November 2018

GLOBAL IT
BUILDING AND MATURING ENTERPRISE ARCHITECTURE

Grant Ecker

Sr. IT Director, Enterprise Architecture

Medtronic

TODAY'S JOURNEY

MEDTRONIC OVERVIEW	THE ARCHITECTURE VALUE PROPOSITION	BUILDING AN ARCHITECTURE PRACTICE	Q&A
Who are we? What do we do? How do we do it?	Where is Architecture focused? What are the desired outcomes?	What are the maturity phases? How can we add value at each stage?	What have you seen? Where can we create insights?

MEDTRONIC OVERVIEW

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WHO WE ARE

Medtronic
Further, Together

FOUNDED ON INNOVATION AND COLLABORATION

Innovation and collaboration are central to who we are. Since the late 1940s, we have been working with others to **alleviate pain, restore health, and extend life**. Today, we are a medical technology leader offering therapies and solutions that enable greater efficiency, access, and value — for healthcare systems, providers, and the people they serve.

Surgeon C. Walton Lillehei in 1961, with a young patient wearing a Medtronic battery-operated pacemaker.

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WHAT WE DO

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OUR STRATEGY
COMMITTED TO TRANSFORMING HEALTHCARE

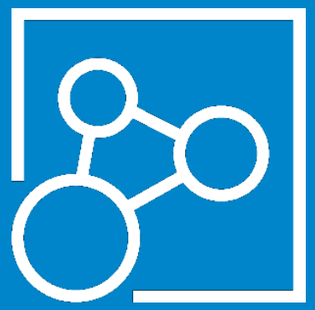
THERAPY INNOVATION

Introducing and delivering meaningful therapies and procedures

GLOBALIZATION

Addressing the inequities in healthcare access globally

ECONOMIC VALUE



Helping lead the creation of value-based healthcare solutions

PROVIDE VALUE TO OUR SHAREHOLDERS
THROUGH OUR DIVERSE PORTFOLIO

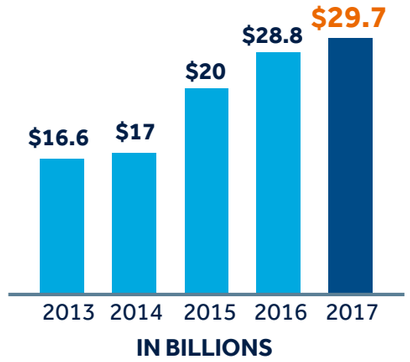
CARDIAC AND VASCULAR GROUP
$10.5
BILLION

RESTORATIVE THERAPIES GROUP
$7.4
BILLION

MINIMALLY INVASIVE THERAPIES GROUP
$9.9
BILLION

DIABETES GROUP
$1.9
BILLION

$29.7 BILLION FY17 TOTAL REVENUE*



* Information based on Medtronic FY2017 reporting.

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HOW WE DO IT

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OUR PEOPLE
EXPERTISE TO ACHIEVE OUR MISSION

84,000+
EMPLOYEES

9,600+
SCIENTISTS & ENGINEERS

1,600+
CLINICAL PROFESSIONALS

And tremendous clinical expertise and investments:

- $2.2 billion in **R&D**
- $450+ million in **clinical investments**
- 4,600+ **patents awarded**
- 45,000+ **patents** in our portfolio
- 400+ **clinical trials**

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OUR GLOBAL PRESENCE
HELPING MORE PEOPLE IN MORE PLACES

OPERATE IN
~160
COUNTRIES

ORGANIZED IN
4
REGIONS

370+
LOCATIONS

92
MANUFACTURING SITES

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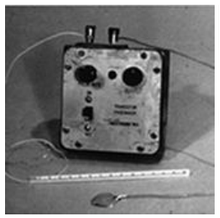
OUR RICH HISTORY OF INNOVATION
DOING WHAT'S NEVER BEEN DONE BEFORE

1949 — **MEDTRONIC** IS FOUNDED

1957 — **CREATED FIRST** BATTERY-OPERATED, EXTERNAL PACEMAKER



1960 — WROTE OUR **MISSION**

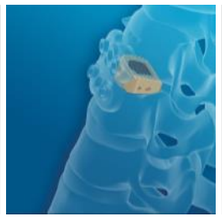
Developed the first implantable pacemaker

1977 — INTRODUCED **PROSTHETIC HEART VALVE**

1979 — ESTABLISHED THE **MEDTRONIC FOUNDATION**

1983 — EXPANDED INTO **NEURO-STIMULATION**

1999 — EXPANDED INTO **SPINAL CARE**



2001 — EXPANDED INTO **DIABETES CARE**

2002 — INTRODUCED **FIRST REMOTE MONITORING SYSTEM**

2015 — **ACQUIRED COVIDIEN**

2016 — INTRODUCED **THE WORLD'S SMALLEST PACEMAKER** AND THE **FIRST HYBRID CLOSED LOOP INSULIN DELIVERY SYSTEM**

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THERE'S MORE TO COME

Working together, we can improve the lives of more people with the power of medical technology. That's the potential of taking healthcare Further, Together.

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THE ARCHITECTURE VALUE PROPOSITION

MEDTRONIC OVERVIEW	THE ARCHITECTURE VALUE PROPOSITION	BUILDING AN ARCHITECTURE PRACTICE	Q&A
Who are we? What do we do? How do we do it?	Where is Architecture focused? What are the desired outcomes?	What are the maturity phases? How can we add value at each stage?	What have you seen? Where can we create insights?

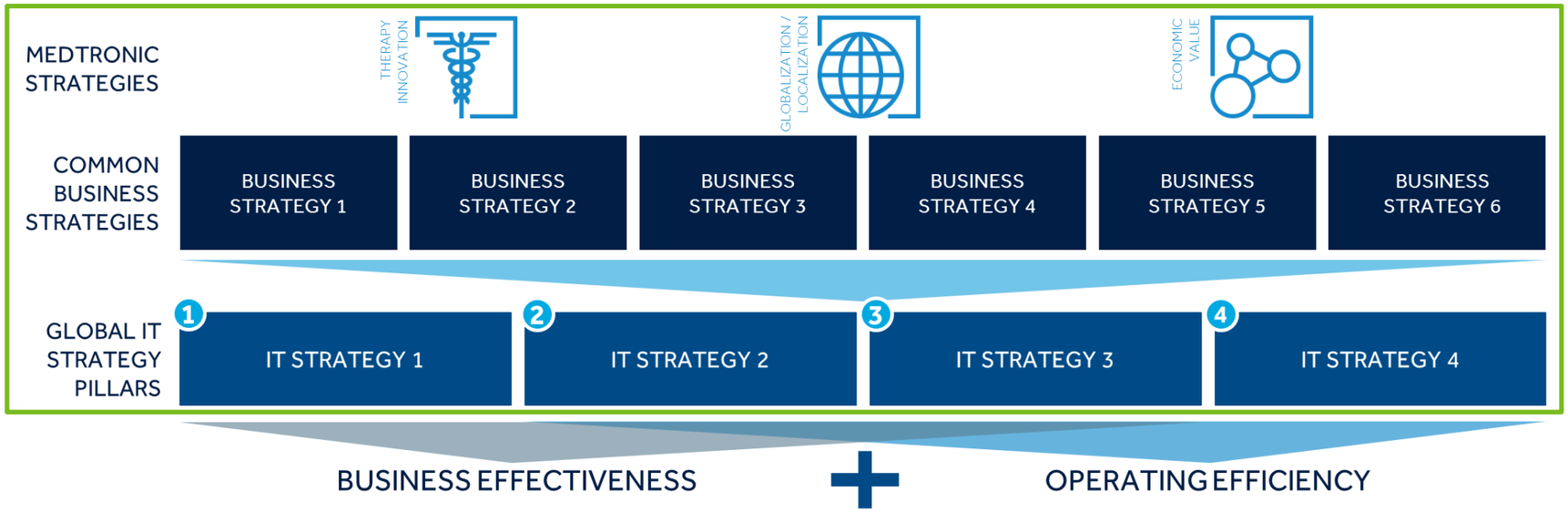
ENTERPRISE ARCHITECTURE
COMPANY ALIGNMENT & VISION

An Industry View…

Architecture is chartered to define, guide, and lead Enterprise-level activities to shape & enable strategy.

EA Value Play

GLOBAL IT STRATEGY OVERVIEW
ALIGNED TO BUSINESS STRATEGIES & OUTCOMES



…understanding ***what*** the business needs and translating these needs into…

how to deliver to enhance business capabilities and value…

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MEDTRONIC'S ARCHITECTURE VISION

ENTERPRISE ARCHITECTURE

ENABLING STRATEGY, OUTCOMES & SOLUTIONS

Your partner to shape and enable strategies and outcomes through transformative services and solutions to deliver business value, enterprise excellence, resilience, and quality.

EXPECTED SERVICES & OUTCOMES
OF ARCHITECTURE PRACTICES

Business Strategy	IT Strategy	Planning and Roadmapping	Governance
1. Manage Business Architecture	6. Design IT Strategic Plan	13. Assess Current State IT Environment	18. Promote Standards Adherence
2. Demonstrate Digital Opportunities to Business Leaders	7. Assess Vendors	14. Develop Future State IT Architecture	19. Support Project Delivery
3. Facilitate Digital Strategy Decisions	8. Introduce New Technologies	15. Set Technology Standards	20. Review Solution Designs
4. Bring the Customer Experience Lens to IT	9. Manage Information Architecture	16. Develop and Maintain Roadmaps	21. Provide Solution Designs (Solutions Architecture)
5. Provide Digital Business Model Consulting	10. Accelerate Agile Adoption	17. Support IT Portfolio Modernization	22. Manage Reference Architecture
	11. Design IT Workforce Plan		23. Manage Integration (SOA, API, etc.)
	12. Conduct IT Talent Assessments		

CEB

Source: CEB analysis.

