PACS Integration

AI-Enhanced PACS Workflow Architecture

Imaging Devices

CT   MR   XR

→ DICOM →

PACS
Picture Archiving &
Communication System

Image Storage

↓ Route

AI Orchestration Layer

Study Router   Priority Queue

AI Models

Classification
Disease Detection

Segmentation
Organ/Lesion

Detection
Nodules/Fractures

↑ Results

Radiologist Workstation

Integrated View

Results Handler
DICOM SR • Annotations
Worklist Updates

- - - → **Audit Trail**
All predictions logged
Compliance tracking

Data Flow:
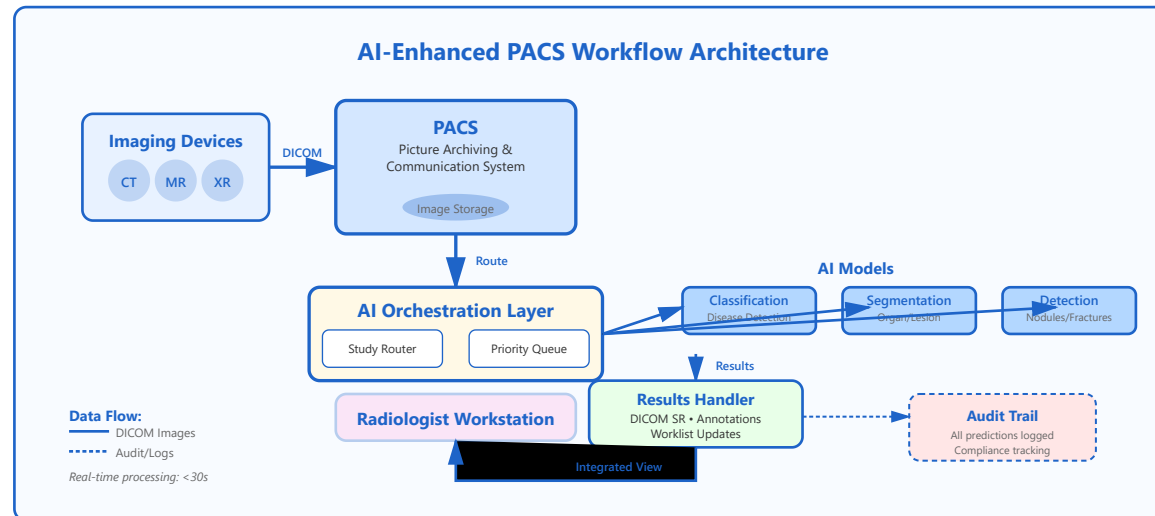—— DICOM Images
----- Audit/Logs

Real-time processing: <30s

DICOM Workflows

Receive images, process, send results. Standard medical imaging communication

AI Orchestration

Routing studies to appropriate AI models. Manage multiple algor

Results Communication

DICOM SR, overlay annotations. Integration with radiology reporting systems

Worklist Prioritization

AI-driven triaging. Urgent findings flagged for immediate review

Audit Trails

Complete logging for compliance. Track every AI prediction and radiologist interaction

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1
DICOM Workflows
DICOM (Digital Imaging and Communications in Medicine) is the international standard for medical imaging
information exchange. It defines formats for medical images and related metadata, as well as the communication
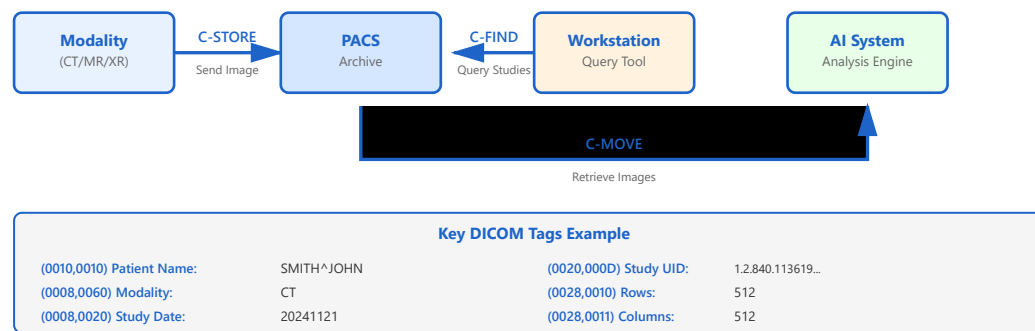protocols between imaging devices and PACS systems.
DICOM Message Exchange Flow

