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The bridge to possible

Operationalize Routed Optical Networking

Randy Zhang, Principal Architect

BRKOPT-2018

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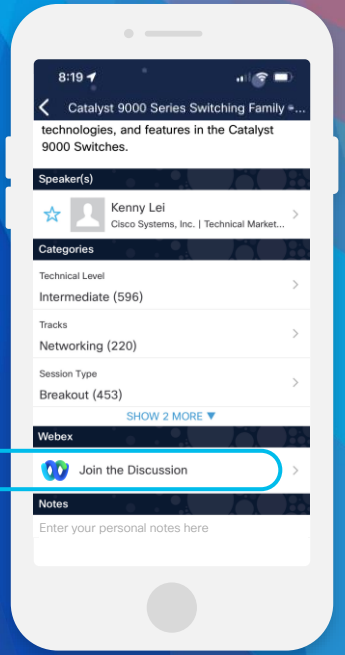

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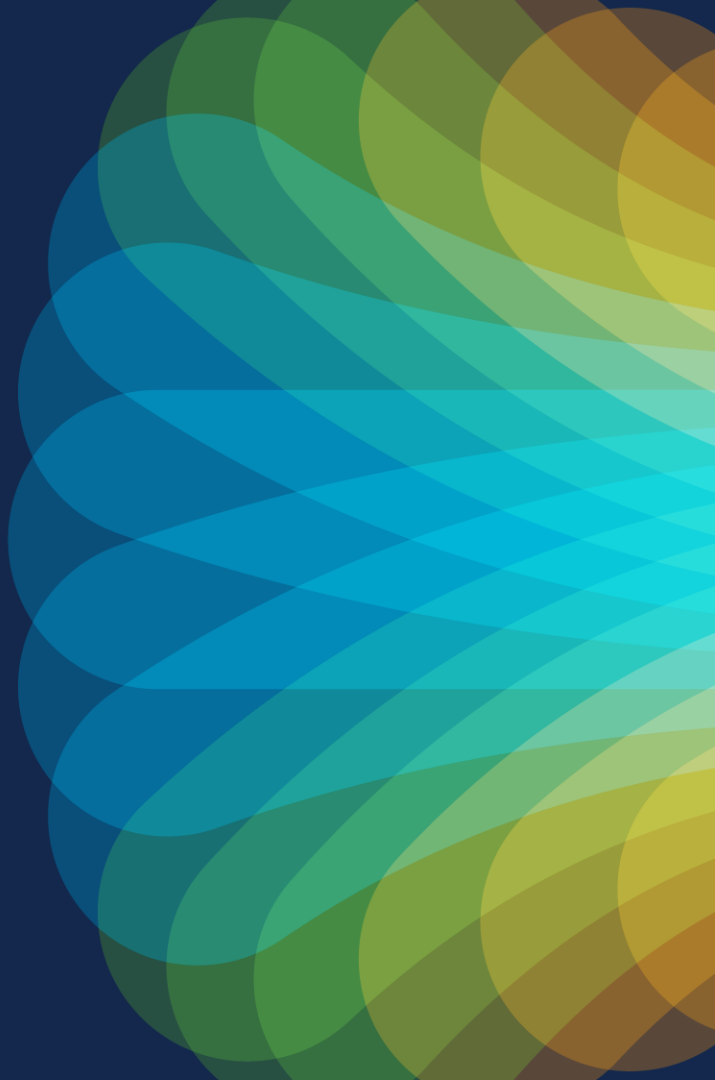
Agenda

- Introduction
- Journey to Operational Convergence
- Converging Network Operational Practices
- Operational Convergence: A Practical Example
- Conclusion

Introduction



Cisco Routed Optical Networking Solution

>250Tbps

+

400GE ZR/ZR+

+

Private Line Emulation

+

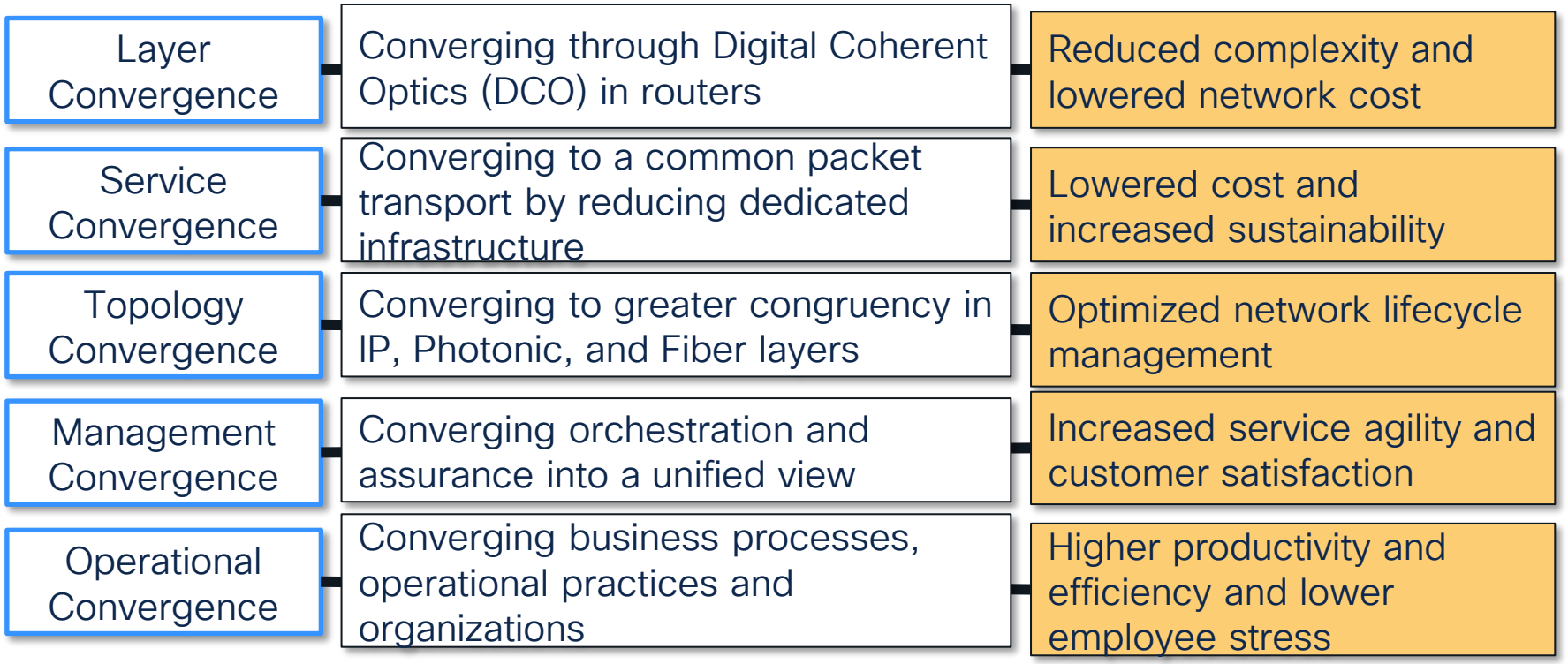
Automation, Modern Software & Control Plane

