

Learning to Drive a CAR at the U.S. Census Bureau

A simple black outline of a car, viewed from the side, positioned behind the main title text.

**Capability, Agility & Resilience
in **Software/Systems Solution Development****

March 22, 2017

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Information Technology and Deputy CIO**

Road Trip

- Why a CAR?
- The Census Enterprise Data Collection and Processing (CEDCaP) Journey
- Planning for the Trip
- Making the Trip
- Did We Arrive Safely?
- Ready to Go Again?

Why a CAR?

- A means to transport you from a current place (“As Is”) to a desired place (“To Be”)
- Capability - Know where you want to go
- Agility - Understand that there may be multiple ways to get there, and that you want to have checkpoints along the way to make sure you are on the right course
- Resilience - Realize that you may hit road bumps or road blocks - things may change or go wrong along the way

Why a CAR?

- Capability – Define what is needed
 - Technical Integration Framework
- Agility – Demonstrate progress
 - Lifecycle Management Frameworks
 - Scaled Agile Framework (SAFe)
- Resilience – Prepare for change and risks
 - Systems Readiness Framework
 - Risk Management Framework

The CEDCaP Journey

- The Census Bureau's mission is to serve as the leading source of quality data about the nation's people and economy.
- The Census Bureau is committed to shared services as a means to harness the benefits of enterprise-wide solutions over duplicative, single-use solutions.

The CEDCaP Journey

- The Census Enterprise Data Collection and Processing (CEDCaP) Program is creating an integrated and standardized enterprise suite of systems that offers shared data collection and processing services for all censuses and surveys.
 - Constitutionally mandated census of population and housing every 10 years (Decennial Census)
 - Census of all business establishments and of all governmental units every 5 years (Economic Census and Census of Governments)
 - Several ongoing business and household surveys that provide the information in several of the Nation's key economic indicators

