The National Plan for UAE Smart Government Goals

High Level Enterprise Architecture

Jul 2014 – Dubai, United Arab Emirates

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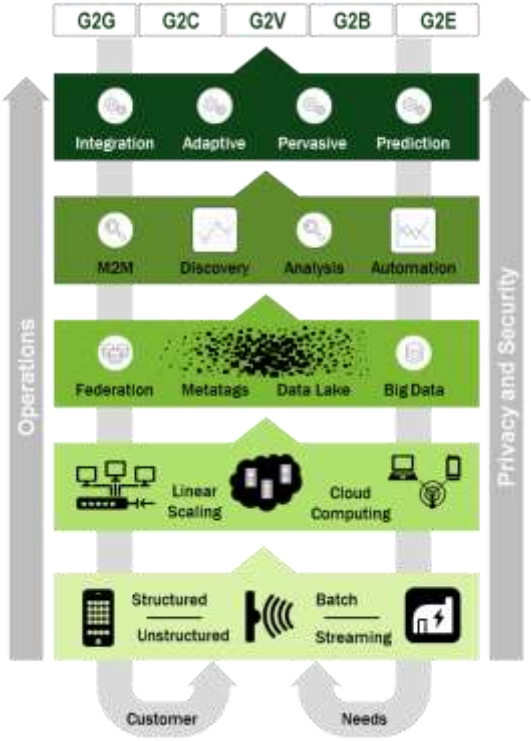
We designed a high level enterprise architecture to help model smart government capabilities and their interactions

Inputs

- Smart Benchmarking
- Enterprise Architecture Frameworks
- Technology Trends
- Government v2.0
- Smart Cities
- Vision, Mission, and Strategic Pillars

Enterprise Architecture



Benefits

- Shared view of service design and delivery
- Connected and integrated view of smart concepts
- Focus on customer needs and requirements
- Abstraction of smart government technologies
- Highlight components needed to deliver smart services

This included benchmarking multiple governments to discover they all use derivatives of the U.S. Federal EA Framework

Country	Enterprise Architecture
Singapore	▪ Created a whole of government enterprise architecture in 2002 with business, data, applications, and technology domains
South Korea	▪ Created Government Enterprise Architecture Framework (GEAF) in 2003 with business, data, applications, and technology domains
United Kingdom	▪ Created Cross Government Enterprise Architecture (xEGA) in 2005 adding cross cutting security, integration, and performance viewpoints
Australia	▪ Created Australian Government Architecture (AGA) in 2008 adding cross cutting services and performance viewpoints
United States	▪ Created the Federal Enterprise Architecture (FEA) in 2012 adding cross cutting security, services, and performance viewpoints

Abu Dhabi

- Created an enterprise architecture that add access and integration domains beside cross cutting security and operations viewpoints

Observations

- All countries surveyed use enterprise architectures **based on the U.S. Federal Enterprise Architecture Framework (FEAF)** created in 1999
- Using FEAF provides a **simple mapping to TOGAF** and other popular enterprise architecture frameworks
- However, the underlying domains **remain unchanged since the Zachman Framework** created in 1987

