

# What You Make Possible







<http://www.youtube.com/watch?v=TWfph3iNC-k&feature=fvsr>



# Deploying Immersive Video

BRKEVT-2662

# Abstract

- Immersive video allows participants to forget about technology, and feel like they are collaborating in person. The Cisco TelePresence TX9000 Series is Cisco's latest immersive TelePresence systems. This session discusses the room design, acoustics, lighting, network, installation, and configuration of TX9000. Special care must be taken in these areas to ensure the most natural experience possible. We will also cover the do's and don'ts, as well as what to expect from the beginning of the process to the end result.



# Session Objectives

- Understand “immersive”
- Understand what it takes to deploy TX9000

# Agenda

- Why Immersive?
- What is the TX9000?
- The Deployment Process
  - Immersive Room Design
  - Network Design
  - Installation Best Practices
  - Configuration
- Summary



# Agenda

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# Why Immersive?





# Definition

**Immersion** is the state of consciousness where an immersant's awareness of physical self is transformed by being surrounded in an engrossing environment; often artificial, creating a **perception of Presence** in a non-physical world.

– Wikipedia



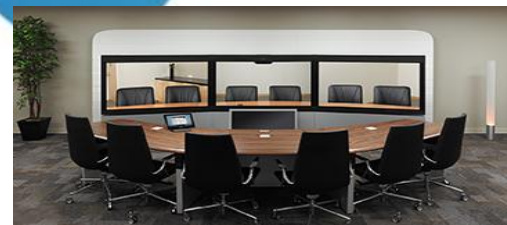
# The Immersive Experience



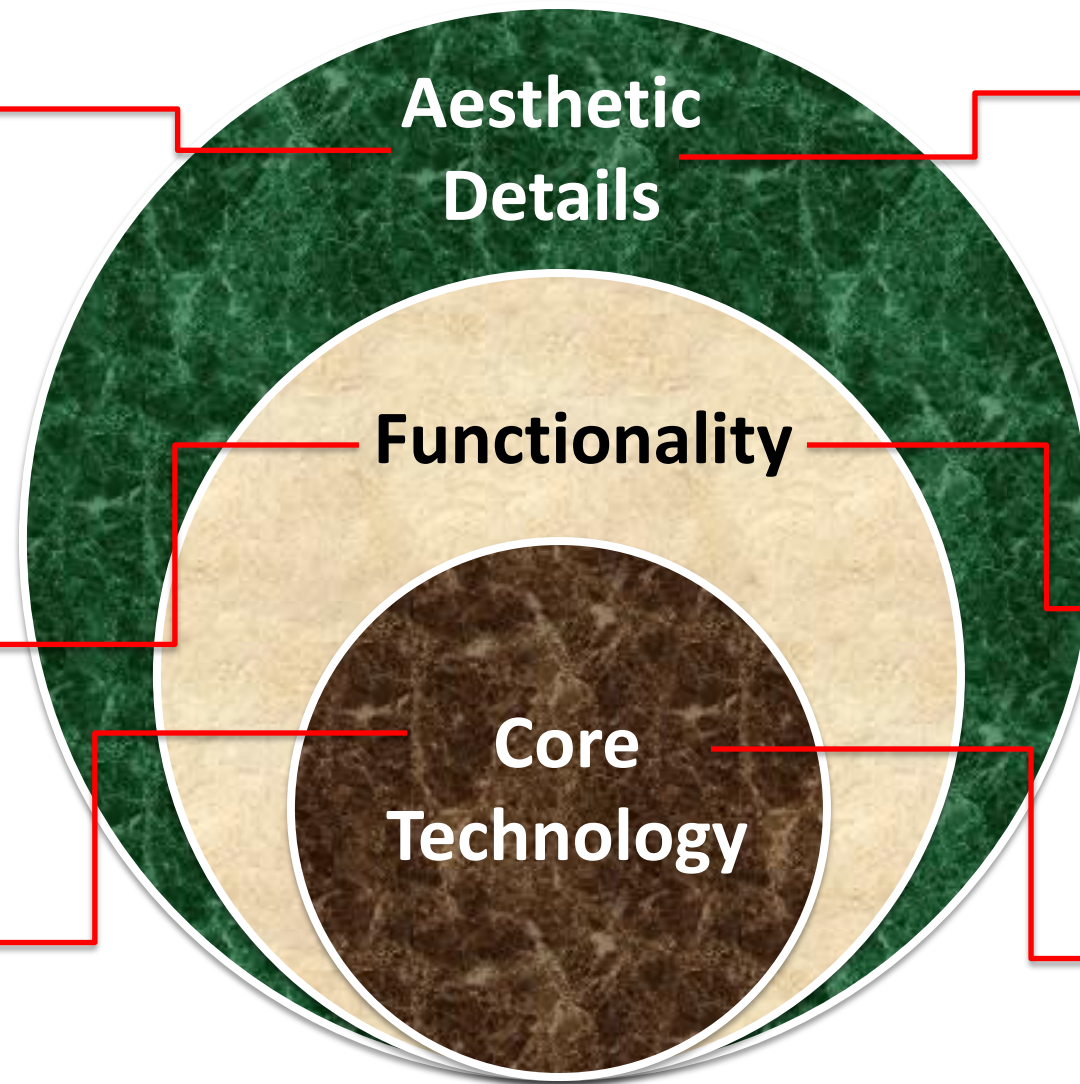
Room Aesthetics



Environmental Quality



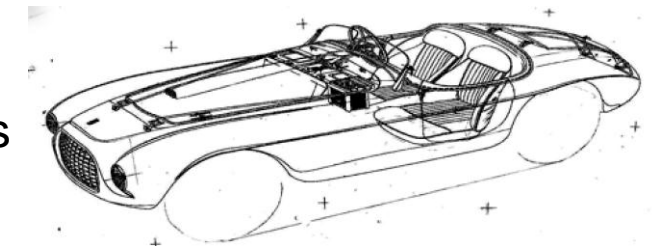
Codec



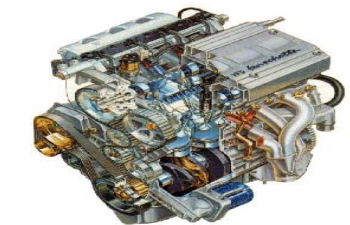
Color Finishes Options



Chassis



Engine





# Agenda

- Why Immersive?
- What is the TX9000?
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  - Network Design
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# What is the TX9000?



# What is the TX9000?



- <http://www.youtube.com/watch?v=sdAR2vdppXw>



# What is the TX9000?

Cisco TelePresence Experience

Spatial Audio

65" 1080p Plasmas

1080p60 Capable  
Cameras and Codecs

Full Size, Life Like

Content Sharing

One Button To Push  
Meeting Launch

The screenshot shows the Cisco TelePresence software interface. At the top, it says "Cisco TelePresence" and "9:01 AM". Below that is a "Meetings" window for "Monday October 13". The window lists several meetings with their times and organizers:

Time	Meeting Name	Organizer	Action
9:00 AM - 10:30 AM	Early Staff Meeting	Tim McCollum	START
9:30 AM - 12:30 PM	Thunderbolt Commit	Doug Hawk	
Unscheduled 12:30 PM - 2:30 PM			
2:30 PM - 3:00 PM	HIP Device Review	Shubha Govil	
3:00 PM - 4:00 PM	Other Meeting	Joe Smith	
4:00 PM - 5:00 PM	Other Meeting	Elvis Presley	
5:00 PM - 5:30 PM			

At the bottom of the interface, there is a navigation bar with icons for "Meetings", "Contacts", "Keypad", "Presentation", and "More".



# What is the TX9200?

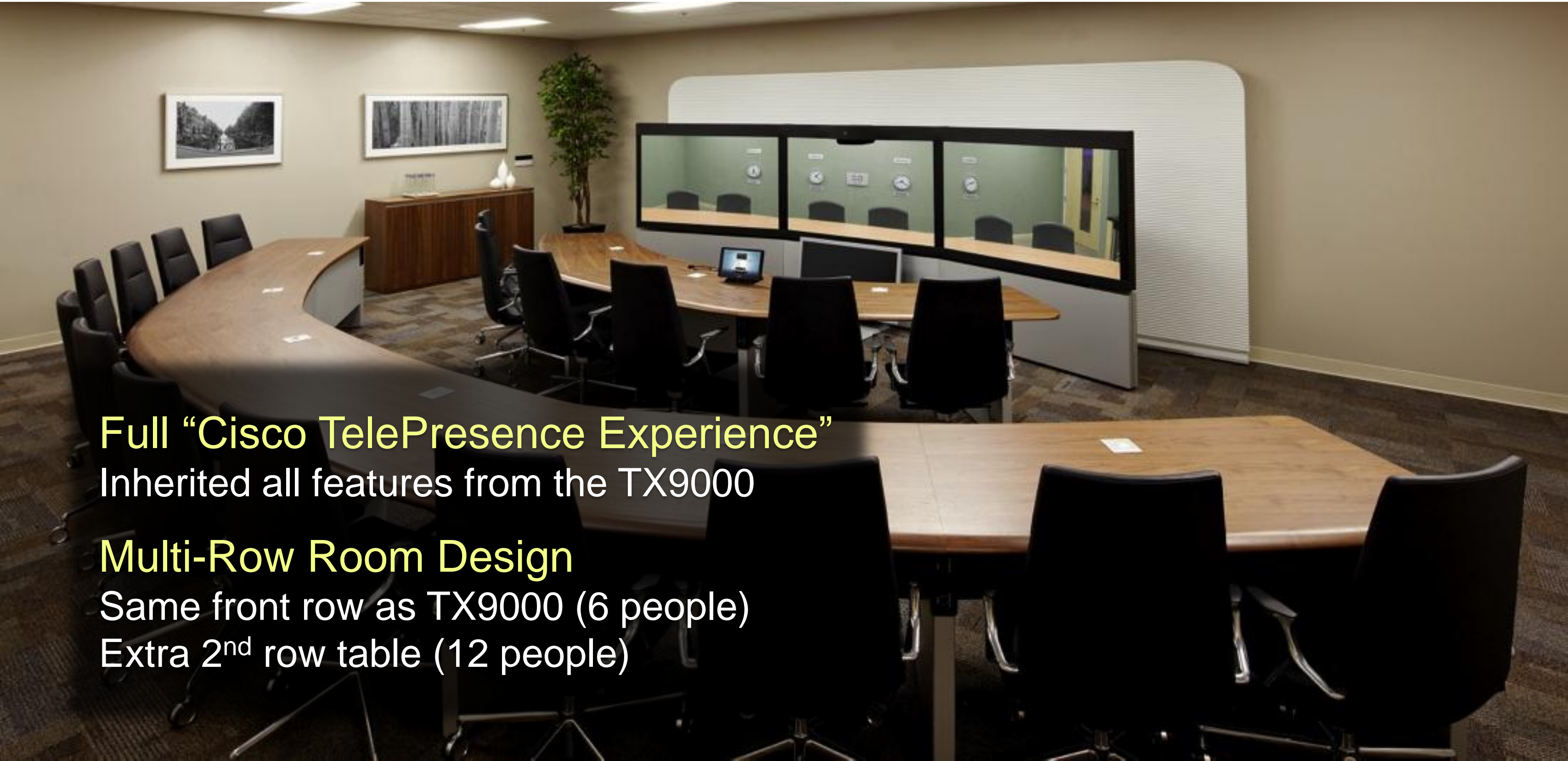
**Full “Cisco TelePresence Experience”**

Inherited all features from the TX9000

**Multi-Row Room Design**

Same front row as TX9000 (6 people)

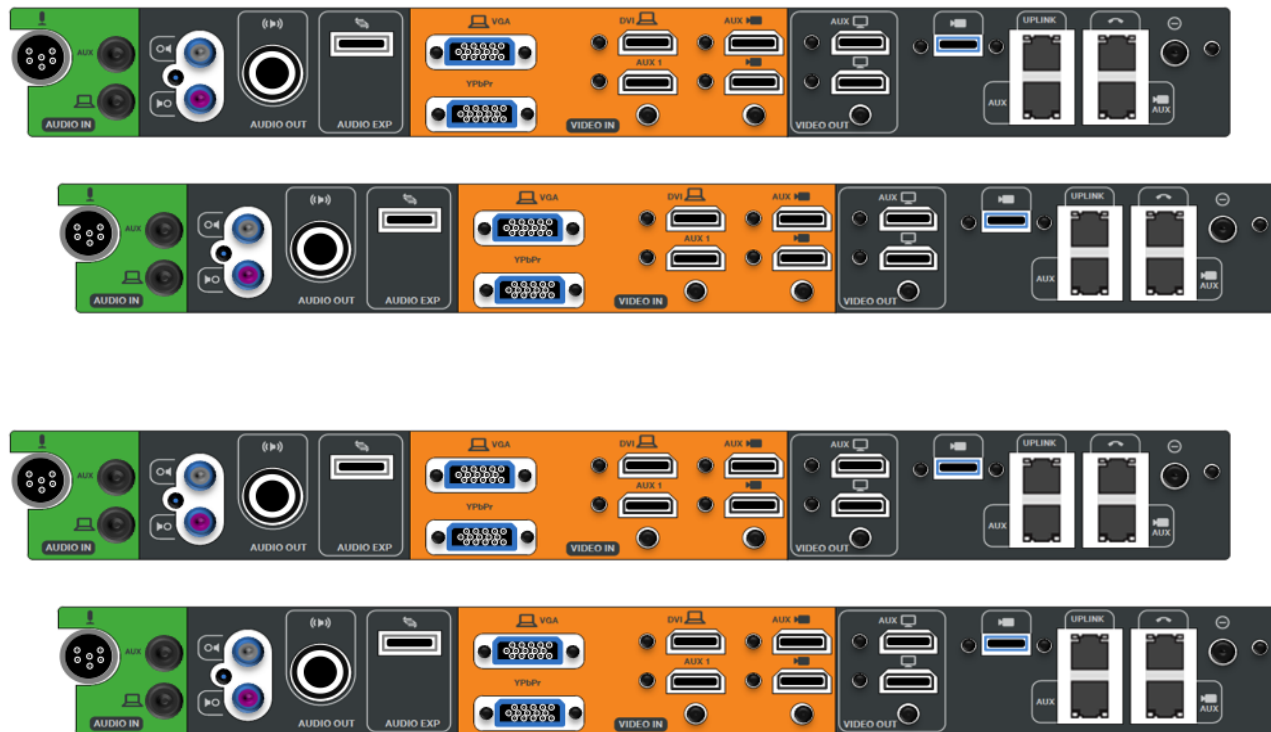
Extra 2<sup>nd</sup> row table (12 people)



# Cisco TelePresence TX9000

## Codec

- TX9X00 ships with four TX codecs
- 1080p60 main video capable\*
- 30 fps content sharing enabled
- HD content sharing capable\*

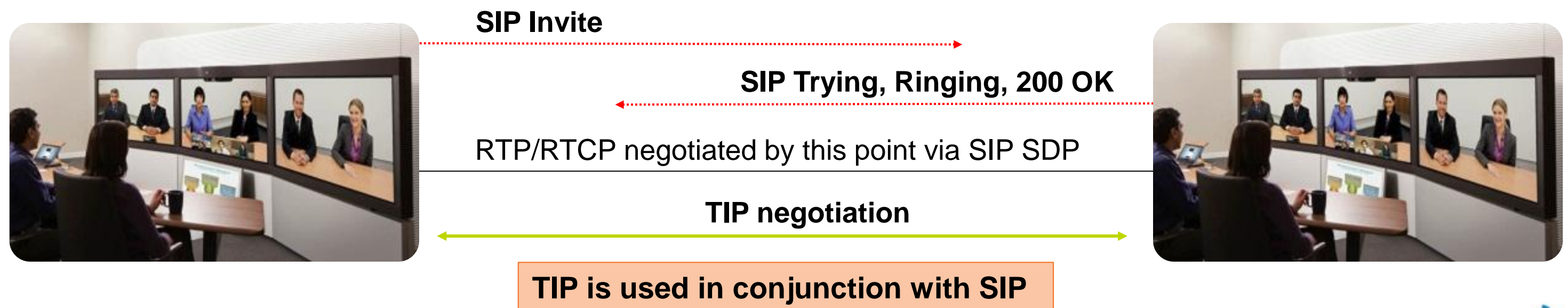




# Interoperability

## SIP and TIP

- What is TIP?
  - TelePresence Interoperability Protocol (TIP)
- Is TIP proprietary?
  - Cisco created, then transferred, TIP to the IMTC (International Multimedia Teleconferencing Consortium) to license royalty-free.
- What is the relationship between SIP and TIP?