=

New Network Paradigm

Routed Optical Network

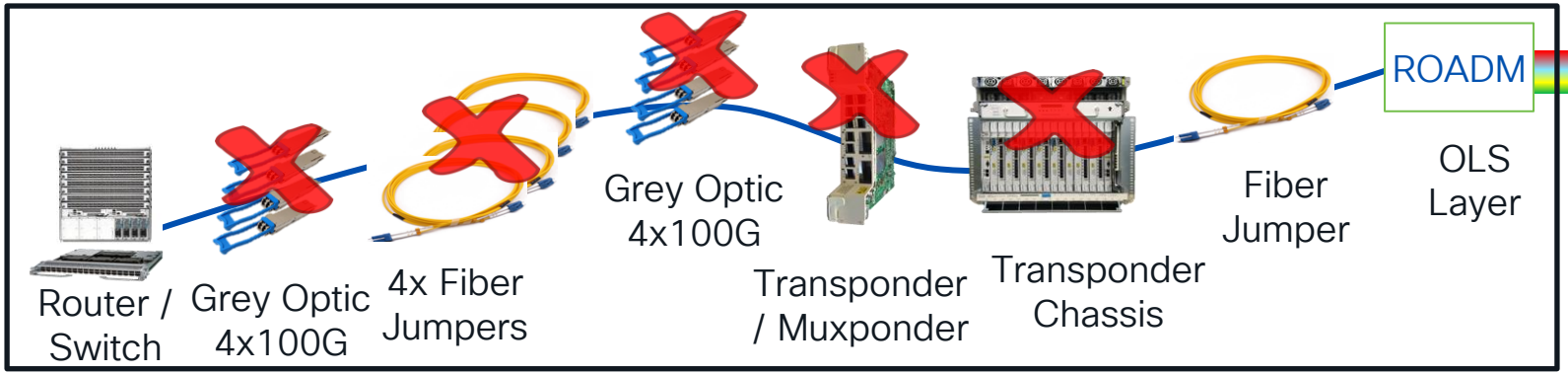
Convergence through Routed Optical Networking

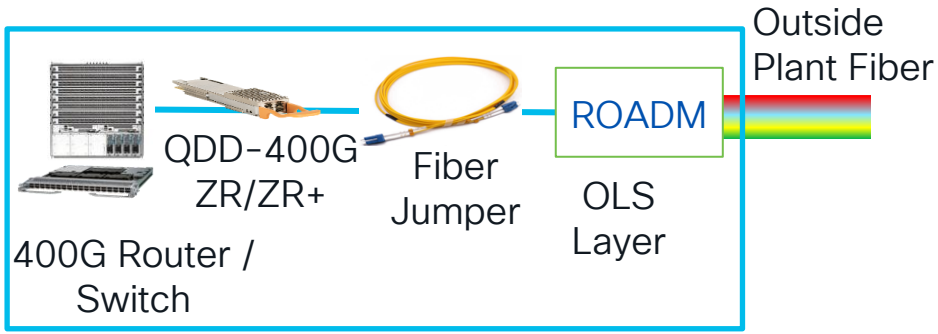


Not necessarily all 5 types of convergences are present in any given project

Simplification through Reduction

ROADM: Reconfigurable Optical Add/Drop Multiplexer





Direct Benefits to Inside Plant

- Reduced power consumption, power distribution, batteries
- Lower HVAC requirements
- Reduced requirements for footprint, cabling, patch panels
- Removing the need for transponder maintenance and upgrades

Business Benefits of Routed Optical Networking

Simplified Network Architecture → Optimized Network Lifecycle Management → Increased Operational Agility

Lower TCO* and Higher Sustainability

More Efficient Operations

Customer Satisfaction and Faster Time to Value

* ACG research: THE ECONOMIC BENEFITS OF IP TRANSPORT AT 400G

Why Operationalize Routed Optical Networking?

A great technology is only valuable if it can be operationalized and made into the core of how your business is run.

- Organizational Structures
- Organizational Culture
- Business Processes
- Operational Tooling

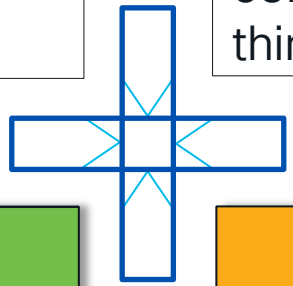
In Particular ...