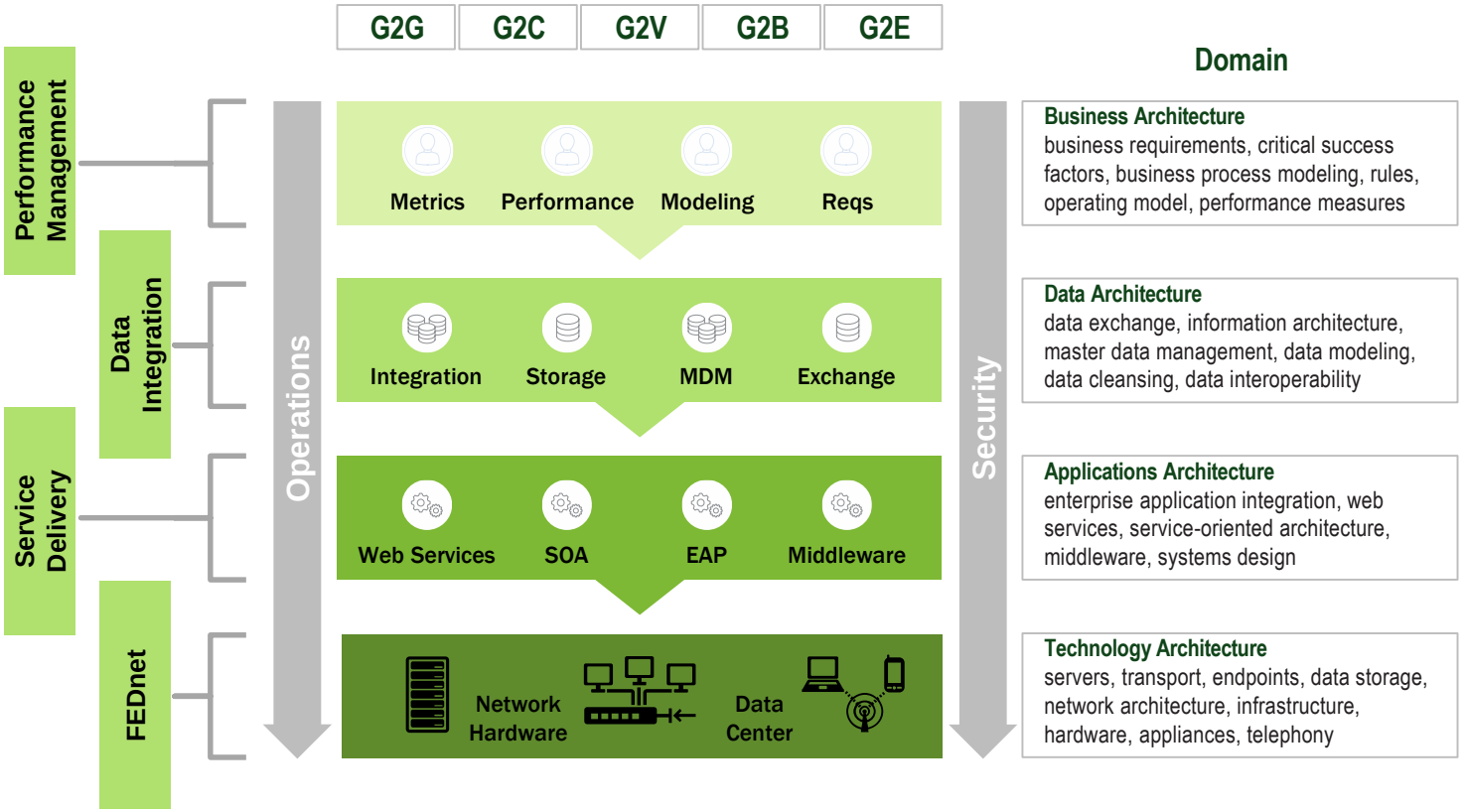
However, the U.S. Federal EA Framework is poorly suited to modeling smart government capabilities or their interactions

Difficult to Model

Smart Government

Big Data
Continuous Feedback
Real-time Monitoring
Machine Learning
Business Intelligence
Cloud Analytics

NON-EXHAUSTIVE



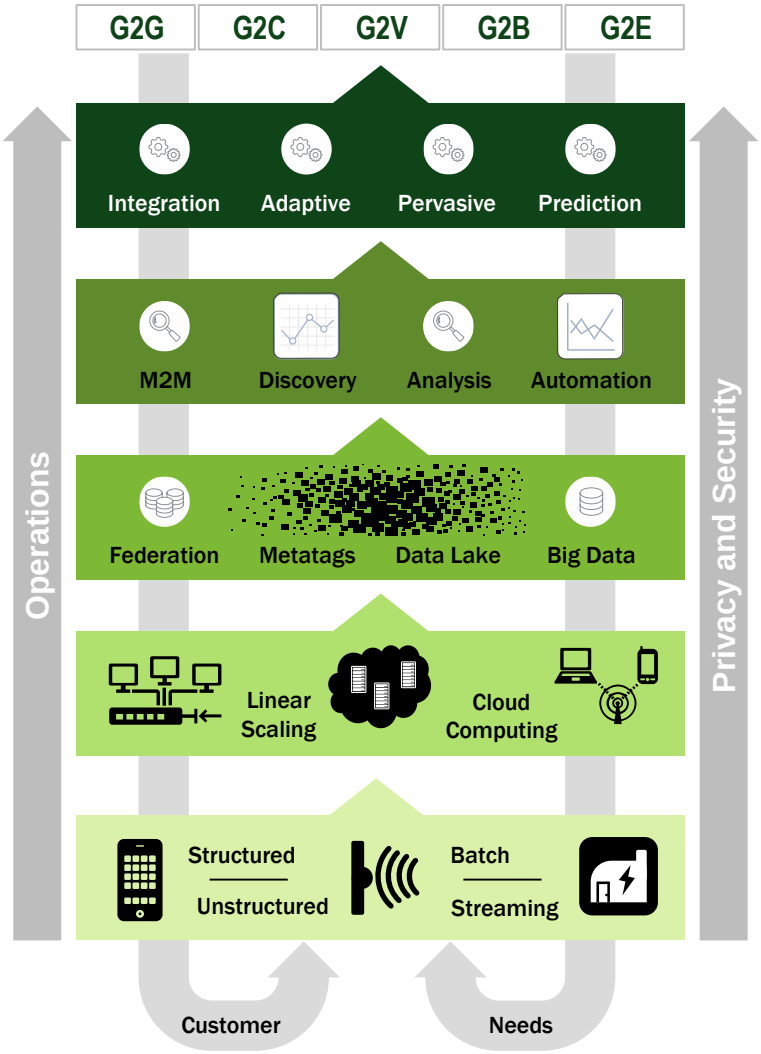
Traditional Assumptions

- Business architecture accurately captures customer needs
- Service delivery success cannot be evaluated real-time
- Data, applications, and technology infrastructure is inflexible