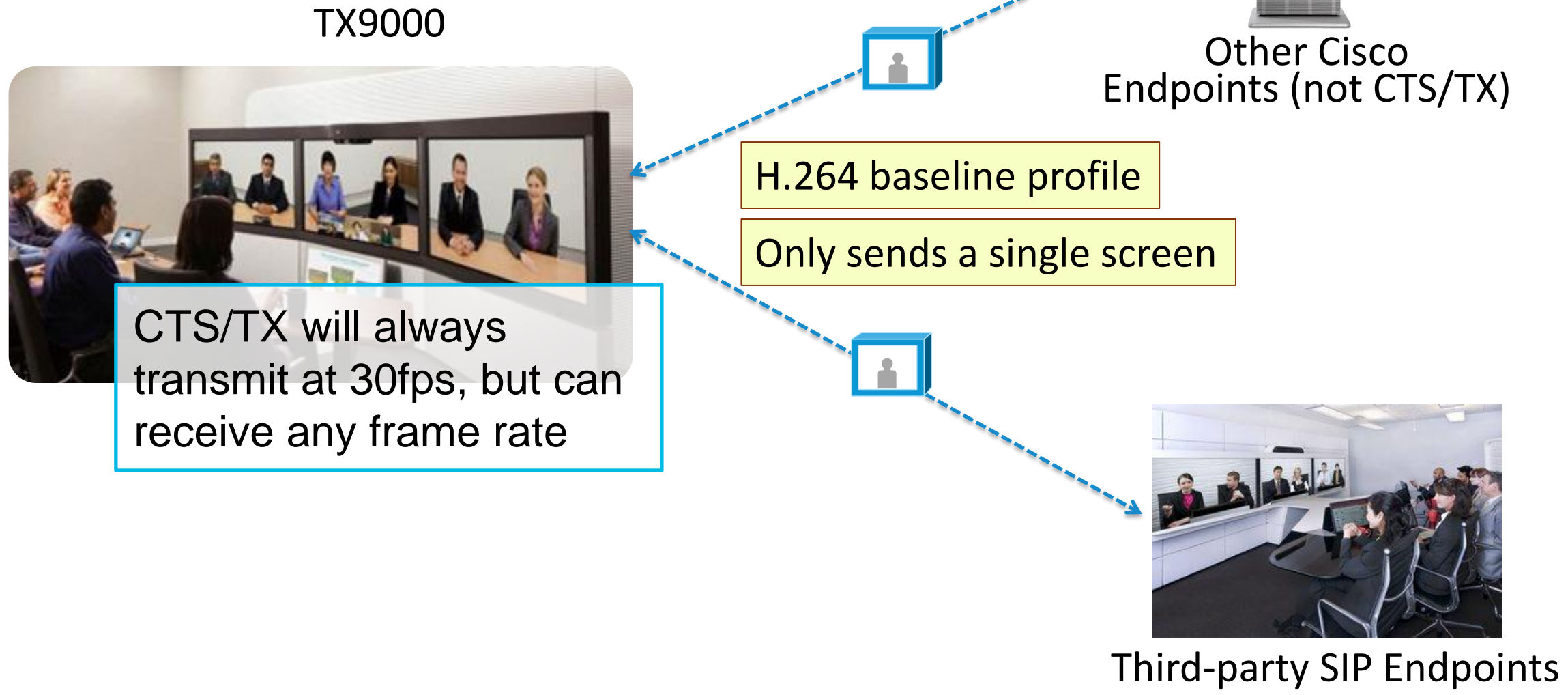
# Interoperability

## Standards Support

CTS 1.8

Transmit Resolutions
1280x720
640x368
352x288
352x240

Receive Resolutions
1280x720
1024x768
640x480
768x448
640x368
352x288
352x240
320x180
256x144
176x144
320x240
576x488
512x288
704x480
704x576
720x400
800x448
848x480
912x512
1024x576
800x600



[http://www.cisco.com/en/US/docs/telepresence/interop/endpoint\\_interop.html](http://www.cisco.com/en/US/docs/telepresence/interop/endpoint_interop.html)





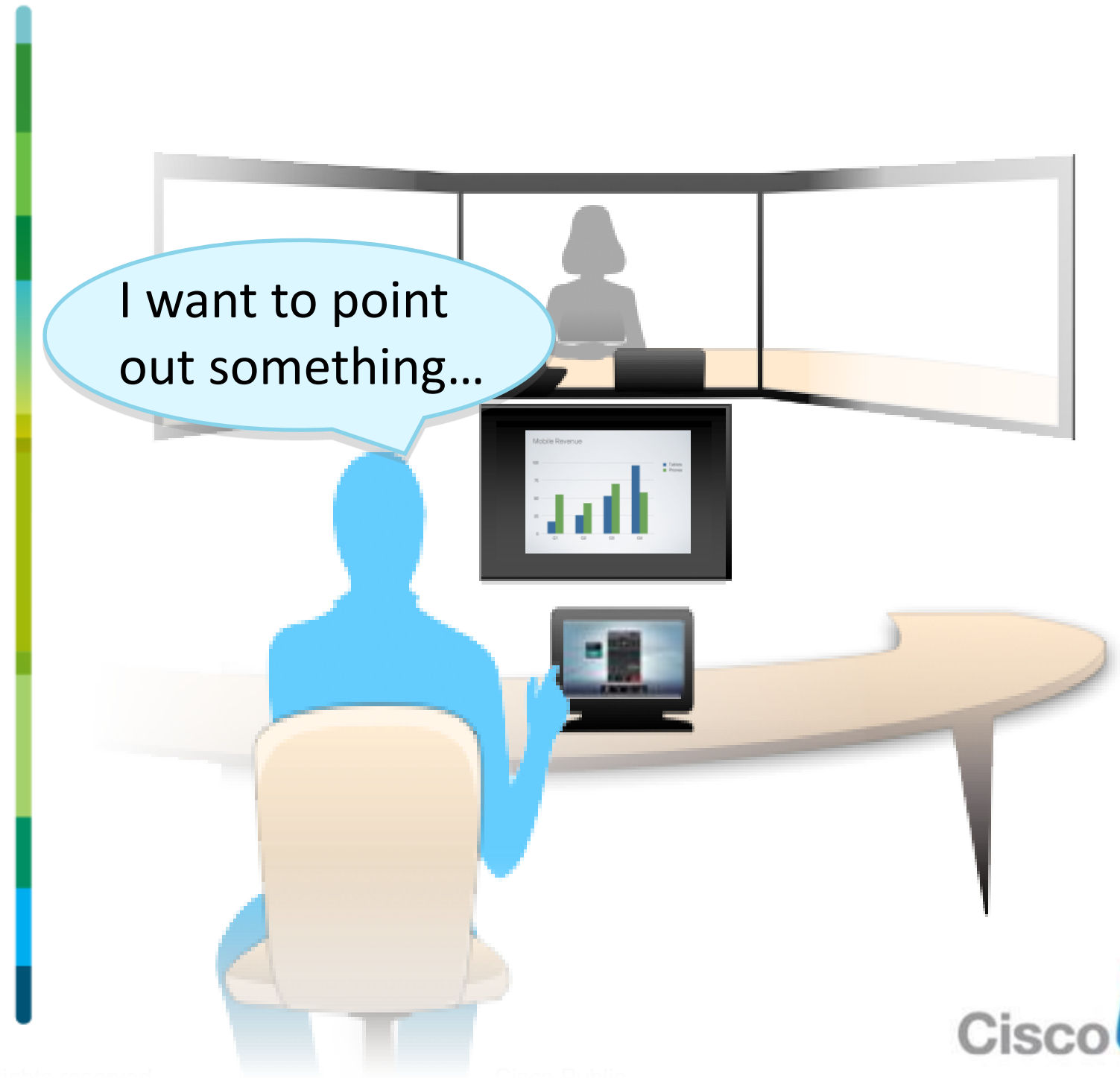
# TX6.0 New Features

## Overview

- 60fps main video
- HD Presentation up to 1080p30
- Annotation
- URI dialing
- Localisation (Languages for Touch 12")
- 802.1x authentication

# TX6.0 New Features

## Annotation



# TX6.0 New Features

## Annotation

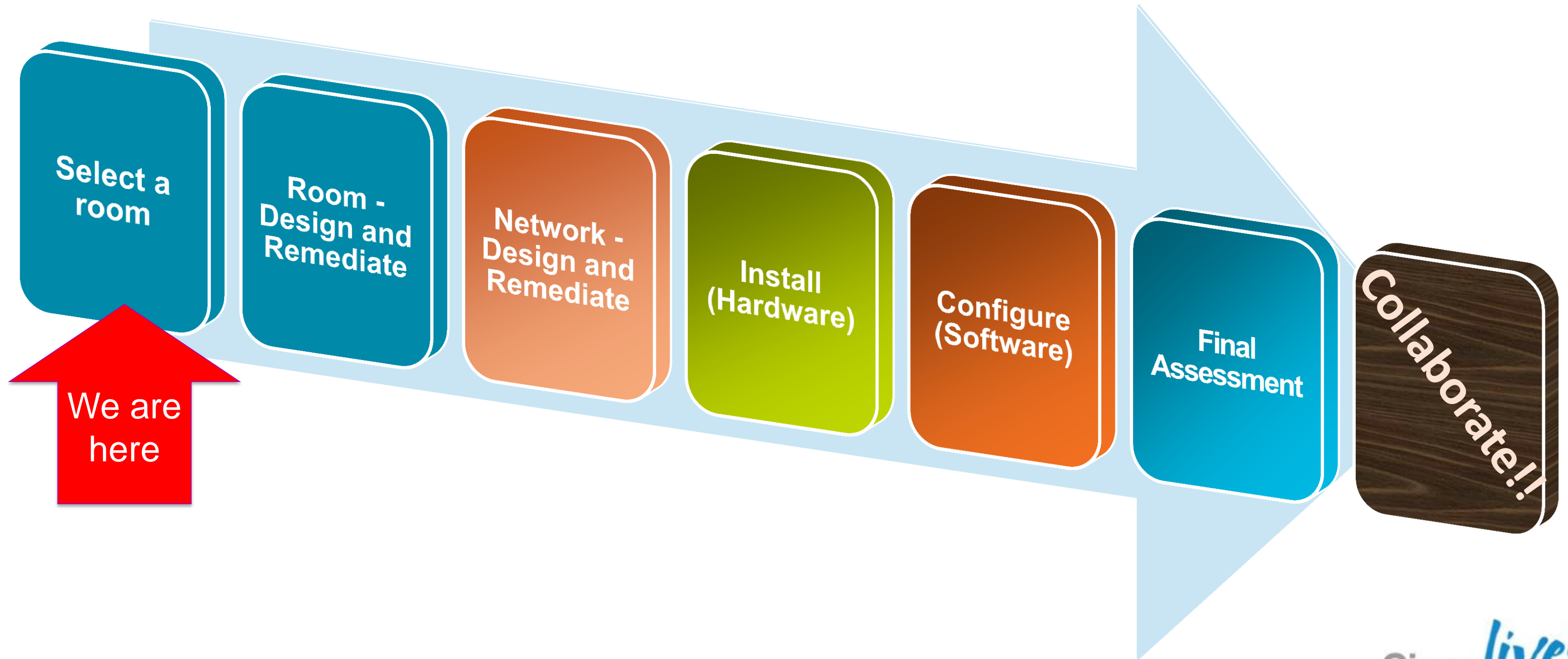


# Agenda

- Why Immersive?
- What is the TX9000?
- **The Deployment Process**
  - Immersive Room Design
  - Network Design
  - Installation Best Practices
  - Configuration
- Summary



# The Deployment Process



We are here

# Immersive Room Design



# Room Requirements

## Cisco TelePresence TX9000

### Room Size Minimum

Width x Depth x Height

19' x 14' 4" x 8' /  
5.79m x 4.37m x 2.44m

### Power

2.93kW Max  
4 power receptacles

Participant convenient ports  
consume additional power  
and receptacles

### HVAC

Independent Room Control  
Typical Cooling 9,500 BTU/Hr

### Lighting

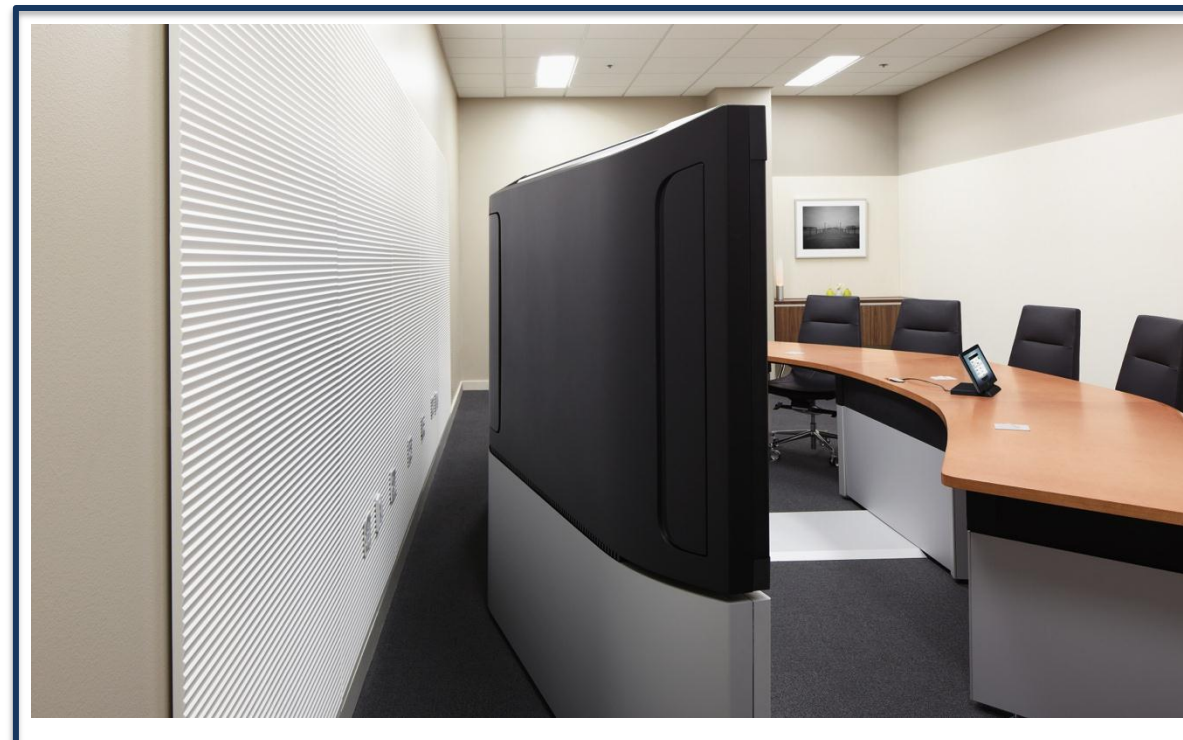
200-400 lux Facial Light  
(vertical plane)