Organizational Structures

Optimizing organizational structures for converged operations

Organizational Culture

Promoting and rewarding convergence skillset and thinking



Business Processes

Enhancing business operating models and processes for convergence

Operational Tooling

Updating or migrating tools to align with network convergence adoption

In Summary

Operationalization of Routed Optical Networking is to

embed the innovative and disruptive IP and optical convergence into

business operations through a flow of business activities so that the

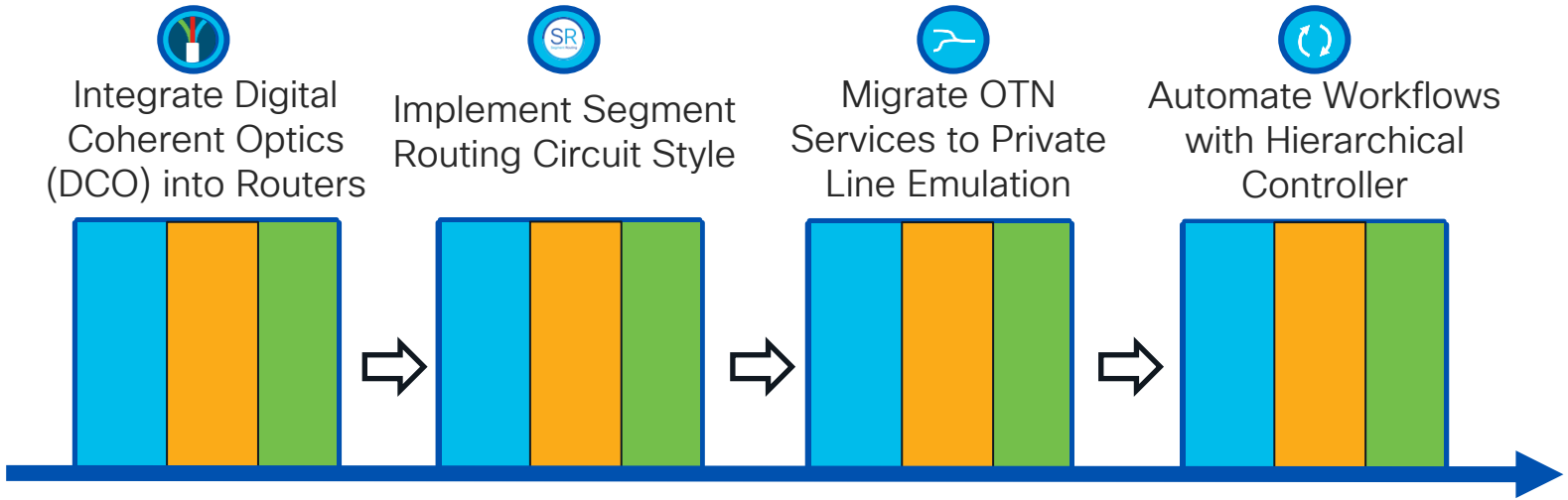
benefits of the Routed Optical Networking solution are fully realized

Journey to Operational Convergence

Journey of Adoption

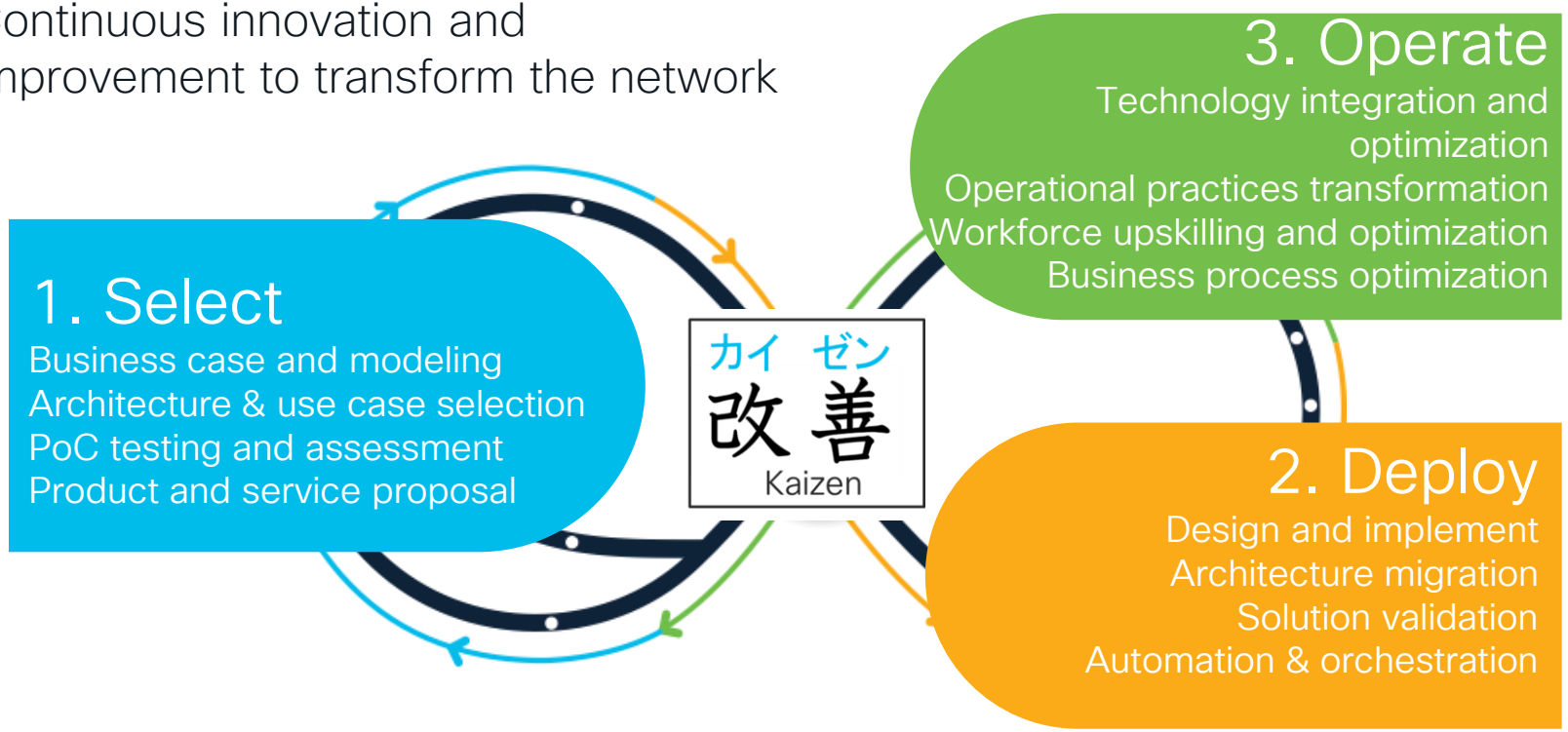
Adoption of Routed Optical Networking may be a journey through a set of use cases, each with specific business outcome

A Hypothetical Adoption Example



Three Phases of Use Case Adoption

Continuous innovation and
improvement to transform the network



Impact of Routed Optical Networking on Operations

Traditionally a technology is more contained in its own domains, often with clearly marked boundaries

Convergence through Routed Optical Networking changes or blurs the boundaries, creating a transformation or disruption that is impacting many areas of the operator's business

Routed Optical Networking provides an opportunity to rethink and to re-optimize how services are delivered through networks