Censuses & Surveys

		1) Construction Indicators					2) Criminal Justice					3) Cross Sector																													
A	BPS Building Permits Survey	A	CPRS Construction Progress Reporting Survey	R	MHS Manufacturing Homes Survey	R	RHFS Rental Housing Finance Survey	AR	SOC Survey of Market Absorption of New Multifamily Units	A	VIP Value of Construction Put in Place Survey	R	PC Census of Adult & State Federal Correctional Facilities	R	CIRP Census of Juveniles in Residential Placement	R	CJEE Criminal Justice Expenditure & Employment	R	JRFC Juvenile Residential Facility Census	R	NPS8 National Prisoner Statistics - 8 Cap. Punish.	R	SSV Survey of Sexual Victimization	A	ACES Annual Capital Expenditures Survey	A	ASE Annual Survey of Entrepreneurs	A	SQ-CLASS Business & Professional Classification Survey												
6/18	Monthly/Annually \$1,937,000 7,000/600	5/16	Monthly \$4,700,000 252,000/46,000	9/17	Monthly 12,13,42,0	12/17	Biennially \$5,450,000 45,207/6,447	5/17	Quarterly/Annually \$1,750,000 900/735	5/16	Monthly \$4,700,000 252,000/46,000	NA	Every 5 or 6 Years, NA/NA	5/16	Placement	NA	Employments, 42	11/16	Annually \$326,800 3,289/1,636	11/16	Annually \$589,800 1,538/1,353	2/17	Annually \$600,000	NA	Annually	NA	9/16	Quarterly \$1,326													
		3) Cross Sector					4) Education					5) Employment					6) Financial Indicators																								
A	BDS Business Dynamics Statistics	A	COS Company Organization Survey	A	CBP & ZBP County & Zip Code Business Patterns	A	ESIA Economic Census of Island Areas	R	SBLF FDIC Small Business Lending Survey	A	ICTS Information & Communication Technology Survey	A	NES Non-Employer Statistics	A	NCE Nonresidential Coverage Evaluation	A	SBO Survey of Business Owners	R	CCD Common Core of Data (Non-Fiscal)	R	EDGE Education Demographic and Geographic Estimates	R	NPEFS National Public Education Financial Survey	R	PLS Public Libraries Survey	R	SABS School Attendance Boundary Survey	A	QWI Quarterly Workforce Indicators	A	QFR Quarterly Financial Report										
NA	Annually NA/NA	5/18	Annually \$11,300,000 47,000/14,630	NA	Annually	12/13	Quinquennially \$7,840,000 70,234/9,111	8/16	Quarterly \$13,000,000 117,000/15,400	7/17	Annually NA	NA	Monthly NA	NA	Quarterly \$1,000,000	NA	Annually NA/NA	NA	Annually \$1,450,000	1/16	Annually \$5,447	12/16	Annually \$2,000,000 13,600/12,600	6/16	Biennially \$2,000,000 13,600/12,600	20	Quarterly \$5,800,000 50,285/14,511	12/15	Quarterly \$7,720,000 50,285/14,511												
		7) Health Statistics					8) International Trade Indicators					9) Manufacturing Sector					10) Public Sector																								
R	MEPS Medical Expenditure Panel Survey	A	AR Advance Report	A	MITR Manufacturing International Trade Report	A	FT-900a Preliminary U.S. Imports for Consumption of Steel Products	A	ISPP Profile of Importing & Exporting	A	RP Related Parties	A	FT-900 U.S. International Trade in Goods & Services	A	ASM Annual Survey of Manufacturers	A	M3 Manufacturers' Shipments, Inventories, & Orders Survey	A	M3UFO Unfilled Orders Survey	R	MECS Manufacturing Energy Consumption Survey	R	QPC Quarterly Survey of Plant Capacity Utilization	A	ASLGF Annual Survey of Local Government Finances	A	ASPEP Annual Survey of Public Employment	A	ASPP Annual Survey of Public Pensions	A	ASFIN Annual Survey of State Government Finances										
12/15	Annually \$10,400,000 124,400/12,115	NA	Monthly NA/NA	NA	Annually NA	13	NA	Annually NA	45,000/29,286	Annually NA	11/17	Monthly \$3,600,000 \$1,600/17,200	11/17	Monthly \$3,600,000 \$1,600/17,200	4/16	Survey	13/18	Survey	8/15	Quarterly \$1,333,300	NA	Annually \$1,000,000	9/15	Annually \$2,000,000	13	Annually \$5,800,000	13	Annually \$7,720,000													
		10) Public Sector					11) Research & Development					12) Retail & Wholesale Indicators					13) Service Sector																								
A	STC Annual Survey of State Government Tax Collections	A	CoG Census of Government	R	FAC Federal Audit Clearinghouse	A	GUS Government Units Survey	A	QTAX Quarterly Summary of State & Local Government Tax Revenue	A	QSPP Quarterly Survey of Public Pensions	R	BRDIS Business Research, Development, & Innovation Survey	R	FRD Research & Development Link	A	SGRD State Government Research & Development	A	MARTS Advance Monthly Retail Trade Survey	A	MARTS Annual Retail Trade Survey	A	AWTS Annual Wholesale Trade Survey	A	BES Business Expenses Supplement	A	MRTS Monthly Retail Trade Survey	A	MWTS Monthly Wholesale Trade Survey	A	QSS Quarterly Services Survey										
NA	NA	12/08	Quinquennially	Continuously	12/12	Quinquennially \$5,400,000 70,234/9,111	9/16	Quarterly \$87,200 20,234/9,111	9/15	Quarterly \$2,000,000 133,000/175,990	12/15	Annually \$5,000,000 133,000/175,990	11/17	Annually NA	5/16	Biennially \$276,542	8/15	Monthly \$2,800,000 20,937/1,426	3/18	Annually \$2,800,000 20,937/1,426	3/18	Annually \$1,200,000 2,140/1,469	12/08	Supplement Depend.	13	Monthly \$3,400,000 12,600/10,442	7/17	Monthly \$1,500,000 50,400/5,800	8/15	Quarterly \$1,770,000 50,400/5,800											
		13) Service Sector					14) Transportation					15) Miscellaneous					16) Other																								
A	SAS Service Annual Survey	A	SA Service Commodity Flow Survey	A	SUSB Statistics of U.S. Businesses	AR	F-33 Annual Survey of School District Finances	A	EC Economic Census	<p>Funding Type: (Appropriated) A or Reimbursable (R)</p> <p>● Economic Directorate</p> <p>● Decennial Directorate</p> <p>■ Demographic Directorate</p> <p>■ Field Directorate</p> <p>■ Research & Methodology Directorate</p>					<p>Example Census or Survey</p> <p>Information Collection Expiration Date: Periodic</p> <p>Information Collection Authorizing Statuses (See Table 2)</p> <p>Approved Annual Time Burden (Hours)</p>					<p>Table 1 = Title 12 of the United States Code outlines the role of Banks and Banking</p> <p>13 = Title 13 of the United States Code outlines the role of the United States Census</p> <p>15 = Title 15 of the United States Code outlines the role of the Commerce and Trade</p> <p>16 = Title 16 of the United States Code outlines the role of Conservation</p> <p>20 = Title 20 of the United States Code outlines the role of Education</p> <p>26 = Title 26 of the United States Code outlines the Internal Revenue Code</p> <p>29 = Title 29 of the United States Code is a code that outlines the role of Labor</p> <p>42 = Title 42 of the United States Code deals with Public Health, Social Welfare, & Civil Rights</p> <p>A = Article 1, Section 2, Clause 3 of the U.S. Constitution</p>																					
12/15	Annually \$14,770,000 83,648/29,316	9/13	Quinquennially \$21,000,000	NA	Annually NA	8/15	Finances	NA	Quinquennially NA																																
		A) Criminal Justice					B) Economic Characteristics					C) Education					D) Estimates & Projections					E) Health					F) Housing					G) International					H) Miscellaneous				
R	ITS Identity Theft Supplement	R	NCVS National Crime Victimization Survey	R	PPCS Police-Public Contact Survey	A	CPS-ASEC Annual Social and Economic Supplement of the CPS	R	CES Consumer Expenditure Survey	R	CED Consumer Expenditure Diary Survey	R	CEQ Consumer Expenditures Quarterly	A	SIPP Survey of Income & Program Participation	R	TPOPS Telephone Point of Purchase Survey	R	BTLS Beginning Teacher Longitudinal Study	R	NITES National Adult Training and Education Survey	R	NHES National Household Education Survey	R	NSCG National Survey of College Graduates	R	NTPS National Teacher & Principal Survey	R	PFS Principal Follow-Up Study	R	SCS School Crime Supplement										
3/15	Biennially \$1,020,104 83,300/29,316	8/15	Monthly 240,000/80,45	12/16	Approx. 3 Years \$84,500	7/15	Economic Supplement of the CPS \$13,290	12/17	Annually \$41,000,000 68,185/60,052	12/17	Annually \$41,000,000 68,185/60,052	12/16	Quarterly \$21,000,000 71,000/23,500	10/12	Periodically \$4,400,000 55,521/11,818	10/12	Annually \$1,575,000 1,744,800	9/17	Annually \$562,500 1,213,000/50,54	9/17	Annually \$65,000,000 108,236/42,22	8/15	Biennially \$600,000 1,213,000/50,54	1/18	Biennially \$6,600,000 5,620/1,368	9/17	Biennially \$788,120 14,461/2,444														
		C) Education					D) Estimates & Projections					E) Health					F) Housing					G) International					H) Miscellaneous														
R	SSCOS School Survey on Crime & Safety	R	TFS Teacher Follow-Up Survey	A	PE & PJ Population Estimates & Projections	A	SAHIE Small Area Health Insurance Estimates	A	SAIPE Small Area Income & Poverty Estimates	R	NAMCS National Ambulatory Medical Care Survey	R	NHIS National Health Interview Survey	R	NHAMCS National Ambulatory Medical Care Survey	R	NSCH National Survey of Children's Health	R	AHS American Housing Survey	R	HVS Housing Vacancy Survey	R	NYCHYS New York City Housing & Vacancy Survey	A	IDB International Programs/Studies	R	ATUS Annual Time Use Survey	A	BAS Boundary & Annexation Survey	AR	MOPS Management & Organizational Practices										
10/12	Biennially \$5,000,000 12,870/1,145	3/15	Biennially \$5,000,000 12,870/1,145	13,0	Annually/Biennially NA	NA	NA	NA	2/18	Monthly \$6,289,206 105,768/4,112	12/17	Monthly \$6,289,206 105,768/4,112	2/18	Monthly \$6,289,206 105,768/4,112	4/18	Biennially \$30,000,000 129,582/64,62	12,13	Quarterly \$900,000	6/15	Survey	13,0	Annually NA	12/16	Monthly \$5,000,000 13,200/1,520	13,29	Annually \$8,000,000	2/14	Survey													
		H) Miscellaneous					I) Population					J) Recreation					K) Employment																								
A	SPD Survey of Program Dynamics	A	ACS American Community Survey	A	CPRIA Census of Puerto Rico & Island Areas	A	2020 Decennial Census of Population & Housing	A	PRCS Puerto Rico Community Survey	A	SCP Special Census Program	R	FHWAR National Survey of Fishing, Hunting, & Wildlife Assoc. Recreation	A	CPS Current Population Survey																										
2/03	Annually NA 11,980/25,138	6/18	Annually \$225,000,000 3,805,745/2,455,868	13	Decennially \$13,000,000,000* 308,745/538* NA	13,0	Decennially \$13,000,000,000* 308,745/538* NA	8/15	Annually NA	8/15	Dependent NA 248,430/53,52	9/12	Quinquennially \$2,637,913 117,677/19,990	7/15	Monthly/Annually \$88,000,000 708,000/19,347																										