Shoulder Light < 2\*Facial light  
(horizontal)

### Acoustics

Ambient Noise  
45dBA SPL  
NC30

Reverberation 150-700ms



# Room Requirements

Cisco TelePresence TX9000

**POP Quiz!**  
How does this compare to the CTS3010 requirements?

**Room Size Minimum**  
Width x Depth x Height  
19' x 14' 4" x 8' /  
5.79m x 4.37m x 2.44m

**Lighting**  
200-400 lux Facial Light  
(vertical plane)  
Shoulder Light < 2\*Facial light  
(horizontal)

**Acoustics**  
Ambient Noise  
45dBA SPL  
NC30  
Reverberation 150-700ms

**Power**  
2.93kW Max  
4 power receptacles  
Participant convenient ports  
consume additional power  
and receptacles

**HVAC**  
Independent Room Control  
Typical Cooling 9,500 BTU/Hr



**Design**  
Aesthetic Continuity  
highly desirable  
- Avoid high contrast  
elements such as very  
dark or bright colours  
- Avoid glossy finishes  
- Avoid clutter



# Room Requirements

## TX9000 and CTS30XX Comparison



Room Size Minimum	Lighting	Acoustics	Power	HVAC
<b>TX9000 (NEW!)</b>				
Width x Depth x Height  19' x 14' 4" x 8' / 5.79m x 4.37m x 2.44m	200-400 lux Facial Light (vertical plane)  Shoulder Light < 2*Facial light (horizontal)	Ambient Noise 45dBA SPL NC30  Reverberation 150-700ms  Acoustic Panel on Side	2.93kW Max 4 power receptacles  Participant convenient ports consume additional power and receptacles	Independent Room Control  Typical Cooling 9,500 BTU/Hr
<b>CTS3010</b>				
Width x Depth x Height  19' x 15' x 8' / 5.8m x 4.3m x 2.44m	300-400 lux Facial Light (vertical plane)  Shoulder Light < 2*Facial light (horizontal)	Same as TX9000	2.93kW Max 4 dedicated circuits  Participant convenient ports consume additional power	Same as TX9000



# Room Requirements

## Cisco TelePresence TX9200



### Room Size Minimum

Width x Depth x Height

31" x 21'5" x 8' /  
9.45m x 6.53m x 2.44m

### Power

2.93kW Max  
4 power receptacles

Participant convenient ports  
consume additional power and  
receptacles

### HVAC

Independent Room Control

Typical Cooling 12,800 BTU/Hr

### Lighting

200-400 lux Facial Light  
(vertical plane)

Shoulder Light < 2\*Facial light  
(horizontal)



### Acoustics

Ambient Noise  
45dBA SPL  
NC30

Reverberation 150-700ms

### Design

Aesthetic Continuity  
highly desirable

- Avoid high contrast elements such as very dark or bright colours
- Avoid glossy finishes
- Avoid clutter



# Selecting a Room

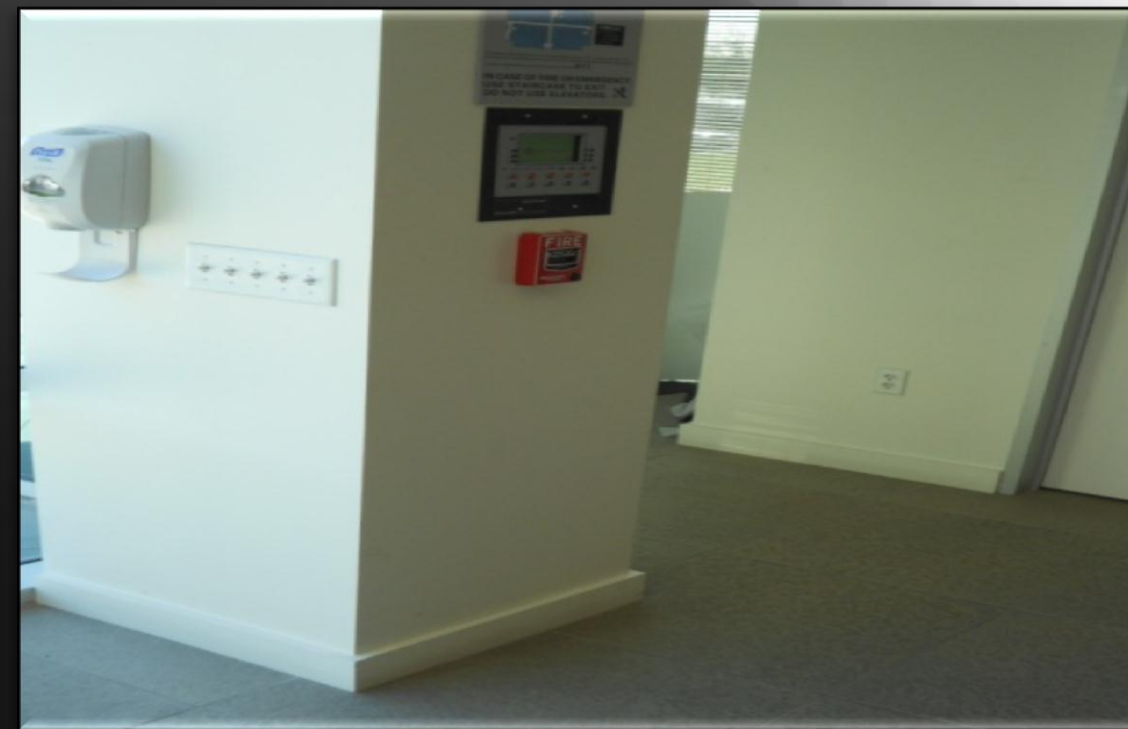
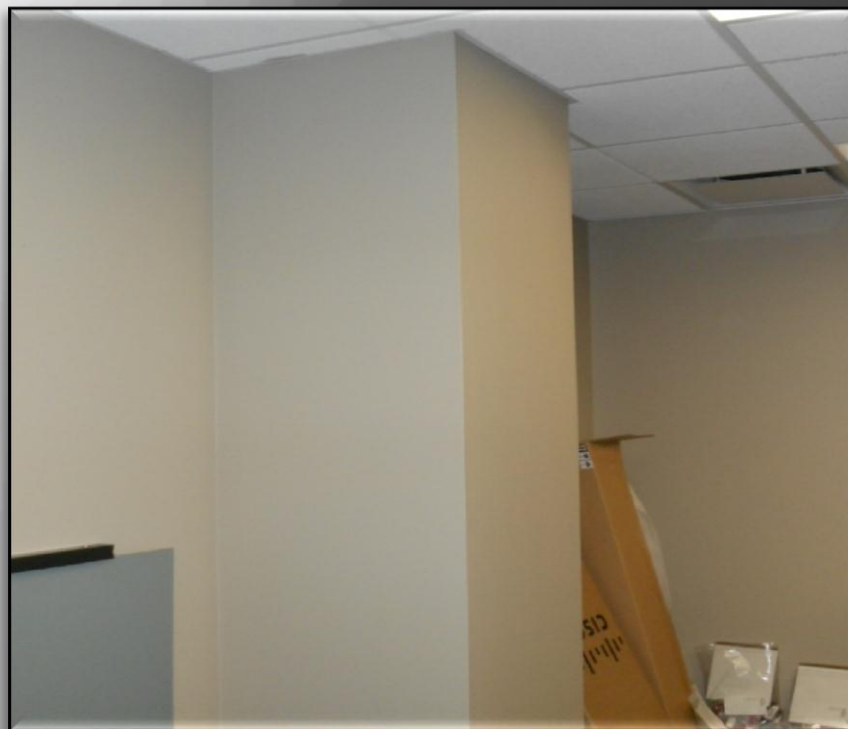
## Architectural Considerations

### Room Size Minimum

Width x Depth x Height

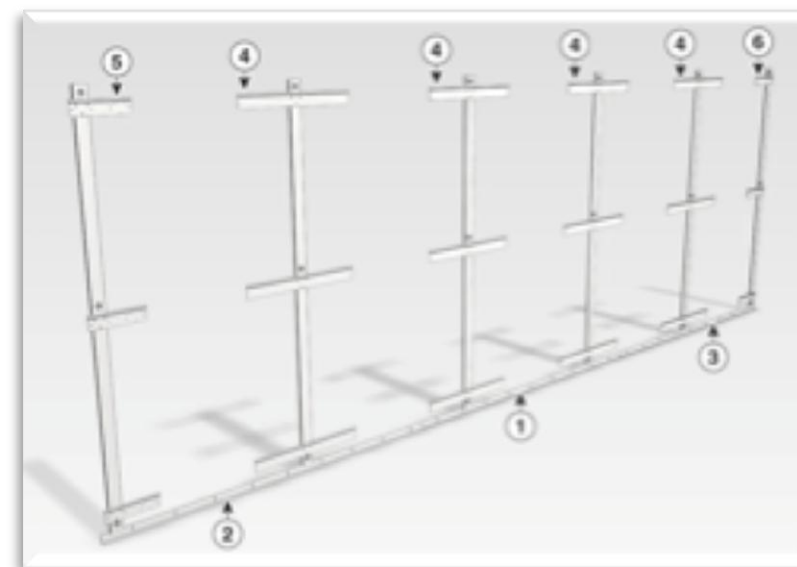
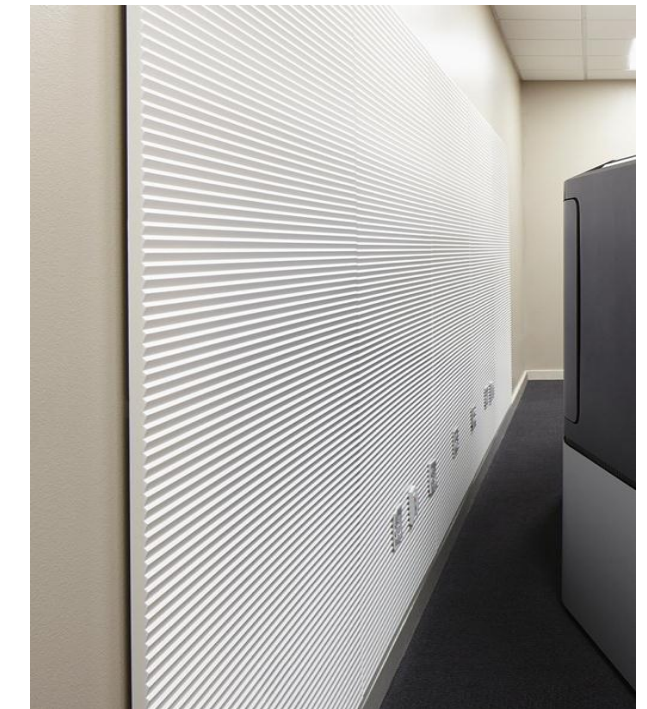
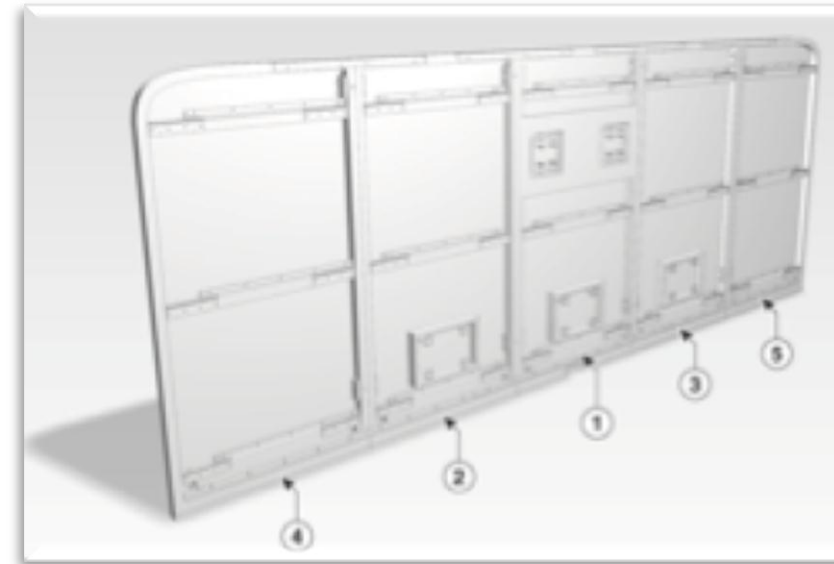
31" x 21'5" x 8' /

9.45m x 6.53m x 2.44m



# Light Reflector Models

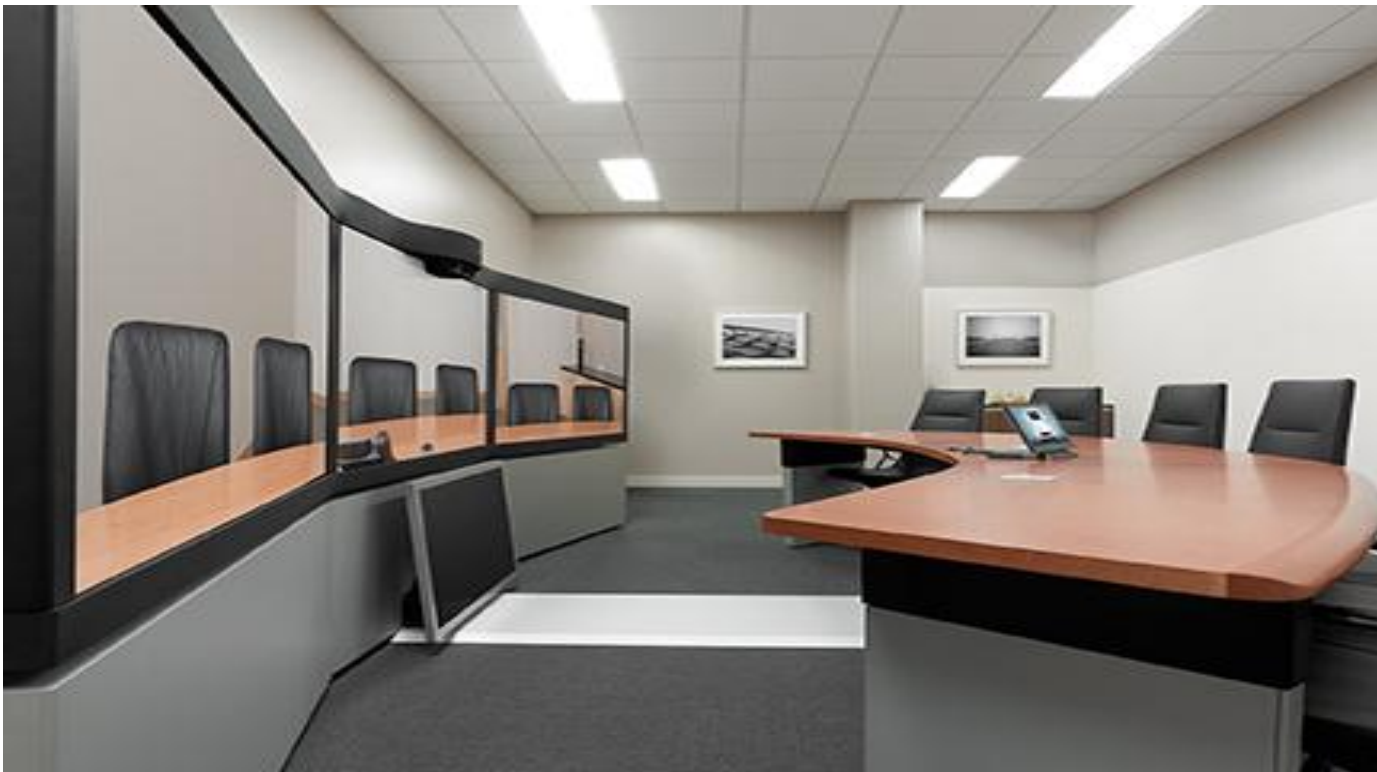
- Wall Mounted
  - Wall Surface Considerations
  - Power Socket Placement
- Free Standing
  - Flexibility
  - Added Cost
  - Greater Room Depth