To address this challenge, we developed a cyclical, customer-centric, and data driven approach to enterprise architecture

Successfully Models

- The intersection between smart cities and government
- Machine-to-machine automation and communication
- Data driven and predictive analysis and analytics
- Cloud computing, big data, and cloud analytics technologies
- Attentive, personalized, and response service design
- Federation of services and data across the whole of government



Domain

Services Architecture
adaptive, personalization, intelligence, responsiveness, pervasive, customer-centrism, access channels, targeting

Analytics Architecture
machine-to-machine, analytics, analysis, business intelligence, statistical inference, automation, learning, modeling, simulation

Data Architecture
federation, information sharing, data lakes, metatagging, schema on read, big data, distributed, natural language processing

Technology Architecture
servers, heterogeneous networking, elastic compute, cloud computing, linear scaling, infrastructure, next generation networking

Sensors Architecture
cameras, actuators, smart grid, sensing, feedback, near field communication, radio frequency identification, Internet of things

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The proposed high level enterprise architecture has both near and long term applications to smart government

Near Term

- **Alignment of initiatives** to a single view of smart government capabilities
- Identification of **technology gaps** in providing smart service delivery
- **Clear interactions** to help drive initiative sequencing
- **Lens for stakeholders** to view smart government
- Tool for the **smart government PMO** and its project teams
- **Balance initiatives** across the entire EA

→

Long Term

- Basis for the **National Government EA Guideline** and its subsequent reference architectures
- Governance and requirements for the **tendering process**
- Organize and govern issuances in the **National Regulatory Framework**
- Build consensus among stakeholders to help drive **technology convergence**
- Depict layer to layer **integration points** between stakeholders

Short term focuses on the smart government PMO and aligning stakeholders to a single view of smart government

Near Term

- **Alignment of initiatives** to a single view of smart government
- Identification of **technology gaps** in providing smart services
- **Clear dependencies** to drive initiative sequencing
- Communicating a **single view of technology** to the stakeholders
- Tool for the **smart government PMO** and its project teams

1

- Use the target state of each initiative to map them against the layers of the high level EA they directly impact

2

- Use the high level requirements of each initiative to develop detailed business and functional requirements that take into account the layer to layer dependencies highlighted in the high level EA

3

- Ensure all tenders for initiatives respect the design, information flow, and layers in the high level EA such that their proposed solutions include compliant architectures and designs

This includes providing a single lens by which to view business and technology processes for smart government

Domains	Business Perspective	Technology Perspective
1 Sensors Architecture	Constituent visits municipal office to conduct business with government	A Biometric and geographic data collected in real-time from mobile devices
2 Technology Architecture		B All data stored in an elastically scalable cloud computing environment
3 Data Architecture	Government automatically determines constituent will need to conduct additional business within the week	C All data loaded into a distributed, non-normalized, columnar big data system
4 Analytics Architecture		D Statistical inferences derived from cloud analytics business intelligence systems
5 Services Architecture	Government alerts the constituent in near real-time to this need and offers service location suggestions	E Machine-to-machine integration turns predictive knowledge into proactive action

Long term focuses on building consensus, issuing guidelines, and driving infrastructure convergence among stakeholders

Long Term

- Basis for the **National Government EA Guideline** and its reference architectures
- Governance and requirements for the **tendering process**
- Organize and govern issuances in the **Smart Government Regulatory Framework**
- Build consensus among stakeholders to help drive **technology convergence**
- Depict layer to layer **integration points** between stakeholders

Domains	Alignment of National Guidelines
1 Sensors Architecture	▪ Guideline for Customer Privacy ▪ Dimensionality and Normalization Guide ▪ Metadata Level Security Tagging Guide
2 Technology Architecture	▪ Network Management System Design ▪ Application Management Guidelines ▪ Cloud Computing Standards
3 Data Architecture	▪ Data Exchange and Interoperability ▪ Data Management and Modeling ▪ Data Hub Reference Architecture
4 Analytics Architecture	▪ Machine-to-Machine Design Guidelines ▪ Guide to Data Science Modeling ▪ Data and Information Extraction Guide
5 Services Architecture	▪ User Experience Design Policy ▪ Mobile Development Guidelines ▪ Service Modernization Guidelines

Example policies and standards that may arise from the Smart Government Regulatory Framework and map to the long term EA