ENTERPRISE ARCHITECTURE DESIGN PRINCIPLES
HOW ARCHITECTURE DELIVERS OUTCOMES

We balance our Design Principles across all of our work, including:

- Presentations and communications we share
- Solutions we design
- Processes we create, operate and measure
- Meetings we facilitate
- Relationships we maintain

We guide our engagement through our Design Principles across Global IT:

- We support one another and the organization in applying the Design Principles
- We promote our Design Principles in Communities of Practice and educate others on consistent use

BUSINESS VALUE DRIVEN

FLEXIBLE

STANDARDIZED

SIMPLE

SECURE & COMPLIANT

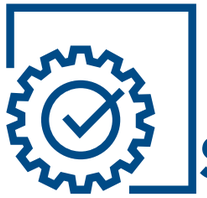
INFORMATION-CENTRIC

ENTERPRISE ARCHITECTURE DESIGN PRINCIPLES
ENABLING SPEED, BALANCE & QUALITY

BUSINESS VALUE DRIVEN
Shared vision and direction
Business capability-enabled

FLEXIBLE
Independent components (de-coupled)
Adjustable and scalable

SECURE & COMPLIANT
Consistently apply security controls
Manage risk to acceptable level



STANDARDIZED
Leverage standards and out-of-the-box solutions
Custom for business competitive advantage only

INFORMATION-CENTRIC
Information as strategic asset
Align to common EIM ecosystem

SIMPLE
Complexity simplified or hidden
Enable ease of use and leverage

BUILDING AN ARCHITECTURE PRACTICE

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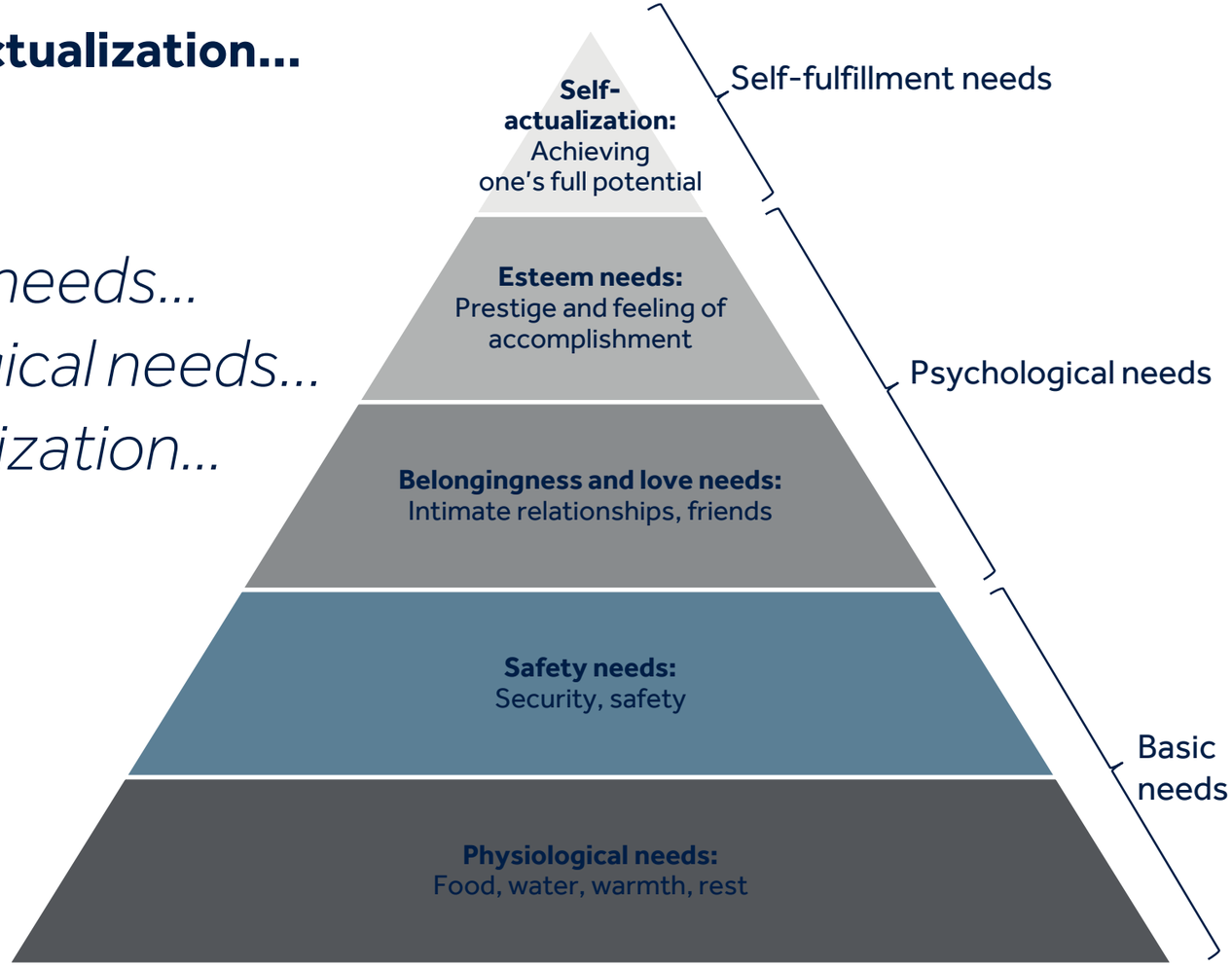
MASLOW'S HIERARCHY OF NEEDS
A JOURNEY TOWARDS SELF-ACTUALIZATION

You may have heard of Maslow's journey to self-actualization…

Premise:

We start with a stable foundation of basic needs…
We build on the foundation into psychological needs…
We ultimately strive to achieve self-actualization…



Typical EA practice maturity grows in Phases

- Level 1: Basic needs met
- Level 2: Psychological needs met
- Level 3: Self-fulfillment outcomes are possible

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INTRODUCING ECKER'S HIERARCHY OF ARCHITECTURE
A JOURNEY TOWARDS "PRACTICE REALIZATION"

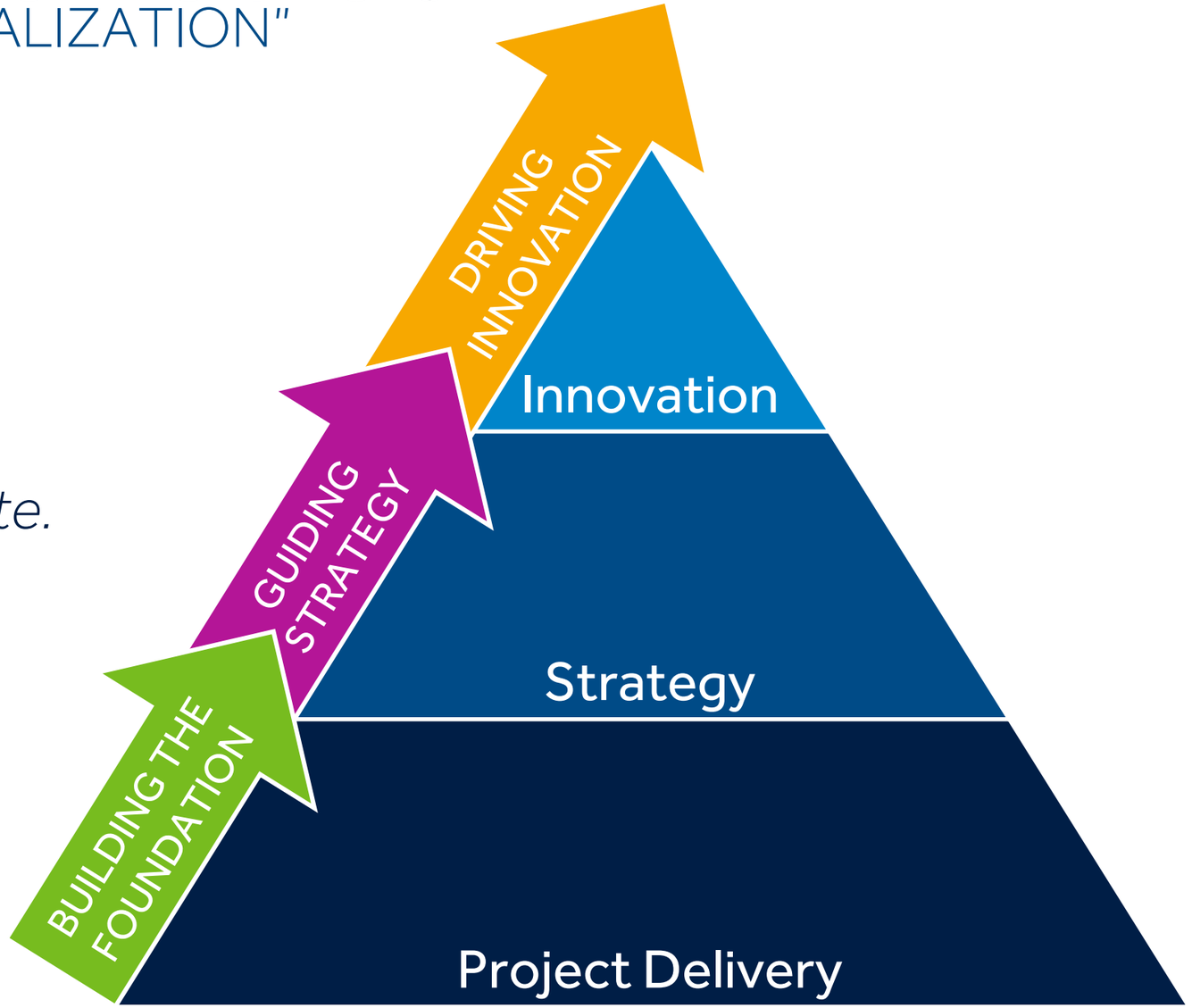
Like Maslow's journey to self-actualization,

Architecture's "practice realization" journey…

Starts with a stable delivery foundation, earning an invitation to guide and innovate.

