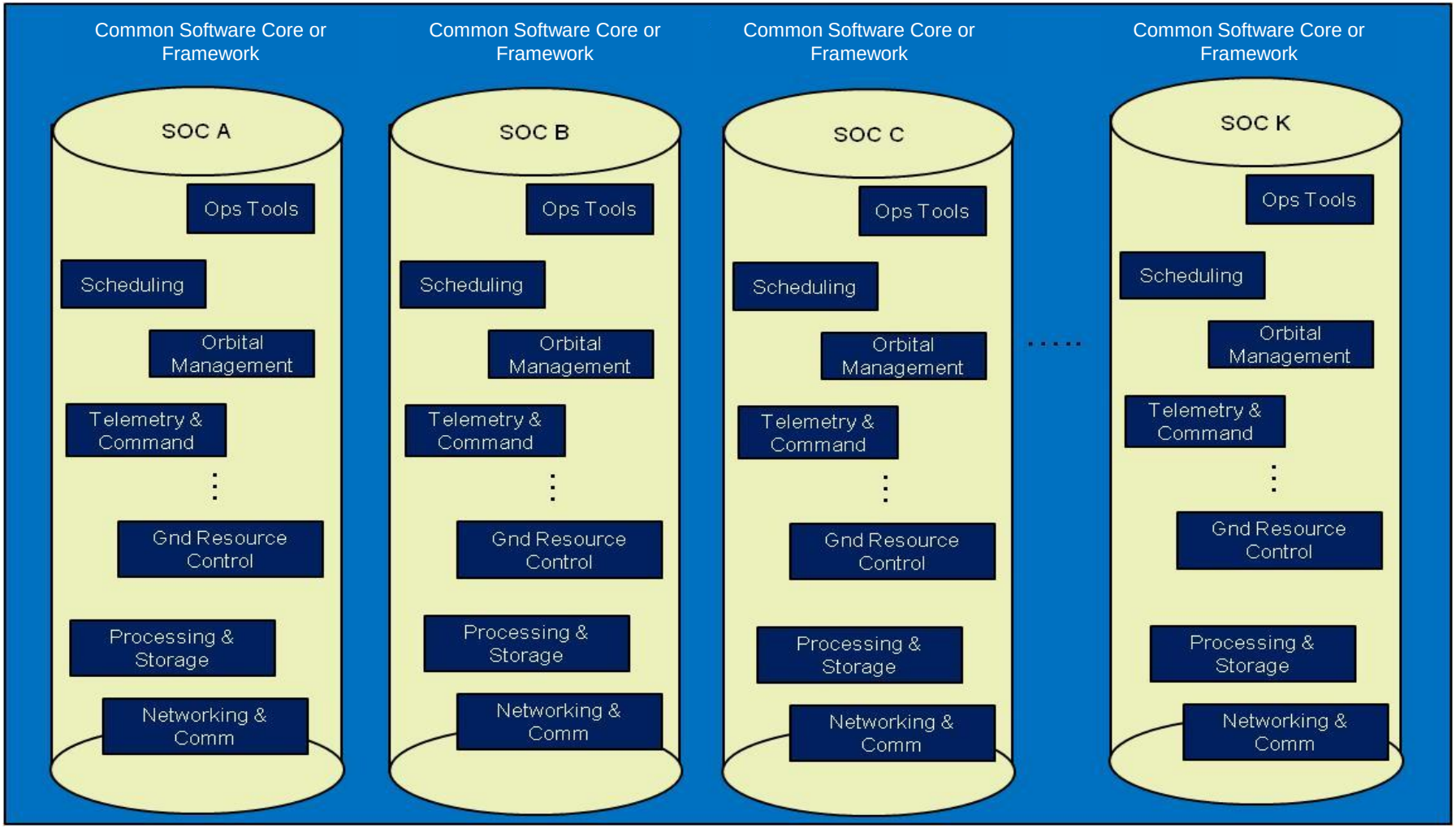