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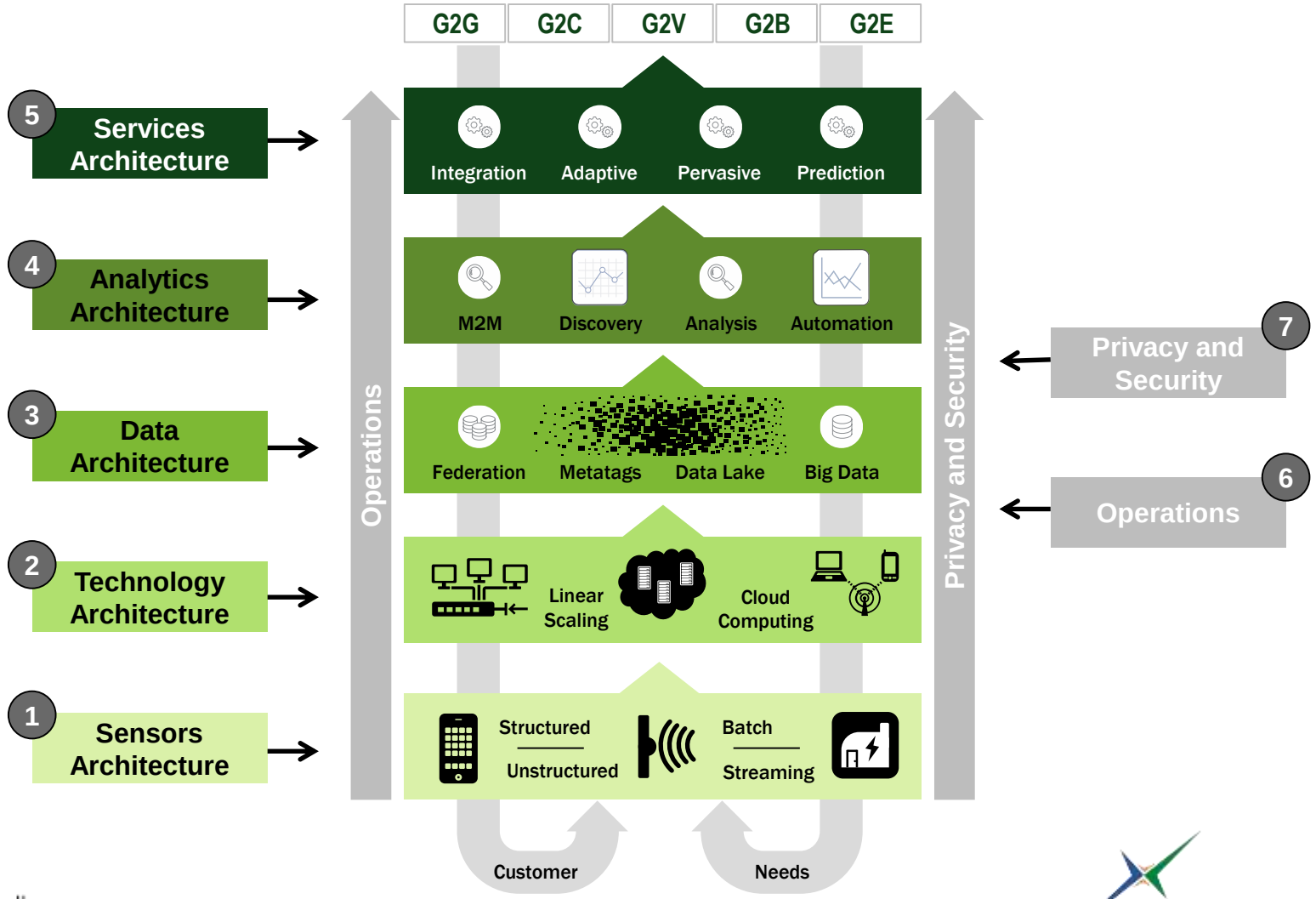
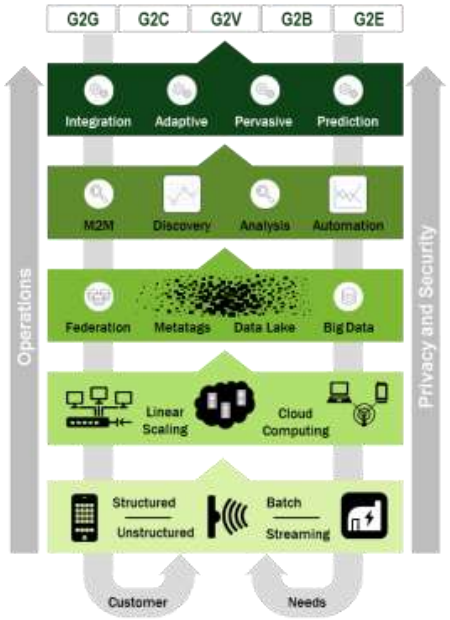
The high level enterprise architecture is divided into five domains and two cross cutting capabilities