Typical EA practice maturity grows in Phases

- Level 1: Project Delivery
- Level 2: Strategic Guidance
- Level 3: Innovation Leadership



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EA MATURES…
AS THE PRACTICE IS REALIZED

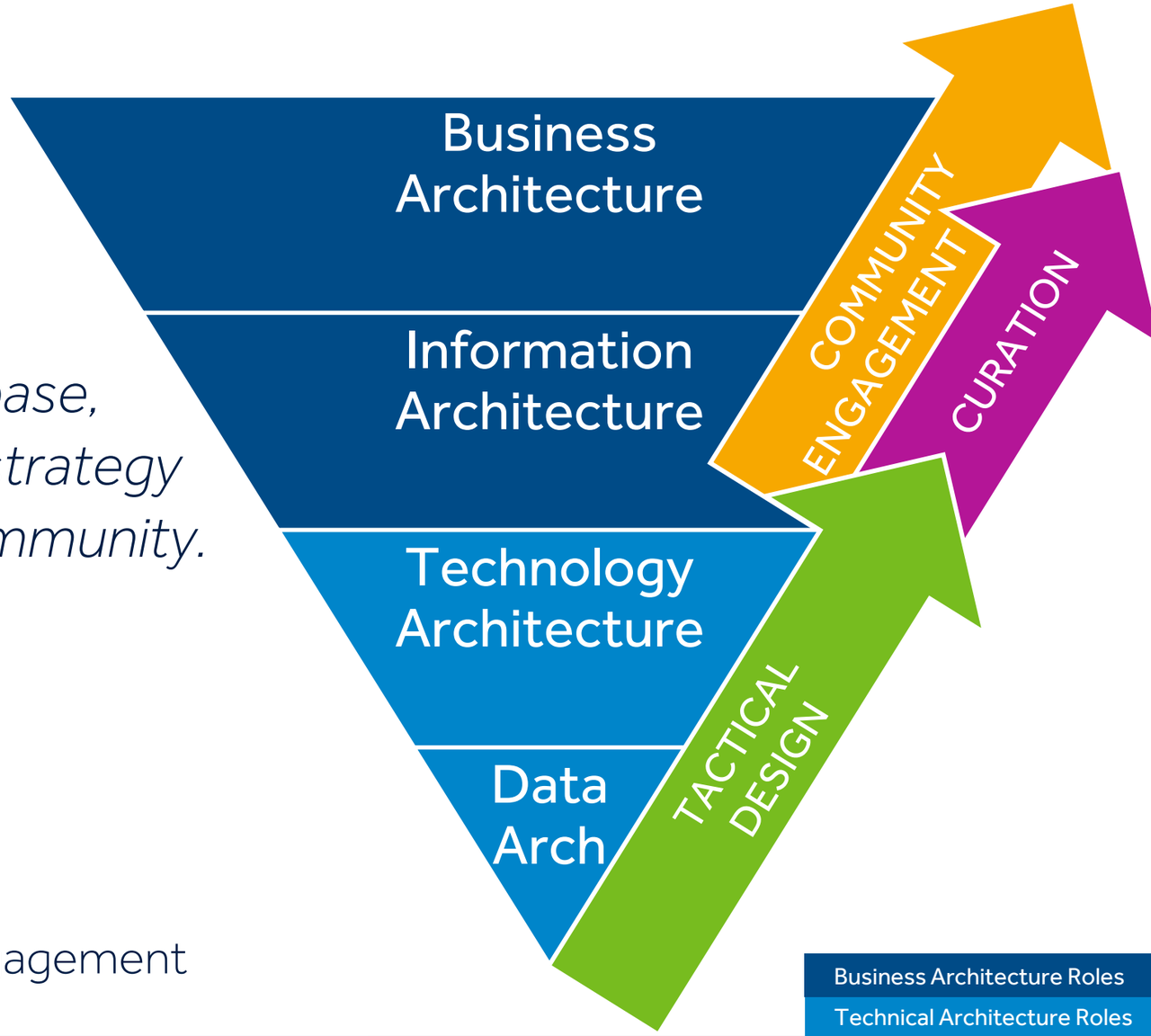
As Architecture's practice is realized,

Focus expands to additional practice areas…

Technical & Data Architecture provides the base, Information & Business Architecture curate strategy and practices drive innovation across the community.

Typical EA practice maturity grows in Phases

- Level 1: Project Delivery via Tactical Designs
- Level 2: Strategic Guidance via Asset Curation
- Level 3: Innovation Leadership with Community Engagement



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EA MATURITY LEVEL 1
BUILDING THE FOUNDATION
WITH TACTICAL DESIGN

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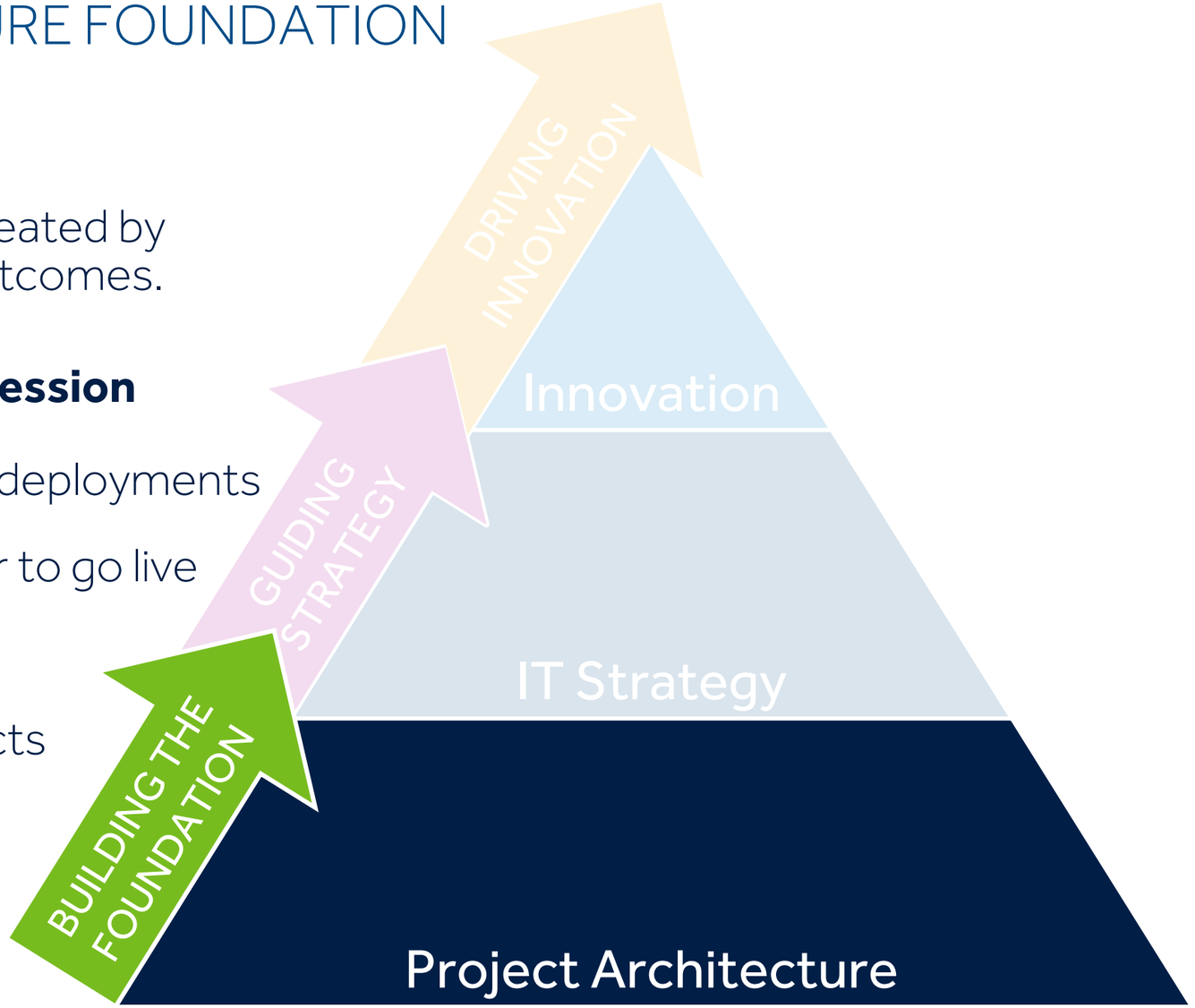
ENTERPRISE COMPLEXITY & DEPLOYMENT CHALLENGES
CREATES THE PROJECT ARCHITECTURE FOUNDATION

Level 1: Project Architecture

The foundation of organizational trust in EA is created by mitigating actions and preventing suboptimal outcomes.

Typical Project Architecture's Maturity Progression

1. Enterprise complexity growth or regrettable deployments
2. High risk deployments are flagged by EA prior to go live
3. EA project mitigations are commonly seen
4. EA guidance is often requested on key projects
5. An EA mandate empowers EA guidance
6. EA is embedded into the PMO's stage gating and the project delivery pipeline



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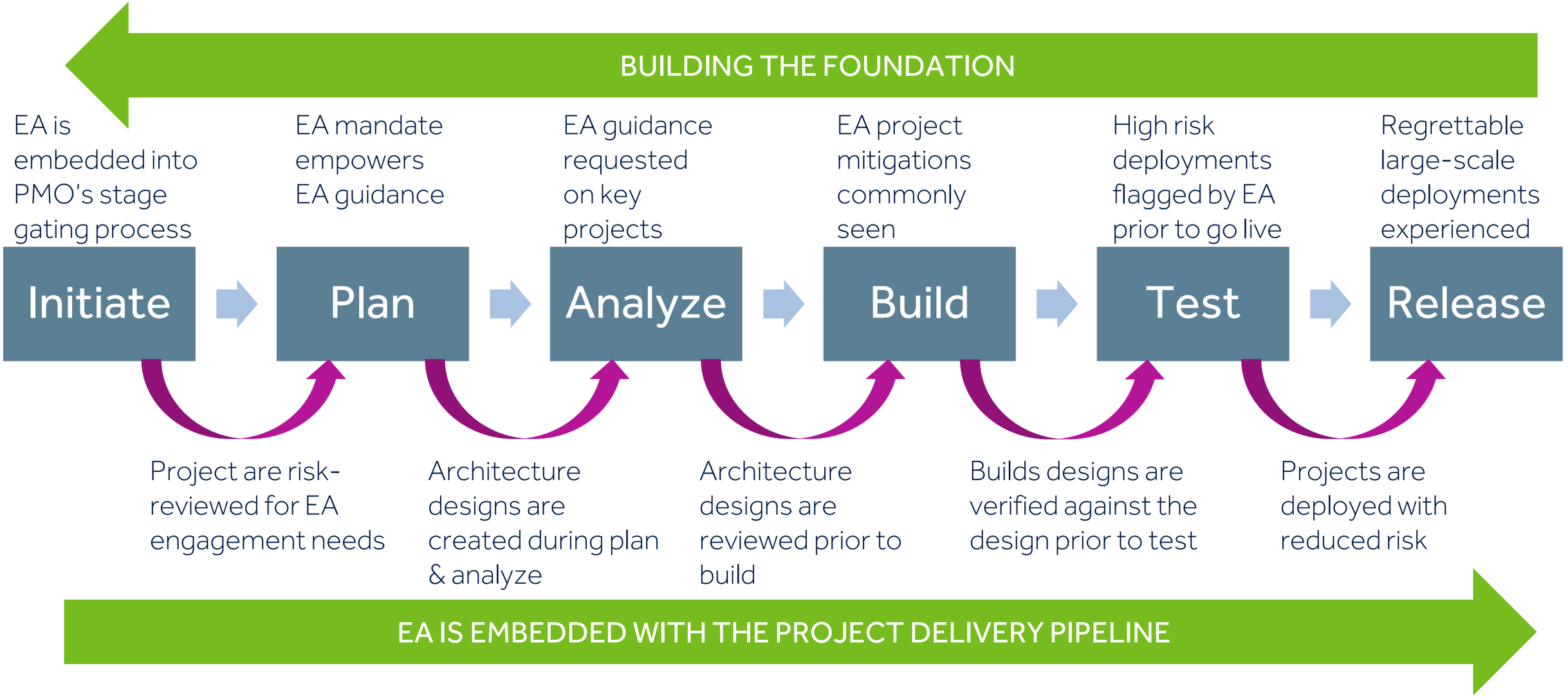
BUILDING THE FOUNDATION
EMBEDDING EA WITH THE PROJECT DELIVERY PIPELINE