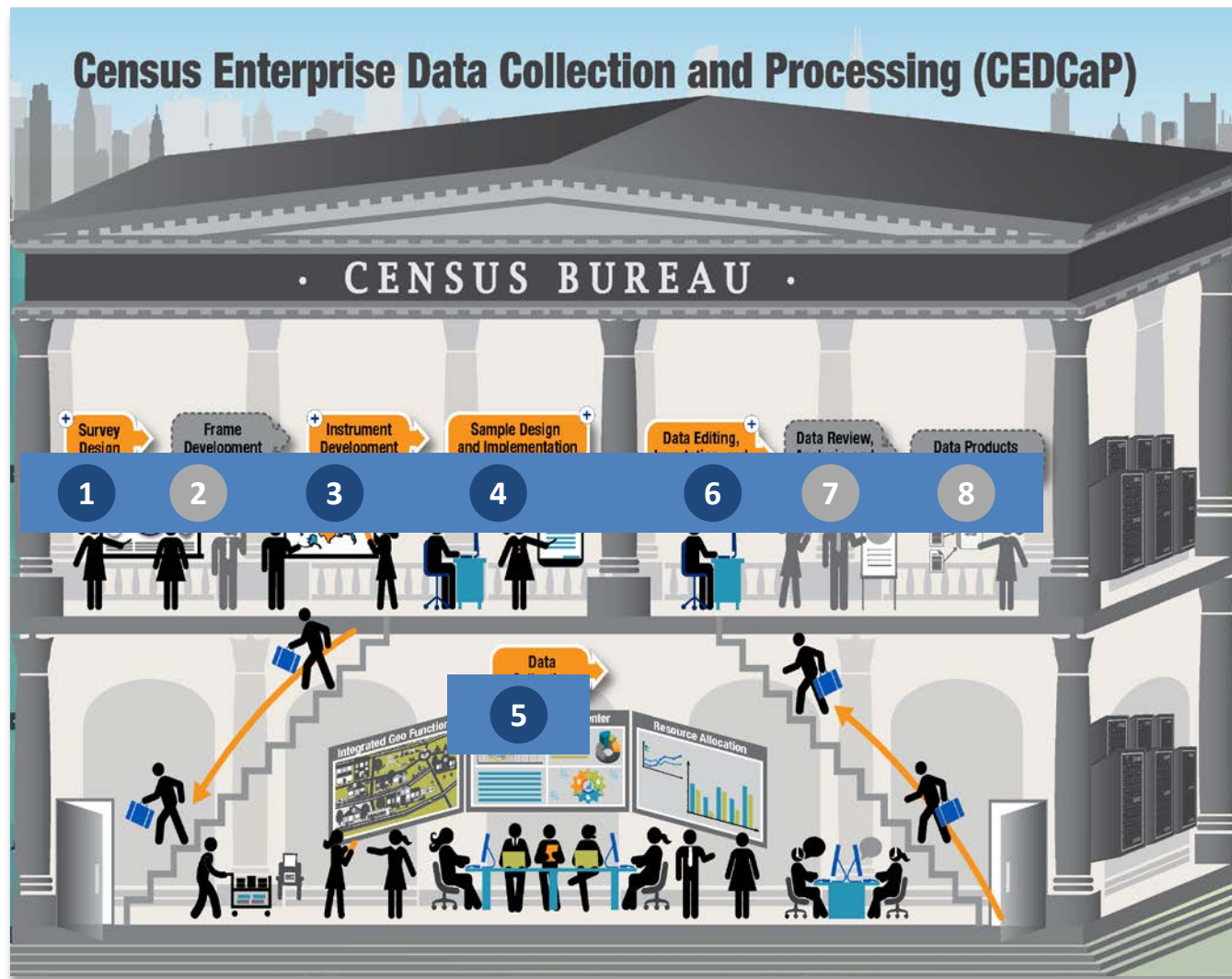
U.S. CENSUS BUREAU
 Business Architecture
 Chief Executive Architect - Necarsia McKinnon

The Office of Management & Budget (OMB), Office of Information and Regulatory Affairs (OIRA), Office of Information Collection Review (OICR) is the source for the Information Collection Expiration Date, # of Approved Annual Responses, Approved Annual Time Burden (Hours), Annual Cost to Federal Government, and Information Collection Authorizing Statutes (<http://www.reginfo.gov/public/do/PSMain>)



U.S. Department of Commerce
 Economics and Statistics Administration
 U.S. CENSUS BUREAU
 census.gov

Stages of the Survey LifeCycle



Lifecycle stages

- 1 Survey design
- 2 Frame development
- 3 Instrument development
- 4 Sample design & implementation
- 5 Data collection
- 6 Data editing, imputation & estimation
- 7 Data review, analysis & correction
- 8 Data products & dissemination