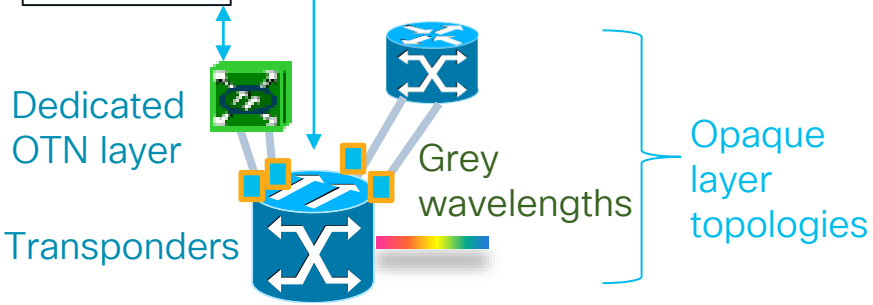
Architectural Impacts

Multilayer Architecture

Multiple views and processes

Photonic OSS | Packet OSS

OTN OSS



Silo'd management

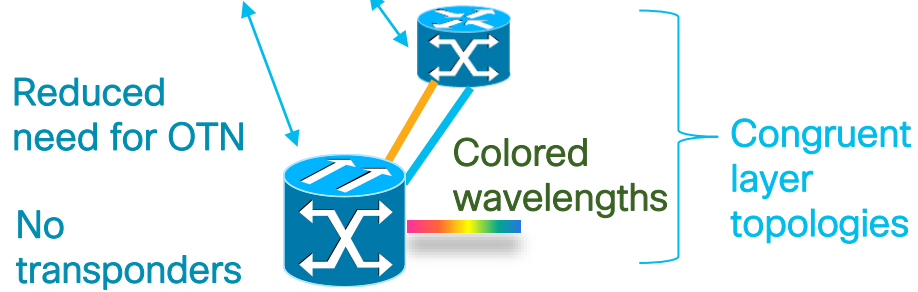
Converged Architecture*

Unified network views

Hierarchical Controller

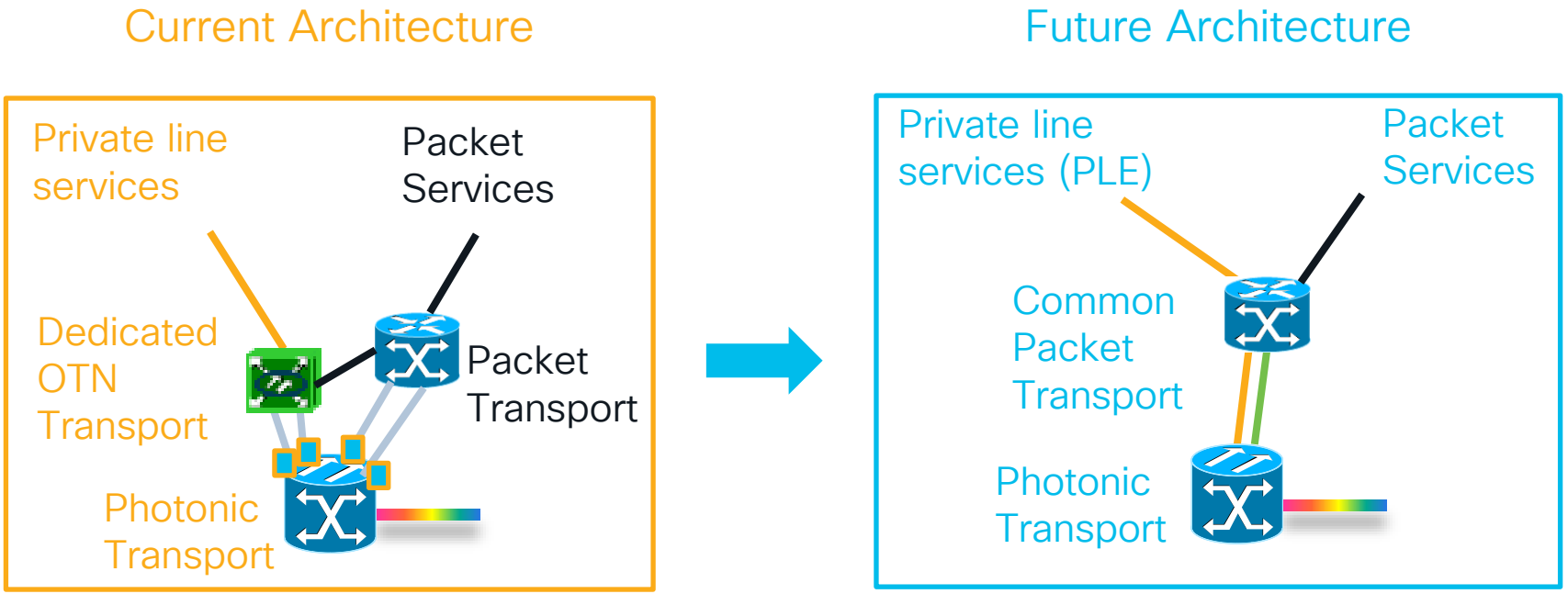
Photonic Network Controller | Packet Network Controller