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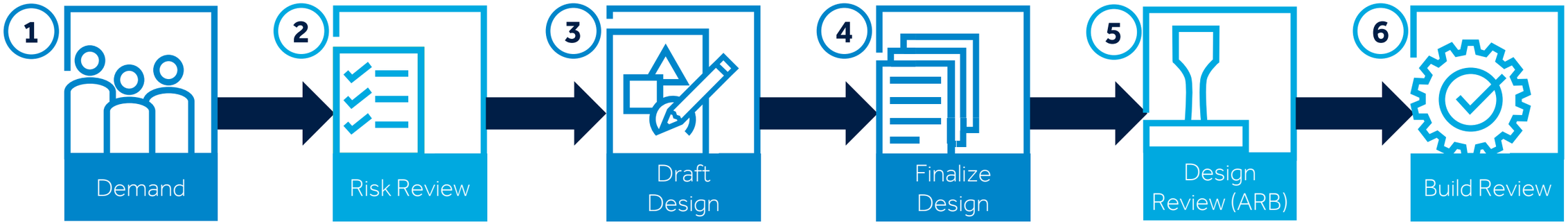
MEDTRONIC'S ENTERPRISE ARCHITECTURE PROCESS OVERVIEW
KEY PROCESS STEPS AND ACTIVITIES

Enterprise and project architecture development, design, review, approval, and governance are managed as shown below.



Demand begins with:
- Strategic programs
- EPMO demand
- Security efforts

Risk level is assessed:
- Technology Risk Review assesses the risk level

Architecture is created:
- Effort is aligned with strategy & standards
- Business context is defined
- Architecture is designed

Architecture is refined:
- Project team ensures the design meets their requirements
- The design is iterated to address and identified gaps

Architecture is approved:
- The architect formally reviews the design with Architecture Review Board (ARB)

Execution is aligned:
- Architects monitor execution to align the design with the build
- Significant risks or modifications from the approved design are managed

ARB Responsibility

Architect Responsibility

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2

ENTERPRISE ARCHITECTURE TECHNOLOGY RISK REVIEW
LEVELS & DESCRIPTIONS

Technology Risk Reviews occur as efforts enter planning:

- Strategic programs
- Projects entering EPMO's assess phase
- Efforts entering Security's assessment process

What happens?

1. An Architects is assigned to risk-review efforts with standard questions
2. Recommendations are presented to Global ARB
3. Global ARB determines EA requirements
   - For risk levels 3+…
     - An ARB review is generally required
     - The deliverable is determined
     - The review is classified as Global or Regional

Guidelines for risk levels

Level	Description	Example
1	Very Low Risk	• Refresh ("Like for Like")
2	Low	• New technology or upgrades • No architectural changes
3	Medium Risk	• New technology or upgrades • Architectural changes
4	High Risk	• Business important • Moderate to large projects • Moderate architectural impacts
5	Very High Risk	• Business critical • Large projects • High architectural impacts • New architecture patterns

2

ENTERPRISE ARCHITECTURE TECHNOLOGY RISK REVIEW
STANDARD QUESTIONS

Will the project change any solution's Medtronic Data Classification?

Does the project migrate data?

Is this a new technology at Medtronic?

What was the complexity of the solution from PPM?

Will the solution start using Personally Identifiable Information (PII)?

Does this project upload, download or interface with other systems?

Which business capabilities will be impacted? Is this technology currently used for these business capabilities?

Is the project planning to customize an application (write code) to extend functionality?

Is this technology on the list of standard or non-standard solutions?

Is the project expanding the use of a standard solution beyond it's currently approved capabilities?

5

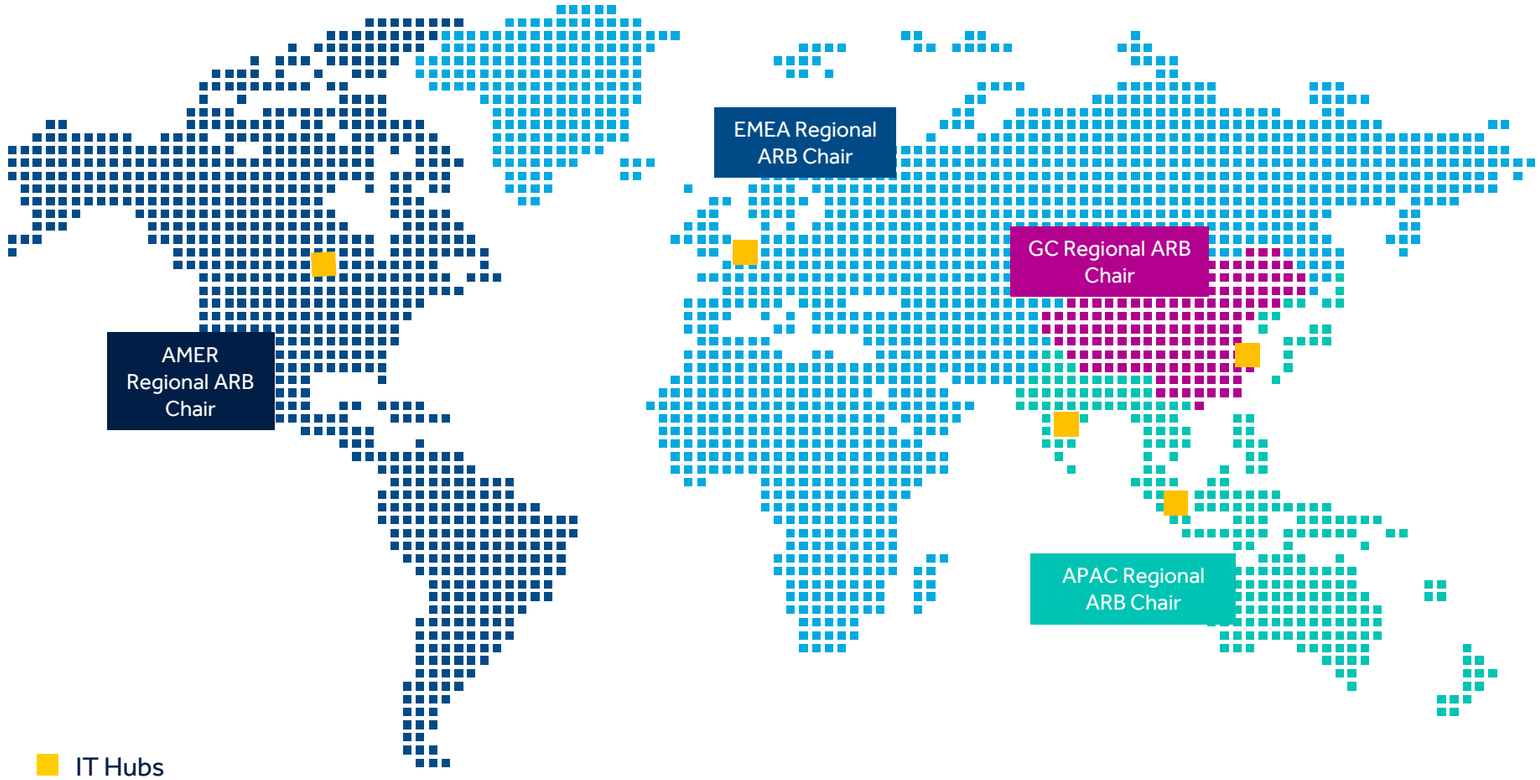
GLOBAL & REGIONAL ARCHITECTURE REVIEW BOARDS

MEDTRONIC'S STRUCTURAL OVERVIEW

Grant Ecker
Global ARB Chair

What is the purpose of an ARB review?

To risk-review the required architecture deliverables for initiatives globally or regionally based on their expected impact and intended use



OBJECTIVE: To produce a risk assessment and a decision summary:

ARCHITECTURE RISK

THE SOLUTION'S DESIGN RISK

QUALITY RISK

THE DOCUMENTATION'S QUALITY OR COMPLETENESS

OVERALL RISK

THE SUMMARY RISK LEVEL BASED ON THE ABOVE RISKS

DECISION SUMMARY

A SUMMARY OF THE RARB'S DECISION AND NEXT STEPS REQUIRED

Regional ARBs are performed by regional members with global oversight.

Global ARB communicates all global & regional reviews.

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AS PROJECT ARCHITECTURE IS PROVEN…
EA'S PRACTICE FUNDAMENTALS ARE ESTABLISHED

Project Architecture

In performing tactical architecture, the fundamental practice skills are established for tech & data architecture.