# Lighting Design

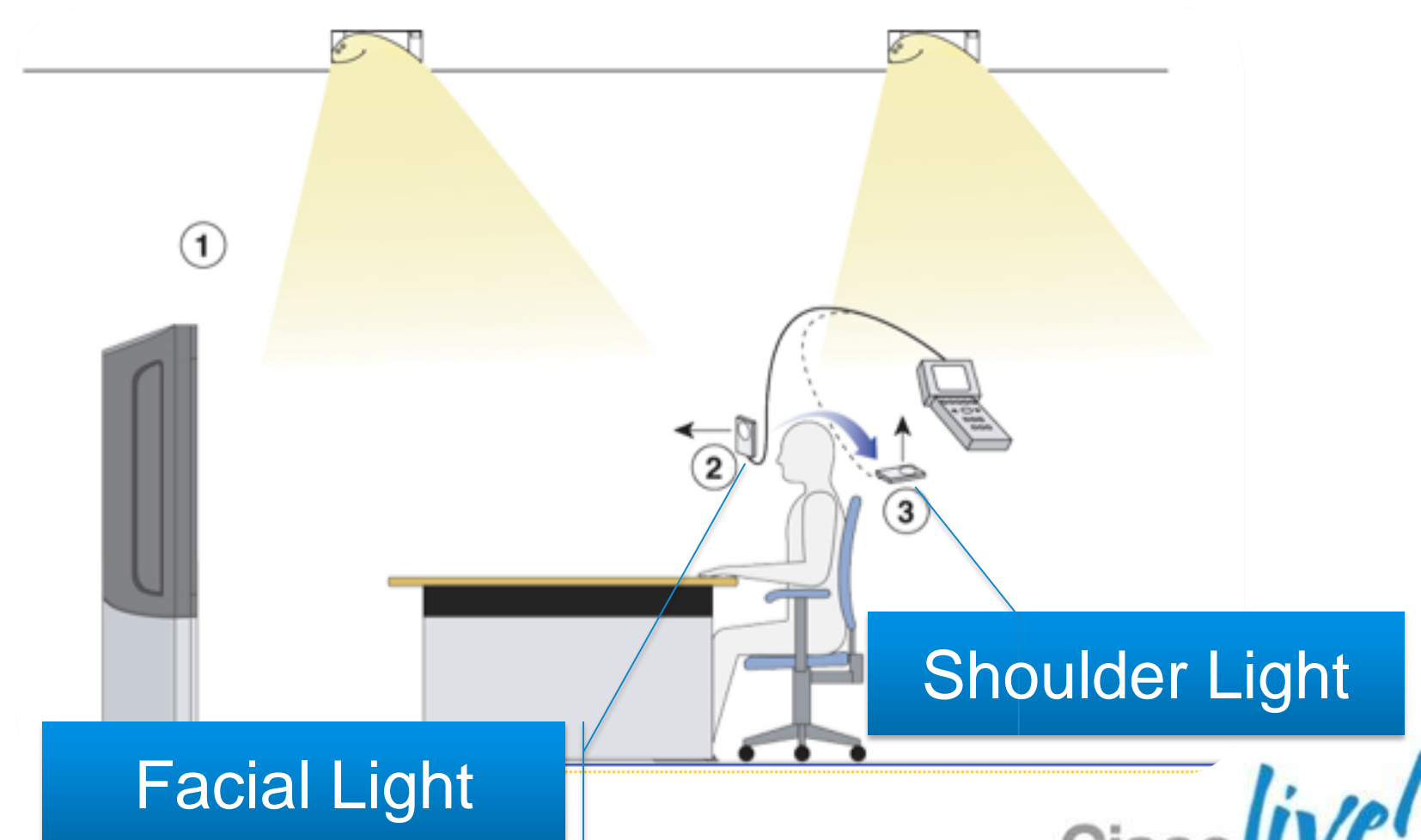
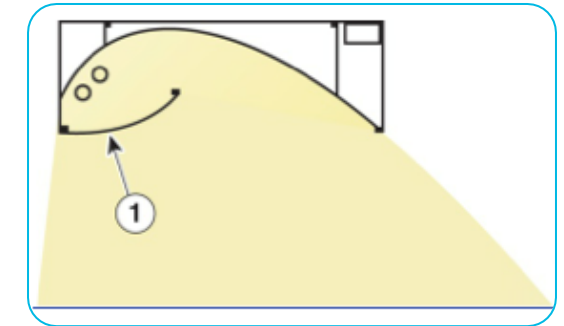
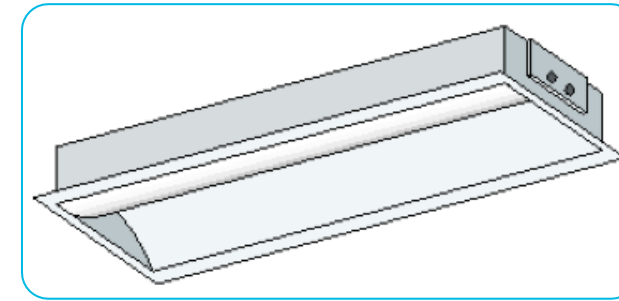
- Dimmable Lighting
- Indirect Linear Lighting Fixtures
- Asymmetric Fixtures



## Lighting

200-400 lux Facial Light (vertical plane)

Shoulder Light < 2\*Facial light (horizontal)



# Acoustic Design

- Common acoustic concerns:
  - Ambient noise
  - Excessive reverberation or echoing
- Key factors:
  - Room size & orientation
  - Construction and finish of materials
  - Objects in the environment
- Remediation
  - Acoustic Paneling
  - Insulation
  - Carpeting
  - Objects and furniture

## Acoustics

Ambient Noise  
45dBA SPL  
NC30

Reverberation 150-700ms

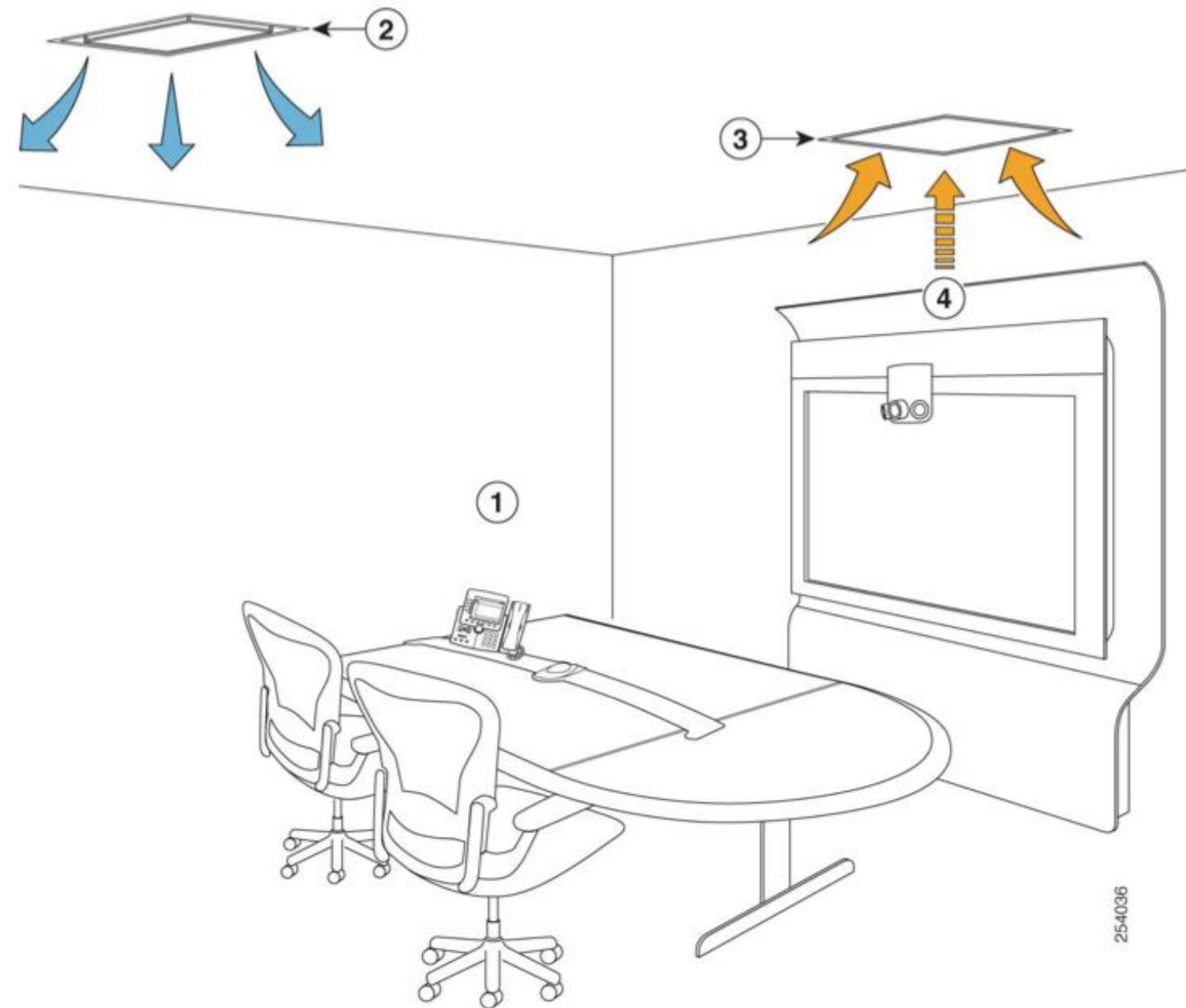


# Heating, Ventilation, and Air Conditioning

## HVAC

Independent Room Control

Typical Cooling 9,500 BTU/Hr

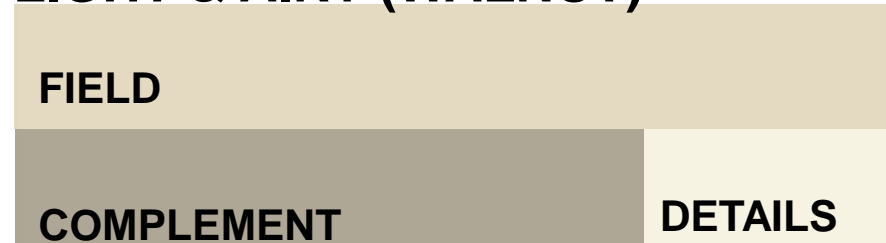




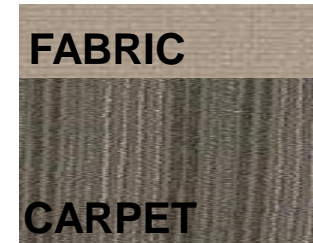
# Aesthetics

## Room Design Palettes

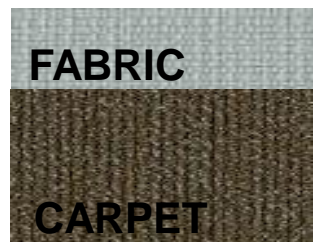
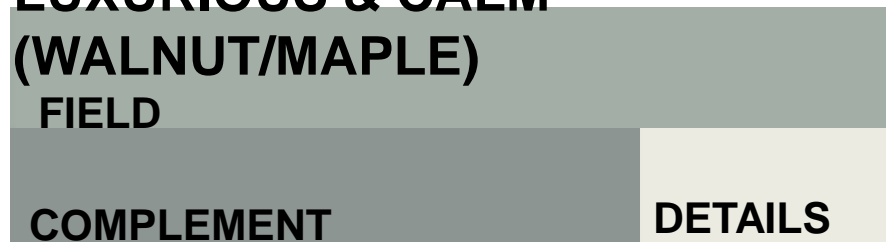
### LIGHT & AIRY (WALNUT)



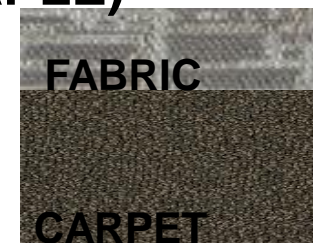
### MODERN WARMTH (WALNUT)



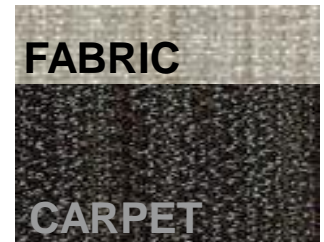
### LUXURIOUS & CALM (WALNUT/MAPLE)



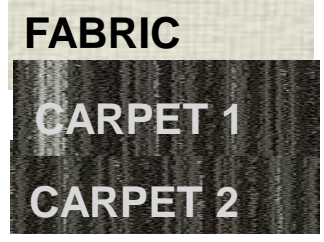
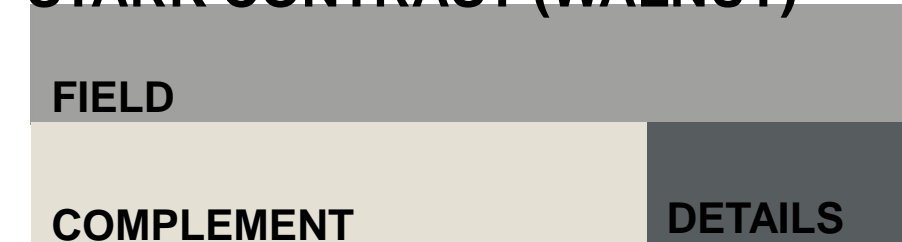
### ELEGANT & EARTHY (WALNUT/MAPLE)



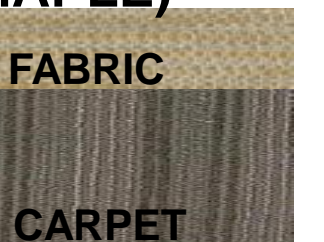
### RICH & BRIGHT (WALNUT)



### STARK CONTRAST (WALNUT)



### TRADITIONAL WARMTH (WALNUT/MAPLE)



[http://www.cisco.com/en/US/solutions/collateral/ns669/color\\_ref\\_guide\\_c07-642558.pdf](http://www.cisco.com/en/US/solutions/collateral/ns669/color_ref_guide_c07-642558.pdf)