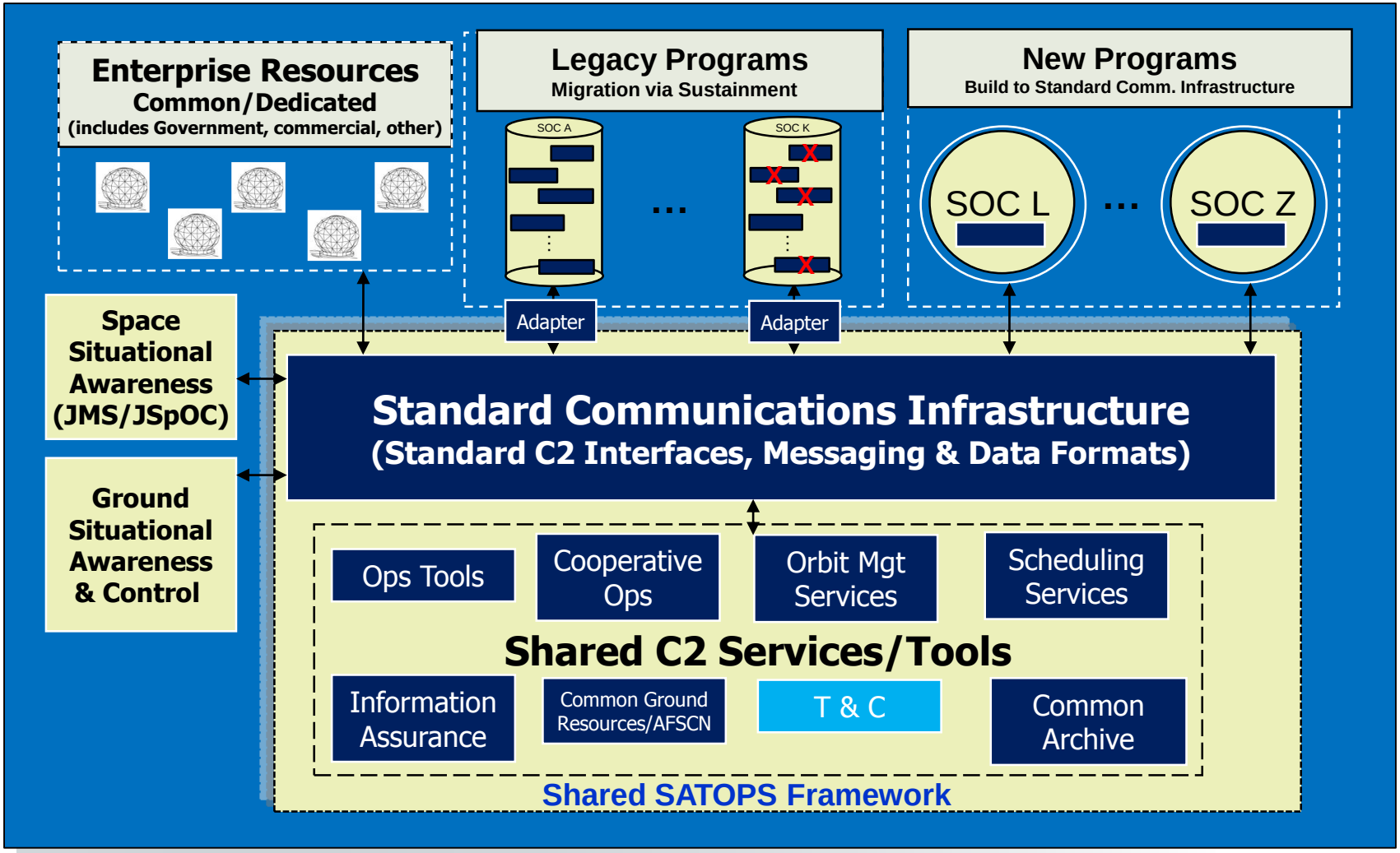
Option 1 – Common Stovepipes