2
AI Orchestration
AI Orchestration intelligently manages the routing of studie
resources, and ensures efficient workflow execution.
AI Orchestration Architecture

Key DICOM Tags Example

(0010,0010) Patient Name:	SMITH^JOHN	(0020,000D) Study UID:	1.2.840.113619...
(0008,0060) Modality:	CT	(0028,0010) Rows:	512
(0008,0020) Study Date:	20241121	(0028,0011) Columns:	512

Core DICOM Services
- **C-STORE:** Stores medical images from modalities to PACS
- **C-FIND:** Queries the PACS database to search for studies
- **C-MOVE:** Retrieves images from PACS to another system
- **C-ECHO:** Tests connectivity between DICOM devices
- **C-GET:** Alternative to C-MOVE for direct image retrieval

DICOM Hierarchy Structure
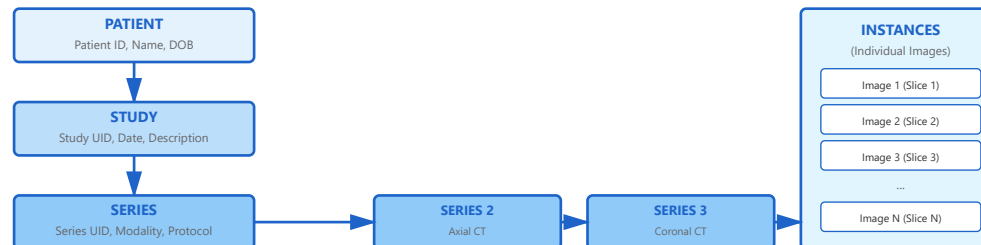
Implementation Considerations
- DICOM nodes configured with Application Entity Titles (AE Titles)
- Network ports (typically 104 or 11112) properly configured
- Transfer syntaxes determine image compression
- Character sets for international patient names

Benefits of Standardized DICOM Workflows
- Interoperability between different vendors' equipment
- Consistent image quality and metadata across enterprise
- Automated routing and distribution of images
- Support for advanced features like structured reports

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Results Communication

Results Communication delivers AI findings to radiologists and clinicians through multiple channels including structured reports, visual annotations, and worklist integration.