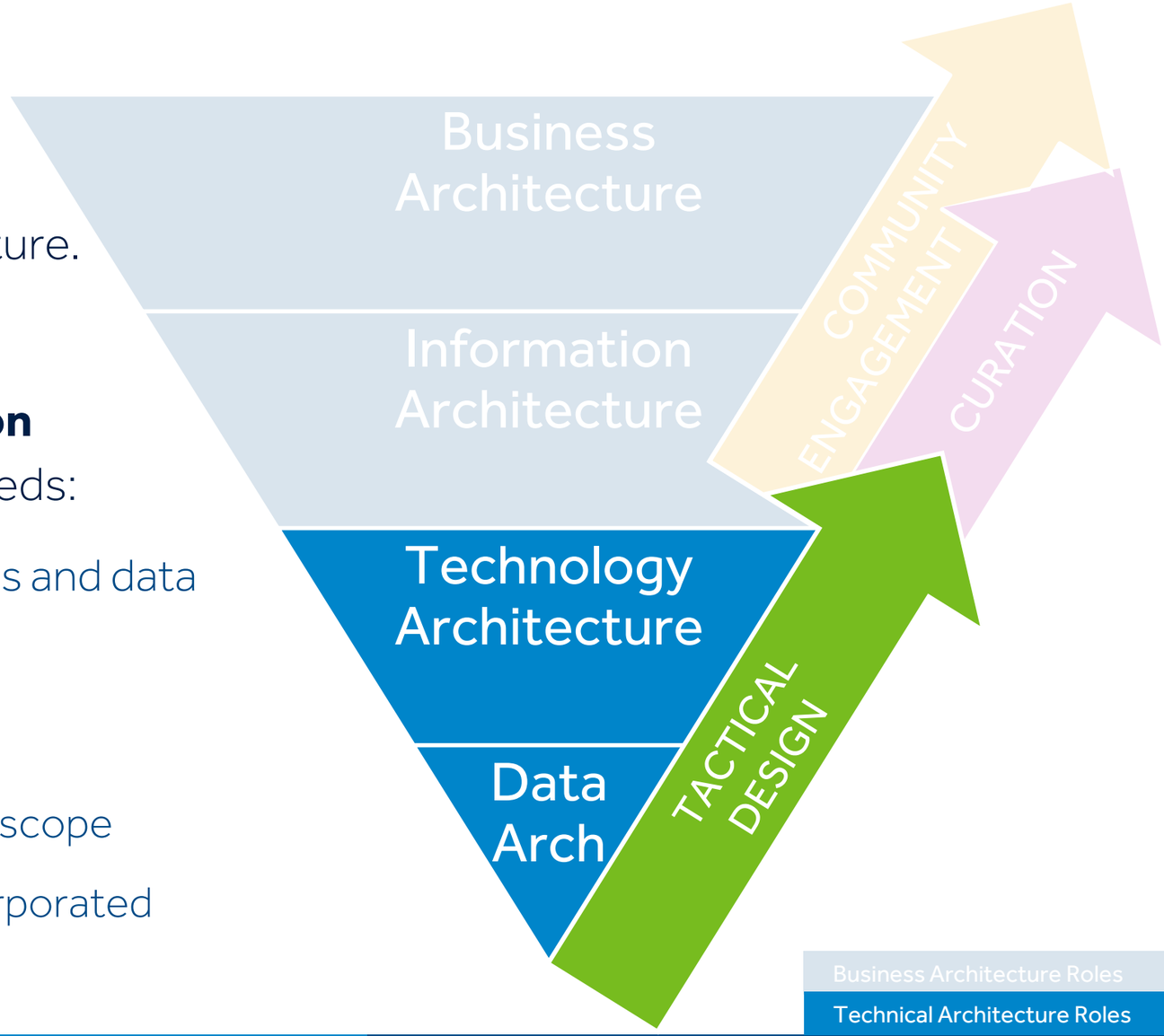
Typical Project Architecture's Maturity Progression

EA builds skills defining solution's "how" for tactical needs:

1. Projects are supported within their scoped systems and data
2. EA builds skills to align solutions and their data

At this maturity phase…

- Information assets are typically confined the effort's scope
- Broader needs across the company are seldom incorporated



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EA MATURITY LEVEL 2
STRATEGIC GUIDANCE WITH CURATION

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PROJECT DELIVERY INVITES STRATEGIC CONVERSATIONS
PROVIDING A PROMOTION INTO STRATEGY

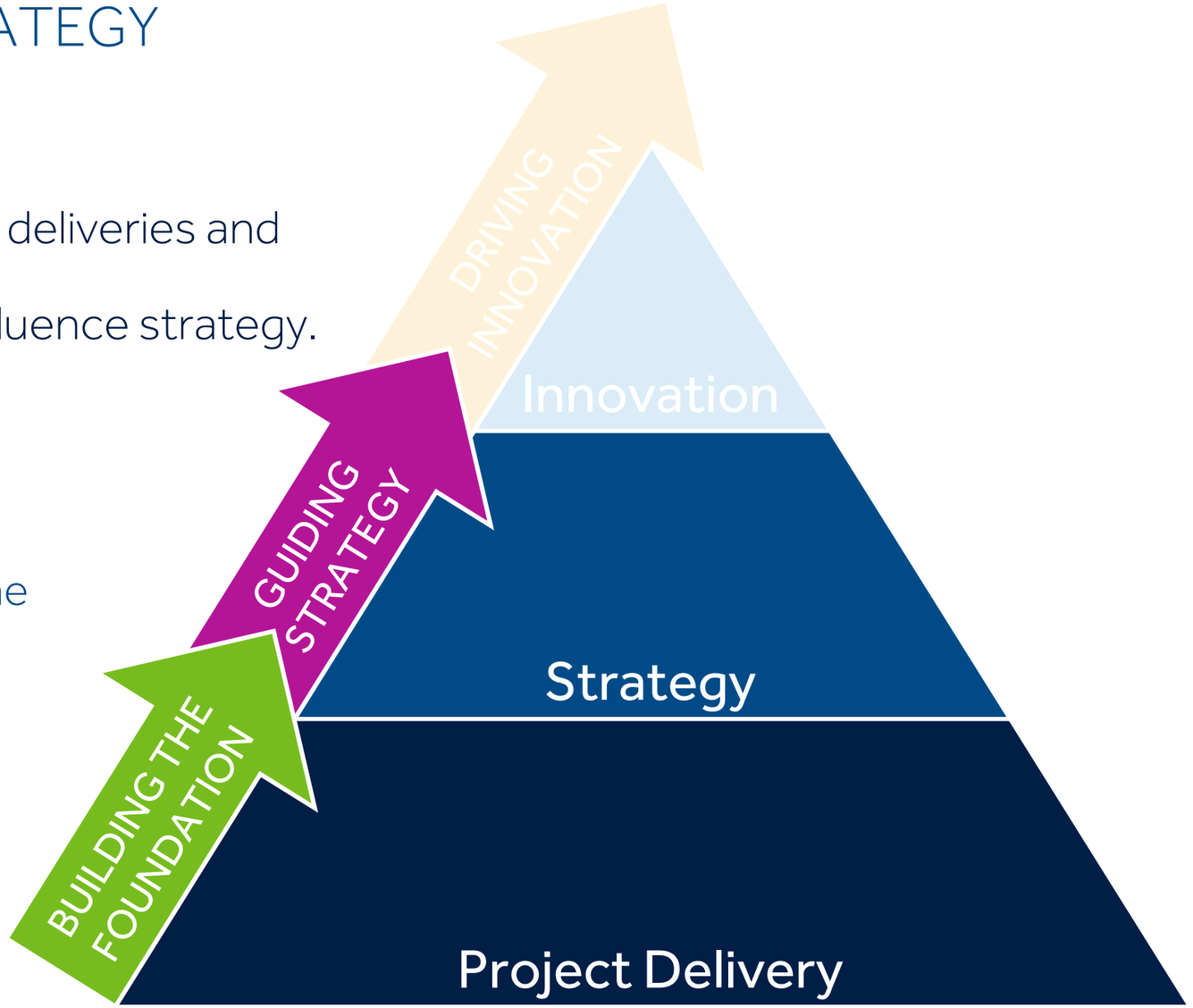
Level 2: Guiding Strategy

Building on the trust established through project deliveries and leveraging a new broad awareness of IT efforts,
EA can create and guide conversations which influence strategy.

Typical Strategy Maturity Progression

Project successes build interest, allowing EA to…

1. Identify strategic themes from project pipeline & industry research visibility
2. Socialize and initiate strategic tracks of work
3. Bridge across siloed strategic workstreams
4. Influence towards a common approach
5. Become a trusted strategic partner



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MASLOW'S HIERARCHY OF ARCHITECTURE
THE MIDDLE: "STARTING TO BELONG" AS AN ENABLER OF IT STRATEGY