Sensors architecture collects and stores data from multiple sources and is the basis for smart government



1

Sensors Architecture

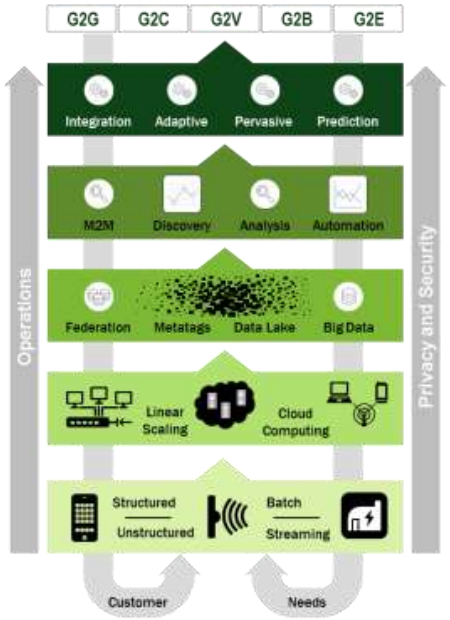
Paradigm Changes

- Collecting and storing data from all sources regardless of bounding, dimensionality, or other attempts to pre-impose structure on the data
- Distributed Internet of things (e.g., appliances, traffic lights, and actuators) collecting real-time data about service delivery and customer needs
- Continuous feedback based on customer needs driving technology requirements across the government from a bottom up perspective starting with infrastructure

Scope

- Includes all sensors and devices such as cameras, smartphones, tables, utility metering, traffic lights, actuators, smoke detectors, and other inputs
- Focuses on managing and ingesting the disparate data streams coming from sensors (e.g., streaming data), integration with entities (e.g., structured data), periodic downloads from entities or partners (e.g., batch data), and raw data (e.g., unstructured data)
- Enables real-time monitoring of customer needs to produce near real-time responses and achieve continuous service delivery improvement
- Represents the touch point between smart government and cities by enabling pervasive collection, analysis, and proactive response

Platform architecture is the collected computing and network resources necessary to scale against government needs



2

Technology Architecture

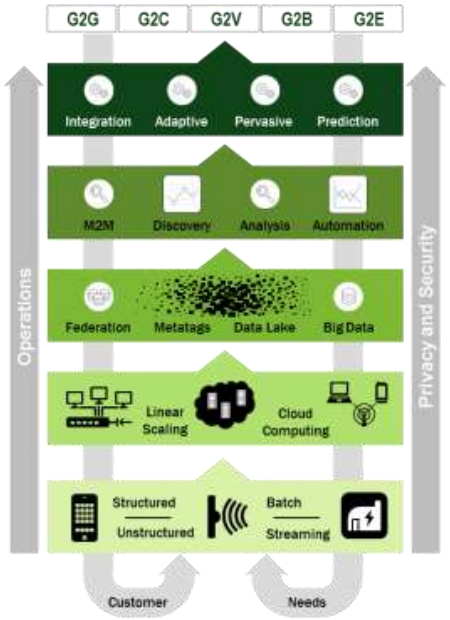
Paradigm Changes

- Dynamic and fault tolerant provisioning of computing resources to quickly and intelligently meet the service delivery needs of customers
- Elastic compute and storage that scale to meet surges in demand, hardware failures, changes in customer habit, and other unforeseen circumstances
- Software defined and next generation networking to abstract management and routing, provide programmable agility, and achieve heterogeneous networking

Scope

- Datacenter and network management based on network management systems providing the tools and appliances necessary to perform DevOps while simultaneously assuring continued service delivery and customer safety
- Includes hardware, software, licensing, third party suppliers, managed services, and other sources of technology infrastructure
- Emphasizes highly scalable computing architecture predicated on cloud computing, brokerage, and provisioning to provide dynamic, on demand infrastructure to services and entities that scales, in real-time, as required
- Essentially focuses on introducing a layer of virtualized, software abstraction to network and server management to increase scalability and fault tolerance

Data architecture is data federation across distributed data stores to facilitate integration and sharing