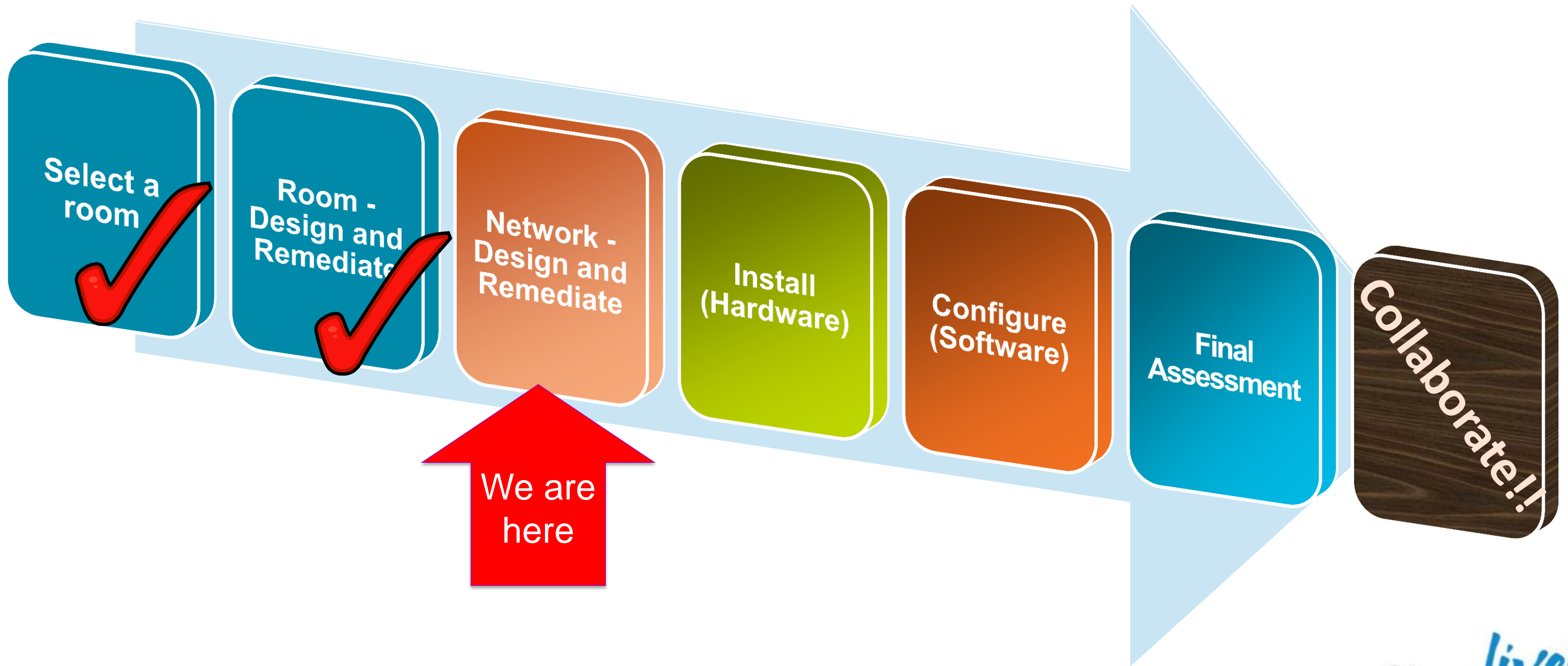
# Aesthetics

## Room Design Examples





# The Deployment Process



# Network Design

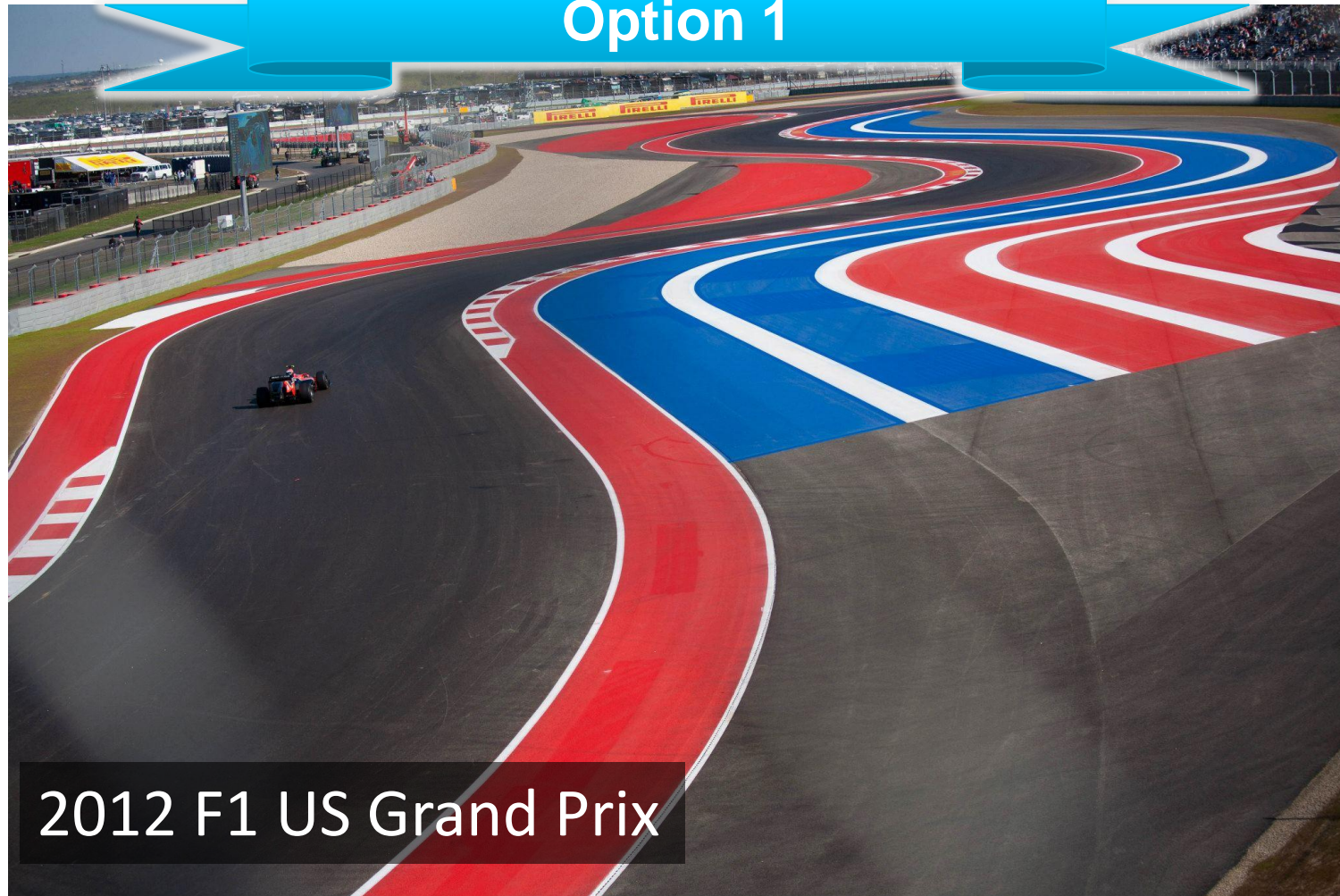




# Why is Network Design Important?

- Where would you want to run your million dollar sports car?

Option 1



Option 2

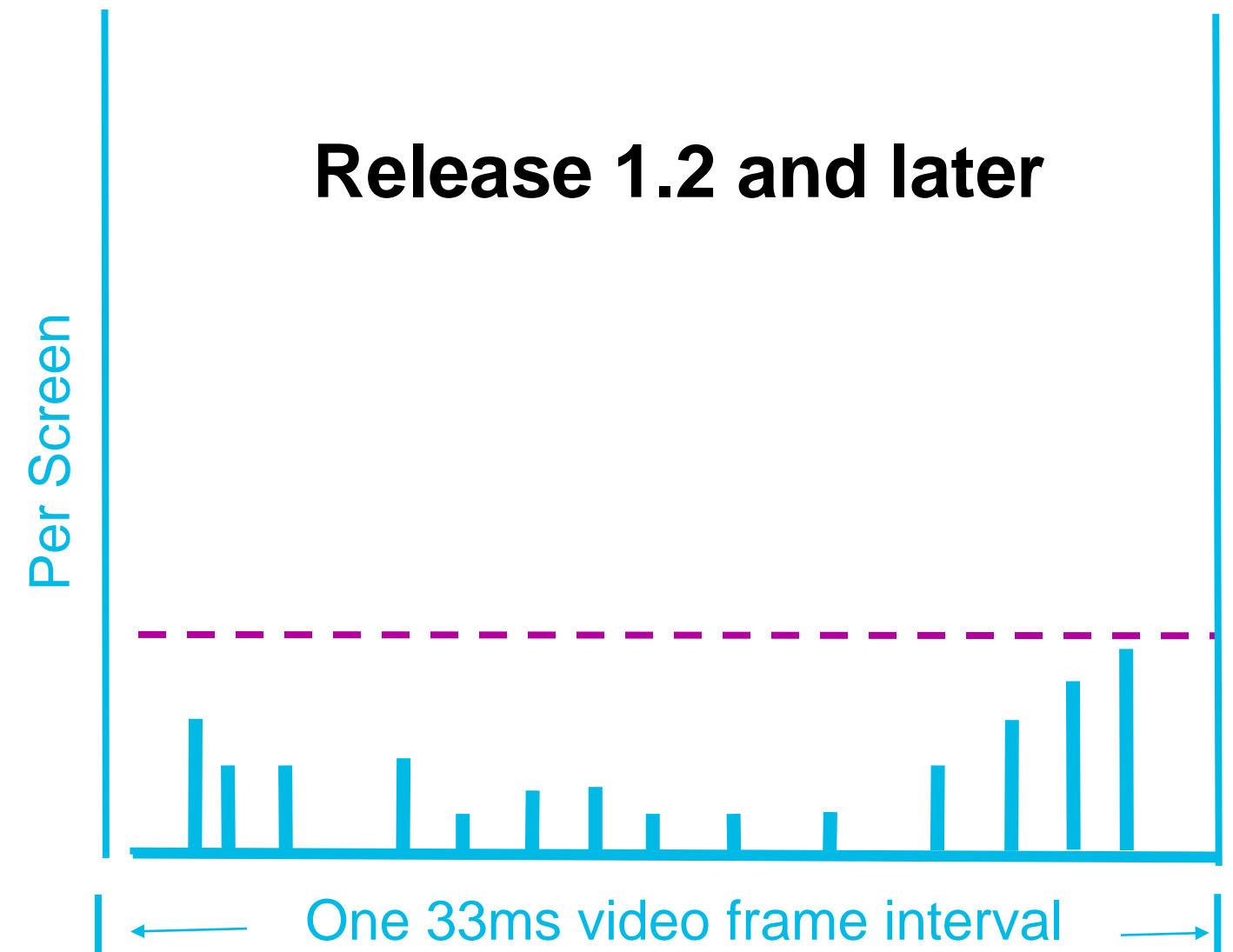
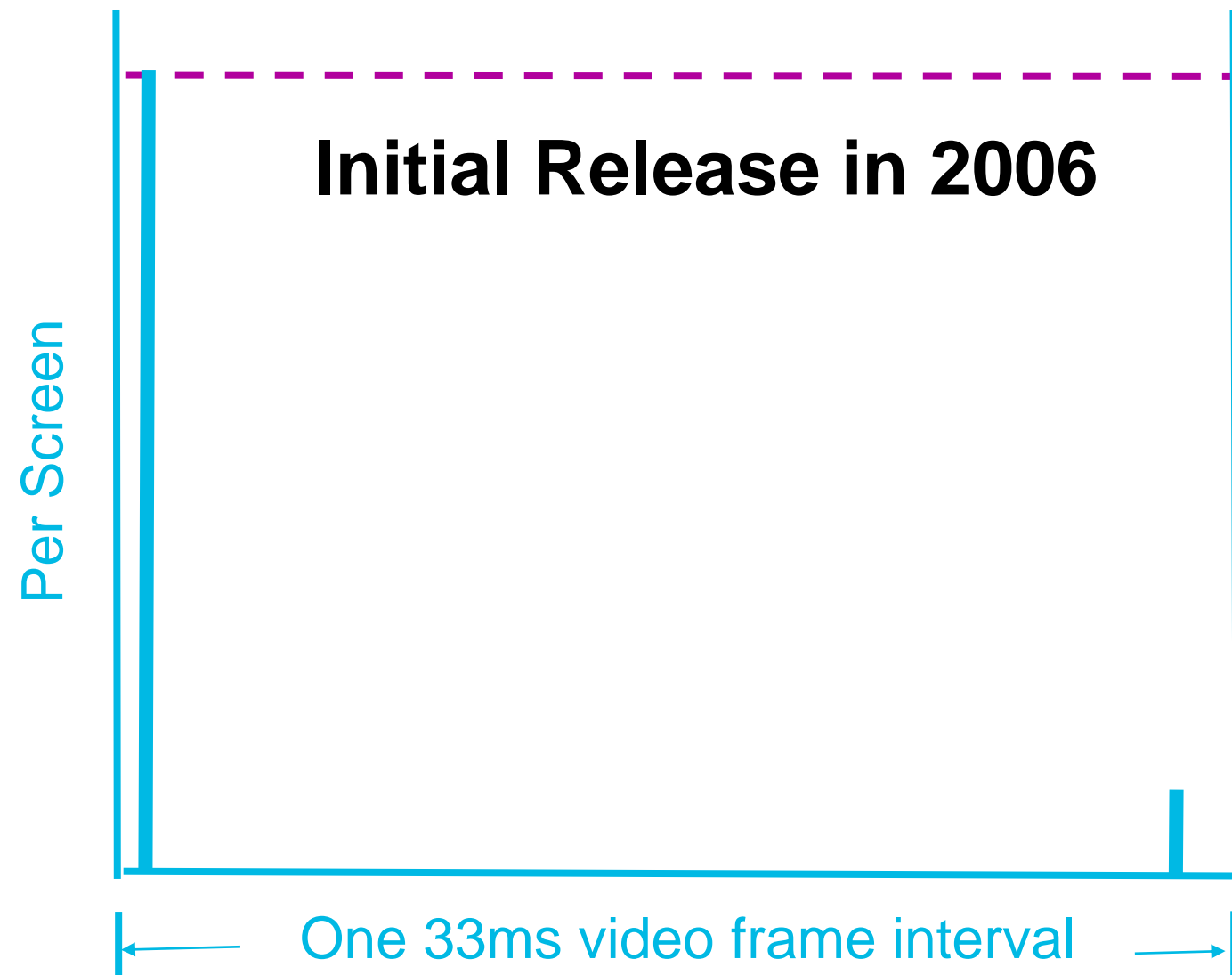


Same thing, you want your TelePresence video traffic to run on a well designed network to ensure optimal immersive experience