PUTTING THE PIECES TOGETHER

EA notices strategic themes across key projects

Initiate → Plan → Analyze

EA aggregates emerging industry research

Tech Trends | Industry | Articles

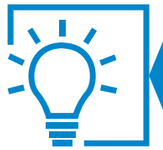
EA CREATES STRATEGIC WORKSTREAMS

EA Strategist
Cognitive Compute

EA Strategist
Integrated Health Solutions

EA Strategist
Value-based Health Care

IT Program Director
Cloud Adoption



EA Strategist
Internet of Things

Technical Architecture Alignment

Business Architecture Alignment

AS STRATEGY WORKSTREAMS ARE DELIVERED…
EA'S HIGHER FUNCTIONS ARE AWAKENED

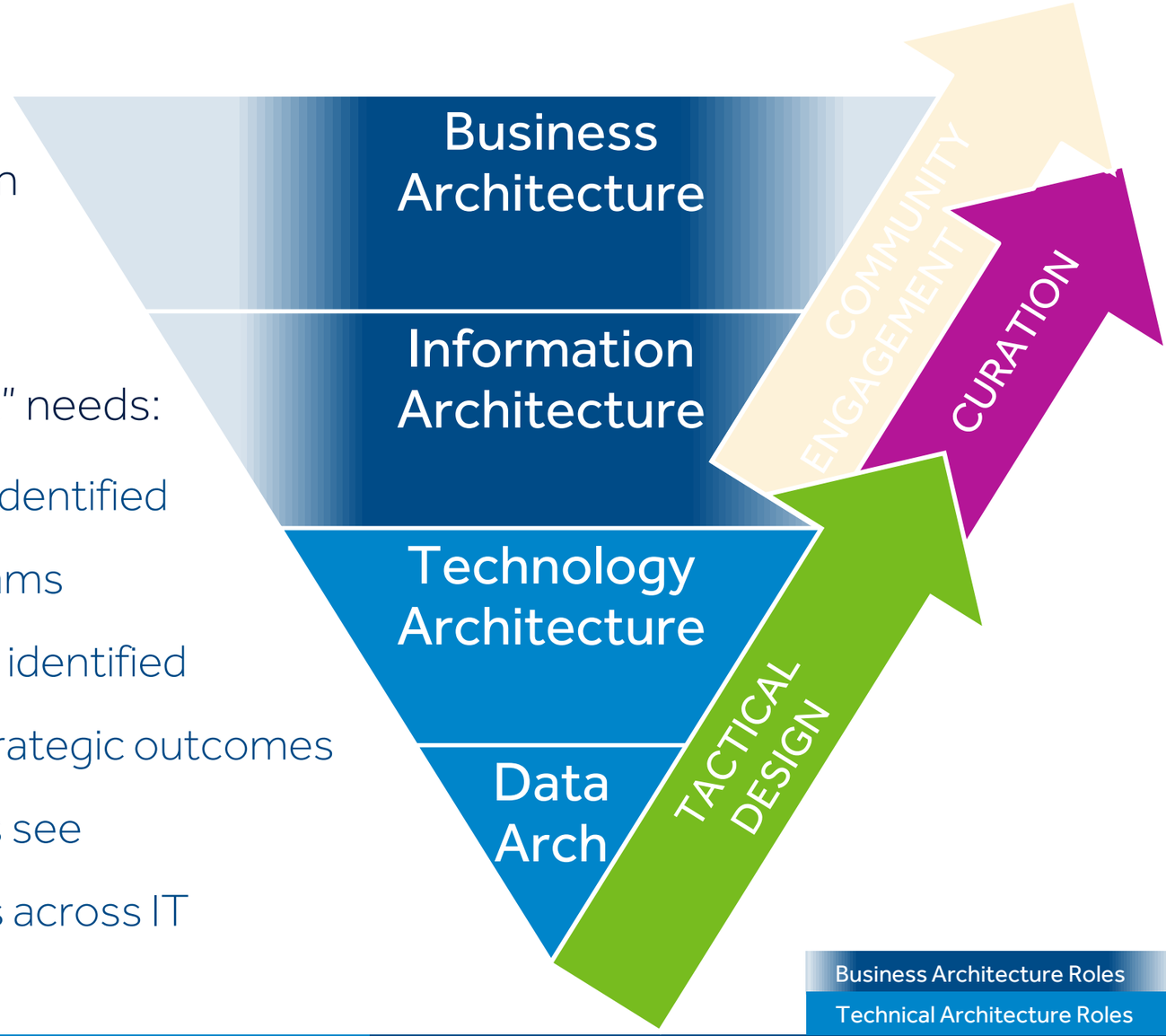
Strategy Architecture

In deploying strategic tracks, business and information architecture skills are built within the workstreams.

Typical Strategy Maturity Progression

EA develops focused skills in understanding the "what" needs:

- Business Architecture skills are developed to group identified company needs & demands into strategic workstreams
- Information Architecture skills are matured to group identified information assets that must be shared to realize strategic outcomes
- Broader Business and Information Architecture skills see experimental use beyond the strategic workstreams across IT



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EA MATURITY LEVEL 3
DRIVING INNOVATION WITH COMMUNITY ENGAGEMENT

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STRATEGIC EFFECTIVENESS WELCOMES COMMUNITY ENGAGEMENT
CHASING "PRACTICE REALIZATION"

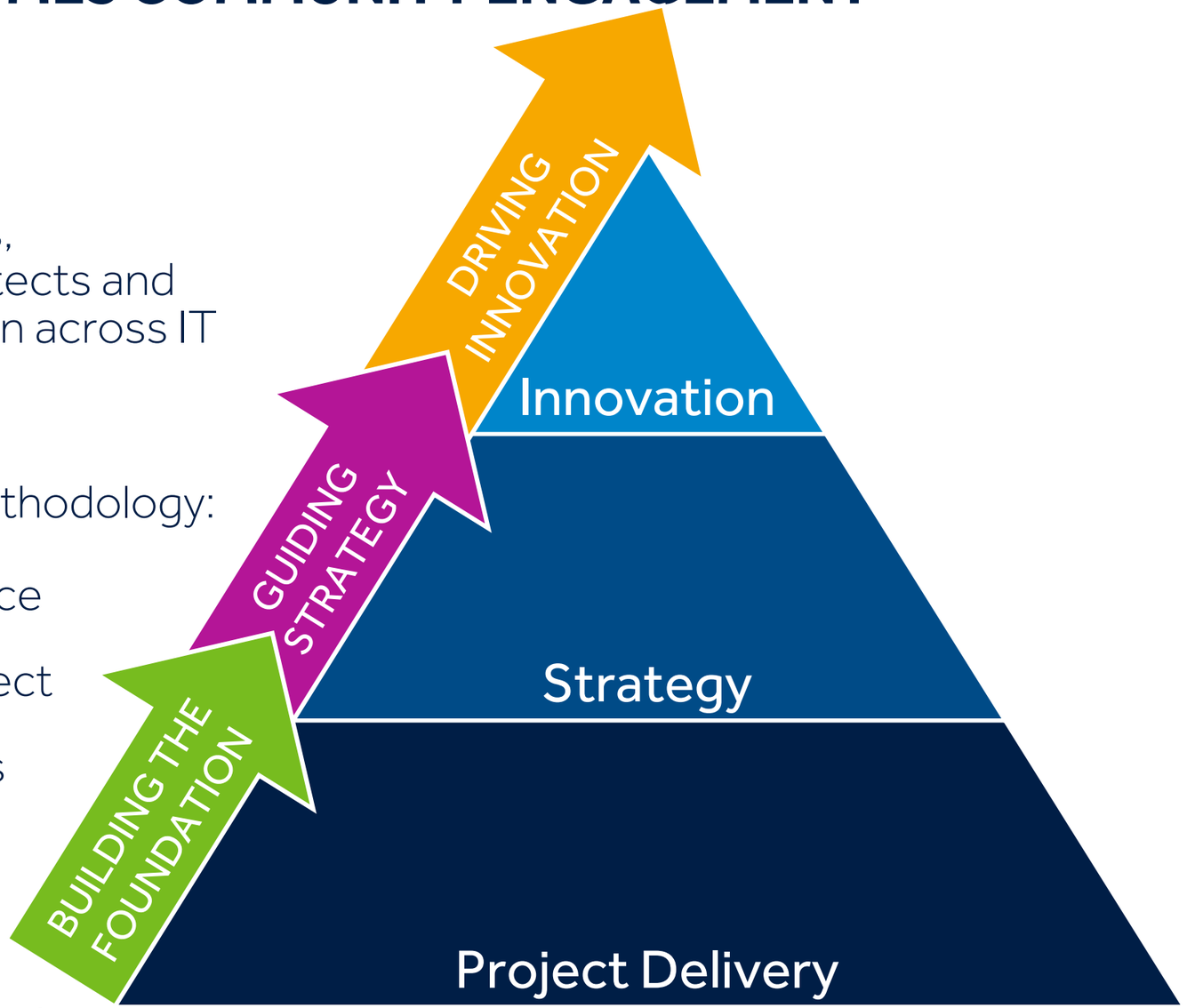
Level 3: Driving Innovation

Growing from successful strategy engagements,
EA Project delivery is created by federated architects and
EA shifts to focus on driving strategy & innovation across IT

Typical Innovation Maturity Progression

Strategy builds IT interest in the architecture methodology:

1. EA builds architecture communities of practice
2. EA trains federated architects to design project architecture by collaborating across domains
3. EA strategy tracks drive explorative research
4. EA works across architect communities to drive innovation, guide strategy and deliver projects



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ENTERPRISE ARCHITETURE SHIFTS LEFT
EA FOCUSES ON STRATEGY, FEDERATED ARCHITECTS FOCUS ON DESIGN

Business Strategy	IT Strategy	Planning and Roadmapping	Governance

Emerging Focus — *Traditional Focus*

CREATE **FOCUS**

1. Manage Business Architecture
2. Demonstrate Digital Opportunities to Business Leaders
3. Facilitate Digital Strategy Decisions
4. Bring the Customer Experience Lens to IT
5. Provide Digital Business Model Consulting
6. Design IT Strategic Plan
7. Assess Vendors
8. Introduce New Technologies
9. Manage Information Architecture
10. Accelerate Agile Adoption
11. Design IT Workforce Plan
12. Conduct IT Talent Assessments
13. Assess Current State IT Environment
14. Develop Future State IT Architecture
15. Set Technology Standards
16. Develop and Maintain Roadmaps
17. Support IT Portfolio Modernization
18. Promote Standards Adherence
19. Support Project Delivery
20. Review Solution Designs
21. Provide Solution Designs (Solutions Architecture)
22. Manage Reference Architecture
23. Manage Integration (SOA, API, etc.)

BY **FEDERATING**

Increasing Emphasis

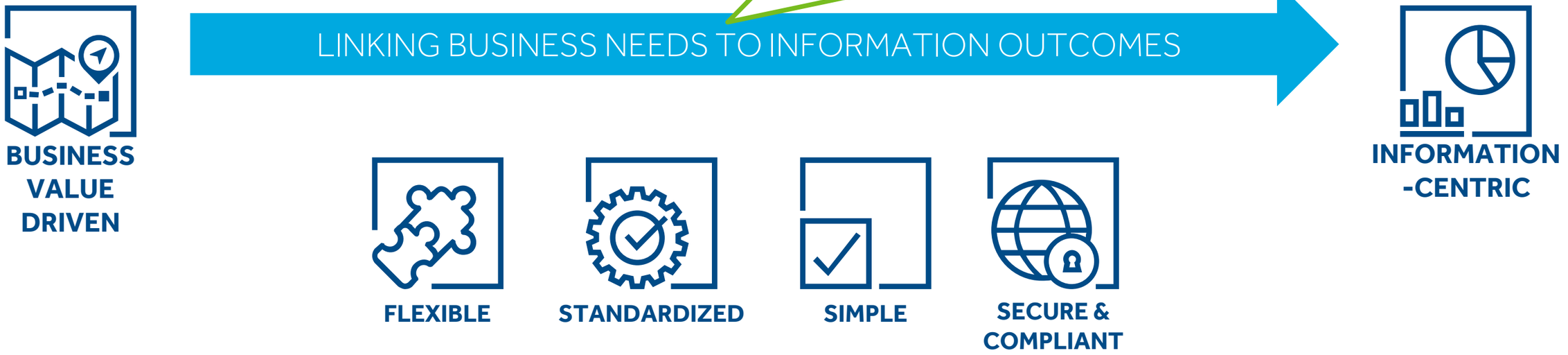
CEB

Source: CEB analysis.