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Data Architecture

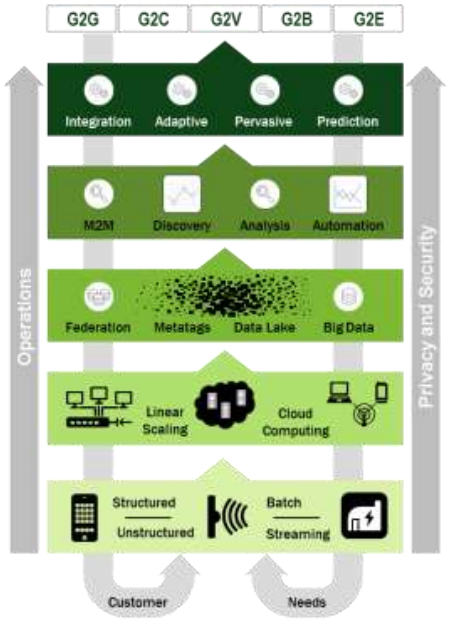
Paradigm Changes

- Distributed, non-dimensional, not only SQL platform that can linearly scale to meet the processing and storage requirements of a smart government
- Use of metadata tagging to assure cleanliness, pedigree, provenance, and security of data and information on behalf of government data owners
- Real-time publishing and federation of data and information between government entities with the ability to dynamically execute queries across data stores

Scope

- Data storage, management, integration, modeling, cleansing, exchange, and interoperability among entities
- Includes metadata management and tagging for purposes of adding security level metadata tags to ensure data owners retain control of their data
- Essentially data federation based on distributed and shared publishing and storage to enable highly scaled analytics and realize smart government
- Emphasizes schema on read, just in time access, and not only SQL platforms that move beyond traditional SQL database designs by storing all data and relying on subsequent analytics to conduct discovery against what traditionally would have been filtered out via bounding, normalization, and modeling

Analytics architecture is the analysis and automation used to produce customer service insights and knowledge



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Analytics Architecture

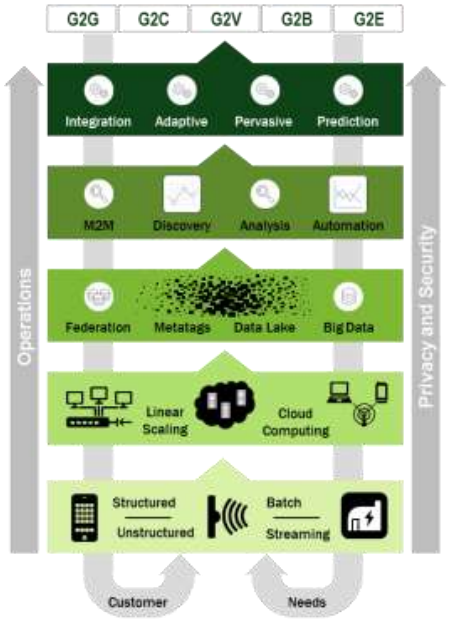
Paradigm Changes

- Distributed analytics executed in parallel across federated data stores to produce service delivery insights and knowledge based on statistical inferences
- Automated machine-to-machine communications that anticipate customer service needs while relying on human oversight rather than intervention
- Natural language processing and queries enabling highly advanced analysis such as inductive inference, simulation, and testing across the whole of government

Scope

- Data and information extraction to include natural language processing, topic modeling, semantic web standards, ontologies, computational semiotics, clustering, genetic algorithms, anomaly detection, and entity extraction
- Focus on predictive analytics with machine-to-machine communication, automation, discovery, end-to-end integration, and statistical inferences
- Human based analysis and research using business intelligence tools to simulate and test different scenarios and construct complex queries across federated data stores to evaluate and verify inductive inferences
- Essentially an implementation and practice centered around data science following the process of sampling, modeling, and trend analysis

Services architecture is the proactive delivery of customer services based on analytical and inferential insights



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Services Architecture

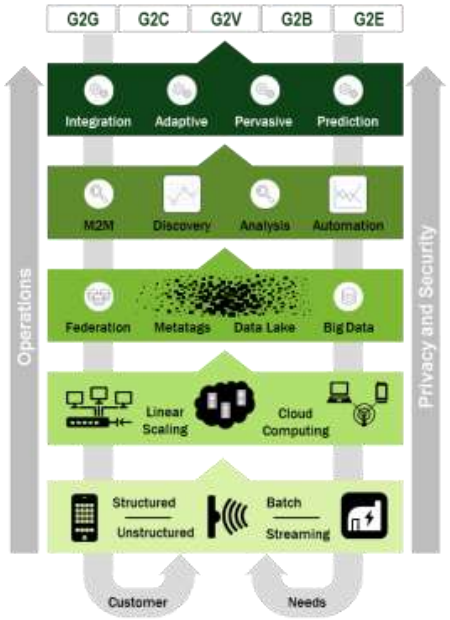
Paradigm Changes

- Proactive service delivery based on predictive insights about what customers need, how it should be delivered, and when customers need it
- Adaptive customer service that responds, in near real-time, to changes in customer behavior as a result of continuous, real-time feedback
- Integrated services seamlessly delivered across access channels and targeted based on demographic, geographic, and other statistical indicators

Scope

- Access channel strategy and design to include personalization, accessibility, discovery, modernization criteria, service bundling, and designing services with respect to demographic, geographic, and other statistical indicators, etc.
- Application and service federation strategy and design predicated on service-oriented architecture covering service brokers, integration, and delivery architecture, service-oriented design patterns, interfaces, and middleware
- Can be extended to include lower level software design and development standards such as secure coding, reuse, source control, testing, and the overall software development lifecycle
- User experience and information architecture for functionality, usability, etc.