- Common software core or framework used across all programs
- Programs responsible for Mission Unique Software (MUS)
- No data sharing

Eases training across programs, possibly lower development costs. Cross program configuration management may be difficult, risky transition, high cost legacy transition if common core is used

Option 2 & 2A – Compatible Open Framework with Shared Services



Programs transition to use of common infrastructure and core services while choosing other mission unique components (2A includes a single shared T&C service). Selected data can be shared across the enterprise.

Endstate Vision is Driven by Cultural Change

- Barriers to enterprise transition are not technical & not necessarily fiscal – they are cultural
  - *The use and advantages of enterprise frameworks has been demonstrated*

- Requires an Enterprise Perspective
  - *Stovepipe view is still required but balanced with an enterprise perspective at an appropriate level*
    - Programs can focus on mission unique elements - can leverage the Enterprise for shared services
  - *Consistent application & implementation of standard products within and **across** programs is required for maximum enterprise benefit*
    - From experience, Contractor implementations will vary if left to themselves – need enterprise-wide "guidance" and governance
  - *May require organizational changes - both structure and personnel – to represent enterprise interests*

- Requires Procurement Paradigm Shifts
  - *Change from a fully defined endstate to a vision*
    - Vision will be adjusted periodically to match needs
    - Can start now!
  - *Shift to agile acquisition practices*
    - Rapid procurement of components (services) vs a long term turnkey monolithic procurement
  - *Transition to procuring open systems as opposed to unique proprietary solutions*

It requires time and active, sustained senior leadership attention to affect necessary changes required for success

Path to Transition

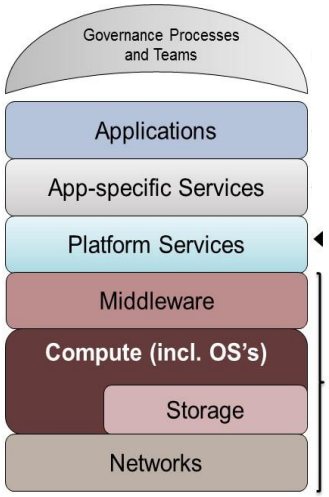
- Step 1: Start three efforts to develop a common IT stack, common mission framework, & enterprise definition
  - ***Key decision:*** *Senior leadership determines functional vision (Option 1, Option 2 or variant thereof) commensurate with the level of cultural change they are willing to make*
    - Earlier the better
    - These efforts can be started without this decision
- Step 2: Review and adjust efforts started in Step 1 to align with the Vision
  - *Determine business model (governance) and transition method/schedule for each effort in accordance with the Vision and budget*
    - Can use each program's planned sustainment to migrate into the Vision
- Step 3: Mandated implementation

A Vision is needed but work can begin at any time

Effort 1 – Establish an IT “Stack”

- Adopt stack/template/”recipe” (includes virtualization schema) for use across programs
  - *Coordinate with Stakeholders*
  - *Determine business and procurement models*
    - Give it to the Contractors (consistency by chance)
    - Group that defined the stack advises programs/Contractors (better consistency)
    - Single entity to govern all implementations (best opportunity for consistency)
  - *Prototype the stack in relevant environments*
- Implement the stack - perhaps on each program’s next recap cycle

The “Stack”*



Owned/managed by the ground enterprise organization – lots of inputs and sometimes contributions from programs.