SDN based workflows



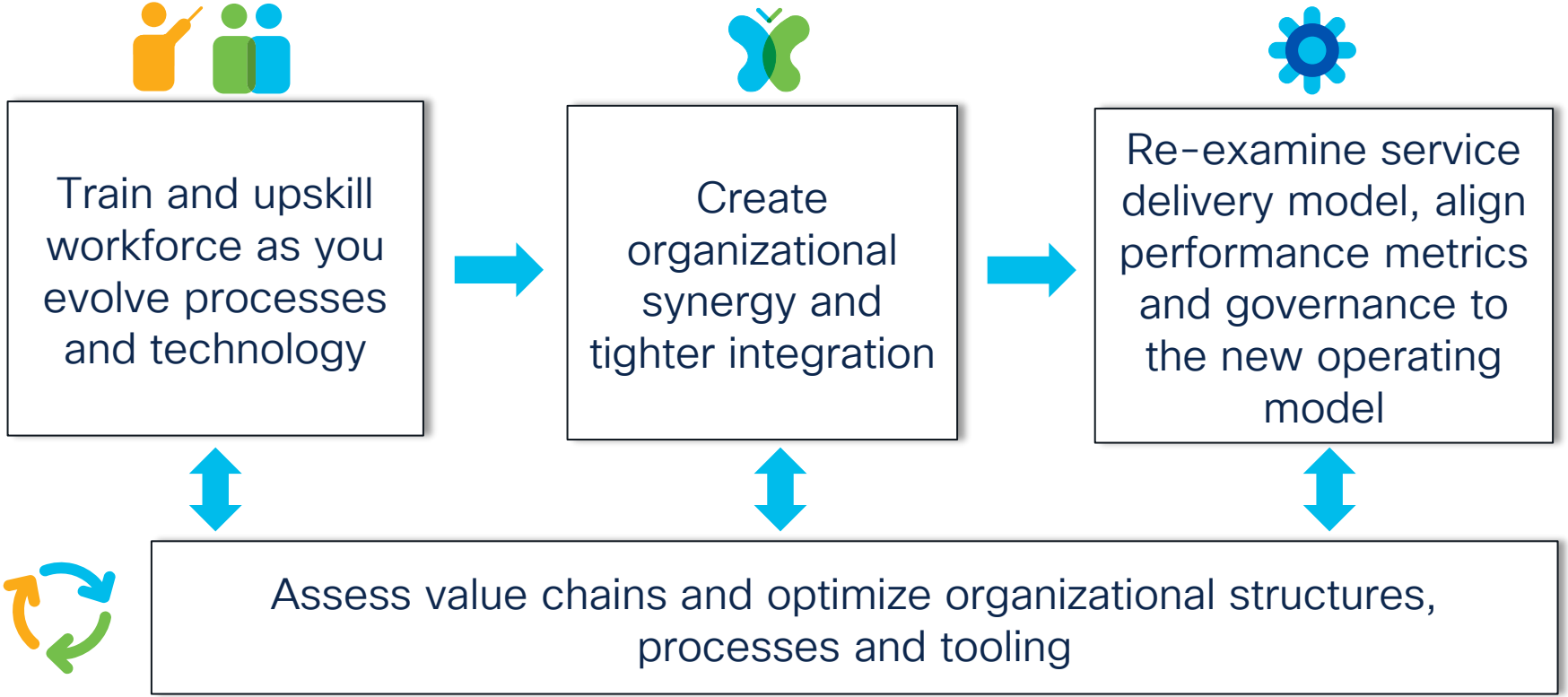
* This is one view of the Converged Architecture

Impacts of Private Line Emulation: An Example



Operational impacts: service lifecycle, tooling, processes, organization

Aligning Operational Convergence to Use Cases



Outcomes of Operational Convergence

Increased efficiency and productivity

Lower cost and better sustainability

Agile and more adaptive organization

- Streamlined processes, better collaboration and faster decision making
- Eliminating redundant and low-value tasks and activities
- Reducing resource and material inputs through better capacity planning

- Collapsing tooling functions and reduce maintenance costs
- More efficient energy use
- Intelligent energy management systems
- Better public image and branding

- Less hierarchy, faster decision making, more nimble, faster response to changing market needs
- Ease of doing business
- Better customer experience

Converging Network Operational Practices

Balancing Competing Values

Present Value

Network reliability that delivers the current customer services

Architectural changes that deliver new business outcomes

Future Value

Network Operators

Barriers to Converging Network Operations

Integration

Challenges integrating with legacy technologies, multivendor interop, tooling, and processes

Cost

Cost of new solution deployment and migration, budget limitations, changing priorities

Organizational

Structure of organizations aligned with technology layers; uncertainty of changes and impact

Tooling

Lack of operational ease for adoption, complex management tooling

Complexity

Inter-dependency and multitude of components being impacted

Skillset

Workforce lack of convergence skillset, lack of time and priority for new skills

High Level Strategies

Executive sponsorship from the top to embrace convergence

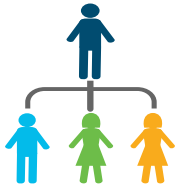
Create a vision for each use case, while implementing necessary incremental changes

Integrate and simplify processes and tooling aligned to the use case

Develop a set of relevant KPIs, monitor, report, build momentum

Evolve the workforce for new skillset and roles

Optimizing Organizational Structures



Reduce and simplify processes through organizational synergies and tighter process integration

Clarify ownership and accountability where technology layers converge

Create job roles to centralize operational responsibilities for convergence

Encourage the top talent to move into the new job roles

Workforce Transformation Example

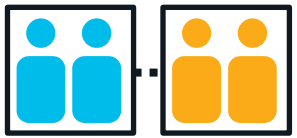
- Bring teams closer together to create better synergies and collaborations
- Cross-train team members to bring up the overall skillset

- Identify any specific job functions that are missing but required to operate the converged architecture
- Promote these roles in the organization

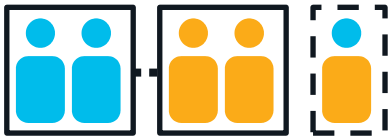
- Identify any specific job functions that are no longer relevant or less needed
- Move affected resources to job roles that are better aligned with the converged architecture