Multi-Channel Results Delivery
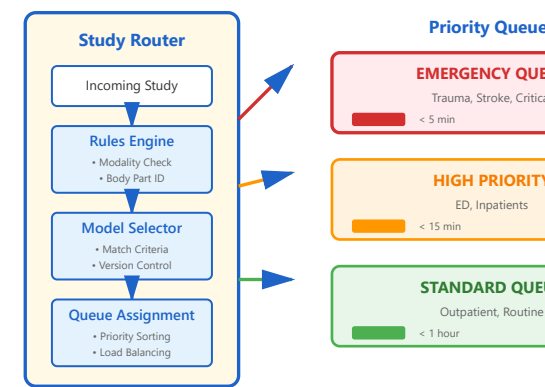
Routing Decision Logic
IF Modality = "CT" AND BodyPart = "CHEST" THEN Route to
Outpatient = STANDARD ELSE IF Modality = "MR" AND Bod
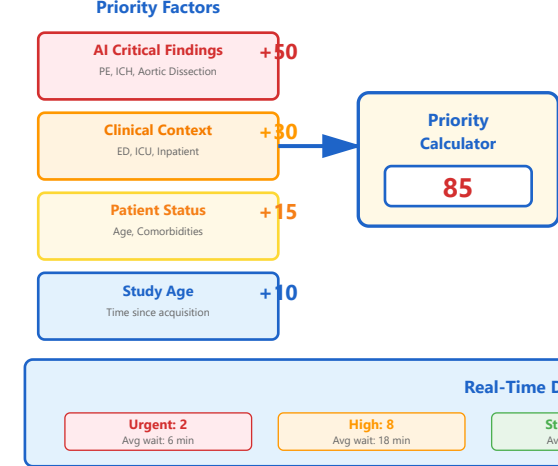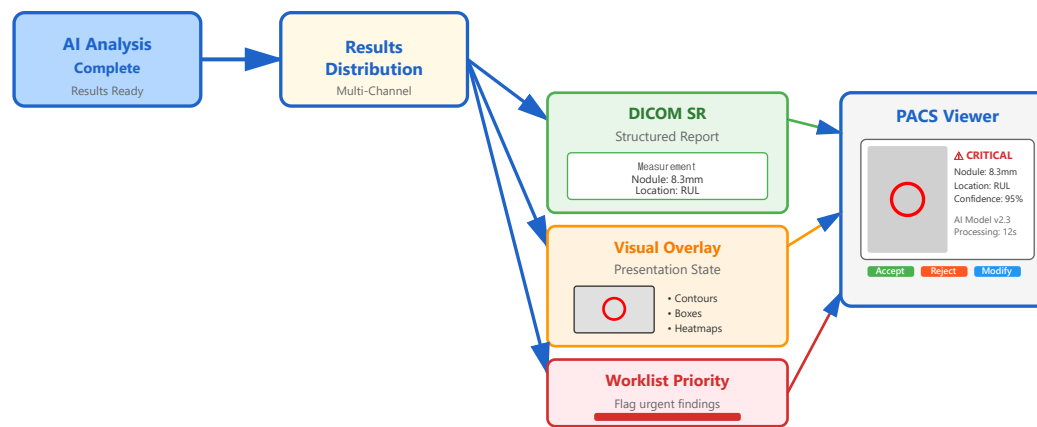Route to: [Stroke Analysis] Priority: EMERGENCY

Advanced Features
- Dynamic Scaling: Auto-provision cloud GPUs during peak ho
- Failover Handling: Redirect to backup models if primary fails
- Smart Caching: Store results for follow-up comparisons
- Multi-Model Ensembles: Combine multiple algorithms

Clinical Impact
- Reduced time to diagnosis: stroke detection under 5 minute
- Optimal GPU utilization: 70-80% without queuing delays
- Scalability: thousands of studies per day
- Flexibility: add new models without downtime

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Worklist Prioritization

AI-driven worklist prioritization automatically triages studies
factors, ensuring critical cases receive immediate attention.

Dynamic Priority System

Priority Factors

AI Critical Findings	+50
PE, ICH, Aortic Dissection	
Clinical Context	+30
ED, ICU, Inpatient	
Patient Status	+15
Age, Comorbidities	
Study Age	+10
Time since acquisition	

Priority Calculator

85

Real-Time D...

| Urgent: 2 | High: 8 | St... |
| Avg wait: 6 min | Avg wait: 18 min | Av... |

Communication Methods

- **DICOM Structured Reports:** Machine-readable standardized format
- **Presentation States:** Visual overlays directly on images
- **Worklist Flags:** Priority indicators in radiologist queue
- **HL7/FHIR:** EMR integration and physician notifications

Best Practices

- Multi-channel delivery for redundancy
- Include confidence scores with predictions
- Provide clinical context and recommendations
- Configurable notification thresholds

Integration Benefits

- Seamless workflow integration - no app switching
- Referring physicians see AI findings in EMR
- QA teams track performance and agreement rates
- Reduced time to treatment for critical findings