# Media Resiliency

## Video Frame Packet Scheduler

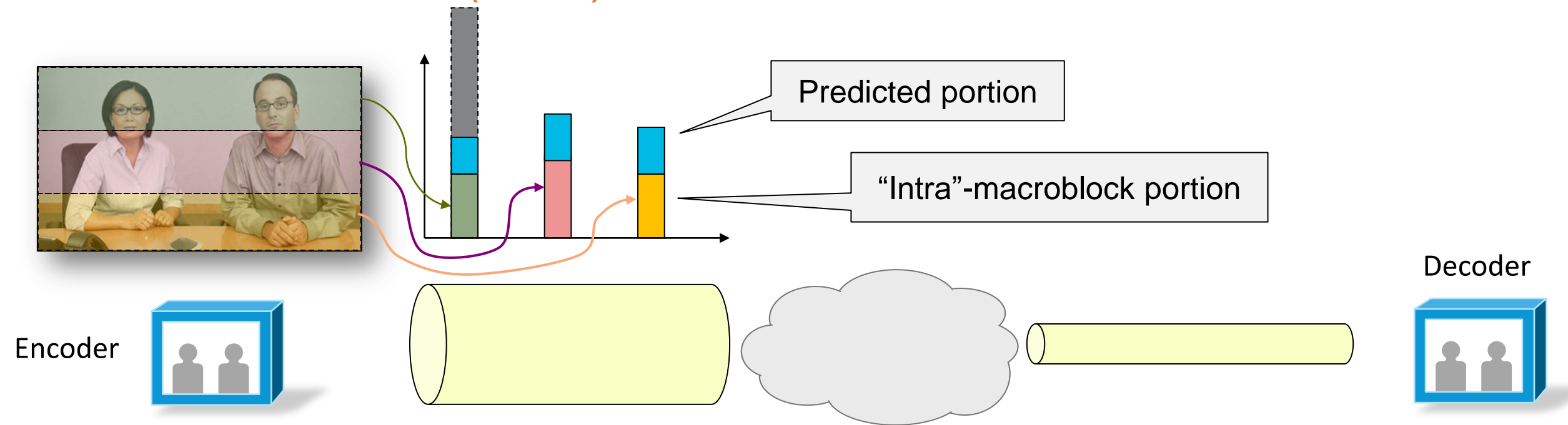


- 30 frames per second => 1 frame per 33ms

# Media Resiliency

## Gradual Decoder Refresh (GDR)

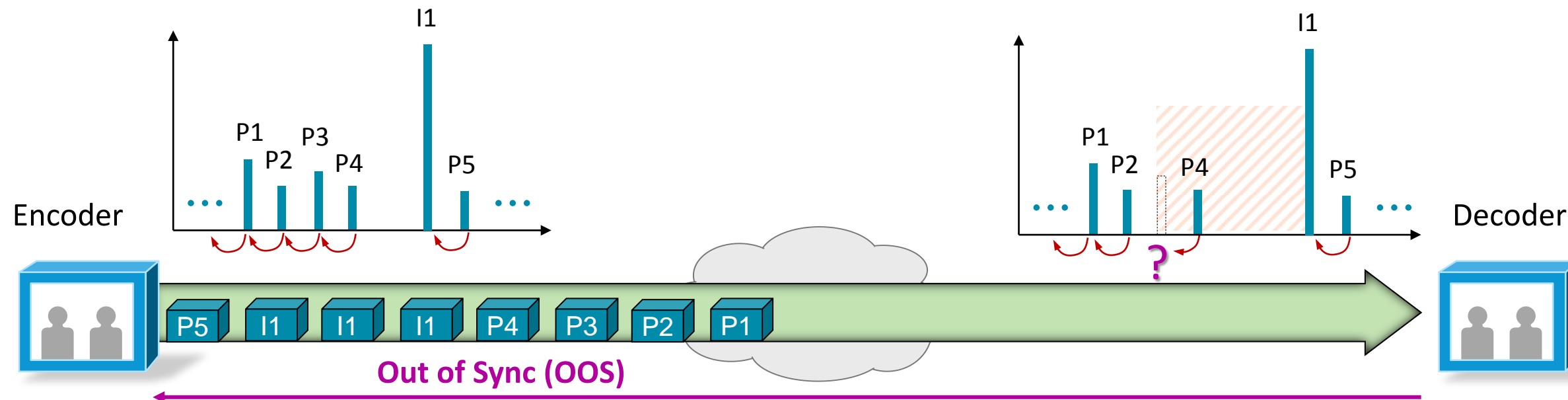
Release 1.6 and later



- Serialisation delay on low-speed links can cause large IDR-frames to arrive too late and be discarded
- Solution: **Gradual Decoder Refresh (GDR)** distributes “intra” picture data over  $N$  frames
  - GDR frames contain a portion of “intra” macroblocks and a portion of predicted macroblocks
  - Once all  $N$  frames have been received, decoder has fully refreshed the picture

# Media Resiliency

## Typical Packet Loss Scenario

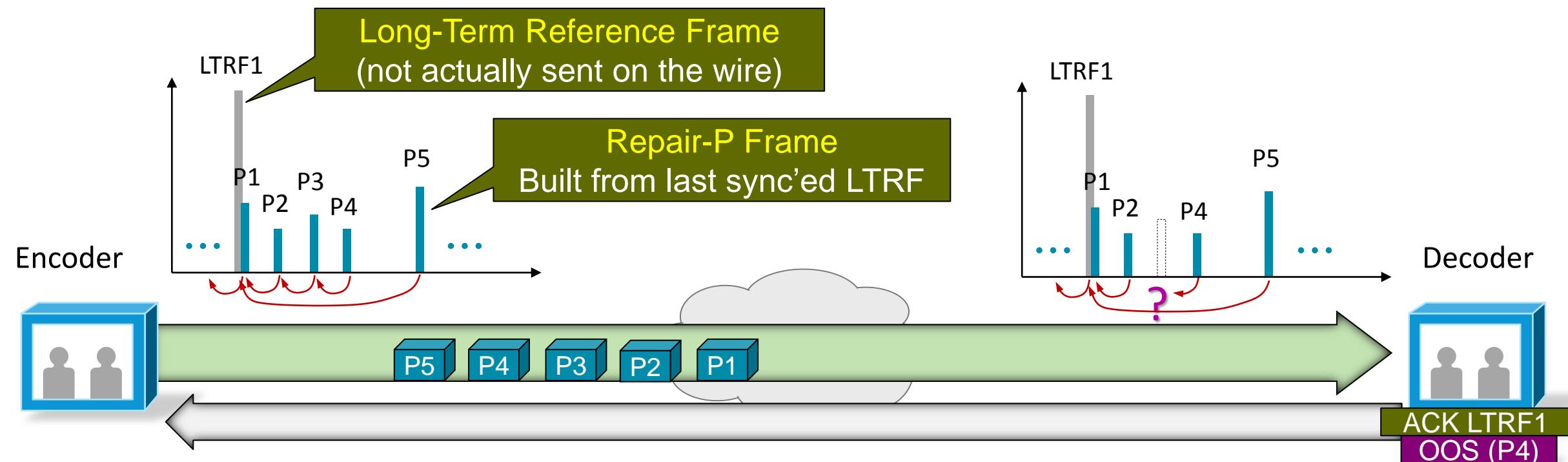


- Loss of a P-frame triggers request for a new I-frame
  - Encoding and transmitting large I-frame takes time
  - If any of the I-frame packets get lost, restart the process
- Flickering/pulsing of video when new I-frame arrives
  - Video freeze or artifacts when multiple packets are lost

# Media Resiliency

Release 1.6 and later

## Long Term Reference Frames and Repair-P Frames (LTRF/LTRP)



- Keep encoder and decoder in sync with active feedback messages
  - Encoder instructs decoder to store raw frames at specific sync points as Long-Term Reference Frames (part of H.264 standard)
  - Decoder uses “back channel” (i.e. RTCP) to acknowledge LTRF’s
- When a frame is lost, encoder creates “Repair-P” differential frame based on last synchronised LTRF

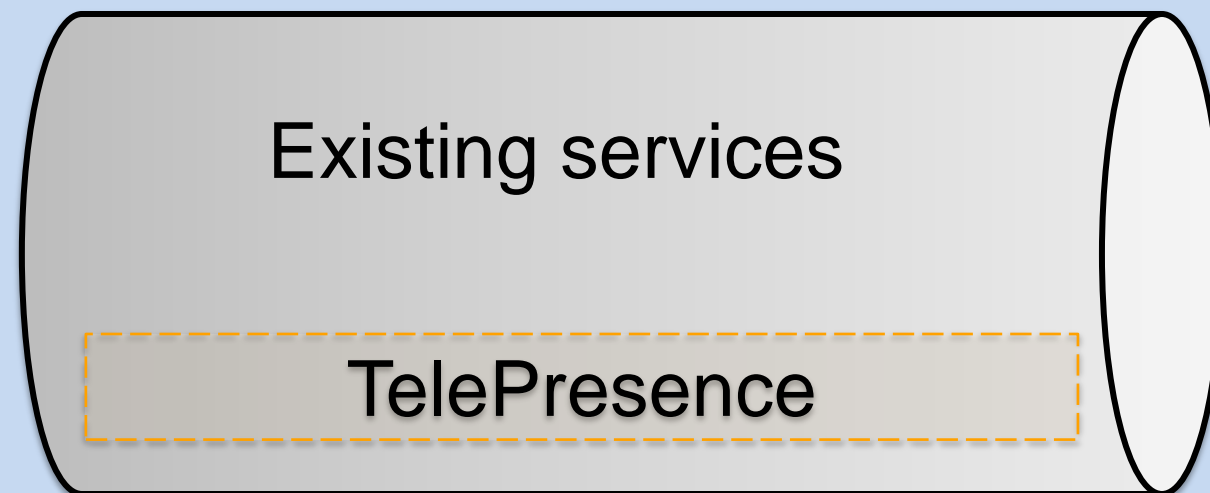


# Network Design Considerations

## Converges v.s. Overlay Deployment Models

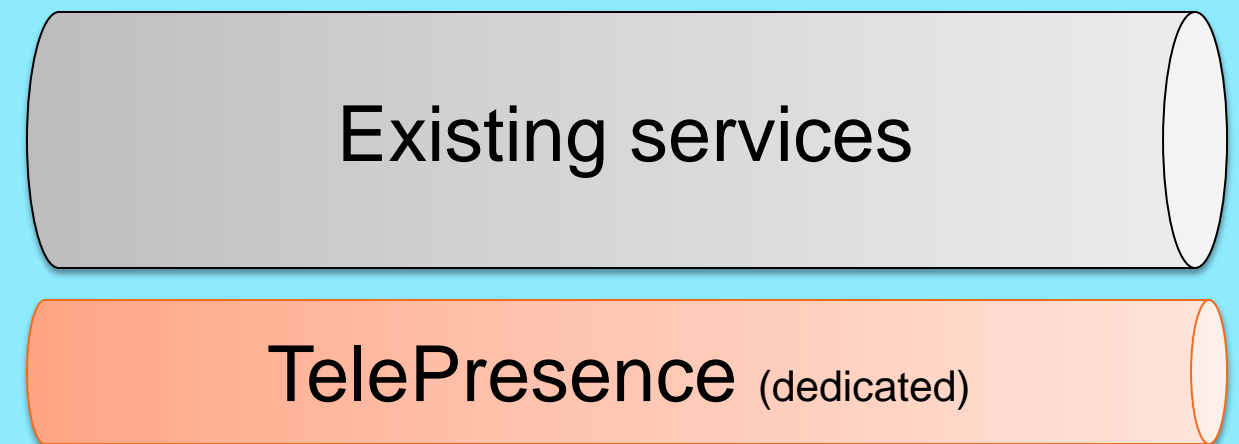
### Converged Network

Definition	TelePresence traffic and other communication services are delivered on the same pipe
Bandwidth	Provision for <b>average</b> bandwidth
Cost	<b>Lowest</b> total cost of ownership
Planning	Requires more planning.



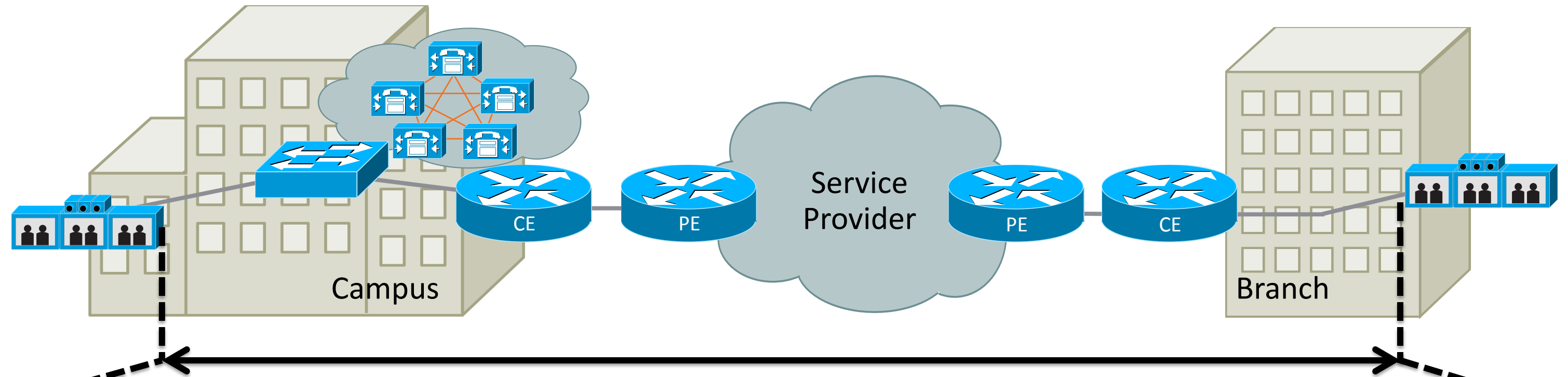
### Overlay Network

Definition	TelePresence traffic runs on a dedicated pipe
Bandwidth	Provision for <b>maximum</b> bandwidth
Cost	Ongoing Opex increases total cost of ownership
Planning	Quicker to implement.