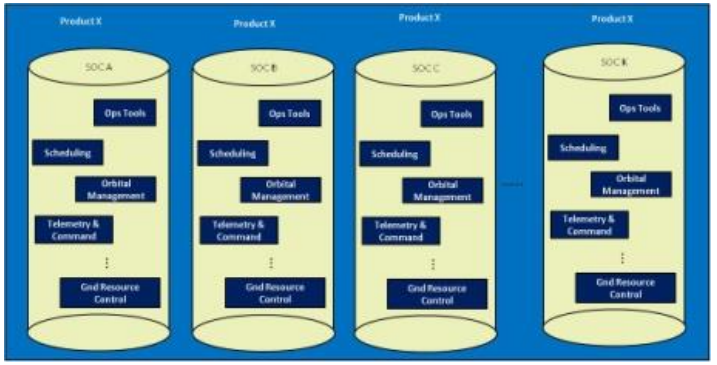
Defined and sustained by a ground enterprise organization for use by all

* Graphic and graphic text courtesy of Dr. Eric Dashofy, The Aerospace Corporation

Effort 2 – Common Framework for Use within Stovepipes

- Adopt/Customize framework
  - *Determine business and governance model in accordance with the Vision*
  - *Develop a few shared services*
  - *Develop & maintain vendor catalog and project archive of compatible services and products*
  - *Prototype the framework*
- Migrate programs to framework at their next recap cycle
  - *Programs can initially just write an adapter for their existing system to share data* ***or***
  - *Deconstruct their existing system into services and integrate them back together using the framework which poises them to use shared services* ***or***
  - *Programs select which COTS/GOTS/FOSS products best fit requirements/budget that are framework compliant and design a new system that does all of the above*

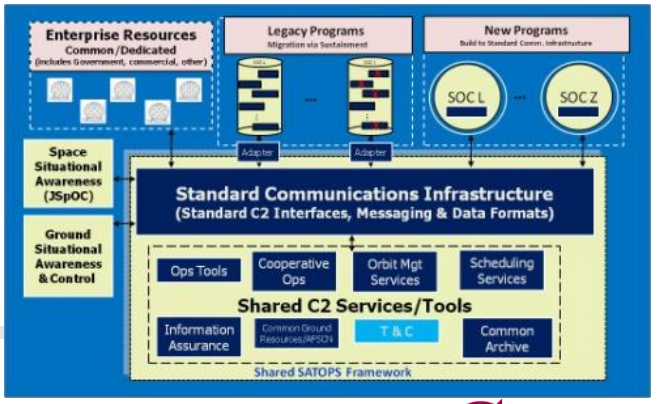
Possible Endstate: Stovepipes based on a common framework