An Example of Team Evolution

Building Synergies



Adding Convergence Engineers



Converged Teams

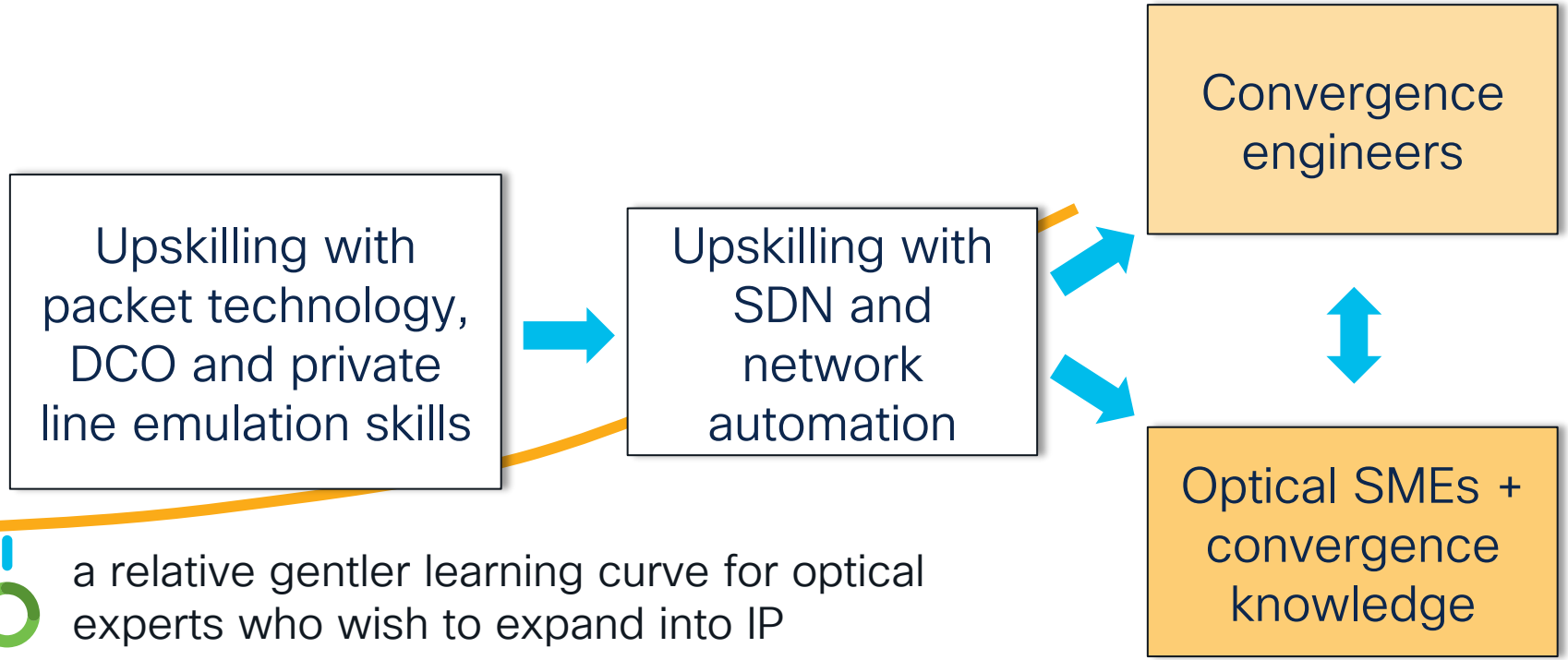
Benefits of Convergence Engineer Job Role

- Centralized subject matter expert(s) and escalations for maintaining convergence related network services
- Helps minimize customer impact as convergence is being adopted
- Provides inputs to other areas of network operations and engineering
- Grow the team as more convergence use cases are deployed

Additional Skills for a Convergence Engineer

- Bridging the packet and optical technologies
- DCO and private line emulation technology and operation
- SDN automation and hierarchical controller

An Example Evolution of the Optical Workforce



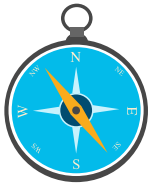
a relative gentler learning curve for optical experts who wish to expand into IP

Promote Organizational Culture for Convergence

Executive leadership and sponsorship of the convergence initiative

Reward convergence skillset and talent

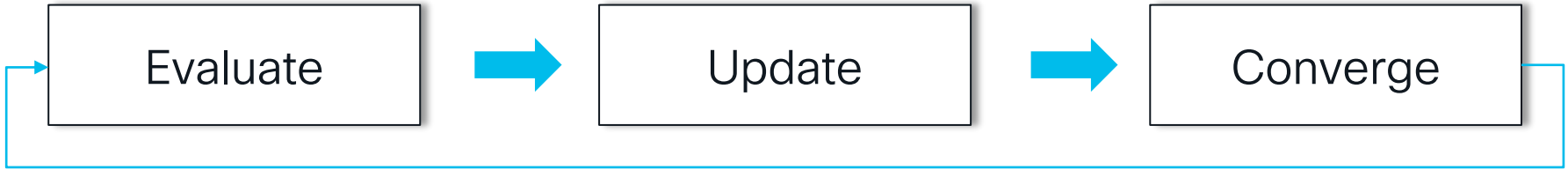
Encourage cross-technology collaborations and matrix reporting



Promote and track agile service delivery for better customer experience

Create new job roles for the IP & Optical convergence skillset

Simplifying Business Processes and Tooling



- Use value stream mapping to identify value chain
- Document tooling needs, gaps, and roadmap
- Eliminate processes and tooling that add little or no values

- Align with the Routed Optical Networking adoption use cases with incremental updates
- Create graceful handoffs between workflows
- Minimize exception handling

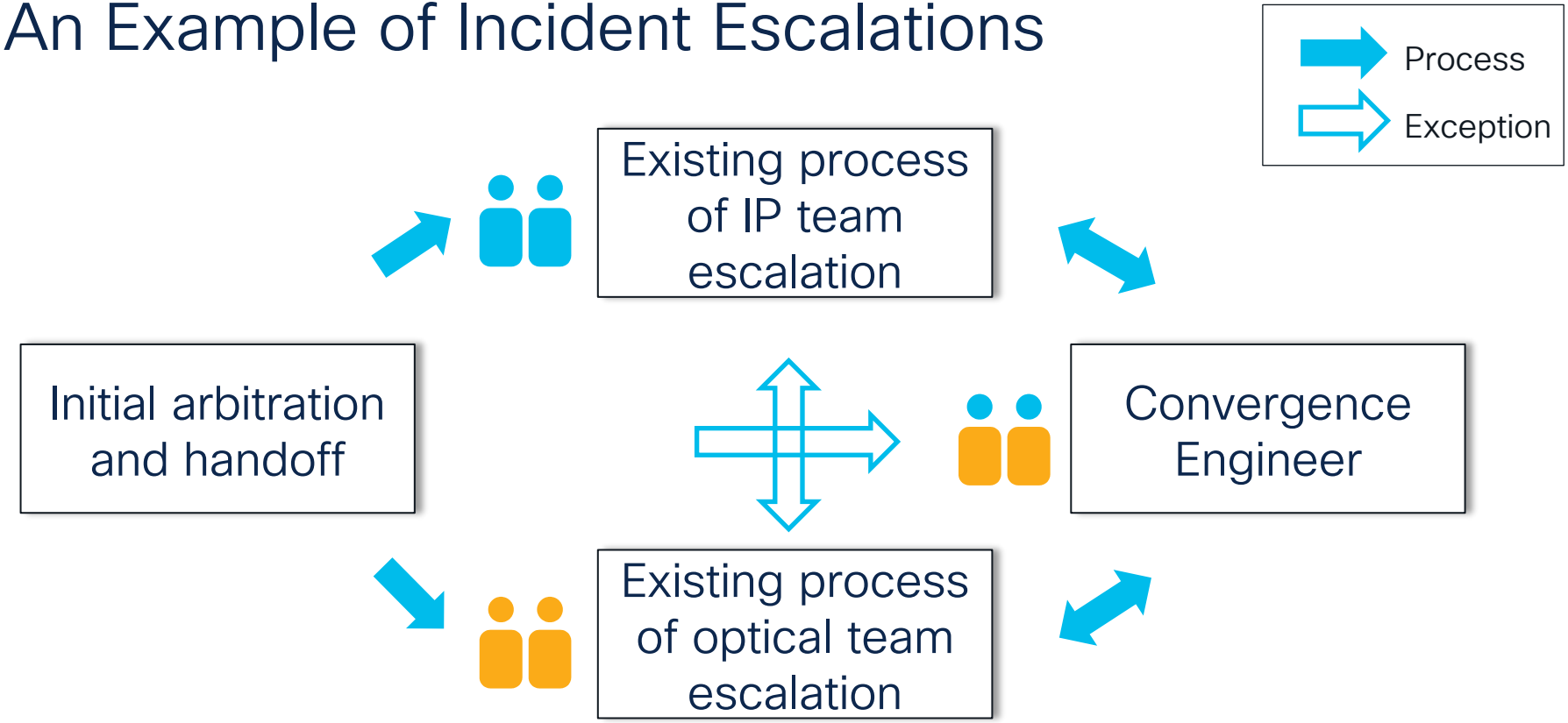
- Unify processes and tooling
- Simplify workflows to reduce manual touch points
- Centralize convergence expertise and escalation