# Network Design

## Latency, Jitter, and Loss Requirements



Metric	Target	Thresholds				Triggered Action on Threshold	
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
Latency	150 ms	250 ms	400 ms			None	None
Video Jitter	50 ms	85 ms	125 ms	165 ms	245 ms	None	None
Loss	0.05%	1%	10%			Network Bar Change	1.Reduce Quality 2.(Drop Call)





# Network Design

## Quality of Service (QoS)

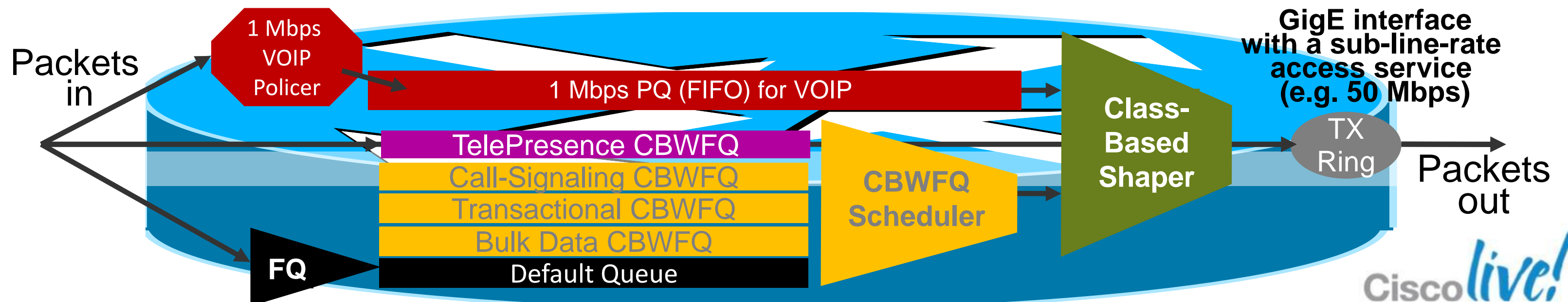
### HQoS Shaping & Queuing Recommendation

```
policy-map WAN-EDGE
class VOIP
priority 1000
class TelePresence
bandwidth 12500
class CALL-SIGNALING
bandwidth x
class TRANSACTIONAL
bandwidth y
class BULK-DATA
bandwidth z
class class-default
fair-queue
```

```
policy-map HQoS-50Mbps
class class-default
shape average 50000000 1000000
service-policy WAN-EDGE
```

#### Recommendations:

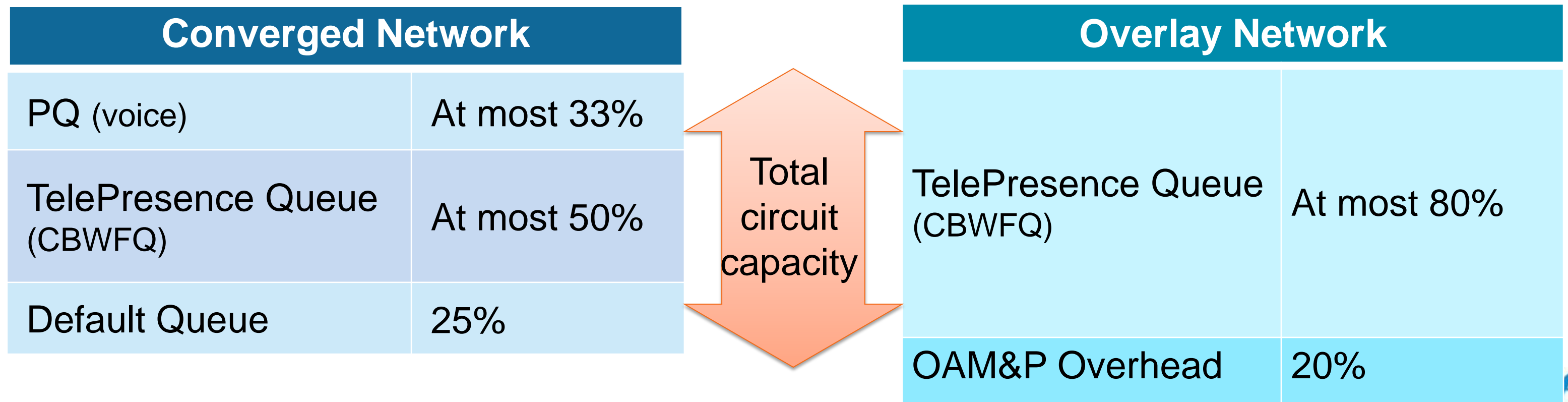
- Assign TelePresence to the CBWFQ
- Use HQoS+Shaping on all WAN interfaces



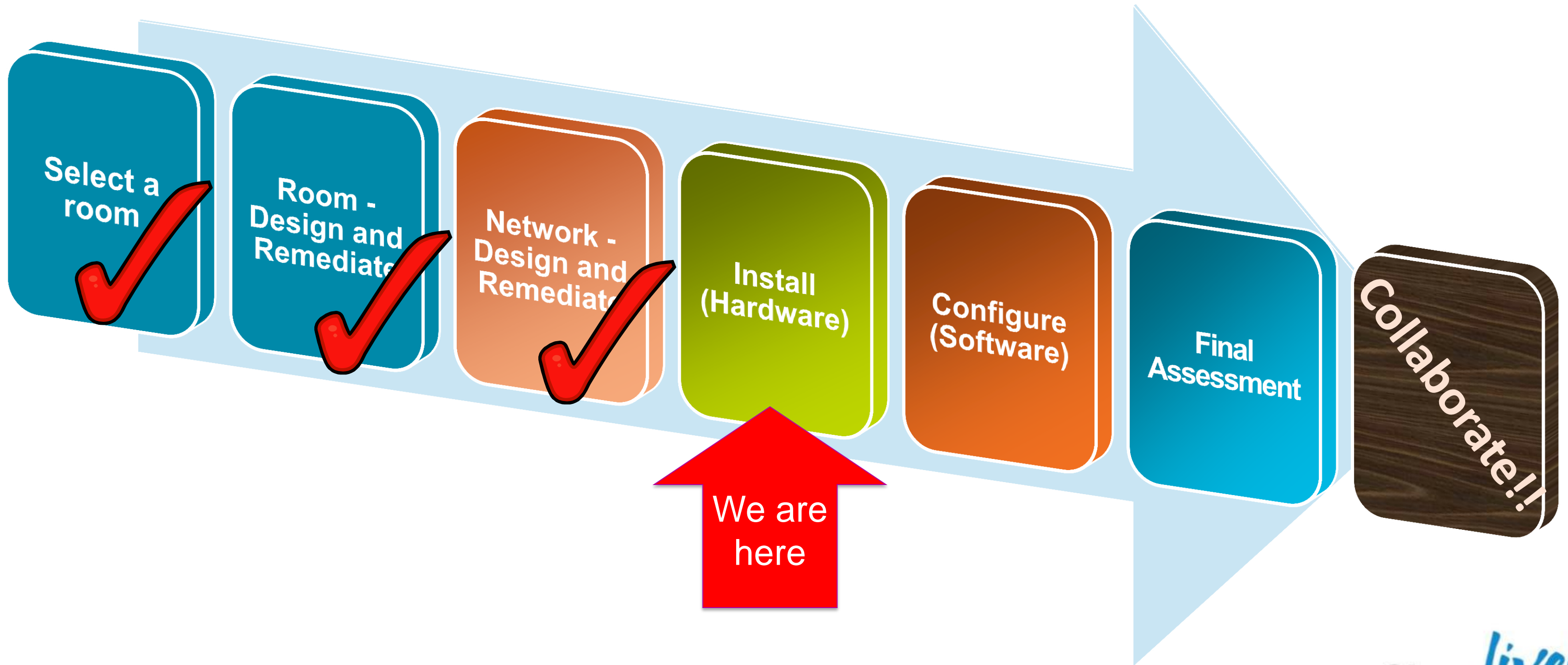
# Network Design

## WAN Best Practices

- Do: Put TelePresence traffic in **CBWFQ**
- *Don't: Put TelePresence traffic in Priority Queue (PQ)*
- Do: Reserve PQ for voice traffic
- Do: Use **HQoS+Shaping** on all WAN interfaces
- Do: Use smallest shaping interval (Tc) supported. [Shaper Tc] < [½ upstream policer's Tc]
- Do: Use **DSCP** whenever possible.



# The Deployment Process





# Installation Best Practices

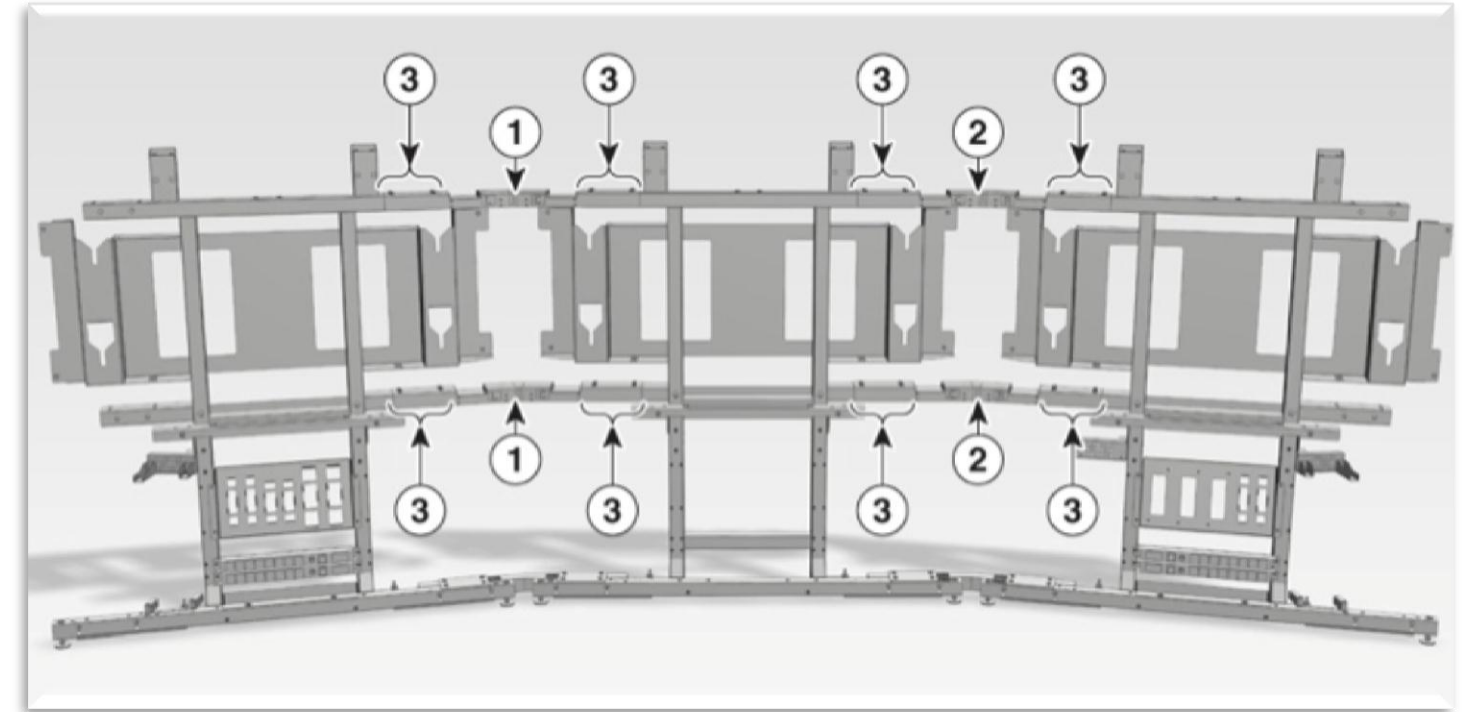


# Installation Best Practices

## Structural Setup and Cabling

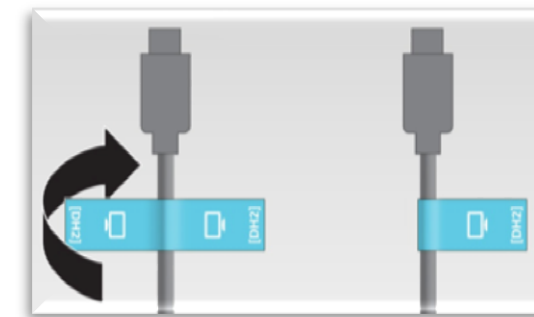
### Structural Setup

- Level entire structure then tighten screws

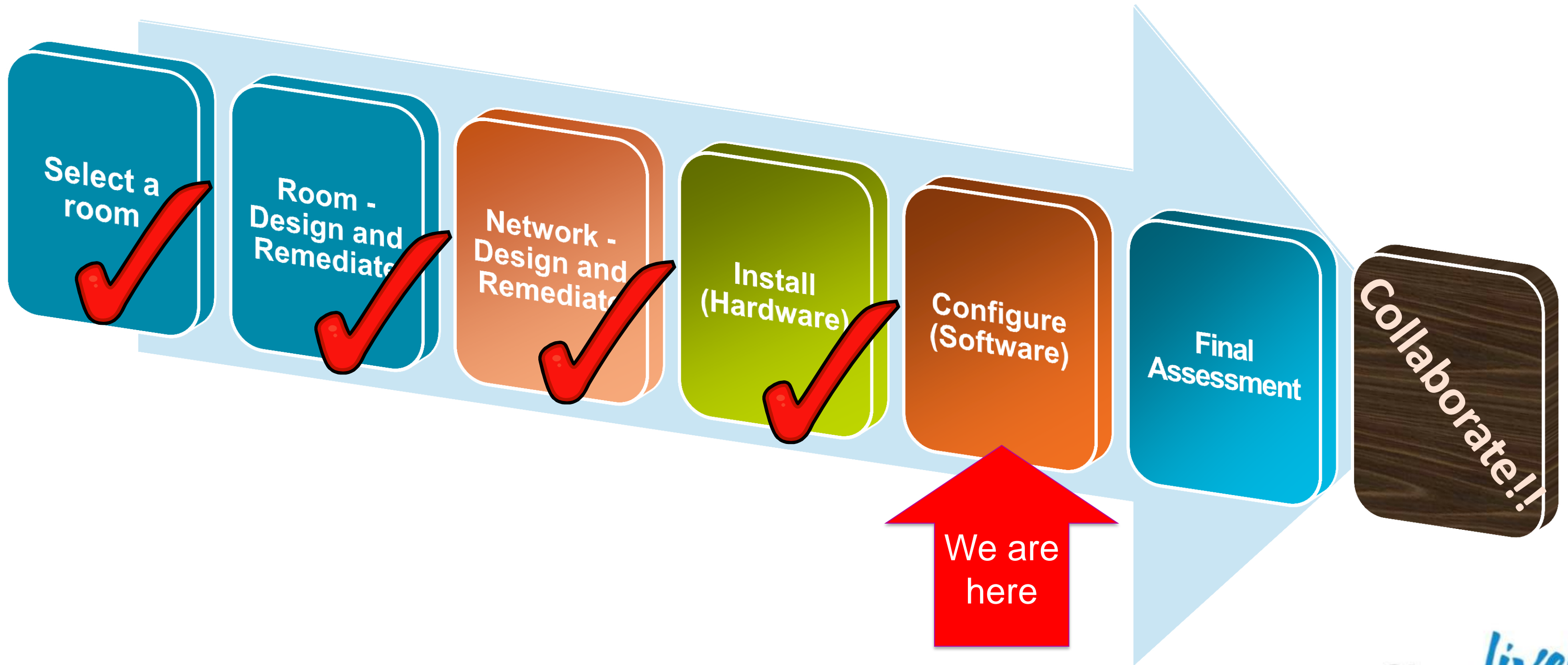


### Cable Routing

- Keep Power, Ethernet, and A/V cables separate.