Effort 3: Enterprise Definition & Infrastructure Development

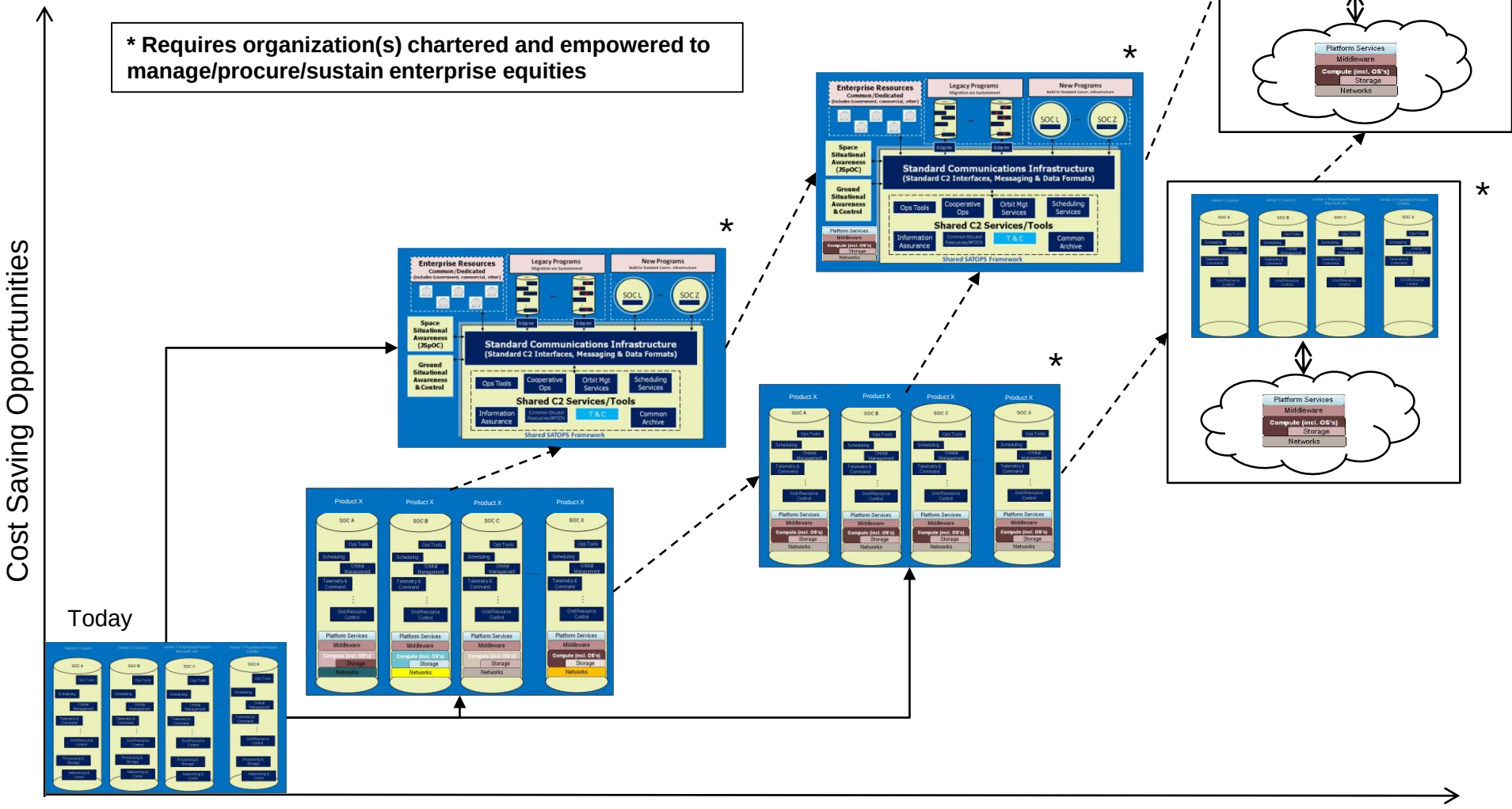
- Define the enterprise and participant roles & responsibilities
- Adopt framework defined & prototyped in Effort 2 for use across enterprise
- Develop a “data strategy” that would include architecture, transition plan, CONOPS and schedule
  - *Determine what data types should be exposed from every program*
  - *Decide which enterprise shared services should be initially deployed*
    - These services can also be developed as part of Effort #2
- Define the IA schema
- Specify and implement an ***enterprise*** archival (and possibly processing) infrastructure
  - *Archive can be used by those outside the enterprise to access data – strengthens the IA posture of all programs*
- Mandate all programs take advantage of available shared services as they become available
  - *“Retire” local code in favor of enterprise services or get a waiver*

Possible Endstate: Compatible services based framework using a shared processing and archival infrastructure



Many Possible Endstates Dependent on Vision

*** Requires organization(s) chartered and empowered to manage/procure/sustain enterprise equities**



Vision can change with little to no breakage. Efforts could stop anywhere and the enterprise and programs would enjoy more opportunities than today

Summary

- Use of frameworks can bring benefits to Space programs
- Leadership needs to select future reference architecture vision (Option 1, 2 or a variant) which will be dependent on leadership push for change
  - *Even this decision is not required to begin work but should be made as early as possible to focus planning & development efforts*
- Endstates or even Visions do not require full definition from the beginning
- Each effort independently yields benefits of its own for those that adopt
  - *Amenable to budgetary ebbs and flows as well as changes in leadership vision*
- For the most part the efforts are separable and can be terminated if vision changes with minimal, if any, breakage

A Vision is required but work can be started now at low risk