In Scope

Out of Scope

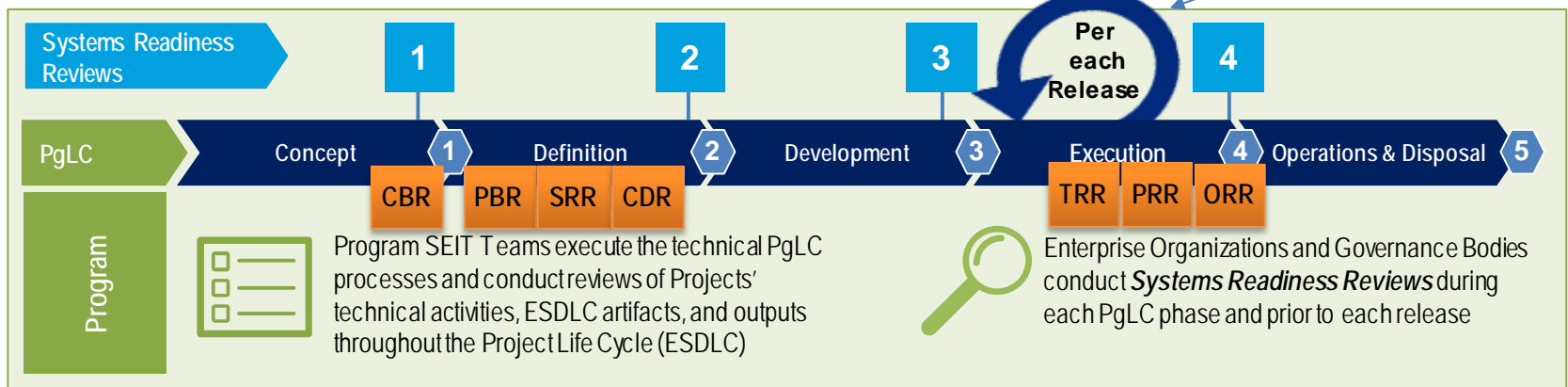
Planning for the Trip

- Guidance & Governance
- Program Lifecycle Framework
- Systems Development Lifecycle
- Technical Integration Framework
- Systems & Software Engineering Discipline
- Architecture & Engineering Standards
- Scaled Agile Framework (SAFe)
- DevOps & Continuous Integration Framework
- Technical Solutions Assessment Framework
- Risk Management Framework

Technical Integration Framework

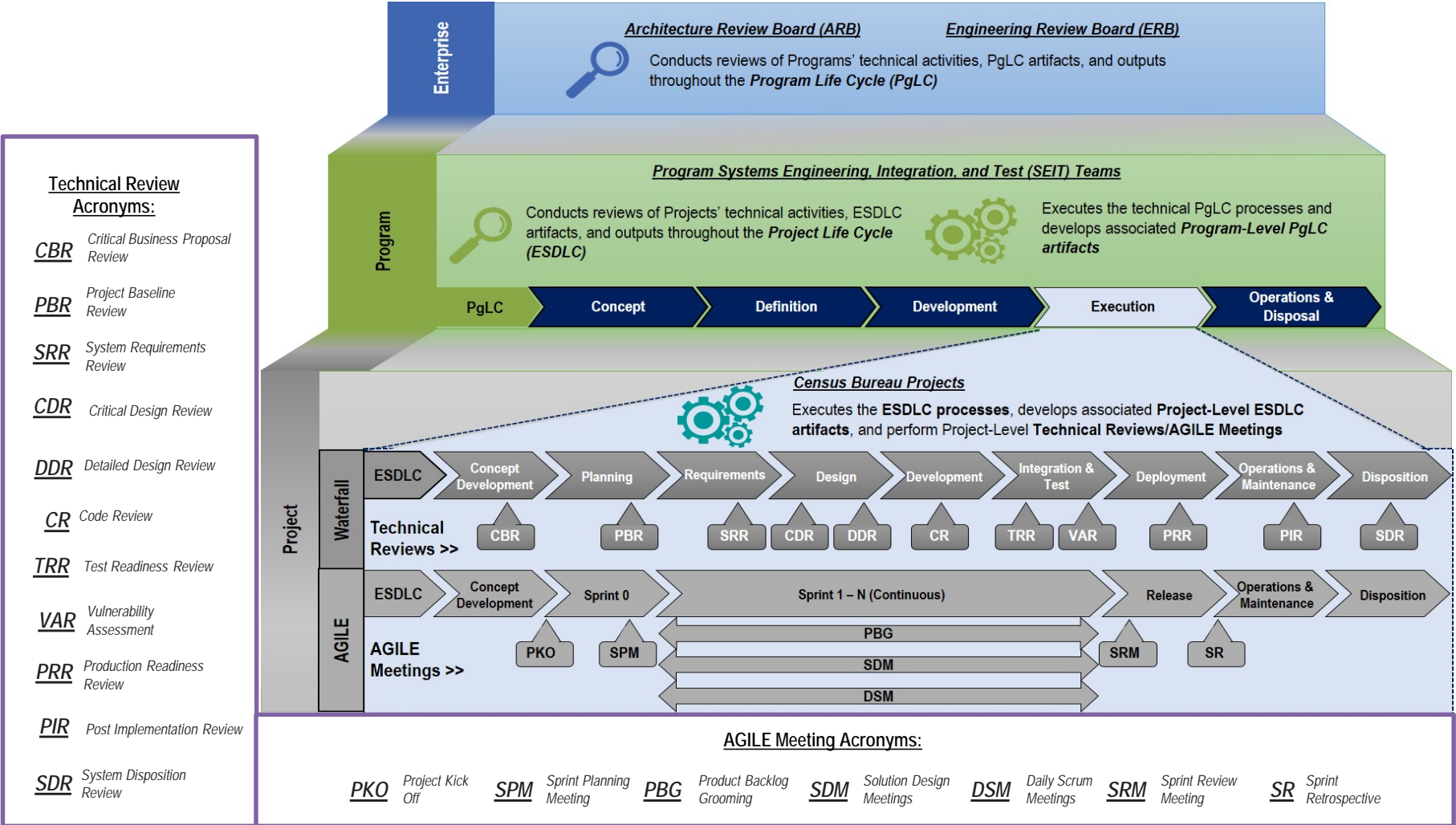
High level, formal reviews (similar to those held at the project level) are held to ensure:

- Initial high level approach is agreed to at Decennial Program level and CM controlled thereafter
- Initial direction is clearly conveyed to projects
- System is appropriately tested and ready for operations to begin testing



<p>CBR <i>Critical Business Proposal Review</i></p> <p>PBR <i>Project Baseline Review</i></p> <p>SRR <i>System Requirements Review</i></p> <p>CDR <i>Critical Design Review</i></p>	<p>Review of initial high level architecture to ensure inclusion of appropriate systems to implement the desired subset of the 34 operations.</p> <p>Review of program baselines. Schedule, organizational structure, etc.</p> <p>Joint review of PLBR/CAP requirements by engineering and operations.</p>	<p>TRR <i>Test Readiness Review</i></p> <p>PRR <i>Production Readiness Review</i></p> <p>ORR <i>Operational Readiness Review</i></p>	<p>Ensures appropriate test objectives, methods procedures, scope and environments.</p> <p>Assessment of test results to ensure system is ready for operations testing.</p> <p>Assessment of Operational testing results to ensure system is ready for production operations to begin.</p>
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Systems Readiness Framework



Making the Trip

- Setting up the Program Management Office
- Defining Business Capability Requirements
- Defining the Business Solutions Architecture
- Determining a Segmented Technical Solutions Architecture
- Engaging IT Security & Privacy
- Defining Functional and non-Functional Requirements
- Planning for Agile Development
- Involving the Business Experts
- Conducting the Release Trains & Readiness Assessments

Defining Requirements

Enterprise Requirements Levels

The following are the type and attributes of requirements required for definition and management throughout the program life cycle.

Mission Level Business Requirements

High-level requirements determined for the enterprise or program; Exist in program or enterprise management documents, e.g., Strategic Plans, Business Plans, Mission Statements, etc.

MLBR

- Originate with the Enterprise or Program, pre-SDLC
- Referenced in, or copied into, Requirements Document and Requirements Traceability Matrix

Program Level Business Requirements

Identifies baselined scope and business capabilities which are needed to satisfy the objectives of the enterprise. Begins to outline the solution capabilities at the highest level.

PLBR

- Originate with the Program or Project as part of SDLC
- Sets the scope of each individual project within the program
- Business Analyst assures traceability to PLBRs in Requirements documentation

Capability Requirements

Place both the stakeholders and users at the center of focus and describe what the project must produce or provide; Provide context for the Solution Requirements and design documents.

Capability (CAP) Requirements

- Originate with the Program or Project as part of SDLC
- Refined or expanded during Requirements Phase
- The bridge between Business and Solution Requirements

Solution Requirements:

Describe what will satisfy the business need, in the lowest level of detail required to create design documentation and move to solution development

Solution (SOL) Requirements

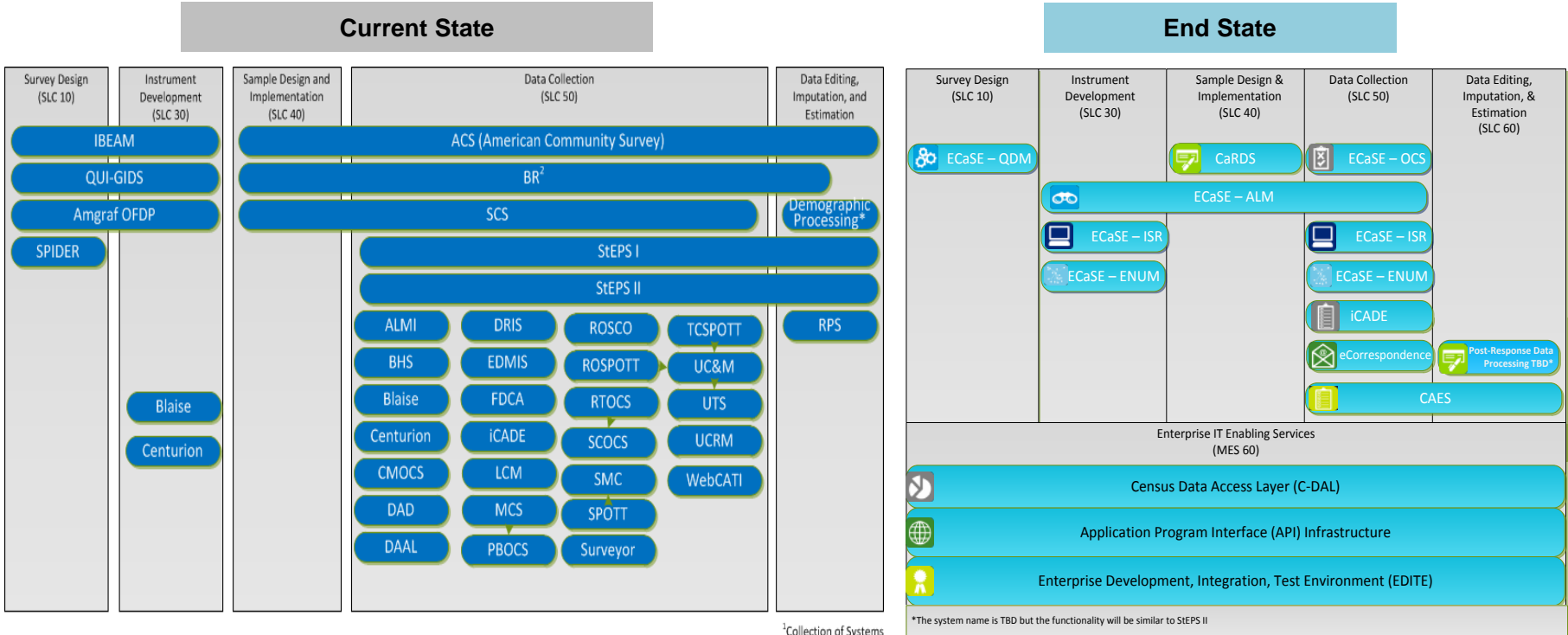
- Defined by stakeholders during the Requirements Phase of the SDLC
- Maintained in SDLC-approved formats
- May include Use Cases, Business Process Models, and other supplemental information to aid in understanding