# The Deployment Process





# Configuration



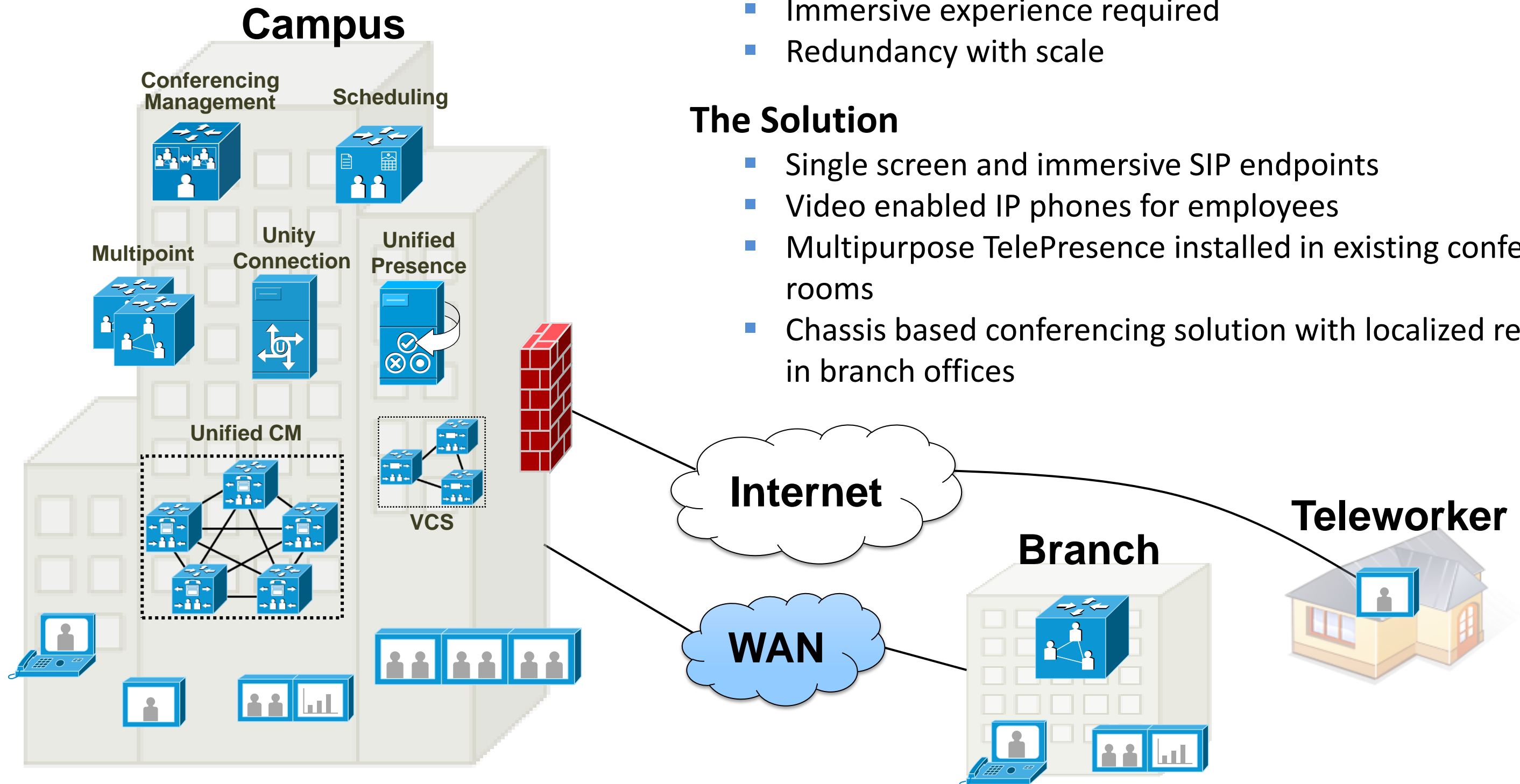
# Use Case

## The Challenge

- 20,000 Users
- Remote workers on video
- Immersive experience required
- Redundancy with scale

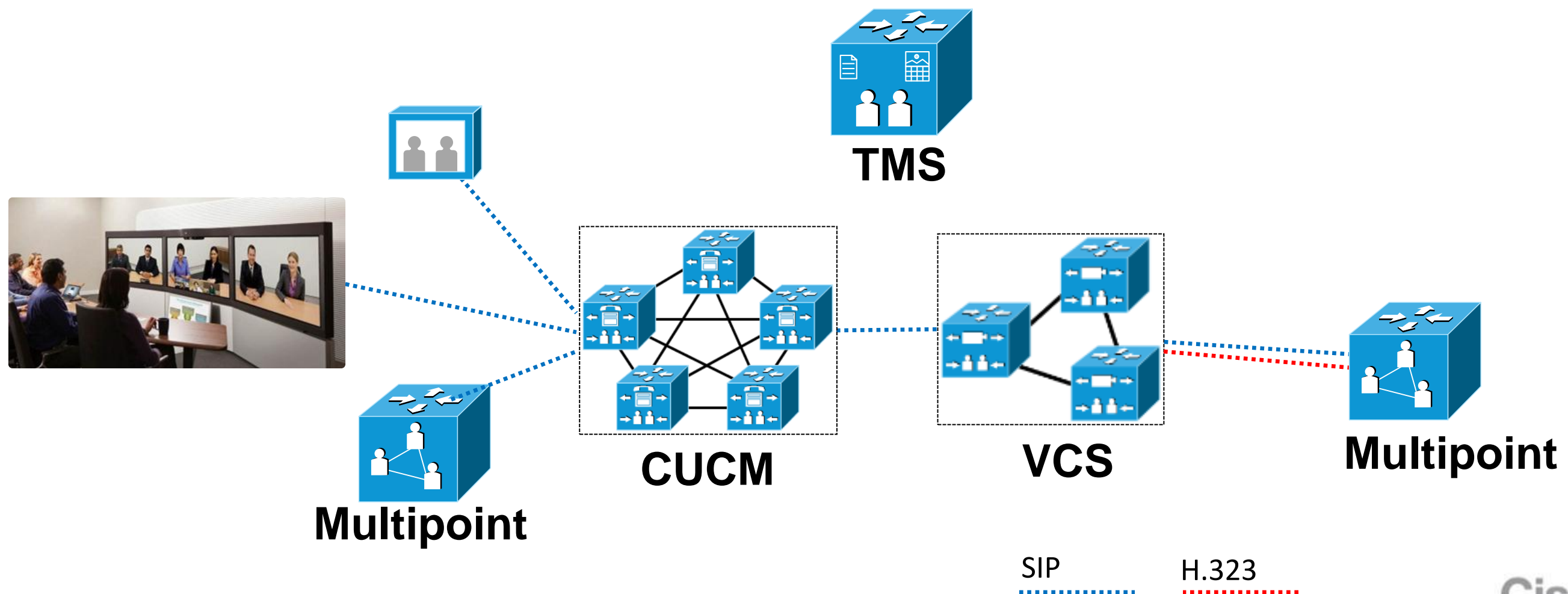
## The Solution

- Single screen and immersive SIP endpoints
- Video enabled IP phones for employees
- Multipurpose TelePresence installed in existing conference rooms
- Chassis based conferencing solution with localized resources in branch offices



# How TX9000 Fits into the Infrastructure

- Registers to CUCM as a SIP device
- Can be added into TMS to enable scheduling
- Easy to make point-to-point, multipoint, scheduled and non-scheduled calls





# CUCM Configuration

- Register TX9000 to CUCM
- Select “Allow Presentation Sharing using BFCP” to enable presentation sharing with non-TIP devices

**Phone Type**

Product Type: Cisco TelePresence TX9000  
Device Protocol: SIP

**Device Information**

Registration: Registered with Cisco Unified Communications Manager 10.35.202.20  
IP Address: [10.35.202.76](#)  
Active Load ID: CTS.6-0-0-55D-K9.P2.SPA  
Download Status: Unknown  
 Device is Active  
 Allow Presentation Sharing using BFCP

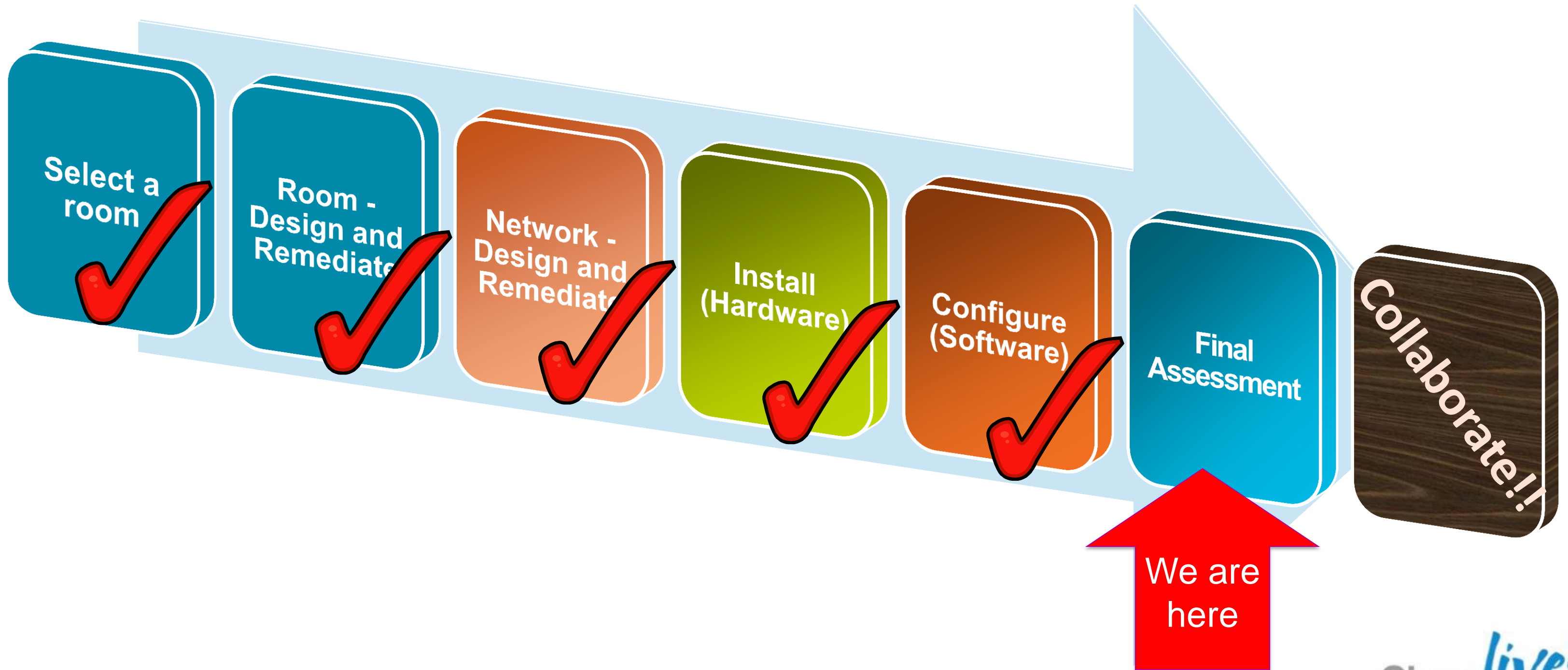
Quality (per Display)\*

- Highest Detail, Best Motion: 1080p
- Highest Detail, Better Motion: 1080p
- Highest Detail, Good Motion: 1080p
- High Detail, Best Motion: 720p
- High Detail, Better Motion: 720p
- High Detail, Good Motion: 720p

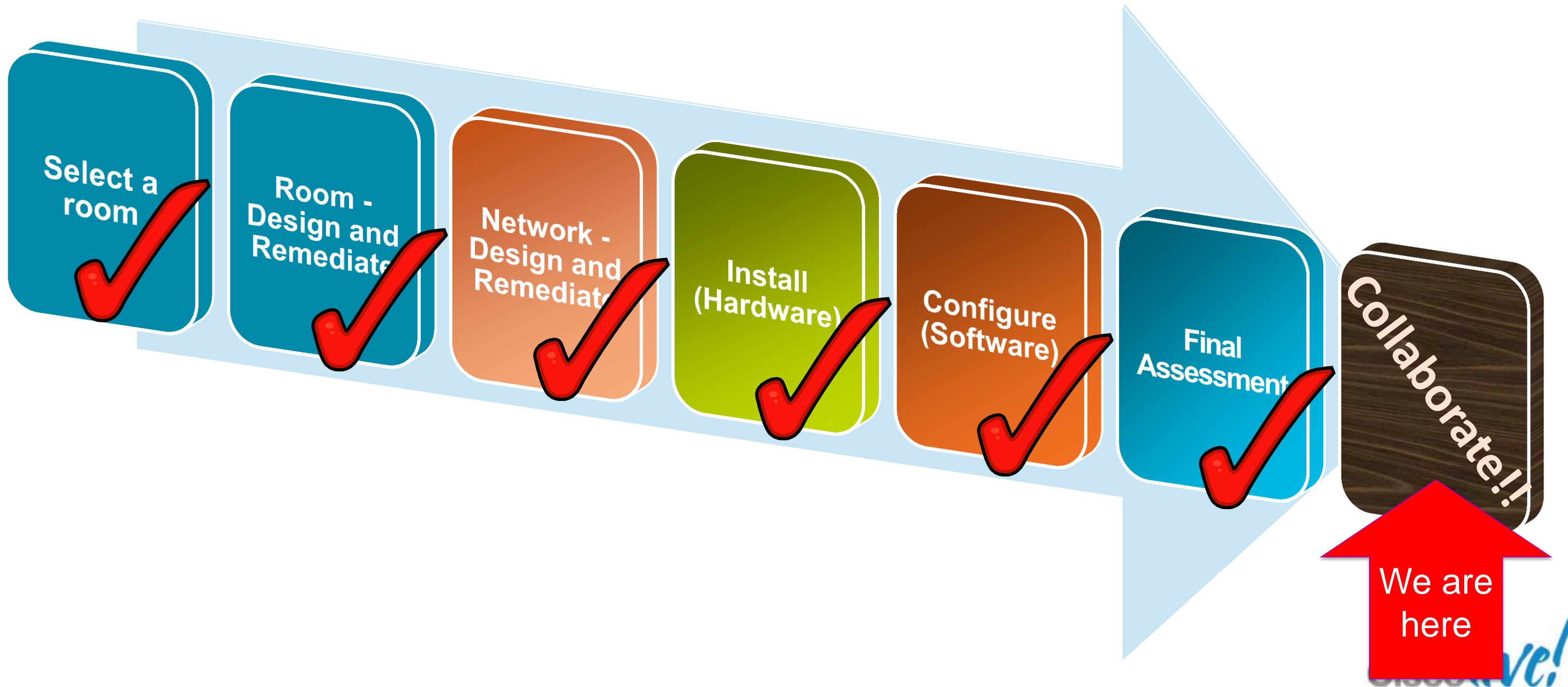
Presentation Frames Per Second\*

- 30 fps presentation
- 5 fps presentation
- 30 fps presentation

# The Deployment Process



# The Deployment Process





# Agenda

- Why Immersive?
- What is the TX9000?
- The Deployment Process
  - Immersive Room Design
  - Network Design
  - Installation Best Practices
  - Configuration
- Summary

# Summary

- TX9000 is interoperable with other SIP devices
- Room Design is key to delivering Cisco's immersive TelePresence Experience
- Good Network Design allows users to experience the best immersive video quality
- When deployed properly, TX9000 provides a superb “in-person” immersive collaboration experience



# Q & A





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# Appendix





# References

- TX9000 Product Webpage:  
<http://www.cisco.com/web/telepresence/products/tx9000.html>
- TX9000 Install and Upgrade Guides:  
[http://www.cisco.com/en/US/products/ps12453/prod\\_installation\\_guides\\_list.html](http://www.cisco.com/en/US/products/ps12453/prod_installation_guides_list.html)
- Cisco TelePresence Immersive Room Design:  
[http://www.cisco.com/en/US/solutions/ns669/networking\\_solutions\\_products\\_genericcontent0900aecd80554cb2.html](http://www.cisco.com/en/US/solutions/ns669/networking_solutions_products_genericcontent0900aecd80554cb2.html)

# Bandwidth Requirement for Overlay Networks

## TX9000 Bandwidth Requirements – Overlay Networks

Average Bandwidth Consumption				
Endpoint	Resolution	Main Video		
		Good	Better	Best
TX9X00	1080p 30fps	11.7 Mbps	13.5 Mbps	<b>15.3 Mbps</b>
	720p 30fps	<b>4.5 Mbps</b>	6.3 Mbps	9.0 Mbps

- Recommendations are for **Overlay Network**
- Includes 20% layer 2-4 overhead
- Includes XGA 5fps content sharing
- Based on maximum bandwidth consumption