Operations is the continual focus on service delivery throughout the customer experience lifecycle



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Operations

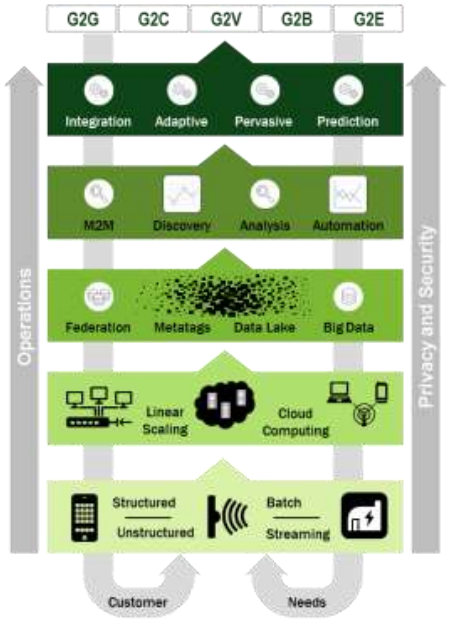
Paradigm Changes

- Realization of information technology service management and its goal of methodologically delivering services starting with service strategy
- Shift toward agile DevOps as the timeframe separating resource provisioning, service design, and customer reception shrinks
- Highly responsive, customer centric operations focused on services from the point of computing resources provisioning through final customer delivery

Scope

- Information technology service management in general covering service strategy, design, transition, and operation, change, configuration, and release management, and the service desk and catalog among other functions
- Based on industry best practices and international standards to include the Information Technology Infrastructure Library (ITIL) v3.0, ISO/IEC 20000-1:2005, ISO/IEC 20000-2:2012, and Fault, Configuration, Accounting, Performance, and Security (FCAPS) from ISO/IEC 10040:1998
- Described in the Service Component Reference Model (SRM) of the U.S. Federal Enterprise Architecture Framework (FEAF)
- Includes DevOps combining development, operations, and quality assurance

Privacy and Security is the constant balance to ensure the safety of constituents while providing ease of access



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Privacy and Security

Paradigm Changes

- Security built from an outward facing vantage that starts with core computing resources and network inputs and which ends with service delivery
- A focus on privacy and security throughout the customer experience lifecycle as data is the basis for intelligent and proactive service delivery
- Federation of data and services across government based on distributed technology architectures that necessitate mutual, policy based access control

Scope

- Information security in general covering information security management systems, data protection, pedigree, and provenance, network and endpoint protection, event lifecycle management, and incident response
- Based on industry best practices and international standards to include ISO/IEC 27001:2001, ISO/IEC 27002:2005, and the U.S. NIST SP 800 series
- Risk management in general covering business continuity management, disaster recovery planning, fault tolerance, continuity of operations, high availability, and failover
- Described in the Sherwood Applied Business Security Architecture (SABSA) as the Enterprise Information Security Architecture (EISA) domain