Technical Specifications

Solution developers derive specs from Requirements; Requirements define **what** is needed while specs focus on **how** the Requirements will be met

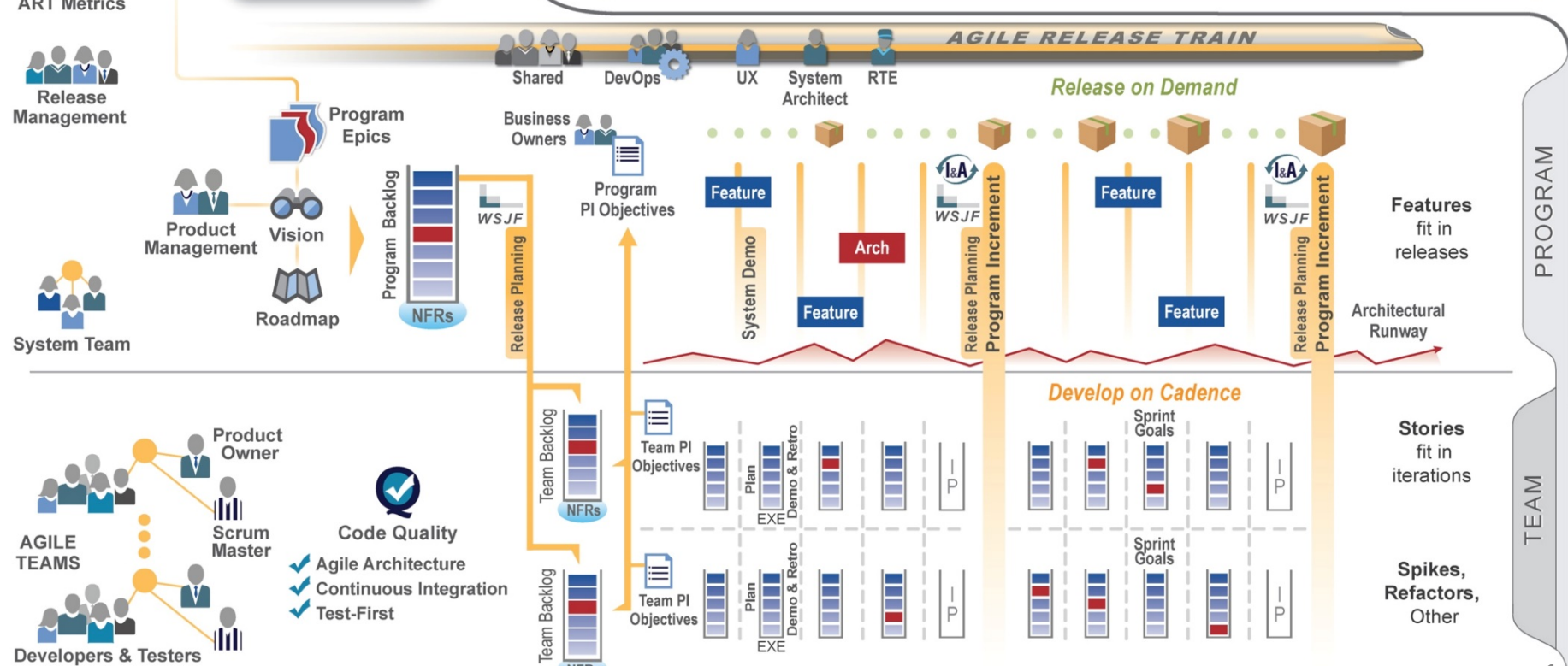
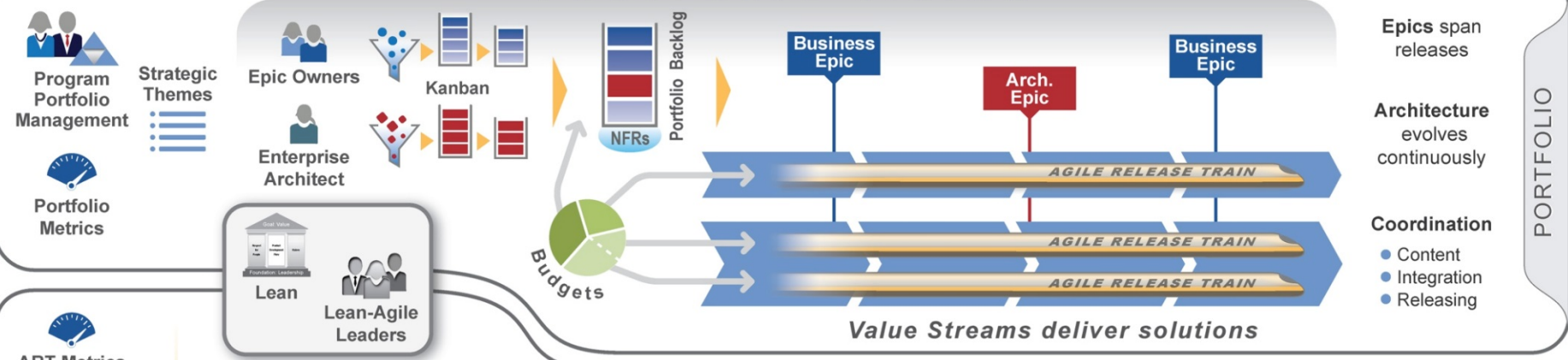
Business Solutions Architecture

CEDCaP capabilities delivered across a series of transition states called product releases.