ENTERPRISE ARCHITECTURE PRINCIPLES
APPLIED WITH FEDERATED ARCHITECTS

EA transforms from the doer to the enabler of federated architects

ENABELED BY
EA, ACROSS IT



WHAT

CONSIDERATIONS FOR 'HOW'

OUTCOME

SHAPED BY
BUSINESS ARCHITECTS

DESIGNED BY
TECHNICAL ARCHITECTS

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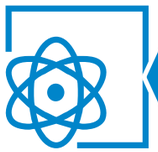
HOW DO WE ENABLE THE COMMUNITY?
CREATING EA-LED COMMUNITIES OF PRACTICE

EA Practice Leader
Business Architecture Strategy

EA Practice Leader
Enterprise Information Management



EA Practice Leader
Technical Architecture Strategy

EA Practice Leader
Security Architecture Strategy

EA Strategist
Cognitive Compute

EA Strategist
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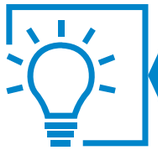
Cloud Adoption



EA Strategist
Internet of Things

Business Architecture Alignment
Technical Architecture Alignment

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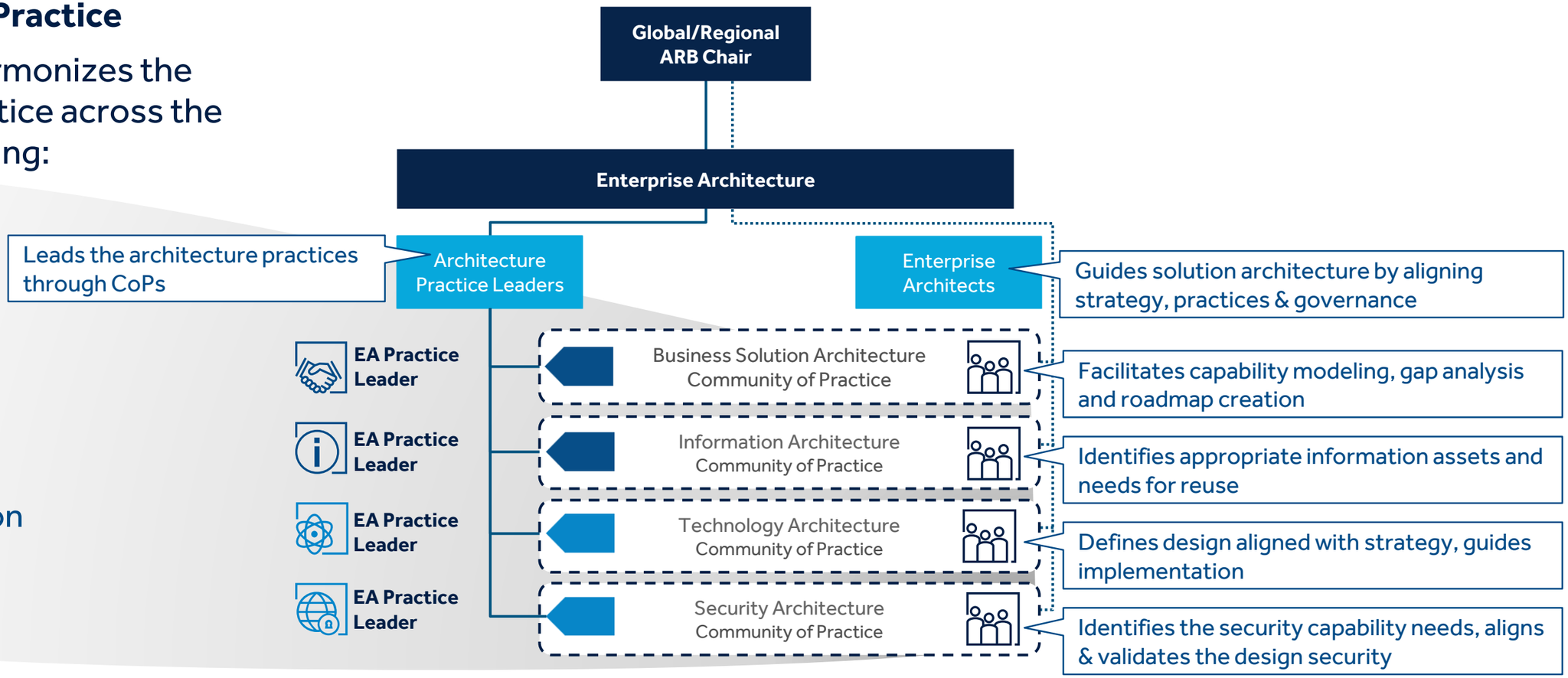
COMMUNITIES OF PRACTICE...
ORGANIZATIONAL & OPERATIONAL STRUCTURE

Communities of Practice

Socializes and harmonizes the architecture practice across the job family by sharing:

- Strategy
- Standards
- Patterns
- Methodology
- Techniques
- Documentation
- Metrics
- Outcomes



Business Architects
Enterprise Architects
Technical Architects

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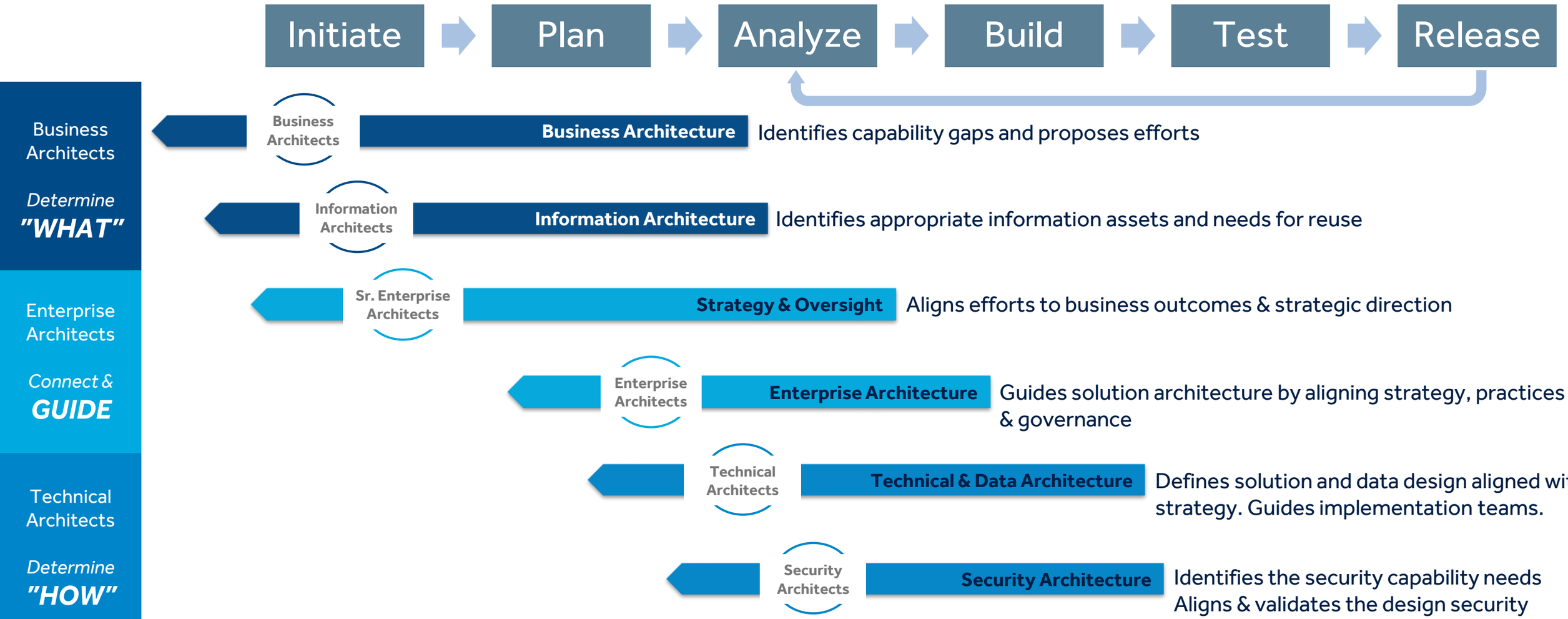
THE FEDERATED ARCHITECTURE MODEL
SHAPING DEMAND, GUIDING INTO EXECUTION



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WHAT OUTCOMES ARE WE SEEKING?
FEDERATION ENABLES COLLABORATION & STANDARDIZATION

When architecture is sourced across distributed teams with common practices:

Local architects (outside of EA) define the roadmap, assess the pipeline, define their solutions and measure their quality.