Priority Score Algorithm

Function CalculatePriority(study): score = 0 // AI Findings (0...
Context (0-30) IF location == "ED": score += 30 IF location =...
AND critical: score += 15 RETURN min(score, 100)

Critical Findings Requiring Immediate Priority

- Massive pulmonary embolism, aortic dissection
- Large ICH, acute stroke with vessel occlusion
- Active arterial bleeding, organ injuries
- Bowel perforation, mesenteric ischemia

Documented Outcomes

- 40-60% reduction in time-to-diagnosis for emergencies
- 70% decrease in delayed critical finding readings
- Improved radiologist satisfaction and workflow
- 15-25% improvement in cases read per shift

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Audit Trails

Comprehensive audit trails ensure regulatory compliance, enable quality improvement, and provide complete traceability of every AI prediction and user interaction.

Audit Trail System Architecture
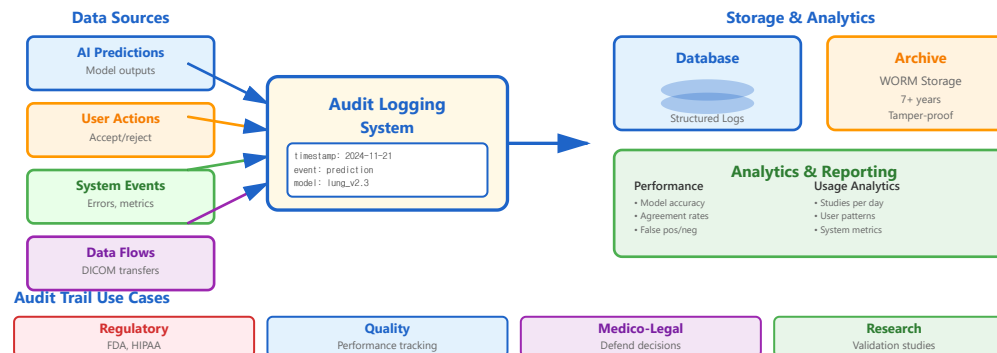
Essential Elements

- **Immutability:** Logs cannot be modified using cryptographic hashing
- **Completeness:** Every action logged without exception
- **Timestamp Precision:** Millisecond accuracy with NTP sync

- **User Attribution:** Every event tied to specific user

Regulatory Compliance

FDA 21 CFR Part 11	HIPAA	GDPR (EU)
✓ Audit trails for changes ✓ Electronic signatures ✓ System validation ✓ Record retention	✓ Access logs for PHI ✓ Authentication tracking ✓ Breach notification ✓ 6-year retention	✓ Processing records ✓ Data access logs ✓ Consent tracking ✓ Right to erasure

Advanced Features
- Blockchain integration for tamper-proof verification
- Real-time monitoring with automated alerts
- Role-based dashboard views for different users
- Automated compliance reporting
  Strategic Value
- Regulatory confidence for FDA and HIPAA compliance
- Early detection of system failures or security breaches
- Objective evidence of AI reliability
- Legal protection with comprehensive documentation
- Data-driven insights for continuous improvement

Integration Success Factors

Technical Excellence

- Robust DICOM connectivity with error handling
- Scalable AI orchestration with load balancing
- Real-time results delivery in workflow
- High-performance infrastructure with 99.9% uptime

Clinical Integration

- Seamless workflow fit with minimal training
- Intelligent prioritization for critical findings
- Clear AI insights with confidence metrics
- Radiologist autonomy - AI as assistant

Regulatory Compliance

- Comprehensive audit trails (FDA 21 CFR Part 11)
- HIPAA-compliant data handling
- Documented validation and QA processes
- Regular security assessments

Continuous Improvement

- Performance monitoring with automated alerts
- Feedback loops for model refinement
- User training and change management
- Regular outcome reviews and ROI tracking

Successful PACS integration requires a holistic approach comb
and robust compli

The goal is not just to deploy AI, but to create seamless augmentation of r
efficiency, and maintains the highe