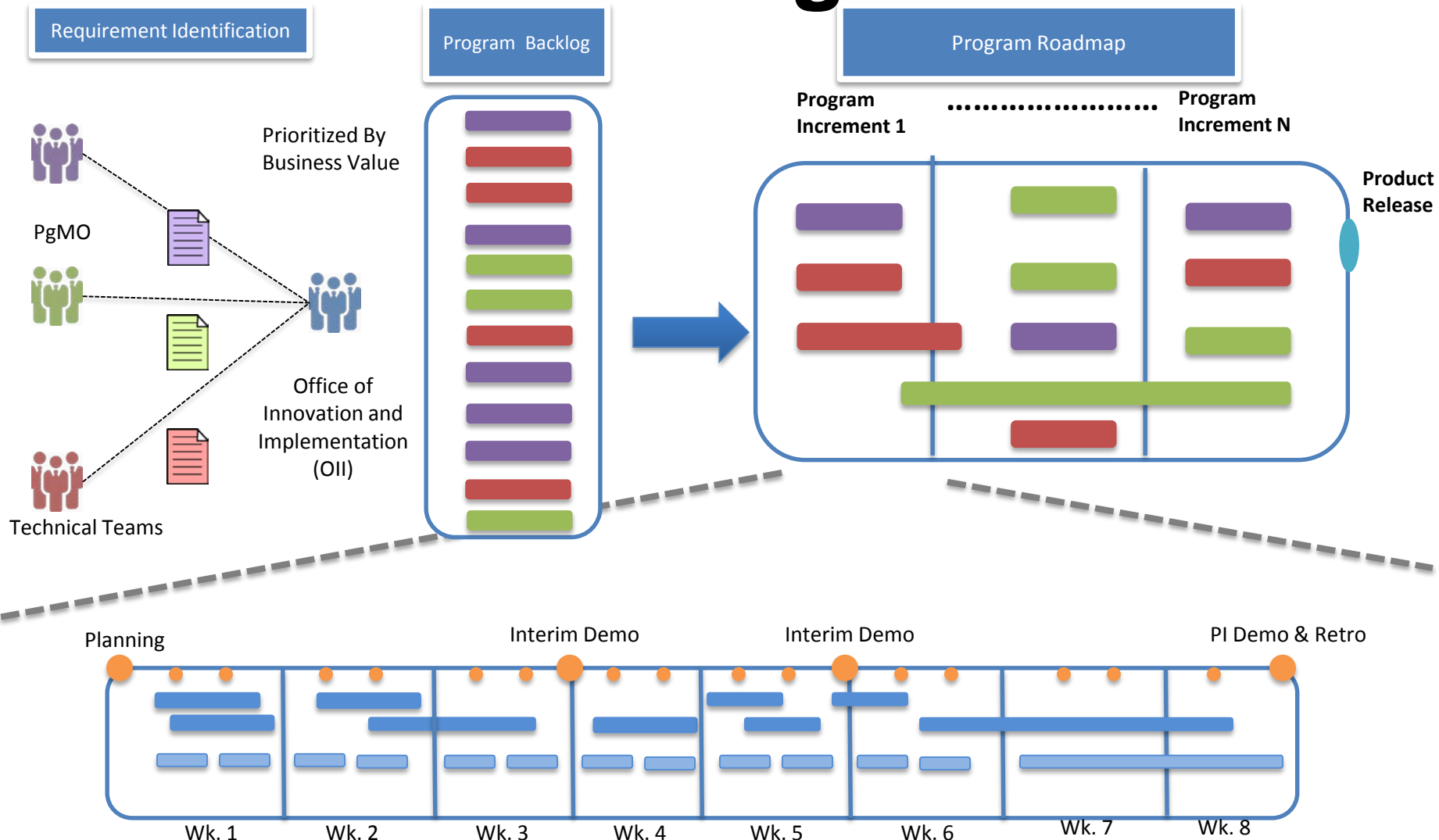


¹Collection of Systems
²Partially covers SLC 60

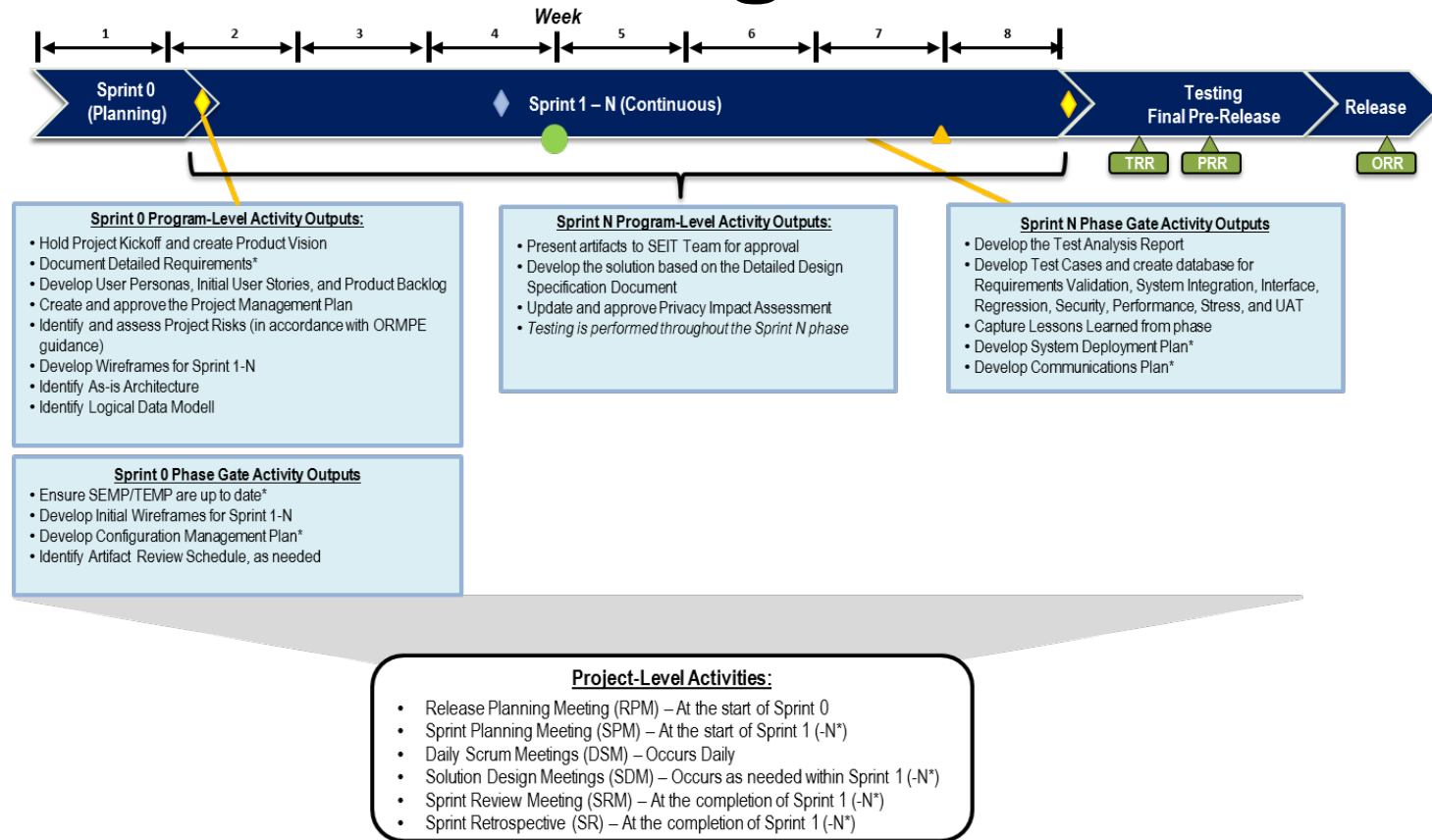
PORTFOLIO VISION



Release Train Agile Process

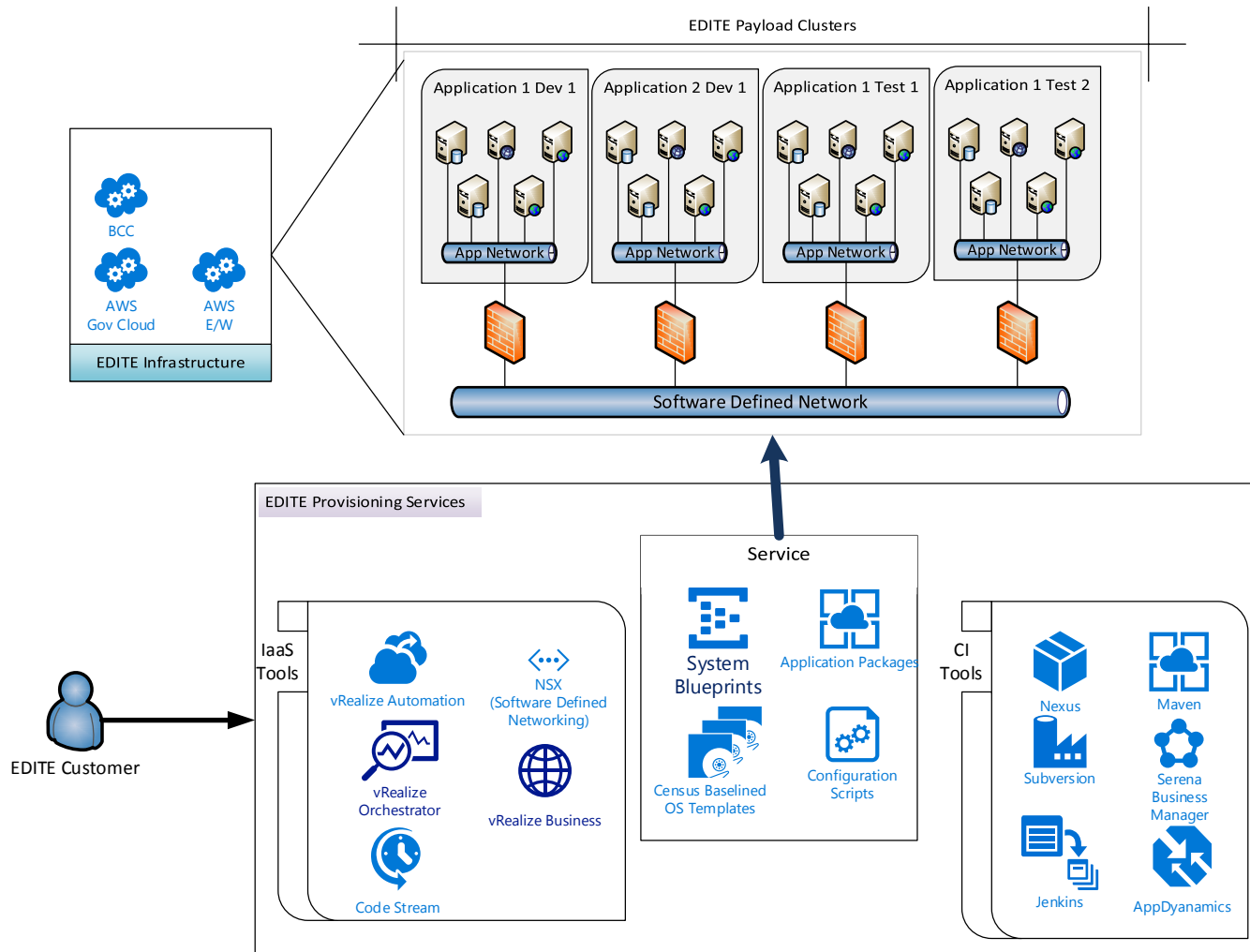


Release Train Agile Governance



*Projects are continuously reviewing and updating artifacts based on current progress

DevOps & Continuous Integration



Did We Arrive Safely?

- Releases delivered on time & within budget
- Enterprise Requirements Management Team & Change Control Board established
- Integrated Master Schedule & Integrated Risk Registers developed
- Transition Plans & Onboarding Plans developed
- Technical Integration & Systems Readiness Frameworks matured
- COTS Capability Assessment & Analysis
- Agile & Waterfall methodologies integrated
- Integrated Test Planning & Execution
- Did not fully leverage enterprise DevOps

Ready to Go Again?

- Requirements, Requirements, Requirements
- Effective Guidance as well as strong Governance
- Get support from senior executive leadership
- Effective Program Delivery requires effective Program Management
- Strong Systems Engineering discipline
- Keep Agile agile
- Build security into every aspect of the lifecycle
- Test, Test, Test
- Involve the Business along the way