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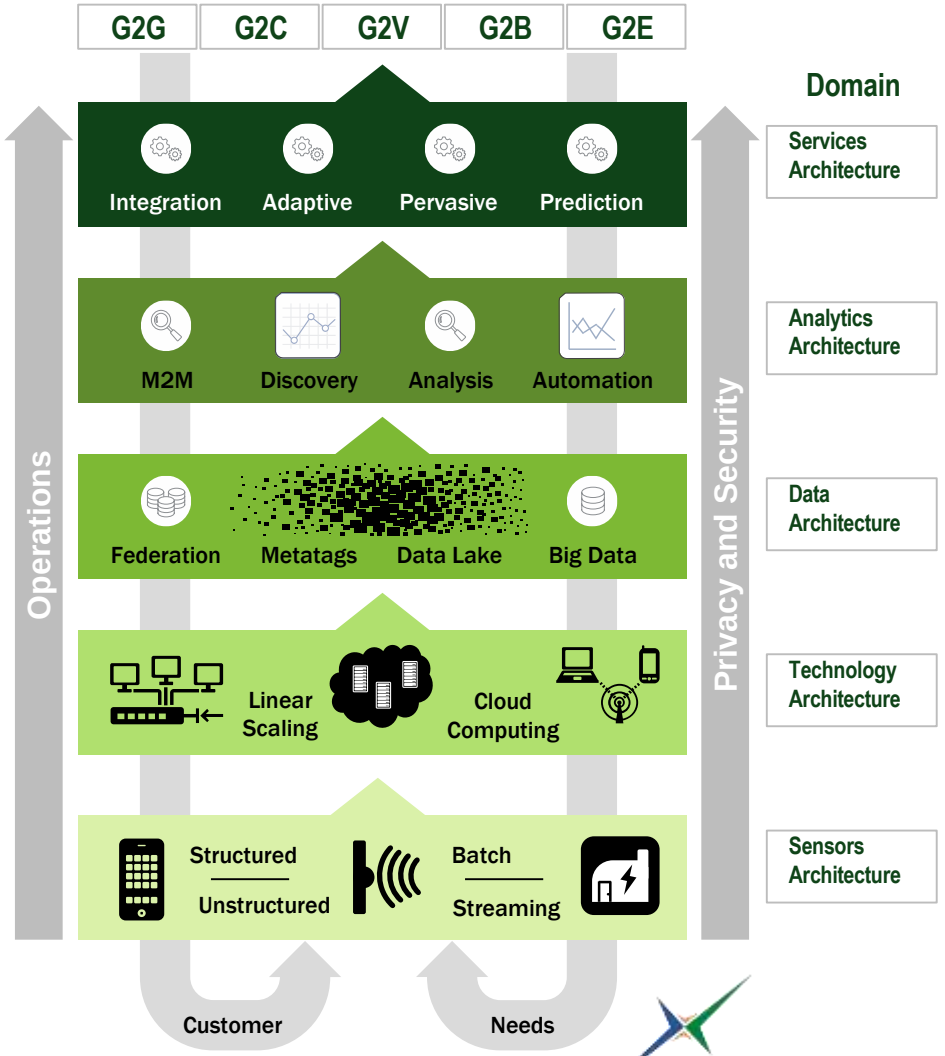
The high level enterprise architecture easily models the collected selected initiatives for smart government

					O	T	SI-1	National Network Infrastructure
				P	S	T	ID-1	National Trusted Service Manager
				P	S		ID-2	National PKI Support
				P	S		ID-3	National Identity Assurance Service
					S		ID-4	Constituent Box
					Enabling		EO-1	Public Awareness Campaign
					S		EO-2	Smart Community Centers
					S		EO-4	Service UAE
				S	D		EO-5	National CRM System
					Enabling		GP-1	Federal CIO Model
P	O	S	A	D	T	S	GP-3	Smart Government Regulatory Framework
				S	D		GP-4	Service Modernization Criteria
					O		GP-5	GEMS Performance Criteria
P	O	S	A	D	T	S	GP-6	National Government EA Guidelines
					S		GP-7	National UX Policy and Standards
				S	T		HC-1	Center of Digital Innovation
					A		SD-1	Smart Analytics
					D		SD-2	National Big Data System
		S	D	T	S		SD-3	National Spatial Data Infrastructure
					S		SM-1	Service Modernization
			S	A	D		SM-2	Smart Health
					S		SM-4	National ePayment Service



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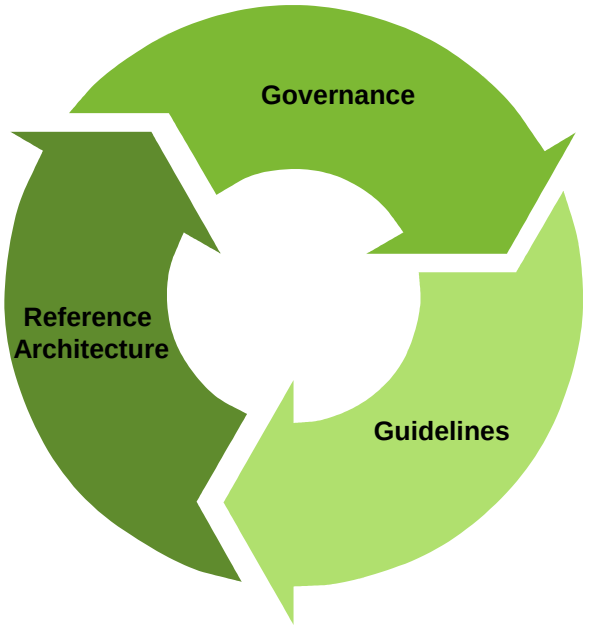
Future steps include building out the key elements for each domain to drive governance and promote consensus

Key Elements



	Focus Areas
Guidance	Develop detailed guidance for the different layers of the smart government enterprise architecture based on international standards and the needs of smart government initiatives
Compliance	Ensure shared infrastructure and services are designed and documented based on the smart government enterprise architecture and any accompanying policies and standards
Accreditation	Ensure services from FGEs that TRA hosts adhere to the smart government enterprise architecture and accompanying policies and standards before granting them the authority to operate
Policies	Publish policies and standards that define minimum requirements for security, integration, performance, and other topics in accordance with the overall structure of the enterprise architecture