Enhance Network Operational Metrics

Availability	Performance	Experience	Agility	Sustainability
Network up or down?	Application or service fast or slow?	User happy with the service?	How fast the service is delivered?	How much energy is used or saved?
Percentage of time a service is available, such as uptime	Response latency for a percentage of requests	Availability + Performance for a percentage of users	Operational efficiency for service delivery or trouble resolution	Network simplification, and energy & capacity efficiency

Adopt comprehensive operational metrics to measure the converged networks

An Example of Incident Escalations



Evolve this process as convergence taking hold

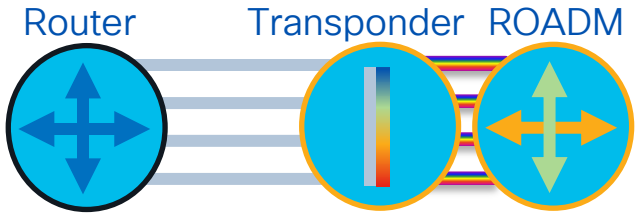
Operational Convergence: A Practical Example

ROADM: Reconfigurable Optical Add/Drop Multiplexer

Integrating DCO into Routers

Present Architecture

Grey optics in routers connected to external transponders



Future Architecture

Colored coherent optics in routers connected to ROADM

- Space and power saving, no need for spares and support cost for transponders
- A step closer to a unified operating model based on IP

Organizational Ownership

Asset Ownership

Budget, procurement, capacity planning, sparing, management tasks

Follow the existing models or create a new model?

Ownership Models

Optical Team

- More suited to existing silo'd models
- Routing team has read access to optics data

Routing Team

- More suited to an IP centric model
- Collaborate with optical team for optics management

Joint Ownership

- More suited for where both teams are under the same management
- Helpful for building a converged team

The ownership model may evolve over time

An Optical Model Example

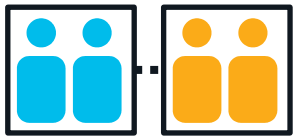
	Optical Team	IP Team
Asset Ownership		
Inventory records	Optical inventory system	Reads from the optical inventory
Turn up & provisioning	Enables end to end optical path provisioning and validation	Prepares the router hardware and software, assigns IP address
Monitoring and maintenance	DSP and optics layer and line systems	Ethernet layer and up

The ownership model and tasks may evolve as adoption continues

Steps to Operational Convergence: An Example

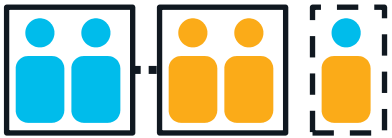
1. Initial: Coordinated Operations

- IP team: router hardware & software
- Optical team: end to end optical path from optics to optics
- Jointly validate paths
- Clarify responsibility for maintenance



2. Intermediate: Adding Convergence Engineer (CE)

- Introduce hierarchical controller to manage DCOs
- Update processes incrementally as needed
- CE acting as final escalation for DCO circuits



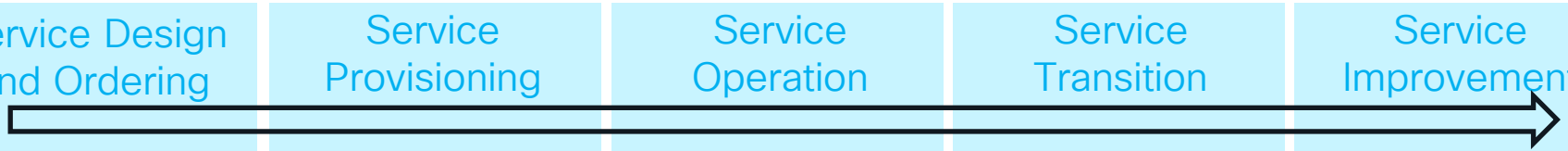
3. Future: Converged Operations

- Enhanced role of hierarchical controller with additional domain controllers
- Converged team with increased number of CEs