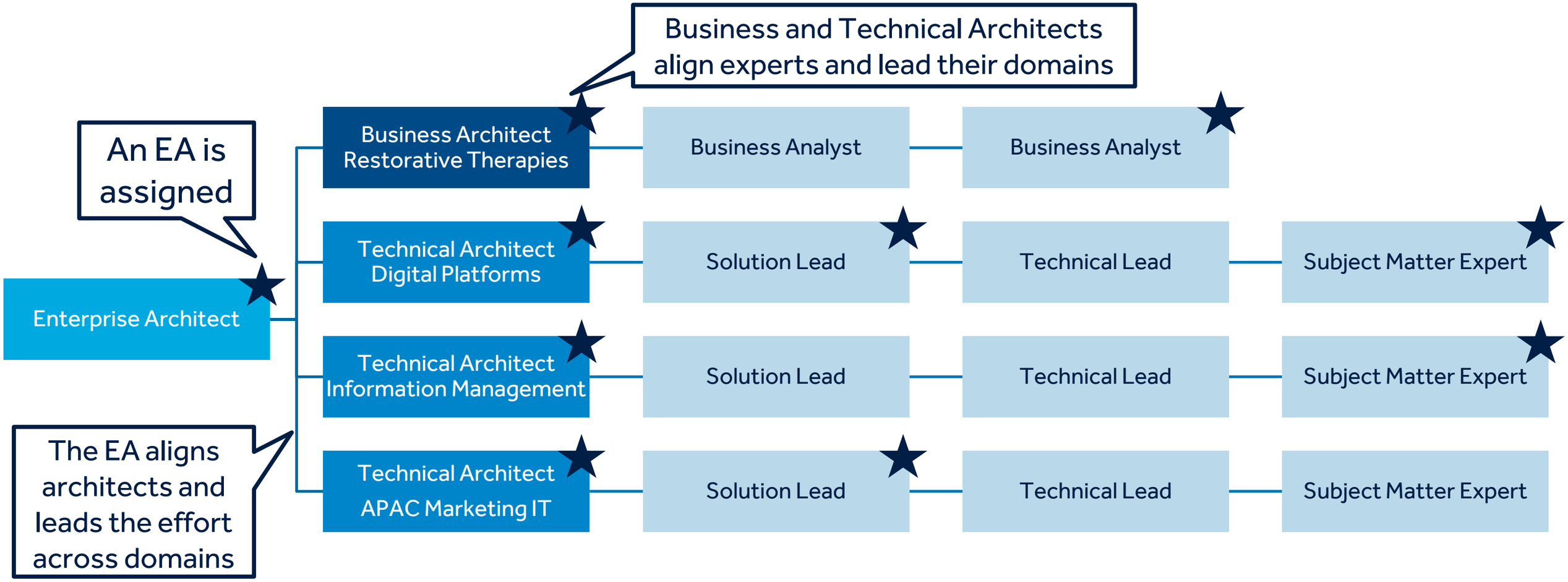
Collaboration across architects creates balanced solutions across business needs (Business Architects), IT domain needs (Technical Architects), and technology strategies (Enterprise Architects).

A network of broad technical leaders with mastery of their areas increases collaboration and knowledge sharing across Global IT.

Global architecture practices create consistent and standardized work that is locally designed.

- Localized architecture
- Balanced solutions
- Increased collaboration
- Standardized work

HOW IS FEDERATED WORK STRUCTURED?
AN EXAMPLE ENTERPRISE EFFORT…



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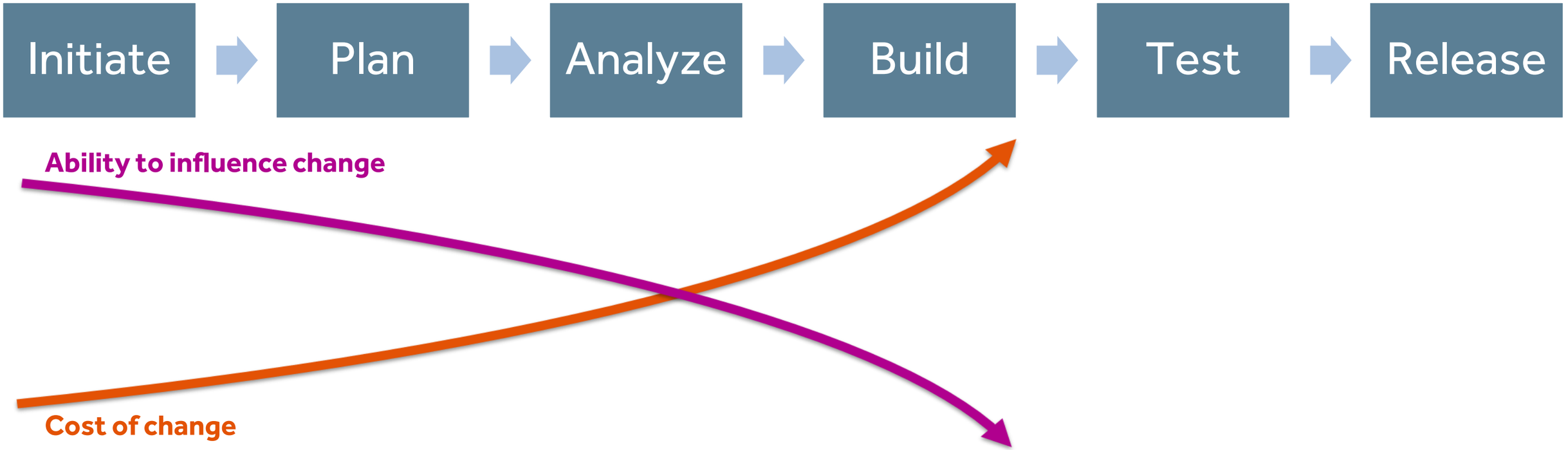
FEDERATING THE 'HOW'
WHY DEFINE THE DESIGN THROUGH TECHNICAL ARCHITECTS?

Why Change?

- A Technical Architect's design and delivery oversight creates supportable outcomes
- They can influences the project's design before change agility is limited in build & test



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WHAT ARE THE ROLES?
HOW DOES IT EXECUTE PROJECTS?

TECHNICAL ARCHITECTS:

- Lead their organizations in defining the HOW in their domain
- Define technology standards & roadmaps within their domains
- Create reusable patterns & blue prints to leverage the standards
- Align, design, document & guide delivery across their domains

ENTERPRISE ARCHITECTURE:

- Align the pipeline of projects for execution
- Measure to ensure delivery is realized
- Drive projects execution to materialize the broader enterprise strategies

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AS THE ARCHITECTURE COMMUNITY GROWS…
THE ARCHITECTURE PRACTICE MATURES

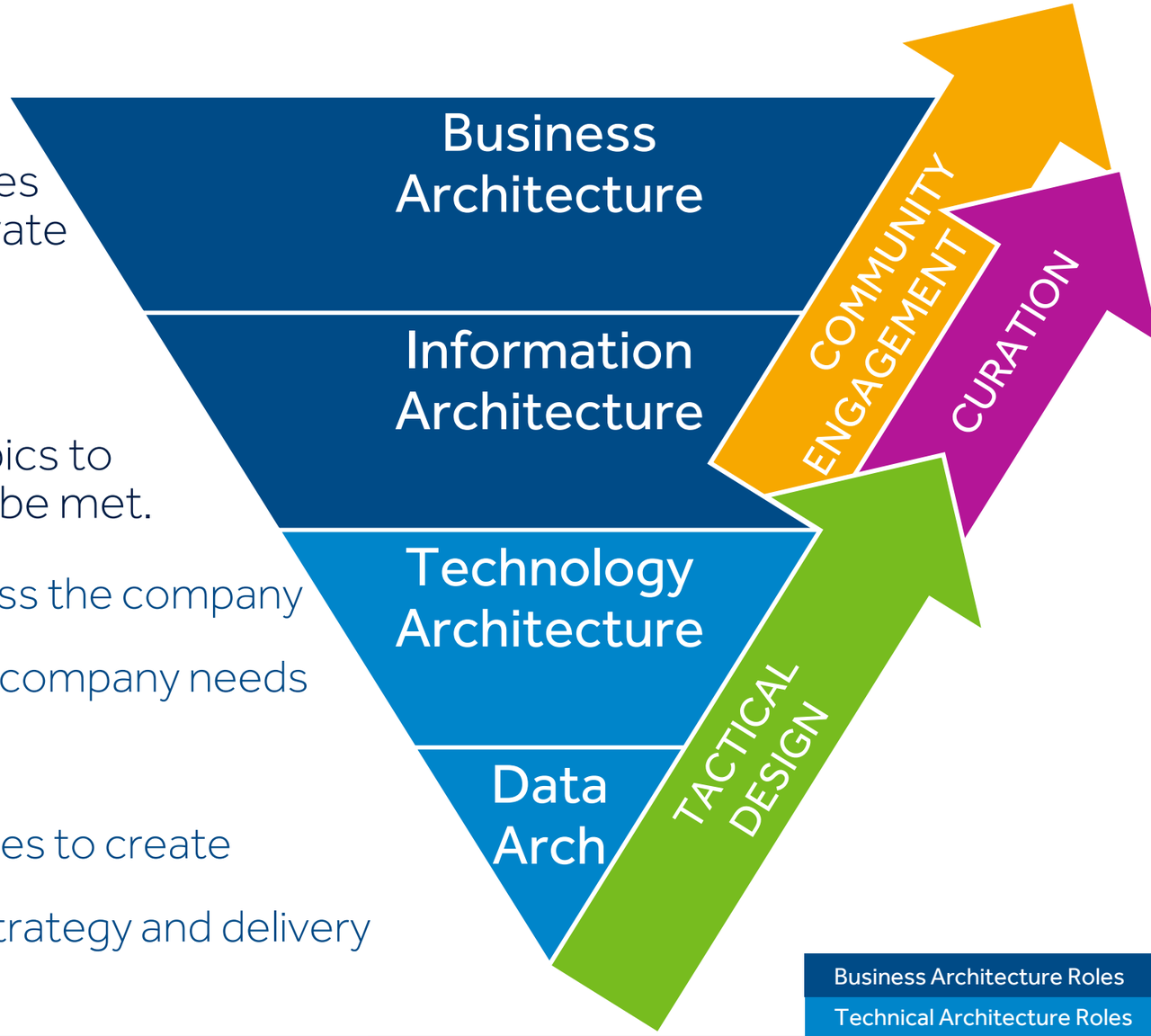
Innovation Architecture

In developing architecture talent across IT, EA identifies strategic themes and partnering architects who innovate to create tomorrow's approaches.

Typical Innovation Maturity Progression

Architects partner to lead strategy and innovation topics to define our "what" future needs are and "how" they will be met.

- Enterprise Architects connect and guide topics across the company
- Business & Information Architects identify common company needs and curates the necessary assets and approaches
- Technical Architects partner across their communities to create solutions to meet common needs with innovation, strategy and delivery



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THE JOURNEY CONTINUES...
ROLE ALIGNMENT EVOLVES OVER TIME

"Practice actualization" does not remain in steady state, it is always evolving.

Architect roles will be continually identified, onboarded and offboarded as company demands and career changes occur.

The continual change will afford fresh perspectives while ensuring architect roles are staffed aligned with demand.

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MEDTRONIC OVERVIEW

MEDTRONIC OVERVIEW	THE ARCHITECTURE VALUE PROPOSITION	BUILDING AN ARCHITECTURE PRACTICE	Q&A
Who are we? What do we do? How do we do it?	Where is Architecture focused? What are the desired outcomes?	What are the maturity phases? How can we add value at each stage?	What have you seen? Where can we create insights?

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THANK YOU