REFERENCE

Process Evolution

Initial Mode of Operation

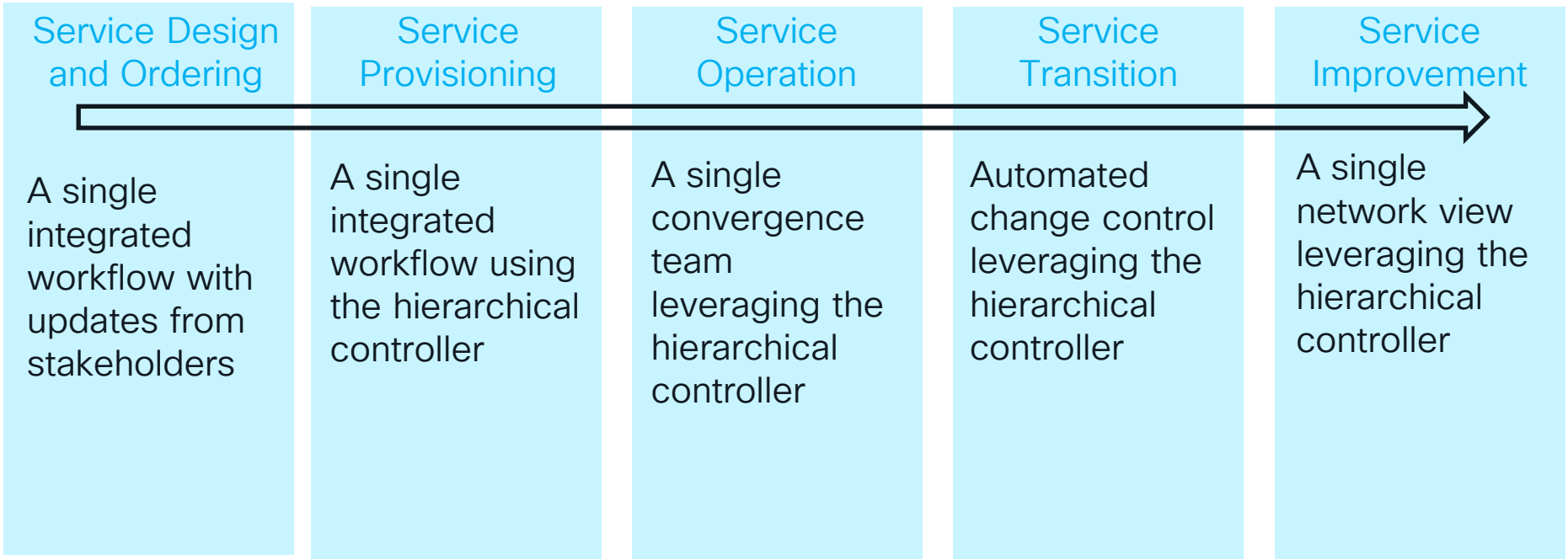


Service Design and Ordering	Service Provisioning	Service Operation	Service Transition	Service Improvement
Adding DCO into optical inventory system	Coordinated provisioning, test and validation by IP and optical teams	Coordinated monitoring and repair	Leveraging the updated inventory for change control	Changing reporting tooling to collect data from routers that host the DCO

REFERENCE

Process Evolution

Future Mode of Operation



Hierarchical Controller Role Evolution

Limited Scope

- Managing optical parameters of the DCO
- More consistent with the optical management model

Intermediate Mode of Operation

Enhanced Scope

- Managing multivendor IP and Optical layers
- Suitable for the end to end converged architecture

Future Mode of Operation

Conclusion

Business Benefits of Routed Optical Networking

Simplified Network Architecture → Optimized Network Lifecycle Management → Increased Operational Agility

Routed Optical Networking provides an opportunity to rethink and to re-optimize how services are delivered through networks

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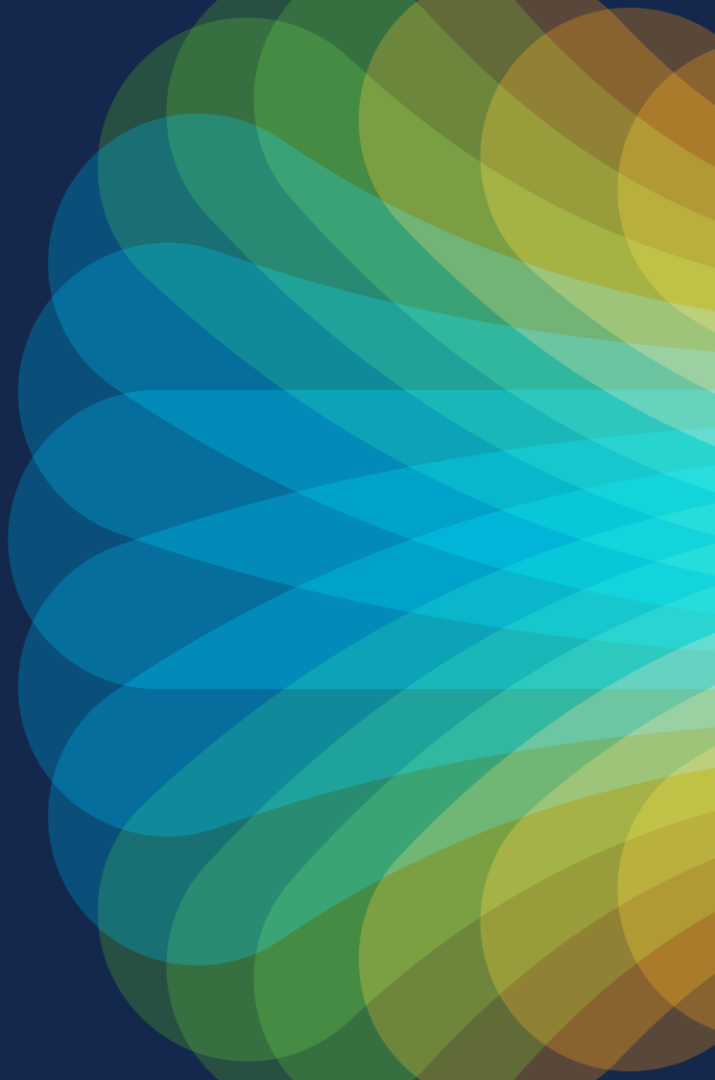

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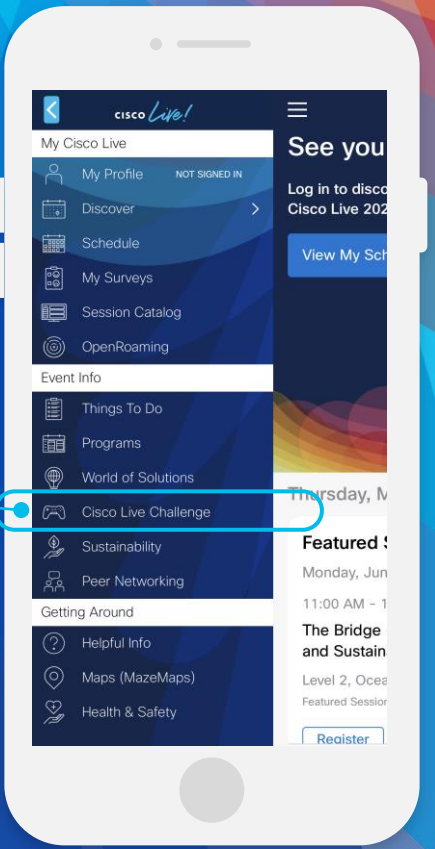


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